UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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SECTION 35 20 16.59

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01/08

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SECTION 35 20 16.59

CLOSURE GATES
01/08

****
NOTE: This guide specification covers the requirements for furnishing all plant, equipment, labor, and materials (except materials specified to be furnished by the government) for fabricating, assembling, delivering, and installing closure gates in accordance with these specifications and applicable drawings. 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.
****

1.1.1 Closure Gates

1.1.1.1 Payment

Payment will constitute full compensation for furnishing all plant, labor, materials and equipment and performing all operations necessary for the installing of closure gates as specified.

1.1.1.2 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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges

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

ASTM INTERNATIONAL (ASTM)

ASTM A1	(2000; R 2018) Standard Specification for Carbon Steel Tee Rails
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 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 A722/A722M	(2015) Standard Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B6	(2018) Standard Specification for Zinc
ASTM B22/B22M	(2017) Standard Specification for Bronze Castings for Bridges and Turntables
ASTM B148	(2014) Standard Specification for Aluminum-Bronze Sand Castings
ASTM B823	(2020) Standard Specification for Materials for Nonferrous Powder Metallurgy (P/M)Structural Parts
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

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1928	(Rev C; Notice 1; Notice 2) Padlock (Combination)
FS RR-C-271	(Rev G) Chains and Attachments, Carbon And Alloy Steel
FS RR-W-410	(2020; Rev J) Wire Rope and Strand

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

Diagonal Prestressing

Sequencing and Scheduling; G[, [_____]]

Anchorage of Overhead Support Beam

Welding; G[, [_____]]

SD-04 Samples

Materials

Manufactured Units; G[, [_____]]

Fabrications; G[, [_____]]

SD-06 Test Reports

Tests, Inspections, and Verifications

SD-07 Certificates

Epoxy Filler

1.4 QUALITY ASSURANCE

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 NIOSH or 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 than100 mm 4 inches from the top.

1.5 QUALIFICATION OF WELDERS AND WELDING OPERATORS

Qualification of welders and welding operators shall conform to the requirements of Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

1.6 DELIVERY, STORAGE, AND HANDLING

Perform delivery, handling, and storage of materials and fabricated items conforming to the requirements specified[herein and] in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.[Unload materials and equipment delivered to the site by the Contracting Officer. Verify the condition and quantity of the items delivered by the Contracting Officer and acknowledge receipt and condition thereof in writing. If delivered items are damaged or a

shortage is determined, notify the Contracting Officer of such in writing within 24 hours after delivery.]

1.6.1 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. Rubber seals shall not be distorted during handling.

1.6.2 [Epoxy Filler

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

1.7 [SEQUENCING AND SCHEDULING

****
NOTE: The name of the appropriate railroad company or roadway agency should be inserted as indicated.
****

Submit a sequencing and scheduling plan, approved before the work is commenced, which illustrates that work affecting [railroads] [roadways] has been coordinated with [_____]. Include in the plan schedules, lists of labor or materials to be provided the affected [company] [agency], and any other aspects of the work that may impact on the operations of these entities as specified in Section SPECIAL CONDITIONS. The protection plan shall clearly demonstrate how all [railroad tracks] [public or private roads, streets, or highways] will be kept open to traffic at all times during the construction period, except as otherwise specified or directed. Refer to Section SPECIAL CONDITIONS for other requirements such as warning signs, flagmen, permits, and debris removal.]

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. Furnish materials orders, materials lists and materials shipping bills conforming 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 alloy,] 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 shapes shall conform to ASTM A36/A36M. Structural steel plates shall conform to [ASTM A36/A36M] [ASTM A572/A572M, Grade 50] [ASTM A588/A588M, Grade [_____]].

2.1.1.2 [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.]

2.1.1.3 [Self-Lubricating Bearings

Self-lubricating bearings shall conform to ASTM B823, Type II. The bearings shall be impregnated with a turbine grade lubricant containing oxidation and rust inhibitors and a polar anti-wear additive.]

2.1.1.4 [Bronze Castings

Bronze castings shall conform to ASTM B22/B22M, Copper Alloy UNS No. C91300 [and ASTM B148].]

2.1.1.5 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.

2.1.1.6 Stainless Steel Plate, Sheet, and Strip

Stainless steel plate, sheet, and strip shall conform to ASTM A240/A240M, UNS [S 20910,] [S 30400,] [S 40500,] [S 41008]. Plate finish shall be hot-rolled, annealed or heat-treated, and blast-cleaned or pickled. Sheet and strip finish shall be No. 1.

2.1.1.7 [High-Strength Steel Bar

High-strength steel bar shall conform to ASTM A722/A722M, Type I or II, and all supplementary requirements.]

2.1.2 Rubber Seals

2.1.2.1 General

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

Rubber seals shall be [fluorocarbon (Teflon) clad rubber seals of the mold type only and 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. 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

PHYSICAL TEST	TEST VALUE	TEST METHOD SPECIFICATION
Elongation at Break	450 percent (min.)	ASTM D412
300 percent Modules	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 of 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 C for 22 plus or minus 1/4 hours. 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 M1 (M1 is defined in ASTM D471). The immersion temperature shall be 70 degrees C plus or minus 1 degree C and the duration of immersion shall be 166 hours.

2.1.2.2 [Fabrication of Seals

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 minimum physical properties:

Tensile strength	13.8 MPa2,000 psi
Elongation	250 percent

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

Submit manufacturer's certificate for epoxy filler with the material delivered to the site. Epoxy filler shall be an approved epoxy resin formulation equal to "Nordback Backing For Locks and Dams," a product of Fel-Pro Chemical Products LP, 6120 East 58th Ave., Commerce City, CO 80022, Phone 1-800-992-9799, 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. The manufacturer must certify that the material meets or exceeds

the specified physical properties.]

2.1.4 [Zinc Filler

Zinc filler shall conform to ASTM B6.]

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 13 mm 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.

2.2.3 Shackles and Turnbuckles

Shackles and turnbuckles shall be of forged steel conforming to ASTM A668/A668M, zinc coated. Turnbuckles shall be end-threaded right and left hand and shall be of the size shown.

2.2.4 Screw Jacks

Screw jacks shall have a [_____] ton (metric) (2000 lb) rated capacity and shall conform to the details shown.

2.2.5 [Hoists

Hoists shall be of [_____] ton (metric) (2000 lb) capacity, with [_____] m foot lift, link type chain and safety latch hook. Hoists shall be of light weight design, weighing not over [_____] kg lb and requiring not more than [_____] kg lb lever pull to lift the full-rated load.]

2.2.6 Winches

Winches shall be [_____] ton (metric) (2000 lb)marine winches with [_____] mminch drum and adjustable handle. Each winch shall be equipped with [_____] mm foot of [_____] mm inch diameter wire cable suitable for exterior exposure.

2.2.7 Sheaves

Sheaves shall be of cast steel conforming to ASTM A27/A27M, sized for the wire rope used.

2.2.8 [Rails

Rails shall conform to ASTM A1, [No. 1] [No. 2], weighing [_____] kg/m. lb/yd. Rail stops shall be as recommended by rail manufacturer for [_____] kg/m lb/yd rails and for the wheel diameters indicated.]

2.2.9 Wire Rope

Wire rope shall conform to FS RR-W-410, Type [_____], Class [_____], Construction [_____], [wire size,] [strand seizing] as shown.

2.2.10 [Wheels

Wheels shall be short hub or long hub, rigid type, heavy duty steel casters fabricated from steel castings conforming to ASTM A148/A148M. Wheel shall be of the size and load capacity shown and shall be provided with lubrication fittings, roller bearings and removable axle. Wheel treads shall be machined-finished to conform with the indicated rail. Unless otherwise specified or shown, axles for wheels shall be of stainless steel bars conforming to ASTM A276/A276M, UNS S30400.]

2.2.11 [Bridge Planks

Bridge planks shall be of steel conforming to ASTM A1011/A1011M, Grade 33. Bridge planks shall have a minimum thickness and minimum section modulus as shown.]

2.2.12 Chains and Attachments

Chains and attachments shall conform to FS RR-C-271, Type [_____], Grade [_____], Class [_____], Style [_____], Size [_____], Finish [_____].

2.2.13 Padlocks and Hasps

Padlocks shall conform to CID A-A-1928, Type [I][II]. Padlocks shall be keyed alike and provided with two keys. Hasps shall be of wrought steel and sized to accommodate padlocks.

2.2.14 [Elastomeric Bearing Pads

Elastomeric bearing pads shall conform to the requirements of AASHTO HB-17, Chapter 25, and shall be reinforced with steel plates.]

2.3 FABRICATION

2.3.1 Detail Drawings

Submit detail drawings as specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS, of closure gates and appurtenant items, including fabrication drawings, shop assembly drawings, delivery drawings, and field installation drawings.

2.3.1.1 Fabrication Drawings

Fabrication drawings shall show complete details of materials, tolerances, connections, and proposed welding sequences which clearly differentiate shop welds and field welds.

2.3.1.2 Shop Assembly Drawings

Shop assembly drawings shall provide details for connecting the adjoining fabricated components in the shop to assure satisfactory field installation.

2.3.1.3 Delivery Drawings

Delivery drawings shall provide descriptions of methods of delivering components to the site, including details for supporting fabricated components during shipping to prevent distortion or other damages.

2.3.1.4 Field Installation Drawings

Field installation drawings shall provide 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 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;] [method for installing hinge anchor plates, including checking and maintaining alignments of the plates during concreting and placement of epoxy filler;] and methods for installing other appurtenant items.

2.3.2 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. 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.

2.3.3 Welding

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

Submit schedules of welding procedures for structural steel conformjng with the requirements specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Welds shall be [in accordance with AWS D1.1/D1.1M[,][and] AWS D1.2/D1.2M][, and] of the type shown and approved detail drawings. Radiographic examination is required on the major shop and field welds of the type and location indicated 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.]

2.3.4 Bolted Connections

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

2.3.5 Machine Work

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

2.3.6 Miscellaneous Provisions

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

2.3.7 Fabrications

Submit samples approved 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.

2.3.7.1 Gate Leaf

Gate leaf shall be of welded structural steel fabrication. Gate leaf shall be provided complete with [quoin and miter contact [blocks] [posts],] [miter guide assembly] [elastomeric bearing pads,] [hinge assemblies,] [pintle assembly,] [wheel assemblies,] [trolley assembly,] [tie-down assembly], [gate hooks,] seal assemblies, and other appurtenant components as specified and shown. [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 gate leaf shall not vary from the nominal dimension [or differ from mating gate leaf] by more than 6 mm. 1/4 inch. The surfaces of framing elements to which [skin plates] [bridge planks] are to be welded shall not vary from a true plane by more than 6 mm.1/4 inch. [Splices in [skin plates] [bridge planks] shall be located only where shown.] [In addition to welds specifically indicated for nondestructive testing, [_____] percent of the welds in the girders, verticals and [skin plate] [bridge planks] of the gate leaf shall receive nondestructive testing. The location of these additional welds for testing shall be as directed.]

2.3.7.2 [Wall Quoin

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

2.3.7.3 [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 the contact [block] [post] shall be made by an offset method so that there will not be a continuous joint across the [block] [post]. Contact faces of the contact [block] [post] shall be milled at splices to assure watertight joints. [Splices in the gate leaf contact [block] [post] shall occur only at the centerlines of horizontal girders.] Contact [blocks] [posts] shall be provided with adjusting bolts as shown.]

2.3.7.4 [Hinge Assembly

Outer cylinder of the hinge assembly shall be of steel pipe conforming to ASTM A53/A53M, Type S, Grade B. Cylinder bushing and thrust washer shall be of bronze casting conforming to ASTM B22/B22M, Copper Alloy UNS No. C91300. Hinge pin [and bearing pedestal for the lower hinge assembly] shall be of stainless steel conforming to ASTM A276/A276M, UNS S 21800. [The pedestal base plate for the lower hinge assembly] shall be of stainless steel conforming to ASTM A240/A240M, UNS S 30400. Hinge assembly gusset, stiffener, and anchor plates shall be of structural steel conforming to ASTM A36/A36M. [In addition to welds specifically indicated for nondestructive testing, [_____] percent of the welds in the hinge assembly and the welds connecting the hinge assembly to the gate framing shall receive nondestructive testing. The location of these additional welds for testing shall be as directed.] After all welding is completed, the hinge assembly shall be stress-relieved by heat-treating. Stress-relieving shall be performed prior to machining.]

2.3.7.5 [Pintle Assembly

Pintle assembly for miter gates shall consist of pintle socket, pintle, and pintle base as shown. Pintle socket shall be of cast nickel-alloy steel and shall be press-fitted with an aluminum bronze bushing with bearing surfaces finished truly hemispherical. Pintle shall be of [cast alloy steel] [forged alloy steel] with bearing surfaces of corrosion-resisting steel. The 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.]

2.3.7.6 [Trolley Gate Trolley Assembly

Trolley gate trolley assembly shall consist of trolley beam, two (2) four-wheeled, push type trolleys, and trolley hangers. Trolleys shall be of steel fabrication, a manufacturer's standard product, rated for a minimum load of [_____] tons (metric) (2000 lb) and suitable for operation on the trolley beam of the type and size shown. Trolley wheels shall be single-flanged with a diameter of [_____] mm inches and the wheel treads shall be machined-finished to conform with the trolley beam. Trolley wheels shall be mounted on weather-protected roller bearings and a removable axle and shall be provided with accessible lubrication fittings. Trolley hangers shall be supported by the wheel axle and shall be provided with a cross pin with machined grooves and retaining rings spaced at intervals of [_____] mm inches to accommodate a [_____] mm inch

thick suspension lug. The centerline of the cross pin shall be located [_____] mm inches below the bottom of the trolley beam. For proper clearance, the maximum horizontal dimension from the centerline of the trolley beam to the end of the cross pin shall not exceed [_____] m. [_____] ft [_____] in. Trolleys shall be designed for continuous outdoor service and shall be painted with the manufacturers standard paint system for outdoor operation.]

2.3.7.7 [Trolley Gate Overhead Support Beam

Trolley gate overhead support beam shall conform to the details shown. Post-tensioned anchorage for support beam shall consist of ASTM A722/A722M, Type [_____] [_____] high-strength steel bars and prestressing system as specified in Section 03 23 00 STRESSED TENDON REINFORCING.]

2.3.7.8 [Rolling Gate Wheel Assembly

Rolling gate wheel assembly shall be provided complete with cast steel wheels as specified herein and fittings, couplings and hoses for lubrication of wheels. Fittings shall be 6 mm 1/4 inch threaded-pipe fitting. Couplings shall be 6 mm 1/4 inch stainless steel half coupling. Hoses shall be 6 mm 1/4 inch inside diameter, double-braided stainless steel flexible hoses. Couplings and hoses shall have a pressure rating of 21 MPa. 3,000 psi.]

2.3.7.9 [Rolling Gate Stabilizing Trolley Assembly

Stabilizing support for trolley wheels shall be of structural steel conforming to ASTM A36/A36M. Trolley wheels shall be of steel fabrication and rated for the minimum load shown. Trolley wheels shall be single-flanged and the wheel treads shall be machined-finished to conform with the guiding gate girder. Trolley wheels shall be mounted on weather-protected roller bearings and a removable axle and shall be provided with lubrication fittings.]

2.3.7.10 Seal Assembly

Seal assembly shall consist of rubber seals, steel retainer and spacer bars, [retractable support,] 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. Steel retainer bars shall be field-spliced only where shown and machine-finished after splicing. [The retractable support shall be provided complete with hinge and operating winch.]

2.3.7.11 Miscellaneous Embedded Metals

Wall armor, shear anchors, protection and seal plates and shapes, and other miscellaneous embedded metals shall be of structural steel or corrosion-resisting steel conforming with the details specified herein and shown.

2.3.8 Shop Assembly

Shop assembly requirements for gates and appurtenant items shall be as shown and specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. 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. [The trolley gate shall be suspended in the shop to verify its center of gravity location. If the trolley gate is more than 3 mm 1/8 inchout-of-plumb in the suspended position, it shall be balanced by means as directed.] Shop assembly and disassembly work shall be performed in the presence of the Contracting Officer unless waived in writing. 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

****
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
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
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

]PART 3 EXECUTION

3.1 INSTALLATION

Installation shall conform with the requirements specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Gates and appurtenant items shall be assembled for installation in strict accordance with the contract drawings, approved installation drawings, and shop match-markings. Before assembly and installation, all bearing surfaces requiring lubrication shall be thoroughly cleaned and lubricated with an approved lubricant. All components to be field-welded shall be in correct alignment before welding is commenced.

3.1.1 Embedded Metals

Corner protection angles, sill angles, seal plates, frames, pedestals, 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 [Lower Hinge Assembly

Base anchors for the lower hinge assembly shall be embedded in the first pour concrete. Base plate shall be attached to base anchors, set to the final position, and epoxy fill shall be placed in the void behind the base plates and allowed to reach the strength as shown and the approved field installation drawings. After the gate leaf is set in place, the hinge assembly shall be adjusted to provide for continuous contact between the sealing surfaces over the full height and length of the gate leaf. Allowances shall be made for the seals which shall not be attached until painting operations are completed. Second pour concrete shall be placed after final adjustments are completed.]

3.1.3 [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 as 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.]

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. [[Lower hinge assembly bearings] [Pintle ball] shall be coated with grease prior to setting the gate leaf in place.] [Grease pipes shall be flushed prior to connecting to bearing.] 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 ends of the gate leaf due to compression of blocking or other causes. After the gate leaf has been set in place and the top hinge assembly installed, the gate leaf shall be plumbed and brought into correct position.

3.1.6 Diagonals

Gate leaf diagonals shall be attached to the gate leaf after the leaf is set in place. Submit diagonal prestressing records immediately after completion of the prestressing operations. Diagonals shall be prestressed before the final adjustment of the [quoin and miter contact [blocks] [post]] [hinge assemblies] are made. Diagonal prestressing shall be as specified herein and as shown and the prestressing plan developed by the Contractor. 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.)
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.					
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 [Top Hinge Assembly

After the gate leaf has been set in place, the top hinge assembly shall be

installed and adjusted so that the center of the hinge pin is in vertical alignment with the center of the [pintle] [bottom hinge assembly pin]. When the top hinge pin is inserted, the gate leaf shall swing horizontally throughout its range of movement. [Any required final adjustments to the top hinge assembly shall be made after the gate leaf diagonals have been prestressed.] The second pour concrete shall be made after final adjustments are completed.]

3.1.8 [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 top hinge assembly, 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.]

3.1.8.1 Placing [Epoxy] [Zinc] Filler

[Epoxy Filler: 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 of15 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. 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.]

[Zinc Filler: Immediately preceding the pouring of the zinc filler, the adjacent metal components shall be pre-heated to a temperature of 100 to 150 degrees C 212 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.]

3.1.8.2 [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].]

3.1.9 [Anchorage of Overhead Support Beam

Submit record of the post-tensioning operation for the trolley gate overhead beam anchors, immediately after the anchorage is completed, set in place and post-tensioned anchored as shown and as specified in Section 03 23 00 STRESSED TENDON REINFORCING.]

3.1.10 [Rolling Gate Stabilizing Trolley Assemblies

Rolling gate stabilizing trolley assemblies shall be installed after the gate is set in place and properly adjusted. Assemblies shall be placed on the top girder of the gate leaf, attached to anchors embedded in the top of the supporting concrete wall, shimmed as required, and secured in place.]

3.1.11 Painting

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

3.1.12 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 PROTECTION OF FINISHED WORK

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

3.3 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 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, shall be made at no additional 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.

-- End of Section --