Preparing Activity: USACE Superseding
UFGS-35 20 16.59 (January 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 35 20 16.59

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08/22

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SECTION 35 20 16.59

HYDRAULIC CLOSURE GATES
08/22

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.

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

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

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

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

****

PART 1 GENERAL

1.1 UNIT PRICES

****

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

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

****

1.1.1 Furnishing and Installing Closure Gates

****

NOTE: Alternate 1.

****

1.1.1.1 Payment

Payment is made for costs associated with furnishing and installing closure gates and appurtenant items, which includes full compensation for the materials, fabrication, delivery, installation, and testing of closure gates and appurtenant items including gate leaves, diagonals, strut connections, miter guides, closure latches, recess latch strikes, quoin and closure 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 Closure Gates

****

NOTE: Alternate 2.

****

1.1.2.1 Payment

Payment is made for costs associated with furnishing closure gates and appurtenant items, which includes full compensation for the materials, fabrication, and delivery of closure gates and appurtenant items including gate leaves, diagonals, strut connections, closure guides, closure latches, recess latch strikes, quoin and closure 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 Closure Gates

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

1.1.3.1 Payment

Payment is made for costs associated with the installation of closure gates and appurtenant items, which includes full compensation for the complete installation and testing of closure 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.
****

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

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
AWS D1.2/D1.2M	(2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum

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	(2022) 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	(2023) 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	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A320/A320M	(2022a) Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A564/A564M	(2019) Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes
ASTM A572/A572M	(2021; E 2021) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A668/A668M	(2023) Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
ASTM A709/A709M	(2021) Standard Specification for Structural Steel for Bridges
ASTM A722/A722M	(2015) Standard Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete
ASTM A1011/A1011M	(2023) 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	(2023) 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; R 2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D413	(1998; R 2017) Standard Test Methods for Rubber Property - Adhesion to Flexible Substrate
ASTM D471	(2016a) Standard Test Method for Rubber Property - Effect of Liquids
ASTM D572	(2004; R 2019) Rubber Deterioration by Heat and Oxygen
ASTM D2240	(2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness
ASTM F3125/F3125M	(2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1928	(Rev C; Notice 1; Notice 2; Notice 3; Notice 4) Padlock (Combination)
FS RR-C-271	(Rev H; Am 1) Chains and Attachments, Carbon And Alloy Steel
FS RR-W-410	(2022; Rev J) Wire Rope and Strand

[1.3 ADMINISTRATIVE REQUIREMENTS

1.3.1 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. Ensure the protection plan 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.

]1.4 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

Fabrication Drawings; G[, [_____]]

Shop Assembly Drawings; G[, [_____]]

Delivery Drawings; G[, [_____]]

Field Installation Drawings; G[, [_____]]

Sequencing and Scheduling; G[, [_____]]

Anchorage of Overhead Support Beam; G[, [_____]]

Stress Relieving Plan; G[, [_____]]

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

Handling Attachments And Pick Points; G[, [_____]]

Diagonals Prestressing Plan; G[, [_____]]

SD-03 Product Data

Materials

SD-04 Samples

Materials; G[, [_____]]

SD-06 Test Reports

Tests, Inspections, and Verifications

Diagonal Prestressing Record

SD-07 Certificates

Epoxy Filler

1.5 QUALITY ASSURANCE

1.5.1 Qualification of Welders

Welders and welding operators are required to conform to the qualification requirements included in 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 as approved by the Contracting Officer. Verify the condition and quantity of the items delivered 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. Ensure rubber seals do not become distorted during handling.

[1.6.2 Epoxy Filler

Receive epoxy filler from the manufacturer just prior to use in the work to insure receipt of recently manufactured material and store the filler 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 SYSTEM DESCRIPTION

2.1.1 Design Requirements

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.

2.1.1.1 Fabrication Drawings

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

2.1.1.2 Shop Assembly Drawings

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

2.1.1.3 Delivery Drawings

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

2.1.1.4 Field Installation Drawings

Within the field installation drawings, provide 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, including 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.

2.2 MATERIALS

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

2.2.1 Metals

****

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

****

All structural steel, steel forgings, steel castings, stainless steel, bronze, [aluminum alloy,] and other metal materials used for fabrication are required to conform to the requirements shown and specified herein and in Section 05 50 15 CIVIL WORKS FABRICATIONS.

2.2.1.1 Structural Steel

Structural steel shapes are required to conform to ASTM A36/A36M. Structural steel plates are required to conform to [ASTM A36/A36M] [ASTM A572/A572M, Grade 50][ASTM A709/A709M, Grade 50].

[2.2.1.2 Steel Pipe

Provide steel pipe conforming 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.

][2.2.1.3 Self-Lubricating Bearings

Ensure self-lubricating bearings conform to ASTM B823, Type II. Impregnate the bearings with a turbine grade lubricant containing oxidation and rust inhibitors and a polar anti-wear additive.

][2.2.1.4 Bronze Castings

Provide bronze castings conforming to ASTM B22/B22M, Copper Alloy UNS No. C91300 [and ASTM B148].

]2.2.1.5 Stainless Steel Bars and Shapes

Provide stainless steel bars and shapes conforming 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.

2.2.1.6 Stainless Steel Plate, Sheet, and Strip

Provide stainless steel plate, sheet, and strip that conforms to ASTM A240/A240M, UNS [S 20910,] [S 30400,] [S 40500,] [S 41008]. Hot-roll, anneal or heat-treat, and blast-clean or pickle plate finish.

Provide No. 1 sheet and strip finish.

[2.2.1.7 High-Strength Steel Bar

Provide high-strength steel bar conforming to ASTM A722/A722M, Type I or II, and all supplementary requirements.

]2.2.2 Rubber Seals

2.2.2.1 Physical Characteristics

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

PHYSICAL TEST	TEST VALUE	TEST METHOD SPECIFICATION
Tensile Strength	17.2 MPa2500 psi (min.)	ASTM D412
Elongation at Break	450 percent (min.)	ASTM D412
300 percent 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

Perform the "Water Absorption" test with distilled water. Bolt the washed specimen dry with filter paper or other absorbent material and suspend 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. Remove the specimen, allow to cool to room temperature in air, and weigh it. Record the weight to the nearest 1 mg as M1 (M1 is defined in ASTM D471). Ensure the immersion temperature is 70 degrees C plus or minus 1 degree C and the duration of immersion is 166 hours.

[2.2.2.2 Fabrication of Rubber Seals

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

Tensile strength	13.8 MPa2,000 psi
Elongation	250 percent

Ensure the outside surface of the bonded film is flush with the surface of the rubber seal and is free of adhering or bonded rubber. Mold strips and

corner seals in lengths suitable for obtaining the finish lengths shown and with sufficient excess length to provide test specimens for testing the adequacy of the adhesion bond between the film and bulb of the seal. At one end of each strip or corner seal to be tested, mask the fluorocarbon film during bonding to prevent a bond for a length sufficient to hold the film securely during testing.

][2.2.3 Epoxy Filler

Use epoxy filler that is an approved epoxy resin formulation equal to "Loctite Nordback," a product of Hennkel Adhesives, or an approved equal, with a specific gravity of 1.90 to 1.95, minimum compressive strength after 72 hours at 20 degrees C 70 degrees F of 89.6 MPa 13,000 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; Deliver material to the site.

][2.2.4 Zinc Filler

Provide zinc filler that conform to ASTM B6.

2.2.4.1 Safety Provisions for Zinc Filler

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

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

b. Workers are required to wear air-line respirators certified by NIOSH or MSHA. In enclosed spaces, utilize both local exhaust ventilation and air-line respirators. The local exhaust ventilation system is required to include movable hoods placed close to the work to remove fumes at the source.

c. Pre-heat ladles, equipment, and material before use to ensure they are moisture-free.

d. Place heating devices and ladles on a level, firm foundation, and protect against traffic, accidental tipping, or similar hazard.

e. Do not carry hot zinc up or down ladders.

f. Ensure all buckets or vessels used for handling and transporting hot zinc are substantially constructed and not filled higher than100 mm 4 inches from the top.

]2.3 MANUFACTURED UNITS

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

2.3.1 Bolts, Nuts and Washers

Provide high-strength bolts, nuts, and washers that conform to ASTM F3125/F3125M, Grade A325, [hot-dip galvanized] . Bolts, nuts, studs, stud bolts and bolting materials other than high-strength are required to

conform to ASTM A307, Grade A, [hot-dip galvanized] or ASTM A320/A320M, [Ferritic Steel, Grade [_____]] [Austenitic Steel, Grade [_____], Class [_____].] Provide bolts 13 mm 1/2 inch and larger with hexagon heads. Ensure the finished shank of bolts is long enough to provide full bearing. Provide washers for use with bolts that conform to the requirements specified in the applicable specification for bolts.

2.3.2 Screws

Provide screws of the type indicated.

2.3.3 Shackles and Turnbuckles

Provide shackles and turnbuckles of forged steel conforming to ASTM A668/A668M, zinc coated. End-thread turnbuckles right and left hand and provide the size shown.

2.3.4 Screw Jacks

Provide screw jacks with a [_____] ton (metric) (2000 lb) rated capacity and ensure they conform to the details shown.

[2.3.5 Hoists

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

]2.3.6 Winches

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

2.3.7 Sheaves

Provide cast steel sheaves conforming to ASTM A27/A27M, sized for the wire rope used.

[2.3.8 Rails

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

]2.3.9 Wire Rope

Provide wire rope that conforms to FS RR-W-410, Type [_____], Class [_____], Construction [_____], [wire size,] [strand seizing] as shown.

[2.3.10 Wheels

Provide short hub or long hub wheels, rigid type, heavy duty steel casters fabricated from steel castings conforming to ASTM A148/A148M. Provide wheel of the size and load capacity shown complete with lubrication fittings, roller bearings and removable axle. Machine finish wheel treads to conform to the indicated rail. Unless otherwise specified or shown,

wheel axles are required to be stainless steel bars conforming to ASTM A276/A276M, UNS S30400.

][2.3.11 Bridge Planks

Fabricate bridge planks of steel conforming to ASTM A1011/A1011M, Grade 33, with a minimum thickness and minimum section modulus as shown.

]2.3.12 Chains and Attachments

Provide chains and attachments conforming to FS RR-C-271, Type [_____], Grade [_____], Class [_____], Style [_____], Size [_____], Finish [_____].

2.3.13 Padlocks and Hasps

Provide padlocks conforming to CID A-A-1928, Type [I][II]. Key all padlocks alike and provide with two keys. Wrought steel hasps are to be provided and sized to accommodate padlocks.

[2.3.14 Elastomeric Bearing Pads

Provide elastomeric bearing pads conforming to the requirements of ASTM F3125/F3125M, and reinforced with steel plates.

]2.4 FABRICATION

2.4.1 Structural Fabrication

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

2.4.2 Welding

****

NOTE: List applicable welds requiring radiographic examination.

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

The designer is to consider whether any components included are likely to be fracture critical. Fracture critical components should be identified as

requiring fabrication in accordance with a Fracture Control Plan.
****

Ensure welding conforms to the requirements of AWS D1.1/D1.1M, AWS D1.2/D1.2M, the requirements specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Provide welds of the types shown on the contract drawings and approved detail drawings. Radiographic examination is required on the major shop and field welds of the type and location indicated on the drawings and as follows: [_____]. Welds which have been designated to receive radiographic examination and are found to be inaccessible to a radiation source or film, or are otherwise so situated that radiographic examination is not feasible may be examined, with written approval, by dye penetrant, magnetic particle tests, or ultrasonic tests. All components are to be stress-relief heat treated after welding where shown. Perform stress-relieving of components prior to the attachment of miscellaneous appurtenances. Submit a Stress Relieving Plan for approval which follows the minimum requirements for thermal stress relief in accordance with AWS D1.1.[Stress-relief heat treat all components after welding where shown. Perform stress-relieving of components prior to the attachment of miscellaneous appurtenances.][Refer to Specification SECTION 05 50 14 STRUCTURAL METAL FABRICATIONS for nondestructive testing requirements.][Submit a Fracture Control Plan (FCP) for fracture critical components.]

2.4.3 Bolted Connections

Ensure bolted connections conform to the requirements specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

2.4.4 Machine Work

Ensure machine work conforms to the requirements specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

2.4.5 Miscellaneous Provisions

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

2.4.6 Fabrications

Submit samples approved prior to use of the represented materials or items in the work. Submitted samples of standard and shop fabricated items are required to 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 are required to conform to the following requirements.

2.4.6.1 Gate Leaf

The gate leaf is required to be a welded structural steel fabrication 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

performed as shown on approved detail drawings. Fabricate segments to permit easy field-assembly in as few segments as practicable to minimize the number of joints to be field-welded.] Ensure the overall height of gate leaf does 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 are not to vary from a true plane by more than 6 mm.1/4 inch. [Locate splices in [skin plates] [bridge planks] only where shown.] [In addition to welds specifically indicated for nondestructive testing, perform nondestructive testing on [_____] percent of the welds in the girders, verticals and [skin plate] [bridge planks] of the gate leaf. Locate these additional welds for testing as directed.]

[2.4.6.2 Wall Quoin

The wall quoin consists of a welded structural steel frame with adjustable base anchors and adjustable quoin contact [block] [post].

][2.4.6.3 Quoin and Miter Contact [Blocks] [Posts]

Quoins and miter contact [blocks] [posts] are to be made of stainless steel bars conforming to ASTM A276/A276M or ASTM A564/A564M. Make splices in the contact [block] [post] by an offset method so that there will not be a continuous joint across the [block] [post]. Mill contact faces of the contact [block] [post] at splices to assure watertight joints. [Locate splices in the gate leaf contact [block] [post] only at the centerlines of horizontal girders.] Provide contact [blocks] [posts] with adjusting bolts as shown.

][2.4.6.4 Hinge Assembly

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

][2.4.6.5 Pintle Assembly

The pintle assembly for miter gates consists of pintle socket, pintle, and pintle base as shown. Fabricate the pintle socket from cast nickel alloys and press-fit with an aluminum bronze bushing with bearing surfaces finished truly hemispherical. Fabricate the pintle of [cast alloy steel] [forged alloy steel] with bearing surfaces of corrosion-resisting steel. Finish the pintle ball to a 0.4 micrometer 16 microinch finish and fit 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. Match-mark the pintle ball with the bushing when fitted and so erected in the field. Fabricate the pintle base of cast

steel. Drill and ream bolt holes for attaching pintle socket to gate leaf after the pintle socket is assembled with gate leaf.

][2.4.6.6 Trolley Gate Trolley Assembly

The trolley gate trolley assembly consists of trolley beam, two (2) four-wheeled, push type trolleys, and trolley hangers. Provide trolleys that are 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. Provide single-flanged trolley wheels with a diameter of [_____] mm inches and with machine-finished wheel treads to conform with the trolley beam. Mount trolley wheels on weather-protected roller bearings and a removable axle and provide with accessible lubrication fittings. Support trolley hangers by the wheel axle and 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. Locate the centerline of the cross pin [_____] mm inches below the bottom of the trolley beam. For proper clearance, ensure the maximum horizontal dimension from the centerline of the trolley beam to the end of the cross pin does not exceed [_____] m. [_____] ft [_____] in. Provide trolleys designed for continuous outdoor service and painted with the manufacturers standard paint system for outdoor operation.

][2.4.6.7 Trolley Gate Overhead Support Beam

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

][2.4.6.8 Rolling Gate Wheel Assembly

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

][2.4.6.9 Rolling Gate Stabilizing Trolley Assembly

Fabricate the stabilizing support for trolley wheels from structural steel conforming to ASTM A36/A36M. Fabricate trolley wheels from steel rated for the minimum load shown. Provide single-flanged trolley wheels and ensure the wheel treads are machined-finished to conform with the guiding gate girder. Mount trolley wheels on weather-protected roller bearings and a removable axle and provide with lubrication fittings.

]2.4.6.10 Seal Assembly

the seal assembly consists of rubber seals, steel retainer and spacer bars, [retractable support,] and fasteners. Provide continuous rubber seals over the full length. Fit the seals accurately and drill for proper installation. Drill bolt holes in the rubber seals by using prepared templates or the retainer bars as templates. Splices in seals are required to be fully molded and develop a minimum tensile strength of 50

percent of the unspliced seal, and occur only at locations shown. Shop vulcanize splices. Locate the vulcanized splices between molded corners and straight lengths as close to the corners as practicable. Place splices on a 45 degree bevel related to the "thickness" of the seal. Ensure the surface of finished splices is smooth and free of irregularities. Field-splice steel retainer bars only where shown. Machine-finish steel retainer bars after splicing. [Provide the retractable support complete with hinge and operating winch.]

2.4.6.11 Miscellaneous Embedded Metals

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

2.4.7 Shop Assembly

Shop assembly requirements for gates and appurtenant items are required to be provided as shown and specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Completely shop assemble gates and appurtenant items, unless otherwise approved, to assure satisfactory field installation. Fit and bolt together adjoining components to facilitate field connections. Carefully preserve the match-marking of unassembled items until the items are assembled. Cover mating surfaces and machined surfaces with a rust preventive until assembly. Shop-weld assembled components in their final positions as much as delivery and field installation conditions will permit. Fit and drill rubber seals to match the seal retainers, match-marked them, and remove for shipment. [Suspend the trolley gate in the shop to verify its center of gravity location. If the trolley gate is more than 3 mm 1/8 inch out-of-plumb in the suspended position, balance it by means as directed.] Perform shop assembly and disassembly work in the presence of the Contracting Officer unless waived in writing. The presence of the Contracting Officer does not relieve the Contractor of any responsibility under this contract.

2.5 TESTS, INSPECTIONS, AND VERIFICATIONS

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

2.5.1 General

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

[2.5.2 Testing of Rubber Seals

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

Test the fluorocarbon film of rubber seals for adhesion bond in accordance with ASTM D413 using either the machine method or the deadweight method. Cut 25 mm 1 inch long piece of seal from the end of the seal which has been masked and subjected to tension at an angle approximately 90 degrees to the rubber surface. Ensure there is no separation between the

fluorocarbon film and the rubber when subjected to the following loads:

THICKNESS OF FLUOROCARBON FILM	MACHINE METHOD AT 50 MM2 INCHES PER MINUTE	DEADWEIGHT METHOD
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 per the requirements specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Assemble miter gates and appurtenant items for installation in strict accordance with the contract drawings, approved installation drawings, and shop match-markings. Thoroughly clean and lubricate bearing surfaces requiring lubrication with an approved lubricant before assembly and installation. Ensure components to be field-welded are placed in correct alignment before welding is commenced. Design and submit handling attachments and pick points required to be added to any specified items herein prior to installation.

3.1.1 Embedded Metals

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

3.1.2 Lower Hinge Assembly

Embed the base anchors for the lower hinge assembly in the first pour concrete. Attach the base plate to base anchors, set to the final position, and place epoxy fill in the void behind the base plates and then allow fill to reach the strength as shown and the approved field installation drawings. After the gate leaf is set in place, adjust the hinge assembly to provide for continuous contact between the sealing surfaces over the full height and length of the gate leaf. Make allowances for the seals which are not attach until painting operations are completed. Place second pour concrete after final adjustments are completed.

3.1.3 Gate Leaf

Assemble gate leaf components not assembled in the shop in the field as required for installation. [[Coat lower hinge assembly bearings] [pintle ball] with grease prior to setting the gate leaf in place.] [Flush the grease pipes prior to connecting to bearing.] Take all necessary precautions to avoid distortion of the gate leaf or any component parts. Exercise special care during installation to prevent any sag of the 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, plumb the gate leaf and bring into correct position.

3.1.4 Diagonals

Attach gate leaf diagonals to the gate leaf after the leaf is set in place. Perform diagonals prestressing before the final adjustment of the quoin and miter contact [blocks] [post] are made. Prestress diagonals as specified, shown, and as approved on the Diagonals Prestressing Plan developed by the Contractor. Submit approved diagonal prestressing plan prior to initiating the prestressing operations. Submit diagonal prestressing record immediately after completion of the prestressing operations. Within the plan for prestressing the diagonals, 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. Collect initial strain gage readings after slack is removed.

2. Collect final strain gage readings 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.

[3.1.5 Top Hinge Assembly

After the gate leaf has been set in place, install and adjust the top hinge assembly 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 is required to swing horizontally throughout its range of movement. [Make any required final adjustments to the top hinge assembly after the gate leaf diagonals have been prestressed.] Make the second pour concrete after final adjustments are completed.

][3.1.6 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, adjust the gate leaf quoin and miter contact [blocks] [posts] 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, swing the gate leaf out of miter and pour [epoxy] [zinc] filler behind the quoin and miter contact [blocks] [posts]. Prior to pouring of the filler, ensure the surfaces to receive the filler are free of dirt, rust, and other foreign materials. Coat the adjusting and holding bolts with grease or other bond breaker to prevent adherence of the filler.

3.1.6.1 Placing [Epoxy] [Zinc] Filler

[Epoxy Filler: Explicitly follow the manufacturer's instructions for placing the epoxy filler. Take special precautions to prevent leakage of the filler during placement. Ensure that the complete masses of the metals whose surface areas are to receive the epoxy filler have a temperature of15 to 30 degrees C. 60 to 90 degrees F. Keep the epoxy filler free from moisture or other foreign materials during mixing and placement and for at least 48 hours after placement. Conduct a field test to determine the indentation hardness of the epoxy filler compound 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. Take necessary care 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, pre-heat the adjacent metal components 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. Pour the zinc filler at a temperature which will insure that it will completely fill all interstices. Maintain pouring temperature of zinc filler between 430 and 480 degrees C 810 and 900 degrees F to minimize volatilization and oxidation of the zinc.]

[3.1.6.2 Adjusting Contact [Blocks] [Posts]

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

]][3.1.7 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.

][3.1.8 Rolling Gate Stabilizing Trolley Assemblies

Install rolling gate stabilizing trolley assemblies after the gate is set in place and properly adjusted. Place assemblies on the top girder of the gate leaf, attach to anchors embedded in the top of the supporting concrete wall, shim as required, and secure in place.

]3.1.9 Painting

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

3.1.10 Seal Assemblies

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

3.2 SYSTEM STARTUP

3.2.1 Trial Operation

After completion of the gate installation, conduct an examination of the gates in the presence of the Contracting Officer for final acceptance. First examine the gates to determine whether or not the workmanship conforms to the specification requirements. Operate the gates from the fully-opened to the fully-closed position a sufficient number of times to demonstrate to the Contracting Officer's satisfaction that all parts are functioning properly. The workmanship in the fabrication and installation of gates is the result in a condition where when the gates are in the closed position watertight barrier is formed across the opening. The contractor is required to make all repairs or replacements to correct defects, as determined by the Contracting Officer, at no cost to the Government. Repeat the trial operation after defects are corrected. Prior to final acceptance of the gates, provide temporary restraints to prevent unauthorized operation of the gates.

3.3 FIELD QUALITY CONTROL

Non-Destructive testing of field welds are required to meet the same quality control requirements of shop-welded components.

3.4 PROTECTION

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

-- End of Section --