

SECTION 11 83 00 STAINLESS STEEL SLUICE GATES



PART 1 GENERAL

1.1. SCOPE OF WORK

This section covers stainless steel sluice gates sealing on both sides and bottom, upwards opening and their associated accessories for operation. The contractor shall furnish all labor, materials, equipment and incidentals required to install and field test the gates shown on the Contract Drawings and specified herein.

1.2. REFERENCES

A. Definitions

Design Head: The maximum differential head that will be applied on the gate under worst case conditions, measured from the gate invert. Design head shall be equal to the height of the slide.

Seating Head: Head applied on a wall mounted gate, in the direction that pushes the gate against the wall it is installed on.

Unseating Head: Head applied on a wall mounted gate in the direction pulling the gate away from the wall it is installed on.

Operating Head: The highest differential head that is to be applied on the gate when it needs to be operated, measured from the gate invert.

B. Reference Standards

ANSI/AWWA C561 – Fabricated Stainless Steel Sluice Gates.

ASTM A240/A240M – Standard Specification for Chromium and Chromium Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes.

ASTM A582/A582M - Standard Specification for Free-Machining Stainless Steel Bars.

ASTM A790/790M - Standard Specification for Seamless and Welded Ferritic / Austenitic Stainless Steel Pipe.

ASTM B179 - Standard Specification for Aluminum Alloys in Ingot and Molten Forms for Castings from All Casting Processes.

ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.

ASTM D4020 - Standard Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials.

ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

1.3. SUBMITTALS

A. Drawings

The sluice gate manufacturer shall submit signed and sealed drawings by a Licensed Engineer in the state of the Texas for acceptance by the Engineer of Record (EOR), including the general arrangement drawings and fastening information of the equipment supplied under this section. Drawings must indicate all dimensions that will allow the contractor to ensure coordination with dimensions of the installation environment. Drawings will also show sufficient details to determine compliance with the requirements, including the stainless-steel plate thickness used for all components. Drawings shall also include certification that the sluice gates supplied meet all requirements of the latest edition of AWWA C561.

B. Design Calculations

The gate manufacturer shall submit signed and sealed calculations by a Licensed Engineer in the state of the Texas for acceptance by the EOR, containing design calculations demonstrating compliance with the design requirements of these specifications and those of the latest edition of AWWA C561. In particular, calculations shall be submitted for the following gate components:

- Slide
- Seat contact pressure
- Frame
- Yoke
- Stem, stem connection
- Lifting nut
- Manual actuator operating force
- Anchors

C. Installation, Operation and Maintenance Manual

The gate manufacturer shall provide a manual containing the instructions for installation, operation and maintenance of the sluice gates. The manual shall also contain the detailed information on the terms of the 5-year warranty on the products.

D. Gearbox Exchange

The gate manufacturer shall provide the contractor any information deemed necessary by contractor to coordinate gearbox exchange.

1.4. QUALITY ASSURANCE

A. Qualifications

All of the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 15-year experience designing and manufacturing water control gates. The manufacturer shall have manufactured water control gates for a minimum of 100 projects.

B. Standards and Certifications

The gates supplied under this section shall conform to all requirements of the latest edition of ANSI/AWWA C561. The sluice gate manufacturer must maintain an ISO-9001 certification and a company certification for its welding operations from the CWB or AWS.

1.5. DELIVERY

The manufacturer shall use due and customary care in preparing the gates and accessories for shipment. Self-contained frame gates shall be shipped assembled with stem and manual operator, whenever size permits. When shipping several gates together, every item shipped separately must be clearly marked to the gate it belongs to.

1.6. WARRANTY

The sluice gates and manual operating accessories shall be covered by a five (5) year warranty from the manufacturer against defects in materials, design and workmanship. The warranty period will start from the date of delivery of the equipment to the installation site.

PART 2 PRODUCTS

2.1. EQUIPMENT

A. Manufacturers

Gates supplied shall be FONTAINE-AQUANOX Series 25 Channel Gates (Model 253), as manufactured by ISE Metal Inc. or approved equal.

B. Description

The gates shall be upwards opening of the 3 sides non-sealing type designed for water or wastewater applications. They shall allow storm water flow through the openings downstream. In conjunction with allowing the flow of water through the horizontal bar openings, the bars will collect grass clippings and other debris. As specified in the gate schedule and drawings, each gate shall be either open-frame or self-contained-frame design and either rising or non-rising stem configuration.

C. Performance and Design

1. Slide

The slide consisting of a 2inch square/rectangular horizontal tubes spaced at 6 inches on center shall be designed to withstand the design head specified in the gate schedule and drawings with a maximum deflection of 1/720 of the gate opening width and with stresses in the slide limited to 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength, whichever is less. Minimum material thickness of all members of the slide shall be ¼ in (6mm).

2. Frame

The gate frame shall be made of formed plates or structural members creating the clear opening of the specified dimensions in a rigid one-piece unit. In wall mounted instances, the mounting and bolting flange of the frame to the wall shall be separate and independent from the seating and sealing plane of the slide. In the cases where the frame is mounted to the side walls of a sluice (surface or embedded), the frame shall be designed in such a manner so that access is provided to the side seal retainer bolts. The bottom of the frame will be of the flush invert type. Stresses in the frame under design head shall not exceed 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength, whichever is less. Minimum material thickness of all members of the frame shall be ¼ in (6mm).

3. Yoke
Gates specified as self-contained design shall include a yoke consisting of a beam made of formed plates or structural members mounted on top of the frame to permit mounting of the actuator with proper stem alignment by the use of slotted holes in both directions. The yoke shall be sized to limit deflection under the design load to a maximum of 1/360 of the gate opening width or ¼ in (6mm) whichever is less. The yoke design load must be considered as the vertical thrust generated by a 80 lbs (356 N) force on the crank or handwheel (for a manual actuator). Per the latest edition of AWWA C561, the stresses in the yoke generated by the design load shall not exceed (for a manual actuator) 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength, whichever is less.
4. Guiding and Seating
The slide shall seat and travel on guides made of ultra high molecular weight polyethylene (UHMWPE) designed to perform for the life of the sluice gate without replacement. The slide shall be kept in positive contact with the guides on both its upstream and downstream faces, all along its travel in the gate clear opening by an elastomeric cord. Above the gate clear opening, the guides shall extend high enough to ensure that the slide is supported on a minimum of 1/2 of its height when fully opened. The low friction guides shall be secured to the frame by bolted retainers allowing factory adjustment of the contact pressure with the slide. The surface of contact on the side seats shall be large enough to limit the stress under the design head to 600 psi (4137 KPa) without considering the bottom seat as load bearing.
5. Sealing
Not Required
6. Stem Connection
In the case of gates with rising stems, the stem or its extension will be connected to the slide by means of a pinned connection. Stem connection design shall limit the stress under the design load to a maximum of 25% of the ultimate tensile, compressive, and shear strength and 50% of the yield strength. The stem connection design load shall be the thrust and torque developed when a 80lbs (356N) efforts is applied the crank or handwheel (for a manual actuator), or 1.5 times the thrust and torque developed with the actuator in stalled condition (for electric motors).
7. Stem
The stem configuration shall be rising or non-rising according to the type specified in the schedule and drawings. The threads shall be machine rolled ACME left hand threads with double entry to minimize the number of turns required for operation and provide gate opening by counterclockwise rotation of the manual actuator. Surface finish of the machined threads will be 32 micro inch (0.813 µm) or better. For manually operated gates with rising stem, the stem shall be equipped with an adjustable stop collar to prevent over-closing the gate and potentially damaging components.

The stem shall be sized so that its critical buckling load (as determined by the Euler column formula) is higher than the design compression load, defined as the vertical force developed by a 80lbs (356N) effort applied on the crank or handwheel (for a manual actuator), or 1.5 times the thrust and torque developed with the actuator in stalled condition (for electric motors).
8. Couplings
The required stem extensions shall be joined together or to the threaded stem by means of a bolted connection, passing through both pipe and stem.
9. Stem guides
Guides will be provided as required to meet the stem buckling design criteria and positioned per the manufacturer's recommendations to ensure that the length to radius of gyration ratio (l/r) does not exceed 200. The guides shall incorporate a UHMWPE bushing supported by a stainless-steel wall bracket adjustable in both horizontal directions.

D. Manual Actuators

1. Operation

Manual actuator of the proper type and mounting location, as listed in the gate schedule and drawings, shall be provided by the gate manufacturer. The effort required on the manual device to operate the gates shall not exceed 40 lbs (178 N), while to start the gate in motion from the fully closed position with the design pressure, the required effort shall not exceed 60 lbs (267 N). Indication of the opening direction of rotation shall be clearly marked in a permanent manner on the handwheel or crank.

2. Crank Operated Gearboxes

The gearbox, comprising a lift nut and thrust bearing assembly (as described below), shall be fully enclosed in a casted housing with seals around the lift nut and around the input pinion shaft. The input pinion shaft shall be supported on ball or tapered roller bearings. The removable crank equipped with a revolving grip shall engage on the input shaft of the gearbox and have a minimum radius of 12" (305mm). Gearbox and crank shall be replaced with an aftermarket gearbox with a 2" hand nut and a handwheel as shown on the drawings.

3. Actuator Lift Nut and Thrust Bearings

All gates shall include a thrust bearing assembly comprising a threaded bronze lift nut to engage the operating stem. This assembly must be enclosed in a machined stainless-steel housing or be an integral part of the gearbox when supplied. Needle roller thrust bearings shall be provided above and below the lift nut to support the operating efforts in closing and opening the gate. The length of thread engagement shall be sufficient to ensure that the maximum pressure on the projected area of thread contact does not exceed 2000 psi (13,8 MPa) at normal maximum operating load and that the PV (pressure velocity) factor does not exceed 30,000. The PV factor is calculated by multiplying the pressure on the projected area of thread contact in psi by the surface velocity in ft/min at the pitch diameter of the threads. For non-rising stem gates, the actuator lift nut shall be keyed to prevent rotation relative to the threaded stem.

4. Mounting

The thrust bearing assembly or the gearbox shall be mounted on the yoke of the gate for all gates specified as self-contained. Pedestal height shall be such that the handwheel or input shaft of the gearbox is located approximately 36" (900mm) above the operating floor. Where shown on the drawings or when specified, a wall bracket shall be supplied to support the pedestal. The pedestal wall bracket shall be designed and supplied by the gate manufacturer to ensure that it can resist to all operating efforts of the gate based on the same design calculation criteria used for the yoke.

5. Stem Cover

All rising stem gates, weather manual or motorized shall be equipped with a clear stem cover with a closed top and ventilation hole. The cover shall bear graduation in both inches and centimeters to indicate the position of the gate.

E. Anchor Bolts

1. The quantity, size and location of anchor bolts shall be determined by the gate manufacturer and shown on the submittal drawings. The minimum required load capacity shall be determined by the gate manufacturer and shown on submittal calculations.

F. Materials

Slide, Frame and Yoke	Stainless Steel	ASTM A240, grade 316L
Side Seal/Guides	Ultra High Molecular Weight Polyethylene (UHMWPE)	ASTM D4020
Flush Invert Bottom Seal	Ethylene Propylene (EPDM)	ASTM D2000
Compression Cord	Ethylene Propylene (EPDM)	ASTM D2000
Wall Gasket	Ethylene Propylene (EPDM)	ASTM D2000
Bolts and Hardware	Stainless Steel	ASTM F593, grade 316

Stem	Stainless Steel	ASTM A582, grade 316
Thrust Nut and Lift Nut	Aluminum Bronze or Manganese Bronze	ASTM B505, C95800 ASTM B584, C86300
Stem Couplings	Stainless Steel or Bronze	ASTM A582, grade 316 ASTM B505, C95800 ASTM B584, C86300
Stem Guide Bracket	Stainless Steel	ASTM A582, grade 316
Stem Guide Bushing	Ultra High Molecular Weight Polyethylene (UHMWPE)	ASTM D4020
Crank	Stainless Steel	ASTM F593, grade 316
Pedestal	Stainless Steel	ASTM F593, grade 316
Gearbox Housing	Cast Iron	ASTM A48 35B/40B
Square Nut	Cast Aluminum	ASTM B179
Stem Cover	Clear PVC	
Stem Cover Cap	PVC	

PART 3 EXECUTION

3.1. INSTALLATION

- A. It is the responsibility of the Contractor to handle, store and install the gates in strict accordance with the manufacturer's instructions and recommendations. The Contractor shall review the installation drawings and instructions before proceeding to the installation of the gates.
- B. The gate assemblies must be installed on a true vertical plane, square and plumb. The operating stem shall be accurately aligned with the gate guides and properly greased.

3.2. FIELD TESTING

- A. After installation, the gates must be field tested by the Contractor, in the presence of the Engineer, Owner and manufacturer's representative, to ensure compliance with the requirements of these specifications. Each gate shall be operated on its complete open-close cycle to confirm operation without binding, scraping or distorting. Operating effort on the crank, handwheel or T-wrench shall be observed or measured.
- B. Each gate shall be water tested by the Contractor.
- C. The Contractor shall supply a detailed report of the field tests to the Engineer for review.

3.3. METHOD OF MEASUREMENT

- A. "Sluice Gate Replacement" will be measured by each sluice gate as a unit. The unit to be paid for will be determined by the number of gates that are provided by the manufacturer, gearbox exchange, non-shrink grout, coordination efforts and any other appurtenances required to complete the work in accordance with Contract Documents. The Contractor shall furnish suitable documentation and measuring devices to assure correct proportioning and accurate measurement for calculating payment quantities.
- B. "Gate Removal" will be measured by each sluice gate as a unit. The unit to be paid for, will be determined by the number of the existing gates and anchors to be demolished, repaired, dewatering and water control of the project site, waste removal, and any other appurtenances required to complete the work in accordance with Contract Documents. The Contractor shall furnish suitable documentation and measuring devices to assure correct proportioning and accurate measurement for calculating payment quantities.

3.4. BASIS OF PAYMENT

- A. Payment shall be at the contract unit price for the accepted quantities by “Method of Measurement” Section 3.3. The price shall be full compensation for furnishing all materials and for all labor, equipment, tools and incidentals necessary to complete the item including but not limited to dewatering and water control of the worksite, the saw-cutting and removal of the existing concrete pavement, removal of existing gate and anchors, completion of soundness testing, protection of joints and surrounding pavement/structure, installation of sluice gate, patching, polyester polymer concrete, curing, clean-up and appurtenances necessary to complete work in accordance with Contract Documents.

STAINLESS STEEL SLUICE GATES SCHEDULE

Item	ID TAG	Qty	SIZE (W x H) (inches)	DESIGN HEAD (ft)		FRAME TYPE	STEM TYPE	ACTUATOR TYPE	ACTUATOR MOUNTING	
				Seat.	Uns.					
1	SG	4	BC	DG	DG	SC	RS	GC	P	

ABBREVIATIONS:

FRAME TYPES:

- SC: Self-Contained
- NSC: Non Self-Contained

STEM TYPE:

- RS Rising Stem
- NR Non-Rising Stem

ACTUATOR TYPES:

- H: Handwheel
- GC: Gearbox and Crank
- GH: Gearbox and Handwheel
- EM: Electric Motor Actuator
- SN: Square Nut

ACTUATOR MOUNTING:

- P: Pedestal Mounted
- PB: Pedestal Mounted with Wall Bracket
- F: Floor Box
- Y: Yoke Mounted

ADDITIONAL:

- BC: By Contractor
- DG: See Drawings

END OF SECTION