



SPECIFICATION: CAST IRON SLIDE & WEIR GATES

PART 1 GENERAL

SCOPE OF WORK

The CONTRACTOR will furnish all labor, materials, equipment, and incidentals required to install, ready for operation, and field test cast iron, bronze mounted slide gates and appurtenances as shown on the Contract Drawings and as specified herein.

The slide gates and appurtenances will be supplied in accordance with the latest edition of the AWWA C560 Standard for Cast Iron Slide Gates as modified herein.

REFERENCES

AWWA C560	Cast Iron Slide Gates
ASTM A126	Gray Iron Castings for Valves, Flanges and Pipe Fittings
ASTM A436	Austenitic Gray Iron Castings (NiResist)
ASTM A536	Ductile Iron Castings
ASTM A240	Stainless and Heat Resisting Plate
ASTM A276	Stainless and Heat Resisting Steel Bars and Shapes.
ASTM F593	Stainless Steel Bolts, Hex Cap Screws and Studs
ASTM F594	Stainless Steel Nuts
ASTM B21	Navel Brass Rod, Bar and Shapes
ASTM B98	Copper-Silicon Alloy Rod, Bar and Shapes
ASTM B139	Phosphor Bronze Rod, Bar and Shapes
ASTM B187	Copper, General Purpose Rod, Bar, and Shapes
ASTM D2000	Rubber Products in Automotive Applications
AWS D1.6	Structural Welding Code – Stainless Steel

SUBMITTALS

Provide the following information to confirm compliance with the specification in addition to the submittal requirements specified in Section_____.

Complete description of all materials.



Installation drawings showing all details of construction, details required for installation, dimensions, and anchor bolt locations.

Calculations for maximum operating load, hoist selection, and stem design.

QUALITY ASSURANCE/QUALIFICATIONS

All equipment specified under this Section will be furnished by a single manufacturer with a minimum of 20 years of experience producing Cast Iron Slide Gates and will have a minimum of 100 Cast Iron Slide Gate installations. Gate frame and slide will be cast in a foundry under the direct supervision of gate supplier's personnel to ensure a high-quality casting. If using a third-party foundry, submit foundry pre-qualifications and references for evaluation and approval.

The manufacturer will test each slide gate specified in this specification section at its testing facility prior to shipment. Submit test reports per PART 2.03 Shop Testing.

PART 2 EQUIPMENT

GENERAL

Each slide gate will be manufactured as detailed here and will be supplied tested as per requirements. To the maximum extent possible, the gate assembly comprising of frame, guides and slide will be supplied as a factory assembled unit and shipped to site ready to install on the wall thimble or wall.

The slide gates will be manufactured from cast iron and will be flat or flange back type suitable for wall thimble or wall mounting and manufactured in accordance with AWWA C-560.

The gate manufacturer will be
Rodney Hunt, Inc.
or prior approved equal.

The slide gates will be designed for water tightness for both seating and un-seating differential head per the actual site requirement as detailed in the Cast Iron Slide Gate Table.

The slide gates will have a seating and un-seating leakage rate of 1/2 the leakage rate allowed by AWWA-C560.



All slide gates will be shop tested to verify the leakage performance at operating head in the un-seating direction. Hydrostatic testing will be conducted at 1.5 times operating head, to demonstrate structural integrity. Opening load at unseating operating head will be measured to verify actuating mechanism sizing.

The slide gates will be of rising stem type unless site geometry prohibits it. Operation will be by means of a manual hoist, electric actuator or hydraulic cylinder as detailed in the Slide Gate Table.

The slide gate will be supplied complete with all accessories such as: wall thimble, gate assembly, gasket between wall thimble and gate assembly, studs and nuts for mounting on the thimble, stem, thrust nut, stem couplings, stem guides, pedestal, operating mechanism as required, gate opening indicating arrangement and as required anchor bolts and fasteners for stem guides and pedestal. The gate will utilize adjustable wedges. All wedge attachment will include a key and keyway or other positive means to prevent rotation.

FRAME AND GUIDES

The frame will be cast iron, one-piece construction with rectangular opening. The gate frame will be sufficiently rigid to withstand the designated water head. The frame will be flat or flange back, conventional, or self-contained as shown on the Contract Drawings and identified in the Slide Gate Table.

The back flange of the gate frame to be precisely machined flat and drilled to engage with the cast iron wall thimble mounted in the wall. A resilient gasket or mastic will be provided to seal between the flange of frame and wall thimble.

The gate frame will be self-contained or non-self-contained in accordance with the Cast Iron Slide Gate Table. Non-self-contained frames will have sufficient length guides to contain no less than one-half the slide in the fully open position on upward opening slide gates or downward opening weir gates. Self-contained frames will extend sufficiently to attach a yoke for mounted the operating mechanism at the appropriate height. All operating loads for self-contained gates will be reacted within the frame with no significant loads imposed on the civil works.

SLIDE

The gate slide will be cast iron and will be ribbed to withstand the designated water head as defined in the Cast Iron Slide Gate Table.

The gate slide will be provided with an integral pocket for the thrust nut connecting the stem with the slide. The slide and thrust nut will be designed to safely withstand the stem design load as defined by this specification.



For non-rising stem applications, the thrust nut will be located above the gate opening.

SEATING/SEALING FACES

Seating/Sealing facing will be bronze or stainless steel. Refer to the materials table below.

Bronze facing will be mechanically swaged into machined dovetailed grooves in the gate frame and slide. At the option of the manufacturer, stainless steel seat facings may be attached with taper screws which cannot be mechanically removed after fitting on facings. The taper screws will be of same material as that of the seat facings. Taper screws will be machined flush with the seat facing to provide an uninterrupted sealing surface. The contact pressure on bronze seat facings cannot exceed 900 psi under full operating head calculated based only the side seat facings. For stainless steel, the limit is 750 psi.

The sealing surfaces will be machined to a 32 micro inch finish. The mating seating/sealing faces on the gate frame and slide will be precisely finished for proper contact. The mating surfaces will exclude a 0.004" feeler gauge at all points.

WEDGING DEVICES

The slide gates will be provided with individually adjustable wedging devices to ensure proper contact of the frame and slide seat facings to achieve the required leakage performance.

Slide gates used for seating head conditions only will be provided with side wedges. Slide gates wider than 24", used for unseating heads will have side and top wedging devices. The bottom will have wedges or a flush bottom closing arrangement as required by the installation geometry.

The wedging system includes wedge brackets on the frame. The wedge bracket will remain in a fixed position and the mating wedge on the slide will be adjustable or vice versa. A key and keyway arrangement will be provided on the base of wedge brackets to prevent any tendency to shift. Provision will be made to secure the adjustable brackets firmly in adjusted position.

The adjustable wedges will be made of solid cast bronze, machined on all contact surfaces. The fixed wedging surface will be bronze faced.

CONVENTIONAL OR FLUSH BOTTOM CLOSING



Conventional closure slide gates will have corrosion resistant metal seat facings around the entire perimeter.

Gates whose inverts are either flush with the concrete or have less than 10" of height difference will be provided with a flush bottom, resilient seal, HYQ™. The resilient seal will be mounted on the frame to prevent it from being exposed to the flow. Gates with less than 20 feet of operating head may have the seal on the slide.

WALL THIMBLES

Cast iron wall thimbles will be provided as shown on the Contract Drawings and detailed in the Cast Iron Slide Gate Table.

The wall thimble will be made from cast iron. Its front flange will be machined, drilled and tapped to match with the frame flange. The word "TOP" and centerlines will be stamped or machined in the front flange.

The cross section of the thimble will be as shown on the Contract Drawings and detailed in the Cast Iron Slide Gate Table. Gates larger than 48" in either dimension will have wall thimbles no less than 18" deep unless precluded by wall thickness. Gates subjected to unseating heads in excess of 30 feet will have either E-section or MJ-section wall thimbles.

To permit entrapped air to escape as the thimble during the concrete pour, 1.25" minimum diameter holes will be provided on the bottom of the wall thimble in each entrapment zone.

OPERATING STEM

The slide gates will be supplied with rising type operating stems unless non-rising stems are required by installation geometry.

The stem will be supplied with ACME full or stub threading. The stem will be designed to allow for elevation deviations of up to 2".

The design of stem will be per the provision in AWWA C-560.

The L/r ratio will not exceed 200.

For buckling, Euler's formula will be used with an end condition of 2.0. For threaded sections, the radius of gyration will be based on the minor diameter. At



the stem design load as follows, the yield strength of the material will not be exceeded.

As a minimum for manual hoists, the stem design load is the load produced with a 100 pound effort on the crank or handwheel.

For electric actuators, the stem design load is the greater of the load produced with a 100 pound handwheel effort and 1.25 times the load produced at a locked rotor condition.

For hydraulic actuation, the stem design load will be 1.25 times the thrust produced at system relief pressure.

STEM GUIDES

Stem guides will be provided as required to meet the stem design criteria.

Wall mounted stem guides will be adjustable in two directions, providing at least 0.50" of adjustment in both directions. Wall brackets will be cast iron or stainless steel.

Wall mounted stem guides will have machine bored, split bushings to facilitate erection. Bushings will be bronze or UHMWPE. Stem guides mounting at the base of the pedestal do not require adjustment.

MANUAL OPERATOR MECHANISMS

Unless otherwise shown on the Drawings, gates shall be operated by a manual handwheel or a manual crank-operated gearbox. The operator shall be mounted on the yoke of self-contained gates or on the pedestal of non-self-contained gates.

The gate manufacturer shall select the proper gear ratio to ensure that the gate can be operated with no more than a 40 lb. effort when the gate is in the closed position and experiencing the maximum operating head.

An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the gate.

Handwheel operators shall be fully enclosed and shall have a cast aluminum housing.

Handwheel operators shall be provided with a threaded cast bronze lift nut to engage the operating stem.



Handwheel operators shall be equipped with roller bearings above and below the operating nut.

Positive mechanical seals shall be provided above and below the operating nut to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.

The handwheel shall be removable and shall have a minimum diameter of 15 inches.

Crank-operated gearboxes shall be fully enclosed and shall have cast aluminum or ductile iron housing.

Gearboxes shall have either single or double gear reduction depending upon the lifting capacity required.

Gearboxes shall be provided with a threaded cast bronze lift nut to engage the operating stem.

Bearings shall be provided above and below the flange on the operating nut to support both opening and closing thrusts.

Gears shall be steel with machined cut teeth designed for smooth operation. The pinion shaft shall be stainless steel and shall be supported on ball or tapered roller bearings.

Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.

The crank shall be cast aluminum or cast iron with a revolving nylon grip. The crank shall be removable.

All gates having widths in excess of 72 inches and widths greater than twice their height shall be provided with two gearboxes connected by an interconnecting shaft for simultaneous operation.

Interconnecting shafting shall be constructed of aluminum or stainless steel. Flexible couplings shall be provided at each end of the interconnecting shaft.

One crank shall be provided to mount on the pinion shaft of one of the gearboxes.



An extended operator system utilizing chain and sprockets shall be furnished by the manufacturer when the centerline of the crank or handwheel, on a non-gear operator, is located over 48 in above the operating floor. Chain wheels are not acceptable.

A removable stainless steel or aluminum cover shall be provided to enclose chain and sprockets.

The extended operator system shall lower the centerline of the pinion shaft to 36 in above the operating floor.

A handwheel may be utilized in conjunction with a gearbox in lieu of the extended operator system if the centerline of the pinion shaft is 60 in or less above the operating floor.

Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable.

The pedestal height shall be such that the handwheel or pinion shaft on the crank-operated gearbox is located approximately 36 in above the operating floor.

Wall brackets shall be used to support floor stands where shown on the Drawings and shall be constructed of stainless steel.

Wall brackets shall be reinforced to withstand in compression at least two times the rated output of the operator with a 40 lb. effort on the crank or handwheel.

The design and detail of the brackets and anchor bolts shall be provided by the gate manufacturer and shall be approved by the ENGINEER. The gate manufacturer shall supply the bracket, anchor bolts and accessories as part of the gate assembly.

Operators shall be equipped with polycarbonate plastic stem covers.

The top of the stem cover shall be closed and vented. Gate opening indication will be provided on the stem cover for all non-rising stem gates. A full height scale will be mounted on the side of the stem cover and an indicator nut mounted on the rising stem to show gate position. The scale graduation will be 1".

The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.



When shown on the Contract Drawings, provide 2-inch square nut, mounted in a floor box, with a non-rising stem.

The square nut shall be constructed of stainless steel.

The floor box shall be constructed of stainless steel or cast iron and shall be set in the concrete floor above the gate as shown.

Provide one aluminum or stainless-steel T-handle wrench for operation.

ELECTRIC MOTOR ACTUATORS

See Section_____.

ANCHOR BOLTS

Anchor bolts, nuts and washers will be provided by the gate manufacturer for mounting the gates and the appurtenances.

The quantity and location determined by the gate manufacturer.

All anchors will be epoxy type with epoxy provided by the contractor.

Anchor bolts will have a minimum diameter of 1/2-inch.

MATERIAL OF CONSTRUCTION

Frame, Slide, Thimble	Cast Iron ASTM A126 Class B
Stem & Coupling	Stainless Steel ASTM A 276 type 304/316
Stem Guides	Bronze ASTM B584 C865 / C873 UHMWPE
Stem Guide Brackets	Cast Iron ASTM A126 Class B Stainless Steel ASTM A 240 type 304L/316L
Seating Faces, Wedge Lining	Bronze ASTM B21 / ASTM B139 / ASTM B98 Stainless Steel ASTM A 240 type 304/316
Rubber Seals (If applicable)	EPDM Neoprene ASTM D 2000



Rubber Seal Retainer Bar	Stainless Steel ASTM A 240 type 304/316
Assembly Bolts, Nuts and Fastener	Stainless Steel ASTM A 276 type 304/316 Stainless Steel ASTM A 193 / 194 B8 / B8M
Yoke (If applicable)	Cast Iron ASTM A126 Class B Carbon Steel ASTM A36 Stainless Steel ASTM A 276 type 304/316
Wedges, Thrust Nut and Lift Nut	Bronze ASTM B584 C865 / C873

PAINTING

The required painting procedure is as follows:

Gates, Thimbles and other Submerged Cast Iron

Surface Preparation - Blast clean to near white metal finish.

Priming - 1 coat of International Interseal 670 HS primer minimum DFT 4 mils before shop testing.

Touch up primer is required after shop testing.

Finish Painting - International Interseal 670 HS, semi-gloss, two coats, minimum DFT 4 mils/coat. Minimum TDFT 12 mils.

Painting for Non-Submerged Cast Iron

Surface Preparation - Blast clean to near white metal finish.

Priming - 1 coat of International Interseal 670 HS primer minimum DFT 4 mils before shop testing.

Touch up primer is required after shop testing.

Finish Painting - International Interseal 670 HS, semi-gloss, two coats, minimum DFT 4 mils/coat. Minimum TDFT 12 mils.

SHOP TESTING

The following tests will be conducted at manufacturers' facility prior to shipment.

Shop Leakage Test

A leakage test by applying unseating pressure will be conducted at manufacturer's facility. Hydrostatic pressure equal to max seating/unseating application head will be applied to the gate. A suitable, calibrated gauge will be used to measure the pressure. The leakage measured will not exceed 50% of the limit as stated in AWWA C-560.

Operating Load Test



After the first leakage test, the gate will be fully opened and closed to simulate normal operation. For gates up to 80" x 80" the torque required to unseat the gate will be measured and the corresponding load calculated from the gear ratio, gear efficiency and stem factor. The calculated load must be no greater than 1.1 times the value used in sizing the hoisting equipment.

The leakage test will then be repeated without adjusting wedges. In the interest of reliability, no alternate testing arrangement will be permitted in place of above.

Structural Integrity Test

After the leakage tests, a Hydrostatic test will be conducted at the manufacturer's facility. A pressure equal to 1.5 times maximum operating head will be applied to the gate for 5 minutes. No permanent deformation or damage to the casting will be observed.

Seat Clearance Check

With the gate in a closed condition, a 0.004" thick feeler gauge will not pass through between seat facings.

PART 3 EXECUTION

INSTALLATION

Installation of the slide gates and appurtenances will be done in a skillful manner. It will be the responsibility of the CONTRACTOR to handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's recommendations.

The CONTRACTOR will review the installation drawings and installation instruction prior to installing the gates.

The gate assembly will be uncrated or removed from skid and installed as a complete assembled unit without stripping down into components.

The slide gate assemblies will be installed in a true vertical plane, square and plumb.

The CONTRACTOR will add a mastic or gasket between the gate frame and wall thimble (when applicable) in accordance with the manufacturer's recommendations. When the gate mounts directly to the concrete the CONTRACTOR will fill the void in between the gate frame and the wall with non-shrink grout (when applicable) as shown on the installation drawing and in accordance with the manufacturer's recommendations.



FIELD TESTING

After installation, all gates will be field tested in the presence of the ENGINEER and OWNER to ensure that all equipment is in full compliance with this section. Each gate will be cycled to confirm operation without binding, scraping, or distorting. The effort to open and close manual operators will be measured and will not exceed the maximum operating effort specified above. Electric motor actuators will function smoothly and without interruption. Each gate will be water tested by the CONTRACTOR, at the discretion of the ENGINEER and OWNER, and where feasible, to confirm that leakage does not exceed the specified allowable leakage.