

# RADIAL GATES

## USES:

- Maintenance of water elevations in canals or spillways
- Increased storage capacity for reservoirs
- Diversion of water for irrigation
- Flow control preserving wide, clear waterways
- Other areas requiring economical water control

Waterman Overflow or Breastwall-type Radial (Tainter) Gates can be engineered for unique applications or can be manufactured from a standardized Waterman design. In either case, they are always made to the customer's exact specifications. They provide a light-weight economical gate that can be opened and closed with a minimum of effort. Waterman Radial Gates can also be ordered for existing locations as replacement gates.

## CONSTRUCTION FEATURES

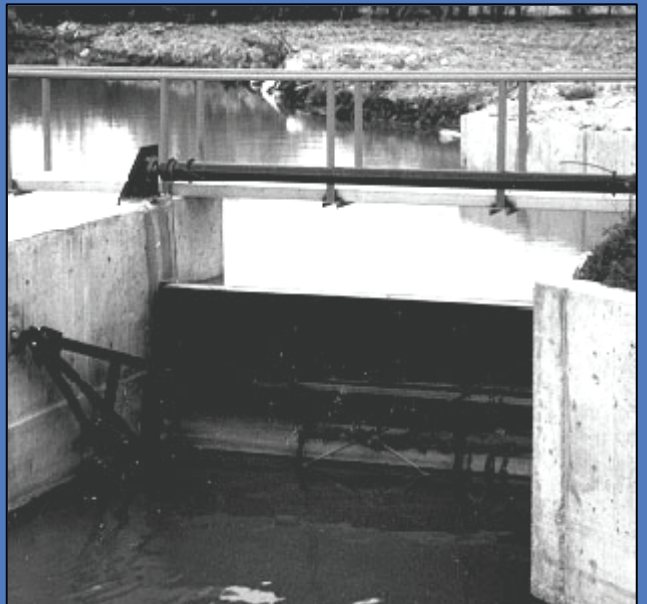
### THE FACE PLATE

The face plate is accurately curved on a required radius to an engineered pivot point. This plate is buttressed along the backside with vertical ribs radiused to match the face plate and stiffened with horizontal support beams along the total width of the plate. The horizontal support beams vary in size with the width of the gate and the maximum head of water. They transfer the pressure from the face plate to the radial arms.

### SEALS

Waterman provides two types of seals. For overflow and breastwall-type gates, J-bulb seals are securely attached along both sides of the face plate. This provides a positive seal against the adjustable rubbing plates embedded in the side wall, and on the bottom of the face plate to seal against the invert. For breastwall-type gates with which there is a headwall, an additional flat seal is attached at the top of the faceplate for sealing against the headwall.

Waterman makes available flat, wiper-type rubber seals in place of the J-bulb type. This type of seal is especially useful for existing installations in which there are no side rub plates.



# RADIAL GATES

## BOTTOM AND SIDE SEALING PLATES

If desired, Waterman can supply galvanized or stainless steel rubbing plates to provide a smooth contact surface for the side seals throughout the full range of movement of the gate. These plates adjust to permit vertical alignment of the contact surfaces. Galvanized or stainless steel bottom sill plates can be supplied to provide a smooth level contact surface for the full width of the invert of the gate. This sill plate can be adjusted to permit leveling and alignment with the side plates.

## RADIAL ARMS

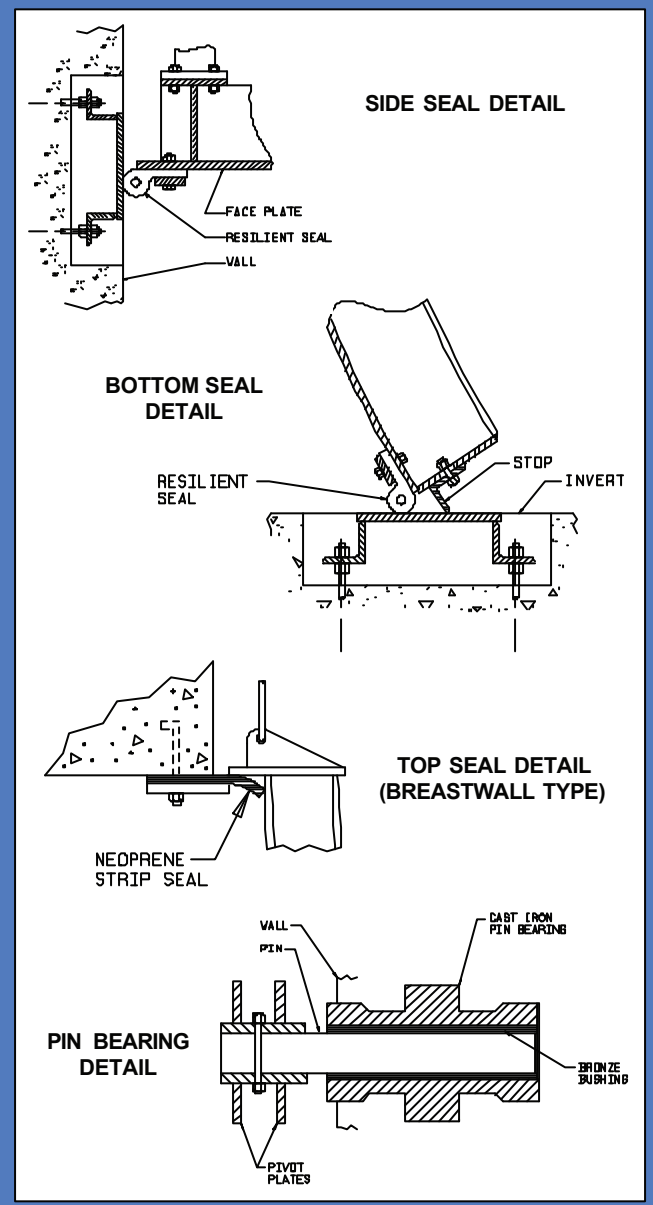
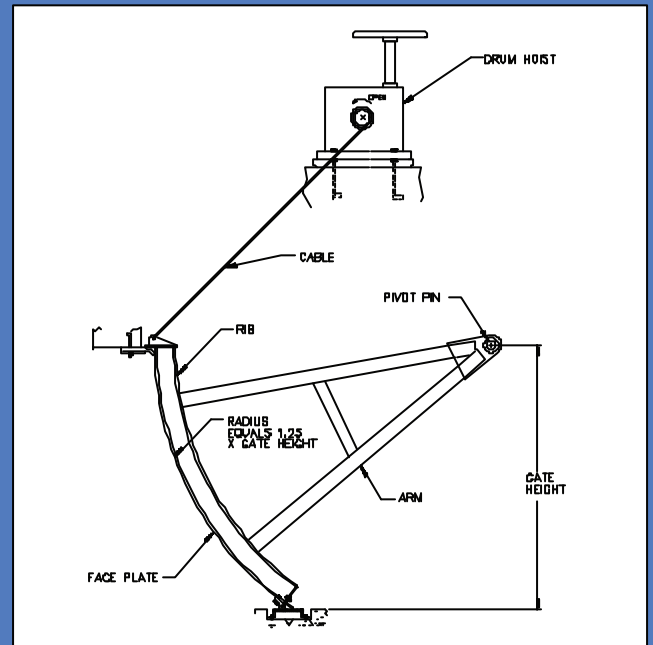
Acting like columns under an arch, radial arms transfer the pressure from the face plate assembly to the pivot bearings on either side of the gate opening. Fabricated from structural steel shapes, larger and thicker members are used as the gate height increases. The radial arms are accurately punched on the forward or upstream end to match corresponding holes in the horizontal support beams. On the downstream end, a steel pin plate assembly is securely welded to the arm to transmit the force to the pivot pin.

## PINS AND PIN BEARINGS

Type 304 stainless steel pivot pins transfer the load to bronze bearings encased in cast iron housings, which are firmly anchored in the concrete structure. The bearings are permanently lubricated or grease lubricated and have sufficient surface area to properly distribute the full load to the structure.

## HOISTS

All Waterman Radial Gates are actuated by cabledrum hoists, each system having twin drums connected by a shaft for winding the two operating cables simultaneously. For powering the cabledrum, Waterman makes available three variations of actuators - a manual hoist with exposed gears; a manual hoist with enclosed gears; and an electric motor operated hoist with auxiliary handwheel.



## TYPICAL SPECIFICATIONS FOR RADIAL GATES

### GENERAL

Gates, hoists, and accessories shall be of the size, type, material, and construction specified herein. They shall be Waterman Industries, Inc. breastwall or overflow type radial gates or approved equal. All component parts shall be of the type of material shown in the Materials section of this specification.

### SIZE AND DESIGN HEAD

The gates shall be designed to withstand the water depth specified as measured from the invert of the gate.

### MATERIALS

Radial gates and appurtenances shall conform to the requirements of the applicable specifications listed below for the alloy, grade, type, or class of material and the condition and finish appropriate to the structural and operational requirements:

MATERIAL	SPECIFICATION (ASTM)
Cast Iron	A 48, Class 30, or A 126, Class B
Structural steel shapes, plates and bars	A 36
Carbon steel bars	A 108, or A 575
Stainless steel	A 167, A 276, or A 582 Type 302, 303, 304, or 304L
Bronze bars, rods, shapes	B 21, or B 98 Permalube Bronze
Steel assembly hardware	A 307
Stainless steel assembly hardware	ASTM F-193 and 194
Galvanizing	A 123, or A 153

### GATE FACE ASSEMBLY

The face assembly shall consist of horizontal structural members, vertical stiffeners and a curved face plate. Horizontal structural members shall be of adequate size and so located to transmit the thrust from the face of the gate to the radial arms. Design loads placed on the structural reinforcing channels shall not induce stresses in excess of those specified in Section 1.51.4 of AISC Specification for Structural Steel Builders. Minimum ¼" thick, curved face plate shall be attached to the structurals by welding. Sufficient holes shall be located around the perimeter of the assembly for attaching the seals.

Each gate shall be fitted with rubber seals, retained by steel bars, along the side and bottom edges of the gate face. The seals shall be of the belt type or "J" type, as specified, and shall be designed to bear on the walls and bottom of the structure or on rubbing plates and sills to insure a water-tight fit when the gate is closed. On breastwall gates, a rubber seal shall also be provided at the top edge of the gate.

### RADIAL ARMS

The radial arm assemblies shall consist of structural members welded to a pin plate and drilled to match gusset plates welded to the horizontal structural members of the face assembly. The slenderness ratio of the radial arms shall not exceed 150. Bolts for field assembly shall be provided.

A steel pin plate shall transmit the load from the radial arms to the pivot pin collar which shall be welded to the pin plate to distribute the bearing load on the pin. The collar shall be match drilled with the pivot pin.

### PINS AND PIN BEARINGS

The type 304 stainless steel pivot pins shall be sized to transmit the load to the pin bearings. They shall be bolted to the pin plate collar for field assembly.

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Permanently lubricated (grease lubricated) bronze bearings encased in cast iron housings shall extend into the concrete and have sufficient surface area to properly distribute the full load to the structure. The bearing shall be bored full length for a running fit with the pivot pin.

#### SIDE SEAL RUBBING PLATES (IF USED)

Galvanized (stainless) steel seal rubbing plate shall provide a smooth contact surface for the side seals throughout the full range of movement of the gate. The rubbing plates shall be adjustable on the anchor bolts to permit vertical alignment of the contact surfaces. Plates shall extend top of wall or minimum one gate height above the gate top in closed position. Rubbing plate shall be ¼" x 6" minimum size.

#### BOTTOM SILL PLATE (IF USED)

The galvanized (stainless) steel bottom sill plate shall provide a smooth, level contact surface for the full width of the invert of the gate. The sill plate shall be adjustable on anchor bolts to permit leveling and alignment with side rubbing plates. Size of bottom sill plate shall be the same as side rubbing plates.

#### WELDING

Manual welding operators performing welding operations on these gates or accessories shall be qualified either under Section 9, Part A of the ASME Boiler and Pressure Vessel Code, or under the "Standard Qualification Procedure" of the American Welding Society. All welds shall have complete fusion with the base metal and shall be free from cracks, oxides, slag inclusions and gas pockets.

#### RADIAL GATE HOISTS - GENERAL

The hoists shall consist of hoist base, hoist operator, cable drums, drum shafts, cables, and bearing bracket to operate the radial gates. The operators shall be adequate for opening of radial gates to double the gate height for operating head specified.

The hoist shall be furnished with cold-rolled steel drum shaft and with two cast iron or steel drums. Drums shall be accurately machined to the same diameter and attached to the drum shaft. Galvanized (stainless) steel cables and clamps shall be furnished for field connection of the drums and to the gate.

#### MANUAL HOIST (ENCLOSED GEAR)

The manual hoist operator shall consist of worm and worm gear, with reduction spur gears as required, totally enclosed in cast iron housing. A suitable size handwheel, located approximately 36" above operating surface, shall be provided to produce necessary output torque to raise gate when maximum 40 pound pull is exerted on handwheel rim. The direction of rotation to open gate shall be marked on handwheel.

#### ELECTRIC MOTOR OPERATED HOIST

The electric hoist actuator shall include the motor, operator unit gearing, limit switch gearing, limit switches, torque switches, controls as specified, declutch lever or knob, space heater, mechanical dial position indicator, gear housings, and auxiliary handwheel as a self-contained unit.

The motor shall be specifically designed for radial gate service and shall be for high torque, totally enclosed, non-ventilated construction, with motor leads brought into the limit switch compartment. Motor insulation shall be Nema Class B with a maximum continuous temperature rating of 120° C (rise + ambient).

The motor shall be of sufficient size to open or close the valve against the maximum expected differential pressure when voltage to the motor terminals is 10% above or below minimal 230/460V-3Ph-60Hz voltage. The motor duty rating shall be sufficient for one complete open to close to open (or reverse) cycle without exceeding its temperature rating. The motor shall be pre-lubricated and all bearings shall be of the anti-friction type.

The actuator shall be a double reduction unit with the capability of quickly changing the output speed with a simple gear change. The power gearing shall consist of generated spur or helical gears of heat-treated steel, and worm gearing. The worm shall be of hardened alloy steel and the worm gear shall be of alloy bronze accurately cut with a hobbing machine. All power gearing shall be grease-lubricated. Ball or roller bearings shall be used throughout.

Limit switches and associated gearing shall be an integral part of the actuator. Limit switch gearing shall be of

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the intermittent type, totally enclosed in its own gear case to prevent dirt and foreign matter from entering the gear train, grease-lubricated, and shall be made of bronze or stainless steel. Limit switches shall be of the adjustable type capable of being set to trip at any point of gate travel between fully open and fully closed, and not be subject to breakage or slippage due to over-travel. Each actuator shall have a minimum of two (four) rotor-switch assemblies and a minimum of eight (sixteen) heavy duty contacts.

Each actuator shall be equipped with a double torque switch which is responsive to loads encountered in either the opening or closing direction. Each side of the switch shall have a numbered dial and shall be adjustable. A calibration tag shall be mounted near each switch correlating dial setting with unit output torque.

The torque switch shall operate during the complete gate cycle without the use of auxiliary relays, linkages, latches, or other devices. The torque switch shall be wired to shut off the actuator motor in the event of excessive torque being generated in either direction of travel.

A handwheel shall be provided for manual operation. The handwheel shall not rotate during motor operation nor shall a fused motor prevent manual operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the gate operator will automatically return to electric operation and shall remain in motor position until handwheel operation is desired. This movement from motor operation to handwheel operation shall be accomplished by a positive declutching knob or lever which will disengage the motor and motor gearing mechanically but not electrically. Hand operation must be reasonably fast and require no more than 40 pounds of rim effort at a maximum required torque. It shall not be possible for the unit to be simultaneously in manual and motor operation. The direction of rotation to open gate shall be marked on handwheel.

The gate control shall have a built-in lost motion device that travels sufficiently enough to allow the motor to reach full speed before imparting a hammer blow to start gate in motion in either the closing or opening direction. This lost motion device also must permit motor to attain full speed before load is encountered, and load should be shared equally by two lugs cast integrally on the drive sleeve.

A mechanical dial position indicator shall be provided to show gate position as a percentage of gate full open. The indicator shall show gate position at all times regardless of manual or power operation.

The motor controller shall be a reversing type, across-the-line, started rated for 600 Volts AC and operated at 230/460 Volts, 3 Phase, 60 Hz. Starters shall be provided with terminal protection of the overload trip type for each of the three (3) phases. The reversing starters shall be provided with auxiliary contacts for electrical interlocks, and in addition, shall be mechanically interlocked. The controller shall include a 120 Volt fused transformer for the control circuit.

The control circuit shall have a red and green pilot light for visual indication of gate position. The red light will indicate that gate is in the closed position, while the green light will indicate that gate is in open position. Both lights on will indicate that gate is in an intermediate position. Three push-buttons, open-stop-close, will be furnished for gate operation. Starter, push-buttons, and lights are to be furnished (integral with) (remote from) the operator.

For remote or automatic operation a three position selector switch, H-O-A (Hand-Off-Auto) shall be provided. Continuous remote gate position indication shall be provided by use of 1000 OHM potentiometer connected to MDPI gearing.

#### **FASTENERS**

All anchor bolts, assembly bolts, screws, nuts, etc. shall be of ample section to safely withstand the forces created by operation of the gate under the specified heads. Quantity and size of fasteners shall be as recommended by the manufacturer. Anchor bolts shall be provided with two nuts each to facilitate installation.

#### **FINISH**

All structural and other exposed carbon steel surfaces shall be painted or galvanized as specified. The hoist shall be given one coat of machinery enamel suitable for outdoor exposure.