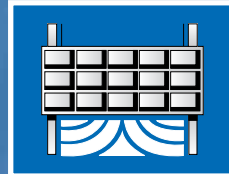


Fabricated Slide Gates



**Hydro
Gate**



Table of Contents

Fabricated Slide Gates:

Applications..... 1

Description..... 1

Materials..... 1

Mounting..... 2-4

Dimensional Data..... 5-6

Weir Gates:

Overview..... 7

Dimensional Data..... 8

Specifications:

Aluminum Slide Gates 9

Stainless Slide Gates..... 10

Heavy Duty Fabricated Slide Gate (HG561):

Applications..... 11

Description..... 11

Dimensional Drawings..... 13-16

Specifications 17-18

Aluminum Hand-Pull Gates:

Overview..... 19

Fabricated Slide Gates



Fabricated Slide Gates

Applications

- Flood Control
- Irrigation Projects
- Low-Head Reservoirs
- Drainage Systems
- Soil Conservation Projects
- Water Treatment Plants
- Sewer Treatment Plant

Description

Hydro Gate fabricated slide gates are designed and manufactured with custom extrusions or structural and brake-formed angles, channels, and plates and are assembled by welds and bolts. Through years of fabricating experience, Hydro Gate has developed techniques for fabricating parts to a close tolerance and straightness. Since there are no machined parts or wedging devices in the gate itself, the gate depends upon water pressure and seal design to seat the fabricated slide. Fabricated slide gates are usually furnished with rubber seals to improve water-tightness. They are designed for either open channel use or aperture type applications. Open channel gates have no frame member or seal at the top of the slide. These gates will overflow. Aperture gates (over an opening) have top frame member and seals to shut off flow at depths greater than the slide height.

Head capacity is dependent on opening size and availability of structural members. The most common head rating is 10 ft seating and unseating, with 20 ft seating being a practical limit for most sizes. Higher heads require special designs. Consult the Hydro Gate's Engineering Department for additional information. Higher heads require special designs. **If low leakage characteristics are desired on gates with higher heads, the Hydro Gate Series HG561 gate is recommended.** Contact Hydro Gate for additional information

Materials

Hydro Gate fabricated slide gates are available in two different material combinations.

Material Combination 1: Stainless Steel

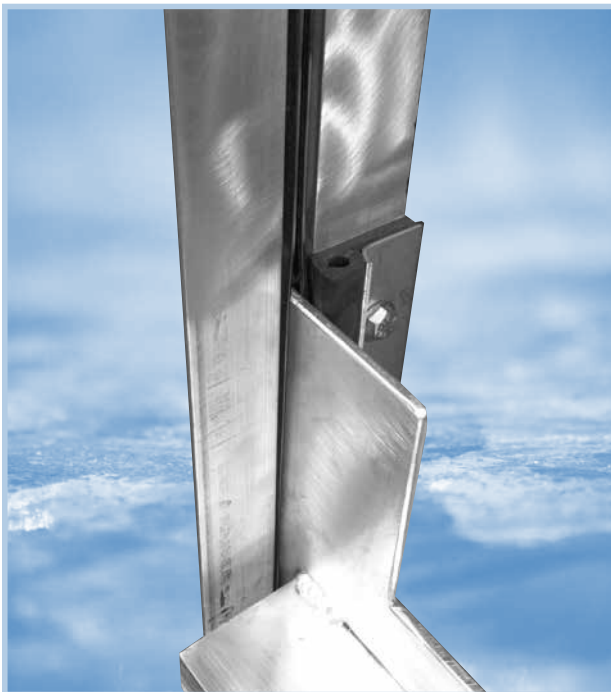
This material is recommended when corrosive conditions make it necessary to add protection. These Hydro Gate fabricated slide gates are made from Type 304 or 316 stainless steel. Gates manufactured from these materials are more corrosion resistant under most conditions than slide gates manufactured from other materials.

Material Combination 2: Aluminum

Various extrusions are utilized with this design. Frame sides are manufactured from an extrusion that forms the guide slot and provides flange back mounting. This special extrusion also can be used for gates fully embedded in concrete channels. An alternate extrusion is used for hand-pull gate frames.



Aluminum Fabricated Slide Gate



UHMW Liner and J Seal Assembly

Mounting

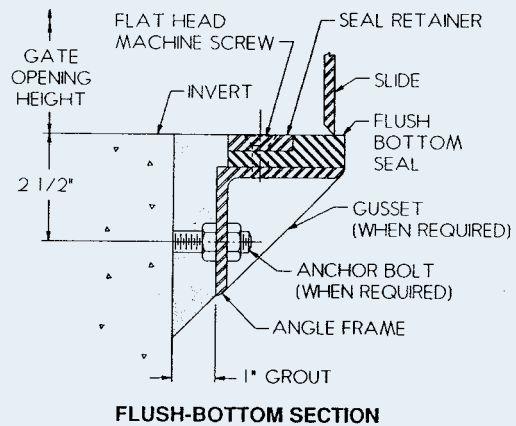
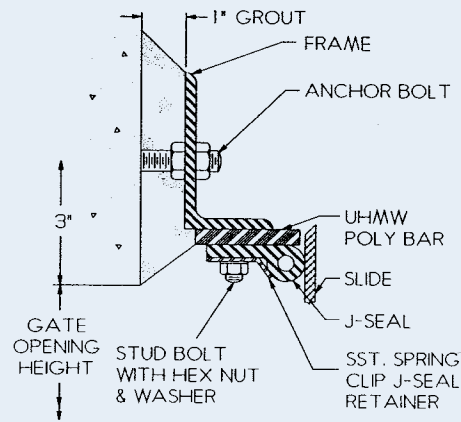
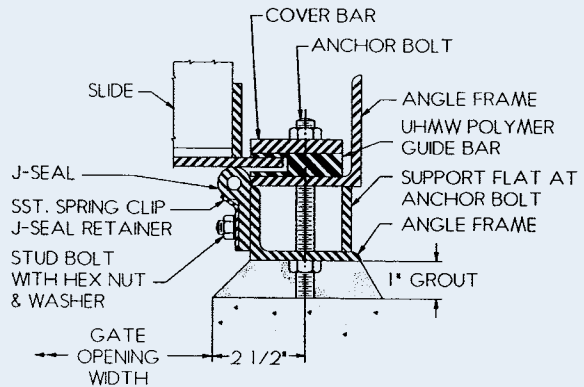


Figure 3-3
Flange Back – Material Combination 1
(Surface Mounting)

Mounting, continued

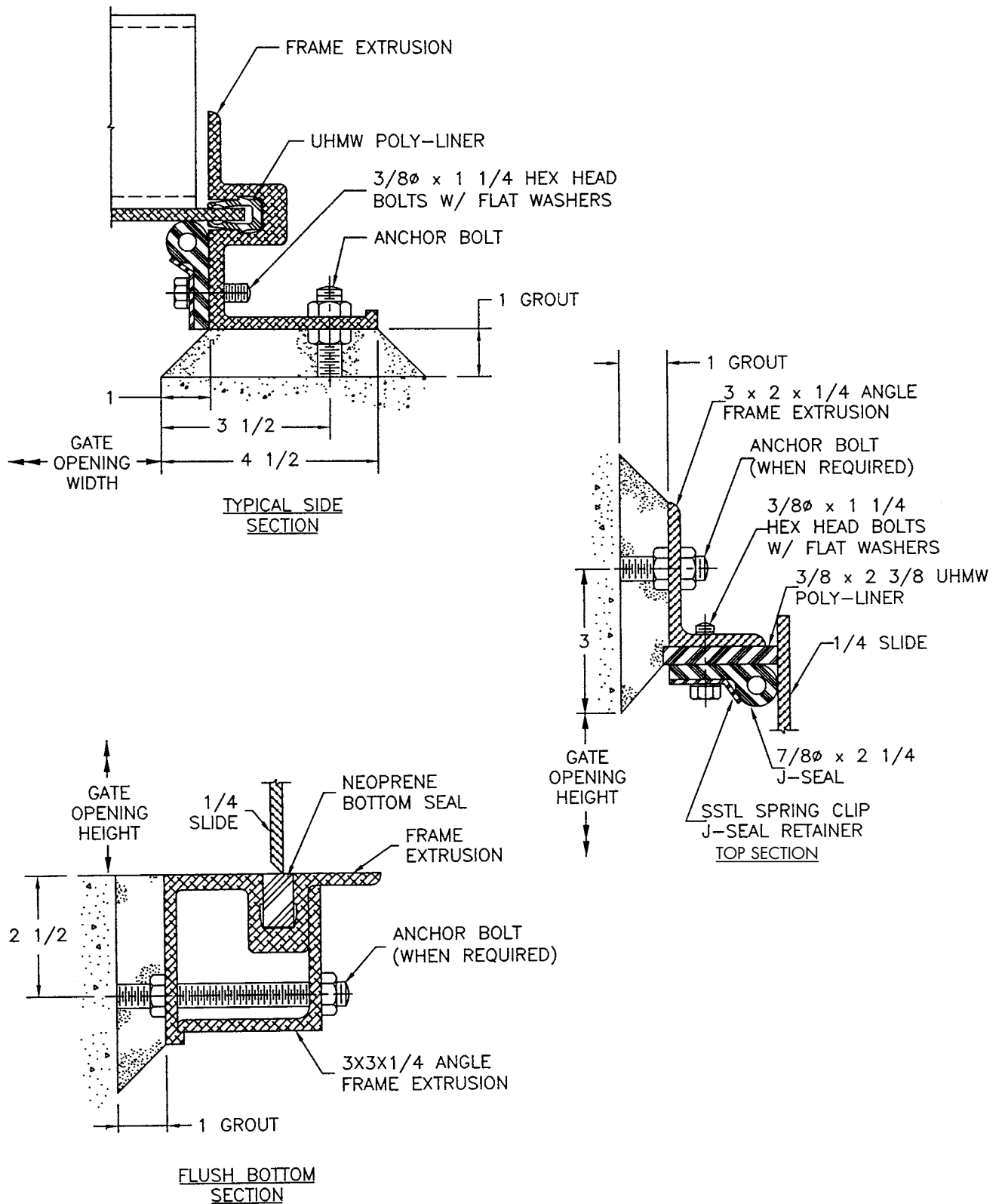


Figure 3-4
Flange Back – Material Combination 2 (Surface Mounting)

Mounting, continued

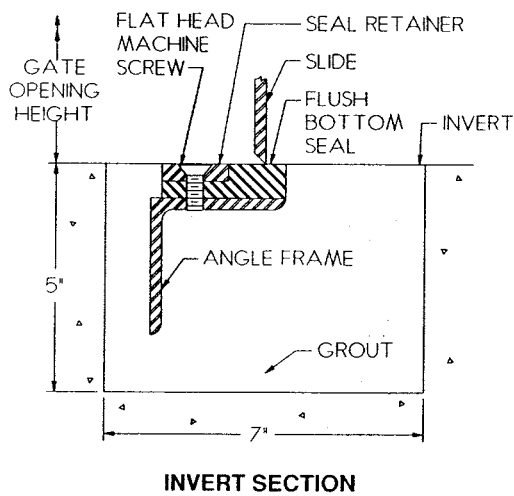
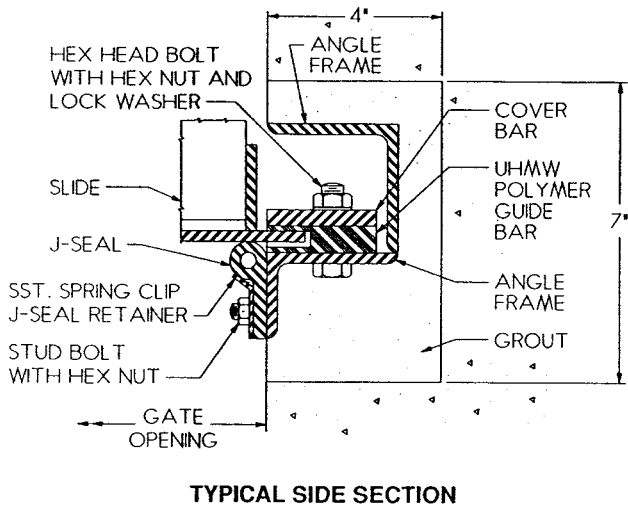


Figure 3-5
Embedded Frame – Material Combination 1
(Embedded Mounting)

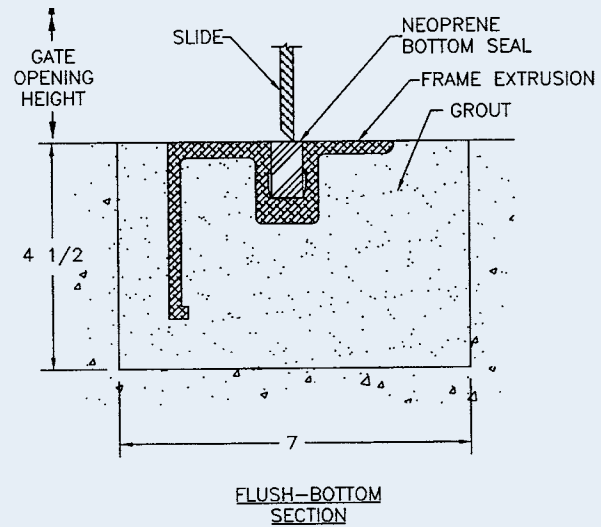
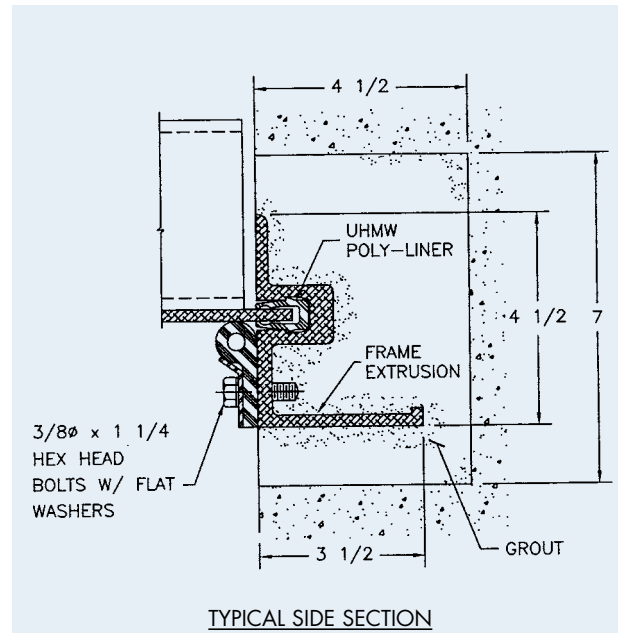


Figure 3-6
Embedded Frame – Material Combination 2
(Embedded Mounting)

Dimensional Data

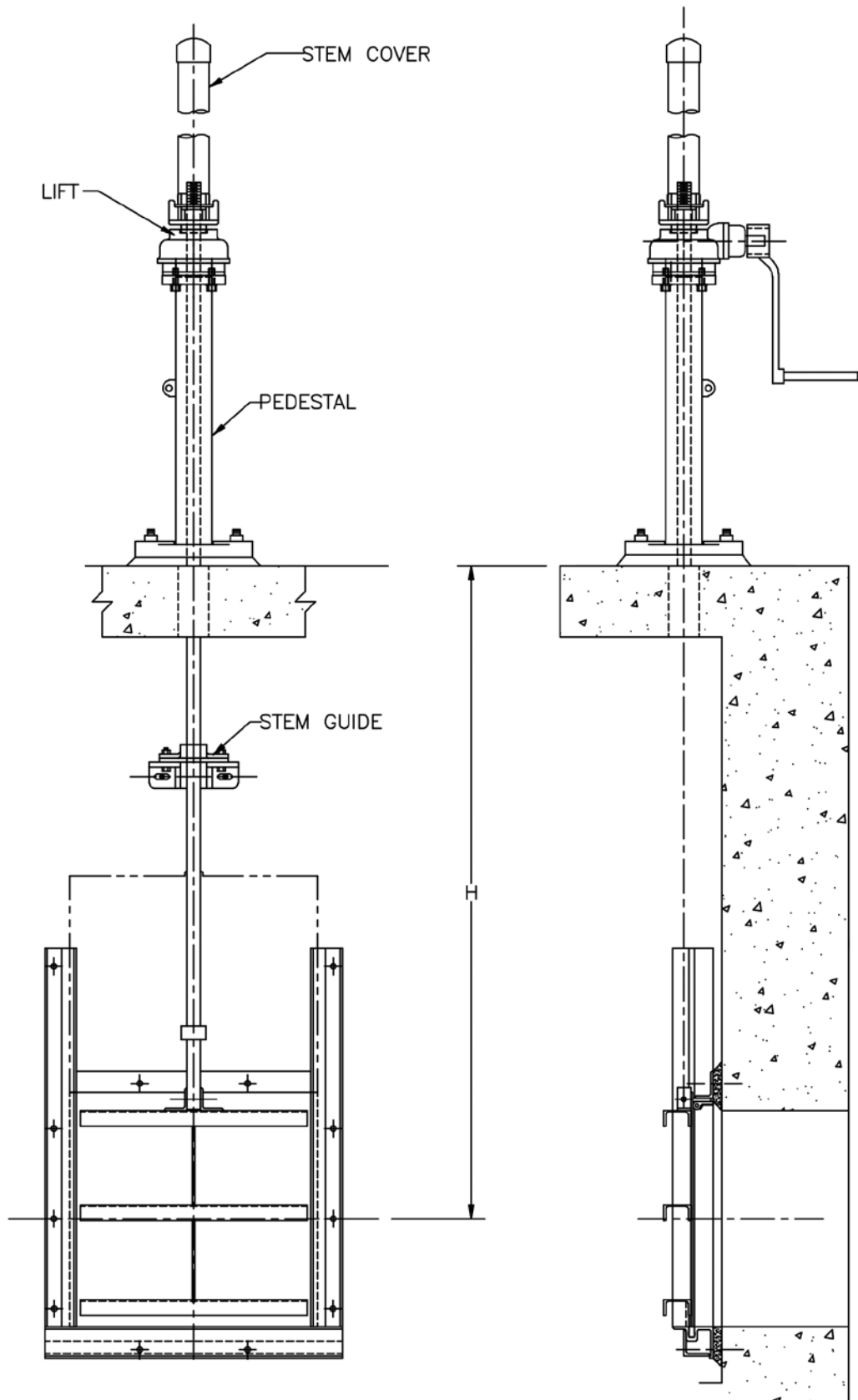


Figure 3-1
Fabricated Slide Gates – Not Self-Contained

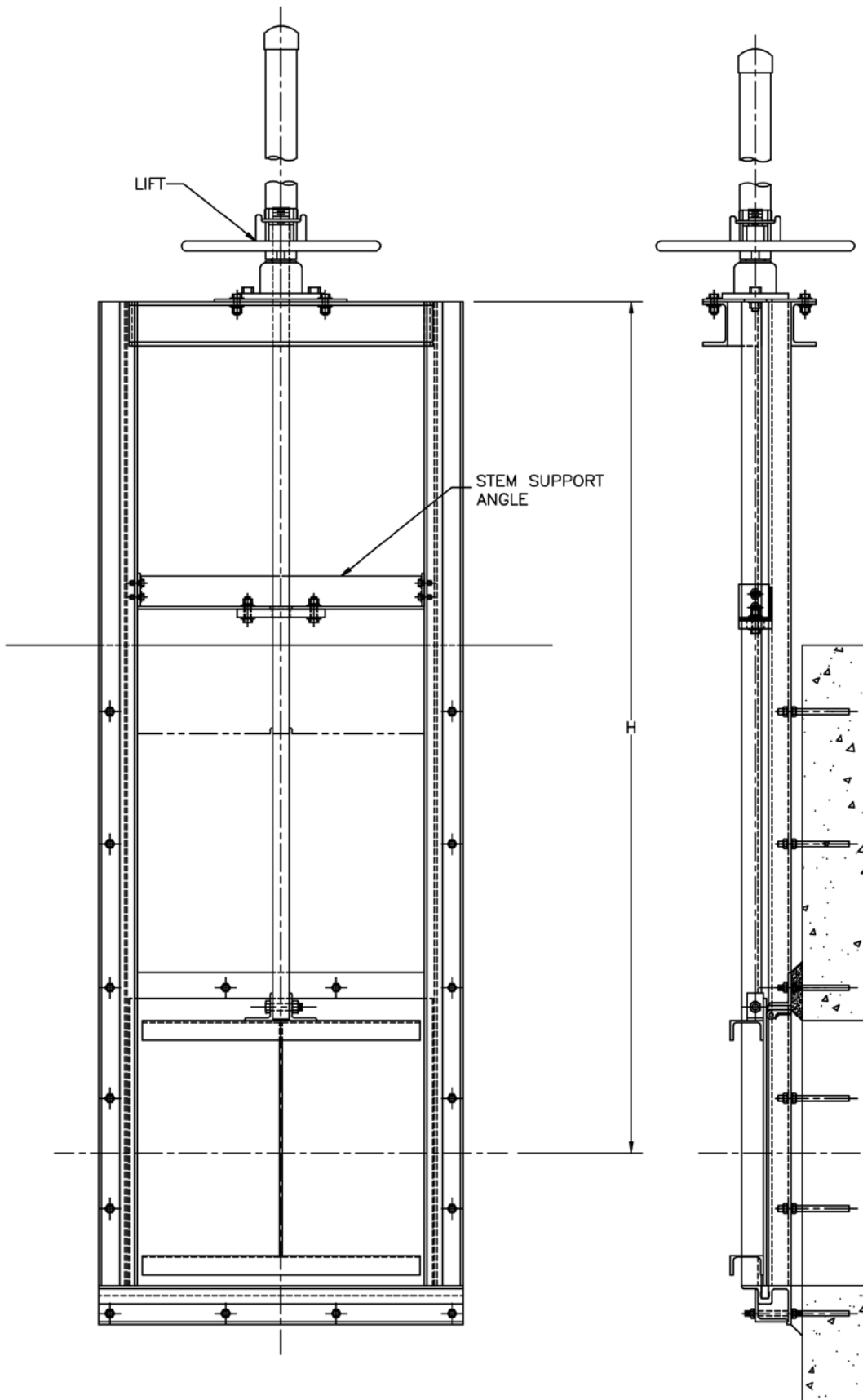


Figure 3-2
Fabricated Slide Gates – Self-Contained

Weir Gates

Many treatment plants require downward-opening fabricated gates to permit a rough measurement of flow or to maintain a constant upstream water elevation. For these installations the gate slide is moved down to allow the flow of water over the top of the slide or weir plate. Sufficient room must be left on the gate side of the wall to permit the slide to travel downward for its maximum specified opening. Every effort should be made to mount the gate so it will be subjected to seating head.

If the gate must be mounted in an unseating position, seals are required along the sides and across the bottom of the gate. Weir gates mounted with unseating pressure, particularly wide gates, are subject to greater leakage because water pressure tends to deflect the slide away from the seals.

Most weir gates are required to be considerably wider than they are high. Gates up to 20 ft in width are not uncommon. Such a gate may be only 24 to 30 in. high. Tandem lifts and stems must be utilized to ensure alignment of the slide as it is raised or lowered. As a general rule, when the width is greater than twice the height and the width is greater than 60 in., a tandem stem arrangement should be used. Either manual or electrically actuated lifting devices may be utilized. Weir gates may be self-contained or not self-contained.

Weir gates are available in Material Combinations 1 & 2. If additional information on gate size, lift selection, etc., is needed, contact your local Hydro Gate sales representative.

Dimensional Data

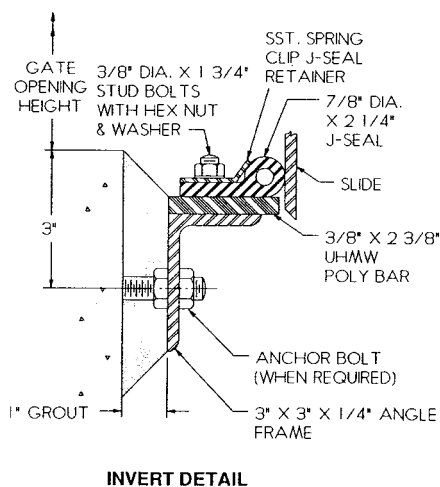
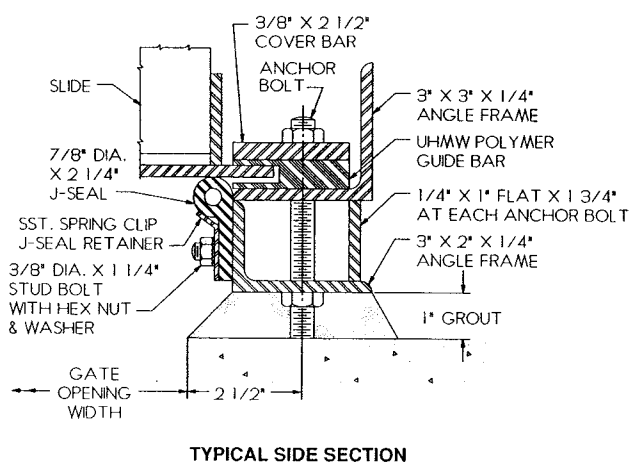


Figure 3-8
Weir Gate – Material Combinations 1

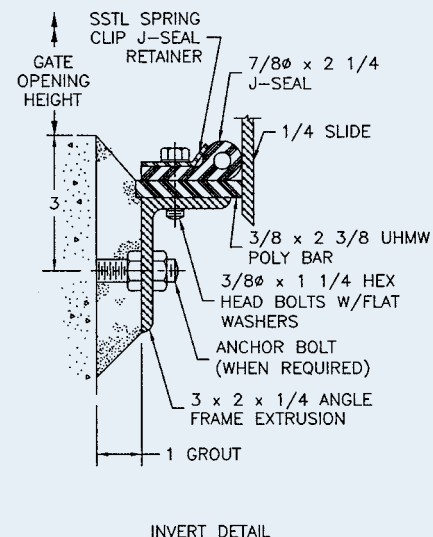
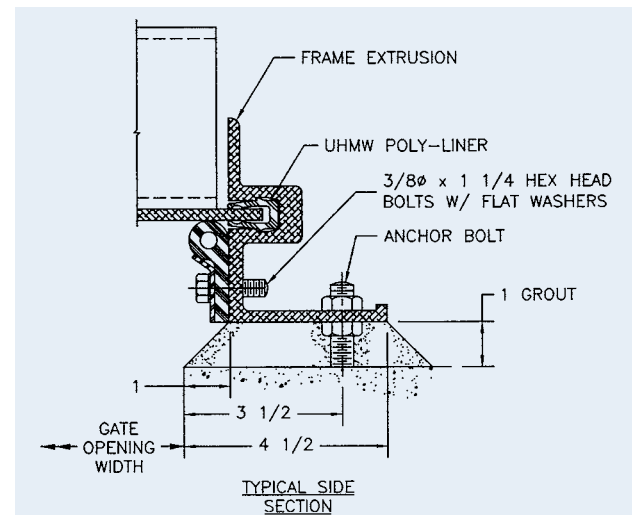


Figure 3-9
Weir Gate – Material Combinations 2

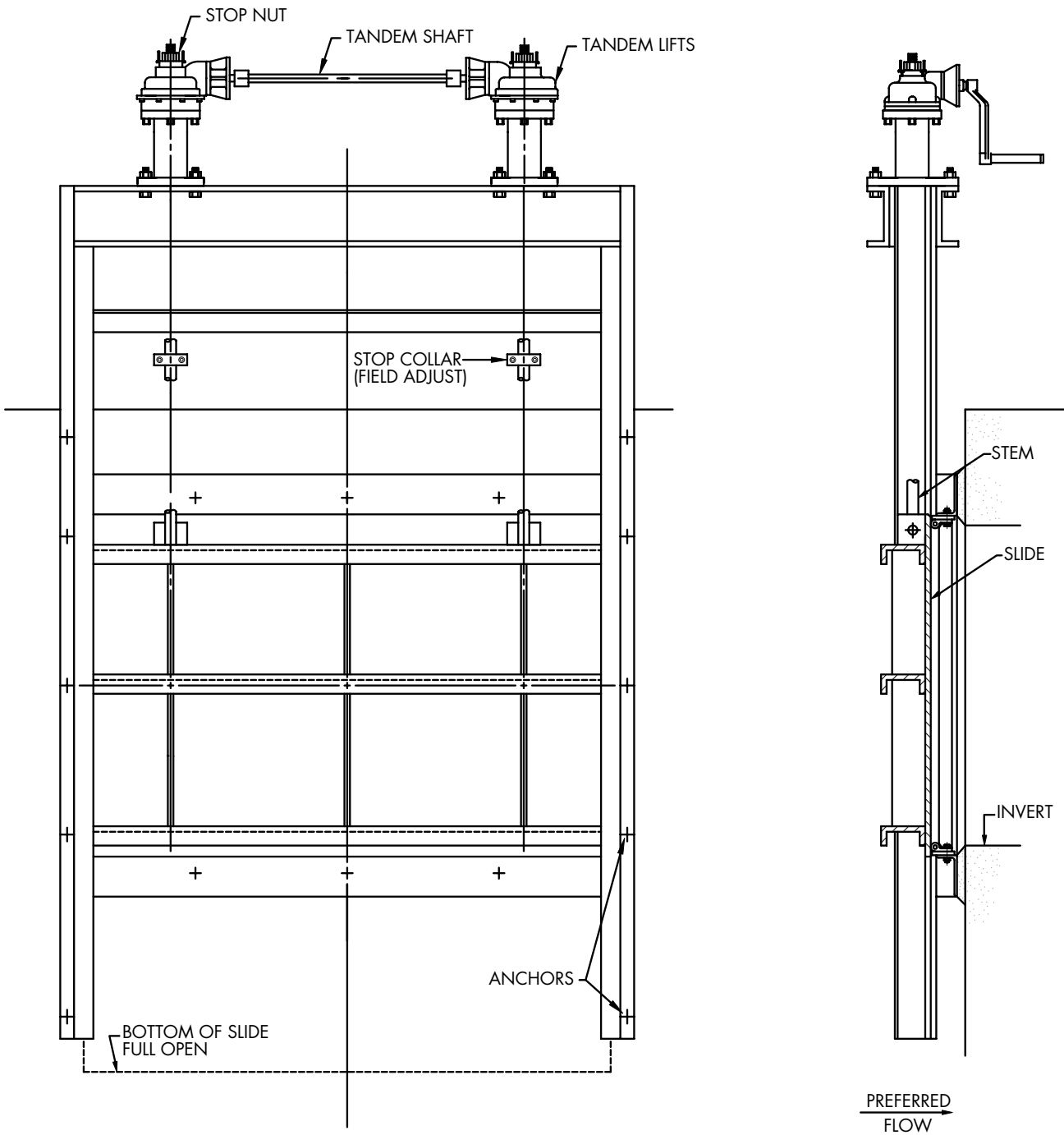


Figure 3-10
Weir Gate – Downward Opening (Self-Contained)

Specifications for Aluminum Slide Gates

General

Slide and weir gates including lifts, stems and accessories, shall be of the size and type shown on the drawings and specified herein. Where possible, gates shall be installed so that there is a seating head on the gate. Gate type, lift type, frame type, size, seating head, and bottom closure type are indicated in the "Gate Schedule." Gate, frame, and yoke design shall conform to AWWA C562 as required.

Manufacturers

Hydro Gate or approved equal.

Materials of Construction

Frame, Slide, and Reinforcing

Aluminum, ASTM B209, Alloy 6061, or ASTM B308, Alloy 6061

Stems

Stainless steel, ASTM A276, Type 304

Fasteners

Stainless steel, ASTM F593/F594, Alloy Group 1

Anchors

Stainless steel, ASTM F593/F594, Alloy Group 1

Rubber Seals

Neoprene, ASTM D2000, Grade 1BE625

Guides

Ultra High Molecular Weight (UHMW) Polymer, ASTM D4020

GATE CONSTRUCTION

Frame

Gate frame shall be flat back or channel mount as shown in the "Gate Schedule." Spigot-back frames are not acceptable. The frame shall be an integral unit of extrusions and structural shapes, rigidly assembled to form the waterway openings. Holes shall be provided for mounting on anchor bolts. The head channels shall be welded to the gate frame. The head channels are to be sufficiently spaced to allow removal of the gate slide. The primary slot of the frame extrusion shall contain polymer guide liner retained in grooves, to prevent metal-to-metal contact between slide and frame.

Slide

Gate slide shall conform to the safety factors stated under "General", but shall, in no case, be less than 1/4-in. thickness. Deflection under full head shall be limited to 1/360 of the span. The stem connector clips or stem block pocket shall be welded to the slide.

Flush Bottom

Slide gates shall incorporate a flush-bottom seal that is attached to the bottom frame invert member. The seal shall be of the materials shown in "Materials of Construction." Seals attached to the slide are not acceptable.

Seals

J-seals shall be provided as specified in the "Gate Schedule." Seals shall be securely fastened to the frame with formed stainless steel retainers and shall be replaceable and adjustable without removing the gate from the installed position. The corners of the J-seals shall be vulcanized.

Stems

Gate stem diameter shall be adequate to withstand twice the force created by a 40-lb pull on the hand-wheel or crank. Stems shall have rolled threads with a maximum roughness of 16 micro-inches. Cut threads are not acceptable. The stem shall be supported by integral stem guide angles or wall mounted brackets with bronze split type stem collars, spaced to provide an l/r ration of 200 or less. Stems shall withstand 1.25 times the stalled motor thrust of the actuator.

Manual Lifts

Gate lifts shall be hand-wheel or geared crank type as shown in the "Gate Schedule." Lifts shall operate the gate with a maximum pull of 40 lb on the hand-wheel or crank. Hand-wheel or crank shall be located approximately 36 in. above grating or walkway. All lifts shall have thrust bearings, bronze lift nuts, and a stop nut to limit the downward travel of the stem and slide. All geared lifts shall have cast iron or steel housings and pedestals. All lifts shall be rising stem type. Stem covers made of clear butyrate shall be furnished for all lifts. Lifts shall be grease lubricated and regreasable through grease zerks. Oil bath lifts are not acceptable.

Motor-Operated Lift

Motor actuator shall be a 460-V, 3-phase, 60-Hz motor with precision reduction gearing enclosed in a weatherproof housing. The actuator shall be designed to raise the gate at a rate of approximately 12 in./min. Integral controls shall include a control power transformer, reversing controller, torque switches, limit switches, open-stop-closed push-buttons, and gate position indicator. Where applicable, the controls shall also include a local-off remote selector switch. Motor reduction helical gear and pinion shall be of heat-treated alloy steel. Final reduction worm shall be of alloy steel and worm gear of machined, high-tensile strength bronze. All gearing shall be proportioned for 100% overload condition. Actuator shall have a declutch lever and hand-wheel for manual operation.

Leakage

Allowable leakage under the design head, seating or unseating head, as specified, shall not exceed 0.1 gpm/ft of seating perimeter.

Specifications For Stainless Steel Slide Gates

General

Slide and weir gates, including lifts, stems and accessories, shall be of the size and type shown on the manufacturer's drawings and specified herein. Where possible, gates shall be installed so that there is a seating head on the gate. Gate type, lift type, frame type, size, seating head, and bottom-closure type are indicated in the "Gate Schedule." Gate, frame and yoke design shall conform to AWWA C561 as required.

Manufacturers

Hydro Gate or approved equal.

Materials of Construction

Frame, Slide and Reinforcing

Stainless steel, ASTM A276, Type 304 or 316

Stems

Stainless steel ASTM A276, Type 304 or 316

Fasteners

Stainless steel, ASTM F593/F594, Alloy Group 1 or 2

Anchor

Stainless steel, ASTM F593/F594, Alloy Group 1 or 2

Rubber Seals

Neoprene, ASTM D2000, Grade 1BE625

Guides

Ultra High Molecular Weight (UHMW) Polymer,
ASTM D4020

GATE CONSTRUCTION

Frame

Gate frame shall be flat back or channel mount as shown in the "Gate Schedule." Spigot-back frames are not acceptable. The frame shall be an integral unit of structural shapes, rigidly assembled to form the waterway opening. The frame members shall form guides for the slide, and holes shall be provided for mounting on anchor bolts. The head channels shall be welded to the gate frame. The head channels are to be sufficiently spaced to allow removal of the gate slide. The primary slot of the frame shall contain polymer guide bars to prevent metal-to-metal contact between slide and frame.

Slide

Gate slide shall conform to the safety factors stated under "General" but shall, in no case, be less than 1/4 in. thickness. Deflection under full head shall be limited to 1/360 of the span. The stem connector clips or stem block pocket shall be welded to the slide.

Flush-Bottom Seals

Slide gates shall incorporate a flush-bottom seal that is attached to the bottom frame invert member. The seal shall be of the materials shown in "Materials of Construction." Seals attached to the slide are not acceptable.

Seals

J-seals shall be provided as specified in the "Gate Schedule." Seals shall be securely fastened to the frame with formed stainless steel retainers and shall be replaceable and adjustable without removing the gate from the installed position. The corners of the J-seals shall be vulcanized.

Stems

Gate stem diameter shall be adequate to withstand twice the force created by a 40-lb pull on the hand-wheel or crank. Stems shall have rolled threads with a maximum roughness of 16 micro-inches. Cut threads are not acceptable. The stem shall be supported by integral stem guide angles or wall mounted brackets with bronze split type stem collars, spaced to provide an l/r ration of 200 or less. Stems shall withstand 1.25 times the stalled motor thrust of the actuator.

Manual Lifts

Gate lifts shall be hand-wheel or geared crank type as shown in the "Gate Schedule." Lifts shall operate the gate with a maximum pull of 40 lb on the hand-wheel or crank. Hand-wheel or crank shall be located approximately 36 in. above grating or walkway. All lifts shall have thrust bearings, bronze lift nuts and a stop nut to limit the downward travel of the stem and slide. All geared lifts shall have cast iron housings and pedestals. Aluminum housings and pedestals shall not be acceptable. All lifts shall be rising stem type. Stem covers made of clear butyrate shall be furnished for all lifts. Lifts shall be grease lubricated and regreasable through grease zerks. Oil bath lifts are not acceptable.

Motor-Operated Lift

Motor actuator shall be a 460-V, 3-phase, 60-Hz motor with precision reduction gearing enclosed in weatherproof housing. The actuator shall be designed to raise the gate at a rate of approximately 12 in./min. Integral controls shall include a control power transformer, reversing controller, torque switches, limit switches, open-stop-closed push-buttons and gate position indicator. Where applicable, the controls shall also include a local-off-remote selector switch. Motor reduction helical gear and pinion shall be of heat-treated alloy steel. Final reduction worm shall be of alloy steel and worm gear of machined high-tensile strength bronze. All gearing shall be proportioned for 100% overload condition. Actuator shall have a declutch lever and hand-wheel for manual operation.

Leakage

Allowable leakage under the design head, seating or unseating head, as specified, shall not exceed 0.1 gpm/ft of seating perimeter.

Heavy Duty Fabricated Slide Gate Series HG561



Fabricated Slide Gates

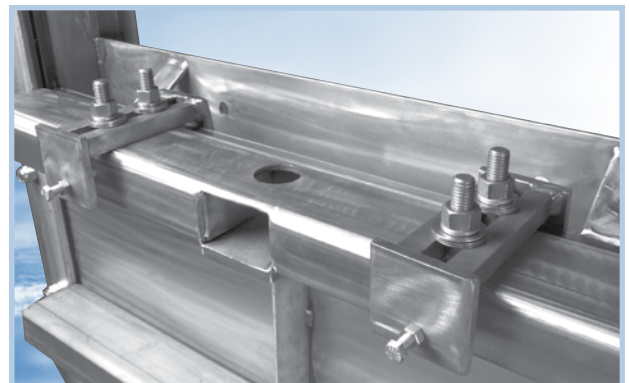
Applications

- Water Treatment Plants
- Wastewater Treatment Plants
- Low-head Reservoirs
- Power Plants

Description

The HG561 Stainless Steel Slide Gate is an exceptional design for low leakage requirements in corrosive environments. The frame, slide, stem and fasteners are all stainless steel type 304 and 316 dependent on your application. The side guide seal assembly utilizes an ultra high molecular weight polymer molded and milled to positively retain the slide and form a watertight seal. The polymer provides a self-lubricating surface with a very low co-efficient of friction, ensuring smooth operation. The guide seal assembly is designed for positive retention allowing the compression force applied to the slide to be completely adjustable. All Hydro Gate seals are factory adjusted and require no adjustment in the field.

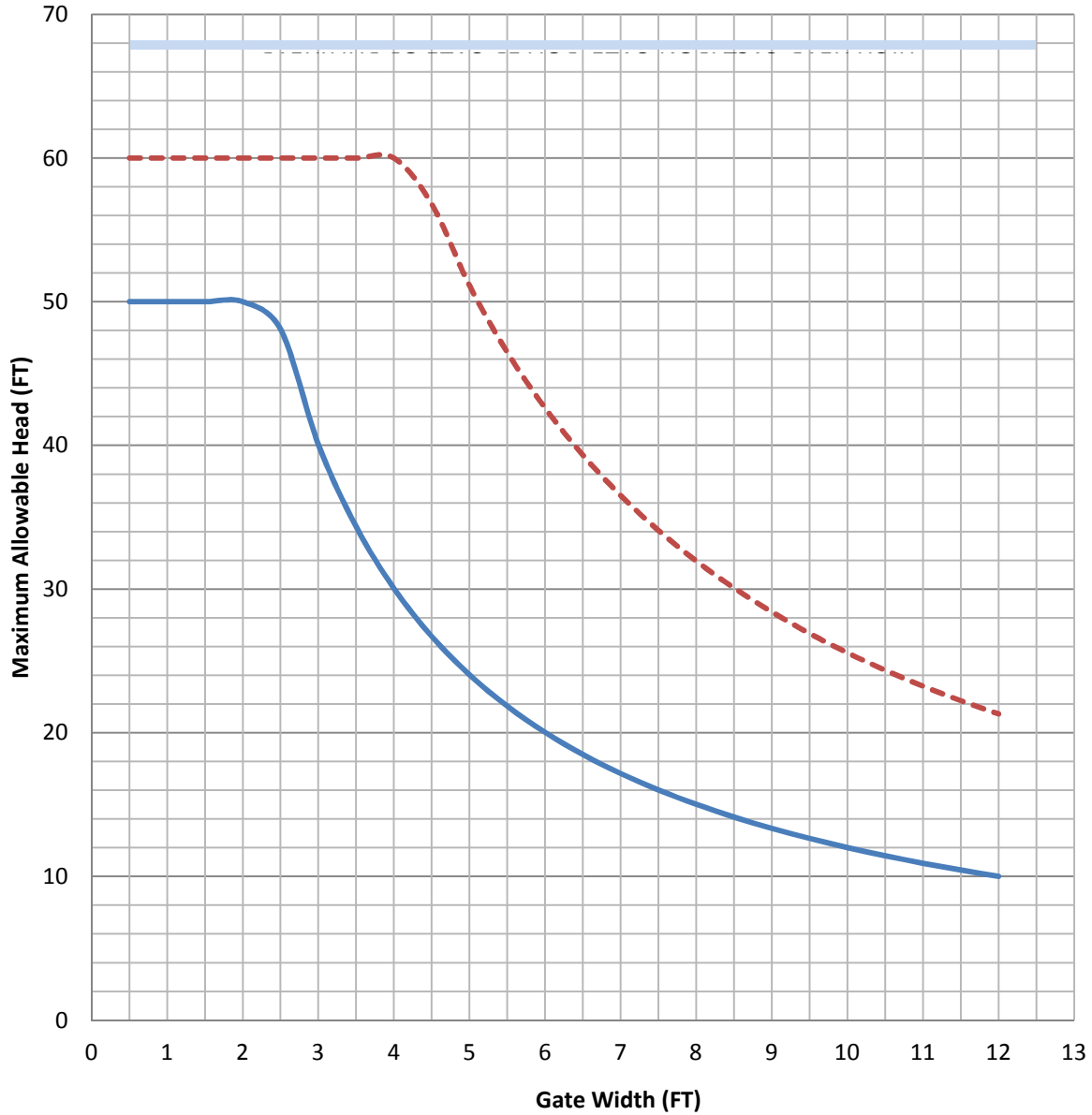
A top wedge system is utilized on gates 24 inches and wider. The Hydro Gate wedge system incorporates a similar design used on cast iron slide gates. Each wedge is securely fastened to the top of the slide, which when in the closed position provides a contact with the top seal of the frame. The flush bottom design features a neoprene seal attached to the frame eliminating the need for a recessed floor. The HG561 frame and sealing system is designed to be flexible, allowing for mounting to head walls (surface) with anchor bolts, embedded in channel walls, mounted to the interior surface walls of a channel or mounted to a wall thimble.



Top wedge system



HG 561 Allowable Head Limits (Unseating)

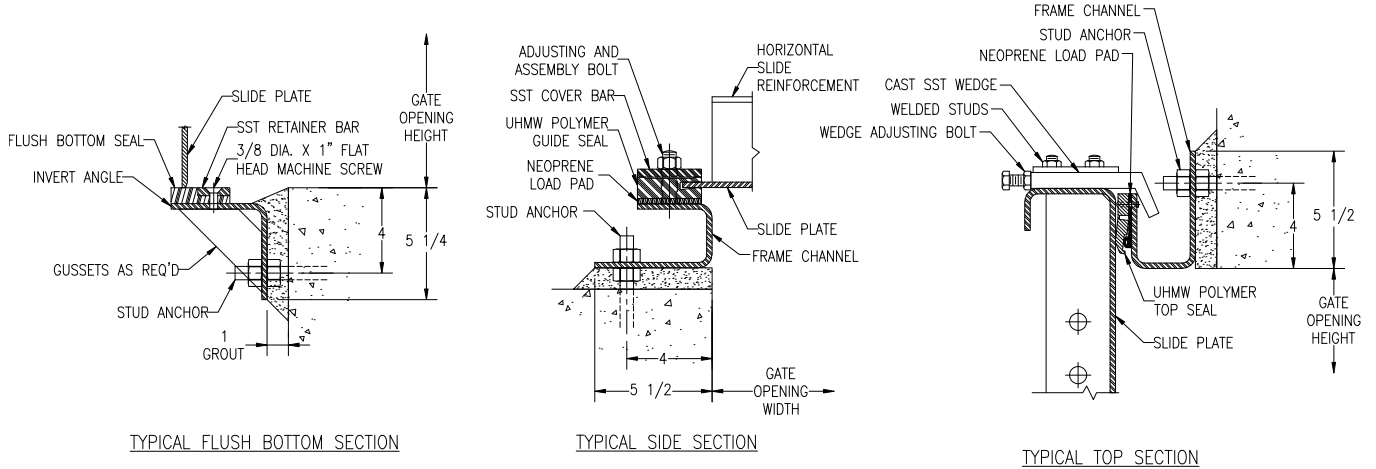


- Model HG561-120
- - - Model HG561-240

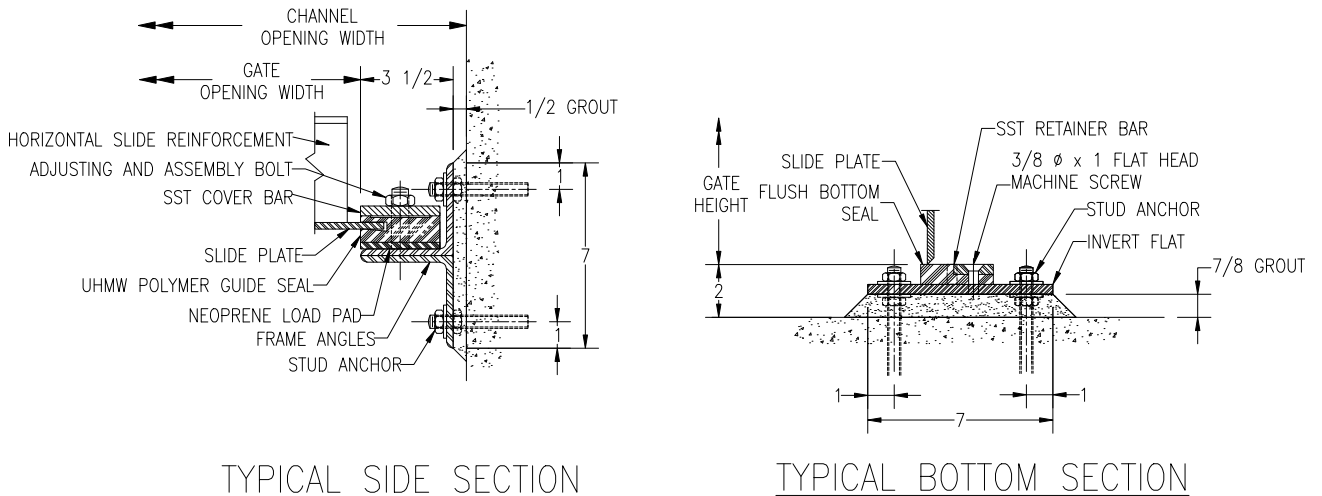
Note: The chart shows the normal maximum range of each HG561 model. Higher ratings can be achieved when necessary. Contact Hydro Gate for details.

Model HG561 Details

Model HG561-120 Wall Mount

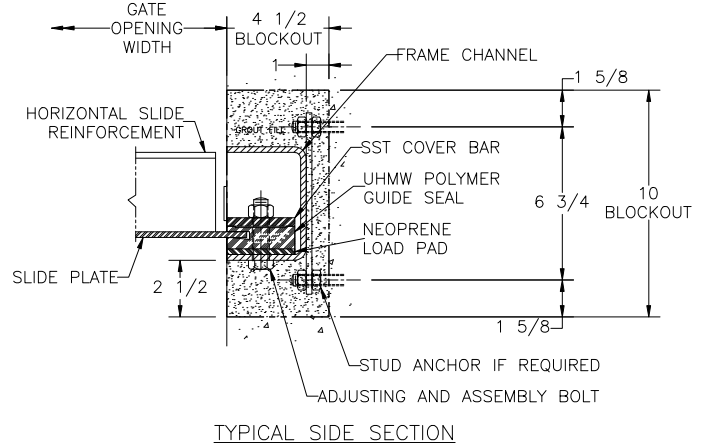
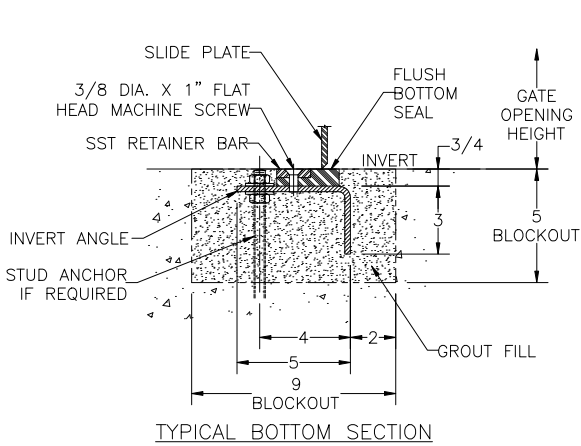


Model HG561-120 Channel Mount

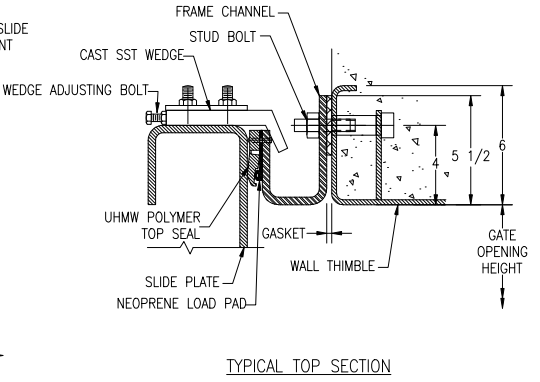
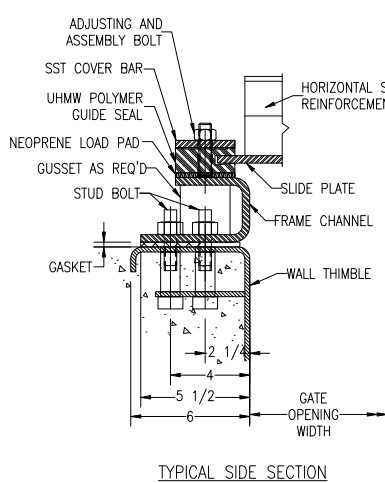
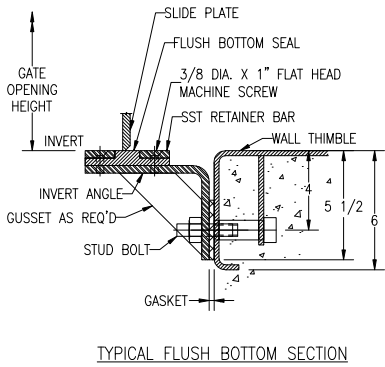


Model HG561 Details

Model HG561-120 Embedded Mount

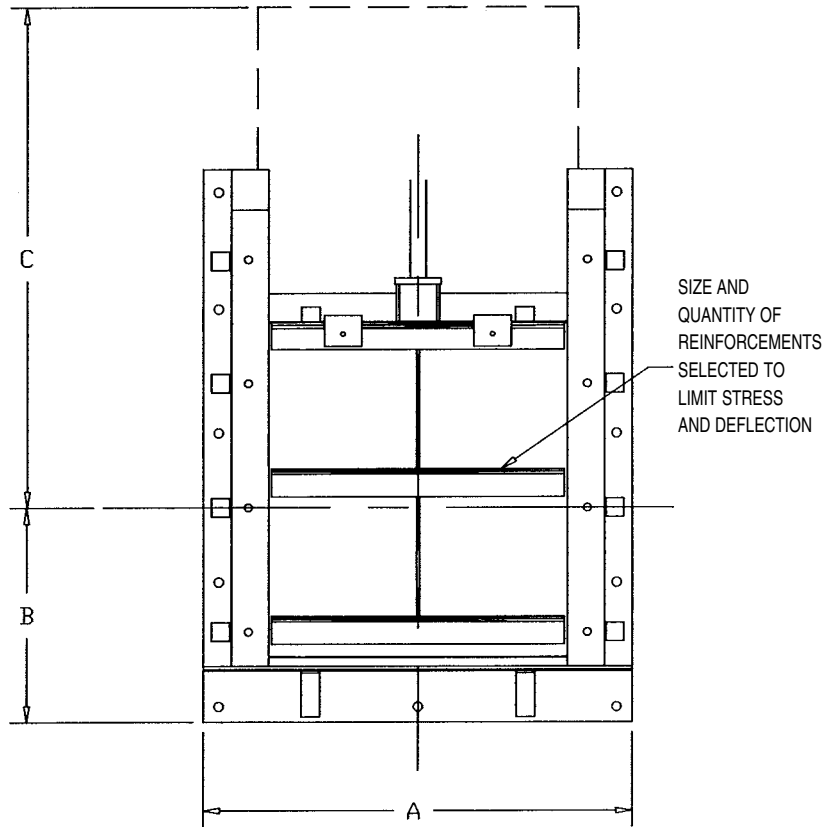


Model HG561-240 Wall Mount



Typical HG561-120 Gate Dimensions

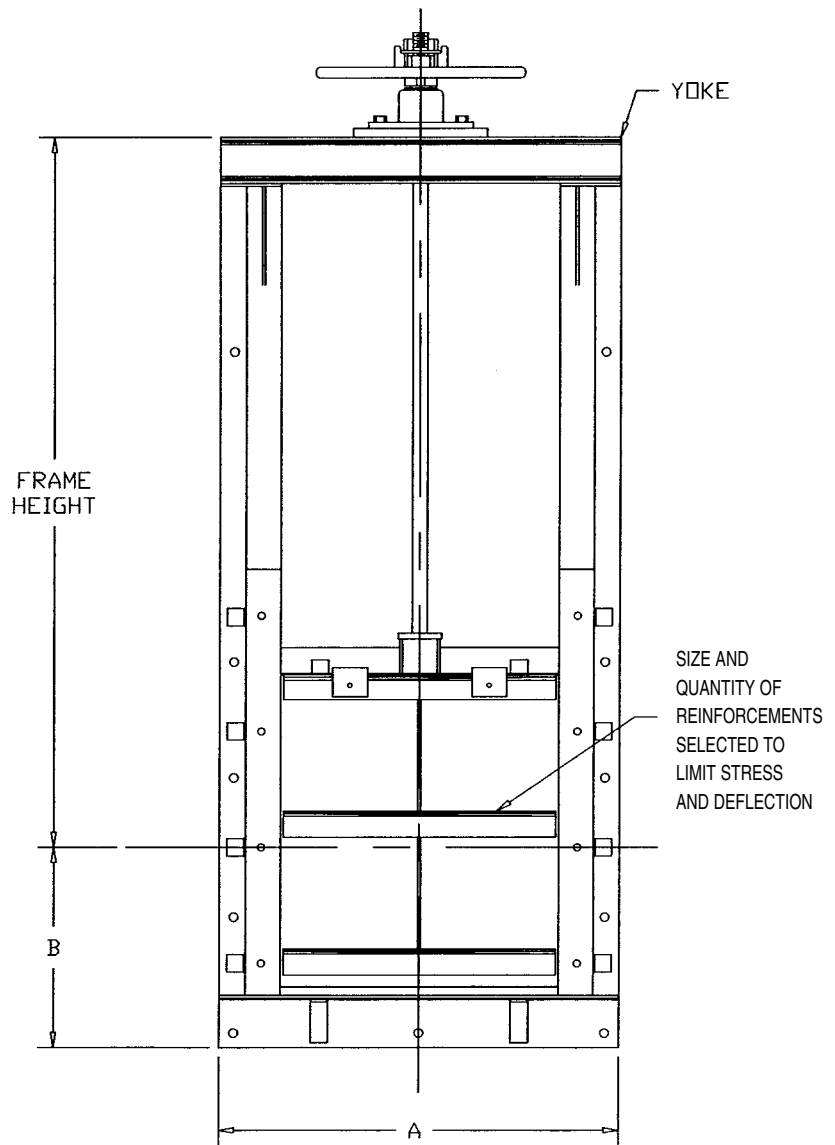
Gate Size W X H	A	B	C
6 x 6	17	8.25	12.75
12 x 12	23	11.25	21.75
12 x 24	23	17.25	21.75
18 x 18	29	14.25	30.75
18 x 24	29	17.25	39.75
18 x 30	29	20.25	48.75
21 x 21	32	15.75	35.25
24 x 24	35	17.25	39.75
24 x 30	35	20.25	48.75
24 x 36	35	23.25	57.75
24 x 48	35	29.25	75.75
30 x 24	41	17.25	39.75
30 x 30	41	20.25	48.75
30 x 36	41	23.25	57.75
30 x 42	41	26.25	66.75
30 x 48	41	29.25	75.75
36 x 30	47	20.25	48.75
36 x 36	47	23.25	57.75
36 x 42	47	26.25	66.75
36 x 48	47	29.25	75.75
36 x 60	47	35.25	93.75
42 x 30	53	20.25	48.75
42 x 36	53	23.25	57.75
42 x 42	53	26.25	66.75
42 x 48	53	29.25	75.75
42 x 60	53	35.25	93.75
48 x 30	59	20.25	48.75
48 x 36	59	23.25	57.75
48 x 42	59	26.25	66.75
48 x 48	59	29.25	75.75
48 x 60	59	35.25	93.75
48 x 72	59	41.25	111.75
54 x 54	65	32.25	84.75
60 x 36	71	23.25	57.75
60 x 42	71	26.25	66.75
60 x 48	71	29.25	75.75
60 x 60	71	35.25	93.75
60 x 72	71	41.25	111.75
72 x 42	83	26.25	66.75
72 x 48	83	29.25	75.75
72 x 60	83	35.25	93.75
72 x 72	83	41.25	111.75



All measurements are in inches.

Typical Self-Contained HG561-120 Gate Dimensions

Gate Size W X H	A	B	Minimum Frame Height
6 x 6	17	8.25	19
12 x 12	23	11.25	28
12 x 24	23	17.25	46
18 x 18	29	14.25	37
18 x 24	29	17.25	46
18 x 30	29	20.25	55
21 x 21	32	15.75	42
24 x 24	35	17.25	46
24 x 30	35	20.25	55
24 x 36	35	23.25	64
24 x 48	35	29.25	82
30 x 24	41	17.25	46
30 x 30	41	20.25	55
30 x 36	41	23.25	64
30 x 42	41	26.25	73
30 x 48	41	29.25	82
36 x 24	47	17.25	46
36 x 30	47	20.25	55
36 x 36	47	23.25	64
36 x 42	47	26.25	73
36 x 48	47	29.25	82
36 x 60	47	35.25	100
42 x 30	53	20.25	55
42 x 36	53	23.25	64
42 x 42	53	26.25	73
42 x 48	53	29.25	82
42 x 60	53	35.25	100
48 x 30	59	20.25	55
48 x 36	59	23.25	64
48 x 42	59	26.25	73
48 x 48	59	29.25	82
48 x 60	59	35.25	100
48 x 72	59	41.25	118
54 x 54	65	32.25	91
60 x 36	71	23.25	64
60 x 42	71	26.25	73
60 x 48	71	29.25	82
60 x 60	71	32.25	100
60 x 72	71	41.25	118
72 x 42	83	26.25	73
72 x 48	83	29.25	82
72 x 60	83	35.25	100
72 x 72	83	41.25	118



All measurements are in inches.

Specifications for Heavy Duty Fabricated Stainless Steel Gate

Manufacturer

Hydro Gate or approved equal.

General

Fabricated stainless steel heavy duty service gates shall be fabricated from formed stainless steel plate and structural shapes. The size, quantity, gate configuration and operating conditions shall be as listed on the gate schedule. Gate, frame and yoke design shall conform to AWWA C561 as required.

Manufacturer shall be experienced and in regular production of gates and water control equipment. Welders and procedures shall be certified according to AWS D1.6 or ASME Section IX.

The gate shall be fully shop assembled, adjusted, inspected and tested for proper operation and leakage before shipment.

Materials

Materials used in construction of gates shall be of type best suited for the application and shall conform to the following ASTM specifications:

Frame and Slide

Stainless Steel, ASTM A276, Type 304 or 316 – specify on gate schedule.

Fasteners and Anchor Bolts

Stainless Steel, ASTM F593/F594 alloy group 1 (304)
Stainless Steel, ASTM F594/F594 alloy group 2 (316) – specify on gate schedule

Guides, Liner and Seals

Ultra High Molecular Weight (UHMW) Polymer,
ASTM D4020

Flush Bottom Seal/Loading Pads

Neoprene Rubber, ASTM D2000 grade 1BE625

GATE CONSTRUCTION

Slide

The slide shall be a weldment of plate with integrally formed reinforcements at top and bottom with welded-on interior reinforcements. A stem block connection shall be used for non-rising stem applications or when precise adjustment of a hydraulic cylinder is required. All edges and corners shall be radiused and polished for smooth operation within the guide seal assembly.

Provision shall be provided for attaching stems to the gate with a clevis-type connection. Alternatively: stem block connection shall be used when precise adjustment of hydraulic cylinders is required.

Frame

The frame shall be of flange type design for mounting on anchor bolts and grout pad. Size and spacing of anchor bolt holes shall be suitable for the operating conditions of the gate. Spacing shall not exceed 12" .

The frame shall be of self-contained or not self-contained design as listed in the gate schedule. The frame shall be sufficiently rigid to transfer hydrostatic loads to the gate anchorage.

The frame shall positively retain the polymer guide/seal strip and the neoprene loading pad on studs welded to it. Non-loosening (prevailing torque) fasteners shall be used on the gate guide assembly. The guide seal assembly shall be field adjustable and replaceable. The length (vertical height) of the guide shall retain at least 1/2 of the slide height in the full open position.

Guide/Seal Assembly

Guide seal shall be special milled or molded polymer to positively retain the slide and form a tight seal on face plate edge. Sealing shall be accomplished by the pinching action of the polymer guide/seal on the elastomer loading pad and the fastener cover bar system. Engagement of slide into guide groove shall be 7/8" nominal.

Top Seal

The top seal shall be specially milled or molded shape securely attached to the frame. It shall have an elastomer loading pad to ensure contact with the slide plate. Corners or intersections of seals and loading pads shall be interlocked and sealed for leak-proof joint.

Flush Bottom Closure

Rectangular solid bulb section neoprene seal shall be attached to frame horizontal member. Sealing action shall be against lower edge of slide plate.

Wedges

Gates 24" wide and wider shall have adjustable wedges across top of opening. Wedges may be fabricated or cast and shall be held onto slide reinforcing member with two in-line welded studs with backing plate.

Yoke

The yoke or head frame may be welded or bolted to frame extensions. The slide shall be removable through the yoke opening or by disassembly/removal of the yoke. Yoke shall be sufficiently strong to prevent deflection greater than 1/4" under load.

Stems

Gate stem diameter shall be adequate to withstand twice the force created by a 40 lb. pull on the hand-wheel or crank. Stems shall have rolled threads with a maximum roughness of 16 micro inches. Cut threads are not acceptable. The stem shall be supported by integral stem guide angles or wall mounted brackets with bronze split type stem collars, spaced to provide an l/r ration of 200 or less. Stems shall withstand 1.25 times the stalled motor thrust of the actuator.

Wall Thimbles

When thimbles are used, they shall be fabricated stainless steel with minimum thickness of 1/4". The flange shall be flat and plane within 3/16" without machining. Welded studs or threaded holes for screwed in studs shall be provided to match the gate layout. The top of the thimble flange shall be permanently marked top. The thimble shall be set plumb and flat. The gate shall be mounted with hard setting mastic and a 1/4" thick rubber gasket. Refer to the gate schedule for type and application of wall thimbles.

Manual Lifts

Gate lifts shall be hand-wheel or geared crank type as shown in the gate schedule. Lifts shall operate the gate with a maximum pull of 40 lb. on the hand-wheel or crank. Hand-wheel or crank shall be located approximately 36" above grating or walkway. All lifts shall have thrust bearings, bronze lift nuts and a bronze stop nut to limit the downward travel of the stem and slide. All geared lifts shall have cast iron or steel housing and pedestals. Aluminum housing and pedestals shall not be acceptable. All lifts shall be rising stem type. Stem covers made of clear butyrate shall be furnished for all lifts. Lifts shall be grease lubricated and regreaseable through grease zerks. Oil bath lifts are not acceptable.

Motor Operated Lifts

Motor operator shall be a 460-V, 3 phase, 60-Hertz motor with precision reduction gearing enclosed in weather-proof housing. The operator shall be designed to raise the gate at a rate of approximately 12 in/min. Integral controls shall include a control power transformer, reversing controller, torque and limit switches, open-stop-close push buttons.

Installation

The gate and accessories shall be installed according to manufacturer's recommendation. The gate shall be clean and free of construction debris and stem threads shall be lubricated prior to operation of the gate. If electric motor operator is used, limit switches shall be adjusted according to manufacturer's instructions. If hydraulic cylinder is used, the rod or stem connection shall be adjusted for correct stroking and closing action. The gate shall be cycled minimum of 1 cycle (open-close or vise versa) to ensure smooth operation. The gates may be field leak tested by the contractor. Leakage shall not exceed 0.1 gpm per foot of perimeter at the rated head, seating or unseating. Consult installation drawing for pressure rating of the specific gate.

Heavy Duty Fabricated Stainless Steel Gate Schedule

Size wxh	Quantity	Operating Head seating/unseating	Gate Configuration mounting & operation	Lift Type	Remarks

Aluminum Hand-Pull Gates

Hydro Gate manufactures several standard sizes of hand-pull or stop gates. An extruded metal section embeds in the side walls or is mounted on the face of the rectangular flume or conduit and acts as a guide for the gate slide. The gate consists of an aluminum plate reinforced if necessary with hand-holes for manual opening of the gate. A hand-pull gate is an economical way to divert water in rectangular channels.

Material Specification – The side guides, slide plate and any necessary reinforcing for Hydro Gate hand-pull gates are manufactured from aluminum meeting the requirements of ATMS Specification B209 Alloy or B308 Alloy 6061.

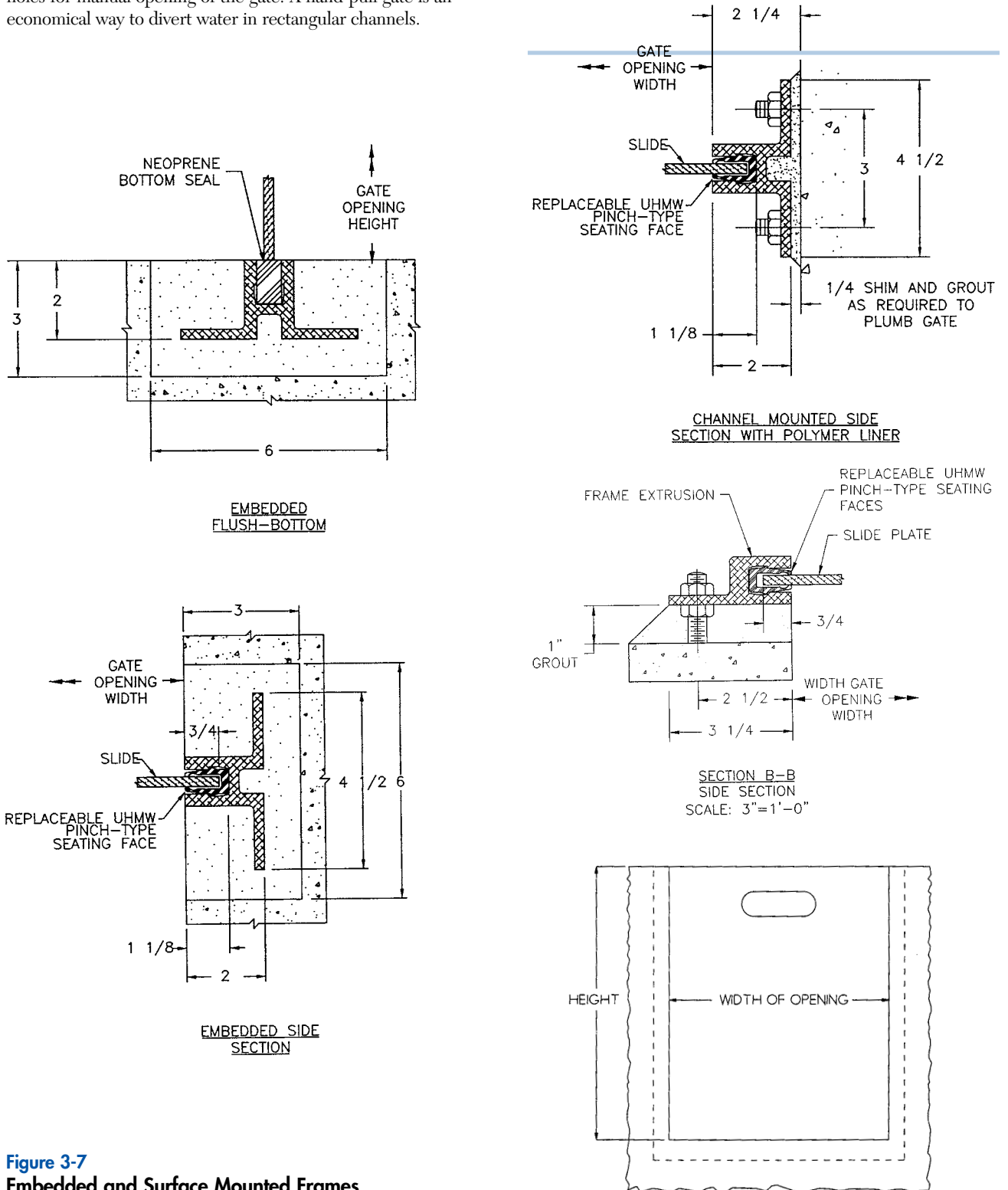


Figure 3-7
Embedded and Surface Mounted Frames

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