State Water Resources Control Board

Office of Delta Watermaster

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Linda S. Adams
Acting Secretary for
Environmental Protection

Edmund G. Brown Jr.
Governor

TO: Craig M. Wilson, Delta Watermaster
Office of Delta Watermaster

FROM: Nichole S. Baker
Office of Delta Watermaster

DATE: May 31, 2011

SUBJECT: MEASUREMENT OF WATER DIVERSIONS

Background

In November 2009, the California Legislature passed Senate Bill X7 8, requiring monthly records of water diversions on and after January 1, 2012. The new law requires that the measurements of water diversions are made using the best available technologies and best professional practices. These are defined in the law as follows:

> "Best available technologies" means technologies at the highest technically practical level, using flow totaling devices, and if necessary, data loggers and telemetry.
>
> "Best professional practices" means practices attaining and maintaining the accuracy of measurement and reporting devices and methods.

Section 5103 of the California Water Code is amended to read:
"Each statement shall include all of the following information"

With Section 5103 (e) (1) reading:
"On and after January 1, 2012, monthly records of water diversions. The measurements of the diversion shall be made using best available technologies and best processional practices. Nothing in this paragraph shall be construed to required the implementation of technologies or practices by a person who provides to the board documentation demonstrating that the implementation of those practices is not locally cost effective."

Discussion

When determining the appropriate method of measuring a diversion or measuring device for the application several factors should be taken into consideration, including: accuracy, cost, environment, delivery system, flow range, straight pipe installation requirement and storage, if used.

Accuracy – the majority of measuring devices when installed properly are accurate within ±1% to ±5%. However, in the field, maintaining these accuracies can require considerable expense

and/or effort (i.e. maintenance, special construction, recalibration, etc.). By selecting a device that is not appropriate for the site conditions can result in a non-standardize installation and reduced accuracy of ±10%.

Cost – includes the device, associated appurtenances, installation and operation and maintenance. These costs vary based on the measuring device and size.

Environment – if the correct measuring device is not chosen based on the environment, the measuring device can become clogged with organics, resulting in inaccurate readings. This may be the most important factor when selecting a measuring device.

Delivery system – the appropriate type of measuring device may vary depending of the delivery system (pressurized pipe, non-pressurized pipe, and open channel).

Flow range – the accuracy of measuring devices is dependent of the rated flow range.

Straight pipe installation requirement – some water measuring devices require a length of straight pipe prior to (upstream) and after (downstream) the measuring device to eliminate any turbulence caused by a transition fitting (elbow). This distance can be up to 10 times the diameter of the pipe upstream and 5 times the diameter of the pipe downstream. Increasing installation cost if additional pipe is needed.

Storage – the law currently requires the measurement of water diversions. However, the current reporting form for Supplemental Statements of Water Diversion and Use, (and reports of Permittee and Licensee) ask for the amount of water consumptively used post storage. This raises the question if the measurement of water post storage is to be estimated or measured in the same manner as pre-storage.

While we are not able to be prescriptive when asking for measuring devices at the point of diversion we are able to ask for the best available technology. As discussed above the best available technology may vary from diversion to diversion or based on various factors within the state, thus making some devices not locally cost effective.

Also over time technology will change, therefore it is recommended to have diverters select the best available technology while using the best professional practices for their location (i.e. to select the device that best suits the location and diversion configuration).

Overview of Measuring Devices

In general metering devices are available from 2-inches to 72-inches in diameter and are rated for flows ranging from 35 gpm (0.078cfs) to 90,000 gpm (200 cfs); however, devices greater than 12-inches in diameter are considered as large devices and many times require additional time to ship to the site. When a meter is used it will generally be sized one to two sizes smaller than the pipe size. Mechanical registers, calculating both the total and instantaneous flow are generally standard with meters. Flow totaling devices, data loggers and telemetry (SCADA (Supervisory Control and Data Acquisition)) would be a significant additional cost.

In reviewing the Initial Statements received by the Division of Water Rights, Division, the average size of diversions within the legal delta are 12-inches and 14-inches in diameter. Therefore the average measuring devices would range from 8-inches to 12-inches in size.

Pricing

When determining the installed price of a measuring device several factors should be taken into account, including:

1. State sales tax on the equipment (8.25%)
2. Shipping and handling (assume 10%)
3. Installation – contractors generally charge approximately 30% of the equipment cost for installation.
4. Contractor's overhead and profit – 30% can be generally be assumed addition to the base price of the measuring device for projects under $100,000.
5. Mobilization and Demobilization – in addition to the above cost the contractor will charge approximately $3/mile/piece of equipment plus the cost of the crew to travel to and from the site. For small projects this will be negligible.

When adding the above percentages a minimum of 78.25% in addition to the cost of the measuring device for installation. Not including in additional associated apparatuses necessary to install the measuring device. This can include additional straight pipe length, metering boxes, pipe supports, etc.

Please note that for projects larger than $100,000 contractors historically have charged a lower percentage for overhead and profit. Also based on conversations with local agencies the construction market is currently fluctuating daily.

Non-Metering Alternatives

For small and older diversions it may not be cost effective to retrofit the existing infrastructure to install a metering device. Several factors may play into making this decision including:

- The age of the facilities.
- The amount of water that is being diverted and how often is the water being diverted, including over what duration.
- The configuration of the existing diversion.

In cases where the cost of retrofitting the existing surface water diversion to install a metering device out ways the benefits, the use of power consumption of the water diversion pump may be used to calculate the volume of water diverted. For this alternative to work the diverter must have the following information:

- Electricity records that isolate the power consumption of the diversion.
- The efficiency of the pump at the diversion.
- The efficiency of the motor of the pump at the diversion.
- The total dynamic head of the system (suction head + discharge head + head loss).

Recommendation

The State Water Board should:

1. Develop a list of water measuring devices for both pipelines and open channels, which meet both best available technologies and best professional practices. Including:
    a. Propeller meters
    b. Magnetic meters
    c. Acoustic meters
    d. Metergates
    e. Calibrated slide gates
    f. Calibrated sluice gates
2. Invite vendors (of the above devices) and diverters to a workshop.
3. Develop a list of vendors and suppliers to post on the State Water Board, Division of Water Rights website.
4. Provide an option for diverters to propose an equal device or measuring method that meets best available technologies and best professional practices.
5. Require diverters to certify that the devices were installed and maintained per manufacturer's recommendations or American Water Works Association.

6. Update the electronic Supplemental Statement of Water Diversion and Use form to request the following information:
    a. Type of measuring device used.
    b. Make, model and serial number of measuring device and any separate counting units.
    c. Size of diversion.
    d. Average depth of diversion.
    e. Date measuring device was last calibrated.
    f. Any dates during which measuring device was not functioning properly.
    g. Electricity[1], when approved by the Division, where;
        i. $V = \frac{318{,}600\ (kWh)(P_{eff})(M_{eff})}{TDH}$

        Where: V = volume of water pumped in gallons;
        318,600 = conversion factor;
        kWh = number of kilowatt-hours for the time period in question; e.g., irrigation season, year or minutes;
        P_{eff} = pump efficiency as a decimal;
        M_{eff} = motor efficiency as a decimal; and
        TDH = total dynamic head of the system in feet.
    h. Electrical records, if measurements is based on power consumption.

[1] Electricity is an acceptable method of measuring diversions in Washington State when approved by the Department of Ecology (http://www.ecy.wa.gov/programs/wr/measuring/measuringhome.html). The following set of criteria is utilized by the State of Washington when determining to approve electricity as an acceptable method:

- If diversion is currently metered
- Age of diversion
- Availablity of power records for diversion
- Amount of diversion

APPENDIX A

Examples: the following examples and prices are for 8-inch and 10-inch measuring devices. The average pipe diameter in the legal delta was found to be 12-inches to 14-inches in size, therefore the approximate measuring device would be one to two sizes smaller. Cut sheets for each type of measuring device is included in Appendix B.

1. Propeller Meters
    a. McCrometer
        i. $967 - 8”
        ii. $1,021 - 10”
        iii. $1,078 - 12”
    b. Netafim
        i. $2,475 - 8”
        ii. $4,125 - 10”
        iii. $5,500 - 12”
        iv. $6,105 - 8” hydrometer (larger sizes available by special order)
2. Magnetic Meters
    a. Elster
        i. $1,000/diameter inch
3. Acoustic Meters
    a. Mace
        i. $4,200
4. Slide Gates
    a. Waterman
        i. $600 to $1,300 - 12” to 14”, does not include automated measuring equipment.

APPENDIX B
CUT SHEETS

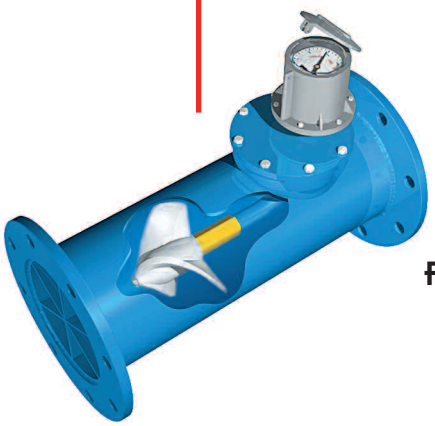
PROPELLER METER CUT SHEETS

Propeller

Flowmeter

Technology

McCROMETER Propeller



For the Real World.

McCROMETER

The Flow Measurement Specialists

Propeller Flowmeters

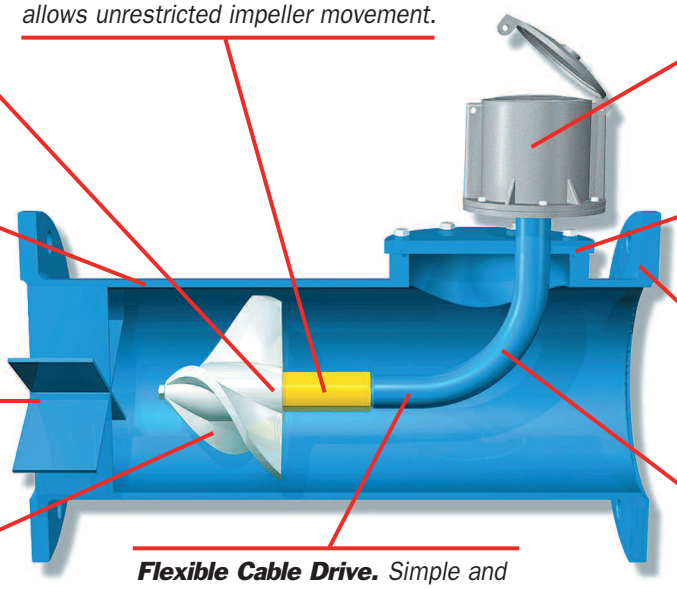
Long-lasting Stainless Steel Ball Bearings. *Factory lubricated and protected from flow stream.*

Epoxy-Coated Carbon Steel Body. *All stainless steel construction available.*

Straightening Vanes. *For optimum flow profiles.*

Corrosion-Resistant Impeller. *Made of durable polymer material, factory calibrated to retain accuracy.*

Magnetic Coupling System. *Isolates register and drive system from flow and allows unrestricted impeller movement.*



Flexible Cable Drive. *Simple and durable, protected by self-lubricating cable guide.*

Instantaneous Flowrate Indicator and Totalizer. *Housed in a Die-Cast Aluminum Register Canopy.*

Removable Top-Plate Assembly. *Available on many models for easy access during field service or replacement.*

Wide Variety of End Fittings. *Including threaded, grooved-end, flanged, and weld-on.*

Heavy Gauge Stainless Steel Support. *Resists corrosion.*

The Most Proven, Dependable Choice

McCrometer offers a complete line of dependable and economical propeller flowmeters for the widest range of applications—from fire hydrant testing to effluent management to farm irrigation. Designed to operate in real-world environments, these flowmeters can measure turbulent flows and fluids containing debris, suspended solids, and other contaminants with an accuracy superior to other technologies.

McCrometer's Mc Propeller flowmeters offer a simple and efficient design. They are easy to install, use, and maintain. After over 50 years of installations, it's no wonder these economical workhorses remain the number one choice for so many water management applications.

Self-Cleaning, Durable Design

Key to the success of McCrometer's Mc Propeller flowmeters is a self-cleaning design that prevents the build-up of solids. A unique, magnetic coupling system keeps the register

FIRE HYDRANT FLOWMETER M1104

- Lightweight, portable design
- Instantaneous readings

BOLT-ON SADDLE FLOWMETER MO300

- 4″ to 16″ line sizes

LARGE-LINE, BOLT-ON SADDLE FLOWMETER M1400

- 18″ to 48″ line sizes

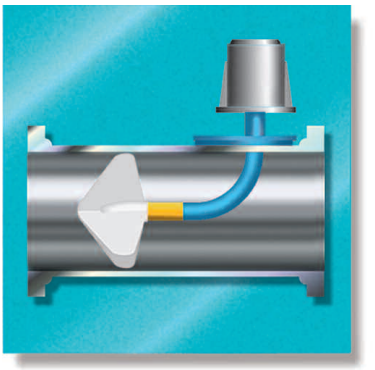
BOLT-ON SADDLE SURFACE WATER FLOWMETER M0300SW

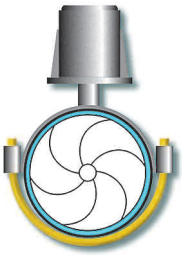
- 4″ to 12″ line sizes

OPEN FLOWMETER M1700

- 10″ to 72″ and larger line sizes

The McCrometer Mc Propeller flowmeter's self-cleaning design uses a flexible drive shaft running within a curved, stainless steel "ell" that makes it easier to shed debris.





The positioning of the impeller directly in the flow stream assures full-flow measurement and greater accuracy.

The McCrometer Propeller flowmeter comes with a standard instantaneous flowrate indicator and straight-reading totalizer. An optional electronic FlowCom register is also available.

six-digit, straight-reading totalizer. They are available in gallons, cubic feet, acre feet, cubic meters and other standard measurements. Both mechanical and electronic registers are available.

Accuracy for Challenging Environments

McCrometer's Mc Propeller flowmeters operate in a wide variety of environments without damage or loss of accuracy. They deliver ±2% of true accuracy and ±.25% repeatability over a flowrange of up to 25 to 1. Whether measuring clean or dirty fluids, McCrometer's Mc Propeller flowmeters excel in measuring turbulent flows, and their built-in versatility makes them ideal for retrofits.

Options to Meet a Wide Range of Needs

McCrometer's Mc Propeller flowmeters come in a variety of standard style configurations—including bolt-on saddle meter, open flow meter, and precision tube—and with a host of options for custom requirements. They offer exceptional sizing flexibility, and can be sized for line diameters of 2″ to 96″ and larger.

MAIN LINE FLOWMETER MW500/MZ500

- 2″ to 24″ or larger line sizes

IRRIGATION-FLANGED FLOWMETER ML100

- 6″ to 12″ line sizes

GROOVED AND SMOOTH-END FLOWMETER MG100/MS100

- 2″ to 24″ line sizes

ALL STAINLESS STEEL MAIN LINE FLOWMETER QW500/QZ500

- 2″ to 24″ line sizes

Proven performance.

and drive isolated from the flow while permitting unrestricted movement of the impeller. Free rotation of the impeller also is assured by factory-lubricated, stainless steel bearings.

The high-impact plastic impeller will not flex or otherwise change in dimension. In fact, it maintains its shape and accuracy over the lifetime of the meter. The impeller also is corrosion and erosion resistant, enabling McCrometer's Mc Propeller flowmeters to operate safely in rugged environments.

Easy to Use and Maintain

McCrometer's Mc Propeller flowmeters install easily and require little maintenance. All their components are easily serviced in the field. The register is driven by a flexible steel cable. The register can also be extended topward for easy reading in confined spaces.

Instantaneous Flow Rate Indicator & Straight-Reading Totalizer: Standard

Registers have an instantaneous rate of flow indicator and

THREADED-END FLOWMETER MT100

- 2″ to 6″ line sizes

WELD-ON SADDLE FLOWMETER MW600

- 4″ to 48″ or larger line sizes

RIGHT ANGLE FLOWMETERS MW800/MM800

- 3″ to 24″ line sizes

MAIN LINE FLOWMETER MW900/MG900/MT900

- 2″ to 24″ or larger line sizes
- Smooth, grooved, or threaded ends

FLANGED-END FLOWMETER MF100

- 2″ to 12″ line sizes

Proven performance.

Engineered for Accuracy, Durability, and Economy for...

Municipal Water/Wastewater

and

Agriculture/Turf Irrigation

- **Potable water**
- **Drip and sprinkler irrigation**
- **Wastewater management**
- **Water well production**
- **Marine system testing**
- **Fire sprinkler testing**
- **Pumping stations**
- **Golf courses and park water management**
- **Truck loading and discharge**
- **Canal laterals**
- **Center pivot systems**

McCrometer's Mc Propeller flowmeters measure both flow rate and volume, using turbine technology and a helical shaped impeller. The flowmeter consists of a rotating device, an impeller, positioned in the flow stream. When fluid passes through the meter, it contacts the impeller, causing it to spin. The impeller's rotational velocity is directly proportional to the velocity of the flow. The rotation is translated through a magnetic coupling and flexible drive system to the register. The register automatically calculates the flow rate by multiplying the flow velocity with the cross-sectional area of the meter tube.

The register incorporates an instantaneous flowrate indicator and straight-reading totalizer. The flowrate and total flow may be indicated in virtually any unit of measurement such as U.S. gallons or liters.

McCrometer

Application

Support

At McCrometer, all we make are flowmeters. We have over 50 years of flow measurement experience in municipal, industrial, and agricultural markets.
Our knowledgeable staff can accurately evaluate your flow applications and specify the best metering technology for your specific flow condition. For a free evaluation of your flow application or to find out about our other flowmeter products, contact your McCrometer representative today, or visit our website at **www.mccrometer.com**

Instrumentation Options For Remote Display & Control

McCrometer's Electronic instrumentation is specifically designed for use on all McCrometer Mc Propeller flowmeters, allowing the flow data generated by the flowmeter to be transmitted and incorporated into flow monitoring and control systems. This instrumentation can be ordered along with the flowmeters or retrofitted to any existing McCrometer Mc Propeller flowmeter.

Transmitters

Transmitters can be easily installed on all new or existing McCrometer Mc Propeller flowmeters to provide a variety of signal outputs to flow computers, irrigation controllers, electronic and electromechanical totalizers, chart recorders, Programmable Logic Controllers (PLCs), and computerized data acquisition systems.

Standard signal outputs available:

- Linear 4-20 mA
- Dual forward and reverse 4-20 mA (separate signal for forward and reverse flows)
- Digital 0-12 volt pulse
- Dry Contact Relay
- Open-Collector

Electronic Registers

These battery-powered FlowCom registers come with LCD Rate of Flow and Total Flow displays. They replace the mechanical register and can be mounted directly on the propeller flowmeter or in a remote enclosure. These registers are field programmable and have optional 4-20 mA and pulse outputs.

Flow Computers

Remote mounted microprocessors display both rate of flow and total flow. These flow computers are easily field programmable and can include control features such as high and low alarm set points, control and alarm outputs, relay outputs, RS-485 serial communications ports and 4-20 mA outputs.

Chart Recorders

McCrometer Chart Recorders are remote, microprocessor-based, circular chart recorders for monitoring and permanent recording of flowrate information. They use a thermal printing stylus to draw charts on blank paper. Chart Recorders are available with both 24-hour and 7-day charts. Recorders are also available with 4-20 mA control outputs.

McCROMETER
The Flow Measurement Specialists

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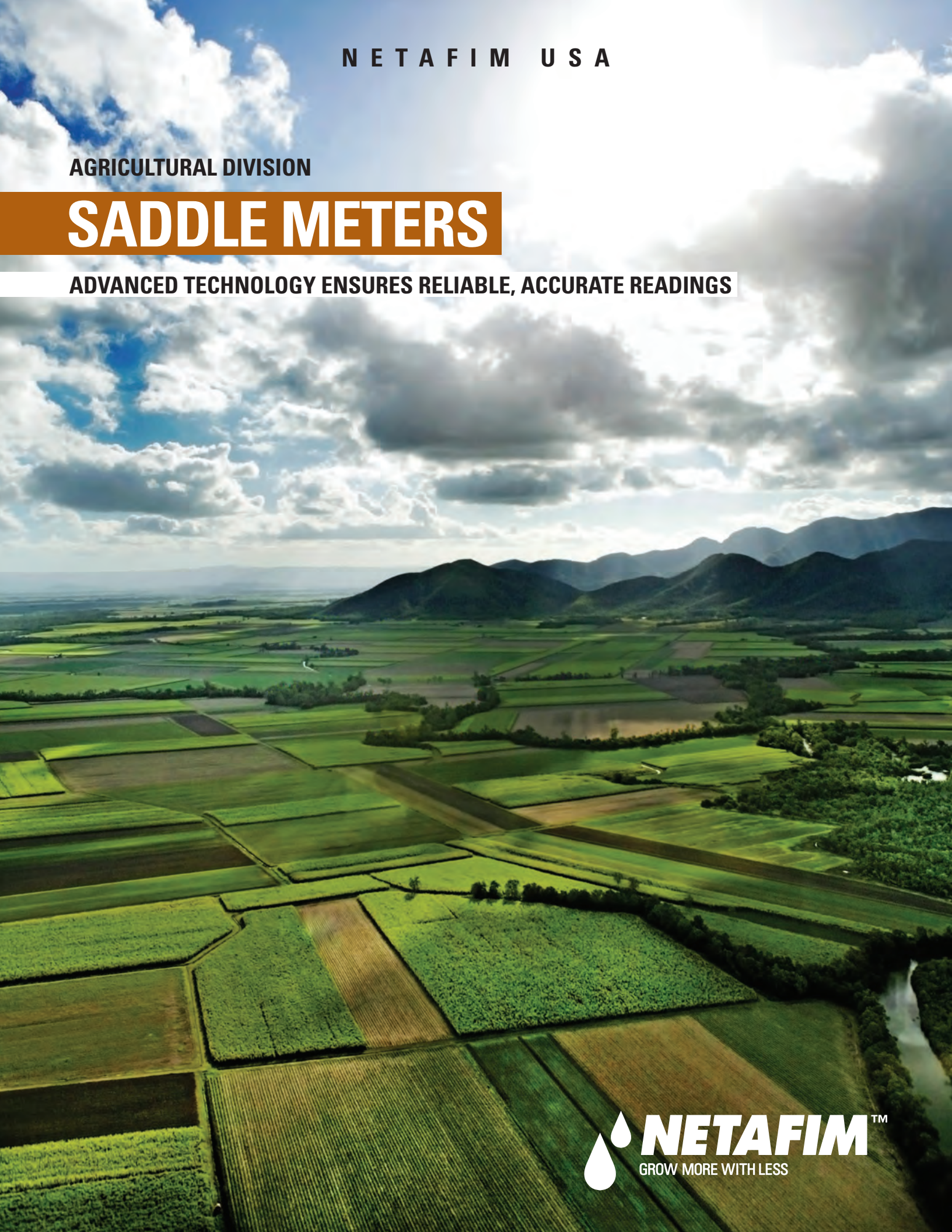
NETAFIM USA

AGRICULTURAL DIVISION

SADDLE METERS

ADVANCED TECHNOLOGY ENSURES RELIABLE, ACCURATE READINGS



NETAFIM™
GROW MORE WITH LESS

IF YOU CAN'T MEASURE IT - YOU CAN'T MANAGE IT

MEASUREMENT IS THE KEY TO EFFECTIVE WATER MANAGEMENT

Every irrigation system - drip/micro, flood, sprinkler or center pivot - needs water and fertilizer delivered at the right time and in the right amounts. Metering is the only way to make sure water and fertilizers are delivered accurately.
High quality Netafim WT-SM Saddle Meters provide the confidence and assurance that the correct amount of water and fertilizer (nutrients) are being delivered to the crop maximizing yields and reducing energy costs.

ADVANCED TECHNOLOGY = RELIABILITY

Netafim's advanced saddle meter technology ensures reliable flow readings without the problems associated with old-style drive trains and speedometer dial indicators. The smooth rotation of the impeller allows accurate measurement of both high and low flows. Performance and reliability you can count on to effectively manage your operation day after day.

THE INDUSTRY'S LONGEST WARRANTY

Netafim stands behind our meters with an unprecedented warranty - the industry's longest - three (3) years. This warranty begins from the date of installation, not the date of sale like other manufacturers.

MORE ACCURATE OVER A WIDE RANGE OF FLOWS

The unique design of a double magnetic transmission allows the meter to handle high loads of sand since only the impeller is in contact with the water.
Repelling magnets enable accurate measurement across a wide range of flow rates, from very high to very low flows, while maintaining high accuracy even after many years of operation.

MORE FEATURES AT NO ADDITIONAL COST

ONLY NETAFIM OFFERS THESE FEATURES

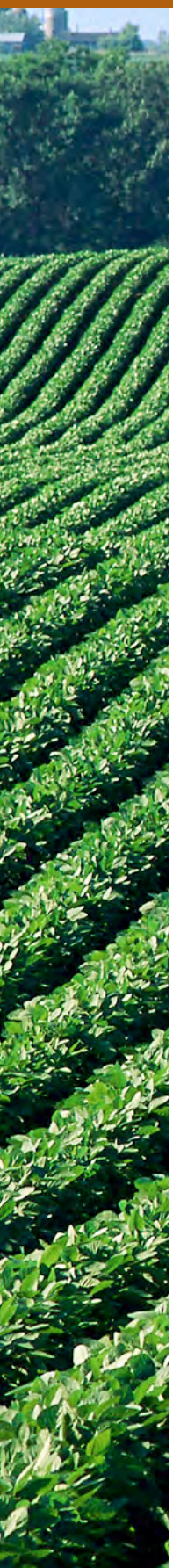
- Accuracy of +/-2% over a wider range of flows (0.7 ft/s up to 13 ft/s) without adding costly overrun bearings
- Corrosion-resistant stainless steel saddle and bearings for long life
- Digital register displays rate of flow and total volume readings without requiring tedious calculations
- Programmable register allows calibration changes for multiple pipe sizes/wall thickness without changing mechanical gears
- Dry pulse output provides reliable communication and integration with Netafim automation products
- Each saddle meter includes a full set of testing documents
- Easy installation and retrofit to existing meters

GET MORE AT NO ADDITIONAL COST

The examples below illustrate product features standard on all Netafim WT-SM Saddle Meters. Because we offer more features than other manufacturer's meters, you save time and money.

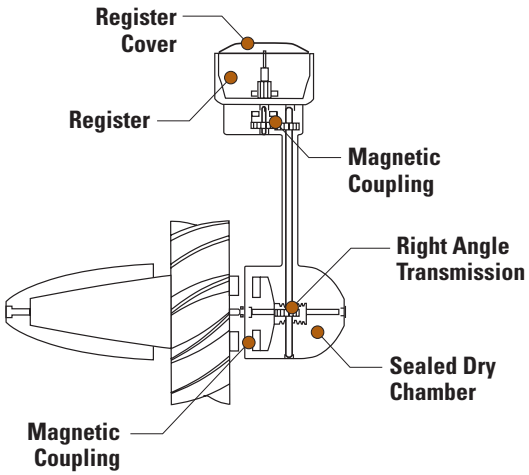
	NETAFIM WT-SM SADDLE METERS	OTHER MANUFACTURER'S SADDLE METERS
Stainless Steel Bearings	✓ Included	Up to $230 Additional
Overrun Bearings	✓ Not Required	Up to $44 Additional
Digital Display	✓ Included	Up to $320 Additional
Dry Pulse Output	✓ Included	Up to $400 Additional
Testing Documents	✓ Included	Up to $145 Additional
Warranty	3 3 Years	1 Year
Shipping Time	2 2 Days	2 + Weeks

OPERATION AND APPLICATION



WT-SM SADDLE METER OPERATION

The double magnetic transmission of the WT-SM Saddle Meter along with repelling magnets ensures accurate measurements. Transmission gears are located in a sealed, dry compartment which has no contact with the water - only the impeller contacts the water. The balanced impeller has an equal load on the front and rear bearings preventing wear and maintaining high accuracy. Injecting fertilizers and chemicals through the system will not damage the non-corrosive components of the saddle meter.



APPLICATIONS

- Agricultural Irrigation
- Wastewater
- Utilities and Industrial Use

AVAILABLE SIZES FOR IPS PIPE

- 6", 8", 10" and 12"

MPE DIGITAL REGISTERS

Netafim Multi-Purpose Electronic (MPE) Digital Registers combine standard digital register features with dry pulse output capabilities. They clearly display the rate of flow and volume readings in gallons or acre feet. Register data is stored on an internal chip and retrievable if the register is damaged. Additional features include:

- Programmable - accommodates a wide variety of pipe sizes
- Stainless steel/plastic (IP67) encapsulated - guaranteed not to accumulate moisture or fog
- Hermetically sealed and mounted in a dry compartment - no contact with the water
- Interchangeable and easily replaced - only need common tools
- Electrical output - driven by a magnetic coupling that activates a reed switch creating a pulsed output for communicating with control and monitoring equipment
- Lithium batteries included - 10+ years of life
- Tamper-proof register - ideal for water district usage

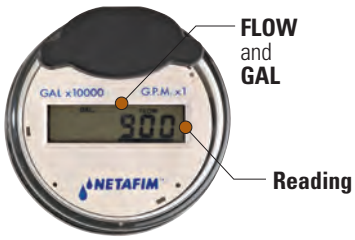
MPE DIGITAL REGISTER GALLON TOTALIZER

MPE DIGITAL REGISTER WITH PULSE OUTPUT

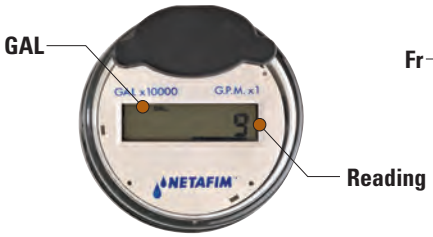
The MPE electronic register's LCD screen displays six digits and alternates every 10 seconds between Rate of Flow in Gallons per Minute (GPM) and Total Volume as a whole number and a fractional number in U.S. Gallons (U.S.G.) or Acre Feet.

- **FLOW** and **GAL** are visible on the display - reading for the Rate of Flow in GPM.
- **GAL** is visible on the display - whole number reading for a portion of Total Volume in U.S.G. or Acre Feet.
- **Fr** is visible on the display and the numbers are underlined in red - fractional number reading for a portion of the Total Volume in U.S.G. or Acre Feet.

READING THIS GALLON TOTALIZER REGISTER

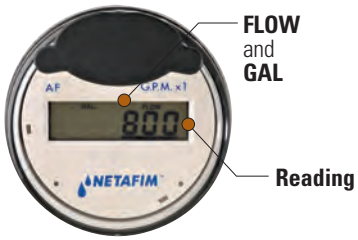


RATE OF FLOW
Reading: 900
Current Rate of Flow is 900 GPM

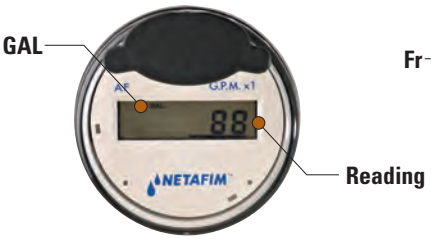


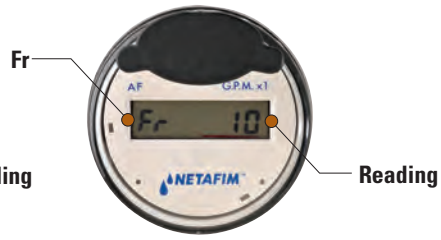
CALCULATING TOTAL VOLUME
1st Reading: 9 **2nd Reading:** 835
1st reading + decimal point + 2nd reading: 9.835
Multiplication: 9.835 x 10,000 = 98,350
Current Total Volume is 98,350 U.S.G.

READING THIS ACRE FEET TOTALIZER REGISTER



RATE OF FLOW
Reading: 800
Current Rate of Flow is 800 GPM





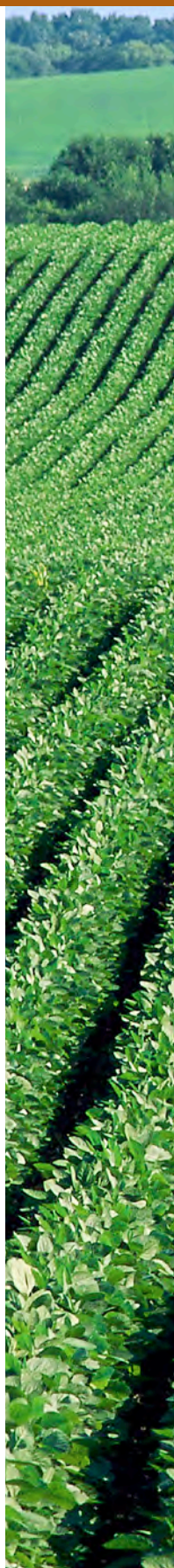
CALCULATING TOTAL VOLUME
1st Reading: 88 **2nd Reading:** 10
1st reading + decimal point + 2nd reading: 88.10
Multiplication: 88.10 x 1 = 88.10
Current Total Volume is 88.10 Acre Feet

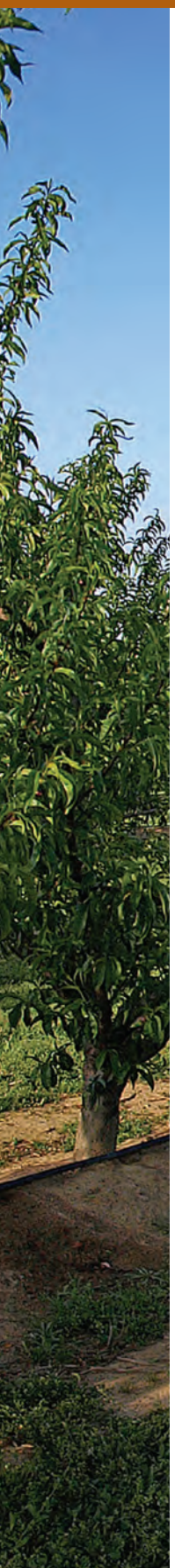
MPE DIGITAL REGISTERS

METER SIZES	VOLUME UNITS	PULSE OUPUT
6", 8", 10", 12"	Gallon x 10,000	100 gal/pulse
6", 8"	Acre Feet x 1.00	32.6 gal/pulse
10", 12"	Acre Feet x 1.00	325.9 gal/pulse

ELECTRICAL SPECIFICATIONS

MINIMUM VOLTAGE	3.6VDC
MAXIMUM VOLTAGE	40VDC
MAXIMUM CURRENT	200mA
MAXIMUM DISTANCE (between meter and control board)	65 feet

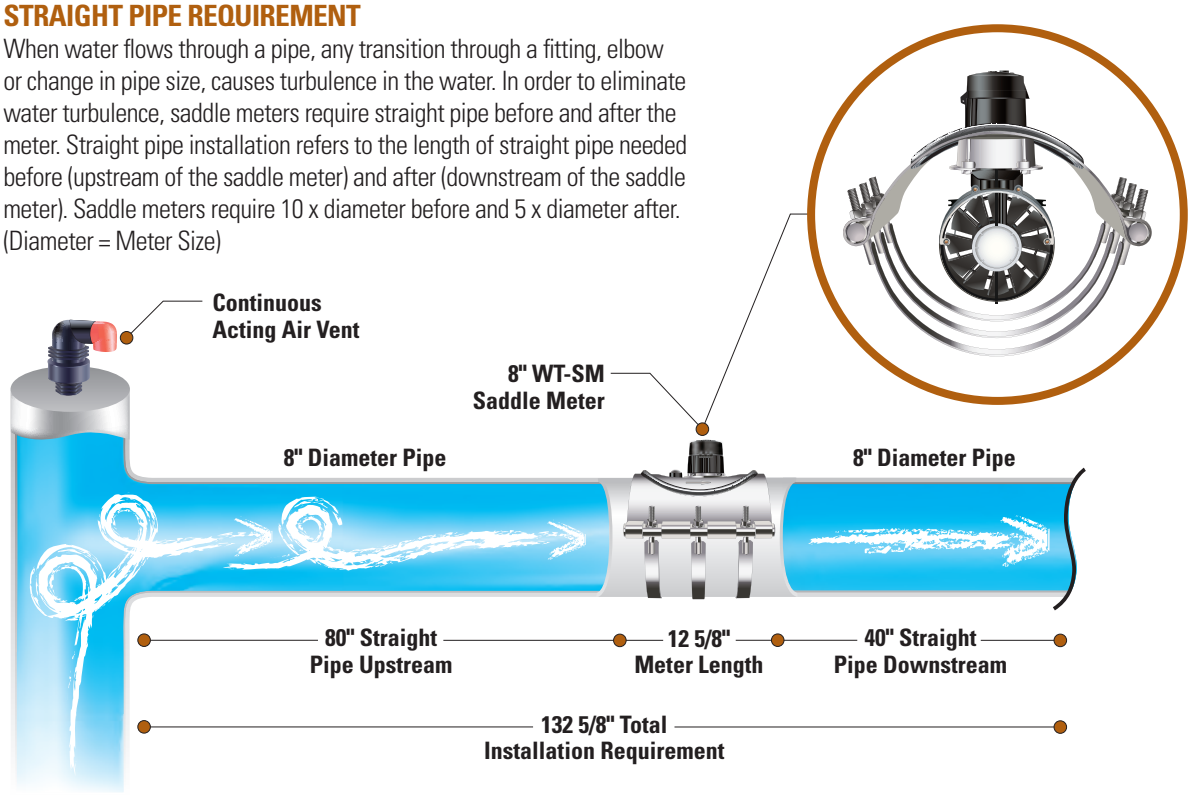




REQUIREMENTS AND TECHNICAL SPECIFICATIONS

STRAIGHT PIPE REQUIREMENT

When water flows through a pipe, any transition through a fitting, elbow or change in pipe size, causes turbulence in the water. In order to eliminate water turbulence, saddle meters require straight pipe before and after the meter. Straight pipe installation refers to the length of straight pipe needed before (upstream of the saddle meter) and after (downstream of the saddle meter). Saddle meters require 10 x diameter before and 5 x diameter after. (Diameter = Meter Size)



STRAIGHT PIPE INSTALLATION REQUIREMENTS

- Straight pipe installation requirement: 10 x diameter pipe upstream (before the meter) and 5 x diameter pipe downstream (after the meter).
- The saddle meter may be installed in any position. For non-horizontal positions, the flow shall be upwards.
- Prior to installation of meter, the pipeline should be thoroughly flushed.
- Meter must be installed so that the pipe is full of water at all times during metering.
- Recommendation: Continuous Acting Air Vents of proper size and type be installed to eliminate air.

WT-SM SADDLE METERS

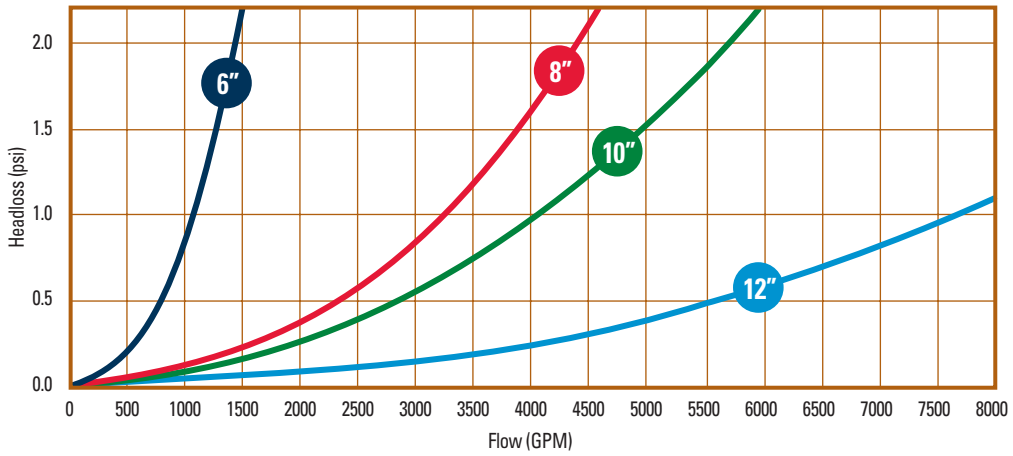
Straight Pipe Installation Requirement - 10 x D and 5 x D

SIZE	UPSTREAM DISTANCE	DOWNSTREAM DISTANCE	METER LENGTH	TOTAL REQUIREMENT
6"	60"	30"	11 3/4"	101 3/4"
8"	80"	40"	12 5/8"	132 5/8"
10"	100"	50"	12 5/8"	162 5/8"
12"	120"	60"	12 5/8"	192 5/8"

SPECIFICATIONS

MAXIMUM WORKING PRESSURE	150 psi
MAXIMUM LIQUID TEMPERATURE	140° F
BODY MATERIAL	Stainless Steel
STANDARDS	AWWA, ISO 4064, EEC

HEADLOSS CHART



FLOW RATE
@ 1.0 psi of Headloss

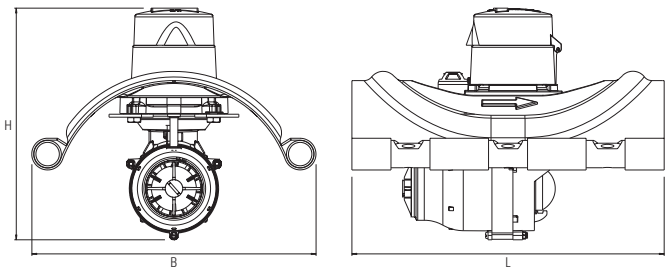
SIZE	GPM
6″	1,056
8″	3,229
10″	4,058
12″	7,711

PERFORMANCE DATA

SIZE	LOWEST FLOW (within ± 5% accuracy)	LOWEST FLOW (within ± 2% accuracy)	NOMINAL FLOW (within ± 2% accuracy)	MAXIMUM FLOW (within ± 2% accuracy)
6″	20 GPM	88 GPM	1,100 GPM	1,805 GPM
8″	33 GPM	132 GPM	1,980 GPM	3,212 GPM
10″	53 GPM	176 GPM	3,300 GPM	6,160 GPM
12″	79 GPM	264 GPM	4,400 GPM	8,800 GPM

DIMENSIONS AND WEIGHT

SIZE	H (Height)	B (Width)	L (Length)	WEIGHT
6″	9 1/2″	10 1/2″	11 3/4″	15.4 lbs.
8″	9 7/16″	11 5/8″	12 5/8″	15.5 lbs.
10″	12 13/32″	13 13/16″	12 5/8″	20.5 lbs.
12″	13 13/32″	15 3/4″	12 5/8″	23.5 lbs.



ORDERING INFORMATION
Required Information: Inside and Outside Pipe Diameter (IPS PIPE ONLY)

SIZE	DIGITAL MPE REGISTER	GALLONS PER PULSE	MINIMUM FLOW (GPM)	MAXIMUM FLOW (GPM)	MODEL NUMBER
6″	Gallons	100	88	1,805	36WTSM6E*.***
	Acre Feet	32.6			36WTSM6EAF*.***
8″	Gallons	100	132	3,212	36WTSM8E*.***
	Acre Feet	32.6			36WTSM8EAF*.***
10″	Gallons	100	176	6,160	36WTSM10E**.***
	Acre Feet	325.9			36WTSM10EAF**.***
12″	Gallons	100	264	8,800	36WTSM12E**.***
	Acre Feet	325.9			36WTSM12EAF**.***

*.*** or **.*** = Specification for inside pipe diameter.

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A030 7/09

Specification Sheet

R1000 Propeller Meter

Description

Operation. The R1000 Propeller meter line uses a specially designed propeller type turbine that presents a relatively low cross section to the flow. The turbine design, combined with the constant area body cross section, results in a very low pressure drop. The unobtrusive design of the measuring device also means that the R1000 is less susceptible to damage from debris than Woltmann style meters that are often used in irrigation applications. The wide range of meter sizes provides an extended flow range to meet most irrigation metering needs. A single measuring chamber fits all sizes of meter housings.

Installation. The meter may be installed horizontally, vertically, or any orientation in between. The meter shall be installed with the direction of the flow as indicated by the arrow cast in the meter case. Note: The meter must have 10 straight pipe diameters ahead of the meter and 5 straight pipe diameters after to insure proper flow through the meter.

Applications. This meter is for use with cold water up to 120°F (50°C) and working pressures up to 150 psi. The meter will register accurately within the flow ranges listed and at the accuracy listed. Accuracy tests are made prior to shipment so no adjustments need to be made prior to installation.

Construction. The meter consists of a main case, a measuring element, and a magnetically driven register assembly with a brass cover. The main case is cast iron, finished with an epoxy coating both inside and out.

Sizes 2" - 10"

Specifications

Size	2"	3"	4"	6"	8"	10"
Performance						
Min Flow GPM ± 5%	5	14	21	53	88	141
Low Flow GPM ± 2%	20	53	79	198	330	530
Rec Cont Flow GPM ± 2%	132	352	528	1320	2200	3520
Peak Flow GPM ± 2%	308	660	1100	2200	3960	5280
Pressure Loss Peak (psi)	1.7	1.5	0.7	0.4	0.7	0.4
Max Operating Pressure (psi)	150	150	150	150	150	150
Max Operating Temp (°F)	120	120	120	120	120	120
Registration						
Smallest Readable Amt (USG)	10	10	10	10	10	10
Capacity (Billions USG)	10	10	10	10	10	10
Smallest Readable Amt (m^3)	0.005	0.005	0.005	0.005	0.005	0.05
Capacity (Million m^3)	10	10	10	10	10	100
Physical Description						
Laying Length (Inches)	7.875	8.875	9.875	11.75	13.75	17.75
Weight (Lbs.)	24	33	42	66	106	187
Low Seped Reed Pulser						
US Gallons per Pulse	1000	1000	1000	1000	1000	10000
Cubic Meters per Pulse	1	1	1	1	1	10
High Speed Reed Pulser						
US Gallons per Pulse	1	10	10	10	10	100
Cubic Meters per Pulse	10	100	100	100	100	1000

Materials	
Body Case	Epoxy Coated Cast Iron
Top Plate	Brass
Gasket/O-ring	EPDM
Rotor	Plastic
Register	Plastic (Makrolon)
Register Housing	Brass

The register cover includes a drilled boss that can accomodate a padlock to prevent tampering.

Register. The six digit register is available in both USG and metric (cubic meter) registration. The register housing is completely separate from the measuring element, insuring a dry register.

Connections. The propeller meter incorporates round raised-face flanged connections conforming to ANSI specifications. Maximum recommended operating pressure is 150 psi.

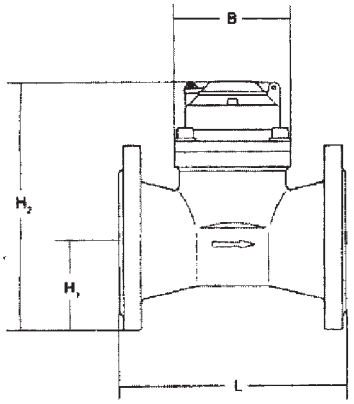
Dimensions in Inches (mm)

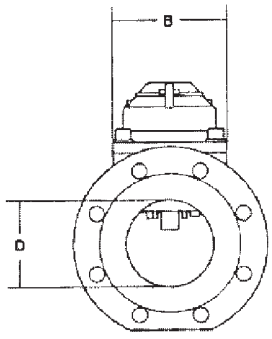
Meter Size	L	B	H_1	H_2
2"	7.875 (200)	5.125 (130)	2.835 (72)	5.125 (130)
3"	8.875 (225)	5.125 (130)	3.750 (95)	9.875 (250)
4"	9.875 (250)	5.125 (130)	4.125 (105)	10.250 (260)
6"	11.750 (300)	5.125 (130)	5.315 (135)	11.375 (290)
8"	13.750 (350)	5.125 (130)	6.300 (160)	12.375 (315)
10"	17.750 (450)	5.125 (130)	7.875 (200)	14.000 (355)

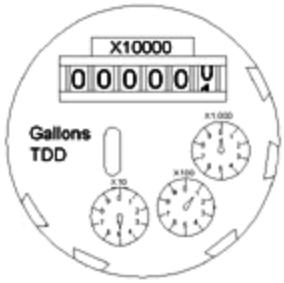
Pulser. **(Low Speed)** An optional reed switch pulser may be ordered with the meter or may be retrofitted at any time. The pulser outputs one pulse per 1000 gallons or one pulse per 1000 liters (one pulse per 10,000 liters for the 10" meter), depending on the registration. The maximum voltage for the pulser is 24 VDC. Maximum current is 100 mA and the internal resistance is 100 Ohms. Approximately 10 feet of cable is supplied with the pulser.

Pulser. (High Speed) (opto-electronic -- PV14) This infrared optical sensor is powered by 12 to 24 VDC, 15/25 mA max. power from an external source, 15 ohm line resistance core. The pulse is provided at a 50/50 open/closed ratio. This is a three-wire system, red wire +12/24 VDC Power, white wire-signal, black wire-ground. The following are the outputs per size:

2"	1 pulse = 1 US Gallon/10 Litres
3"-8"	1 pulse = 10 US Gallon/100 Litres
10"	1 pulse = 100 US Gallon/1000 Litres







The company's policy is one of continuous product improvement and the right is reserved to modify the specifications contained herein without notice. These products have been manufactured with current technology and in accordance with applicable AWWA Standards.

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R1000-100/01-03

MAGNETIC METER CUT SHEETS

accuMAG™ Register

Technical Report

THE ACCUMAG ELECTRONIC REGISTER

The Sensus accuMAG Register provides the enhanced features and benefits that are available with the Sensus ICE Register. The register is fully compliant with ANSI/AWWA Encoder Standard C707-10.

The Sensus accuMAG electronic register is available in either a non-submersible (i.e. weatherproof) or a submersible (i.e. waterproof) enclosure. The register may be mounted directly to the meter or remotely. The remote register can be located 30 to 75 feet from the meter. The display contains AMR or Totalization and a high-resolution Resettable Test Totalizer. The accuMAG register features:

- AMR resolution units – fully programmable
- Pulse output units – fully programmable
- Integral resettable accuracy testing feature
- Two electronic outputs – enable links to AMR/AMI systems and SCADA systems at the same time
- Large, easy-to-read LCD
- Standard display shows net totalization or AMR digits and flow rate
- Custody transfer application displays forward (+) and reverse (-) flow totalizer
- Field replaceable batteries

ASCII-BASED PROTOCOL FOR COMPATIBILITY WITH OTHER BRANDS OF READERS

The Sensus accuMAG Register extends the use of the ASCII-based communication protocol first utilized by Sensus in 1984. The meter reading data, which consists of the odometer reading and register ID number, are transmitted in ASCII code, the standard data code used by most of the data communications industry. ASCII encoding methodology requires that a complete reading of a register wheel contain 10 bits of information, which includes a "start, "stop" and a "parity" bit. The parity bit is used as a self-check to insure that the interrogation device has correctly received the data from each wheel.

accuMAG Register Display

Waterproof enclosure

Remote Non-submersible enclosure

Although additional data fields have been incorporated, it can be read by any handheld or AMR reading device that could read ICE or OMNI registers. Now widely considered to be the defacto industry standard, the Sensus 3-wire AMR interface protocol is made available free of charge to other AMR equipment manufacturers, thereby promoting accuMAG register compatibility with present and future AMR networks.

IMPROVED RESOLUTION FOR TESTING AND VISUAL READING

With its eight odometer digits and resettable test totalizer, testing the accuracy of an accuMAG water meter fitted with the electronic register is greatly enhanced. Visual readings in the test mode are more precise by a factor of one hundred, thereby enabling a precise comparison with the volume "standard" of the testing equipment. Decimal points on the dial face are used to separate whole units from fractional measurement units. Following tradition, the meter's unit of measurement, gallons, cubic feet, imperial gallons, or acre feet, is displayed on the register face.

PERMANENT, FACTORY-SET ID NUMBER

The accuMAG electronic register incorporates a unique, never – duplicated identification number that is factory-set into the register's non-volatile electronic memory. The exclusive ID number can be used to identify a particular meter and link it in a utility's billing computer to the customer served by that meter.

UTILITY PROGRAMMABILITY

The Sensus accuMAG electronic register has four data fields that can be programmed by a utility for incorporating and gathering useful information.

One field could be used to identify the register's unit of measurement. Another to identify a reading multiplier. A third, 12-character field could be used to incorporate a unique ID number. And lastly, a 20-character alphanumeric data field could be used to indicate meter size, a customer account number or address, or to identify the utility to protect against inadvertently picking up readings from an adjoining utility's meters.

TWO OR THREE-WIRE REGISTER INTERROGATION TECHNOLOGY

The Sensus accuMAG electronic register can be interrogated in either two-wire mode or three-wire AMR mode, which makes it totally compatible for incorporation into existing systems such as two-wire TouchRead or three-wire RadioRead, or fixed base systems. This feature makes it easy and economical for a utility that starts out with a TouchRead System to easily upgrade to a more-advanced AMR system without having to replace the registers on its meters.

WATERPROOF ENCLOSURE

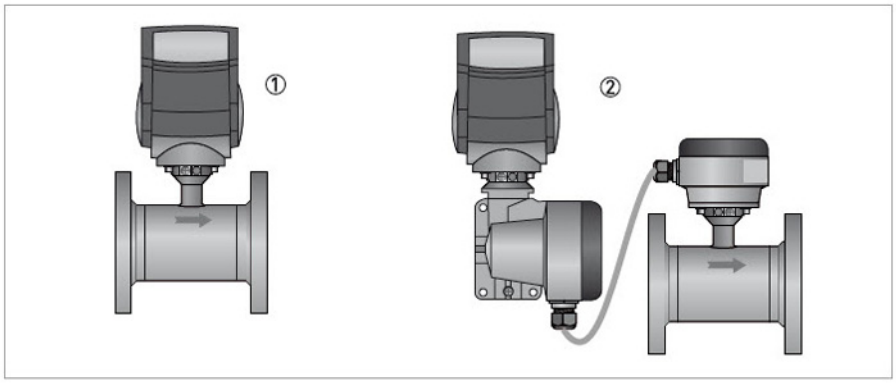
An important requirement for insuring meter reading integrity and accuracy is to protect a register's electronic components from moisture, dirt, sunlight and mechanical damage. This is crucial for meters installed underground in meter boxes and vaults that are subject to flooding, as the potential exists for moisture to pass through a register's cover and damage its electronic components. The accuMAG waterproof electronic register protects the electronic components from moisture in pit sets up to four feet in depth.

PROTECTION OF WIRING CONNECTIONS

Another important requirement for maintaining reading integrity is to insure that wiring connections are protected from moisture, and especially critical for providing long-term operational stability in pit-set environments. To prevent moisture-infiltration, connection components on Sensus accuMAG waterproof electronic registers utilize special waterproof connectors.

DOCUMENTATION

For more detailed accuMAG meter information, please see the Sensus website at www.sensus.com.



① Attached non-submersible
② Remote mounted non-submersible

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evoQ4

Electromagnetic Water Meter

Make every drop count

www.elsteramcowater.com
www.elster-evolution.com

evoQ$_4$ Electromagnetic water meter

Today's water meters need to be more reliable, accurate and durable with advanced flow technology that has the capability to capture revenue while reducing overall operating costs. The evoQ$_4$ provides a total solution for commercial water utility metering, by filling the needs of turbines, compounds, single jets and electromagnetic.

With advanced measurement and flow technology, the evoQ4 battery powered mag meter delivers high accuracy through a wide range of flows and varied conditions and applications. Typical accuracy performance ranges from 99.25% to 100.75% (+/- 0.75% error) of true value through the normal flow range.
The meter line can be sized to suit either predominantly high or low flow rates, and is ideal for a wide variety of bulk flow metering applications, such as network monitoring, leakage detection and commercial billing.

Reliable connectivity

With a choice of bi-directional pulse or encoded outputs, the evoQ4 provides dependable connectivity to critical distribution management and billing systems, including AMR and data-logging devices. The evoQ4 is compatible with evolution™ AMI and other AMR/AMI devices.

Accurate measurement

The evoQ4 has a standard, continuous sampling rate of 0.5 second, so you can be confident of accurate and reliable measurement. It also features anticorrosive electrodes to ensure consistently accurate performance throughout its entire life.

Durability

The evoQ4's tough stainless steel construction ensures a long, corrosion-free working life, while its lightweight body makes storage, transportation and installation both simpler and safer.
An IP68 rating provides protection for internal electronics meaning long-term reliability.

Zero maintenance

Designed without moving parts and a 10-year battery life, the evoQ4 is maintenance free, eliminating regular battery change outs and calibration often required with mechanical and electromagnetic meters.

Real-time data

A large, bright and easy-to-read LCD, displays volume and instantaneous flow rate for referrence The evoQ4 also has alarm functions providing real time status, to ensure no loss in measuring continuity.

Easy access

The evoQ4's optional remote display unit provides a clear LCD for simpler access in hard-to-read applications. The unit also includes two pulse outputs for connection to ancillary devices such as AMR or process monitoring devices.

Low pressure loss

An unrestricted flow tube ensures minimal pressure loss, even at the highest flow rates. This means that overall network system pressures can be reduced, lowering energy expendatures, reducing the occurances of burst pipes and extending the useful life of pumping stations.

Simple installation

Installation of the evoQ4 is simple. Just fit and go, no need for grounding rings or programming with a laptop in a vault. The evoQ4 comes in AWWA C701 Class II Turbine meter lay lengths. The flanges are epoxy coated cast iron to reduce weight and prevent corrosion. The 1.5 and 2" comes with an oval flange and the 3" and larger meters come with a round flange. All flanges conform to ANSI B16.1 Class 125 standards.

evoQ4 AL (Alternate Length)

The evoQ4 meter is now available in alternate lengths for 1.5 and 2" meter installations. The lengths are typical of C700, C702 and C712 lay lengths to facilitate direct replacement of mechanical meters without the added expense of makeup spool pieces. Additionaly, these meters feature a shorter height dimension, fitting into tight spaces. The complete suite of output modules is available to provide remote display or AMR / AMI functionality.

evoQ4 FSM (Fire Service Meter)

As an optional feature, the evoQ4 comes with a full FM Standard 1044 approval for use as a fire service instrument. Replace those monstrous mechanical fire service assemblies with an easily fit solid state meter.

System options

1. Display only
Simple, visual read meter only with no output communications. Pulse or encoder output can be easily added through upgrade in-the-field with option 2 or remote and pulse with option 3.

2. Pulse or encoded output meter
As above with the addition of a plug and play pulse or encoder output transmitter for connection to ancillary devices including AMR, data-loggers or remote monitoring system.

3. Meter + remote display
As in option 1 with the addition of a pulse output and remote display unit (pictured right) connected electronically to the meter. The remote display features two pulse output channels.

Display functions

Volume – the net volume of water measured is diplayed.

Flow Rate – If water is flowing in the reverse direction a minus sign is displayed to the left of the value.

Low-Battery – The indicator appears when the battery voltage is low and the meter should be replaced.

No-Water – The indicator blinks when there is an empty pipe condition in the meter.

Comparison mechanical commercial meters

		evoQ$_4$	AWWA C701 Turbine	AWWA C702 Compound	AWWA C712 Single Jet
1.5"	AL Low Flow (gpm)	1/2	4	N/A	1/2
	Continuous Flow (gpm)	176	80	N/A	50
	High Flow (gpm)	220	160	N/A	10
	Weight	9.5	16	N/A	12
	Lay Length	13	13	N/A	13
	Operating PSI	150	150	N/A	150
	Warranty (years)	5	2	N/A	2
2"	Low Flow (gpm)	1/4	4	1/4	1/2
	Continuous Flow (gpm)	176	100	80	90
	High Flow (gpm)	220	160	160	160
	Weight	11	21*	51*	30*
	Lay Length	10	10	17	17
	Operating PSI	230	150	150	150
	Warranty (years)	5	2	2	2
3"	Low Flow	1/2	8	1/2	1/2
	Continuous Flow	440	350	175	160
	High Flow	550	435	350	320
	Weight	22.5	37*	92*	60*
	Lay Length	12	12	17	17
	Operating PSI	230	150	150	150
	Warranty (years)	5	2	2	2
4"	Low Flow	1.7	15	3/4	3/4
	Continuous Flow	700	650	300	250
	High Flow	880	750	600	500
	Weight	35.5	50*	134*	94*
	Lay Length	14	14	20	20
	Operating PSI	230	150	150	150
	Warranty (years)	5	2	2	2
6"	Low Flow	4	30	1 1/2	1 1/2
	Continuous Flow	1100	1400	675	500
	High Flow	1400	1600	1350	1000
	Weight	55.5	113*	165*	142*
	Lay Length	18	18	24	24
	Operating PSI	230	150	150	150
	Warranty (years)	5	2	2	2
8"	Low Flow	8	50	2	N/A
	Continuous Flow	2770	2400	900	N/A
	High Flow	3500	2800	1600	N/A
	Weight	81.5	177*	523*	N/A
	Lay Length	20	20	34.5	N/A
	Operating PSI	230	150	150	N/A
	Warranty (years)	5	2	2	N/A

* Average Weight of Each Manufacturer's Offering

The evoQ$_4$ is a single meter that meets the needs of traditional turbine, compound, single jet and mag meters.

Traditional electromagnetic meter comparison

Specifications	evoQ4	Traditional Utility E-Mag
Power Options		
AC Only	No	Yes
AC Battery Back Up	No	Yes
Battery Only	Yes	Some
Battery Life	10 yrs	3 yrs (Maximum)
Reading Sample Rate	0.5 sec	15 sec
Reading Options		
Pulse Output	Yes	Yes
Encoder Output	Yes	Yes
4-20mA	No*	No*
Meter Accuracy		
Typical 4" meter		
Low Flow	1.7 gpm	5.9 gpm
Maximum Flow	880 gpm	704 gpm
Dimensions		
Lay Lengths	AWWA C701	Non-standard 4"
Weight	35.5 lbs	33 lbs
Approvals		
CE	Yes	Yes
NSF61	Yes	Yes
FM	Yes	Yes

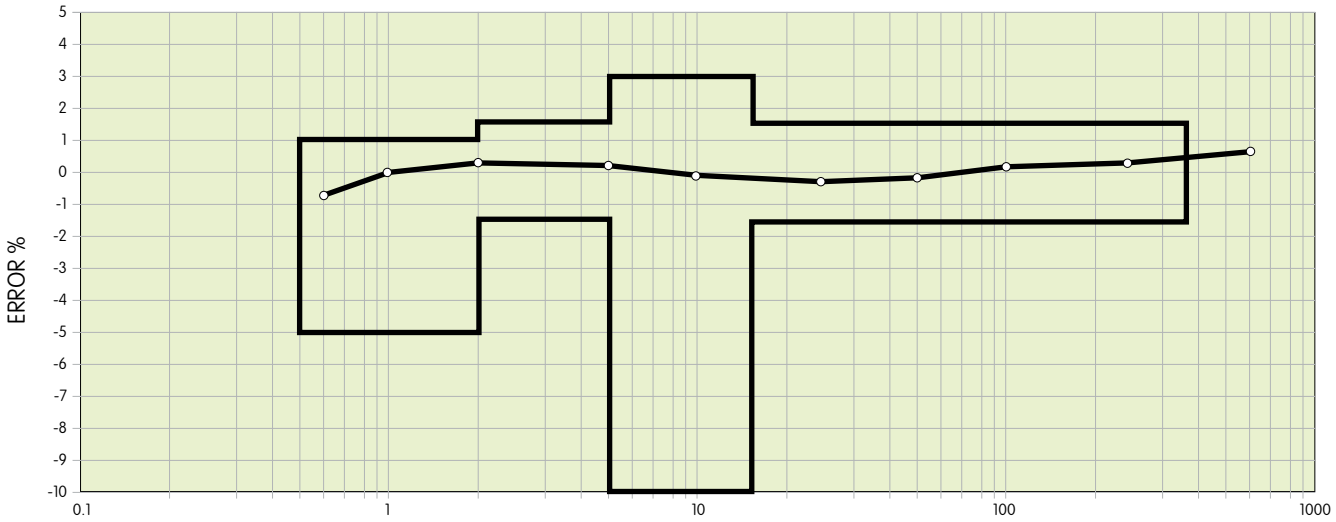
* 4-20mA output can be achieved with a converter

FM APPROVED

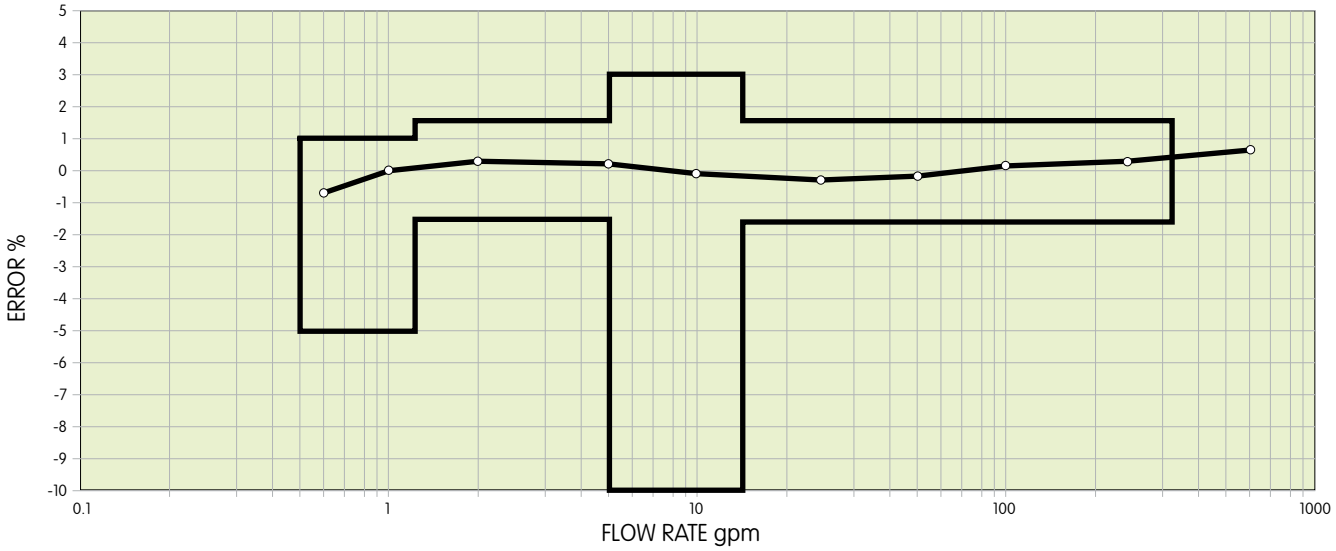
High accuracy measurement

C702 compound accuracy limits

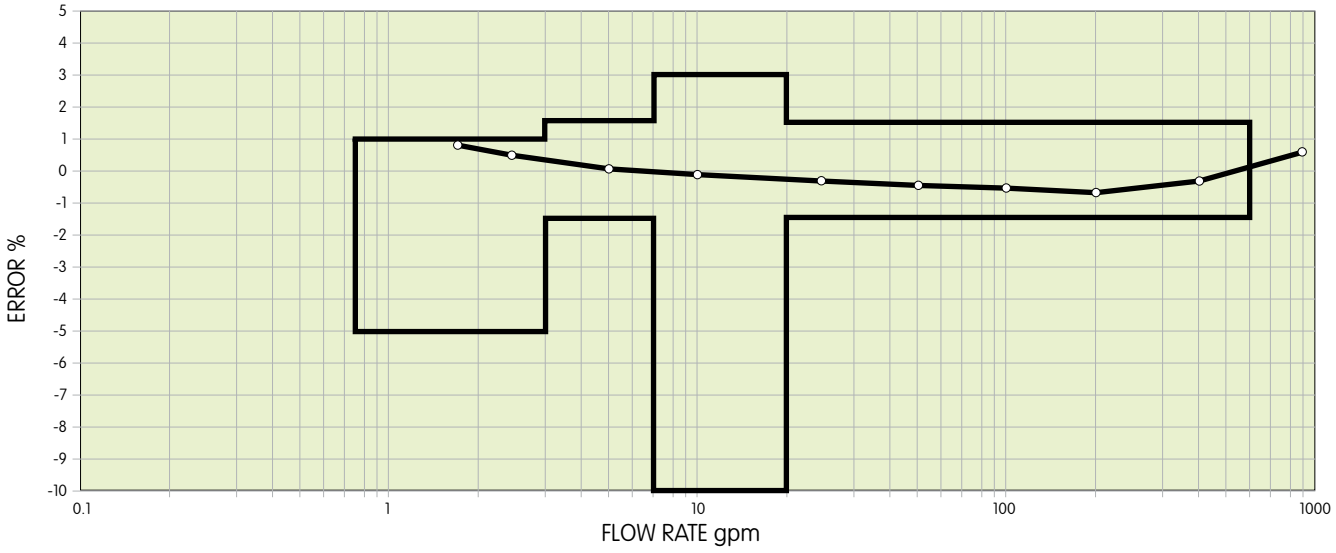
2" evoQ$_4$ vs C702 Accuracy Envelope



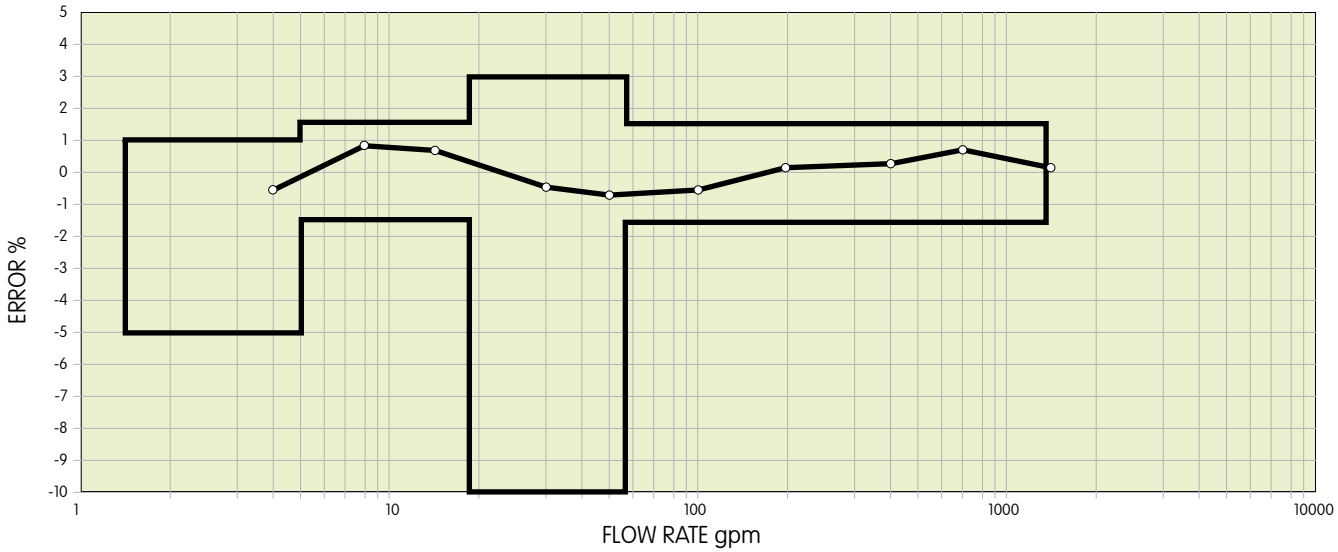
3" evoQ$_4$ C702 Accuracy Envelope



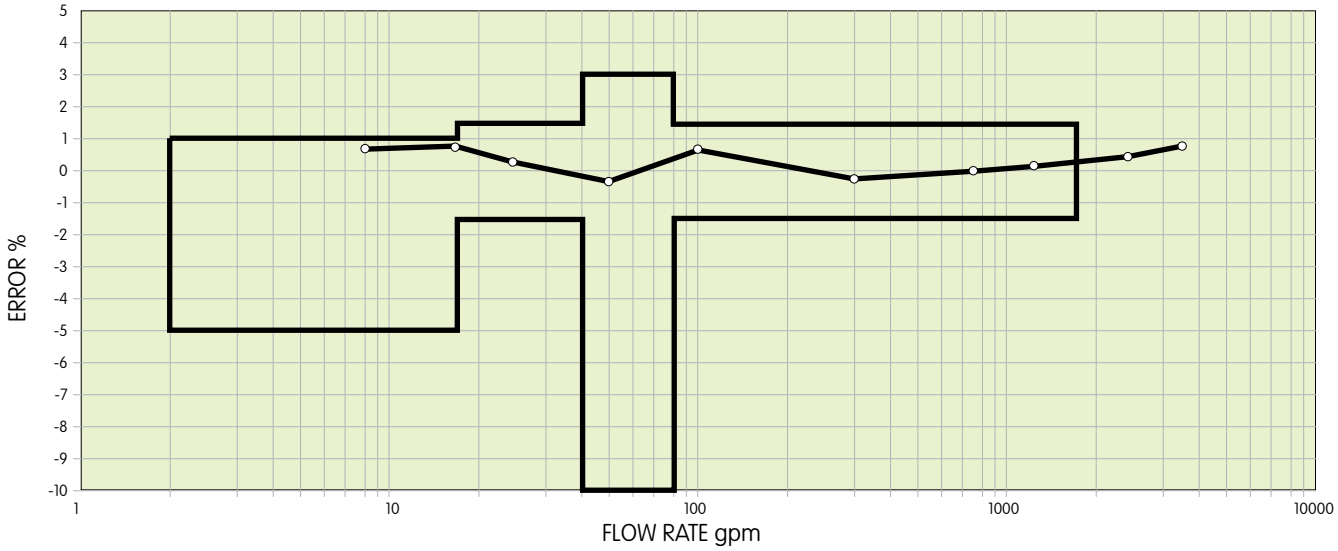
4" evoQ$_4$ C702 Accuracy Envelope



6" evoQ$_4$ C702 Accuracy Envelope



8" evoQ$_4$ C702 Accuracy Envelope



evoQ4 pressure loss

Size	Flow Rate (gpm)	Pressure Loss (PSI)
1.5"	220	4.35
2"	220	4.35
3"	550	3.62
4"	880	3.62
6"	1400	2.17
8"	3500	5.80

About Elster AMCO Water, Inc.

Located in Ocala, Florida, Elster AMCO Water is part of Elster, the world's largest metering and smart metering system solution company. Elster AMCO Water is an industry leader in the development and implementation of innovative metering and system solutions and is committed to delivering superior customer service, quality products, solutions and services to the water utility industry.

About Elster Group

Elster has delivered over 1.5 million smart metering devices worldwide with systems located in North America, Central America, Europe, Australia, New Zealand and the Caribbean. Elster smart metering systems allow utilities to implement energy conservation measures, demand response programs, smart grid initiatives, and smart home solutions as well as achieve operational efficiencies resulting in significant value creation across the utility enterprise. Elster has over 7,500 staff and operations in 38 countries, focused in North and South America, Europe, and Asia.

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Lit Ref: evoQ_4-101/03-09

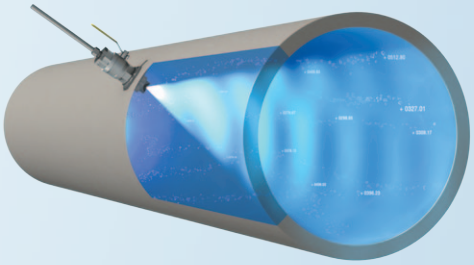
ACOUSTIC METER CUT SHEETS

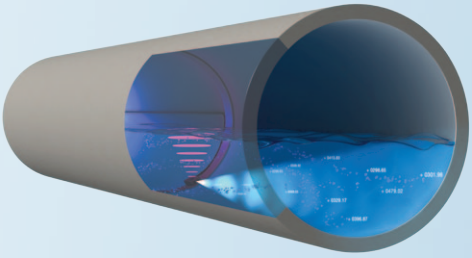
AgriFlo XCi

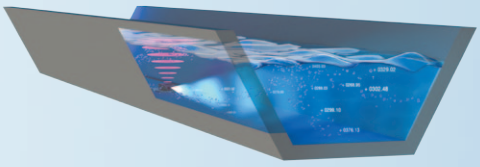
DOPPLER ULTRASONIC WATER FLOW METER

Measure Agricultural Flows with MACE Doppler Ultrasonic Technology

in full pipes, partially full pipes & open channels







www.maceusa.com

mace
Water Monitoring Solutions

Key Benefits

Multiple cards for multiple sensor applications
- 5 card slots allows control of up to 5 MACE Doppler sensors
- Choose cards and sensors for your exact requirements
- Compatible MACE cards:
  - Doppler, FloSI, Pulse I/O, WebComm.

High accuracy with NO moving parts
- Works great in dirty water and animal waste
- No more broken propellers – ever
- No more blocked pipes – ever

Measures flow practically anywhere
- Same insertion sensor will measure in full pipes 0.1 to 2.54m (4" to 100") diameter
- Area/velocity sensor will measure in partially full pipes 0.15 to 2.54m (6" to 100") diameter
- Open channel flow
  - regular cross-sections
  - irregular cross-sections

Low cost of ownership
- Economical to purchase and install
- Single unit with up to 5 Doppler sensors
- No moving parts - virtually maintenance-free
- No pipe blockages - less field maintenance

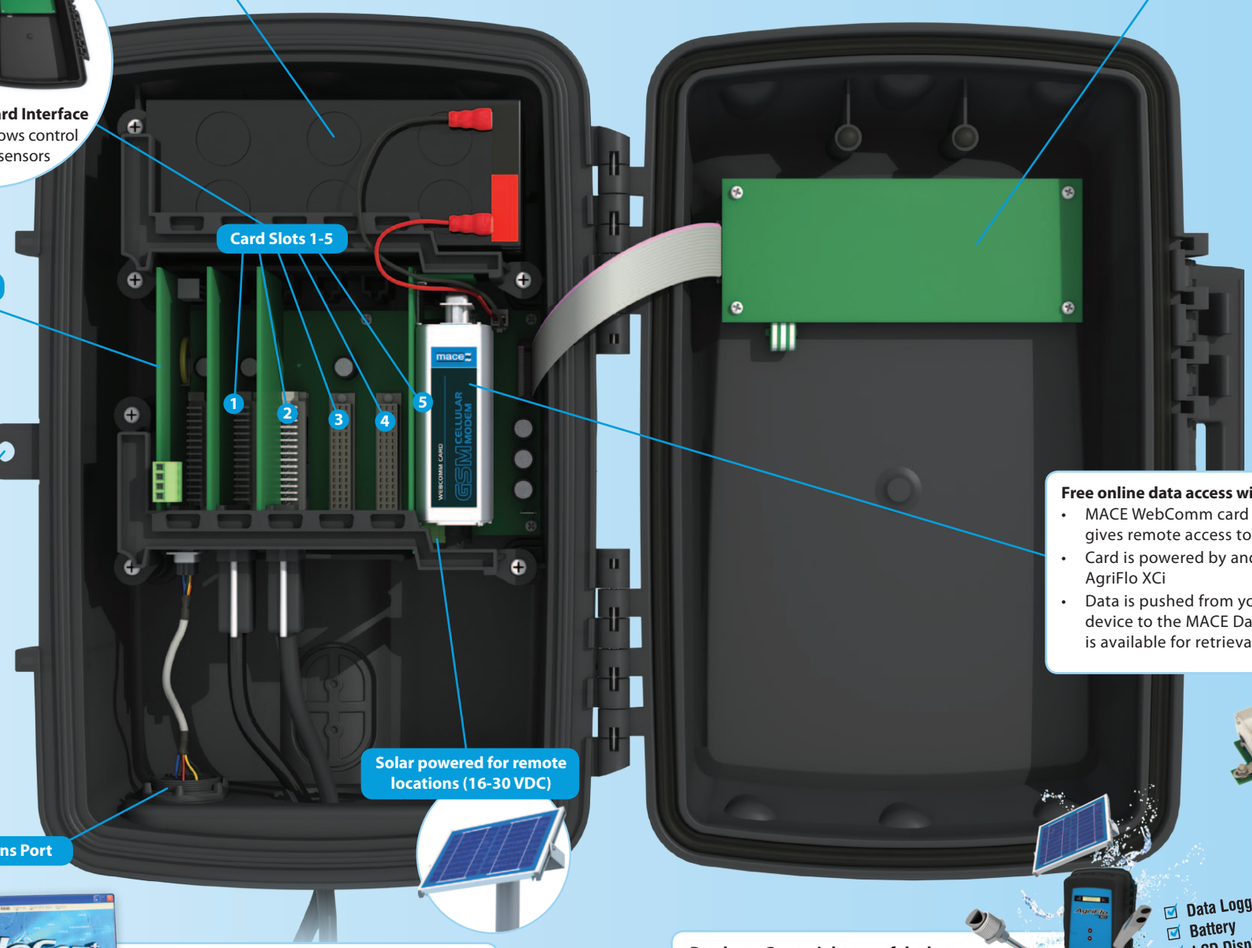
Versatile straight run requirements
- Only 8 total diameters of straight run
- AgriFlo can "look" upstream or downstream
- Different sensor styles - versatile mounting options

Telemetry ready
- ModBUS
- SDI-12
- GSM/CDMA/3G WebComm card

Inside AgriFlo XCi

Card Slot Config Shown: 1) Doppler, 2) Doppler, 3) Empty, 4) Empty, 5) WebComm

XCi Multiple Card Interface
5 card slots allows control of up to 5 sensors



Free online data access with WebComm
- MACE WebComm card for GSM/CDMA/3G gives remote access to your data
- Card is powered by and housed in your AgriFlo XCi
- Data is pushed from your AgriFlo XCi device to the MACE Data Server where it is available for retrieval

Configure with FloCom+ Software
- Free configuration and diagnostic software
- Powerful easy to use Windows® interface
- Painless point 'n' click channel calibration
- No proprietary coding knowledge required

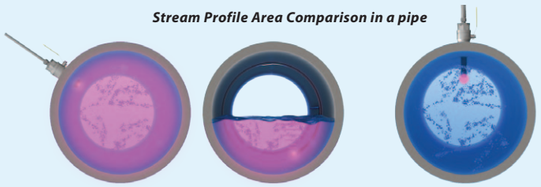
Ready-to-Go straight out of the box
- AgriFlo XCi comes complete with everything you need to get going as quickly as possible
- In most cases, you can be up and monitoring in just a couple of hours.

- Data Logger
- Battery
- LCD Display
- Solar Panel
- Required Card/s
- Velocity Sensor/s

Total stream profile velocity measurement

In a full pipe, electromagnetic or mechanical insertion devices "see" a golf ball sized velocity profile and then use complex algorithms to calculate velocity. The MACE Doppler insertion sensor utilizes advanced spectrum signal processing to give a true average velocity across the whole stream profile.

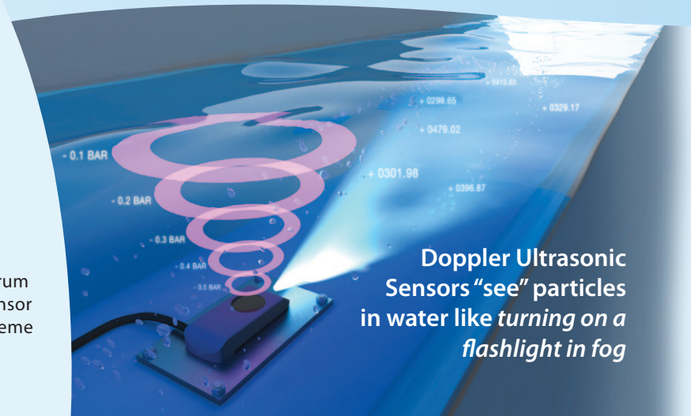
Stream Profile Area Comparison in a pipe



MACE Doppler Velocity Sensors full pipe/partially full pipe

Traditional Insert Sensor in a full pipe

In partially full pipes or open channels, the same advanced spectrum signal processing available with a MACE Doppler area/velocity sensor results in superior average velocity measurements even with extreme turbulence, or reverse flows.

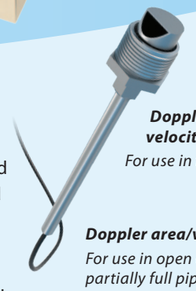


Doppler Ultrasonic Sensors "see" particles in water like *turning on a flashlight in fog*

Doppler Ultrasonic Sensors

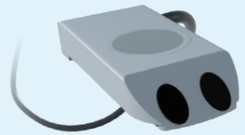
Velocity
- Measured using continuous wave Doppler ultrasound
- Sound wave measures the speed of dirt, bubbles and other particles across the whole stream profile to calculate a true average velocity.

Integral Depth
- Integral hydrostatic ceramic depth sensor measures the "weight" of the water above it and converts it to a depth.
- Mounting versatility is the key. This style of depth sensor can be mounted on the channel bottom or on the side, away from sand & silt.



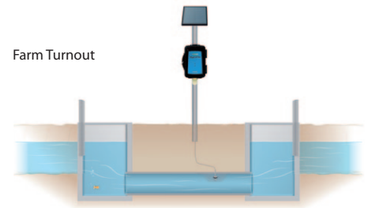
Doppler insert velocity sensor
For use in full pipes

Doppler area/velocity sensor
For use in open channels and partially full pipes

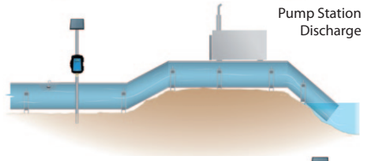


Applications for AgriFlo XCi

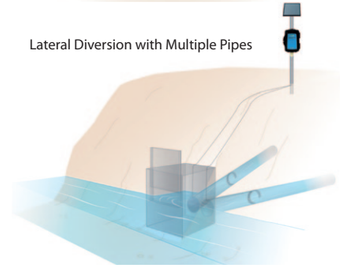
Farm Turnout



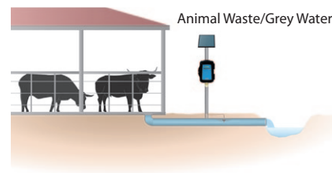
Pump Station Discharge



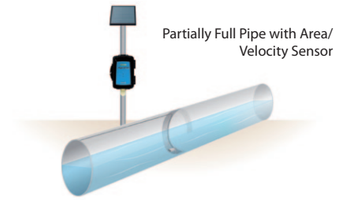
Lateral Diversion with Multiple Pipes



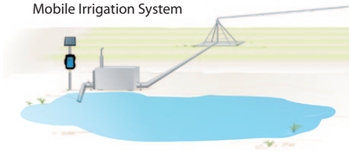
Animal Waste/Grey Water



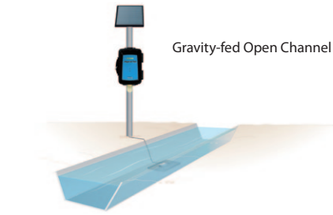
Partially Full Pipe with Area/ Velocity Sensor



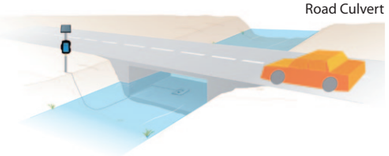
Mobile Irrigation System



Gravity-fed Open Channel



Road Culvert



AgriFlo XCi Specifications

GENERAL

Weight	Approx. 5kg (11lbs)
Dimensions	36.5cm (H) x 26cm (W) x 17cm (D) 14.4" (H) x 10.2" (W) x 6.7" (D)
Enclosure rating	IP66
Enclosure material	UV stabilized polycarbonate
Operating temperature (with internal battery installed)	-15 to +50° C (5 to 122° F)
Operating temperature (with internal battery removed and external power used)	-20 to +65° C (-4 to 150° F)
Backlit display	16 character x 2 line alphanumeric LCD
Program memory	2 Mb flash (sufficient for 600,000 discreet readings)
Power	Internal 12Volt 7.2Ah battery with external solar panel or mains charger
Units of measure	User definable (metric/US)
Application software	FloCom+ PC software for system configuration, data downloading and velocity profile testing. Minimum system requirements - Windows® XP
Factory backup	24 month parts and labour guarantee

DEPTH MEASUREMENT

Method	Ceramic pressure transducer with large flat sensing diaphragm which allows straight, undeflected flow over the sensing area to reduce drawdown effects at high stream velocities and provides for self cleaning with an impervious Alumina ceramic surface.
Full scale range	4m (13ft) above the transducer face
Accuracy	0.2% of full scale at constant temperature in a static stream. 1% of full scale over a stream 5 to 55° C (41 to 130° F)
Resolution	1mm (0.04")
Overrange	60m (200ft) without damage
Minimum operating depth	17mm (0.67")

VELOCITY MEASUREMENT

Method	Submerged Ultrasonic Doppler
Range	±0.025 to ± 8.0 m/s (±0.08 to ± 26ft/s)
Resolution	1mm at 1.0 m/s (0.04" at 3.3ft/s)
Accuracy	±1% up to 3.0 m/s (±1% up to 10ft/s)
PVC sensor cable	9mm (D) up to 50m (L) (0.35" (D) up to 164ft (L))
Minimum operating depth	40mm (1.57")

AgriFlo XCi Compatible Cards [Please refer to the appropriate MACE card specifications brochure for further details]

DOPPLER CARD

This card supports one MACE Doppler insertion sensor or one MACE Doppler area/velocity sensor

PULSE I/O (INPUT/OUTPUT) CARD

This card powers (+5VDC or + 12VDC) a single pulsing flow sensor (Eg. MACE RotoFlo) and provides a pulse output. This also allows AgriFlo XCi the ability to sense pulses from non-MACE flow sensors.

FLOSI CARD

This card provides an SDI-12 or ModBus output to interface AgriFlo XCi to SCADA systems or 3rd party data loggers

WEBCOMM CARD

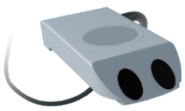
This card provides AgriFlo XCi the ability to automatically upload internal logged data to the web-based MACE Data Server via mobile telephone networks.

AgriFlo XCi Compatible Velocity Sensors

DOPPLER INSERT VELOCITY SENSOR

For use in full pipes 0.1 to 2.54m (4" to 100") diameter

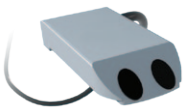
Process fitting	2" BSP or 2" NPT
Shaft dimensions	33cm (L) x 2cm (D) 13" (L) x 0.8" (D)
Head dimensions	4.5cm (D) x 2.5cm (H) 1.8" (D) x 1" (H)
Pipe intrusion area	11.25cm² 1.75 sq."



DOPPLER AREA/VELOCITY SENSOR (STRAP MOUNT)

For use in partially full pipes 0.15 to 2.54m (6" to 100") diameter

Dimensions	12.5cm (L) x 5cm (W) x 1.6cm (H) 5" (L) x 2" (W) x 0.63" (H)
Pipe intrusion area	8cm² 1.25 sq."



DOPPLER VELOCITY SENSOR (STRAP MOUNT)

For use in full pipes 0.15 to 2.54m (6" to 100") diameter

Dimensions	12.5cm (L) x 5cm (W) x 1.6cm (H) 5" (L) x 2" (W) x 0.63" (H)
Pipe intrusion area	8cm² 1.25 sq."

Note to end users: These specifications are subject to change at any time without notice. MACE takes no responsibility for the use of these figures. Please consult MACE for the latest specifications before using them in contract submittals or third party quotes etc. MACE reserves the right to change specifications without prior warning. All quoted figures are based on test conditions and are subject to variation due to site conditions.

Part No. 825-310 Rev. 2.0

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Phone: 888 440 4215 Fax: 888 440 6999
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www.maceusa.com

mace
Water Monitoring Solutions

Quote

Date	Quote #
5/26/2011	3925

MACE USA LLC
PO BOX 7144
OVERLAND PARK, KS 66207

Name / Address	Ship To

Project

Item	Description	Qty	Total
850-365	MACE FloSeries 3 - AgriFlo XCi	1	2,040.00T
850-328	MACE FloSeries3 - Doppler Velocity Module S/N	1	547.00T
850-112	Sensor - Insert 2 - 4m/s 10mCable - D9 - NPB - NPT	1	1,851.00T
814-017	MACE Solar Panel (for FloSeries 3) 12Volt/5Watt	1	270.00T
850-302	Mounting Kit - FloSeries 3 - device and solar panel	1	92.00T
850-363	MACE FloSeries 3 - USB External Comms Lead	1	144.00T
	Subtotal		4,944.00
Agriculture Discount	Agriculture Discount - 15%		-741.60
	Subtotal		4,202.40

Total $4,202.40

Phone #	Fax #	E-mail	Web Site
888-440-4215	888-440-6999	kathy.peterson@maceusa.com	www.maceusa.com

SLIDE GATE CUT SHEETS

TABLE OF CONTENTS

KEY TO WATERMAN SLUICE GATE TERMINOLOGY

(applies to Series 3000 only this section)

PREFIX	SERIES	SUFFIX
Q = Flushbottom Seal	Gate I.D.	f = Standard Flangeback
S = Sluice Gate		ff = Extended Flangeback
C = Circular Opening		NRS = Non-Rising Stem
		Y = Self-Contained Frame
		X = Special Modifications

Example: QSC-3000-f-NRS-Y
Flushbottom Sluice Gate with Circular Opening, Standard Flangeback, Non-Rising Stem, Self-Contained Frame

Note: Canal Gate Models and Terminology are identified on Canal Gate pages.

SERIES 3000 SLUICE GATE

CAST IRON
MEDIUM DUTY

- **Cast Iron Standard Flangeback, Extended Flangeback or Spigotback Frame**
- **Rectangular or Circular Openings**
- **Rectangular, Ribbed Slide for Rising or**
- **Non-Rising Stems**
- **Finished Iron or Bronze Seat Faces**
- **Galvanized or Optional Stainless Steel Structural Guide Rails and Fasteners**
- **Adjustable Side Wedge Assemblies**
- **Optional Adjustable Top and Bottom Wedge Assemblies (for gates wider than 24")**
- **May be Thimble, Wall or Flange Mounted**

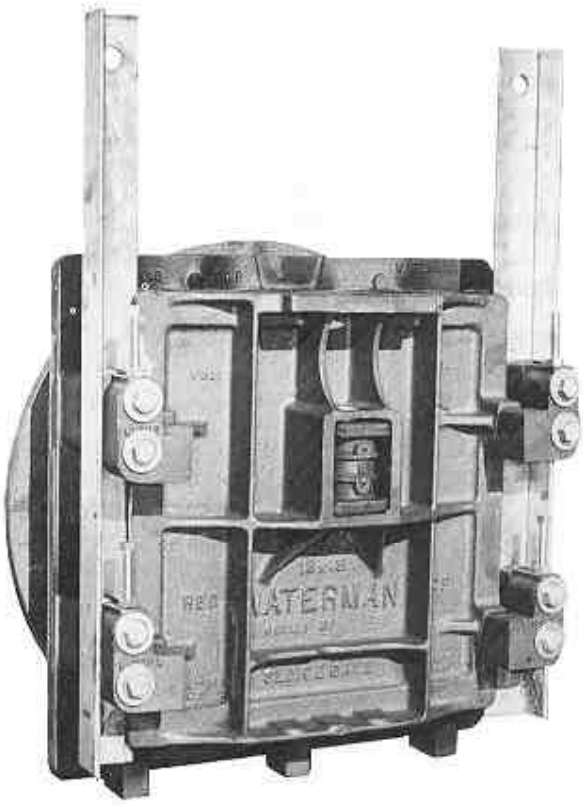
Waterman Series 3000 Sluice Gates have been designed to give maximum water control service, operating at seating heads up to 50 feet and unseating heads up to 20 feet.

Gates have one-piece cast iron, standard flangeback, extended flangeback or spigotback frames. Slides (covers) have horizontal and vertical ribs, and cast side wedges. Fully adjustable, positive locking wedge blocks force the smoothly machined seats into a practical water tight closure (maximum clearance between faces: .004 inch). Adjustable top and bottom wedges augment the side wedges for unseating heads.

Heavy galvanized structural steel guide angles and bolts are furnished as standard. Stainless steel guides and bolts are optional and recommended for corrosive water conditions.

Bronze seat facings should be specified where the gate will not be operated for long periods of time or where salt water, industrial wastes or sewage will be handled.

APPLICATIONS



SC-3000ff

- Flood control projects
- Industrial and municipal treatment plants
- Drainage systems
- Reservoirs
- Fish hatcheries
- Canal and irrigation systems

Similar projects where operating conditions will be moderate and first cost is an important factor.

SERIES 3000 SLUICE GATE

FEATURES:

Gates with non-rising stems, flushbottom closures, self-contained frames and special downward opening models are available.

Side wedges are cast integrally with the cover. Wedge blocks are cast ductile iron. They easily adjust and are securely locked in position.

Top and bottom wedges are provided to meet higher unseating heads, are bolted to the frame and slide, and are adjustable.

A cast iron or bronze thrust nut is shipped with each gate and is threaded to fit the stem ordered with the gate. The thrust nut located in a reinforced pocket cast in the slide, is prevented from turning on the stem in rising stem model gates by set screws. (Pins or keys are optional.)

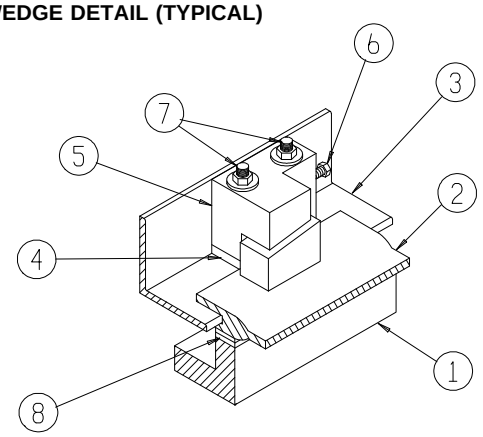
Slides for non-rising stem gates are supplied with a nut pocket located so as to provide a full gate opening without allowing the stem to extend into the waterway. The thrust nut on these units is threaded to receive the gate stem and travels up or down, operating the slide, as the stem is rotated.

Gates with a self-contained frame (yoke) and lift are available with rising or non-rising stems. Flushbottom seals can be provided (see page 6). Downward opening models, special material combinations and coatings are also available.

QS-3000F
WITH TOP WEDGES AND
FLUSHBOTTOM SEAL

SIDE WEDGE DETAIL (TYPICAL)

PARTS LIST	
No.	Name
1	Frame
2	Slide w/Cast-in Wedge
3	Guide Rail
4	Wedge Spacer
5	Adjustable Wedge Blocks
6	Adjusting Screw w/Lock Nut
7	Wedge Bolts
8	Seat Facings



SERIES 3000 SELF-CONTAINED SLUICE GATE

- **Galvanized or Stainless Steel Rails**
- **Rising Stem or Non-rising Stem**

The Series 3000-Y Sluice Gate (Y indicates self-contained frame and yoke) can be furnished with any of the options noted for the standard units and includes extended side rails, a structural steel yoke (headrail), stem, and lift. The thrust of operation is transferred directly to the yoke. Both rising stem (S-3000-RSY) and non-rising stem gates (S-3000 NRS-Y) are available.

Standard units feature galvanized steel structural guide rails and fasteners. Stainless steel may be substituted as an extra cost item. Minimum frame heights for openings are provided unless extended heights are specified.

Self-contained gates with rising stems can be installed where it is impractical to have independently mounted handwheel and pedestal lifts and can project above a headwall to give necessary operating clearance. Stems are cold finished steel with modified acme threads, secured to the slide (cover) with a thrust nut and operated by a cast bronze lift nut with suitable handwheel or geared crank lift. Stainless steel stems are optional.

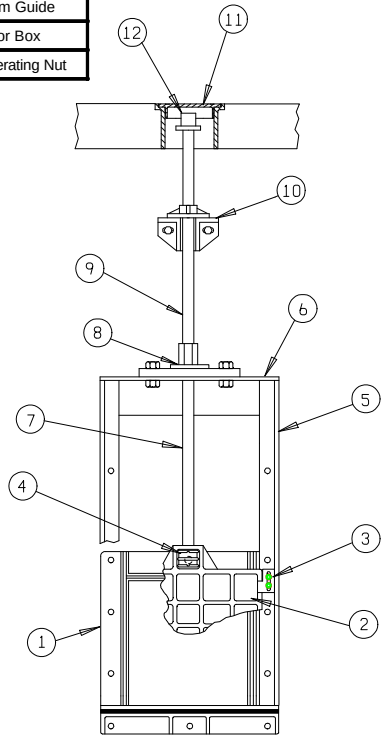
Self-contained gates with non-rising stems are similar to rising stem units, but have a cast bronze thrust nut threaded to match the stem threads which travel up and down (operating the slide) as the stem is rotated. Non-rising stems are stainless steel unless specified otherwise. The thrust of the stem is transferred directly to the yoke (headrail) through a flange and thrust collar. Ball or roller bearings should not be used at the thrust flange if they will be submerged.

APPLICATION

A non-rising stem gate is used where a standard Series 3000 gate is required, and where it is desirable not to have the stem rise into walk-ways, roads, or other obstructions.

MODEL S-3000-NRS-Y (NON-RISING STEM)

PARTS LIST			
No.	**Name**	**No.**	**Name**
1	Frame	7	Stem
2	Cover	8	Lift
3	Wedge	9	Extension Stem
4	Thrust Nut	10	Stem Guide
5	Guide Rail	11	Floor Box
6	Headrail	12	Operating Nut



Typical installation of S-3000-NRS-Y Gate with floor box, stem extension and coupling.

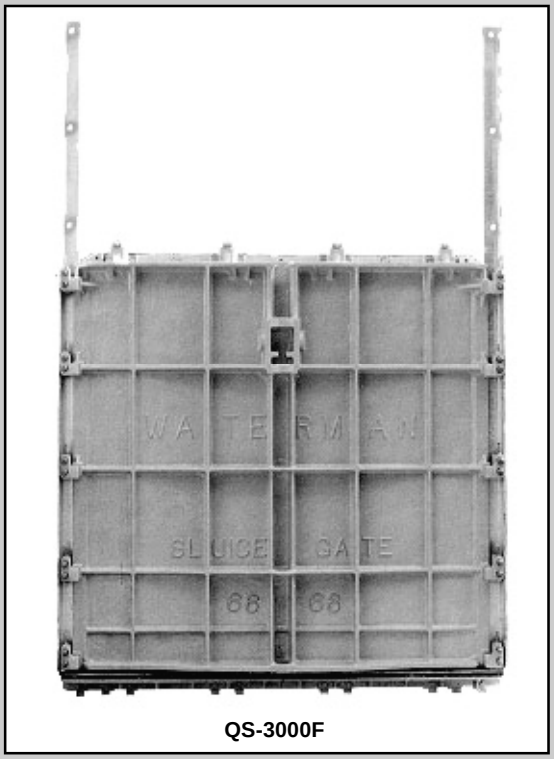
QS-3000 FLUSHBOTTOM SLUICE GATES

- **Maximum Flow**
- **Flushing Action**
- **Complete Drainage**
- **Lowest Invert**
- **Maximum Hydraulic Gradient**
- **Fully Contained Neoprene Bottom Seal**

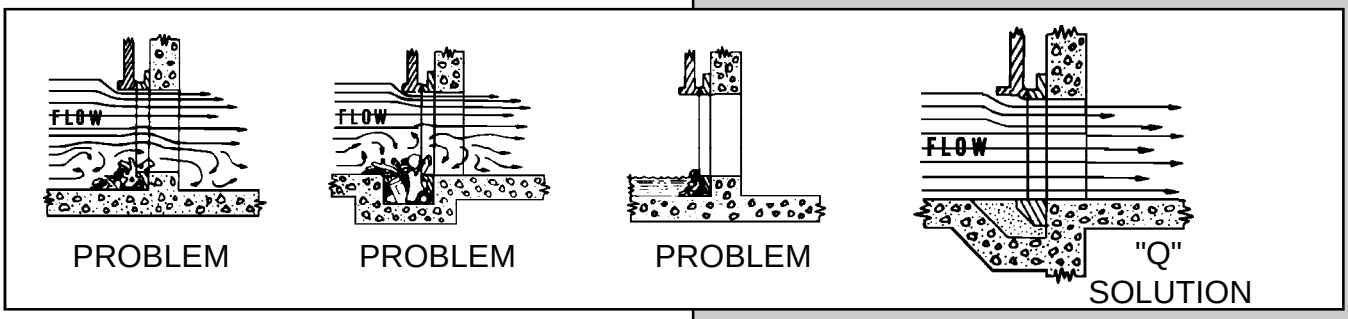
Use anywhere that an unimpeded flow, free of debris, is required. Use for maximum flow and minimum clearances in sewage disposal plants, filtration plants, drainage projects, settling tanks, flood control, distribution systems, etc.

Waterman Series 3000 Cast Iron Sluice Gates in both rising and non-rising stem models are available with flushbottom openings. A neoprene seal confined on three sides in the frame bottom compresses upon contact with the blunt bottom edge of the slide, providing a tight seal. When open, the flat plane across the bottom provides unobstructed high capacity flow and flushing action.

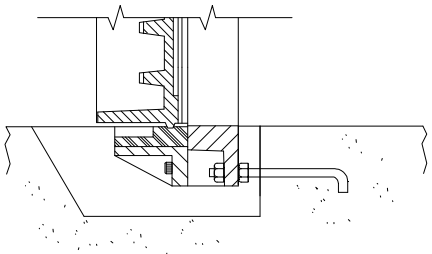
The prefix "Q" indicates a flushbottom seal on your Waterman gate, i.e. - a "QS-3000-f" indicates a rectangular Sluice Gate with a flushbottom seal.



QS-3000F



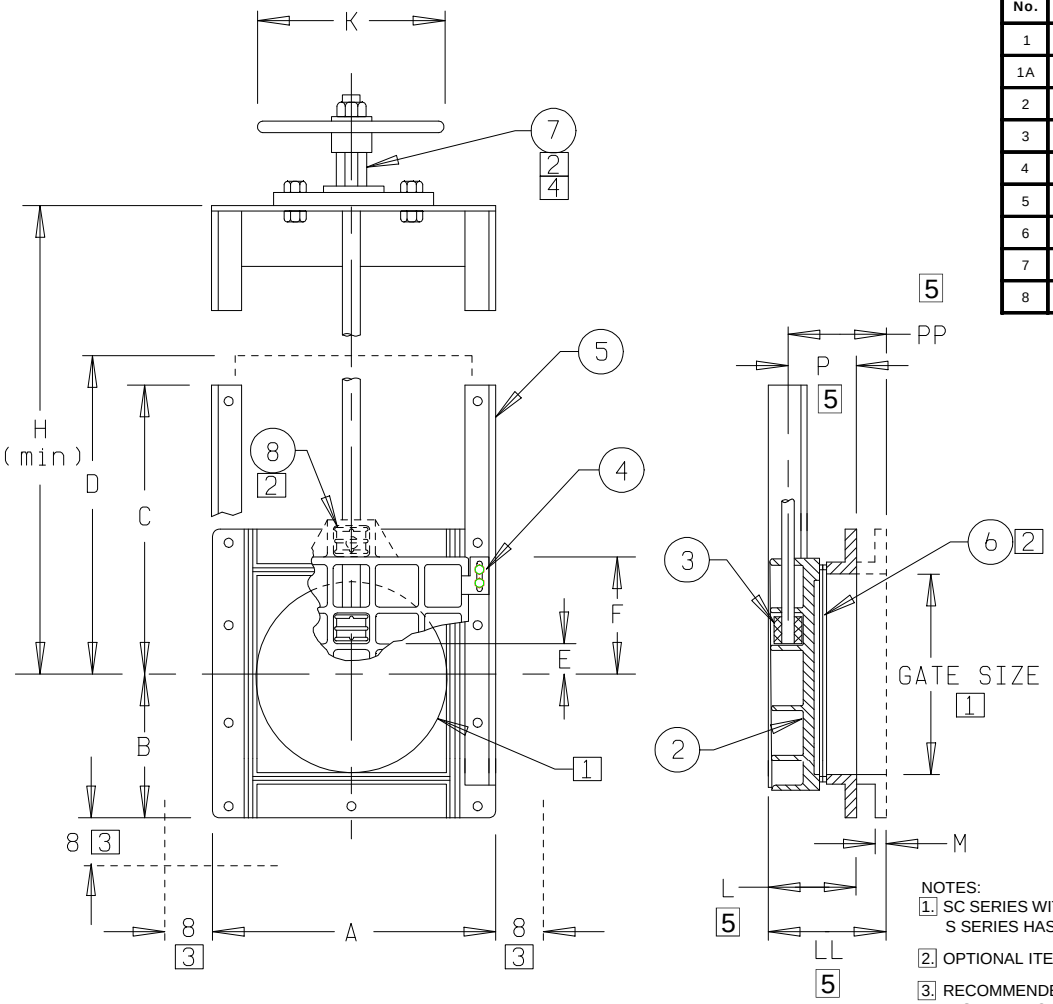
PROBLEM PROBLEM PROBLEM "Q" SOLUTION



SECTION THROUGH TYPICAL FLUSHBOTTOM, GATE CLOSED

SERIES 3000 SLUICE GATE

PARTS LIST	
No.	**Name**
1	Standard Flangeback
1A	Extended Flangeback
2	Cover
3	Thrust Nut
4	Wedge Assembly
5	Guide Rail
6	Bronze Seats (Optional)
7	Self-Contained Frame w/Lift (Optional)
8	Non-Rising Stem (Optional)



NOTES:
1. SC SERIES WITH CIRCULAR OPENING SHOWN; S SERIES HAS SQUARE OPENING
2. OPTIONAL ITEMS
3. RECOMMENDED CLEARANCE TO ALLOW INSTALLATION OF ANCHOR BOLTS.
4. GEARED, CRANK TYPE LIFTS REQUIRED ON 54" AND LARGER GATES.
5. IF GROUT PAD MOUNTING IS USED, ADD GROUT THICKNESS TO DIMENSION.

GATE DIMENSIONS IN INCHES

GATE SIZE	A	B	C	D	E	F	H	J	K	L	M	P	LL	PP
12 X 12	19	9½	18	29	3½	6½	30	4¼	15	8	⅝	5	11	8
14 X 14	20¾	10⅜	21	33	1½	8	34	4¼	15	7½	⅝	4½	10½	7½
15 X 15	20¾	10⅜	21	33½	1½	8	34	4¼	15	7½	⅝	4¼	10½	7½
16 X 16	23¼	11⅝	21	35	2	8½	36	4¼	15	8	¾	5¼	11½	8½
18 X 18	24	12	22	38	6¼	9½	40	6	18	8½	¾	5½	12	9
20 X 20	26¾	13⅜	29	42	1½	12	44	6	18	8½	¾	5½	12	9¼
21 X 21	26¾	13⅜	29	42½	7½	12	44	6	18	8½	¾	5½	12	9¼
24 X 24	30	16	32	47	9	12½	48	6	24	9	¾	5¾	12¾	9½
30 X 30	38	19	37	56	5¾	16½	58	6	24	10	⅞	6	14	10
36 X 36	44	22	42	65	7	20	67	6	30	10	⅞	6¼	14½	10½
42 X 42	50¼	25⅛	45¾	74	8	23	76	NA	NA	11½	1	7	15½	11
48 X 48	57	28½	47¼	83	5½	26	85	NA	NA	12	1	7¾	16	11½
54 X 54	62½	31¼	64	93	15	29½	95	NA	NA	12½	1	7½	16½	11½
60 X 60	69	34½	70½	102	17¼	32	104	NA	NA	12½	1¼	7	16½	11
66 X 66	82	41	83	112	21	35	116	NA	NA	13½	1½	8½	17½	12½
72 X 72	81	40½	83	120	21	38	124	NA	NA	13	1½	8	17	12

NOTE: FOR PRELIMINARY DESIGN PURPOSES ONLY
DO NOT USE FOR INSTALLATION
UNLESS PART OF CERTIFIED & APPROVED SUBMITTAL

TYPICAL SPECIFICATIONS
FOR WATERMAN MODEL S-3000 SLUICE GATE

The sluice gates shall be Waterman Model S-3000 or approved equal.

General
The gates shall be self-contained with yoke and bench stand operators; self-contained with either non-rising stem extension (NRE) or rising stem extensions (RSE); or gates with minimum height frames and separate stem guides and operators, in accordance with requirements of these specifications. Grooves shall be cast on the vertical sides of the cover to match guide angles. The cover shall have horizontal and vertical stiffening ribs to withstand a maximum seating head of 50 feet or specific gate design and configuration shall be noted in gate schedule or as shown on plans.

Frame and Cover
The frame and cover (slide) shall be cast iron with machined seating faces. The frame shall be flatback, spigot back, or flangeback configuration as specified.

Grooves shall be cast on the vertical sides of the cover to match guide angles. The cover shall have horizontal and vertical stiffening ribs to withstand a maximum seating head of 50 feet or unseating head from 5 to 20 feet. For unseating head conditions greater than 5 feet, gates 24 inches wide or wider shall have adjustable bronze top and bottom wedges.

The guide rails and head rails shall be minimum ¼-inch thick galvanized steel, designed and built to withstand the total thrust of the gate slide due to water pressure and wedge action.

There shall be adjustable cast ductile iron wedges located along side of gate as required to insure proper sealing. The wedges, located on the cover shall be integrally cast with the cover. The frame wedges shall be attached to the guide rails with two bolts. The wedges shall have smooth bearing surfaces and shall be adjustable to insure effective contact between gate seating surfaces.

Flushbottom Closure
When a flushbottom closure in specified, a resilient seal shall be attached to the frame so that it is flush with the invert. It shall be supported by a cast iron bracket which shall be bolted to machined pads provided on the frame. The seal shall be held in place by a stainless steel bar which shall be bolted through the seal to the bracket with stainless steel fasteners. The cover (slide) shall be shortened and provided with a smooth, rounded surface along the bottom to depress the seal. When unseating heads are to be acting on a flushbottom gate, top wedges shall be added, but bottom wedges will not be required. Sealing pressure shall be varied by adjusting side and top wedges.

Stem
The stems shall be cold finished steel of suitable length and ample strength for the intended service. The stem diameter shall be capable of withstanding twice the rated out put of the operator at 40 pound pull, and shall be supported such that the l/r ratio for the unsupported part of the stem shall not exceed 200.

When a rising stem extension is used, the stem extension shall be supported such that a rigid installation shall be provided. Stem guides shall be spaced so that the l/r ratio of the stem does not exceed 200.

Operators
Manual operated lifting mechanisms shall be indicated on the plan drawings or specified in the gate schedule. Handwheel type lifts shall have threaded bronze lift nut to match stem. Threads shall be machine cut, acme type. An arrow shall be cast on the handwheel to indicate the direction of rotation to open the gate. A maximum effort of 40 pounds shall be required top operate the gate after it is unseated, based on the maximum specified operating head.

Materials
Frame, Cover (Slide), Handwheel - Cast Iron - ASTM A-126; Class B
Rails and Yoke - Galvanized Structural Steel - ASTM A-36, Galvanized per ASTM-A-123
Stem - Leaded Cold Rolled Steel - CF Steel ASTM A-108 Gr. 12L14
Assembly Hardware and Fasteners - Galvanized per ASTM A-153
Paint - Manufacturer's Standard or as specified.

Optional Items Include:
Bronze Seating Faces
Type 304 or 316 Stainless Steel Rails and Yokes
Stainless Steel (Type 304 or 316) or Brass Stems
Stainless Steel Assembly Hardware
Structural Steel pipe (w/cast iron brackets) NRE & RSE Stem Extensions
Total Galvanizing per ASTM-A-123 (Frame, Cover, Rails, Lift, Etc.)
Special Paint Finish; Coal Tar Epoxy, Polyamide Epoxy, Etc.

C-20
CANAL GATE

- **10 foot Unseated Head**
- **Rugged Cast Bronze Lift Nut**
- **Machined Cast Iron Seats, standard**
- **Rising Stems**
- **Adjustable Side Wedges**
- **Sizes 8" - 42" Available**

USES:

The Waterman Model C-20 Canal Gate is made to fit the need for a moderate pressure cut-off where both moderate seating and/or low unseating pressures are encountered. Typical uses include installation in treatment plants, flood control projects, irrigation canals and diversion stands.

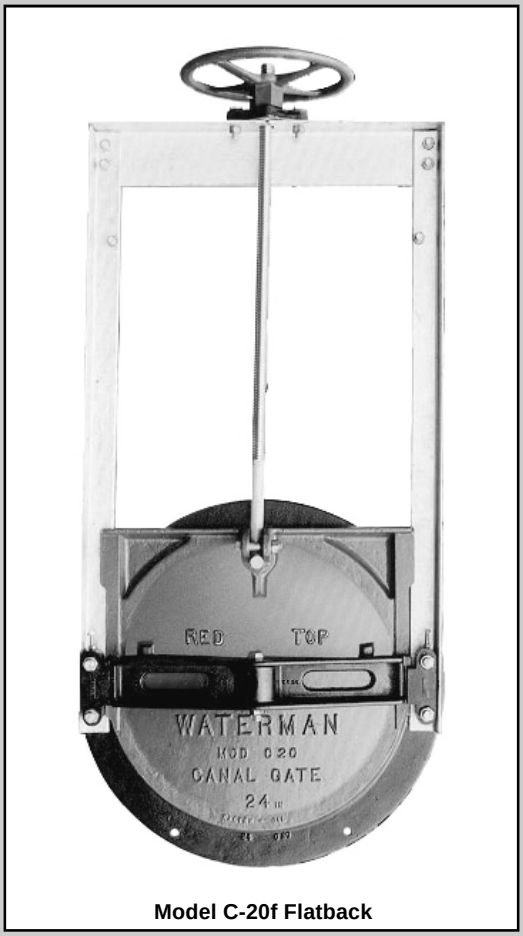
FEATURES:

Flatback gates for headwall mounting, spigotback models for attaching to corrugated metal pipe, or machined flangeback for mounting to pipe flange are available.

The cover, frame ring, adjustable wedges, arch, and handwheel are of cast iron. The lift nut is cast bronze and utilizes rugged acme type threads. The steel stem is secured to the cover by an easily removable pin to permit removal for maintenance. This feature also allows the user to stock standard frame length gates and provide field installation of rising stem extensions, where this is desirable.

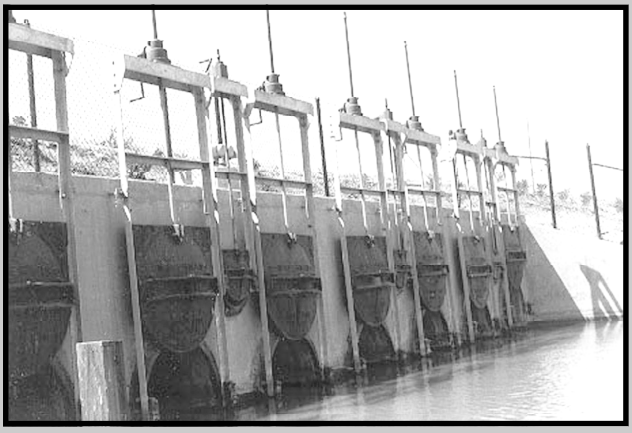
Flatback flanges with 25# or 125# ANSI standard drilling available on special order, but bolt holes must be located on vertical center line.

- **Stainless Steel Guide Rails and Stem, optional**
- **Bronze Seats, optional**
- **25# and 125# ANSI drilling, optional**
- **Total Galvanizing**

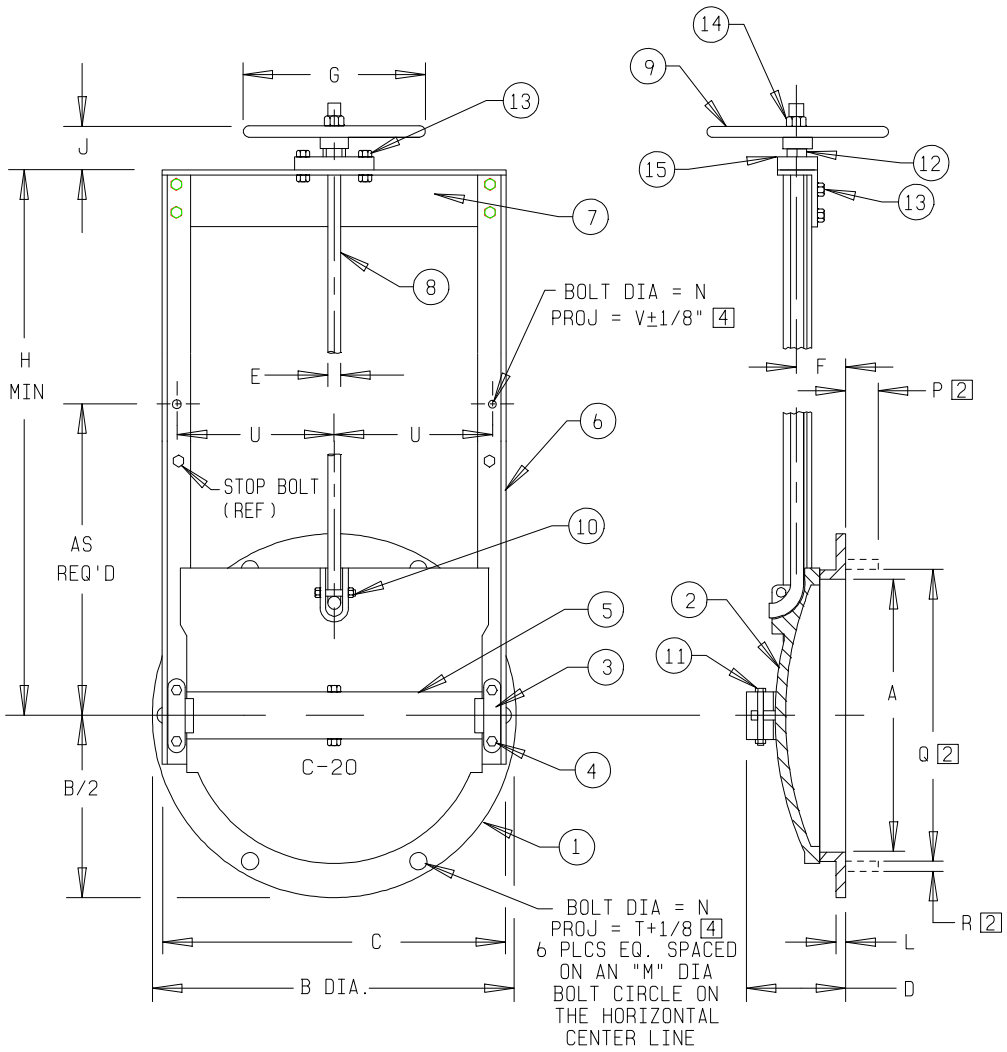


Model C-20f Flatback

RECOMMENDED MAXIMUM SEATING and UNSEATING HEADS		
GATE SIZE	RECOMMENDED MAXIMUM SEATING HEAD	RECOMMENDED MAXIMUM UNSEATING HEAD
8" TO 12"	35 FEET	10 FEET
14" TO 18"	32 FEET	10 FEET
20" TO 24"	26 FEET	10 FEET
30" TO 42"	20 FEET	10 FEET



C-20 CANAL GATE DIMENSIONS



NOTES

1. TYPE 2 lubricated ball bearing lift used on 42" gate.
2. Applies to spigotback gate only. Optional spigot, shown in phantom.
3. Drilling for mounting to 25 or 125 lb. pipe flange available for all gates. Due to gate design, bolt hole location (orientation) is straddle center drilling.
4. Add grout pad thickness to anchor bolt projection.

PARTS LIST	
No.	**Name**
1	FRAME
2	COVER
3	WEDGE (R & L)
4	WEDGE BOLTS
5	ARCH
6	GUIDE RAIL
7	HEAD RAIL
8	STEM
9	HANDWHEEL
10	STEM BOLT
11	ARCH BOLT & NUT
12	LIFT NUT
13	ATCH. HDW.
14	LIMIT NUT (optional)
15	LIFT COLLAR

GATE DIMENSIONS IN INCHES

A	B	C	D	E	F	G	H	J	L	M	N	P 2	Q 2	R 2	T	U	V
8	13½	13⅛	5⅞	⅞	3½	12	24	2⅞	⅝	11⁹⁄₁₆	½	2¼	9	⁵⁄₁₆	1½	5⁹⁄₁₆	3¾
10	16	14½	6	⅞	3½	12	24	2⅞	⅝	14	½	2¼	11	⅜	1½	6⁵⁄₁₆	3¾
12	19	17½	6¹⁄₁₆	⅞	3½	12	30	2⅞	⅝	16¼	½	2¼	13	⅜	1½	7½	3¾
14	21	19⅛	6⅜	⅞	3⅜	12	32	2⅞	⅝	18⅞	½	2¼	15	⅜	1½	8½	3½
15	22½	20⅝	6¾	⅞	3⅜	12	32	2⅞	⅝	20	½	2¼	16	⁷⁄₁₆	1½	9	3½
16	23 ½	21⅛	7⅛	⅞	3⅝	12	32	2⅞	⅝	21	½	2¼	17	⅜	1½	9⁹⁄₁₆	3¾
18	25	24	8⅛	1⅛	4⅜	15	36	4	⅞	23	⅝	2¼	19	⅜	2	10⅞	4½
20	27½	26	8¾	1⅛	4⅜	15	42	4	⅞	25⅛	⅝	2¼	21	⅜	2	11¾	4½
21	28⅛	26¾	9	1⅛	4½	15	42	4	⅞	26¾	⅝	2¼	22	⅜	2	12⅛	4¾
24	32	30¼	9⅜	1⅛	4¼	15	48	4	⅞	30	⅝	2¼	25	⅜	2	13⅞	4½
30	39⅛	36½	10	1½	5⅜	18	60	4½	1	37½	¾	2¼	31	½	1¾	17	4¾
36	46	42½	12	1½	4½	18	70	4½	1	43½	¾	2¼	37	½	2	20	4½
42 1	53	49¾	13½	1½	5⅝	24	84	6	1⅛	49½	¾	2½	43	⅝	2¼	23⅜	5¾

TYPICAL SPECIFICATIONS
FOR WATERMAN MODEL C-20 CANAL GATE

The canal gates shall be Waterman Model C-20 or approved equal.

General
The gates shall be self-contained with yoke and bench stand operators; self-contained with either non-rising stem extension (NRE) or rising stem extensions (RSE); or gates with minimum height frames and separate stem guides and operators, in accordance with requirements of these specifications. Specific gate design and configuration shall be noted in gate schedule or as shown on plans.

Frame and Cover (Slide)
The frame and cover (slide) shall be cast iron with machined seating faces. The frame shall be flatback or spigotback special mounting configuration as specified.

Grooves shall be cast on the vertical sides of the cover to match guide angles. The cover shall be of domed design to withstand a maximum seating head of 20 feet or unseating head of 10 feet.

The guide rails and head rails shall be minimum ¼-inch thick steel, designed and built to withstand the total thrust of the gate slide due to water pressure and wedge action.

There shall be one adjustable cast iron wedge per side, located on the horizontal centerline of the gate. A heavy cast iron arch shall be provided and bolted to the slide. The ends of the arch shall contain integrally cast wedges, which shall wedge in beneath the other half of the wedge system, attached to the guide rails with two bolts. The wedges shall have smooth bearing surfaces and shall be adjustable to insure effective contact between gate seating surfaces.

Stem
The stem shall be cold finished steel of suitable length and ample strength for the intended service. The stem diameter shall be capable of withstanding twice the rated out put of the operator at 40 pound pull, and shall be supported such that the L/r ratio for the unsupported part of the stem shall not exceed 200.

When rising stem extension is used, the stem extension shall be supported such that a rigid installation shall be provided. Stem guides shall be spaced such that the L/r ratio of the stem does not exceed 200.

Operators
Manually operated lifting mechanisms shall be indicated on the plan drawings or in the gate schedule. Handwheel type lifts shall have threaded bronze lift nut to match stem. Threads shall be machine cut, acme type.

An arrow shall be cast on the handwheel to indicate the direction of rotation to open the gate. A maximum effort of 40 pounds shall be required to operate the gate after it is unseated, based on the maximum specified operating head.

Material
Frame, Cover (slide), Handwheel - Cast Iron - ASTM A-126, Class B.
Rails and Yoke - Painted Structural Steel - ASTM A-36.
Stem - Leaded cold rolled steel - ASTM A-108, Gr. 12L14.
Lift Nut - Bronze - ASTM B-584, Alloy 836 or 865.
Assembly Hardware and Fasteners - Galvanized per ASTM A-153.
Paint - Manufacturer's Standard.

Optional Items Include:
Bronze Seating Surfaces
Galvanized Steel Rails and Yokes
Type 304 Stainless Steel Rails and Yokes
Stainless Steel (Type 304 or 316) or Brass Stems
Stainless Steel (Type 304 or 316) Assembly Hardware
Structural Steel Pipe (w/cast iron brackets) NRE & RSE Stem Extensions
Total Galvanizing per ASTM-A-123 (Frame, Cover, Rails, Lift, etc.)
Special Paint Finish; Coal Tar Epoxy, Polyamide Epoxy, etc.

C-10 CANAL GATE

- **Sizes 6" - 72"**
- **Attachments Available for**
  - **CMP**
  - **Concrete Pipe**
  - **Headwall**
  - **Plastic Pipe**
- **Seating Heads to 23 Feet***

This gate is designed for use on canal and pipeline systems which operate at low "heads" and where a moderately priced gate is desired. Typical installations include: farm turnouts, control of industrial wastes, drainage and for tide control.

Construction is of grey iron with an all-bolted steel frame with ¼" minimum thickness. The standard stem is of a special leaded steel which resists corrosion. The stem is operated at the structural frame top by a heavy cast-bronze lift nut and a cast iron handwheel.

Adjustable cast iron wedge blocks, held securely in place by two machine bolts, assure a dependable seating closure with a practical degree of water tightness. The cast iron seats are machined or ground. A solid rim "easy-grip" handwheel is standard.

Optional materials include: bronze seats; stainless steel structural frame and bolts; stainless steel or brass stems; and special epoxy, coal tar or galvanized coatings.

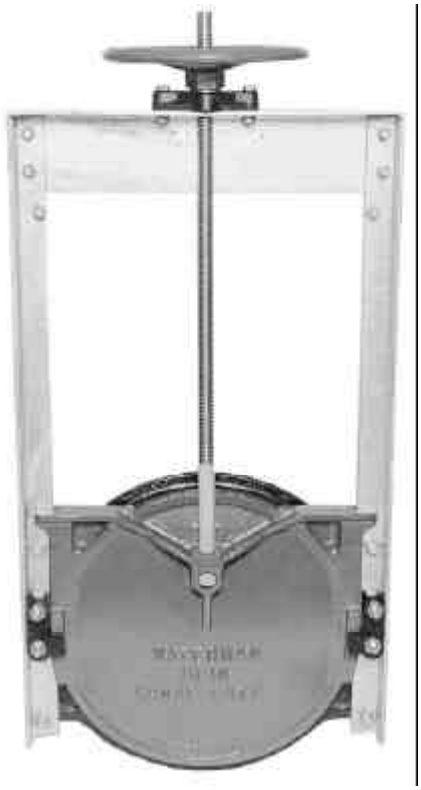
When desired, design variations in stem diameter, pitch and thread rotation are available to match existing equipment. Extended stems, special lifts, oil seals, stem guides and limit nuts are a few of the optional items available for use with these gates.

Frame Types for Various Installation Requirements

F-	Flatback for headwall mounting.
SB-	Spigotback for annular or recor spiral corrugated pipe.
CIP-	For solvent cement mounting onto plastic pipe.
C-	With galvanized steel tapered setting collar for concrete or asbestos cement pipe.
SA-	Spigot for annular corrugated pipe. (special order)
TYPE 4-	For mounting on plastic pipe utilizing special two part epoxy.

(See following pages for more detailed information.)

C-10

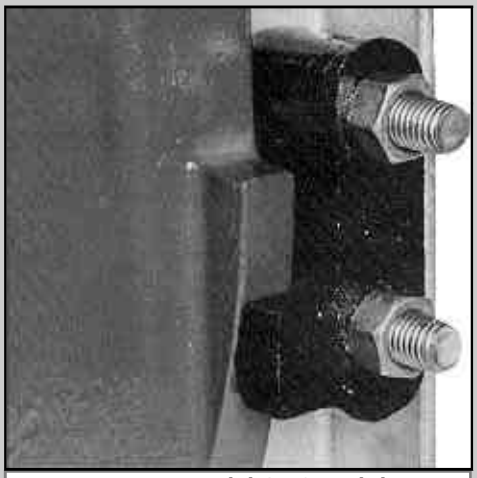


Note: Bronze Lift Nut furnished as standard on all Waterman Canal Gates

*** Recommended Maximum Seating Heads**

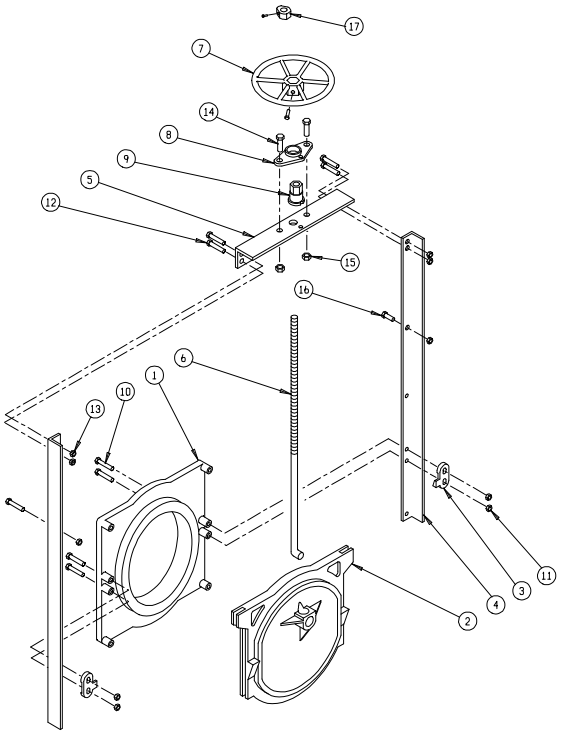
6" - 24"	23 Feet
30" - 36"	11 Feet
42" - 48"	9 Feet
54" - 72"	6 Feet

Recommended Maximum Unseating Head - 0



Waterman Model C-10 wedging system offers two point adjustment and larger wedging surfaces for a more positive contact.

C-10 CANAL GATE PARTS



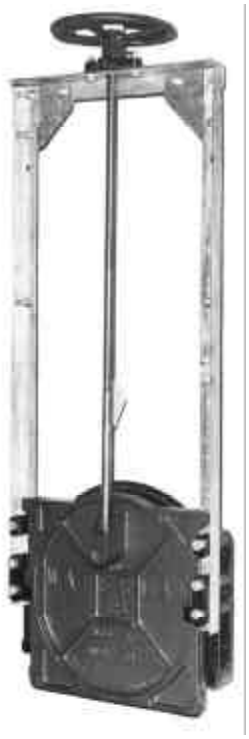
PARTS LIST		
No.	**Name**	**Qty.**
1	Frame	1
2	Cover	1
3	Wedge (R&L)	2
4	Guide Rail (R&L)	2
5	Headrail	1
6	Stem	1
7	Handwheel	1
8	Thrust Collar	1
9	Lift Nut	1
10	Wedge Bolt	4
11	Wedge Nut	4
12	Frame Bolt	4
13	Frame Nut	4
14	Collar Bolt	2
15	Collar Nut	2
16	Stop Bolt & Nut	1
17	Limit Nut (optional) *	1

* With set screw

CL-10
CANAL GATE

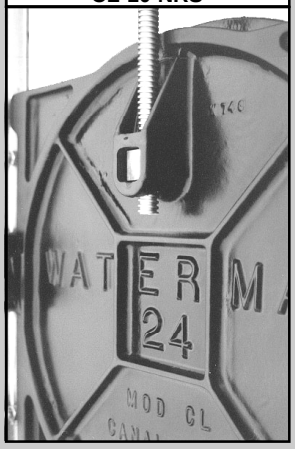
Waterman CL-10 Canal Gates are identical to our model C-10 Gates with the exception of the cast iron cover (slide) which is of a flat plate type construction with ribs reinforcing its face, to withstand the maximum heads as noted for our C-10 gates. This gate cover also features a square bottom design, which allows a more open “clog-free” flow at points of initial opening. The seat being only slightly raised above the cover plate surface helps prevent trash from collecting behind the cover which can cause difficulty in operation.

CL-10



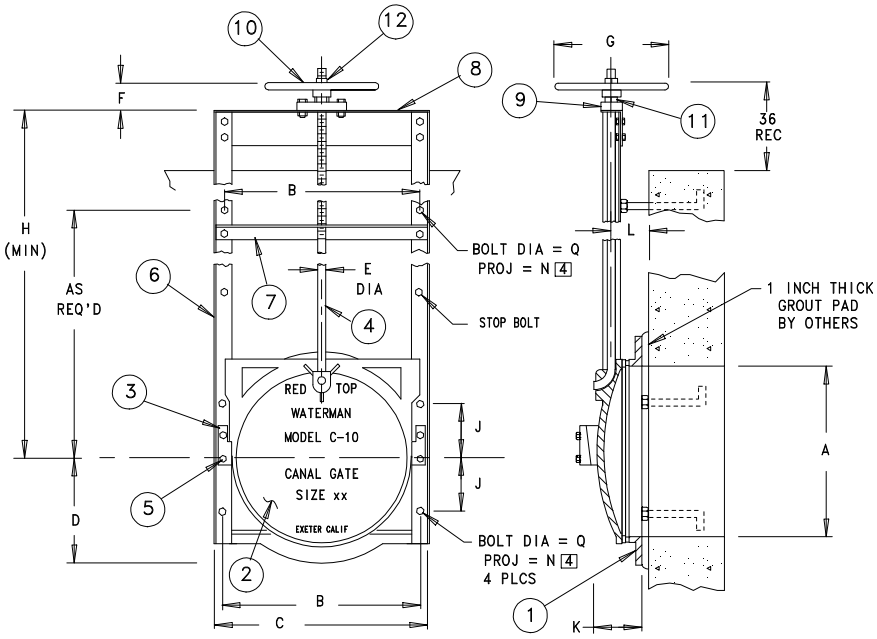
Flat , Square Bottom Cover

CL-10 NRS



Available with threaded thrust nut for true NRS application. All parts are interchangeable with our Standard C-10 gate. Available in a variety of sizes.

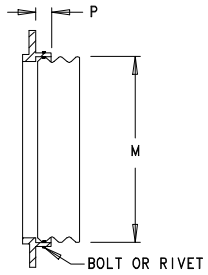
C-10 CANAL GATE



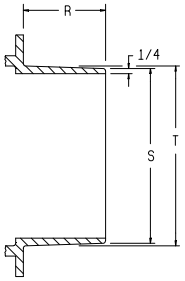
Wall Mounted Flatback Frame

NOTES

1. TYPE 2 lubricated ball bearing lift used on 48" and larger gates.
2. Applies to spigotback gate only. Optional spigot, shown in separate detail.
3. All dimensions are also applicable for model CL-10 & CM-10 when available.
4. Add grout pad thickness to anchor bolt projection.
5. Type 3E 2:1 lift used, mounted to dual headrail.

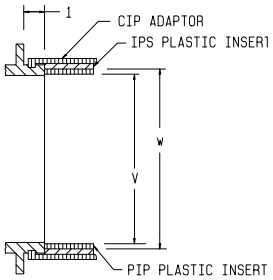


Corrugated Pipe Attached to Spigotback Frame



Type 4 Spigot Frame

PARTS LIST		
No.	**Name**	**Qty.**
1	Frame	1
2	Cover	1
3	Wedge (Right & Left)	1 ea.
4	Stem	1
5	Wedge Bolts	4
6	Guide Rail	2
7	Stem Support	A/R
8	Head Rail	1
9	Lift Collar	1
10	Handwheel	1
11	Lift Nut	1
12	Limit Nut	1



CIP Frame

A	B	C	D	E	F	G	H	J	K	L	M 2	N	P 2	Q	R	S	T	V	W
6	8	9⅞	4	⅞	2⅞	10	24	3	3½	2⅝	7	3½	2¼	½	-	-	-	6.160	6.645
8	10	12	4⅞	⅞	2⅞	10	24	3	3¾	2½	9	3½	2¼	½	4	7 13/16	8	8.180	8.645
10	12	13⅞	6	⅞	2⅞	10	24	3½	3¾	2½	11	3½	2¼	½	3⅞	9⅞	10	10.220	10.770
12	14	15⅞	7	⅞	2⅞	10	24	4	3½	3	13	4	2¼	½	4	11⅞	12	12.270	12.780
14	16	17⅞	8	⅞	2⅞	10	27	4¾	3¾	3¼	15	4	2¼	½	-	-	-	-	-
15	17	18⅞	8⅞	⅞	2⅞	10	30	5	4½	3½	16	4	2⅛	½	4	14⅞	15	-	-
16	18¾	20⅝	9⅞	⅞	2⅞	10	32	5½	4½	3½	17	4½	2¼	⅝	-	-	-	-	-
18	21	22⅞	10½	1	3⅛	12	34	6	4½	4¼	19	4½	2¼	⅝	4	17 13/16	18	-	-
20	23¼	25⅛	11¾	1	3⅛	12	38	7	4¾	4	21	4½	2¼	⅝	-	-	-	-	-
21	24	25⅞	12 5/16	1	3⅛	12	40	7	4¾	4	22	4½	2¼	⅝	-	-	-	-	-
24	27¼	29⅛	13⅞	1	3⅛	12	44	8	5¾	4⅛	25	4½	2¼	⅝	-	-	-	-	-
30	33¾	36⅛	17⅜	1⅛	4	15	54	10	6	4½	31	6	2¼	¾	-	-	-	-	-
36	39¾	42⅛	20½	1⅛	4	15	62	12	6¼	5⅜	37	6	2⅛	¾	-	-	-	-	-
42	45¾	48⅜	23⅝	1½	5	18	84	14	7	6	43	6	2½	¾	-	-	-	-	-
48	51¾	54⅜	26¾	1½	6	24 1	90	16	7⅜	6⅛	49⅛	6	2½	¾	-	-	-	-	-
54	58½	61½	30	2	6	30 1	100	18	7⅞	6½	55⅛	7	3	1	-	-	-	-	-
60	65	68	34	2	6	30 1	102	20	8⅛	7⅛	61⅛	8	3¼	1	-	-	-	-	-
72	77½	80¼	41	2	13	5	121	25½	10⅝	8¾	73¼	8	3⅜	1	-	-	-	-	-

GATE DIMENSIONS IN INCHES

TYPICAL SPECIFICATIONS
FOR WATERMAN MODEL C-10 CANAL GATE

General
The gates shall be self-contained with yoke mounted bench stand operators with rising stem, or self-contained with either non-rising stem extension (NRE) or rising stem extension (RSE), or with separate stem guides and operators, in accordance with the requirements of these specifications. Specific gate design and configuration shall be as noted in gate schedule or shown on plans.

Frame and Cover (Slide)
The frame and cover (slide) shall be cast iron with machined seating faces. Seating surfaces of both frame and cover shall be assembled so that maximum clearance between seating faces shall be .004 when in fully closed and wedged position. The frame shall be flatback or spigotback, or other special mounting configuration as specified herein or shown on plans.

Grooves shall be cast on the vertical sides of the cover to match guide angles. The cover shall be of domed design to withstand maximum seating head as specified following:

Gate Size	Max. Seating Head (Ft.)
6" - 24"	23
30" - 36"	11
42" - 48"	9
54" - 72"	6

The guide rails and head rails shall be minimum ¼-inch thick structural steel, designed and built to withstand the total thrust of the gate slide due to water pressure and wedge action.

There shall be one adjustable cast iron wedge per side, located on the horizontal centerline of the gate. The cover wedge shall be integrally cast with the cover, while the other half of the wedging system shall be attached to the guide rail with two bolts. The wedges shall have smooth bearing surfaces and shall be adjustable to insure effective contact between gate seating surfaces.

Stem
The stem shall be cold finished steel of suitable length and ample strength for the intended service. The stem diameter shall be capable of withstanding twice the rated output of the operator at 40 pound pull, and shall be supported such that the L/r ratio for the unsupported part of the stem shall not exceed 200.

When rising stem extension is used, the stem extension shall be supported such that a rigid installation shall be provided. Stem guides shall be spaced that the L/r ratio of the stem does not exceed 200.

Operators
Manual operated lifting mechanisms shall be as indicated on the plan drawings or in the gate schedule. Handwheel type lifts shall have threaded bronze lift nut to match stem. Threads shall be machine cut, acme type, and right hand unless otherwise specified.

An arrow shall be cast on the handwheel to indicate the direction of rotation to open the gate. A maximum effort of 40 pounds shall be required to operate the gate after it is unseated, based on the maximum specified head.
The canal gates shall be Waterman Model C-10 or approved equal.

Materials
Frame, Cover (Slide), Handwheel - Cast Iron - ASTM A=126; Class B
Rails and Yoke - Structural Steel - ASTM 1-36
Stem - Leaded Cold Rolled Steel - ASTM A-108, Type 12L14
Lift Nut - Bronze - ASTM B-584, Alloy 844 or 865
Assembly Hardware and Fasteners - Galvanized per ASTM A-153
Paint - Manufacturer's Standard

Optional Items Include:
Galvanized Steel or 304 or 316 Stainless Steel Rails and Yoke
Type 304 or 316 Stainless Steel or Brass Stems
Stainless Steel Assembly Hardware
Structural Steel Pipe (w/cast iron brackets) NRE and RSE
Stem Extensions
Total Galvanizing per ASTM A-123 (Frame, Cover, Rails, Lift, Etc.)
Special Paint Finish: Coal Tar Epoxy, Polyamide Epoxy, Etc.

FC-10 CAST IRON COMBINATION DRAINAGE AND CANAL GATE

- **Sizes 16" - 60"**

The Waterman Model FC-10 Combination Drainage and Canal Gate combines our Models F-10 Drainage Gate and C-10 Canal Gate in one convenient unit. When the unit is closed, the flap functions as an automatic drainage gate, permitting outflow and stopping backflow. The gate can be raised with the handwheel or other suitable lift to permit backflow when desired.

This gate can be installed in locations suitable for the Model F-10 and C-10 Gates, and has the same operating characteristics and limitations.

The gate is normally furnished with a self-contained frame and handwheel lift. Special short frames with optional lifts and extensions are available as well as the standard options used on our F-10 and C-10 Gates, such as stainless rails, bronze links, bolts and bushings, etc.

These gates are ideal for use in tidal basins, drainage, and certain industrial and water district applications where automatic control is usually desired, but where manual control is needed occasionally.

For more detailed information refer to the Drainage Gate Section of this catalog.

FC-10

AFC-331 FABRICATED ALUMINUM COMBINATION DRAINAGE AND CANAL GATE

- Sizes 12" through 84"
- A corrosion-resistant rust-proof combination canal and automatic drainage gate.
- Prevents electrolysis associated with cast iron gates to aluminum pipe connections.
- J-Bulb neoprene adjustable seats provide excellent sealing against return flow.
- Frame, cover, retainer ring, hinge arm, and pivot lug are of aluminum alloy 6061-T6. Gate hardware is stainless steel.
- Heavy duty construction.
- Seating heads to 30 feet.

AFC-331

CM-10 CANAL GATE

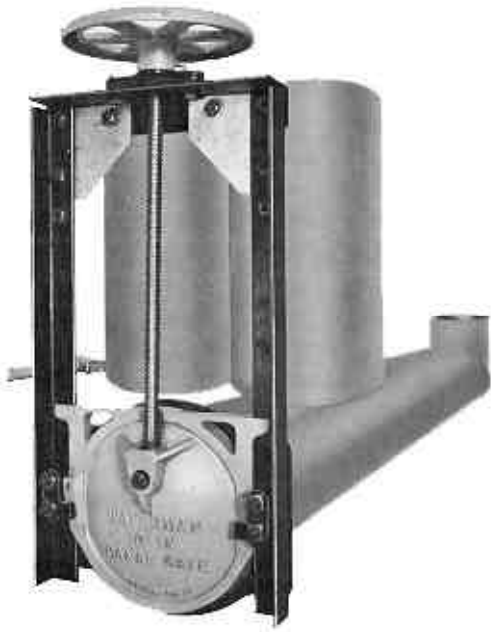
METER GATE INSTALLATIONS

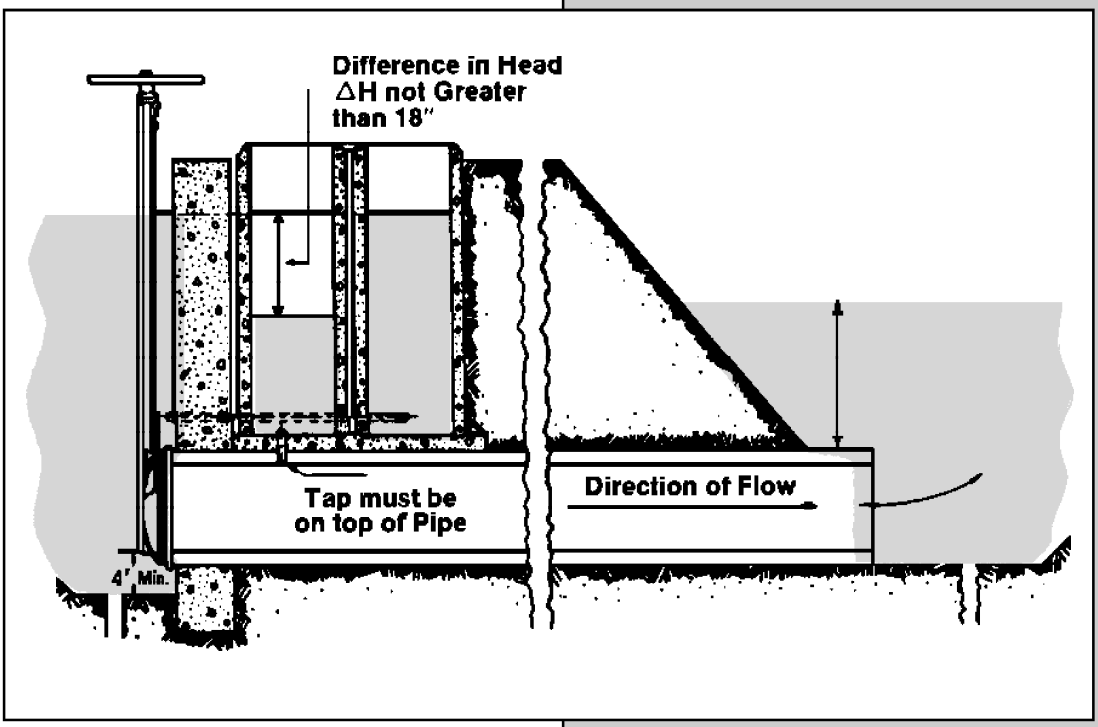
The time tested WATERMAN RED TOP CANAL GATE (Model CM-10) can be furnished with calibration tables, enabling the user to install it in standard meter gate installations. A typical installation is shown below and should be duplicated as accurately as possible to assure measurements compatible with conditions under which these calibrations have been made. Standard setting demensions and design have been maintained to assure interchangeability with systems already in operation.

This gate is available in various mounting configurations (see frame types). Standard and special frame lengths are available. Our rising stem extensions and other standard options are available as on our regular Model C-10 gates.

Complete installation and technical data can be found in our bulletin "Waterman Data Book, CM-10 Canal Gate."

CM-10





RED TOP

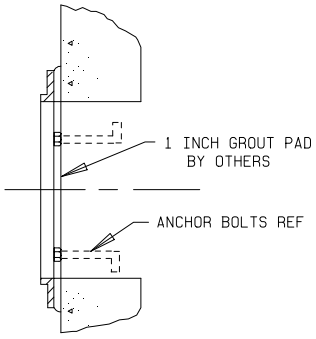
CANAL GATE FRAME TYPES

FOR C-10,CL-10, FC-10 AND CM-10 GATES

The Waterman C-10 gate and its variations can be furnished to suit many installation requirements. These include:

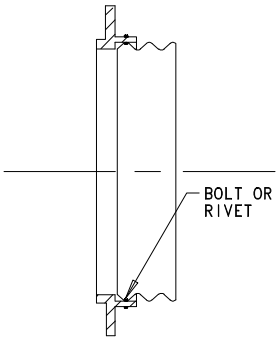
- "F" flatback for headwall mounting with anchor bolts
- "SB" spigotback for attaching to annular or spiral corrugated metal pipe
- "SA" spigotback for annular corrugated metal pipe
- "C" galvanized steel tapered setting collar for installation on concrete pipe
- "CIP" for quick, easy, rugged mounting onto plastic pipe using standard PVC solvent cement
- "Type 4" for mounting gate to plastic pipe utilizing two part epoxy

"F" FLATBACK



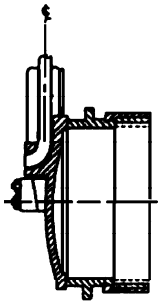
HEADWALL MOUNTED

"SB" SPIGOTBACK



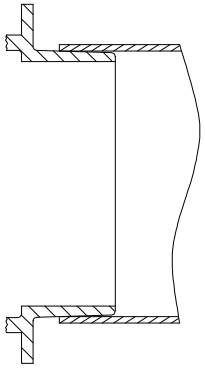
FOR ANNULAR OR SPIRAL CORRUGATED PIPE

"CIP" PLASTIC PIPE



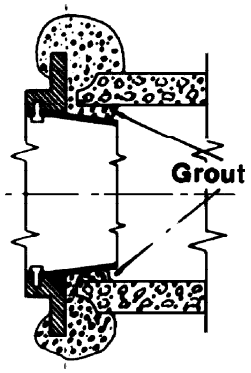
HEAVY DUTY FEMALE SPIGOT FOR SOLVENT CEMENT BONDING ONTO OUTSIDE OF PLASTIC PIPE.

"TYPE 4" FRAME



MALE SPIGOT FOR MOUNTING GATE TO PLASTIC PIPE I.D. UTILIZING TWO PART EPOXY.

"C" TAPER SETTING COLLAR



WITH GALVANIZED STEEL TAPER SETTING COLLAR FOR CONCRETE PIPE OR ASBESTOS CEMENT.

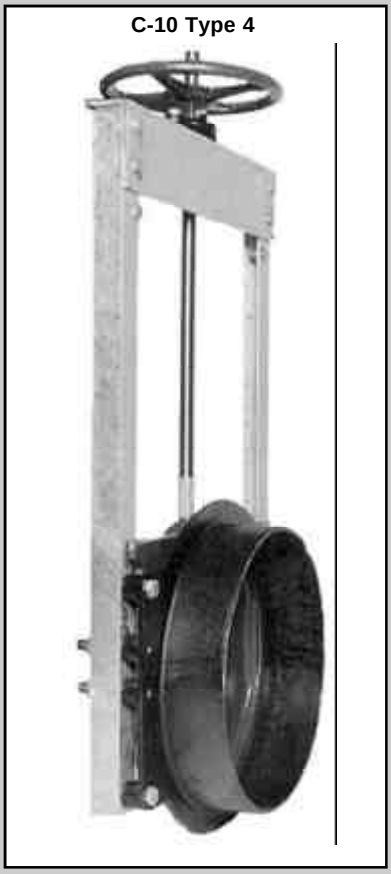
RED TOP

C-10 TYPE 4
CANAL GATE

The Waterman C-10 Canal Gate with Type 4 frame is designed for direct bonding onto PVC plastic pipe utilizing a two part epoxy cement such as IPS.

The frame is quick and easy to install, simply apply epoxy to the special spigot and push into I.D. of low head pipe. It is recommended that additional headrail for frame support be provided to reduce stress on the plastic pipe, particularly on extended frames. This can be accomplished with the use of anchor bolts.

C-10 Type 4



RED TOP C-10 CIP

WITH CIP FRAME

The Waterman C-10 Canal Gate with CIP frame is designed for direct solvent cement bonding onto PVC plastic pipe. The need for costly, high labor two-part epoxy cement is eliminated, as use of standard PVC cement is recommended.

The CIP is a rugged, long-lasting, patented frame that is quick and easy to install. It is recommended that additional headrail or frame support be provided to reduce stress on the plastic pipe, particularly on extended frames. This can be accomplished with the use of anchor bolts.

The CIP frame, along with the other frame types on this page, is an example of Waterman's leadership is design and response to water control needs.

C-10 CIP

MODEL CL-11 "SAHARA"™ LEAK-RESISTANT CAST IRON CANAL GATE

- **Tapered Slide for Low Friction Leak-Resistant Closure**
- **Seating and Unseating Heads to 10 Feet**
- **Spigotback for CMP or Flatback for Wall Mounting**
- **Exclusive Flat Bottom Slide and O-Ring Seat**

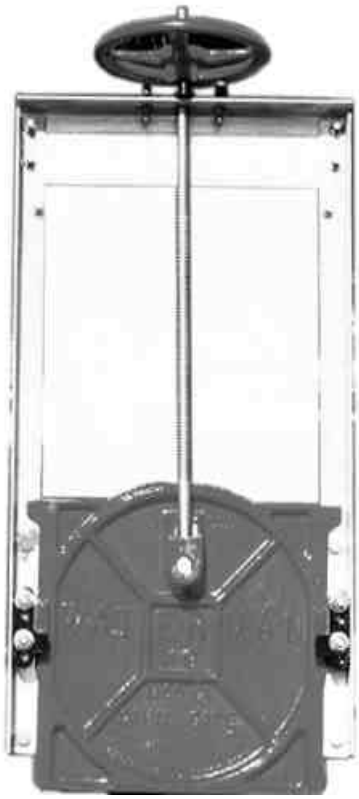
The CL-11 "SAHARA" ™ leak-resistant canal gate is designed to fill the need for a canal gate that prevents water loss to the delivery systems of water conscience irrigation districts. The slide is machined on a taper to allow full travel without wearing on the neoprene seat ring. Testing has produced no wear on the seal after 5000 cycles while still maintaining a leak-resistant seal. Options are the same for the CL-11 as for the C-10.

Standard Materials:

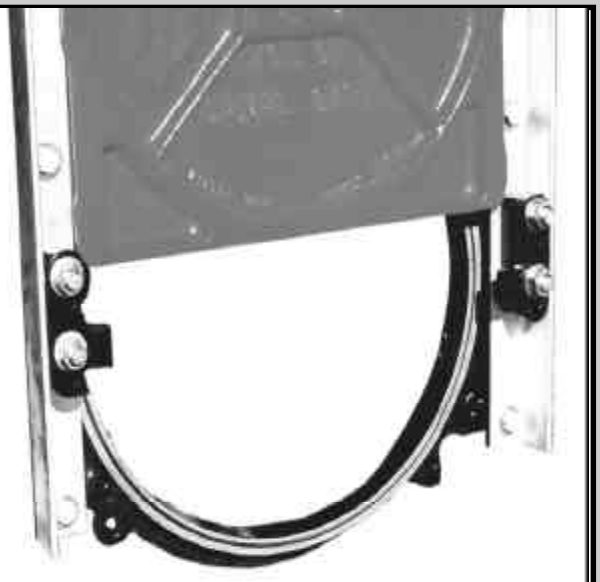
- Rugged galvanized or painted ASTM A-36 Steel Guide Rails and Head Rails
- ASTM A-36 Steel Stem
- A-126 Cast Iron Frame, Cover and Wedges
- Bronze Lift Nut w/Cast Iron Handwheel
- Seat Seal - Neoprene

Available with:

- Flatback Frame
- Spigotback Frame
- Type 4 Frame
- CIP Frame
- All C-10 Options



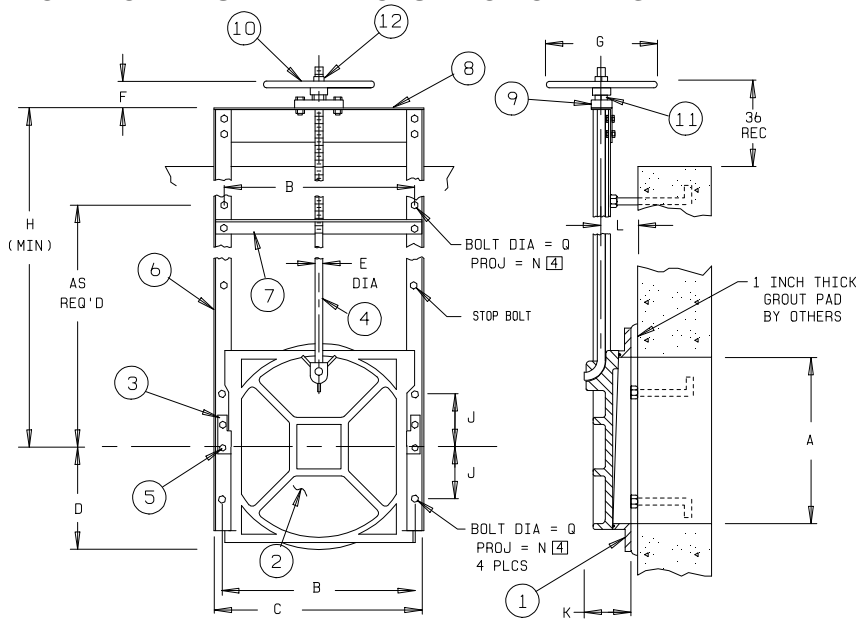
Leak-Resistant
CL-11 "SAHARA"™ Canal Gate



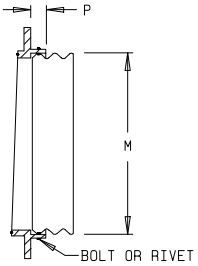
Neoprene Seat for Tight Seal

MODEL CL-11 "SAHARA"™ CAST IRON CANAL GATE

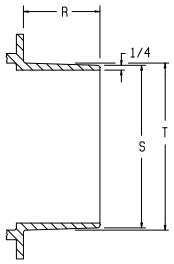
NOTES
1. TYPE 2 lubricated ball bearing lift used on 48" and larger gates.
2. Applies to spigotback gate only. Optional spigot, shown in separate detail.
3. Add grout pad thickness to anchor bolt projection.
4. Type 3E 2:1 lift used, mounted to dual headrail.



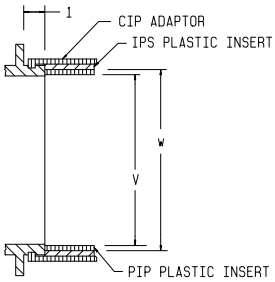
Headwall Mounted Flatback Frame



Corrugated Pipe Attached to Spigotback Frame



Type 4 Spigot



CIP

PARTS LIST		
No.	**Name**	**Qty.**
1	Frame	1
2	Cover	1
3	Wedge (R&L)	1 ea.
4	Stem	1
5	Wedge Bolts	4
6	Guide Rail	2
7	Stem Support	A/R
8	Headrail	1
9	Lift Collar	1
10	Handwheel	1
11	Lift Nut	1
12	Limit Nut	1

A	B	C	D	E	F	G	H	J	K	L	M 2	N	P 2	Q	R	S	T	V	W
6	8	9⅞	4	⅞	2⅞	10	24	3	3½	2⅝	7	3½	2	½	-	-	-	6.160	6.645
8	10	12	4⅞	⅞	2⅞	10	24	3	3¾	2½	9	3½	2	½	4	7 13/16	8	8.180	8.645
10	12	13⅞	6	⅞	2⅞	10	24	3½	3¾	2½	11	3½	2	½	3⅞	9⅞	10	10.220	10.770
12	14	15⅞	7	⅞	2⅞	10	24	4	3½	3	13	4	2	½	4	11⅞	12	12.270	12.780
14	16	17⅞	8	⅞	2⅞	10	27½	4¾	3¾	3¼	15	4	2	½	-	-	-	-	-
15	17	18⅞	8⅞	⅞	2⅞	10	30	5	4½	3½	16	4	2⅛	½	4	14⅞	15	-	-
16	18¾	20⅝	9⅞	⅞	2⅞	10	32	5½	4½	3½	17	4½	2	⅝	-	-	-	-	-
18	21	22⅞	10½	1	3⅛	12	34	6	4½	4¼	19	4½	2	⅝	4	17 13/16	18	-	-
20	23¼	25⅛	11¾	1	3⅛	12	38	7	4¾	4	21	4½	2	⅝	-	-	-	-	-
21	24	25⅞	12 5/16	1	3⅛	12	40	7	4¾	4	22	4½	2	⅝	-	-	-	-	-
24	27¼	29⅛	13⅞	1	3⅛	12	44	8	5¾	4⅛	25	4½	2	⅝	-	-	-	-	-

GATE DIMENSIONS IN INCHES

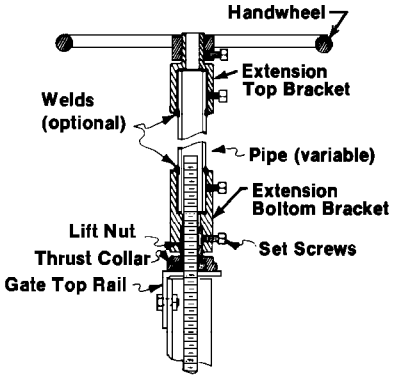
STEM EXTENSIONS

(USE WITH C-10, CL-11 AND C-20 MODELS)

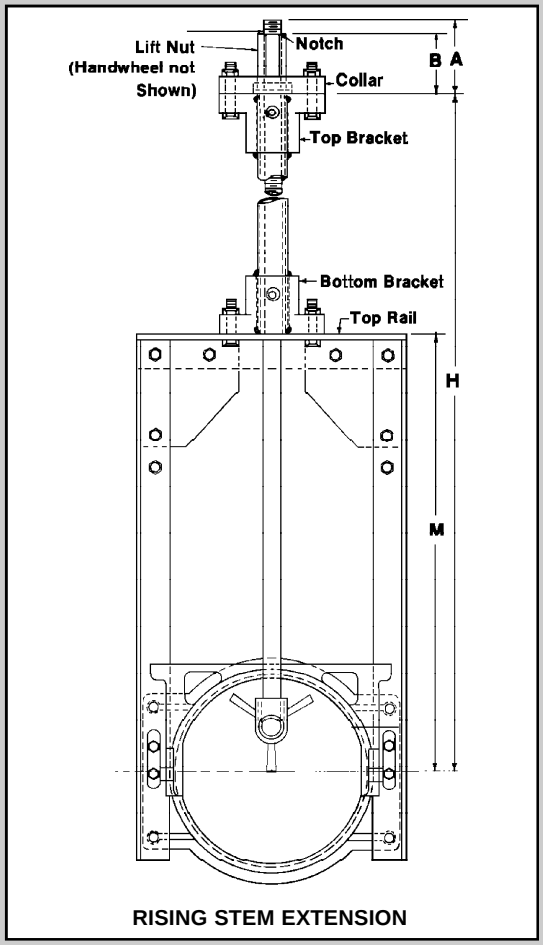
RISING STEM EXTENSIONS (RSE)

Waterman Rising-Stem Extensions are factory installed to the height ("H") required. They provide a rising stem and handwheel, keeping threads and lifts above the water level and allowing the amount of gate opening to be readily determined. Cast iron brackets, fastened to the top and bottom of standard galvanized steel pipe, are secured to the frame headrail and mount to the standard handwheel and stem hardware.

The stem extends through the entire length of pipe. With the addition of oil seals, these rising stem extension can be used where weather conditions require that the stem operate in oil to prevent freezing.



NON-RISING STEM EXTENSION



RISING STEM EXTENSION

NON-RISING STEM EXTENSIONS

(USE WITH C-10, CL-11 AND C-20 MODELS)

Waterman Non-Rising Stem Extensions are an accessory to Waterman stock gates. They are used to position the gate handwheel at convenient and non-changing operating elevations. This eliminates the problem of gate stems protruding into traffic areas or walkways.

The use of Waterman Non-Rising Stem Extensions also eliminates the expense and inconvenience of ordering gate frames of special dimensions to meet different operating height conditions.

The extensions are readily installed in the field. The upper and lower brackets are joined by a section of standard galvanized steel pipe (normally not furnished) by means of threads, set screws, pins or welds. The length of the pipe determines the elevation of the handwheel. Waterman Stem Guides, such as Eye Bolt, NRS-K, SK-1, SK-2, K-1 and K-2 Series, are recommended to secure the handwheel location.

Complete units are available from the factory when desired.
6" - 24" gates require 1¼" pipe
30" - 36" gates require 1½" pipe
42" - 48" gates require 2" pipe
These extensions may also be adapted to C-20 gates and Series R slide gates.

RSE EXTENSION

NRE EXTENSION

Gate Size	A	B	M	H
6	3⅞	2⅞	24	VARIABLE AS REQUIRED
8	3⅞	2⅞	24	
10	3⅞	2⅞	24	
12	3⅞	2⅞	24	
14	3⅞	2⅞	27½	
15	3⅞	2⅞	30	
16	3⅞	2⅞	32	
18	4⅛	3⅛	34	
20	4⅛	3⅛	38	
21	4⅛	3⅛	40	
24	4⅛	3⅛	44	
30	5	4	54	
36	5	4	62	
42	6	5	84	
48	7	6	90	
54	7	6	100	
60	7	6	102	
72	*	*	121	

All dimensions in inches and apply to C-10 Series gates.
* Special fabricated design for geared type lift.

P-30ff PRESSURE SLIDE GATE

- **MEDIUM DUTY**
- **CORROSION RESISTANT TRIM**
- **FLANGEBACK**

This Waterman Model P-30ff Red Top Pressure Slide Gate features a circular opening, circular flangeback frame and is provided with bronze seat faces and stem, and stainless steel assembly hardware for Sluice Gate type applications in water treatment facilities.

It is an economical gate, ideally suited for effluent ponding installations, pumping stations, and distributing boxes.

This gate is a product of many years of field, as well as manufacturing experience, and is of particularly sturdy construction. It has a powerful center wedge closing action, but is always easily opened. A bronze non-rising stem is standard and features rugged modified acme threads. Seat faces are iron (bronze optional). Guide rails on 6" - 14" are cast iron. Guide rails on 16" and larger are stainless steel. Frame, cover and arch are high strength cast iron.

Used in water control applications where a rugged but economical circular opening gate is required, such as small reservoirs, distribution boxes, ponding areas and pumping stations where fluid and operating conditions are only moderately severe and continuous throttling action is not anticipated.

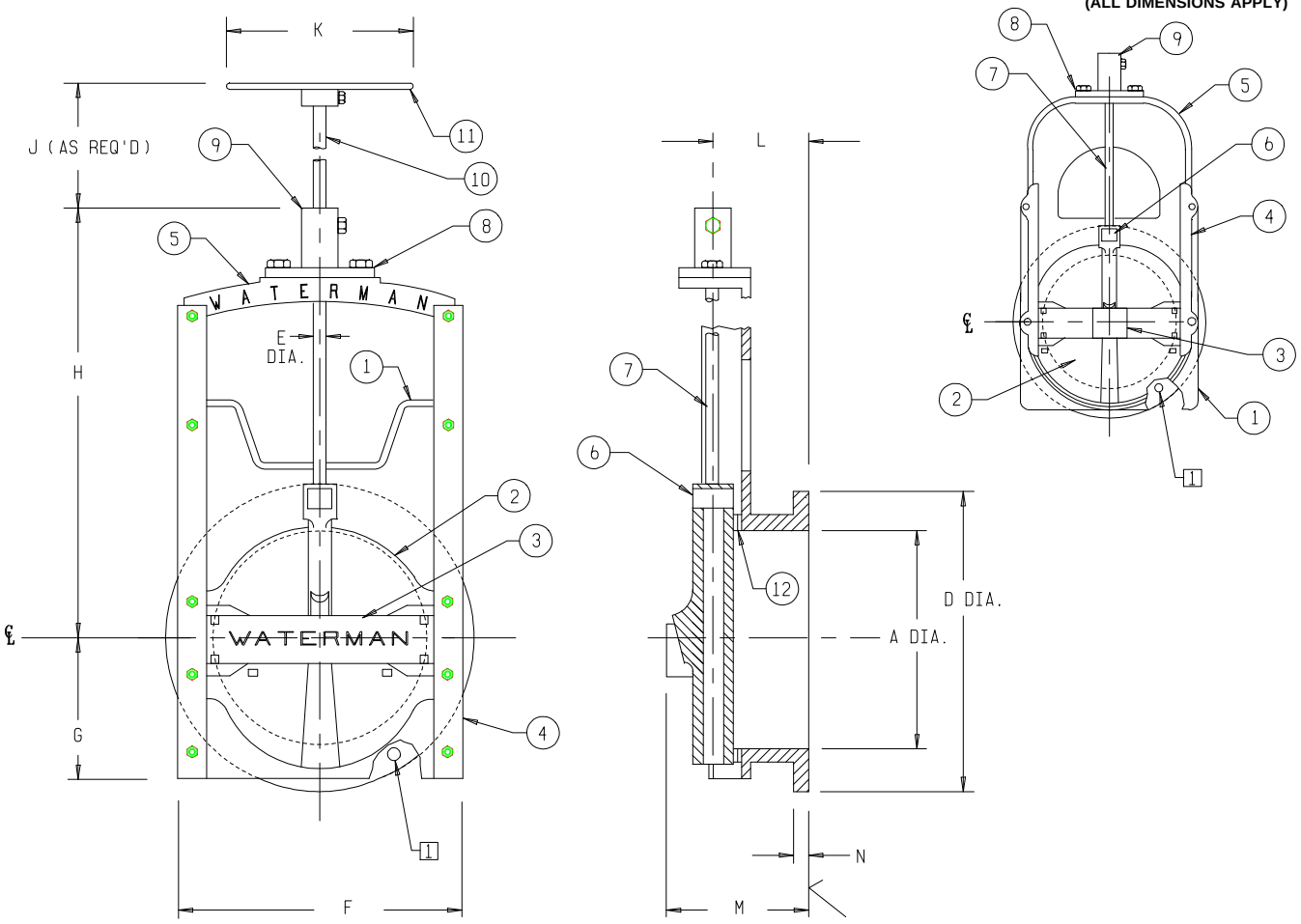
FEATURES:

- Circular opening cast iron slide gate
- For **60 foot** seating (face) pressure and **10 foot** unseating (back) pressure.
- Circular flangeback mounting with 125 lb. ANSI straddle center drilling standard. 25 lb. ANSI drilling optional
- Non-rising bronze stem standard. (Rising stainless steel stem, optional).
- Optional bronze seat faces
- Center-point wedge action
- Stainless steel assembly hardware.

P-30ff

P-30ff FLANGEBACK PRESSURE GATE

CAST ON YOKE
SIZE 6" - 14" ONLY
(ALL DIMENSIONS APPLY)



NOTES:

1. 125# drilling standard; "P" dia. holes, "S" places eq. spaced, straddle centerline on "BC" dia. bolt circle, uses "R" NC bolts.

2. Gate capacity:
   Max. seating head 60 Ft.
   Max. unseating head 10 Ft.

3. Standard gate with non-rising stem.

4. All assembly hardware 300 series stainless steel.

GATE DIMENSIONS IN INCHES

A	BC	D	E	F	G	H	K	L	M	N	P	R	S
6	9½	11	⅞	10	5½	14	10	5¼	7¼	1	⅞	¾	8
8	11¾	13½	⅞	11⅛	5½	17⅝	10	4½	7	⅞	⅞	¾	8
10	14¼	16	⅞	13⅜	6½	20⅞	10	4½	7	⅞	1	⅞	12
12	17	19	⅞	15⅝	8	24⅛	12	4½	7½	1	1	⅞	12
14	18¾	21	⅞	18	9	26	12	4½	8	1⅛	1⅛	1	12
16	21¼	23½	1	20⅝	10½	30¼	12	4½	8	1⅛	1⅛	1	16
18	22¾	25	1	22¾	11½	33¾	15	5	8½	1¼	1¼	1⅛	16
20	25	27½	1⅛	25	12½	40	15	5	9	1¼	1¼	1⅛	20
24	29½	32	1½	29¾	14½	48½	18	6¾	10½	1½	1⅜	1¼	20

PARTS LIST	
No.	**Name**
1	Frame- Cast Iron
2	Cover - Cast Iron
3	Arch - Cast Iron
4	Rails - 304 Stn. Stl. (Cast Iron thru 14")
5	Yoke - Cast Iron (cast on thru 14")
6	Thrust Nut - Bronze
7	Stem - Bronze
8	Collar - Cast Iron
9	Stem Ext. Brkt. - Cast Iron
10	Ext. Stem - Mat'l. as req'd.
11	Handwheel - Cast Iron
12	Bronze Seat - Optional

TYPICAL SPECIFICATIONS
FOR WATERMAN MODEL P-30ff PRESSURE SLIDE GATE

The pressure slide gates shall be Waterman Model P-30ff or approved equal.

General
The gates shall be self-contained with yoke, benchstand operators, and non-rising stems (rising stem optional). Specific gate design and configuration shall be noted in gate schedule or as shown on plans.

Frame and Cover (Slide)
The frame and cover (slide) shall be cast iron with machined (bronze optional) seating faces. The frame shall be flatback or flangeback with 125 lb. drilling (25 lb. optional), while the cover shall be of domed design to withstand maximum seating head of 60 feet, or unseating head of 10 feet.

A cast iron (on 14" and smaller, stainless steel on 16" and larger) guide rail shall be mounted to the frame to form a guide slot for flat vertical sides of cover and arch. The guide rail and headpiece, whether it be separate or integrally cast with frame, shall be designed to withstand the total thrust of the gate slide due to water pressure and wedging action.

A heavy duty cast iron arch, pivoting about a center positioned cast iron wedge located on the cover, shall be provided to uniformly distribute wedging action over the entire seating surface. Predetermined stops on the frame shall stop the arch at the lowermost portion of gate travel, while allowing the cover to continue and wedge against the arch, forcing the seating surfaces together.

Stem
The stem shall be bronze (optional stainless steel) of suitable length and ample strength for the intended service. Any potion of the stem subject to thrust force, shall be capable of withstanding twice the rated output of the operator at 40 pound pull, and shall be supported such that a L/r ratio for the unsupported part of the stem shall not exceed 200.

When rising stem is used, the stem extension shall be supported with stem guide such that a rigid installation shall be provided. Stem guides shall be so spaced, that the L/r ratio of the stem does not exceed 200.

Operators
On a standard gate with non-rising stem, the screw head is mounted on top of the headrail, and includes a handwheel (2" square nut optional) located above the gate as shown on the plans.

On a rising stem gate, manually operated lifting mechanisms shall be as indicated on the plan drawings or in the gate schedule. Handwheel type lifts shall have threaded bronze lift nuts to match the stem. Threads shall be machine cut, acme type, and left hand.

An arrow shall be cast on the handwheel to indicate the direction of rotation to open the gate. A maximum effort of 40 pounds shall be required to operate the gate after it is unseated, based on the maximum specified operating head.

Material
Frame, Cover (slide), Handwheel, Yoke and Rails (14" and smaller), Screwhead - Cast Iron - ASTM A-126, Class B
Rails (16" and larger) Stainless Steel - A-276, Type 304
Stem and Lift Nut - Free Cutting Brass - Alloy 360
Assembly Hardware and Fasteners - Stainless Steel ASTM F-593 and 594
Paint - Manufacturer's Standard

Other Optional Items Include
Galvanized Steel Rails - ASTM A-36 Galvanized per A-123
Stainless Steel (Type 304) Stems
Galvanized Assembly Hardware
Special Paint Finish: Coal Tar Epoxy, Polyamide Epoxy, etc.