

McCrometer Meter Installation Guide

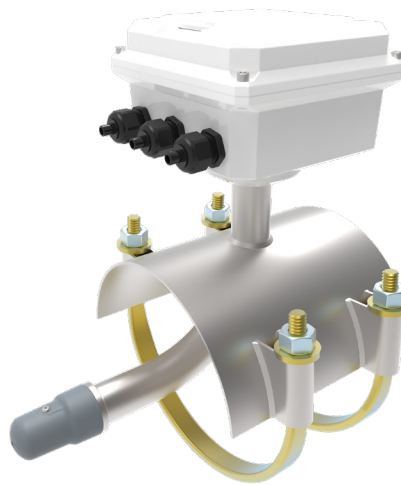
Installation instructions for
the following meters:

McPropeller

McMag2000

McMag3000

Dura Mag



30126-61 Rev. 1.0
26APR2024

Contents

- SAFETY1**
- 1.0 MC PROPELLER METER INSTALLATION.....2**
 - 1.1 Specifications2**
 - 1.2 General Specifications2**
 - 1.3 How to Read a Totalizer3**
 - 1.4 Understanding the Register Gear Ratio3**
 - 1.5 Installation Instructions4**
 - 1.6 Straightening Vanes.....5**
 - 1.7 Other Installation Considerations5**
 - 1.8 McSpaceSaver Installation for M0300 / M0300F Flow Meters6**
 - 1.9 McSpaceSaver Installation in Flow Tube in Forward Configuration7**
 - 1.10 Pipe Run Requirements8**
- 2.0 MCMAG2000 METER INSTALLATION9**
 - 2.1 Principle Of Operation.....9**
 - 2.2 Flow Direction9**
 - 2.3 Pipe Run Requirements9**
- 3.0 MCMAG3000 METER INSTALLATION10**
 - 3.1 Introduction10**
 - 3.2 Flow Direction10**
 - 3.3 Straight Pipe Requirements.....10**
 - 3.4 Flow Direction11**
 - 3.5 Straight Pipe Requirements.....11**
- 4.0 DURA MAG METER INSTALLATION.....12**
 - 4.1 Description of the Flow Meter.....12**
 - 4.2 Pipe Run Requirements.....12**
 - 4.3 Positioning and Orienting the Sensor.....13**

Safety

Safety

Safety Symbols

Throughout this manual are safety warning and caution information boxes. Each warning and caution box will be identified by a large symbol indicating the type of information contained in the box. The symbols are explained below:



WARNING - This symbol indicates important safety information. Failure to follow the instructions can result in serious injury or death.



IMPORTANT - This symbol indicates important information. Failure to follow the instructions can result in permanent damage to the meter or installation site.

Safety Warnings

When installing, operating, and maintaining McCrometer equipment where hazards may be present, you must protect yourself by wearing Personal Protective Equipment (PPE) and be trained to enter confined spaces. Examples of confined spaces are manholes, pumping stations, pipelines, pits, septic tanks, sewage digesters, vaults, degreasers, storage tanks, boilers, and furnaces.

You must follow all state and local laws, as well as Occupational Safety and Health Administration (OSHA) regulations concerning Personal Protective Equipment and confined-space entry. Specific requirements can be found in the OSHA section of the Code of Federal Regulations: 29 CFR, 1910.132 - 1910.140, Personal Protective Equipment; and CFR Title 29, Part 1910.146, Permit-Required Confined-Spaces.



WARNING!

Incorrect installation or removal of meters can result in serious injury or death. Read the instructions in this manual on the proper procedures carefully.



WARNING!

Never enter a confined space without testing the air at the top, middle, and bottom of the space. The air may be toxic, oxygen deficient, or explosive. Do not trust your senses to determine if the air is safe. You cannot see or smell many toxic gases.



WARNING!

Never enter a confined space without the proper safety equipment. You may need a respirator, gas detector, tripod, lifeline, and other safety equipment.



WARNING!

Never enter a confined space without standby/rescue personnel within earshot. Standby/rescue personnel must know what action to take in case of an emergency.



WARNING!

Cutting into a pressurized pipe may cause injury or death. Always insure the pipe is empty BEFORE cutting.

Mc Propeller Meter Installation

1.0 Mc Propeller Meter Installation

1.1 Specifications

The measuring element of a propeller flow meter consists of a rotating device, called a rotor or propeller. Positioned in the center of the flowstream, the propeller rotates at a rate proportional to the velocity of the fluid through the flow meter. This rotation can be transmitted mechanically to a register assembly and the fluid's volumetric flowrate and accumulated volume can then be displayed.



1.2 General Specifications

DESCRIPTIONS:

TURNDOWN: Propeller meters are specified to work within a certain range of flowrates. Turndown is the ratio of the maximum flowrate to the minimum flowrate of the meter. A typical turndown of an 8" meter is 15:1. (e.g., max. flow = 1500 gpm to min. flow = 100 gpm)

ACCURACY: Accuracy is the relation between the volume shown on the meter's totalizer and the actual volume of fluid which has passed through the meter. McCrometer guarantees that the meter will report within $\pm 2\%$ of the actual flow if it is normally operated between its minimum and maximum rates of flow.

REPEATABILITY: Flow meter repeatability is the ability of a meter to reproduce a measurement under similar conditions. This is not by itself a measure of accuracy, but rather a component of the meter's total accuracy. McCrometer propeller meters have a repeatability of $\pm 0.25\%$.

PRESSURE: The pressure rating for standard propeller meters is 150 PSI. This pressure rating refers to the constant line pressure in the pipe. Some models can be rated up to 300 PSI. Higher pressures are available on special request.

TEMPERATURE: The temperature rating for standard propeller meters is 160° F constant temperature. This temperature rating refers to fluid temperature. Most standard models can be upgraded to 180° F constant temperature on special request.

Mc Propeller Meter Installation

1.3 How to Read a Totalizer

The following guidelines should be helpful for reading totalizers on Mc Propeller flow meters:

Most totalizers have “multipliers”. Multipliers are always a multiple or fraction of ten which are used to multiply the direct reading of the totalizer.

Reading a 6-Digit Totalizer

Gallons: A meter that totalizes in gallons will have a multiplier of times 10, times 100, or higher. That means that the meter is read not as gallons, but as tens of gallons or hundreds of gallons.

Acre Feet: A meter that totalizes in acre feet will have a multiplier of times .01, times .001, times .0001, or smaller. The digit counters on the right side are colored yellow to indicate where a decimal point should be placed when reading the totalizer.

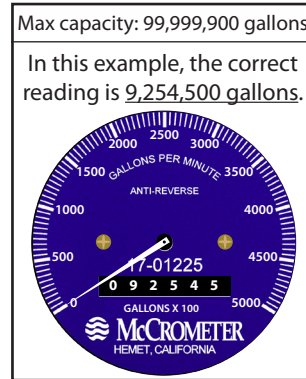


Figure 1. Totalizer In Gallons x 100

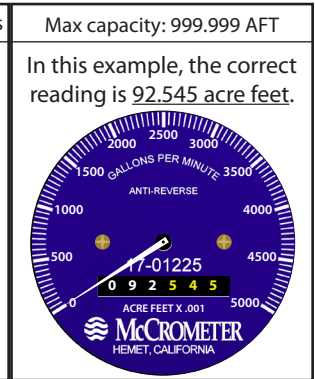


Figure 2. Totalizer In Acre Feet x .001

Reading a 7-Digit Totalizer

The 7-digit totalizer for gallons and acre feet is read the same as described above. See maximum possible values for each multiplier.

When reading a totalizer, be sure to add the correct number of zeroes or to place the decimal point in the right place. If a mistake is made, the meter reading can be off by a factor of 10, 100, or even 1000 units.

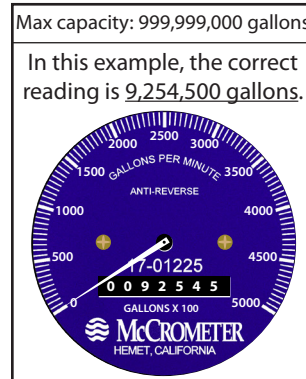


Figure 3. Totalizer In Gallons x 100

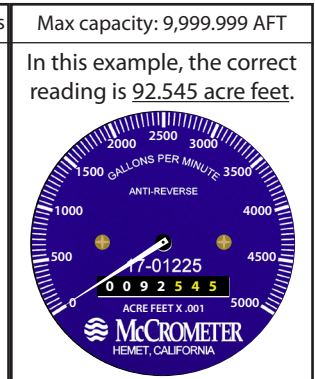


Figure 4. Totalizer In Acre Feet x .001

1.4 Understanding the Register Gear Ratio

Each register has a gear ratio that is matched to the propeller. For instance, consider an 8” McCrometer meter totalizing in gallons. A standard 8” meter will have a gear ratio of 400:1, which means the propeller must rotate 400 times for the first odometer wheel to turn one complete revolution. This first odometer wheel usually symbolizes a certain multiple of the totalizing units, called a multiplier. Since the totalizer on the 8” meter has a multiplier of times 100 (signified by two zeros to the right of the odometer wheels), each number on the first odometer wheel represents one hundred gallons.

Therefore, one complete rotation of the first odometer wheel is ten times one hundred gallons, or 1000 gallons. So remembering the gear ratio for this example is 400 propeller revolutions to one full turn of the odometer wheel, 400 propeller revolutions equals 1000 gallons.

Example: Standard 8” meter: 400 propeller revolutions = 1 rev. of odometer wheel = 1000 gallons

NOTE Each line size has its own gear ratio. **Registers from different size meters cannot be interchanged freely.** Be sure you know your meter’s gear ratio and multiplier for reference.

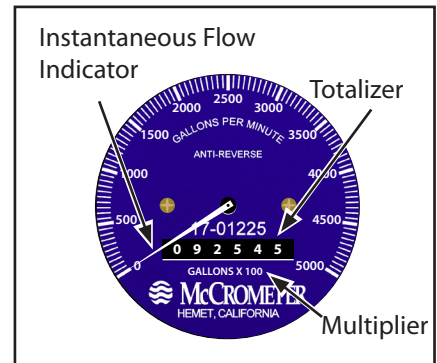


Figure 5. Typical Dial Face

Mc Propeller Meter Installation

1.5 Installation Instructions

Proper meter installation is the first step to ensure excellent meter performance. Follow these instructions closely. Consult an authorized service representative or the factory for any circumstances encountered which are not covered in this manual.

All McCrometer products are tested and inspected during manufacture and prior to shipping. An inspection should be performed at the time of unpacking to detect any damage that might have occurred during shipment.

Safety



WARNING!

NEVER ATTEMPT TO REMOVE A METER WHILE THE LINE IS UNDER PRESSURE!

- Any person installing, inspecting, or maintaining a McCrometer flow meter should have a working understanding of piping configurations and systems under pressure.
- Before adjusting or removing any meter, be certain the system has depressurized completely.
- Be careful when lifting meters. Meters can cause serious injury if lifted incorrectly or dropped.
- Only necessary and appropriate tools should be used when working on a meter.
- Before starting a system, make sure all connections are properly secured. Keep a safe and prudent distance away from the meter during system start-up.



NOTE

When cutting a hole in the pipe is required, be sure to use the provided template. It is recommended that four holes be drilled at the corners of the square for guiding the cut. It is also recommended that the cut be made on the inside of the lines that are drawn from the template.

1. Apply MolyKote lubricant or equivalent to the saddle gasket and the ID of the U-bolts.
2. Place saddle with gasket in place over the cut out.
3. Place U-bolts underneath the pipe and through the saddle clips.
4. Place the provided washers and nuts on the U-bolts that have been installed through the saddle clips.
5. Start tightening down the nuts **evenly in a diagonal or figure 8 pattern**.
 - 5a. Tighten the nuts to **40 ft. lbs.**
 - 5b. Tighten the nuts to **60 ft. lbs.**
 - 5c. Tighten the nuts to **80 ft. lbs.**
6. Go back around and loosen all of the nuts. Do not back the nuts completely off of the U-bolts. The goal is to release force and tension off of the saddle and the gasket.
7. Repeat steps 5a through 5c exactly as described. Any step that is skipped may result in an improper seal.
8. Apply pressure/turn on pump.
9. Verify the saddle is not leaking water. If it is, repeat steps 6 through 8 until the saddle has sealed.

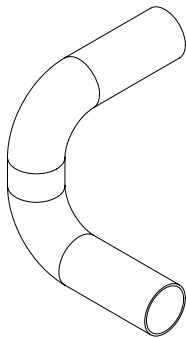
Mc Propeller Meter Installation

1.6 Straightening Vanes

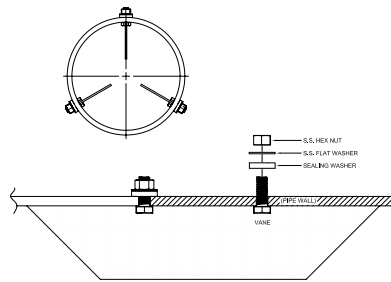
Special attention should be given to systems using two elbows “out of plane” or devices such as a centrifugal sand separator. These cause swirling flow in the line that affect propeller meters. Well developed swirls can travel up to 100 diameters downstream if unobstructed. Since most installations have less than 100 diameters to work with, straightening vanes become necessary to alleviate the problem. Straightening vanes will break up most swirls and ensure more accurate measurement.

McCrometer’s mainline meters like the MW500 series have vanes included as a standard feature. If your model does not have straightening vanes (e.g., M0300 Bolt-On Saddle series), McCrometer actively encourages installing vanes just ahead of the meter. Straightening vanes are available in weld-in, bolt-in, and the FS100 and FS200 Flow Straightener. For more information on vane installation, please visit www.mccrometer.com and download the following McCrometer documents:

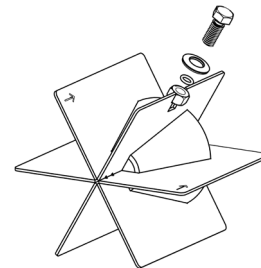
- 24510-72 Installation Instructions For Bolt-In Vanes
- 24517-03 Flow Straightener Installation Instructions



Elbows out of plane



**Bolt-in
straightening vanes**



Flow Straightener

1.7 Other Installation Considerations

- All propeller flow meters are calibrated for a full pipeline only; if less, the flow meter will over register the flow. Although a minimum line pressure is not necessary for an accurate measurement, a full pipe is necessary.
- Mc Propeller flow meters can be mounted either horizontally or vertically. Mc Propeller flow meters are calibrated for horizontal installation. Vertical mounting can offer some slight advantages due to gravity having a more pronounced flow conditioning effect in vertical lines. If the meter is to be mounted vertically, please notify the factory at time of order as the mechanical indicator needs to be calibrated for vertical installations.
- With the meter installed, check the rate-of-flow indicator. It should be stable to the point that it can be easily read. Some indicator movement is normal due to variations in flow. Erratic movement of the indicator is normally caused by flow variations and the system should be checked. Drastic variations in flow can decrease meter accuracy. If you suspect a problem with the meter, please contact your local McCrometer representative.

Mc Propeller Meter Installation

McSpaceSaver Installation for M0300 / M0300F Flow Meters

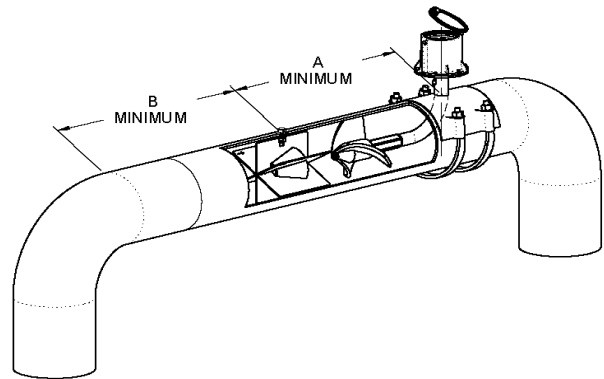
Applies to:

Mc Propeller models M0300 and M0300F

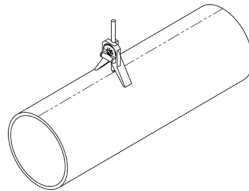
See the template supplied with the M0300F for flowmeter installation instructions.

1. Relieve the pressure and drain the line prior to installation. Determine the location of the flow straightener on the outside of the pipe. The distance (A) between the bolt hole and the centerline of the ell is indicated on the table below. The centerline of the flow straightener must be parallel to the centerline of the pipe.

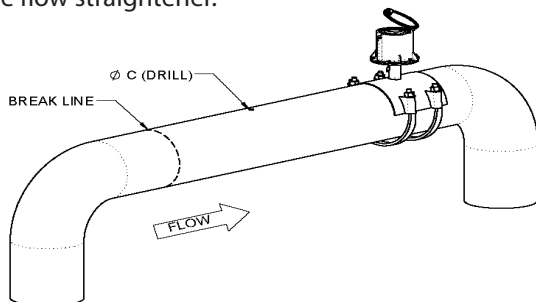
METER SIZE	A	B	C
6"	20 5/8	2 5/8	17/32
8"	22 3/4	3 1/2	17/32
10"	24 7/8	4 3/8	21/32
12"	27	5 1/4	21/32



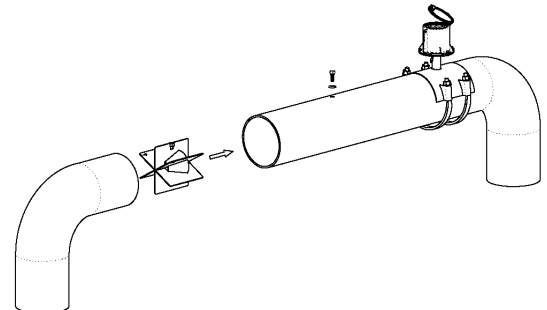
2. Establish the centerline of the pipe by a centering tool. Mark the pipe for the bolt location (see B dimension in the table above).



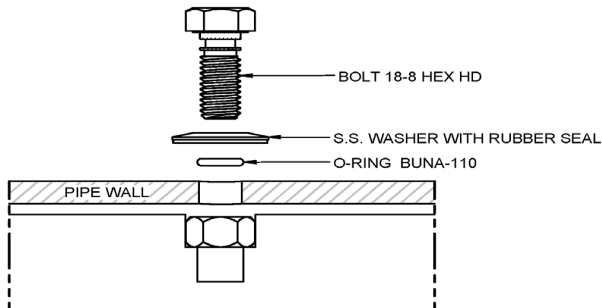
3. Drill a hole (see C dimension in the table). Break line at a flange or cut pipe in a portion near the installation location of the flow straightener.



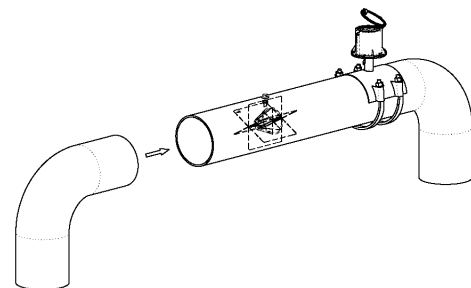
4. Insert the flow straightener into the pipe.



5. Secure the flow straightener with the bolt, washer and O-ring supplied with the flow straightener. Place sealing rubber washer and the o-ring under bolt against the outside of the pipe. Secure the bolt to hold the flow straightener to the pipe. Apply Loctite® anti-seize C5-A, or other appropriate lubricant, to the bolt prior to installation to ensure the bolt and nut do not seize up prior to creating an effective seal.



6. Close the line at the flange or repair the break.



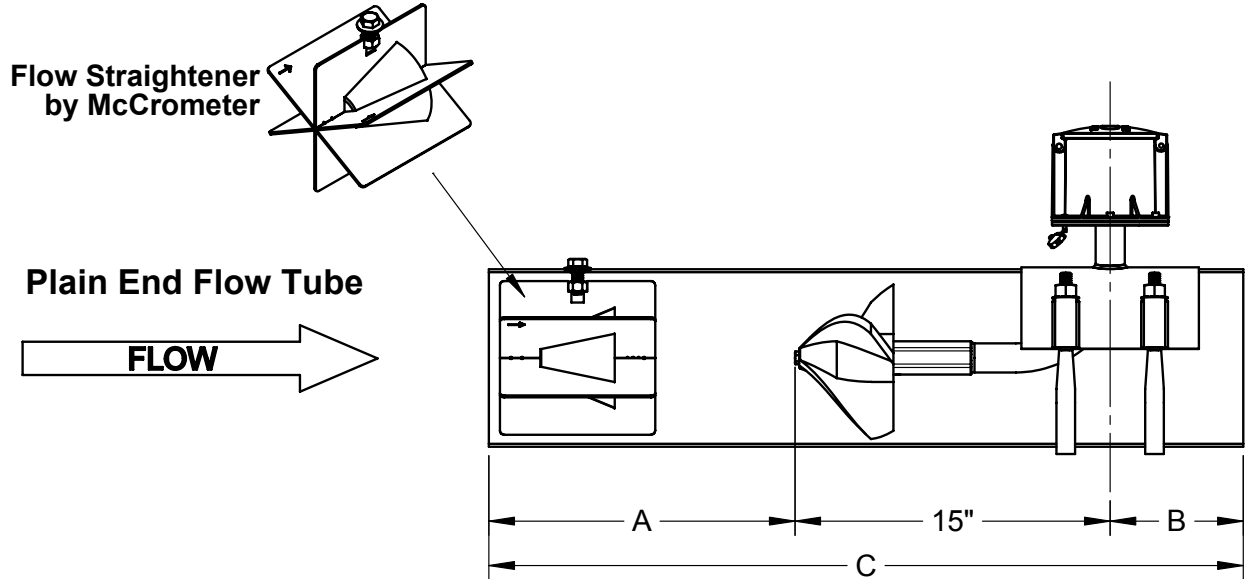
NOTE: It is advised the installer not use air guns or impact wrenches to tighten the bolt as it may damage the flow straightener.

Mc Propeller Meter Installation

McSpaceSaver Installation in Flow Tube in Forward Configuration

Applies to:

Mc Propeller, Water Specialties, and McMag2000 flow meters

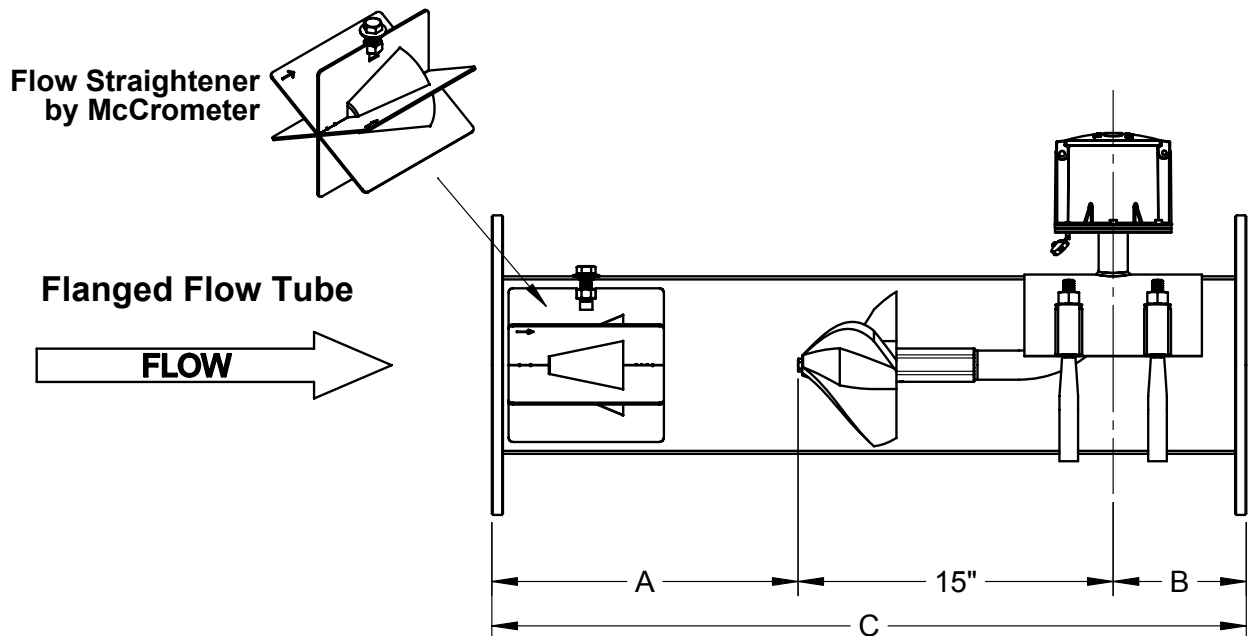


Meter Tube Features

- Steel couplers can be welded to these tubes.
- Steel tubes are epoxy coated 10 Gauge.
- Tubes include total required lengths.
- Tubes can be fastened directly to check valves.
- Tubes can be Aluminum w/ couplers, flanges, or rolled ends.

Pipe Size	A	B	C
6	9	6	30
8	12	7	34
10	15	10	40
12	18	13	46

All dimensions are in inches



Mc Propeller Meter Installation

1.10 Pipe Run Requirements

Flow meters are velocity sensing devices and are vulnerable to certain upstream disturbances. Because of this, meters need certain lengths of straight pipe runs before and after the meter. These distances usually relate to the diameter (D) of the pipe used. Obstructions can include elbows, valves, pumps, and changes in pipe diameter. The uneven flow created by these obstructions can vary with each system. If your application provides for more than the minimum distance required of upstream run, use the available distance.

- **Upstream Requirement:** McPropeller meters should be installed a minimum of 5D (with vanes) or 10D (without vanes). When the meter is installed with less than 10D upstream, the meter should be installed with vanes. See the table below. In the case of backflow, chemigation valves, or check valves, which are significant disturbers, we recommend installation of the meter at a greater distance if possible. 5D (with vanes) or 10D (without vanes) is the **minimum** requirement. If the installation does not allow for 5D upstream of the meter, the upstream distance can be shortened to 1.5D with the use of the FS100 Flow Straightener. See pages 6 and 7.
- **Downstream Requirement:** The downstream run should be one to two diameters of straight pipe length after the meter.

For upstream and downstream piping requirements relating to your specific meter, contact your local McCrometer representative. (Please be prepared to provide the serial number of your meter.)

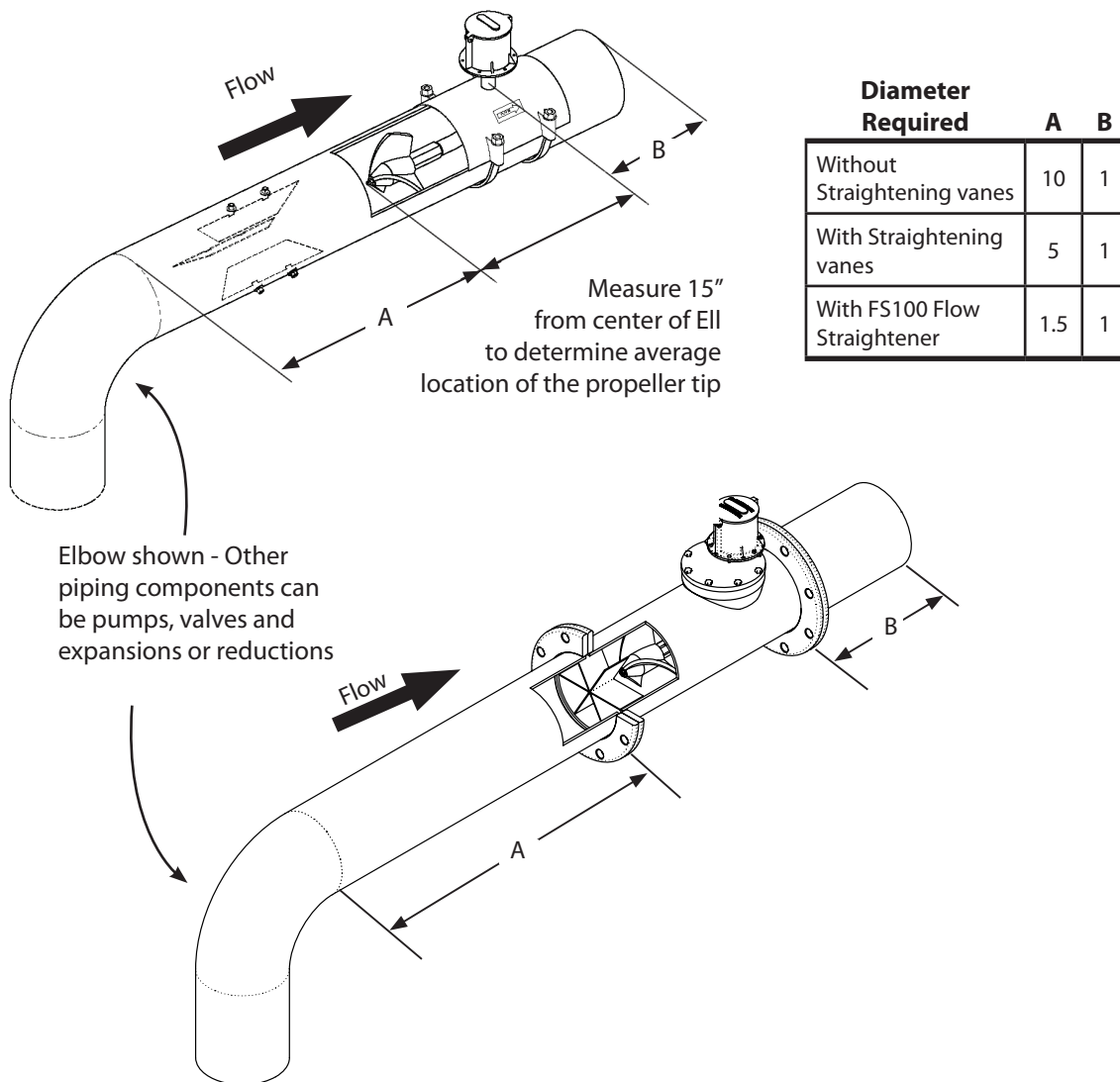


Figure 6. Pipe Run Requirements For Saddle And Tube Style Flow Meters

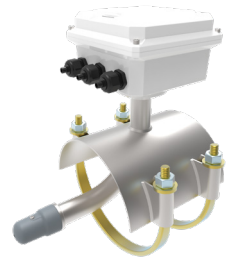
McMag2000 Meter Installation

2.0 McMag2000 Meter Installation

2.1 Principle Of Operation

The McMag²⁰⁰⁰ uses Faraday's Law of electromagnetic induction to measure water velocity. Faraday's Law states that a conductor, moving through a magnetic field, produces a voltage.

Charge carriers in the fluid produce a voltage when passing through a magnetic field. The magnitude of the voltage is directly proportional to the velocity at which the fluid moves through the magnetic field. Electromagnetic coil inside the sensor produces a magnetic field, and electrodes on the sensor's surface measure the voltage generated by the moving fluid. The individual velocity measurements are averaged together providing the average velocity across the pipe center line. Flow is calculated by multiplying the average velocity by the cross-sectional area of the pipe.



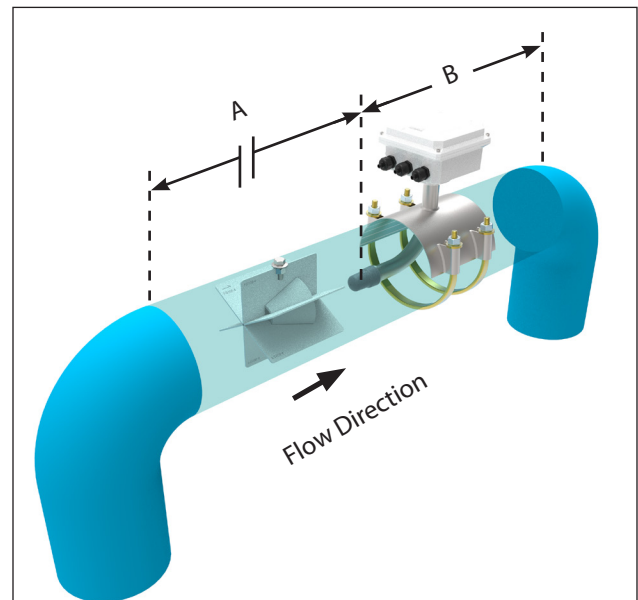
2.2 Flow Direction

It is very important to install the flow meter relative to the flow of the water. The sensor must face the flow direction in order for it to make proper measurements.

2.3 Pipe Run Requirements

Flow meters are velocity sensing devices and are vulnerable to certain upstream disturbances. Because of this, meters need certain lengths of straight pipe before and after the meter. These distances relate to the diameter of the pipe used. Obstructions can include elbows, valves, pumps, and changes in pipe diameter. The uneven flow created by these obstructions can vary with each system.

Both upstream and downstream distances are measured from the center of the sensor as shown below. In a typical installation to achieve $\pm 2\%$ accuracy the McMag²⁰⁰⁰ flow meter should be installed a minimum of five diameters upstream from most flow disturbers and two diameters downstream of the meter.



Pipe run requirements

Configuration	A	B
With or without straightening vanes	5	2
With flow straightener	1.5	1

McMag3000 Meter Installation

3.0 McMag3000 Meter Installation

3.1 Introduction

The Mc Mag³⁰⁰⁰ flow meter combines an innovative multi-point sensor with a battery powered integrated electronic converter package to provide accurate flow measurement for full-pipe flow monitoring applications.

The saddle mounted sensor (available for pipe sizes from 4 to 12 inches) uses electromagnetic technology to measure the water flow and correct for shifting velocity in the pipe by constantly obtaining a mean velocity from its multiple sensors.

The integrated converter is powered by a replaceable three cell lithium-thionyl chloride (Li-SOCl₂) battery that can provide flow measurement for five years (including a five-year battery warranty). Also available is the optional DC power supply (required for 4-20mA output). The streamlined, debris-shedding sensor shape allows the Mc Mag³⁰⁰⁰ to be used under many flow conditions, including surface water applications.

The Mc Mag³⁰⁰⁰ includes the McLogger data logger as standard with any order. Please see the McLogger manual for more information (Literature number 30121-87).

The Mc Mag3000 uses Faraday's Law of Electromagnetic Induction to measure water velocity. Faraday's Law states that a conductor, moving through a magnetic field, produces a voltage.

Charge carriers in the fluid produce a voltage when passing through a magnetic field. The magnitude of the voltage is directly proportional to the velocity at which the fluid moves through the magnetic field. Electromagnetic coils inside the sensor produce magnetic fields, and electrodes on the sensor's surface measure the voltage generated by the moving fluid.

The electrode pairs are positioned in specific configurations along the axis of the sensor. The individual velocity measurements are averaged together providing the average velocity across the pipe center line. Flow is calculated by multiplying the average velocity by the cross-sectional area of the pipe.

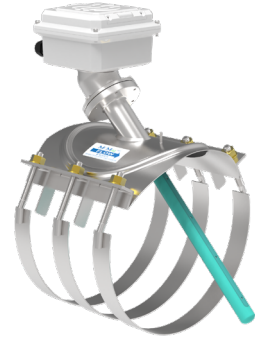
3.2 Flow Direction

It is very important to install the flow meter relative to the flow of the water. The sensor is designed at an angle to shed debris in the flow and for other performance enhancements.

3.3 Straight Pipe Requirements

Flow meters are velocity sensing devices and are vulnerable to certain upstream disturbances. Because of this, meters need certain lengths of straight pipe before and after the meter. These distances relate to the diameter of the pipe used. Obstructions can include elbows, valves, pumps, and changes in pipe diameter. The uneven flow created by these obstructions can vary with each system.

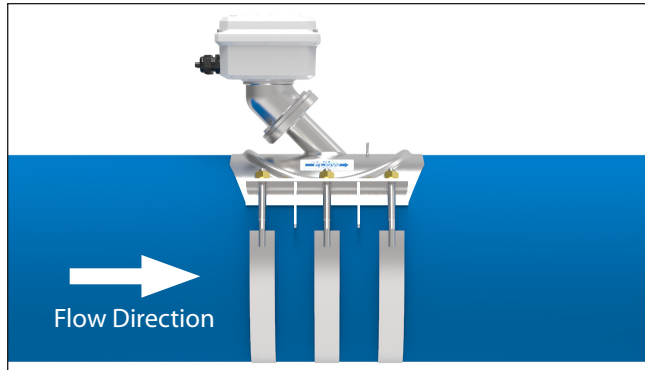
Both upstream and downstream distances are measured from the center of the saddle. In a typical installation to achieve $\pm 2\%$ accuracy the Mc Mag³⁰⁰⁰ flow meter should be installed a minimum of three diameters upstream from most flow disturbers and one diameter downstream of the meter. Accuracy of $\pm 1\%$ is available in many applications with a Factory consultation prior to ordering.



McMag3000 Meter Installation

3.4 Flow Direction

It is very important to install the flow meter relative to the flow of the water. The sensor is designed at an angle to shed debris in the flow and for other performance enhancements.



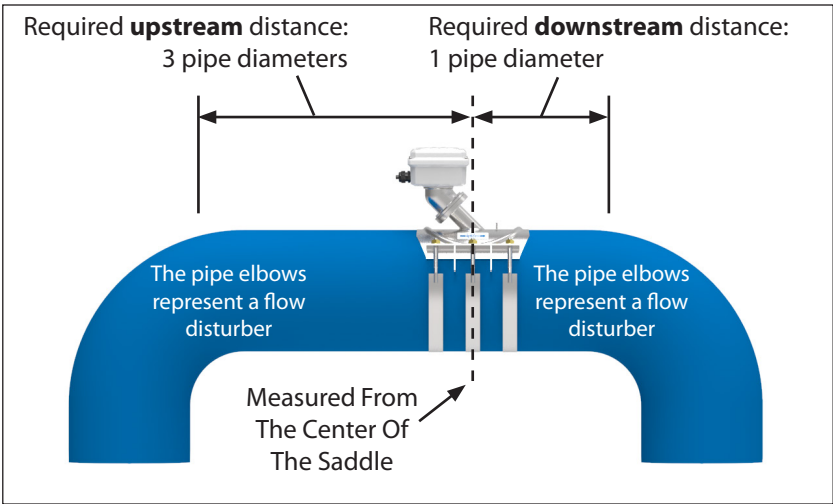
Note: 6" to 12" line size configuration shown in the example at left.

Proper meter installation for flow direction

3.5 Straight Pipe Requirements

Flow meters are velocity sensing devices and are vulnerable to certain upstream disturbances. Because of this, meters need certain lengths of straight pipe before and after the meter. These distances relate to the diameter of the pipe used. Obstructions can include elbows, valves, pumps, and changes in pipe diameter. The uneven flow created by these obstructions can vary with each system.

Both upstream and downstream distances are measured from the center of the saddle as shown below. In a typical installation to achieve $\pm 2\%$ accuracy the Mc Mag³⁰⁰⁰ flow meter should be installed a minimum of **three** diameters upstream from most flow disturbers and **one** diameter downstream of the meter. Accuracy of $\pm 1\%$ is available in many applications with a Factory consultation prior to ordering.



Measuring straight pipe requirements

Dura Mag Meter Installation

4.0 Dura Mag Meter Installation

4.1 Description of the Flow Meter

The Dura Mag flow meter combines the proven full bore magnetic flow sensor with a battery powered electronic converter package to provide accurate flow measurement in tough, remote applications.

The Dura Mag flow meter uses Faraday's Law of Electromagnetic Induction to measure water velocity. Faraday's Law states: A conductor, moving through a magnetic field, produces a voltage. Charge carriers in the fluid produce a voltage when passing through a magnetic field. The magnitude of the voltage is directly proportional to the velocity at which the fluid moves through the magnetic field. Electromagnetic coils inside the sensor produce magnetic fields, and electrodes on the sensor's surface measure the voltage generated by the moving fluid.



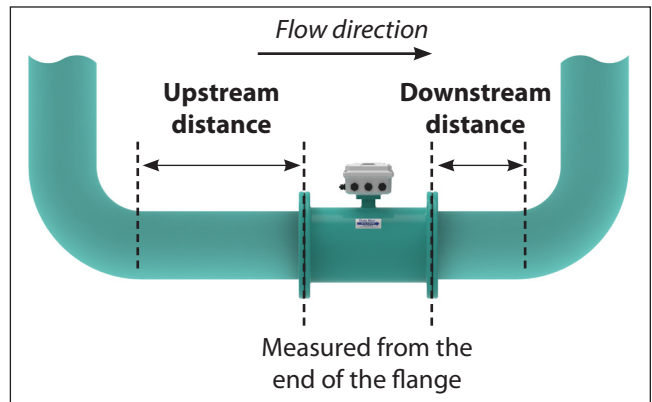
The flanged end tube and wafer style designs permit use in a wide range of applications and are available for pipe sizes from 1½ to 24 inches. The converter is powered by lithium batteries that can provide flow measurement for an estimated five years (battery is covered by warranty for that period). Also available is the optional DC power supply (required for 4-20mA output). The flow meter has optional pulse, 4-20mA, and AMI outputs available. All Dura Mag flow meters have an internal datalogger standard. the optional datalogger software and cable is required to retrieve the stored data.

4.2 Pipe Run Requirements

Flow meters are velocity sensing devices and are vulnerable to certain upstream disturbances. Because of this, meters need certain lengths of straight pipe before and after the meter. These distances relate to the diameter of the pipe used. Obstructions can include elbows, valves, pumps, and changes in pipe diameter. The uneven flow created by these obstructions can vary with each system.

Both upstream and downstream distances are measured from the end of the flange as shown below.

Meter size	Upstream/ downstream
Flanged 1½" to 3"	0 / 0
Wafer 2" & 3"	3 / 1
Flanged 4" to 24"	2 / 1



Upstream and downstream requirements

Dura Mag Meter Installation

4.3 Positioning and Orienting the Sensor

The installation recommendations shown below should be followed:

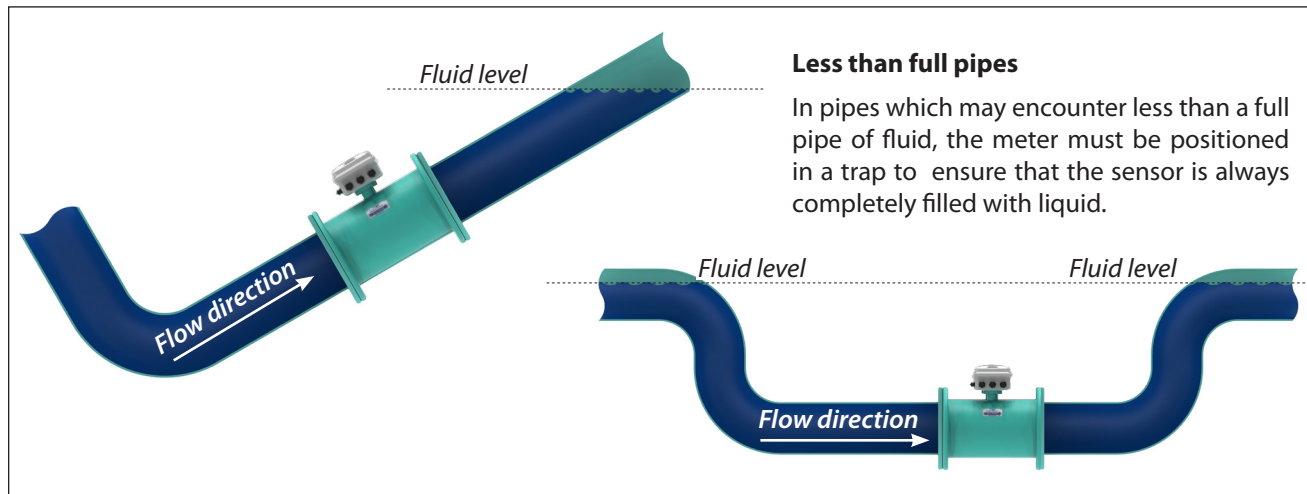
Horizontal installation

In horizontal pipe runs, the meter should be installed so that the junction box is vertical insuring the electrodes are positioned to prevent coating by sediments or loss of electrode contact due to air bubbles.



Vertical installation

In vertical pipe runs, the flow should be upward. In slurry application, a vertical position ensures optimal distribution of solids under all flow conditions.



Less than full pipes

In pipes which may encounter less than a full pipe of fluid, the meter must be positioned in a trap to ensure that the sensor is always completely filled with liquid.

Sensor orientation options

Copyright © 2024 McCrometer, Inc. All printed material should not be changed or altered without permission of McCrometer. Any published pricing, technical data, and instructions are subject to change without notice. Contact your McCrometer representative for current pricing, technical data, and instructions.

3255 WEST STETSON AVENUE • HEMET, CALIFORNIA 92545 USA
TEL: 951-652-6811 • 800-220-2279 • FAX: 951-652-3078
www.mccrometer.com

