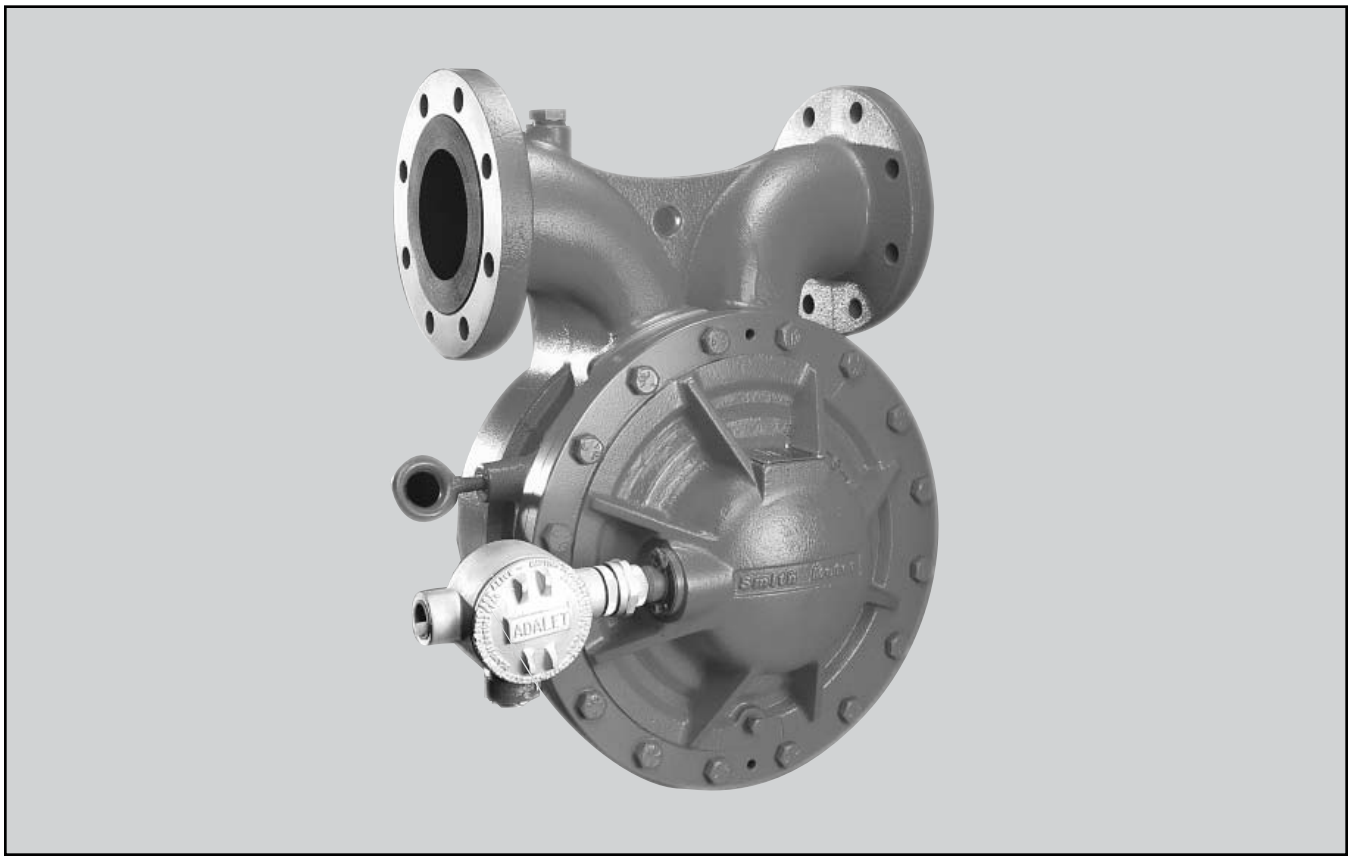
FMC Technologies

Smith Meter™ Rotary Vane Meters

PRIME 4

Installation/Operation

Issue/Rev. 0.5 (2/07) Bulletin MN01038



Contents

Caution:

Read instructions carefully before attempting to operate. Claims for damage caused by air, line contamination, or pressure shock waves during start-up will not be accepted by FMC Technologies Measurement Solutions, Inc.

This meter is of the rotary positive displacement type. The accurately-machined housing contains a rotor which revolves on tungsten carbide bearings and carries two evenly-spaced polyketone blades. As liquid flows through the meter, the rotor and blades revolve about a fixed cam causing the blades to reciprocate. The successive movement of the blades forms a measuring chamber of precise volume between the two blades, the rotor, the housing, the bottom, and the top covers. A continuous series of these closed chambers is produced as the rotor revolves. Neither blades nor rotor contact the stationary walls of the measuring chamber.

One of the outstanding features of the Smith PRIME 4 meter principle is that the flow is literally undisturbed while it is being metered. Energy is not wasted by unnecessary hydraulic bending of the liquid.

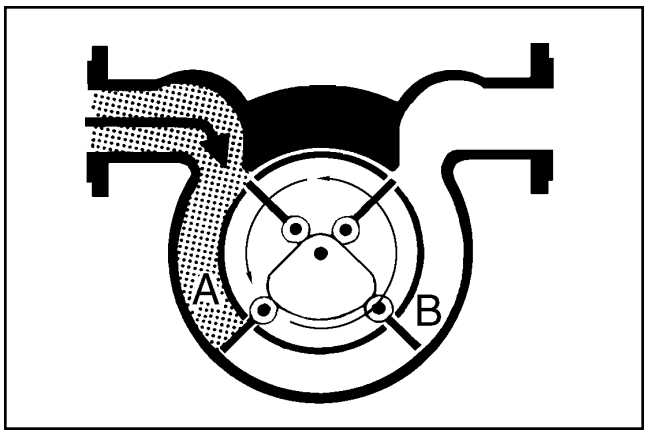


Figure 1

Unmeasured liquid (dark area) is shown entering and causing the meter rotor and blades to turn counterclockwise. Blades A and B are fully extended forming the measuring chamber; the opposite ends of blades are retracted and flush with the rotor.

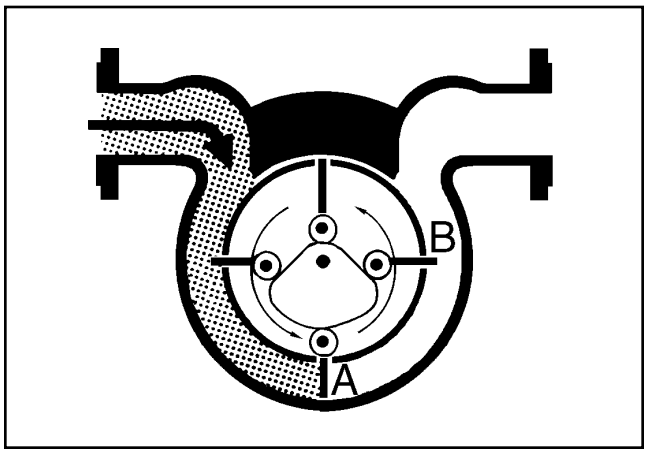


Figure 2

The rotor and blades have made one-eighth revolution. Blade A is fully extended; Blade B is partially drawn back, and the opposite end of blade B is starting to extend.

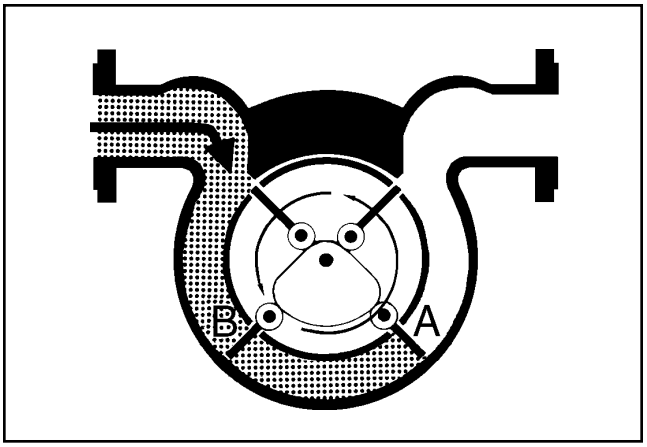


Figure 3

A quarter revolution has been made. Blade A is still extended and Blade B is now fully extended. An exact known volume of new liquid is now in the measuring chamber.

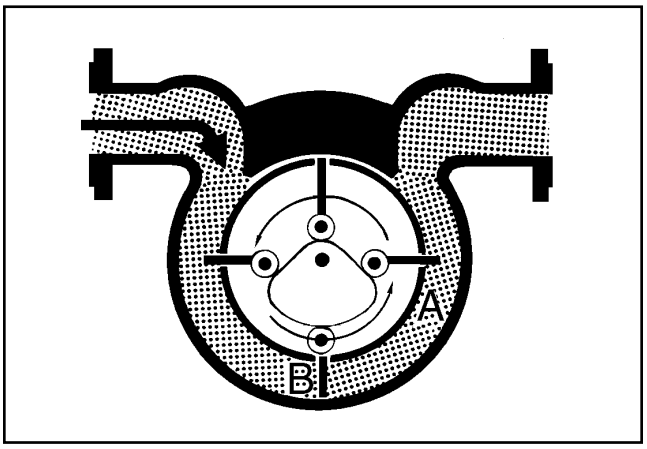


Figure 4

One-eighth of a revolution later, the measured liquid will then move out of the meter. Blade A will retract on the outlet side and will start to extend on the inlet side to form another measuring chamber. A second measuring chamber will form between blades B and A as the rotor rotates around the cam.

In one-half revolutions, two measuring chambers have formed and the third is forming. This cycle is repeated as long as liquid flows.

The rotation of the rotor is converted into electronic pulses by means of an exciter gear, which is an integral part of the rotor, and a pulse pick-up located in a well on the side of the meter cover. The meter produces approximately 50 pulses per gallon (13 pulses per litre).

1. The meter is a precision instrument and should be treated accordingly. Prior to installation, it should be protected from adverse weather conditions and accidental abuse.
2. Adequate pipe support must be provided close to the meter because the meter is supported by the flanges. Piping must not produce an undue strain on the meter.

   Dimensional outline drawings of the meter are available.
3. When installing the meter, a carpenter's level should be used on a flat surface of the meter housing (for example on the cover around the bolt circle or on the nameplate pad) to ensure the rotor is level.

   This is important because the meter rotor must not gravitate to one side.
4. When installing the meter, be sure the drain plug is accessible but that the meter cannot be accidentally drained of product.
5. Protect the meter and system against the effects of thermal expansion with a relief valve.

WARNING!
Thermal Pressure

Thermal expansion of liquid in this equipment can cause high pressure damage. A Thermal Pressure Relief Valve may be necessary in the system.

6. Where necessary, a deaerator or air eliminator should be installed to keep air and vapor out of the meter.
7. All piping should be internally cleaned before the meter is put into operation.

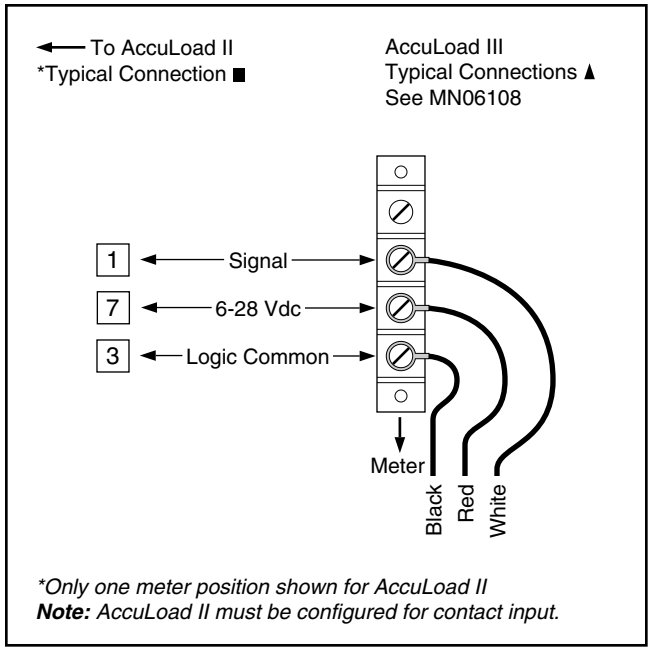
   Rust, dirt, welding shot, and other foreign material should be removed completely.

   Remove the meter and install a spool piece if the system is to be pressure-tested with water or if debris is to be flushed from the system.

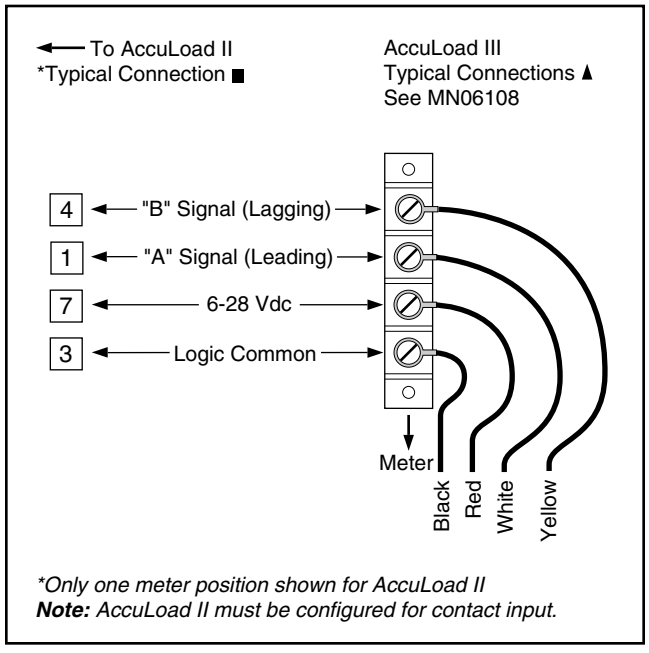
   The meter should be protected by at least a 40-mesh strainer.
8. Where necessary, a flow-limiting valve should be installed downstream of the meter to protect it from excessive flow rates.
9. Do not calibrate with water or allow water to stand in the meter.
10. Flush the meter with a light lubricating oil if it is left idle or stored.
11. The meter can measure flow in either direction.

    For standard and reverse flow directions, see meter arrangements on page 4.

Wire Connections



Single Channel - Standard or Reverse Flow



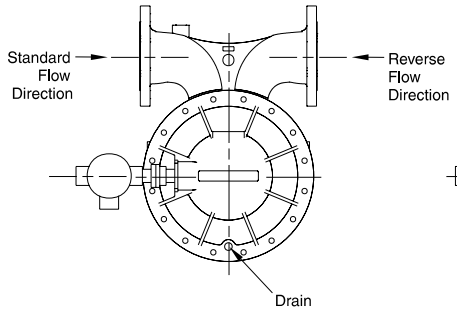
Quadrature (Two Channel) - Standard Flow Shown

For single channel meter installation with standard or reverse flow direction refer to top wiring diagram.

For Quadrature (Two Channel) meter installation with standard flow direction, refer to bottom wiring diagram.

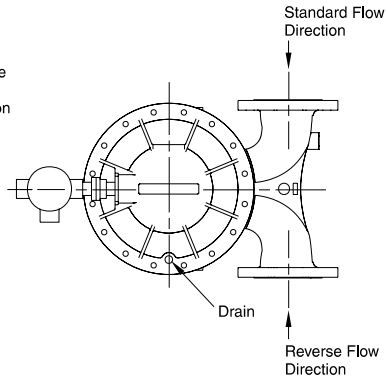
For Quadrature (Two Channel) meter installation with ***reverse flow direction***, refer to bottom wiring diagram and reverse white and yellow wire connections. Yellow wire becomes the "A" signal and white wire becomes the "B" signal.

Arrangement

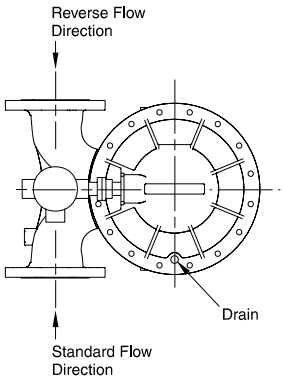


Horizontal Flow
Standard & Reverse Flow

Note: *Drain must always be in down position as shown.*



Vertical Flow, Nozzles Right
Reverse Flow



Vertical Flow, Nozzles Left
Standard Flow

Changing Meter Cover Orientation

The PRIME meter can be operated in the horizontal or vertical position. In either case, the cover drain plug must be located at the bottom to ensure proper drainage of the meter.

1. Remove cover mounting bolts.
2. Rotate cover to desired position.
3. Reinstall cover mounting bolts and torque to 28-34 ft. lbs. The bolt threads must be cleaned and lubricated with a light machine oil.

Start-Up Procedure

When the meter is first installed in the line there is air inside the rotor. The air takes some time to work out. If the meter is subjected to hydraulic shock during this vulnerable time, the rotor can pinch down on the blades and cause blade breakage or cam shaft rotation. By following the procedure listed below, the likelihood of meter damage will be greatly reduced.

1. If possible, gravity head should be used to initially fill the meter as air is vented from a high-point vent.
2. Close the upstream isolation valve and energize the pump.
3. Slowly open the upstream isolation valve until the meter and flow control valve are *just* pressurized. It is important that the upstream valve be just barely open to ensure that the meter will be operated at very low flow.
4. Initiate low flow (less than 200 gpm) via the electronic preset.
5. Vent air from the high-point vent until there is no sign of air being vented (30 seconds or more). REMEMBER – air is trapped inside the rotor and takes time to be displaced.
6. Gradually open the isolation valve and initiate normal operation.

This procedure should be used whenever air has been introduced to the line or meter.

General Operating Information

1. The meter has been tested on kerosene and the meter median K-factor has been attached.
2. To obtain maximum service from Smith meters, it is suggested that detailed records be maintained.

   Data such as model, serial number, operating rate, type of product, meter clearances, totalizer readings, meter factor, and other pertinent information should be recorded. Such information is an excellent guide in scheduling a preventive maintenance program.

Reference Publications

American Petroleum Institute
2101 L Street, Northwest
Washington, DC 20037

Manual of Petroleum Measurement Standards.

API Chapter 4 - Proving Systems.

API Chapter 5, Section 5.2 - Measurement of Liquid Hydrocarbons by Displacement Meter Systems.

API Chapter 12, Section 2 Field Manual - Instructions for Calculating Liquid Petroleum Quantities Measured by Turbine or Displacement Meters.

Revisions included in MN01038 Issue/Rev. 0.5 (2/07): Page 3: Revised step three of the installation instructions.

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