FMC Technologies

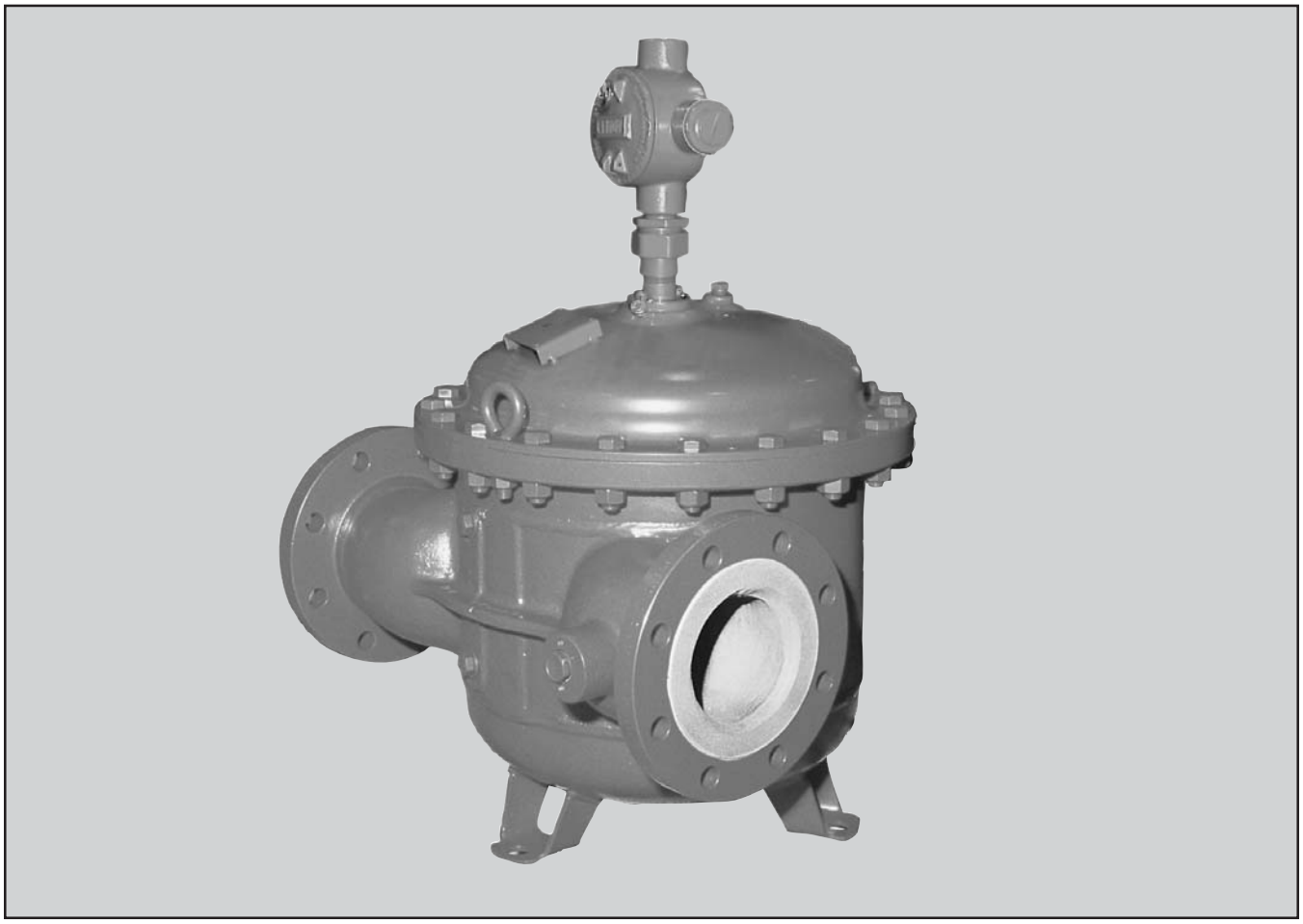
Smith Meter™ PD Rotary Vane Meters

F4-S1/A1-S3/A3 PRIME Upgrade

Installation/Operation

Issue/Rev. 0.1 (3/01)

Bulletin MN01037



Contents

Caution

Read instructions carefully before attempting to operate. Each meter is thoroughly tested before leaving the factory. FMC Technologies Measurement Solutions, Inc. cannot accept claims for damage caused by air, line contamination, or pressure shock waves during start-up.

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

One of the outstanding features of the Smith 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 meter. Rotor and vanes are turning clockwise. Vanes A and D are fully extended forming the measuring chamber; Vanes B and C retracted.

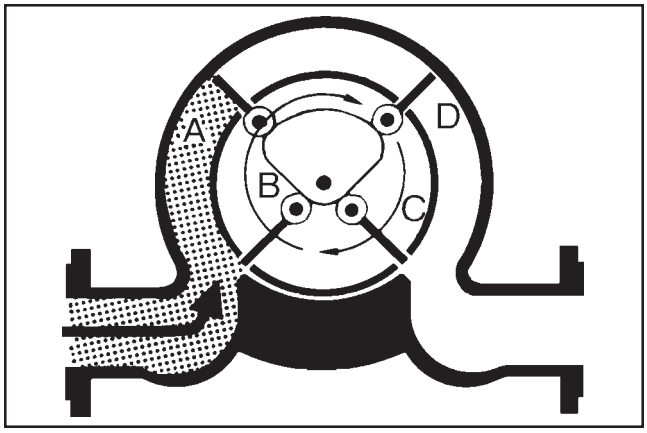


Figure 1

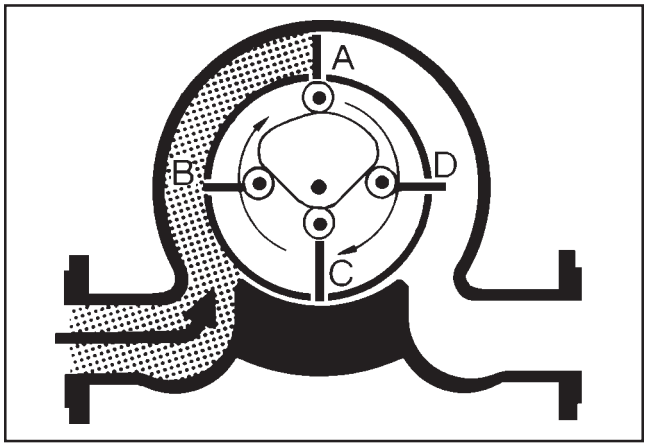


Figure 2

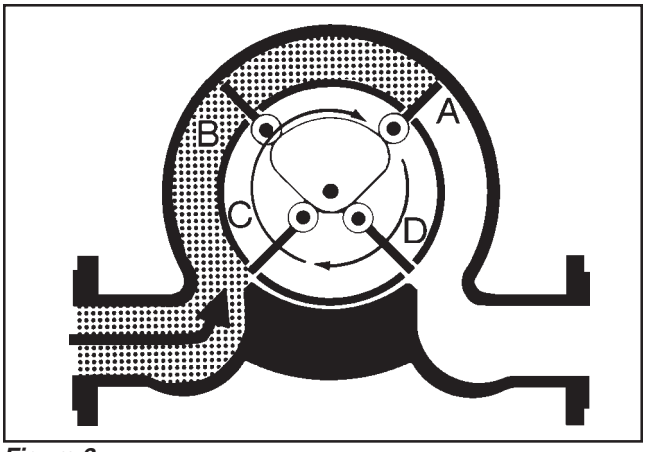


Figure 3

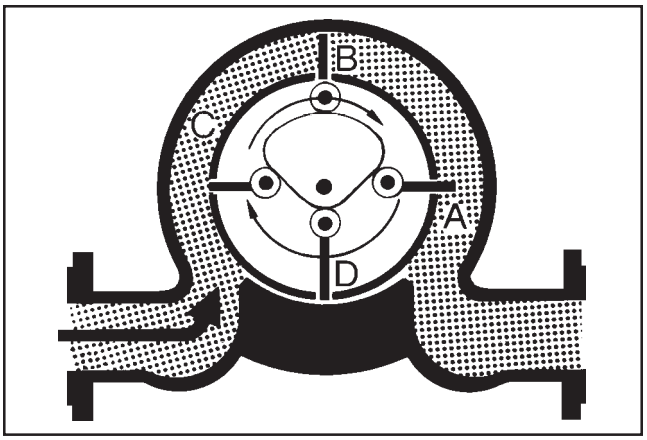


Figure 4

Figure 2

The rotor and vanes have made one-eighth revolution. Vane A is fully extended; Vane D is partially drawn back; Vane C is fully recessed; Vane B is partially extended.

Figure 3

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

Figure 4

A quarter revolution later, the measured liquid is moving out of the meter. A second measuring chamber has formed between Vanes C and B. Vane A has drawn back and Vane D is ready to be extended.

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 pickup 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. The installation should provide protection from sand, dust, rain, sleet, etc. where extreme adverse weather conditions are encountered.
3. The meter should be mounted on a suitable base or platform so it will not be supported by the piping.

   Dimensional outline drawings showing size and location of anchor holes are available.
4. Install the meter so that it cannot be accidentally drained of product; however, it is advisable to drain the meter of water and sediment periodically.
   When installing the meter, be sure the drain plug is accessible.
5. Piping must not produce an undue strain on the meter.
6. Protect the meter and system against the effects of thermal expansion with a relief valve.
7. Where necessary, a dearator or air eliminator should be installed to keep air and vapor out of the meter.
8. 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 inner mechanism and flush the lines to prevent damage to the metering element.

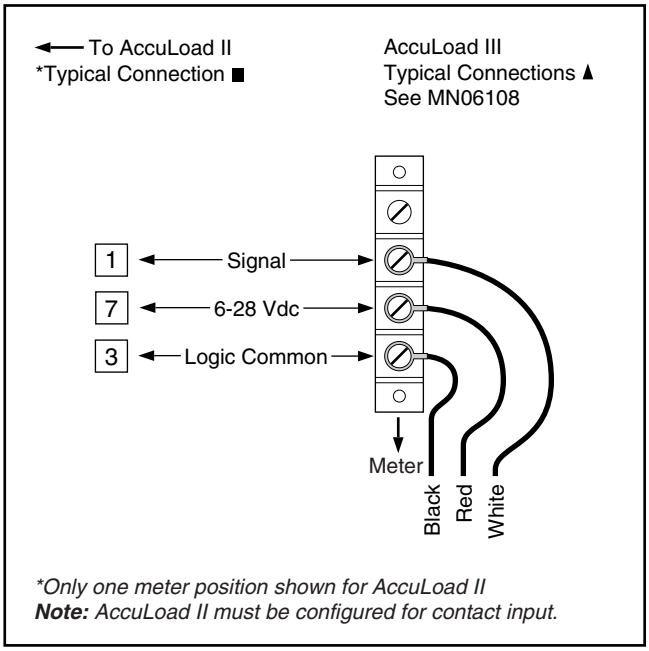
   The meter should be protected by at least a 4-mesh strainer.
9. Where necessary, a flow-limiting valve should be installed downstream of the meter to protect it from excessive flow rates.
10. Remove the meter and install a spool piece if the system is to be pressure-tested with water or if debris is to be flushed from the system.
11. Do not calibrate with water or allow water to stand in the meter.

    Flush the meter with a light lubricating oil if it is left idle or stored.
12. The meter can measure flow in either direction.

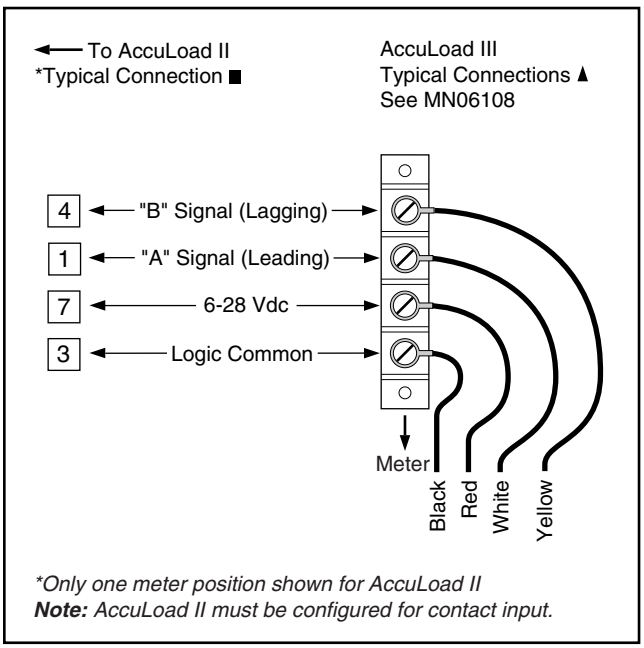
WARNING!
Thermal Pressure

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

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.

NOTE

Conduit seals shall be installed within 18" inches (457 mm) from the junction box (enclosure). Per Chapter 5, 1999 National Electrical Handbook.

Start-Up Procedure

Air and gas must be removed from the internals of the meter prior to normal operation. If the rotor inside this meter is not vented completely, a pressure differential can form across the rotor walls during start-up causing collapse of the blade slots, pinching the blade and causing breakage. Complete venting can be accomplished by following this procedure:

1. Remove pipe plug from the vent connection at the top of the meter cover and **install an appropriate bleed valve** system.
2. With the downstream valve completely closed and only gravity pressure being exerted, **slowly open the upstream valve** until liquid begins to flow into the meter. Open the bleed valve and vent until no air or gas is apparent. The meter housing vents much faster than the rotor.
3. **Close the upstream valve** prior to starting pumps and repeat step 2. Venting can take several minutes if the pressure is low and the liquid viscosity is high.
4. **Slowly open the downstream valve** until flow begins. Notice that more air or gas will be vented. Continue to operate at this very low rate until venting is complete.
5. Close the bleed valve and **fully open the downstream valve**. The upstream valve can now be slowly opened to establish full flow.

This procedure must be followed each time the meter is drained.

General Operating Information

1. Inlet and outlet valves should be operated slowly to avoid line shock. Abrupt closure can create forces in excess of normal line pressure. This could result in damage to the meter and other equipment.
2. The meter has been tested on kerosene and the meter factor has been attached.
3. 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.

Service

The meter calibrator requires lubrication with light oil (SAE-10). Initially, apply it after approximately five hours of operation and then about twice yearly.

Reference Publications

F4-S1/A1 PRIME Upgrade and Service Manual MN01039

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 MN01037 Issue/Rev. 0.1 (3/01):
Page 3: Updated Wiring Connections.

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