Smith Meter® Turbine Meters

Models 3" Through 16" MV Series

Installation / Operation Manual

Bulletin MN02009 Issue/Rev 0.4 (2/19)

Contents

Introduction

The Smith Meter® MV Series Turbine Meter (see figure 1) is intended for measurement of crude oils and other applications where a wide range of viscosities are likely to be encountered.

The turbine meter consists of a helical shaped rotor that rotates as liquid passes through the meter. The rotation of the rotor is proportional to the amount of liquid passing through the meter. The rotor is equipped with small magnets on each blade that produce a pulse signal in the reluctance-type pickups located in the pickup bosses on the housing. Each pulse represents an increment of volume passed through the meter.

The nominal pulses per unit volume (K-Factors) are listed in the MV Series Turbine Meter Specifications (Bulletin SS02016). These K-Factors can be used when initially setting up the flow computer that will be used with the meter. When field proving results are obtained, the nominal K-Factor can be exchanged for actual K-Factor in the flow computer to achieve meter factors closer to unity.

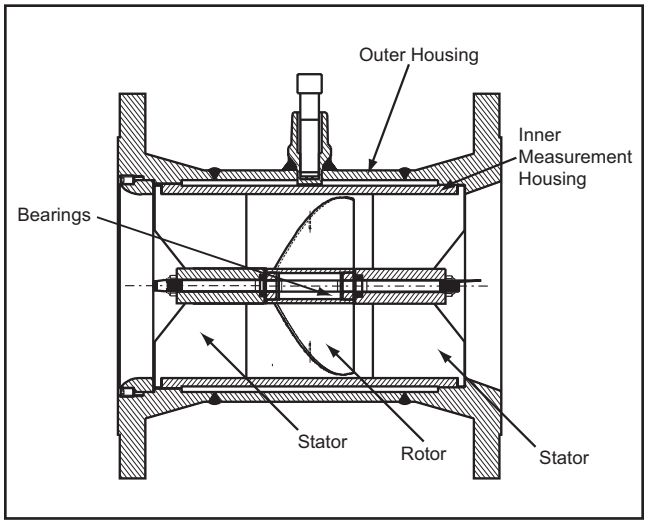


Figure 1

Receipt of Equipment

When the equipment is received, the outside packing case should be checked immediately for any shipping damage. If the packing case has been damaged, the local carrier should be notified at once regarding his liability. Carefully remove the unit from its packing case and inspect for damaged or missing parts.

If damage has occurred during shipment or parts are missing, a written report should be submitted to the Customer Service Department, TechnipFMC Measurement Solutions, P.O. Box 10428, Erie, Pennsylvania 16514-0428.

Prior to installation, the unit should be stored in its original packing case and protected from adverse weather conditions and abuse.

Pre-Installation Inspection

Visually inspect the meter and meter nameplate to insure the proper size, model number, flange rating, and flow range. Note the direction of flow (described by an arrow) in which the unit was calibrated and should be installed.

The MV Series Turbine Meter is a precise measuring instrument and should be treated as such. Install carefully.

When transporting the meter, make certain it is not subjected to any severe shock as bearings may be damaged. Cover flange openings to protect internals.

Mechanical Installation

Warning: Care must be taken in the installation of turbine meters. The installer must comply with all national, regional, and local codes.

It is recommended that turbine meters be installed in the section of piping where the pressure is highest, downstream from pumps and upstream from valves (see figure 3). When it is expected that flow will be intermittent, the turbine meter should not be mounted at or near a low point in the piping. Solids or water which settle in a low point can freeze or damage the metering element.

The piping arrangements herein described are intended to be general recommendations and, therefore, may require modification top fit your specific applications.

Back Pressure

A positive back pressure is required to prevent cavitation and inaccurate measurement. The required back pressure at any flow rate should be a value greater than the following approximation:

Back Pressure = 2 x Pressure Drop + 1.25 x Absolute Vapor Pressure.

Example: 6-inch Turbine Meter, Flow Rate 4000 BPH, Vapor Pressure 3 psia, Pressure Drop 4 psi.

Back Pressure = 2 x 4 + 1.25 x 3 = 11.75 psig.

Strainer

A strainer should be installed to protect the turbine meter. A 4 mesh basket can be used to provide minimum protection, however, 20 mesh or even 40 mesh are typical in most cases.

Flow Conditioner

The accuracy of the turbine meter is affected by swirl and profile distortion of the flow stream. Unless the meter is installed downstream of a long run of straight pipe (over 20 diameters), it is necessary to condition the flow stream prior to the turbine meter. A Smith Meter High Performance Flow Conditioner is 10 diameters long and should be installed immediately upstream of the MV Series Turbine Meter (see Bulletin SS02018). It is also important that downstream obstructions are at least 5 diameters from the meter.

The Smith Meter High Performance Flow Conditioner and the Smith Meter MV Series Turbine Meter are doweled to provide precise and repeatable alignment. If the dowels are removed after installation, the holes should be packed with grease to prevent corrosion.

Meter Bypass

Where possible, such as in a new system, it is advisable to include a valved bypass around the metering section. This allows inspection of the meter without stopping the system flow. The bypass connections, however, should not be placed within the “meter run” (see Figure 2).

Electrical Installation

The Smith Meter MV Series Turbine Meter comes with a PA-6 Preamplifier in the junction box. The PA-6 receives the sinusoidal signal from the reluctance-type pickup and converts it to a consistent positive square wave signal suitable for transmission over long distances. (See SS02012).

Recommended Signal Transmission Cable

Distance	Wire Size	Type Cable (or Equal)
Up to 2,000 ft (610 meters)	#20 AWG	2 Conductor - Belden 8762 3 Conductor - Belden 8772 4 Conductor - Alpha 2414
Up to 3,000 ft (915 meters)	#18 AWG	2 Conductor - Belden 8760 3 Conductor - Belden 8770 4 Conductor - Alpha 2424
Up to 5,000 ft (1,525 meters)	#16 AWG	2 Conductor - Belden 8719 3 Conductor - Belden 8618 4 Conductor - Alpha 3248

Note: For distances greater than 5,000 ft, a trial run should be made, employing the best available engineering techniques.

Important: All cable shields must be terminated **only** at the instruments.

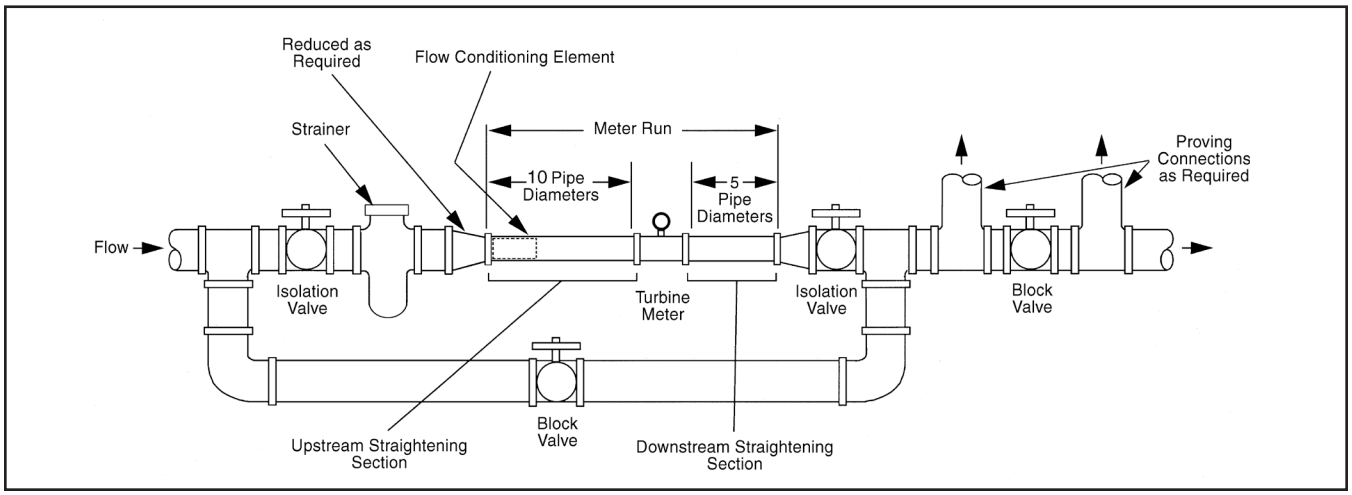


Figure 2 – Typical MV Series Turbine Meter Installation

Electrical Installations (General)

The maximum ambient temperature for the GP Junction box w/ PA-x amplifier and or UPCC/ID-2000 instrument is 70°C; if the process temperature of the Turbine meter is expected to exceed this value then the enclosure(s) shall be remotely mounted to guarantee the 70°C ambient is not exceeded.

Note: Electrical installations should only be performed by qualified technicians / electricians that are trained in the techniques that apply to hazardous locations electrical equipment.

Caution: To prevent ignition of hazardous atmospheres, disconnect from supply circuit before opening, keep enclosure tightly closed when circuits are in operation.

Warning: Enclosure may contain batteries and or capacitors, to prevent ignition of hazardous atmospheres, do not open unless area is known to be non-hazardous.

Electrical Installations Utilizing ATEX and IECEx Certifications

All electrical installations shall be in accordance with EN/IEC 60079-14 “Explosive atmospheres – Part 14: Electrical installations design, selection and erection”.

Cable entry must be in accordance to EN/IEC 60079-1 section 13. For systems utilizing cable glands the gland and or thread adaptor must be Ex db certified. The cable end must be securely installed and depending on the cable type be properly protected from mechanical damage.

Conduit Entry must be in accordance to EN/IEC 60079-1 section 13. For systems utilizing conduit, an Ex db certified sealing device must be used immediately at the entrance of the enclosure.

Any unused entry must be suitably blocked with an Ex db certified plug.

The maximum ambient temperature for the GP Junction box w PA-x amplifier and or other certified instruments is 70°C; if the process temperature of the Turbine meter exceeds this value, then the enclosure(s) shall be remotely mounted to guarantee the 70°C ambient is not exceeded.

If the temperature at entry fittings exceeds 70°C, the connecting cables used must be of the temperature-resistant type.

The field connecting wire/cable must be installed into an enclosure which complies with the requirements of an accepted type protection according to IEC/EN 60079-0, section 1, if the connection takes place in an area with potentially explosive atmosphere.

The device must be included into the local equipotential bonding.

Repairs on flameproof joints may only be performed in accordance with the manufactures design specifications. Repair on the basis of the values in table 1 and 2 of EN/IEC 60079-1 is not accepted.

Installations Following North American Electrical Codes

All electrical installations shall be in accordance with appropriate electrical codes or with the rules provided by the regulatory authority having jurisdiction.

USA – NEC code, NFPA 70 Articles 500 – 515 as appropriate

Canada – CEC Code, CSA 22.1 as appropriate

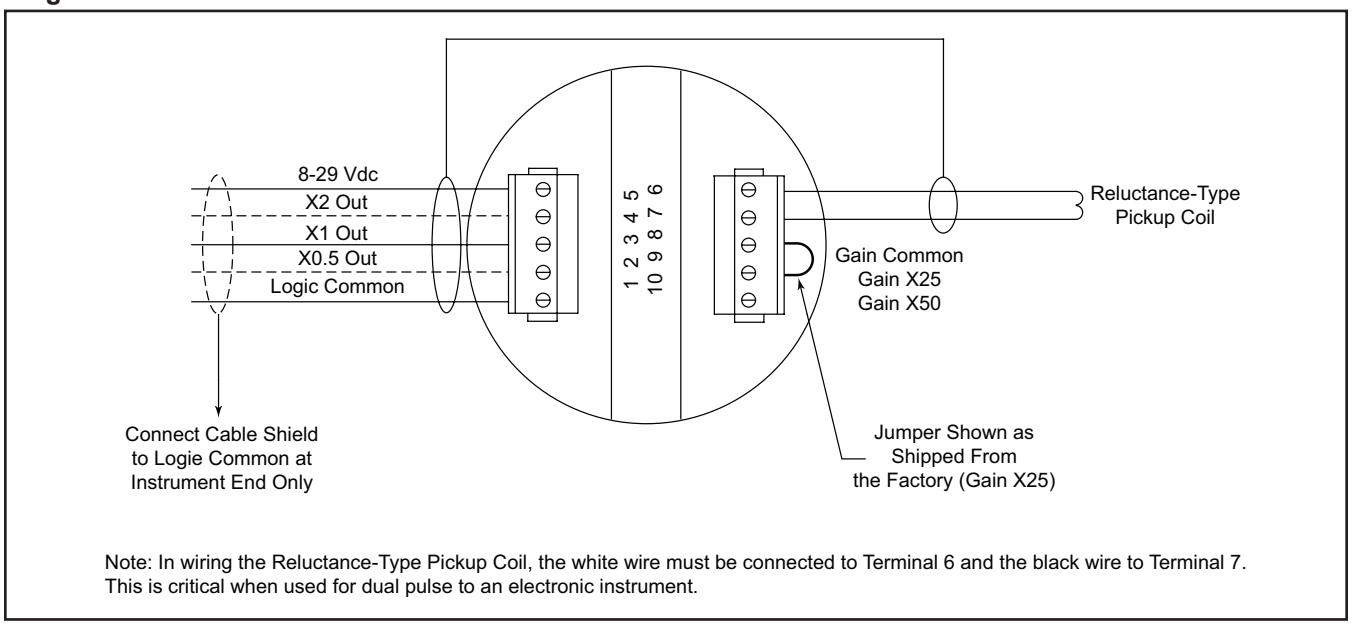
Electrical Connections

When the meter is equipped with two pickup coils and preamps, pulses coming from the boss stamped “A” will precede those from “B” by 90 electrical degrees. Refer to Figure 3 for suggested wiring for pickup coil and PA-6 preamplifier.

If the meter will be operated at very low flow rates (less than 5% of max. flow rate), the preamplifier gain can be increased. Consult the factory for instructions.

Wire Connections

Single Channel Transmission



Note: In wiring the Reluctance-Type Pickup Coil, the white wire must be connected to Terminal 6 and the black wire to Terminal 7. This is critical when used for dual pulse to an electronic instrument.

Figure 3 – PA-6 Preamplifier Wiring

Proving

Once the meter has been installed, it should be proved. This is normally accomplished using a displacement type prover of certified volume. Recommended procedures are covered in the API Manual of Petroleum Measurement Standards, Chapters 4 and 12. It is very important that the proving be done under conditions (flow rate, pressure, temperature, and liquid characteristics) that are as close to those of normal operation as possible.

Verify that there are no leaks (internal or external) and that all liquid going into the prover has passed through the meter.

If, during the proving, suitable repeatability of runs is not obtained and the prover is functioning properly, verify that the pickup coil is tightly in place and that there is no electrical “noise” on the pulse circuit. If poor repeatability continues, check for adequate back pressure as described in Section 2.

Since the MV Series Turbine Meter produces relatively few pulses per unit volume, the required 10,000 pulses between prover detector switches may not be met. In this case, it will be necessary to use a proving instrument that has “Pulse Interpolation”.

Maintenance

Maintenance is normally required when proving shows a dramatic shift in the K-Factor or suitable repeatability cannot be obtained.

In some cases, the internals may have to be cleaned of buildup or deposits. When draining the turbine meter installation for inspection, the line should be opened downstream of the meter so that fine debris that may be attached to the leading edges of the blades remains affixed. Draining from upstream creates a back flow that may remove this debris.

Notes:

1. When a meter is removed from the line, particularly if it has been disassembled and reassembled, it should be re-calibrated for optimum accuracy.
2. These products have been designed for petroleum applications, where corrosion/erosion is normally minimum. The design has adequate material allowance for typical petroleum applications. Consult the factory for other applications or for the actual material allowances.

Section 4 – Related Publications

The following literature can be obtained from FMC Technologies Measurement Solutions, Inc. Literature Fulfillment at measurement.fulfillment@technipfmc.com or online at http://info.smithmeter.com/literature/online_index.html.

When requesting literature from Literature Fulfillment, please reference the appropriate bulletin number and title.

Turbine Meters

Manual

MVTM Storage Instructions MN02016

Specifications

MV Series Turbine Meters SS02016

Parts Lists

3" MVTM PO02022
4" MVTM PO02023
6" MVTM PO02024
8" MVTM PO02025
10" MVTM PO02026
12" MVTM PO02027
16" MVTM PO02028

Technical Support

Contact Information:
Field Service Response Center
24/7 Technical Support/Schedule a Technician: 1-844-798-3819
System Installation Supervision, Start-Up, Training, and Commissioning Services Available

Revisions included in MN02009 Issue/Rev. 0.4 (2/19):
Page 4: Electrical Installations Utilizing ATEX and IECEx Certification section has been updated.

TechnipFMC
FMC Technologies
Measurement Solutions, Inc.
13460 Lockwood Road
Building S01
Houston, Texas 77044 USA
P:+1 281.591.4200

USA Operation
1602 Wagner Avenue
Erie, Pennsylvania 16510 USA
P:+1 814.898.5000

Germany Operation
Smith Meter GmbH
Regentstrasse 1
25474 Ellerbek, Germany
P:+49 4101 304.0

TechnipFMC.com