

MV Series

Bulletin SS02016 Issue/Rev. 2.1 (6/19)

Smith Meter® Turbine Meters

The Smith Meter® MV Series Turbine Meter is intended for the measurement of crude oils and other products having a relatively wide range of viscosities. It provides highly accurate measurement for custody transfer and volume balance pipeline applications. The design of the helical rotor makes the MV Series a valuable asset for any pipeline application.

Features

- **Titanium swept-front helical rotor** swept front design allows for increased meter factor stability while minimizing the effects of containments or debris.
- **Stainless steel interchangeable measuring element** provides for ease of serviceability while providing corrosion-free service.
- **Tungsten carbide bearings** provide long service life and dependability on a wide variety of products.
- **NACE Compliance** to MR0175/ISO 15126-1.



Reynolds number is calculated using the following equations:

$$Re_{max} = \frac{2214 \times \text{Flow Rate}_{max}}{\text{Meter Size} \times \text{Visc}_{min}}$$

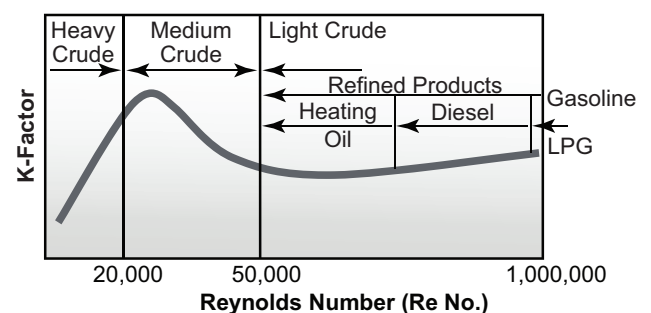
$$Re_{min} = \frac{2214 \times \text{Flow Rate}_{min}}{\text{Meter Size} \times \text{Visc}_{max}}$$

The minimum Reynolds number will determine the measurement turndown over which the meter can accurately measure.

Operating Specifications

The Smith Meter MV Series Turbine Meter is a Reynolds Number dependent measurement device which accurately measures over a wide measurement turndown range. The Measurement Turndown Range (MTR) of all turbine meters is dependent upon both the Flow Range and the Viscosity Range for a given application. The ratio of Flow Range to Viscosity Range is expressed in Reynolds Number. The MTR is then determined by using the ratio of the maximum Reynolds (Re_{max}) number over the minimum Reynolds (Re_{min}) number.

Estimated Minimum Reynolds Number by Product



Linearity

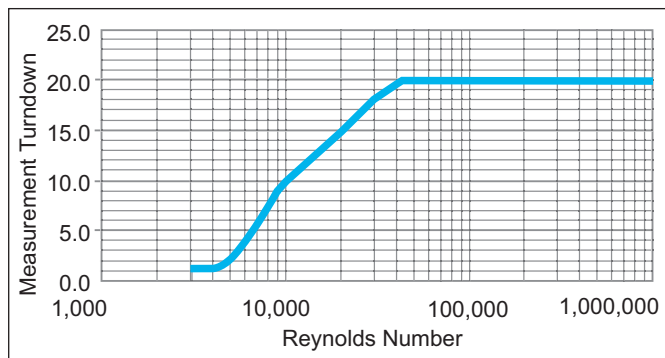
±0.15% over the **APPROVED**¹ Measurement Turndown Range.

Repeatability

Per API MPMS or OIML R-117-1.

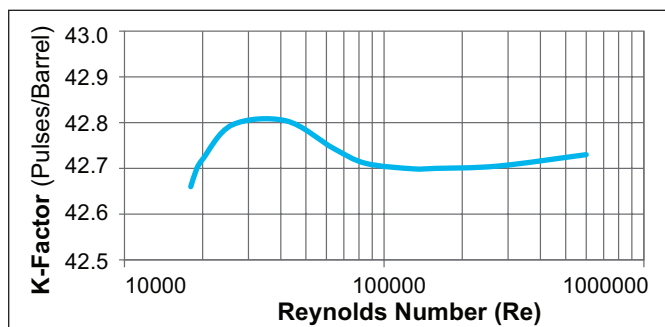
Standard MVTM Operating Range

Maximum linear measurement turndown range for a standard 8" MVTM:

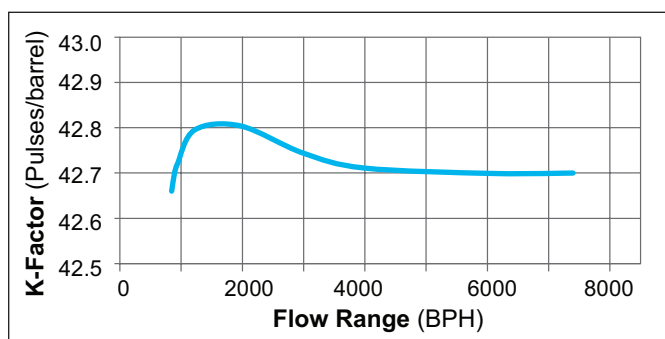


Typical Accuracy Curve for 8" MVTM

Accuracy over the complete Reynolds number range tested on 13 cSt product:



Accuracy over the entire flow range tested on 13 cSt product:



MVTM Flow Range

Minimum and maximum design flow range:

Flow Range				
Meter Sizes	Units	Normal Flow Range		Nominal K-Factor
		Min. Rate	Max. Rate	
3"	BPH	90	900	600
	m ³ /h	14	140	3,775
4"	BPH	190	1,900	250
	m ³ /h	30	300	1,570
6"	BPH	400	4,000	100
	m ³ /h	64	640	630
8"	BPH	750	7,500	40
	m ³ /h	119	1,190	250
10"	BPH	1,250	12,500	18.5
	m ³ /h	199	1,990	116
12"	BPH	1,900	19,000	11.1
	m ³ /h	302	3,020	70
16"	BPH	2,700	27,000	6
	m ³ /h	429	4,290	38

Material Specifications

End Connections*

Class 150, 300, 600

ASME B16.5, 125-250 AARH finish raised face (RF) flanges

*Consult factory for higher working pressure or other types of flanges.

Maximum Working Pressure - PSI (kPa)	
ASME	Carbon Steel Flanges
150	285 (1,965)
300	740 (5,102)
600	1,480 (10,205)

Meter Operating Temperature Range (with low temperature Carbon Steel Flanges)		
Meter with:	UL / CUL	ATEX
Pickup Coil and Preamp	-50°F to 158°F -46°C to 70°C	-40°F to 158°F -40°C to 70°C
Pickup Coil and Preamp with 24" Standoff	-50°F to 225°F -46°C to 107°C	-40°F to 225°F -40°C to 107°C

Pulse Output

See PA-6 Preamp specification bulletin [SS02012](#) or UPCC specification bulletin [SS02017](#).

¹ Contact TechnipFMC for review of all applications to determine the Measurement Turndown Range for the specific application.

Approvals

Electrical Safety for Hazardous Locations

North American (United States and Canada) and countries following the US NEC Code

UL/CUL File E23545

Class I, Division I, Groups C & D

Class 1, Zone 1, Tamb = -50° to 70°C, IP66

UNL-UL ENCL 4, CNL ENCL 4

International

IECEX PTB 08.0040X (meter)

Exd IIC T3 - T6 Tamb = -40°C to +70°C, IP66

IECEX PTB 10.0052X (GP Junction Box)

Exd IIC T4 - T6 Gb Tamb = -40°C to +70°C, IP66.

European Union: ATEX – Explosive Atmospheres Directive, ATEX 2014/34/EU

PTB 08 ATEX 1034X (meter)

Exd IIC T3 - T6 Tamb = -40°C to +70°C, IP66

PTB 10 ATEX 1039X (GP Junction Box)

Exd IIC T4 - T6 Gb Tamb = -40°C to +70°C, IP66

Weights and Measures

OIML R117 Test Report

European Union: MID - Measuring Instrument Directive, MID 2014/32/EU

Consult Factory for others

Pressure Safety Requirements

European Union: PED – Pressure Equipment Directive, PED 2014/68/EU

CRN – Canadian Registration Number – Consult Factory

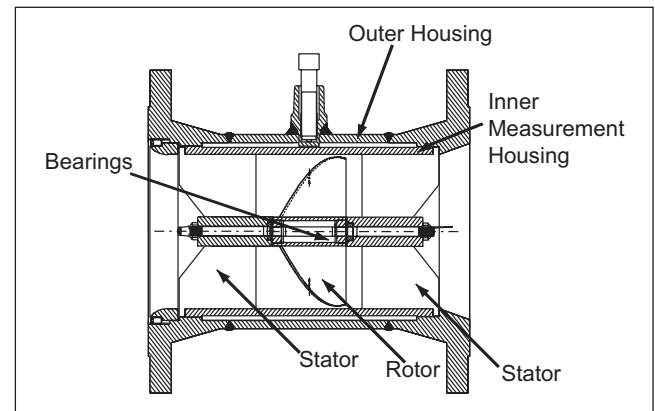
Electromagnetic Compatibility

European Union: EMC Compliance by Council Directive EMC Directive 2014/30/EU

EN 61326-1: Electrical equipment for measurement, control and laboratory use.

Materials of Construction

Housing and Flanges	Low Temperature Carbon Steel
Internals:	
Measurement Housing	316 Stainless Steel
Stators	316 Stainless Steel
Rotor	Titanium
Bearings	Tungsten Carbide



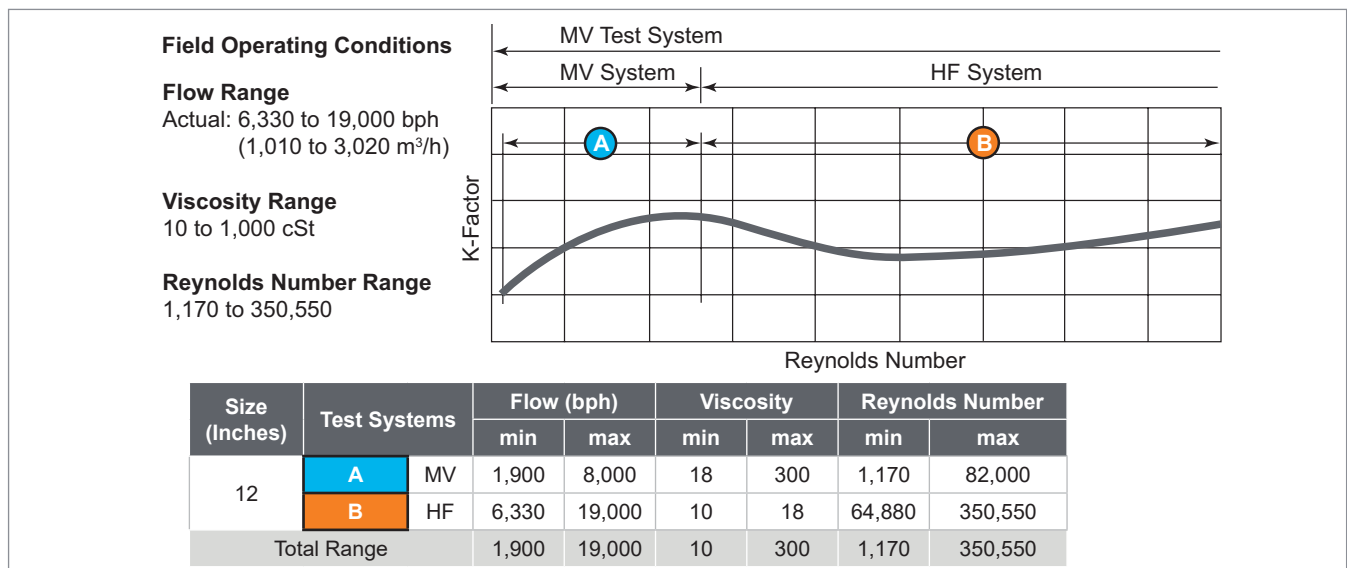
Testing

Dynamic Testing

Dynamic testing enables a meter's performance to be simulated over a wide flow and viscosity operating range. Each meter will be tested over the entire Reynolds number range of the application by utilizing a multiple product, high accuracy test.

Flow Conditioning

The MVTM will be tested with a Flow Conditioner and will conform to API Chapter 5.3.



Installation

The meter must be mounted in a horizontal attitude ($\pm 5^\circ$) downstream of a strainer with flow conditioning per API Ch. 5.3, followed by the system control valve. Refer to the installation manual for full instructions.

Applications

Meter Selection

Consult Factory.

Minimum Back Pressure

In order to prevent cavitation, API MPMS, Chapter 5 recommends a minimum back pressure according to the following:

$$BP = (2 \times \Delta P) + 1.25 V_p$$

Where: BP = Minimum back pressure
 ΔP = Pressure drop at maximum flow rate
 V_p = Absolute vapor pressure at operating temperature

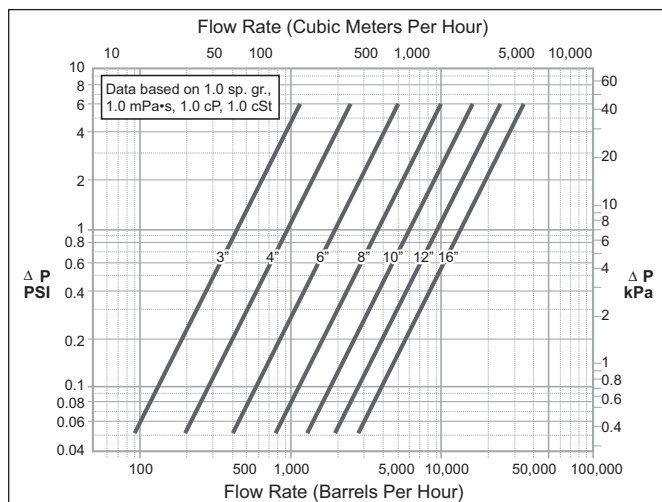
Example:

6" MV at 4,000 BPH - $\Delta P = 4$ psi.

Absolute vapor pressure of crude oil at operating temperature - $V_p = 5$ psia.

$$\begin{aligned} \text{Min. BP} &= (2 \times 4) + 1.25 (5) \\ &= 14.25 \text{ psi} \end{aligned}$$

Pressure Drop



Pressure Drop Correction

For liquids with other than 1.0 cP viscosity and/or 1.0 specific gravity, the meter pressure drop can be estimated by the following equation:

$$\Delta P = PD \times \mu^{1/4} \times (\text{sp. gr.})^{3/4}$$

Where: PD = Pressure drop from chart at desired flow rate.

μ = Absolute viscosity
(cP or mPa·s)

sp. gr. = Specific Gravity

Example:

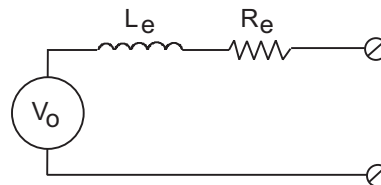
6" meter at 4,000 BPH, 50 cP, 0.9 sp. gr.

$$\Delta P = 4 \text{ psi (from chart)} (50)^{1/4} \times (0.9)^{3/4}$$

$$\Delta P = 9.8 \text{ psi.}$$

Pickup Coil Specifications

Type: Inductive



Electrical Characteristics

Effective Series Resistance (R_e): 4,700 Ω ($\pm 10\%$).

Effective Series Inductance (L_e): 6H @ 100 Hz.

Minimum Open Circuit Voltage (V_0): 75 millivolts p/p at minimum flow rate.

Maximum Transmission Distance: 2,000 ft (610 m) using #20 AWG two-conductor, shielded cable.

Note: A preamplifier is recommended for remote instrumentation that does not have Common Mode Noise Rejection. See Bulletin [SS02012](#) for PA-6 Preamplifier Specifications.

Catalog Code

The following guide defines the correct MV Series turbine meter for a given application and the respective catalog code. This code is part of the ordering information and should be included on the purchase order.

1	2	3	4	5	6	7	8	9	10	11
K	2	V	F	A	L	U	1	A	0	0

Position 1: Code

K - Catalog Code

Position 2: Product Line

2 - Turbine Meter

Position 3 and 4: Model²

VE - 3-Inch
 VF - 4-Inch
 VG - 6-Inch
 VH - 8-Inch
 VJ - 10-Inch
 VK - 12-Inch
 VM - 16-Inch

Position 5: Pressure Class

ASME End Connections (ASME B16.5)
 A - Class 150
 B - Class 300
 D - Class 600

Position 6: Material / End Connections

L - Low Temperature Carbon Steel RF Flanges

Position 7: Internal Configuration

U - Swept-Front Titanium Rotor, Unidirectional Flow

Position 8: Pickup Coils and Preamplifiers

Meter Mounted Junction Box(es) with
 1 - 1 Pickup Coil and Preamplifier
 3 - 2 Pickup Coils and 2 Preamplifiers
 Pickup Coil(s) with Online Diagnostics
 S - 1 Pickup Coil and AccuLERT³ XU
 T - 2 Pickup Coils and AccuLERT³ XU
 U - UPC Compensator with 1 Pickup Coil
 W - UPC Compensator with 2 Pickup Coils
 Extended Temperature Range with Preamplifier
 D - 1 Pickup Coil and 1 Preamplifier on 24-Inch Standoff (-40°F to 225°)
 J - 2 Pickup Coils and 2 Preamplifiers on 24-Inch Standoff (-40°F to 225°)
 Extended Temperature Range with Online Diagnostics
 E - 1 Pickup Coil and AccuLERT³ XU on 24-Inch Standoff (-40°F to 225°)
 K - 2 Pickup Coils and AccuLERT³ XU on 24-Inch Standoff (-40°F to 225°)

Position 9: Testing / Linearity

Standard Meters
 0 - Linearity ±0.15, Tested with High Performance Flow Conditioner
 1 - Linearity ±0.15, Tested with Conventional Flow Conditioner

Note: All meters are tuned to a specific application. Consult factory for more information.

Meters Tuned for Special Conditions

A - Linearity (Specify) Tested with High Performance Flow Conditioner
 B - Linearity (Specify) Tested with Conventional Flow Conditioner

Meters Configured for Viscosity Compensation with UPCC

C - Linearity (Specify) Tested with High Performance Flow Conditioner
 D - Linearity (Specify) Tested with Conventional Flow Conditioner

Position 10: Compliance with Standards

0 - UL/CUL Listed, File (E23545)
 3 - ATEX / IEC Ex Certified
 4 - ATEX / IEC Ex / PED⁴ Certified
 5 - UL / CUL / CRN Approved

Position 11: Specials

0 - None
 X - Special - Specify

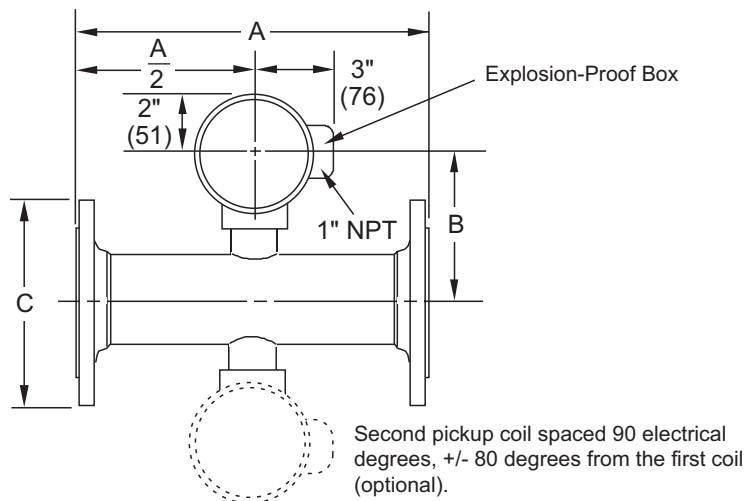
² Two (2) pickup bosses are standard for all sizes. Additional pickup coils and preamps, can be added if required.

³ The AccuLERT also provides dual channel preamplification and online diagnostics - for details see [SS02015](#).

⁴ PED required for all European countries; equipment must be manufactured by Ellerbek, Germany facility.

Dimensions • Weight

Inches (mm) and Pounds (kg)



Size	A	B ⁵	Class 150 ASME		Class 300 ASME		Class 600 ASME	
			C	Wt.	C	Wt.	C	Wt.
3"	10.0 (254)	6.38 (162)	7.5 (191)	60 (27)	8.3 (211)	76 (34)	8.3 (211)	100 (45)
4"	12.0 (305)	6.8 (173)	9.0 (229)	65 (30)	10.0 (254)	85 (39)	10.8 (274)	110 (50)
6"	14.0 (356)	7.9 (201)	11.0 (279)	100 (45)	12.5 (318)	145 (66)	14.0 (356)	245 (111)
8"	16.0 (406)	8.9 (226)	13.5 (343)	155 (70)	15.0 (381)	230 (104)	16.5 (419)	320 (145)
10"	20.0 (508)	9.9 (252)	16.0 (406)	265 (120)	17.5 (445)	350 (159)	20.0 (508)	560 (254)
12"	24.0 (610)	11.0 (279)	19.0 (483)	385 (175)	20.5 (521)	575 (261)	22.0 (559)	750 (340)
16"	32.0 (813)	12.6 (320)	23.5 (597)	835 (379)	25.5 (648)	1,080 (490)	C/F	C/F

Dimensions – inches to the nearest tenth (millimeters to the nearest whole mm), each independently dimensioned from respective engineering drawings.

Note – Meter weights by flange class with one pickup coil and explosion-proof box. Add 5 lb (2.3 kg) for each additional pickup coil and explosion-proof box.

5 Add 24" for a standoff when using a preamplifier for temperatures 158°F to 225°F (70°C to 107°C).

Revisions included in SS02016 Issue/Rev. 2.1 (6/19):

Page 6: Dimensions/Weight section - second pickup coil statement has been revised.

The specifications contained herein are subject to change without notice and any user of said specifications should verify from the manufacturer that the specifications are currently in effect. Otherwise, the manufacturer assumes no responsibility for the use of specifications which may have been changed and are no longer in effect.

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