

1.5" to 4" Guardsman™ (G) Series

Bulletin SS02002 Issue/Rev. 1.3 (2/18)

Smith Meter® Turbine Meters

The **Smith Meter® Guardsman™ Series Turbine Meter** is a bladed, rotor-type meter which utilizes an upstream, cantilevered stator to support the tungsten carbide, bearing-mounted rotor. It is intended for a wide range of petroleum, petrochemical, and chemical custody transfer measurement applications, such as small product pipelines ranging from Natural Gas Liquids (NGL) to light fuel oils.



3" Model Code K2BDA

Features

- Stainless Steel measuring chamber and internals
- Locking stator prevents wear and improves performance
- Tungsten carbide bearings system provides long life on low lubricating fluids
- Hydrodynamic thrust balance to minimize friction and wear on thrust bearings which allows for long service life and high accuracy
- 125-250 AARH flange face finish

Options

- Bidirectional flow allows the meter to accurately register flow in either direction.
- Multiple pickup coils are used when direction sensing or pulse security is required.
- NACE compliance may be necessary when dealing with liquids containing hydrogen sulfide. The meter has housing materials which are certified to be in compliance with the material requirements set forth in NACE Standard MR-01-75 latest revision.
- Premium $\pm 0.15\%$ and Super Premium Linearity $\pm 0.10\%$.
- AccuLERT ID-2000 Smart Preamplifier for real-time diagnostics of meter performance.

Operating Specifications

Flow Range ¹					
Meter Sizes	Units ²	Normal Flow Range ³		Extended Max. Flow Rate ³	Nominal K-Factor (Pulses/Unit) $\pm 5\%$
		Min. Linear	Max. Linear		
1.5"	USGPM	13	140	190	240
	USBPH	18	200	270	10,080
	L/min	50	530	710	63.4
	m ³ /h	3	32	43	63,400
2"	USGPM	25	280	375	125
	USBPH	36	400	535	5,250
	L/min	95	1,060	1,415	33
	m ³ /h	6	64	85	33,000
3" LF	USGPM	40	420	560	75
	USBPH	55	600	800	3,158
	L/min	150	1,590	2,120	19.8
	m ³ /h	9	96	128	19,800
3"	USGPM	60	650	870	52.7
	USBPH	85	930	1,240	2,215
	L/min	230	2,460	3,280	13.9
	m ³ /h	14	148	198	13,900
4"	USGPM	110	1,200	1,600	25
	USBPH	160	1,700	2,270	1,050
	L/min	415	4,500	6,000	6.6
	m ³ /h	25	270	360	6,600

¹ Based on 0.8 sp. gr., 1.5 mPa·s (1.5 cP) liquid.

² Metric units are nominal and may not convert precisely.

³ a. For bidirectional flow, the linearity in the reverse direction is $\pm 0.25\%$ and the minimum linear flow rate is 20% of the normal maximum linear.

b. From Normal Minimum to Extended Maximum, the linearity is normally not degenerated.

c. Extended Minimum is the flow rate at which the meter can provide a reliable signal, but accuracy (linearity and repeatability) may be diminished.

Linearity

Normal Flow Range	
Standard	±0.25%
Premium	±0.15%
Super Premium (3" and 4" ONLY)	±0.10%

Repeatability

±0.02% over the normal flow range

End Connections

Class 150, 300, 600, 900 ASME B16.5, 125-250 AARH finish raised face (RF) flanges

PN 16, 25 and 40 DIN 2526 Form C flanges

PN 63 and 100 DIN 2526 Form E flanges

Maximum Working Pressure⁴ - PSI (kPa)

ASME	Carbon Steel Flange	Stainless Steel Flanges
150	285 (1,965)	275 (1,896)
300	740 (5,102)	720 (4,964)
600	1,480 (10,205)	1,440 (9,929)
900	2,220 (15,307)	2,160 (14,893)
DIN	Carbon Steel Flanges	Stainless Steel Flanges
PN16	232 (1,600)	176 (1,210)
PN25	362 (2,500)	274 (1,890)
PN40	580 (4,000)	439 (3,030)
PN63	928 (6,400)	692 (4,770)
PN100	1,450 (10,000)	1,098 (7,570)

Operating Temperature Range

Meter with:	Carbon Steel Flanges	Stainless Steel Flange
Pickup Coil	-20°F to 225°F -29°C to 107°C	-40°F to 225°F -40°C to 107°C
Pickup Coil and Preamp	-20°F to 158°F -29°C to 70°C	-40°F to 158°F -40°C to 70°C
Pickup Coil and Preamp with 24" Standoff	-20°F to 225°F -29°C to 107°C	-40°F to 225°F -40°C to 107°C

Note: Consult factory for higher temperatures.

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

USA NTEP Certificate of Conformance: CC 93-053

Canadian NOA AV-2279

PTB Issued OIML R117-1 Test Report

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

Australia NMI 5/6B/87B

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

Body	300 Series Stainless Steel
Flanges	Carbon Steel Optional: 300 Series Stainless Steel
Internals	300 Series Stainless Steel, except 430 Stainless Steel Blades and Cones
Bearings and Thrust Washers	Tungsten Carbide Journal and Bearings

⁴ Maximum working pressures are for temperatures of -20°F to 100°F (-28°C to 38°C). Consult factory for maximum working pressures at other temperatures.

Installation

The meter must be mounted in a horizontal attitude ($\pm 5^\circ$) within a suitable flow conditioning assembly and is recommended that the meter be installed downstream of a strainer for protection and upstream of the flow control valve in the system.

Refer to the installation manual **MN02002** for full instructions.

Applications

High Viscosity

The flow range of turbine meters is reduced considerably when metering viscous liquids. The minimum flow rate must be increased as the viscosity increases. The following relationships can be used to approximate the increase (reduction in range) that will maintain the stated linearity.

$$\text{Viscous Min. Rate} = \text{Normal Min. Rate} \times \frac{\text{Viscosity (cP)}}{\text{Meter Size (in)}}$$

Note: Caution should be used when dealing with liquids that result in a viscous minimum rate greater than two times the normal, since variations in operating temperature can result in substantial meter factor shifts.

Low Density

When metering light hydrocarbons such as LPG or other liquids with specific gravity less than 0.8, the minimum flow rate should be shifted upward. The amount of shift can be approximated by multiplying the normal minimum flow rate by the following factor:

$$\text{Rate Increasing Factor} = \frac{0.9}{\sqrt{S}}$$

Where: S = The specific gravity of the liquid being metered.

Minimum Back Pressure

In order to prevent cavitation, API M.P.M.S. Chapter 5 recommends a minimum back pressure according to the following:

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

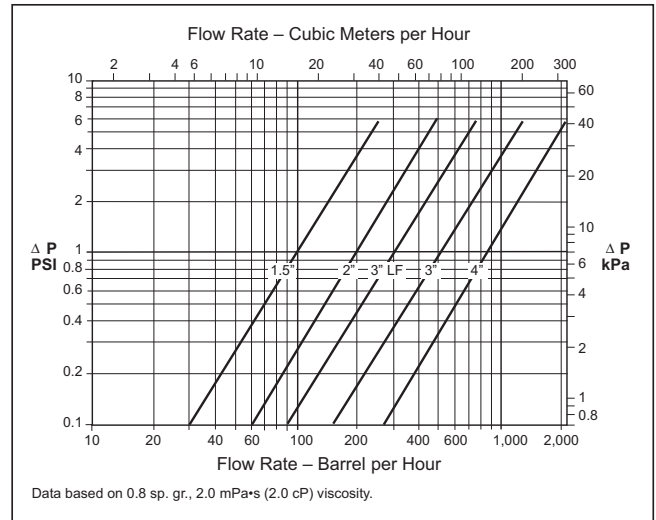
Where: BP = Minimum back pressure
 ΔP = Pressure drop at maximum flow rate
 VP = Absolute vapor pressure at operating temperature

Example:

3" Guardsman at 1,000 BPH - $\Delta P = 4$ psi.
 Absolute vapor pressure of butane at operating temperature - $V_p = 50$ psia.

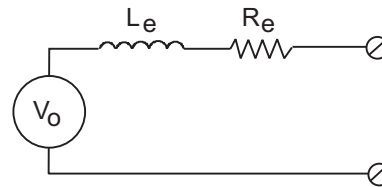
$$\begin{aligned} \text{BP} &= (2 \times 4) + 1.25 (50) \\ &= 70.5 \text{ psig} \end{aligned}$$

Pressure Drop



Pickup Coil Specifications

Type: Variable reluctance.



Electrical Characteristics

Effective Series Resistance (R_e): 1,200 Ω ($\pm 10\%$).

Effective Series Inductance (L_e): 400 mH @ 1,000 Hz.

Minimum Open Circuit Voltage (V_o): 300 millivolts p/p at minimum flow rate.

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

Notes: 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 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	B	A	A	0	A	0	0	0	0

Position 1: Code

K - Catalog Code

Position 2: Product Line

2 - Turbine Meter

Positions 3 and 4: Model and Size

Guardsman G Series - Journal Bearings

BA - 1.5"

BB - 2"

BC - 3" Low Flow

BD - 3"

BE - 4"

Positions 5 and 6: Pressure Class and End Connections

ASME End Connections

DIN End Connections

Carbon Steel RF Flg's

Carbon Steel RF Flg's

A0 - Class 150

H0 - PN16

B0 - Class 300

J0 - PN25

D0 - Class 600

K0 - PN40

E0 - Class 900

M0 - PN100

300 Series SS RF Flg's

300 Series SS RF Flg's

AF - Class 150

HF - PN16

BF - Class 300

JF - PN25

DF - Class 600

KF - PN40

EF - Class 900

LF - PN63

MF - PN100

Position 7: Internal Configuration

A - Unidirectional Flow, 430 Stainless Steel Blades

B - Bidirectional Flow, 430 Stainless Steel Blades

Position 8: Pickup Coils and Preamplifiers

Meter Mounted Junction Box(es) with

0 - 1 Pickup Coil

1 - 1 Pickup Coil and Preamplifier (standard)

2 - 2 Pickup Coils

3 - 2 Pickup Coils and 2 Preamplifiers

4 - 2 Pickup Coils and 1 Preamplifier

Pickup Coil(s) with Explosion Proof Totalizer/Flow Rate Indicator

8 - MMRT⁸ with PA-11 and 1 Pickup Coil

9 - MMRT⁸ with PA=11 and 2 Pickup Coils

Pickup Coil(s) with Online Diagnostics with

S - 1 Pickup Coil and AccuLERT⁶ XU

T - 2 Pickup Coils and AccuLERT⁶ XU

Extended Temperature Range with Preamplifier

D - 1 Pickup Coil and 1 Preamplifier on 24-Inch Stand-off

J - 2 Pickup Coils and 2 Preamplifiers on 24-Inch Stand-off

Extended Temperature with Online Diagnostics with

E - 1 Pickup Coil and AccuLERT⁶ XU on 24-Inch Stand-off

K - 2 Pickup Coils and AccuLERT⁶ XU on 24-Inch Stand-off

Extended Temperature Range with Explosion Proof Totalizer/Flow Rate Indicator on 24-Inch Standoff

F - MMRT⁸ with PA-11 and 1 Pickup Coil

L - MMRT⁸ with PA-11 and 2 Pickup Coils

Position 9: Testing/Linearity

0 - Standard $\pm 0.25\%$ Linearity

1 - Premium $\pm 0.15\%$ Linearity

2 - Super Premium $\pm 0.10\%$ Linearity⁵

Position 10: Compliance with Electrical and Other Standards

0 - UL/CUL Listed

3 - ATEX / IEC Ex Certified

4 - ATEX / IEC Ex / PED⁷ Certified

5 - UL/CUL/CRN

Position 11: Specials

0 - None

X - Special - Specify

⁵ Super Premium $\pm 0.10\%$ Linearity is not available for Sizes 1.5", 2" and 3" Low Flow.

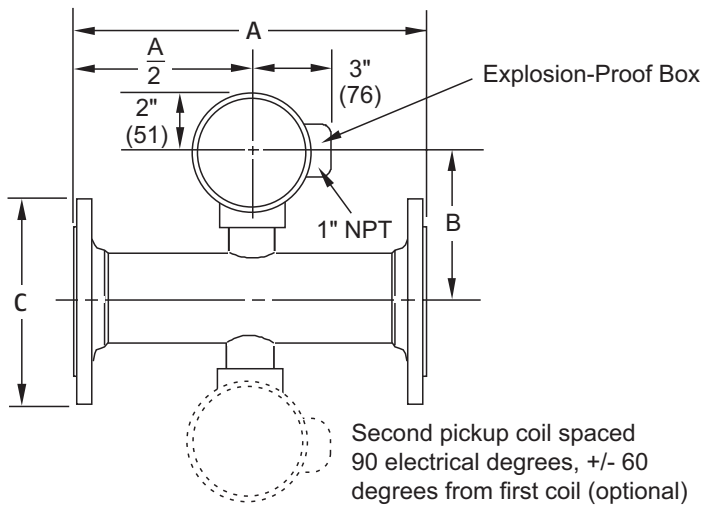
⁶ The AccuLERT also provides dual channel preamplification and online diagnostics - for details see [SS02015](#).

⁷ PED required for all European countries; equipment must be manufactured by Ellerbek, Germany facility.

⁸ Hazardous locations certificate not available, enclosure meets the requirements for CLI, Div 1, Groups C&D, for details see [SS09040](#).

Dimensions • Weight

Inches (mm) and Pounds (kg)



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

Size	A ⁹	B ¹⁰	Class 150 ASME		Class 300 ASME		Class 600 ASME		Class 900 ASME		
			C	Weight	C	Weight	C	Weight	A	C	Weight
1.5"	6.0" (152)	6.4" (162)	5.0" (127)	14 lb (6 kg)	6.1" (155)	19 lb (9 kg)	6.1" (155)	24 lb (11 kg)	9.0" (229)	7.0" (178)	40 lb (18 kg)
2"	6.5" (165)	6.6" (168)	6.0" (152)	20 lb (9 kg)	6.5" (165)	24 lb (11 kg)	6.5" (165)	33 lb (15 kg)	9.0" (229)	8.5" (216)	65 lb (30 kg)
3" and 3" LF	10.0" (254)	5.1" (130)	7.5" (191)	65 lb (30 kg)	8.3" (211)	76 lb (34 kg)	8.3" (211)	45 lb (20 kg)	10.0" (254)	9.5" (241)	152 lb (69 kg)
4"	12.0" (305)	5.6" (142)	9.0" (229)	65 lb (30 kg)	10.0" (254)	80 lb (36 kg)	10.8" (274)	110 lb (50 kg)	12.0" (305)	11.5" (292)	160 lb (72 kg)

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.

Size	PN16		PN26 / PN40	
	C	Weight	C	Weight
1.5"	5.9" (150)	13 lb (6 kg)	5.9" (150)	18 lb (8 kg)
2"	6.5" (165)	20 lb (9 kg)	6.5" (165)	20 lb (9 kg)
3" and 3" LF	7.9" (200)	55 lb (25 kg)	7.9" (200)	60 lb (27 kg)
4"	8.6" (220)	60 lb (27 kg)	9.2" (235)	66 lb (30 kg)

⁹ For Class 150-600.

¹⁰ Add 24" for a standoff when using a preamplifier for temperatures 158°F to 225°F (70°C to 107°C).

Revisions included in SS02002 Issue/Rev. 1.3 (2/18):

Page 2: Approvals section updated.

Page 4: Catalog Code position 8 - 8, 9, F, L have been added.

Footnotes 8 - 10 have been added/adjusted.

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.

Contact information is subject to change. For the most current contact information, visit our website at www.fmctechnologies.com/measurementsolutions and click on the "Contact Us" link in the left-hand column.