

# 1.5" to 4" Guardsman™ (G) Series

Bulletin SS02002 Issue/Rev. 1.0 (11/10)



**We put you first.  
And keep you ahead.**

## 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.

### 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**



3" Model Code K2BDA

## 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 ±0.15% and Super Premium Linearity ±0.10%.**
- » **AccuLERT ID-2000 Smart Preamplifier** for real-time diagnostics of meter performance.

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 ±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.

## OPERATING SPECIFICATIONS

### FLOW RANGE<sup>1</sup>

Meter Sizes	Units <sup>2</sup>	Normal Flow Range <sup>3</sup>		Extended Max. Flow Rate <sup>3</sup>	Nominal K-Factor (Pulses/Unit) ±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 <sup>3</sup> /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 <sup>3</sup> /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 <sup>3</sup> /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 <sup>3</sup> /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 <sup>3</sup> /h	25	270	360	6,600

## 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 ANSI 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 PRESSURE<sup>4</sup> - PSI (kPa)

ANSI	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

Consult factory for higher temperatures.

### Approvals

**UL/CUL, Listed 557 N** – Class I Groups C and D; Class I, Zone I, Group IIB; Class I, Zone I, AExd IIB T6 IP66;  
**UNL-UL ENCL. 4, CNL-CSA ENCL. 4;** Tamb -50°C to 70°C  
**ATEX / IEC Ex**  
 PTB 08 ATEX 1034X, IEC Ex PTB 08.0040X  
 Ex d IIC T6 Tamb = -40°C to 70°C IP66.

### Essential Health and Safety Requirements

**EN/IEC 60079-0:** Electrical apparatus for potentially explosive atmospheres – General requirements

**EN/IEC 60079-1:** Electrical apparatus for potentially explosive atmospheres – Flameproof enclosures 'd'  
**EN 60529:** 1992. Degrees of protection provided by enclosures (IP code)

**EMC Compliance:** (by Council Directive 2004/108/EC)

**Electromagnetic Emissions:** EN 61000-6-3

**Electromagnetic Immunity:** EN 55022

**IEC 61000-4-2:** Electrostatic Discharge (ESD), Level 3+ (8.0 kV by contact, 12 kV by air)

**IEC 61000-4-3:** Radiated Electromagnetic Field, Level 3 (10 V/m)

**IEC 61000-4-4:** Electrical Fast Transient (Burst), Level 2 (1kV)

**IEC 61000-4-5:** Electrical High Energy Pulses (Surge), Installation Class 3, Criterion B

## MATERIALS OF CONSTRUCTION

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

### INSTALLATION

The meter must be mounted in a horizontal attitude (±5°) 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.

<sup>4</sup> 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.

### Low Density

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

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

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:

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

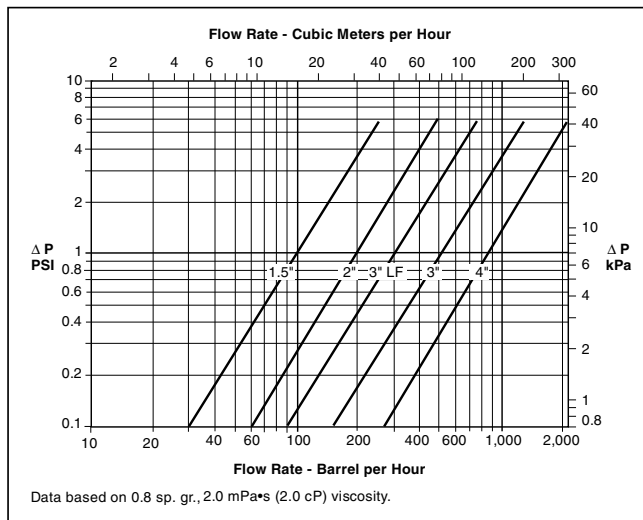
Where: BP = Minimum back pressure  
 $\Delta P$  = Pressure drop at maximum flow rate  
 VP = Absolute vapor pressure at operating temperature

### Example:

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

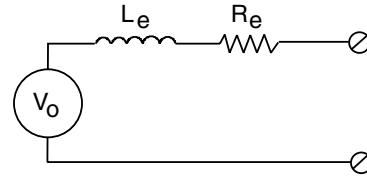
$$BP = (2 \times 4) + 1.25 (50) = 70.5 \text{ psig}$$

### Pressure Drop



### PICKUP COIL SPECIFICATIONS

Type: Variable reluctance.



### Electrical Characteristics

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

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

ANSI End Connections

Carbon Steel RF Flg's

A0 - Class 150

B0 - Class 300

D0 - Class 600

E0 - Class 900

DIN End Connections

Carbon Steel RF Flg's

H0 - PN16

J0 - PN25

K0 - PN40

M0 - PN100

300 Series SS RF Flg's

AF - Class 150

BF - Class 300

DF - Class 600

EF - Class 900

300 Series SS RF Flg's

HF - PN16

JF - PN25

KF - PN40

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 Online Diagnostics with

S - 1 Pickup Coil and AccuLERT<sup>6</sup> XU

T - 2 Pickup Coils and AccuLERT<sup>6</sup> 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 AccuLERT<sup>6</sup> XU on 24-Inch Stand-off

K - 2 Pickup Coils and AccuLERT<sup>6</sup> XU on 24-Inch Stand-off

### Position 9: Testing/Linearity

0 - Standard  $\pm 0.25\%$  Linearity

1 - Premium  $\pm 0.15\%$  Linearity

2 - Super Premium  $\pm 0.10\%$  Linearity<sup>5</sup>

### Position 10: Compliance with Electrical and Other Standards

0 - UL/CUL Listed

3 - ATEX / IEC Ex Certified

4 - ATEX / IEC Ex / PED<sup>7</sup> Certified

5 - UL/CUL/CRN

### Position 11: Specials

0 - None

X - Special - Specify

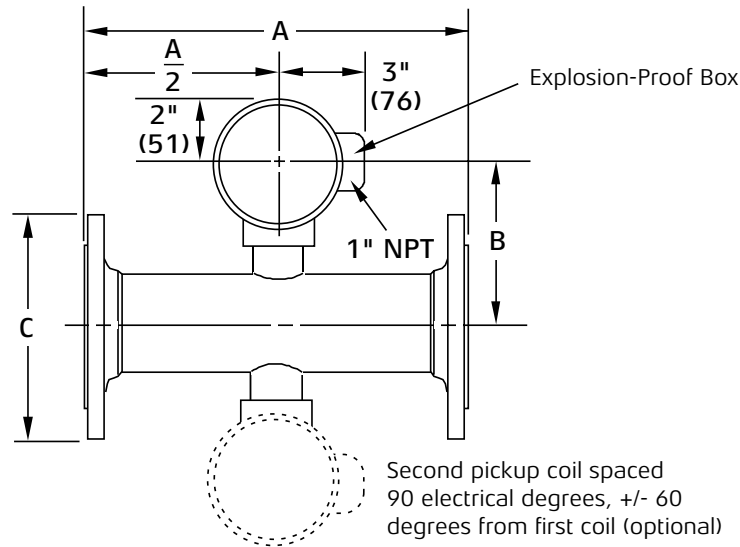
<sup>5</sup> Super Premium  $\pm 0.10\%$  Linearity is not available for Sizes 1.5", 2" and 3" Low Flow.

<sup>6</sup> The AccuLERT also provides dual channel preamplification and online diagnostics.

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

## DIMENSIONS

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 <sup>8</sup>	B <sup>9</sup>	Class 150 ANSI		Class 300 ANSI		Class 600 ANSI		Class 900 ANSI		
			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)

<sup>8</sup> For Class 150-600.

<sup>9</sup> Add 24" for a standoff when using a preamplifier for temperatures 158°F to 225°F (70°C to 107°C).



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**Revisions included in SS02002 Issue/Rev. 1.0 (11/10):**

Editorial Change - Applications / Low Density - February 2014. Modeling Code - Position 9: Premium corrected from  $\pm 0.25\%$  to  $\pm 0.15\%$ . Editorial change to Materials of Construction - corrected error in body and flanges fields.

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](http://www.fmctechnologies.com/measurementsolutions) and click on the "Contact Us" link in the left-hand column.