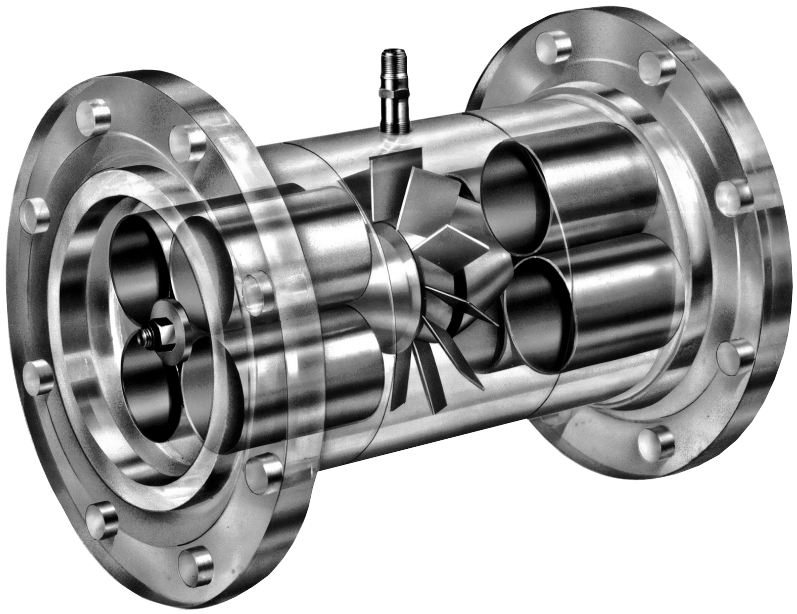
BARTON®

Model 7400 Precision Gas Turbine Flowmeters

Overview

Barton Model 7400 Precision Turbine Flowmeters are designed for gas service in a wide range of industrial,commercial, pipeline, and aerospace applications. Because the output from the pickup coil is digital, Barton Model 7400 meters are a perfect match for electronic output devices — no A/D conversion required. The rotor response is in milliseconds, providing precise metering in rapidly changing flow pattern applications.



General Features

- **High accuracy** — custody transfer quality measurements with ±0.2% of flow rate repeatability and a single K-factor linearity of better than ±1.0% of reading over flow range.
- **Wide application** — metering of gases from oxygen to ethylene for natural gas production, gas transmission, petrochemical, transport, aerospace, and petroleum production/refining industries.
- **Responsive** — a major advantage over other primary flow devices. Rotor response in milliseconds provides precision even in rapidly changing environments.
- **High frequency digital output** — easy interface with digital equipment.
- **Wide rangeability** — depending on the flowing gas density,the meter inherently often provides for min to max flow range of more than a 10:1 ratio. Rangeability is extended with the addition of optional linearizing electronics.
- **Wide temperature and pressure ranges** — flexible measurement options.
- **Symmetrical bi-directional design** — ideal for reverse flow applications in which flow capacities are the same in either direction. Electronic options provide instantaneous flow direction sensing.
- **Compact and efficient** — compared to other Precision metering techniques, Barton turbine meters are able to handle a larger flow rate in a smaller meter and at a lower pressure drop. With the use of reduced diameter block valves and meter runs, substantial installation cost savings are achieved.
- **Low maintenance** — sealed self-lubricating bearings feature a maintenance free 10-year design life.
- **Integral pressure tap** — precisely positioned to accommodate pressure measurement at the turbine meter.
- **Mounting flexibility** — meter can be installed in any orientation.

Operation

As gas passes over the diffuser section, it is accelerated onto a multi-blade turbine rotor. The rotor speed is proportional to the volumetric flow rate. As the rotor turns, a reluctance type pickup coil (mounted on the meter) senses the passage of each blade tip and in-turn generates a sine wave output with a frequency directly proportional to the flow rate. Additional coils can be added for redundancy or flow direction sensing.

The pickup coil can drive a variety of instruments, including, totalizers, pre-amplifiers, or flow computers/RTUs. Pre-amplifiers are used to transmit the coil signal over extended distances to remote mounted instruments. All turbine instruments can be local or remote mounted and are available with intrinsically safe or explosion/flame proof or weatherproof approvals.

Model Selection

Actual Flow Rates

7400 Model Selection (Actual Flowrate)

Model Number	Body Size		Minimum Repeatable						Rated Max.		Extended Range [1]		Nominal Meter Output (±5.0%)		
	in	mm	0.25 lb/ft3 (4kg/m3)		0.5 lb/ft3 (8kg/m3)		2.0 lb/ft3 (32.08kg/m3)						Pulses /ft3	Pulses /M3	Rated Max Freq. (Hz)
			ACFM	ACMH	ACFM	ACMH	ACFM	ACMH	ACFM	ACMH	ACFM	ACMH			
7486	3/4	20	1.4	2.37	1.0	1.69	0.5	0.85	6.7	11.3	7.4	12.5	21600	762800	2400
7450	1	25	2.7	4.58	1.9	3.22	1.0	1.69	15	25.5	17	28.0	10700	377900	2675
7475	1	25	3.2	5.42	2.3	3.90	1.25	2.12	22	37.4	24	40.7	7400	261300	2715
7401	1	25	4.8	8.14	3.5	5.93	1.7	2.88	50	85	55	93.4	3350	118300	2790
7446	1-1/2	40	12.5	21.19	8.5	14.41	4.2	7.12	125	212	138	234	1700	60000	3540
7402	2	50	19	32.20	14.5	24.58	6.7	11.36	200	340	220	374	740	26100	2465
7403	3	80	55	93.22	39	66.10	18.7	31.69	560	950	616	1045	190	6000	1770
7404	4	100	82	138.9	59	100.0	31	52.54	850	1445	935	1590	80	3000	1130
7406A[2]	5/6	150	130	220.3	92	155.9	46	78.0	1350	2300	1485	2525	35	1250	800
7406	6	150	215	364.4	158	267.8	73	123.7	2200	3740	2420	4110	22	1000	800
7408	8	200	340	576.3	243	411.9	117	198.3	3500	5950	3850	6540	9	400	525
7410	10	250	550	932.2	390	661.0	193	327.1	5800	9855	6380	10840	5	180	500
7412	12	300	850	1440.7	610	1033.9	300	508.5	9000	15290	9900	16820	3	105	450

Notes: (1) Operating continuously in the **Extended Range** will reduce the bearing life by approximately 25%
(2) **7406A** (6" [150 mm] end connections)

Calculating Gas Turbine Meter Size

For calculating gas turbine meter size for conditions other than those given in Selection Table (actual flow rates) use the following method (per AGA-7):

(1) $$Q_f = \frac{P_b}{T_b} \times Q_h \times \frac{T_f}{P_f}$$

where:

Q_f = quantity rate of flow at line conditions
P_b = atmospheric pressure or pressure at base conditions
T_b = absolute temperature at base conditions
Q_h = quantity rate of flow at reference (base) conditions
T_f = absolute temperature at line conditions
P_f = absolute static pressure

(2) $$\gamma = \gamma_b \times \frac{P_f}{P_b} \times \frac{T_b}{T_f}$$

where:

γ = density at flowing conditions
γ_b = density at base conditions

(3) $$Qf_{min} = Qf_{ref} \times \sqrt{\frac{\gamma_{ref}}{\gamma}}$$

where:

Qf_{min} = rate of minimum linear flow at line conditions
Qf_{ref} = minimum flowrate from flowrate table on page 2 from column selected for γ_{ref}

Specifications

Compliances:	CSA certified for hazardous areas, Class I, Division I, Group B,C,D; Class II, E,F,G: Class III, Enclosure 4 waterproof to NEC (USA) and CEC (Canadian) standards
	Compliant to ANSI 12.27.01-2003 single seal requirements
	Available with CE mark for Pressure Equipment Directive (PED, 97/23/CE)
	Supplied with companion electronics for Class I/Zone 1 explosion-proof/flame-proof/ or intrinsic safety rating
Pressure Rating:	The following are pressure ratings for meters manufactured to ASME B31.1 and B31.3 and European PED standards and tested to 450°F (232°C). Higher pressure ratings are also available. For flanged meters, the pressure rating will be the lower of the flange rating or the meter body rating. Pressure ratings will be re-evaluated for temperatures above 450°F (232°C).

Connection Size (inches)	PSI	Bar
< 1	5000	345
1	4400	303
1-1/2	3200	220
2	2650	183
2-1/2	2250	155
3	1650	114
4	1350	93

Pressure ratings for 6", 8", 10", 12" meters are specific to the application and vary, depending on flange connection, process fluid, process conditions, body material and construction detail.

End Connections	
Flanged	ANSI B16.5 (BS EN 1759); DIN (BS EN 1092)
Threaded (up to 4-inch)	BSP; NPT Others to special order.

Materials	
Rotor Blades	430 Stainless Steel
Ball Bearings	440C Stainless Steel,with dry lubricant impregnated, Rulon® ball separators
Body/Flanges	316 Stainless Steel; Carbon Steel on sizes 4"(102 mm) and larger
Internals	316 Stainless Steel Others to special order

Process Specifications	
Temp. Range*	-425°F to 570°F (-254°C to 299°C) CSA certification is standard for meters rated for 450°F (232°C) and below; meters rated for higher temperatures will be evaluated for CSA certification as required.
	PED meters for applications above 450°F (232°C) must be re-evaluated to ensure an adequate safety factor.
Pressure Drop	1.8 psi (0.12 bar) at maximum flow rate (based on air with density of 1.0 lb/ft^3 (16 kg/m^3) for specific flow rate values, see Selection charts).
Gas Density	0.08 to 4.5 lb/ft^3) 1.25 to 73 kg/m^3 Other densities available

*Note: The electronic equipment mounted directly on the meter can be exposed to temperatures from -40°F (-40°C) to +160°F (+71°C). Use mounting extensions or remote mounts for higher process temperatures.

Output	
Type	Sine Wave
Voltage	Varies with meter size and flow rate. Typical values are: 20 - 500 mV rms on 3/4" (20 mm) 0.2 – 5V rms on 12" (300 mm)
Frequency	Proportional to flow

Performance & Calibration

The average K-factor for each turbine is determined at the factory by using water as the calibration media. Performed at six different flow rates, this multi-point calibration verifies linearity and repeatability over a limited range of the meter capacity. The average K-factors derived in water as compared to gas are within 1% deviation of each other. A water calibration is also an effective method to validate a meter in the field. Consult factory for field water calibration procedures.

Gas calibrations are comparatively expensive but can be valuable in the following instances:

- When verifying the low end capacity of the meter as would be required to implement electronic linearization.
- For testing of upper end capacity of the meter. Full capacity testing can rarely be performed on water due to pressure drop issues.

Gas calibration should be performed on a gas density similar to the process fluid density.

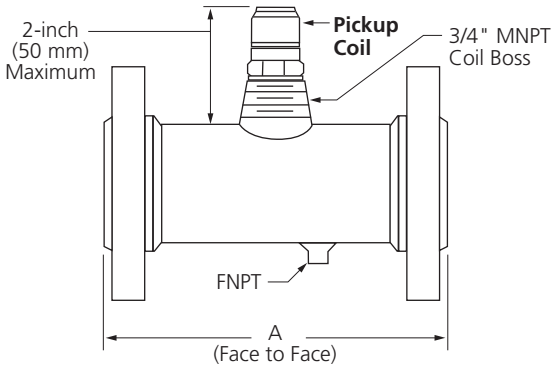
Meter performance specified in this bulletin is based on historical gas calibration performed at independent world class calibration facilities using gas media. Not included in our accuracy statement is any systemic bias the calibration lab may have. Repeatability is limited by gas laboratory precision but in water is typically ±0.02%.

Linearity indicates that no data point will exceed the average of all the data points within the linear meter capacity (normally 10 to 100% capacity) as per ISA standard RP31.1. Installation with straight pipe per American Gas Association report #7 is required to achieve the specified linearity.

All meters should be installed with upstream filtration to isolate the meter from contamination and damage from liquids or solids.

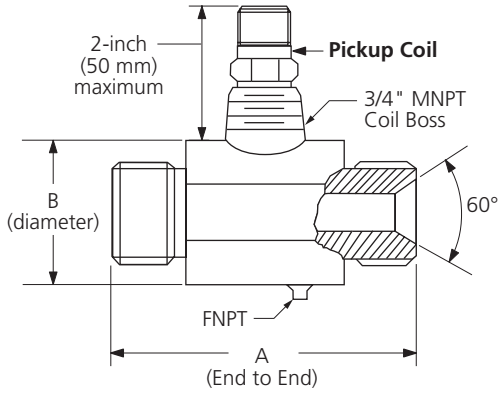
Dimensions

Flanged Meter



Rating	Face to Face Dimension (A)					
BSEN 1759 (ANSI)	Up to ANSI 600		ANSI 900 & 1,500		ANSI 2,500	
BSEN 1092 (DIN)	Up to PN 64		PN 100 & 160		PN 250 & 320	
Model	Inch	mm	Inch	mm	Inch	mm
7450	5-1/2	140	8	203	8	203
7475	5-1/2	140	8	203	8	203
7401	5-1/2	140	8	203	8	203
7446	6	152	9	229	9	229
7402	6-1/2	165	9	229	9	229
7403	10	254	10	254	11	279
7404	12	305	12	305	12	305

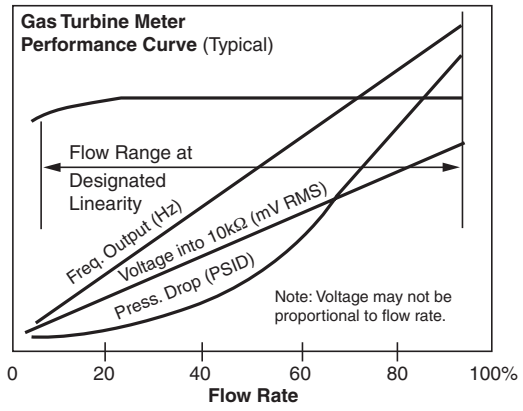
Threaded Meter



Model	Thread (BSP or NPT)	Dim. (A)		Dim. (B)	
		Inch	mm	Inch	mm
7486	3/4	3-3/4	83	1-1/4	32
7450	1	3-1/2	89	1-1/4	32
7475	1	3-1/2	89	1-1/2	40
7401	1	3-1/2	89	2-1/4	57
7446	1-1/2	4-3/8	111	2-3/4	70
7402	2	4-3/4	121	5-1/2	140

Integral Pressure Tap	
Nominal Pipe Sizes (inches)	Tap Size (FNPT)
3/4 through 2-1/2	1/8"
3 through 8	1/4''
10 and 12	1/2''

Performance



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