



Cox[®]
Turbine Flow Meters

Turbine Flow Meters

Precision Series

DESCRIPTION

Cox Precision Turbine Flow Meters have unprecedented mechanical linearity, resulting in minimizing, or negating, temperature induced viscosity influence. Cox Precision Turbine Meters come with a variety of process fittings, sizes and options to accommodate the requirements of most applications while offering wide flow ranges.

Features	Benefits
Expanded mechanical linearity	Increased usable flow range with less sensitivity to fluid temperature/viscosity effect on the output.
Helical rotor design	Exceptional speed-of-response, with reduced pressure drop.
Comprehensive pickoff selection	Meets application requirements for temperature and electronic outputs.
High-Performance ceramic ball bearings	Ceramic bearings provide near-perfect roundness, higher Rockwell hardness and are lighter and more tolerant to temperature than 440C stainless steel bearings. They eliminate adhesive wear and perform well in non-lubricating liquids found in cryogenic fluids and water.
6-bladed rotor supports	Improved flow conditioning.
Facility with NIST traceable standards	Third party audits to ensure calibration uncertainty. Laboratory correlation to verify that all calibrators produce the same result.
A variety of end fittings	AN, NPT, flange, and special fittings to meet specific installation configurations.

APPLICATIONS

Cox Precision Flow Meters are the ideal solutions for standard and high pressure liquid flow applications in test and measurement and precision industrial processes, found in the automotive, aerospace and general industries.



CALIBRATIONS

Calibrations are accomplished by using various blends of solvent and oil to simulate actual fluid conditions. For varying process temperature conditions, multiple viscosity calibrations are used to develop a universal viscosity curve. UVC calibrations enable a flow computer to track temperature and compensate for fluid viscosity. Flow Dynamics tailors calibrations to replicate process conditions so the meter is characterized to provide the best attainable accuracy.

Calibrations are performed by our Flow Dynamics NVLAP (Lab Code 200668-0) accredited calibration facility located in Racine WI, which uses primary standard calibrators, offering uncertainties of ± 0.05 percent of reading with ± 0.02 percent repeatability. Users can be assured that Cox Precision Meters come with a best-in-class calibration, traceable to NIST standards.



NVLAP accreditation applies only to the Badger Meter Flow Dynamics calibration Lab, located in Racine, WI.



Badger Meter

CXX-DS-00169-EN-09 (March 2024)

Product Data Sheet

OPERATION AND PERFORMANCE

As a fluid passes through the meter, the velocity of the fluid provides rotational energy on the rotor. The rotor blades, passing through a magnetic or radio frequency field, generate pulses proportional to flow. Each pulse is transmitted to the meter electronics, where it amplifies the pulse output.

Outstanding mechanical linearity, up to 100:1, is achievable, depending on meter size. Paired with a flow processor, meter linearity improves from the standard ± 0.50 percent to within ± 0.1 percent of reading over the entire repeatable flow range, while providing fluid temperature viscosity compensation. Temperature effects on the meter bore diameter are compensated for by using thermal expansion coefficients, with Strouhal-Roshko equations, to provide a very accurate and repeatable volumetric flow rate.

SPECIFICATIONS

Repeatability	$\pm 0.02\%$ of reading	
Linearity	$\pm 0.50\%$ ($\pm 0.1\%$ with flow processor)	
Calibrator Uncertainty	$\pm 0.05\%$ of reading	
Frequency Output	1200...1500 Hz	
Response Time	2...3 ms (at 1.2 cSt)	
Materials of Construction	Body	316 stainless steel
	Shafts	316 stainless steel
	Rotors	17-4 PH stainless steel
	Bearing	Ceramic
	Other internal parts	301, 302, 303, 440C, 316/316L, PH 15-7 Mo and SV30 stainless steel

NOTE: The flow data below represents two different pickoff types, radio frequency and magnetic. Radio frequency (RF) pickoffs extend the measurable linear flow range by eliminating magnetic induced drag. RF pickoffs require a power input, whereas magnetic pickoffs generate their own power to produce an output signal and typically, have greater tolerance to higher process temperatures.

U.S. Standard Flow Data

Carrier (RF) Linear Range ²				Non-Linear Repeatable Range			Δp^1 at Max. Flow PSIG (g/cm ²)	Freq. Output at Max. Flow
Size	gpm (lpm)	lb/hr (kg/hr)	Linear Flow Ratio	gpm (lpm)	lb/hr (kg/hr)	Flow Ratio (Turndown)		
8-4	0.20...3.00 (0.76...11.36)	76...1143 (34.47...518.46)	15:1	0.05...3.00 (0.19...11.36)	19...1143 (8.62...518.46)	60:1	6.5 (0.46)	1500 Hz
8-6	0.30...6.00 (1.14...22.71)	114...2286 (51.71...1036.91)	20:1	0.06...6.00 (0.23...22.71)	22.8...2286 (10.34...1036.91)	100:1	8.5 (0.60)	
8	0.40...9.50 (1.51...35.96)	152...3619 (68.95...1641.55)	24:1	0.09...9.50 (0.34...35.96)	34.3...3619 (15.56...1641.55)		8.5 (0.60)	
10	0.50...15.5 (1.89...58.67)	190...5905 (86.18...2678.46)	30:1	0.16...15.5 (0.61...58.67)	60.9...5905 (27.62...2678.46)		9.0 (0.63)	
12	1.00...30.0 (3.78...113.56)	381...11,430 (172.82...5184.56)	30:1	0.30...30.0 (1.13...113.56)	114...11,430 (51.71...5184.56)		9.0 (0.63)	
16	1.60...65.0 (6.06...246.05)	610...24,765 (276.69...11,233.2)	40:1	0.45...65.0 (1.70...246.05)	171...24,765 (77.67...11,233.2)	150:1	9.0 (0.63)	
20	1.90...95.0 (7.19...359.61)	724...36,195 (328.40...16,417.7)	50:1	0.65...95.0 (2.46...359.61)	247...36,195 (112.04...16,417.7)		8.5 (0.60)	
24	2.60...155 (9.84...586.74)	990...59,055 (449.06...26,786.9)	60:1	1.05...155 (3.97...586.74)	400...59,055 (181.44...26,786.9)		9.0 (0.60)	
32	3.10...310 (11.73...1,173.48)	1181...118,110 (535.69...53,573.7)	100:1	2.10...310 (7.95...1173.48)	800...118,110 (362.87...53,573.7)		9.0 (0.63)	

1. Pressure drop is based on using MIL-PRF-17024E, Type II at 80° F, with a specific gravity of 0.762 and 1.12 cSt viscosity.
2. Linear flow range was developed using 1.2 centistokes.

Magnetic 10:1 Linear Range				K-Factor Pulses/ Gallon ³ (Liter ³)	Extended Range – Linear ²			
Size	gpm (lpm)	lb/hr (kg/hr)	Δp^1 at 10:1 PSID (kg/cm ²)		gpm (lpm)	lb/hr (kg/hr)	Flow Ratio (Turndown)	Freq. at Min./Max. Output (Hz)
8-4	0.25...2.50 (0.95...9.46)	95...952 (43.09...431.82)	3.5 (0.25)	28,800 (7610)	0.25...3.00 (0.95...11.36)	95...1143 (43.09...518.46)	12:1	120/1440

Magnetic 10:1 Linear Range				K-Factor Pulses/ Gallon ³ (Liter ³)	Extended Range – Linear ²			
Size	gpm (lpm)	lb/hr (kg/hr)	Δp^1 at 10:1 PSID (kg/cm ²)		gpm (lpm)	lb/hr (kg/hr)	Flow Ratio (Turndown)	Freq. at Min./Max. Output (Hz)
8-6	0.50...5.00 (1.89...18.93)	190...1905 (86.18...864.10)	4.5 (0.32)	14,400 (3805)	0.50...6.00 (1.89...22.71)	190...2286 (86.18...1036.91)	12:1	120/1440
8	0.75...7.50 (2.84...28.39)	285...2857 (129.27...1295.91)	6.0 (0.42)	9600 (2536)	0.60...9.00 (2.27...34.07)	229...3429 (103.87...1555.37)	15:1	96/1440
10	1.25...12.5 (4.73...47.32)	476...4762 (215.91...2160.01)	5.0 (0.35)	5760 (1522)	1.00...15.0 (3.79...56.78)	381...5715 (172.82...2592.28)	15:1	96/1440
12	2.50...25.0 (9.46...94.74)	952...9525 (431.82...4320.47)	5.0 (0.35)	2800 (761)	1.50...30.0 (5.68...113.56)	571...11,430 (259.01...5184.56)	20:1	72/1440
16	5.00...50.0 (18.93...189.27)	1905...19,050 (864.09...8640.93)	5.0 (0.35)	1440 (380)	2.50...60.0 (9.46...227.13)	953...22,860 (432.27...10,369.1)	24:1	60/1440
20	7.50...75.0 (28.39...283.91)	2857...28,575 (1295.91...12,961.4)	5.5 (0.39)	960 (254)	3.00...90.0 (11.36...340.69)	1143...34,290 (518.46...15,553.6)	30:1	48/1440
24	12.5...125 (47.32...473.18)	4762...47,625 (2160.01...21,602.3)	6.0 (0.42)	576 (152)	5.00...150 (18.93...567.81)	1905...57,150 (864.09...25,922.8)	30:1	48/1440
32	25.0...250 (94.64...946.35)	9525...95,250 (4320.47...43,204.6)	6.5 (0.46)	288 (76)	6.20...300 (23.47...1135.62)	2362...114,300 (1071.39...51,845.6)	48:1	30/1440

1. Pressure drop is based on using MIL-PRF-17024E, Type II at 77° F, with a specific gravity of 0.77.
2. Extended range is linear, with liquids up to 1.5 centistokes. Over 2.0 centistokes, output becomes non-linear but repeatable.
3. K-factor varies slightly from meter to meter.

Pressure Ratings for AN End Fittings

Size	Pipe Size	Meter Body: 316 Stainless Steel					
		100° F		300° F		500° F	
		bar	psig	bar	psig	bar	psig
8-4	0.25 in. (6.35 mm)	367	5330	299	4340	231	3350
8-6	0.37 in. (9.52 mm)	317	4600	245	3550	172	2500
8	0.50 in. (12.7 mm)	483	7000	388	5625	293	4250
10	0.62 in. (15.87 mm)	390	5660	319	4630	248	3600
12	0.75 in. (19.05 mm)	317	4600	245	3550	172	2500
16	1.00 in. (25.4 mm)	248	3600	193	2800	138	2000
20	1.25 in. (31.75 mm)	190	2760	157	2280	124	1800
24	1.50 in. (38.1 mm)	168	2430	135	1965	103	1500
32	2.00 in. (50.8 mm)	121	1760	97	1405	72	1050

Pressure Ratings for NPT End Fittings

Size	ISO/NPT Pipe Size in. (mm)	Female (Mating Thread)	
		bar	psig
8-4	0.25 in. (6.35 mm)	408	5922
8-6	0.37 in. (9.52 mm)	324	4700
8	0.50 in. (12.7 mm)	305	4418
10	0.75 in. (19.05 mm)	285	4136
12	0.75 in. (19.05 mm)	285	4136
16	1.00 in. (25.4 mm)	278	4042
20	1.25 in. (31.75 mm)	324	4700
24	1.50 in. (38.1 mm)	291	4230
32	2.00 in. (50.8 mm)	253	3666

NOTES:

1. Pressure ratings listed are for temperatures up to 100° F (37.8° C).
2. Pressure rating is calculated with an allowable stress value of 20,000 psi for 316 SS per pressure piping code ASME B31.3.
3. Chart is displaying safe working pressure, in accordance with power piping code ASME B31.1.
4. It is recommended that the flow meter have "AN" end fittings and that the "NPT" transition be done on the far ends of the flow straighteners. This avoids a step in the flow stream next to the flow meter and produces an improved flow profile. If the NPT end fittings were selected for their high pressure rating, then the step is unavoidable and the calibration will account for the distorted profile.

Pressure Ratings for Flange End Fittings (in accordance with ASME B16.5 Standards)

ANSI Flange	PSIG	Bar
150#	275	19

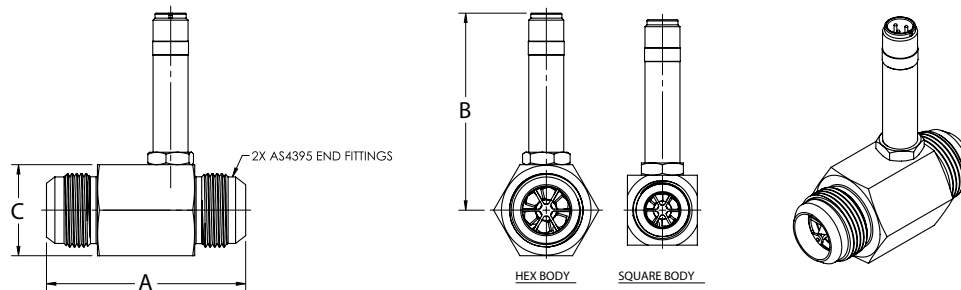
NOTES:

- Specifications from maximum non-shock allowable working pressure in psig at 100° F (37.8° C) or less.
- Stainless steel 316A-181 material.

DIMENSIONS

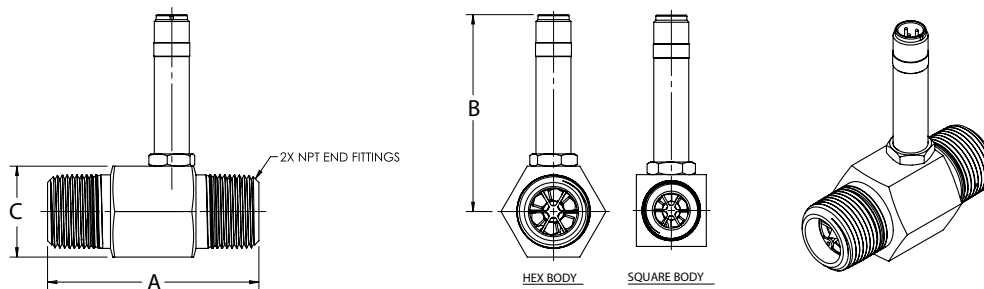
Dimension B specifies the most common pickup type. Actual size may vary depending on pickup choice. Consult the factory for details.

AN End Fitting



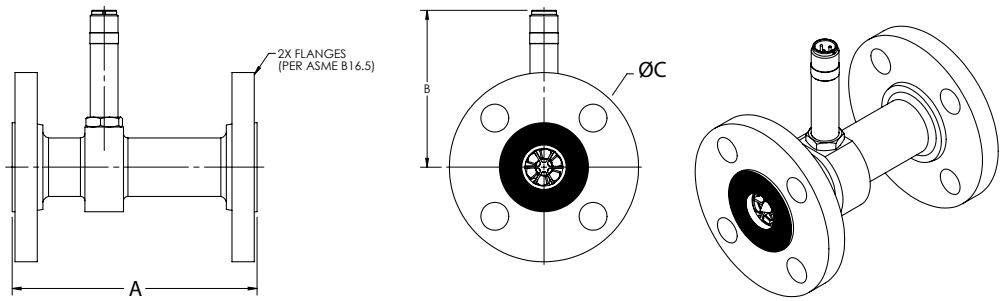
Size	End Fitting	A	B (RF)	B (MAG)	C
8-4	0.50 in. (12.70 mm)	2.45 in. (62.23 mm)	3.20 in. (81.28 mm)	2.70 in. (68.58 mm)	1.12 in. (28.45 mm) Square Body
8-6	0.50 in. (12.70 mm)	2.45 in. (62.23 mm)	3.20 in. (81.28 mm)	2.70 in. (68.58 mm)	1.12 in. (28.45 mm) Square Body
8	0.50 in. (12.70 mm)	2.45 in. (62.23 mm)	3.30 in. (83.82 mm)	2.80 in. (71.12 mm)	1.12 in. (28.45 mm) Square Body
10	0.625 in. (15.88 mm)	2.72 in. (69.08 mm)	3.30 in. (83.82 mm)	2.80 in. (71.12 mm)	1.25 in. (31.75 mm) Square Body
12	0.75 in. (19.05 mm)	3.25 in. (82.55 mm)	3.40 in. (86.36 mm)	2.90 in. (73.66 mm)	1.25 in. (31.75 mm) Square Body
16	1.00 in. (25.40 mm)	3.56 in. (90.42 mm)	3.50 in. (88.90 mm)	3.00 in. (76.20 mm)	1.63 in. (41.40 mm) Hex Body
20	1.25 in. (31.75 mm)	4.06 in. (103.1 mm)	3.60 in. (91.44 mm)	3.10 in. (78.74 mm)	1.88 in. (47.75 mm) Hex Body
24	1.50 in. (38.10 mm)	4.59 in. (116.6 mm)	3.80 in. (96.52 mm)	3.30 in. (83.82 mm)	2.25 in. (57.15 mm) Hex Body
32	2.00 in. (50.80 mm)	6.06 in. (153.9 mm)	4.00 in. (101.6 mm)	3.50 in. (88.90 mm)	2.75 in. (69.85 mm) Hex Body

NPT End Fitting



Size	End Fitting	A	B (RF)	B (MAG)	C
8-4	0.50 in. (12.70 mm)	2.70 in. (68.58 mm)	3.20 in. (81.28 mm)	2.70 in. (68.58 mm)	1.12 in. (28.45 mm) Square Body
8-6	0.50 in. (12.70 mm)	2.70 in. (68.58 mm)	3.20 in. (81.28 mm)	2.70 in. (68.58 mm)	1.12 in. (28.45 mm) Square Body
8	0.50 in. (12.70 mm)	2.70 in. (68.58 mm)	3.30 in. (83.82 mm)	2.80 in. (71.12 mm)	1.12 in. (28.45 mm) Square Body
10	0.75 in. (19.05 mm)	3.29 in. (83.57 mm)	3.30 in. (83.82 mm)	2.80 in. (71.12 mm)	1.25 in. (31.75 mm) Square Body
12	0.75 in. (19.05 mm)	3.29 in. (83.57 mm)	3.40 in. (86.36 mm)	2.90 in. (73.66 mm)	1.25 in. (31.75 mm) Square Body
16	1.00 in. (25.40 mm)	3.78 in. (96.01 mm)	3.50 in. (88.90 mm)	3.00 in. (76.20 mm)	1.63 in. (41.40 mm) Hex Body
20	1.25 in. (31.75 mm)	4.23 in. (107.4 mm)	3.60 in. (91.44 mm)	3.10 in. (78.74 mm)	1.88 in. (47.75 mm) Hex Body
24	1.50 in. (38.10 mm)	4.67 in. (118.6 mm)	3.80 in. (96.52 mm)	3.30 in. (83.82 mm)	2.25 in. (57.15 mm) Hex Body
32	2.00 in. (50.80 mm)	5.89 in. (149.6 mm)	4.00 in. (101.6 mm)	3.50 in. (88.90 mm)	2.75 in. (69.85 mm) Hex Body

Flange End Fitting



Size	A	B (RF)	B (MAG)	C—150# Flange
8-4	5.00 in. (127.0 mm)	3.20 in. (81.28 mm)	2.70 in. (68.58 mm)	3.50 in. (89 mm)
8-6	5.00 in. (127.0 mm)	3.20 in. (81.28 mm)	2.70 in. (68.58 mm)	3.50 in. (89 mm)
8	5.00 in. (127.0 mm)	3.30 in. (83.82 mm)	2.80 in. (71.12 mm)	3.50 in. (89 mm)
10	5.50 in. (139.7 mm)	3.30 in. (83.82 mm)	2.80 in. (71.12 mm)	3.50 in. (89 mm)
12	5.50 in. (139.7 mm)	3.40 in. (86.36 mm)	2.90 in. (73.66 mm)	3.88 in. (99 mm)
16	5.50 in. (139.7 mm)	3.50 in. (88.90 mm)	3.00 in. (76.20 mm)	4.25 in. (108 mm)
20	6.00 in. (152.4 mm)	3.60 in. (91.44 mm)	3.10 in. (78.74 mm)	4.62 in. (117 mm)
24	6.00 in. (152.4 mm)	3.80 in. (96.52 mm)	3.30 in. (83.82 mm)	5.00 in. (127 mm)
32	6.50 in. (165.1 mm)	4.00 in. (101.6 mm)	3.50 in. (88.90 mm)	6.00 in. (152 mm)

METER MODEL NUMBER

Cox Precision Turbine Flow Meters

Model					
Precision Turbine	CPT				
Meter Size					
8-4 (1/2" End Fitting, 1/4" Bore)	84				
8-6 (1/2" End Fitting, 3/8" Bore)	86				
8 (1/2" End Fitting, 1/2" Bore)	08				
10 (5/8" End Fitting)	10				
12 (3/4" End Fitting)	12				
16 (1" End Fitting)	16				
20 (1-1/4" End Fitting)	20				
24 (1-1/2" End Fitting)	24				
32 (2" End Fitting)	32				
End Fitting Type					
37° MS Flare (Standard)		AN			
National Pipe Thread		NP			
150# ANSI Raised Face Flange		F1			
Bearing					
Hybrid Ceramic Ball Bearing, Water/Hydrocarbon Service (Sizes 84, 86, 10...32)			C		
Stainless Steel Ball Bearing, Hydrocarbon Service (Size 8)			H		
Pickoff					
RF 2-Pin MS -250...400° F					C01
RF 2-Flying Leads -250...400° F					C02
RF 4-Flying Leads -330...450° F RTD					C03
RF 4-Pin MS3113-8HA-4P -300...450° F RTD					C13
RF 3-Pin MS -40...248° F Amp					C06
RF 6-Pin MS -49...284° F Amp, RTD					C07
RF 3-Flying Leads -40...248° F Amp					C09
MAG 2-Pin MS -450...450° F Sizes 8-4 and 8-6 45-55 G					M01
MAG 2-Pin MS -450...450° F Size 8...32 140-150 G					M02
MAG NPT 2-Flying Lead -450...450° F Sizes 8...32 140...150 G					M25
MAG NPT 2-Flying Lead -450...450° F Sizes 8-4 and 8-6 45...55 G					M36

NOTE: Meters are available with signal conditioners or flow computers, and can be calibrated using water, solvent or oil blends.

Control. Manage. Optimize.

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