

2800 Series Flanged Magnetic Flowtubes
ptfe, pfa, or Polyurethane Lined 1/10 through 12 in Sizes



2800 SERIES
MAGNETIC FLOWTUBES
15 TO 300 mm
(1/2 TO 12 in)
FLOWTUBE SIZES

2800 SERIES
MAGNETIC FLOWTUBES
2.5 AND 6 mm
(1/10 AND 1/4 in)
FLOWTUBE SIZES



The Foxboro[®] brand 2800 Series Magnetic Flowtubes are used with Model IMT96 MagEXPERT Intelligent Magnetic Flow Transmitters using eX-Pulse coil excitation, and Model E96 Magnetic Flow Transmitters using ac coil excitation, and Model IMT25 Magnetic Flow Transmitters using pulsed dc coil excitation. They measure the volumetric flow rate of virtually any conductive liquid. For 2800 Series flowtubes in 14 through 36 in sizes, see PSS 1-6B5 E. For 2800 Series Sanitary Flowtubes in 1/2 through 3 in sizes, see PSS 1-6B5 C.

**SUPERIOR REPUTATION FOR
DEPENDABILITY AND QUALITY**

The magnetic flow measurement systems were introduced to the process industries in 1954 and have demonstrated the broadest and most time-proven application expertise with tens of thousands of successful installations.

**USED WITH eX-Pulse, ac, OR PULSED DC
TRANSMITTERS**

The 2800 Series Magnetic Flowtubes are calibrated for use with eX-Pulse coil excitation with the Model IMT96 MagEXPERT Transmitters, or for use with ac coil excitation with the Model E96 Transmitters, or for use with Pulsed dc coil excitation with the Model IMT25 Transmitters. Numerous calibration options with the above transmitters are offered.

EXCELLENT ZERO STABILITY

Excellent zero stability is inherent in the design that features accurately located and securely mounted coil and electrode assemblies, spring-loaded electrodes, optimized field characterization, and power-driven screens (shields) on the signal leads. All of these features ensure the ultimate in long-term stability and accurate measurement.

HOUSING CONSTRUCTION

These flowtubes are offered with a selection of a Weatherproof housing, a High Humidity/High Condensate housing, and a Total/Accidental Submergence Housing. See paragraphs below.

Weatherproof Housing

This housing is designed for harsh in-plant or outdoor environments. It is weatherproof as defined by IEC IP65, and provides the watertight and corrosion-resistant protection of NEMA Type 4X. Select Housing Code -G if with a remote mounted transmitter; and select Housing Code -T if with an integrally mounted Model E96 Transmitter.

High Humidity/High Condensate Housing

Only offered when transmitter is mounted in a remote location. This construction consists of special sealing techniques to help prevent internal formation of condensate in applications involving cold process temperature and warm ambient, e.g., brewery or dairy processes. Select Housing Code -C.

Total/Accidental Submergence Housing

Only offered when transmitter is mounted in a remote location. The weatherproof flowtube housing is factory sealed for accidental or continuous operation under water up to a maximum depth of 9 m (30 ft). A field kit is provided to the customer for final sealing after site installation. Select Housing Code -N.

DESIGNED FOR WIDEST VARIETY OF LIQUIDS

A choice of ptfе, pfa, or polyurethane lining material, and a selection of electrode materials and shapes, enables these flowtubes to handle a wide variety of liquids ranging from water to slurries, and sticky, abrasive, and highly corrosive processes.

MULTI-AGENCY CERTIFICATION FOR HAZARDOUS LOCATIONS

These flowtubes meet Agency requirements for use in hazardous locations. Refer to ELECTRICAL SAFETY SPECIFICATIONS section.

PED QUALIFICATION

This product is qualified for SEP (Standard Engineering Practice) Category 1 with Group 2 fluids (nonhazardous).

FLOWTUBE CALIBRATION

All flowtubes are wet calibrated to verify their specified accuracy with traceability to the U.S. National Institute of Science and Technology (NIST). The calibration produces a calibration factor that is needed to accurately configure the transmitter. The calibration factors for use with a Model IMT96 MagEXPERT, Model E96, or Model IMT25 Transmitter are different. The selection of calibration type is via the Model Code (see Model Code section - Nominal Supply Voltage and Frequency). If the transmitter type is changed later, the calibration factor can be converted by calculation. This calibration factor, however, will be slightly less accurate than that derived by wet calibration.

FlowExpertPro™

FlowExpertPro is a program primarily used to size Foxboro flowmeters. It also ensures that the user has selected the proper flowmeter type for his application.

This meter selection tool is provided as a free web site to all users, without the need for registration. In addition to flowmeter selection and sizing, FlowExpertPro includes the following features:

- ▶ Incorporates a large library of the physical properties of typical process fluids.
- ▶ Displays results in tabular or graphic format.
- ▶ Allows user to save, print, or E-mail results.
- ▶ Provides reference to applicable flowmeter PSSs and other related flowmeter documentation.

provides ANSI or metric flange recommendations for predicted flow pressure and temperature. You are invited to visit www.FlowExpertPro.com to access this program, or contact Global Customer Support for further information, and technical support.

The program calculates minimum and maximum flow rates, rangeability, pressure loss, and Reynolds Number, using established flow equations. It also allows for material and flange selection, and

OPERATING CONDITIONS

Influence	Reference Operating Conditions (a)	Normal Operating Condition Limits (a)	Operative Limits (a)
Ambient Temperature	23 ±2°C (73 ±3°F)	-10 and +50°C (20 and 120°F)	-30 and +60°C (-20 and +140°F)
Process Pressure and Process Temperature	Varies with Line Size, Flange Rating, and Lining Material. Refer to Figure 1 and Table 1.		

a. Temperatures listed are for the flowtubes only, refer to applicable transmitter PSS for transmitter specifications.

PERFORMANCE SPECIFICATIONS

(Combined Flowtube And Transmitter System Under Reference Operating Conditions)

2800 Flowtube with Model E96	See PSS 1-6C1 A
2800 Flowtube with Model IMT96 MagEXPERT	See PSS 1-6F8 A
2800 Flowtube with Model IMT25 (FoxCom/HART)	See PSS 1-6F5 A
2800 Flowtube with Model IMT25 (Foundation Fieldbus)	See PSS 1-6F5 B
2800 Flowtube with Model IMT25L (FoxCom)	See PSS 1-6F6 A

FUNCTIONAL SPECIFICATIONS

Nominal Line Sizes

2.5, 6, 15, 25, 40, 50, 80, 100, 150, 200, 250, and 300 mm

(1/10, 1/4, 1/2, 1, 1 1/2, 2, 3, 4, 6, 8, 10, and 12 in)

NOTE

The 2.5 and 6 mm (1/10 and 1/4 in) Flowtube sizes are used with the Model E96 Transmitter only.

End Connections

ANSI and Metric flanges. Refer to Model Code Table for flange type, ratings, and material.

Process Pressure and Temperature Limits

See Figure 1 and Table 2.

Power Consumption

Refer to Table 3.

Signal and Power Cables

See OPTIONAL SELECTIONS AND ACCESSORIES section.

Minimum and Maximum Flow Measurement Ranges

The Model IMT96 MagEXPERT, Model E96, or Model IMT25 Transmitter, when used with a 2800 Series Flowtube, can be adjusted to vary the flowrate required to produce a 100% output signal. The minimum and maximum flow measurement ranges for each flowtube size are listed in Table 3. Normally, selecting the flowtube size is as simple as matching the pipeline size. Table 3 can be used to verify this selection, or to select a different size, if your flowrate is unusual. The minimum upper range value (URV) reflects that flowrate required to generate enough flow signal to produce a 100% output. The maximum URV mainly refers to liner wear with normal fluids. Depending on the abrasiveness of the process fluid, the maximum URV limit should be reduced. Also visit FlowExpertPro.com.

Minimum Conductivity of Process Liquid

The minimum required conductivity is 2 $\mu\text{S/cm}$ for 15 to 300 mm (1/2 to 12 in) sizes, and 5 $\mu\text{S/cm}$ for 2.5 and 6 mm (1/10 and 1/4 in) sizes. Refer to Model IMT96 MagEXPERT, Model E96, or Model IMT25 Transmitter literature for additional information relating to the relationship between conductivity and cable configuration (length, type, and installation). For the electrical conductivity of more than 200 process liquids, refer to TI 027-072.

Process Liquid Ground

Grounding is through the flange bolts if the connecting piping is unlined metal. If the connecting piping is nonmetallic or lined, grounding rings are required at each end of the flowtube. Grounding rings are available.

Upstream and Downstream Piping

The flowtube should have straight, unobstructed piping for a distance of five pipe diameters (5 PDs) upstream and 3 PDs downstream (measured from the center of the flowtube) to ensure optimum performance. Adjacent process piping should have the same diameter or be slightly larger than the flowtube.

Lining and Electrode Application Guide

pfa and ptfe flowtube linings are generally selected for most corrosive liquid applications. Polyurethane is generally selected for wear resistance. See Table 1 for recommended lining applications.

Also refer to TI 27-71f (Magnetic Flowtube Material Selection Guide) for ratings of process-wetted materials (linings and electrodes) with over 150 process liquids.

Table 1. Fluid Characteristics versus Flowtube Lining - Application Guide

Flowtube Lining	Fluid Characteristic (a) (b)					
	Clean	Mild Corrosion	Severe Corrosion	Mild Abrasion	Severe Abrasion (c)	Mild Corrosion and Abrasion
ptfe/pfa	A	A	A	B	X	B
Polyurethane	A	B	X	A	A	B

(a) A = Preferred: Generally considered best choices.

B = Satisfactory: Reasonable life under most conditions.

X = Not Recommended: Generally considered unsuitable.

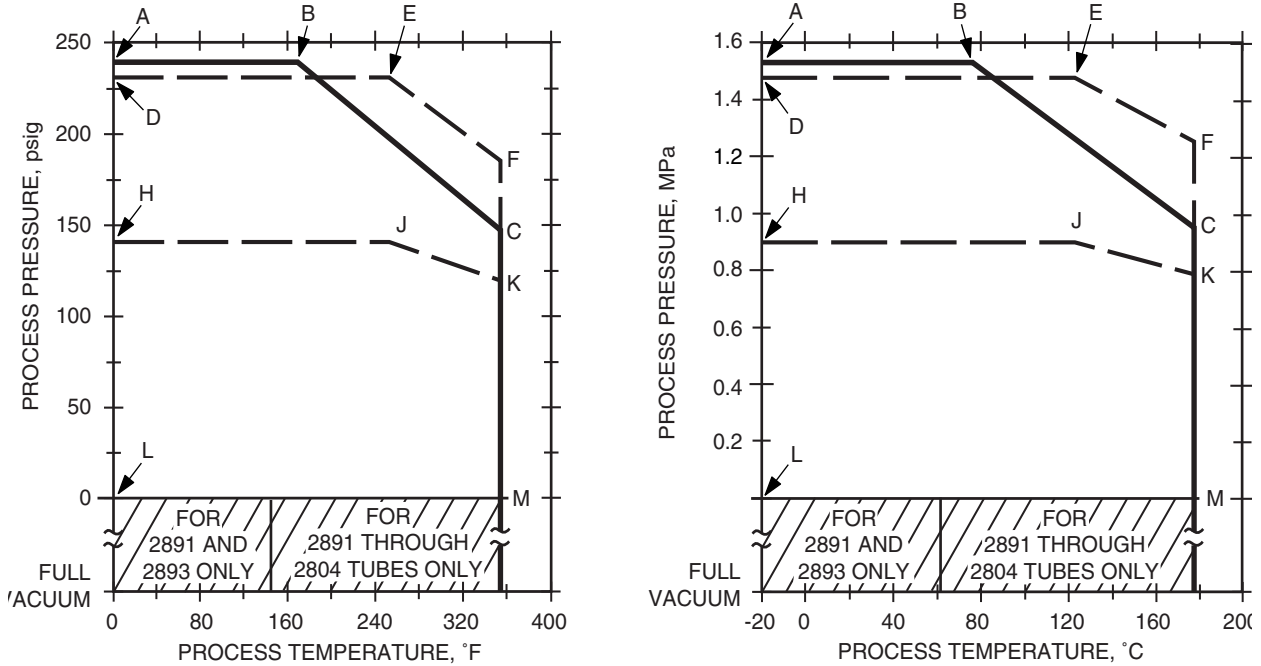
(b) Severe abrasion rating also includes/considers effects on electrode.

(c) This product is qualified for SEP (Standard Engineering Practice) Category 1 with Group 2 fluids (nonhazardous).

Process Temperature and Pressure Limits for Flowtubes with pfa Lining (Models 2891 and 2893) and ptfe Lining (Models 280H to 2812)

Refer to Figure 1 below.

Figure 1. Process Temperature and Pressure Limits for Flowtubes with pfa or ptfe Lining



NOTES

- Process pressure and temperature must be within the following boundaries:
 - L-ABC-M for flowtubes with ANSI Class 150 or 300 flanges
 - L-H-J-K-M for flowtubes with PN 10 flanges
 - L-D-E-F-M for flowtubes with PN 16, 25, or 40 flanges
- Contact Global Customer Support for applications involving elevated pressure.

**Process Temperature and Pressure Limits for Flowtubes with Polyurethane Lining
(Models 2802 to 2812)**

Refer to Table 2.

Table 2. Process Pressure and Temperature Limits for Flowtubes with Polyurethane Lining Models 2802 to 2812

Flange Rating	Nominal Line Size (See Model Code Section)	Process Pressure Limits		Process Temperature Limits	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
ANSI Class 150	2802 to 2812	Full Vacuum	1.7 MPa (240 psig)	-18°C (0°F)	71°C (160°F)
ANSI Class 300	2802 to 2804	Full Vacuum	4.8 MPa (700 psig)	-18°C (0°F)	71°C (160°F)
	2806 and 2808	Full Vacuum	1.7 MPa (240 psig)	-18°C (0°F)	71°C (160°F)
Metric PN 10	2802 to 2812	Full Vacuum	1.0 MPa (145 psig)	-18°C (0°F)	71°C (160°F)
Metric PN 16	2802 to 2812	Full Vacuum	1.6 MPa (232 psig)	-18°C (0°F)	71°C (160°F)
Metric PN 25	2802 to 2804	Full Vacuum	2.5 MPa (362 psig)	-18°C (0°F)	71°C (160°F)
	2806 to 2812	Full Vacuum	1.7 MPa (240 psig)	-18°C (0°F)	71°C (160°F)
Metric PN 40	2802 to 2804	Full Vacuum	4.0 MPa (580 psig)	-18°C (0°F)	71°C (160°F)
	2806 to 2812	Full Vacuum	1.7 MPa (240 psig)	-18°C (0°F)	71°C (160°F)

Table 3. Flowtube Selection Table based on Transmitter Model, Flow Measurement Range, and Liner Material

Line Size		Transmitter Model (f)	Power to Flowtube			Flow Measurement Range (c)				Liner Mat'l (d)
mm	in		Supply Voltage and Coil Connection (a) (b)	Watts	VA	Minimum L/min	Maximum L/min	Minimum U.S.gpm	Maximum U.S. gpm	
2.5	1/10	E96	(A, D, or E)[s] B [s]; C [p]	48 48	525 525	0 to 0.3 0 to 0.3	0 to 3	0 to 0.08 0 to 0.08	0 to 0.8	pfa
6	1/4	E96	(A, C, D, or E)[s] B [s]; (A, C, or D)[p]	13 62	180 720	0 to 1.92 0 to 0.96	0 to 19	0 to 0.50 0 to 0.25	0 to 5	pfa
15	1/2	E96	(A, C, D, or E)[s] B [s]; (A, C, or D)[p]	17 95	275 1220	0 to 8.4 0 to 4.2	0 to 75	0 to 2.2 0 to 1.1	0 to 20	ptfe
		IMT96	Pwr by IMT96[s]	-	70	0 to 4.2		0 to 1.1		
25	1	E96	(A, C, D, or E)[s] B [s]; (A, C, or D)[p]	13 60	195 775	0 to 30 0 to 15	0 to 290	0 to 8 0 to 4	0 to 76	ptfe
		IMT96	Pwr by IMT96[s]	6	70	0 to 15		0 to 4		
40	1 1/2	E96	(A, C, D, or E) [s] B [s]; (A, C, or D)[p]	14 67	175 690	0 to 75 0 to 37.5	0 to 740	0 to 20 0 to 10	0 to 195	ptfe
		IMT96	Pwr by IMT96[s]	-	70	0 to 37.5		0 to 10		
50 (e)	2 (e)	E96	(A, C, D, or E)[s] B [s]; (A, C, or D)[p]	13 62	160 625	0 to 120 0 to 60	0 to 1260	0 to 32 0 to 16	0 to 335	ptfe
		IMT96	Pwr by IMT96[s]	-	70	0 to 60		0 to 16		

Table 3. Flowtube Selection Table based on Transmitter Model, Flow Measurement Range, and Liner Material (Continued)

Line Size		Transmitter Model (f)	Power to Flowtube			Flow Measurement Range (c)				Liner Mat'l (d)
mm	in		Supply Voltage and Coil Connection (a) (b)	Watts	VA	Minimum L/min	Maximum L/min	Minimum U.S.gpm	Maximum U.S. gpm	
50 (e)	2 (e)	E96	(A, C, D, or E)[s] B [s]; (A, C, or D)[p]	13 62	160 625	0 to 84 0 to 42	0 to 600	0 to 22 0 to 11	0 to 160	poly
		IMT96	Pwr by IMT96[s]	-	70	0 to 42		0 to 11		
80 (e)	3 (e)	E96	(A, C, D, or E)[s] B [s]; (A, C, or D)[p]	19 91	160 625	0 to 270 0 to 135	0 to 2900	0 to 70 0 to 35	0 to 770	ptfe
		IMT96	Pwr by IMT96[s]	-	70	0 to 135		0 to 35		
80 (e)	3 (e)	E96	(A, C, D, or E)[s] B [s]; (A, C, or D)[p]	19 91	160 625	0 to 228 0 to 114	0 to 1930	0 to 60 0 to 30	0 to 510	poly
		IMT96	Pwr by IMT96[s]	-	70	0 to 114		0 to 30		
100 (e)	4 (e)	E96	(A, C, D, or E)[s] B [s]; (A, C, or D)[p]	21 100	150 595	0 to 490 0 to 245	0 to 5100	0 to 130 0 to 65	0 to 1350	ptfe
		IMT96	Pwr by IMT96[s]	-	70	0 to 245		0 to 65		
100 (e)	4 (e)	E96	(A, C, D, or E)[s] B [s]; (A, C, or D)[p]	21 100	150 595	0 to 384 0 to 192	0 to 3240	0 to 100 0 to 50	0 to 855	poly
		IMT96	Pwr by IMT96[s]	-	70	0 to 192		0 to 50		
150 (e)	6 (e)	E96	(A, C, D, or E)[s] B [s]; (A, C, or D)[p]	36 169	240 950	0 to 1140 0 to 570	0 to 11 400	0 to 300 0 to 150	0 to 3000	ptfe
		IMT96	Pwr by IMT96[s]	-	70	0 to 570		0 to 150		
150 (e)	6 (e)	E96	(A, C, D, or E)[s] B [s]; (A, C, or D)[p]	36 169	240 950	0 to 960 0 to 480	0 to 8800	0 to 260 0 to 130	0 to 2300	poly
		IMT96	Pwr by IMT96[s]	-	70	0 to 480		0 to 130		
200 (e)	8 (e)	E96	(A, C, D, or E)[s] B [s]; (A, C, or D)[p]	50 232	285 1140	0 to 2040 0 to 1020	0 to 19 500	0 to 520 0 to 260	0 to 5150	ptfe
		IMT96	Pwr by IMT96[s]	-	70	0 to 1020		0 to 260		
200 (e)	8 (e)	E96	(A, C, D, or E)[s] B [s]; (A, C, or D)[p]	50 232	285 1140	0 to 1800 0 to 900	0 to 16 400	0 to 480 0 to 240	0 to 4300	poly
		IMT96	Pwr by IMT96[s]	-	70	0 to 900		0 to 240		
250 (e)	10 (e)	E96	(A)[p]; (B,C, D, or E)[s] (B, C, or D)[p]	83 345	450 1880	0 to 3000 0 to 1500	0 to 31 000	0 to 800 0 to 400	0 to 8200	ptfe
		IMT96	Pwr by IMT96[s]	-	70	0 to 1500		0 to 400		
250 (e)	10 (e)	E96	(A)[p]; (B,C, D, or E)[s] (B, C, or D)[p]	83 345	450 1880	0 to 2880 0 to 1440	0 to 27 000	0 to 750 0 to 375	0 to 7150	poly
		IMT96	Pwr by IMT96[s]	-	70	0 to 1440		0 to 375		
300 (e)	12 (e)	E96	(A)[p]; (B,C, D, or E)[s] (B, C, or D)[p]	91 375	465 2040	0 to 4500 0 to 2250	0 to 44 200	0 to 1200 0 to 600	0 to 11 700	ptfe
		IMT96	Pwr by IMT96[s]	-	70	0 to 2250		0 to 600		

Table 3. Flowtube Selection Table based on Transmitter Model, Flow Measurement Range, and Liner Material (Continued)

Line Size		Transmitter Model (f)	Power to Flowtube			Flow Measurement Range (c)				Liner Mat'l (d)
mm	in		Supply Voltage and Coil Connection (a) (b)	Watts	VA	Minimum L/min	Maximum L/min	Minimum U.S.gpm	Maximum U.S. gpm	
300 (e)	12 (e)	E96	(A)[p]; (B,C, D, or E)[s] (B, C, or D)[p]	91 375	465 2040	0 to 4200 0 to 2100	0 to 39 600	0 to 1100 0 to 550	0 to 10 450	poly
		IMT96	Pwr by IMT96[s]	–	70	0 to 2100		0 to 550		

- (a) A = 120 V ac, 60 Hz; B = 240 V ac, 60 Hz; C = 120 V ac, 50 Hz; D = 220 V ac, 50 Hz; E = 240 V ac, 50 Hz; and [s] = Series connection of the flowtube coils; and [p] = Parallel connection of the flowtube coils.
- (b) IMT96 (MagEXPERT) Power Options are 120, 240 V ac, 60 Hz, or 230 V ac, 50 Hz. In table above, Pwr = power. IMT96 Transmitters may only be connected to 2800 Series Flowtubes which have coils in series [s] connection.
- (c) Higher flow rates are permissible, but may accelerate liner wear.
- (d) pfa = perfluoroalkoxy; ptfe = polytetrafluoroethylene (Teflon); poly = polyurethane.
- (e) Sizes from 50 mm (2 in) and above are shown twice, first with a ptfe liner and then with a polyurethane liner. Note the higher flow measurement ranges when the ptfe liner is used.
- (f) Contact Global Customer Support if flowtubes are to be used with the Model IMT25 Transmitter.

PHYSICAL SPECIFICATIONS

Enclosure

The housing is cast from low-copper aluminum alloy and silicone rubber sealant is used in all joints. The overall construction meets the dusttight and weatherproof rating of IP65 as defined by IEC 60529, and provides the environmental and corrosion resistant protection rating of NEMA 4X.

Enclosure Finish

High-build epoxy paint.

Electrical Connections

The housing has three 3/4 NPT tapped holes. Two for power conduit fittings and one for signal conduit fitting. Refer to "OPTIONAL SELECTIONS AND ACCESSORIES" section for cable glands offered for nonconduit applications, or a signal cable seal for conduit applications.

End Connection

ANSI Class 150 and 300 raised face flanges, and Metric PN 10, PN 16, PN 25, and PN 40 raised face flanges, as specified. Refer to Figure 1 and Figure 2 for process pressure and temperature limits with each flange type and line size.

Mounting Position

The flowtube can be mounted in any orientation provided it remains full of process liquid and the electrodes are in a horizontal plane.

Data Plate

Stainless steel data plate fastened to instruments with drive screws. Includes space for customer tag data up to a maximum of 60 characters and spaces. For additional space, see Optional Customer Tag.

Metering Tube

300 Series stainless steel with pfa, ptfe, or polyurethane lining, as specified.

Electrode Materials

MODELS 2891 AND 2893

Hastelloy C, or platinum -10% iridium

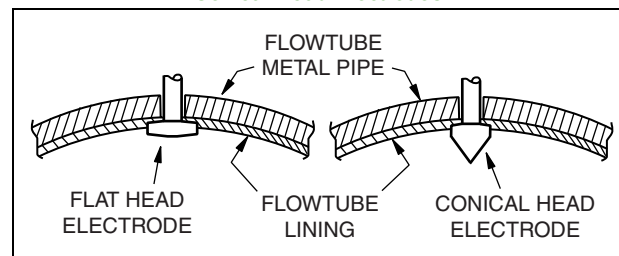
MODELS 280H TO 2812

316L ss for both ptfe and polyurethane. Other electrodes available for flowtubes with ptfe lining are Hastelloy C, tantalum-tungsten, titanium, or platinum-10% iridium.

Flat Head and Conical Head Electrodes

Standard flat head electrodes are offered with all electrode materials. The conical head electrode is offered when fluids can cause coatings to deposit on the electrode surface, possibly degrading measurement accuracy. Conical head electrodes are available in 316L ss or Hastelloy C materials for 25 through 300 mm (1 through 12 in) flowtube sizes. The conical head extends out through deposits into a higher velocity area of the flow profile where process liquid tends to sweep the electrodes clean. See Figure 2 for flat and conical head electrode configurations.

Figure 2. Inside Surface of Flowtube Showing Flat Head and Conical Head Electrodes



Approximate Mass

See table below.

Nominal Line Size	Approx. Mass	Nominal Line Size	Approx. Mass	Nominal Line Size	Approx. Mass	Nominal Line Size	Approx. Mass
25 mm (0.1 in)	13 kg (35 lb)	25 mm (1 in)	18 kg (40 lb)	80 mm (3 in)	27 kg (60 lb)	200 mm (8 in)	85 kg (188 lb)
6 mm (1/4 in)	13 kg (35 lb)	40 mm (1 1/2 in)	20 kg (45 lb)	100 mm (4 in)	34 kg (76 lb)	250 mm (10 in)	91 kg (200 lb)
15 mm (1/2 in)	21 kg (46 lb)	50 mm (2 in)	21 kg (47 lb)	150 mm (6 in)	55 kg (122 lb)	300 mm (12 in)	125 kg (275 lb)

ELECTRICAL SAFETY SPECIFICATIONS

Testing Laboratory, Types of Protection and Area Classification	Conditions of Certification	Certification Specification
CSA certified for use in Class I, Groups A, B, C, and D, Division 2.	–	CS-E/CN-A
CSA certified for Type Y Purging for Class I, Groups A, B, C, and D, Division 1.	–	CS-E/CP-A
FM approved for use in nonincendive Class I, Groups A, B, C, and D, Division 2.	–	CS-E/FN-A
FM approved for Type Y purging, intrinsically safe connection for Class I, Groups A, B, C, and D, Division 1.	–	CS-E/FP-A (a)
PTB certified EEx e (ib) for IIC, Zone 1 (CENELEC).	280H to 2808 with 220 V, 50 Hz coils only. Coils can be series or parallel connected, but cannot be changed in the field. Use only with PTB certified E96. Temperature Class per Table 4.	CS-E/PS-E

(a) Refer to Global Customer Support for use with Ultrasonic Electrode Cleaning options, or Submersible construction.

Table 4. Temperature Classification for PTB Certified Flowtubes in ac Systems (Model E96 Transmitter)

Nominal Line Size		Series Connected Coils, 220 V, 50 Hz Only Process Temperature Classification				Parallel Connected Coils, 220 V, 50 Hz Only Process Temperature Classification			
mm	in	T3	T4	T5	T6	T3	T4	T5	T6
15	1/2	155°C	110°C	–	80°C	155°C	–	–	–
25	1	155°C	110°C	–	80°C	155°C	110°C	70°C	–
40	1 1/2	155°C	110°C	–	80°C	155°C	–	–	–
50	2	155°C	110°C	–	80°C	155°C	–	–	–
80	3	155°C	110°C	–	80°C	155°C	110°C	70°C	–

Table 4. Temperature Classification for PTB Certified Flowtubes in ac Systems (Model E96 Transmitter)
(Continued)

Nominal Line Size		Series Connected Coils, 220 V, 50 Hz Only Process Temperature Classification				Parallel Connected Coils, 220 V, 50 Hz Only Process Temperature Classification			
mm	in	T3	T4	T5	T6	T3	T4	T5	T6
100	4	155°C	110°C	–	80°C	155°C	–	100°C	–
150	6	155°C	110°C	–	80°C	155°C	–	70°C	–
200	8	155°C	110°C	–	70°C	155°C	–	–	–

OPTIONAL SELECTIONS AND ACCESSORIES

Power Wiring

Power wiring to the flowtube is dependent on the transmitter to be used. Refer to the applicable transmitter installation literature for more detail.

Signal Cable

Two-core (two-conductor), multiscreened (multishielded) cable with two driven screens (shields). Refer to applicable transmitter literature regarding the application and selection of this signal cable. Specify Part Number R0101ZS and length in feet if ordering the cable in units of feet; and Part Number B4017TE and length in meters if ordering the cable in units of meters.

Flowtube Calibration Certificate

When specified, a data sheet showing the results of the hydraulic flow calibration is supplied.

Certified System Calibration

The flowtube and the E96 Transmitter (with analog and/or pulse rate output option) are calibrated to $\pm 0.5\%$ of flow rate for flow velocities greater than 1 m/s ($\pm 0.5\%$ of the 1 m/s flow rate for flow velocities less than 1 m/s).

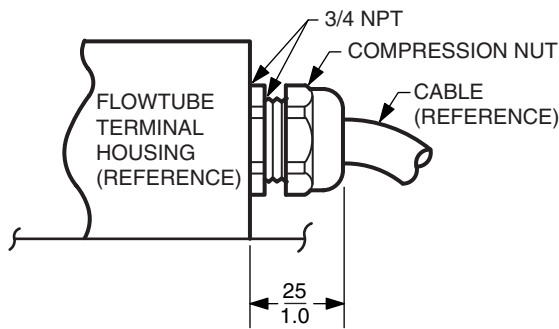
The flowtube and the Model IMT96 MagEXPERT or IMT25 Transmitter can be multi-point system calibrated to the standard accuracy (see applicable transmitter PSS).

A comprehensive certified system calibration report is provided with all data and graphs for five-point calibration distributed over the specified range. The specification for this option must identify the instruments (flowtube, transmitter, etc.) to be calibrated together. Specify Certified System Calibration.

Option -G: Signal Cable Gland (see Figure 3)

Usually selected for nonconduit applications. Used to provide rain tight, strain relieved entrance for the signal cable. External 3/4 NPT threads into flowtube terminal housing. Body and compression nut are nylon, and compression gland is neoprene. This type of gland can also be used on the transmitter (see applicable transmitter PSS). Three cable glands are provided. Selectable using Model Code Option -G.

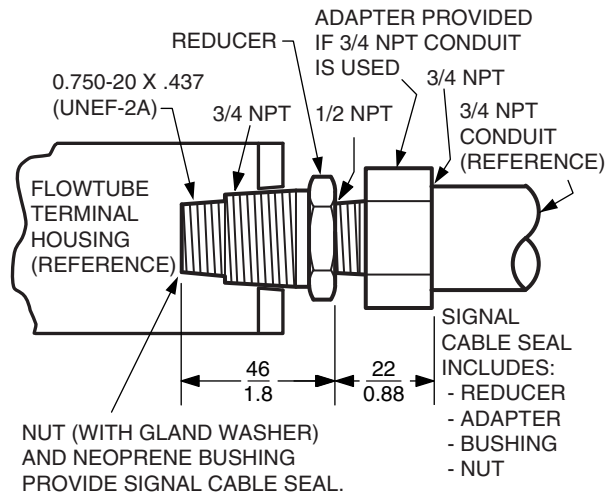
Figure 3. Option -G



Option -S: Signal Cable Seal (see Figure 4)

Usually selected for conduit applications to provide a means of clamping and sealing the signal cable. External 3/4 NPT threads into flowtube terminal housing. As installed, the cable seal accommodates a 1/2 NPT conduit. By removing the reducer, a 3/4 NPT conduit can be used. One signal cable seal is provided. Select Model Code Option -S.

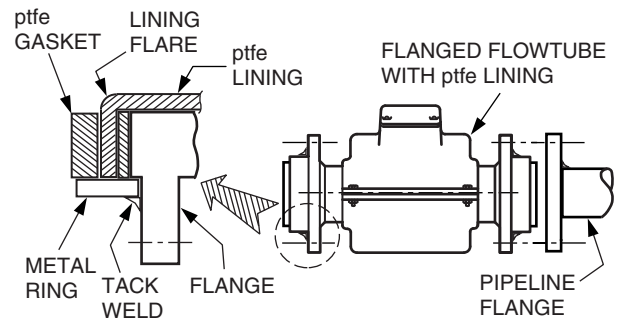
Figure 4. Option -S



Option -T: ptfе Lining Protector (see Figure 5)

A 13 mm (0.5 in) thick ptfе gasket is centered over the flowtube lining flare by a stainless steel ring which is tack welded to the flowtube flange. This option helps to prevent damage to the lining flare if the flange bolts are overtightened. It also helps to protect the lining from prying tool cuts when separating the mating flanges in the process line. Available for 15 through 300 mm (1/2 through 12 in) ptfе-lined flowtubes. Specify Option Suffix -T.

Figure 5. Option -T



Options -U, -W, and -Z: Ultrasonic Electrode Cleaning

Available on magnetic flow systems with -N or -G housings. Vibrations of 65 ± 10 kHz are continuously applied to electrodes, to prevent accumulation of coatings or to remove certain coatings which can interfere with the flow measurement. This option (Option Suffix -U) consists of two main components; a pair of electrode drivers (transducers) internal to the flowtube housing, and a pipe or wall mounted oscillator power supply unit, with 7.6 m (25 ft) connecting cable. Available on 50 to 300 mm (2 to 12 in) flowtubes, but is not available with PTB approved versions, nor with tantalum-tungsten or platinum 10% iridium electrodes.

To facilitate addition of ultrasonic cleaning in the field if needed, electrode drivers can be built-in (Option Suffix -Z), and the oscillator power supply can be purchased later.

Also available is an ultrasonic driver assembly with cable and junction box (Option Suffix -W) for use with a portable ultrasonic electrode cleaner (Part D0138NG).

Grounding Ring

If connecting piping is lined metal or nonmetallic, grounding rings are required at each end of the flowtube. Grounding rings (i.e., orifice plates) are available in 316 ss, Hastelloy C, Monel, and Tantalum material. Specify flowtube line size and lining material, in addition to grounding ring material. Contact Global Customer Support for further information.

Customer Tag

Stainless steel tag wired to instrument for customer tag data that doesn't fit on data plate. There can be a maximum of 10 lines of data with 40 characters and spaces per line. Specify AS Reference MTS.

MODEL CODES

Flowtube Models 2891 and 2893 - 2.5 and 6 mm (1/10 and 1/4 in) Line Sizes with pfa Lining

<u>Nominal Line Size</u>	<u>Code</u>
2.5 mm (1/10 in)	2891
6 mm (1/4 in)	2893
<u>Tube Construction</u>	
Stainless Steel - Investment Casting	-SB
<u>End Connections - All End Connections are 15 mm (1/2 in)</u>	
ANSI Class 150 RF Flange, AISI Type 316 stainless steel (316 ss)	BB
Metric PN 10, RF Flange, 316 ss (Mates with EN 1092-1)	ZL
Metric PN 16, RF Flange, 316 ss (Mates with EN 1092-1)	ZM
Metric PN 25, RF Flange, 316 ss (Mates with EN 1092-1)	ZN
Metric PN 40, RF Flange, 316 ss (Mates with EN 1092-1)	ZP
<u>Flowtube Lining</u>	
pfa (Perfluoroalkoxy)	-P
<u>Electrode Material and Head Style</u>	
Hastelloy C - Flat Head Electrode	H
Platinum - Flat Head Electrode	P
<u>Nominal Supply Voltage and Frequency - See Tables 3-5</u>	
For use with 120 V, 60 Hz (E96), (2891 w/Series Coils Only; 2893 w/Series or Parallel Coils) (a)	A
For use with 240 V, 60 Hz (E96), (2893 and Series Coils Only) (a)	B
For use with 120 V, 50 Hz (E96), (2891 w/Parallel Coils Only; 2893 w/Series or Parallel Coils) (a)	C
For use with 220 V, 50 Hz (E96), (2891 w/Series Coils Only; 2893 w/Series or Parallel Coils) (a)	D
For use with 240 V, 50 Hz (E96), (2891 and 2893 Series Coils Only) (a)	E
Calibration for Pulsed dc from 896 Transmitter (Series Coils Only) (b)	F
Dual Calibration for Either Pulsed dc from 896 Transmitter (b); or 120 V/240 V, 60 Hz (E96 Transmitter)	G
<u>Flowtube Housing and Transmitter Mounting</u>	
General Purpose, NEMA 4X Housing - Remote Mounted Transmitter	-G
Total/Accidental Submergence Housing - Remote Mounted Transmitter (d)	-N
High Humidity/Condensate Housing - Remote Mounted Transmitter (e)	-C
<u>Optional Selections</u>	
Cable Glands; Select for Nonconduit Applications (not available with -S Option) (c)	-G
Signal Cable Seal; Select for Conduit Applications (not available with -G Option) (c)	-S
Examples: 2891-SBBB-PHA-G, 2893-SBZN-PHD-GG	

- (a) When ordering these flowtubes with the Model IMT25 Transmitter, ECEP 13420D must be specified. Contact Global Customer Support.
- (b) 896 Series Transmitters have been withdrawn from sale. However, you can use this selection for a replacement tube used with an existing 896 Transmitter in the field.
- (c) The cable glands ("-G" option) selected here provide glands for field wiring to the flowtube junction box. Glands are generally specified in nonconduit applications. For conduit applications, specify Signal Cable Seal Option "-S".
- (d) Sealed for accidental or continuous operation under water up to 9 m (30 ft) deep. Supplied with a kit for final sealing after installation.
- (e) Recommended for warm ambient, cold process service; eg., brewery, dairy applications.

MODEL CODES

Flowtube Models 280H to 2812 - 15 to 300 mm (1/2 to 12 in) Line Sizes with ptfе and Polyurethane Lining

Nominal Line Size	Code
15 mm (1/2 in) Line Size	280H
25 mm (1 in) Line Size	2801
40 mm (1 1/2 in) Line Size	281H
50 mm (2 in) Line Size	2802
80 mm (3 in) Line Size	2803
100 mm (4 in) Line Size	2804
150 mm (6 in) Line Size	2806
200 mm (8 in) Line Size	2808
250 mm (10 in) Line Size	2810
300 mm (12 in) Line Size)	2812
Tube Construction	
2801 through 2812 Sizes only. AISI Type 304 Stainless Steel (304 ss), Schedule 10	-SA
280H Size Only: Stainless Steel - Investment Casting	-SB
End Connections	
ANSI Class 150 Raised Face (RF) Flange, Carbon Steel (cs)	BA
ANSI Class 150 RF Flange, 316 ss (280H to 2808 Only with ptfе Lining Only)	BB
ANSI Class 300 RF Flange, cs (280H to 2808 Only)	BD
Metric PN 10 RF Flange, cs (Mates with EN 1092-1)	ZD
Metric PN 16 RF Flange, cs (Mates with EN 1092-1)	ZE
Metric PN 25 RF Flange, cs (Mates with EN 1092-1)	ZF
Metric PN 40 RF Flange, cs (Mates with EN 1092-1)	ZG
Metric PN 10 RF Flange, 316 ss (280H to 2808 Only with ptfе Lining Only) (Mates with BS 4504)	ZL
Metric PN 16 RF Flange, 316 ss (280H to 2808 Only with ptfе Lining Only) (Mates with BS 4504)	ZM
Metric PN 25 RF Flange, 316 ss (280H to 2808 Only with ptfе Lining Only) (Mates with BS 4504)	ZN
Metric PN 40 RF Flange, 316 ss (280H to 2808 Only with ptfе Lining Only) (Mates with BS 4504)	ZP
Flowtube Lining	
Polyurethane - 2802 to 2812 Line Sizes Only	-A
ptfе (polytetrafluoroethylene) - Applicable to All Line Sizes	-T
Electrode Material and Head Style	
Tantalum-tungsten - Flat Head (with ptfе Lining Only)	B
316L ss - Conical Head (with ptfе Lining Only but not available with 280H)	C
Hastelloy C - Flat Head (with ptfе Lining Only)	H
Hastelloy C - Conical Head (with ptfе Lining Only but not available with 280H)	K
Platinum-10% iridium - Flat Head (with ptfе Lining Only)	P
316L ss - Flat Head	S
Titanium - Flat Head (with ptfе Lining Only)	T

MODEL CODES

MODEL CODES (CONTINUED)

Flowtube Models 280H to 2812 - 15 to 300 mm (1/2 to 12 in) Line Sizes with ptfе and Polyurethane Lining

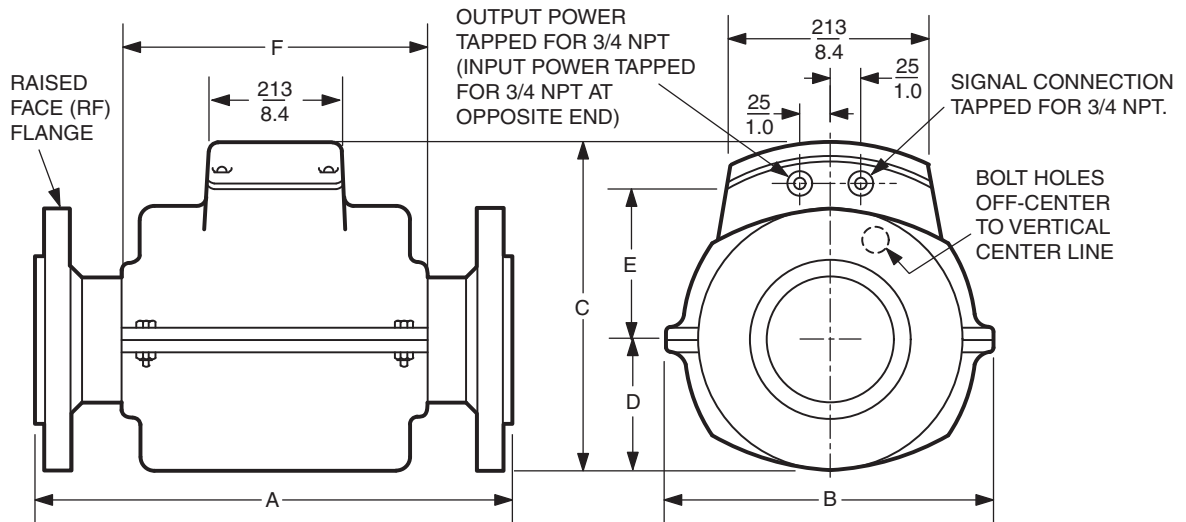
Nominal Supply Voltage and Frequency - See Table 2	
Calibration for use with 120 V, 60 Hz (E96)(Serial Coils not available with 2810 and 2812) (a)	A
Calibration for use with 240 V, 60 Hz (E96)(Parallel Coils not available with 280H to 2808) (a)	B
Calibration for use with 120 V, 50 Hz (E96) (a)	C
Calibration for use with 220 V, 50 Hz (E96) (a)	D
Calibration for use with 240 V, 50 Hz (E96) (Series Coils Only) (a)	E
Calibration for Pulsed dc from 896 Transmitter (b)	F
Dual Calibration for Pulsed dc from 896 Transmitter (b); or 120 V, 60 Hz (E96) or 120 V, 60 Hz (E96)	G
Calibration for use with IMT96, 60 Hz	K
Calibration for use with IMT96, 50 Hz	L
Dual Calibration for use with IMT96, or 120 V, 60 Hz (E96) (a)	M
Dual Calibration for use with IMT96, or 240 V, 60 Hz (E96) (a)	N
Dual Calibration for use with IMT96, or 120 V, 50 Hz (E96) (a)	Q
Dual Calibration for use with IMT96, or 230 V, 50 Hz (E96) (a)	R
Dual Calibration for use with IMT96, or 240 V, 50 Hz (E96) (a)	S
Flowtube Housing and Transmitter Mounting	
High Humidity/Condensate Housing - Remote Mounted Transmitter (e)	-C
General Purpose, NEMA 4X Housing - Remote Mounted Transmitter	-G
Total/Accidental Submergence Housing - Remote Mounted Transmitter (d)	-N
General Purpose, NEMA 4X Housing - Integrally Mounted Transmitter Available with Model E96 Transmitter only	-T
Optional Selections (More than one of the Options below may be selected, as applicable)	
Cable Glands; Select for Nonconduit Applications (not available with “-S” Option) (c)	-G
Signal Cable Seal; Select for Conduit Applications (not available with “-G” Option) (c)	-S
ptfe Lining Protector (with ptfе Flowtube Lining Only)	-T
Ultrasonic Electrode Cleaning - Transducer with Oscillator and Cable (2802 to 2812 Only)	-U
Ultrasonic Electrode Cleaning - Transducer, Cable, and Junction Box for Portable Oscillator (2802 to 2812 Only)	-W
Ultrasonic Electrode Cleaning - Transducer Only (2802 to 2812 Only)	-Z
Examples: 280H-SBBB-ATA-G-G; 2812-SASD-ASD-G-GW; 2802-SABB-TBA-GTU	

- (a) When ordering these flowtubes with the Model IMT25 Transmitter, ECEP 13420D must be specified. Contact IPS.
- (b) 896 Series Transmitters have been withdrawn from sale. However, you can use this selection for a replacement tube used with existing 896 Transmitter.
- (c) The cable glands (“-G” option) selected here provide glands for field wiring to the flowtube junction box. Glands are generally specified in nonconduit applications. For conduit applications, specify Signal Cable Seal Option “-S”.
- (d) Sealed for accidental or continuous operation under water up to 9 m (30 ft) deep. Supplied with a kit for final sealing after installation.
- (e) Recommended for warm ambient, cold process service; eg., brewery, dairy applications.

DIMENSIONS-NOMINAL

280H TO 2812 FLOWTUBE - 15 TO 300 mm (1/2 TO 12 in) SIZES

mm
in



FLANGE RATING

CLASS 150
CLASS 300 — ANSI

PN10
PN16
PN25
PN40 — BS 4504

FLANGE MATERIAL

316 ss
CARBON STEEL

Nominal Line Size		A	A**	B	C	D	E	F	Inside Diameter	
mm	in								ID*	ID**
15	1/2	$\frac{365}{14.4}$	—	$\frac{273}{10.8}$	$\frac{294}{11.6}$	$\frac{114}{4.5}$	$\frac{141}{5.6}$	$\frac{221}{8.7}$	$\frac{12.70}{0.500}$	—
25	1	$\frac{365}{14.4}$	—	$\frac{273}{10.8}$	$\frac{294}{11.6}$	$\frac{114}{4.5}$	$\frac{141}{5.6}$	$\frac{221}{8.7}$	$\frac{24.71}{0.973}$	—
40	1 1/2	$\frac{365}{14.4}$	—	$\frac{273}{10.8}$	$\frac{294}{11.6}$	$\frac{114}{4.5}$	$\frac{141}{5.6}$	$\frac{221}{8.7}$	$\frac{39.57}{1.558}$	—
50	2	$\frac{365}{14.4}$	$\frac{356}{14.0}$	$\frac{273}{10.8}$	$\frac{294}{11.6}$	$\frac{114}{4.5}$	$\frac{141}{5.6}$	$\frac{221}{8.7}$	$\frac{51.71}{2.036}$	$\frac{35.76}{1.408}$
80	3	$\frac{418}{16.4}$	$\frac{406}{16.0}$	$\frac{292}{11.5}$	$\frac{289}{11.4}$	$\frac{113}{4.4}$	$\frac{138}{5.4}$	$\frac{265}{10.4}$	$\frac{78.44}{3.088}$	$\frac{63.75}{2.510}$
100	4	$\frac{418}{16.4}$	$\frac{406}{16.0}$	$\frac{292}{11.5}$	$\frac{289}{11.4}$	$\frac{113}{4.4}$	$\frac{138}{5.4}$	$\frac{265}{10.4}$	$\frac{103.84}{4.088}$	$\frac{82.80}{3.260}$
150	6	$\frac{522}{20.6}$	$\frac{508}{20.0}$	$\frac{400}{15.8}$	$\frac{360}{14.2}$	$\frac{146}{5.8}$	$\frac{176}{6.9}$	$\frac{345}{13.6}$	$\frac{155.12}{6.107}$	$\frac{136.04}{5.356}$
200	8	$\frac{624}{24.6}$	$\frac{610}{24.0}$	$\frac{483}{19.0}$	$\frac{418}{16.4}$	$\frac{171}{6.8}$	$\frac{205}{8.1}$	$\frac{403}{15.9}$	$\frac{203.28}{8.003}$	$\frac{186.13}{7.328}$
250	10	$\frac{727}{28.6}$	$\frac{711}{28.0}$	$\frac{611}{24.1}$	$\frac{483}{19.0}$	$\frac{208}{8.2}$	$\frac{237}{9.3}$	$\frac{445}{17.5}$	$\frac{256.39}{10.094}$	$\frac{239.27}{9.420}$
300	12	$\frac{829}{32.6}$	$\frac{813}{32.0}$	$\frac{718}{28.3}$	$\frac{567}{22.3}$	$\frac{249}{9.8}$	$\frac{279}{11.0}$	$\frac{505}{19.9}$	$\frac{306.43}{12.064}$	$\frac{289.31}{11.390}$

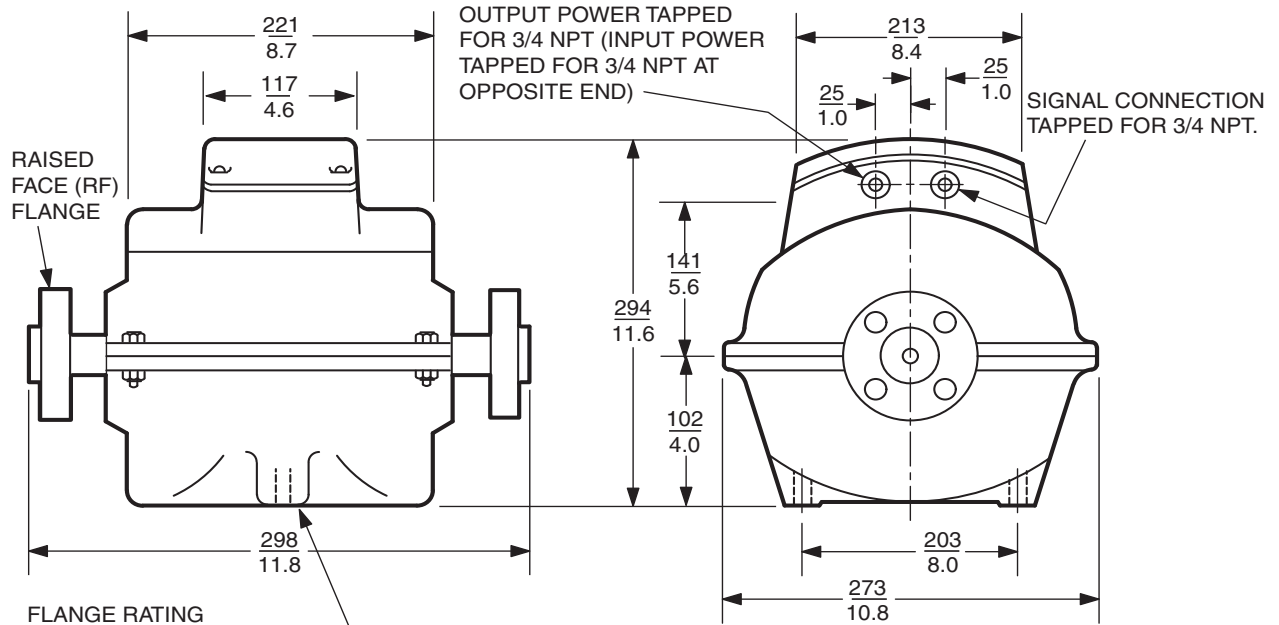
* ptfE LINING

** POLYURETHANE LINING

NOTE: "A" length increases by approximately 25 mm (1 in) when flowtube has optional lining protection (Optional Suffix "-T").

2891 AND 2893 FLOWTUBE - 2.5 AND 6 mm (1/10 AND 1/4 in) SIZES

$\frac{\text{mm}}{\text{in}}$



RAISED
FACE (RF)
FLANGE

OUTPUT POWER TAPPED
FOR 3/4 NPT (INPUT POWER
TAPPED FOR 3/4 NPT AT
OPPOSITE END)

SIGNAL CONNECTION
TAPPED FOR 3/4 NPT.

FLANGE RATING
CLASS 150 - ANSI
PN10
PN16
PN25
PN40

HOLES (2) EITHER CAN BE USED WITH SELF
TAPPING BOLTS OR CAN BE TAPPED FOR BOLTS
TO MOUNT FLOWTUBE.
USE EITHER M8 X 20 mm OR 18 X 3/4 in BOLT.

FLANGE MATERIAL
316 ss

NOTE:
1. INSIDE DIAMETERS ARE 2.54 mm (0.100 in)
FOR THE 2891 FLOWTUBE, AND 6.35 mm
(0.250 in) FOR THE 2893 FLOWTUBE.

ORDERING INSTRUCTIONS

1. Model Number
2. Specify Series or Parallel Coil Connection (Only applicable for E96 Transmitter, since IMT96 may only be used with coils in series connection.)
3. Certification Specification (See Electrical Safety Specifications Section)
4. Flow Rate - Upper Range Value must be within Minimum and Maximum URVs shown in Table 3.
5. Process Temperature-Pressure Range
6. Process Composition and Conductivity
7. Grounding Rings - If Mating Pipe is Nonmetallic or Lined Metal
8. Signal Cable Length
9. Options and Accessories - if not included in Model Code Optional Selections (See "OPTIONAL SELECTIONS AND ACCESSORIES" Section)
10. Customer Tag Data

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