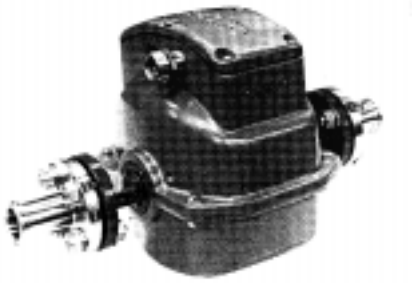
FOXBORO®

Instruction

MI 021-381
January 1996

8300 Series
Flanged Magnetic Flowtubes
ptfe, Polyurethane, and Neoprene Lined,
1/2- through 36-inch Sizes

Flowtube Installation



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Introduction

The 8300 Series Magnetic Flowtubes together with an I/A Series® Magnetic Flow Transmitter or an 8000 Series Magnetic Flow Transmitter combine to form an easy-to-use, versatile magnetic flowmeter that measures the volumetric flow rate of virtually any conductive liquid. The transmitter converts the low level, high impedance signal from the flowtube to a standard transmission signal, either 4 to 20 mA, digital, or pulse output, that is proportional to flow rate. The stainless steel tubes can be lined with either ptfe, polyurethane, or Neoprene. Various end connections are provided. The flanged end tubes (either ANSI or metric) are available in sizes from 15 to 900 mm (1/2 to 36 in). Sanitary Tri-Clamp end connections can also be provided in flowtube sizes from 15 to 80 mm (1/2 to 3 in) to accommodate sanitary liquid applications.

Reference Documents

Doc. No.	Description
PSS 1-6F2 D	8000 Series Transmitter, Product Specifications
PSS 1-6F3 A	IMT10 (I/A Series) Transmitter, Product Specifications
PSS 1-6F3 B	IMT20 (I/A Series) Transmitter, Product Specifications
PSS 1-6F5 A	IMT25 (I/A Series) transmitter, Product Specifications
DP 021-360	8300 Flanged Flowtubes, 1/2 to 36 in, Dimensions
DP 021-361	8300 Sanitary Flowtubes, 1/2 to 3 in, Dimensions
MI 021-369	8000 Series Transmitters, Remote Mounted, Installation
MI 021-372	IMT10 Series Transmitters, Remote Mounted, Installation
MI 021-382	IMT20 Series Transmitters, Remote Mounted, Installation
MI 021-365	8300 Series Magnetic Flowtube, Type Y Purge
MI 021-151	Magnetic Flow Sealing Kit for Flowtube Submergence
MI 021-387	IMT25 Series Transmitter, Installation
PL 008-742	8300 Flanged Flowtubes, 1/2 to 36 in, Parts List
PL 008-743	8300 Sanitary Flowtubes, 1/2 to 3 in, Parts List
TI 27-71f	Magnetic Flowtube Materials Selection Guide
TI 027-072	Magnetic Flowmeter Liquid Conductivity Tables

General Description

The 8300 Series Flowtubes have been designed to operate in harsh in-plant or outdoor environments and are suitable for installation in most hazardous area locations. A selection of High Humidity/Condensate, General Purpose NEMA 4X, Accidental Submergence, or Accidental/Total Submergence Housings are offered.

Foxboro offers the I/A Series Magnetic Flow Transmitters for use with these flowtubes. The transmitter is connected to the flowtube with a signal cable having a maximum length of 300 m (1000 ft).

The stainless steel flowtube is lined with a choice of ptfe, polyurethane, or Neoprene lining. Together with the choice of lining materials, a selection of electrode metals and electrode shapes enables these flowtubes to handle a wide variety of liquids such as water, slurries, and sticky, abrasive, and highly corrosive processes. A ptfe-lined flowtube may also be used in sanitary applications by attaching a sanitary, quick-disconnect end connection assembly to each flange.

All flowtubes are wet calibrated to verify their specified accuracy with traceability to the U.S. National Institute of Science and Technology (NIST).

The transmitter uses a pulsed-dc technique to energize the flux-producing coils of the flowtube. As the process liquid passes through the magnetic field in the flowtube, low-level voltage pulses are developed across a pair of electrodes. The voltage level of these pulses is directly proportional to the average velocity of the liquid. The transmitter converts the voltage pulse to both a standard 4 to 20 mA and pulse output signal. The 4 to 20 mA signal is used with a suitable receiver to indicate, record, and/or control a variable. The proportional pulse output can be used for totalization and can be configured for either a high rate or low rate pulse. With an I/A Series transmitter, a digital output signal is also provided for flowmeters serving as a primary device in an I/A Series system. Both the digital and 4 to 20 mA outputs are simultaneously available at a common pair of output terminals. Details of the output signals are given in the applicable transmitter instruction.

This instruction relates to the installation of the flowtube portion of the magnetic flowmeter system. For installation, wiring, operation, configuration, and maintenance details relating to the flowmeter system, refer to the applicable transmitter documents.

Standard Specifications

Ambient Temperature

Normal Operating Condition Limits: -10 and +50°C (20 and 120°F)

Operative Limits: -30 and +60°C (-20 and +140°F)

Nominal Line Sizes

Flanged Flowtubes:

15, 25, 40, 50, 80, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 750, and 900 mm

(1/2, 1, 1 1/2, 2, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 30, and 36 in)

Sanitary Flowtubes:

15, 25, 40, 50, and 80 mm (1/2, 1, 1 1/2, 2, and 3 in) flowtube size. These flowtubes are fitted with Sanitary Tri-clamp end connections for installation in line sizes 25, 40, 50, 80, and 100 mm (1, 1-1/2, 2, 3, and 4 in).

Electrodes

Tantalum, 316 ss, Hastelloy C, platinum, or titanium. 316 ss and Hastelloy C electrodes are also offered in conical shaped configurations. Refer to TI 27-71f for process-wetted materials selection guide.

Metering Tube

AISI Type 304 or 310 stainless steel.

Process Fluid Conductivity

The minimum process fluid conductivity required is 5 µS/cm.

Signal and Coil Driver Cable Length

Using Foxboro cable Part Number R0101ZS, the maximum allowable cable length is 300 m (1000 ft) between flowtube and transmitter. Refer to appropriate transmitter installation instruction for additional detail.

Minimum and Maximum Upper Range Values and Nominal Calibration Factors

Minimum and maximum upper range value (URV) flow rates and nominal calibration factors are shown in Table 2 for the different tube sizes and linings. In this table, URV is not the lowest flow rate that the flowtube can measure; it is the lowest flow rate which can correspond to the 4 to 20 mA signal. For example: for the 8301, the minimum range is 0 to 3.8 U.S. gpm, and this will generate 4 to 20 mA.

Process Liquid Earth (Ground)

If connecting piping is unlined metal:

System grounded through flange bolts or ground straps.

If connecting piping is lined metal or nonmetallic:

Systems grounded using earthing (grounding) rings at each end of the flowtube. Grounding rings (i.e., orifice plates) are available from Foxboro, if needed. Sanitary flowtubes do not require any additional grounding.

Process Pressure and Temperature Limits

See Tables 3, 4, 5, and 6.

Enclosure Construction

Model 830H TO 8312

Housing is cast from low-copper aluminum alloy, and silicone sealant and gaskets are used in all joints. Offered for high humidity, NEMA 4X, or for both accidental or accidental/total submergence applications, as specified.

Model 8314 TO 8336

Housing is fabricated from fiberglass reinforced plastic (FRP), silicone sealant, and gaskets are used to seal all joints. Offered for high humidity, NEMA 4X, or accidental submergence applications, as specified.

Enclosure Finish

Model 830H TO 8312

High-build epoxy paint.

Model 8314 TO 8336

Polyurethane paint.

Electrical Connections

The housing has two 3/4 NPT tapped holes for power conduit fittings and one 1/2 NPT tapped hole for an optionally provided 3/4 NPT signal cable seal.

Mounting Position

The flowtube can be mounted in any orientation provided that during normal flow, it remains full of process liquid. In a horizontal installation, position the flowtube so that the electrodes are in the horizontal plane.

End Connection

ANSI Class 150 and 300, AWWA Class D; Metric PN 6, 10, 16, 25, and 40 flanges; and Sanitary quick-disconnect ferrules for flowtube sizes up to 80 mm (3 in).

Product Safety Specifications

Refer to Table 7 for Electrical Classifications.

Approximate Mass

Refer to Table 1.

Table 1. Approximate Flowtube Mass

Flowtube Size		Approximate Flowtube Mass				Flowtube Size		Approximate Flowtube Mass			
		Flanged Ends		Sanitary Ends				Flanged Ends		Sanitary Ends	
mm	in	kg	lb	kg	lb	mm	in	kg	lb	kg	lb
15	1/2	21	46	23	50	300	12	125	275	N/A	N/A
25	1	18	40	20	45	350	14	170	375	N/A	N/A
40	1 1/2	20	45	23	51	400	16	195	425	N/A	N/A
50	2	21	47	25	56	450	18	215	475	N/A	N/A
80	3	27	60	33	73	500	20	285	625	N/A	N/A
100	4	34	76	N/A	N/A	600	24	410	900	N/A	N/A
150	6	55	122	N/A	N/A	750	30	545	1200	N/A	N/A
200	8	85	188	N/A	N/A	900	36	660	1450	N/A	N/A
250	10	91	200	N/A	N/A						

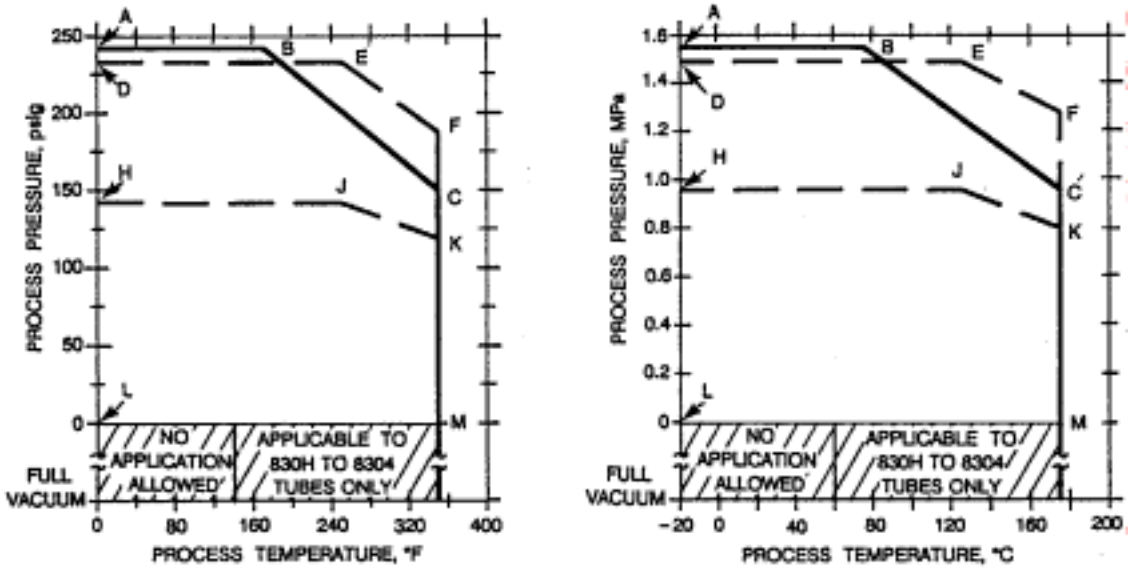
Table 2. Minimum and Maximum Upper Range Limits and Nominal Calibration Factors

Flowtube Line Size		Approximate Minimum and Maximum URV's*						Nominal Calibration Factor** with	
		with ptfe*		with Polyurethane*		with Neoprene*		ptfe or Neoprene	Poly-urethane
mm	in	L/m	U.S. gpm	L/m	U.S. gpm	L/m	U.S. gpm		
15	½	3.75 & 75	1 & 20	—	—	—	—	200	—
25	1	14.5 & 290	3.8 & 76	—	—	—	—	67	—
40	1 ½	37 & 740	10 & 195	—	—	—	—	28	—
50	2	63 & 1260	17 & 335	30 & 600	8 & 160	—	—	15	22
80	3	145 & 2900	39 & 770	96 & 1930	25 & 510	—	—	7.5	8.6
100	4	255 & 5100	68 & 1350	162 & 3240	43 & 855	—	—	4.1	5.2
150	6	570 & 11400	150 & 3000	440 & 8800	115 & 2300	—	—	1.7	1.9
200	8	975 & 19500	260 & 5150	820 & 16400	220 & 4300	—	—	0.79	0.88
250	10	1550 & 31000	410 & 8200	1350 & 27000	360 & 7150	—	—	0.51	0.55
300	12	2210 & 44200	590 & 11700	1980 & 39600	525 & 10450	—	—	0.30	0.32
350	14	2725 & 54500	720 & 14400	2725 & 54500	720 & 14400	2725 & 54500	720 & 14400	0.23	0.23
400	16	3600 & 72000	950 & 19000	3600 & 72000	950 & 19000	3600 & 72000	950 & 19000	0.136	0.136
450	18	4550 & 91000	1200 & 24000	4550 & 91000	1200 & 24000	4550 & 91000	1200 & 24000	0.115	0.115
500	20	6170 & 11400	1630 & 30000	6170 & 114000	1630 & 30000	6170 & 114000	1630 & 30000	0.079	0.079
600	24	10500 & 162000	2780 & 43000	10500 & 162000	2780 & 43000	10500 & 162000	2780 & 43000	0.046	0.046
750	30	—	—	22700 & 258000	6000 & 68000	22700 & 258000	6000 & 68000	0.024	0.024
900	36	—	—	37800 & 374000	10000 & 99000	37800 & 374000	10000 & 99000	0.014	0.014

* The inside diameter of each flowtube size varies depending on the lining used. Therefore, different URVs are indicated for flowtube sizes through 300 mm (12 in), depending on the lining used. However, on sizes larger than 300 mm (12 in), the variance in inside diameter is sufficiently small percentagewise to approximate the same URV regardless of the lining used for the line size.

** The nominal calibration factor is unitless.

Table 3. Process Pressure and Temperature Limits — ptfe-Lined Flowtubes — 830H to 8312 Sizes Only (See Table 4 for 8314 to 8324 Sizes)



NOTES

1. PROCESS PRESSURE AND TEMPERATURE MUST BE WITHIN THE BOUNDARIES:

   LABCM FOR FLOWTUBES WITH ANSI CLASS 150 OR 300 FLANGES
   LHJKM FOR FLOWTUBES WITH PN 10 FLANGES
   LDEFM FOR FLOWTUBES WITH PN 16, 25, OR 40 FLANGES

2. REFER TO FOXBORO FOR APPLICATIONS INVOLVING ELEVATED PRESSURE.

Table 4. Process Pressure and Temperature Limits — ptfe-Lined Flowtubes — 8314-8324 Sizes Only

cf Flange Rating	Flowtube Line Size	Process Pressure Limits		Process Temperature Limits	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
ANSI Class 150	8314 and 8316	Zero (No Vacuum)	1.38 MPa (200 psig)	–18 °C (0 °F)	82 °C (180 °F)
	8318 to 8324	Zero (No Vacuum)	1.03 MPa (150 psig)	–18 °C (0 °F)	82 °C (180 °F)
Metric PN 6	8314 to 8324	Zero (No Vacuum)	0.60 MPa (87 psig)	–18 °C (0 °F)	82 °C (180 °F)
Metric PN 10	8314 to 8324	Zero (No Vacuum)	1.00 MPa (145 psig)	–18 °C (0 °F)	82 °C (180 °F)

Table 5. Process Pressure and Temperature Limits — Polyurethane-Lined Flowtubes — 8302 to 8336 Sizes

Flange Rating	Flowtube Line Size	Process Pressure Limits		Process Temperature Limits	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
ANSI Class 150	8302 to 8312	Full Vacuum	1.65 MPa (240 psig)	–18 °C (0 °F)	71 °C (160 °F)
	8314 and 8316	Full Vacuum	1.38 MPa (200 psig)	–18 °C (0 °F)	71 °C (160 °F)
	8316 to 8324	Full Vacuum	1.03 MPa (150 psig)	–18 °C (0 °F)	71 °C (160 °F)
ANSI Class 300	8302 to 8304	Full Vacuum	4.83 MPa (700 psig)	–18 °C (0 °F)	71 °C (160 °F)
	8306 and 8308	Full Vacuum	1.65 MPa (240 psig)	–18 °C (0 °F)	71 °C (160 °F)
Metric PN 10	8302 to 8324	Full Vacuum	1.00 MPa (145 psig)	–18 °C (0 °F)	71 °C (160 °F)
	8330	Full Vacuum	0.69 MPa (100 psig)	–18 °C (0 °F)	71 °C (160 °F)
	8336	Full Vacuum	0.62 MPa (90 psig)	–18 °C (0 °F)	71 °C (160 °F)
Metric PN 16	8302 to 8312	Full Vacuum	1.62 MPa (235 psig)	–18 °C (0 °F)	71 °C (160 °F)
Metric PN 25	8302 to 8304	Full Vacuum	2.50 MPa (362 psig)	–18 °C (0 °F)	71 °C (160 °F)
	8306 to 8312	Full Vacuum	1.65 MPa (240 psig)	–18 °C (0 °F)	71 °C (160 °F)
Metric PN 40	8302 to 8304	Full Vacuum	4.00 MPa (580 psig)	–18 °C (0 °F)	71 °C (160 °F)
	8306 to 8312	Full Vacuum	1.65 MPa (240 psig)	–18 °C (0 °F)	71 °C (160 °F)
Metric PN 6	8314 to 8336	Full Vacuum	0.60 MPa (87 psig)	–18 °C (0 °F)	71 °C (160 °F)
AWWA Class D	8330	Full Vacuum	0.69 MPa (100 psig)	–18 °C (0 °F)	71 °C (160 °F)
	8336	Full Vacuum	0.62 MPa (90 psig)	–18 °C (0 °F)	71 °C (160 °F)

Table 6. Process Pressure and Temperature Limits — Neoprene-Lined Flowtubes — 8314 to 8336 Sizes

Flange Rating	Flowtube Line Size	Process Pressure Limits		Process Temperature Limits	
		Lower Limit	Upper Limit	Lower Limit	Upper Limit
ANSI Class 150	2814 and 2816	Full Vacuum	1.38 MPa (200 psig)	–18 °C (0 °F)	82 °C (180 °F)
	2818 to 2824	Full Vacuum	1.03 MPa (150 psig)	–18 °C (0 °F)	82 °C (180 °F)
AWWA Class D	2830	Full Vacuum	0.69 MPa (100 psig)	–18 °C (0 °F)	82 °C (180 °F)
	2836	Full Vacuum	0.62 MPa (90 psig)	–18 °C (0 °F)	82 °C (180 °F)
Metric PN 6	2814 to 2836	Full Vacuum	0.60 MPa (87 psig)	–18 °C (0 °F)	82 °C (180 °F)
Metric PN 10	2814 to 2824	Full Vacuum	1.00 MPa (145 psig)	–18 °C (0 °F)	82 °C (180 °F)
	2830	Full Vacuum	0.69 MPa (100 psig)	–18 °C (0 °F)	82 °C (180 °F)
	2836	Full Vacuum	0.62 MPa (90 psig)	–18 °C (0 °F)	82 °C (180 °F)

Table 7. Electrical Classifications

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
CSA for use in General Purpose (Ordinary) Locations.	---	CGZ
CSA for use in Class I, Division 2, Groups A, B, C, and D, hazardous locations.	Temperature Class T6.	CNZ
CSA for Type Y Purging for Class I, Division 1, Groups A, B, C, and D.	Model 830H through 8312. Temperature Class T6.	CPZ
FM for use in general purpose (ordinary) locations.	---	FGZ
FM for use in Class I, Division 2, Groups A, B, C, and D, hazardous locations.	Temperature Class T6.	FNA
FM for Type Y purging for Class I, Division 1, Groups A, B, C, and D	Model 830H through 8312. Temperature Class T6.	FPA

NOTE: These flowtubes have been designed to meet the electrical safety descriptions listed in the table above. For detailed information, or status of testing laboratory approvals/certifications, contact Foxboro.

Flowtube Identification

The flowtube can be identified by a data plate located on the housing surface of the flowtube. Typical data plates are shown in Figure 1. Refer to the applicable transmitter instruction for information regarding transmitter data plates.

NOTE: Do not remove flowtube from shipping carton without first reviewing the "Unpacking and Handling Procedures" section that follows.

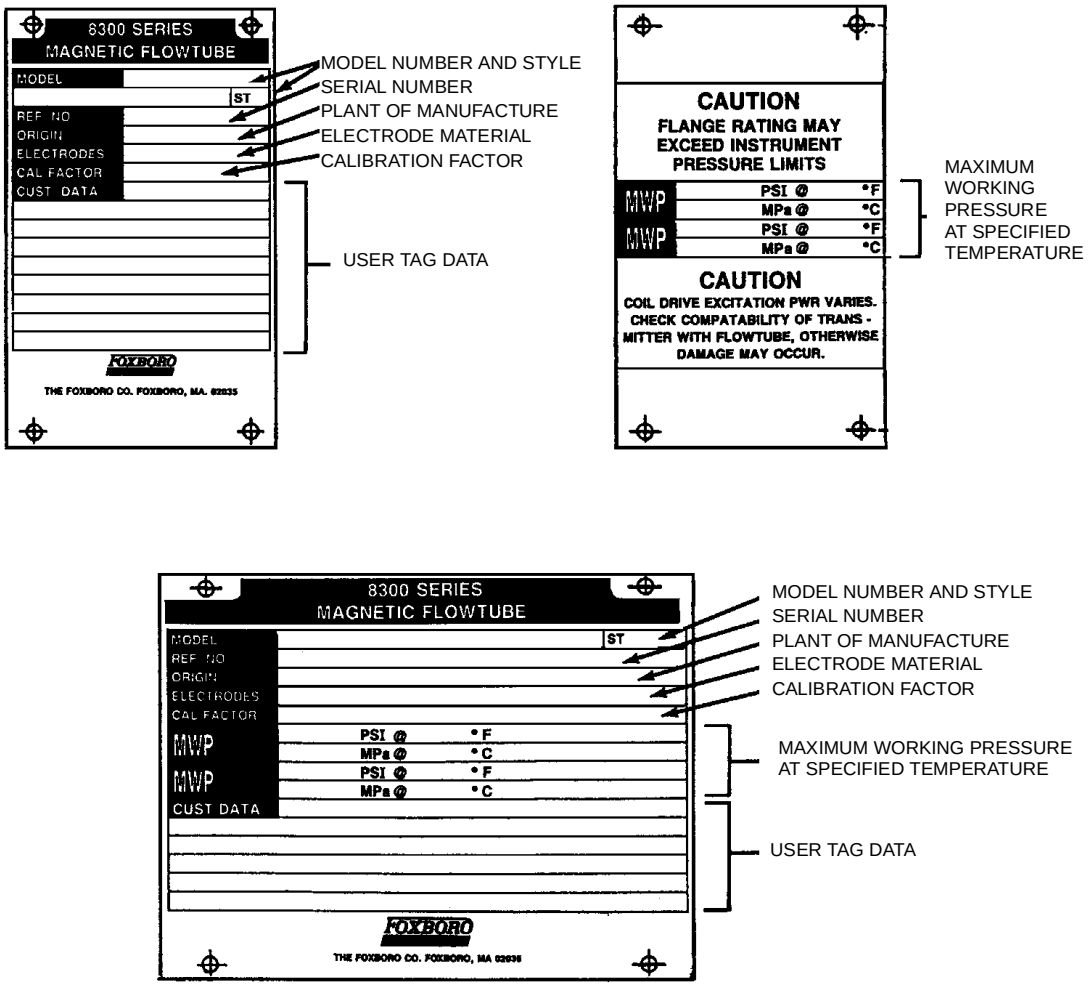


Figure 1. Flowtube Data Plate

Unpacking and Handling Considerations

Unpacking for Inspection

The Foxboro magnetic flowtube is built to be durable, but it is also part of a calibrated precision system and should be handled as such. Avoid dropping or otherwise subjecting it to impact, particularly at the flange faces.

The flowtube is shipped from the factory in a sturdy carton and cradled between flange covers for protection. Before removing it from the carton, move it as close as possible to its installation point. If the flowtube must be removed for receiving inspection, *reinstall the end covers after inspection*. This is particularly true with ptfe-lined flowtubes.

Lift flowtube out of carton with rope falls, chain hoist, etc. as shown in the “Flowtube Handling” sections that follow. In some instances it may be more convenient to insert bolts into the flange bolt holes and use hooks around the bolts for lifting (rather than tying slings

around the flowtube). *Never put anything through the flowtube to lift it, since this will cause damage to the lining.*

After removing flowtube from its shipping carton, inspect it for visible damage. If any damage is observed, notify the carrier immediately and request an inspection report. Obtain a signed copy of the report from the carrier.

Avoid touching electrodes with fingers or materials that can contaminate electrodes. Deposit on electrodes will result in high impedance boundary between electrodes and conductive fluid. If electrodes have been touched, clean them with isopropyl alcohol.

General Precautions

1. Leave end covers installed over flanges any time flowtube is put in storage. Do not cut or remove flowtube lining.

NOTE: In ptfe-lined flowtubes, the white material extending over the flanges is the ptfe lining, not packaging material. DO NOT ATTEMPT TO REMOVE OR CUT THE FLOWTUBE LINING.

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2. Check that cable length between flowtube and transmitter is within limit for specified system accuracy. Maximum cable length is 300 m (1000 ft).
3. Good piping practice should be used for the installation of all magnetic flowtubes. Gaskets are recommended. Select a gasket material which is compatible with the process liquid.
4. The flowtube lining extends outward and over the raised face of the flange.

CAUTION: To avoid damage to the lining extension, do not exceed torque values specified when tightening flange bolts.

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5. The flowtube lining (especially polyurethane) is susceptible to damage from excessive heat. Avoid such heat sources (such as welding adjacent piping).

To avoid excessive lining wear (especially with ptfe), it is recommended that five pipe diameters of straight section of pipe be connected from the flowtube flange end. If this recommendation cannot be met, it is suggested that a protective device (i.e., grounding ring) be installed on the upstream end of the flowtube.

Lifting Flowtube For Mounting

Care should be taken in lifting the flowtube into the pipeline position required for horizontal or vertical mounting. In order to prevent damage to the flowtube lining, housing, or the tube's structural integrity, it is important to reiterate flowtube handling precautions.

1. Never put anything through the flowtube to lift it.
2. Do not use the housing to support or lift the flowtube. Figures 2 through 5 show correct and incorrect methods for lifting the flowtubes. Note that in

Figure 2, Figure 3, and Figure 4 (horizontal lifting), the suggested approach is to place the lifting rope between the flange and flowtube body. For vertical lifting, shown in Figure 5, the use of eye bolts in the flange to which the lifting rope is attached is the preferred method. This ensures that the lifting force is applied to the eye bolts as nearly straight upward as possible.

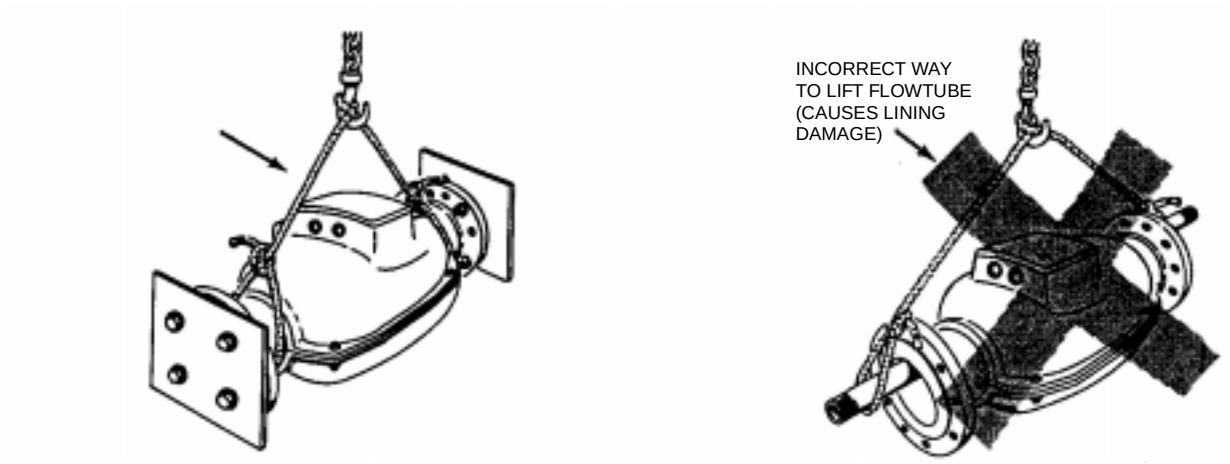

Figure 2. Lifting Flanged Flowtube for Horizontal Mounting (1/2- to 12-in Size Shown)

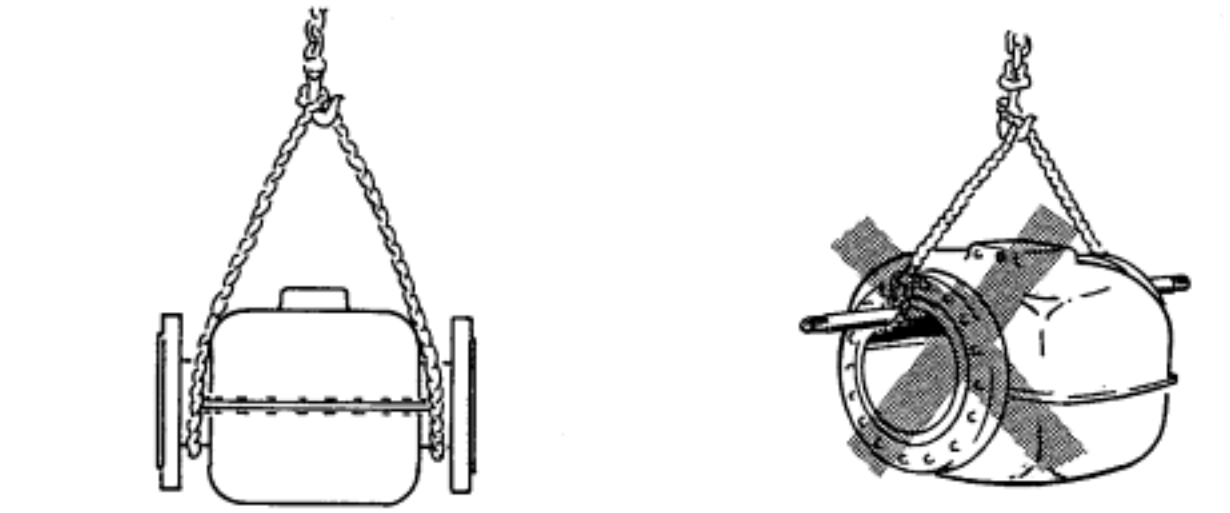

Figure 3. Lifting Flanged Flowtube for Horizontal Mounting (14- to 36-in Size Shown)

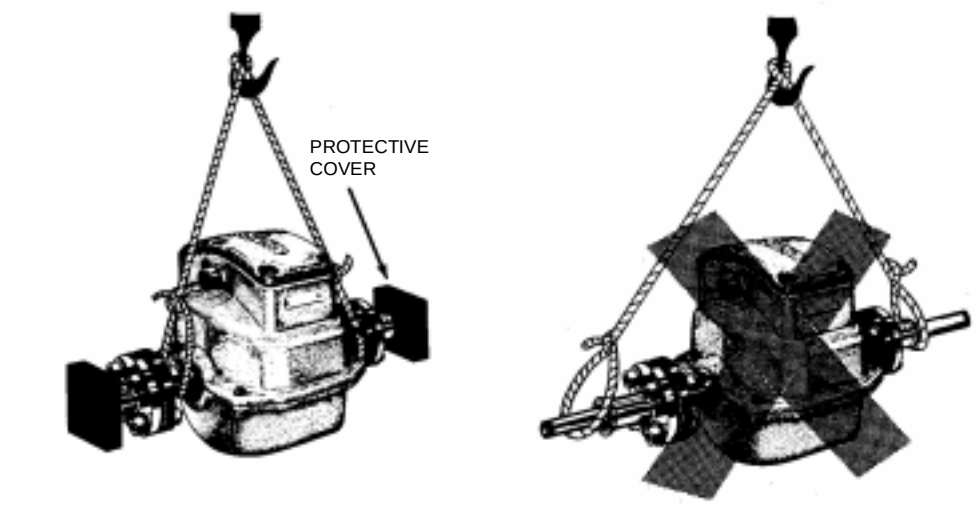

Figure 4. Lifting Sanitary Flowtube for Horizontal Mounting

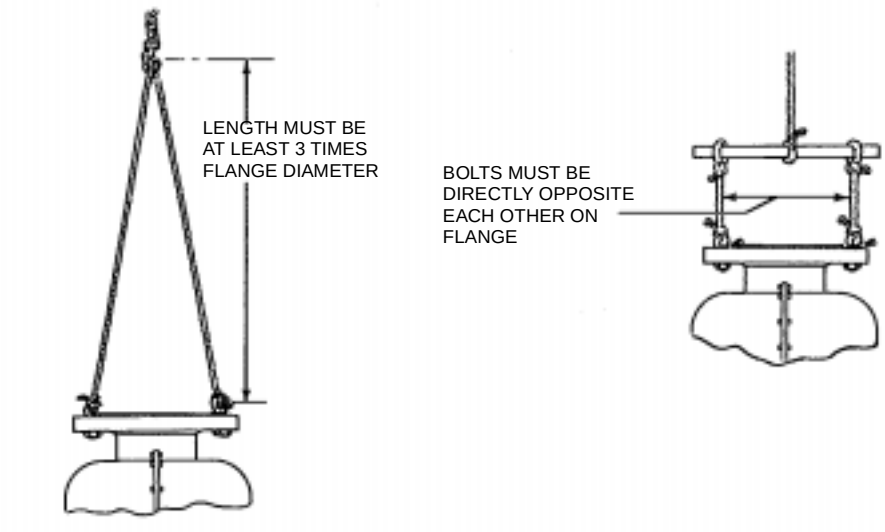

Figure 5. Lifting Flanged Flowtube for Vertical Mounting (14- to 36-in Size Shown)

Installation Procedures

The installation must comply with any local regulations. See MI 021-382 for electrical wiring. If flowtube is installed in a Division 1 area, refer to MI 021-365 for installation of purge to flowtube.

Flowtube Dimensions

Refer to the Dimensional Prints listed in the “Reference Documents” section.

Lining Application

Refer to Table 8 for recommended application of each lining. Also refer to TI 27-71f to best determine compatibility of lining with fluid types and fluid characteristics.

Table 8. Lining Application Guide

Flowtube Construction	Fluid Characteristic*					
	Clean	Mild Corrosion	Severe Corrosion	Mild Abrasion	Severe Abrasion	Mild Corrosion and Abrasion
ptfe Lining	A	A	A	B	X	B
Polyurethane Lining	A	B	X	A	A	B
Neoprene Lining	A	A	X	A	X	A

*A = Preferred: Generally considered best choices.
B = Satisfactory: Reasonable life under most conditions.
X = Not Recommended: Generally considered unsuitable.

Use of ptfe Lining

Because of its inertness to a wide range of acids and bases, the ptfe lining is best suited for corrosive processes.

Use of Polyurethane Lining

Because of its abrasive resistance and high wear resistance, this lining is best suited for abrasive slurries.

Use of Neoprene Lining

This lining is best suited for general purpose use.

CAUTION: Do not use hydrocarbon defoamers, such as kerosene or sulfonated oils, with the neoprene lining as they cause Neoprene to swell.

Pre-Startup Flowtube Cleaning

If possible, make up a flanged "spool piece" the same length as the flowtube. Insert it in the line before startup. On startup, any foreign objects in the line, such as pieces of wood or metal, should be located and removed before the flowtube is installed. This greatly lessens the possibility of accidental damage to the flowtube. Refer to Table 9 for end-to-end dimensions of the different flowtube sizes.

Table 9. End-to-End Dimensions, Flanged End and Sanitary End Connections

Flowtube Size		Flanged End Flowtubes with the Following Linings			Sanitary End Flowtubes with the Following Lining
mm	in	ptfe(a)	Polyurethane	Neoprene	ptfe
15	½	365 mm (14.4 in)	–	–	518 mm (20.4 in)
25	1	365 mm (14.4 in)	–	–	518 mm (20.4 in)
40	1 ½	365 mm (14.4 in)	–	–	518 mm (20.4 in)
50	2	365 mm (14.4 in)	356 mm (14.0 in)	–	518 mm (20.4 in)
80	3	418 mm (16.4 in)	406 mm (16.0 in)	–	568 mm (22.4 in)
100	4	418 mm (16.4 in)	406 mm (16.0 in)	–	–
150	6	522 mm (20.6 in)	508 mm (20.0 in)	–	–
200	8	624 mm (24.6 in)	610 mm (24.0 in)	–	–
250	10	726 mm (28.6 in)	711 mm (28.0 in)	–	–
300	12	828 mm (32.6 in)	813 mm (32.0 in)	–	–
350	14	726 mm (28.6 in)	711 mm (28.0 in)	711 mm (28.0 in)	–
400	16	772 mm (30.6 in)	762 mm (30.0 in)	762 mm (30.0 in)	–
450	18	879 mm (34.6 in)	864 mm (34.0 in)	864 mm (34.0 in)	–
500	20	879 mm (34.6 in)	864 mm (34.0 in)	864 mm (34.0 in)	–
600	24	980 mm (38.6 in)	965 mm (38.0 in)	965 mm (38.0 in)	–
750	30	–	1067 mm (42.0 in)	1067 mm (42.0 in)	–
900	36	–	1219 mm (42.0 in)	1219 mm (42.0 in)	–

(a) On flanged end flowtubes with ptfe lining, when the optional ptfe lining protector is used, add 25 mm (1 in) to the end-to-end dimension.

Mounting Positions

The flowtube can be mounted in any position: vertical, horizontal, or at an angle, as long as both electrodes are in constant contact with the measured liquid (see Figure 6). However, for accurate measurement, the flowtube must be completely full. Vertical installation with flow in an upward direction, as shown in Figure 7, is generally recommended. This is particularly so

in slurries with abrasive solids. If mounting flowtube in other than a vertical position, it is recommended that it be turned about the flow axis shown in Figure 8 so that electrodes are in a horizontal plane. Electrodes should be in a horizontal plane to avoid contacting bubbles (at top) or sediment (at bottom) inside metering flowtube.

NOTE: Figure 7 and Figure 8 also show the recommended length of straight piping upstream and downstream from the center of the flowtube. To avoid possible loss of accuracy with a flowtube, it is recommended that the flowtube be connected in a straight section of pipe at least five pipe diameters upstream from the center line of the flowtube and three pipe diameters downstream. The center line of the flowtube is the same location as the electrode location. Note, on some small line size flowtubes, the recommended straight runs of pipe are already included in the overall length of the flowtube.

Flow through the flowtube can be in either direction. However, if it is installed with the "direction-of-flow" arrow pointing upstream, it will be necessary to reverse the flowtube coil-drive wires. An indication that the coil-drive wires should be reversed is given by a negative flow reading or "-A" reading during process flow. Wiring details are given in the System Wiring section of the applicable transmitter installation instructions.

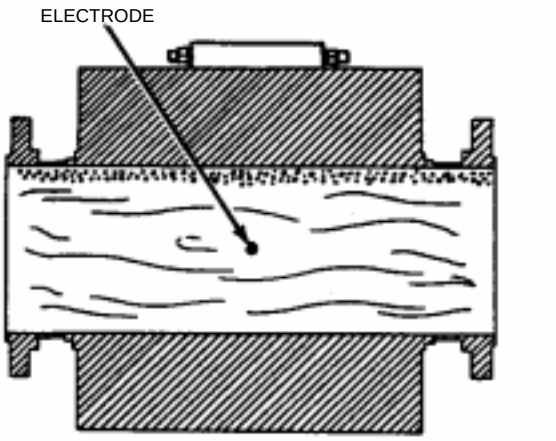

Figure 6. Horizontally Mounted Flowtube Showing Correct Relationship of Electrodes

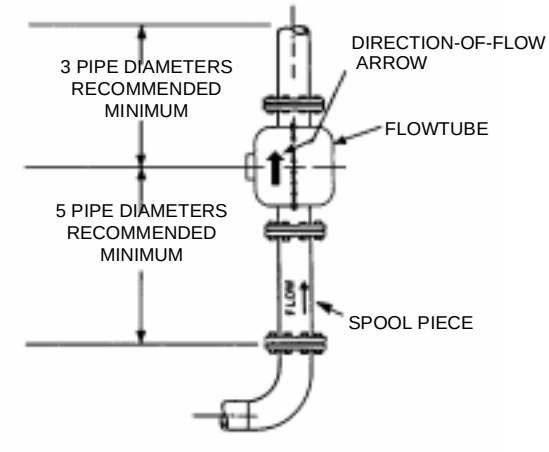

Figure 7. Flanged Body Flowtube Mounted Vertically

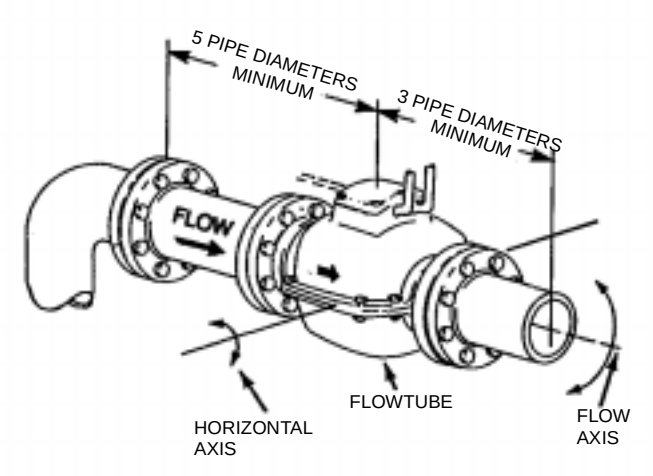

Figure 8. Flanged Body Flowtube Mounted Horizontally

Flowtube Earthing (Grounding)

Continuity between flowing liquid and metal metering tube is required to provide a reference for the measurement signal. With *unlined metal pipe* connected to the flowtube flange, continuity is provided by the pipe and the flange bolts. Refer to the System Wiring section of the applicable transmitter installation instructions for earthing (grounding) details between the transmitter, flowtube, and earth.

Installations in which *non-metal or lined metal* pipe is used require installation of earthing rings (grounding rings) on each flowtube flange as shown in Figure 9. To provide continuity, connect one end of a wire (recommended size is 8 AWG or 10 mm^2) to the grounding ring; connect the other end to a flange bolt or to a hole drilled and tapped in the flange. For flowtube sizes greater than 300 mm (12 in), use two ground wires on each end. Ground rings can be made from orifice plates. Inside diameters of the grounding rings should be slightly less than the inside diameter of the flowtube liners. This reduced grounding ring inside diameter

will provide positive contact with the process liquid and protect the leading edge of the flowtube liner from abrasives. Refer to Table 10 for the inside bore diameter of grounding rings.

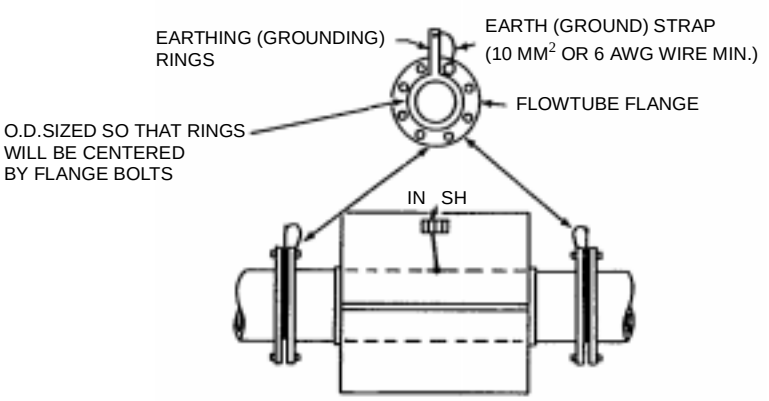

Figure 9. Use of Earthing (Grounding) Rings with Flanged End Flowtubes

Table 10. Grounding Ring Bore Diameters

Flowtube Size		Bore Diameter					
		ptfe		Polyurethane		Neoprene	
mm	in	mm	in	mm	in	mm	in
15	½	11.1	0.437	N/A	N/A	N/A	N/A
25	1	21.4	0.843	N/A	N/A	N/A	N/A
40	1½	36.5	1.437	N/A	N/A	N/A	N/A
50	2	48.4	1.906	42.1	1.656	N/A	N/A
80	3	75.4	2.968	70.2	2.765	N/A	N/A
100	4	101	3.968	92.5	3.640	N/A	N/A
150	6	152	5.984	146	5.734	N/A	N/A
200	8	200	7.875	196	7.703	N/A	N/A
250	10	253	9.968	249	9.796	N/A	N/A
300	12	303	11.937	299	11.765	N/A	N/A
350	14	330	13.000	337	13.25	340	13.38
400	16	381	15.000	387	15.25	391	15.38
450	18	432	17.000	438	17.25	442	17.38
500	20	483	19.000	489	19.25	492	19.38
600	24	584	23.000	584	23.00	594	23.38
750	30	737	29.000	737	29.00	746	29.38
900	36	889	35.000	889	35.00	899	35.38

Mounting Procedure - Flanged End Flowtubes

CAUTION: Excessive forces during installation and operation of flowtube can crush extended ends of flowtube lining. Some causes of these forces are excessive bolt torque, weight of vertical pipeline, thermal expansion of pipeline, and misalignment of flanges. To minimize these forces, adhere to the following procedure.

1. Before installing flowtube, install and adequately support the piping. If flowtube is being mounted vertically, add piping supports above and below flowtube to avoid strain to flanges and to avoid damaging lining. Also, for horizontal mounting, do not rest flowtube on floor as this can cause undue flange alignment and stresses. The pipeline can support the flowtube adequately by merely using piping supports.
2. Leave space for later installation of flowtube. Adjust piping and flanges so that flanges will be aligned and parallel with flowtube flanges when flowtube is installed. Flanges must *not* be forced into alignment during installation of flowtube. See Figure 10 for correct alignment of piping. See Figure 11 for correct use of hoist in installing flowtube. Also allow for thermal expansion of piping during operation, as required.

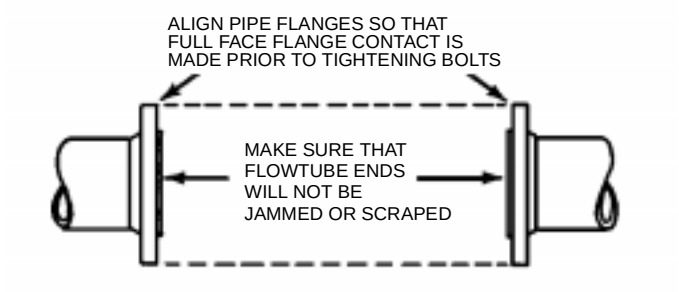

Figure 10. Piping Alignment for Flanged End Flowtube

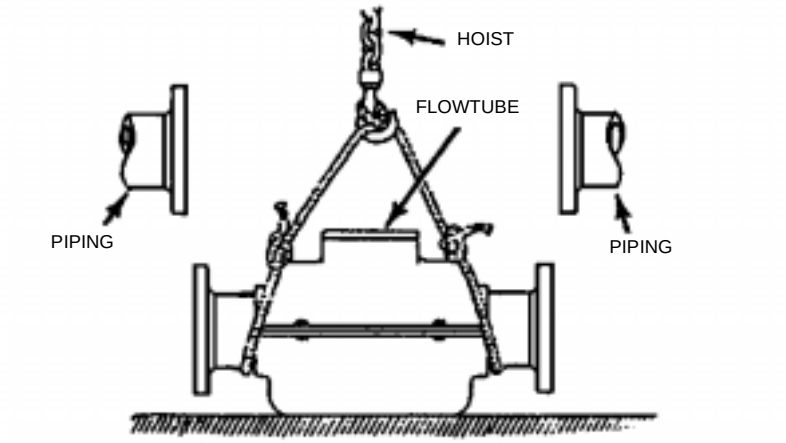

Figure 11. Hoisting Flowtube into Place

CAUTION: Piping supports must be firm enough so that addition of process fluid does not disrupt alignment of flowtube and adjacent piping.

3. Locate and remove all foreign objects from the piping. If possible, make up and install a section of pipe (spool piece) in the space provided for the flowtube. Start up the process to help locate any foreign objects.
4. To install the flowtube into the pipeline, proceed as follows:
   a. Hoist flowtube into place (see Figure 11).
   b. Refer to Figure 12. Spring back piping to allow clearance as necessary to insert flowtube without causing damage to lining.
   c. Install gaskets and grounding rings (as applicable) adjacent to flowtube flanges.
   d. Align flanges, install bolts, and position piping into place.
   e. Tighten flange bolts alternately and uniformly to torque values given in Table 11.

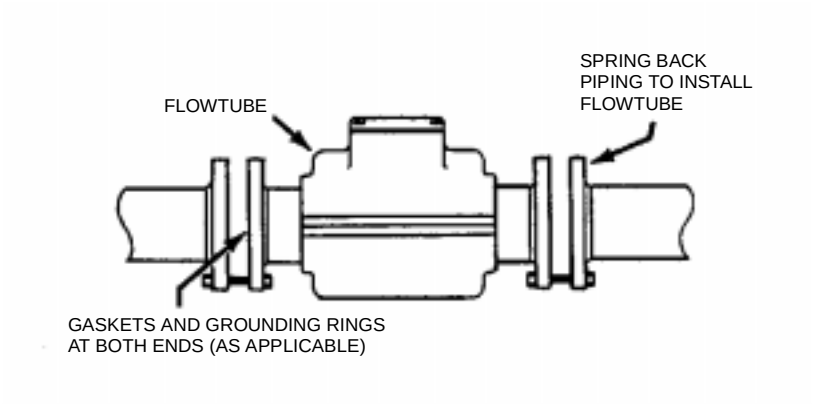

Figure 12. Installing Flowtube into Pipeline

Table 11. Flange-Bolt Torque Values for Flanged-End Flowtubes

Flowtube Size		Number of Bolts in Flange	Flange-Bolt Torque				Flowtube Size		Number of Bolts in Flange	Flange-Bolt Torque	
			ptfe		Polyurethane					All Liners	
mm	in		n·m	lb·ft	n·m	lb·ft	mm	in		n·m	lb·ft
15	½	4	7	5	–	–	350	14	12* 16**	135 110	100 80
25	1	4	15	10	–	–	400	16	16	135	100
40	1½	4* 8**	20 15	15 10	–	–	450	18	16* 20**	170 135	125 100
50	2	4* 8**	35 20	25 15	55 30	40 20	500	20	20	170	125
80	3	4* 8**	55 35	40 25	80 55	60 40	600	24	20	200	150
100	4	8	40	30	60	45	750	30	24* 28**	200 200	150 150
150	6	8* 12**	80 60	60 45	120 95	90 70	900	36	28* 32**	240 240	175 175
200	8	8* 12**	100 80	75 60	150 120	120 90					
250	10	12* 16**	95 80	70 60	250	10					
300	12	12* 16**	110 95	80 70	300	12					

* 150-lb flange
**300-lb flange

Mounting Procedure - Sanitary End Flowtubes

Sanitary end flowtubes have the Tri-Clamp end connections already assembled to the magnetic flowtube. This is necessary to comply with 3A Sanitary Standards.

Prior to mounting the sanitary end flowtubes, if the abutting piping is in place, spring back this piping on either side to allow as much space as is required to install the flowtube without damaging the flowtube ends. Full face contact should be made prior to installing Tri-Clover clamps or clamping nuts. Refer to Table 9 for end-to-end dimensions, and to Figure 13 for mounting information.

The flowtube generally requires no more support than an equal length of pipe. However, care should be taken not to overstress the end connection interfaces. When the flowtube is vertically mounted, it should not be used to support the piping above it. When the flowtube is horizontally mounted, use either floor supports or hanger supports at surfaces A or B. Do not use the flowtube housing surface to support the installation. Refer to Figure 13.

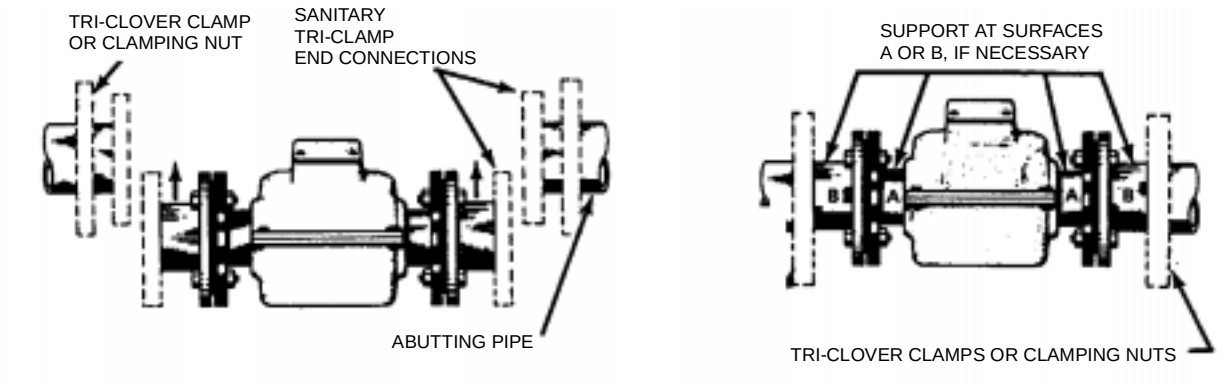

Figure 13. Mounting Sanitary End Flowtubes

Should it become necessary to remove or replace the sanitary end connection extension assembly, remove the flange bolts and remove the extension assembly. Reassemble the extension assembly as shown in Figure 14, and in accordance with the flange-bolt torques listed in Table 12.

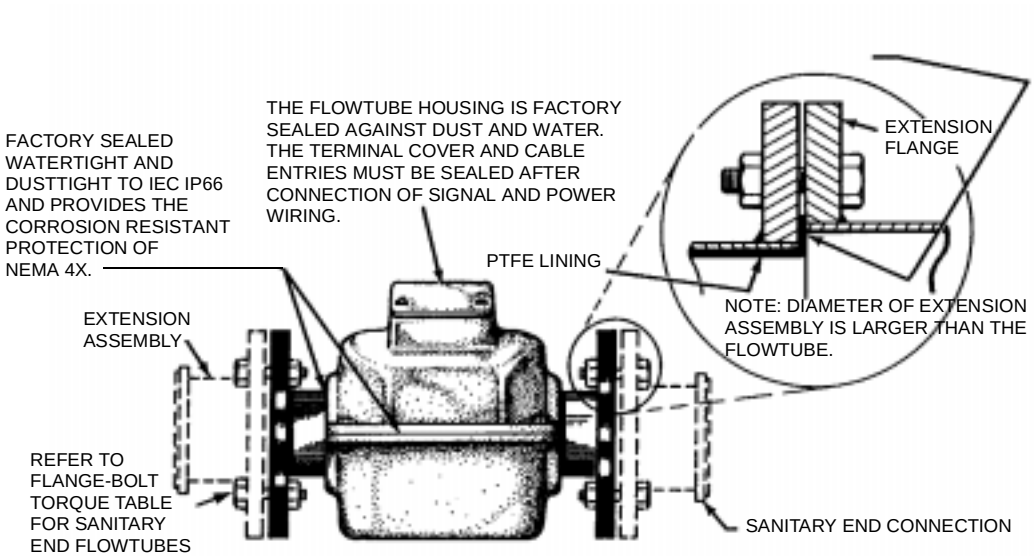

Figure 14. Assembling Sanitary End Connection Assembly to Flowtube

Table 12. Flange-Bolt Torque Values for Sanitary End Flowtubes

Flowtube Size		Line Size		Number of Bolts in Flange	Flange-Bolt Torque	
mm	in	mm	in		N·m	lb·ft
15	1/2	25	1	4	6	4
25	1	40	1-1/2	4	10	7
40	1-1/2	50	2	4	20	15
				8	14	10
50	2	80	3	4	27	20
				8	20	15
80	3	100	4	4	54	40
				8	34	25

NOTE: Bolts should be tightened gradually and in a sequence consistent with good flange-bolt tightening procedures. Do not overtighten, as this may damage the ptfe lining.

Flowtube Field Coil Connections

For pulsed dc systems, the flowtube coils are always wired in series as shown in Figure 15.

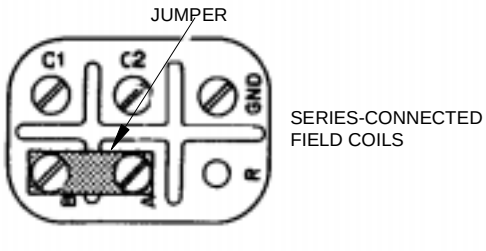

Figure 15. 8300 Series-Connected Field Coils Showing Jumper Position

Transmitter Installation And System Wiring

Transmitter installation and system wiring (flowtube and transmitter) are described in the applicable transmitter installation instructions. Refer to the “Reference Documents” section for the applicable transmitter document.

Maintenance

System fault location and maintenance information are described in the instruction book shipped with the applicable transmitter. For flowtube parts, refer to the applicable flowtube parts list in the “Reference Document” section.

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