

Series 8700 Magnetic Flowmeter Flowtubes



ROSEMOUNT®

FISHER-ROSEMOUNT™

Series 8700 Magnetic Flowmeter Flowtubes

NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

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IMPORTANT

Procedures and instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations. **Refer to the safety messages at the beginning of each section before performing any operations.**

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Introduction

MANUAL SCOPE

The Rosemount® Series 8700 Magnetic Flowmeter System combines separate flowtube and transmitter units. This manual is designed to assist in the installation and operation of Rosemount Model 8705, Model 8707 High-Signal, and Model 8711 Magnetic Flowmeter Flowtubes.

Specific transmitter information is located in the product manual for the Model 8712C/U/H (document 00809-0100-4729), Model 8732C (document 00809-0100-4725), or Model 8742C (document 00809-0100-4793) Magnetic Flowmeter Transmitters.

WARNING

Attempting to install and operate Model 8705, Model 8707 High-Signal, or Model 8711 Magnetic Flowmeter Flowtubes without reviewing the instructions contained in this manual could result in personal injury or equipment damage.

Section 2: Installation

- installation instructions

Section 3: Start-Up and Operation

- flowtube calibration number
- flowtube configuration information.

Section 4: Troubleshooting

- troubleshooting procedures
- electrical circuit diagrams

Section 5: Model 8705 and Model 8707 High-Signal Flowtube Specifications

- specifications for Model 8705 and Model 8707
- reference tables
- dimensional drawings

Section 6: Model 8711 Flowtube Specifications

- specifications for Model 8711
- reference tables
- dimensional drawings

Appendix A: Field-Removable Electrodes

- instructions for removing and replacing the field-removable electrode assembly

SYSTEM DESCRIPTION

Rosemount Series 8700 Magnetic Flowmeter Systems measure volumetric flow rate by detecting the velocity of a conductive liquid that passes through a magnetic field. Magnetic Flowmeter Systems consist of a flowtube and a transmitter.

There are three Rosemount magnetic flowmeter flowtubes:

- Flanged Model 8705
- Flanged High-Signal Model 8707
- Wafer-Style Model 8711

There are three Rosemount magnetic flowmeter transmitters:

- Model 8712C/U/H
- Model 8732C
- Model 8742C

The flowtube is installed in-line with process piping — either vertically or horizontally. Coils located on opposite sides of the flowtube create the necessary magnetic field. A conductive liquid moving through the magnetic field generates a voltage that is detected by two electrodes.

The transmitter drives the coils to generate a magnetic field and electronically conditions the voltage detected by the electrodes. The transmitter then produces output signals proportional to the liquid velocity.

SAFETY MESSAGES

Procedures and instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations. Refer to the safety messages listed at the beginning of each section before performing any operations.

Installation

SAFETY MESSAGES

This section covers the steps required to physically install the flowtube. Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Please refer to the following safety messages before performing any operation in this section.

WARNING

Failure to follow these installation guidelines could result in death or serious injury:

Installation and servicing instructions are for use by qualified personnel only. Performing any servicing other than that contained in this manual may result in death or serious injury. Do not perform any servicing other than that contained in the operating instructions, unless qualified.

CAUTION

The flowtube liner is vulnerable to handling damage. Never place anything through the flowtube for the purpose of lifting or gaining leverage. Liner damage can render the flowtube useless.


CAUTION

To avoid possible damage to the flowtube liner ends, do not use metallic or spiral-wound gaskets. If frequent removal is anticipated, take precautions to protect the liner ends. Short spool pieces attached to the flowtube ends are often used for protection.

CAUTION

Correct flange bolt tightening is crucial for proper flowtube operation and life. All bolts must be tightened in the proper sequence to the specified torque limits. Failure to observe these instructions could result in severe damage to the flowtube lining and possible flowtube replacement.

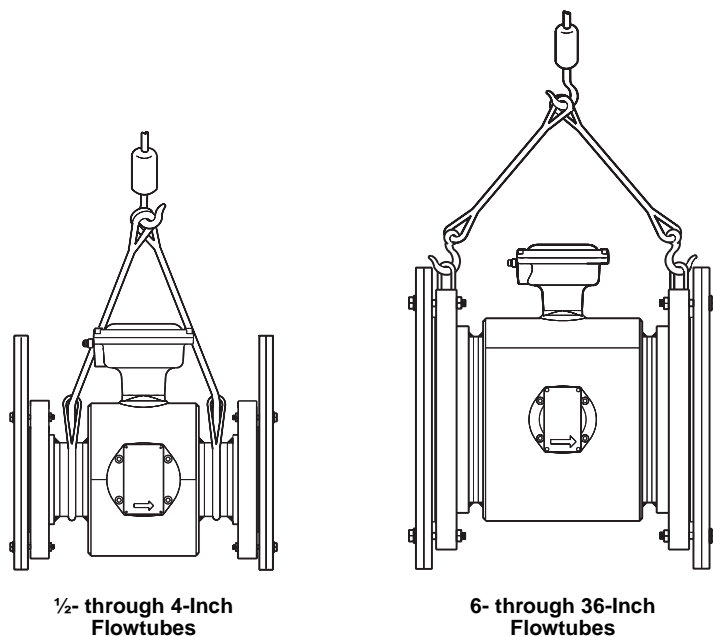
STEP 1: HANDLING

 Handle all parts carefully to prevent damage. Whenever possible, transport the system to the installation site in the original shipping containers. Teflon[®]-lined flowtubes are shipped with end covers that protect it from both mechanical damage and normal unrestrained distortion. Remove the end covers just before installation.

Flanged 6- through 36-inch flowtubes come with a lifting lug on each flange. The lifting lugs make the flowtube easier to handle when it is transported and lowered into place at the installation site. Flanged ½- to 4-inch flowtubes do not have lugs. They must be supported with a lifting sling on either side of the housing.

Figure 2-1 shows flowtubes correctly supported for handling and installation. Notice the plywood end pieces are still in place to protect the flowtube liner during transportation.

FIGURE 2-1. Flowtube Support for Handling and Installation




8705-0281D02A, 0281E02A

STEP 2: MOUNTING

Physical mounting of a flowtube is similar to installing a typical section of pipe. Conventional tools, equipment, and accessories (bolts, gaskets, and grounding hardware) are required.

Calibration

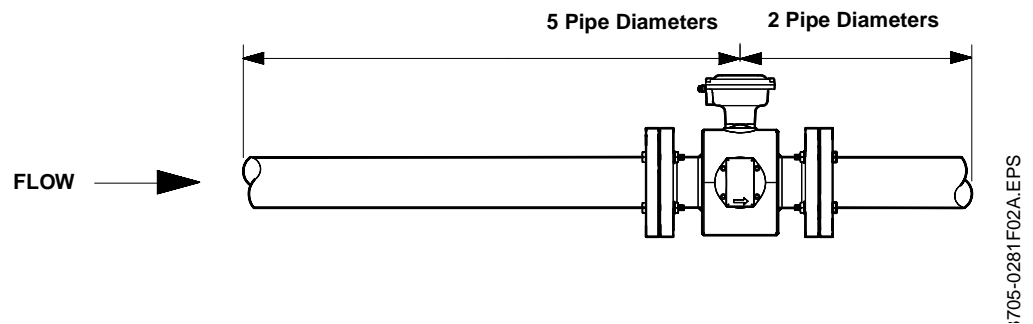
Rosemount flowtubes are wet calibrated at the factory. They do not need further calibration during installation.

 See **Safety Messages** on page 2-1 for complete warning information.

Upstream/ Downstream Piping

To ensure specification accuracy over widely varying process conditions, install the flowtube a minimum of five straight pipe diameters upstream and two pipe diameters downstream from the electrode plane (see Figure 2-2).

FIGURE 2-2. Upstream and Downstream Straight Pipe Diameters



Flowtube Orientation

The flowtube should be installed in a position that ensures the flowtube remains full during operation. Horizontal or inclined positions are preferred. Figures 2-3, 2-4, and 2-5 show the proper flowtube orientation for the most common installations.

The following orientations ensure that the electrodes are in the optimum plane to minimize the effects of entrapped gas. Further information on electrode orientation can be found in Appendix A.

As illustrated in Figures 2-4B and 2-5B, avoid *downward* flows where back pressure does not ensure that the flowtube remains full at all times.

FIGURE 2-3.
Horizontal Flowtube Orientation

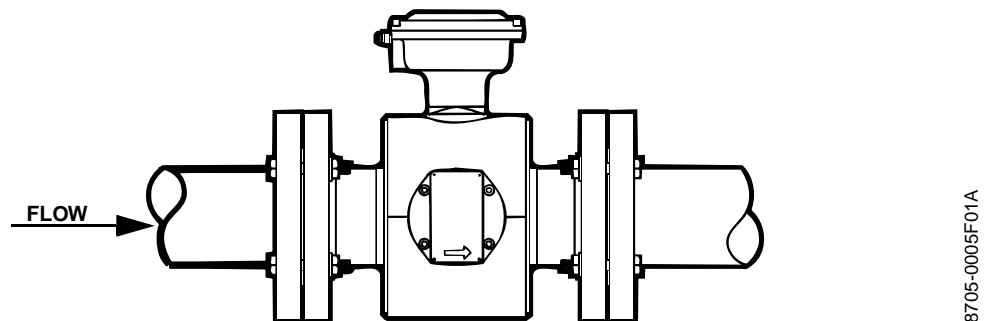


FIGURE 2-4.
Vertical Flowtube Orientation

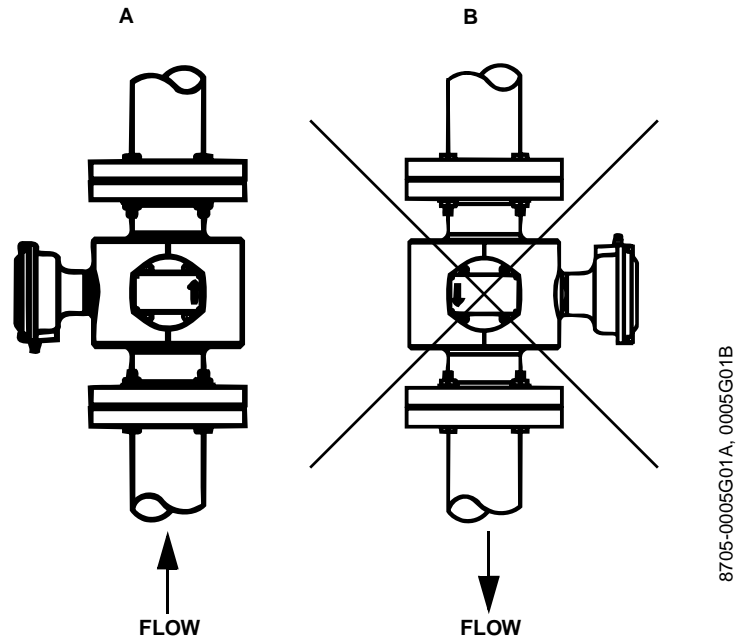
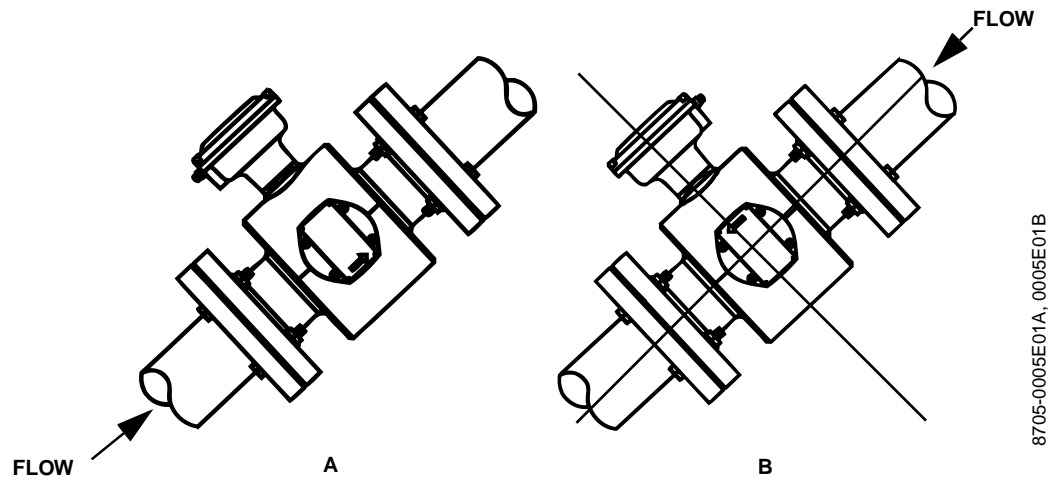


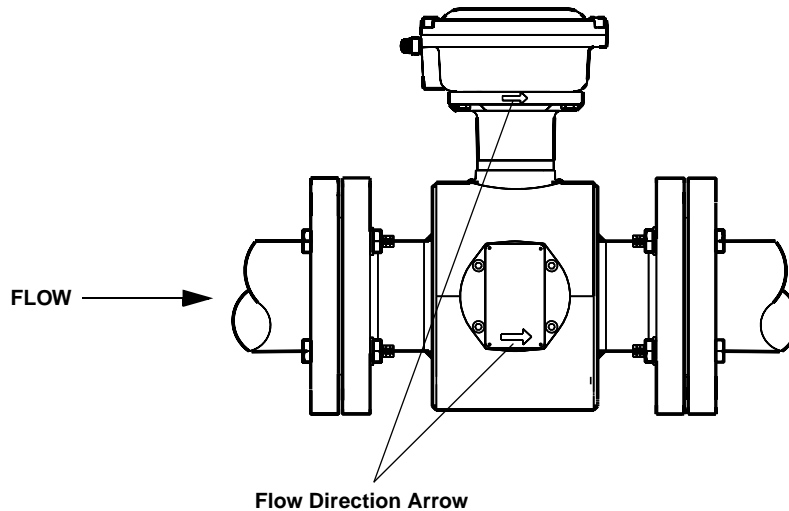
FIGURE 2-5.
Incline or Decline Orientation



Flow Direction

The flowtube should be mounted so that the FORWARD end of the flow arrow, shown on the flowtube identification tag, points in the direction of flow through the tube (see Figure 2-6). In this mounting configuration, the conduit ports point upstream.

FIGURE 2-6. Flow Direction




8705-0281H02F

STEP 3: INSTALLATION OF MODEL 8705 AND MODEL 8707 HIGH-SIGNAL

The following drawings should be used as a guide in the installation of the Model 8705 and Model 8707 High-Signal Flowtubes. Refer to page 2-8 for installation of the Model 8711 Flowtube.

Gaskets

 The flowtube requires a gasket at each of its connections to adjacent devices or piping. The gasket material selected must be compatible with the process fluid and operating conditions. Metallic or spiral-wound gaskets can damage the liner. If the gaskets will be removed frequently, protect the liner ends.

A gasket is required on each side of the grounding ring, as shown in Figure 2-7. All other applications (including lining protector and grounding electrode) require only one gasket on each end connection, as shown in Figure 2-8.


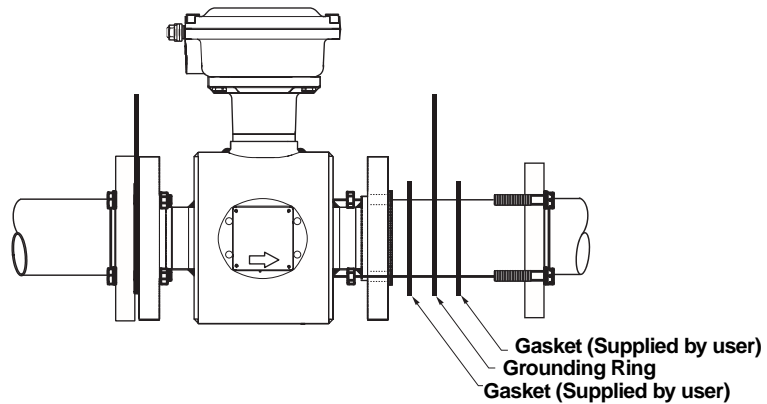
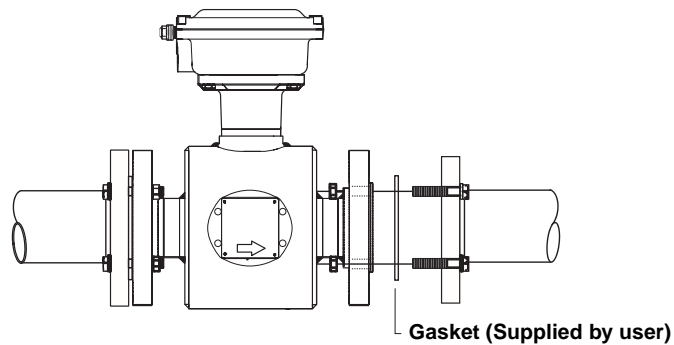
 See **Safety Messages** on page 2-1 for complete warning information.

FIGURE 2-7. Gasket Placement with Non-attached Grounding Rings



8705-0038D

FIGURE 2-8. Gasket Placement



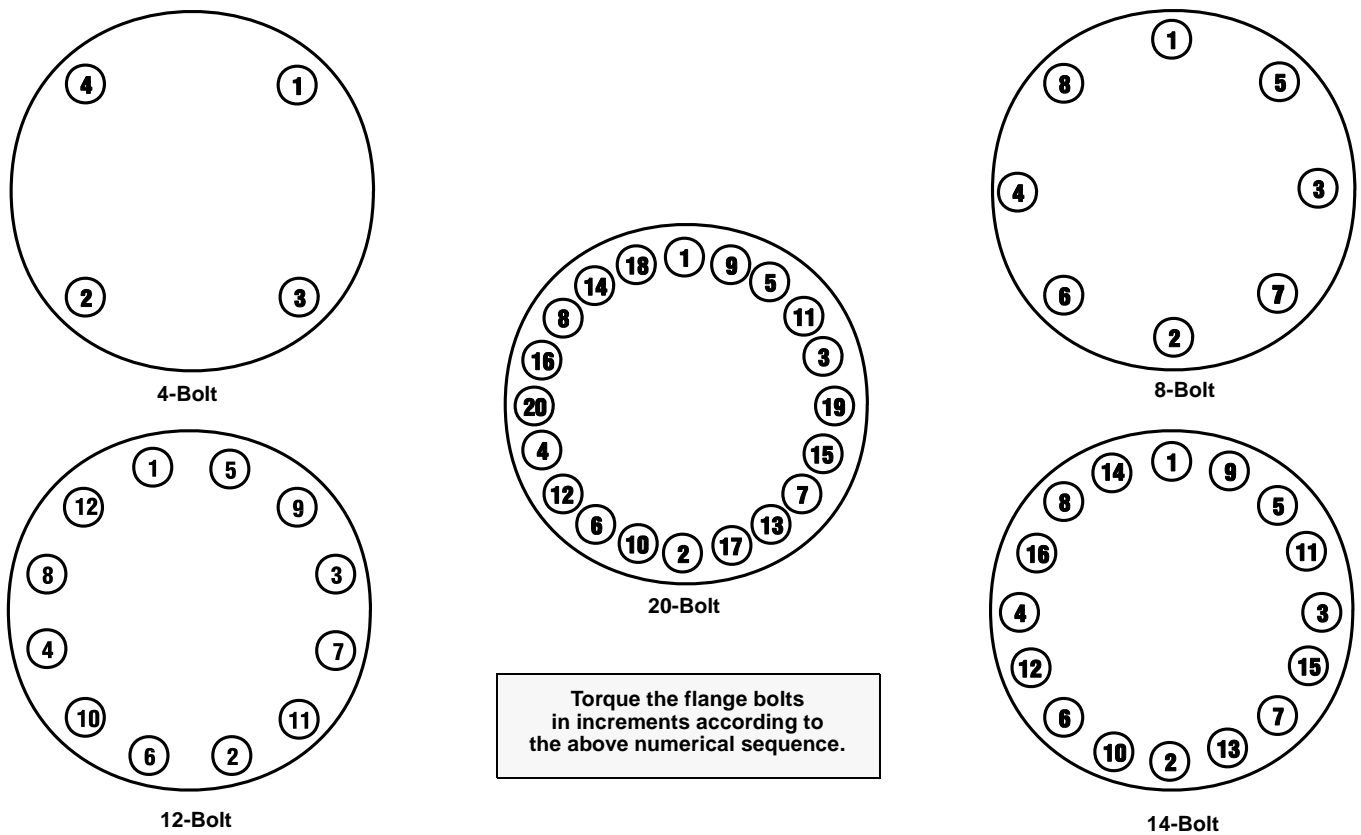
8705-0040E

Flange Bolts

Flowtube sizes and torque values for both ASME B16.5 (ANSI) Class 150 and Class 300 flanges are listed in Table 2-1. Consult factory for other flange ratings and types. Tighten flange bolts in the incremental sequence as shown in Figure 2-9. See Table 5 and Table 7 for bolt sizes and hole diameters.

- ⚠ Always check for leaks at the flanges after tightening the flange bolts. Failure to use the correct flange bolt tightening methods can result in severe damage. All flowtubes require a second torquing twenty-four hours after initial flange bolt tightening.

FIGURE 2-9. Flange Bolt Torquing Sequence



8701-0870G02A


TABLE 2-1. Flange Bolt Torque Specifications for Model 8705 and Model 8707 High-Signal Flowtubes

Size Code	Line Size	Class 150 (pound-feet)	Class 300 (pound-feet)
005	½-inch (15 mm)	10	10
010	1 inch (25 mm)	10	10
015	1½ inch (40 mm)	17	22
020	2 inch (50 mm)	25	17
030	3 inch (80 mm)	45	35
040	4 inch (100 mm)	35	50
060	6 inch (150 mm)	60	65
080	8 inch (200 mm)	80	60
100	10 inch (250 mm)	70	65
120	12 inch (300 mm)	80	80
140	14 inch (350 mm)	100	–
160	16 inch (400 mm)	90	–
180	18 inch (450 mm)	125	–
200	20 inch (500 mm)	125	–
240	24 inch (600 mm)	150	–
300	30 inch (750 mm)	150	–
360	36 inch (900 mm)	200	–

STEP 3: INSTALLATION OF MODEL 8711

The following section should be used as a guide in the installation of the Model 8711 Flowtube.

Gaskets

 The flowtube requires a gasket at each of its connections to adjacent devices or piping. The gasket material selected must be compatible with the process fluid and operating conditions. Metallic or spiral-wound gaskets can damage the liner. If the gaskets will be removed frequently, protect the liner ends. If grounding rings are used, a gasket is required on each side of the grounding ring.

Alignment and Bolting

1. On 1½ - through 8-inch (40 through 200 mm) line sizes, place centering rings over each end of the flowtube. The smaller line sizes, 0.15- through 1-inch (4 through 25 mm), do not require centering rings.
2. Insert studs for the bottom side of the flowtube between the pipe flanges. Stud specifications are listed in Table 2-2 **Using carbon steel bolts on smaller line sizes, 0.15- through 1-inch (4 through 25 mm), rather than the required stainless steel bolts, will degrade performance.**

TABLE 2-2. Stud Specifications

Nominal Flowtube Size	Stud Specifications
0.15 – 1 inch (4 – 25 mm)	316 SST ASTM A193, Grade B8M Class 1 threaded mounted studs
1½ – 8 inch (40 – 200 mm)	CS, ASTM A193, Grade B7, threaded mounting studs

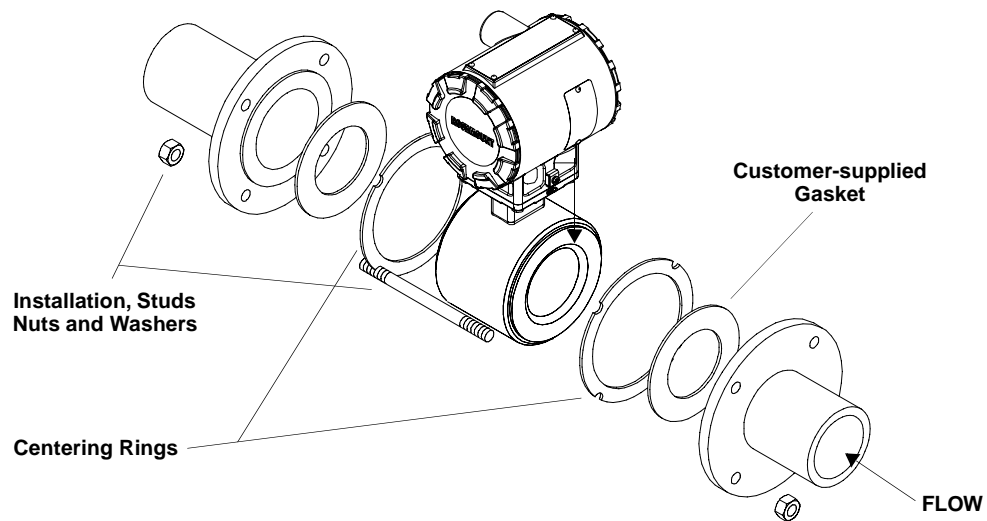
3. Place the flowtube between the flanges. Make sure that the centering rings are properly placed in the studs. The studs should be aligned with the markings on the rings that correspond to the flange you are using.
4. Insert the remaining studs, washers, and nuts.
5. Tighten to the torque specifications shown in Table 2-1 Do not overtighten the bolts or the liner may be damaged.

NOTE

On the 4- and 6-inch PN 10–16, insert the flowtube with rings first and then insert the studs. The slots on this ring scenario are located on the inside of the ring.

 See **Safety Messages** on page 2-1 for complete warning information.

FIGURE 2-10. Gasket Placement with Centering Rings



Flange Bolts

Flowtube sizes and torque values for both Class 150 and Class 300 flanges are listed in Table 2-3. Tighten flange bolts in the incremental sequence, shown in Figure 2-9.

Always check for leaks at the flanges after tightening the flange bolts. All flowtubes require a second torquing 24 hours after initial flange bolt tightening.

TABLE 2-3. Torque specifications

Size Code	Line Size	Pound-feet	Newton-meter
15F	0.15 inch (4 mm)	5	6.8
30F	0.30 inch (8 mm)	5	6.8
005	½-inch (15 mm)	5	6.8
010	1 inch (25 mm)	10	13.6
015	1½ inch (40 mm)	15	20.5
020	2 inch (50 mm)	25	34.1
030	3 inch (80 mm)	40	54.6
040	4 inch (100 mm)	30	40.1
060	6 inch (150 mm)	50	68.2
080	8 inch (200 mm)	70	81.9

STEP 4: GROUNDING

Grounding the flowtube is one of the most important details of flowtube installation. Proper grounding ensures that only the voltage induced in the magnetic field of the flowtube is measured. Use Table 2-4 to determine which grounding option to follow for proper installation. Attached grounding rings should be grounded equivalently to non-attached grounding rings.

NOTE

Consult factory for installations requiring cathodic protection or situations where there are high currents or high potential in the process.

The flowtube case should always be grounded in accordance with national and local electrical codes. Failure to do so may impair the protection provided by the equipment. The most effective grounding method is direct connection to earth ground with minimal impedance.


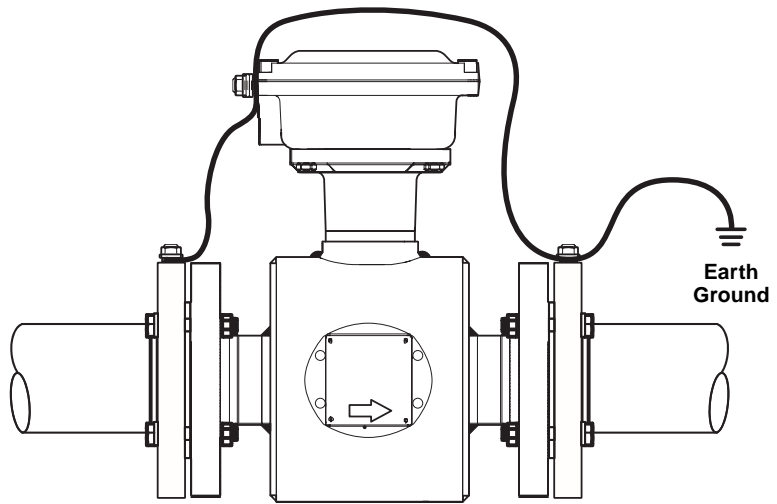
The Internal Ground Connection (Protective Ground Connection) located in side the junction box is the Internal Ground Connection screw. This screw is identified by the ground symbol: 

TABLE 2-4. Grounding Installation

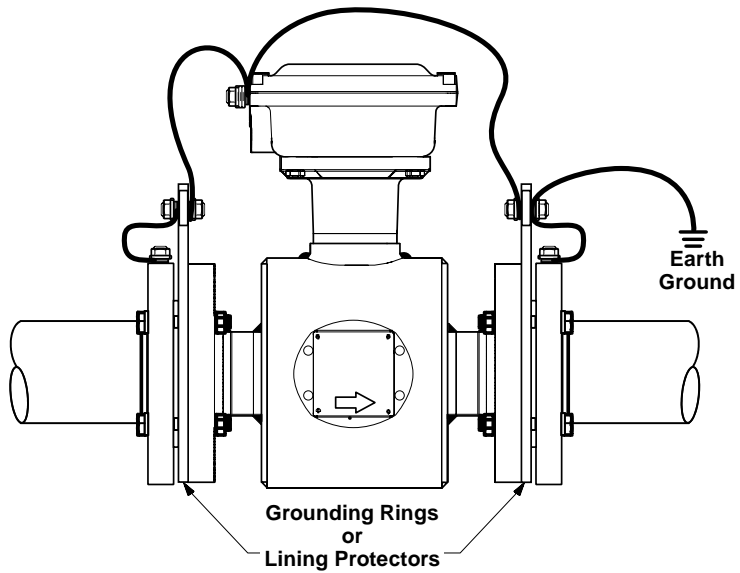
Type of Pipe	Grounding Options			
	No Grounding Options	Grounding Rings	Grounding Electrodes	Lining Protectors
Conductive Unlined Pipe	See Figure 2-11	Not Required	Not Required	See Figure 2-12
Conductive Lined Pipe	Insufficient Grounding	See Figure 2-12	See Figure 2-11	See Figure 2-12
Non-Conductive Pipe	Insufficient Grounding	See Figure 2-13	See Figure 2-14	See Figure 2-13

FIGURE 2-11. No Grounding Options or Grounding Electrode in Lined Pipe



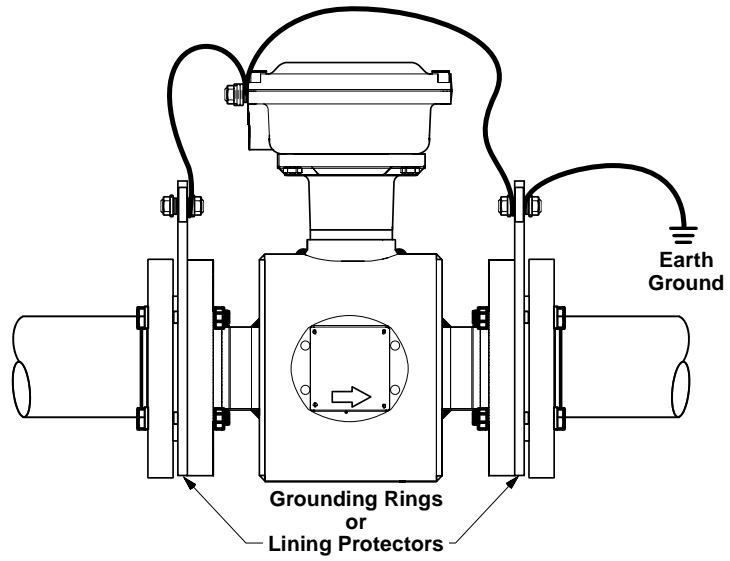
8705-0040C

FIGURE 2-12. Grounding with Grounding Rings or Lining Protectors



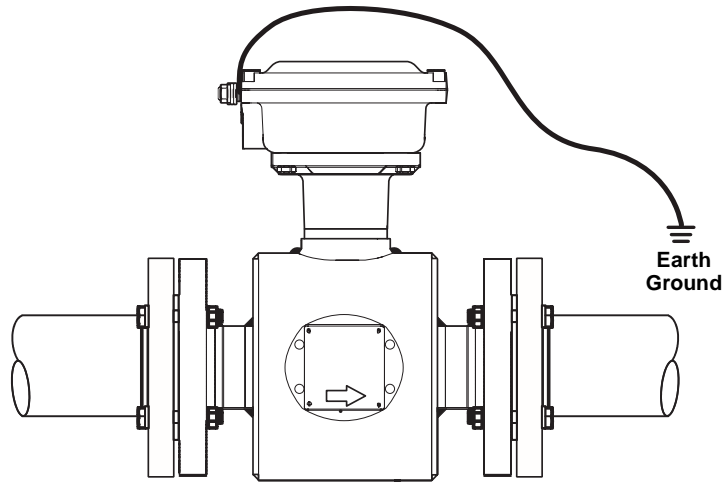
8705-0038C

FIGURE 2-13. Grounding with Grounding Rings or Lining Protectors



8705-0038E

FIGURE 2-14. Grounding with Grounding Electrodes



8705-0040D

STEP 5: WIRING


Conduit Ports and Connections

The conduit connections needed for installation depend on transmitter location. A conduit run between the flowtube and transmitter is not required if the transmitter is integrally mounted on the flowtube.

Both the flowtube and transmitter junction boxes have ports for 3/4-inch NPT conduit connections. These connections should be made in accordance with local or plant electrical codes. Unused ports should be sealed with metal plugs. Housing damage will result if metal plugs are overtightened.

Flanged and wafer flowtubes have two conduit ports as shown in Figures 1, 2, 3, and 1. Either one may be used for both the coil drive and electrode cables. Use the stainless steel plug that is provided to seal the unused conduit port.

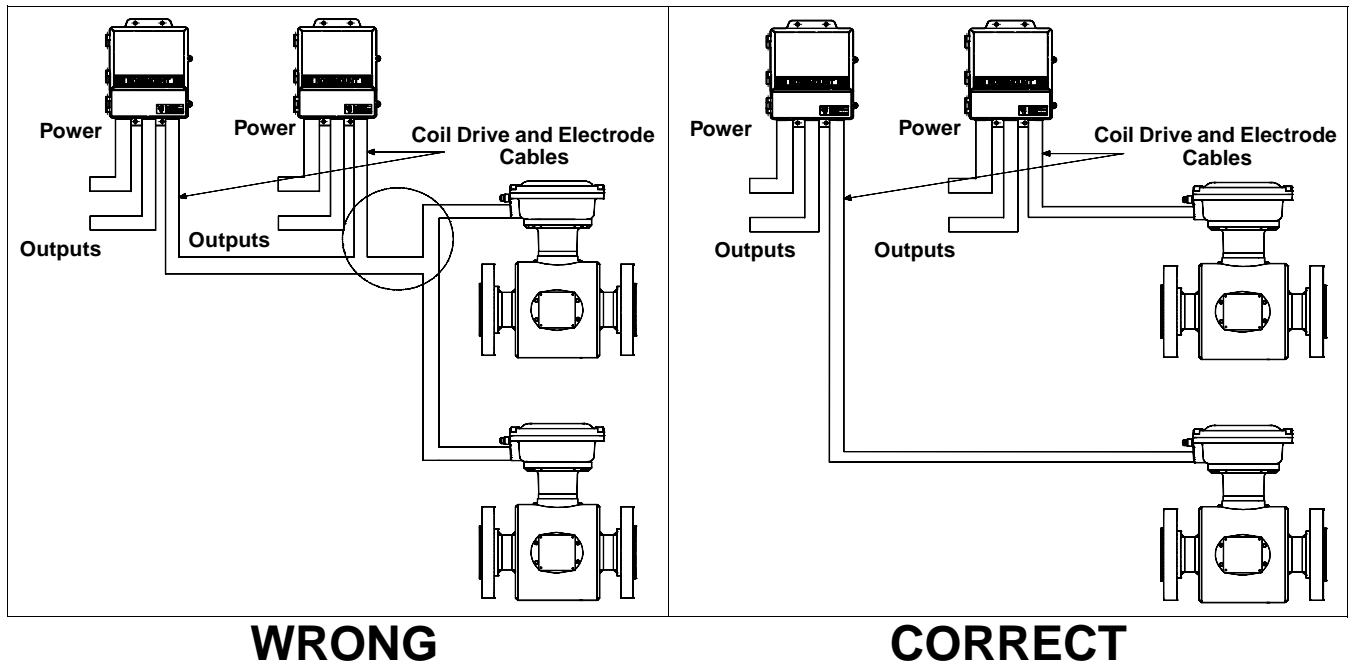
Series 8700 Flowtubes use a pulsed-dc signal generated by Model 8712C/U/H, Model 8732C, or Model 8742C Magnetic Flowmeter Transmitter. Connect the Model 8712H High-Signal Magnetic Flowmeter Transmitter only to the Model 8707 High-Signal Flowtube.

⚠ CAUTION	
<p>This is a pulsed dc magnetic flowmeter. Do not connect ac power to the flowtube or to terminals 1 and 2 of the transmitter, or replacement of the electronics board will be necessary.</p>	

A single dedicated conduit run for the coil drive and electrode cables is needed between a flowtube and a remote transmitter. Bundled cables in a single conduit are likely to create interference and noise problems in your system. Use one set of cables per conduit run. See Figure 2-15 for proper conduit installation diagram and Table 2-5 for recommended cable.

Use wire rated for the proper temperature application. For connections in ambient temperatures above 140 °F (60 °C), use a wire rated for 176 °F (80 °C). For ambients greater than 176 °F (80 °C), use a wire rated for 230 °F (110 °C).

FIGURE 2-15. Conduit Preparation



8705-0005CDGA, DDGA

TABLE 2-5. Cable Requirements

Description	Part Number
Signal Cable (20 AWG) Belden 8762, Alpha 2411 equivalent	08712-0061-0001
Coil Drive Cable (14 AWG) Belden 8720, Alpha 2442 equivalent	08712-0060-0001
Combination Signal and Coil Drive Cable (18 AWG) ⁽¹⁾ Belden 9368 equivalent	08712-0750-0001

(1) Combination signal and coil drive cable is not recommended for high-signal magmeter system. For remote mount installations, combination signal and coil drive cable should be limited to less than 100 ft (30 m).

Remote transmitter installations require equal lengths of signal and coil drive cables. Integrally mounted transmitters are factory wired and do not require interconnecting cables.

Lengths from 5 to 1,000 feet (1.5 to 300 meters) may be specified, and will be shipped with the flowtube.

Cable longer than 100 feet (30 meters) is not recommended for high-signal magmeter systems.

Cable Preparation

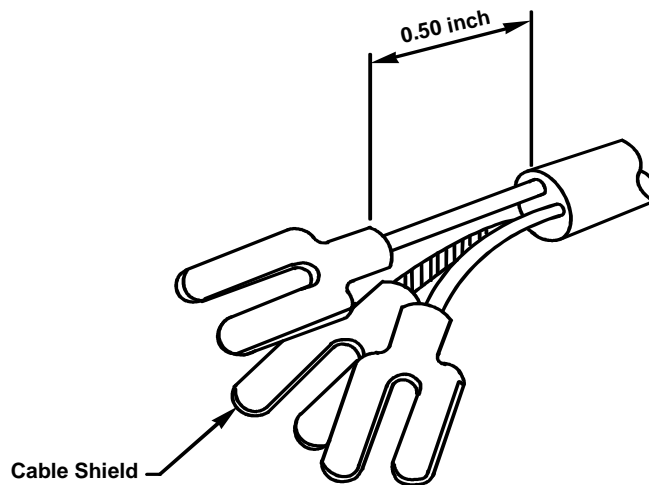
Prepare the flowtube ends of the coil drive and electrode cables, as shown in Figure 2-16.

NOTE

The maximum length for unshielded wire in the wiring compartment is ½-inch.

Correct cable preparation is important for a successful installation. The cable shield should be stripped back no more than 0.50 inch. If more wire is exposed, electrical noise will increase and create unstable meter readings.

FIGURE 2-16. Cable Preparation Detail



8705-0041B

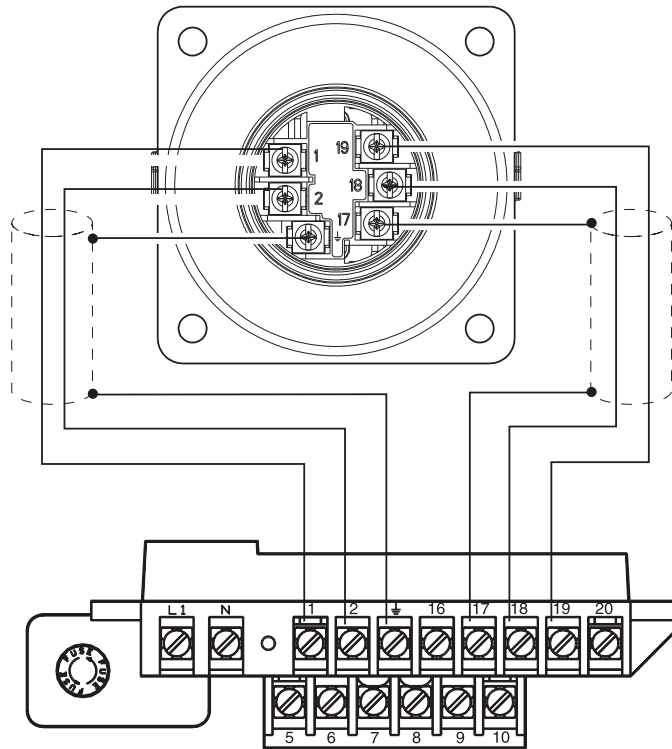
IMPORTANT

Failure to connect the cable shields will result in improper operation. Series 8700 Flowtube Systems require that the cable shields be connected at the flowtube for proper operation.

Flowtube to Model 8712C/U Transmitter Connections

Connect coil drive and electrode cables as shown in Figure 2-17.

FIGURE 2-17. Wiring Diagram to Model 8712C/U Transmitter



8712-04A

TABLE 2-6. Flowtube to Remote Mount Transmitter

Rosemount Model 8712C/U Transmitters	Rosemount Model 8705/8707/8711 Flowtubes
1	1
2	2
$\frac{1}{2}$	$\frac{1}{2}$
17	17
18	18
19	19

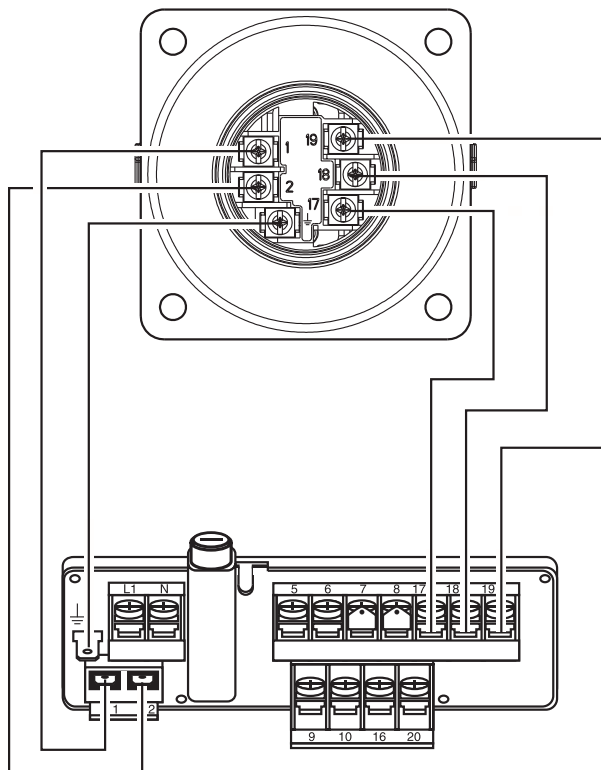
⚠ CAUTION

This is a pulsed dc magnetic flowmeter. **Do not connect ac power to the flowtube or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.

High-Signal Flowtube to High-Signal Transmitter Connections

Connect coil drive and electrode cables as shown in Figure 2-18.

FIGURE 2-18. Wiring Diagram to Model 8712H High-Signal Transmitter



8712-03A

TABLE 2-7. High-Signal Flowtube to High-Signal Transmitter

Rosemount Model 8712H Transmitters	Rosemount Model 8707 Flowtubes
1	1
2	2
$\frac{1}{2}$	$\frac{1}{2}$
17	17
18	18
19	19

⚠ CAUTION

This is a pulsed dc magnetic flowmeter. **Do not connect ac power to the flowtube or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.

Flowtube to Integral Mount Transmitter Connections

Connect coil drive and electrode cables as shown in Figure 2-19.

FIGURE 2-19. Wiring Diagram to Model 8732C/8742C Transmitter

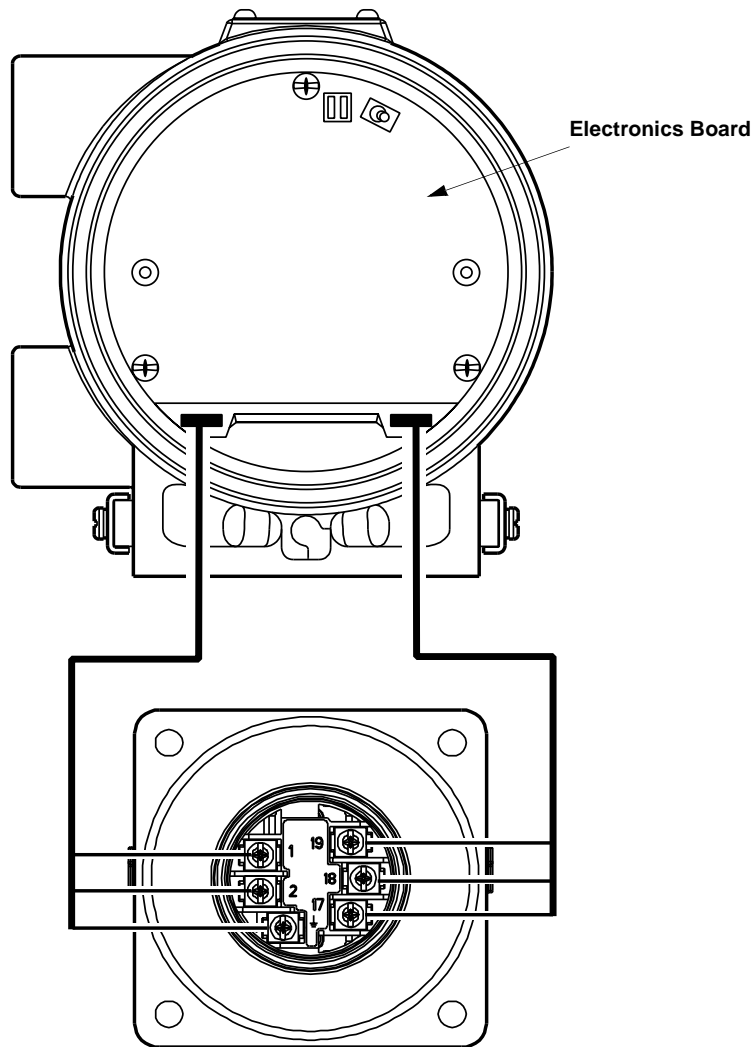


TABLE 2-8. Flowtube to Integral Mount Transmitter

Rosemount Model 8732C/8742C	Rosemount Model 8705/8711 Flowtubes
1	1
2	2
$\frac{1}{2}$	$\frac{1}{2}$
17	17
18	18
19	19

⚠ CAUTION

This is a pulsed dc magnetic flowmeter. **Do not connect ac power to the flowtube or to terminals 1 and 2 of the transmitter**, or replacement of the electronics board will be necessary.

8732-8732B01A

STEP 6: PROCESS LEAK PROTECTION (MODEL 8705 AND MODEL 8707 HIGH-SIGNAL ONLY)

The Model 8705 and Model 8707 High-Signal Flowtube housing is fabricated from carbon steel to perform two separate functions. First, it provides shielding for the flowtube magnetics so that external disturbances cannot interfere with the magnetic field and thus affect the flow measurement. Second, it provides the physical protection to the coils and other internal components from contamination and physical damage that might occur in an industrial environment. The housing is completely welded and gasket-free.

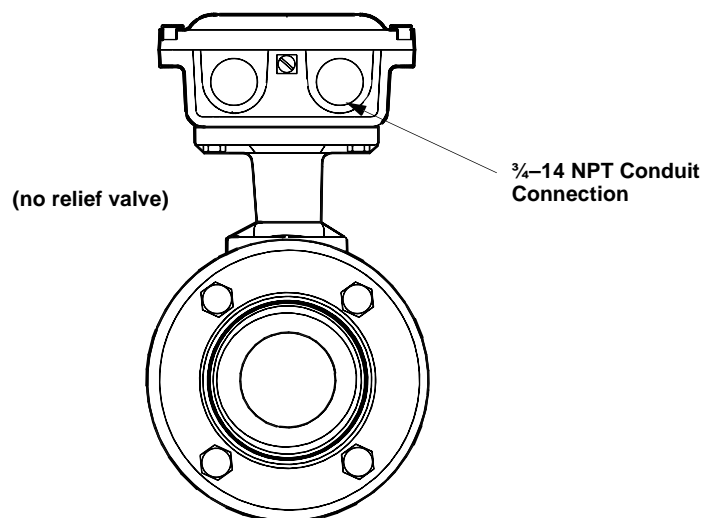
The three housing configurations are identified by the W0, W1, or W3 in the model number option code when ordering. Below are brief descriptions of each housing configuration, which are followed by a more detailed overview.

- **Code W0** — sealed, welded coil housing (standard configuration)
- **Code W1** — sealed, welded coil housing with a relief valve capable of venting fugitive emissions to a safe location (additional plumbing from the flowtube to a safe area, installed by the user, is required to vent properly)
- **Code W3** — sealed, welded coil housing with separate electrode compartments capable of venting fugitive emissions (additional plumbing from the flowtube to a safe area, installed by the user, is required to vent properly)

Standard Housing Configuration

The standard housing configuration is identified by a code W0 in the model number. This configuration does not provide separate electrode compartments with external electrode access. In the event of a process leak, these models will not protect the coils or other sensitive areas around the flowtube from exposure to the pressure fluid.

FIGURE 2-20. Standard Housing — Configuration Sealed Welded Housing (Option Code W0)

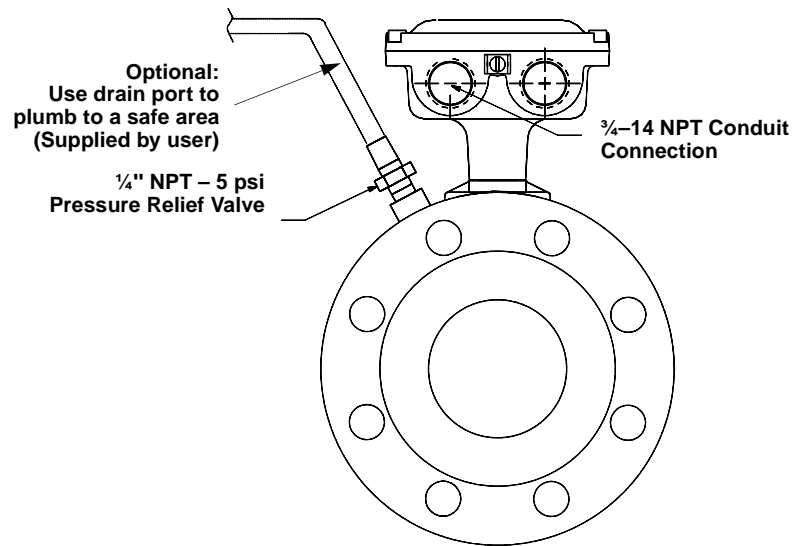


8705-1002A05D

Relief Valves

The first optional configuration, identified by the W1 in the model number option code, uses a completely welded coil housing. This configuration does not provide separate electrode compartments with external electrode access. This optional housing configuration provides a relief valve in the housing to prevent possible overpressuring caused by damage to the lining or other situations that might allow process pressure to enter the housing. The relief valve will vent when the pressure inside the flowtube housing exceeds 5 psi. Additional piping (provided by the user) may be connected to this relief valve to drain any process leakage to safe containment (see Figure 2-21).

FIGURE 2-21. Coil-Housing Configuration — Standard Welded Housing With Relief Valve (Option Code W1)



8705-0021A05B

Process Leak Containment

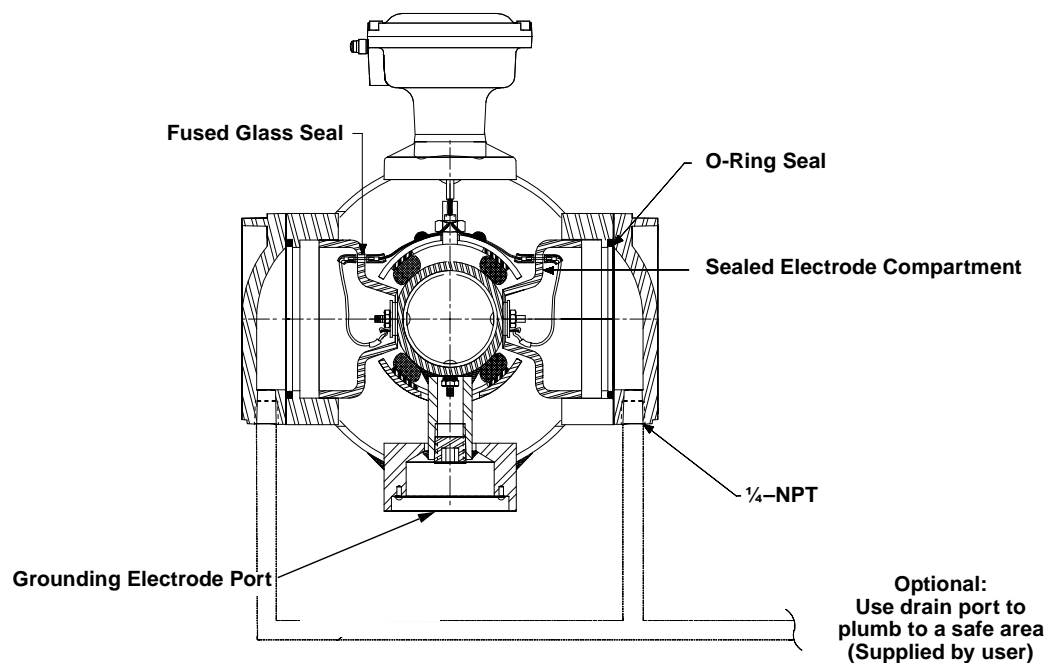
The second optional configuration, identified as option code W3 in the model number, divides the coil housing into three compartments: one for each electrode and one for the coils. Should a damaged liner or electrode fault process fluid to migrate behind the electrode seals, the fluid is contained in the electrode compartment. The sealed electrode compartment prevents the process fluid from entering the coil compartment where it would damage the coils and other internal components.

The electrode compartments are designed to contain the process fluid at full line pressure. An o-ring sealed cover provides access to each of the electrode compartments from outside the flowtube; drainports are provided in each cover for the removal of fluid.

NOTE

The electrode compartment could contain full line pressure and it must be depressurized before the cover is removed.

FIGURE 2-22. Housing Configuration
— Sealed Electrode Compartment
(Option Code W3)



8705-0007 ADGB

If necessary, capture any process fluid leakage, connect the appropriate piping to the drainports, and provide for proper disposal (see Figure 2-22).

STEP 7: START-UP AND OPERATION

Start-up and operation is dependent upon the transmitter selected to complement the flowtube. For transmitter start-up information, refer to the Model 8712C/U/H manual (document 00809-0100-4729), the Model 8732C manual (document 00809-0100-4725), or the Model 8742C manual (document 00809-0100-4793).

Flowtube Calibration Number

A unique flowtube calibration number, imprinted on the flowtube tag, enables any flowtube to be used with any Rosemount transmitter without further calibration. Rosemount flow lab tests determine individual flowtube output characteristics. The characteristics are identified by a 16-digit calibration number.

The 16-digit calibration number can be programmed into the Model 8712C/U/H or Model 8732C transmitter using the Local Operator Interface (LOI) or the Model 275 HART® Communicator. Refer to the appropriate transmitter product manual for complete instructions. In a FOUNDATION™ fieldbus environment, the Model 8742C can be configured using the DeltaV™ configuration tool or another FOUNDATION fieldbus configuration device.

The calibration number is more than a correction factor, or K- factor, for the flowtube. The first five digits represent the low frequency gain. The ninth through thirteenth digits represent the high frequency gain. Both numbers are normalized from an ideal number of 10000. Standard configurations use the low frequency gain, but in noisy applications it may be worthwhile to switch to the higher frequency. An additional transmitter procedure, called Auto Zero, is required to perform at the higher coil drive frequency. The full procedure can be found in the appropriate transmitter manual. The seventh and eighth digits represent the zero offset at both frequencies where the nominal value is 50. Empty pipe functionality is a transmitter feature that is controlled by the flowtube calibration number. To turn off this feature, change the fourteenth digit to the number 7.

Quick Start-up

To initiate a basic transmitter start-up, only four parameters are required:

- Tube calibration number
- Tube size
- Units
- Analog output range (URV)

Refer to the Model 8712C/U/H, Model 8732C, or Model 8742C product manuals for complete transmitter start-up instructions.

Troubleshooting

SAFETY MESSAGES

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Refer to the following safety messages before performing any operation in this section.

WARNING

Failure to follow these installation guidelines could result in death or serious injury:

Installation and servicing instructions are for use by qualified personnel only. Performing any servicing other than that contained in this manual may result in death or serious injury. Do not perform any servicing other than that contained in the operating instructions, unless qualified.

WARNING

Mishandling products exposed to a hazardous substance may result in death or serious injury. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

INDEPENDENT FLOWTUBE AND TRANSMITTER REPLACEMENT

Rosemount flow lab tests determine individual flowtube characteristics and account for them with the 16-digit calibration number. Flowtube interchangeability reduces the need for spare transmitters. It also ensures factory-calibrated accuracy without additional calibration procedures or equipment. The unique calibration number is loaded into the transmitters, enabling the interface of a Rosemount flowtube to communicate with a Rosemount transmitter. A description of the flowtube calibration number is included on page 2-22.

**FLOWTUBE
TROUBLESHOOTING**

The Model 8712C/U/H, Model 8732C, or Model 8742C Magnetic Flowmeter Transmitters perform self diagnostics on the entire magnetic flowmeter system: the transmitter, the flowtube, and the interconnecting wiring. While most of the diagnostics are related to the transmitter microprocessor, some tests diagnose specific flowtube problems.

NOTE

Before performing any of the flowtube tests, cut off power and disconnect all connections inside the flowtube junction box.

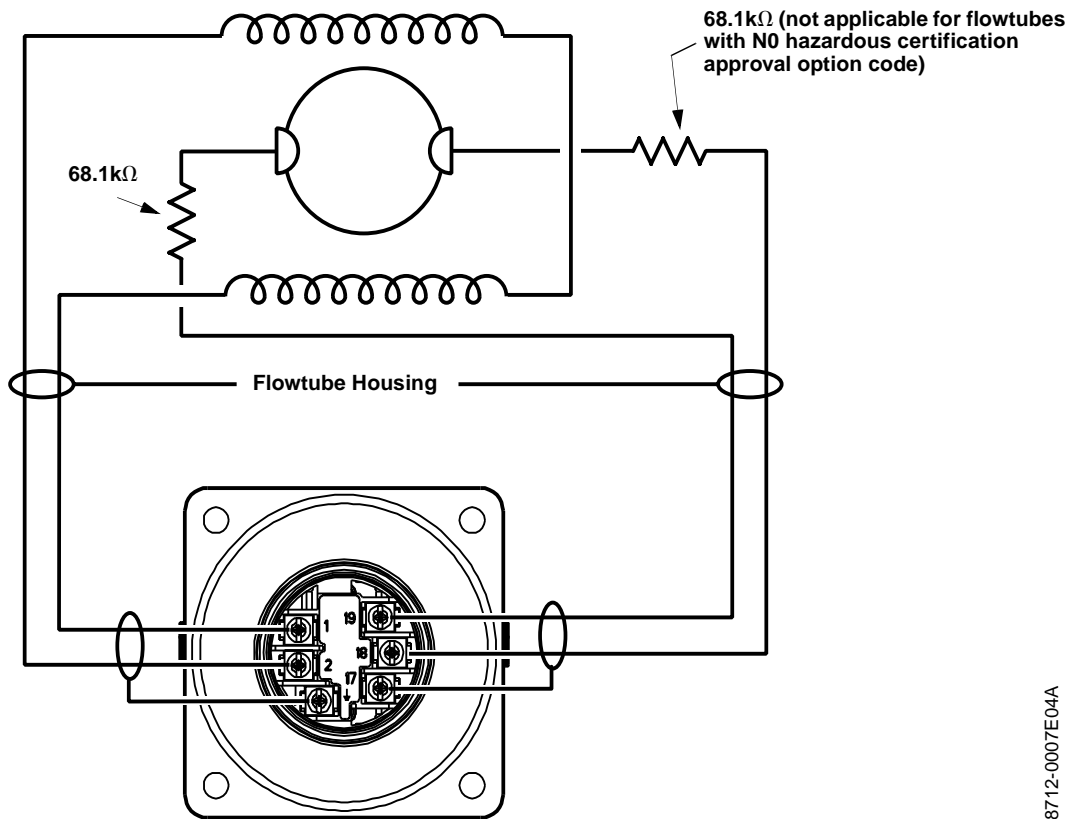
If a problem with the flowtube is identified, the following chart can assist in troubleshooting the flowtube.

Take all readings from inside the junction box with a multimeter. Readings taken at the transmitter terminals may provide incorrect or inconclusive information and should be avoided. A flowtube circuit diagram is shown in Figure 3-1.

TABLE 3-1. Flowtube Troubleshooting

Test A—Flowtube Coil		
Step 1	Step 2	Step 3
Disconnect power from the transmitter by removing the fuse. Disconnect wires 1 and 2 from the transmitter.	➤ Measure the resistance across wires 1 and 2 going to the flowtube, using the lowest ohms scale. The reading should be between 2 and 18 Ω.	➤ A reading outside this range indicates that the coils or cables may be open or shorted.
Test B— Coil Shield to Coil		
Step 1	Step 2	Step 3
Disconnect power from the transmitter by removing the fuse. Disconnect wires 1, 2, and ground from the transmitter.	➤ Measure the resistance from the coil shield (ground) to wires 1 and 2 using the highest scale. Both readings should be overrange.	➤ Any reading on the scale indicates that the coils are shorted to the housing.
Test C— Electrode Shield to Electrode (See Note Below)		
Step 1	Step 2	Step 3
Disconnect power from the transmitter by removing the fuse. Disconnect wires 17, 18, and 19 from the transmitter. Test with process in the flowtube (either flow or no flow).	➤ Measure the resistance from wire 17 to 18 and 17 to 19. This reading will change as you hold the leads on the wires, so use the initial reading. These readings should both be between 1 kΩ and 3 MΩ and close to each other.	➤ A reading near 68kΩ or 0Ω indicates a possible shorted electrode. A stable reading indicates a shorted electrode. A high reading indicates a possible coated electrode, non-conductive process, or electrode not in contact with process.
Test D— Positive to Negative Electrode (See Note Below)		
Step 1	Step 2	Step 3
Disconnect power from the transmitter by removing the fuse. Disconnect wires 18, and 19 from the transmitter. Test with process in the flowtube (either flow or no flow).	➤ Measure the resistance between wires 18 and 19. This reading should be in the range between 100 kΩ and 2MΩ.	➤ An overrange reading indicates a coated electrode, non-conductive process, or electrode not in contact with the process.
Test E— Coils to Electrode		
Step 1	Step 2	Step 3
Disconnect power from the transmitter by removing the fuse. Disconnect all wires from the transmitter.	➤ Measure the resistance between wires 1 or 2 and 18 and between 1 or 2 and 19. Both readings should be in overrange.	➤ Any reading on scale indicates a resistive path from the coils to electrode.

FIGURE 3-1.
Flowtube Circuit Diagram




8712-0007E04A


RETURN OF MATERIALS

To expedite the return process outside the United States, contact the nearest Fisher-Rosemount representative.

The North American Response Center (1-800-654-7768) will assist you with any needed information or materials and is available for users within the United States and Canada, 24 hours a day.

 The center will ask for product model and serial numbers, and will provide a Return Material Authorization (RMA) number. The center will also ask for the name of the process material the product was last exposed to. Mishandling products exposed to a hazardous substance may result in death or serious injury. A copy of the Material Safety Data Sheet may be required, depending on the nature of the hazardous substance as defined by OSHA.

The North American Response Center will provide the additional information and procedures necessary to return goods exposed to hazardous substances.

 See **Safety Messages** on page 3-1 for complete warning information.

Specifications: Model 8705 and Model 8707 High-Signal Flowtubes

SPECIFICATIONS

Functional Specifications

Service

Conductive liquids and slurries

Line Sizes

1/2–36 inch (15–900 mm) for Model 8705

3–36 inch (80–600 mm) for Model 8707

Interchangeability

Model 8705 flowtubes are interchangeable with Model 8712C/U, Model 8732, and Model 8742C Transmitters. Model 8707 High-Signal Flowtubes are interchangeable with Model 8712H High-Signal Transmitters. System accuracy is maintained regardless of line size or optional features. Each flowtube nameplate has a sixteen-digit calibration number that can be entered into a transmitter through the Local Operator Interface (LOI) or the HART Communicator on the Model 8712C/U/H and the Model 8732C. In a FOUNDATION™ fieldbus environment, the Model 8742C can be configured using the DeltaV™ fieldbus configuration tool or another FOUNDATION fieldbus configuration device. No further calibration is necessary.

Upper Range Limit

30 ft/s (10 m/s)

Process Temperature Limits

Teflon (PTFE) Lining

–20 to 350 °F (–29 to 177 °C)

Tefzel (ETFE) Lining

–20 to 300 °F (–29 to 149 °C)

Polyurethane Lining

0 to 140 °F (–18 to 60 °C)

Neoprene Lining

0 to 185 °F (–18 to 85 °C)

Linatex Lining (Not available for Model 8707)

0 to 158 °F (–18 to 70 °C)

Ambient Temperature Limits

–30 to 150 °F (–34 to 65 °C)

Ambient Conditions

Overvoltage category I. Pollution Degree 2

Pressure Limits

See Table 1 and Table 2 for flange limits. (Verify that the process temperature does not exceed liner material specifications.)

Pressure and Vacuum Limits

Full vacuum at maximum lining material temperature; consult factory for vacuum applications that require Teflon (PTFE) lining material and line sizes greater than 6 inches (150 mm) or larger

TABLE 4-1. Flowtube Temperature vs. Pressure Limits for ASME B16.5 Class Flanges (1/2- to 24-inch line sizes)⁽¹⁾

Flange Material	Flange Rating	Pressure			
		@ -20 to 100 °F (-29 to 38 °C)	@ 200 °F (93 °C)	@ 300 °F (149 °C)	@ 350 °F (177 °C)
Carbon Steel	Class 150	255 psi	260 psi	230 psi	215 psi
	Class 300	740 psi	675 psi	655 psi	645 psi
304 Stainless Steel	Class 150	275 psi	235 psi	205 psi	190 psi
	Class 300	720 psi	600 psi	530 psi	500 psi

(1) 30- and 36-inch AWWA C207 Table 2 Class D rated to 150 psi at 150 °F (66 °C).

TABLE 4-2. Flowtube Temperature vs. Pressure Limits for DIN Flanges (15 to 600 mm line sizes)

Flange Material	Flange Rating	Pressure			
		@ -29 to 50 °C (-20 to 122 °F)	@ 100 °C (212 °F)	@ 150 °C (302 °F)	@ 175°C (347 °F)
Carbon Steel	PN 10 ⁽¹⁾	10 bar	10 bar	9.6 bar	9 bar
	PN 16	16 bar	16 bar	15.2 bar	14.2 bar
	PN 25	25 bar	25 bar	24 bar	22.5 bar
	PN 40	40 bar	40 bar	37.1 bar	34.5 bar
304 Stainless Steel	PN 10 ⁽¹⁾	10 bar	8.4 bar	7.6 bar	7.2 bar
	PN 16	16 bar	13.5 bar	12.2 bar	11.6 bar
	PN 25	25 bar	21.2 bar	19.1 bar	18.2 bar
	PN 40	31.1 bar	27.5 bar	25.8 bar	25.1 bar

(1) Minimum temperature is -10 °C (14 °F).

Submergence Protection

IP 68. Continuous to 30 feet (10 meters)

Enclosure Rating

NEMA 4x. CSA 4

Electrical Rating (Model 8707 only)

Coil drive: 185 V pulse dc, 6 Hz, 250 W

Electrode: 5 V 1 W

Hazardous Location Certifications

NO Factory Mutual (FM) Approval Dust-ignition proof for Class II/III, Division 1 Groups E, F, and G; Non-incendive for Class I, Division 2 Groups A, B, C, and D; T5 temperature code; For non-flammable process fluid service only

AND

Canadian Standards Association (CSA) Approval Suitable for use in Class I, Division 2 Groups A, B, C, and D; Dust-ignition proof for Class II/III, Division 1, Groups E, F, and G hazardous locations

AND

CE Marking (Model 8705 only)

- N5** Factory Mutual (FM) Approval Dust-ignition proof for Class II/III, Division 1 Groups E, F, and G; Non-incendive for Class I, Division 2 Groups A, B, C, and D; T5 temperature code; For flammable process fluid service
- KD** KEMA/CENELEC (Model 8705 only)
 EEx e ia IIC T3...T6 (See Table 3)
AND
 CE Marking (Model 8705 only)

TABLE 4-3. Relation Between Ambient Temperature, Process Temperature, and Temperature Class⁽¹⁾

Meter Size (inches)	Maximum Ambient Temperature	Maximum Process Temperature	Temperature Class
1/2	149 °F (65 °C)	240 °F (116 °C)	T3
1	149 °F (65 °C)	248 °F (120 °C)	T3
1	95 °F (35 °C)	95 °F (35 °C)	T4
1 1/2	149 °F (65 °C)	257 °F (125 °C)	T3
1 1/2	140 °F (60 °C)	140 °F (60 °C)	T4
2	149 °F (65 °C)	257 °F (125 °C)	T3
2	149 °F (65 °C)	167 °F (75 °C)	T4
2	104 °F (40 °C)	104 °F (40 °C)	T5
3 - 4	149 °F (65 °C)	266 °F (130 °C)	T3
3 - 4	149 °F (65 °C)	167 °F (75 °C)	T4
3 - 4	131 °F (55 °C)	194 °F (90 °C)	T5
3 - 4	104 °F (40 °C)	104 °F (40 °C)	T6
6	149 °F (65 °C)	175 °F (79 °C)	T3
6	149 °F (65 °C)	167 °F (75 °C)	T4
6	149 °F (65 °C)	230 °F (110 °C)	T5
6	140 °F (60 °C)	140 °F (60 °C)	T6
8 - 36	149 °F (65 °C)	284 °F (140 °C)	T3
8 - 36	149 °F (65 °C)	240 °F (116 °C)	T4
8 - 36	149 °F (65 °C)	176 °F (80 °C)	T5
8 - 36	149 °F (65 °C)	149 °F (65 °C)	T6

(1) This table is applicable for KEMA/CENELEC approval only.

Conductivity Limits

Process liquid must have a conductivity of 5 microsiemens/cm (5 micromhos/cm) or greater for Model 8705. Process liquid must have a conductivity of 50 microsiemens/cm (50 micromhos/cm) for Model 8707 (excludes the effect of interconnecting cable length in remote mount transmitter installations).

Performance Specifications

(System specifications are given using the frequency output and with the unit at referenced conditions.)

Accuracy

Model 8705 with Model 8712C/U, Model 8732C, or Model 8742C

±0.5% of rate from 1 to 30 ft/s (0.3 to 10 m/s); includes combined effects of linearity, hysteresis, repeatability, and calibration uncertainty; accuracy is ±0.005 ft/s (±0.0015 m/s) from low-flow cutoff to 1.0 ft/s (0.3 m/s)

Model 8707 with Model 8712C/U/H, Model 8732C, or Model 8742C

±0.5% of rate from 3 to 30 ft/s (1 to 10 m/s); include combined effects of linearity, hysteresis, repeatability and calibration uncertainty; accuracy is ±0.015 ft/s (±0.0045 m/s) from low-flow cutoff to 3.0 ft/s (1 m/s)

Vibration Effect

IEC 770 Pipeline Installation Conditions

Mounting Position Effect

None when installed to ensure flowtube remains full.

Physical Specifications

Non-Wetted Materials

Flowtube Housing

Welded, AISI Type 304 SST or Type 316L SST

Flanges

Carbon steel, AISI Type 304 SST, or Type 316L SST

Paint

Polyurethane

Process Wetted Materials

Lining

Teflon (PTFE), Tefzel (ETFE), polyurethane, neoprene, Linatex

Electrodes

316L SST, Hastelloy C-276, tantalum, 90% platinum-10% iridium, titanium

Process Connections

ASME B16.5 (ANSI) Class 150, Class 300, or Class 600

0.5- to 24-inch

AWWA C207 Table 2 Class D

30- and 36-inch

DIN PN 10, 16, 25, and 40

PN10: Not available for flange sizes from 15 to 150 mm

PN16: Not available for flange sizes from 15 to 80 mm

PN 25: Not available for flange sizes from 15 to 150 mm

PN40: Available for all flange sizes

AISI Type 304 SST Sanitary Tri-Clover

3-A approved quick disconnect ferrule-mounted to ASME B16.5 (ANSI) Class 150 flange; 0.5- to 3-inch

Electrical Connections

Two ¾–14 NPT connections with number 8 screw terminals are provided in the terminal enclosure for electrical wiring.

Grounding Electrode

A grounding electrode is installed similarly to the measurement electrodes through the flowtube lining. It is available in all electrode materials.

Grounding Rings

Grounding rings are installed between the flange and the tube face on both ends of the flowtube. They have an I.D. slightly larger than the flowtube I.D. and an external tab to attach ground wiring. Grounding rings are available in 316L SST, Hastelloy-C, titanium, and tantalum.

Lining Protectors

Lining protectors are installed between the flange and the tube face on both ends of the flowtube. The leading edge of lining material is protected by the lining protector; lining protectors cannot be removed once they are installed. Lining protectors are available in 316L SST, Hastelloy-C, and titanium.

Flowtube Dimensions

See Table 5, Table 7, Table 6

See Figure ?-??, Figure ?-??, and Figure ?-??

Weight

See Table 4

TABLE 4-4. Flowtube Weight

CF = Consult Factory

Nominal Line Size ⁽¹⁾ Inches (mm)	Flowtube Flange Rating		Flowtube Weight lb (kg)
	ASME B16.5 (ANSI)	DIN	
½ (15)	150	PN 40	20 (9)
½ (15)	300		22 (10)
1 (25)	150	PN 40	20 (9)
1 (25)	300		22 (10)
1½ (40)	150	PN 40	22 (10)
1½ (40)	300		24 (11)
2 (50)	150	PN 40	26 (12)
2 (50)	300		28 (13)
3 (80)	150	PN 40	40 (18)
3 (80)	300		47 (21)
4 (100)	150	PN 16	48 (22)
4 (100)	300		65 (30)
6 (150)	150	PN 16	81 (37)
6 (150)	300		93 (42)
8 (200)	150	PN 10	110 (50)
8 (200)	300		162 (74)
10 (250)	150	PN 10	220 (98)
10 (250)	300		300 (136)
12 (300)	150	PN 10	330 (150)
12 (300)	300		435 (197)
14 (350)	150	PN 10	370 (168)
16 (400)	150	PN 10	500 (227)
18 (450)	150	PN 10	600 (272)
20 (500)	150	PN 10	680 (308)
24 (600)	150	PN 10	1,000 (454)
30 (750)	125	CF	1,400 (637)
36 (900)	125	CF	1,975 (898)

(1) 30- and 36-inch AWWA C207 Table 2 Class D rated to 150 psi at 150 °F (66 °C).

Rosemount Series 8700 Magnetic Flowmeter Flowtubes

TABLE 4-5. Model 8705 and Model 8707 Dimensions in Inches (Millimeters).
Refer to Dimensional Drawings, Figure 1, Figure 2, and Figure 3

Line Size ⁽¹⁾ and Flange Rating (ASME B 16.5)	Liner Face Diameter "A"	Process Flange Rad. "B"	Overall Flowtube Length "L" ⁽²⁾	Body Height "C"	Body Width "D"	Centerline to Conduit "E"	Bolt Hole Circle Diameter	Bolt Hole Diameter	Number and Size of Bolts
0.5-150 0.5-300	1.38 (35) 1.38 (35)	1.75 (44) 1.88 (48)	7.88 (200) 7.88 (200)	8.75 (222) 8.75 (222)	6.88 (175) 6.88 (175)	5.16 (131) 5.16 (131)	2.38 (60) 2.62 (67)	0.62 (16) 0.62 (16)	4-1/2 4-1/2
1-150 1-300	2.00 (51) 2.00 (51)	2.13 (54) 2.44 (62)	7.88 (200) 7.88 (200)	8.75 (222) 8.75 (222)	7.34 (186) 7.34 (186)	5.16 (131) 5.16 (131)	3.12 (79) 3.50 (89)	0.62 (16) 0.75 (19)	4-1/2 4-5/8
1.5-150 1.5-300	2.88 (73) 2.88 (73)	2.50 (64) 3.06 (78)	7.88 (200) 7.88 (200)	9.52 (242) 9.52 (242)	7.05 (179) 7.05 (179)	5.57 (141) 5.57 (141)	3.88 (99) 4.50 (114)	0.62 (16) 0.88 (22)	4-1/2 4-3/4
2-150 2-300	3.62 (92) 3.62 (92)	3.00 (76) 3.25 (83)	7.88 (200) 7.88 (200)	9.52 (242) 9.52 (242)	7.47 (190) 7.47 (190)	5.57 (141) 5.57 (141)	4.75 (121) 5.00 (127)	0.75 (19) 0.75 (19)	4-5/8 8-5/8
3-150 3-300	5.00 (127) 5.00 (127)	3.75 (95) 4.13 (105)	7.88 (200) 8.63 (219)	11.52 (293) 11.52 (293)	9.57 (243) 9.57 (243)	6.57 (167) 6.57 (167)	6.00 (152) 6.62 (168)	0.75 (19) 0.88 (22)	4-5/8 8-3/4
4-150 4-300	6.19 (157) 6.19 (157)	4.50 (114) 5.00 (127)	9.84 (250) 10.88 (276)	12.22 (310) 12.22 (310)	10.01 (254) 10.01 (254)	6.92 (176) 6.92 (176)	7.50 (191) 7.88 (200)	0.75 (19) 0.88 (22)	8-5/8 8-3/4
6-150 6-300	8.50 (216) 8.50 (216)	5.50 (140) 6.25 (159)	11.81 (300) 13.06 (332)	14.39 (366) 14.39 (366)	10.41 (264) 10.41 (264)	8.05 (204) 8.05 (204)	9.50 (241) 10.62 (270)	0.88 (22) 0.88 (22)	8-3/4 12-3/4
8-150 8-300	10.62 (270) 10.62 (270)	6.75 (171) 7.50 (191)	13.78 (350) 15.60 (396)	16.33 (415) 16.33 (415)	11.38 (289) 11.38 (289)	9.02 (229) 9.02 (229)	11.75 (298) 13.00 (330)	0.88 (22) 1.00 (25)	8-3/4 12-7/8
10-150 10-300	12.75 (324) 12.75 (324)	8.00 (203) 8.75 (225)	15.00 (381) 17.13 (435)	19.11 (485) 19.11 (485)	17.00 (432) 17.00 (432)	10.44 (265) 10.44 (265)	14.25 (362) 15.25 (387)	1.00 (25) 1.12 (28)	12-7/8 16-1
12-150 12-300	15.00 (381) 15.00 (381)	9.50 (241) 10.25 (260)	18.00 (457) 20.14 (512)	21.27 (540) 21.27 (540)	19.16 (487) 19.16 (487)	11.52 (293) 11.52 (293)	17.00 (432) 17.75 (451)	1.00 (25) 1.25 (32)	12-7/8 16-1 1/8
14-150 14-300	16.25 (413) 16.25 (413)	10.50 (267) 11.50 (292)	21.00 (533) 23.25 (591)	23.39 (594) 23.39 (594)	21.28 (541) 21.28 (541)	12.58 (320) 12.58 (320)	18.75 (476) 20.25 (514)	1.12 (28) 1.25 (32)	12-1 20-1 1/8
16-150 16-300	18.50 (470) 18.50 (470)	11.75 (298) 12.75 (324)	24.00 (610) 26.25 (667)	25.41 (645) 25.41 (645)	23.30 (592) 23.30 (592)	13.59 (345) 13.59 (345)	21.25 (540) 22.50 (572)	1.12 (28) 1.38 (35)	16-1 20-1 1/4
18-150 18-300	21.00 (533) 21.00 (533)	12.50 (318) 14.00 (356)	27.00 (686) 30.12 (765)	27.93 (709) 27.93 (709)	25.82 (656) 25.82 (656)	14.85 (377) 14.85 (377)	22.75 (578) 24.75 (629)	1.25 (32) 1.38 (35)	16-1 1/8 24-1 1/4
20-150 20-300	23.00 (584) 23.00 (584)	13.75 (349) 15.25 (387)	30.00 (762) 33.25 (845)	29.95 (761) 29.95 (761)	27.84 (707) 27.84 (707)	15.86 (403) 15.86 (403)	25.00 (635) 27.00 (686)	1.25 (32) 1.38 (35)	20-1 1/8 24-1 1/4
24-150 24-300	27.25 (692) 27.25 (692)	16.00 (406) 18.00 (457)	36.00 (914) 39.64 (1007)	34.50 (876) 34.50 (876)	32.39 (823) 32.39 (823)	18.14 (461) 18.14 (461)	29.50 (749) 32.00 (813)	1.37 (35) 1.62 (41)	20-1 1/4 24-1 1/2
30 36	33.80 (859) 40.27 (1023)	19.38 (492) 23.00 (584)	37.25 (946) 40.75 (1035)	40.41 (1026) 48.29 (1227)	38.50 (928) 46.38 (1178)	21.31 (541) 25.25 (641)	36.00 (914) 42.75 (1086)	1.38 (35) 1.63 (41)	28-1 1/4 32-1 1/2

Dimensions with ASME B16.5 (ANSI) Flanges

- (1) 30- and 36-inch AWWA C207 Table 2 Class D rated to 150 psi at 150 °F.
 (2) When grounding rings (2 rings per meter) are specified, add 0.25 inch (6.35 mm) for 0.50- through 14-inch (15 through 350 mm) flowtubes, add 0.50 inch (12.7 mm) for 16-inch (400 mm) and larger. When lining protectors are specified, add 0.25 inch (6.35 mm) for 1/2- through 12-inch (15 through 300 mm) flowtubes, add 0.50 inch (12.7 mm) for 14- through 36-inch (350 through 900 mm) flowtubes.

TABLE 4-6. Flowtube Dimensions in inches (millimeters)

Line Size and Flange Rating	Nominal Tri-Clamp Diameter	Process Flange Rad. "B"	Body Height "C" Max	Centerline to Conduit "E"	Overall Flowtube Length "L"
0.5-150 lb.	1.00 (25)	1.75 (44)	8.38 (213)	5.16 (131)	13.78 (350)
1-150 lb.	1.50 (40)	2.13 (54)	8.38 (213)	5.16 (131)	13.78 (350)
1.5-150 lb.	2.00 (50)	2.50 (64)	9.00 (229)	5.56 (141)	13.78 (350)
2-150 lb.	3.00 (80)	3.00 (76)	9.00 (229)	5.56 (141)	13.78 (350)
3-150 lb.	4.00 (100)	3.75 (95)	12.00 (305)	6.57 (167)	13.78 (350)

Dimensions with ASME B16.5 (ANSI) Flanges and Tri-Clamp Adapters.

TABLE 4-7. Model 8705 Flowtube Dimensions with DIN Flanges in Millimeters (Inches)

Line Size ⁽¹⁾ and Flange Rating	Liner Face Diameter "A"	Process Flange Rad. "B"	Overall Flowtube Length "L" ⁽²⁾	Body Height "C"	Body Width "D" with Port	Centerline to Conduit "E"	Bolt Hole Circle Diameter	Bolt Hole Diameter	Number of Bolts
15 mm PN 10-40	45 (1.77)	47 (1.87)	200 (7.88)	222 (8.75)	175 (6.88)	131 (5.16)	65 (2.56)	14 (0.55)	4
25 mm PN 10-40	68 (2.68)	58 (2.27)	200 (7.88)	222 (8.75)	186 (7.34)	131 (5.16)	85 (3.35)	14 (0.55)	4
40 mm PN 10-40	88 (3.46)	75 (2.96)	200 (7.87)	242 (9.52)	179 (7.05)	141 (5.57)	110 (4.33)	18 (0.71)	4
50 mm PN 10-40	102 (4.02)	83 (3.25)	200 (7.87)	242 (9.52)	190 (7.47)	141 (5.57)	125 (4.92)	18 (0.71)	4
80 mm PN 10-40	138 (5.43)	100 (3.94)	200 (7.87)	293 (11.52)	243 (9.57)	167 (6.57)	160 (6.30)	18 (0.71)	8
100 mm PN 10-16	158 (6.22)	110 (4.33)	250 (9.84)	310 (12.22)	254 (10.01)	176 (6.92)	180 (7.09)	18 (0.71)	8
100 mm PN 25-40	162 (6.38)	117 (4.63)	250 (9.84)	310 (12.22)	254 (10.01)	176 (6.92)	190 (7.48)	22 (0.87)	8
150 mm PN 10-16	212 (8.35)	142 (5.61)	300 (11.81)	366 (14.39)	264 (10.41)	204 (8.05)	240 (9.45)	22 (0.87)	8
150 mm PN 25	218 (8.58)	150 (5.91)	300 (11.81)	366 (14.39)	264 (10.41)	204 (8.05)	240 (9.45)	22 (0.87)	8
150 mm PN 40	218 (8.58)	150 (5.91)	332 (13.06)	366 (14.39)	264 (10.41)	204 (8.05)	240 (9.45)	22 (0.87)	8
200 mm PN 10	268 (10.55)	170 (6.70)	351 (13.81)	415 (16.33)	289 (13.38)	229 (9.02)	295 (11.61)	22 (0.87)	8
200 mm PN 16	268 (10.55)	170 (6.70)	351 (13.81)	415 (16.33)	289 (13.38)	229 (9.02)	295 (11.61)	22 (0.87)	8
200 mm PN 25	278 (10.94)	180 (7.09)	350 (13.78)	415 (16.33)	289 (13.38)	229 (9.02)	310 (12.20)	26 (1.02)	12
200 mm PN 40	285 (11.22)	187 (7.38)	396 (15.60)	415 (16.33)	289 (13.38)	229 (9.02)	320 (12.60)	30 (1.18)	12
250 mm PN 10	320 (12.60)	197 (7.70)	381 (15.00)	485 (19.11)	432 (17.00)	265 (10.44)	350 (13.78)	22 (0.87)	12
250 mm PN 16	320 (12.60)	202 (7.97)	381 (15.00)	485 (19.11)	432 (17.00)	265 (10.44)	355 (13.98)	26 (1.02)	12
250 mm PN 25	335 (13.19)	213 (8.39)	381 (15.00)	485 (19.11)	432 (17.00)	265 (10.44)	370 (14.67)	30 (1.18)	12
250 mm PN 40	345 (13.58)	225 (8.86)	435 (17.13)	485 (19.11)	432 (17.00)	265 (10.44)	385 (15.16)	33 (1.30)	12
300 mm PN 10	370 (14.57)	223 (8.76)	457 (18.00)	540 (21.27)	487 (19.16)	265 (10.44)	400 (15.75)	22 (0.87)	12
300 mm PN 16	378 (14.88)	230 (9.06)	457 (18.00)	540 (21.27)	487 (19.16)	293 (11.52)	410 (16.14)	26 (1.02)	12
300 mm PN 25	395 (15.55)	242 (9.55)	457 (18.00)	540 (21.27)	487 (19.16)	293 (11.52)	430 (16.93)	30 (1.18)	16
300 mm PN 40	410 (16.14)	258 (10.12)	512 (20.14)	540 (21.27)	487 (19.16)	293 (11.52)	450 (17.72)	33 (1.30)	16
350 mm PN 10	430 (16.93)	252 (9.94)	534 (21.03)	594 (23.39)	541 (21.28)	293 (11.52)	460 (18.11)	22 (0.87)	16
350 mm PN 16	438 (17.24)	260 (10.24)	534 (21.03)	594 (23.39)	541 (21.28)	320 (12.58)	470 (18.50)	26 (1.02)	16
350 mm PN 25	450 (17.72)	277 (10.93)	534 (21.03)	594 (23.39)	541 (21.28)	320 (12.58)	490 (19.29)	33 (1.30)	16
350 mm PN 40	465 (18.31)	290 (11.42)	591 (23.25)	594 (23.39)	541 (21.28)	320 (12.58)	510 (20.08)	36 (1.42)	16
400 mm PN 10	482 (18.98)	282 (11.12)	610 (24.00)	645 (25.04)	592 (23.30)	345 (13.59)	515 (20.28)	26 (1.02)	16
400 mm PN 16	490 (19.29)	290 (11.42)	610 (24.00)	645 (25.04)	592 (23.30)	345 (13.59)	525 (20.67)	30 (1.18)	16
400 mm PN 25	505 (19.88)	310 (12.21)	610 (24.00)	645 (25.04)	592 (23.30)	345 (13.59)	550 (21.65)	36 (1.42)	16
400 mm PN 40	535 (21.06)	330 (12.99)	667 (26.25)	645 (25.04)	592 (23.30)	345 (13.59)	585 (23.03)	39 (1.54)	16
450 mm PN 10	532 (20.94)	308 (12.13)	686 (27.00)	709 (27.93)	656 (25.82)	377 (14.85)	565 (22.24)	26 (1.02)	20
450 mm PN 16	550 (21.65)	320 (12.60)	686 (27.00)	709 (27.93)	656 (25.82)	377 (14.85)	585 (23.03)	30 (1.18)	20
450 mm PN 40	560 (22.05)	343 (13.50)	765 (30.12)	709 (27.93)	656 (25.82)	377 (14.85)	610 (24.02)	30 (1.18)	20
500 mm PN 10	585 (23.03)	335 (13.19)	762 (30.00)	761 (29.95)	707 (27.84)	403 (15.86)	620 (24.41)	26 (1.02)	20
500 mm PN 16	610 (24.02)	358 (14.08)	762 (30.00)	761 (29.95)	707 (27.84)	403 (15.86)	650 (25.59)	33 (1.30)	20
500 mm PN 25	615 (24.21)	365 (14.37)	762 (30.00)	761 (29.95)	707 (27.84)	403 (15.86)	660 (25.98)	36 (1.42)	20
500 mm PN 40	615 (24.21)	378 (14.88)	845 (33.25)	761 (29.95)	707 (27.84)	403 (15.86)	670 (26.38)	42 (1.65)	20
600 mm PN 10	685 (26.97)	390 (15.36)	914 (36.00)	885 (34.85)	823 (32.39)	461 (18.14)	725 (28.54)	30 (1.18)	20
600 mm PN 16	725 (28.54)	420 (16.54)	914 (36.00)	877 (34.51)	823 (32.39)	461 (18.14)	770 (30.31)	36 (1.42)	20
600 mm PN 25	720 (28.35)	423 (16.64)	914 (36.00)	877 (34.51)	823 (32.39)	461 (18.14)	770 (30.31)	39 (1.54)	20
600 mm PN 40	735 (18.94)	445 (17.52)	1,007 (39.64)	886 (34.88)	823 (32.39)	461 (18.14)	795 (31.30)	48 (1.88)	20

Dimensions with DIN Flanges

(1) Consult factory for larger line sizes.

(2) When grounding rings (2 rings per meter) are specified, add 6.35 mm (0.25 in.) for 15 mm through 350 mm (½- through 14 in.) flowtubes or 12.7 mm (0.50 in.) for 400 mm (16 in.) and larger. When lining protectors are specified, add 6.35 mm (0.25 in.) for 15 mm through 300 mm (½- through 12-in.) flowtubes, 12.7 mm (0.50 in.) for 350 mm through 900 mm (14- through 36-in.) flowtubes.

Rosemount Series 8700 Magnetic Flowmeter Flowtubes

Figure 4-1. Dimensional Drawing of Model 8705 and Model 8707 Flowtubes, Typical of 1/2- through 4-inch (15 through 100 mm) Line Sizes with Option Code W1, Housing Configuration

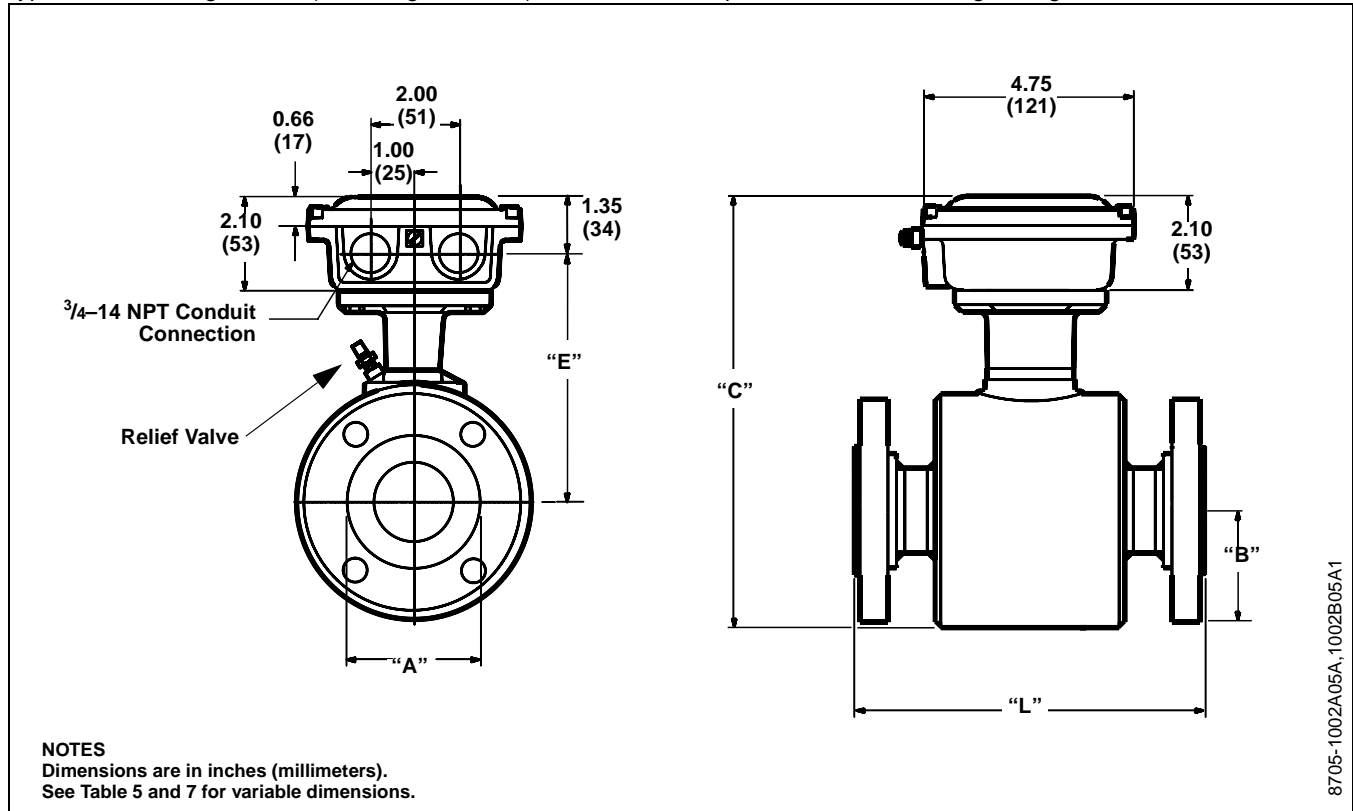


Figure 4-2. Dimensional Drawing of Model 8705 and Model 8707 Flowtubes, Typical of 6- through 36-inch (150 through 900 mm) Line Sizes with Option Code W3, Housing Configuration

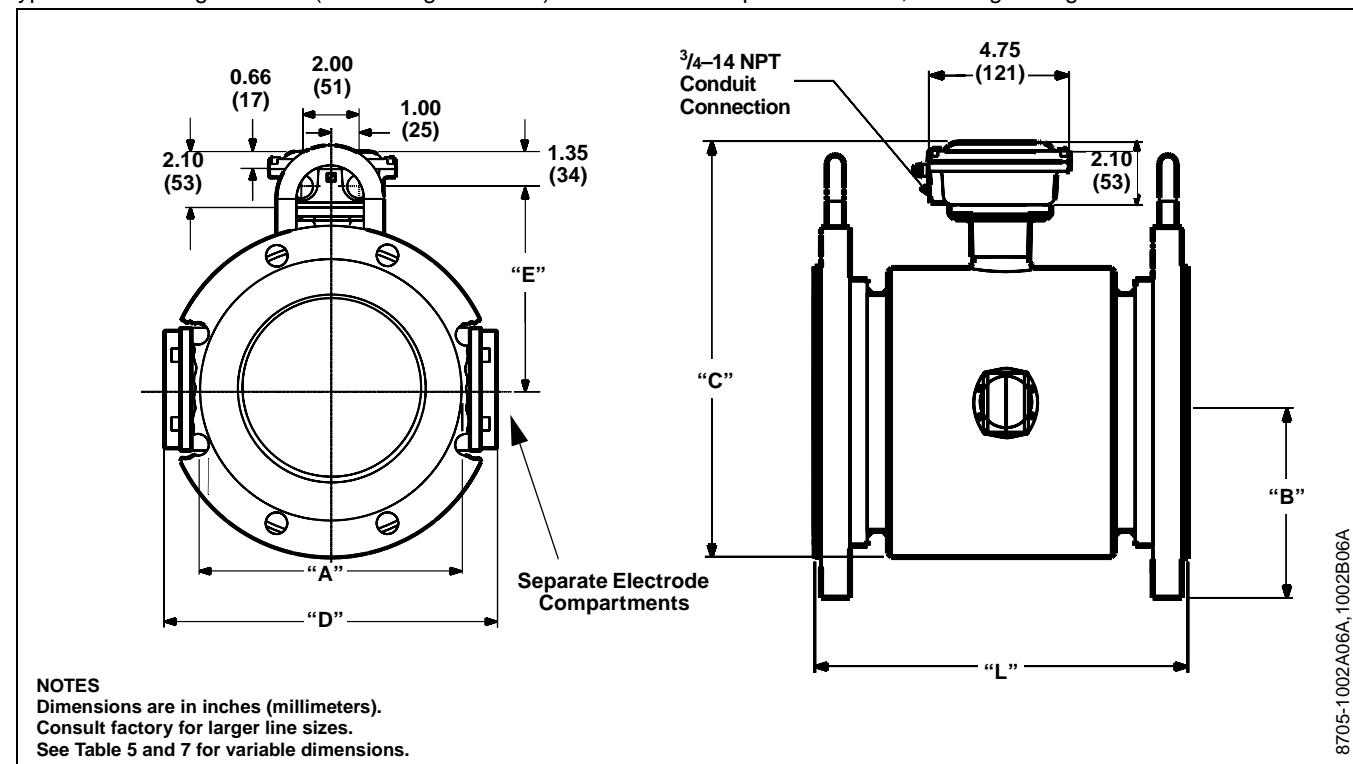
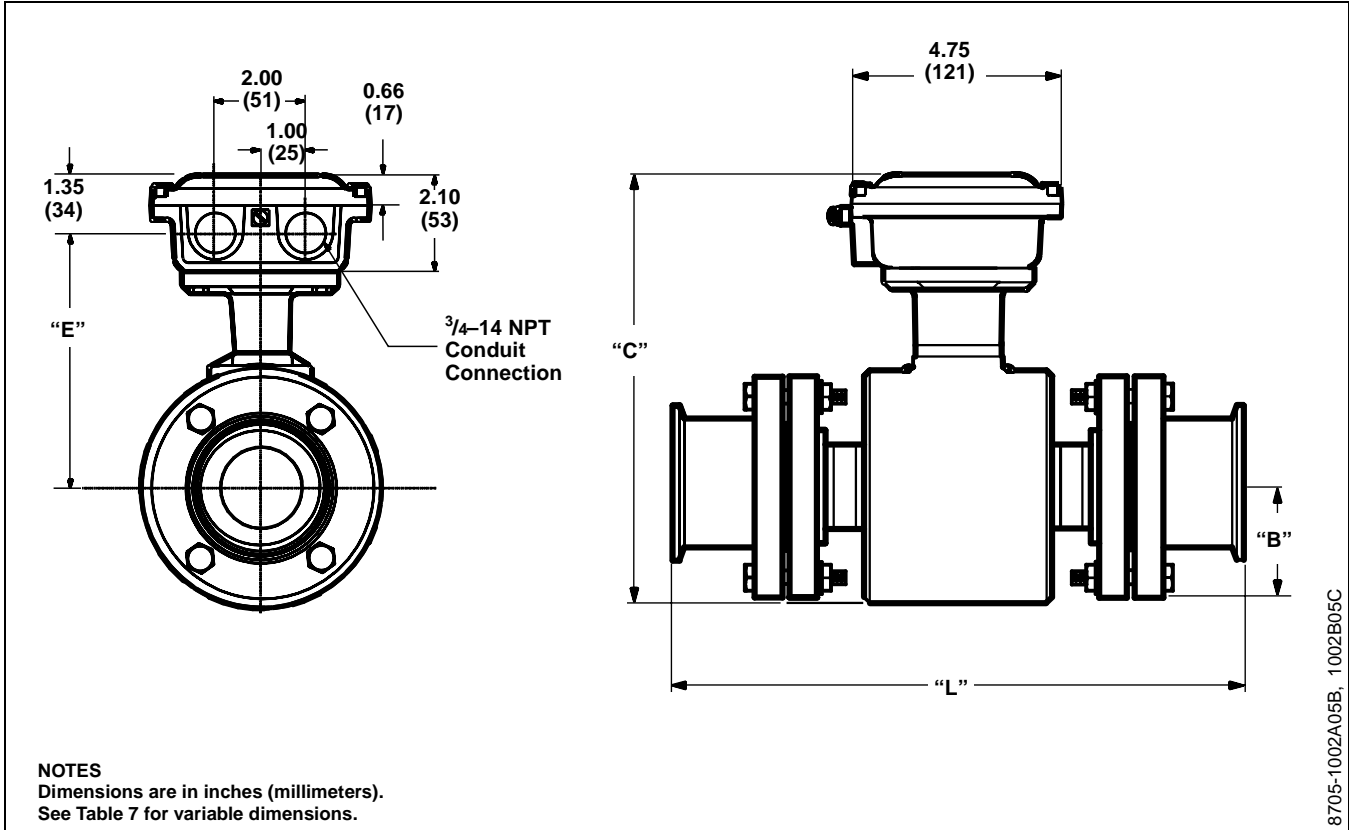


Figure 4-3. Dimensional Drawing of Model 8705 Sanitary Flowtubes, Typical of 1/2- through 3-inch (15 through 86 mm) Line Sizes with Option Code W0, Housing Configuration



Specifications: Model 8711 Flowtube

SPECIFICATIONS

Functional Specifications

Service

Conductive liquids and slurries

Line Sizes

0.15- through 8-inch (4 through 200 mm)

Interchangeability

Model 8711 Flowtubes are interchangeable with Model 8712C/U, Model 8732, and Model 8742C Transmitters. System accuracy is maintained regardless of line size or optional features. Each flowtube nameplate has a sixteen-digit calibration number that can be entered into a transmitter through the Local Operator Interface (LOI) or the HART Communicator on the Model 8712C/U/H and the Model 8732C. In a FOUNDATION fieldbus environment, the Model 8742C can be configured using the DeltaV fieldbus configuration tool or another FOUNDATION fieldbus configuration device. No further calibration is necessary.

Upper Range Limit

30 ft/s (10 m/s)

Process Temperature Limits

Tefzel (ETFE) Lining

-20 to 300 °F (-29 to 149 °C) for 0.5- through 8-inch (15–200 mm) line sizes

-20 to 200 °F (-29 to 93 °C) for 0.15- and 0.3-inch (4 and 8 mm) line sizes

Teflon (PTFE) Lining

-20 to 350 °F (-29 to 177 °C)

Ambient Temperature Limits

-30 to 150 °F (-34 to 65 °C)

Ambient Conditions

Overvoltage Category I. Pollution Degree 2

Pressure and Vacuum Limits

Line sizes 0.5- through 8-inch (15 through 200 mm): full vacuum to 740 psi (51.0 bar); line sizes 0.15- through 0.30-inch (4 through 8 mm): full vacuum to 288 psi (19.8 bar); consult factory for vacuum applications that require Teflon (PTFE) lining material

Enclosure Rating

NEMA 4x. CSA Type 4

Hazardous Location Certifications

- N0** Factory Mutual (FM) Approval Dust-ignition proof for Class II/III, Division 1 Groups E, F, and G; Non-incendive for Class I, Division 2 Groups A, B, C, and D; T5 temperature code; For non-flammable process fluid service only
AND
 Canadian Standards Association (CSA) Approval Suitable for use in Class I, Division 2 Groups A, B, C, and D; Dust-ignition proof for Class II/III, Division 1, Groups E, F, and G hazardous locations
AND
 CE Marking.
- N5** Factory Mutual (FM) Approval; Dust-ignition proof for Class II/III, Division 1 Groups E, F, and G hazardous locations; Non-incendive for Class I, Division 2 Groups A, B, C, and D; T5 temperature code; For flammable process fluid service
- E5** Factory Mutual (FM) Approval Explosion Proof for Class I, Division 1, Groups C and D; T6 temperature code; flammable process fluid service; Available for remote mount transmitter or integral mount Model 8732C transmitters
- CD** KEMA/CENELEC Approval
 EEx e ia IIC T3...T6 (See Table 5-1)

Conductivity Limits

Process liquid must have a conductivity of 5 microsiemens/cm (5 micromhos/cm) or greater for Model 8711. Excludes the effect of interconnecting cable length in remote mount transmitter installations

TABLE 5-1. Relation Between Ambient Temperature, Process Temperature, and Temperature Class⁽¹⁾

Meter Size (inches)	Maximum		Temperature Class
	Ambient Temperature	Maximum Process Temperature	
1/2	149 °F (65 °C)	240 °F (116 °C)	T3
1	149 °F (65 °C)	248 °F (120 °C)	T3
1	95 °F (35 °C)	95 °F (35 °C)	T4
1 1/2	149 °F (65 °C)	257 °F (125 °C)	T3
1 1/2	140 °F (60 °C)	140 °F (60 °C)	T4
2	149 °F (65 °C)	257 °F (125 °C)	T3
2	149 °F (65 °C)	167 °F (75 °C)	T4
2	104 °F (40 °C)	104 °F (40 °C)	T5
3 - 4	149 °F (65 °C)	266 °F (130 °C)	T3
3 - 4	149 °F (65 °C)	167 °F (75 °C)	T4
3 - 4	131 °F (55 °C)	194 °F (90 °C)	T5
3 - 4	104 °F (40 °C)	104 °F (40 °C)	T6
6	149 °F (65 °C)	175 °F (79 °C)	T3
6	149 °F (65 °C)	167 °F (75 °C)	T4
6	149 °F (65 °C)	230 °F (110 °C)	T5
6	140 °F (60 °C)	140 °F (60 °C)	T6
8 - 36	149 °F (65 °C)	284 °F (140 °C)	T3
8 - 36	149 °F (65 °C)	240 °F (116 °C)	T4
8 - 36	149 °F (65 °C)	176 °F (80 °C)	T5
8 - 36	149 °F (65 °C)	149 °F (65 °C)	T6

(1) This table applicable for KEMA/CENELEC approval only.

Performance Specifications

(System specifications are given using the frequency output and with the unit at referenced conditions.)

Accuracy

Model 8711 with Model 8712C/U, Model 8732C, or Model 8742C Transmitters

±0.5% of rate from 3 to 30 ft/s (1 to 10 m/s); include combined effects of linearity, hysteresis, repeatability and calibration uncertainty; accuracy is ±0.015 ft/s (±0.0045 m/s) from low-flow cutoff to 3.0 ft/s (1 m/s)

Vibration Effect

IEC 770 Pipeline Installation Conditions

Mounting Position Effect

None when installed to ensure flowtube remains full.

Physical Specifications

Non-Wetted Materials

Flowtube

303 SST (ASTM A-743)

Coil Housing

Investment cast steel (ASTM A-27)

Paint

Polyurethane

Process-Wetted Materials

Lining

Tefzel (ETFE), Teflon (PTFE)

Electrodes

316L SST, Hastelloy C-276, tantalum, 90% platinum—10% iridium, titanium

Process Connections

Mounts between these Flange Configurations

ASME B16.5 (ANSI): Class 150, 300.vv

DIN: PN 10 and 25

BS: 10 Table D, E, and F

Studs, Nuts, and Washers⁽¹⁾

ASME B16.5 (ANSI)

Line sizes 0.15- through 1-inch (4 through 25 mm):

316 SST, ASTM A193, Grade B8M, Class 1 threaded mounting studs;
ASTM A194, Grade 8M heavy hex nuts; SAE per ANSI B18.2.1, Type A, Series N flat washers

Line sizes 1.5- through 8-inch (40 through 200 mm):

CS, ASTM A193, Grade B7, Class 1 threaded mounting studs; ASTM A194, Grade 2H heavy hex nuts; SAE per ANSI B18.2.1, Type A, Series N flat washers; all items clear, chromate zinc-plated

DIN

Line sizes 4 through 25 mm (0.15- through 1-inch):

316 SST ASTM A193, Grade B8M Class 1 threaded mounting studs;
ASTM A194, Grade 8M, DIN 934 H=D, metric heavy hex nuts; 316 SST, A4, DIN 125 flat washers

Line sizes 40 through 200 mm (1.5- through 8-inch):

CS, ASTM A193, Grade B7 threaded mounting studs; ASTM A194, Grade 2H, DIN 934 H=D, metric heavy hex nuts; CS, DIN 125 flat washers; all items yellow zinc-plated

Electrical Connections

Two 3/4–14 NPT connections with number 8 screw terminals are provided in the terminal enclosure for electrical wiring.

Grounding Electrode

A grounding electrode is installed similarly to the measurement electrodes through the flowtube lining. It is available in all electrode materials.

Grounding Rings

Grounding rings are installed between the flange and the tube face on both ends of the flowtube. They have an I.D. slightly larger than the flowtube I.D. and an external tab to attach ground wiring. Grounding rings are available in 316L SST, Hastelloy C-276, titanium, and tantalum.

Flowtube Dimensions and Weight

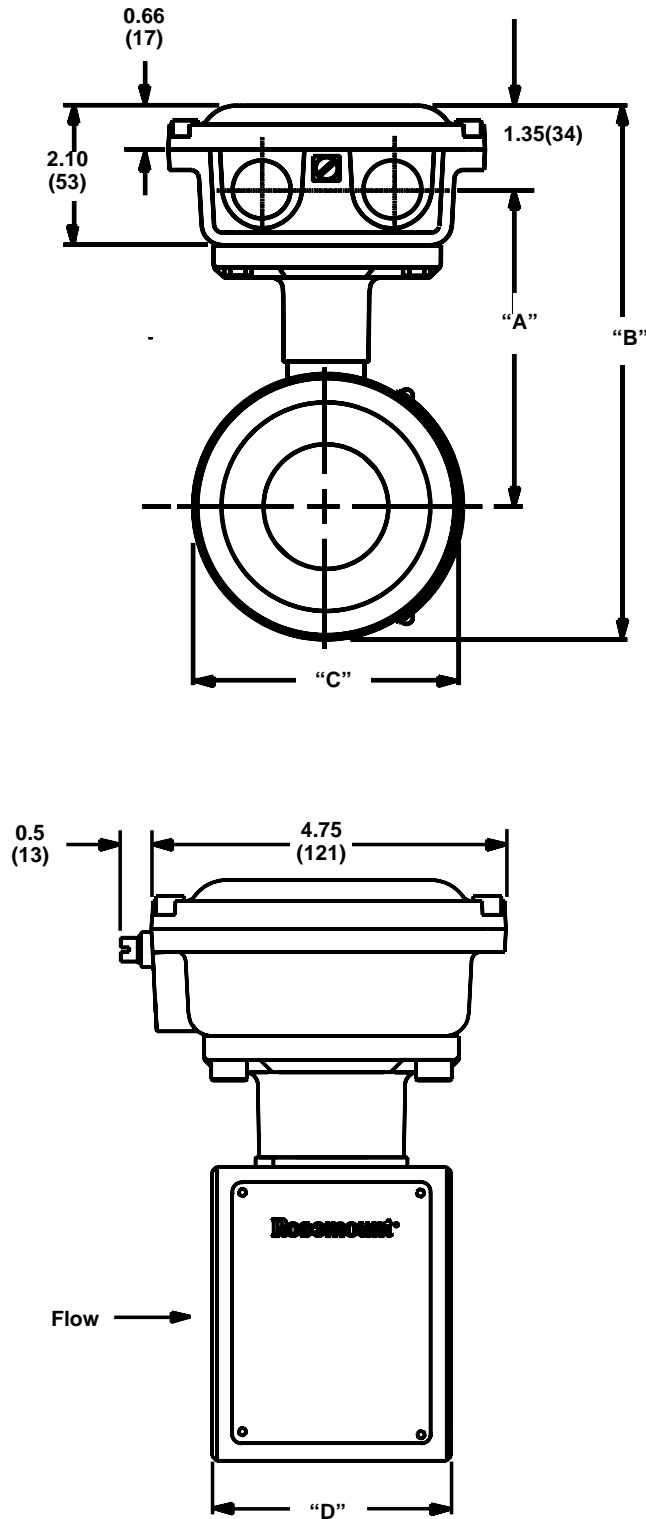
See Table 1

TABLE 1. Flowtube Dimensions and Weight

Nominal Line Size Inches (mm)		Flowtube Housing Dimensions						Flowtube Length "D"		Inside Diameter		Weight lb (kg)	
		"A" Max.		"B"		"C"							
0.15	(4)	4.00	(102)	5.44	(138)	3.56	(90)	2.17	(55)	.165	(4)	4	(2)
0.30	(8)	4.00	(102)	5.44	(138)	3.56	(90)	2.17	(55)	.287	(7)	4	(2)
0.5	(15)	4.00	(102)	5.44	(138)	3.56	(90)	2.17	(55)	.595	(15)	4	(2)
1	(25)	4.31	(109)	6.06	(154)	4.50	(114)	2.17	(55)	.959	(24)	5	(2)
1.5	(40)	4.42	(112)	7.41	(188)	3.28	(83)	2.73	(69)	1.50	(38)	5	(2)
2	(50)	4.64	(118)	7.94	(202)	3.91	(99)	3.26	(83)	1.95	(50)	7	(3)
3	(80)	5.26	(134)	9.19	(233)	5.16	(131)	4.68	(119)	2.98	(76)	13	(6)
4	(100)	5.87	(149)	10.41	(264)	6.38	(162)	5.88	(149)	3.90	(99)	22	(10)
6	(150)	6.97	(177)	12.60	(320)	8.56	(217)	6.87	(174)	5.825	(148)	35	(16)
8	(200)	8.00	(2003)	14.66	(372)	10.63	(270)	8.86	(225)	7.87	(200)	60	(27)

(1) 0.15 and 0.30 inch (4 and 80 mm) flowtubes mount between 1/2-inch (13 mm) flange.

Figure 5-1. Model 8711 Dimensional Drawings (1.5-inch through 8-inch line sizes)

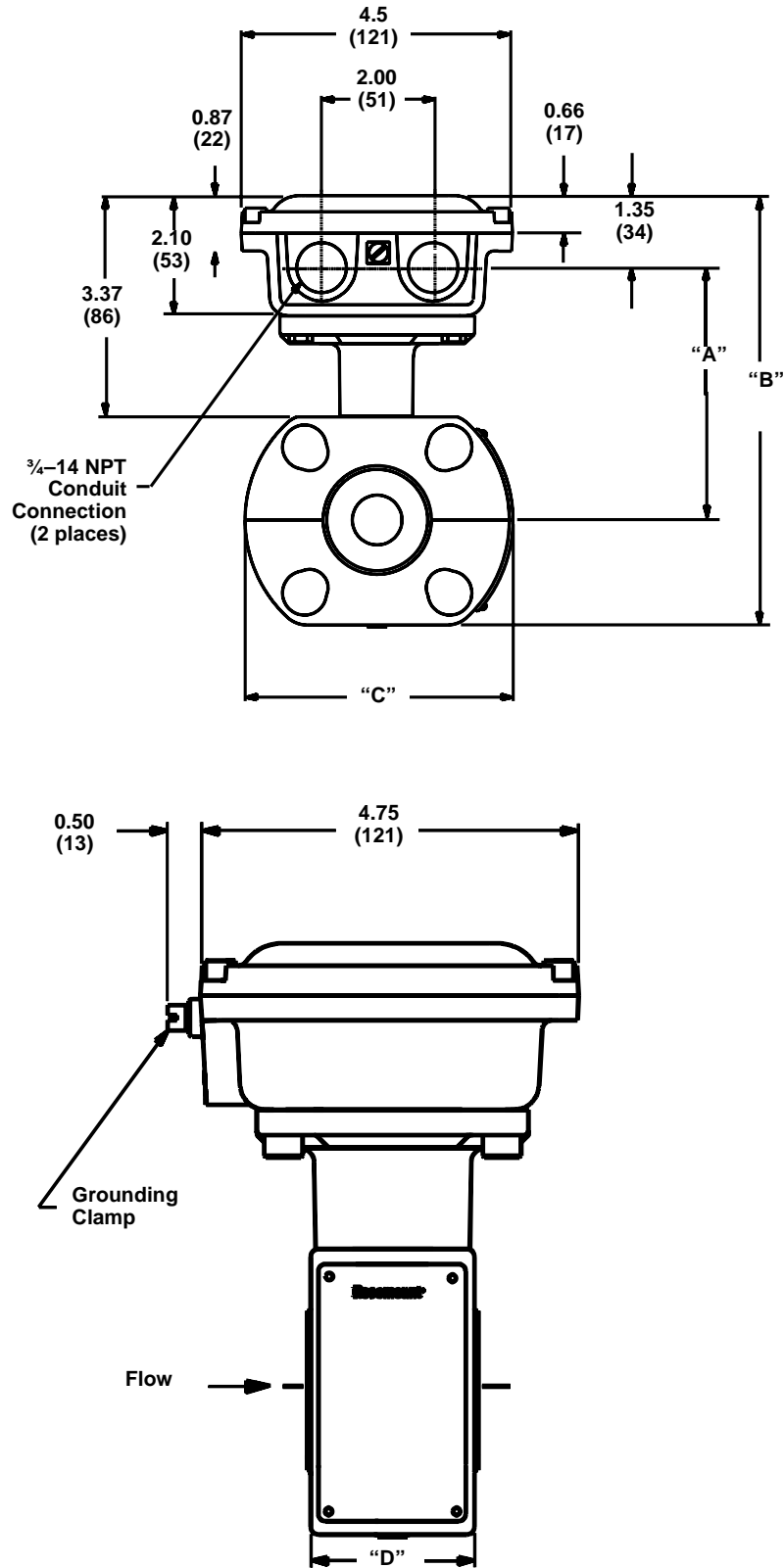


NOTE
 Dimensions are in
 inches (millimeters).
 See Table 1 for
 variable dimensions.

8711-1012B04A, 1012A04A

Rosemount Series 8700 Magnetic Flowmeter Flowtubes

Figure 5-2. Model 8711 Dimensional Drawings (0.15-inch through 1-inch line sizes).



NOTE
 Dimensions are in inches (millimeters).
 See Table 1 for variable dimensions.

8711-1012B03A, 1012A03A

Field-Removable Electrodes

SAFETY MESSAGES

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations.

⚠ WARNING

Failure to follow these installation guidelines could result in death or serious injury:

Installation and servicing instructions are for use by qualified personnel only. Performing any servicing other than that contained in this manual may result in death or serious injury. Do not perform any servicing other than that contained in the operating instructions.

The field-removable electrode option allows the user to remove the electrode assembly with the flowtube still mounted in the line. Frequently, this option will be used for cleaning the electrode head when coating is of concern.

The flowtube should be drained of any process fluid prior to disassembly of the electrodes. To avoid personal injury, care should be taken when handling electrodes that have been in contact with corrosive process fluids. Take care to avoid rotating the electrode when removing it to avoid damage to the o-ring. Some resistance may be experienced due to the tight o-ring fit.

REMOVE THE ELECTRODE ASSEMBLY

Use the following procedure to remove the electrode assembly from the flowtube.

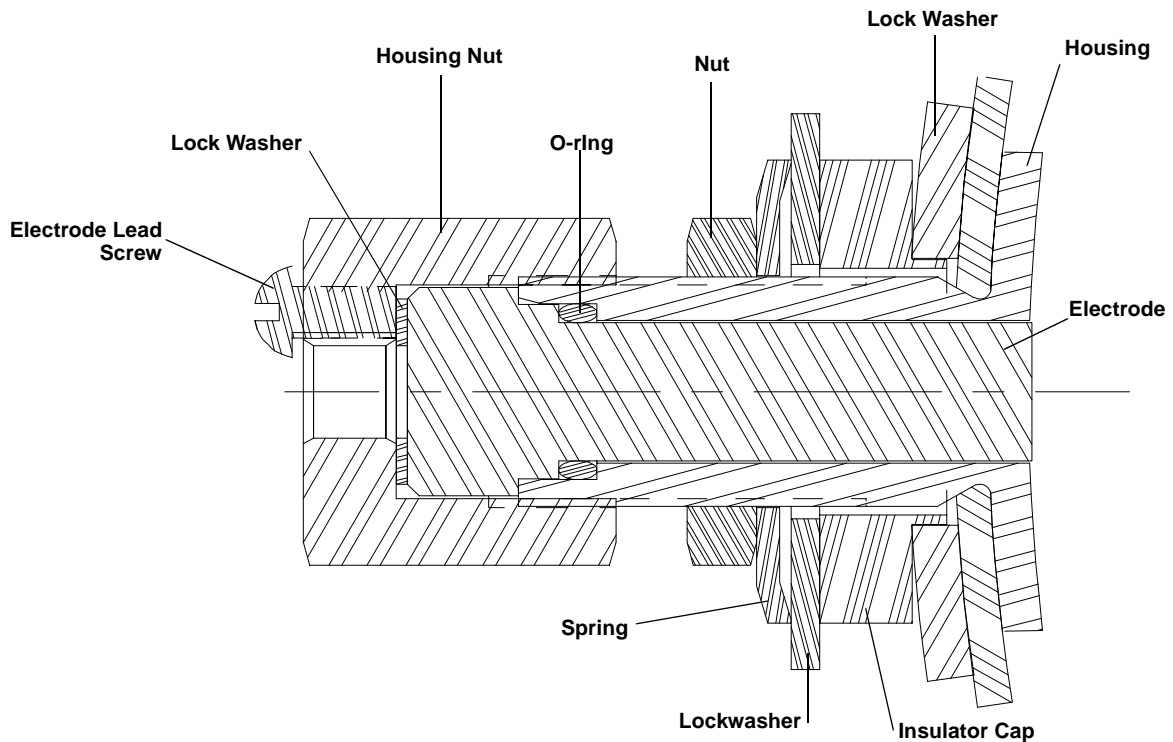
1. Drain the flowtube of any process fluid prior to disassembly of the electrodes.
2. Remove the screws that secure the electrode cover.
3. Remove the electrode cover and o-ring. It is generally recommended that new o-rings be installed on the electrode and the electrode cover during reassembly.
4. Remove the electrode lead screw that secures the signal wire to the electrode.
5. Remove the electrode retaining nut.
6. Take the electrode from the electrode housing by pulling it straight out, with firm pressure, along the axis of the electrode.

REPLACE THE ELECTRODE ASSEMBLY

Use the following procedure to replace the electrode assembly into the flowtube.

1. Lubricate the o-ring.
2. Install the o-ring on the electrode.
3. Insert the electrode into the electrode housing. Push straight in until the electrode is seated. Avoid rotating the electrode or the electrode housing as this could result in leakage.
4. Secure the electrode into the housing with the retaining nut and lock washer. Tighten the retaining nut to 15 in/oz of torque. Failure to tighten the fasteners can cause loss of liquid tight seal and result in damage to the unit.
5. Secure the signal wire to the electrode with the electrode lead screw.
6. Install the o-ring into the electrode cover.
7. Secure the electrode cover to the flowtube with the screws.

FIGURE A-1.
The Field-Replaceable Electrode



8705-1002B03A

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