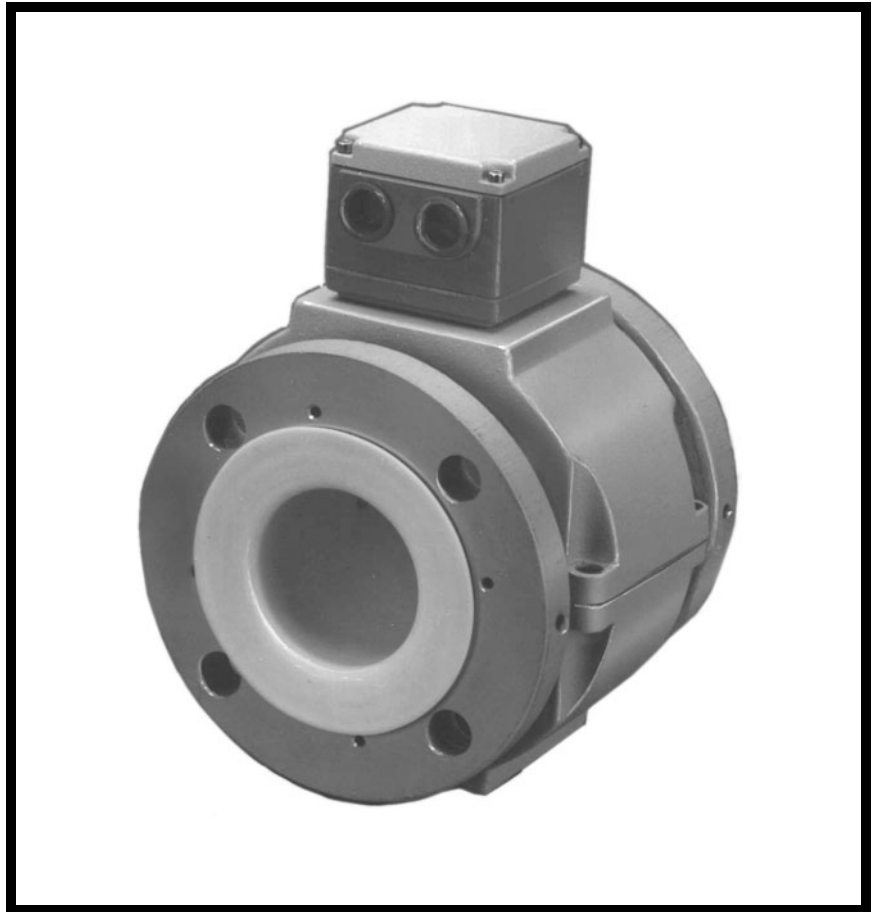


INSTRUCTION MANUAL

***MAGNETIC FLOWMETERS
10DS3111 Design Level E
Sizes 1 through 12 inches***

SERIES 3000 AC MAGNETIC FLOWMETER



PN25011

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CAUTION notices apply to hazards or unsafe practices which could result in property damage.

NOTES highlight procedures and contain information which assist the operator in understanding the information contained in this manual.

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WARNING

POSSIBLE PROCESS UPSETS

Maintenance must be performed only by qualified personnel and only after securing equipment controlled by this product. Adjusting or removing this product while it is in the system may upset the process being controlled. Some process upsets may cause injury or damage.

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READ FIRST

WARNING

INSTRUCTION MANUALS

Do not install, maintain, or operate this equipment without reading, understanding and following the proper factory-supplied instructions and manuals, otherwise injury or damage may result.

RETURN OF EQUIPMENT

All Flowmeters and/or Signal Converters being returned to the factory for repair must be free of any hazardous materials (acids, alkalis, solvents, etc). A Material Safety Data Sheet (MSDS) for all process liquids must accompany returned equipment. Contact the factory for authorization prior to returning equipment.

Read these instructions before starting installation;
save these instructions for future reference.

Contacting the Factory . . .

Should assistance be required with any of the company's products, contact the following:

Telephone:

**24-Hour Call Center
1-800-HELP-365**

E-Mail:

ins.techsupport@us.abb.com

The NEMA 4X rating applies to the meter body and electronics enclosure only. The following accessories (if supplied) may not meet NEMA 4X unless specifically ordered as NEMA 4X:

- meter flanges
- meter installation hardware: studs, nuts, bolts
- enclosure mounting hardware for pipe or wall mounting
- conduit hardware

This product is painted with a high performance epoxy paint. The corrosion protection provided by this finish is only effective if the finish is unbroken. It is the users' responsibility to "touch-up" any damage that has occurred to the finish during shipping or installation of the product. Special attention must be given to: meter flange bolting, pipe mounting of electronics, conduit entries and covers that are removed to facilitate installation or repair. For continued corrosion protection throughout the product life, it is the users' responsibility to maintain the product finish. Incidental scratches and other finish damage must be repaired and promptly re-painted with approved touch-up paint. Provide the model number and size of your product to the nearest factory representative to obtain the correct touch-up paint.

1.0 INTRODUCTION

1.1 General

1.1.1 Description

The Series 3000 Magnetic Flowmeter is a compact, volumetric, liquid flow rate detector that uses as the process transducing method the characteristic of a conductive liquid to generate an induced voltage when flowing through a magnetic field. The amplitude of the voltage produced is directly proportional to the flow rate of the metered liquid.

Being a completely obstructionless metering instrument, the meter may be used with many non-homogeneous liquids and is as independent of the tendency to plug or foul as the pipeline in which it is mounted. An inherent advantage of obstructionless construction is that pressure losses are reduced to levels occurring in equivalent lengths of equal diameter pipeline. This reduces or conserves pressure source requirements in new or existing hydraulic lines as compared to other metering methods. The compact size of the meter results in a light-weight unit which requires no additional support other than that used normally on pipe runs. Short laying lengths minimize the need for altering existing pipe runs to accommodate metering. A basic construction of corrosion resistant wetted parts and a variety of meter lining materials permit metering of most corrosive and reactant liquids.

Factors such as liquid viscosity and density require no compensation and have no effect on the measurement accuracy of the meter. Metering limitations are confined to a minimum threshold of electrical conductivity inherent to the liquid being metered. The degree of liquid conductivity has no effect upon metering accuracy as long as it is greater than this minimum level. Liquid temperature is limited only to the extent that it may affect liquid conductivity, and liquid pressure to the extent that it can not exceed the meter material specification limits.

For information applicable to the signal converter, refer to the signal converter instruction bulletin.

1.1.2 Construction

The meter consists of a flanged, stainless steel pipe spool which serves as a meter body. A pair of flat magnet coils are installed on opposite sides of the meter housing inner surface. Permeable iron straps and pole pieces focus the magnetic field generated by the coils and provide a flux return path.

An interior liner of Hard Rubber, Soft Rubber, TEFLON[®] (PTFE), TEFZEL[®] (ETFE), neoprene, polyurethane, or LINATEX[™] is assembled into the spool and formed against the flange faces. Two cylindrical electrodes are mounted diametrically opposed within the central portion of the meter body and are completely insulated from the metal pipe. The end surfaces of the electrodes are virtually flush with the inner surface of the insulating liner and come into contact with the liquid to be metered.

The Primary housing for the continuous submergence and explosion-proof design is different from the other configurations in that it is sealed with a round screw-on access cover. The interior of this housing is filled with a gelatin-like silicone rubber compound which helps give the meter its waterproof rating. The construction of this meter is shown in Figure 1-1.

The NEMA 4X rating applies to the meter body and electronics enclosure only. The following accessories (if supplied) may not meet NEMA 4X unless specifically ordered as NEMA 4X:

- meter flanges
- meter installation hardware: studs, nuts, bolts
- enclosure mounting hardware for pipe or wall mounting
- conduit hardware



FIGURE 1-1. EXPLOSION-PROOF/ CONTINUOUS SUBMERGENCE METER

NEMA 4X, Corrosion Resistant Finish

This product is painted with a high performance epoxy paint. The corrosion protection provided by this finish is only effective if the finish is unbroken. It is the users' responsibility to "touch-up" any damage that has occurred to the finish during shipping or installation of the product. Special attention must be given to: meter flange bolting, pipe mounting of electronics, conduit entries and covers that are removed to facilitate installation or repair. For continued corrosion protection throughout the product life, it is the users' responsibility to maintain the product finish. Incidental scratches and other finish damage must be repaired and promptly re-painted with approved touch-up paint. Provide the model number and size of your product to the nearest factory representative to obtain the correct touch-up paint.

1.2 Model Number Breakdown

Refer to the data sheet or data tag on the equipment for the model number of the instrument furnished. The details of a specific model number are shown on the following pages.

Model Number Breakdown (continued)

10DS3111	E	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Electrode Material																			
316 Strn. Steel													B						
HASTELLOY® B													C						
HASTELLOY® C													D						
Titanium													E						
Tantalum													F						
Platinum / Iridium													H						
Zirconium													L						
Certification																			
Standard (None)													A						
FM Approved-Nonincendive for CL I, Div 2, Gp A,B,C & D; Electrodes Intrinsically Safe for CL I, Div 1, Gp A,B,C & D; Outdoor Hazardous Locations, NEMA 4X. Dust-Ignitionproof CL II, Div 1, Gp E,F & G; Suitable for CL III, Div 1.													K						
FM Approved - Explosionproof for CL I, Div 1, GP B,C & D; Dust-Ignitionproof CL II, Div 1, GP E,F & G; Suitable for CL III, Div 1, Electrodes Intrinsically Safe for CL I, Div 1, GP A, B, C & D - Outdoor Hazardous Location, NEMA 4X.													L						
Enclosure Classification																			
General Purpose: IEC 529, IP 65, NEMA 4X														1					
Accidental Submergence: IEC 529, IP 67, NEMA 4X, 33ft H ₂ O/48h (10m H ₂ O/48h)														2					
Continuous Submergence: IEC 529, IP 68, NEMA 4X, 33ft H ₂ O (10m H ₂ O) Continuous Duty, Signal Cable permanently installed														5					
Accidental Submergence: IEC 529, IP 67, NEMA 4X, 33ft H ₂ O/48h (10m H ₂ O/48h), Tropical - Improved Moisture Protection, Signal Cable permanently installed														9					
Fluid Temperature Range																			
Teflon, Rotomolded Tefzel, < 266° F (130° C)														1					
Teflon, Extended Temperature, < 356° F (180° C)														2					
Hard Rubber / Soft Rubber / Linatex, < 176° F (80° C)														3					
Neoprene / Polyurethane < 190° F (88° C)														4					
Line Excitation Frequency																			
50 Hz																		1	
60 Hz																		3	
Customer Information Language																			
English w/ Riveted SST Tag																			2
English w/ Self-adhesive Tag																			8
Converter Type																			
50SM1000																			1
Other																			9
None																			X

1.3 Specifications

Power Requirements	Refer to Section 1.2 Model Number Breakdown.
Power Consumption	Refer to the signal converter instruction bulletin.
Meter Characteristics	
Meter Size/Flow Capacity	Refer to Table 1-4.
Span	Factory set at specified range between extremes listed in Table 1-4; can be field adjusted.
Rangeability	20:1
Minimum Liquid Conductivity	20 μ S/cm
System Accuracy	Refer to the signal converter instruction bulletin.
Meter Capacity	Specified on meter data tag (equal to maximum flow capacity in engineering units). Refer to Table 1-4.
Environmental Limits	
Ambient Temperature	-13° to 140° F (-25° to 60° C)
Relative Humidity	10 to 90% Non-condensing

Process Limits

TABLE 1-1. LIQUID TEMPERATURE

Liner Material	Maximum Temperature	Minimum Temperature
TEFLON	356° F (180° C)	-13° F (-25° C)
TEFZEL	266° F (130° C)	
Neoprene/Polyurethane	190° F (88° C)	
Hard Rubber, Soft Rubber, LINATEX	175° F (80° C)	

TABLE 1-2. PRESSURE RATING, PSIG (MPa)

Flange Class	Flange Material	Maximum Temperature				
		100° F (38° C)	175° F (80° C)	190° F (88° C)	266° F (130° C)	356° F (180° C)
		Pressure PSIG (MPa)				
ANSI 150	Carbon Steel	285 (1.96)	260 (1.79)	255 (1.76)	235 (1.62)	215 (1.48)
	304 SST	275 (1.90)	245 (1.69)	240 (1.76)	215 (1.48)	190 (1.31)
ANSI 300	Carbon Steel	740 (5.10)	690 (4.76)	680 (4.69)	660 (4.55)	640 (4.41)
	304 SST	720 (4.96)	630 (4.34)	615 (4.24)	555 (3.83)	495 (3.41)
DIN PN10	Carbon Steel	145 (1.00)	145 (1.00)	145 (1.00)	145 (1.00)	145 (1.00)
	304 SST	140 (0.97)	137 (0.94)	137 (0.94)	133 (0.92)	128 (0.88)
DIN PN16	Carbon Steel	232 (1.60)	232 (1.60)	232 (1.60)	232 (1.60)	232 (1.60)
	304 SST	224 (1.54)	219 (1.51)	218 (1.50)	212 (1.46)	205 (1.41)
DIN PN25	Carbon Steel	362 (2.50)	362 (2.50)	362 (2.50)	362 (2.50)	362 (2.50)
	304 SST	352 (2.43)	331 (2.28)	327 (2.25)	304 (2.10)	280 (1.93)
DIN PN40	Carbon Steel	580 (4.00)	580 (4.00)	580 (4.00)	580 (4.00)	580 (4.00)
	304 SST	564 (3.89)	530 (3.65)	525 (3.62)	488 (3.36)	449 (3.10)

TABLE 1-3. VACUUM LIMIT

Meter Size	Liner Material	Temperature			
		68° F (20° C)	212° F (100° C)	266° F (130° C)	356° F (180° C)
1- 4 in (15-100 mm)	TEFLON/ TEFZEL	Full Vacuum To 266° F (130° C)			6.7 psia
6 - 12 in (150-300 mm)	TEFLON/ TEFZEL	3.9 psia	5.8 psia	6.7 psia	8.7 psia
All	Neoprene/ Polyurethane	Full Vacuum To 190° F (88° C)			
All	Hard Rubber/ Soft Rubber	Full Vacuum To 175° F (80° C)			
1- 4 in (15-100 mm)	LINATEX	Full Vacuum To 175° F (80° C)			
6 - 12 in (150-300 mm)	LINATEX	3.9 psia	5.8 psia To 175° F (80° C)		

TABLE 1-4. METER CAPACITY VALUES

Meter Size		Meter Capacity*	Flow Ranges 0 to Value Tabulated				Capacity Setting (If not specified by customer)	
			Minimum		Maximum			
inch	mm	gpm	gpm	L/min	gpm	L/min	gpm	L/min
1	25	52.83	2.65	10.0	52.8	200.0	16.00	60.0
1½	40	158.5	7.93	30.0	158.0	600.0	50.0	200
				m ³ /h		m ³ /h		m ³ /h
2	50	264.1	13.3	3.0	264.0	60.0	80.0	20.0
3	80	792.5	39.7	9.0	792.0	180.0	250	60.0
4	100	1056	52.9	12.0	1056.0	240.0	320	80.0
6	150	2641	133	30.0	2641.0	600.0	800	200
8	200	4755	238	54.0	4755.0	1080.0	1500	300
10	250	7925	397	90.0	7925.0	1800.0	2500	550
12	300	10567	528	120.0	10567	2400	3500	800

* Each meter is calibrated to determine its flow capacity at a given velocity, which has been established as 32.808 ft/s (10 m/s) for the meter capacity (Range DN). The meter capacity expressed in gpm is recorded on the meter nameplate.

The meter capacity is the base upon which maximum and minimum limits for range settings and outputs are established.

Flow velocity can be determined as follows:

Meter Capacity:

$$\text{Flow Velocity (ft/s)} = (\text{Operating gpm} \times 32.808) / \text{Meter Capacity}$$

NOTE

The maximum meter flow range is a function of the signal converter used. The maximum flow range can not exceed the meter capacity.

Physical Characteristics

Outline Dimensions	See Figures 2-3 through 2-6
Vibration Limits	1.5 g for 10 - 150 Hz

**Signal Cable
(supplied with the
signal converter)**

Non-Permanently Installed Cable:	100 ft. (33 m) Max.
Permanently Installed Cable:	Standard Length - 50 feet (16 m)
	Optional Length - Up to 100 feet (33 m) in 10 foot increments, as specified

**Materials of
Construction**

Meter Liner	see Section 1.2 Model Number Breakdown
Electrodes	see Section 1.2 Model Number Breakdown
Meter Body	304 SST, epoxy finish
Flanges	carbon steel or 304 SST, as specified
Meter Housing	cast aluminum, epoxy finish
Electronics Housing	cast aluminum, epoxy finish, 316 SST attachment screws, gasketed cover

Meter Enclosure Ratings

NOTE
Enclosures are suitable for indoor or outdoor installation.
Enclosure ratings apply to the meter.

Watertight Housing (standard)	NEMA 4X, IEC 529 IP65
Accidental Submergence	NEMA 4X, IEC 529 IP67, 30 feet H ₂ O/48 h (9 m H ₂ O/48 h)
Continuous Submergence	NEMA 4X, IEC 529 IP68, 30 feet H ₂ O (9 m H ₂ O)
Conduit Connections	two 1/2 inch NPT internally threaded entrances
Certifications	refer to Section 1.2 Model Number Breakdown

2.0 INSTALLATION

2.1 Inspection

All meters are shipped in heavy duty containers which are specially designed to provide adequate protection during transit. Since the meter will be operated in conjunction with an electronic signal converter, both instruments may be in the same shipping container. An itemized list of all items included in the shipment is attached to the shipping container. Refer to the instruction bulletin supplied with the signal converter for operation and maintenance procedures for the converter.

The system is normally supplied with a signal converter. Interconnection cable and conduit seals are supplied with the signal converter.

Inspect all items included in the shipment for indications of damage which may have occurred during shipment. All damage claims should be reported to the shipping agent involved before attempting to install or operate this equipment. If the damage is such that faulty operation is likely to result, the damage should be brought to the attention of the factory Service Department.

2.2 Meter Handling

When a TEFLON lined meter is specified, two optional liner protector plates (one on each flange face) are factory installed (when specified at time of order). These plates serve to contain the flared ends of the liner, and to prevent damage to the liner during installation and handling. These protector plates are attached to the meter with flat head screws that securely hold the liner in place. If the pressure on the liner is relieved, the TEFLON will tend to curl away from the flange. These protector plates must remain in place when the meter is installed. Refer to Figure 2-1.

During shipment, the liner is protected by wood or composition protectors as shown in Figure 2-2; these are removed before the meter is installed; leave them in position while moving the meter to the installation site.

To place the meter in the pipeline a sling and hoist may be necessary. Do not pass a rope or wire sling through the meter; the liner will be damaged if the meter is supported by the liner. Lift the meter as shown in Figure 2-2.

Table 2-1 lists the weights of the meters by size and flange classification. Weights shown are approximate and should be used only as a guide when installing the meter.

TABLE 2-1. METER WEIGHTS

Meter Size		ANSI Class 150 DIN PN10-16		ANSI Class 300 DIN PN25-40	
Inches	mm	lbs	kg	lbs	kg
1	25	8	3.5	19	8.4
1½	40	12	5.3	23	10.1
2	50	16	7.1	27	11.9
3	80	26	11.5	36	15.9
4	100	37	16.3	51	22.5
6	150	70	32	140	64
8	200	155	70	210	95
10	250	220	100	295	134
12	300	275	125	365	166

If the continuous submergence option is chosen for Model 10DS3111, the meter weights shown above must be modified by adding the weights shown in the following table:

TABLE 2-2. CONTINUOUS SUBMERGENCE WEIGHT FACTORS

Meter Size		Add to Meter Weight from Table Above	
Inches	mm	lbs	kg
1	25	1.01	.46
1 ½	40	0.96	.44
2	50	1.04	.47
3	80	1.08	.49
4	100	1.92	.87
6	150	11.23	5.1
8	200	15.57	7.1
10	250	23.27	10.6
12	300	50.47	22.9

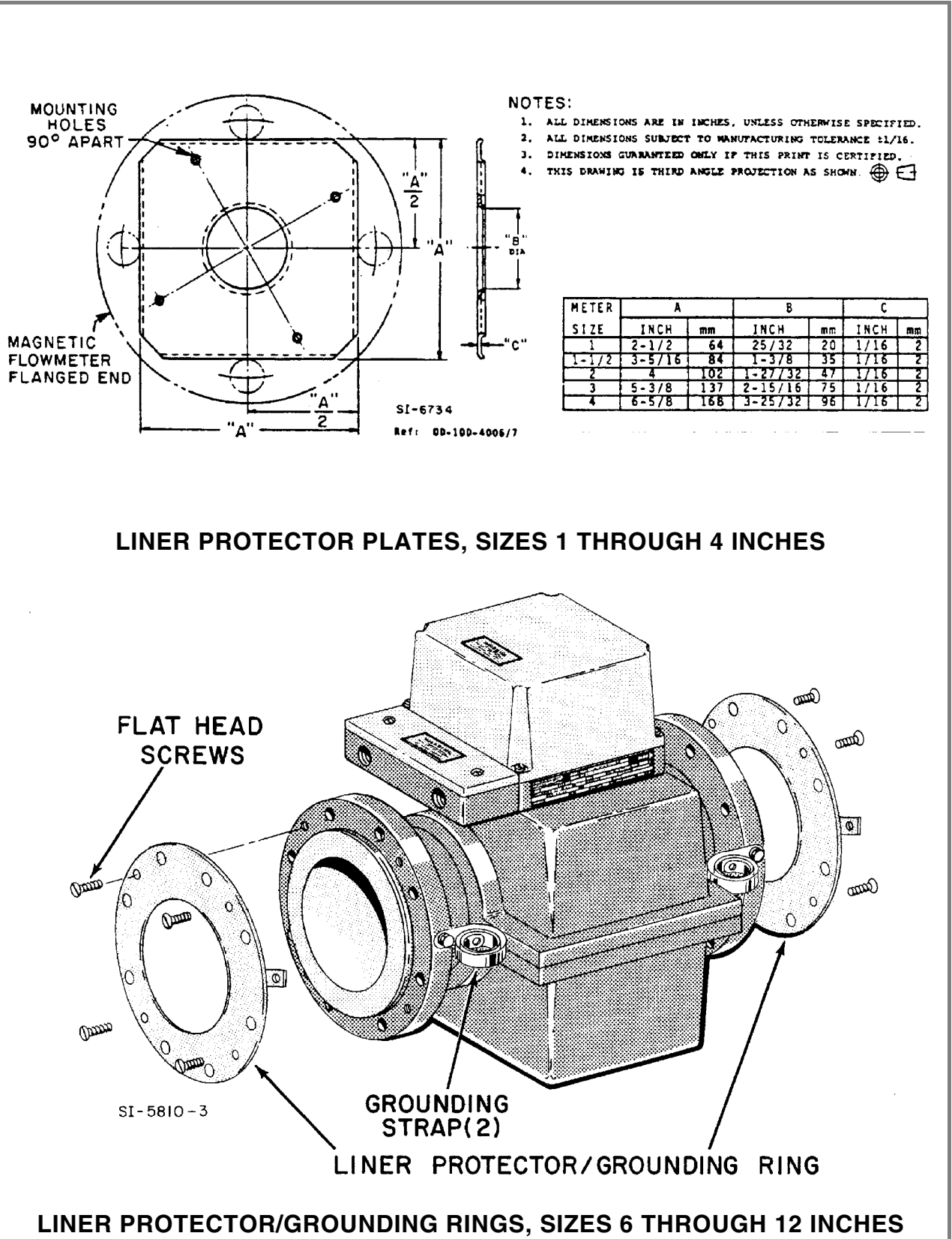
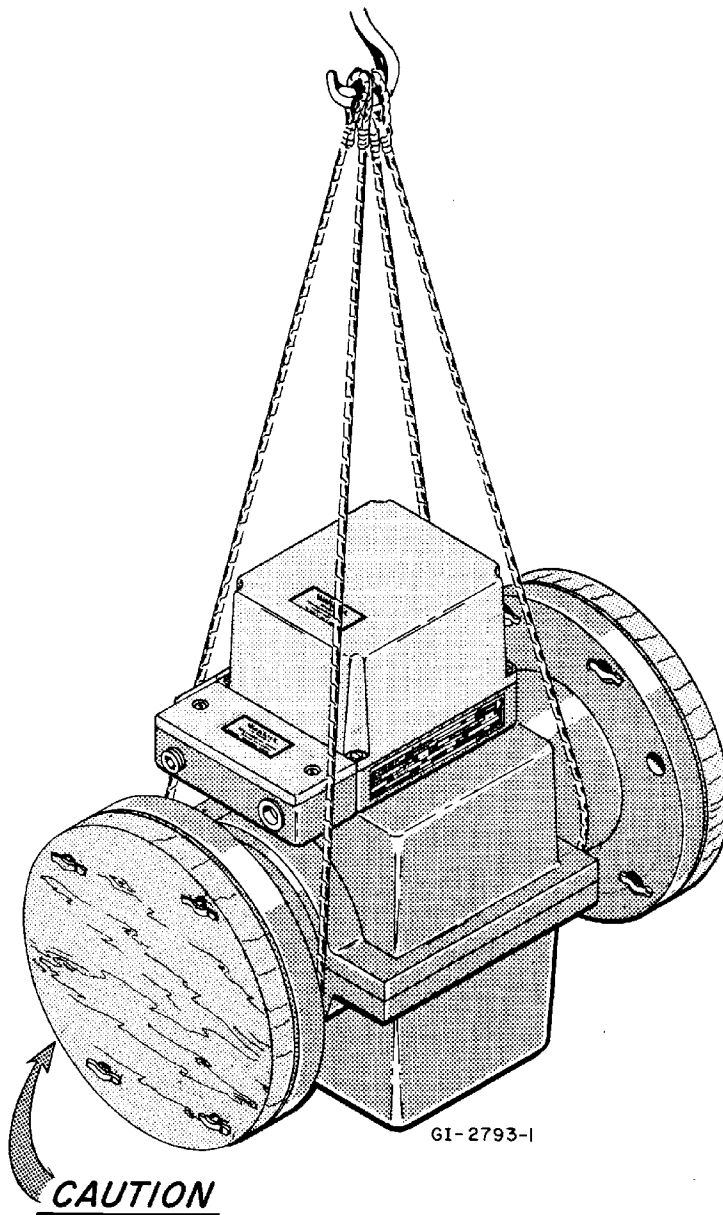


FIGURE 2-1. PROTECTOR PLATES FOR TEFLON LINERS



DO NOT PUT SLING THRU METER LINER.
DO NOT REMOVE METAL LINER PROTECTOR AT ANYTIME.
REMOVE WOOD SHIPPING PROTECTOR (SHOWN) AT THE TIME OF ACTUAL INSTALLATION IN THE PIPELINE.

FIGURE 2-2. PROPER HOISTING METHOD

Figure is for reference only, the flowmeter shown in this illustration is not the meter described in this instruction bulletin.

2.3 Location

The Flowmeter is suitable for either indoor or outdoor installation. When selecting the location of the installation, consideration should be given to the ambient and process temperature limits, as stated in the Specifications Sub-Section 1.3.

Several variations of resistance to water-entry are available:

- The Standard meter is rated NEMA 4X (IEC 529 IP65), watertight, and will withstand periods of rain and hose down.
- If periodic flooding may occur, an optional NEMA 4X (IEC 529 IP67) **accidental submergence** Flowmeter is available to withstand submergence up to 48 hours. These ratings apply to TEFLON-lined meters only after the meter is properly installed in the pipeline.
- If periodic flooding is expected to keep the meter submerged for periods longer than 48 hours, an optional **continuous submergence** NEMA 4X (IEC 529 IP68) configuration is available.

It is recommended that the meter not be installed in the immediate vicinity of heavy induction equipment.

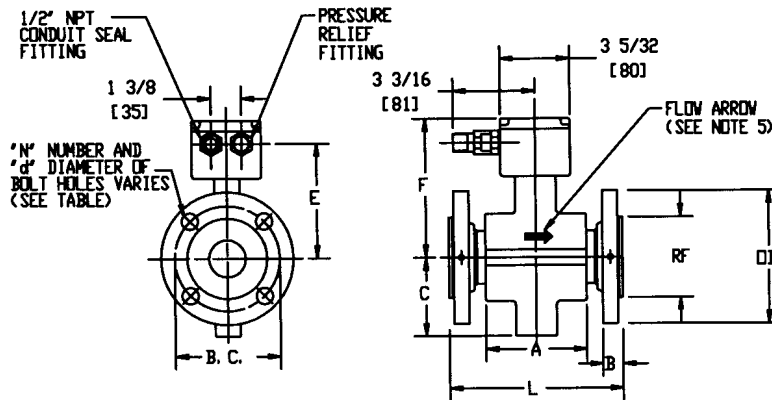
Access for wiring interconnections and servicing of the integrally mounted Signal Converter should be considered when installing the meter. A minimum of five inches of overhead clearance is required for cover removal.

Outline dimensions of the Flowmeter are given in Figures 2-3 through 2-8.

Outline dimensions of the optional remotely mounted Signal Converter are given in the instruction manual supplied with the Signal Converter.

The installation site must be provided with a convenient source of power as specified for the Signal Converter. The power line should have a disconnect switch and a suitable fuse or circuit breaker as shown on the applicable interconnection diagram provided in the instruction manual supplied with the Signal Converter.

DIM	SIZE	1 [25]		1-1/2 [40]		2 [50]		3 [80]		4 [100]	
	FLANGE CLASS	150	300	150	300	150	300	150	300	150	300
L	10D S X 3111ED	7-7/8 [200]	9 [229]	7-7/8 [200]	9 [229]	7-7/8 [200]	9 [229]	7-7/8 [200]	9 [229]	9-7/8 [250]	11 [280]
L	10D S X 3111EE	14 [356]		16 [406]		16 [406]		12 [305]		12 [305]	
L	10D S X 3111EZ	SEE SALES ORDER INFORMATION FOR 'L' DIMENSION									
RF		2 [51]		2-7/8 [73]		3-5/8 [92]		5 [127]		6-3/16 [157]	
B	POLY/NEO/RUBBER LINER	N/A		N/A		15/16 [24]	1-1/16 [27]	1-1/8 [29]	1-5/16 [33]	1-1/8 [29]	1-7/16 [36]
	TEFLON LINER	11/16 [17]	13/16 [21]	27/32 [21]	31/32 [25]	29/32 [23]	1-1/32 [26]	1-3/32 [27]	1-9/32 [32]	1-3/32 [27]	1-13/32 [35]
	TEFZEL LINER	5/8 [16]	3/4 [19]	3/4 [19]	7/8 [22]	27/32 [21]	31/32 [25]	3/4 [19]	1-1/4 [32]	1-3/32 [27]	1-3/8 [35]
d		5/8 [16]	3/4 [19]	5/8 [16]	7/8 [22]	3/4 [19]		3/4 [19]	7/8 [22]	3/4 [19]	7/8 [22]
N		4		4		4	8	4	8	8	8
BC		3-1/8 [79]	3-1/2 [89]	3-7/8 [98]	4-1/2 [114]	4-3/4 [121]	5 [127]	6 [152]	6-5/8 [168]	7-1/2 [191]	7-7/8 [200]
OD		4-1/4 [108]	4-7/8 [124]	5 [127]	6-1/8 [156]	6 [152]	6-1/2 [165]	7-1/2 [190]	8-1/4 [210]	9 [229]	10 [254]
A		3-7/16 [87]		3-15/16 [100]		4-9/16 [116]		3-15/16 [100]		5-1/8 [130]	
C		2-7/8 [73]		3-7/32 [82]		3-17/32 [90]		4-11/32 [110]		5-1/8 [130]	
E	STD. TEMP.	4-11/16 [119]		5-1/32 [128]		5-11/32 [136]		6-5/32 [156]		6-15/16 [176]	
F		5-3/4 [146]		6-3/32 [155]		6-13/32 [163]		7-7/32 [183]		8 [203]	
E	HIGH TEMP.	5-1/16 [128]		5-13/32 [137]		5-23/32 [145]		6-17/32 [166]		7-5/16 [186]	
F		61/8 [156]		6-15/32 [164]		6-25/32 [172]		7-19/32 [193]		8-3/8 [213]	

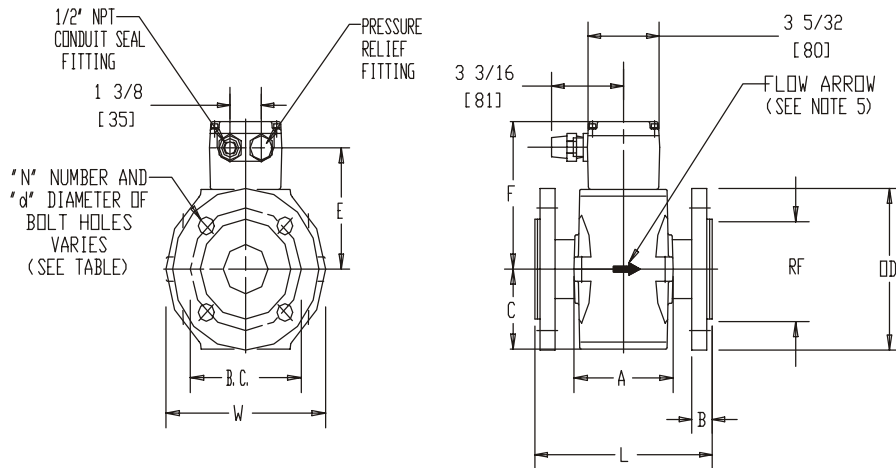


- NOTES:
- 1) ALL DIMENSIONS ARE IN INCHES. DIMENSIONS IN BRACKETS [] ARE IN MILLIMETERS [MM].
 - 2) DIMENSIONS ARE GUARANTEED ONLY IF THIS PRINT IS CERTIFIED.
 - 3) THIS DRAWING IS THIRD ANGLE PROJECTION AS SHOWN.
 - 4) FLANGE BOLTS STRADDLE CENTERLINES.
 - 5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
 - 6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
 - 7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [3].

Ref. 10D4287

FIGURE 2-3. OUTLINE DIMENSIONS, 1 - 4 INCH FLOWMETER WITH ANSI FLANGES

DIM	SIZE	6 [150]		8 [200]		10 [250]		12 [300]	
		FLANGE CLASS		150	300	150	300	150	300
L	10D $\frac{S}{X}$ 3111_D	11-13/16 [300]		13-25/32 [350]		17-23/32 [450]		19-11/16 [500]	
L	10D $\frac{S}{X}$ 3111_E	17-23/32 [450]		19-11/16 [500]		21-21/32 [550]		24-13/32 [620]	
L	10D $\frac{S}{X}$ 3111_E	N/A		N/A		N/A		18 [457]	
RF		8-1/2 [216]		10-5/8 [270]		12-3/4 [324]		15 [381]	
B	POLY/NEO/ RUBBER LINER	1-3/16 [30]	1-5/8 [41]	1-5/16 [33]	1-13/16 [46]	1-3/8 [35]	2-1/16 [52]	1-1/2 [38]	2-1/4 [57]
	TEFLON LINER	1-1/8 [29]	1-9/16 [40]	1-9/32 [33]	1-25/32 [45]	1-3/8 [35]	2-1/16 [52]	1-1/2 [38]	2-1/4 [57]
	TEFZEL LINER	1-1/8 [29]	1-9/16 [40]	1-1/4 [32]	1-3/4 [44]	1-5/16 [33]	2 [51]	1-25/64 [35]	2-9/64 [54]
d		7/8 [22]	7/8 [22]	7/8 [22]	1 [25]	1 [25]	1-1/8 [29]	1 [25]	1-1/8 [29]
N		8	12	8	12	12	16	12	16
BC		9-1/2 [241]	10-5/8 [270]	11-3/4 [298]	13 [330]	14-1/4 [362]	15-1/4 [387]	17 [432]	17-3/4 [451]
DD		11 [279]	12-1/2 [318]	13-1/2 [343]	15 [381]	16 [406]	17-1/2 [445]	19 [483]	20-1/2 [521]
A		6-11/16 [170]		7-11/16 [195]		9-27/32 [250]		9-27/32 [250]	
C		5-25/32 [147]		7-1/16 [179]		8-5/32 [207]		9-27/32 [250]	
E		7-5/8 [194]		8-7/8 [225]		9-31/32 [253]		12-9/16 [319]	
F		8-5/8 [216]		9-7/8 [251]		11 [279]		13-23/32 [348]	
W		12-3/16 [310]		14-3/8 [365]		16-25/32 [426]		20-5/64 [510]	

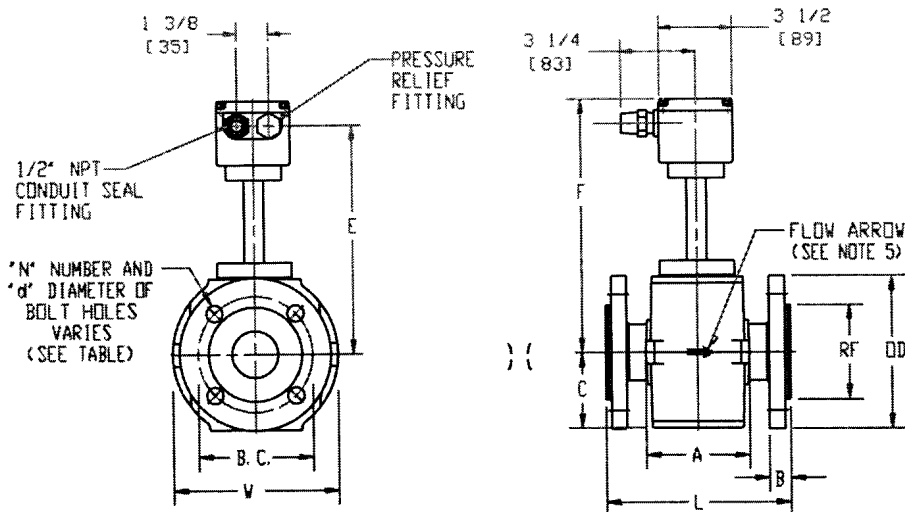


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 - 4) FLANGE BOLTS STRADDLE CENTERLINES.
 - 5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
 - 6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
 - 7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [3].

Ref. OD-10D-4123 r4

FIGURE 2-4. OUTLINE DIMENSIONS, 6 - 12 INCH FLOWMETER WITH ANSI FLANGES

OUTLINE DIMENSIONS inches (mm)									
DIM	SIZE	6 (150)		8 (200)		10 (250)		12 (300)	
	ANSI FLG CL	150	300	150	300	150	300	150	300
MODEL NO.									
L	10D $\frac{S}{X}$ 3111AD	11-13/16 (300)		13-25/32 (350)		17-23/32 (450)		19-11/16 (500)	
	10D $\frac{S}{X}$ 3111AE	17-23/32 (450)		19-11/16 (500)		21-21/32 (550)		24-13/32 (620)	
	10D $\frac{S}{X}$ 3111AF	N/A		N/A		N/A		18 (457)	
RF		8-1/2 (216)		10-5/8 (270)		12-3/4 (324)		15 (381)	
B		1-1/8 (29)	1-9/16 (40)	1-9/32 (33)	1-25/32 (45)	1-3/8 (35)	2-1/16 (52)	1-1/2 (38)	2-1/4 (57)
d		7/8 (22)	7/8 (22)	7/8 (22)	1 (25)	1 (25)	1-1/8 (29)	1 (25)	1-1/8 (29)
N		8	12	8	12	12	16	12	16
BC		9-1/2 (241)	10-5/8 (270)	11-3/4 (298)	13 (330)	14-1/4 (362)	15-1/4 (387)	17 (432)	17-3/4 (451)
DD		11 (279)	12-1/2 (318)	13-1/2 (343)	15 (381)	16 (406)	17-1/2 (445)	19 (483)	20-1/2 (521)
A		6-11/16 (170)		7-11/16 (195)		9-27/32 (250)		9-27/32 (250)	
C		5-25/32 (147)		7-1/16 (179)		8-5/32 (207)		9-27/32 (250)	
E		12-3/8 (314)		13-5/8 (346)		14-23/32 (374)		16-13/32 (417)	
F		13-7/16 (341)		14-11/16 (373)		15-25/32 (401)		17-7/16 (443)	
W		12-3/16 (310)		14-3/8 (365)		16-25/32 (426)		20-5/64 (510)	

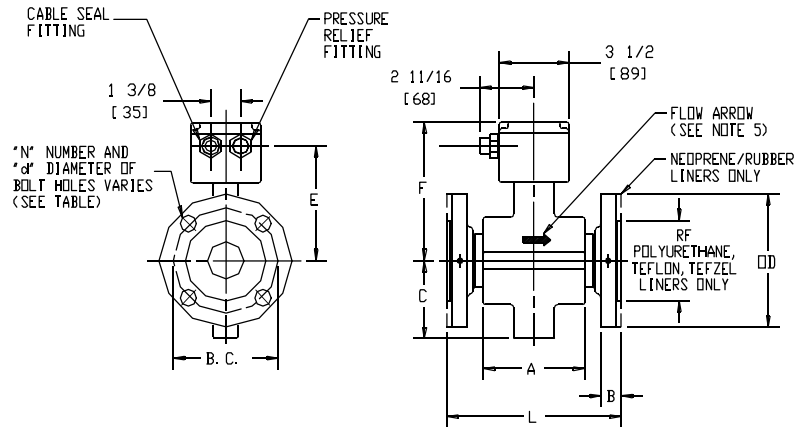


- NOTES
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 - 3) THIS DRAWING IS A THIRD ANGLE PROJECTION AS SHOWN.
 - 4) FLANGE BOLT HOLES STRADDLE CENTERLINES
 - 5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
 - 6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
 - 7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [3] .

FIGURE 2-5. OUTLINE DIMENSIONS, 6 - 12 INCH FLOWMETER WITH ANSI FLANGES, HI-TEMP

10DS3111E INSTRUCTION MANUAL

DIM	SIZE	1 [25]		1-1/2 [40]		2 [50]		3 [80]		4 [100]	
	DIN PN	10/16	25/40	10/16	25/40	10/16	25/40	10/16	25/40	10/16	25/40
MODEL NO.											
L	10D ^S _X 3111ED	7-7/8 [200]	9 [229]	7-7/8 [200]	9 [229]	7-7/8 [200]	9 [229]	7-7/8 [200]	9 [229]	9-7/8 [250]	11 [280]
L	10D ^S _X 3111EE	14 [356]		16 [406]		16 [406]		12 [305]		12 [305]	
L	10D ^S _X 3111EF	N/A		N/A		N/A		N/A		N/A	
L	10D ^S _X 3111EZ	SEE SALES ORDER INFORMATION FOR "L" DIMENSION									
LINER											
RF	POLY/TEFL/TEFZ	2-11/16 [68]		3-15/32 [88]		4 [102]		5-7/16 [138]		6-7/32 [158]	6-3/8 [162]
B	POLY/NEO/RUBBER	N/A		N/A		15/16 [24]	1-1/16 [27]	1-1/8 [29]	1-5/16 [33]	1-1/8 [29]	1-7/16 [36]
	TEFLON	11/16 [17]	13/16 [21]	27/32 [21]	31/32 [25]	29/32 [23]	1-1/32 [26]	1-3/32 [27]	1-9/32 [32]	1-3/32 [27]	1-13/32 [35]
	TEFZEL	5/8 [16]	3/4 [19]	3/4 [19]	7/8 [22]	27/32 [21]	31/32 [25]	3/4 [19]	1-1/4 [32]	1-3/32 [27]	1-3/8 [35]
d		9/16 [14]		23/32 [18]		23/32 [18]		23/32 [18]		23/32 [18]	7/8 [22]
N		4		4		4		8		8	
BC		3-11/32 [85]		4-11/32 [110]		4-29/32 [125]		6-5/16 [160]		7-3/32 [180]	7-1/2 [190]
DD		4-17/32 [115]		5-29/32 [150]		6-1/2 [165]		7-7/8 [200]		8-21/32 [220]	9-1/4 [235]
A		3-7/16 [87]		3-15/16 [100]		4-9/16 [116]		3-15/16 [100]		5-1/8 [130]	
C		2-7/8 [73]		3-7/32 [82]		3-17/32 [90]		4-11/32 [110]		5-1/8 [130]	
E		4-11/16 [119]		5-1/32 [128]		5-11/32 [136]		6-5/32 [156]		6-15/16 [176]	
F	STD. TEMP.	5-3/4 [146]		6-3/32 [155]		6-13/32 [163]		7-7/32 [183]		8 [203]	
E	HIGH TEMP.	5-1/16 [128]		5-13/32 [137]		5-23/32 [145]		6-17/32 [166]		7-5/16 [186]	
F	HIGH TEMP.	6-1/8 [156]		6-15/32 [164]		6-25/32 [172]		7-19/32 [193]		8-3/8 [213]	

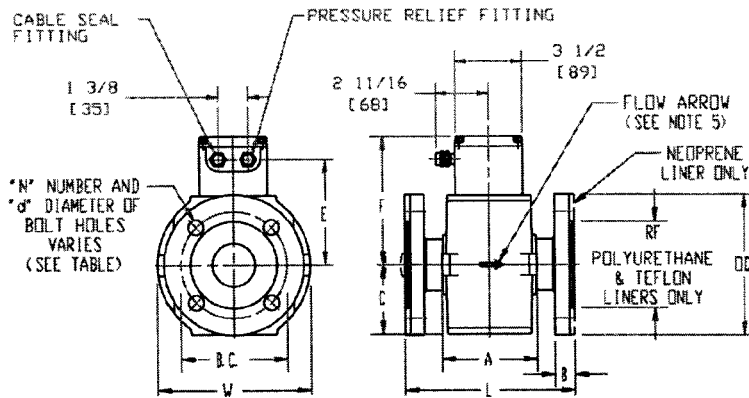


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 - 4) FLANGE BOLTS STRADDLE CENTERLINES.
 - 5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
 - 6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
 - 7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [3].

Ref. 10D4288

FIGURE 2-6. OUTLINE DIMENSIONS, 1 - 4 INCH FLOWMETER WITH DIN FLANGES

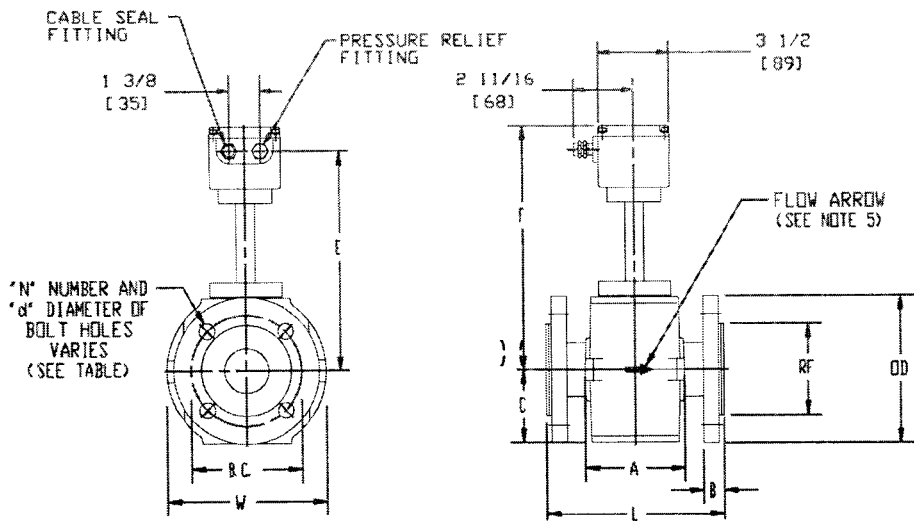
		OUTLINE DIMENSIONS inches (mm)															
DIM	SIZE	6 (150)				8 (200)				10 (250)				12 (300)			
	DIN PN	10/16	25/40	10	16	25	40	10	16	25	40	10	16	25	40		
MODEL NO.																	
L	10D 3111AD	11-13/16 (300)				13-25/32 (350)				17-23/32 (450)				19-11/16 (500)			
L	10D 3111AE	17-23/32 (450)				19-11/16 (500)				21-21/32 (550)				24-13/32 (620)			
LINER																	
RF	NEOPRENE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
RF	OTHERS	8-11/32 (212)	8-19/32 (218)	10-9/16 (268)	10-15/16 (278)	11-7/32 (285)	12-19/32 (320)	13-3/16 (335)	13-19/32 (345)	14-9/16 (370)	14-7/8 (378)	15-9/16 (395)	16-3/32 (410)				
B	POLY/NEOP	1-3/16 (30)	1-5/8 (41)	1-3/8 (35)	1-7/8 (48)	1-7/16 (36)	2-1/8 (50)	NA	NA								
B	TEFL	1-1/8 (28)	1-9/16 (40)	1-9/32 (33)	1-25/32 (45)	1-3/8 (35)	2-1/16 (52)	1-1/2 (38)	2-1/4 (57)								
	TEFZ	1-1/8 (28)	1-9/16 (40)	1-1/4 (32)	1-3/4 (44)	1-5/16 (33)	2 (51)	1-25/64 (36)	2-9/64 (54)								
d		7/8 (22)	1-1/32 (26)	7/8 (22)	1-1/32 (26)	1-3/16 (30)	7/8 (22)	1-1/32 (26)	1-3/16 (30)	1-5/16 (30)	7/8 (22)	1-1/32 (26)	1-3/16 (30)	1-5/16 (33)			
N		8				12				12				12			
BC		9-1/2 (240)	9-27/32 (250)	11-5/8 (295)	12-7/32 (310)	12-19/32 (320)	13-25/32 (350)	13-31/32 (355)	14-9/16 (370)	15-5/32 (385)	15-3/4 (400)	16-9/16 (410)	16-15/16 (420)	17-23/32 (450)			
DD		11-7/32 (285)	11-13/16 (300)	13-3/8 (340)	14-3/16 (360)	14-3/4 (375)	15-9/16 (395)	15-15/16 (405)	16-23/32 (450)	17-23/32 (445)	17-17/32 (460)	18-1/8 (485)	19-3/32 (485)	20-9/32 (515)			
A		6-11/16 (170)				7-11/16 (195)				9-27/32 (250)				9-27/32 (250)			
C		5-25/32 (147)				7-1/16 (179)				8-5/32 (207)				9-27/32 (250)			
E		7-5/8 (194)				8-7/8 (225)				9-31/32 (253)				12-9/16 (319)			
F		8-5/8 (219)				9-7/8 (251)				11 (279)				13-9/16 (345)			
W		12-3/16 (310)				14-3/8 (365)				16-25/32 (426)				20-3/32 (510)			



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 - 6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
 - 7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [3].

FIGURE 2-7. OUTLINE DIMENSIONS, 6 - 12 INCH FLOWMETER WITH DIN FLANGES

OUTLINE DIMENSIONS inches (mm)																
DIM	SIZE	6 (150)		8 (200)				10 (250)				12 (300)				
		DIN PN	10/16	25/40	10	16	25	40	10	16	25	40	10	16	25	40
MODEL NO.																
L	10D ^S _X 3111AD	11-13/16 (300)		13-25/32 (350)				17-23/32 (450)				19-11/16 (500)				
L	10D ^S _X 3111AE	17-23/32 (450)		19-11/16 (500)				21-21/32 (550)				24-13/32 (600)				
RF		8-11/32 (212)	8-19/32 (218)	10-9/16 (268)	10-15/16 (278)	11-7/32 (285)		12-19/32 (320)	13-3/16 (335)	13-19/32 (345)		14-9/16 (320)	14-7/8 (378)	15-9/16 (395)	16-5/32 (410)	
B		1-1/8 (28)	1-9/16 (40)	1-9/32 (32)		1-25/32 (45)		1-3/8 (35)		2-1/16 (52)		1-1/2 (38)		2-1/4 (57)		
d		7/8 (22)	1-1/32 (26)	7/8 (22)	1-1/32 (26)	1-3/16 (30)		7/8 (22)	1-1/32 (26)	1-3/16 (30)	1-5/16 (33)		7/8 (22)	1-1/32 (26)	1-3/16 (30)	1-5/16 (33)
N		8		8	12	12		12			12			12		
BC		9-1/2 (240)	9-27/32 (250)	11-5/8 (295)	12-7/32 (310)	12-19/32 (320)		13-25/32 (350)	13-31/32 (355)	14-9/16 (370)	15-5/32 (385)		15-3/4 (400)	16-9/16 (410)	16-15/16 (430)	17-23/32 (450)
DB		11-7/32 (285)	11-13/16 (300)	13-3/8 (340)	14-3/16 (360)	14-3/4 (375)		15-9/16 (395)	15-15/16 (405)	16-23/32 (425)	17-23/32 (450)		17-17/32 (445)	18-1/8 (460)	19-3/32 (485)	20-9/32 (515)
A		6-11/16 (170)		7-11/16 (195)				9-27/32 (250)				9-27/32 (250)				
C		5-25/32 (147)		7-1/16 (179)				8-5/32 (207)				9-27/32 (250)				
E		12-3/8 (314)		13-5/8 (346)				14-23/32 (374)				16-9/32 (414)				
F		13-7/16 (341)		14-11/16 (373)				15-25/32 (401)				17-5/16 (440)				
W		12-3/16 (310)		14-3/8 (365)				16-25/32 (426)				20-3/32 (510)				

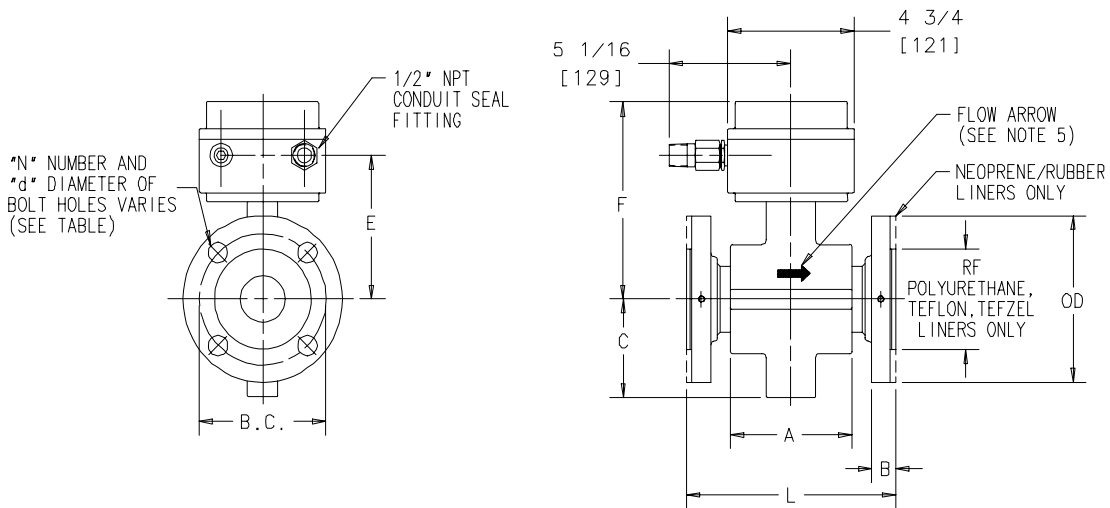


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 - 7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [31].

FIGURE 2-8. OUTLINE DIMENSIONS, 6 - 12 INCH FLOWMETER WITH DIN FLANGES, HI-TEMP

10DS3111E INSTRUCTION MANUAL

DIM	SIZE	1 [25]		1-1/2 [40]		2 [50]		3 [80]		4 [100]	
		FLANGE CLASS		150	300	150	300	150	300	150	300
MODEL NO.											
L	10D ^S _X 3111ED	7-7/8 [200]	9 [229]	7-7/8 [200]	9 [229]	7-7/8 [200]	9 [229]	7-7/8 [200]	9 [229]	9-7/8 [250]	11 [280]
L	10D ^S _X 3111EE	14 [356]		16 [406]		16 [406]		12 [305]		12 [305]	
L	10D ^S _X 3111EF	N/A		N/A		N/A		N/A		N/A	
L	10D ^S _X 3111EZ	SEE SALES ORDER INFORMATION FOR "L" DIMENSIONS									
LINER											
RF	POLY/TEFL/TEFZ	2 [51]		2-7/8 [73]		3-5/8 [92]		5 [127]		6-3/16 [157]	
B	POLY/NEO/RUBBER	N/A		N/A		15/16 [24]	1-1/16 [27]	1-1/8 [29]	1-5/16 [33]	1-1/8 [29]	1-7/16 [36]
	TEFLON	11/16 [17]	13/16 [21]	27/32 [21]	31/32 [25]	29/32 [23]	1-1/32 [26]	1-3/32 [27]	1-9/32 [32]	1-3/32 [27]	1-13/32 [35]
	TEFZEL	5/8 [16]	3/4 [19]	3/4 [19]	7/8 [22]	27/32 [21]	31/32 [25]	3/4 [19]	1-1/4 [32]	1-3/32 [27]	1-3/8 [35]
d		5/8 [16]	3/4 [19]	5/8 [16]	7/8 [22]	3/4 [19]		3/4 [19]	7/8 [22]	3/4 [19]	7/8 [22]
N		4		4		4	8	4	8	8	8
BC		3-1/8 [79]	3-1/2 [89]	3-7/8 [98]	4-1/2 [114]	4-3/4 [121]	5 [127]	6 [152]	6-5/8 [168]	7-1/2 [191]	7-7/8 [200]
OD		4-1/4 [108]	4-7/8 [124]	5 [127]	6-1/8 [156]	6 [152]	6-1/2 [165]	7-1/2 [190]	8-1/4 [210]	9 [229]	10 [254]
A		3-7/16 [87]		3-15/16 [100]		4-9/16 [116]		3-15/16 [100]		5-1/8 [130]	
C		2-7/8 [73]		3-7/32 [82]		3-17/32 [90]		4-11/32 [110]		5-1/8 [130]	
E		4-9/16 [116]		4-29/32 [125]		5-7/32 [133]		6-1/32 [153]		6-13/16 [173]	
F		5-11/16 [144]		6-1/32 [153]		6-11/32 [161]		7-5/32 [182]		7-15/16 [202]	

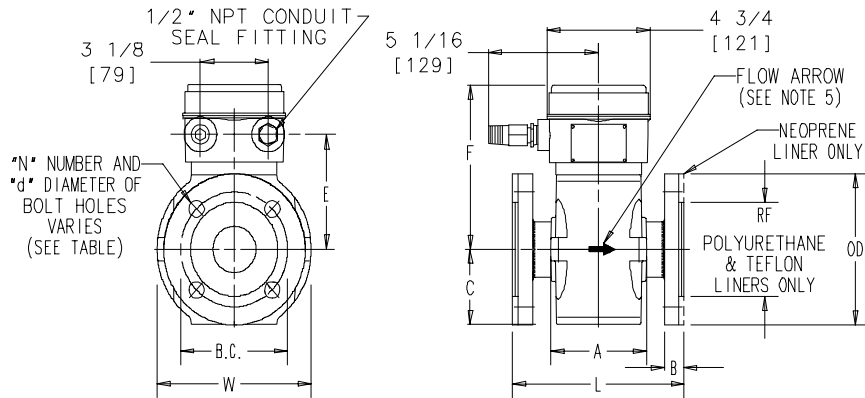


- NOTES:
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 - 2) DIMENSIONS ARE GUARANTEED ONLY IF THIS PRINT IS CERTIFIED.
 - 3) THIS DRAWING IS THIRD ANGLE PROJECTION AS SHOWN.
 - 4) FLANGE BOLTS STRADDLE CENTERLINES.
 - 5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
 - 6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
 - 7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [3].

Ref. 10d4290 r0

FIGURE 2-9. OUTLINE DIMENSIONS, 1 - 4 INCH FLOWMETER WITH ANSI FLANGES, CONTINUOUS SUBMERGENCE

		OUTLINE DIMENSIONS inches (mm)							
DHM	SIZE	6 (150)		8 (200)		10 (250)		12 (300)	
	ANSI FLG CL	150	300	150	300	150	300	150	300
MODEL NO.									
L	10D $\frac{S}{X}$ 3111AD	11-13/16 (300)		13-25/32 (350)		17-23/32 (450)		19-11/16 (500)	
L	10D $\frac{S}{X}$ 3111AE	17-23/32 (450)		19-11/16 (500)		21-21/32 (550)		24-13/32 (620)	
L	10D $\frac{S}{X}$ 3111AF	NA		NA		NA		18 (457)	
LINER									
RF	NEOPRENE	NA	NA	NA	NA	NA	NA	NA	NA
RF	OTHERS	8-1/2 (216)		10-5/8 (270)		12-3/4 (324)		15 (381)	
B	POLY/NEOP	1-3/16 (30)	1-5/8 (41)	1-5/16 (33)	1-13/16 (46)	1-3/8 (35)	2-1/16 (52)	1-1/2 (38)	2-1/4 (57)
	TEFLON	1-1/8 (29)	1-9/16 (40)	1-9/32 (33)	1-25/32 (45)	1-3/8 (35)	2-1/16 (52)	1-1/2 (38)	2-1/4 (57)
	TEFZEL	1-1/8 (29)	1-9/16 (40)	1-1/4 (32)	1-3/4 (44)	1-5/16 (33)	2 (51)	1-25/64 (35)	2-9/64 (54)
d		7/8 (22)	7/8 (22)	7/8 (22)	1 (25)	1 (25)	1-1/8 (29)	1 (25)	1-1/8 (29)
N		8	12	8	12	12	16	12	16
BC		9-1/2 (241)	10-5/8 (270)	11-3/4 (298)	13 (330)	14-1/4 (362)	15-1/4 (387)	17 (432)	17-3/4 (451)
OD		11 (279)	12-1/2 (318)	13-1/2 (343)	15 (381)	16 (406)	17-1/2 (445)	19 (483)	20-1/2 (521)
A		6-11/16 (170)		7-11/16 (195)		9-27/32 (250)		9-27/32 (250)	
C		5-25/32 (147)		7-1/16 (179)		8-5/32 (207)		9-27/32 (250)	
E		7-1/2 (190)		8-3/4 (222)		9-27/32 (250)		12-9/16 (319)	
F		9-9/16 (243)		10-13/16 (273)		11-15/16 (303)		14-21/32 (372)	
W		12-3/16 (310)		14-3/8 (365)		16-25/32 (426)		20-5/64 (510)	



NOTES

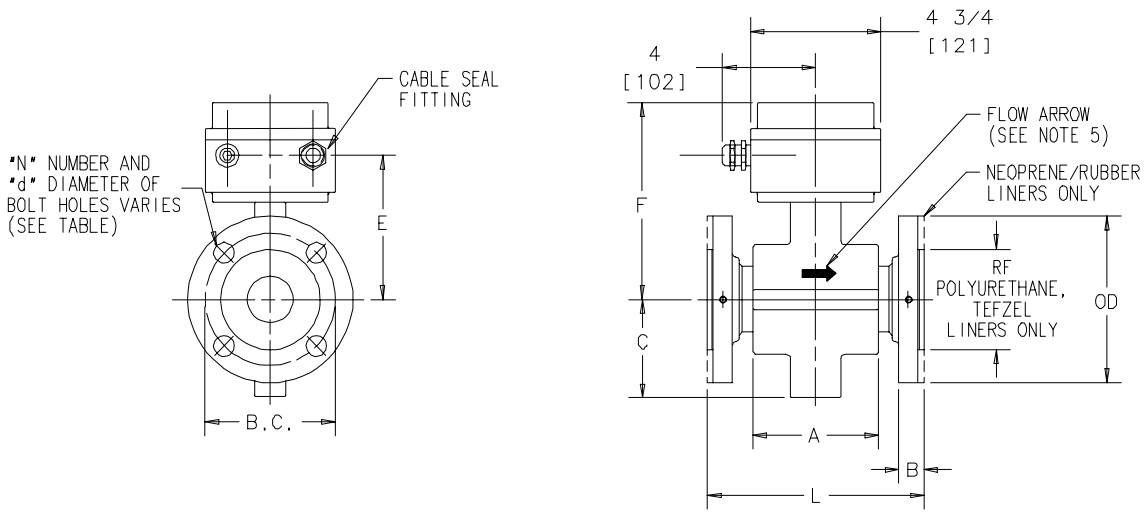
- 1) ALL DIMENSIONS ARE IN INCHES. DIMENSIONS IN PARENTHESIS [] ARE IN MILLIMETERS [mm].
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- 4) FLANGE BOLT HOLES STRADDLE CENTERLINES
- 5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
- 6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
- 7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/-1/8 [3] .

Ref. 10d4265 r0

FIGURE 2-10. OUTLINE DIMENSIONS, 6 - 12 INCH FLOWMETER WITH ANSI FLANGES, CONTINUOUS SUBMERGENCE

10DS3111E INSTRUCTION MANUAL

DIM	SIZE	1 [25]		1-1/2 [40]		2 [50]		3 [80]		4 [100]	
	DIN PN	10/16	25/40	10/16	25/40	10/16	25/40	10/16	25/40	10/16	25/40
MODEL NO.											
L	10D $\frac{S}{X}$ 3111ED	7-7/8 [200]	9 [229]	7-7/8 [200]	9 [229]	7-7/8 [200]	9 [229]	7-7/8 [200]	9 [229]	9-7/8 [250]	11 [280]
L	10D $\frac{S}{X}$ 3111EE	14 [356]		16 [406]		16 [406]		12 [305]		12 [305]	
L	10D $\frac{S}{X}$ 3111EF	N/A		N/A		N/A		N/A		N/A	
L	10D $\frac{S}{X}$ 3111EZ	SEE SALES ORDER INFORMATION FOR "L" DIMENSION									
LINER											
RF	POLY/TEFZEL	2-11/16 [68]		3-15/32 [88]		4 [102]		5-7/16 [138]		6-7/32 [158]	6-3/8 [162]
	POLY/NEO/RUBBER	N/A		N/A		15/16 [24]	1-1/16 [27]	1-1/8 [29]	1-5/16 [33]	1-1/8 [29]	1-7/16 [36]
B	TEFZEL	5/8 [16]	3/4 [19]	3/4 [19]	7/8 [22]	27/32 [21]	31/32 [25]	3/4 [19]	1-1/4 [32]	1-3/32 [27]	1-3/8 [35]
d		9/16 [14]		23/32 [18]		23/32 [18]		23/32 [18]		23/32 [18]	7/8 [22]
N		4		4		4		8		8	
BC		3-11/32 [85]		4-11/32 [110]		4-29/32 [125]		6-5/16 [160]		7-3/32 [180]	7-1/2 [190]
OD		4-17/32 [115]		5-29/32 [150]		6-1/2 [165]		7-7/8 [200]		8-21/32 [220]	9-1/4 [235]
A		3-7/16 [87]		3-15/16 [100]		4-9/16 [116]		3-15/16 [100]		5-1/8 [130]	
C		2-7/8 [73]		3-7/32 [82]		3-17/32 [90]		4-11/32 [110]		5-1/8 [130]	
E		4-9/16 [116]		4-29/32 [125]		5-7/32 [133]		6-1/32 [153]		6-13/16 [173]	
F		5-11/16 [144]		6-1/32 [153]		6-11/32 [161]		7-5/32 [182]		7-15/16 [202]	

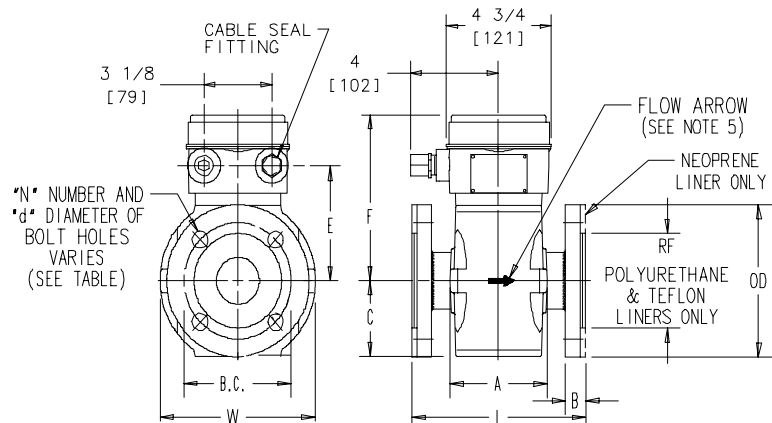


- NOTES:
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 - 6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
 - 7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [3].

Ref. 10d4292 r0

FIGURE 2-11. OUTLINE DIMENSIONS, 1 - 4 INCH FLOWMETER WITH DIN FLANGES, CONTINUOUS SUBMERGENCE

OUTLINE DIMENSIONS inches (mm)																	
DIM	SIZE	6 (150)				8 (200)				10 (250)				12 (300)			
		DIN PN		10/16	25/40	10	16	25	40	10	16	25	40	10	16	25	40
MODEL NO.																	
L	10D ^S _X 3111AD	11-13/16 (300)				13-25/32 (350)				17-23/32 (450)				19-11/16 (500)			
L	10D ^S _X 3111AE	17-23/32 (450)				19-11/16 (500)				21-21/32 (550)				24-13/32 (620)			
LINER																	
RF	NEOPRENE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
RF	OTHERS	8-11/32 (212)	8-19/32 (218)	10-9/16 (268)	10-15/16 (278)	11-7/32 (285)	12-19/32 (320)	13-3/16 (335)	13-19/32 (345)	14-9/16 (370)	14-7/8 (378)	15-9/16 (395)	16-5/32 (410)				
B	POLY/NEOP	1-3/16 (30)	1-5/8 (41)	1-3/8 (35)	1-7/8 (48)		1-7/16 (36)	2-1/8 (54)		NA		NA					
B	TEFL	1-1/8 (28)	1-9/16 (40)	1-9/32 (33)	1-25/32 (45)		1-3/8 (35)	2-1/16 (52)		1-1/2 (38)		2-1/4 (52)					
	TEFZ	1-1/8 (28)	1-9/16 (40)	1-1/4 (32)	1-3/4 (44)		1-5/16 (33)	2 (51)		1-25/64 (36)		2-9/64 (54)					
d		7/8 (22)	1-1/32 (26)	7/8 (22)	1-1/32 (26)	1-3/16 (30)	7/8 (22)	1-1/32 (26)	1-3/16 (30)	1-5/16 (33)	7/8 (22)	1-1/32 (26)	1-3/16 (30)	1-5/16 (33)			
N		8				8 12				12				12			
BC		9-1/2 (240)	9-27/32 (250)	11-5/8 (295)	12-7/32 (310)	12-19/32 (320)	13-25/32 (350)	13-31/32 (355)	14-9/16 (370)	15-5/32 (385)	15-3/4 (400)	16-9/16 (410)	16-15/16 (430)	17-23/32 (450)			
OD		11-7/32 (285)	11-13/16 (300)	13-3/8 (340)	14-3/16 (360)	14-3/4 (375)	15-9/16 (395)	15-15/16 (405)	16-23/32 (425)	17-23/32 (450)	17-17/32 (445)	18-1/8 (460)	19-3/32 (485)	20-9/32 (515)			
A		6-11/16 (170)				7-11/16 (195)				9-27/32 (250)				9-27/32 (250)			
C		5-25/32 (147)				7-1/16 (179)				8-5/32 (207)				9-27/32 (250)			
E		7-1/2 (190)				8-3/4 (222)				9-27/32 (250)				12-9/16 (319)			
F		9-9/16 (243)				10-13/16 (275)				11-15/16 (303)				14-21/32 (372)			
W		12-3/16 (310)				14-3/8 (365)				16-25/32 (426)				20-3/32 (510)			



NOTES

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- 6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
- 7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/-1/8 [3] .

Ref. 10d4267 r 0

FIGURE 2-12. OUTLINE DIMENSIONS, 6 - 12 INCH FLOWMETER WITH DIN FLANGES, CONTINUOUS SUBMERGENCE

2.4 Mounting

2.4.1 Orientation

The meter may be installed in horizontal, vertical or sloping pipe runs. However, precautions must be taken to assure that the metering tube is filled at all times during measurement. A vertical installation, with the pipe line carrying liquid upwards assures a filled line under low flow rate conditions and also minimizes wear on the meter lining by abrasive grit. Horizontal installations should be made with the meter in the lower section of a pipeline to assure a filled meter condition.

For horizontal or sloping installations the meter should be placed so that the electronic housing of the meter is on top. This will align the meter electrodes in a lateral plane. Positioning the meter in this way eliminates the possibility of entrained air acting as an electrode insulator.

The meter must be oriented in accordance with the direction of process flow, as indicated by the FLOW arrow on the meter body. For accurate metering, a straight pipe run equivalent to a minimum of three straight pipe diameters are required upstream of the meter for elbows and tees, measured from the center of the meter (refer to Figure 2-15).

If a control valve is required, it is recommended that it be placed downstream of the meter. Upstream valves can create turbulence that result in air pockets and may affect the meter's accuracy or cause its output to be noisy. A **minimum of ten pipe diameters** of straight pipe are required upstream between the meter and a control valve or pump.

2.4.2 Pipe Connections

The TEFLON and polyurethane lined meters have raised faced flanges rated as specified. The neoprene and hard-rubber lined meters have full faced flanges rated as specified. Two flange gaskets are supplied per meter; the mounting studs and nuts are furnished by the user.

For 4-bolt and 8-bolt flanges, tighten the flange bolts in a "star" pattern as shown in FIGURE 2-13 to avoid localized stresses on the gaskets. Use a similar method for 8-bolt flanges.

Refer to Figure 2-14 for proper gasket locations and Figure 2-15 for recommended piping arrangement.

The meter should be oriented such that the pressure relief valve points in a safe direction should a situation occur where the device could be activated. For further discussion of the pressure relief mechanism and orientation, refer to Section 2.7 of this instruction manual.

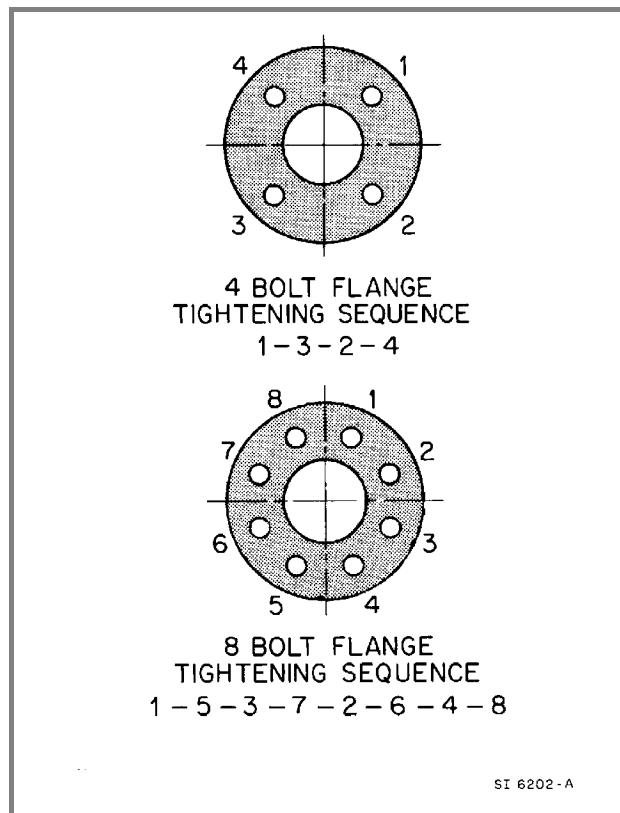


FIGURE 2-13. BOLT TIGHTENING SEQUENCE

2.4.3 Torque Specifications

It is recommended that the bolts and nuts be lubricated and tightened using a torque wrench. The bolts and nuts should be tightened to approximately 50% of the torque value during the first pass, to approximately 80% during the second pass and to the full torque during the third pass. The maximum torque rate values shown in TABLES 2-3 and 2-4 **must not be exceeded**.

For liner materials other than those shown in the tables, the flange bolts should be tightened sufficiently to stop any leaks but should not exceed the values shown in the tables.

TABLE 2-3. TORQUE RECOMMENDATIONS (ANSI)

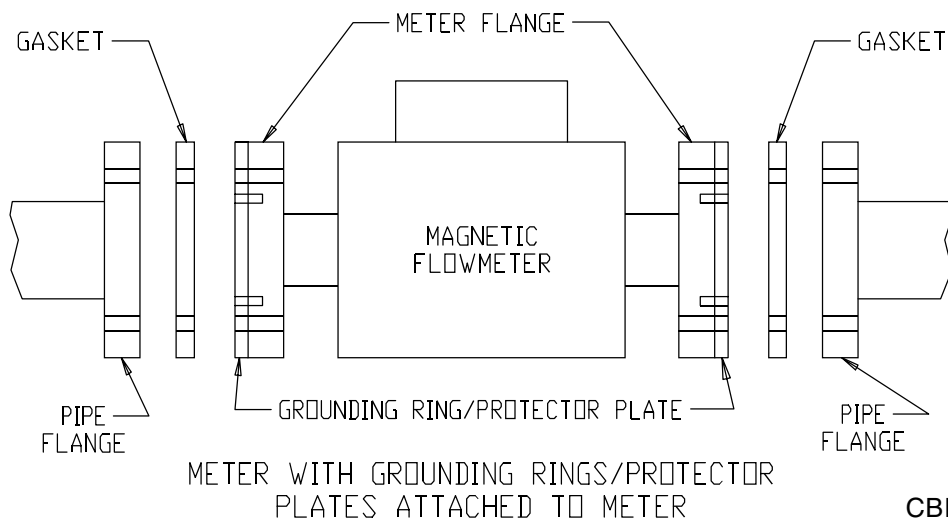
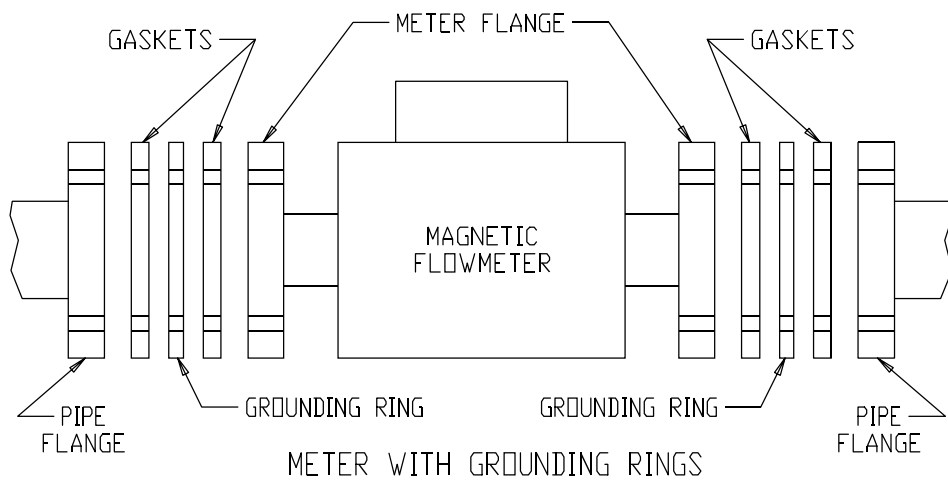
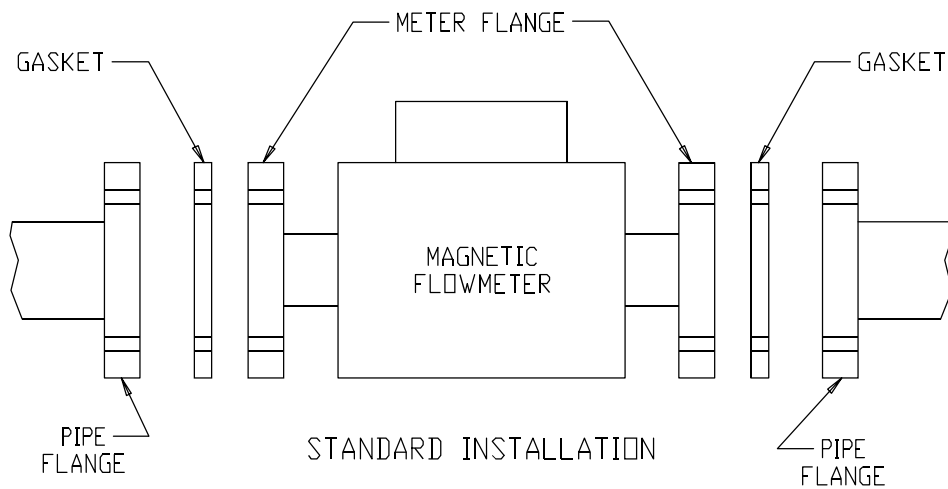
Liner Material	Size in. mm		ANSI Class 150		ANSI Class 300	
			Bolt No. & Size (in.)	Max. Torque Rate (ft-lb)	Bolt No. & Size (in.)	Max. Torque Rate (ft-lb)
PTFE / TEFZEL / Rubber	1	25	"	10	"	15
	1-1/2	40	"	15	4 x 3/4	25
	2	50	4 x 5/8	25	8 x 5/8	15
	3	80	"	40	"	25
	4	100	8 x 5/8	35	"	40
	6	150	8 x 3/4	60	12 x 3/4	65
	8	200	"	75	12 x 7/8	120
	10	250	12 x 7/8	70	16 x 1	150
	12	300	"	95	16 x 1-1/8	230

TABLE 2-4. TORQUE RECOMMENDATIONS (DIN)

Liner Material	Size		Bolt No. & Size	Max. Torque Rate		PN bar
	in.	mm		ft-lb	Nm	
PTFE/ Rubber	1	25	4 x M12	15.1	20.5	40
	1-1/2	40	4 x M16	31.3	42.5	40
	2	50	4 x M16	41.0	55.5	40
	3	80	8 x M16	35.8	48.5	40
	4	100	8 x M16	34.3	46.5	16
	6	150	8 x M20	60.8	82.5	16
	8	200	12 x M20	59.7	81.0	16
	10	250	12 x M24	88.5	120.0	16
	12	300	12 x M24	118.0	160.0	16

NOTE:

- Torques listed are for bolts with threads lubricated
- All meters with PTFE liners need to be re-torqued after 48 hours of operation



CBI-3007

FIGURE 2-14 . GASKET LOCATIONS

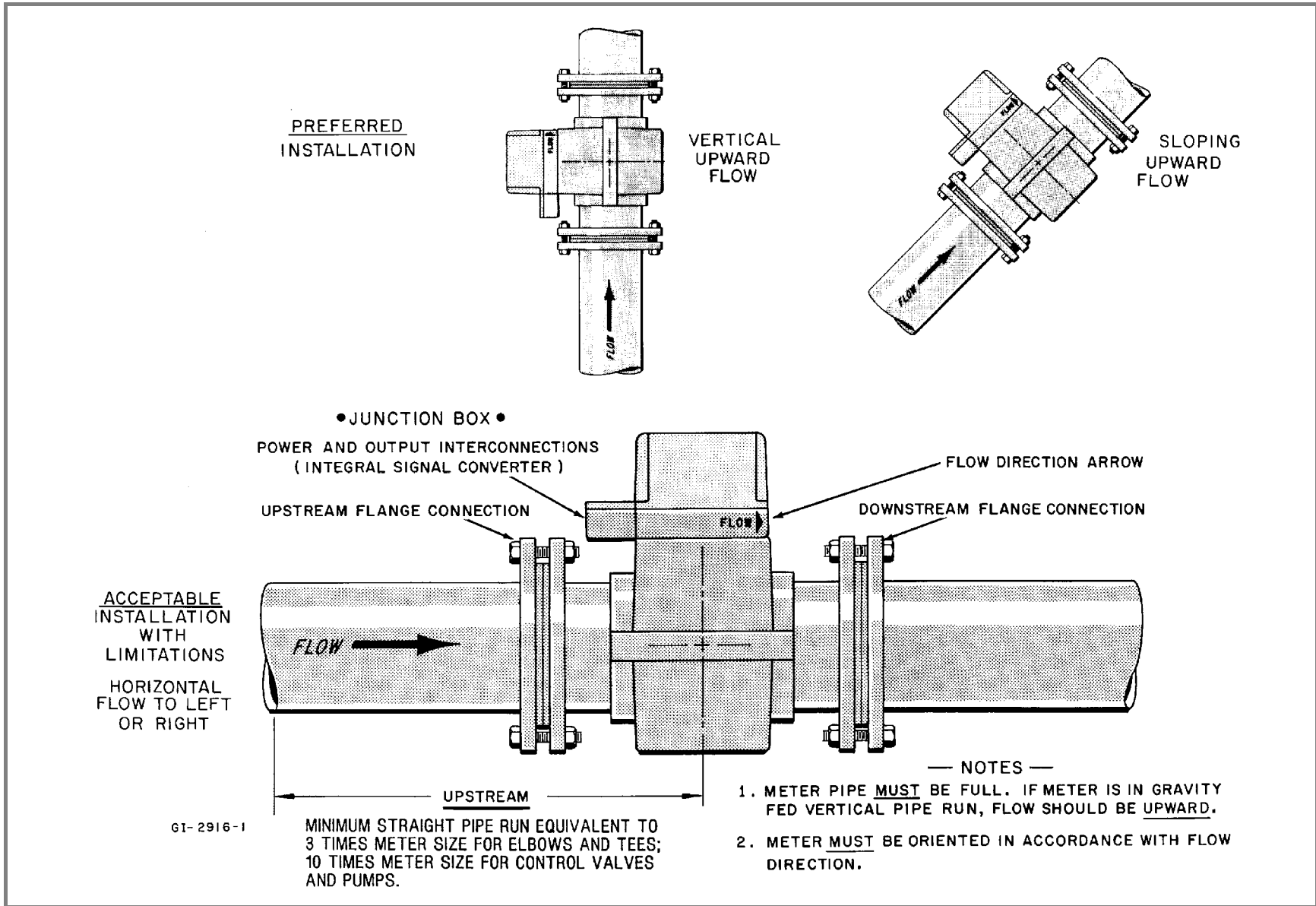


FIGURE 2-15. RECOMMENDED PIPING ARRANGEMENT

Figure is for reference only, the flowmeter shown in this illustration is not the meter described in this instruction bulletin.

2.5 Grounding Procedure

2.5.1 General

Satisfactory operation of metering system requires that careful attention be paid to proper grounding techniques. A good ground is one that is in contact with the earth over a large conductive area. An excellent example of this is a metallic cold water pipe which is underground. A great number of pipe branches form a large conductive area of contact which provides a low resistance connection to earth. A hot water or steam pipe must first return to a boiler before it becomes a cold water pipe, and therefore, its greater length of ungrounded path offers a less desirable ground bus. A metallic structural member of a building, such as a supporting "I" beam, may be a good earth ground, but it is a second choice to a metallic cold water pipe.

Flowmeter grounding requirements are a combination of standard grounding methods and a bonding of the meter body to the process liquid. The most important of these is the process bonding, which is ensuring that the meter body is in contact with the process liquid at both ends of the meter body. The bonding procedure places an electrical short circuit across the meter, thereby routing any stray current around the liquid in the meter (rather than through it).

From the point of view of grounding there are two basic types of piping systems:

- electrically conductive pipeline: the process liquid comes in contact with conductive pipe. This piping requires that each meter flange be connected with a bonding wire to the adjacent pipeline flange. The grounding procedure to use with conductive pipeline is described in 2.5.2.
- non-conductive or electrically insulated pipeline: the pipeline may be made of an electrically non-conductive material (plastic, concrete, etc.) or lined with a non-conductive material (rubber, TEFLON, etc). These non-conductive pipelines require the use of metal grounding rings to bond the process liquid to ground. The grounding procedure to use with nonconductive pipeline is described in 2.5.3.

Proper grounding of the meter is required for optimum system performance.

2.5.2 Conductive Pipeline

If the meter is included as part of a conductive pipeline that is not electrically insulated from the liquid to be metered, the following grounding procedure should be followed. Refer to Figure 2-16 to supplement the following text.

- 1) Drill and tap both pipeline flanges adjacent to the bonding connections on the meter. The lugs on the bonding cables are sized for a 1/4 inch bolt (metric M6 fasteners).
- 2) Obtain a bright metal surface around the edges of the tapped hole with a file or emery cloth.
- 3) Attach the bonding wire and another length of ground wire to the flanges as shown. Use internal tooth lockwashers as shown in the detail. The wire to the good external ground should be #12 AWG or heavier copper wire.

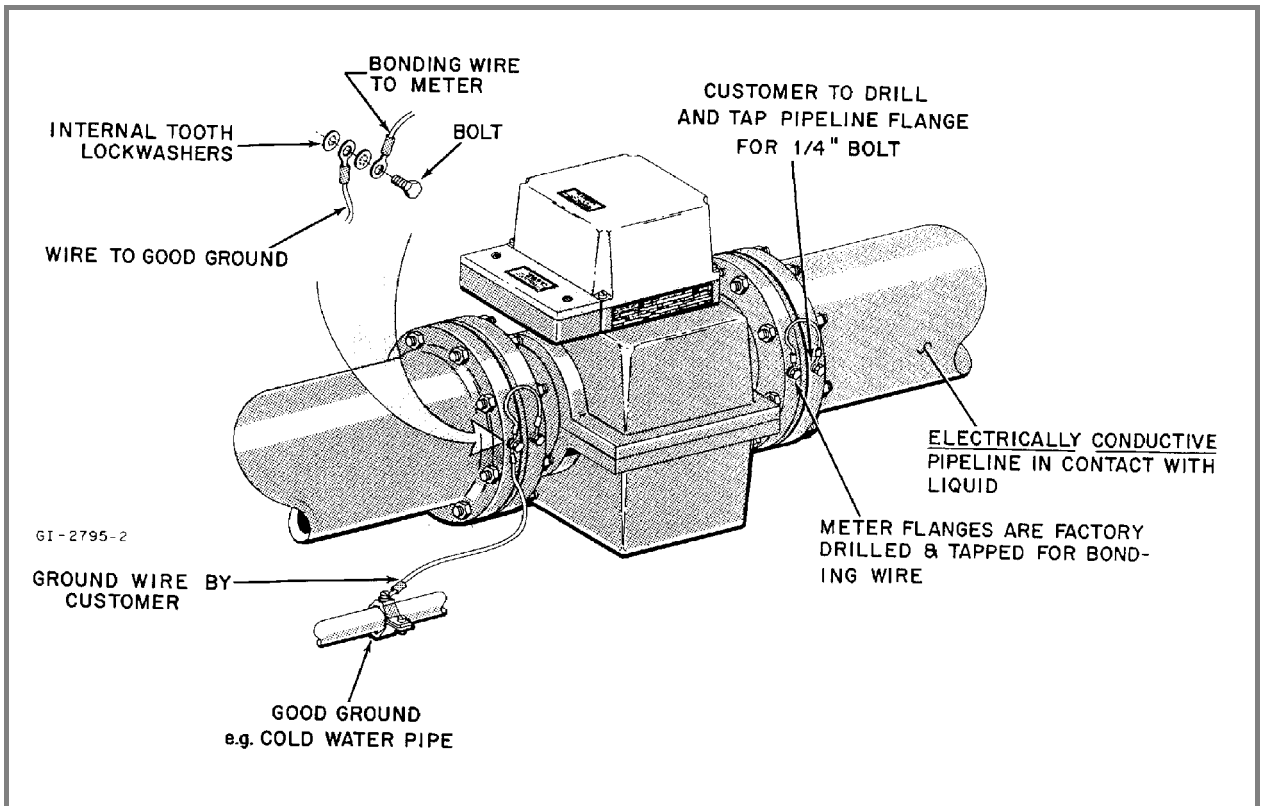


FIGURE 2-16. GROUNDING PROCEDURE; CONDUCTIVE PIPELINE

Figure is for reference only, the flowmeter shown in this illustration is not the meter described in this instruction bulletin.

2.5.3 Non-Conductive or Electrically Insulated Pipeline

If the meter is included as part of a non-conductive or liquid insulated pipeline (such as totally plastic pipe, ceramic lined iron pipe, or cast pipe with internal bitumastic coating), the following grounding procedures apply. Refer to Figure 2-17 to supplement the following text.

1) For this service, the meter requires the use of grounding rings. The grounding rings should be installed between the meter flanges and the mating flanges of the pipeline as shown in Figure 2-14. A gasket is required on both sides of the grounding ring. If the meter is supplied with a grounding ring/protector plate fastened to the meter flange, only one gasket is required between the grounding ring/protector plate and the pipeline flange. Proper gasket locations are shown in Figure 2-14.

2) Attach the bonding wire and ground wire to the tab of the grounding ring. Use internal tooth lockwashers and hex head nut and bolts as shown in Figure 2-15. The ground wire should be #12 AWG, or heavier, copper wire.

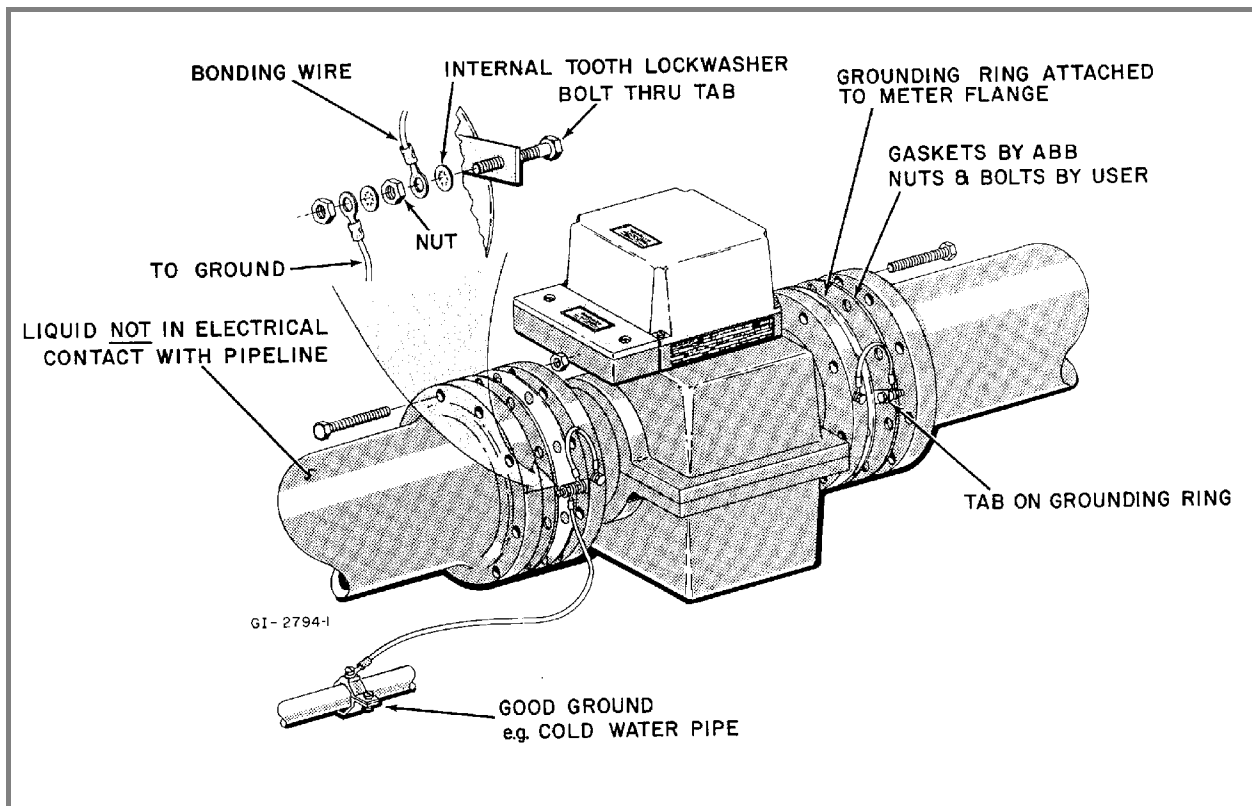


FIGURE 2-17. GROUNDING PROCEDURE; NON-CONDUCTIVE PIPELINE

Figure is for reference only, the flowmeter shown in this illustration is not the meter described in this instruction bulletin.

2.6 Electrical Interconnection

The Series 3000 Magnetic Flowmeter is furnished with a remotely mounted Signal Converter. Interconnection details are provided in the Instruction Bulletin provided with the Signal Converter.

WARNING
ELECTRICAL SHOCK HAZARD. Equipment powered by ac line voltage constitutes a potential electric shock hazard to the user. Make certain that the system power input leads are disconnected from the operating branch circuit before attempting electrical interconnections.

The cable from the remote converter is connected to the Primary using the customer connection box mounted on the meter body. FIGURE 3-2 shows the customer connection circuit board located inside the customer connection box. The signal cable from the remote converter is connected to the meter using the terminal blocks labeled "CUSTOMER CONNECTIONS" shown in FIGURE 3-2.

When incorporating the interconnection procedures, the grounding procedures given in Section 2.5 must be followed.

For explosion proof meter installation, all interconnection wiring must be installed according to National Electrical Code (NEC) ANSI/NFPA 70 Section 500.

NOTE
For meters capable of continuous submergence, the signal cable has been permanently installed by the factory. Do not loosen the cable seal fitting or remove the connection box lid since this will break the seal and void the warranty.

2.7 Conduit Seal and Pressure Relief

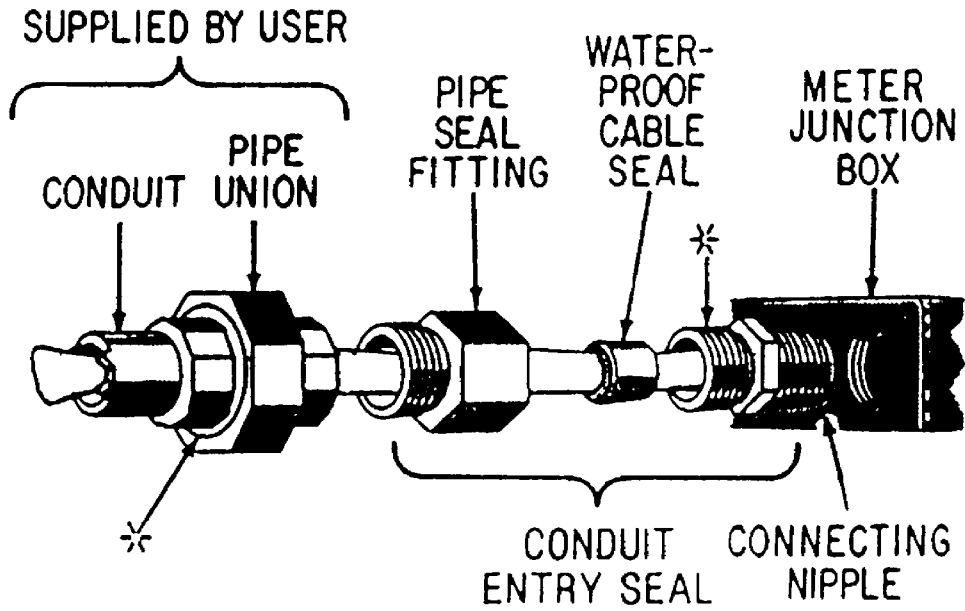
In accordance with the National Electrical Code (NEC) ANSI/NFPA 70, Article 501-5(f)(3), the flowmeter includes a conduit entry seal and pressure relief to prevent the process liquid from entering the electrical conduit system. This safety feature considers the remote possibility of a primary seal failure, in which case, the secondary seal will prevent the process from entering the electrical conduit system.

It is the user's responsibility to properly install the conduit entry cable seal fitting supplied with the signal cable provided with the remotely mounted signal converter. This will ensure proper performance of this safety feature. Refer to Figure 2-18.

A pressure relief is provided in the electronics housing in the customer connection box on the meter. The pressure relief is located in the center of the housing joint on the side opposite from the conduit connection. If the primary seal should fail, the pressure relief will vent the process preventing an over pressurization and potentially dangerous failure of the electronics housing.

It is the user's responsibility to be aware of this safety feature and to consider the unlikely event of its functioning. Based on knowledge of the process and meter application, the user should consider the installation orientation of the meter and possible use of deflectors to safely direct the vented process.

THE CONDUIT ENTRY SEAL FITTING PROVIDED WITH THIS METER SHALL BE INSTALLED AS SHOWN.



* CONDUCTIVE THREAD SEALANT TO BE USED ON ALL EXCEPT THESE STRAIGHT THREADS.

FIGURE 2-19. CONDUIT ENTRY SEAL INSTALLATION

3.0 START-UP and OPERATION

3.1 General

The meter is calibrated at the factory. Each meter is calibrated to determine its meter capacity at a given velocity. Refer to Table 1-4.

Prior to initial system start up, verify that the meter is properly installed; check flow direction, wiring interconnection and grounding as discussed in Section 2.0 Installation. Particular attention should be given to the meter grounding procedures; improper grounding may result in unsatisfactory performance. Refer to the signal converter instruction bulletin for interconnection wiring.

Except for system zero adjustment, there are no operating controls that require field adjustment unless the full scale range setting was not specified at time of purchase. If the full scale range setting must be set or changed, refer to the instruction bulletin supplied with the signal converter.

The flowmeter does not require zeroing, however, system zero adjustment must be performed prior to start-up. The procedure for system zero adjustment is discussed in the signal converter instruction bulletin.

Start flow through the process piping system that includes the meter. Allow a nominal flow through the pipeline for several minutes to purge entrapped air. The pipeline must be full for accurate flow measurement.

Apply the appropriate power for the meter by closing the external switch or circuit breaker; there are no switches inside of the equipment. Also, energize any auxiliary equipment associated with the flow metering system, such as remote analog recorders, controllers or rate indicators.

Initiate process flow through the pipeline. Flow measurement and concurrent output signal transmission will commence with flow through the meter.

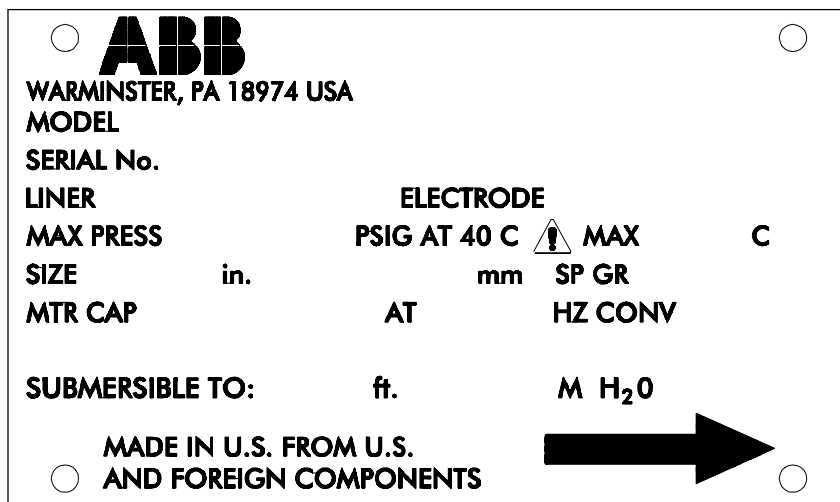


FIGURE 3-1. TYPICAL INSTRUMENT TAG

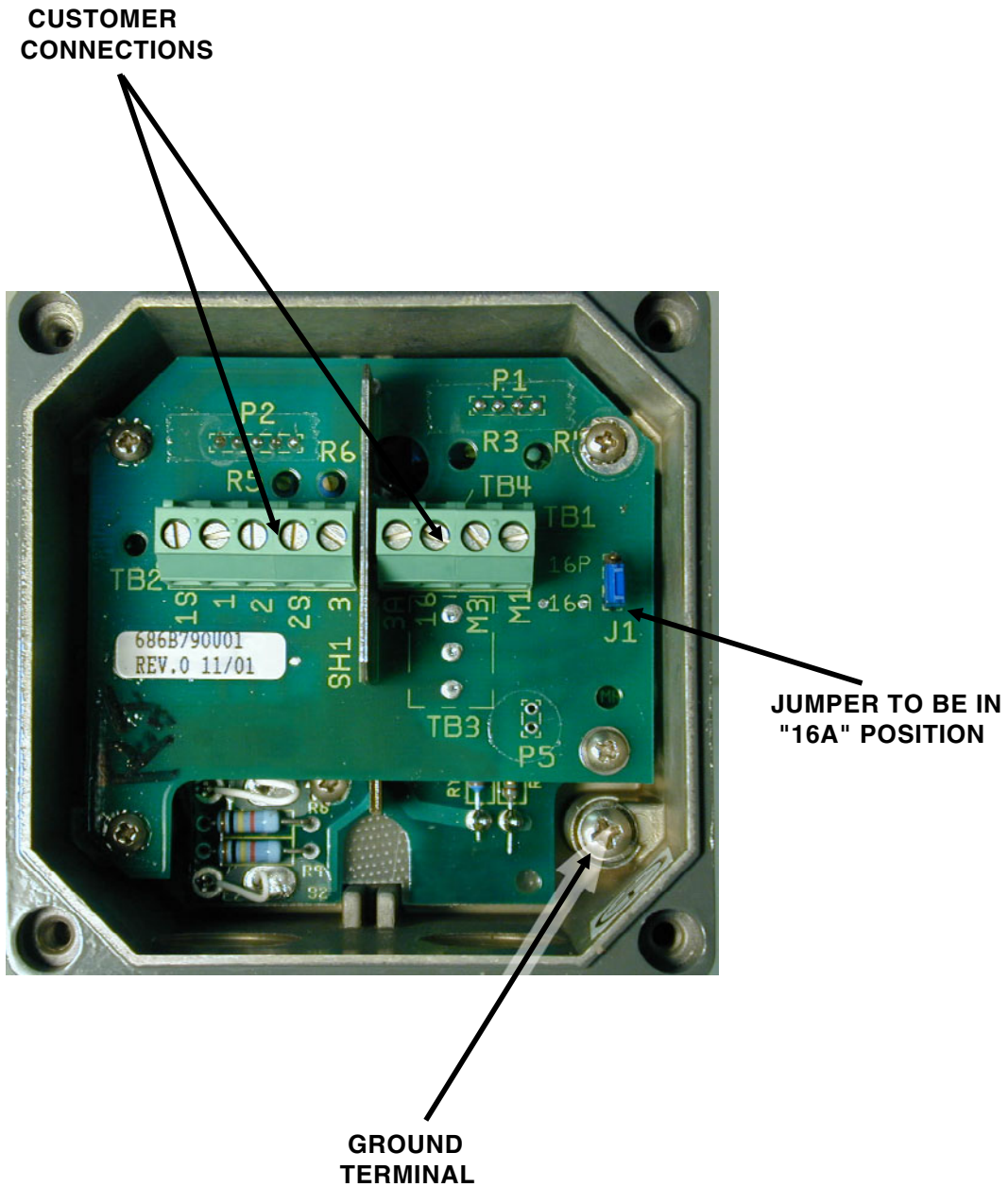


FIGURE 3-2. 10DS3111E PRIMARY CONNECTIONS FOR REMOTE MOUNTED SIGNAL CONVERTER

Note: The assembly shown is a "typical" assembly and may not represent the configuration of your specific model. Newer models may be different from the configuration shown.

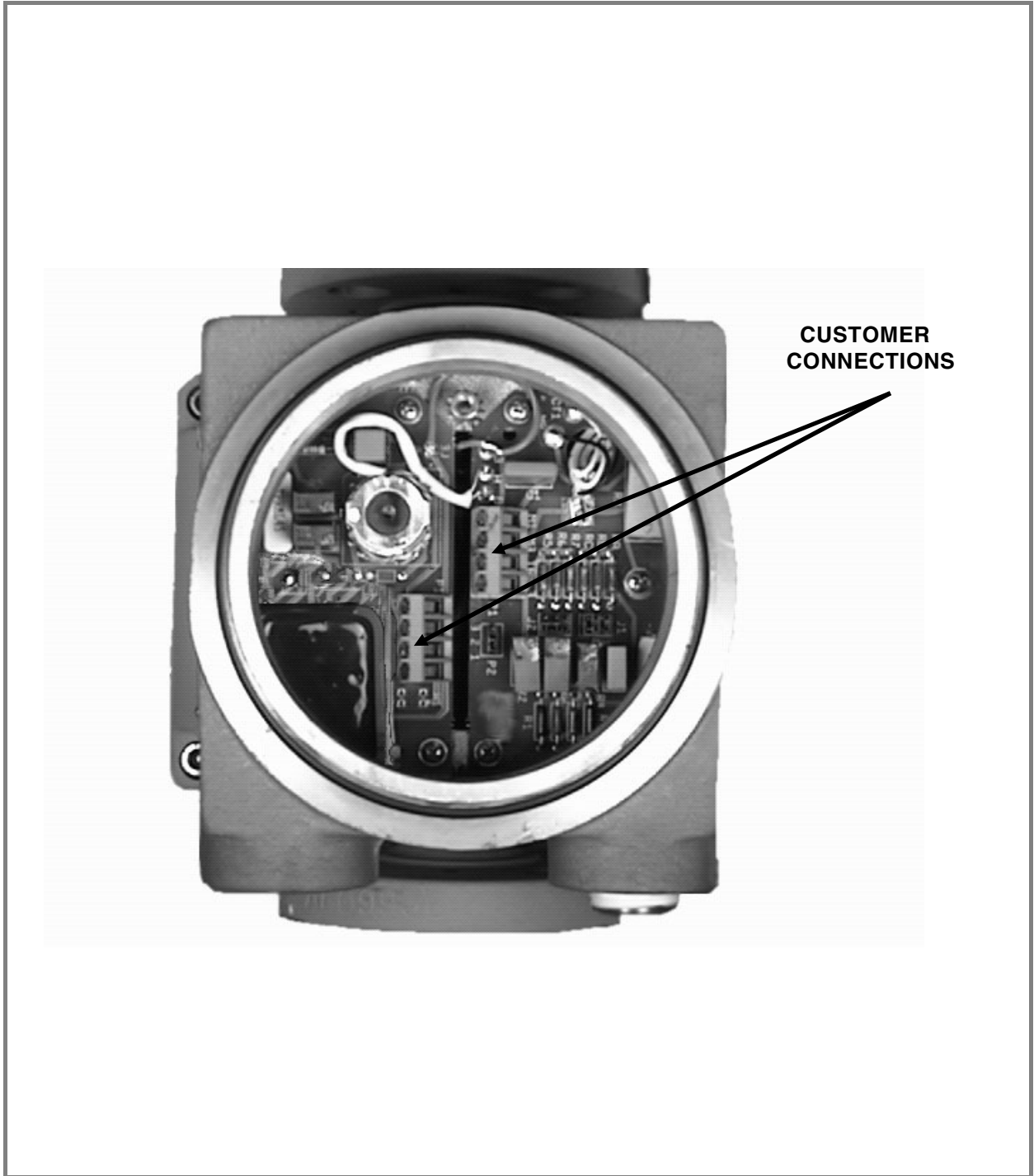


FIGURE 3-3. CONTINUOUS SUBMERGENCE PRIMARY CONNECTIONS FOR REMOTE MOUNTED SIGNAL CONVERTER

Note: Figure shows electronics without encapsulation material. Normally the converter housing is filled with a silicone rubber encapsulant.

4.0 FUNCTIONAL DESCRIPTION

The meter body houses two signal electrodes and two flux producing magnet coils, as shown schematically in Figure 4-1. All flowmeter intraconnection wiring is terminated at a printed circuit assembly located in the base mounted on the meter housing.

The meter provides two output signals to the signal converter:

- an electrode signal that contains the flow rate information
- the reference signal which is proportional to the magnet excitation current (theoretically, this reference signal is proportional to the flux density in the metering section).

The reference voltage is derived across a precision constant meter capacity (CMC) resistance network that is connected in series with the magnet coils. Changes in magnet drive voltage, which cause a variation of flow signal, will simultaneously cause a proportional variation of the reference voltage. The circuitry will provide an exact ratio and thereby provide immunity to power supply variation. The magnet coil drive circuitry is contained in the signal converter.

4.1 Basic Operating Principle

4.1.1 Signal Voltage Generation

The operating principle of the Series 3000 meter is based upon Faraday's Law of Induction which states that the voltage induced across any conductor as it moves at right angles through a magnetic field will be proportional to the velocity of that conductor. This principle finds common application in direct and alternating current generators. Essentially, the meter constitutes a modified form of a generator.

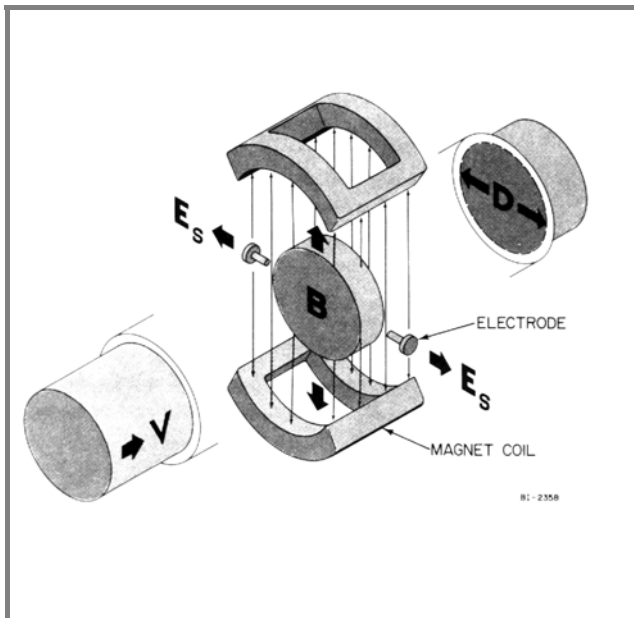


FIGURE 4-1. BASIC OPERATING PRINCIPLE

Figure 4-1 graphically illustrates the basic operating principle. A magnetic field, "B", being generated in planes which are perpendicular to the axis of the meter pipe. A disk of the metered liquid can be considered as a conductor. The transverse length "D" is equal to the meter pipe diameter. Since the velocity "V" of the liquid disk is directed along the axis of the meter pipe, a voltage, signal "E_s", will be induced within this liquid which is mutually perpendicular to the direction of the liquid velocity and the flux linkages of the magnetic field; i.e., in the axial direction of the meter electrodes. This electrode voltage is the summation of all incremental voltages developed within each liquid particle that passes under the influence of the magnetic field.

This may be expressed mathematically as:

(Equation #1)

$$E_s = \frac{1}{\alpha} BDV$$

where:

- E_s = induced electrode voltage
- B = magnetic field strength
- D = meter pipe diameter
- α = dimensionless constant
- V = liquid velocity

The metered liquid constitutes a continuous series of conductive liquid disks moving through a magnetic field. The more rapid the rate of liquid flow, the greater the instantaneous value of signal voltage as monitored at the meter electrodes.

4.1.2 Volumetric Flow Rate Measurement

The meter is a volumetric flow rate measuring instrument. This can be shown by substituting the physical equivalent of liquid velocity into equation #1 as follows:

(Equation #2)

$$V = \frac{Q}{A} = \frac{4Q}{\pi D^2}$$

Substituting for V in equation #1

$$E_s = \frac{1}{\alpha} BD \frac{4Q}{\pi D^2}$$

and solving for Q :

$$\therefore Q = \frac{\pi \alpha D}{4} \cdot \frac{E_s}{B}$$

Since $B = \beta E_r$

and since α , D and β are constant:

(Equation #3)

$$Q = \gamma \frac{E_s}{E_r}$$

where:

Q = volumetric flow rate
A = cross-sectional area
D = pipe section diameter
E_s = induced signal voltage
E_r = reference voltage
B = magnetic flux density
α = dimensionless constant
β & γ = dimensional constant
V = liquid velocity

Therefore, volumetric flow rate is directly proportional to the ratio of the induced signal voltage to the reference voltage as measured by the meter.

4.2 Operating Characteristics

4.2.1 Liquid Variables

4.2.1.1 Liquid Conductivity

The meter requires a liquid conductivity of 20 microsiemens per centimeter or higher for operation. This minimum liquid conductivity requirement is not affected by the length of the signal interconnection cable as long as the factory-supplied or factory-approved interconnection cable (with driven shields) is used. The nominal maximum transmission distance is limited to 100 feet (30 m) which is the standard length of cable supplied unless specified otherwise.

The conductivity of a given liquid, σ , may be determined experimentally under a filled meter condition, as follows:

- 1) Turn off power to the signal converter. Remove the converter housing cover. Disconnect and identify the electrode signal interconnection leads from terminals "1" and "2" of the signal converter.
- 2) Measure the resistance between signal leads "1" and "2" with an ac ohmmeter.

CAUTION

Do not use a dc ohmmeter for this measurement as polarization effects will produce completely erroneous data.

The conductivity of the process liquid (in microsiemens/cm) may be determined from the electrode ac resistance measurement (in megohms) by substitution of values in the following equation.

$$\sigma = \frac{1}{(R_{ac} - 0.072) \times \text{Electrode Diameter, in cm}}$$

where,

0.072 is the electrode barrier resistance in megohms; i.e., 36 kΩ x 2/10⁶

and,

typical electrode diameter is 0.77 cm

For example, assuming the measured ac electrode resistance (full pipe) is 192,000 ohms and electrode diameter is 0.76 cm, then

$$\sigma = \frac{1}{(0.192 - 0.072) \times 0.77} = 10.82 \mu\text{S/cm}$$

This is above the threshold for specified measurement accuracy for the particular liquid, meter size and signal converter combination. Liquid conductivities at the operating temperature may also be determined from standard references for many pure liquids. Factory Field Engineers are equipped to determine the conductivities of special liquids at the user's site.

Electrode diameters vary with meter size and type of liner, the values given in Table 4-1 are typical electrode diameters.

TABLE 4-1. ELECTRODE DIAMETERS

Meter Size inches (mm)	Electrode Diameters	
	TEFLON Lined Meter	Neo/Poly Lined Meter
1 - 1½ (25-40)	.770 cm (.303 inch)	-----
2 - 4 (50-100)	.820 cm (.323 inch)	.635 cm (.250 inch)
6 - 12 (150-300)	1.200 cm (.472 inch)	.635 cm (.250 inch)

4.2.1.2 Liquid Temperature

Having established the minimum liquid conductivity requirements for a given application, any liquid which exhibits equal or higher conductivity may be metered without concern for any system compensating adjustments. However, the effect of the liquid conductivity versus temperature should be considered.

Most liquids exhibit a positive temperature coefficient of conductivity. It is possible for certain marginal liquids to become sufficiently non-conductive at lower temperatures so as to hamper accurate metering; whereas, the same liquid at higher or normal environmental temperatures may be metered with optimum results. The possibility of an adverse temperature conductivity characteristic should be investigated before attempting to meter such a liquid. Process or ambient temperatures are limited by the meter materials specification.

Other normal effects of temperature, such as influence upon liquid viscosity and density, the size of the metering area, and the flux density of the magnetic field, have negligible or no effect upon metering accuracy.

4.2.1.3 Other Liquid Variables

Other liquid variables such as viscosity, density and liquid pressure have no direct influence on metering accuracy. Liquid density has no effect on volumetric flow rate since only the area of the meter pipe and liquid velocity are required to determine the rate of flow. Viscosity and metering pressure are restricted to physical limitations alone, such as the pressure limits of the meter pipe flange connections.

4.2.2 Metering Characteristics

The metering pipe must be completely filled at all times for accurate measurement. Where there is a possibility of operation with a partially filled horizontal pipeline, it is recommended that the meter be installed in a vertical position so that the process flows upward. A vertical installation offers the advantage of an even distribution of wear on the meter liner in the event that abrasives are present in the process stream.

The meter will measure the total amount of material passing in the process stream. The meter will not differentiate between the amount of liquid and the amount of entrained gases. Also, in the case of a slurry, the meter will not differentiate between the amount of liquid and solids. If the liquid to mixant ratio is important for process control, then separate measurements of the concentration of the medium must be made and appropriate correction factors applied to the meter output.

In applications involving variable quantities of uniformly dispersed, non-conductive mixing agents, it must be determined that the higher concentrations of mixant will not drive the average conductivity of the liquid mixture below the minimum conductivity level for the given installation.

5.0 CIRCUIT DESCRIPTION

5.1 Meter Signals

The meter body houses two signal electrodes and two flux producing magnet coils. All meter intraconnection wiring is terminated at the CMC/ZERO pc board located in the base of the meter housing.

The meter provides two output signals to the associated signal converter; one, an electrode signal that contains the flow rate information, and two, the reference signal which is proportional to the magnet excitation current (theoretically, this reference signal is proportional to the flux density in the metering section). The reference voltage is derived across a precision "constant meter factor" resistance network that is connected in series with the magnet coils. Changes in magnet drive voltage, which cause a variation of flow signal, will simultaneously cause a proportional variation of the reference voltage. The circuitry will provide an exact ratio and thereby provide immunity to power supply variation. The magnet coil drive circuitry is contained in the signal converter.

5.2 Constant Meter Capacity (CMC) PC Assembly

The CMC pc assembly provides the following functions:

1. Establishes interconnections between the meter internal wiring and the signal converter.
2. Permits factory adjustment of meter capacity values to a fixed value for each nominal size meter.
3. Permits factory adjustment of meter zero.
4. Aligns the phase of the electrode and reference signals.

6.0 MAINTENANCE

6.1 General

Except for an occasional performance verification check, there is no routine maintenance required for the meter. It is suggested that the meter body not be disassembled. If disassembled, complete waterproof sealing is required for satisfactory operation and is best done at the factory. Replacement of faulty magnet drive coils and electrode replacement is a factory operation. Factory calibration after this type of repair is the only way to guarantee meter accuracy.

The manufacturer offers a Repair/Exchange Program to facilitate replacement of a defective meter or converter. If the equipment is beyond the warranty limit, under this program a fixed price will be charged for replacement of defective equipment, with appropriate credit issued when the repairable unit is received by the manufacturer (charges prepaid). The equipment available under this program is as follows:

- the meter with the interconnection junction box without the signal converter
- the signal converter

WARNING

All flowmeters and/or signal converters being returned to the manufacturer for repair must be free of any hazardous materials (acids, alkalis, solvents, etc.). A Material Safety Data Sheet (MSDS) for all process liquids must accompany returned equipment. Contact the manufacturer for authorization prior to returning equipment.

NOTE

Operation and maintenance procedures for the signal converter are provided in the instruction bulletin supplied with the signal converter.

When communicating with the manufacturer in regard to replacement of a complete meter or the signal converter, it is important to refer to the complete instrument serial number to assure that the correct replacement will be supplied. This information is provided on the manufacturing specification sheet supplied with the meter, and on the instrument data tag.

6.2 System Troubleshooting

In the event that faulty operation of the meter is evident, the following procedure can be used as a guide to isolate the malfunctioning device as either the meter or the signal converter. A standard multimeter is suitable for making most of the test measurements.

To supplement the following discussion refer to:

- Section 5.0 Circuit Description
- Signal converter instruction manual

NOTE

The meter housing is supplied as a sealed unit. Therefore, customer field repairs to these meters are not recommended. In the event of a malfunction, repairs should only be performed by a factory field service engineer, or the complete meter returned to the manufacturer for service (shipping charges prepaid).

WARNING

Equipment powered by an ac line voltage presents a potential electric shock hazard. Servicing of the flowmeter or signal converter should only be attempted by a qualified electronics technician.

1. If improper meter operation is suspected, proceed as follows:

- a) Remove the access cover from the meter junction box.
- b) Inspect for evidence of water entry in the junction box.

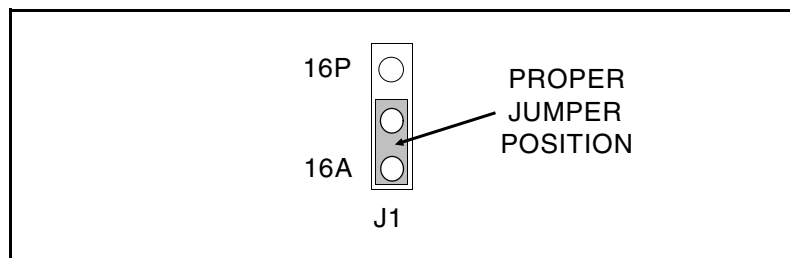
If water is present, de-energize system at power source. Inspect conduit seals and cover gaskets for possible source of water entry. Replace the seals and/or gasket as required. Allow interior of junction box and converter housing to dry completely before restoring system power.

2. Since signal wiring and operating procedures are dependent upon the type of converter and the mounting option selected, the user should refer to the instruction bulletin supplied with the signal converter for system troubleshooting procedures. A static performance test for the meter mounted components is discussed in Section 6.3.

3. Possible causes of erroneous flow rate indication are:

- incorrect grounding
- excessive noise due to a heavy slurry process or a non-homogeneous process
- loose or intermittent wiring
- non-full or empty meter pipe
- excess air entrained in process liquid
- fluid conductivity below minimum specifications

4. The customer connection box mounted on the meter Primary contains an assembly of two printed circuit boards. The upper board contains the terminal blocks for the customer connections as well as a terminal strip with a jumper block labeled **J1** (shown in FIGURE 3-2). The proper position for this jumper in the 10DS3111E is between the center terminal and the lower terminal marked 16A as shown in the figure below.



6.3 Static Test

If improper operation of the meter is suspected, the following resistance measurements can be made to establish whether an electrical malfunction has occurred. An analog multimeter is required for checking the electrodes. Either an analog or digital multimeter can be used for checking the coils. These measurements can be made at the flowmeter pc board.

WARNING
Equipment that operates from ac line voltage constitutes a potential electric shock hazard to the user. Make certain that the system power is disconnected before making the following ohmmeter checks.

6.3.1 Magnet Coil Check

6.3.1.1 Signal Converter

Verify that the system power service has been de-energized. Turn off the power to the signal converter to de-energize the meter. Remove cable leads M1 and M2/M3 from the customer terminal block. Measure magnet coil series resistance by connecting the ohmmeter between M1 and M2/M3. The value displayed should correspond to that indicated in Table 6-1. A reading of infinity or a short circuit between leads indicates defective coil(s). If proper coil resistance is verified, reconnect cable leads to terminals M1 and M2/M3. If coil(s) is defective, meter must be returned to the factory for service.

TABLE 6 -1. METER COIL RESISTANCE

Meter Size		Coil Resistance	
		Nominal, ohms ±20%	
inches	mm	Each Coil	Series Resistance *
1	25	156	312
1½	40	240	480
2	50	190	380
3	80	110	220
4	100	74	148
6	150	11	22
8	200	10.7	21.4
10	250	10.7	21.4
12	300	10.7	21.4

* M1 to M3
 Reference temperature = 60° C

6.3.2 Electrode Check

The electrode check is essentially a resistance measurement that can be made to establish that a short (or high resistance leakage path) does not exist between one, or both, electrodes and the meter body. Verify that the system power service has been de-energized.

To perform this test, the meter must be removed from the pipeline and the meter liner thoroughly dried. When the meter liner has been dried, proceed as follows:

- 1) Disconnect and identify(tag) the electrode signal leads, 1 and 2, from the terminal board in the signal converter (or from the terminal board in the base of the meter housing).
- 2) Place ohmmeter on highest available range (for example: R x 100,000).
- 3) Connect the ohmmeter "minus" lead to the meter ground stud and the "plus" lead to electrode line 1. This reading should be infinite. If any resistance can be measured, the meter is defective and must be replaced.
- 4) Check the other electrode by connecting the ohmmeter "plus" lead to line 2. This reading must also be infinite. If any resistance can be measured, the meter is defective and must be replaced.
- 5) If measurement of both electrodes indicate an infinite resistance reading, the meter may then be returned to on-stream operation. **LINES 1 AND 2 FROM THE RESPECTIVE ELECTRODES MUST BE RECONNECTED TO TERMINALS 1 AND 2 OF THE TERMINAL BOARD. DO NOT INTERCHANGE THESE PROCESS SIGNAL CONNECTIONS.**

7.0 PARTS LIST

TABLE 7-1. FLANGE GASKETS FOR METER BODY

<p>NOTE Polyurethane and neoprene lined meters use neoprene gaskets. TEFLON lined meters use TEFLON gaskets.</p>
--

Two gaskets are required for each meter. If the meter has grounding rings, two additional gaskets are required for each meter.

Meter Size		ANSI Flange Class	Liner Material	
Inches	mm		Teflon/ Tefzel	Neoprene Polyurethane Hard/Soft Rubber
1	25	150	333N239P30	-----
		300	333N205P30	-----
1½	40	150	333C526U20	-----
		300	333N314P30	-----
2	50	150	333N415P30	333N415Q10
		300	333N416P30	333N416Q10
3	80	150	333N509P30	333N509Q10
		300	333N510P30	333N510Q10
4	100	150	333N604P30	333N604Q10
		300	333N702P30	333N702Q10
6	150	150	333N811P30	333N811Q10
		300	333N801P30	333N801Q10
8	200	150	333N812P30	333N812Q10
		300	333N802P30	333N802Q10
10	250	150	333N807P30	333N807Q10
		300	333N821P30	333N821Q10
12	300	150	333N806P30	333N806Q10
		300	333N803P30	333N803Q10
1	25	DIN PN 10-40	333C609U02	-
1-½	40	DIN PN 10-40	333C609U03	-
2	50	DIN PN 10-40	333C608U05	333C609U01
3	80	DIN PN 10-40	333C608U06	333C609U02
4	100	DIN PN 10/16	333C608U07	333C609U03
		DIN PN 25/40	333C608U08	333C609U04

TABLE 7-2. PROTECTOR PLATES FOR TEFLON LINED METERS

Order number consists of two protector plates and mounting screws. Grounding rings are not available for this application. When ordering, specify **614B452U**__ and suffix from the table below.

Protector Plate Material	Meter Size Inches = (mm) =	Flange Rating ANSI Class 150					
		1/2 (15)	1 (25)	1 1/2 (40)	2 (50)	3 (80)	4 (100)
316 sst	Suffix =	02	03	04	05	06	07
HAST "C"	Suffix =	16	17	18	19	20	21

Protector Plate Material	Meter Size Inch = (mm) =	Flange Rating ANSI Class 300
		4 (100)
316 sst	Suffix =	40
HAST "C"	Suffix =	47

TABLE 7-3. LINER PROTECTOR/GROUNDING RINGS FOR TEFLON LINED METERS

Order number consists of two protector plates which serve as grounding rings, and mounting screws. Separate grounding rings are not available for this application. When ordering, specify **614B384U**__ and suffix from the table below.

Protector Plate Material	Meter Size Inches = (mm) =	Flange Rating ANSI Class 150				Flange Rating ANSI Class 300			
		6 (150)	8 (200)	10 (250)	12 (300)	6 (150)	8 (200)	10 (250)	12 (300)
316 sst	Suffix =	01	07	13	19	04	10	16	22
HAST "C"	Suffix =	02	08	14	20	05	11	17	23

TABLE 7-4. GROUNDING RINGS - SIZES 1 THROUGH 4 INCHES

Order number consists of two grounding rings and mounting screws. When ordering, add suffix to the BM number.

Meter Size		Material = BM No.	Flange Rating ANSI Class 150		Flange Rating ANSI Class 300	
Inches	mm		316 SST	HAST "C"	316 SST	
			Suffix		BM No.	Suffix
1	25	800D508	U02	U10	800D708	U03
1 1/2	40	800D508	U03	U11	-----	---
2	50	800D508	U04	U12	800D708	U04
3	80	800D508	U05	U13	800D708	U05
4	100	800D508	U06	U14	800D708	U06

TABLE 7-5. GROUNDING RINGS - SIZES 6 THROUGH 12 INCHES

NOTE
 Polyurethane and neoprene lined meters use **neoprene** gaskets.
 TEFLON lined meters use **TEFLON** gaskets.

Order number consists of one grounding ring and mounting screws. Order a quantity of two for each meter. Order by the referenced part number.

Meter size		Flange Rating ANSI Class 150		Flange Rating ANSI Class 300	
		304 SST with Neoprene gasket	304 SST with TEFLON gasket	304 SST with Neoprene gasket	304 SST with TEFLON gasket
Inches	mm	Part Number	Part Number	Part Number	Part Number
6	150	644B009U01	644B009U02	644B009U23	644B009U24
8	200	644B009U03	644B009U04	644B009U25	644B009U26
10	250	644B009U69	644B021U24	644B009U71	644B021U26
12	300	644B009U70	644B021U25	644B009U72	644B021U27

TABLE 7-6. METER BASE AND JUNCTION BOX GASKETS

Standard Meter	
Junction Box Base Gasket	D333F021U01
Base to Spacer Gasket	D333F009U01
Spacer to Cover Gasket	D333F008U01

Continuous Submergence Meter	
Cover O-Ring	101A820U01

TABLE 7-7. HARDWARE

Description	Remote Converter
Cover Mounting Screws	09G114AU20 - Qty. 4

PN25011



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ABB Inc.
125 East County Line Road
Warminster, PA 18974 USA
Tel: 215-674-6000
FAX: 215-674-7183

ABB Instrumentation Ltd
Howard Road, St. Neots
Cambs. England, PE19 3EU
Tel: +44 (0) 1480-475-321
FAX: +44 (0) 1480-217-948

ABB Instrumentation S.p.A
Via Sempione 243
20016 Pero (Milano) Italy
Tel: +39 (02) 33928 1
Fax: +39 (02) 33928 240

ABB Automation Products GmbH
Industriestr. 28
D-65760 Eschborn Germany
Tel: +49 (0) 6196 800 0
Fax: +49 (0) 6196 800 1849