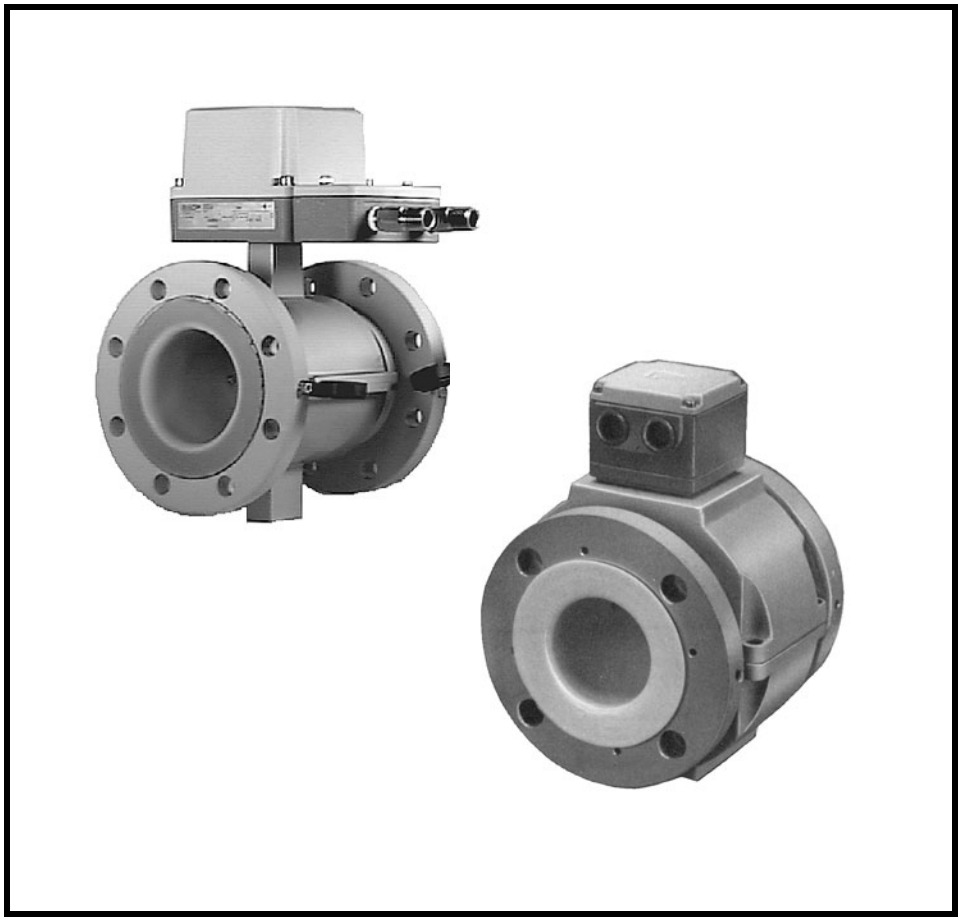
INSTRUCTION MANUAL

MAGNETIC FLOWMETERS
10DX3111/3311 Design Level E
Sizes ½ through 12 Inches

COPA-XM™ and MAG-X®
SERIES 3000 MAGNETIC FLOWMETER



PN25013

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WARNING notices as used in this manual apply to hazards or unsafe practices which could result in personal injury or death.

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.

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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SAFETY SUMMARY

GENERAL WARNINGS

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.

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.

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

ELECTRICAL SHOCK HAZARD
Equipment powered by AC line voltage presents a potential electric shock hazard to the user. Make certain that the system power is disconnected from the operating branch circuit before attempting electrical interconnections or service.

SPECIFIC WARNINGS

ELECTRICAL SHOCK HAZARD. Equipment powered by an AC line voltage presents a potential electric shock hazard. Servicing of the Magnetic Flow meter or Signal Converter should only be attempted by a qualified electronics technician. (pg. 6-2)

ELECTRICAL SHOCK HAZARD. Equipment powered by an AC line voltage presents a potential electric shock hazard. Make certain that the system power is disconnected before making the following ohmmeter checks. (pg. 6-3)

SPECIFIC CAUTIONS

Do not use a DC ohmmeter for this measurement as polarization effects will produce completely erroneous data. (pg. 4-3)

Some of the IC devices used in the signal converter are static sensitive and may be damaged by improper handling. When adjusting or servicing the signal converter, use of a grounded wrist strap is recommended to prevent inadvertant damage to the integral solid state circuitry. (pg. 6-1)

GÉNÉRAUX AVERTISSEMENTS

PROBLÈMES POTENTIELS. La maintenance doit être réalisée par du personnel qualifié et seulement après avoir sécurisé les équipements contrôlés par ce produit. L'ajustement ou le démontage de ce produit lorsqu'il est lié au système peut entraîner des dysfonctionnements dans le procédé qu'il contrôle. Ces dysfonctionnements peuvent entraîner des blessures ou des dommages.

RETOUR D'ÉQUIPEMENT. Tout débitmètre et(ou) convertisseur retourné à ABB pour réparation doit être exempt de toute trace de produit dangereux (acide, base, solvant, …). Un certificat de sécurité matériel doit être joint pour tous les liquides utilisés dans le procédé. Contacter ABB pour autorisation avant renvoi du matériel.

MANUEL DE MISE EN ROUTE. Ne pas installer, maintenir ou utiliser cet équipement sans avoir lu, compris et suivi les instructions et manuels de ABB, dans le cas contraire il y a risque d'entraîner blessures ou dommages.

RISQUE DE CHOC ÉLECTRIQUE
Les équipements alimentés en courant alternatif constituent un risque de choc électrique potentiel pour l'utilisateur. Assurez-vous que les câbles d'alimentation amont sont déconnectés avant de procéder à des branchements, des essais ou tests.

SPÉCIFIQUES AVERTISSEMENTS

RISQUE DE CHOC ÉLECTRIQUE
Les équipements alimentés en courant alternatif constituent un risque de choc électrique potentiel. La maintenance sur des équipements électromagnétiques ou des convertisseurs doit être effectuée par des techniciens qualifiés. (pg. 6-2)

RISQUE DE CHOC ÉLECTRIQUE
Les équipements alimentés en courant alternatif constituent un risque de choc électrique potentiel. Assurez-vous que la puissance est déconnectée avant de procéder aux mesures de résistance suivantes. (pg 6-3)

SPÉCIFIQUES ATTENTIONS

N'utilisez pas un ohmmètre de C.C pour cette mesure car les effets de polarisation produiront des données complètement incorrectes. (pg. 4-3)

Certains Circuits Intégrés utilisés dans le convertisseur sont sensibles à l'électricité statique et peuvent être endommagés par une mauvaise manipulation. Pendant l'ajustement ou la maintenance d'un convertisseur, l'utilisation d'un bracelet antistatique est recommandé pour éviter la destruction par inadvertance d'un circuit intégré. (pg. 6-1)

READ FIRST

WARNING

INSTRUCTION MANUALS
Do not install, maintain, or operate this equipment without reading, understanding and following the proper manufacturer's instructions and manuals, otherwise injury or damage may result.

RETURN OF EQUIPMENT
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.

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

Contacting the factory

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

Telephone:

Automation Services 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 Series 3000 Magnetic Flowmeter can be used to meter liquids without regard to heterogeneous consistency 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 corrosive 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 Magnetic Flowmeter. 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, like liquid pressure, to the extent that it can not exceed the meter material specification limits.

The associated electronics package is called the Signal Converter and may be either integrally or remotely mounted. Either an analog or a microprocessor signal converter may be used with the Series 3000 Magnetic Flowmeter. The Flowmeter without the electronic package is used with a remote mounted Signal Converter. A remotely mounted Signal Converter is recommended for any or all of the following conditions:

- if the summation of ambient and process temperature is greater than 262^{o} F (110^{o} C) for COPA-XM™, the Signal Converter must be remotely mounted.
- vibrations above the specification given in Section 1.3

The Signal Converter also contains a magnet driver unit that is used to power the meter's magnet coils. The steady bipolar state magnetic field principle, referred to as the MAG-X® design concept, provides optimum zero point stability at an optimized drive frequency.

For information concerning the Signal Converter, refer to the Signal Converter Instruction Manual.

1.1.2 Construction

The Series 3000 Magnetic Flowmeter consists of a flanged, stainless steel pipe spool which serves as a meter body. A pair of flat magnet coils fit 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.

Construction of the meter is dependent on the type of insulating interior liner used. A TEFLON® (PTFE) liner is inserted into the spool and turned-out against the flange faces. All other liner materials are bonded to the interior and face of the pipe spool. For all liner materials, 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 & 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.

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

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

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 may occur 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 continuing corrosion protection throughout the product life, it is the users' responsibility to maintain the product finish. Incidental scratches and finish damage must be repaired and promptly repainted with approved 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 number are referenced on the following pages.

1.2.1 Model 10DX3111E

10DX3111	E	_	_	_	_	_	_	_	_ _ _ _ _ _ _

Engineering Reference
Obstructionless Remote Magnetic Flowmeter

Design Level	
Remote with 50XM1000 Converter Electronics	**E**

Meter Lay Length	
Short Form (WMAG)	**D**
Replacement for 10D1419 & 10D1465	**E**
Replacement for 10D1435	**F**
Other	**Z**

Liner Material	
Hard Rubber	**A**
Polyurethane	**D**
PTFE Teflon	**E**
Neoprene	**L**
TEFZEL	**N**

Size		
mm	(inches)	
15	(1/2)	**07**
25	(1)	**09**
40	(1-1/2)	**11**
50	(2)	**12**
80	(3)	**14**
100	(4)	**15**
150	(6)	**17**
200	(8)	**18**
250	(10)	**19**
300	(12)	**20**

Flange Standard Pressure Rating	
DIN PN 10	**C**
DIN PN 16	**D**
DIN PN 25	**E**
DIN PN 40	**F**
ANSI Class 150	**P**
ANSI Class 300	**Q**
ANSI Class 600	**R**
ANSI Class 900	**5**

Flange Material	
Carbon Steel	**1**
304 Stn. Steel	**2**

Protector Plate (TEFLON Liner only)	
None Required	**A**
316 Stn. Steel	**B**
HASTELLOY C	**E**

Electrode Type	
Flush	**2**
Bullet Nose	**3**
Flush (Slurry Service)	**7**

1.2.1 Model 10DX3111E (continued)

10DX3111	E	_	_	_	_	_	_	_	_	_	_	_	_	_

Electrode Material

316 Stn. 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 ClI, Div 2, Gp A,B,C & D; Electrodes Intrinsically Safe for ClI, Div 1, Gp A,B,C & D; Outdoor Hazardous Locations, NEMA 4X. Dust-Ignitionproof Cl II, Div1, Gp E,F & G: Suitable for Cl III, Div 1, Accidental Submergence, 30ft H_2O/48h (9m H_2O/48h)	**K**
FM Approved-Explosionproof for ClI, 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 Locations, NEMA 4X	**L**

Enclosure Classification

IEC 529 IP 65, NEMA 4X	**1**
Accidental Submergence: IEC 529, IP 67, NEMA-4X. 33ft H_2O/48h (10m H_2O/48h)	**2**
Accidental Submergence: IEC 529, IP 67, NEMA-4X. 33ft H_2O/48h (10m H_2O/48h) Tropical-High Moisture Protection, Signal Cable Permanently Installed.	**4**
Continuous Submergence: IEC 529, IP 68, NEMA-4X. 33ft H_2O/48h (10m H_2O/48h) Continuous Duty. Signal Cable Permanently Installed.	**5**
Accidental Submergence: IEC 529, IP 67, NEMA-4X. 33ft H_2O/48h (10m H_2O/48h) Tropical-Improved Moisture Protection, Signal Cable Permanently Installed.	**9**

Liquid Temperature Range

Teflon, Rotomolded Tefzel, < 266° F (130° C)	**1**
Teflon, Extended Temperature, < 356° F (180° C)	**2**
Hard Rubber / Soft Rubber, < 176° F (80° C)	**3**
Neoprene / Polyurethane < 190° F (88° C)	**4**

Line Excitation Frequency

50 Hz / 6-1/4 Hz	**1**
50 Hz / 12-1/2 Hz	**2**
60 Hz / 7-1/2 Hz	**3**
60 Hz / 15 Hz	**4**

Customer Information Language

English w/ riveted SST tag	**2**
English w/ self-adhesive tag	**8**

Converter Type

50XM1000	**1**
none	**X**

1.2.2 Model 10DX3311E

10DX3311	E	_	_	_	_	_	_	_	_	_	1	_	2	X	_	A	_	_	_	_

Engineering Reference
Obstructionless Integral Magnetic Flowmeter

Design Level

Integral with 50XM1000 Converter Electronics	**E**

Meter Lay Length

Short Form (WMAG)	**D**
Replacement for 10D1419 & 10D1465	**E**
Replacement for 10D1435	**F**
Other	**Z**

Liner Material

Hard Rubber	**A**
Polyurethane	**D**
PTFE TEFLON	**E**
Neoprene	**L**
TEFZEL	**N**

Size

mm	(inches)	
15	(1/2)	**07**
25	(1)	**09**
40	(1-1/2)	**11**
50	(2)	**12**
80	(3)	**14**
100	(4)	**15**
150	(6)	**17**
200	(8)	**18**
250	(10)	**19**
300	(12)	**20**

Flange Standard Pressure Rating

DIN PN 10	**C**
DIN PN 16	**D**
DIN PN 25	**E**
DIN PN 40	**F**
ANSI Class 150	**P**
ANSI Class 300	**Q**

Flange Material

Carbon Steel	**1**
304 Stn. Steel	**2**

Protector Plate (TEFLON Liner only)

None Required	**A**
316 Stn. Steel	**B**
HASTELLOY C	**E**

Electrode Type

Flush	**2**
Bullet Nose	**3**
Flush (Slurry Service)	**7**

Electrode Material

316 Stn. Steel	**B**
HASTELLOY B	**C**
HASTELLOY C	**D**
Titanium	**E**
Tantalum	**F**
Platinum/Iridium	**H**
Zirconium	**L**

Certification

General Purpose	**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, Accidental Submergence, 30ft H_2O/48h (9m H_2O/48h)	**K**

1.2.2 Model 10DX3311E (continued)

10DX3311 E _ _ _ _ _ _ _ _ _ _ _ **1** _ **2** **X** _ **A** _ _ _ _

Enclosure Classification

IEC 529 IP 65, NEMA 4X	**1**
Accidental Submergence, IEC 529 IP 67, NEMA 4X, 30ft H_2O/48h (9m H_20/48h)	**2**

Liquid Temperature Range

Standard	**1**

Line ExcitationFrequency

50 Hz / 6-1/4 Hz	**1**
50 Hz / 12-1/2 Hz	**2**
60 Hz / 7-1/2 Hz	**3**
60 Hz / 15 Hz	**4**
12-1/2 Hz (DC Power, in vicinity of 50 Hz Line)	**6**
15 Hz (DC Power, in vicinity of 60 Hz Line)	**8**
Other Frequency	**9**

Customer Information Language

English	**2**

Software Level

Generation	**X**

Pulse Output / Data Link

None / None	**0**
Active Scaled Pulse Fwd & Rev / None	**1**
None / RS485 Port	**4**
None / RS232 Port	**5**

Measuring Mode

Continuous Flow Measurement	**A**

Option Terminals

None	**A**
Alarm, Opto-coupled	**D**
External Zero Return	**F**
External Totalizer Reset	**G**
Forward Pulse Output, Opto-coupled	**K**

Accessories

Without	**A**
Empty Pipe Detection (standard)	**B**
HART Protocol	**C**
Empty Pipe Detection & HART Protocol	**D**

Power Supply

230/240 V, 50/60 Hz	**A**
200/220 V, 50/60 Hz	**B**
115/120 V, 50/60 Hz	**C**
100/110 V, 50/60 Hz	**D**
48 V, 50/60 Hz	**E**
24 V, 50/60 Hz	**F**
48 VDC	**G**
24 VDC	**H**

Converter

Required	**1**
Not-Required	**2**

1.3 Specifications

Power Requirements	Refer to Section 1.2 Model Number Breakdown.
Power Consumption	Refer to Signal Converter Instruction Bulletin.

Flowmeter 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	100:1
Minimum Liquid Conductivity	5 µS/cm
System Accuracy	Refer to Signal Converter Instruction Bulletin.
Meter Capacity	Specified on Flowmeter data tag (equal to maximum flow capacity in engineering units). Refer to Table 1-4.

Environmental Limits

Ambient Temperature	Models 10DX3111: -13^{o} to 140^{o} F* (-25^{o} to 60^{o} C *) Model 10DX3311: -13^{o} to 122^{o} F (-25^{o} to 50^{o} C)

* For Process Temperatures up to 266^{o} F (130^{o} C) , maximum temperature is reduced by one degree for each degree increase in Process Temperature above 266^{o} F (130^{o} C).

Relative Humidity	10% to 90%

Process Limits

TABLE 1-1. MAXIMUM LIQUID TEMPERATURE

Liner Material	Temperature
TEFLON, Model 10DX3111	356° F [180° C]
TEFZEL, Model 10DX3111	300° F [149° C]
TEFLON / TEFZEL, Model 10DX3311	266° F [130° C]
Neoprene/Polyurethane	190° F [88° C]
Soft & Hard Rubber	170° F [77° C]

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

Flange Class	Flange Material	Temperature				
		100° F [38° C]	175° F [80° C]	190° F [88° C]	266° F [130° C]	356° F [180° C]
ANSI 150	Carbon Steel	1.96 (285)	1.79 (260)	1.81 (262)	1.65 (240)	1.47 (213)
	304 sst	1.90 (275)	1.69 (245)	1.65 (239)	1.48 (215)	1.32 (191)
ANSI 300	Carbon Steel	5.10 (740)	4.76 (690)	4.70 (682)	4.56 (662)	4.44 (644)
	304 sst	4.96 (720)	4.34 (630)	4.22 (612)	3.82 (554)	3.42 (496)
DIN PN6	Carbon Steel	0.60 (87)	0.60 (87)	0.60 (87)	0.59 (86)	0.57 (82)
	304 sst	0.58 (84)	0.57 (82)	0.57 (82)	0.54 (79)	0.50 (73)
DIN PN10	Carbon Steel	1.00 (145)	1.00 (145)	1.00 (145)	1.00 (145)	1.00 (145)
	304 sst	0.97 (140)	0.94 (137)	0.94 (137)	0.92 (133)	0.88 (128)
DIN PN16	Carbon Steel	1.60 (232)	1.60 (232)	1.60 (232)	1.60 (232)	1.60 (232)
	304 sst	1.54 (224)	1.51 (219)	1.50 (218)	1.46 (212)	1.41 (205)
DIN PN25	Carbon Steel	2.50 (362)	2.50 (362)	2.50 (362)	2.50 (362)	2.50 (362)
	304 sst	2.43 (352)	2.28 (331)	2.25 (327)	2.10 (304)	1.93 (280)
DIN PN40	Carbon Steel	4.00 (580)	4.00 (580)	4.00 (580)	4.00 (580)	4.00 (580)
	304 sst	3.89 (564)	3.65 (530	3.62 (525)	3.36 (488)	3.10 (449)

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]
1/2 -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]			
	Soft & Hard Rubber	Full Vacuum To 175° F [80° C]			

TABLE 1-4. METER CAPACITY VALUES

Meter Size		Meter Capacity*	Flow Ranges 0 to Value Tabulated			
			Minimum		Maximum	
inch	mm	gpm	gpm	L/min	gpm	L/min
½	15	26.4172	0.5	2.0	26.4	100.0
1	25	52.8344	1.06	4.0	52.8	200.0
1½	40	158.503	3.17	6.0	158.0	600.0
				m^3/h		m^3/h
2	50	264.372	5.28	1.2	264.0	60.0
3	80	792.516	15.85	3.60	792.0	180.0
4	100	1056.68	21.14	4.80	1056.0	240.0
6	150	2641.72	52.84	12.0	2641.0	600.0
8	200	4755.09	95.11	21.6	4755.0	1080.0
10	250	7925.16	158.5	36.0	7925.0	1800.0
12	300	10566.8	211.4	48.0	10567.0	2400.0

* 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. The Meter Capacity expressed in gpm is recorded on the meter nameplate.

All series 3000 meters are calibrated at 32.808 ft/s (10 m/s). Note that the display on the Signal Converter supplied may read "Cal Factor" even when configured for 32.808 ft/s (10 m/s).

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:

Flow Velocity (ft/s) = (Operating gpm x 32.808)/Meter Capacity

> NOTE
> The maximum meter flow range is a function of the Signal Converter used. The maximum flow range may exceed the meter capacity to allow for overrange.

Physical Characteristics

Outline Dimensions	See Figures 2-3, 2-4 and 2-5.
Vibration Limits - with integral Converter	1.5 g @ 10-150 Hz

NOTE
A remotely mounted Signal Converter must be used when vibration limits are exceeded.

Signal Cable for remote Converter (supplied with instrument when applicable)

Permanently Installed:	
Standard Length	50 feet (15 m)
Optional Length	100ft. (30m), 150ft. (45m) & 200ft. (60m)
Non-Permanently Installed:	
Standard Length	30 feet (9 m)
Optional Length	Up to 500 feet (150 m) in 10 feet increments, as specified.

Materials of Construction

Meter Liner	see Section 1.2 Model Number Breakdown
Electrode Assembly	see Section 1.2 Model Number Breakdown
Meter Body	304 sst, epoxy finish
Flanges	carbon steel or 304 sst, as specified
Meter Housing	aluminum, epoxy finish
Electronics Housing	cast aluminum, epoxy finish, 316 sst attachment screws, gasketed covers

Primary Enclosure Ratings

Watertight Housing (standard)	NEMA 4X, IEC 529 IP65

Accidental Submergence	NEMA 4X, IEC 529 IP67, 30 feet H_2O/48 h (9 m H_2O/48 h)
Conduit Connections	two 1/2 inch NPT internally threaded entrances - remote Converter three 1/2 inch NPT internally threaded entrances - integral Converter

NOTE
Enclosures are suitable for indoor or outdoor installation. Enclosure ratings apply to the Magnetic Flowmeter with or without an integral Signal Converter.

Certifications	refer to Section 1.2, Model Number Breakdown

2.0 INSTALLATION

2.1 Inspection

All Series 3000 Magnetic Flowmeters are shipped in heavy duty containers which are specially designed to provide adequate protection during transit. Since the Magnetic Flowmeter 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 associated Signal Converter for operation and maintenance procedures for the particular Converter.

If the specified Magnetic Flowmeter is supplied with a remote Signal Converter, thirty feet of interconnection cable(standard) and conduit or cable seals will be included in the shipment.

Inspect all items included in the shipment immediately 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 Service Department.

2.2 Meter Handling

The liner of the flowmeter may be damaged if it comes in contact with a sharp object and must be protected at all times.

When a TEFLON lined meter is specified, two 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 for a view of these protector plates. Also, due to the susceptibility of the meter to moisture penetration behind the liner before installation in the pipeline, TEFLON-lined meters should not be stored outdoors in uncovered areas, in wet locations or subjected to cleaning operations with excessive liquids prior to being fully installed in the pipeline.

During shipment, the liner is protected by wood or composition protectors as shown in Figure 2-2 (standard); these are removed before the meter is installed. These protectors should be left in position while moving the meter to the installation site. In the case of wood protectors, make certain there are no wood chips between the liner and the meter flange face prior to installation.

To place the meter in the pipeline a sling and hoist may be necessary. Do not pass any 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.

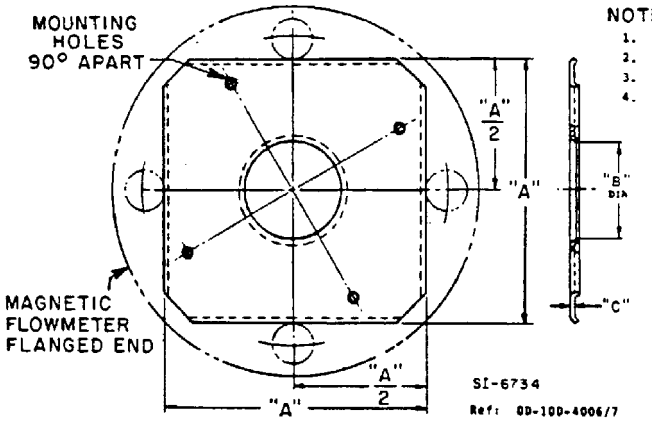
TABLE 2-1. METER WEIGHTS

Meter Size		ANSI Class 150		ANSI Class 300		DIN PN 10		DIN PN 16		DIN PN 25		DIN PN 40	
Inches	mm	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg
½	15	5	2.2	15	6.6	5	2.2	5	2.2	15	6.6	15	6.6
1	25	8	3.5	19	8.4	8	3.5	8	3.5	19	8.4	19	8.4
1½	40	12	5.3	23	10.1	12	5.3	12	5.3	23	10.1	23	10.1
2	50	16	7.1	27	11.9	16	7.1	16	7.1	27	11.9	27	11.9
3	80	26	11.5	36	15.9	26	11.5	26	11.5	36	15.9	36	15.9
4	100	37	16.3	51	22.5	37	16.3	37	16.3	51	16.3	51	16.3
6	150	70	32	140	64	105	47	105	47	140	64	140	64
8	200	155	70	210	95	155	70	155	70	210	95	210	95
10	250	220	100	295	134	220	100	220	100	295	134	295	134
12	300	275	125	365	166	275	125	275	125	365	166	365	166

If the continuous submergence option is chosen for Model 10DX3111/3311, the meter weights shown above must be modified by adding the weights in the following table:

TABLE 2-2. CONTINUOUS SUBMERGENCE WEIGHT FACTORS

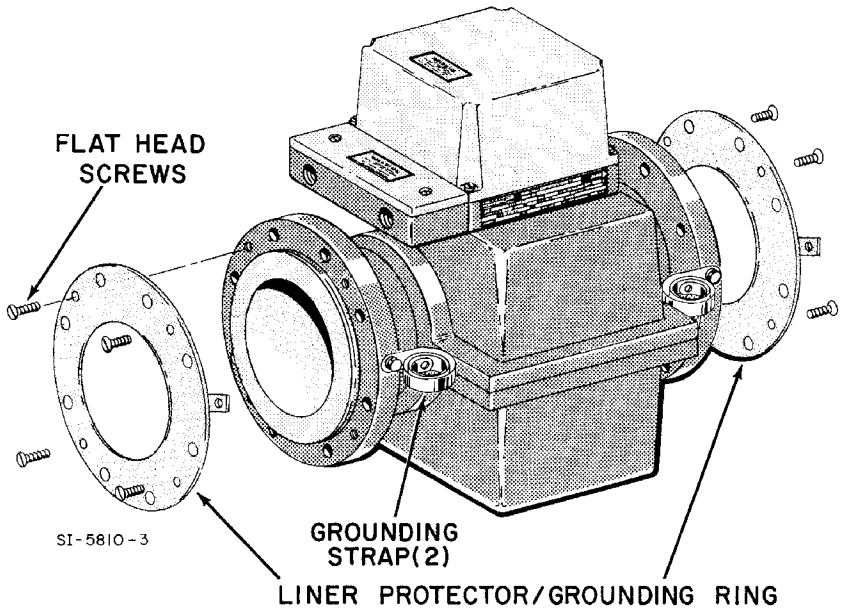
Meter Size		Add to Meter Weight from Table Above	
Inches	mm	lbs	kg
½	15	1.04	.47
1	25	1.01	.46
1 ½	40	0.96	.44
2	50	1.04	.47
3	80	1.08	.49
4	100	1.92	.87
6	150	11.23	5.1
8	200	15.57	7.1
10	250	23.27	10.6
12	300	50.47	22.9



NOTES:
1. ALL DIMENSIONS ARE IN INCHES, UNLESS OTHERWISE SPECIFIED.
2. ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCE ±1/16.
3. DIMENSIONS GUARANTEED ONLY IF THIS PRINT IS CERTIFIED.
4. THIS DRAWING IS THIRD ANGLE PROJECTION AS SHOWN.

METER SIZE	A		B		C	
	INCH	mm	INCH	mm	INCH	mm
1/2	1-7/8	48	1/2	13	5/64	2
1	2-1/2	64	25/32	20	1/16	2
1-1/2	3-5/16	84	1-3/8	35	1/16	2
2	4	102	1-27/32	47	1/16	2
3	5-3/8	137	2-15/16	75	1/16	2
4	6-5/8	168	3-25/32	96	1/16	2

LINER PROTECTOR PLATES, SIZES 1/2 THROUGH 4 INCHES



LINER PROTECTOR/GROUNDING RINGS, SIZES 6 THROUGH 12 INCHES

FIGURE 2-1. PROTECTOR PLATES FOR TEFLON LINERS

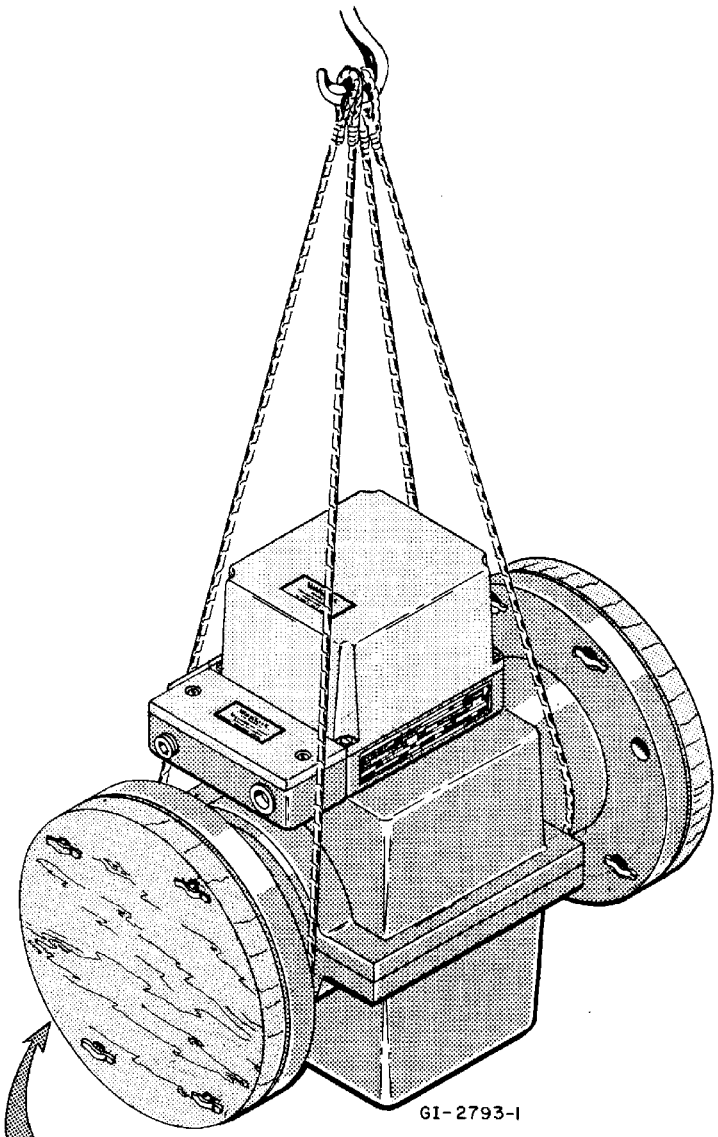


FIGURE 2-2. PROPER HOISTING METHOD

Note that 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 electrical conductors carrying large currents or equipment generating strong magnetic fields.

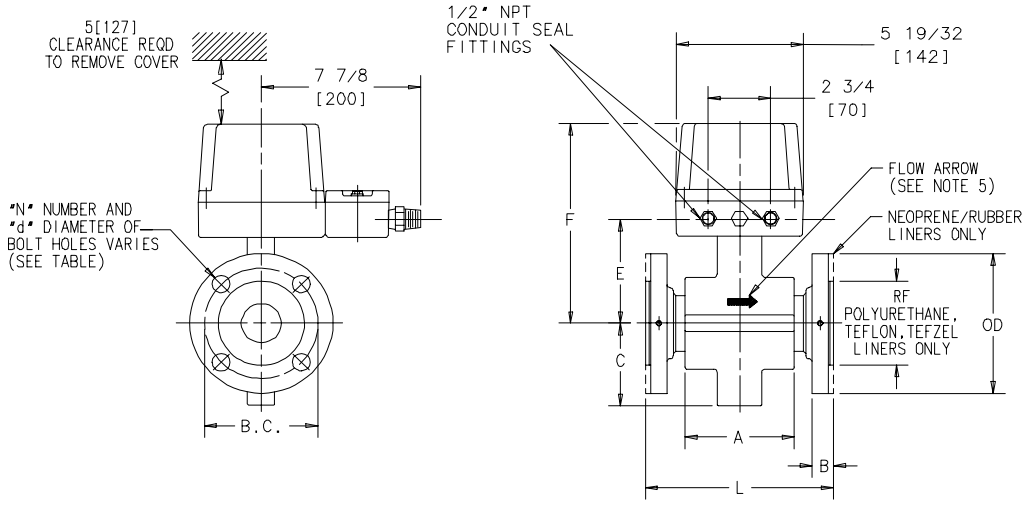
Access for wiring interconnections and servicing of the integrally mounted Signal Converter should be considered when installing the meter. A minimum of five inches of overhead clearance is required for cover removal.

Outline dimensions of the Flowmeter are given in Figures 2-3 through 2-16.

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 Bulletin supplied with the Signal Converter.

DIM	SIZE	1/2 [15]		1 [25]		1-1/2 [40]		2 [50]		3 [80]		4 [100]	
	FLANGE CLASS	150	300	150	300	150	300	150	300	150	300	150	300
	MODEL NO.												
L	10DX3311ED	7-7/8 [200]	9 [229]	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	10DX3311EE	14 [356]		14 [356]		16 [406]		16 [406]		12 [305]		12 [305]	
L	10DX3311EF	N/A		N/A		N/A		N/A		N/A		N/A	
L	10DX3311EZ	SEE SALES ORDER INFORMATION FOR "L" DIMENSION											
	LINER												
RF	POLY/ TEFL/TEFZ	1-3/8 [35]		2 [51]		2-7/8 [73]		3-5/8 [92]		5 [127]		6-3/16 [157]	
B	POLY/NEO/ RUBBER	N/A		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	1/2 [13]	5/8 [16]	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]		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		4	8	4	8	8	8
BC		2-3/8 [60]	2-5/8 [67]	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		3-1/2 [89]	3-3/4 [95]	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		2-15/16 [75]		3-7/16 [87]		3-15/16 [100]		4-9/16 [116]		3-15/16 [100]		5-1/8 [130]	
C		2-7/16 [62]		2-7/8 [73]		3-7/32 [82]		3-17/32 [90]		4-11/32 [110]		5-1/8 [130]	
E		3-9/32 [83]		3-23/32 [94]		4-1/16 [103]		4-3/8 [111]		5-5/32 [131]		5-31/32 [152]	
F		7-5/16 [186]		7-3/4 [197]		8-3/32 [206]		8-13/32 [214]		9-3/16 [233]		10 [254]	



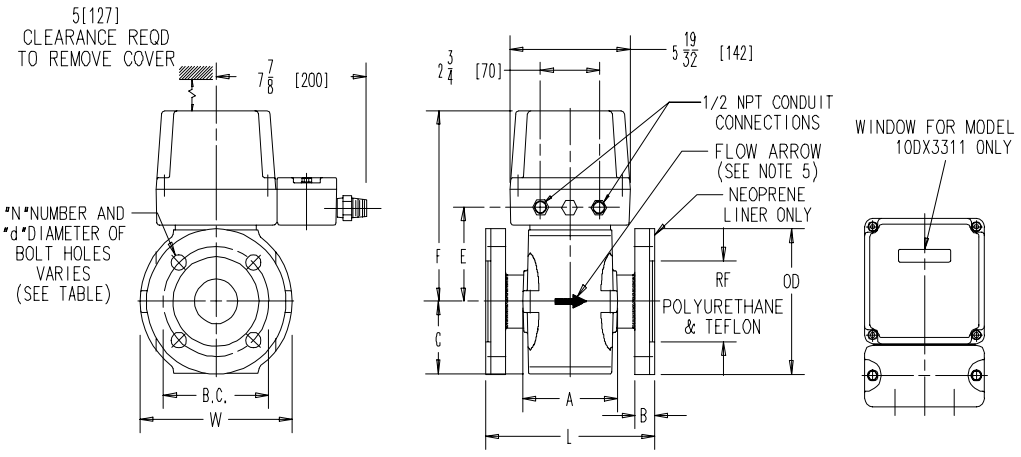
NOTES:
1) ALL DIMENSIONS ARE IN INCHES. DIMENSIONS IN BRACKETS [ ] ARE IN MILLIMETERS [MM].
2) DIMENSIONS ARE GUARANTEED ONLY IF THIS PRINT IS CERTIFIED.
3) THIS DRAWING IS THIS ANGLE PROJECTION AS SHOWN.
4) FLANGE BOLTS STRADDLE CENTERLINES.
5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
6) METER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

Ref. 11J4293 r0

Ref. CD-10D-4293 r0

FIGURE 2-3. OUTLINE DIMENSIONS, 1/2-4 INCH INTEGRAL CONVERTER 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	10DX 32/33 11AD	11-13/16 (300)		13-25/32 (350)		17-23/32 (450)		19-11/16 (500)	
	10DX 32/33 11AE	17-23/32 (450)		19-11/16 (500)		21-21/32 (550)		24-13/32 (620)	
	10DX 32/33 11AF	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 (32)	1-25/32 (44)	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		4-13/32 (173)		8-3/32 (205)		9-3/16 (233)		12-9/16 (319)	
F		10-7/8 (276)		12-1/8 (308)		13-1/4 (336)		13-19/32 (345)	
W		12-3/16 (310)		14-3/8 (365)		16-25/32 (426)		20-5/64 (510)	



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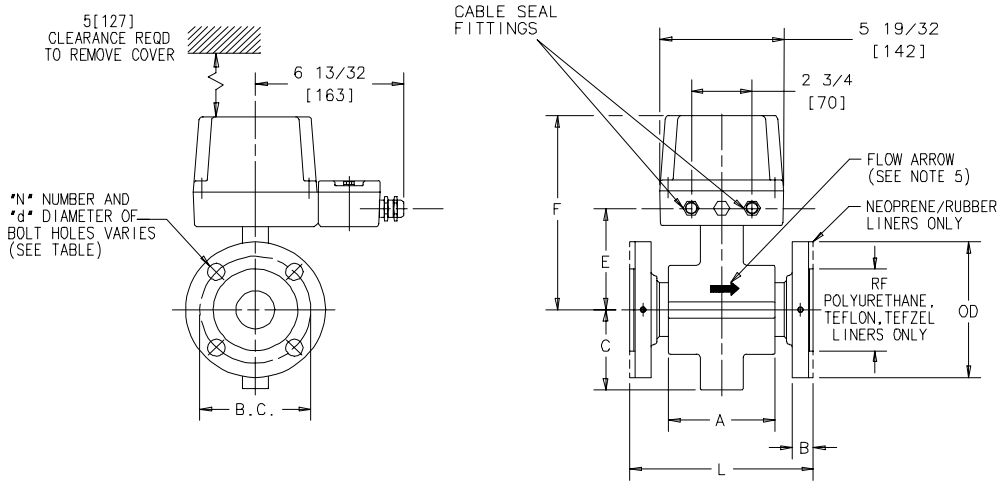
2) DIMENSIONS ARE GUARANTEED ONLY IF THIS PRINT IS CERTIFIED.
3) THIS DRAWING IS A THIRD ANGLE PROJECTION AS SHOWN.
4) FLANGE BOLT HOLES STRADDLE CENTERLINES
5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
7) ALL DIMENSIONS SUBJECT TO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

Ref. ([-1([-4124 r1

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

DIM	SIZE	1/2 [15]		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	10/16	25/40
	MODEL NO.												
L	10DX3311ED	7-7/8 [200]	9 [229]	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	10DX3311EE	14 [356]		14 [356]		16 [406]		16 [406]		12 [305]		12 [305]	
L	10DX3311EF	N/A		N/A		N/A		N/A		N/A		N/A	
L	10DX3311EZ	SEE SALES ORDER INFORMATION FOR "L" DIMENSION											
	LINER												
RF	POLY/ TEFL/TEFZ	1-25/32 [45]		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		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	1/2 [13]	5/8 [16]	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]		9/16 [14]		23/32 [18]		23/32 [18]		23/32 [18]		23/32 [18]	7/8 [22]
N		4		4		4		4		8		8	
BC		2-9/16 [65]		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		3-3/4 [95]		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		2-15/16 [75]		3-7/16 [87]		3-15/16 [100]		4-9/16 [116]		3-15/16 [100]		5-1/8 [130]	
C		2-7/16 [62]		2-7/8 [73]		3-7/32 [82]		3-17/32 [90]		4-11/32 [110]		5-1/8 [130]	
E		3-9/32 [83]		3-23/32 [94]		4-1/16 [103]		4-3/8 [111]		5-5/32 [131]		5-31/32 [152]	
F		7-5/16 [186]		7-3/4 [197]		8-3/32 [206]		8-13/32 [214]		9-3/16 [233]		10 [254]	



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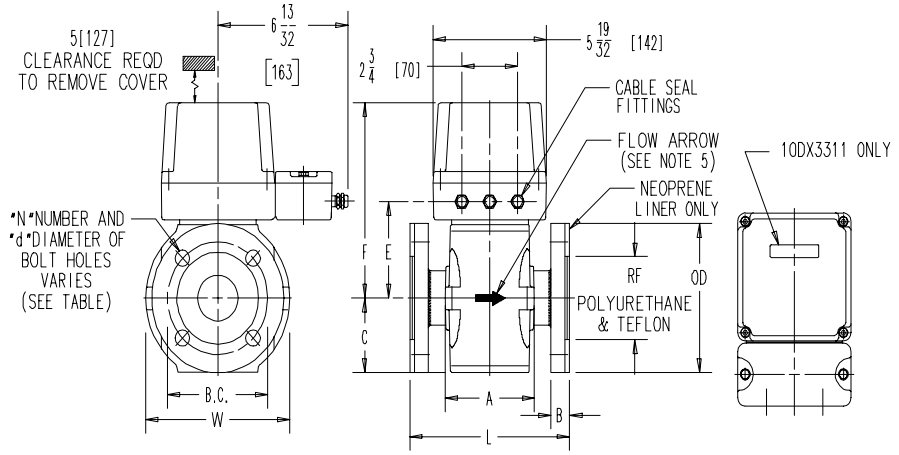
4) FLANGE BOLTS STRADDLE CENTERLINES.
5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [3].

10d4294revO

FIGURE 2-5. OUTLINE DIMENSIONS, 1/2-4 INCH INTEGRAL CONVERTER 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	10DX$^{32}_{33}$11AD	11-13/16 (300)		13-25/32 (350)				17-23/32 (450)				19-11/16 (500)					
L	10DX$^{32}_{33}$11AE	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)						
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 (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)			
	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 (35)		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				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		4-13/32 (173)		8-3/32 (205)				9-3/16 (233)				12-9/16 (319)					
F		10-7/8 (276)		12-1/8 (308)				13-1/4 (336)				13-19/32 (345)					
W		12-3/16 (310)		14-3/8 (365)				16-25/32 (426)				20-3/32 (510)					



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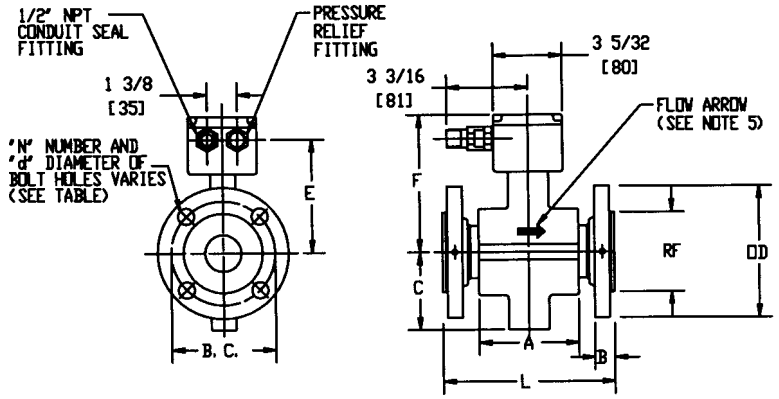
4) FLANGE BOLT HOLES STRADDLE CENTERLINES
5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/-1/8 [3] .

Ref. 10d4189r1
10d4230r0

FIGURE 2-6. OUTLINE DIMENSIONS, 6-12 INCH INTEGRAL CONVERTER WITH DIN FLANGES

DIM	SIZE	1/2 [15]		1 [25]		1-1/2 [40]		2 [50]		3 [80]		4 [100]	
	FLANGE CLASS	150	300	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]	7-7/8 [200]	9 [229]	9-7/8 [250]	11 [280]
L	10D S/X 3111EE	14 [356]		14 [356]		16 [406]		16 [406]		12 [305]		12 [305]	
L	10D S/X 3111EZ	SEE SALES ORDER INFORMATION FOR 'L' DIMENSION											
RF		1-3/8 [35]		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		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	1/2 [13]	5/8 [16]	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]		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		4	8	4	8	8	8
BC		2-3/8 [60]	2-5/8 [67]	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		3-1/2 [89]	3-3/4 [95]	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		2-15/16 [75]		3-7/16 [87]		3-15/16 [100]		4-9/16 [116]		3-15/16 [100]		5-1/8 [130]	
C		2-7/16 [62]		2-7/8 [73]		3-7/32 [82]		3-17/32 [90]		4-11/32 [110]		5-1/8 [130]	
E	STD. TEMP.	4-1/4 [108]		4-11/16 [119]		5-1/32 [128]		5-11/32 [136]		6-5/32 [156]		6-15/16 [176]	
F	STD. TEMP.	5-5/16 [135]		5-3/4 [146]		6-3/32 [155]		6-13/32 [163]		7-7/32 [183]		8 [203]	
E	HIGH TEMP.	4-5/8 [117]		5-1/16 [128]		5-13/32 [137]		5-23/32 [145]		6-17/32 [166]		7-5/16 [186]	
F	HIGH TEMP.	5-11/16 [144]		61/8 [156]		6-15/32 [164]		6-25/32 [172]		7-19/32 [193]		8-3/8 [213]	



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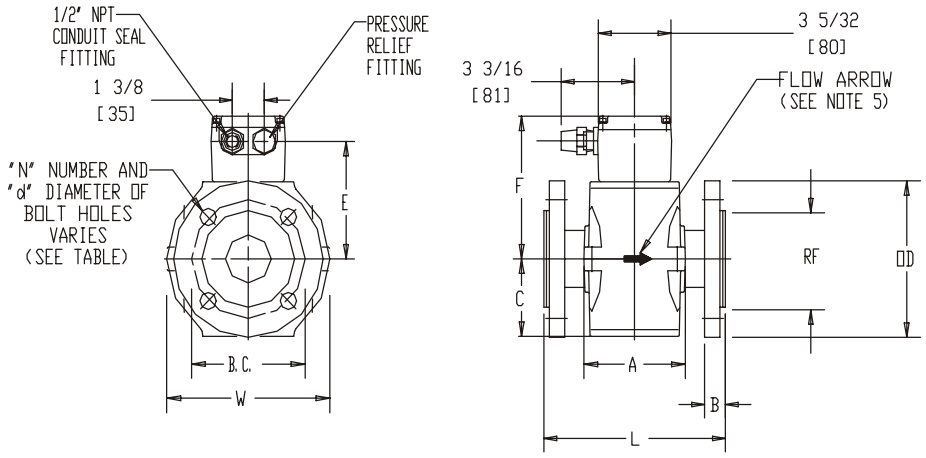
2) DIMENSIONS ARE GUARANTEED ONLY IF THIS PRINT IS CERTIFIED.
3) THIS DRAWING IS THIRD ANGLE PROJECTION AS SHOWN.
4) FLANGE BOLTS STRADDLE CENTERLINES.
5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
7) ALL DIMENSIONS SUBJECT TO MANUFACTURING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

Ref. OD-10D-4287 r1

FIGURE 2-7. OUTLINE DIMENSIONS, 1/2-4 INCH REMOTE CONVERTER WITH ANSI FLANGES

DIM	SIZE	6 [150]		8 [200]		10 [250]		12 [300]	
	FLANGE CLASS	150	300	150	300	150	300	150	300
L	10D$^{S}_{X}$3111_D	11-13/16 [300]		13-25/32 [350]		17-23/32 [450]		19-11/16 [500]	
L	10D$^{S}_{X}$3111_E	17-23/32 [450]		19-11/16 [500]		21-21/32 [550]		24-13/32 [620]	
L	10D$^{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]
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		7-5/8 [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]	



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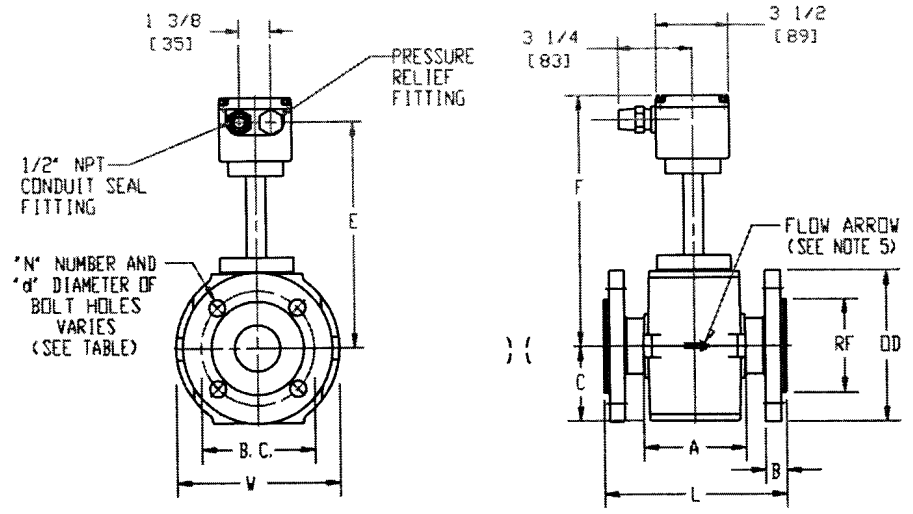
5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [3].

Ref. OD-10D-4123 r4

FIGURE 2-8. OUTLINE DIMENSIONS, 6-12 INCH REMOTE CONVERTER 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$^{S}_{X}$3111AD	11-13/16 (300)		13-25/32 (350)		17-23/32 (450)		19-11/16 (500)	
	10D$^{S}_{X}$3111AE	17-23/32 (450)		19-11/16 (500)		21-21/32 (550)		24-13/32 (620)	
	10D$^{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)
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		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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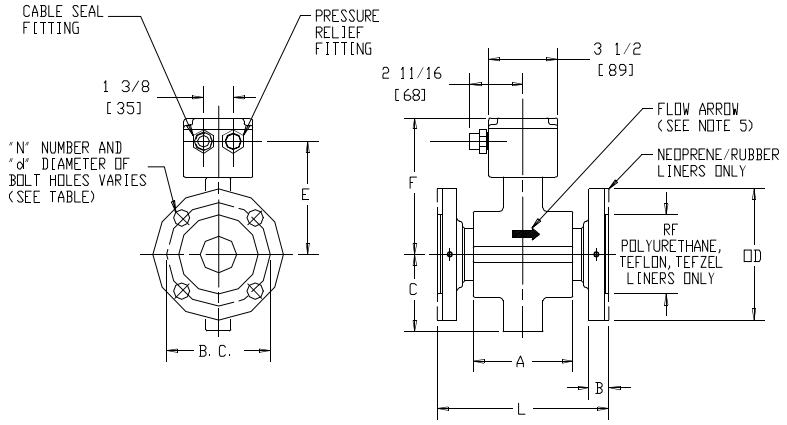
7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/-1/8 [3] .

Ref. OD-10D-4127 r3

FIGURE 2-9. OUTLINE DIMENSIONS, 6-12 INCH REMOTE CONVERTER WITH ANSI FLANGES, HI-TEMP

DIM	SIZE	1/2 [15]		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	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]	7-7/8 [200]	9 [229]	9-7/8 [250]	11 [280]
L	10D S/X 3111EE	14 [356]		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		N/A	
L	10D S/X 3111EZ	SEE SALES ORDER INFORMATION FOR "L" DIMENSION											
	LINER												
RF	POLY/ TEFL/TEFZ	1-25/32 [45]		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		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	1/2 [13]	5/8 [16]	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]		9/16 [14]		23/32 [18]		23/32 [18]		23/32 [18]		23/32 [18]	7/8 [22]
N		4		4		4		4		8		8	
BC		2-9/16 [65]		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		3-3/4 [95]		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		2-15/16 [75]		3-7/16 [87]		3-15/16 [100]		4-9/16 [116]		3-15/16 [100]		5-1/8 [130]	
C		2-7/16 [62]		2-7/8 [73]		3-7/32 [82]		3-17/32 [90]		4-11/32 [110]		5-1/8 [130]	
E	STD. TEMP.	4-1/4 [108]		4-11/16 [119]		5-1/32 [128]		5-11/32 [136]		6-5/32 [156]		6-15/16 [176]	
F		5-5/16 [135]		5-3/4 [146]		6-3/32 [155]		6-13/32 [163]		7-7/32 [183]		8 [203]	
E	HIGH TEMP.	4-5/8 [117]		5-1/16 [128]		5-13/32 [137]		5-23/32 [145]		6-17/32 [166]		7-5/16 [186]	
F		5-11/16 [144]		6-1/8 [156]		6-15/32 [164]		6-25/32 [172]		7-19/32 [193]		8-3/8 [213]	



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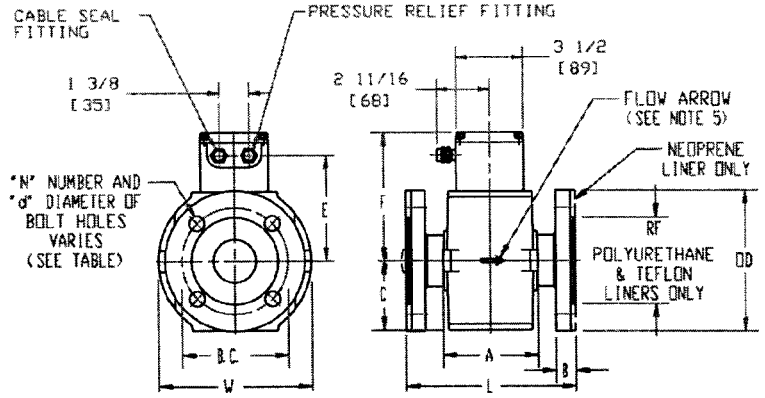
7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [3].

Ref. OD-10D-4288_r1

FIGURE 2-10. OUTLINE DIMENSIONS, 1/2-4 INCH REMOTE CONVERTER 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 (620)			
	LINER														
RF	NEOPRENE	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 (57)	
B	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				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		7-5/8 (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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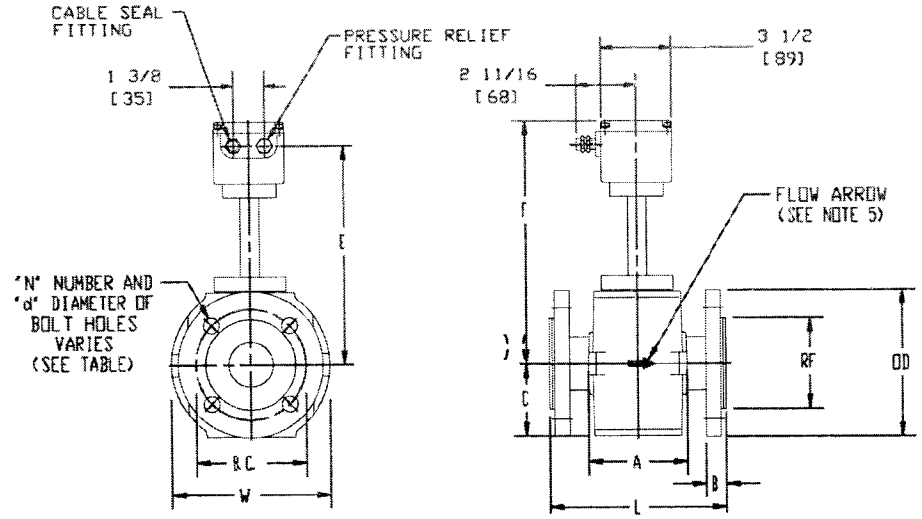
Ref. OD-10D-4194 r2
& OD-10D-4231 r0

FIGURE 2-11. OUTLINE DIMENSIONS, 6-12 INCH REMOTE CONVERTER 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			
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		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)			



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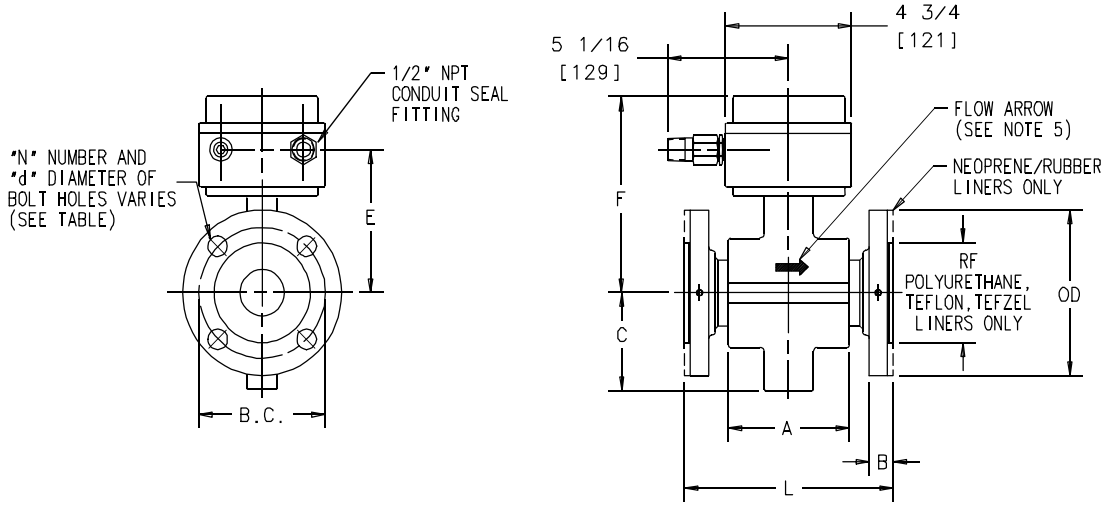
3) THIS DRAWING IS A THIRD ANGLE PROJECTION AS SHOWN.
4) FLANGE BOLT HOLES STRADDLE CENTERLINES
5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/-1/8 [3] .

Ref. OD-10D-4195
& OD-10D-4232

FIGURE 2-12. OUTLINE DIMENSIONS, 6-12 INCH REMOTE CONVERTER WITH DIN FLANGES, HI-TEMP

DIM	SIZE	1/2 [15]		1 [25]		1-1/2 [40]		2 [50]		3 [80]		4 [100]	
	FLANGE CLASS	150	300	150	300	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]	7-7/8 [200]	9 [229]	9-7/8 [250]	11 [280]
L	10D S/X 3111EE	14 [356]		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		N/A	
L	10D S/X 3111EZ	SEE SALES ORDER INFORMATION FOR "L" DIMENSIONS											
	LINER												
RF	POLY/ TEFL/TEFZ	1-3/8 [35]		2 [51]		2-7/8 [73]		3-5/8 [92]		5 [127]		6-3/16 [157]	
B	POLY/NEO/ RUBBER	N/A		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	1/2 [13]	5/8 [16]	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]		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		4	8	4	8	8	8
BC		2-3/8 [60]	2-5/8 [67]	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		3-1/2 [89]	3-3/4 [95]	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		2-15/16 [75]		3-7/16 [87]		3-15/16 [100]		4-9/16 [116]		3-15/16 [100]		5-1/8 [130]	
C		2-7/16 [62]		2-7/8 [73]		3-7/32 [82]		3-17/32 [90]		4-11/32 [110]		5-1/8 [130]	
E		4-1/8 [105]		4-9/16 [116]		4-29/32 [125]		5-7/32 [133]		6-1/32 [153]		6-13/16 [173]	
F		5-1/4 [133]		5-11/16 [144]		6-1/32 [153]		6-11/32 [161]		7-5/32 [182]		7-15/16 [202]	



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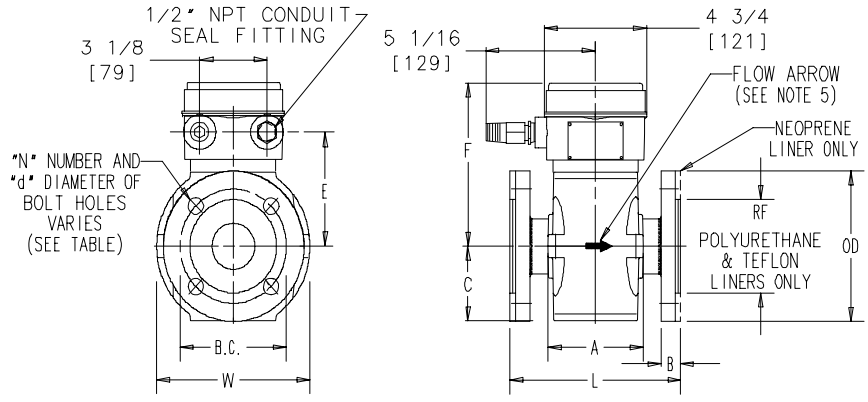
4) FLANGE BOLTS STRADDLE CENTERLINES.
5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [3].

Ref. 10d4290 r0

FIGURE 2-13. OUTLINE DIMENSIONS, 1/2-4 INCH REMOTE CONVERTER WITH ANSI FLANGES, CONTINUOUS SUBMERGENCE

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 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)	
L	10D 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
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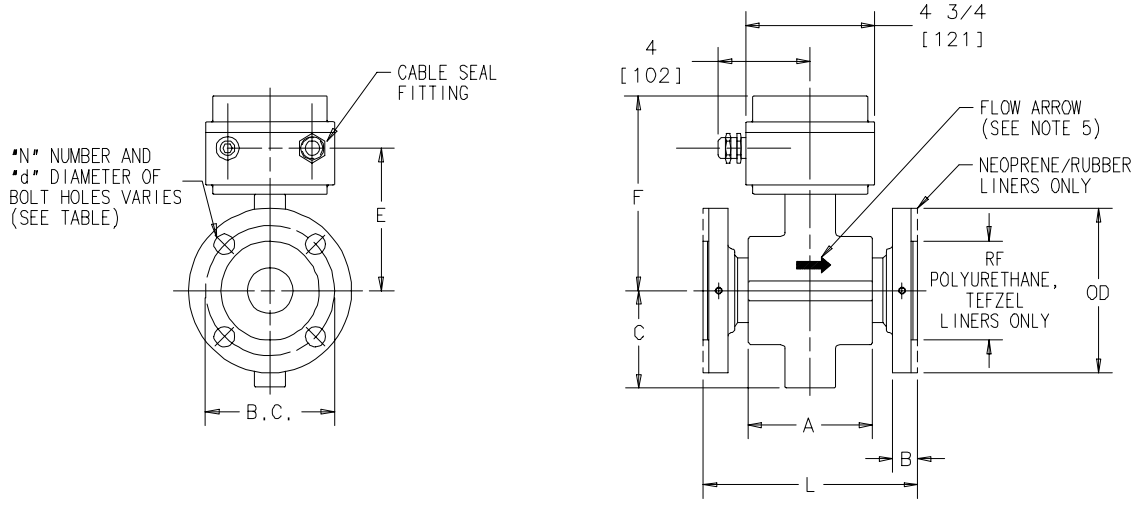
4) FLANGE BOLT HOLES STRADDLE CENTERLINES
5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/-1/8 [3] .

Ref. 10d4265 r0

FIGURE 2-14. OUTLINE DIMENSIONS, 6-12 INCH REMOTE CONVERTER WITH ANSI FLANGES, CONTINUOUS SUBMERGENCE

DIM	SIZE	1/2 [15]		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	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]	7-7/8 [200]	9 [229]	9-7/8 [250]	11 [280]
L	10D S/X 3111EE	14 [356]		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		N/A	
L	10D S/X 3111EZ	SEE SALES ORDER INFORMATION FOR "L" DIMENSION											
	LINER												
RF	POLY/TEFZEL	1-25/32 [45]		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		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]
	TEFZEL	1/2 [13]	5/8 [16]	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]		9/16 [14]		23/32 [18]		23/32 [18]		23/32 [18]		23/32 [18]	7/8 [22]
N		4		4		4		4		8		8	
BC		2-9/16 [65]		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		3-3/4 [95]		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		2-15/16 [75]		3-7/16 [87]		3-15/16 [100]		4-9/16 [116]		3-15/16 [100]		5-1/8 [130]	
C		2-7/16 [62]		2-7/8 [73]		3-7/32 [82]		3-17/32 [90]		4-11/32 [110]		5-1/8 [130]	
E		4-1/8 [105]		4-9/16 [116]		4-29/32 [125]		5-7/32 [133]		6-1/32 [153]		6-13/16 [173]	
F		5-1/4 [133]		5-11/16 [144]		6-1/32 [153]		6-11/32 [161]		7-5/32 [182]		7-15/16 [202]	



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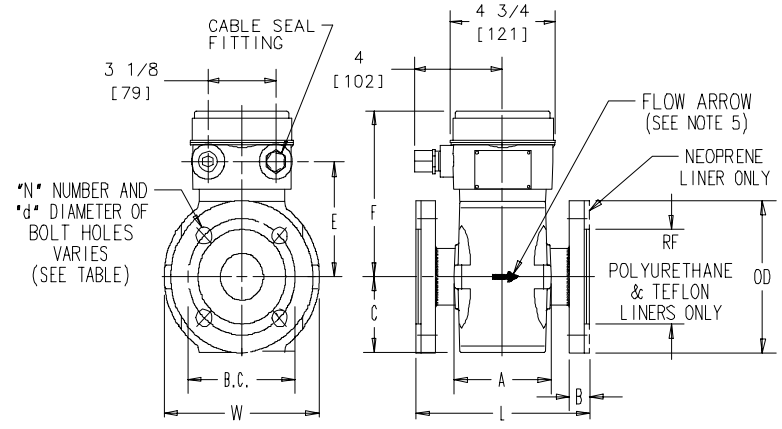
5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [3].

Ref. 10d4292 r0

FIGURE 2-15. OUTLINE DIMENSIONS, 1/2-4 INCH REMOTE CONVERTER 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	
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				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)				



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7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/-1/8 [3] .

Ref. 10d4267 r0

FIGURE 2-16. OUTLINE DIMENSIONS, 6-12 INCH REMOTE CONVERTER WITH DIN FLANGES, CONTINUOUS SUBMERGENCE

2.4 MOUNTING

2.4.1 Orientation

The Series 3000 Magnetic Flowmeter 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 hydraulic 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 Magnetic Flowmeter 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 magmeter for elbows and tees, measured from the center of the meter (refer to Figure 2-17).

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 magmeter and a control valve or pump (refer to Figure 2-17).

2.4.2 Meter Handling

The liner of the Flowmeter must be protected at all times. The liner can be damaged by sharp objects or cut by undue pressure. The protective covers provide protection for the liner. Keep the covers in place until the Primary is actually ready for installation. Once the protective covers are removed during installation, be careful not to damage the liner with the mating flanges in order to avoid potential process leaks. Do not pass any rope or wire sling through the meter liner (Refer to Figure 2-2 for proper hoisting method).

NOTE
Leave metal protector plates or plywood lining protectors in place on the meter until the meter is ready to be installed, otherwise the Teflon meter liner will have a tendency to "flare" away from the meter face and may make meter installation difficult.

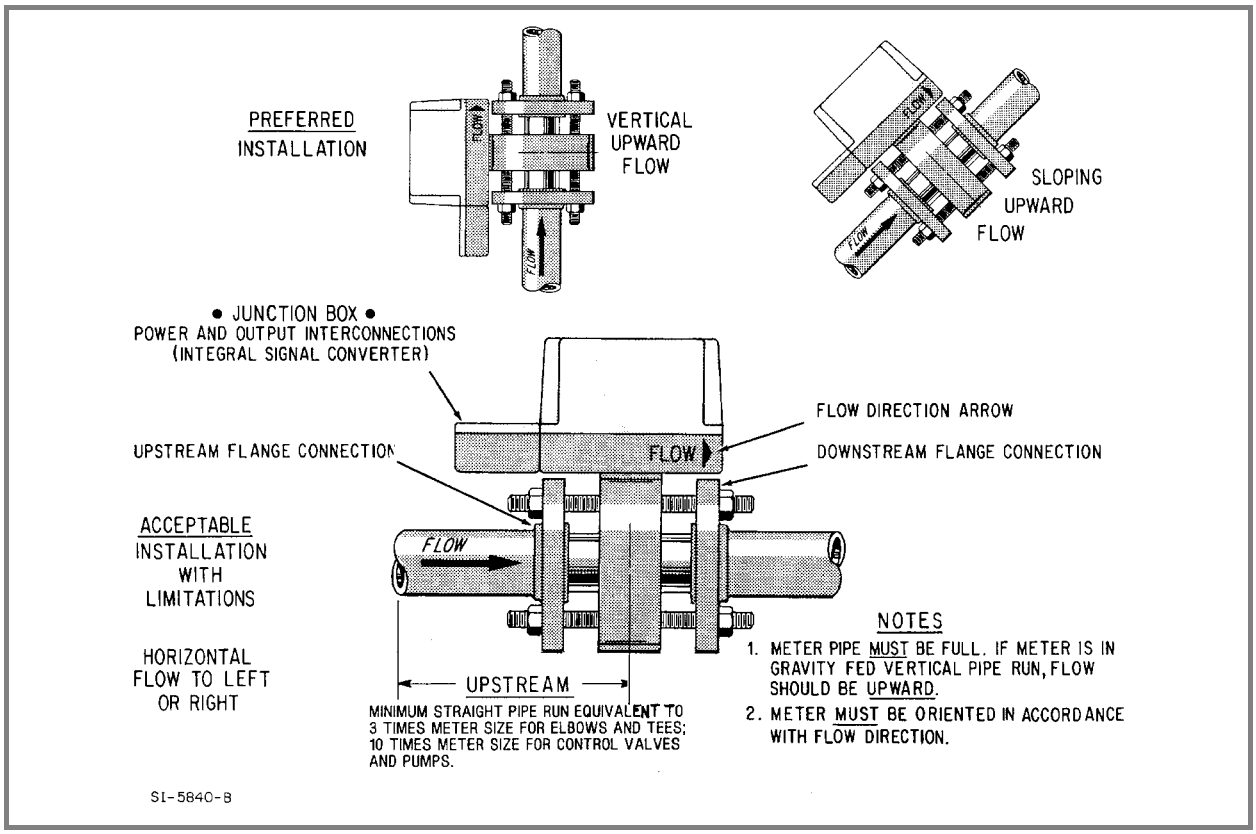


FIGURE 2-17. RECOMMENDED PIPING ARRANGEMENT

2.4.3 Pipe Connections

The TEFLON, TEFZEL 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.

Flange nuts should be tightened in an alternate pattern (e.g., 1-3, 2-4) as shown in Figure 2-18 to produce equal pressure distribution around the flange face. Bolt torque should be limited to the values shown in Tables 2-1 & 2-2. For TEFLON-lined meters, the bolt-torque must be sufficient to force the flared liner flat against the flange's raised face.

Refer to Figure 2-17 for recommended piping arrangement.

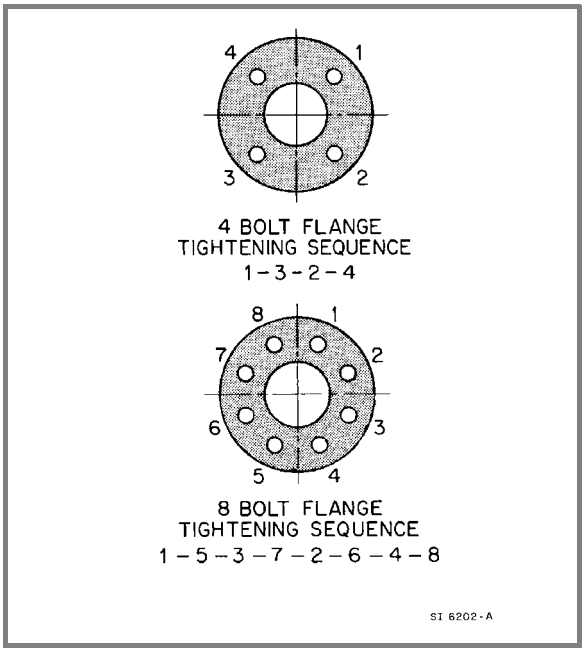


FIGURE 2-18. BOLT TIGHTENING SEQUENCE

2.4.4 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 2-1 and 2-2 **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.	Size mm	ANSI Class 150 Bolt No. & Size (in.)	ANSI Class 150 Max. Torque Rate (ft-lb)	ANSI Class 300 Bolt No. & Size (in.)	ANSI Class 300 Max. Torque Rate (ft-lb)
PTFE / TEFZEL / Rubber	1/2	15	4 x 1/2	6	4 x 1/2	7
	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 in.	Size mm	Bolt No. & Size	Max.Torque Rate ft-lb	Max.Torque Rate Nm	PN bar
PTFE/ Rubber	1/2	15	4 x M12	6.8	9.25	40
	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

2.4.5 Gaskets

Use only the gaskets supplied with the instrument. The gaskets supplied with the meter are the proper size for the meter size and type specified. When installing the meter it is important that the correct size gaskets be utilized. Use of the wrong size gaskets could allow the inner diameter of the gasket to protrude into the flow stream, thereby altering the flow profile within the meter. This condition could affect meter accuracy significantly and must be avoided. Using the proper gaskets and installing them correctly will also avoid any possibility of leakage. Observe parts information given in Section 6.0. Refer to Figure 2-19 for proper gasket locations.

NOTE
Do not use graphite gaskets. Under certain conditions they may cause an electrically conductive layer to form on the inside wall of the meter, causing meter operation to degrade.

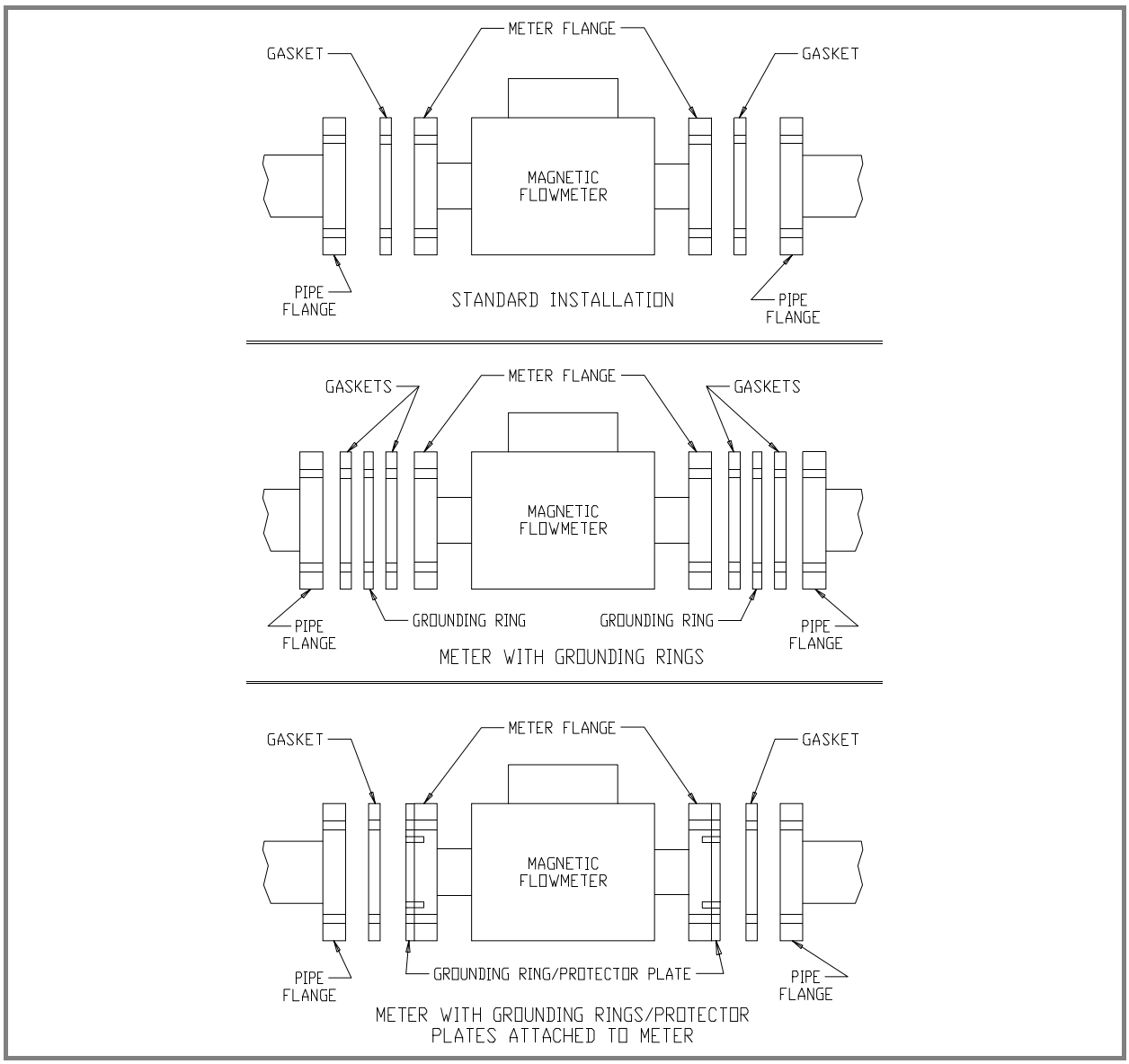


FIGURE 2-19 . GASKET LOCATIONS

2.5 Grounding Procedure

2.5.1 General

Satisfactory operation of Magnetic Flowmeter Systems 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 cold water pipe which is buried in the earth and travels many miles in its distribution system. 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 cold water pipe.

Meter grounding requirements are really 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 nothing more than ensuring that the meter body is in contact with the process liquid at both ends of the meter body. Basically, 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 Magnetic Flowmeter is required for optimum system performance.

2.5.2 Conductive Pipeline

If the flowmeter 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 2-20 to supplement the following text.

1) Drill and tap both pipeline flanges adjacent to the bonding connections on the flowmeter. The lugs on the bonding cables are sized for metric M6 fasteners (a 1/4" bolt).

2) Obtain a bright metal surface around the edges of the tapped hole with a file or burnishing tool.

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.

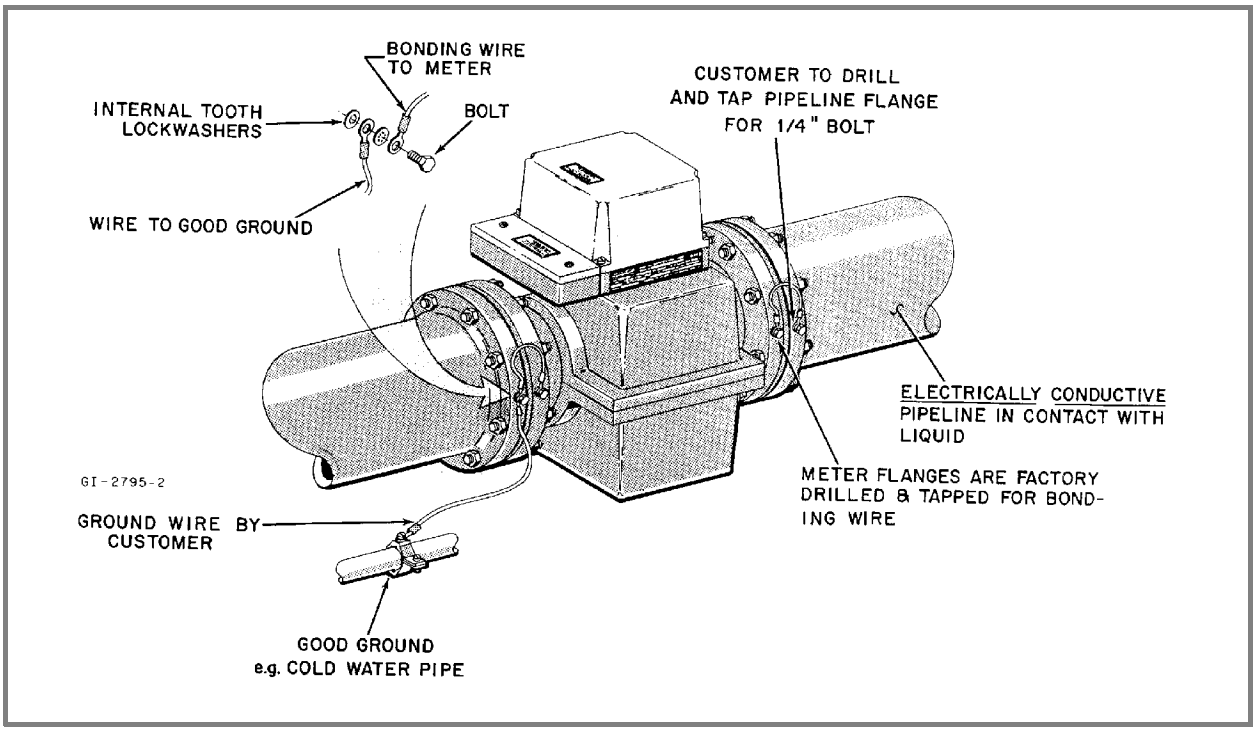


FIGURE 2-20. GROUNDING PROCEDURE; CONDUCTIVE PIPELINE

Note that 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 flowmeter 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 2-21 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 2-21. 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 2-19.

NOTE
When using grounding rings and gaskets, add 1/8 inch per end (1/4 inch total) to the overall meter installation length (dimension "L" in Figures 2-3 through 2-16) to allow for the added thickness of these items.

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 2-21. The ground wire should be #12 AWG, or heavier, copper wire.

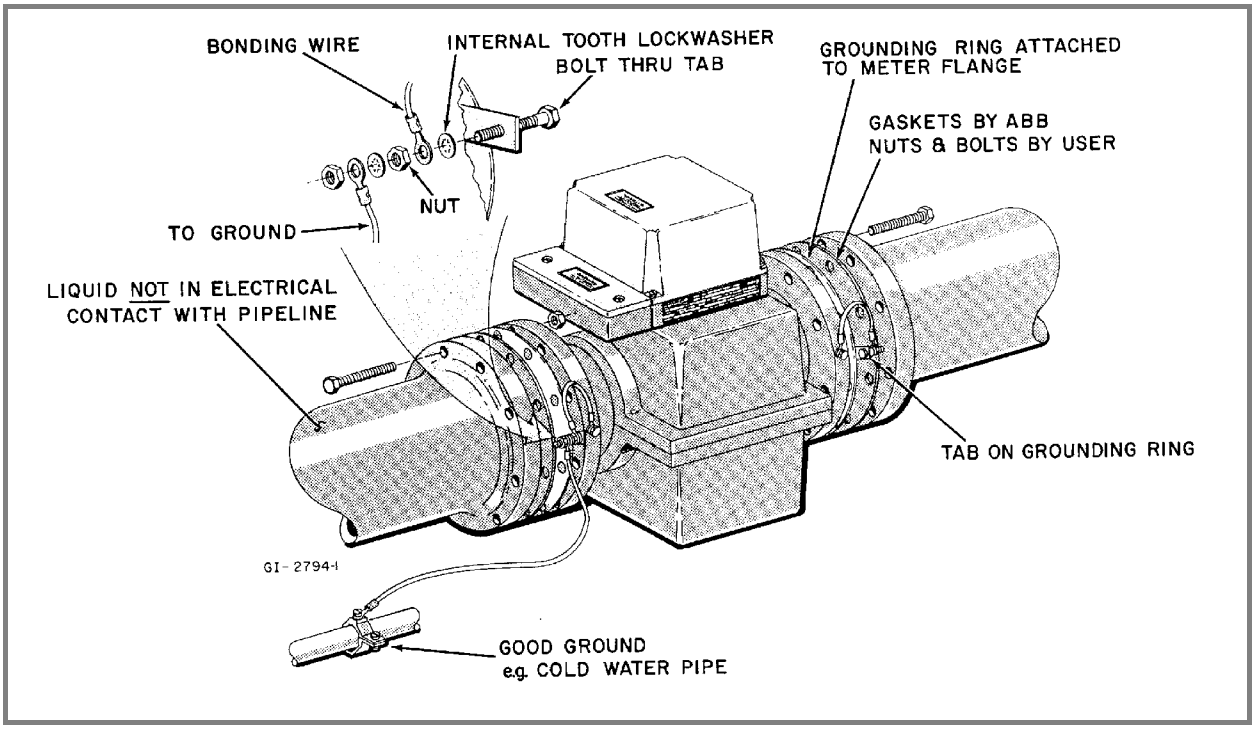


FIGURE 2-21. GROUNDING PROCEDURE; NON-CONDUCTIVE PIPELINE

Note that the flowmeter shown in this illustration is not the meter described in this instruction bulletin.

2.6 Electrical Interconnection

The Series 3000 Magnetic Flowmeter may be furnished with either an integrally or remotelymounted (optional) Signal Converter. Interconnection wiring is arranged differently for the two systems. Interconnection details are provided in the Instruction Manual 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.

Regardless of the interconnection procedure used, 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 flowmeters include a conduit entry seal and pressure relief to prevent the process fluid from entering the electrical conduit system. This safety feature is avai;able for NPT fittings only and 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. The secondary seal consists of the following:

Integral Converter - Feed-through's between the electronics housing and field wiring (customer connection) junction box.

Remote Primary - Conduit entry cable seal on meter customer connection box.

It is the user's responsibility to properly install the conduit entry cable seal fitting supplied with the signal cable provided with the remote mounted signal converter. This will ensure proper performance of this safety feature. See Figure 2-22.

A pressure relief is provided in the electronics housing for the integrally mounted signal converter and in the customer connection box on the remote mounted Flowmeter. In both housings, the pressure relief is located in the center of the cover 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.

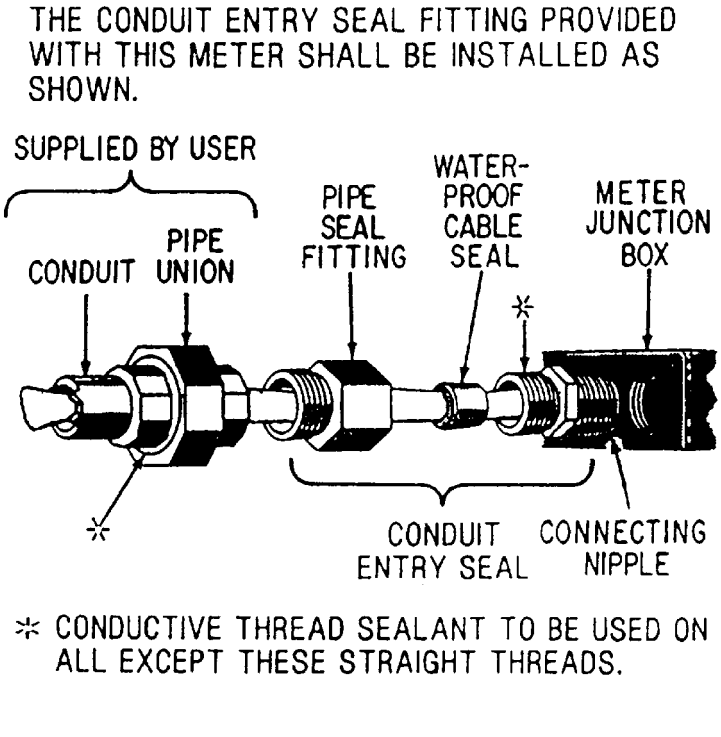


FIGURE 2-22. CONDUIT ENTRY SEAL INSTALLATION

3.0 START-UP & OPERATION

The Series 10DX3000 Magnetic Flowmeter (which includes the integral or remote Signal Converter) is precision calibrated at the factory. Each Flowmeter is calibrated to determine its meter capacity at a given velocity. Refer to Table 1-4.

There are no operating controls that require field adjustment unless the full scale range setting was not specified. If a change in the full scale range setting is required, refer to the Instruction Bulletin supplied with the Signal Converter. If no change is required, the equipment is ready for operation as received.

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 grounding.

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 10DX3111 Magnetic Flowmeter 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. Information concerning operation of the Signal Converter is provided in the Instruction Manual supplied with the Converter.

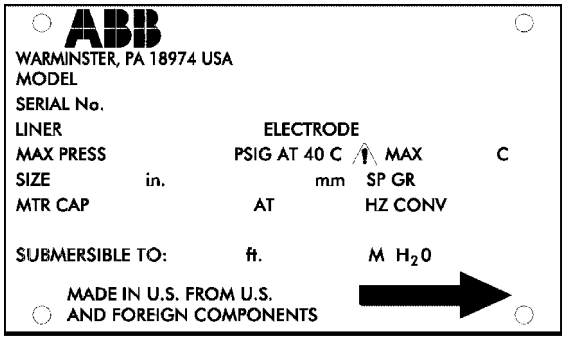


FIGURE 3-1. TYPICAL REMOTE PRIMARY DATA TAG

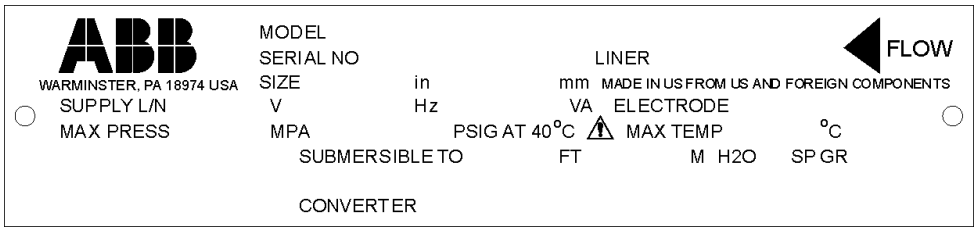


FIGURE 3-2. TYPICAL INTEGRAL PRIMARY DATA TAG

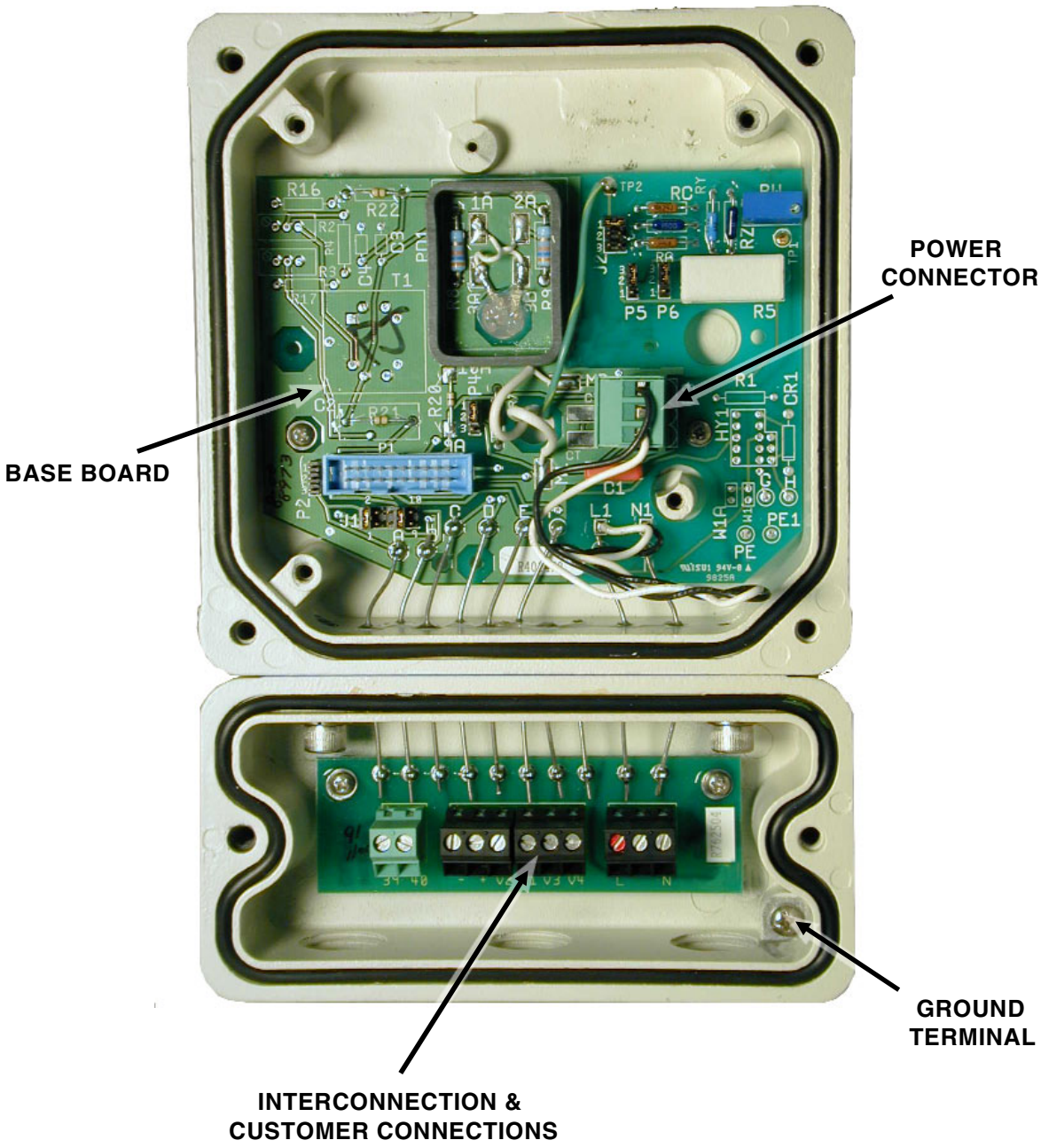


FIGURE 3-3 . INTEGRALLY MOUNTED ENCLOSURE WITHOUT CONVERTER MODULE [10DX3311E]

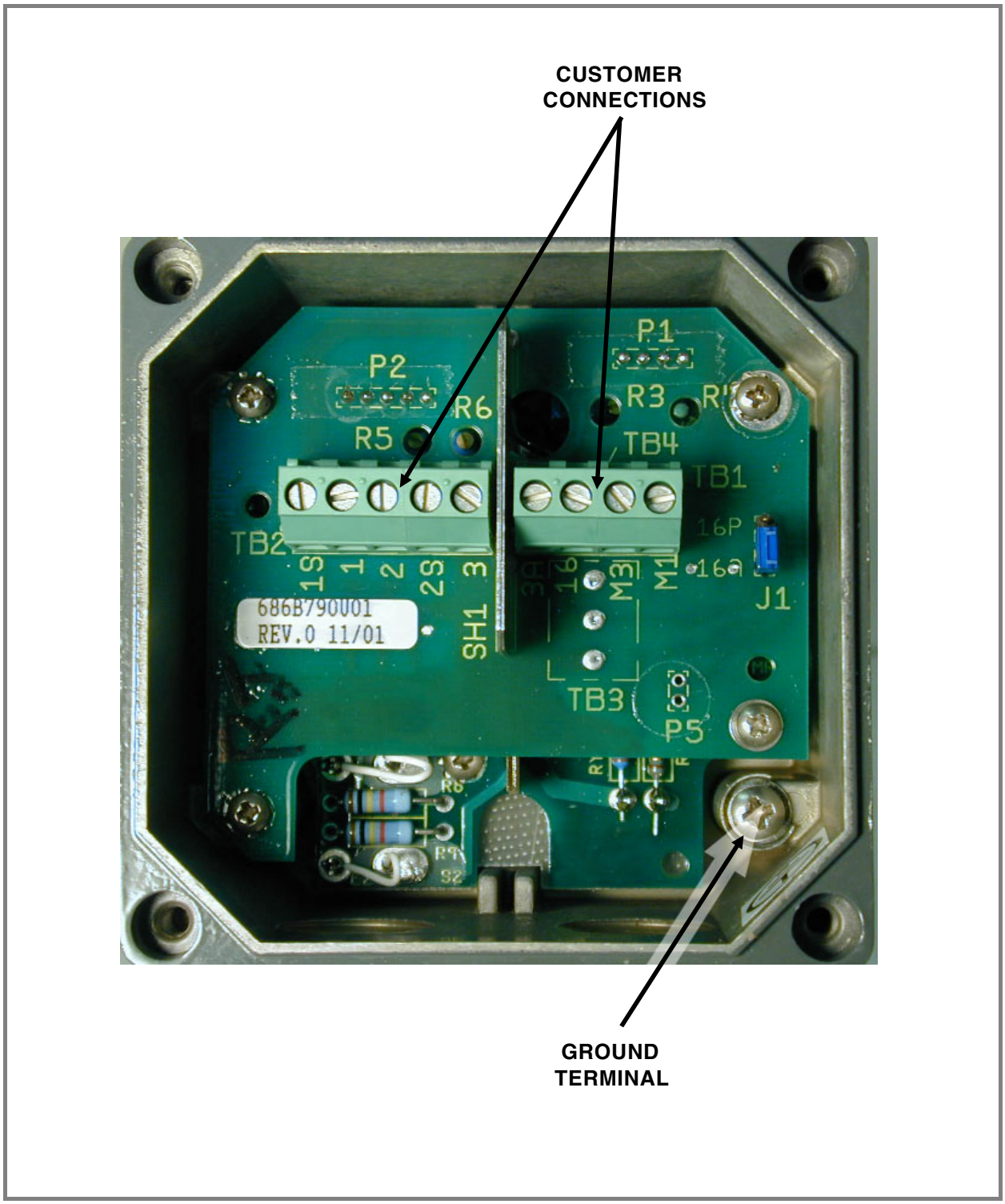


FIGURE 3-4. REMOTE PRIMARY PCB ASSEMBLY IN GENERAL PURPOSE OR FM CLASS I, DIV.2 HOUSING [10DX3111E]

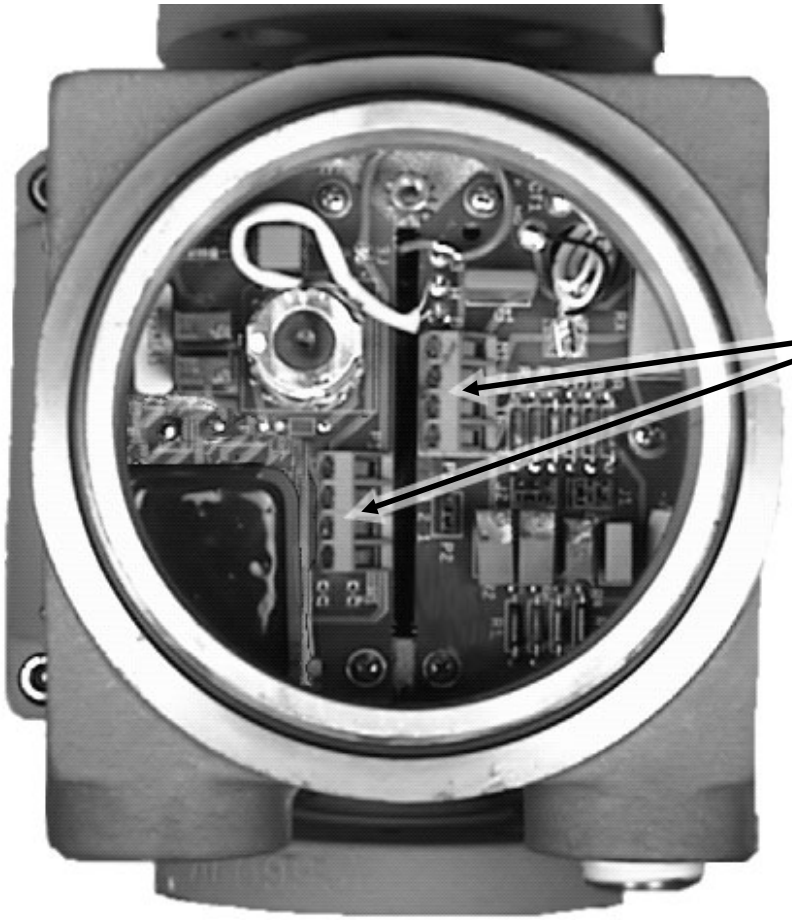


FIGURE 3-5. EXPLOSION-PROOF PRIMARY FOR REMOTE MOUNTED SIGNAL CONVERTER

NOTE
Figure 3-5 shows Explosion-Proof configuration. The Continuous Submergence model is identical to that shown except that the housing is filled with a silicone rubber encapsulant.

4.0 FUNCTIONAL DESCRIPTION

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

The Flowmeter provides two output signals to the associated 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 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.

4.1 Basic Operating Principle

4.1.1 Signal Voltage Generation

The operating principle of the Model 10D1475 magnetic flowmeter 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 magnetic flowmeter constitutes a modified form of a generator.

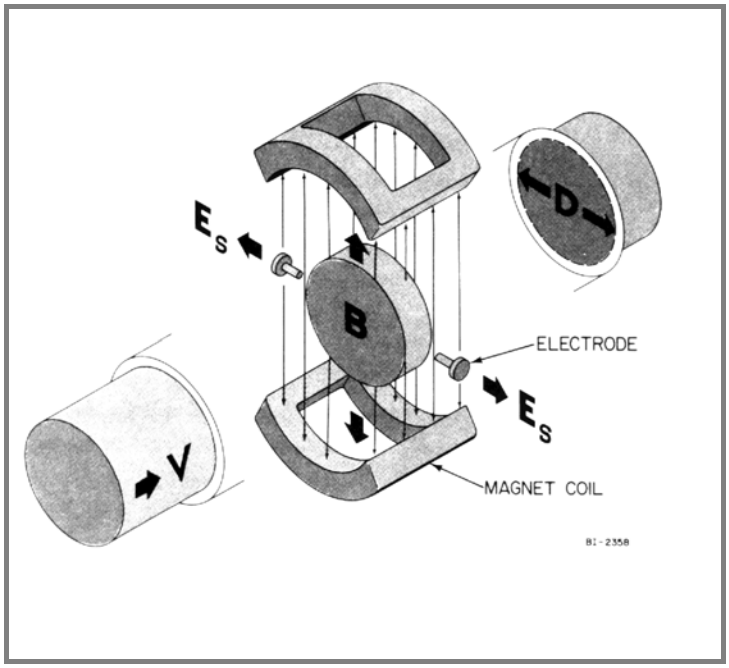


Figure 4-1 graphically illustrates the basic operating principle. A magnetic field, "B", is being generated in a plane which is perpendicular to the axis of the meter pipe. A disk of the metered liquid can be considered as a conductor. The transverse length "D" is equal to the meter pipe diameter. Since the velocity "V" of the liquid disk is directed along the axis of the meter pipe, a signal voltage, "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.

FIGURE 4-1. BASIC OPERATING PRINCIPLE

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

Thus, 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 Magnet Coil Drive Circuits

In many conventional magnetic flowmeters the integral magnet coils are driven directly by the customer's 50/60 Hz power service. The design of the Series 10D1475 magnetic flowmeter uses magnet drive circuits which are alternately energized bi-directionally at a low frequency rate as commanded by the associated Converter/Driver assembly.

4.1.3 Volumetric Flow Rate Measurement

The magnetic flowmeter 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:

$$\therefore \quad Q = \frac{\pi \alpha D^2}{4} \bullet \frac{E_s}{B}$$

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 induced signal voltage as measured by the magnetic flowmeter.

4.2 Operating Characteristics

4.2.1 Liquid Variables

4.2.1.1 Liquid Conductivity

The magnetic flowmeter requires a liquid conductivity of 5 microsiemens per centimeter or higher for operation. This minimum liquid conductivity requirement is not affected by the length of the signal interconnection cable when remote mounting of the signal converter is required, as long as the factory-supplied interconnection cable (with driven shields) is utilized. The nominal maximum transmission distance is limited to 30 meters (100 feet), however longer distance can be accommodated (contact factory for details).

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

1) Remove the Converter housing cover. Disconnect the electrode signal interconnection leads from terminals "1" and "2" of the signal converter. (These leads should be identified so that they will be properly reconnected.)

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.

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

where,

0.072 is the electrode barrier resistance in megohms; i.e., 36 k x $2/10^6$

For example, assuming the measured ac electrode resistance (full pipe and zero flow) is 192,000 ohms and electrode diameter is 7.92 mm (0.792 cm), then

$$\sigma = \frac{1}{(0.192 - 0.072) \times 0.792} = 10.52\ \mu S/cm$$

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 reference works for many pure liquids. Company Field Engineers are equipped to determine the conductivities of special liquids at the user's site as an engineering service.

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, due regard for 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. However, 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 also 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 leakage pressure of the meter pipe flange connections.

4.2.2 Metering Characteristics

The metering pipe must be completely filled at all times for accurate results. Where there is possibility of operation with a partially filled horizontal pipeline, it is recommended that the magnetic flowmeter be installed in a vertical section of that pipeline such that liquid flow moves upward. A vertical installation also offers the advantage of an even distribution of liner wear in the event that solid abrasives are being carried along in the liquid stream.

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

In applications involving variable quantities of uniformly dispersed, non-conductive mixing agents, it must be ascertained 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.

4.3 Circuit Description

4.3.1 Primary Signals

The Model 10DX3111E flowmeters use **integral or remote** 50XM1000 Converter electronics. As described in paragraph 4.1, the magnetic flowmeter body houses two signal electrodes and two flux producing magnet coils. Refer to the 50XM1000 Converter Instruction Manual for remote-configuration interconnection wiring diagrams. All Flowmeter intraconnection wiring is terminated at the CMC PC board located in the base of the meter housing.

The Flowmeter provides two output signals to the associated signal converter, an electrode signal that contains the flow rate information and the reference signal which is proportional to the magnet excitation current (theoretically, the 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.

The (gated) magnet driver operates at a frequency that permits magnetic flux in the Flowmeter to reach a steady state level during the last 25% of each half period of magnet excitation. By using sampling techniques, the flow (differential mode) signal is measured only during the intervals that magnetic flux is constant:

$$\left(\frac{d\Phi}{dt} = 0\right)$$

Therefore, zero instability due to changing flux is eliminated by use of the MAG-X design concept (sampling technique), providing a meter totally free of zero drift. A thorough discussion of signal converter operation is provided in the Instruction Manual supplied with the particular signal converter.

Models 10DX3111/3311E flanged flowmeter primaries contain two flux producing coils wired in series and a pair of diametrically opposed electrodes mounted at 90 degrees to the coil flux plane (refer to FIGURE 4-2 below). Meter coils are excited with approximately ±10 volts of pulsed DC. A precision current sensing network is connected in series with the coils. The current sense network produces what Fischer & Porter refers to as a "Reference Voltage", which is typically ±70 millivolts. The reference voltage is directly proportional to the strength of the magnetic field in the measuring tube and is measured by the signal converter. The reference voltage must be measured, since any variation in reference voltage will also produce a proportional change in electrode signal voltage, assuming an unchanged flow velocity. The current sense (reference network) may be in the Primary or the Secondary, depending on the model number and/or the design level.

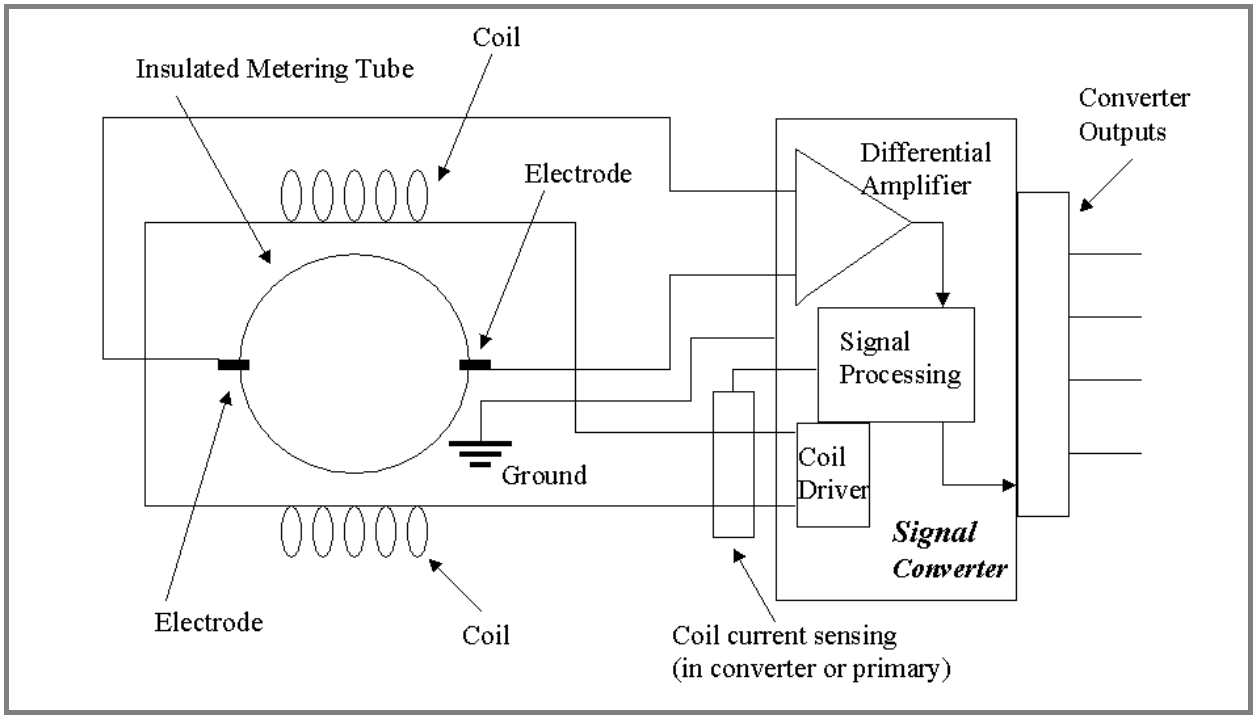


FIGURE 4-2. SIMPLIFIED MAGMETER SYSTEM BLOCK DIAGRAM

4.3.2 Constant Meter Capacity (CMC) PC Assembly

The CMC PC Assembly provides several functions. These include:

1. Establishing interconnections between the Flowmeter internal wiring and the signal converter.

2. Permitting factory adjustment of meter capacity values to a fixed value for each nominal size Flowmeter.

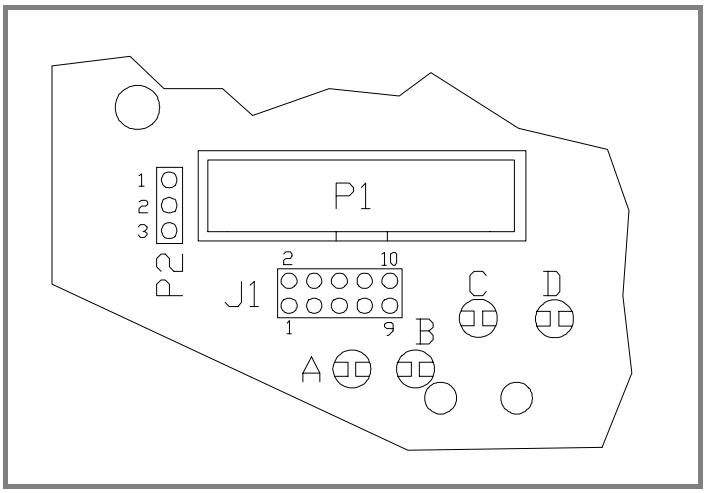
3. Establishing proper wiring connections for remotely mounted signal converters.

Meter coil current and, consequently, calibration factor are established by adjusting a precision current-sense network which is in series with the meter coils. The current-sense network consists of a low-resistance current-sensing resistor along with an adjustable resistive divider network placed across the current-sense resistor. A potentiometer is also used to provide fine-tuning of the meter capacity. Should this resistive network be damaged, repair and recalibration are only possible by using precision electronic calibration instruments.

4.4 Jumper Selections

4.4.1 Integral Converter

For the Model 10DX3311E integral magmeter, zero return and functions associated with the 50XM1000 signal converter are established by the movable jumpers on terminal-strip J1 located in the lower left corner of the **686B762U02 Primary Board** assembly. The following table and diagram correlates the zero return and functions with the jumper connections:



The full view of the 686B762U02 Primary Board Assembly is shown in Figure 4-3. Table 4-1 shows selectable functions and their respective jumper settings.

TABLE 4-1. 686B762U02 PCB JUMPER FUNCTIONS

JUMPER NO.	POSITION	FUNCTION
J1	1-2 *	Zero Return
	3-4 *	10 KHz Signal
	5-6 *	Reverse Pulse Signal
	7-8	GND for 10 KHz, Zero Return
	9-10	COMMON for Reverse Pulse
P4	1-2	** Integral Converter
P5, P6	2-3	** CD-1, XM1000 Mode
J2	1-2	** IEX = 85 to 141 mA
	1-6	IEX = 125 to 230 mA
	2-5	IEX = 210 to 350 mA
	3-4	IEX = 337 to 560 mA
P2	-	Not to be Jumpered

*** Mutually exclusive, only one function at a time may be selected**
**** Indicates factory default positions**

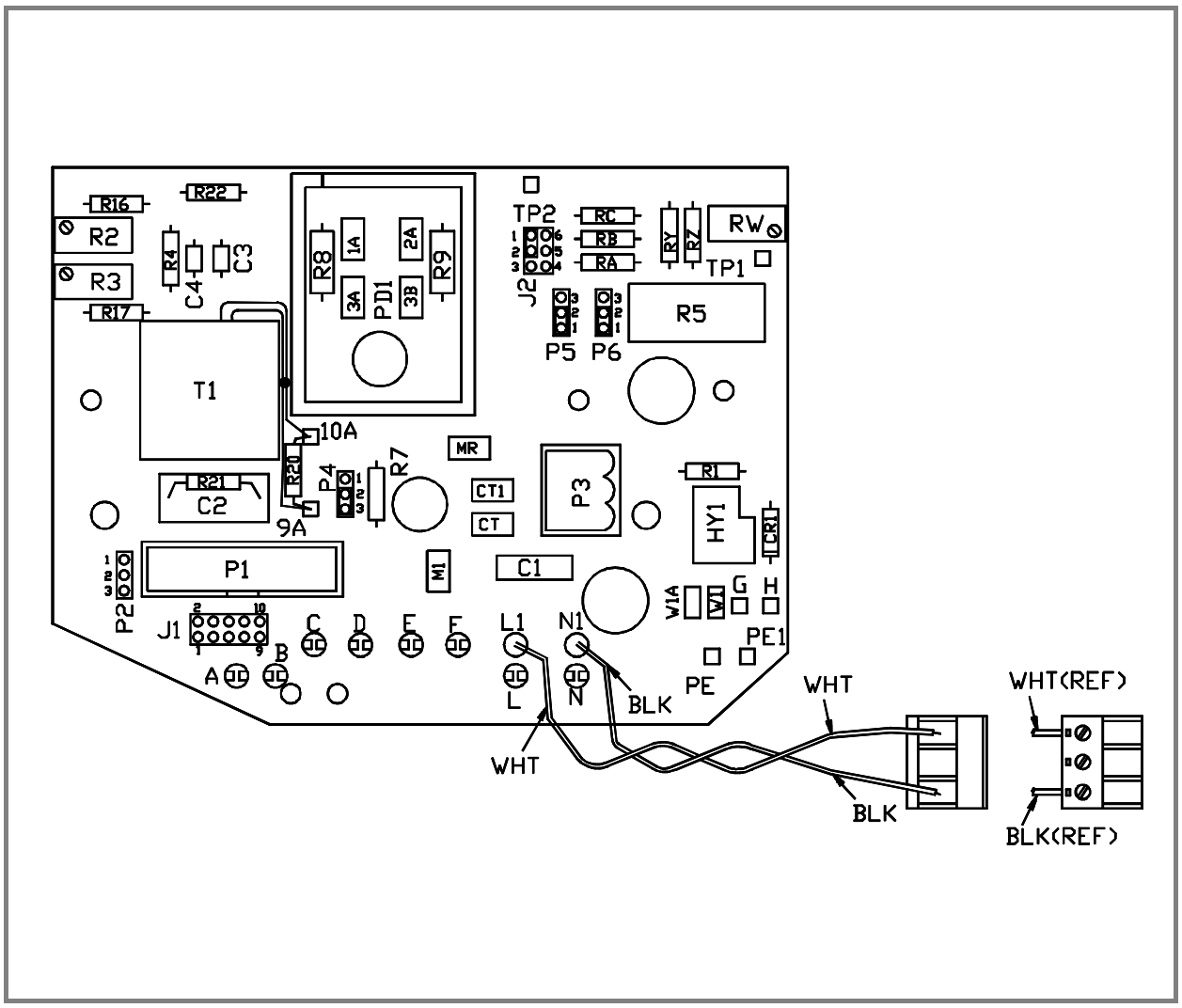


FIGURE 4-3. 686B762U02 PRIMARY BOARD ASSEMBLY

4.4.2 Remote Converter

The Model 10DX3111E remote version uses the smaller two-piece housing which contains two circuit board assemblies, the **686B789U01 CMF** PCB assembly and the **686B790U01 Customer Connection** PCB assembly. The **686B790U01** PCB interfaces to the remote 50XM1000 Converter via the supplied interconnection cable.

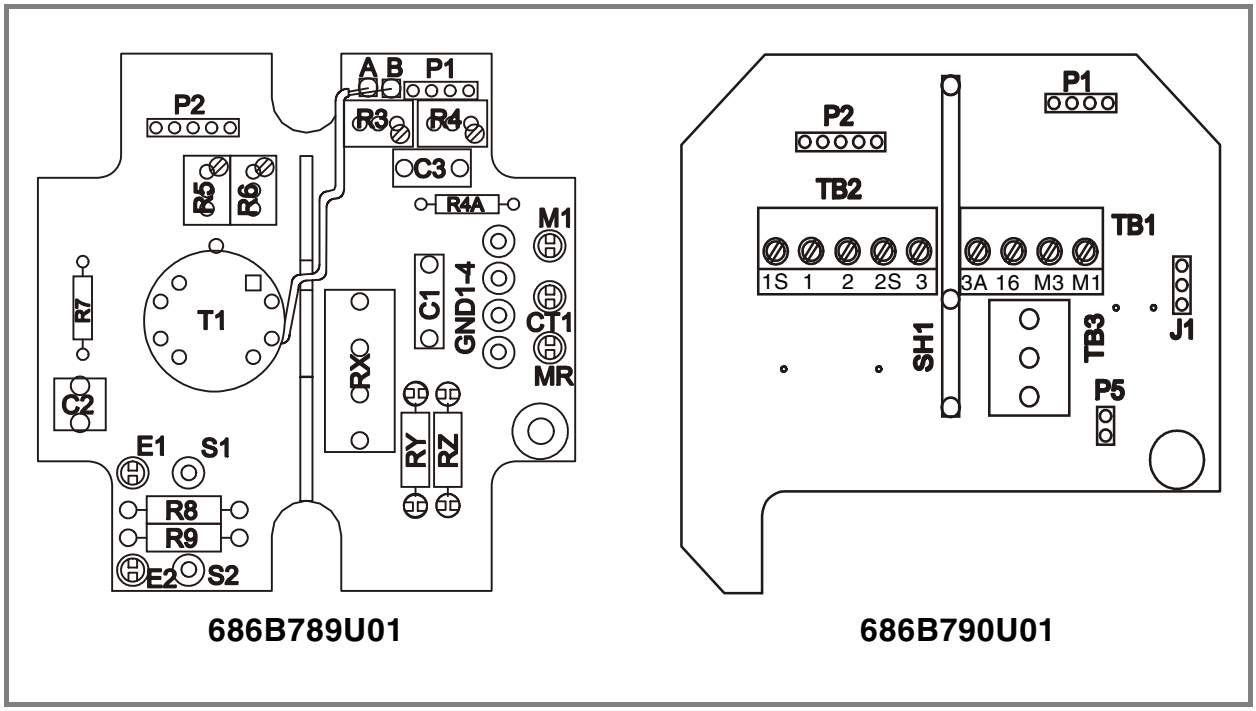
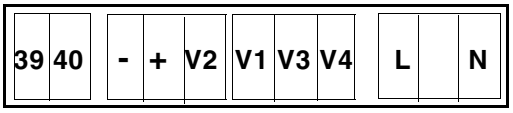


FIGURE 4-4. 10DX3111E REMOTE PRIMARY PCB ASSEMBLIES

4.5 Terminal Numbering

THE FOLLOWING INFORMATION PROVIDES TERMINAL NUMBERING AND FUNCTION FOR THE INTEGRAL MODEL 10DX3311E CUSTOMER CONNECTION TERMINALS (Refer to Figure 3-3)

TERMINAL BLOCK



TERMINALS	TERMINAL FUNCTION
39/40	a) Zero return or totalizer reset (software selectable) b) Solid-state status contact (39 = emitter) c) Forward flow scaled pulse output, open collector (39 = emitter) d) Reverse scaled pulse output (40 = common) e) 10 KHz output (40 = common)
-/+	4-20 mA current output
V2/V1	a) Forward scaled pulse output (V1 = negative)
V3/V4	INACTIVE
L/N	Signal converter power supply (N is negative or neutral)

Refer to the signal converter instruction manual for remote model 10DX3111E customer connection terminals and functions.

5.0 MAINTENANCE

5.1 General

Except for an occasional performance verification check, there is no required routine maintenance for the Series 3000 Magnetic Flowmeter. For practical reasons 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 company 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 factory (charges prepaid). The equipment available under this program is as follows:

- the complete meter with integrally mounted Signal Converter
- the meter and associated primary board; that is, the hydraulic portion without the Signal Converter
- the Signal Converter

WARNING
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 <u>all process liquids</u> must accompany returned equipment. Contact the factory for authorization prior to returning equipment.

NOTE
Operation and maintenance procedures for the Signal Converter are provided in the instruction manual supplied with the Signal Converter.

When communicating with the company in regard to replacement of a complete meter (with integrally mounted Converter), the meter body, 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 Magnetic Flowmeter, and on the instrument data tag.

CAUTION
Some of the IC devices used in the signal converter are static sensitive and may be damaged by improper handling. When adjusting or servicing the signal converter, use of a grounded wrist strap is recommended to prevent inadvertant damage to the integral solid state circuitry.

5.2 System Troubleshooting

In the event that faulty operation of the Magnetic Flowmeter is evident, the following procedure can be used as a guide to isolate the malfunctioning device to either the primary meter or the Signal Converter. A standard multimeter and an oscilloscope are suitable for making most of the test measurements.

To supplement the following discussion refer to:

Section 4.3 Circuit Description

Signal Converter ... refer to applicable instruction manual

NOTE
The Series 3000 Magnetic Flowmeter 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 an authorized field service engineer, or the complete meter returned (shipping charges prepaid) to the factory for service.

WARNING
ELECTRICAL SHOCK HAZARD. Equipment powered by an AC line voltage presents a potential electric shock hazard. Servicing of the Magnetic 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 access covers from the junction box and the Converter housing (remote or integral).

   b) Inspect for evidence of water entry in the junction box and Converter housing.

If water is present in either the junction box or converter housing of the flowmeter, immediately de-energize system power to eliminate the possibility of a shock hazard.

The presence of water in either the converter housing or the terminal box atop the remote primary most often results in irreparable damage to the circuit board assemblies inside. If such damage is evident, the meter should be removed from the process pipeline and returned to the factory for repair. It is also important that the source of the water-entry be found so that the situation doesn't reoccur when the meter is placed back into service.

Should water be found inside the wiring compartment of an integrally mounted converter housing, the circuit board assembly in this section may be replaced in the field (Consult the factory for additional instructions if this procedure becomes necessary).

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 manual supplied with the associated Signal Converter for system troubleshooting procedures. A static performance test for the primary mounted components is discussed in Section 5.3.

The Signal Converter options available for use with the Series 3000 Magnetic Flowmeter are eitheran integrally or remotely mounted 50XM1000N Microprocessor-based Signal Converter

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 specified minimum

5.3 Static Test

If improper operation of the Magnetic Flowmeter 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
ELECTRICAL SHOCK HAZARD. Equipment powered by an ac line voltage presents a potential electric shock hazard. Make certain that the system power is disconnected before making the following ohmmeter checks.

5.3.1 Magnet Coil Check

5.3.1.1 Remote Model 10DX3111E

Verify that the system power service has been de-energized. Measure the resistance between terminal M1 on the Primary connection board and the flowmeter body. The value displayed should be between 15Ω and 80Ω. A reading significantly outside this range or a short circuit between leads indicates defective coil(s).

Measure the resistance between terminal 16 of the Primary connection board and the flowmeter body. This resistance should measure between 10Ω and 500Ω.

5.3.1.2 Integral Model 10DX3311E

There are two magnet coils in the meter that are wired in series and brought up to terminals M1 & CT and MR & CT1 of the flowmeter PC board in the electronics base.

Verify that the system power service has been de-energized. Loosen and remove the four screws that hold the Signal Converter to the base. Disconnect the connector from signal (P1) on the CMC PC board and the power (P3) connector to the Converter (refer to Figure 3-2) and set the Converter module aside. Measure the series resistance of the magnet coils by connecting the ohmmeter between terminals M1 & MR. The value displayed should be between 10Ω and 80Ω.

If it is suspected that process fluid or excess moisture has entered the Primary housing, unsolder the coil wires from the M1 and MR pads. Verify that the resistance of each coil lead (M1, MR and CT) to the flowmeter body is greater than 20 MΩ or infinite. If the resistance value is incorrect, the coils are defective and the meter must be returned to the factory for service.

5.3.2 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 thoroughly test the electrodes of flowmeters with remote converters (Model 10DX3111E), meters must be tested under both full and empty pipe conditions. If this is not possible, it may still be helpful to perform one of the tests since useful partial information may be gained from the results of either portion of the test.

5.3.2.1 Full Pipe Test

The wetted electrodes of all flowmeters manufactured in accordance with FM Div.1 or Div.2 requirements must have energy-limiting resistance placed in series with them. Depending on the model being tested, the nominal resistance value is 100,000 ohms and will add to any resistance measured between the wetted electrode and the fluid in contact with that electrode.

Electrode full pipe measurements should be made with the ohmmeter placed on its highest range. An AC type ohmmeter (i. e. conductivity bridge) is preferred because DC voltage will tend to polarize the electrode (but will nevertheless provide meaningful information). Connect the ohmmeter positive lead first to electrode terminal "1" and then to electrode terminal "2" with the negative lead to terminal "3" or the flowmeter body. The measured resistance should be 100,000 ohms plus the intrinsic resistance between electrode and fluid (typically 50,000 additional ohms or less). If using a DC ohmmeter, the resistance between the electrode and the fluid will tend to increase as the electrode becomes polarized by a DC signal. This effect is normal. AC resistance readings will not vary once established. Readings greater than 150,000 ohms may indicate a coated electrode. Infinite readings indicate a broken connection in the electrode wiring path. Meters with infinite full pipe readings should be returned to the factory for repair.

5.3.2.2 Empty Pipe Test

If possible, the pipeline should now be drained and the flowmeter should be given a few minutes to allow the fluid to drain off the electrode to liner interface. Connection of either a DC or AC ohmmeter between electrode terminals "1" or "2" and the meter body (terminal "3") should result in a reading greater than 20 MΩ. Lower readings indicate either that process fluid has leaked behind the electrode or that moisture has entered the flowmeter housing. If this is the case, the defective meter should be returned to the factory for repair.

5.3.2.3 Electrode Voltage Test

This test may only be performed on remote models (10DX3111E). If no erroneous readings are found when the electrode resistance test is performed, an additional test may be performed with the system powered and the field wiring restored. Use a digital voltmeter, with a range-setting of 20VDC, to measure the voltage between electrode terminals 1 & 3 (common) and between electrode terminals 2 & 3. The voltage readings should be between $\pm$10 mV and $\pm$2 VDC and should not differ by more than 0.4 VDC. If measured voltages are outside of these ranges, it may indicate that an electrode is open, shorted or that the process fluid is non-conductive.

NOTE

Model 10DX3311E flowmeters with integrally mounted signal Converters incorporate a buffer preamplifier for each electrode. Since this preamplifier is also encapsulated, an on-site evaluation of the condition of the electrodes is not possible.

If the results of the procedures in Sections 5.3.2.1 through 5.3.2.3 indicate normal meter parameters, the flowmeter may be returned to service.

Refer to the instruction manual supplied with the Signal Converter for additional advice on troubleshooting flowmeter electronics.

6.0 PARTS LIST

TABLE 6-1. FLANGE GASKETS FOR METER BODY

NOTE
Polyurethane, neoprene & hard-rubber lined meters use neoprene gaskets. TEFLON & TEFZEL lined meters use TEFLON gaskets.

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

Meter Size		Flange Class	Liner Material			
Inches	mm		TEFLON / TEFZEL	Polyurethane	Neoprene	Hard-Rubber
½	15	ANSI 150	333N123P30	----------	----------	----------
		ANSI 300	333N240P30			
1	25	ANSI 150	333N239P30	----------	----------	----------
		ANSI 300	333N205P30			
1½	40	ANSI 150	333C526U20	----------	----------	----------
		ANSI 300	333N314P30			
2	50	ANSI 150	333N415P30	333N415Q10	333C376Q10	----------
		ANSI 300	333N416P30	333N416Q10	333C373Q10	
3	80	ANSI 150	333N509P30	333N509Q10	333C377Q10	----------
		ANSI 300	333N510P30	333N510Q10	333C374Q10	
4	100	ANSI 150	333N604P30	333N604Q10	333C370Q10	----------
		ANSI 300	333N702P30	333N702Q10	333C375Q10	
6	150	ANSI 150	333N811P30	333N811Q10	333C371Q10	----------
		ANSI 300	333N801P30	333N801Q10	333C378Q10	
8	200	ANSI 150	333N812P30	333N812Q10	333C372Q10	----------
		ANSI 300	333N802P30	333N802Q10	333C379Q10	
10	250	ANSI 150	333N807P30	333N807Q10	333C382Q10	----------
		ANSI 300	333N821P30	333N821Q10	333C514Q10	
12	300	ANSI 150	333N806P30	333N806Q10	333C383Q10	----------
		ANSI 300	333N803P30	333N803Q10	333C513Q10	
½	15	DIN PN 10-40	333C609U01	----------		
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 6-2. PROTECTOR PLATES FOR TEFLON & TEFZEL 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					
		½ (15)	1 (25)	1½ (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 6-3. LINER PROTECTOR/GROUNDING RINGS FOR TEFLON & TEFZEL LINED METERS

Order number consists of two protector plates and mounting screws. 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 6-4. GROUNDING RINGS - SIZES 1/2 THROUGH 4 INCHES

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

Meter Size		Material =	Flange Rating ANSI Class 150		Flange Rating ANSI Class 300	
			316 sst	HAST "C"	316 sst	
Inches	mm	BM No.	Suffix		BM No.	Suffix
½	15	800D508	U01	U09	800D708	U02
1	25	800D508	U02	U10	800D708	U03
1½	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 6-5. GROUNDING RINGS - SIZES 6 THROUGH 12 INCHES

NOTE
Polyurethane, neoprene & hard-rubber lined meters use neoprene gaskets. TEFLON & TEFZEL 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 neoprene gasket
Inches	mm	Part Number	Part Number
6	150	644B009U01	644B009U23
8	200	644B009U03	644B009U25
10	250	644B009U69	644B009U71
12	300	644B009U70	644B009U72

Meter size		Flange Rating ANSI Class 150	Flange Rating ANSI Class 300
		304 sst with TEFLON gasket	304 sst with TEFLON gasket
Inches	mm	Part Number	Part Number
6	150	644B009U02	644B009U24
8	200	644B009U04	644B009U26
10	250	644B021U19	644B021U21
12	300	644B021U20	644B021U22

TABLE 6-6. CONVERTER BASE AND JUNCTION BOX GASKETS

Integrally mounted Converter	
Converter Base Gasket	D333F021U01
Large Cover Gasket	D101A009U01
Small Cover Gasket	D333F004U01

Remotely mounted Converter	
Junction Box Base Gasket	D333F021U01
Base to Spacer Gasket	D333F009U01
Spacer to Cover Gasket	D333F008U01

Continuous Submergence Converter	
Cover O-Ring	101A820U01

TABLE 6-7. HARDWARE

Description	Integral Converter	Remote Converter
Cover Mounting Screws	----------	09G114AU20 - Qty. 4
Large Cover Mounting Screws	09J114AU20 - Qty. 4	----------
Small Cover Mounting Screws	22J114AU20 - Qty. 2	----------

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