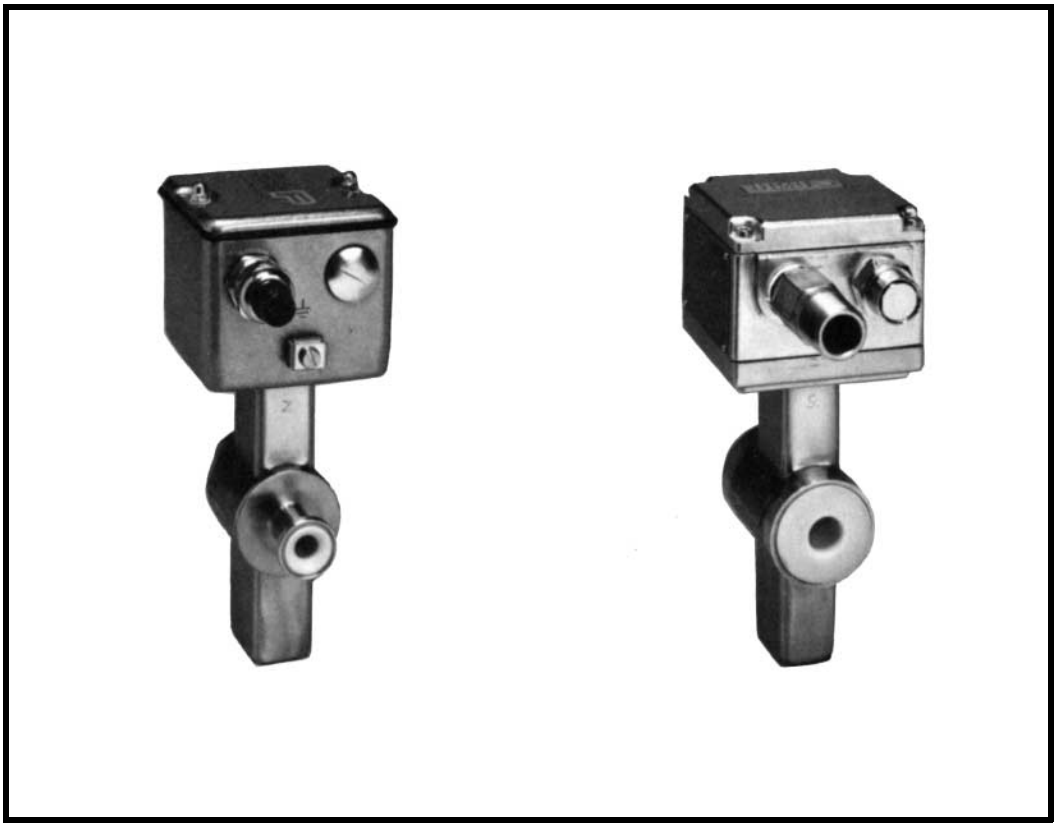
INSTRUCTION BULLETIN

MAGNETIC FLOWMETERS
DM21 / DS21 Design Level A
Sizes 3/8 through 4 Inches

STAINLESS STEEL MAGNETIC FLOWMETERS



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TEFZEL®

The following is a trademark of Haynes International Incorporated:

HASTELLOY™

The following is a registered trademark of the HART Communication Foundation:

HART®

The following is a registered trademark of Tri-Clover Incorporated:

TRI-CLAMP®

TRI-CLAMP accessories shown on the cover are not supplied as part of the meter.

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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Table of Contents

Figure List

Table List

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 equipment being returned to ABB Inc. 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 ABB Inc. for authorization prior to returning equipment.

INSTRUCTION MANUALS. Do not install, maintain or operate this equipment without reading, understanding and following the proper ABB Inc. 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

All flowmeters and/or signal converters being returned to the factory 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. (pg. 5-1)

Equipment powered by an AC line voltage presents a potential electric shock hazard. Servicing of the flowmeter ot signal converter should only be attempted by a qualified electronics technician. (pg. 5-2)

Equipment that operates from AC line voltage constitutes a potential electric shock hazard to the user. Make certain that the system power is disconnected before making the following ohmmeter checks. (pg. 5-3)

SPECIFIC CAUTIONS

Some of the shields in the interconnection cable contain active voltages, that is, the shields are not necessarily grounded. For this reason, shields should not be permitted to contact other shields, or the housing of the flowmeter or signal converter. Good wiring practice dictates that the insulated center conductor of shielded cables should be trimmed to 1½ inches and excessive amounts of cable should not be stuffed into the junction box. Failure to adhere to these requirements may result in the flowmeter/signal converter system being inoperative. (pg. 2-11)

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 Inc. 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 Inc. 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 Fischer & Porter, 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

Tout débitmètre et(ou) convertisseur retourné à ABB Inc. 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 Inc. pour autorisation avant renvoi du matériel. (pg. 5-1)

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. 5-2)

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 5-3)

SPÉCIFIQUES ATTENTIONS

Certains des boucliers dans le câble d'interconnexion contiennent des tensions actives, c.-à-d., les boucliers ne sont pas nécessairement fondus. Pour cette raison, des boucliers ne devraient pas être autorisés pour entrer en contact avec d'autres boucliers, ou le logement du convertisseur de débitmètre ou de signal. La bonne pratique en matière de câblage dicte que le conducteur central isolé des câbles protégés devrait être équilibré à 1 pouces et des quantités excessives de câble ne devraient pas être bourrées dans la boîte de jonction. Le manque d'adhérer à ces conditions peut avoir comme conséquence le système de convertisseur de flowmeter/signal étant inopérant. (pg. 2-11)

READ FIRST

WARNING

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

RETURN OF EQUIPMENT
All Flowmeters and/or Signal Converters being returned to ABB for repair must be free of any hazardous materials. A Material Safety Data Sheet (MSDS) for all process liquids must accompany returned equipment. Contact ABB for authorization prior to returning equipment.

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

1.0 INTRODUCTION

1.1 General

1.1.1 Description

The Model DM21 or Model DS21 Flowmeter is a compact, volumetric, liquid flow rate detector that uses the characteristic of a conductive liquid generating an induced voltage when flowing through a magnetic field to develop process flow information. The amplitude of the voltage produced is directly proportional to the flow rate of the metered liquid.

Being a completely obstructionless metering instrument, the Model DM21 or DS21 Flowmeters 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 obstruction-less 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 typically have no effect on the measurement accuracy of the flowmeter. Metering limitations are confined to a minimum thresh-old 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 is remotely mounted.

The signal converter also contains a magnet driver unit that is used to power the meter's magnet coils. The DM21 uses the steady bipolar-state DC magnetic field principle, referred to as the MAG-X® design concept. This provides optimum zero point stability at an optimized drive frequency. The DS21 operates on an AC magnetic field excitation principle.

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

1.1.2 Construction

The Model DS21 or DM21 Flowmeters consist of a stainless steel pipe spool which serves as a meter body. A pair of flat magnet coils are mounted internally on opposite sides of the meter housing. Permeable iron straps and pole pieces focus the magnetic field generated by the coils and provide a flux return path.

An insulating liner of either PTFE or PFA TEFLON® is inserted into the spool and turned-out against the flange faces. Two electrodes are mounted diametrically opposite within the spool of the meter body and are insulated from the meter body. The exposed end of the electrodes are in contact with the liquid to be metered.

The flowmeter is available in three configurations:

1. Wafer design for mounting between pipeline flanges
2. US TRI-CLAMP® for sanitary piping applications
3. US TRI-CLAMP® Pharmaceutical for sanitary piping applications

1.1.3 EEPROM Data

For DM21 Primaries used with an M2 Converter, the calibration data of the Primary is electronically stored in an EEPROM located in the associated M2 Converter. This EEPROM is specific to an individual Primary and must be installed in conjunction with the Converter for proper operation. DM21 Primaries and associated remote M2 Converters are available either as calibrated systems or individually as spare parts.

When the DM21 Primary is calibrated as a system, the EEPROM is already installed in the remote M2 Converter and the Converter only needs to have power applied to begin operating.

If a DM21 Primary is supplied as a separate spare part for a system used with an M2 Converter, all calibration information about that Primary is stored in the EEPROM supplied with the Primary. The **new** EEPROM is stored in the terminal compartment of the Primary and must be used to replace the **old** EEPROM in the M2 Converter. For detailed information on replacing and installing the EEPROM, refer to Section 7.3.1 in the M2 Converter Instruction Bulletin.

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 as follows:

1.2 Model Number Breakdown - Model DM21

DM21	_	_	__	S	_	_	_	S	_	2	E	A	_	1	_
Engineering Reference															
Process Connection															
Wafer	W														
US Tri-Clamp	X														
US Tri-Clamp, Pharmaceutical	Y														
Liner Material															
PFA		P													
PTFE		T													
Meter Size															
3/8 in. (DN10) [Pharmaceutical Only]			10												
1/2 in. (DN15)			15												
1 in. (DN25)			25												
1 1/2 in. (DN40)			40												
2 in. (DN50)			50												
3 in. (DN80)			80												
4 in. (DN100)			1H												
Signal / Grounding Electrode															
316 Stainless Steel / None				S											
Pressure Rating															
ANSI Class 150					P										
Tri-Clamp					C										
Process Connection Material															
None						0									
304 SST						6									
Design (Special Options)															
SST Conn. Box, 3-A Approval							C								
SST Conn. Box, Standard							W								
Temperature Range															
Standard, ≤ 130°C w/ M2 Converter								S							
Standard, ≤ 130°C w/ XM1000N Converter								M							
Certifications															
None									A						
3-A Construction									S						
Enclosure Classification															
Accidental Submergence; IEC529, IP67, NEMA 4X, 33 ft. H_2O/48 hrs. (10 m H_2O/48 hrs.)										2					
Identification Tag															
English											E				
Design Level												A			
Gasket Material															
PTFE													A		
Food Grade O-Ring													B		
Electrode Design															
Standard														1	
Excitation Frequency															
6 1/4, 7 1/2 Hz															3
12 1/2, 15 Hz															4

1.2 Model Number Breakdown - Model DS21

DS21	_	_	__	S	_	_	_	S	_	2	E	A	_	1	_
Engineering Reference															
Process Connection															
Wafer	W														
US Tri-Clamp	X														
US Tri-Clamp, Pharmaceutical	Y														
Liner Material															
PFA		P													
PTFE		T													
Meter Size															
3/8 in. (DN10) [Pharmaceutical Only]			10												
1/2 in. (DN15)			15												
1 in. (DN25)			25												
1 1/2 in. (DN40)			40												
2 in. (DN50)			50												
3 in. (DN80)			80												
4 in. (DN100)			1H												
Signal / Grounding Electrode															
316 Stainless Steel / None				S											
Pressure Rating															
ANSI Class 150					P										
Tri-Clamp					C										
Process Connection Material															
None						0									
304 SST						6									
Design (Special Options)															
SST Conn. Box, 3-A Approval							C								
SST Conn. Box, Standard [N/A for W or X Process Connec.]							W								
Temperature Range															
Standard, ≤ 130°C								S							
Certifications															
None									A						
3-A Construction									S						
Enclosure Classification															
Accidental Submergence; IEC529, IP67, NEMA 4X, 33 ft. H_2O/48 hrs. (10 m H_2O/48 hrs.)										2					
Identification Tag															
English											E				
Design Level												A			
Gasket Material															
PTFE													A		
Food Grade O-Ring													B		
Electrode Design															
Standard														1	
Excitation Frequency															
50 Hz															1
60 Hz															3

1.3 Specifications

Power Requirements Refer to signal converter instruction bulletin.

Flowmeter Characteristics

TABLE 1-1. METER CAPACITY VALUES

Meter Size		Meter Capacity*	Flow Ranges 0 to any flow rate between min. and max.			
			Minimum		Maximum	
inch	mm	gpm	gpm	L/min	gpm	L/min
3/8	10	11.8877	0.6	2.25	11.8	45.0
1/2	15	26.4172	1.33	5.0	26.4	100.0
1	25	52.8344	2.65	10.0	52.8	200.0
1 1/2	40	158.503	7.93	30.0	158.0	600.0
				m^3/h		m^3/h
2	50	264.172	1.33	3.0	264.0	60.0
3	80	792.516	39.7	9.0	792.0	180.0
4	100	1056.68	52.9	12.0	1056.0	240.0

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

Span Factory set at specified range between values listed in Table 1-1; can be field adjusted.

System Accuracy Refer to signal converter instruction bulletin.

Converter Type	Typical Pulse Output Accuracy	
	Standard	System Calibration
50XM1000N	±0.5% of rate	±0.25% of rate
M2	±0.5% of rate	±0.25% of rate
50SM1000	±1.0% of rate	-----

Environmental Limits

Vibration 1.5 g for 10 to 150 Hz

Ambient Temperature -13^o F to 140^o F (-25^o C to 60^o C)

Process Limits

Temperature	-40° F to 266° F (-40° C to 130° C)
Pressure at 266° F (130° C)	Wafer meters: 4.0 MPa (40 Bar/580 psig) TRI-CLAMP: 1.0 MPa (10 Bar/145 psig)
Vacuum	0 psia (0 Bar) at 266° F (130° C)
Conductivity	5 µS/cm minimumfor DM21 20 µS/cm minimumfor DS21

Physical Characteristics

Outline Dimensions	See Figures 2-1 through 2-6.

Signal Cable for Remote Signal Converter

Standard Length	30 feet (9 m)
Optional Length	250 feet (90 m) max. in increments of 10 feet, 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
Process Connections	304 SST
Meter Housing	304 SST
Interconnection Junction Box	304 SST

Flowmeter Enclosure Ratings

Accidental Submergence	NEMA 4X, IEC 529 IP67, 33 feet H_2O/48 h (10 m H_2O/48 h)
Conduit Connections	1/2" NPT conduit fittings.
Certifications	Refer to Section 1.2 Model Number Breakdown.

2.0 INSTALLATION

2.1 Inspection

All Model DM21 or DS21 Flowmeters are shipped in heavy duty containers which are specially designed to provide adequate protection during transit. Since the 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 signal converter.

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 Location

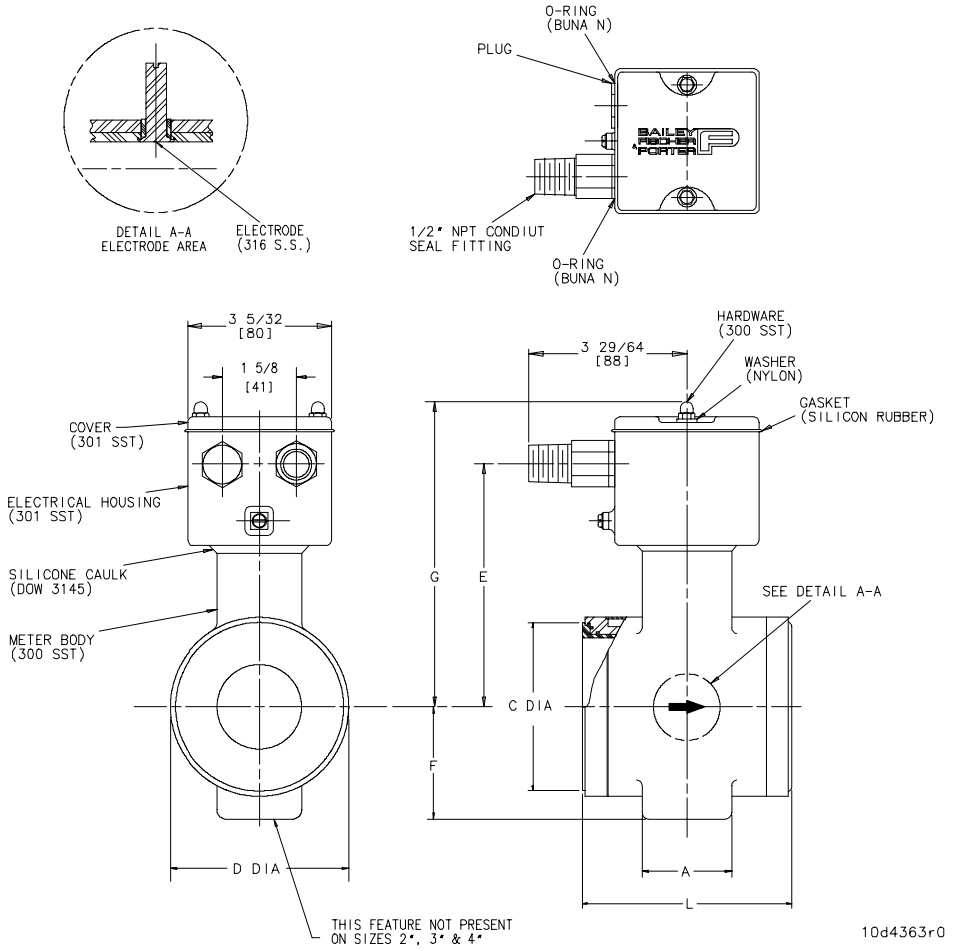
The flowmeter is suitable for either indoor or outdoor installation. When selecting the installation site, consideration should be given to the specifications stated in Sub-Section 1.3.

It is recommended that the flowmeter **not** be installed within the immediate proximity of heavy induction equipment.

Access for wiring interconnections should be considered when installing the flowmeter. Outline dimensions of the flowmeters are given in Figures 2-1 through 2-6.

Outline dimensions of the remotely mounted signal converter are given in the instruction bulletin supplied with the signal converter.

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



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 A THIRD ANGLE PROJECTION AS SHOWN.
4) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
5) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
6) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/-1/8 (3).

METER SIZE	A	C DIA	D DIA	E	F	G	L
1/2 [15]	1-15/32 [37]	1-5/8 [42]	1-25/32 [45]	4-1/4 [108]	2-7/16 [62]	5-3/16 [135]	2-11/16 [68]
1 [25]	2-1/8 [54]	2-5/16 [59]	2-15/32 [63]	4-11/16 [119]	2-7/8 [73]	5-3/4 [146]	3-17/32 [90]
1-1/2 [40]	2-5/8 [67]	3-1/32 [77]	3-7/32 [82]	5-1/32 [128]	3-7/32 [82]	6-1/8 [155]	4-1/16 [103]
2 [50]	—	3-3/4 [95]	3-15/16 [100]	5-11/32 [136]	1-31/32 [50]	6-13/32 [163]	4-5/8 [117]
3 [80]	—	5-1/32 [128]	5-1/4 [133]	6-3/16 [157]	2-5/8 [66.5]	7-1/4 [184]	4-1/16 [103]
4 [100]	—	6-3/32 [155]	6-5/16 [160]	6-15/16 [176]	3-5/32 [80]	8 [203]	5-1/4 [133]

FIGURE 2-1. OUTLINE DIMENSIONS, STANDARD WAFER DESIGN w/3A CONNECTION BOX [MODELS DM21W/DS21W]

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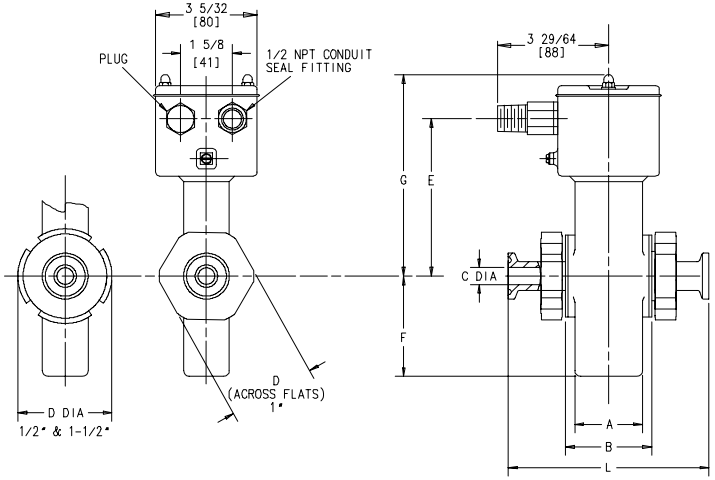
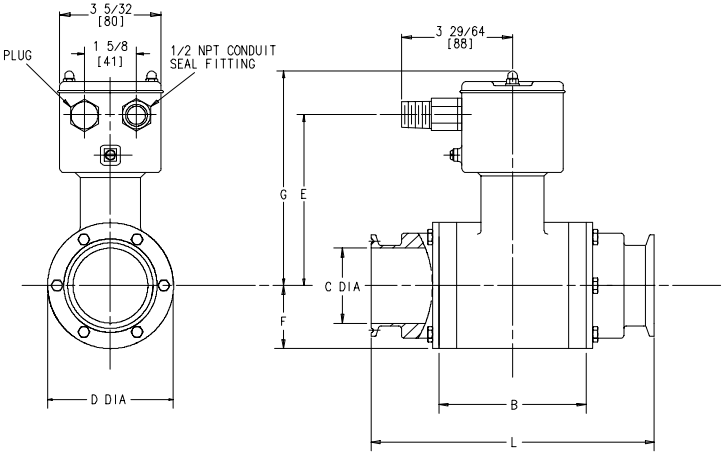
4) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
5) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
6) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/-1/8 (3).



SIZES 1/2" - 1-1/2"

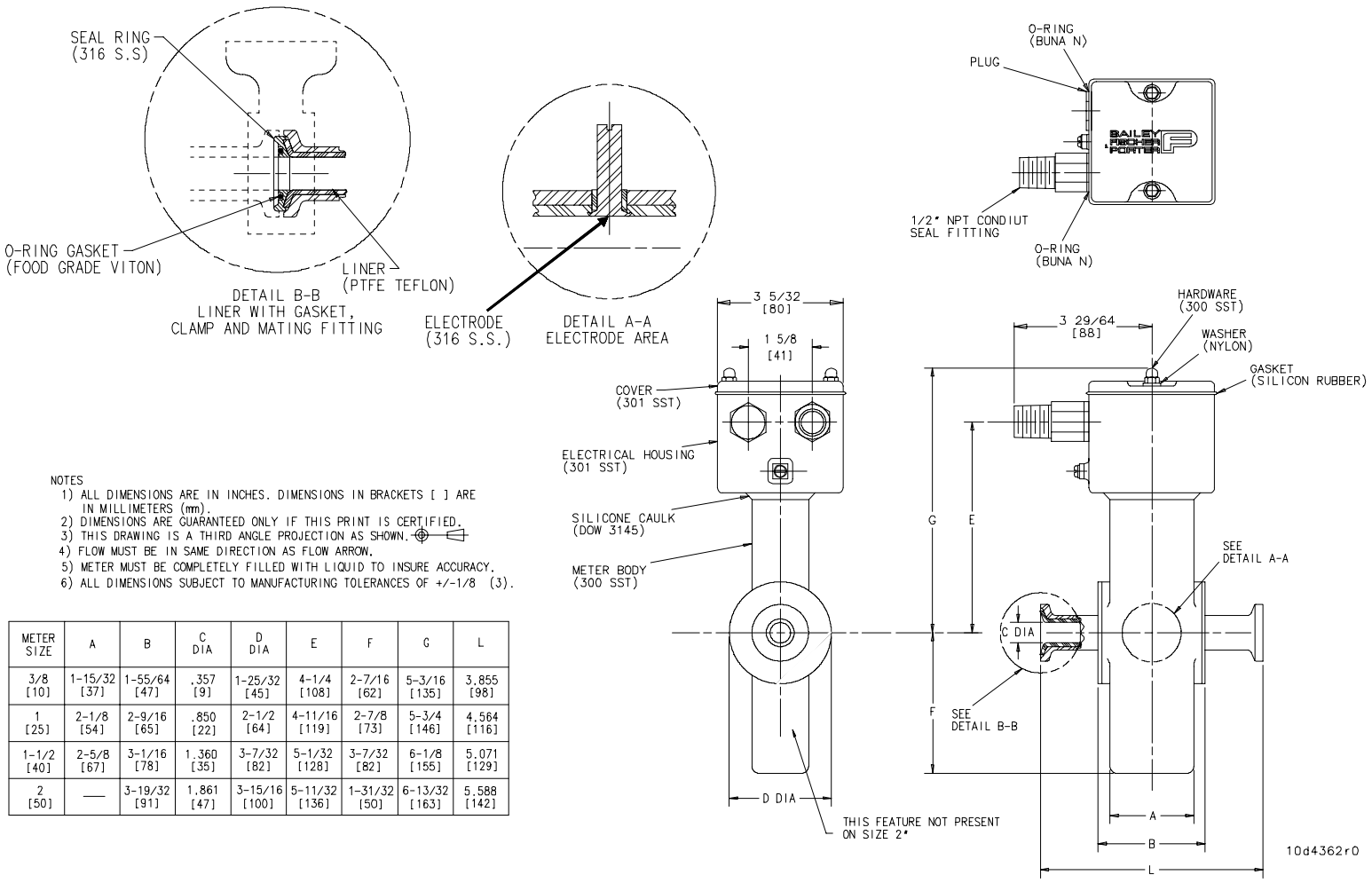


SIZES 2" - 4"

10d4361r0

METER SIZE	A	B	C DIA	D	E	F	G	L
1/2 [15]	1-15/32 [37]	2 [51]	.375 [10]	1-23/32 [44]	4-1/4 [108]	2-7/16 [62]	5-3/16 [135]	6.444 [164]
1 [25]	2-1/8 [54]	2-5/8 [67]	.856 [22]	2-15/16 [75]	4-11/16 [119]	2-7/8 [73]	5-3/4 [146]	7.583 [193]
1-1/2 [40]	2-5/8 [67]	3-5/32 [80]	1.356 [35]	3-1/16 [78]	5-1/32 [128]	3-7/32 [82]	6-1/8 [155]	8.449 [215]
2 [50]	—	5-1/32 [128]	1.865 [47]	3-15/16 [100]	5-11/32 [136]	1-31/32 [50]	6-13/32 [163]	8.403 [213]
3 [80]	—	4-1/2 [114]	2.856 [73]	5-1/4 [133]	6-3/16 [157]	2-5/8 [66.5]	7-1/4 [184]	9.094 [231]
4 [100]	—	5-21/32 [144]	3.810 [97]	6-5/16 [160]	6-15/16 [176]	3-5/32 [80]	8 [203]	10.248 [260]

FIGURE 2-2. OUTLINE DIMENSIONS, US TRI-CLAMP w/ 3A CONNECTION BOX [MODELS DM21X/DS21X]



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

METER SIZE	A	B	C DIA	D DIA	E	F	G	L
3/8 [10]	1-15/32 [37]	1-55/64 [47]	.357 [9]	1-25/32 [45]	4-1/4 [108]	2-7/16 [62]	5-3/16 [135]	3.855 [98]
1 [25]	2-1/8 [54]	2-9/16 [65]	.850 [22]	2-1/2 [64]	4-11/16 [119]	2-7/8 [73]	5-3/4 [146]	4.564 [116]
1-1/2 [40]	2-5/8 [67]	3-1/16 [78]	1.360 [35]	3-7/32 [82]	5-1/32 [128]	3-7/32 [82]	6-1/8 [155]	5.071 [129]
2 [50]	—	3-19/32 [91]	1.861 [47]	3-15/16 [100]	5-11/32 [136]	1-31/32 [50]	6-13/32 [163]	5.588 [142]

FIGURE 2-3. OUTLINE DIMENSIONS, US TRI-CLAMP PHARMACEUTICAL w/ 3A CONNECTION BOX [MODELS DM21Y/DS21Y]

NOTES
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METER SIZE	A	B	C DIA	D DIA	E	F	G	L
3/8 [10]	1-15/32 [37]	1-55/64 [47]	.357 [9]	1-25/32 [45]	3-11/32 [85]	2-7/16 [62]	4-3/8 [111]	3.855 [98]
1 [25]	2-1/8 [54]	2-9/16 [65]	.850 [22]	2-1/2 [64]	4-1/16 [108]	2-7/8 [73]	5-1/8 [130]	4.564 [116]
1-1/2 [40]	2-5/8 [67]	3-1/16 [78]	1.360 [35]	3-7/32 [82]	4-13/32 [122]	3-7/32 [82]	5-27/32 [148]	5.071 [129]
2 [50]	—	3-19/32 [91]	1.861 [47]	3-15/16 [100]	5-1/4 [133]	1-31/32 [50]	6-1/4 [159]	5.588 [142]

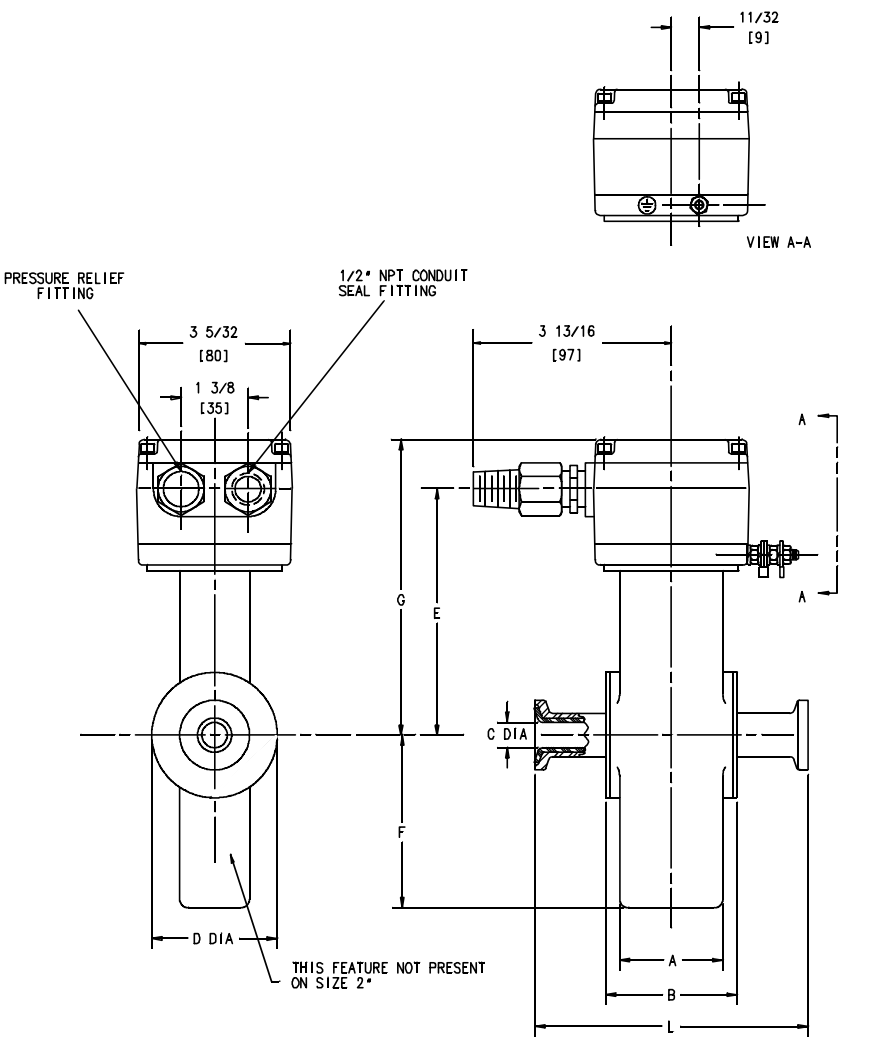


FIGURE 2-4. OUTLINE DIMENSIONS, US TRI-CLAMP PHARMACEUTICAL w/ STANDARD CONNECTION BOX [MODELS DM21Y/DS21Y]

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 A THIRD ANGLE PROJECTION AS SHOWN.
4) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
5) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
6) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/-1/8 (3).

METER SIZE	A	C DIA	D DIA	E	F	G	L
1/2 [15]	1-15/32 [37]	1-5/8 [42]	1-25/32 [45]	3-11/32 [85]	2-7/16 [62]	4-3/8 [111]	2-11/16 [68]
1 [25]	2-1/8 [54]	2-5/16 [59]	2-15/32 [63]	4-1/16 [108]	2-7/8 [73]	5-1/8 [130]	3-17/32 [90]
1-1/2 [40]	2-5/8 [67]	3-1/32 [77]	3-7/32 [82]	4-13/16 [122]	3-7/32 [82]	5-27/32 [148]	4-1/16 [103]
2 [50]	—	3-3/4 [95]	3-15/16 [100]	5-1/4 [133]	1-31/32 [50]	6-1/4 [159]	4-5/8 [117]
3 [80]	—	5-1/32 [128]	5-1/4 [133]	6-1/32 [153]	2-5/8 [66.5]	7-1/32 [180]	4-1/16 [103]
4 [100]	—	6-3/32 [155]	6-5/16 [160]	6-13/16 [173]	3-5/32 [80]	7-27/32 [199]	5-1/4 [133]

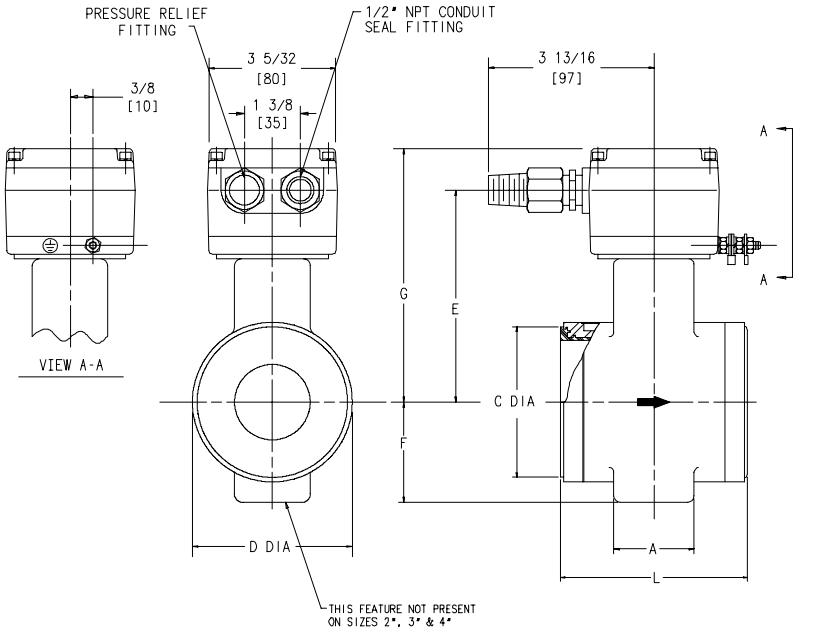
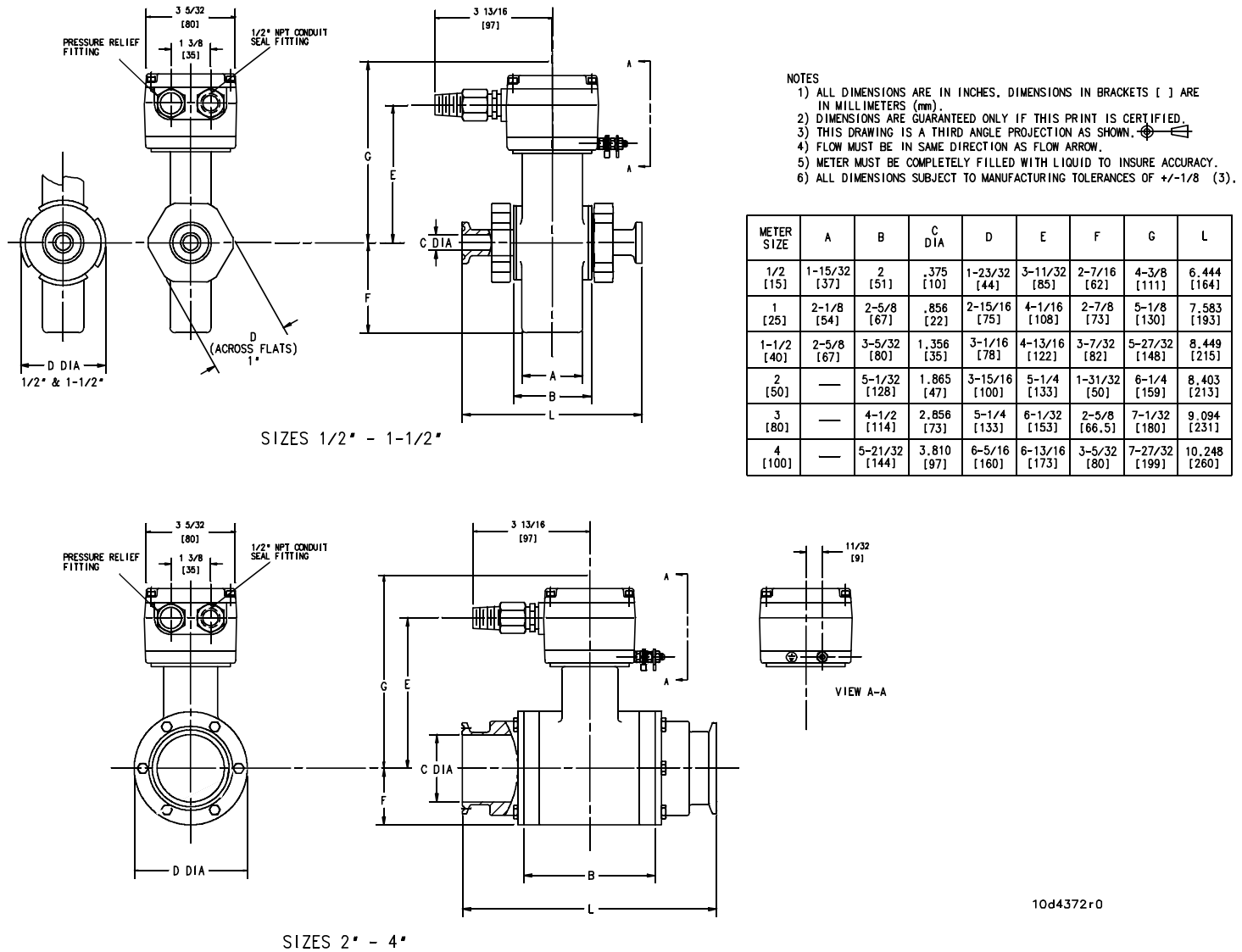


FIGURE 2-5. OUTLINE DIMENSIONS, STANDARD WAFER DESIGN w/ STANDARD CONNECTION BOX [MODEL DM21W]



METER SIZE	A	B	C DIA	D	E	F	G	L
1/2 [15]	1-15/32 [37]	2 [51]	.375 [10]	1-23/32 [44]	3-11/32 [85]	2-7/16 [62]	4-3/8 [111]	6.444 [164]
1 [25]	2-1/8 [54]	2-5/8 [67]	.856 [22]	2-15/16 [75]	4-1/16 [108]	2-7/8 [73]	5-1/8 [130]	7.583 [193]
1-1/2 [40]	2-5/8 [67]	3-5/32 [80]	1.356 [35]	3-1/16 [78]	4-13/16 [122]	3-7/32 [82]	5-27/32 [148]	8.449 [215]
2 [50]	—	5-1/32 [128]	1.865 [47]	3-15/16 [100]	5-1/4 [133]	1-31/32 [50]	6-1/4 [159]	8.403 [213]
3 [80]	—	4-1/2 [114]	2.856 [73]	5-1/4 [133]	6-1/32 [153]	2-5/8 [66.5]	7-1/32 [180]	9.094 [231]
4 [100]	—	5-21/32 [144]	3.810 [97]	6-5/16 [160]	6-13/16 [173]	3-5/32 [80]	7-27/32 [199]	10.248 [260]

FIGURE 2-6. OUTLINE DIMENSIONS, US TRI-CLAMP w/ STANDARD CONNECTION BOX [MODEL DM21X]

2.3 Mounting

2.3.1 Meter Orientation

The Model DM21 or DS21 MINI-MAG Magnetic Flowmeters may be installed in horizontal, vertical or sloping pipe runs (refer to Figure 2-7). However, precautions must be taken to assure that the meter 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.

The electronic housing of the meter should be **top** oriented for horizontal or sloping installations. If the electronic housing must be **bottom** oriented, vibration must be limited to be within the specifications shown in Section 1.3. Orienting the electronic housing top or bottom aligns the meter electrodes in a lateral plane which eliminates the possibility of entrained air acting as an electrode insulator. An electrode must not be on "top" when the meter is horizontally mounted.

The Magnetic Flowmeter must be oriented in accordance with the direction of process flow, as indicated by the **FLOW** arrow on the meter data tag. Elbows should be located a minimum of three pipe diameters upstream from the meter. Control valves should be located on the downstream side of the meter. Control valves upstream of the meter can create turbulence that result in air pockets and may effect the meter's accuracy or cause its output to be noisy. If for some reason the control valve cannot be located downstream from the meter, a minimum of ten pipe diameters upstream are required between the meter and the control valve. The requirements for control valves also applies to pumps. Pipe diameters are measured from the centerline of the meter to the nearest edge of the device, as shown in Figure 2-7. For higher accuracy requirements, use twice the number of pipe diameters referenced. See Figure 2-7 for recommended piping arrangement.

When the process liquid contains abrasive grit, avoid disturbance upstream of the meter so that the liquid passes smoothly through the meter; elbows and tees can distort the flow pattern causing uneven liner wear.

2.3.2 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. Do not pass any rope or wire sling through the meter liner.

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.

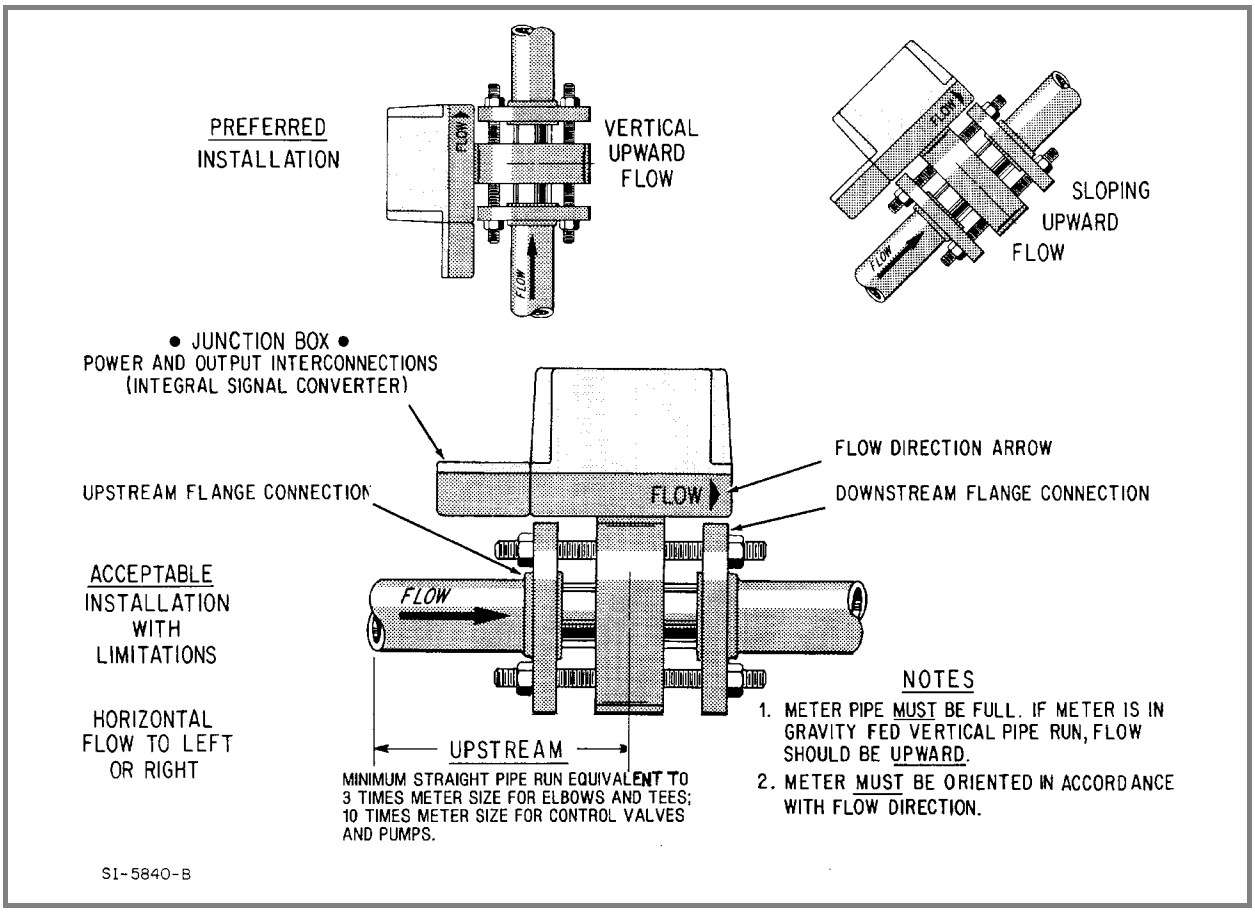


FIGURE 2-7. RECOMMENDED PIPING ARRANGEMENT

2.3.3 Pipe Connections

The flowmeter is available in three configurations:

1. Wafer design for mounting between pipeline flanges.
2. TRI-CLAMP for sanitary piping applications.
3. TRI-CLAMP Pharmaceutical for sanitary piping applications.

In the wafer configuration, the flowmeter is designed for mounting between adjacent pipe flanges. Most commonly used ANSI, BS and DIN type flanges can be accommodated.

Mounting hardware (studs, nuts, gaskets and the flange adaptor device(s) for the particular flange type and rating specified) is supplied for use with common ANSI flanges. Line schedule 80 or lighter pipe is recommended for system piping.

When the Magnetic Flowmeter is to be mounted in an electrically non-conductive pipeline such as totally plastic pipe, or a metal pipeline with an insulating liner, the user must obtain a pair of meter grounding rings (discussed in Section 2.4 Grounding Procedure) to facilitate grounding of the process. Good grounding is effected by bonding the meter body to the process liquid both upstream (inlet end) and downstream (outlet end) of the meter; thereby preventing any stray electrical currents that may be carried by the pipeline, or by the process, from passing through the Magnetic Flowmeter. Improper grounding often results in unsatisfactory meter performance, therefore particular attention should be paid to the meter grounding procedure.

The threaded mounting studs and nuts supplied in the meter installation kit should be well lubricated before use. When the meter has been installed in the pipeline, tighten the nuts in even increments around the flange surface. It is recommended that an open end wrench with a handle length no greater than 8 inches be used for tightening the nuts; i.e., torque should be limited to that which will produce a positive seal without damage to the face of the meter lining.

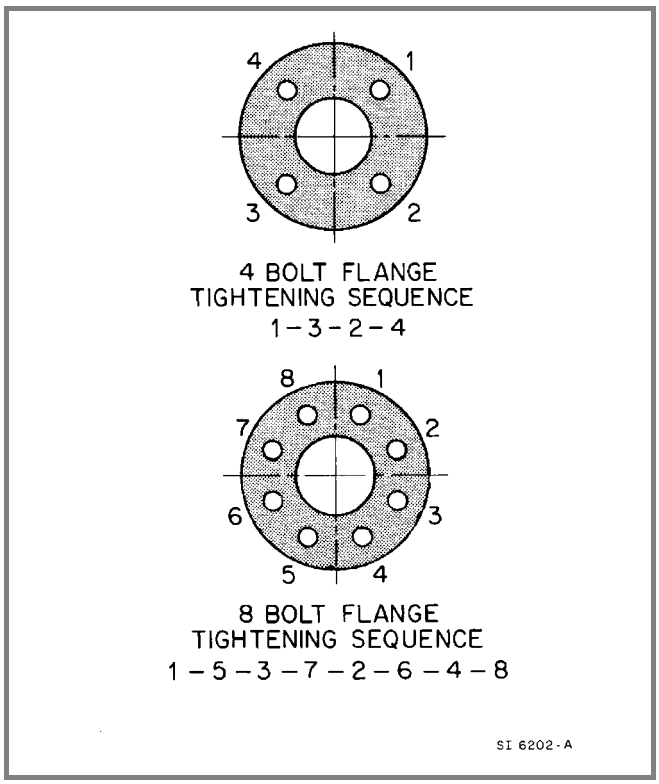


FIGURE 2-8. BOLT TIGHTENING SEQUENCE

NOTE
All 1/10 - 1/2 inch (3 - 15 mm) size Magnetic Flowmeters are supplied for use with 1/2 inch (15 mm) pipe flange.

2.3.4 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 2-1 - 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 /	3/8	10	4 x 1/2x13	6	4 x 1/2-13	7
TEFZEL /	1/2	15	"	"	"	"
	1	25	"	10	"	15
	1-1/2	40	"	15	4 x 3/4-10	25
	2	50	4 x 5/8-11	25	8 x 5/8-11	15
	3	80		40	"	25
	4	100	8 x 5/8-11	35	"	40

TABLE 2-2 - Torque Recommendations (DIN)

Liner Material	Size in.	Size mm	Bolt No. & Size	Max.Torque Rate ft-lb	Max.Torque Rate Nm	PN bar
PTFE/	3/8	10	4 x M12	4.0	5.4	40
TEFZEL	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

2.3.5 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.

CAUTION

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.

2.4 Grounding Procedure

2.4.1 General

Satisfactory operation of the flowmeter system requires that careful attention be paid to proper grounding techniques. A good ground is one that is in contact with the earth over a large conductive area. An example of this is a cold water pipe which is buried in the earth and provides a low resistance connection to earth ground. 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 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 ensures 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 the meter body be connected with a bonding wire to the adjacent pipeline flange. The grounding procedure to use with conductive pipeline is described in Sub-Section 2.4.2.
- 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 Sub-Section 2.4.3.

Proper grounding of the flowmeter is required for satisfactory system performance.

2.4.2 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. The following steps 1 through 3 only apply to wafer meters. Step 4 applies to all style meters. Refer to Figure 2-7 to supplement the following text.

1. Drill and tap a blind hole on the peripheral surface of each of the two adjacent pipeline flanges (see Figure 2-7 inset). These tapped holes should be placed so that they are within easy reach of the bonding straps (2 supplied) attached to the ground lug on the meter housing.

2. Obtain a bright metal surface around the edges of both tapped holes with a file or emery cloth.

3. Clamp the end of each bonding strap to the adjacent pipe flange, using hex head bolts and external tooth lockwashers (supplied by user).

4. The user must supply a grounding wire for connecting the meter grounding post to a good electrical ground. (Number 12 AWG, or heavier, copper wire may be used for this grounding wire.)

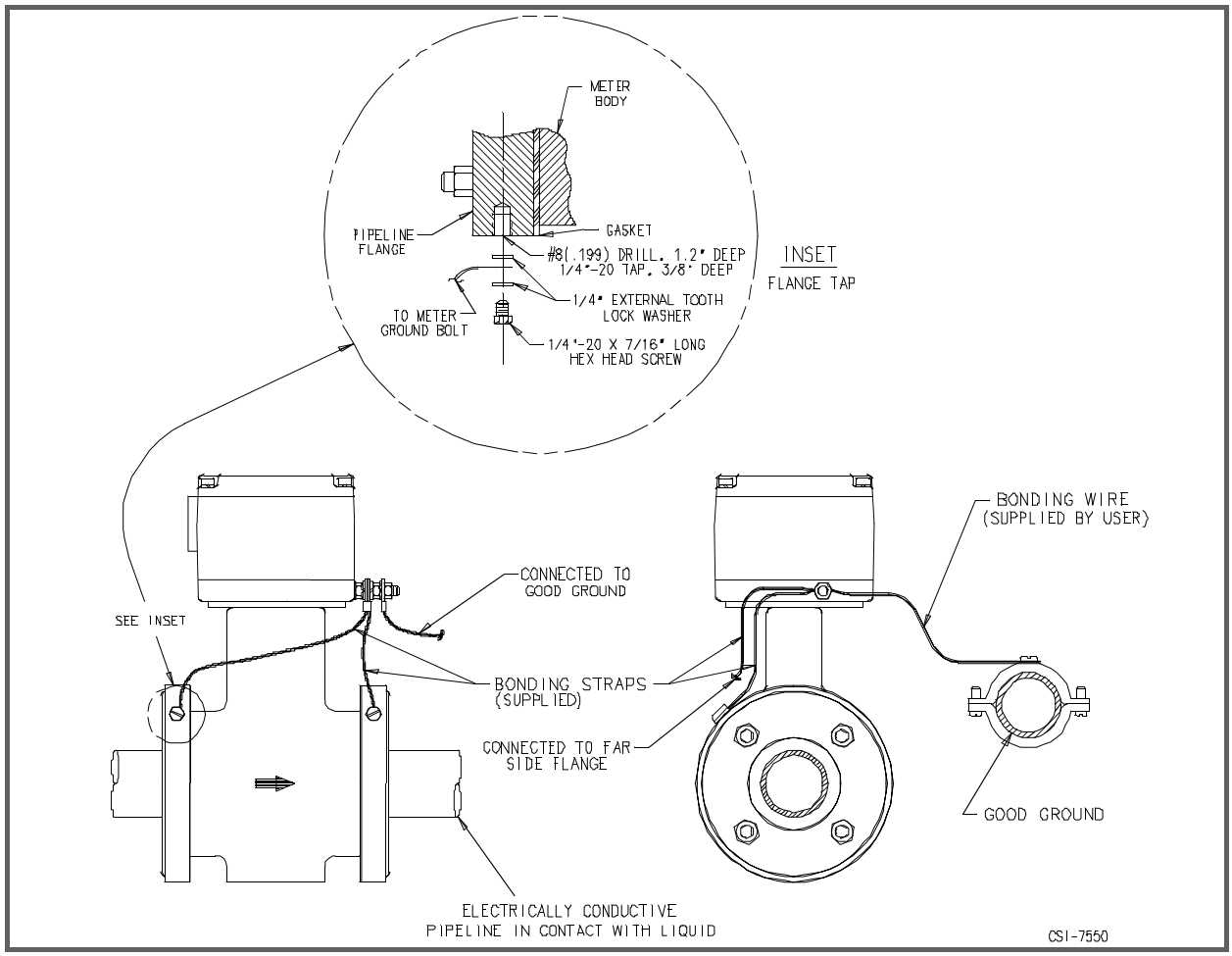


FIGURE 2-9. GROUNDING PROCEDURE, CONDUCTIVE PIPELINE

2.4.3 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 or TEFLON lined pipe), the following grounding procedures apply. The following steps 1 through 3 only apply to wafer meters. Step 4 applies to all style meters. Refer to Figure 2-8 to supplement the following text.

1. Grounding rings are required if the meter is installed in non-conductive or insulated pipe. Grounding rings and gaskets can be ordered from the manufacturer if they were not specified at the time the flowmeter was ordered. Grounding rings are available in various corrosion resistant materials and should be selected to be compatible with the process liquid.

2. When installing the flowmeter in the pipeline, place a grounding ring at both the inlet and outlet connections of the flowmeter. Provide standard gasketing between the face of the meter liner and the grounding ring and the adjacent pipe flange; i.e., four gaskets required. Position the grounding rings in the pipeline so that the two meter bonding straps that are attached to the meter ground post will reach the connection bolt on the grounding rings.

3. Clamp the free end of the two bonding straps to the applicable grounding ring; using the hex head bolt and external tooth lockwasher (supplied with the grounding rings).

4. The user must supply a bonding wire from the meter grounding post to a good electrical ground. Number 12 AWG copper wire (or heavier) may be used for this bonding wire.

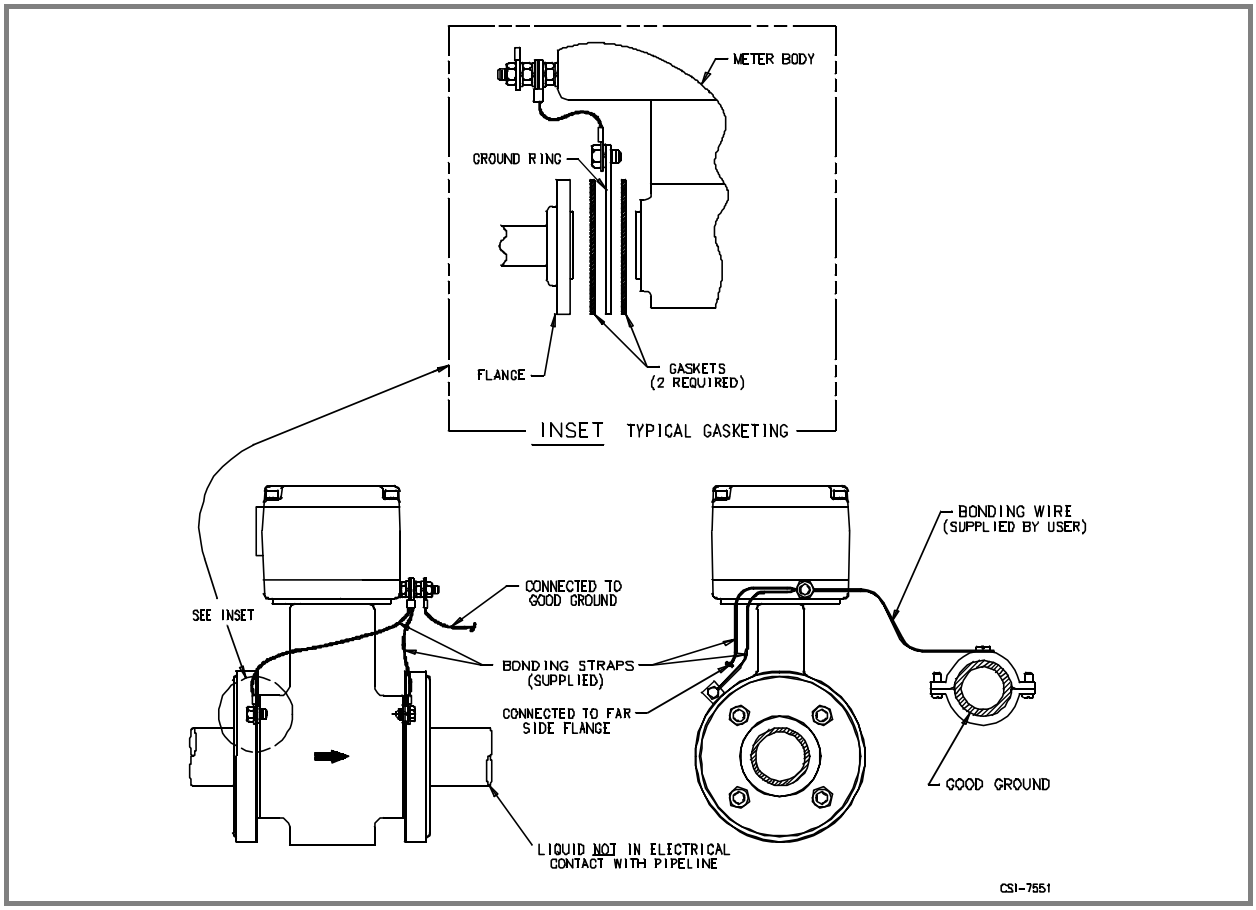


FIGURE 2-10. GROUNDING PROCEDURE, NON-CONDUCTIVE PIPELINE

2.5 Electrical Interconnection

The flowmeter is furnished with a remotely mounted signal converter. Interconnection details are described in the instruction bulletin provided with the signal converter.

Regardless of the interconnection procedure, the grounding procedures given in Section 2.4 must be followed.

CAUTION

Some of the shields in the interconnection cable contain active voltages, that is, the shields are not necessarily grounded. For this reason, shields should not be permitted to contact other shields, or the housing of the flowmeter or signal converter. Good wiring practice dictates that the insulated center conductor of shielded cables should be trimmed to 1½ **i**nches and excessive amounts of cable **should not** be stuffed into the junction box. Failure to adhere to these requirements may result in the flowmeter/signal converter system being inoperative.

2.6 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 to prevent the process fluid from entering the electrical conduit system. This safety feature considers the remote possibility of a primary seal failure, in which case, the secondary seal will prevent the process from entering the electrical conduit system. Unused access ports are sealed with a plug fitting.

It is the user's responsibility to properly install the conduit entry cable seal fitting to insure proper performance of this safety feature. Refer to Figure 2-9.

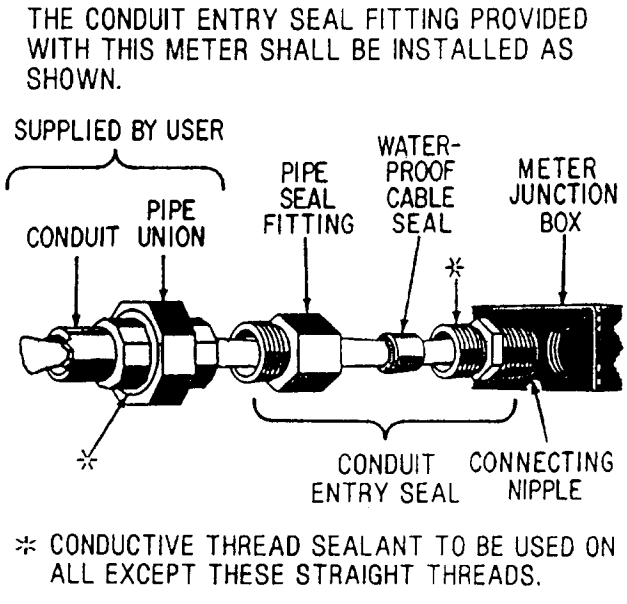


FIGURE 2-11. CONDUIT ENTRY SEAL INSTALLATION

3.0 START-UP and OPERATION

The Model DM21 or DS21 Flowmeters (including the remotely mounted signal converter) are precision calibrated at the factory. Each flowmeter is calibrated to determine its meter capacity at a given velocity. Refer to Table 1-1.

There are no operating controls that require field adjustment unless the full scale range setting was not specified at time of order. 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 flowmeter. 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 flowmeter system by closing the external switch or circuit breaker; there are no switches inside of the flowmeter/signal converter system. 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 bulletin supplied with the signal converter.

4.0 FUNCTIONAL DESCRIPTION

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

The flowmeter provides two output signals to the signal converter:

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

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

4.1 Basic Operating Principle

4.1.1 Signal Voltage Generation

The operating principle of the 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, flowmeter constitutes a modified form of a generator.

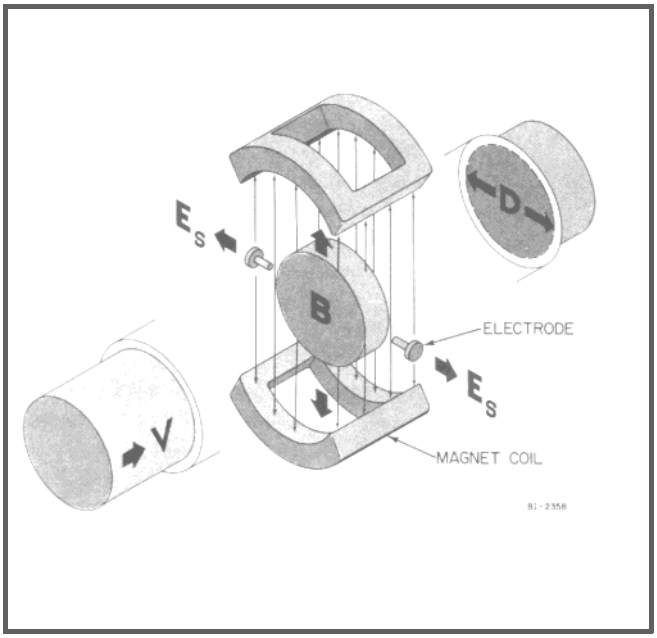


FIGURE 4-1. BASIC OPERATING PRINCIPLE

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

This may be expressed mathematically as:

(Equation #1)

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

where:

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

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

4.1.2 Magnet Coil Drive Circuits

In older conventional flowmeters the integral magnet coils are driven directly by the customer's 50/60 Hz power service. However, the design of the Model DM21 or DS21 Flowmeter uses magnet drive circuits which are alternately energized bi-directionally at a low frequency rate as commanded by the associated converter/driver assembly. This provides maximum zero stability.

4.1.3 Volumetric Flow Rate Measurement

The 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:

$$\therefore \quad Q = \frac{\pi \alpha D}{4} \bullet \frac{E_S}{B}$$

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 ratio of the induced signal voltage to the reference voltage as measured by the flowmeter.

5.0 MAINTENANCE

5.1 General

Except for an occasional performance verification check, there is no required routine maintenance for the Model DM21 or DS21 Flowmeter. The design and construction of the flowmeter is such that repair or replacement of component parts is not feasible. A faulty flowmeter must be replaced in its entirety.

WARNING
All flowmeters and/or signal converters being returned to the factory 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.

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

When communicating with the manufacturer in regard to replacement of a flowmeter or signal converter, it is important to reference 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 flowmeter, and on the instrument data tag.

5.2 System Troubleshooting

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

To supplement the following discussion refer to the applicable signal converter instruction bulletin.

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

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

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

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

2. The user should refer to the instruction bulletin supplied with the signal converter for additional troubleshooting procedures. A static performance test for the flowmeter is discussed in Section 5.3.

3. Possible causes of erroneous flow rate indication are:

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

5.3 Static Test

If improper operation of the 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 terminal board.

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

5.3.1 Flowmeter Coil Check

Turn off the power to the signal converter to de-energize the flowmeter. Remove cable leads M1 and MR/M3 from the customer terminal block. Measure coil series resistance by connecting the ohmmeter between M1 and MR/M3. Readings of either less than 10 ohms or infinity between leads indicate a defective coil. If a coil is defective, the flowmeter must be replaced.

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 perform this check, the flowmeter must be removed from the pipeline and the flowmeter liner must be dry.

1. Disconnect **and identify (tag)** the electrode signal leads, 1 and 2, from the terminal board in the signal converter (or from the terminal board in the base of the flowmeter housing).

2. Place ohmmeter on highest available range (for example: R x 100,000).

3. Connect the ohmmeter "minus" lead to the meter ground stud and the "plus" lead to electrode line 1. This reading should be infinite. If any resistance can be measured, the meter is defective and must be replaced.

4. Check the other electrode by connecting the ohmmeter "plus" lead to line 2. This reading must also be infinite. If any resistance can be measured, the meter is defective and must be replaced.

5. Check continuity of the number 1 electrode circuit by measuring resistance between terminal "1" and the end of one of the electrodes in the meter bore. The resistance should be between 30,000 and 160,000 ohms. Make certain that the electrode end is free of any insulating (process) coating.

6. Check continuity of the number 2 electrode circuit by measuring resistance between terminal "2" and the end of the other electrode in the meter bore. The resistance should be between 30,000 and 160,000 ohms. Make certain that the elelctrode end is free of any insulating (process) coating.

7. If all resistance readings are as they should be, the meter may then be returned to on-stream operation. LINES 1 AND 2 FROM THE RESPECTIVE ELECTRODES MUST BE RECONNECTED TO TERMINALS 1 AND 2 OF THE TERMINAL BOARD. DO NOT INTERCHANGE THESE PROCESS SIGNAL CONNECTIONS.

8. If any one of the resistance readings are not as specified, the flowmeter is defective and must be replaced.

6.0 ACCESSORY PARTS

NOTE
3/8 in. diameter meters are supplied in US Tri-Clamp Pharmaceutical version only and do not require any of the hardware shown below.

6.1 For Models DM21WP & DS21WP (Wafer configuration)

TABLE 6-1. GROUNDING RINGS

Grounding rings are sized for ANSI Class 150 flanges. One part number consists of two grounding rings. When ordering grounding rings, add a suffix from the list in Table 6-1 to the part number. Also specify a quantity of two gaskets from the list in Table 6-2.

Meter Size		Part Number	316 SST	HAST "C"
inches	mm		Suffix	
½	15	800D508...	U01	U09
1	25	800D508...	U02	U10
1½	40	800D508...	U03	U11
2	50	800D508...	U04	U12
3	80	800D508...	U05	U13
4	100	800D508...	U06	U14

TABLE 6-2. GASKETS

Gaskets are sized for ANSI Class 150 flanges. The gasket material is TEFLON

Meter Size		Part Number
inches	mm	
½	15	333J092U01
1	25	333J092U10
1½	40	333J092U15
2	50	333J092U19
3	80	333J092U22
4	100	333J092U29

TABLE 6-3. MOUNTING HARDWARE KIT

A Mounting Hardware Kit Part Number shown in the table consists of stainless steel studs and nuts, centering sleeves (when needed) and TEFLON gaskets.

Meter Size		ANSI Class 150
inches	mm	Part Number
½	15	614C123U01
1	25	614C123U02
1½	40	614C023U35
2	50	614C023U39
3	80	614C123U05
4	100	614C123U06

6.2 For Models DM21XP & DS21XP (Tri-Clamp configuration)

TABLE 6-4. ADAPTER KIT

An Adapter Kit Part Number shown in the table consists of Tri-Clamp pieces, attachment hardware and food-grade O-rings.

Meter Size		Part Number
inches	mm	
½	15	614C147U01
1	25	614C147U02
1½	40	614C147U03
2	50	614C147U04
3	80	614C147U05
4	100	614C147U06

6.3 For Models DM21Y & DS21Y (Tri-Clamp Pharmaceutical config.)

TABLE 6-5. REPLACEMENT PARTS

Meter Size		Gasket (2 Req'd)	O-Ring (2 Req'd)
inches	mm		
⅜	10	333D018U02	102E077U59
1	25	333D018U06	102E077U57
1½	40	333D018U01	102E077U62
2	50	333D018U03	102E077U58

CUT ALONG LINE, FOLD, STAPLE

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