

INSTRUCTION MANUAL

WEDGEMETER II WM Series

WM Series WedgeMeters



PN25110

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

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

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WARNING

POSSIBLE PROCESS UPSETS

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

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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 Instrumentation 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 Instrumentation for authorization prior to returning equipment.

INSTRUCTION MANUALS

Do not install, maintain or operate this equipment without reading, understanding and following the proper ABB Instrumentation 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

Never exceed the maximum pressure or temperature recommended for the measured process. Exceeding proper pressure or temperature ratings can lead to personal injury or equipment damage. The process piping flanges for installation should be identical as called out in the serial number on the data plate. The process temperature and pressure should never exceed the ratings for the element stamped on the data plate. (pg. 2-3)

Process pressure and material retained in the flow element can cause injury and damage to the equipment. Standard plant safety procedures must be followed when removing the element from service. (pg. 4-1)

READ FIRST

WARNING

INSTRUCTION MANUALS

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

RETURN OF EQUIPMENT

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

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

Contacting the Factory . . .

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

Telephone:

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

E-Mail:

ins.techsupport@us.abb.com

1.0 INTRODUCTION

1.1 Description

WEDGE™ Flow Elements utilize V-shaped restrictions to produce a square root relationship between differential pressure and volumetric flow. Elements are designed for either clean or dirty service and are offered in various materials, pipe sizes, and pressure ratings. The differential pressure is measured by a differential pressure transmitter. Various connections on the WEDGE are provided for either pneumatic or electronic differential pressure transmitters or other differential pressure sensing devices. Calibrated elements are optional and are supplied with a factory calibration report, including calculations for the user's process when such data is supplied.

The differential pressure measurement can be related to volume flow rate by using either a calibration curve for the specific element or a standard flow equation applying to all WEDGE flow elements. A calibration report based on a flow laboratory calibration is supplied with the element when specified on the order. Refer to **3.2 Accuracy** and **3.3 Flow Equations**.

The WEDGE elements are available with six different standard WEDGE ratios to provide the required differential pressures over a wide range of flow rates. The WEDGE ratio is defined as H/D where H is the WEDGE opening height and D is the nominal pipe diameter.

The WEDGE restriction is V-shaped at an optimum angle to give the best possible characteristics when measuring viscous fluids. The element will handle applications where the pipe Reynolds number is as low as 500 (well into the laminar flow zone) and as high as several million. This makes the element well suited to gas or steam flow measurement.

The area of unrestricted flow of the wedgometer is determined by different Height/Diameter ratios thus defining the differential range produced with respect to the fluid flow range. This H/D ratio equals the height of the opening under restriction divided by the internal pipe diameter.

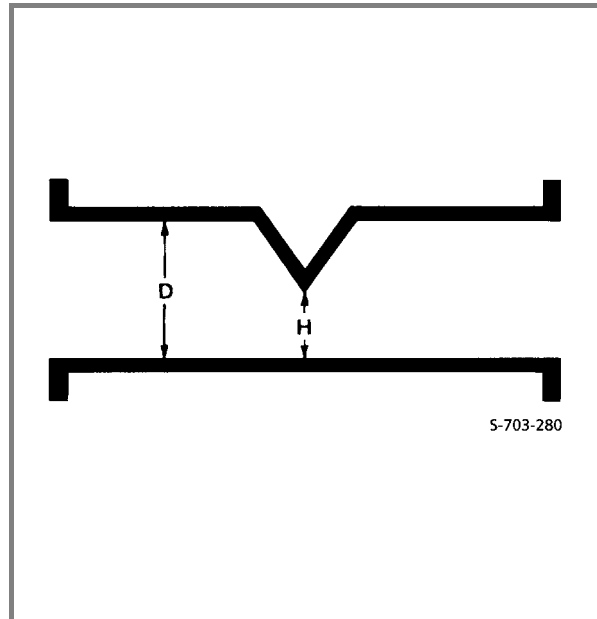


FIGURE 1-1. WEDGE ELEMENT CROSS-SECTION VIEW

1.1.1 WM Series

1.1.1.1 Model WMP - Clean Service

The WMP WEDGE Flow Element offers in-line mounting in a flanged style body with internal NPT taps for the connection of transmitter impulse lines. This model is well suited for gas and steam applications as well as clean liquids. Refer to Specification Sheet **D-FW-Wedge_CFP** for physical and performance specifications and ordering information.



**FIGURE 1-2. Model WMP
Wedgemeter**

1.1.1.2 Model WMC, WMF - Dirty Service

These WEDGE Flow elements are offered in a flanged body style and are designed for use with remote seal pressure transmitters. Application of this model is recommended for use on difficult to measure slurries and fluids with high solid content that are prone to plugging or have high erosion factors. In addition, these models may also be used where it is necessary to contain hazardous materials within the process piping or where process temperatures exceed the limits of a conventional direct-connect transmitter. Remote seal connections are offered in both WMF flanged and WMC chemical tee type seal design. Selection of the seal design is typically based on process conditions. The WMF is generally suited for fluids with a high solid content and abrasive properties since the seal is raised up and eliminates erosive effects of the process on the diaphragm surface. The WMC chemical tee type is more suited for processes that tend to plug since the diaphragm face is flush with the pipe ID, and allows free passage of materials without buildup in the seal area. Refer to Specification Sheet **D-FW-Wedge_CFP** for physical and performance specifications and ordering information.



**FIGURE 1-3. Model WMC
Wedgemeter**



**FIGURE 1-4. Model WMF
Wedgemeter**

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1.2 Model Number Breakdown

Refer to the equipment data sheet or data tag on the equipment for the model number of the instrument furnished. The information contained on the data tag includes the model number and a sequential serial number. The model number describes the construction of the instrument. An X after the model number indicates that the instrument has been built to meet a customer's special requirements. The details of a specific model number are explained on the following pages.

1.2.1 Series WM Model Numbering

	WM	-	-	-	-	-	-	-	-	-	-	-	-	-
Base Number														
Transmitter Connection														
Chem Tee														
3" Flanged														
Pipe Tap														
Pipe Size - inches (mm)														
1/2 (13)														05
1 (25)														01
1-1/2 (38)														15
2 (51)														02
3 (76)														03
4 (102)														04
6 (152)														06
8 (203)														08
10 (254)														10
12 (305)														12
14 (356)														14
16 (406)														16
18 (457)														18
20 (508)														20
24 (610)														24
H/D Ratio														
0.2														2
0.3														3
0.4														4
0.5														5
0.6														6
0.7														7
Material														
Carbon Steel														1
316/316L														2
Hastelloy														3
Monel														4
Flange Rating														
None														0
ANSI 150														1
ANSI 300														2
ANSI 600														3

NOT TO BE USED FOR ORDERING PURPOSES. REFER TO SPECIFICATION SHEET FOR VALID COMBINATIONS

1.2.1 Series WM Model Numbering (Cont.)

<u>WM</u> - - - - -	-	-	-	-	-	-	-
Flange Style							
RFSO Std. Face	A						
RFWN Std. Face	B						
Pipe Schedule							
STD		1					
XS		2					
Hydro Testing							
Hydro w/o Certificate			1				
Hydro with Certificate			2				
Material Certificate							
None				0			
Mat'l Certs				1			
PMI				2			
Mat'l Certs & PMI				3			
Welding Std.							
ASME B31.3 Normal Service					B		
ASME B31.3 Cyclic Service					C		
ASME B31.3 Category D Service					D		
ASME B31.3 Category M Service					M		
PED B3.1 SEP Level					P		
PED B3.1 Category I Module A					R		
NDE Testing							
None						0	
XRAY or DYE Pent. Random						A	
XRAY or DYE Pent 100%						B	
XRAY-DYE Pen or Mag Particle 100%						D	
Transmitter Mounting							
None							0
System I (N/A with WMP, WMC 1/2" - 1")							1
System II with 3 Valve Manifold (WMP Only)							2
System II with 5 Valve Manifold (WMP Only)							3
System I or II, Mounting Bracket Only							4
Calibration							
Standard							1

1.3 GENERAL SPECIFICATIONS

1.3.1 Accuracy

1.3.1.1 Models WMC, WMF & WMP

Pipe Size (Inches)	WEDGE Ratio (H/D)	Accuracy in % of Flow Rate	
		Water Calibrated in Factory Flow Lab *	Uncalibrated
1/2	0.2, 0.3, 0.4, 0.5	± 0.75%	± 5%
1 & 1 1/2	0.2, 0.3, 0.4, 0.5	± 0.5%	± 5%
2 & 3	0.2, 0.3, 0.4, 0.5	± 0.5%	± 5%
4 - 24	0.3, 0.4, 0.5, 0.6, 0.7	± 0.5%	± 5%

* Refer to calibration report supplied with each calibrated instrument

1.3.2 Maximum Working Pressure

1.3.2.1 Models WMC, WMF & WMP

Flanged Element

Maximum working pressure is that of flange rating per ANSI B16.5, except forms with WMC chemical tee transmitter connections that may not exceed 300 psi or flange rating, whichever is less.

1.3.3 Maximum Working Temperature

Models WMC, WMF & WMP

Dependent upon wetted material & gasket material.

2.0 INSTALLATION

2.1 WM Series

2.1.1 Selecting A Mounting Location

2.1.1.1 General

A horizontal installation is recommended for all WEDGE elements rotated 45° to approximately 90° along the pipe center line as shown in Figure 2-1. This method of mounting allows for free passage of solids and eliminates air entrapment at the transmitter connection. Other positions are acceptable provided proper venting of the transmitter is accomplished and differences in lead line elevations are considered. Vertical installations as shown in Figure 2-2 may introduce a slight hydrostatic head effect which must be considered when zeroing the transmitter. Refer to Section 3 Operation.

2.1.2 Straight Pipe Run Requirements

As with most flow elements, proper operation and performance is dependent on the required lengths of unrestricted upstream and downstream piping. The recommended minimum length of the upstream side of the WEDGE Flow Element depends on the type of fitting at the end of the straight run, and the pipe configuration. Minimum upstream and downstream lengths are shown in Table 2-1. The minimum lengths will cause a slight Kd^2 shift.

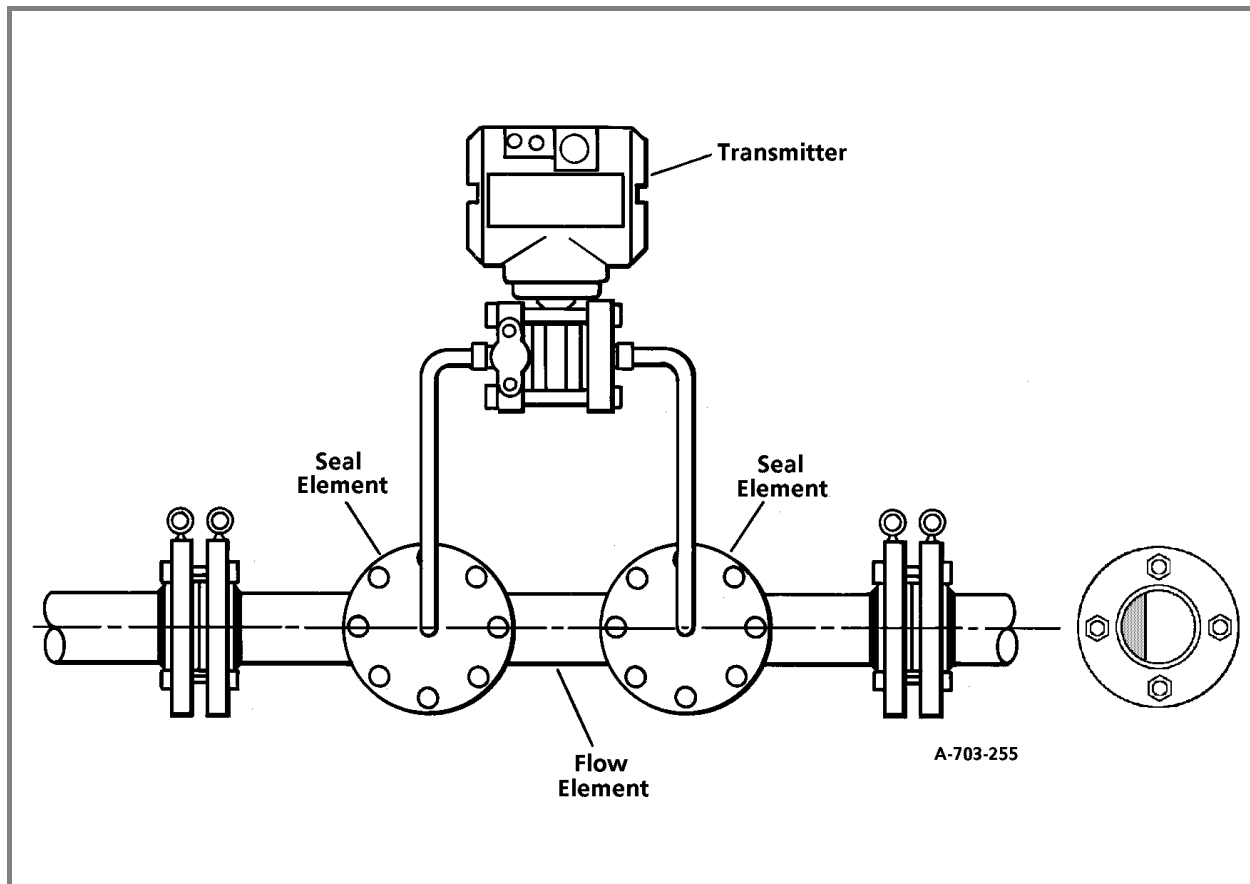


FIGURE 2-1. Typical WEDGEMETER Horizontal Installation

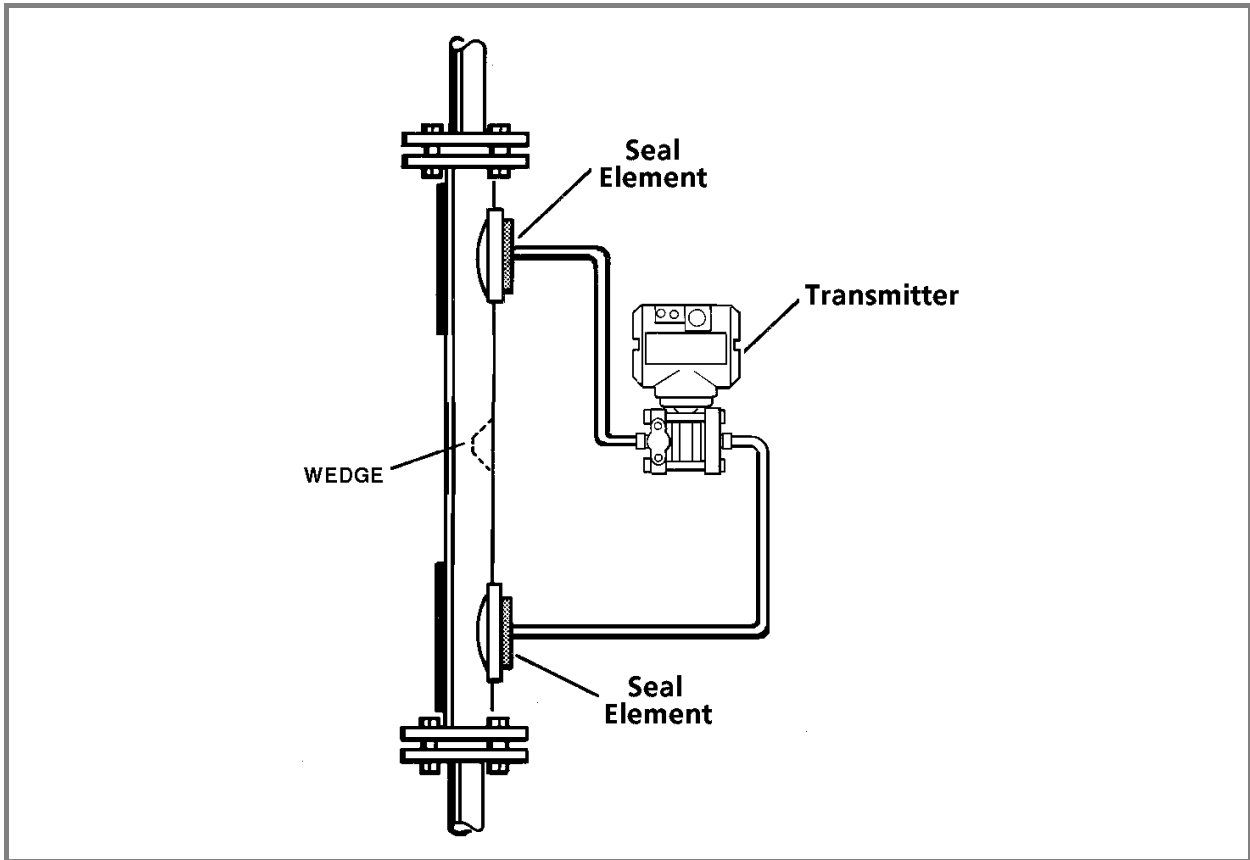


FIGURE 2-2. Typical Chemical Tee Vertical Installation

Table 2-1. Straight Pipe Length Requirements from Various Flow Obstructions *

Fittings	Recommended		Minimum	
	Upstream	Downstream	Upstream	Downstream
3 Elbows Close Coupled	15D	5D	15D	3D
2 Elbows Close Coupled Out Of Plane	10D	5D	10D	3D
2 Elbows Close Coupled In Plane	10D	5D	5D	3D
1 Elbow	10D	5D	5D	3D
Tee-bull Plugged	10D	5D	5D	3D
Tee-Run Plugged	10D	5D	5D	3D
Tee-Flow In Bull & Run	10D	5D	5D	3D
Y-Run Plugged	10D	5D	5D	3D
Concentric Reducer	10D	5D	5D	3D
Concentric Expander	10D	5D	5D	3D
Partially Open Gate Valve	10D	5D	10D	3D

* Based on testing conducted in the flow calibration laboratory.
Measured from apex of wedge element.

2.1.3 Installation And Differential Pressure Connections

WARNING

Never exceed the maximum pressure or temperature recommended for the measured process. Exceeding proper pressure or temperature ratings can lead to personal injury or equipment damage. The process piping flanges for installation should be identical as called out in the serial number on the data plate. The process temperature and pressure should never exceed the ratings for the element stamped on the data plate.

2.1.3.1 General

Before installation of any WEDGE element inspect for damage; particularly at sealing surfaces. Any damage should be reported to the factory Service Department as soon as possible. Also check the data plate to ensure that the stamped ratings match the process conditions of the pipeline in which it will be installed. Each flow element has a data plate attached with an arrow indicating the required direction of flow. Failure to properly orientate the WEDGE element according to the direction of flow may result in improper results when using data supplied for an element that has been calibrated.

2.1.3.2 Line Installation

All WEDGE flow elements require a gasket between the process line connection and the mating flange. Select gaskets that will be able to withstand the maximum process temperature and pressure and resist corrosive attack of the process itself. End gaskets and gaskets for the 3-inch WMF seal are **not provided by ABB Automation**.

To provide safe installation, it is important that the pipeline flanges be suitable for the temperature and pressure of the measured process. When completing the bolting process, be sure that the gaskets are properly centered so that protrusion into the pipe opening is minimized. Misalignment may cause added flow turbulence, however performance affects are typically minimal depending upon the application. Bolt the element in line with suitable hardware using recommended bolt torques for the type and class rating of the flanges.

2.1.3.3 Differential Pressure Connections

The high pressure connection is always on the upstream side of the flow direction arrow and the low pressure connection on the downstream side. Fittings used must be able to withstand the process temperature and pressure conditions as well as provide proper corrosion resistance. Refer to the appropriate transmitter manual for connections to the transmitter high and low ports.

The WMF seals require a backup flange rated for the same type and class as that on the WEDGE element. Backup flanges with bolts and nuts are generally offered as an option to the transmitter and are not supplied with the WEDGE element. Again, observe recommended torque specifications for the type and class being used.

Wedges ordered for Model WMC type seals are supplied with the seal mounting hardware and gaskets. Do not substitute the type of cap screws or gaskets supplied as injury may result due to improper installation. Refer to Figure 2-3 for the identification code of mounting screws. When installing chemical tee seals, tighten caps screws uniformly and avoid excessive tightening of one while others are loose. Final torque values are dependent on selected temperature rating of the WEDGE as two different gaskets are employed.

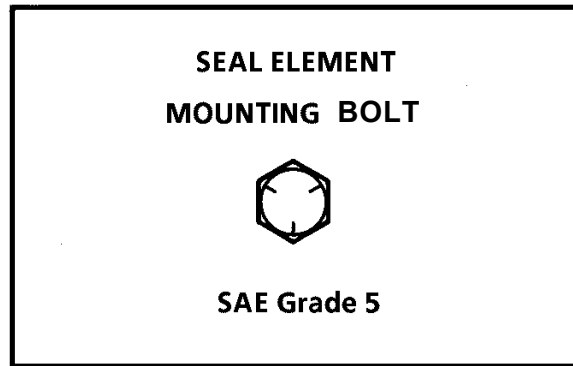
Final torque values for Model WMC are:

400°F (204°C) maximum temperature garlock gylon 3500 gasket - 140-150 inch/pounds

645°F (340°C) maximum temperature Graphite gasket - 110-120 inch/pounds

Torque all other models per ANSI flange ratings.

DO NOT EXCEED SPECIFIED TORQUE!



A-1212-324

FIGURE 2-3. Mounting Bolt Identification

2.1.3.4 Pipe Connections

Tighten the flange bolts in a "star" pattern as shown in FIGURE 2-4 to avoid localized stresses on the gaskets.

2.1.3.5 Mounting Dimensions

Mounting dimension drawings are shown in Figures 2-5 through 2-14 on the following pages.

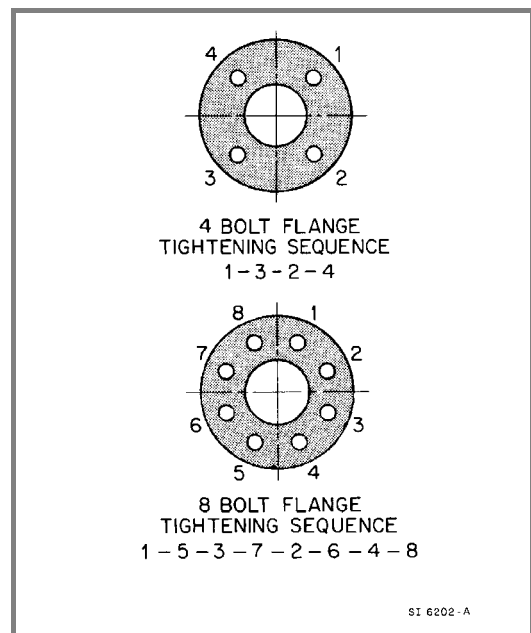
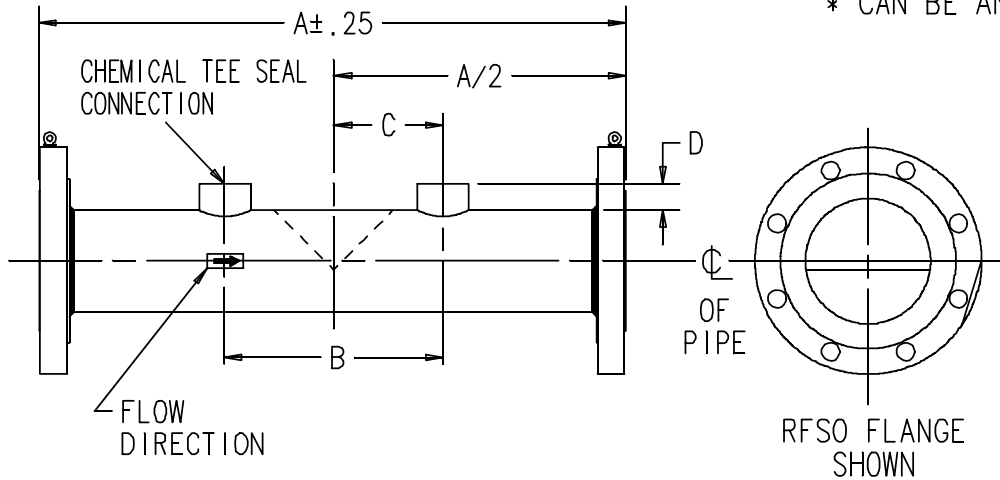


FIGURE 2-4. Flange Bolt Tightening Pattern

DRAWING APPLIES ONLY TO THE FOLLOWING CATALOG NO
 W M C * * * * * A * * * * * *

* CAN BE ANY DIGIT



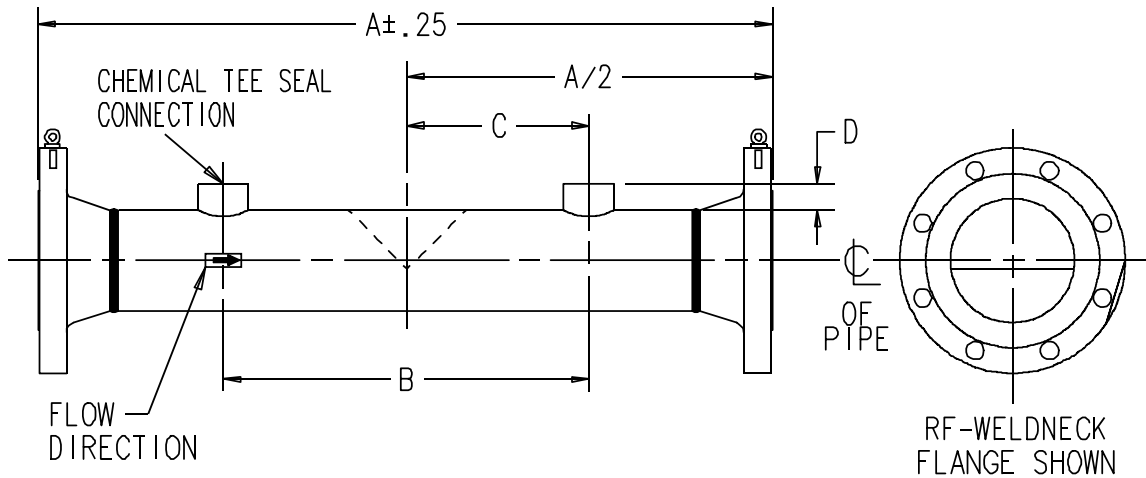
PIPE SIZE	A DIM.	B DIM.	C.DIM.	D DIM.	APPROX WEIGHT LBS.		
					FLANGE RATING		
					150	300	600
4	30.00	15.00	7.50	0.81	70	90	115
6	34.00	18.00	9.00	0.81	90	140	185
8	36.00	20.50	10.25	0.81	125	180	270
10	38.00	23.50	11.75	0.81	180	250	420
12	44.00	26.50	13.25	0.81	260	365	
14	46.00	28.00	14.00	0.81	330	480	
16	49.00	30.50	15.25	0.81	445	545	
18	52.00	33.50	16.75	0.81	495	725	
20	56.00	37.00	18.50	0.81	580	880	
24	62.00	42.00	21.00	0.81	810	985	

Ref. MD-WMC-1-1

FIGURE 2-5. Model WMC Mounting Dimensions

DRAWING APPLIES ONLY TO THE FOLLOWING CATALOG NO
 W M C * * * * * B * * * * * *

* CAN BE ANY DIGIT



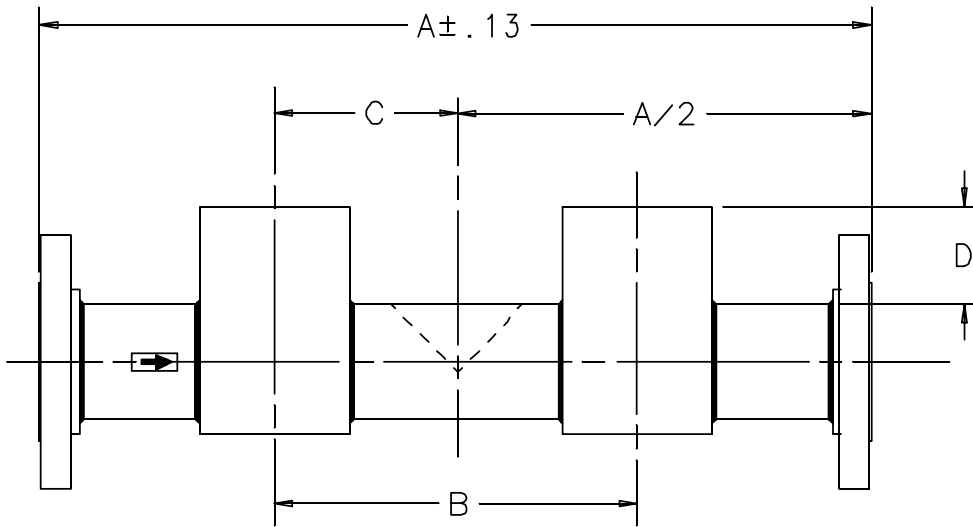
PIPE SIZE	A DIM FLANGE RATING			B DIM	C DIM	D DIM	APPROX. WGT. LBS FLANGE RATING		
	150	300	600				150	300	600
4	35.50	36.25	38.00	15.00	7.50	0.94	65	75	110
6	40.50	41.25	43.25	18.00	9.00	0.94	90	130	195
8	43.00	43.75	46.00	20.50	10.25	0.94	115	175	285
10	45.00	46.25	49.50	23.50	11.75	0.94	165	280	450
12	52.00	53.25	55.75	26.50	13.25	0.94	235	380	
14	55.00	66.25	58.50	28.00	14.00	0.94	310	625	
16	58.00	59.50	62.50	30.50	15.25	0.94	410	640	
18	62.00	63.50	66.00	33.50	16.75	0.94	500	810	
20	66.37	67.75	70.50	37.00	18.50	0.94	630	1005	
24	73.00	74.25	77.50	42.00	21.00	0.94	870	1190	

Ref. MD-WMC-1-2

FIGURE 2-6. Model WMC Mounting Dimensions

DRAWING APPLIES ONLY TO THE FOLLOWING CATALOG NO
 W M C * * * * * A * * * * * *

* CAN BE ANY DIGIT



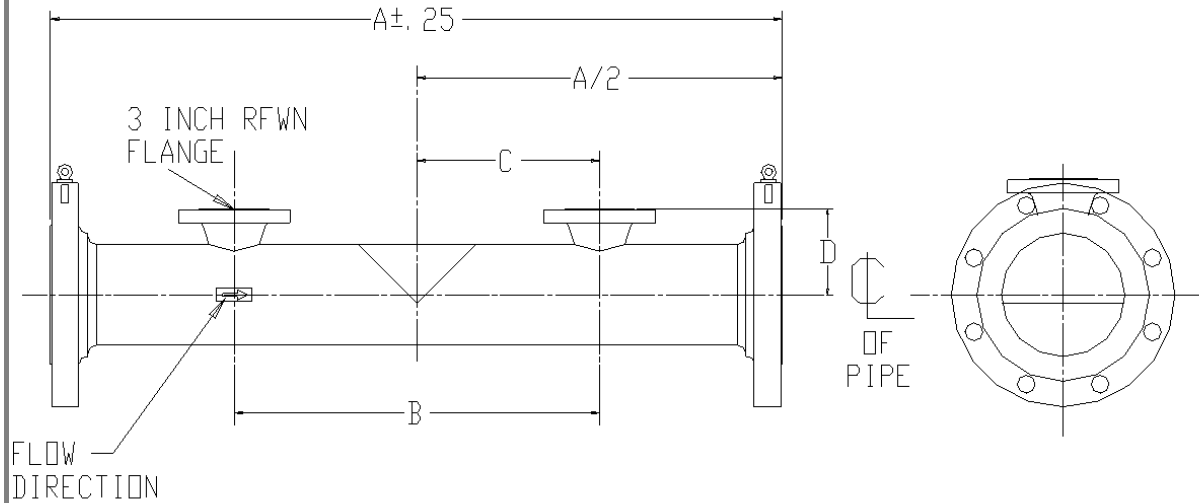
PIPE SIZE	A DIM	B DIM	C DIM	D DIM	APPROX WGT. LBS		
					FLANGE RATING		
					150	300	600
0.5	18.00	6.50	3.25	1.00	23	23	23
1.0	19.00	7.06	3.53	1.50	26	29	30
1.5	20.00	8.00	4.00	1.86	43	49	51
2.0	21.00	8.38	4.19	2.25	51	55	59
3.0	24.00	10.35	5.19	2.75	69	79	84

Ref. MD-WMC-1-3

FIGURE 2-7. Model WMC Mounting Dimensions

DRAWING APPLIES ONLY TO THE FOLLOWING CATALOG NO
 WMF * * * * * A * * * * * * * *

* CAN BE ANY DIGIT



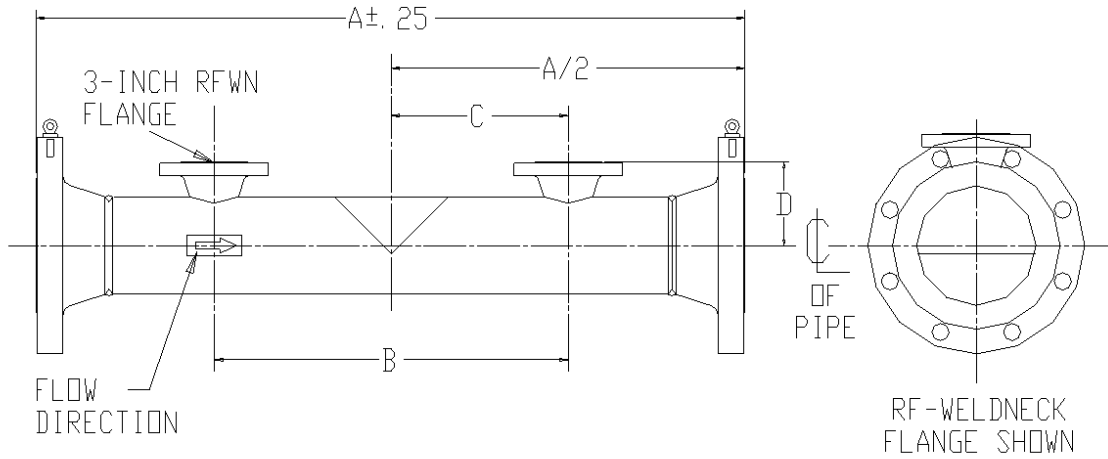
PIPE SIZE	"A" DIM	"B" DIM	"C" DIM	"D" DIM FLANGE RATING			APPROX WGT. LESS FLANGE RATING		
				150	300	600	150	300	600
<input type="checkbox"/> 4	30.00	15.00	7.50	2.75	3.12	3.50	85	105	130
<input type="checkbox"/> 6	34.00	18.00	9.00	2.75	3.12	3.50	105	155	215
<input type="checkbox"/> 8	36.00	20.50	10.25	2.75	3.12	3.50	140	205	320
<input type="checkbox"/> 10	38.00	23.50	11.75	2.75	3.12	3.50	205	265	460
<input type="checkbox"/> 12	44.00	26.50	13.25	2.75	3.12	3.50	275	380	
<input type="checkbox"/> 14	46.00	28.00	14.00	2.75	3.12	3.50	345	505	
<input type="checkbox"/> 16	49.00	30.50	15.25	2.75	3.12	3.50	460	570	
<input type="checkbox"/> 18	52.00	33.50	16.75	2.75	3.12	3.50	510	760	
<input type="checkbox"/> 20	56.00	37.00	18.50	2.75	3.12	3.50	595	905	
<input checked="" type="checkbox"/> 24	62.00	42.00	21.00	2.75	3.12	3.50	825	1015	

Ref. MD-WMF-1-1, Rev.2

FIGURE 2-8. Model WMF Mounting Dimensions

DRAWING APPLIES ONLY TO THE FOLLOWING CATALOG NO
 W M F * * * * * B * * * * * * * *

* CAN BE ANY DIGIT

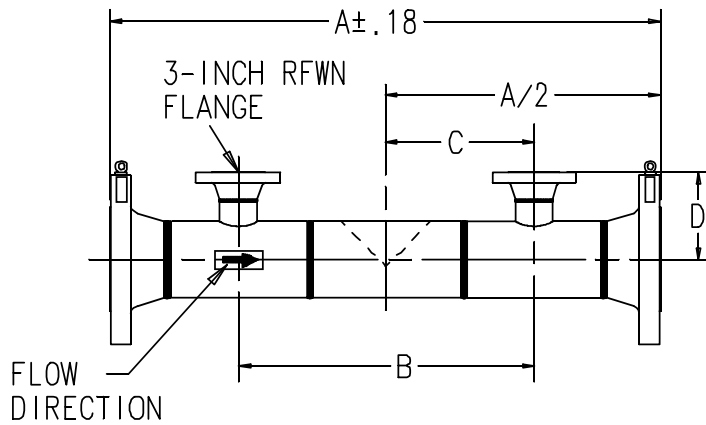


PIPE SIZE	"A" DIM FLANGE RATING			"B" DIM	"C" DIM	"D" DIM FLANGE RATING			APPROX WGT. LESS FLANGE RATING		
	150	300	600			150	300	600	150	300	600
<input type="checkbox"/> 4	35.50	36.25	38.00	15.00	7.50	2.75	3.12	3.50	135	150	175
<input type="checkbox"/> 6	40.50	41.25	43.25	18.00	9.00	2.75	3.12	3.50	160	210	270
<input type="checkbox"/> 8	43.00	43.75	46.00	20.50	10.25	2.75	3.12	3.50	210	265	365
<input type="checkbox"/> 10	45.00	46.25	49.50	23.50	11.75	2.75	3.12	3.50	270	345	525
<input type="checkbox"/> 12	52.00	53.25	55.75	26.50	13.25	2.75	3.12	3.50	350	480	
<input type="checkbox"/> 14	55.00	56.25	58.50	28.00	14.00	2.75	3.12	3.50	410	610	
<input type="checkbox"/> 16	58.00	59.50	62.50	30.50	15.25	2.75	3.12	3.50	500	755	
<input type="checkbox"/> 18	62.00	63.50	66.00	33.50	16.75	2.75	3.12	3.50	580	870	
<input type="checkbox"/> 20	66.37	67.75	70.50	37.00	18.50	2.75	3.12	3.50	700	1100	
<input checked="" type="checkbox"/> 24	73.00	74.25	77.50	42.00	21.00	2.75	3.12	3.50	955	1310	

Ref. MD-WMF-1-2, Rev.2

FIGURE 2-9. Model WMF Mounting Dimensions

DRAWING APPLIES ONLY TO THE FOLLOWING CATALOG NO
 W M F 1 5 * * * B 2 * * * * * *
 0 2
 0 3 * CAN BE ANY DIGIT



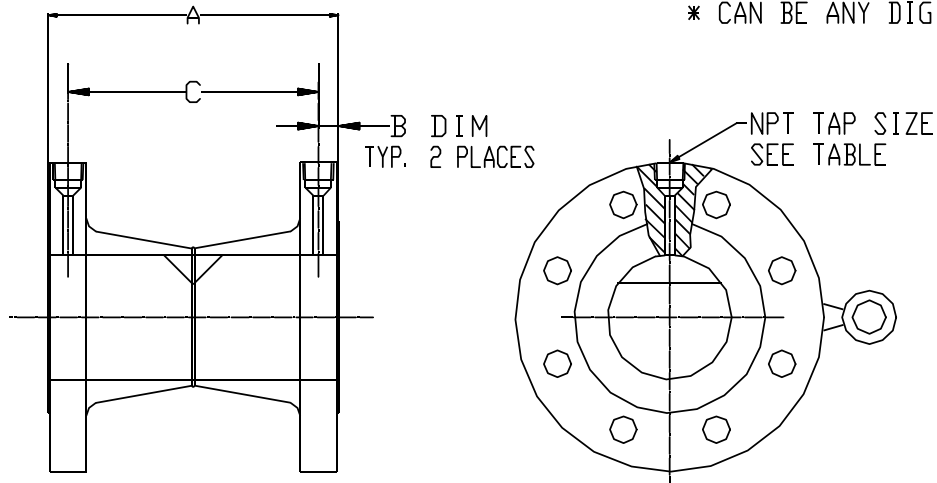
PIPE SIZE	A DIM			B DIM	C DIM	D DIM			APPROX WGT. LBS		
	FLANGE RATING					FLANGE RATING			FLANGE RATING		
	150	300	600			150	300	600	150	300	600
1.5	20.86	21.37	22.00	11.50	5.75	8.18	8.43	8.37	55	61	71
2.0	21.50	22.00	22.75	11.50	5.75	8.50	8.75	9.12	62	70	84
3.0	24.50	25.25	26.00	12.25	6.13	6.13	6.56	6.88	78	92	102

Ref. MD-WMF-1-3

FIGURE 2-10. Model WMF Mounting Dimensions

DRAWING APPLIES ONLY TO THE FOLLOWING CATALOG NO
 W M P * * * * * * * * * * * * * * *

* CAN BE ANY DIGIT



PIPE SIZE	A DIM			B DIM			C DIM			NPT TAP SIZE			APPROX WGT. LBS		
	FLANGE RATING			FLANGE RATING			FLANGE RATING			FLANGE RATING			FLANGE RATING		
	150	300	600	150	300	600	150	300	600	150	300	600	150	300	600
* 1	N/A	6.5	6.5	N/A	0.94	0.94	N/A	4.62	4.62	N/A	1/2	1/2	N/A	18	18
* 1-1/2	N/A	6.75	6.75	N/A	0.94	0.94	N/A	4.87	4.87	N/A	1/2	1/2	N/A	22	22
2	5.00	6.75	6.75	0.44	0.94	0.94	4.13	4.87	4.87	1/4	1/2	1/2	14	27	36
3	5.50	7.00	7.00	0.52	0.94	0.94	4.44	5.12	5.12	3/8	1/2	1/2	25	43	52
4	7.50	8.75	10.00	0.50	0.94	0.94	6.50	6.87	8.12	3/8	1/2	1/2	35	66	76
6	10.00	10.87	12.75	0.56	0.94	0.94	8.80	9.00	6.87	3/8	1/2	1/2	54	106	110

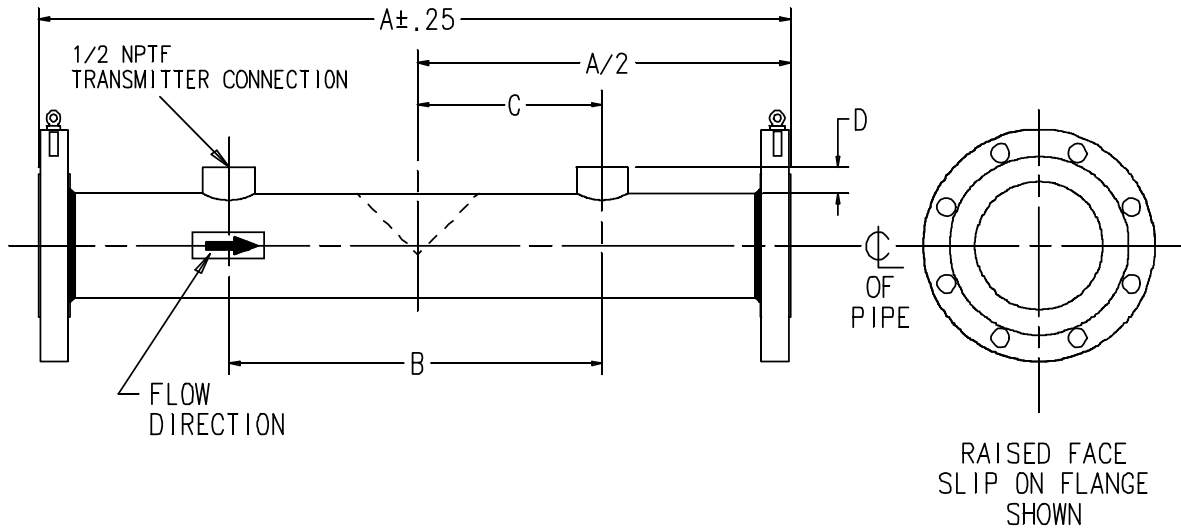
* = SPECIAL PRODUCT ONLY

WMP-1-1-5

FIGURE 2-11. Model WMP Mounting Dimensions

DRAWING APPLIES ONLY TO THE FOLLOWING CATALOG NO
 W M P * * * * * A * * * * * *

* CAN BE ANY DIGIT



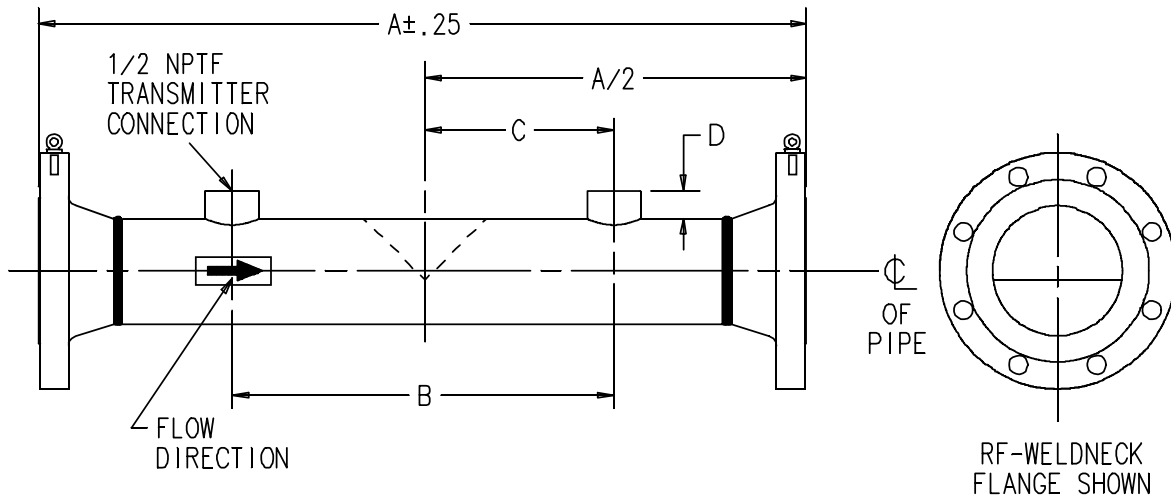
PIPE SIZE	PIPE DIMENSIONS				FLANGE RATING		
	A DIM	B DIM	C DIM	D DIM	150	300	600
4	30.00	15.00	7.50	0.94	55	65.00	85
6	34.00	18.00	9.00	0.94	75	110.00	155
8	36.00	20.50	10.25	0.94	95	145.00	240
10	38.00	23.50	11.75	0.94	160	210.00	370
12	44.00	26.50	13.25	0.94	215	325.00	
14	46.00	28.00	14.00	0.94	290	440.00	
16	49.00	30.50	15.25	0.94	410	510.00	
18	52.00	33.50	16.75	0.94	445	685.00	
20	56.00	37.00	18.50	0.94	540	930.00	
24	62.00	42.00	21.00	0.94	750	940.00	

Ref. MD-WMP-1-2

FIGURE 2-12. Model WMP Mounting Dimensions

DRAWING APPLIES ONLY TO THE FOLLOWING CATALOG NO
 W M P * * * * * * * * * * * * * * *

* CAN BE ANY DIGIT



PIPE SIZE	A DIM FLANGE RATING			B DIM	C DIM	D DIM	APPROX. WGT. LBS FLANGE RATING		
	150	300	600				150	300	600
4	35.50	36.25	38.00	15.00	7.50	0.94	65	75	110
6	40.50	41.25	43.25	18.00	9.00	0.94	90	130	195
8	43.00	43.75	46.00	20.50	10.25	0.94	115	175	285
10	45.00	46.25	49.50	23.50	11.75	0.94	165	280	450
12	52.00	53.25	55.75	26.50	13.25	0.94	235	380	
14	55.00	66.25	58.50	28.00	14.00	0.94	310	625	
16	58.00	59.50	62.50	30.50	15.25	0.94	410	640	
18	62.00	63.50	66.00	33.50	16.75	0.94	500	810	
20	66.37	67.75	70.50	37.00	18.50	0.94	630	1005	
24	73.00	74.25	77.50	42.00	21.00	0.94	870	1190	

Ref. MD-WMP-1-3

FIGURE 2-13. Model WMP Mounting Dimensions

3.0 START-UP

3.1 Operation

Before any true zero reading can be taken it is necessary to establish that the process pipe and flow element are completely filled with the process fluid and that there is no flow. A shutoff valve or control valve downstream of the element will facilitate this condition. Opening the valve for a short period of time will remove any gases that are present in the system. In the case of the Model WMP WEDGE, it is necessary to purge air from the transmitter body by opening the vent valves on the high and low side flanges. Any air present in the transmitter body will result in a false zero reading.

3.1.1 Zero Check

With the flow element under full line pressure, at normal operating temperature, and at zero flow, the transmitter zero can be adjusted to an exact reading on the readout device. If possible, open the downstream valve for a few seconds and close it. The output should return to a zero reading. If it does not, readjust the zero screw on the transmitter. Repeat this procedure two or three times to establish a true zero.

3.1.2 Span Check

In most cases, it will not be possible to check for the correct span as this would require a field calibration. The transmitter may be calibrated at the factory if ordered to agree with the calibration and/or calculation of the WEDGE flow element.

NOTE

A calibration report is supplied with each WEDGE flow element that is flow laboratory calibrated. Check that the calculated differential of the flow element agrees with the differential span of the transmitter. If it does not, it will be necessary to recalibrate the transmitter.

3.2 Accuracy

3.2.1 Models WMC, WMF & WMP

All WEDGE flow elements that are calibrated in the factory flow laboratory are calibrated to within 0.5% of the flow rate (1/2 inch size WEDGE meters are 0.75%). The accuracy of uncalibrated elements may be up to 5% of flow rate, depending upon the type of element, pipe size, and WEDGE ratio (refer to Section 1.3.1). Additional errors will be evident if the process fluid density differs from the designed value. Also, the same will be true if improper upstream pipe conditions exist. The percent errors given do not include the inherent errors of the transmitter which are normally very small until flow rates fall below 30% of maximum flow (9% of maximum differential pressure).

3.3 Flow Equations

The differential pressure flow equations for all WEDGE flow elements are as follows:

Liquid Flow:
$$h = g_f \left[\frac{q}{5.688 \times F_a \times Kd^2} \right]^2$$

Gas Flow:
$$h = \frac{G \times T}{P} \left[\frac{Q}{7727 \times F_a \times Y \times F_{pv} \times Kd^2} \right]^2$$

Steam Flow:
$$h = V \left[\frac{W}{359 \times F_a \times Y \times Kd^2} \right]^2$$

The reciprocal volumetric /mass flow equations are as follows:

Liquid Flow:
$$q = (5.668 \times F_a \times Kd^2) \sqrt{\frac{h}{g_f}}$$

Gas Flow:
$$Q = (7727 \times F_a \times Y \times F_{pv} \times Kd^2) \sqrt{\frac{h \times P}{G \times T}}$$

Steam Flow:
$$W = (359 \times F_a \times Y \times Kd^2) \sqrt{\frac{h}{V}}$$

where:

- q = Liquid flow rate, gallons/min
- Q = Gas flow rate, SCFH (Ref. cond. = 14.7 PSIA, 60°F)
- W = Steam flow rate, lbs/hr
- F_a = Expansion factor, Refer to Figure 3-1
- F_{pv} = Gas supercompressibility factor = $\sqrt{Z_b/Z_f}$ [normally 1]
- Z_b = Compressibility of the gas at base conditions
- Z_f = Compressibility of the gas at flowing conditions
- h = Maximum differential pressure, inches of water at 60°F
- Kd² = WEDGE flow coefficient
- g_f = Liquid specific gravity at flow conditions
- Y = Gas Correction factor, Refer to Figure 3-2
- P = Process pressure, psia (psig + 14.7)
- T = Process temperature, °R (°F + 460)
- G = Gas specific gravity (Ref. cond. = 14.7 PSIA, 60°F)
- V = Specific volume of steam, cu ft/lb

3.4 Metric Conversions

1 kPa = 0.1450 psi	1 bar = 14.50 psi
1 kg/cm ² = 14.22 psi	1 mm Hg = 0.5357 inches of water
1 meter = 3.281 ft	1 cm = 0.3937 inches
1 liter = 0.2642 US gallons	1 Imp Gal = 1.201 US gallons
1 cu meter/sec = 35.32 cu ft/sec	1 kg/hr = 2.205 lbs/hr
°C = 5/9 x (°F - 32)	

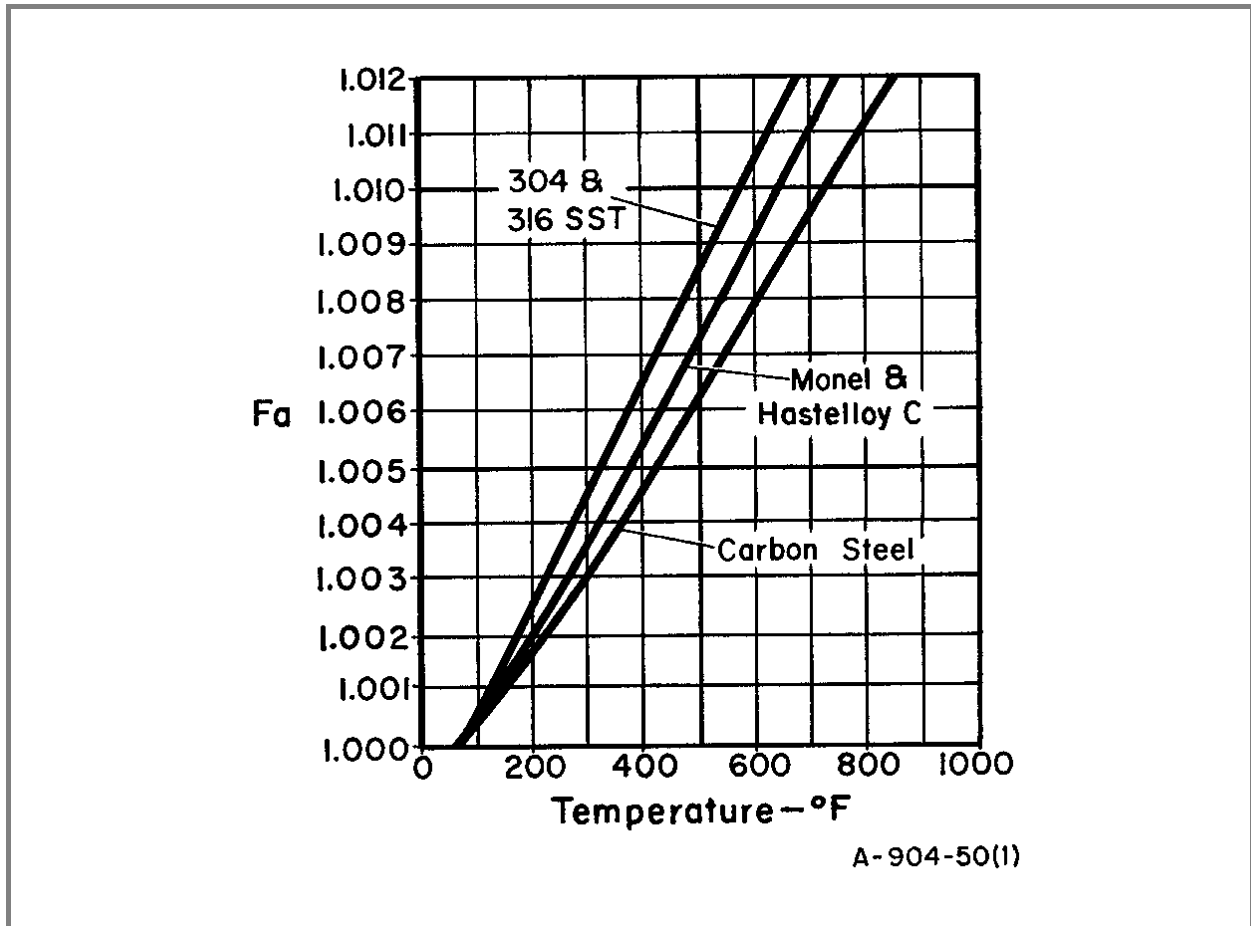


FIGURE 3-1. Expansion Factor (Fa)

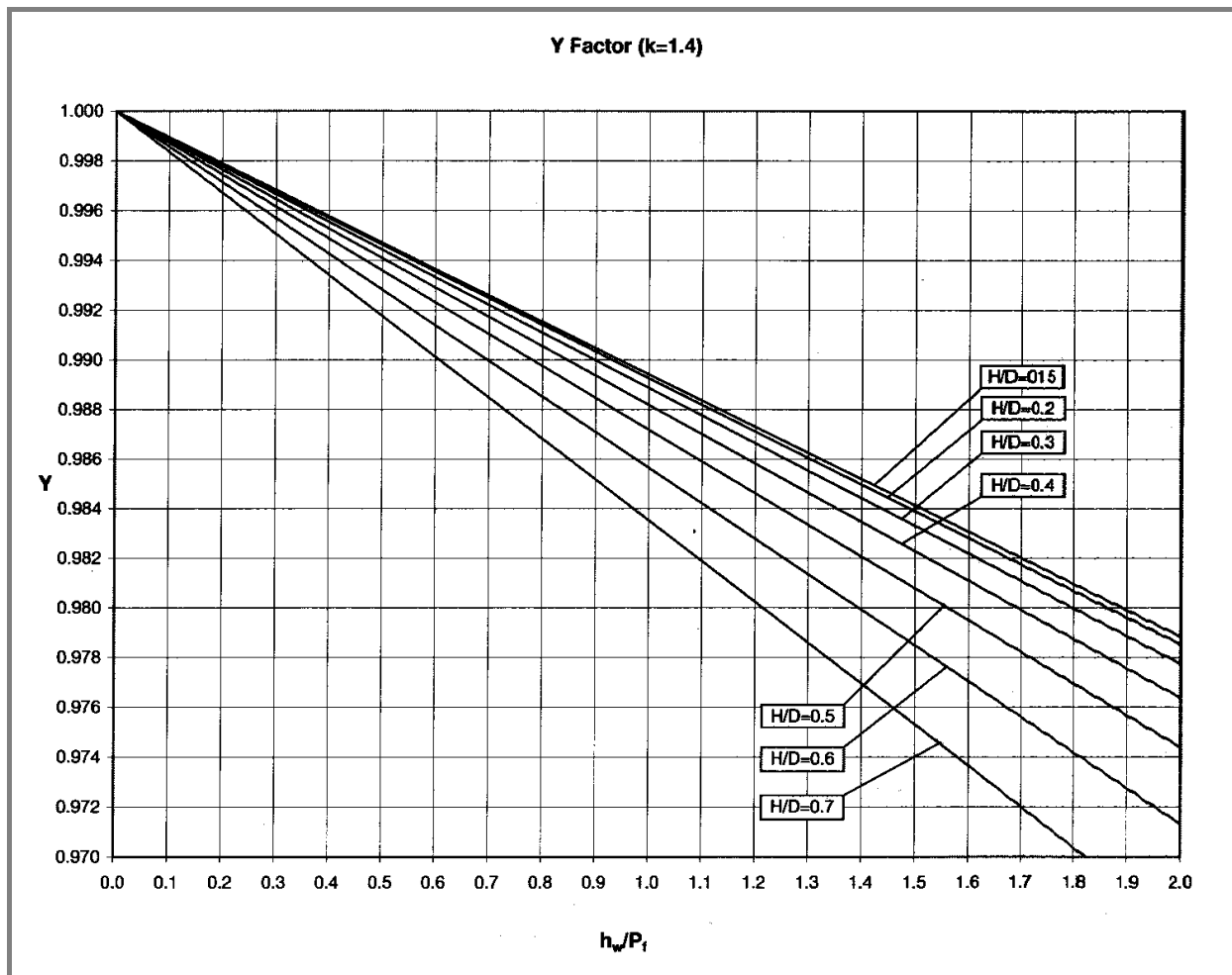


FIGURE 3-2. Correction Factor (Y)

4.0 MAINTENANCE

4.1 Models WMC, WMF & WMP

4.1.1 Removing Element From Service

WARNING

Process pressure and material retained in the flow element can cause injury and damage to equipment. Standard plant safety procedures must be followed when removing the element from service.

The WEDGEMETER has no moving parts that require servicing. Removal of the wedge element is generally not required other than for normal maintenance cleaning of process lines. Before removal, shut off all process flow, pressure, and drain lines if possible before loosening any bolts. Disconnect transmitter connections and remove impulse lines or remote seal elements. Loosen and disconnect element line connections and remove from process pipe line.

4.1.2 Inspection

General practices suggest that sealing surfaces be periodically checked for nicks and gouges before reinstallation. Elements under severe operating conditions should also be inspected for effects of corrosion and erosion to minimize unexpected shutdowns.

4.1.3 Reinstallation

Reinstallation should follow procedures outlined in SECTION 2.0 - INSTALLATION. Model WMC chemical tee seal screws should be applied with Molykote 505 or equivalent lubricant to prevent seizure of threads. Gaskets should be replaced upon reinstallation.

5.0 PARTS

5.1 Model WMC

5.1.1 Replacement Parts

TABLE 5-1. Replacement Parts

Ref.	Description	Part No.	Qty. Req'd
1	Gasket, Chemical Tee:		
	Garlock gylon 3500: Up to 204 °C (400 °F) Graphite: 204 °C (400 °F) to 340 °C (645 °F)	43P1604 155S1043	2 1
2	Chemical Tee Cap Screw	9P2342	16

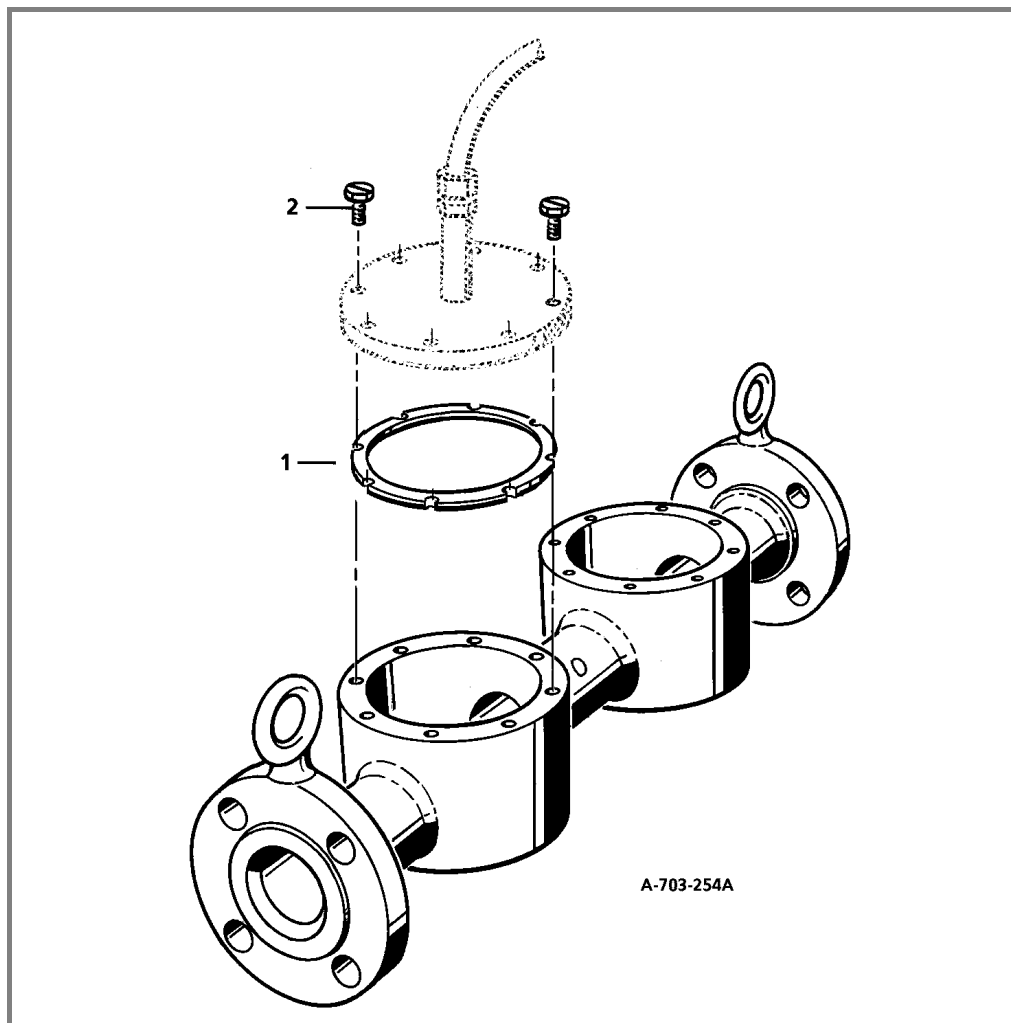


FIGURE 5-1. Model WMC Replacement Parts

6.0 DATA SHEET

ABB		WEDGEMETER II FLOW ELEMENT	NO.	DATE	APPVD	REVISION	SPEC. NO.: _____ SHEET: _____ REV. NO.: _____ PROJ. NO.: _____ BY: _____ DATE: _____
CLIENT: _____ PROJECT: _____ LOCATION: _____ PROJECT MGR: _____		SALES CONTACT: _____ SALES CO.: _____ PHONE: _____ FAX/EMAIL: _____					
GENERAL				Model code: _____			
1	Tag No.	_____		22	Transmitter Connection.....		
2	Service	_____			Chemical Tee (1/2" thru 24" pipe size only)		_____
3	Line No./Vessel or Skid No.	_____			3" Flanged (1.1/2" thru 24" pipe size only)		_____
4	P&ID No.	_____			Pipe Tap (2 thru 24" pipe size only)		_____
					Other		_____
OPERATING CONDITIONS				23	Pipe Size	1/2" _____ 10" 1" _____ 12" 1-1/2" _____ 14" 2.0" _____ 16" 3.0" _____ 18" 4.0" _____ 20" 6.0" _____ 24" 8.0" _____ Other	
		Units	Minimum	Normal	Maximum		
5	Flow	_____	_____	_____	_____		
6	Pressure	_____	_____	_____	_____		
7	Temperature	_____	_____	_____	_____		
8	Viscosity	_____	_____	_____	_____		
		Units	Value				
9	S.G. Operating	_____	_____				
10	Density Oper.	_____	_____	(Specify Eng Units)			
11	Fluid Type	_____	_____	(Liquid, Gas)			
12	Vapor Gas Mol. Wt ...	_____	_____				
13	Super Com. Factor ...	_____	_____				
INSTALLATION CONDITIONS				24	H/D Ratio	0.2 _____ (N/A 4" and above) 0.3 _____ 0.4 _____ 0.5 _____ 0.6 _____ (N/A 1.2 - 1-1/2") 0.7 _____ (N/A 1.2 - 1-1/2")	
14	Upstream Pipe Dia.	_____		25	Material	Carbon Steel (N/A w/ WMI) _____ 316 SST _____ Hast C (N/A w/ WMI or >14") _____ Monel (N/A w/ WMI or >14") _____ Other _____	
15	Downstream Pipe Dia.	_____					
16	Other	_____		26	Flange Rating	ANSI Class 150 _____ ANSI Class 900 _____ ANSI Class 300 _____ ANSI Class 1500 _____ ANSI Class 600 _____ Other _____	
INSTALLATION SKETCH				27	Flange Style	Raised Face Slip On _____ Raised Face Weld Neck _____ Other _____	
NOTES				28	Pipe Schedule	Standard (N/A 3" and below) _____ X-Strong _____ Other _____	
NOTE 1: EXTENDED DIAPHRAGM SEALS FOR WMI SERIES MUST BE ABLE TO BE INSTALLED IN A 3" SCH80 PIPE ID., MAXIMUM 2" EXTENSION				29	Hydrostatic Tesing	ABB Standard no certificate _____ ABB Standard w/ certificate _____	
_____				30	Material Certificates	None _____ Material Certificates _____ Positive Material ID _____ Other _____	
_____				31	Weld Standard	ASME B31.3 Normal Service _____ ASME B31.3 Cyclic Service _____ ASME B31.3 Cat. D Service _____ ASME B31.3 Cat. M Service _____ PED, SEP Level _____ PED, CAT. 1 MODULE A _____	
_____				32	NDE Testing.....	None _____ Xray or Dye Pent. Random _____ Xray or Dye Pent. 100% _____ Xray/Dye Pent or Mag Pt. 100% _____	
_____				33	Transmitter MTG. ...	None _____ NOTE 1 System I _____ System II w/ 3 Valve Manif. _____ System II w/ 5 Valve Manif. _____ Mounting Bracket only _____	
REFERENCE				34	Water Calibration ...	Standard 6 Point _____ Other _____	
Wedge Instruction Manual: PN25005, PN25102		www.abbgenie.com (password = abbgenie)					

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