



• LINED FITTINGS



SECURE FLUID SYSTEMS



• ACCESSORIES



• CUSTOM PARTS



• LINED PIPES AND COLUMNS



• VALVES



• EXPANSION JOINTS

3P SECURE FLUID SYSTEMS

1

Over the last forty years or so, lined piping systems with high-performance polymers have established themselves as the ideal solution to the problem of handling fluids under extreme conditions.

Ease of use, low assembly cost and limited maintenance make lined piping an economical solution from every angle.

Despite their increasingly frequent use in industry these products should not be regarded as commonplace.

The quality of lined products is a guarantee of safety for both people and the environment.

• 40 years experience

Since the 60's, 3P has manufactured and marketed the most comprehensive product range available on the market in North America, Europe, and Asia (i.e. expansion joints, hoses, valves, custom lined products).

• Technical expertise

Two Research & Development centers in Houston, TX (USA), and in Langres (France).

• Industrial strength

Two main plants manufacturing facilities: in Houston, TX (USA), and Langres (France).

• Project management

Frequent management of major lined piping projects has enabled 3P to develop unique expertise that is ideally suited to the special requirements of engineering companies on a world wide basis.

• Quality systems

The quality of 3P products is based on ISO 9001 systems certified by organizations working to the strictest standards.

• An international group

3P is a subsidiary of the Plastic Omnium group and generates 50% of its sales in North America.

• Safety

3P is a recognized supplier of safety parts not only to the pharmaceutical or chemical industry, but also to the semi-conductor, aeronautics and automotive industries.

• Proximity

3P has a presence in North America via a distribution network of technical and sales support. Consequently, most 3P distributors offer pipe, fittings, valves and expansion joints from local stock and are equipped to fabricate custom spools made to length within very short lead-times.

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The information and data contained herein are based on test data, experience and information from material suppliers and is believed to be accurate. However, no guarantee is made or implied as to application suitability or chemical compatibility regarding the products or their performance. 3P Inc. reserves the right to change product specifications without prior notice.

PIPE

- ▶ Quantity
- ▶ Size (diameter)
- ▶ Length (to nearest 1/16-inch)
- ▶ Configuration:
 - Flange by Flange
 - Flange One End
 - Plain End
- ▶ Liner Material
- ▶ Slip Fit or Interference Fit
- ▶ “Standard Liner or Full-Vacuum Rated”
- ▶ Special Requirements

FITTING & ACCESSORIES

- ▶ Quantity
- ▶ Description
- ▶ Size
- ▶ Liner Material
- ▶ Special Requirements

LINED COLUMNS

- ▶ Consult 3P

Refer to “Notes” on applicable pages of this Manual for additional information required, if any, on certain items.

PROCESS OPERATING CONDITIONS

The following factors should be considered in the selection and specifications of your fluid systems.

3P recommends that you include this information on your inquiry or order.

1. Process Fluid (include primary chemical concentration, trace chemicals, contaminants, solids concentration and average particle size).
2. Normal Operating Pressure
3. Normal Operating Temperature
4. Pressure Range (minimum-maximum)
5. Temperature Range (minimum-maximum)
6. Ambient Temperature (minimum-maximum)
7. Vacuum Conditions
8. Pipe Cleaning Methods to be Used
9. Insulation and/or Heat Tracing Requirements
10. Maximum Flow Rate or Fluid Velocity
11. Operating Conditions – Stable or Variable*
12. Possible Upset Conditions

* Indicate frequency of pressure and/or temperature cycle.

ONE OF THE SERVICES 3P OFFERS YOU

To assist you in specifying our plastic lined products, 3P will prepare a fully detailed Bill of Material from your isometric drawings. This service is available at your request for both orders and inquiries.

Each item of the completed Bill of Material is cross-referenced to the corresponding item on your drawing by a tag number which we (or you) assign.

On orders, the tag numbers will be applied to the pipe spool and end-covers with an indelible marker. Tag numbers will also be shown on our packing lists included with every shipment for easy identification at the jobsite.

In addition to simplifying the receipt and installation of the material, these documents are helpful later on when you need to revise your process or piping configuration.



PERFORMANCE PLASTICS PRODUCTS

Bill of Materials

CUSTOMER: _____ REFERENCE: _____
 QUOTE NO. _____ PAGE NO. _____
 DISTRIBUTOR _____

ITEM	DRAWING OR MARK NO	QTY	DESCRIPTION	LINER	NET UNIT PRICE	EXTENDED
			351-6-DM-015	S.H. 4-8		
	351-6-DM-015-4G	2	1" 90 ELL	PVDF		
	351-6-DM-015-4H	1	1" 90 ELL	PVDF		
	351-6-DM-015-4I	3	2" 90 ELL	PVDF		
	351-6-DM-015-4J	1	2" 45 ELL	PVDF		
	351-6-DM-015-4K	4	2" x 4" x 2" TEE	PVDF		
	351-6-DM-015-4L	6	2" x 1/2" x THK. RING-TYPE SPACER	PTFE		
	351-6-DM-015-4M	1	1" x 20'-0" LG. spool	PVDF		
	351-6-DM-015-4N	2	1" x 10'-6" LG. spool	PVDF		
	351-6-DM-015-4O	2	1 1/2" x 3'-4 1/8" LG. spool	PVDF		
	351-6-DM-015-4P	1	2" x 19'-7 7/8" LG. spool	PVDF		
	351-6-DM-015-4Q	3	4" x 6'-9 7/16" LG. spool	PVDF		
	351-6-DM-015-4R	1	4" x 8'-3 3/16" F.O.E. / P.C.E.	PVDF		

1. Scope

- 1.1 This specification provides design information applicable to lined products manufactured by Performance Plastics Products. Products covered in this specification consist of pipe spools, fittings, valves, sight flow indicators, liquid level gauges, dip pipes, spargers, thermowells, etc. lined with the following polymers. Unless otherwise noted, all pipes and fittings are supplied in accordance with ASTM F1545.

Polymer	Abbreviation	ASTM Spec.
Perfluoroalkoxyalkane	PFA	D3307
Polytetrafluoroethylene	PTFE	D4894 & D4895
Polyvinylidene Fluoride	PVDF	D3222
Polypropylene	PP	D4101

- 1.2 This specification covers products with ANSI Class 150 flanges.

- 1.3 Products covered by this specification are suitable for temperature operating ranges as follows, unless otherwise specified:

PFA	-20° to 450° F	(-29° to 232° C)	
PTFE	-20° to 450° F	(-29° to 232° C)	
PVDF	-20° to 275° F	(-29° to 135° C)	
PP	-20° to 225° F	(-29° to 107° C)	1" thru 8"
PP	0° to 225° F	(-18° to 107° C)	10" thru 12"

- 1.4 For vacuum applications and/or aggressive environments, advise operating conditions for factory's recommendations. (See How-to-Specify, page 1.)

2. Materials

- 2.1 Liner

Physical Properties (Test Method: ASTM D638)

Property	Wrapped	Paste	PFA	PVDF	PP
	PTFE*	Extruded PTFE			
Tensile Strength (psi)					
Longitudinal	3300	3000	3900	5000	3000
Circumferential	5000	2500			
Elongation (%)					
Longitudinal	300	250	300	50	300
Circumferential	230	200			

* Average values. Minimum values are equal to or higher than applicable ASTM specifications.

2.2 Pipe

1" thru 4" size, Standard is schedule 40 steel per ASTM A587.
Also available in A106, A53 Gr.B, and A312 Type 304 or 316

6" thru 10" size, Standard is schedule 40 steel per ASTM A53 Gr. B.
Also available in A106 and A312 Type 304 or 316

12" size, Standard is schedule 20 steel per ASTM A53 Gr. B.
Also available in A312 Type 304 or 316

14" size, Standard is schedule 20 steel per ASTM A53Gr. B

16" thru 18" size, Standard is standard weight steel per ASTM
A53 Gr. B

20" thru 30" size, Standard is schedule 20 steel per ASTM A53 Gr. B

2.3 Flanges

Ductile iron lap joint type,
1" thru 10" size, available in cast ductile iron (60-40-18) per
ASTM A395

Ductile iron threaded type,
1" thru 8" size, available in cast ductile iron (60-40-18) per
ASTM A395

Forged carbon steel lap joint type,
1" thru 12" size, available in forged carbon steel per ASTM A105

Forged carbon steel slip on type,
1" thru 30" size, available in forged carbon steel per ASTM A105

Forged carbon steel socket weld type,
1" thru 12" size, available in forged carbon steel per ASTM A105

Forged carbon steel weld neck type,
1" thru 30" size, available in forged carbon steel per ASTM A105

Forged carbon steel threaded type,
1" thru 8" size, available in forged carbon steel per ASTM A105

Forged stainless steel lap joint type,
1" thru 12" size, available in forged stainless steel per ASTM A182
Type 304 or 316

Forged stainless steel slip-on type,
1" thru 12" size, available in forged stainless steel per ASTM A182
Type 304 or 316

Forged stainless steel socket weld type,
1" thru 12" size, available in forged stainless steel per ASTM A182
Type 304 or 316

Forged stainless steel weld neck type,
1" thru 12" size, available in forged stainless steel per ASTM A182
Type 304 or 316

Forged stainless steel threaded type,
1" thru 8" size, available in forged stainless steel per ASTM A182
Type 304 or 316

2.4 Weld Fittings

Forged carbon steel per ASTM A234

Forged stainless steel Type 304 or 316 per ASTM A403

2.5 Cast Fittings

Cast ductile iron (60-40-18) per ASTM A395

3. Fabrication Tolerances

3.1 Pipe Spool

<u>Dimension</u>	<u>Tolerance</u>
Length	±1/8"

	<u>Alignment</u>
Bolt Hole	±1/16"

3.2 Flange

All dimensions per ANSI B16.5 or B16.42 unless otherwise noted.

SYSTEMS SPECIFICATIONS

3.3 Fittings

All dimensions Per ANSI B16.1, B16.5, or B16.42 unless otherwise noted.

3.4 Minimum Inside Diameter Radius Size of All Pipe and Fitting Flanges

<u>Size</u>	<u>Radius</u>
1"	1/8"
1 1/2" & 2"	1/4"
3" & Over	3/8"

4. Temperature/Pressure Ratings

Maximum temperature/pressure ratings for standard pipe and fittings with ANSI Class 150 flanges and fittings are as follows:

<u>Temperature (°F)</u>	<u>Pressure (psig)</u>
100	250
200	235
300	215
400	200
500	170

Higher design pressures may be attained by the use of ANSI Class 300 flanges. Consult 3P for recommendations on maximum design pressure and availability.

5. Vacuum Ratings

Straight Length Lined Pipe Size	V A C U U M R A T I N G S								
	1"	1 1/2"	2"	3"	4"	6"	8"	10"	12"
PTFE									
Interference Fit									
Nominal Liner Thickness (")	0.138	0.150	0.160	0.185	0.235	0.236	0.420	0.450	0.500
Vacuum (in. Hg)	Full	Full	Full	Full	Full	Full	Full	Full	Full
Temperature (°F)	450	450	450	450	450	450	450	450	450
Slip Fit									
Nominal Liner Thickness (")	0.138	0.150	0.160	0.185	0.235	0.236	0.420	—	—
Vacuum (in. Hg)	Full	Full	Full	Full	Full	Full	Full	—	—
Temperature (°F)	450	450	450	450	450	450	450	—	—
PFA									
Interference Fit									
Nominal Liner Thickness (")	0.125	0.125	0.125	0.125	0.200	0.140	0.155	—	—
Vacuum (in. Hg)	Full	Full	Full	Full	Full	None*	None*	—	—
Temperature (°F)	450	450	450	450	450	450	450	—	—
Slip Fit									
Nominal Liner Thickness (")	0.125	0.125	0.125	0.155	0.250	0.140	0.155	—	—
Vacuum (in. Hg)	Full	Full	Full	Full	Full	None*	None*	—	—
Temperature (°F)	450	450	450	450	450	450	450	—	—
PVDF									
Interference Fit									
Nominal Liner Thickness (")	0.125	0.135	0.145	0.165	0.180	0.200	0.200	—	—
Vacuum (in. Hg)	Full	Full	Full	Full	Full	Full	Full	—	—
Temperature (°F)	275	275	275	275	275	275	275	—	—
Slip Fit									
Nominal Liner Thickness (")	0.125	0.135	0.145	0.165	0.225	0.265	0.320	—	—
Vacuum (in. Hg)	Full	Full	Full	Full	Full	Full	Full	—	—
Temperature (°F)	275	275	275	275	275	275	275	—	—
PP									
Interference Fit									
Nominal Liner Thickness (")	0.135	0.150	0.170	0.175	0.210	0.220	0.220	0.380	0.400
Vacuum (in. Hg)	Full	Full	Full	Full	Full	Full	Full	Full	Full
Temperature (°F)	225	225	225	225	225	225	225	225	225
Slip Fit									
Nominal Liner Thickness (")	0.135	0.150	0.170	0.175	0.210	0.275	0.330	—	—
Vacuum (in. Hg)	Full	Full	Full	Full	Full	Full	Full	—	—
Temperature (°F)	225	225	225	225	225	225	225	—	—
Size	14"	16"	18"	20"	24"	30"			
PTFE									
Slip Fit									
Nominal Liner Thickness (")	0.180	0.200	0.200	0.200	0.200	0.200			
Vacuum (in. Hg)	*	*	*	*	*	*			
Temperature (°F)	450	450	450	450	450	450			

* Consult 3P

Note 1: Certain chemicals may affect vacuum ratings, consult 3P.

Note 2: Standard 1"-12" fittings meet or exceed pipe liner thickness and vacuum ratings for same size and liner material.

For vacuum ratings on 14"-30" PTFE fittings, consult 3P.

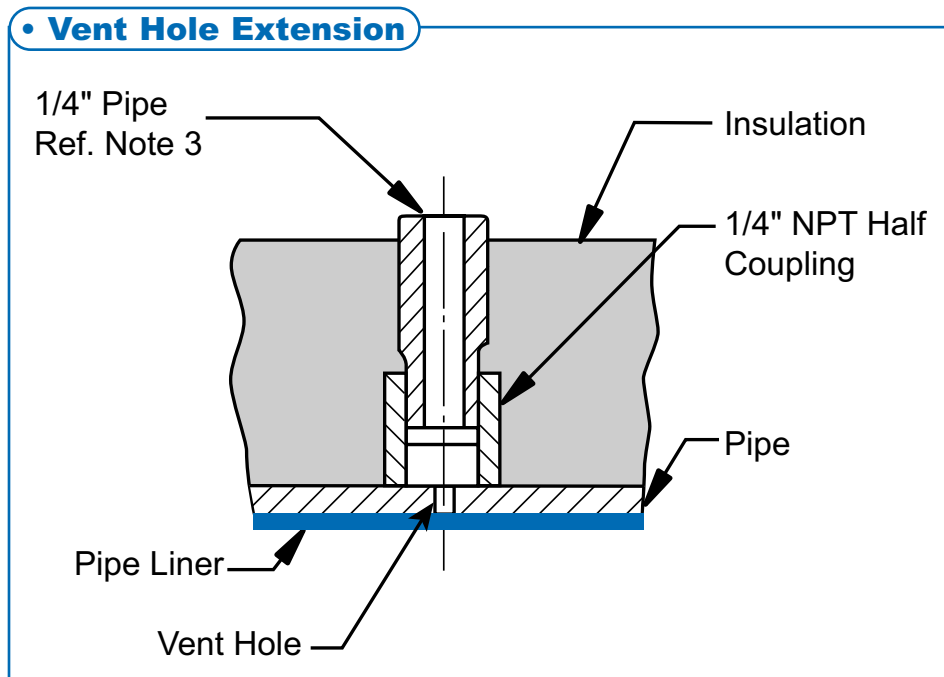
Note 3: Full vacuum on 20' spools.

6. Venting

PFA and PTFE fittings, except blind flanges, reducing flanges, reinforced spacers and instrumentation connections, are vented with one vent hole near the center of the fitting.

PFA and PTFE lined pipe spools, 3 feet and under, have one vent hole near the center of the pipe spool. Pipe spools longer than 3 feet have two vent holes, one near each flange.

Insulated systems may require vent hole extensions.



Notes:

1. Couplings for vent holes are to be specified for individual pipe spools.
2. Couplings are not rated for pressure service.
3. Pipe for vent hole extensions to be supplied by others.
Length determined by thickness of insulation.

7. Protective Coating and Marking

- 7.1 Metal surfaces of pipe and fittings shall be given a protective coating of primer prior to leaving the factory. This is to protect the metal surfaces during transit and storage. For all other paint specifications, consult 3P.
- 7.2 Each flanged end lined pipe spool and fitting shall be identified with 3P's trademark, pipe size, liner and ASTM designations. Pipe spools will also be marked for length.

8. Inspection

- 8.1 Metal pipe and fitting casting shall be visually inspected prior to lining.
- 8.2 Prior to installation, pipe liners shall be thoroughly examined for pinholes, cracks, gouges, nicks or inclusions of foreign particles. If any of these items measure greater than 10% of liner thickness or reduce dielectric capacity below 10,000 volts, liner is subject to rejection.
- 8.3 Pipe and fittings shall be subjected to either a 10,000 volt non-destructive electrostatic test after lining and machining or will be hydrostatically tested to 425 psi. These tests are to detect any pinholes or porosity in the liner which is cause for rejection.
- 8.4 Liner forming the flange gasket sealing surface of pipe and fittings shall be free of defects as described in paragraph 8.2.
- 8.5 Lined pipes and fittings shall be checked for dimensional accuracy in accordance with the drawings and tolerances included in this specification. After inspection, flange protectors shall be installed on each flange prior to any further handling.

9. Handling and Shipping

- 9.1 Prior to shipment, all lined products must have their sealing surfaces covered by flange protectors. These flange protectors shall be removed only for installation. Flange protectors removed for inspection or testing purposes must be re-installed immediately upon completion. Flange protectors must remain in place during packaging, handling and storage of lined products. Slings, chains, or lifting equipment shall not be placed inside lined products or otherwise contact the plastic liner.
- 9.2 Extreme care must be used at all times when placing, transferring and removing product to and from the truck/trailer. Loading and unloading shall be performed by using slings/chains to lift rather than dragging the product.
- 9.3 Avoid storing products in direct sunlight or other adverse conditions.
- 9.4 Consult 3P when handling and installing in extreme temperatures.
- 9.5 Protection of the plastic flare faces is necessary during handling, sandblasting, and painting.

Note: Failure to follow handling and shipping instructions will void 3P's warranty.

10. Installation Instructions

10.1 Flange Protectors

Do not remove flange protectors until pipe and fittings are ready to be installed to prevent damage of plastic sealing surface. Flange protectors should be replaced after inspection or when the item is removed from service.

10.2 Bolting

Recommended bolt torques for installation in foot-pounds:*

Size	PTFE	PFA	PVDF	PP
1"	25	20	40	35
1 1/2"	55	25	55	75
2"	75	30	60	110
3"	110	40	80	125
4"	95	40	80	140
6"	125	50	120	220
8"	190	70	150	220
10"	200	70	—	240
12"	260	80	—	240

Lubricate all bolts and nuts with a suitable grease. Finger tighten all nuts. With a calibrated torque wrench, using the criss-cross method, tighten each bolt to above listed torque. After 24 hours, a temperature cycle or a pressure cycle, the torque of each bolt should be checked and those falling below the above listed value must be retorqued. Torqued values listed above should be exceeded only when necessary to effect a seal.

* When bolting items having dissimilar liner materials, use the higher of the two bolt torques.

10.3 Gaskets

Gaskets must be used when flanging plastic-lined items to bare metal, glass lined or fiberglass flanges. Gaskets may be required when flanging other dissimilar materials (consult 3P). Otherwise, gaskets should not be used except when repeated connections and disconnections are to be made.

Note: Failure to use a calibrated torque wrench and properly lubricated nuts and bolts can result in faulty seals at the flare face or possible damage to the flare.

10.4 Vent Holes

Do not plug vent holes or use sharp instrument to clean plugged vent holes.
Vent hole extensions are recommended for insulated pipe systems.

10.5 Disassembly

Do not remove pipe spools or fittings from system at elevated temperatures.
Upon removal from a system, a flange protector must be bolted to each flange.

10.6 Welding

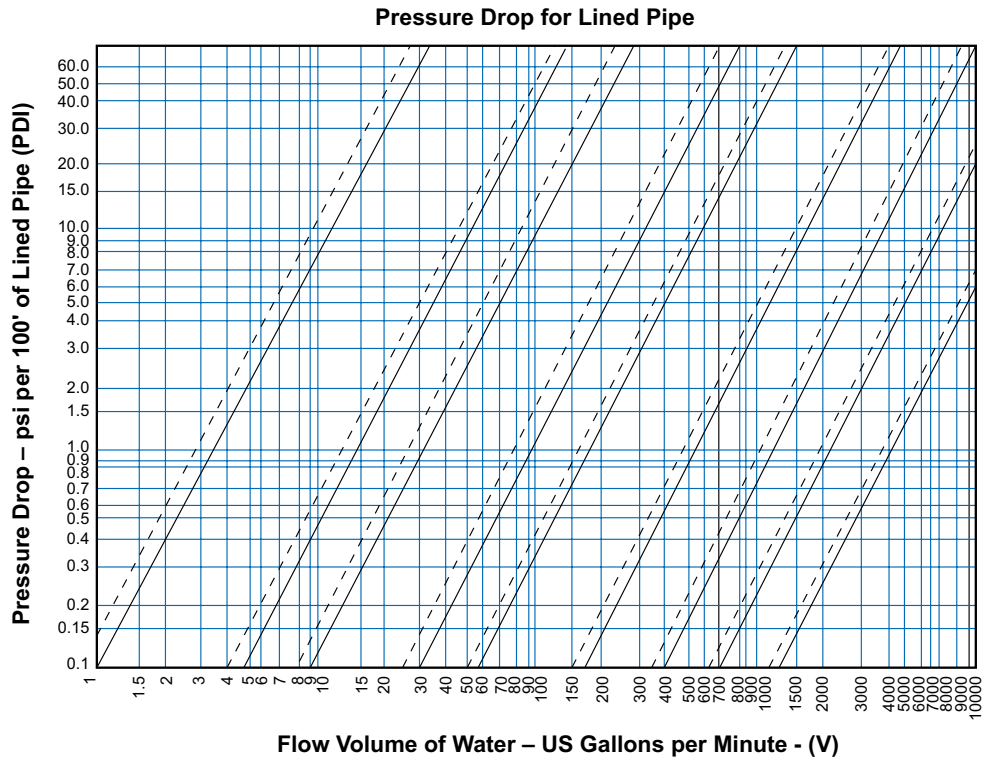
No welding shall be performed on any 3P lined product before or after installation.

10.7 Field Testing

Caution must be exercised when steam is used for field testing. Consult 3P for specific instructions and recommendations.

Subjecting the liner to temperatures above maximum rated temperature or to vacuum conditions exceeding rated vacuum resistance will void factory's warranty.

Warning: Electrostatic field testing in excess of 10,000 volts shall not be conducted without prior approval or supervision, as undue damage may occur to liner material.



Key:
 ————— Pipe Lined with PFA, PTFE or PVDF
 - - - - - Pipe Lined with Polypropylene - PP

For Pressure Loss of Fluids Other than Water:

$$Pd = (2.43 \times 10^{-3}) (V^{1.76}) (\mu^{0.24}) (\rho^{0.76}) / d^{4.76}$$

Pd = Pressure Loss per 100 feet of pipe – psi

V = Flow Volume – gal. per min.

d = Inside Diameter – in. (see chart – opposite page)

μ = Viscosity – Centipoise

ρ = Density – lb. per cu. ft.

For Converting Pressure Loss in psi to Pressure Loss in feet

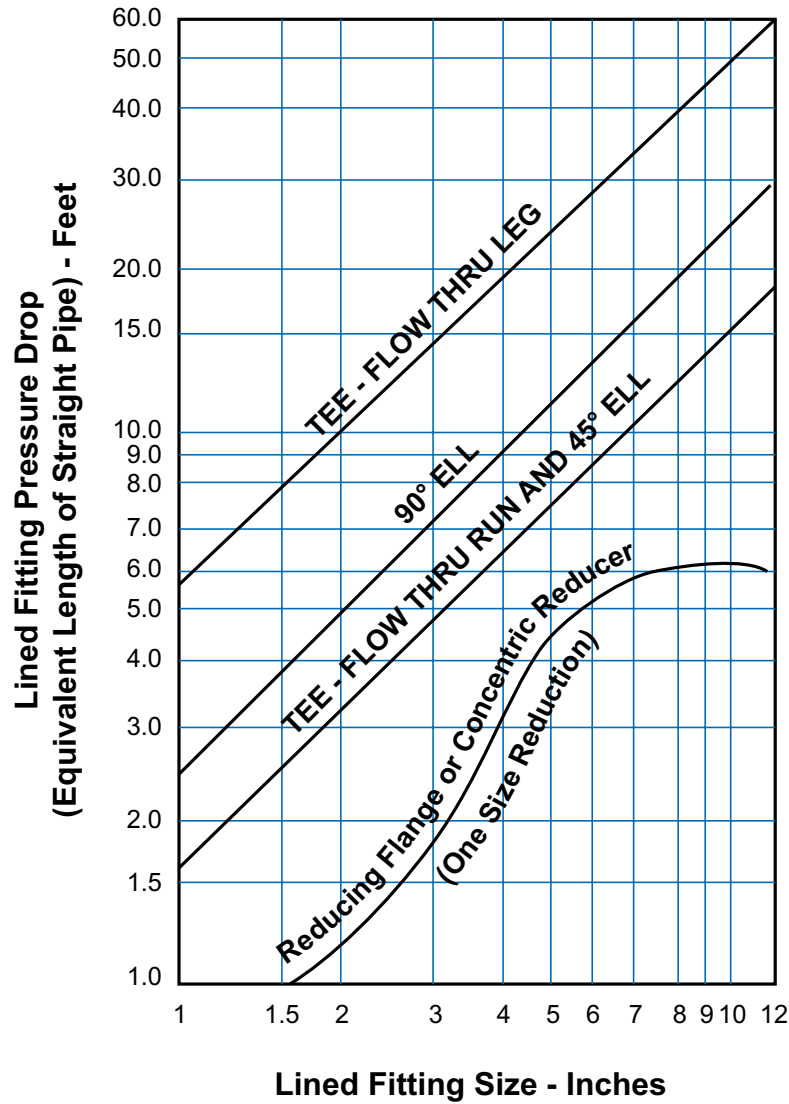
$$\Delta h = 2.31 \Delta p / S.G.$$

Δh = Pressure Loss in Feet

Δp = Pressure Loss in psi

S.G. = Specific Gravity

PRESSURE LOSS FOR 3P LINED FITTINGS

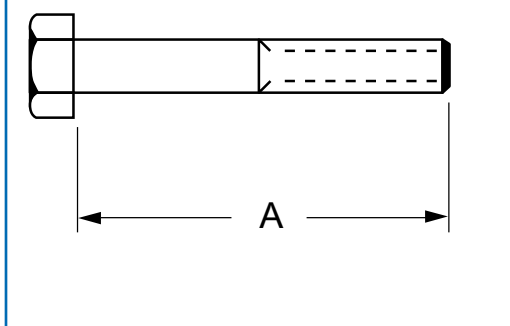


Inside Diameter with Standard Wall Thickness Liner

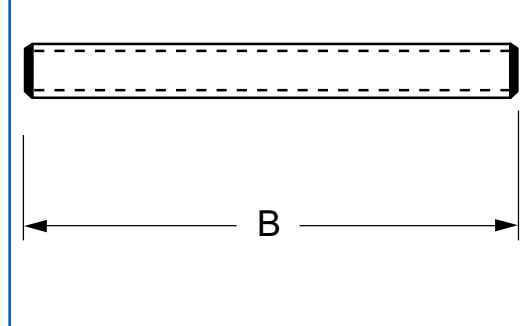
Lined Pipe Size, Nominal	1"	1 1/2"	2"	3"	4"	6"	8"	10"	12"
PFA (in.)	0.780	1.310	1.800	2.745	3.500	5.710	7.630	N/A	N/A
PTFE (in.)	0.754	1.260	1.730	2.685	3.530	5.518	7.100	9.120	11.250
PVDF (in.)	0.765	1.290	1.745	2.710	3.535	5.560	7.320	N/A	N/A
Polypropylene (PP)	0.745	1.260	1.70	2.705	3.575	5.440	7.280	9.260	11.450

INSTALLATION BOLTS

• Bolt



• Stud



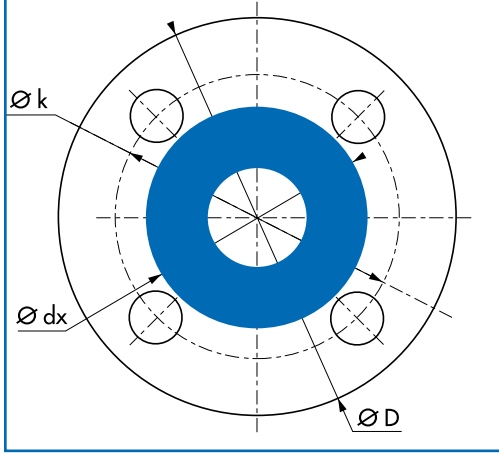
ANSI Class 150 Series				
Pipe Size	Number of Bolts	Bolt Diameter/ Nut Thickness	Recommended Length	
			A	B
1/2"	4	1/2"	2 1/4"	2 3/4"
3/4"	4	1/2"	2 1/4"	2 3/4"
1"	4	1/2"	2 1/4"	2 3/4"
1 1/2"	4	1/2"	2 1/2"	3 1/4"
2"	4	5/8"	2 3/4"	3 1/2"
3"	4	5/8"	3 1/4"	4"
4"	8	5/8"	3 1/2"	4"
6"	8	3/4"	3 3/4"	4 1/2"
8"	8	3/4"	4"	5"
10"	12	7/8"	4 1/2"	5 1/2"
12"	12	7/8"	4 1/2"	5 1/2"

NOTES:

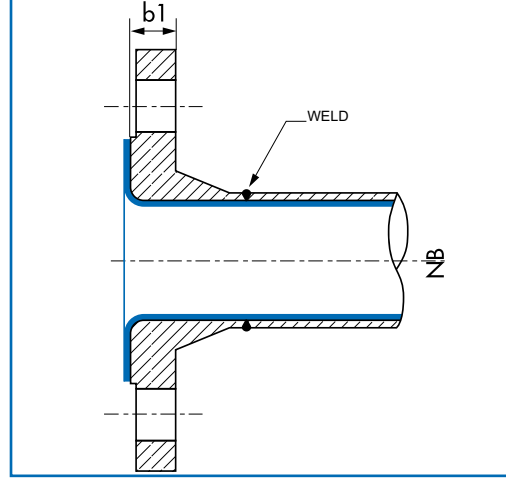
1. Use heavy hex head nuts.
2. Bolt and stud lengths determined using nut thickness noted above.
3. Add 1/4" to length if washers are used.
4. Recommended bolts: ASTM A-193-B7
5. Recommended nuts: ASTM A-194-2H

ANSI CLASS 150 FLANGES

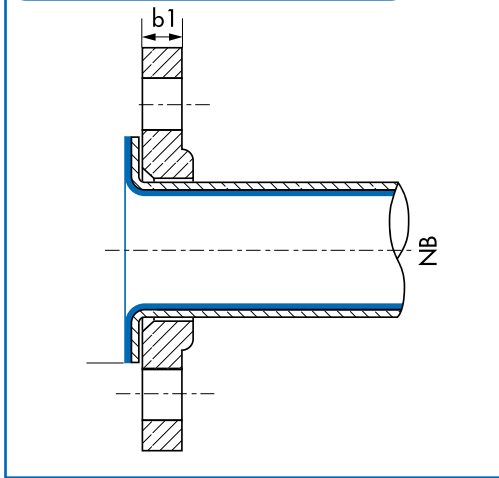
• **FLANGE (frontview)**



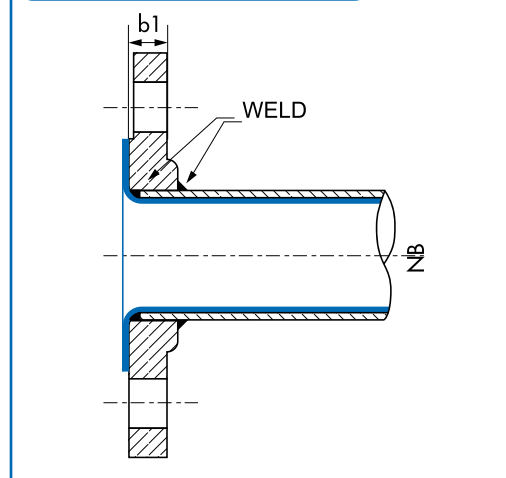
• **WELDING NECK FLANGE**



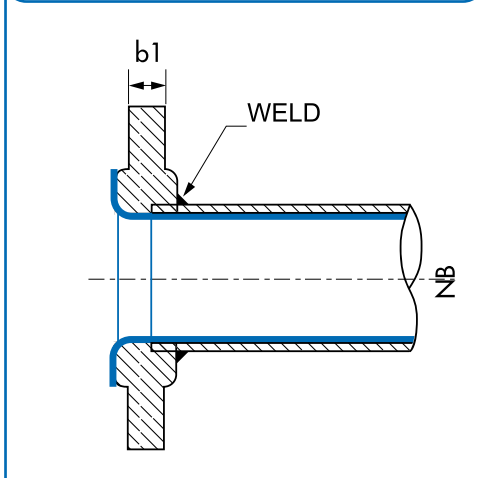
• **LAP JOINT FLANGE**



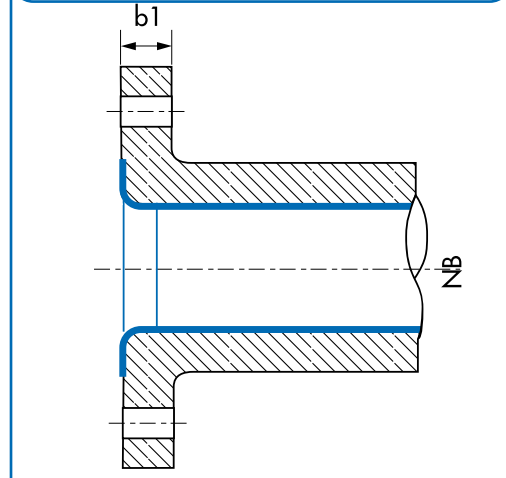
• **SLIP-ON FLANGE**



• **SOCKET WELD FLANGE**



• **DUCTILE IRON FITTING FLANGE**



ANSI CLASS 150 FLANGES

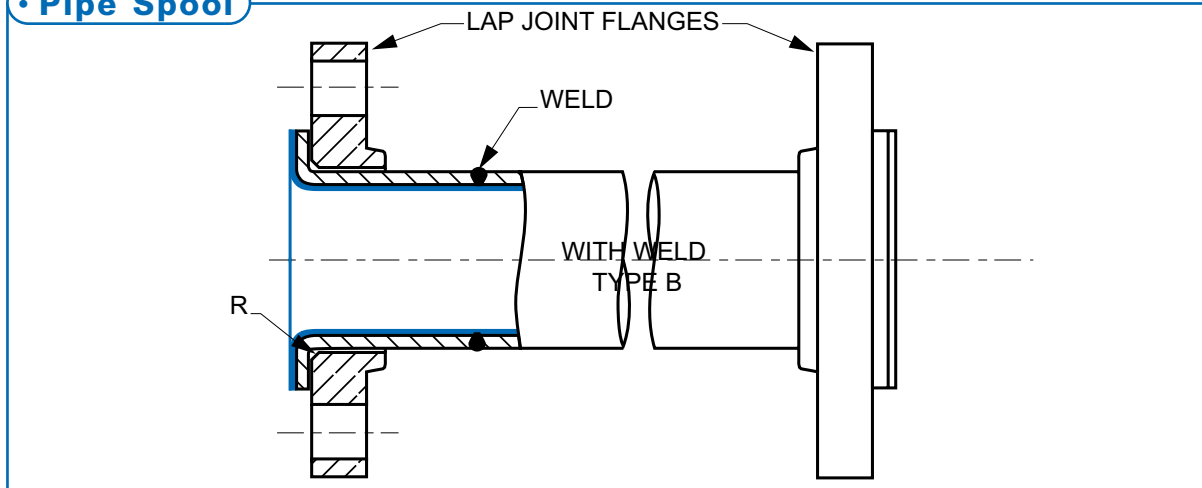
NB	D	dx Min.	k	b1	Holes		UNC
					nbr	∅	
1/2"	3 1/2"	1 1/4"	2 3/8"	7/16"	4	5/8"	1/2"
3/4"	3 7/8"	1 9/16"	2 3/4"	1/2"	4	5/8"	1/2"
1"	4 1/4"	1 7/8"	3 1/8"	9/16"	4	5/8"	1/2"
1 1/2"	5"	2 11/16"	3 7/8"	11/16"	4	5/8"	1/2"
2"	6"	3 7/16"	4 3/4"	3/4"	4	3/4"	5/8"
3"	7 1/2"	4 5/8"	6"	15/16"	4	3/4"	5/8"
4"	9"	5 15/16"	7 1/2"	15/16"	8	3/4"	5/8"
6"	11"	8"	9 1/2"	1"	8	7/8"	3/4"
8"	13 1/2"	10 1/16"	11 3/4"	1 1/8"	8	7/8"	3/4"
10"	16"	12 1/4"	14 1/4"	1 3/16"	12	1"	7/8"
12"	19"	14 3/8"	17"	1 1/4"	12	1"	7/8"
14"	21"	15 1/2"	18 3/4"	1 3/8"	12	1 1/8"	1"
16"	23 1/2"	17 3/4"	21 1/4"	1 17/16"	16	1 1/8"	1"
18"	25"	20 1/4"	22 3/4"	1 9/16"	16	1 1/4"	1 1/8"
20"	27 1/2"	22 1/4"	25"	1 11/16"	20	1 1/4"	1 1/8"
24"	32"	26 1/4"	29 1/2"	1 7/8"	20	1 3/8"	1 1/4"
30**	38 3/4"	32 3/4***	36"	2 1/8"	28	1 3/8"	1 1/4"

* Dimensions in Accordance with B3293

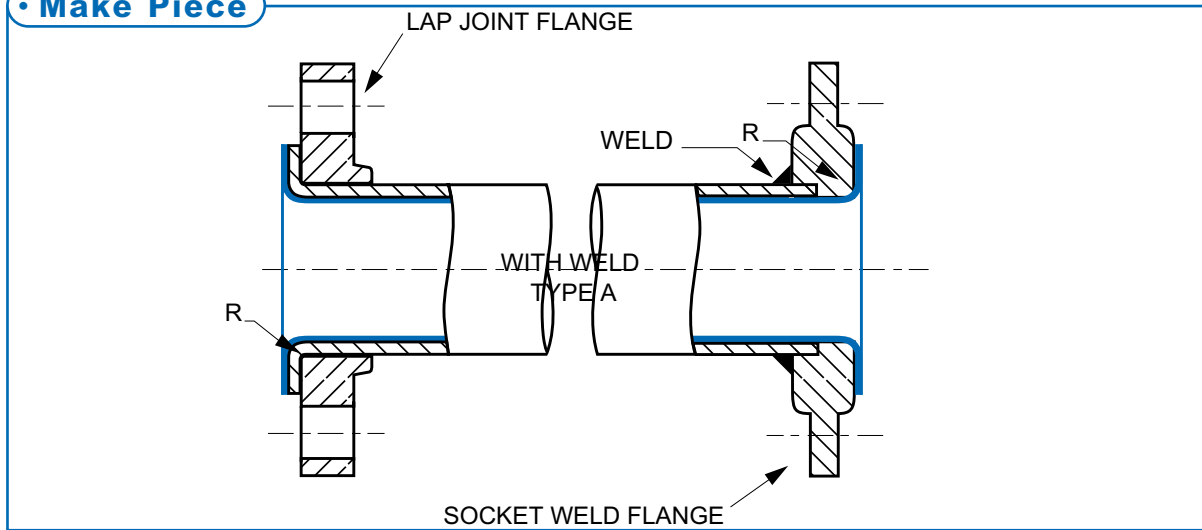
** Not specified in ASTM F1545

STANDARD FLANGED PIPE

• Pipe Spool

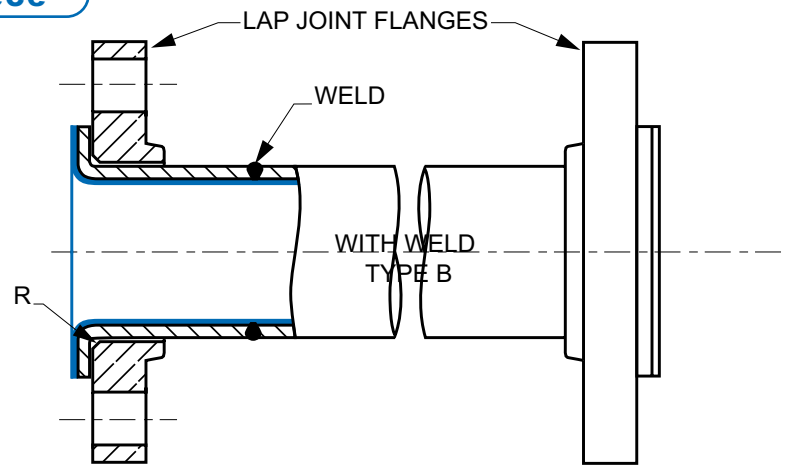


• Make Piece



STANDARD FLANGED PIPE

• Make Piece



Pipe Size	Maximum Lengths Available				R	Weight		Minimum Spool Length	
	Interference Fit Liner PTFE, PP	PFA, PVDF	PTFE	Slip Fit Liner PFA, PVDF, PP		1st ft. w/ 2 flgs	Ea add Foot	With Weld	Without Weld
1"	20'	20'	20'	20'	1/8"	6	2	3 1/16"	5 1/4"
1 1/2"	20'	20'	20'	40'	1/4"	9	3	3 1/16"	6"
2"	20'	20'	20'	40'	1/4"	14	4	3 5/8"	6 1/4"
3"	20'	20'	20'	40'	3/8"	26	8	4"	8 1/8"
4"	20'	20'	20'	40'	3/8"	38	11 1/2	4 1/16"	10 1/8"
6"	20'	20'	10'	40'	3/8"	60	21	5"	11"
8"	20'	20'	10'	20'	3/8"	98	32	5 1/2"	11"
10"	20'	—	—	—	3/8"	128	39	6"	18 5/8"
12"	20'	—	—	—	3/8"	180	52	6 1/4"	21 1/2"
14"	—	—	10'	—	3/8"	230	62	*	*
16"	—	—	10'	—	3/8"	281	72	*	*
18"	—	—	10'	—	3/8"	320	81	*	*
20"	—	—	10'	—	3/8"	396	97	*	*
24"	—	—	10'	—	3/8"	497	118	*	*
30"	—	—	10'	—	3/8"	786	190	*	*

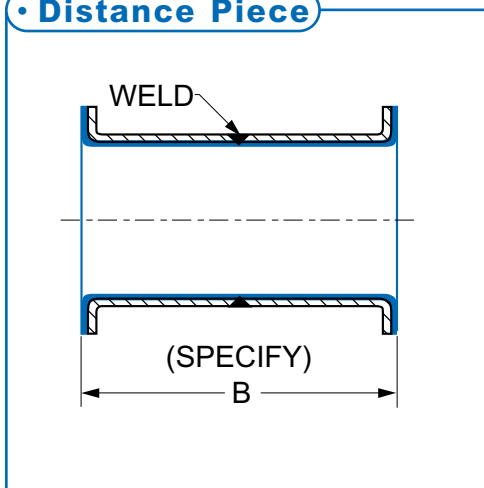
* Consult 3P

NOTES:

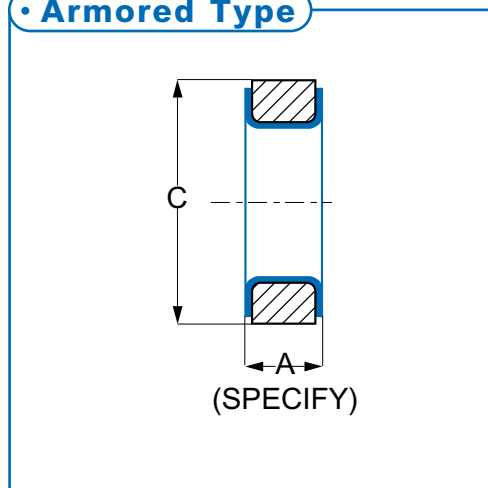
1. Available in custom lengths to nearest 1/16" up to maximum lengths.
2. For lengths shorter than minimum spool length with weld, see spacers.
3. Full vacuum rating on spools to 20' in length, consult 3P over 20'.
4. Pipe spools that require welds may be supplied per Type A or Type B

REINFORCED SPACERS

Distance Piece



Armored Type

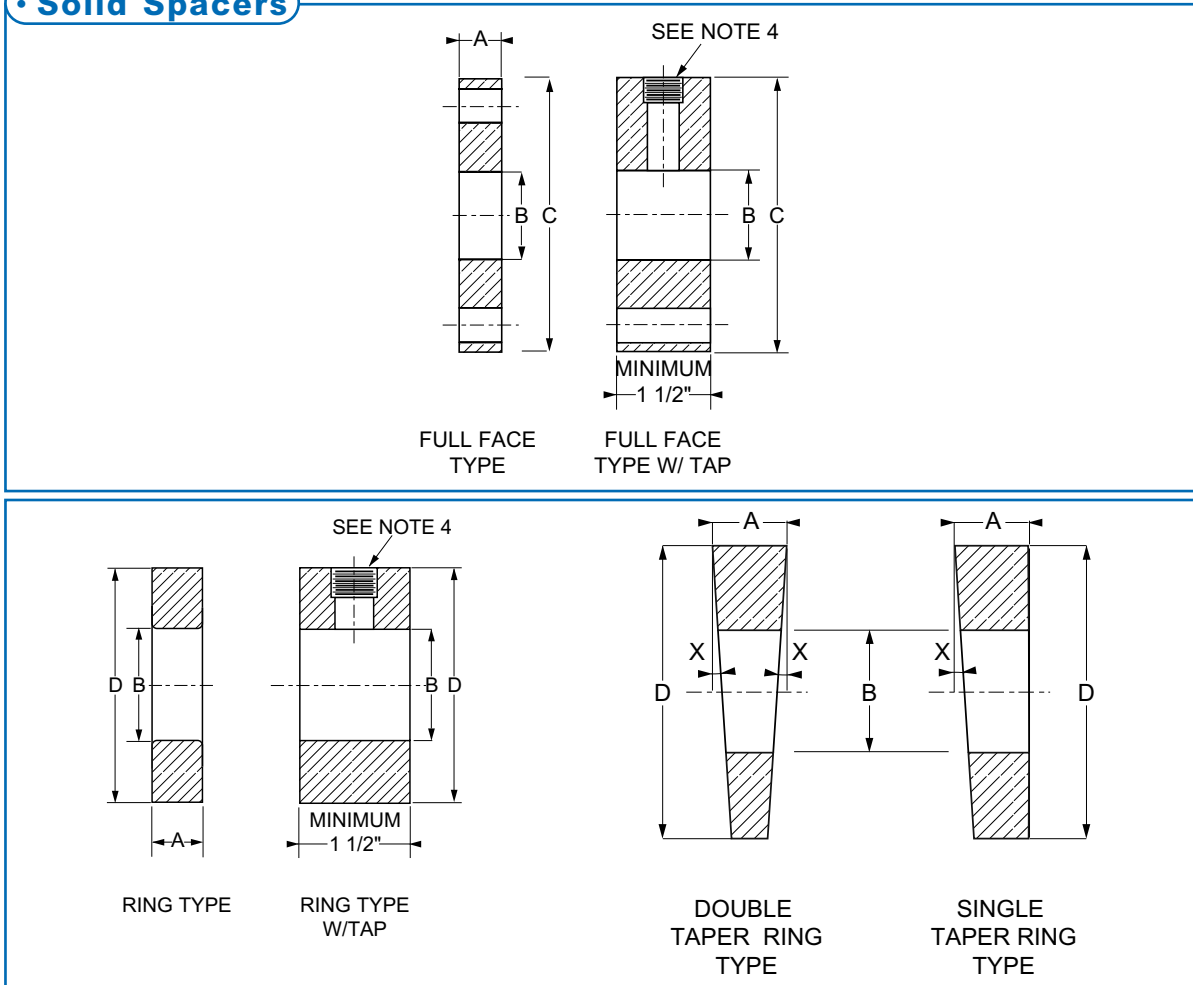


Size	A Specify Length in (")	B Specify Length in (")	C	Lbs/Inch
1"	1/2" thru 3"	—	2 1/2"	1 1/4
1 1/2"	1/2" thru 3"	—	3 1/4"	1 7/8
2"	1/2" thru 3"	3 1/16" thru 3 9/16"	4"	2 5/8
3"	1/2" thru 3"	3 1/16" thru 3 15/16"	5 1/4"	4 1/4
4"	1/2" thru 3"	3 1/16" thru 4"	6 3/4"	5 5/8
6"	1/2" thru 3"	3 1/16" thru 4 15/16"	8 5/8"	8 5/8
8"	1/2" thru 3"	3 1/16" thru 5 7/16"	10 5/8"	11 3/4
10"	1/2" thru 3"	3 1/16" thru 5 15/16"	12 7/8"	16
12"	1/2" thru 3"	3 1/16" thru 6 3/16"	15 5/8"	21 1/2

NOTES:

1. Lengths: Available in 1/16" increments (specify)
2. Liner Material:
 Distance Piece Type: PTFE, PFA, PVDF, PP
 Armored Spacer Type: PFA

• Solid Spacers



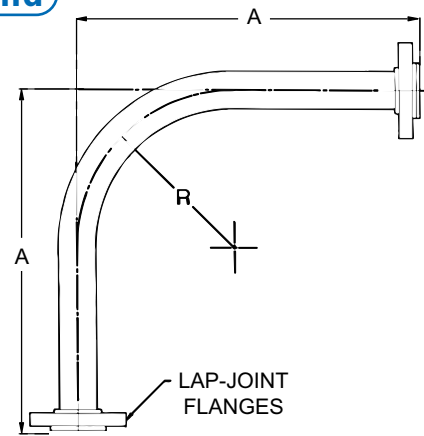
Size	B	C	D
1"	13/16"	4 1/4"	2 1/2"
1 1/2"	1 5/16"	5"	3 1/4"
2"	1 3/4"	6"	4"
3"	2 3/4"	7 1/2"	5 1/4"
4"	3 5/8"	9"	6 3/4"
6"	5 5/8"	11"	8 5/8"
8"	7 1/2"	13 1/2"	10 5/8"
10"	9 1/2"	16"	12 7/8"
12"	11 1/2"	19"	15 5/8"

NOTES:

1. Material: PTFE, PVDF and PP
2. Length (A): 1/4" thru 3" to be specified. Available in 1/16" increments.
3. Angle (X): To be specified
4. Outlet: Tap size of 1/2" or 3/4" NPT – please specify
5. Bolt circle and bolt hole sizes per ANSI Class 150 dimensions.

LONG RADIUS PIPE BEND

• Long Radius Pipe Bend

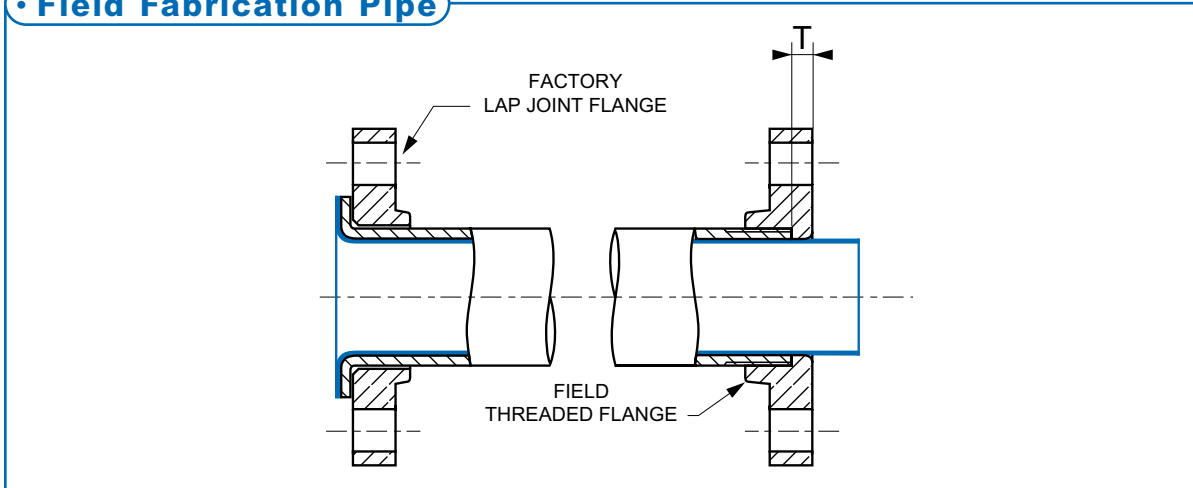


Pipe Size	A Min.	R	Weight		Liner Availability		
			First Foot	Ea Add Foot	PTFE	PP	PVDF
1"	16"	5 3/4"	6	2	X	X	X
1 1/2"	18"	8 1/4"	9	3	X	X	X
2"	21"	9 1/2"	14	4	X	X	X
3"	29"	15"	26	8	X	X	X
4"	36"	20"	38	11 1/2	X	X	X

NOTES:

1. Pipe does not remain round after bending. Roundness within 5%.

• Field Fabrication Pipe



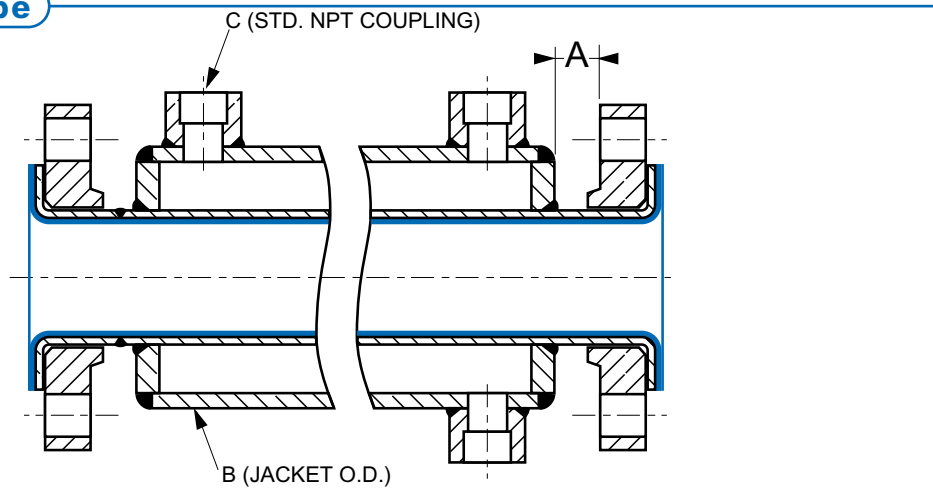
Pipe Size	Lengths Available Slip Fit Liner PTFE, PFA, PVDF, PP	Weight		Threaded Flange	
		10 ft w/ 1 Flg	10 ft Plain End	T	Approx Wt.
1"	10' & 20'	22	20	3/16"	1 7/8
1 1/2"	10' & 20'	33	30	1/4"	3 1/8
2"	10' & 20'	46	40	5/16"	4 3/4
3"	10' & 20'	92	80	3/8"	8 1/2
4"	10' & 20'	132	116	3/8"	12 1/4
6"	10'	231	210	1/2"	17 3/4
8"	10'	356	320	1/2"	34

NOTES:

1. Field fabrication pipe is available with both ends or one end unflanged.
2. Maximum length: plain-end and one-end flanged field fabrication pipe is supplied with sufficient pipe and liner to fabricate a finished spool length of the length stated above.
3. Both lap joint and threaded flanges are available from 3P.

JACKETED PIPE

• Jacketed Pipe



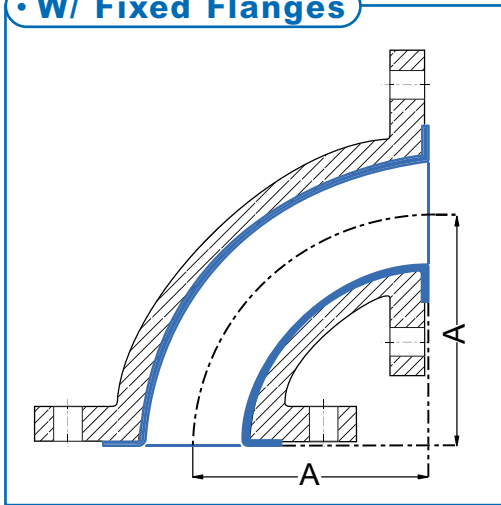
Pipe Size	A	B	LBS. Weight	
			1st ft 2/ 2 Flgs	Each Add Ft
1"	1 1/2"	2 3/8"	9 3/4	5 3/8
1 1/2"	1 1/2"	3 1/2"	16 1/4	10 1/4
2"	1 1/2"	4 1/2"	24 1/2	14 1/2
3"	2"	5 9/16"	40 1/3	22 1/4
4"	2"	6 5/8"	55 7/8	29 7/8
6"	2"	8 5/8"	85 1/2	47 1/2
8"	2"	10 3/4"	123	72 1/2

NOTES:

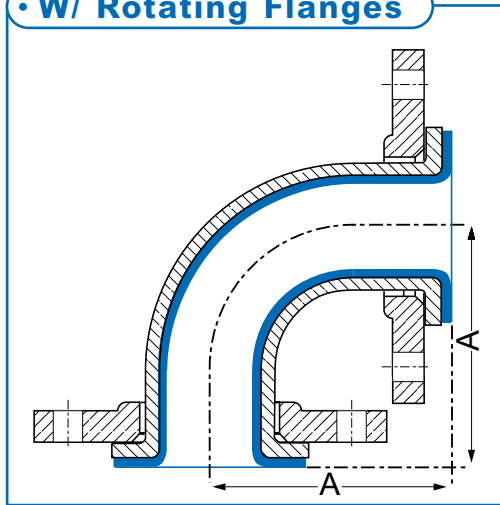
1. Liner Material: PTFE, PFA
2. Flanges: Lap-joint type standard or slip-on type when specified.
3. Coefficient of thermal conductivity: consult 3P.
4. Available in custom lengths to nearest 1/16".
5. Maximum Length: 20 feet.

90° LINED ELBOWS

• W/ Fixed Flanges



• W/ Rotating Flanges



Size	A	LBS. Weight	LINER AVAILABILITY			
			PTFE	PFA	PVDF	PP
1"	3 1/2"	8	DI,VS,FS,SS	DI,VS,FS,SS	DI	DI
1 1/2"	4"	12	DI,VS,FS,SS	DI,VS,FS,SS	DI	DI
2"	4 1/2"	17	DI,VS,FS,SS	DI,VS,FS,SS	DI	DI
3"	5 1/2"	31	DI,VS,FS,SS	DI	DI	DI
4"	6 1/2"	51	DI,VS,FS,SS	DI	DI	DI
6"	8"	72	DI,FS,SS	DI	DI	DI
8"	9"	135	DI	DI	DI	DI
10"	11"	270	DI	—	—	DI
12"	12"	280	FF	—	—	DI
14"	14"	258	FF			
16"	17 3/4" *	344	FF			
18"	18 11/16" **	394	FF			
20"	31 7/8" *	1186	FF**			
24"	38 3/8" *	1528	FF**			
30"	47 1/4" **	2630	FF**			

* Dimension does not conform to ANSI B 16.5

** Body is constructed of 3 sections bolted together

DI - Ductile iron body with fixed flanges

VS - Fabricated carbon steel body with rotating ductile iron flanges

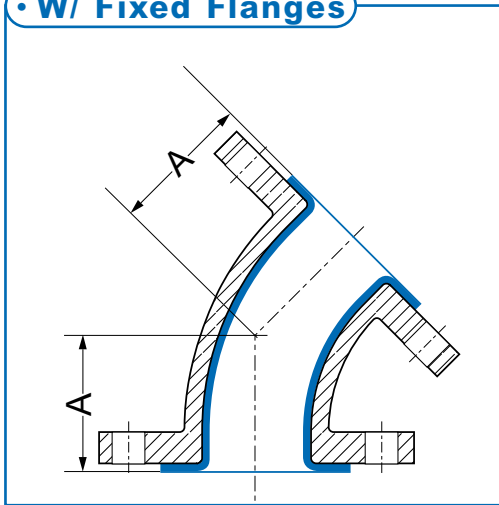
FS - Fabricated carbon steel body with rotating carbon steel flanges

FF - Fabricated carbon steel body with fixed carbon steel flanges

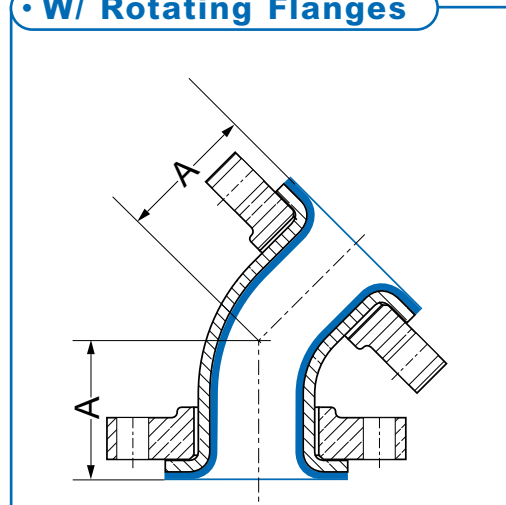
SS - Fabricated stainless steel body with rotating stainless steel flanges

45° LINED ELBOWS

• W/ Fixed Flanges



• W/ Rotating Flanges



Size	A	LBS. Weight	L I N E R A V A I L A B I L I T Y			
			PTFE	PFA	PVDF	PP
1"	1 3/4"	6	VS,FS,SS	VS,FS,SS	DI	DI
1 1/2"	2 1/4"	8	VS,FS,SS	VS,FS,SS	DI	DI
2"	2 1/2"	12	VS,FS,SS	VS,FS,SS	DI	DI
3"	3"	20	VS,FS,SS	DI	DI	DI
4"	4"	36	VS,FS,SS	DI	DI	DI
6"	5"	60	FS,SS	DI	DI	DI
8"	5 1/2"	102	DI	DI	DI	DI
10"	6 1/2"	150	FF	—	—	DI
12"	7 1/2"	238	FF	—	—	DI
14"	7 1/2"	205	FF			
16"	8"	267	FF			
18"	8 1/2"	304	FF			
20"	13 1/2" *	752	FF**			
24"	16 1/4" *	968	FF**			
30"	on request	on request	FF**			

* Dimension does not conform to ANSI B 16.5

** Body is constructed of 2 sections bolted together

DI - Ductile iron body with fixed flanges

VS - Fabricated carbon steel body with rotating ductile iron flanges

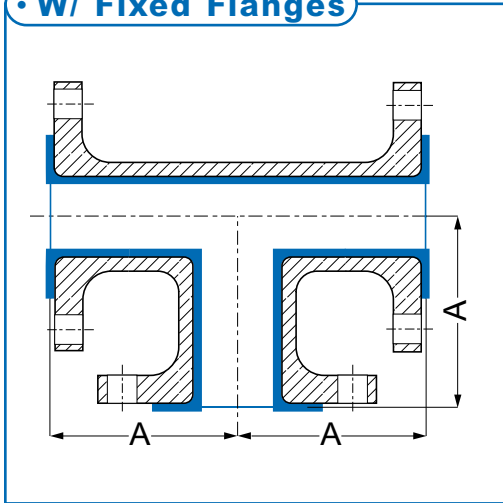
FS - Fabricated carbon steel body with rotating carbon steel flanges

FF - Fabricated carbon steel body with fixed carbon steel flanges

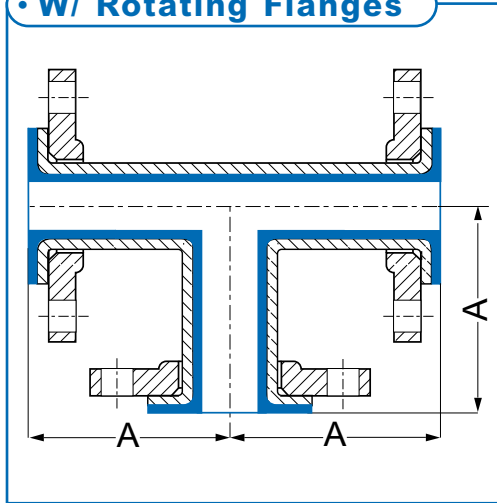
SS - Fabricated stainless steel body with rotating stainless steel flanges


LINED EQUAL TEES

• W/ Fixed Flanges



• W/ Rotating Flanges



Size	A	LBS. Weight	L I N E R A V A I L A B I L I T Y			
			PTFE	PFA	PVDF	PP
1"	3 1/2"	12	—	DI,VS,FS,SS	DI,FS	DI,FS
1 1/2"	4"	17	—	DI,VS,FS,SS	DI,FS	DI,FS
2"	4 1/2"	24	—	DI,VS,FS,SS	DI,FS	DI,FS
3"	5 1/2"	48	—	DI,VS,FS,SS	DI,FS	DI,FS
4"	6 1/2"	73	—	DI,VS,FS,SS	DI,FS	DI,FS
6"	8"	104	DI,FS	DI,FS,SS	DI,FS	DI,FS
8"	9"	178	FS	FS,SS	FS	FS
10"	11"	245	DI	—	—	DI
12"	12"	425	FF	—	—	DI
14"	14"	474	FF**			
16"	15"	587	FF**			
18"	16 1/2"	679	FF**			
20"	18"	873	FF**			
24"	22"	1147	FF**			
30"	on request	on request	FF**			

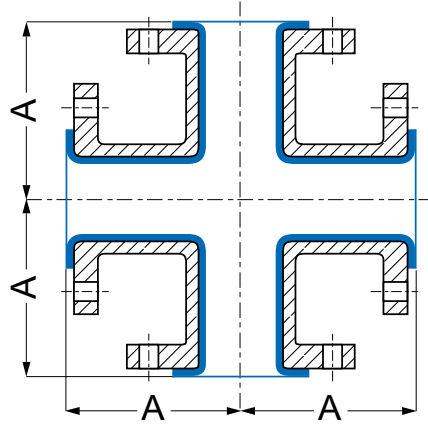
For Short Stack Tees, Consult 3P.

** Body is constructed of 2 sections bolted together

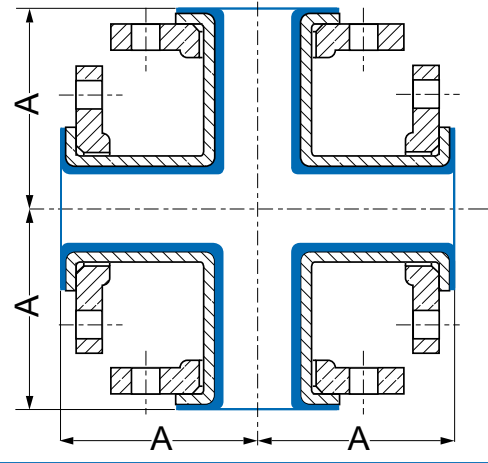
- DI - Ductile iron body with fixed flanges
- VS - Fabricated carbon steel body with rotating ductile iron flanges
- FS - Fabricated carbon steel body with rotating carbon steel flanges
- FF - Fabricated carbon steel body with fixed carbon steel flanges
- SS - Fabricated stainless steel body with rotating stainless steel flanges

LINED CROSSES

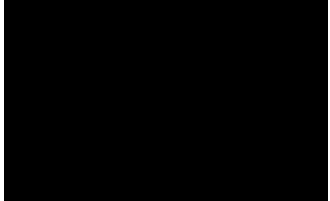
• W/ Fixed Flanges



• W/ Rotating Flanges



Size	A	LBS. Weight	LINER AVAILABILITY			
			PTFE	PFA	PVDF	PP
1"	3 1/2"	12	—	DI,VS,FS,SS	DI,FS	DI,FS
1 1/2"	4"	18	—	DI,VS,FS,SS	DI,FS	DI,FS
2"	4 1/2"	30	—	DI,VS,FS,SS	DI,FS	DI,FS
3"	5 1/2"	52	—	DI,VS,FS,SS	DI,FS	DI,FS
4"	6 1/2"	73	—	DI,VS,FS,SS	DI,FS	DI,FS
6"	8"	115	—	FS,SSFS,SS	FS	FS
8"	9"	190	—	FS,SS	FS	FS
10"	11"	273	FF**			
12"	12"	372	FF**			
14"	14"	661	FF**			
16"	15"	818	FF**			
18"	16 1/2"	941	FF**			
20"	18"	1206	FF**			
24"	22"	1570	FF**			
30"	on request	on request	FF**			

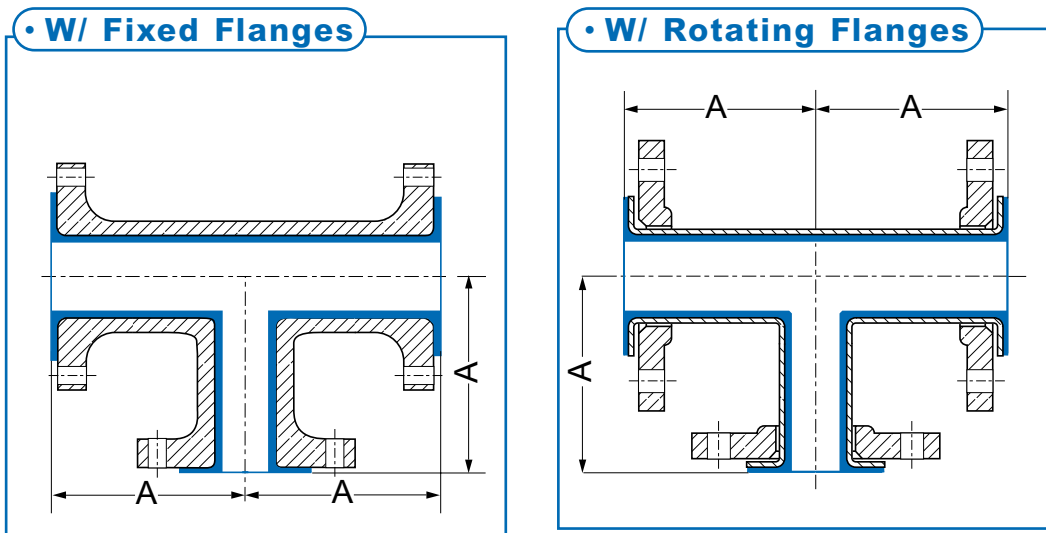


For Short Stack Crosses, Consult 3P.

** Body is constructed of 3 sections bolted together

- DI - Ductile iron body with fixed flanges
- VS - Fabricated carbon steel body with rotating ductile iron flanges
- FS - Fabricated carbon steel body with rotating carbon steel flanges
- FF - Fabricated carbon steel body with fixed carbon steel flanges
- SS - Fabricated stainless steel body with rotating stainless steel flanges

LINED REDUCING TEES



Size	A	LBS. Weight	LINER AVAILABILITY			
			PTFE	PFA	PVDF	PP
1 1/2" x 1"	4"	20	—	DI,FS,SS	DI,FS	DI,FS
2" x 1"	4 1/2"	22	—	DI,FS,SS	DI,FS	DI,FS
2" x 1 1/2"	4 1/2"	22	—	DI,FS,SS	DI,FS	DI,FS
3" x 1"	5 1/2"	38	—	DI,FS,SS	DI,FS	DI,FS
3" x 1 1/2"	5 1/2"	38	—	DI,FS,SS	DI,FS	DI,FS
3" x 2"	5 1/2"	38	—	DI,FS,SS	DI,FS	DI,FS
4" x 1"	6 1/2"	62	—	FS,SS	FS	FS
4" x 1 1/2"	6 1/2"	62	—	FS,SS	FS	FS
4" x 2"	6 1/2"	62	—	DI,FS,SS	DI,FS	DI,FS
4" x 3"	6 1/2"	62	—	DI,FS,SS	DI,FS	DI,FS
6" x 1"	8"	104	—	FS,SS	FS	FS
6" x 1 1/2"	8"	104	—	FS,SS	FS	FS
6" x 2"	8"	104	—	FS,SS	FS	FS
6" x 3"	8"	104	—	FS,SS	FS	FS
6" x 4"	8"	104	—	FS,SS	FS	FS

- DI - Ductile iron body with fixed flanges
- FS - Fabricated carbon steel body with rotating carbon steel flanges
- FF - Fabricated carbon steel body with fixed carbon steel flanges
- SS - Fabricated stainless steel body with rotating stainless steel flanges

LINED REDUCING TEES

Size	A	LBS. Weight	LINER AVAILABILITY			
			PTFE	PFA	PVDF	PP
8" x 1"	9"	179	—	FS,SS	FS	FS
8" x 1 1/2"	9"	179	—	FS,SS	FS	FS
8" x 2"	9"	179	—	FS,SS	FS	FS
8" x 3"	9"	179	—	FS,SS	FS	FS
8" x 4"	9"	179	—	FS,SS	FS	FS
8" x 6"	9"	179	—	FS,SS	FS	FS
10" x 6"	11"	193	FF	—	—	FF
10" x 8"	11"	200	FF	—	—	FF
12" x 8"	12"	253	FF	—	—	FF
12" x 10"	12"	264	FF	—	—	FF
14" x 4"	14"	320	FF	—	—	—
14" x 6"	14"	335	FF**	—	—	—
14" x 8"	14"	364	FF**	—	—	—
14" x 10"	14"	388	FF**	—	—	—
14" x 12"	14"	434	FF**	—	—	—

** Body is constructed of 2 sections bolted together

DI - Ductile iron body with fixed flanges

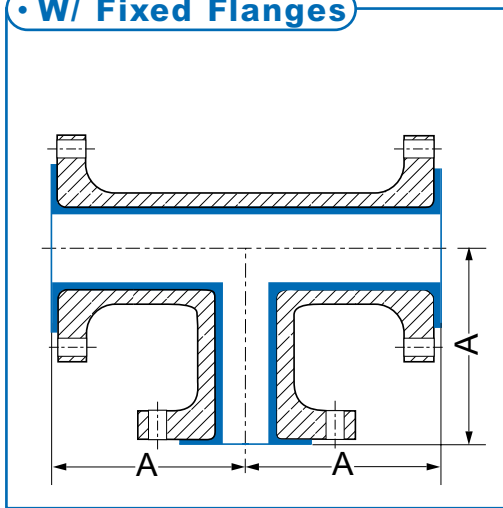
FS - Fabricated carbon steel body with rotating carbon steel flanges

FF - Fabricated carbon steel body with fixed carbon steel flanges

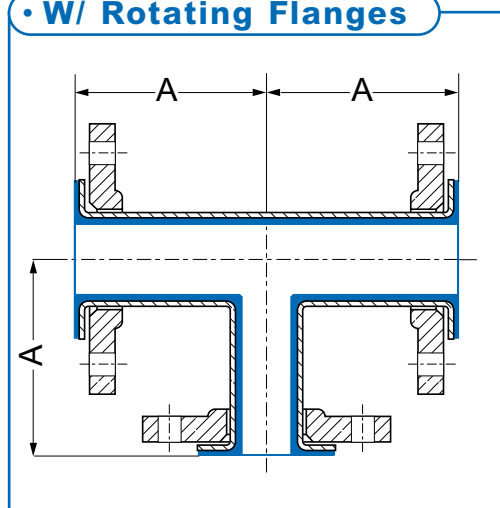
SS - Fabricated stainless steel body with rotating stainless steel flanges

LINED REDUCING TEES

• W/ Fixed Flanges



• W/ Rotating Flanges



Size	A	LBS. Weight	LINER AVAILABILITY			
			PTFE	PFA	PVDF	PP
16" x 4"	15"	390	FF**	—	—	—
16" x 6"	15"	403	FF**	—	—	—
16" x 8"	15"	432	FF**	—	—	—
16" x 10"	15"	456	FF**	—	—	—
16" x 12"	15"	503	FF**	—	—	—
16" x 14"	15"	542	FF**	—	—	—
18" x 8"	16 1/2"	496	FF**	—	—	—
18" x 10"	16 1/2"	520	FF**	—	—	—
18" x 12"	16 1/2"	567	FF**	—	—	—
18" x 14"	16 1/2"	608	FF**	—	—	—
20" x 8"	18"	619	FF**	—	—	—
20" x 10"	18"	644	FF**	—	—	—
20" x 12"	18"	690	FF**	—	—	—
20" x 14"	18"	732	FF**	—	—	—
20" x 16"	18"	776	FF**	—	—	—

** Body is constructed of 2 sections bolted together

DI - Ductile iron body with fixed flanges

FS - Fabricated carbon steel body with rotating carbon steel flanges

FF - Fabricated carbon steel body with fixed carbon steel flanges

SS - Fabricated stainless steel body with rotating stainless steel flanges

LINED REDUCING TEES

Size	A	LBS. Weight	LINER AVAILABILITY			
			PTFE	PFA	PVDF	PP
20" x 18"	18"	802	FF**	—	—	—
24" x 10"	22"	838	FF**	—	—	—
24" x 12"	22"	884	FF**	—	—	—
24" x 14"	22"	928	FF**	—	—	—
24" x 16"	22"	972	FF**	—	—	—
24" x 18"	22"	1003	FF**	—	—	—
24" x 20"	22"	1074	FF**	—	—	—
30" x 10"	O N R E Q U E S T		FF**	—	—	—
30" x 12"			FF**	—	—	—
30" x 14"			FF**	—	—	—
30" x 16"			FF**	—	—	—
30" x 18"			FF**	—	—	—
30" x 20"			FF**	—	—	—
30" x 24"			FF**	—	—	—

** Body is constructed of 2 sections bolted together

DI - Ductile iron body with fixed flanges

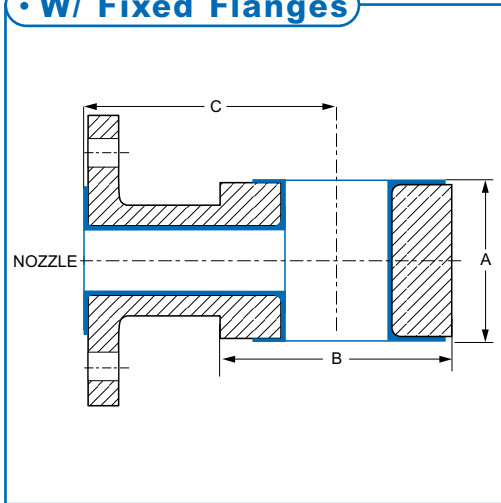
FS - Fabricated carbon steel body with rotating carbon steel flanges

FF - Fabricated carbon steel body with fixed carbon steel flanges

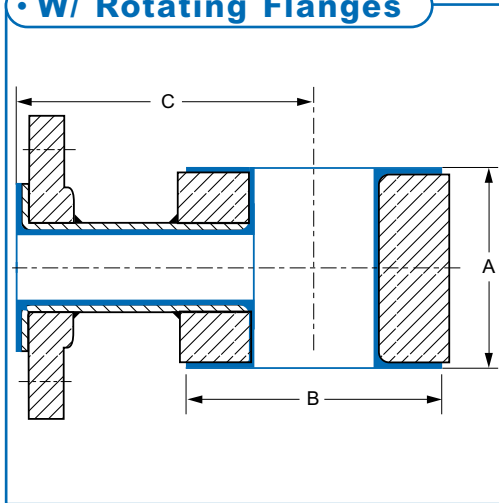
SS - Fabricated stainless steel body with rotating stainless steel flanges

LINED INSTRUMENT TEES

• W/ Fixed Flanges



• W/ Rotating Flanges



Size	Nozzle Size	A	B	C	LBS. Weight	LINER AVAILABILITY			
						PTFE	PFA	PVDF	PP
1"	1"	2"	2 1/2"	3 1/2"	5	—	DI,FS,SS	DI,FS	DI,FS
1 1/2"	1"	2"	3 1/4"	4"	7	—	DI,FS,SS	DI,FS	DI,FS
1 1/2"	1 1/2"	4"	3 1/4"	4"	10	—	FS,SS	FS	FS
2"	1"	2"	4"	4 1/2"	10	—	DI,FS,SS	DI,FS	DI,FS
2"	1 1/2"	4"	4"	4 1/2"	13	—	FS,SS	FS	FS
2"	2"	4"	4"	4 1/2"	13	—	FS,SS	FS	FS
3"	1"	2"	5 1/4"	5 1/2"	13	—	DI,FS,SS	DI,FS	DI,FS
3"	1 1/2"	4"	5 1/4"	5 1/2"	25	—	FS,SS	FS	FS
3"	2"	4"	5 1/4"	5 1/2"	25	—	FS,SS	FS	FS
4"	1"	2"	6 3/4"	6 1/2"	16	—	DI,FS,SS	DI,FS	DI,FS
4"	1 1/2"	4"	6 3/4"	6 1/2"	31	—	FS,SS	FS	FS
4"	2"	4"	6 3/4"	6 1/2"	31	—	FS,SS	FS	FS
6"	1"	2"	8 5/8"	8"	22	—	DI,FS,SS	DI,FS	DI,FS
6"	1 1/2"	4"	8 5/8"	8"	42	—	FS,SS	FS	FS
6"	2"	4"	8 5/8"	8"	42	—	FS,SS	FS	FS

DI - Ductile iron body with fixed flanges

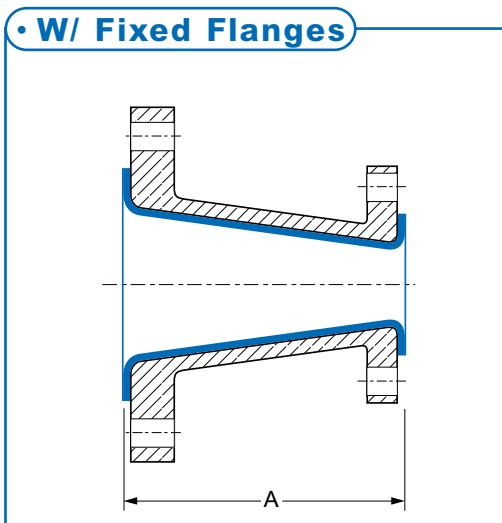
FS - Fabricated carbon steel body with rotating carbon steel flanges

SS - Fabricated stainless steel body with rotating stainless steel flanges

LINED INSTRUMENT TEES

Size	Nozzle Size	A	B	C	LBS. Weight	LINER AVAILABILITY			
						PTFE	PFA	PVDF	PP
8"	1"	2"	10 5/8"	9"	65	—	DI,FS,SS	DI,FS	DI,FS
8"	1 1/2"	4"	10 5/8"	9"	85	—	FS,SS	FS	FS
8"	2"	4"	10 5/8"	9"	85	—	FS,SS	FS	FS
10"	1"	2"	12 7/8"	11"	90	—	DI,SS	—	DI,FS
10"	1 1/2"	4"	12 7/8"	11"	110	—	FS	—	FS
10"	2"	4"	12 7/8"	11"	110	—	FS	—	FS
12"	1"	2"	15 5/8"	12"	100	—	DI,FS	—	DI,FS
12"	1 1/2"	4"	15 5/8"	12"	140	—	FS	—	FS
12"	2"	4"	15 5/8"	12"	140	—	FS	—	FS
14"	1"	2"	17 3/4"	14"	91	FF	—	—	—
14"	1 1/2"	3"	17 3/4"	14"	97	FF	—	—	—
14"	2"	3 1/2"	17 3/4"	14"	99	FF	—	—	—
16"	1"	2"	20"	15"	102	FF	—	—	—
16"	1 1/2"	3"	20"	15"	106	FF	—	—	—
16"	2"	3 1/2"	20"	15"	110	FF	—	—	—
18"	1"	2"	21 5/8"	16 1/2"	113	FF	—	—	—
18"	1 1/2"	3"	21 5/8"	16 1/2"	119	FF	—	—	—
18"	2"	3 1/2"	21 5/8"	16 1/2"	121	FF	—	—	—
20"	1"	2"	23 1/4"	18"	132	FF	—	—	—
20"	1 1/2"	3"	23 1/4"	18"	139	FF	—	—	—
20"	2"	3 1/2"	23 1/4"	18"	141	FF	—	—	—
24"	1"	4"	28 1/4"	22"	152	FF	—	—	—
24"	1 1/2"	6"	28 1/4"	22"	159	FF	—	—	—
24"	2"	6"	28 1/4"	22"	161	FF	—	—	—
30"	On Request					FF	—	—	—

CONCENTRIC REDUCERS



Size	A	LBS. Weight	LINER AVAILABILITY			
			PTFE	PFA	PVDF	PP
1 x 1/2"	4"	8	FS,SS	DI *	DI *	DI *
1 x 3/4"	4"	8 1/2	DI*,FS,SS	DI *	DI *	DI *
1 1/2 x 1"	4 1/2"	10	DI,FS,SS	DI	DI	DI
2 x 1"	5"	11	FS,SS	DI	DI	DI
2 x 1 1/2"	5"	12	DI,FS,SS	DI	DI	DI
3 x 1"	6"	14	FS,SS	DI	DI	DI
3 x 1 1/2"	6"	15	FS,SS	DI	DI	DI
3 x 2"	6"	16	DI,FS,SS	DI	DI	DI
4 x 1"	7"	22	FS,SS	DI	DI	DI
4 x 1 1/2"	7"	24	FS,SS	DI	DI	DI
4 x 2"	7"	25	FS,SS	DI	DI	DI
4 x 3"	7"	28	DI,FS,SS	DI	DI	DI
6 x 3"	9"	42	DI	DI	DI	DI
6 x 4"	9"	47	DI,FS,SS	DI	DI	DI
8 x 4"	11"	68	DI	DI	DI	DI
8 x 6"	11"	80	DI,FS,SS	DI	DI	DI
10 x 6"	12"	89	DI	—	—	DI
10 x 8"	12"	93	DI	—	—	DI
12 x 8"	14"	110	FF	—	—	DI
12 x 10"	14"	118	FF	—	—	DI

* "A" dimension not in compliance with ANSI B16.42 (DI sizes 1 x 1/2" and 1 x 3/4" only).

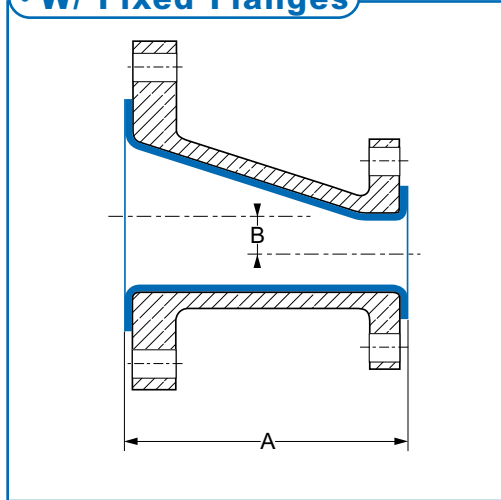
- DI - Ductile iron body with fixed flanges
- FS - Fabricated carbon steel body with rotating carbon steel flanges
- FF - Fabricated carbon steel body with fixed carbon steel flanges
- SS - Fabricated stainless steel body with rotating stainless steel flanges

CONCENTRIC REDUCERS

Size	A	LBS. Weight	LINER AVAILABILITY			
			PTFE	PFA	PVDF	PP
14 x 6"	16"	147	FF	—	—	—
14 x 8"	16"	166	FF	—	—	—
14 x 10"	16"	181	FF	—	—	—
14 x 12"	16"	205	FF	—	—	—
16 x 8"	18"	199	FF	—	—	—
16 x 10"	18"	215	FF	—	—	—
16 x 12"	18"	238	FF	—	—	—
16 x 14"	18"	265	FF	—	—	—
18 x 10"	19"	238	FF	—	—	—
18 x 12"	19"	260	FF	—	—	—
18 x 14"	19"	287	FF	—	—	—
18 x 16"	19"	313	FF	—	—	—
20 x 12"	20"	306	FF	—	—	—
20 x 14"	20"	335	FF	—	—	—
20 x 16"	20"	359	FF	—	—	—
20 x 18"	20"	379	FF	—	—	—
24 x 20"	24"	498	FF	—	—	—
30 x 24"	On Request		FF	—	—	—

ECCENTRIC REDUCERS

• W/ Fixed Flanges



Size	A	B	LBS. Weight	LINER AVAILABILITY			
				PTFE	PFA	PVDF	PP
1 1/2 x 1"	4 1/2"	1/4"	10	DI	DI	DI	DI
2 x 1"	5"	1/2"	11	—	DI	DI	DI
2 x 1 1/2"	5"	1/4"	12	DI	DI	DI	DI
3 x 1"	6"	1"	14	—	DI	DI	DI
3 x 1 1/2"	6"	3/4"	16	—	DI	DI	DI
3 x 2"	6"	1/2"	17	DI	DI	DI	DI
4 x 1 1/2"	7"	1 1/4"	27	—	DI	DI	DI
4 x 2"	7"	1"	28	—	DI	DI	DI
4 x 3"	7"	1/2"	29	DI	DI	DI	DI
6 x 3"	9"	1 1/2"	45	DI	DI	DI	DI
6 x 4"	9"	1"	50	DI	DI	DI	DI
8 x 4"	11"	2"	75	—	DI	DI	DI
8 x 6"	11"	1"	80	DI	DI	DI	DI
10 x 6"	12"	2"	92	FF	—	—	DI
10 x 8"	12"	1"	96	FF	—	—	DI
12 x 8"	14"	2"	112	FF	—	—	DI
12 x 10"	14"	1"	122	FF	—	—	DI

ECCENTRIC REDUCERS

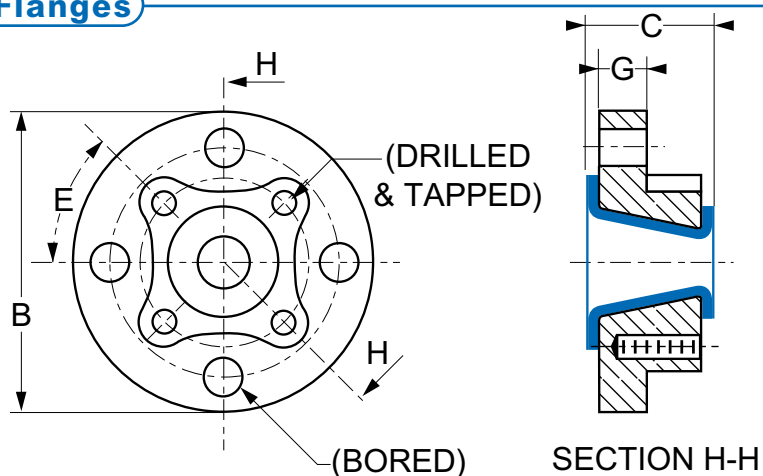
Size	A	B	LBS. Weight	LINER AVAILABILITY			
				PTFE	PFA	PVDF	PP
14 x 6"	16"	3 9/16"	147	FF	—	—	—
14 x 8"	16"	2 5/8"	166	FF	—	—	—
14 x 10"	16"	1 5/8"	181	FF	—	—	—
14 x 12"	16"	5/8"	205	FF	—	—	—
16 x 8"	18"	3 5/8"	199	FF	—	—	—
16 x 10"	18"	2 5/8"	215	FF	—	—	—
16 x 12"	18"	1 5/8"	238	FF	—	—	—
16 x 14"	18"	1"	265	FF	—	—	—
18 x 10"	19"	3 5/8"	238	FF	—	—	—
18 x 12"	19"	2 5/8"	260	FF	—	—	—
18 x 14"	19"	2"	287	FF	—	—	—
18 x 16"	19"	1"	313	FF	—	—	—
20 x 12"	20"	3 9/16"	306	FF	—	—	—
20 x 14"	20"	3"	335	FF	—	—	—
20 x 16"	20"	2"	359	FF	—	—	—
20 x 18"	20"	1"	379	FF	—	—	—
24 x 20"	24"	2"	498	FF	—	—	—
30 x 24"	On Request			FF	—	—	—

DI - Ductile iron body with fixed flanges

FF - Fabricated carbon steel body with fixed carbon steel flanges

REDUCING FLANGES

• Reducing Flanges

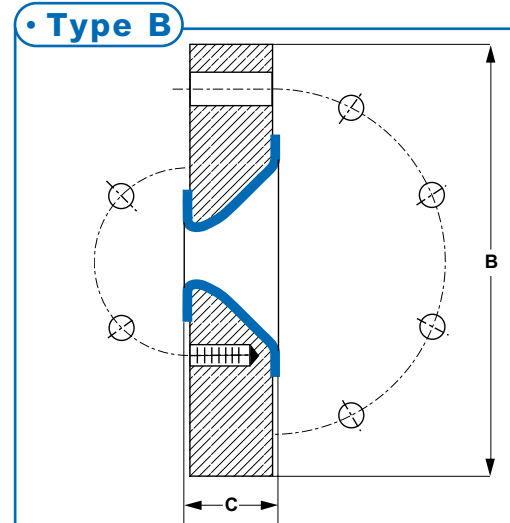
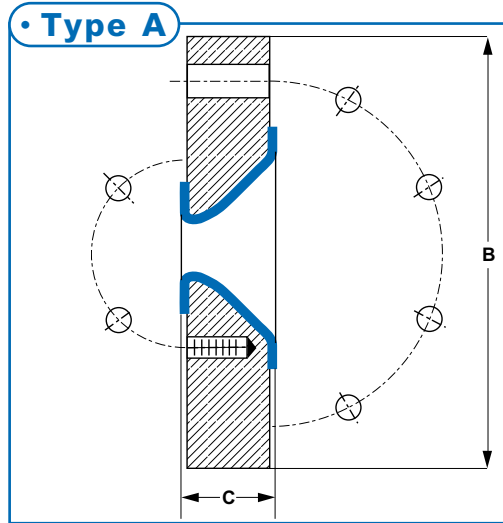


Size	B	C	E*	G	LBS. Weight	LINER AVAILABILITY		
						PFA	PVDF	PP
1 x 1/2"	4 1/2"	1 3/4"	B	7/16"	4 3/4	DI, FF, SF	DI, FF	DI, FF
1 x 3/4"	4 1/2"	1 3/4"	B	7/16"	5 1/4	DI, FF, SF	DI, FF	DI, FF
1 1/2 x 1"	5"	1 3/4"	B	9/16"	5 3/4	DI, FF, SF	DI, FF	DI, FF
2 x 1"	6"	1 3/4"	B	5/8"	7 1/2	DI, FF, SF	DI, FF	DI, FF
2 x 1 1/2"	6"	1 3/4"	B	5/8"	7	DI, FF, SF	DI, FF	DI, FF
3 x 1"	7 1/2"	1 25/32"	B	3/4"	13 1/4	DI, FF, SF	DI, FF	DI, FF
3 x 1 1/2"	7 1/2"	1 25/32"	B	3/4"	12 1/2	DI, FF, SF	DI, FF	DI, FF
3 x 2"	7 1/2"	1 25/32"	B	3/4"	12	DI, FF, SF	DI, FF	DI, FF
4 x 1"	9"	1 5/8"	A	15/16"	16	DI, FF, SF	DI, FF	DI, FF
4 x 1 1/2"	9"	1 5/8"	A	15/16"	15	DI, FF, SF	DI, FF	DI, FF
4 x 2"	9"	1 17/32"	A	15/16"	14 1/2	DI, FF, SF	DI, FF	DI, FF
4 x 3"	9"	1 5/8"	A	15/16"	14	DI, FF, SF	DI, FF	DI, FF
6 x 1 1/2"	11"	2 3/32"	A	1"	27	DI, FF, SF	DI, FF	DI, FF
6 x 2"	11"	2 3/32"	A	1"	26 1/2	DI, FF, SF	DI, FF	DI, FF
6 x 3"	11"	1 31/32"	A	1"	25 1/2	DI, FF, SF	DI, FF	DI, FF
6 x 4"	11"	1 31/32"	B	1"	24 1/2	DI, FF, SF	DI, FF	DI, FF
8 x 4"	13 1/2"	2 3/32"	B	1 1/8"	43 1/2	DI, FF, SF	DI, FF	DI, FF
8 x 6"	13 1/2"	2 3/32"	B	1 1/8"	38 1/2	DI, FF, SF	DI, FF	DI, FF
10 x 4"	16"	2 3/32"	A	1 7/64"	75	DI	—	DI
10 x 6"	16"	2 3/32"	A	1 7/64"	60	DI	—	DI
10 x 8"	16"	2 3/32"	A	1 7/64"	56	DI	—	DI
12 x 6"	19"	2 3/32"	A	1 1/4"	98	DI	—	DI
12 x 8"	19"	2 3/32"	A	1 1/4"	84	DI	—	DI
12 x 10"	19"	2 3/32"	A	1 1/4"	79	DI	—	DI

DI - Ductile iron with fixed flanges
 FF - Fabricated carbon steel with fixed flanges
 SF - Fabricated stainless steel with fixed flanges

* BOLT HOLE ROTATION
 (A) All straddle centerline
 (B) One set straddle centerline and one set on centerline

LARGE DIAMETER REDUCING FLANGES

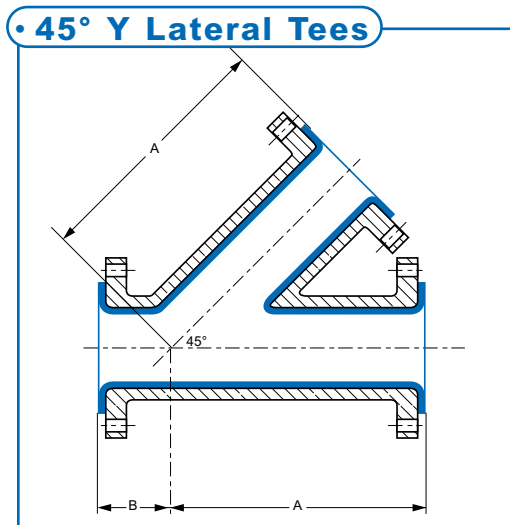


Size	B	C	Type	Weight lbs.	Liner Availability PTFE
14" x 6"	21"	2"	A	132	FF
14" x 8"	21"	2"	A	123	FF
14" x 10"	21"	2"	A	117	FF
14" x 12"	21"	2"	B	110	FF
16" x 8"	23 1/2"	2"	A	165	FF
16" x 10"	23 1/2"	2"	A	156	FF
16" x 12"	23 1/2"	2"	A	147	FF
16" x 14"	23 1/2"	2"	B	141	FF
18" x 10"	25"	2"	A	172	FF
18" x 12"	25"	2"	A	165	FF
18" x 14"	25"	2"	A	161	FF
18" x 16"	25"	2"	B	156	FF
20" x 6"	27 1/2"	2"	A	273	FF
20" x 8"	27 1/2"	2"	A	251	FF
20" x 10"	27 1/2"	2"	A	455	FF
20" x 12"	27 1/2"	2"	A	216	FF
20" x 14"	27 1/2"	2"	A	205	FF
20" x 16"	27 1/2"	2"	A	194	FF
20" x 18"	27 1/2"	2"	B	183	FF
24" x 18"	32"	2"	A	176	FF
24" x 20"	32"	2"	A	172	FF
30" x 24"	38 3/4"	2"	A	189	FF

NOTES:

1. Bolt circle and flange hole size and quantity per ANSI Class 150 dimensions, except 30". For information on 30", consult 3P.
2. FF – Fabricated carbon steel with fixed flanges

* Straight Bore

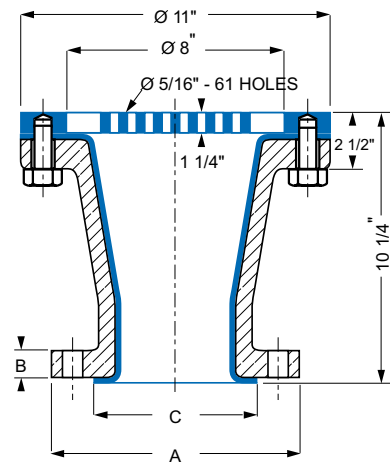


Size	A	B	LBS. Weight	LINER AVAILABILITY		
				PFA	PVDF	PP
1"	5 3/4"	1 3/4"	11	DI	DI	DI
1 1/2"	7"	2"	18	DI	DI	DI
2"	8"	2 1/2"	27	DI	DI	DI
3"	10"	3"	45	DI	DI	DI
4"	12"	3"	86	DI	DI	DI
6"	14 1/2"	3 1/2"	135	DI	DI	DI
8"	17 1/2"	4 1/2"	235	DI	DI	DI

DI - Ductile iron body with fixed flanges

FLOOR DRAIN

• Floor Drain

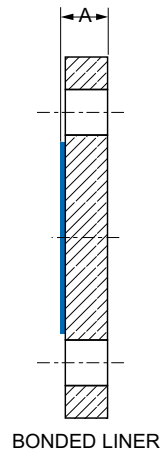


Drain Size	A	B	C	LBS. Weight
2"	6"	5/8"	3 5/8"	43
3"	7 1/2"	3/4"	6"	47
4"	9"	15/16"	6 1/8"	42

NOTES:

- Flange Dimensions:
Bolt circle and flange bolt hole sizes per ANSI Class 150 Dimensions.
- Materials:
Body - Cast Ductile Iron (60-40-18) per ASTM A395
Liner Availability - PP
Drain Cover - Solid PP

• Blind Flanges



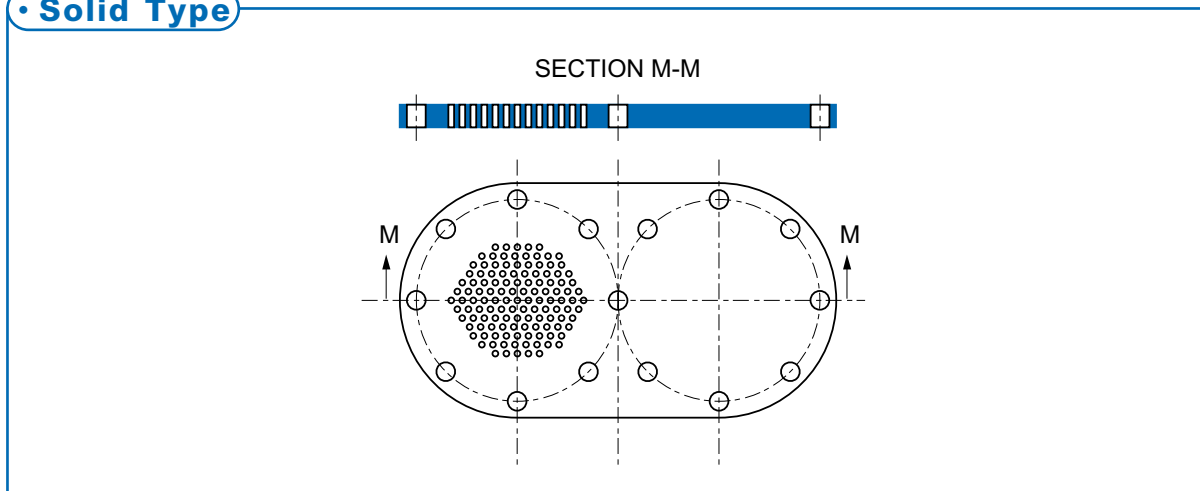
Size	A	LBS. Weight
1"	5/8"	2
1 1/2"	3/4"	3
2"	13/16"	4
3"	15/16"	9
4"	1 1/8"	17
6"	1 3/16"	26
8"	1 5/16"	45
10"	1 3/8"	70
12"	1 7/16"	100

NOTES:

1. Flange Dimensions: per ANSI Class 150
2. Liner Availability: PTFE, PFA

SPECTACLE BLINDS

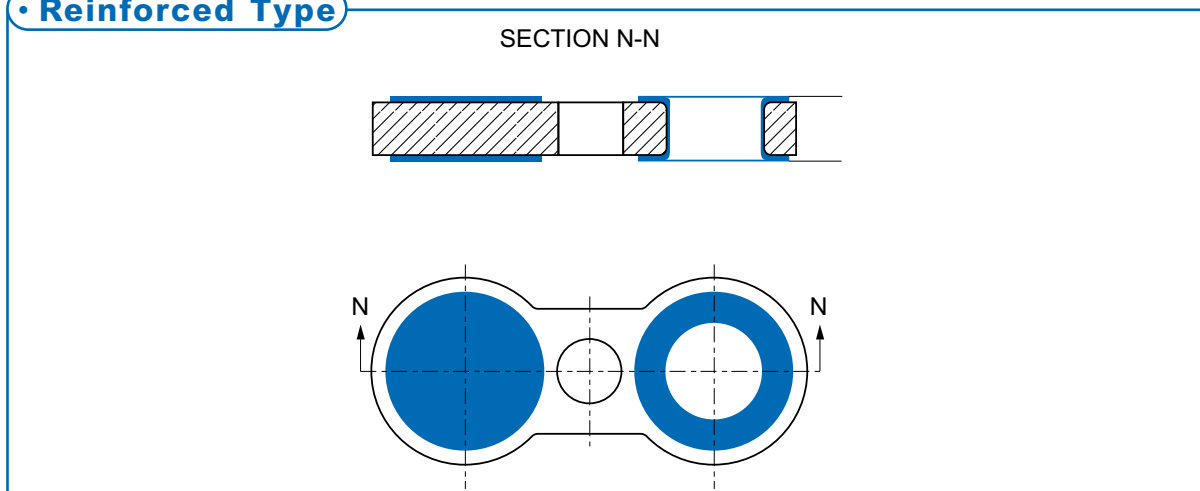
• Solid Type



NOTES:

1. Available in PTFE 1" thru 12" size full face or ring type.
2. Available in PP 1" thru 4" size full face.
1" thru 6" size ring type
3. Thickness: 1/2" minimum, 1" maximum (to be specified)
4. Hole pattern and size to be specified.

• Reinforced Type

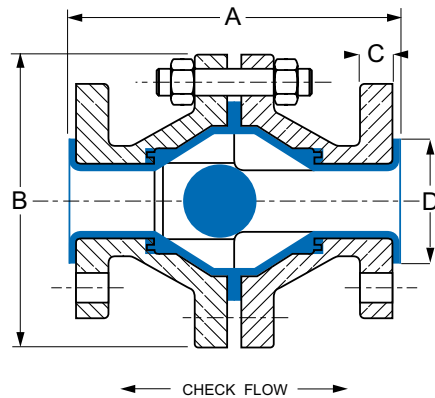


NOTES:

1. Material: metal, mild steel; liner, PTFE
2. Available in 1" thru 12" size, ring type.
3. Thickness: 1/2" minimum, 1" maximum (to be specified)

MODEL 770 BALL CHECK VALVE

• Model 770 Ball Check Valve



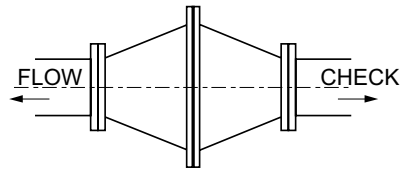
Valve Size	A	B	C	D	Valve Weight Lbs.	Ball Weight Lbs.	Flow (GPM)
1"	6"	5"	7/16"	2"	12	0.079	30
1 1/2"	7"	6 1/2"	9/16"	2 7/8"	22	0.268	75
2"	7"	7 1/4"	5/8"	3 5/8"	29	0.544	150
3"	8"	9"	3/4"	5"	49	1.759	250
4"	10 1/2"	11 1/2"	15/16"	6 1/8"	82	3.722	400
6"	15 1/2"	17 1/4"	1"	8 3/8"	190	18.69	550
8"	19 11/16"	17 1/4"	1 1/8"	10 1/2"	266	18.69	550

NOTES:

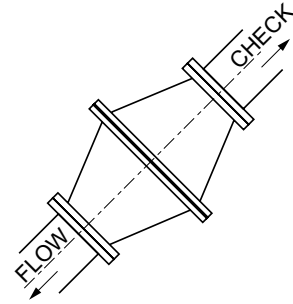
- Flange Dimensions:
Bolt circle and flange bolt hole sizes per ANSI Class 150 dimensions
- Materials:
Body - Cast Ductile Iron (60-40-18) per ASTM A395
Liner Availability - PFA (1-8"), PVDF (1"-4"), or PP (1"-8")
Ball: Solid PTFE (1"-8" Solid)
Hardware - Studs per ASTM A193 Gr. B7, Nuts per SAE J995 Gr. 8.
All hardware is zinc-p.
- Permanent name plates show sizes, liner material, and flow direction.
- Pressure Rating: Full-Vacuum to 150 psi
- Temperature Rating: PFA: -20° to 450° F
PVDF: -20° to 275° F
PP: -20° to 225° F
- Flow (GPM) at pressure drop of 1 psi (water at 60° F).
- 8" Ball Check Valve consists of a 6" valve with two 8" x 6" reducing flanges.
- Model 770 Ball Check Valve can be installed vertically or horizontally.
See Model 770 Ball Check Valve Ball sealing force data sheet.

MODEL 770 BALL CHECK VALVE SEALING FORCE DATA SHEET

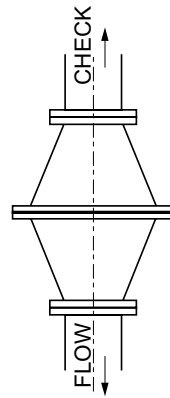
• 0 Degree



• 45 Degree



• 90 Degree

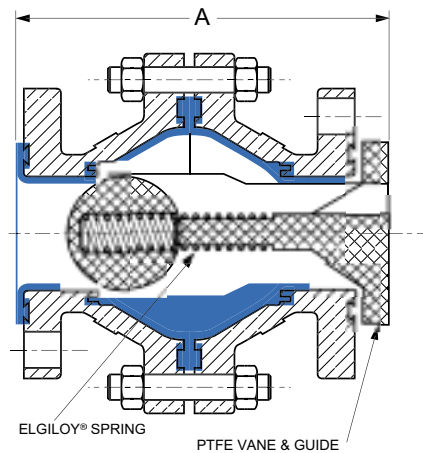


Flow required to force ball into seat at various inclinations
(Solid Ball)

Size	Gallon/Minute			Velocity in Feet/Second			To Unseat DP 180°	CV
	0°	45°	90°	0°	45°	90°		
1"	1.3	8.3	12.5	.6	3.6	6	.114	30
1 1/2"	5.9	23	30	.94	4.1	5.45	.159	75
2"	7	52	80	.76	5.5	8.69	.196	150
3"	16	71	105	.73	3.4	5	.273	250
4"	31	121	160	.86	3.5	4.47	.367	400
6" - 8"	60	170	210	.74	2.08	2.6	.520	550

SPRING LOADED MODEL 770 BALL CHECK VALVE

• Spring Loaded Model 770 Ball Check Valve



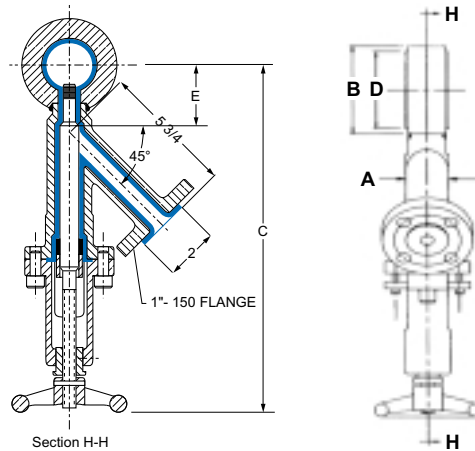
Size	A	Approx. Force Reqd. to Open
1"	6 1/2"	4 - 6 lbs.
1 1/2"	7 1/2"	5 - 8 lbs.
2"	7 1/2"	5 - 8 lbs.
3"	8 3/4"	5 - 10 lbs.

NOTES:

1. Standard Model 770 Ball Check Valve modified with Spring Loaded Ball
2. Liner Availability: PFA, PVDF or PP
3. Ball: PTFE (1" - 3" Solid)
4. Pressure Rating: Full-Vacuum to 150 psi
5. Temperature Rating: PFA: -20° to 450° F
PVDF: -20° to 275° F
PP: -20° to 225° F
6. ANSI Class 150 dimensions apply.
7. Spring Loaded Model 770 Ball Check Valve can be installed vertically or horizontally.

MODEL 760 SAMPLING VALVE

• Model 760 Sampling Valve

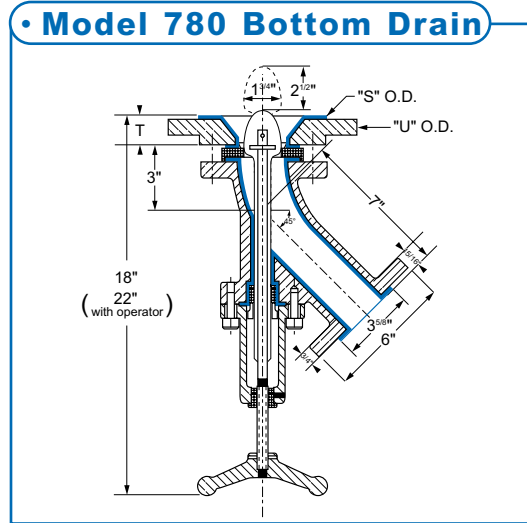
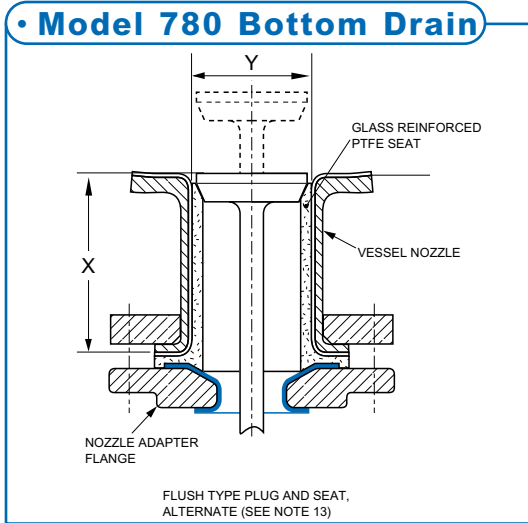


Size	A	B	C (Closed)	C (Open)	D	E	LBS. Weight
1"	2"	4 1/4"	15 1/4"	18"	2"	2 1/2"	28
1 1/2"	2"	5"	15 1/2"	18 1/4"	2 7/8"	2 3/4"	30
2"	2"	4 1/8"	15 1/4"	18 1/2"	3 5/8"	2 1/4"	26
3"	2"	5 3/8"	15 1/2"	18 3/4"	5"	2 3/4"	38
4"	2"	6 7/8"	16 3/4"	19 1/2"	6 1/8"	4"	44
6"	2"	8 3/4"	17 1/2"	20"	8 3/8"	4 1/2"	55
8"	2"	11"	18 3/4"	21 3/8"	10 1/2"	5 3/4"	98

NOTES:

1. Fitting: Steel
2. Liner: PFA
3. Plug: PTFE Covered 316 Stainless Steel
4. Packing: PTFE, Chevron Type
5. Plug rotates during opening and closing.
6. 1" Size Outlet Flange
7. Pressure Rating: Full-Vacuum to 150 psi at 400°F
8. Outlets rotated 90° must have a 4" face-to-face body, except 1" and 1 1/2", which are 2" face-to-face.
9. Extra nozzles are available in 1", 1 1/2" and 2" sizes.
10. Installation Bolt Size: 1" (1/2 x 4 1/2), 1 1/2" (1/2 x 5), 2" (3/4 x 5), 3" (3/4 x 5 1/2), 4" (3/4 x 5 1/2), 6" (7/8 x 6), 8" (7/8 x 6 1/2)
11. 1" x 1 1/2" are full faced flange.
12. All sizes to be installed between 150 Class flanges with long bolts.

MODEL 780 BOTTOM DRAIN



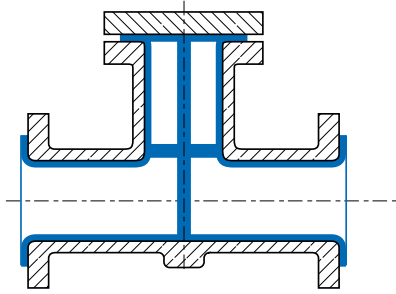
Valve Size	S (Min.)	T	U	No Bolt Holes	Bolt Hole Size	Dia. Bolt Circle	Approx. Valve LBS. Weight
3"	5"	1 5/8"	7 1/2"	4	3/4"	6"	37
4"	6 1/8"	1 17/32"	9"	8	3/4"	7 1/2"	40
6"	8 3/8"	2 1/32"	11"	8	7/8"	9 1/2"	56
8"	10 1/2"	2 3/32"	13 1/2"	8	7/8"	11 3/4"	70

NOTES:

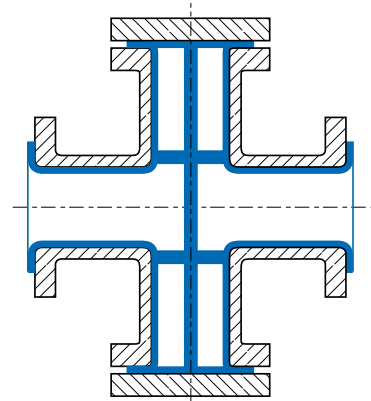
1. Body: 150 lb. Cast Ductile Iron
2. Liner Material: PFA
3. Plug: 316 Stainless Steel with PFA Covering
4. Seat: Glass Reinforced PTFE, Replaceable
5. Packing: PTFE, Chevron Type, Adjustable and Replaceable
6. Plug rotates during opening and closing.
7. Outlet Flange: 2" size, 150 lb. ANSI Drilling
8. Flanges are double drilled for field rotation.
9. Pressure: Full-Vacuum to 150 psi
10. Temperature: -20° to +450°F
11. Nozzle Adapter Flange: 150 lb. Cast Ductile Iron, Nozzle Sizes of 3", 4", 6" or 8". (Vessel nozzle size must be specified.)
12. Flow (GPM) at pressure drop of 1 psig: 60
13. Flush Type Plug: Nozzle Length "X" and I.D. "Y" are critical and must be specified. Plug Seat is glass reinforced PTFE.

STRAINER ASSEMBLY

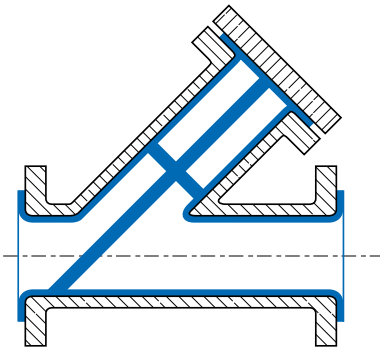
• Tee



• Cross



• 45° Y Lateral Tee

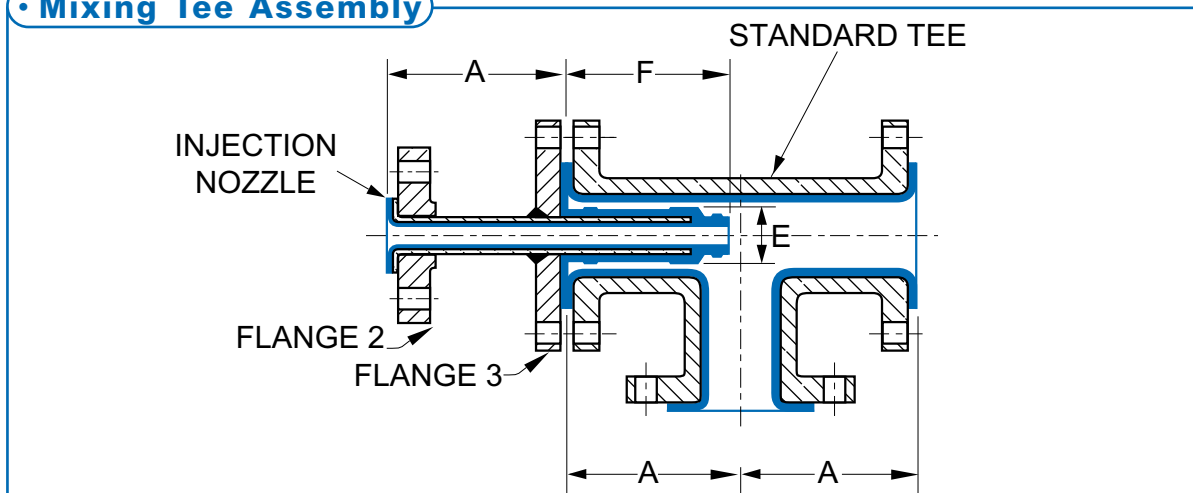


Size	WEIGHT (LBS.)		
	Tee	Cross	45° Y Lateral Tee
1"	15	14	14
1 1/2"	20	21	21
2"	30	34	33
3"	59	62	55
4"	90	91	104
6"	132	143	163
8"	226	237	275

NOTES:

1. Fitting: Standard Tee, Cross or 45° Y Lateral Tee. See appropriate page for materials and dimensions.
2. Strainer Plate and Centering Screw: Solid PP or PTFE
3. Number and size of holes for strainer to be specified. (1/16" minimum).

Mixing Tee Assembly



Tee Size	Injection Nozzle Size Available	A	F	LBS. Weight
2"	1"	4 1/2"	4"	35
3"	1", 1 1/2", 2"	5 1/2"	5"	65
4"	1"* , 1 1/2"*, 2", 3"	6 1/2"	6"	100
6"	1"* , 1 1/2"* , 2"* , 3", 4"	8"	7 1/2"	140
8"	1"* , 1 1/2"* , 2"* , 3"* , 4", 6"	9"	8 1/2"	240

* Reducing Flange Required.

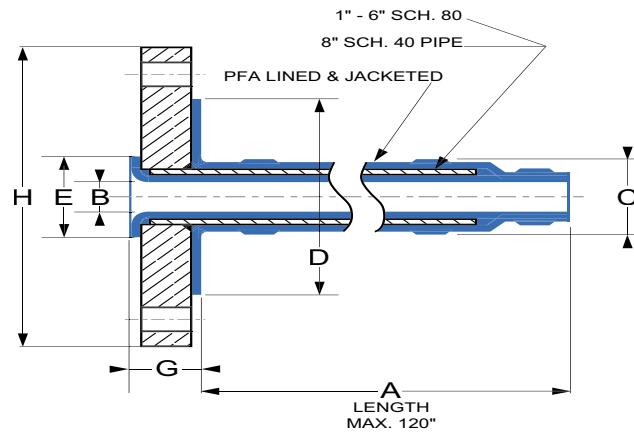
Nozzle Size	E
1"	1 11/16"
1 1/2"	2 5/16"
2"	2 3/4"
3"	3 15/16"
4"	4 15/16"
6"	7 1/16"

NOTES:

1. Injection nozzle lining and covering is PFA.
2. Do not inject live stream through fitting branch. Use run only.
3. Flange 2 is same size as injection nozzle size.
4. When a reducing flange is required to connect flange 3, "A" dimension is changed.

SINGLE FLANGE DIP PIPE

• Single Flange Dip Pipe



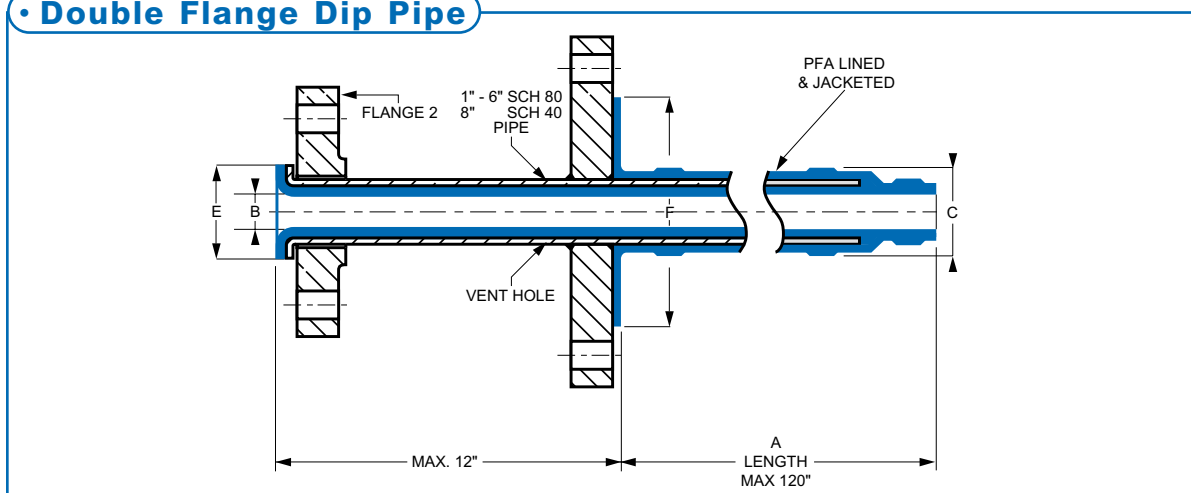
Dip Pipe Size	Flange Size	B	C	D	E	G	H	LBS. Weights	
								1st ft. w/Flange	Add'd Ft.
1"	2"	11/16"	1 11/16"	4"	2"	1"	6"	8	3
1 1/2"	3"	1 3/16"	2 5/16"	5 1/4"	2 7/8"	1 1/4"	7 1/2"	13	4
2"	3"	1 5/8"	2 3/4"	5 1/4"	3 5/8"	1 1/4"	7 1/2"	15	6
3"	4"	2 9/16"	3 15/16"	6 3/4"	5"	1 1/4"	9"	24	11
4"	6"	3 7/16"	4 15/16"	8 5/8"	6 1/8"	1 3/8"	11"	33	16
6"	8"	5 3/8"	7 1/16"	10 7/8"	8 3/8"	1 1/2"	13 1/2"	58	30
8"	10"	7 9/16"	9 1/4"	13 1/4"	10 1/2"	1 5/8"	16"	69	29

NOTES:

1. For lined nozzles (glass, alloy, etc.), check I.D. of nozzle before selecting dip pipe size (see Dimension "C").
2. This type of construction is not recommended for installations that utilize agitation of product when dip pipe extends into fluid.
3. When connecting single flange dip pipe to a larger feed line, a reducing flange is required.
4. Compare dimension "B" with I. D. of inlet pipe. Liner erosion could result if inlet size is larger than "B".
5. "A" dimension can be angled up to 45° depending on diameter and length.
6. Maximum recommended length: 120", for longer lengths, consult 3P.

DOUBLE FLANGE DIP PIPE

• Double Flange Dip Pipe



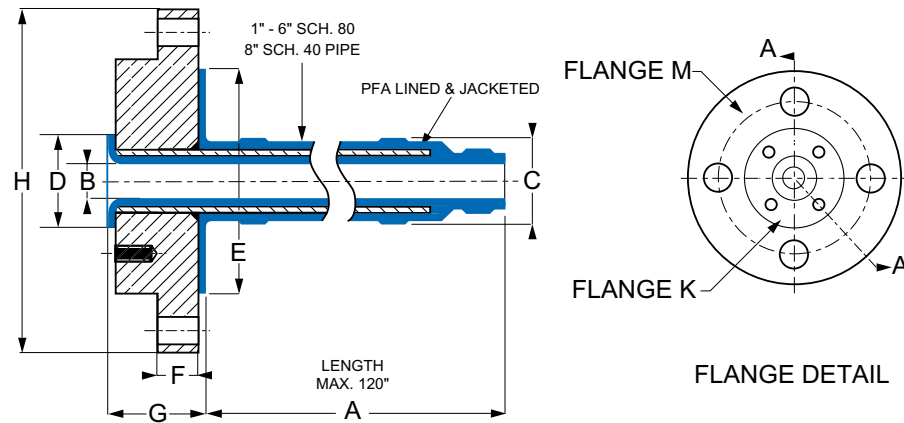
Pipe Size	B	C	Flange 2 Size	Flange Size		LBS. Weight Per Ft w/o Flanges	Flange		E	F
				Min	Max		Size	LBS. Weight		
1"	1 1/16"	1 11/16"	1"	2"	3"	3	1"	2	2"	—
1 1/2"	1 3/16"	2 5/16"	1 1/2"	3"	4"	4	1 1/2"	3	2 7/8"	—
2"	1 5/8"	2 3/4"	2"	3"	4"	6	2"	5	3 5/8"	4"
3"	2 9/16"	3 15/16"	3"	4"	6"	11	3"	8	5"	5 1/4"
4"	3 7/16"	4 15/16"	4"	6"	8"	16	4"	13	6 1/8"	6 3/4"
6"	5 3/8"	7 1/16"	6"	8"	10"	30	6"	19	8 3/8"	8 5/8"
8"	7 9/16"	9 1/4"	8"	10"	12"	29	8"	30	10 1/2"	10 7/8"

NOTES:

1. For lined nozzles (glass, alloy, etc.), check nozzle I.D. before selecting dip pipe size and compare with dimension "C".
2. Total weight of dip pipe = wt/ft x length + wt flg 2 + wt flg 3.
3. Distance between flanges to be specified, maximum is 12".
4. For installations requiring agitation of product, the reinforced dip pipe is recommended.
5. For vacuum service, consult 3P for recommendations.
6. Compare dimension "B" with I.D. of inlet pipe. Liner erosion could result if inlet size is larger than "B".
7. "A" dimension can be angled up to 45° depending on diameter and length.
8. Maximum recommended length: 120". For longer lengths, consult 3P.

REDUCING FLANGE DIP PIPE

• Reducing Flange Dip Pipe



Pipe Size	B	C	D	Fig. Size K	Fig. Size M	Bolt* Hole Align	E	F	G	H	LBS. Weights	
											1st ft. w/Fig.	Add'l Ft.
1"	1 1/16"	1 11/16"	2"	1"	2"	2	4"	3/4"	1 7/8"	6"	10	3
					3"	2	5 1/4"	15/16"	2"	7 1/2"	14	3
1 1/2"	1 3/16"	2 5/16"	2 7/8"	1 1/2"	3"	2	5 1/4"	15/16"	2"	7 1/2"	16	4
					4"	1	6 3/4"	15/16"	2 1/8"	9"	20	4
2"	1 5/8"	2 3/4"	3 5/8"	2"	3"	2	5 1/4"	15/16"	1 3/4"	7 1/2"	20	6
					4"	1	6 3/4"	15/16"	1 3/4"	9"	24	6
3"	2 9/16"	3 15/16"	5	3"	4"	1	6 3/4"	15/16"	1 3/4"	9"	33	11
					6"	1	8 5/8"	1"	2 1/2"	11"	37	11
4"	3 7/16"	4 15/16"	6 1/8"	4"	6"	2	8 5/8"	1"	2 1/2"	11"	46	16
					8"	2	10 7/8"	1 1/8"	2 1/2"	13 1/2"	57	16
6"	5 3/8"	7 1/16"	8 5/8"	6"	8"	2	10 7/8"	1 1/8"	2 1/2"	13 1/2"	75	30
					10"	1	13 1/4"	1 3/16"	2 1/2"	16"	87	30
8"	7 9/16"	9 1/4"	10 1/2"	8"	10"	1	13 1/4"	1 3/16"	2 5/8"	16"	97	29
					12"	1	16"	1 1/4"	2 5/8"	19"	118	29

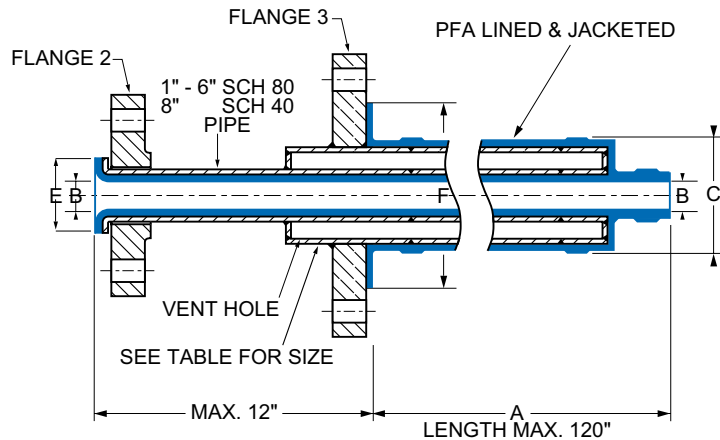
* (1) All holes straddle centerline. (2) One set of holes straddle centerline, other set is on centerline.

NOTES:

- For lined nozzles (glass alloy, etc.), check the I.D. of the nozzle before selecting dip pipe size (see dimensions "C").
- This type of construction is not recommended for installations that utilize agitation of product when dip pipe extends into fluid.
- For vacuum applications, contact factory for recommendations.
- Compare dimension "B" with I. D. of inlet pipe. Liner erosion could result if inlet size is larger than "B".
- Maximum recommended length: 120". For longer lengths, consult 3P.

REINFORCED DOUBLE FLANGE DIP PIPE

Reinforced Double Flange Dip Pipe



Size	Flange	LBS. Weight	E	F
1"		2	2"	—
1 1/2"		3	2 7/8"	—
2"		5	3 5/8"	4"
3"		8	5"	5 1/4"
4"		13	6 1/8"	6 3/4"
6"		19	8 3/8"	8 5/8"
8"		30	10 1/2"	10 7/8"

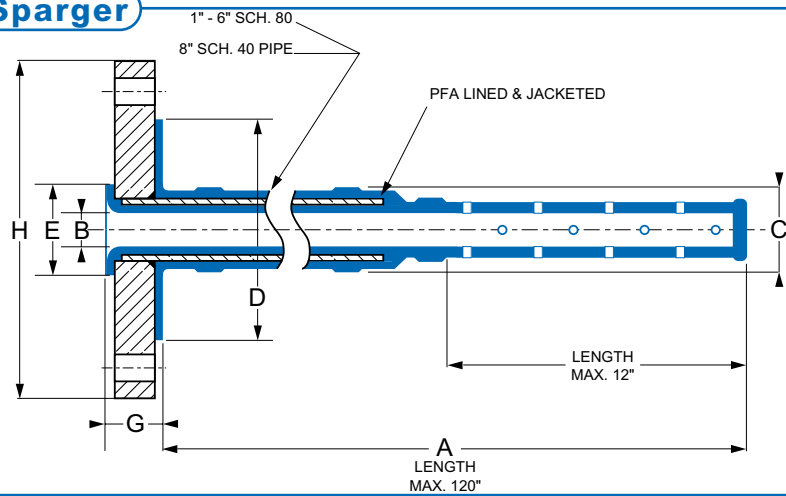
Pipe Size	Reinforcing Pipe Size Schedule	B	C	FLG 2 Size	FLG 3 Min	FLG 3 Max	LBS. Weight Per Ft w/o Flanges
1"	2/160	11/16"	2 3/4"	1"	3"	4"	11
1 1/2"	2/80	1 3/16"	2 3/4"	1 1/2"	3"	4"	10
2"	3/160	1 5/8"	3 15/16"	2"	4"	6"	20
3"	4/120	2 9/16"	4 15/16"	3"	6"	8"	26
4"	6/160	3 7/16"	7 1/16"	4"	8"	10"	62
6"	8/120	5 3/8"	9 1/4"	6"	10"	12"	91
8"	10/120	7 9/16"	11 1/2"	8"	12"	14"	118

NOTES:

1. For lined nozzles (glass, alloy, etc.), check nozzle I.D. before selecting dip pipe size and compare with dimension "C".
2. Total weight = wt/ft x length + wt flg 2 + wt flg 3.
3. Recommended for vessels where agitation is required.
4. Distance between flanges to be specified, maximum is 12".
5. For vacuum service, consult 3P for recommendations.
6. Compare dimension "B" with I.D. of inlet pipe. Liner erosion could result if inlet size is larger than "B".
7. Maximum recommended length: 120". For longer lengths, consult 3P.
8. ANSI Class 150 dimensions apply.

SINGLE FLANGE SPARGER

• Single Flange Sparger

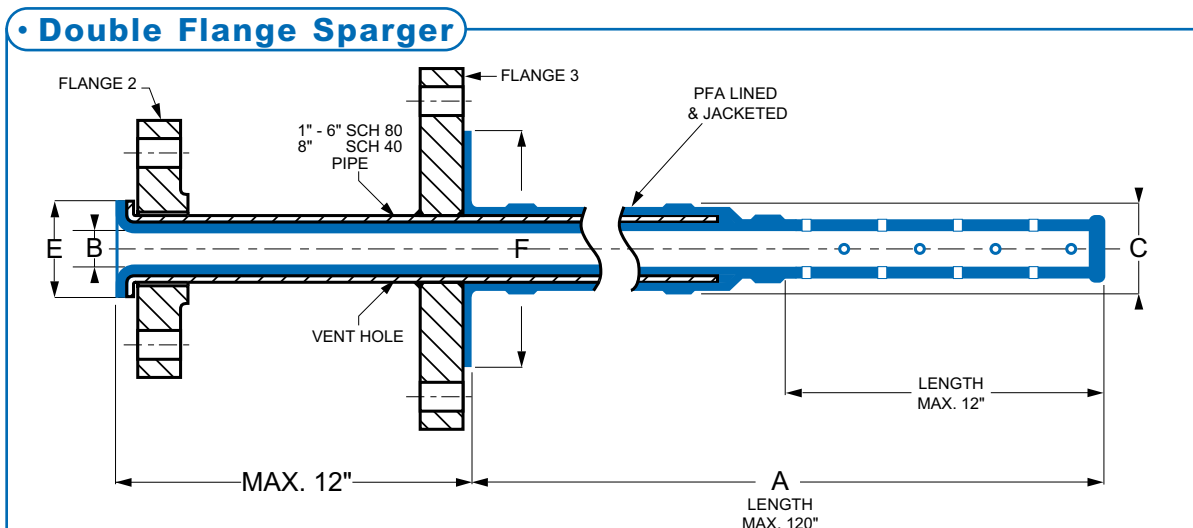


Dip Pipe Size	Flange Size	B	C	D	E	G	H	LBS. Weights	
								1st ft. w/Flange	Add'd Ft.
1"	2"	11/16"	1 11/16"	4"	2"	1"	6"	8	3
1 1/2"	3"	1 3/16"	2 5/16"	5 1/4"	2 7/8"	1 1/4"	7 1/2"	13	4
2"	3"	1 5/8"	2 3/4"	5 1/4"	3 5/8"	1 1/4"	7 1/2"	15	6
3"	4"	2 9/16"	3 15/16"	6 3/4"	5"	1 1/4"	9"	24	11
4"	6"	3 7/16"	4 15/16"	8 5/8"	6 1/8"	1 3/8"	11"	33	16
6"	8"	5 3/8"	7 1/16"	10 7/8"	8 3/8"	1 1/2"	13 1/2"	58	30
8"	10"	7 9/16"	9 1/4"	13 1/4"	10 1/2"	1 5/8"	16"	69	29

NOTES:

1. For lined nozzles (glass, alloy, etc.), check I.D. of nozzle before selecting dip pipe size (see Dimension "C").
2. This type of construction is not recommended for installations that utilize agitation of product when dip pipe extends into fluid.
3. State size, number and spacing of perforations. Perforations are normally 90° to centerline of sparger, however, other angles can be furnished.
4. When adapting single flange sparger to a feed line larger than sparger, a reducing flange must be used.
5. Compare dimension "B" with I.D. of inlet pipe. Liner erosion could result if inlet size is larger than "B".
6. Maximum recommended length: 120". For longer lengths, consult 3P.

DOUBLE FLANGE SPARGER



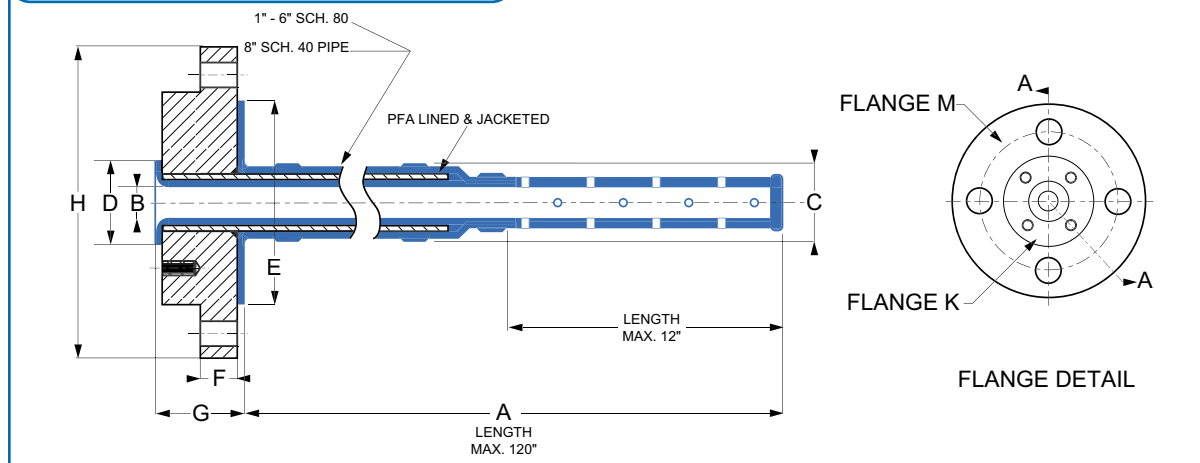
Pipe Size	B	C	Flange 2 Size	Flange Size		LBS. Weight Per Ft w/o Flanges	Flange		E	F
				Min	Max		Size	LBS. Weight		
1"	1 1/16"	1 11/16"	1"	2"	3"	3	1"	2	2"	—
1 1/2"	1 3/16"	2 5/16"	1 1/2"	3"	4"	4	1 1/2"	3	2 7/8"	—
2"	1 5/8"	2 3/4"	2"	3"	4"	6	2"	5	3 5/8"	4"
3"	2 9/16"	3 15/16"	3"	4"	6"	11	3"	8	5"	5 1/4"
4"	3 7/16"	4 15/16"	4"	6"	8"	16	4"	13	6 1/8"	6 3/4"
6"	5 3/8"	7 1/16"	6"	8"	10"	30	6"	19	8 3/8"	8 5/8"
8"	7 9/16"	9 1/4"	8"	10"	12"	29	8"	30	10 1/2"	10 7/8"

NOTES:

1. For lined nozzles (glass, alloy, etc.), check nozzle I.D. before selecting dip pipe size and compare with dimension "C".
2. Total weight of sparger = wt/ft x length + wt flg 2 + wt flg 3.
3. State size, number and spacing of perforations. Perforations are normally 90° to centerline, however, other angles can be furnished.
4. Distance between flanges to be specified, maximum is 12".
5. For installations requiring agitation of product, the reinforced sparger is recommended.
6. For vacuum service, consult 3P for recommendations.
7. Compare dimension "B" with I.D. of inlet pipe. Liner erosion could result if inlet size is larger than "B".
8. Maximum recommended length: 120". For longer lengths, consult 3P.

REDUCING FLANGE SPARGER

• Reducing Flange Sparger



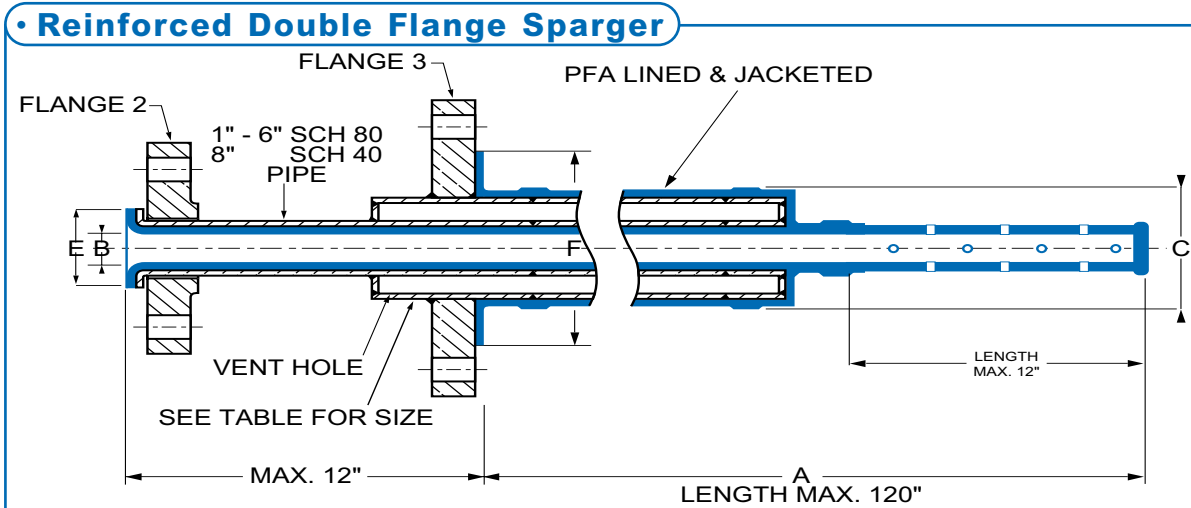
Pipe Size	B	C	D	Fig. Size K	Fig. Size M	Bolt* Hole Align	E	F	G	H	LBS. Weights	
											1st ft. w/Fig.	Add'l Ft.
1"	1 1/16"	1 11/16"	2"	1"	2"	2	4"	3/4"	1 7/8"	6"	10	3
					3"	2	5 1/4"	15/16"	2"	7 1/2"	14	3
1 1/2"	1 3/16"	2 5/16"	2 7/8"	1 1/2"	3"	2	5 1/4"	15/16"	2"	7 1/2"	16	4
					4"	1	6 3/4"	15/16"	2 1/8"	9"	20	4
2"	1 5/8"	2 3/4"	3 5/8"	2"	3"	2	5 1/4"	15/16"	1 3/4"	7 1/2"	20	6
					4"	1	6 3/4"	15/16"	1 3/4"	9"	24	6
3"	2 9/16"	3 15/16"	5"	3"	4"	1	6 3/4"	15/16"	1 3/4"	9"	33	11
					6"	1	8 5/8"	1"	2 1/2"	11"	37	11
4"	3 7/16"	4 15/16"	6 1/8"	4"	6"	2	8 5/8"	1"	2 1/2"	11"	46	16
					8"	2	10 7/8"	1 1/8"	2 1/2"	13 1/2"	57	16
6"	5 3/8"	7 1/16"	8 5/8"	6"	8"	2	10 7/8"	1 1/8"	2 1/2"	13 1/2"	75	30
					10"	1	13 1/4"	1 3/16"	2 1/2"	16"	87	30
8"	7 9/16"	9 1/4"	10 1/2"	8"	10"	1	13 1/4"	1 3/16"	2 5/8"	16"	97	29
					12"	1	16"	1 1/4"	2 5/8"	19"	118	29

* (1) All holes straddle centerline. (2) One set of holes straddle centerline, other set is on centerline.

NOTES:

1. For lined nozzles (glass alloy, etc.), check the I.D. of the nozzle before selecting dip pipe size (see dimensions "C").
2. This type of construction is not recommended for installations that utilize agitation of product when dip pipe extends into fluid.
3. State size, number and spacing of perforations. Perforations are normally 90° to centerline of sparger, however, other angles can be supplied.
4. For vacuum applications, contact factory for recommendations.
5. Compare dimension "B" with I. D. of inlet pipe. Liner erosion could result if inlet size is larger than "B". For longer lengths, consult 3P.

REINFORCED DOUBLE FLANGE SPARGER



Size	Flange	LBS. Weight	E	F
1"		2	2"	—
1 1/2"		3	2 7/8"	—
2"		5	3 5/8"	4"
3"		8	5"	5 1/4"
4"		13	6 1/8"	6 3/4"
6"		19	8 3/8"	8 5/8"
8"		30	10 1/2"	10 7/8"

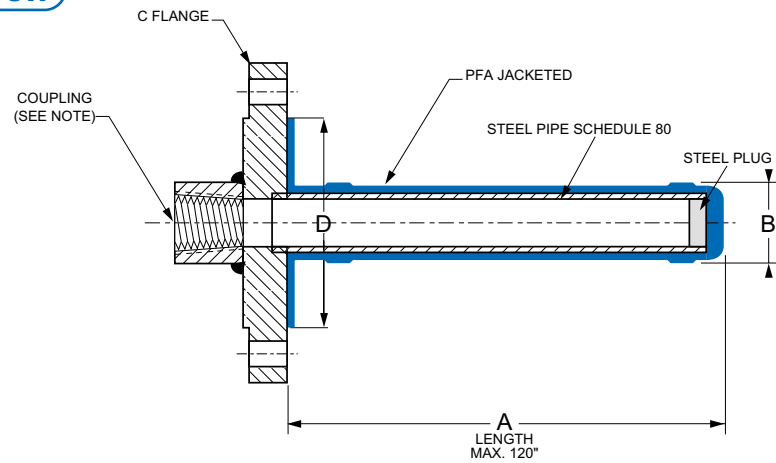
Pipe Size	Reinforcing Pipe Size Schedule	B	C	FLG 2 Size	FLG 3 Min	FLG 3 Max	LBS. Weight Per Ft w/o Flanges
1"	2/160	11/16"	2 3/4"	1"	3"	4"	11
1 1/2"	2/80	1 3/16"	2 3/4"	1 1/2"	3"	4"	10
2"	3/160	1 5/8"	3 15/16"	2"	4"	6"	20
3"	4/120	2 9/16"	4 15/16"	3"	6"	8"	26
4"	6/160	3 7/16"	7 1/16"	4"	8"	10"	62
6"	8/120	5 3/8"	9 1/4"	6"	10"	12"	91
8"	10/120	7 9/16"	11 1/2"	8"	12"	14"	118

NOTES:

1. For lined nozzles (glass, alloy, etc.), check nozzle I.D. before selecting dip pipe size and compare with dimension "C".
2. Total weight = wt/ft x length + wt flg 2 + wt flg 3.
3. Recommended for vessels where agitation is required.
4. Distance between flanges to be specified, maximum is 12".
5. For vacuum service, consult 3P for recommendations.
6. Compare dimension "B" with I.D. of inlet pipe. Liner erosion could result if inlet size is larger than "B".
7. Maximum recommended length: 120". For longer lengths, consult 3P.

THERMOWELL

• Thermowell

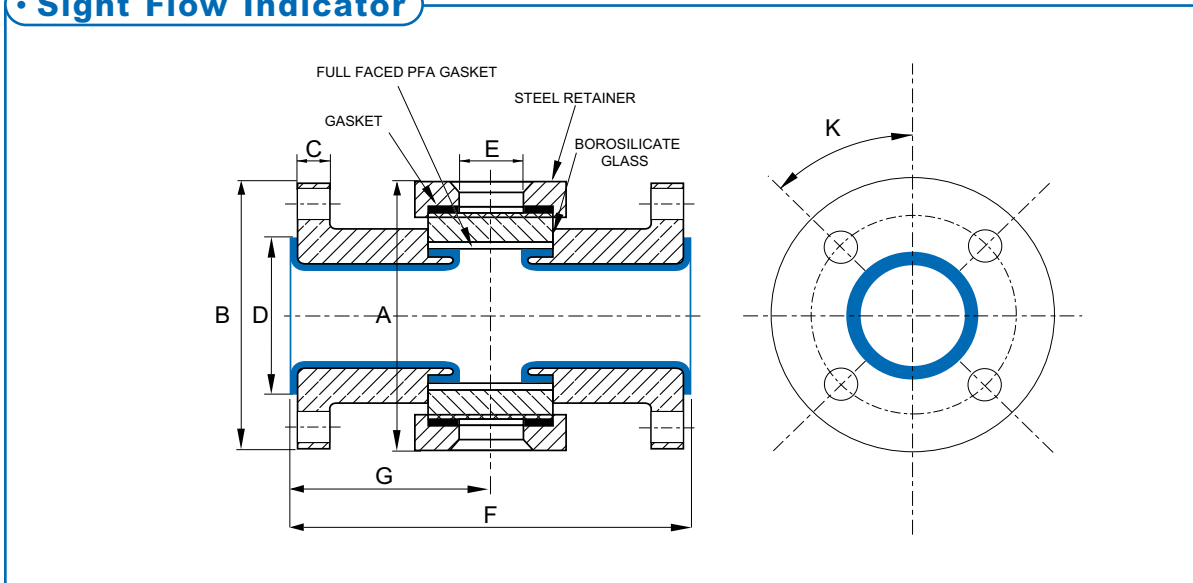


Pipe Size	B	"C" Size		Flange Size	D
		Min	Max		
1/2"	1 3/16"	1 1/2"	2"	1 1/2"	3 1/4"
3/4"	1 3/8"	1 1/2"	2"	2"	4"
1"	1 11/16"	2"	3"	3"	5 1/4"
1 1/2"	2 5/16"	3"	4"	4"	6 3/4"
2"	2 3/4"	3"	4"	6"	8 5/8"
3"	3 15/16"	4"	6"	8"	10 7/8"
4"	4 15/16"	6"	8"		

NOTES:

1. For nozzle openings larger than Thermowell flange, lined reducing flanges are available.
2. Male or female couplings are available, size and type to be specified.
3. Compare dimension "B" with nozzle I.D. to ensure adequate inlet size.
4. Liner material: PFA.

• Sight Flow Indicator



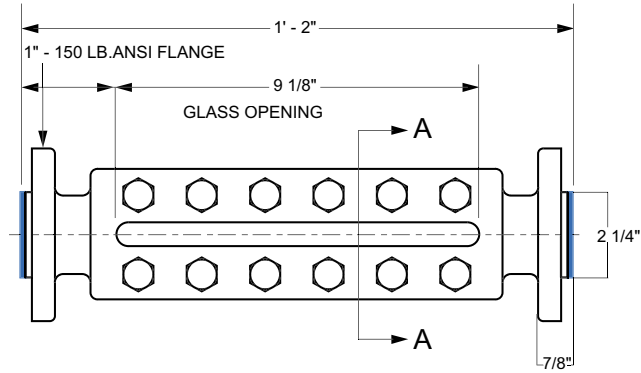
Size	A	B	C	D	E	F	G	K	LBS. Weight
1"	5"	4 1/4"	7/16"	2"	1"	7"	3 1/2"	45°	14
1 1/2"	5 1/4"	5"	9/16"	2 7/8"	1 1/8"	8"	4"	45°	16
2"	6"	6"	5/8"	3 5/8"	1 1/2"	9"	4 1/2"	45°	20
3"	7 1/4"	7 1/2"	3/4"	5"	2 1/4"	11"	5 1/2"	45°	51
4"	8 3/4"	9"	15/16"	6 1/8"	3"	13"	6 1/2"	22.5°	93
6"	12"	11"	1"	8 3/8"	4 1/2"	16"	8"	22.5°	151

NOTES:

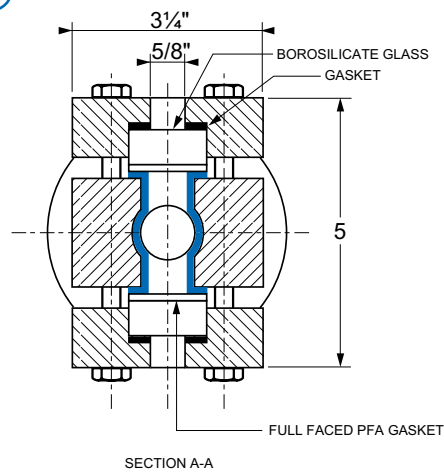
- Flange Dimensions:
Bolt circle and flange bolt hole sizes per ANSI Class 150 Dimensions.
- Materials:
Body - Cast Ductile Iron (60-40-18) per ASTM A395
Liner Availability - PFA
Sight Glass - Borosilicate
Hardware - Bolts Gr. 5 All hardware is zinc-plated.

LIQUID LEVEL GAUGE

• Liquid Level Gauge



• Liquid Level Gauge

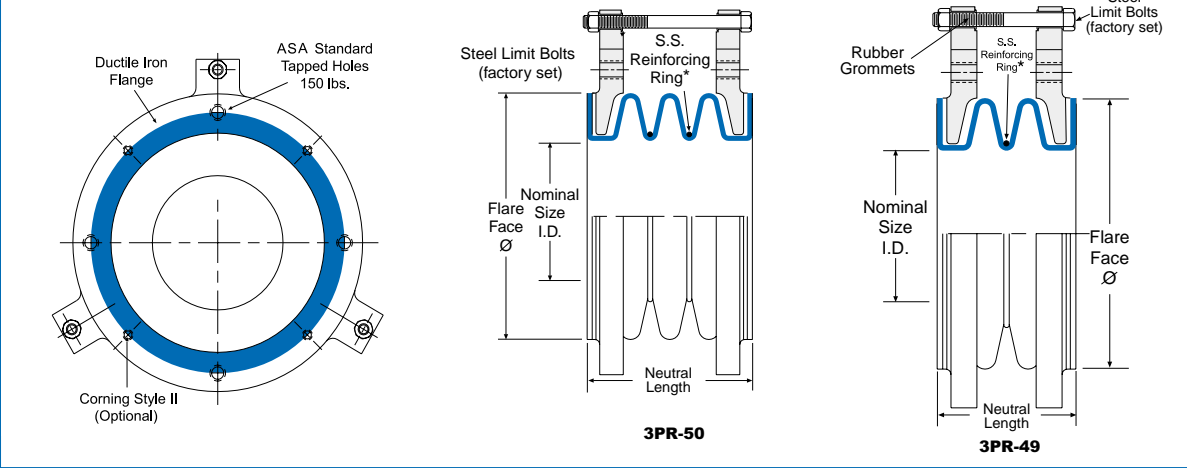


NOTES:

1. Flange Dimensions:
Bolt circle and flange bolt hole sizes per ANSI Class 150 Dimensions.
2. Materials:
Body - Cast Ductile Iron (60-40-18) per ASTM A395
Liner Availability - PFA
Sight Glass - Borosilicate
Hardware - Bolts Gr. 5 All hardware is zinc-plated.

R SERIES MOLDED JOINTS

Expansion Joints and Flexible



Pipe Size	Style	Nominal Length	ASA Standard Tapped Holes		
			No. of Holes	Thread	Bolt Circle
1"	3PR-50	1 3/4"	4	1/2 - 13	3 1/8"
1"	3PR-49	1 3/8"	4	1/2 - 13	3 1/8"
1 1/2"	3PR-50	2"	4	1/2 - 13	3 7/8"
1 1/2"	3PR-49	1 3/8"	4	1/2 - 13	3 7/8"
2"	3PR-50	2 3/4"	4	5/8 - 11	4 3/4"
2"	3PR-49	1 9/16"	4	5/8 - 11	4 3/4"
2 1/2"	3PR-50	3 3/16"	4	5/8 - 11	5 1/2"
2 1/2"	3PR-49	2 1/4"	4	5/8 - 11	5 1/2"
3"	3PR-50	3 5/8"	4	5/8 - 11	6"
3"	3PR-49	2 1/4"	4	5/8 - 11	6"
4"	3PR-50	3 5/8"	8	5/8 - 11	7 1/2"
4"	3PR-49	2 5/8"	8	5/8 - 11	7 1/2"
5"	3PR-50	4"	8	3/4 - 10	8 1/2"
5"	3PR-49	3 1/4"	8	3/4 - 10	8 1/2"
6"	3PR-50	4"	8	3/4 - 10	9 1/2"
6"	3PR-49	2 3/4"	8	3/4 - 10	9 1/2"
8"	3PR-50	6"	8	3/4 - 10	11 3/4"
8"	3PR-49	4"	8	3/4 - 10	11 3/4"
10"	3PR-49	5 1/4"	12	7/8 - 9	14 1/4"
12"	3PR-49	6"	12	7/8 - 9	17"

Corning Style II Holes			C Flange O.D.	D Flare Face	E Flange Thickness	Weight (lbs)
No. of Holes	Thread	Bolt Circle				
4	5/16 - 18	3 1/8"	4 1/4"	2"	7/16"	2.5
4	5/16 - 18	3 1/8"	4 1/4"	2"	7/16"	2.0
4	5/16 - 18	3 7/8"	5"	2 3/4"	7/16"	3.5
4	5/16 - 18	3 7/8"	5"	2 3/4"	7/16"	3.0
4	5/16 - 18	4 3/4"	6"	3 1/2"	7/16"	8.0
4	5/16 - 18	4 3/4"	6"	3 1/2"	7/16"	7.5
4	5/16 - 18	5 1/2"	7"	4"	3/8"	11.0
4	5/16 - 18	5 1/2"	7"	4"	3/8"	10.5
4	5/16 - 18	6"	7 1/2"	5"	11/16"	13.0
4	5/16 - 18	6"	7 1/2"	5"	11/16"	12.5
8	5/16 - 18	7 1/2"	9"	6"	11/16"	19.0
8	5/16 - 18	7 1/2"	9"	6"	11/16"	18.5
8	3/8 - 16	8 1/2"	10"	7"	11/16"	25.0
8	3/8 - 16	8 1/2"	10"	7"	11/16"	24.5
8	3/8 - 16	9 1/2"	11"	8"	11/16"	28.0
8	3/8 - 16	9 1/2"	11"	8"	11/16"	27.5
-	-	-	13 1/2"	10 1/4"	7/8"	48.5
-	-	-	13 1/2"	10 1/4"	7/8"	48.0
-	-	-	16"	12 1/4"	1"	67.0
-	-	-	19"	14 1/2"	1"	95.5

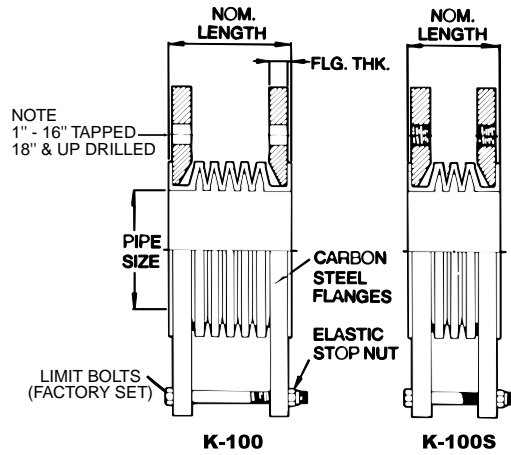
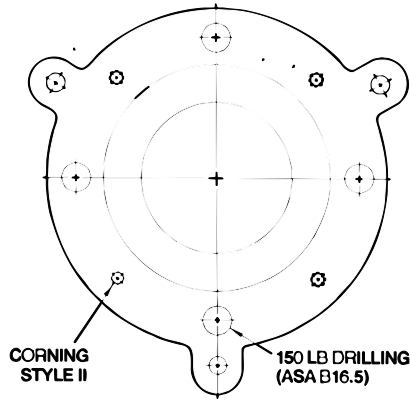
* ML-50 and ML-49 available upon request.

NOTES:

1. Materials: PTFE

MACHINED EXPANSION JOINTS

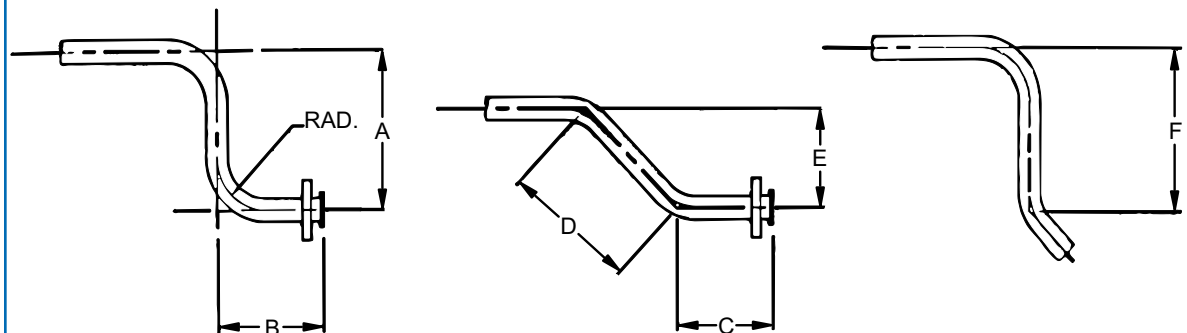
Machined Expansion Joints



ASA Standard Tapped Holes								
Size	Style	Nominal Length	No.	Bolt Circle	Size	Corning Size	Thickness	Weight (lbs.)
1"	K-100	2"	4	3 1/8"	1/2" - 13NC	5/16" - 18NC	3/8"	3.125
	K-100S	1 1/8"	4	3 1/8"	1/2" - 13NC	5/16" - 18NC	3/8"	2.875
1 1/2"	K-100	2"	4	3 7/8"	1/2" - 13NC	5/16" - 18NC	3/8"	4.250
	K-100S	1 1/8"	4	3 7/8"	1/2" - 13NC	5/16" - 18NC	3/8"	3.875
2"	K-100	3"	4	4 3/4"	5/8" - 11NC	5/16" - 18NC	3/8"	6.375
	K-100S	1 7/8"	4	4 3/4"	5/8" - 11NC	5/16" - 18NC	3/8"	5.375
2 1/2"	K-100	3"	4	5 1/2"	5/8" - 11NC	5/16" - 18NC	3/8"	8.250
	K-100S	1 7/8"	4	5 1/2"	5/8" - 11NC	5/16" - 18NC	3/8"	7.125
3"	K-100	4"	4	6"	5/8" - 11NC	5/16" - 18NC	7/16"	10.750
	K-100S	2 1/8"	4	6"	5/8" - 11NC	5/16" - 18NC	7/16"	9.125
4"	K-100	4"	8	7 1/2"	5/8" - 11NC	5/16" - 18NC	7/16"	14.750
	K-100S	2 1/8"	8	7 1/2"	5/8" - 11NC	5/16" - 18NC	7/16"	12.625
6"	K-100	4"	8	9 1/2"	3/4" - 10NC	3/8" - 16NC	1/2"	23.125
	K-100S	2 1/8"	8	9 1/2"	3/4" - 10NC	3/8" - 16NC	1/2"	19.000
8"	K-100	4"	8	11 3/4"	3/4" - 10NC	-	1/2"	31.750
	K-100S	2 1/8"	8	11 3/4"	3/4" - 10NC	-	1/2"	26.375
10"	K-100	5"	12	14 1/4"	7/8" - 9NC	-	5/8"	50.625
	K-100S	2 1/2"	12	14 1/4"	7/8" - 9NC	-	5/8"	43.250
12"	K-100	5"	12	17"	7/8" - 9NC	-	5/8"	69.125
	K-100S	2 1/2"	12	17"	7/8" - 9NC	-	5/8"	60.500
14"	K-100	5"	12	18 3/4"	1" - 8NC	-	3/4"	92.875
	K-100S	2 1/2"	12	18 3/4"	1" - 8NC	-	3/4"	81.875
16"	K-100	5"	16	21 1/4"	1" - 8NC	-	3/4"	111.375
	K-100S	2 1/2"	16	21 1/4"	1" - 8NC	-	3/4"	99.000
18"	K-100	5"	16	22 3/4"	1 1/8" - 7NC	-	3/4"	114.250
	K-100S	2 1/2"	16	22 3/4"	1 1/8" - 7NC	-	3/4"	100.375
20"	K-100	6"	20	25"	1 1/8" - 7NC	-	3/4"	134.375
	K-100S	3"	20	25"	1 1/8" - 7NC	-	3/4"	119.000
24"	K-100	6"	20	29 1/2"	1 1/4" - 7NC	-	3/4"	168.000
	K-100S	3"	20	29 1/2"	1 1/4" - 7NC	-	3/4"	149.750

NOTES:
1. Materials: PTFE

• EnviroBend® Lined Pipe



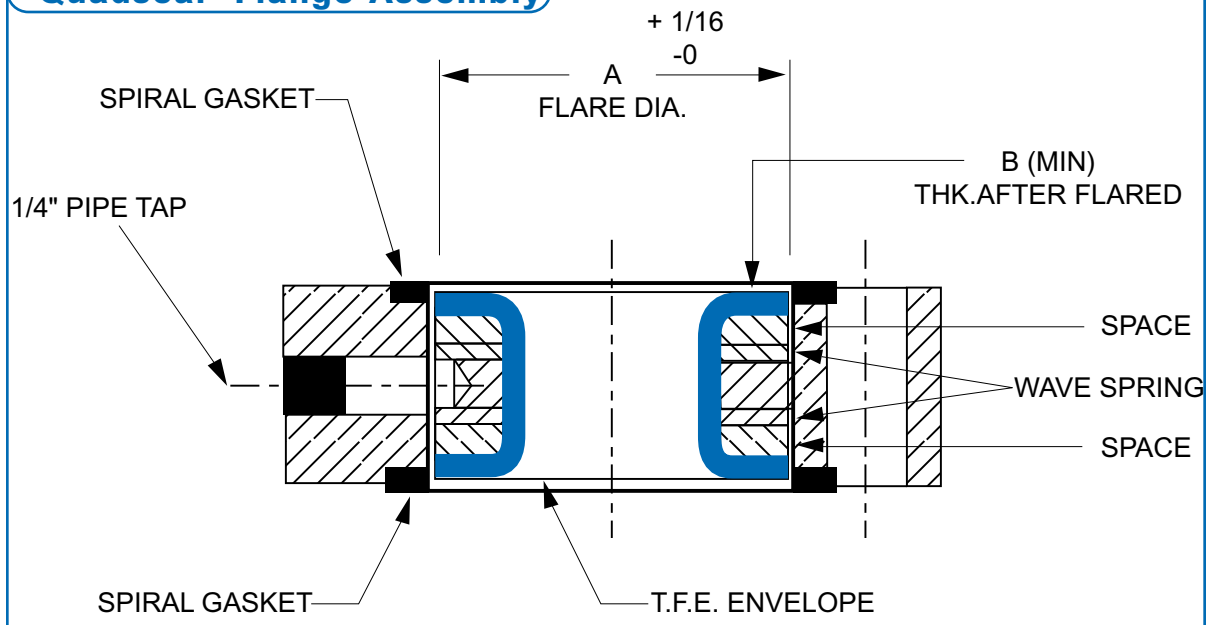
Pipe Size	Radius	90° Bends		45° Bends			
		A	B	C	D	E	F
1"	3"	9"	7"	6 1/2"	8"	5 5/8"	8"
1 1/2"	4 1/2"	13 1/2"	10"	9"	12"	8 1/2"	12"
2"	6"	18"	13"	12"	15 1/2"	11"	16"
3"	9"	27"	18"	17"	24"	17"	25"
4"	12"	33"	22"	21"	30"	21 1/4"	32"

Whether you require a 30°, 45°, 90° or a three dimensional combination bend, 3P EnviroBend® Lined Pipe can meet your specification. All 3P EnviroBend® Lined Pipe products possess the same mechanical and corrosion resistant integrity as 3P's standard lined pipe because the bending is a cold process which does not require heat treating. The EnviroBend® System employs the interference fit lining method. The pipe is then precision bent to specification and heat flared at the flange. For larger sizes, consult 3P.

Liner materials available: PTFE, PFA, PVDF, PP

QUADSEAL® FLANGE ASSEMBLY

• Quadseal® Flange Assembly

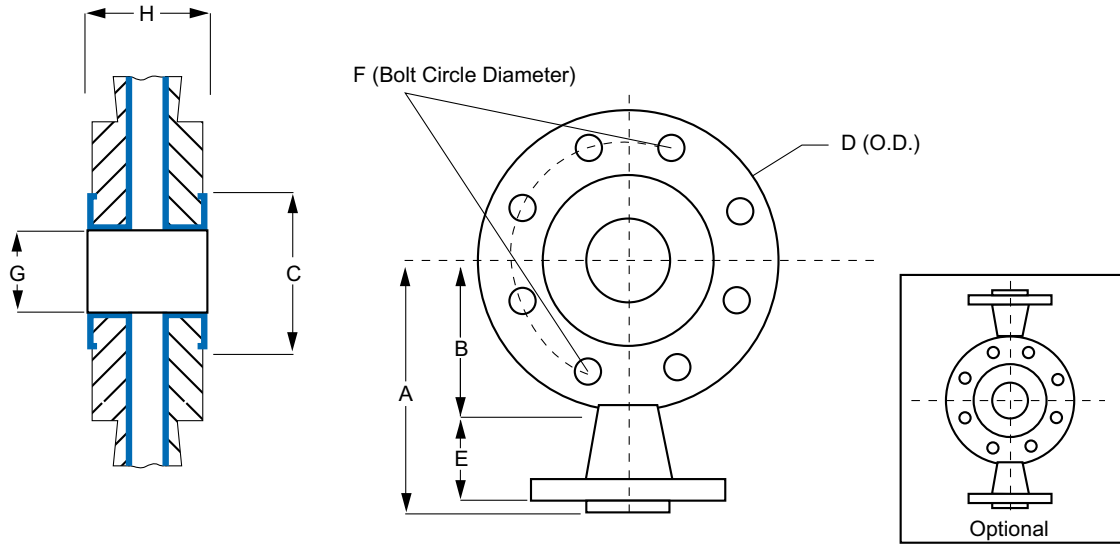


Nominal Size	A	B Min.	Thickness Compressed
1"	1 7/8"	.125"	1 1/4"
1 1/2"	2 11/16"	.125"	1 1/4"
2"	3 7/16"	.135"	1 1/4"
3"	4 5/8"	.135"	1 1/4"
4"	5 15/16"	.135"	1 1/4"
6"	8"	.135"	1 1/4"

The 3P Quadseal® flange provides dual containment, fire safety and the ability to fully monitor each flange connection. The Quadseal® is self-contained and easy to install. By simply placing the Quadseal® flange between mating flanges and tightening the flange to the specific torque, dual containment is achieved.

LUGGED BODY INSTRUMENT CONNECTOR

Lugged Body Instrument Connector



Size	150 Class – Dimensions								
	A	B	C	D	E	F	G	H	Thread
1"	4 1/4"	1.93"	2"	4 1/4"	2 1/8"	3 1/8"	3/4"	2 3/8"	1/2"-13
1 1/2"	4 5/8"	2.31"	2 7/8"	5"	2 1/8"	3 7/8"	1 5/16"	2 3/8"	1/2"-13
2"	5 1/8"	2.81"	3 5/8"	6"	2 1/8"	4 3/4"	1 13/16"	2 3/8"	5/8"-11
3"	5 7/8"	3.56"	5"	7 1/2"	2 1/8"	6"	2 13/16"	2 3/8"	5/8"-11
4"	6 5/8"	4.31"	6 3/16"	9"	2 1/8"	7 1/2"	3 3/4"	2 3/8"	5/8"-11
6"	7 5/8"	5.31"	8 1/2"	11"	2 1/8"	9 1/2"	5 3/4"	2 3/8"	3/4"-10
8"	8 7/8"	6.56"	10 5/8"	13 1/2"	2 1/8"	11 3/4"	7 3/4"	2 3/8"	3/4"-10

Size	300 Class – Dimensions								
	A	B	C	D	E	F	G	H	Thread
1"	5 9/16"	2.24"	2"	4 7/8"	2 3/8"	3 1/2"	3/4"	2 3/8"	1/2"-13
1 1/2"	5 3/16"	2.87"	2 7/8"	6 1/8"	2 3/8"	4 1/2"	1 5/16"	2 3/8"	1/2"-13
2"	5 5/8"	3.06"	3 5/8"	6 1/2"	2 3/8"	5"	1 13/16"	2 3/8"	5/8"-11
3"	6 1/2"	3.94"	5"	8 1/4"	2 3/8"	6 5/8"	2 13/16"	2 3/8"	5/8"-11
4"	7 3/8"	4.81"	6 3/16"	10"	2 3/8"	7 7/8"	3 3/4"	2 3/8"	5/8"-11
6"	8 5/8"	6.06"	8 1/2"	12 1/2"	2 3/8"	10 5/8"	5 3/4"	4 1/8"	3/4"-10
8"	9 7/8"	7.31"	10 5/8"	15"	2 3/8"	13"	7 3/4"	4 1/8"	3/4"-10

Notes:

1. Body Types: Lugged, Single Branch or Double Branch
2. Body Sizes: 2", 3", 4", 6", 8"
3. Nozzle Size: 1" (1/2" inside diameter)
4. Liner; PP, PFA, PVDF
5. Liner Thickness: 0.150" minimum
6. Body Material: Carbon steel
7. Flange Material: Carbon steel



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