

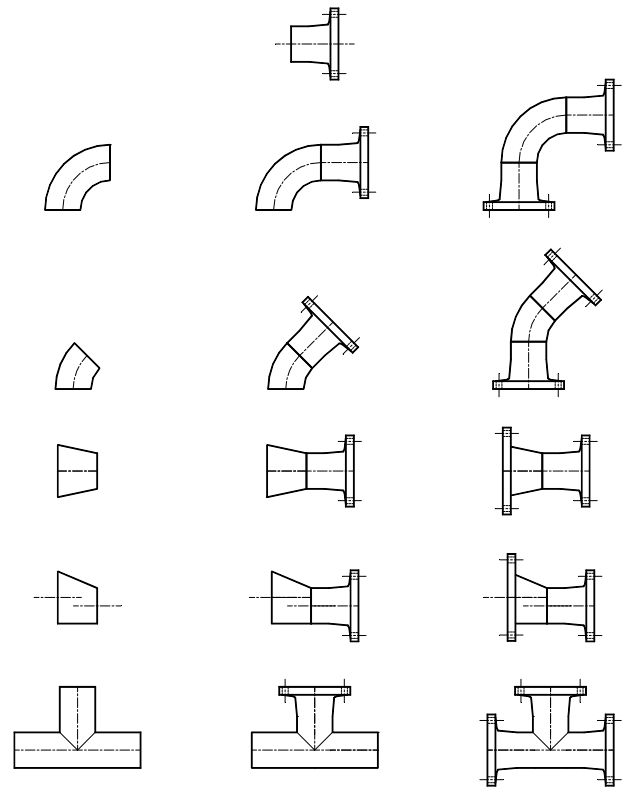
FIBERBOND®

FIBERGLASS AND ADVANCED COMPOSITE PIPING SYSTEMS

THE FIBERBOND® FITTINGS GUIDE

FIBERBOND® SERIES

- 20C
- 110FW
- 20HV-D



www.fiberbond.com
www.exelinc.com

March 2010 Edition

FIBERBOND® Fittings Guide

PIPE SERIES:

The fittings contained in this book are available in the following series (unless otherwise noted):

20C	Electrically conductive piping series for handling non-conductive fluids. 20C differs from 20HV-C in that the 20C piping products are electrically conductive throughout using a homogenously conductive resin.
20HV-D	A modified version of 20HV designed for drains and vents, rated for 100psig.
110FW	110mil liner product for corrosive chemical environments.

GASKETS:

1. In systems hydrotesting above 225psig (15.5bar), gaskets with better sealing properties, such as Garlock's "Stress Saver" gasket (www.garlock.com), CTG's "ET Energizer" gasket (www.ctgasket.com) or Asahi's "Low Torque" gasket (www.asahi-america.com), are recommended.
2. O-ring gaskets may also be used, but they do require a special o-ring groove to be machined in one face (and only one face) of the mating pair of flanges. O-ring gaskets have no takeout. Shore "A" hardness values are typically between 55 and 75. A typical material is Buna-N (NBR). For higher temperatures and resistance to certain acids and solvents, Viton® is also available. Viton® is a fluoroelastomer manufactured by DuPont Dow.
3. In systems hydrotesting between 150psig (10.3bar) and 225psig (15.5bar), either full-face 1/8" thick flat rubber gaskets (neoprene, red rubber, etc.) or gaskets with better sealing properties may be used.
4. In systems hydrotesting only up to 150psig (10.3bar), full-face 1/8" thick rubber gaskets are recommended. Shore "A" hardness values can range from 60 to 80, although values down to 50 may be suitable as well as higher values.
5. These gasket recommendations do not take into account the required corrosion resistance of the systems. Make sure that gasket materials are suitable for the intended services. CR (neoprene) is normally good for water and seawater and has excellent weathering resistance. SBR (red rubber) is normally good for water, seawater, alcohol, glycol, and weak acids. NBR (Buna-N) is normally good for water, seawater, dilute acids, and aliphatic hydrocarbons (propane, butane, petroleum oil, mineral oil, grease, diesel fuel). EPDM (ethylene-propylene-diene rubber) is a good choice for hot water service, many solvents and many acid services.

RULES FOR O-RING GASKETS:

1. Takeout of the gasket is essentially zero inches. The gasket is 3/16" (0.1875") nominal diameter and the groove is 0.15". With compression of the gasket, the takeout is zero.

2. A groove is only provided in one face of each mating pair of flanges. The #1 situation to avoid with the o-ring gasket is a grooved flange mated directly to another grooved flange. The only solution to this situation is 1) remove one of the grooved flanges and replace with a flat-face flange, 2) fill one of the grooved flanges with a putty material to obtain a flat-face, or 3) insert a rubber gasket or harder material between the two grooved flanges along with an o-ring gasket in each groove to provide a suitable seal.

3. Other general rules that are usually followed with o-ring gaskets:

A. For FRP to FRP flange connection, the groove is placed in one of the FIBERBOND® flanges at the discretion of the fabricator. For convenience during installation, if the flange is in the vertical, the groove is normally placed in the lower flange.

B. For connections to alloy flanges, the groove is applied to the FIBERBOND® flange. There is only one exception to this rule and that is when the alloy flange is a drilled-and-tapped blind flange supplied by the fabricator. In this case, the groove is applied to the alloy blind flange.

C. For connections to full-face flanged valves, lug type valves, or wafer valves that do not have an integral seal, a groove is applied to the FIBERBOND® flange.

D. For connections to valves with integral seals (not seats), as is typical with many butterfly valves, no groove is applied to the FIBERBOND® flange as no gasket is used.

E. For connections to raised face flanges, an o-ring groove is not needed, but can still be used. A full-face 1/8" thick rubber gasket, such as red rubber "SBR" can be used. The takeout for the gasket is 1/8".

F. O-ring grooves are not applied to FIBERBOND® flanges smaller than 2" diameter. If the connection is not to an alloy blind flange that can be "grooved" by the fabricator, then a full-face 1/8" thick rubber gasket can be used.

G. For flange to blind flange connections, normally the groove is placed in the blind flange. Blind flanges are usually slightly less expensive to "groove" than flanges.

FLANGES:

1. All flanges are flat face and should be bolted to flat face flanges. FIBERBOND® flanges can be bolted to raised-face flanges, however, care should be taken when torquing these flanges. Over-torquing can cause cracking in the flange.
2. The flange thickness will differ from ANSI B16.5 150#.
3. The outside diameter and bolt pattern will match 150#. Other bolt patterns, such as 300# and BS4504 PN10 & PN16, can be provided. The flange will still be limited to its standard pressure and temperature rating.

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4. Reducing flanges are also available.

NUTS, BOLTS, & WASHERS:

1. There are no special requirements for bolting materials except that SAE "Narrow" series washers must be used. USS washers will not fit on FRP flanges.

LATERAL WELDS AND FITTINGS:

1. Lateral welds are currently only rated for design pressures up to 100 psig up to 16in. diameter and 50psig for larger sizes. If higher pressures are required, please consult with Specialty Plastics.

THREAD-O-LETS:

1. Fig.94: The most reliable and heavy-duty solution for threaded connections is to use an FRP flange and bolt an alloy (316SS, 90/10 Cu-Ni, Gr Ti, etc.) blind flange that is drilled-and-tapped for the NPT size. This type of connection has been used for many years and is the most durable and toughest solution.
2. Fig.47JF: To eliminate the need for a bolted connection, the Figure 47JF MNPT alloy saddle is available. Alloy material choices include 316SS, 90/10 Cu-Ni, Titanium, and Monel. Other alloy materials may be available. This alloy MNPT is designed for connections to spray nozzles in deluge systems and can also be used for connecting to vents, drains, and instruments. Due to the large bending moment that could be applied, it is not recommended that the Fig.47JF MNPT be used to connect directly to long runs of threaded alloy piping. Note: the alloy MNPT is permanently bonded to the FRP piping.
3. If no alloy components are desired (for the best in corrosion resistance), FRP threads are available in Fig.95F and Fig.97. Fig.95F is a plain end by threaded end FRP coupling. Fig.97 is an FRP threaded saddle (thread o-let). Fig.95F is limited to 150psig up to 2" FNPTs. Fig.97 has the same limitations. When installing a nipple into the FRP thread, it is normally necessary to apply several "wraps" of teflon tape to properly seal the joint. If, after wrapping with teflon tape, the nipple "bottoms out", a proper seal has most likely not been made and the connection will need to be remade prior to hydrotesting. Also, FRP NPTs can not be re-tapped. If the FRP thread were to be damaged, then the NPT coupling would have to be removed and replaced with a new one. Like the Fig.47JF MNPT, it is not intended to be directly connected to long runs of alloy piping due to the bending moment that could be applied to the threaded connection.

CERTIFICATIONS AND APPROVALS:

Series 20C ABS 00 NO 32171-X

ANSI DIMENSION FITTINGS:

ANSI "short radius" flanged fittings are available, but are normally rated only to 150psig. Please consult Specialty Plastics for information on these fittings.

VICTAULIC CONNECTIONS:

For most pipes up to 12in. nominal diameter, ends can be machined to fit a victaulic coupling. Please consult Specialty Plastics for information on these fittings.

WALL THICKNESSES & OUTSIDE DIAMETERS:

All FIBERBOND® Fiberglass Piping Series are manufactured with a fixed inside diameter. As the pressure rating of the pipe series increases, the wall thickness and outer diameter also increase.

Ratings, Wall Thicknesses, and Outside Diameters

Size	I.D.	20C			20HV-D			110FW		
		Rating	Wall	O.D.	Rating	Wall	O.D.	Rating	Wall	O.D.
1"	1.00"	150	0.25"	1.50"	100	0.25"	1.50"	150	0.25"	1.50"
1.5"	1.50"	150	0.25"	2.00"	100	0.25"	2.00"	150	0.25"	2.00"
2"	2.00"	150	0.25"	2.50"	100	0.20"	2.40"	150	0.25"	2.50"
3"	3.00"	150	0.25"	3.50"	100	0.20"	3.40"	150	0.25"	3.50"
4"	4.00"	150	0.25"	4.50"	100	0.20"	4.40"	150	0.25"	4.50"
6"	6.00"	150	0.25"	6.50"	100	0.20"	6.40"	150	0.31"	6.63"
8"	8.00"	150	0.31"	8.63"	100	0.20"	8.40"	150	0.38"	8.75"
10"	10.00"	150	0.31"	10.63"	100	0.20"	10.40"	150	0.44"	10.88"
12"	12.00"	150	0.38"	12.75"	100	0.21"	12.42"	150	0.50"	13.00"
14"	14.25"	150	0.44"	15.13"	100	0.24"	14.73"	150	0.56"	15.38"
16"	16.25"	150	0.50"	17.25"	100	0.27"	16.79"	150	0.63"	17.50"
18"	18.25"	150	0.56"	19.38"	100	0.30"	18.85"	150	0.69"	19.63"
20"	20.25"	150	0.63"	21.50"	100	0.33"	20.91"	150	0.75"	21.75"
24"	24.25"	150	0.75"	25.75"	100	0.39"	25.03"	150	0.88"	26.00"
30"	30.25"	100	0.63"	31.50"				100	0.75"	31.75"
36"	36.25"	100	0.75"	37.75"				100	0.88"	38.00"
42"	42.25"	50	0.44"	43.13"				50	0.56"	43.38"
48"	48.25"	50	0.50"	49.25"				50	0.63"	49.50"
60"	60.25"	50	0.63"	61.50"				50	0.75"	61.75"

SPECIAL NOTES ON DRAIN SYSTEMS:

Slopes can be fabricated in FIBERBOND® systems at any angle. When shop prefabrication work is performed by Specialty Plastics, laterals can be fabricated at special angles, such as 45.9 degrees (for a 3/16" sloped header). This eliminates the need for any special dimensioning. The same is true for tees and reducing tees. In sloped systems, elbows are normally kept at their full sweep for 45 or 90 degrees and the pipe is mitered to maintain the slope in the header.

MODELING FIBERBOND® FITTINGS:

Many FIBERBOND® fittings are similar to steel butt weld fittings. Most flanges up to 12" diameter have the same neck length as a long welding neck flange. All elbows are long radius and have the same takeout as plain end LR steel fittings. Tees, reducing tees, concentric & eccentric reducers, laterals, and reducing laterals all have the same geometrical shape as steel butt weld fittings, however, the takeouts will differ from size to size.

The outside diameters of FIBERBOND® pipe will differ from steel in most sizes.

VPDMS CATALOGS:

Catalogs for the 3D modeling software VPDMS by Aveva Inc. are available by contacting Specialty Plastics.

CHANGES FROM THE PREVIOUS EDITION:

March 2010: Clarified that the Fig.46 and Fig.48 olets consist of the branch fitting only.

February 2010: Corrected the "L" dimension for the Fig.10-O orifice flanges.

April 2009: Changed wording on gasket recommendations.

August 2008: Changed wording on material choices for the Fig.47JF MNPT olet and Fig.94 threaded blind flange. Changed "metallic" to "alloy" throughout the document.

February 2005: Corrected lateral pressure ratings. Removed information on all series except for 20C, 20HV-D, and 110FW. The other series (20FR-E, 20HV, 20FR16, etc.) now have their own fittings guide.

December 2004: Updated pressure rating, wall thickness, & flange thickness for 20HV and 20C in sizes 20" and 24". Corrected wall thickness for 110FW in sizes 6" and larger. Updated flange thickness for 110FW in sizes 20" and 24". Added Fig.10o and Fig.15 data for sizes above 24". Added new note on gaskets. Added thicknesses and O.D.s for fittings. Added note for Fig.47JF MNPT olets. Changed 110 to 110FW.

August 2003: No dimensional changes were made. Additional information was added about the threaded connections, rules for o-rings, and selection of gaskets in the preceding pages. O.D.s and thicknesses of 20HV-D 1" and 1.5" pipe were corrected.

April 2003: Details of the Figure 47 FNPT alloy saddle have been removed from the Fittings Guide. Details of the Figure 47JF MNPT alloy saddle have been added. The "C" dimension of the Figure 88 Reducing Lateral was corrected. The thicknesses of the Figure 17 Bleed Ring were changed to 1.5" for sizes up to 12". Changed dummy leg size for Figure 90 for elbow sizes 6", 14", 16", and 18".

May 2002: Quantity and size of bolts and capscrew data was added to the Bolt Lengths table. Added a "Blinds & Bleed Rings" section with Figures 16, 17, 19H, and 19C. Information on "pup" lengths was added to the Dummy Legs & Hemicaps section. Information on the availability of reducing flanges was added to the Flanges section.

March 2002: The pipe wall thicknesses and outside diameters for Series 20HV-D were corrected. The "C" and "C+L" dimensions for the 3" and 6" Figure 30 elbows were corrected. The "C" dimension was changed from 1 5/8" to 1 7/8" for 3" diameter and 3 3/8" to 3 3/4" for 6" diameter. Other minor text changes were made.

January 2002: Only minor changes have been made. The lettering terminology for the Figure 20, 20PF, and 20FF elbows were corrected so that the table matched the figure. No values changed. The pipe outside diameter of various series was listed incorrectly for the 18" size only. The outside diameters that were 18.38" should have been listed as 19.38". A separate Fittings Guide has been created for Series 20FR16 and 20FR20.

April 2001: The "B" dimension in the table for Figures 46 and 48 was changed to "LS" to match the figure. The "E" and "E+L" dimensions for a 6" x 2" reducer (Fig.60 & 61) were changed to 10" and 16", respectively. The previous dimensions were incorrect. A great deal of new information is included in this edition of the Fittings Guide. The only change from our previous edition is the 'L' dimension of our Fig.10 Flange in sizes 20" and larger. These dimensions have increased by 3" for sizes 20", 24", and 30", 9" for sizes 36" and 42", and 6" for sizes 48" and 60". The Max.L dimension has also increased by 6" for sizes 36", 42", and 48". These changes have also affected the dimensions of Fig.20PF, 20FF, 30PF, 30FF, 60PF, 60FF, 61PF, and 61FF.

FLANGES

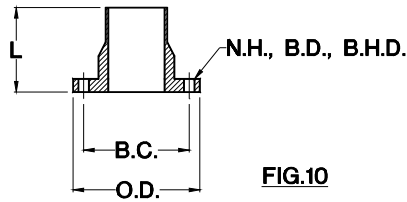


FIG.10

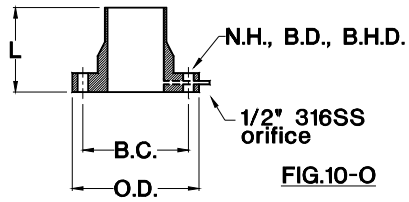


FIG.10-O

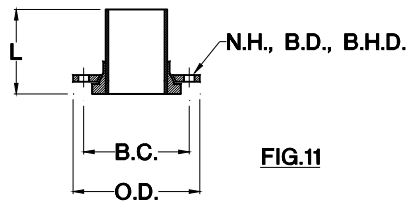


FIG.11

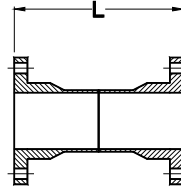


FIG.15

Size	Fig.10			Fig.10O	Fig.11	Fig.15	
	L	Min.L	Max.L	L	L	L	Min.L
1"	6"	4"	6"	8"	6"	12"	6"
1.5"	6"	4"	6"	8"	6"	12"	6"
2"	6"	6"	12"	8"	6"	12"	7"
3"	6"	6"	12"	8"	6"	12"	7"
4"	6"	6"	12"	8"	6"	12"	7"
6"	8"	6"	12"	8"	8"	16"	8"
8"	8"	8"	12"	8"	8"	16"	8"
10"	10"	8"	18"	10"	10"	20"	9"
12"	10"	10"	18"	10"	10"	20"	10"
14"	12"	10"	18"	12"	12"	24"	10"
16"	12"	10"	18"	12"	12"	24"	11"
18"	12"	10"	18"	12"	12"	24"	11"
20"	15"	10"	18"	15"	15"	30"	12"
24"	15"	10"	18"	15"	15"	30"	15"
30"	18"	12"	18"	18"		36"	15"
36"	24"	12"	24"	24"		48"	15"
42"	24"	12"	24"	24"		48"	15"
48"	24"	15"	24"	24"		48"	15"
60"	30"	18"	30"	30"		60"	18"

1. For Fig.10, the minimum L length may vary depending upon the series.
2. For Fig.15, the minimum L length for the Fig.15 flange requires special fabrication techniques and normally requires additional time for delivery.
3. 300# drilling and other special drillings are also available.
4. Reducing flanges are also available. Figure number is 10R. The 'L' dimension for Fig.10R is the same as Fig.10. Use the small bore pipe size for the 'L' dimension; e.g. a 6" x 2" Fig.10R reducing flange has a standard 'L' dimension of 6".

FLANGE THICKNESSES

Size	20C	110FW	20HV-D			
1"	1/2"	1/2"	1/2"			
1.5"	1/2"	1/2"	1/2"			
2"	11/16"	11/16"	9/16"			
3"	13/16"	13/16"	11/16"			
4"	15/16"	15/16"	13/16"			
6"	1 3/16"	1 3/16"	7/8"			
8"	1 1/4"	1 1/4"	1 1/16"			
10"	1 7/16"	1 7/16"	1 1/4"			
12"	1 3/4"	1 3/4"	1 7/16"			
14"	1 3/4"	1 3/4"	1 1/2"			
16"	1 15/16"	1 15/16"	1 11/16"			
18"	2"	2"	1 3/4"			
20"	2 1/8"	2 1/8"	1 7/8"			
24"	2 3/8"	2 3/8"	2 1/16"			
30"	2 3/8"	2 3/8"				
36"	3 3/16"	3 3/16"				
42"	2 3/8"	2 3/8"				
48"	2 5/8"	2 5/8"				
60"	4 1/16"	4 1/16"				

1. Blind flanges are designated as Fig.16. Fig.16 Blind flanges have the same thicknesses as Fig.10 flanges.

BOLT LENGTHS

Recommended Stud Bolt Length (LSSB)

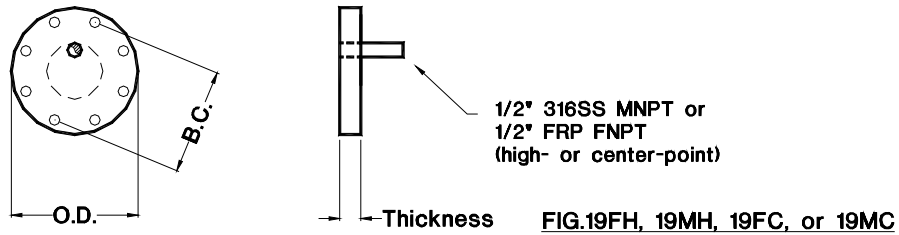
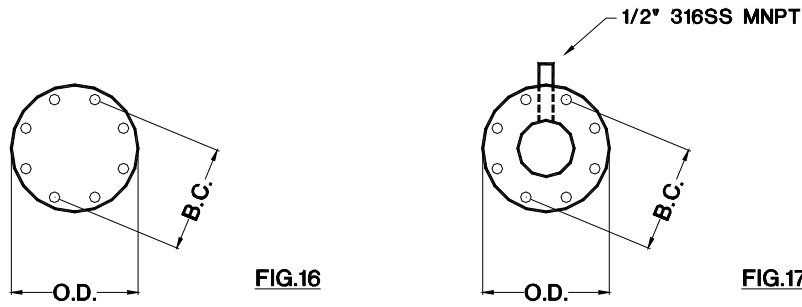
Size	No./Size	20C		110FW		20HV-D			
		F/F	F/S	F/F	F/S	F/F	F/S		
1"	(4) 1/2"	2 3/4"	2 3/4"	2 3/4"	2 3/4"	2 3/4"	2 3/4"		
1.5"	(4) 1/2"	2 3/4"	3"	2 3/4"	3"	2 3/4"	3"		
2"	(4) 5/8"	3 1/4"	3 1/2"	3 1/4"	3 1/2"	3"	3 1/4"		
3"	(4) 5/8"	3 1/2"	3 3/4"	3 1/2"	3 3/4"	3 1/4"	3 1/2"		
4"	(8) 5/8"	3 3/4"	3 3/4"	3 3/4"	3 3/4"	3 1/2"	3 3/4"		
6"	(8) 3/4"	4 1/2"	4 1/2"	4 1/2"	4 1/2"	4"	4"		
8"	(8) 3/4"	4 3/4"	4 1/2"	4 3/4"	4 1/2"	4 1/4"	4 1/2"		
10"	(12) 7/8"	5 1/4"	5"	5 1/4"	5"	5"	5"		
12"	(12) 7/8"	6"	5 1/2"	6"	5 1/2"	5 1/4"	5 1/4"		
14"	(12) 1"	6 1/4"	5 3/4"	6 1/4"	5 3/4"	5 3/4"	5 1/2"		
16"	(16) 1"	6 1/2"	6"	6 1/2"	6"	6"	5 3/4"		
18"	(16) 1 1/8"	7"	6 1/2"	7"	6 1/2"	6 1/2"	6 1/4"		
20"	(20) 1 1/8"	7 1/4"	7"	7 1/4"	7"	6 3/4"	6 3/4"		
24"	(20) 1 1/4"	8"	7 1/2"	8"	7 1/2"	7 1/2"	7 1/4"		
30"	(28) 1 1/4"	8"	7 3/4"	8"	7 3/4"				
36"	(32) 1 1/2"	10 1/4"	9 1/2"	10 1/4"	9 1/2"				
42"	(36) 1 1/2"	8 1/2"	8 3/4"	8 1/2"	8 3/4"				
48"	(44) 1 1/2"	9"	9 1/4"	9"	9 1/4"				
60"	(52) 1 3/4"	12 1/2"	11 1/2"	12 1/2"	11 1/2"				

1. The F/F column is for FRP to FRP flange connections. The F/S column is for FRP to 150# alloy flange connections.
2. For FRP to FRP flange connections, LSSB = 2 * (Flange Thickness + PTOL + Nut Thickness) + Gasket + (2 * Washer).
3. For FRP to 150# alloy flange connections, LSSB = Flange Thickness + PTOL + 150# Flange Thickness + PTOL + (2 * Nut Thickness) + Gasket + (2 * Washer).
4. PTOL = 1/8" up to 18" nominal size and 3/16" above 18" nominal size. Gasket is 1/8". Washer is 1/8".

Recommended Capscrew Length

Size	No./Size	Valve Takeout	20C	110FW	20HV-D	
2"	(4) 5/8"	1 3/4"	1 1/2"	1 1/2"	1 1/4"	
3"	(4) 5/8"	1 3/4"	1 1/2"	1 1/2"	1 1/2"	
4"	(8) 5/8"	2"	1 3/4"	1 3/4"	1 3/4"	
6"	(8) 3/4"	2 1/8"	2 1/4"	2 1/4"	1 3/4"	
8"	(8) 3/4"	2 1/2"	2 1/2"	2 1/2"	2 1/4"	
10"	(12) 7/8"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	
12"	(12) 7/8"	3"	3 1/4"	3 1/4"	2 3/4"	
14"	(12) 1"	3"	3 1/4"	3 1/4"	3"	
16"	(16) 1"	4"	3 3/4"	3 3/4"	3 1/2"	

BLINDS & BLEED RINGS



Size	Thicknesses						
	Fig.16	Fig.17	Fig.19				
1"	See Flange Thickness Table Fig.16 thicknesses are the same as the Fig.10 flange.		See Flange Thickness Table Fig.19 thicknesses are the same as the Fig.10 flange.				
1.5"							
2"		1 1/2"					
3"		1 1/2"					
4"		1 1/2"					
6"		1 1/2"					
8"		1 1/2"					
10"		1 1/2"					
12"		1 1/2"					
14"							
16"							
18"							
20"							
24"							
30"							
36"							
42"							
48"							
60"							

1. 300# drilling and other special drillings are also available.
2. 316SS, 90/10 Cu-Ni, Titanium, Monel and other materials are available for the MNPTs. FRP is not available as the MNPT material.
3. For Fig.19, specify 19FH for a blind with a high point FNPT, 19MH for a blind with a high point MNPT, 19FC for a blind with a center point FNPT, or 19MC for a blind with a center point MNPT.
4. Fig.17 bleed rings with heavier thicknesses are available on a custom basis.

ELBOWS

FIG.20

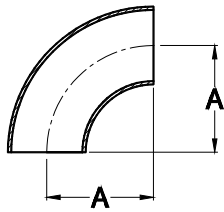


FIG.20S

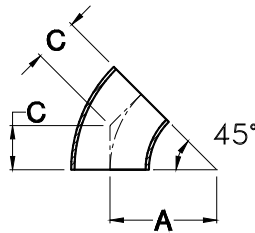
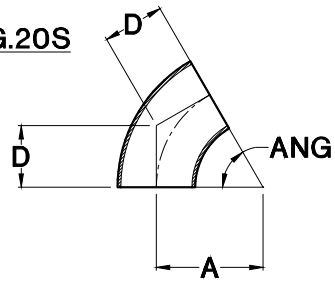


FIG.30

Size	Fig.20	Fig.20S			Fig.30	
	A	A	D	ANG	A	C
1"	1.5"	1.5"	ANG can be from 20 to 89degrees.			
1.5"	2.25"	2.25"				
2"	3"	3"	D = 1.5 * Size * TAN (ANG/2).		3"	1 1/4"
3"	4.5"	4.5"				4.5"
4"	6"	6"	Smaller angles can be mitered.		6"	2 1/2"
6"	9"	9"				9"
8"	12"	12"			12"	5"
10"	15"	15"			15"	6 1/4"
12"	18"	18"			18"	7 1/2"
14"	21"	21"			21"	8 3/4"
16"	24"	24"			24"	10"
18"	27"	27"			27"	11 1/4"
20"	30"	30"			30"	12 1/2"
24"	36"	36"			36"	15"
30"	45"	45"			45"	18 3/4"
36"	54"	54"			54"	22 1/2"
42"						
48"						
60"						

1. Fig. 20PF and 30PF are available for shop fabricated systems only.
2. 42", 48" & 60" elbows are mitered, all other sizes are full sweep.

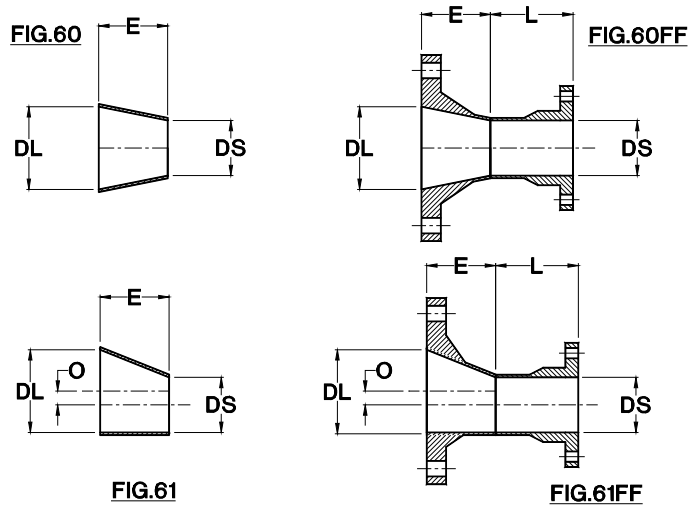
ELBOW THICKNESSES

Ratings, Wall Thicknesses, and Outside Diameters for Fittings

Size	I.D.	20C			20HV-D			110FW		
		Rating	Wall	O.D.	Rating	Wall	O.D.	Rating	Wall	O.D.
1"	1.00"	150	0.25"	1.50"	100	0.25"	1.50"	150	0.25"	1.50"
1.5"	1.50"	150	0.25"	2.00"	100	0.25"	2.00"	150	0.25"	2.00"
2"	2.00"	150	0.25"	2.50"	100	0.25"	2.50"	150	0.25"	2.50"
3"	3.00"	150	0.25"	3.50"	100	0.25"	3.50"	150	0.25"	3.50"
4"	4.00"	150	0.25"	4.50"	100	0.25"	4.50"	150	0.31"	4.63"
6"	6.00"	150	0.25"	6.50"	100	0.25"	6.50"	150	0.38"	6.75"
8"	8.00"	150	0.31"	8.63"	100	0.25"	8.50"	150	0.44"	8.88"
10"	10.00"	150	0.38"	10.75"	100	0.25"	10.50"	150	0.50"	11.00"
12"	12.00"	150	0.44"	12.88"	100	0.31"	12.63"	150	0.56"	13.13"
14"	14.25"	150	0.56"	15.38"	100	0.38"	15.00"	150	0.63"	15.50"
16"	16.25"	150	0.63"	17.50"	100	0.44"	17.13"	150	0.69"	17.63"
18"	18.25"	150	0.69"	19.63"	100	0.44"	19.13"	150	0.75"	19.75"
20"	20.25"	150	0.75"	21.75"	100	0.50"	21.25"	150	0.88"	22.00"
24"	24.25"	150	0.88"	26.00"	100	0.63"	25.50"	150	1.00"	26.25"
30"	30.25"	100	0.75"	31.75"				100	0.81"	31.88"
36"	36.25"	100	0.88"	38.00"				100	1.00"	38.25"
42"	42.25"	50	0.50"	43.25"				50	0.63"	43.50"
48"	48.25"	50	0.56"	49.38"				50	0.69"	49.63"
60"	60.25"	50	0.75"	61.75"				50	0.81"	61.88"

1. These ratings are also valid for flanges (Fig.10, Fig.10O, Fig.11, & Fig.15), blind flanges (Fig.16, Fig.19MC, Fig.19MH, Fig.19FC, Fig.19FH), bleed rings (Fig.17), tees (Fig.40, Fig.40PPF, & Fig.40F3), saddles (Fig.46 & Fig.48), reducers (Fig.60 & Fig.61), hemicaps (Fig.96), MNPT saddles (Fig.47JF & Fig.97), and "dummy legs" (Fig.90 & Fig.91). Laterals (Fig.80 & Fig.80F3) and reducing laterals (Fig.88) are only rated to 100psig up to 16" and 50psig up to 60". The FRP FNPTs (Fig.97 and 95F) are only rated to 150psig up to the 2" NPT size.

REDUCERS



Size	E	E+L
1.5" x 1"	1 1/4"	7 1/4"
2" x 1.5"	1 1/4"	7 1/4"
3" x 2"	2 1/2"	8 1/2"
4" x 3"	2 1/2"	8 1/2"
6" x 4"	5"	13"
8" x 6"	5"	13"
10" x 8"	5"	15"
12" x 10"	5"	15"
14" x 12"	5"	17"
16" x 14"	5"	17"
18" x 16"	5"	17"
20" x 18"	5"	20"
24" x 20"	10"	25"
30" x 24"	15"	33"
36" x 30"	15"	39"
42" x 36"	15"	39"
48" x 42"	15"	39"
60" x 48"	30"	60"

Size	E	E+L
2" x 1"	2 1/2"	8 1/2"
3" x 1.5"	3 3/4"	9 3/4"
4" x 2"	5"	11"
6" x 3"	7 1/2"	15 1/2"
8" x 4"	10"	18"
10" x 6"	10"	20"
12" x 8"	10"	20"
14" x 10"	10"	22"
16" x 12"	10"	22"
18" x 14"	10"	22"
20" x 16"	10"	25"
24" x 18"	15"	30"

Size	E	E+L
3" x 1"	5"	11"
4" x 1.5"	6 1/4"	12 1/4"
6" x 2"	10"	16"
8" x 3"	12 1/2"	20 1/2"
10" x 4"	15"	25"
12" x 6"	15"	25"
14" x 8"	15"	27"
16" x 10"	15"	27"
18" x 12"	15"	27"
20" x 14"	15"	30"

1. Offset dimension for eccentric reducers is 0.5" x (D2 - D1).
2. Reducers may be available in other sizes than those shown above. Min. E+L dimensions are also available.

EQUAL SIZE TEES

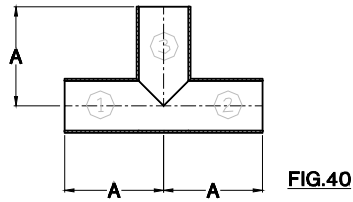


FIG.40

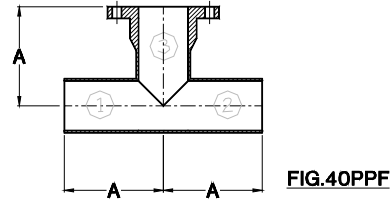


FIG.40PPF

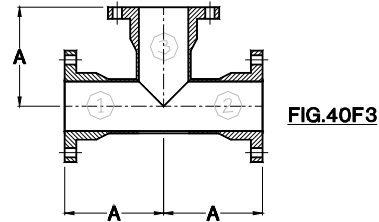


FIG.40FF

Size	A
1"	5"
1.5"	5 1/2"
2"	6"
3"	7"
4"	8"
6"	10"
8"	12"
10"	14"
12"	16"
14"	18"
16"	20"
18"	21"
20"	22"
24"	24"
30"	30"
36"	33"
42"	36"
48"	45"
60"	54"

1. Fig.40 tees in sizes 1", 1.5", and 14" & larger are shop-fabricated.
2. Fig.40PPF and Fig.40FF tees are all shop-fabricated.

REDUCING BRANCHES (OLETS)

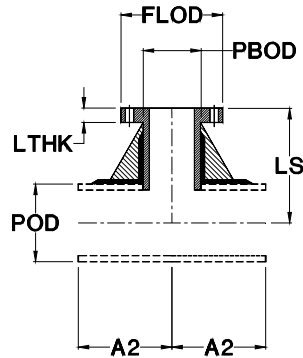


FIG.46

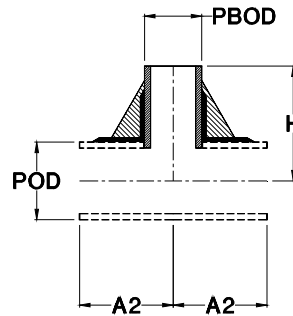


FIG.48

A2							
6"	7"	8"	10"	12"	14"	16"	18"

Branch Diameter							
1" thru 2"	3"	4"	6"	8"	10"	12"	14"

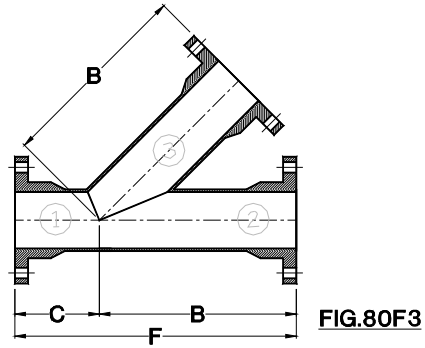
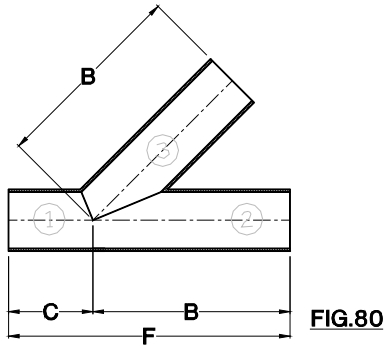
A
6"
6"
6"
7"
8"
10"
12"
14"
16"
18"
20"
21"
22"
24"
30"
33"
36"
45"
54"

Header Diameter
1"
1.5"
2"
3"
4"
6"
8"
10"
12"
14"
16"
18"
20"
24"
30"
36"
42"
48"
60"

LS							
7"							
7"							
7.5"							
8"	8"						
9"	9"	9"					
10"	10"	10"	12"				
11"	11"	11"	13"	13"			
12"	12"	12"	14"	14"	16"		
13"	13"	13"	15"	15"	17"	17"	
14"	14"	14"	16"	16"	18"	18"	20"
15"	15"	15"	17"	17"	19"	19"	21"
16"	16"	16"	18"	18"	20"	20"	22"
18"	18"	18"	20"	20"	22"	22"	24"
21"	21"	21"	23"	23"	25"	25"	27"
24"	24"	24"	26"	26"	28"	28"	30"
27"	27"	27"	29"	29"	31"	31"	33"
30"	30"	30"	32"	32"	34"	34"	36"
36"	36"	36"	38"	38"	40"	40"	42"

1. The 'A' dimension is based on header size. The 'A2' dimension is based on branch size. The 'LS' dimension is based on both header and branch size; e.g. 3" on 6" Fig. 46 has LS = 9", A2 = 7"
2. An olet fitting includes only the branch components. Unless purchased as part of a pre-fabricated (pre-assembled) system, it does require some assembly and bonding work.

LATERALS



Size	Fig.80 and Fig.80F3						
	B	C	B+C				
1"							
1.5"							
2"	10"	6"	16"				
3"	12"	6"	18"				
4"	14"	6"	20"				
6"	16"	8"	24"				
8"	20"	10"	30"				
10"	24"	10"	34"				
12"	26"	12"	38"				
14"	30"	12"	42"				
16"	32"	14"	46"				
18"	36"	14"	50"				
20"	38"	16"	54"				
24"	42"	18"	60"				
30"	52"	20"	72"				
36"	62"	22"	84"				
42"	72"	24"	96"				
48"							
60"							

1. Standard laterals are limited to a 100psig design pressure up to 16" and 50psig up to 60".
2. The Fig.80F3 flanged lateral may pose some difficulties for bolt installation. A Fig.80 lateral with a Fig.10 flange will eliminate this potential difficulty.

REDUCING LATERALS

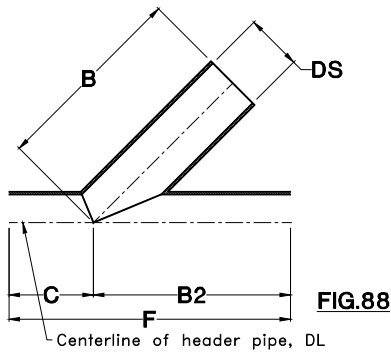


FIG.88

C							
6"	6"	6"	8"	10"	10"	12"	12"

Branch Diameter							
1" thru 2"	3"	4"	6"	8"	10"	12"	14"

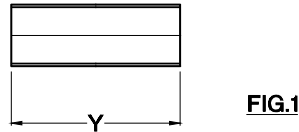
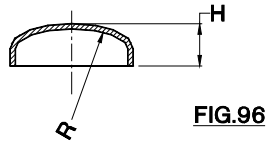
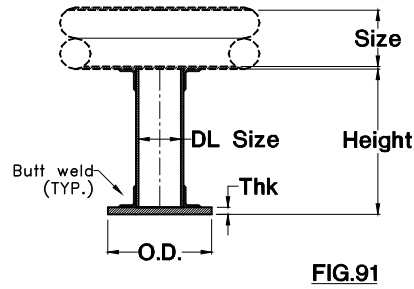
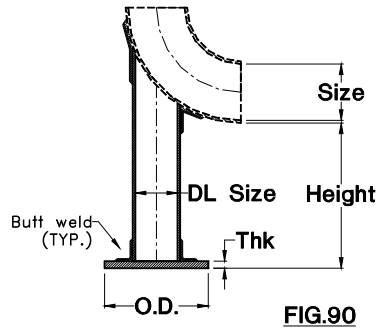
B
10"
12"
14"
16"
20"
24"
26"
30"
32"
36"
38"
42"
52"
62"
72"

Header Diameter
1"
1.5"
2"
3"
4"
6"
8"
10"
12"
14"
16"
18"
20"
24"
30"
36"
42"
48"
60"

B2							
10"							
10"	12"						
10"	12"	14"					
10"	12"	14"	16"				
12"	13"	14"	16"	20"			
14"	15"	16"	18"	20"	24"		
16"	17"	18"	20"	22"	24"	26"	
18"	19"	20"	22"	24"	26"	28"	30"
20"	21"	22"	24"	26"	28"	30"	32"
22"	23"	24"	26"	28"	30"	32"	34"
26"	27"	28"	30"	32"	34"	36"	38"
32"	33"	34"	36"	38"	40"	42"	44"
38"	39"	40"	42"	44"	46"	48"	50"
44"	45"	46"	48"	50"	52"	54"	56"

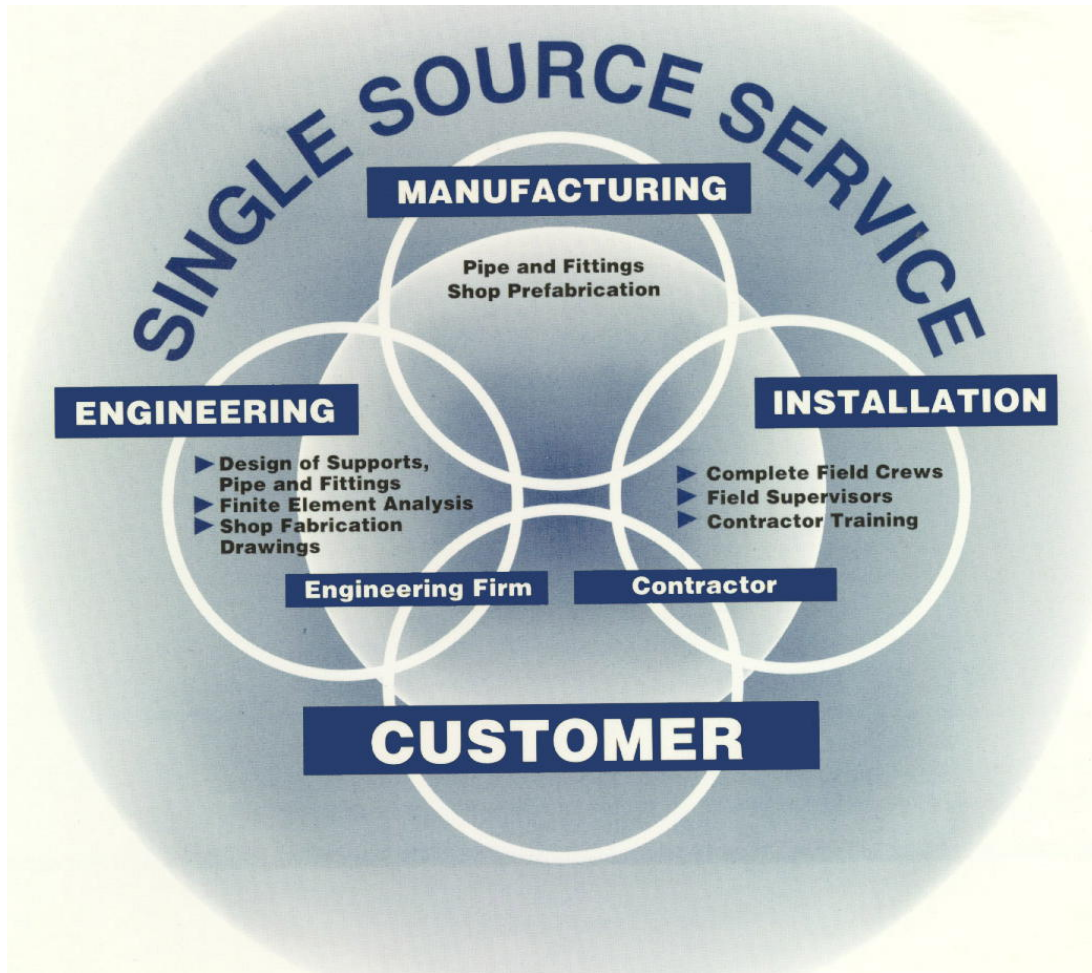
1. The 'B' dimension is based on header size. The 'C' dimension is based on branch size. The 'B2' dimension is based on header and branch size; e.g. 3" on 6" Fig. 88 has B=16", C=12", B2=12".
2. Standard reducing laterals are limited to a 100psig design pressure up to 16" and 50psig up to 60".

DUMMY LEGS, HEMICAPS, PUPS



Size	Fig.90 and Fig.91			Fig.96		Fig.1		
	DL	O.D.	Plate Thick.	H		Y		
1"						4"		
1.5"						4"		
2"	2"	5"	1/2"			4"		
3"	2"	5"	1/2"			4"		
4"	3"	6"	1/2"	2 1/2"		6"		
6"	4"	7"	1/2"	3 1/2"		6"		
8"	6"	9"	1/2"	4"		7"		
10"	6"	9"	1/2"	5"		9"		
12"	8"	12"	1/2"	6"		11"		
14"	10"	14"	1/2"	6 1/2"		14"		
16"	12"	16"	1/2"	7"		16"		
18"	14"	18"	1/2"	8"		18"		
20"	18"	22"	1/2"	9"		19"		
24"	18"	22"	1/2"	10 1/2"		22"		
30"	24"	28"	3/4"	10 1/2"		19"		
36"	24"	28"	3/4"	10 1/2"		22"		
42"	36"	40"	3/4"	12"		15"		
48"	36"	40"	3/4"	13 1/2"		15"		
60"	48"	52"	3/4"	16 1/2"		20"		

1. Fig. 90 and Fig. 91 include the dummy leg only, not the elbow nor pipe. Dummy legs can also be placed under tees and reducers.
2. Maximum dummy leg length is 3'-0". Specify the required leg length with the figure number.
3. Plate to be shipped loose and field installed. 6" of trim to be provided on dummy leg.
4. In shop prefabricated systems, the Fig.1 'Y' dimension can be as short as 1".



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