
"The Standard Of Excellence"

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# Flo-Concepts International


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# Flo-Concepts International

## Mission Statement

MISSION

- Our mission is to establish and maintain mutually beneficial relationships with our customers, suppliers, and employees. FCI strives to develop a long-term business relationship with our customers, which is founded on our ability to help identify and recommend the best solution for each customer's needs.

QUALITY

- FCI adopts the highest quality standards in customer service, manufacturing, distribution, and innovation through a continuous effort to exceed customer needs. We maintain an environment that fosters continual quality improvement in all areas of operation. By following superior quality standards, FCI strives to become "The Standard of Excellence".

VALUES

- At FCI we are committed to the highest standards of ethics and integrity. We have a total commitment to our values, shaping the way we do business for our employees, our customers, and our company.

## Rotational Molding

**F.C.I.** offers its capability to develop, design, and manufacture lined metal and solid plastic products and equipment through the use of its ***ROTATIONAL MOLDING*** processes. We hope the following will provide a better understanding of rotational molding and its advantages over other molding, lining, and coating methodologies.

The innovation of rotational molding equipment and technology provided new uses for free flowing resins. Whether your focus is on external aesthetics using molds, or internal linings, rotomolding should be a consideration. Utilizing computer controls to drive the machines, the products are passed through an oven and cooler for a heating and cooling cycle. Certain flow paths and temperature/time profiles are used while rotating the product on more than one axis at a time. This allows the resin to flow and form a **consistent uniform wall or lining** throughout the internal surface area of the housing used. Any resin available for rotomolding can be applied by varying the principles above. **F.C.I.'s** capabilities include **PFA**-Teflon, **ETFE**-Tefzel, **ECTFE**-Halar, **PVDF FLEX**-Kynar, **PP**-Polypropylene, **HDPEX**-High Density Polyethylene Cross linked and others.

Even distribution of resin throughout any configuration provides **a seamless wall**, eliminating the need for plastic welding and specially designed accesses required in dispersion coatings. **The wall thickness is not limited**, enabling **greater structural integrity**, and **permeation resistance** in chemical handling equipment. A **smooth, non-porous bore** means **less friction loss** and voids are eliminated, providing an ultra pure interior environment for semiconductor, pharmaceutical, FDA, and other application considerations. **The resin maintains intimate contact with the interior surface of the mold or containment shell.** In linings, this eliminates air entrapment which can lead to local failure in temperature fluctuations and permeation as compared to adhesive bonding in dual laminate products. The physical property of the resin is maintained because stresses from hydraulic pressure and additional preparations using heat to modify finished products are not induced. This also adds **dimensional stability and enables close tolerance achievements.**

**Engineering at F.C.I.** can develop the product of need from concept to completion. Our manufacturing and engineering **technical support** add the assurance of meeting or exceeding your product requirements along with providing continual assistance toward your application needs. Drawings from the latest versions of **CADD** software and equipment are provided for your review and approval process. Following approval, a certified set is available on paper or disk giving you an engineering record of your business experience with **F.C.I.**

**Our Quality Assurance Program** maintains specific parameter controls based on your requirements and the regulations of **ANSI, ASTM, ASME, MIL** and **ISO** standards. Full traceability from order to completion is recorded. Any information concerning your order while in production or after shipment can be provided with the proper authorization. **Our goal is the overall satisfaction of our customers through a continuing commitment to exceeding your needs!**

## Material Specifications

This Section provides the standards that are used during the various stages of development, manufacturing, and testing of lined steel products at FCI. Also covered is the design information needed to determine material selections suited for most process applications. FCI offers process, chemical, and mechanical engineers for further consultation.

## Design Material Offered

| | | | Temperature | Range | ASTM Ref. |
|---|---|---|---|---|---|
| PFA | Perfluoroalkoxyalkane (Teflon) | | 0° – 450° | 18 – 232 C | F1545 |
| PTFE | Polytetrafluorethylene (Virgin Teflon) | | -20° – 450° | -29° – 232° C | F1545 |
| ETFE | Ethylene trifluoroethylene (Tefzel) | | -20° – 300° | -29 – 149 C | F1545 |
| ECTFE | Ethylene chlorotrifluoroethylene (Halar) | | -20° – 300° | -29° – 149° C | F1545 |
| PVDF FLEX | Polyvinylidene fluoride (Kynar) FLEX | | 0° – 275° | 18° – 135° C | F1545 |
| PP | Polypropylene | | 0° – 225° | 18° – 107° C | F1545 |
| HDPEX | High Density Polyethylene Crosslinked | | -40° – 200° | -40 – 93 C | F1545 |

*Note: ASTM Designations meet the requirements for Plastic-Lined Ferrous Metal Pipe and Fittings

Halar is a trademark of Ausimont U.S.A. - Teflon is a trademark of E.I. Dupont.

## Physical Properties

| | PFA | PTFE | ETFE | ECTFE | PVDF FLEX | PP | HDPEX |
|---|---|---|---|---|---|---|---|
| ASTM D 638 - Avg. Values | mt* | ** | mt* | mt* | mt* | mt* | mt* |
| Tensile Strength at Yield of Ultimate PSI: | 4250 | 3000 | 7500 | 4800 | 4500-5500 | 4250 | 3000 |
| Elongation - % Ultimate: | | | | | | | |
| Specific Gravity: ASTM D 792 | 2.15 | 2.15-2.20 | 1.70 | 1.68 | 1.76-1.78 | 0.90 | 0.94 |
| Thermal Conductivity BTU in/h.ft? ?F | 1.30 | 1.70 | 1.65 | 1.07 | 1.10 | 1.10 | 3.40 |
| Color: | Grey | White | Natural or Spec. | Natural or Spec. | Black | Orange | Natural or Spec. |

* Note: mt - melt processible resins have excellent resistance to cold flow and are available in virgin, non-pimented, for semi-conductor, and other ultra purity applications.

** Note: Isostatically molded

## Temperature/Vacuum Ratings

| | Size | 1" | 1-1/2" | 2" | 3" | 4" | 6" | 8" | 10" | 12" |
|---|---|---|---|---|---|---|---|---|---|---|
| PTFE | Liner Thickness | 0.130 | 0.150 | 0.160 | 0.160 | 0.160 | 0.275 | 0.310 | 0.320 | 0.425 |
| | Vacuum (in. HG) | Full | Full | Full | Full | Full | Full | Full | * | * |
| | Temperature °F | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 |
| PFA | Liner Thickness | 0.125 | 0.125 | 0.125 | 0.125 | 0.015 | 0.160 | 0.160 | 0.200 | 0.200 |
| | Vacuum (in. HG) | Full | Full | Full | Full | Full | * | * | * | * |
| | Temperature °F | 450 | 450 | 450 | 450 | 450 | 275 | 150 | | |
| ETFE | Liner Thickness | 0.125 | 0.125 | 0.125 | 0.125 | 0.145 | 0.190 | 0.250 | 0.250 | 0.285 |
| | Vacuum (in. HG) | Full | Full | Full | Full | Full | Full | Full | * | * |
| | Temperature °F | 300 | 300 | 300 | 300 | 300 | 300 | 250 | 200 | 200 |
| PVDF | Liner Thickness | 0.125 | 0.125 | 0.125 | 0.125 | 0.145 | 0.190 | 0.190 | 0.250 | 0.285 |
| | Vacuum (in. HG) | Full | Full | Full | Full | Full | Full | Full | * | * |
| | Temperature °F | 275 | 275 | 275 | 275 | 275 | 275 | 275 | 275 | |
| PP | Liner Thickness | 0.150 | 0.160 | 0.175 | 0.175 | 0.210 | 0.220 | 0.220 | 0.320 | 0.380 |
| | Vacuum (in. HG) | Full | Full | Full | Full | Full | Full | Full | Full | Full |
| | Temperature °F | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |

Note: The table above indicates vacuum in inches of mercury as tested according to ASTM requirements. The test is performed on pipe and fittings that have not been exposed to prior services. Use in various environments may alter the temperature/vacuum ratings. Consult factory when system will be exposed long term to linings upper limits.

* Consult Factory

* All pipe liners are available in slip, or interference fit. - FCI fittings meet or exceed ratings for pipe liner.

## Temperature/Pressure Ratings

| Temperature F | Class 150 Pressure psig | Class 300 Pressure psig |
|---|---|---|
| 100 | 250 | 450 |
| 200 | 235 | 390 |
| 300 | 215 | 345 |
| 400 | 200 | 295 |
| 500 | 170 | 245 |

Note: Maximum design ratings are based upon standard liner thickness and ANSI 150 & 300 # rated flanges.

## PTFE Lined Piping System Product Specifications

| | |
|---|---|
| Material Specification: | Liners are to be manufactured from ASTM D-1457, type IV TFE resin and meet ASTM D-3294, type II, Grade A, except as noted.<br>Lining shall be mnufactured from resins conforming to requirements of ASTM D-1457, type IV.<br>Liner tubing shall be manufactured per ASTM D-3294, Type II, Grade I, Class A. |
| Physical Specification Testing: | Specific Gravity<br>Tensile Strength , Ultimate (PSI)<br>Elongation, Ultimate (%)<br>O.D. Out of Roundness (%) |
| Requirements: | Liners must withstand 40,000 volts minimum electrostatic potential across the thickness throughout the entire surface area without audible or visual spark.<br>All liners shall be inspected with high intensity light for micro fractures.<br>Liners shall be marked and tagged with reason for failure, and shall not be allowed for use any Flo-Concepts finished products.<br>No rejected material shall be allowed reprocessing in Flo-Concepts finished or supplemental products. |
| Preparations of Liner Specimens: | Tensile specimens shall be prepared from the full thickness of the liner with dimensions as specified in ASTM D-1708 |
| Dimensional Specification: | Dimensions are determined according to ASTM D-2122 |
| Pipe Specification: | Shall be determined by end users yet comply with the following: A587SW1, 1" - 4" carbon, A312 and SW41M 1" - 12" stainless steel, A53/A106 6" - 12" carbon (options, schedule 10 stainless can be substitued for standard schedule 40 pipe at the CUSTOMER's request. 304 & 316 are available, straight and L grade |
| Fitting Specification: | Housings for 45 degree ells, 90 degree ells, tees, standard crosses, reducing tees are formed from materials complying to ASTM A587 &A587SWI or A312 stainless steel. Cast fittings are from ASTM A395 ductile iron or A216 carbon and A182 stainless steel. |
| Flange Specification: | FCI's flange options consist of one of the following:<br>Ductile Iron ASTM A395<br>Carbon Steel ASTM A105<br>Forged Steel ASTM A181<br>Stainless Steel ASTM A182<br>Note: 150# &300& per ANSI B16.5 are both standard<br>Available options include: cadmium - nichol - or zinc plated, hot dip galvanized and painted per customer specifications. |
| Finished Product Specification: | FCI's PTFE Lined Piping Systems are available in 1"-12" diameters. 1"-4" are rated for full vacuum at 450 degrees F. Sizes 6"-12" are also available for full vacuum services, call for information extra heavy wall PTFE in large diameters.<br>FCI's PTFE lined pipe and fittings are manufactured per ASTM F423<br>All dimensions are per ANSI B16.5.<br>300# fittings are manufactured to true 300# dimensions. 300#-150# dimensions are available. |

## Installation

Each spool contains an identification tag giving mark numbers, diameter, length and other requested information (per customer request). If using F.C.I.'s isometric installation drawings, all information will correspond. Otherwise spools will be tagged according to customer specifications.

Do not remove flange covers until each piece of the piping system is ready to be installed.

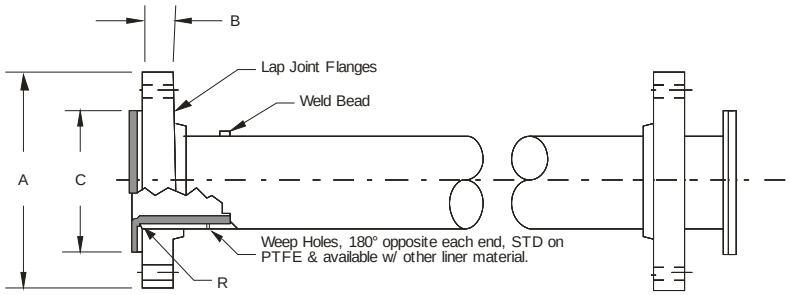
Utilize the provided table for selecting the proper bolt torque values and sequences.

Be sure to follow the proper guidelines for determining structural supports and expansion joints for F.C.I. piping systems. Hand for standard piping systems may be used in conjunction with F.C.I.'s ENGINEERING DESING INFORMATION to insure safe application of our products.

Gaskets are only required when connecting dissimilar materials.

## Flanged Pipe

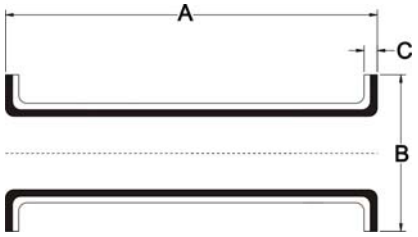
| | | | | | Weight | | Min. Length Spool | |
|---|---|---|---|---|---|---|---|---|
| Size | A | B | C | R | 1st ft. with 2 flanges | Ea. Added foot | with weld | without weld |
| 1 | 4-1/4 | 9/16 | 2 | 1/8 | 6 | 2 | 3-2/8 | 8-1/2 |
| 1-1/2 | 5 | 11/16 | 2-7/8 | 1/4 | 9 | 3 | 3-1/2 | 9-3/8 |
| 2 | 6 | 3/4 | 3-5/8 | 1/4 | 14 | 4 | 4 | 12 |
| 3 | 7-1/2 | 15/16 | 5 | 3/8 | 26 | 8 | 4-1/2 | 13-3/8 |
| 4 | 9 | 15/16 | 6-1/8 | 3/8 | 38 | 11.5 | 4-1/2 | 13-5/8 |
| 6 | 11 | 1 | 8-3/8 | 3/8 | 60 | 21 | 5 | 19-15/16 |
| 8 | 13-1/2 | 1-1/8 | 10-1/2 | 3/8 | 98 | 32 | 5-1/2 | 19-15/16 |
| 10 | 16 | 1-3/16 | 12-7/8 | 3/8 | 128 | 39 | 6 | 27 |
| 12 | 19 | 1-1/4 | 14-5/8 | 3/8 | 180 | 52 | 6-1/4 | 27 |
| 14 | 21 | 1-3/8 | 16-1/4 | 3/8 | 235 | 60 | 6-1/2 | 36 |
| 16 | 23-1/2 | 1-7/16 | 18-1/2 | 3/8 | 260 | 69 | 6-3/4 | 36 |



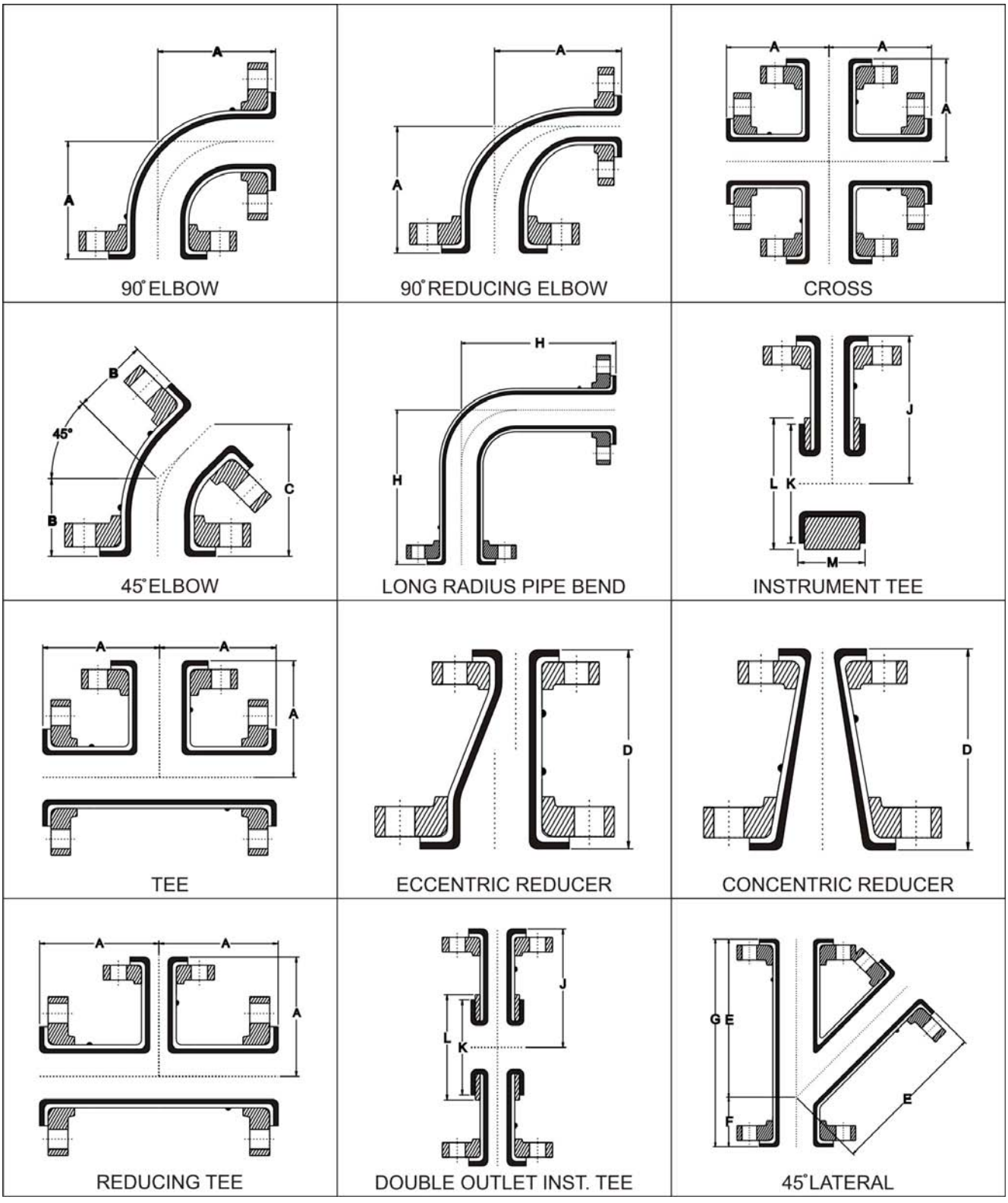

## Distance Piece

| Size | A | B | C | R | Weight per inch |
|---|---|---|---|---|---|
| 1 | 4-1/4 | 9/16 | 2 | 1/8 | |
| 1-1/2 | 5 | 11/16 | 2-7/8 | 1/4 | |
| 2 | 6 | 3/4 | 3-5/8 | 1/4 | |
| 3 | 7-1/2 | 15/16 | 5 | 3/8 | |
| 4 | 9 | 15/16 | 6-1/8 | 3/8 | |
| 6 | 11 | 1 | 8-3/8 | 3/8 | |

Notes:
1. Pipe is schedule 40.
2. Liner material: PTFE, PFA, ETFE, ECTFE, PVDF, PP, HDPEX
3. Minimum length: 3".



## Plastic Lined Flanged Fitting




** Optional body materials are: CI, DI, CS, 304SS, or 316SS. Material options for rotating lap joints are: CI, DI, CS, 304SS, 316SS, Galvanized, or Special Paintings.

** Special reductions are available—For example: 10" x 6" x 1"

## 150 lb. ANSI Cast Iron And Steel Flanged Fitting Dimensions

| Size | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1/2, 3/4, 1 | 3-1/2 | 1-3/4 | 3 | 4-1/2 | 5-3/4 | 1-3/4 | 7-1/2 | * |
| 1-1/4 | 3-3/4 | 2 | 3-13/32 | 4-1/2 | 6-1/4 | 1-3/4 | 8 | * |
| 1-1/2 | 4 | 2-1/4 | 3-27/32 | 4-1/2 | 7 | 2 | 9 | * |
| 2 | 4-1/2 | 2-1/2 | 4-1/4 | 5 | 8 | 2-1/2 | 10-1/2 | * |
| 2-1/2 | 5 | 3 | 5-1/8 | 5-1/2 | 9-1/2 | 2-1/2 | 12 | * |
| 3 | 5-1/2 | 3 | 5-1/8 | 6 | 10 | 3 | 13 | * |
| 4 | 6-1/2 | 4 | 6-13/16 | 7 | 12 | 3 | 15 | * |
| 6 | 8 | 5 | 8-9/16 | 9 | 14-1/2 | 3-1/2 | 18 | * |
| 8 | 9 | 5-1/2 | 9-3/8 | 11 | 17-1/2 | 4-1/2 | 22 | * |
| 10 | 11 | 6-1/2 | 11-1/8 | 12 | 20-1/2 | 5 | 25-1/2 | * |
| 12 | 12 | 7-1/2 | 12-13/16 | 14 | 24-1/2 | 5-1/2 | 30 | * |

* Special dimensions upon request. Consult factory.

## 300 lb. ANSI Steel Flanged Fitting Dimensions

| Size | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1/2, 3/4, 1 | 4 | 2-1/4 | 3-13/16 | 4-1/2 | 6-1/2 | 2 | 8-1/2 |
| 1-1/2 | 4-1/2 | 2-3/4 | 4-11/16 | 4-1/2 | 8-1/2 | 2-1/2 | 11 |
| 2 | 5 | 3 | 5-1/8 | 5 | 9 | 2-1/2 | 11-1/2 |
| 2-1/2 | 5-1/2 | 3-1/2 | 6 | 5-1/2 | 10-1/2 | 2-1/2 | 13 |
| 3 | 6 | 3-1/2 | 6 | 6 | 11 | 3 | 14 |
| 4 | 7 | 4-1/2 | 7-11/16 | 7 | 13-1/2 | 3 | 16-1/2 |
| 6 | 8-1/2 | 5-1/2 | 9-3/8 | 9 | 17-1/2 | 4 | 21-1/2 |
| 8 | 10 | 6 | 10-1/4 | 11 | 20-1/2 | 5 | 25-1/2 |

## Instrument Tee

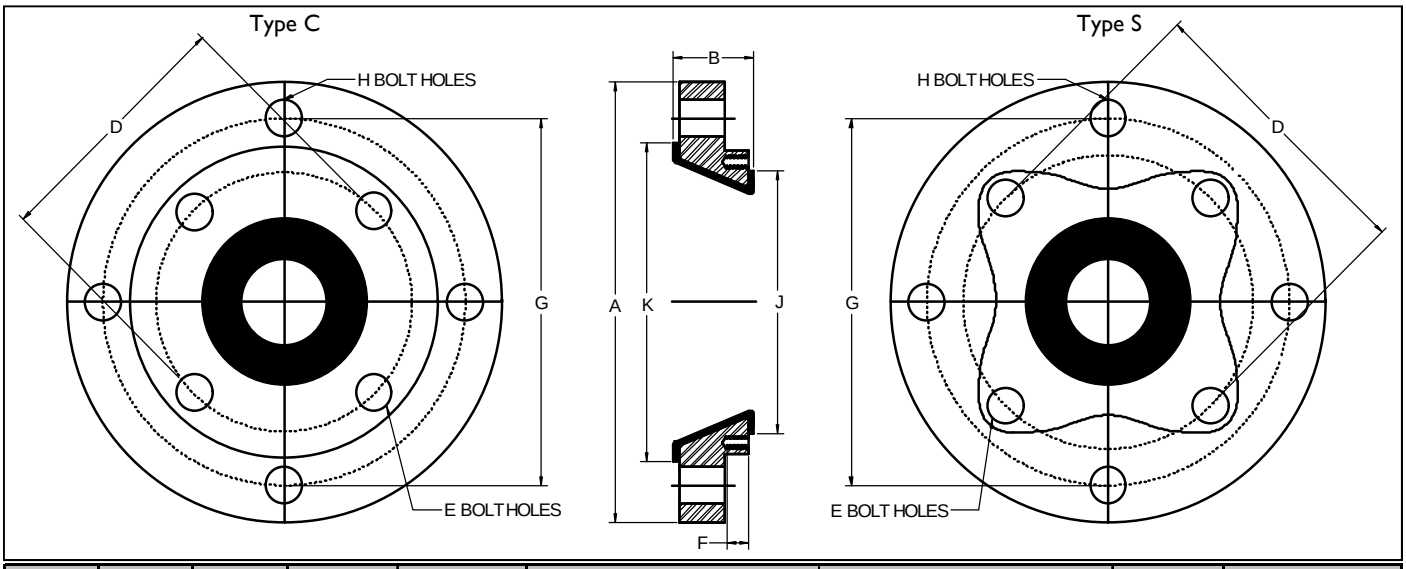
| Nominal Size | Tees with 1" Branch | | | | Tees with 1-1/2" Branch | | | |
|---|---|---|---|---|---|---|---|---|
| | J | J (Optional) | K | L | J | J (Optional) | K | L |
| 1 | 3-1/2 | 3-1/2 | 2 | 2-5/8 | | | | |
| 1-1/2 | 4 | 4 | 2-7/8 | 3-3/8 | 4 | 4 | 2-7/8 | 3-3/8 |
| 2 | 4-1/2 | 5-9/16 | 3-5/8 | 4-1/8 | 4-1/2 | 5-9/16 | 3-5/8 | 4-1/8 |
| 3 | 5-1/2 | 6-5/16 | 5 | 5-3/8 | 5-1/2 | 6-5/16 | 5 | 5-3/8 |
| 4 | 6-1/2 | 7-1/16 | 6-3/16 | 6-7/8 | 6-1/2 | 7-1/16 | 6-3/16 | 6-7/8 |
| 6 | 8 | 8-1/16 | 8-1/2 | 8-3/4 | 8 | 8-1/16 | 8-1/2 | 8-3/4 |
| 8 | 9 | 9-5/16 | 10-5/8 | 11 | 9 | 9-5/16 | 10-5/8 | 11 |
| 10 | 11 | 10-3/8 | 12-3/4 | 13-3/8 | 11 | 10-3/8 | 12-3/4 | 13-3/8 |
| 12 | 12 | 11-7/8 | 15 | 16-1/8 | 12 | 11-7/8 | 15 | 16-1/8 |

1. All dimensions have a tolerance of +/- 1/8".
2. Pipe and fittings flare dimensions are the same.
3. Special fitting with non-standard dimensions available upon request.
4. Please specify "J" dimension as STANDARD OR OPTIONAL.

Note:

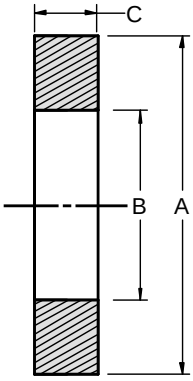
| | |
|---|---|
| 1" Branch Instrument Tee | M = 2" |
| 1-1/2" Branch Instrument Tee | M = 4" Standard |
| | M = 3" Optional |
| 2" Branch Instrument Tee | M = 4" Standard |

## 150# TFE Lined Reducing Flanges

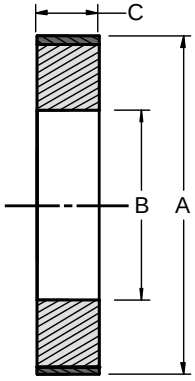



| Major Size (NPS) | Type | Minor Size (NPS) | Thick-ness | OD | H-Bolt Holes | | | E-Bolt Holes | | | Depth | Flare Diameters | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | No. | Size | Bolt Circle Dia. | No. | Size | Bolt Circle Dia. | | | |
| | | | B | A | | | G | | | D | F | K | J |
| 1 | S | 1/2 | 1-5/8 | 4-1/4 | 4 | 5/8 | 3-1/8 | 4 | 1/2-13 | 2-3/8 | 7/8 | 2 | 1-3/8 |
| | S | 3/4 | | | | | | | | 2-3/4 | | | 1-11/16 |
| 1-1/2 | S | 1 | 1-9/16 | 5/8 | 4 | 5/8 | 3-7/8 | 4 | 1/2-13 | 3-1/8 | 7/8 | 2-7/8 | 2 |
| 2 | S | 1 | 1-9/16 | 6 | 4 | 3/4 | 4-3/4 | 4 | 1/2-13 | 3-1/8 | 7/8 | 3-5/8 | 2 |
| | S | 1-1/2 | | | | | | | | 3-7/8 | | | 2-7/8 |
| 2-1/2 | S | 2 | 1-9/16 | 7 | 4 | 3/4 | 5-1/2 | 4 | 5/8-11 | 4-3/4 | 7/8 | 4-1/4 | 3-5/8 |
| 3 | S | 1 | 1-5/8 | 7-1/2 | 4 | 3/4 | 6 | 4 | 1/2-13 | 3-1/8 | 3/4 | 5 | 2 |
| | S | 1-1/2 | | | | | | | | 3-7/8 | 7/8 | | -7/8 |
| | S | 2 | 1-3/4 | | | | | | 5/8-11 | 4-3/4 | | | 3-5/8 |
| | S | 2-1/2 | 1-5/8 | | | | | | | 5-1/2 | | | 4-1/8 |
| 4 | C | 1 | 1-7/8 | 9 | 8 | 3/4 | 7-1/2 | 4 | 1/2-13 | 3-1/8 | 11/16 | 6-3/16 | 2 |
| | C | 1-1/2 | 1-5/8 | | | | | | | 3-7/8 | 7/8 | | 2-7/8 |
| | C | 2 | 2 | | | | | | 5/8-11 | 4-3/4 | | | 3-5/8 |
| | S | 3 | 1-3/4 | | | | | | | 6 | | | 5 |
| 5 | S | 4 | 1-5/8 | 10 | 8 | 7/8 | 8-1/2 | 8 | 5/8-11 | 4 | 1 | 7-5/16 | 6-3/16 |
| 6 | C | 1-1/2 | 1-7/8 | 11 | 8 | 7/8 | 9-1/2 | 4 | 1/2-13 | 3-7/8 | 11/16 | 8-1/2 | 2-7/8 |
| | C | 2 | | | | | | | 5/8-11 | 5 | 3/4 | | 3-5/8 |
| | C | 3 | 1-3/4 | | | | | | | 6 | 1 | | 5 |
| | S | 4 | 2-1/8 | | | | | 8 | | 7-1/2 | 7/8 | | 6-3/16 |
| | S | 5 | 1-3/4 | | | | | | 3/4-10 | 8-1/2 | 1 | | 7-5/16 |
| 8 | C | 4 | 2 | 13-1/2 | 8 | 7/8 | 11-3/4 | 8 | 5/8-11 | 7-1/2 | 7/8 | 10-5/8 | 6-3/16 |
| | S | 6 | | | | | | | 3/4-10 | 9-1/2 | 1-1/8 | | 8-1/2 |
| 10 | C | 4 | 2-7/16 | 16 | 12 | 1 | 14-1/4 | 8 | 5/8-11 | 7-1/2 | 7/8 | 12-3/4 | 6-3/16 |
| | C | 6 | | | | | | | 3/4-10 | 9-1/2 | 1 | | 8-1/2 |
| | S | 8 | | | | | | | | 11-3/4 | | | 10-5/8 |

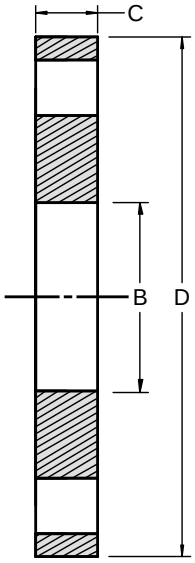
## Spacers



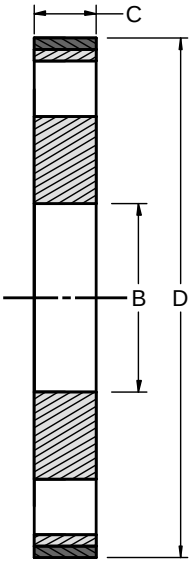
Ring Spacer



Armored Ring



Full Face Spacer



Armored Full Face Spacer

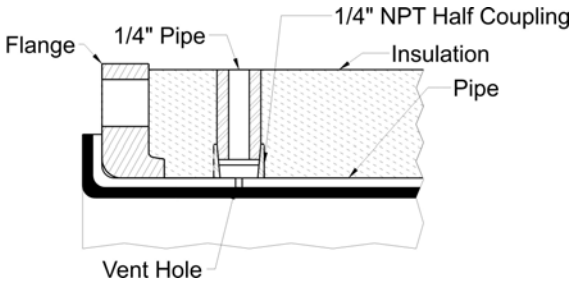
| Size (NPS) | Class 150 & 300 | | | Class 150 | | | | Class 300 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ring | B | | Full Face | | | | Full Face | | | |
| | A | PP/PVDF | PTFE | D | Bolt Holes No. | Bolt Holes Size | Bolt Circle Dia. | D | Bolt Holes No. | Bolt Holes Size | Bolt Circle Dia. |
| 1/2 | 1-7/8 | 1/2 | 1/2 | 3-3/8 | 4 | 5/8 | 2-3/8 | 3-3/4 | 4 | 5/8 | 2-5/8 |
| 3/4 | 2-1/4 | 3/4 | 3/4 | 3-7/8 | 4 | 5/8 | 2-3/4 | 4-5/8 | 4 | 3/4 | 3-1/4 |
| 1 | 2-1/2 | 1 | 1 | 4-1/4 | 4 | 5/8 | 3-1/8 | 4-7/8 | 4 | 3/4 | 3-1/2 |
| 1-1/4 | 3 | 1-1/4 | 1-1/4 | 4-5/8 | 4 | 5/8 | 3-1/2 | 5-1/4 | 4 | 3/4 | 3-7/8 |
| 1-1/2 | 3-1/4 | 1-1/2 | 1-1/2 | 5 | 4 | 5/8 | 3-7/8 | 6-1/8 | 4 | 7/8 | 4-1/2 |
| 2 | 4 | 2 | 2 | 6 | 4 | 3/4 | 4-3/4 | 6-1/2 | 8 | 3/4 | 5 |
| 2-1/2 | 4-7/8 | 2-1/2 | 2-1/2 | 7 | 4 | 3/4 | 5-1/2 | 7-1/2 | 8 | 7/8 | 5-7/8 |
| 3 | 5-1/4 | 3 | 3 | 7-1/2 | 4 | 3/4 | 6 | 8-1/4 | 8 | 7/8 | 6-5/8 |
| 4 | 6-1/2 | 4 | 4 | 9 | 8 | 3/4 | 7-1/2 | 10 | 8 | 7/8 | 7-7/8 |
| 5 | 7-1/2 | 5 | 5 | 10 | 8 | 7/8 | 8-1/2 | 11 | 8 | 7/8 | 9-1/4 |
| 6 | 8-1/2 | 6 | 6 | 11 | 8 | 7/8 | 9-1/2 | 12-1/2 | 12 | 7/8 | 10-5/8 |
| 8 | 10-1/2 | 8 | 8 | 13-1/2 | 8 | 7/8 | 11-3/4 | 15 | 12 | 1 | 13 |
| 10 | 13 | 10 | 10 | 16 | 8 | 1 | 14-1/4 | 17-1/2 | 16 | 1-1/8 | 15-1/4 |
| 12 | 16 | 12 | 12 | 19 | 8 | 1 | 17 | 20-1/2 | 16 | 1-1/4 | 17-3/4 |

Note:

- Tapered Spacers, Orifice Spacers, and other Custom-Machined Spacers available upon request.
- “C” Dimension - As requested by customer

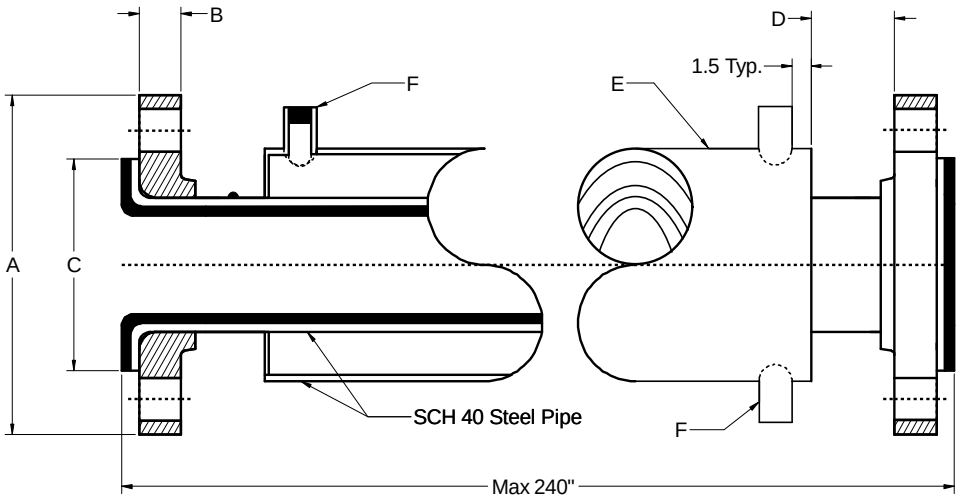
## Painting and Insulation

FCI's in house blasting and painting facilities provide our customers with the optional capabilities of adding special exterior coatings to our piping system components. Stainless steel sch. 40 and sch. 10 housing materials are competitive with many epoxy coating systems. Consult factory for pricing and deliveries. Special crating may be necessary to provide adequate protection during shipping/PPA. Crates may be returned in good condition for credits. FCI's standard primer is compatible with most epoxy systems. When using other than factory applied coatings or insulation, the following procedures are recommended:




- Do not use chisels or burn off flange cover bolting.
- Replace flange covers properly immediately after coating. Do not leave flares exposed and unprotected.
- Some distributors identify liner material, spool lengths, and mark numbers on flange covers. Care should be taken to avoid painting over or mismatching these covers.
- Do not fill weep holes with coatings of any kind.
- Keep all flares clean and free from all paint and residue. This includes the inside bore of all liners.
- Do not paint over identification tags.

When insulating lined systems with weep holes, it is important to specify NPT/half couplings as illustrated. Nipples should be




Jacketed pipe is available in carbon, 304L, and 316L casing materials. Do not exceed the liners temperature limits when using any external heating process.

| Size | A | B | C | D | E | F | Weight | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1st ft. w/ 2 flgs. | Each add. Ft. |
| 1 | 4-1/4 | 9/16 | 2 | 1-1/2 | 2-3/8 | 1 | 9-3/4 | 5-3/8 |
| 1-1/2 | 5 | 11/16 | 2-7/8 | 1-1/2 | 3-1/2 | 1 | 16-1/4 | 10-1/4 |
| 2 | 6 | 3/4 | 3-5/8 | 1-1/2 | 4-1/2 | 1 | 24-1/2 | 14-1/2 |
| 3 | 7-1/2 | 15/16 | 5 | 2 | 5-9/16 | 1-1/4 | 40-1/3 | 22-1/4 |
| 4 | 9 | 15/16 | 6-3/16 | 2 | 6-5/8 | 1-1/4 | 55-7/8 | 29-7/8 |
| 6 | 11 | 1 | 8.5 | 2 | 10-3/4 | 1-1/2 | 85-1/2 | 47-1/2 |
| 8 | 13-1/2 | 1-1/8 | 10-5/8 | 2 | | 1-1/2 | 123 | 72-1/2 |

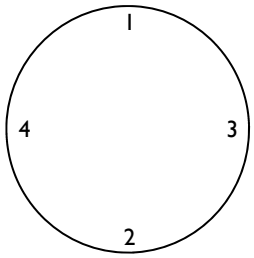
## Bolt/Stud Length Chart

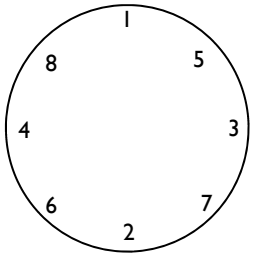
| NPS | Studs per Connection 150# | Bolt or Stud Size 150# | Bolt Length 150# | Stud Length 150# | Studs per Connection 300# | Bolt or Stud Size 300# | Bolt Length 300# | Stud Length 300# |
|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 1/2-13 | 2-3/4 | 3-3/8 | 4 | 5/8-11 | 3 | 3-3/4 |
| 1-1/2 | 4 | 1/2-13 | 3 | 3-5/8 | 4 | 3/4-10 | 3-1/4 | 4-1/2 |
| 2 | 4 | 5/8-11 | 3-1/4 | 4-1/8 | 8 | 5/8-11 | 3-1/2 | 4-1/4 |
| 3 | 4 | 5/8-11 | 3-3/4 | 4-3/4 | 8 | 3/4-10 | 4-1/8 | 5-1/4 |
| 4 | 8 | 5/8-11 | 3-3/4 | 4-5/8 | 8 | 3/4-10 | 4-3/8 | 5-1/2 |
| 6 | 8 | 3/4-10 | 4-1/2 | 5-3/8 | 12 | 3/4-10 | 5-3/8 | 6 |
| 8 | 8 | 3/4-10 | 4-3/4 | 5-3/4 | 12 | 7/8-9 | 5-3/4 | 7 |
| 10 | 12 | 7/8-9 | 5 | 6-1/4 | 16 | 1-8 | 6-3/8 | 7-3/4 |
| 12 | 12 | 7/8-9 | 5 | 6-1/4 | 16 | 1 1/8-7 | 6-1/2 | 8-1/4 |

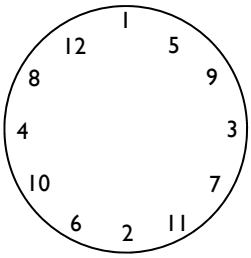
## Torque Chart

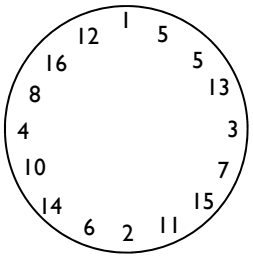
| NPS | PTFE | PFA | TEFZEL | HALAR | KYNAR | POLYPROYLENE | HDPEX |
|---|---|---|---|---|---|---|---|
| 1/2 | 10 | 15 | 30 | 30 | 30 | 20 | 30 |
| 3/4 | 10 | 15 | 30 | 30 | 30 | 20 | 30 |
| 1 | 15 | 20 | 35 | 35 | 35 | 30 | 35 |
| 1 1/2 | 20 | 30 | 45 | 45 | 45 | 40 | 45 |
| 2 | 35 | 35 | 50 | 50 | 50 | 45 | 50 |
| 3 | 60 | 45 | 80 | 80 | 80 | 65 | 80 |
| 4 | 45 | 45 | 80 | 80 | 80 | 70 | 80 |
| 6 | 70 | 65 | 120 | 120 | 120 | 80 | 120 |
| 8 | 90 | 85 | 150 | 150 | 150 | 100 | 150 |
| 10 | 80 | 85 | 140 | 140 | 140 | 110 | 140 |
| 12 | 105 | 85 | 160 | 160 | 160 | 125 | 160 |
| 14 | 180 | 100 | 200 | 200 | 200 | 160 | 200 |
| 16 | 170 | 100 | 200 | 200 | 200 | 165 | 200 |

## Recommended Torque Sequence




Note: Do not exceed one and one half times the given amounts for tightening torques.