

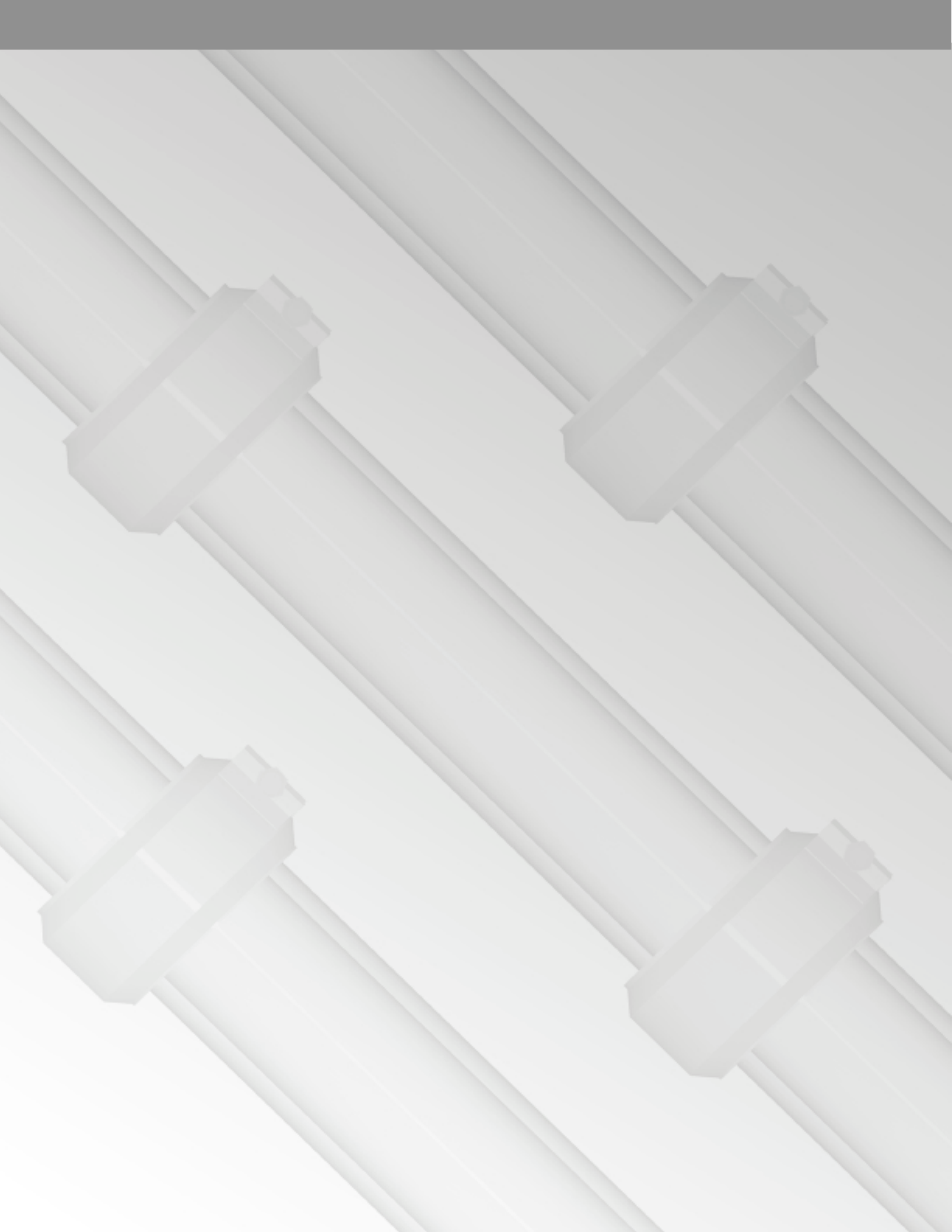
# **QVF**

## **Process Pipe**

### Fittings & Hardware



*The Material Advantage*



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## QVF Process Piping Systems

Industry has long regarded QVF borosilicate glass piping components to be one of the best corrosion resistant materials of construction. For a wide range of manufacturing and process piping applications QVF brand glass pipe installations have provided excellent service in the most difficult piping applications, positive evidence of its outstanding performance. The use of glass offers many advantages over other conventional piping materials such as:

### ■ Long Service Life

QVF low-expansion borosilicate glass is resistant to almost all substances except hydrofluoric acid, hot concentrated phosphoric acid and strong alkalis at elevated temperatures.

### ■ Product Purity

All QVF glass piping systems are comprised of chemically inert borosilicate glass and TFE gaskets to ensure no chemical contamination of process fluids. Materials that do not corrode do not contaminate.

### ■ Smooth Interior Surface

The hard, liquid smooth surface inhibits or prevents scale formation and product buildup. For example, sticky latex dispersions easily move through smooth glass pipe. Glass resists fouling and is easy to clean.

### ■ Transparency

You can see what is happening inside glass systems. Process and product can be inspected at a glance. Trouble can not hide behind glass so processes stay in better control.

### ■ Versatility

It is a fact of chemical plant life that processes change over the years. QVF glass piping systems can be quickly disassembled and reassembled as required and are easily connected to other plant equipment.

### ■ Low Maintenance Cost

Over the life of a piping system this can be the smallest cost component for QVF piping systems and the largest cost consideration for many other competitive piping systems. Chances are that low maintenance cost is the prime reason for considering, specifying, and operating a QVF piping system.

## Properties of Borosilicate Glass

### Chemical Composition

The borosilicate glass used in the manufacture of our pipeline components conforms to the standard ASTM E 438 and has the following approximate composition.

Component	% By Weight
SiO <sub>2</sub>	81%
B <sub>2</sub> O <sub>3</sub>	13%
Na <sub>2</sub> O	4%
Al <sub>2</sub> O <sub>3</sub>	2%

### Chemical Resistance

Borosilicate glass is resistant to almost all substances except hydrofluoric acid, phosphoric acid and hot strong caustic solutions. Of these, hydrofluoric acid has the most serious effect and, even when a solution contains a few parts per million, corrosion will occur. Phosphoric acid and caustic solutions at elevated temperatures will also attack glass.

Under service conditions, the effects of turbulence and some trace chemicals in solution may increase or decrease the rate of attack. Therefore, it is not possible to give precise figures for corrosion by hydrofluoric acid and caustic solutions, but Figures 1 and 2 show typical rates.

#### Corrosion by HF Solutions

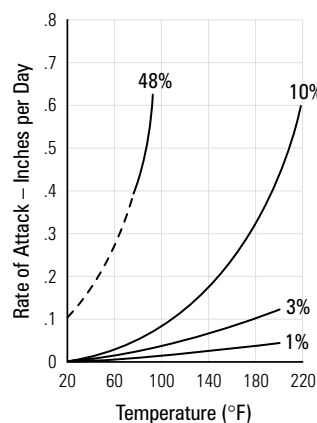


Figure 1

#### Corrosion by NaOH Solutions

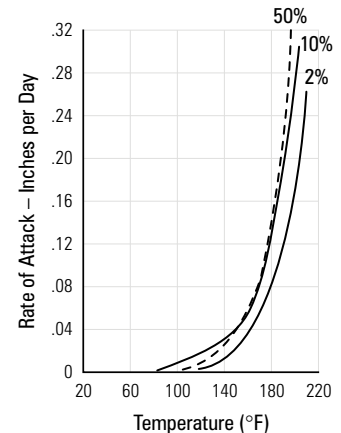


Figure 2

## Physical Properties

Coefficient of mean linear expansion Between 20°C and 300°	$(3.3 \pm 0.1) \times 10^{-6} \text{ K}^{-1}$
Mean thermal conductivity Between 20°C and 200°C	1.3 W/mK
Mean specific heat capacity Between 20°C and 200°	0.98 kJ/kgK
Density at 20°C	2.23 g/cm <sup>3</sup>

## Pressure Drop

At normal flow rates the liquid smooth surface of QVF brand pipe leads to lower pressure drop due to friction. The pressure drop in QVF brand beaded or conical pipe, is approximately 80-90% that of clean steel pipe<sup>1</sup>. It is still lower percentage-wise when compared to steel pipe having scale buildup as shown in Figure 3.

### Calculated Pressure Drop for Water at 70°F in Glass and Steel Pipe

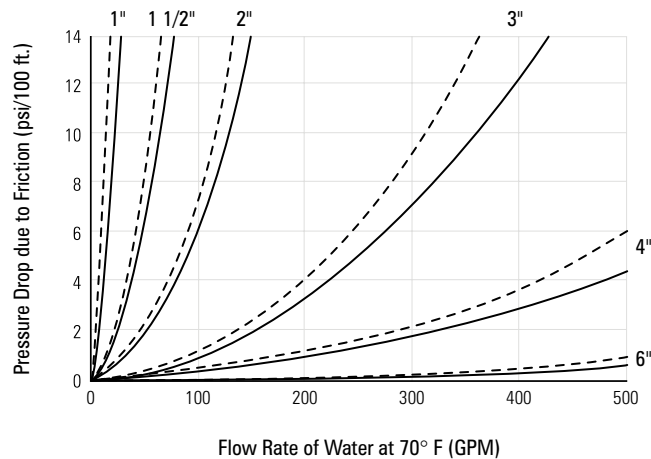


Figure 3

<sup>1</sup>Data was calculated from equations for friction factors by Drew, Koo, and McAdams, Tran. Am. Inst. Chem. Engrs., 28, 56 (1933); and Wilson, MsAdams, and Seltzer, Ind. Eng. Chem., 14, 105 (1922)

## Equivalent Lengths (Feet) by Pipe Size

Size	90° Ell, Miter	45° Ell, Miter	90° Sweep	Tee, Run	Tee, (S.O.)	Tee, (S.I.)
1"	5	1	2.7	1.7	5	5.8
1 1/2"	7.5	1.3	4	2.5	7.5	8.7
2"	10	2	5.3	3.3	10	12
3"	15	3	8	5	15	18
4"	20	4	11	6.7	20	23
6"	30	6	16	10	30	35

## Weight

For comparison purposes, weights of various 2" pipes are given in the table below.

Material	Approximate Weight of 2" Pipe, Lbs/ft.
QVF Glass Process Pipe	1.13
Steel (Schedule 40)	3.65
High Silicon Iron	7.70
Stainless Steel (Schedule 40)	3.65
TFE Lined Steel	4.10
Glass Lined Steel	3.95
FRP	1.25

## Relative Thermal Expansion

The thermal expansion of QVF brand pipe is 0.022 inches per 100 feet of pipe and 100°F temperature change. Values of other materials relative to this (assuming QVF Pipe = 1) are given below. These relative thermal expansions should be considered when connecting QVF pipe into other materials. When other materials expand more than QVF pipe, allowance must be made for the expansion difference. A common way to accommodate this differential expansion is with flexible "bellows" or hose at critical locations.

Material	Relative Thermal Expansion
QVF Glass Process Pipe	1.00
Steel (Schedule 40)	3.60
High Silicon Iron	4.90
Stainless Steel (Schedule 40)	6.20
TFE Lined Steel	3.65
Glass Lined Steel	3.65
FRP	7.00

## Beaded Pressure System

A large bead design feature assures a tight leak-free joint under pressure conditions.

The one-bolt compression coupling shell is made from 300-series stainless steel. The flexible, elastomeric sleeve is lined with a tough layer of TFE fluorocarbon plastic. The flexibility feature allows deflections up to 3° per joint from the axis under bending loads due to misalignment or pitching.

## Permissible Operating Conditions

### Temperature

QVF beaded pipe will operate from the freezing point of the fluid, but not below 0°F, to 275°F continuous and 300°F intermittent with the QVF universal coupling. With the use of the QVF Uni-Vit™ coupling QVF beaded pipe will operate with temperatures up to 350°F continuous and 400°F intermittent.

When operating over 250°F the pipe must be protected from temperature shock. Insulation is most commonly used. Allowable temperature shock depends on the pipe diameter.

Pipe Diameter	Maximum Sudden Temperature Differential
1" to 2"	200°F
3"	180°F
4"	140°F
6"	122°F

## Pressure

The Permissible operating gauge pressure for QVF beaded pipe and fittings depends on the pipe diameter.

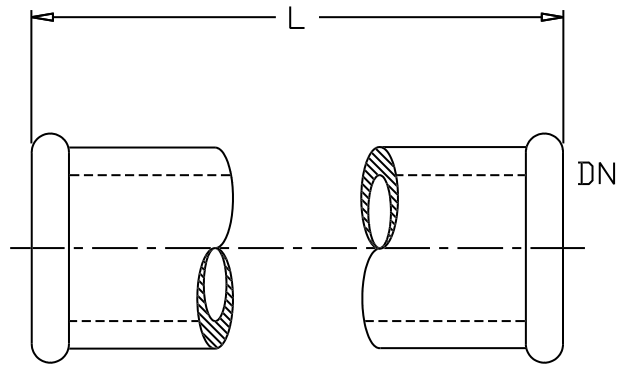
Pipe Diameter	Maximum Working Pressure
1"	100 psig
1 1/2"	75 psig
2"	75 psig
3"	50 psig
4"	50 psig
6"	30 psig

When a system is assembled from several glass components with different pressure ratings, the maximum operating pressure of the system is limited to the pressure rating of the component with lowest permissible working gauge pressure.

All sizes of QVF piping are suitable for full vacuum service. Full vacuum is defined as 29.92" (760mm) of Hg below standard sea-level pressure. Of course the vacuum actually achieved is a function of system design, tightness of the gasket joints, types of gasket used and other operating factors.

Permissible operating pressures require the use of QVF bead to bead process couplings.

**Please Note:** Because of the potential energy of gases under pressure, we recommend that you specify and provide, when and if required, safeguards for equipment and personnel in the unlikely event of a system failure. Safeguards can be expanded-wire mesh, or rigid clear plastic sheet, or even the judicious placing of metal pipelines between glass pipe and the personnel and equipment.



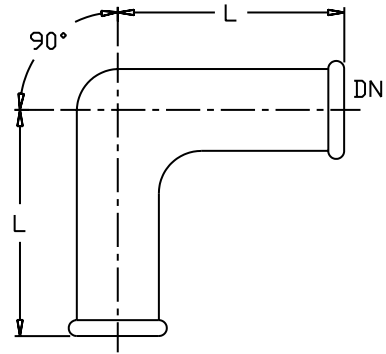
DN	L	Catalogue Reference
	6"	720062
	12"	720122
	24"	720242
	36"	720362
	48"	720482
<b>1"</b>	60"	720602
	72"	720722
	84"	720842
	96"	720902
	108"	720182
	120"	720202
<hr/>		
	6"	721062
	12"	721122
	24"	721242
	36"	721362
	48"	721482
<b>1 1/2"</b>	60"	721602
	72"	721722
	84"	721842
	96"	721902
	108"	721182
	120"	721202
<hr/>		
	6"	722062
	12"	722122
	24"	722242
	36"	722362
	48"	722482
<b>2"</b>	60"	722602
	72"	722722
	84"	722842
	96"	722912
	108"	722182
	120"	722202

DN	L	Catalogue Reference
	6"	723076
	12"	723502
	24"	723219
	36"	723392
	48"	723482
<b>3"</b>	60"	723602
	72"	723722
	84"	723842
	96"	723902
	108"	723582
	120"	723702
<hr/>		
	6"	724062
	12"	724122
	24"	724242
	36"	724362
	48"	724482
<b>4"</b>	60"	724607
	72"	724522
	84"	724832
	96"	724912
	108"	724182
	120"	724202
<hr/>		
	6"	726044
	12"	726045
	24"	726046
	36"	726047
	48"	726048
<b>6"</b>	60"	726049
	72"	726051
	84"	726052
	96"	726053
	108"	726054
	120"	726055

*The length (L) of the beaded pressure systems is measured to the center of the beaded coupling*

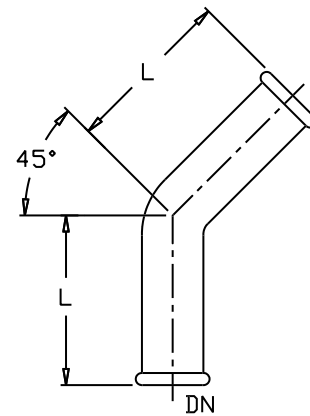
### Beaded 90° EII, Mitered

DN	L	Catalogue Reference
1"	2 3/4"	720094
1 1/2"	3 1/2"	721194
2"	4"	722294
3"	5"	723394
4"	7"	724494
6"	9"	726107



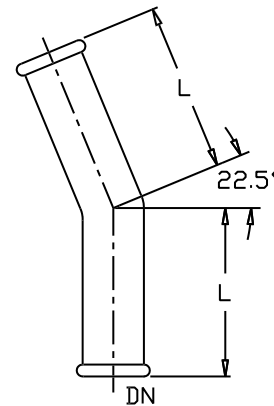
### Beaded 45° EII, Mitered

DN	L	Catalogue Reference
1"	2 3/4"	720096
1 1/2"	3 1/2"	721196
2"	4"	722296
3"	5"	723396
4"	7"	724496
6"	9"	726113



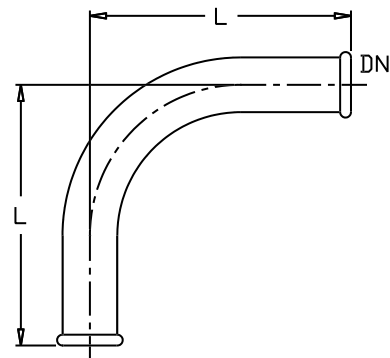
### Beaded 22 1/2° EII, Mitered

DN	L	Catalogue Reference
1"	2 3/4"	720098
1 1/2"	3 1/2"	721198
2"	4"	722298
3"	5"	723398
4"	7"	724498
6"	9"	726145



### Beaded 90° EII, Sweep

DN	L	Catalogue Reference
1"	4 3/4"	720099
1 1/2"	5"	721199
2"	6"	722299
3"	7"	723399
4"	10"	724499
6"	12"	726038

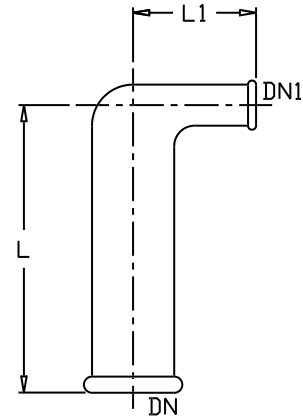


The length (L) of the beaded pressure systems is measured to the center of the beaded coupling



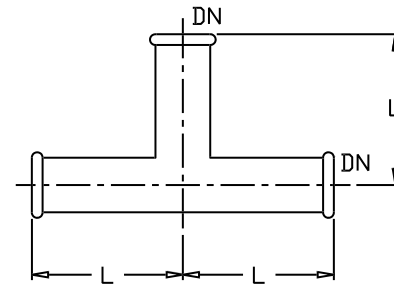
### Beaded 90° Ell, Reducer

DN	DN1	L	L1	Catalogue Reference
1 1/2"	1"	3 1/2"	3"	721048
2"	1"	4"	3"	722048
2"	1 1/2"	4"	3 1/2"	722148
3"	1"	5"	3 1/2"	723048
3"	1 1/2"	5"	4"	720148
3"	2"	5"	4 1/2"	720248
4"	1"	7"	4"	724048
4"	1 1/2"	7"	4 1/2"	724148
4"	2"	7"	5"	724248
4"	3"	7"	5 1/2"	724348
6"	1 1/2"	9"	5 1/2"	726108
6"	2"	9"	6"	726109
6"	3"	9"	6 1/2"	726110
6"	4"	9"	8"	726112



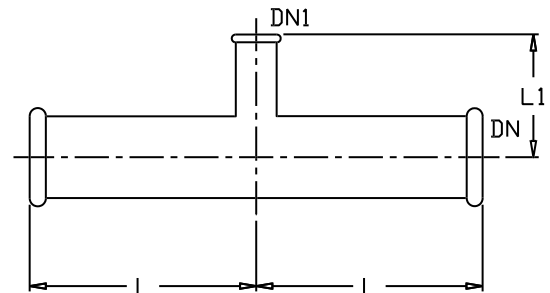
### Beaded Straight T

DN	L	Catalogue Reference
1"	2 3/4"	720087
1 1/2"	3 1/2"	721187
2"	4"	722287
3"	5"	723387
4"	7"	724487
6"	9"	726044



### Beaded Reducing T (Branch)

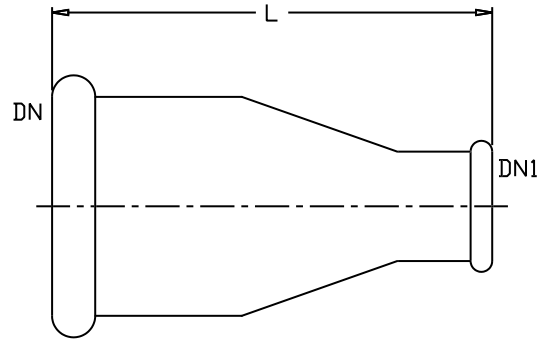
DN	DN1	L	L1	Catalogue Reference
1 1/2"	1"	3 1/2"	3"	721068
2"	1"	4"	3"	722068
2"	1 1/2"	4"	3 1/2"	722168
3"	1"	5"	3 1/2"	728268
3"	1 1/2"	5"	4"	728368
3"	2"	5"	4 1/2"	728468
4"	1"	7"	4"	724068
4"	1 1/2"	7"	4 1/2"	724168
4"	2"	7"	5"	724268
4"	3"	7"	5 1/2"	724368
6"	1 1/2"	9"	5 1/2"	726039
6"	2"	9"	6"	726041
6"	3"	9"	6 1/2"	726042
6"	4"	9"	8"	726043



The length (L) of the beaded pressure systems is measured to the center of the beaded coupling

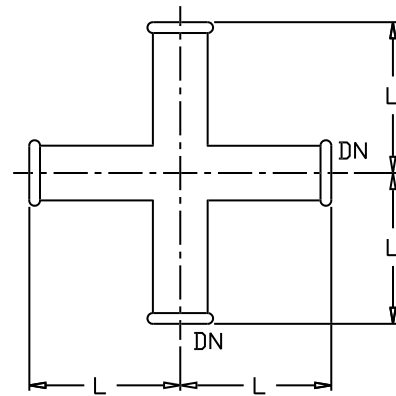
### Beaded Reducer, Concentric

DN	DN1	L	Catalogue Reference
1 1/2"	1"	4"	721097
2"	1"	4"	722097
2"	1 1/2"	4"	722197
3"	1"	5"	723097
3"	1 1/2"	5"	720197
3"	2"	5"	720297
4"	1"	7"	724097
4"	1 1/2"	7"	724197
4"	2"	7"	724297
4"	3"	7"	724397
6"	1"	9"	726031
6"	1 1/2"	9"	726032
6"	2"	9"	726033
6"	3"	9"	726034
6"	4"	9"	726035



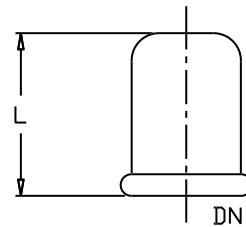
### Beaded Cross

DN	L	Catalogue Reference
1"	2 3/4"	720086
1 1/2"	3 1/2"	721186
2"	4"	722286
3"	5"	723386
4"	7"	724486
6"	9"	726037



### Beaded End Cap

DN	L	Catalogue Reference
1"	2 9/16"	720093
1 1/2"	3 5/16"	721093
2"	3 3/4"	722093
3"	4 9/16"	723093
4"	5 13/16"	724093
6"	7 13/16"	726036

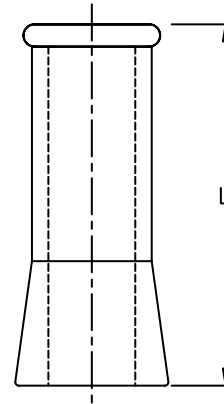


The Length (L) of the beaded pressure system is measured to the center of the beaded coupling.

### Adapter, Straight

(12° Conical to QVF Beaded End Pipe)

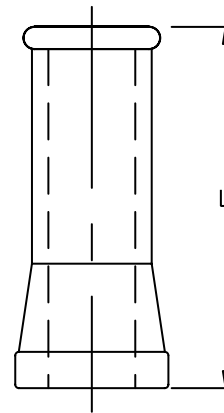
DN	L	Catalogue Reference
1"	6"	722604
1 1/2"	6"	722605
2"	6"	722606
3"	6"	722607



### Adapter, Straight

(9° QVF Safety Flat Buttress End to QVF Beaded End Pipe)

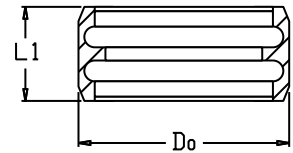
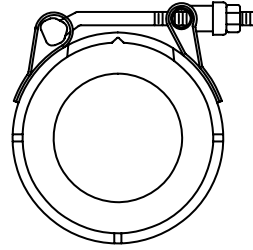
DN	L	Catalogue Reference
1"	6"	902604
1 1/2"	6"	902605
2"	6"	902606
3"	6"	902607
4"	6"	902608
6"	6"	902609



The Length (L) of the beaded pressure system is measured to the center of the beaded coupling.

## Beaded Coupling, Universal

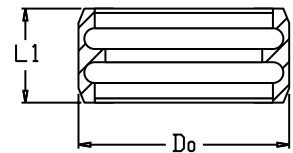
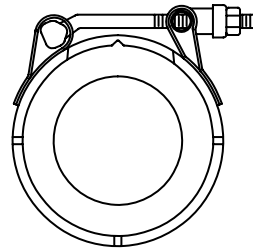
Size	O.D. $d_o$	$L_1$	Gasket Thickness	Catalogue Reference
1"	2 3/32"	1 1/16"	3/16"	721519
1 1/2"	2 5/8"	1 3/8"	3/16"	721520
2"	3 1/8"	1 1/2"	3/16"	721521
3"	4 3/8"	1 5/8"	3/16"	721522
4"	5 1/2"	1 3/4"	3/16"	721523
6"	8 1/2"	2 3/8"	1/4"	759796



The Shell, nut, bolt and washer are 300 series stainless steel.  
The sleeve is made from an elastomer designed for use up to 275°F continuous and 300° intermittent service and which maintains a seal at up to 3° deflection. The liner is virgin TFE.

## Beaded Coupling, Uni-Vit™

Size	O.D. $d_o$	$L_1$	Gasket Thickness	Catalogue Reference
1"	2 3/32"	1 1/16"	3/16"	720546
1 1/2"	2 5/8"	1 3/8"	3/16"	720547
2"	3 1/8"	1 1/2"	3/16"	720548
3"	4 3/8"	1 5/8"	3/16"	720549
4"	5 1/2"	1 3/4"	3/16"	720558
6"	8 1/2"	2 3/8"	1/4"	720559

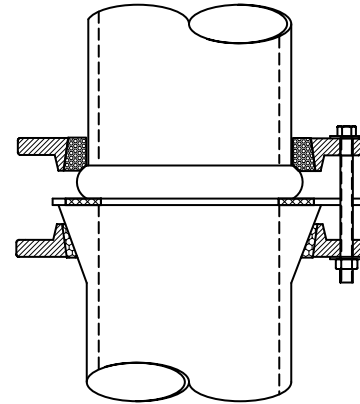


The Shell, nut, bolt and washer are 300 series stainless steel. The sleeve is made from a Viton® elastomer designed for use up to 250°F continuous and 400°F intermittent service and which maintains a seal at up to 3° deflection. The liner is virgin TFE.

## Complete QVF Beaded Process Pipe to 12° Conical Pipe Coupling Style 2

Size	Catalogue Reference
1"	720135
1 1/2"	720235
2"	720335
3"	720435

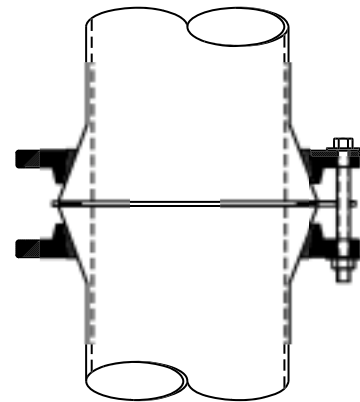
Style 2 cast iron flanges are used to join QVF beaded process pipe to 12° taper pipe. Each set includes two cast iron flanges, one conical molded insert, one beaded adapter insert, and the bolts and nuts. Gasket purchased separately.



## Complete Conical Coupling Style 2

Size	Catalogue Reference
1"	720139
1 1/2"	720239
2"	720339
3"	720439

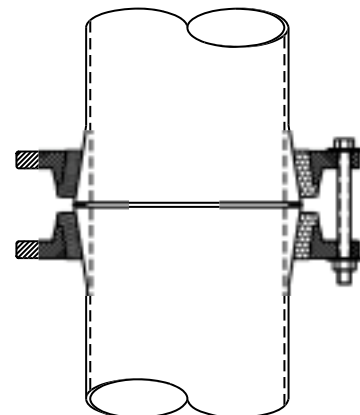
Style 2 cast iron flanges are used to join 12° taper pipe. Each set includes two cast iron flanges, two molded inserts, and the bolts and nuts. Gasket purchased separately.



## Complete QVF Safety Flat Buttress End Coupling

Size	Catalogue Reference
1"	869079
1 1/2"	869080
2"	869145
3"	869146
4"	869147
6"	869148

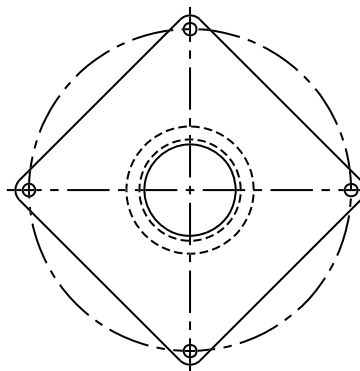
ACF flanges are used to join 9° taper pipe. Each set includes two cast iron flanges, two CIP inserts, and the bolts and nuts. Gasket purchased separately.



## Backing Flange 12° Taper Style 2, Cast Iron

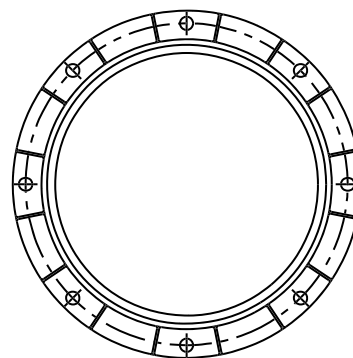
Size	Bolt Circle	Maximum O.D.	Maximum Thickness	Cone Angle	Catalogue Reference
1"	3 1/8"	3 7/8"	1/2"	12°	729652
1 1/2"	3 7/8"	4 5/8"	11/16"	12°	729653
2"	4 3/4"	5 9/16"	11/16"	12°	729654
3"	6"	6 15/16"	13/16"	12°	729655

Where QVF beaded glass pipe and fittings have to be connected to flanges of other materials or other styles of glass pipe these cast iron adapter flanges provide a solution. Inserts purchased separately.



## Backing Flange, Beaded, Cast Iron

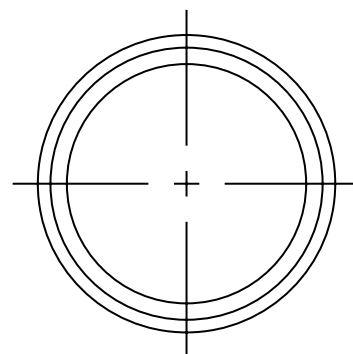
Size	Bolt Circle	Maximum O.D.	Maximum Thickness	Cone Angle	Catalogue Reference
4"	7 1/2"	8 1/4"	9/16"	21°	729005
6"	9 1/2"	10 1/4"	5/8"	21°	729006



## Insert, for Unarmored Beaded

Size	Cone Angle	Catalogue Reference
1"	12°	729900
1 1/2"	12°	729901
2"	12°	729902
3"	12°	729903
4"	21°	729904
6"	21°	729906

One piece compressed fiber inserts are used for all unarmored QVF beaded glass pipe and fittings. Please note this insert can not be used with glass that has been armored. Please consult the factory for more information if you have armored beaded glass.



## Insert Soft Molded for 12° Taper Conical

Size	Cone Angle	Catalogue Reference
1"	12°	729050
1 1/2"	12°	729051
2"	12°	729052
3"	12°	729053

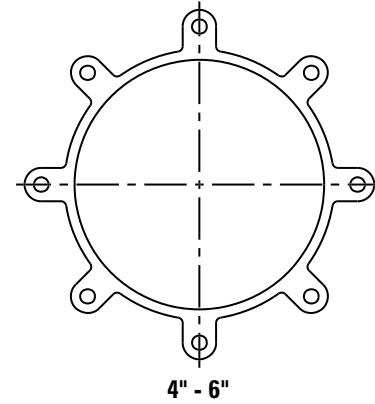
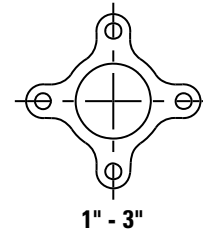
The soft molded insert allows the use of the Style 2 flange for use with conical 12° style glass pipe and fittings.



### Backing Flange, QVF Safety Flat Buttress End

Size	Bolt Circle	Maximum O.D.	Maximum Thickness	Cone Angle	Catalogue Reference
1"	3 1/8"	3 7/8"	5/8"	9°	869000
1 1/2"	3 7/8"	4 5/8"	3/4"	9°	869001
2"	4 3/4"	5 1/2"	7/8"	9°	869002
3"	6"	6 6/8"	1"	9°	869003
4"	7 1/2"	8 1/4"	1"	9°	869004
6"	9 1/2"	10 3/8"	1"	9°	869005

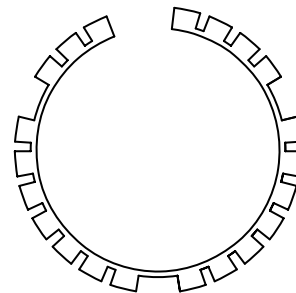
The ACF style cast iron flange is used to connect QVF safety buttress end glass to either QVF beaded pipe and fittings or QVF safety buttress end glass to flanges of other materials. Inserts purchased separately.



### Insert CIP, Glass Filled Nylon for QVF Safety Flat Buttress End

For all services EXCEPT Nitric Acid

Size	Cone Angle	Catalogue Reference
1"	9°	CIP25
1 1/2"	9°	CIP40
2"	9°	CIP50
3"	9°	CIP80
4"	9°	CIP100
6"	9°	CIP150



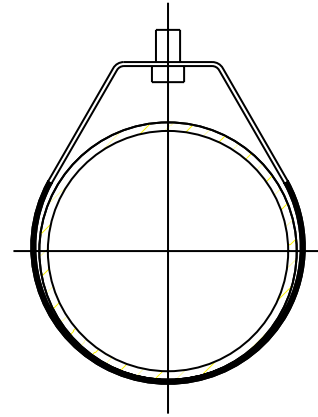
### Insert CN, Fiber for QVF Safety Flat Buttress End

Size	Cone Angle	Catalogue Reference
1"	9°	869038
1 1/2"	9°	869039
2"	9°	869040
3"	9°	869041
4"	9°	869042
6"	9°	869043



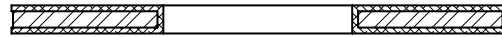
### Padded Pipe Hanger

DN	Thread Diameter	Catalogue Reference
1"	3/8-16	729620
1 1/2"	3/8-16	729621
2"	3/8-16	729622
3"	3/8-16	729623
4"	3/8-16	729624
6"	1/2-13	729625



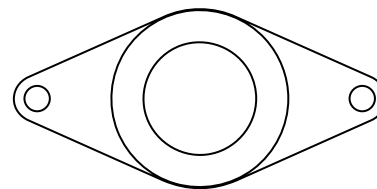
### Teflon-Covered Donut Gasket

DN	Thickness	Catalogue Reference
1"	5/16"	729576
1 1/2"	5/16"	729577
2"	5/16"	729578
3"	5/16"	729579
4"	5/16"	729581
6"	3/8"	729582



### Gasket, Style 2 TFE Machined Envelope

Size	Thickness	Catalogue Reference
1"	1/8"	729554
1 1/2"	1/8"	729555
2"	1/8"	729556
3"	1/8"	729557
4"	1/8"	729558
6"	1/8"	729559





### Reducing Washers for Flanges to ANSI, Class 150

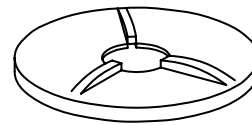
Flange	Catalogue Reference
1" - 1 1/2"	RWSS15/9
2" - 4"	RWSS18/9
6"	RWSS21/11



Whenever connecting QVF beaded glass pipe and fittings to those of other materials, we recommend the use of QVF cast iron style 2 flanges as described in this catalogue. The diameter of the bolt holes is ANSI, Class 150, however as the diameter of the bolt holes is smaller we recommend the use of reducing washers or adapter buttons to locate the smaller bolts centrally in the mating flange hole.

### Adapter Button

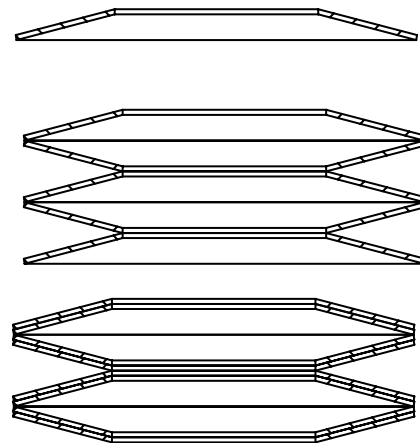
Fits Bolt Sizes	Adapts to Flange Hole Size	Catalogue Reference
1/4" x 3/8"	1/2" x 3/4"	729651



### Belleville Spring Washers

Bolt Size	Min. I.D. $d_1$	Max. O.D. $d_0$	Stock Thickness L	Approx Height $L_1$	Catalogue Reference
5/16"	0.317"	0.625"	.032"	.048"	869142
3/8"	0.380"	0.750"	.040"	.059"	869143

Use these in series (see drawing) on joints where thermal cycling tends to cause leakage. For 1" through 3" diameter glass use 8 in series. For 4" and 6" diameter glass use 16 in parallel, 8 series. Longer bolts will be required.



## Introduction

Glass Piping Systems are designed to provide safe, low cost, corrosion and abrasion resistant performance. The success of your system is highly dependent on the design of your process and the care with which the initial installation is made.

Below is a table showing adaptations for various styles of pipe. The table indicates the page and figure where the information can be found.

<b>To:</b>	<b>QVF Beaded Pipe</b>	<b>QVF 9° Taper Pipe</b>	<b>Pyrex® Style Conical Pipe</b>	<b>Corgard™ Pipe</b>	<b>ANSI Flanged Lined Pipe</b>	<b>ANSI Flanged Pipe</b>	<b>Bellows or Flex. Coupling</b>
<b>From:</b> <b>QVF Beaded Pipe</b>	Figure 1 (Page 21)	Figure 2 (Page 21)	Figure 3 (Page 22)	Figure 4 (Page 22)	Figure 5 (Page 23)	Figure 6 (Page 23)	Figure 7 (Page 24)

## Glass Piping Installation Rules

**Three important considerations must be made in testing or operating glass piping systems.**

1. Because of the potential energy of gases under pressure, provide safeguards for equipment and personnel in the unlikely event of a system failure. Safeguards such as expanded-wire mesh, rigid plastic sheet, or the judicious placing of metal pipelines between unarmored pipe and the personnel and equipment can be used.
2. Hydrofluoric acid, hot concentrated phosphoric acid and strong alkalis at elevated temperatures must be avoided because these chemicals will corrode Borosilicate glass.
3. Listed recommendations take into consideration the limitations imposed by gasketing.

## Tools Required

**Tools needed to install glass piping (installation tools):**

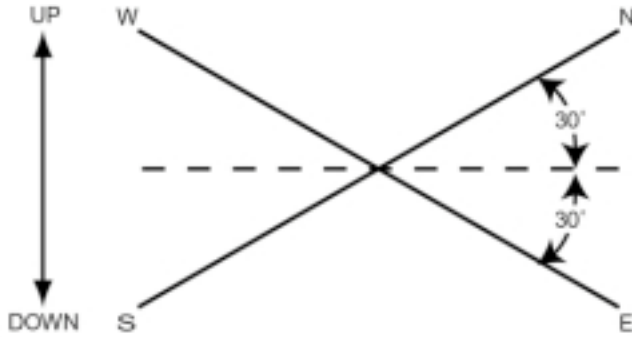
a) Wrenches	7/16" Open End, 1/2" Open End 9/16" Open End, 3/4" Open End
b) Ratchet	3/8" Drive
c) Sockets	7/16" Deep Socket, 1/2" Deep Socket, 9/16" Deep Socket, 3/4" Deep Socket
d) Torque wrench	Calibrated in inch-lbs. Preferred ratchet type 3/8" Drive.
e) Water-pump pliers	
f) Various screw-drivers	
g) Hammer	Plastic or rubber head

## Structural Tools

a) Allen wrenches	5/16" and 3/8"
b) Hammer	
c) Hack saw	

## Layout

Laying out QVF beaded process pipe is similar to laying out any other kind of pipe. It is always a good idea to prepare an isometric sketch of the layout. When making the layout keep in mind the recommendations on pipe hanging, direction, pitch and the connection to fixed points.

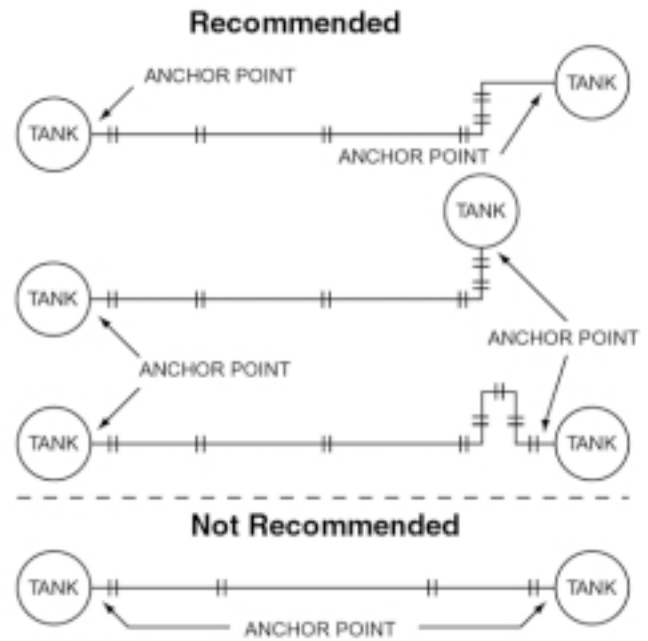


## Handling

Care must be taken in handling glass pipe and fittings. It is best to keep the pipe and fittings in the shipping boxes and keep all wrappings on the ends of individual pieces. If lengths of pipe are removed from boxes, store on wooden racks. Never pipe glass on glass or on concrete. All glass pipe and fittings must be protected from inside or outside scratching or any other surface damage. Always replace damaged pieces prior to use or installation.

## Anchor Points

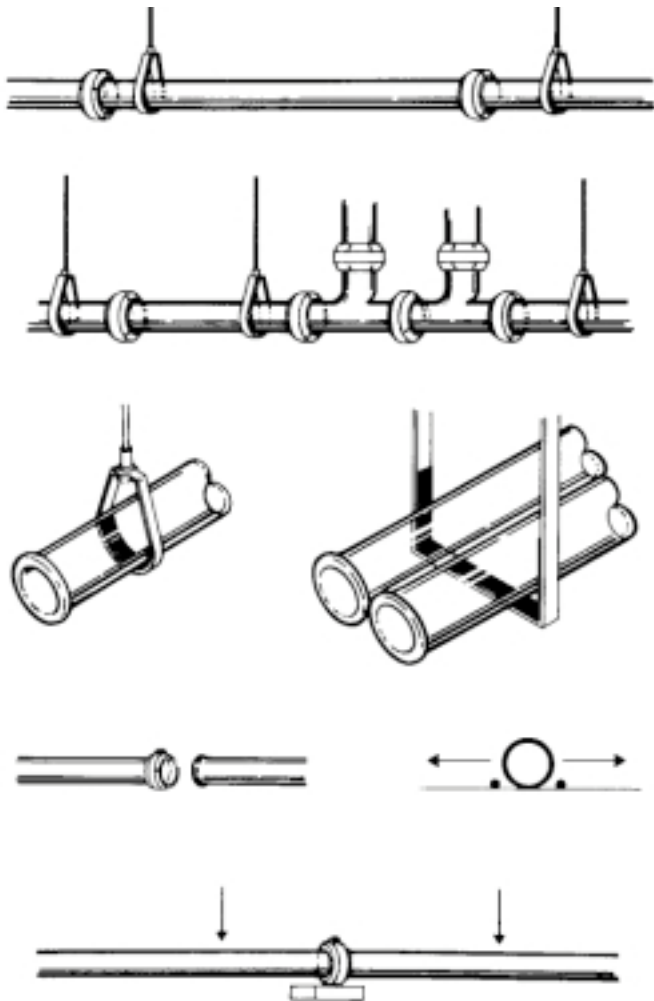
An anchor point is a rigid support for the glass line tying it into the building structure, or to fixed equipment such as tanks, pumps or independently supported valves. There should be one and only one anchor point in each straight run of pipe. The diagrams below show the correct and incorrect installation methods between anchor points. Note the use of right-angle bends to obtain flexibility.



All valves, strainers, meters or other heavy equipment must be supported rigidly and independently of the QVF pipeline. This prevents transmitting the dead weight to the QVF pipeline. It also prevents transmitting stresses to the line when valves are operated; equipment shifts positions, or expands more than the QVF pipe. Rigidly supported equipment such as the above are considered anchor points. No more than one anchor point should be used in any straight run of QVF pipe. Flexible "bellows" or hose can be used at the tie-in place.

## Pipe Hanging and support

QVF glass piping must be installed without mechanical restraint and the pipe should be free to move to prevent stresses. A mechanical restraint may set up a tensile stress that over a period of time will cause the pipe to fail. Hangers should not clamp the pipe tightly. Some lengthwise and sidewise movements are desirable. Padded hangers should always be used and spaced 8-10 feet apart. Use an extra hanger where there are two or more couplings in an 8-10 foot span. Do not pull or spring the pipe into place. Always move the hanger to the pipe do not force the pipe to the hanger.



## Vertical line support

Vertical lines should be supported by plates beneath the couplings or by padded saddles beneath 90-degree elbows at the bottom of vertical rises. Do not support by rigid clamp anchorages around the vertical

pipe. Usually only one rigid support is used. Lateral guides should be used approximately every 20 feet of unsupported riser. The horizontal run at the top of the riser should not be supported within 7 feet of the riser. This reduces bending strains in the horizontal run.

## Vibration

Connection to vibrating machinery such as a pump can be made with the use of a flexible connection consisting of either hoses, or Teflon "bellows" as determined by the characteristics of the service.

## Pressure Surges

Pressure surges must be controlled to prevent end motion in a line. If lines have hydraulic pressure surges, (positive displacement pumps or shutoff valves), it may be necessary to provide a pressure relief valve. It is usually necessary to provide a protected air dome to reduce the pressure surge. The domes can be installed on the discharge side of the pump, next to a valve, or at the highest point in the vertical rise of the discharge line. Use a tee at the top of the riser, plus a straight section and a cap.

## Protection

It is usually desirable to run QVF pipe close to structures such as walls, columns, ceilings, etc., where conditions are favorable for obtaining a firm support. This also would keep the pipelines away from the heaviest traffic. When the pipelines are run through congested areas, provision should be made for protection. Angle or channel iron, or expanded metal guards, should be provided around exposed sections of glass pipe.

## Testing

Tighten bolts on all couplings and flanges at the time of installation. The pipeline when empty should be examined for stresses by gently shaking the line. There should be some limited movement the lines. To make sure all joints are tight when line is ready for service, test at 1 1/2 times the working pressure. However do not test at more than the maximum working pressure. All air must be removed from the pipeline so there is no trapped air. **DO NOT TEST WITH AIR PRESSURE.** If a joint leaks carefully check the joint assembly, retighten to recommended torque value and retest. If leaking persists, remove coupling, check the gasket surface to be sure they are free from dirt, sand or other particles and replace if necessary.

## Spare Parts

Generally one spare for every twelve should be provided. The proper storage of spare parts will ensure they are available when required. Keep lengths of pipe on racks and store them in a protected area. Keep fittings in their original packaging.

## Cleaning

Flush line clean with water, other cleaning fluids, or atmospheric pressure steam (open drain). Do not use hydrofluoric acid, hot caustic solutions, abrasives or metallic tube cleaners.

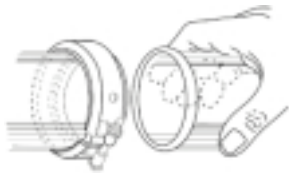
## Joining QVF Beaded Pipe

Joining QVF Beaded Unarmored pipe to itself or to QVF Beaded Armored pipe is done in three simple steps. (Universal and UNI-VIT™ Beaded Couplings).

1. Dip the whole coupling into water.



2. Slip the beaded ends into each side of the coupling.

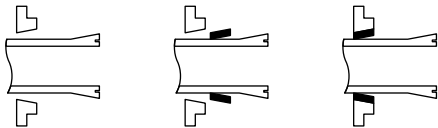


3. Tighten the single nut with a socket to the proper torque rating.



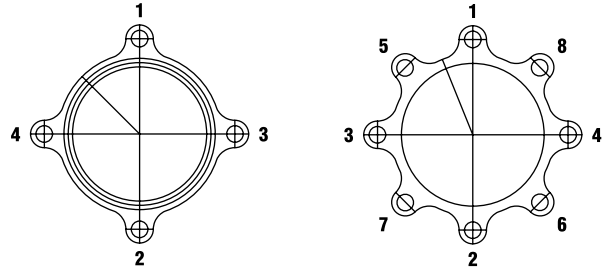
## Joint Assembly for QVF 9° Taper Pipe

1. Slip the metal flange carefully over the glass conical end. The flange side with the larger I.D. faces the glass end. Move away from the glass end.
2. Spread the insert and slip it over the glass conical end. The side of the insert with the larger I.D. faces the conical end.



3. Snap the insert into the flange.
4. Repeat this procedure for the other half of the joint.
5. Insert the bolts and position the gasket.
6. Bolt the assembly together finger tight. Center the gasket with the O.D. of the pipe. Make sure pipe is aligned and the flanges are parallel.

7. Tighten bolts evenly one turn at a time in an X pattern to the specified torque for one to four inch pipe and in a cross pattern for four and six inch pipe.



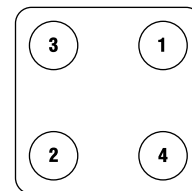
## Joint Assembly for Pyrex® Style Conical Pipe

### Assembly (1" - 3")

1. Slip the metal flange carefully over the conical end of the glass. The flange side with the larger I.D. should face the conical end.
2. Slip the "preformed" soft insert over the conical end of the glass.
3. While keeping both the flange and the insert away from the conical end wedge the insert down inside the flange. Work the insert so it is parallel with the front face of the flange.
4. Slide the flange/insert unit firmly and securely against the glass conical end. Make sure the insert is still parallel to the front face of the metal flange. Then check to make sure its parallel with the glass face. If you cock the flange/insert unit you may point load the glass end when you tighten the bolts.

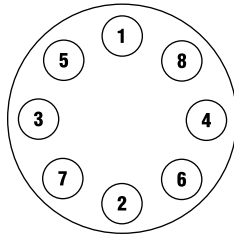


5. Repeat this procedure for the other half of the joint.
6. Insert the bolts and position the gasket.
7. Bolt the assembly together finger tight. Center the gasket with the O.D. of the pipe. Make sure pipe is aligned and the flanges are parallel.
8. Tighten bolts evenly one turn at a time in an X pattern to the specified torque if you are using a style 2 flange. Tighten bolts evenly one turn at a time in a triangular pattern to the specified torque if you are using a Style 1 flange.



### Assembly (Style 2 flanges 4" and 6")

1. Slip the metal flange (with bolt holes) over the glass conical end. Make sure that the part of the step with the larger I.D. faces the conical end.
2. Spread the inner ring and slip it over the glass conical end. The side of the inner ring with the larger I.D. faces the conical end.
3. Snap the inner and outer rings together.
4. Repeat this procedure for the other half of the joint.
5. Insert the bolts and position the gasket.
6. Bolt the assembly together finger tight. Center the gasket with the O.D. of the pipe. Make sure pipe is aligned and the flanges are parallel.
7. Tighten bolts evenly one turn at a time in a cross pattern to specified torque.



### Trouble Shooting

The inability to make a new joint seal is generally attributed to improper assemble or misalignment. Reoccurring leaks are usually caused by misalignment, vibration, water hammer, or thermal expansion. If you experience seal problems, use the following checklist:

#### Is the Joint Properly Assembled? Check to See that...

- Correct gasket has been used.
- Pipe ends and gaskets are properly aligned.
- Flanges have been tightened evenly and are parallel to each other.
- Bolts are tightened to the specified torque.

#### Are the Mating Pipe Sections Properly Aligned?

- Carefully remove the bolts on a joint to be tested – the pipe ends should not pull apart or shift positions.
- Slide out the gasket – the pipe ends should remain evenly spaced and parallel to each other.

#### Are the Hangers and Guides Properly Adjusted to the Pipe?

##### Check to See if...

- All clevis hangers must hang straight down and have at least 12" of threaded rod between the bracket and clevis.
- The pipe has 1/8" clearance on all sides of the bracket on lateral guides.

#### Have the Installation Rules Been Followed?

- Review the glass piping installation rules.
- Vibration must be isolated according to the procedures in this manual.
- Systems subject to thermal cycling must have spring loaded joints.

## QVF Beaded Process Pipe to QVF Beaded Process Pipe

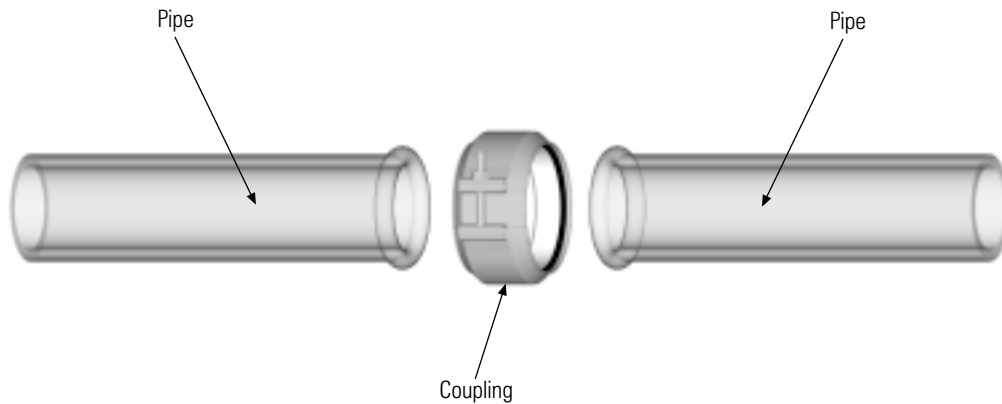


Figure 1

### Universal Beaded Coupling

Size	Code	Torque
1"	721519	36 in-lbs. or 3 ft-lbs.
1 1/2"	721520	36 in-lbs. or 3 ft-lbs.
2"	721521	36 in-lbs. or 3 ft-lbs.
3"	721522	60 in-lbs. or 5 ft-lbs.
4"	721523	60 in-lbs. or 5 ft-lbs.
6"	729796	60 in-lbs. or 5 ft-lbs.

### UNI-VIT™ Beaded Coupling

Size	Code	Torque
1"	720546	25 in-lbs. or 2.1 ft-lbs.
1 1/2"	720547	40 in-lbs. or 3.3 ft-lbs.
2"	720548	50 in-lbs. or 4.2 ft-lbs.
3"	720549	75 in-lbs. or 6.2 ft-lbs.
4"	720558	100 in-lbs. or 8.3 ft-lbs.
6"	720559	100 in-lbs. or 8.3 ft-lbs.

## QVF Beaded Process Pipe to QVF 9° Taper Process Pipe

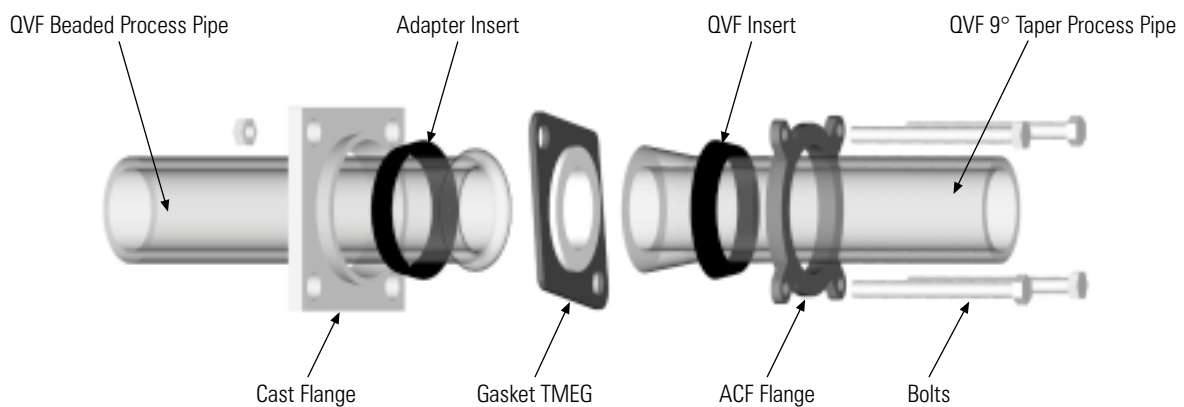


Figure 2

Size	Cast Flange (Need 1) Code	Adapter Insert (Need 1) Code	ACF Flange (Need 1) Code	QVF Insert (Need 1) Code	Bolts		Gasket TMEG (Need 1) Code	Torque
					Hole Size	Qty.		
1"	729652	729900	869000	869009	5/16"	4	729554	30 in-lbs. or 2.5 ft-lbs.
1 1/2"	729653	729901	869001	869010	5/16"	4	729555	30 in-lbs. or 2.5 ft-lbs.
2"	729654	729902	869002	869011	5/16"	4	729556	30 in-lbs. or 2.5 ft-lbs.
3"	729655	729903	869003	869012	5/16"	4	729557	40 in-lbs. or 3.3 ft-lbs.
4"	729005	729904	869004	869013	5/16"	8	729558	60 in-lbs. or 5 ft-lbs.
6"	729006	729906	869005	869014	3/8"	8	729559	60 in-lbs. or 5 ft-lbs.

## QVF Beaded Process Pipe to PYREX® Style Conical Process Pipe

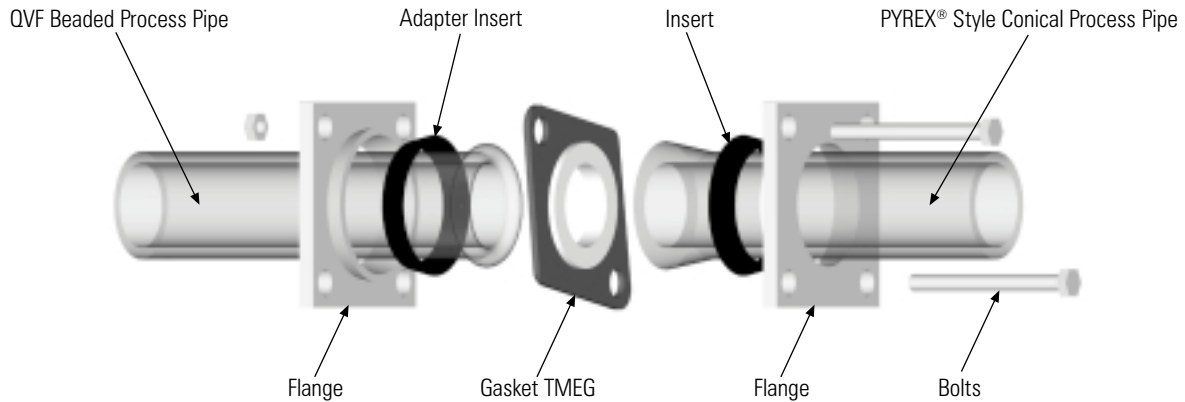


Figure 3

Complete Kit Without Gasket Code	Size	Flanges			Insert Code	Adapter Insert Code	Bolts		Gasket TMEG (Need 1) Code	Torque
		Qty.	Code	Code			Hole Size	Qty.		
720135	1"	2	729652	-	729050	729900	5/16"	4	729554	30 in-lbs. or 2.5 ft-lbs.
720235	1 1/2"	2	729653	-	729051	729901	5/16"	4	729555	30 in-lbs. or 2.5 ft-lbs.
720335	2"	2	729654	-	729052	729902	5/16"	4	729556	30 in-lbs. or 2.5 ft-lbs.
720435	3"	2	729655	-	729053	729903	5/16"	4	729557	40 in-lbs. or 3.3 ft-lbs.
720535	4"	1	725504	729005	-	729904	5/16"	8	729558	60 in-lbs. or 5 ft-lbs.
720735	6"	1	725505	729006	-	729906	3/8"	8	729559	60 in-lbs. or 5 ft-lbs.

## QVF Beaded Process Pipe to CORGARD™ Pipe

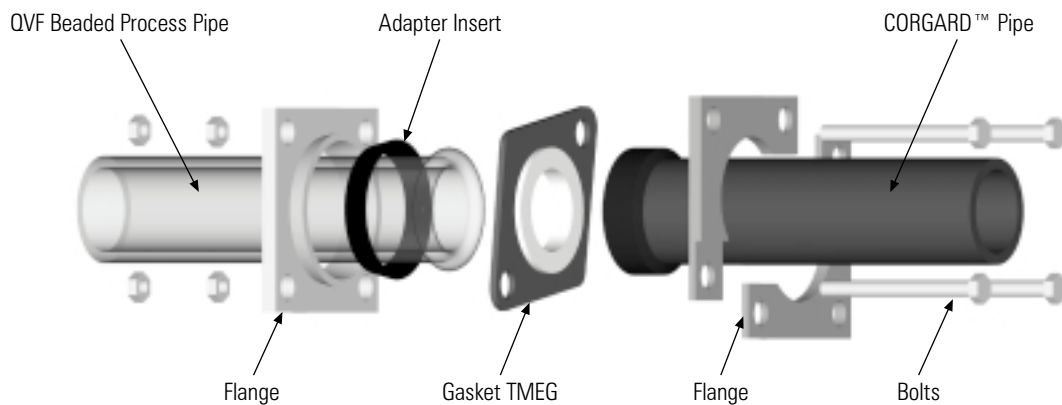


Figure 4

Size	Flanges		Adapter Insert (Need 1) Code	Bolts		Gasket TMEG (Need 1) Code	Torque
	(Need 1) Code	(Need 1) Code		Hole Size	Qty.		
1"	704017	729652	729900	5/16"	4	729554	30 in-lbs. or 2.5 ft-lbs.
1 1/2"	705017	729653	729901	5/16"	4	729555	30 in-lbs. or 2.5 ft-lbs.
2"	706017	729654	729902	5/16"	4	729556	30 in-lbs. or 2.5 ft-lbs.
3"	707017	729655	729903	5/16"	4	729557	40 in-lbs. or 3.3 ft-lbs.
4"	704117	729005	729904	5/16"	8	729558	60 in-lbs. or 5 ft-lbs.
6"	706117	729006	729906	3/8"	8	729559	60 in-lbs. or 5 ft-lbs.



## QVF Beaded Process Pipe to ANSI Flanged Lined Pipe

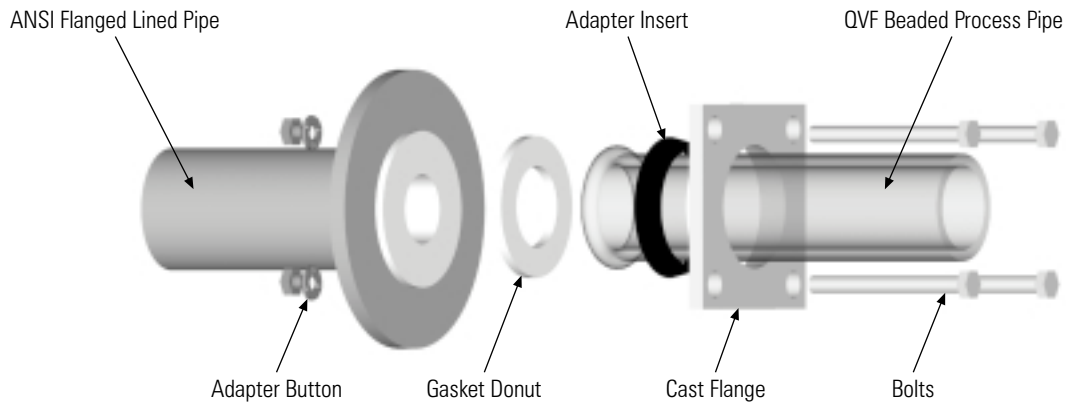


Figure 5

Size	Cast Flange (Need 1) Code	Adapter Insert (Need 1) Code	Adapter Button		Bolts		Gasket Donut (Need 1)	Torque
			Qty.	Code	Hole Size	Qty.		
1"	729652	729900	4	729651	5/16"	4	72401000	30 in-lbs. or 2.5 ft-lbs.
1 1/2"	729653	729901	4	729651	5/16"	4	72401500	30 in-lbs. or 2.5 ft-lbs.
2"	729654	729902	4	729651	5/16"	4	72402000	30 in-lbs. or 2.5 ft-lbs.
3"	729655	729903	4	729651	5/16"	4	72403000	40 in-lbs. or 3.3 ft-lbs.
4"	729005	729904	8	729651	5/16"	8	72404000	60 in-lbs. or 5 ft-lbs.
6"	729006	729906	8	729651	3/8"	8	72406000	60 in-lbs. or 5 ft-lbs.

## QVF Beaded Process Pipe to ANSI Flanged Pipe

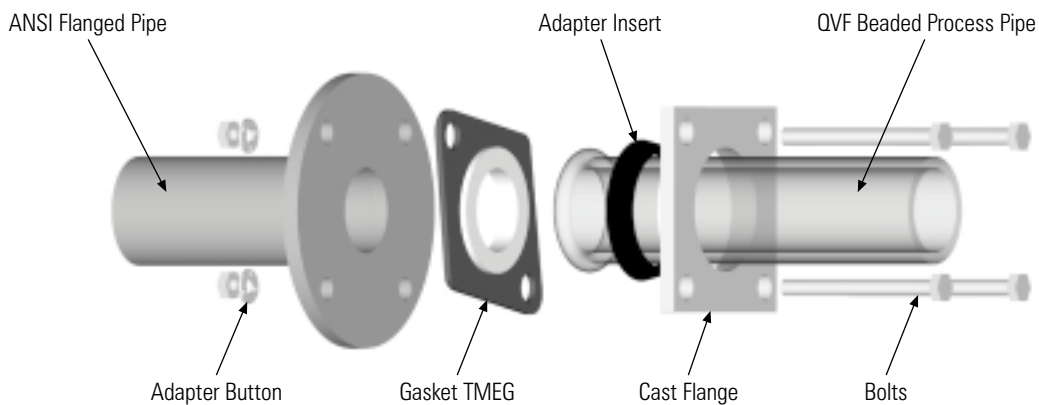


Figure 6

Size	Cast Flange (Need 1) Code	Adapter Insert (Need 1) Code	Adapter Button		Bolts		Gasket TMEG (Need 1) Code	Torque
			Qty.	Code	Hole Size	Qty.		
1"	729652	729900	4	729651	5/16"	4	729554	30 in-lbs. or 2.5 ft-lbs.
1 1/2"	729653	729901	4	729651	5/16"	4	729555	30 in-lbs. or 2.5 ft-lbs.
2"	729654	729902	4	729651	5/16"	4	729556	30 in-lbs. or 2.5 ft-lbs.
3"	729655	729903	4	729651	5/16"	4	729557	40 in-lbs. or 3.3 ft-lbs.
4"	729005	729904	8	729651	5/16"	8	729558	60 in-lbs. or 5 ft-lbs.
6"	729006	729906	8	729651	3/8"	8	729559	60 in-lbs. or 5 ft-lbs.

## QVF Beaded Process Pipe to Flexible Coupling with Glass Drilling

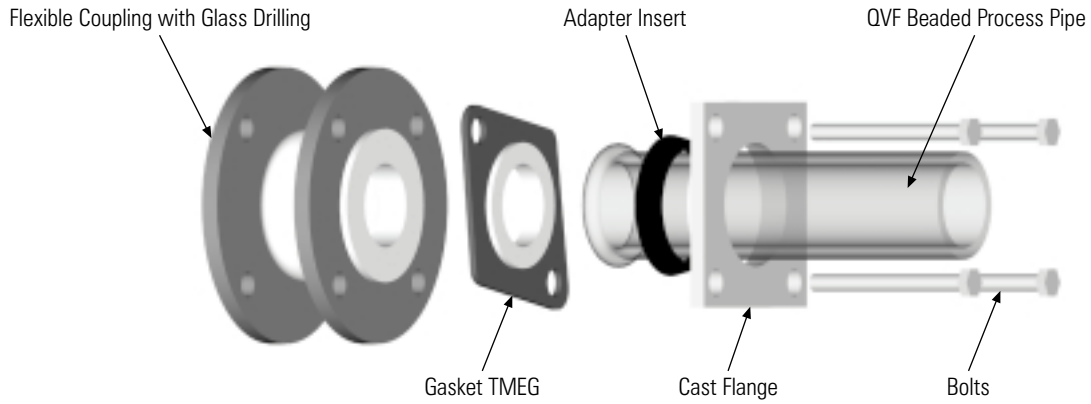


Figure 7

Size	Cast Flange (Need 1) Code	Adapter Insert (Need 1) Code	Bolts		Gasket TMEG (Need 1) Code	Torque
			Hole Size	Qty.		
1"	729652	729900	5/16"	4	729554	30 in-lbs. or 2.5 ft-lbs.
1 1/2"	729653	729901	5/16"	4	729555	30 in-lbs. or 2.5 ft-lbs.
2"	729654	729902	5/16"	4	729556	30 in-lbs. or 2.5 ft-lbs.
3"	729655	729903	5/16"	4	729557	40 in-lbs. or 3.3 ft-lbs.
4"	729005	729904	5/16"	8	729558	60 in-lbs. or 5 ft-lbs.
6"	729006	729906	3/8"	8	729559	60 in-lbs. or 5 ft-lbs.