Valco Fittings

The two piece compression fitting (**Figure 1**), in which a ferrule is compressed onto the tube as a nut is tightened, offers reliability in high pressure situations and in connecting metal tubing. Valco excels in all critical areas of the design and manufacture of such fittings. Quality considerations, which cannot be ignored if an analytical system is to reach and maintain optimum performance levels, include interchangeability, counterbore tolerances, ID/OD concentricity, mixing potential, cleaning procedures, and the method employed to "make up" the ferrule on the tube.

No Tubing Deformation

The basic concept of compression fittings carries the inherent danger of tube deformation (**Figure 2**). While some manufacturers emphasize this positively as a method of ensuring that the tubing doesn't blow out of the ferrule, the flow anomalies introduced by the restricted ID make these fittings a poor choice for many instrument applications.

Valco metal ferrules cut a ring near the end of the tube (**Figure 3**), which prevents tube release at high pressures without significantly deforming and restricting the tube interior. Because our ferrules have a sharp edge at the ID near the nose, this usually takes only about 1/4 turn beyond the point where the ferrule first starts to grab the tubing. There is so little tube distortion that they are routinely used with glass-lined tubing! Only Valco's polymer fittings rely on friction to hold a tube.

CAUTION!
The analytical devices market has attracted numerous companies which copy Valco/Cheminert designs. Please exercise caution in the use of copies, which may not be compatible with the original versions in this catalog.

Because of VICI's high volume production and dedicated machinery, our fittings are often less expensive and of consistently higher quality than competing copies.

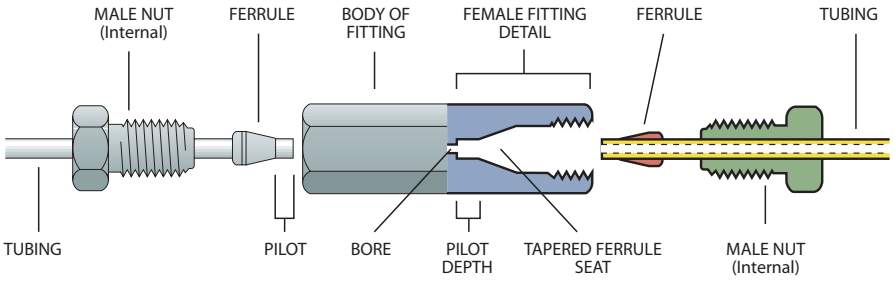


Figure 1
Valco compression fitting

TECH TIP
For optimal zero dead volume connections, make sure your tubing meets the best industry standards—OD tolerance should be nominal dimension ± .002".

Fractional dimension	Nominal dimension
1/32"	.031
1/16"	.062
1/8"	.125
1/4"	.250
3/8"	.375
1/2"	.500

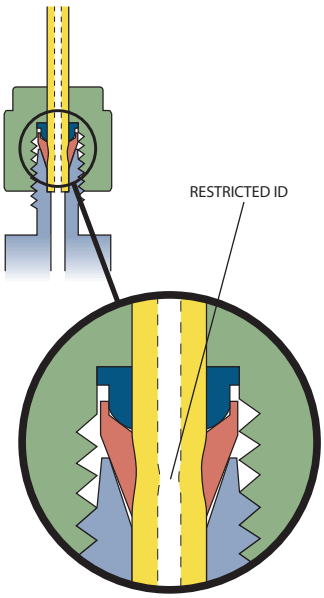


Figure 2
ID restriction
in common compression fitting

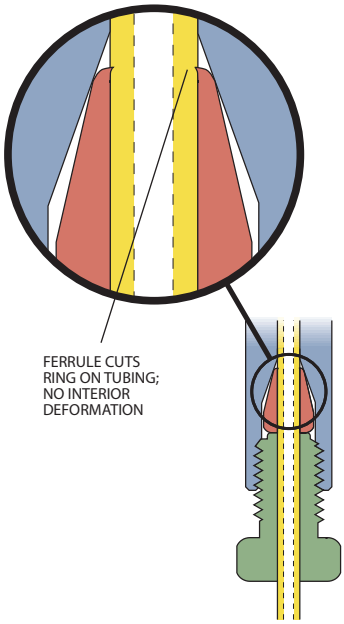


Figure 3
No ID restriction
in Valco compression fitting

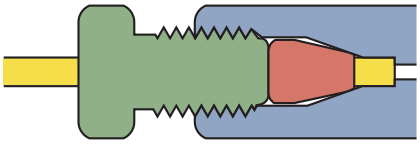
Interchangeability

Valco fitting details are designed with a consistent pilot depth, permitting reliable interchangeability as connections are revised or fittings are replaced. This interchangeability extends throughout the Valco and Cheminert fitting and valve product lines. Indeed, the Valco standard has been so widely copied that Valco and Cheminert fittings are, in general, fully interchangeable with those of our major competitors. In initial installations, Valco ferrules will often improve other manufacturers' fitting connections.

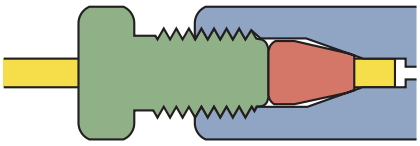
Because of variations in tubing OD and in pilot and taper designs from manufacturer to manufacturer, the amount of tubing extending beyond the made up ferrule can vary. (The most radical variation is in the fittings manufactured by Waters. Based on the old Swagelok design, they have a pilot depth considerably longer than standard.) **Figure 4a** shows a properly made up fitting. If that same fitting is installed in a detail which was designed for a slightly longer tube extension (as in **Figure 4b**), dead volume will be introduced. In the opposite case, with the pilot shorter than the pilot depth (**Figure 4c**), the tube will bottom out before the ferrule has sealed. However, our tests prove that except in the most extreme cases, a Valco ferrule will "creep" on the tubing until it reaches the bottom of the ferrule taper, making a proper seal.

Reliably Clean

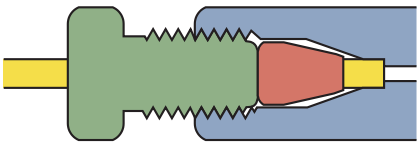
Most of our state of the art CNC machines use water-based lubricants. After each part comes off the machine, it is cleaned with water-soluble detergents and then rinsed in hot deionized water. Finally, every metal fitting that we make is given a thorough cleaning with steam from deionized water at 140°C. Any critical parts processed with oil-based lubricants are baked to remove all traces. The practical result of the extra effort is this: you don't have to be concerned about solvent residues.



a. Tubing seats correctly at bottom of detail



b. Tubing doesn't reach bottom of detail, introducing dead volume



c. Tubing reaches bottom of detail before ferrule seats

Figure 4

Introduction

Precision Machining, Finishing, and Tolerances

The machining methods used by different manufacturers to finish the detail of compression fittings vary in several ways that affect performance, as shown below. The fitting in **Figure 5** is the best choice for high performance fittings, as the tube fits squarely into the bottom of the detail. This is the detail used in Valco and Cheminert high pressure fittings.

Some fitting manufacturers omit a critical finishing operation which makes the bottom of the detail square, leaving the shape of the typical tapered drill bit instead. This results in the fitting shown in **Figure 6**, which introduces extra volume and mixing potential. VICI uses proprietary tooling specifically designed to produce the same high precision detail in every Valco and Cheminert fitting.

Although sometimes the tube end may seal in the bottom of the detail, the intent is for the seal to be made at the ferrule. This leaves the possibility of seepage up around the tube and into the minute cavities between the end of the ferrule and the bottom of the ferrule seat. The probability of this seepage increases when there is an excessive variance between the tubing OD and the diameter of the counterbored pilot in which it sits, and between the ferrule OD and the ferrule ID at the point where it "bites" or crimps the tubing. The possibility is virtually eliminated in VICI's fittings, which are manufactured with the precise dimensions that chromatographic applications demand. Use of VICI precut tubing, which is manufactured to quality standards in excess of most commercial tubing, further assures the best fitting connection.

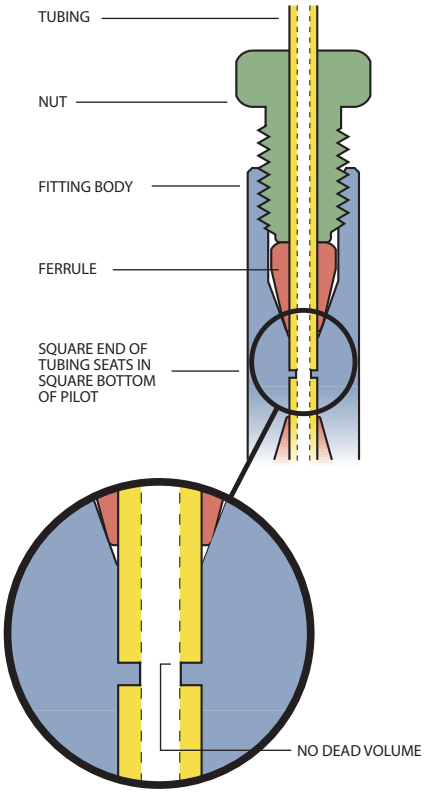


Figure 5
Valco/Cheminert high pressure compression fitting

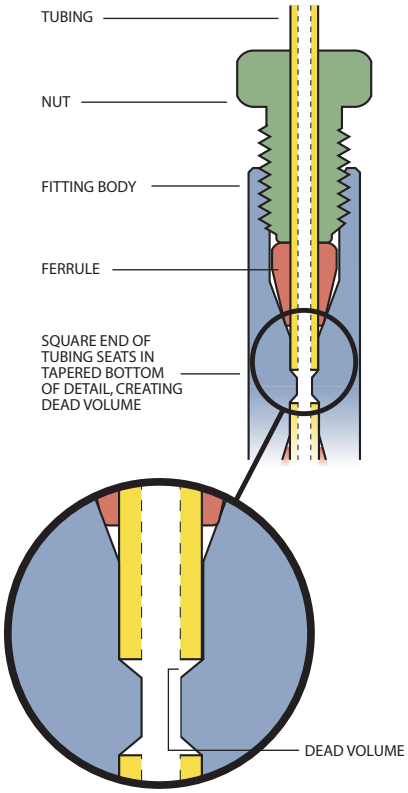


Figure 6
Poor quality compression fitting

Comparison of Compression Fitting Designs

The potential for dead volume and mixing is a consideration in other aspects of fitting design as well, and varies considerably among manufacturers. For example, the common gas distribution reducing union in **Figure 7** illustrates two problems for instrumentation: a large connecting volume, and various steps and restrictions which cause mixing. While there are many uses for these fittings upstream of the analytical system (such as bulk gas distribution), they cause problems when used downstream in critical applications.

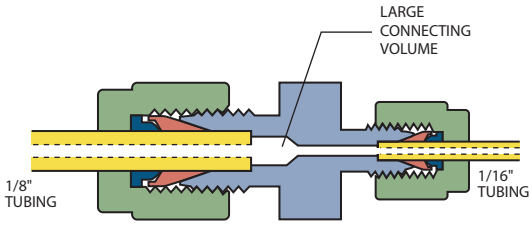


Figure 7
Common commercial reducing union

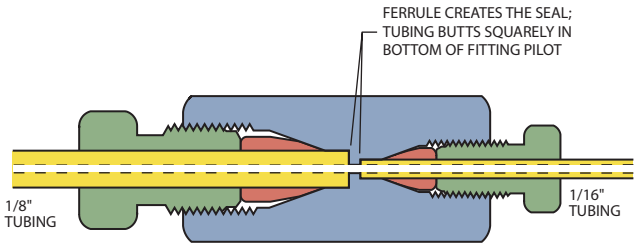


Figure 8
Valco zero dead volume reducing union

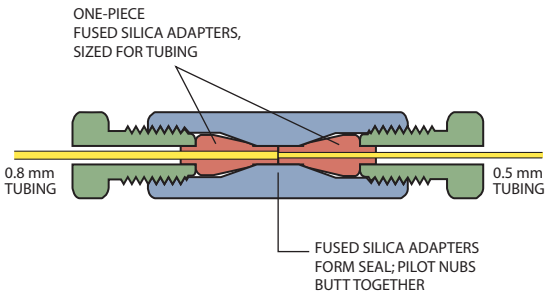


Figure 9
Valco zero dead volume through-bore union

Additional difficulties may be encountered if this type of fitting is loosened and retightened repeatedly. The male threaded part can become flared to the point where it is impossible to get the nut on, and the tube end often flares out in the fitting detail so that it's difficult to remove the tube.

The Valco internal union (**Figure 8**) has a larger mass surrounding the ferrule, so that even with repeated remakes or overtightening, it's impossible to flare the fitting as in the external design. When a union is selected with a bore to match the ID of the connecting tubing, mixing and dead volume are virtually eliminated.

For connection of fused silica tubing of the same or differing sizes, the through-bore union shown in **Figure 9** is recommended. This fitting permits the use of our one-piece fused silica adapters to effect a true zero dead volume connection. The ferrule features an integrated pilot which adapts to the ID of the unions, resulting in an inert, zero volume connection.

Every Valco and Cheminert fitting is manufactured to exacting specifications. Fitting concentricity – the relationship of the center of one fitting to another – is held to within 10% of the bore size (0.05 mm in a typical 1/16" union with 0.5 mm bore), which is better than that of commonly used *tubing*. This results in fittings which contribute no "extra column effects" or loss of efficiency to the chromatographic system.

Nuts

Internal nuts – stainless steel

Nuts with product numbers starting with Z are for use with all standard Valco internal fittings and most valves. They may be used with fittings from other manufacturers as well. The L (long) and XL (extra-long) types are for situations where the fitting head may be otherwise inaccessible or where interference between fittings exists, as on many Valco multiposition valves. Standard material is 300 series stainless.

Stainless nuts

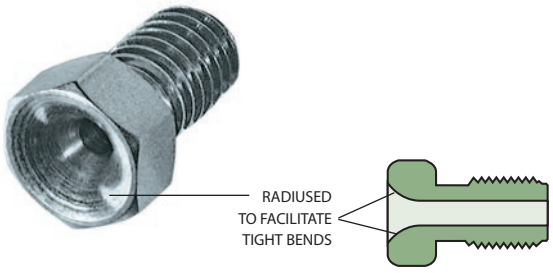
Package of 10:	*Length*	*Prod No*	*Price*
1/32" nut	.30"	ZN.5-10	
1/32" nut	.45"	LZN.5-10	
1/16" nut	.43"	ZN1-10	
1/16" nut	.50"	MZN1-10	
1/16" nut	.75"	LZN1-10	
1/16" nut	1.00"	XLZN1-10	
1/8" nut	.57"	ZN2-10	
1/8" nut	.82"	LZN2-10	
1/8" nut	1.07"	XLZN2-10	
1/4" nut	.70"	ZN4-10	
1/4″ nut	1.11″	LZN4-10	

NEW Specialty nuts – stainless steel

These special purpose nuts facilitate a tight bend as the tube exits the fitting, and can also help prevent kinks in very thin wall tubing. Quick bend nuts are available in standard length (.43") and in a short version (.30") for certain custom applications. Note that the short version (ZSN1) can *only* be used in certain applications. Call for more information.

Stainless nuts

Description	*Length*	*Prod No*	*Price*	
1/16", standard	.43"	ZN1Q		
1/16", short	.30"	ZSN1		



Specialty nut
Standard length

MORE INFORMATION

PEEK nuts ..... page 63
HPLC column end fittings 43-46
Reducing unions
Internal.....29
External 30
External/internal.....31
Internal/external.....31
Unions
Internal.....26
External 27
External/internal.....27

TECH TIP
Fittings for **360 micron** tubing are available on pages 57-58.

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

External nuts – stainless steel

External nuts are used with external fittings, such as our column end fittings (ECEF series) and external unions (EZU and EZRU series). They may also be used with Valco ferrules on Parker CPI and Swagelok type fittings. Standard material is 300 series stainless.

* PTFE-coated threads standard.

	Stainless nuts	
Description	*Prod No*	*Price*
1/32″ external nut	EN.5	
1/32″ external nut, knurled	EN.5KN	
1/16" external nut	EN1	
1/8" external nut	EN2	
1/4" external nut	EN4 *	
3/8" external nut	EN6 *	
1/2" external nut	EN8 *	
1" external nut	EN1K *	

Plugs – stainless steel and high pressure

Stainless plugs consist of a zero volume nut with a ferrule made up on a solid rod. For high pressure applications such as UHPLC, SFE, and SFC (>7000 psi), we recommend the special high pressure plugs with the ferrule and rod machined as a single, solid piece.

		Stainless plugs		High pressure Stainless plugs	
Description	*Length of nut**	*Prod No*	*Price*	*Prod No*	*Price*
1/32"	.30"	ZP.5		ZP.5H	
1/16"	.43"	ZP1		ZP1H	
1/16"	.75"	LZP1		LZP1H	
1/8"	.57"	ZP2		ZP2H	
1/8"	.82"	LZP2		LZP2H	
1/4"	.70"	ZP4		–	

Caps – stainless steel

A cap is essentially a piece of hex stock with a zero volume fitting detail machined into it, but with no through-hole.

		Stainless caps	
Description	*Length of nut**	*Prod No*	*Price*
1/32"	.30"	ZC.5	
1/16"	.43"	ZC1	
1/8"	.57"	ZC2	
1/4"	.70"	ZC4	

MORE INFORMATION

PEEK plugs . . pages 64, 71
PEEK plugs for high pressure Cheminert valves 64
PEEK caps 57, 64

Ferrules

Valco metal ferrules cut a ring near the end of the tube, preventing tube release at high pressures without significantly deforming and restricting the tube interior. (However, if the hardness of the tubing is equal to or greater than that of the ferrule, deformation of the tube rather than a cut ring is likely.) Make up usually takes only about a 1/4 turn beyond the point where the ferrule first starts to grab the tubing. Polymeric ferrules seal by the increased friction from compression.

Valco zero volume ferrules may be used with all Valco fittings and with those of most other manufacturers. The maximum pressure limit is generally determined by the yield strength of the tubing. The maximum pressure for softer materials (such as brass and polymers) is lower, and depends on the tubing used. If in doubt about a particular combination, consult our technical staff.

For trace gas analysis, use gold-plated ferrules to achieve sealing with $<10^{-9}$ cc/atm/sec leakage.

MORE INFORMATION
For more detailed information on metals, refer to the discussion on pages 254-255.

Metal ferrules

	Prod No	*Price*	*Prod No*	*Price*	*Prod No*	*Price*
Package of 10:	**Stainless, Type 303**		**Stainless, Type 316**		**Stainless, Gold-plated**	
1/32"	ZF.5-10		ZF.5S6-10	$40	ZF.5GP-10	
1/16"	ZF1-10		ZF1S6-10	30	ZF1GP-10	
1/8"	ZF2-10		ZF2S6-10	22	ZF2GP-10	
1/4"	–		ZF4S6-10	19	ZF4GP-10	
Sold individually:	**Hastelloy C**		**Nickel**		**Titanium**	
1/32"	ZF.5HC		ZF.5NI	$9	ZF.5TI	
1/16"	ZF1HC		ZF1NI	8	ZF1TI	
1/8"	ZF2HC		ZF2NI	8	ZF2TI	
1/4"	ZF4HC		ZF4NI	9	ZF4TI	
Package of 10:	**Brass**					
1/32"	ZF.5B-10					
1/16"	ZF1B-10					
1/8"	ZF2B-10					
1/4"	ZF4B-10					

– Not available
Larger sizes and/or specific materials may be available on special order.

METALS AT A GLANCE

Hastelloy C ® .....HC
Resistant to pitting; Resists oxidizing atmospheres

Nickel ..... NI
Resistant to caustics, high temp halogens, and hydrogen halides

Stainless steel, Gold-plated .....GP
More inert than standard stainless

Stainless steel, Type 303
GC, gas lines, general purpose

Stainless steel, Type 316 ..... S6
LC with high chloride ion in solutions

Titanium .....TI
Outstanding resistance to most media except hydrofluoric acids

Brass ..... B
Not recommended for most chromatographic applications

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

Polymeric ferrules

	Prod No	Price	Prod No	Price	Prod No	Price
Package of 10:	**PTFE, Virgin**		**PTFE, Glass-filled**		**FEP**	
1/32"	ZF.5TF-10		ZF.5TFG-10		ZF.5FEP-10	
1/16"	ZF1TF-10		ZF1TFG-10		ZF1FEP-10	
1/8"	ZF2TF-10		ZF2TFG-10		ZF2FEP-10	
1/4"	ZF4TF-10		ZF4TFG-10		ZF4FEP-10	
3/8"	ZF6TF-10		ZF6TFG-10		ZF6FEP-10	
1/2"	ZF8TF-10		ZF8TFG-10		ZF8FEP-10	

Package of 10:	**PFA**	**CTFE**	
1/32"	ZF.5PFA-10	ZF.5KF-10	
1/16"	ZF1PFA-10	ZF1KF-10	
1/8"	ZF2PFA-10	ZF2KF-10	
1/4"	ZF4PFA-10	ZF4KF-10	
3/8"	ZF6PFA-10	ZF6KF-10	
1/2"	ZF8PFA-10	ZF8KF-10	

Package of 5:	**Polyimide, Graphite**	**Polyimide, Valcon**	**Polyimide, Virgin**
1/32"	ZF.5GV-5	ZF.5V-5	ZF.5V1-5
1/16"	ZF1GV-5	ZF1V-5	ZF1V1-5
1/8"	ZF2GV-5	ZF2V-5	ZF2V1-5
1/4"	ZF4GV-5	ZF4V-5	ZF4V1-5
3/8"	ZF6GV-5	ZF6V-5	ZF6V1-5
1/2"	ZF8GV-5	ZF8V-5	ZF8V1-5

MORE INFORMATION

PEEK ferrules .... page 63
Grooved PEEK ferrules..... 63

For more detailed information on polymers, refer to the discussion on page 256.

POLYMERS AT A GLANCE

CTFE ..... KF
Resists all inorganic corrosives. Produced as Kel-F ®

FEP ..... FEP
Chemical resistance equals PTFE, but lower creep and higher friction

PTFE, Glass-filled..... TFG
Inert, mechanically stable

PTFE, Virgin..... TF
Inert; very soft, easily cold flows. Produced as Teflon ®

Polyimide, Graphite....GV
Soft, easy to form ferrules

Polyimide, Valcon..... V
High temp, graphite reinforced

Polyimide, Virgin..... V1
High temp, electrical insulator

FERRULE IDENTIFICATION

To differentiate among the most commonly ordered metal ferrules, ring(s) are engraved on the non-sealing surfaces.

Reducing Ferrules

Reducing ferrules provide an inexpensive way to connect small temporary transfer lines to valves or fittings designed for larger tubing. For long term use, we recommend our reducing unions, internal reducers (IZRs), or external reducers (EZRs), as appropriate.

Internal ZDV (zero dead volume) reducing ferrules are designed for use with all standard Valco internal style fittings – that is, those with a male nut and female fitting detail. The ferrule features an integral pilot which fills the pilot cavity (the space between the end of the ferrule and the bottom of the detail), yielding a zero dead volume fitting.

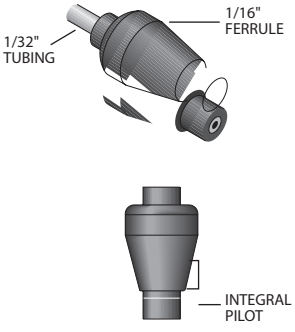
External ZDV reducing ferrules are designed for use with all standard external style fittings – that is, those with a female nut and a male fitting detail. This ferrule has a slightly longer pilot than the internal version, to accommodate the longer external detail. The result is a zero dead volume fitting. A single groove indicates that the ferrule has the longer pilot and is for use in an external detail.

Standard reducing ferrules can be used where mixing is not a problem, such as with liquid or gas delivery. A 1/16" to 1/32" ferrule of this style is simply a 1/16" ferrule with a 1/32" hole.

nternal reducing ferrules

Use these ferrules in internal type fitting details, with nuts that have external threads.

	Prod No	*Price*	*Prod No*	*Price*	*Prod No*	*Price*
Package of 5:	**PTFE, Glass-filled**		**PEEK**		**Polyimide, Valcon**	
1/16" to 1/32"	ZRF1.5TFG-5		ZRF1.5PK-5		ZRF1.5V-5	
1/8" to 1/32"	ZRF2.5TFG-5		ZRF2.5PK-5		ZRF2.5V-5	
1/8" to 1/16"	ZRF21TFG-5		ZRF21PK-5		ZRF21V-5	
1/4" to 1/16"	ZRF41TFG-5		ZRF41PK-5		ZRF41V-5	
1/4" to 1/8"	ZRF42TFG-5		ZRF42PK-5		ZRF42V-5	
Package of 5:	**CTFE**		**Polyimide, Virgin**			
1/16" to 1/32"	ZRF1.5KF-5		ZRF1.5V1-5			
1/8" to 1/32"	ZRF2.5KF-5		ZRF2.5V1-5			
1/8" to 1/16"	ZRF21KF-5		ZRF21V1-5			
1/4" to 1/16"	ZRF41KF-5		ZRF41V1-5			
1/4" to 1/8"	ZRF42KF-5		ZRF42V1-5			



Internal reducing ferrule
(ZRF)

PEEK reducing ferrule and internal nut
(Order nut separately.)

MORE INFORMATION

Internal reducers (IZR) . . . . . page 34
External reducers (EZR) 35
Ferrule removal kits. . . . 16

For 1/16" and 1/32" reducing ferrules with smaller ODs for use with fused silica, see the FS and FSR adapters on pages 16-17.

TECH TIP
Fittings for **360 micron** tubing are available on pages 57-58.

TECH TIP
If you are doing resistive heating of traps or columns, note that our virgin polyimide reducing ferrules are effective electrical insulators.

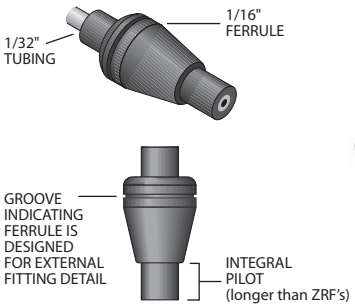
Virgin polyimide is produced as Vespel ®.

OPTION
Available in Virgin Polyimide.

External reducing ferrules

Use these ferrules in external type fitting details, with nuts that have internal threads.

	Prod No	*Price*	*Prod No*	*Price*	*Prod No*	*Price*
Package of 5:	**PTFE, Glass-filled**		**PEEK**		**Polyimide, Valcon**	
1/16" to 1/32"	EZRF1.5TFG-5		EZRF1.5PK-5		EZRF1.5V-5	
1/8" to 1/32"	EZRF2.5TFG-5		EZRF2.5PK-5		EZRF2.5V-5	
1/8" to 1/16"	EZRF21TFG-5		EZRF21PK-5		EZRF21V-5	
1/4" to 1/16"	EZRF41TFG-5		EZRF41PK-5		EZRF41V-5	
1/4" to 1/8"	EZRF42TFG-5		EZRF42PK-5		EZRF42V-5	
Package of 5:	**CTFE**					
1/16" to 1/32"	EZRF1.5KF-5					
1/8" to 1/32"	EZRF2.5KF-5					
1/8" to 1/16"	EZRF21KF-5					
1/4" to 1/16"	EZRF41KF-5					
1/4" to 1/8"	EZRF42KF-5					



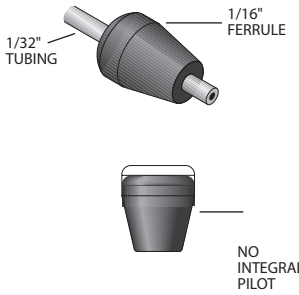
External reducing ferrule
(EZRF)

PEEK reducing ferrule and external nut
(Order nut separately.)

Standard reducing ferrules

Use these ferrules for bulk distribution only, since the resulting connection will not be zero dead volume. These ferrules can be used in either internal or external type fitting details.

	Prod No	*Price*	*Prod No*	*Price*	*Prod No*	*Price*
Package of 5:	**PTFE, Glass-filled**		**PEEK**		**Polyimide, Valcon**	
1/16" to 1/32"	RF1.5TFG-5		RF1.5PK-5		RF1.5V-5	
1/8" to 1/32"	RF2.5TFG-5		RF2.5PK-5		RF2.5V-5	
1/8" to 1/16"	RF21TFG-5		RF21PK-5		RF21V-5	
1/4" to 1/16"	RF41TFG-5		RF41PK-5		RF41V-5	
1/4" to 1/8"	RF42TFG-5		RF42PK-5		RF42V-5	
Package of 5:	**CTFE**					
1/16" to 1/32"	RF1.5KF-5					
1/8" to 1/32"	RF2.5KF-5					
1/8" to 1/16"	RF21KF-5					
1/4" to 1/16"	RF41KF-5					
1/4" to 1/8"	RF42KF-5					



Standard reducing ferrule
(RF)

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

Fused Silica Adapters

Fused silica adapters are available in Valcon polyimide for use up to 350°C and in PEEK for lower temperature applications (up to 175°C). Valcon polyimide is a unique graphite-reinforced composite, specially prepared to maximize mechanical stability at high temperatures. Small blocks are subjected to extreme loads by a process known as hot isostatic pressing, with individual ferrules subsequently machined from these blocks. The result of this two-step process is a fused silica adapter with high temperature stability which far exceeds that of parts produced by conventional molding. Note that the determining factor in adapter size selection is the fused silica tubing's outer diameter, or OD. Typical ODs for common columns are included in the product number tables.

One piece fused silica adapter (FS)

The one piece FS adapter, essentially a reducing ferrule, is recommended for use in fittings where the polyimide ferrule will not be removed. Connections are made and disconnected by loosening the fitting nut and sliding the tube out.

Package of 5:		Polyimide, Valcon		PEEK		Polyimide, Virgin	
		Prod No	*Price*	*Prod No*	*Price*	*Prod No*	*Price*
1/32" Adapters	Tubing OD:						
	< 0.25 mm	FS.25-5		FS.25PK-5		FS.25V1-5	
	0.25 ≤ 0.40 mm	FS.4-5		FS.4PK-5		FS.4V1-5	
	0.40 ≤ 0.50 mm	FS.5-5		FS.5PK-5		FS.5V1-5	
	0.50 ≤ 0.80 mm	ZF.5V-5		ZF.5PK-5		ZF.5V1-5	
1/16" Adapters	Tubing OD:						
	<0.25 mm	FS1.2-5		FS1.2PK-5		FS1.2V1-5	
	0.25 ≤ 0.30 mm	FS1.25-5		FS1.25PK-5		FS1.25V1-5	
	0.30 ≤ 0.35 mm	FS1.3-5		FS1.3PK-5		FS1.3V1-5	
	0.35 ≤ 0.40 mm	FS1.4-5		FS1.4PK-5		FS1.4V1-5	
	0.40 ≤ 0.50 mm	FS1.5-5		FS1.5PK-5		FS1.5V1-5	
	0.50 ≤ 0.80 mm	FS1.8-5		FS1.8PK-5		FS1.8V1-5	
	0.80 ≤ 0.90 mm	FS1.9-5		FS1.9PK-5		FS1.9V1-5	
	0.90 ≤ 1.0 mm	FS11.0-5		FS11.0PK-5		FS11.0V1-5	

Ferrule removal kit

These tapered tools have teeth designed to grip and remove fused silica adapters if they get stuck in a fitting detail. Each kit has two sizes of tools, so they can retrieve 1/32" and 1/16" adapters.

Prod No	*Price*
FRK1	$23

TEMPERATURE RATINGS
Polyimide adapters can be used at temperatures up to 350°C.

PEEK adapters are not recommended for use above 175°C.

TECH TIP
Virgin polyimide adapters are effective electrical insulators, making them the ideal choice for capillary electrophoresis.

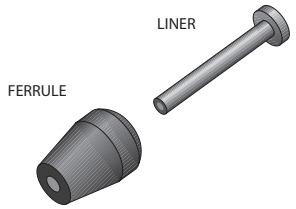
Virgin polyimide is produced as Vespel®.

TECH TIP
If a fused silica tube breaks off in a through-type union, remove the nuts and the tube opposite the broken one. Clear the fitting by passing a drill or wire of the appropriate diameter into the unbroken side and through the center of the fitting.

Our **ferrule removal kit**, left, can be used to remove ferrules from all types of fittings.

WHICH ADAPTER FOR WHICH COLUMN?

Column ID	Typical column OD	1/32" adapter	1/16" adapter
< 0.20 mm	0.25 mm	FS.25	FS1.25
0.25 mm	0.4 mm	FS.4	FS1.4
0.32 mm	0.5 mm	FS.5	FS1.5
0.53 mm	0.8 mm	ZF.5V	FS1.8

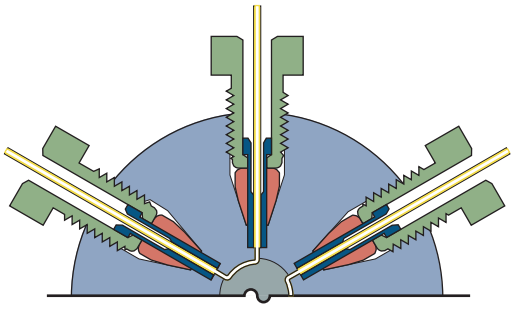


Removable fused silica adapters (FSR)

The FSR adapter is the only adapter recommended for use in valves. It consists of a liner which slides over the fused silica tubing and a ferrule which makes up on the liner. The polyimide liner has an enlarged diameter at one end which is captured by the nut, so the liner and the tube within it are removed as the nut is unscrewed from the valve. The 1/16" FSR adapter includes a special counter-bored 1/16" nut. The 1/32" FSR adapter uses standard Valco 1/32" nuts.

Package of 5:		**Polyimide, Valcon** *Prod No*	*Price*
1/32"			
Removable adapters	Tubing OD:		
	< 0.25 mm	FSR.25-5	
	0.30 ≤ 0.35 mm	FSR.3-5	
	0.35 ≤ 0.40 mm	FSR.4-5	
	0.40 ≤ 0.50 mm	FSR.5-5	
1/32"			
Replacement liners	Tubing OD:		
	< 0.25 mm	FSL.25-5	
	0.25 ≤ 0.40 mm	FSL.4-5	
	0.40 ≤ 0.50 mm	FSL.5-5	

Package of 5:		**Polyimide, Valcon** *Prod No*	*Price*	**PEEK** *Prod No*	*Price*
1/16"	Tubing OD:				
Removable adapters	< 0.15 mm	–		FS1R.15PK-5	
	< 0.20 mm	FS1R.2-5		FS1R.2PK-5	
	0.20 ≤ 0.40 mm	FS1R.4-5		FS1R.4PK-5	
	0.40 ≤ 0.50 mm	FS1R.5-5		FS1R.5PK-5	
	0.50 ≤ 0.80 mm	FS1R.8-5		FS1R.8PK-5	
	0.90 ≤ 1.0 mm	FS1R1.0-5		FS1R1.0PK-5	
1/16"					
Replacement liners	Tubing OD:				
	< 0.15 mm	–		FS1L.15PK-5	
	< 0.20 mm	FS1L.2-5		FS1L.2PK-5	
	0.20 ≤ 0.40 mm	FS1L.4-5		FS1L.4PK-5	
	0.40 ≤ 0.50 mm	FS1L.5-5		FS1L.5PK-5	
	0.50 ≤ 0.80 mm	FS1L.8-5		FS1L.8PK-5	
	0.90 ≤ 1.0 mm	FS1L1.0-5		FS1L1.0PK-5	



Removable FSR adapters in a valve

MORE INFORMATION

Fused silica
Unions . pp 18-19, 58, 61
Fittings 18-21
A pin vise and drill index are useful for enlarging the inner diameters of the FS adapters.
Pin vise and drill index 55

REPLACEMENT PARTS

Ferrules		*(package of 5)*
1/32" Polyimide	ZF.5V-5	$30
1/16" Polyimide	ZF1V-5	25
	(package of 10)	
1/16" PEEK	ZF1PK-10	33
Nuts		*(package of 10)*
1/32" SS	ZN.5-10	29
Special nuts for FSRs:		
1/16" SS	ZCN1-10	30
1/16" SS long	LZCN1-10	45

100 µm = .004"
150 µm = .006"

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
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27.0 mm = 1.08"

1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
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Fused Silica Fittings

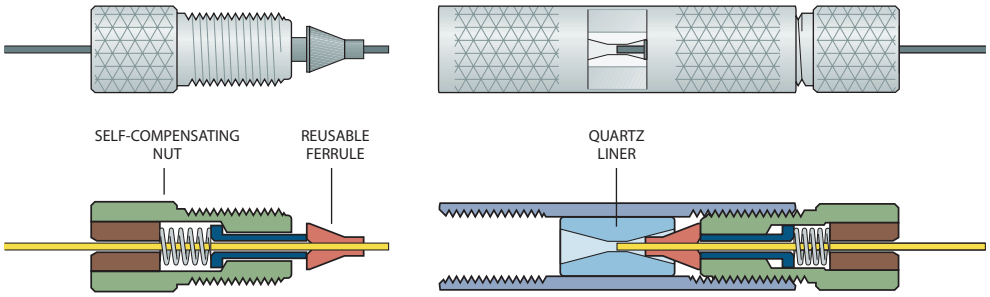
The patented design of our fused silica fittings ensures stable, leak-free connections at temperatures up to 400°C, and undistorted ferrules that are easily removed and reused. Columns may be changed without the risk of the leaks which can devastate systems such as mass spectrometers or atomic emission detectors. This is accomplished with a spring-loaded self-compensating nut which provides a constant sealing force as the temperature varies.

Self-compensating nuts are currently employed in two basic designs: a fused silica-lined union and an injector/detector nut for Agilent 6890 and 5890 GCs.

Fused silica unions

The fused silica union* has a quartz liner, providing an inert connection zone of minimal volume. Since the seal occurs only at the ferrule tip, the total sealing force is minimized, leaving the ferrule undistorted and reusable.
Note: The ferrules used in this union are unique, due to the seal at the tip. Standard ferrules will not work in this union.

Description	*Prod No*	*Price*
Fused silica union	FSKZU1	
Replacement liner	FSQ1	
Replacement nut	FSZN1	



Fused silica union
with self-compensating nut

Replacement ferrules for fused silica unions and self-compensating nuts (Agilent injector nuts)

These reusable ferrules seal at the tip, and are different from standard ferrules. Order for use with FSKZU1 fused silica unions and FSZNA-HP nuts on these two pages.

Package of 10:		*Prod No*	*Price*
Column ID:	.20 –.25 mm	FS1.35-R10	
	.32 mm	FS1.45-R10	
	.53 mm	FS1.75-R10	

*U.S. patent numbers 5,234,235 and 4,991,883.

100 µm = .004"
150 µm = .006"

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
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7.0 mm = .275"
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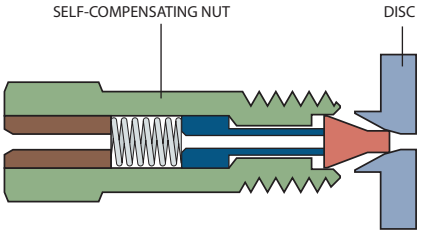
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

Injector nut for Agilent 6890 and 5890, Series I and II

This self-compensating nut is a direct replacement for the standard nut on the split/splitless injectors of Agilent 6890 and 5890 series GCs. This retrofit offers enhanced ferrule reusability and temperature stability, resulting in fingertight leak-free connections over the full programmed temperature range of mass spectrometry and gas chromatography. To use this nut, the split/splitless disk must also be upgraded; the new disk will also work with older HP nuts and ferrules.

	Prod No	*Price*
Injector nut system Includes nut and seal disk	FSZA-HP	
Replacement parts		
Self-compensating nut	FSZNA-HP	
HP-5890 split/splitless seal disk	SEAL1-HP	

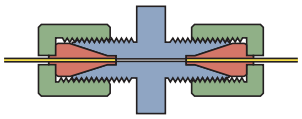


Self-compensating nut
for the 6890/5890 GC

1/32" Ultra low mass external unions

The 1/32" external union is specially designed for use with capillary columns in GC. It has very low mass and does not require wrenches to seal. Use only with one-piece fused silica adapters, since metal ferrules will distort the detail. Order fused silica adapters separately *(see box at left)*.

Bore	*Prod No*	*Price*
0.25 mm	EU.5	
0.50 mm	EU.5L	
1/32"	EU.5T	



1/32" external union
for use with capillary columns in GC

MORE INFORMATION
1/32" fused silica adapter ferrules..... page 16

1/32" FUSED SILICA FERRULES
(package of 5)

Tubing OD:

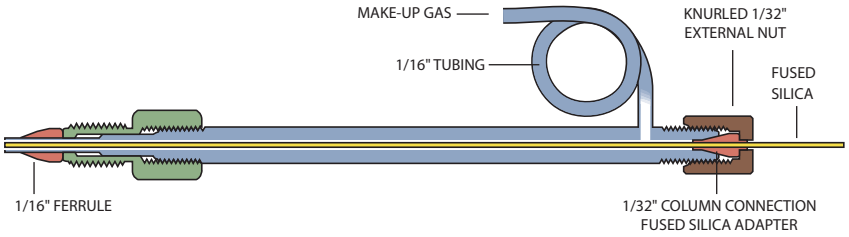
	≤ 0.25 mm	FS.25-5	$25
0.25 mm	≤ 0.4 mm	FS.4-5	25
0.4 mm	≤ 0.5 mm	FS.5-5	25
0.5 mm	≤ 0.8 mm	ZF.5V-5	25

Fused Silica Adapters

Fused silica make-up adapters

The fused silica make-up adapter connects a fused silica capillary column to a valve or detector while adding a make-up gas. In the reverse mode it works like a splitter, without the uneven or erratic split seen with basic tees. Two lengths are available. Order 1/32" fused silica adapter ferrules separately *(see box on facing page)*.

Description	*Length*	*Bore*	*Prod No*	*Price*
1/16" to 1/32"	1.5"	0.5 mm	FSMUAS1.5M	
	1.5"	0.75 mm	FSMUAS1.5	
	1.5"	1.0 mm	FSMUAS1.5L	
	3.5"	0.75 mm	FSMUA1.5	



Fused silica make-up adapter
(FSMUA1.5)

100 µm = .004"
150 µm = .006"

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

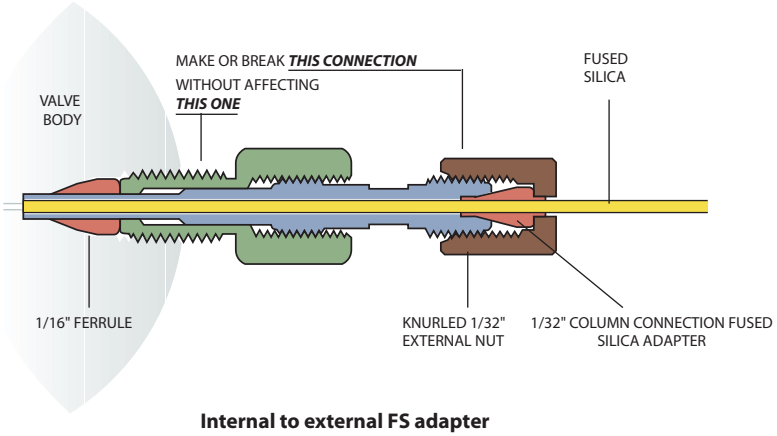
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

Internal to external reducer/adapters

Internal fittings provide the smallest possible fitting volume. But there are situations, such as when you're using graphite ferrules which tend to become lodged in internal details, when an external fitting might be more desirable. A typical situation of that nature is the connection of a fused silica capillary to a valve. Our unique design permits the 1/32" nut to be tightened without affecting the 1/16" connection. Order 1/32" fused silica adapter ferrules separately *(see box below)*.

Description	*Bore*	*Prod No*	*Price*
1/16" to 1/32"	0.25 mm	IZERA1.5C	
	0.5 mm	IZERA1.5M	
	1.0 mm	IZERA1.5	



Internal to external FS adapter
(IZERA1.5)
shown installed in a valve

MORE INFORMATION
1/32" fused silica adapter ferrules..... page 16

CAUTION
Polymeric ferrules are strongly recommended for 1/16" and 1/32" external details. Metal ferrules may distort the fitting.

1/32" FUSED SILICA FERRULES
(package of 5)

Tubing OD:

	≤ 0.25 mm	FS.25-5	$30
0.25 mm	≤ 0.4 mm	FS.4-5	30
0.4 mm	≤ 0.5 mm	FS.5-5	30
0.5 mm	≤ 0.8 mm	ZF.5V-5	30

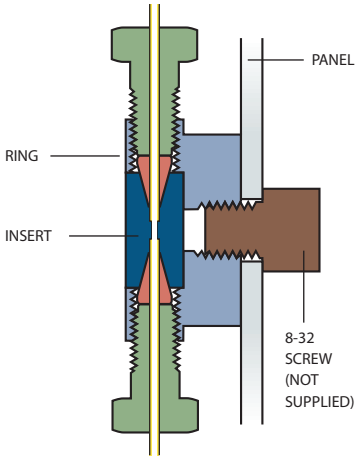
Microvolume Connectors

Micro-unions, -tees, -crosses, and -Y's have a unique two-piece design which allows us to provide an extremely small bore in a conventional ferrule and nut fitting. The actual connection area is separated from the nut threads, with the ferrule detail in a metal or polymer insert and the threads machined into a stainless steel or polymer ring. Since the insert has a much smaller diameter than a standard one-piece fitting, it can be drilled with much shorter tools; and, since a shorter drill has less tendency to wander or break, holes as small as .006" (0.15 mm) can be machined with the same high degree of concentricity found in all Valco fittings.

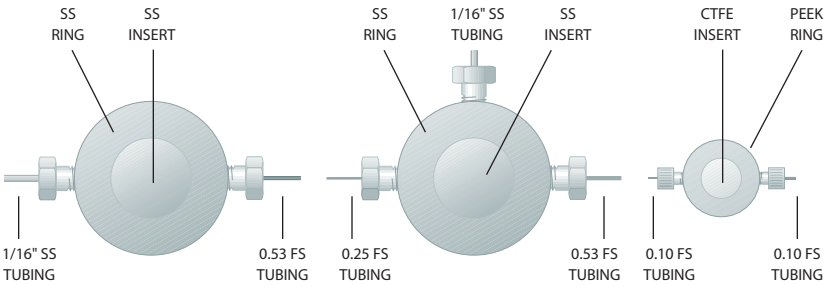
Valco microvolume fittings make it possible to couple 100 micron ID capillary GC, HPLC, or CZE columns without special nuts and ferrules. A stainless ring with one of the plastic inserts provides electrical insulation within the insert, while the PEEK ring achieves total isolation.

The ring containing the threads is made from PEEK or stainless steel. Inserts are made of stainless steel, Hastelloy C, Titanium, PEEK, or CTFE. PEEK rings are not as robust as stainless steel, and are not usable above 75°C. The stainless steel ring with a metal insert can operate at up to 10,000 psi for HPLC or SFC.

All standard Valco zero dead volume reducing ferrules (ZRF, FS, and FSR) will work in these fittings. They are uniquely designed to fill the void between the fitting pilot and the smaller tubing OD, eliminating any dead volume in the fitting. (Reducing ferrules such as Valco's RF series should be avoided, since they leave dead volume.)



Panel mounting



Stainless to fused silica union
1/16" fittings

Make-up adapter
1/16" fittings

CZE union
1/32" fittings

MORE INFORMATION

100 µm = .004"
150 µm = .006"

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
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1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

1/32" Microvolume connectors

Includes ring, nuts, and ferrules. With metal inserts: ferrules are the same material as the insert, and ring and nuts are stainless steel. With polymer inserts: ferrules are the same material as the insert, and ring and nuts are PEEK.

Insert Material:	Stainless steel		Hastelloy C		Titanium		PEEK		CTFE	
	Prod No	*Price*	*Prod No*	*Price*	*Prod No*	*Price*	*Prod No*	*Price*	*Prod No*	*Price*
0.15 mm bore										
Union	MU.5XCS6		MU.5XCHC		MU.5XCTI		MU.5XCPK		MU.5XCKF	
Tee	MT.5XCS6		MT.5XCHC		MT.5XCTI		MT.5XCPK		MT.5XCKF	
Y	MY.5XCS6		MY.5XCHC		MY.5XCTI		MY.5XCPK		MY.5XCKF	
Cross	MX.5XCS6		MX.5XCHC		MX.5XCTI		MX.5XCPK		MX.5XCKF	
0.25 mm bore										
Union	MU.5CS6		MU.5CHC		MU.5CTI		MU.5CPK		MU.5CKF	
Tee	MT.5CS6		MT.5CHC		MT.5CTI		MT.5CPK		MT.5CKF	
Y	MY.5CS6		MY.5CHC		MY.5CTI		MY.5CPK		MY.5CKF	
Cross	MX.5CS6		MX.5CHC		MX.5CTI		MX.5CPK		MX.5CKF	

1/16" Microvolume connectors

Includes ring, nuts, and ferrules. With metal inserts: ferrules are the same material as the insert, and ring and nuts are stainless steel. With polymer inserts: ferrules are the same material as the insert, and ring and nuts are PEEK.

Insert Material:	Stainless steel		Hastelloy C		Titanium		PEEK		CTFE	
	Prod No	*Price*	*Prod No*	*Price*	*Prod No.*	*Price*	*Prod No*	*Price*	*Prod No*	*Price*
0.15 mm bore										
Union	MU1XCS6		MU1XCHC		MU1XCTI		MU1XCPK		MU1XCKF	
Tee	MT1XCS6		MT1XCHC		MT1XCTI		MT1XCPK		MT1XCKF	
Y	MY1XCS6		MY1XCHC		MY1XCTI		MY1XCPK		MY1XCKF	
Cross	MX1XCS6		MX1XCHC		MX1XCTI		MX1XCPK		MX1XCKF	
0.25 mm bore										
Union	MU1CS6		MU1CHC		MU1CTI		MU1CPK		MU1CKF	
Tee	MT1CS6		MT1CHC		MT1CTI		MT1CPK		MT1CKF	
Y	MY1CS6		MY1CHC		MY1CTI		MY1CPK		MY1CKF	
Cross	MX1CS6		MX1CHC		MX1CTI		MX1CPK		MX1CKF	

Replacement components

	1/32" connectors		1/16" connectors	
Description	*Prod No*	*Price*	*Prod No*	*Price*
SS ring for union, tee, or cross	MRX.5S6		MRX1S6	
SS ring for Y	MRY.5S6		MRY1S6	
PEEK ring for union, tee, or cross	MRX.5PK		MRX1PK	
PEEK ring for Y	MRY.5PK		MRY1PK	
Nuts for SS ring	ZN.5		ZN1	
Nuts for PEEK ring	ZN.5FPK		ZN1FPK	

Inserts for any connector:
To order an insert, add an "I" after the "M" in the product number, and deduct $5 from the connector price.
For example, to order an insert for a 1/16" microvolume union MU1CS6, order part number MIU1CS6.

OPTIONS
0.50, 0.75, and 1.0 mm bores are available in most materials and configurations.

NANOVOLUME CONNECTIONS
For 0.10 mm (100 µm) bore fittings, see pages 57- 60.

Unions

Unions join two pieces of tubing of the same OD. Select the union with the bore that matches the ID of the tubing. If the IDs are different, choose the union with a bore which matches the smaller tube bore. Standard material is 300 series stainless steel.

- **Internal** unions have female threads and a fitting detail for zero volume fittings. The nuts have male (external) threads.
- **External** unions have male threads, requiring a nut with internal threads.
- **External/internal** unions have male threads on one end and female threads on the other, for connecting a standard zero dead volume fitting to an existing tube which already has an external nut made up on it.

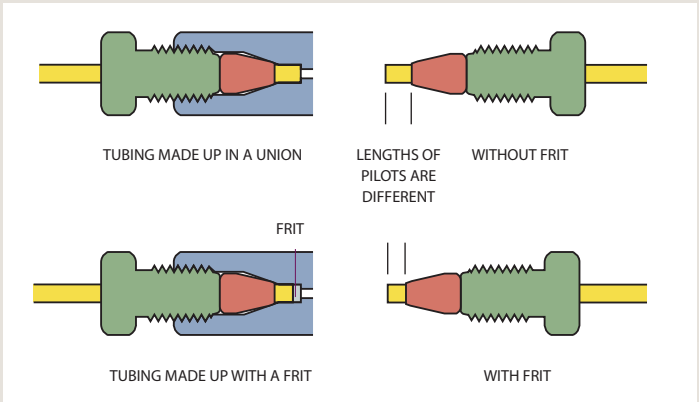
Internal fittings are almost always the best with tubing of 1/8" OD or smaller. They make a stronger connection and offer the lower volume necessary for high performance instrumentation. Also, because 1/16" external fittings have very thin, easily distorted walls, they are not as durable as 1/16" internal fittings. In sizes larger than 1/8", external fittings are generally easier to make up because of less thread friction.

Bulkhead versions can be mounted through an instrument panel or on a bracket. The fitting body is undercut so that it bites into the panel when the mounting nut is tightened, eliminating the need for a lock washer. An O-ring can be installed between the body and the panel to allow operation in purged environments. Typically the mounting nut goes inside the instrument, so that the long threaded portion will be out of sight. In the external/internal bulkhead unions, the mounting nut is on the side with the Valco internal fitting.

TECH TIP

Filtering capability can be added to a union by inserting a screen or frit into it before making up the fittings. However, when a fitting detail has a screen or frit in it, the pilot depth is reduced, so that the ferrule makes up closer to the tube end than it otherwise would. If that tube is used in any other Valco fitting, it will introduce unswept volume. Our filter design takes this into account, allowing our fittings to remain truly interchangeable.

Filters . . . . . pages 50-52
Frits and screens. 53



0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

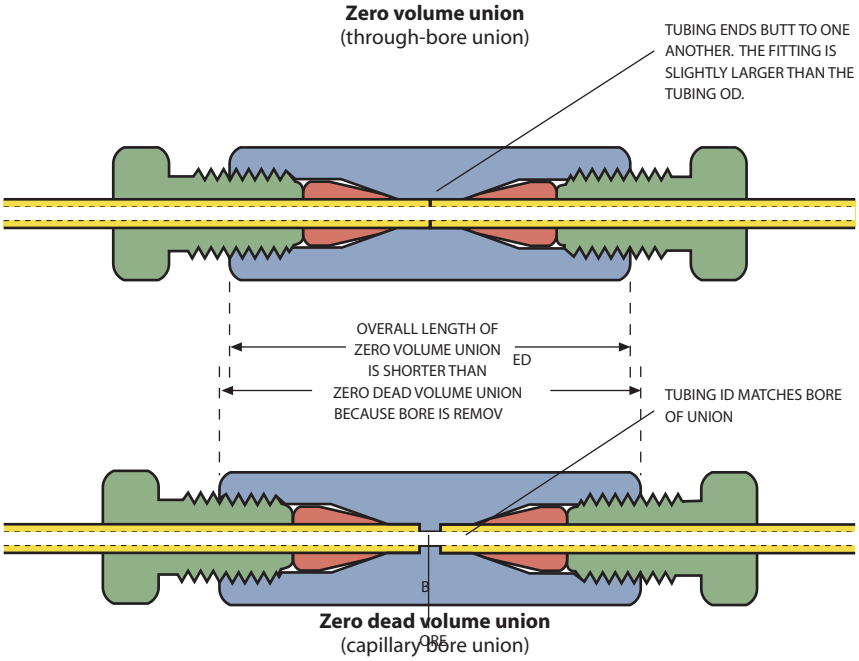
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

Zero Volume vs. Zero Dead Volume

A true zero volume fitting is one in which no part of the fitting actually becomes a part of the flow path. The only Valco fittings which fit this description are our through-bore unions, which allow tubing to butt end-to-end. (So these are only zero volume if the tube ends are perfectly square.)

All other fittings are designed with zero *dead* volume: that is, there is no volume introduced by the fitting which is not cleanly swept.



MORE INFORMATION

Reducing unions to connect two tubes with different ODs . . . . . p 29-31
Unions with 1/4-28 fittings 72

TECH TIP
Through-bore Union Installation

Because the tubing will pass all the way through a through-bore union, we suggest making up the first tube in a standard Valco fitting to establish the proper length of tubing extending beyond the ferrule. Install this made-up connection in the through-bore union; then the second tube can be butted against it for a zero volume connection.

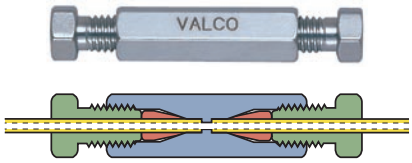
Unions

Internal unions – stainless steel

Standard material is 300 series stainless. Also available in Hastelloy C, gold-plated stainless, and titanium.

Standard internal unions

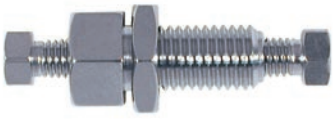
Tubing OD	*Bore*	*Prod No*	*Price*
1/32"	0.15 mm	ZU.5XC	
	0.25 mm	ZU.5	
	0.50 mm	ZU.5L	
	1/32"	ZU.5T	
1/16"	0.15 mm	ZU1XC	
	0.25 mm	ZU1C	
	0.50 mm	ZU1M	
	0.75 mm	ZU1	
	1.0 mm	ZU1L	
	1/16"	ZU1T	
1/8"	0.75 mm	ZU2	
	2.0 mm	ZU2L	
	1/8"	ZU2T	
1/4"	0.75 mm	ZU4	
	4.6 mm	ZU4L	
	1/4"	ZU4T	



Internal union – metal
Standard bore version
(ZU1)
Ends of tubing seat squarely
at bottoms of fitting details

Bulkhead internal unions

Tubing OD	*Bore*	*Prod No*	*Price*	**Bulkhead panel hole diameter**
1/32"	0.15 mm	ZBU.5XC		5/16"
	0.25 mm	ZBU.5		5/16"
	0.50 mm	ZBU.5L		5/16"
	1/32"	ZBU.5T		5/16"
1/16"	0.15 mm	ZBU1XC		5/16"
	0.25 mm	ZBU1C		5/16"
	0.50 mm	ZBU1M		5/16"
	0.75 mm	ZBU1		5/16"
	1.0 mm	ZBU1L		5/16"
	1/16"	ZBU1T		5/16"
1/8"	0.75 mm	ZBU2		7/16"
	2.0 mm	ZBU2L		7/16"
	1/8"	ZBU2T		7/16"
1/4"	0.75 mm	ZBU4		5/8"
	4.6 mm	ZBU4L		5/8"
	1/4"	ZBU4T		5/8"



Bulkhead internal union – metal
(ZBU1)

MORE INFORMATION
Internal unions, high pressure PEEK . . p 57, 65

For special materials and/or smaller bores:
Microvolume connectors offer a complete range of 1/32" and 1/16" unions in various metals and polymers, with bore sizes ranging from .006" (0.15 mm) to .040" (1.0 mm). Refer to pages 22-23.

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

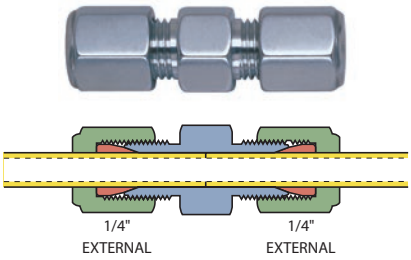
7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

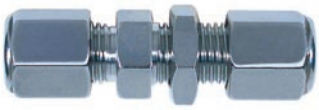
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

5/16" = .312" = 7.9 mm
3/8" = .375" = 9.5 mm
7/16" = .437" = 11.1 mm



External union
Through-bore version
(EU4T)
Ends of tubing butt together



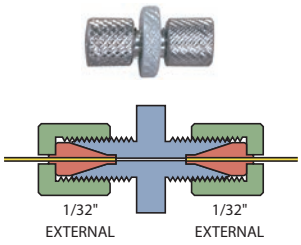
Bulkhead external union
(EBU2L)

External unions

Standard material is 300 series stainless. Also available in Hastelloy C and gold-plated stainless.

Note: Because 1/16" external fittings have very thin, easily distorted walls, they are not as durable as 1/16" internal fittings. We recommend the use of external/internal unions (below) when connecting to an installed external nut.

Tubing OD	*Bore*	**Standard** *Prod No*	*Price*	**Bulkhead** *Prod No*	*Price*	**Bulkhead panel hole diameter**
1/16"	See note above					
1/8"	1.0 mm	EU2		–		–
	2.0 mm	EU2L		EBU2L		5/16"
	1/8"	EU2T		EBU2T		5/16"
1/4"	2.0 mm	EU4		EBU4		7/16"
	4.6 mm	EU4L		EBU4L		7/16"
	1/4"	EU4T		EBU4T		7/16"

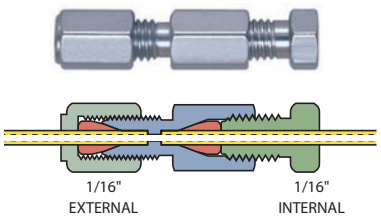


1/32" external union
(EU.5)
For use with GC capillary columns

External unions – 1/32" ultra low mass

The 1/32" external union is specially designed for use with capillary columns in GC. It is very low mass and does not require wrenches to seal. Use *only* with one-piece fused silica adapters, since metal ferrules will distort the detail. Order fused silica adapters separately *(page 16)*. Standard material is 300 series stainless.

Bore	*Prod No*	*Price*
0.25 mm	EU.5	
0.50 mm	EU.5L	
1/32"	EU.5T	



External/internal union
Standard bore
(EZU1)
Adapts existing external fittings
to Valco zero volume internal fittings

Bulkhead external/internal union
(EZBU1)

External/internal unions

Standard material is 300 series stainless. Also available in Hastelloy C and gold-plated stainless.

Tubing OD	*Bore*	**Standard** *Prod No*	*Price*	**Bulkhead** *Prod No*	*Price*	**Bulkhead panel hole diameter**
1/32"	0.25 mm	EZU.5		–		–
	0.50 mm	EZU.5L		–		–
1/16"	0.25 mm	EZU1C		EZBU1C		5/16"
	0.50 mm	EZU1M		EZBU1M		5/16"
	0.75 mm	EZU1		EZBU1		5/16"
	1/16"	EZU1T		EZBU1T		5/16"
1/8"	1.0 mm	EZU2		EZBU2		7/16"
	2.0 mm	EZU2L		EZBU2L		7/16"
	1/8"	EZU2T		EZBU2T		7/16"

Reducing Unions

Reducing unions join two tubes of different outside diameters. Standard material is 300 series stainless.

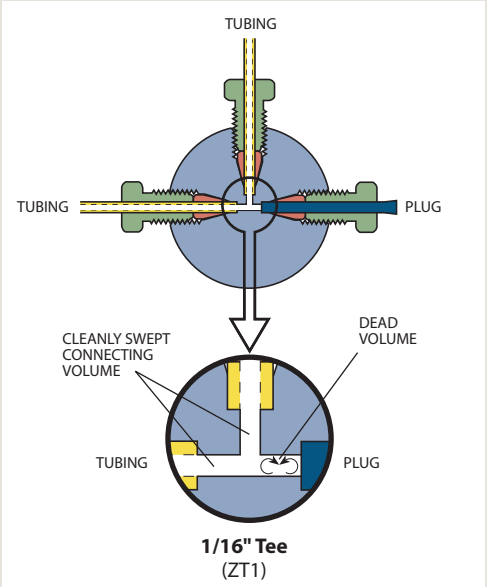
- Internal reducing unions have female threads and a fitting detail for zero volume fittings. The nuts have male (external) threads.
- External reducing unions have male threads, requiring a nut with internal threads.
- External/internal and internal/external reducing unions have male threads on one end and female threads on the other. We recommend the use of external/internal fittings when connecting to an existing external nut.

Internal fittings are almost always the best with tubing of 1/8" OD or smaller. They make a stronger connection and offer the lower volume necessary for high performance instrumentation. Also, because 1/16" external fittings have very thin, easily distorted walls, they are not as durable as 1/16" internal fittings. In sizes larger than 1/8", external fittings are generally easier to make up because of less thread friction.

Bulkhead versions can be mounted through an instrument panel or on a bracket. The fitting body is undercut so that it bites into the panel when the mounting nut is tightened, eliminating the need for a lock washer. An O-ring can be installed between the body and the panel to allow operation in purged environments. Typically the mounting nut goes inside the instrument, so that the long threaded portion will be out of sight. In the external/internal bulkhead unions, the mounting nut is on the side with the Valco internal fitting.

DEAD VOLUME

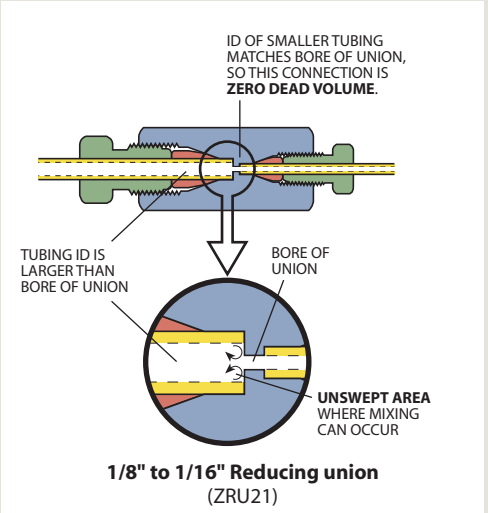
"Dead volume" is created in obvious situations such as the one shown.



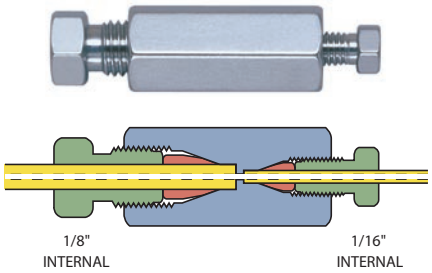
1/16" Tee
(ZT1)

UNSWEPT VOLUME

Even in connections which are by most definitions "zero dead volume", unswept volume may be created where large ID transitions occur. The amount of mixing depends on the amount of mismatch in the IDs.



1/8" to 1/16" Reducing union
(ZRU21)



Internal reducing union – metal
Standard bore
(ZRU21)

Internal reducing unions – stainless steel

These unions connect two sizes of tubing, using zero dead volume internal fittings on each end. In the bulkhead version, the bulkhead nut is on the side with smaller tubing.

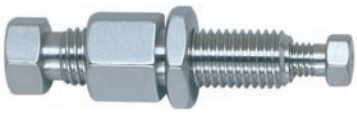
Standard material is 300 series stainless. Also available in Hastelloy C, gold-plated stainless, and titanium.

Standard internal reducing unions

Tubing OD	*Bore*	*Prod No*	*Price*
1/16" to 1/32"	0.15 mm	ZRU1.5XC	
	0.25 mm	ZRU1.5	
	0.50 mm	ZRU1.5L	
	1/32"	ZRU1.5T	
1/8" to 1/32"	0.25 mm	ZRU2.5	
	0.50 mm	ZRU2.5L	
	1/32"	ZRU2.5T	
1/8" to 1/16"	0.25 mm	ZRU21C	
	0.75 mm	ZRU21	
	1/16"	ZRU21T	
1/4" to 1/16"	0.25 mm	ZRU41C	
	0.75 mm	ZRU41	
	1/16"	ZRU41T	
1/4" to 1/8"	0.75 mm	ZRU42	
	2.0 mm	ZRU42L	
	1/8"	ZRU42T	

Bulkhead internal reducing unions

Tubing OD	*Bore*	*Prod No*	*Price*	**Bulkhead panel hole diameter**
1/16" to 1/32"	0.25 mm	ZBRU1.5		5/16"
	0.50 mm	ZBRU1.5L		5/16"
	1/32"	ZBRU1.5T		5/16"
1/8" to 1/32"	0.25 mm	ZBRU2.5		5/16"
	0.50 mm	ZBRU2.5L		5/16"
	1/32"	ZBRU2.5T		5/16"
1/8" to 1/16"	0.25 mm	ZBRU21C		5/16"
	0.75 mm	ZBRU21		5/16"
	1/16"	ZBRU21T		5/16"
1/4" to 1/16"	0.25 mm	ZBRU41C		7/16"
	0.75 mm	ZBRU41		7/16"
	1/16"	ZBRU41T		7/16"
1/4" to 1/8"	0.75 mm	ZBRU42		7/16"
	2.0 mm	ZBRU42L		7/16"
	1/8"	ZBRU42T		7/16"



Bulkhead internal reducing union – metal
(ZBRU21)

MORE INFORMATION

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

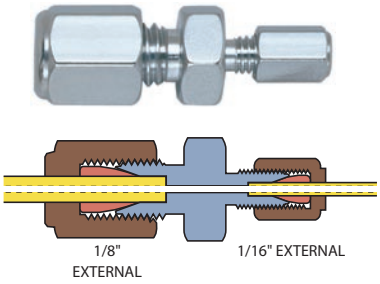
Reducing Unions

External reducing unions

These unions connect two sizes of tubing, using external fittings on each end. Standard material is 300 series stainless. Custom bulkhead versions are available in OEM quantities.

Standard external reducing unions

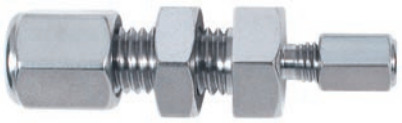
Tubing OD	*Bore*	*Prod No*	*Price*
1/8" to 1/16"	0.75 mm	ERU21	
	1.00 mm	ERU21L	
	1/16"	ERU21T	
1/4" to 1/16"	0.75 mm	ERU41	
	1/16"	ERU41T	
1/4" to 1/8"	1.0 mm	ERU42	
	2.0 mm	ERU42L	
	1/8"	ERU42T	



External reducing union
Standard bore
(ERU21)

Bulkhead external reducing unions

Tubing OD	*Bore*	*Prod No*	*Price*	**Bulkhead panel hole diameter**
1/8" to 1/16"	1.0 mm	EBRU12L		5/16"
	1/16"	EBRU12T		5/16"
1/4" to 1/16"	1.0 mm	EBRU14L		7/16"
	1/16"	EBRU14T		7/16"
1/4" to 1/8"	2.0 mm	EBRU24L		7/16"



Bulkhead external reducing union
(EBRU12L)

TECH TIP
Note: Because 1/16" external fittings have very thin, easily distorted walls, they are not as durable as 1/16" internal fittings. We recommend the use of 1/16" internal fittings when possible.

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

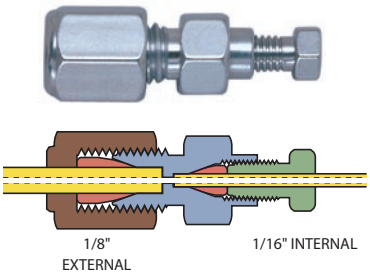
7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

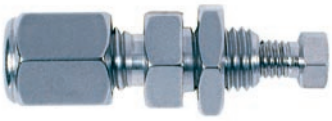
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

5/16" = .312" = 7.9 mm
3/8" = .375" = 9.5 mm
7/16" = .437" = 11.1 mm



External/internal reducing union
Standard bore
(EZRU21)



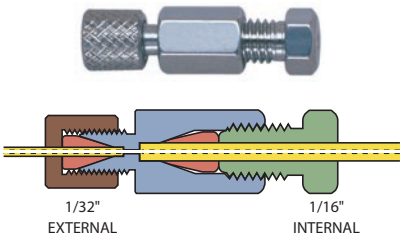
Bulkhead external/internal reducing union
(EZBRU21)

External/internal reducing unions

In these reducing unions, the larger size tubing is made up with an external fitting and the smaller size tubing is made up with an internal fitting. In the bulkhead version, the bulkhead nut is on the side with the internal fitting. Other configurations, such as an external nut on the locking nut side, are available on special request.

Standard material is 300 series stainless. Also available in Hastelloy C, gold-plated stainless, and titanium.

		Standard		Bulkhead		Bulkhead
Tubing OD	*Bore*	*Prod No*	*Price*	*Prod No*	*Price*	**panel hole diameter**
1/16" to 1/32"	0.25 mm	EZRU1.5		–		–
	0.50 mm	EZRU1.5L		EZBRU1.5L		5/16"
	1/32"	EZRU1.5T		EZBRU1.5T		5/16"
1/8" to 1/32"	0.25 mm	EZRU2.5		–		–
	0.50 mm	EZRU2.5L		EZBRU2.5L		5/16"
	1/32"	EZRU2.5T		EZBRU2.5T		5/16"
1/8" to 1/16"	0.25 mm	EZRU21C		–		–
	0.75 mm	EZRU21		EZBRU21		5/16"
	1/16"	EZRU21T		EZBRU21T		5/16"
1/4" to 1/16"	0.25 mm	EZRU41C		–		–
	0.75 mm	EZRU41		EZBRU41		7/16"
	1/16"	EZRU41T		EZBRU41T		7/16"
1/4" to 1/8"	1.0 mm	EZRU42		EZBRU42		7/16"
	2.0 mm	EZRU42L		EZBRU42L		7/16"
	1/8"	EZRU42T		EZBRU42T		



Internal/external reducing union
Standard bore
(EZRU.51)

Bulkhead internal/external reducing union
(EZBRU.51)

Internal/external reducing unions

These reducing unions are the opposite of the ones above. The larger size tubing is made up with an internal fitting and the smaller size tubing is made up with an external fitting. In the bulkhead version, the bulkhead nut is on the side with the internal fitting. Standard material is 300 series stainless.

Internal/external reducing unions are typically used to connect 1/16" stainless steel tubing to fused silica tubing.

Only polymeric ferrules should be used with 1/32" external details – metal ferrules will distort them. These unions include a stainless steel ferrule for the 1/16" SS tube, but because of the variety of fused silica ODs and corresponding ferrules, a 1/32" fused silica adapter must be ordered separately. *(See page 16.)*

		Standard		Bulkhead		Bulkhead
Tubing OD	*Bore*	*Prod No*	*Price*	*Prod No*	*Price*	**panel hole diameter**
1/16" to 1/32"	0.25 mm	EZRU.51		EZBRU.51		5/16"
	0.50 mm	EZRU.51L		EZBRU.51L		5/16"
	1/32"	EZRU.51T		EZBRU.51T		5/16"

MORE INFORMATION

Tees and Crosses

Tees

Tees connect three lines. Standard material is 300 series stainless. Also available in Hastelloy C, gold plated stainless, and titanium.

Tubing OD	*Bore*	*Prod No*	*Price*
1/32"	0.25 mm	ZT.5	
	0.50 mm	ZT.5L	
1/16"	0.25 mm	ZT1C	
	0.50 mm	ZT1M	
	0.75 mm	ZT1	
	1.00 mm	ZT1L	
1/8"	0.75 mm	ZT2	
	2.00 mm	ZT2L	
1/4"	1.00 mm	ZT4	
	4.60 mm	ZT4L	

Crosses

Crosses connect four lines. Standard material is 300 series stainless. Also available in Hastelloy C, gold plated stainless, and titanium.

Tubing OD	*Bore*	*Prod No*	*Price*
1/32"	0.25 mm	ZX.5	
	0.50 mm	ZX.5L	
1/16"	0.25 mm	ZX1C	
	0.50 mm	ZX1M	
	0.75 mm	ZX1	
	1.00 mm	ZX1L	
1/8"	0.75 mm	ZX2	
	2.00 mm	ZX2L	
1/4"	1.00 mm	ZX4	
	4.60 mm	ZX4L	

MORE INFORMATION

PEEK tees. . . . pages 57, 64
PEEK crosses 57, 64

SPECIAL METALS AND/OR SMALLER BORES

See microvolume connectors: 1/32" and 1/16" tees, crosses, Y's, and unions in various metals and polymers, with smaller bores.

Microvolume connectors . . . .pp 22-23
High pressure PEEK connectors. . 63-66
Nanovolume connectors 57-61

TECH TIP

To join tubes of different ODs, use the fitting sized for the largest tube along with IZR reducers for the smaller tubes.

IZR reducer. . . . . page 34

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

1/16" Manifolds

1/16" manifolds connect 4 - 16 inlet lines to a single outlet, and are often used to connect the outlets from several columns to a single detector. The unique angled entry of our design reduces dispersion to a minimum. Available with 1.00 mm inlet/outlet bore. Standard materials are PEEK or 300 series stainless.

	Inlet bore	*Outlet bore*	*Material*	*Prod No*	*Price*
4 inlets	0.25 mm	0.75 mm	Stainless steel	Z4M1	
	0.25 mm	0.75 mm	PEEK	Z4M1PK	
6 inlets	0.25 mm	0.75 mm	Stainless steel	Z6M1	
	0.25 mm	0.75 mm	PEEK	Z6M1PK	
8 inlets	0.25 mm	0.75 mm	Stainless steel	Z8M1	
	0.25 mm	0.75 mm	PEEK	Z8M1PK	
10 inlets	0.25 mm	0.75 mm	Stainless steel	Z10M1	
	0.25 mm	0.75 mm	PEEK	Z10M1PK	
12 inlets	0.25 mm	0.75 mm	Stainless steel	Z12M1	
	0.25 mm	0.75 mm	PEEK	Z12M1PK	
14 inlets	0.25 mm	0.75 mm	Stainless steel	Z14M1	
	0.25 mm	0.75 mm	PEEK	Z14M1PK	
16 inlets	0.40 mm	0.75 mm	PEEK	Z16M1PK	

1/8" Manifolds

1/8" manifolds connect 4 - 12 inlet lines to a single outlet, and are typically used in a gas distribution system to minimize the number of fitting connections. A manifold pipe fitting version is also available. (*See page 37.*) Standard material is 300 series stainless steel.

	Inlet bore	*Outlet bore*	*Prod No*	*Price*
4 inlets	2.00 mm	2.00 mm	Z4M2	
6 inlets	2.00 mm	2.00 mm	Z6M2	
8 inlets	2.00 mm	2.00 mm	Z8M2	
10 inlets	2.00 mm	2.00 mm	Z10M2	
12 inlets	2.00 mm	2.00 mm	Z12M2	

TECH TIP
A manifold used with an SD flowpath multiposition valve allows HPLC column selection with a single valve. See page 139 for an illustration.

SD UW valves. . . . . .pg 132

Internal Reducers

NEW Internal reducers — *for 360 µm tubing*

Directly connect 360 µm tubing into a 1/32" Valco valve or fitting detail, providing a positive leak-free seal with zero dead volume. The same patented design as our larger internal reducers (below). Both versions have a stainless steel body.

Tubing OD	*Nut/ferrule material*	*Prod No*	*Price*
1/32" to 360 µm	Stainless	C360IZR.5S6	
	PEEK	C360IZR.5S6PKG	

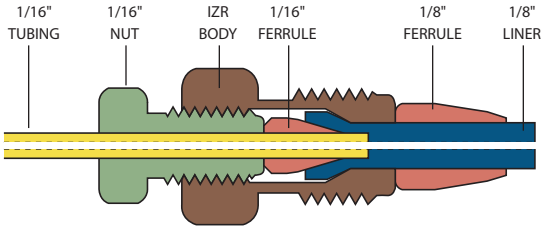
Internal reducers

Valco's patented internal reducer (IZR) allows smaller tubing to be used in valves with fitting details for larger tubing, forming a positive leak-free seal with zero dead volume. The small line from your system goes directly into the IZR and the sample goes directly into the valve, without the short pieces of connecting tubing required if a reducing union was used instead. (A reducing ferrule would also work, but makes a seal of less integrity.) Once the fitting is installed, only one wrench is required to remove and reinstall it.

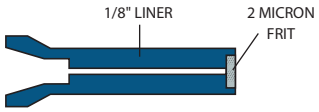
A second version has a 2 micron stainless steel frit pressed into the end of the liner, adding filtering capability. However, we suggest using these only as a final or backup filter, with a standard filter (*see page 52*) as the primary filter. Because IZRs have a much smaller surface area than the standard filter, they tend to plug too often if used in a stand-alone capacity.

Patent No. 4,173,363.

		Without frit		**With 2µ frit**	
Tubing OD	*Bore*	*Prod No*	*Price*	*Prod No*	*Price*
1/16" to 1/32"	0.25 mm	IZR1.5		IZR1.5F	
	0.50 mm	IZR1.5L		IZR1.5LF	
	1/32"	IZR1.5T		–	
1/8" to 1/16"	0.25 mm	IZR21C		IZR21CF	
	0.50 mm	IZR21		IZR21F	
	1.00 mm	IZR21L		IZR21LF	
	1/16"	IZR21T		–	
1/4" to 1/16"	1.00 mm	IZR41		IZR41F	
1/4" to 1/8"	1.00 mm	IZR42		IZR42F	
1/4" to 1/8"	2.00 mm	IZR42L		IZR42LF	



Valco's unique internal reducer
(IZR21)



IZR liner with pressed-in frit

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

External to internal adapters (injector/detector adapters)

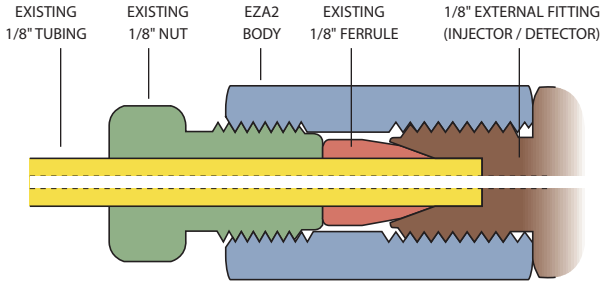
EZAs (external adapters) and EZRs (external reducers) adapt an external tee or union or the external type fittings common on injectors and detectors to Valco zero dead volume connections. Since EZAs are commonly used to connect an external fitting to an existing tube already made up with a Valco internal fitting, a nut and ferrule are not included.

Only one wrench is required to change tubes after the fitting is made up. While an external to internal union or reducing union plus a length of tubing can accomplish the same thing, these adapters do the trick with a single fitting.

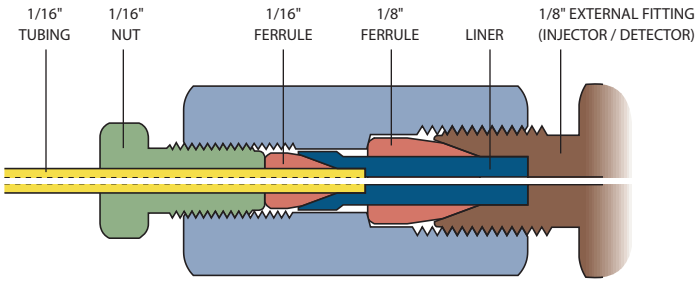
Standard material is 300 series stainless. The EZA does not include a nut or ferrule. The EZR includes a liner, one nut, and two ferrules.

Patent No. 4,173,363

Description	*Bore*	*Prod No*	*Price*
External to internal adapters			
1/16" ext. to 1/16" int.	–	EZA1	
1/8" ext. to 1/8" int.	–	EZA2	
External reducers			
1/16" ext. to 1/32" int.	0.25 mm	EZR1.5	
	1/32"	EZR1.5T	
1/8" ext. to 1/32" int.	0.25 mm	EZR2.5	
1/8" ext. to 1/16" int.	0.50 mm	EZR21	
	1/16"	EZR21T	
1/4" ext. to 1/16" int.	1.00 mm	EZR41	
	1/16"	EZR41T	
1/4" ext. to 1/8" int.	1.00 mm	EZR42	
	1/8"	EZR42T	



External to internal adapter (EZA2)



External to internal reducer (EZR21)

MORE INFORMATION

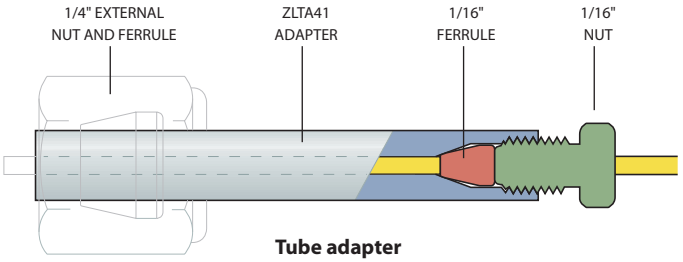
Ferrules ..... page 12
Nuts 10

Special Fittings

Tube adapters

These external adapters are ideal for connecting 1/16" tubing to a detector or injector with a 1/4" fitting. The shorter size is used with 1/4" external fittings while the longer works with 1/4" internal or external fittings. (1/16" nut and ferrule are included; 1/4" nut and ferrule are not.) Standard material is 300 series stainless.

Description	*Bore*	*Prod No*	*Price*
1/4" to 1/16"			
0.975" long	1/16"	ZTA41	
2.075" long	1/16"	ZLTA41	
2.800" long	1/16"	ZXLTA41	



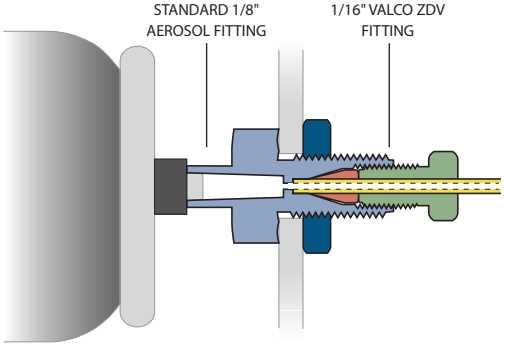
Tube adapter
(ZLTA41)

Aerosol adapter bulkhead union

This unique fitting provides an easy, direct method of connecting the nozzle of a standard aerosol can to a 1/16" Valco zero dead volume fitting.

As with all Valco bulkhead fittings, the flange is undercut to act as a "lock nut" against the instrument wall. Standard material is 300 series stainless.

Description	*Prod No*	*Price*
Aerosol adapter bulkhead union	ZBAA1	



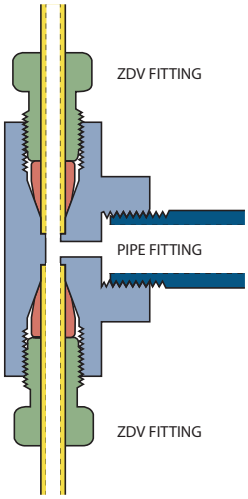
Aerosol adapter bulkhead union
(ZBAA1)

0.25 mm	=	.010"
0.50 mm	=	.020"
0.75 mm	=	.030"
1.0 mm	=	.040"
1.5 mm	=	.060"
2.0 mm	=	.080"
4.6 mm	=	.180"
6.0 mm	=	.236"
6.4 mm	=	.253"
7.0 mm	=	.275"
10.0 mm	=	.400"
27.0 mm	=	1.08"
1/32"	=	0.8 mm
1/16"	=	1.6 mm
1/8"	=	3.2 mm
1/4"	=	6.4 mm
3/8"	=	9.5 mm
1/2"	=	12.7 mm

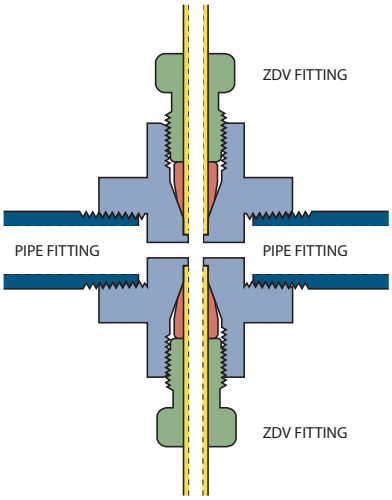
Manifold pipe adapters

These manifolds, which go from one or two pipe fittings to three or more Valco zero dead volume fittings, minimize the number of connections between a regulator and the various carrier gas lines in a chromatographic system. The models with two pipe fittings go a step further, allowing the support of a gauge, a second regulator, or a valve leading to a separate system. Additional Valco zero dead volume fittings can be machined on a special order basis. Standard material is 300 series stainless. Also available in Hastelloy C and titanium by special order.

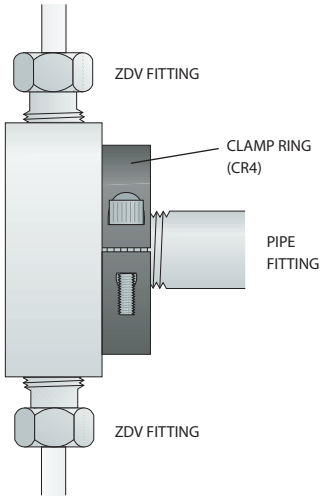
Description	*Bore*	*Prod No*	*Price*
One 1/8" female pipe to:			
three 1/16" ZDV fittings	1.0 mm	FP1Z3M21	
three 1/8" ZDV fittings	2.0 mm	FP1Z3M22	
three 1/4" ZDV fittings	4.6 mm	FP1Z3M24	
One 1/4" female pipe to:			
three 1/16" ZDV fittings	1.0 mm	FP1Z3M41	
three 1/8" ZDV fittings	2.0 mm	FP1Z3M42	
three 1/4" ZDV fittings	4.6 mm	FP1Z3M44	
Two 1/8" female pipe to:			
three 1/16" ZDV fittings	1.0 mm	FP2Z3M21	
three 1/8" ZDV fittings	2.0 mm	FP2Z3M22	
three 1/4" ZDV fittings	4.6 mm	FP2Z3M24	
Two 1/4" female pipe to:			
three 1/16" ZDV fittings	1.0 mm	FP2Z3M41	
three 1/8" ZDV fittings	2.0 mm	FP2Z3M42	
three 1/4" ZDV fittings	4.6 mm	FP2Z3M44	



One pipe fitting
to Valco ZDV fittings



Two pipe fittings
to Valco ZDV fittings



Adapter with optional mounting clamp ring

Pipe Adapters

Male pipe to Valco internal adapters

Male pipe adapters make a minimum volume connection from the female pipe fittings on pressure gauges and regulators to Valco zero dead volume internal fittings. Standard material is 300 series stainless. Also available in Hastelloy C and titanium.

Description	*Bore*	*Prod No*	*Price*
1/8" NPT male to:			
1/16" ZDV fitting	1.0 mm	PZA21	
1/16" ZDV fitting	1/16"	PZA21T	
1/8" ZDV fitting	1.0 mm	PZA22	
1/4" NPT male to:			
1/16" ZDV fitting	1.0 mm	PZA41	
1/8" ZDV fitting	1.0 mm	PZA42	
1/8" ZDV fitting	2.0 mm	PZA42L	
1/4" ZDV fitting	4.6 mm	PZA44L	
1/2" NPT male to:			
1/16" ZDV fitting	1.0 mm	PZA81	
1/8" ZDV fitting	1.0 mm	PZA82	
1/8" ZDV fitting	2.0 mm	PZA82L	
1/4" ZDV fitting	4.6 mm	PZA84L	

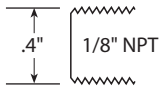
MORE INFORMATION
Our manifold pipe adapters on page 37 allow you to connect one or two pipe fittings to three Valco zero dead volume fittings.

Female pipe to Valco internal adapters

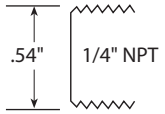
Female pipe adapters make a minimum volume connection from the male pipe fittings typically found in gas distribution plumbing to Valco zero dead volume internal fittings. Standard material is 300 series stainless. Also available in Hastelloy C and titanium.

Description	*Bore*	*Prod No*	*Price*
1/8" NPT female to:			
1/16" ZDV fitting	1.0 mm	FPZA21	
1/8" ZDV fitting	1.0 mm	FPZA22	
1/8" ZDV fitting	2.0 mm	FPZA22L	
1/4" NPT female to:			
1/16" ZDV fitting	1.0 mm	FPZA41	
1/8" ZDV fitting	1.0 mm	FPZA42	
1/8" ZDV fitting	2.0 mm	FPZA42L	
1/4" ZDV fitting	4.6 mm	FPZA44L	
1/2" NPT female to:			
1/16" ZDV fitting	1.0 mm	FPZA81	
1/8" ZDV fitting	1.0 mm	FPZA82	
1/8" ZDV fitting	2.0 mm	FPZA82L	
1/4" ZDV fitting	4.6 mm	FPZA84L	

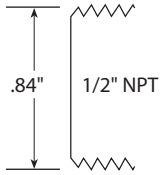
TECH TIP
NPT, National Pipe Thread, is a standard developed a long time ago by people without rulers. 1/8" NPT is nowhere close to 1/8"! Measure the diameter of the fitting across the narrow end. You can also count the number of threads in a 1" section. Then look at the diagrams below to determine the correct size needed.



27 threads per inch



18 threads per inch



14 threads per inch

Male pipe to Valco external adapters

Male pipe adapters make a minimum volume connection from the female pipe fittings typically found on pressure gauges and regulators to Valco external fittings. Standard material is 300 series stainless.

Note: We do not manufacture adapters with 1/16" external fittings because they have very thin, easily distorted walls. We recommend use of the PZAs on the facing page.

Description	*Bore*	*Prod No*	*Price*
1/8" NPT male to:			
1/8" external fitting	2.0 mm	PEA22	
1/4" external fitting	4.6 mm	PEA24	
1/4" NPT male to:			
1/8" external fitting	2.0 mm	PEA42	
1/4" external fitting	4.6 mm	PEA44	
1/2" NPT male to:			
1/8" external fitting	2.0 mm	PEA82	
1/4" external fitting	4.6 mm	PEA84	

TECH TIP
Because of their dead volume and the risk of thread leaks, pipe fittings are a poor choice for trace gas analysis. Thread sealants, particularly PTFE tape, cannot boost their performance to adequate levels. For trace gas applications, choose Valco zero dead volume fittings with gold-plated stainless ferrules. *(See page 12.)*

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

Female pipe to Valco external adapters

Female pipe adapters make a minimum volume connection from the male pipe fittings typically found in gas distribution plumbing to Valco external fittings. Standard material is 300 series stainless.

Note: We do not manufacture adapters with 1/16" external fittings because they have very thin, easily distorted walls. We recommend use of the FPZAs on the facing page.

Description	*Bore*	*Prod No*	*Price*
1/8" NPT female to:			
1/8" external fitting	2.0 mm	FPEA22	
1/4" external fitting	4.6 mm	FPEA24	
1/4" NPT female to:			
1/8" external fitting	2.0 mm	FPEA42	
1/4" external fitting	4.6 mm	FPEA44	
1/2" NPT female to:			
1/8" external fitting	2.0 mm	FPEA82	
1/4" external fitting	4.6 mm	FPEA84	

Syringe Adapters

NEW Zero dead volume fill ports

The ZVISF-1 is a unique fill port fitting designed so that a leaktight seal is formed against the face of the bottom of the fitting detail instead of at the end of an angular ferrule, resulting in a true zero dead volume connection with no carry over or sample loss. The polymer bushing snaps into the knurled PEEK nut, providing the convenience of a one-piece fitting. An ultrathin metal sleeve surrounds and supports the portion of the bushing which extends into the pilot of the fitting detail, preventing the bushing from mushrooming and getting stuck in the pilot as the fitting is tightened.

For use with 22 gauge blunt tip needle.

Description		*Prod No*	*Price*
For high pressure 1/16" Cheminert injectors with polymeric stators (C2, C3, C4, and C52 series)			
Most applications	PFA bushing	ZVISF-1PFAH	
High throughput applications	High density polyethylene bushing	ZVISF-1PEH	
For low pressure 1/16" Cheminert injectors, fittings, and most Valco injectors			
Most applications	PFA bushing	ZVISF-1PFA	
High throughput applications	High density polyethylene bushing	ZVISF-1PE	

Fill ports *for 1/16" polymeric Cheminert valves*

These fill ports provide direct syringe connections to polymeric valves and fittings. Since the fitting detail in the high pressure Cheminert valve is unique, be sure to order the high pressure version for polymeric HPLC injectors. For use with 22 gauge blunt tip needle.

Description	*Prod No*	*Price*
For high pressure injectors (C2, C3, C4, and C52 series injectors)	C-VISF-1H	
For fittings and low pressure injectors (C22Z and C62Z series injectors)	C-VISF-1	
Replacement liners and ferrules		
Liner for C-VISF-1	VISL-1	
Liner for C-VISF-1H	VISL-1H	
Ferrule for C-VISF-1 (or 1H)	ZF1VISF	

Fill ports *for metal Valco and Cheminert valves*

Fill ports provide direct syringe connections to valves and fittings, with the polymeric ferrule compressing a liner to seal around the needle. These fill ports are for use with metal valves.

Description	*Prod No*	*Price*
For use with blunt tip needle		
For 1/16" fittings and injectors - 22 ga	VISF-1	
For 1/32" fittings and injectors - 26 ga	VISF.5FPK	
For use with 2" 22 gauge blunt tip needle		
For 1/16" fittings and injectors	VISF-2	
For 1/8" fittings and injectors	VISF-A	
Replacement liners and ferrules		
Liner for VISF-1	VISL-1	
Liner for VISF-2 or VISF-A	VISL-2	
Ferrule for VISF-1 or VISF-2	ZF1VISF	

TECH TIP
When using Cheminert Nanovolume® CN2 injectors and valves, use fill ports designed just for them.

Nanovolume fill ports ..... page 60

for Cheminert C2 and C4 valves

Loop fill port assembly

The loop fill port assembly, for use with Cheminert high pressure valves (C2 and C4 series), permits sample loading and manual injection from the front of the valve. It includes an aluminum bracket, two syringe fill ports (for 3/4" or 2" needles), a bulkhead union, and two pieces of stainless tubing: one piece is 0.013" ID with a volume of 7 µl, and the other is 0.50 mm ID and 17 µl.

Description	*Prod No*	*Price*
Loop fill port assembly	C-LFP	

Female luer adapters

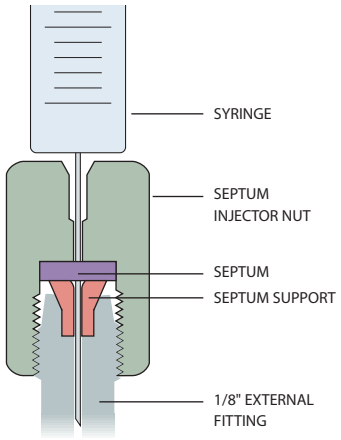
Female luer adapters provide direct syringe connections to zero dead volume fittings and valves.

Description		*Prod No*	*Price*
Female luer to:	1/32" fitting	ZLA-.5	
	1/16" fitting	ZLA-1	
	1/8" fitting	ZLA-2	

Septum injector nuts

Septum injector nuts are a simple way to provide syringe access to any point of a gas or liquid system. The injector nut includes a Valcon T polyimide septum support which accepts a standard 1/4" GC septum. The nut's 1/8" external fitting detail can connect directly to common external type fittings, or can be adapted to Valco internal fittings using an external/internal union or reducing union.

Description	*Prod No*	*Price*
Septum injector nut with support	EN2SI	
Replacement support	ZF2SI	
Septum, low bleed, pkg. of 10	SI4G	



Septum injector nut
with septum and support (EN2SI)

MORE INFORMATION

External/internal reducing unions . . pg 31
External/internal unions 27

Cheminert valves

Model C2 . . . . . 158, 161
Model C4 . . . . . 159, 162

0.25 mm	=	.010"
0.50 mm	=	.020"
0.75 mm	=	.030"
1.0 mm	=	.040"
1.5 mm	=	.060"
2.0 mm	=	.080"
4.6 mm	=	.180"
6.0 mm	=	.236"
6.4 mm	=	.253"
7.0 mm	=	.275"
10.0 mm	=	.400"
27.0 mm	=	1.08"
1/32"	=	0.8 mm
1/16"	=	1.6 mm
1/8"	=	3.2 mm
1/4"	=	6.4 mm
3/8"	=	9.5 mm
1/2"	=	12.7 mm

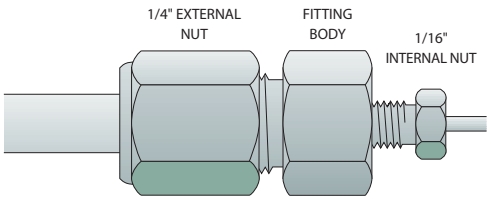
HPLC Column End Fittings

Although our column end fittings look like ordinary reducing unions, they are machined with a conical recess to match a specific column ID so that there are no abrupt or irregular diameter changes which can cause loss of theoretical plates. *(See illustrations, below.)* This optimization results in an assortment of column end fittings for each column OD. To receive full benefit of this design, use column end fittings only with the specific column ID for which they are intended. We can design special fittings for unusual sizes or OEM use.

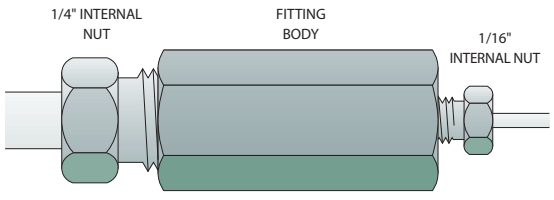
If a temporary frit is used during column packing, the frit OD should match the column OD. Permanent frits should have an OD matched to the column ID, and should be pressed in to give the lowest dead volume. Our frits are available in a variety of pore sizes, and we offer titanium and Hastelloy C frits for systems sensitive to exposed stainless steel.

All column end fittings are rated to 10,000 psi. However, the functional limit is dictated by the yield strength of the tubing used with the fitting. Standard 1/4", 3/8", and 1/2" columns are usually packed at 8,000-10,000 psi, which is right at the yield strength for the tubing commonly used. Columns with 1" ID have a yield strength of 6,000-8,000 psi, and the fitting will not hold if the system pressure exceeds that limit.

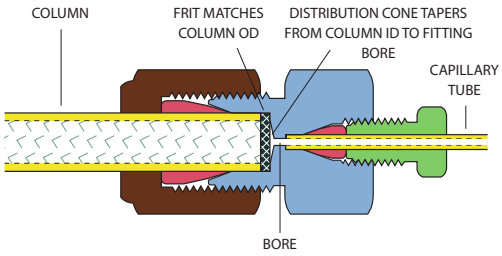
The newest addition to the line is the Nanovolume® column end fitting. *(See page 62.)* These all-PEEK fittings feature fingertight zero dead volume connections with 100 or 150 micron bore. PEEK sleeves permit use with any fused silica tubing.

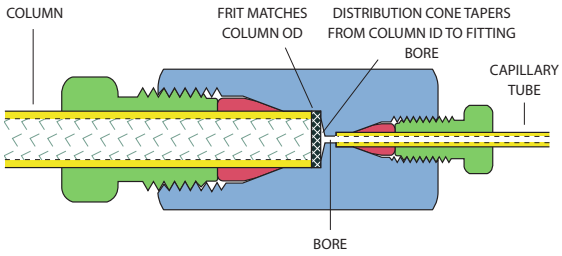


External column end fitting
1/4" to 1/16", 4.6 mm column ID, with removable frit
(ECEF414.6F)



Internal column end fitting
1/4" to 1/16", 4.6 mm column ID, with removable frit
(CEF414.6F)





MORE INFORMATION
Frits . . . . . page 45

TECH TIP
Standard column end fittings are Type 316 stainless, but since the column wall and frit form over 99% of the column surface area, standard fittings with titanium frits can generally be used on inert columns.

TECH TIP
When packing columns, use Valco "through-type" unions to couple the column to the packing reservoir.

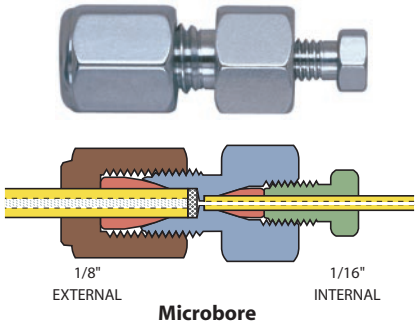
Size	*Prod No*
1/16" union	ZU1T
1/8" union	ZU2T
1/4" union	ZU4T

Through-type unions for packing columns . . . . . page 26

Microbore column end fittings *(1.0 mm – 2.0 mm column ID)*

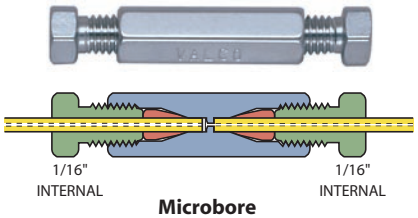
Standard material is Type 316 stainless.

	Bore	Column ID	Without frit Prod No	Price	Removable 2µ frit Prod No	Price
External column end fittings						
1/16" to 1/16"	0.25 mm	1.0 mm	ECEF111.0		ECEF111.0F	
1/8" to 1/16"	0.25 mm	1.0 mm	ECEF211.0		ECEF211.0F	



Microbore external column end fitting
(ECEF211.0F)

	Bore	Column ID	Without frit Prod No	Price	Removable 2µ frit Prod No	Price
Internal column end fittings						
1/16" to 1/32"	0.25 mm	1.0 mm	CEF1.5		CEF1.5F	
1/16" to 1/16"	0.25 mm	1.0 mm	CEF1		CEF1F	
1/8" to 1/32"	0.25 mm	1.0 mm	CEF2.51.0		CEF2.51.0F	
1/8" to 1/16"	0.25 mm	1.0 mm	CEF211.0		CEF211.0F	
1/8" to 1/16"	0.25 mm	2.0 mm	CEF212.0		CEF212.0F	



Microbore internal column end fitting
(CEF1F)

NANOBORE COLUMN END FITTINGS
See our complete line of 100 µm and 150 µm bore fittings on page 62.

100 µm = .004"
150 µm = .006"

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

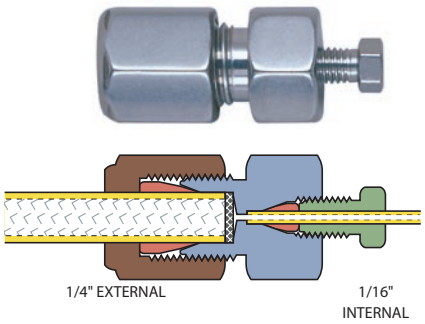
1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

HPLC Column End Fittings

Analytical column end fittings *(2.0 mm – 4.6 mm column ID)*

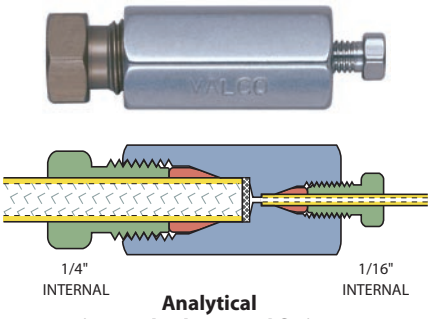
Standard material is Type 316 stainless.

	Bore	Column ID	Without frit Prod No	Price	Removable 2µ frit Prod No	Price
External column end fittings						
1/4" to 1/16"	0.4 mm	2.1 mm	ECEF412.1		ECEF412.1F	
1/4" to 1/16"	0.4 mm	3.0 mm	ECEF413.0		ECEF413.0F	
1/4" to 1/16"	0.4 mm	4.0 mm	ECEF414.0		ECEF414.0F	
1/4" to 1/16"	0.4 mm	4.6 mm	ECEF414.6		ECEF414.6F	



Analytical external column end fitting with removable frit (ECEF414.6F)

	Bore	Column ID	Without frit Prod No	Price	Removable 2µ frit Prod No	Price
Internal column end fittings						
1/4" to 1/16"	0.4 mm	2.1 mm	CEF412.1		CEF412.1F	
1/4" to 1/16"	0.4 mm	3.0 mm	CEF413.0		CEF413.0F	
1/4" to 1/16"	0.4 mm	4.0 mm	CEF414.0		CEF414.0F	
1/4" to 1/16"	0.4 mm	4.6 mm	CEF414.6		CEF414.6F	



Analytical internal column end fitting with removable frit (CEF414.6F)

NANOBORE COLUMN END FITTINGS
See our complete line of 100 µm and 150 µm bore fittings on page 62.

100 µm = .004"
150 µm = .006"

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

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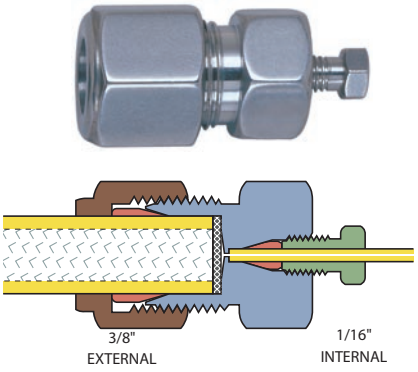
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

Semi-preparative and preparative column end fittings

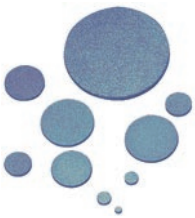
Standard material is Type 316 stainless.

	Bore	Column ID	Without frit Prod No	Price	Removable 2µ frit Prod No	Price
External column end fittings						
3/8" to 1/16"	0.40 mm	6.0 mm	ECEF616.0		ECEF616.0F	
3/8" to 1/16"	0.40 mm	7.0 mm	ECEF617.0		ECEF617.0F	
1/2" to 1/16"	0.75 mm	9.0 mm	ECEF819.0		ECEF819.0F	
1/2" to 1/16"	0.75 mm	10.0 mm	ECEF8110.0		ECEF8110.0F	
1" to 1/16"	0.75 mm	20.0 mm	ECEF1K1		ECEF1K1F	



Semi-preparative external column end fitting
(ECEF616.0F)

Replacement frits

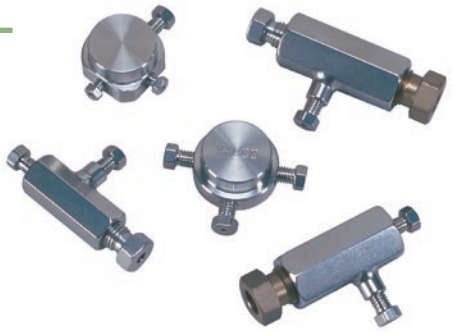


1/16", 1/8" and 1/4" frits are sold in packages of 10. 3/8", 1/2", and 1" frits are sold individually. Other sizes may be available or special-ordered in OEM quantities.

	Pore Size	Frit thickness	Stainless steel Prod No	Price	Hastelloy C Prod No	Price	Titanium Prod No	Price
Package of 10:								
1/16" frits	0.5µ	0.75 mm	.5FR1-10		.5FR1HC-10		–	
	2µ	0.75 mm	2FR1-10		2FR1HC-10		2FR1TI-10	
	10µ	0.75 mm	10FR1-10		–		–	
1/8" frits	0.5µ	1.00 mm	.5FR2-10		–		–	
	2µ	1.00 mm	2FR2-10		2FR2HC-10		2FR2TI-10	
	10µ	1.00 mm	10FR2-10		–		–	
1/4" frits	0.5µ	1.00 mm	.5FR4-10		–		–	
	2µ	1.00 mm	2FR4-10		2FR4HC-10		2FR4TI-10	
	10µ	1.00 mm	10FR4-10		10FR4HC-10		–	
Each:								
3/8" frits	2µ	1.00 mm	2FR6		2FR6HC		2FR6TI	
1/2" frits	2µ	1.00 mm	2FR8		2FR8HC		2FR8TI	
1" frits	2µ	1.50 mm	2FR1K		2FR1KHC		2FR1KTI	

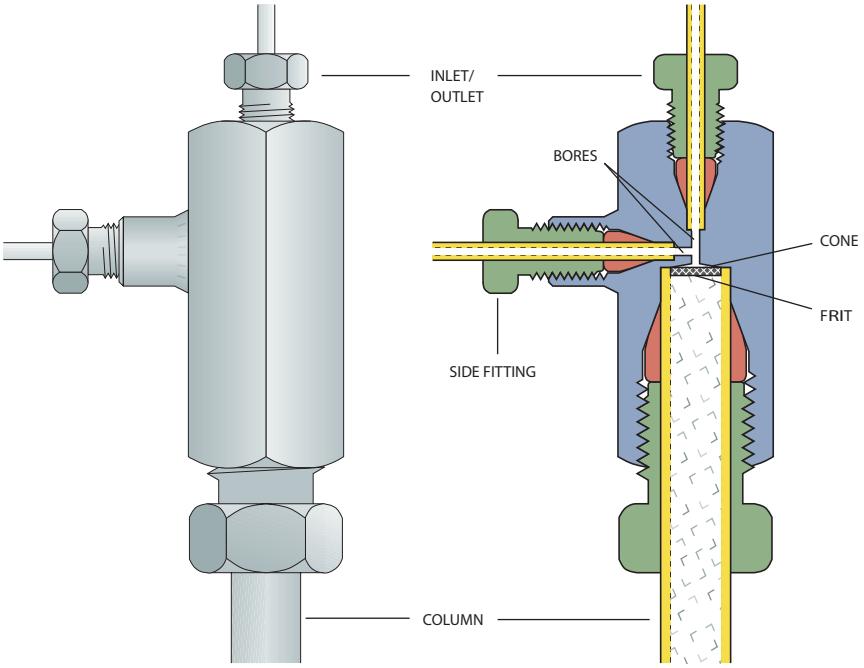
Post-Column Reaction Tee Fittings

Post-column reaction tee fitting



The tee column end fitting (TCEF) has a third connection perpendicular to the normal flowpath. The TCEF permits post-column derivation, or may be used as a curtain flow column inlet fitting. Standard material is Type 316 stainless.

Column OD	*Cone OD*	*Inlet/outlet OD*	*Bore*	*Side OD*	*Bore*	*Prod No*	*Price*
1/16"	1.0 mm	1/32"	0.25 mm	1/32"	0.25 mm	TCEF1.5.5C	
1/16"	1.0 mm	1/32"	0.90 mm	1/32"	0.25 mm	TCEF1.5.5T	
1/16"	1.0 mm	1/16"	0.25 mm	1/16"	0.25 mm	TCEF111	
1/8"	1.0 mm	1/16"	0.50 mm	1/16"	0.50 mm	TCEF211	
1/8"	1.0 mm	1/16"	1.65 mm	1/16"	0.40 mm	TCEF211T	
1/4"	4.6 mm	1/16"	0.25 mm	1/16"	0.25 mm	TCEF411C	
1/4"	4.6 mm	1/16"	0.75 mm	1/16"	0.75 mm	TCEF411	
1/4"	4.6 mm	1/16"	1.65 mm	1/16"	0.75 mm	TCEF411T	
1/4"	4.6 mm	1/8"	0.75 mm	1/16"	0.75 mm	TCEF421	
3/8"	6.0 mm	1/16"	0.75 mm	1/16"	0.75 mm	TCEF611	
3/8"	6.0 mm	1/16"	1.65 mm	1/16"	0.75 mm	TCEF611T	
1/2"	9.0 mm	1/16"	0.75 mm	1/16"	0.75 mm	TCEF811	
1/2"	9.0 mm	1/16"	1.65 mm	1/16"	0.75 mm	TCEF811T	



Post-column reaction fitting
(TCEF411)

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

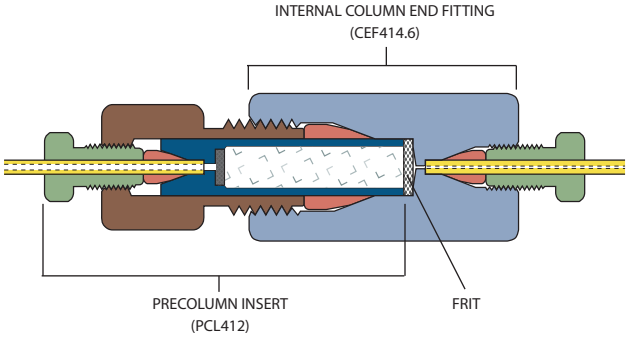
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

Precolumns (guard columns)

Precolumns are available in 2 cm and 5 cm lengths, and can be filled with either 5µ packing or 37 - 44µ pellicular packing. Both lengths are used in conjunction with a column end fitting. When packed for high efficiency they can be used as analytical columns, but a more typical use is as a guard column installed between the injector and the analytical column. Standard material is Type 316 stainless.

Description	*Prod No*	*Price*
1/4" x 2 cm precolumn system	PCS412F	
Includes:		
One precolumn insert		
One internal column end fitting		
One 2µ frit		
1/4" x 5 cm precolumn system	PCS415F	
Includes:		
One precolumn insert		
One external column end fitting		
One 2µ frit		
Precolumns (for use with existing column end fittings)		
1/4" x 2 cm precolumn insert	PCL412	
1/4" x 5 cm precolumn insert	PCL415	



1/4" x 2 cm precolumn system
(PCS412F)

Fingertight HPLC cartridge precolumns

This cartridge-based system is designed for use as a precolumn or concentrator column in HPLC and FIA applications. It is particularly suited to applications requiring frequent changes: snap-on seals are replaceable, the cartridge is reusable, and the tubing connections are stable since the end fittings do not rotate as the assembly is tightened. Standard material is Type 316 stainless, with PEEK seals and 2µ titanium frits.

Description	*Prod No*	*Price*
0.25 ml (4.0 mm ID x 2 cm)		
Fin gertight cartridge assembly	SFECH412	
Replaceable cartridge	SFEC42	

NOTE:
As a courtesy to our OEM customers, VICI does not supply pre-packed columns.

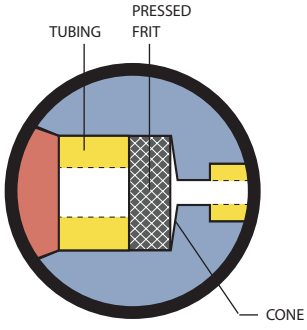
Filters

There are many flow elements of analytical instruments which require protection from foreign particles, such as orifices that may become plugged or surfaces that may get scratched. However, conventional filtering devices may have too large a volume to be consistent with good system performance – particularly in chromatographic applications.

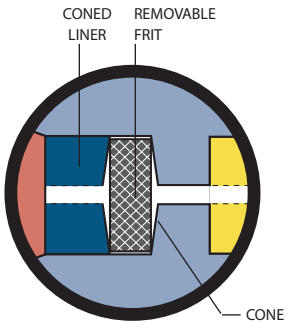
Valco's unique patented* filter design results in extremely low internal volume and simplifies filter element replacement. Filter bodies are "coned" for uniform flow and maximum filter surface area. The filters are made entirely of metal, so they can be used at any instrumentation temperature. While the standard metal is 316 series stainless, filters can be made from alloys that can be used in virtually any application.

We offer a choice of three different filtering elements. All styles are available in bulkhead configurations for mounting on a panel or instrument wall. (Please note that since frits and screens have significantly different thicknesses, they cannot be used interchangeably in the same filter body.)

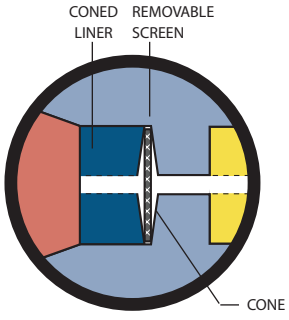
- **Pressed frits**, permanently installed in the filter, are recommended where contaminants are the exception and not the rule. The frits are 2µ stainless.
- **Removable frits** are the best choice for maximum filtration, or if the application requires Hastelloy C or titanium. However, they allow more mixing and tend to clog more than screens. A 2µ frit is included with the filter, but 0.5, 2, and 10µ replacement frits are available in three materials.
- **Removable screens** plug less rapidly and provide lower pressure drop than frits. Since they are thinner, there is less mixing and dispersal than might occur with a frit, but frits provide better filtration. A 2µ screen is included with the filter, and 2 and 10µ stainless replacement screens may be ordered.



Pressed frit



Removable frit



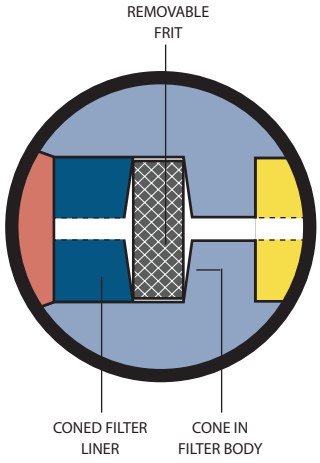
Removable screen

* Patent Numbers 4,281,679 and 4,173,363

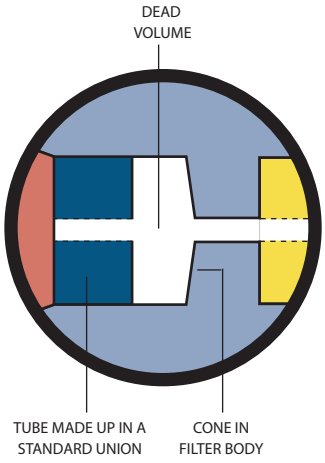
MORE INFORMATION

Filters with removable frits are designed to compensate for the thickness of the filter element – the resulting pilot depths are identical with the rest of the Valco product line, facilitating interchangeability of *made up* fittings. Therefore, although our filters look very much like our unions, they are not interchangeable with unions; a filter with its frit removed should not be substituted for a union, because the space designed for the frit introduces dead volume into the system. In addition, since filter bodies are coned, they will have dead volume when used as a union even if the tubing is made up in the filter with a longer, non-standard pilot length.

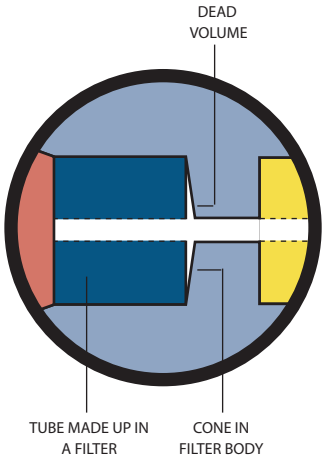
An arrow imprinted on all filter bodies serves to differentiate them from unions and to indicate recommended flow direction.



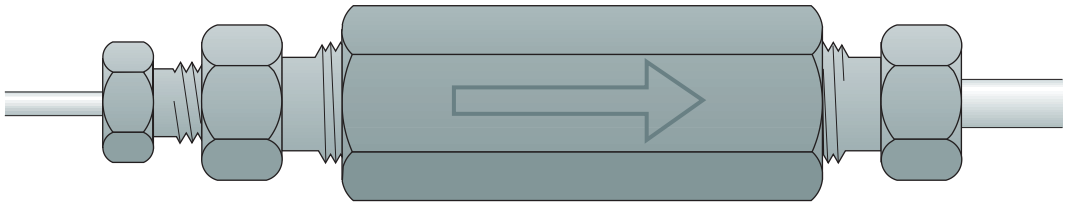
Filter with removable frit
Coned for uniform flow and maximum filter surface



Filter with frit removed being used as a reducing union
Dead volume is created where frit should be



Filter with frit removed being used as a reducing union
Cone in filter body creates dead volume

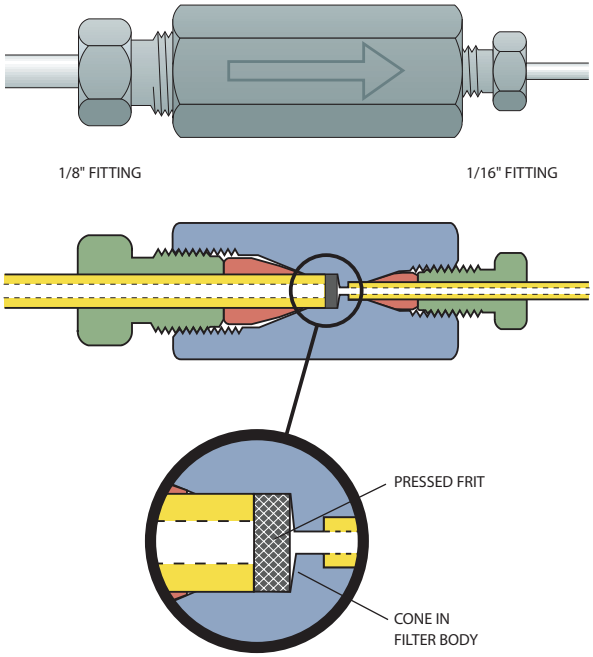


Arrow imprinted on filter body showing recommended direction of flow

Filters with a pressed frit

Pressed frit filters contain a permanently installed stainless steel 2µ frit, and are recommended for applications where contaminants are the exception and not the rule – that is, when the sample is generally clean but you wish to guard against the stray burr from a carelessly prepared tube end that might find its way into the flowpath. Standard material is Type 316 stainless.

		Standard		Bulkhead	
Description	*Bore*	*Prod No*	*Price*	*Prod No*	*Price*
1/16" to 1/32"	0.25 mm	ZRUF1.5		ZBRUF1.5	
1/16" to 1/16"	0.75 mm	ZUF1		ZBUF1	
1/8" to 1/16"	0.75 mm	ZRUF21		ZBRUF21	
1/8" to 1/8"	0.75 mm	ZUF2		ZBUF2	
1/4" to 1/8"	2.00 mm	ZRUF42		ZBRUF42	
1/4" to 1/4"	4.60 mm	ZUF4		ZBUF4	



Reducing filter with a pressed frit
1/8" to 1/16"
(ZRUF21)

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

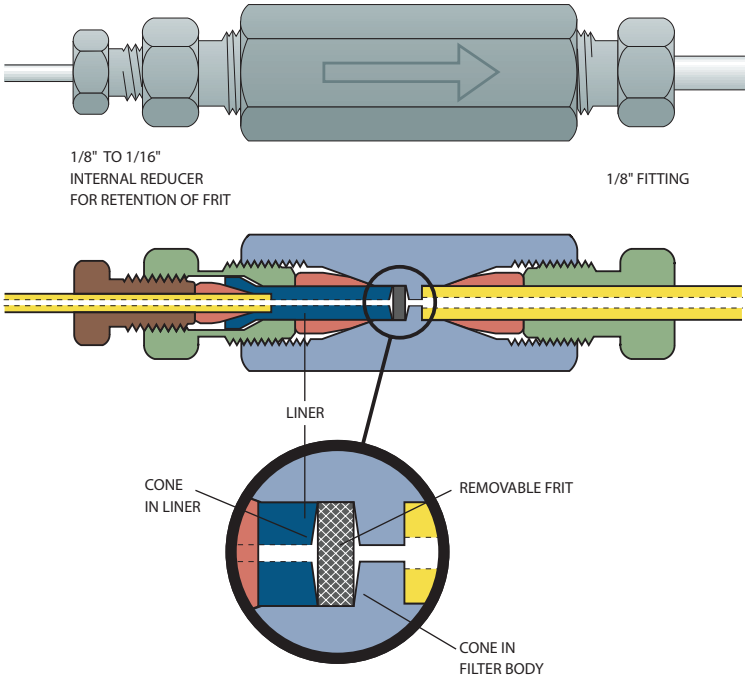
1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

Filters with a removable frit

These filters come with a removable 2µ frit. The standard frit can be replaced with any frit of the proper diameter, *but not by a screen*. These filters are suitable for streams with frequent contamination, since the filtering element is easily changed. Standard material is Type 316 series stainless.

Patent Numbers 4,281,679 and 4,173,363

		Standard		Bulkhead	
Description	*Bore*	*Prod No*	*Price*	*Prod No*	*Price*
1/32" to 1/32"	0.25 mm	ZUFR.5F		ZBUFR.5F	
1/16" to 1/32"	0.25 mm	ZRUFR1.5F		ZBRUFR1.5F	
1/16" to 1/16"	0.25 mm	ZUFR1CF		ZBUFR1CF	
	0.50 mm	ZUFR1F		ZBUFR1F	
1/8" to 1/16"	0.75 mm	ZRUFR21F		ZBRUFR21F	
1/8" to 1/8"	2.00 mm	ZUFR2F		ZBUFR2F	
1/4" to 1/16"	1.00 mm	ZRUFR41F		ZBRUFR41F	
1/4" to 1/8"	2.00 mm	ZRUFR42F		ZBRUFR42F	



Reducing filter with a removable frit
1/8" to 1/16"
(ZRUFR21F)

TECH TIP
Should you use a filter with a frit or one with a screen?

Screens have much higher flow capacity (Cv), but frits are the best choice for maximum filtration or if your application requires Hastelloy C or titanium. However, since they are thicker than screens, frits allow more mixing, and the downside of their superior filtration is that they clog more often than screens.

Note! The difference in thickness also means that frits and screens cannot be used interchangeably in the same fitting body:

A frit must always be replaced with a frit.

A screen must always be replaced with a screen.

Replacement frits ..... page 53

Filters

ilters with a removable screen

These filters come with a removable 2µ screen. The standard screen can be replaced with any screen of the proper diameter, *but not by a frit*. These filters are suitable for streams with frequent contamination, since the filtering element is easily changed. Standard material is Type 316 series stainless.

atent Numbers 4,281,679 and 4,173,363

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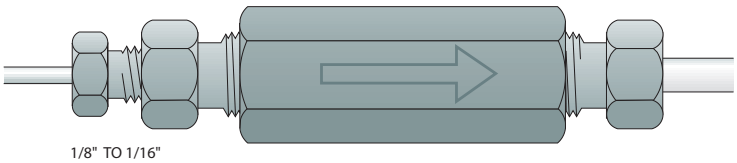
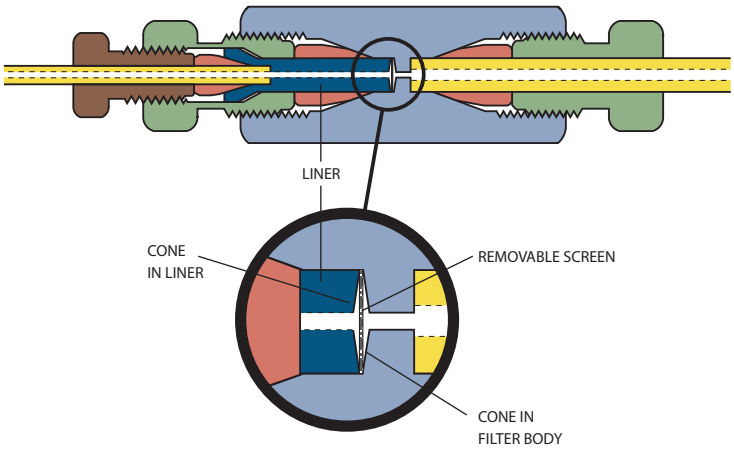
		Standard		Bulkhead	
Description	*Bore*	*Prod No*	*Price*	*Prod No*	*Price*
1/32" to 1/32"	0.25 mm	ZUFR.5		ZBUFR.5	
1/16" to 1/32"	0.25 mm	ZRUFR1.5		ZBRUFR1.5	
1/16" to 1/16"	0.25 mm	ZUFR1C		ZBUFR1C	
	0.50 mm	ZUFR1		ZBUFR1	
1/8" to 1/16"	0.75 mm	ZRUFR21		ZBRUFR21	
1/8" to 1/8"	2.00 mm	ZUFR2		ZBUFR2	
1/4" to 1/16"	1.00 mm	ZRUFR41		ZBRUFR41	
1/4" to 1/8"	2.00 mm	ZRUFR42		ZBRUFR42	



1/8" TO 1/16"
INTERNAL REDUCER
TO HOLD SCREEN IN POSITION

1/8" FITTING



Reducing filter with a removable screen
1/8" to 1/16"
(ZRUFR21)

TECH TIP
Should you use a filter with a frit or one with a screen?

Screens have much higher flow capacity (Cv), but frits are the best choice for maximum filtration or if your application requires Hastelloy C or titanium. However, since they are thicker than screens, frits allow more mixing, and the downside of their superior filtration is that they clog more often than screens.

Note! The difference in thickness also means that frits and screens cannot be used interchangeably in the same fitting body:

A frit must always be replaced with a frit.

A screen must always be replaced with a screen.

Replacement screens..... page 53

0.25 mm = .010"
0.50 mm = .020"
0.75 mm = .030"

1.0 mm = .040"
1.5 mm = .060"
2.0 mm = .080"

4.6 mm = .180"
6.0 mm = .236"
6.4 mm = .253"

7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

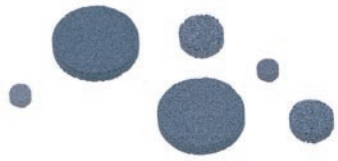
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

5/16" = .312" = 7.9 mm
3/8" = .375" = 9.5 mm
7/16" = .437" = 11.1 mm

Replacement frits

Other sizes may be available or special ordered in OEM quantities.
Note: If a filter was ordered with a removable frit, the frit ***cannot*** be replaced with a screen.



Package of 10:	*Pore Size*	*Frit Thickness*	Stainless Steel *Prod No*	*Price*	Hastelloy C *Prod No*	*Price*	Titanium *Prod No*	*Price*
1/16" frits	0.5µ	0.75 mm	.5FR1-10		.5FR1HC-10		–	
	2µ	0.75 mm	2FR1-10		2FR1HC-10		2FR1TI-10	
	10µ	0.75 mm	10FR1-10		–		–	
1/8" frits	0.5µ	1.00 mm	.5FR2-10		.5FR2HC-10		–	
	1µ	1.00 mm	1FR2-10		1FR2HC-10		–	
	2µ	1.00 mm	2FR2-10		2FR2HC-10		2FR2TI-10	
	10µ	1.00 mm	10FR2-10		–		–	
1/4" frits	0.5µ	1.00 mm	.5FR4-10		–		–	
	2µ	1.00 mm	2FR4-10		2FR4HC-10		2FR4TI-10	
	10µ	1.00 mm	10FR4-10		10FR4HC-10		–	

WHICH FRIT FITS MY FILTER?

1/16" frit fits:
ZUFR.5F
ZBUFR.5F

ZRUFR1.5F
ZBRUFR1.5F

1/8" frit fits:
ZUFR1CF
ZBUFR1CF

ZUFR1F
ZBUFR1F

ZRUFR21F
ZBRUFR21F

1/4" frit fits:
ZUFR2F
ZBUFR2F

ZRUFR41F
ZBRUFR41F

ZRUFR42F
ZBRUFR42F

WHICH SCREEN FITS MY FILTER?

1/16" screen fits:
ZUFR.5
ZBUFR.5

ZRUFR1.5
ZBRUFR1.5

1/8" screen fits:
ZUFR1C
ZBUFR1C

ZUFR1
ZBUFR1

ZRUFR21
ZBRUFR21

1/4" screen fits:
ZUFR2
ZBUFR2

ZRUFR41
ZBRUFR41

ZRUFR42
ZBRUFR42

Replacement screens

Other sizes may be available or special ordered in OEM quantities.
Note: If a filter was ordered with a removable screen, the screen ***cannot*** be replaced with a frit.

Package of 10:	*Pore Size*	*Screen Thickness*	Stainless Steel *Prod No*	*Price*
1/32" screens	0.5µ	0.040 mm	.5SR.5-10	
	1µ	0.050 mm	1SR.5-10	
	2µ	0.075 mm	2SR.5-10	
	10µ	0.125 mm	10SR.5-10	
1/16" screens	0.5µ	0.040 mm	.5SR1-10	
	1µ	0.050 mm	1SR1-10	
	2µ	0.075 mm	2SR1-10	
	10µ	0.125 mm	10SR1-10	
1/8" screens	0.5µ	0.040 mm	.5SR2-10	
	1µ	0.050 mm	1SR2-10	
	2µ	0.075 mm	2SR2-10	
	10µ	0.125 mm	10SR2-10	
1/4" screens	0.5µ	0.040 mm	.5SR4-10	
	1µ	0.050 mm	1SR4-10	
	2µ	0.075 mm	2SR4-10	
	10µ	0.125 mm	10SR4-10	