

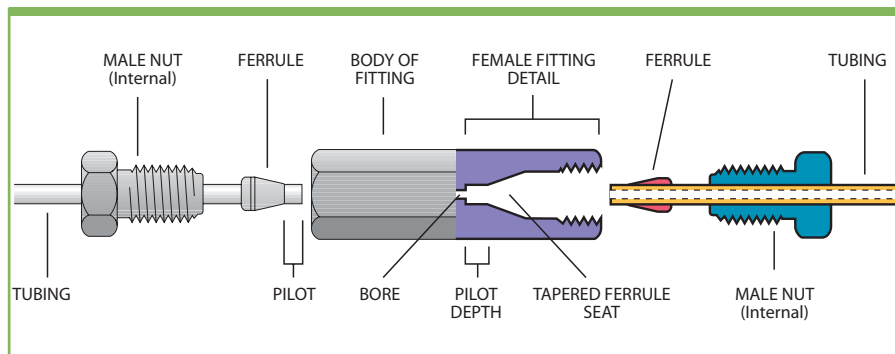
VALCO FITTINGS



THE INDUSTRY STANDARD

The compression fitting (**FIGURE 1**), in which a one- or two-piece 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.

FIGURE 1. VALCO COMPRESSION FITTING



! 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.

t TECH TIP

For optimal zero dead volume connections, make sure your tubing meets the best industry standards – OD tolerance should be nominal dimension $\pm .002$ ".

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



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.

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. The practical result of the extra effort is this: you don't have to be concerned about solvent residues.

* An exception is the longer pilot depth on Cheminert high pressure valves with polymeric stators.

FIGURE 2.
COMMON COMPRESSION FITTING –
ID RESTRICTION

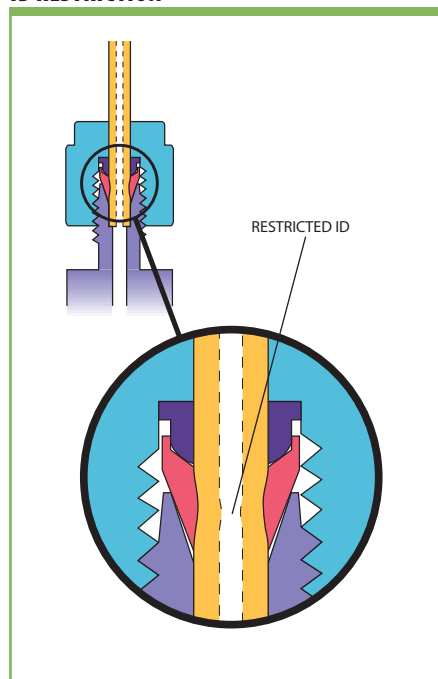


FIGURE 3.
VALCO COMPRESSION FITTING –
NO ID RESTRICTION

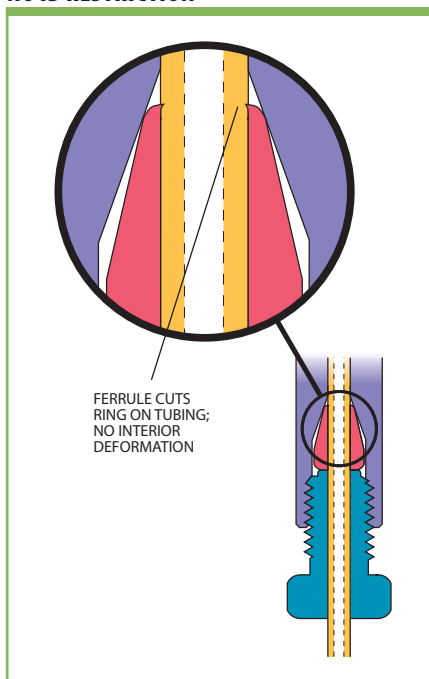
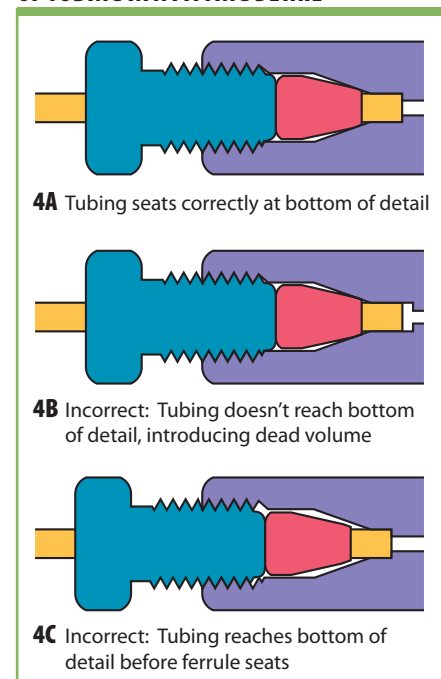
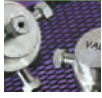


FIGURE 4.
CORRECT AND INCORRECT SEATING
OF TUBING IN A FITTING DETAIL





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

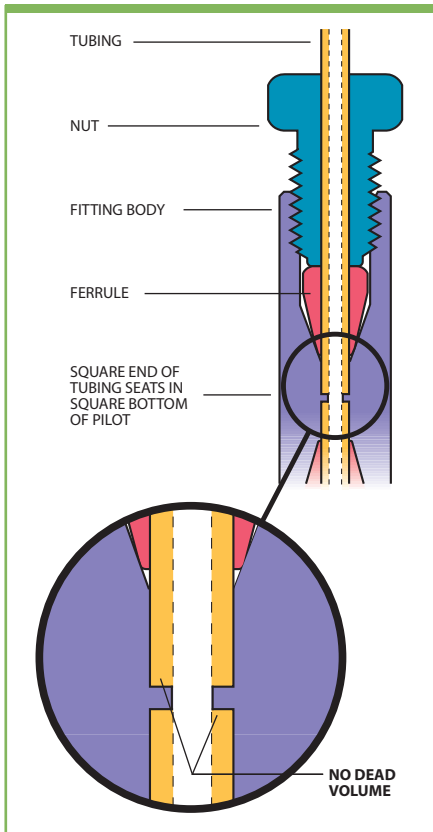
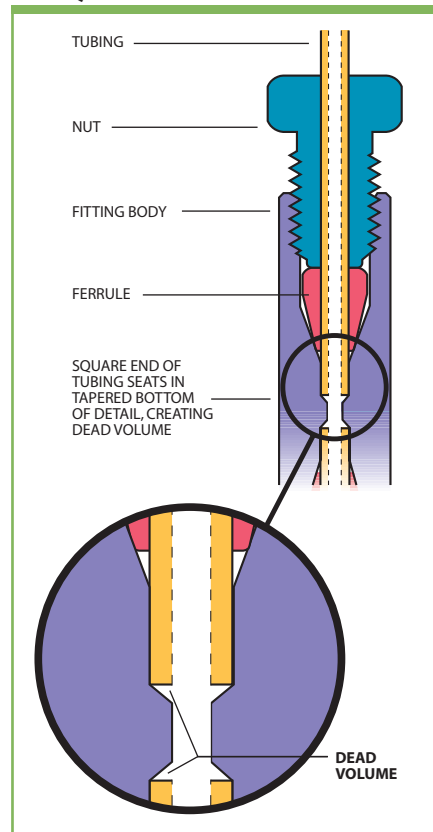


FIGURE 6.
POOR QUALITY COMPRESSION FITTING





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.

Additional difficulties arise 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.

FIGURE 7.
COMMERCIAL REDUCING UNION

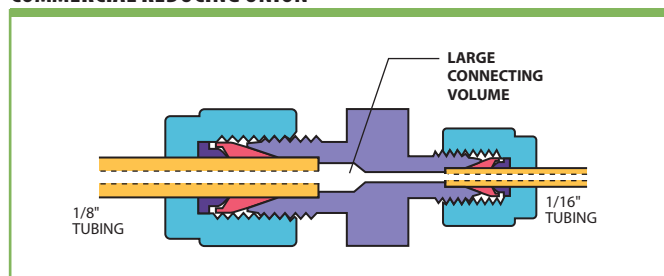


FIGURE 8.
VALCO ZDV REDUCING UNION

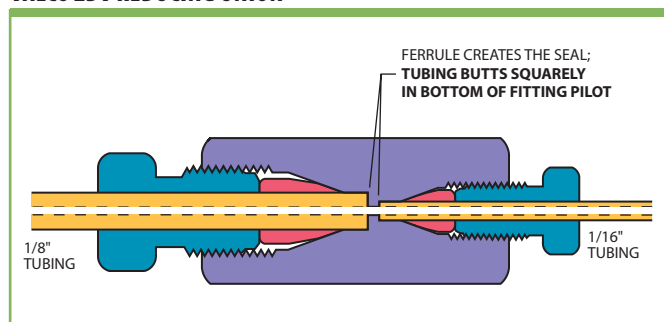
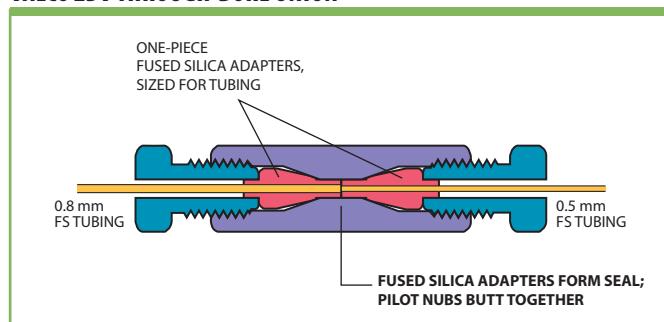


FIGURE 9.
VALCO ZDV THROUGH-BORE UNION



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.

Valco metal compression fittings can be used safely at UHPLC and SFC pressures when the fitting size is 1/16" or smaller. Our fittings of this type have been tested at pressures exceeding 50,000 psi. The pressure limitation with these is generally the safe working pressure of the tubing, and not the fitting itself.

Nuts



VALCO FITTINGS

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.

(Package/10)

Stainless nuts

	Length	Prod No
1/32" nut	.30"	ZN.5-10
	.45"	LZN.5-10
1/16" nut	.43"	ZN1-10
	.50"	MZN1-10
	.625"	IZN1-10
	.75"	LZN1-10
	1.00"	XLZN1-10
1/8" nut	.57"	ZN2-10
	.82"	LZN2-10*
	1.07"	XLZN2-10






* Not a stock item. Please contact us for a quote.
Also available in 1/4".

Controlled radius nuts

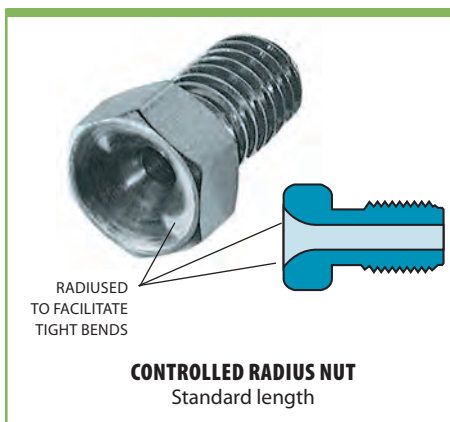
STAINLESS STEEL AND PEEK

These patented* special purpose nuts facilitate a tight bend as the tube exits the fitting, and can also help prevent kinks in very thin wall tubing. Controlled radius nuts are available in a range of sizes. Note that the short version (ZSN1R) can *only* be used in certain applications. Call for more information.



		Length	Prod No	
Stainless steel				
1/16"	Standard	.43"	ZN1R	
	Short	.30"	ZSN1R	
1/8"	Standard	.57"	ZN2R*	
PEEK				
1/16"	Hex	.45"	ZN1RPK*	
	Fingertight	.88"	ZN1RFPK	

* Not a stock item. Please contact us for a quote.



t TECH TIP

Fittings for 360 micron tubing are available on pages 43-44.

➔ MORE INFO

PEEK nuts page 43
HPLC column end fittings 32-35
Reducing unions
Internal 24
External 25
External/internal 25
Internal/external 25
Unions
Internal 22
External 23
External/internal 23

↔ CONVERSIONS

0.25 mm ≈ .010"
0.50 mm ≈ .020"
0.75 mm ≈ .030"
1.0 mm ≈ .040"
1.5 mm ≈ .060"
2.0 mm ≈ .080"
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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
1/2" ≈ 12.7 mm

*U.S. patent number 6,247,731



External nuts

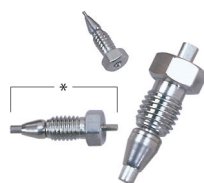
STAINLESS STEEL

External nuts are used with external fittings, such as our column end fittings (ECEP 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.

	Stainless nuts	
	Thread	Prod No
1/32"	8-32	EN.5
1/32", knurled	8-32	EN.5KN
1/16"	10-32	EN1
1/8"	5/16-20	EN2
1/4"	7/16-20	EN4 *

* PTFE-coated threads standard.

Also available in 3/8", 1/2", and 1" external nuts. Please contact us for a quote.



Plugs

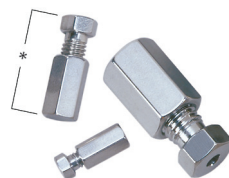
STAINLESS STEEL AND HIGH PRESSURE

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.

	Length of plug*	High pressure	
		Stainless plugs Prod No	Stainless plugs Prod No
1/32"	.49"	ZP.5	ZP.5H
1/16"	.75"	ZP1	ZP1H
	1.13"	LZP1	LZP1H
1/8"	1.00"	ZP2	ZP2H
	1.40"	LZP2	LZP2H*

* Not a stock item. Please contact us for a quote.

Also available in 1/4" stainless.



Caps

STAINLESS STEEL

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

	Length of cap*	Stainless caps Prod No
1/32"	.55"	ZC.5
1/16"	.77"	ZC1
1/8"	1.01"	ZC2
1/4"	1.24"	ZC4*

* Not a stock item. Please contact us for a quote.

MORE INFO

- PEEK plugs page 50
- PEEK plugs for high pressure Cheminert valves 50
- PEEK caps 50



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.

Metal ferrules

Larger sizes and/or specific materials may be available on special order.

(Package/10)	Stainless, Type 303 Prod No	Stainless, Type 316 Prod No	Stainless, Gold-plated Prod No
1/32"	-	ZF.5S6-10	ZF.5GP-10
1/16"	ZF1-10	ZF1S6-10	ZF1GP-10
1/8"	ZF2-10	ZF2S6-10	ZF2GP-10
1/4"	-	ZF4S6-10	ZF4GP-10*

* Not a stock item. Please contact us for a quote.

(Sold individually)	Hastelloy C Prod No	Nickel Prod No	Titanium Prod No
1/32"	ZF.5HC	ZF.5NI*	ZF.5TI*
1/16"	ZF1HC	ZF1NI	ZF1TI
1/8"	ZF2HC	ZF2NI*	ZF2TI*

* Not a stock item. Please contact us for a quote.

(Package/10)	Brass Prod No
1/32"	ZF.5B-10
1/16"	ZF1B-10
1/8"	ZF2B-10

Also available in 1/4".

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.
Improved sealing for gas applications

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

Stainless steel,
Type 316 S6
Improved corrosion resistance over SS 303

Titanium TI
Outstanding resistance to most media except hydrofluoric acids

Brass B
Not recommended for most chromatographic applications

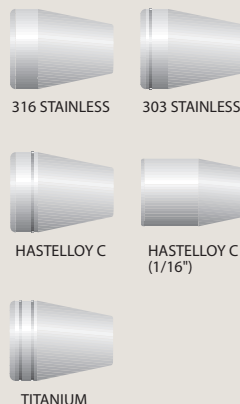
For more detailed information on metals, refer to the discussion on pages 246-247.

CONVERSIONS

- 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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- 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

FERRULE IDENTIFICATION

To differentiate among the most commonly ordered metal ferrules, ring(s) are engraved on the non-sealing surfaces. The 1/16" Hastelloy C ferrule has a different shape.





Polymeric ferrules

(Package/10)	PEEK Prod No	PTFE, Glass-filled Prod No	PTFE, Virgin Prod No
1/32"	ZF.5PK-10	ZF.5TFG-10	ZF.5TF-10*
1/16"	ZF1PK-10	ZF1TFG-10	ZF1TF-10
1/8"	ZF2PK-10	ZF2TFG-10	ZF2TF-10
1/4"	ZF4PK-10	ZF4TFG-10	ZF4TF-10
3/8"	ZF6PK-10*	ZF6TFG-10*	ZF6TF-10
1/2"	ZF8PK-10*	ZF8TFG-10*	ZF8TF-10

* Not a stock item. Please contact us for a quote.

(Package/10)	FEP Prod No	PFA Prod No	CTFE Prod No
1/32"	ZF.5FEP-10	ZF.5PFA-10	ZF.5KF-10*
1/16"	ZF1FEP-10*	ZF1PFA-10*	ZF1KF-10
1/8"	ZF2FEP-10	ZF2PFA-10*	ZF2KF-10

* Not a stock item. Please contact us for a quote.
Also available in 1/4", 3/8", and 1/2".

(Package/5)	Polyimide, Valcon Prod No	Polyimide, Graphite Prod No	Polyimide, Virgin Prod No
1/32"	ZF.5V-5	ZF.5GV-5	ZF.5V1-5*
1/16"	ZF1V-5	ZF1GV-5	ZF1V1-5*
1/8"	ZF2V-5	ZF2GV-5*	ZF2V1-5*
1/4"	ZF4V-5	ZF4GV-5*	ZF4V1-5*

* Not a stock item. Please contact us for a quote.
Also available in 3/8" and 1/2".

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

PEEK PK
Chemical resistance; up to 225°C

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

For more detailed information on polymers, refer to the discussion on page 248.

MORE INFO

Grooved PEEK ferrules page 43

Reducing ferrules



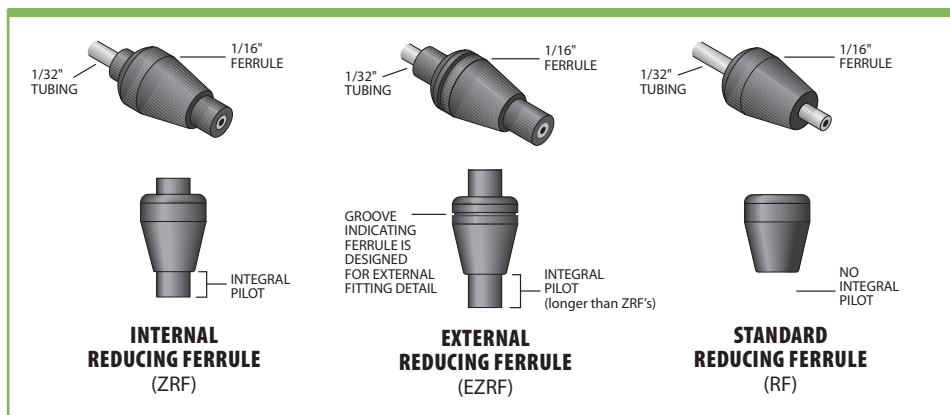
VALCO FITTINGS

REDUCING FERRULES

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

Internal ZDV (zero dead volume) reducing ferrules are used with standard Valco internal fittings, which have a male nut and a female fitting detail. The ferrule's integral pilot fills the pilot cavity between the end of the ferrule and the bottom of the detail, yielding a zero dead volume fitting.

External ZDV reducing ferrules are used with all standard external style fittings, which have 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, resulting in a zero



dead volume fitting. A single groove indicates that the ferrule is for use in an external detail.

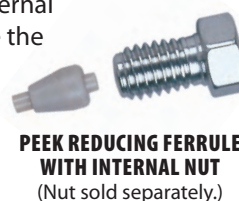
Standard reducing ferrules can be used where mixing is not a problem, such as with liquid or gas delivery. A 1/16" to 1/32" ferrule of this style is simply a 1/16" ferrule with a 1/32" hole.

Internal reducing ferrules

Use these ferrules in internal type fitting details, with nuts that have external threads. Not for use in Cheminert HPLC PAEK valves (C1-C5 series) since the fitting detail in these valves has an extended pilot length.

(Package/5)	PEEK Prod No	Glass-filled PTFE Prod No	Valcon Polyimide Prod No
1/16" to 1/32"	ZRF1.5PK-5	ZRF1.5TFG-5	ZRF1.5V-5

Also available in other sizes, and in CTFE and virgin polyimide.



External reducing ferrules

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

(Package/5)	PEEK Prod No
1/8" to 1/16"	EZRF21PK-5
1/4" to 1/8"	EZRF42PK-5

Also available in other sizes, and in glass-filled PTFE, CTFE, Valcon polyimide, and virgin polyimide.



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.

(Package/5)	PEEK Prod No	Valcon Polyimide Prod No
1/8" to 1/16"	RF21PK-5	RF21V-5

Also available in other sizes, and in glass-filled PTFE, CTFE, and virgin polyimide.



TECH TIP

Fittings for **360 micron** tubing are available on pages 43-44.

TECH TIP

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

Virgin polyimide is produced as Vespel®.

MORE INFO

Internal reducers (IZR)..... page 27
Ferrule removal kits.... 41

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

CONVERSIONS

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



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.

360 MICRON FITTINGS

Our PEEK or stainless 360 micron fittings provide direct connection of 360 µm tubing with no adapter required.



TEMPERATURE RATINGS

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

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

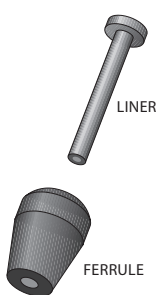
TECH TIP

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

Virgin polyimide is produced as Vespel®.

MORE INFO

360 micron fittings pages 43-44
 Fused silica Unions 18, 43-44
 Fittings 18-19, 43-44, 47
 Ferrule removal kits. 41
 Pin vise and drill index 41



REMOVABLE FSR ADAPTER
Exploded view



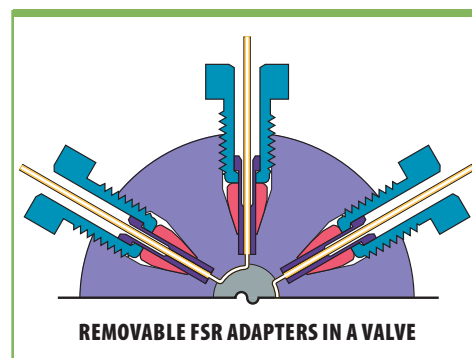
Removable fused silica adapters (FSR)

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 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.

(Package/5) Valcon Polyimide
Prod No

1/16" removable adapter assembly	
0.20 ≤ 0.40 mm OD	FS1R.4-5
0.40 ≤ 0.50 mm OD	FS1R.5-5
0.50 ≤ 0.80 mm OD	FS1R.8-5
1/16" replacement liners	
0.20 ≤ 0.40 mm OD	FS1L.4-5
0.40 ≤ 0.50 mm OD	FS1L.5-5
0.50 ≤ 0.80 mm OD	FS1L.8-5

Also available in other sizes.



REMOVABLE FSR ADAPTERS IN A VALVE

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/5) Valcon Polyimide
Prod No

1/32" Adapters	
0.20 ≤ 0.25 mm OD	FS.25-5
0.25 ≤ 0.36 mm OD	FS.36-5
0.36 ≤ 0.40 mm OD	FS.4-5
0.40 ≤ 0.50 mm OD	FS.5-5
0.50 ≤ 0.80 mm OD	ZF.5V-5
1/16" Adapters	
< 0.20 mm OD	FS1.2-5
0.20 ≤ 0.25 mm OD	FS1.25-5
0.25 ≤ 0.30 mm OD	FS1.3-5
0.30 ≤ 0.40 mm OD	FS1.4-5
0.40 ≤ 0.50 mm OD	FS1.5-5
0.50 ≤ 0.80 mm OD	FS1.8-5
0.90 ≤ 1.0 mm OD	FS11.0-5

(Package/5) PEEK
Prod No

1/32" Adapters	
0.36 ≤ 0.40 mm OD	FS.4PK-5
0.40 ≤ 0.50 mm OD	FS.5PK-5
0.50 ≤ 0.80 mm OD	ZF.5PK-5

Also available in other sizes.

(Package/5) Virgin Polyimide
Prod No

1/16" Adapters	
0.90 ≤ 1.0 mm OD	FS11.0V1-5

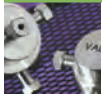
Also available in other sizes.

REPLACEMENT PARTS

Ferrules (pkg of 5)
 1/32" Polyimide ZF.5V-5
 1/16" Polyimide ZF1V-5
 (pkg of 10)
 1/16" PEEK ZF1PK-10

Nuts (pkg of 10)
 1/32" SS ZN.5-10
Special nuts for FSRs:
 1/16" SS ZCN1-10
 1/16" SS long LZCN1-10

Fused silica fittings



VALCO FITTINGS

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 or loosened without affecting the 1/16" connection.

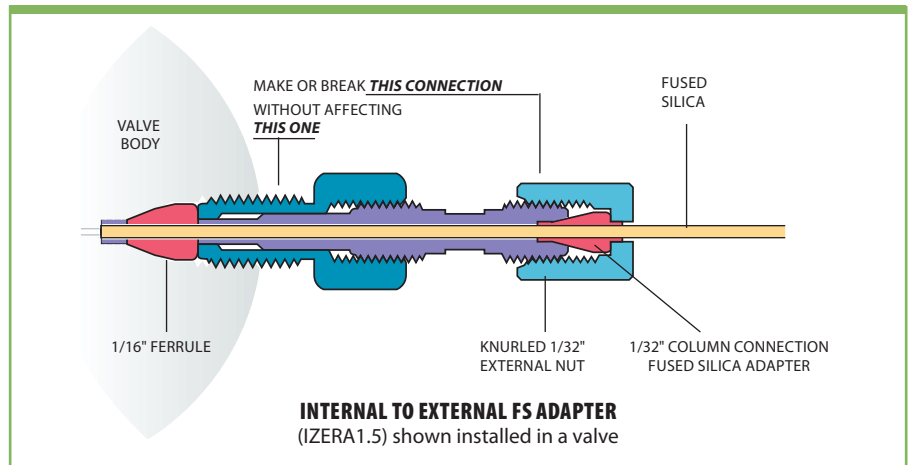
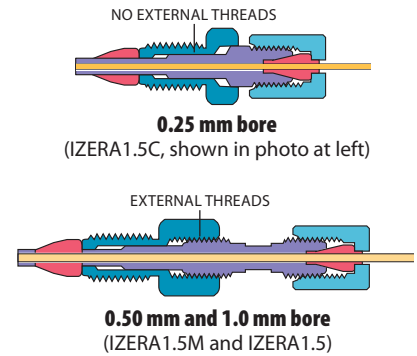
Note: Order 1/32" fused silica adapter ferrules separately (see box below).



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

IZERA DESIGNS

The larger bore designs have external threads on the liner, while the capillary version does not.



External unions

1/32" ULTRA LOW MASS

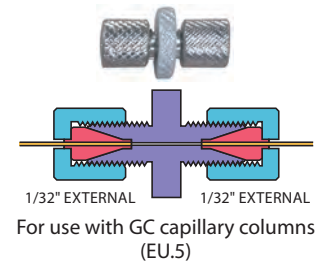
The 1/32" external union is specially designed for use with capillary columns in GC. It is very low mass and does not require wrenches to seal. Use *only* with one-piece fused silica adapters, since metal ferrules will distort the detail. Standard material is 300 series stainless.

Note: Order fused silica adapters (for ferrules) separately, see box, below right.

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

* Not a stock item. Please contact us for a quote.

1/32" EXTERNAL UNION



1/32" FUSED SILICA FERRULES

Package of 5.

Tube OD	Prod No
≤ 0.25 mm	FS.25-5
0.25 mm ≤ 0.36 mm	FS.36-5
0.36 mm ≤ 0.40 mm	FS.4-5
0.40 mm ≤ 0.50 mm	FS.5-5
0.50 mm ≤ 0.80 mm	ZF.5V-5

! CAUTION

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



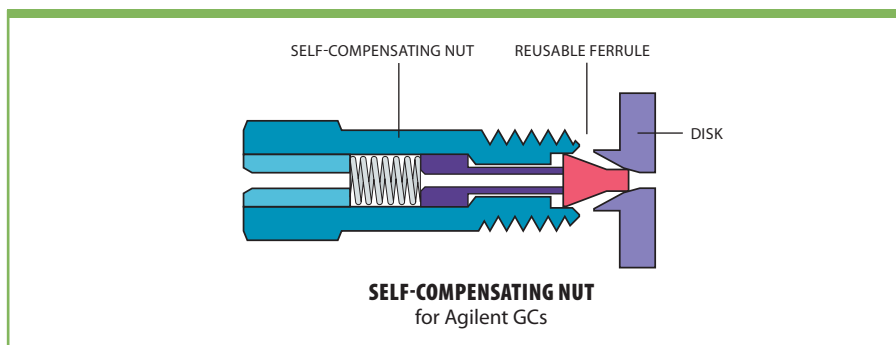
Injector nut for Agilent 6850, 6890, 7890, and 5890, Series I and II

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.

The 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.

To use this nut, the split/splitless disk must also be upgraded; the new disk will also work with older HP nuts and ferrules.

Call for a quote.

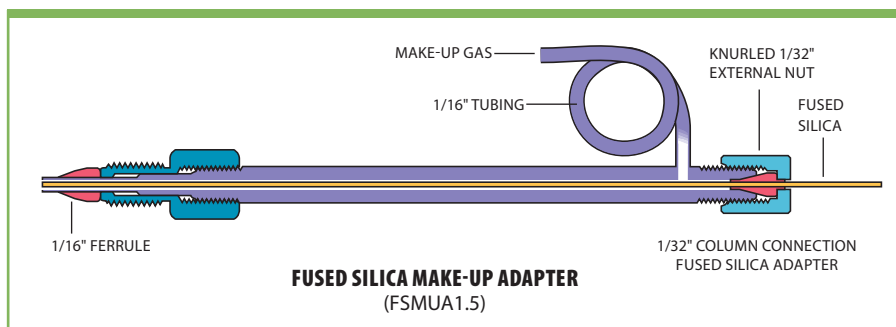


Fused silica make-up adapters

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*).



Call for a quote.



CONVERSIONS

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



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.

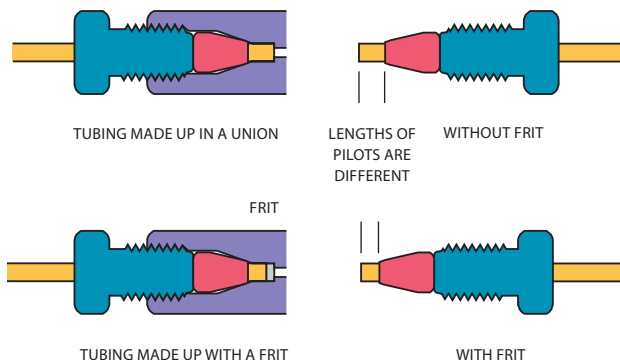
Bulkhead versions can be mounted through an instrument panel or on a bracket. The fitting body is undercut so that it bites into the panel when the mounting nut is tightened, eliminating the need for a lock washer. An O-ring can be installed between the body and the panel to allow operation in purged 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.



t 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 36-39
Frits and screens. 40



t 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.

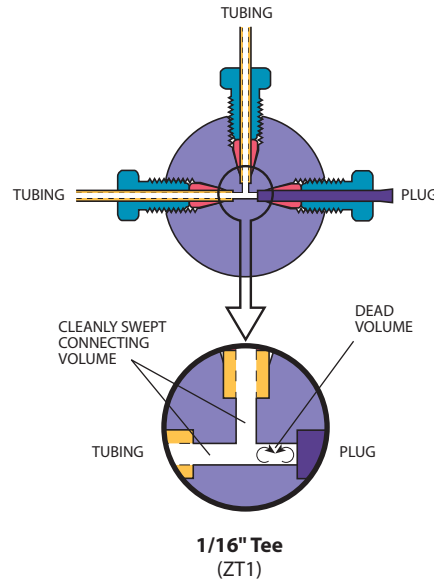
➔ MORE INFO

Reducing unions to connect two tubes with different ODs. p 24-25
Unions with 1/4-28 fittings 56



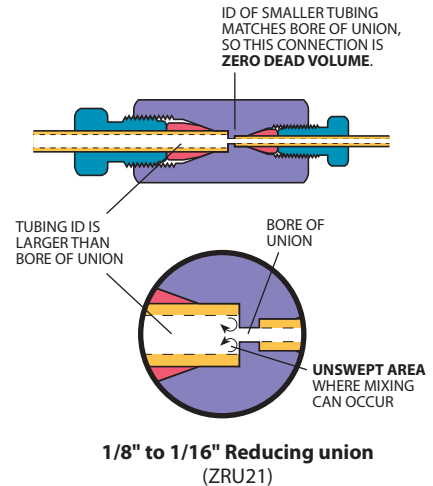
DEAD VOLUME

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



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.

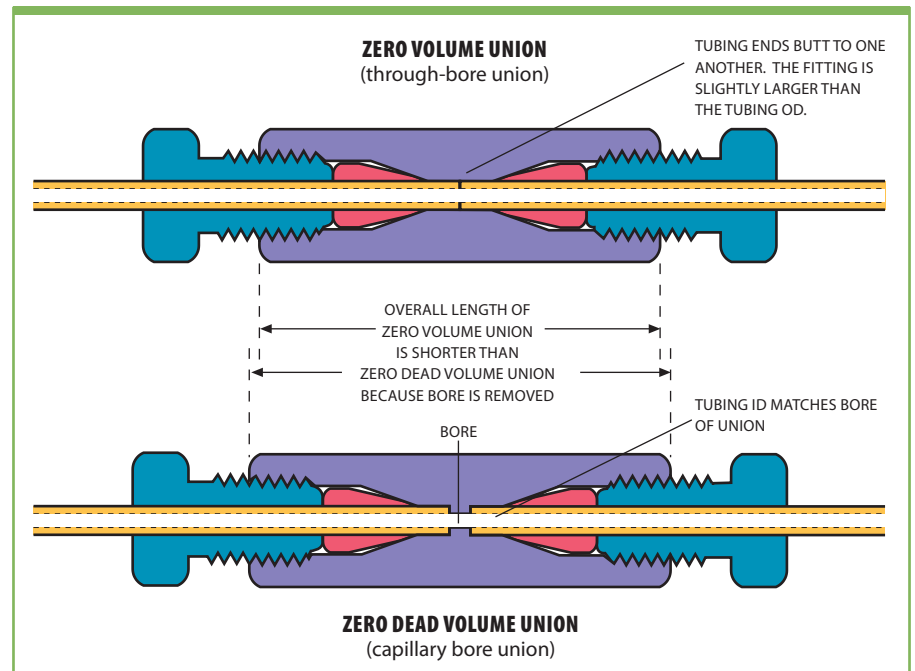


ZERO VOLUME VS. ZERO DEAD VOLUME

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.

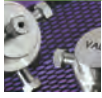
COMPARISON OF ZERO VOLUME VS. ZDV



CONVERSIONS

- 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

Unions



VALCO FITTINGS

Internal unions

STAINLESS STEEL

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

Tubing OD Bore Prod No

Standard internal unions		
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

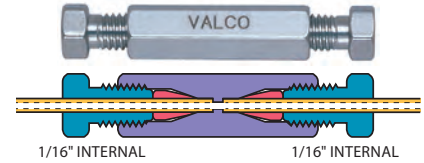
Also available in 1/4".

Tubing OD Bore Prod No Bulkhead panel hole diameter

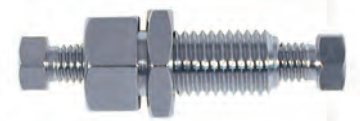
Bulkhead internal unions			
1/32"	0.25 mm	ZBU.5	5/16"
1/16"	0.15 mm	ZBU1XC	5/16"
	0.25 mm	ZBU1C	5/16"
	0.50 mm	ZBU1M	5/16"
	0.75 mm	ZBU1	5/16"
	1.0 mm	ZBU1L	5/16"
1/8"	1/16"	ZBU1T	5/16"
	0.75 mm	ZBU2	7/16"
	2.0 mm	ZBU2L	7/16"

Also available in other bore sizes and 1/4".

INTERNAL UNION



Standard bore – ends of tubing seat squarely at bottoms of fitting details (ZU1)



Bulkhead internal union – metal (ZBU1)

TECH TIP

1/16", 1/8", and 1/4" external Valco fitting components are compatible with Parker and Swagelok fittings.

MORE INFO

360 µm unions 43-44
Internal unions, high pressure PEEK 51

CONVERSIONS

- 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

TECH TIP

Through-bore union installation

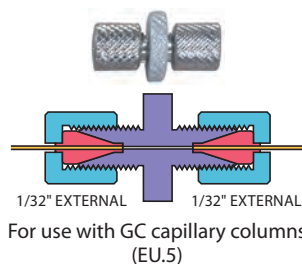
A through-bore union is indicated by "T" at the end of the product number.

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.



1/32" ULTRA LOW MASS

1/32" EXTERNAL UNION



External unions

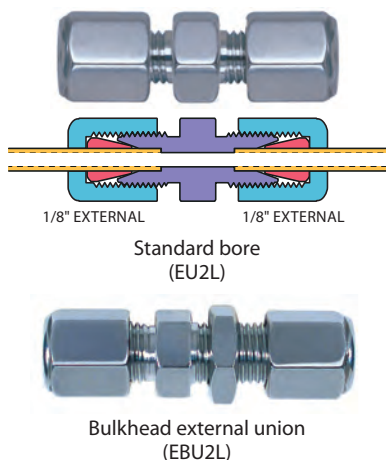
The 1/32" external union is specially designed for use with capillary columns in GC. It is very low mass and does not require wrenches to seal. Use *only* with one-piece fused silica adapters, since metal ferrules will distort the detail. Standard material is 300 series stainless.

Note: Order fused silica adapters (for ferrules) separately, *page 17*.

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

* Not a stock item. Please contact us for a quote.

EXTERNAL UNION



External unions

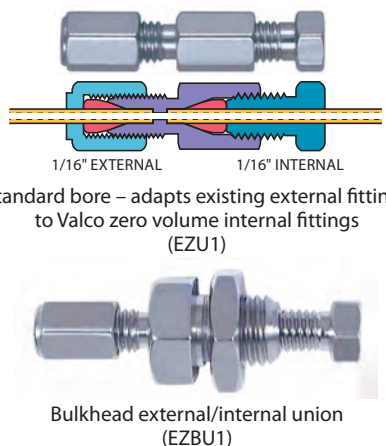
Standard material is 300 series stainless. Also available in Hastelloy C and gold-plated stainless.

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	Bulkhead	Bulkhead panel hole diameter
		Prod No	Prod No	
1/8"	2.0 mm	EU2L*	EUB2L	5/16"

* Not a stock item. Please contact us for a quote. Also available in other bore sizes and 1/4".

EXTERNAL/INTERNAL UNION

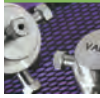


External/internal unions

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

Tubing OD	Bore	Standard	Bulkhead	Bulkhead panel hole diameter
		Prod No	Prod No	
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"

* Not a stock item. Please contact us for a quote. Also available in 1/32" and 1/8".



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.

With tubing of 1/8" OD or smaller, internal fittings are almost always the better choice. 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.

Internal reducing unions

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.

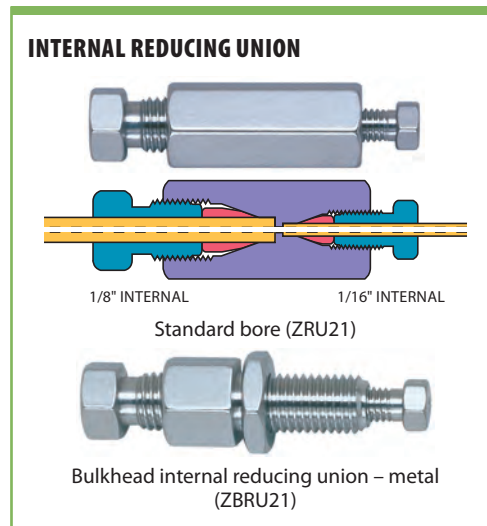
Standard material is 300 series stainless. Also available in Hastelloy C, gold-plated stainless, and titanium.

Tubing OD	Bore	Prod No
Standard internal reducing unions		
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 1/16"	0.25 mm	ZRU21C
	0.75 mm	ZRU21
	1/16"	ZRU21T
1/4" to 1/16"	1/16"	ZRU41T

Also available in other sizes. Please contact us for a quote.

Tubing OD	Bore	Prod No	Bulkhead panel hole diameter
Bulkhead internal reducing unions			
1/16" to 1/32"	0.25 mm	ZBRU1.5	5/16"
1/8" to 1/16"	0.75 mm	ZBRU21	5/16"
	1/16"	ZBRU21T	5/16"
1/4" to 1/8"	2.0 mm	ZBRU42L	7/16"

Also available in other sizes. Please contact us for a quote.



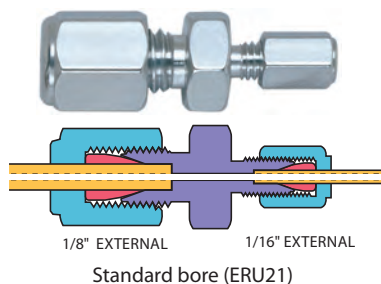
CONVERSIONS	
0.25 mm ≈ .010"	1/32" ≈ 0.8 mm
0.50 mm ≈ .020"	1/16" ≈ 1.6 mm
0.75 mm ≈ .030"	1/8" ≈ 3.2 mm
1.0 mm ≈ .040"	1/4" ≈ 6.4 mm
1.5 mm ≈ .060"	3/8" ≈ 9.5 mm
2.0 mm ≈ .080"	1/2" ≈ 12.7 mm
4.6 mm ≈ .180"	5/16" ≈ .312" ≈ 7.9 mm
6.0 mm ≈ .236"	3/8" = .375" ≈ 9.5 mm
6.4 mm ≈ .253"	7/16" ≈ .437" ≈ 11.1 mm
7.0 mm ≈ .275"	
10.0 mm ≈ .400"	
27.0 mm ≈ 1.08"	

T TECH TIP
1/16", 1/8", and 1/4" external Valco fitting components are compatible with Parker and Swagelok fittings.

T MORE INFO
Internal reducing unions, high pressure PEEK page 51
Standard unions 22
Unions with 1/4-28 fittings 56



EXTERNAL REDUCING UNION



External reducing unions

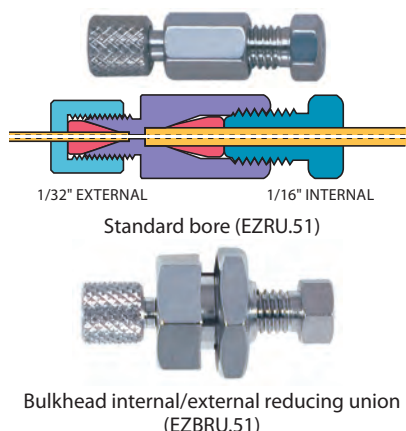
These unions connect two sizes of tubing, using external fittings on each end. Standard material is 300 series stainless. Custom bulkhead versions are available in OEM quantities.

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.

Tubing OD	Bore	Prod No
Standard external reducing unions		
1/8" to 1/16"	0.75 mm	ERU21
	1/16"	ERU21T

Please contact us for a quote on bulkhead versions and other sizes and bores.

INTERNAL/EXTERNAL REDUCING UNION



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.

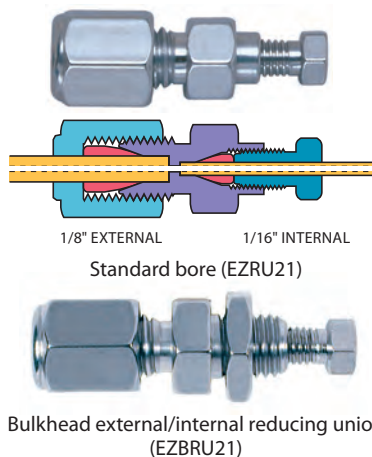
Internal/external reducing unions are typically used to connect 1/16" stainless steel tubing to fused silica tubing.

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 17.) Only polymeric or soft metal ferrules should be used with 1/32" external details.

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

Please contact us for a quote on other bores.

EXTERNAL/INTERNAL REDUCING UNION



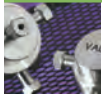
External/internal reducing unions

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.

Tubing OD	Bore	Standard Prod No	Bulkhead Prod No	Bulkhead panel hole diameter
1/8" to 1/16"	0.75 mm	EZRU21	EZBRU21	5/16"
	1/16"	EZRU21T*	EZBRU21T	5/16"
1/4" to 1/16"	0.75 mm	EZRU41	EZBRU41*	7/16"

* Not a stock item. Please contact us for a quote. Also available in other sizes and bores..



Tees

Tees connect three lines. Standard material is 300 series stainless, except for 0.15mm bore which comes standard in 316 stainless. Also available in Hastelloy C, gold plated stainless, and titanium. Mounting holes are standard in 1/8" models, and optional in others. Call for more information.

Tube OD	Bore	Prod No
1/32"	0.25 mm	ZT.5
1/16"	0.15 mm	ZT1XCS6
	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

Also available in other bore sizes and 1/4". Please contact us for a quote.



Crosses

Crosses connect four lines. Standard material is 300 series stainless, except for 0.15mm bore which comes standard in 316 stainless. Also available in Hastelloy C, gold plated stainless, and titanium. Call for information about versions with mounting holes.

Tube OD	Bore	Prod No
1/16"	0.15 mm	ZX1XCS6
	0.25 mm	ZX1C
	0.50 mm	ZX1M
	0.75 mm	ZX1
	1.00 mm	ZX1L

Also available in 1/32", 1/8", and 1/4". Please contact us for a quote.

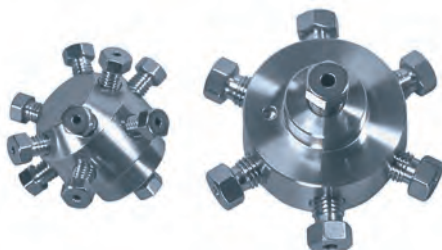


Manifolds

1/16" manifolds connect 4 - 16 inlet lines to a single outlet. The unique angled entry of our design minimizes dispersion. Standard materials are PEEK or Nitronic 60.

1/8" manifolds connect 4 - 12 inlet lines to a single outlet. Standard material is 300 series stainless steel.

Call for a quote.



→ SURFACE MOUNTING TEES AND CROSSES

1/8" tees and crosses have two threaded mounting holes (8-32).

To mount 1/32" and 1/16" tees and crosses, order mounting kit below.

Mounting kit includes:
 Standard bracket SABB
 Clamp ring CR4
 Screws and nuts

Mounting kit DVBRKIT

Some configurations are available with two through holes. Consult factory.

t 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 27

t TECH TIP

A manifold used with an SD flowpath multi-position valve allows HPLC column selection with a single valve. See page 121 for an illustration.

SD UW valves. page 114

→ SEE ALSO

PEEK tees. page 51
 PEEK crosses 51



Internal reducers

FOR 360 μ m TUBING

Directly connect 360 μ m tubing into a 1/16" or 1/32" Valco valve or fitting detail, providing a positive leak-free seal with zero dead volume. These are the same design as our larger internal reducers shown below. All versions have a stainless steel body, with 360 μ m nut/ferrule materials as indicated.

Tubing OD	For use with	Nut/ferrule material	Prod No
1/32" to 360 μ m	Metal tubing	Stainless/stainless	C360IZR.5TS6
	PEEK tubing	PEEK/glass-filled PEEK	C360IZR.5TS6PK
	Fused silica	SS/gold-plated nickel	C360IZR.5TS6FS
1/16" to 360 μ m	Metal tubing	Stainless/stainless	C360IZR1S6
	PEEK tubing	PEEK/glass-filled PEEK	C360IZR1S6PK
	Fused silica	SS/aluminum	C360IZR1S6AL
		SS/gold-plated nickel	C360IZR1S6FS

Internal reducers

FOR 1/32" THROUGH 1/4" TUBING

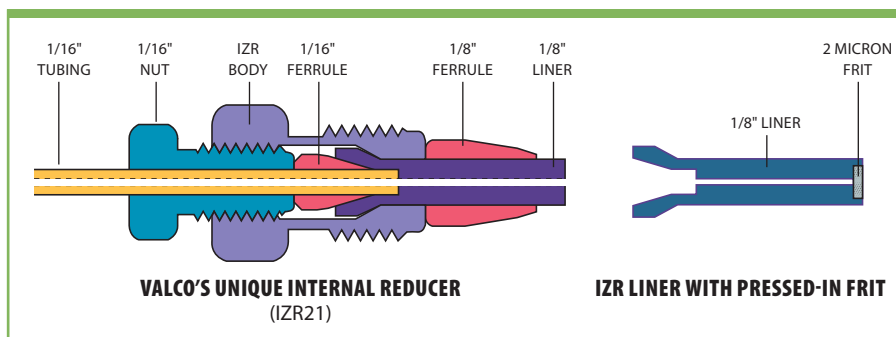


Valco's internal reducer (IZR) allows smaller tubing to be used in valves with fitting details for larger tubing, forming a positive leak-free seal with zero dead volume. The small line from your system goes directly into the IZR and the sample goes directly into the valve, without the short pieces of 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 38) 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.

Tubing OD	Bore	Prod No
Without frit		
1/16" to 1/32"	0.25 mm	IZR1.5
	0.50 mm	IZR1.5L
	1/32"	IZR1.5T
1/8" to 1/16"	0.25 mm	IZR21C
	0.50 mm	IZR21
	1.00 mm	IZR21L
	1/16"	IZR21T
With 2μ frit		
1/8" to 1/16"	1.00 mm	IZR21LF

1/4" reducers and versions with 2 μ frit are also available. Please contact us for a quote.



360 MICRON FITTINGS

See our extensive line of 360 μ m fittings pages 43-44

CONVERSIONS

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

Pipe adapters



VALCO FITTINGS

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.

NPT male	ZDV fitting	Bore	Prod No
1/8"	1/16"	1.0 mm	PZA21
		1/16"	PZA21T
1/4"	1/16"	1.0 mm	PZA22
		1/8"	PZA41
	1/8"	2.0 mm	PZA42L



Also available in other sizes.
Please contact us for a quote.

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.

NPT female	ZDV fitting	Bore	Prod No
1/8"	1/16"	1.0 mm	FPZA21
1/4"	1/8"	2.0 mm	FPZA42L



Pipe to Valco external adapters

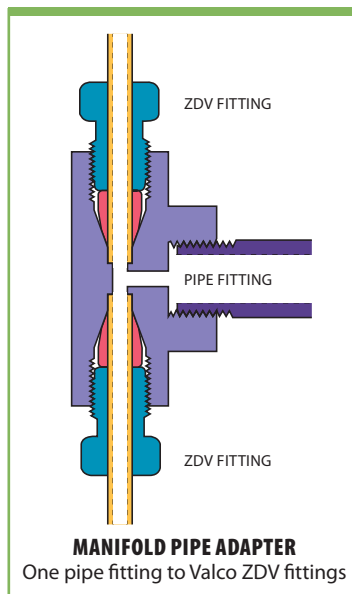
Pipe adapters make a minimum volume connection from pipe fittings to Valco external fittings. Available for both female and male connectors. Standard material is 300 series stainless.

Call for a quote.

Manifold pipe adapters

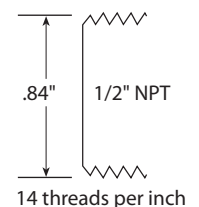
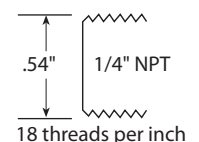
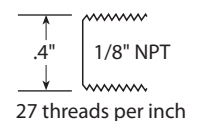
These manifolds, which go from one or two pipe fittings to three or more Valco zero dead volume fittings, minimize the number of connections between a regulator and the various carrier gas lines in a chromatographic system. The models with two pipe fittings go a step further, allowing the support of 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.

Call for a quote.



t 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.



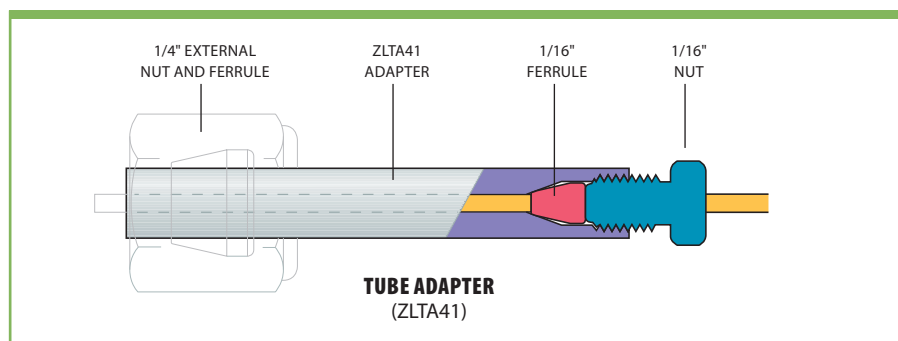


Tube adapters

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.

	Length	Bore	Prod No
1/4" to 1/16"	0.7"	1/16"	ZTA41
	1.8"	1/16"	ZLTA41
	2.8"	1/16"	ZXLT41*

*Not a stock item. Please contact us for a quote.

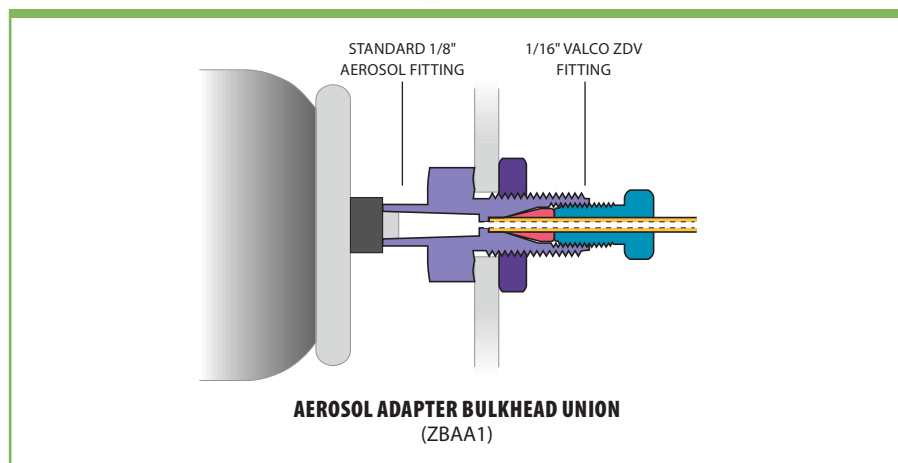


Aerosol adapter bulkhead union

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.

Call for a quote.



CONVERSIONS

- 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

Syringe adapters








VALCO FITTINGS

Fill ports

FOR VALCO AND METAL 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.

Prod No

For use with blunt tip needle		
For 1/16" fittings and injectors - 22 ga	VISF-1	
For use with 2" 22 gauge blunt tip needle		
For 1/16" fittings and injectors	VISF-2	
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	






1/32" and 1/8" fill ports are also available. Please contact us for a quote.

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.

Prod No

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	

* Not a stock item. Please contact us for a quote.

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.

Call for a quote.

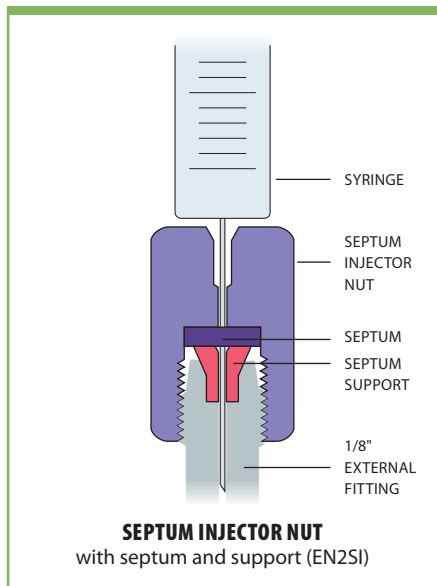
➔ MORE INFO

Cheminert valves

Model C2..... 140, 144
Model C4..... 141, 145




↔ CONVERSIONS

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



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. The thread is 5/16-20 which is a standard external thread.

		<i>Prod No</i>
Septum injector nut with support		EN2SI
Replacement support		ZF2SI
Septum, low bleed, pkg. of 10		SI4G



Female luer adapters

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

	<i>Fitting</i>	<i>Prod No</i>
Female luer to:	1/32"	ZLA-.5*
	1/16"	ZLA-1
	1/8"	ZLA-2

* Not a stock item. Please contact us for a quote.



Loop fill port assembly

FOR CHEMINERT VALVES

The loop fill port assembly, for use with Cheminert HPLC and UHPLC valves, 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.

Call for a quote.



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.

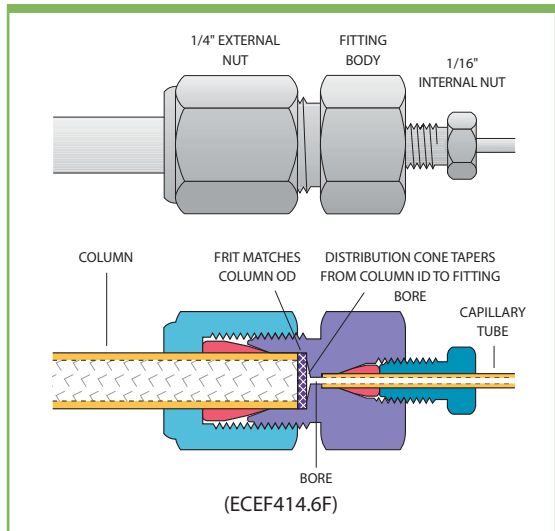
Standard 1/4", 3/8", and 1/2" columns are usually packed at 8,000 - 10,000 psi, which is right at the yield strength for the tubing commonly used. Columns with 1" ID have a yield strength of 6,000 - 8,000 psi, and the fitting will not hold if the system pressure exceeds that limit.

Our all-PEEK Nanovolume® column end fittings (page 47) feature fingertight zero dead volume connections with 100 or 150 micron bore. PEEK sleeves permit use with any fused silica tubing.



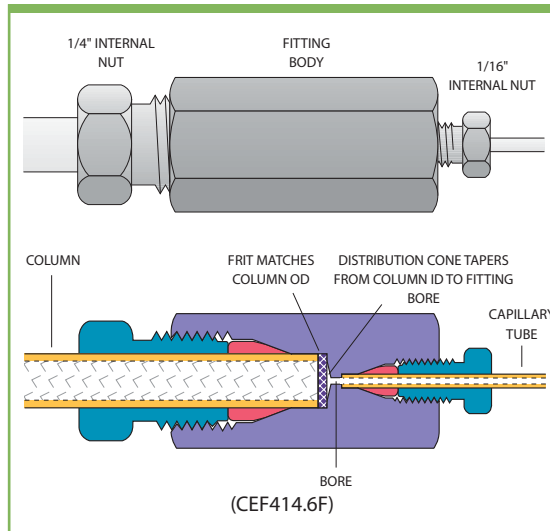
EXTERNAL COLUMN END FITTING

1/4" to 1/16", 4.6 mm column ID, with removable frit



INTERNAL COLUMN END FITTING

1/4" to 1/16", 4.6 mm column ID, with removable frit



t 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 22

↔ CONVERSIONS

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

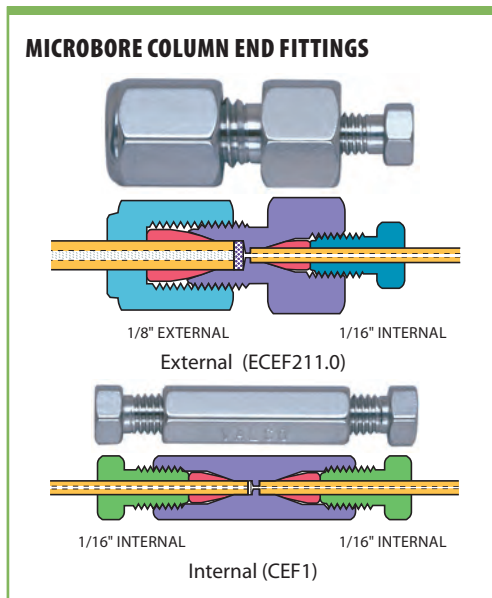
t TECH TIP

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.



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

Standard material is Type 316 stainless.

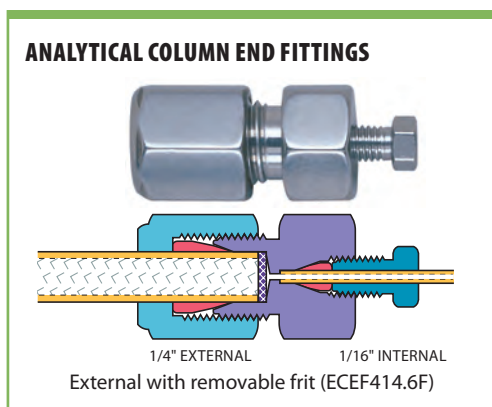


				Without frit
		Bore	Column ID	Prod No
External column end fittings				
1/16" to	1/16"	0.25 mm	1.0 mm	ECEF111.0
1/8" to	1/16"	0.25 mm	1.0 mm	ECEF211.0
Internal column end fittings				
1/16" to	1/32"	0.25 mm	1.0 mm	CEF1.5*
	1/16"			CEF1
1/8" to	1/32"	0.25 mm	1.0 mm	CEF2.51.0*
	1/16"		1.0 mm	CEF211.0
			2.0 mm	CEF212.0

* Not a stock item. Please contact us for a quote. Also available with removable 2µ frit.

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

Standard material is Type 316 stainless.

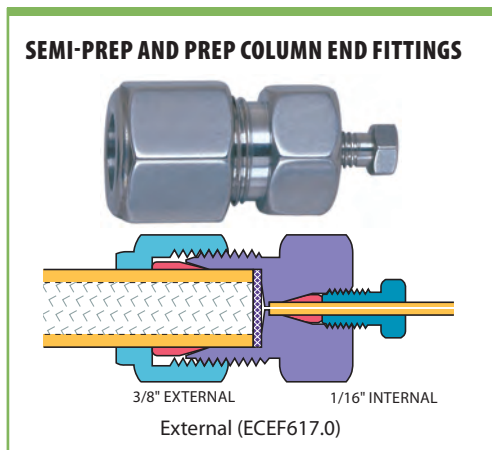


				Without frit	Removable 2µ frit
		Bore	Column ID	Prod No	Prod No
External column end fittings					
1/4" to	1/16"	0.4 mm	2.1 mm	ECEF412.1	ECEF412.1F
			4.6 mm	ECEF414.6	ECEF414.6F

Please contact us for a quote on other column IDs. Also available with internal fittings.

Semi-preparative and preparative column end fittings

Standard material is Type 316 stainless.



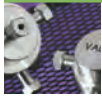
				Without frit	Removable 2µ frit
		Bore	Column ID	Prod No	Prod No
External column end fittings					
3/8" to	1/16"	0.40 mm	7.0 mm	ECEF617.0	ECEF617.0F*
1/2" to	1/16"	0.75 mm	10.0 mm	ECEF8110.0	ECEF8110.0F

* Not a stock item. Please contact us for a quote. Also available in other column IDs and sizes.

➔ **NANOBORE COLUMN END FITTINGS**
 100 µm and 150 µm bore CEF'spage 47

➔ **MORE INFO** Replacement frits 34

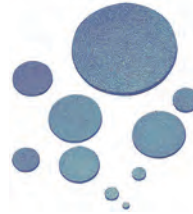
Frits • Post-column reaction tee fittings



VALCO FITTINGS

Replacement frits for column end fittings

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	Hastelloy C
			Prod No	Prod No
Package of 10:				
1/16" frits	0.5μ	0.75 mm	.5FR1-10	.5FR1HC-10*
	2μ	0.75 mm	2FR1-10	2FR1HC-10*
1/8" frits	0.5μ	1.00 mm	.5FR2-10	–
	2μ	1.00 mm	2FR2-10	2FR2HC-10
1/4" frits	0.5μ	1.00 mm	.5FR4-10	–
	2μ	1.00 mm	2FR4-10	2FR4HC-10*
Each:				
3/8" frits	2μ	1.00 mm	2FR6	2FR6HC*
1/2" frits	2μ	1.00 mm	2FR8	2FR8HC*
1" frits	2μ	1.50 mm	2FR1K	2FR1KHC*

* Not a stock item. Please contact us for a quote.
 Also available in pore size of 10μ and in Titanium.

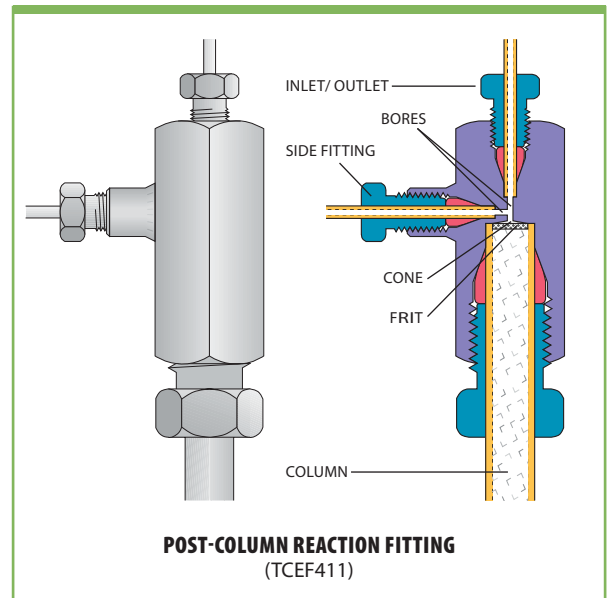
Post-column reaction tee fitting

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
1/16"	1.0 mm	1/32"	0.25 mm	1/32"	0.25 mm	TCEF1.5.5C*
			0.90 mm			TCEF1.5.5T*
1/8"	1.0 mm	1/16"	0.25 mm	1/16"	0.25 mm	TCEF111*
			0.50 mm			TCEF211*
1/4"	4.6 mm	1/16"	1.65 mm	1/16"	0.40 mm	TCEF211T*
			0.25 mm		0.25 mm	TCEF411C*
			0.75 mm		0.75 mm	TCEF411*
			1.65 mm		TCEF411T*	
3/8"	6.0 mm	1/8"	0.75 mm	1/16"	0.75 mm	TCEF421*
			0.75 mm			TCEF611*
1/2"	9.0 mm	1/16"	1.65 mm	1/16"	0.75 mm	TCEF611T*
			0.75 mm			TCEF811*
			1.65 mm			TCEF811T*

* Not a stock item. Please contact us for a quote.

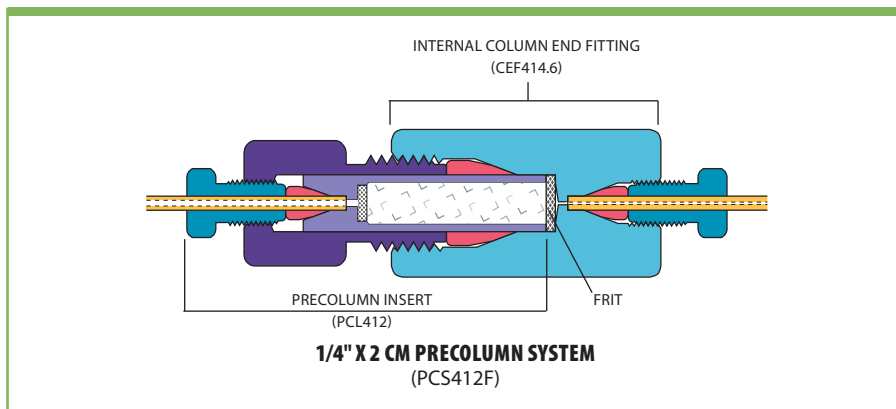




Precolumns (guard columns)

Precolumns are available in 2 cm and 5 cm lengths, and can be filled with either 5 μ packing or 37 - 44 μ 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.

Call for a quote on 1/4" x 2 cm or 1/4" x 5 cm systems.



i NOTE

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

↔ CONVERSIONS

- 100 μ m \approx .004"
- 150 μ m \approx .006"
- 0.25 mm \approx .010"
- 0.50 mm \approx .020"
- 0.75 mm \approx .030"
- 1.0 mm \approx .040"
- 1.5 mm \approx .060"
- 2.0 mm \approx .080"
- 4.6 mm \approx .180"
- 6.0 mm \approx .236"
- 6.4 mm \approx .253"
- 7.0 mm \approx .275"
- 10.0 mm \approx .400"
- 27.0 mm \approx 1.08"
- 1/32" \approx 0.8 mm
- 1/16" \approx 1.6 mm
- 1/8" \approx 3.2 mm
- 1/4" \approx 6.4 mm
- 3/8" \approx 9.5 mm
- 1/2" \approx 12.7 mm



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 2 μ titanium frits.

Call for a quote.



FILTERS

Valco's unique 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.

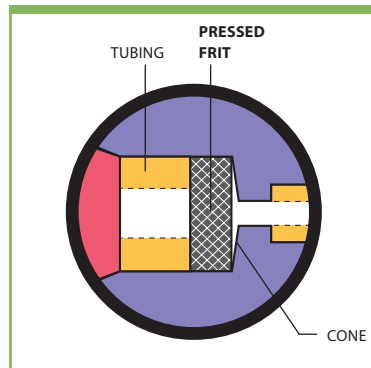
There are many flow elements of analytical instruments which require protection from foreign particles, such as orifices that may become plugged or surfaces that may get scratched. However, conventional filtering devices may have too large a volume to be consistent with good system performance – particularly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

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.)

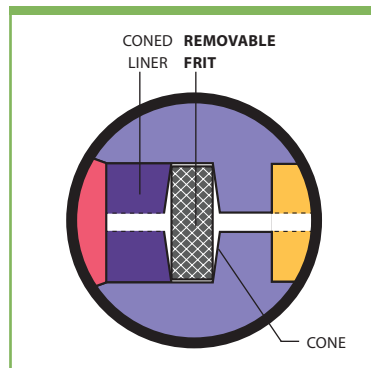


- **PRESSED FRITS**, permanently installed in the filter, are recommended where contaminants are the exception and not the rule. The frits are 2 μ stainless.
- **REMOVABLE FRITS** are the best choice for maximum filtration, or if the application requires Hastelloy C or titanium. However, they allow more mixing and tend to clog more than screens. A 2 μ frit is included with the filter, but 0.5, 2, and 10 μ 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 2 μ screen is included with the filter, and 2 and 10 μ stainless replacement screens may be ordered.

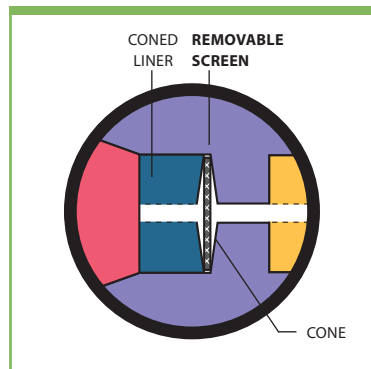
PRESSED FRIT



REMOVABLE FRIT



REMOVABLE SCREEN

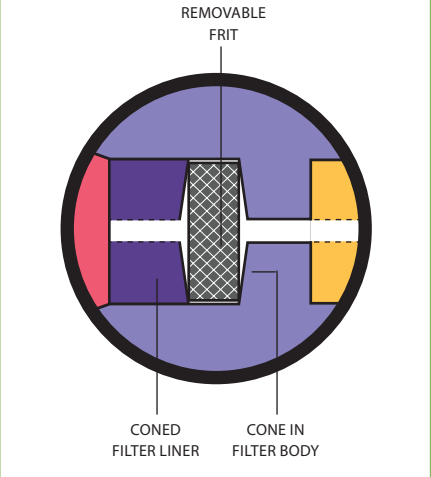




Filters with removable frits are designed to compensate for the thickness of the filter element – the resulting pilot depths are identical with the rest of the Valco product line, facilitating interchangeability of *made up* fittings. Therefore, although our filters look very much like our unions, they 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.

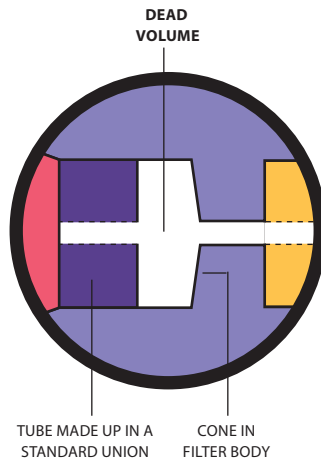
FILTER WITH REMOVABLE FRIT

Correct installation:
 Coned for uniform flow and maximum filter surface

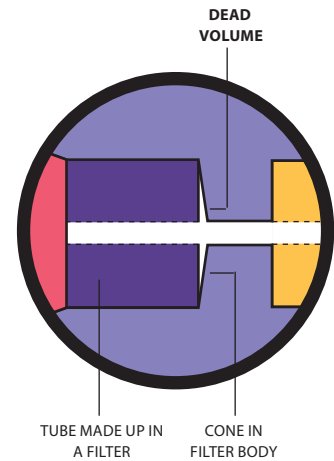


FILTER WITH FRIT REMOVED BEING USED AS A REDUCING UNION

Bad installation:
 Dead volume is created where frit should be

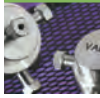


Bad installation:
 Cone in filter body creates dead volume



MORE INFO

- Biocompatible filters..... pages 58-60
- In-line filters for 1/4-28 fittings 58
- Mobile phase filters.....58-60



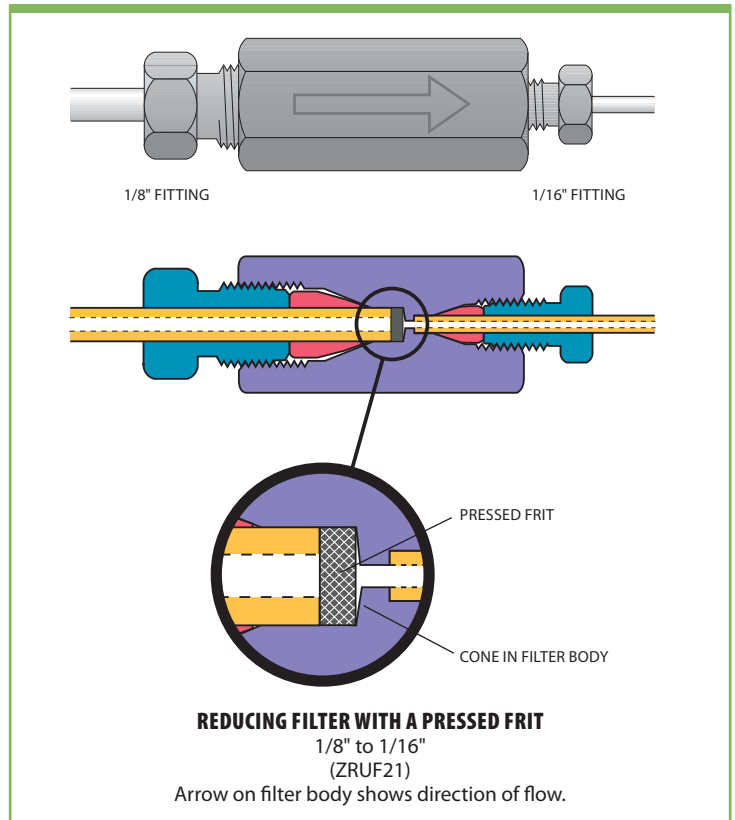
Pressed frit filters

Pressed frit filters contain a permanently installed stainless steel 2 μ 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.

Pressed frit filters have an arrow imprinted on the body to make it easy to differentiate them from unions, and to indicate the recommended flow direction.

Bore	Standard		Bulkhead
	Prod No	Prod No	Prod No
1/16" to 1/16"	0.75 mm	ZUF1	ZBUF1

Please contact us for a quote on other sizes.

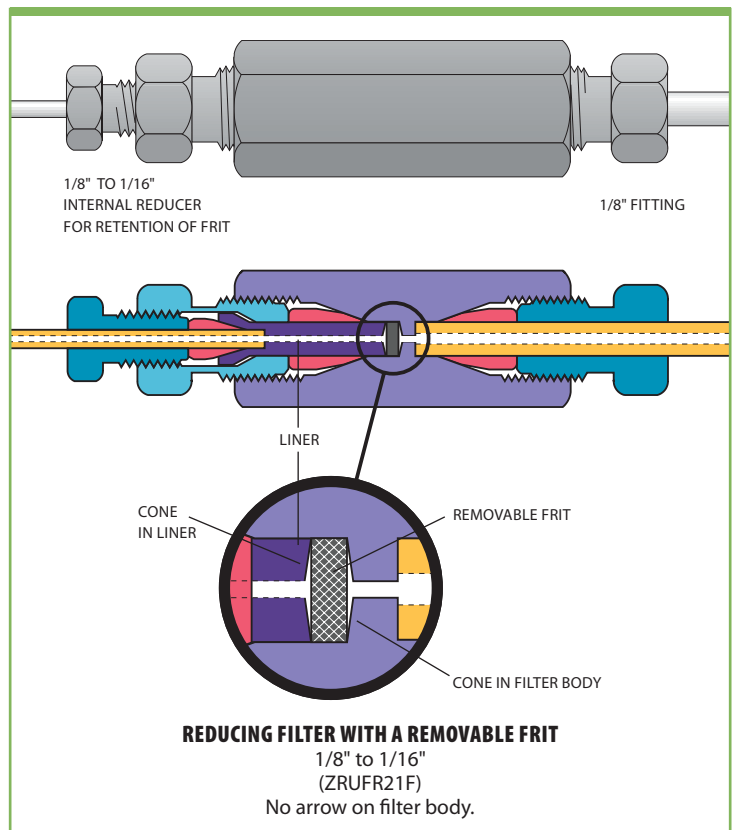


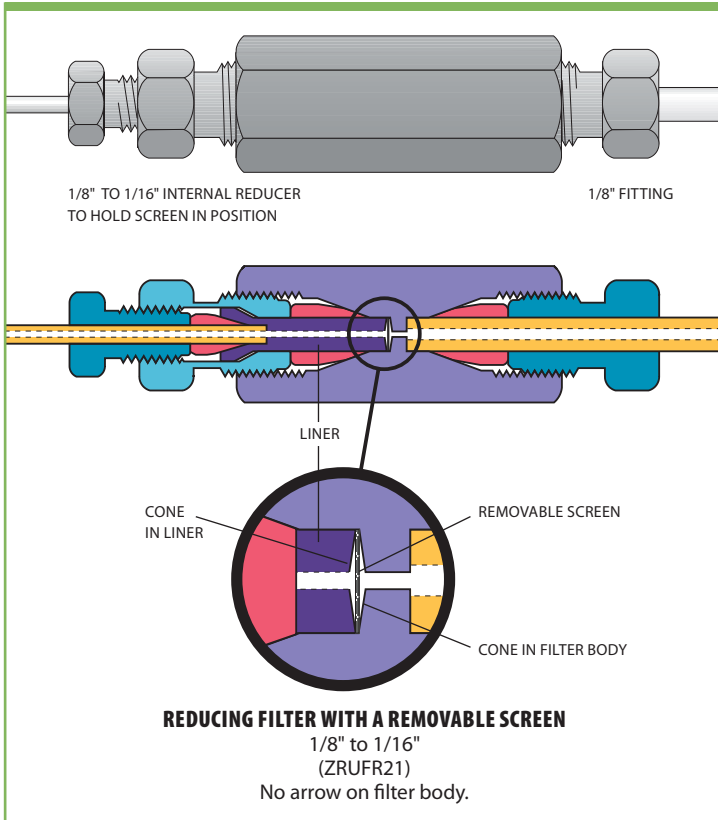
Removable frit filters

These filters come with a removable 2 μ 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.

Bore	Standard	
	Prod No	Prod No
1/16" to 1/16"	0.25 mm	ZUFR1CF
	0.50 mm	ZUFR1F

Please contact us for a quote on bulkhead versions and other sizes.





Removable screen filters

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.

Description	Bore	Standard	Bulkhead
		Prod No	Prod No
1/16" to 1/16"	0.50 mm	ZUF1	ZBUFR1
1/8" to 1/16"	0.75 mm	ZRUF21	ZBRUF21*
1/8" to 1/8"	2.00 mm	ZUF2	ZBUFR2*

* Not a stock item. Please contact us for a quote.
Also available in other sizes.



➔ MORE INFO

Replacements for filters
Frits page 40
Screens 40

↔ CONVERSIONS

- 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

t 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

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.

	Pore size	Frit thickness	Stainless steel (Package/10) Prod No	Hastelloy C (Package/10) Prod No
1/32" frits				
Pkg of 5:	0.5μ	0.25 mm	.5FR.5-5	–
	2μ	0.25 mm	2FR.5-5	–
1/16" frits				
Pkg of 10:	0.5μ	0.75 mm	.5FR1-10	.5FR1HC-10*
	2μ	0.75 mm	2FR1-10	2FR1HC-10*
	10μ	0.75 mm	10FR1-10	–
1/8" frits				
Pkg of 10:	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
	10μ	1.00 mm	10FR2-10	–
1/4" frits				
Pkg of 10:	0.5μ	1.00 mm	.5FR4-10	–
	2μ	1.00 mm	2FR4-10	2FR4HC-10*
	10μ	1.00 mm	10FR4-10	10FR4HC-10*

* Not a stock item. Please contact us for a quote.
 Also available in Titanium and in other sizes.

Replacement screens

Other sizes may be available or special ordered in OEM quantities. 20μ and 75μ screens are also available.

Note: If a filter was ordered with a removable screen, the screen **cannot** be replaced with a frit.

	Pore size	Screen thickness	Stainless steel (Package/10) Prod No
1/32" screens			
Pkg of 10:	1μ	0.050 mm	1SR.5-10
	2μ	0.075 mm	2SR.5-10
1/16" screens			
Pkg of 10:	1μ	0.050 mm	1SR1-10
	2μ	0.075 mm	2SR1-10
1/8" screens			
Pkg of 10:	1μ	0.050 mm	1SR2-10
	2μ	0.075 mm	2SR2-10
1/4" screens			
Pkg of 10:	2μ	0.075 mm	2SR4-10
	10μ	0.125 mm	10SR4-10

Please contact us for a quote on other pore sizes and screen thicknesses.



? 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

t TECH TIP

Our screen materials are described in terms of *nominal* micron retention. For example, a screen with a 2 μ pore size will retain *most* particles 2 μ or larger, but the *absolute* retention will be of particles 7-8 μ in diameter or larger. This is true only of the smallest pore screens:

Pore size	Nominal retention	Absolute retention
1μ	1μ	6-7μ
2μ	2μ	7-8μ
10μ	10μ	11-13μ



Custom socket wrenches

These socket wrenches have a slot to slip over the tubing, making them especially useful when nuts are difficult to access with an open end wrench. The SWH4 works with all types of 1/4" hex nuts, such as Valco 1/16" ZDV fitting nuts. The SWH3 fits our 1/32" nuts.

Prod No	
3/16"	SWH3*
1/4"	SWH4

* Not a stock item. Please contact us for a quote.

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** can be used to remove ferrules from tee and cross fittings.

Ferrule removal kits

Remove polymeric ferrules stuck in fitting details. One version is for 1/32" and 360 micron ferrules, and the other version is for 1/16" and 1/8" ferrules.

Prod No	
For 360 μm, FS, and 1/32"	FRK1
For 1/16" and 1/8"	FRK2



FOR 360 μm AND 1/32" FERRULES



FOR 1/16" AND 1/8" FERRULES



Hex key set

The hex key set has a wrench to fit any socket head screw on any VICI valve or actuator. Includes the following sizes: .050", 1/16", 5/64", 3/32", 7/64", 1/8", 9/64", and 5/32".

Prod No
HKS

Open end wrenches

	For use with	Prod No
3/16" x 1/4"	1/32" and 1/16" nuts	OEW
3/8" x 7/16"	1/8" nuts	OEW-2
1/2" x 9/16"	1/4" nuts	OEW-3



MORE INFO

- Tools for valves
- Pencil magnet p 192
- Valve spanner handle. 193
- Tightening tools for 360 μm fittings . . . 49
- for PEEK fittings. 49
- Tubing accessories 69, 72



Pin vise and drill index

The drill index has drills sized from 0.0135" to 0.039" (0.34 to 1 mm). These are useful tools when a fused silica tube breaks in a union (see Tech Tip above), and for enlarging the inner diameter of fused silica adapters.

Prod No
PV