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.

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.

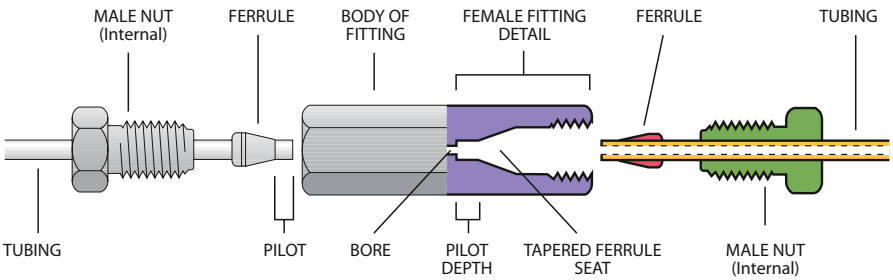


Figure 1
Valco compression fitting

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.

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

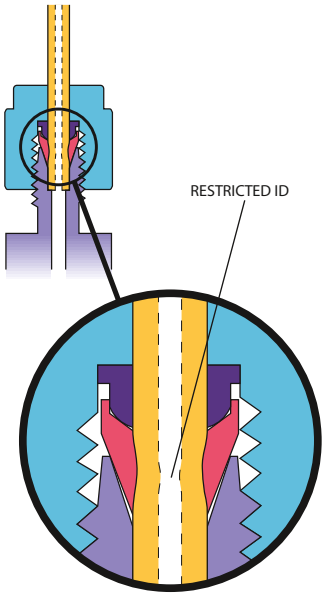


Figure 2
ID restriction
in common compression fitting

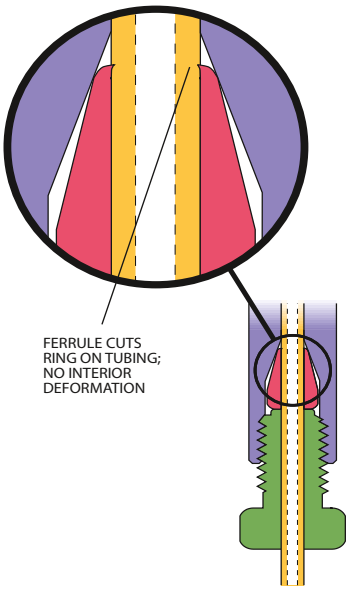


Figure 3
No ID restriction
in Valco compression fitting

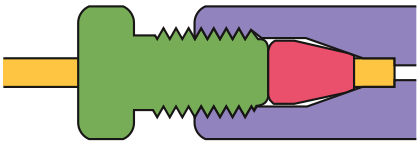
Interchangeability

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.

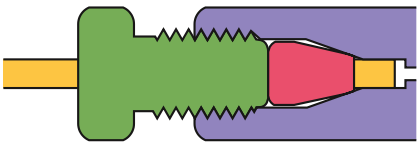
Because of variations in tubing OD and in pilot and taper designs from manufacturer to manufacturer, the amount of tubing extending beyond the made up ferrule can vary. (The most radical variation is in the fittings manufactured by Waters. Based on the old Swagelok design, they have a pilot depth considerably 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

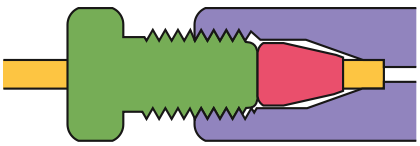
Most of our state of the art CNC machines use water-based lubricants. After each part comes off the machine, it is cleaned with water-soluble detergents and then rinsed in hot deionized water. Finally, every metal fitting that we make is given a thorough cleaning with steam from deionized water at 140°C. 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

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

VALCO FITTINGS

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.

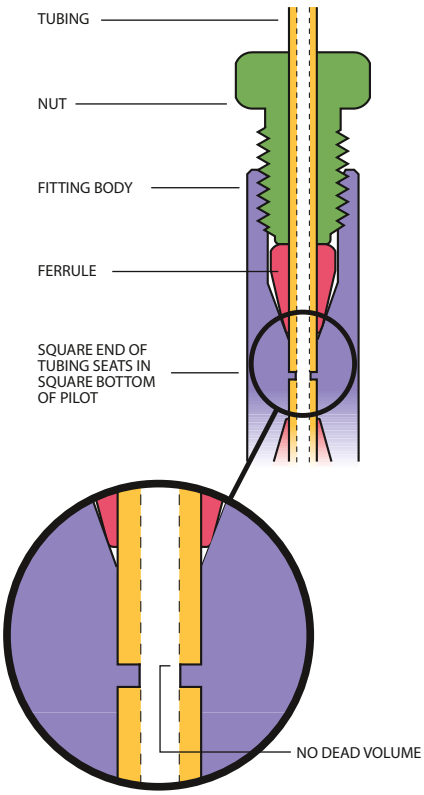


Figure 5
Valco/Cheminert high pressure compression fitting

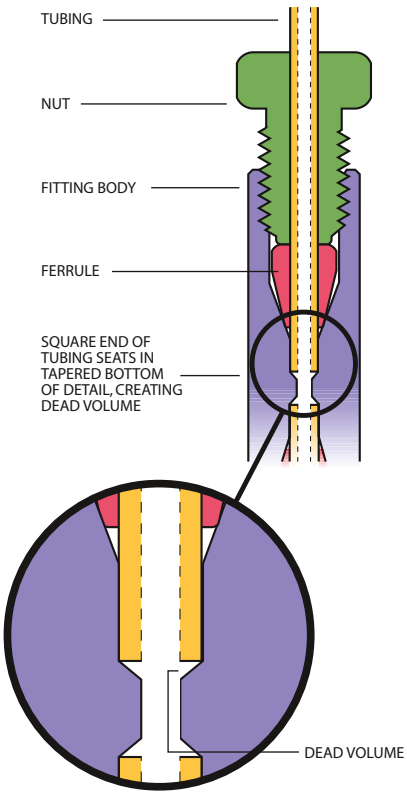


Figure 6
Poor quality compression fitting

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.

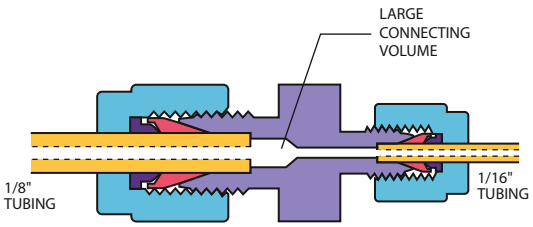


Figure 7
Common commercial reducing union

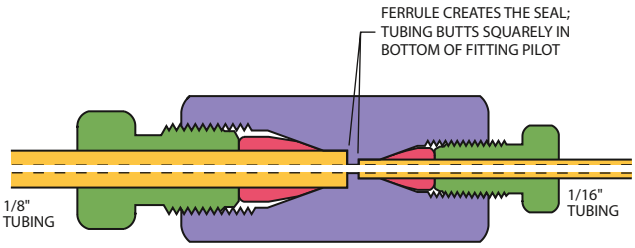


Figure 8
Valco zero dead volume reducing union

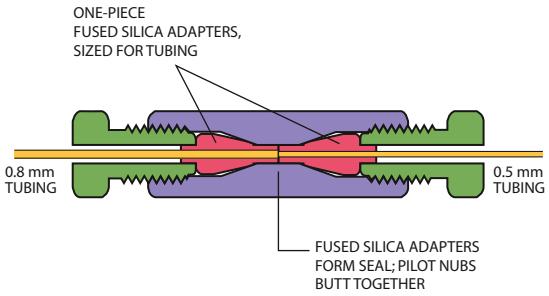


Figure 9
Valco zero dead volume through-bore union

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.

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.

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.

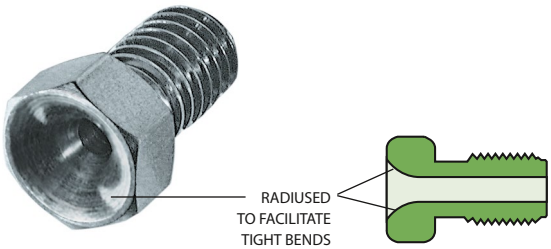
Stainless nuts

Package of 10:	*Length*	*Prod No*
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	.625"	IZN1-10
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

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.

Description	*Length*	*Prod No*
Stainless steel		
1/16", standard	.43"	ZN1R
1/16" , short	.30"	ZSN1R
1/8", standard	.57"	ZN2R
PEEK		
1/16", hex	.45"	ZN1RPK
1/16", fingertight	.88"	ZN1RFPK



Controlled radius nut
Standard length

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

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

MORE INFORMATION

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

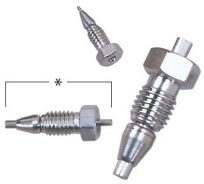
1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

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.

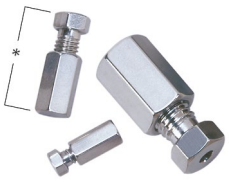
	Stainless nuts
Description	*Prod No*
1/32″ e xternal nut	EN.5
1/32″ external nut, knurled	EN.5KN
1/16" external nut	EN1
1/8" external nut	EN2
1/4" external nut	EN4 *
3/8" external nut	EN6 *
1/2" external nut	EN8 *
1" external nut	EN1K *



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 plug**	*Prod No*	*Prod No*
1/32"	.49"	ZP.5	ZP.5H
1/16"	.75"	ZP1	ZP1H
1/16"	1.13"	LZP1	LZP1H
1/8"	1.00"	ZP2	ZP2H
1/8"	1.40"	LZP2	LZP2H
1/4"	1.20"	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 cap**	*Prod No*
1/32"	.55"	ZC.5
1/16"	.77"	ZC1
1/8"	1.01"	ZC2
1/4"	1.24"	ZC4

MORE INFORMATION

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

VALCO FITTINGS

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.

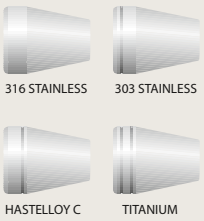
Metal ferrules

	Prod No	*Prod No*	*Prod No*
Package of 10:	**Stainless, Type 303**	**Stainless, Type 316**	**Stainless, Gold-plated**
1/32"	ZF.5-10	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
Sold individually:	**Hastelloy C**	**Nickel**	**Titanium**
1/32"	ZF.5HC	ZF.5NI	ZF.5TI
1/16"	ZF1HC	ZF1NI	ZF1TI
1/8"	ZF2HC	ZF2NI	ZF2TI
1/4"	ZF4HC	ZF4NI	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.

FERRULE IDENTIFICATION

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



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 ions in solutions

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 254-255.

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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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

Package of 10:	*Prod No* **PTFE, Virgin**	*Prod No* **PTFE, Glass-filled**	*Prod No* **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**	**PEEK**
1/32"	ZF.5PFA-10	ZF.5KF-10	ZF.5PK-10
1/16"	ZF1PFA-10	ZF1KF-10	ZF1PK-10
1/8"	ZF2PFA-10	ZF2KF-10	ZF2PK-10
1/4"	ZF4PFA-10	ZF4KF-10	ZF4PK-10
3/8"	ZF6PFA-10	ZF6KF-10	ZF6PK-10
1/2"	ZF8PFA-10	ZF8KF-10	ZF8PK-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

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 256.

MORE INFORMATION

Grooved PEEK ferrules. . . . . page 63

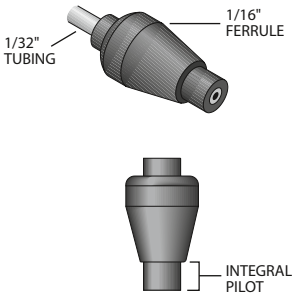
VALCO FITTINGS

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.

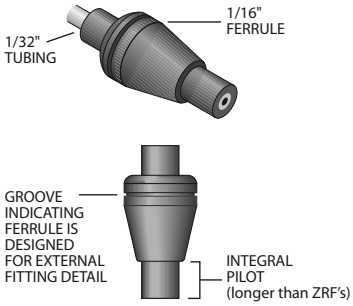
Internal ZDV (zero dead volume) reducing ferrules are designed for use with all standard Valco internal style fittings – that is, those with a male nut and female fitting detail. The ferrule features an integral pilot which fills the pilot cavity (the space between the end of the ferrule and the bottom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

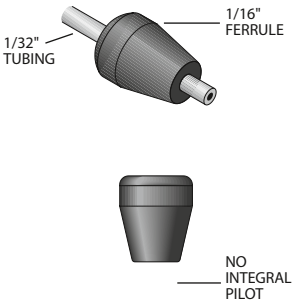
Standard reducing ferrules can be used where mixing is not a problem, such as with liquid or gas delivery. A 1/16" to 1/32" ferrule of this style is simply a 1/16" ferrule with a 1/32" hole.



Internal reducing ferrule
(ZRF)



External reducing ferrule
(EZRF)



Standard reducing ferrule
(RF)

Internal reducing ferrules

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

	Prod No	*Prod No*	*Prod No*
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	

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

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 ®.

MORE INFORMATION
Internal reducers (IZR) . . . . . page 38
External reducers (EZR) 39
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.

OPTION
Available in Virgin Polyimide.

External reducing ferrules

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

Package of 5:	*Prod No* **PTFE, Glass-filled**	*Prod No* **PEEK**	*Prod No* **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

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.

Package of 5:	*Prod No* **PTFE, Glass-filled**	*Prod No* **PEEK**	*Prod No* **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

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

VALCO FITTINGS

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** *Prod No*	**PEEK** *Prod No*	**Polyimide, Virgin** *Prod No*
1/32" Adapters			
Tubing OD:			
< 0.20 mm	FS.2-5	FS.2PK-5	—
0.20 ≤ 0.25 mm	FS.25-5	FS.25PK-5	FS.25V1-5
0.25 ≤ 0.36 mm	FS.36-5	FS.36PK-5	—
0.36 ≤ 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:			
< 0.20 mm	FS1.2-5	FS1.2PK-5	FS1.2V1-5
0.20 ≤ 0.25 mm	FS1.25-5	FS1.25PK-5	FS1.25V1-5
0.25 ≤ 0.30 mm	FS1.3-5	FS1.3PK-5	FS1.3V1-5
0.30 ≤ 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 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

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

OPTIONS
Other sizes may be available in some materials. Contact Tech Support for availability.

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

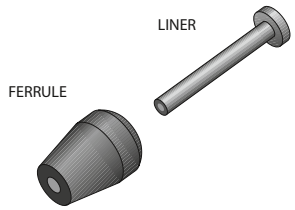
PEEK adapters are not recommended for use above 175°C.

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.

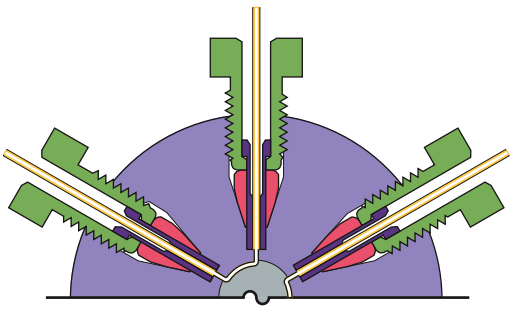


Removable fused silica adapters (FSR)

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 counterbored 1/16" nut. The 1/32" FSR adapter uses a standard Valco 1/32" nut.

Package of 5:	**Polyimide, Valcon** *Prod No*
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*	**PEEK** *Prod No*
1/16" removable adapters		
Tubing OD:		
< 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 .... pages 19, 61
Fittings 16-21, 58-61

A pin vise and drill index are useful for enlarging the inner diameters of the FS adapters.

Pin vise and drill index 55

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

REPLACEMENT PARTS

Ferrules

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

Nuts

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

VALCO FITTINGS

Injector nut for Agilent 6850, 6890, 7820, 7890, and 5890, Series I and II

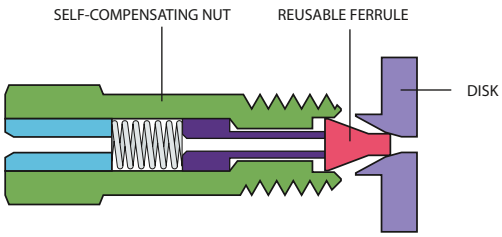
This self-compensating nut is a direct replacement for the standard nut on the split/splitless injectors of the Agilent GCs listed above. This retrofit offers enhanced ferrule reusability and temperature stability, resulting in fingertight leak-free connections over the full programmed temperature range 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.

		Prod No
Injector nut system		FSZA-HP
Includes nut and seal disk		
Replacement parts		
Self-compensating nut		FSZNA-HP
HP-5890 split/splitless seal disk		SEAL1-HP
Reusable ferrules, pkg/10 *		
Column ID:	.20 –.25 mm	FS1.35-R10
	.32 mm	FS1.45-R10
	.53 mm	FS1.75-R10

*These reusable ferrules seal at the tip, and are different from standard ferrules.



Self-compensating nut
for Agilent GCs

Replacement ferrules *for injector nuts, above*

These reusable ferrules seal at the tip, and are different from standard ferrules. For use with FSZNA-HP nuts above.

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

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"

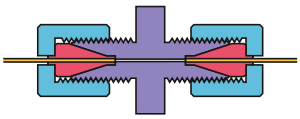
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

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

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, below.

Bore	*Prod No*
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

1/32" One piece fused silica adapters (FS)

The 1/32" one piece FS adapter is recommended for use in 1/32" ultra low mass external unions, and 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.

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.

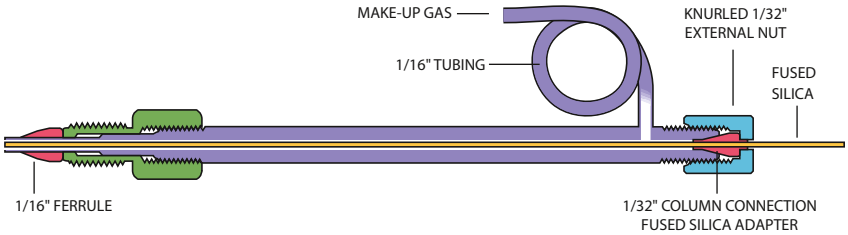
Package of 5:	**Polyimide, Valcon** *Prod No*	**PEEK** *Prod No*	**Polyimide, Virgin** *Prod No*
Tubing OD:			
< 0.20 mm	FS.2-5	FS.2PK-5	—
0.20 ≤ 0.25 mm	FS.25-5	FS.25PK-5	FS.25V1-5
0.25 ≤ 0.36 mm	FS.36-5	FS.36PK-5	—
0.36 ≤ 0.40 mm	FS.4-5	FS.4PK-5	FS.4V1-5
0.40 ≤ 0.50 mm	FS.5-5	FS.5PK-5	FS.5V1-5
0.50 ≤ 0.80 mm	ZF.5V-5	ZF.5PK-5	ZF.5V1-5

VALCO FITTINGS

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*
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)

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"

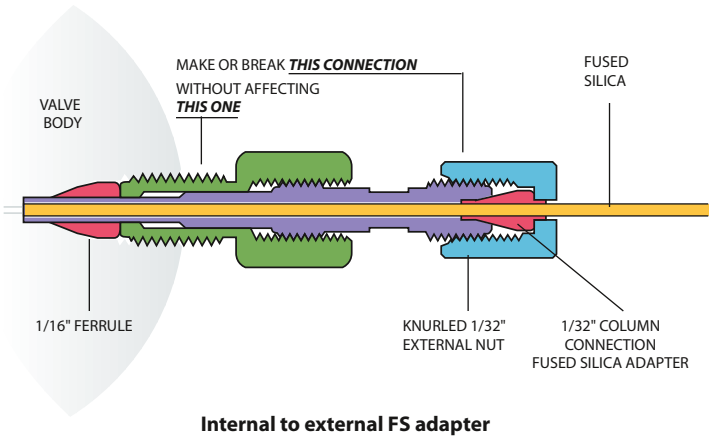
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

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

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

Description	*Bore*	*Prod No*
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

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

MORE INFORMATION
1/32" fused silica adapter ferrules . . . . . page 19

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

Tubing OD:

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

VALCO FITTINGS

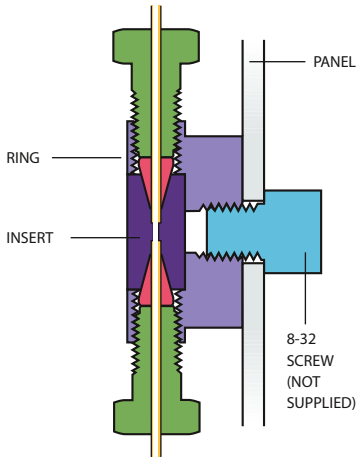
Micro-unions, -tees, -crosses, and -Y's have a unique two-piece design which allows us to provide an extremely small bore in a conventional ferrule and nut fitting. The actual connection area is separated from the nut threads, with the ferrule detail in a metal or polymer insert and the threads machined 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.

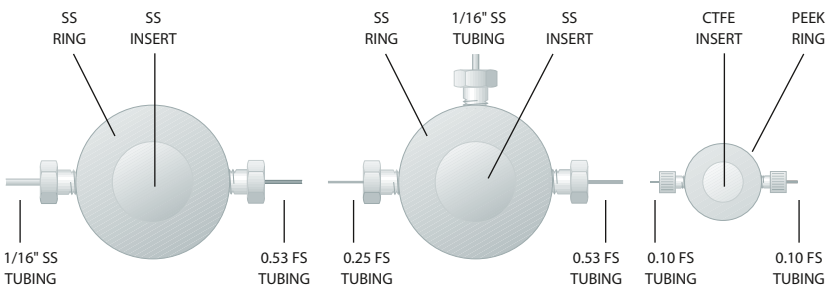
A stainless ring with one of the plastic inserts provides electrical insulation within the insert, while the PEEK ring achieves total isolation.

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 (liquid) 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

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"
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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

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	*Prod No*	*Prod No*	*Prod No*	*Prod No*
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	*Prod No*	*Prod No*	*Prod No*	*Prod No*
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

Description	1/32" connectors *Prod No*	1/16" connectors *Prod No*
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.
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.

NANOBORE CONNECTIONS
For 0.10 mm (100 µm) bore fittings, see pages 57-61.

VALCO FITTINGS

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.

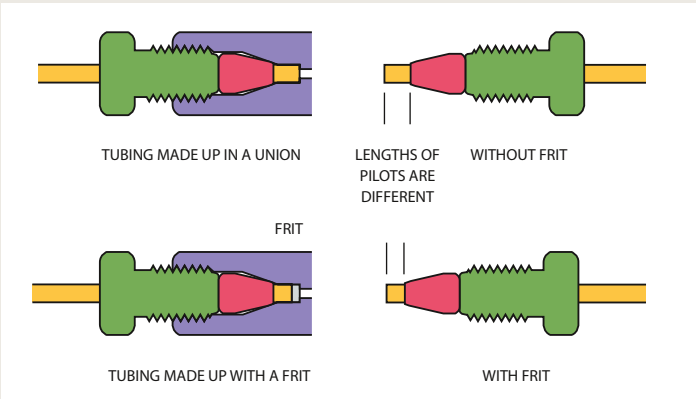
Internal fittings are almost always the best with tubing of 1/8" OD or smaller. They make a stronger connection and offer the lower volume necessary for high performance instrumentation. Also, because 1/16" external fittings have very thin, easily distorted walls, they are not as durable as 1/16" internal 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 48-52
Frits and screens. 53



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"

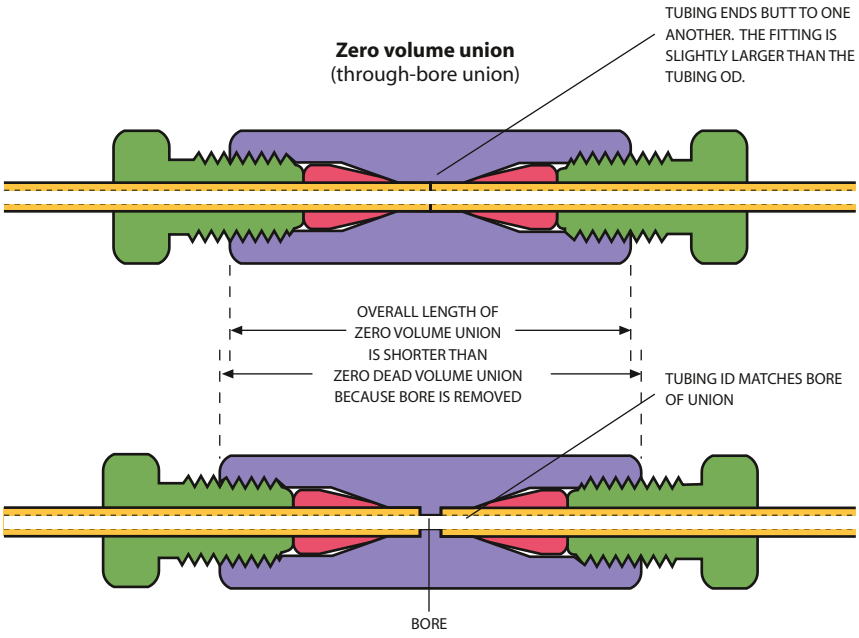
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

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

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.



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 INFORMATION
Reducing unions to connect two tubes with different ODs . . . . . p 28-31
Unions with 1/4-28 fittings 72-73

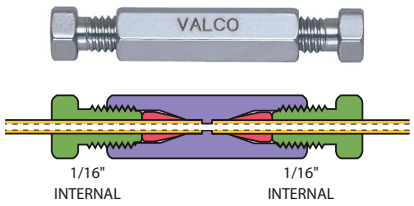
VALCO FITTINGS

Internal unions – stainless steel

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

Standard internal unions

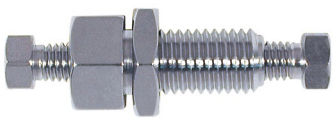
Tubing OD	*Bore*	*Prod No*
1/32"	0.15 mm	ZU.5XC
	0.25 mm	ZU.5
	0.50 mm	ZU.5L
	1/32"	ZU.5T
1/16"	0.15 mm	ZU1XC
	0.25 mm	ZU1C
	0.50 mm	ZU1M
	0.75 mm	ZU1
	1.0 mm	ZU1L
	1/16"	ZU1T
1/8"	0.75 mm	ZU2
	2.0 mm	ZU2L
	1/8"	ZU2T
1/4"	0.75 mm	ZU4
	4.6 mm	ZU4L
	1/4"	ZU4T



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*	**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.

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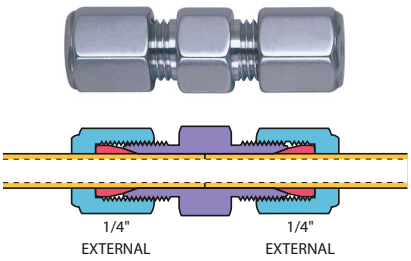
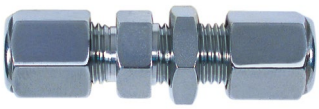
1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

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



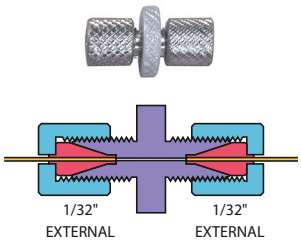
Bulkhead external union
(EBU2L)

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*	**Bulkhead** *Prod No*	**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"

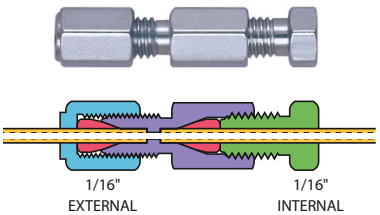


1/32" external union
(EU.5)
For use with GC capillary columns

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*
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

External/internal unions

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

Tubing OD	*Bore*	**Standard** *Prod No*	**Bulkhead** *Prod No*	**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"

Bulkhead external/internal union
(EZBU1)

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

VALCO FITTINGS

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

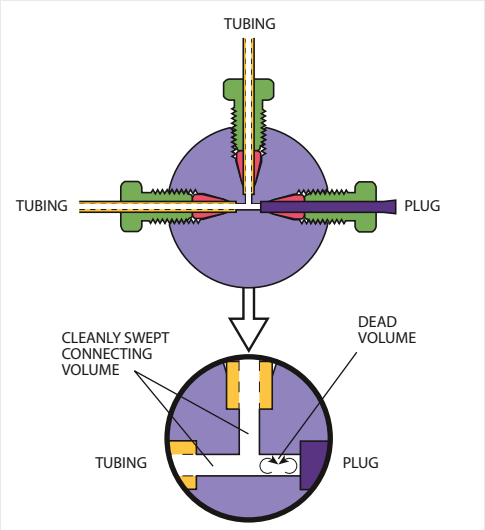
- Internal reducing unions have female threads and a fitting detail for zero volume fittings. The nuts have male (external) threads.
- External reducing unions have male threads, requiring a nut with internal threads.
- External/internal and internal/external reducing unions have male threads on one 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

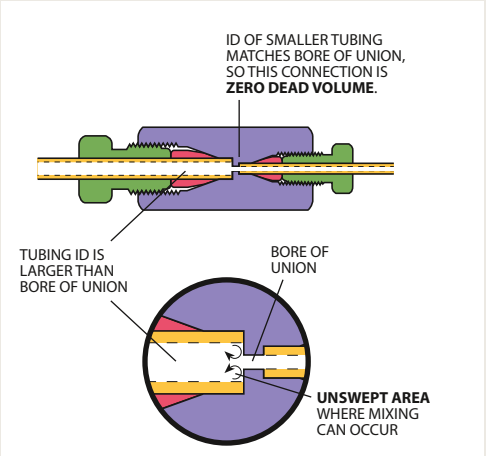
"Dead volume" is created in obvious situations such as the one shown.



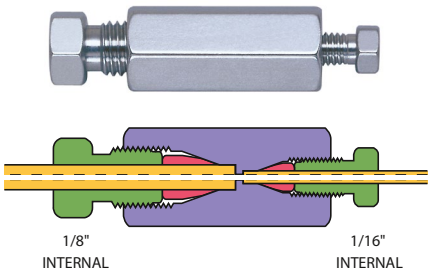
1/16" Tee
(ZT1)

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.

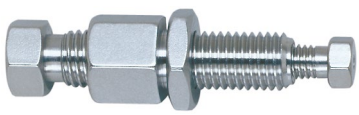
Standard material is 300 series stainless. Also available in Hastelloy C, gold-plated stainless, and titanium.

Standard internal reducing unions

Tubing OD	*Bore*	*Prod No*
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*	**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

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

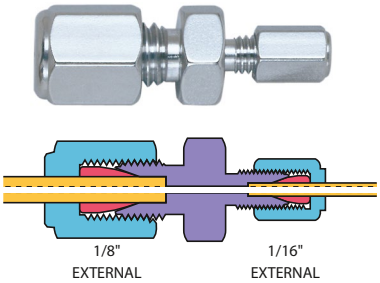
VALCO FITTINGS

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

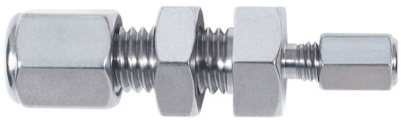
Tubing OD	*Bore*	*Prod No*
1/8" to 1/16"	0.75 mm	ERU21
	1.00 mm	ERU21L
	1/16"	ERU21T
1/4" to 1/16"	0.75 mm	ERU41
	1/16"	ERU41T
1/4" to 1/8"	0.75 mm	ERU42
	2.0 mm	ERU42L
	1/8"	ERU42T



External reducing union
Standard bore
(ERU21)

Bulkhead external reducing unions

Tubing OD	*Bore*	*Prod No*	**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
1/16", 1/8", and 1/4" external Valco fitting components are compatible with Parker and Swagelok fittings.

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.

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"

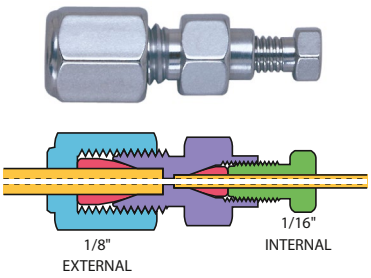
7.0 mm = .275"
10.0 mm = .400"

27.0 mm = 1.08"

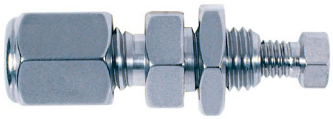
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

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



External/internal reducing union
Standard bore
(EZRU21)



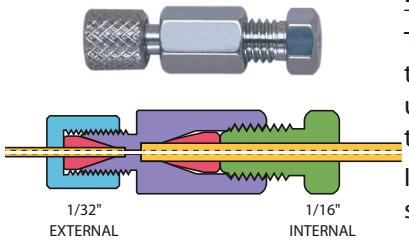
Bulkhead external/internal reducing union
(EZBRU21)

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.

Tubing OD	*Bore*	**Standard** *Prod No*	**Bulkhead** *Prod No*	**Bulkhead 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	7/16"



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

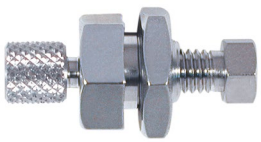
Internal/external reducing unions

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.

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.)* 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 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"



Bulkhead internal/external reducing union
(EZBRU.51)

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

MORE INFORMATION

VALCO FITTINGS

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*
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*
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

SURFACE MOUNTING TEES AND CROSSES

1/8" and 1/4" tees and crosses have two threaded mounting holes (8-32). For 1/32" and 1/16", 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.

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 . . 62-66
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 38

MORE INFORMATION

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

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*
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	0.25 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 34.*) Standard material is 300 series stainless steel.

	Inlet bore	*Outlet bore*	*Prod No*
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

SURFACE MOUNTING MANIFOLDS

Mounting kit DVBRKIT

TECH TIP

A manifold used with an SD flowpath multi-position valve allows HPLC column selection with a single valve. See page 141 for an illustration.

SD UW valves. . . page 134

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

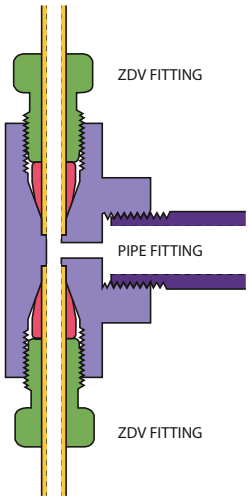
1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

VALCO FITTINGS

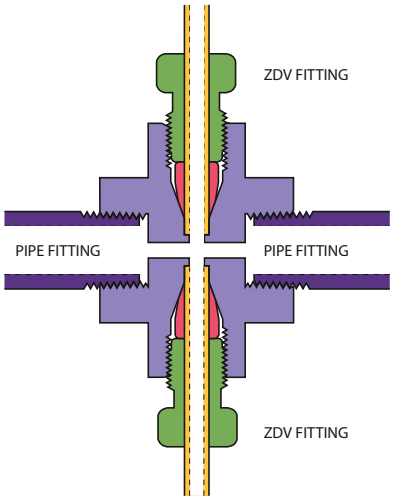
Manifold pipe adapters

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.

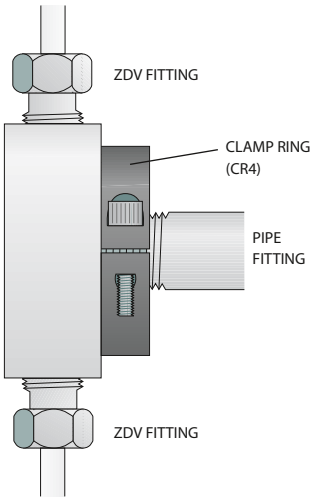
Description	*Bore*	*Prod No*
One 1/8" female pipe to:		
three 1/16" ZDV fittings	1.0 mm	FP1Z3M21
three 1/8" ZDV fittings	2.0 mm	FP1Z3M22
three 1/4" ZDV fittings	4.6 mm	FP1Z3M24
One 1/4" female pipe to:		
three 1/16" ZDV fittings	1.0 mm	FP1Z3M41
three 1/8" ZDV fittings	2.0 mm	FP1Z3M42
three 1/4" ZDV fittings	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

SURFACE MOUNTING MANIFOLDS

Mounting kit DVBRKIT

CONVERSIONS

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

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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

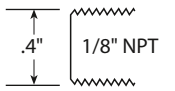
Male pipe to Valco internal adapters

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.

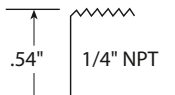
Description	*Bore*	*Prod No*
1/8" NPT male to:		
1/16" ZDV fitting	1.0 mm	PZA21
1/16" ZDV fitting	1/16"	PZA21T
1/8" ZDV fitting	1.0 mm	PZA22
1/4" NPT male to:		
1/16" ZDV fitting	1.0 mm	PZA41
1/8" ZDV fitting	1.0 mm	PZA42
1/8" ZDV fitting	2.0 mm	PZA42L
1/4" ZDV fitting	4.6 mm	PZA44L
1/2" NPT male to: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

TECH TIP

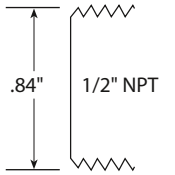
NPT, National Pipe Thread, is a standard developed a long time ago by people without rulers. 1/8" NPT is nowhere close to 1/8"! Measure the diameter of the fitting across the narrow end. You can also count the number of threads in a 1" section. Then look at the diagrams below to determine the correct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



27 threads per inch



18 threads per inch



14 threads per inch

MORE INFORMATION

Pipe to Valco external adapters. . . . . page 36

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*
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

VALCO FITTINGS

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 previous page.

Description	*Bore*	*Prod No*
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

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 previous page.

Description	*Bore*	*Prod No*
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

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 page12.)*

MORE INFORMATION

Our manifold pipe adapters on page 34 allow you to connect one or two pipe fittings to three Valco zero dead volume fittings.

Pipe to Valco internal adapters. . . . . page 35

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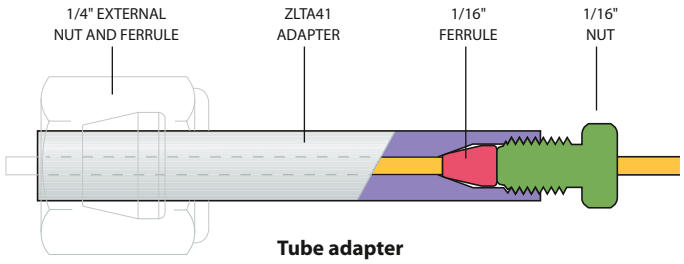
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

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

Tube adapters

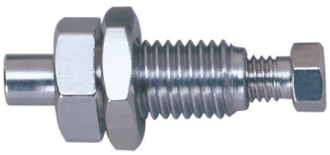
These external adapters are ideal for connecting 1/16" tubing to a detector or injector with a 1/4" fitting. The shorter size is used with 1/4" external fittings while the longer works with 1/4" internal or external fittings. (1/16" nut and ferrule are included; 1/4" nut and ferrule are not.) Standard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

Description	*Length*	*Bore*	*Prod No*
1/4" to 1/16"	0.7"	1/16"	ZTA41
	1.8"	1/16"	ZLTA41
	2.8"	1/16"	ZXLTA41



Tube adapter
(ZLTA41)

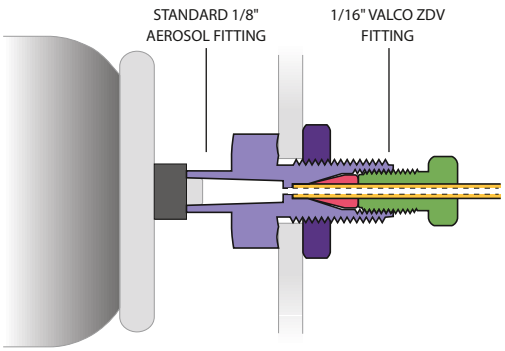
Aerosol adapter bulkhead union



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*
Aerosol adapter bulkhead union	ZBAA1



Aerosol adapter bulkhead union
(ZBAA1)

VALCO FITTINGS

Internal reducers *NEW* *for 360 µm tubing*

Directly connect 360 µm 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 *(illustration below)*. All versions have a stainless steel body, with 360 µm nut/ferrule material as indicated.

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

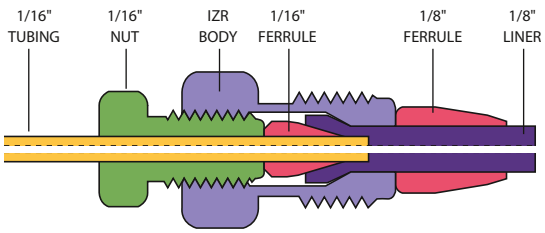
* glass-filled

Internal reducers

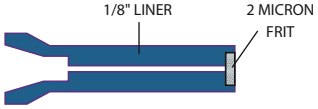
Valco's internal reducer (IZR) allows smaller tubing to be used in valves with fitting details for larger tubing, forming a positive leak-free seal with zero dead volume. The small line from your system goes directly into the IZR and the sample goes directly into the valve, without the short pieces of 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 pages 48-52*) 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.

		Without frit	**With 2µ frit**
Tubing OD	*Bore*	*Prod No*	*Prod No*
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

360 MICRON FITTINGS
See our extensive line of 360 µm fittings . .pp 57-58

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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6.4 mm = .253"

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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

External to internal reducer *NEW* *for 360 µm tubing*

Directly connect 360 µm tubing into a 1/32" Valco external union or the external type fittings common on injectors and detectors with a Valco zero dead volume connection.

Tubing OD	*Nut/ferrule material*	*Bore*	*For use with*	*Prod No*
1/32" to 360 µm	Stainless	150 µm	Metal tubing	C360EZR.5XC

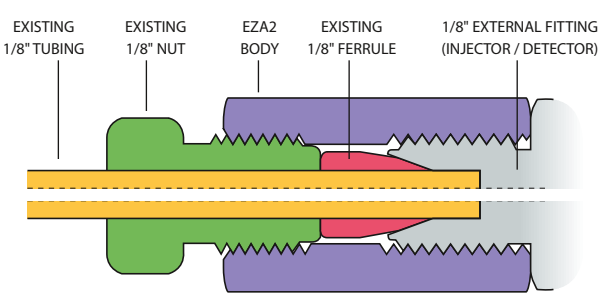
External to internal adapters (injector/detector adapters)

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.

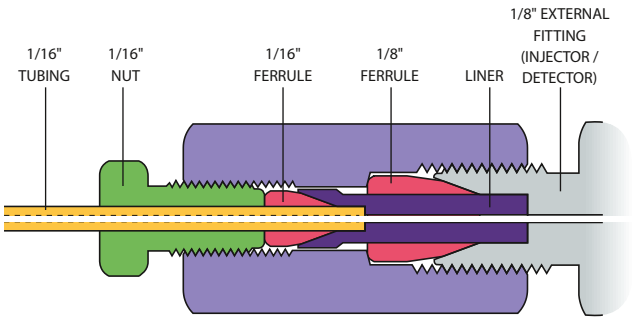
Only one wrench is required to change tubes after the fitting is made up. While an external to internal union or reducing union plus a length of tubing can accomplish the same thing, these adapters do the trick with a single fitting.

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.

	Description	*Bore*	*Prod No*
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)

VALCO FITTINGS

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*
For high pressure 1/16" ZDV 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" ZDV 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*

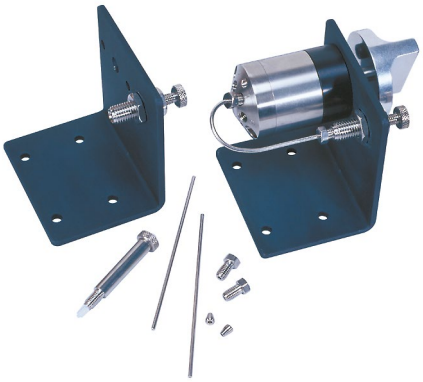
These fill ports provide direct syringe connections to polymeric valves and fittings. Since the fitting detail in the high pressure Cheminert valve is unique, be sure to order the high pressure version for polymeric HPLC injectors. For use with 22 gauge blunt tip needle.

Description	*Prod No*
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 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.

Description	*Prod No*
For use with blunt tip needle	
For 1/32" fittings and injectors - 26 ga	VISF.5FPK
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
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



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*
Loop fill port assembly	C-LFP

Female luer adapters

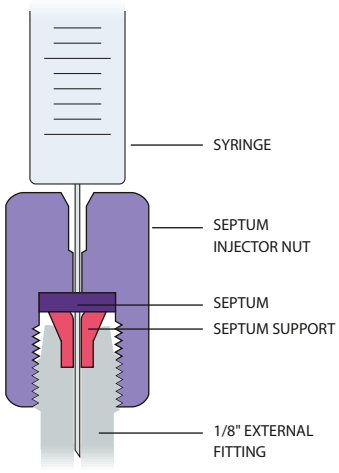
Female luer adapters provide direct syringe connections to zero dead volume fittings and valves.

Description		*Prod No*
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*
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. . . . . 160, 163
Model C4. . . . . 161, 164

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

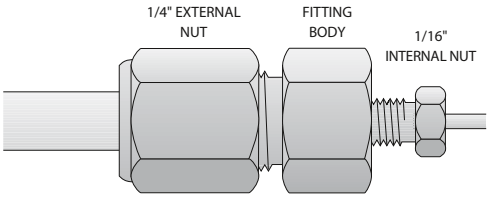
VALCO FITTINGS

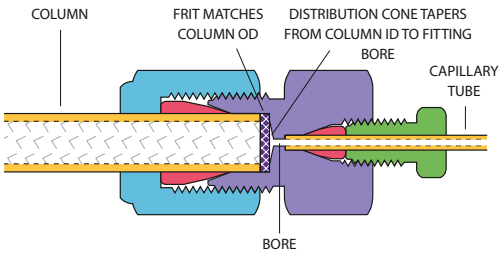
Although our column end fittings look like ordinary reducing unions, they are machined with a conical recess to match a specific column ID so that there are no abrupt or irregular diameter changes which can cause loss of theoretical plates. *(See illustrations, below.)* This optimization results in an 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.

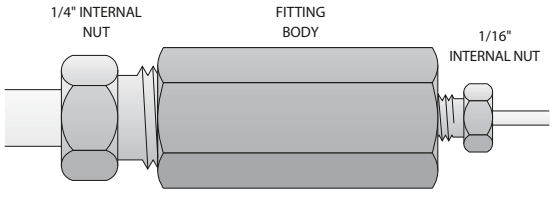
All column end fittings are rated to 10,000 psi. However, the functional limit is dictated by the yield strength of the tubing used with the fitting. Standard 1/4", 3/8", and 1/2" columns are usually packed at 8,000 -10,000 psi, which is right at the yield strength for the tubing commonly used. Columns 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.

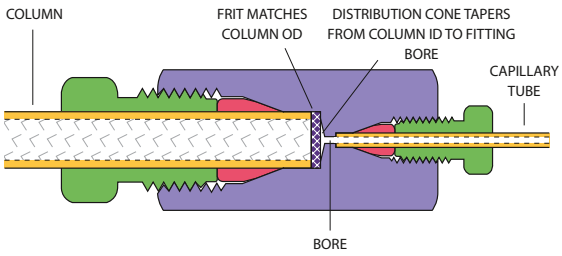
The newest addition to the line is the Nanovolume® column end fitting. *(See page 61.)* These all-PEEK fittings feature fingertight zero dead volume connections with 100 or 150 micron bore. PEEK sleeves permit use with any fused silica tubing.





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)

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

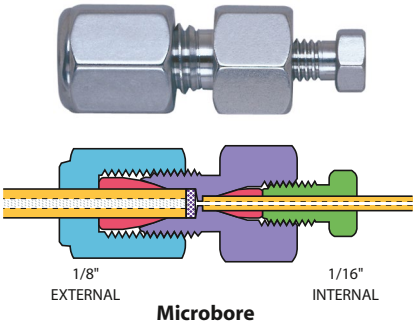
Through-type unions for packing columns..... page 26

MORE INFORMATION
Frits..... page 45

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

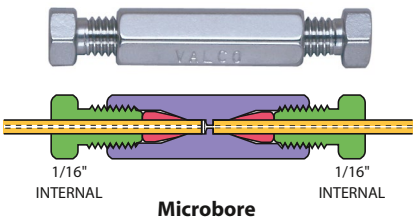
Standard material is Type 316 stainless.

	Bore	Column ID	Without frit Prod No	Removable 2µ frit Prod No
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	Removable 2µ frit Prod No
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 61.

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"
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7.0 mm = .275"
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27.0 mm = 1.08"

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

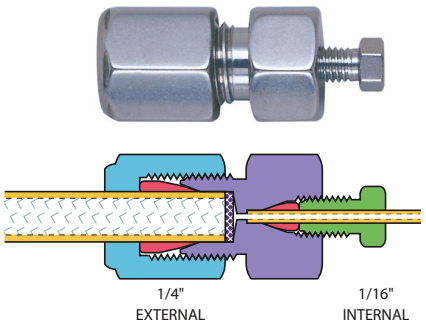
1/4" = 6.4 mm
3/8" = 9.5 mm
1/2" = 12.7 mm

VALCO FITTINGS

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

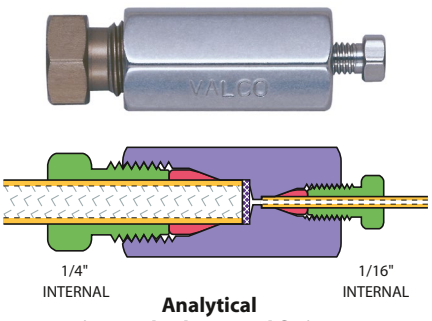
Standard material is Type 316 stainless.

	Bore	Column ID	Without frit Prod No	Removable 2µ frit Prod No
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	Removable 2µ frit Prod No
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 61.

CONVERSIONS

100 µm = .004"
150 µm = .006"

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

1.0 mm = .040"
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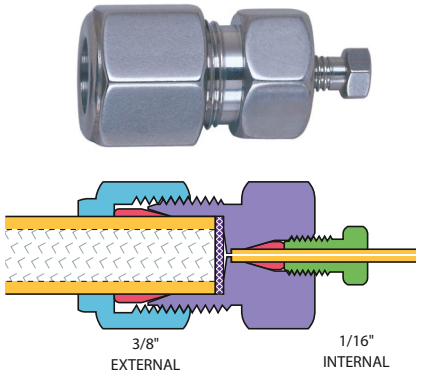
1/8" = 3.2 mm

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

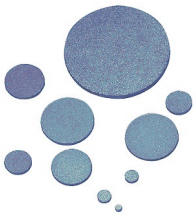
Semi-preparative and preparative column end fittings

Standard material is Type 316 stainless.

	Bore	Column ID	Without frit Prod No	Removable 2µ frit Prod No
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

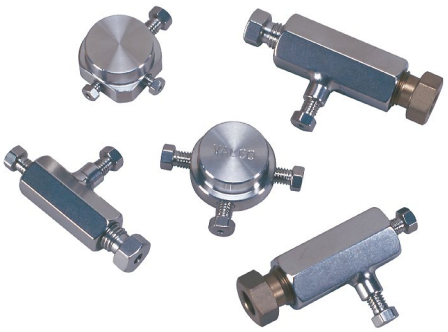
1/16", 1/8" and 1/4" frits are sold in packages of 10. 3/8", 1/2", and 1" frits are sold individually. Other sizes may be available or special-ordered in OEM quantities.

Package of 10:		*Pore Size*	*Frit thickness*	Stainless steel *Prod No*	Hastelloy C *Prod No*	Titanium *Prod No*
	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

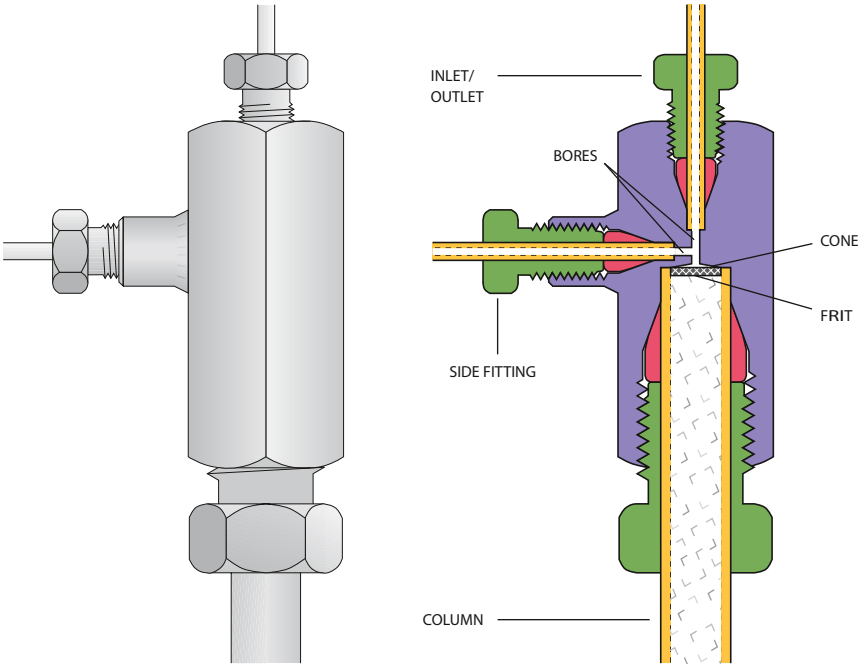
VALCO FITTINGS

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*
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"	0.75 mm	1/16"	0.75 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)

TECH TIP
Tee column end fittings (TCEFs) for 1/16" OD tubing/columns have a round profile. For other sizes, they are made of hexagonal bar stock.

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
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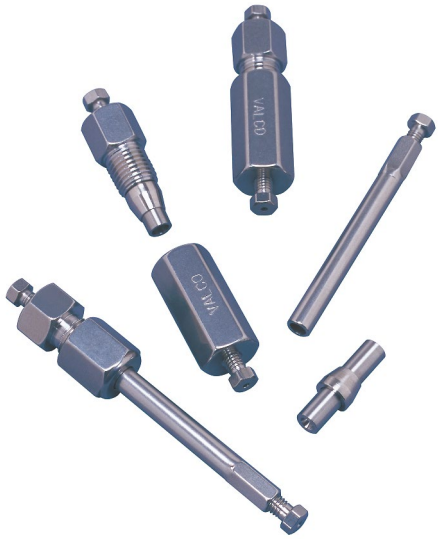
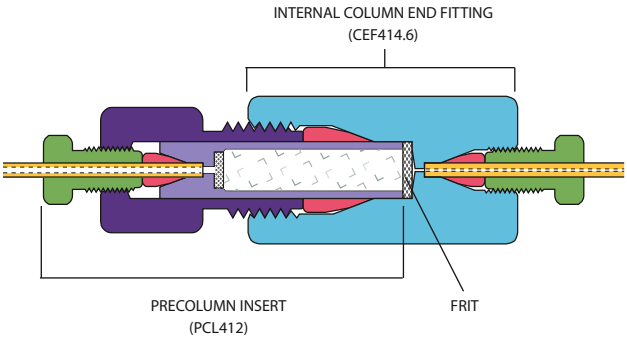


Precolumns (guard columns)

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*
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*
0.25 ml (4.0 mm ID x 2 cm)	
Fingertight cartridge assembly	SFECH412
Replaceable cartridge	SFEC42

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

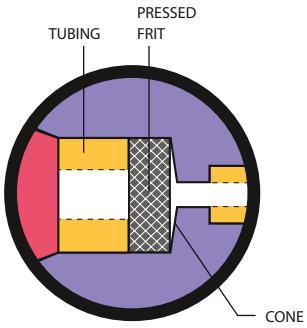
VALCO FITTINGS

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.

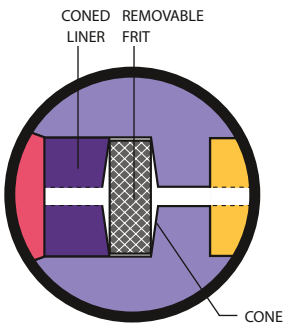
Valco's unique filter design results in extremely low internal volume and simplifies filter element replacement. Filter bodies are "coned" for uniform flow and maximum filter surface area. The filters are made entirely of metal, so they can be used at any instrumentation temperature. While the standard 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.)

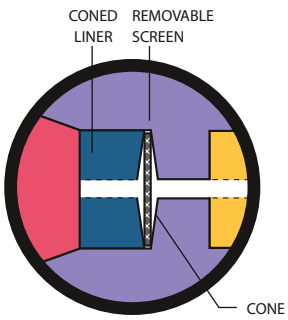
- **Pressed frits**, permanently installed in the filter, are recommended where contaminants are the exception and not the rule. The frits are 2µ stainless.
- **Removable frits** are the best choice for maximum filtration, or if the application requires Hastelloy C or titanium. However, they allow more 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



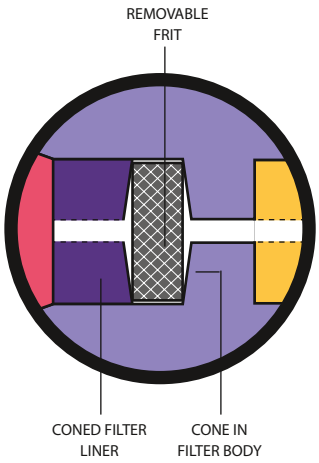
Removable screen

MORE INFORMATION

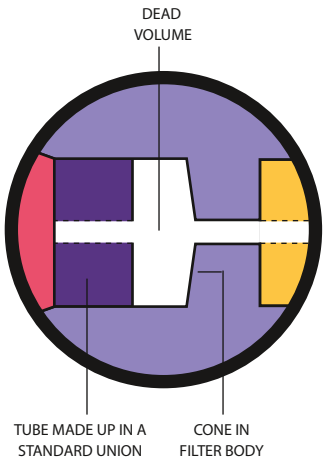
Biocompatible filter . p 78
In-line filters for 1/4-28 fittings 78
Mobile phase filters 79-80

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.

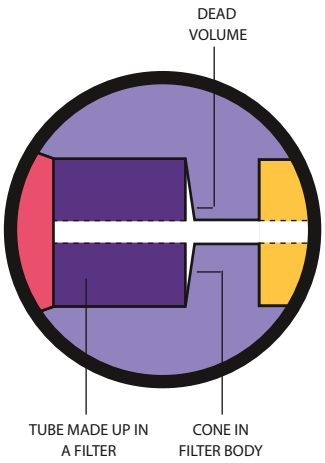
An arrow imprinted on all filter bodies serves to differentiate them from unions and to indicate recommended flow direction.



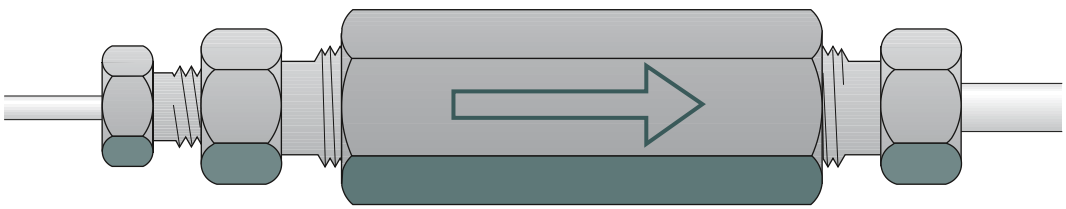
Filter with removable frit
Coned for uniform flow and maximum filter surface



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



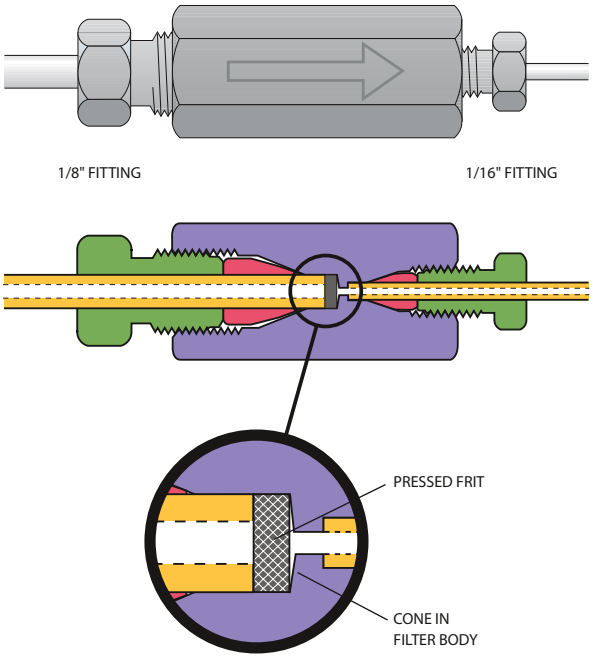
Arrow imprinted on filter body showing recommended direction of flow

VALCO FITTINGS

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.

Description	*Bore*	**Standard** *Prod No*	**Bulkhead** *Prod No*
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)

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"

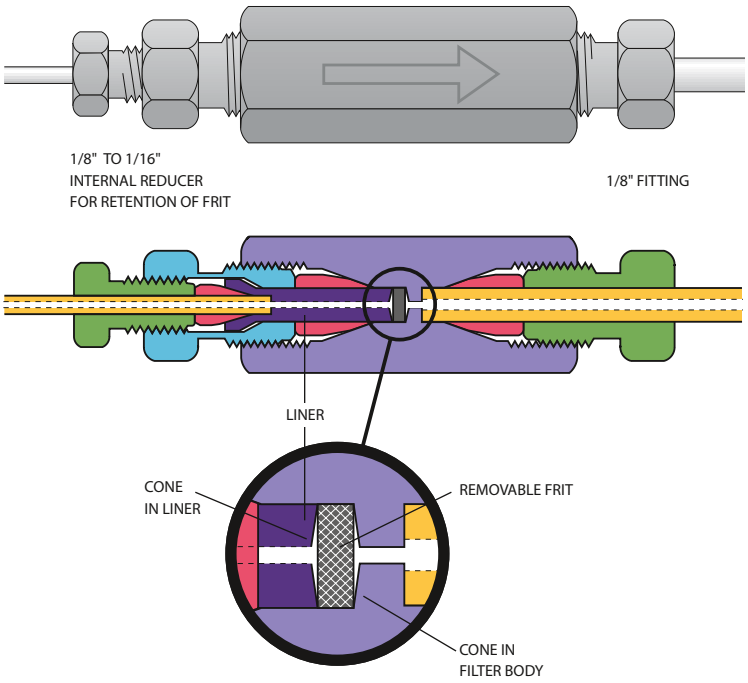
1/32" = 0.8 mm
1/16" = 1.6 mm
1/8" = 3.2 mm

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

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.

Description	*Bore*	**Standard** *Prod No*	**Bulkhead** *Prod No*
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.

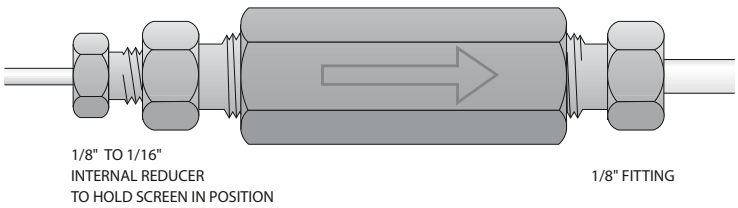
Replacement frits ..... page 53

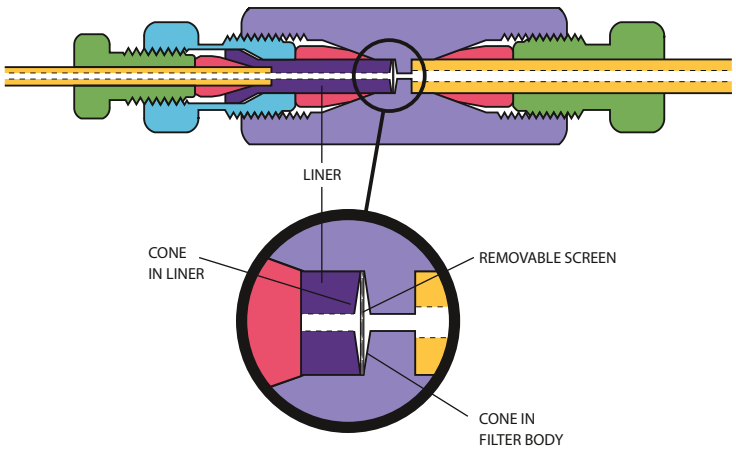
VALCO FITTINGS

Filters 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.

Description	*Bore*	**Standard** *Prod No*	**Bulkhead** *Prod No*
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





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

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"

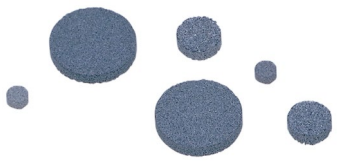
27.0 mm = 1.08"

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

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** *Prod No*	**Hastelloy C** *Prod No*	**Titanium** *Prod No*
Pkg of 5:	1/32" frits	0.2µ	0.25 mm	.2FR.5-5	—	—
		0.5µ	0.25 mm	.5FR.5-5	—	—
		2µ	0.25 mm	2FR.5-5	—	—
Pkg 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	—	—
Pkg of 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	—	—
Pkg of 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. 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.

Package of 10:	*Pore Size*	*Screen Thickness*	**Stainless Steel** *Prod No*
1/32" screens	<1µ	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	<1µ	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	<1µ	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	<1µ	0.040 mm	.5SR4-10
	1µ	0.050 mm	1SR4-10
	2µ	0.075 mm	2SR4-10
	10µ	0.125 mm	10SR4-10

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 diamter or larger. This is true only of the smallest pore screens:

Pore size	*Nominal* retention	*Absolute* retention
<1µ	<1µ	5-6µ
1µ	1µ	6-7µ
2µ	2µ	7-8µ
10µ	10µ	11-13µ

VALCO FITTINGS

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.

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

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

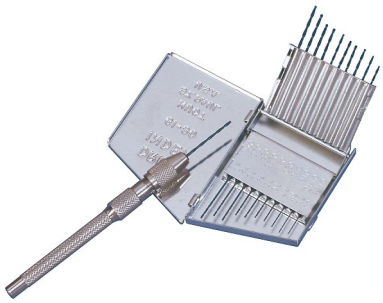
TECH TIP

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.

Open end wrenches

Size	*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



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 on the facing page)*, and for enlarging the inner diameter of fused silica adapters.

Prod No

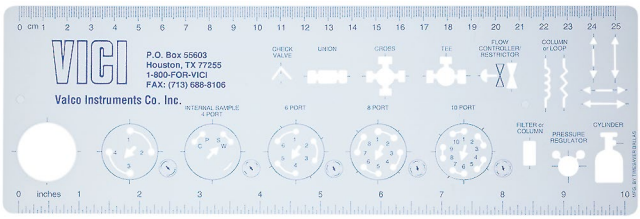
PV

Template

This tool is just what you need when you're working out plumbing and valve switching schematics. It features templates for two position valves with 4, 6, 8, and 10 ports with indications of both positions, as well as various flow symbols. For added convenience, the sides are edged with metric and inch rulers.

Prod No

TEMPLATE1



Mirror

Helpful to get access to valve serial numbers and to check discharge on pulsed discharge detectors (PDD).

Prod No

MR

MORE INFORMATION