

## The Supelco Guide to Leak-Free Connections: Ferrules and Fittings for Packed and Capillary GC

*The ideal GC ferrule provides a leak-tight seal, accommodates column OD variations, seals with minimum torque, and does not stick to the column or fittings. Supeltex and CapSeal Bullet ferrules provide leak-free connections for each designated application. If you are not sure of your needs, a kit containing several types of Supeltex ferrules will enable you to determine the best ferrule for your application. Also listed in this bulletin are Swagelok fittings for virtually any GC plumbing application.*

### Key Words:

- GC ferrules
- GC connections
- gas chromatography systems

### Choosing the Right Ferrule

The ideal GC ferrule provides a leak-tight seal, accommodates column OD variations, seals with minimum torque, and does not stick to the column or fittings. Use the table on page 3 of this bulletin to select the ferrule you need, based on:

- compatibility with column tubing material
- temperature requirements (maximum temperature, isothermal or programmed analyses)
- connection requirements (one-time use or multiple connections/disconnections)
- variations in column diameter

*Compatible Materials* To ensure leak-free connections, the column and ferrule must be made of compatible materials (see recommendations on page 3), and the ferrule should fit the column precisely. Take special care when selecting ferrules for delicate 1/8" OD glass columns – a ferrule that is too hard can break the tubing.

*Temperature Requirements* CapSeal Bullet,™ Supeltex™ (except Supeltex M-1), and metal ferrules can be used under isothermal or programmed temperature conditions, to the limits listed on page 3. Supeltex M-1 ferrules shrink when heated, and should be used only for isothermal analyses.

*Single-Use Ferrules* Soft ferrules, such as Supeltex M-4 ferrules, protect the column by deforming when tightened. Consequently, they can be used only once or twice, depending on the torque applied. Brass or stainless steel ferrules constrict metal columns and cannot be removed for reuse unless the end of the column is removed.

*Multiple-Use Ferrules* A ferrule that is repeatedly tightened and loosened should resist deformation if it is to provide leak-free connections. If you are using temperature programmed analyses, the ferrule also must be resilient enough to maintain a good seal when column temperature and corresponding back pressure increase. CapSeal Bullet and Supeltex M-2A, M-2, and M-1 ferrules are multiple-use ferrules.

CapSeal Bullet ferrules have a clean, sharp profile, with minimal flashing, to ensure maximum sealing surface and minimal possibility of column contamination in a capillary GC system. Their unique design (see page 3) makes it easy to remove these ferrules from any fitting. The special end taper reduces graphite extrusion into the fitting. The composition and design of CapSeal Bullet ferrules also ensures low-torque sealing – they seal effectively at only 1/8 turn past fingertight.

**Note:** Use care when attempting to remove and reuse ferrules on 1/8" OD glass columns.

*Variations in Column Diameter* Outside diameters of supposedly equal OD columns often differ because glass tubing dimensions cannot be absolutely controlled. A good ferrule is designed to seal tightly on all columns having the same nominal OD. Soft ferrules, such as those made of graphite, usually are flexible enough to adjust to these variations; harder materials, such as Vespel®, can deform and crush an undersized glass column before making a good seal.

Supeltex M-2A and other hard Supeltex ferrules will accommodate maximum OD variations among columns of the same nominal OD. In fact, the special design of Supeltex M-2A ferrules enables ferrules of one size to fit both 6mm and 1/4" OD columns. Supeltex M-2 and Supeltex M-4 ferrules will seal on tubing over or under the specified OD, but 6mm columns and 1/4" columns require ferrules of different size.

### Connecting a Glass Column

The column should slide easily into the fittings. Ferrules that stick to the column or fitting make removal difficult and can cause you to break your column. Should a ferrule stick, do not pull forcibly on the column. Instead, loosen the nut and gently tap the ferrule with a small wrench until it loosens.

The torque exerted on a ferrule greatly affects the length of the ferrule's life, and its sealing characteristics. When inserting or removing a glass column from your instrument, use minimal force and be sure the fittings are properly aligned. Overtightening can deform a ferrule and limit it to a single use, and also can

break the column. Undertightening causes leaks and can even allow back pressure to push the column out of the fitting. With experience, most chromatographers develop a feel for the proper torque. This experience may come, however, at the expense of broken columns. An easier and less costly way to obtain consistent and proper tightness is to use a reliable torque wrench. The controlled torque of our Glasrench™ wrench (described in our catalog) prevents column breakage and prolongs ferrule life.

### Connecting a Metal Column

Because metal columns withstand high torque, you can swage a metal ferrule onto the column to provide a permanent leak-free seal. Therefore, if you intend to install your metal column only once and remove it only when it deteriorates, choose brass or stainless steel ferrules. Note that a brass or stainless steel ferrule requires a back ferrule that turns as the nut is tightened or loosened.

Excessive tightening will cause metal ferrules to deform and lose their sealing ability when used on a column that is frequently removed and reinstalled. In addition, in order to replace the deformed ferrule, you must cut the column end. In the process, the packing bed may be disrupted, reducing the quality of column performance.

Made of Vespel material, reusable Supeltex M-2A ferrules provide leak-free seals on a metal column, without constricting the tubing, at temperatures up to 400°C. They are easily removed with a pair of wire cutters, without disrupting the packing or damaging the column. Easy-to-remove Supeltex M-2A ferrules are especially useful with expensive injection port or detector sleeves. Metal ferrules can be overtightened until they deform these sleeves, but Supeltex M-2A ferrules protect these sleeves. Supeltex M-2A ferrules also are useful when a metal column must be moved among several instruments – they can easily be repositioned to accommodate differences in the injector and detector insertion distances specified for each instrument.

### Installing and Tightening Ferrules

When sliding a ferrule onto a column, be sure the column end does not damage the ferrule. Scraping the inner surface can reduce the ferrule's sealing ability and may force ferrule fragments into the column, where they can bleed or absorb sample components. To reduce the risk of ferrule damage, we deburr all metal column edges and polish glass column edges. If you must file a sharp edge on a metal column, take care not to contaminate the column with the filings. Minute particles nearly always enter a capillary column during ferrule installation. Point the end of the column toward the floor while inserting the ferrule, and when the ferrule is in place remove the first 1-1½ inches of tubing. Avoid installation problems by making sure the cut is clean.

Forcing a column too far into a fitting can cause problems. Glass columns can be chipped or broken when the fitting is tightened, or when the column expands as it is heated. Metal columns can deform, causing the seal to leak. In some instruments, carrier gas flow could be obstructed. To properly install a column, push it into the fitting as far as it will go, then pull it back about 1/16" and tighten the ferrule (Figure A). The instructions provided with Supeltex ferrules specify the necessary torque.

Remember – requirements for proper ferrule installation vary with the specific ferrule you use. Read the installation instructions before attempting to install any ferrule.

### Be Sure Your Connections Are Leak-Free

Using the appropriate ferrule does not automatically ensure a leak-free seal. Failure to check all seals in your system can lead to unpleasant surprises. A leaking injection port or detector connection can allow oxygen to mix with the carrier gas and degrade the stationary phase, shortening column life. An outward leak of carrier gas can decrease the flow rate to the detector, causing varying retention times, baseline drift, and sample loss. In an MS high vacuum system, even a minute leak increases the background signal and reduces sensitivity.

You can use a liquid leak detector to check for leaks prior to operating a packed column GC system, but exercise caution. Any liquid entering the system will contaminate your column and can affect your system for weeks or longer. If you intend to operate your column at a high detector sensitivity ( $1 \times 10^{-10}$  -  $1 \times 10^{-12}$  AFS), use a thermal conductivity leak detector, such as the GOW-MAC® instruments listed in our catalog. *Never* use a liquid leak detector in a capillary GC system.

A head pressure gauge is indispensable for detecting leaks or other gas flow problems in a flow-controlled system. An unusual gauge reading will alert you to a moderate leak at the inlet ferrule or septum, improper flow controller operation, or other problem. An incorrectly packed column also affects gauge readings. A loosely packed column produces a pressure reading lower than normal. A higher than normal reading indicates a too tightly packed column, a plugged column, an overtight septum, or a clogged detector. For more information about leaks and other GC problems, ask for our GC Troubleshooting Guide, which is free on request.

For detailed information on connections of all kinds, refer to the *Swagelok Tube Fitter's Manual* (see page 8 of this bulletin).

# Ferrules

## Select the best ferrule for your application:

Ferrule	Composition	Temp. Limit	Characteristics and Recommendations
<b>CapSeal Bullet</b>	graphite in aluminum base	450°C prog./iso.*	Seals at 1/8 turn past fingertight. Minimum flashing. Will not stick to column or fitting. High reusability. <b>Use for all capillary GC applications.</b>
<b>Supeltex M-1</b>	ceramic-filled Teflon®	250°C iso.	High reusability. <b>Ideal for connections to mass spectrometers</b>
<b>Supeltex M-2</b>	VESPEL SP-1 (100% polyimide)	350°C prog./iso.	High reusability. <b>Recommended for use with metal columns.</b>
<b>Supeltex M-2A</b>	VESPEL SP-21 (85% polyimide/ 15% graphite)	400°C prog./iso.	Seals at 1/4 turn past fingertight. Will not stick to metal or glass. High reusability. <b>Recommended for use with glass or metal columns.</b>
<b>Supeltex M-2B</b>	VESPEL SP-211 (10% Teflon/ 15% graphite/ 75% polyimide)	350°C prog./iso.	Conforms easily to a capillary column, ensuring an effective seal with less chance of breakage. High reusability. <b>Use for all capillary GC applications.</b>
<b>Supeltex M-4</b>	flexible graphite prog./iso.	450°C	Seals at 1/4 turn past fingertight. Maximum surface contact, minimal chance of column contamination during installation. Will not stick to column. Limited reusability. <b>Recommended for glass column, capillary GC applications.</b>
<b>O-Ring</b>	silicone	200°C	Seals column having OD over or under specifications. Requires back ferrule. <b>Recommended for use with Teflon columns.</b>

\* prog. = temperature programmed use, iso. = isothermal use.

## Improved Design Supeltex M-4 Ferrules

We have refined the design of graphite ferrules so that we can offer you the finest quality ferrule available. Compare these ferrules to the graphite ferrules you are now using — the improved Supeltex M-4 ferrule offers a clean, sharp profile with minimal flash.

Supeltex ferrules form leaktight seals without sticking to your column. And they don't require back ferrules.



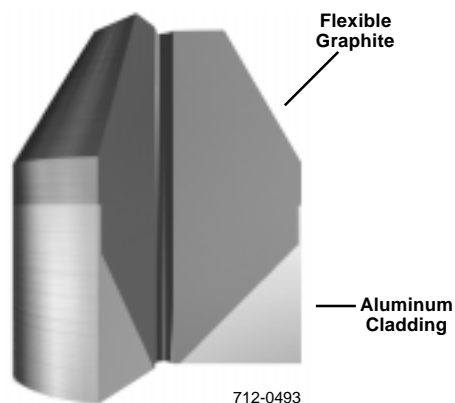
911-0249

## CapSeal Bullet Ferrules

### Will not adhere to fittings.

Reusable CapSeal Bullet Ferrules<sup>▲</sup> consist of a graphite material captured in an aluminum base. This unique design keeps the ferrule from adhering to the fitting, making it easy to remove. Eliminate the headache of digging out a stuck ferrule and risking damage to your fittings.

- 450°C temperature limit — temperature programmed or isothermal use
- Special end taper — reduces graphite extrusion into fitting
- Low-torque sealing (1/8 turn past fingertight)

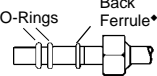


712-0493


<sup>▲</sup>Patent pending.

# Ferrules

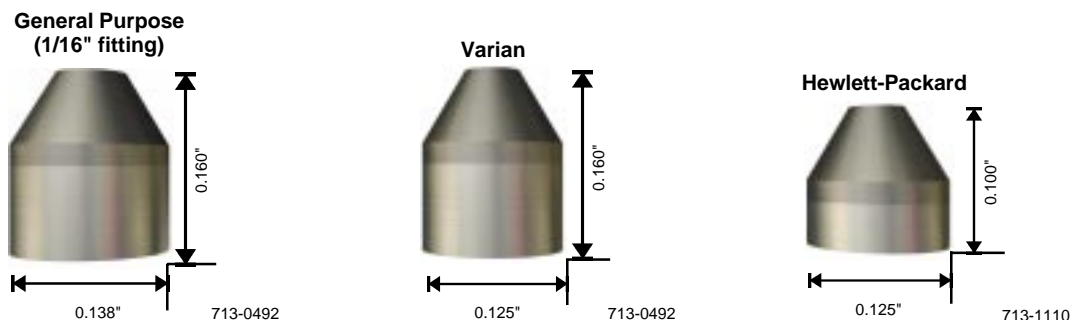
## Supeltex Ferrules Fill any Column Need

Ferrule Type and Temp. Limit	Qty.	Packed Column Ferrules Column OD				Capillary Column Ferrules (for 1/16" fittings) Column OD				
		1/4" Cat. No.	6mm Cat. No.	1/8" Cat. No.	1/16" Cat. No.	0.75mm glass Cat. No.	0.50- 0.75mm glass Cat. No.	0.53mm silica Cat. No.	0.32mm silica Cat. No.	0.20- 0.25mm silica Cat. No.
M-1 (250°C)	10 100	22086-U 22087-U	22089-U —	22496 22309	22386 —	— —	— —	22499 —	— —	— —
M-2 (350°C)	10 50	22320-U 22475	— —	22331 22476	20644-U —	— —	— —	— —	— —	— —
M-2A (400°C)	10 50	22481 22471	22393 —	22483-U 22472	22487-U —	22459 —	— —	22489 22473	22461 —	22490 22474
2-hole Indented Blank (drill to fit your column)	5 10	— 22488	— 22488	— 22488	— 22488	— 22488	— 22488	— 22488	22463 22488	22467 22488
M-2B (350°C) for Varian SPI system	10	—	—	—	—	—	—	22512	22511	22510-U
M-4 (450°C)	10 50	22492 22478	22493 —	22491 —	22495-U —	22460 —	22494 —	20628 22479	22642 22412	22498 22480-U
O-Rings (200°C) Back Ferrule*	100	20407	—	20406	—	—	—	—	—	—
										
Ferrule ID	713-0461	1/4"	6mm	1/8"	1/16"	1.2mm	1.0mm	0.8mm	0.5mm	0.4mm

## Supeltex Reducing Ferrules

	Dimensions	Supeltex M-1 Pk. of 10 Cat. No.	Supeltex M-2A Pk. of 10 Cat. No.	Supeltex M-2 Pk. of 10 Cat. No.	Supeltex M-4 Pk. of 2 Cat. No.
	713-0460	1/8" to 0.50mm 1/8" to 1/16" 1/4" to 0.50mm 1/4" to 1/16" 1/4" to 1/8"	— 22387 — — 22389	— — — 22486 22485-U	— 22484-U — 22384 22314

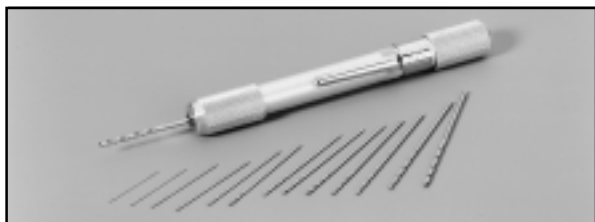
## CapSeal Bullet Ferrules



Column ID	Ferrule ID	Qty.	General Purpose (1/16" fitting)	Varian	Qty.	Hewlett-Packard
0.20-0.25mm fused silica	0.4mm	12	23480-U	23488	10	23864
		48	23485	23493	50	23867
0.32mm fused silica	0.5mm	12	23481	23489	10	23865
		48	23486	23494	50	23868
0.53mm fused silica	0.8mm	12	23482	23490	10	23866
		48	23487	23495	50	23869
0.50-0.75mm glass	1.0mm	12	23483	23491	—	—
0.75mm glass	1.2mm	12	23484	23492	—	—

## Ferrules

### Pin Vise Drill Kit



913-0402

Drill the exact bore you need in hard or soft ferrules. This kit consists of a pin vise and 14 drill bits:

0.33mm/0.0135"	0.77mm/0.031"	1.06mm/0.042"
0.40mm/0.016"	0.83mm/0.033"	1.17mm/0.046"
0.56mm/0.022"	0.91mm/0.036"	1.40mm/0.055"
0.63mm/0.025"	0.97mm/0.038"	1.61mm/0.061"
0.72mm/0.028"	1.02mm/0.040"	

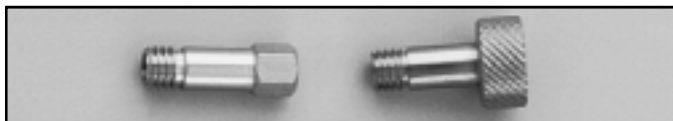
The handle holds all bits to keep them at your fingertips. The improved chuck is handy for gripping fine wire when cleaning FID jets, syringe needles or any other small orifice.

Description	Cat. No.
Pin Vise Drill Kit	23820

### Drill Bits (pk. of 6)

Diameter	Cat. No.
0.34mm	23811
0.40mm	23810
0.51mm	23809
0.84mm	23808
1.18mm	23807

### HP Ferrule Nut Adapter



913-0196

Allows you to use Supeltex and other common capillary ferrules in your Hewlett-Packard 5710, 5790, 5840, 5880, 5890, or 5987 system. Install fused silica or glass capillary columns without restricting ferrule choice. Not recommended for use with HP capillary ferrules.

Description	Cat. No.
HP Ferrule Nut Adapter, pk. of 2	22470
HP Ferrule Nut Adapter, knurled, pk. of 2	22509
Replacement Male Nut, 1/16", pk. of 4	23805

## Glasrench Wrench

No more leaks or breakage when connecting glass columns.

Connecting glass columns to a chromatograph often results in leaks or in a broken column. Our Glasrench wrench lets you consistently apply the correct force needed to tighten a given type of ferrule. The wrench slips when too much force is applied so you don't damage your column by over-tightening a ferrule.

Since different ferrules require different amounts of tightening force, we offer two color-coded wrenches for our 1/4" ferrules. Use Glasrench Model A for Supeltex M-1 and Supeltex M-2 ferrules. Use Glasrench Model C for Supeltex M-2A and Supeltex M-4 ferrules.

Description	Cat. No.
Glasrench Model A	22901
Glasrench Model C	22903

## Ferrule Kits



995-0095

Finding the right ferrule can be difficult. Simplify this chore with one of our ferrule starter kits. Each kit contains several different Supeltex ferrules for capillary or packed columns. You can determine which type is best for your applications. Kits include instructions for installing each ferrule.

### For Glass Columns (0.8mm to 1.19mm OD)

Kit includes: 4 Supeltex M-1, 4 Supeltex M-2A, and 4 Supeltex M-4 ferrules, our pin vise drill kit (Cat. No. 23820), and instructions.

Description	Cat. No.
Glass Capillary Ferrule Kit	22468

### For Fused Silica Columns (0.40mm to 0.51mm OD)

Kit Includes: 4 drilled Supeltex M-2A, 4 indented blank Supeltex M-2A, and 4 Supeltex M-4 ferrules, our pin vise drill kit (Cat. No. 23820), and instructions.

Description	Cat. No.
Fused Silica Capillary Ferrule Kit	22469

### For Packed Glass Columns (1/4" OD)

Kit includes: Four 1/4" Supeltex M-1, 4 Supeltex M-2A, and 4 Supeltex M-4 ferrules, a 6" (15cm) x 1/4" practice piece of glass tubing, and instructions.








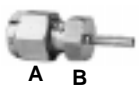


Description	Cat. No.
Ferrule Kit, Packed Glass Columns	20648

# Swagelok® Tube Fittings








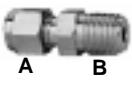
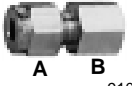
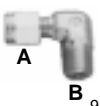


*...a tradition of  
Excellence*



713-0530/913-0251

Fitting	Swagelok No.	Size (in.)	Brass		Stainless Steel	
			Qty./Pkg.	Cat. No.	Qty./Pkg.	Cat. No.
 910-0060	102-1	1/16	10	22021	2	22047
	202-1	1/8	20	22011	5	22037
	402-1	1/4	20	22000	5	22026
 910-0060	103-1	1/16	10	22022-U	2	22048
	203-1	1/8	20	22012	5	22038
	403-1	1/4	20	22001	5	22027
 910-0060	104-1	1/16	10	22023	2	22049
	204-1	1/8	20	22013	5	22039
	404-1	1/4	20	22002	5	22028
 910-0060	100-S	1/16	10	22024	1	22050
	200-S	1/8	10	22014	5	22040
	400-S	1/4	10	22003	5	22029
 910-0061	201-PC	1/8	2	22688	2	22689
	401-PC	1/4	2	22690	—	—
	401-PC-2	1/4 to 1/8 reducer	2	22094	2	22095
 910-0062	200-C	1/8	6	22018	—	—
	400-C	1/4	6	22008	2	22034
 910-0063	100-P	1/16	3	22136	1	22137
	200-P	1/8	6	22019-U	1	22045
	400-P	1/4	6	22009	2	22035
 910-0064	100-R-2	1/16A x 1/8B	2	22017	1	22043
	100-R-4	1/16A x 1/4B	2	22701	1	22702
	200-R-4	1/8A x 1/4B	2	22006	1	22032
	400-R-2	1/4A x 1/8B	2	21516	1	21517
 910-0065	100-6	1/16	1	22025	1	22051-U
	200-6	1/8	2	22015	1	22041
	400-6	1/4	2	22004	1	22030-U
 910-0066	200-6-1	1/8 x 1/16	2	22016	1	22042
	300-6-2	3/16 x 1/8	2	22072	—	—
	400-6-1	1/4 x 1/16	2	22074	1	22075
	400-6-2	1/4 x 1/8	2	22005	1	22031
	400-6-3	1/4 x 3/16	—	—	1	22077
	400-6-2BT	1/4 x 1/8**	—	—	1	22061
	810-6-2	1/2 x 1/8	2	22714	—	—
	810-6-4	1/2 x 1/4	2	22716	—	—

# Swagelok® Tube Fittings

Fitting	Swagelok No.	Size (in.)	Brass		Stainless Steel	
			Qty./Pkg.	Cat. No.	Qty./Pkg.	Cat. No.
<b>Bored-Through Union**</b>  913-0366	200-6BT	1/8 x 1/8	—	—	1	22088
	400-6BT	1/4 x 1/4	1	21664	1	21518
<b>Bulkhead Union</b> (for panel mounting)  913-0193	100-61	1/16	1	21980	1	22665
	200-61	1/8	1	21981	1	22666
	400-61	1/4	1	21982	1	22667
<b>Zero Dead Volume Union</b>  910-0067	I FO-6-GC	1/16	1	22053	1	22052
<b>Tee</b>  910-0068	100-3	1/16	1	22132	1	22133
	200-3	1/8	1	22020	1	22046
	400-3	1/4	1	22010	1	22036
<b>Female Branch Tee</b>  913-0347	200-3TTF	1/8NPT top 1/8 sides	1	22143	—	—
<b>Union Cross</b>  910-0069	200-4	1/8	1	22684	—	—
	400-4	1/4	1	22686	—	—
<b>Pipe Adapter</b> (tube OD to male NPT)  910-0159	2-TA-1-4	1/8A x 1/4B	2	22098	—	—
	4-TA-1-2	1/4A x 1/8B	2	22100	—	—
	4-TA-1-4	1/4A x 1/4B	2	22102	—	—
<b>Connector</b> (Swagelok to male NPT)  910-0040	200-1-2	1/8A x 1/8B	2	22082	1	22084
	400-1-2	1/4A x 1/8B	2	22083	1	22085
	400-1-4	1/4A x 1/4B	2	21519	1	22700
	200-1-4	1/8A x 1/4B	2	22066	1	22067
<b>Connector</b> (Swagelok to female NPT)  910-0072	200-7-2	1/8A x 1/8B	2	22703	—	—
	400-7-2	1/4A x 1/8B	2	22705	1	22706
	400-7-4	1/4A x 1/4B	2	22707]	1	22708
	200-7-4	1/8A x 1/4B	2	21978	1	21979
<b>90° Male Elbow</b> (tube (A) to male NPT(B))  913-0194	200-2-2	1/8A x 1/8B	2	21970	1	21974
	200-2-4	1/8A x 1/4B	2	21971	1	21975
	400-2-2	1/4A x 1/8B	2	21972	1	21976
	400-2-4	1/4A x 1/4B	2	21973	1	21977
<b>Miniature Quick Connects*** Stem Assembly</b>  910-0073	QM2-S-200	1/8	1	22710	1	22711
<b>Miniature Quick Connects*** Body Assembly</b>  910-0158	QM2-B-200	1/8	1	22712	1	22713

\*For Teflon fittings, see chart at right.

\*\*Bored through by Supelco machine shop.

\*\*\*Install gas purifiers if used in carrier gas lines.





**IMPORTANT:** When ordering, please specify the number of packages, not the number per package. For example, 1 package of 22021, not 10 – or you might get 10 packages!

## Teflon Fittings for Swagelok Ferrules

	Swagelok No.	Size (in.)	Qty./Pkg.	Cat. No.
<b>For Front Ferrules</b>	103-1	1/16	5	22068
	203-1	1/8	10	22058
	403-1	1/4	10	22054
<b>For Back Ferrules</b>	104-1	1/16	5	22069
	204-1	1/8	10	22059
	404-1	1/4	10	22055

# Swagelok® Tube Fittings

## High Quality Whitey®/Nupro® Valves

Valve Type	Size (in.)	Brass Cat. No.	Stainless Steel Cat. No.
<b>Toggle Valve</b> (quick acting)  910-0074	1/8 x 1/8 straight 1/8 x 1/8 angle 1/4 x 1/4 straight 1/4 x 1/4 angle	22699 22123 22697 22125	22698 22124 — 22126
<b>On/Off Throttling Valve</b>  910-0075	1/8 1/4	22138 22140	22139 22141
<b>Fine Metering Valve</b> (for accurate regulation)  910-0076	1/8 straight 1/8 angle 1/16 straight 1/16 angle	22116 22114 — 22118	22117 22115 22121 —
<b>Vernier Handle</b> (for fine metering valve; order valve separately)  910-0077	22122		

## Swagelok Kit

Includes the following brass parts:

Swagelok No.	Description	Qty.
202-1	1/8" nut	10
402-1	1/4" nut	10
203-1	1/8" front ferrule	10
403-1	1/4" front ferrule	10
204-1	1/8" back ferrule	10
404-1	1/4" back ferrule	10
200-C	1/8" cap	6
400-C	1/4" cap	6
200-P	1/8" plug	6
400-P	1/4" plug	6
200-6	1/8" union	2
400-6	1/4" union	2
400-60-2	1/4" x 1/8" reducing union	2
200-3	1/8" tee	2
400-3	1/4" tee	2
200-R-4	Reducer 1/8" Swagelok x 1/4" tube	2
400-R-2	Reducer 1/4" Swagelok x 1/8" tube	2
MS-IG-200	1/8" inspection gauge	1
MS-IG-400	1/4" inspection gauge	1

Description	Cat. No.
Swagelok Kit	22668

## Swagelok Manual

A leak-free system is the first requirement in a systematic approach to gas quality. This requires proper tubing, quality fittings, and skilled installation. The *Swagelok Tube Fitter's Manual* provides detailed instructions for tubing selection and proper installation of Swagelok fittings. It will help you avoid many tubing installation problems and can easily save you its purchase price.

Description	Cat. No.
Swagelok Manual	22339

### Trademarks

CapSeal Bullet, Glasrench, Supeltex – Sigma-Aldrich Co.  
 GOW-MAC — GOW-MAC Instrument Co.  
 Swagelok – Crawford Fitting Co.  
 Teflon, VESPEL – E.I. du Pont de Nemours and Company, Inc.  
 Nupro — Nupro Co.  
 Whitey — Whitey Co.

BULLETIN 741

For more information, or current prices, contact your nearest Supelco subsidiary listed below. To obtain further contact information, visit our website ([www.sigma-aldrich.com](http://www.sigma-aldrich.com)), see the Supelco catalog, or contact Supelco, Bellefonte, PA 16823-0048 USA.

ARGENTINA • Sigma-Aldrich de Argentina, S.A. • Buenos Aires 1119 AUSTRALIA • Sigma-Aldrich Pty. Ltd. • Castle Hill NSW 2154 AUSTRIA • Sigma-Aldrich Handels GmbH • A-1110 Wien  
 BELGIUM • Sigma-Aldrich N.V./S.A. • B-2880 Bornem BRAZIL • Sigma-Aldrich Quimica Brasil Ltda. • 01239-010 São Paulo, SP CANADA • Sigma-Aldrich Canada, Ltd. • 2149 Winston Park Dr., Oakville, ON L6H 6J8  
 CZECH REPUBLIC • Sigma-Aldrich s.r.o. • 186 00 Praha 8 DENMARK • Sigma-Aldrich Denmark A/S • DK-2665 Vallensbaek Strand FINLAND • Sigma-Aldrich Finland/YA-Kemia Oy • FIN-00700 Helsinki  
 FRANCE • Sigma-Aldrich Chimie • 38297 Saint-Quentin-Fallavier Cedex GERMANY • Sigma-Aldrich Chemie GmbH • D-82041 Deisenhofen GREECE • Sigma-Aldrich (o.m.) Ltd. • Ilioupoli 16346, Athens  
 HUNGARY • Sigma-Aldrich Kft. • H-1067 Budapest INDIA • Sigma-Aldrich Co. • Bangalore 560 048 IRELAND • Sigma-Aldrich Ireland Ltd. • Dublin 24 ISRAEL • Sigma Israel Chemicals Ltd. • Rehovot 76100  
 ITALY • Sigma-Aldrich s.r.l. • 20151 Milano JAPAN • Sigma-Aldrich Japan K.K. • Chuo-ku, Tokyo 103 KOREA • Sigma-Aldrich Korea • Seoul MALAYSIA • Sigma-Aldrich (M) Sdn. Bhd. • Selangor  
 MEXICO • Sigma-Aldrich Quimica S.A. de C.V. • 50200 Toluca NETHERLANDS • Sigma-Aldrich Chemie BV • 3330 AA Zwijndrecht NORWAY • Sigma-Aldrich Norway • Torshov • N-0401 Oslo  
 POLAND • Sigma-Aldrich Sp. z o.o. • 61-663 Poznań PORTUGAL • Sigma-Aldrich Quimica, S.A. • Sintra 2710 RUSSIA • Sigma-Aldrich Russia • Moscow 103062 SINGAPORE • Sigma-Aldrich Pte. Ltd.  
 SOUTH AFRICA • Sigma-Aldrich (pty) Ltd. • Jet Park 1459 SPAIN • Sigma-Aldrich Quimica, S.A. • 28100 Alcobendas, Madrid SWEDEN • Sigma-Aldrich Sweden AB • 135 70 Stockholm  
 SWITZERLAND • Supelco • CH-9471 Buchs UNITED KINGDOM • Sigma-Aldrich Company Ltd. • Poole, Dorset BH12 4QH  
 UNITED STATES • Supelco • Supelco Park • Bellefonte, PA 16823-0048 • Phone 800-247-6628 or 814-359-3441 • Fax 800-447-3044 or 814-359-3044 • email: [supelco@sial.com](mailto:supelco@sial.com)

H

Supelco is a member of the Sigma-Aldrich family. Supelco products are sold through Sigma-Aldrich, Inc. Sigma-Aldrich warrants that its products conform to the information contained in this and other Sigma-Aldrich publications. Purchaser must determine the suitability of the product for a particular use. Additional terms and conditions may apply. Please see the reverse side of the invoice or packing slip.

AXR