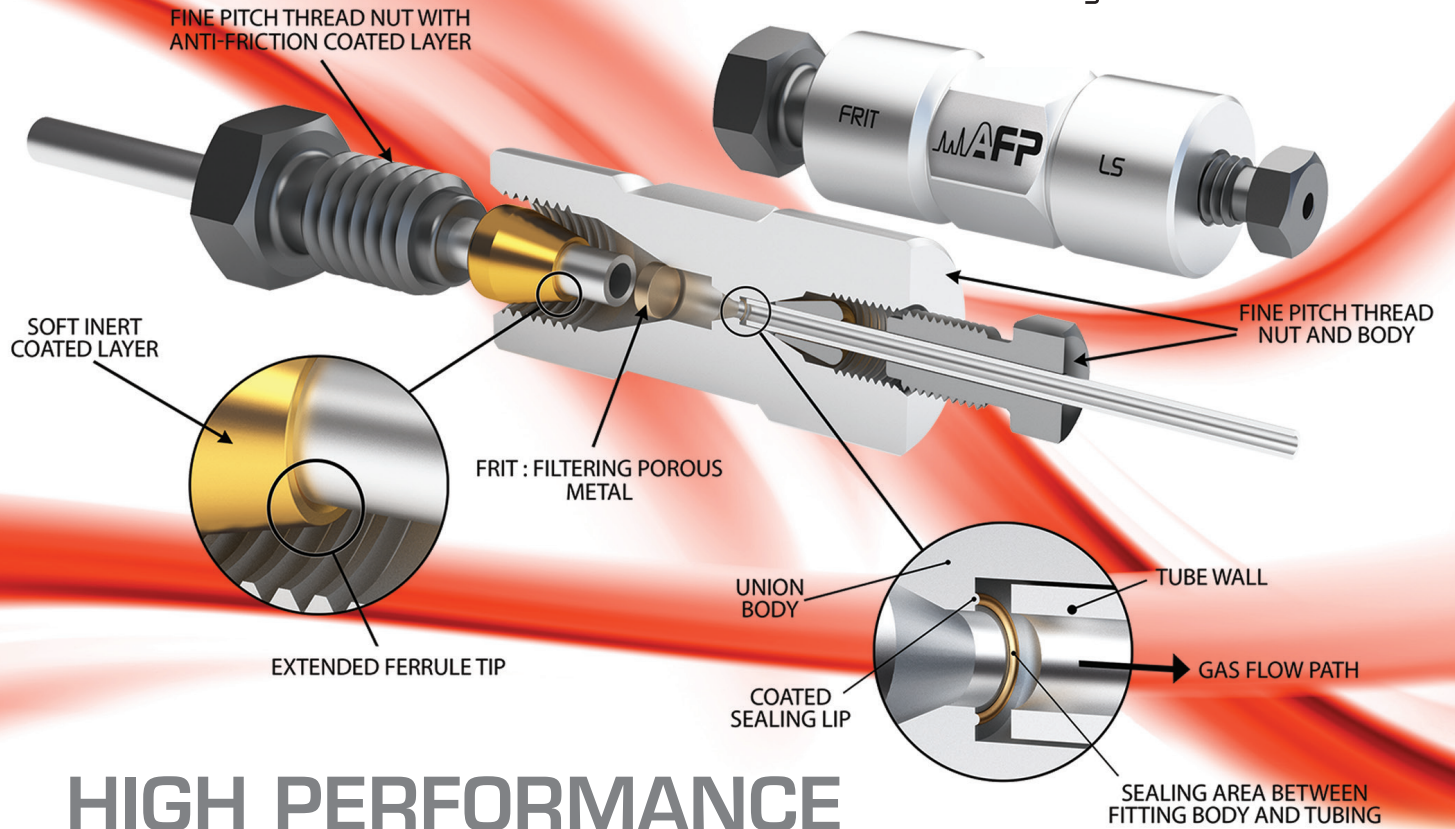
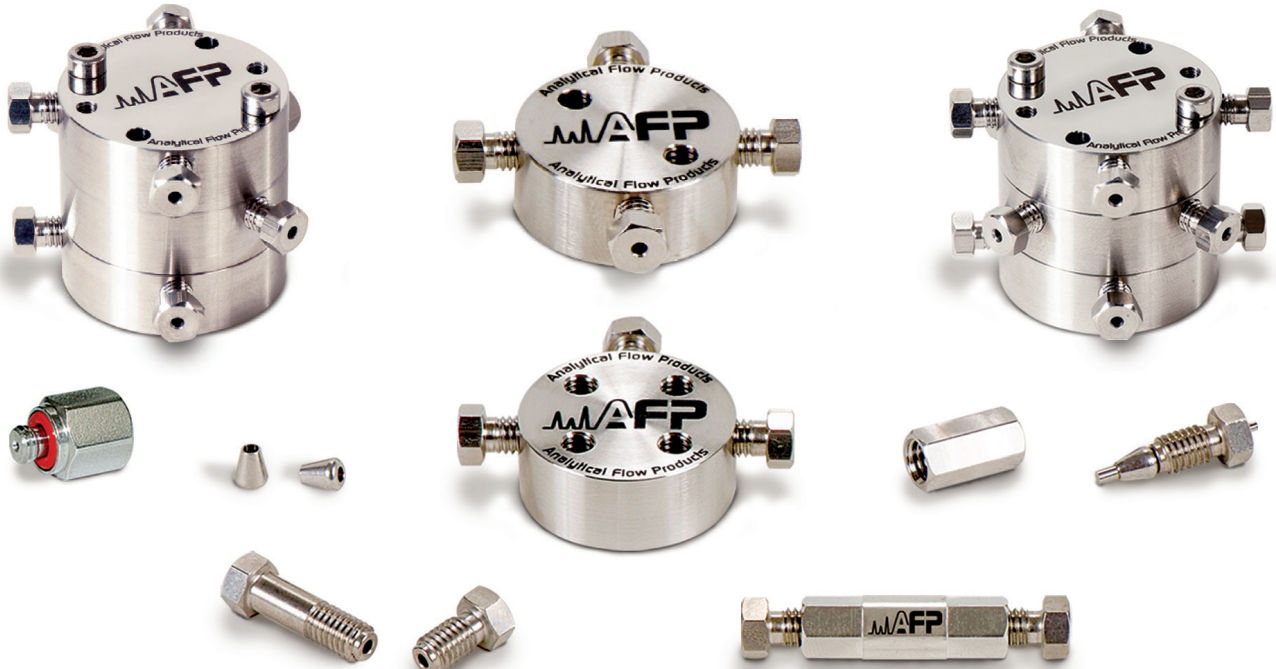


# LIP SEAL



## HIGH PERFORMANCE ANALYTICAL FITTINGS



- 316L Stainless Steel wetted parts construction
- New stackable Tees & Crosses
- Interchangeability
- No dead volume effect

- Leak Tested
- No clamp ring required for mounting tees and crosses
- No tubing deformation



## Analytical Flow Products

# FITTINGS: Standard and Supercharged!

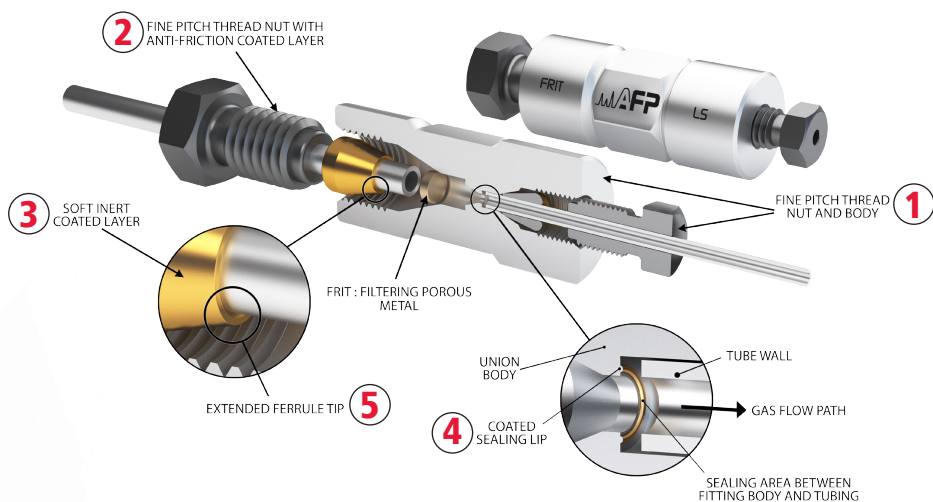
For several decades fittings have been the same. Fittings are critical components of any analytical system. The level of sealing, dead volumes, mechanical characteristics could vary dramatically based on manufacture process even if externally they look the same. But don't get fool; there are serious differences between them. Nothing looks more like a fitting than another fitting! Differences reside in details.

### **Standard:**

Here we are offering a line of fittings that have, by design, improved characteristics. Internal finish, ferrule design, thread finish are some of the characteristic that have been improved. Practical details, like stackable crosses and tees, eliminate the need of mounting clamps and allow space saving. Low torque column end fittings and unions make 1/8"OD and 1/4"OD size tubing assembly much easier and better. Available in several materials and custom design to fit OEM needs.

### **AFP® Lip Seal type:**

We also introduce here new patent pending fitting concept. This new design results in two levels of sealing, and much lower torque required, increased number of remakes are among improved features of this design. These are simply the best. Look at our design report DR-3 in the technical section of our AFP Cookbook and see by yourself.



**1** Ultra fine pitch threads transfer the force to the ferrule in a much smoother way.

**2** An anti-friction and anti-galling coating is applied to the front and the threaded portions of nut. This reduces the friction at least by an ordered of 10, eliminating the rotation of the ferrule when the nut is screwed in.

**3** Gold plated ferrule are used to insure an optimized sealing performance.

**4** A fine lip has been added on the bottom of the detail, this creates a first metal to metal seal section with no dead volume, similar to VCR fitting.

**5** The front portion of the ferrule is longer, in order to occupy more of the empty volume. Doing so reduces as eventual dead volume, as shown in Figure 11.

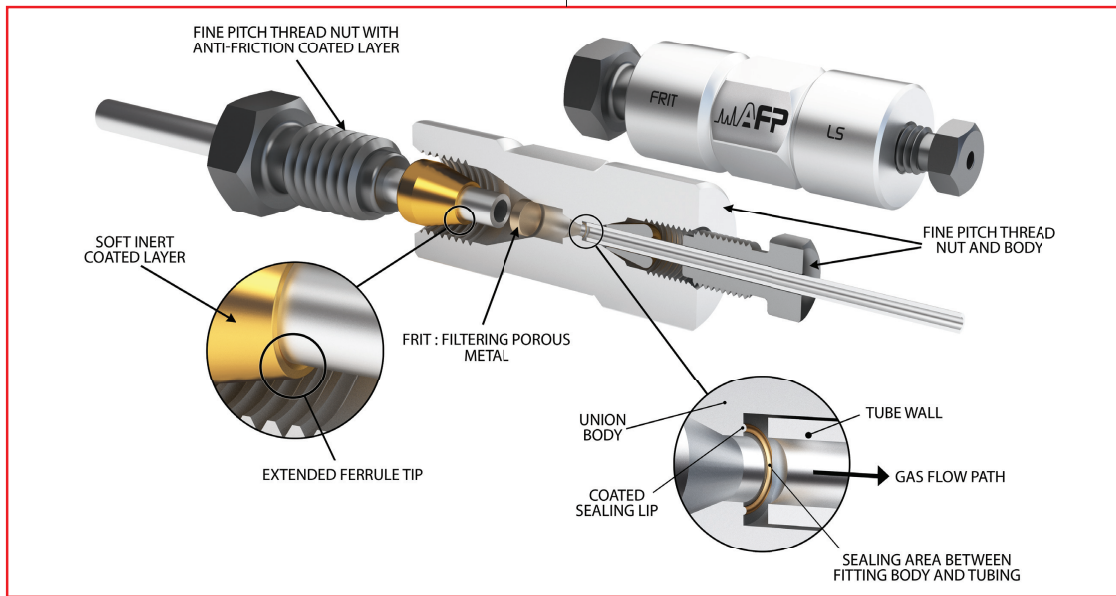
\*Patent pending



# AFP Fitting Family

Lip Seal\*

\*Lip seal available on each fitting type



Unions

Reducing Unions

Filtering Unions

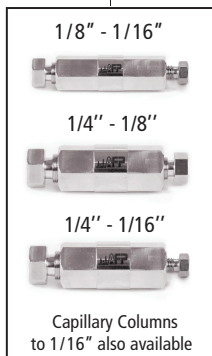
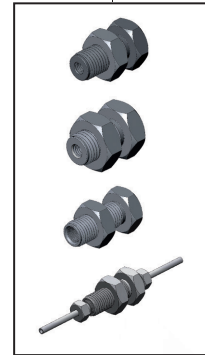
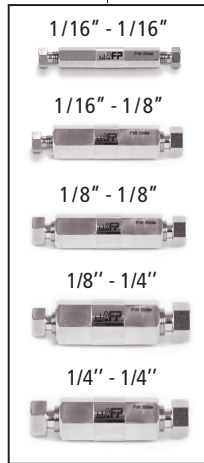
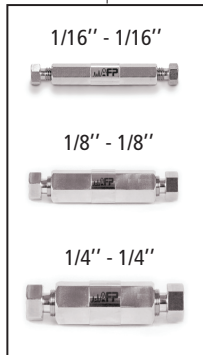
Tees

Crosses

Hardware

Bulkheads

Others



All other configurations and types of material

Note: All 1/8" ports are available as Valco™ compatible or as per AFP standards i.e. low torque.



## STANDARD AFP® FITTINGS

Unions from AFP® are compression fittings (figure 1). They are used to join two tubes of the same O.D. (outside diameter). As the name implies, compression fittings form a tight seal by applying a compressive force to the ferrule and the fitting seat. The ferrule is compressed against the fitting seat and it cuts a ring on the tube and makes them locked together. The ferrule will then be compressed with sufficient force to eliminate all spaces remaining between the ferrule and the fitting seat, thus preventing gas from leaking.

These fittings are very low outgassing because they are made of stainless steel 316 L. Using a two pieces compression fitting as AFP® will improve your connection because when tightened, it's only the screw that rotates and not the ferrule so that way you are not damaging the sealing surface.

Compression fittings are popular because they do not require soldering, so they are comparatively quick and easy to use. They are especially useful in installations that may require occasional disassembly or partial removal for maintenance.

AFP® is always constant on the way to process these fittings. We choose the right material for it, our machining accuracy is always verified and our cleaning process is unbeatable. It's a quality consideration, which cannot be ignored when an analytical system needs to meet and maintain optimum performance levels. With that we are sure to keep the interchangeability between all others fittings on the market and even beat their performance.

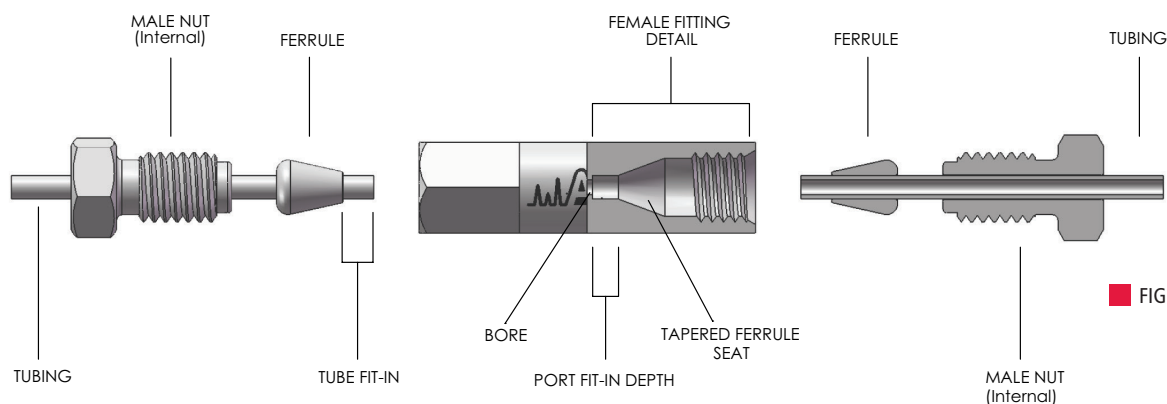


FIGURE 1

## NO RESTRICTED ID

Compression fittings always need deformation to seal. But we only want the ferrule to fit in the taper of the fitting; we also know that there is a deformation of the tube. We have to insure that it's still in place. What happens if the tube gets too many deformities? It will create a flow anomaly done by the restricted ID (inside diameter) and this is not what most instrument applications need.

We have to insure that the tubing doesn't blow out of the ferrule, that's why AFP® metal ferrules cut a ring near the end of the tube. This prevents the tube release at high pressure without significantly deforming and restricting the interior of the tube. Because our ferrules have a sharp edge at the ID near the nose created by a chamfer and this when compressed defines a real and significant edge that grips the tube. The average torque needed to do this usually takes only about 1/4 of a turn beyond the point where the ferrule first starts to grab the tubing.

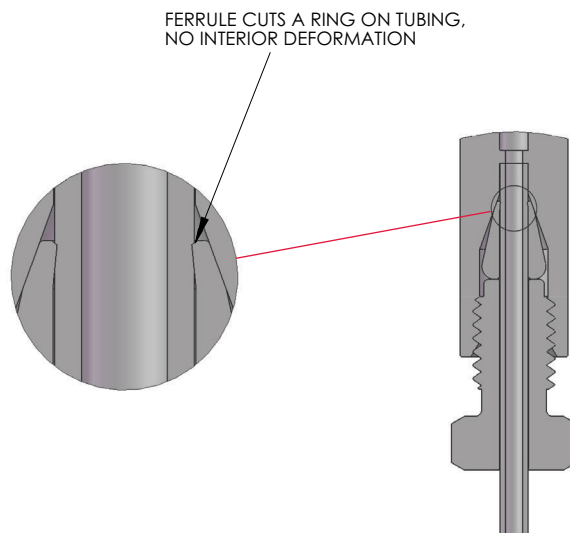


FIGURE 2



## MANUFACTURING

There are many ways to manufacture fittings, only one really works. The fluid media integrity (i.e. leak rate and contamination) is our prime concern. Monitored design and our manufacturing process method gives us the expected performance we want. Every step in the manufacturing has been studied to make sure that the final product passes all quality control procedure. The fitting in figure 4 is the best choice for high performance fittings: the tube fits squarely into the bottom of the detail.

Let's see what happens when a critical finishing operation is omitted. The bottom of the fitting, the detail of the port fit-in should be square, but leaves the shape of the typical tapered drill bit instead. This results in the fitting shown in figure 3, which could have a mixing potential. This introduces extra volume and also dead volume. AFP® uses proper tooling specifically designed to produce the same high precision detail in all AFP® fittings and valves.

The sealing of the compression fitting is to be made at the ferrule and the fittings seat, but sometimes it can happen that the end of the tube may seal in the bottom of the port fit-in. This leaves the possibility that the fluid flow around the tube. This will go in the tiny cavities between the end of the ferrule and the bottom of the port fit-in. This increases when there is an excessive variance between the tubing O.D. and the diameter of the counter bored port fit-in in which it sits.

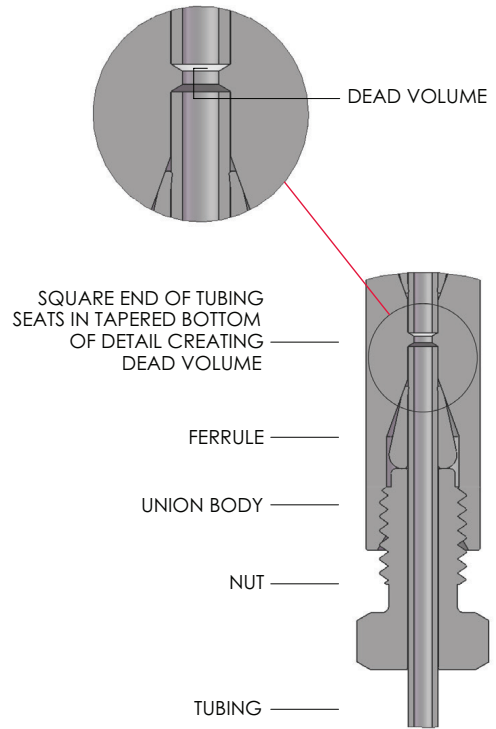


FIGURE 3

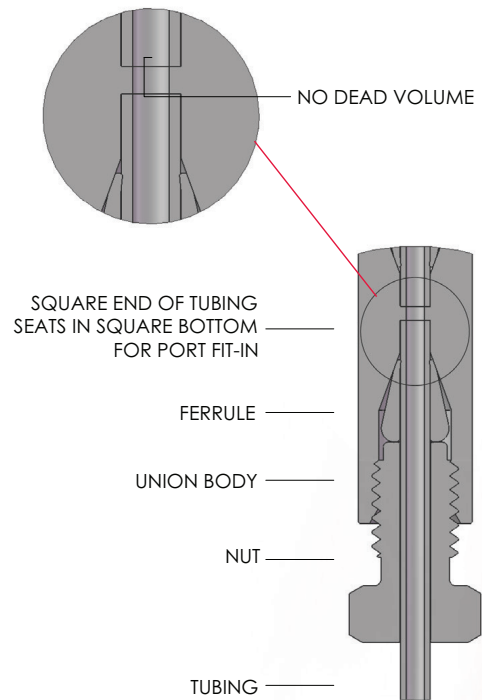


FIGURE 4

### TECH TIP

For an accurate connection, make sure your tubing OD tolerance is nominal dimension  $\pm .002$ ".

## UNIONS



Unions join two pieces of tubing of the same O.D. Internal fittings are almost always the best; they make a stronger connection and offer the lower volume necessary for high performance instrumentation.

They are generally made of stainless steel 316 L, an Austenitic stainless steel that it's use in most chromatographic applications.

## FILTERING UNIONS

We also have the possibility to manufacture filtering unions. A frit can be added to a union into the port fit-in before making the ferrule on the tube. However, when a fitting detail has a frit in it, the port fit-in depth is deeper, so that the port fit-in length from the ferrule nose is still standard. If that tube is used in any other AFP® fitting, it will be exactly the same as an ordinary union. Other companies also offer a filtering capability. They make the port fit-in at the same depth as ordinary fitting. But when we make the ferrule on the tube, we can see that there is a smaller port fit-in required in these types of union. If someone uses a pre-made tube and ferrule in this union, it will damage the frit and send a lot of small particles into your system. That's why our filter design remains truly interchangeable.

## THROUGH-BORE UNION INSTALLATION

Here is a tip to install a through-bore union; because the tubing will pass all the way through a through-bore union, to be sure of getting the right length of tube extending the ferrule, we suggest making the first tube in a standard AFP® fitting first. Install this made-up connection in the through-bore union: then the second tube can be set against it for a zero dead volume connection.

Material	Connection	Bore	Option
SS= Stainless Steel 316L HC= Hastelloy® MO= Monel® TI= Titanium	16 = Fitting 1/16" LS16 = Lip Seal 1/16"* 08 = Fitting 1/8" LS08 = Lip Seal 1/8"* 04 = Fitting 1/4" LS04 = Lip Seal 1/4"*	16 005= .005" 010= .010" 020= .020" 030= .030" 040= .040" 060= .060"	S= SilcoNert 2000™ D= Dursan™
	Ex: U-SS-16-040 U= Union SS= Stainless Steel 316L 16= Tube OD Ø1/16" 040= Bore Ø.040"	08 085= .085" 04 180= .180"	
		<b>Frit (option)</b> F005= .5 µm F010= 1 µm F020= 2 µm F100= 10 µm	

\*Lip Seal : See description on page 10

UNION ASSEMBLY INCLUDES 2 SHORT NUTS AND 2 STAINLESS STEEL FERRULES. IF YOU NEED SPECIAL LENGTH OF NUT OR OTHER FERRULE, PLEASE ORDER SEPARATELY.

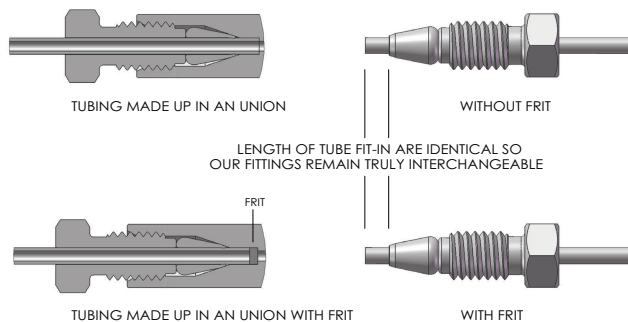


FIGURE 5

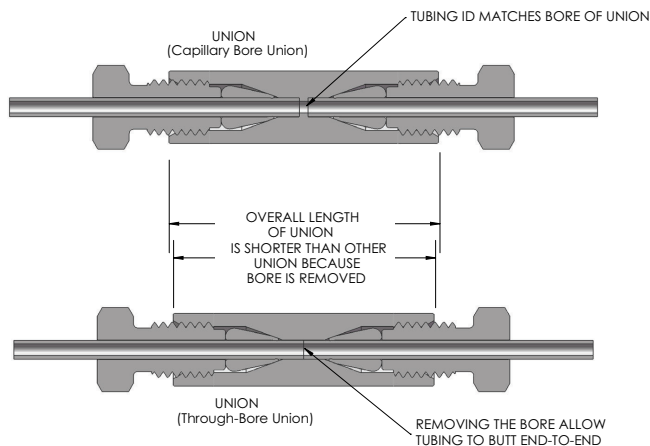


FIGURE 6

## REDUCING UNION/ END COLUMN FITTING

Reducing union are use to join two different size of tubing together. We actually are able to offer 1/8" and 1/16" tubing size and 1/32" will be available soon.

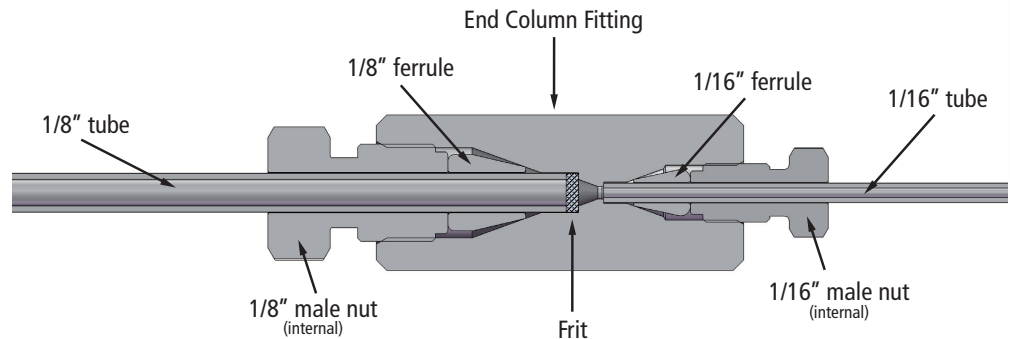
All our 1/8" fittings are made with a fine pitch thread. This design reduces the torque required to make proper connections and also ease the plumbing inside the analyzer.

We also develop filtering reducing union that we called End Column Fitting. This is an excellent column end fitting for the typical packed columns found in gas GC. This type of fitting make the welding at the end of column obsolete.

Material	Connection	Connection	Bore	Option
SS= Stainless Steel 316L HC= Hastelloy® MO= Monel® TI= Titanium	08 = Fitting 1/8" LS08 = Lip Seal 1/8"*** 04 = Fitting 1/4" LS04 = Lip Seal 1/4"***	16 = Fitting 1/16" LS16 = Lip Seal 1/16"*** 08 = Fitting 1/8" LS08 = Lip Seal 1/8"***	085= .085"  Frit (option) F005= .5 µm F010= 1 µm F020= 2 µm F100= 10 µm	S= SilcoNert 2000™ D= Dursan™

Ex: RU-SS-08-16-085  
RU= Reducing Union  
SS= Stainless Steel 316L  
08= Tube OD Ø1/8"  
16= Tube OD Ø1/16"  
085= Bore ID Ø.085"

\*Lip Seal : See description on page 10



## FERRULES



These ferrules are standard for all fittings and valves on the market using UPCHURCH SCIENTIFIC®, VICI® compatible fittings. An AFP® metal ferrule does not create a restricted ID when they swage on the tube thus preventing a release at high pressure. They cut a ring near the end of the tube fit-in, so this way the ferrule stays in place on the tube. This usually takes only about 1/4 turn beyond the point where the ferrule first starts to grab the tubing.

AFP® ferrules may be used with all AFP® fittings and with those from 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) is lower, and it depends on the tubing used. If you have doubts about a particular combination, consult our technical staff.

They are generally made of stainless steel 316 L, an Austenitic stainless steel that is used in most chromatographic applications. We can also offer some of them in a variety of materials.

Material	Tube dimension	Option
SS= Stainless Steel 316L GP= Gold Plated B= Brass A= Aluminum HC= Hastelloy® MO= Monel® TI= Titanium	16 = Fitting 1/16" 08 = Fitting 1/8" 04 = Fitting 1/4"	S= SilcoNert 2000™ D= Dursan™  Ex: F-SS-16 F = Ferrule SS= Stainless Steel 316L 16= Tube OD Ø 1/16"

MOST AFP™ FITTINGS AND VALVES ARE SUPPLIED WITH THE APPROPRIATE QUANTITY OF NUTS AND FERRULES. HOWEVER, IF ADDITIONAL ARE REQUIRED, THEY MAY BE ORDERED SEPARATELY.



## STAINLESS STEEL INTERNAL NUTS



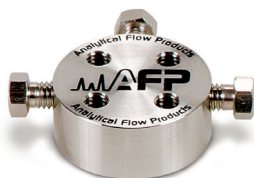
These nuts are standard for all valves and fittings on the market using Upchurch, VICI® compatible, 10-32 thread. They are suitable with the standard 1/16" O.D. tubing. For 1/8" O.D. tubing we have our 1/8" fine pitch thread nut that require less torque to achieve the sealing of the ferrule and we also have the standard 1/8" as well but not recommended. The long type is for situations where the fitting head may be other wise inaccessible or where interference between fittings occur.

Tube dimension	Length	Option
16= 1/16" 08= 1/8" 04= 1/4"	S= Short L= Long	LFC= Low Friction Coating

Ex: N-16-S

N= Nut  
16= Tube OD Ø 1/16"  
S= Short

## TEES



Tees are the same as a union but they connect three lines. They have an outside diameter of 1" and they don't need any clamp ring for mounting them. They are made of Stainless Steel 316L.

They have 4 mounting holes and you have 2 ways to fix them: on top with M3 screw and underneath with M4 screw.

Material	Connection	Bore	Option
SS= Stainless Steel 316L HC= Hastelloy® MO= Monel® TI= Titanium	16 = Fitting 1/16" LS16 = Lip Seal 1/16" 08 = Fitting 1/8" LS08 = Lip Seal 1/8" 04 = Fitting 1/4" LS04 = Lip Seal 1/4"	16 010= .010" 020= .020" 030= .030" 040= .040" 060= .060"	S= SilcoNert 2000™ D= Dursan™

Ex: T-SS-16-040

T= Tee  
SS= Stainless Steel 316L  
16= Tube OD Ø1/16"  
040= Bore ID Ø.040"

\*Lip Seal : See description on page 10

### TECH TIP

If in your system you don't have lot of space, use our "Stackable Tees" developed by AFP® to increase considerably your working space for an easy and nice looking tube routing.

## CROSSES



Crosses are the same as a union but they connect four lines. They have an outside diameter of 1" and they don't need a clamp ring for mounting them. They are made of Stainless Steel 316L.

They have 2 mounting holes and you have 2 ways to fix them: on top with M3 screw and underneath with M4 screw.

Material	Connection	Bore	Option
SS= Stainless Steel 316L HC= Hastelloy® MO= Monel® TI= Titanium	16 = Fitting 1/16" LS16 = Lip Seal 1/16" 08 = Fitting 1/8" LS08 = Lip Seal 1/8" 04 = Fitting 1/4" LS04 = Lip Seal 1/4"	16 010= .010" 020= .020" 030= .030" 040= .040" 060= .060"	S= SilcoNert 2000™ D= Dursan™

Ex: C-SS-16-040

C= Cross  
SS= Stainless Steel 316L  
16= Tube OD Ø1/16"  
040= Bore ID Ø.040"

\*Lip Seal : See description on page 10

### TECH TIP

If in your system you don't have lot of space, use our "Stackable Crosses" developed by AFP® to increase considerably your working space for an easy and nice looking tube routing.

## STACKABLE TEES



Stackable tees are the same as a regular tee but they can be stacked together for space saving. They have an outside diameter of 1 1/4" and they don't need any clamp ring for mounting them. They are made of Stainless Steel 316L.

They have 6 mounting holes and for the one on the bottom, you have 2 ways to fix it; on top with M3 screw or underneath with M4 screw. For each additional, you can only fix them on top with M3 screw.

Material	Connection	Bore	Option
SS= Stainless Steel 316L HC= Hastelloy® MO= Monel® TI= Titanium	16 = Fitting 1/16" LS16 = Lip Seal 1/16" 08 = Fitting 1/8" LS08 = Lip Seal 1/8" 04 = Fitting 1/4" LS04 = Lip Seal 1/4"	16 010= .010" 020= .020" 030= .030" 040= .040" 060= .060"	S= SilcoNert 2000™ D= Dursan™
Ex: ST-SS-16-040			
ST= Stackable tee SS= Stainless Steel 316L 16= Tube OD Ø1/16" 040= Bore ID Ø.040"			
*Lip Seal : See description on page 10			
		08	
		085= .085"	
		04	
		180= .180"	

TEES AND CROSSES ARE SUPPLIED WITH SHORTS NUTS AND STAINLESS STEEL FERRULES. IF YOU NEED SPECIAL LENGTH OF NUT OR OTHER FERRULE, PLEASE ORDER SEPARATELY.

### TECH TIP

If you stack more than 2 tees, use a longer nut on the bottom to increase the accessibility.

## STACKABLE CROSSES



Stackable crosses are the same as a regular Cross but they can be stacked together for space saving. They have an outside diameter of 1 1/4" and they don't need a clamp ring for mounting them. They are made of Stainless Steel 316L.

They have 6 mounting holes and for the one on the bottom, you have 2 ways to fix it; on top with M3 screw or underneath with M4 screw. For the additional, you can only fix them on top with M3 screw.

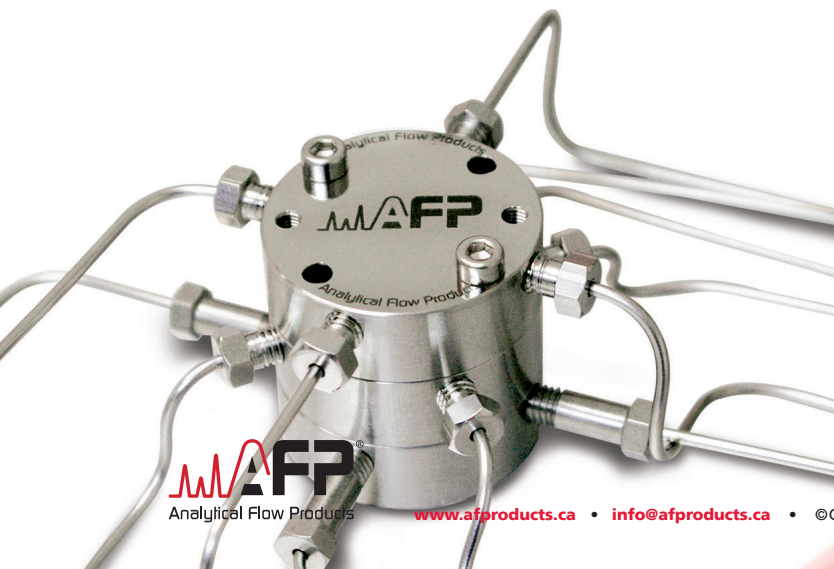
Material	Connection	Bore	Option
SS= Stainless Steel 316L HC= Hastelloy® MO= Monel® TI= Titanium	16 = Fitting 1/16" LS16 = Lip Seal 1/16" 08 = Fitting 1/8" LS08 = Lip Seal 1/8" 04 = Fitting 1/4" LS04 = Lip Seal 1/4"	16 010= .010" 020= .020" 030= .030" 040= .040" 060= .060"	S= SilcoNert 2000™ D= Dursan™
Ex: SC-SS-16-040			
SC= Stackable cross SS= Stainless Steel 316L 16= Tube OD Ø1/16" 040= Bore ID Ø.040"			
*Lip Seal : See description on page 10			
		08	
		085= .085"	
		04	
		180= .180"	

TEES AND CROSSES ARE SUPPLIED WITH SHORTS NUTS AND STAINLESS STEEL FERRULES. IF YOU NEED SPECIAL LENGTH OF NUT OR OTHER FERRULE, PLEASE ORDER SEPARATELY.

OUR TEES AND CROSSES DESIGN MAKE THE USE OF CLAMP RINGS OBSOLETE. THIS IS A SPACE AND MONEY SAVING FEATURE.

### TECH TIP

If you stack more than 2 crosses, use a longer nut on the bottom to increase the accessibility.



## PLUGS AND CAPS



Stainless plugs include a nut with ferrule made up on a piece of solid rod. They already have the port fit-in set at the right length. You can use a plug to close off an unused port in a valve, manifold, or column.

A cap is essentially the same as a union but cut in half without a through hole. They are used to close off a tube with a ferrule and internal nut already made up.

## ADAPTOR



This adaptor is used to make a short connection from a thread 10-32 to AFP® 1/16" or 1/8" connections. This is required on our ELDV /MDVG-SERIES valve and can also be used on many gauges, regulators and flow controllers. An O-ring is inserted into this adaptor to insure the sealing.

Type	Material	Connection	Option
Cap= C Plug Short= PS Plug Long= PL	SS= Stainless Steel 316L	16 = Fitting 1/16" LS16 = Lip Seal 1/16" 08 = Fitting 1/8" LS08 = Lip Seal 1/8" 04 = Fitting 1/4" LS04 = Lip Seal 1/4"	LS= Lip Seal*

Ex: PS-SS-16  
PS= Plug Short  
SS= Stainless Steel 316L  
16= Tube OD Ø 1/16"

\*Lip Seal : See description on page 10

Connection 1	Connection 2
16= 1/16" 08= 1/8" 04= 1/4"	10_32= 10-32 male thread

Ex: A-16-10\_32

A = Adaptor  
16 = Tube fitting 1/16"  
10\_32 = 10-32 male thread

## CLEANING PROCESS

Please refer to our web site for AFPC-2 i.e. AFP cleaning procedure for O2 compatibility.

## LEAK TESTING

Leak rates are verified at maximum operation conditions. See engineering note EN-01 for more information, available on our website. Verified on a VARIAN™ helium leak mass spectrometer detector and on AFP® proprietary online leak detection system.

### Option

- S** = SilcoNert 2000™ The ultimate passivation of treated surfaces. A required treatment for metal components when analyzing for parts-per-billion levels of organo-sulfur compounds & mercury. Greatly reduce moisture contamination, improve system performance and eliminates surface adsorption of active compounds on steel.
- D** = Dursan™ is a coating designed to improve the inertness, hardness, and corrosion resistance of stainless steel. Ideal for sulfur, H<sub>2</sub>S, mercaptan, ammonia and mercury sampling.
- LFC** = Low friction coating is an anti-friction and anti-galling coating that has been applied to the front and the threaded portions of nut. This reduces the friction at least by an order of 10, eliminating the rotation of the ferrule when the nut is screwed in. So, now the fitting can be easily assembled with small tool and this without the need of a vise. This option is highly recommended for high temperature use. Ideal for frequent fitting assembly/disassembly.

**\*Lip Seal:** Lip Seal fitting is our new patent pending AFP fitting detail. This reduces the dead volume, eliminates the rotation of the ferrule and improves the sealing resulting in an improved connection for valve and fitting. This is very beneficial for any analytical high sensitivity instrumentation. Sealing integrity of a VCR fitting with the flexibility of a compression fitting. Please refer to Design Report 3 (DR-3) in the Analytical Flow Product Cookbook.

\*Patent Pending

### WARNING: NOT BE USE IN LIFE SUPPORT EQUIPMENT WITHOUT FORMAL AGREEMENT OF AFP®.

Base on a specific system configuration and working condition, warranty period and fitting maintenance procedure, (i.e.) parts replacement are different. Please refer to Analytical Flow Products® specific products documentation for more information.

Is still the responsibility of the user to make sure that for the selected products (fitting or other) configuration is safe and reliable for his application.

Analytical Flow Products engineering team will do their best to help customers for any application that may require custom modification. Analytical flow products will be please to supply demonstration parts to qualified O.E.M.

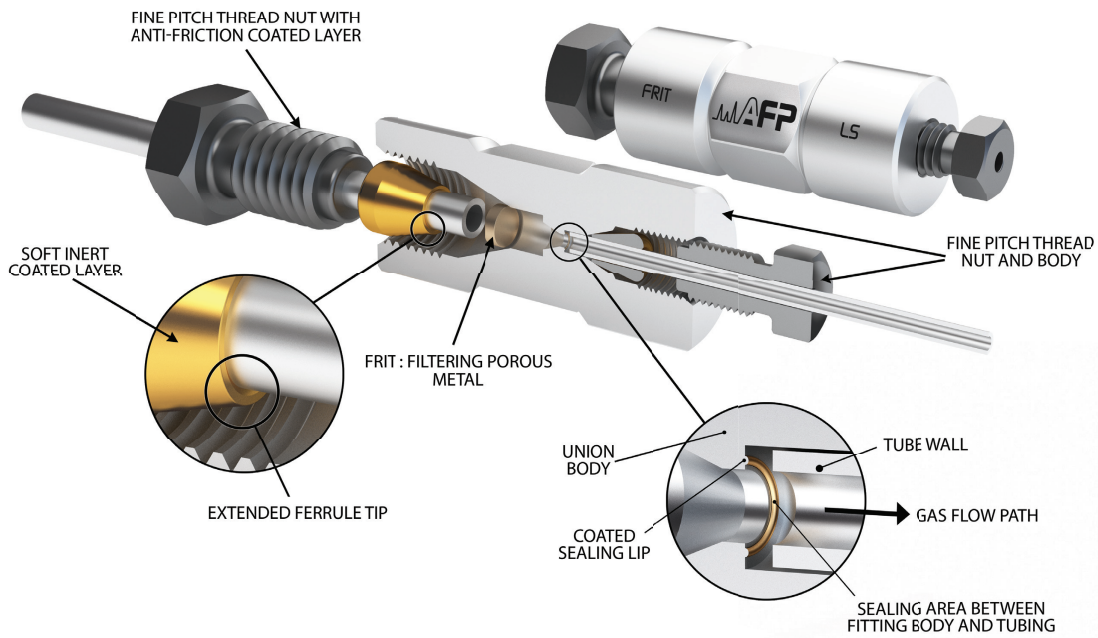
\*SEE WEBSITE FOR WARRANTY AND DISCLAIMER NOTICE. PRODUCT SPECIFICATION MAY CHANGE WITHOUT NOTICE, ASK FOR UPTODATE NOTIFICATION.

AFP® is a trademark of Analytical Flow Products Company  
UPCHUCH SCIENTIFIC® is a registered trademarks of IDEX® Corporation  
VICI® is a registered trademarks of Valco Instruments Co. Inc. and VICI AG  
Varian® is a registered trademark under license to Varian, Inc.

SilcoNert 2000™ is a trademark of SilcoTek corporation  
DURSAN™ is a trademark of Silcotek corporation  
Hastelloy® is a registered trademark of Haynes International inc.  
Monel® is a registered trademarks of Special Metals Corporation



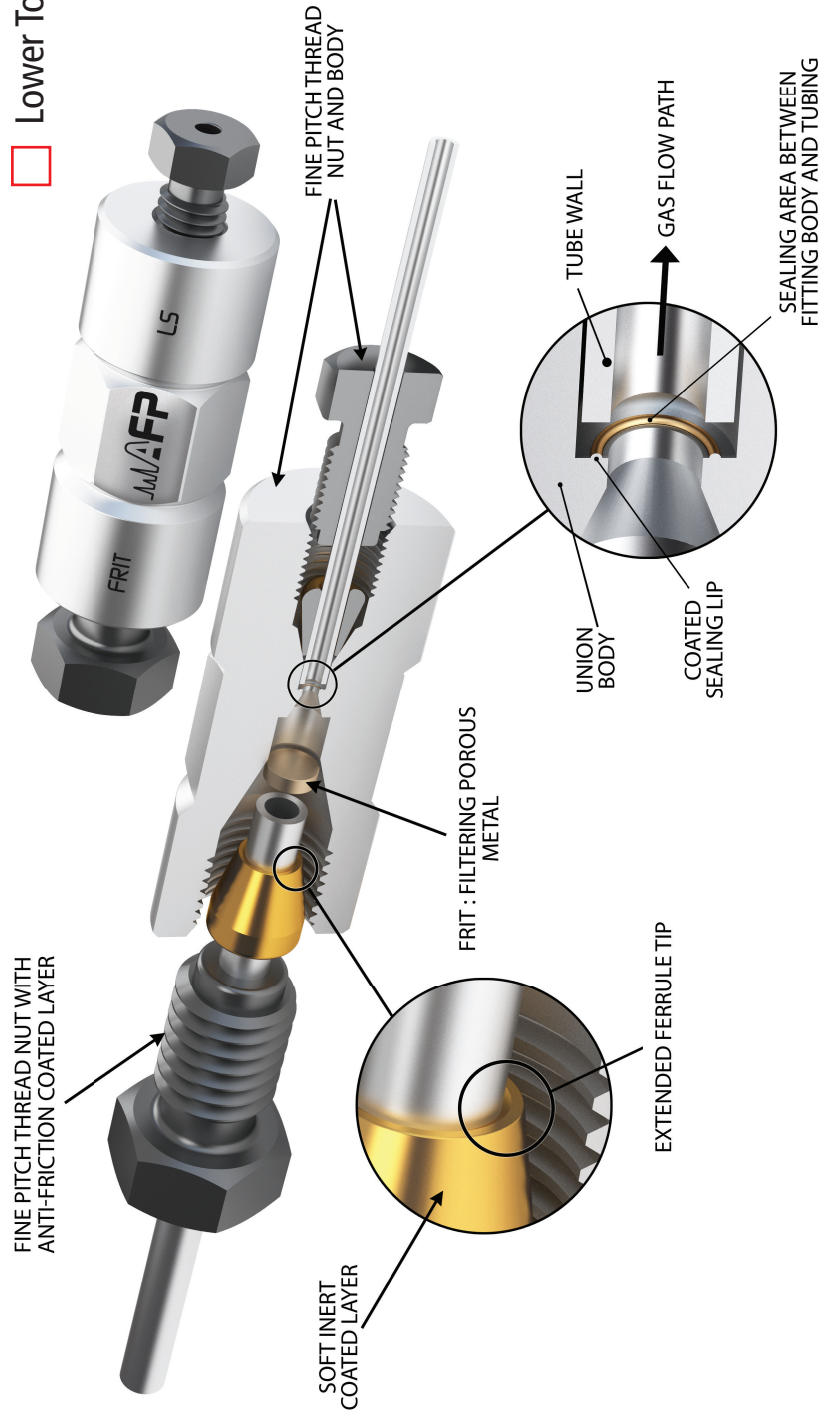
## SHORT TUTORIAL AND TECHNICAL NOTE ON THE FITTINGS



# IMPROVED ANALYTICAL FITTING

- Low dead volume
- Better sealing integrity
- Lower Torque

## LIP SEAL\*

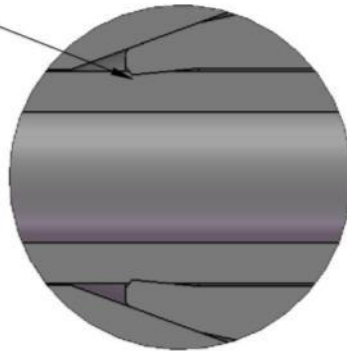
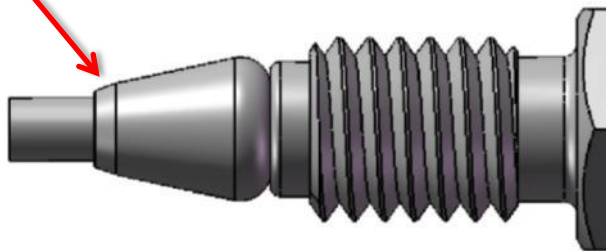


\*patent pending

# STANDARD FITTINGS

**Ferrule:**

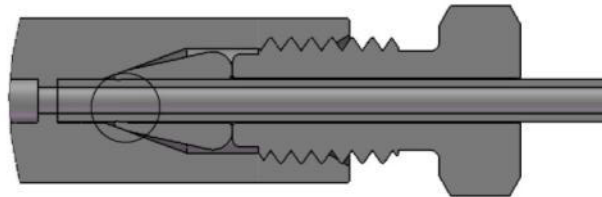
**Sealing Area**



FERRULE CUT A RING ON TUBING,  
NO INTERIOR DEFORMATION

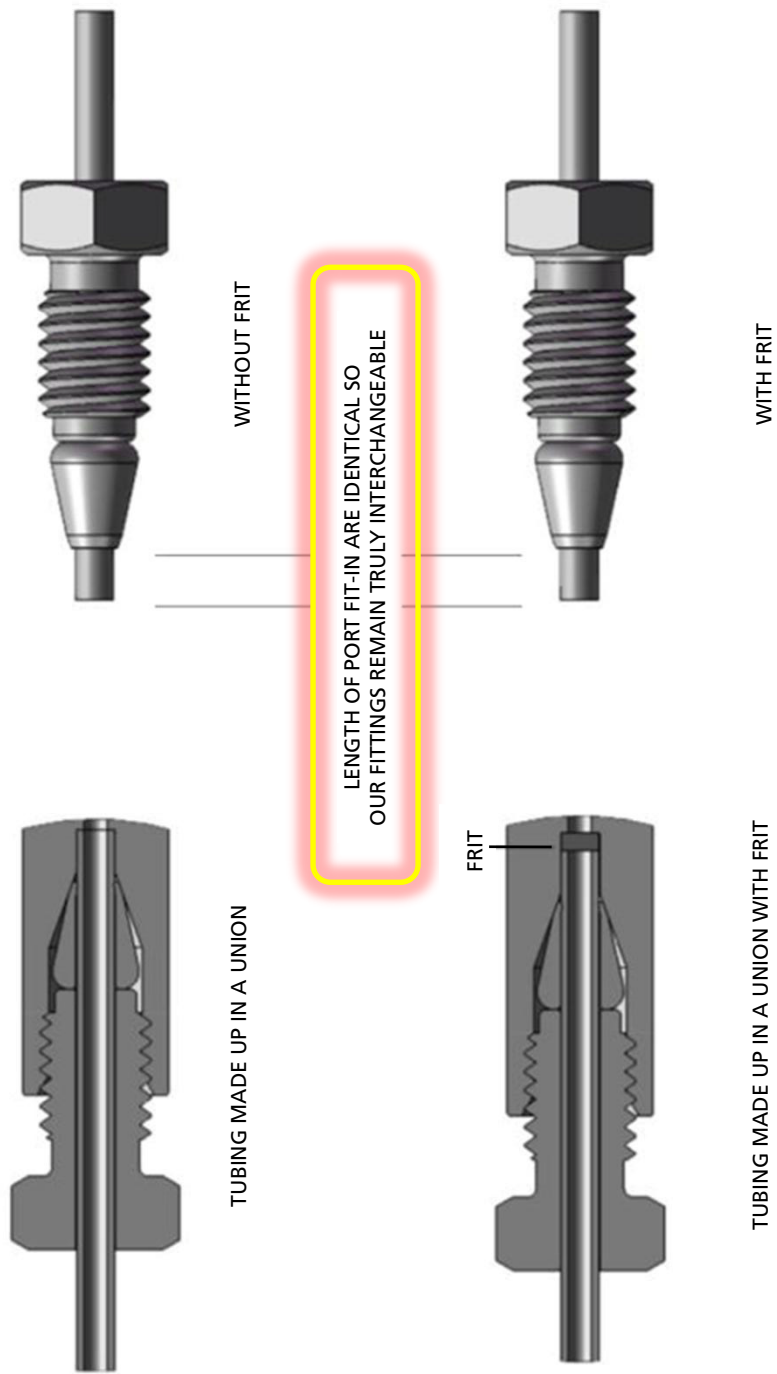
## Features / Benefits

- F:** Longer tip of the ferrule to go deeper into the sealing taper
- B:** Reduces the dead volume area
- F:** Shorter sealing area
- B:** Increases sealing strength

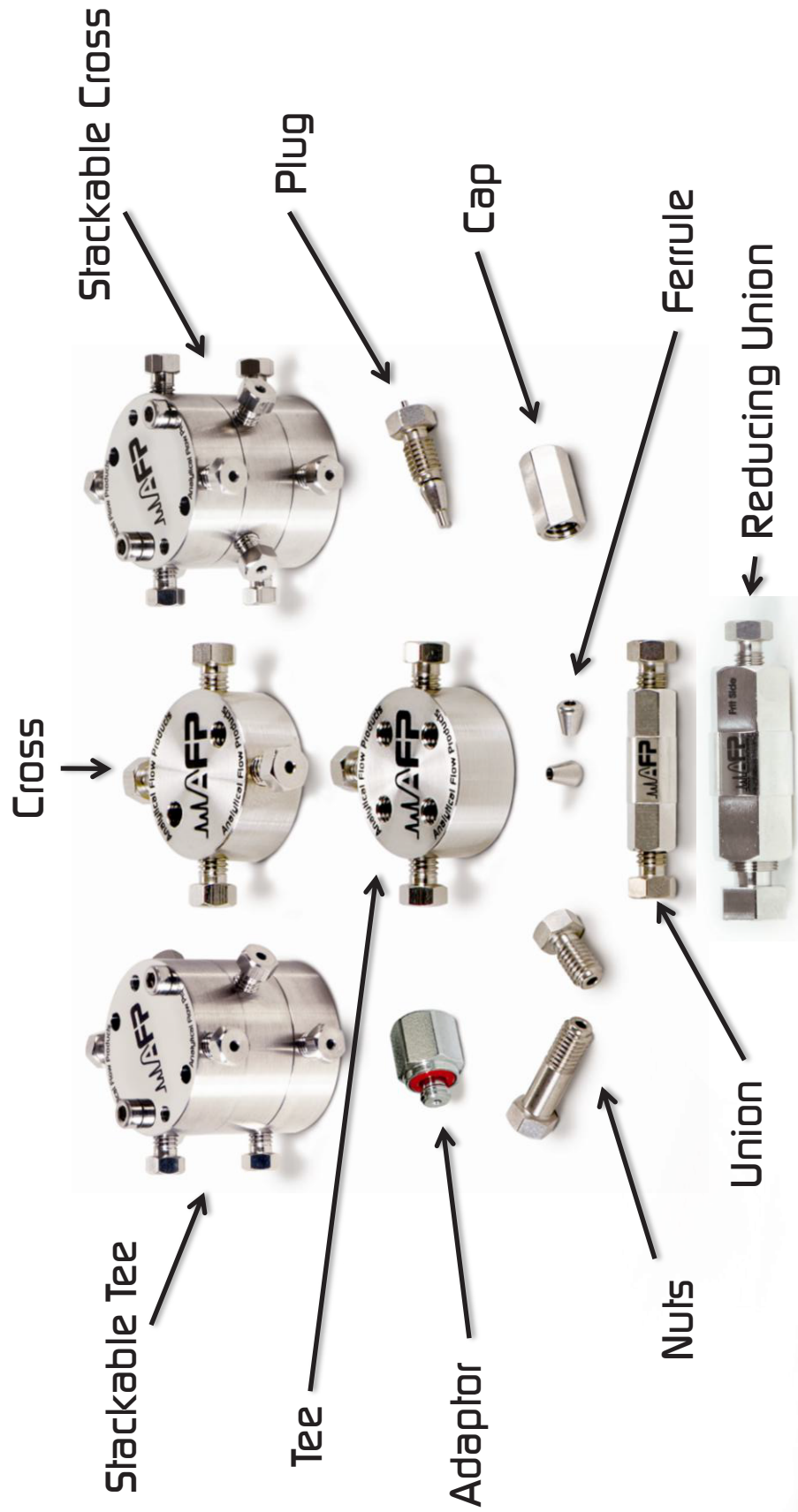




# Filtering Union:



# FITTINGS



# FITTINGS 1/8"



1/8" Union



1/8" Filtering Union



1/8"-1/16" Reducing Union  
(End Column)



Long SS Plug



Short Brass Plug



SS Cap



Special Thread Nut



Ferrule



Fine Pitch Nut

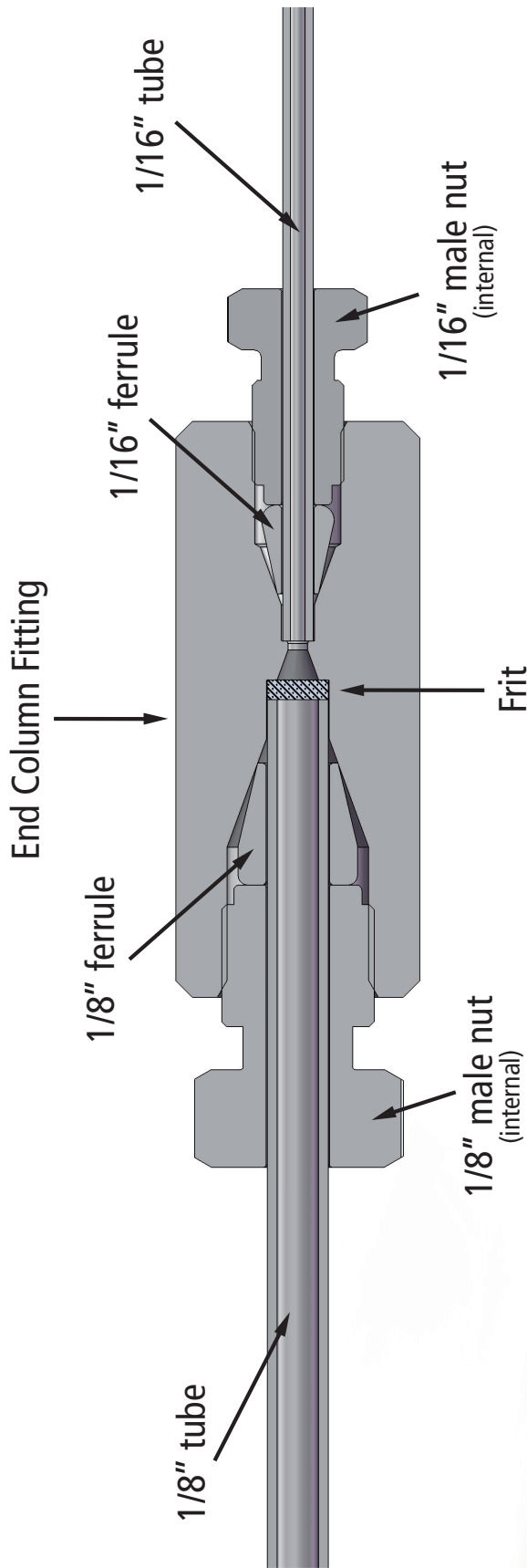


# REDUCING UNION/END COLUMN FITTING

Reducing union are use to join two different size of tubing together. We actually are able to offer 1/8" and 1/16" tubing size and 1/32" will be available soon.

All our 1/8" fittings are made with a fine pitch thread. This design reduces the torque required to make proper connections and also ease the plumbing inside the analyzer.

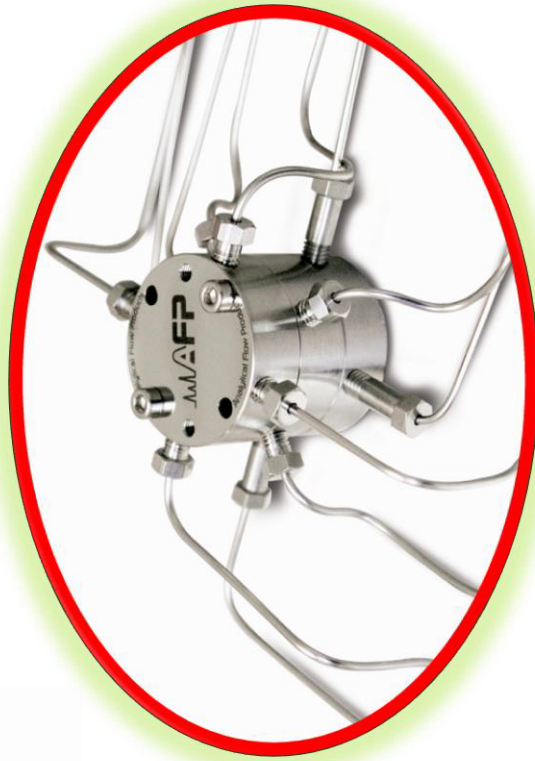
We also develop filtering reducing union that we called End Column Fitting. This is an excellent column end fitting for the typical packed columns found in gas GC. This type of fitting make the welding at the end of column obsolete.



## Stackable Tees & Crosses



- No clamp ring required
- Space saver
- Easy tube routing
- Leak tested









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