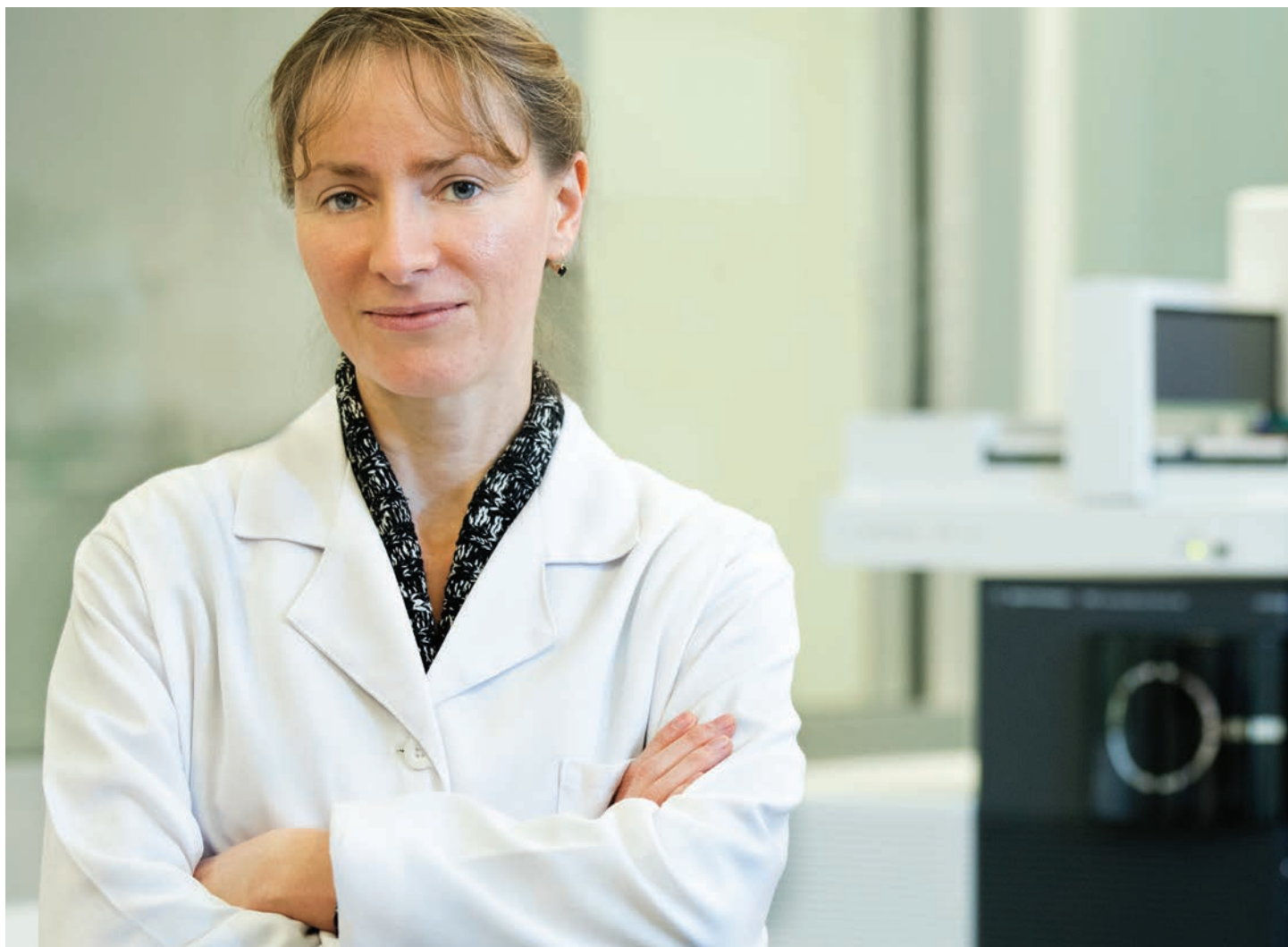


Better Connections, Better Results with Your Agilent GC System

GC inlet resource guide





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There's More to Agilent Instruments, Parts, and Consumables Than a Superior Product

You also get more than half a century of knowledge and experience.

We understand that successful chromatography depends upon everything, from instrument to supplies, working optimally. Because each component adds to, or detracts from overall system performance, the importance of regular maintenance cannot be overstated.

That's why we created this resource guide. It describes the role of inlet supplies, and the problems that can occur if maintenance is not performed regularly. You'll also learn why it's important to regularly replace key parts of the inlet—including the septum, liner, and ferrule.

Remember, too, that you can ensure an inert flow path for peak performance and reduced downtime using Agilent inlet supplies. For your convenience, we've included ordering information right here in this guide. You can purchase Agilent parts and supplies by visiting www.agilent.com/store, or by calling your local sales office or authorized distributor.

From finding the perfect liner... to solving challenging application problems... you can rely on Agilent for all of your chromatography needs.

Septa: Keep Air Out of Your Inlet



What's the function?

Septa isolate the sample flow path from the outside world. They provide a barrier that is readily penetrated by the injector needle while maintaining internal pressure without contaminating the analysis. Generally, septa are made from high-temperature, low-bleed silicone rubber.

Why replace?

Replace septa regularly to avoid:

- Leaks
- Decomposition
- Sample loss
- Reduced column or split vent flow
- Ghost peaks
- Column degradation

How to minimize problems

- Use within the recommended temperature range
- Change regularly
- Install "hand tight"
- Use septum purge when available
- Use autoinjectors and sharp syringe needles

Inlet septa maintain a leak-free seal and exclude air from the inlet, which is critical to sample introduction. That's because all columns must achieve carrier gas head pressure to establish flow through the column.

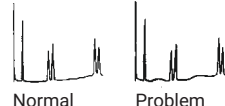

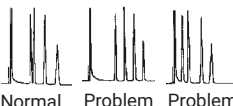
Septa are available in various sizes, materials, and temperature limits specific to inlet type and analytical needs. Lower-temperature septa are usually softer, seal better, and can withstand more injections than their high-temperature counterparts. However, if used above their recommended temperatures, they can leak or decompose—causing lower column flow, decreased column life, and ghost peaks.

What are the characteristics of common inlet septa?

Septum Type	Bleed Prevention	Lifetime	Temperature Limit
BTO (bleed and temperature optimized)	••• (Optimized for high temperature)	•	to 400 °C
Long life	•	•••	to 350 °C
Advanced Green	••	••	to 350 °C

••• = best •• = very good • = good

Septa troubleshooting

Symptom	Possible Cause	Remedy
Extra peaks/humps  Normal Problem	Septum bleed	1. Turn off injector heater 2. If extra peaks disappear, use higher-temperature septum or analyze at lower inlet temperatures
Baseline change after large peak  Normal Problem Problem	Large leak at septum during injection and for a short time thereafter (common with large-diameter needles)	Replace septum and use smaller-diameter needles
Prolonged retention times  Normal Problem Problem	Carrier gas leaks at septum or column connection	1. Check for leaks 2. Replace septum or tighten connections if necessary

Precise Performance: Agilent Premium Septa

Our premium septa have an injection-side recess that directs the syringe needle to the same point with every injection.

- Center point guides the needle for easy penetration, less coring, and reduced needle bending.
- Precision molding ensures an accurate fit in the inlet.
- Each batch is tested for bleed on an Agilent GC-FID.
- Plasma coating and conditioning prevent inlet sticking once heated.
- Touchless packaging enables easy, inert installation.



Agilent bleed and temperature optimized septa (BTO)

- Extended temperature range, low bleed
- Maximum injection port temperature 400 °C
- Virtually eliminates injection-port sticking
- Preconditioned and blister packaged to prevent contamination
- Ideal for low-bleed MS capillary columns



Agilent Advanced Green septa

- Long-life, high temperature
- More injections per septum
- Less injection port sticking
- Maximum injection port temperature 350 °C
- Economical alternative to competitive green septa



Agilent long-life septa

- Prepierced for extended life and reduced coring
- Ideal for overnight runs
- Up to 400 injections per septum
- Maximum injection port temperature 350 °C
- Soft, 45 durometer, easy on autosampler needles



General-Purpose Septa for Diverse Applications

Maintain complete confidence in your chromatographic results. Agilent septa are made from an enhanced injection-molded silicone rubber, and are specified to withstand over 200 injections at 350 °C. In addition, each is placed through a demanding QC test to ensure that only the highest-quality product is delivered to your laboratory.



Cost-effective red/gray septa

- Low bleed for less instrument maintenance and increased productivity
- Long lifetime for less frequent replacement
- Easy penetration
- Resistance to coring and leaking from multiple injections



Merlin Microseal septa

- A low-bleed, longer-life alternative to standard septa for split/splitless injection
- Withstands more than 2,000 injections, depending on samples and operating conditions
- Reduced instrument downtime for septa changes and injection port liner changes due to septa particulates
- Two sealing mechanisms: double O-ring seal around the syringe needle and spring-assisted duckbill to seal the injection port

Septa Ordering Information

Description	Part Number
Premium septa	
Bleed and temperature optimized (BTO), nonstick, 11 mm, 50/pk	5183-4757
Bleed and temperature optimized (BTO), nonstick, 5 mm, through-hole for on-column, 50/pk for on-column inlets	5183-4758
Advanced Green, nonstick, 11 mm, 50/pk	5183-4759
Advanced Green, nonstick, 5 mm, through-hole for on-column, 50/pk for on-column inlets	5183-4760
Long-life, nonstick, 11 mm, 50/pk	5183-4761
Long-life, nonstick, 5 mm, through-hole for on-column, 50/pk for on-column inlets	5183-4762
General-purpose septa	
Low bleed, gray, 11 mm, 50/pk	5080-8896-50
Low bleed, red, 11 mm partial through-hole, 50/pk	5181-3383-50
Low bleed, red, 5 mm partial through-hole, 50/pk for on-column inlets	5181-1260
Low bleed, gray, 5 mm, 25/pk for on-column inlets	5181-1261
Merlin Microseal septa (high pressure)	
High-pressure Merlin Microseal starter kit (microseal septa and nut)	5182-3442
High-pressure (100 psi) replacement Microseal	5182-3444
Merlin Microseal 100 psi nut	5182-3445
Merlin Microseal high-volume kit, includes general-purpose Merlin Microseal, six 23-gauge syringes, 500 vials and caps	5181-8839
Microseal nut for use with SPME Arrows	5182-3446
Microseal for 1.1 mm Arrow SPME probes	5182-3447
Microseal for 1.5 mm Arrow SPME probes	5182-3448
Merlin Microseal replacement Microseal, low pressure (30 psi)	5181-8815
Microseal PTFE nut liners, 2/pk	5182-0853
Merlin Microseal kit original low-pressure system, includes nut and Microseal	5181-8816
Merlin Microseal kit original low-pressure system, includes nut and 2 Microseals	5181-8833

Ferrules: Maintain Leak-Free Connections



What's the function?

Ferrules seal the column or liner connection to the system. The ideal ferrule provides a leak-free seal, accommodates various column outer diameters, and seals with minimal torque. It also tolerates temperature cycling and avoids sticking to the column or fittings.

Why replace?

Signs that a ferrule is damaged include:

- Background noise from oxygen diffusing into the system
- Column bleed catalyzed by oxygen
- Sample degradation or loss
- Decrease in the signal/noise ratio
- Poor retention time reproducibility

How to minimize problems

- Don't overtighten
- Maintain cleanliness
- Bake out ferrules before use
- Avoid contamination with fingerprints and oils
- Inspect used ferrules with magnifier for cracks, chips, or other damage before reuse
- Change ferrules when you install new columns or injector/detector parts

Using an incorrect or worn-out ferrule to seal your column connection often results in inconsistent and unreliable chromatography. The wrong ferrule can cause leaks, which allow air and other contaminants to enter the instrument through the column seal. These impurities interfere with column and detector performance.

For optimum results, replace ferrules every time you replace the column or perform column maintenance. Agilent offers a comprehensive selection of ferrules made from different materials and configurations to suit your instrument.

Common ferrule types for capillary GC columns

Material	Advantages	Limitations
Graphite	<ul style="list-style-type: none"> - Easy to use - Stable seal - Higher temperature limit (450 °C) 	<ul style="list-style-type: none"> - Soft, easily deformed or destroyed - Possible system contamination - Not for use with GC/MS
Vespel	<ul style="list-style-type: none"> - Mechanically robust - Long lifetime - 280 °C temperature limit 	<ul style="list-style-type: none"> - Flows at elevated temperature - Must retighten frequently - Leakage prone - Polymer bleed problematic with NPD/ECD detectors
Vespel/graphite	<ul style="list-style-type: none"> - Mechanically robust - Long lifetime - 350 °C temperature limit 	<ul style="list-style-type: none"> - Flows at elevated temperature - Must retighten frequently* - Leakage prone - Polymer bleed problematic with NPD/ECD detectors
UltiMetal Plus Flexible Metal	<ul style="list-style-type: none"> - Ultra Inert deactivation - Reduced mass and stiffness for a compressed seal 	Nonreusable
Gold-plated Flexible Metal	<ul style="list-style-type: none"> - Soft gold coating to eliminate leaks from microscratches in CFT devices 	<ul style="list-style-type: none"> - Nonreusable - Only recommended for CFT usage

* See Self-Tightening column nut.



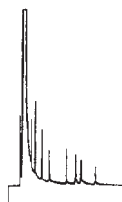
Ferrule Selection and Troubleshooting

Ferrule troubleshooting



Normal peaks

Column is correctly positioned in both the injection port and FID.



Tailing solvent peaks

Column is positioned incorrectly in the injection port, or a ferrule particle may be trapped inside the carrier gas flow path.



Wrong peak ratios

Column is incorrectly positioned in the inlet (either too far away or not far enough). Verify an installation distance of 4 to 6 mm.

High-purity 100% graphite ferrules

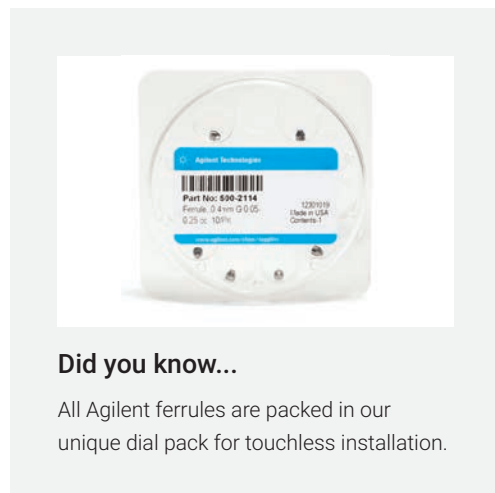
Pure graphite ferrules are soft and pliable. That means you can make effective seals with fused silica or glass columns without generating excess graphite flashing, which can contaminate detectors and inlets.

All Agilent graphite ferrules are made with the highest-purity graphite available. This material is free of sulfur and other contaminants that can interfere with certain detectors. Proper installation requires a finger-tight turn on the nut, followed by a one-quarter turn with a wrench.

Two types of Agilent column nuts can be used with graphite ferrules:

- Universal column nuts have a hexagonal head, and require a wrench to tighten completely.
- Finger-tight column nuts do not require a wrench to tighten. They can only be used with 100% graphite ferrules.

Note: Due to the softness of graphite, we do not recommend using 100% graphite ferrules with GC/MS transfer lines.



Did you know...

All Agilent ferrules are packed in our unique dial pack for touchless installation.



p/n 8010-0303



p/n 500-2114



p/n 8001-0221



p/n 8010-0308



p/n 5062-3580

Vespel/graphite ferrules for oxygen-sensitive detectors

Ferrules made from a combination of Vespel and graphite (85%/15%) have low oxygen diffusion rates, and they shrink less than ferrules made from pure Vespel. They are ideal for oxygen-sensitive detectors like GC/MS and ECD, but are also compatible with detectors such as FID and NPDs.

In addition, Vespel/graphite ferrules provide leak-free connections when installed correctly. You should also keep these factors in mind:

- The ferrule hole must match the column's outer diameter exactly to ensure a leak-free seal.
- Capillary column applications require a specific ferrule for each column diameter.
- Choosing a ferrule with a larger hole than specified can cause a large leak.
- An improper seal at the injector can cause high column bleed and shortened column lifetime.
- An improper seal at the detector can result in decreased signal/noise ratio. It also contributes to ion source oxidation, which can increase the need for detector maintenance.

Two Vespel/graphite ferrules are available for capillary column use:

- Standard-sized ferrules are compatible with universal column nuts.
- Slightly longer ferrules are designed to fit the MS interface nut used for the GC/MS transfer line connection. You can also use them to make column connections to inlets and other detectors, but you'll need a special column nut ([p/n 05988-20066](#)).

When using Vespel/graphite ferrules, Agilent recommends using the Self-Tightening column nuts. That's because even preconditioned ferrules can exhibit some shrinkage after a temperature-programmed run.



Column nut and Vespel/graphite ferrule combinations

Standard ferrule and standard nut

Inlet/detector column nut G3440-81011	+	Vespel/graphite nut and ferrule combinations 5181-3323 (0.1, 0.2, 0.25 mm id columns) 5062-3514 (0.32 mm) 5062-3512 (0.45 to 0.53 mm)
MSD column nut G3440-81013		

Longer ferrule with MS interface nut

MS interface column nut 05988-20066	+	Vespel/graphite nut and ferrule combinations 5062-3508 (0.25 mm id columns) 5062-3506 (0.32 mm) 5062-3538 (0.53 mm)
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Flexible Metal ferrules for capillary column connections

Proprietary Agilent UltiMetal Plus Flexible Metal ferrules let you make confident, leak-free connections at your inlet and detector. These metal ferrules fix the problems of poor fit and column breakage during installation—while providing ease of use and inertness. Other advantages include:

- Complete inertness. UltiMetal Plus ferrules are composed of stainless steel and coated with our novel UltiMetal coating. Additionally, the UltiMetal Plus chemical deactivation provides an inert surface for analyzing active analytes at trace levels.
- Less column breakage. A unique mechanical design includes reduced mass and stiffness, allowing the ferrule to gently compress around the column.
- More consistent seals with less scrap. Tighter id tolerances allow these ferrules to accommodate a wider range of column tubing.
- Easy selection. Each UltiMetal Plus Flexible Metal ferrule is designed to prevent inventory mix-ups, and to help you find the ferrule you need quickly.



p/n G3188-27501

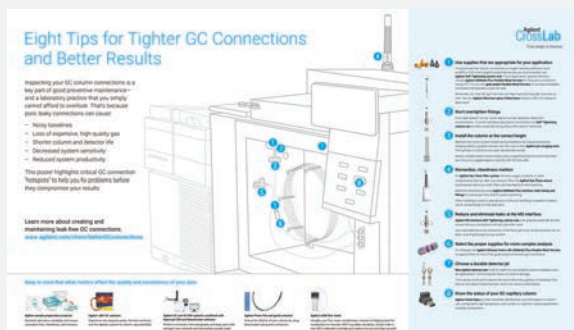
Gold-plated Flexible Metal ferrules for CFT applications

Now you can get the inertness of UltiMetal Plus Flexible Metal ferrules with the added benefits of a more secure seal and enhanced CFT installation. The softness of the gold plating allows the ferrule to form to any surface—preventing leakage due to microscratching and creating a tight, leak-free seal without any retightening upon installation.

Gold-plated ferrules are only recommended for CFT backflush, effluent splitting, retention gap connections, multidimensional GC, Dean's switch, or LTM column connections. They cannot be used in the inlet.

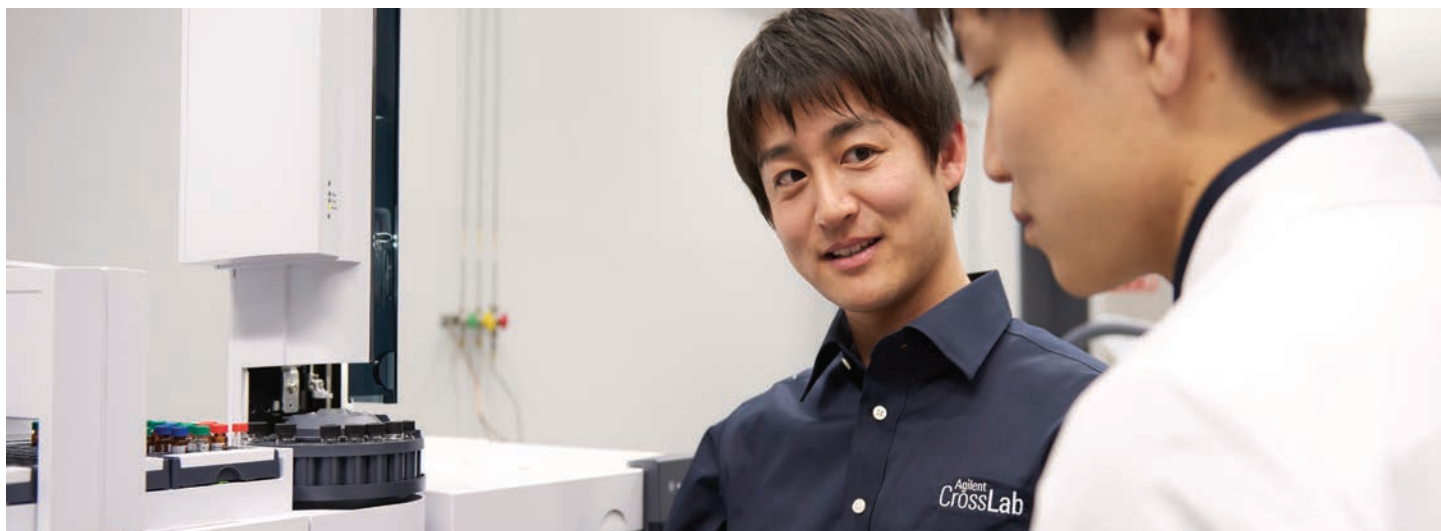


p/n G2855-28501



Flexible Metal ferrules: A key component in maintaining an inert flow path

The importance of an inert, leak-free flow path is no secret. However, creating and maintaining one isn't always easy. That's why Agilent has put together a simple and straightforward guide to ensure you have the optimal products for quality analyses. Download the Agilent Inert Flow Path [poster](#) and [brochure](#).



p/n 0100-1342

100% Vespel ferrules for maximum durability

Vespel is a high-temperature, polyimide-based material that is very hard. This material also has the lowest permeability to oxygen, making it an excellent sealing choice for metal or glass connections.

A big advantage of 100% Vespel ferrules is that they are reusable, and can be repositioned for easy mounting to other injectors and detectors. However, these ferrules do not deform easily, so it's important to match the ferrule hole size to the proper column diameter. The main disadvantage of 100% Vespel ferrules is material shrinkage when exposed to temperature cycling conditions.

Ferrule usage guide

Ferrule/Seal Type	Uses	Limitations
Graphite (100%)	<ul style="list-style-type: none"> – General purpose for capillary columns – Suitable for FID and NPD – Ideal for high-temperature and cool on-column applications – Easy removal 	<ul style="list-style-type: none"> – Not for MS or oxygen-sensitive detectors – Cannot be used with Agilent Self-Tightening column nuts – Upper temperature limit 450 °C
Vespel (100%)	<ul style="list-style-type: none"> – Isothermal operation – Easy reuse or removal 	<ul style="list-style-type: none"> – Leaks after temperature cycle – Upper temperature limit 280 °C
Vespel/graphite (85%/15%)	<ul style="list-style-type: none"> – General purpose for capillary columns – Ideal for MS or oxygen-sensitive detectors – Most reliable leak-free connection 	<ul style="list-style-type: none"> – Not reusable – Upper temperature limit 350 °C
UltiMetal Plus Flexible Metal ferrules	<ul style="list-style-type: none"> – Flexible—less column breakage and fitting damage – UltiMetal coating ensures complete inertness 	<ul style="list-style-type: none"> – Not suited for capillary flow technology fittings – Upper temperature limit 300 °C
Gold-plated Flexible Metal ferrules	<ul style="list-style-type: none"> – Soft and inert gold plating – Ideal for CFT devices – Fewer leaks caused by microscratches 	<ul style="list-style-type: none"> – Not to be used in the inlet – Must avoid contact with gold seal – Upper temperature limit 300 °C

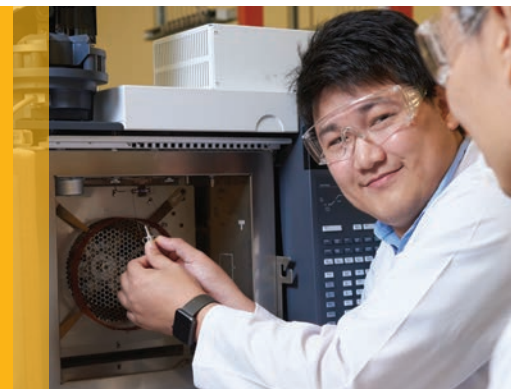
Ferrule Ordering Information

Description	Part Number
General-purpose graphite ferrules (short ferrules)	
0.5 mm id ferrule, 0.1, 0.2, 0.25, 0.32 mm id col, 10/pk	5080-8853
1.0 mm id ferrule, 0.53 mm id col, 10/pk	5080-8773
0.4 mm id ferrule, 0.05-0.25 mm id col, 10/pk	500-2114
0.8 mm id ferrule, 0.45, 0.53 mm id col, 10/pk	500-2118
85% Vespel/15% graphite ferrules (short ferrules)	
0.4 mm id ferrule, 0.1, 0.2, 0.25 mm id col, 10/pk	5181-3323
0.5 mm id ferrule, 0.32 mm id col, 10/pk	5062-3514
0.8 mm id ferrule, 0.45, 0.53 mm id col, 10/pk	5062-3512
Preconditioned 85% Vespel/15% graphite ferrules (long ferrules)*	
0.3 mm id ferrule, 0.1 mm id col, 10/pk	5062-3507
0.4 mm id ferrule, 0.1, 0.2, 0.25 mm id col, 10/pk	5062-3508
0.5 mm id ferrule, 0.32 mm id col, 10/pk	5062-3506
0.8 mm id ferrule, 0.53 mm id col, 10/pk	5062-3538
100% Vespel high-performance ferrules (short ferrules)**	
0.4 mm id ferrule, 0.1, 0.2, 0.25 mm id col, 10/pk	5181-3322
0.5 mm id ferrule, 0.32 mm id col, 10/pk	5062-3513
0.8 mm id ferrule, 0.45, 0.53 mm id col, 10/pk	5062-3511
Specialty ferrules, 85% Vespel/15% graphite	
Two hole 0.4 mm id holes, 0.1, 0.2, 0.25 mm id col, 10/pk	5062-3580
Two hole 0.5 mm id holes, 0.32 mm id col, 10/pk	5062-3581
No hole, 10/pk	5181-3308
UltiMetal Plus Flexible Metal ferrules	
Flexible Metal ferrule, UltiMetal Plus, 0.4 mm id, for 0.1 to 0.25 mm id fused silica tubing, 10/pk	G3188-27501
Flexible Metal ferrule, UltiMetal Plus, 0.5 mm id, for 0.32 mm fused silica tubing, 10/pk	G3188-27502
Flexible Metal ferrule, UltiMetal Plus, 0.8 mm id, for 0.53 mm id fused silica tubing, 10/pk	G3188-27503
Flexible Metal ferrule, UltiMetal Plus, for 0.25 and 0.32 mm id UltiMetal column tubing, 10/pk	G3188-27505
Flexible Metal ferrule, UltiMetal Plus, for 0.53 mm id UltiMetal column tubing, 10/pk	G3188-27506
Flexible Metal ferrule, UltiMetal Plus, without hole, to plug capillary flow technology fittings, 10/pk	G3188-27504
Gold-plated Flexible Metal ferrules	
CFT ferrule, Flexi, gold 0.25 mm id col, 10/pk	G2855-28501
CFT ferrule, Flexi, gold 0.32 mm id col, 10/pk	G2855-28502
CFT ferrule, Flexi, gold 0.53 mm id col, 10/pk	G2855-28503
CFT ferrule, Flexi, gold UltiMetal Plus small, 10/pk	G2855-28505
CFT ferrule, Flexi, gold UltiMetal Plus large, 10/pk	G2855-28506

*These ferrules are recommended for use with GC/MS.

**These ferrules are recommended for use in isothermal analysis only.

Column Nuts: Make Better GC Connections



What's the function?

Column nuts are essential components for connecting your GC column to your instrument. Quality column nuts help to ensure a tight, leak-free connection and enhance the longevity of your column.

Why replace?

Column nuts do not need to be replaced as often as other inlet materials. However, a damaged or loose column nut can cause:

- O₂ contamination
- Damaged columns
- Leaks
- Rising baselines

How to minimize problems

By choosing an Agilent Self-Tightening column nut, you're ensured the long-lasting, most reliable column nut on the market. With its unique technology, our Self-Tightening column nuts ensure a secure, leak-free fit for every run.

Column nuts perform the crucial task of connecting your column to the inlet and detector. To ensure a leak-free seal over hundreds of temperature cycles, Agilent strongly recommends our Self-Tightening column nuts. These unique, stainless steel GC column nuts deliver a finger-tight connection—without expensive upgrades, adaptors, or tools. Plus, their innovative design maintains a leak-free seal even after hundreds of injections.

The next generation design comes with a column locking collar, allowing for consistent column length installation and enhancing your ease of use.

Other advantages include:

- Reduced background noise for more reliable results
- Less wasted time, because you never need to retighten the fittings
- Lower column bleed for longer column life
- A finger-tight design that lets anyone make quality, consistent connections without tools
- A low-torque seal that prevents ferrules from sticking or crumbling
- Accurate, repeatable column installations: a locking collar securely holds the column in place

Self-Tightening column nuts are especially well-suited for oxygen-sensitive detectors, such as MS and ECD.



p/n G3440-81013



p/n G3440-81011 and G3440-81013

Column Nut Ordering Information

Description	Part Number
Self-Tightening column nuts	
Column nut, collared, self-tightening, inlet/detector	G3440-81011*
Replacement collar, for self-tightening nut	G3440-81012
Column nut, collared, self-tightening, MSD	G3440-81013*
Short nuts	
Column nut for GC capillaries, 2/pk	5181-8830
Finger-tight column nut for 0.1 to 0.32 mm columns	5020-8292**
Finger-tight column nut for 0.53 mm columns	5020-8293**
Finger-tight blanking plug	5020-8294
Column nut for Agilent 6850 GC, 2/pk	5183-4732
Long nuts	
Column nut for MS interface	05988-20066
Column nut for inlet with long or long 2-hole ferrule	05921-21170
Column nut wrench, 1/4 in and 5/16 in, 1 each	8710-0510
Column nut, 65 mm, for 6890 and 7890 systems	G3504-20504
Additional nuts	
PTV column nut, high temperature, hex	5188-5312
Nut, UltiMetal Plus, 1/16 in, front and back ferrule set	5190-6986
Nut, UltiMetal Plus, 1/8 in, front and back ferrule set	5190-6987
Nut, UltiMetal Plus, 1/4 in, front and back ferrule set	5190-6988
Wrench, open-ended, 1/4 in and 5/16 in	8710-0510

* For use with Vespel/graphite ferrules only.

** For use with graphite ferrules only.

For a secure connection, always match short nuts with short ferrules and long nuts with long ferrules.

Learn more about Agilent Self-Tightening column nuts with these videos



Self-Tightening column nut Installation – Inlet and Detectors video:

www.agilent.com/en/video/stcn-inlet-detector



Self-Tightening column nut Installation – MS interface video:

www.agilent.com/en/video/stcn-mass-spec

Liners: Ensure Flawless Analyte Delivery



What's the function?

Liners are the inlet system's centerpieces—into which samples are evaporated and brought into the gas phase.

Why replace?

If the liner is not changed regularly, or if the correct liner is not used, it can cause:

- Peak shape degradation
- Solute discrimination
- Poor reproducibility
- Sample decomposition
- Ghost peaks

How to minimize problems

Change liners regularly based on:

- Previous use pattern
- Sample cleanliness
- Peak shape changes
- Peak discrimination
- Poor reproducibility
- Sample pyrolysis

Choosing the proper liner can be challenging because you need to consider several characteristics for every application, including liner volume, treatments and deactivation, liner filter/barrier, and any design features that might affect sample vaporization or carrier gas flow through the inlet.

Agilent offers a complete selection of GC liners for your split/splitless inlet. All are designed and engineered to meet strict specifications for dimensional accuracy and inertness toward demanding compounds. For example—our splitless liners are ground and polished so that the outside diameter complies with exacting tolerances. So you can count on a proper fit into the inlet, and optimal splitless injection performance.

Agilent Ultra Inert inlet liners: Best-in-class deactivation performance

Maintaining an inert flow path prevents loss of peak shape and signal for sensitive or active compounds. Agilent Ultra Inert inlet liners prevent adsorption and ensure accurate sample transfer onto the GC column through a robust deactivated surface. These liners are recommended for trace-level analysis of active analytes, and give you these advantages:

- Consistently high inertness for greater sensitivity, accuracy, and reproducibility
- A choice between split and splitless liners, with and without filters
- Unique touchless packaging with a precleaned O-ring that minimizes contamination from touching
- Certificate of Performance: each Ultra Inert inlet liner is certified to ensure efficient, consistent coverage using both acidic and basic probes at trace levels (2 ng) on-column
- Compatibility with all Agilent—and many non-Agilent—GC systems





Liner Characteristics

How do I choose the right liner volume?

The injection port allows the sample to be accurately and reproducibly introduced into the GC. Vaporized sample must be a true representation of the liquid sample and, unless otherwise desired, should be injected without chemical change.

Elevated inlet temperatures vaporize the liquid sample into a gas for transfer to the column head—significantly changing the volume. Importantly, the volume of the resulting vapor must be small enough to fit within the liner volume. Otherwise, reproducibility and sensitivity can be compromised due to backflash and sample loss into the septum purge or split lines. Backflash can also result in sample carryover.

Larger-volume liners (> 800 μL) feature larger inside diameters (id) and are typically used with injection sizes of 1 μL or more. Small-volume liners have a smaller id, and are usually used with small injection sizes (< 1 μL). They are also well-suited for fast 100 μm id columns, gas samples, or when using external sampling devices like headspace and purge and trap.

Why is deactivation so important?

Active sites on inlet liners can adsorb sample components and cause peak tailing, with loss of sensitivity and reproducibility. Agilent liners are deactivated using deactivation procedures that produce inert, reproducible liners with long lifetimes. For splitless applications, or when analyzing polar compounds, a deactivated liner is best.

Over time, even deactivated liners begin to exhibit activity, and should be replaced. Although liners can be cleaned to remove particulates (or solvent rinsed to remove less volatile components), choosing the proper cleaning procedure is difficult. Some solvents remove the deactivation layer, and tools might scratch the glass surface of the liner—resulting in unwanted active sites. For this reason, Agilent recommends against washing and reusing inlet liners.

What liner dimensions are best for my application?

The outside diameter (od) determines if the liner is more effectively used in split or splitless mode.

- Larger-od liners are designed for splitless operation, fit tightly, and limit sample contact with metal inlet parts.
- Larger-od liners improve analyte recovery by retaining more sample inside the liner.
- Large-volume liners are used for split injections with enforced dimensional stability for various split ratios.
- Smaller-od liners are designed for split injection because they produce less resistance to carrier and split flow through the inlet.

Agilent splitless liners are designed with exacting dimensional tolerances to fit tightly in the inlet and minimize sample contact with metal surfaces.

Why do many liners use deactivated glass wool packing?

The glass wool is positioned or held in place near the center of the liner to:

- Provide extra surface area for complete sample volatilization to minimize thermal discrimination.
- Trap nonvolatile components and septum particles before they reach the column.
- Wipe any sample from the syringe needle to increase reproducibility and prevent residue buildup at the septum or Merlin Microseal.

Need help determining the vapor volume of common solvents at various temperatures and pressures?

Download our free Vapor Volume Calculator at www.agilent.com/chem/gccalculators

Why are some liners tapered?

Tapering (or narrowing) the liner id is done for several reasons:

- Bottom tapering focuses sample onto the column head, and minimizes contact with the metal parts of the inlet.
- Center tapering positions glass wool correctly.

Top tapering minimizes sample backflash

Reproducible positioning is important for repeatable results. To operate properly, the column tip should be located about halfway into the taper, or about 6 mm from the top of the ferrule. Some applications work better with different column installation depths. Therefore, you should check the instrument manual for proper installation distances and determine which distance is appropriate for your application.



When should I use glass wool liners?

Glass wool liners, which have glass wool near the center of the liner, are recommended for automatic injections or when using the Merlin Microseal septum. If the glass wool is positioned at the bottom of the liner, its main purpose is to trap nonvolatile components.

We do not recommend glass wool liners for the following analytes:

- Phenols
- Organic acids
- Pesticides
- Amines
- Drugs of abuse
- Reactive polar compounds
- Thermally labile compounds

What about glass cup liners?

Incorporating a glass cup inside the liner helps volatilize the sample and encourage mixing. Glass cup liners are available with extra glass wool and inert packing to increase reproducibility and limit sample discrimination. Not recommended for use with electronic pressure control inlets.



What are glass-fritted liners, and why do they last up to two times longer than other liners?

While glass wool is the industry standard, there are some inherent vulnerabilities, including:

- Dislodged wool after contact with the syringe needle can lead to fibers traveling through the flow path.
- Active sites due to needle exposure can interact with sensitive analytes, leading to tailing, degradation, carryover, and response loss.
- Inconsistent packing can cause slight differences in wool density and porosity.


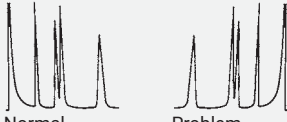
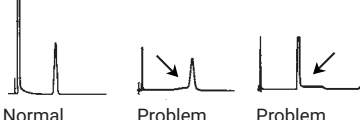

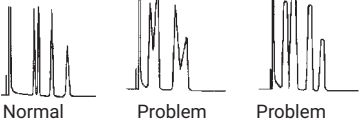
That's why we recommend Agilent Ultra Inert glass-fritted liners. Their sintered glass frit replaces the wool while providing equivalent vaporization and enhancing performance consistency. What's more, the frit is immobilized in the liner, preventing dislodged glass fibers from exposing active sites that can interact with sensitive analytes. You can also count on increased liner-to-liner and batch-to-batch consistency, compared to traditional glass wool liners.

Depending on your method, Ultra Inert glass-fritted liners can extend your liner lifetime up to two times. So you can have more time to run samples and analyze data.



Liner Selection and Troubleshooting

Liner troubleshooting

Symptom	Possible Cause	Remedy
<p>Tailing peaks</p>  <p>Normal Problem</p>	<ul style="list-style-type: none"> - Sample components adsorbed by column, inlet liner, or contaminated gold inlet seal - Needle hitting and breaking the inlet liner packing - Column end poorly cut (sample absorption) - Broken or chipped inlet liner 	<ul style="list-style-type: none"> - Use a new, deactivated liner or clean the old liner and replace glass wool - Partially remove packing from liner or use without packing - Remove column - Make a clean, square cut using a capillary fused silica cutting tool (such as a ceramic wafer or the Agilent column cutter) - Reinstall column - Make sure that the total inlet flow is above 40 mL/min
<p>Fronting peaks</p>  <p>Normal Problem</p>	<ul style="list-style-type: none"> - Decomposing sample - Liner overload - Improper column installation 	<ul style="list-style-type: none"> - Remove inlet liner and check cleanliness - Use a new, deactivated liner or replace glass wool and packing
<p>Baseline rise before or after peak</p>  <p>Normal Problem Problem</p>	<p>Decomposing sample</p>	<ul style="list-style-type: none"> - Remove inlet liner and check cleanliness - Use a new, deactivated liner or replace glass wool and packing
<p>Baseline change after large peak</p>  <p>Normal Problem Problem</p>	<p>Misaligned column and inlet liner</p>	<p>Check installation of column end and inlet liner; adjust if necessary</p>
<p>Unresolved peaks</p>  <p>Normal Problem Problem</p>	<ul style="list-style-type: none"> - Contaminated column or inlet liner - Deteriorating column 	<ul style="list-style-type: none"> - Use a guard column to prolong column life - Remove inlet liner and check cleanliness - Use a new, deactivated liner or replace glass wool and packing - Trim the front end of the column a minimum of six inches

Recommended Agilent Liners

As a result of intensive liner development and testing, Agilent recommends the following liners for method development, optimization, and troubleshooting.



p/n 5190-5105



p/n 5190-5112



p/n 5181-3316



p/n 5062-3587



p/n 5181-3315



p/n 210-4004-5



p/n 5180-4168



p/n 5188-5365

Split injection

- Ultra Inert deactivated split liner with glass wool, bottom taper, and glass bead for easy positioning. Features tight dimensional control for optimum performance.
- Ultra Inert, midfrit universal liner.

Splitless injection

- Ultra Inert deactivated single-tapered liner.
- Ultra Inert low-frit splitless liner.

General-purpose split/splitless injection

- Similar to split-injection liners, but with a different deactivation and outside diameter.

Direct injection

- Ultra Inert deactivated straight liner without glass wool. Use only for gas samples, headspace, or purge-and-trap applications.

Direct Connect

Agilent Direct Connect liners are ideal for highly sensitive compounds. They also ensure the highest GC or GC/MS performance without sample exposure to inlet-related degradation.

The liners are deactivated, are available in both single and double taper, and use a press-fit column connection. In addition, a small drilled hole—the size and placement of which was optimized by Agilent R&D engineers—allows the liners to work with EPC.

Focus liners

Focus liners trap a precisely controlled amount of glass wool in the ideal injection port liner position. At the point of injection, the glass wool provides extra surface area for vaporization, traps nonvolatile sample residue, and wipes residual sample from the needle. The result: greater reproducibility.

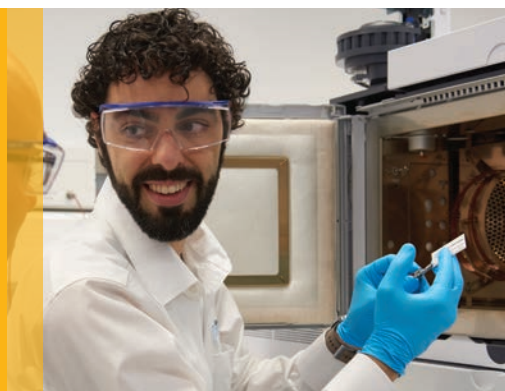
Liner O-rings

You can seal liners in the inlet using either O-rings or graphite seals. O-ring seals are easier to remove and replace than graphite, which can deform and flake apart. Graphite seals should only be used when inlet temperatures exceed 350 °C.

Liner Ordering Information

Description	Volume (µL)	Single Liner	5/Pack	25/Pack
Agilent recommended liners				
Inlet liner, Ultra Inert, splitless, single taper, glass wool	900	5190-2293	5190-3163	5190-3167
Inlet liner, Ultra Inert splitless, glass-fritted, low	870	5190-5112	5190-5112-005	5190-5112-025
Inlet liner, Ultra Inert split, low pressure drop, glass wool	870	5190-2295	5190-3165	5190-3169
Inlet liner, Ultra Inert, universal, glass-fritted, middle	870	5190-5105	5190-5105-005	5190-5105-025
Agilent Ultra Inert split liners				
Inlet liner, Ultra Inert, split, straight, glass wool	990	5190-2294	5190-3164	5190-3168
Inlet liner, Ultra Inert split, low pressure drop, glass wool	870	5190-2295	5190-3165	5190-3169
Inlet liner, Ultra Inert, universal, glass-fritted, middle	870	5190-5105	5190-5105-005	5190-5105-025
Agilent splitless liners				
Inlet liner, Ultra Inert, splitless, single taper	900	5190-2292	5190-3162	5190-3166
Inlet liner, Ultra Inert, splitless, single taper, glass wool	900	5190-2293	5190-3163	5190-3167
Inlet liner, Ultra Inert, splitless, dimpled, 2 mm id	200	5190-2297	5190-4006	NA
Inlet liner, Ultra Inert splitless, glass-fritted, low	870	5190-5112	5190-5112-005	5190-5112-025
Agilent standard split liners				
Inlet liner, split, single taper, glass wool, deactivated, low pressure drop	870	5183-4647	5183-4701	5183-4702
Inlet liner, split, single taper, glass wool, deactivated	870	5183-4711	5183-4712	5183-4713
Inlet liner, split, straight, glass wool	990	19251-60540	5183-4691	5183-4692
Agilent standard splitless liners				
Inlet liner, splitless, single taper, deactivated	900	5181-3316	5183-4695	5183-4696
Inlet liner, splitless, single taper, glass wool, deactivated	900	5062-3587	5183-4693	5183-4694
Other liners				
Inlet liner, direct, splitless, straight, deactivated, quartz	250	5181-8818	5183-4707	5183-4708
Inlet liner, direct, 1.5 mm id, for gas samples, headspace, purge and trap	140	18740-80200	5183-4709	5183-4710
Inlet liner, direct, splitless, straight, 4.0 mm id	990	210-3003	210-3003-5	N/A
Inlet liner, direct, split, straight, with cup (for manual injections)	800	18740-80190	5183-4699	5183-4700
Inlet liner, Direct Connect press-fit column connection, single taper, bottom hole, deactivated	675	G1544-80730	N/A	N/A
Inlet liner, Direct Connect press-fit column connection, double taper, bottom hole, deactivated	675	G1544-80700	N/A	N/A
Inlet liner, split, focus, glass wool, deactivated	935	N/A	210-4004-5	N/A
Inlet liner, split, focus, tapered, glass wool, deactivated	900	N/A	210-4022-5	N/A
Description				Part Number
Liner O-rings				
Inlet liner O-ring, standard, nonstick fluorocarbon, 10/pk				5188-5365
Inlet liner O-ring, FPM, high temperature PTV (300 °C), 10/pk				5188-5311
Inlet liner O-ring, graphite, extremely high temperatures (+350 °C), 10/pk				5180-4168
Inlet liner O-ring, graphite, for splitless liner, extremely high temperatures (+350 °C), 10/pk				5180-4173

Why Settle for Less? Choose Agilent Inlet Parts and Supplies



Our inlets are designed, tested, and manufactured by Agilent engineers to work perfectly with Agilent instruments and give you superior performance. Plus, we supply every replacement part for your entire system—not just a few select pieces.

Description	Part Number
GC split/splitless inlet supplies	
Retainer nut for headspace	18740-60830
Septum retainer nut	18740-60835
Shell weldment	G1544-80570
Retaining nut	G1544-20590
Reducing nut	18740-20800
Liner seals	
Stainless steel	18740-20880
Gold-plated with washer	5188-5367
Gold-plated with washer, Ultra Inert	5190-6144
Gold-plated with cross	5182-9652



p/n 5182-9652



p/n 5190-2209



p/n 5088-5367

For a complete parts list, see your GC instrument user and/or service manuals, or visit www.agilent.com/chem/gc-supplies

Need a multipack? Go to www.agilent.com/chem/gc-supplies-gold-seals

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