



**GC consumables**



In the laboratory today, the time spent and the precision required for sample preparation are key investments in an efficient workflow. Having spent that time and effort in sample preparation, it then becomes critical to maintain the integrity of the sample as it is delivered to the separation and detection steps of the analysis. This is why Trajan Scientific and Medical (Trajan) is focused on delivering a portfolio of high performance GC Inlet liners, GC columns, connections and fittings all with the specific and aggregate intent of ensuring the sample is not compromised on its journey to the detection system.



Our portfolio is built on the strength and world class heritage of the SGE GC supplies portfolio. In each of our manufacturing operations around the world, our products are built to exacting standards so that you can rely on their performance, accuracy and precision.

With a strong team of design chemists and production engineers, and an extensive network of application based industry opinion leaders, our portfolio of GC consumables continues to develop within Trajan. This means you, as a user in the laboratory, are assured of your sample integrity through collection, injection, separation and detection, optimizing your analysis.



We are confident that in this selection guide you will be able to identify and select the correct consumables for your application. If not, please contact us and we can investigate a custom solution for you.



As a major provider of tools and components for the analytical industry, Trajan is manufacturing product in the USA, Malaysia and Australia and we continue to service our valued customers around the world via a connected group of commercial and distribution facilities in Europe, the Americas, Asia and Australia. This supply chain is ably supported by a strong field technical team around the world.

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# Trajan consumables | GC selection

## SGE Syringes



Please refer to the Syringes for the laboratory brochure.

## SGE Inlet liners



Color	Injection technique	Sample types	Liner geometry
Dark green	Splitless	<ul style="list-style-type: none"> <li>Trace level analyses</li> <li>Active compounds</li> </ul>	Taper/gooseneck 
Blue	Split	<ul style="list-style-type: none"> <li>General purpose</li> <li>Concentrated samples</li> <li>Dirty samples</li> </ul>	FocusLiner® 
Aqua	Splitless	<ul style="list-style-type: none"> <li>Trace level analyses</li> <li>Dirty samples</li> <li>Wide boiling point range</li> </ul>	Tapered FocusLiner 
Orange	Direct	<ul style="list-style-type: none"> <li>Trace level analyses</li> <li>Active compounds</li> </ul>	ConnecTite™ 
Purple	Split/ splitless	<ul style="list-style-type: none"> <li>General purpose</li> <li>Concentrated samples</li> <li>Dirty samples (only if quartz wool is present)</li> <li>Gaseous samples (also purge and trap, headspace)</li> </ul>	Straight 
Yellow	Splitless LVI	<ul style="list-style-type: none"> <li>Trace level analyses</li> <li>Low boiling point compounds</li> <li>Active compounds</li> </ul>	Double taper 
Gray	PTV LVI	<ul style="list-style-type: none"> <li>Trace level analyses</li> <li>Large volume injections</li> </ul>	PTV/LVI 



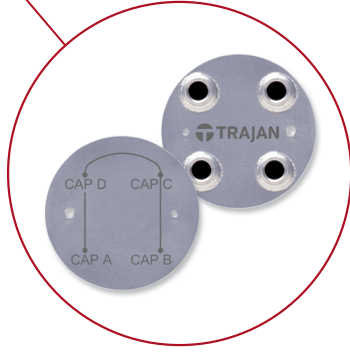
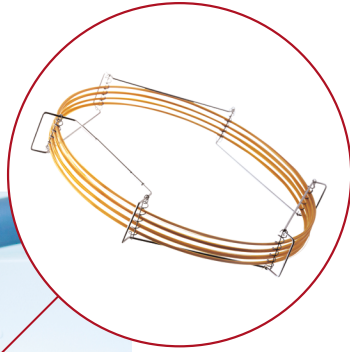
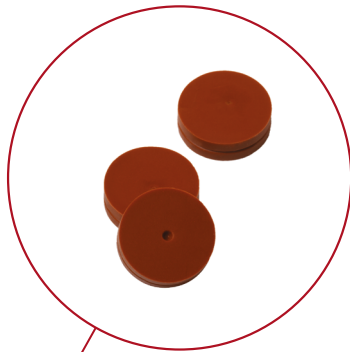
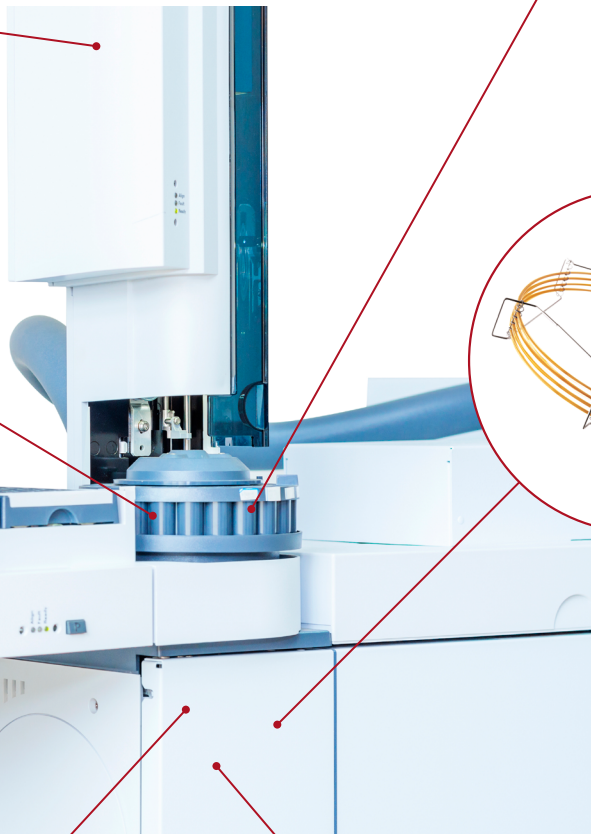
## Connectors and ferrules



SiTite®

Material	Uses	Advantages	Limitations
100% Graphite	FID, NPD, high temperature	<ul style="list-style-type: none"> <li>Easy-to-use stable seal</li> <li>Higher temperature limit</li> <li>Easily removed</li> <li>Reusable</li> </ul>	<ul style="list-style-type: none"> <li>Not for MS or oxygen-sensitive detectors</li> <li>Soft, easily deformed or destroyed</li> <li>Possible system contamination</li> </ul>
15% Graphite/ 85% Vespel®	MS and oxygen-sensitive detectors	<ul style="list-style-type: none"> <li>Long lifetime</li> <li>High temperature limit</li> <li>MS compatible</li> </ul>	<ul style="list-style-type: none"> <li>Cannot be re-used</li> <li>Must be re-tightened after initial temperature cycles</li> </ul>
SiTite® metal	MS and oxygen-sensitive detectors	<ul style="list-style-type: none"> <li>Long lifetime</li> <li>High temperature limit</li> <li>MS compatible</li> </ul>	<ul style="list-style-type: none"> <li>Cannot be re-used</li> </ul>





## Septa

Material	Max operating temperature	Key features
GP grade	275°C*	Low temperature applications
EC grade	350°C*	Low bleed
MN grade	350°C*	Premium septa for autosamplers
HT grade	400°C*	Outstanding mechanical properties for the highest temperature applications

\*Temperature for 11 mm septa only.

## SGE GC columns



Column parameter	Parameters affecting resolution			Performance changes
	Efficiency	Retention	Selectivity	
Column length (m)	✓			Doubling column length increases resolution by ~40%
Internal diameter (mm)	✓	✓		The smaller the column ID, the greater the efficiency and better the resolution
Film thickness (µm)		✓		The thicker the film, the greater the retention, e.g. ideal for highly volatile compounds. The thinner the film, the sharper the peaks and lower the bleed
Stationary phase chemistry			✓	Altering the stationary phase can affect elution order and help separate closely, or co-eluting peaks

## SilFlow®



3 port, 4 port or Deans' switch configuration microchannel devices for multidimensional analysis.






# Septa

Low bleed | Long lifetime



The purpose of a septa in a GC system is to isolate the sample flow path from the outside world. The septa provides a barrier that is readily penetrated by the injector needle whilst maintaining internal pressure without causing system contamination. An ideal septa has low bleed and a long lifetime.

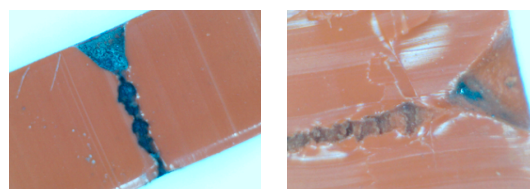
## Septa selection

	GP grade	EC grade	MN grade	HT grade	Enduro blue
					
	<ul style="list-style-type: none"> <li>• Low temperature applications.</li> </ul>	<ul style="list-style-type: none"> <li>• Combines significantly longer injection life, low bleed and low injection port adhesion.</li> </ul>	<ul style="list-style-type: none"> <li>• Premium septa for autosamplers.</li> <li>• Up to 400 injections per septa.</li> <li>• Pre-pierced to reduce coring.</li> </ul>	<ul style="list-style-type: none"> <li>• Bleed and temperature optimized, combined with outstanding mechanical properties for the highest temperature applications.</li> <li>• Retains softness and pierceability at high temperatures, and low injection port adhesion.</li> </ul>	<ul style="list-style-type: none"> <li>• For Shimadzu GCs.</li> </ul>
Material	Silicone	High temperature silicone	High temperature silicone	BTO silicone	High temperature silicone
Durability	Good	Excellent	Excellent	Excellent	Excellent
Resealing	Good	Excellent	Excellent	Excellent	Excellent
Solvent resistance	Excellent	Excellent	Excellent	Excellent	Excellent
Tear resistance	Good	Excellent	Excellent	Excellent	Excellent
Maximum temperature	275°C	350°C	350°C	400°C	350°C

*Temperature for 11 mm septa only.*

### Why septa should be replaced regularly:

- Avoid decomposition in GC inlet
- Prolong column lifetime
- Avoid system leaks and sample loss

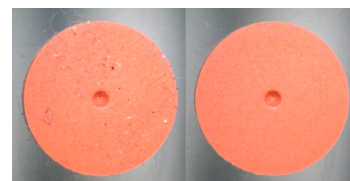


*Examples of worn septa.*

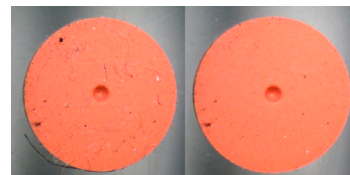
## Heat stability and sticking

All EC, MN and HT grade septa are treated with a non-stick coating:

- Reduces sticking in the injection port
- Improves ease of replacement
- Prevents dust accumulation on the surface
- Reduces potential causes of leaks and contamination



Coated MN septa after exposing to dust and wiping.



Uncoated MN septa after exposing to dust and wiping.

## Septa for Agilent instruments

Diameter (mm)	Type	Pack size	VWR cat. no.
For Agilent 7890, 6890, 6850, 5890 and 4890			
11	GP	50	60361-506
11	EC	25	89205-416
11	MN	50	14225-856
11	HT	25	89205-430

## Septa for PerkinElmer instruments

Diameter (mm)	Type	Pack size	VWR cat. no.
For PerkinElmer Autosystem, Clarus 500, 600, 590 and 690			
11	GP	50	60361-506
11	EC	25	89205-416
11	MN	50	14225-856
11	HT	25	89205-430

## Septa for Shimadzu instruments

Style	Type	Pack size	VWR cat. no.
For Shimadzu GC-2030, GC-2014, GC-2010 and GC-17A			
Plug	Enduro blue	50	14217-534
Plug	EC	50	89205-424
Plug	HT	50	89205-438

## Septa for Thermo Scientific instruments

Diameter (mm)	Type	Pack size	VWR cat. no.
For Thermo Scientific TRACE 1300 series GC†			
11	GP	50	60361-506
11	EC	25	89205-416
11	MN	50	14225-856
11	HT	25	89205-430

†Contact us for 17 mm septa part numbers for previous Thermo Scientific instruments.

## Confidence in your analysis



The purpose of an inlet liner in a GC system is to allow a sample injected in the liquid phase to pass into the gaseous phase and onto the GC column.

The elevated temperature used in the GC inlet vaporizes the liquid sample into a gaseous sample for transfer to the GC column.

During the transition from a liquid to a gas, there is change in the volume and the liner must be able to contain this volume.

If the volume is too large, sample is lost, impacting reproducibility and sensitivity.

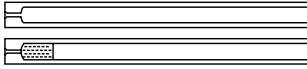


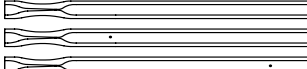
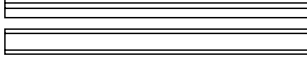




### Important considerations when selecting inlet liners:

- Must ensure complete vaporization of the sample before it reaches the column entrance.
- Must not react with the sample.
- The liner volume must be larger than the volume of vaporized sample.
- The liner should minimize discrimination not promote it.
- Adding quartz wool increases the surface area and promotes mixing.
- Inlet liners should be deactivated, especially for analysis of polar solutes and for splitless injections.
- Wool should be placed in the optimum position.



## Liner selection guide

Color	Injection technique	Sample types	Liner geometry	How the Geometry Works
Dark green	Splitless	<ul style="list-style-type: none"> <li>Trace level analyses</li> <li>Active compounds</li> </ul>	Taper/gooseneck 	<ul style="list-style-type: none"> <li>A bottom taper focuses sample onto the head of the column and minimizes sample contact with metal parts of the inlet.</li> <li>Remember – the addition of quartz wool to your inlet liner promotes mixing of analytes, aids the vaporization of liquid samples, and works as a trap to collect non-volatile residue in the sample (i.e. protects capillary column from 'dirty' samples).</li> </ul>
Blue	Split	<ul style="list-style-type: none"> <li>General purpose</li> <li>Concentrated samples</li> <li>Dirty samples</li> </ul>	FocusLiner 	<ul style="list-style-type: none"> <li>Ensures quartz wool remains in the correct position in the liner.</li> <li>Excellent reproducibility results from the wiping of the sample from the syringe needle and the prevention of droplet formation.</li> <li>Minimizes high molecular weight discrimination.</li> </ul>
Aqua	Splitless	<ul style="list-style-type: none"> <li>Trace level analyses</li> <li>Dirty samples</li> <li>Wide boiling point range</li> </ul>	Tapered FocusLiner 	<ul style="list-style-type: none"> <li>Bottom taper focuses sample onto the head of the column and minimizes contact with metal parts of the inlet.</li> <li>Ensures quartz wool remains in the correct position in the liner.</li> <li>Excellent reproducibility results from the wiping of the sample from the syringe needle and the prevention of droplet formation.</li> </ul>
Orange	Direct	<ul style="list-style-type: none"> <li>Trace level analyses</li> <li>Active compounds</li> </ul>	ConnecTite 	<ul style="list-style-type: none"> <li>ConnecTite liners facilitate maximum transfer of sample to the GC column and inhibit sample degradation due to hot metal components inside the inlet.</li> <li>Systems equipped with electronic pressure control require a hole in the liner body to maintain system gas flows.</li> <li>ConnecTite liners that have a hole near the bottom are best suited to analyses where a tailing solvent peak could affect early eluting compounds. ConnecTite liners with a hole at the top of the liner will improve your analysis with aqueous injections or where compounds of interest elute away from the solvent peak.</li> </ul>
Purple	Split/splitless	<ul style="list-style-type: none"> <li>General purpose</li> <li>Concentrated samples</li> <li>Dirty samples (only if quartz wool is present)</li> <li>Gaseous samples (also purge and trap, headspace)</li> </ul>	Straight 	<ul style="list-style-type: none"> <li>Straight liners facilitate higher split flows.</li> <li>Narrow bore straight liners facilitate fast GC work.</li> <li>Small injection volumes of less than 0.5 µL are best used with a narrow bore.</li> <li>Narrow bore straight liners improve focussing of gaseous samples (purge, trap and headspace).</li> </ul>
Yellow	Splitless LVI	<ul style="list-style-type: none"> <li>Trace level analyses</li> <li>Low boiling point compounds</li> <li>Active compounds</li> </ul>	Double taper 	<ul style="list-style-type: none"> <li>Bottom taper minimizes contact with metal parts of the inlet and focuses sample onto the head of the column.</li> <li>Top taper aids in minimizing sample flashback.</li> </ul>
Gray	PTV LVI	<ul style="list-style-type: none"> <li>Trace level analyses</li> <li>Large volume injections</li> </ul>	PTV/LVI 	<ul style="list-style-type: none"> <li>PTV and LVI liners generally have sintered glass beads or powder to increase the surface area and trap nonvolatile residue.</li> <li>PTV liners use baffles or a wisp of quartz wool to aid in vaporization of samples and retain droplets during low temperature injections.</li> <li>Side hole needles are recommended for these techniques to ensure effective distribution of sample within the liner.</li> </ul>

## Inlet liner volume

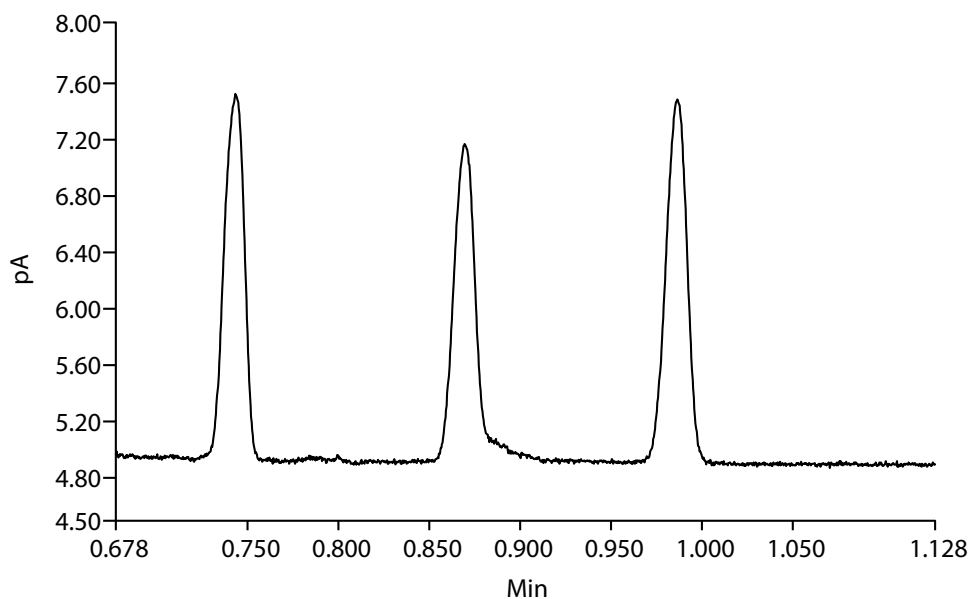
The volume of the vaporized sample should not exceed half of the total volume of the liner. Expansion volumes of solvents need to be understood to calculate injection volume. Solvents with low densities enable more volume of solvent to be injected into the GC system.

To demonstrate this, acetonitrile was injected onto a split straight liner with volume of 986  $\mu\text{L}$ .



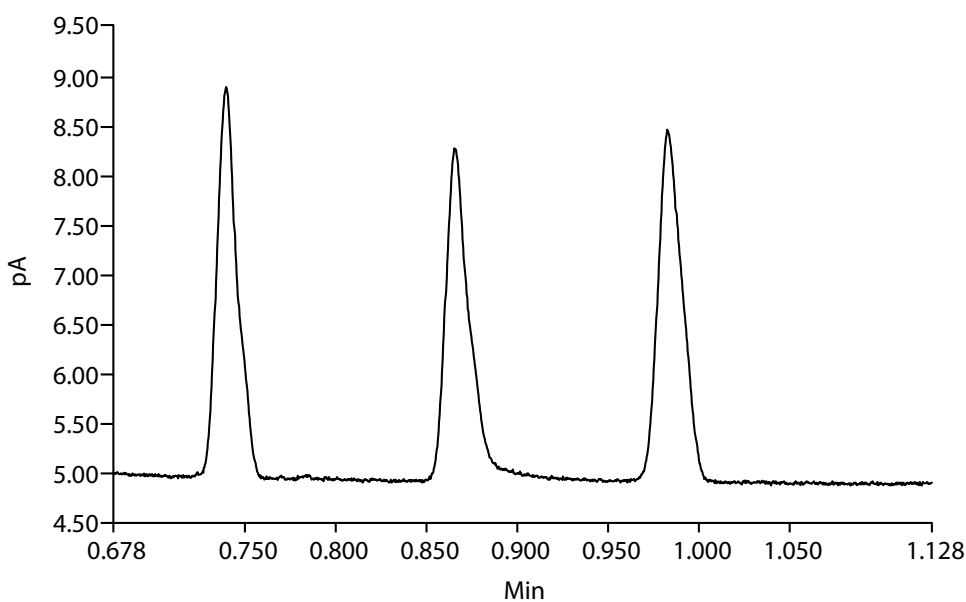
### Comparison of injection volume

#### 1 $\mu\text{L}$ injection



1  $\mu\text{L}$  expands to 432  $\mu\text{L}$ : Good peak shape, but approaching limits of half total liner volume.

#### 2 $\mu\text{L}$ injection



2  $\mu\text{L}$  expands to 864  $\mu\text{L}$ : Peak shape distorted as vapor exceeded half of liner volume.

## Liner deactivation

Deactivation is carried out at a temperature  $>400^{\circ}\text{C}$  which is hotter than injection port temperatures. This ensures no thermal breakdown of the deactivation under normal injection operating conditions.

Deactivation of liners with wool in situ means there is no handling of the wool after deactivation. Manual handling of wool can cause fracturing which can lead to active sites.

Proprietary deactivation reagent ensures stability of deactivation and excellent lifetime.

### Liner comparison of Endrin and DDT% breakdown

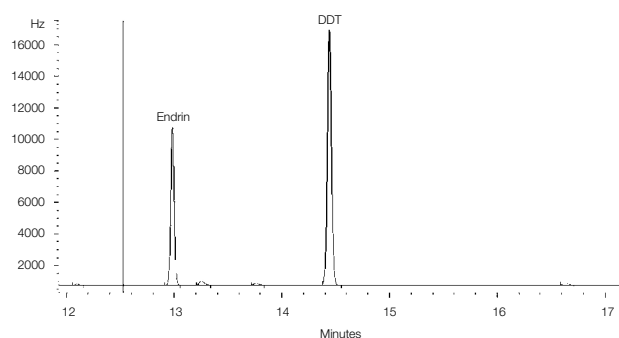
If the Endrin or DDT breakdown is 3% or higher it fails.

Competitor	
Endrin Deg%	3.23
DDT Deg%	1.95

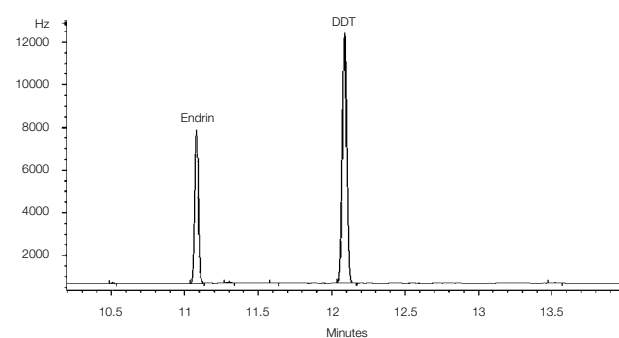
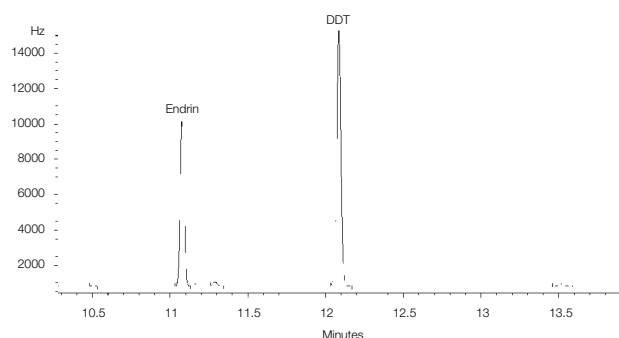
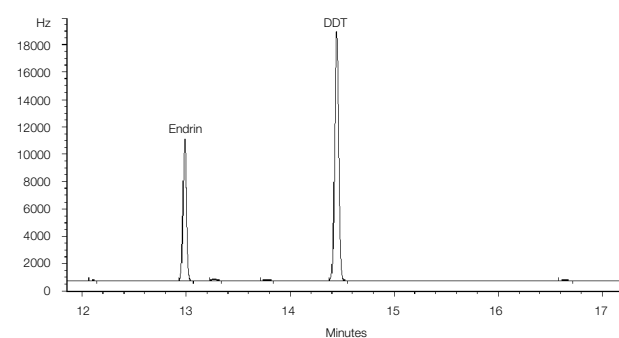
SGE FocusLiner	
Endrin Deg%	1.33
DDT Deg%	0.83



### Competitor liner

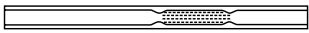
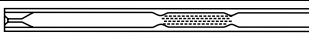
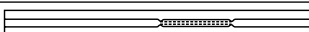

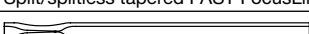
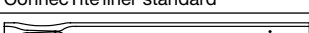
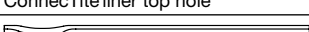
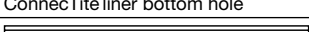
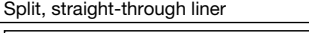
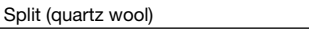
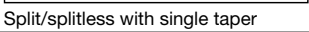
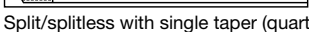
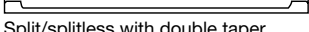
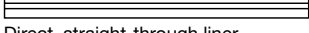
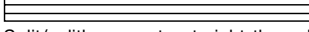
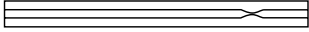


### SGE FocusLiner





## SGE Inlet liners

Description and geometry sketch	OD (mm)	ID (mm)	Length (mm)	Pack size	VWR cat. no.
<b>For Agilent 7890, 6890, 6850, 5890 and 4890</b>					
 Split/splitless FocusLiner	6.3	4	78.5	5	60362-506
				25	60362-590
 Split/splitless tapered FocusLiner	6.3	4	78.5	5	60362-664
				25	14226-448
 Split/splitless FAST FocusLiner	6.3	2.3	78.5	5	14226-444
				25	14226-446
 Split/splitless tapered FAST FocusLiner	6.3	2.3	78.5	5	14226-470
				25	14226-474
 ConnectTite liner standard	6.3	4	78.5	5	89205-574
 ConnectTite liner top hole				5	89205-578
 ConnectTite liner bottom hole	6.3	4	78.5	5	89205-582
 Split, straight-through liner	6.3	4	78.5	5	60362-510
				25	60362-594
 Split (quartz wool)	6.3	4	78.5	5	60362-504
				25	60362-592
 Split/splitless with single taper	6.3	4	78.5	5	60362-516
				25	60362-602
 Split/splitless with single taper (quartz wool)	6.3	4	78.5	5	60362-520
				25	87003-016
 Split/splitless with double taper	6.3	4	78.5	5	60362-518
				25	60362-604
 Direct, straight-through liner	6.3	1.2	78.5	5	60362-514
				25	60362-596
 Split/splitless quartz, straight-through liner	6.1	2	78.5	5	60362-508
 Splitless with recessed gooseneck	6.3	2	78.5	5	14226-450
 Split/splitless recessed gooseneck (quartz wool)				5	60362-512





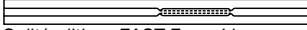
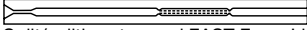
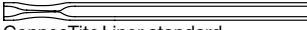
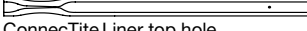
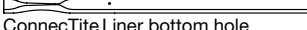
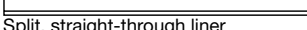
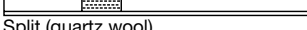
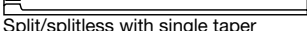
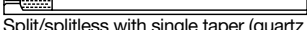
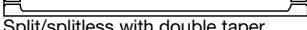
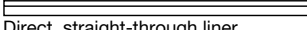
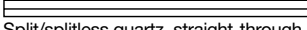
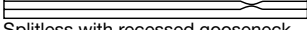
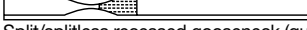
- Taper/gooseneck
- FocusLiner
- Tapered FocusLiner
- ConnectTite
- Straight
- Double taper
- PTV/LVI

## O-rings and sealing rings

Description	Usage	Pack size	VWR cat. no.
<b>For Agilent 7890, 6890, 6850, 5890 and 4890</b>			
O-ring	Temperatures up to 300°C. Suitable for inlet liners with OD of 6.3 mm	10	60361-576
Graphite sealing ring	Temperatures up to 450°C. Suitable for inlet liners with OD of 6.3 mm	10	60362-682
Graphite sealing ring	Temperatures up to 450°C. Suitable for use with inlet liners 092004	10	60362-684



## SGE Inlet liners

Description and geometry	OD (mm)	ID (mm)	Length (mm)	Pack size	VWR cat. no.
<b>For PerkinElmer Clarus 590 and 690</b>					
 Split/splitless FocusLiner	6.3	4	78.5	5	60362-506
				25	60362-590
 Split/splitless tapered FocusLiner	6.3	4	78.5	5	60362-664
				25	14226-448
 Split/splitless FAST FocusLiner	6.3	2.3	78.5	5	14226-444
				25	14226-446
 Split/splitless tapered FAST FocusLiner	6.3	2.3	78.5	5	14226-470
				25	14226-474
 ConnectTite Liner standard	6.3	4	78.5	5	89205-574
 ConnectTite Liner top hole				5	89205-578
 ConnectTite Liner bottom hole				5	89205-582
 Split, straight-through liner	6.3	4	78.5	5	60362-510
				25	60362-594
 Split (quartz wool)	6.3	4	78.5	5	60362-504
				25	60362-592
 Split/splitless with single taper	6.3	4	78.5	5	60362-516
				25	60362-602
 Split/splitless with single taper (quartz wool)	6.3	4	78.5	5	60362-520
				25	87003-016
 Split/splitless with double taper	6.3	4	78.5	5	60362-518
				25	60362-604
 Direct, straight-through liner	6.3	1.2	78.5	5	60362-514
				25	60362-596
 Split/splitless quartz, straight-through liner	6.1	2	78.5	5	60362-508
 Splitless with recessed gooseneck	6.3	2	78.5	5	14226-450
 Split/splitless recessed gooseneck (quartz wool)	6.3	4	78.5	5	60362-512
				25	14226-482



- Taper/gooseneck
- FocusLiner
- Tapered FocusLiner
- ConnectTite
- Straight
- Double taper
- PTV/LVI

## O-rings and sealing rings

Description	Usage	Pack size	VWR cat. no.
<b>For PerkinElmer Clarus 590 and 690</b>			
O-ring	Temperatures up to 300°C. Suitable for inlet liners with OD of 6.3 mm	10	60361-576
Graphite sealing ring	Temperatures up to 450°C. Suitable for inlet liners with OD of 6.3 mm	10	60362-682
Graphite sealing ring	Temperatures up to 450°C. Suitable for use with inlet liners 092004	10	60362-684



## SGE Inlet liners

Description and geometry sketch	OD (mm)	ID (mm)	Length (mm)	Pack size	VWR cat. no.
<b>For Shimadzu GC-2030 (SPL injector), GC-2010 (SPL-2010 injector), GC-2014 (SPL-2014 injector) and GC-17A (SPL-17 injector)</b>					
Split/splitless FocusLiner (top of wool 25 mm)	5	3.4	95	5	10799-832
Split/splitless tapered FocusLiner (top of wool 25 mm)	5	3.4	95	5	10799-830
Split/splitless FocusLiner (top of wool 15 mm)	5	3.4	95	5	60362-548
Split/splitless tapered FocusLiner (top of wool 15 mm)	5	3.4	95	5	60362-672
ConnecTite liner standard	5	3.4	95	5	89205-586
ConnecTite liner top hole	5	3.4	95	5	89205-590
ConnecTite liner bottom hole	5	3.4	95	5	89205-594
Split, straight-through liner	5	3.4	95	5	14226-460
Splitless, straight-through liner	5	2.6	95	5	60362-562
Split/splitless with single taper	5	3.4	95	5	10799-834
Split/splitless with middle gooseneck	5	3.4	95	5	10799-836
Split/splitless with recessed gooseneck and quartz wool	5	3.4	95	5	14226-458
Split/splitless with middle gooseneck	5	3.4	95	5	60362-558
ConnecTite (0.53 mm ID columns)	5	2.6	95	5	60362-564
SPME liner	5	0.75	95	5	14226-464



- Taper/gooseneck
- FocusLiner
- Tapered FocusLiner
- ConnecTite
- Straight
- Double taper
- PTV/LVI

\* When using a standard 42 mm needle for autosamplers, the sample will be injected on top of the wool for this liner.

## O-rings and sealing rings

Description	Usage	Pack size	VWR cat. no.
O-ring	For GC-2030 (SPL-2030 injector), GC-2014 (SPL-2014 injector) and GC-2010 (SPL-2010 injector)	10	10799-842
Graphite sealing ring	Temperatures up to 450°C. For GC-17A (SPL-17 injector)	10	14233-666

# Inlet liners | Thermo Scientific



## SGE Inlet liners

Description and geometry	OD (mm)	ID (mm)	Length (mm)	Pack size	VWR cat. no.
<b>For Thermo Scientific TRACE 1300 series GC</b>					
Split/splitless FocusLiner	6.3	4	78.5	5	60362-506
				25	60362-590
Split/splitless tapered FocusLiner	6.3	4	78.5	5	60362-664
				25	14226-448
Split/splitless FAST FocusLiner	6.3	2.3	78.5	5	14226-444
				25	14226-446
Split/splitless tapered FAST FocusLiner	6.3	2.3	78.5	5	14226-470
				25	14226-474
ConnectTite Liner standard	6.3	4	78.5	5	89205-574
ConnectTite Liner top hole	6.3	4	78.5	5	89205-578
ConnectTite Liner bottom hole	6.3	4	78.5	5	89205-582
Split, straight-through liner	6.3	4	78.5	5	60362-510
				25	60362-594
Split (quartz wool)	6.3	4	78.5	5	60362-504
				25	60362-592
Split/splitless with single taper	6.3	4	78.5	5	60362-516
				25	60362-602
Split/splitless with single taper (quartz wool)	6.3	4	78.5	5	60362-520
				25	87003-016
Split/splitless with double taper	6.3	4	78.5	5	60362-518
				25	60362-604
Direct, straight-through liner	6.3	1.2	78.5	5	60362-514
				25	60362-596
Split/splitless quartz, straight-through liner	6.1	2	78.5	5	60362-508
Splitless with recessed gooseneck	6.3	2	78.5	5	14226-450
Split/splitless recessed gooseneck (quartz wool)	6.3	4	78.5	5	60362-512
				25	14226-482



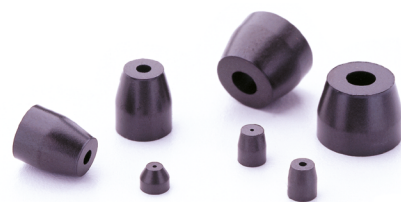
- Taper/gooseneck
- FocusLiner
- Tapered FocusLiner
- ConnectTite
- Straight
- Double taper
- PTV/LVI

## O-rings and sealing rings

Description	Usage	Pack size	VWR cat. no.
<b>For Thermo Scientific TRACE 1300 series GC</b>			
O-ring	Temperatures up to 300°C. Suitable for inlet liners with OD of 6.3 mm	10	60361-576
Graphite sealing ring	Temperatures up to 450°C. Suitable for inlet liners with OD of 6.3 mm	10	60362-682
Graphite sealing ring	Temperatures up to 450°C. Suitable for use with inlet liners 092004	10	60362-684

# Connectors and ferrules

Easy to install | Leak free | Stable



Ferrules are used to seal the connection of the column or liner to the GC system.

## Considerations in ferrule selection include:

- Leak free seal
- Accommodate various column ODs
- Seal with minimum torque
- Non-stick to column or fittings
- Withstand temperature cycling

## Minimizing problems associated with ferrules:

- Do not over tighten
- Ensure clean prior to use
- Bake out prior to use
- Change ferrule when installing new column
- Use correct ferrule for column size

## Ferrule selection guide

Material	Uses	Advantages	Disadvantages
100% Graphite	FID, NPD	<ul style="list-style-type: none"> <li>• Easy-to-use stable seal</li> <li>• High temperature limit</li> <li>• Easily removed</li> <li>• Reusable</li> </ul>	<ul style="list-style-type: none"> <li>• Not for MS or oxygen-sensitive detectors</li> <li>• Soft, easily deformed or destroyed</li> <li>• Possible system contamination</li> </ul>
15% Graphite/85% Vespel	MS and oxygen-sensitive detectors	<ul style="list-style-type: none"> <li>• Long lifetime</li> <li>• High temperature limit</li> <li>• MS compatible</li> </ul>	<ul style="list-style-type: none"> <li>• Cannot be re-used</li> <li>• Must be re-tightened after initial temperature cycle</li> </ul>
SilTite metal	MS and oxygen-sensitive detectors	<ul style="list-style-type: none"> <li>• Long lifetime</li> <li>• High temperature limit</li> <li>• MS compatible</li> </ul>	<ul style="list-style-type: none"> <li>• Cannot be re-used</li> </ul>

## SilTite metal ferrules



Designed for connecting fused silica GC columns and tubing to mass spectrometer interfaces and injectors.

SilTite metal ferrules provide a continuous leak free connection without the need to re-tighten the nut after a few temperature cycles. SilTite ferrules are a high performing alternative to Graphite/Vespel ferrules in a GCMS system. Their performance and cost effectiveness also makes them ideal for connecting GC columns to injectors and atmospheric detectors.



## SilTite GC connectors



Column connections in GC have traditionally suffered from unreliability, leaks, excessive dead volumes and lack of inertness, leading to poor chromatography results and instrument downtime.

SilTite GC connectors are designed to minimize installation time and provide ongoing, robust connections throughout the life of the GC column.



## SilTite FingerTite ferrules



Designed for each injector and detector, simplify your GC column installation.

- Typical kit contains 5 x female nuts, 10 x ferrules and 1 x measuring tool.
- A ferrule system for GC systems delivering an easy, leak free installation for capillary columns without the use of any tools.
- SilTite FingerTite will simplify your column installation process, giving you less hassle and more time for chromatography.



## SilTite $\mu$ -Union



Designed to connect columns without the complications of conventional connectors.

- Tubing connections without leakage concern from temperature cycling or fear of getting pieces of ferrule stuck inside the tubing.
- Low thermal mass: 9 mm in length and mass <0.5 g.
- Available in kits to connect a range of columns from 0.1 mm ID through to 0.53 mm ID.
- Each kit contains: 5 x ferrules, 2 x male  $\mu$ -connector end fittings, 2 x female  $\mu$ -connector end fittings and installation tooling.



The SilTite  $\mu$ -Union comes fitted standard when you order a GC capillary column with integrated guard (5 m). Just add SGXX to the end of the column part number where XX is the column ID e.g. 054101SG32 for a 0.32 mm ID guard on column part number 054101.

VWR cat. no.	Part description and detail
89232-106	SilTite $\mu$ -Union for joining 0.10-0.25 mm and 0.10-0.25 mm ID columns/fused silica
89232-108	SilTite $\mu$ -Union for joining 0.10-0.25 mm and 0.32 mm ID columns/fused silica
89232-110	SilTite $\mu$ -Union for joining 0.10-0.25 mm and 0.53 mm ID columns/fused silica
89232-112	SilTite $\mu$ -Union for joining 0.32 mm and 0.32 mm ID columns/fused silica
89232-114	SilTite $\mu$ -Union for joining 0.32 mm and 0.53 mm ID columns/fused silica
89232-116	SilTite $\mu$ -Union for joining 0.53 mm and 0.53 mm ID columns/fused silica
<b>Replacement parts</b>	
89232-118	Replacement SilTite $\mu$ -Union ferrules for joining 0.10-0.25 mm and 0.10-0.25 mm ID columns/fused silica, PK10
89232-120	Replacement SilTite $\mu$ -Union ferrules for joining 0.10-0.25 mm and 0.32 mm ID columns/fused silica, PK10
89232-122	Replacement SilTite $\mu$ -Union ferrules for joining 0.10-0.25 mm and 0.53 mm ID columns/fused silica, PK10
89232-124	Replacement SilTite $\mu$ -Union ferrules for joining 0.32 mm and 0.32 mm ID columns/fused silica, PK10
89232-126	Replacement SilTite $\mu$ -Union ferrules for joining 0.32 mm and 0.53 mm ID columns/fused silica, PK10
89232-128	Replacement SilTite $\mu$ -Union ferrules for joining 0.53 mm and 0.53 mm ID columns/fused silica, PK10
89232-130	Replacement SilTite $\mu$ -Union only (no ferrules) for joining 0.10-0.32 mm and 0.10-0.32 mm ID columns/fused silica, PK5
89232-132	Replacement SilTite $\mu$ -Union only (no ferrules) for joining 0.10-0.32 mm and 0.53 mm ID columns/fused silica, PK5
89232-134	Replacement SilTite $\mu$ -Union only (no ferrules) for joining 0.53 mm and 0.53 mm ID columns/fused silica, PK5

# Connectors and ferrules | Agilent

## SilTite FingerTite ferrules



Description	Column ID	Ferrule ID	Pack size	VWR cat. no.
<b>For Agilent 7890, 6890, 6850, 5890 and 4890</b>				
SilTite FingerTite INJ/FID starter kit	0.10-0.25 mm	0.4 mm	*	97051-946
SilTite FingerTite capillary/FID starter kit	0.10-0.25 mm	0.4 mm	*	89232-154
SilTite FingerTite INJ/MS starter kit	0.10-0.25 mm	0.4 mm	*	97051-948
SilTite FingerTite INJ/FID starter kit	0.53 mm	0.7 mm	*	89232-150
SilTite FingerTite injector starter kit	0.53 mm	0.7 mm	*	89232-152
<b>Replacement parts</b>				
SilTite FingerTite ferrule 0.4 mm	0.10-0.25 mm	0.4 mm	10	97051-958
SilTite FingerTite ferrule 0.5 mm	0.32 mm	0.5 mm	10	97051-960
SilTite FingerTite ferrule 0.7 mm	0.53 mm	0.7 mm	10	89232-196
SilTite FingerTite blanking ferrule	–	–	2	97051-962
SilTite FingerTite female nut	–	–	5	97051-964
SilTite FingerTite INJ base seal	0.10-0.25 mm	–	2	97051-966
SilTite FingerTite capillary adaptor	–	–	1	89232-140
SilTite FingerTite MS adaptor	–	–	1	89232-142
SilTite FingerTite FID detector	–	–	1	89232-144
SilTite FingerTite injector adaptor (includes 2 base seals)	0.10-0.25 mm	–	1	89232-146

\*Each starter kit includes all the parts necessary to convert one GC system (one injector and one detector) to the SilTite FingerTite system. In addition there are five SilTite FingerTite nuts, ten SilTite FingerTite ferrules, and a ferrule install tool which allows you to seat the ferrule in the correct position on the capillary column.

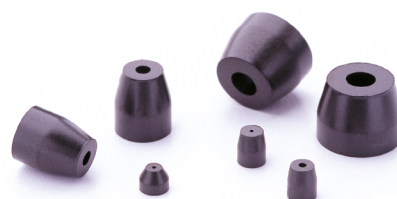
## Ferrules

Instrument	Column ID	Ferrule ID	Pack size	VWR cat. no.
<b>15% Graphite/85% Vespel ferrules</b>				
Injectors and detectors at atmospheric pressure e.g. FID	0.10-0.25 mm	0.4 mm	10	60361-614
	0.32 mm	0.5 mm	10	60361-616
	0.53 mm	0.8 mm	10	60361-618
	for 1/8" OD packed columns	1/8"	10	60361-604
	for 1/4" OD packed columns	1/4"	10	60361-602
GCMS interface connection	0.10-0.25 mm	0.4 mm	10	60361-600
	0.32 mm	0.5 mm	10	60361-578
	0.53 mm	0.8 mm	10	60361-586
<b>100% Graphite ferrules</b>				
Injectors and detectors at atmospheric pressure e.g. FID (not for GCMS)	0.10-0.32 mm	0.5 mm	10	60362-634
	0.45-0.53 mm	0.8 mm	10	60362-636
	for 1/8" OD packed columns	1/8"	10	60361-546
	for 1/4" OD packed columns	1/4"	10	60362-686
<b>SilTite metal ferrules</b>				
GCMS interface connection (starter kit)	0.10-0.25 mm	0.4 mm	10*	14226-368
	0.32 mm	0.5 mm	10*	14226-370
	0.53 mm	0.8 mm	10*	14226-372
Split/splitless injectors (starter kit)	0.10-0.25 mm	0.4 mm	10#	14226-396
	0.32 mm	0.5 mm	10#	14226-398
	0.45-0.53 mm	0.8 mm	10#	14226-400
	1/32"	0.81 mm	10#	10799-744

\*Includes ten ferrules, two SilTite nuts. #Includes ten ferrules, two SilTite nuts and two SilTite inlet base seals.

## Ferrules continued

Instrument	Column ID	Ferrule ID	Pack size	VWR cat. no.
<b>Replacement SilTite metal ferrules</b>				
All connections	0.10-0.25 mm	0.4 mm	10	14226-376
	0.32 mm	0.5 mm	10	14226-378
	0.53 mm	0.8 mm	10	14226-380
	1/32"	0.81 mm	10	10799-820
<b>Replacement SilTite nuts</b>				
GCMS interface connection	–	–	5	14226-384
Split/splitless injector	–	–	5	14226-388
<b>Replacement SilTite base seals</b>				
Split/splitless injector	–	–	2	14226-420
	–	–	10	14226-422



## Connectors and ferrules | PerkinElmer

### SilTite FingerTite ferrules



Description	Column ID	Ferrule ID	Pack size	VWR cat. no.
SilTite FingerTite PerkinElmer injector/GCMS starter kit	0.10-0.25 mm	0.4 mm	*	89232-188
SilTite FingerTite PerkinElmer injector/FID starter kit	0.10-0.25 mm	0.4 mm	*	89232-182
<b>Replacement parts</b>				
SilTite FingerTite ferrule 0.4 mm	0.10-0.25 mm	0.4 mm	10	97051-958
SilTite FingerTite ferrule 0.5 mm	0.32 mm	0.5 mm	10	97051-960
SilTite FingerTite ferrule 0.7 mm	0.53 mm	0.7 mm	10	89232-196
SilTite FingerTite blanking ferrule	–	–	2	97051-962
SilTite FingerTite female nut	–	–	5	97051-964

\*Each starter kit includes all the parts necessary to convert one GC system (one injector and one detector) to the SilTite FingerTite system. In addition there are five SilTite FingerTite nuts, ten SilTite FingerTite ferrules, and a ferrule install tool which allows you to seat the ferrule in the correct position on the capillary column.

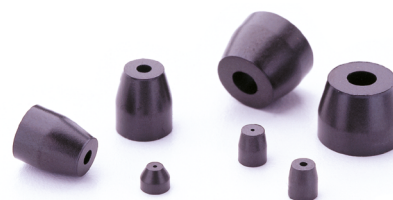
### Ferrules

Instrument	Column ID	Size of nut	Ferrule ID	Pack size	VWR cat. no.
<b>15% Graphite/85% Vespel ferrules</b>					
For injectors and detectors at atmospheric pressure e.g. FID	0.10-0.25 mm	1/16"	0.4 mm	10	60361-600
	0.10-0.25 mm	1/8"	0.4 mm	10	60361-608
	0.32 mm	1/16"	0.5 mm	10	60361-578
	0.32 mm	1/8"	0.5 mm	10	60361-606
	0.45-0.53 mm	1/16"	0.8 mm	10	60361-586
	0.45-0.53 mm	1/8"	0.8 mm	10	60361-610
	for 1/8" OD packed columns	1/8"	1/8"	10	60361-604
	for 1/4" OD packed columns	1/4"	1/4"	10	60361-602

## Ferrules continued

Instrument	Column ID	Size of nut	Ferrule ID	Pack size	VWR cat. no.
<b>100% Graphite ferrules</b>					
Injectors and detectors at atmospheric pressure e.g. FID (not for GCMS)	0.10-0.32 mm	1/16"	0.5 mm	10	60361-572
	0.10-0.32 mm	1/8"	0.5 mm	10	60361-568
	0.45-0.53 mm	1/16"	0.8 mm	10	60361-570
	0.45-0.53 mm	1/8"	0.8 mm	10	60361-574
	1/8" OD packed columns	1/8"	1/8"	10	60361-566
	1/4" OD packed columns	1/4"	1/4"	10	60361-562
<b>SilTite metal ferrules</b>					
GCMS interface connection (starter kit)	0.10-0.25 mm	–	0.4 mm	10*	14226-368
	0.32 mm	–	0.5 mm	10*	14226-370
	0.53 mm	–	0.8 mm	10*	14226-372
<b>Replacement SilTite metal ferrules</b>					
GCMS interface connection	0.10-0.25 mm	–	0.4 mm	10	14226-376
	0.32 mm	–	0.5 mm	10	14226-378
	0.53 mm	–	0.8 mm	10	14226-380
	1/32"	–	0.81 mm	10	10799-820
<b>Replacement SilTite nuts</b>					
SilTite metal nuts	–	–	–	5	14226-384

\*Includes ten ferrules, two SilTite nuts.



## Connectors and ferrules | Shimadzu

### SilTite FingerTite ferrules



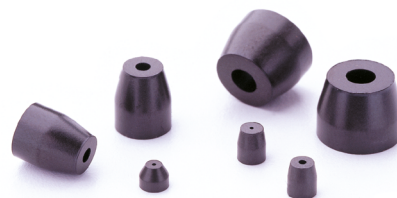
Description	Column ID	Ferrule ID	Pack size	VWR cat. no.
<b>For Shimadzu GC-2030 and GC-2010</b>				
SilTite FingerTite INJ/FID starter kit	0.10-0.25 mm	0.4 mm	*	89232-176
SilTite FingerTite INJ/MS starter kit	0.10-0.25 mm	0.4 mm	*	89232-170
SilTite FingerTite INJ/FID starter kit	0.53 mm	0.7 mm	*	89232-178
<b>Replacement parts</b>				
SilTite FingerTite ferrule 0.4 mm	0.10-0.25 mm	0.4 mm	10	97051-958
SilTite FingerTite ferrule 0.5 mm	0.32 mm	0.5 mm	10	97051-960
SilTite FingerTite ferrule 0.7 mm	0.53 mm	0.7 mm	10	89232-196
SilTite FingerTite ferrule blanking	–	–	2	97051-962
SilTite FingerTite female nut	–	–	5	97051-964

\*Each starter kit includes all the parts necessary to convert one GC system (one injector and one detector) to the SilTite FingerTite system. In addition there are five SilTite FingerTite nuts, ten SilTite FingerTite ferrules, and a ferrule install tool which allows you to seat the ferrule in the correct position on the capillary column.

## Ferrules

Column ID	Description	Pack size	VWR cat. no.
<b>For Shimadzu GC-2030, GC-2014, GC-2010, and GC-17A injectors (not for MS interfaces or QP2010 injector)</b>			
0.10-0.32 mm ID columns	100% Graphite	10	60361-550
0.45-0.53 mm ID columns	100% Graphite	10	60361-552
5 mm OD packed columns	100% Graphite	10	60361-538
0.10-0.25 mm ID columns	SilTite metal - initial installation	10*	14226-408
0.10-0.25 mm ID columns	SilTite ferrules	10	14233-536
0.32 mm ID columns	SilTite metal - initial installation	10*	14226-410
0.32 mm ID columns	SilTite ferrules	10	10799-822
0.45-0.53 mm ID columns	SilTite metal - initial installation	10*	14226-412
0.53 mm ID columns	SilTite ferrules	10	10799-824
n/a	SilTite metal nuts - slotted	5	10799-736
<b>For Shimadzu QP5000/5050 standard MS interface</b>			
QP5000-I 0.10-0.25 mm ID columns	15% Graphite/85% Vespel ferrules	10	60362-668
QP5000-I 0.32 mm ID columns	15% Graphite/85% Vespel ferrules	10	60362-670
QP5000-II and QP5050 0.10-0.25 mm ID columns	15% Graphite/85% Vespel ferrules	10	60361-594
QP5000-II and QP5050 0.32 mm ID columns	15% Graphite/85% Vespel ferrules	10	60361-596
0.10-0.25 mm ID columns	SilTite metal - initial installation	10*	14233-668
0.10-0.25 mm ID columns	SilTite ferrules	10	14233-536
0.32 mm ID columns	SilTite metal - initial installation	10*	10799-738
0.32 mm ID columns	SilTite ferrules	10	10799-822
0.53 mm ID columns	SilTite ferrules	10	10799-824
n/a	SilTite metal nuts - QP5000/5050 standard MS interface	5	10799-740
<b>For Shimadzu QP5000/5050 wide bore MS interface, QP2010 injector and QP2010 standard MS interface</b>			
0.10-0.25 mm ID columns	15% Graphite/85% Vespel ferrules	10	60361-600
0.32 mm ID columns	15% Graphite/85% Vespel ferrules	10	60361-578
0.45-0.53 mm ID columns	15% Graphite/85% Vespel ferrules	10	60361-586
0.10-0.25 mm ID columns	SilTite metal - initial installation	10*	14226-368
0.10-0.25 mm ID columns	SilTite ferrules	10	14226-376
0.32 mm ID columns	SilTite metal - initial installation	10*	14226-370
0.32 mm ID columns	SilTite ferrules	10	14226-378
0.45-0.53 mm ID columns	SilTite metal - initial installation	10*	14226-372
0.45-0.53 mm ID columns	SilTite ferrules	10	14226-380
n/a	SilTite metal nuts	5	14226-384
<b>Replacement SilTite nuts</b>			
GC-2030/GC-2010 GCMS system		5	14226-384
GC-2030/GC-2010 GCMS system with QP5000 series MS		5	14226-384
GC-2030/GC-2014/GC-2010 GC injectors and atmospheric detectors		5	14226-384
QP5000 jet separator MS interface		5	14226-384
QP5000 direct MS interface		5	10799-740
All injectors jet separator (starter kit), except GC-2030/GC-2014/GC-2010		5	10799-736

\*Includes ten ferrules, two SilTite nuts.



# Connectors and ferrules | Thermo Scientific

## SilTite FingerTite ferrules



Description	Column ID	Ferrule ID	Pack size	VWR cat. no.
<b>For Thermo Scientific TRACE 1300 series GC</b>				
SilTite FingerTite INJ/MS starter kit (ISQ/ITQ MS only)	0.10-0.25 mm	0.4 mm	*	97051-948
SilTite FingerTite injector starter kit**	0.10-0.25 mm	0.4 mm	*	89232-136 + 89232-146
<b>Replacement parts</b>				
SilTite FingerTite ferrule 0.4 mm	0.10-0.25 mm	0.4 mm	10	97051-958
SilTite FingerTite ferrule 0.5 mm	0.32 mm	0.5 mm	10	97051-960
SilTite FingerTite ferrule 0.7 mm	0.53 mm	0.7 mm	10	89232-196
SilTite FingerTite blanking ferrule	–	–	2	97051-962
SilTite FingerTite female nut	–	–	5	97051-964
SilTite FingerTite INJ base seal	0.10-0.25 mm	–	2	97051-966
SilTite FingerTite MS adaptor	–	–	1	89232-142
SilTite FingerTite injector adaptor (includes 2 base seals)	0.10-0.25 mm	–	1	89232-146

\*Each starter kit includes all the parts necessary to convert one GC system (one injector and one detector) to the SilTite FingerTite system. In addition there are five SilTite FingerTite nuts, ten SilTite FingerTite ferrules, and a ferrule install tool which allows you to seat the ferrule in the correct position on the capillary column. \*\* Starter kit 89232-136 requires injector adaptor 89232-146.

## Ferrules

Instrument	Column ID	Ferrule ID	Pack size	VWR cat. no.
<b>15% Graphite/85% Vespel ferrules</b>				
For Thermo Scientific TRACE 1300 series GC split/splitless injectors	0.10-0.25 mm	0.4 mm	10	60361-614
	0.32 mm	0.5 mm	10	60361-616
	0.53 mm	0.8 mm	10	60361-618
For Thermo Scientific TRACE 1300 series GC GCMS interface connection	0.10-0.25 mm	0.4 mm	10	60361-600
	0.32 mm	0.5 mm	10	60361-578
	0.53 mm	0.8 mm	10	60361-586
<b>100% Graphite ferrules</b>				
For Thermo Scientific TRACE 1300 series GC split/splitless injectors	0.10-0.32 mm	0.5 mm	10	60362-634
	0.45-0.53 mm	0.8 mm	10	60362-636
<b>SilTite metal ferrules</b>				
GCMS interface connection (starter kit)	0.10-0.25 mm	0.4 mm	10*	14226-368
	0.32 mm	0.5 mm	10*	14226-370
	0.53 mm	0.8 mm	10*	14226-372
For Thermo Scientific TRACE 1300 series GC split/splitless injectors (starter kit)	0.10-0.25 mm	0.4 mm	10#	14226-396
	0.32 mm	0.5 mm	10#	14226-398
	0.45-0.53 mm	0.8 mm	10#	14226-400
	1/32"	0.81 mm	10#	10799-744
<b>Replacement SilTite metal ferrules</b>				
All GCMS interface connections	0.10-0.25 mm	0.4 mm	10	14226-376
	0.32 mm	0.5 mm	10	14226-378
	0.53 mm	0.8 mm	10	14226-380
	1/32"	0.81 mm	10	10799-820
For Thermo Scientific TRACE 1300 series GC split/splitless injector connections	0.10-0.25 mm	0.4 mm	10	14226-376
	0.32 mm	0.5 mm	10	14226-378
	0.53 mm	0.8 mm	10	14226-380
	1/32"	0.81 mm	10	10799-820
<b>Replacement SilTite nuts</b>				
SilTite metal nuts for all GCMS interface connections	–	–	5	14226-384
For Thermo Scientific TRACE 1300 series GC split/splitless injector	–	–	5	14226-388
<b>Replacement SilTite base seals</b>				
For Thermo Scientific TRACE 1300 series GC split/splitless injector	–	–	2	14226-420
	–	–	10	14226-422

\*Includes ten ferrules, two SilTite nuts. #Includes ten ferrules, two SilTite nuts and two SilTite inlet base seals.

# Connectors and ferrules | SilFlow®

Easy to install | Leak free | Stable



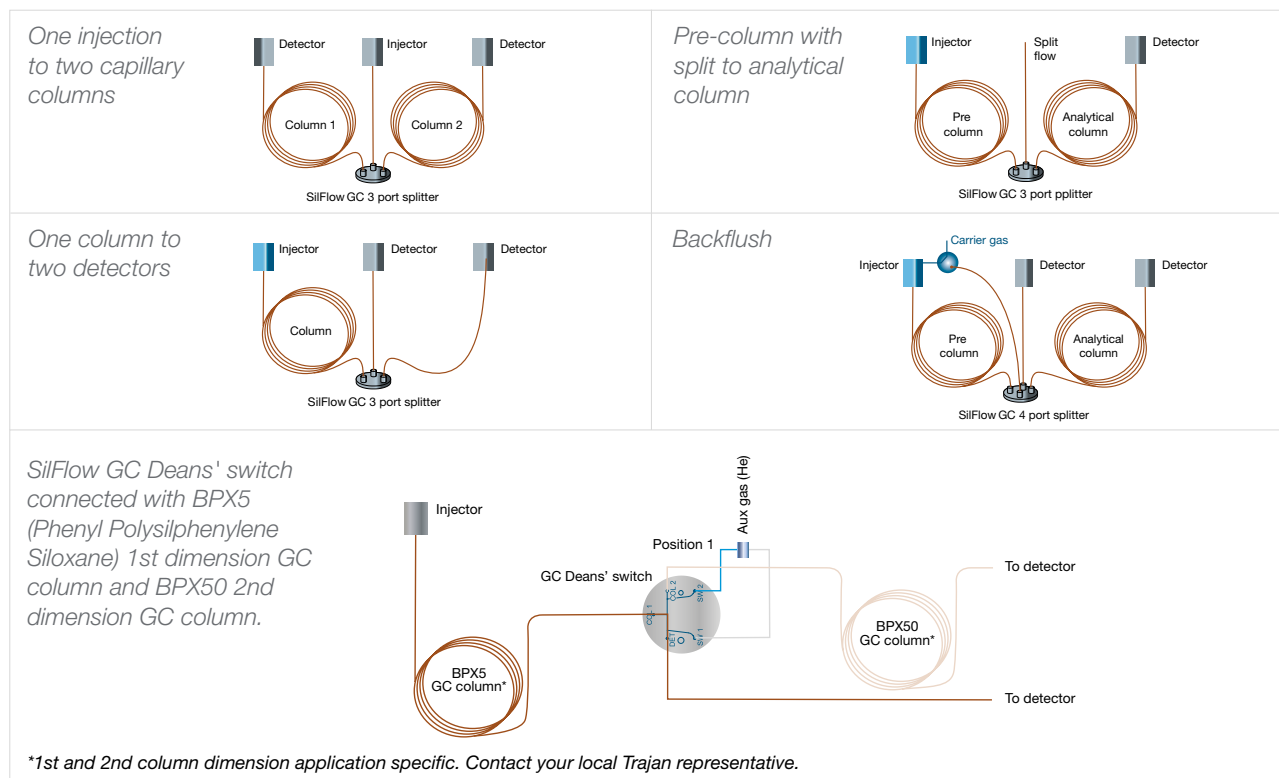
Trajan understands today's chromatographers need to move from tubing based flow systems to planar microchannel systems to deliver flexible chromatography solutions. SilFlow is an innovation in design and fabrication resulting in a highly efficient and reliable microfluidic platform that improves your GC connectivity to enable maximum chromatography performance.

## Configuration options for your chromatography solutions

The SilFlow microchannel device (MCD) is available in a number of configurations:

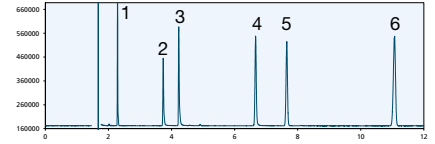
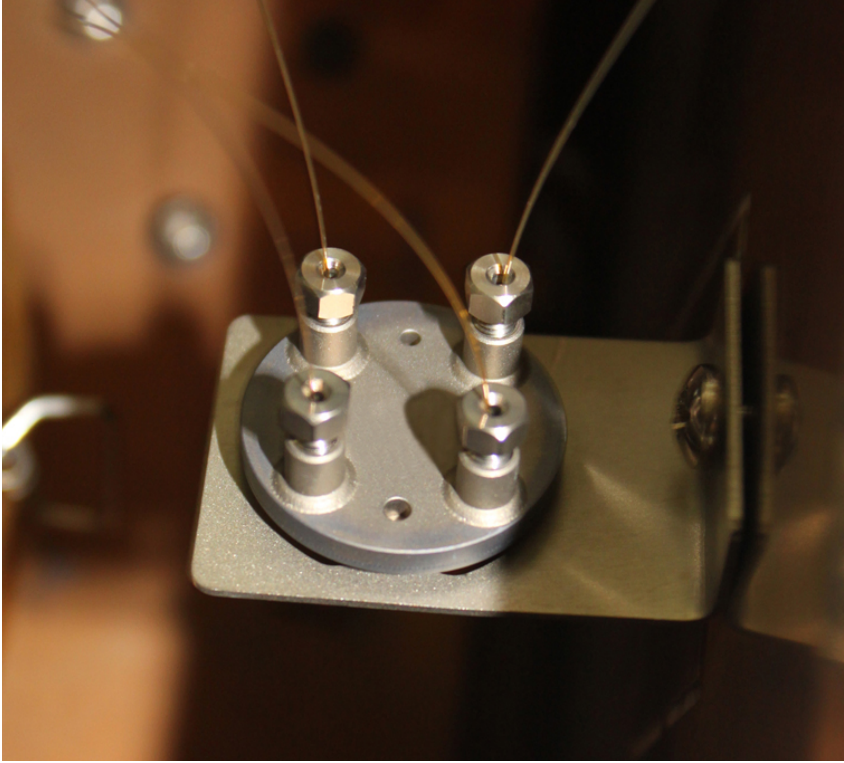
- 3 port GC splitters allowing flow splitting options with three different configurations.
- 4 port GC splitters offering similar configuration flexibility as the 3 port solution.
- Deans' switch MCD, perfect for multidimensional analyses.

Some suggested application configurations for use with SilFlow splitters:

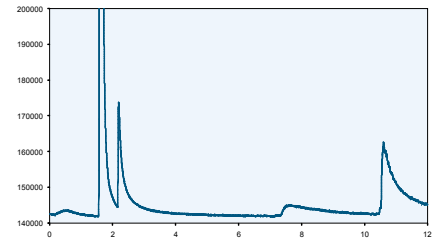


## Chemically inert

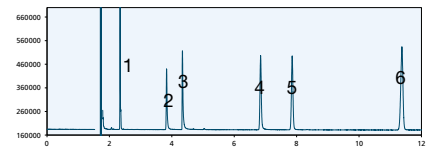
- Enabled by Trajan's expertise in surface chemistry, SilFlow features chemically deactivated stainless steel channels avoiding active sites experienced with conventional connections.
- SilFlow can be incorporated into your system without impacting your chromatography.



a) Column only



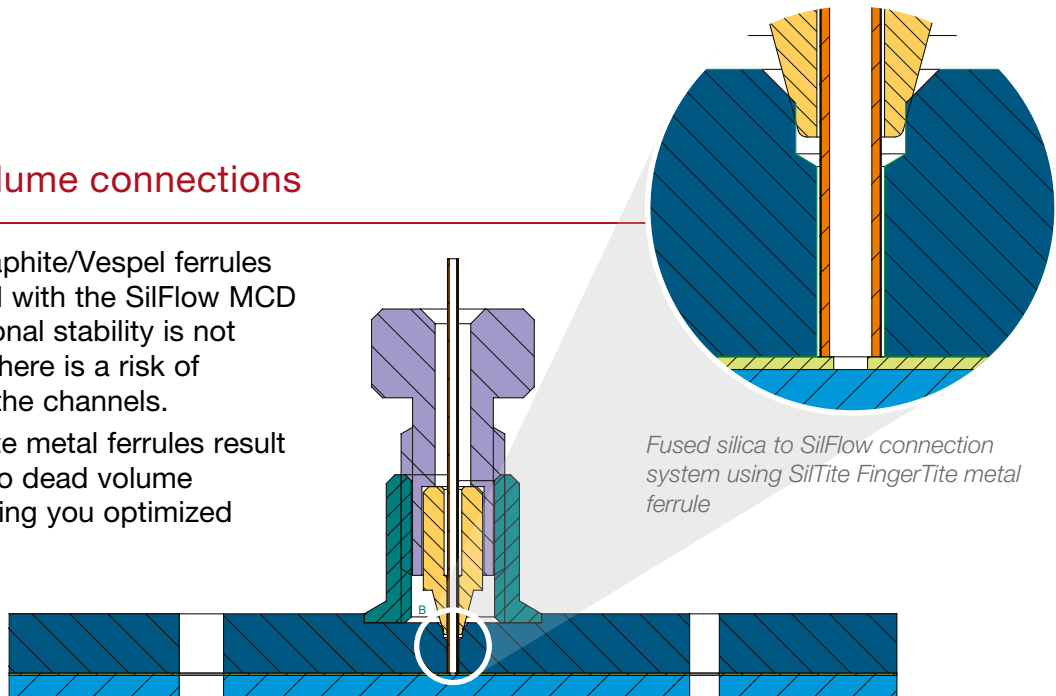
b) Column with metal connector without special deactivation



c) Column with deactivated SilFlow (GC Deans' switch)

## Low dead volume connections

- Graphite or Graphite/Vespel ferrules cannot be used with the SilFlow MCD as the dimensional stability is not adequate and there is a risk of contaminating the channels.
- SilTite FingerTite metal ferrules result in a reliable zero dead volume connection, giving you optimized peak shapes.



Fused silica to SilFlow connection system using SilTite FingerTite metal ferrule



## Superb operational stability

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### SilFlow technical specifications:

- Pressure capability - The SilFlow system can be operated at pressures greater than 25,000 psi (170,000 kPa).
- Thermal lag - SilFlow tracks oven temperature up to 20°C/min. The design of SilFlow alleviates cold spots and sample condensation.
- Maximum temperature - No practical temperature limit. Limited only by the temperature rating of the GC column being used,  $\leq 420^{\circ}\text{C}$ .

## Easy to install and leak free

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SilFlow kits incorporate SilTite FingerTite fittings that are easy to set up and can be tightened using finger force to achieve a perfect, reliable seal, even for the most sensitive MS systems – no wrenches required!



Each SilFlow kit contains:

- SilFlow microfluidic device (MCD)
- SilTite FingerTite tool
- Mounting bracket
- Ferrules, nuts and blanking ferrules

## SilFlow GC 3 port splitter



VWR cat. no.	Part description and detail
89205-342	Port A 0.25/0.32 mm ID, ports B and C 0.25/0.32 mm ID SilFlow GC 3 port splitter kit
89205-340	Port A 0.53 mm ID, ports B and C 0.25/0.32 mm ID SilFlow GC 3 port splitter kit
89205-338	Port A 1.1 mm OD, ports B and C 0.25/0.32 mm ID SilFlow GC 3 port splitter kit
89205-348	Microchannel device only, port A 0.25/0.32 mm ID, ports B and C 0.25/0.32 mm ID SilFlow GC 3 port splitter
89205-346	Microchannel device only, port A 0.53 mm ID, ports B and C 0.25/0.32 mm ID SilFlow GC 3 port splitter
89205-344	Microchannel device only, port A 1.1 mm OD, ports B and C 0.25/0.32 mm ID SilFlow GC 3 port splitter

## SilFlow GC 4 port splitter



VWR cat. no.	Part description and detail
89205-354	Port A 0.25/0.32 mm ID, ports B, C, and D 0.25/0.32 mm ID SilFlow GC 4 port splitter kit
89205-352	Port A 0.53 mm ID, ports B, C, and D 0.25/0.32 mm ID SilFlow GC 4 port splitter kit
89205-350	Port A 1.1 mm OD, ports B, C, and D 0.25/0.32 mm ID SilFlow GC 4 port splitter kit
89205-360	Microchannel device only, port A 0.25/0.32 mm ID, ports B, C, and D 0.25/0.32 mm ID SilFlow GC 4 port splitter
89205-358	Microchannel device only, port A 0.53 mm ID, ports B, C, and D 0.25/0.32 mm ID SilFlow GC 4 port splitter
89205-356	Microchannel device only, port A 1.1 mm OD, ports B, C, and D 0.25/0.32 mm ID SilFlow GC 4 port splitter

## SilFlow GC Deans' switch



VWR cat. no.	Part description and detail
89205-362	Deans' switch kit (includes 1.1 mm OD tubing)
89205-364	Microchannel device only Deans' switch

## SilFlow replacement parts



VWR cat. no.	Part description and detail
<b>Replacement parts</b>	
89205-366	SilFlow nuts, PK10
10799-714	SilFlow ferrules 0.35 mm ID, PK10
89205-370	SilFlow ferrules 0.4 mm ID, PK10
89205-372	SilFlow ferrules 0.5 mm ID, PK10
89205-374	SilFlow ferrules 0.7 mm ID, PK10
89205-368	SilFlow ferrules 1.1 mm ID, PK5
75815-606	SilFlow blanking ferrules and pins, PK5
89205-376	SilTite FingerTite tool
10799-724	SilFlow ferrules 0.55 mm ID, PK10
10799-720	SilFlow ferrules 0.75 mm ID, PK10
10799-718	SilFlow ferrules 0.8 mm ID, PK10
10799-722	SilFlow stainless steel capillary tubing, 75 cm long, 1.1 mm OD sleeved to 1/16" at one end (not included in kits, must be purchased separately if required)

## Minimal bleed | Highly inert Temperature stable

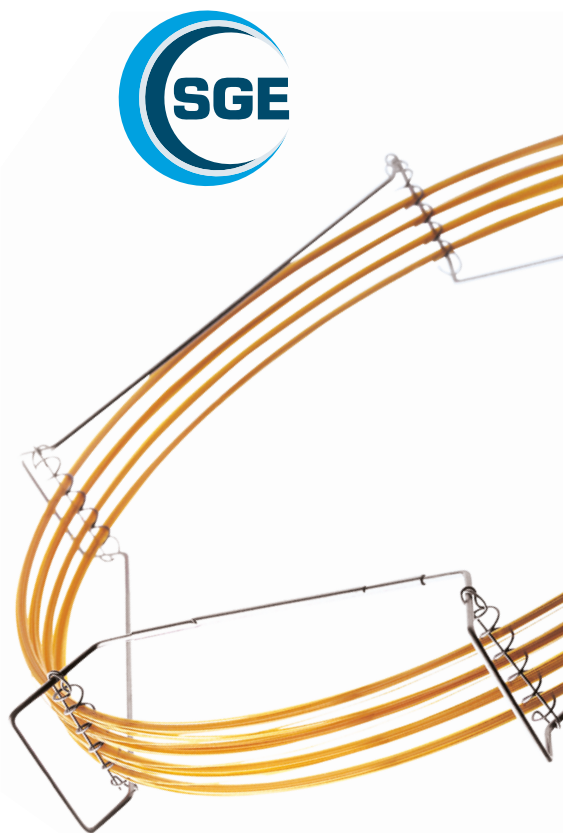
The GC column carries out the separation. When selecting a column for an application, four basic parameters need to be considered:

- Stationary phase
- Column internal diameter
- Film thickness
- Column length

A GC column is generally specified with two maximum operating temperatures:

- The isothermal limit at which the column may be run continuously.
- A programmed maximum where the column reaches a maximum for a limited period only.

There is also a minimum temperature below which a column will perform poorly. If a column is run continuously at the upper limit of temperature, column bleed will be observed. This is background noise caused by stationary phase degradation and this increases with increased film thickness.



## Adjusting GC column performance

Column parameter	Parameters affecting resolution			Performance changes
	Efficiency	Retention	Selectivity	
Column length (m)	✓			Doubling column length increases resolution by ~40%
Internal diameter (mm)	✓			The smaller the column ID, the greater the efficiency and better the resolution
Film thickness (µm)		✓		The thicker the film, the greater the retention e.g. ideal for highly volatile compounds. The thinner the film, the sharper the peaks and lower the bleed
Stationary phase chemistry			✓	Altering the stationary phase can affect elution order and help separate closely, or co-eluting peaks

## Stationary phase

### General rules on selecting a phase

- Select the least polar phase that will perform the separation you require.
- Non-polar stationary phases separate analytes predominantly by order of boiling point. Increase the amount of phenyl and/or cyanopropyl content in the phase, and the separation is then influenced more by differences in dipole moments or charge distributions (BP10 (1701), BPX35, BPX50, BPX70).
- To separate compounds that differ more in their hydrogen bonding capacities (for example aldehydes and alcohols), polyethylene glycol type phases are best suited (BP20 (WAX), BP21 (FFAP), SolGel-WAX).
- Wherever possible use published retention indices to assist in your selection. Retention indices are calculated for a range of probe compounds which can highlight specific selectivity characteristics of a stationary phase.

### Retention indices for eight cross-linked phases

The use of retention indices is a valuable tool in assisting selection of the stationary phase which provides maximum resolution for the compounds to be analyzed.

The retention indices of the five test compounds indicate the differences and similarities of each stationary phase. The values are calculated in reference to a homologous series of n-alkane hydrocarbons plotted on a logarithmic scale. Each n-alkane has a retention index of 100 times the carbon number (ie. C6, RI=600). Therefore, the retention index for each of the test compounds illustrates the elution position in reference to this n-alkane series.

Each probe compound is selected to represent the interaction characteristics of various organic functionalities.

Retention indices are calculated using the following formula:

Probe compound	Interactions represented
Benzene	Aromatics, unsaturated hydrocarbons
Butanol	Alcohols, diols
2-Pentanone	Ethers, esters, ketones and aldehydes
Nitropropane	Nitro and nitrile derivatives
Pyridine	Aromatic bases

$$IA = 100N + 100n (\log t'R(A) - \log t'R(N)) / (\log t'R(N+n) - \log t'R(N))$$

*IA is the retention index of compound A (from corrected retention times) which elutes between two n-paraffins separated by either one or two carbon numbers.*

Phase	Benzene (X)	Butanol (Y)	2-Pentanone (Z)	Nitropropane (U)	Pyridine (S)	Average
BP1	647	646	666	707	722	678
BP5	667	665	692	743	746	703
BPX5	664	667	697	752	750	706
HT8	680	673	728	796	780	731
BPX35	728	726	763	862	848	785
BP10 (1701)	709	774	772	862	832	790
BP20 (WAX)	947	1153	998	1217	1185	1100
BPX70	1067	1219	1170	1365	1300	1224

*The table lists the responses to each test compound and the average value for eight cross-linked phases ranging from the non-polar BP1 to the very polar BPX70. The range has been developed to cover the widest possible range of compound functionality and application areas.*

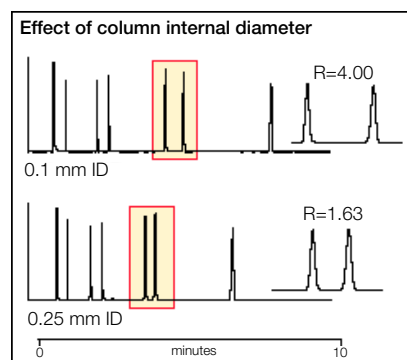
*Average retention index values are listed, and provide an indication of the phase polarity. This can assist in selecting a suitable stationary phase for a particular application area. The individual responses to each test compound can further assist in determining the best phase for any specific type or group of compounds.*

## Column internal diameter

### Effect of column internal diameter

The smaller the internal diameter the greater the efficiency and therefore the better the resolution. Reduce the diameter by half and the column efficiency doubles.

As the diameter increases, the film thickness can increase to maintain the same phase ratio. The thicker the film, the greater the loading capacity. Overloading a column will always result in loss of resolution. If the column diameter is halved while maintaining the same film thickness, then the loading capacity will also be halved.



Column ID	Recommendations
0.1 mm and 0.15 mm	Fast GC columns ideal for FID, ECD.
0.22 mm and 0.25 mm	Ideal for MS and high resolution applications.
0.32 mm	Provide good resolution for most applications, ample sample loading and compatibility with nearly all detector systems.
0.53 mm	Provide large sample capacities.

## Film thickness

### Sample loading

For samples with a variation in solute concentration, a thick film column is recommended. This will reduce the possibility of broad overloaded peaks co-eluting with other compounds of interest. If the separation of two solutes is sufficient and co-elution is still unlikely, even with large differences in concentration, then a thinner film can be used.

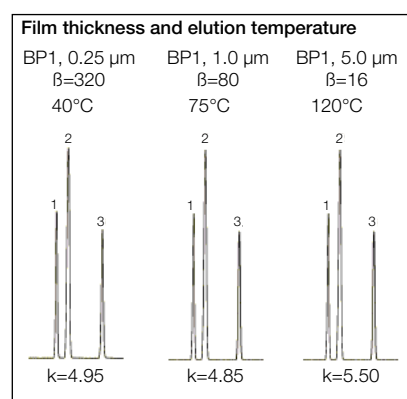
### Volatility of solute

The greater the film thickness, the greater the retention of a solute, therefore the higher the elution temperature. As a rule, doubling the film thickness results in an increase in elution temperature of approximately 15-20°C, under isothermal conditions. Using a temperature program, the increase in elution temperature is slightly less.

As well as film thickness, changing the column internal diameter also effects the elution temperature. To avoid using two parameters that can alter individually, phase ratio is often used as it takes both into account.

The chromatograms demonstrate the effect on elution temperature for a mixture of compounds using 0.32 mm ID columns with film thickness of 0.25 µm, 1 µm and 5 µm.

An increase in film thickness from 0.25 µm to 5 µm needs a change in analysis temperature of 80°C to maintain the same elution time.



## Film thickness continued

### Phase ratio

Phase ratio encompasses both the film thickness and column internal diameter to give a value that can characterize all column internal diameters and film thickness combinations.

Calculate phase ratio using the following formula:

$$\beta = d/4d_f$$

where:

$\beta$  = phase ratio

$d$  = column internal diameter ( $\mu\text{m}$ )

$d_f$  = film thickness ( $\mu\text{m}$ )

From the phase ratio value, a column can be categorized for the type of application it would best suit. The smaller the  $\beta$  value, the greater the concentration of phase to the volume of the column, making it better suited for analyzing volatile compounds. Columns which have thin films, are generally better suited for high molecular weight compounds and are characterized by large  $\beta$  values.

Film thickness ( $\mu\text{m}$ )	Column ID ( $\mu\text{m}$ )					
	100	150	220	250	320	530
	Phase ratio					
0.1	250	-	550	625	800	1325
0.15	-	-	-	-	-	883
0.25	-	150	220	250	320	530
0.5	-	75	110	125	160	265
1.0	-	-	55	63	80	132
3.0	-	-	-	-	27	44
5.0	-	-	-	-	16	26

Keeping a similar phase ratio when changing column internal diameters will ensure that your chromatographic parameters will not need substantial changes.

## Column length

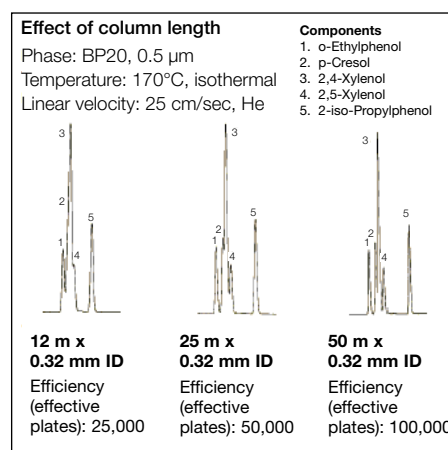
### Effect of column length

Always try to select the shortest column length that will provide the required resolution for the application (12-30 m).

If the maximum column length available is being used and resolution of the sample mixture is still inadequate, try changing the stationary phase or internal diameter.

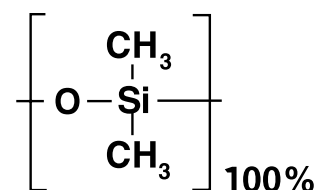
Resolution is proportional to the square root of the column efficiency. Therefore, doubling the column length will only increase the resolving power of the column by approximately 40%.

The three chromatograms give an indication of how column length influences the resolution of a mixture.



### 100% Dimethyl Polysiloxane

- Classic dimethyl polysiloxane technology with high temperature cross-linking
- Excellent general purpose GC column
- Low bleed
- Non-polar
- Suitable for all routine analyses



**Application areas:** Suitable for analysis of hydrocarbons, aromatics, pesticides, phenol, herbicides, amines.

**Operating temperature:** 0.1-1 µm film thickness: -60°C to 340/360°C.

>1-3 µm film thickness: -60°C to 300/320°C.

>3-5 µm film thickness: -60°C to 280/300°C.

**Suitable replacement for:** CP-Sil 5 CB, DB-1, DB-Petro, Elite-1, HP-1, HP-1ms, Petrocol DH, Rtx-1, SPB-1, SPB-1 SULFUR, Ultra 1, VB-1, VF-1ms, ZB-1.

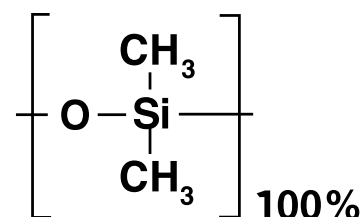
ID (mm)	Length (m)	Film thickness (µm)	VWR cat. no.
0.1	10	0.1	14225-864
0.22	12	0.25	60362-152
0.22	25	0.25	60362-150
0.22	30	0.25	60362-144
0.22	50	0.25	60362-148
0.22	50	1	60362-136
0.22	60	0.25	60362-142
0.25	15	0.1	76409-322
0.25	15	0.25	60362-156
0.25	30	0.25	60362-154
0.25	30	1	14225-870
0.25	60	0.25	14225-868
0.32	12	0.5	60362-124
0.32	12	1	14225-876
0.32	25	0.5	60362-122
0.32	25	1	60362-116
0.32	30	0.25	60362-126
0.32	30	0.5	14225-872
0.32	30	3	14225-878
0.32	50	0.5	60362-120
0.32	50	1	60362-114
0.32	50	5	60362-108
0.32	60	0.5	14225-874
0.53	12	1	60362-106
0.53	25	1	60362-104
0.53	25	5	60362-096
0.53	30	1	60362-100
0.53	30	3	14226-060
0.53	30	5	14226-056
0.53	50	5	60362-094
0.53	60	5	14226-058
0.32	30	1	14226-070
0.25	30	0.5	14226-078
0.32	60	1	14226-064

## BPX1



### 100% Dimethyl Polysiloxane

- Non-polar column
- Dimensionally stabilized phase
- Low bleed
- Specifically designed for high temperature hydrocarbon analysis
- Ideal for simulated distillation



**Application areas:** ASTM methods D2887 and D6532.

**Operating temperature:** Polyimide clad, 0.1-0.9 µm film thickness: -30°C to 400°C.  
Polyimide clad, 2.65 µm film thickness: -30°C to 370°C.

**Suitable replacement for:** DB-2887, DB-HT, Elite-SimDist, HP-1, Petrocol 2887, Petrocol EX2887, Rtx-2887.

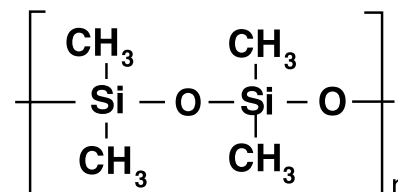
ID (mm)	Length (m)	Film thickness (µm)	VWR cat. no.
0.1	10	0.1	14226-030
0.53	6	2.65	14226-054
0.53	10	0.1	14233-472
0.53	10	0.9	60361-650
0.53	10	2.65	60361-648

## SolGel-1ms™



### 100% Dimethyl Polysiloxane in a Sol-Gel matrix

- A robust, inert, high temperature, non-polar phase for use with mass spectrometers
- Highly inert
- Less bleed - better MS library identification, less ion source maintenance, and better sensitivity
- Also suitable for use with all non-MS detectors



**Application areas:** Recommended for highly active compounds.

**Operating temperature:** 0.25 µm film thickness: 0°C to 340/360°C.

**Suitable replacement for:** CP-Sil 5 CB, DB-1, DB-Petro, Elite-1ms, HP-1ms, Petrocol DH, Rtx-1, SPB-1, SPB-1 SULFUR, TG-1MS, Ultra 1, VB-1, VF-1ms, ZB-1.

ID (mm)	Length (m)	Film thickness (µm)	VWR cat. no.
0.25	30	0.25	14226-040
0.25	60	0.25	14226-042
0.32	30	0.25	14226-052

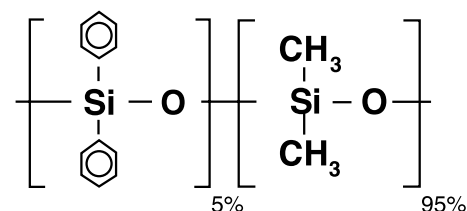


## BP5



### 5% Phenyl / 95% Dimethyl Polysiloxane

- Excellent general purpose GC column
- Low bleed
- Non-polar
- High temperature



**Application areas:** Aromatics, pesticides, herbicides, drugs of abuse, hydrocarbons.

**Operating temperature:** 0.25-1.5  $\mu\text{m}$  film thickness:  $-60^\circ\text{C}$  to  $320/340^\circ\text{C}$ .  
>1.5  $\mu\text{m}$  film thickness:  $-60^\circ\text{C}$  to  $280/300^\circ\text{C}$ .

**Suitable replacement for:** CP-Sil 8 CB, DB-5, Elite-5, HP-5, MDN-5, PTE-5, Rtx-5, SPB-5, Ultra 2, VB-5, ZB-5.

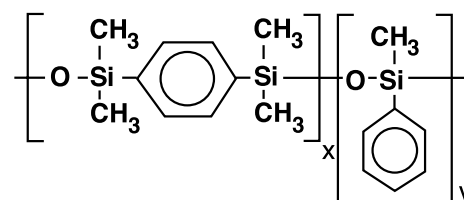
ID (mm)	Length (m)	Film thickness ( $\mu\text{m}$ )	VWR cat. no.
0.22	25	0.25	60361-964
0.25	15	0.25	60361-938
0.25	30	0.25	60361-936
0.25	30	1	14225-916
0.25	60	0.25	60361-934
0.32	25	0.5	60361-930
0.32	30	0.25	60361-946
0.32	30	0.5	14225-922
0.32	30	1	14225-908
0.53	30	1	60361-918
0.53	30	5	14225-912

## BP5MS



### 5% Phenyl Polysilphenylene-siloxane

- Perfect for your 5% GCMS analysis
- Optimized silphenylene content for general purpose MS analyses



**Application areas:** 5% GCMS analyses

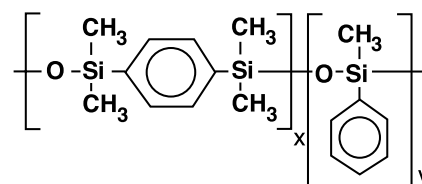
**Operating temperature:** 0.1-0.25  $\mu\text{m}$  film thickness:  $-40^\circ\text{C}$  to  $330/350^\circ\text{C}$ .

**Suitable replacement for:** CP-Sil 8 CB, DB-5ms, Elite-5ms, RTX-5ms, TG-5SiIMS, VF-5ms, ZB-5ms.

ID (mm)	Length (m)	Film thickness ( $\mu\text{m}$ )	VWR cat. no.
0.18	20	0.18	89232-102
0.25	15	0.25	10799-664
0.25	30	0.25	89232-104

### 5% Phenyl Polysilphenylene-siloxane

- High temperature
- General purpose GC column - suitable for over 80% of all routine analyses performed by gas chromatography
- Very low bleed - ideal for trace analysis
- Non-polar
- Extremely inert
- Ideal for GCMS



**Application areas:** Ultra trace analyses, pesticides/herbicides, hydrocarbons, solvents, phenols, amines, GCMS and other specific detector applications.

**Operating temperature:** 0.1-1.5  $\mu\text{m}$  film thickness:  $-40^{\circ}\text{C}$  to  $360/370^{\circ}\text{C}$ .

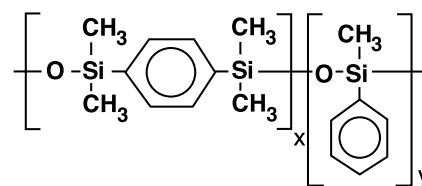
>1.5  $\mu\text{m}$  film thickness:  $-40^{\circ}\text{C}$  to  $350/360^{\circ}\text{C}$ .

**Suitable replacement for:** AT-5ms, CP-Sil 8 CB, DB-5, DB-5ms, DB-5.625, Elite-5ms, HP-5, HP-5ms, MDN-5S, Rtx-5MS, Rxi-5Sil MS, SPB-5, TG-5MS, TG-5SilMS, Ultra 2, VB-5, VF-5ms, XTI-5, ZB-5, ZB-5ms.

ID (mm)	Length (m)	Film thickness ( $\mu\text{m}$ )	VWR cat. no.
0.1	10	0.1	14225-890
0.15	25	0.25	60362-080
0.22	12	0.25	60362-070
0.22	25	0.25	60362-068
0.22	50	0.25	60362-066
0.25	7	0.25	76409-324
0.25	15	0.25	60362-088
0.25	15	0.1	76409-326
0.25	15	1	60362-052
0.25	30	0.25	60362-086
0.25	30	0.1	76409-328
0.25	60	0.25	60362-084
0.25	30	0.5	14225-892
0.25	30	1	60362-050
0.25	60	1	60362-048
0.32	12	0.25	60362-058
0.32	25	0.25	60362-056
0.32	15	0.25	60362-006
0.32	30	0.25	60362-004
0.32	60	0.25	60362-002
0.32	25	0.5	60362-044
0.32	30	0.5	14225-894
0.32	6	1	14225-896
0.32	12	1	60362-040
0.32	30	1	60361-990
0.32	50	1	60362-036
0.32	60	1	60361-988
0.53	12	1	60362-034
0.53	25	1	60362-032
0.53	25	0.25	60362-026
0.53	30	0.5	14225-900
0.53	30	1.5	14225-904
0.53	30	1	60361-998
0.53	30	3	60361-976

### 35% Phenyl Polysilphenylene-siloxane

- Mid polarity column
- Ideal for conformational analysis
- Inert
- Equivalent to USP phase G42
- High temperature
- Low bleed



**Application areas:** Environmental analyses, pesticides/herbicides, drugs of abuse, pharmaceuticals, polynuclear aromatic hydrocarbons, GCMS applications.

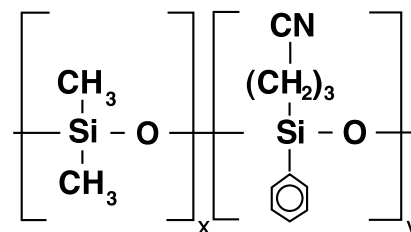
**Operating temperature:** 0.1-0.5  $\mu\text{m}$  film thickness: 10°C to 330/360°C.

**Suitable replacement for:** DB-35, DB-35ms, Elite-35ms, HP-35, MDN-35, Rtx-35, SPB-35, TG-35MS, VF-35ms, ZB-35.

ID (mm)	Length (m)	Film thickness ( $\mu\text{m}$ )	VWR cat. no.
0.1	10	0.1	14226-016
0.25	30	0.25	60361-716
0.25	60	0.25	60361-714
0.32	30	0.5	14226-020

### Cyanopropylphenyl Polysiloxane

- US EPA method 624 optimized column
- Designed for volatiles analysis
- Ideal for EPA methods 624, 8240 and 8260 and method SW-846



**Application areas:** EPA method 624, drinking water volatiles, chlorinated hydrocarbons solvents.

**Operating temperature:** 1.4-3  $\mu\text{m}$  film thickness: 0°C to 230/240°C.

**Suitable replacement for:** AT-624, CP-Select 624 CB, DB-624, Elite-624, HP-VOC, OV-624, 007-624, Rtx-624, TG-624, VOCOL, ZB-624.

ID (mm)	Length (m)	Film thickness ( $\mu\text{m}$ )	VWR cat. no.
0.25	15	1.4	14233-476
0.25	30	1.4	14233-478
0.25	60	1.4	10799-630
0.32	30	1.8	60361-638
0.32	60	1.8	14233-480
0.53	30	3	60361-632
0.53	50	3	60361-634
0.53	60	3	14233-474

## BP10 (1701)



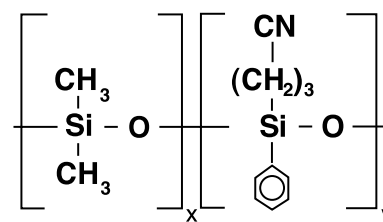
### 14% Cyanopropylphenyl Polysiloxane

- Ideal for organochlorine pesticides analysis
- Highly inert
- Low bleed

**Application areas:** Environmental analyses (EPA methods 608 and 8081), pesticides/herbicides, drugs of abuse, pharmaceuticals.

**Operating temperature:** 0.25-0.5 µm film thickness: -20°C to 280/300°C.  
1 µm film thickness: -20°C to 260/280°C.

**Suitable replacement for:** CP-Sil 19 CB, 007-1701, DB-1701, Elite-1701, HP-1701, Rtx-1701, TG-1701, VF-1701ms, ZB-1701.



ID (mm)	Length (m)	Film thickness (µm)	VWR cat. no.
0.22	25	0.25	60361-900
0.25	30	0.25	14225-926
0.32	25	0.5	60361-892
0.32	30	0.25	14225-932
0.32	30	1	14225-942
0.53	25	1	60361-886
0.53	30	1	14225-946

## BPX50



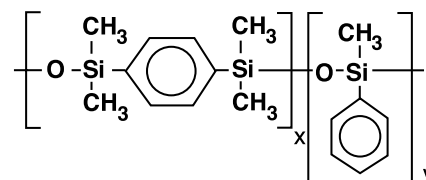
### 50% Phenyl Polysilphenylene-siloxane

- Mid polarity
- Inert
- Low bleed
- High temperature
- Ideal for a range of EPA methods and pharmaceutical applications

**Application areas:** EPA methods 604, 608, 8060, 8081, triazines/herbicides, drug screening, steroids and a variety of pharmaceutical applications.

**Operating temperature:** 0.1-1 µm film thickness: 80°C to 330/350°C.

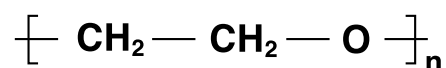
**Suitable replacement for:** AT-50, CP-Sil 24 CB, DB-17, Elite-17, HP-17, OPTIMA 17MS, Rtx-50, Rxi-17, SPB-17, SPB-50, 007-17, VF-17ms, ZB-50.



ID (mm)	Length (m)	Film thickness (µm)	VWR cat. no.
0.1	10	0.1	14226-024
0.15	30	0.15	14233-460
0.25	15	0.25	60361-668
0.25	30	0.25	60361-666
0.25	60	0.25	60361-664
0.32	30	0.25	60361-660
0.53	30	1	14226-028

### Polyethylene Glycol

- Industry standard wax column
- Polar phase
- Cross-linked for stability and washing



**Application areas:** Alcohol, free acids, fatty acid methyl esters, aromatics, solvents, essential oils.

**Operating temperature:** 0.1-1 µm film thickness: 20°C to 260/280°C.

>1 µm film thickness: 20°C to 240/260°C.

**Suitable replacement for:** Carbowax 20M, CP-Wax 52 CB, DB-WAX, Elite-WAX, HP-20M, HP-INNOWax RH-WAX, Rtx-Wax, Stabilwax, SUPELCOWAX 10, TG-WaxMS, VF-WAXms, ZB-WAX.

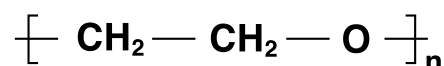
ID (mm)	Length (m)	Film thickness (µm)	VWR cat. no.
0.22	25	0.25	60361-876
0.22	30	0.25	60361-870
0.22	50	0.25	60361-874
0.25	30	0.25	60361-864
0.25	60	0.25	60361-862
0.25	30	0.5	14225-962
0.25	30	1	14225-966
0.32	30	0.25	60361-852
0.32	50	0.25	60361-856
0.32	25	0.5	60361-846
0.32	30	0.5	14225-964
0.32	50	0.5	60361-844
0.32	25	1	60361-842
0.53	30	1	14233-458
0.53	30	1	60361-830
0.53	60	1	14225-972
0.53	25	2	14225-976

## BP21 (FFAP)



### Polyethylene Glycol (PEG) – TPA Treated

- Nitroterephthalic acid modified PEG
- Polar phase
- Ideal for low molecular weight acids



**Application areas:** Volatile free acids, fatty acid methyl esters, alcohols, aldehydes, acrylates, ketones.

**Operating temperature:** 0.25-1 µm film thickness: 35°C to 240/250°C.

**Suitable replacement for:** CP-Wax 58 FFAP CB, DB-FFAP, Elite-FFAP, HP-FFAP, Stabilwax-DA, TG-WaxMS A, ZB-FFAP.

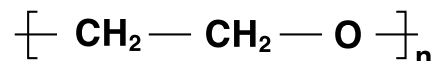
ID (mm)	Length (m)	Film thickness (µm)	VWR cat. no.
0.22	25	0.25	60361-826
0.25	30	0.25	14225-984
0.25	60	0.25	14225-986
0.32	25	0.25	60361-820
0.32	30	0.25	14225-990
0.32	50	0.25	60361-818
0.32	50	0.5	76409-330
0.53	30	0.5	14225-996
0.53	30	1	14225-998

## SolGel-WAX™



### Polyethylene Glycol (PEG) in a Sol-Gel matrix

- Bonded polyethylene glycol
- Very robust high temperature column
- Less susceptible to damage by oxygen than conventional wax phases
- Polar phase
- Low bleed and inert



**Application areas:** Recommended for highly active compounds.

**Operating temperature:** 0.1-1 µm film thickness: 30°C to 260/280°C.

**Suitable replacement for:** AT-Wax, CP-Wax 52 CB, DB-Wax, Elite-WAX, HP-20M, HP-INNOWax, Nukol, Rtx-Wax, Stabilwax, SUPELCOWAX 10, TG-WaxMS, VB-WAX, ZB-WAX.

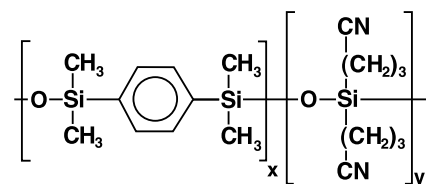
ID (mm)	Length (m)	Film thickness (µm)	VWR cat. no.
0.1	10	0.1	76409-332
0.25	30	0.25	14226-048
0.25	60	0.25	14226-038
0.25	30	1	14233-466
0.32	30	0.25	14227-484
0.32	60	0.25	14227-488
0.32	30	0.5	14226-050
0.32	60	0.5	14226-040
0.53	30	0.5	14227-486
0.53	30	1	14233-462

## BPX70



### 70% Cyanopropyl Polysilphenylene-siloxane

- High temperature
- Custom designed for separation of fatty acid methyl esters (FAMES)
- Industry standard column for FAME analysis
- Ideal for cis/trans isomer separation
- Polar phase



**Application areas:** Fatty acid methyl esters, carbohydrates, pharmaceuticals, GCMS applications.

**Operating temperature:** 0.2-0.5  $\mu\text{m}$  film thickness: 50°C to 250/260°C.

**Suitable replacement for:** CP-Sil 88, DB-23, Rtx-2330, SP-2330, SP-2380, VF-23ms, ZB-FAME.

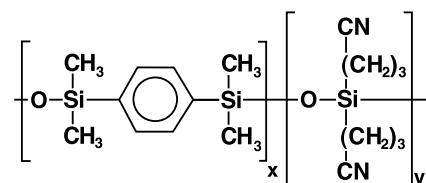
ID (mm)	Length (m)	Film thickness ( $\mu\text{m}$ )	VWR cat. no.
0.1	10	0.2	14226-000
0.22	25	0.25	60361-810
0.22	30	0.25	60361-796
0.22	50	0.25	60361-808
0.22	60	0.25	60361-794
0.25	30	0.25	60361-782
0.25	60	0.25	60361-780
0.25	120	0.25	60361-778
0.32	25	0.25	60361-804
0.32	30	0.25	60361-792
0.32	50	0.25	60361-802
0.32	60	0.25	60361-790
0.53	30	0.5	60361-786

## BPX90



### 90% Cyanopropyl Polysilphenylene-siloxane

- Unique bonded phase
- Highly polar
- Thermally stable



**Application areas:** Fast separation of fragrances, aromatics, petrochemical, pesticides, PCBs and isomers of Fatty Acid Methyl Esters (FAMES).

**Operating temperatures:** 0.25-0.5  $\mu\text{m}$  film thickness: 80°C to 280°C.

**Suitable replacement for:** CP-Sil 88, DB-23, HP-23, Rtx-2330, SP-2330, SP-2380, TG-POLAR.

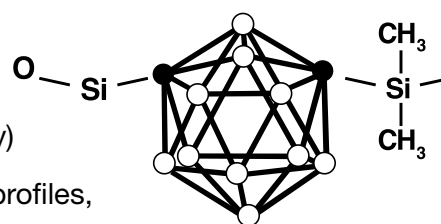
ID (mm)	Length (m)	Film thickness ( $\mu\text{m}$ )	VWR cat. no.
0.25	15	0.25	76409-334
0.25	30	0.25	76409-336
0.25	60	0.25	76409-338
0.25	100	0.25	76409-340
0.32	30	0.5	76409-342

## HT5



### 5% Phenyl (equiv.) Polycarborane siloxane

- Ultra high temperature column range
- Unique phase – no equivalent phases
- Ideal for simulated distillation applications (petroleum industry)



**Application areas:** Simulated distillation, general hydrocarbon profiles, pesticides/herbicides, GCMS applications.

**Operating temperature:** 0.1-0.5  $\mu\text{m}$  film thickness: 10°C to 380/400°C.

**Suitable replacement for:** No equivalents, unique ultra high temperature column.

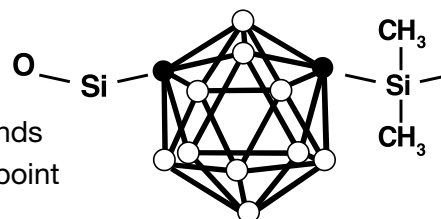
ID (mm)	Length (m)	Film thickness ( $\mu\text{m}$ )	VWR cat. no.
0.22	12	0.1	60361-776
0.22	25	0.1	60361-774
0.25	15	0.1	14226-002
0.25	30	0.1	14226-004
0.32	12	0.1	60361-768
0.32	25	0.1	60361-766
0.32	30	0.5	60361-742
0.53	6	0.1	60361-758
0.53	12	0.15	60361-756
0.53	25	0.15	60361-754

## HT8



### 8% Phenyl (equiv.) Polycarborane siloxane

- High temperature
- Low bleed
- Preferred column for polychlorinated biphenyl (PCB) compounds
- Separates PCBs on ortho ring substitution as well as boiling point
- Ideal for environmental analyses



**Application areas:** PCB congener analyses, nitro-substituted aromatics, polynuclear aromatic hydrocarbons, pesticides/herbicides.

**Operating temperature:** 0.1-0.25  $\mu\text{m}$  film thickness: -20°C to 360/370°C.

**Suitable replacement for:** No equivalents, unique ultra high temperature column.

ID (mm)	Length (m)	Film thickness ( $\mu\text{m}$ )	VWR cat. no.
0.22	25	0.25	60361-730
0.22	50	0.25	60361-728
0.25	30	0.25	14226-008
0.25	60	0.25	10799-632
0.32	25	0.25	60361-724



## 8% Phenyl (equiv.) Polycarborane siloxane

- Unique ultra high temperature column optimizes for 209 PCB congener separations
- Optimized for 209 PCB congener separations

VWR cat. no.	Part description and detail
<b>HT8-PCB</b>	
10811-186	0.25 mm ID x 60 m length HT8-PCB GC capillary column
<b>Fast HT8-PCB</b>	
14226-014	0.1 mm ID x 10 m length Fast HT8-PCB GC capillary column

## Gas filters

Clean gas | Accurate analysis  
Easily installed



Gas filters are an essential part of your GC analysis as contaminants in gases can significantly impact the quality of results. Oxygen, hydrocarbons and moisture can lead to problems such as noisy baselines, moisture entering the GC column, excessive bleed and septa degradation.

Even if carrier gas is of the highest quality, contaminants can be picked up from every part of the gas line. Therefore, a gas filter is needed to ensure that maximum productivity is achieved.



### Clean gas

Gas filters are designed to provide fast stabilization times to reduce gas consumption, and provide clean gas to GC and GCMS systems.

### Accurate analysis

Inserting a gas filter in the gas line significantly reduces impurity levels, thus improving trace analysis.

### Easily installed

The gas filter system consists of two key parts: the filters and the connecting unit. The connecting unit has inlet and outlet connectors for the gas lines. The connecting unit can be bench or wall-mounted and is available in 1, 2 and 4 port configurations and for 1/4" and 1/8" gas lines.

## Enhanced gas quality for maximum productivity

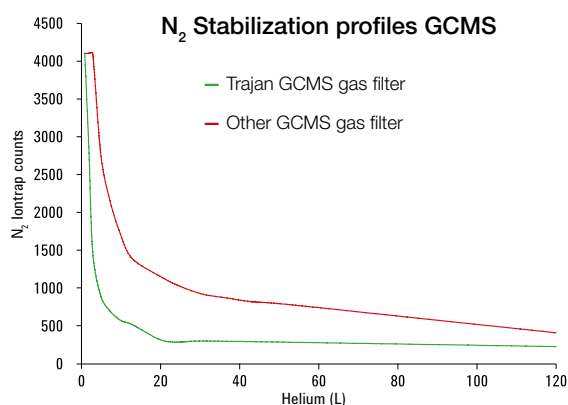


Figure 1 shows the fast stabilization rate (the  $N_2$  mass measured by mass spectrometry) of a GCMS after replacement of the filter.

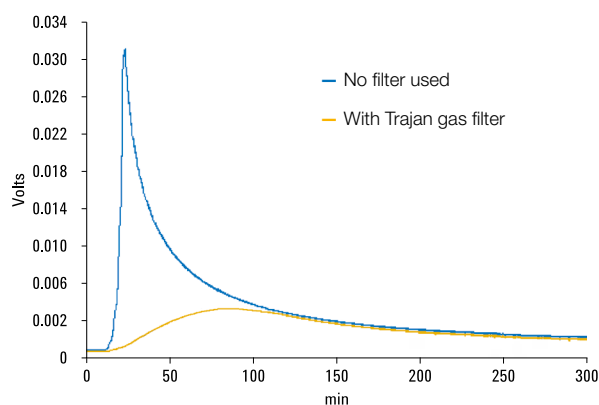


Figure 2 shows the difference in bleed levels of two GC columns due to moisture exposure with and without a filter when running a temperature program (50°C to 350°C, 20°C/min). When no filter is used, an extreme rise in the bleed profile is clearly visible due to moisture in the carrier gas. By using gas filters, a normal bleed profile is achieved with the removal of all moisture in the carrier gas.

### Gas filter selection guide

Technique	Recommended filter(s)	Advantages
GCMS	Carrier gas	High data accuracy, lower maintenance
GC column	Moisture and oxygen	Longer lifetime
Electron capture detectors (GC)	Moisture and oxygen	High sensitivity
Thermal conductivity detectors (GC)	Moisture and oxygen	High sensitivity, lower maintenance
Flame ionization detectors (GC)	Two hydrocarbon	High sensitivity
Photoionization detectors (GC)	Oxygen and hydrocarbon	High sensitivity

### Gas filter technical specifications

	Oxygen filter	Moisture filter	Hydrocarbon filter	Carrier gas filter
Function	Removes oxygen as well as traces of sulfur and chlorine compounds from the carrier gas	Removes water, oil and other foreign material from the carrier gas	Removes organic compounds from gas streams	Single combination filter; removes water, oxygen and organic compounds
Indicator color change	From green to gray	From green to pale brown	No indicator	Oxygen: from green to gray Moisture: from green to pale brown Hydrocarbons: no indicator
Capacity	150 mL oxygen	7.2 g water	Approximately 7 g, depending on impurities	100 mL oxygen, 1 g water, organics depending on impurities
Outlet concentration at operating flow of 1-10 L/min	<50 ppb	<0.1 ppm	<0.1 ppm	Oxygen <50 ppb Moisture <0.1 ppm Organics <0.1 ppm

## Gas filters

### Gas filters

VWR cat. no.	Part description and detail
75996-958	Gas filter - Hydrocarbon
75996-956	Gas filter - Moisture
75997-114	Gas filter - Oxygen
75996-960	Gas filter - Carrier gas

### Connecting units

VWR cat. no.	Part description and detail
75997-098	Gas filter connecting unit 1/4" (high flow)
75997-100	Gas filter connecting unit 1/8" (high flow)
75997-102	Gas filter connecting unit 1/4" (4 position)
75997-104	Gas filter connecting unit 1/8" (4 position)
75997-106	Gas filter connecting unit 1/4" (2 position)
75997-108	Gas filter connecting unit 1/8" (2 position)
75997-110	Gas filter connecting unit 1/4" (1 position)
75997-112	Gas filter connecting unit 1/8" (1 position)

### Gas filter kits

VWR cat. no.	Part description and detail
75996-964	Gas filter kit - Carrier gas 1/4" (1 gas filter, connecting unit - 1 position)
75996-962	Gas filter kit - Carrier gas 1/8" (1 gas filter, connecting unit - 1 position)
75996-968	Gas filter kit - FID 1/4" (4 gas filters, connecting unit - 4 position)
75996-966	Gas filter kit - FID 1/8" (4 gas filters, connecting unit - 4 position)

## Big Trap gas filter



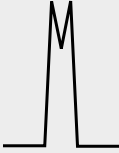
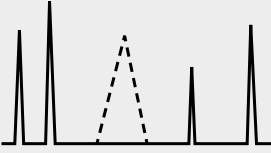
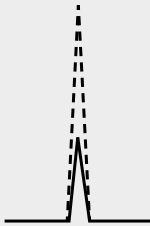
For bulk purification applications or where several instruments are plumbed from a single source, a Big Trap gas filter is an ideal solution. A one-piece heavy walled aluminium tube provides 750 cm<sup>3</sup> of capacity and a pressure rating up to 250 psig.



### Big Traps

VWR cat. no.	Part description and detail
75996-972	Big Trap gas filter 1/4" - Hydrocarbon
75996-970	Big Trap gas filter 1/8" - Hydrocarbon
75996-976	Big Trap gas filter 1/4" - Moisture
75996-974	Big Trap gas filter 1/8" - Moisture
75996-980	Big Trap gas filter 1/4" - Oxygen
75996-978	Big Trap gas filter 1/8" - Oxygen
75996-984	Big Trap gas filter 1/4" - Universal
75996-982	Big Trap gas filter 1/8" - Universal
75996-986	Big Trap mounting clip, PK2

## Basic troubleshooting guide

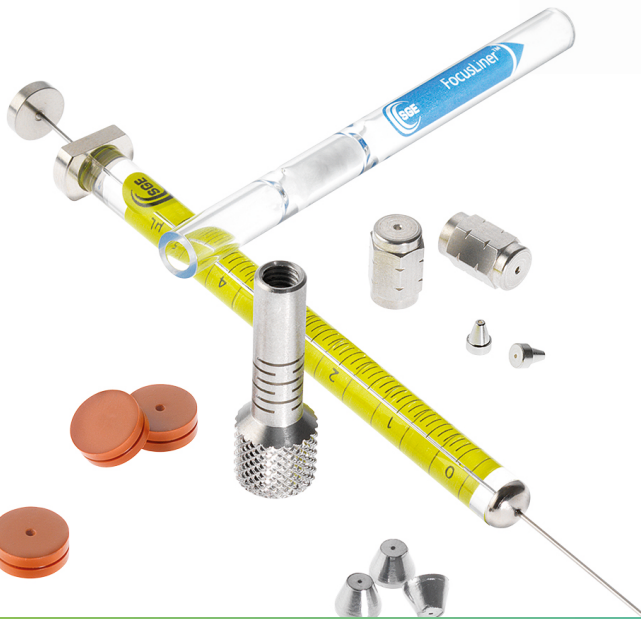
Problem	Reason	Resolution
Peak fronting 	Column overload	Reduce sample concentration or injection volume
	Incorrect polarity of column for compound	Use correct column
Peak tailing 	Column is active	Remove first meter of column, recheck; replace column if necessary
	Active inlet liner	Replace liner with clean, deactivated liner
	Incorrect column for analysis	Use correct column
	Incorrect column installation	Check inlet and outlet connections, and for any cold spots
Peak splitting 	Poor injection technique	Refine injection technique
	Mixed solvents	Use only single solvent system
	Poor resolution	Use different column or change temperature profile
Ghost peaks 	Run GC without injection; if ghost peaks disappear then the problem is probably the syringe or solvent; if ghost peaks are still evident then the problem is either the septum or the breakdown of the phase.	
	Contaminated syringe or solvents	Clean syringe thoroughly and replace solvents
	Septum bleed	Replace with Trajan septa
	Breakdown of column phase	Choose different phase which restricts breakdown
	Too large an injection volume	Decrease injection volume
Specific peaks low response 	Column is active	Remove first meter of column; recheck; replace column if necessary
	Active inlet liner	Replace liner with clean, deactivated liner
	Incorrect calculation of sample	Verify calculations
	FID altered gas flows	Readjust gas flows

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# GC consumables



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