

## 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.

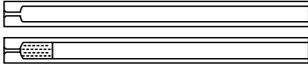
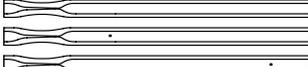
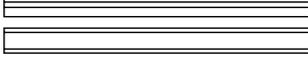
If the volume is too large, sample is lost, impacting reproducibility and sensitivity.



### 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

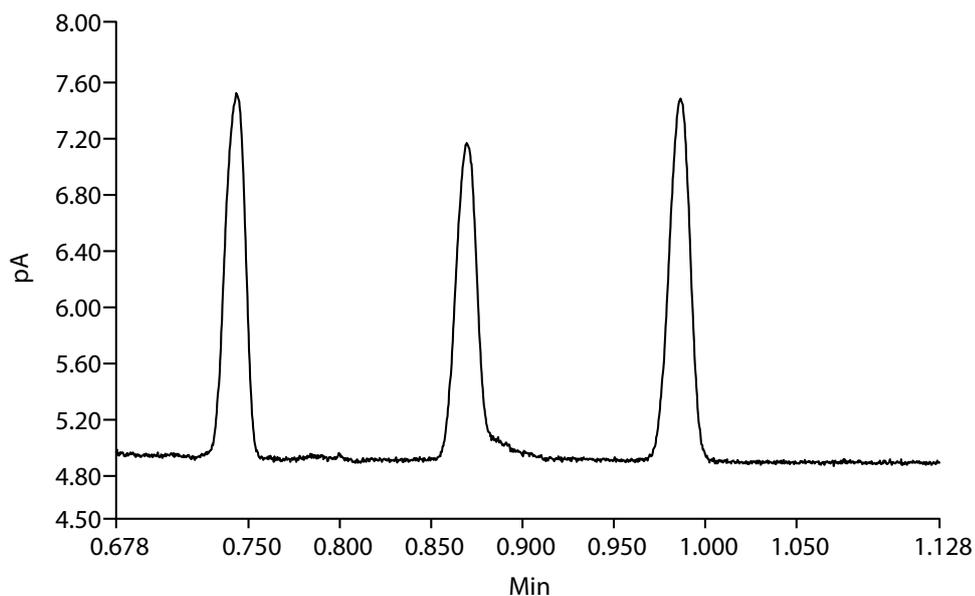
The volume of the vaporized sample should not exceed half of the total volume of the liner. Expansion volumes of solvents need to be understood to calculate injection volume. Solvents with low densities enable more volume of solvent to be injected into the GC system.

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



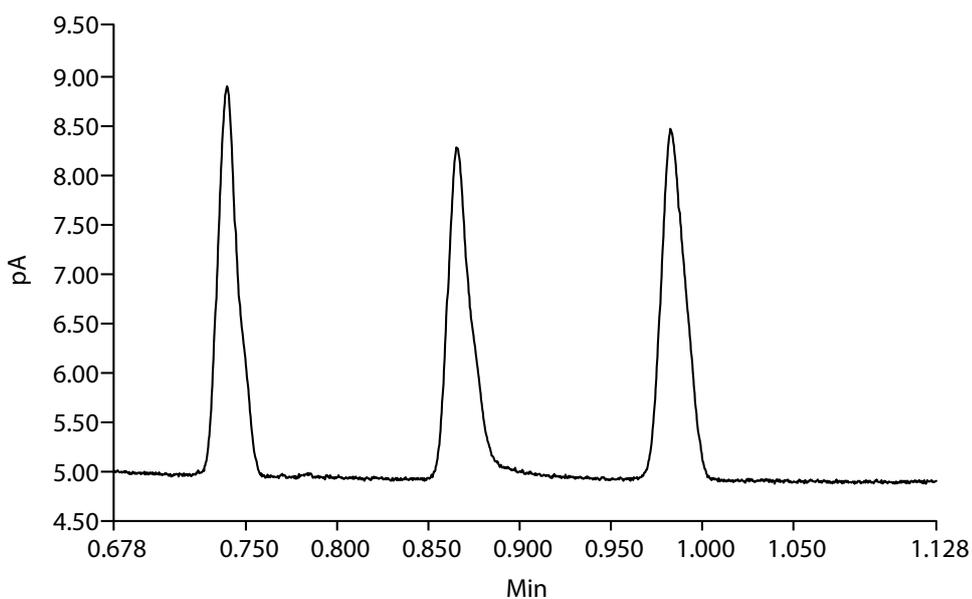
### Comparison of injection volume

#### 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

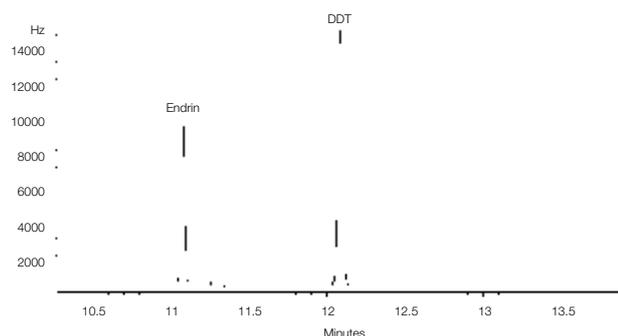
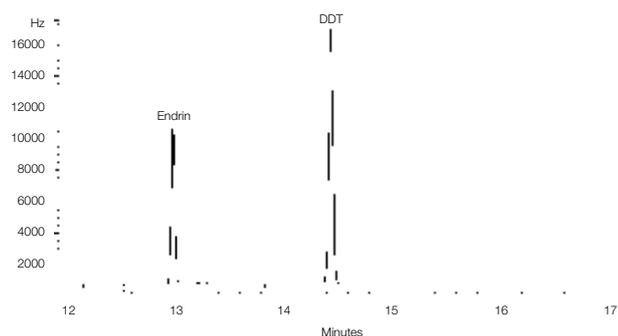
If the Endrin or DDT breakdown is 3% or higher it fails.

Competitor	
Endrin Deg%	3.23
DDT Deg%	1.95

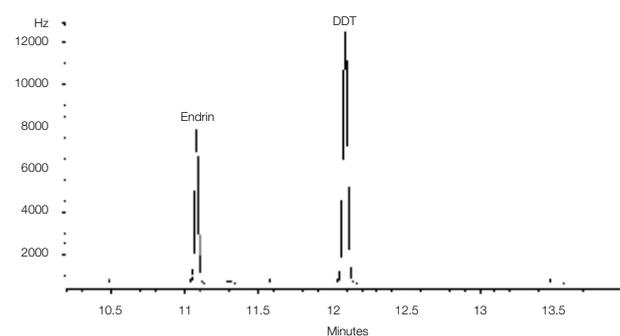
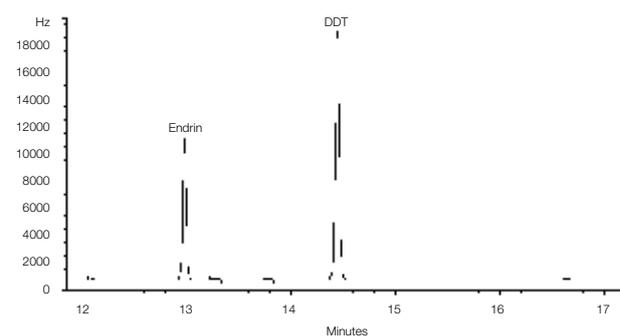
SGE FocusLiner	
Endrin Deg%	1.33
DDT Deg%	0.83



### Competitor liner



### SGE FocusLiner

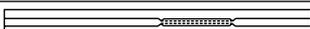
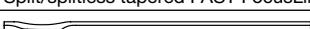
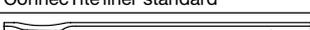
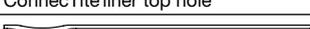
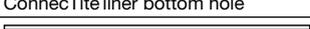
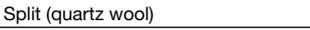
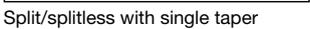
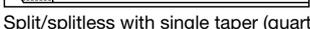
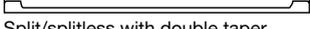
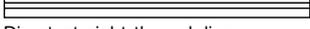




## SGE Inlet liners



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

Description and geometry sketch	OD (mm)	ID (mm)	Length (mm)	Pack size	Part number
<b>For Agilent 7890, 6890, 6850, 5890 and 4890</b>					
 Split/splitless FocusLiner	6.3	4	78.5	5	092002
				25	092219
 Split/splitless tapered FocusLiner	6.3	4	78.5	5	092003
				25	092011
 Split/splitless FAST FocusLiner	6.3	2.3	78.5	5	092005
				25	092008
 Split/splitless tapered FAST FocusLiner	6.3	2.3	78.5	5	092111
				25	092115
 ConnecTite liner standard	6.3	4	78.5	5	092324
 ConnecTite liner top hole				5	092325
 ConnecTite liner bottom hole	6.3	4	78.5	5	092326
				5	092326
 Split, straight-through liner	6.3	4	78.5	5	092007
				25	092222
 Split (quartz wool)	6.3	4	78.5	5	092001
				25	092220
 Split/splitless with single taper	6.3	4	78.5	5	092017
				25	092229
 Split/splitless with single taper (quartz wool)	6.3	4	78.5	5	092019
				25	092218
 Split/splitless with double taper	6.3	4	78.5	5	092018
				25	092230
 Direct, straight-through liner	6.3	1.2	78.5	5	092016
				25	092224
 Split/splitless quartz, straight-through liner	6.1	2	78.5	5	092004
 Splitless with recessed gooseneck	6.3	2	78.5	5	092013
 Split/splitless recessed gooseneck (quartz wool)				5	092010

## O-rings and sealing rings

Description	Usage	Pack size	Part number
<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	0726532
Graphite sealing ring	Temperatures up to 450°C. Suitable for inlet liners with OD of 6.3 mm	10	0726005
Graphite sealing ring	Temperatures up to 450°C. Suitable for use with inlet liners 092004	10	0726006



## SGE Inlet liners

Description and geometry	OD (mm)	ID (mm)	Length (mm)	Pack size	Part number
<b>For PerkinElmer Clarus 590 and 690</b>					
Split/splitless FocusLiner	6.3	4	78.5	5	092002
				25	092219
Split/splitless tapered FocusLiner	6.3	4	78.5	5	092003
				25	092011
Split/splitless FAST FocusLiner	6.3	2.3	78.5	5	092005
				25	092008
Split/splitless tapered FAST FocusLiner	6.3	2.3	78.5	5	092111
				25	092115
ConnectTite Liner standard	6.3	4	78.5	5	092324
ConnectTite Liner top hole				5	092325
ConnectTite Liner bottom hole				5	092326
Split, straight-through liner	6.3	4	78.5	5	092007
				25	092222
Split (quartz wool)	6.3	4	78.5	5	092001
				25	092220
Split/splitless with single taper	6.3	4	78.5	5	092017
				25	092229
Split/splitless with single taper (quartz wool)	6.3	4	78.5	5	092019
				25	092218
Split/splitless with double taper	6.3	4	78.5	5	092018
				25	092230
Direct, straight-through liner	6.3	1.2	78.5	5	092016
				25	092224
Split/splitless quartz, straight-through liner	6.1	2	78.5	5	092004
Splitless with recessed gooseneck	6.3	2	78.5	5	092013
Split/splitless recessed gooseneck (quartz wool)	6.3	4	78.5	5	092010
				25	092223



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

## O-rings and sealing rings

Description	Usage	Pack size	Part number
<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	0726532
Graphite sealing ring	Temperatures up to 450°C. Suitable for inlet liners with OD of 6.3 mm	10	0726005
Graphite sealing ring	Temperatures up to 450°C. Suitable for use with inlet liners 092004	10	0726006



## SGE Inlet liners

Description and geometry sketch	OD (mm)	ID (mm)	Length (mm)	Pack size	Part number
For Shimadzu GC-2030 (SPL injector), GC-2010 (SPL-2010 injector), GC-2014 (SPL-2014 injector) and GC-17A (SPL-17 injector)					
Split/splitless FocusLiner (top of wool 25 mm)	5	3.4	95	5	092059*
Split/splitless tapered FocusLiner (top of wool 25 mm)	5	3.4	95	5	092058
Split/splitless FocusLiner (top of wool 15 mm)	5	3.4	95	5	092062
Split/splitless tapered FocusLiner (top of wool 15 mm)	5	3.4	95	5	092068
ConnecTite liner standard	5	3.4	95	5	092329
ConnecTite liner top hole	5	3.4	95	5	092330
ConnecTite liner bottom hole	5	3.4	95	5	092331
Split, straight-through liner	5	3.4	95	5	092064
Splitless, straight-through liner	5	2.6	95	5	0920861
Split/splitless with single taper	5	3.4	95	5	092071
Split/splitless with middle gooseneck	5	3.4	95	5	092077
Split/splitless with recessed gooseneck and quartz wool	5	3.4	95	5	092061
Split/splitless with middle gooseneck	5	3.4	95	5	092085
ConnecTite (0.53 mm ID columns)	5	2.6	95	5	092087
SPME liner	5	0.75	95	5	092089



- 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	Part number
O-ring	For GC-2030 (SPL-2030 injector), GC-2014 (SPL-2014 injector) and GC-2010 (SPL-2010 injector)	10	0726533
Graphite sealing ring	Temperatures up to 450°C. For GC-17A (SPL-17 injector)	10	0726007

# Inlet liners | Thermo Scientific



## SGE Inlet liners



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

Description and geometry	OD (mm)	ID (mm)	Length (mm)	Pack size	Part number
<b>For Thermo Scientific TRACE 1300 series GC</b>					
Split/splitless FocusLiner	6.3	4	78.5	5	092002
				25	092219
Split/splitless tapered FocusLiner	6.3	4	78.5	5	092003
				25	092011
Split/splitless FAST FocusLiner	6.3	2.3	78.5	5	092005
				25	092008
Split/splitless tapered FAST FocusLiner	6.3	2.3	78.5	5	092111
				25	092115
ConnecTite Liner standard	6.3	4	78.5	5	092324
ConnecTite Liner top hole				5	092325
ConnecTite Liner bottom hole	6.3	4	78.5	5	092326
Split, straight-through liner	6.3	4	78.5	5	092007
				25	092222
Split (quartz wool)	6.3	4	78.5	5	092001
				25	092220
Split/splitless with single taper	6.3	4	78.5	5	092017
				25	092229
Split/splitless with single taper (quartz wool)	6.3	4	78.5	5	092019
				25	092218
Split/splitless with double taper	6.3	4	78.5	5	092018
				25	092230
Direct, straight-through liner	6.3	1.2	78.5	5	092016
				25	092224
Split/splitless quartz, straight-through liner	6.1	2	78.5	5	092004
Splitless with recessed gooseneck	6.3	2	78.5	5	092013
Split/splitless recessed gooseneck (quartz wool)	6.3	4	78.5	5	092010
				25	092223

## O-rings and sealing rings

Description	Usage	Pack size	Part number
<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	0726532
Graphite sealing ring	Temperatures up to 450°C. Suitable for inlet liners with OD of 6.3 mm	10	0726005
Graphite sealing ring	Temperatures up to 450°C. Suitable for use with inlet liners 092004	10	0726006

