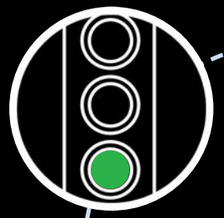
Liner Anatomy

By the Chromatographers at Restek



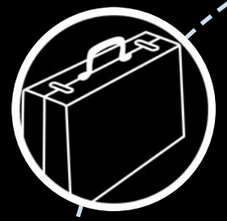
LET'S BEGIN

To correctly diagnose which inlet liner is right for your application, let's first consider the method of sample introduction.

SPLIT INJECTIONS
Split injections are a fast, efficient way to transfer a portion of the sample onto the column for analysis. Split injection is often used for dirty samples or highly concentrated samples.

SPLITLESS INJECTIONS
Splitless injection involves an initial hold time where the split vent flow is turned off and the incoming sample flow is forced onto the column. It is an excellent technique for low concentration samples and commonly is used in drug screening and pesticide residue methods.

DIRECT INJECTIONS
Direct injection is an alternative to splitless injection. It is an excellent technique for trace samples, especially those that are prone to degradation inside the injection port.



PACKING OPTIONS

Proper selection of liner packing material and position improves sample vaporization and prevents nonvolatile compounds from entering the column. Sample characteristics and injection technique will dictate packing use. Analyses of high molecular weight analytes, especially in split mode, benefit from the use of packing.

PACKING MATERIAL
Glass wool is the most common packing material. However, broken wool fibers can expose undeactivated areas, increasing the potential for analyte degradation. Deactivated fused silica beads and CarboFrit™ packing (highly dense and inert) are alternative packings that minimize analyte breakdown.

PACKING POSITION

- Packing placed near the bottom of the liner prevents nonvolatile compounds and septum particles from entering the column. Liners designed for splitless applications often have packing near the bottom, since the long analyte residence time in the liner is usually adequate to vaporize the sample.
- Packing near the middle of the liner enhances vaporization and can improve reproducibility. Precision™ liners are designed with built-in stops to keep the wool properly positioned to wipe the needle. Good needle maintenance is critical as a burred needle can pull the packing out of position, eliminating its effectiveness.

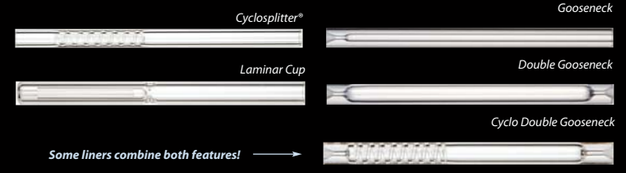
Precision™ liners keep wool in position injection after injection.

GEOMETRY

Many inlet liners are designed with special geometries. They serve two purposes: to aid vaporization and to protect the sample, especially during splitless injections.

ENHANCE VAPORIZATION
To avoid molecular weight (MW) discrimination (a phenomenon where high MW compounds are not vaporized efficiently and are therefore under-represented in the analyzed sample), some liners are designed with complex flow paths to aid vaporization.

PROTECT THE SAMPLE
Some samples are prone to degradation inside of the injector, especially when in contact with hot metal surfaces. Several liners are designed specifically to minimize contact with the injection port.



Drilled Uniliner® inlet liners allow direct injections on EPC-equipped GCs.

Drilled Uniliner® inlet liners create a leak-free seal with the column—assuring virtually complete sample transfer and preventing contact with the injection port. Use the Drilled Uniliner® inlet liner with the hole near the bottom for semivolatile analyses or when compounds of interest could be affected by a tailing solvent peak. Use the Drilled Uniliner® inlet liner with the hole near the top for chlorinated pesticides analyses, aqueous injections, and analyses in which the compounds of interest elute away from the solvent peak.

DEACTIVATION

Liners and their packing materials need to provide highly inert pathways to guard against sample adsorption (reversible or irreversible) and sample degradation. There are three prominent deactivation options to choose from.

SILTEK® DEACTIVATION
Siltek® deactivated liners offer the most chemically inert sample pathway—perfect for low-level analyses or highly active compounds, where preventing sample loss and degradation is critical.

INTERMEDIATE POLARITY (IP) DEACTIVATION
IP deactivation offers good recovery and reproducibility for both polar and nonpolar compounds—making IP an excellent general-purpose deactivation.

BASE DEACTIVATION
Base deactivation (BD) is ideal for the analysis of basic compounds, such as amines and basic drugs. It prevents analyte adsorption which manifests as either irreproducible results or peak tailing. Couple BD liners with BD columns for best results.

Restek **exclusive**!

Siltek® treated metal inlet liners—inert as glass with no chipping!

Siltek® Deactivation means **ULTIMATE** inertness

VOLUME AND INNER DIAMETER

Sample expansion volume and linear velocity should be considered when choosing liner dimensions.

SAMPLE EXPANSION VOLUME
When a liquid sample is vaporized inside an inlet liner, its volume expands considerably. Care should be taken to match the effective liner volume and the expanded volume of the injected sample. If the liner volume is exceeded, the sample will be forced back into the gas lines, causing irreproducible peak areas and sample carryover.

Solvent expansion volumes based on an injection port temperature of 250°C and a 10 psig head-pressure.

For a straight 4mm ID x 78.5mm long liner, the effective liner volume is approximately 500µL.

Injection Volume (µL)	Expansion Volume (µL)				
	H_2O	C_2S	CH_2Cl_2	Hexane	Isooctane
0.5	~~710~~	212	200	98	78
1.0	~~1420~~	423	401	195	155
2.0	~~2840~~	~~846~~	~~802~~	390	310
5.0	~~7100~~	~~2120~~	~~2000~~	~~975~~	~~775~~

LINEAR VELOCITY
Choosing a liner with a narrow inner diameter will give a faster linear velocity (for a given flow rate), which will move the sample onto the column quickly, improving efficiency and helping keep peak widths narrow. This is particularly important for gaseous samples introduced via purge-and-trap or static headspace techniques, or when 0.18mm, 0.15mm, and 0.10mm ID columns are used.

LINER MAINTENANCE

Inlet liners are key consumables and need to be changed regularly to avoid the following problems:

- Sample degradation resulting in poor response.
- Sample adsorption resulting in poor peak shape (tailing).
- Sample discrimination.
- Irreproducibility.
- Extraneous peaks from contamination or cored septum particles.

Be sure to condition your liners at 20°C higher than the operating inlettemperature for a minimum of 10 minutes to prepare them for use.

Restek
ISO 9001:2000 QUALITY
Lit. Cat.# GNWC1014-INT