GC Inlet Liner Deactivation, Make Your GC Liners Inert!

SilcoTek Now Offers Re-deactivation Services for Used GC Inlet Liners!

Eliminate:

- Signal loss
- Peak tailing
- Adsorption

Improve:

- Peak Separation
- Sensitivity
- Baseline quality

Improve the analytical performance of your GC with the ultimate surface treatment for precise, part-per-trillion level sampling.

An inert GC liner is critical for low level detection of sensitive compounds, efficient analysis, and reliable results. New in 2014, SilcoTek® will re-deactivate **any liner** from **any manufacturer** – all shapes and sizes – with the industry's most popular inert coating, SilcoNert® 2000, also known as Siltek®.

Achieve the lowest levels of detection for:

- Chlorinated pesticides (EPA 8081)
- Semi-volatile Organics (EPA 8270)
- OP pesticides
- Ammonia NOx and SOx
- Sulfurs
- More

Siltek

deactivation

from RESTEK

The Next Generation of Surface Deactivation

- ✔ Maximizes the inertness of sample pathway
- ✔ Minimizes breakdown and bleed
- ✔ Thermally stable

What is Siltek™ Deactivation?

The Siltek™ process (patent pending) produces a highly inert glass surface that features high-temperature stability, extreme durability, and virtually no bleed.

Siltek™ deactivation is not susceptible to cleavage or formation of active silanols like traditional deactivations can be; and, therefore, greatly reduce bleed, breakdown, and adsorption of active components.

LOW BLEED

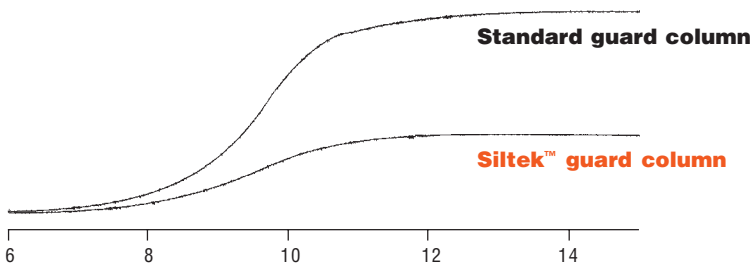
Lower Limits of Detection for High Molecular Weight Compounds

Traditional deactivated surfaces thermally degrade at the elevated temperatures used in GC analysis. As the temperature increases, so does the rate of thermal degradation of the column phase, which is reflected by an increase in the baseline of a detection system. This undesirable phenomena, called bleed, can interfere with the accurate quantitation of analytes. Although deactivated guard columns are not coated with stationary phase, their surface treatment can still show a measurable bleed level.

Siltek™ deactivation, however, results in extremely low bleed levels at elevated temperatures. A Siltek™ guard column has 60% less bleed than a standard deactivated guard column (Figure 1). Lower bleed translates to lower limits of detection for high molecular weight compounds. Better deactivation provides better analytical results!

Figure 1

An expanded bleed plot shows the Siltek™ guard column exhibits 60% less bleed than the standard deactivated guard column at 330°C.



The Next Generation of Surface Deactivation

INERTNESS

Enhanced Recovery of Trace-Level Chlorinated Pesticides

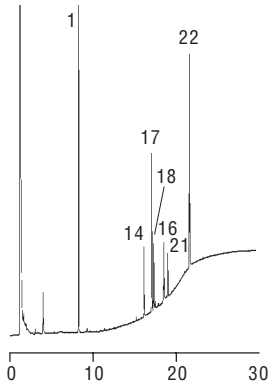
US Environmental Protection Agency (EPA) Method 8081A is a challenging analysis that requires gas chromatographic (GC) separation and detection of chlorinated pesticides in low ppb levels. Three compounds listed in the 8081A Method—endrin, DDT, and methoxychlor—are highly susceptible to breakdown on a variety of active surfaces, making accurate analysis difficult. A typical configuration for this analysis includes a direct injection sleeve and a guard column connected to one or two analytical columns via a press-tight connector. This entire chromatographic system needs to be optimized to prevent breakdown and ensure accurate results.

In Figure 2a, an on-column analyte concentration of 50ppb shows 62% endrin breakdown on an inadequately deactivated liner, as indicated by the integrated decomposition products of endrin aldehyde (peak 18) and endrin ketone (peak 21). Use of a Siltek™ inlet liner results in less than 1% endrin breakdown, and undetectable DDT and methoxychlor breakdown (Figure 2b). A completely deactivated GC system shows unsurpassed response and resolution of the complete list of 8081A analytes using a Siltek™ liner, Siltek™ Press-Tight® connector, Siltek™ guard column, and an Rtx®-CLPesticides analytical column (Figure 3).

Figure 2

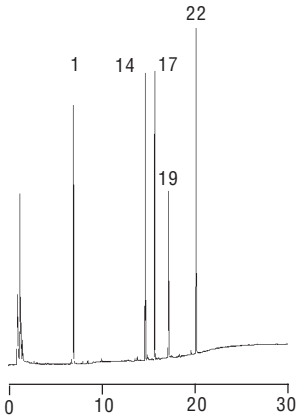
a) Before

A chromatographic system that is inadequately deactivated will cause poor linearity, a loss of reproducibility, and costly analytical downtime.



b) After

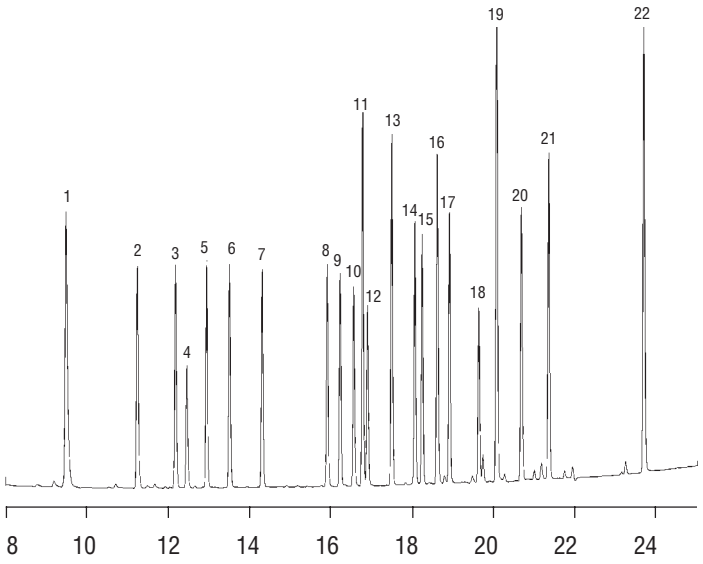
Siltek™-deactivated Uniliner® inlet liners result in less than 1% endrin breakdown, and undetectable DDT and methoxychlor breakdown.



Conditions for Figure 2
30m, 0.53mm ID, 0.42µm Rtx-CLPesticides2 (cat.#11340) with open-top Siltek™ Uniliner® w/o wool (cat.# 20843-214.1)
Inj.: 1µL of 50pg/µL standard of tetrachloro-meta-xylene (IS), endrin, 4,4'-DDT, methoxychlor, and decachlorobiphenyl (IS); **Oven temp.:** 120°C (hold 1 min.) to 300°C @ 9°C/min. (hold 10 min.)
Inj. temp.: 250°C; **Det.:** ECD, 300°C
Carrier gas: helium

Figure 3

A completely deactivated GC system shows excellent resolution of the complete list of US EPA Method 8081A analytes at very low levels.



Peak List for Figures 2 and 3

1. 2,4,5,6-tetrachloro-m-xylene (IS)
2. α-BHC
3. γ-BHC
4. β-BHC
5. δ-BHC
6. heptachlor
7. aldrin
8. heptachlor epoxide
9. γ-chlordane
10. α-chlordane
11. 4,4'-DDE
12. endosulfan I
13. dieldrin
14. endrin
15. 4,4'-DDE
16. endosulfan II
17. 4,4'-DDT
18. endrin aldehyde
19. methoxychlor
20. endosulfan sulfate
21. endrin ketone
22. decachlorobiphenyl (IS)

Conditions for Figure 3
30m, 0.32mm ID, 0.5µm (cat.# 11139) Rtx®-CLPesticides with a 5m, 0.32mm ID Siltek™ guard column (cat.# 10027) and a Siltek™ gooseneck liner (cat.# 20798-214.1)
On-column conc.: 16-160pg
Oven temp.: 120°C (hold 1 min.) to 300°C @ 9°C/min. (hold 10 min.)
Inj. temp.: 250°C, splitless (hold for 0.75 min.)
Det.: ECD, 300°C with anode purge
Carrier gas: helium, 31cm/sec.

The Next Generation of Surface Deactivation

Siltek™ Inlet Liners

For Siltek™ inlet liners, add the corresponding suffix number to your Restek liner catalog number.

Qty.	Siltek™		Siltek™ with Siltek™ wool		Siltek™ with CarboFrit™	
each	-214.1	addl. cost	-213.1	addl. cost	-216.1	addl. cost
5-pk.	-214.5	addl. cost	-213.5	addl. cost	-216.5	addl. cost
25-pk.	-214.25	addl. cost	-213.5	addl. cost	-216.25	addl. cost

Siltek™ Press-Tight® Connectors

Type	Ea.	3-Pk.	5-Pk.	25-Pk.	100-Pk.
straight	—	—	20480	20449	20481
angled	—	—	20482	20483	20484
"Y"	20485	20486	—	—	—
angled "Y"	20487	20469	—	—	—

Siltek™ Borosilicate Wool

Qty.	cat.#
10 g	21100

Siltek™ Guard Columns

Nominal ID	Nominal OD	5-Meter	10-Meter
0.25mm	0.37 ±0.04mm	10026	10036
0.28mm	0.37 ±0.04mm	10016	10017
0.32mm	0.45 ±0.04mm	10027	10037
0.45mm	0.69 ±0.05mm	10018	10019
0.53mm	0.69 ±0.05mm	10028	10038

Rtx®-CLPesticides Column Kits

Kits include a universal angled "Y" Siltek™ Press-Tight® connector, 5m Siltek™ guard column, and columns listed.

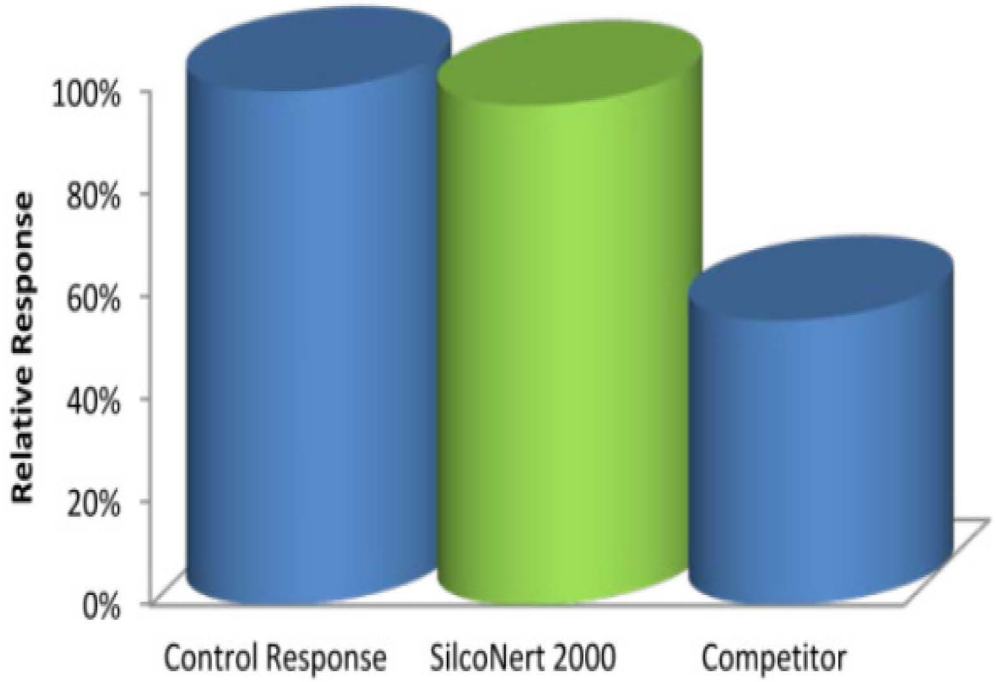
Nominal ID	cat.#
30m, 0.53mm ID, 0.50µm Rtx®-CLPesticides column	
30m, 0.53mm ID, 0.42µm Rtx®-CLPesticides2 column	11197
30m, 0.32mm ID, 0.50µm Rtx®-CLPesticides column	
30m, 0.32mm ID, 0.25µm Rtx®-CLPesticides2 column	11198
30m, 0.25mm ID, 0.25µm Rtx®-CLPesticides column	
30m, 0.25mm ID, 0.20µm Rtx®-CLPesticides2 column	11199

U.S.: 110 Benner Circle • Bellefonte, PA 16823 • 814-353-1300 • **800-356-1688** • fax: 814-353-1309 • **www.restekcorp.com**
Restek Germany: (49) 06172 2797 0
Thames Restek U.K. LTD: (44) 01753 624111
Restek France: (33) 01 60 78 32 10
Thames Restek Scotland LTD: (44) 870 241 1247
Restek Ireland: (44) 2 890 814 576

Lit. Cat.# 59803A-INT

RESTEK

SilcoNert Improves System Response



SilcoTek makes the process easy!

Send us your used liners and we'll return them to you clean and ultra-inert in 10 business days or less. Get a quote and see how easy it is to improve performance!

Get a Deactivation Quote

Don't waste your time or money on unreliable results – guarantee the best sample analysis by deactivating your liners with SilcoNert® 2000.

Attractive quantity pricing available.

Watch our inert sampling video!

NEW!

True Blue Performance

Exceptionally inert, Sky™ inlet liners with **state-of-the-art deactivation** improve trace level analysis.

- Increase accuracy and precision
- Lower detection limits
- Use wool with confidence

Sky™
Inlet Liners

RESTEK

Sky™ Inlet Liners

True Blue Performance

- Increase accuracy and reproducibility with state-of-the-art deactivation.
- Achieve lower detection limits for a wide range of active compounds.
- Use wool without risking the loss of sensitive analytes.

When faced with complex choices, simple solutions stand out. Sky™ inlet liners from Restek use a comprehensive, state-of-the-art deactivation and are the only blue liners on the market—making them an easy-to-recognize solution to common inlet problems.

New Sky™ liners give you the inertness you need for more accurate trace level results.

The innovative deactivation used for Sky™ liners results in exceptional inertness for a wide range of analyte chemistries. By reducing active sites and enhancing analyte transfer to the column, these liners increase accuracy and precision, allowing lower detection limits for many active compounds. In addition to improved data quality, you'll benefit from fewer liner changes and less downtime for maintenance.

Selecting the right liner for your application can be a daunting task. Sky™ inlet liners make the choice simple; the comprehensive deactivation, distinctive color, and availability in popular configurations mean Sky™ liners are the best choice for optimizing chromatographic performance. Regardless of your application, Sky™ liners provide reliable inertness and assured performance, day-after-day and analysis-after-analysis.

The Story Behind Sky™

For over 25 years, Restek's vision has been to be the company chromatographers trust. This philosophy is the cornerstone of our business, and it's the reason our chemists and engineers are dedicated to developing innovative, best-in-class products like Sky™ liners. As chromatographers, we understand your needs and strive to develop and deliver products that make your life easier.

With Sky™ liners our goal was to create a state-of-the-art deactivation that provides superior performance, but why did we make them blue? Restek has always been associated with the color blue; to us, it signifies strength, innovation, and excellence. We made SKY™ liners blue because it represents the technological advancements and unmatched quality that define Restek products. Choose blue—the best choice for dependable results.

www.restek.com/sky

Simple Solutions:
Inert Sky™ Inlet Liners Improve Accuracy and Precision for a Wide Range of Analytes

Many chromatographic problems, such as poor response and missing or tailing peaks are caused by activity in the inlet liner. These effects complicate quantification and can be particularly problematic for sensitive analytes. New Sky™ inlet liners from Restek offer exceptional inertness, assuring enhanced transfer of analytes to the column, good response, and highly symmetric peaks. The inertness of these liners is due to a state-of-the-art deactivation process that completely passivates the liner and wool so that they are inert to a wide variety of reactive analytes.

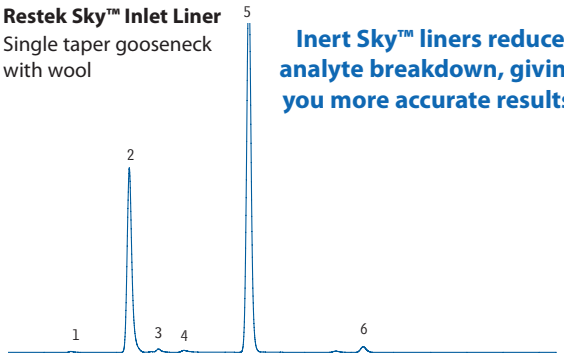
Some deactivations, such as base deactivation, are effective only for particular target compound chemistries. In contrast, the balanced deactivation of Sky™ liners prevents interactions with many chemical classes. As shown on the following pages, complex pesticide probes, as well as both acidic and basic compounds have strong responses and excellent peak shapes, demonstrating the inertness of Sky™ liners. With new Sky™ inlet liners you will see improved sensitivity, accuracy, and reproducibility liner-to-liner, which allows you to quantify challenging compounds at trace levels with confidence.

Reduced Breakdown Improves Trace Analyses

Endrin & DDT are important analytes for the environmental and food safety industries, and also serve as excellent general probes for liner inertness. Both compounds are sensitive to different modes of activity due to their chemical structures and because they are analyzed at very low concentrations (typically parts-per-billion concentrations for µECD analyses). As shown in Figure 1, Sky™ liners are significantly more inert than comparable liners from Agilent, showing 3-4 times less endrin and DDT breakdown.

Figure 1 Endrin and DDT breakdown is significantly reduced with Sky™ liners, demonstrating higher inertness.

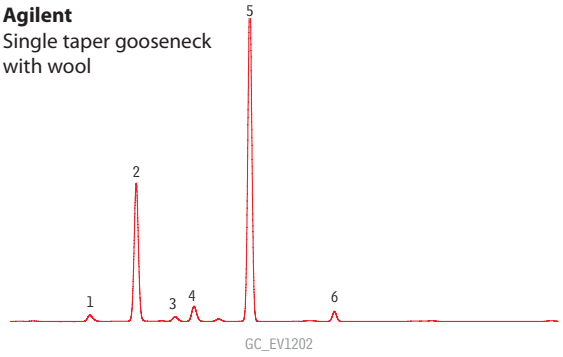
Restek Sky™ Inlet Liner
Single taper gooseneck with wool



Inert Sky™ liners reduce analyte breakdown, giving you more accurate results.

	% Breakdown	
	endrin	DDT
Restek	4.8	1.3
Agilent	16.5	4.2

Agilent
Single taper gooseneck with wool



Peaks
1. DDE*
2. Endrin
3. DDD*
4. Endrin aldehyde*
5. DDT
6. Endrin ketone*

*breakdown products

Column Rxi®-5Sil MS, 15 m, 0.25 mm ID, 0.25 µm (cat.# 13620); **Sample** endrin (50 ng/mL) and DDT (100 ng/mL) in hexane; **Injection** Inj. Vol.: 1 µL splitless (hold 0.75 min.); Liner: Comparison of Sky™ Single Taper Gooseneck Liner with Wool (cat.# 23303.5) and Agilent Single Taper Gooseneck Liner with Wool (cat.# 5062-3587); Inj. Temp.: 250 °C.

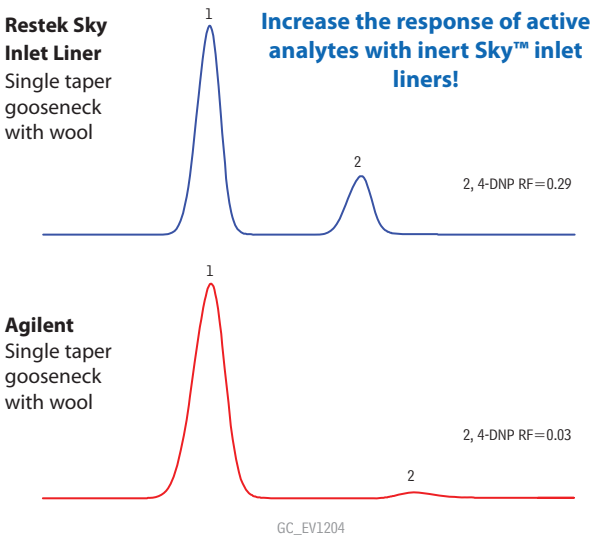
did you **know**?

Sky™ inlet liners from Restek are extensively tested to assure consistent product quality. The color and label have been shown not to interfere with analyses or contribute to background. Choose blue—the best liner for sensitive applications.

Greater Inertness Results in Higher Analyte Response

Another common probe used to illustrate inertness is 2,4-dinitrophenol (2,4-DNP), which functions as an indicator of acid compound interactions. It is used to monitor system suitability in semivolatiles methods, which benefit from the use of wool to assist in sample vaporization. As shown in Figure 2, the response of 2,4-DNP with the Sky™ inlet liner, even at low concentrations, is superior to a competitor's liner. The Agilent liner with wool has active sites that adsorb 2,4-DNP and reduce its response. In contrast an excellent response is achieved using the Sky™ liner, even in the presence of wool.

Figure 2 The state-of-the-art deactivation used for Sky™ liners with wool results in higher responses for active acid compounds, such as 2,4-DNP.



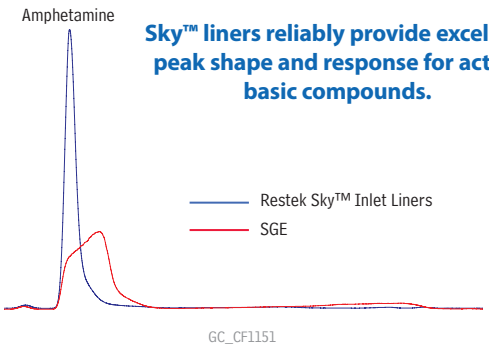
Peaks
1. Acenaphthene (IS)
2. 2,4-DNP

Column Rxi®-5Sil MS, 15 m, 0.25 mm ID, 0.25 µm (cat.# 13620); **Sample** 10 µg/mL each 2,4-dinitrophenol and acenaphthene standard in methylene chloride; **Injection** Inj. Vol.: 1 µL splitless (hold 1 min.); Liner: Comparison of Sky™ Single Taper Gooseneck Inlet Liner with Wool (cat.# 23303.5) and Agilent Single Taper Gooseneck Inlet Liner with Wool (cat.# 5062-3587); Inj. Temp.: 250 °C.

Comprehensive Deactivation Assures Excellent Peak Shape

In addition to providing excellent results for reactive pesticides and acidic compounds, Sky™ inlet liners are also highly inert to active basic compounds, such as underivatized amphetamines. The exceptional inertness of Sky™ liners produces much better peak shape than is typically seen on other liners, resulting in simpler quantification and more accurate results (Figure 3).

Figure 3 Sky™ liners are completely passivated. Even when using wool, peak shape for highly active underivatized amphetamine is excellent.



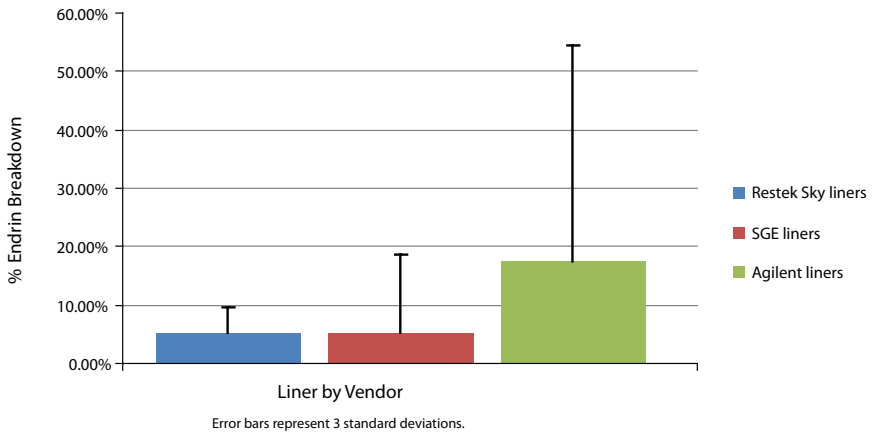
Column Rxi®-5Sil MS, 30 m, 0.25 mm ID, 0.25 µm (cat.# 13623); **Sample** ~10 µg/mL amphetamine in 1-chlorobutane; **Injection** Inj. Vol.: 1 µL splitless (hold 1 min.); Liner: Comparison of Sky™ Single Taper Gooseneck with Wool (cat.# 23303.5) and SGE Single Taper Gooseneck with Wool (cat.# 092019); Inj. Temp.: 250 °C.

Liner-to-Liner Reproducibility: A Measure of Consistent Quality

It's not good enough to have one quality liner. You have to be confident that every liner will give the same level of performance. We test Sky™ liners extensively to ensure that each one is exceptionally inert and will provide optimal results. Using endrin breakdown as a measure of reproducibility, the data in Figure 4, based on multiple lots, illustrate that Sky™ liners are more consistently inert than competitor products.

New Sky™ liners provide exceptional inertness across a wide range of active analytes. The consistent, comprehensive deactivation process results in the accuracy and precision you need for reliable trace level analyses. Simplify liner selection with Sky™ liners from Restek—**choose blue, the best choice for dependable results.**

Figure 4 Sky™ inlet liners from Restek consistently show less endrin breakdown than comparable liners from other sources.



New Sky™ inlet liners are easily recognizable for your reordering convenience. All Sky™ liners come in specially marked boxes and are packaged in ultra-clean blister packs.

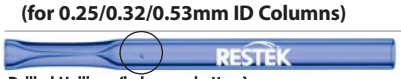
Sky™ Inlet Liners for Agilent GCs

COLUMN INSTALLS THIS END

Splitless Liners for Agilent GCs	ID OD x Length	Similar to Agilent part #	ea.	cat.#/price 5-pk.	25-pk.
 2mm Splitless	2.0mm 6.5mm x 78.5mm	5181-8818 (ea.) 5183-4703 (5-pk.) 5183-4704 (25-pk.)	23313.1	23313.5	23313.25
 2mm Splitless w/Wool	2.0mm 6.5mm x 78.5mm		23314.1	23314.5	23314.25
 2mm Single Taper Gooseneck	2.0mm 6.5mm x 78.5mm		23315.1	23315.5	23315.25
 2mm Single Taper Gooseneck w/Wool	2.0mm 6.5mm x 78.5mm		23316.1	23316.5	23316.25
 4mm Straight	4.0mm 6.3mm x 78.5mm	210-3003 (ea.) 210-3003-05 (5-pk.)	23301.1	23301.5	23301.25
 4mm Straight w/Wool	4.0mm 6.3mm x 78.5mm	19251-60540 (ea.) 5183-4691 (5-pk.) 5183-4692 (25-pk.)	23300.1	23300.5	23300.25
 4mm Single Taper Gooseneck	4.0mm 6.5mm x 78.5mm	5181-3316 (ea.) 5183-4695 (5-pk.) 5183-4696 (25-pk.)	23302.1	23302.5	23302.25
 4mm Single Taper Gooseneck w/Wool	4.0mm 6.5mm x 78.5mm	5062-3587 (ea.) 5183-4693 (5-pk.) 5183-4694 (25-pk.)	23303.1	23303.5	23303.25
 4mm Double Taper Gooseneck	4.0mm 6.5mm x 78.5mm	5181-3315 (ea.) 5183-4705 (5-pk.) 5183-4706 (25-pk.)	23308.1	23308.5	23308.25
 4mm Cyclo Double Taper Gooseneck	4.0mm 6.5mm x 78.5mm		23310.1	23310.5	23310.25

Split Liners for Agilent GCs	ID OD x Length	Similar to Agilent part #	ea.	cat.# 5-pk.	25-pk.
 4mm Straight w/Wool	4.0mm 6.3mm x 78.5mm	19251-60540 (ea.) 5183-4691 (5-pk.) 5183-4692 (25-pk.)	23304.1	23304.5	23304.25
 4mm Precision Liner w/Wool	4.0mm 6.3mm x 78.5mm	210-4004-5 (5-pk.)	23305.1	23305.5	23305.25
 4mm Cyclosplitter	4.0mm 6.3mm x 78.5mm		23312.1	23312.5	23312.25

Split/Splitless Liners for Agilent GCs	ID OD x Length	Similar to Agilent part #	ea.	cat.# 5-pk.
 Low Pressure Drop Liner w/Wool	4.0mm 6.3mm x 78.5mm		23309.1	23309.5

DI Liners for Agilent GCs (for 0.25/0.32/0.53mm ID Columns)	ID OD x Length	Similar to Agilent part #	ea.	cat.# 5-pk.	25-pk.
 Drilled Uniliner (hole near bottom)	4.0mm 6.3mm x 78.5mm	G1544-80730 (ea.)	23306.1	23306.5	
 Drilled Uniliner (hole near bottom) w/Wool	4.0mm 6.3mm x 78.5mm		23307.1	23307.5	
 Drilled Uniliner (hole near top)	4.0mm 6.3mm x 78.5mm		23311.1	23311.5	23311.25

Sky™ Inlet Liners for PerkinElmer GCs

PSS Liners for PerkinElmer GCs	ID OD x Length	Similar to PE part #	ea.	cat.# 5-pk.
 Auto SYS XL PSS Split/Splitless w/Wool	2.0mm 4.0mm x 86.2mm	N6121004	23317.1	23317.5

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Sky™ Inlet Liners for Shimadzu GCs

Split Liners for Shimadzu 17A, 2010, and 2014 GCs	ID OD x Length	Similar to Shimadzu part #	ea.	cat.# 5-pk.	25-pk.
 3.5mm Split	3.5mm 5.0mm x 95mm	221-41444-01	23318.1	23318.5	23318.25
 3.5mm Split w/Wool	3.5mm 5.0mm x 95mm		23319.1	23319.5	23319.25
 3.5mm Precision Liner w/Wool	3.5mm 5.0mm x 95mm		23320.1	23320.5	
Splitless Liners for Shimadzu 17A, 2010, and 2014 GCs	**ID OD x Length**	**Similar to Shimadzu part #**	**ea.**	**cat.# 5-pk.**	
 3.5mm Single Taper Gooseneck	3.5mm 5.0mm x 95mm	221-48335-01	23321.1	23321.5	
 3.5mm Single Taper Gooseneck w/Wool	3.5mm 5.0mm x 95mm		23322.1	23322.5	

Sky™ Inlet Liners for Thermo Scientific GCs

Split Liners for Thermo TRACE, 8000, 8000 TOP, & Focus SSL	ID OD x Length	Similar to TS part #	ea.	cat.# 5-pk.	25-pk.
 5mm Straight	5.0mm 8.0mm x 105mm	453 20030	23323.1	23323.5	23323.25
 5mm Straight w/Wool	5.0mm 8.0mm x 105mm		23324.1	23324.5	23324.25
 5mm Precision Liner w/Wool	5.0mm 8.0mm x 105mm		23327.1	23327.5	
Splitless Liners for Thermo TRACE, 8000, 8000 TOP, & Focus SSL	**ID OD x Length**	**Similar to TS part #**	**ea.**	**cat.# 5-pk.**	**25-pk.**
 5mm Splitless	5.0mm 8.0mm x 105mm	453 20033	23325.1	23325.5	23325.25
 5mm Splitless w/Wool	5.0mm 8.0mm x 105mm		23326.1	23326.5	23326.25

Sky™ Inlet Liners for Varian GCs

Liners for Varian 1177 S/SL Injection Ports	ID OD x Length	Similar to Varian part #	ea.	cat.# 5-pk.	
 4mm Split Liner w/Glass Frit	4.0mm 6.3mm x 78.5mm		23330.1	23330.5	
 4mm Precision Liner w/Wool	4.0mm 6.3mm x 78.5mm		23328.1	23328.5	
 4mm Single Taper Gooseneck	4.0mm 6.5mm x 78.5mm	392611927	23331.1	23331.5	
 4mm Single Taper Gooseneck w/Wool	4.0mm 6.5mm x 78.5mm	392611936	23332.1	23332.5	
Liners for Varian 1078/1079 Injection Ports	**ID OD x Length**	**Similar to Varian part #**	**ea.**	**cat.# 5-pk.**	**25-pk.**
 3.4mm Split–No Frit	3.4mm 5.0mm x 54mm	392611945	23329.1	23329.5	23329.25

COLUMN INSTALLS THIS END

RESTEK

ISO 9001:2008 cert.# FM80397

Lit. Cat.# GNFL1323