

THE RESTEK ADVANTAGE

Turning Visions into Reality

2004 vol. 4

Fast, Sensitive GC Analyses of Semivolatile Organics in Water

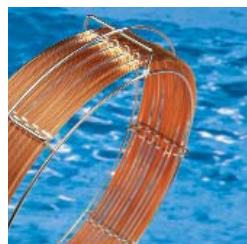
Using an 0.18mm ID Rtx®-XLB Column

new!

by Christopher English, Environmental Innovations Chemist

- Extremely low bleed—ideal for GC/MS applications.
- Excellent resolution, high sensitivity for semivolatile compounds in water.
- Stable to 340°C.

A single analysis of semivolatile organic compounds in water, performed according to US EPA Method 8270D or other GC/MS methods, can involve 100 or more analytes having widely diverse chemical properties and reactivity. This complexity puts stringent demands on the column used to perform the analysis. Some analytes elute at high temperatures, for example, so column bleed must be low at high temperature. The column also must exhibit excellent efficiency,



to resolve closely eluting compounds with similar mass spectra, and overcome challenges to high sensitivity and low detection limits, for reliable quantification of all target compounds.

In *Advantage* 2004v2 (literature #59037) we showed how a 20m, 0.18mm ID, 0.18 μ m df Rtx®-5Sil MS column (cat.# 42702) offers excellent selectivity, improves detection limits, and increases productivity in an analysis of a complex mixture of EPA Method 8270 semivolatile compounds. Here, we show equally notable results from our ultra-low-bleed Rtx®-XLB column, in equivalent dimensions, under equivalent conditions.

A 20m, 0.18mm ID, 0.18 μ m df Rtx®-XLB column (cat.# 42802) is an excellent choice for analyzing semivolatile compounds. The Rtx®-XLB stationary phase is specifically designed for the demanding GC/MS analysis of semivolatiles, and these columns exhibit extremely low bleed. Figure 1 (page 3) is a chromatogram for nearly 90 analytes and surrogates, at 2.5ng each on-

column, showing excellent resolution and negligible baseline rise at 330°C. The short length and small internal diameter of these columns ensure faster runtimes, increasing productivity: the last compound elutes in less than 18 minutes. The thin phase film allows satisfactory resolution of structural isomers benzo(b)fluoranthene and benzo(k)fluoranthene in this very short analysis time. Peak shape and response are excellent for active compounds such as pyridine (peak 1), 2,4-dinitrophenol (peak 54), and pentachlorophenol (peak 66); even at this low concentration, all compounds can be quantified with high accuracy.

The temperature program, as well as the physical dimensions of the column, contributes to better resolution of closely eluting peaks and shortens the analysis time. The column accommodates the 330°C final temperature very well,

Rtx®-XLB Columns (fused silica)

(proprietary low-polarity phase)

ID	df (μ m)	temp. limits	12-Meter	20-Meter	25-Meter
0.18mm	0.18	30 to 340/360°C		42802	
0.20mm	0.33	30 to 340/360°C	42815		42820
ID	df (μ m)	temp. limits*	15-Meter	30-Meter	60-Meter
0.25mm	0.10	30 to 340/360°C		12808	
	0.25	30 to 340/360°C	12820	12823	12826
	0.50	30 to 340/360°C		12838	
0.32mm	1.00	30 to 340/360°C	12850	12853	
	0.10	30 to 340/360°C		12809	
	0.25	30 to 340/360°C	12821	12824	12827
0.53mm	0.50	30 to 340/360°C		12839	
	1.00	30 to 340/360°C		12854	
	1.50	30 to 340/360°C	12867	12870	

*Maximum temperatures listed are for 15- and 30-meter lengths. Longer lengths may have a slightly reduced maximum temperature.

Chromatography on page 3

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because our QA bleed specification for Rtx®-XLB columns, including the new 0.18mm ID, 0.18 μ m df column, is less than 6pA at 340°C.

Optimization of injection conditions also is an important consideration in this analysis. To reduce solvent effects with pyridine and N-nitrosodimethylamine we chose to use a splitless injection liner. (cont. on page 3)

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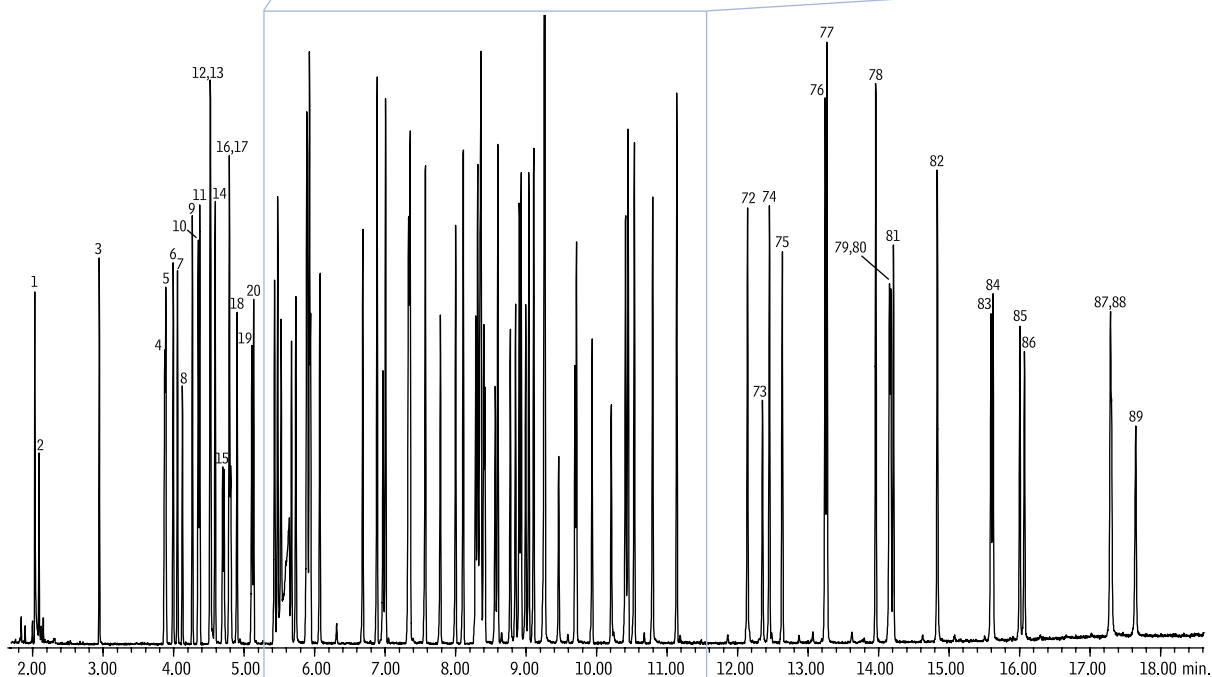
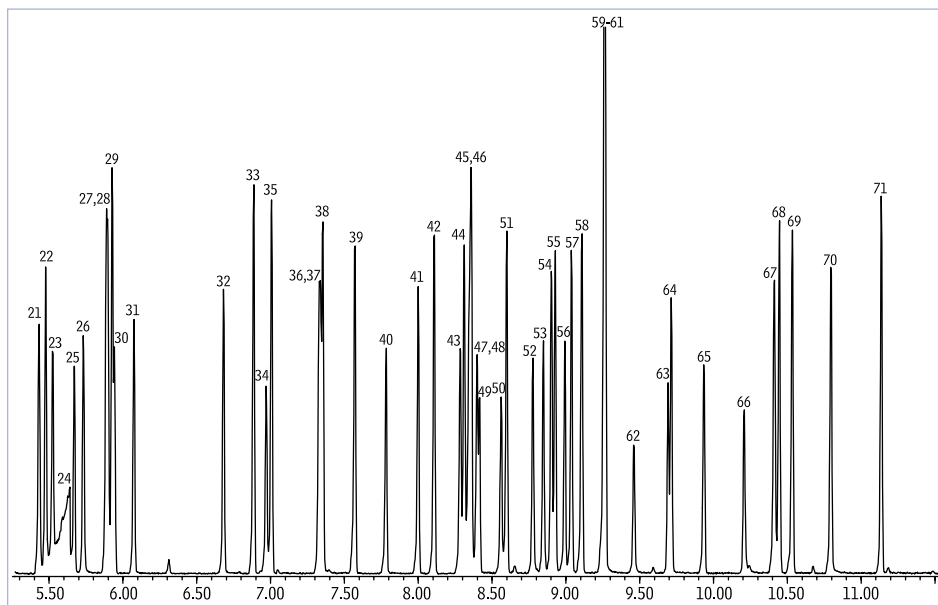
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Figure 1

70 semivolatiles organics, plus surrogates, separated in less than 18 minutes on a 0.18mm ID Rtx®-XLB column.

Rtx®-XLB, 20m, 0.18mm ID, 0.18µm (cat.# 42802)
 Sample: US EPA Method 8270D mix:
 8270 MegaMix™ (cat.# 31850),
 benzoic acid (cat.# 31415),
 benzidine (cat.# 31441),
 2,4-dinitrophenol (cat.# 31291),
 Acid Surrogate Mix (4/89 SOW)
 (cat.# 31063),
 B/N Surrogate Mix (4/89 SOW)
 (cat.# 31062)
 Inj.: 0.5µL, 5ppm each analyte
 (2.5ng on column) (2.5ppm/1.25ng
 on column for 3-methylphenol and
 4-methylphenol)
 2mm splitless cyclo double
 gooseneck injector liner
 (cat.# 20907);
 splitless hold time 0.15 min.;
 pressure pulse: 0.20 min. @30psi
 GC: Agilent 6890
 Inj. temp.: 270°C
 Carrier gas: helium
 Flow rate: 1.2mL/min., constant flow
 Oven temp.: 40°C (hold 0.5 min.) to 90°C @
 14°C/min. (no hold) to 330°C @
 22°C/min. (hold 1 min.)
 Det.: Agilent 5973 GC/MS
 Transfer line
 temp.: 280°C
 Scan range: 35–550 amu
 Solvent delay: 1 min.
 Tune: DFTPP
 Ionization: EI



GC_EV00747

- | | | | | |
|---------------------------------|--------------------------------|-------------------------------|---------------------------------|--------------------------------|
| 1. pyridine | 19. nitrobenzene-d5 | 38. 2-fluorobiphenyl | 57. 4-chlorophenyl phenyl ether | 76. butyl benzyl phthalate |
| 2. N-nitrosodimethylamine | 20. nitrobenzene | 39. 2-chloronaphthalene | 58. fluorene | 77. bis(2-ethylhexyl)adipate |
| 3. 2-fluorophenol | 21. isophorone | 40. 2-nitroaniline | 59. diphenylamine | 78. bis(2-ethylhexyl)phthalate |
| 4. phenol-d6 | 22. 2,4-dimethylphenol | 41. dimethylphthalate | 60. 4-nitroaniline | 79. benzo(a)anthracene |
| 5. phenol | 23. 2-nitrophenol | 42. acenaphthylene | 61. azobenzene | 80. chrysene-d12 |
| 6. aniline | 24. benzoic acid | 43. 2,6-dinitrotoluene | 62. 2,4,6-tribromophenol | 81. chrysene |
| 7. 2-chlorophenol | 25. bis(2-chloroethoxy)methane | 44. acenaphthene-d10 | 63. 4,6-dinitro-2-methylphenol | 82. di-n-octyl phthalate |
| 8. bis(2-chloroethyl)ether | 26. 4-dichlorophenol | 45. 1,4-dinitrobenzene | 64. 4-bromophenyl phenyl ether | 83. benzo(b)fluoranthene |
| 9. 1,3-dichlorobenzene | 27. 1,2,4-trichlorobenzene | 46. acenaphthene | 65. hexachlorobenzene | 84. benzo(k)fluoranthene |
| 10. 1,4-dichlorobenzene-d4 | 28. naphthalene-d8 | 47. 1,3-dinitrobenzene | 66. pentachlorophenol | 85. benzo(a)pyrene |
| 11. 1,4-dichlorobenzene | 29. naphthalene | 48. 3-nitroaniline | 67. phenanthrene-d10 | 86. perylene-d12 |
| 12. 1,2-dichlorobenzene | 30. hexachlorobutadiene | 49. 1,2-dinitrobenzene | 68. phenanthrene | 87. indeno(1,2,3-cd)pyrene |
| 13. benzyl alcohol | 31. 4-chloroaniline | 50. 4-nitrophenol | 69. anthracene | 88. dibenzo(a,h)anthracene |
| 14. 2-methylphenol | 32. 4-chloro-3-methylphenol | 51. dibenzofuran | 70. carbazole | 89. benzo(ghi)perylene |
| 15. bis(2-chloroisopropyl)ether | 33. 2-methylnaphthalene | 52. 2,3,4,6-tetrachlorophenol | 71. di-n-butylphthalate | |
| 16. hexachloroethane | 34. hexachlorocyclopentadiene | 53. 2,3,5,6-tetrachlorophenol | 72. fluoranthene | |
| 17a. 4-methylphenol | 35. 1-methylnaphthalene | 54. 2,4-dinitrophenol | 73. benzidine | |
| 17b. 3-methylphenol | 36. 2,4,6-trichlorophenol | 55. diethyl phthalate | 74. pyrene | |
| 18. N-nitroso-di-n-propylamine | 37. 2,4,5-trichlorophenol | 56. 2,4-dinitrotoluene | 75. p-terphenyl-d14 | |

A cyclo double gooseneck splitless liner allowed the samples to be completely volatilized in the injection port prior to transfer into the column, and achieved more reproducible results than standard straight splitless liners. A liner with an internal diameter of 2mm worked best with 0.5µL injections. We found that changing the splitless hold time by several seconds could reduce sensitivity by 50%. A pulsed splitless analysis using a pressure pulse 5psi higher than the column backpressure dramatically improved sample transfer onto the column. We extended the pulse 3 seconds (0.05 min.) past the splitless hold time (0.15 min.) to allow excess solvent to be swept away quickly.

We adjusted GC conditions to resolve analytes that coelute and share ions. Phenol and aniline, for example (peaks 5 and 6), were resolved by using an initial ramp rate of 14°C/ min. The key to resolving benzo(b)fluoranthene from benzo(k)fluoranthene (peaks 83 and 84) is to

ensure that these analytes elute during the temperature ramp part of the program. If they elute during the final hold time they tend to exhibit band broadening, which affects resolution.

Six reference mixes, including 8270 MegaMix™ calibration mix, were combined to prepare the sample for the analysis in Figure 1. We have carefully determined the components of the MegaMix™ calibration mix for maximum stability. We use highly purified methylene chloride as the solvent, to avoid possible reactions between analytes and trace impurities in the solvent. Because 3-methylphenol and 4-methylphenol coelute, we include each in the MegaMix™ mix at half the concentration of the other components, to enable the user to calibrate at lower levels to quantify these compounds at the required limits. N-nitrosodiphenylamine, a target compound in Method 8270D, readily oxidizes to diphenylamine and nitric oxide, a highly reactive gas that can participate in many chemical reactions or act as

a catalyst for other oxidation and reduction reactions in the mix. Consequently, we include diphenylamine, rather than N-nitrosodiphenylamine, in the 8270 MegaMix™ mix, to prevent degradation of other components within the mix. Another target compound, diphenylhydrazine, also oxidizes easily, forming azobenzene, so we include azobenzene, not diphenylhydrazine, in the 8270 MegaMix™ mix to assure stability. The stability of an unopened ampul of 8270 MegaMix™ mix, 18 months, is determined by real-time analysis. In addition to the best choice for analytical column, and stable calibration mixtures, we also have available internal standards, surrogate standards, and other reference mixes recommended for analyses of semivolatiles.

If you are analyzing for semivolatile compounds by a GC/MS method, we recommend you evaluate a 0.18mm ID Rtx®-XLB column, and Restek reference mixes, for highest productivity and most reliable data.

8270 MegaMix™ (76 components)

acenaphthene	2,4-dinitrophenol
acenaphthylene	2,4-dinitrotoluene
aniline	2,6-dinitrotoluene
anthracene	di- <i>n</i> -butyl phthalate
azobenzene	di- <i>n</i> -octyl phthalate
benzo(a)anthracene	diphenylamine
benzo(a)pyrene	fluorene
benzo(b)fluoranthene	fluoranthene
benzo(ghi)perylene	hexachlorobenzene
benzo(k)fluoranthene	hexachlorobutadiene
benzyl alcohol	hexachlorocyclopentadiene
benzyl butyl phthalate	hexachloroethane
bis 2-ethylhexyl adipate	indeno(1,2,3- <i>cd</i>)pyrene
bis(2-chloroethoxy)methane	isophorone
bis(2-chloroethyl)ether	1-methylnaphthalene
bis(2-chloroisopropyl)ether	2-methylnaphthalene
bis(2-ethylhexyl)phthalate	2-methylphenol
4-bromophenyl phenyl ether	3-methylphenol*
carbazole	4-methylphenol*
4-chloroaniline	naphthalene
4-chloro-3-methylphenol	2-nitroaniline
2-chloronaphthalene	3-nitroaniline
2-chlorophenol	4-nitroaniline
4-chlorophenyl phenyl ether	nitrobenzene
chrysene	2-nitrophenol
dibenzo(a,h)anthracene	4-nitrophenol
dibenzofuran	N-nitrosodimethylamine
1,2-dichlorobenzene	N-nitroso-di- <i>n</i> -propylamine
1,3-dichlorobenzene	pentachlorophenol
1,4-dichlorobenzene	phenanthrene
2,4-dichlorophenol	phenol
diethyl phthalate	pyrene
dimethyl phthalate	pyridine
2,4-dimethylphenol	2,3,4,6-tetrachlorophenol
1,2-dinitrobenzene	2,3,5,6-tetrachlorophenol
1,3-dinitrobenzene	1,2,4-trichlorobenzene
1,4-dinitrobenzene	2,4,5-trichlorophenol
4,6-dinitro-2-methylphenol	2,4,6-trichlorophenol



Acid Surrogate Mix (4/89 SOW)

Each	5-pk.	10-pk.
2-fluorophenol	2,4,6-tribromophenol	
phenol-d6		
2,000µg/mL each in methanol, 1mL/ampul		
31025	31025-510	—
	w/data pack	
31025-500	31025-520	31125
10,000µg/mL each in methanol, 1mL/ampul		
31063	31063-510	—
	w/data pack	
31063-500	31063-520	31163
10,000µg/mL each in methanol, 5mL/ampul		
31087	31087-510	—
	w/data pack	
31087-500	31087-520	31187

B/N Surrogate Mix (4/89 SOW)

Each	5-pk.	10-pk.
2-fluorobiphenyl	p-terphenyl-d14	
nitrobenzene-d5		
1,000µg/mL each in methylene chloride, 1mL/ampul		
31024	31024-510	—
	w/data pack	
31024-500	31024-520	31124
5,000µg/mL each in methylene chloride, 1mL/ampul**		
31062	31062-510	—
	w/data pack	
31062-500	31062-520	31162
5,000µg/mL each in methylene chloride, 5mL/ampul**		
31086	31086-510	—
	w/data pack	
31086-500	31086-520	31186

**Requires warming and sonication before use.

Benzoic Acid

Each	5-pk.	10-pk.
31415	31415-510	—
	w/data pack	
31415-500	31415-520	31515

Benzidine

Each	5-pk.	10-pk.
31441	31441-510	—
	w/data pack	
31441-500	31441-520	31541

Inlet Liners

For Agilent GCs



Cyclo Double Gooseneck

(2.0mm ID, 6.5mm OD, 78.5mm length)
20907 (ea.)
20908 (5-pk.)

For PerkinElmer GCs



Splitless

(2.0mm ID, 5.0mm OD, 100mm length)
20730 (ea.)
20731 (5-pk.)
20732 (25-pk.)

For Thermo Finnigan 5000-6000 GCs



Splitless

(2.0mm ID, 5.4mm OD, 79.5mm length)
20811 (ea.)
20812 (5-pk.)
20813 (25-pk.)

For Varian 1075/1077GCs



Splitless

(2.0mm ID, 6.3mm OD, 74mm length)
20721 (ea.)
20722 (5-pk.)
20723 (25-pk.)

2,4-Dinitrophenol

Each	5-pk.	10-pk.
31291	31291-510	—
	w/data pack	
31291-500	31291-520	31391

Siltek™ and Silcosteel®-CR Treated Fittings and Tubing for Demanding Applications

by Gary Barone, Restek Performance Coatings Division

- Siltek™ treatment for exceptional inertness.
- Silcosteel®-CR treatment for protection from acids or seawater.
- Treated surfaces will not chip, flake, or delaminate.
- Custom treatment available.

Siltek™ and Silcosteel®-CR Treated Swagelok® Fittings

Swagelok® fittings are world-renowned for meeting demanding standards. Now, a wide selection of Swagelok® products, available from stock with Restek's unparalleled surface treat-



Restek
Performance
Coatings

ments, set the highest standards for inertness and corrosion resistance.

Siltek™ treated fittings ensure ultimate inertness, and are the ideal choice for systems used to collect, store, and trans-

fer active compounds.* The most reactive sample components can be retained in a Siltek™ treated system: even at parts-per-billion levels, sulfur-containing compounds, chlorinated pesticides, or other very active compounds exhibit virtually no adsorption. And, unlike coatings, the protective layer produced by Siltek™ or other Restek treatments is integral with the surface - it will not chip, flake, or delaminate, not even in the most stressful applications.

Silcosteel®-CR treatment is highly effective protection for stainless steel exposed to hydrochloric acid, nitric acid, or sulfuric acid, or to marine environments. In independent tests, Silcosteel®-CR treatment upgraded the corrosion resistance of 300-grade stainless steel by an order of magnitude (Table 1) and totally protected samples against crevice corrosion (Figure 1).

If you need to construct a tubing system for a demanding application, you will not find more suitable fittings than the Siltek™ and Silcosteel®-CR treated Swagelok® fittings listed on page 5. If you already have the components of your sys-

tem, or need unusual parts, Siltek™, Silcosteel®-CR, or other Restek surface treatments can be applied to these parts on request. For information, contact our Technical Service chemists or your Restek representative.

Siltek™ and Silcosteel®-CR Treated Electropolished Stainless Steel Tubing
Restek also sets the highest standard of inertness for transfer tubing for analytical and process applications. The near-mirror finish inside our electropolished tubing (surface roughness of only 5-7 micro-inches), in combination with our unequalled surface treatments, ensures superior inertness or greatly enhanced corrosion resistance. We can provide continuous coils of treated 1/8" tubing up to 100 feet/30.5m long, or coils of 1/4" tubing up to 300 feet/91.4m long; these lengths of treated electropolished tubing are not available anywhere else.

Extremely inert, Siltek™ treated tubing is ideal in systems used for transferring active sulfur-containing compounds, for testing automotive exhaust or sampling stack gas, for process monitoring, or in any other application in which a representative sample of chemically active compounds must be transferred without loss.

In systems used to transfer hydrochloric, nitric, or sulfuric acid, or seawater, Silcosteel®-CR treated electropolished stainless steel tubing will last longer and require less maintenance than untreated tubing. Table 1 and Figure 1 show Silcosteel®-CR treated stainless steel is



Restek Surface
Technology Earns R&D
100 Award

Our newest surface treatment, Silcosteel®-UHV, has been recognized by a panel of independent judges and editors of R&D Magazine as one of the 100 most technologically significant products introduced in 2003. Silcosteel®-UHV treatment minimizes the migration of water and oxygen molecules from the surfaces of ultra high vacuum system components into the vacuum chamber, allowing the system to be evacuated much more quickly, with less costly pumping equipment.

very well protected from both pitting and crevice corrosion, compared to untreated stainless steel.

Total Protection

For maximum inertness, we recommend a sample transfer system constructed from Restek treated electropolished stainless steel tubing and Restek treated Swagelok® fittings. To find out how these components can improve the reliability of your data, and/or minimize costly, time-consuming maintenance, contact our Technical Service Group (ext. 4), or your Restek representative, and speak with our surface treatment experts.



*Siltek™ treatment is the multiple-purpose equivalent to Sulfinert® treatment, the surface we apply specifically to systems used to collect, store, and transfer active sulfur-containing compounds.

New Publication Features Restek Surface Technology

Learn more about our precisely applied, highly durable surface treatments: request our new 38-page brochure today (lit. cat.# 59493), or review it on our [new](#) Performance Coatings Division website:

www.restekcoatings.com

Table 1 Silcosteel®-CR treated stainless steel coupons show little weight loss after exposure to 6% w/w ferric chloride solution.

Sample	Weight Loss (g/m ²)
Silcosteel®-CR	19
Silcosteel®-CR	25
Silcosteel®-CR	25
Bare Steel	231
Bare Steel	20
Bare Steel	228

Figure 1 Silcosteel®-CR treated 316L stainless steel coupons show no crevice corrosion and only slight pitting corrosion; untreated coupons exhibit severe crevice corrosion.



Silcosteel®-CR treated



untreated

Fittings from Swagelok®

- Siltek™ treatment ensures ultimate inertness.
- Silcosteel®-CR treatment enhances corrosion resistance tenfold, or more.
- Custom treatment available for other Swagelok® fittings or other system parts.

Fitting Type	Size	Similar to Swagelok® #	Siltek™		Silcosteel®-CR	
			qty.	cat.#	qty.	cat.#
Union	1/16"	SS-100-6	ea.	22540	ea.	22575
	1/8"	SS-200-6	ea.	22541	ea.	22576
	1/4"	SS-400-6	ea.	22542	ea.	22577
Tee	1/16"	SS-100-3	ea.	22543	ea.	22578
	1/8"	SS-200-3	ea.	22544	ea.	22579
	1/4"	SS-400-3	ea.	22545	ea.	22580
Reducing Union	1/8" to 1/16"	SS-200-6-1	ea.	22546	ea.	22581
	1/4" to 1/16"	SS-400-6-1	ea.	22547	ea.	22582
	1/4" to 1/8"	SS-400-6-2	ea.	22548	ea.	22583
Elbow	1/8"	SS-200-9	ea.	22549	ea.	22584
	1/4"	SS-400-9	ea.	22550	ea.	22585
Port Connector	1/8"	SS-201-PC	ea.	22557	ea.	22592
	1/4"	SS-401-PC	ea.	22558	ea.	22593
	3/8" tube to 1/4"	SS-401-PC-2	ea.	22559	ea.	22594
Male Connector	1/8" to 1/8" NPT	SS-200-1-2	ea.	22561	ea.	22595
	1/4" to 1/4" NPT	SS-400-1-4	ea.	22562	ea.	22596
	3/16" to 3/8" NPT	SS-100-1-2	ea.	22563	ea.	22610
	1/8" to 1/4" NPT	SS-200-1-4	ea.	22564	ea.	22611
	1/4" to 3/8" NPT	SS-400-1-2	ea.	22565	ea.	22612
Female Connector	3/8" to 1/8" NPT	SS-200-7-2	ea.	22566	ea.	22613
	1/4" to 1/4" NPT	SS-400-7-4	ea.	22567	ea.	22614
	1/4" to 3/8" NPT	SS-400-7-2	ea.	22568	ea.	22615
	3/8" to 1/4" NPT	SS-200-7-4	ea.	22569	ea.	22616
Female Connector	1/8"	SS-200-61	ea.	22570	ea.	22617
	1/4"	SS-400-61	ea.	22571	ea.	22618



Internal surface smoothness in stainless steel tubing: a smoother surface is less adsorptive. Top: electropolished finish, surface roughness average number: 5-10. Bottom: conventional finish, surface roughness average number: approx. 23-27.

Silcosteel®-CR-Treated Electropolished Tubing

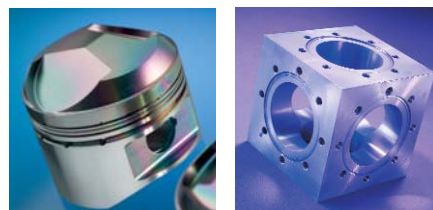
ID	OD	cat.#	5-24 ft.	25-99 ft.	100-299 ft.	> 300 ft.
0.085"	1/8"	22536				
0.180"	1/4"	22537				

Siltek™-Treated Electropolished Tubing

ID	OD	cat.#	5-24 ft.	25-99 ft.	100-299 ft.	> 300 ft.
0.085"	1/8"	22538				
0.180"	1/4"	22539				

1/8" OD: 5 ft. to 100 ft. in one continuous coil; 1/4" OD: 5 ft. to 300 ft. in one continuous coil. Longer lengths will be more than one coil.

Note: (required length in meters) x (3.2808) = length in feet.



did you know?

Restek surface treatments are not only used in analytical chemistry.

Silcosteel®

A general-purpose passivation layer for steel and stainless steel. U.S. patent 6,511,760.

Silcosteel®-AC

Dramatically reduces carbon buildup on stainless steel components. U.S. patent 6,444,326.

Silcosteel®-CR

A corrosion resistant layer that increases the life-time of system components in acidic environments containing hydrochloric acid, nitric acid, sulfuric acid, or seawater. Patent pending.

Silcosteel®-UHV

Greatly reduces outgassing from components of ultra-high vacuum systems. Patent pending.

Siltek™

The ultimate passivation for treated components, from glass to high nickel alloys of steel. U.S. patent 6,444,326.

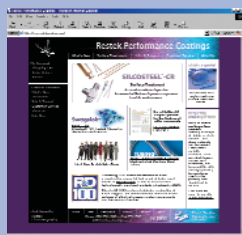
Sulfinert®

A required treatment for metal components when analyzing for parts-per-billion levels of organo-sulfur compounds. U.S. patent 6,444,326.

Performance Coatings Division Website Now Up and Running!

www.restekcoatings.com

- Descriptions and performance information about our innovative surface treatments.
- Frequently-asked questions.
- Bibliography of technical articles discussing surface passivation.
- Restek literature to download or request by mail.
- Stock treated tubing, fittings, and other items.
- Electronic custom request form.



We welcome your comments and suggestions! Discover our capabilities here, then give us your toughest surface activity problems, and let us do what "cannot be done" for you.

Above-Ambient GSC Analysis of Permanent Gases and Light Hydrocarbons

Using ShinCarbon ST Micropacked Columns

by Barry Burger, Petroleum Chemist, and Gary Stidsen, GC Columns Marketing Manager

- Rapid separations, including CO/CO₂, without cryogenics.
- Minimal baseline rise with GC/GSC detectors.
- Fast stabilization - ready to use in 30 minutes.

ShinCarbon ST, a high surface area carbon molecular sieve (~1500 m²/g), is the GSC medium of choice for gases and highly volatile compounds. A 2-meter, 1mm ID ShinCarbon ST micropacked column separates the permanent gases in about 10 minutes, without cryogenic cooling (Figure 1), and separates permanent gas / light hydrocarbon mixtures quickly and effectively (Figure 1). Additional applications for ShinCarbon ST include natural gas (Figure 2), sulfur dioxide, and Freon® fluorocarbons (Figure 3).*

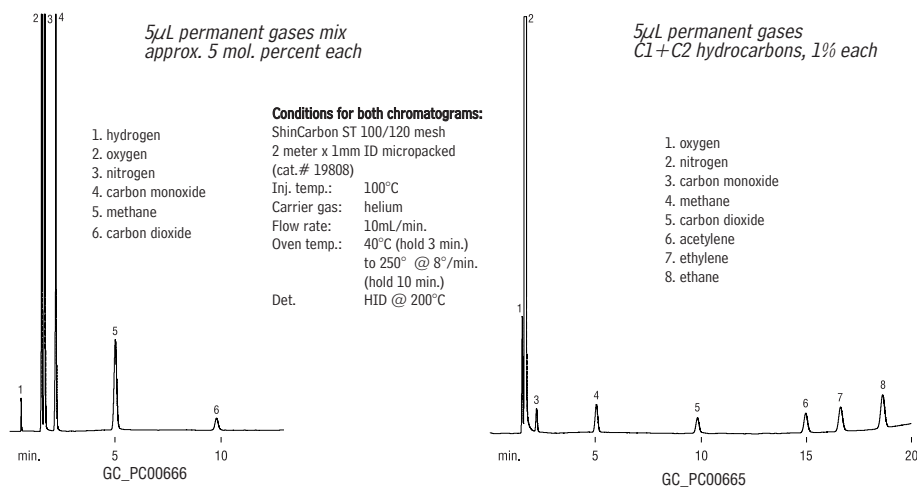
ShinCarbon ST is highly stable. A 330°C upper temperature limit ensures minimal bleed and baseline rise during temperature programming and makes the material compatible with most

detection systems used for gas analysis, including TCDs and HIDs. ShinCarbon ST columns are conditioned in an oxygen/moisture free environment to minimize stabilization time (less than 30 minutes) when installing a new column.

ShinCarbon ST columns eliminate the temperature and bleed problems that can complicate analyses of permanent gases, light hydrocarbons, and other highly volatile compounds, and provide excellent resolution and analysis times for these applications. Micropacked columns and 2-meter, 2mm ID packed columns are available from stock; custom columns are available on request.

Figure 1

Rapidly separate permanent gases or permanent gas / light hydrocarbon mixtures, without cryogenic cooling, on a ShinCarbon ST micropacked column.



ShinCarbon ST 100/120 Micropacked Columns (Silcosteel®-treated stainless steel)

OD	ID	1-Meter	2-Meter
1/8"	1.0mm	19809	19808
0.95mm	0.75mm	19810	—

ShinCarbon ST 80/100 Packed Columns (Silcosteel®-treated stainless steel)

OD	ID	2-Meter**
1/8"	2.0mm	80486-

Installation Kits for Micropacked Columns

	for 0.75mm ID col.	for 1mm ID col.
For valve applications	21062	21065
For split applications	21063	—
For all Agilent GCs	21064	—
For direct injections	—	21066



Refer to our catalog or website for Scott gas standards for permanent gases and light hydrocarbons

Figure 2
Monitor components of natural gas on a ShinCarbon ST micropacked column.

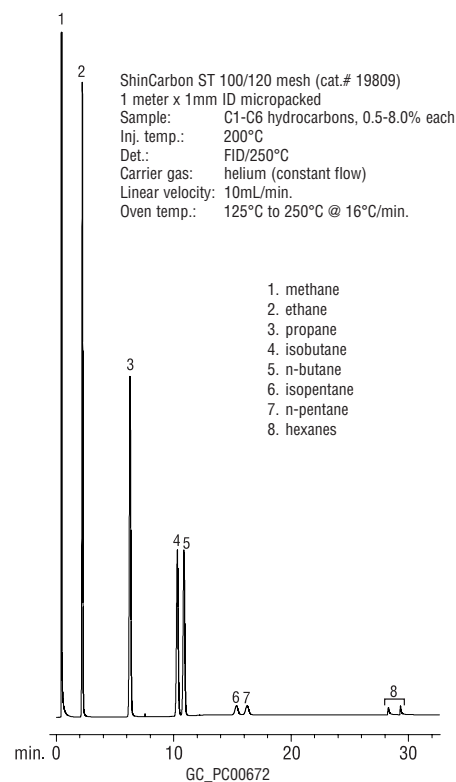
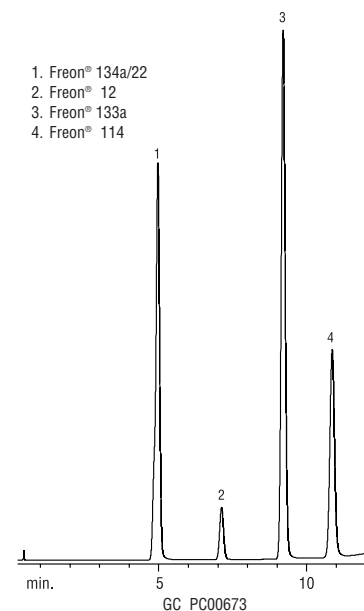


Figure 3

Fluorocarbons separated in 11 minutes on a ShinCarbon ST column.



ShinCarbon ST 100/120 mesh (cat.# 19809)
 1 meter x 1mm ID micropacked
 Sample: 5µL, ~1-3% each
 Inj. temp.: 200°C
 Det.: FID/250°C
 Carrier gas: helium
 Linear velocity: 10mL/min.
 Oven temp.: 125°C to 320°C @ 16°C/min.

*For a chromatogram of a sulfur dioxide analysis, visit our website or request publication 59519A.

** Refer to our catalog or website for available configurations.

Redesigned Rt-QPLOT™ GSC Columns

For Improved Inertness, Reproducibility, and Column Lifetime

by Barry Burger, Petroleum Chemist

- Sharp peaks and excellent resolution for alcohols.
- Effective particle bonding eliminates the need for particle traps.
- Stable to 310°C, for effective reconditioning.

The most common mode of gas chromatography, gas-liquid chromatography (GLC), has limitations in analyses of gases and highly volatile analytes. Subambient temperatures often are required in these applications, and cryogenic cooling systems are costly and inconvenient. In gas-solid chromatography (GSC) these small molecules are absorbed into the pore structure of the packing material, which provides strong retention and unique selectivity. By this approach, difficult-to-separate gaseous or highly volatile analytes can be separated at above ambient temperatures.

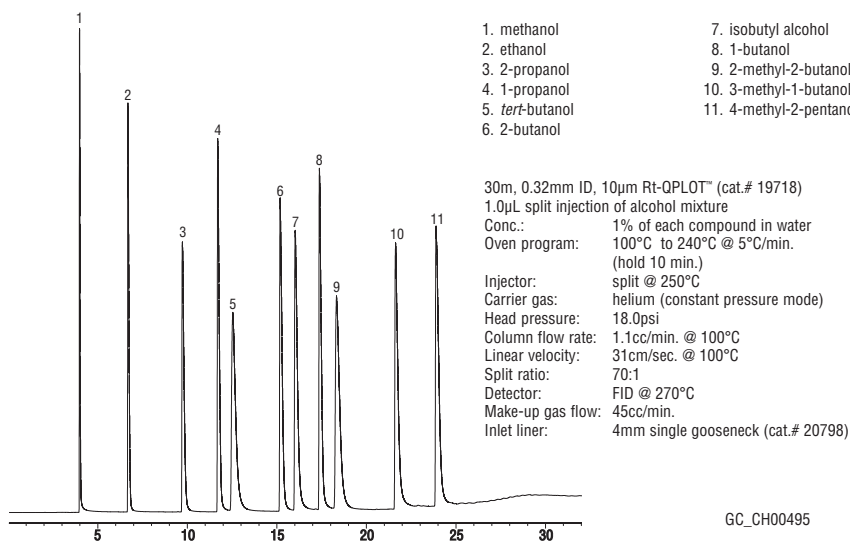
Just as capillary columns offer advantages over packed GLC columns, porous layer open tubular columns—PLOT columns—offer significant advantages over packed GSC columns. PLOT columns provide faster and more sensitive analyses. Their open design gives PLOT columns greater permeability, and their narrow diameter

ensures sharper peaks. The open construction affords a smaller pressure drop per unit length, so longer columns can be used. This means much higher column efficiency and, therefore, superior resolution.

Rt-QPLOT™, Rt-SPLOT™, and Rt-UPLOT™ columns are porous polymer based PLOT columns that incorporate polar functional groups in a styrene/divinylbenzene matrix. The least polar of these, the nonpolar Rt-QPLOT™ columns, are made with divinylbenzene. Rt-QPLOT™ columns are well suited to a wide variety of ambient-temperature analyses, including hydrocarbon mixtures and solvents. An Rt-QPLOT™ column is an excellent choice for analyzing alcohols (Figure 1) or polar solvents (Figure 2). Additional separations on Rt-QPLOT™ columns are in the GC Applications section of our catalog (Permanent Gases, Hydrocarbon Gases, and Solvents sub-sections), and on our website.

Figure 1

Sharp peaks and excellent resolution of alcohols on an Rt-QPLOT™ column.



Why Use RESTEK PLOT Columns?

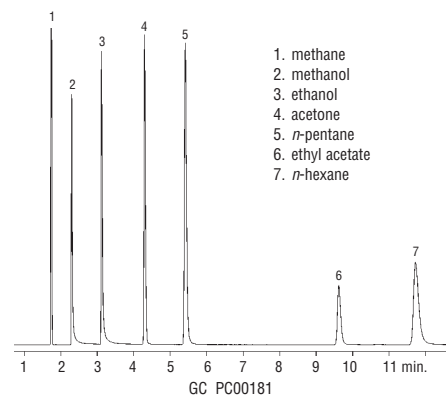
1. Uniform, highly consistent porous materials, for the most efficient and consistent analyses.
2. Advanced manufacturing technology and demanding quality assurance ensure highly reproducible quality.
3. Choice of alumina, three porous polymers, and molecular sieve—you can perfectly match a column to your application.
4. Highly efficient particle bonding - no loose particles to enter your system, no need for particle traps.

An Rt-QPLOT™ column requires no particle trap and exhibits minimum bleed (<20pA at 310°C). Unlike alumina or molecular sieve PLOT columns, porous polymer PLOT columns are unaffected by moisture, and thus are particularly useful for applications in which water is likely to be part of the sample.

We think you will find the performance, column lifetime, and reproducibility of our PLOT columns superior to any other PLOT columns available.

Figure 2

Fast, baseline resolution of polar and nonpolar solvents on an Rt-QPLOT™ column.



30m, 0.32mm ID Rt-QPLOT™ PLOT (cat.# 19718)
 20µL split injection, 50ppm (w/v) each in helium with a Cyclosplitter® liner (cat.# 20755)

Oven temp.: 150°C
 Inj./det. temp.: 200°C
 Carrier gas: hydrogen
 Det.: FID
 Split ratio: 20/1

Rt-QPLOT™ PLOT Columns (fused silica)

(divinylbenzene)

ID	df (µm)	temp. limits	15-Meter	30-Meter
0.32mm	10	to 310°C	19717	19718
0.53mm	20	to 310°C	19715	19716

For performance and ordering information for Rt-SPLOT™ and Rt-UPLOT™ columns, refer to our catalog or website.

New Analytical Reference Materials in 2004

by Katia May, Ph.D., Senior R&D Chemist

- Environmental mixes: volatiles - semivolatiles - pesticides/herbicides - petroleum products.
- Miscellaneous mixes: deactivation reagent - drinking water odor standard.
- Custom mixes and packaging always available.

Restek's chemists worked hard during 2004 to introduce many new reference mixes. For your convenience, we've listed them all here, because they are not included in our 2004 general catalog. They also are available on our website. Look for many more new Restek mixes in 2005.

Volatile Organics

Drinking Water VOA MegaMix™, 524.2

Rev. 4.1 (73 components)

Each	5-pk.	10-pk.
2,000µg/mL each in P&T methanol, 1mL/ampul		
30601	30601-510	—
w/data pack		
30601-500	30601-520	30701

Ketones Mix, 524.2 Rev. 4.1

acetone 2-hexanone
2-butanone (MEK) 4-methyl-2-pentanone (MIBK)
1,1-dichloro-2-propanone

Each	5-pk.	10-pk.
5,000µg/mL each in 90% P&T methanol:10% water, 1mL/ampul		
30602	30602-510	—
w/data pack		
30602-500	30602-520	30702

524 Internal Standard/Surrogate Mix

Each	5-pk.	10-pk.
2,000µg/mL each in P&T methanol, 1mL/ampul		
30201	30201-510	—
w/data pack		
30201-500	30201-520	30301

524.2 Surrogate Standard

Each	5-pk.	10-pk.
2,000µg/mL in P&T methanol, 1mL/ampul		
30607	30607-510	—
w/data pack		
30607-500	30607-520	30707

Volatiles MegaMix™ with Gases

(60 components)

Each	5-pk.	10-pk.
200µg/mL each in P&T methanol, 1mL/ampul		
30603	30603-510	—
w/data pack		
30603-500	30603-520	30703

Formaldehyde-DNPH Mix

Each	5-pk.
500µg/mL in acetonitrile, 1mL/ampul	
31837	31837-510

free literature

Optimizing the Analysis of Volatile Organic Compounds

72-page guide to analyzing volatile compounds in environmental samples, with many example chromatograms. An excellent resource for the new or experienced analyst. Request lit. cat.# 59887A from your Restek representative.

Semivolatile Organics

8270 MegaMix™ (76 components)

Each	5-pk.	10-pk.
1,000µg/mL each (except where noted) in methylene chloride, 1mL/ampul		
31850	31850-510	—
w/data pack		
31850-500	31850-520	31950

*3-methylphenol and 4-methylphenol concentration is 500µg/mL.
†1,2-diphenylhydrazine (8270-listed analyte) decomposes to azobenzene (mix component).

‡N-nitrosodiphenylamine (8270-listed analyte) decomposes to diphenylamine (mix component).

8270 Matrix Spike Mix (76 components)
same list as 8270 MegaMix™ above

Each	5-pk.	10-pk.
200µg/mL each in methylene chloride, 5mL/ampul**		
31851	31851-510	—
w/data pack		
31851-500	31851-520	31951

**3-methylphenol and 4-methylphenol concentration is 100µg/mL.

1,4-Dioxane

Each	5-pk.	10-pk.
2,000µg/mL in methylene chloride, 1mL/ampul		
31853	31853-510	—
w/data pack		
31853-500	31853-520	31953

8270 Benzidines Mix

Each	5-pk.	10-pk.
2,000µg/mL in methylene chloride, 1mL/ampul		
31852	31852-510	—
w/data pack		
31852-500	31852-520	31952

PAH Mixes

EPA Method 8310 Quality Control Check*

(18 components)

acenaphthene	100µg/mL	dibenzo(a,h)anthracene	10
acenaphthylene	100	fluoranthene	10
anthracene	100	fluorene	100
benzo(a)anthracene	10	indeno(1,2,3-cd)pyrene	10
benzo(a)pyrene	10	1-methylnaphthalene	100
benzo(b)fluoranthene	10	2-methylnaphthalene	100
benzo(g)h)perylene	10	naphthalene	100
benzo(k)fluoranthene	5	phenanthrene	100
chrysene	10	pyrene	10

Each	5-pk.	10-pk.
In acetonitrile, 1mL/ampul		
31843	31843-510	—
	w/data pack	
31843-500	31843-520	31943

Sonicate before using.

EPA Method 8310 PAH Mixture*

acenaphthene	dibenzo(a,h)anthracene
acenaphthylene	fluoranthene
anthracene	fluorene
benzo(a)anthracene	indeno(1,2,3-cd)pyrene
benzo(a)pyrene	1-methylnaphthalene
benzo(b)fluoranthene	2-methylnaphthalene
benzo(g)h)perylene	naphthalene
benzo(k)fluoranthene	phenanthrene
chrysene	pyrene

Each	5-pk.	10-pk.
500µg/mL each in acetonitrile, 1mL/ampul		
31841	31841-510	—
	w/data pack	
31841-500	31841-520	31941

Sonicate before using.

EPA Method 8310 Surrogate Standard

decafluorobiphenyl

Each	5-pk.	10-pk.
1,000µg/mL in acetonitrile, 1mL/ampul		
31842	31842-510	—
	w/data pack	
31842-500	31842-520	31942

Phthalate and Adipate Mixes

506 Laboratory Performance Check Mix

benzyl butyl phthalate	250µg/mL	di-n-octyl phthalate	650
bis(2-ethylhexyl)adipate	1200	diethylphthalate	100
bis(2-ethylhexyl)phthalate	250	dimethylphthalate	100
di-n-butylphthalate	100		

Each	5-pk.	10-pk.
In P&T methanol, 1mL/ampul		
31844	31844-510	—
	w/data pack	
31844-500	31844-520	31944

506 Calibration Mix

benzyl butyl phthalate	di-n-octyl phthalate
bis(2-ethylhexyl)adipate	diethylphthalate
bis(2-ethylhexyl)phthalate	dimethylphthalate
di-n-butylphthalate	

Each	5-pk.	10-pk.
1,000µg/mL in isoctane, 1mL/ampul		
31845	31845-510	—
	w/data pack	
31845-500	31845-520	31945



Why choose Restek reference mixes?

- Carefully formulated for dependability and long shelf life.
- Convenient, economical one-stop shopping: columns, supplies, reference mixes.
- Plus 1[™] service, always.

Pesticide and Herbicide Mixes

Phenylurea Pesticide Mixture

diflufenzuron	propanil
diuron	siduron
fluometuron	tebuthiuron
linuron	thidiazuron

Each	5-pk.	10-pk.
200µg/mL each in acetonitrile:acetone, 1mL/ampul		
32434	32434-510	—
	w/data pack	
32434-500	32434-520	32534

Phenylurea Surrogate Mixture

carbazole	monuron
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Each	5-pk.	10-pk.
500µg/mL each in methanol:acetonitrile, 1mL/ampul		
32433	32433-510	—
	w/data pack	
32433-500	32433-520	32533

531.2 Carbamate Pesticide Calibration Mixture

aldicarb	methiocarb
aldicarb sulfone	methomyl
aldicarb sulfoxide	1-naphthol
carbaryl (sevin)	oxamyl
carbofuran	propoxur (baygon)
3-hydroxycarbofuran	

Each	5-pk.	10-pk.
100µg/mL in acetonitrile, 1mL/ampul		
32435	32435-510	—
	w/data pack	
32435-500	32435-520	32535

Paraquat & Diquat Calibration Mix

diquat dibromide	paraquat dichloride
------------------	---------------------

Each
1,000µg/mL each in water, 1mL/ampul
32437
w/data pack
32437-500

Ultra Quat Reagent Solution

Each	10-pk.
In water, 20mL/ampul	
32441	32541

Petroleum Reference Standards

MA VPH Standard with Surrogate (Revised)

benzene	n-nonane (C9)
n-butylcyclohexane	n-pentane (C5)
n-decane (C10)	toluene
2,5-dibromotoluene	1,2,4-trimethylbenzene
ethylbenzene	2,2,4-trimethylpentane (isooctane)
2-methylpentane	m-xylene
methyl tert-butyl ether (MTBE)	o-xylene
naphthalene	p-xylene

Each	5-pk.	10-pk.
10,000µg/mL in P&T methanol, 1mL/ampul		
30604	30604-510	—
	w/data pack	
30604-500	30604-520	30704

MA VPH Matrix Spike Mix with Surrogate (Revised)

benzene	n-nonane (C9)
n-butylcyclohexane	n-pentane (C5)
n-decane (C10)	toluene
2,5-dibromotoluene	1,2,4-trimethylbenzene
ethylbenzene	2,2,4-trimethylpentane (isooctane)
2-methylpentane	m-xylene
methyl tert-butyl ether (MTBE)	o-xylene
naphthalene	p-xylene

Each	5-pk.	10-pk.
50µg/mL in P&T methanol, 1mL/ampul		
30605	30605-510	—
	w/data pack	
30605-500	30605-520	30705

Hydraulic Oil Standard

Each	5-pk.	10-pk.
50,000µg/mL in methylene chloride, 1mL/ampul		
31839	31839-510	—
	w/data pack	
31839-500	31839-520	31939

Creosote Oil Standard

Each	5-pk.	10-pk.
50,000µg/mL in methylene chloride, 1mL/ampul		
31838	31838-510	—
	w/data pack	
31838-500	31838-520	31938

Other Mixes

Dimethyldichlorosilane (DMDCS)

Each	5-pk.
Neat, 20mL/ampul	
31840	31840-510

Drinking Water Odor Standard

(+/-)-geosmin	2-methylisoborneol
---------------	--------------------

Each	5-pk.
100µg/mL in P&T methanol, 1mL/ampul	
30608	30608-510

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fax (814-355-2895),
visit our website, or contact your Restek representative.

Pinnacle™ DB Base-Deactivated HPLC Columns

Effective Replacements for Hypersil® BDS Columns

by Rebecca Wittrig, Ph.D., HPLC Product Marketing Manager,
and Vernon Bartlett, HPLC Innovations Team Manager

- Sharp, symmetric peaks for basic analytes.
- Excellent reproducibility, column-to-column and lot-to-lot.
- Chromatography equivalent to Hypersil® BDS material.

With Pinnacle™ DB base-deactivated silica, we have created an exceptional material for analyses of basic compounds, matching or exceeding the chromatographic performance of Hypersil® BDS material. Pinnacle™ DB silica and bonded phase packings are made through efficient processes that ensure reproducible performance and reliable stock levels—we ship 90% of all analytical columns ordered within 24 hours.

In Figure 1, peak symmetry for the basic compound pyridine is noticeably better on the Pinnacle™ DB C18 column than on a typical Type B C18 column, and the analysis time is shorter by more than 30%. You can expect similar results if you make your own comparisons. Figure 2 shows how closely matched the important physical characteristics of particle size and pore size distribution are for Pinnacle™ DB and Hypersil® BDS materials. Physical/chemical characteristics of Pinnacle™ DB packings are listed in Table I.

For certain physical parameters - most notably, metals content - we intentionally deviate from Hypersil® BDS material, as Figure 3 shows. The major difference in sodium content is especially important, as metal ions on the surface of silica particles negatively affect peak symmetry and

otherwise interfere with chromatography, particularly for basic analytes. But, there is another important problem with silicas that have a high metal content, especially sodium—they are structurally inferior to silicas containing lesser amounts of metals. To strengthen silica particles containing high concentrations of sodium, some manufacturers use an annealing process to embed the sodium into the framework of the particles. Although annealing imparts strength to the particles, it destroys some of their useable surface area. And, as the particles age or crack, embedded ions are re-exposed. Deactivation for bases is lost, and stability in highly aqueous mobile phases erodes.

Our manufacturing process strips metals and other impurities from the silica surface. By removing metals, rather than covering them, we make a more rugged silica that does not need annealing to impart strength. Peak shapes for bases are more consistent as the column ages, and the potential lifetime for a Pinnacle™ DB column is longer. Also, large pores (140Å) make Pinnacle™ DB material an excellent choice when you want to shorten analysis time.

But - how do separations on Pinnacle™ DB columns and Hypersil® BDS columns compare? The chromatograms in Figures 4 and 5 are

analyses of a base/neutral test mix and an acid/base test mix, respectively. Behavior of each of these analytes will vary, based on differences in carbon load, ligand density, degree of base deactivation, endcapping, and exposed metals. Columns that are similar for these characteristics should provide similar chromatography, and Figures 4 and 5 show Pinnacle™ DB C18 columns and Hypersil® BDS columns perform nearly identically.

If you are looking for rugged, high-quality columns for analyzing basic compounds, or as replacements for Hypersil® BDS columns, and you want them supplied quickly and reliably, Pinnacle™ DB columns are the ideal answer. In addition to the product quality you expect, you'll receive Plus 1™ service and prompt, expert technical help when you deal with Restek.

Table I

Physical/chemical characteristics of Pinnacle™ DB packings.

Particle:	5µm, spherical
Pore size:	140Å
Pore volume:	0.65mL/g
Carbon load:	C18—11%
	C8—6%
	Cyano—4%

Figure 1

Superior peak symmetry for pyridine, and a faster analysis, on a Pinnacle™ DB column.

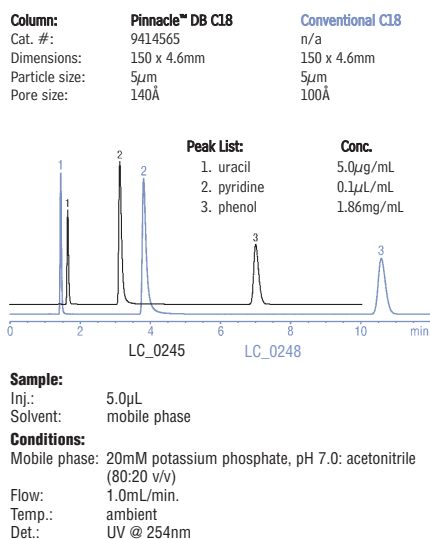


Figure 2

Physical characteristics of Pinnacle™ DB silica and Hypersil® BDS silica are remarkably similar.

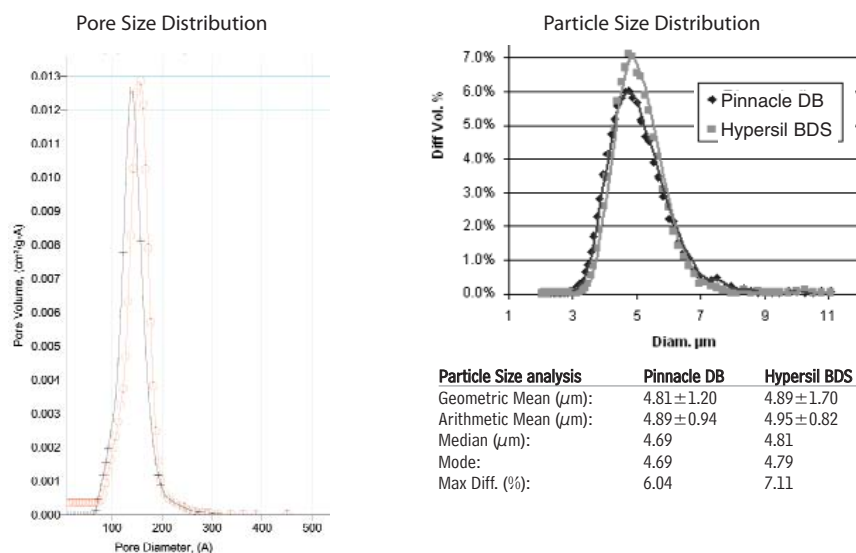


Figure 3

Low metals content in Pinnacle™ DB silica ensures sharper, more symmetric peaks for basic analytes.

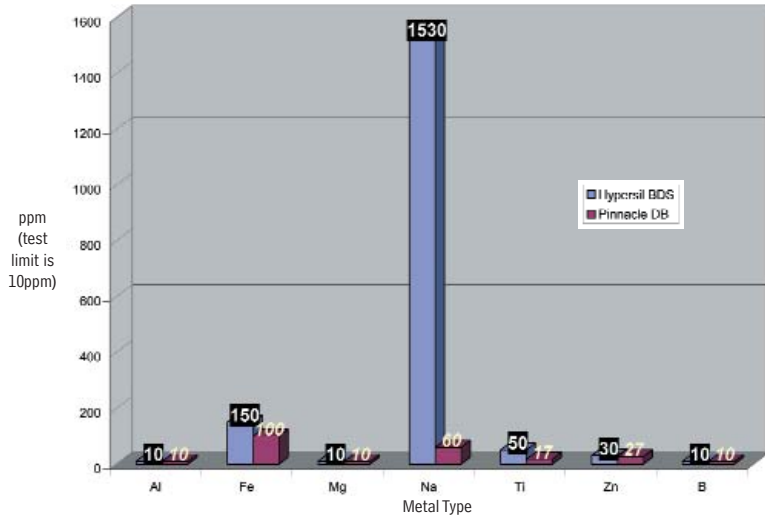
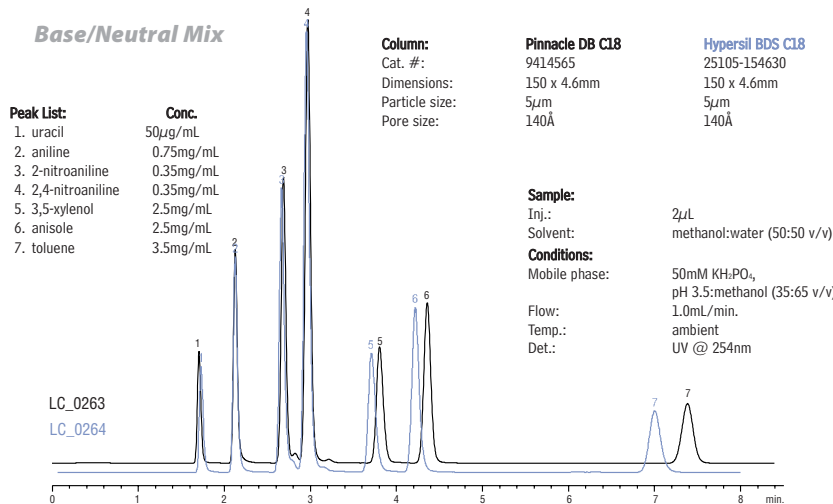


Figure 4

Pinnacle™ DB columns and Hypersil® BDS columns provide nearly identical retention, peak symmetry, and efficiency.



Pinnacle™ DB Columns

The Pinnacle™ DB column line includes silica and C18, C8, and cyano bonded phases. Other phases and particle sizes are available on request.

Pinnacle™ DB C18 (USP L1), 5µm

	1.0mm ID	2.1mm ID	3.2mm ID	4.6mm ID
Length	cat.#	cat.#	cat.#	cat.#
30mm	9414531	9414532	9414533	9414535
50mm	9414551	9414552	9414553	9414555
100mm	9414511	9414512	9414513	9414515
150mm	9414561	9414562	9414563	9414565
200mm	9414521	9414522	9414523	9414525
250mm	9414571	9414572	9414573	9414575

Pinnacle™ DB C8 (USP L7), 5µm

	1.0mm ID	2.1mm ID	3.2mm ID	4.6mm ID
Length	cat.#	cat.#	cat.#	cat.#
30mm	9413531	9413532	9413533	9413535
50mm	9413551	9413552	9413553	9413555
100mm	9413511	9413512	9413513	9413515
150mm	9413561	9413562	9413563	9413565
200mm	9413521	9413522	9413523	9413525
250mm	9413571	9413572	9413573	9413575

Pinnacle™ DB Cyano (USP L10), 5µm

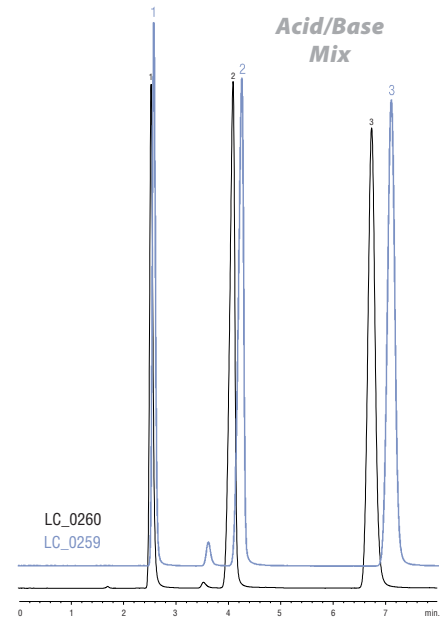
	1.0mm ID	2.1mm ID	3.2mm ID	4.6mm ID
Length	cat.#	cat.#	cat.#	cat.#
30mm	9416531	9416532	9416533	9416535
50mm	9416551	9416552	9416553	9416555
100mm	9416511	9416512	9416513	9416515
150mm	9416561	9416562	9416563	9416565
200mm	9416521	9416522	9416523	9416525
250mm	9416571	9416572	9416573	9416575

Pinnacle™ DB Silica (USP L3), 5µm

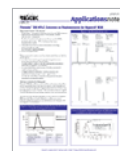
	1.0mm ID	2.1mm ID	3.2mm ID	4.6mm ID
Length	cat.#	cat.#	cat.#	cat.#
30mm	9410531	9410532	9410533	9410535
50mm	9410551	9410552	9410553	9410555
100mm	9410511	9410512	9410513	9410515
150mm	9410561	9410562	9410563	9410565
200mm	9410521	9410522	9410523	9410525
250mm	9410571	9410572	9410573	9410575

Figure 5

Pinnacle™ DB columns and Hypersil® BDS columns provide nearly identical retention, peak symmetry, and efficiency.



Column:	Pinnacle™ DB C18	Hypersil® BDS C18
Cat #:	9414565	25105-154630
Dimensions:	150 x 4.6mm	150 x 4.6mm
Particle size:	5µm	5µm
Pore size:	140Å	140Å



for more info

To see additional performance comparisons, request *Pinnacle™ DB HPLC Columns as Replacements for Hypersil® BDS* (lit. cat.# 59742).

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by Donna Lidgett, GC Accessories Product Marketing Manager

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SGE Syringes for Agilent 1090 & 1100 LC Autosamplers

- Termination: 1/4-32 UNF thread



Volume	SGE			Restek	
	Model	cat.#	qty.	cat.#	
25µL	25D-HP1090-GT	003670	ea.	22290	
250µL	250D-HP1090-GT	006670	ea.	22291	

SGE Syringe for Hitachi LC Autosamplers

- Termination: M10x1 thread



Volume	SGE			Restek	
	Model	cat.#	qty.	cat.#	
500µL	500C-HITACHI	007660	ea.	22292	

SGE Syringes for PerkinElmer LC Autosamplers

- Termination: 1/4-28 UNF thread



Volume	SGE			Restek	
	Model	cat.#	qty.	cat.#	
50µL	50D-CX-GT	004995	ea.	22295	
100µL	100D-CX-GT	005990	ea.	22296	
250µL	250D-CX-GT	006995	ea.	22297	
500µL	500D-CX-GT	007995	ea.	22298	
1mL	1MD-C-GT	008185	ea.	22299	

SGE Syringes for Waters™ WISP® LC Autosamplers

- Termination: 1/4-28 UNF thread



Volume	SGE			Restek	
	Model	cat.#	qty.	cat.#	
25µL	25D-WISP	003990	ea.	22293	
250µL	250D-WISP	006690	ea.	22294	

Hamilton Syringes for Waters™ WISP® LC Autosamplers

- Teflon® PTFE-tipped plunger

Volume	Hamilton			Restek	
	Model	cat.#	qty.	cat.#	
25µL	1702	80020	ea.	24528	
250µL	1725	80024	ea.	24529	



free literature

Genuine Restek
Replacement Parts for
HPLC Systems

Defective parts can cause poor chromatography and shorten column lifetimes. Use Restek check valves, pump piston seals, detector lamps, and other parts to keep your Agilent, Beckman, Hitachi, PerkinElmer, Shimadzu, or Waters system running smoothly and chromatographically sharp. Genuine Restek Replacement Parts equal or exceed the performance of original equipment components.

Request lit. cat.# 59012 (4 pages).

Gas-Tight Syringes for Rheodyne® & Valco® Valves

- Teflon®-tipped plungers.
- Removable needles: point style 3 (90° tip); 2"/51mm.
- Replaceable syringe barrels, plungers, and plunger tips.

Hamilton Syringes

10µL syringe: 26s needle

All others: 22s needle



Volume	Hamilton		
	Model	cat.#	Restek
10µL	1701	21260	
25µL	1702	21261	
50µL	1705	21262	
100µL	1710	21263	
250µL	1725	21264	

SGE Syringes

Needle gauge: 22



Volume	SGE			Restek	
	Model	cat.#	qty.	cat.#	
10µL	10R-GT-LC	24866			
25µL	25R-GT-LC	24867			
50µL	50R-GT-LC	24868			
100µL	100R-GT-LC	24869			
250µL	250R-GT-LC	24870			
500µL	500R-GT-LC	24871			

For many more HPLC and GC syringes, request our catalog or visit our website.

Super-Clean™ Gas Trapping System for LC/MS

Quick-Change Cartridge System for Removing Hydrocarbon Impurities from Nitrogen

by Donna Lidgett, Purus™ Gas Systems Product Marketing Manager

- “Quick connect” fittings, for easy, leak-tight cartridge changes—no tools required to install the traps.
- Spring-loaded check valves—no loosening/tightening fittings each time you change a cartridge.
- No oxygen introduced during filter change-outs—decreases down time.
- Cartridges pre-purged with inert gas—saves time.
- Durable, patented full glass/metal design—combines safety and impermeability.

High-Purity Outlet Gas

Outlet Gas Purity %	Maximum Pressure	Estimated Filter Lifetime
99.9999%	11 bar/159psi	3 to 6 months

The Super-Clean™ Gas Trapping System is the latest technology in cartridge-style gas filtration for removing hydrocarbons from nitrogen, and is ideal for use in LC/MS systems. The cartridge-based system makes changing filters quick and easy. A two-position baseplate (1/4" fittings), installed in the gas line, allows cartridges to be exchanged without introducing oxygen into the system. Spring-loaded check valves seal when a cartridge is removed and open only when a new cartridge has been locked in place. There is no need for loosening and tightening fittings every time you change cartridges, and your system cannot become contaminated during the changing process.

To meet the high flow needs of the LC/MS system, the incoming gas stream is split equally between the two charcoal-filled cartridges, and the two streams are rejoined after purification but before the gas exits the base plate. This approach allows longer contact between the nitrogen and the adsorbent, ensuring higher gas purity and eliminating a potential source of contaminants to your analyses. The system delivers flows of up to 20L of hydrocarbon-free nitrogen per minute.

A handy date wheel, included with the system, indicates the cartridge installation date and the recommended replacement date.



20L of purified nitrogen per minute!

Super-Clean™ Gas Trapping System for LC/MS

Description	qty.	cat.#
Super-Clean™ Gas-Trapping System (2-position base plate, 2 charcoal filters)	ea.	22062
2-Position Base Plate	ea.	22060
Replacement Charcoal Filters	2-pk.	22061

Replacement O-Rings for Cartridge Baseplates

Pack includes 10 large O-rings and 10 small O-rings.



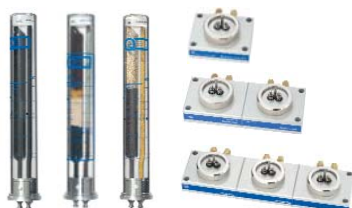
Description	qty.	cat.#
Replacement O-Rings for Cartridge Baseplates	20-pk.	22023

1/8-Inch to 1/4-Inch Tube-End Unions

To adapt the 1/8" baseplate fittings to 1/4", use these 1/8" to 1/4" tube-end unions.



Description	qty.	cat.#
1/8" to 1/4" Tube-End Unions	5-pk.	21833



For descriptions of Super-Clean™ systems for GC, request our catalog or visit our website.



free literature

HPLC Columns and Accessories

General-purpose and unique special-purpose columns, guard columns, column kits, and bulk materials, of course, but also instrument parts, innovative tools, accessories, and many example chromatograms. Our four silica bases have characteristics tailored to meet specific analytical requirements. Request lit. cat.# 59241B (100+ pages).

FID Jets for Agilent Equipment

Performance Equivalent to Original Manufacturer's Parts

by Donna Lidgett, GC Accessories Product Marketing Manager

Standard Version:

- Fluted tip to guide the capillary column into the jet.
- Threads specially coated for easy installation and removal.
- Special processing ensures the highest degree of cleanliness.

High Performance Version:

- Similar to the standard version, but Siltek™ treated.
- Extremely inert—use with active compounds.

Capillary Adaptable FID Replacement Jet for Agilent 5890/6890/6850 GCs (0.011-inch ID tip)

Description	Similar to		qty.	cat.#	qty.	cat.#
	Agilent part #					
Standard	19244-80560	ea.	20670		3-pk.	20671
High-Performance Siltek™	19244-80560	ea.	20672		3-pk.	20673

Capillary Dedicated FID Replacement Jet for Agilent 6890/6850 GCs

Description	Similar to		qty.	cat.#	qty.	cat.#
	Agilent part #					
Standard	G1531-80560	ea.	21621		3-pk.	21682
High-Performance Siltek™	G1531-80560	ea.	21620		3-pk.	21683

Packed Column Replacement Jets for Agilent 5890/6890/6850 GCs

0.018-Inch ID	Similar to		qty.	cat.#	qty.	cat.#
	Agilent part #					
Standard	18710-20119	ea.	21694		3-pk.	21695
High-Performance Siltek™	18710-20119	ea.	21696		3-pk.	21697

0.030-Inch ID	Similar to		qty.	cat.#	qty.	cat.#
	Agilent part #					
Standard	18789-80070	ea.	21688		3-pk.	21689
High-Performance Siltek™	18789-80070	ea.	21686		3-pk.	21687

FID Maintenance Kits for Agilent GCs

- Include the most common consumable supplies.
- All parts meet or exceed performance by instrument manufacturer's parts.
- Parts list makes reordering easy.

FID kits include: 1/4-inch, 0.4, 0.5, and 0.8mm ID graphite ferrules, FID/NPD capillary adaptor, capillary nuts, jet reamers/ferrule removers, 1/4-inch nut, scoring wafer, capillary column caps, ignitor for either Agilent 5890 or 6890/6850 GCs, FID flow measuring adaptor, 1/4" x 3/16-inch wrench, installation gauge, wire cleaning brush, high-performance Siltek™-treated FID jet for either Agilent 5890 or 6890/6850 GCs, 1/4-inch nut driver for jet removal.

Description	qty.	cat.#
FID Maintenance Kit for Agilent 5890 GCs	kit	21070
FID Maintenance Kit for Agilent 6890/6850 GCs	kit	21071

1/4-Inch Nut Driver

- Ideal for changing Agilent 5890/6890/6850 FID jets.
- Securely grips jet for easy removal or installation.

Description	qty.	cat.#
1/4-Inch Nut Driver	ea.	21076



tech tip

Which FID Jet Should I Use?

There are two FID jet configurations for Agilent GCs. The longer "adaptable" jet fits both 5890 and 6890 GCs, and can be used with capillary or packed columns. The shorter "dedicated" jet is for the FID in the 6890 GC that is designed only for use with capillary columns.



FID Gauge Pack

Pressure regulators and gauges for air & hydrogen. The 1/8-inch bulkhead allows easy hookup to instrument. Rated for inlet pressures to 250psi, outlet pressures of 0 to 60psi.

Description	qty.	cat.#
FID Gauge Pack	ea.	20129



COOL TOOLS!

Restek Innovations Save You Time and Money

Inlet Liner Removal Tool

- Easily remove liner from injector—no more burned fingers.
- Made from high-temperature silicone.
- Won't chip or crack the liner.



No more burned fingers!



Gently push the liner removal tool onto the liner in the injection port, with a slight circular motion.



Slowly pull the liner out of the injection port.



Place a new liner in the injection port, avoiding hot metal surfaces.

Description	qty.	cat.#
Inlet Liner Removal Tool	3-pk.	20181

Scoring Wafer with Handle

- Unique, ergonomic handle is made of soft, comfortable rubber.
- Ceramic wafer cuts both fu



Hold tubing firm hand, allowing a inches to extend Hold the scoring a 45° angle to the tubing. Exert just enough pressure to put a slight arc in the tubing. Pull perpendicular across the tubing.



the wafer.



water. Look for a clean, square cut.



Make clean, square cuts!

" some" promos / Products / Offers in the ADVNews have been since been progressively superceded / UPDATED OR Since Discontinued
 CHECK THE latest Restek ADVantage Newsletter, Restek ESSENTIALS ... Or The Restek Catalog ... Or other Restek publications for updates
www.chromtech.net.au or NEW site 2015 > www.chromalytic.net.au

Description	qty.	cat.#
Scoring Wafer with Handle	2-pk.	23015

Septum Puller

- Many uses—keep several on hand.
- Use hooked end for removing septa and O-rings; pointed end works well for removing stuck ferrules or fragments.



Easily remove septa and ferrules!



Remove septum without damaging an expensive weldment.



Dislodge a stuck ferrule quickly and easily—without scoring the fitting.

Description	qty.	cat.#
Septum Puller	ea.	20117