

**Put the power of Restek® packed columns to work for you.**

- SilcoSmooth® tubing provides the inertness of glass and the durability of stainless steel, so you get accurate results for a wide range of active compounds.
- Stable bonded stationary phases mean short conditioning times, low bleed, and long column lifetimes.
- Excellent retention time reproducibility delivers reliable, consistent results.

Packed columns offer large sample capacity and often can retain and separate compounds that cannot be analyzed by other techniques. While these advantages have resulted in their use in a wide range of GC applications, traditional packed columns are limited by unstable phases that break down easily, producing high column bleed and short column lifetimes. In addition, the tubing used for packed columns can present challenges; columns packed in glass tubing are inflexible and break easily, whereas columns made with metal tubing typically are not inert, meaning active compounds cannot be analyzed accurately as they react with metal tubing.

Restek® packed columns overcome these problems and are preferred over conventional packed columns, because they are exceptionally rugged and inert. You can generate accurate data quickly and reliably with less downtime for column changes with Restek® packed columns since they combine high-quality SilcoSmooth® tubing with stable bonded phase technology. SilcoSmooth® tubing is rugged, ultra-smooth seamless 304 stainless steel tubing that is deactivated with an innovative Siltek® treatment. This process results in packed columns that have both the inertness of glass and the strength and flexibility of stainless steel. In addition, our bonded phase technology features a coated support that is extremely stable and results in longer column lifetimes, lower bleed, and excellent reproducibility.

Put the power of Restek® packed columns to work in your lab today. We offer a broad range of common phases, as well as application-specific products developed for light hydrocarbon analysis, sulfurs, permanent gases, and ASTM Method D3606.

- Know which Restek® packed column you need? Find it on the following pages and order by web, phone, or fax today.
- Looking for an application-specific column? See what we recommend for your work on the following page.
- Need a custom column? Complete our custom product form on page 150 and we will send you a quote within two business days!

**Who says packed columns are old technology? Not Restek!**

By combining flexible SilcoSmooth® tubing with low-bleed bonded phases, we have made the most significant improvements in packed column technology in more than 25 years!

Columns available in  
0.53, 0.75, 1.0, 2.0, 2.1,  
3.2, & 5.3 mm ID.

Bonded phase packings  
decrease conditioning times  
and bleed, and increase  
column lifetime.

Columns can be configured  
for all GC models.

Silcosmooth® tubing has a Siltek®-treated  
surface, which is more inert than glass.

The most complete  
line of packing  
materials available.

### Bonded Stationary Phases

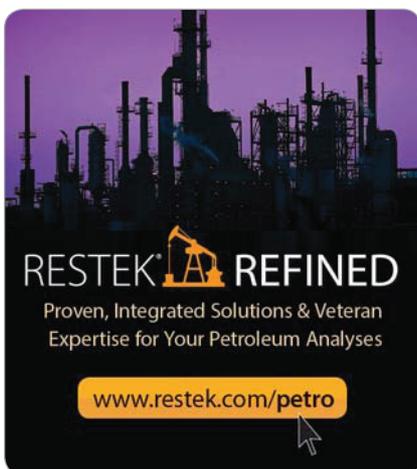
We combined our stationary phase synthesis experience with our unique Silcoport® packing deactivation process to create bonded phase packings that provide longer lifetimes, lower bleed, and shorter conditioning times.

Bonded methyl silicone phases (Rtx®-1 and Rtx®-5 columns) and bonded Carbowax® phase (Stabilwax® columns) are completely cross-linked on Silcoport® packing. We have evaluated Rtx®-1 and Rtx®-5 bonded packed column phases side-by-side with non-bonded phases of comparable polarity; the bonded phases last longer than the equivalent nonbonded packing materials. Table I shows that retention times on an Rtx®-1 bonded packed column are highly repeatable after only 30 minutes of conditioning.

**Table I:** Retention data shows the perfect reproducibility of the bonded phase packed columns with respect to retention times.

Hydrocarbon	Retention Time			
	Min.	Max.	Mean	Stand. Dev.
C5	0.241	0.243	0.242	0.001
C6	0.493	0.497	0.495	0.002
C10	5.746	5.765	5.752	0.005
C20	18.482	18.491	18.486	0.004
C28	25.093	25.103	25.098	0.004
C40	32.160	32.171	32.166	0.004
C44	34.316	34.328	34.326	0.007

n = 9 columns



### Quick Reference Chart

For specific applications, Restek recommends using these optimized columns for better method performance.

Application	Column	Feature	Benefit
ASTM Method D3606	D3606 Application Column Set, p. 138 (Column 1: 6' (1.8 m), 1/8" OD, 2.0 mm ID, Rtx-1; Column 2: 16' (4.9 m), 1/8" OD, 2.0 mm ID, proprietary packing material)	Excellent separation of ethanol and benzene.	Reliably meets method requirements.
Refinery gases	2abc Refinery Gas Column Set, p. 139  Backflush Column	Optimized three-column set. (Backflush column sold separately.)	Elutes C5 hydrocarbons before C1-C4 hydrocarbons for optimized resolution.
Unsaturated light hydrocarbons	n-Octane on Res-Sil C Column, p. 139	Unique selectivity for unsaturated hydrocarbons.	Excellent resolution of unsaturated light hydrocarbons gives increased data accuracy.
cis-2-Butene and 1,3-butadiene	OPN on Res-Sil C Column, p. 139	Optimized selectivity for cis-2-butene and 1,3-butadiene resolution.	Increases data accuracy.
Permanent gases	Shincarbon ST Columns, p. 140 Packed or micropacked	Optimized selectivity for permanent gas resolution without cryogenic cooling. Preconditioned.	Increases productivity.
Low-level sulfurs	Rt-XLSulfur Columns, p. 141 Packed or micropacked	Highly inert for ppbv levels of sulfur. Eliminates need for PTFE tubing.	Increases data accuracy for low-level sulfur analysis. Eliminates need for a special GC setup.

### Bonded Packed Column Stationary Phases

- Short conditioning times.
- Reproducible bonded phase selectivity.
- Low bleed levels.
- Longer column lifetimes.
- Unsurpassed inertness for active compounds.

Bonded phases are used in capillary columns because they provide a dramatic increase in column quality. To truly bridge the gap between traditional packed columns and capillary columns, it was necessary to develop bonded liquid phases for packed columns. Packed column chromatographers can expect shorter conditioning times, lower bleed, and longer column lifetimes by using Restek bonded phase packed columns.

Bonded phases also last much longer than nonbonded phases. Bonded phases are more resistant to oxidation than nonbonded phases because of the stronger intermolecular forces produced by cross-linking. Because the material is thoroughly cross-linked, the phase will not migrate or puddle, as often happens with nonbonded phases. Figure 1 shows a comparison of a bonded and a nonbonded methyl silicone column after 170 temperature cycles. The results show the impressive durability of bonded phases.

### Restek's packed columns deliver the 1-2-3 PUNCH!

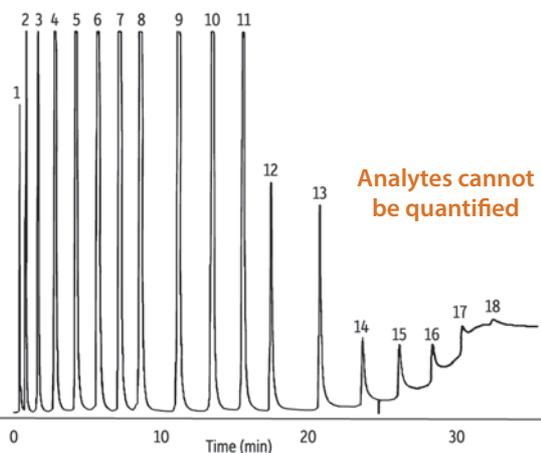
1. Bonded stationary phases mean short conditioning times, low bleed, and unsurpassed column lifetimes.
2. SilcoSmooth® tubing provides the inertness of glass and the durability of stainless steel.
3. Excellent retention time reproducibility for reliable, consistent results!

### Equivalent Liquid Phases

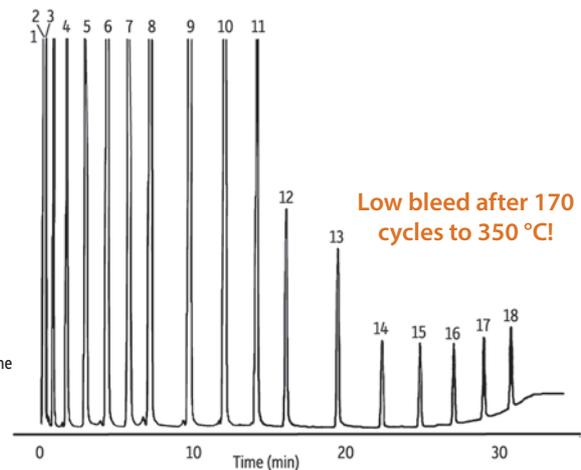
	BP-1, CC-1, CP-Sil 5CB, DB-1, DC-200, GE-SF-96, HP-1, HP-101, OV-1, OV-101,
<b>Rtx-1</b>	RSK-150, RH-1, SE-30, SP-2100, SPB-1, UCC W-98, G2, G1
<b>Rtx-5</b>	BP-5, CB-5, CC-5, CP-Sil 8CB, DB-5, HP-5, OV-73, SE-52, SE-54, SPB-5, Ultra-5, G27, G36
<b>Stabilwax</b>	BP-20, CP-Wax, CW-20, DB-Wax, HP-Innowax, PE-Wax, Supelcowax-10, G16

**Figure 1: Bonded packed columns exhibit longer lifetime than nonbonded packed columns.**

Nonbonded Methyl Silicone



Bonded Rtx®-1



- Peaks**
1. Pentane
  2. Hexane
  3. Heptane
  4. Octane
  5. Nonane
  6. Decane
  7. Undecane
  8. Dodecane
  9. Tetradecane
  10. Hexadecane
  11. Octadecane
  12. Eicosane
  13. Tetracosane
  14. Octacosane
  15. Dotricontane
  16. Hexatricontane
  17. Tetracontane
  18. Tetratetracontane

GC\_PC00369

<b>Column Sample</b>	Rtx®-1 Sim Dist 2887, SilcoSmooth® Tubing, 25 inches, 1/8 in. OD, 2 mm ID (cat.# 80000-800) 1-12% (w/w) each component ASTM D2887-01 calibration mix (1% each listed analyte in CS <sub>2</sub> ) (cat.# 31674) ASTM D2887-01 calibration mix (5% each, neat) (cat.# 31675)
<b>Injection</b>	1.0 µL packed not on-column
<b>Inj. Vol.:</b>	350 °C
<b>Inj. Temp.:</b>	
<b>Oven</b>	35 °C to 350 °C at 10 °C/min (hold 5 min)
<b>Oven Temp.:</b>	
<b>Carrier Gas</b>	He, constant flow
<b>Flow Rate:</b>	25 mL/min
<b>Detector</b>	FID @ 350 °C
<b>Notes</b>	FID sensitivity: 256 x 10 <sup>-11</sup> AFS