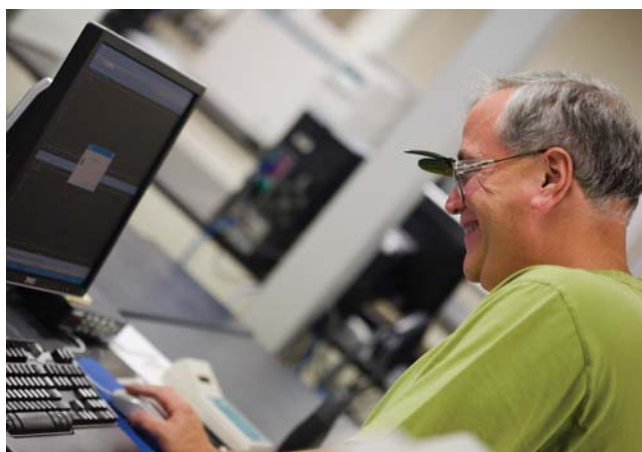


# GC COLUMNS PACKED/ MICROPACKED COLUMNS

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 Packed Column Tubing ..... 115  
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Top: Scott Grossman, Applications Chemist  
 Bottom: Glenn Gerhab, Quality Assurance

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. Silcoport™ diatomaceous earth provides unsurpassed inertness for trace analysis.

### 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 life-times, lower bleed, and shorter conditioning times.

Bonded methyl silicone phases (Rtx®-1 and Rtx®-5) and bonded Carbowax® phase (Stabilwax®) are completely cross-linked on Silcoport™ packing. We have evaluated Rtx®-1 and Rtx®-5 bonded packed column phases side-by-side with nonbonded phases of comparable polarity; the bonded phases last longer than the equivalent non-bonded 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

**Who says packed columns are old technology? Not Restek!**  
By combining flexible Siltek® 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, 2, 3.2, & 5.2mm 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 Packed Column Stationary Phases**

- Short conditioning times.
- Low bleed levels.
- Higher sensitivities.
- 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.

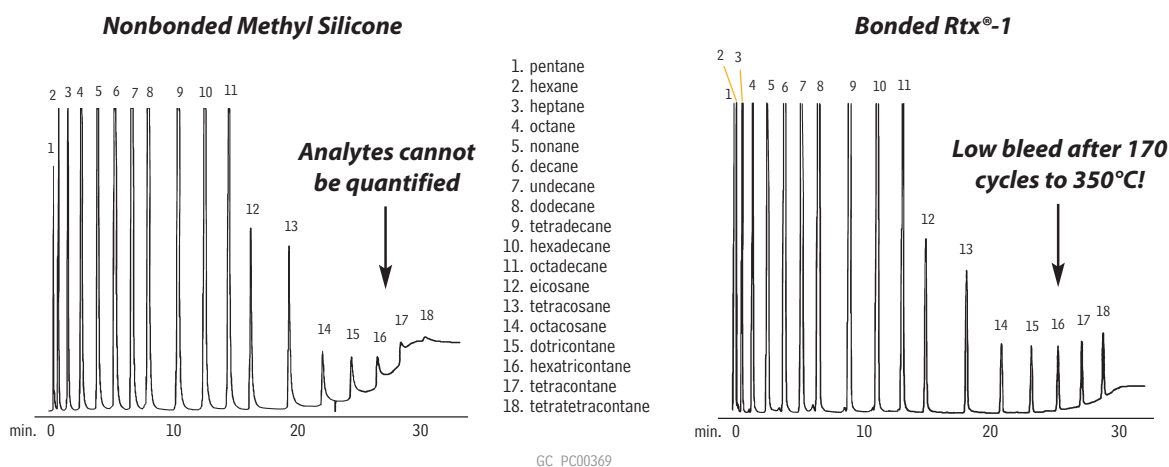
2. SilcoSmooth™ tubing provides the inertness of glass and the durability of stainless steel.

3. Silcoport™ diatomaceous earth provides unsurpassed inertness for trace analysis.

**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
<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
<b>Stabilwax</b>	BP-20, CP-Wax, CW-20, DB-Wax, HP-Innowax, PE-Wax, Supelcowax-10

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



25<sup>n</sup> x 1/8" x 2mm ID Rtx®-1 Sim Dist 2887 SilcoSmooth™ stainless steel (cat.# 80000-800)  
1.0 $\mu$ l direct injection, 1–12% (w/w) each component  
Oven temp.: 35°C to 350°C @ 10°C/min. (hold 5 min.)  
Inj. & det. temp.: 350°C  
Carrier gas: helium @ 25mL/min.  
FID sensitivity: 256 x 10<sup>-11</sup> AFS

cat.# 31674 (1% each listed analyte in CS<sub>2</sub>) and cat.# 31675 (5% each, neat) meet requirements of ASTM D2887-01.



## Packed Column Tubing

Restek offers a wide range of tubing choices for our packed columns, including SilcoSmooth™ (Siltek®-treated stainless steel), stainless steel, Hastelloy®, nickel, copper, and Teflon® tubing. SilcoSmooth™ and stainless steel tubing are our two most popular column materials. SilcoSmooth™ tubing is an excellent replacement for fragile glass columns. Stainless steel tubing works well with most applications for nonreactive compounds.

### SilcoSmooth™ Tubing

If your analysis involves reactive compounds, you can use fragile and inflexible glass columns, or you can step up to SilcoSmooth™ tubing which combines the inertness of glass with the strength and flexibility of stainless steel. Made from ultra-smooth, seamless 304 stainless steel and treated with Restek's innovative Siltek® deactivation process, SilcoSmooth™ tubing can replace glass columns for virtually any application.

### Stainless Steel Tubing

If you are analyzing hydrocarbons or nonreactive compounds, you can use our rugged, flexible, and economical stainless steel columns. Restek stainless steel columns are made from high-quality weldrawn tubing.

### Hastelloy® Tubing

Hastelloy® tubing is a nickel-chromium alloy with excellent inertness. It is normally used only for highly corrosive or oxidizing compounds or gases.

### Nickel Tubing

Nickel tubing is often used for analyses of caustic or oxidizing compounds or gases.

### Copper Tubing

Copper is a general purpose tubing that is only recommended for nonactive compounds.

### Teflon® Tubing

Teflon® tubing is often used for reactive compounds or other special applications. Note that this tubing is permeable to gases.

**Table I** Packed column tubing dimensions

Material	1/4-inch OD x 5.3mm ID	3/16-inch OD x 3.1mm ID <sup>1</sup>	1/8-inch OD x 2.0mm ID <sup>2</sup>	1/16-inch OD x 1.2mm ID <sup>3</sup>	1/16-inch OD x 1.0mm ID <sup>3</sup>	0.95mm OD x 0.75mm ID <sup>4</sup>
SilcoSmooth	✓	✓	✓		✓	✓
Stainless Steel	✓	✓	✓	✓	✓	✓
Hastelloy			✓			
Nickel			✓			
Copper	✓		✓			
Teflon			✓			

<sup>1</sup> 3/16-inch OD x 3.1mm ID replaces 1/4-inch OD x 4mm ID glass columns.

<sup>2</sup> 1/8-inch OD x 2mm ID replaces 1/4-inch OD x 2mm ID glass columns.

<sup>3</sup> 1/16-inch OD x 1.2mm and 1.0mm ID micropacked columns are designed for packed column injection systems.

<sup>4</sup> 0.95mm OD x 0.75mm ID micropacked columns are designed for capillary injection systems.

1/8- or 3/16-inch OD columns are easily adaptable to 1/4-inch or 5mm ID injection ports, using inexpensive adaptors. All Restek packed columns can be coiled to fit any instrument configuration.

## please note

We do not offer packed glass columns. SilcoSmooth™ columns offer the inertness of glass, without breakage problems.

## did you know?

Restek's advanced packed column technology provides columns with unmatched inertness and efficiency.

### Packed Column Reduction Fittings

We will weld tubing reducers or VCR fittings to your column. Call Customer Service (ext. 3), or your Restek representative, for pricing & availability.



Welded Tubing Reducers



Welded VCR Fittings

**Bonded Packed Column Stationary Phases**

- Low bleed levels.
- Longer column lifetimes.
- Short conditioning times.

Bonded Phase on 100/120 Silcoport W	L (ft.)	Stainless Steel Tubing				price	SilcoSmooth Tubing**				price
		OD (in.)	ID (mm)	cat.#**	price		L (m)	OD (in.)	ID (mm)	cat.#**	
3% Rtx-1	6	1/8	2.1	80441-		2	1/8	2	80401-		
10% Rtx-1	6	1/8	2.1	80442-		2	1/8	2	80405-		
20% Rtx-1	6	1/8	2.1	80443-		2	1/8	2	80409-		
3% Rtx-5	6	1/8	2.1	80444-		2	1/8	2	80477-		
10% Rtx-5	6	1/8	2.1	80445-		2	1/8	2	80478-		
20% Rtx-5	6	1/8	2.1	80446-		2	1/8	2	80479-		
5% Rtx-Stabilwax	6	1/8	2.1	80447-		2	1/8	2	80415-		
10% Rtx-Stabilwax	6	1/8	2.1	80448-		2	1/8	2	80416-		
20% Rtx-Stabilwax	6	1/8	2.1	80449-		2	1/8	2	80417-		
Rtx-1 SimDist 2887***	25"	1/8	2.1	80450-		25"	1/8	2	80000-		

**please note**

These columns are for on-column injections. For not-on-column configurations, add suffix -901.

**Chromosorb®-Based Packed Columns**

On 100/120 Silcoport W***	L (ft.)	Stainless Steel Tubing				price	SilcoSmooth Tubing**				price
		OD (in.)	ID (mm)	cat.#**	price		L (m)	OD (in.)	ID (mm)	cat.#**	
3% Rt-101	6	1/8	2.1	80461-		2	1/8	2	80400-		
3% Rt-2100	6	1/8	2.1	80462-		2	1/8	2	80420-		
5% Rt-1200/1.75% Bentone 34	6	1/8	2.1	80463-		2	1/8	2	80125-		
5% Rt-1200/5% Bentone 34	6	1/8	2.1	80464-		2	1/8	2	80129-		

**for custom columns**

see page 131

On Chromosorb PAW	Mesh	L (ft.)	Stainless Steel Tubing				price	SilcoSmooth Tubing**				price
			OD (in.)	ID (mm)	cat.#**	price		L (m)	OD (in.)	ID (mm)	cat.#**	
10% TCEP	100/120	8	1/8	2.1	80465-		2.5	1/8	2	80126-		
23% Rt-1700	80/100	30	1/8	2.1	80466-		9.2	1/8	2	80128-		

**please note**

Temperature limits for stationary phases are listed on page 128.

**Porous Polymers**

Restek offers a full range of porous polymers, including HayeSep®, Porapak, Chromosorb® Century Series polymers, and Tenax® TA packing, for analyses of volatile components and light solvents. Our QA procedures give you the confidence that every batch you purchase will deliver consistent column-to-column performance.

**Porous Polymer Packed Columns**

Porous Polymers 80/100 Mesh	L (ft.)	Stainless Steel Tubing				price	SilcoSmooth Tubing**				price
		OD (in.)	ID (mm)	cat.#**	price		L (m)	OD (in.)	ID (mm)	cat.#**	
HayeSep Q	6	1/8	2.1	80467-		2	1/8	2	80433-		
Porapak Q	6	1/8	2.1	80468-		2	1/8	2	80427-		
Porapak QS	6	1/8	2.1	80469-		2	1/8	2	80426-		
Porapak R	6	1/8	2.1	80470-		2	1/8	2	80425-		
Chromosorb 101	6	1/8	2.1	80471-		2	1/8	2	80435-		
Chromosorb 102	6	1/8	2.1	80472-		2	1/8	2	80434-		

**also available**

Chromosorb®, Porapak, HayeSep®, and Tenax® packing materials.  
 See pages 126-127.

\*Please add column instrument configuration suffix number to cat.# when ordering. See chart on the next page.

\*\*Siltek-treated stainless steel.

\*\*\*Modified version of Chromosorb W; highest inertness, most consistent performance.

### CarboBlack Solid Supports

Graphitized carbon black offers unique selectivity and very little adsorption for alcohol analyses. Two types of CarboBlack supports are available, CarboBlack B and CarboBlack C. CarboBlack B support, with its higher surface area, can hold up to a 10% loading of a nonsilicone liquid phase. CarboBlack C support can hold up to a 1% loading of a nonsilicone liquid phase. Many Carbowax® 20M-loaded CarboBlack packings are available. CarboBlack packings are treated with KOH or picric acid for basic or acidic compounds, and special alcoholic beverage loadings are available. CarboBlack supports provide resolution and retention similar to Carbowax and Carbowax supports.

also **available**

CarboBlack packing materials. See [page 124](#).

On CarboBlack B	Mesh	Stainless Steel Tubing					SilcoSmooth Tubing**				
		L (ft.)	OD (in.)	ID (mm)	cat.#**	price	L (m)	OD (in.)	ID (mm)	cat.#**	price
5% Carbowax 20M	80/120	—	—	—	—	—	2	1/8	2	80105-	
5% Carbowax 20M	60/80	6	1/8	2.1	88012-		1.8	1/8	2	80106-	
6.6% Carbowax 20M	80/120	6	1/8	2.1	80451-		2	1/8	2	80107-	
4% Carbowax 20M/ 0.8% KOH	60/80	—	—	—	—	—	2	1/8	2	80116-	
1% Rt-1000	60/80	8	1/8	2.1	88013-		2.4	1/8	2	80206-	
1% Rt-1000	60/80	6	1/8	2.1	80452-		2	1/8	2	80207-	
3% Rt-1500	80/120	10	1/8	2.1	80453-		3.05	1/8	2	80211-	
1% Rt-1510	60/80	10	1/8	2.1	80454-		3.05	1/8	2	80216-	
1.5% XE-60/1% H <sub>3</sub> PO <sub>4</sub>	60/80	6	1/8	2.1	80455-		1.8	1/8	2	80305-	

On CarboBlack B	Mesh	Nickel 200 Tubing				price
		L (m)	OD (in.)	ID (mm)	cat.#**	
5% Krytox (Ni 200 tubing)	60/80	3.05	1/8	2.1	80127-	

On CarboBlack C	Mesh	Stainless Steel Tubing					SilcoSmooth Tubing**				
		L (ft.)	OD (in.)	ID (mm)	cat.#**	price	L (m)	OD (in.)	ID (mm)	cat.#**	price
0.2% Carbowax 1500	60/80	6	1/8	2.1	80456-		2	1/8	2	80121-	
0.2% Carbowax 1500	80/100	6	1/8	2.1	80457-		2	1/8	2	80122-	
0.1% Rt-1000	80/100	6	1/8	2.1	80458-		1.8	1/8	2	80205-	
0.19% picric acid	80/100	6	1/8	2.1	80459-		2	1/8	2	80311-	
0.3% Carbowax 20M/ 0.1% H <sub>3</sub> PO <sub>4</sub>	60/80	2.5	3/16	3.1	80460-		0.75	3/16	3.1	80111-	

### Column Instrument Configurations



General Configuration  
Suffix -800



Agilent 5880, 5890, 5987,  
6890, 7890:  
Suffix -810\*



Varian 3700, Vista Series, FID:  
Suffix -820



PE 900-3920, Sigma 1,2,3:  
Suffix -830



PE Auto System 8300, 8400, 8700  
(Not On-Column):  
Suffix -840

See page 133 for additional configurations.

**Note:** Initial 2" of column will be empty, to accommodate a needle. For a completely filled column (not on-column) add suffix -901.

\*-810 suffix also includes 1/8" void on detector side.

### Improved Molecular Sieves

Molecular sieve packed columns easily separate permanent gases at above-ambient temperatures. Restek's R&D chemists have developed a process for preparing molecular sieve packings, which result in excellent batch-to-batch reproducibility. In addition, our molecular sieves are preactivated and ready to use. Each column comes with metal end-fittings to prevent water or carbon dioxide from adsorbing into the packing during shipment.

### Molecular Sieve Packed Columns

Molecular Sieve	Mesh	Stainless Steel Tubing					SilcoSmooth Tubing**				
		L (ft.)	OD (in.)	ID (mm)	cat.#**	price	L (m)	OD (in.)	ID (mm)	cat.#**	price
Molesieve 5A	60/80	6	1/8	2.1	80473-		2	1/8	2	80428-	
Molesieve 5A	80/100	3	1/8	2.1	88015-		1	1/8	2	80440-	
Molesieve 5A	80/100	6	1/8	2.1	80474-		2	1/8	2	80429-	
Molesieve 5A	80/100	10	1/8	2.1	88014-		3.05	1/8	2	80430-	
Molesieve 13X	60/80	6	1/8	2.1	80475-		2	1/8	2	80480-	
Molesieve 13X	80/100	6	1/8	2.1	80476-		2	1/8	2	80439-	

\*Please add column instrument configuration suffix number to cat.# when ordering. See chart on this page.

\*\*Siltek-treated stainless steel.

## Aromatics Analysis

### D3606 Application Column (2 column set)

- Complete resolution of ethanol and benzene, with a resolution value > 3.00.
- Accurate quantification of benzene and toluene.
- Fully conditioned two column set—ready to use out of the box.
- A chromatogram is provided with each column set demonstrating conformance to the method.

Conforms to the specifications established in ASTM method D-3606-06 for the quantitation of benzene and toluene in spark ignition fuel containing ethanol.

free  
literature

#### Resolve Benzene and Toluene in Spark Ignition Fuels Containing Ethanol

Download your free copy from [www.restek.com](http://www.restek.com)

lit. cat.# 580227



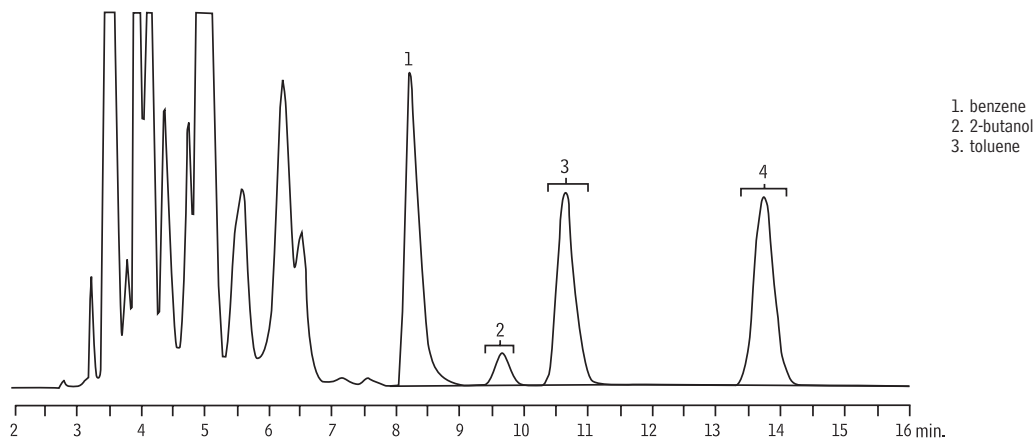
### D3606 Application Column (2 column set)

Description	cat.#*	price
D3606 Application Column (2 column set)**		
Column 1: 6' (1.8m), 1/8" OD, 2.0mm ID, nonpolar Rbx-1		
Column 2: 16' (4.9m), 1/8" OD, 2.0mm ID, proprietary packing material	83606-	

\*Please add column instrument configuration suffix number to cat.# when ordering. See chart on page 133.

\*\*The column set is designed to accommodate both valve injection and/or syringe injection. Column 1 is configured with a 2" inlet void to facilitate on-column injection. The inlet is identified on both column 1 and column 2. Note: The inlet of column 2 is identified for proper orientation for connection to the valve.

### Gasoline on a D3606 Application Column Set.



GC\_PC01079

Column: D3606 Application Column (2 column set, cat.# 83606-800)  
 Column 1: nonpolar Rbx®-1, 6' (1.8m), 1/8" OD, 2.0mm ID  
 Column 2: proprietary packing material, 16' (4.9m), 1/8" OD, 2.0mm ID  
 Sample: 1.5µL gasoline  
 Inj.: 200°C  
 Backflush: ~1 min.  
 Carrier gas: helium, constant flow  
 Flow rate: 25mL/min.  
 Oven temp.: 135°C, isothermal  
 Det.: TCD @ 200°C

Chromatogram courtesy of Boguslaw Dudek, Conoco Phillips, Linden, NJ.

## Light Hydrocarbon Analysis

### Special Columns for Unsaturated Light Hydrocarbons

- Faster separations of C1 to C4 hydrocarbons.
- Res-Sil™ packing replaces Porasil materials.

#### *n*-Octane on Res-Sil™ C Packed Column

This packed column has unique selectivity for resolving unsaturated light hydrocarbons (Figure 1).

#### OPN on Res-Sil™ C Packed Column

This column separates the light hydrocarbons, and baseline resolves *cis*-2-butene from 1,3-butadiene (Figure 2).

#### 2abc Refinery Gas Column Set

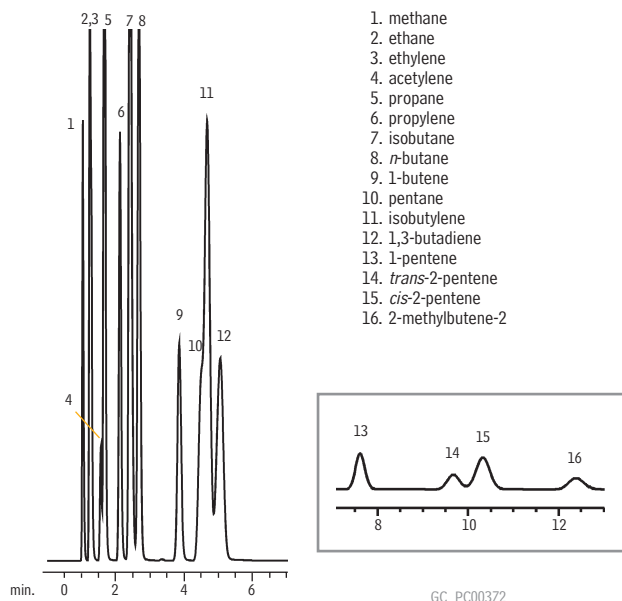
This 3-column set is finely tuned to resolve light hydrocarbons. When used in the proper valving system, it will elute C5+ hydrocarbons ahead of C1 through C4 hydrocarbons (Figure 3).

Description	cat.#*	PRICE
<i>n</i> -Octane on Res-Sil™ C, 80/100 (20', 2.0mm ID, 1/8" SilcoSmooth™ OD)	80436-	
OPN on Res-Sil™ C, 80/100 (12', 2.0mm ID, 1/8" SilcoSmooth™ OD)	80437-	
2abc Refinery Gas Column Set (3 column set)**	88000-	

\*Please add column instrument configuration suffix number to cat.# when ordering. See chart on page 133.

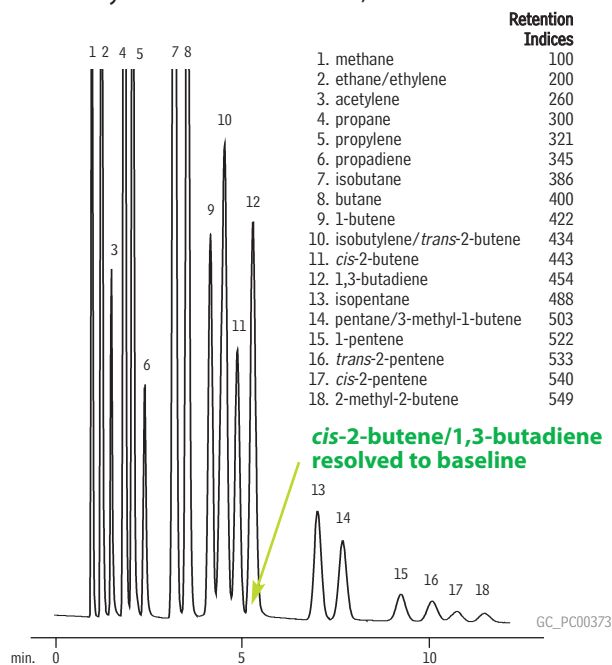
\*\*This column set is for a valving system; therefore, packing material is filled to ends of columns.

**Figure 1** *n*-Octane on Res-Sil™ C packing has unique selectivity for unsaturated light hydrocarbons.



*n*-octane 80/100 Res-Sil™ C  
20', 1/8" OD x 2mm ID, SilcoSmooth™ tubing (cat. # 80436)  
Oven temp.: 60°C  
Inj. temp.: 150°C  
Det. temp.: 150°C FID  
Flow rate: 30mL/min. He  
Sample: refinery gas C1-C5  
Sample size: 20µL

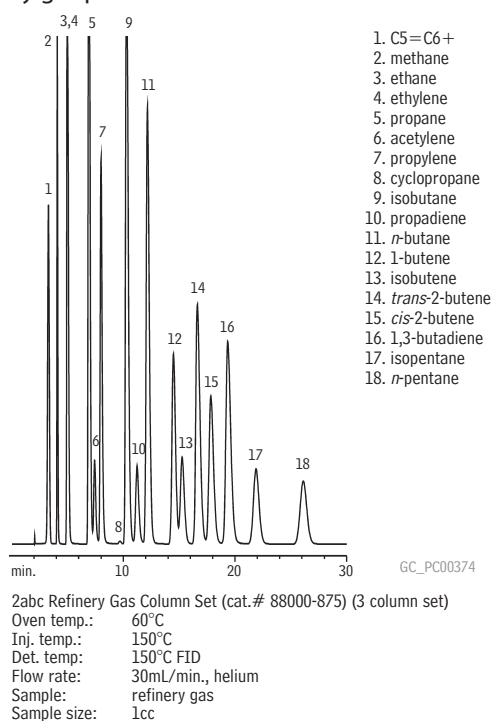
**Figure 2** OPN on Res-Sil™ C packing has unique selectivity for *cis*-2-butene and 1,3-butadiene.



OPN on Res-Sil™ C, 80/100 mesh, 12' x 2mm ID x 1/8" OD in SilcoSmooth™ tubing (cat. # 80437). 20µL on-column injection of refinery gas.  
Concentration: 0.1-6 absolute mole %  
Oven temp.: 50°C  
Inj. & det. temp.: 200°C  
Carrier gas: helium  
Flow rate: 30mL/min

Reference standard courtesy of AC Analytical Controls, Bensalem, PA.

**Figure 3** Refinery gas calibration standard on a Restek refinery gas packed column set.



2abc Refinery Gas Column Set (cat.# 88000-875) (3 column set)  
Oven temp.: 60°C  
Inj. temp.: 150°C  
Det. temp.: 150°C FID  
Flow rate: 30mL/min., helium  
Sample: refinery gas  
Sample size: 1cc

for **more** info

See page 125 for more information on Res-Sil™ packing materials.



## Permanent Gases & Hydrocarbon Analysis

### ShinCarbon ST Packed/Micropacked Columns

- Separate permanent gases, including CO/CO<sub>2</sub>, without cryogenic cooling.
- Rapid separations of permanent gas/light hydrocarbon mixtures.
- Excellent compatibility with most GC detectors—minimal bleed, minimal baseline rise.
- Preconditioned, less than 30 minutes to stabilize.

Analyze oxygen, nitrogen, methane, carbon monoxide, and carbon dioxide with one column and at room temperature. ShinCarbon ST material, a high surface area carbon molecular sieve (~1,500 m<sup>2</sup>/g), is the ideal medium for separating gases and highly volatile compounds by GSC. The rapid, above-ambient analyses these columns provide will be a great convenience. Excellent thermal stability of the high surface area carbon, combined with careful conditioning during column manufacturing, ensures low-bleed operation and rapid stabilization when installing a new column. Custom-made ShinCarbon ST columns are available on request.

ShinCarbon ST is a highly stable material. Its 330°C upper temperature limit minimizes bleed and baseline rise during temperature programming, making the material compatible with most detection systems used for gas analysis, including TCD or HID. All ShinCarbon ST columns are fully conditioned in an oxygen/moisture free environment to prevent contamination. This minimizes stabilization time (less than 30 minutes) when installing a new column which, in turn, minimizes downtime.

### ShinCarbon ST 80/100 Packed Columns (SilcoSmooth™ Stainless Steel)\*

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

### ShinCarbon ST 100/120 Micropacked Columns\*\*

OD	ID	1-Meter	2-Meter
1/16"	1.0mm	19809	19808
0.95mm	0.75mm	19810	—

\*Please add column instrument configuration suffix number to cat.# when ordering. See chart on the next page.

\*\*Order installation kit separately. See page 123.

### it's a fact

ShinCarbon ST is an ideal packing material for permanent gases, low molecular weight hydrocarbons, sulfur dioxide, and Freon® gases.

### also available

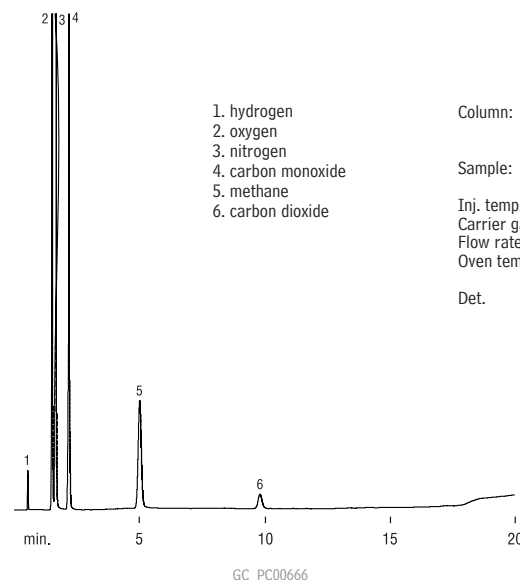
For adapter kits for installing packed/micropacked columns, see [page 123](#).

### a plus 1 story

"Being one of the first labs to utilize the ShinCarbon column in a real working environment, I was pleased to find that I was able to do all my permanent gas analysis on one column instead of the customary two. The peaks were sharper than I had experienced in the past and run time was significantly reduced. We are extremely pleased with the performance of the ShinCarbon column and will continue to find even more applications for it."

**Bruce Nasser,**  
Quality Control Chemist, Oxygen Service Spec Lab

### Separate permanent gases in 10 minutes, without cryogenics.



1. hydrogen
2. oxygen
3. nitrogen
4. carbon monoxide
5. methane
6. carbon dioxide

Column: ShinCarbon ST, 100/120 mesh, 2m, 1mm ID micropacked (cat.# 19808)  
 Sample: 5µL permanent gases mix, approx. 5 mol. percent each  
 Inj. temp.: 100°C  
 Carrier gas: helium  
 Flow rate: 10mL/min.  
 Oven temp.: 40°C (hold 3 min.) to 250°C @ 8°/min. (hold 10 min.)  
 Det. HID @ 200°C

### please note

For additional example applications for ShinCarbon ST columns, see [pages 650, 652, and 654](#) in the Applications section.

## Sulfur Analysis

### Rt®-XLSulfur Packed/Micropacked Columns

- Optimized columns for low ppbv sulfur analyses.
- Eliminate the need for Teflon® tubing.
- Column and end-fittings are Siltek® treated for maximum inertness.

Sulfur analyses are traditionally performed using Teflon® tubing to improve column inertness. Unfortunately, Teflon® tubing is gas permeable, difficult to pack with high efficiency, prone to shrinkage, and has poor thermal stability. The Rt®-XLSulfur packed or micropacked column eliminates these problems. The packing material for Rt®-XLSulfur columns is extensively deactivated for analysis of low ppbv levels of hydrogen sulfide and methyl mercaptan. It is then treated to achieve effective separation of hydrocarbons from sulfur compounds. The interior wall and the end-fittings of the Rt®-XLSulfur column are Siltek® treated, making the column as inert as Teflon®. The extra care taken to manufacture this column ensures more accurate analyses of sulfur compounds.

### Rt®-XLSulfur Packed Columns\*

OD	ID	1-Meter	2-Meter
1/8"	2.0mm	80484-	80485-
3/16"	3.1mm	80482-	80483-

### Rt®-XLSulfur Micropacked Columns\*\*

OD	ID	1-Meter	2-Meter
1/16"	1.0mm	19804	19805
0.95mm	0.75mm	19806	19807

\*Please add column instrument configuration suffix number to cat.# when ordering. See chart on this page.

\*\*Order installation kit separately. See page 123.

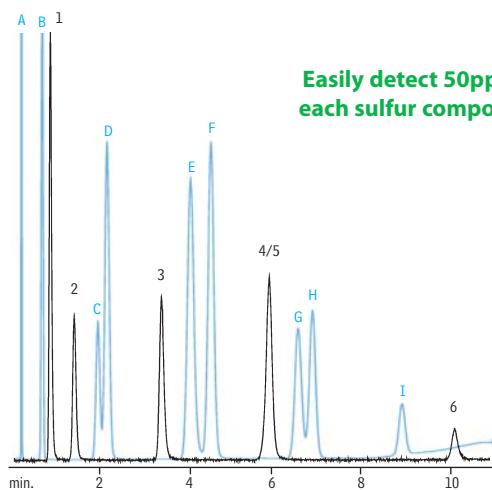
### did you know?

Rt®-XLSulfur columns are optimized for low ppbv-level sulfur analysis!

### also available

For adapter kits for installing packed/micropacked columns, see [page 123](#).

### Rt®-XLSulfur micropacked column separates hydrocarbons from sulfur compounds.



Easily detect 50ppb of each sulfur compound!

#### sulfurs

1. hydrogen sulfide
2. carbonyl sulfide
3. methyl mercaptan
4. ethyl mercaptan
5. dimethyl sulfide
6. dimethyl disulfide

#### hydrocarbons

- A. methane
- B. ethane
- C. propylene
- D. propane
- E. isobutane
- F. butane
- G. isopentane
- H. pentane
- I. hexane

Column: Rt®-XLSulfur micropacked column, 1m, 0.75mm ID (cat.# 19806)  
 Conc.: 50ppb each  
 Oven temp.: 60°C to 230°C @ 15°C/min.  
 Carrier gas: helium  
 Flow rate: 9mL/min.  
 Det.: SCD/FID

Sulfur standards courtesy of DCG Partnership 1 Ltd., Pearland, TX.

### Column Instrument Configurations



General Configuration  
Suffix -800



Agilent 5880, 5890, 5987,  
6890, 7890:  
Suffix -810\*



Varian 3700, Vista Series, FID:  
Suffix -820



PE 900-3920, Sigma 1,2,3:  
Suffix -830



PE Auto System 8300, 8400, 8700  
(Not On-Column):  
Suffix -840

See page 133 for additional configurations.

**Note:** Initial 2" of column will be empty, to accommodate a needle. For a completely filled column (not on-column) add suffix -901.

\*-810 suffix also includes 1 1/2" void on detector side.

## also available

For adapter kits for installing micropacked columns, see page 123.



All micropacked columns are made with inert SilcoSmooth™ tubing, see page 115.

## also available

0.53mm ID micropacked columns. Please contact Technical Service for more information.

**Micropacked Columns**

- Increased efficiency over traditional packed columns.
- Higher capacity than PLOT columns.
- Made from inert, flexible Siltek®-treated stainless steel tubing.
- Siltek®-treated, braided-wire end plug keeps packing intact, even under intense pressure surges during valve switching.
- Wide range of packings available.

**Efficient, inert, and flexible**

Micropacked columns are highly efficient and provide good sample capacity. With our inert Siltek® treatment, micropacked columns are a powerful tool for solving many difficult application problems. Because the Siltek® treatment permeates the stainless steel surface, the column can be flexed and coiled without any fear of chipping or cracking the inert surface.

**Easy to install—multiple internal diameters**

Our micropacked columns are designed to fit packed and capillary injection systems. 1mm ID, standard wall (1/16-inch OD) micropacked columns offer improved efficiency in packed column instruments, without the expense of converting to capillary injection systems. 0.75mm ID, thin wall (0.95mm OD) micropacked columns install easily into a capillary injector, using slightly larger ferrules. Micropacked columns operate at flows exceeding 10cc/min., for trouble-free operation.

**Braided wire end plugs**

Glass wool end plugs can be dislodged easily by carrier gas pressure surges. Restek's chemists insert braided wire into the column and secure it by making a small crimp near the column outlet. End plugs are Siltek® treated—the sample contacts only inert surfaces.

**Micropacked Columns**

		ID	OD	Temp. Range	0.56-Meter	
20% TCEP on 80/100 Chromosorb PAW						
		0.75mm	1/16"	0–120°C	19040	
	Mesh	ID	OD	Temp. Range	1-Meter	2-Meter
HayeSep R	100/120	0.75mm	0.95mm	up to 250°C	19014	19015
HayeSep R	100/120	1.00mm	1/16"	up to 250°C	19012	19013
HayeSep Q	100/120	0.75mm	0.95mm	up to 275°C	19018	19019
HayeSep Q	100/120	1.00mm	1/16"	up to 275°C	19016	19017
HayeSep N	100/120	0.75mm	0.95mm	up to 165°C	19022	19023
HayeSep N	100/120	1.00mm	1/16"	up to 165°C	19020	19021
HayeSep S	100/120	0.75mm	0.95mm	up to 250°C	19010	19011
HayeSep S	100/120	1.00mm	1/16"	up to 250°C	19008	19009
Molesieve 5A	80/100	0.75mm	0.95mm	up to 300°C	19002	19003
Molesieve 5A	80/100	1.00mm	1/16"	up to 300°C	19000	19001
Molesieve 13X	80/100	0.75mm	0.95mm	up to 350°C	19006	19007
Molesieve 13X	80/100	1.00mm	1/16"	up to 350°C	19004	19005

## Searching for a product?

**Don't see the column you need?**

Contact our Technical Service team at 800-356-1688 or 814-353-1300, ext. 4, or contact your Restek representative, to obtain the column needed for your application.

### Packed Column Inlet Adaptor Kits

- Use 1/8" and 3/16" OD columns in 1/4" on-column injection ports.
- Centers column perfectly in injection port to eliminate bent syringe needles.
- Slotted design prevents carrier gas occlusion.
- Vespel®/graphite reducing ferrules make installation easy.
- Includes all nuts & ferrules used to attach tubing to the injector or detector.



Adaptor kit centers the packed column in the injection port, so the syringe will not scrape the sides of the column.

Description	For 1/8" Columns			For 3/16" Columns		
	qty.	cat.#	price	qty.	cat.#	price
Packed Column Inlet Adaptor Kit for 1/4" Injection Ports	kit	21651		kit	21650	
Packed Column Inlet Adaptor Kit for Shimadzu 5mm Injection Ports	kit	21119		kit	21120	
Packed Column Inlet Adaptor Kit for Carlo-Erba GCs	kit	21129		kit	21130	

### Installation Kits

Description	qty.	cat.#	price
<b>Micropacked Column Installation Kit for 0.75mm ID columns; for valve applications.</b> Kit contains: 1/16" Valco nut (1), 1/16" Vespel/graphite ferrule (1), 1/16" graphite ferrule (1), 1/16" Sulfinert union (1), 1/16" to 1/16" stainless steel union (1), Sulfinert tubing, 1/16" OD x 0.04" ID (1ft/0.3m), stainless steel ferrule (1), graphite ferrules (2), Vespel/graphite ferrules (2).	kit	21062	
<b>Micropacked Column Installation Kit for 0.75mm ID columns; for split applications.</b> Kit contains: graphite ferrules (2), Vespel/graphite ferrules (2).	kit	21063	
<b>Micropacked Column Installation Kit for 0.75mm ID columns; for all Agilent GCs.</b> Kit contains: graphite ferrule (1), graphite ferrule (1), Vespel/graphite ferrule (1), Vespel/graphite ferrule (1).	kit	21064	
<b>Micropacked Column Installation Kit for 1mm ID columns; for valve applications.</b> Kit contains: 1/16" Valco nut (1), 1/16" stainless steel nut (1), 1/16" Vespel/graphite ferrule (1), 1/16" graphite ferrule (1), stainless steel ferrule (1), 1/16" stainless steel front ferrule (1), 1/16" stainless steel back ferrule (1).	kit	21065	
<b>Micropacked Column Installation Kit for 1mm ID columns; for direct injections.</b> Kit contains: 1/16" stainless steel nuts (2), 1/16" Vespel/graphite ferrules (2), 1/16" graphite ferrules (2), 1/16" stainless steel front ferrules (2), 1/16" stainless steel back ferrules (2).	kit	21066	
<b>Packed Column Installation Kit for 2mm ID columns; for valve applications.</b> Kit contains: 1/4" stainless steel nut (1), stainless steel Valco nut (1), 1/8" Vespel/graphite ferrule (1), stainless steel Valco ferrule (1), 1/8" stainless steel front ferrule (1), 1/8" stainless steel back ferrule (1).	kit	21067	

### Micropacked Inlet Conversion Kits

Convert a capillary GC split/splitless inlet for use with 1/16" OD micropacked columns.

- For use with Agilent 5890 and 6890 GCs.
- Sample pathways deactivated for ultimate inertness.

Description	qty.	cat.#	price
<b>Micropacked Column Adaptor Kit for Split/Splitless Injection*</b> <i>Complete kit with FID and injection port adaptors</i> Kit includes: Dual Vespel Ring Inlet Seal, large bore; reducing nut, large bore; FID adaptor, large bore; 1/4" ferrule, Vespel/graphite; 1/4" nut, stainless steel; 1/16" ferrules, Vespel/graphite (2); 4mm splitless liner, intermediate polarity deactivated; 1/16" nuts, stainless steel (2)	kit	22424	
<b>Micropacked Column Adaptor Kit for On-Column Injection*</b> <i>Complete kit with FID and injection port adaptors</i> Kit includes: Dual Vespel Ring Inlet Seal, large bore; reducing nut, large bore; FID adaptor, large bore; 1/4" ferrule, Vespel/graphite; 1/4" nut, stainless steel; 1/16" ferrules, Vespel/graphite (2); Siltek treated metal liner installation guide; 1/16" nuts, stainless steel (2)	kit	22425	
<b>Micropacked Column Adaptor Kit for Split/Splitless Injection</b> <i>Injection Port Adaptor Kit</i> Kit includes: Dual Vespel Ring Inlet Seal, large bore; reducing nut, large bore; 1/16" ferrule, Vespel/graphite; 1/16" nut, stainless steel; 4mm splitless liner, intermediate polarity deactivated	kit	22426	
<b>Micropacked Column Adaptor Kit for On-Column Injection</b> <i>Injection Port Adaptor Kit</i> Kit includes: Dual Vespel Ring Inlet Seal, large bore; reducing nut, large bore; 1/16" ferrule, Vespel/graphite; Siltek treated metal liner installation guide; 1/16" nut, stainless steel	kit	22427	
<b>Micropacked Column Adaptor Kit for FID*</b> <i>FID Adaptor Kit</i> Kit includes: FID adaptor, large bore; 1/4" ferrule, Vespel/graphite; 1/4" nut, stainless steel; 1/16" nut, stainless steel; 1/16" ferrule, Vespel/graphite	kit	22428	
<b>Replacement Inlet Seals for Micropacked Column Adaptor</b> Dual Vespel Ring Inlet Seals, large bore (2)	2-pk.	22429	
<b>Replacement Metal Liner Installation Guide for On-Column Injection</b> Siltek treated metal liner installation guide	ea.	22430	
<b>Replacement 4mm Splitless Liner</b>	ea.	20772	



\*For use with packed column FIDs only.





### Silcoport™ Support Materials Outperform Any Deactivated Diatomaceous Earth Supports Available!

- Superior deactivation technology for improved inertness.
- Available in 80/100 and 100/120 mesh.
- Uniform particle distribution for maximum efficiency.

restek  
innovation!

The increased sensitivity of modern detection systems and the desire to reduce detection limits requires a solid support to meet the challenging demands faced by analysts. Unlike conventional dimethyldichlorosilane (DMDCS) deactivation, Silcoport™ incorporates our proprietary fused silica deactivation technology on diatomaceous earth solid supports. Silcoport™ supports were developed using a special mixture of deactivants that yields the highest inertness without changing the polarity of the stationary phase. Silcoport™ supports from Restek are the perfect match for highly inert SilcoSmooth™ tubing.

### did you know?

**Silcoport support replaces**

- Supelcoport
- Chromosorb W HP
- GasChrom Q 2

**Silcoport W BW support replaces**

- GasChrom Q

### Silcoport™ Packing Materials

Description	Temp. Limit (°C)	Mesh	Min. Qty.†	cat.#	price/g
Silcoport P*	400	80/100	100g	25641	
	400	100/120	100g	25642	
Silcoport W**	400	80/100	100g	25689	
	400	100/120	100g	25673	
Silcoport W BW***	400	100/120	100g	25674	

\*Prepared from Chromosorb P; Restek acid washed deactivation.

\*\*Prepared from Chromosorb W; Restek acid washed deactivation.

\*\*\*Prepared from Chromosorb W; Restek base washed deactivation.

†Bulk quantities are available.

### please note

Silcoport™ is available uncoated or coated with the liquid stationary phase of your choice on 80/100 or 100/120 mesh sizes. Call Restek at 800-356-1688 or 814-353-1300, ext. 3, or contact your Restek representative, for pricing and availability.

### CarboBlack Packing Materials

Description	Temp. Limit (°C)	Mesh	Min. Qty.	cat.#	price/g
CarboBlack B	500	60/80	10g	25500	
	500	80/120	10g	25501	
CarboBlack C	500	60/80	10g	25502	
	500	80/100	10g	25503	
CarboBlack BHT-100	150	40/60	10g	25504	
CarboBlack III (F)	175	80/100	10g	25506	
5% Carbowax 20m on CarboBlack B	225	80/120	10g	25507	
6.6% Carbowax 20m on CarboBlack B	225	80/120	10g	25508	
4% Carbowax 20m / 0.8% KOH on CarboBlack B	220	60/80	10g	25509	
0.19% picric acid on CarboBlack C	120	80/100	10g	25510	
4% Carbowax 20m on CarboBlack B-DA	200	80/120	10g	25511	

## Res-Sil™ C Packings

- Unique separation of saturated and unsaturated hydrocarbons.
- Innovative bonding chemistry for batch-to-batch reproducibility, excellent thermal stability, and long life.
- Wide range of bonded phases available.
- Equivalent to Waters Durapak packings.

Bonded silica packings with *n*-octane or cyanopropyl (OPN) functional groups yield faster separations of C1 to C4 hydrocarbons, higher thermal stability, shorter conditioning times, and longer lifetimes than conventional packings. However, bonded silica packings have had inconsistent reproducibility and limited availability. Restek's research team has solved these age-old problems by developing Res-Sil™ C packings for consistent performance.

### Unique Selectivity for Process GC and High-Speed Analysis of Petrochemicals

Res-Sil™ C bonded packings are ideal for fast resolution of difficult-to-separate saturated and unsaturated C4 hydrocarbons (e.g., see page 119). This unique selectivity, when combined with other columns in series, provides petroleum and petrochemical method developers with a powerful tool for fast determination of C1 to C5 hydrocarbons.<sup>1</sup>

### Innovative Research and Stringent QA Provide Batch-to-Batch Consistency

Restek's synthesis procedure eliminates batch-to-batch variations. The amount of bonded liquid phase is precisely controlled in every batch, for reproducible retention times and separations. Each production batch of Res-Sil™ C packing is tested with a complex hydrocarbon mixture to meet demanding retention time and retention index specifications. Column bleed is also evaluated to ensure that there are no retention shifts or high baselines.

### OPN on Res-Sil™ C Packing—the Latest in a Line of Bonded GC Phases

Restek offers a wide range of bonded packings for packed column GC, including Rtx®-1, Stabilwax®, and Carbowax® phases. We have extended this technology to make *n*-octane on Res-Sil™ C packing, and OPN on Res-Sil™ C packing. Each of these packings has low bleed, conditioning times of less than 30 minutes, long lifetime, and consistent batch-to-batch reproducibility.

## also available

Custom packing materials are also available. See page 130.

## Res-Sil™ Packing Materials

Description	Temp. Limit (°C)	Mesh	Min. Qty.	cat.#	price/g
Res-Sil C	300	60/80	10g	25400	
	300	80/100	10g	25028	
Res-Sil B	300	60/80	10g	25401	
	300	80/100	10g	25080	
1% TCEP on Res-Sil B	175	80/100	10g	25081	
OPN on Res-Sil C	150	80/100	10g	25042	
<i>n</i> -Octane on Res-Sil C	150	80/100	10g	25030	
2% Carbowax 1540 on Res-Sil C	150	80/100	10g	25044	

<sup>1</sup>N.C. Saha, S.K. Jain, and R.K. Dua. J. Chromat. Sci 1978, 323-328.

## did you know?

### Res-Sil replaces

- Porasil B
- Porasil C



## Technical Service

Do you have a technical question? Restek's Technical Service group has answers! Drawing from our extensive libraries of technical information and many years of collective chromatography experience, the experts in Technical Service can help you from set-up to method development.

### Contact us:

For quick answers to commonly asked questions any time of the day, visit [www.restek.com/answers](http://www.restek.com/answers) or contact us directly:

#### In the U.S.

Phone: 1-800-356-1688, ext. 4  
Fax: 814-353-1568  
e-mail: [support@restek.com](mailto:support@restek.com)

#### Outside the U.S.

Contact your Restek representative.

### Chromosorb® Diatomaceous Earth Supports

Restek offers the full line of Chromosorb® solid supports. Choosing the appropriate support will depend on your application. Need assistance? Call Technical Service at 800-356-1688 or 814-353-1300, ext. 4, or contact your Restek representative.

#### Chromosorb® P (used to prepare Silcoport™ P)

Chromosorb® P support is manufactured from hard firebrick, making it a rugged material. This support is available acid washed (AW), nonacid washed (NAW), and traditional dimethyldichlorosilane (DMDCS) treated. Chromosorb® P support can hold up to 30 weight% of liquid stationary phase, making it the highest loading support available.

#### Chromosorb® W (used to prepare Silcoport™ W and Silcoport™ BW)

Chromosorb® W support is a flux-calcinated diatomite. This solid support is very fragile but offers the highest inertness of all diatomaceous earth supports. It can be prepared with up to 25 weight% of liquid stationary phase. Chromosorb® W support is available in AW, NAW, and DMDCS, or treated with Restek's proprietary (Silcoport™) deactivation. Chromosorb® W-HP is an acid washed, silanized version of Chromosorb® W.

#### Chromosorb® G

Chromosorb® G support is the hardest support available and has the lowest surface area of all the diatomaceous earth supports. Chromosorb® G support is available as AW, NAW, and DMDCS-treated. It can hold up to 10 weight% of liquid stationary phase.

#### Chromosorb® T

Chromosorb® T support is made from Teflon® material and is an extremely inert solid support.

Chromosorb® G and Chromosorb® T are available as custom products. Contact us for more information.

### Chromosorb® Packings

Description	Mesh	gm/btl.*	cat.#	price
Chromosorb PNAW	45/60	100g	25629	
	60/80	100g	25630	
	80/100	100g	25631	
	100/120	100g	25632	
Chromosorb PAW	60/80	100g	25634	
	80/100	100g	25635	
	100/120	100g	25636	
Chromosorb PAW/DMDCS	60/80	100g	25638	
	80/100	100g	25639	
	100/120	100g	25640	
Chromosorb WNAW	60/80	100g	25657	
	80/100	100g	25658	
	100/120	100g	25659	
Chromosorb WAW	60/80	100g	25661	
	80/100	100g	25662	
	100/120	100g	25663	
Chromosorb WAW/DMDCS	60/80	100g	25665	
	80/100	100g	25666	
	100/120	100g	25667	
Chromosorb W-HP	60/80	100g	25668	
	80/100	100g	25669	
	100/120	100g	25670	

\*Please call for larger quantities (>100gm bottles) of Chromosorb packings.

NAW—nonacid washed  
AW—acid washed  
DMDCS—dimethyldichlorosilane  
BW—base washed

### Chromosorb® Century Packings

Description	Temp. Limits (°C)	g/btl.	Mesh 60/80		Mesh 80/100		Mesh 100/120	
			cat.#	price	cat.#	price	cat.#	price
Chromosorb 101	275/325	50g	25608		25609		25610	
Chromosorb 102	250/300	50g	25611		25612		25613	
Chromosorb 103	275/300	50g	25614		25615		25616	
Chromosorb 104			(equivalent to HayeSep C)					
Chromosorb 105	250/275	50g	25617		25618		25619	
Chromosorb 106	250/275	50g	25620		25621		25622	
Chromosorb 107	250/275	50g	25623		25624		25625	
Chromosorb 108	250/275	50g	25626		25627		25628	

### Porapak Series Packings

Description	Temp. Limit (°C)	g/btl.	Mesh 50/80		Mesh 80/100		Mesh 100/120	
			cat.#	price	cat.#	price	cat.#	price
Porapak P	250	20g	25576		25577		25578	
Porapak PS	250	20g	25579		25580		25581	
Porapak Q	250	26g	25582		25583		25584	
Porapak QS	250	26g	25585		25586		25587	
Porapak R	250	24g	25588		25589		25590	
Porapak S	250	26g	25591		25592		25593	
Porapak N	190	29g	25594		25595		25596	
Porapak T	190	31g	25597		25598		25599	

also available

Custom packing materials are also available.  
See page 130.

### HayeSep® Series Packings

Description	Temp. Limit (°C)	g/btl.	Mesh 60/80		Mesh 80/100		Mesh 100/120	
			cat.#	price	cat.#	price	cat.#	price
HayeSep A	165	24g	22560		25032		25033	
HayeSep B	190	24g	25561		25034		25035	
HayeSep C	250	24g	25562		25036		25037	
HayeSep D	290	24g	25563		25038		25039	
HayeSep DIP	290	24g	25564		25565		25566	
HayeSep DB	290	24g	25567		25568		25569	
HayeSep DOX			(Use HayeSep DB)					
HayeSep N	165	24g	25570		25045		25046	
HayeSep P	250	24g	25571		25047		25048	
HayeSep Q	275	24g	25572		25049		25050	
HayeSep R	250	24g	25573		25051		25052	
HayeSep S	250	24g	25574		25053		25054	
HayeSep T	165	24g	25575		25055		25056	

### Tenax® Packings

Description	Temp. Limit (°C)	Min. Qty.	Mesh 60/80		Mesh 80/100	
			cat.#	price/g	cat.#	price/g
Tenax-TA	350	10g	25550	/g	25551	/g
Tenax-GR	350	10g	25552	/g	25553	/g



## Restek's Learning Network

Sign up for our widely acclaimed seminars today!

Visit [www.restek.com/seminars](http://www.restek.com/seminars)



## Liquid Phases

We can prepare packed columns from the extensive list of liquid phases shown here. We have many more liquid phases. If you don't see the phase you need, call technical service or contact your Restek representative for availability.

Phase	min./max. temp. (°C)	Phase	min./max. temp. (°C)
Apiezon L	50/300	OV-22, phenyl methyl diphenyl, 65% phenyl	0/350
<i>p,p'</i> -Azoxydiphenetole	132/140	OV-25, phenyl methyl diphenyl, 75% phenyl	0/350
BC-120	0/125	OV-61, diphenyl, 33% phenyl	0/350
Bentone-34	0/180	OV-73, 5.5% diphenyl	0/325
bis (2-ethoxyethyl) adipate	0/150	OV-101, dimethyl (fluid)	0/350
bis (2-ethylhexyl) phthalate	150 max.	OV-105, cyanopropyl methyl	0/275
bis (2-methoxyethyl) adipate	20/100	OV-202, trifluoropropyl (fluid)	0/275
<i>n,n'</i> -Bis( <i>p</i> -methoxybenzylidene)- $\alpha,\alpha'$ -bi- <i>p</i> -toluidine (BMBT)	189/225	OV-210, trifluoropropyl (fluid)	0/275
Carbowax 1000	40/150	OV-215, trifluoropropyl (gum)	0/275
Carbowax 1540	50/175	OV-225, cyanopropyl methylphenyl methyl	0/265
Carbowax 20M	60/225	OV-275, dicyanoallyl	25/250
Carbowax 20M-terephthalic acid	60/225	OV-330, silicone - Carbowax	0/250
Carbowax 400	10/100	OV-351	50/270
Carbowax 600	30/125	OV-1701, vinyl	0/250
Cyclohexanedimethanol succinate	100/250	Phenyldiethanolamine succinate	0/230
DC-11	0/300	Polethylene glycol adipate (EGA)	100/225
DC-200	0/200	Polyphenyl ether (5 rings) OS-124	0/200
DC-550	20/250	Polyphenyl ether (6 rings) OS-138	0/225
DEGS-PS	20/200	Polypropylene glycol	0/150
Dexsil 300 carborane/methyl silicone	50/540	Rtx-1 (Rt-101)	0/350
Di(2-ethylhexyl)sebacate	0/125	Rt-1000	50/250
Diethylene glycol succinate (DEGS)	20/200	Rt-1200	25/200
Diethylene glycol adipate (DEGA)	0/200	Rt-1220	50/200
Diisodecyl phthalate	0/175	Rt-1500, Rt-1510	50/230
2,4-Dimethylsulfolane	0/50	Rt-2100	0/350
Di- <i>n</i> -decyl phthalate	10/175	Rt-2300	20/275
Dinonyl phthalate	20/150	Rt-2330, Rt-2340	25/275
Ethylene glycol adipate	100/225	Rt-608Pkd	0/275
Ethylene glycol phthalate	100/200	Rt-Sebaconitrile	25/110
Ethylene glycol succinate	100/200	Rt-XLSulfur	300 max.
FFAP	50/250	SE-30, SE-52, SE-54	50/300
Fluorad FC-431, 50% solution in ethyl acetate	40/200	Silar 5 CP, Silar 10 CP	0/250
Hallcomid M-18-OL	8/150	Sorbitol	150 max.
Halocarbon 10-25	20/100	Squalane	20/100
Halocarbon K-352	0/250	Squalene	0/100
Halocarbon wax	50/150	Stabilwax	40/240
Igepal CO-880 (Nonoxynol)	100/200	Tetracyanoethylated pentaerythritol	30/175
Igepal CO-890	100/200	THEED (Tetrahydroxyethlenediamine)	0/125
Krytox	-30/260	$\beta,\beta$ -Thiodipropionitrile (TDPN)	100
Neopentyl glycol adipate	50/225	Tricresyl phosphate	20/125
Neopentyl glycol sebacate	50/225	1,2,3-Tris (2-cyanoethoxy) propane (TCEP)	0/175
Neopentyl glycol succinate	50/225	Triton X-100, Triton X-305	0/200
Nonoxynol (Igepal CO-880)	100/200	UC W982	0/300
$\beta,\beta$ -Oxydipropionitrile	0/75	UCON 50-HB-2000	0/200
OV-1, dimethyl (gum)	100/350	UCON 50-HB-280-X	0/200
OV-1, vinyl	100/350	UCON 50-HB-5100	0/200
OV-3, phenyl methyl	0/350	UCON HB-1800-X	200 max.
OV-7, phenyl methyl dimethyl, 20% phenyl	0/350	UCON LB-550-X	0/200
OV-11, phenyl methyl dimethyl, 35% phenyl	0/350	Versamid 9000	190/275
OV-17, phenyl methyl, 50% phenyl	0/375		

### Advantages of using Restek packed columns

- Reasonably priced.
- Low-bleed, long-lifetime bonded phases.
- Wide variety of supports and packings.
- Produced by experienced packed column chromatographers.

## USP Liquid Phase &amp; Solid Support Cross-Reference

Restek can meet all of your packed column needs for US Pharmacopeia methods. Commonly used USP liquid phases and supports are listed below. Call Restek or your representative for a quote on your next packed column for pharmaceuticals.

USP	Phase Description	Restek-Supplied Equivalent
G1	dimethylpolysiloxane oil	Rt-2100, OV-101, Rtx-1
G2	dimethylpolysiloxane gum	OV-1, Rtx-1
G3	50% phenyl-50% methylpolysiloxane	Rt-2250, OV-17
G4	diethylene glycol succinate polyester	Rt-DEGS
G5	3-cyanopropylpolysiloxane	Rt-2340
G6	trifluoropropylmethylpolysiloxane	Rt-2401, OV-210
G7	50% 3-cyanopropyl-50% phenylmethylsilicone	Rt-2300
G8	80% bis (3-cyanopropyl)-20% phenylpolysiloxane	Rt-2330
G9	methylvinylpolysiloxane	UCW 98
G10	polyamide	polyamide
G11	bis(2 ethylhexyl) sebecate polyester	bis(2 ethylhexyl) sebecate polyester
G12	phenyldiethanolamine succinate polyester	phenyldiethanolamine succinate polyester
G13	sorbitol	sorbitol
G14	polyethylene glycol (average mol. wt. 950-1050)	Carbowax 1000
G15	polyethylene glycol (average mol. wt. 3000-3700)	Carbowax 4000
G16	polyethylene glycol compound (average mol. wt. 15,000), a high molecular weight compound of polyethylene glycol and a diepoxide linker	Carbowax 20M
G17	75% phenyl-25% methylpolysiloxane	OV-25
G18	polyalkylene glycol	UCON LB 550X
G19	25% phenyl-25% cyanopropyl-50% methylsilicone	OV 225
G20	polyethylene glycol (average mol. wt. 380-420)	Carbowax 400
G21	neopentyl glycol succinate	neopentyl glycol succinate
G22	bis(2 ethylhexyl) phthalate	bis(2 ethylhexyl) phthalate
G23	polyethylene glycol adipate	EGA
G24	diisodecyl phthalate	diisodecyl phthalate
G25	polyethylene glycol compound TPA, a high molecular weight compound of a polyethylene glycol and a diepoxide that is esterified with terephthalic acid	Carbowax 20M TPA
G26	25% 2-cyanoethyl-75% methylpolysiloxane	Rt-XE 60
G27	5% phenyl-95% methylpolysiloxane	SE-52, Rtx-5
G28	25% phenyl-75% methylpolysiloxane	DC 550
G29	3,3'-thiodipropionitrile	TDPN
G30	tetraethylene glycol dimethyl ether	tetraethylene glycol dimethyl ether
G31	nonylphenoxypoly(ethyleneoxy)ethanol (average ethyleneoxy chain length is 30): nonoxynol 30	Igepal CO 880
G32	20% phenylmethyl-80% dimethylpolysiloxane	OV-7
G33	20% Carborane <sup>®</sup> -80% methylsilicone	Dexsil 300
G34	diethylene glycol succinate polyester stabilized with phosphoric acid	Rt-DEGS PS
G35	a high molecular weight compound of a polyethylene glycol and a diepoxide that is esterified with nitroterephthalic acid	Rt-1000
G36	1% vinyl-5% phenylmethylpolysiloxane	SE 54, Rtx-5
G37	polyimide	polyimide
G38	phase G1 containing a small amount of tailing inhibitor	Rt-2100/0.1% Carbowax 1500
G39	polyethylene glycol (average mol. wt. 1500)	Carbowax 1500
G40	ethylene glycol adipate	Rt-EGA
USP	Support Description	Restek-Supplied Equivalent
S1A	siliceous earth, see method for details on treatment	Silcoport W
S1AB	siliceous earth, treated as S1A and both acid- and base-washed	Silcoport WBW
S1C	crushed firebrick, calcined or burned with a clay binder >900°C, acid-washed, may be silanized	Chromosorb PAW or PAW DMDCS
S1NS	untreated siliceous earth	Chromosorb W- Non Acid Washed
S2	styrene-divinylbenzene copolymer with nominal surface area of less than 50m <sup>2</sup> /g and an average pore diameter of 0.3 to 0.4µm	Chromosorb 101
S3	ethylvinylbenzene-divinylbenzene copolymer with nominal surface area of 500 to 600m <sup>2</sup> /g and an average pore diameter of 0.0075µm	Hayesep Q
S4	styrene-divinylbenzene copolymer with aromatic -O and -N groups having a nominal surface area of 400 to 600m <sup>2</sup> /g and an average pore diameter of 0.0076µm	Hayesep R
S5	high molecular weight tetrafluorethylene polymer, 40- to 60-mesh	Chromosorb T
S6	styrene-divinylbenzene copolymer having a nominal surface area of 250 to 350m <sup>2</sup> /g and an average pore diameter of 0.0091µm	Chromosorb 102
S7	graphitized carbon having a nominal surface area of 12m <sup>2</sup> /g	CarboBlack C
S8	copolymer of 4-vinyl-pyridine and styrene-divinylbenzene	Hayesep S
S9	porous polymer based on 2,6-diphenyl- <i>p</i> -phenylene oxide	Tenax TA
S10	highly cross-linked copolymer of acrylonitrile and divinylbenzene	HayeSep C
S11	graphitized carbon having a nominal surface area of 100m <sup>2</sup> /g, modified with small amounts of petrolatum and polyethylene glycol compound	CarboBlack B 80/120 3% Rt 1500
S12	graphitized carbon having a nominal surface area of 100m <sup>2</sup> /g	CarboBlack B

### Custom Coated Packing Materials

Custom coated packing materials can be made with any of the supports listed below. The liquid stationary phases available are listed on page 128 and the coating ranges are listed in the chart. Coated packings are available in minimum orders of 20 grams.

**To order, please call your Restek representative for pricing and specify the following:**

- 1) stationary phase and stationary phase concentration
- 2) support and support mesh size
- 3) amount of packing needed

Ordering Example: (3%) (Rtx®-1) (Silcoport™ P) (80/100) (20g).

Support	Max. Coating %	Mesh Sizes
CarboBlack B	1–10%*	60/80, 80/120
CarboBlack B HT	1–10%	40/60
CarboBlack C	0.1–1%*	60/80, 80/100
Chromosorb 101-108	5%*/10%**	60/80, 80/100, 100/120
Chromosorb W HP	20%	45/60, 60/80, 80/100, 100/120
Chromosorb G HP	20%	45/60, 60/80, 80/100, 100/120
Chromosorb G, P or W (AW or NAW)	10% (G) 25% (W) 30% (P)	45/60, 60/80, 80/100, 100/120
Chromosorb G, P or W (AW or DMDCS)	10% (G) 25% (W) 30% (P)	45/60, 60/80, 80/100, 100/120
Chromosorb T	15%	40/60
HayeSep	15%	60/80, 80/100, 100/120
Porapak	15%	50/80, 80/100, 100/120
Silcoport P	30%	80/100, 100/120
Silcoport W BW	20%	80/100, 100/120
Silcoport W (replacement for Chromosorb 750)	20%	80/100, 100/120

\*Nonsilicone phase.

\*\*Silicone phase.

For coatings over 15% or quantities over 50 grams, please call your Restek representative.

NAW—nonacid washed  
 AW—acid washed  
 DMDCS—dimethyldichlorosilane  
 BW—base washed  
 DA—deactivated for acidic compounds

### please note

Special phases that require a surcharge:  
 OV®-275, OV®-330, OV®-225, BMBT,  
 2,4-dimethylsulfolane, Silar, OV®-1701,  
 XE-60, and Dexsil®

### ordering note

#### Mesh Size

When ordering a packed column solid support, please specify mesh size. Refer to this chart to convert microns to mesh size.

Example:

150–180 micron particles = 80/100 mesh

(µm)	Mesh Size
850	20
710	25
600	30
500	35
425	40
355	45
300	50
250	60
212	70
180	80
150	100
125	120
106	140
90	170
75	200
63	230
53	270

### Custom Packed Columns

To order, contact your Restek representative and specify the following:

- 1) column dimensions (length, ID) and tubing material
- 2) packing description (percent coating and phase, support mesh size, and treatment)
- 3) column configuration (instrument manufacturer, model number, on-column injection or not) and with or without nuts and ferrules

**Ordering Example:** (6' x 1/8") (stainless steel) (3%) (Rtx®-1) (Silcoport™ P) (80/100) (Agilent 6890) (on-column injection) (fittings kit).

Please use the custom order form on page 132.



### ordering note

For international pricing on custom packed or micropacked columns, please contact your Restek representative.

### Custom Micropacked Columns

To order, contact your Restek representative and specify the following:

- 1) physical dimensions (length, OD, ID, and tubing material)
- 2) packing description (percent coating and phase, support mesh size, and treatment)
- 3) installation kit (see page 123)

**Ordering Example:** (2m x 1/16" OD x 1.00mm ID) (Siltek®-treated tubing) (5%) (Carbowax® 20M) (CarboBlack B) (80/120) (installation kit for valve applications, cat. #21065)

Please use the custom order form on page 132.



# Packed/Micropacked Column Custom Order Form

Order: \_\_\_\_\_ Quote: \_\_\_\_\_ Reference # from previous order (if available): \_\_\_\_\_

Date: \_\_\_\_\_

Restek Account #: \_\_\_\_\_

Contact: \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

**Restek Use Only:**

Custom No.: \_\_\_\_\_

Stock No.: \_\_\_\_\_

Price: \_\_\_\_\_

Fitting Costs: \_\_\_\_\_

Authorization: \_\_\_\_\_

**Number of Columns:** \_\_\_\_\_

1) Column Dimensions:

Length \_\_\_\_\_ OD x ID: \_\_\_\_\_

2) Tubing (choose one):  SilcoSmooth™  Stainless Steel  Hastelloy®  Nickel  Copper  Teflon®

3) Packing Description:

Liquid Phase A (% + description): \_\_\_\_\_

Liquid Phase B (% + description): \_\_\_\_\_

Liquid Phase C (% + description): \_\_\_\_\_

Solid Support: \_\_\_\_\_ Mesh: \_\_\_\_\_

4) Column Configuration:

Instrument (mfr. + model): \_\_\_\_\_

Inlet: Packed Full?  Yes  No, leave \_\_\_\_\_" void (for on-column injection)

Outlet: Packed Full?  Yes  No, leave \_\_\_\_\_" void

Do you want this column preconditioned?  Yes (additional charge)  No

Standard configuration suffix number (next page): \_\_\_\_\_

Special configuration (next page): Figure: \_\_\_\_\_ Dimensions: \_\_\_\_\_

Welded Tubing Reducers  (additional charge)

Special Instructions: \_\_\_\_\_

**Fittings** (check appropriate circle)

**KIT 1S**

1/4" brass nuts  
1/4" to 1/8" V/G reducing ferrules  
No additional charge

**KIT 2S**

1/4" brass nuts  
1/4" to 3/16" V/G reducing ferrules  
No additional charge

**KIT A**

1/8" brass nuts  
1/8" V/G ferrules  
No additional charge

**KIT B**

1/8" brass nuts  
1/8" brass front & back ferrules  
No additional charge

**KIT C**

1/8" stainless steel nuts  
1/8" stainless steel front & back ferrules  
Additional charge

**KIT D**

1/8" stainless steel nuts  
1/8" V/G ferrules  
Additional charge

**KIT E**

1/4" stainless steel nuts  
1/4" to 1/8" V/G reducing ferrules  
Additional charge

**KIT F**

1/4" stainless steel nuts  
1/4" to 3/16" V/G reducing ferrules  
Additional charge

**KIT V**

1/8" VCR fitting  
check appropriate circle:  
 Stainless Steel (additional charge)  
 Nickel (additional charge)

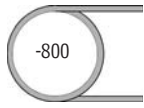
for a **quote:**

Complete this form and fax to Restek at 814-353-1309, or to your Restek representative.

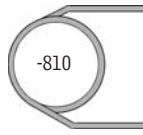
V/G = Vespel®/graphite

Standard Configurations (choose one)

General Configuration



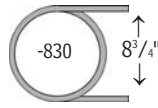
Agilent 5880, 5890, 5987, 6890, 7890



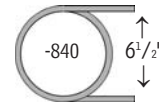
Varian 3700, Vista Series, FID



PE 900-3920, Sigma 1,2,3



PE Auto System 8300, 8400, 8700



- 810 Agilent 5880, 5890, 5987, 6890, 7890
- 811 Agilent 6850
- 820 Varian 3700, Vista Series, FID
- 821 Varian 3800
- 830 PerkinElmer 900-3920, Sigma 1,2,3
- 840 PerkinElmer Auto System 8300, 8400, 8700, Clarus 500 (C500)
- 841 PerkinElmer Auto Sys XL
- 845 ABB 3100, AAI (4" coil)
- 850 Shimadzu 14A, 2014
- 851 Shimadzu 8A

- 852 Shimadzu 9A
- 853 Shimadzu 17A, 2010
- 854 Shimadzu Mini 2
- 860 Thermo Scientific - TRACE 2000
- 865 Carlo Erba
- 870 Tometrics/Tracor
- 874 HNU 310 & 311 (4.5" coil)
- 875 Analytical Controls Configuration
- 880 Carle 40030
- 881 Hitachi 263
- 885 Pye Unicam 4500

- 890 Gow Mac 590
- 891 Gow Mac 550
- 892 Gow Mac 750
- 893 Gow Mac 816 (3" coil, 3" spread on the arms, and a total height of 5")
- 894 Gow Mac 580
- 895 SRI 8610C
- 895R SRI 8610C Dual GC Right Side
- 895L SRI 8610C Dual GC Left Side
- 896 SRI 9300

Custom Configurations (Please provide dimensions on order form, page 132.)

