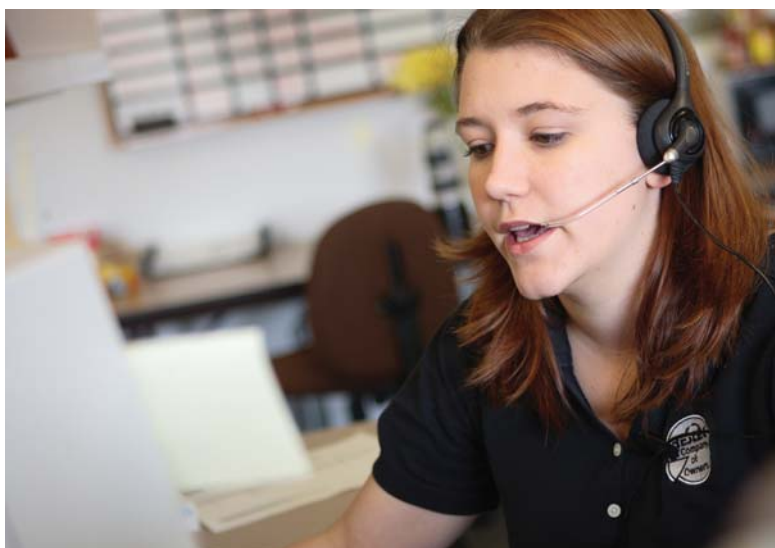


Packed & Micropacked Columns

Top: Jason Thomas, Innovations Chemist and
Chris English, Innovations Group Leader

Bottom: Melissa Decker, Customer Service
Representative



Bonded Stationary Phases

Combining our stationary phase synthesis experience with our unique Silcoport™ packing deactivation created bonded phase packings that provide longer lifetimes, lower bleed, and shorter conditioning times.

We offer bonded methyl silicone phases (Rtx®-1 and Rtx®-5) and a bonded Carbowax® phase (Stabilwax®). These phases 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 non-bonded packing materials. Table I shows retention times on an Rtx®-1 bonded packed column are highly repeatable after only 30 minutes conditioning.

Table I Highly repeatable retention times demonstrate the Rtx®-1 bonded packed column is stable after only 30 minutes of conditioning.

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

Who says packed columns are old technology? Not Restek!
By combining flexible Silcosteel® tubing with low-bleed bonded phases, we have made the most significant improvements in packed column technology in more than 25 years!

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

Columns available in 0.75, 1, 2, 3.2, & 5.2mm ID.

Can be bent to fit any oven configuration.

Silcosteel® treatment makes the stainless steel surface more inert than glass.

The most complete line of packing materials available.

Specially Bonded Stationary Phases



Barry Burger
Innovations Chemist
14+ years of service!

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 provided 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. Now 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 non-bonded phases. Bonded phases are more resistant to oxidation than non-bonded phases because of the stronger intermolecular forces produced by cross-linking. Because the material is thoroughly cross-linked, the phase will not sag, as often happens with non-bonded phases. Figure 1 shows a comparison of a bonded and a non-bonded 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.

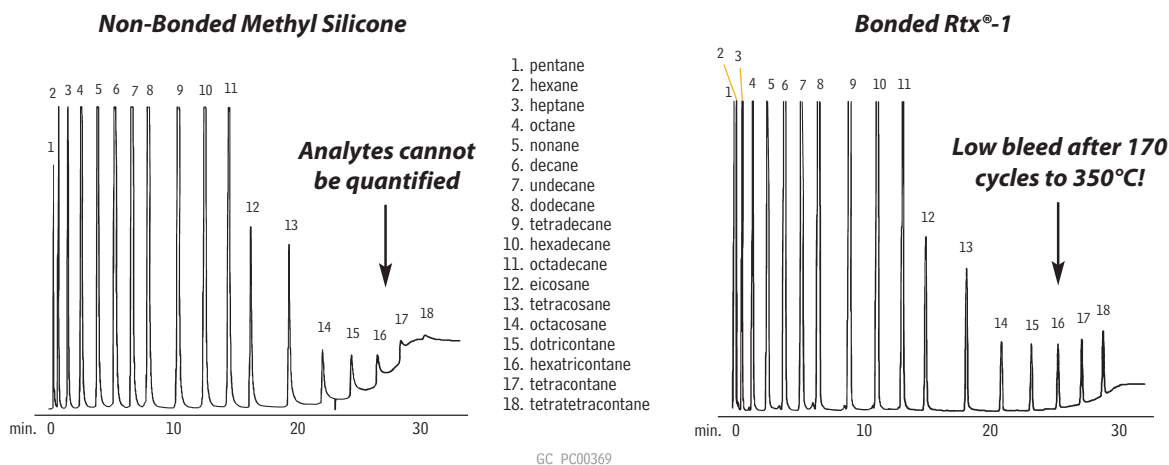
2. SilcoSmooth™ tubing provides the inertness of glass and the durability of stainless steel.

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

Equivalent Liquid Phases

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

Figure 1 Bonded packed columns exhibit longer lifetime than non-bonded packed columns.



25" x 1/8" x 2mm ID Rtx®-1 Sim Dist 2887 SilcoSmooth™ stainless steel (cat.# 80000-800)
1.0µl 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 10⁻¹¹ AFS

cat.# 31674 (1% each listed analyte in CS₂) and cat.# 31675 (5% each, neat) meet requirements of ASTM D2887-01.

Packed Column Tubing

Restek offers a wide range of tubing choices for packed columns, including SilcoSmooth™, Sulfinert®, 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 non-reactive 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 Silcosteel® deactivation process, SilcoSmooth™ tubing can replace glass columns for virtually any application.

Sulfinert® Tubing

Analyzing ppb levels of sulfur compounds has been virtually impossible using stainless steel columns. Made with a revolutionary deactivation process, Restek's Sulfinert®-treated tubing offers unsurpassed inertness for sulfur compounds, even at ppb levels. Sulfinert® tubing combined with Rt-XLSulfur™ packing material is ideal for trace-level sulfur compound analysis.

Stainless Steel Tubing

If you are analyzing hydrocarbons or non-reactive 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 non-active 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 5.2mm ID	3/16-inch OD x 3.2mm ID ¹	1/8-inch OD x 2.0mm ID ²	1/16-inch OD x 1.2mm ID ³	1/16-inch OD x 1.0mm ID ³	0.95mm OD x 0.75mm ID ⁴
SilcoSmooth™	✓	✓	✓		✓	✓
Sulfinert®		✓	✓		✓	
Stainless Steel	✓	✓	✓	✓	✓	✓
Hastelloy®			✓			
Nickel			✓			
Copper	✓		✓			
Teflon®			✓			

¹ 3/16-inch OD x 3.2mm ID replaces 1/4-inch OD x 4mm ID glass columns.

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

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

⁴ 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.

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

please note

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

Stock Packed Columns

Bonded Packed Column Stationary Phases

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

for custom
columns

see page 107

Bonded Phase on 100/120 Silcoport™ W	Stainless Steel Tubing				SilcoSmooth™ Tubing**			
	L (ft.)	OD (in.)	ID (mm)	cat.#*	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-

Chromosorb®-Based Packed Columns

also available

Chromosorb®, Porapak®,
HayeSep®, and Tenax®
packing materials.
See pages 113-114.

On 100/120 Silcoport™ W†	Stainless Steel Tubing				SilcoSmooth™ Tubing**			
	L (ft.)	OD (in.)	ID (mm)	cat.#*	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-

On Chromosorb® PAW	Mesh	Stainless Steel Tubing				SilcoSmooth™ Tubing**			
		L (ft.)	OD (in.)	ID (mm)	cat.#*	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-

Porous Polymers

Restek offers a full range of porous polymers, including HayeSep®, Porapak®, and Chromosorb® Century Series polymers and Tenax® TA packing, for analyses of volatile components and light solvents. To ensure fast stabilization times, each lot of packing is extensively solvent extracted and conditioned. Our QA test procedures give you the confidence that every batch you purchase will deliver consistent column-to-column performance.

Porous Polymer Packed Columns

please note

Temperature limits for
stationary phases are
listed on page 116.

Porous Polymers 80/100 Mesh	Stainless Steel Tubing				SilcoSmooth™ Tubing**			
	L (ft.)	OD (in.)	ID (mm)	cat.#*	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-

*Please add configuration suffix number to cat.# when ordering.

**Silcosteel®-deactivated stainless steel.

***Application specific column.

†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 non-silicone liquid phase. CarboBlack™ C support can hold up to a 1% loading of a non-silicone 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 Carbopack™ and CarboGraph™ supports.

also **available**

CarboBlack™ packing materials. See **page 111**.

On CarboBlack™ B	Mesh	Stainless Steel Tubing				SilcoSmooth™ Tubing**			
		L (ft.)	OD (in.)	ID (mm)	cat.#*	L (m)	OD (in.)	ID (mm)	cat.#*
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 ₃ PO ₄	60/80	6	1/8	2.1	80455-	1.8	1/8	2	80305-

On CarboBlack™ B	Mesh	Nickel 200 Tubing			
		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.#*	L (m)	OD (in.)	ID (mm)	cat.#*
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 ₃ PO ₄	60/80	2.5	3/16	3.2	80460-	0.75	3/16	3.2	80111-

Improved Molecular Sieves

Molecular sieve packed columns easily separate permanent gases at above-ambient temperatures. Restek's R&D chemists have developed new processes for preparing molecular sieve packings, which result in excellent batch-to-batch reproducibility. In addition, our molecular sieves are pre-activated 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.#*	L (m)	OD (in.)	ID (mm)	cat.#*
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 configuration suffix number to cat.# when ordering.

**Silcoteel®-deactivated stainless steel.

Column Configurations

General Configuration Suffix -800

Agilent 5880, 5890, 5987, 6890: 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 109 for custom configurations

Note: Initial 2" of column will be empty, to accommodate a needle. For a completely filled column add suffix -901.

Specialty Packed/Micropacked Columns

Permanent Gases & Hydrocarbon Analysis

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 micropacked columns, see page 110.

ShinCarbon ST Packed/Micropacked Columns

- Separate permanent gases, including CO/CO₂, without cryogenic cooling.
- Rapid separations of permanent gas / light hydrocarbon mixtures.
- Excellent compatibility with most GC detectors—minimal bleed, minimal baseline rise.
- Pre-conditioned, 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 (~1500 m²/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 manufacture, 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-

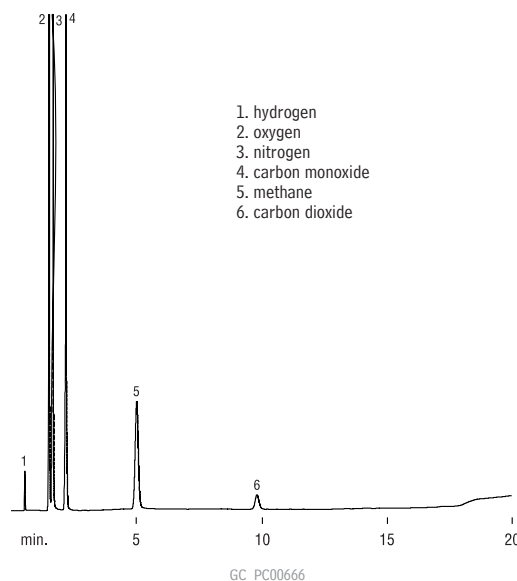
ShinCarbon ST 100/120 Micropacked Columns**

OD	ID	1-Meter	2-Meter
1/32"	1.0mm	19809	19808
0.95mm	0.75mm	19810	—

*Please add configuration suffix number to cat.# when ordering.

**Order installation kit separately. See page 110.

Separate permanent gases in 10 minutes, without cryogenics.



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

ShinCarbon ST 100/120 mesh
2 meter x 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 696, 698, 700, and 710 in the Applications section.

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

Rt-XLSulfur™ Packed/Micropacked Columns

- Optimized columns for low ppbv sulfur analyses.
- Eliminate the need for Teflon® tubing.
- Column and end-fittings are Sulfinert® 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. Analyses of ppbv levels of sulfur compounds are now possible with the Rt-XLSulfur™ column. 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 Sulfinert® treated, making the column as inert as Teflon®. The extra care taken with this column ensures more accurate analyses of sulfur compounds (see figure below).

Rt-XLSulfur™ Packed Columns

Purchase installation kit separately.**

OD	ID	1-Meter*	2-Meter*
1/8"	2.0mm	80484-	80485-
3/16"***	3.2mm	80482-	80483-

Rt-XLSulfur™ Micropacked Columns

Purchase installation kit separately.**

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

*Please add configuration suffix number to cat.# when ordering.

**See page 110 for installation kits.

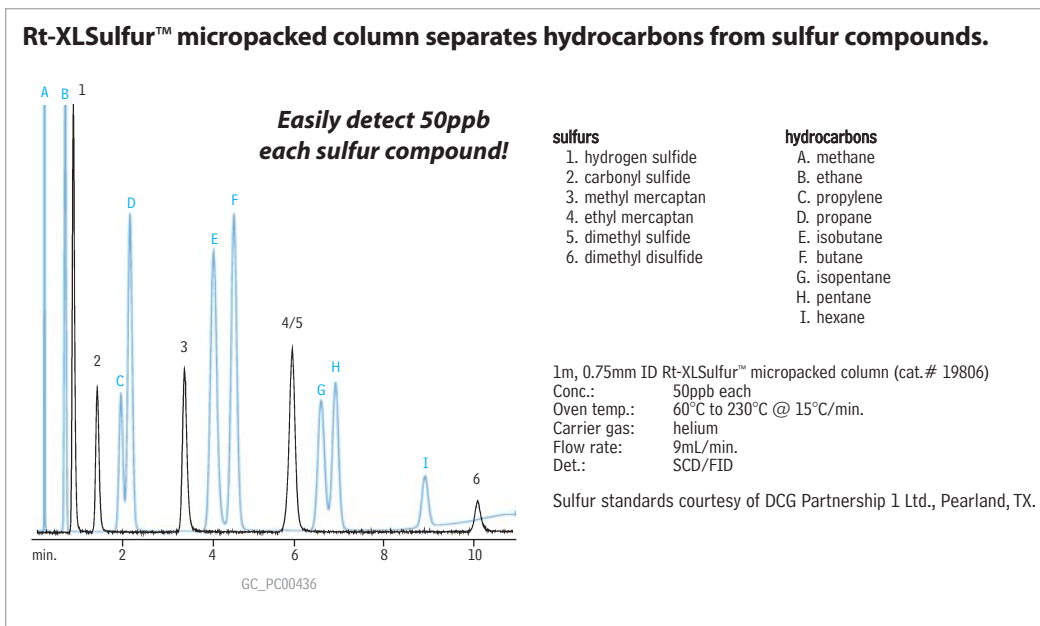
Excellent for Sulfur Analysis

did you know?

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

also available

For adapter kits for installing micropacked columns, see page 110.



Column Configurations	
	General Configuration Suffix -800
	Agilent 5880, 5890, 5987, 6890: Suffix -810
	Varian 3700, Vista Series, FID: Suffix -820
	PE 900-3920 8 3/4" Sigma 1,2,3: Suffix -830
	PE Auto System 8300, 8400, 8700 (Not On-Column): Suffix -840

See page 109 for custom configurations

Note: Initial 2" of column will be empty, to accommodate a needle. For a completely filled column add suffix -901.

Specialty Columns

Light Hydrocarbon Analysis

for more info

See page 112 for more information on Res-Sil™ packing materials.

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

*Please add configuration suffix number to cat.# when ordering.

Column Configurations



General Configuration
Suffix -800



Agilent 5880, 5890, 5987, 6890:
Suffix -810



Varian 3700, Vista Series, FID:
Suffix -820



PE 900-3920
8 7/8" Sigma 1,2,3:
Suffix -830



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

See page 109 for custom configurations

Note: Initial 2" of column will be empty, to accommodate a needle. For a completely filled column add suffix -901.

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

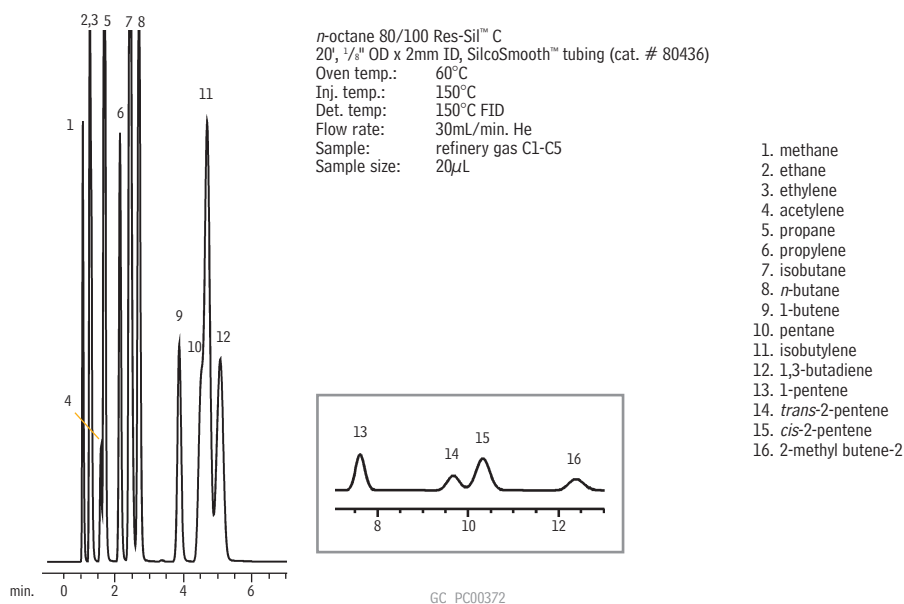
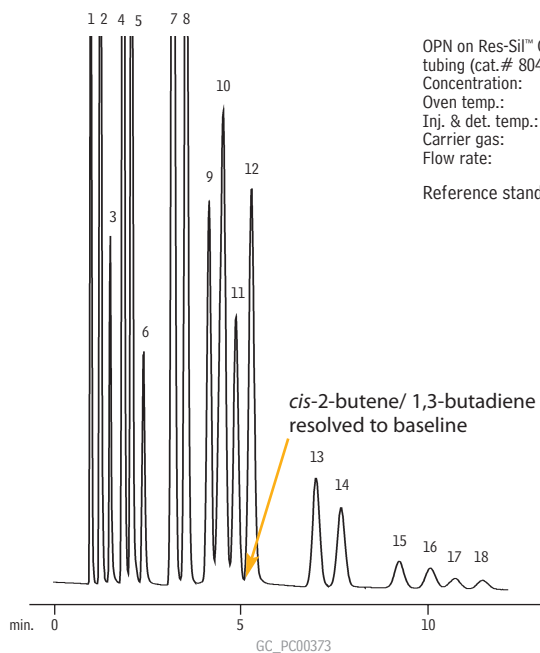


Figure 2 OPN on Res-Sil™ C packing has unique selectivity for *cis*-2-butene and 1,3-butadiene.

Darrel Zezzo
Ohio Valley Sales
Representative

also **available**

Res-Sil™ packing materials.
See **page 112**.

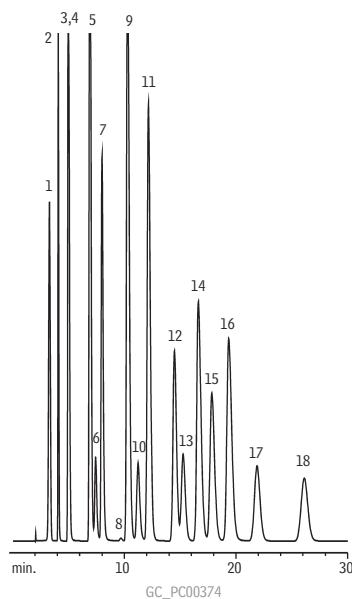


OPN on Res-Sil™ C, 80/100 mesh, 12' x 2mm ID x 1/8" OD in SilcoSmooth™ tubing (cat.# 80437). 20μL on-column injection of refinery gas.
Concentration: 0.1-6 absolute mole %
Oven temp.: 50°C
Inj. & det. temp.: 200°C
Carrier gas: helium
Flow rate: 30mL/min

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

Retention Indices

Peak #	Retention Index
1. methane	100
2. ethane/ethylene	200
3. acetylene	260
4. propane	300
5. propylene	321
6. propadiene	345
7. isobutane	386
8. butane	400
9. 1-butene	422
10. isobutylene/trans-2-butene	434
11. cis-2-butene	443
12. 1,3-butadiene	454
13. isopentane	488
14. pentane/3-methyl-1-butene	503
15. 1-pentene	522
16. trans-2-pentene	533
17. cis-2-pentene	540
18. 2-methyl-2-butene	549

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

1. C5=C6+
2. methane
3. ethane
4. ethylene
5. propane
6. acetylene
7. propylene
8. cyclopropane
9. isobutane
10. propadiene
11. n-butane
12. 1-butene
13. isobutene
14. trans-2-butene
15. cis-2-butene
16. 1,3-butadiene
17. isopentane
18. n-pentane

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

Micropacked Columns

Micropacked Columns

- Increased efficiency over traditional packed columns.
- Higher capacity than PLOT columns.
- Made from inert, flexible Silcosteel®-treated stainless steel tubing.
- Silcosteel®-treated, braided-wire end plug keeps packing intact, even under intense pressure surges during valve switching.
- Wide range of packings available.
- 100/120 mesh particles (molecular sieves are 80/100 mesh).

also available

For adapter kits for installing micropacked columns, see [page 110](#).

Efficient, inert, and flexible

Micropacked columns are highly efficient and provide good sample capacity. With our inert Silcosteel® treatment, micropacked columns are a powerful tool for solving many difficult application problems. Because the Silcosteel® 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.

did you know?

All micropacked columns are made with inert SilcoSmooth™ tubing, see [page 99](#).

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 Silcosteel® 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

also available

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

Custom Packed Columns

To order, 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 108.

ordering note

For international pricing on custom packed 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 110)

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

Please use the custom order form on page 108.

please note

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

Maximum length for custom micropacked columns is 25ft./8m.

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: _____

Number of Columns: _____

1) Column Dimensions:

Length _____ OD x ID: _____

2) Tubing (choose one): SilcoSmooth™ Sulfinert® 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: _____

Special configuration: _____ 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

Additional charge for stainless steel or SilcoSmooth™

Additional charge for nickel

for a quote:

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

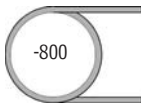
V/G = Vespel/graphite

RESTEK

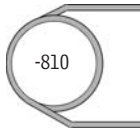
HROMalytic **RESTEK** **'07**
 Australian Distributors **ECH**nology
 Tel: 03 9762 2034 Fax: 03 9761 1169 www.chromtech.net.au info@chromtech.net.au

Standard Configurations (choose one)

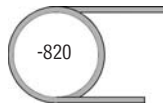
General Configuration



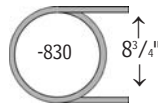
Agilent 5880, 5890, 5987, 6890



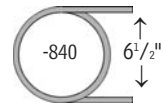
Varian 3700, Vista Series, FID



PE 900-3920, Sigma 1,2,3



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



Custom Configurations (Please provide dimensions on order form, page 108.)

Figure 1

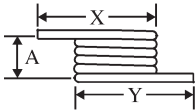
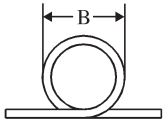


Figure 2

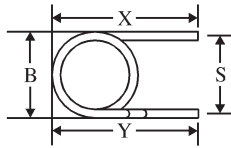


Figure 3

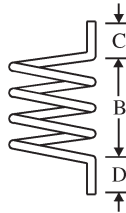
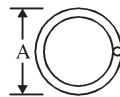


Figure 4

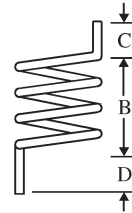
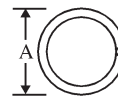


Figure 5

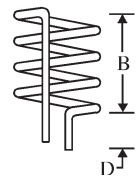
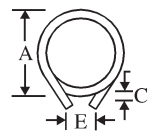


Figure 6

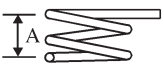
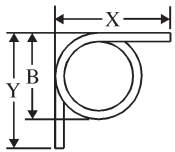


Figure 7

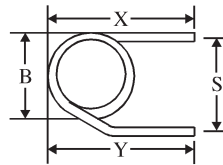


Figure 8

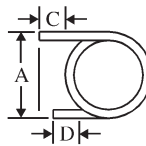


Figure 9

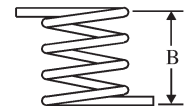
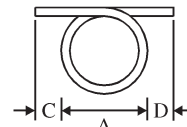


Figure 10

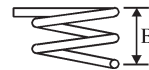
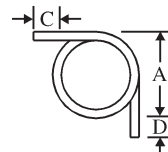


Figure 11

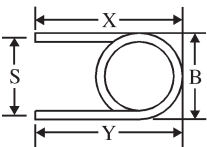


Figure 12

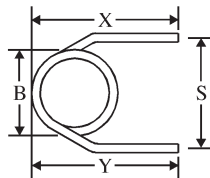


Figure 13

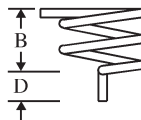
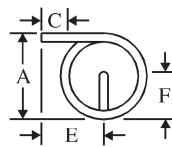


Figure 14

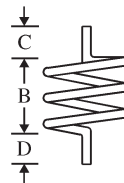


Figure 15



Packed and Micropacked Installation Kits



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.

Description	For $1/8$ " Columns		For $3/16$ " Columns	
	qty.	cat.#	qty.	cat.#
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
Micropacked Column Installation Kit for 0.75mm ID columns; for valve applications. 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	
Micropacked Column Installation Kit for 0.75mm ID columns; for split applications. Kit contains: graphite ferrules (2), Vespel®/graphite ferrules (2).	kit	21063	
Micropacked Column Installation Kit for 0.75mm ID columns; for all Agilent GCs. Kit contains: graphite ferrule (1), graphite ferrule (1), Vespel®/graphite ferrule (1), Vespel®/graphite ferrule (1).	kit	21064	
Micropacked Column Installation Kit for 1mm ID columns; for valve applications. 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	
Micropacked Column Installation Kit for 1mm ID columns; for direct injections. 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	
Packed Column Installation Kit for 2mm ID columns; for valve applications. Kit contains: $1/8$ " 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.#
Micropacked Column Adaptor Kit for Split/Splitless Injection* <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
Micropacked Column Adaptor Kit for On-Column Injection* <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
Micropacked Column Adaptor Kit for Split/Splitless Injection <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
Micropacked Column Adaptor Kit for On-Column Injection <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
Micropacked Column Adaptor Kit for FID* <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
Replacement Inlet Seals for Micropacked Column Adaptor Dual Vespel® Ring Inlet Seals, large bore (2)	2-pk.	22429
Replacement Metal Liner Installation Guide for On-Column Injection Siltek® treated metal liner installation guide	ea.	22430
Replacement 4mm Splitless Liner	ea.	20772

*For use with packed column FIDs only.



Large Bore Dual Vespel® Ring Inlet Seal



$1/4$ " SS Nut, Large Bore FID Adaptor, $1/16$ " SS Nuts, $1/4$ " Vespel®/Graphite Ferrule



Large Bore Reducing Nut



$1/16$ " Vespel®/Graphite Ferrules

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.

The increased sensitivity of modern detection systems and the desire to reduce detection limits requires a new solid support to meet the challenging demands faced by analysts. Silcoport™ supports from Restek are the perfect match for highly inert SilcoSmooth™ tubing. Unlike conventional 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. Each batch is carefully tested for particle size distribution, to ensure maximum efficiency. Inertness is confirmed by the analysis of a 50pg pesticide mixture.

restek
innovation!

Silcoport™—the most inert solid support available!

Silcoport™ Packings

Description	Temp. Limit (°C)	Mesh	Min. Qty.†	cat.#
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.

did you know?

Silcoport™ support replaces

- Supelcoport™
- Chromosorb® W HP
- GasChrom® Q

Silcoport™ W BW support replaces

- GasChrom® Q

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™ Packings

Description	Temp. Limit (°C)	Mesh	Min. Qty.	cat.#
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

Packed Column Packing Materials

did you know?

Res-Sil™ replaces

- Poracil B
- Poracil C

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 pages 104 and 105). 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.¹

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 and Stabilwax® phases, Carbowax® and *n*-octane phases on Res-Sil™ C packing, and our 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. Every batch of Restek's bonded phases is tested for bleed, efficiency, and retention index and retention time reproducibility.

Res-Sil™ Packing Materials

Description	Temp. Limit (°C)	Mesh	Min. Qty.	cat.#
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

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

Chromosorb® Diatomaceous Earth Supports

Restek offers the full line of Chromosorb® solid supports that are specially sieved to remove fines and ensure tight particle distribution. 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 for more information.

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), non-acid 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® and is an extremely inert solid support.

Call Restek at 800-356-1688 or 814-353-1300, ext. 3, or contact your Restek representative for quotes on any Chromosorb® material. Some of the popular Chromosorb®-based stock columns and packings available are:

Chromosorb® Packings

Description	Mesh	Min.		Description	Mesh	Min.	
		Qty.*	cat.#			Qty.*	cat.#
Chromosorb® PNAW	45/60	100g	25629	Chromosorb® GAW/DMDCS	45/60	100g	25651
	60/80	100g	25630		60/80	100g	25652
	80/100	100g	25631		80/100	100g	25653
	100/120	100g	25632		100/120	100g	25654
Chromosorb® PAW	45/60	100g	25633	Chromosorb® G-HP	100/120	100g	25655
	60/80	100g	25634	Chromosorb® WNAW	45/60	100g	25656
	80/100	100g	25635		60/80	100g	25657
	100/120	100g	25636		80/100	100g	25658
			100/120		100g	25659	
Chromosorb® PAW/DMDCS	45/60	100g	25637	Chromosorb® WAW	45/60	100g	25660
	60/80	100g	25638		60/80	100g	25661
	80/100	100g	25639		80/100	100g	25662
	100/120	100g	25640		100/120	100g	25663
Chromosorb® GNAW	45/60	100g	25643	Chromosorb® WAW/DMDCS	45/60	100g	25664
	60/80	100g	25644		60/80	100g	25665
	80/100	100g	25645		80/100	100g	25666
	100/120	100g	25646		100/120	100g	25667
Chromosorb® GAW	45/60	100g	25647	Chromosorb® W-HP	60/80	100g	25668
	60/80	100g	25648		80/100	100g	25669
	80/100	100g	25649		100/120	100g	25670
	100/120	100g	25650		120/140	100g	25671
				Chromosorb® T	40/60	100g	25676

NAW—non-acid washed

AW—acid washed

DMDCS—dimethyldichlorosilane

BW—base washed

DA—deactivated for acidic compounds

*Bulk quantities are available.

Packed Column Packing Materials

Chromosorb® Century Packings

Description	Temp.		Mesh 60/80		Mesh 80/100	Mesh 100/120
	Limit (°C)	g/btl.	cat.#	cat.#	cat.#	cat.#
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.		Mesh 50/80		Mesh 80/100	Mesh 100/120
	Limit (°C)	g/btl.	cat.#	cat.#	cat.#	cat.#
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

HayeSep® Series Packings

Description	Temp.		Mesh 60/80		Mesh 80/100	Mesh 100/120
	Limit (°C)	g/btl.	cat.#	cat.#	cat.#	cat.#
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.	Min.	Mesh 60/80		Mesh 80/100	
	Limit (°C)	Qty.	cat.#	cat.#	cat.#	cat.#
Tenax®-TA	350	10g	25550		25551	
Tenax®-GR	350	10g	25552		25553	

it's a fact

Restek On-The-Road training seminars are full-day courses presented in an engaging multimedia format. They are equally valuable to beginning chromatographers, those who have moderate experience and want a better understanding of the subject matter, and those interested in the "best practices" and latest technologies. **No sales pitch is presented**, just the facts on how to make your chromatography results better. The bulk of each course is lecture, but numerous demonstrations and problem-solving exercises facilitate and reinforce the understanding of important principles. See [page 500](#) for more information.

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 116 and the coating ranges are listed below. Coated packings are available in standard 20 and 50 gram quantities.

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

- 1) stationary phase and stationary phase concentration
- 2) support type and 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 - 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

*Non-silicone phase.

**Silicone phase.

For coatings over 15% or quantities over 50 grams, please call for custom pricing.

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



Don Rhodes
R&D Technical Specialist
9+ years of service!

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

please note

Special phases that require a surcharge:
OV®-275, OV®-330, OV®-225, BMBT, 2,4-dimethylsulfolane, Silar®, EDO-1, OV®-1701, XE-60, and Dexsil®

Liquid Phases

We can prepare packed columns from the extensive list of liquid phases shown here.

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)- α,α' - <i>bi-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	Polyethylene 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™	250 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	β,β -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
β,β -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.

did you know?

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.



USP Liquid Phase and Solid Support Cross-Reference

Restek can meet all of your packed column needs for US Pharmacopoeia methods. Commonly used USP (24th ed.) 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 (av. mol. wt. 950-1050)	Carbowax [®] 1000
G15	polyethylene glycol (av. mol. wt. 3000-3700)	Carbowax [®] 4000
G16	polyethylene glycol compound (av. 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 (av. 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
G28	25% phenyl-75% methylpolysiloxane	DC 550
G29	3,3'-thiodipropionitrile	TDPN
G30	tetraethylene glycol dimethyl ether	tetraethylene glycol dimethyl ether
G31	nonylphenoxy poly(ethyleneoxy)ethanol (av. ethyleneoxy chain length is 30): nonoxynol 30	Igepal [®] CO 880
G32	20% phenylmethyl-80% dimethylpolysiloxane	OV [®] -7
G33	20% Carborane [®] -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 (av. 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 ¹	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 ² /g and an av. pore diameter of 0.3 to 0.4µm	Chromosorb [®] 101
S3	ethylvinylbenzene-divinylbenzene copolymer with nominal surface area of 500 to 600m ² /g and an av. 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 ² /g and an av. pore diameter of 0.0076µm	Hayesep [®] R
S5	high molecular weight tetrafluoroethylene polymer, 40- to 60-mesh	Chromosorb [®] T
S6	styrene-divinylbenzene copolymer having a nominal surface area of 250 to 350m ² /g and an av. pore diameter of 0.0091µm	Chromosorb [®] 102
S7	graphitized carbon having a nominal surface area of 12m ² /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 ² /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 ² /g	CarboBlack [™] B

¹USP 24/NF19<621> Chromatography pp. 1924-1926.