



GC Columns

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Packed/Micropacked Columns

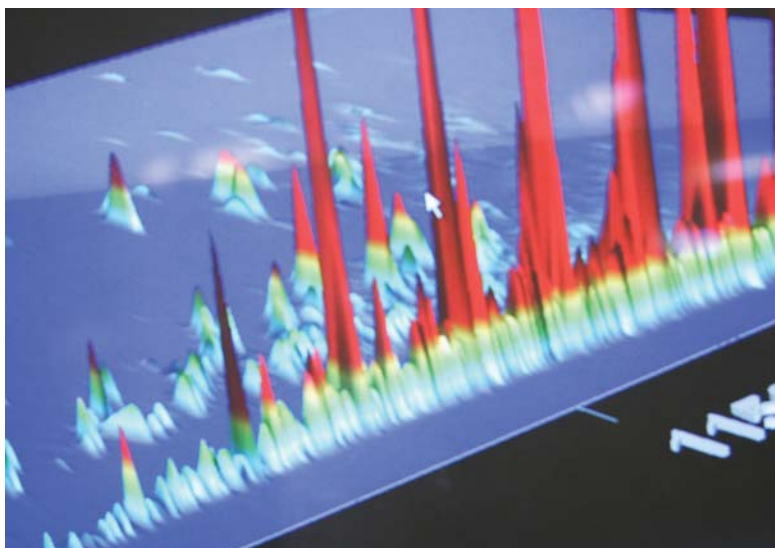
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Fused Silica Capillary GC

Top: Rick Morehead, R&D GC Column
Group Leader

Bottom: Restek Innovation at Work:
Comprehensive GCxGC-FID chromatogram of
diesel fuel (instrument courtesy of LECO Corp.)



High-Quality Fused Silica Tubing

A column's quality is only as good as the materials from which it is manufactured. We use only high-quality fused silica tubing for our Rxi™, Rtx®, Rt, and Stx™ capillary columns.

High-Quality Polymers

We synthesize the polymers that go into Restek's columns to exact standards, in our own laboratory; this ensures the highest quality and consistency. Residual catalysts and low molecular weight fragments are removed to provide a tight molecular weight distribution and reduce column bleed. Every polymer is fully characterized to ensure that the column you buy today will meet the same specifications as the column you bought last month, or last year.

Strict Testing Requirements for Every Column

Every Restek capillary column is individually tested for inertness, coating efficiency, film thickness, selectivity, and bleed, to ensure the product meets column specifications and will perform to your expectations.

Unbreakable Metal Capillary Columns Available in Many Phases

Fused silica tubing may not be the ideal material for harsh environments or special applications. We make MXT® capillary columns from unbreakable, thin-walled stainless steel treated with our Silcosteel® process to give inertness similar to our fused silica columns. MXT® columns are caged in small diameter coils that are ideal for portable or process GCs. See pages 78-89.

Innovative Cage Design

Our specially-designed stainless steel cage completely surrounds the column, protecting it from damage. Our 7.65" (19.4 cm) diameter cage for fused silica columns fits most GC ovens. We also offer other cage designs for smaller ovens, including the Agilent 6850 oven.

Customer Support

Have a special request? Call us! At Restek, satisfying your needs is our #1 priority. It is our policy to do everything within our power to meet our customers' needs.

Restek Columns in Action

Interested in seeing real results from Restek columns? Just turn to pages 576–747 for hundreds of application chromatograms covering an extensive range of samples. If you don't find what you're looking for there, please check our website, call us at 800-356-1688 or 814-353-1300, ext. 4, or contact your Restek representative.



Research & Development Group

Steve Allison, Lisa Pantzar, Jarl Snider, Mike Wittrig, Donald Rhoads, Valerie Strohm, Doug Smith, Chris Cox, Jennifer Weston, Paul Silvis

Selecting a Column



Rick Crago
Applied Science
Group Chemist
17+ years of service!

How Do I Know Which Column to Use?

Restek offers over 1000 different capillary columns. If you do not know exactly which column to choose, selection can be a hit-or-miss decision. The next several pages of this catalog contain information that will help you determine the proper column for a particular sample. In addition, it might encourage you to carefully examine whether the column currently being used is the best choice, or whether improvements in resolution, speed of analysis, and quantification could be achieved by using a different column.

Column Materials: Fused Silica vs. MXT® Tubing

Both fused silica (Rxi™, Rtx®, Rt, and Stx™) and stainless steel (MXT®) columns offer a high degree of inertness and excellent flexibility. The fused silica columns are the first material of choice for capillary chromatography. Fused silica offers the best column coating efficiency, resulting in better resolution of closely eluting compounds. Fused silica columns are also available with an integral guard column (Integra-Guard™ columns). Under harsh operating conditions, such as high temperatures (>360°C) or rugged usage encountered in field sampling, MXT® columns may be the best choice. MXT® columns are resistant to breakage from abrasion and scratches, and show little risk of spontaneous breakage at any GC operating temperature. MXT® columns are caged in 4" diameter coils or smaller, which are ideal for small ovens. MXT® columns also are ideal for process or portable GCs, where column integrity is of great importance, or for any lab conditions in which it is critical to avoid down-time due to spontaneous breakage. See pages 78-89 for our MXT® columns.

Stationary Phase Selectivity

Table II (on the facing page) shows the chemical structures of many Restek phases. The non-polar Rxi™-1/Rtx®-1 phase will preferentially retain non-polar compounds. As methyl groups are replaced by different functionalities such as phenyl or cyanopropyl units, the selectivity of the column shifts toward more polar compounds. In turn, non-polar compounds are retained less. The Rtx®-200 stationary phase provides high selectivity for analytes containing lone pair electrons, such as nitro or carbonyl groups. Polyethylene glycol columns, such as Stabilwax® and Rtx®-WAX columns, are highly selective toward polar compounds such as alcohols.

Table I lists the Kovats retention indices for the stationary phases in Table II. These are useful for comparing selectivity among columns, or among different manufacturers' columns.

Table I Retention Indices for Restek Phases

Phase	Benzene	Butanol	Pentanone	Nitropropane
Rxi™-1/Rtx®-1	651	651	667	705
Rxi™-5/Rtx®-5/				
Rtx®-5Sil MS/Rtx®-5MS	667	667	689	743
Rtx®-20	711	704	740	820
Rtx®-1301/Rtx®-624	689	729	739	816
Rtx®-35	746	733	773	867
Rtx®-200	738	758	884	980
Rxi™-50	778	769	813	921
Rtx®-1701	721	778	784	881
Rtx®-65TG	794	779	825	938
Rtx®-225	847	937	958	958
Stabilwax®	963	1158	998	1230

free literature

*Selection Guide for Polar Wax
GC Column Phases*

- Performance information
about six polyethylene
glycol (PEG) columns.

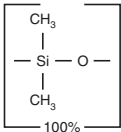
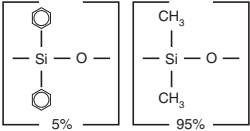
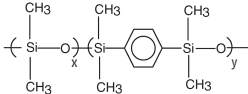
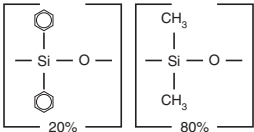
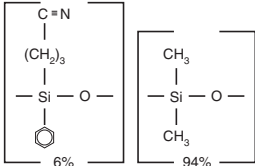
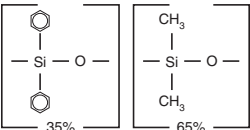
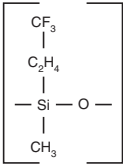
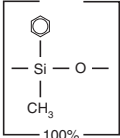
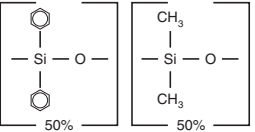
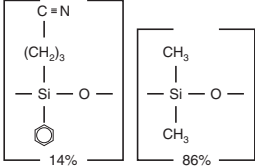
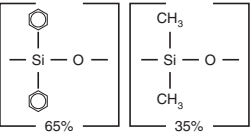
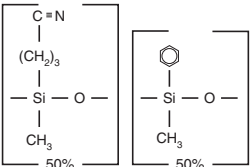
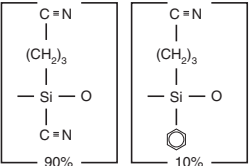
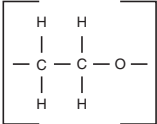
- Applications for each column.

Call Restek at 800-356-1688
or 814-353-1300, ext. 5, or
contact your Restek
representative, to request
your free copy!

lit. cat.# 59890 (domestic)

lit. cat.# 59891 (international)

Table II Structures, Polarities, Properties, and Uses for Restek Capillary Column Phases, In Order of Increasing Polarity.

<p>Rxi™-1ms/Rtx®-1 100% dimethyl polysiloxane</p>  <p>Polarity: non-polar Uses: solvents, petroleum products, pharmaceutical samples, waxes [G1]</p>	<p>Rxi™-5ms/Rtx®-5/Rtx®-5MS 5% diphenyl 95% dimethyl polysiloxane</p>  <p>Polarity: slightly polar Uses: flavors, environmental, aromatic hydrocarbons [G27]</p>	<p>Rtx®-5Sil MS proprietary</p>  <p>Polarity: slightly polar Uses: flavors, environmental, pesticides, PCBs, aromatic hydrocarbons</p>	<p>Rtx®-20 20% diphenyl 80% dimethyl polysiloxane</p>  <p>Polarity: slightly polar Uses: volatile compounds, alcohols [G32]</p>
<p>Rtx®-1301, Rtx®-624 6% cyanopropylphenyl 94% dimethyl polysiloxane</p>  <p>Polarity: slightly polar Uses: volatile compounds, insecticides, residue solvents in pharmaceutical products [G43]</p>	<p>Rtx®-35 35% diphenyl 65% dimethyl polysiloxane</p>  <p>Polarity: intermediately polar Uses: pesticides, Aroclor® PCBs, amines, nitrogen-containing herbicides [G42]</p>	<p>Rtx®-200 trifluoropropylmethyl polysiloxane</p>  <p>Polarity: selective for lone pair electrons Uses: environmental, solvents, Freon® gases, drugs, ketones, alcohols [G6]</p>	<p>Rxi™-50 100% methylphenyl polysiloxane</p>  <p>Polarity: intermediately polar Uses: FAMES, carbohydrates [G3]</p>
<p>Rxi™-17 50% diphenyl 50% dimethyl polysiloxane</p>  <p>Polarity: intermediately polar Uses: triglycerides, phthalate esters, steroids, phenols [G3]</p>	<p>Rtx®-1701 14% cyanopropylphenyl 86% dimethyl polysiloxane</p>  <p>Polarity: intermediately polar Uses: pesticides, Aroclor® PCBs, alcohols, oxygenates [G46]</p>	<p>Rtx®-65TG 65% diphenyl 35% dimethyl polysiloxane</p>  <p>Polarity: intermediately polar Uses: triglycerides, rosin acids, free fatty acids</p>	<p>Rtx®-225 50% cyanopropylmethyl 50% phenylmethyl polysiloxane</p>  <p>Polarity: polar Uses: FAMES, carbohydrates [G7]</p>
<p>Rt-2330 90% biscyanopropyl 10% cyanopropylphenyl polysiloxane</p>  <p>Polarity: very polar Uses: cis/trans FAMES, dioxin isomers, rosin acids [G48]</p>	<p>Stabilwax® Carbowax® PEG</p>  <p>Polarity: polar Uses: FAMES, flavors, acids, amines, solvents, xylene isomers [G16]</p>	<p>ordering note Designations in [brackets] are USP codes. We recommend this phase when your application calls for this code. See page 117.</p>	

Selecting a Column



Gary Stidsen
GC Columns Product
Marketing Manager
10+ years of service!

Internal Diameter (ID)

When selecting an internal diameter, sample concentration and instrumentation must be considered. If the concentration of the sample exceeds the column capacity, loss of resolution, poor reproducibility, and peak distortion will result. Table III shows typical column characteristics. Larger ID columns are recommended for high concentration analysis or with dirty matrices. Narrower bore columns can be connected directly to a mass spectrometry detector (MSD) because of the low flow at optimum linear velocity. They also can be used in low concentration analysis, or when there is a need for higher resolution.

Table III Typical Column Characteristics

Characteristic	0.10mm	0.18mm	0.25mm	0.32mm	0.53mm
Helium Flow (@ 20cm/sec.)	0.05cc/min.	0.3cc/min.	0.7cc/min.	1.2cc/min.	2.6cc/min.
Hydrogen Flow (@ 40cm/sec.)	0.09cc/min.	0.6cc/min.	1.4cc/min.	2.4cc/min.	5.2cc/min.
Sample Capacity	<10ng	<50ng	50–100ng	400–500ng	1000–2000ng
Effective Plates/Meter	8000	3700	2700	2100	1300

Film Thickness

Film thickness has a direct effect on the retention and elution temperature for each sample component. Extremely volatile compounds should be analyzed on thick-film columns to increase the time the compounds spend in the stationary phase, allowing them to separate. High molecular weight compounds must be analyzed on a thin-film column. This reduces the length of time the analytes stay in the column, and minimizes bleed at required higher temperatures.

To provide similar resolution and retention (equivalent phase ratio) when internal diameter is increased, film thickness (df) must be increased. Table IV shows phase ratio (β) values for common dimensions of columns. Similar values indicate similar elution.

Table IV Phase Ratio (β) Values for Common Column Dimensions*

Column ID	Film Thickness (df) / β Value						
	0.10 μ m	0.25 μ m	0.50 μ m	1.0 μ m	1.5 μ m	3.0 μ m	5.0 μ m
0.18mm	450	180	90	45	30	15	9
0.25mm	625	250	125	63	42	21	13
0.32mm	800	320	160	80	53	27	16
0.53mm	1325	530	265	128	88	43	27

* $\beta = r/2df$ (r = internal radius of tubing; df = phase film thickness)

Length

Capillary columns are made in lengths from 15 meters to 105 meters. Longer columns provide more resolving power, but increase analysis time and column cost. Doubling the column length only increases resolution by approximately 40% but, under isothermal conditions, will double analysis time. In temperature-programmed analyses, retention times are more dependent on temperature than column length, with only a marginal increase in analysis time.

Rising Baselines: Column Bleed & System Contamination

Rising baselines during temperature-programmed GC (Figure 1, facing page) can be caused by several factors: stationary phase bleed from the analytical column, septum bleed, contamination in the injection port or detection system, and/or a change in the flow rate. With very sensitive detectors, even a small amount of bleed or contamination can cause a significant baseline rise. Reducing or eliminating rising baselines can improve qualitative and quantitative reliability of your analyses.

The simplest way to distinguish between column and system contributions to rising baselines is to use a systematic approach. The first step is to remove the analytical column from the system, cap off the detector, and monitor the background during a temperature-programmed run. If the baseline is unstable, see “How can detector effects be reduced?” (facing page) If the baseline is stable, connect a short length of clean, uncoated fused silica tubing from the injector to the detector and perform another temperature-programmed run, to reveal the effects of the injector. If the baseline is unstable, see “How can sample or injector effects be reduced?” If the baseline is stable, re-install the column and perform a temperature-programmed run, without making an injection, to determine if the column increases the background.

frequently asked question

Still have questions on column selection? Let us help!

1) Call Technical Service at 800-356-1688 or 814-353-1300, ext. 4, or contact your Restek representative.

2) Visit us online—
www.restek.com

3) Attend the Restek Comprehensive GC Seminar. (See Educational Materials for details: [page 500](#).)

How can detector effects be reduced?

Baseline rise originating in the detector usually is caused by trace hydrocarbons in the make-up gas and/or fuel gases. Using high-quality gas purifiers for make-up gas and fuel gases is critical to reducing background levels caused by the detection system. A high-purity air generator can greatly improve FID baseline stability (Figure 2). Proper detector maintenance, including periodic cleaning, also is critical to minimizing this source of baseline rise.

How can sample or injector effects be reduced?

High molecular weight, non-volatile sample residue can slowly migrate through the column and cause a rise in the baseline during a temperature-programmed run. Re-conditioning the column usually can remove these contaminants. Solvent rinsing is an alternative. Be sure to read the manufacturer's recommendations before rinsing a column. Contamination can be reduced by using a guard column. If the injector is contributing to the baseline, replace the septum, liner, and seal. Rinsing the injection port with solvent may be necessary. After maintenance, confirm the cleanliness of the injection port by making a blank injection onto a short length of uncoated tubing, installed between the injector and the detector.

How can column bleed be reduced?

To minimize column bleed, follow the conditioning procedures that accompany your new column. As a general rule, condition the column at 20°C above the final temperature of the analysis, or at the maximum operating temperature of the column, whichever is lower. Longer conditioning times at lower temperatures may reduce column bleed. Conditioning a column at high temperature can damage the column if the carrier gas contains trace amounts of oxygen or moisture, or if leaks in the carrier gas line allow these contaminants into the gas. Oxygen or moisture can oxidize the stationary phase and cause column bleed (Figure 3). After exposure to oxygen, several hours of conditioning with clean gas were needed to return the baseline in Figure 3 to its original level; damage to the stationary phase cannot be un-done. If trace amounts of oxygen are introduced continuously onto the column, the baseline may never be at a minimum. Therefore, use high-quality oxygen and moisture traps on all carrier gas lines and thoroughly check for leaks, using an electronic leak detector, before conditioning the column, and routinely over the column's lifetime.

Also, samples with extremely low or high pH may react with the polymer, resulting in high bleed and tailing peaks.

frequently asked question

How do I know which column to use for my analysis?

Follow our column selection suggestions on [pages 18-23](#) or call 800-356-1688 or 814-353-1300, ext. 4, or contact your Restek representative for help.

Figure 1 Rising baselines are common during temperature-programmed analyses.

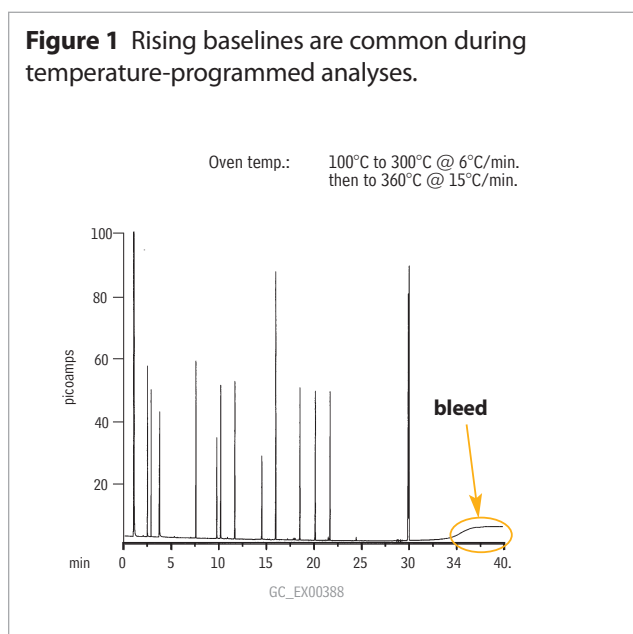


Figure 2 Carrier gas purity affects FID baselines.

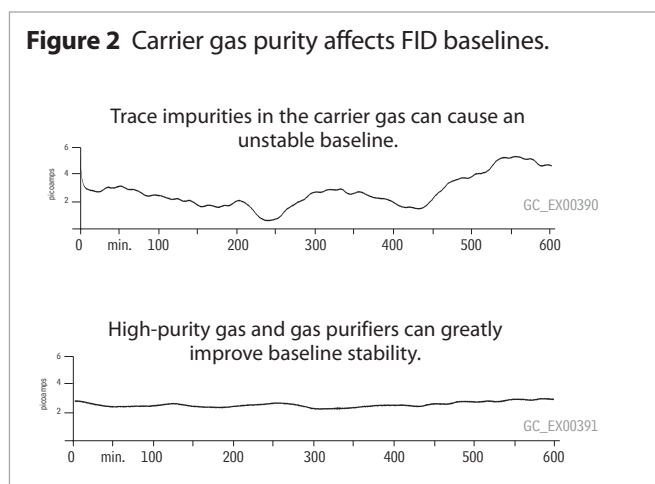
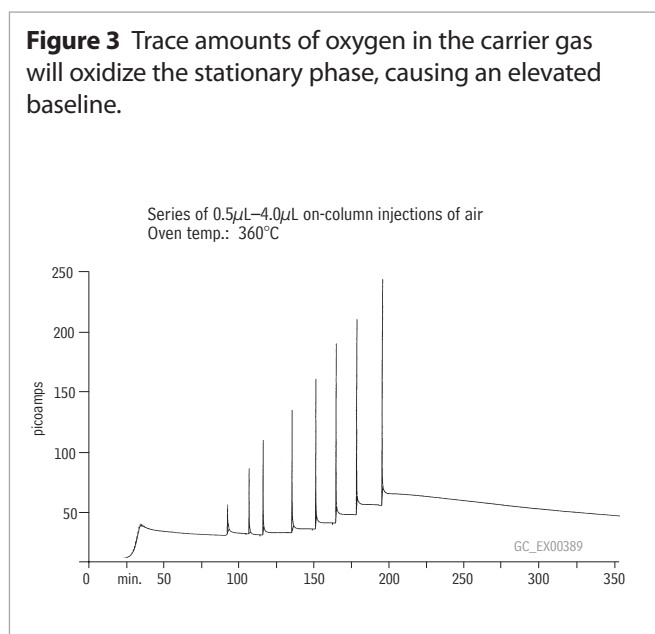


Figure 3 Trace amounts of oxygen in the carrier gas will oxidize the stationary phase, causing an elevated baseline.



Columns by Phase Composition

Restek	Phase Composition	Agilent/J&W	Supelco	Alltech	Macherey-Nagel	SGE	Varian/Chrompack	Phenomenex	Quadrex	PerkinElmer	USP Nomenclature*
Rxi-1ms (p.32), Rbx-1 (p.35), Rbx-1MS (p.35)	100% dimethyl polysiloxane	HP-1, HP-101, HP-1MS, Ultra-1, DB-1, DB-1MS, DB-1ht, SE-30	Equity-1, SPB-1, SP-2100, SPB-1 Sulfur, SE-30, MDN-1	AT-1, SE-30, AT-1MS, EC-1	Optima 1, Optima-1ms	BP-1	VF-1MS, CP Sil 5 CB, CP Sil 5 CB MS, SolGel-1MS	ZB-1	007-1	Elite-1	G1, G2, G38
Rxi-5ms (p.33), Rbx-5 (p.39), Rbx-5MS (p.39)	95% dimethyl/ 5% diphenyl polysiloxane	HP-5, HP-5MS, PAS-5, DB-5, DB-5.625, DB-5ht, SE-54	Equity-5, SPB-5, PTE-5, SE-54, SAC-5, PTE-5 QTM, MDN-5	AT-5, SE-54, AT-5MS, EC-5	Optima 5, Optima-5ms	BP-5	VF-5MS, CP Sil 8 CB, CP Sil 8 CB MS	ZB-5	007-2	PE-2	G27, G36
Rbx-5Sil MS (p.41)	95% dimethyl/ 5% diphenyl polysilarylene	HP-5TA, DB-5ms	MDN-5S	—	—	BPX-5	VF-XMS	ZB-5MS	—	—	—
Rbx-1301 (p.48), Rbx-624 (p.73)	6% cyanopropylphenyl/ 94% dimethyl polysiloxane	HP-1301, HP-624, DB-1301, DB-624	SPB-1301	AT-624	Optima 1301, Optima 624	BP-624	—	ZB-624	007-1301	—	G43
Rbx-20 (p.44)	80% dimethyl/ 20% diphenyl polysiloxane	—	SPB-20, VOCOL	AT-20	—	—	—	—	007-7	PE-7	G28, G32
Rbx-35, Rbx-35MS (p.45)	65% dimethyl/ 35% diphenyl polysiloxane	HP-35, HP-35MS, DB-35	SPB-35, SPB-608, MDN-35	AT-35, AT-35MS, EC-35	—	BPX-35, BPX-608	VF-35MS	ZB-35	007-11	PE-11	G42
Rbx-1701 (p.49)	14% cyanopropylphenyl/ 86% dimethyl polysiloxane	HP-1701, PAS-1701, DB-1701	SPB-1701	AT-1701	Optima 1701	BP-10	CP Sil 19 CB	ZB-1701	007-1701	PE-1701	G46
Rbx-200, Rbx-200MS (p.51)	trifluoropropylmethyl polysiloxane	DB-210, DB-200	—	AT-210	Optima 210	—	VF-200MS	—	007-210	—	G6
Rxi-17 (p.34)	50% dimethyl/ 50% diphenyl polysiloxane	DB-17, DB-17HT, DB-608	—	—	—	—	—	—	—	—	—
Rxi-50 (p.34)	100% methyl phenyl polysiloxane	HP-17, HP-50+	SP-2250, SPB-50	AT-50, AT-50MS	Optima 17	BPX-50	VF-17MS, CP Sil 24 CB	ZB-50	007-17	PE-17	G3
Rbx-65, Rbx-65TG (p.47)	35% dimethyl/ 65% diphenyl polysiloxane	—	—	—	—	—	TAP-CB	—	400-65HT, 007-65HT	—	G17
Rbx-225 (p.50)	50% cyanopropylmethyl/ 50% phenylmethyl polysiloxane	HP-225, DB-225	—	AT-225	Optima 225	BP-225	CP Sil 43 CB	—	007-225	PE-225	G7, G19
Stabilwax (p.53), Rbx-WAX (p.56)	polyethylene glycol (PEG)	HP-20M, Inno Wax, DB-Wax, Carbowax 20M, HP-Wax, DB-Waxetr	Supelcowax-10, Carbowax PEG 20M	AT-Wax, Carbowax, AT-WAXMS	Permabond CW 20M, Optima WAX	BP-20	CP Wax 52 CB	ZB-WAX	007-CW	PE-CW	G14, G15, G16, G20, G39
Stabilwax-DB (p.55)	PEG for amines and basic compounds	CAM	Carbowax-Amine	—	—	—	CP Wax 51	—	—	—	—
Stabilwax-DA (p.54)	PEG for acidic compounds	HP-FFAP, DB-FFAP, OV-351	Nukol, SP-1000	AT-1000, FFAP	Permabond FFAP, Optima FFAP	BP-21	CP Wax 58 CB	—	007-FFAP	PE-FFAP	G25, G35
Rbx-2330 (p.52)	90% biscyanopropyl/ 10% cyanopropylphenyl polysiloxane	—	SP-2330, SP-2331, SP-2380	AT-Silar	—	BPX-70	CP Sil 84	—	007-23	—	G48
Rt-2560 (p.52)	biscyanopropyl polysiloxane	—	SP-2560	—	—	—	—	—	—	—	—
Rt-βDEXm (p.76)	permethylated β cyclodextrin	Cyclodex-β	β-DEX	Chiraldex-β	—	Cydex-β	CP-Cyclodextrin β	—	—	—	—
Rt-TCEP (p.58)	1,2,3-tris(cyanoethoxy)propane	—	TCEP	—	—	—	CP-TCEP	—	—	—	—
Rbx-440 (p.43)	restek exclusive	—	—	—	—	restek exclusive	—	—	—	—	—
Sbx-500 (p.64)	phenyl polycarbonate-siloxane	—	—	—	—	HT-5	—	—	—	—	—
Rbx-XLB (p.42)	proprietary phase	DB-XLB	—	—	—	—	—	—	—	—	—
Column Features	Phase Composition	Agilent/J&W	Supelco	Alltech	Macherey-Nagel	SGE	Varian/Chrompack	Phenomenex	Quadrex	PerkinElmer	USP Nomenclature*
Integra-Guard (p.29)	built in guard column	DuraGuard	—	—	—	—	EZ-Guard	Guardian	—	—	—
MXT (p.78-89)	Silcosteel-treated stainless steel	ProSteel	Metallon	—	—	AlumaClad	Ultimet	—	Ultra-Alloy	—	—

Columns by Application

Restek	Application	Agilent/J&W	Supelco	Alltech	SGE	Varian/Chrompack	Phenomenex	Quadrex	PerkinElmer	USP*
Rbx-VMS (p.69), Rbx-VGC (p.70)	Volatile organics analysis - EPA methods 502.2, 524.2, 601, 602, 624, 8010, 8020, 8240, 8260	restek exclusive	—	—	—	restek exclusive	—	—	—	—
Rbx-VRX (p.71), Rbx-502.2 (p.72), Rbx-624 (p.73), Rbx-Volatiles (p.72)	Volatile organics analysis - EPA methods 502.2, 524.2, 601, 602, 624, 8010, 8020, 8240, 8260	HP-624, HP-VOC, DB-624, DB-502.2, DB-VRX	VOCOL, SPB-624	AT-624	—	CP Sil 13 CB	OV-624	007-624, 007-502	PE-502	—
Rbx-CLPesticides, Rbx-CLPesticides2, (p.62) Sbx-CLPesticides, Sbx-CLPesticides2 (p.60)	Organochlorine pesticides - EPA methods 8081, 608, and CLP Pesticides	restek exclusive	—	—	—	restek exclusive	—	—	—	—
Rbx-OPPesticides, Rbx-OPPesticides2 (p.59)	Organophosphorus pesticides - EPA method 8141A	restek exclusive	—	—	—	restek exclusive	—	—	—	—
Rxi-5ms (p.33), Rbx-5 (p.39), Rbx-35 (p.45), Rxi-50 (p.34), Rbx-1701 (p.49)	Organochlorine pesticides - EPA method 608	HP-5, PAS-5, DB-5, DB-35, DB-608, HP-608, PAS-1701, DB-1701, DB-17, HP-50, HP-35	SPB-5, SPB-608, SPB-1701	AT-5, AT-35, AT-50, AT-1701, AT-Pesticides	BP-5, BP-10, BP-608	CP Sil 8 CB, CP Sil 19 CB	ZB-5, ZB-35, ZB-1701, ZB-50	007-2, 007-608, 007-17, 007-1701	PE-2, PE-608, PE-1701	G3
Rbx-2887 (p.38)	ASTM Test Method D2887	DB-2887	Petrocol 2887, Petrocol EX2887	—	—	CP-SimDist-CB	—	007-1-10V-1.0F	—	—
Rbx-1PONA (p.37)	PONA Analysis	HP-PONA, DB-Petro	Petrocol DH	AT-Petro	BPI-PONA	CP Sil PONA CB	—	007-1-10V-0.5F	—	—
MXT-500 Sim Dist (p.82)	Simulated Distillation	—	—	—	HT-5	—	—	—	—	—
Rbx-5 Amine (p.40)	Amines and Basic Compounds	—	PTA-5	—	—	—	—	—	—	G50
FAMEWAX (p.57)	Fatty Acid Methyl Esters (FAMES)	—	Omegawax	—	—	—	—	—	—	—
Rbx-BAC1, Rbx-BAC2 (p.74)	Blood Alcohol Analysis	DB-ALC1, DB-ALC2	—	—	—	—	—	—	—	—
Rbx-G27 (p.75)	Residual Solvents in Pharmaceuticals	—	—	—	—	—	—	—	—	G27
Rbx-G43 (p.75)	Residual Solvents in Pharmaceuticals	—	OVI-G43	—	—	—	—	—	—	G43
Rt-CW20M F&F (p.57)	Fragrances and flavors	HP-20M, Carbowax 20M	—	—	BP-20M	—	—	007-CW	—	—
Rbx-TNT, Rbx-TNT2 (p.73)	Explosives	restek exclusive	—	—	—	restek exclusive	—	—	—	—
Rbx-Dioxin, Rbx-Dioxin2 (p.66-67)	Dioxins and furans	restek exclusive	—	—	—	restek exclusive	—	—	—	—
Rbx-PCB (p.65)	PCB Congeners	restek exclusive	—	—	—	restek exclusive	—	—	—	—

*See page 117.

please note

Need a column for a volatiles analysis? see page 577

Table of Contents for Applications see pages 510-513

ordering note

Prefer a different column cage? 5-inch column cage/Agilent 6850: add the suffix "6850" to your column catalog number. No additional cost.

Uncaged: add the suffix "051" to your column catalog number. No additional cost.

4-inch column cage (not available for 0.53mm ID columns): add the suffix "280" to your column catalog number. Additional cost

In your cage: add the suffix "031" to your column catalog number. Additional cost

GC Column Installation Checklist



Lisa Pantzar
R&D Chemist

There are other approaches, but the Restek Technical Service specialists have found this to be a reliable sequence for avoiding problems when installing and using a capillary GC column. For in-depth information about any step, refer to our website, or contact our Technical Service specialists or your Restek representative.

1. Cool all heated zones.
2. Visually inspect indicating oxygen and moisture traps; replace spent traps.
3. Examine the inlet liner and the detector connection; clean if necessary. Replace the inlet liner if necessary.
4. Replace the injector critical seal and detector seals.
5. Replace the septum.
6. Set the make-up gas and detector gas flow rates.
7. Carefully inspect the column for damage or breakage.
8. Mount the column in the oven, using a support that protects it from scratches or abrasion.
9. Cut 10cm from each end of the column.
 - To cut a fused silica column - use the smooth edge of a ceramic scoring wafer (cat.# 20116) or a sapphire scribe (cat.# 20115).
 - To cut a metal (MXT®) column - use the rough edge of a ceramic scoring wafer (cat.# 20116) or a sharp file to score the column, then break the column by flexing it at the score.
10. Install a nut and ferrule on the inlet end of the column. Cut an additional 10cm from the end of the column, to be sure the column does not contain ferrule fragments.
11. Install the column the appropriate distance in the injector, as indicated in your instrument manual.
12. Set the carrier gas flow to the rate recommended for purging your column (see www.restek.com for flow rates).
13. Confirm there is gas flow through the column by immersing the outlet end in a solvent compatible with the stationary phase.
14. Purge the column (see www.restek.com for purging times). **Check the system for leaks**, using a thermal conductivity leak detector.
15. Condition the column, to stabilize the baseline (see www.restek.com for conditioning temperatures and times).
16. Cool the oven, but maintain the flow of carrier gas.
17. Install a nut and ferrule on the outlet end of the column. Cut an additional 10cm from the end of the column, to be sure the column does not contain ferrule fragments.
18. Install the column the appropriate distance in the detector, as indicated in your instrument manual. Set inlet and detector to operating temperature.
19. Repeat the conditioning procedure (see www.restek.com for conditioning temperatures and times).
20. Adjust the carrier gas flow to the rate you intend to use for the analysis; set the split vent, septum purge, and any other applicable gas rates according to instrument specifications. Check the system for leaks, using a thermal conductivity leak detector.
21. Verify the injector and detector temperatures. Turn the detector on when the temperatures have equilibrated. Do not exceed the column's maximum operating temperature!
22. Set the oven to the initial temperature for your analysis and inject an unretained substance, to determine the dead volume time (see www.restek.com for details). Adjust the carrier gas flow as necessary.
23. Verify system integrity by examining the dead volume peak: it should not tail.
24. Inject a test mix, to confirm correct installation and proper column and system performance.
25. Calibrate the instrument and begin analyzing samples.

If you have any questions or problems installing a Restek column, visit www.restek.com/guide_cap.asp or call Technical Service at 800-356-1688 or 814-353-1300, ext. 4, or contact your Restek representative.

What Are the Operating Temperatures for My Column?

All Restek columns have published minimum and maximum operating temperatures that establish the working range for the stationary phase. Note that these ranges vary with the thickness of the coating.

Rtx®-VMS (fused silica)

ID	df (μm)	temp. limits
0.25mm	1.40	-40 to 240/260°C
0.32mm	1.80	-40 to 240/260°C
0.45mm	2.55	-40 to 240/260°C
0.53mm	3.00	-40 to 240/260°C

Many phases list 2 maximum operating temperatures. The first temperature is the maximum isothermal operating temperature. This is the temperature to which the columns are QA-tested and guaranteed to meet the minimum bleed specification (i.e., lowest bleed level). The second temperature is the maximum temperature-programmed operating temperature, the temperature to which the column can be heated for short periods of time (i.e., during a temperature-programmed analysis). The maximum isothermal operating temperature usually is 10–20°C lower than the temperature-programmed temperature because the GC oven and column are held at a constant temperature for long periods in the isothermal mode. If only one temperature is listed, it is both the isothermal and the maximum temperature.

The minimum operating temperature defines the lowest usable temperature before the stationary phase solidifies. Operating the column below the minimum temperature will not harm the phase, but poor peak shape and other chromatography problems will occur.

Custom Phases

Over the years, we have developed numerous proprietary phases for specific separations. We have more than 35 custom stationary phases in stock. Also note that some of our “common” phases are available in variations for specific purposes. If you don’t see it in this catalog, call us. Our experienced synthesis group is ready to work for you.



Paul Silvis
 Founder, Inventor, Coach
 22+ years of service!

Custom Phases Currently in Stock*

Apiezon® L	DEGS (G4)	OV®-351 (G35)	Squalane
Butane 1,4 diol succinate	DEXSIL 300	Rt-2330 (G8)	Squalene
Carbowax® 300	DIIDP (G24)	Rt-2340 (G5)	Superox® 20M
Carbowax® 600	FFAP	SE®-30 (G1,G2)	TCEP
Carbowax®1000 (G14)**	OS®-124	SE®-54 (G36)	Tricresyl phosphate
Carbowax® 8000 (G47)	OS®-138	Silar® 5CP	UCON® 50HB
Carbowax® 20M (G16)	OV®-202	Silar® 9CP (G8)	XE®-60
DC-550 (G28)	OV®-275	Silar® 10CP	XF®-1150

*Other phases available on request.

**Codes in parentheses are USP designations—see page 117.

Custom Column Dimensions

Need a specific film thickness? Locked into a method that uses a 42-meter column? If you need it, we can make it. We have shipped lengths from 3 to 150 meters, and film thicknesses from 0.1µm to 10.0µm.

Inverse Gas Chromatography Columns

We have extensive experience in coating capillary columns with a wide variety of polymers. If you need an IGC column, contact us and we’ll assist you in coating a column with your polymer.

PIE® service

Plus 1

Exceeding your expectations in everything we do.

Innovation

Turning visions into reality®.

Execution

On-time delivery of products and services.

Restek’s vision is to be the company that chromatographers trust by providing the highest quality, most innovative products and services throughout the world.

We will soon reach our goal of 100% employee ownership. As owners, our success depends on your success.



please note

For superior inertness, try our Siltek® guard columns! See [page 27](#) for details.

Having trouble making a leak-free connection? Try our “built in” Integra-Guard™ columns!

See [page 29](#) for details.

What is a guard column?

A capillary GC guard column is a short length of deactivated, uncoated fused silica or MXT® stainless steel tubing that is connected to the inlet end of the analytical column (Figure 1). The guard column traps nonvolatile residues and prevents them from collecting at the inlet of the analytical column, increasing column lifetime (more injections).

Contaminants that accumulate within the analytical column can adsorb active compounds, reduce resolution, and cause poor peak symmetry. When this contamination begins to affect sample analysis, a small section (15-30cm) of the column must be removed to restore performance. Each time a section of the column is removed, retention times change and some resolution is lost, eventually resulting in a need to replace the column. By removing contaminated loops from the guard column, instead of from the analytical column, resolution remains intact.

A guard column also improves analyte focusing and prevents peak splitting during splitless analysis. The amount of time the sample spends in the guard column is minimal because there is no stationary phase.

What type of guard column should be used?

When using a guard column it is important to match the polarity of the solvent and the polarity of the surface deactivation. Intermediate-Polarity (IP) is good for a wide variety of applications and allows most common solvents (methylene chloride, hexane, isooctane, toluene) to easily wet and create a uniform film on the tubing surface. If more polar solvents such as methanol or water are used, a polar-deactivated guard column is recommended, to allow the solvent to wet the tubing surface. Polar-deactivated guard columns are not resistant to harsh “water vaporization”, which occurs when water in the liquid state is injected onto the tubing, and rapidly vaporizes (such as in steam cleaning). Hydroguard™ deactivation is an alternative for direct aqueous injections. However, a Hydroguard™-deactivated guard column will not allow polar solvents to wet the tubing surface, and may cause beading of the solvent if the oven temperature is 20°C below the solvent boiling point.

Siltek® deactivation creates a highly inert surface for very active compounds such as chlorinated pesticides. Base-deactivated guard columns reduce adsorption and tailing for amines and other basic compounds.

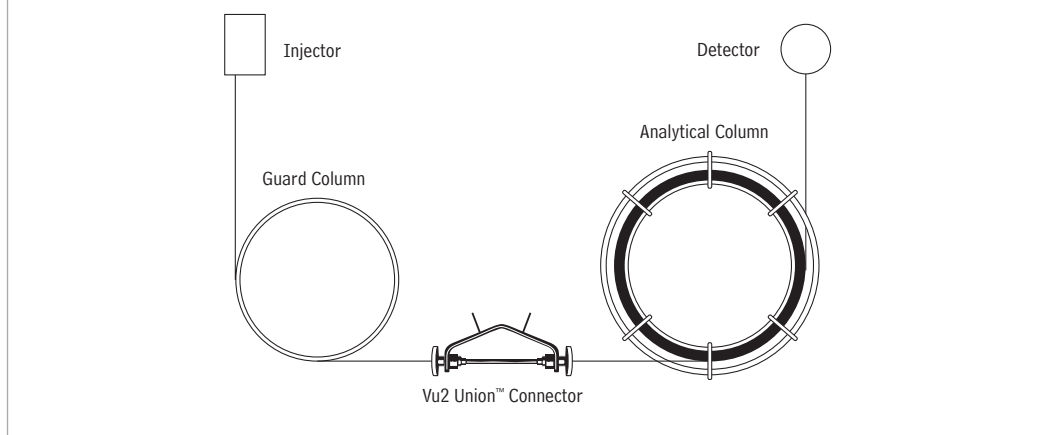
How is a guard column connected to the analytical column?

We offer Vu2-Union™, Press-Tight®, and other connectors for attaching guard columns to fused silica columns. MXT® unions are available for connecting stainless steel MXT® columns and guard columns. See pages 206 to 213 for information about these connectors.

did you know?

We test our guard columns/transfer lines with the Grob test mix to ensure high inertness.

Figure 1 A guard column connected to an analytical column



Intermediate-Polarity Deactivated Guard Columns/Transfer Lines

Diameters greater than 0.10mm are tested with the Grob test mix, to ensure high inertness.

- Useful for a wide range of applications.
- Use with most common solvents.
- Maximum temperature: 325°C

Fused Silica

Nominal ID	Nominal OD	1-Meter	5-Meter	5-Meter/6-pk.
0.025mm*	0.363 ± 0.012mm	10097		
0.05mm*	0.363 ± 0.012mm	10098	10040	10040-600
0.075mm*	0.363 ± 0.012mm	10099		
0.10mm*	0.363 ± 0.012mm	10100	10041	
0.15mm	0.363 ± 0.012mm	10101	10042	
0.18mm	0.37 ± 0.04mm	10102	10046	
0.25mm	0.37 ± 0.04mm		10043	10043-600
0.28mm	0.37 ± 0.04mm		10003	10003-600
0.32mm	0.45 ± 0.04mm		10044	10044-600
0.45mm	0.69 ± 0.04mm		10005	10005-600
0.53mm	0.69 ± 0.05mm		10045	10045-600

Nominal ID	Nominal OD	10-Meter	10-Meter/6-pk.	30-Meter**	60-Meter**†
0.25mm	0.37 ± 0.04mm	10049	10049-600	10012	10013
0.32mm	0.45 ± 0.04mm	10048	10048-600	10022	10023
0.53mm	0.69 ± 0.05mm	10047		10032	10033

Polar-Deactivated Guard Columns

Tested with the Grob test mix, to ensure high inertness.

- Polyethylene glycol deactivation layer provides optimum wettability for polar compounds.
- Minimize peak splitting when using polar solvents such as methanol or water.
- Compatible with Stabilwax®, Rtx®-225, and Rtx®-2330 capillary columns.
- Maximum temperature: 280°C.

Fused Silica

Nominal ID	Nominal OD	5-Meter	10-Meter	30-Meter**	60-Meter**†
0.25mm	0.37 ± 0.04mm	10065	10068	10014	10015
0.32mm	0.45 ± 0.04mm	10066	10069	10024	10025
0.53mm	0.69 ± 0.05mm	10067	10070	10034	10035

Siltek®-Deactivated Guard Columns/Transfer Lines

Tested with the Grob test mix, to ensure high inertness.

- Revolutionary deactivation process for superior inertness.
- Minimize bleed.
- Analyze active samples accurately; ideal for chlorinated pesticide analysis (reduces endrin breakdown to less than 1%).
- Maximum temperature: 380°C.

Fused Silica

Nominal ID	Nominal OD	5-Meter	10-Meter
0.25mm	0.37 ± 0.04mm	10026	10036
0.32mm	0.45 ± 0.04mm	10027	10037

*Not tested with the Grob test mix because of a large pressure drop.

**30- and 60-meter lengths are banded in 5-meter sections.

†Recommendation: Cut 60m guard columns into shorter lengths. Using full length may cause peak distortion.

it's a fact

To eliminate connections, use an Integra-Guard™ Column. See [page 29](#).

also available**MXT® Guard Columns**

Rugged, flexible, Silcosteel® treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 80](#) for our Intermediate-Polarity Deactivated MXT® Guard Columns/Transfer Lines.

it's a fact

Use guard columns to:

- Reduce effects of dirty samples on column performance.
- Reduce downtime and maintenance.

did you know?

Siltek®-deactivated guard columns minimize breakdown and improve recovery of analytes!



Guard Columns



Chris English
Innovations Group Leader
10+ years of service!

Hydroguard™ Water-Resistant Guard Tubing/Transfer Lines

Diameters greater than 0.10mm are tested with the Grob test mix, to ensure high inertness.

- Extend analytical column lifetime by preventing degradation by harsh “steam-cleaning” water injections.
- Maximum temperature: 325°C.

When transfer lines from purge & trap systems, air monitoring equipment, or other instruments carry condensed water vapor, deactivated column tubing quickly becomes active because of the creation of free silanol groups. These silanol groups adsorb active oxygenated compounds such as alcohols and diols.

Restek chemists have addressed this concern and found a solution—the Hydroguard™ deactivation process. A unique deactivation chemistry creates a high-density surface that is not readily attacked by aggressive hydrolysis. The high-density surface coverage of the Hydroguard™ deactivation layer effectively prevents water vapor from reaching the fused silica surface beneath. Use Hydroguard™ tubing for connecting GCs to:

- Purge & trap systems.
- Headspace analyzers.
- Air analysis equipment and concentrator units.
- Other instruments that trap/release water vapor.
- Any analytical instrument that needs an inert, water-resistant sample pathway.

For water-free injections (organic solvent-based samples), use Restek Intermediate-Polarity-deactivated guard tubing (page 27).

Fused Silica

Nominal ID	Nominal OD	5-Meter	5-Meter/6-pk.	10-Meter	30-Meter**	60-Meter**†
0.05mm*	0.363 ± 0.012mm	10075				
0.10mm*	0.363 ± 0.012mm	10076				
0.15mm	0.363 ± 0.012mm	10077				
0.18mm	0.37 ± 0.04mm	10078				
0.25mm	0.37 ± 0.04mm	10079	10079-600	10082	10085	10088
0.32mm	0.45 ± 0.04mm	10080	10080-600	10083	10086	10089
0.53mm	0.69 ± 0.05mm	10081	10081-600	10084	10087	10090

Base-Deactivated Guard Columns

- Tested with a basic amine test mix.
- Excellent inertness for basic compounds.
- Recommended for use with Rtx®-5 Amine and Stabilwax®-DB capillary columns.
- Batch test chromatogram included.
- Maximum temperature: 315°C.

Chemists using guard columns in analyses of basic compounds frequently observe peak tailing and low recovery, because conventionally deactivated tubing surfaces can be adsorptive to basic compounds. Restek offers base-deactivated guard columns for completely inert sample pathways.

Fused Silica

Nominal ID	Nominal OD	5-Meter	5-Meter/6-pk.
0.25mm	0.37 ± 0.04mm	10000	10000-600
0.32mm	0.45 ± 0.04mm	10001	10001-600
0.53mm	0.69 ± 0.05mm	10002	10002-600

*Not tested with the Grob test mix because of a large pressure drop.

**30- and 60-meter lengths are banded in 5-meter sections.

†Recommendation: Cut 60m guard columns into shorter lengths. Using full length may cause peak distortion.

also available

MXT® Guard Columns

Rugged, flexible, Silcosteel® treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 80](#) for our Hydroguard™ MXT® Guard Tubing/Transfer Lines.

save money!

Get six columns for the price of five. Call 800-356-1688, ext. 4, or your Restek representative for details!

did you know?

We test our guard columns/transfer lines with the Grob test mix to ensure high inertness.

Innovative Integra-Guard™ Columns

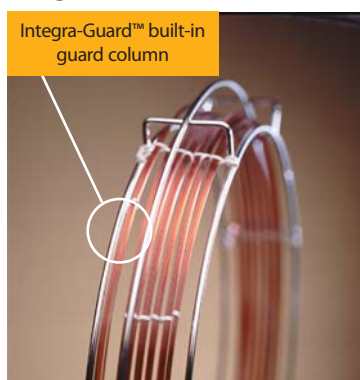
For analysts who find it inconvenient to make a leak-free connection between the guard column and the analytical column, we offer Integra-Guard™ columns. These innovative columns incorporate both guard column and analytical column in a continuous length of tubing, eliminating the connection and all connection-associated problems! The guard column section is tied separately from the analytical column, using high-temperature string. The column is suspended in our unique “crush-free” cage, which protects the column from damage.

Our wide variety of Integra-Guard™ capillary columns are listed in the figure below. The Integra-Guard™ column is so economical that we challenge you to compare our price against that of a conventional connection, even if you assemble it yourself. If you are currently using a guard column, or are considering using one, call today and ask about Integra-Guard™ columns.

Ordering is simple. Just add the appropriate suffix number and price to the analytical column's catalog number and price. For example, a 30m, 0.25mm ID, 0.25µm Rtx®-5 column with a 5-meter Integra-Guard™ column is cat.# 10223-124.

ID	Length	Suffix #
0.25mm	5m	-124
	10m	-127
0.28mm	5m	-243
	10m	-244
0.32mm	5m	-125
	10m	-128
0.53mm	5m	-126
	10m	-129

Phases currently available as Integra-Guard™ columns



Rtx®-1
Rtx®-1MS
Rtx®-5
Rtx®-5MS
Rtx®-5Sil MS
Rtx®-1301
Rtx®-624
Rtx®-1701
Rtx®-Volatiles
Rtx®-20
Rtx®-35
Rtx®-35MS
Rtx®-BAC 1 & 2
Stabilwax®

restek
innovation!

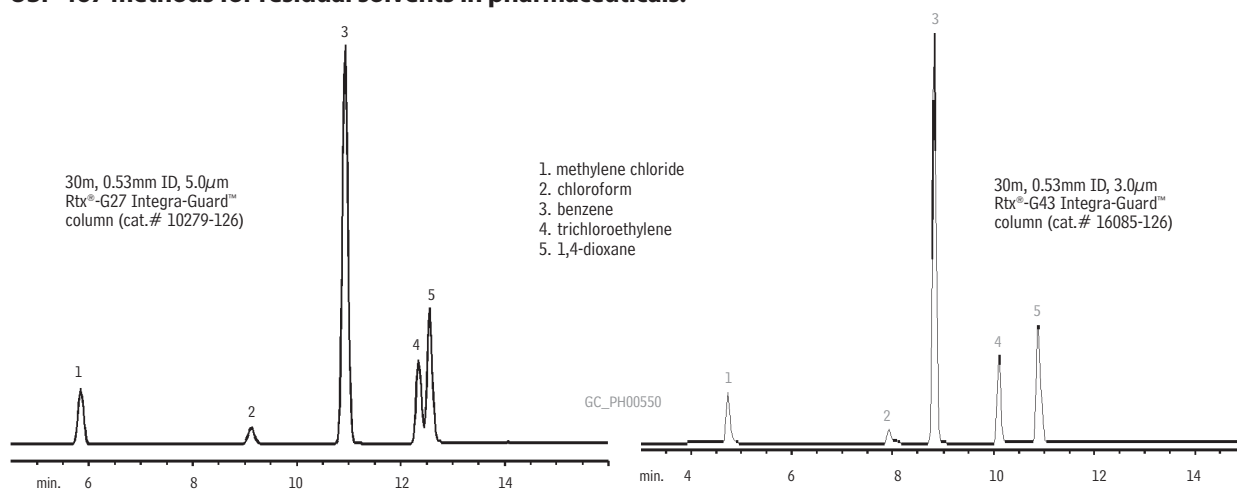
Integra-Guard™ Columns: guard columns WITHOUT connections—protecting your analytical column has never been this easy!

similar
products

DuraGuard, EZ-Guard, Guardian

Integra-Guard™ columns are available for all phases listed, for columns with 0.25 to 0.53mm ID and lengths to 75 meters.

An Rtx®-G27 or Rtx®-G43 column with a 5-meter Integra-Guard™ column meets the requirements of USP 467 methods for residual solvents in pharmaceuticals.



1.0µL direct injection of USP 467 Mix #1, cat.# 36004
Oven temp.: 35°C (hold 5 min.) to 175°C @ 8°C/min. to 260°C @ 35°C/min.
Inj. / det. temp.: 200°C / 240°C
Carrier gas: helium
Linear velocity: 34cm/sec. set @ 35°C
FID sensitivity: 1 x 10⁻¹¹ AFS
Recommended liner: Uniliner®

New Rxi™ Columns

Exceptionally Inert Capillary Columns



Unsurpassed inertness

Tailing peaks and poor responses for active compounds reveal surface activity in a column.

An Rxi™ column's inertness allows analysis of active compounds at levels not attainable with other manufacturers' columns. Basic and acidic compounds can be analyzed on the same column, often under the same conditions.



Ultra-low bleed

With the lowest column bleed in the industry, Rxi™-5ms columns improve detection for trace level GC/MS analysis. Ultra-low bleed also reduces conditioning time after instrument maintenance.

Save time and money through faster baseline stabilization.



Guaranteed reproducibility

Consistency is everything. With Rxi™ column technology, we guarantee it: every new column will perform exactly as the column it replaces.

Rxi™-1ms and Rxi™-5ms columns are perfect for use with Retention Time Locking (RTL) or other retention indices software.



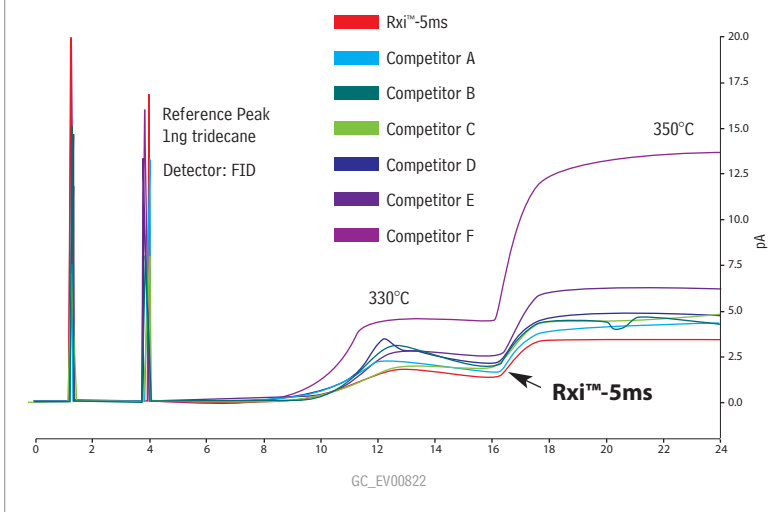
Unmatched performance

Every Rxi™ column is held to stringent performance specifications for coating efficiency, selectivity, film thickness, inertness, and bleed. This guarantees you the most reliable columns available anywhere.

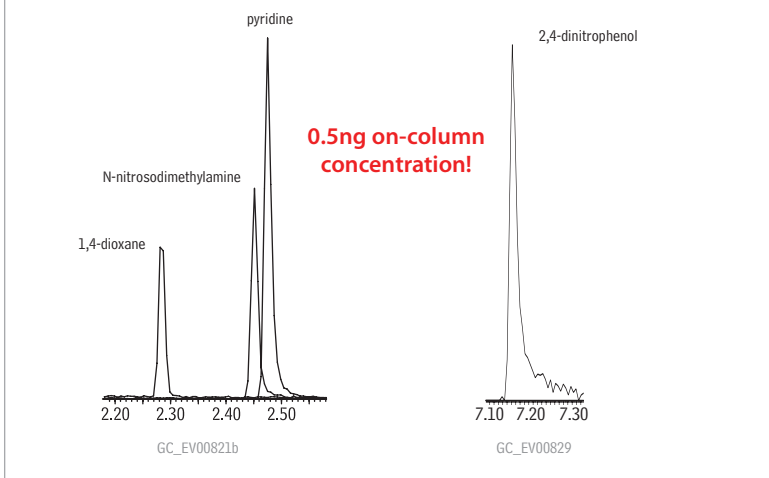
The Rxi™ column combination of inertness, ultra-low bleed, and column-to-column reproducibility assures you of the best performance of any columns on the market.

Rxi™-5ms columns have the lowest bleed among all major brands of columns.

Comparison of 30m x 0.25mm ID, 0.25µm columns at 330°C through 350°C; hydrogen carrier gas; flame ionization detection.



Peak symmetry for pyridine or 2,4-dinitrophenol is excellent from an Rxi™-5ms column, even with 0.5ng on-column!



Unmatched Performance, Reliable Results

Our goal was to develop a superior column that had the highest inertness, lowest bleed, and greatest reproducibility of any column available – a column unmatched in every measurable aspect of performance. To achieve this aim, we hired the world’s best polymer chemists and built a new state-of-the-art research facility, Restek West. The result of their expertise, the new Rxi™ family of columns, is unmatched in both performance and column-to-column consistency.

In developing Rxi™ columns, we focused on achieving **unsurpassed inertness**. We worked with our fused silica tubing supplier to establish rigorous controls on internal diameter, outer diameter, ovality, and surface activity. Then, we treated this highly uniform tubing with our unique deactivation chemistry, producing a consistent, inert surface on which to apply the polymer.

Next, we reformulated our polymers, taking steps to ensure neutrality and to fine tune selectivity for retention time locking. The resulting **ultra low-bleed columns** are ideal for trace level GC/MS analysis of active compounds. With Rxi™ columns, you can chromatograph sub-nanogram levels of acidic or basic compounds on the same column, often under the same conditions.

To **guarantee reproducibility**, we redeveloped our manufacturing process to maximize column-to-column consistency. Every Rxi™ column is individually tested for coating efficiency, selectivity, film thickness, inertness, and bleed.

Critical applications demand the proven, **unmatched performance** of Rxi™ columns. The accuracy and reliability of your results are as important to us as to you. We promise that every Rxi™ column you receive will be the best column you have ever used – you have our 100% satisfaction guarantee.



Restek West

Shawn Reese, Gianna Barlupi, Roy Lautamo
(not pictured - Bill Bromps)

Rxi™ Guard Columns

- Useful for a wide range of applications.
- Tested with isothermal test mix.
- Excellent inertness.
- Maximum temperature: 360°C.

new!

Fused Silica

Nominal ID	Nominal OD	5-Meter	5-Meter/6-pk.	10-Meter	10-Meter/6-pk.
0.25mm	0.37 ± 0.04mm	10029	10029-600	10059	10059-600
0.32mm	0.45 ± 0.04mm	10039	10039-600	10064	10064-600
0.53mm	0.69 ± 0.05mm	10054	10054-600	10073	10073-600

Rxi™-1ms (nonpolar phase, Crossbond® 100% dimethyl polysiloxane)

- General purpose columns for drugs of abuse, essential oils, hydrocarbons, pesticides, PCB congeners or (e.g.) Aroclor® mixes, sulfur compounds, amines, solvent impurities, simulated distillation, oxygenates, gasoline range organics (GRO), refinery gases.
- Ultra-low bleed - improved signal to noise ratio, for better sensitivity and mass spectral integrity.
- Temperature range: -60°C to 330/350°C (bleed tested temperature/maximum operating temperature).
- Equivalent to USP G2 phase.

Rxi™-1ms Columns (fused silica)

(Crossbond® 100% dimethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter	60-Meter	
0.25mm	0.25	-60 to 330/350°C	13320	13323	13326	
	0.50	-60 to 330/350°C	13335	13338	13341	
	1.00	-60 to 330/350°C	13350	13353	13356	
0.32mm	0.25	-60 to 330/350°C	13321	13324	13327	
	0.50	-60 to 330/350°C	13336	13339	13342	
	1.00	-60 to 330/350°C	13351	13354	13357	
	4.00	-60 to 330/350°C		13396	new!	
0.53mm	0.50	-60 to 330/350°C	13337	13340		
	1.00	-60 to 330/350°C	13352	13355		
	1.50	-60 to 330/350°C	13367	13370	13373	new!
ID	df (μm)	temp. limits	12-Meter	20-Meter	25-Meter	50-Meter
0.18mm	0.18	-60 to 330/350°C		13302		
0.20mm	0.33	-60 to 330/350°C	13397		13398	13399

similar phases

DB-1, DB-1ms, HP-1, HP-1ms, Ultra-1, SPB-1, Equity-1

new!**Alumasal™ Connector for Rxi™ Guard Columns**

The best column connector available:

- Leak-tight.
- Inert.
- No dead volume.

A novel approach to connecting an Rxi™ guard column to an Rxi™ analytical column, developed by Restek's engineers. This connector is leak-tight, inert, and permits no tailing of peaks.

Currently, the connection is made in-house, which gives our customers the advantage of having their column tested with the guard column attached, before we ship the assembly.

To have an Rxi™ guard column attached and tested with your Rxi™ analytical column, add the appropriate suffix number (listed below) to the column catalog number.

ID	Length	Suffix #
0.25mm	5m	-170
	10m	-173
0.32mm	5m	-171
	10m	-174
0.53mm	5m	-172
	10m	-175

Rxi™-5ms (low-polarity phase, Crossbond® 5% diphenyl / 95% dimethyl polysiloxane)

- General purpose columns for semivolatiles, phenols, amines, residual solvents, drugs of abuse, pesticides, PCB congeners or (e.g.) Aroclor® mixes, solvent impurities.
- Most inert column on the market.
- Ultra-low bleed - improved signal to noise ratio, for better sensitivity and mass spectral integrity.
- Temperature range: -60°C to 330/350°C (bleed tested temperature/maximum operating temperature).
- Equivalent to USP G27 phase.

Rxi™-5ms Columns (fused silica)

(Crossbond® 5% diphenyl / 95% dimethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.25	-60 to 330/350°C	13420	13423	13426
	0.40	-60 to 330/350°C		13481	new!
	0.50	-60 to 330/350°C	13435	13438	13441 new!
0.32mm	1.00	-60 to 330/350°C	13450	13453	13456
	0.25	-60 to 330/350°C	13421	13424	13427 new!
	0.50	-60 to 330/350°C	13436	13439	13442 new!
0.53mm	1.00	-60 to 330/350°C	13451	13454	13457
	0.25	-60 to 330/350°C	13422	13425	
	0.50	-60 to 330/350°C	13437	13440	
0.20mm	1.00	-60 to 330/350°C	13452	13455	
	1.50	-60 to 330/350°C	13467	13470	
	0.33	-60 to 330/350°C	13497		13498 13499

ID	df (μm)	temp. limits	12-Meter	20-Meter	25-Meter	50-Meter
0.18mm	0.18	-60 to 330/350°C		13402		
	0.30	-60 to 330/350°C		13409	new!	
	0.36	-60 to 330/350°C		13411		
0.20mm	0.33	-60 to 330/350°C	13497		13498	13499

similar **phases**

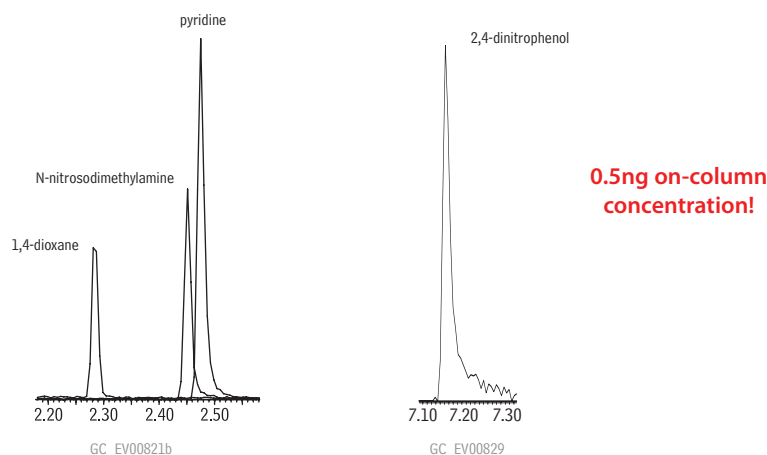
DB-5, HP-5, HP-5ms, Ultra-2, SPB-5, Equity-5

Most Inert Columns on the Market!

The Restek R&D Team developed new chemistry and a manufacturing process for making Rxi™ columns, which produces columns that are more inert to active compounds. Tailing of pyridine is a stringent test used to evaluate a deactivated column for basic active sites. Figure 1 shows the peaks for 0.5ng pyridine and 2,4-dinitrophenol on an Rxi™-5ms column are sharp and symmetric—unsurpassed by any standard column on the market.

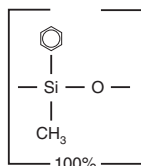
free literatureNew Rxi™ Columns Brochure
lit. cat.# 580086Rxi™-5ms Columns Flyer
lit. cat.# 580046

Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

Figure 1 Excellent peak symmetry for basic pyridine or acidic 2,4-dinitrophenol, using an Rxi™-5ms column!

Rxi™-50 and Rxi™-17

Rxi™-50 Structure



Rxi™-50 (mid-polarity phase; Crossbond® 100% methylphenyl polysiloxane)

- General purpose columns for pesticides, herbicides, rosin acids, phthalate esters, triglycerides, sterols.
- Ultra-low bleed - improved signal to noise ratio, for better sensitivity and mass spectral integrity.
- Temperature range: 0°C to 320°C.
- Equivalent to USP G3 phase.

The high thermal stability of Rxi™-50 columns makes possible dual-column analysis with common phases such as Rxi™-1ms or Rxi™-5ms. Between analyses, high temperatures can be used to drive poorly volatile contaminants off of the column.

similar phases

HP-17, SPB-50, SP-2250

did you know?

Our former Rtx®-50 columns are now manufactured using new Rxi™ column technology! See [pages 30-31](#).

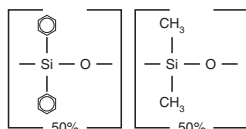
Rxi™-50 Columns (fused silica)

(Crossbond® 100% methylphenyl polysiloxane)

ID	df (µm)	temp. limits*	15-Meter	30-Meter	60-Meter
0.25mm	0.10	0 to 300/320°C	10505	10508	
	0.25	0 to 300/320°C	10520	10523	10526
	0.50	0 to 290/310°C	10535	10538	10541
	1.00	0 to 280/300°C	10550	10553	10556
0.32mm	0.10	0 to 300/320°C	10506	10509	
	0.25	0 to 300/320°C	10521	10524	10527
	0.50	0 to 290/310°C	10536	10539	10542
	1.00	0 to 280/300°C	10551	10554	10557
0.53mm	0.25	0 to 280/300°C	10522		
	0.50	0 to 270/290°C	10537	10540	10543
	0.83	0 to 270/290°C		10569	
	1.00	0 to 260/280°C	10552	10555	10558
	1.50	0 to 250/270°C	10567	10570	10573
ID	df (µm)	temp. limits	10-Meter	20-Meter	40-Meter
0.18mm	0.20	0 to 310/330°C	40501	40502	40503
	0.40	0 to 300/320°C	40510	40511	40512

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

Rxi™-17 Structure



Rxi™-17 (mid-polarity phase; Crossbond® 50% diphenyl / 50% dimethyl polysiloxane)

- General purpose columns for pesticides, herbicides, rosin acids, phthalate esters, triglycerides, sterols.
- Ultra-low bleed - improved signal to noise ratio, for better sensitivity and mass spectral integrity.
- Temperature range: 0°C to 300°C.

Rxi™-17 Columns (fused silica)

(Crossbond® 50% diphenyl / 50% dimethyl polysiloxane)

ID	df (µm)	temp. limits	15-Meter	30-Meter
0.25mm	0.25	40 to 280/300°C	13520	13523
	0.50	40 to 280/300°C	13535	13538
	1.00	40 to 280/300°C	13550	13553
0.32mm	0.25	40 to 280/300°C	13521	13524
	0.50	40 to 280/300°C	13536	13539
	1.00	40 to 280/300°C	13551	13554
0.53mm	0.25	40 to 280/300°C	13522	13525
	0.50	40 to 280/300°C	13537	13540
	0.83	40 to 280/300°C		13569
	1.00	40 to 280/300°C	13552	13555
	1.50	40 to 280/300°C	13567	13570

similar phases

DB-17, DB-608

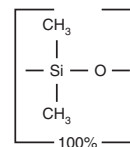
did you know?

Our former Rtx®-17 columns are now manufactured using new Rxi™ column technology! See [pages 30-31](#).

Rtx[®]-1 / Rtx[®]-1MS (nonpolar phase; Crossbond[®] 100% dimethyl polysiloxane)

- General purpose columns for solvent impurities, PCB congeners or (e.g.) Aroclor[®] mixes, simulated distillation, drugs of abuse, gases, natural gas odorants, sulfur compounds, essential oils, hydrocarbons, semivolatiles, pesticides, oxygenates.
- Temperature range: -60°C to 350°C.
- Equivalent to USP G1, G2, G38 phases.

Rtx[®]-1 columns exhibit long lifetime and very low bleed at high operating temperatures. A proprietary synthesis process eliminates residual catalysts that could cause degradation and increase bleed.

**Rtx[®]-1
Structure****Rtx[®]-1 Columns** (fused silica)(Crossbond[®] 100% dimethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter	60-Meter	75-Meter	105-Meter
0.25mm	0.10	-60 to 330/350°C	10105	10108	10111		10114
	0.25	-60 to 330/350°C	10120	10123	10126		10129
	0.50	-60 to 330/350°C	10135	10138	10141		10144
	1.00	-60 to 320/340°C	10150	10153	10156		10159
0.32mm	0.10	-60 to 330/350°C	10106	10109	10112		10115
	0.25	-60 to 330/350°C	10121	10124	10127		10130
	0.50	-60 to 330/350°C	10136	10139	10142		10145
	1.00	-60 to 320/340°C	10151	10154	10157		10160
	1.50	-60 to 310/330°C	10166	10169	10172		10175
	3.00	-60 to 280/300°C	10181	10184	10187		10190
0.45mm	2.55	-60 to 270/290°C				10992	
	5.00	-60 to 260/280°C	10176	10178	10180		
0.53mm	0.10	-60 to 320/340°C	10107	10110	10113		
	0.25	-60 to 320/340°C	10122	10125	10128		
	0.50	-60 to 310/330°C	10137	10140	10143		
	1.00	-60 to 310/330°C	10152	10155	10158		
	1.50	-60 to 310/330°C	10167	10170	10173		
	3.00	-60 to 270/290°C	10182	10185	10188		10189
	5.00	-60 to 270/290°C	10177	10179	10183		10194
	7.00	-60 to 240/260°C	10191	10192	10193		
0.10mm	0.10	-60 to 330/350°C	41101	41102			
	0.40	-60 to 320/340°C	41103	41104			
0.18mm	0.20	-60 to 330/350°C	40101	40102	40103		
	0.40	-60 to 320/340°C	40110	40111	40112		

crossbond[®] technology

reduces bleed, prolongs column lifetime, and allows rejuvenation through solvent rinsing.

Rtx[®]-1MS—Low-bleed GC/MS Columns (fused silica)(Crossbond[®] 100% dimethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter
0.25mm	0.10	-60 to 330/350°C	11605	11608
	0.25	-60 to 330/350°C	11620	11623
	0.50	-60 to 330/350°C	11635	11638
	1.00	-60 to 325/350°C	11650	11653
0.32mm	0.10	-60 to 330/350°C	11606	11609
	0.25	-60 to 330/350°C	11621	11624
	0.50	-60 to 330/350°C	11636	11639
0.53mm	1.00	-60 to 325/350°C	11651	11654
	0.50	-60 to 320/340°C	11637	11640
	1.00	-60 to 320/340°C	11652	11655
	1.50	-60 to 310/330°C	11667	11670

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

similar phases

DB-1, DB-1MS, HP-1, HP-1MS, Ultra-1, SPB-1, Equity-1, MDN-1

also available**MXT[®] Columns**

Rugged, flexible, Silcosteel[®] treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 81](#) for our MXT[®]-1 columns.

it's a fact

For exceptional inertness, ultra-low bleed, and unsurpassed performance, choose Rxi[™]-1ms columns! See [pages 30-32](#).

please **note**

Our Rt-CW20M[™] F&F column is the perfect confirmation column for flavor and fragrance analysis. See page 57.

free literature

Foods, Flavors, and Fragrances Catalog!

Includes important analysis tips, and chromatograms for analysis of fats and oils, carbohydrates, vitamins, amino acids, organic acids, preservatives, flavors and fragrances, essential oils, and chiral separations. Retention time indices and complete product listings for all relevant GC and HPLC products also are included (lit. cat.# 59260A).

Also available—Applications Note *Monitoring Volatile Compounds in Food Contact Packaging, Using Purge and Trap GC/MS and an Rtx[®]-5MS Capillary Column* (lit. cat.# 59348).

Rtx[®]-1 F&F (nonpolar phase; Crossbond[®] 100% dimethyl polysiloxane)

- Application-specific columns for flavor and fragrance compounds.
- Stable to 350°C.

Retention index libraries in the flavor and fragrance industry have been compiled from years of data and thousands of compounds. Any slight variation in column selectivity could render the column useless. Rtx[®]-1 F&F columns are tailored to match the selectivity required in the industry, while offering excellent thermal stability. Our stringent quality testing ensures column-to-column reproducibility and extended column lifetimes over conventional 100% dimethyl polysiloxane columns.

Rtx[®]-1 F&F Columns (fused silica)(Crossbond[®] 100% dimethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter	50-Meter	60-Meter
0.25mm	0.25	-60 to 330/350°C		18023		18026
	0.50	-60 to 330/350°C		18038		18041
	1.00	-60 to 320/340°C		18053		18056
0.32mm	0.25	-60 to 330/350°C		18024		18027
	0.50	-60 to 330/350°C		18039	18010	18042
	1.00	-60 to 320°C		18054		18057
0.53mm	0.50	-60 to 310/330°C	18037	18040		18043
	1.00	-60 to 310/330°C	18052	18055		18058
	1.50	-60 to 310/330°C	18067	18070		18073

**Fused Silica Manufacturing Group**

Sheldon McMurtrie, Tina Klinefelter, Tom Barone, Ken Kline, Linda Holden, Tom Gurecki, Jack Haesler, Aaron Decker, Carolyn Williams, Dale Lucas, Kelsea Miller



Raymond Ciampichini, Pete Rose, David Rhodes, Kim Dawson, Kim Shaffer, Jess Myers, Santina Newlen, David W. Rhodes, Henry Knepp, Russ Stewart, Jessica Andrus, Tim Wilson, Bob Langford

Rtx®-1PONA (nonpolar phase; Crossbond® 100% dimethyl polysiloxane)*

- Application-specific columns meet ASTM and CGSB requirements for detailed hydrocarbon analysis.
- Stable to 340°C.

The Rtx®-1PONA polymer was designed to offer the exact polarity necessary to resolve hydrocarbons in the specific order requested by petrochemical companies. In order to meet the demanding resolution and retention criteria of the American Society for Testing and Materials (ASTM) and the Canadian General Standards Board (CGSB), Restek has developed unique quality control tests and specifications for the Rtx®-1PONA column. The measured values for retention (k), efficiency (n), and stationary phase selectivity (RI) are controlled so that each column exceeds the requirements of the ASTM and CGSB methods.

Rtx®-1PONA Column (fused silica)

(Crossbond® 100% dimethyl polysiloxane)*

ID	df (μm)	temp. limits	100-Meter
0.25mm	0.50	-60 to 300/340°C	10195

*Optimized phase for hydrocarbon analysis

Rtx®-5PONA Tuning Column (fused silica)

(Crossbond® 5% diphenyl/95% dimethyl polysiloxane)

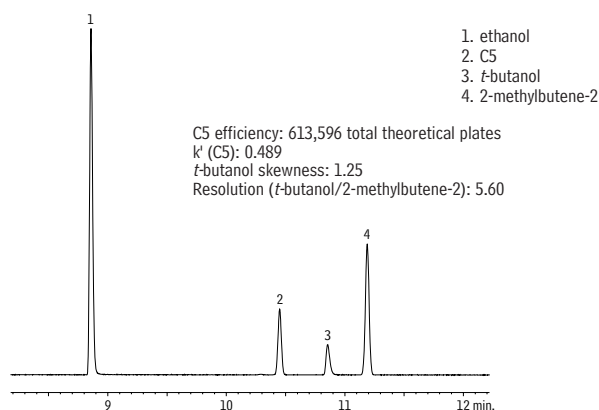
ID	df (μm)	temp. limits	5-Meter
0.25mm	1.0	-60 to 325°C	10196

similar phases

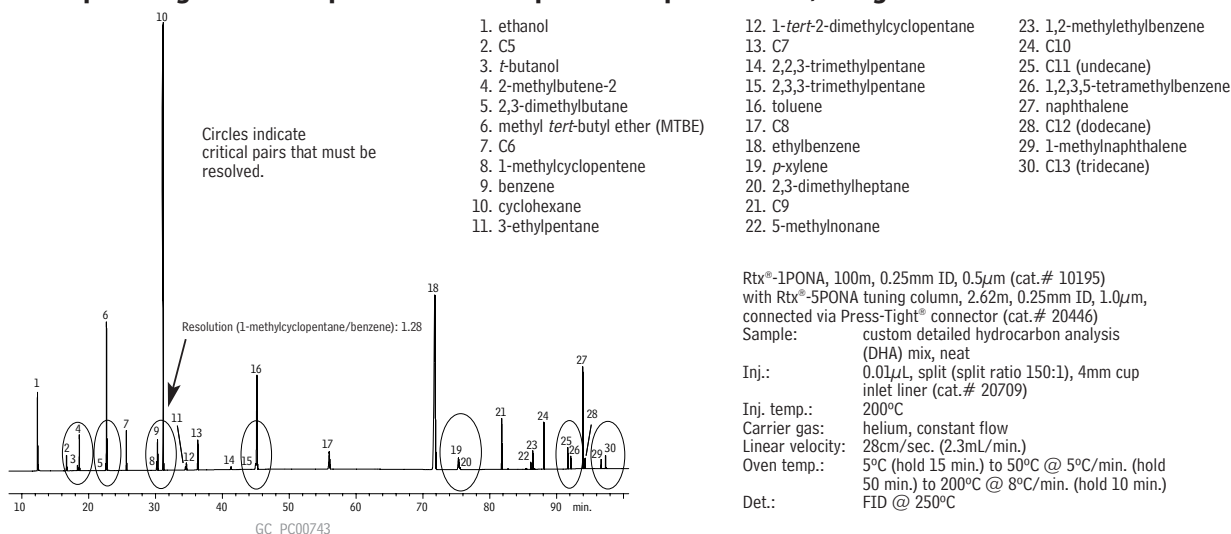
Petrocol DH, DB-Petro, HP-PONA

please note

To achieve critical resolutions, a 5-meter tuning column is connected to the analytical column and adjusted to the needed length through a series of trial analyses.

Sharp, symmetric peak for ethanol (gasoline oxygenate), using an Rtx®-1PONA column.**

**P=paraffins; O=olefins; N=naphthenes; A=aromatics.
In alternate terminology: paraffins & isoparaffins = alkanes;
naphthenes = cyclic alkanes; olefins = alkenes.

Critical pairs of gasoline components resolved per ASTM specifications, using an Rtx®-1PONA column.

Rtx®-1PONA, 100m, 0.25mm ID, 0.5μm (cat.# 10195)
with Rtx®-5PONA tuning column, 2.62m, 0.25mm ID, 1.0μm,
connected via Press-Tight® connector (cat.# 20446)
Sample: custom detailed hydrocarbon analysis
(DHA) mix, neat
Inj.: 0.01μL, split (split ratio 150:1), 4mm cup
inlet liner (cat.# 20709)
Inj. temp.: 200°C
Carrier gas: helium, constant flow
Linear velocity: 28cm/sec. (2.3mL/min.)
Oven temp.: 5°C (hold 15 min.) to 50°C @ 5°C/min. (hold
50 min.) to 200°C @ 8°C/min. (hold 10 min.)
Det.: FID @ 250°C

Rtx®-2887



Christine Vargo
Director of Sales
19+ years of service!

Rtx®-2887 (nonpolar phase; Crossbond® 100% dimethyl polysiloxane)

- Application-specific columns for simulated distillation.
- Stable to 360°C.

Rtx®-2887 columns' stationary phase, column dimensions, and film thickness have been optimized to exceed the resolution and skewing factor requirements currently specified in ASTM method D-2887. Each column is individually tested to guarantee a stable baseline with low bleed and reproducible retention times. The Crossbond® methyl silicone stationary phase has increased stability compared to packed columns, ensuring stable baselines and shorter conditioning times.

Rtx®-2887 Column (fused silica)

(Crossbond® 100% dimethyl polysiloxane—for simulated distillation)

ID	df (μm)	temp. limits	10-Meter
0.53mm	2.65	-60 to 360°C	10199

similar phases

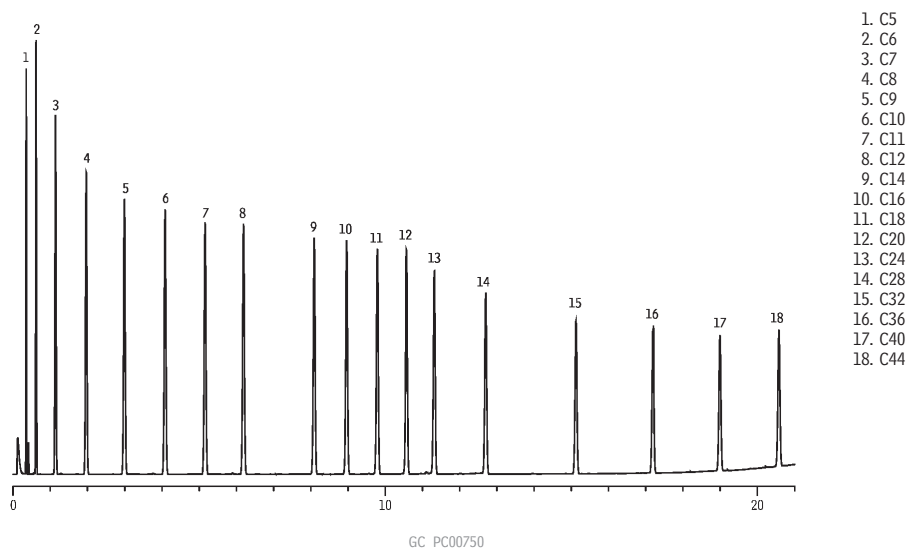
DB-2887, Petrocol EX2887

also available

MXT® Columns

Rugged, flexible, Silcosteel® treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 83](#) for our MXT®-2887 columns.

Negligible baseline rise for C5 to C44 hydrocarbons on an Rtx®-2887 column.



Rtx®-2887 Sim Dist 10m, 0.53mm ID, 2.65μm (cat.# 10199)

Sample: 1μL direct injection of 0.01-0.1 wt. % C5 to C44 hydrocarbon standard in carbon disulfide

Inj. temp.: 360°C

Det. temp.: 360°C

Carrier gas: helium (constant flow)

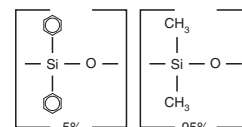
Linear velocity: 15 mL/min. (112cm/sec.)

Oven temp.: 35°C to 360°C @ 15°C/min. (hold 5 min.)

Rtx[®]-5 / Rtx[®]-5MS (low-polarity phase; Crossbond[®] 5% diphenyl / 95% dimethyl polysiloxane)

- General purpose columns for drugs, solvent impurities, pesticides, hydrocarbons, PCB congeners or (e.g.) Aroclor[®] mixes, essential oils, semivolatiles.
- Temperature range: -60°C to 350°C.
- Equivalent to USP G27, G36 phases.

The 5% diphenyl/95% dimethyl polysiloxane stationary phase is the most popular GC stationary phase and is used in a wide variety of applications. All residual catalysts and low molecular weight fragments are removed from the Rtx[®]-5 polymer, providing a tight mono-modal distribution and extremely low bleed.

Rtx[®]-5/Rtx[®]-5MS Structure**Rtx[®]-5 Columns** (fused silica)(Crossbond[®] 5% diphenyl/95% dimethyl polysiloxane)

ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter	105-Meter	
0.25mm	0.10	-60 to 330/350°C	10205	10208	10211	10214	
	0.25	-60 to 330/350°C	10220	10223	10226	10229	
	0.50	-60 to 330/350°C	10235	10238	10241	10244	
	1.00	-60 to 320/340°C	10250	10253	10256	10259	
	0.32mm	0.10	-60 to 330/350°C	10206	10209	10212	10215
0.32mm	0.25	-60 to 330/350°C	10221	10224	10227	10230	
	0.50	-60 to 330/350°C	10236	10239	10242	10245	
	1.00	-60 to 330/350°C	10251	10254	10257	10260	
	1.50	-60 to 310/330°C	10266	10269	10272	10275	
	3.00	-60 to 280/300°C	10281	10284	10287	10290	
	0.53mm	0.10	-60 to 320/340°C	10207	10210	10213	
		0.25	-60 to 320/340°C	10222	10225	10228	
0.50		-60 to 310/330°C	10237	10240	10243		
1.00		-60 to 310/330°C	10252	10255	10258		
1.50		-60 to 310/330°C	10267	10270	10273		
0.53mm	3.00	-60 to 270/290°C	10282	10285	10288		
	5.00	-60 to 270/290°C	10277	10279	10283		
	ID	df (μm)	temp. limits	10-Meter	20-Meter	40-Meter	
0.10mm	0.10	-60 to 330/350°C	41201	41202			
	0.40	-60 to 320/340°C	41203	41204			
0.18mm	0.20	-60 to 325/340°C	40201	40202	40203		
	0.40	-60 to 315/330°C	40210	40211	40212		

6-pack

30-meter	cat.#
0.25mm ID, 0.25μm	10223-600
0.25mm ID, 0.50μm	10238-600
0.32mm ID, 1.00μm	10254-600
0.53mm ID, 1.50μm	10270-600

Six columns for the price of five!

Other phases and configurations available on request.

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

Rtx[®]-5MS—Low-bleed GC/MS Columns (fused silica)(Crossbond[®] 5% diphenyl / 95% dimethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.10	-60 to 330/350°C	12605	12608	12611
	0.25	-60 to 330/350°C	12620	12623	12626
	0.50	-60 to 330/350°C	12635	12638	12641
	1.00	-60 to 325/350°C	12650	12653	
0.32mm	0.10	-60 to 330/350°C	12606	12609	12612
	0.25	-60 to 330/350°C	12621	12624	12627
	0.50	-60 to 330/350°C	12636	12639	12642
	1.00	-60 to 325/350°C	12651	12654	
0.53mm	0.50	-60 to 320/340°C	12637	12640	
	1.00	-60 to 320/340°C	12652	12655	
	1.50	-60 to 310/330°C	12667	12670	

similar **phases**

DB-5, HP-5, HP-5MS, Ultra-2, SPB-5, Equity-5, MDN-5

DB-5MS is a silylene based polymer, similar to Rtx[®]-5Sil MS. See [page 41](#).also **available****MXT[®] Columns**Rugged, flexible, Silcosteel[®] treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 83](#) for our MXT[®]-5 columns.it's a **fact**For exceptional inertness, ultra-low bleed, and unsurpassed performance, choose Rxi[™]-5ms columns! See [pages 30-31, 33](#).

Rtx[®]-5 Amine

restek
innovation!

similar phases

PTA-5

also available

See **page 46** for Rtx[®]-35 Amine columns.

please note

We recommend using base-deactivated fused silica guard columns (**page 28**) and base-deactivated liners (Instrument Supplies section of this catalog) with Rtx[®]-5 Amine columns.

Rtx[®]-5 Amine (low-polarity phase; Crossbond[®] 5% diphenyl / 95% dimethyl polysiloxane)

- Application-specific columns for amines and other basic compounds, including alkylamines, diamines, triamines, ethanolamines, and nitrogen-containing heterocyclics.
- Stable to 315°C.

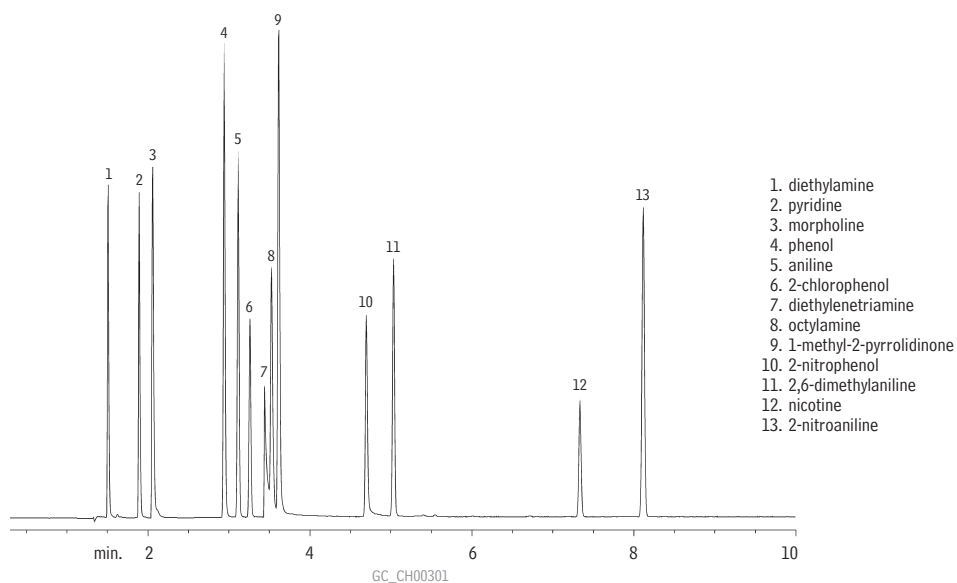
Active basic compounds that otherwise require derivatization, or an alternative analytical technique, can be analyzed on an Rtx[®]-5 Amine column. The tubing surface is chemically altered to reduce tailing of basic compounds, eliminating the need for column priming. An Rtx[®]-5 Amine column is ideal for analyzing a wide variety of basic compounds, but breakthrough technology also allows the analysis of neutral compounds, adsorptive compounds with oxygen groups susceptible to hydrogen bonding, or even weakly acidic compounds such as phenols. Every Rtx[®]-5 Amine column is tested to ensure that it exceeds the requirements for analyzing ppm levels of amines, without priming, and to ensure low bleed at maximum operating temperature.

Rtx[®]-5 Amine Columns (fused silica)

(Crossbond[®] 5% diphenyl/95% dimethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter
0.25mm	0.25	-60 to 300/315°C	12323	12320
	0.50	-60 to 300/315°C	12335	12338
	1.00	-60 to 300/315°C	12350	12353
0.32mm	1.00	-60 to 300/315°C	12351	12354
	1.50	-60 to 290/305°C	12366	12369
0.53mm	1.00	-60 to 290/305°C	12352	12355
	3.00	-60 to 280/295°C	12382	12385

Excellent peak shapes for amines & phenols on an Rtx[®]-5 Amine column.



30m, 0.32mm ID, 1.0μm Rtx[®]-5 Amine (cat.# 12354)
1.0μL split injection of miscellaneous amines and phenols in water
On-column conc.: 22ng

Oven temp.: 120°C to 220°C @ 10°C/min.
Inj. & det. temp.: 305°C
Carrier gas: hydrogen
Linear velocity: 38cm/sec. set @ 120°C
FID sensitivity: 6.4 x 10⁻¹¹ AFS
Split ratio: 25:1

Table of Contents for Applications

see **pages 510-513**

save money!

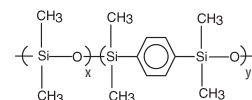
Get six columns for the price of five. Call **800-356-1688**, **ext. 4**, or your Restek representative for details!

Searching for a chromatogram?
www.restek.com

Rtx[®]-5Sil MS (low-polarity Crossbond[®] silarylene phase; similar to 5% diphenyl / 95% dimethyl polysiloxane)

- General purpose columns, ideal for GC/MS analysis of chlorinated hydrocarbons, phthalates, phenols, amines, organochlorine pesticides, organophosphorus pesticides, drugs, solvent impurities, hydrocarbons. Excellent inertness for active compounds.
- Temperature range: -60°C to 350°C.

**Rtx[®]-5Sil MS
Structure**



The Rtx[®]-5Sil MS stationary phase incorporates phenyl rings in the polymer backbone. This improves thermal stability, reduces bleed, and makes the phase less prone to oxidation. Rtx[®]-5Sil MS columns are ideal for GC/MS applications requiring high sensitivity, including use in ion trap systems.

Rtx[®]-5Sil MS Columns (fused silica)

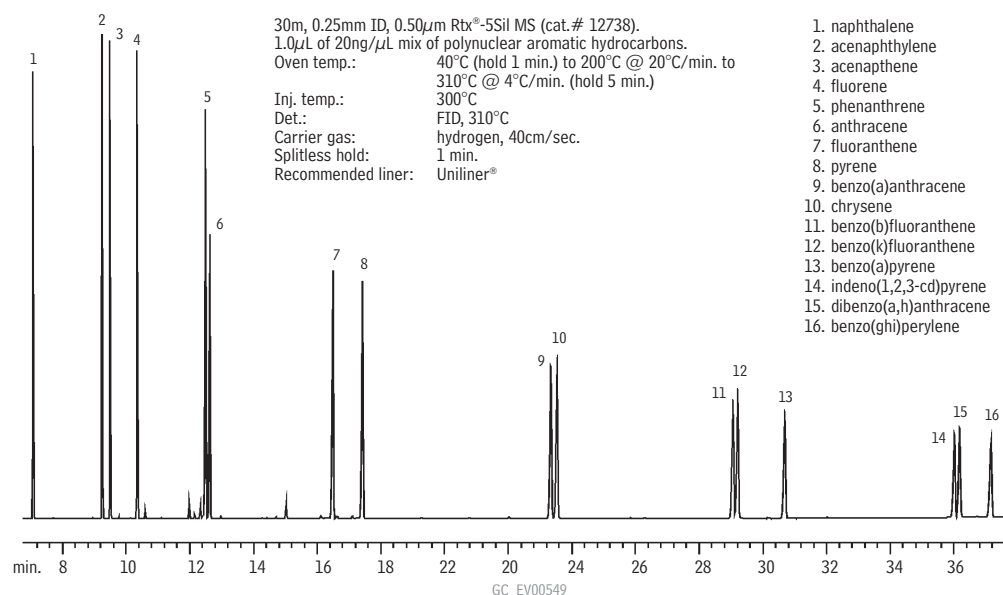
(Crossbond[®], selectivity similar to 5% diphenyl/95% dimethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	25-Meter	30-Meter	40-Meter	60-Meter
0.25mm	0.10	-60 to 330/350°C	12705		12708		
	0.25	-60 to 330/350°C	12720		12723		12726
	0.50	-60 to 330/350°C	12735		12738		12796
	1.00	-60 to 325/350°C	12750		12753		12797
	0.28mm	0.25	-60 to 330/350°C	12790		12793	
0.28mm	0.50	-60 to 330/350°C	12791		12794		
	1.00	-60 to 325/350°C	12792		12795		
	0.32mm	0.10	-60 to 330/350°C	12706		12709	
0.32mm	0.25	-60 to 330/350°C	12721		12724		12780
	0.50	-60 to 330/350°C	12736		12739		
	1.00	-60 to 325/350°C	12751	12781	12754		12782
0.45mm	1.50	-60 to 310/330°C				12798	
0.53mm	0.50	-60 to 320/340°C	12737		12740		
	1.00	-60 to 320/340°C	12752		12755		
	1.50	-60 to 310/330°C	12767		12770		
ID	df (μm)	temp. limits	10-Meter	12-Meter	20-Meter	25-Meter	50-Meter
0.18mm	0.18	-60 to 330/350°C	42703		42702		
	0.36	-60 to 330/350°C			42704		
0.20mm	0.20	-60 to 330/350°C				42706	42707
	0.33	-60 to 330/350°C		42705			
	0.35	-60 to 330/350°C		42708			42709

similar **phases**

DB-5MS

Baseline separation of polycyclic aromatic hydrocarbons on an Rtx[®]-5Sil MS column.



free literature

Request A *Technical Guide to Semivolatiles Analysis*
(lit. cat.# 59411A)

Rtx®-XLB (low-polarity proprietary phase)

- General purpose columns exhibiting extremely low bleed. Ideal for many GC/MS applications, including pesticides, PCB congeners or (e.g.) Aroclor® mixes, PAHs.
- Unique selectivity.
- Temperature range: 30°C to 360°C.

similar phases

DB-XLB

tech tip

In combination with an Rtx®-XLB column, simple adjustments to the injection conditions can greatly improve sensitivity for active and high molecular weight Method 525.2 target compounds.

- By eliminating contact between the sample and the hot metal surfaces in the injection port, a Drilled Uniliner® inlet liner prevents analytes from degrading in the injection port.
- A pulsed injection (30psi/0.4 min.) reduces the time the analytes spend in the injection port, and helps to minimize breakdown.

Improvements in polymer synthesis and tubing deactivation enable us to make inert, stable Rtx®-XLB columns especially well suited for analyzing active, high molecular weight compounds with sensitive GC/MS systems, including ion trap detectors. Excellent efficiency, coupled with inertness, low bleed, and high thermal stability, makes Rtx®-XLB columns ideal for analyzing semivolatile compounds in drinking water (e.g., US EPA Method 525).

Rtx®-XLB Columns (fused silica)

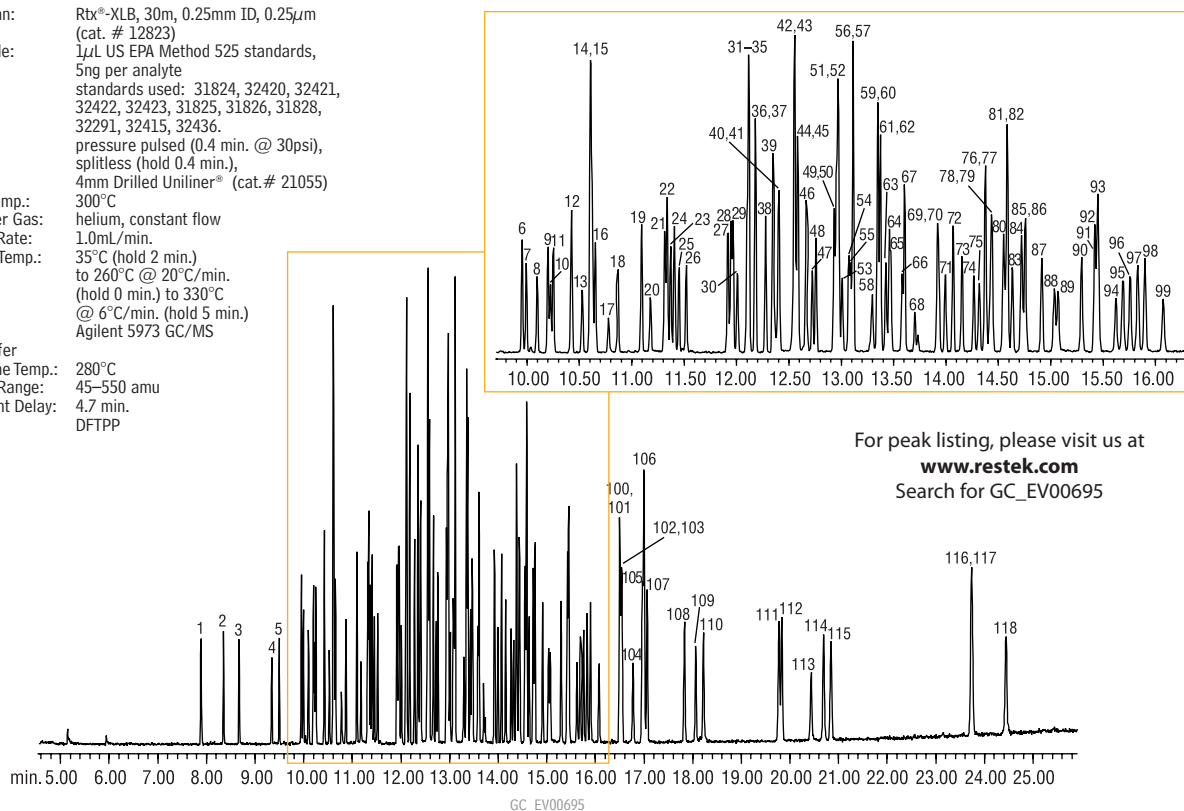
(low-polarity proprietary phase)

ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter
0.25mm	0.10	30 to 340/360°C		12808	
	0.25	30 to 340/360°C	12820	12823	12826
	0.50	30 to 340/360°C		12838	
0.32mm	0.10	30 to 340/360°C	12850	12853	
	0.25	30 to 340/360°C	12821	12824	12827
	0.50	30 to 340/360°C		12839	
0.53mm	0.10	30 to 340/360°C		12854	
	0.25	30 to 340/360°C	12840		
	0.50	30 to 340/360°C	12867	12870	
ID	df (μm)	temp. limits	12-Meter	20-Meter	25-Meter
0.18mm	0.18	30 to 340/360°C		42802	
0.20mm	0.33	30 to 340/360°C	42815		42820

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

Semivolatile organics in US EPA Method 525, using an Rtx®-XLB column.

Column: Rtx®-XLB, 30m, 0.25mm ID, 0.25μm (cat. # 12823)
 Sample: 1μL US EPA Method 525 standards, 5ng per analyte standards used: 31824, 32420, 32421, 32422, 32423, 31825, 31826, 31828, 32291, 32415, 32436.
 Inj.: pressure pulsed (0.4 min. @ 30psi), splitless (hold 0.4 min.), 4mm Drilled Uniliner® (cat.# 21055)
 Inj. Temp.: 300°C
 Carrier Gas: helium, constant flow
 Flow Rate: 1.0mL/min.
 Oven Temp.: 35°C (hold 2 min.) to 260°C @ 20°C/min. (hold 0 min.) to 330°C @ 6°C/min. (hold 5 min.)
 Det: Agilent 5973 GC/MS
 Transfer Line Temp.: 280°C
 Scan Range: 45–550 amu
 Solvent Delay: 4.7 min.
 Tune: DFTPP



For peak listing, please visit us at
www.restek.com
 Search for GC_EV00695

Rtx®-440 (intermediate-polarity proprietary Crossbond® phase)

- General purpose columns for pesticides, PAHs, or other semivolatiles. Ideal for low/trace level analyses.
- Low bleed, high-resolution columns with unique selectivity.
- Temperature range: 20°C to 340°C.

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innovation!

Rtx®-440 Columns (fused silica)

(intermediate-polarity proprietary Crossbond® phase)

ID	df (μm)	temp. limits	30-Meter	
0.25mm	0.25	20°C to 320/340°C	12923	
	0.50	20°C to 320/340°C	12938	
0.32mm	0.25	20°C to 320/340°C	12924	
	0.50	20°C to 320/340°C	12939	
0.53mm	0.50	20°C to 320/340°C	12940	
	1.00	20°C to 320/340°C	12955	
ID	df (μm)	temp. limits	20-Meter	40-Meter
0.18mm	0.18	20°C to 320/340°C	42902	42903

**Dave Krantz**

Vice President of
Operations

4+ years of service!

Twenty organochlorine pesticides separated in less than 9 minutes on an Rtx®-440 column.

Rtx®-440 30m, 0.32mm ID, 0.50μm (cat.# 12939), intermediate-polarity deactivated guard column, 5m x 0.32mm ID (cat.# 10044)

Sample: Organochlorine Pesticide Mix AB #2 (cat.# 32292),
2,4,5,6-tetrachloro-*m*-xylene (ss) (cat.# 32027),
decachlorobiphenyl (ss) (cat.# 32029), diluted in hexane,
on-column amounts listed on figure

Inj.: 1.0μL splitless (hold 0.75 min.), 4mm Drilled Uniliner® inlet liner
(cat.# 21055)

Inj. temp.: 225°C

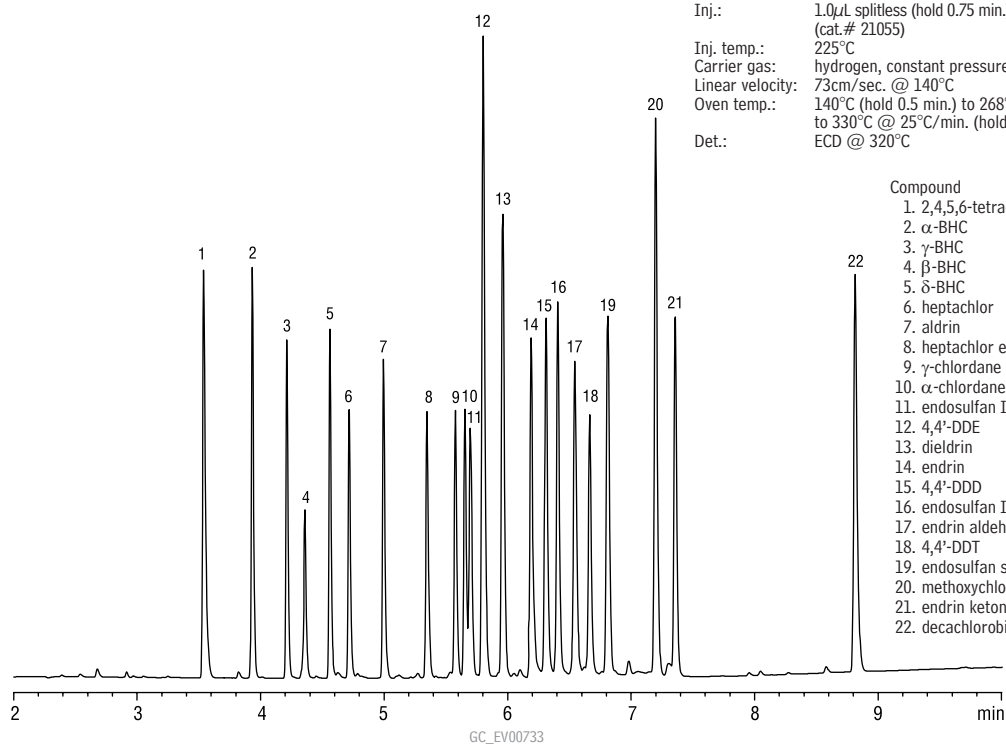
Carrier gas: hydrogen, constant pressure

Linear velocity: 73cm/sec. @ 140°C

Oven temp.: 140°C (hold 0.5 min.) to 268°C @ 30°C/min., to 290°C @ 11°C/min.,
to 330°C @ 25°C/min. (hold 5 min.)

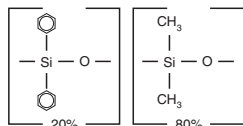
Det.: ECD @ 320°C

Compound	Conc. (ppb)	RT (min.)
1. 2,4,5,6-tetrachloro- <i>m</i> -xylene (ss)	80	3.538
2. α-BHC	80	3.931
3. γ-BHC	80	4.211
4. β-BHC	80	4.356
5. δ-BHC	80	4.560
6. heptachlor	80	4.715
7. aldrin	80	4.995
8. heptachlor epoxide	80	5.346
9. γ-chlordane	80	5.576
10. α-chlordane	80	5.653
11. endosulfan I	80	5.698
12. 4,4'-DDE	160	5.800
13. dieldrin	160	5.959
14. endrin	160	6.190
15. 4,4'-DDD	160	6.309
16. endosulfan II	160	6.404
17. endrin aldehyde	160	6.543
18. 4,4'-DDT	160	6.662
19. endosulfan sulfate	160	6.810
20. methoxychlor	800	7.198
21. endrin ketone	160	7.355
22. decachlorobiphenyl (ss)	160	8.813



Rtx[®]-20

Rtx[®]-20 Structure



Rtx[®]-20 (low/mid-polarity phase; Crossbond[®] 20% diphenyl / 80% dimethyl polysiloxane)

- General purpose columns for volatile compounds, flavor compounds, alcoholic beverages.
- Temperature range: -20°C to 320°C.
- Equivalent to USP G28, G32 phases.

Rtx[®]-20 polymer is synthesized to exacting standards. All residual catalysts and low molecular weight fragments are removed from the polymer, providing a tight mono-modal distribution and extremely low bleed.

Rtx[®]-20 Columns (fused silica)

(Crossbond[®] 20% diphenyl / 80% dimethyl polysiloxane)

ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter	105-Meter
0.25mm	0.10	-20 to 300/320°C	10305	10308	10311	10314
	0.25	-20 to 300/320°C	10320	10323	10326	10329
	0.50	-20 to 290/310°C	10335	10338	10341	10344
	1.00	-20 to 280/300°C	10350	10353	10356	10359
0.32mm	0.10	-20 to 300/320°C	10306	10309	10312	10315
	0.25	-20 to 300/320°C	10321	10324	10327	10330
	0.50	-20 to 290/310°C	10336	10339	10342	10345
	1.00	-20 to 280/300°C	10351	10354	10357	10360
	1.50	-20 to 270/290°C	10366	10369	10372	10375
0.53mm	3.00	-20 to 250/270°C	10381	10384	10387	10390
	0.10	-20 to 260/280°C	10307	10310	10313	
	0.25	-20 to 260/280°C	10322	10325	10328	
	0.50	-20 to 260/280°C	10337	10340	10343	
	1.00	-20 to 260/280°C	10352	10355	10358	
	1.50	-20 to 250/270°C	10367	10370	10373	
0.18mm	3.00	-20 to 240/260°C	10382	10385	10388	
	ID	df (μm)	temp. limits	10-Meter	20-Meter	40-Meter
0.18mm	0.20	-20 to 300/320°C	40301	40302	40303	
	0.40	-20 to 300/320°C	40310	40311	40312	

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

similar phases

SPB-20

did you know?

Rtx[®]-20 columns are available with Integra-Guard™ built-in guard columns. Get the protection without the connection! See [page 29](#) for descriptions and ordering information.

also available

MXT[®] Columns

Rugged, flexible, Silcosteel[®] treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 84](#) for our MXT[®]-20 columns.



Applied Sciences Group

Wendy Henninger, Brian Salisbury, Rick Crago, Tom Veza

Rtx[®]-35 / Rtx[®]-35MS (mid-polarity phase; Crossbond[®] 35% diphenyl / 65% dimethyl polysiloxane)

- General purpose columns for organochlorine pesticides, PCB congeners or (e.g.) Aroclor[®] mixes, herbicides, pharmaceuticals, sterols, rosin acids, phthalate esters.
- Temperature range: 0°C to 320°C.
- Equivalent to USP G42 phase.

An Rtx[®]-35 column is a popular confirmation column for pesticides and herbicides, in conjunction with an Rtx[®]-5 or Rtx[®]-1701 column. The higher phenyl content causes useful elution order and retention time changes.

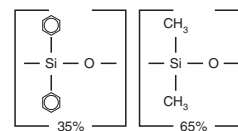
Rtx[®]-35 Columns (fused silica)(Crossbond[®] 35% diphenyl/65% dimethyl polysiloxane)

ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter	105-Meter
0.25mm	0.10	0 to 320°C	10405	10408	10411	10414
	0.25	0 to 320°C	10420	10423	10426	10429
	0.50	0 to 310°C	10435	10438	10441	10444
	1.00	0 to 290°C	10450	10453	10456	10459
0.32mm	0.10	0 to 320°C	10406	10409	10412	10415
	0.25	0 to 320°C	10421	10424	10427	10430
	0.50	0 to 310°C	10436	10439	10442	10445
	1.00	0 to 290°C	10451	10454	10457	10460
	1.50	0 to 270/290°C	10466	10469	10472	10475
0.53mm	0.10	0 to 260/280°C	10407	10410	10413	
	0.25	0 to 260/280°C	10422	10425	10428	
	0.50	0 to 300°C	10437	10440	10443	
	1.00	0 to 290°C	10452	10455	10458	
	1.50	0 to 280°C	10467	10470	10473	
0.53mm	3.00	0 to 250/270°C	10481	10484	10487	10490
	3.00	0 to 240/260°C	10482	10485	10488	
	3.00	0 to 240/260°C	10482	10485	10488	
ID	df (μm)	temp. limits	10-Meter	20-Meter	40-Meter	
0.18mm	0.20	0 to 300/320°C	40401	40402	40403	
	0.40	0 to 290/310°C	40410	40411	40412	

Rtx[®]-35MS—Low-bleed GC/MS Columns (fused silica)(Crossbond[®] 35% diphenyl / 65% dimethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter
0.25mm	0.10	0 to 320°C	14605	14608
	0.25	0 to 320/340°C	14620	14623
	0.50	0 to 310/330°C	14635	14638
	1.00	0 to 290/310°C	14650	14653
0.32mm	0.10	0 to 320/340°C	14606	14609
	0.25	0 to 320/340°C	14621	14624
	0.50	0 to 310/330°C	14636	14639
	1.00	0 to 290/310°C	14651	14654
0.53mm	0.50	0 to 300/320°C	14637	14640
	1.00	0 to 290°C	14652	14655
	1.50	0 to 280/300°C	14667	14670

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

Rtx[®]-35 Structuresimilar **phases**

DB-35, HP-35, SPB-35, SPB-608

ordering **note**

Rtx[®]-35 columns are available with Integra-Guard™ built-in guard columns. Get the protection without the connection! See [page 29](#) for descriptions and ordering information.

also **available****MXT[®] Columns**

Rugged, flexible, Silcosteel[®] treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 84](#) for our MXT[®]-35 columns.

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innovation!



Julie Kowalski
Innovations Chemist
2+ years of service!

Rtx[®]-35 Amine (mid-polarity phase; Crossbond[®] 35% diphenyl / 65% dimethyl polysiloxane)

- Application-specific columns for amines and other basic compounds, including alkylamines, diamines, triamines, ethanolamines, and nitrogen-containing heterocyclics.
- Stable to 220°C.

Active basic compounds that otherwise require derivatization, or an alternative analytical technique, can be analyzed on an Rtx[®]-35 Amine column. The tubing surface is chemically altered to reduce tailing of basic compounds, eliminating the need for column priming. An Rtx[®]-35 Amine column is ideal for analyzing a wide variety of basic compounds, but breakthrough technology also allows the analysis of neutral compounds, adsorptive compounds with oxygen groups susceptible to hydrogen bonding. Every Rtx[®]-35 Amine column is tested to ensure that it meets the requirements for analyzing ppm levels of amines, without priming, and to ensure low bleed at maximum operating temperature.

Rtx[®]-35 Amine Columns (fused silica)

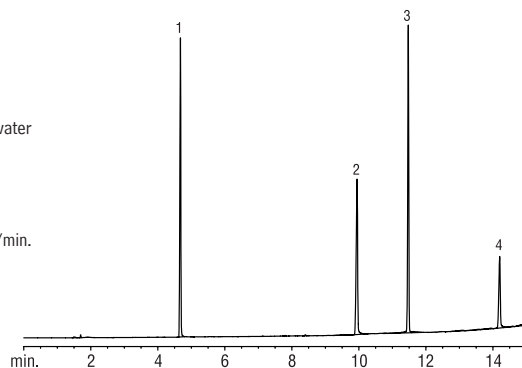
(Crossbond[®] 35% diphenyl/65% dimethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter
0.25mm	0.50	0 to 220°C	11335	11338
	1.00	0 to 220°C	11350	11353
0.32mm	1.00	0 to 220°C	11351	11354
	1.50	0 to 220°C	11366	11369
0.53mm	1.00	0 to 220°C	11352	11355
	3.00	0 to 220°C	11382	11385

Sharp ethanolamine peaks, low bleed: Rtx[®]-35 Amine column.

1. monoethanolamine
2. diethanolamine
3. triethyleneglycol monomethylether
4. triethanolamine

Rtx[®]-35 Amine 30m, 0.32mm ID, 1.0μm (cat.# 11354)
 Sample: 500μg/mL ethanolamine standard in water
 Inj.: 1.0μL split (split ratio 10:1),
 cup splitter inlet liner (cat.# 20709)
 Inj. temp.: 300°C
 Carrier gas: helium, constant pressure
 Linear velocity: 40cm/sec. @ 50°C
 Oven temp.: 50°C (hold 0.50min.) to 280°C @15°C/min.
 Det.: FID @ 300°C



GC_CH00585

Table of Contents for
Applications

see pages 510-513

Rtx[®]-65 (mid- to high polarity phase; Crossbond[®] 65% diphenyl / 35% dimethyl polysiloxane)

- General purpose columns for phenols, fatty acids.
- Temperature range: 50°C to 300°C.
- Equivalent to USP G17 phase.

The Rtx[®]-65 phase contains the highest phenyl content of any bonded stationary phase available, to improve separation of aromatic compounds through increased phase-analyte interaction. A unique polarity makes these columns ideal for a variety of analyses, from phenols to FAMES. As a confirmation column for EPA Method 604 phenols, an Rtx[®]-65 column produces a different elution order, compared to the primary Rtx[®]-5 column. Rtx[®]-65 columns elute FAMES according to equivalent chain length, similar to bonded Carbowax[®] columns, but the Rtx[®]-65 phase does not suffer the thermal stability limitations of other polar stationary phases.

Rtx[®]-65 Columns (fused silica)(Crossbond[®] 65% diphenyl/35% dimethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter
0.25mm	0.25	50 to 300°C	17020	17023
	0.50	50 to 280/300°C	17035	17038
	1.00	50 to 260/280°C	17050	17053
0.32mm	0.25	50 to 300°C	17021	17024
	0.50	50 to 280/300°C	17036	17039
	1.00	50 to 260°C	17051	17054
0.53mm	0.25	50 to 290/300°C	17022	17025
	0.50	50 to 270/290°C	17037	17040
	1.00	50 to 250/270°C	17052	17055

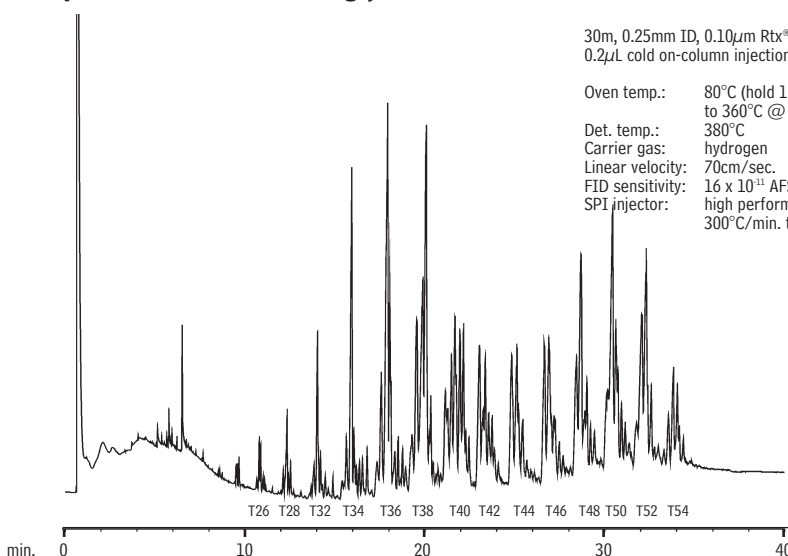
Rtx[®]-65TG (high polarity phase; Crossbond[®] 65% diphenyl / 35% dimethyl polysiloxane)

- Application-specific columns, specially tested for triglycerides.
- Stable to 370°C.

The Rtx[®]-65TG phase resolves triglycerides by degree of unsaturation as well as by carbon number. Because of the chemistry required to achieve 370°C thermal stability, an Rtx[®]-65TG column should not be used for analyses of compounds that contain active oxygenated groups.

Rtx[®]-65TG Columns (fused silica)(Crossbond[®] 65% diphenyl/35% dimethyl polysiloxane)

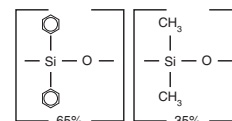
ID	df (μm)	temp. limits	15-Meter	30-Meter
0.25mm	0.10	40 to 370°C	17005	17008
0.32mm	0.10	40 to 370°C	17006	17009
0.53mm	0.10	40 to 370°C	17007	17010

Sharp resolution of butter triglycerides on an Rtx[®]-65TG column.

30m, 0.25mm ID, 0.10μm Rtx[®]-65TG (cat.# 17008)
0.2μL cold on-column injection of 1% butterfat in isoctane.

Oven temp.: 80°C (hold 1 min.) to 240°C @ 30°C/min.
to 360°C @ 4°C/min. (hold 5 min.)
Det. temp.: 380°C
Carrier gas: hydrogen
Linear velocity: 70cm/sec.
FID sensitivity: 16 x 10⁻¹¹ AFS
SPI injector: high performance capillary insert 60°C,
300°C/min. to 400°C (hold 5 min.)

GC_FF00137

**Rtx[®]-65/
Rtx[®]-65TG
Structure**similar **phases**

TAP-CB, 400-65HT, 007-65HT

also **available****MXT[®] Columns**

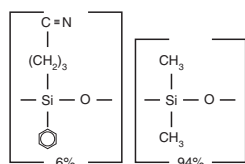
Rugged, flexible, Silcosteel[®] treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 85](#) for our MXT[®]-65 and MXT[®]-65TG columns.

crossbond[®]
technology

reduces bleed, prolongs column lifetime, and allows rejuvenation through solvent rinsing.

save **money!**

Get six columns for the price of five. Call 800-356-1688, ext. 4, or your Restek representative for details!

Rtx[®]-1301Rtx[®]-1301
Structure

Rtx[®]-1301 (low to mid-polarity phase; Crossbond[®] 6% cyanopropylphenyl / 94% dimethyl polysiloxane)

- General purpose columns for residual solvents, alcohols, oxygenates, volatile organic compounds.
- Temperature range: -20°C to 280°C.
- Equivalent to USP G43 phase.

Many analysts feel the Rtx[®]-1301 column has the best cyanosilicone bonded stationary phase available, with no other column manufacturer providing lower bleed, longer lifetime, or better inertness. Our polymer is fully characterized to ensure long-term reproducibility, column-to-column consistency, and low bleed, even with sensitive detectors such as ECDs and MSDs.

similar phases

DB-1301, DB-624, HP-1301,
SPB-1301, SPB-624

please note

Rtx[®]-1301 columns are available with Integra-Guard[™] built-in guard columns. Get the protection without the connection! See [page 29](#) for descriptions and ordering information.

Rtx[®]-1301 (G43) Columns (fused silica)

(Crossbond[®] 6% cyanopropylphenyl/94% dimethyl polysiloxane)

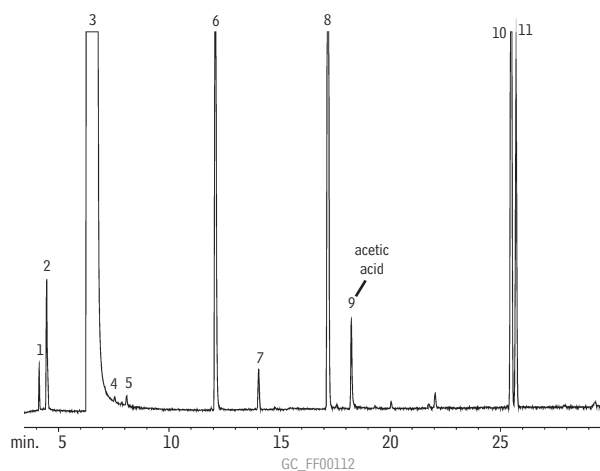
ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter	75-Meter	105-Meter
0.25mm	0.10	-20 to 280°C	16005	16008	16011		16014
	0.25	-20 to 280°C	16020	16023	16026		16029
	0.50	-20 to 270°C	16035	16038	16041		16044
	1.00	-20 to 260°C	16050	16053	16056		16059
	1.40	-20 to 240°C			16016		
0.32mm	0.10	-20 to 280°C	16006	16009	16012		16015
	0.25	-20 to 280°C	16021	16024	16027		16030
	0.50	-20 to 270°C	16036	16039	16042		16045
	1.00	-20 to 260°C	16051	16054	16057		16060
	1.50	-20 to 250°C	16066	16069	16072		16075
0.53mm	0.10	-20 to 280°C	16007	16010	16013		
	0.25	-20 to 280°C	16022	16025	16028		
	0.50	-20 to 270°C	16037	16040	16043		
	1.00	-20 to 260°C	16052	16055	16058		
	1.50	-20 to 250°C	16067	16070	16073		
	3.00	-20 to 240°C	16082	16085	16088	16076	16091

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

also available

MXT[®] Columns

Rugged, flexible, Silcosteel[®] treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 86](#) for our MXT[®]-1301 columns.

Scotch sample on an Rtx[®]-1301.

1. acetaldehyde
2. methanol
3. ethanol
4. acetone
5. isopropanol
6. *n*-propanol
7. ethyl acetate
8. isobutanol
9. acetic acid
10. isoamyl alcohol
11. active amyl alcohol

60m, 0.25mm ID, 1.4μm Rtx[®]-1301 (cat.# 16016)
1.0μL split injection using a Cycloplitter[®] inlet liner (cat.# 20706).
Conc.: neat
Oven temp.: 35°C (hold 5 min.) to 100°C @ 1°C/min.
Inj./det. temp.: 150°C / 200°C
Carrier gas: hydrogen @ 40cm/sec.
Split ratio: 100:1

Rtx®-1701 (mid-polarity phase; Crossbond® 14% cyanopropylphenyl / 86% dimethyl polysiloxane)

- General purpose columns for alcohols, oxygenates, PCB congeners or (e.g.) Aroclor® mixes, pesticides.
- Temperature range: -20°C to 280°C.
- Equivalent to USP G46 phase.

Rtx®-1701 is one of the more popular stationary phases used in capillary GC. The mix of cyano and phenyl functional groups increases the polarity, and offers a different elution order relative to less polar Rtx®-1 or Rtx®-5 columns. An Rtx®-1701 column is ideal for confirmation analysis, in combination with an Rtx®-35 or Rtx®-5 column. The polymer is fully characterized to ensure long-term reproducibility, column-to-column consistency, and low bleed, even with sensitive detectors such as ECDs and MSDs.

Rtx®-1701 Columns (fused silica)

(Crossbond® 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter	105-Meter
0.25mm	0.10	-20 to 280°C	12005	12008	12011	12014
	0.25	-20 to 280°C	12020	12023	12026	12029
	0.50	-20 to 270/280°C	12035	12038	12041	12044
	1.00	-20 to 260/280°C	12050	12053	12056	12059
0.32mm	0.10	-20 to 280°C	12006	12009	12012	12015
	0.25	-20 to 280°C	12021	12024	12027	12030
	0.50	-20 to 270/280°C	12036	12039	12042	12045
	1.00	-20 to 260/280°C	12051	12054	12057	12060
	1.50	-20 to 240/260°C	12066	12069	12072	12075
0.53mm	0.10	-20 to 270/280°C	12007	12010	12013	
	0.25	-20 to 270/280°C	12022	12025	12028	
	0.50	-20 to 260/270°C	12037	12040	12043	
	1.00	-20 to 250/270°C	12052	12055	12058	
	1.50	-20 to 240/260°C	12067	12070	12073	
	3.00	-20 to 230/250°C	12082	12085	12088	
ID	df (μm)	temp. limits	10-Meter	20-Meter	40-Meter	
0.10mm	0.10	-20 to 280°C	42201	42202		
0.18mm	0.20	-20 to 280°C	42001	42002	42003	
	0.40	-20 to 270/280°C	42010	42011	42012	

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

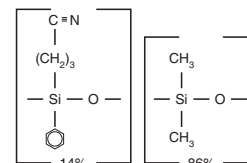
crossbond® technology

reduces bleed, prolongs column lifetime, and allows rejuvenation through solvent rinsing.

Searching for free technical literature?

www.restek.com

Rtx®-1701 Structure



similar phases

DB-1701, HP-1701, SPB-1701

please note

Rtx®-1701 columns are available with Integra-Guard™ built-in guard columns. Get the protection without the connection! See [page 29](#) for descriptions and ordering information.

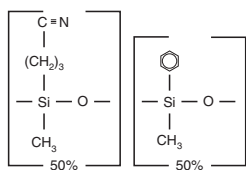
also available

MXT® Columns

Rugged, flexible, Silcosteel® treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 86](#) for our MXT®-1701 columns.

Need a column for a **volatiles analysis?**

see [page 577](#)

Rtx[®]-225Rtx[®]-225
Structure

Rtx[®]-225 (polar phase; Crossbond[®] 50% cyanopropylmethyl / 50% phenylmethyl polysiloxane)

- General purpose columns for FAMES, carbohydrates, sterols, flavor compounds.
- Temperature range: 40°C to 240°C.
- Equivalent to USP G7, G19 phases.

The cyanopropyl-containing Rtx[®]-225 phase is slightly less polar than bonded polyethylene glycol (PEG) phases, but it can be used for many of the same applications. Some popular applications for the Rtx[®]-225 column are analyses of fatty acid methyl esters (FAMES), sugar derivatives, and food and flavor compounds. As with all cyano phases, strongly acidic compounds can show non-linearity at ppm levels.

Improvements to the Rtx[®]-225 polymer have increased thermal stability, reduced bleed, and improved inertness. The Rtx[®]-225 column provides a 20°C thermal stability advantage over other “225” columns because of our unique polymer synthesis technology and proprietary siloxane deactivation. In most similar columns, the Carbowax[®] deactivation layer is not fully compatible with the cyanopropyl siloxane polymer, causing adsorption, tailing of active compounds, and lower efficiency.

Rtx[®]-225 Columns (fused silica)

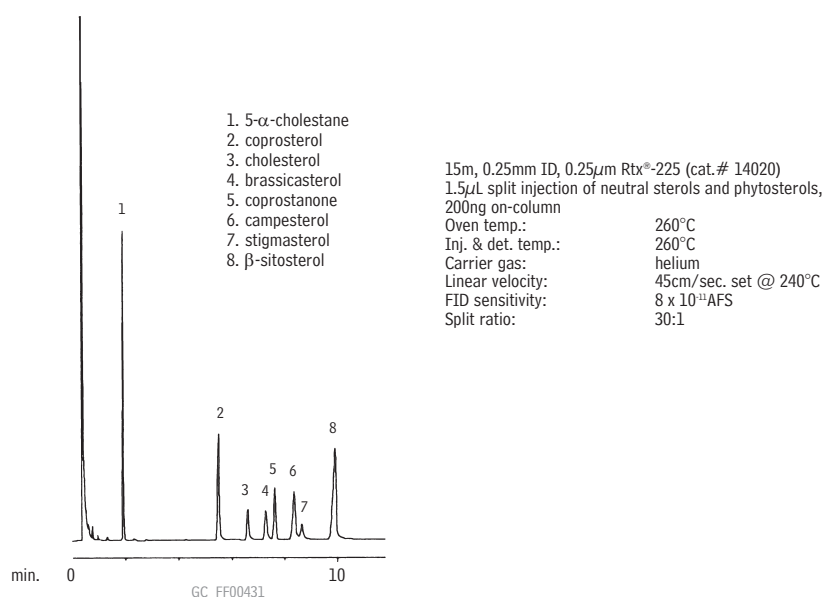
(Crossbond[®] 50% cyanopropylmethyl/50% phenylmethyl polysiloxane)

ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter
0.25mm	0.10	40 to 220/240°C	14005	14008	
	0.25	40 to 220/240°C	14020	14023	14026
	0.50	40 to 220/240°C	14035	14038	14041
0.32mm	0.10	40 to 220/240°C	14006	14009	
	0.25	40 to 220/240°C	14021	14024	14027
	0.50	40 to 220/240°C	14036	14039	14042
	1.00	40 to 200/220°C	14051	14054	14057
0.53mm	0.10	40 to 200/220°C	14007	14010	
	0.25	40 to 200/220°C	14022	14025	
	0.50	40 to 200/220°C	14037	14040	14043
	1.00	40 to 200/220°C	14052	14055	14058

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

similar phases

DB-225, HP-225, SPB-225

Neutral sterols resolved on an Rtx[®]-225 column.

Rtx[®]-200 (mid-polarity phase; Crossbond[®] trifluoropropylmethyl polysiloxane)

- General purpose columns for solvents, Freon[®] fluorocarbons, alcohols, ketones, silanes, glycols. Excellent confirmation column, with an Rtx[®]-5 column, for phenols, nitrosamines, organochlorine pesticides, chlorinated hydrocarbons, chlorophenoxy herbicides.
- Temperature range: -20°C to 340°C.
- Equivalent to USP G6 phase.

Rtx[®]-200 columns have accomplished many difficult separations not possible on any other bonded stationary phase, and many analysts consider these the best, most inert mid-polarity columns available. The trifluoropropyl stationary phase has a unique selectivity that changes elution orders and resolves compounds that phenyl, cyano, or Carbowax[®] phases can not. Exceptional thermal stability, low bleed, and superior inertness, even for active compounds such as phenols, even with sensitive detectors such as ECDs, NPDs, and MSDs.

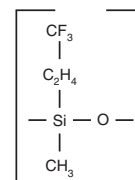
Rtx[®]-200 Columns (fused silica)(Crossbond[®] trifluoropropylmethyl polysiloxane)

ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter	105-Meter
0.25mm	0.10	-20 to 320/340°C	15005	15008	15011	
	0.25	-20 to 320/340°C	15020	15023	15026	15029
	0.50	-20 to 310/330°C	15035	15038	15041	15044
	1.00	-20 to 290/310°C	15050	15053	15056	15059
0.32mm	0.10	-20 to 320/340°C	15006	15009	15012	
	0.25	-20 to 320/340°C	15021	15024	15027	15030
	0.50	-20 to 310/330°C	15036	15039	15042	15045
	1.00	-20 to 290/310°C	15051	15054	15057	15060
	1.50	-20 to 280/300°C	15066	15069	15072	15075
0.53mm	0.10	-20 to 310/330°C	15007	15010	15013	
	0.25	-20 to 310/330°C	15022	15025	15028	
	0.50	-20 to 300/320°C	15037	15040	15043	
	1.00	-20 to 290/310°C	15052	15055	15058	
	1.50	-20 to 280/300°C	15067	15070	15073	
3.00	-20 to 260/280°C	15082	15085	15088	15091	
ID	df (μm)	temp. limits	10-Meter	20-Meter	40-Meter	
0.18mm	0.20	-20 to 310/330°C	45001	45002	45003	
	0.40	-20 to 310/330°C	45010	45011	45012	

Rtx[®]-200MS—Low-bleed GC/MS Columns (fused silica)(Crossbond[®] trifluoropropylmethyl polysiloxane)

ID	df (μm)	temp. limits	15-Meter	30-Meter
0.25mm	0.10	-20 to 320/340°C	15605	15608
	0.25	-20 to 320/340°C	15620	15623
	0.50	-20 to 310/330°C	15635	15638
	1.00	-20 to 290/310°C	15650	15653
0.32mm	0.10	-20 to 320/340°C	15606	15609
	0.25	-20 to 320/340°C	15621	15624
	0.50	-20 to 310/330°C	15636	15639
	1.00	-20 to 290/310°C	15651	15654
0.53mm	0.50	-20 to 300/320°C	15637	15640
	1.00	-20 to 290/310°C	15652	15655
	1.50	-20 to 280/300°C	15667	15670

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

Rtx[®]-200 Structuresimilar **phases**

DB-200, DB-210



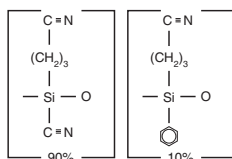
Rob Freeman
Innovation Chemist

also **available****MXT[®] Columns**

Rugged, flexible, Silcosteel[®] treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 87](#) for our MXT[®]-200 columns.

Rtx[®]-2330 and Rt-2560

Rtx[®]-2330 Structure



Rtx[®]-2330 (highly polar phase; 90% bis(cyanopropyl) / 10% phenylcyanopropyl polysiloxane—not bonded)

- General purpose columns for *cis/trans* FAMES, dioxin isomers.
- Temperature range: 0°C to 275°C.
- Equivalent to USP G48 phase.

Rtx[®]-2330 is one of the most polar capillary column stationary phases. Cyano groups on both sides of the polymer backbone give the phase a strong dipole moment and high selectivity for *cis/trans* compounds or compounds with conjugated double bonds. Highly polar columns typically exhibit poor column efficiencies, high bleed, and short column lifetimes when thermally cycled. To overcome some of these problems, we developed a surface treatment that is more compatible with the Rtx[®]-2330 phase. In addition, our improved polymer produces columns with improved column efficiency and lower bleed.

Because the Rtx[®]-2330 stationary phase is not bonded, it should not be solvent rinsed.

Rtx[®]-2330 Columns (fused silica)

(90% bis(cyanopropyl)/10% phenylcyanopropyl polysiloxane)

ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter	105-Meter
0.25mm	0.10	0 to 260/275°C	10705	10708	10711	10714
	0.20	0 to 260/275°C	10720	10723	10726	10729
0.32mm	0.10	0 to 260/275°C	10706	10709	10712	10715
	0.20	0 to 260/275°C	10721	10724	10727	10730
0.53mm	0.10	0 to 260/275°C	10707	10710	10713	
	0.20	0 to 260/275°C	10722	10725	10728	

ID	df (μm)	temp. limits	10-Meter	20-Meter	40-Meter
0.18mm	0.10	0 to 260/275°C	40701	40702	40703

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

Rt-2560 (highly polar phase; bis(cyanopropyl) polysiloxane—not bonded)

- Application-specific column for *cis/trans* FAMES.
- Stable to 250°C.

similar phases

SPB-2560

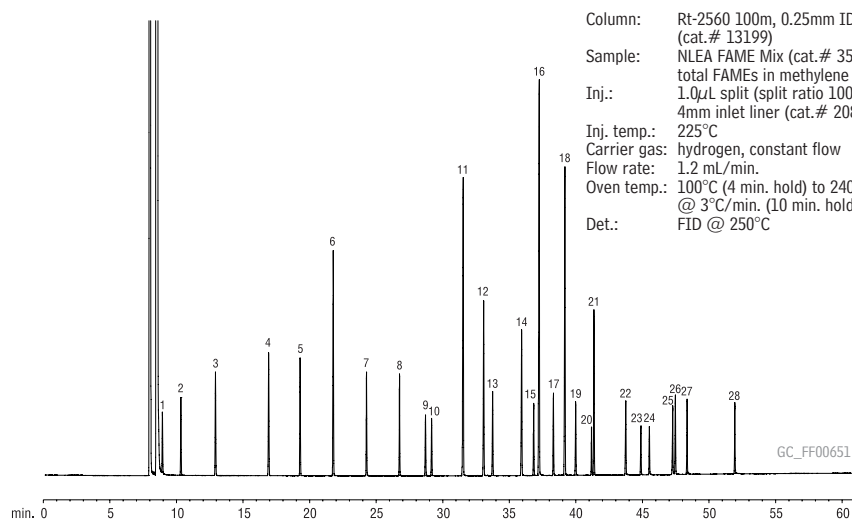
Because the Rt-2560 stationary phase is not bonded, it should not be solvent rinsed.

Rt-2560 Column (fused silica)

(bis(cyanopropyl) polysiloxane)

ID	df (μm)	temp. limits	100-Meter
0.25mm	0.20	20 to 250°C	13199

NLEA FAMES resolved on an Rt-2560 column.



Column: Rt-2560 100m, 0.25mm ID, 0.20μm (cat.# 13199)
 Sample: NLEA FAME Mix (cat.# 35078), 30mg/mL total FAMES in methylene chloride
 Inj.: 1.0μL split (split ratio 100:1), 4mm inlet liner (cat.# 20814)
 Inj. temp.: 225°C
 Carrier gas: hydrogen, constant flow
 Flow rate: 1.2 mL/min.
 Oven temp.: 100°C (4 min. hold) to 240°C @ 3°C/min. (10 min. hold)
 Det.: FID @ 250°C

1. C4:0 methyl butyrate
2. C6:0 methyl hexanoate
3. C8:0 methyl octanoate
4. C10:0 methyl decanoate
5. C11:0 methyl undecanoate
6. C12:0 methyl laurate
7. C13:0 methyl tridecanoate
8. C14:0 methyl myristate
9. C14:1 methyl myristoleate (*cis*-9)
10. C15:0 methyl pentadecanoate
11. C16:0 methyl palmitate
12. C16:1 methyl palmitoleate (*cis*-9)
13. C17:0 methyl heptadecanoate
14. C18:0 methyl stearate
15. C18:1 methyl elaidate (*trans*-9)
16. C18:1 methyl oleate (*cis*-9)
17. C18:2 methyl linoleate (*trans*-9,12)
18. C18:2 methyl linoleate (*cis*-9,12)
19. C20:0 methyl arachidate
20. C20:1 methyl eicosanoate (*cis*-11)
21. C18:3 methyl linolenate (*cis*-9,12,15)
22. C22:0 methyl behenate
23. C22:1 methyl erucate (*cis*-13)
24. C23:0 methyl tricosanoate
25. C24:0 methyl lignocerate
26. C20:5 methyl eicosapentaenoate (*cis*-5,8,11,14,17)
27. C24:1 methyl nervonate (*cis*-15)
28. C22:6 methyl docosahexaenoate (*cis*-4,7,10,13,16,19)

Stabilwax® (polar phase; Crossbond® Carbowax® polyethylene glycol)

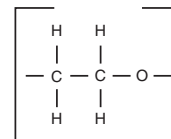
- General purpose columns for FAMES, flavor compounds, essential oils, amines, solvents, xylene isomers, US EPA Method 603 (acrolein/acrylonitrile).
- Resistant to oxidative damage.
- Temperature range: 40°C to 250°C.
- Equivalent to USP G14, G15, G16, G20, G39 phases.

Our polar-deactivated surface tightly binds the Carbowax® polymer and increases thermal stability, relative to competitive columns. The bonding mechanisms produce a column that can be rejuvenated by solvent washing. Compared to silicone stationary phases, PEG phases are more resistant to damage from strongly acidic or basic volatile compounds, including inorganic acids and volatile inorganic bases.

Stabilwax® Columns (fused silica)

(Crossbond® Carbowax® polyethylene glycol)

ID	df (µm)	temp. limits	15-Meter	30-Meter	30-Meter/6-pk.	60-Meter
0.25mm	0.10	40 to 250°C	10605	10608		10611
	0.25	40 to 250°C	10620	10623		10626
	0.50	40 to 250°C	10635	10638		10641
0.32mm	0.10	40 to 250°C	10606	10609		10612
	0.25	40 to 250°C	10621	10624		10627
	0.50	40 to 250°C	10636	10639		10642
	1.00	40 to 240/250°C	10651	10654	10654-600	10657
0.53mm	0.10	40 to 250°C	10607	10610		10613
	0.25	40 to 250°C	10622	10625		10628
	0.50	40 to 250°C	10637	10640		10643
	1.00	40 to 240/250°C	10652	10655	10655-600	10658
	1.50	40 to 230/240°C	10666	10669		10672
	2.00	40 to 220/230°C	10667	10670		

Stabilwax® Structuresimilar **phases**

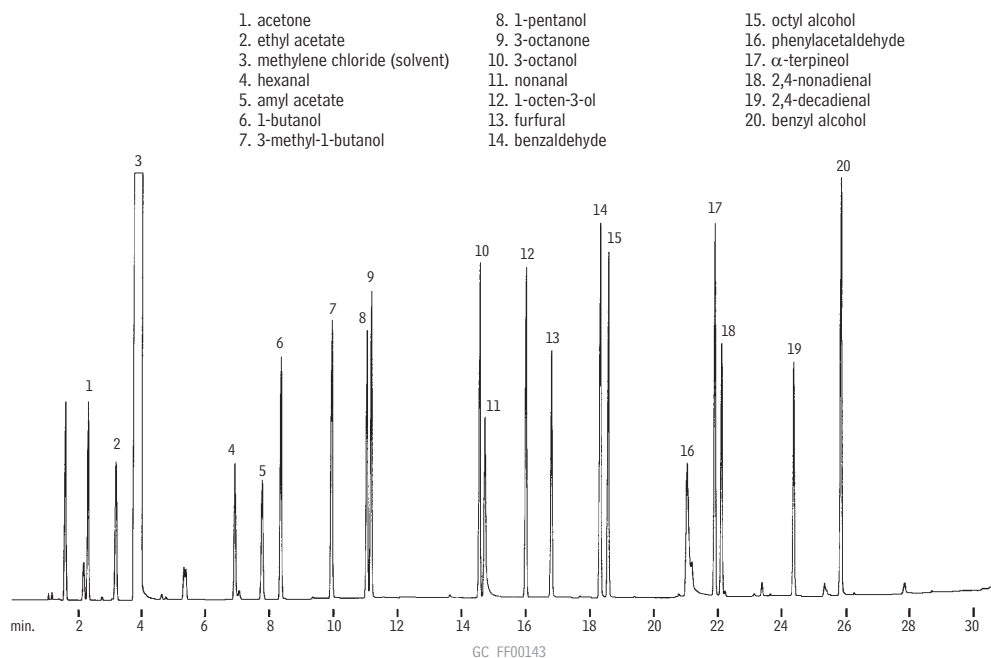
DB-WAX, DB-WAXetr, HP-Wax, HP-Innowax, Supelcowax 10

ordering **note**

Stabilwax® columns are available with Integra-Guard™ built-in guard columns. Get the protection without the connection! See [page 29](#) for descriptions and ordering information.

also **available****MXT® Columns**

Rugged, flexible, Silcosteel® treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 87](#) for our MXT®-WAX columns.

Synthetic mushroom aroma on a Stabilwax® column.

- | | | |
|---------------------------------|------------------|------------------------|
| 1. acetone | 8. 1-pentanol | 15. octyl alcohol |
| 2. ethyl acetate | 9. 3-octanone | 16. phenylacetaldehyde |
| 3. methylene chloride (solvent) | 10. 3-octanol | 17. α-terpineol |
| 4. hexanal | 11. nonanal | 18. 2,4-nonadienal |
| 5. amyl acetate | 12. 1-octen-3-ol | 19. 2,4-decadienal |
| 6. 1-butanol | 13. furfural | 20. benzyl alcohol |
| 7. 3-methyl-1-butanol | 14. benzaldehyde | |

30m, 0.32mm ID, 1.0µm Stabilwax® (cat.# 10654)
 1.0µL split injection of a synthetic mushroom aroma
 Conc.: 10ng per component
 Oven temp.: 40°C to 220°C @ 6°C/min.
 Inj. & det. temp.: 260°C
 Carrier gas: hydrogen
 Linear velocity: 40cm/sec.
 FID sensitivity: 4 x 10⁻¹¹ AFS
 Split ratio: 100:1

Stabilwax®-DA

Stabilwax®-DA (polar phase; Crossbond® acid-deactivated Carbowax® polyethylene glycol)

- Application-specific columns for free (underivatized) acids, some inorganic acids.
- Resistant to oxidative damage.
- Temperature range: 40°C to 250°C.
- Equivalent to USP G25, G35 phases.

Stabilwax®-DA bonded polyethylene glycol has an acidic functionality incorporated into the polymer structure. This permits analysis of acidic compounds without derivatization, significantly reduces adsorption of acids, and increases sample capacity for volatile free acids. Stabilwax®-DA columns last longer and give better peak shapes for high molecular weight acids. Some inorganic acids also chromatograph well on a Stabilwax®-DA column; the limitation is the volatility of the acidic compound.

similar phases

DB-FFAP, HP-FFAP, NUKOL, OV-351

Stabilwax®-DA Columns (fused silica)

(Crossbond® Carbowax® polyethylene glycol for acidic compounds)

ID	df (µm)	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.10	40 to 250°C	11005	11008	11011
	0.25	40 to 250°C	11020	11023	11026
	0.50	40 to 250°C	11035	11038	11041
0.32mm	0.10	40 to 250°C	11006	11009	11012
	0.25	40 to 250°C	11021	11024	11027
	0.50	40 to 250°C	11036	11039	11042
1.00mm	0.10	40 to 240/250°C	11051	11054	11057
	0.25	40 to 250°C	11022	11025	11028
	0.50	40 to 250°C	11037	11040	11043
0.53mm	0.10	40 to 240/250°C	11052	11055	11058
	0.25	40 to 230/240°C	11062	11065	11068
	1.00	40 to 230/240°C	11062	11065	11068

crossbond® technology

reduces bleed, prolongs column lifetime, and allows rejuvenation through solvent rinsing.

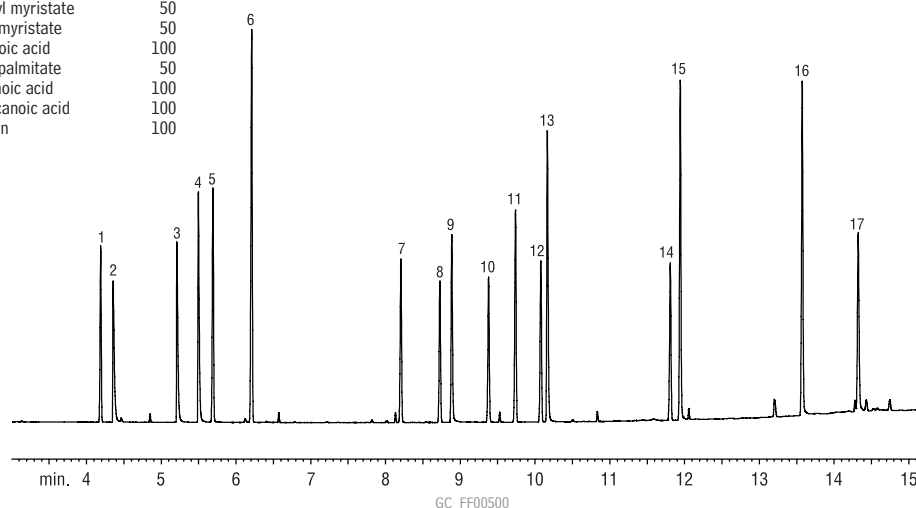
Underivatized alcoholic beverage acids and methyl esters on a Stabilwax®-DA column.

Peak List	Conc. (ppm)
1. ethyl octanoate	100
2. acetic acid	100
3. propionic acid	100
4. isobutyric acid	100
5. 3-decanol	50
6. ethyl decanoate	50
7. ethyl laurate	50
8. <i>cis</i> -lactone	100
9. 2-phenylethanol	50
10. <i>trans</i> -lactone	100
11. methyl myristate	50
12. ethyl myristate	50
13. octanoic acid	100
14. ethyl palmitate	50
15. decanoic acid	100
16. dodecanoic acid	100
17. vanillin	100

Stabilwax®-DA 30m, 0.18mm ID, 0.18µm (cat.# 550752)

Inj.: 1µL splitless (hold 0.5 min.) at conc. shown in peak list, in ethyl acetate, 4mm ID splitless liner w/wool (cat.# 20814-202.1)

Inj. temp.: 240°C
Carrier gas: hydrogen
Make-up gas: nitrogen
Linear velocity: 28psi @ 240°C
Oven temp.: 70°C to 240°C at 12°C/min. (hold 3 min.)
Det.: FID



Stabilwax®-DB (polar phase; Crossbond® base-deactivated Carbowax® polyethylene glycol)

- Application-specific columns for underivatized amines and other basic compounds, including alkylamines, diamines, triamines, nitrogen-containing heterocyclics. No need for column priming.
- Temperature range: 40°C to 220°C.

Stabilwax®-DB columns reduce adsorption and improve responses for many basic compounds, without analyte derivatization or column priming. For different selectivity for basic compounds, or higher oven temperatures, use an Rtx®-5 Amine or Rtx®-35 Amine column.

Stabilwax®-DB is a bonded stationary phase, but avoid rinsing these columns with water or alcohols.

Stabilwax®-DB Columns (fused silica)

(Crossbond® Carbowax® polyethylene glycol for amines and basic compounds)

ID	df (μm)	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.25	40 to 210/220°C	10820	10823	
	0.50	40 to 210/220°C		10838	
0.32mm	0.25	40 to 210/220°C	10821	10824	
	0.50	40 to 210/220°C		10839	
	1.00	40 to 210/220°C	10851	10854	10857
0.53mm	0.50	40 to 210/220°C		10840	
	1.00	40 to 210/220°C	10852	10855	10858
	1.50	40 to 210/220°C		10869	



Mark Lawrence
Northeast Area
Sales Representative
9+ years of service!

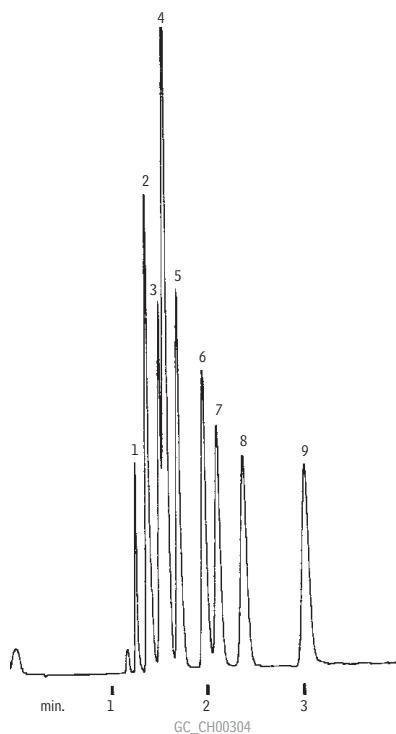
similar **phases**

DB-CAM, Carbowax® Amine,
CP Wax 51

Effective resolution and sharp peaks for low molecular weight primary amines, using a Stabilwax®-DB column.

1. trimethylamine
2. dimethylamine
3. ethylamine
4. methylamine
5. isopropylamine
6. *n*-propylamine
7. *tert*-butylamine
8. diethylamine
9. *sec*-butylamine

30m, 0.53mm ID, 1.0μm Stabilwax®-DB (cat.# 10855)
1.0μL direct injection of amines in water
Oven temp.: 45°C
Inj. & det. temp.: 250°C
Carrier gas: hydrogen
Linear velocity: 40cm/sec. (flow rate: 5cc/min.)
FID sensitivity: 1 x 10⁻¹¹ AFS
Recommended inlet liner: Uniliner®



a plus 1 story

"For many years, I have searched the market place for a bonded polar gc phase that delivered the chemical inertness, long term phase stability and practical robustness necessary to meet my operational requirements. Only after an extensive nine month in-house testing programme, can I say that I have finally found that phase in Rtx[®]-Wax."

Steve Rowlands, Quest International (Kent UK)

similar phases

DB-WAX, HP-Wax

Rtx[®]-Wax (polar phase; Crossbond[®] Carbowax[®] polyethylene glycol)

- General purpose columns for FAMES, solvents, BTEX aromatics, flavor compounds.
- Temperature range: 20°C to 250°C.
- Equivalent to USP G14, G15, G16, G20, G39 phases.

Rtx[®]-Wax columns are the most inert and efficient PEG columns currently available. The extended operating temperature range allows analysis of compounds having a wide volatility range, and ensures low bleed at temperatures as high as 250°C. Selectivity is comparable to other Carbowax[®] columns, for compounds of intermediate to high polarity. Selectivity data available on request.

Rtx[®]-Wax Columns (fused silica)

(Crossbond[®] Carbowax[®] polyethylene glycol)

ID	df (μm)	temp. limits*	15-Meter	30-Meter	60-Meter
0.25mm	0.10	20 to 250°C	12405	12408	
	0.25	20 to 250°C	12420	12423	12426
	0.50	20 to 250°C	12435	12438	12441
0.32mm	0.10	20 to 250°C	12406	12409	
	0.25	20 to 250°C	12421	12424	12427
	0.50	20 to 250°C	12436	12439	12442
0.53mm	1.00	20 to 240/250°C	12451	12454	12457
	0.25	20 to 250°C	12422	12425	
	0.50	20 to 250°C	12437	12440	12443
	1.00	20 to 240/250°C	12452	12455	12458
ID	df (μm)	temp. limits	10-Meter	20-Meter	
0.10mm	0.10	20 to 250°C	41601	41602	
	0.20	20 to 240/250°C	41603	41604	

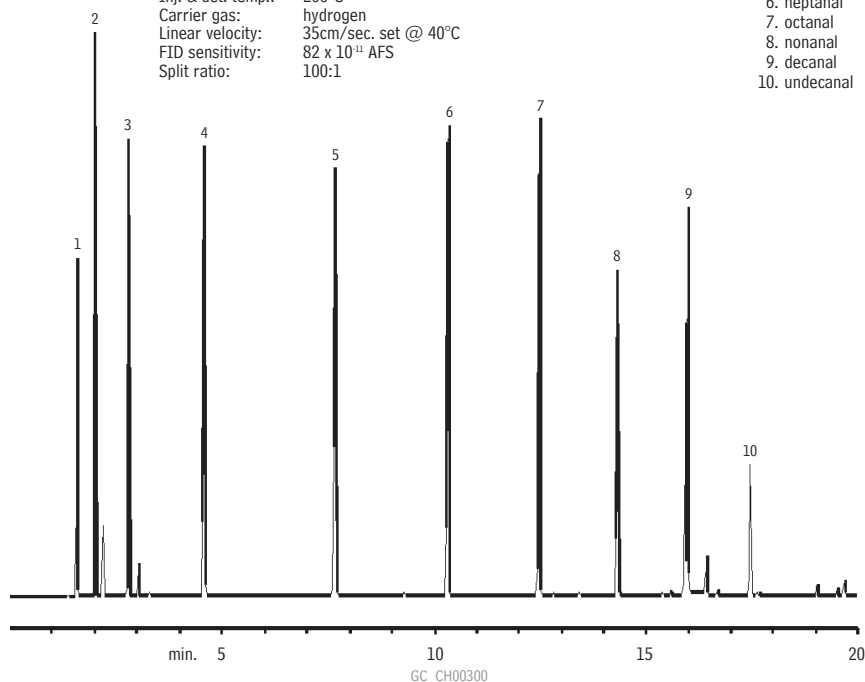
*Maximum temperatures listed are for 15- and 30-meter lengths. Longer lengths may have a slightly reduced maximum temperature.

Sharp, well-resolved peaks for aldehydes, using an Rtx[®]-Wax column.

30m, 0.25mm ID, 0.50μm Rtx[®]-WAX (cat.# 12438)
split injection of C2-C11 aldehydes mixture
On-column conc.: 250ng

Oven temp.: 40°C (hold 5 min.) to 200°C @ 10°C/min.
Inj. & det. temp.: 200°C
Carrier gas: hydrogen
Linear velocity: 35cm/sec. set @ 40°C
FID sensitivity: 82 x 10⁻¹¹ AFS
Split ratio: 100:1

1. ethanal
2. propanal
3. butanal
4. pentanal
5. hexanal
6. heptanal
7. octanal
8. nonanal
9. decanal
10. undecanal



free literature

- Performance information about six polyethylene glycol (PEG) columns.
- Applications for each column.
Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copy!

lit. cat.# 59890 (domestic)
lit. cat.# 59891 (international)

FAMEWAX™ (polar phase; Crossbond® polyethylene glycol)

- Application-specific columns for FAMES, specially tested with a FAME mixture.
- Temperature range: 60°C to 250°C.

The elution order of polyunsaturated FAMES on FAMEWAX™ columns is comparable to that on other Carbowax® columns, but baseline resolution is achieved in significantly less time.

FAMEWAX™ Columns (fused silica)

(Crossbond® polyethylene glycol)

ID	df (µm)	temp. limits	30-Meter
0.25mm	0.25	20 to 250°C	12497
0.32mm	0.25	20 to 250°C	12498
0.53mm	0.50	20 to 250°C	12499

similar phases

Omegawax®

FAMES (marine oil standard) on a FAMEWAX™ column.

30m, 0.32mm ID, 0.25µm FAMEWAX™ (cat. # 12498)

Inj.: 1µL

Conc.: 10,000µg/mL in isoctane (total FAMES; see breakdown in peak list)

Oven temp.: 195–240°C at 5°C/min., 1 min. hold

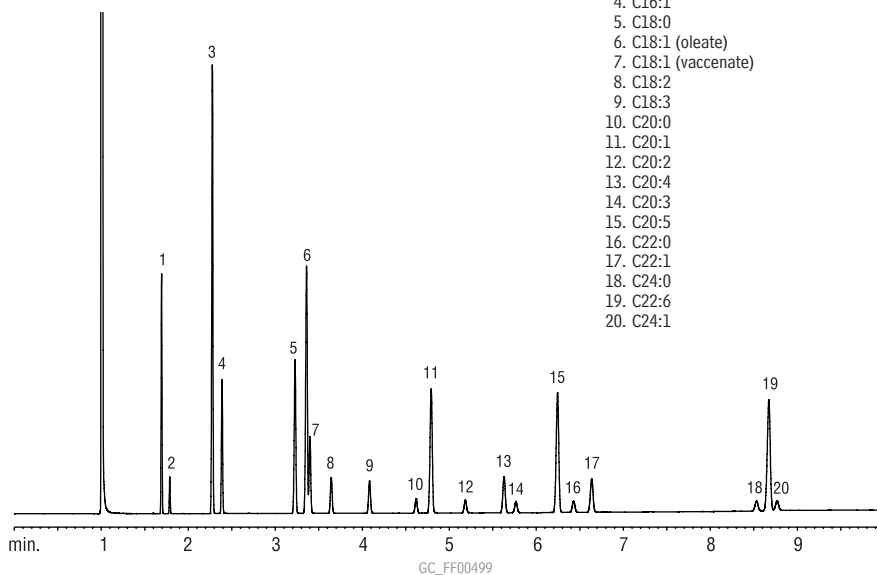
Inj. / det. temp.: 250°C / 275°C

Carrier gas: hydrogen

Flow rate: 3 mL/min. (constant flow)

Split ratio: 100:1

Peak List	Conc. (µg/mL)
1. C14:0	600
2. C14:1	100
3. C16:0	1600
4. C16:1	500
5. C18:0	800
6. C18:1 (oleate)	1300
7. C18:1 (vaccenate)	400
8. C18:2	200
9. C18:3	200
10. C20:0	100
11. C20:1	900
12. C20:2	100
13. C20:4	300
14. C20:3	100
15. C20:5	1000
16. C22:0	100
17. C22:1	300
18. C24:0	100
19. C22:6	1200
20. C24:1	100



Steve Allison
R&D Chemist

Rt-CW20M™ F&F (polar phase; Carbowax® polyethylene glycol—not bonded)

- Application-specific columns for flavor and fragrance compounds, specially tested.
- True non-bonded Carbowax® 20M polarity.
- Temperature range: 20°C to 220°C.

We test the Rt-CW20M™ F&F column with a special mix to ensure selectivity corresponding to the nonbonded Carbowax® 20M phase for many flavor and fragrance applications.

Rt-CW20M™ F&F Columns (fused silica)

(Carbowax® polyethylene glycol)

ID	df (µm)	temp. limits	30-Meter	50-Meter
0.25mm	0.25	60 to 220°C	12523	
0.32mm	0.33	60 to 220°C		12539

similar phases

HP-20M, Carbowax® 20M

Rt-TCEP™ (highly polar phase; 1,2,3-tris(2-cyanoethoxy)propane—not bonded)

- General purpose columns, ideal for aromatics and oxygenates in gasoline.
- Temperature range: 0°C to 135°C.

Most gasolines contain aliphatic hydrocarbons up to *n*-dodecane (C12). To improve identification of the aromatics and oxygenates, it is desirable to elute benzene after C11 and toluene after C12. The extremely polar Rt-TCEP™ stationary phase provides a retention index for benzene greater than 1100 and permits the separation of alcohols and aromatics from the aliphatic constituents in gasoline.

similar phases

SPB-TCEP, CP-TCEP

Rt-TCEP™ columns have the same high polarity as TCEP packed columns (precolumns in ASTM Method D4815 for the analysis of petroleum oxygenates), with the efficiency of a capillary column. The result is a column that can separate a wide variety of compounds with an elution pattern unattainable using other high polarity siloxanes.

The Rt-TCEP™ column incorporates a non-bonded stationary phase coated on a surface specialized for enhanced polymer stability and extended column lifetime. Solvent rinsing should be avoided. Conditioning is necessary only if the column is to be used at temperatures near the maximum operating temperature.

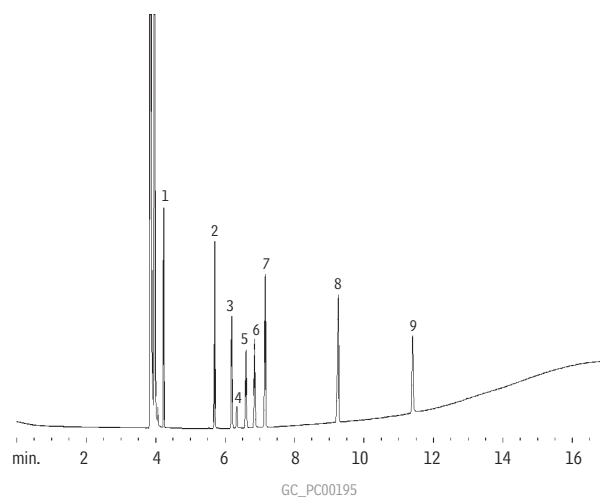
Rt-TCEP™ Columns (fused silica)

(1,2,3-tris(2-cyanoethoxy)propane)

ID	df (μm)	temp. limits	30-Meter	60-Meter
0.25mm	0.40	0 to 135°C	10998	10999



Rick Lake
Innovations Chemist
2+ years of service!

Petroleum oxygenates resolved from aliphatics: Rt-TCEP™ column.

1. methyl *tert*-butyl ether
2. *n*-undecane
3. *tert*-butanol
4. methanol
5. isopropyl alcohol
6. ethanol
7. *n*-dodecane
8. *n*-tridecane
9. *n*-butanol

60m, 0.25mm ID, 0.4μm Rt-TCEP™ (cat.# 10999)
1.0μL split injection, components @ 500ppm.

Oven temp.: 60°C (hold 5 min.) to 100°C @ 5°C/min. (hold 10 min.)
Inj. & det. temp.: 200°C
Carrier gas: helium
Linear velocity: 30cm/sec. set @ 80°C
FID sensitivity: 6.4 x 10⁻¹¹ AFS
Split flow: 46mL/min.

Rtx®-OPPesticides / Rtx®-OPPesticides2 (proprietary Crossbond® phases)

- Application-specific columns for organophosphorus pesticides; best column combination for US EPA Method 8141A.
- Low bleed - ideal for GC/FPD, GC/NPD, or GC/MS analyses.
- Stable to 330°C.

restek
innovation!

- Better separations
- Faster analysis

Using sophisticated computer modeling software, we created two stationary phases for separating the 55 organophosphorus pesticides (OPP) listed in EPA Method 8141A. Separation is improved, and analysis time is significantly reduced, compared to other columns. The extended upper temperature limit of these phases (330°C) allows analysts to bake out high molecular weight contamination typically associated with pesticide samples. The low bleed columns are a perfect match for sensitive detection systems.

Rtx®-OPPesticides Columns (fused silica)

ID	df (μm)	temp. limits	30-Meter
0.32mm	0.50	-20 to 310/330°C	11239
0.53mm	0.83	-20 to 310/330°C	11240

Rtx®-OPPesticides2 Columns (fused silica)

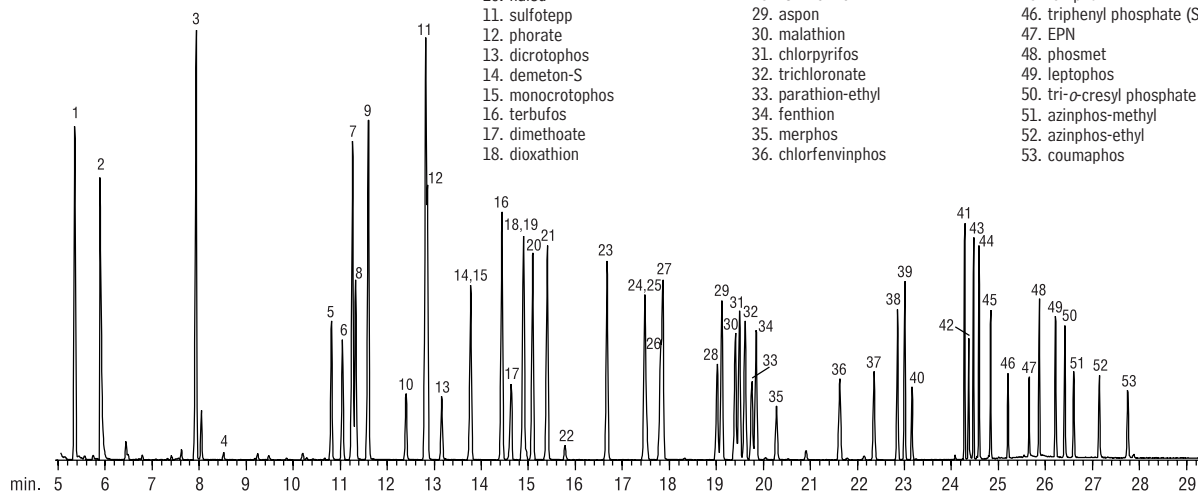
ID	df (μm)	temp. limits	20-Meter	30-Meter
0.18mm	0.20	-20 to 310/330°C	11244	
0.25mm	0.25	-20 to 310/330°C		11243
0.32mm	0.32	-20 to 310/330°C		11241
0.53mm	0.50	-20 to 310/330°C		11242

did you **know?**

These application-specific Restek columns give fast, efficient analysis of the OPPs listed in EPA Method 8141A

Organophosphorus pesticides by US EPA Method 8141A on an Rtx®-OPPesticides2 column.

1. dichlorvos
2. hexamethylphosphoramide
3. mevinphos
4. trichlorfon
5. TEPP
6. demeton-O
7. thionazin
8. tributyl phosphate (IS)
9. ethoprop
10. naled
11. sulfotepp
12. phorate
13. dicrotophos
14. demeton-S
15. monocrotophos
16. terbufos
17. dimethoate
18. dioxathion
19. fonophos
20. diazinon
21. disulfoton
22. phosphamidon isomer
23. dichlorofenthion
24. chlorpyrifos methyl
25. phosphamidon
26. parathion-methyl
27. ronnel
28. fenitrothion
29. aspon
30. malathion
31. chlorpyrifos
32. trichloronate
33. parathion-ethyl
34. fenthion
35. merphos
36. chlorfenvinphos
37. crotoxyphos
38. stirofos
39. tokuthion
40. merphos oxone (breakdown product)
41. ethion
42. fensulfothion
43. bolstar
44. carbophenothion
45. famphur
46. triphenyl phosphate (SS)
47. EPN
48. phosmet
49. leptophos
50. tri-*o*-cresyl phosphate
51. azinphos-methyl
52. azinphos-ethyl
53. coumaphos



GC_EV00602

Column: Rtx®-OPPesticides2, 30m, 0.25mm ID, 0.25μm (cat.# 11243)
 Sample: US EPA Method 8141A Custom Standard Mix 1μL 100ppm (100ng on column)
 Triphenylphosphate Standard (cat.# 32281)
 Tributylphosphate Standard (cat.# 32280)
 8140/8141 OP Pesticides Calibration Mix A (cat.# 32277)
 8141 OP Pesticides Calibration Mix B (cat.# 32278)
 Custom Mixes: Call Restek for Information
 Inj.: 1.0μL splitless (hold 0.4 min.), 4mm double gooseneck inlet liner (cat.# 20785)

Inj. temp.: 250°C
 Carrier gas: helium, constant flow
 Flow rate: 1.0mL/min.
 Oven temp.: 80°C (hold 0.5 min.) to 140°C @ 20°C/min. to 210°C @ 4°C/min. (hold 1 min.) to 280°C @ 30°C (hold 5 min.)
 Det: MS
 Transfer line temp.: 280°C
 Scan range: 35-400amu
 Ionization: EI

Stx™-CLPesticides and Stx™-CLPesticides2

restek
innovation!

Stx™-CLPesticides / Stx™-CLPesticides2 (proprietary Crossbond® phases)

- Application-specific columns for organochlorine pesticides and herbicides; exceed performance criteria for US EPA methods 8081, 608, CLP.
- Baseline separations in less than 15 minutes.
- Siltek® surface deactivation enhances responses for endrin, DDT, methoxychlor.
- Stable to 330°C.

Many laboratories analyzing organochlorine pesticides struggle with breakdown and adsorption of endrin, DDT, and methoxychlor caused by active sites throughout the analytical system. Siltek® passivation technology enables these columns to offer unsurpassed inertness and the highest responses for active pesticides.

Stx™-CLPesticides Columns (fused silica with Siltek® deactivation)

ID	df (μm)	temp. limits	15-Meter	30-Meter
0.25mm	0.25	-60 to 310/330°C	11540	11543
0.32mm	0.50	-60 to 310/330°C	11541	11544

Stx™-CLPesticides2 Columns (fused silica with Siltek® deactivation)

ID	df (μm)	temp. limits	15-Meter	30-Meter
0.25mm	0.20	-60 to 310/330°C	11440	11443
0.32mm	0.25	-60 to 310/330°C	11441	11444

Stx™-CLPesticides Kits

(Note: Columns are not preconnected in these kits.)

0.25mm ID Stx™-CLPesticides Kit cat.# 11190 (kit)

kit

Includes:	cat.#
30m, 0.25mm ID, 0.25μm Stx™-CLPesticides Column	11543
30m, 0.25mm ID, 0.20μm Stx™-CLPesticides2 Column	11443
Universal Angled "Y" Press-Tight® Connector	20403
5m, 0.25mm ID Siltek® Guard Column	10026

0.32mm ID Stx™-CLPesticides Kit cat.# 11191 (kit)

kit

Includes:	cat.#
30m, 0.32mm ID, 0.50μm Stx™-CLPesticides Column	11544
30m, 0.32mm ID, 0.25μm Stx™-CLPesticides2 Column	11444
Universal Angled "Y" Press-Tight® Connector	20403
5m, 0.32mm ID Siltek® Guard Column	10027

it's a fact

These columns are treated with Siltek® deactivation, for better responses for endrin, DDT, and methoxychlor.

ordering note

Kits include Siltek® deactivated guard column.

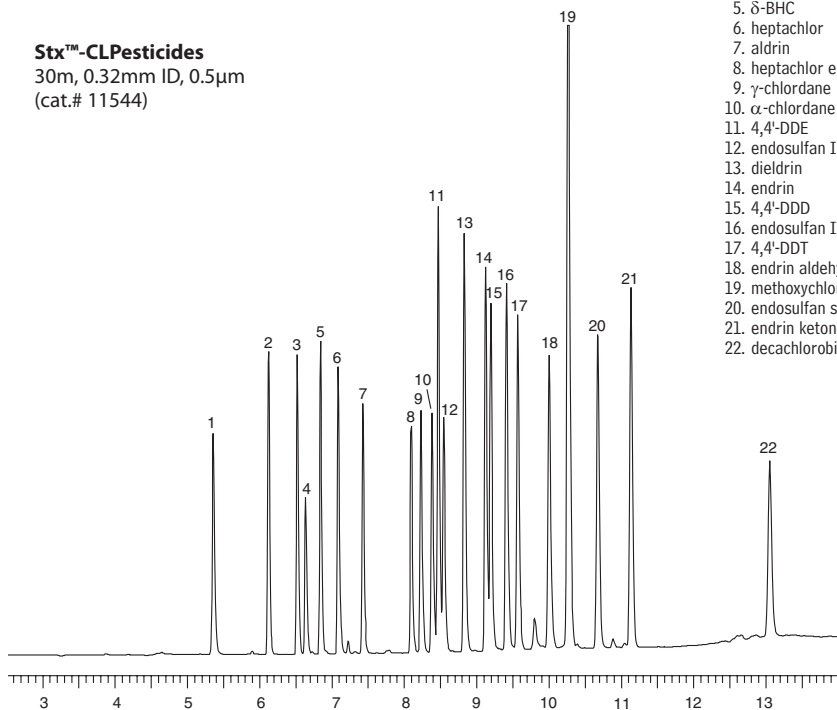
a plus 1 story

"I wanted to extend my thanks to the fine folks at Restek for being so helpful as I worked through some difficulties with my 60 meter column setup for CLPesticides and PCB congeners. People like Kristi Sellers were not only informative but also so patient as I struggled to achieve results. While still working on getting better numbers, your Siltek products helped reduce my Endrin breakdown values by 50%. We are fortunate to be using your products."

Gregory Lull, Katahdin Analytical Services

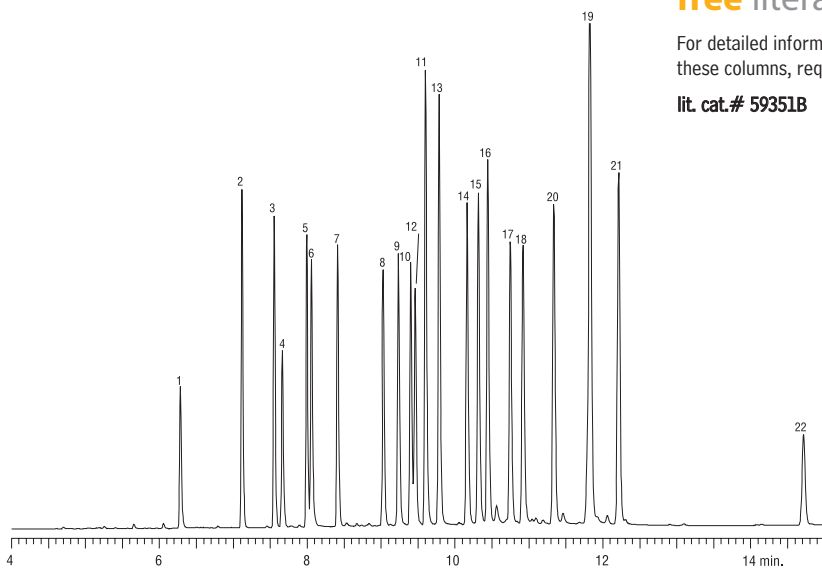
Excellent responses for all US EPA Method 8081 chlorinated pesticides: Stx™-CLPesticides columns.

Stx™-CLPesticides
30m, 0.32mm ID, 0.5µm
(cat.# 11544)



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

Stx™-CLPesticides2
30m, 0.32mm ID, 0.25µm
(cat.# 11444)



free literature

For detailed information about these columns, request

lit. cat.# 59351B

GC_EV00512

Inj.: 1µL direct injection of 20/40/200ng/mL std. concentration in hexane
 Oven temp.: 110°C (hold 1 min.) to 245°C @ 20°C/min. to 300°C @ 6°C/min.
 Inj. & det. temp.: 210°C / 310°C
 Carrier gas: helium
 Dead time: 0.8min. @ 120°C
 Inlet liner: Silitek® deactivated Drilled Uniliner® inlet liner (cat.# 21055-214.1)
 Make-up gas: nitrogen

Table of Contents for Applications

see pages 510-513



Chris Cox
R&D Group Manager
15+ years of service!

it's a fact

An Rtx®-CLPesticides and Rtx®-CLPesticides2 column pair will provide the same resolution under these same instrument conditions.

Rtx[®]-CLPesticides and Rtx[®]-CLPesticides2

restek
innovation!

- Very low bleed
- Faster analysis

Rtx[®]-CLPesticides / Rtx[®]-CLPesticides2 (proprietary Crossbond[®] phases)

- Application-specific columns for organochlorine pesticides and herbicides; exceed performance criteria for US EPA methods 8081, 608, CLP.
- Low bleed - ideal for GC/ECD or GC/MS analyses.
- Baseline separations in less than 25 minutes.
- Stable to 340°C.

Improved resolution and faster analyses, compared to 1701 or phenyl phases, make these the pesticide columns of choice. Rtx[®]-CLPesticides columns are specially designed to overcome the coelutions and analyte breakdown typically encountered in chlorinated pesticide analyses for EPA Methods 8081, 608, and CLP. By achieving baseline resolution of the 20 target analytes, more accurate qualitative data can be obtained, providing reliable identification without GC/MS.

Column bleed, measured by ECD, is extremely low at temperatures greater than 300°C, which is critical for baking-out the column to remove high-boiling compounds commonly found in pesticide/PCB extracts. An analysis time of less than 25 minutes improves throughput compared to other stationary phases. Faster analysis times also can be achieved by using the analysis program used with Stx[™]-CLPesticides/ Stx[™]-CLPesticides2 columns.

Rtx[®]-CLPesticides Columns (fused silica)

ID	df (μm)	temp. limits	10-Meter	15-Meter	20-Meter	30-Meter	60-Meter
0.10mm	0.10	-60 to 310/330°C	43101				
0.18mm	0.18	-60 to 310/330°C	42101		42102		
0.25mm	0.25	-60 to 320/340°C		11120		11123	11126
0.32mm	0.50	-60 to 320/340°C		11136		11139	
0.53mm	0.50	-60 to 300/320°C		11137		11140	

Rtx[®]-CLPesticides2 Columns (fused silica)

ID	df (μm)	temp. limits	10-Meter	15-Meter	20-Meter	30-Meter	60-Meter
0.10mm	0.10	-60 to 310/330°C	43301		43302		
0.18mm	0.14	-60 to 310/330°C	42301		42302		
0.25mm	0.20	-60 to 320/340°C		11320		11323	11326
0.32mm	0.25	-60 to 320/340°C		11321		11324	
	0.50	-60 to 320/340°C				11325	
0.53mm	0.42	-60 to 300/320°C		11337		11340	

Rtx[®]-CLPesticides Kits

(Note: Columns are not preconnected in these kits.)

0.25mm ID Rtx [®] -CLPesticides Kit	cat.# 11199 (kit),	kit
Includes:		cat.#
30m, 0.25mm ID, 0.25μm Rtx [®] -CLPesticides Column		11123
30m, 0.25mm ID, 0.20μm Rtx [®] -CLPesticides2 Column		11323
Universal Angled "Y" Press-Tight [®] Connector		20403
5m, 0.25mm ID Siltek [®] Guard Column		10026

also available

For new & improved column connectors, see pages 206-213.

ordering note

Add "-530" or "-535" to the catalog number for the kit, to save on the cost of the reference mix.

0.32mm ID Rtx [®] -CLPesticides Kit	cat.# 11198 (kit),	kit
Includes:		cat.#
30m, 0.32mm ID, 0.50μm Rtx [®] -CLPesticides Column		11139
30m, 0.32mm ID, 0.25μm Rtx [®] -CLPesticides2 Column		11324
Universal Angled "Y" Press-Tight [®] Connector		20403
5m, 0.32mm ID Siltek [®] Guard Column		10027

0.53mm ID Rtx [®] -CLPesticides Kit	cat.# 11197 (kit),	kit
Includes:		cat.#
30m, 0.53mm ID, 0.50μm Rtx [®] -CLPesticides Column		11140
30m, 0.53mm ID, 0.42μm Rtx [®] -CLPesticides2 Column		11340
Universal Angled "Y" Press-Tight [®] Connector		20403
5m, 0.53mm ID IP Deactivated Guard Column		10045

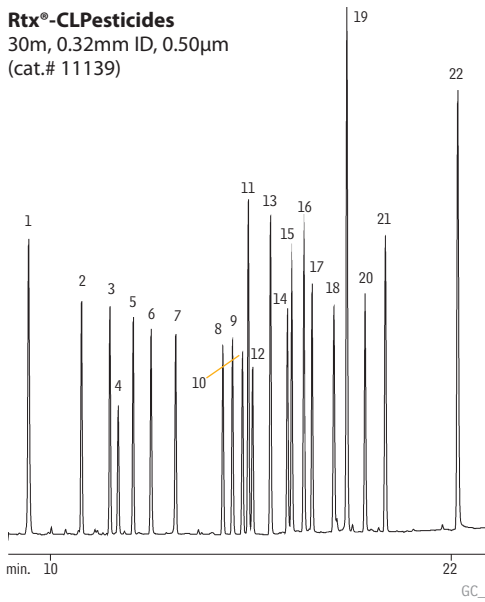
Add a reference mix to your kit order and save!

Description	suffix #
Organochlorine Pesticide Mix AB #1 (cat.# 32291)	-530
Organochlorine Pesticide Mix AB #2 (cat.# 32292)	-535

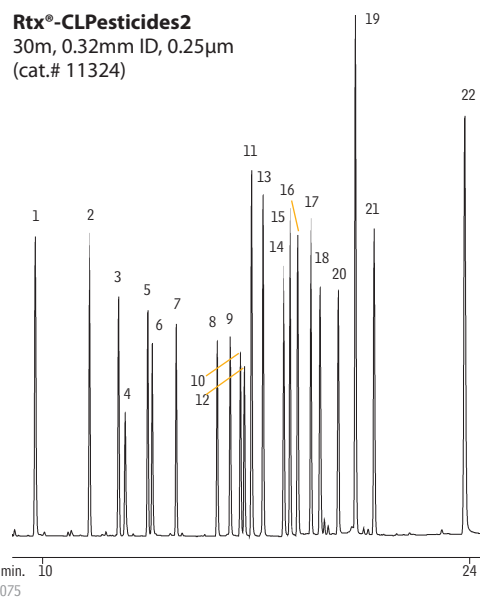
Excellent responses for all US EPA Method 8081 organochlorine pesticides.

Rtx®-CLPesticides & Rtx®-CLPesticides2 columns (0.32mm ID)

Rtx®-CLPesticides
30m, 0.32mm ID, 0.50µm
(cat.# 11139)



Rtx®-CLPesticides2
30m, 0.32mm ID, 0.25µm
(cat.# 11324)



free literature

For information about these columns, request

lit. cat.# 59487

lit. cat.# 59539

lit. cat.# 59547

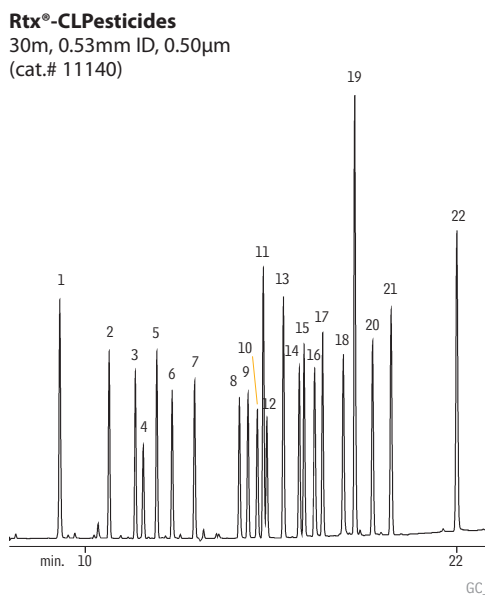
lit. cat.# 59559A

lit. cat.# 59101

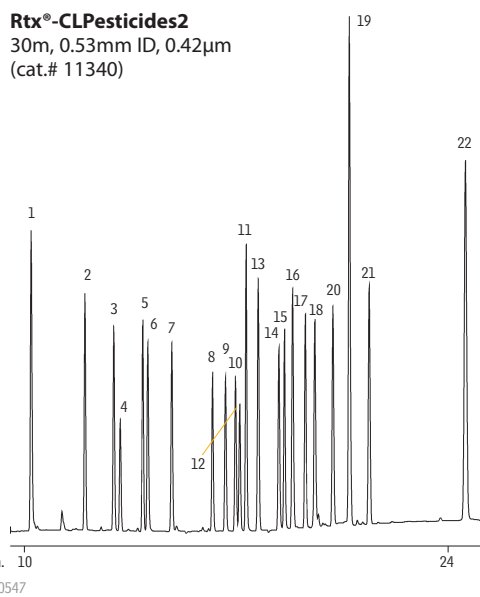
Call Restek at 800-356-1688 or 814-353-1300, ext. 5, or contact your Restek representative, to request your free copies!

Rtx®-CLPesticides & Rtx®-CLPesticides2 columns (0.53mm ID)

Rtx®-CLPesticides
30m, 0.53mm ID, 0.50µm
(cat.# 11140)



Rtx®-CLPesticides2
30m, 0.53mm ID, 0.42µm
(cat.# 11340)



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

On-column concentration: 16–160pg Organochlorine Pesticide Mix AB#2 (cat.# 32292), Pesticide Surrogate Mix (cat. # 32000)
Oven temp.: 120°C (hold 1 min.) to 300°C (hold 10 min.) @ 9°C/min.
Inj.: direct, Uniliner® inlet liner (cat.# 20335), 200°C
Detector: ECD, 300°C with anode purge
Dead time: 1.9 min.
Head pressure: 8.7psi (0.32mm ID) or 3psi (0.53mm ID) (constant)
Flow rate: 1.3mL/min. (0.32mm ID) or 2.83mL/min. (0.53mm ID) @ 120°C, helium

Stx™-500

Stx™-500 (Crossbond® carborane / dimethyl polysiloxane)

- Application-specific columns for co-planar PCB congeners and other analytes with high boiling temperatures.
- Low bleed - ideal for GC/FPD, GC/NPD, or GC/MS analyses.
- Stable to 380°C.

similar phases

HT-8

The Stx™-500 column gives excellent results for neutral or slightly acidic compounds. It is not recommended for analyses of basic compounds.

Stx™-500 Columns (fused silica)

(Crossbond® carborane/dimethyl polysiloxane)

ID	df (µm)	temp. limits*	30-Meter	60-Meter
0.25mm	0.15	-60°C to 380°C	10750	10751
0.53mm	0.15	-60°C to 380°C	10752	

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

did you know?

Carborane phases are active. Active compounds might not chromatograph well with this phase.



Innovations Group

Silvia Martinez, Kristi Sellers, Rick Lake, Robert Freeman, Chris English, Barry Burger, Jason Thomas, Lydia Nolan, Julie Kowalski

Rtx®-PCB (proprietary Crossbond® phase)

- Unique polymer for PCBs analysis by GC/ECD or GC/MS.
- Good results for other semivolatiles.
- Low polarity; inert to active compounds.
- Stable to 320°C.

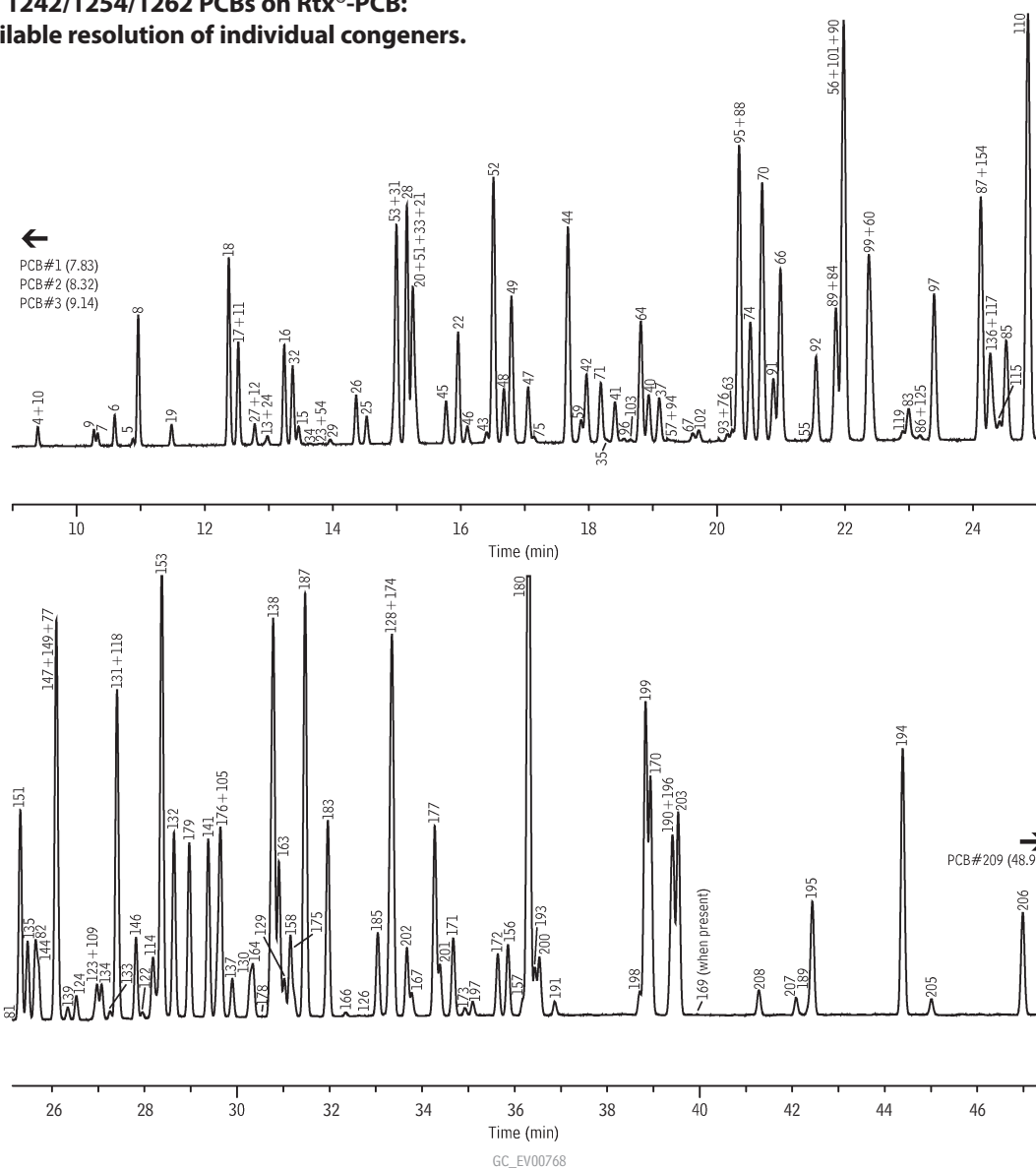
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innovation!

Rtx®-PCB Columns (fused silica)

ID	df (μm)	temp. limits*	20-Meter	30-Meter	40-Meter	60-Meter
0.18mm	0.18	30°C to 320/340°C	41302		41303	41304
0.25mm	0.25	30°C to 320/340°C		13223		13226
0.32mm	0.50	30°C to 320/340°C		13239		

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

Aroclor® 1242/1254/1262 PCBs on Rtx®-PCB:
best available resolution of individual congeners.



Column: Rtx®-PCB 40m, 0.18mm ID, 0.18μm (cat.# 41303)
 Sample: 300ng/mL Aroclor® 1242/1254/1262 in hexane: Aroclor® 1242 (cat.# 32009),
 Aroclor® 1254 (cat.# 32011), Aroclor® 1262 (cat.# 32409)
 Inj.: 1.0μL splitless (hold 0.75 min.), 4mm single gooseneck inlet liner (cat.# 20983)
 Inj. temp.: 230°C
 Carrier gas: hydrogen, constant pressure
 Linear velocity: 40cm/sec. @ 100°C
 Oven temp.: 100°C (hold 1 min.) to 200°C @ 30°C/min., to 320°C @ 2°C/min. (hold 1 min.)
 Det.: ECD @ 330°C

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Excellent for dioxins or furans.

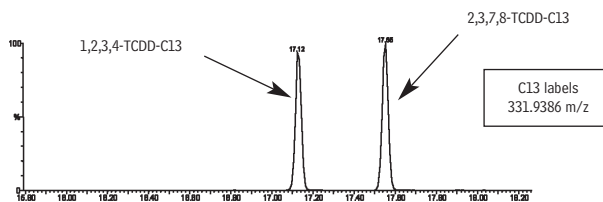
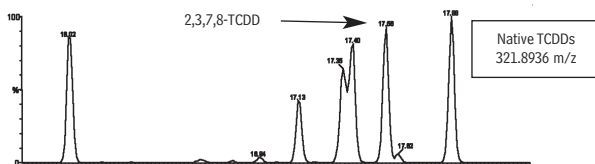
Rtx[®]-Dioxin2 (proprietary Crossbond[®] phase)

- Excellent resolution of dioxin or furan congeners and congeners from sample matrix components.
- Greater thermal stability than 5% diphenyl columns or high-cyano confirmation columns.
- Confirmation column can be eliminated.
- Outperforms all other columns used for dioxin analysis, including 5% diphenyl, 2330, and “dioxin” columns.

Rtx[®]-Dioxin2 Columns (fused silica)

ID	df (μm)	temp. limits	40-Meter	60-Meter
0.18mm	0.18	20°C to 320°C	10759	—
0.25mm	0.25	20°C to 320°C	—	10758

2,3,7,8-Tetrachlorodibenzodioxin resolved from other TCDD congeners, using an Rtx[®]-Dioxin2 column.

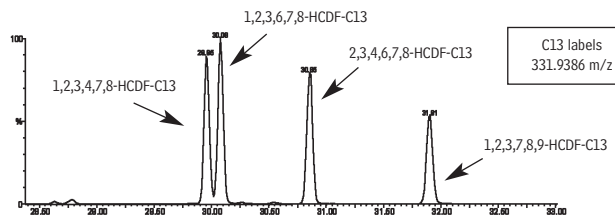
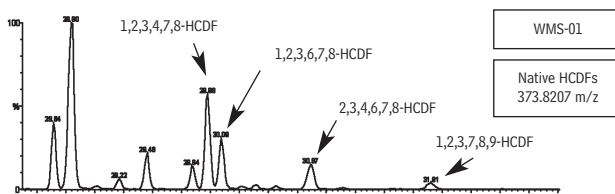


GC_EV00702

Column: 60m, 0.25mm ID, 0.25μm Rtx[®]-Dioxin2 (cat.# 10758)
Oven temp.: 130°C (hold 1 min.) to 205°C @ 45°C/min. to 305°C @ 6°C/min. (hold 30 min.);
Dead time: 2.89 min.; Carrier gas: helium at 1.5mL/min., constant flow

Chromatograms courtesy of Karen MacPherson and Eric Reiner, Ontario Ministry of the Environment, Etobicoke, Ontario, Canada.
HCDF reference material courtesy of Wellington Laboratories, Guelph, Ontario, Canada.

Hexachlorodibenzofuran congeners resolved on an Rtx[®]-Dioxin2 column.



GC_EV00703

Column: 60m, 0.25mm ID, 0.25μm Rtx[®]-Dioxin2 (cat.# 10758)
Oven temp.: 130°C (hold 1 min.) to 205°C @ 45°C/min. to 305°C @ 6°C/min. (hold 30 min.);
Dead time: 2.89 min.; Carrier gas: helium at 1.5mL/min., constant flow

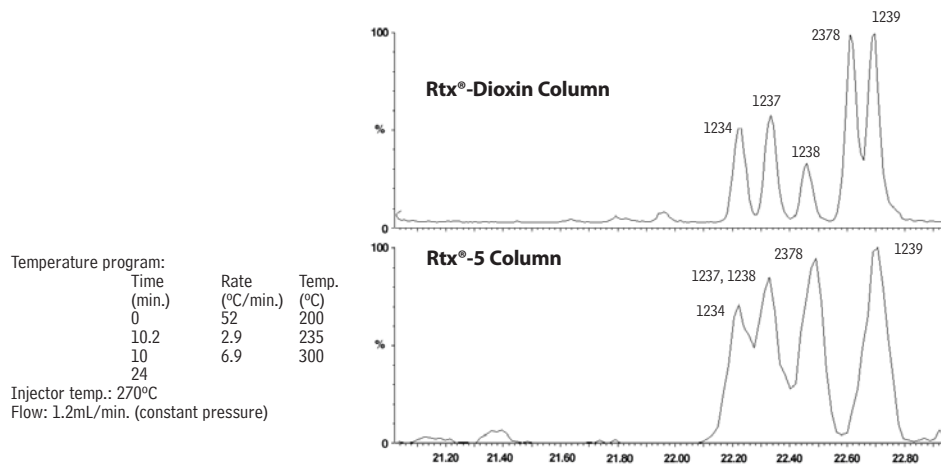
Chromatograms courtesy of Karen MacPherson and Eric Reiner, Ontario Ministry of the Environment, Etobicoke, Ontario, Canada.
HCDF reference material courtesy of Wellington Laboratories, Guelph, Ontario, Canada.

Rtx[®]-Dioxin (proprietary Crossbond[®] phase)

- Replacement column for 5% diphenyl phases.
- Improved separations of dioxin or furan congeners.
- Greater thermal stability than 5% diphenyl phases or high-cyano confirmation columns.

Rtx[®]-Dioxin Columns (fused silica)

ID	df (μm)	temp. limits	60-Meter
0.25mm	0.15	-60°C to 380°C	10755

Rtx[®]-Dioxin column separates all five components in the TCDD resolution check mixture.

Column: Rtx[®]-Dioxin, 40m, 0.18mm ID, 0.11μm
Initial temp.: 130°C
Instrument: Micromass Altima high resolution GC/MS

Chromatography courtesy of Karen MacPherson and Eric Reiner, Ontario Ministry of the Environment, Etobicoke, ON, Canada.



Jarl Snider
R&D Chemist
11+ years of service!

PIE[®] service**Plus 1**

Exceeding your expectations in everything we do.

Innovation

Turning visions into reality[®].

Execution

On-time delivery of products and services.

Restek's vision is to be the company that chromatographers trust by providing the highest quality, most innovative products and services throughout the world.

We will soon reach our goal of 100% employee ownership.

As owners, our success depends on your success.

Rt-LC50 and Rt-PAH

new!

Rt-LC50 (polar dimethylpolysiloxane - 50% liquid crystal)

- General purpose column with selectivity for PAHs, dioxin or furan congeners, or PCB congeners.
- Low bleed at 270°C.
- Temperature range: 100°C to 270°C.

The unique liquid crystalline Rt-LC50 stationary phase resolves compounds of similar structure and boiling point. It has proven effective for resolving many polycyclic aromatic hydrocarbons; other potential applications include dioxin, furan, or PCB congeners.



Kristi Sellers
Innovations Chemist
19+ years of service!

Rt-LC50 Columns (fused silica)

ID	df (μm)	temp. limits	10-Meter	20-Meter
0.10mm	0.10	100°C to 270°C	19736	—
0.18mm	0.10	100°C to 270°C	19735	—
0.25mm	0.10	100°C to 270°C	—	19734

new!

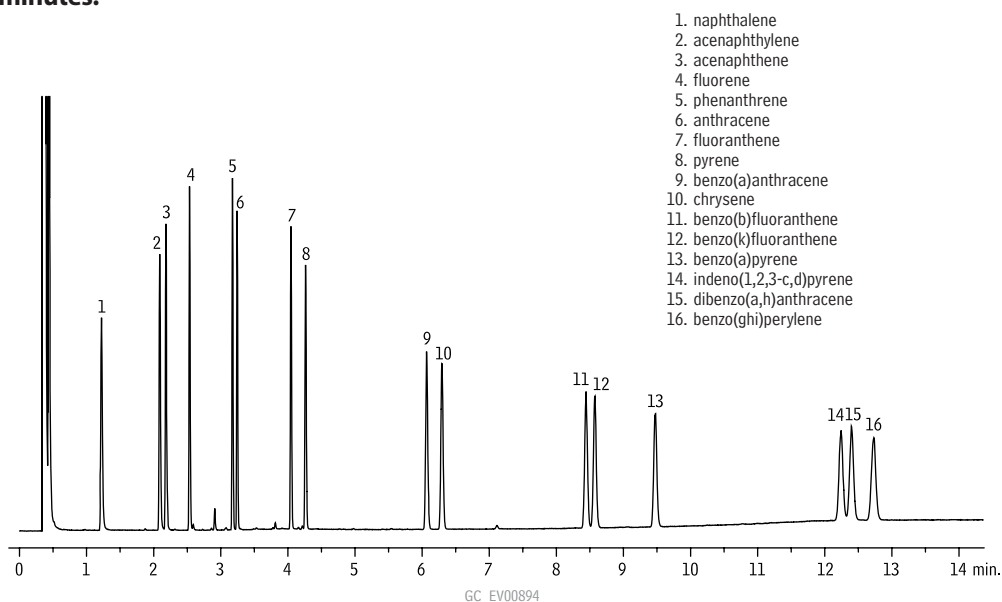
Rt-PAH (polar proprietary liquid crystalline phase)

- Specially designed for the analysis of polycyclic aromatic hydrocarbons (PAHs) listed in US EPA methods 610 and 8100.
- Low bleed at 285°C.
- Temperature range: 80°C to 285°C.

Rt-PAH Columns (fused silica)

ID	df (μm)	temp. limits	12-Meter
0.25mm	0.15	80°C to 285°C	19733

Separation of 16 regulated polycyclic aromatic hydrocarbons (PAHs) in less than 15 minutes.



Column: 12m, 0.25mm ID, 0.15μm Rt-PAH (cat.# 19733)
 Sample: 16 component EPA Method 610 PAH standard
 (20ng/μl of each component in dichloromethane)
 1.0μL split (split ratio 10:1)
 Inj.: 225°C
 Inj. temp.: 225°C
 Carrier gas: helium, 110kPa column head pressure
 Oven temp.: 80°C to 220°C @ 40°C/min., 220°C to 285°C @ 8°C/min. (hold 5 min.)
 Detector: FID @ 290°C

Chromatogram courtesy of J&K Scientific.

Rtx®-VMS (proprietary Crossbond® phase)

- Application-specific columns for volatile organic pollutants by GC/MS.
- Complete separation of US EPA Method 8260 compounds in less than 18 minutes.
- Stable to 260°C.
- No known equivalent phases.

Rtx®-VMS columns offer lower bleed, better selectivity, and overall faster analysis for separating volatile organic compounds, such as those listed in US EPA Method 8260. The Rtx®-VMS stationary phase is a highly stable polymer that provides outstanding analysis of volatile compounds, in combination with sensitive ion traps and Agilent 5973 mass spectrometers. 0.18 and 0.25mm ID columns allow sample splitting at the injection port, eliminating the added expense and maintenance of a jet separator. A 0.45mm or 0.53mm ID column can be directly connected to the purge & trap transfer line in a system equipped with a jet separator.

Rtx®-VMS Columns (fused silica)

ID	df (μm)	temp. limits	30-Meter	60-Meter	75-Meter
0.25mm	1.40	-40 to 240/260°C	19915	19916	
0.32mm	1.80	-40 to 240/260°C	19919	19920	
0.45mm	2.55	-40 to 240/260°C	19908	19909	
0.53mm	3.00	-40 to 240/260°C	19985	19988	19974

ID	df (μm)	temp. limits	20-Meter	40-Meter
0.18mm	1.00	-40 to 240/260°C	49914	49915

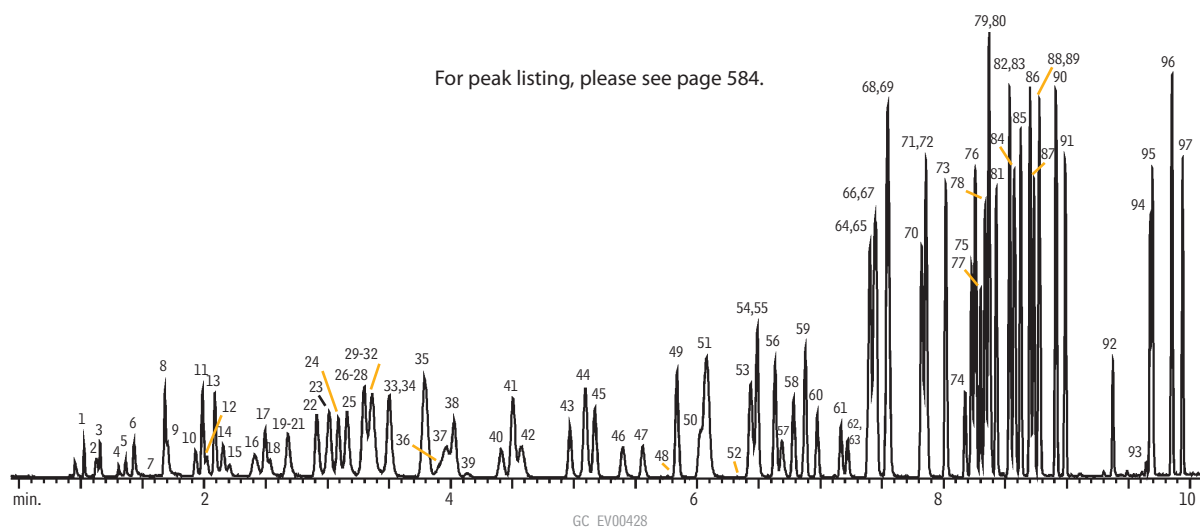
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- First choice for use with dual purge & traps¹
- EPA recommended surrogate used.

¹A.L. Hilling and G. Smith, Environmental Testing & Analysis, 10(3), 15-19, 2001.

Need a column for a
volatiles analysis?

see page 577

Rapid analysis of volatile organics in US EPA Method 8260B, on an Rtx®-VMS column.

20m, 0.18 mm ID, 1.00μm Rtx®-VMS (cat.# 49914)
 Conc.: 10ppb in 5mL of RO water
 unless otherwise noted; ketones at 2.5X
 Concentrator: Tekmar LSC-3100 Purge and Trap
 Trap: Vocab 3000 (type K)
 Purge: 11 min. @ 40mL/min. (ambient temperature)
 Dry purge: 1 min. @ 40mL/min.
 Desorb preheat: 245°C
 Desorb: 250°C for 2 min., flow 40mL/min.
 Bake: 260°C for 8 min.
 Interface: 0.53mm ID Silcosteel® tubing transfer line
 1:40 split at injection port. 1mm ID liner.
 Oven temp.: 50°C (hold 4 min.) to 100°C @ 18°C/min. (hold 0 min.)
 to 230°C @ 40°C/min. (hold 3 min.)
 Carrier gas: helium @ ~1.0mL/min. constant flow
 Adjust dichlorodifluoromethane to a retention time of 1.03 min. @ 50°C.
 Detector: Agilent 5973 MSD
 Scan range: 35-300amu

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innovation!

Polymer specially designed for volatiles analysis by PID/ELCD.

Rtx®-VGC (proprietary Crossbond® phase)

- Application-specific columns for volatile organic pollutants by GC/PID/ELCD. Excellent separation of trihalomethanes.
- Complete US EPA Method 8021A analysis in less than 28 minutes.
- Stable to 260°C.
- No known equivalent phases.

Using computer modeling techniques, we optimized the Rtx®-VGC column for analysis of volatile organic compounds on GC systems equipped with photoionization (PID) and electrolytic conductivity detectors (ELCD). It performs the most difficult separations of volatile organic compounds, such as those listed in US EPA Methods 502.2 and 8021, providing unsurpassed separation in the fastest analysis time, thereby increasing sample throughput. The Rtx®-VGC column provides ≥85% resolution of the THMs from other volatile compounds. This unique column also achieves excellent separation of gases and early eluting compounds.

Rtx®-VGC Columns (fused silica)

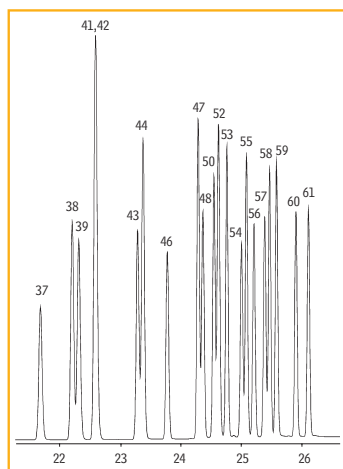
ID	df (μm)	temp. limits	30-Meter	60-Meter	75-Meter	105-Meter
0.25mm	1.40	-40 to 240/260°C	19415	19416		
0.32mm	1.80	-40 to 240/260°C	19419	19420		
0.45mm	2.55	-40 to 240/260°C	19408		19409	
0.53mm	3.00	-40 to 240/260°C	19485	19488	19474	19489
ID	df (μm)	temp. limits	20-Meter	40-Meter		
0.18mm	1.00	-40 to 240/260°C	49414	49415		

Need a column for a
volatiles analysis?
see page 577

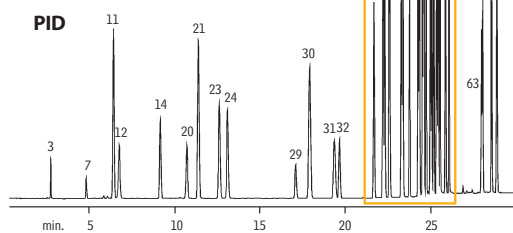
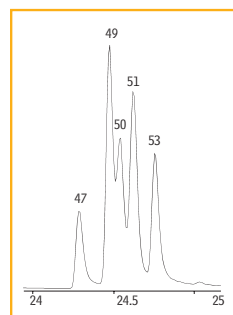
Fast separation of US EPA Method 8021 volatile organics: Rtx®-VGC column.

Primary column, dual-column analysis. Confirmation analysis shown on page 580.

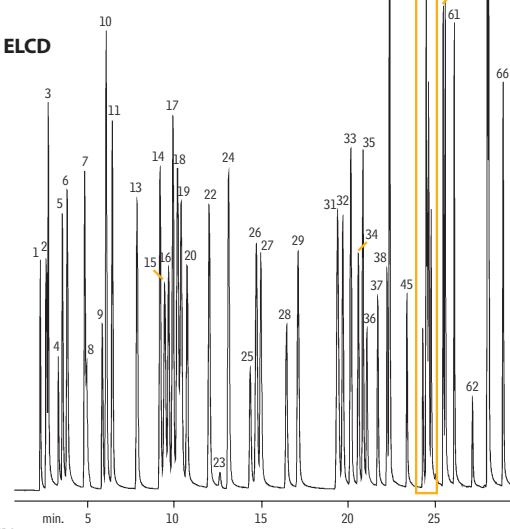
Rtx®-VGC
75m, 0.45mm ID, 2.55μm (cat.# 19409)



See page 579 for the peak list and run conditions.



ELCD



GC_EV00416

Acknowledgement: Finnigan 9001 GC, μGold Tandem Photoionization/HALL® 2000 Electrolytic Conductivity Detector provided courtesy of Thermo Finnigan GC & GC/MS Division, 2215 Grand Avenue Pkwy, Austin, Texas 78728

Rtx®-VRX (proprietary Crossbond® phase)

- Application-specific columns for volatile organic pollutants.
- Excellent for US EPA Method 8021 compounds.
- Stable to 260°C.

The Rtx®-VRX stationary phase and optimized column dimensions provide low bleed, excellent resolution, and fast analysis times for volatile compounds.

similar **phases**

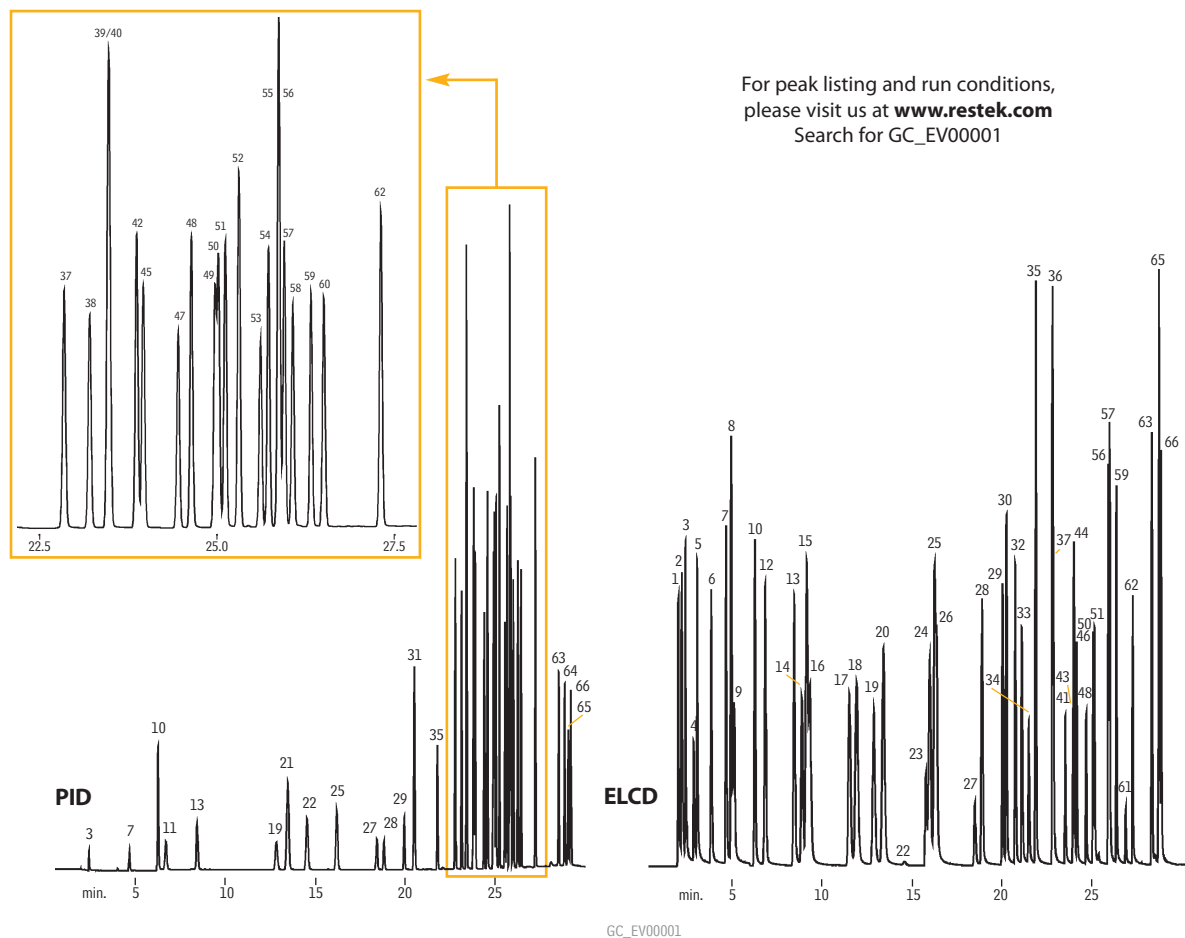
DB-VRX

Rtx®-VRX Columns (fused silica)

ID	df (μm)	temp. limits	30-Meter	60-Meter	75-Meter	105-Meter
0.25mm	1.40	-40 to 240/260°C	19315	19316		
0.32mm	1.80	-40 to 240/260°C	19319	19320		
0.45mm	2.55	-40 to 240/260°C	19308		19309	
0.53mm	3.00	-40 to 240/260°C	19385	19388	19374	19389
ID	df (μm)	temp. limits	20-Meter	40-Meter		
0.18mm	1.00	-40 to 240/260°C	49314	49315		

Need a column for a
volatiles analysis?

see page 577

Excellent resolution of EPA Method 8021 volatile organics on an Rtx®-VRX column.

Rtx[®]-502.2 and Rtx[®]-Volatiles

Rtx[®]-502.2 (proprietary Crossbond[®] diphenyl / dimethyl polysiloxane phase)

- Application-specific columns with unique selectivity for volatile organic pollutants, cited in US EPA Method 502.2 and in many gasoline range organics (GRO) methods for monitoring underground storage tanks. Excellent separation of trihalomethanes; ideal polarity for light hydrocarbons and aromatics.
- Stable to 270°C.

similar phases

DB-502.2

An Rtx[®]-502.2 column will enable you to quantify all compounds listed in US EPA methods 502.2 or 524.2, whether you use a mass spectrometer or a PID in tandem with an ELCD. The diphenyl/dimethyl polysiloxane based Rtx[®]-502.2 stationary phase provides low bleed and thermal stability to 270°C. A 105-meter column can separate the light gases specified in EPA methods without subambient cooling. Narrow bore columns can interface directly in GC/MS systems.

Rtx[®]-502.2 Columns (fused silica)

ID	df (μm)	temp. limits	30-Meter	60-Meter	75-Meter	105-Meter
0.25mm	1.40	-20 to 250/270°C	10915	10916		
0.32mm	1.80	-20 to 250/270°C	10919	10920		10921
0.45mm	2.55	-20 to 250/270°C			10986	
0.53mm	3.00	-20 to 250/270°C	10908	10909		10910

ID	df (μm)	temp. limits	20-Meter	40-Meter
0.18mm	1.00	-20 to 250/270°C	40914	40915

also available

MXT[®] Columns

Rugged, flexible, Silcosteel[®] treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 88](#) for our MXT[®]-502.2 and MXT[®]-Volatiles columns.

similar phases

VOCOL[®]

Rtx[®]-Volatiles (proprietary Crossbond[®] diphenyl / dimethyl polysiloxane phase)

- Application-specific columns for volatile organic pollutants.
- Stable to 280°C.

Rtx[®]-Volatiles columns were the first columns designed specifically for analyses of the 34 volatile organic pollutants listed in US EPA methods 601, 602, and 624. With these columns, you can quantify all compounds listed in these methods, whether you use a mass spectrometer or a PID in tandem with an ELCD. The diphenyl/dimethyl polysiloxane based Rtx[®]-Volatiles stationary phase provides low bleed and thermal stability to 280°C. Narrow bore columns can interface directly in GC/MS systems.

Rtx[®]-Volatiles Columns (fused silica)

ID	df (μm)	temp. limits*	30-Meter	60-Meter	105-Meter
0.25mm	1.00	-20 to 270/280°C	10900	10903	
0.32mm	1.50	-20 to 270/280°C	10901	10904	
0.53mm	2.00	-20 to 270/280°C	10902	10905	10906

ordering note

Rtx[®]-Volatiles columns are available with Integra-Guard[™] built-in guard columns. Get the protection without the connection! See [page 29](#) for descriptions and ordering information.

it's a fact

Quantify all compounds in US EPA method 601, 602, or 624, using an Rtx[®]-Volatiles column.

Rtx[®]-624 (low to mid-polarity phase; Crossbond[®] 6% cyanopropylphenyl / 94% dimethyl polysiloxane)

- Application-specific columns for volatile organic pollutants. Recommended in US EPA methods for volatile organic pollutants.
- Temperature range: -20°C to 240°C.
- Equivalent to USP G43 phase.

Since the February 1994 revision of the CLP Statement of Work for volatile organic analysis, Rtx[®]-624 columns have become the column of choice for many labs. This revision to the CLP SOW requires that all of the gaseous compounds be resolved by more than 90% from each other, or sub-ambient oven conditions must be used. 105-meter Rtx[®]-624 columns achieve baseline separation of the gases at a starting temperature of 35°C. Rtx[®]-624 columns can be used with a GC/MS system, or a PID in tandem with an ELCD. The unique polarity of Rtx[®]-624 columns makes them ideal for analyses of volatile organic pollutants. Although the Rtx[®]-502.2 column is recommended in many methods, Rtx[®]-624 columns offer the best separation of the early-eluting gases.

Rtx[®]-624 Columns (fused silica)(Crossbond[®] 6% cyanopropylphenyl/94% dimethyl polysiloxane)

ID	df (μm)	temp. limits	30-Meter	60-Meter	75-Meter	105-Meter
0.25mm	1.40	-20 to 240°C	10968	10969		
0.32mm	1.80	-20 to 240°C	10970	10972		
0.45mm	2.55	-20 to 240°C			10982	
0.53mm	3.00	-20 to 240°C	10971	10973	10974	10975
ID	df (μm)	temp. limits	10-Meter	20-Meter	40-Meter	
0.18mm	1.00	-20 to 240°C		40924	40925	

Rtx[®]-TNT / Rtx[®]-TNT2 (proprietary Crossbond[®] phase)

- Application-specific columns for explosives in US EPA Method 8095.
- Low bleed—ideal for ECD analysis.
- Complete analysis in less than 20 minutes.
- Rtx[®]-TNT2 confirmation column provides 8 elution order changes under same conditions.
- Economical 3-packs.
- Stable to 310°C.

We designed Rtx[®]-TNT and Rtx[®]-TNT2 columns specifically for analyses of nitroaromatic compounds by GC/ECD, such as the 16 analytes listed in US EPA Method 8095. They provide better resolution and higher thermal stability than any other currently recommended columns. Operate the Rtx[®]-TNT primary column and Rtx[®]-TNT2 confirmation column under identical GC oven temperature programs.

Rtx[®]-TNT Columns (fused silica)

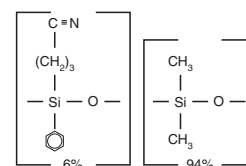
ID	df (μm)	temp. limits	6-Meter/3-pk.
0.53mm	1.50	-20 to 300/310°C	12998

Rtx[®]-TNT2 Columns (fused silica)

ID	df (μm)	temp. limits	6-Meter/3-pk.
0.53mm	1.50	-20 to 300/310°C	12999

Need a column for a
volatiles analysis?

see **page 577**

**Rtx[®]-624
Structure**similar **phases**

DB-624, HP-624

also **available****MXT[®] Columns**

Rugged, flexible, Silcosteel[®] treated stainless steel tubing; inertness comparable to fused silica tubing. See **page 89** for our MXT[®]-624 columns.

restek
innovation!

please **note**

Polymer specially designed for explosives analysis.



Cindy Ross
Southeast Sales
Representative
20+ years of service!

Rtx[®]-BAC1 and Rtx[®]-BAC2

restek innovation!

Baseline resolution in less than 3 minutes.

Rtx[®]-BAC1 / Rtx[®]-BAC2 (proprietary Crossbond[®] phase)

- Application-specific columns for blood alcohol analysis, achieving baseline resolution in less than 3 minutes. Also excellent for abused inhalant anesthetics, γ -hydroxybutyrate (GHB) / γ -butyrolactone (GBL), glycols, and common industrial solvents.
- Rtx[®]-BAC2 confirmation column provides four elution order changes under the same conditions.
- Rtx[®]-BAC1 stable to 260°C, Rtx[®]-BAC2 stable to 240°C.

These columns separate to baseline all blood alcohol compounds in blood, breath, or urine, in less than 3 minutes, under isothermal conditions. Isothermal analysis increases productivity by eliminating the need for oven cycling. Confirmation is easily achieved with this tandem set because there are four elution order changes between the two columns.

Rtx[®]-BAC1 Columns (fused silica)

ID	df (μ m)	temp. limits	30-Meter
0.32mm	1.80	-20 to 240/260°C	18003
0.53mm	3.00	-20 to 240/260°C	18001

Rtx[®]-BAC2 Columns (fused silica)

ID	df (μ m)	temp. limits	30-Meter
0.32mm	1.20	-20 to 240/260°C	18002
0.53mm	2.00	-20 to 240/260°C	18000

similar phases

DB-ALC1, DB-ALC2

also available

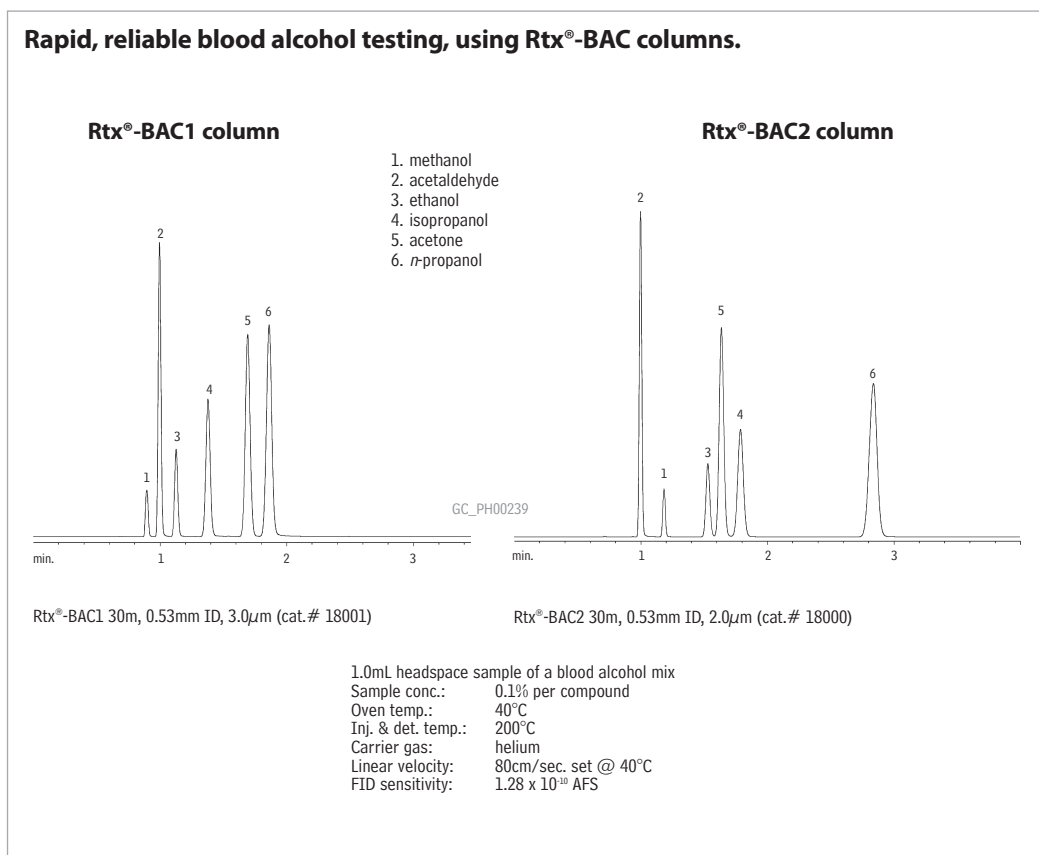
MXT[®] Columns

Rugged, flexible, Silcosteel[®] treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 89](#) for our MXT[®]-BAC1 and MXT[®]-BAC2 columns.

ordering note

Rtx[®]-BAC1 and Rtx[®]-BAC2 columns are available with Integra-Guard[™] built-in guard columns. Get the protection without the connection! See [page 29](#) for descriptions and ordering information.

Rapid, reliable blood alcohol testing, using Rtx[®]-BAC columns.



Rtx[®]-G27 (Crossbond[®] 5% diphenyl/95% dimethyl polysiloxane)

with Integra-Guard[™] Guard Column

Rtx[®]-G43 (Crossbond[®] 6% cyanopropylphenyl/94% dimethyl polysiloxane)

with Integra-Guard[™] Guard Column

- Application-specific columns for residual solvents in pharmaceutical products. Meet all requirements of USP 467.
- Integra-Guard[™] guard+analytical column eliminates connecting problems and leaks.
- Rtx[®]-G27 stable to 290°C; Rtx[®]-G43 stable to 240°C.

Some USP 467 methods require the use of a guard column. Our Integra-Guard[™] integrated guard column system makes it easy to comply.

Rtx[®]-G27 Column (fused silica with 5-meter Integra-Guard[™])

(Crossbond[®] 5% diphenyl/95% dimethyl polysiloxane)

ID	df (μm)	temp. limits	30-Meter with 5-Meter, 0.53mm ID Integra-Guard [™] Column
0.53mm	5.00	-60 to 270/290°C	10279-126

Rtx[®]-G43 Column (fused silica with 5-meter Integra-Guard[™])

(Crossbond[®] 6% cyanopropylphenyl/94% dimethyl polysiloxane)

ID	df (μm)	temp. limits	30-Meter with 5-Meter, 0.53mm ID Integra-Guard [™] Column
0.53mm	3.00	-20 to 240°C	16085-126



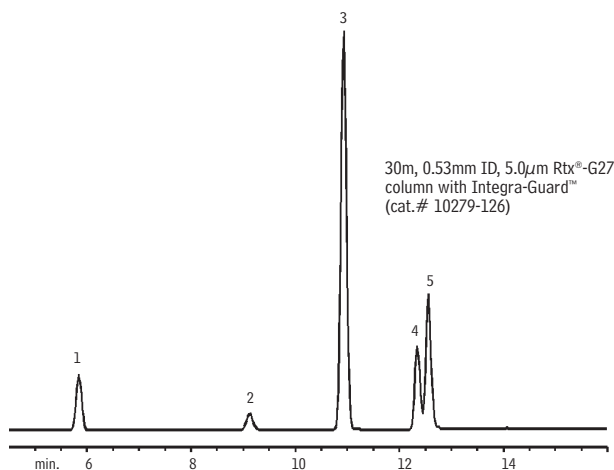
Rick Morehead
R&D GC Column
Group Leader
16+ years of service!

please note

Analytical Reference Materials for USP 467 are available on page 490.

Specially-designed Rtx[®]-G27 and Rtx[®]-G43 columns resolve residual solvents in USP 467.

1. methylene chloride
2. chloroform
3. benzene
4. trichloroethylene
5. 1,4-dioxane



1.0μL direct injection of USP 467 Mix #1, cat.# 36001 (Discontinued, recommended replacement: USP Calibration Mix #3, cat.# 36004).

Oven temp.: 35°C (hold 5 min.) to 175°C @ 8°C/min. to 260°C @ 35°C/min.

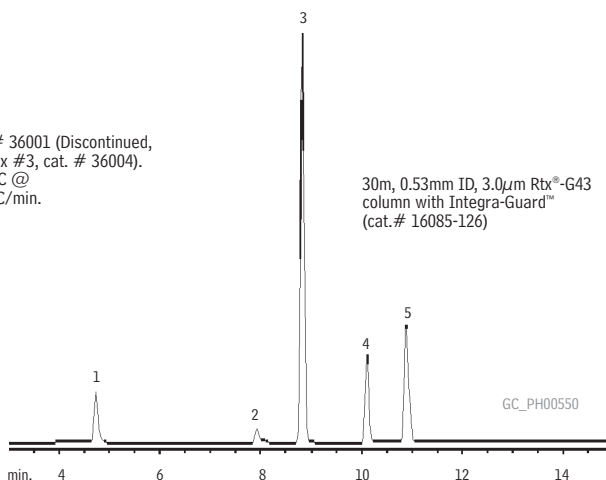
Inj. / det. temp.: 200°C / 240°C

Carrier gas: helium

Linear velocity: 34cm/sec. set @ 35°C

FID sensitivity: 1 x 10⁻¹¹ AFS

Recommended liner: Uniliner[®]



free literature

Request A Technical Guide for Static Headspace Analysis Using GC.

Call Restek at **800-356-1688** or **814-353-1300, ext. 5**, or contact your Restek representative, to request your free copy!
lit. cat.# 59895A

free literature

Request *A Guide to the Analysis of Chiral Compounds by GC* for more information about chiral separations.

Many example chromatograms in our 24-page chiral analysis guide will help you find the best chiral column, or columns, for your application.

Call Restek at **800-356-1688** or **814-353-1300, ext. 5**, or contact your Restek representative, to request your free copy!

lit. cat.# 59889

please note

Application-specific chiral column kits are available! See **page 77**.

free literature

FREE applications notes to assist you with your analysis. Request your copies today!

Grape Flavor Analysis, Using an Rt- γ DEXsa™ GC Column (lit. cat.# 59553)

GC Analysis of Chiral Flavor Compounds in Apple Juices, Using Rt- β DEXsm™ and Rt- β DEXse™ Columns (lit. cat.# 59546)

Cyclodextrin Columns for Analyzing Many Chiral Compounds

By adding β or γ cyclodextrin to our bonded Rtx®-1701 stationary phase, we greatly enhance overall utility and column lifetime for our chiral columns, compared to columns that have pure cyclodextrin stationary phases. Separations of more than one hundred chiral compounds have been achieved using our unique DEX columns, and our columns continue to demonstrate stability after hundreds of temperature program cycles. Refer to the applications section of this catalog for example applications, or call our Technical Service chemists or your Restek representative for assistance in matching a column to your chiral analysis.

Rt- β DEXm™ Columns (fused silica)

(permethylated beta cyclodextrin doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df (μ m)	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13100
0.32mm	0.25	40 to 230°C	13101

Uses: General purpose chiral phase with many published applications.

Rt- β DEXsm™ Columns (fused silica)

(2,3-di-O-methyl-6-O-*tert*-butyl dimethylsilyl beta cyclodextrin doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df (μ m)	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13105
0.32mm	0.25	40 to 230°C	13104

Uses: Excellent column for most chiral compounds in essential oils.

Rt- β DEXse™ Columns (fused silica)

(2,3-di-O-ethyl-6-O-*tert*-butyl dimethylsilyl beta cyclodextrin doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df (μ m)	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13107
0.32mm	0.25	40 to 230°C	13106

Uses: Similar in performance to Rt- β DEXsm™ but provides better resolution for limonene, linalool, linalyl acetate, ethyl-2-methylbutyrate, 2,3-butane diol, and styrene oxides.

Rt- β DEXsp™ Columns (fused silica)

(2,3-di-O-propyl-6-O-*tert*-butyl dimethylsilyl beta cyclodextrin doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df (μ m)	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13111
0.32mm	0.25	40 to 230°C	13110

Uses: Often useful in dual-column configurations, with the Rt- β DEXsm™ column, for complex enantiomeric separations.

Rt- β DEXsa™ Columns (fused silica)

(2,3-di-acetoxy-6-O-*tert*-butyl dimethylsilyl beta cyclodextrin doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df (μ m)	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13109
0.32mm	0.25	40 to 230°C	13108

Uses: Unique selectivity for esters and lactones, and other fruit flavor components.

Rt- β DEXcst™ Columns (fused silica)

(Proprietary cyclodextrin material doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df (μ m)	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13103
0.32mm	0.25	40 to 230°C	13102

Uses: Proprietary stationary phase, developed specifically for the fragrance industry. Also used for pharmaceutical applications.

Rt- γ DEXsa™ Columns (fused silica)

(2,3-di-acetoxy-6-O-*tert*-butyl dimethylsilyl gamma cyclodextrin doped into 14% cyanopropylphenyl/86% dimethyl polysiloxane)

ID	df (μ m)	temp. limits	30-Meter
0.25mm	0.25	40 to 230°C	13113
0.32mm	0.25	40 to 230°C	13112

Uses: Larger organic molecules. Also useful for flavor compounds in fruit juices.

Convenient chiral column kits, based on sample type. Enantiomeric profile and confirmational identification of individual chiral compounds.

- Broad range of columns and selectivities.
- Rugged, highly stable columns.
- Extended column lifetime.
- Convenience and cost savings.

For phase descriptions, or to order columns separately, see page 76.

Pharmaceutical Chiral Column Kits (fused silica) **kit**

Dimensions & Columns	cat.#
30m, 0.25mm ID, 0.25 μ m Rt- β DEXcst™ & Rt- β DEXsm™ columns	13190
30m, 0.32mm ID, 0.25 μ m Rt- β DEXcst™ & Rt- β DEXsm™ columns	13191

Environmental Chiral Column Kits (fused silica) **kit**

Dimensions & Columns	cat.#
30m, 0.25mm ID, 0.25 μ m Rt- β DEXcst™ & Rt- β DEXsm™ columns	13192
30m, 0.32mm ID, 0.25 μ m Rt- β DEXcst™ & Rt- β DEXsm™ columns	13193

Juices Chiral Column Kits (fused silica) **kit**

Dimensions & Columns	cat.#
30m, 0.25mm ID, 0.25 μ m Rt- β DEXse™, Rt- β DEXsm™ & Rt- γ DEXsa™ columns	13194
30m, 0.32mm ID, 0.25 μ m Rt- β DEXse™, Rt- β DEXsm™ & Rt- γ DEXsa™ columns	13195

Essential Oils Chiral Column Kits (fused silica) **kit**

Dimensions & Columns	cat.#
30m, 0.25mm ID, 0.25 μ m Rt- β DEXsm™, Rt- β DEXse™, Rt- β DEXsa™, & Rt- β DEXsp™ columns	13196
30m, 0.32mm ID, 0.25 μ m Rt- β DEXsm™, Rt- β DEXse™, Rt- β DEXsa™, & Rt- β DEXsp™ columns	13197



Doug Smith
R&D Technician
9+ years of service!

please **note**

Application-specific chiral column kits offer convenience and cost savings.

tech tip

To optimize chiral separations, use:

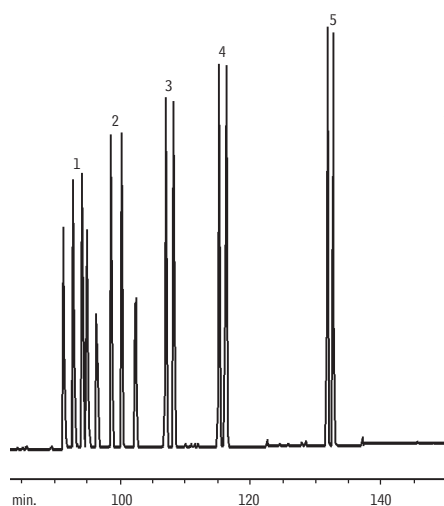
Faster linear velocities (80cm/sec.) with hydrogen carrier gas.

Slower temperature ramp rates (1–2°C/min.).

Appropriate minimum operating temperature (40 or 60°C).

On-column concentrations of 50ng or less.

Complex γ -lactones mix resolved on an Rt- β DEXcst™ column.



1. (+/-)- γ -heptalactone
2. (+/-)- γ -octalactone
3. (+/-)- γ -nonalactone
4. (+/-)- γ -decalactone
5. (+/-)- γ -dodecalactone

30m, 0.32mm ID, 0.25 μ m Rt- β DEXcst™ (cat.# 13102)
Oven temp.: 60°C (hold 1 min.) to 200°C @ 1°C/min.
Carrier gas: hydrogen
Linear velocity: 40cm/sec. set @ 60°C
Det.: FID set @ 220°C

GC_FF00152

Table of Contents for
Applications

see pages 510-513

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