

# General Purpose Columns



## Chemically bonded capillary columns

- Allow for direct solvent injection onto column.
- Columns can be solvent rinsed.

## Extensive GC column selection

- Available in many dimensions, including variations in length, internal diameter, and film thickness.
- Internal diameters include 0.10mm and 0.18mm for faster analysis time and greater resolution.

## Broad range of stationary phases

- Columns based on polysiloxane backbone; functional groups added to the polymers to vary selectivity:



Rtx<sup>®</sup>-1, Rtx<sup>®</sup>-5, Rtx<sup>®</sup>-5MS, Rtx<sup>®</sup>-20, Rtx<sup>®</sup>-35, Rtx<sup>®</sup>-50, Rtx<sup>®</sup>-65, Rtx<sup>®</sup>-440, Rtx<sup>®</sup>-200, Rtx<sup>®</sup>-200MS, Rtx<sup>®</sup>-1301, Rtx<sup>®</sup>-624, Rtx<sup>®</sup>-1701, Rtx<sup>®</sup>-225, Rtx<sup>®</sup>-2330, Rtx<sup>®</sup>-Wax, Stabilwax<sup>®</sup>

visit [www.restek.com](http://www.restek.com) for complete product listings

**Rtx<sup>®</sup>-1 Columns (fused silica)**(nonpolar phase; Crossbond<sup>®</sup> 100% dimethyl polysiloxane)

- General purpose columns for solvent impurities, PCB congeners (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<sup>®</sup>-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.

ID	df	temp. limits*	15-Meter	30-Meter	60-Meter	105-Meter
0.25mm	0.10 $\mu$ m	-60 to 330/350°C	10105	10108	10111	
	0.25 $\mu$ m	-60 to 330/350°C	10120	10123	10126	10129
	0.50 $\mu$ m	-60 to 330/350°C	10135	10138	10141	10144
	1.00 $\mu$ m	-60 to 320/340°C	10150	10153	10156	10159
0.32mm	0.10 $\mu$ m	-60 to 330/350°C	10106	10109	10112	
	0.25 $\mu$ m	-60 to 330/350°C	10121	10124	10127	10130
	0.50 $\mu$ m	-60 to 330/350°C	10136	10139	10142	
	1.00 $\mu$ m	-60 to 320/340°C	10151	10154	10157	10160
	1.50 $\mu$ m	-60 to 310/330°C	10166	10169	10172	10175
	3.00 $\mu$ m	-60 to 280/300°C	10181	10184	10187	10190
	4.00 $\mu$ m	-60 to 280/300°C		10198		
	5.00 $\mu$ m	-60 to 260/280°C	10176	10178	10180	
	0.53mm	0.10 $\mu$ m	-60 to 320/340°C	10107	10110	
0.25 $\mu$ m		-60 to 320/340°C	10122	10125	10128	
0.50 $\mu$ m		-60 to 310/330°C	10137	10140	10143	
1.00 $\mu$ m		-60 to 310/330°C	10152	10155	10158	
1.50 $\mu$ m		-60 to 310/330°C	10167	10170	10173	
3.00 $\mu$ m		-60 to 270/290°C	10182	10185	10188	10189
5.00 $\mu$ m		-60 to 270/290°C	10177	10179	10183	10194
7.00 $\mu$ m		-60 to 240/260°C	10191	10192	10193	

ID	df	temp. limits	10-Meter	20-Meter	40-Meter
0.10mm	0.10 $\mu$ m	-60 to 330/350°C	41101	41102	
	0.40 $\mu$ m	-60 to 320/340°C	41103	41104	
0.18mm	0.20 $\mu$ m	-60 to 330/350°C	40101	40102	40103
	0.40 $\mu$ m	-60 to 320/340°C	40110	40111	40112

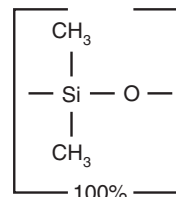
\*Maximum temperatures listed are for 15- and 30-meter lengths. Longer lengths may have a slightly reduced maximum temperature.

**Rtx<sup>®</sup>-1 with Integra-Guard<sup>®</sup> Column**

Get the protection without the connection!

- Extend column lifetime.
- Eliminate leaks with a built-in retention gap.
- Inertness verified by isothermal testing.

Description	qty.	cat.#
30m, 0.25mm ID, 0.25 $\mu$ m Rtx-1 w/5m Integra-Guard Column	ea.	10123-124
30m, 0.53mm ID, 1.00 $\mu$ m Rtx-1 w/5m Integra-Guard Column	ea.	10155-126
30m, 0.53mm ID, 5.00 $\mu$ m Rtx-1 w/5m Integra-Guard Column	ea.	10179-126

**Rtx<sup>®</sup>-1 Structure****similar phases**

DB-1, DB-1MS, HP-1, HP-1MS, Ultra-1, SPB-1, Equity-1, MDN-1, VF-1ms, CP-Sil 5 CB

**also available****Metal MXT<sup>®</sup> Columns**

Rugged, flexible, Siltek<sup>®</sup> treated stainless steel tubing; inertness comparable to fused silica tubing. See **page 115** for our MXT<sup>®</sup>-1 columns.

**it's a fact**

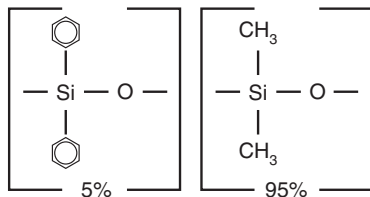
For exceptional inertness, ultra-low bleed, and unsurpassed performance, choose Rxi<sup>®</sup>-1ms columns! See **pages 36-41**.

**crossbond<sup>®</sup> technology**

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

**Catch the Buzz**

Sign up for Restek's e-newsletter, *The Buzz*  
[www.restek.com/buzz](http://www.restek.com/buzz)

Rtx<sup>®</sup>-5/Rtx<sup>®</sup>-5MS StructureRtx<sup>®</sup>-5/Rtx<sup>®</sup>-5MS (fused silica)

- General purpose columns for drugs, solvent impurities, pesticides, hydrocarbons, PCB congeners (e.g. Aroclor mixes), essential oils, semivolatiles.
- Temperature range: -60 °C to 350 °C.
- Equivalent to USP G27 and 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<sup>®</sup>-5 polymer, providing a tight mono-modal distribution and extremely low bleed.

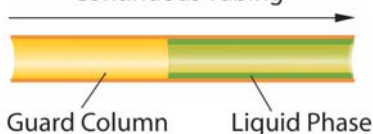
## similar phases

DB-5, HP-5, HP-5MS, Ultra-2, SPB-5, Equity-5, MDN-5, CP-Sil 8 CB

NOTE: DB-5MS is a silarylene based polymer, similar to Rxi-5Sil MS.

Integra-Guard<sup>®</sup> built-in guard column

Continuous Tubing



## Get the protection without the connection!

For Rtx<sup>®</sup>-5 and Rtx<sup>®</sup>-5MS columns with built-in Integra-Guard<sup>®</sup> guard columns, see [page 35](#).

## also available

Metal MXT<sup>®</sup> Columns

Rugged, flexible, Siltek<sup>®</sup> treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 116](#) for our MXT<sup>®</sup>-5 columns.

Rtx<sup>®</sup>-5 Amine Columns

See [page 64](#).

## it's a fact

For exceptional inertness, ultra-low bleed, and unsurpassed performance, choose Rxi<sup>®</sup>-5ms columns! See [pages 36-41](#).

Rtx<sup>®</sup>-5 Columns (fused silica)

(low polarity phase; Crossbond<sup>®</sup> 5% diphenyl/95% dimethyl polysiloxane)

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

ID	df	temp. limits	10-Meter	20-Meter	40-Meter
0.10mm	0.10μm	-60 to 330/350°C	41201	41202	
	0.40μm	-60 to 320/340°C	41203	41204	
0.18mm	0.20μm	-60 to 325/340°C	40201		40203
	0.40μm	-60 to 315/330°C	40210	40211	40212

30-meter	6-pack 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

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

Six columns for the price of five!

Other phases and configurations available on request.

Rtx<sup>®</sup>-5MS—Low-bleed GC/MS Columns (fused silica)

(low-polarity phase; Crossbond<sup>®</sup> 5% diphenyl/95% dimethyl polysiloxane)

Column specifically tested for low bleed performance.

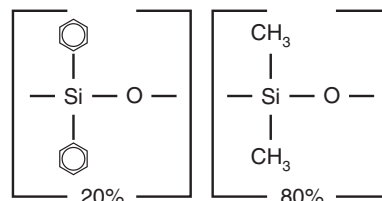
ID	df	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.10μm	-60 to 330/350°C	12605	12608	12611
	0.25μm	-60 to 330/350°C	12620	12623	12626
	0.50μm	-60 to 330/350°C	12635	12638	12641
	1.00μm	-60 to 325/350°C	12650	12653	
0.32mm	0.10μm	-60 to 330/350°C	12606	12609	12612
	0.25μm	-60 to 330/350°C	12621	12624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

**Rtx<sup>®</sup>-20 Columns (fused silica)**(low to midpolarity phase; Crossbond<sup>®</sup> 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<sup>®</sup>-20 polymer is synthesized to exacting standards. All residual catalysts and low molecular weight fragments are removed from the polymer, providing a tight monomodal distribution and extremely low bleed.

ID	df	temp. limits	15-Meter	30-Meter
0.25mm	0.25μm	-20 to 300/320°C	10320	10323
	0.50μm	-20 to 290/310°C	10335	10338
	1.00μm	-20 to 280/300°C	10350	10353
0.32mm	0.25μm	-20 to 300/320°C	10321	10324
	0.50μm	-20 to 290/310°C	10336	10339
	1.00μm	-20 to 280/300°C	10351	10354
0.53mm	0.25μm	-20 to 260/280°C	10322	10325
	1.00μm	-20 to 260/280°C	10352	10355

**Rtx<sup>®</sup>-20 Structure**similar **phase**

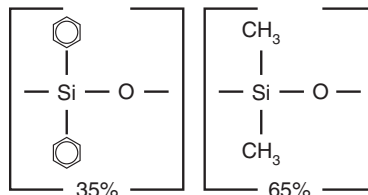
SPB-20, AT-20, 007-7

**Rtx<sup>®</sup>-35 Columns (fused silica)**(midpolarity phase; Crossbond<sup>®</sup> 35% diphenyl/65% dimethyl polysiloxane)

- General purpose columns for organochlorine pesticides, PCB congeners (e.g. Aroclor mixes), herbicides, pharmaceuticals, sterols, rosin acids, phthalate esters.
- Temperature range: 40 °C to 320 °C.
- Equivalent to USP G42 phase.

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

ID	df	temp. limits	15-Meter	30-Meter
0.25mm	0.25μm	40 to 320°C	10420	10423
	0.50μm	40 to 310°C	10435	10438
	1.00μm	40 to 290°C	10450	10453
0.32mm	0.25μm	40 to 320°C	10421	10424
	0.50μm	40 to 310°C	10436	10439
	1.00μm	40 to 290°C	10451	10454
0.53mm	0.25μm	40 to 260/280°C	10422	10425
	0.50μm	40 to 300°C	10437	10440
	1.00μm	40 to 290°C	10452	10455
	1.50μm	40 to 280°C	10467	10470
	3.00μm	40 to 240/260°C	10482	10485

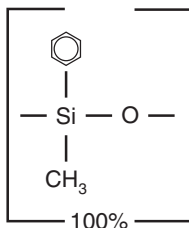
**Rtx<sup>®</sup>-35 Structure**similar **phases**

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

also **available****Metal MXT<sup>®</sup> Columns**

Rugged, flexible, Siltek<sup>®</sup> treated stainless steel tubing; inertness comparable to fused silica tubing. See **page 116** for our MXT<sup>®</sup>-20 columns and **page 117** for our MXT<sup>®</sup>-35 columns.

**Rtx<sup>®</sup>-35 Amine Columns**See **page 65**.

Rtx<sup>®</sup>-50 StructureRtx<sup>®</sup>-50 Columns (fused silica)

(midpolarity phase; Crossbond<sup>®</sup> 50% phenyl/50% methyl polysiloxane)

- General purpose columns for pesticides, herbicides, rosin acids, phthalate esters, triglycerides, sterols.
- Temperature range: 40 °C to 320 °C.
- Equivalent to USP G3 phase.

The high thermal stability of Rtx<sup>®</sup>-50 columns makes possible dual-column analysis with common phases such as Rtx<sup>®</sup>-1MS or Rtx<sup>®</sup>-5MS. Between analyses, high temperatures can be used to drive less volatile contaminants off of the column.

## similar phases

HP-50, SPB-50, SP-2250

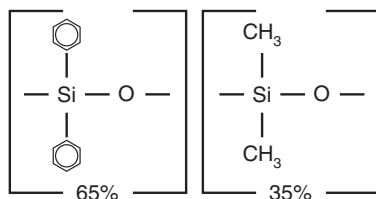
## also available

Metal MXT<sup>®</sup> Columns

Rugged, flexible, Siltek<sup>®</sup> treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 117](#) for our MXT<sup>®</sup>-50 columns.

ID	df	temp. limits	15-Meter	30-Meter
0.25mm	0.25μm	40 to 300/320°C	10520	10523
	0.50μm	40 to 290/310°C	10535	10538
	1.00μm	40 to 280/300°C	10550	10553
0.32mm	0.25μm	40 to 300/320°C	10521	10524
	0.50μm	40 to 290/310°C	10536	10539
	1.00μm	40 to 280/300°C	10551	10554
0.53mm	0.25μm	40 to 280/300°C	10522	
	0.50μm	40 to 270/290°C	10537	10540
	0.83μm	40 to 270/290°C		10569
	1.00μm	40 to 260/280°C	10552	10555
	1.50μm	40 to 250/270°C	10567	10570

ID	df	temp. limits	10-Meter	20-Meter
0.18mm	0.20μm	40 to 310/330°C	40501	40502
	0.40μm	40 to 300/320°C	40510	40511

Rtx<sup>®</sup>-65 StructureRtx<sup>®</sup>-65 Columns (fused silica)

(mid to high polarity phase; Crossbond<sup>®</sup> 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<sup>®</sup>-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<sup>®</sup>-65 column produces a different elution order, compared to the primary Rtx<sup>®</sup>-5 column. Rtx<sup>®</sup>-65 columns elute FAMES according to equivalent chain length, similar to bonded Carbowax<sup>®</sup> columns, but the Rtx<sup>®</sup>-65 phase does not suffer the thermal stability limitations of other polar stationary phases.

## similar phases

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

## also available

Metal MXT<sup>®</sup> Columns

Rugged, flexible, Siltek<sup>®</sup> treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 117](#) for our MXT<sup>®</sup>-65 columns.

ID	df	temp. limits	30-Meter
0.25mm	0.25μm	50 to 300°C	17023
	0.50μm	50 to 280/300°C	17038
	1.00μm	50 to 260/280°C	17053
0.32mm	0.25μm	50 to 300°C	17024
	0.50μm	50 to 280/300°C	17039
	1.00μm	50 to 260/280°C	17054
0.53mm	0.25μm	50 to 290/300°C	17025
	0.50μm	50 to 270/290°C	17040
	1.00μm	50 to 250/270°C	17055

## also available

Rtx<sup>®</sup>-65TG Columns

Tested specifically for triglycerides. See [page 72](#).

crossbond<sup>®</sup> technology

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

**Rtx®-440 Columns (fused silica)**

(midpolarity proprietary Crossbond® phase)

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

restek **innovation!**

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

ID	df	temp. limits	20-Meter	40-Meter
0.18mm	0.18µm	20°C to 320/340°C	42902	42903

**Organochlorine Pesticides (US EPA Method 8081A) on an Rtx®-440 column.**

Column: Rtx®-440 30m, 0.32mm ID, 0.50µm (cat.# 12939)

Sample: Organochlorine Pesticides Mix AB #2 (cat.# 32292),  
8-80µg/mL each component in ethyl acetate  
Chlorobenzilate (cat.# 32211) 1,000µg/mL in methanol  
Diallate (cis & trans) (custom) 1,000µg/mL in hexane  
Hexachlorobenzene (cat.# 32231) 1,000µg/mL in acetone  
Hexachlorocyclopentadiene (cat.# 32232) 1,000µg/mL in methanol  
Isodrin (custom) 1,000µg/mL in hexane  
Kepone (custom) 1,000µg/mL in hexane  
Mirex (custom) 1,000µg/mL in hexane  
2,4'-DDD (cat.# 32098) 1,000µg/mL in methanol  
2,4'-DDE (cat.# 32099) 1,000µg/mL in methanol  
2,4'-DDT (cat.# 32200) 1,000µg/mL in methanol  
TCMX (cat.# 32027) 200µg/mL in acetone  
DCB (cat.# 32029) 200µg/mL in acetone

Inj.: 1.0µL splitless (hold 0.75 min.), 2mm Siltek®  
treated single gooseneck inlet liner (cat.# 20961-214.1)  
Inj. temp.: 275°C

Carrier gas: hydrogen, constant pressure

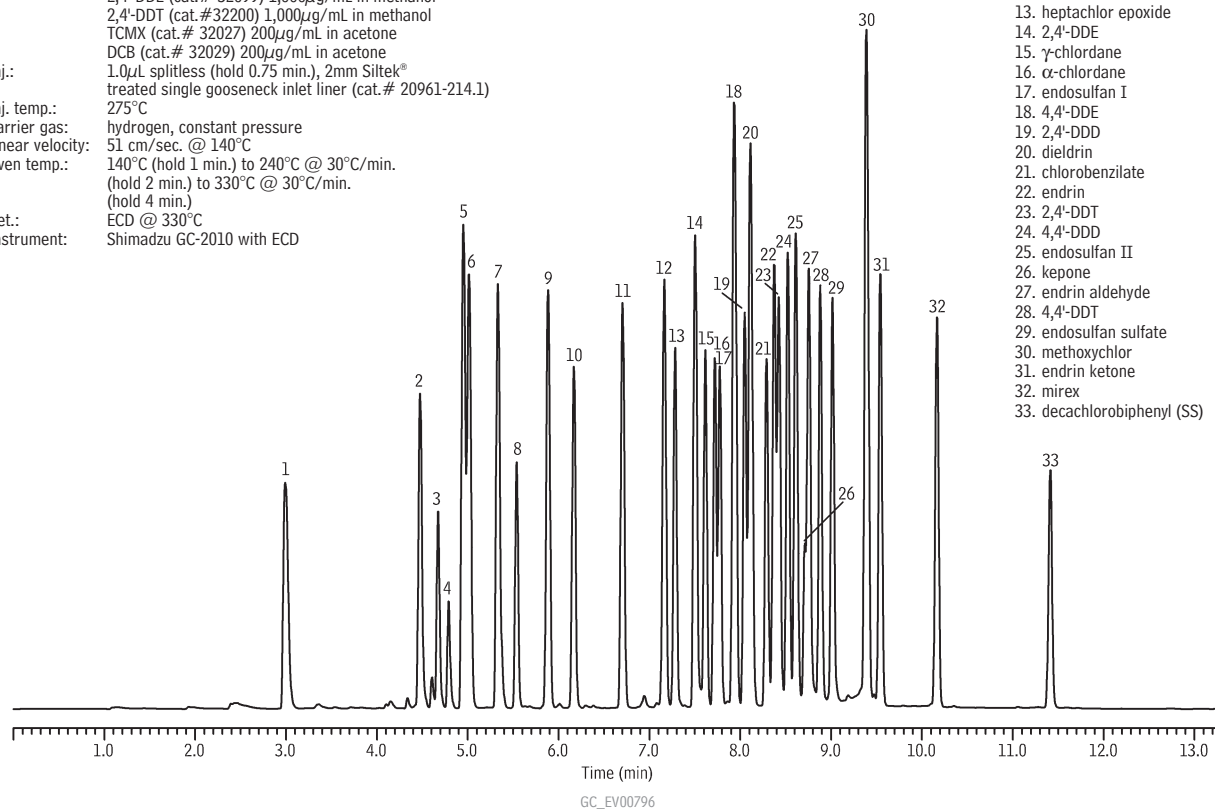
Linear velocity: 51 cm/sec. @ 140°C

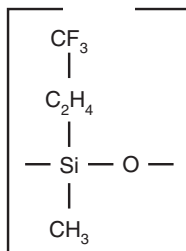
Oven temp.: 140°C (hold 1 min.) to 240°C @ 30°C/min.  
(hold 2 min.) to 330°C @ 30°C/min.  
(hold 4 min.)

Det.: ECD @ 330°C

Instrument: Shimadzu GC-2010 with ECD

1. hexachlorocyclopentadiene
2. 2,4,5,6-tetrachloro-m-xylene (SS)
3. cis-diallate
4. trans-diallate
5. α-BHC
6. hexachlorobenzene
7. γ-BHC
8. β-BHC
9. δ-BHC
10. heptachlor
11. aldrin
12. isodrin
13. heptachlor epoxide
14. 2,4'-DDE
15. γ-chlordane
16. α-chlordane
17. endosulfan I
18. 4,4'-DDE
19. 2,4'-DDD
20. dieldrin
21. chlorobenzilate
22. endrin
23. 2,4'-DDT
24. 4,4'-DDD
25. endosulfan II
26. kepone
27. endrin aldehyde
28. 4,4'-DDT
29. endosulfan sulfate
30. methoxychlor
31. endrin ketone
32. mirex
33. decachlorobiphenyl (SS)



Rtx<sup>®</sup>-200 Structure

## similar phases

DB-200, DB-210, VF-200ms

Rtx<sup>®</sup>-200/Rtx<sup>®</sup>-200MS (fused silica)

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

Rtx<sup>®</sup>-200 columns have accomplished many difficult separations not possible on any other bonded stationary phase. 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<sup>®</sup> phases can not. The Rtx<sup>®</sup>-200 column offers exceptional thermal stability, low bleed, and superior inertness—even for active compounds such as phenols, and with sensitive detectors such as ECDs, NPDs, and MSDs.

Rtx<sup>®</sup>-200 Columns (fused silica)(midpolarity phase; Crossbond<sup>®</sup> trifluoropropylmethyl polysiloxane)

ID	df	temp. limits*	15-Meter	30-Meter	60-Meter	105-Meter
0.25mm	0.25μm	-20 to 320/340°C	15020	15023	15026	15029
	0.50μm	-20 to 310/330°C	15035	15038	15041	15044
	1.00μm	-20 to 290/310°C	15050	15053	15056	15059
0.32mm	0.25μm	-20 to 320/340°C	15021	15024	15027	15030
	0.50μm	-20 to 310/330°C	15036	15039	15042	15045
	1.00μm	-20 to 290/310°C	15051	15054	15057	15060
	1.50μm	-20 to 280/300°C	15066	15069	15072	15075
0.53mm	0.25μm	-20 to 310/330°C	15022	15025	15028	
	0.50μm	-20 to 300/320°C	15037	15040	15043	
	1.00μm	-20 to 290/310°C	15052	15055	15058	
	1.50μm	-20 to 280/300°C	15067	15070	15073	
	3.00μm	-20 to 260/280°C	15082	15085	15088	15091

ID	df	temp. limits	10-Meter	20-Meter	40-Meter
0.18mm	0.20μm	-20 to 310/330°C	45001	45002	45003
	0.40μm	-20 to 310/330°C	45010	45011	45012

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

## also available

Metal MXT<sup>®</sup> Columns

Rugged, flexible, Siltek<sup>®</sup> treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 118](#) for our MXT<sup>®</sup>-200 columns.

Rtx<sup>®</sup>-200MS—Low-bleed GC/MS Columns (fused silica)(midpolarity phase; Crossbond<sup>®</sup> trifluoropropylmethyl polysiloxane)

Column specifically tested for low bleed performance.

ID	df	temp. limits	30-Meter
0.25mm	0.10μm	-20 to 320/340°C	15608
	0.25μm	-20 to 320/340°C	15623
	0.50μm	-20 to 310/330°C	15638
	1.00μm	-20 to 290/310°C	15653
0.32mm	0.10μm	-20 to 320/340°C	15609
	0.25μm	-20 to 320/340°C	15624
	0.50μm	-20 to 310/330°C	15639
	1.00μm	-20 to 290/310°C	15654

**Rtx<sup>®</sup>-1301 (G43) Columns (fused silica)**(low to midpolarity phase; Crossbond<sup>®</sup> 6% cyanopropylphenyl/94% dimethyl polysiloxane)

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

Many analysts feel the Rtx<sup>®</sup>-1301 column has the best cyanosiloxane bonded stationary phase available, with no other column manufacturer providing lower bleed, longer life-time, 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.

ID	df	temp. limits*	15-Meter	30-Meter	60-Meter	75-Meter	105-Meter
0.25mm	0.25 $\mu$ m	-20 to 280°C	16020	16023	16026		
	0.50 $\mu$ m	-20 to 270°C	16035	16038	16041		
	1.00 $\mu$ m	-20 to 260°C	16050	16053	16056		
	1.40 $\mu$ m	-20 to 240°C			16016		
0.32mm	0.25 $\mu$ m	-20 to 280°C	16021	16024	16027		
	0.50 $\mu$ m	-20 to 270°C	16036	16039	16042		
	1.00 $\mu$ m	-20 to 260°C	16051	16054	16057		
	1.50 $\mu$ m	-20 to 250°C	16066	16069	16072		
	1.80 $\mu$ m	-20 to 240°C		16092	16093		
0.53mm	0.25 $\mu$ m	-20 to 280°C	16022	16025	16028		
	0.50 $\mu$ m	-20 to 270°C	16037	16040	16043		
	1.00 $\mu$ m	-20 to 260°C	16052	16055	16058		
	1.50 $\mu$ m	-20 to 250°C	16067	16070	16073		
	3.00 $\mu$ m	-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.

**please note**

Rtx<sup>®</sup>-1301 columns and Rtx<sup>®</sup>-624 columns are exactly the same columns.

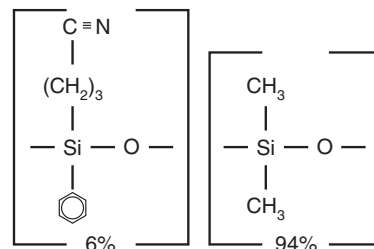
**Rtx<sup>®</sup>-624 Columns (fused silica)**(low to midpolarity phase; Crossbond<sup>®</sup> 6% cyanopropylphenyl/94% dimethyl polysiloxane)

- 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.

The unique polarity of the Rtx<sup>®</sup>-624 column makes it ideal for analyzing volatile organic pollutants. Although the Rtx<sup>®</sup>-502.2 column is recommended in many methods, the Rtx<sup>®</sup>-624 column offers better resolution of early eluting compounds. The Rtx<sup>®</sup>-624 phase produces greater than 90% resolution of the first six gases in EPA Methods 8260 and 524.2. This stationary phase is especially well-suited for EPA Method 524.2 revision IV since it resolves 2-nitropropane from 1,1-dichloropropanone, which share quantification ion m/z 43 and must be separated chromatographically.

ID	df	temp. limits	30-Meter	60-Meter	75-Meter	105-Meter
0.25mm	1.40 $\mu$ m	-20 to 240°C	10968	10969		
0.32mm	1.80 $\mu$ m	-20 to 240°C	10970	10972		
0.45mm	2.55 $\mu$ m	-20 to 240°C			10982	
0.53mm	3.00 $\mu$ m	-20 to 240°C	10971	10973	10974	10975

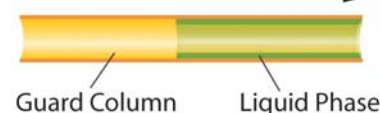
ID	df	temp. limits	20-Meter	40-Meter
0.18mm	1.00 $\mu$ m	-20 to 240°C	40924	40925

**Rtx<sup>®</sup>-1301 Structure****similar phases**

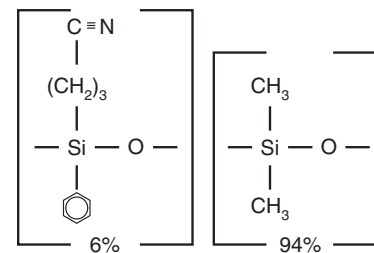
DB-1301, DB-624, HP-1301, HP-624, SPB-1301, SPB-624, VF-1301, VF-624ms, CP-1301, CP-Select 624 CB

**Integra-Guard<sup>®</sup> built-in guard column**

Continuous Tubing

**Get the protection without the connection!**

For Rtx<sup>®</sup>-1301 and Rtx<sup>®</sup>-624 columns with built-in Integra-Guard<sup>®</sup> guard columns, see **page 35**.

**Rtx<sup>®</sup>-624 Structure****similar phases**

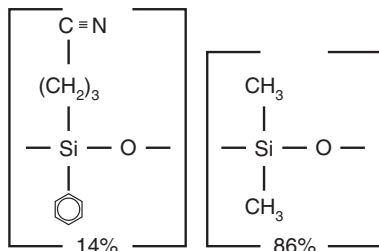
DB-1301, DB-624, HP-1301, HP-624, SPB-1301, SPB-624, VF-1301, VF-624ms, CP-1301, CP-Select 624 CB

**also available****Metal MXT<sup>®</sup> Columns**

Rugged, flexible, Siltek<sup>®</sup> treated stainless steel tubing; inertness comparable to fused silica tubing. See **page 117** for our MXT<sup>®</sup>-1301 columns and **page 121** for our MXT<sup>®</sup>-624 columns.



## Rtx®-1701 Structure

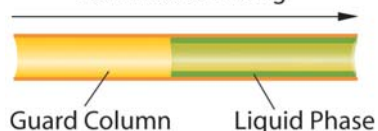


## similar phases

DB-1701, HP-1701, SPB-1701, VF-1701,  
CP-Sil 19 CB

## Integra-Guard® built-in guard column

Continuous Tubing



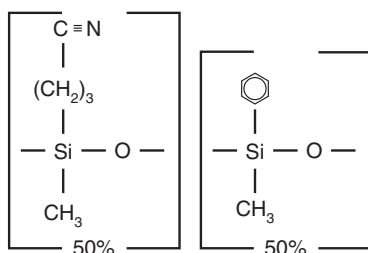
**Get the protection without the connection!**  
For Rtx®-1701 columns with built-in  
Integra-Guard® guard columns,  
see [page 35](#).

## also available

## Metal MXT® Columns

Rugged, flexible, Siltek® treated stainless steel tubing; inertness comparable to fused silica tubing. See [page 118](#) for our MXT®-1701 columns.

## Rtx®-225 Structure



## similar phases

DB-225, HP-225, SPB-225, CP-Sil 43 CB

## Rtx®-1701 Columns (fused silica)

(midpolarity phase; Crossbond® 14% cyanopropylphenyl/86% dimethyl polysiloxane)

- General purpose columns for alcohols, oxygenates, PCB congeners (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.

ID	df	temp. limits*	15-Meter	30-Meter	60-Meter
0.25mm	0.10µm	-20 to 280°C			12011
	0.25µm	-20 to 280°C	12020	12023	12026
	0.50µm	-20 to 270/280°C	12035	12038	12041
	1.00µm	-20 to 260/280°C	12050	12053	12056
0.32mm	0.10µm	-20 to 280°C		12009	
	0.25µm	-20 to 280°C	12021	12024	12027
	0.50µm	-20 to 270/280°C	12036	12039	12042
	1.00µm	-20 to 260/280°C	12051	12054	12057
	1.50µm	-20 to 240/260°C	12066	12069	12072
0.53mm	0.10µm	-20 to 270/280°C	12007		
	0.25µm	-20 to 270/280°C	12022	12025	12028
	0.50µm	-20 to 260/270°C	12037	12040	12043
	1.00µm	-20 to 250/270°C	12052	12055	12058
	1.50µm	-20 to 240/260°C	12067	12070	12073
	3.00µm	-20 to 230/250°C	12082	12085	12088

ID	df	temp. limits	10-Meter	20-Meter
0.10mm	0.10µm	-20 to 280°C	42201	42202
0.18mm	0.20µm	-20 to 280°C	42001	42002
	0.40µm	-20 to 270/280°C	42010	42011

## Rtx®-225 Columns (fused silica)

(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.

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, which can cause adsorption, tailing of active compounds, and lower efficiency.

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

**Rt®-2330 Columns (fused silica)**

(highly polar phase; 90% biscyanopropyl/10% phenylcyanopropyl polysiloxane—not bonded)

- General purpose columns for *cis/trans* FAMES, dioxin isomers.
- Temperature range: 0 °C to 275 °C.
- Equivalent to USP G8 and G48 phase.

Rt®-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 Rt®-2330 phase. In addition, our improved polymer produces columns with improved column efficiency and lower bleed.

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

ID	df	temp. limits*	30-Meter	60-Meter	105-Meter
0.25mm	0.10µm	0 to 260/275°C	10708	10711	10714
	0.20µm	0 to 260/275°C	10723	10726	10729
0.32mm	0.20µm	0 to 260/275°C	10724	10727	10730
0.53mm	0.10µm	0 to 260/275°C	10710	10713	
	0.20µm	0 to 260/275°C	10725	10728	

ID	df	temp. limits	10-Meter	20-Meter	40-Meter
0.18mm	0.10µm	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.

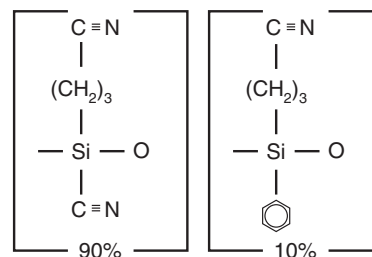
**Rt®-2560 Column (fused silica)**

(highly polar phase; biscyanopropyl polysiloxane—not bonded)

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

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

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

**Rt®-2330 Structure****similar phases**

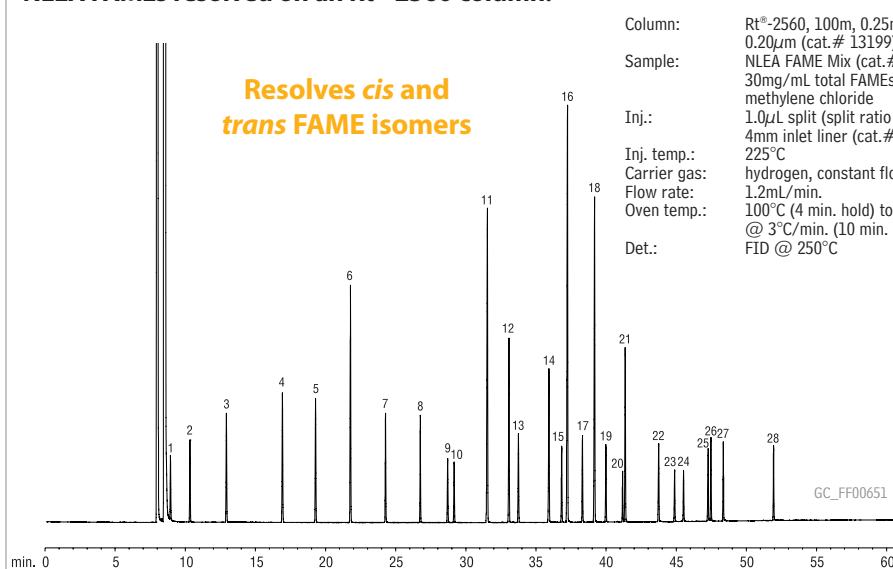
DB-23, HP-23, SP-2330, SP-2380

**Doing Dioxin Analysis?**

Rtx®-Dioxin2 columns provide better resolution and higher maximum temperatures than conventional columns. See **page 96**.

**similar phases**

SPB-2560, HP-88, Silar 10C, CP-Sil 88 FAME, CP-Sil 88

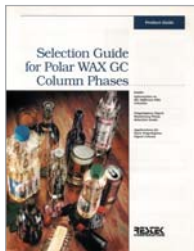
**NLEA FAMES resolved on an Rt®-2560 column.**

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: 1.2mL/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 linoelaidate (*trans*-9,12)
18. C18:2 methyl linoleate (*cis*-9,12)
19. C20:0 methyl arachidate
20. C20:1 methyl eicosenoate (*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 methyltricosanoate
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)

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## Rtx®-Wax Columns (fused silica)

(polar phase; Crossbond® Carbowax® polyethylene glycol)

- Best polyethylene glycol (PEG) phase for alkenols, glycols, and aldehydes.
- 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.

ID	df	temp. limits*	15-Meter	30-Meter	60-Meter
0.25mm	0.25µm	20 to 250°C	12420	12423	12426
	0.50µm	20 to 250°C	12435	12438	12441
0.32mm	0.25µm	20 to 250°C	12421	12424	12427
	0.50µm	20 to 250°C	12436	12439	12442
	1.00µm	20 to 240/250°C	12451	12454	12457
0.53mm	0.25µm	20 to 250°C	12422	12425	
	0.50µm	20 to 250°C	12437	12440	12443
	1.00µm	20 to 240/250°C	12452	12455	12458

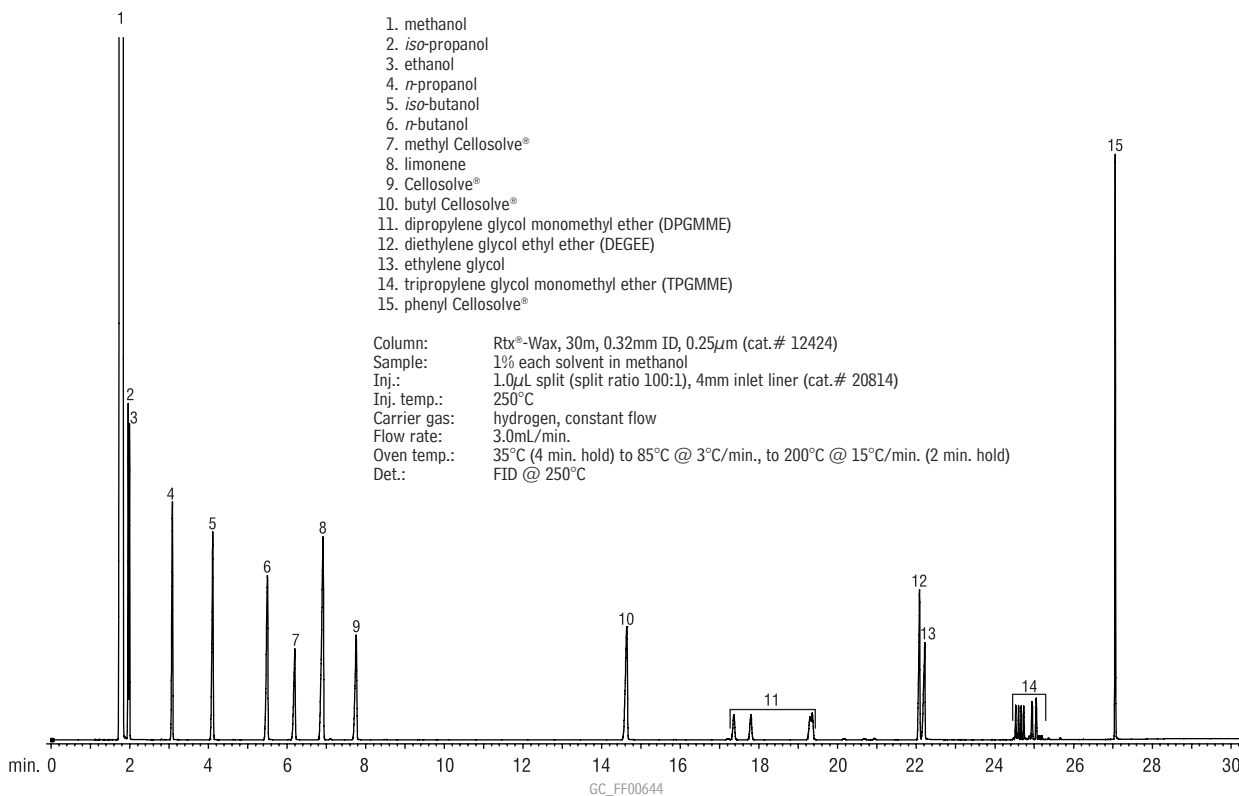
ID	df	temp. limits	10-Meter	20-Meter
0.10mm	0.10µm	20 to 250°C	41601	41602
	0.20µm	20 to 240/250°C	41603	41604

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

## similar phases

DB-WAX, HP-Wax

## Cleaning solvents on an Rtx®-Wax column.



**Stabilwax® Columns (fused silica)**

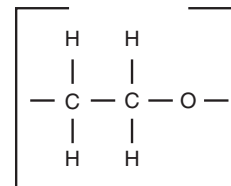
(polar phase; Crossbond® Carbowax® polyethylene glycol)

- Most stable polyethylene glycol (PEG) column available.
- Rugged enough to withstand repeated water injections.
- Lowest bleed PEG column on the market; long column lifetimes are assured
- Temperature range: 40 °C to 260 °C.
- Equivalent to USP G14, G15, G16, G20, and G39 phases.

Restek's polar-deactivated surface tightly binds the Carbowax® polymer and increases thermal stability, relative to competitive columns. Because of the increased stability produced by the bonding process, Stabilwax® columns exhibit long column lifetimes, even when programming repeatedly up to 260 °C. The bonding mechanism of the column also produces polar compound retention times that do not shift as is often observed on other wax-type columns. In addition, this bonding mechanism produces a column that can be rejuvenated by solvent washing. Stabilwax® columns are used for a wide range of compounds and matrices including: FAMES, flavor compounds, essential oils, solvents, aromatics including xylene isomers, acrolein/acrylonitrile (EPA 603), and oxygenated compounds. Also used for purity testing of chemicals and analyzing impurities in water matrices and alcoholic beverages.

ID	df	temp. limits	15-Meter	30-Meter	60-Meter
0.25mm	0.10µm	40 to 250/260°C	10605	10608	10611
	0.25µm	40 to 250/260°C	10620	10623	10626
	0.50µm	40 to 250/260°C	10635	10638	10641
0.32mm	0.25µm	40 to 250/260°C	10621	10624	10627
	0.50µm	40 to 250/260°C	10636	10639	10642
	1.00µm	40 to 240/260°C	10651	10654	10657
0.53mm	0.25µm	40 to 250/260°C	10622	10625	10628
	0.50µm	40 to 250/260°C	10637	10640	10643
	1.00µm	40 to 240/260°C	10652	10655	10658
	1.50µm	40 to 230/240°C	10666	10669	10672
	2.00µm	40 to 220/230°C	10667	10670	

ID	df	temp. limits	10-Meter	20-Meter
0.10mm	0.10µm	40 to 250/260°C	42601	
0.18mm	0.18µm	40 to 250/260°C		40602

**Stabilwax® Structure****manufacturing procedure**

Better column-to-column reproducibility

**similar phases**

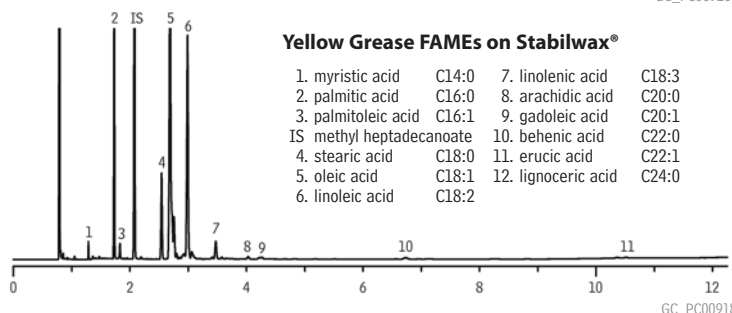
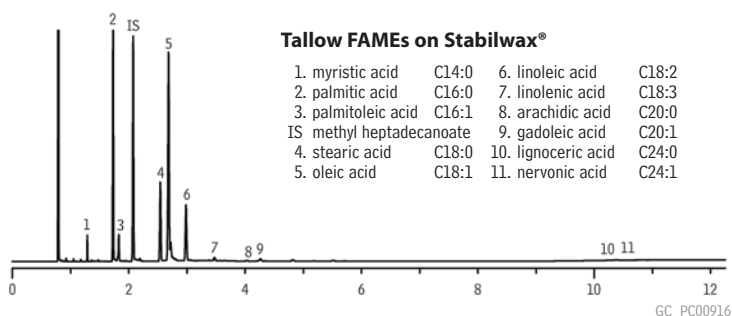
DB-WAX, DB-WAXetr, HP-Wax, HP-Innowax, Supelcowax 10, CP-Wax 52 CB

**Six columns for the price of five!**

Call 800-356-1688, ext. 4, or your Restek representative for details!

**also available****Metal MXT® Columns**

Rugged, flexible, Silcosteel® treated stainless steel tubing; inertness comparable to fused silica tubing. See **page 118** for our MXT®-WAX columns.

**FAMES in biodiesel oils on a Stabilwax® column.**

Column: Stabilwax®, 30m, 0.32mm ID, 0.25µm (cat.# 10624)  
 Sample: various sources of biodiesel (B100), prepared according to European Method EN 14103  
 Inj.: 1.0µL split (split ratio 100:1), Cyclosplitter® inlet liner (cat.# 20706)  
 Inj. temp.: 250°C  
 Carrier gas: hydrogen, constant flow, 3mL/min.  
 Linear velocity: 60cm/sec.  
 Oven temp.: 210°C (hold 5 min.) to 230°C @ 20°C/min. (hold 5 min.)  
 Det.: FID @ 250°C

See page 646 for Soy FAMES and Rapeseed FAMES analysis.

**Fast GC Using 0.10 mm and 0.15 mm ID Capillary Columns**

- Significantly reduces analysis time without sacrificing resolution.
- Higher column efficiencies speed up separations.
- Ideal for GC/MS.
- Excellent for comprehensive GC (GCxGC) as second dimension column.

Narrow bore (less than or equal to 0.15 mm ID) columns are attractive alternatives to conventional-diameter capillary columns because they provide faster analysis times and higher resolving power. As column ID decreases, column efficiency (plates/meter) greatly increases. Therefore, resolution can be achieved with a shorter column, which decreases analysis time. In addition, narrow bore columns are more compatible with GC/MS since typical flow rates are 1.0 mL/min. or less, eliminating the need to split the column flow at the MS interface. Conventional methods are easily converted to narrow bore columns, but some research may be necessary due to lower column capacities and higher back pressures.

**Rxi®-1ms Columns for Fast GC (fused silica)**

(nonpolar phase, Crossbond® 100% dimethyl polysiloxane)

ID	df	temp. limits	10-Meter	20-Meter
0.10mm	0.10 $\mu$ m	-60 to 330/350°C	13301	
0.15mm	0.15 $\mu$ m	-60 to 330/350°C	43800	43801
	2.0 $\mu$ m	-60 to 330/350°C		43802

**Rxi®-5ms Columns for Fast GC (fused silica)**

(low polarity phase, Crossbond® 5% diphenyl/95% dimethyl polysiloxane)

ID	df	temp. limits	10-Meter
0.10mm	0.10 $\mu$ m	-60 to 330/350°C	13401

**Rxi®-5Sil MS Columns for Fast GC (fused silica)**

(low polarity Crossbond® silarylene phase; selectivity close to 5% diphenyl/95% dimethyl polysiloxane)

ID	df	temp. limits	10-Meter	20-Meter
0.10mm	0.10 $\mu$ m	-60 to 330/350°C	43601	
0.15mm	0.15 $\mu$ m	-60 to 330/350°C	43815	43816
	2.0 $\mu$ m	-60 to 330/350°C		43817

**Rxi®-17 Columns for Fast GC (fused silica)**

(midpolarity phase; Crossbond® 50% diphenyl/50% dimethyl polysiloxane)

ID	df	temp. limits	10-Meter
0.10mm	0.10 $\mu$ m	40 to 280/320°C	13501

**Rxi®-17Sil MS Columns for Fast GC (fused silica)**

(midpolarity Crossbond® silarylene phase; equivalent to 50% phenyl methyl polysiloxane)

ID	df	temp. limits	10-Meter	20-Meter
0.15mm	0.15 $\mu$ m	40 to 340/360°C	43820	43821

**Rtx®-200 Columns for Fast GC (fused silica)**

(midpolarity phase; Crossbond® trifluoropropylmethyl polysiloxane)

ID	df	temp. limits	10-Meter	20-Meter
0.15mm	0.15 $\mu$ m	-20 to 320/340°C	43835	43836

**Stabilwax® Columns for Fast GC (fused silica)**

(polar phase; Crossbond® Carbowax® polyethylene glycol)

ID	df	temp. limits	10-Meter	20-Meter
0.10mm	0.10 $\mu$ m	40 to 250/260°C	42601	
0.15mm	0.15 $\mu$ m	40 to 250/260°C	43830	43831

**Rtx®-LC50 Columns for Fast GC (fused silica)**

(polar, dimethyl [50% liquid crystal] polysiloxane)

ID	df	temp. limits	10-Meter
0.10mm	0.10 $\mu$ m	100°C to 270°C	19736

**Rtx®-CLPesticides for Fast GC (fused silica)**

(proprietary Crossbond® phase)

ID	df	temp. limits	10-Meter
0.10mm	0.10 $\mu$ m	-60 to 310/330°C	43101

**Rtx®-CLPesticides2 for Fast GC (fused silica)**

(proprietary Crossbond® phase)

ID	df	temp. limits	10-Meter	20-Meter
0.10mm	0.10 $\mu$ m	-60 to 310/330°C	43301	43302

**Operating considerations for 0.10 mm ID columns**

The small degree of extra care involved in using 0.10 mm ID columns will be more than repaid by faster analyses and higher column efficiencies. 0.10 mm ID columns require higher operating pressures (>40 psig), which can result in more ferrule leaks, septum leaks, and sample flashback through leaking syringe plungers. Connections must be monitored and leak-checked more often. Operating a 0.10 mm ID column below optimum pressure will cause poor resolution and other poor performance. Sample capacity also is reduced, relative to wider-bore columns. Take care to not overload the column, and make sure you inject quickly when using split injection.

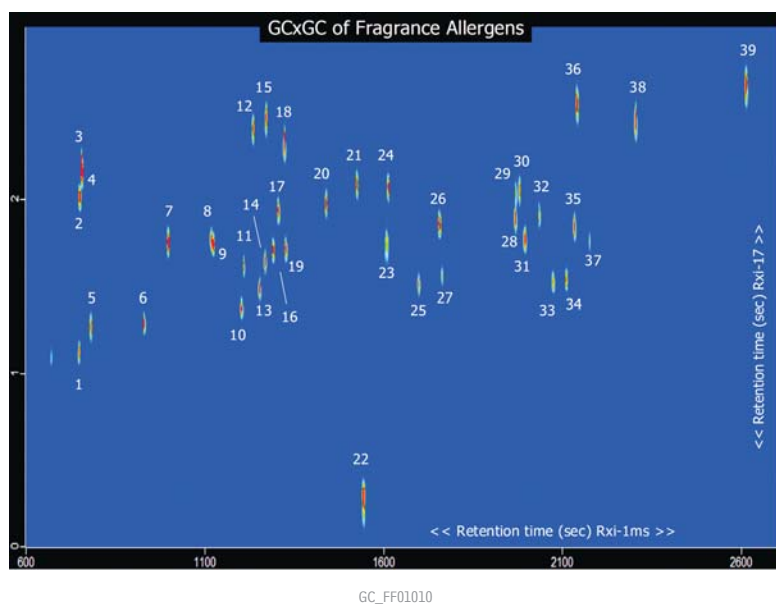
## GCxGC Second Dimension Selectivity Kit

The selectivity kit contains four columns of different selectivity for method development. Includes one each of the following:

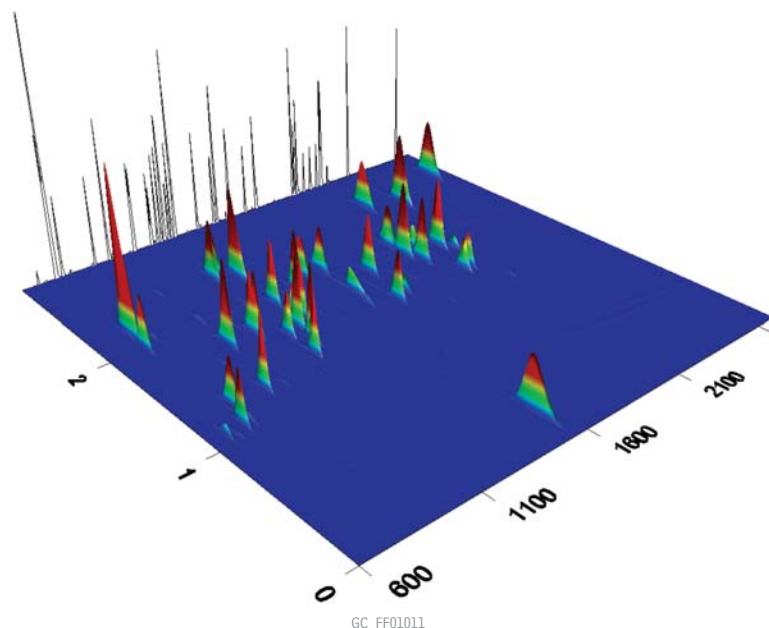
- Rxi®-17, 50% diphenyl dimethylpolysiloxane
- Rtx®-CLPesticides, trifluoropropyl containing polymer
- Stabilwax®, polar polyethylene glycol
- Rt®-LC350, liquid crystalline phase selective for aromatic compounds

Description	qty.	cat.#
GCxGC Second Dimension Selectivity Kit	kit	15105
<b>Columns can also be purchased individually.</b>		
Rxi-17, 1.1m (±3cm), 0.10mm ID, 0.10µm	ea.	15104
Rtx-CLPesticides, 1.1m (±3cm), 0.10mm ID, 0.10µm	ea.	15103
Stabilwax, 1.1m (±3cm), 0.10mm ID, 0.10µm	ea.	15102
Rt-LC350, 1.1m (±3cm), 0.15mm ID, 0.10µm	ea.	15101

### Fragrance Allergens on Rxi®-1ms & Rxi®-17 (GC x GC)



- |                          |                            |
|--------------------------|----------------------------|
| 1. limonene              | 21. methyl eugenol         |
| 2. 1-fluoronaphthalene   | 22. coumarin               |
| 3. benzyl alcohol        | 23. hydroxycitronellol     |
| 4. phenyl acetaldehyde   | 24. isoeugenol             |
| 5. eucalyptol            | 25. α-isomethyl ionone 1   |
| 6. linalool              | 26. linal                  |
| 7. camphor               | 27. α-isomethyl ionone 2   |
| 8. methyl-2-octynoate    | 28. amyl cinnamal          |
| 9. estragole             | 29. lylal 1                |
| 10. citronellol          | 30. lylal 2                |
| 11. citral 1             | 31. amylcinnamyl alcohol 1 |
| 12. trans-cinnamaldehyde | 32. amylcinnamyl alcohol 2 |
| 13. geraniol             | 33. farnesol 1             |
| 14. citral 2             | 34. farnesol 2             |
| 15. anise alcohol        | 35. hexyl cinnamal 1       |
| 16. hydroxycitronellol   | 36. benzyl benzoate        |
| 17. saffrole             | 37. hexyl cinnamal 2       |
| 18. cinnamyl alcohol     | 38. benzyl salicylate      |
| 19. methyl-2-nonynoate   | 39. benzyl cinnamate       |
| 20. eugenol              |                            |



Columns: Rxi®-1ms, 30m, 0.25mm ID, 0.25µm (cat.# 13323)  
Rxi®-17, 1m, 0.10mm ID, 0.10µm (10m, cat.# 13501)

Sample: fragrance allergens in MTBE

Instrument: LECO Corporation GCxGC/FID with quad-jet, dual-stage modulator and secondary oven

Inj.: 0.2µL split (split ratio 1:200), 4mm laminar cup splitter (cat.# 20801)

Inj. temp.: 250°C

Carrier gas: helium, corrected constant flow via pressure ramps

Flow rate: 2mL/min.

Oven temp.: Rxi®-1ms: 40°C (hold 1 min.) to 240°C @ 4°C/min.  
Rxi®-17: 45°C (hold 1 min.) to 245°C @ 4°C/min.

Modulation: modulator temperature offset: 20°C  
second dimension separation time: 3 sec.  
hot pulse time: 0.8 sec.  
cool time between stages: 0.7 sec.

Det.: FID @ 300°C  
makeup flow + column flow: 50mL/min.  
hydrogen: 40mL/min.  
air: 450mL/min.  
data collection rate: 200 Hz