



Restek GC

## Rtx-200 GC Columns

Excellent retention and separation of intermediate polar compounds

- Unique polymer composition provides excellent retention and separation of intermediate polar compounds.
- Higher thermal stability ensures low bleed for sensitive detectors.
- Stable deactivation provides consistent retention, efficiency, and inertness.
- Pro EZGC libraries for simplified method development and optimization.



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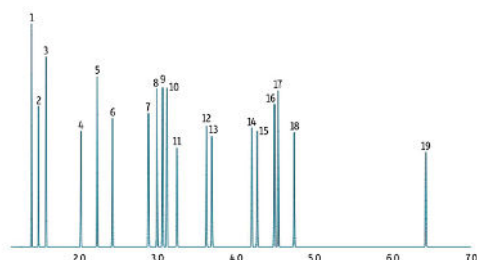
# Unique Polymer Composition Enables Unique Selectivity

Restek's Rtx-200 GC columns are coated with a trifluoropropylmethylpolysiloxane stationary phase, which provides a unique selectivity for compounds that display lone pair electrons, such as ketones, aldehydes, nitro-containing compounds, and halogen-containing compounds. The distinctive polarity of Rtx-200 columns ensures separations that often cannot be achieved with either nonpolar or polar columns—making them suitable for a broad range of analyses.

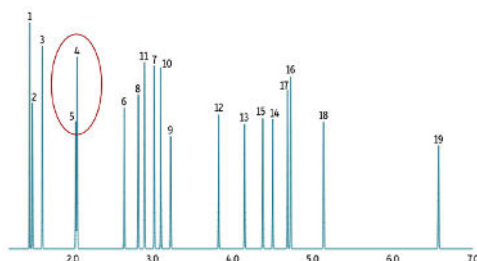
Using our Pro EZGC software to model GC separations, the retention of several common solvents was determined for three columns of different polarities: a nonpolar Rtx-1 column; a midpolar Rxi-624Sil MS column; and the selective Rtx-200 column (Figure 1). Under identical analytical conditions, Rtx-200 columns provide complete resolution of these solvents and a different elution order compared to either a Rtx-1 or Rxi-624Sil MS column.

**Figure 1:** The unique polarity of Rtx-200 columns separates common solvents better than a nonpolar Rtx-1 column or a midpolar Rxi-624Sil MS column.

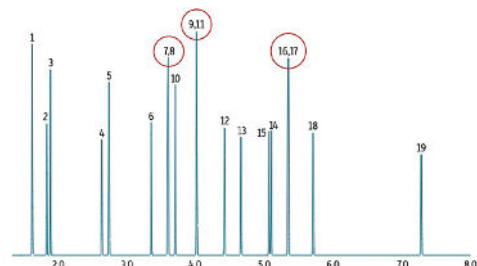
## Rtx-200



## Rtx-1



## Rtx-624Sil MS



### Peaks

1. Chloromethane
2. Methanol
3. Bromomethane
4. Methylene Chloride
5. *tert*-Butyl Alcohol
6. Chloroform
7. Benzene
8. 1,2-Dichloroethane
9. Dibromomethane
10. Fluorobenzene
11. 2-Chloroethanol
12. Toluene
13. Tetrachloroethene
14. Ethylbenzene
15. Chlorobenzene
16. *o*-Xylene
17. Styrene
18. *n*-Propylbenzene
19. Naphthalene

### Conditions

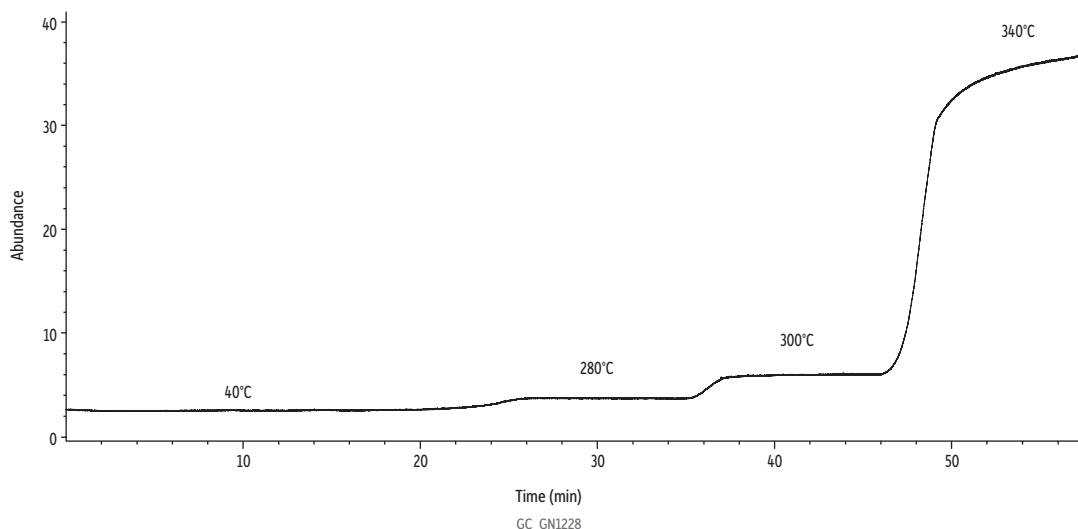
**Column:** 30 m, 0.32 mm ID, 1.0  $\mu$ m  
**Carrier Gas:** Helium, Constant Flow @ 2.0 mL/min  
**Average Velocity:** 40.88 cm/sec  
**Outlet Pressure (abs):** 14.70 psi  
**Oven Temp.:** 35  $^{\circ}$ C (hold 1 min) to 235  $^{\circ}$ C @ 30  $^{\circ}$ C/min

# High Thermal Stability and Low Bleed—Ready for MS

The stable column chemistry of Rtx-200 allows thermal stability to 360 °C with low bleed. The high thermal stability of the Rtx-200 phase makes it compatible with sensitive detectors and analyses that require high temperatures.

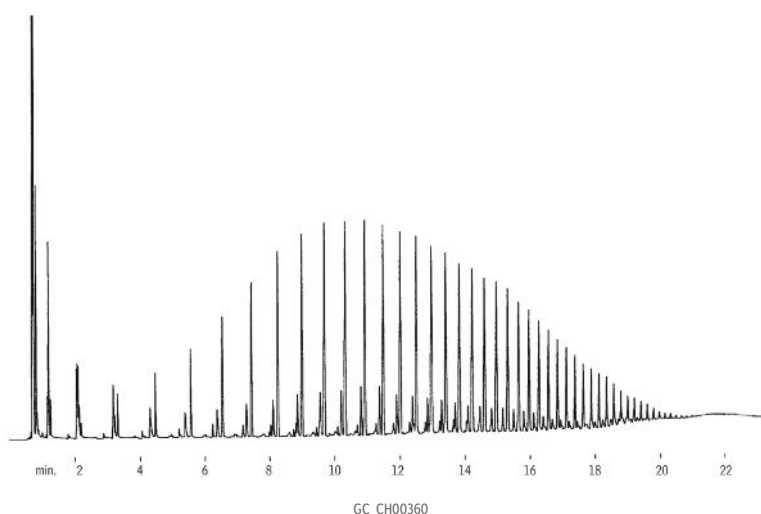
For applications that require even lower bleed, our Rtx-200MS columns have a bleed specification lower than that of Rtx-200, making them ideal for labs using sensitive mass specs.

**Figure 2:** The excellent thermal stability of Rtx-200 columns ensures low bleed, even at elevated temperatures.



**Column:** Rtx-200ms, 30 m, 0.25 mm ID, 0.25  $\mu$ m (cat.# 15623); **Standard/Sample:** Instrument blank; **Injection:** split; **Oven:** Oven Temp.: 40 °C to 280 °C at 10 °C/min (hold 10 min) to 300 °C at 20 °C/min (hold 10 min) to 340 °C at 20 °C/min (hold 10 min); **Carrier Gas:** He, constant flow; Flow Rate: 1.4 mL/min; Linear Velocity: 32.113 cm/sec @ 40 °C; Dead Time: 1.54 min @ 40 °C; **Detector:** FID @ 300 °C; Make-up Gas Flow Rate: 30 mL/min; Hydrogen flow: 40 mL/min; Air flow: 400 mL/min; Data Rate: 50 Hz; **Instrument:** Agilent 7890B GC

**Figure 3:** Rtx-200 columns exhibit low bleed at 360 °C, even for high molecular weight compounds like siloxanes that require higher temperatures.



**Column:** Rtx-200, 15 m, 0.25 mm ID, 0.25  $\mu$ m (cat.# 15020); **Standard/Sample:** Polymethyl siloxane; **Injection:** Inj. Vol.: 1.0  $\mu$ L split; Inj. Temp.: 250 °C; **Oven:** Oven Temp.: 40 °C to 360 °C at 15 °C/min (hold 30 min); **Carrier Gas:** H<sub>2</sub>, constant flow; Linear Velocity: 40 cm/sec; **Detector:** FID @ 360 °C; **Notes:** FID sensitivity: 5.12 x 10<sup>-10</sup> AFS; Split vent: 40 cc/min.

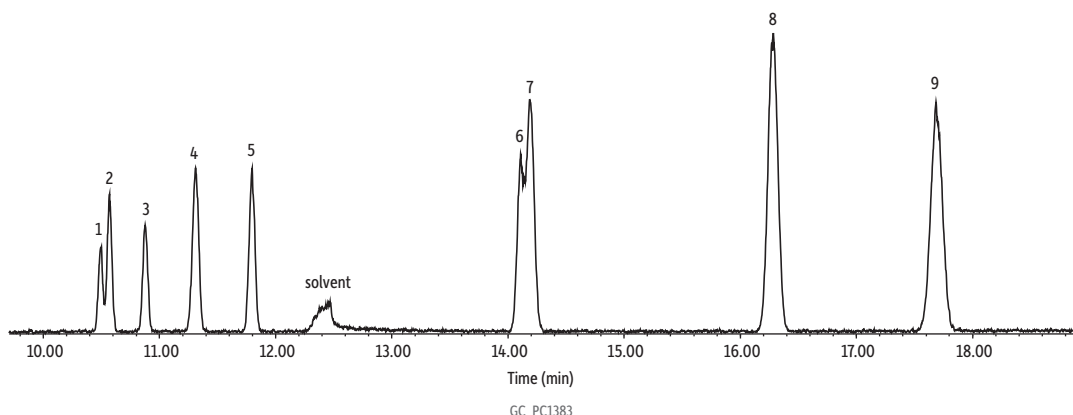
## Versatile

Rtx-200 columns are available in a variety of dimensions (lengths, IDs, and film thicknesses), and can be used for a broad range of applications, from solvents to silanes to pesticides. Due to its neutrality and inertness, Rtx-200 columns can be used to analyze acidic, basic, or neutral compounds. Its unique polarity also makes it an ideal confirmation column for many analyses because it will produce a different elution pattern compared to most other stationary phases.

## CFCs

The Rtx-200 is the best non-PLOT column option that can be used with GC-MS without the need for a particle trap or cryofocusing for chlorofluorocarbons (CFCs). This stationary phase's unique selectivity exhibits the best retention and separation of these specific commonly found halogenated compounds (Figure 4).

**Figure 4:** Rtx-200 columns exhibit excellent retention and separation of chlorofluorocarbons (CFCs).



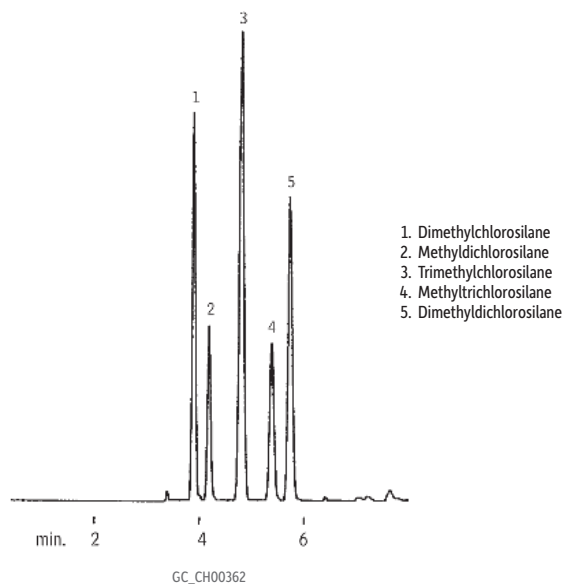
|                                   | tr (min) |                                       | tr (min) |
|-----------------------------------|----------|---------------------------------------|----------|
| 1. Dichlorodifluoromethane        | 10.489   | 6. Vinyl bromide                      | 14.114   |
| 2. Chlorodifluoromethane          | 10.578   | 7. Trichloromonofluoromethane         | 14.196   |
| 3. Ethane, 1,1-difluoro-          | 10.879   | 8. 2,2-Dichloro-1,1,1-trifluoroethane | 16.282   |
| 4. Dichlorotetrafluoroethane      | 11.309   | 9. 1,1,2-Trichlorotrifluoroethane     | 17.693   |
| 5. Ethane, 1-chloro-1,1-difluoro- | 11.797   |                                       |          |

|                              |                                                                                                                                                |                             |                             |                                  |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|----------------------------------|
| <b>Column</b>                | Rtx-200, 105 m, 0.25 mm ID, 1.00 µm (cat.# 15059)                                                                                              |                             |                             |                                  |
| <b>Standard/Sample</b>       | Dichlorodifluoromethane (cat.# 30275)<br>Fluorocarbons standard (cat.# custom)<br>Trichlorofluoromethane (cat.# 30421)                         |                             |                             |                                  |
| <b>Diluent:</b>              | Methanol                                                                                                                                       |                             |                             |                                  |
| <b>Conc.:</b>                | 500 ppm                                                                                                                                        |                             |                             |                                  |
| <b>Injection</b>             |                                                                                                                                                |                             |                             |                                  |
| <b>Inj. Vol.:</b>            | 1 µL split (split ratio 400:1)                                                                                                                 |                             |                             |                                  |
| <b>Liner:</b>                | Topaz 4.0 mm ID Precision inlet liner w/ wool (cat.# 23305)                                                                                    |                             |                             |                                  |
| <b>Inj. Temp.:</b>           | 250 °C                                                                                                                                         |                             |                             |                                  |
| <b>Split Vent Flow Rate:</b> | 400 mL/min                                                                                                                                     |                             |                             |                                  |
| <b>Gas Saver Time:</b>       | 2 min                                                                                                                                          |                             |                             |                                  |
| <b>Gas Saver Flow Rate:</b>  | 20 mL/min                                                                                                                                      |                             |                             |                                  |
| <b>Oven</b>                  |                                                                                                                                                |                             |                             |                                  |
| <b>Oven Temp.:</b>           | 32 °C (hold 20 min)                                                                                                                            |                             |                             |                                  |
| <b>Carrier Gas</b>           | He, constant flow                                                                                                                              |                             |                             |                                  |
| <b>Flow Rate:</b>            | 1 mL/min                                                                                                                                       |                             |                             |                                  |
| <b>Linear Velocity:</b>      | 19.303 cm/sec @ 32 °C                                                                                                                          |                             |                             |                                  |
| <b>Dead Time:</b>            | 9.553 min @ 40 °C                                                                                                                              |                             |                             |                                  |
| <b>Detector</b>              | MS                                                                                                                                             |                             |                             |                                  |
| <b>Mode:</b>                 | Scan                                                                                                                                           |                             |                             |                                  |
| <b>Scan Program:</b>         |                                                                                                                                                |                             |                             |                                  |
|                              | <b>Group</b>                                                                                                                                   | <b>Start Time<br/>(min)</b> | <b>Scan Range<br/>(amu)</b> | <b>Scan Rate<br/>(scans/sec)</b> |
|                              | 1                                                                                                                                              | 10                          | 50-500                      | 10.8                             |
| <b>Transfer Line Temp.:</b>  | 250 °C                                                                                                                                         |                             |                             |                                  |
| <b>Analyzer Type:</b>        | Quadrupole                                                                                                                                     |                             |                             |                                  |
| <b>Source Type:</b>          | Extractor                                                                                                                                      |                             |                             |                                  |
| <b>Source Temp.:</b>         | 230 °C                                                                                                                                         |                             |                             |                                  |
| <b>Quad Temp.:</b>           | 150 °C                                                                                                                                         |                             |                             |                                  |
| <b>Electron Energy:</b>      | 1708 eV                                                                                                                                        |                             |                             |                                  |
| <b>Tune Type:</b>            | PFTBA                                                                                                                                          |                             |                             |                                  |
| <b>Ionization Mode:</b>      | EI                                                                                                                                             |                             |                             |                                  |
| <b>Instrument</b>            | Agilent 7890B GC & 5977B MSD                                                                                                                   |                             |                             |                                  |
| <b>Sample Preparation</b>    | Standards were combined and diluted to 500 ppm, then transferred to a 2 mL vial (cat.# 21142) and capped with a short screw cap (cat.# 24498). |                             |                             |                                  |

## Chlorosilanes

Chlorosilanes are volatile, reactive compounds used as silylating agents and intermediates for silicone synthesis. Due to their highly reactive nature, these compounds are difficult to analyze by GC. However, a 60 m, 0.53 mm ID 3.0  $\mu$ m Rtx-200 column can successfully analyze a wide range of chlorosilane compounds (Figure 5).

**Figure 5:** Reactive chlorosilanes analyzed using a 60 m Rtx-200 column.



|                        |                                                                       |
|------------------------|-----------------------------------------------------------------------|
| <b>Column</b>          | Rtx-200, 60 m, 0.53 mm ID, 3.00 $\mu$ m (cat.# 15088)                 |
| <b>Standard/Sample</b> | Methyl silanes                                                        |
| <b>Injection</b>       |                                                                       |
| Inj. Vol.:             | 0.5 $\mu$ L split                                                     |
| Inj. Temp.:            | 200 °C                                                                |
| <b>Oven</b>            |                                                                       |
| Oven Temp.:            | 40 °C to 250 °C at 8 °C/min (hold 5 min)                              |
| <b>Carrier Gas</b>     | H <sub>2</sub> , constant flow                                        |
| Linear Velocity:       | 40 cm/sec                                                             |
| <b>Detector</b>        | FID @ 270 °C                                                          |
| <b>Notes</b>           | FID sensitivity: 1.02 x 10 <sup>-9</sup> AFS<br>Split vent: 40 cc/min |

## Model Separations on Our Pro EZGC Software

Restek's free Pro EZGC chromatogram modeler makes it easy to simulate your analysis in minutes without stepping foot into the lab.

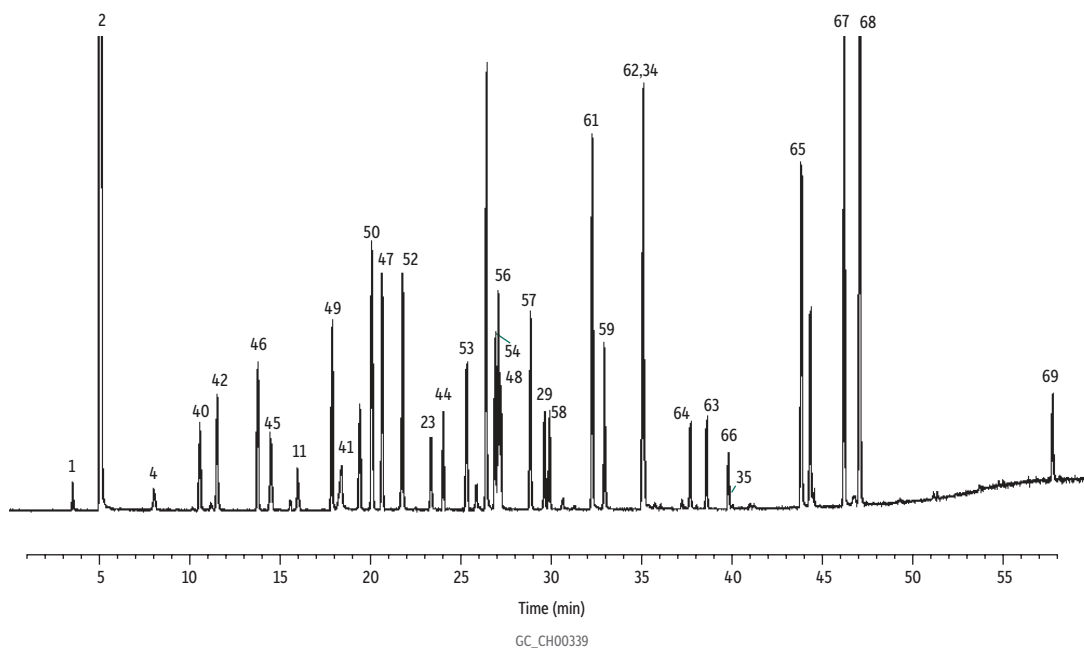
[www.restek.com/proezgc](http://www.restek.com/proezgc)



## Solvents

Testing solvent purity or analyzing solvents from manufacturing processes requires a column that quickly and accurately resolves a variety of industrial solvents. Rtx-200 columns are ideal for analyzing a wide range of common industrial solvents (Figure 6).

**Figure 6:** Rtx-200 columns can quickly and accurately analyze a wide variety of common solvents.



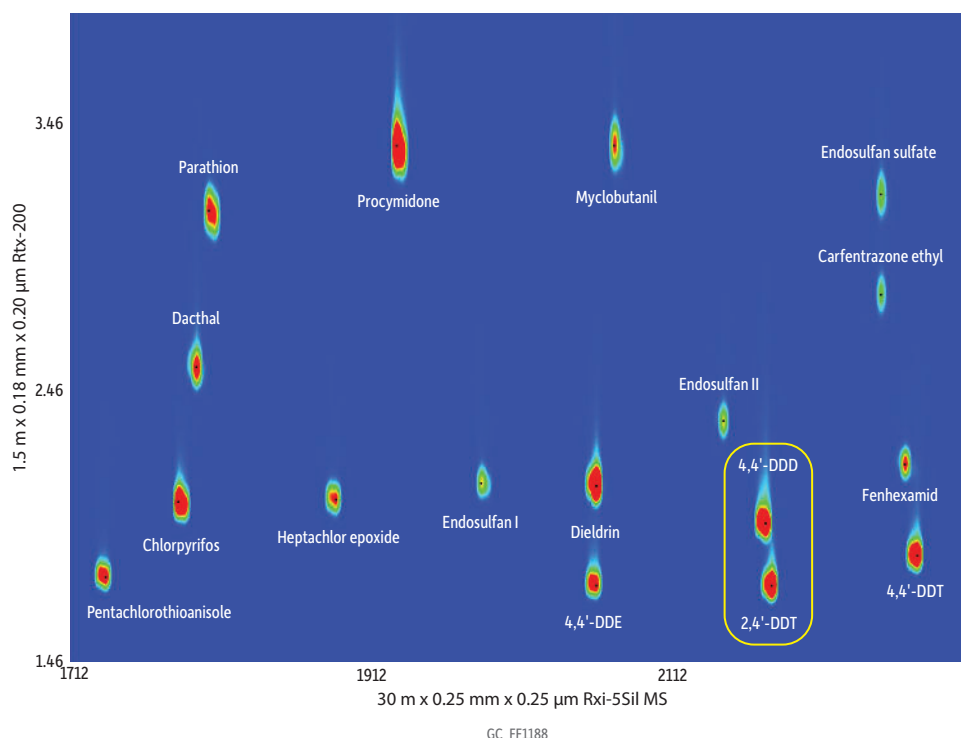
- |                             |                                 |                                    |                                    |
|-----------------------------|---------------------------------|------------------------------------|------------------------------------|
| 1. Pentane                  | 27. Dodecane                    | 53. 2,6-Dimethyl-4-heptanone       | 79. Cyclopentanone                 |
| 2. Methylene chloride       | 28. Undecanal                   | 54. 2-Octanone                     | 80. 2-Hexanol                      |
| 3. Ethylene glycol          | 29. Tridecane                   | 55. <i>o</i> -Cresol               | 81. Butyl acetate                  |
| 4. Heptane                  | 30. Unknown                     | 56. $\alpha$ -Methylbenzyl alcohol | 82. 2-Ethyl-1-butanol              |
| 5. Cyclopentanol            | 31. Dodecanal                   | 57. 5-Nonanone                     | 83. 3-Ethyl-3-pentanol             |
| 6. 3-Hexanol                | 32. Dicyclohexylamine           | 58. Nonanal                        | 84. 1,4-Dichlorobutane             |
| 7. Acetamide                | 33. Bis(2,2-methoxy)ethyl ether | 59. Decanal                        | 85. 2-Methyl-2,4-pentanediol       |
| 8. 2-Methyl-1-pentanol      | 34. Pentadecane                 | 60. Unknown                        | 86. Butoxyethanol                  |
| 9. Furfuryl alcohol         | 35. Heptadecane                 | 61. 1-Decanol                      | 87. 1,2,3-Trichloropropane         |
| 10. Butyl ether             | 36. Octadecane                  | 62. 1-Undecanol                    | 88. 1,4-Butanediol                 |
| 11. Nonane                  | 37. Nonadecane                  | 63. 2-Dodecanone                   | 89. Methyl hexanoate               |
| 12. Cumene                  | 38. Eicosane                    | 64. 1-Dodecanol                    | 90. 1,2,4-Trimethylbenzene         |
| 13. Ethyl amyl ketone       | 39. Acetyl tributyl citrate     | 65. Tetraethylene glycol           | 91. 2-Ethyl-1-hexanol              |
| 14. Heptanol                | 40. 2-Buten-1-ol                | 66. Dibenzyl                       | 92. Dipentene/limonene             |
| 15. Butyl butanoate         | 41. Formamide                   | 67. Diethyl phthalate              | 93. Tetrahydrofurfuryl acetate     |
| 16. Unknown                 | 42. 3-Pentanol                  | 68. Tributyl phosphate             | 94. Unknown                        |
| 17. Benzyl alcohol          | 43. 1-Nitropropane              | 69. Diphenyl sulfone               | 95. Decahydronaphthalene           |
| 18. Dipropylene glycol      | 44. Dimethylformamide           | 70. Allyl alcohol                  | 96. Unknown                        |
| 19. Benzene, diethyl-       | 45. 2-Methyl-3-pentanol         | 71. Unknown                        | 97. Unknown                        |
| 20. Unknown                 | 46. Toluene                     | 72. Isopropyl acetate              | 98. 2-Decanol                      |
| 21. Unknown                 | 47. Ethyl chloroacetate         | 73. Benzene                        | 99. 1,2-Bis(2-methoxyethoxy)ethane |
| 22. Hexachloroethane        | 48. Dimethylacetamide           | 74. 2-Nitropropane                 | 100. 2-Phenoxyethanol              |
| 23. Undecane                | 49. <i>p</i> -Xylene            | 75. Nitroethane                    | 101. Unknown                       |
| 24. 1-Nonanol               | 50. sec-Tetrachloroethane       | 76. Pentanal                       | 102. Benzyl ether                  |
| 25. <i>p</i> -Methoxyphenol | 51. Benzaldehyde                | 77. 2-Bromobutane                  |                                    |
| 26. Triethylene glycol      | 52. <i>o</i> -Chlorotoluene     | 78. 1-Chloropentane                |                                    |

**Column** Rtx-200, 60 m, 0.53 mm ID, 3.00  $\mu$ m (cat.# 15088)  
**Sample Injection** Solvent mix #2  
 Inj. Vol.: 1.0  $\mu$ L split  
 Inj. Temp.: 275  $^{\circ}$ C  
 Split Vent  
 Flow Rate: 50 mL/min  
**Oven**  
 Oven Temp.: 40  $^{\circ}$ C (hold 5 min) to 285  $^{\circ}$ C at 5  $^{\circ}$ C/min  
**Carrier Gas** He, constant flow  
 Linear Velocity: 40 cm/sec  
**Detector** MS  
 Mode: Scan  
 Source Temp.: 285  $^{\circ}$ C  
**Notes** TIC using open split interface (OSI).

## Pesticides in Dietary Supplements GCxGC (Secondary Column)

As shown by the extensive spread along the x and y axes, a GCxGC analysis with Rxi-5Sil MS and Rtx-200 columns easily separates and quantifies compounds with isobaric interferences, such as 2,4'-DDT and 4,4'-DDD (Figure 7).

**Figure 7:** Excellent two-dimensional separation of pesticides using orthogonal column set of Rxi-5Sil MS and Rtx-200 columns. Note 2D separation of compounds that have isobaric interferences when coeluting on Rxi-5Sil MS, 2,4'-DDT and 4,4'-DDD.



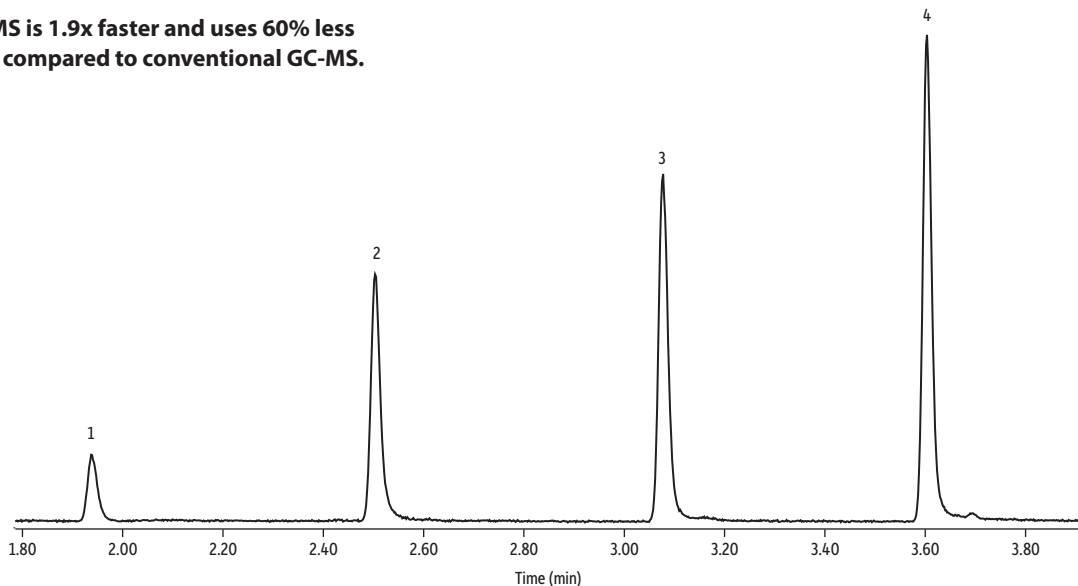
|                            |                                                                                                                                                                                                                                                                     |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Column</b>              | Rxi-5Sil MS 30 m, 0.25 mm ID, 0.25 µm (cat.# 13623)<br>Rtx-200 1.5 m, 0.18 mm ID, 0.20 µm (cat.# 45001)                                                                                                                                                             |
| <b>Standard/Sample</b>     | Mixed pesticide standard                                                                                                                                                                                                                                            |
| <b>Diluent:</b>            | Toluene                                                                                                                                                                                                                                                             |
| <b>Conc.:</b>              | 2 ng/µL                                                                                                                                                                                                                                                             |
| <b>Injection</b>           |                                                                                                                                                                                                                                                                     |
| Inj. Vol.:                 | 1 µL splitless (hold 1 min)                                                                                                                                                                                                                                         |
| Liner:                     | Gooseneck Splitless (4mm) w/Wool (cat.# 22405)                                                                                                                                                                                                                      |
| Inj. Temp.:                | 250 °C                                                                                                                                                                                                                                                              |
| Purge Flow:                | 40 mL/min                                                                                                                                                                                                                                                           |
| <b>Oven</b>                |                                                                                                                                                                                                                                                                     |
| Oven Temp.:                | Rxi-5Sil MS: 80 °C (hold 1 min) to 310 °C at 4 °C/min (hold 1.5 min)<br>Rtx-200: 90 °C (hold 1 min) to 320 °C at 4 °C/min (hold 1.5 min)                                                                                                                            |
| <b>Carrier Gas</b>         | He, constant flow                                                                                                                                                                                                                                                   |
| Flow Rate:                 | 1.8 mL/min                                                                                                                                                                                                                                                          |
| <b>Modulation</b>          |                                                                                                                                                                                                                                                                     |
| Modulator Temp. Offset:    | 25 °C                                                                                                                                                                                                                                                               |
| Second Dimension           |                                                                                                                                                                                                                                                                     |
| Separation Time:           | 4 sec                                                                                                                                                                                                                                                               |
| Hot Pulse Time:            | 1.2 sec                                                                                                                                                                                                                                                             |
| Cool Time between Stages:  | 0.8 sec                                                                                                                                                                                                                                                             |
| <b>Detector</b>            | TOFMS                                                                                                                                                                                                                                                               |
| Transfer Line Temp.:       | 290 °C                                                                                                                                                                                                                                                              |
| Analyzer Type:             | TOF                                                                                                                                                                                                                                                                 |
| Source Temp.:              | 225 °C                                                                                                                                                                                                                                                              |
| Electron Energy:           | 70 eV                                                                                                                                                                                                                                                               |
| Mass Defect:               | -20 mu/100 u                                                                                                                                                                                                                                                        |
| Solvent Delay Time:        | 4 min                                                                                                                                                                                                                                                               |
| Ionization Mode:           | El                                                                                                                                                                                                                                                                  |
| Acquisition Range:         | 45 to 550 amu                                                                                                                                                                                                                                                       |
| Spectral Acquisition Rate: | 100 spectra/sec                                                                                                                                                                                                                                                     |
| <b>Instrument</b>          | LECO Pegasus 4D GCxGC-TOFMS                                                                                                                                                                                                                                         |
| <b>Notes</b>               | See application note GNAN1338 for extraction and cleanup details. A 1.5 m length of the Rtx-200 column was trimmed from a 10 m column. Columns were connected with a Universal Press-Tight Connector (cat.# 20429). See chromatogram GC_FF1187 for full scale view. |

## Increase Analysis Speeds with Low-Pressure GC-MS Column Kits

Restek's Low-Pressure GC (LPGC) Rtx-200 column kit allows for significant speeds gains while also conserving helium. In this rapid analysis of four common fluorotelomer alcohols on the LPGC Rtx-200, excellent separations of all compounds were achieved with a run time of under four minutes (Figure 8). The LPGC method is 1.9x faster and uses 60% less helium than conventional GC-MS methods.

**Figure 8:** This analysis of FTOHs on the LPGC Rtx-200 allowed for significant speeds gains while still achieving excellent separation of all isobars.

**LPGC-MS is 1.9x faster and uses 60% less helium compared to conventional GC-MS.**



GC\_EV1518

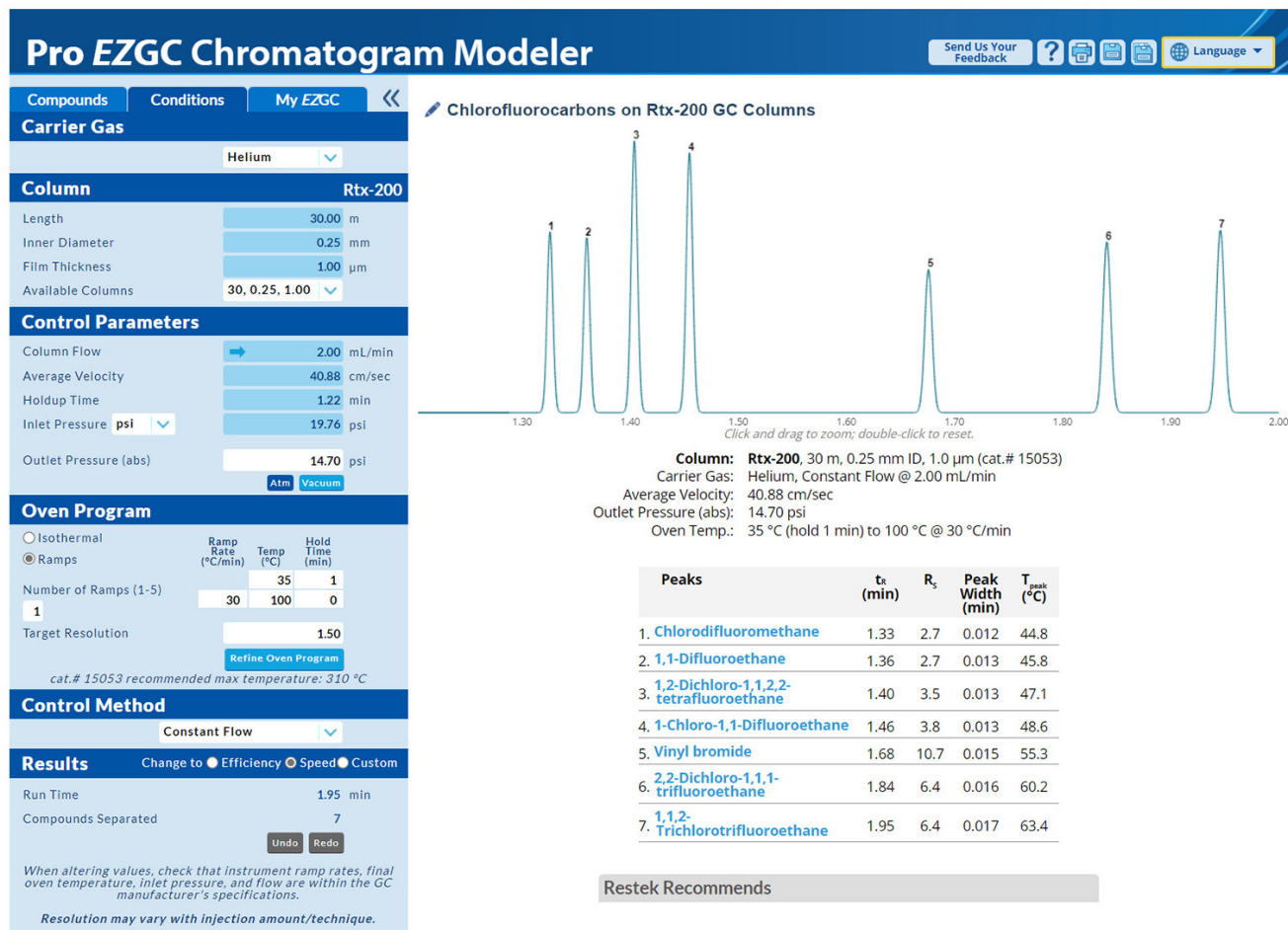
| Peaks                                   | ts (min) | Conc. (µg/mL) | SIM Ion |
|-----------------------------------------|----------|---------------|---------|
| 1. 4:2 FTOH (2-perfluorobutyl alcohol)  | 1.94     | 1             | 131     |
| 2. 6:2 FTOH (2-perfluorohexyl alcohol)  | 2.51     | 1             | 131     |
| 3. 8:2 FTOH (2-perfluorooctyl alcohol)  | 3.08     | 1             | 131     |
| 4. 10:2 FTOH (2-perfluorodecyl alcohol) | 3.61     | 1             | 131     |

|                           |                                                                                                                                                                                                                           |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Column</b>             | LPGC Rtx-200 column kit, includes 10 m x 0.32 mm ID x 1.00 µm Rtx-200 analytical column and 5 m x 0.15 mm ID Rxi restrictor factory connected via SilTite connector (cat.# 11807)                                         |
| <b>Standard/Sample</b>    | 2-(Perfluorobutyl)ethanol<br>2-(Perfluorohexyl)ethanol<br>2-(Perfluorooctyl)ethanol<br>2-(Perfluorodecyl)ethanol                                                                                                          |
| <b>Diluent:</b>           | Methanol (PT)                                                                                                                                                                                                             |
| <b>Conc.:</b>             | 1 µg/mL                                                                                                                                                                                                                   |
| <b>Injection</b>          |                                                                                                                                                                                                                           |
| Inj. Vol.:                | 1 µL split (split ratio 5:1)                                                                                                                                                                                              |
| Liner:                    | Topaz, precision inlet liner, 4.0 mm x 6.3 x 78.5 (cat.# 23305)                                                                                                                                                           |
| Inj. Temp.:               | 280 °C                                                                                                                                                                                                                    |
| Split Vent Flow Rate:     | 4.5 mL/min                                                                                                                                                                                                                |
| <b>Oven</b>               |                                                                                                                                                                                                                           |
| Oven Temp.:               | 35 °C (hold 0.5 min) to 280 °C at 35 °C/min (hold 5 min)                                                                                                                                                                  |
| <b>Carrier Gas</b>        | He, constant flow                                                                                                                                                                                                         |
| Flow Rate:                | 0.9 mL/min                                                                                                                                                                                                                |
| <b>Detector</b>           | MS                                                                                                                                                                                                                        |
| Mode:                     | SIM                                                                                                                                                                                                                       |
| SIM Program:              | 131 m/z, 300 ms dwell                                                                                                                                                                                                     |
| Transfer Line Temp.:      | 280 °C                                                                                                                                                                                                                    |
| Analyzer Type:            | Quadrupole                                                                                                                                                                                                                |
| Source Temp.:             | 250 °C                                                                                                                                                                                                                    |
| Quad Temp.:               | 180 °C                                                                                                                                                                                                                    |
| Solvent Delay Time:       | 1.3 min                                                                                                                                                                                                                   |
| Tune Type:                | PFTBA                                                                                                                                                                                                                     |
| Ionization Mode:          | EI                                                                                                                                                                                                                        |
| <b>Instrument</b>         | Agilent 7890A GC & 5975C MSD                                                                                                                                                                                              |
| <b>Sample Preparation</b> | All standards were combined into one solution at concentration 1 ppm in polypropylene vial (cat. #23242) with a polypropylene cap (cat. #23244). A 50 µL aliquot was analyzed by GC-MS using 100 µL insert (cat. #24512). |
| <b>Notes</b>              | Pulsed split injection was used; 30 psi until 0.15 min.                                                                                                                                                                   |

# Simplified Analysis Optimization with Pro EZGC Software

Rtx-200 columns are supported by our Pro EZGC chromatogram modeler, allowing labs to simplify their analysis optimization. This free, easy-to-use software helps you perform GC method optimization and method development in minutes—without needing to use an instrument.

**Figure 9:** Rtx-200 GC columns are supported by Restek's Pro EZGC chromatogram modeler, helping labs quickly and easily optimize their analysis.

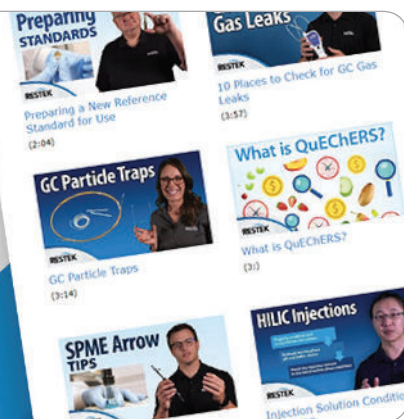


## On-Demand Videos

### 24/7 Education in Minutes

The Restek Video Library contains close to 100 quick-hitting videos—with more being released each month—that are targeted at specific topics we have helped actual Restek customers with. Higher lab throughput (and a job made easier) are only a click away.

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### Rtx-200 GC Capillary Columns (fused silica)

- Unique polymer composition provides excellent retention and separation of a broad range of polar compounds, such as solvents, chlorofluorocarbons, alcohols, ketones, silanes, and siloxanes.
- Excellent second dimension column for GC x GC.
- Temperature range: -20°C to 360°C.
- Equivalent to USP G6 phase.

| Cat.# | ID      | df      | Length | Units |
|-------|---------|---------|--------|-------|
| 45002 | 0.18 mm | 0.20 µm | 20 m   | ea.   |
| 45003 | 0.18 mm | 0.20 µm | 40 m   | ea.   |
| 45011 | 0.18 mm | 0.40 µm | 20 m   | ea.   |
| 45012 | 0.18 mm | 0.40 µm | 40 m   | ea.   |
| 15023 | 0.25 mm | 0.25 µm | 30 m   | ea.   |
| 15026 | 0.25 mm | 0.25 µm | 60 m   | ea.   |
| 15029 | 0.25 mm | 0.25 µm | 105 m  | ea.   |
| 15038 | 0.25 mm | 0.50 µm | 30 m   | ea.   |
| 15041 | 0.25 mm | 0.50 µm | 60 m   | ea.   |
| 15044 | 0.25 mm | 0.50 µm | 105 m  | ea.   |
| 15050 | 0.25 mm | 1.0 µm  | 15 m   | ea.   |
| 15053 | 0.25 mm | 1.0 µm  | 30 m   | ea.   |
| 15056 | 0.25 mm | 1.0 µm  | 60 m   | ea.   |
| 15059 | 0.25 mm | 1.0 µm  | 105 m  | ea.   |
| 15009 | 0.32 mm | 0.10 µm | 30 m   | ea.   |
| 15024 | 0.32 mm | 0.25 µm | 30 m   | ea.   |
| 15027 | 0.32 mm | 0.25 µm | 60 m   | ea.   |
| 15039 | 0.32 mm | 0.50 µm | 30 m   | ea.   |
| 15042 | 0.32 mm | 0.50 µm | 60 m   | ea.   |
| 15045 | 0.32 mm | 0.50 µm | 105 m  | ea.   |
| 15051 | 0.32 mm | 1.0 µm  | 15 m   | ea.   |
| 15054 | 0.32 mm | 1.0 µm  | 30 m   | ea.   |
| 15057 | 0.32 mm | 1.0 µm  | 60 m   | ea.   |
| 15060 | 0.32 mm | 1.0 µm  | 105 m  | ea.   |
| 15069 | 0.32 mm | 1.5 µm  | 30 m   | ea.   |
| 15072 | 0.32 mm | 1.5 µm  | 60 m   | ea.   |
| 15075 | 0.32 mm | 1.5 µm  | 105 m  | ea.   |
| 15040 | 0.53 mm | 0.50 µm | 30 m   | ea.   |
| 15043 | 0.53 mm | 0.50 µm | 60 m   | ea.   |
| 15052 | 0.53 mm | 1.0 µm  | 15 m   | ea.   |
| 15055 | 0.53 mm | 1.0 µm  | 30 m   | ea.   |
| 15058 | 0.53 mm | 1.0 µm  | 60 m   | ea.   |
| 15070 | 0.53 mm | 1.5 µm  | 30 m   | ea.   |
| 15073 | 0.53 mm | 1.5 µm  | 60 m   | ea.   |
| 15085 | 0.53 mm | 3.0 µm  | 30 m   | ea.   |
| 15088 | 0.53 mm | 3.0 µm  | 60 m   | ea.   |
| 15091 | 0.53 mm | 3.0 µm  | 105 m  | ea.   |

### Rtx-200ms Low-Bleed GC Capillary Columns (fused silica)

- Rtx-200ms columns exhibit low bleed for use with sensitive detectors.
- Temperature range: -20°C to 340°C.
- Equivalent to USP G6 phase.

| Cat.# | ID      | df      | Length | Units |
|-------|---------|---------|--------|-------|
| 15620 | 0.25 mm | 0.25 µm | 15 m   | ea.   |
| 15623 | 0.25 mm | 0.25 µm | 30 m   | ea.   |
| 15635 | 0.25 mm | 0.50 µm | 15 m   | ea.   |
| 15638 | 0.25 mm | 0.50 µm | 30 m   | ea.   |
| 15653 | 0.25 mm | 1.0 µm  | 30 m   | ea.   |
| 15624 | 0.32 mm | 0.25 µm | 30 m   | ea.   |
| 15639 | 0.32 mm | 0.50 µm | 30 m   | ea.   |
| 15654 | 0.32 mm | 1.0 µm  | 30 m   | ea.   |
| 15640 | 0.53 mm | 0.50 µm | 30 m   | ea.   |
| 15655 | 0.53 mm | 1.0 µm  | 30 m   | ea.   |
| 15670 | 0.53 mm | 1.5 µm  | 30 m   | ea.   |

## Rtx-200 Secondary GC Capillary Columns for GCxGC (fused silica)

- Convenient 2 m length is ideal for use as a secondary column in GCxGC analyses.
- Temperature range: -20°C to 340°C.

| Cat.# | ID      | df      | Length | Units |
|-------|---------|---------|--------|-------|
| 15111 | 0.15 mm | 0.15 µm | 2 m    | ea.   |
| 15117 | 0.18 mm | 0.18 µm | 2 m    | ea.   |
| 15124 | 0.25 mm | 0.25 µm | 2 m    | ea.   |

## LPGC Rtx-200 Column Kit

- 1.9x faster fluorotelomer alcohols (FTOH) analysis with 60% less helium consumption.
- Factory-coupled, leak-free kit makes set up as simple as a column change.
- Ideal for speeding up GC-MS and GC-MS/MS methods.

| Catalog No. | Includes                                                                                                                       | Units |
|-------------|--------------------------------------------------------------------------------------------------------------------------------|-------|
| 11807       | 10 m x 0.32 mm ID x 1 µm Rtx-200 analytical column and 5 m x 0.15 mm ID Rxi restrictor factory connected via SilTite connector | kit   |

## Topaz Straight Inlet Liner

| ID x OD x Length          | Packing     | Similar to Part #                                                                                                                             | qty.  | cat.# |
|---------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|
| 4.0 mm x 6.3 mm x 78.5 mm | Quartz Wool | Agilent 19251-60540 (ea.); 5183-4691 (5-pk.); 5183-4692 (25-pk.); 5190-2294 (ea.); 5190-3164 (5-pk.); 5190-3168 (25-pk.); 5190-3172 (100-pk.) | 5-pk. | 23300 |

## Topaz Single Taper Inlet Liner

| ID x OD x Length          | Similar to Part #                                                                                                                           | qty.  | cat.# |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|
| 4.0 mm x 6.5 mm x 78.5 mm | Agilent 5181-3316 (ea.); 5183-4695 (5-pk.); 5183-4696 (25-pk.); 5190-2292 (ea.); 5190-3162 (5-pk.); 5190-3166 (25-pk.); 5190-3170 (100-pk.) | 5-pk. | 23302 |

## Topaz Single Taper with Quartz Wool Inlet Liner

| ID x OD x Length          | Packing     | Similar to Part #                                                                                                                           | qty.  | cat.# |
|---------------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|
| 4.0 mm x 6.5 mm x 78.5 mm | Quartz Wool | Agilent 5062-3587 (ea.); 5183-4693 (5-pk.); 5183-4694 (25-pk.); 5190-2293 (ea.); 5190-3163 (5-pk.); 5190-3167 (25-pk.); 5190-3171 (100-pk.) | 5-pk. | 23303 |

## Topaz Precision Inlet Liner

| ID x OD x Length          | Packing     | Similar to Part #  | qty.  | cat.# |
|---------------------------|-------------|--------------------|-------|-------|
| 4.0 mm x 6.3 mm x 78.5 mm | Quartz Wool | Agilent 210-4004-5 | 5-pk. | 23305 |

## FastPack Inlet Kits for Agilent GCs

- Convenient: all the parts you need in one package—no hunting for individual items.
- Economical: costs less than the sum of the individual parts.
- Clean: Mylar bag is factory sealed; no contamination of the products from weeks in the lab.

Each kit includes Viton O-ring; 0.8 mm ID gold-plated inlet seal and washer; 11 mm Thermolite Plus CenterGuide septum

| Type                                        | qty.           | cat.# |
|---------------------------------------------|----------------|-------|
| 4 mm Topaz Straight Liner                   | pack of 5 kits | 21101 |
| 4 mm Topaz Single Taper                     | pack of 5 kits | 21102 |
| 4 mm Topaz Straight with Wool               | pack of 5 kits | 21104 |
| 4 mm Topaz Single Taper Splitless with Wool | pack of 5 kits | 23258 |
| 4 mm Topaz Precision with Wool              | pack of 5 kits | 23259 |





22656

#### Flowmeter Specifications

Type of Flowmeter: Volumetric  
 Battery: 2-AA  
 Operating Temp. Range: 32–120 °F (0–48 °C)  
 Warranty: One-year warranty (excludes recalibration)  
 Certification/Compliance: CE, Ex, Canadian ICES-003,  
 WEEE, RoHS 2, China RoHS 2, UKCA

### Restek ProFLOW 6000 Electronic Flowmeter

The Restek ProFLOW 6000 is the only flowmeter you need for any type of chromatography gas measurement because of its wide range of capabilities. The ProFLOW 6000 is an electronic meter capable of measuring volumetric flow for most gases. Real-time measurements can be made for various types of flow paths, including continually changing gas types. This portable unit is designed for easy handheld use, and the stand adds benchtop convenience.

- Measures volumetric flow for gases across a range of 0.5–500 mL/min.
- NIST traceable calibration.
- Ex rating (electrical apparatus for explosive gas atmospheres) for hydrogen and related gas types.
- Accuracy of  $\pm 2.00\%$  of flow reading or  $\pm 0.200$  mL/min, whichever is greater.
- Over-range warning indicator.
- Auto shutoff feature.
- Use as a benchtop or handheld unit.
- Ergonomic design and side grips for comfort.
- Measures most gas types.\*
- Convenient carrying/storage case included.
- Uses two AA batteries (included).
- Data output via USB port.
- One-year warranty (excludes recalibration).
- Recalibration service available.

\*The flowmeter is designed to measure clean, dry, noncorrosive gases.

| Cat.# | Product Name                                                           | Units |
|-------|------------------------------------------------------------------------|-------|
| 22656 | Restek ProFLOW 6000 Electronic Flowmeter with Hard-Sided Carrying Case | ea.   |

Patented

## Be Certain with Restek Reference Standards

Precision data can only be delivered by high-purity, rigorously controlled reference standards. With decades of chemical expertise, Restek standards ensure accuracy and reliability.

- Fully characterized starting materials blended for maximum stability and convenience.
- Professionally formulated mixes reduce time, expense, and uncertainty compared to in-house preparation.
- Single and multicomponent standards covering a wide range of compounds and classes.



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Lit. Cat.# GNSS4041A-UNV