

Acidic Compounds Analysis

Stabilwax®-DA Columns (fused silica)

(polar phase; Crossbond® acid-deactivated Carbowax® polyethylene glycol—for acidic compounds)

- Application-specific columns for free (underivatized) acids, some inorganic acids.
- Resistant to oxidative damage.
- Temperature range: 40 °C to 260 °C.
- Equivalent to USP G25, G35 phases.

Stabilwax®-DA bonded polyethylene glycol has an acidic functionality incorporated into the polymer structure. This permits analysis of acidic compounds without derivatization, significantly reduces adsorption of acids, and increases sample capacity for volatile free acids. Stabilwax®-DA columns last longer and give better peak shapes for high molecular weight acids.

Some inorganic acids also chromatograph well on a Stabilwax®-DA column; the limitation is the volatility of the acidic compound.

similar phases

HP-FFAP, DB-FFAP, CP-WAX 58 FFAP CB, NUKOL, ZB-FFAP

crossbond® technology

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

please note

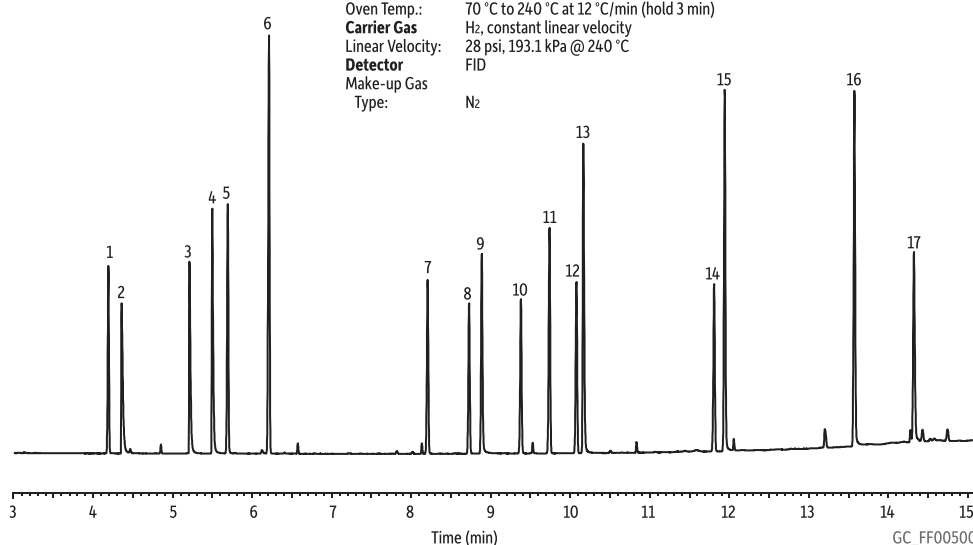
Stabilwax®-DA columns should not be rinsed with water.

ID	df	temp. limits	15-Meter cat.#	30-Meter cat.#	60-Meter cat.#
0.25 mm	0.10 µm	40 to 250/260 °C	11005	11008	
	0.25 µm	40 to 250/260 °C	11020	11023	11026
	0.50 µm	40 to 250/260 °C	11035	11038	11041
0.32 mm	0.10 µm	40 to 250/260 °C		11009	
	0.25 µm	40 to 250/260 °C	11021	11024	11027
	0.50 µm	40 to 250/260 °C	11036	11039	11042
	1.00 µm	40 to 240/250 °C	11051	11054	11057
0.53 mm	0.10 µm	40 to 250/260 °C	11007		
	0.25 µm	40 to 250/260 °C	11022	11025	
	0.50 µm	40 to 250/260 °C	11037	11040	
	1.00 µm	40 to 240/250 °C	11052	11055	11058
	1.50 µm	40 to 230/240 °C	11062	11065	11068

Underivatized Alcoholic Beverage Acids and Methyl Esters on Stabilwax®-DA

Column Stabilwax®-DA, 30 m, 0.18 mm ID, 0.18 µm (cat.# 550752)
Sample Ethyl acetate
Diluent:
Injection
 Inj. Vol.: 1 µL splitless (hold 0.5 min)
 Liner: Splitless (4 mm ID) w/glass wool (cat.# 20814-202.1)
 Inj. Temp.: 240 °C
Oven
 Oven Temp.: 70 °C to 240 °C at 12 °C/min (hold 3 min)
Carrier Gas H₂, constant linear velocity
 Linear Velocity: 28 psi, 193.1 kPa @ 240 °C
Detector FID
 Make-up Gas
 Type: N₂

Peaks	Conc. (µg/mL)
1. Ethyl octanoate	100
2. Acetic acid	100
3. Propionic acid	100
4. Isobutyric acid	100
5. 3-Decanol	50
6. Ethyl decanoate	50
7. Ethyl laurate	50
8. <i>cis</i> -Lactone	100
9. 2-Phenylethanol	50
10. <i>trans</i> -Lactone	100
11. Methyl myristate	50
12. Ethyl myristate	50
13. Octanoic acid	100
14. Ethyl palmitate	50
15. Decanoic acid	100
16. Dodecanoic acid	100
17. Vanillin	100





Basic Compounds Analysis

Rtx®-Volatile Amine Columns (fused silica)

- Unique selectivity for baseline resolution of all volatile amines.
- Excellent inertness assures accuracy and sensitivity for volatile amines, including free ammonia.
- Highly robust phase withstands repeated water injections, resulting in longer column lifetime.
- High temperature stability (290 °C) ensures elution of amines up to C16 and allows contaminants to be removed by “baking out” the column.

The Rtx®-Volatile Amine column was designed specifically for analyzing volatile amines in difficult matrices, such as water. The unique base deactivation creates an exceptionally inert surface for these sensitive compounds, resulting in highly symmetrical peaks, which allow low detection limits. The stable bonded phase yields a column that is not only retentive and highly selective for these compounds but is also very robust and able to withstand repeated water injections. Comparisons made by customers performing routine volatile amine applications have shown the Rtx®-Volatile Amine column outperforms other amine-specific columns, especially for peak shape and lifetime. Each Rtx®-Volatile Amine column is held to stringent quality specifications and tested with a specially designed test mix that includes basic compounds to ensure exceptional inertness, reliability, and reproducibility. These qualities assure consistent performance and make the Rtx®-Volatile Amine column the best choice for volatile amines analysis.

similar phases

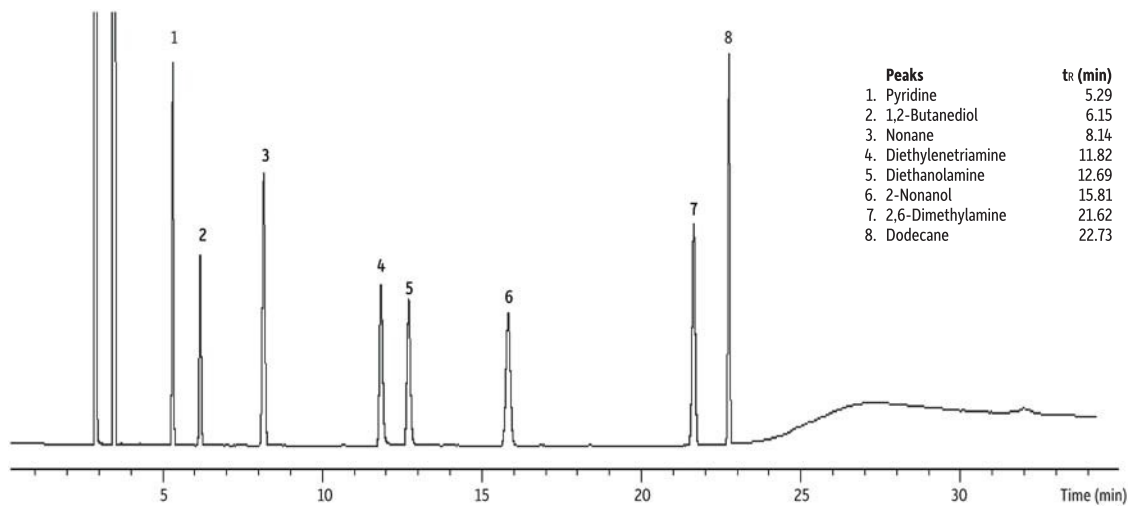
CP-Volamine

please note

We recommend using base-deactivated fused silica guard columns ([page 22](#)) and base-deactivated liners ([page 203](#)) with Rtx®-Volatile Amine columns.

ID	temp. limits	15-Meter cat.#	30-Meter cat.#	60-Meter cat.#
0.32 mm	-60 to 270/290 °C	18076	18077	18078

Volatile Amine Test Mix on Rtx®-Volatile Amine (60 m x 0.32 mm ID)



Column Rtx®-Volatile Amine, 60 m, 0.32 mm ID (cat.# 18078)
Sample Volatile amine column test mix (cat.# 35008)
Diluent: Methanol:dichloromethane (50:50)
Conc.: 900-1,800 µg/mL snap and shoot
Injection
Inj. Vol.: 1 µL split (split ratio 17.8:1)
Liner: Sky® 4 mm single taper w/wool (cat.# 23303.1)
Inj. Temp.: 250 °C
Split Vent
Flow Rate: 60 mL/min
Oven
Oven Temp.: 160 °C (hold 21 min) to 290 °C at 40 °C/min (hold 10 min)

Carrier Gas He, constant flow
Flow Rate: 3.4 mL/min
Detector FID @ 300 °C
Make-up Gas
Flow Rate: 30 mL/min
Make-up
Gas Type: N₂
Data Rate: 50 Hz
Instrument Agilent/HP6890 GC

Time (min)

GC_PC1228

Basic Compounds Analysis

Restek
innovation!

similar phases

Optima-5Amine

Rtx®-5 Amine Columns (fused silica)

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

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

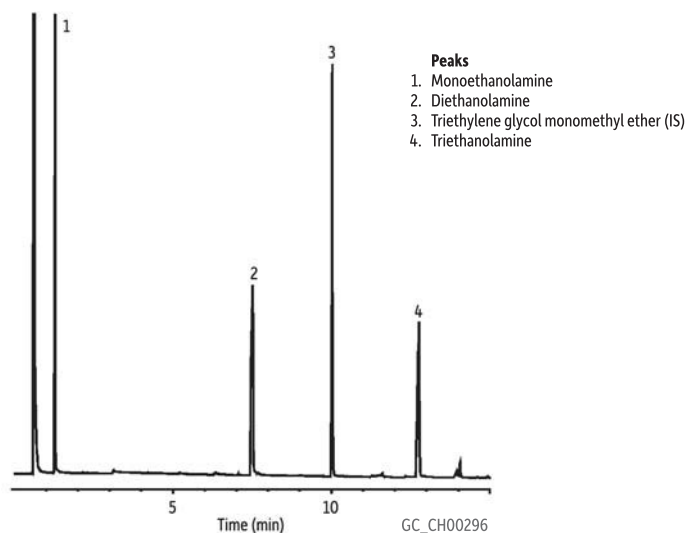
Active basic compounds that otherwise require derivatization, or an alternative analytical technique, can be analyzed on an Rtx®-5 Amine column. The tubing surface is chemically altered to reduce tailing of basic compounds, eliminating the need for column priming. An Rtx®-5 Amine column is ideal for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

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

please note

We recommend using base-deactivated fused silica guard columns ([page 22](#)) and base-deactivated liners ([page 203](#)) with Rtx®-5 Amine columns.

Ethanolamines on Rtx®-5 Amine



Column Rtx®-5 Amine, 15 m, 0.25 mm ID, 0.50 µm (cat.# 12335)
Sample Ethanolamine mix
Diluent: Methanol
Conc.: 34 ng on column
Injection
 Inj. Vol.: 1.0 µL split (split ratio 58:1)
 Inj. Temp.: 280 °C
Oven
 Oven Temp.: 50 °C (hold 2 min) to 180 °C at 10 °C/min (hold 2 min)
Carrier Gas H₂, constant pressure
 Linear Velocity: 43 cm/sec @ 50 °C
Detector FID @ 300 °C
Notes FID sensitivity: 6.4 x 10⁻¹¹ AFS



Basic Compounds Analysis

Rtx®-35 Amine Columns (fused silica)

(midpolarity phase; Crossbond® 35% diphenyl/65% dimethyl polysiloxane)

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

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

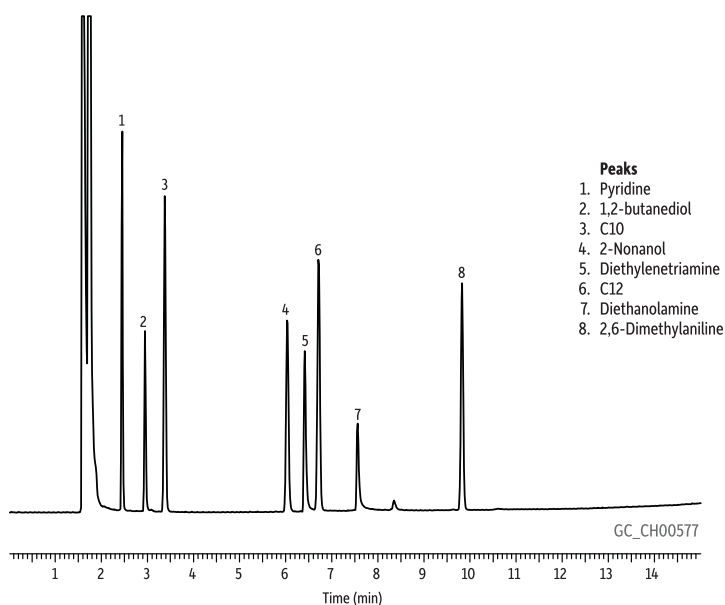
ID	df	temp. limits	15-Meter cat.#	30-Meter cat.#
0.25 mm	0.50 µm	0 to 220 °C	11335	11338
	1.00 µm	0 to 220 °C	11350	11353
0.32 mm	1.00 µm	0 to 220 °C	11351	11354
	1.50 µm	0 to 220 °C	11366	11369
0.53 mm	1.00 µm	0 to 220 °C	11352	11355
	3.00 µm	0 to 220 °C		11385

Restek innovation!

please note

We recommend using base-deactivated fused silica guard columns ([page 22](#)) and base-deactivated liners ([page 203](#)) with Rtx®-35 Amine columns.

Amine Test Mix Rtx®-35 Amine



Column Rtx®-35 Amine, 30 m, 0.53 mm ID, 1.00 µm (cat.# 11355)
Sample Amine column test mix (cat.# 35002)
Diluent: Methanol/methylene chloride
Conc.: 450-900 ppm
Injection
Inj. Vol.: 1.0 µL split (split ratio 10:1)
Liner: Splitless taper (4 mm), base deactivated (cat.# 20798-210.1)
Inj. Temp.: 250 °C
Oven
Oven Temp.: 110 °C (hold 4 min) to 200 °C at 8 °C/min (hold 5 min)
Carrier Gas He, constant pressure
Linear Velocity: 30 cm/sec
Detector FID @ 300 °C



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similar phases

CAM, CP-WAX 51 for Amines,
Carbowax® Amine


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Basic Compounds Analysis

Stabilwax®-DB Columns (fused silica)

(polar phase; Crossbond® base-deactivated Carbowax® polyethylene glycol—for amines and basic compounds)

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

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

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

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

Volatile Organic Compounds by U.S. EPA Method 1671 on Stabilwax®-DB

Peaks	tr (min)	Conc. (µg/mL)
1. Dimethylamine	1.71	200
2. Methylamine	1.76	200
3. Diethylamine	2.46	200
4. Triethylamine	2.64	200
5. Tetrahydrofuran (IS)	4.88	100
6. Methanol	7.12	40
7. Ethanol	8.01	40
8. Acetonitrile	9.82	200
9. <i>n</i> -Propanol	11.03	200
10. Methyl Cellosolve®	15.56	200
11. Formamide	18.68	500
12. Dimethyl sulfoxide	23.75	100
13. Ethylene glycol*		500

*Included in sample, but does not elute due to base deactivation in the DB phase.

Columns Stabilwax®-DB 30 m, 0.32 mm ID, 1.00 µm (cat.# 10854) and Stabilwax® 30 m, 0.32 mm ID, 1.00 µm (cat.# 10654) using IP deactivated guard column 5 m, 0.53 mm ID (cat.# 10045) with SeCure® "Y" connector kit (cat.# 20278)

Sample 1671 Volatile organics mix

Diluent: Deionized water

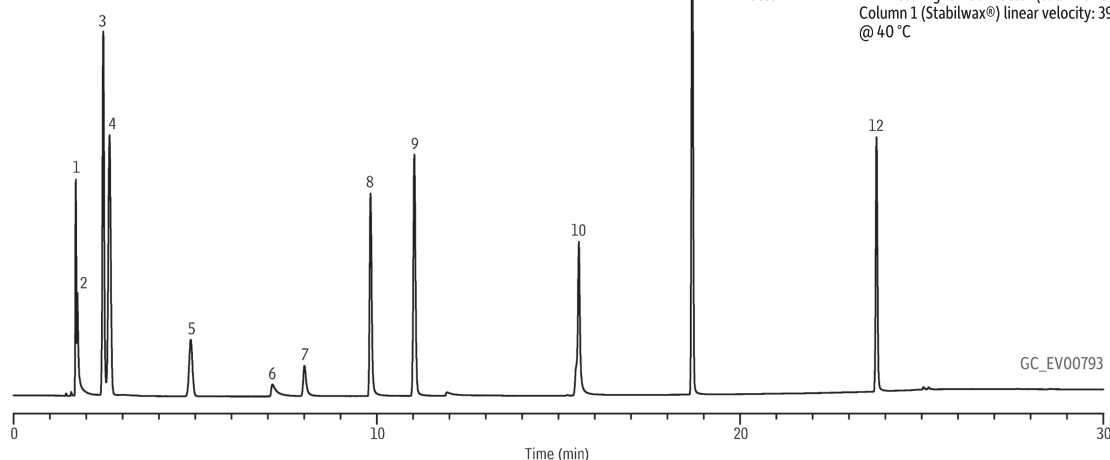
Injection Inj. Vol.: 1.0 µL split (split ratio 12:1)
Liner: Gooseneck splitless (4 mm) (cat.# 20798)
Inj. Temp.: 200 °C

Oven Oven Temp.: 40 °C (hold 5 min) to 180 °C at 7 °C/min (hold 5 min)

Carrier Gas He, constant pressure
Linear Velocity: 39.68 cm/sec @ 40 °C

Detector FID @ 250 °C

Notes "Y" Press-Tight® Connector (cat.# 20405) also used
Column 1 (Stabilwax®) linear velocity: 39.25 cm/sec @ 40 °C



Chiral Analysis

Cyclodextrin Columns for Analyzing Many Chiral Compounds

By adding β or γ cyclodextrin to our bonded Rtx®-1701 stationary phase, we greatly enhance overall utility and column lifetime for our chiral columns, compared to columns that have pure cyclodextrin stationary phases. Separations of more than one hundred chiral compounds have been achieved using our unique DEX columns, and our columns continue to demonstrate stability after hundreds of temperature program cycles.

Rt®- γ DEXsa Columns (fused silica)

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

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

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

Rt®- β DEXm Columns (fused silica)

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

Uses: General-purpose chiral phase with many published applications.

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

Rt®- β DEXsm Columns (fused silica)

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

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

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

Rt®- β DEXse Columns (fused silica)

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

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

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

Rt®- β DEXsp Columns (fused silica)

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

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

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

Rt®- β DEXsa Columns (fused silica)

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

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

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

Rt®- β DEXcst Columns (fused silica)

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

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

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

free literature

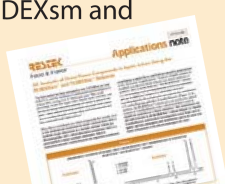
Grape Flavor Analysis, Using an Rt®- γ DEXsa GC Column

lit. cat.#
59553



GC Analysis of Chiral Flavor Compounds in Apple Juices, Using Rt®- β DEXsm and Rt®- β DEXse Columns

lit. cat.#
59546



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tech tip

Lower elution temperatures significantly improve chiral selectivity.

This can be achieved the following ways:

- Faster linear velocities (80 cm/sec) with hydrogen carrier gas.
- Slower temperature ramp rates (1–2 °C/min).
- Appropriate minimum operating temperature (40 or 60 °C).
- On-column concentrations of 50 ng or less.