Chemical Industry

LC & GC Separation Solutions Guide

Petroleum Oils

Commodity and Specialty Chemicals

High pH Conditions

Carbohydrates and Saccharides

Low pH Conditions

phenomenex®

...breaking with tradition℠

At our core, Phenomenex is a separation science company that creates unique technologies to provide solutions for our customers.

In this guide you will find key separation solutions for the Chemical industry, powered by Phenomenex separation products.

For the entire product portfolio and technical guidance visit **www.phenomenex.com**

Have a question or just want to chat about your latest chromatographic endeavor? Contact our technical experts 24 hours a day, 7 days a week.

www.phenomenex.com/chat

Contents

Our Story

Every great company has a story, and we take tremendous pride in telling ours. In 1982 from its humble beginnings in a garage, Phenomenex grew to a global firm spanning 6 continents in only three decades.

In 1985 we opened our first manufacturing line for HPLC columns where our core strength as a chromatography chemistry innovator began.

In 1997 we acquired a leading GC technology company, InventX, from Dr. Robert Wohleb, further expanding our capabilities within the GC manufacturing space.

Phenomenex today is a global leader in separation science technology.

Explore Our Expansive Portfolio of Technologies

www.phenomenex.com

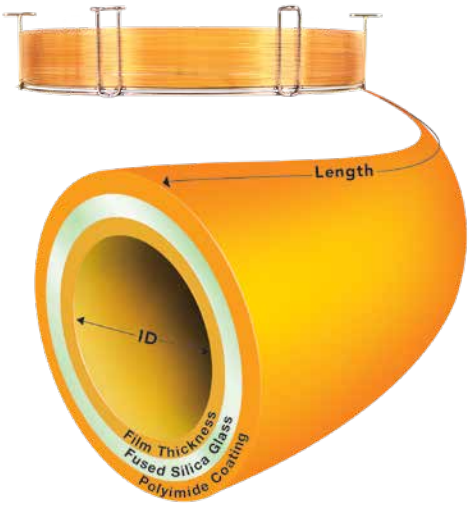
Selecting a GC Column Phase

The Master Resolution Equation

How do you choose a column? Do you reach into a cabinet of mystery columns, look to your favorite 5 % phenyl phase, or borrow one from a colleague? Understanding how column paramaters impact key elements of the master resolution equation will help you quickly make the right column selection for successful separations.

$$R_s = \left[\frac{\sqrt{N}}{4}\right] \times \left[\frac{\alpha - 1}{\alpha}\right] \times \left[\frac{k}{k+1}\right]$$

	Efficiency Term	Selectivity Term	Retention Term
Relates to:	Column Length Column ID Carrier Gas Linear Velocity	Column Phase Temperature	Column ID Film Thickness Temperature



Length

Longer columns can improve resolution, but they will also increase run times. Under isothermal conditions, doubling column length only increases resolution by 41 %, but doubles the run time! Choose a column length that balances efficiency with acceptable run times.

Short — **Long**

15 m or less

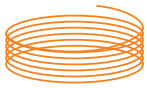
Applications
- High boilers
- GC-MS applications

Advantages
- Faster run times
- Higher temp. limits
- Lower bleed
- Higher efficiency

Disadvantages
- Less inert
- Limited retention

Good Starting Length

30 m



60 m or more

Applications
- Complex samples with closely eluting peaks
- Low boilers
- Less active samples
- Complex temperature ramps

Advantages
- Better resolution

Disadvantages
- Slow run times

Internal Diameter

Column internal diameter (ID) has a major impact on both resolution and sample capacity. Unlike column length, using smaller ID columns can actually lead to faster run times, because the column length required with a small ID is often shorter due to increased efficiency.

Narrow — **Wide**

0.10, 0.18, 0.20 mm

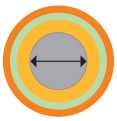
Applications
- Complex samples

Advantages
- Faster run times
- Better resolution

Disadvantages
- Lower sample capacity
- Easily overloaded

Good Starting ID

0.25 mm



0.32, 0.53 mm

Applications
- Dirty samples
- Highly concentrated samples

Advantages
- Increased sample capacity
- Good for on-column injections

Disadvantages
- Decreased efficiency
- May need higher flow rates and not compatible with most GC-MS

Film Thickness

Film thickness determines solute retention and plays an important role in column sample capacity. Thin film columns are faster and provide higher resolution, but lower sample capacity. In most instances, choose the thinnest film possible that still provides adequate retention. When working with active samples, using a slightly thicker film can significantly improve peak shape.

Thin — **Thick**

0.10, 0.18 µm

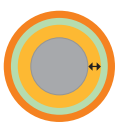
Applications
- High boilers
- GC-MS applications

Advantages
- Faster run times
- Higher temp. limits
- Lower bleed
- Higher efficiency

Disadvantages
- Less inert
- Limited retention

Good Starting Film

0.25 µm



0.50 µm or more

Applications
- Low boilers
- Gases, solvents, purgeables, volatiles
- Purity testing

Advantages
- Better inertness
- Higher capacity

Disadvantages
- Slower run times
- Lower temp. limits
- Higher bleed

Selectivity Has the Biggest Impact on Resolution

Resolution between two analytes is mainly determined by the selectivity of the stationary phase. By increasing the resolution between two compounds, the total analysis time can often be reduced significantly!

Selectivity vs. Polarity

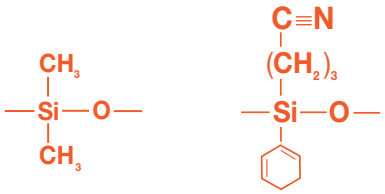
Polarity gives a general guideline for sample capacity and separation, which can affect peak shape and resolution. However, two columns may have similar polarity but show different separation profiles due to dissimiliar phase chemistries. For example, Zebron™ ZB-35 and ZB-1701 are close in polarity, but the cyanopropyl group makes ZB-1701 very different from ZB-35 in terms of selectivity.

ZB-35
Polarity: 18

65 % Dimethylpolysiloxane

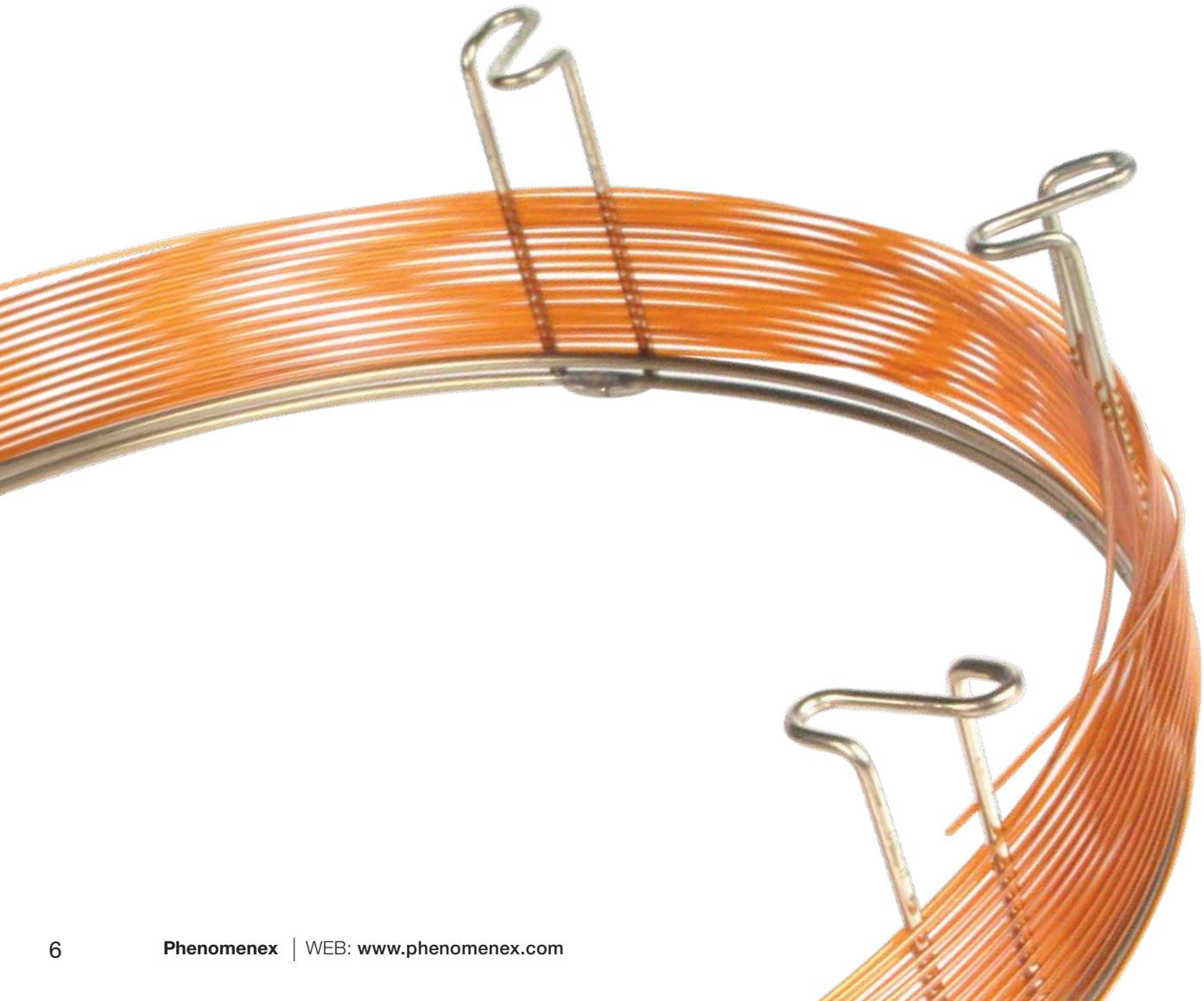
35 % Phenyl

ZB-1701
Polarity: 19



86 % Dimethylpolysiloxane

14 % Cyanopropylphenyl



Selected Zebron™ Polarities

Polarity

5	ZB-1	Non-polar phase suited for boiling point separations. 100 % Dimethylpolysiloxane
	ZB-DHA-PONA	Non-polar phase tested for Detailed Hydrocarbon Analysis. 100 % Dimethylpolysiloxane
	ZB-1*PLUS*™	Low bleed phase for non-polar compounds. 100 % Dimethylpolysiloxane
	ZB-1HT Inferno	Non-metal high temperature stability up to 430 °C for non-polar compounds. 100 % Dimethylpolysiloxane
	ZB-1XT SimDist	Glass Infusion™ metal column technology for efficient, reproducible separations up to 450 °C. 100 % Dimethylpolysiloxane
8	ZB-5	Low polarity phase for general purpose use. 5 % Phenyl
	ZB-5ms	General purpose with enhanced selectivity for aromatics. 5 % Phenyl-Arylene
	ZB-5*PLUS*™	Versatile, low bleed, inert for multi-use applications and improved peak shape of acidic/basic compounds. 5 % Phenyl
	ZB-5MS*PLUS*™	The next generation of inertness for specialty chemical, forensic, toxicology, and food testing applications. 5 % Phenyl-Arylene
	ZB-5HT Inferno	Non-metal high temperature stability (up to 430 °C) for high boiling point compounds. 5 % Phenyl
	ZB-SemiVolatiles	Semi-volatiles (SVOCs), PAHs, PBDEs. Supreme inertness for acids, amines, and other notoriously active compounds. 5 % Phenyl-Arylene
9	ZB-XLB	Low polarity proprietary si-arylene phase with extra low bleed for sensitive analyses
	ZB-XLB-HT Inferno	Non-metal proprietary si-arylene high temperature stability up to 400 °C with extra low bleed
11	ZB-MultiResidue™-1	Novel proprietary phase designed for pesticides, herbicides, and insecticides
13	ZB-624*PLUS*™	Optimized proprietary phase for volatile organic compounds (VOCs) and organic volatile impurities (OVIs). High temperature stability (300/320 °C)
15	ZB-MultiResidue-2	Novel proprietary phase designed for pesticides, herbicides, and insecticides
18	ZB-35	Intermediate polarity for high molecular weight samples and method development screening. 35 % Phenyl
	ZB-35HT Inferno	Intermediate polarity with high temperature stability up to 400 °C. 35 % Phenyl
19	ZB-1701 ZB-1701P	Alternate selectivity to phenyl phases, with similar polarity. 14 % Cyanopropylphenyl
24	ZB-50	High polarity 50 % Phenyl phase with stability for high temperature bakeouts
52	ZB-WAX*PLUS*™	100 % aqueous stability with high retention of alcohols and chlorinated solvents. 100 % Polyethylene Glycol (PEG)
57	ZB-WAX	Bonded, solvent rinseable phase excellent for complex polar samples. 100 % Polyethylene Glycol (PEG)
	ZB-FFAP	Excellent peak shape for underivatized acids, organic acids, free fatty acids, and alcohols. 100 % Nitroterephthalic Modified Polyethylene Glycol
Proprietary	ZB-FAME	ZB-FAME proprietary high cyano phase for high polar analytes and great for fatty acid methyl esters (FAMEs), Cis/trans FAME isomers

For Non-Polar Analytes

- Alkanes
- Aromatics
- Oils
- Boiling Point Separations

PLUS

Upgrades compared to their Essentials counterparts—from exceptional inertness to enhanced aqueous stability

For Slightly Polar Analytes

- Volatiles
- Drugs
- Pesticides

Inferno™

Resilient under even the most intense GC conditions, Inferno phases dare to defy high boilers, contaminants, and carry-overs

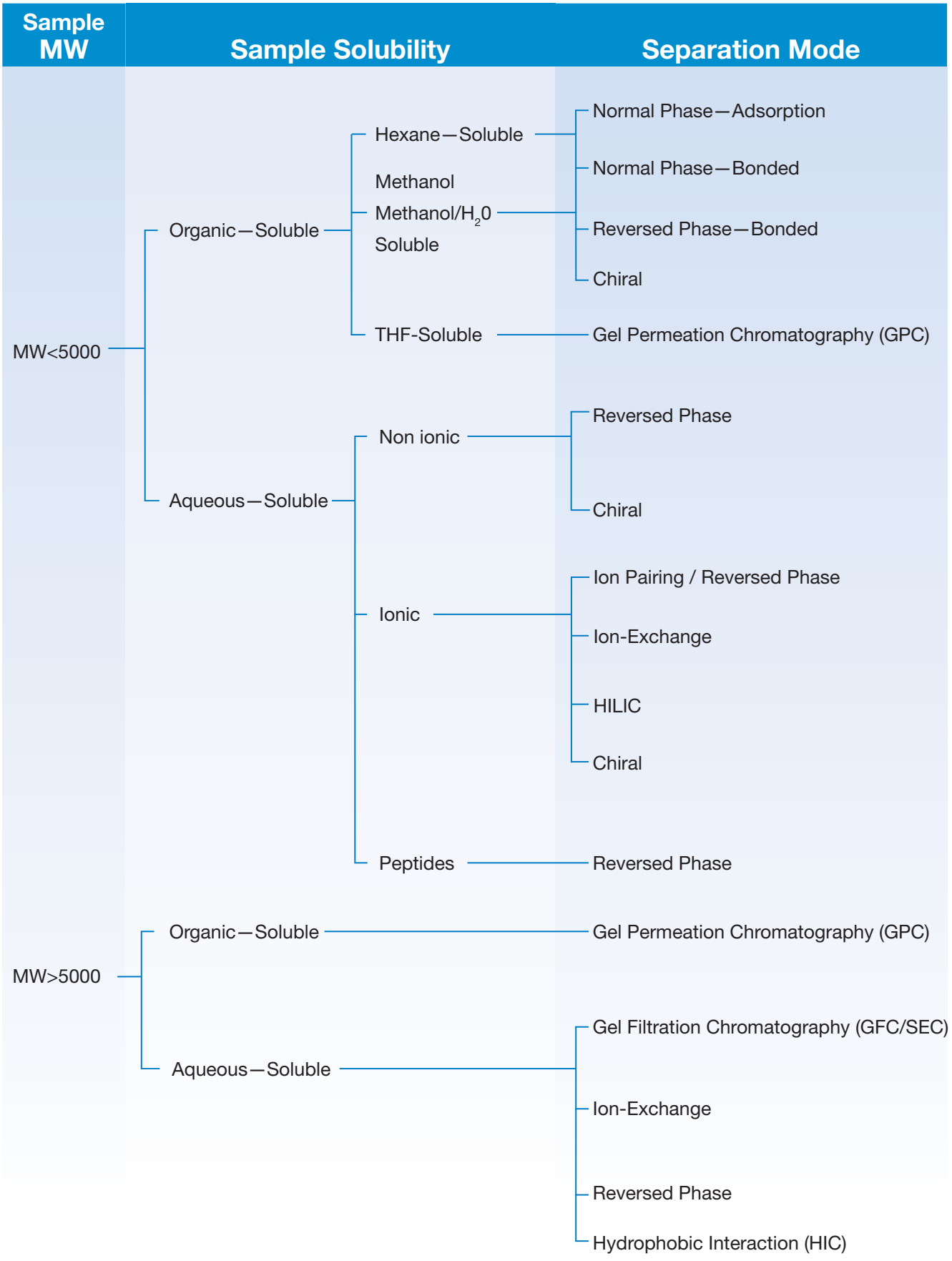
For Very Polar Analytes

- Polar Volatiles
- Alcohols
- Phenols
- Acids

Selecting an LC Column Phase

In the beginning, use the matrix and analyte identities to determine the best LC method for the application. Start with the molecule's size and then whether it is organic or aqueous soluble.

Each situation will dictate which method is best for separating the analytes of interest. For scouting to dial in on the optimum method please contact our technical experts at **www.phenomenex.com/chat**

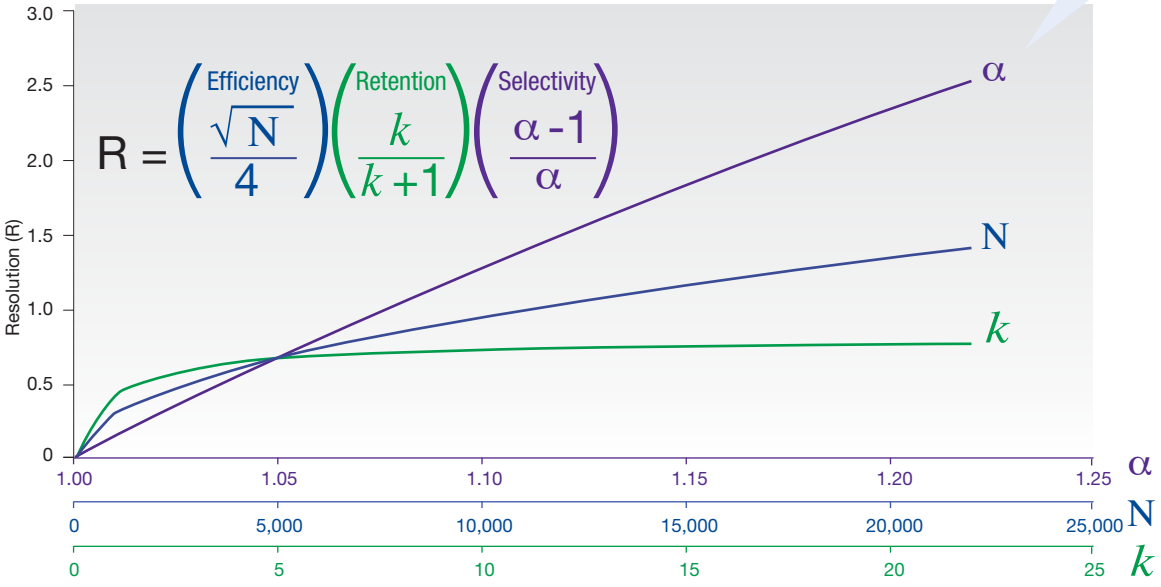


The Importance of Selectivity

Selectivity (α) has the greatest impact on changing resolution (R), as compared to efficiency (N) and retention (*k*), and the easiest way to change your chromatographic results is to change your column phase. Phenomenex provides a wide breadth of phase chemistries across multiple solid supports for easier and faster method development and optimization.

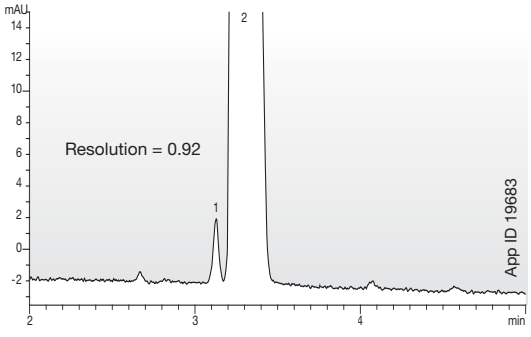
The Impact of Selectivity on Resolution

Selectivity is the most important parameter for increasing resolution.



Change Your Selectivity, Dramatically Change Your Results

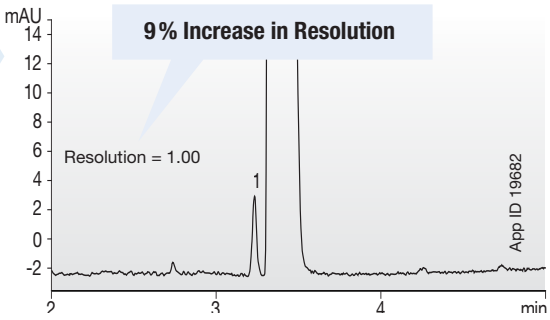
Gemini® 5µm NX-C18



Conditions same for all columns:
Columns: as noted
Dimensions: 150 x 4.6 mm
Mobile Phase: A: 20 mM Potassium phosphate, pH 2.5
B: Acetonitrile
Gradient: A/B (75:25) to (15:85) in 15 minutes
Flow Rate: 1.5 mL/min
Temperature: Ambient
Detection: UV (ambient)
Sample: 1. Impurity A
2. Oxymetazoline

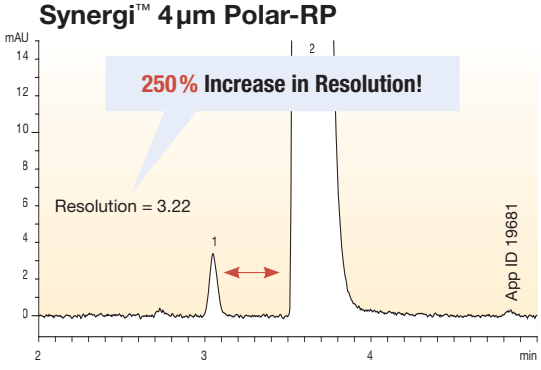
Option 1:
Increase Efficiency
(5 µm to 3 µm particle)

Gemini 3µm NX-C18



Option 2:
Change Selectivity
(C18 to ether-linked phenyl)

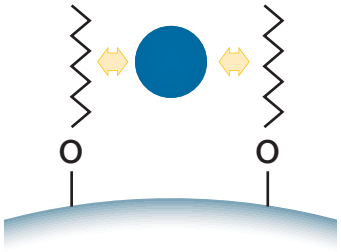
Synergi™ 4µm Polar-RP



Characterizing Selectivity

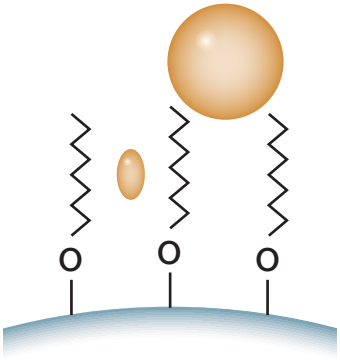
Though hydrophobicity is a dominant retention mechanism in reversed phase chromatography, selectivity is strongly influenced by the other parameters described below.

Step 1: The Primary Parameters Influencing Selectivity



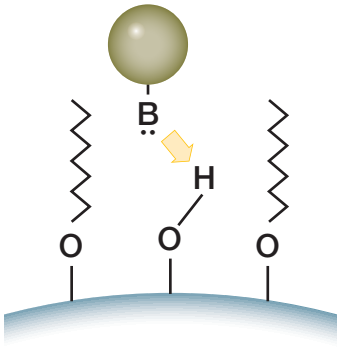
Hydrophobicity

These interactions occur with all analytes. They are always present and are dominant for neutral compounds.



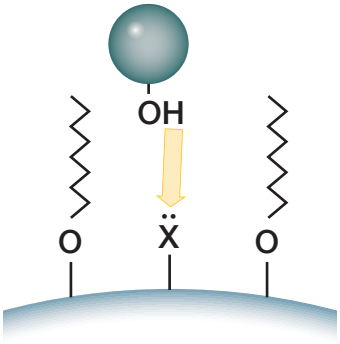
Steric Influences

A measurement of the accessibility of solutes to the stationary phase. Structural differences between compounds can lead to different retention characteristics due to shape selectivity.



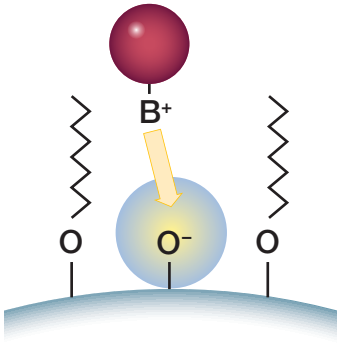
Hydrogen Bond (H-bond) Donating Capacity

This interaction can be attributed to an exposed silanol or an intentionally added polar functional group. Phenomenex employs the latter technique to create phases that have the ability to hydrogen bond with proton accepting groups like weak bases (amines and amides).



Hydrogen Bond (H-bond) Accepting Capacity

Like the hydrogen bond donating capacity parameter, Phenomenex engineers phases that have the ability to hydrogen bond and interact with proton donating acidic groups such as carboxylic acids or alcohols.



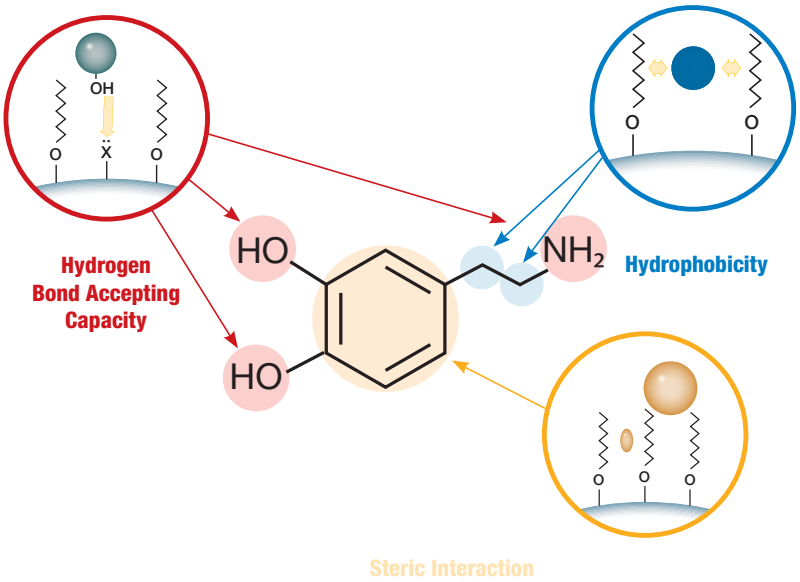
Cation Selectivity at pH 7.0

At neutral pH, residual silanols on the silica surface will be largely ionized, increasing the cation-exchange component of selectivity.

Cation Selectivity at pH 2.8

At low pH, most residual silanols are neutral and the cation-exchange component will be reduced.

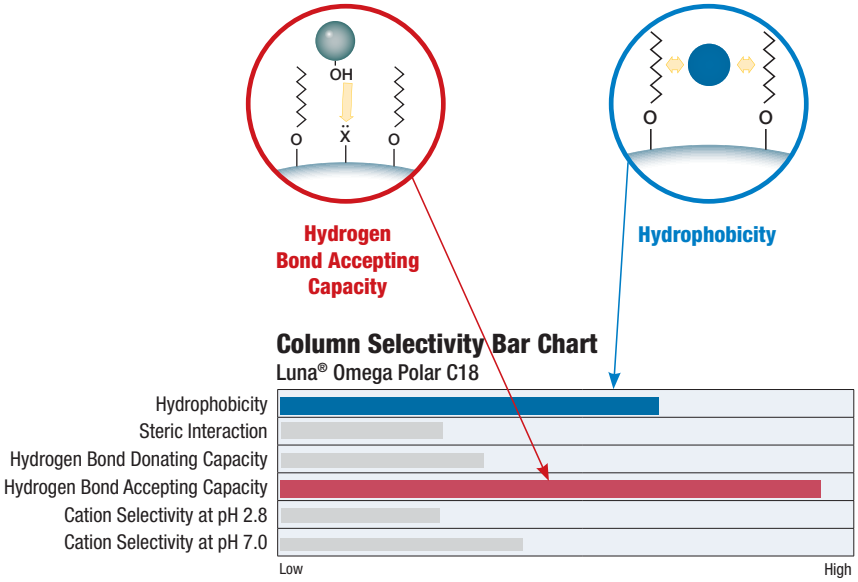
Step 2: Relating Selectivity to Stationary Phases



Observe:

The relationship between the structural features and functional groups of compounds and how to relate them to column selectivity profiles.

Step 3: Select a Column Selectivity Profile



Select:

A column phase with the highest degree of selectivity for each related category.

Selecting a Sample Preparation Product

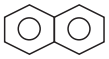
Solid Phase Extraction (SPE) is a very targeted form of sample preparation that allows you to isolate your analyte of interest while removing any interfering compounds that may be in your sample.

- A method for rapid sample preparation
- Used to selectively extract, concentrate, and purify target analytes. Terrific preparatory tool for analysis by HPLC or GC.

The key element to any SPE product is the sorbent.

- The physiochemical properties of the sorbent determine extraction efficiency and the overall quality of the separation.
- SPE sorbents are available in a wide range of surface chemistries, pore sizes, particle sizes, and base supports (silica, alumina, polymers).
- The optimal sorbent for any given extraction problem is dependent upon the properties of the target analyte, the sample/matrix composition, as well as physiochemical properties of typical SPE sorbents along with their particle size, surface area, and pore size.

To find the best SPE sorbent for your analysis, identify the general mechanism based on you sample type, then determine the most specific Strata® or Strata-X SPE sorbent by matching the analyte functional groups to the sorbent functional group.

Sample Matrix	SPE Mechanism	Analyte Functional Group	Sorbent Functional Group	Polymeric SPE Sorbent (strataX)	Silica-Based SPE Sorbent (strata)
Aqueous — Add Water	**Reversed Phase**	R ~ hydrocarbon  aromatic	R ~ hydrocarbon  aromatic	X, XL	C18-E, C18-U, C8 C18-T PH, SDBL
Organic (Water Miscible) — For ionic species only	**Ion-Exchange**	NR_4^+ strong RNH_3^+ weak RSO_3^- strong RCO_2^- weak	$-O_2C$—weak $-O_3S$—strong ^+H_3N—weak ^+R_3N—strong	X-CW, XL-CW XL-C, X-C X-AW, XL-AW X-A, XL-A	WCX Screen-C, SCX NH_2 Screen-A, SAX
Organic (Water Immiscible) — Add Hexane	**Normal Phase**	R - OH hydroxyl R - NH_2 amino	CN polar OH polar		CN, NH_2 Si-1, CN, EPH

Sample Prepeartion Support at Your Fingertips
www.phenomenex.com/SamplePrep

How Sweet (and Non-sweet) It Is

Carbohydrates and Saccharides:
Monosaccharides and Polysaccharides

Chemicals isolated as natural products from plants or from carbohydrate feedstocks are typically restricted to ultrafine chemicals and a relatively few fine chemicals, with the exception of ethanol for fuel.

Specialty chemicals can be synthesized from polyol starting materials such as d-glucose, d-xylose, l-arabinose, and glycerol. These starting materials, in turn, are derived from renewable feedstocks derived from plants such as starch, hemicellulose, cellulose, and oils.

Applications:

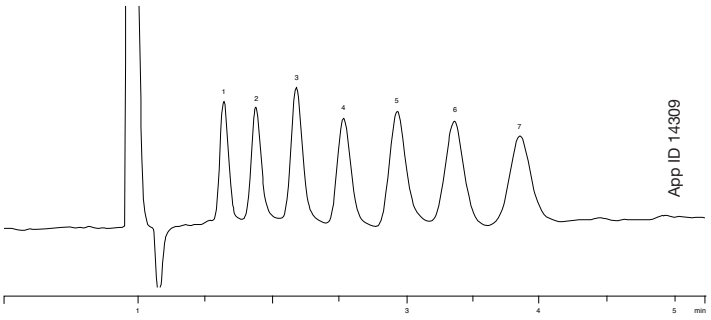
- Complex Sugars
- Simple Sugars
- Amino Sugars
- Sugars and Organic Acids
- Oligosaccharides

Featured Applications

Complex Sugars

Luna® NH_2

Luna NH_2 is a 100 % aqueous stable versatile phase that can retain analytes by normal, reversed, ion-exchange, and HILIC mode. As seen here, it works great to retain sugars and saccharides by HILIC mode.

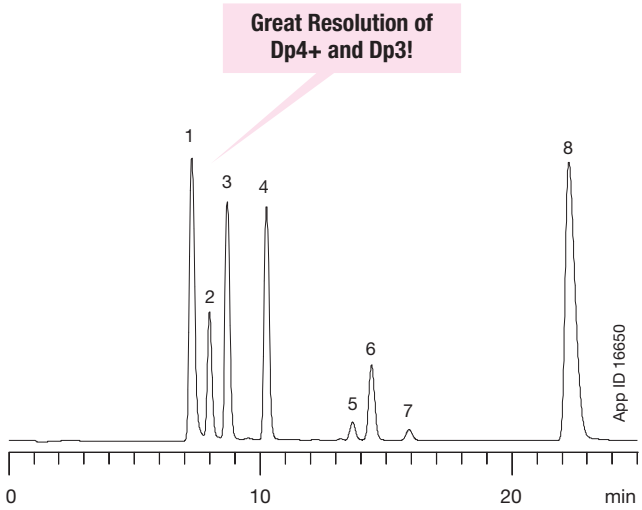


Column: Luna® 5 µm NH_2 100 Å
Dimensions: 250 x 4.6 mm
Part No.: 00G-4378-E0
Guard: SecurityGuard™ Guard Cartridge System extends column lifetime.
SecurityGuard Cartridges, NH_2 4 x 3.0 mm, 10/Pk Part No.: AJ0-4302
Holder Part No.: KJ0-4282
Mobile Phase: Acetonitrile/Water (65:35)
Gradient: Isocratic
Flow Rate: 3 mL/min
Temperature: 40 °C
Detection: Refractive Index (RI) @ 40 °C
Sample:
1. Glucose
2. Maltose
3. Maltotriose
4. Maltotetraose
5. Maltopentaose
6. Maltohexaose
7. Maltoheptaose

Bioethanol Fermentation Broth

Rezex™

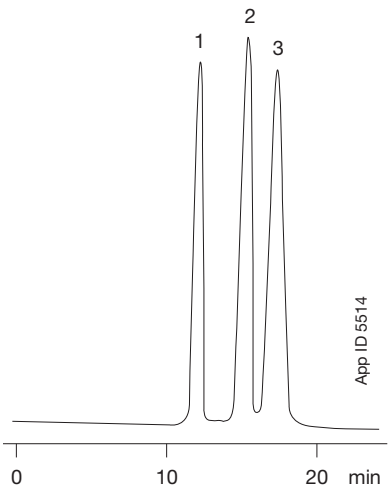
The Rezex brand of columns achieves separations based on multiple modes of interaction that includes ion-exchange, ion exclusion, size exclusion, reversed phase, and partition. In many cases, this allows for separation of multiple compound classes utilizing one column.



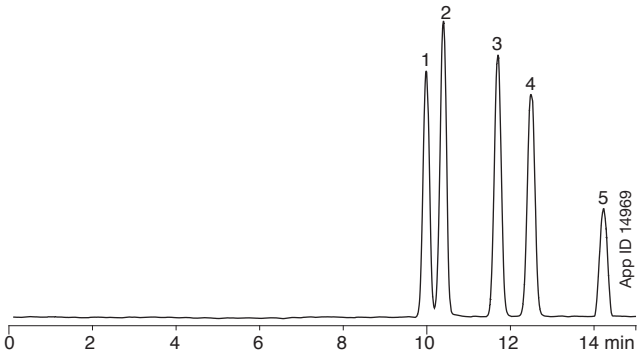
Column: Rezex ROA-Organic Acid
Dimensions: 300 x 7.8 mm
Part No.: 00H-0138-K0
Guard Cartridge: AJ0-4490
Guard Holder: KJ0-4282
Mobile Phase: 0.005 N Sulfuric Acid
Flow Rate: 0.6 mL/min
Detection: RI @ 40 °C
Vial: AR0-9925-13
Filter: AF0-8103-52
Temperature: 60 °C
System: Shimadzu® Prominence® LC-20A System
Sample:
1. Dp4+
2. Dp3
3. Maltose
4. Glucose
5. Lactic Acid
6. Glycerol
7. Acetic Acid
8. Ethanol

Amino Sugars

Column: Rezex ROA-Organic Acid
Dimensions: 300 x 7.8 mm
Part No.: 00H-0138-K0
Mobile Phase: 1 % Phosphoric Acid
Flow Rate: 0.6 mL/min
Detection: RI
Temperature: Ambient
Sample:
1. Glucose
2. N-Acetylglucosamine
3. N-Acetylgalactosamine



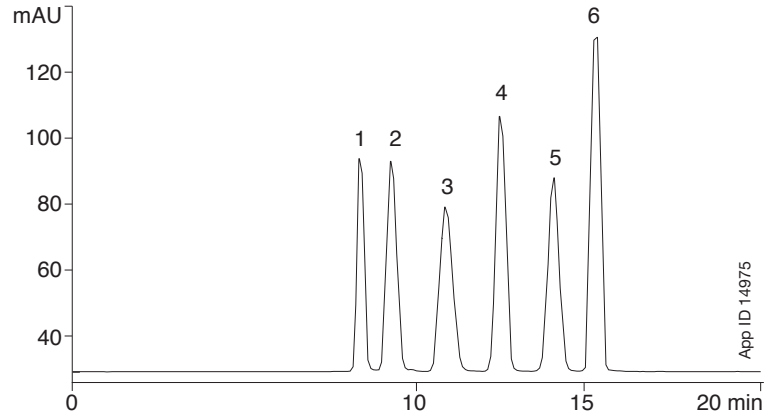
Sugars and Organic Acids



Column: Rezex™ ROA-Organic Acid
Dimensions: 300 x 7.8 mm
Part No.: 00H-0138-K0
Mobile Phase: 0.1 % Formic Acid
Flow Rate: 0.5 mL/min
Temperature: 75 °C
Detection: ELSD
Sample: 1. Citric Acid
2. Tartaric Acid
3. Glucose
4. Fructose
5. Succinic Acid

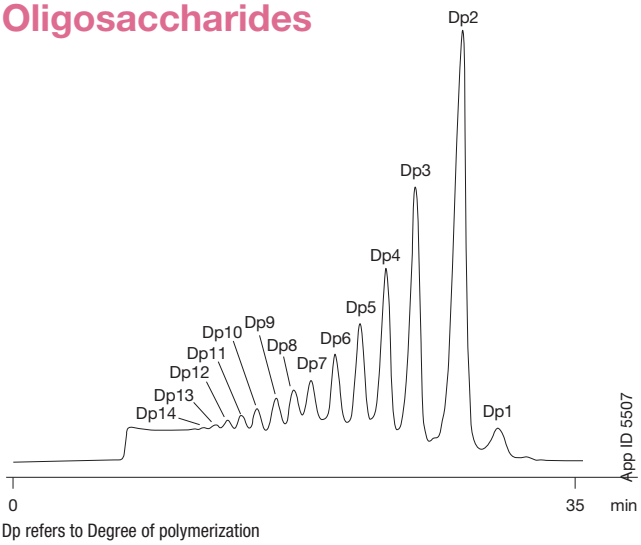
Simple Sugars

by LC-ELSD or LC-RI



Column: Rezex RCM-Monosaccharide
Dimensions: 300 x 7.8 mm
Part No.: 00H-0130-K0
Guard Cartridge: AJ0-4493
Guard Holder: KJ0-4282
Mobile Phase: Water
Flow Rate: 0.6 mL/min
Temperature: 80 °C
Detection: ELSD
Sample: 1. Melezitose
2. Maltose
3. Glucose
4. Mannose
5. Fructose
6. Ribitol

Oligosaccharides



Dp refers to Degree of polymerization

Column: Rezex RSO-Oligosaccharide
Dimensions: 200 x 10 mm
Part No.: 00P-0133-N0
Mobile Phase: Water
Flow Rate: 0.3 mL/min
Detection: Refractive Index (RI)
Vial: AR0-9925-13
Filter: AF0-8103-52
Temperature: 75 °C
Sample: Malto-Oligosaccharides as shown

Crude but Effective

Petroleum Oils

Understanding the complex components in crude oil

Practically all pseudo commodity and commodity chemicals as well as most fine chemicals are synthesized from petroleum feedstocks. Petroleum can be found in porous rock formations in some regions of the planet's upper strata and the exact molecular composition of crude oil varies widely from formation to formation.

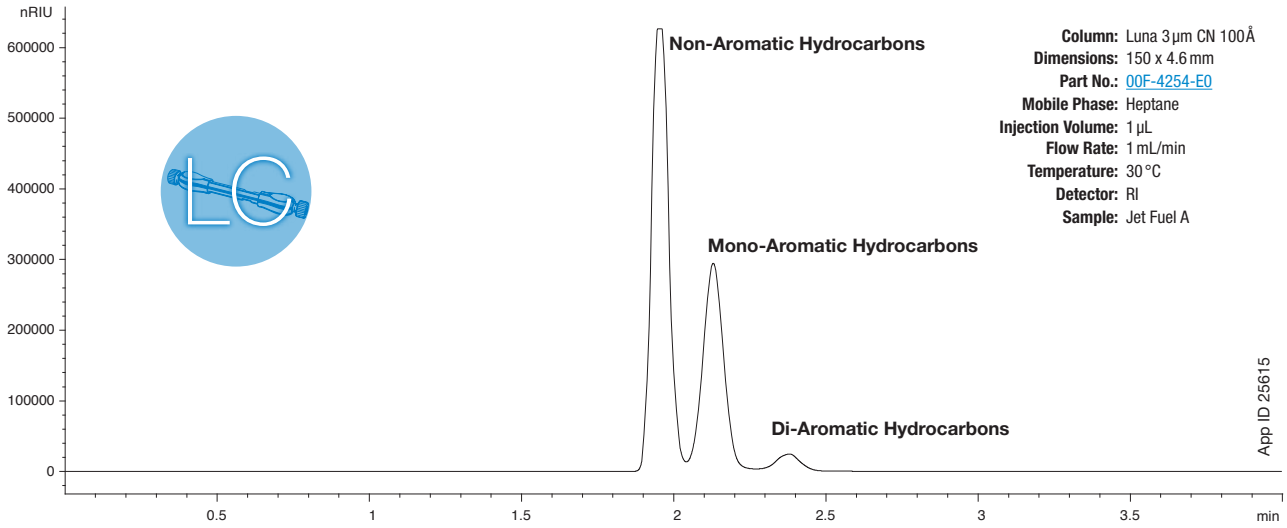
Applications:

- Jet Fuel, Aromatics
- High MW Hydrocarbon Waxes, Glass Column
- PAHs and PCBs
- High MW Hydrocarbon Waxes, Metal Column

Featured Applications

Jet Fuel

Using a Luna® 3 µm CN LC Column

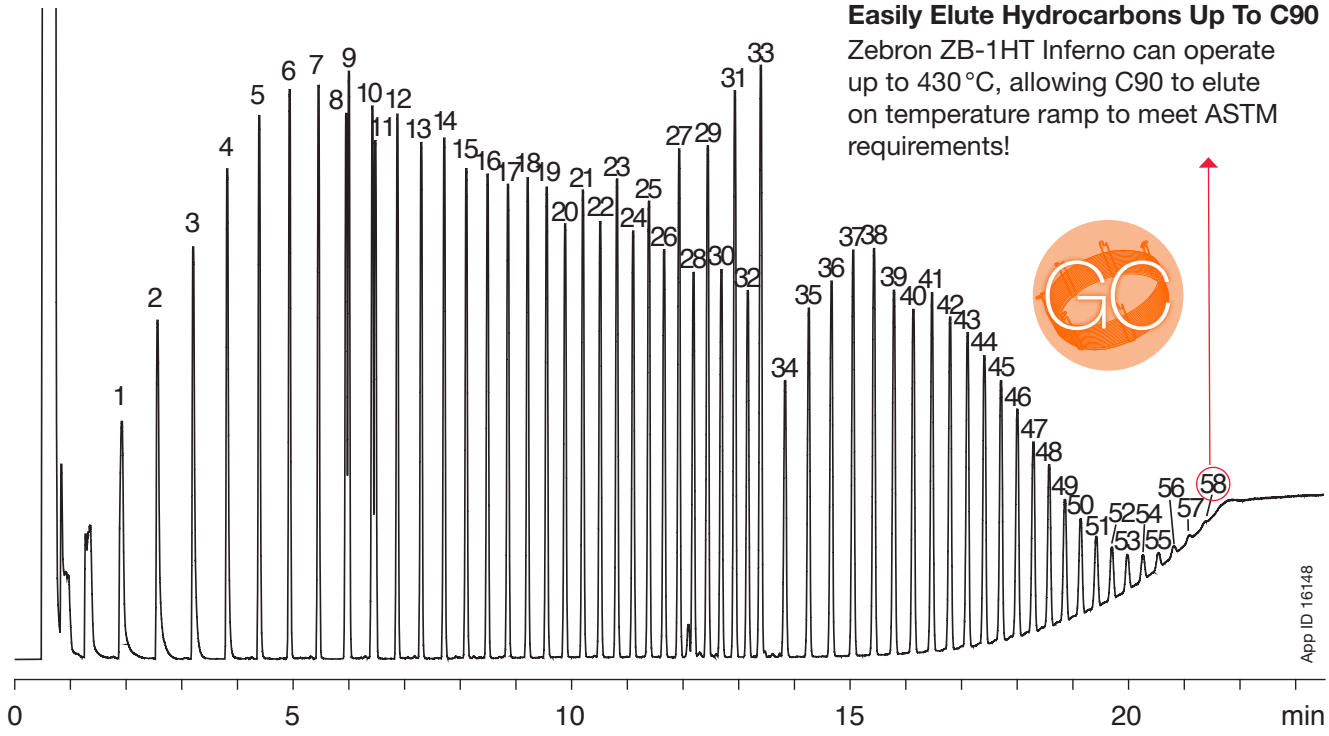


Column: Luna 3 µm CN 100Å
Dimensions: 150 x 4.6 mm
Part No.: 00F-4254-E0
Mobile Phase: Heptane
Injection Volume: 1 µL
Flow Rate: 1 mL/min
Temperature: 30 °C
Detector: RI
Sample: Jet Fuel A

Separation of High Boiling Hydrocarbons, High MW Hydrocarbon Waxes, Glass Column (ASTM Method D6352)

Using a Zebron™ ZB-1HT Inferno™ GC Column

Easily Elute Hydrocarbons Up To C90
Zebron ZB-1HT Inferno can operate up to 430 °C, allowing C90 to elute on temperature ramp to meet ASTM requirements!



Column: Zebron ZB-1HT Inferno
Dimensions: 5 meter x 0.53 mm x 0.10 µm
Part No.: 7AK-G014-02
Injection: On-Column @ 43 °C, 0.1 µL
Carrier Gas: Helium @ 4.4 mL/min (constant flow)
Oven Program: 40 °C for 0.5 min to 430 °C @ 20 °C/min for 10 min
Detector: FID @ 430 °C
Note: Sample was a combination of POLYWAX® 655 and retention time markers C8-C40 in CS_2/Chloroform

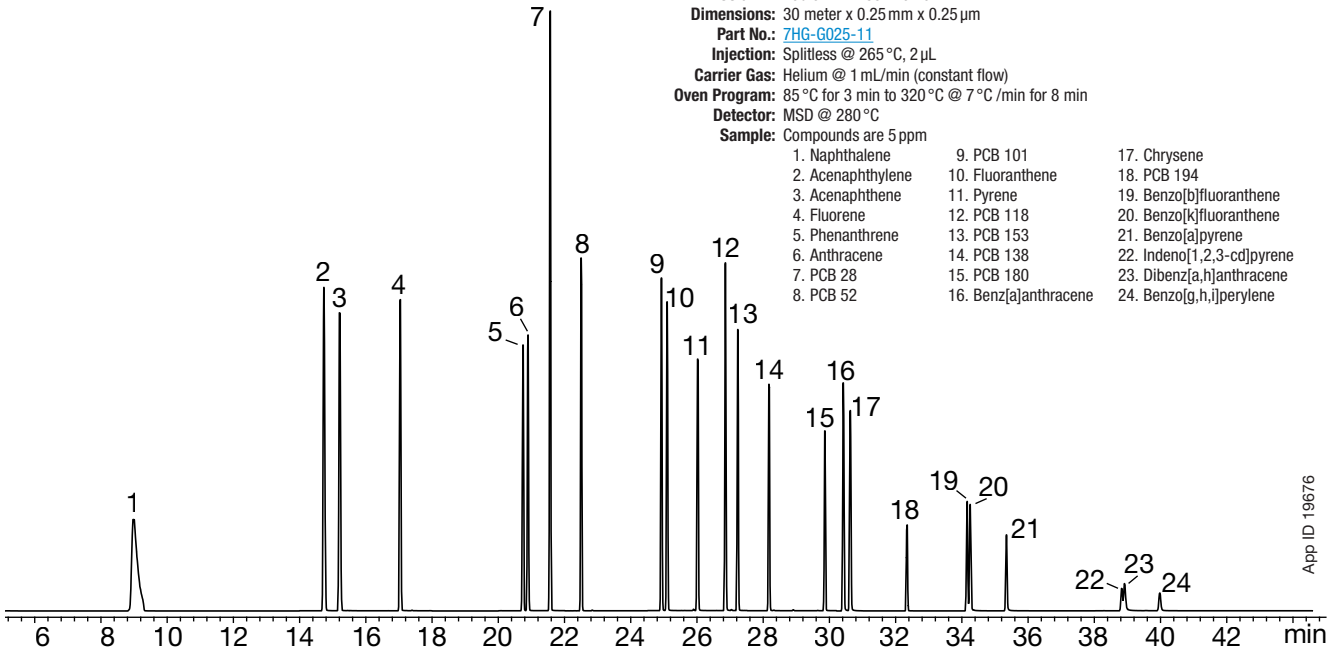
Sample:

1. C10	11. Phytane	21. C28	31. C38	41. C56	51. C76
2. C11	12. C19	22. C29	32. C39	42. C58	52. C78
3. C12	13. C20	23. C30	33. C40	43. C60	53. C80
4. C13	14. C21	24. C31	34. C42	44. C62	54. C82
5. C14	15. C22	25. C32	35. C44	45. C64	55. C84
6. C15	16. C23	26. C33	36. C46	46. C66	56. C86
7. C16	17. C24	27. C34	37. C48	47. C68	57. C88
8. C17	18. C25	28. C35	38. C50	48. C70	58. C90
9. Pristane	19. C26	29.C36	39. C52	49. C72	
10. C18	20. C27	30. C37	40. C54	50. C74	

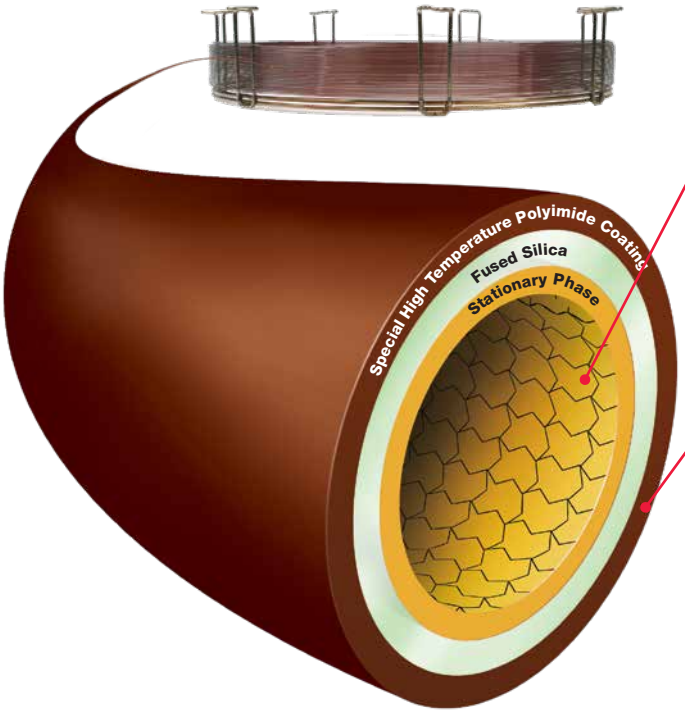
PAHs and PCBs

Column: Zebron™ ZB-35 Inferno™
Dimensions: 30 meter x 0.25 mm x 0.25 µm
Part No.: 7HG-G025-11
Injection: Splitless @ 265 °C, 2 µL
Carrier Gas: Helium @ 1 mL/min (constant flow)
Oven Program: 85 °C for 3 min to 320 °C @ 7 °C /min for 8 min
Detector: MSD @ 280 °C
Sample: Compounds are 5 ppm

1. Naphthalene
2. Acenaphthylene
3. Acenaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. PCB 28
8. PCB 52
9. PCB 101
10. Fluoranthene
11. Pyrene
12. PCB 118
13. PCB 153
14. PCB 138
15. PCB 180
16. Benz[a]anthracene
17. Chrysene
18. PCB 194
19. Benzo[b]fluoranthene
20. Benzo[k]fluoranthene
21. Benzo[a]pyrene
22. Indeno[1,2,3-cd]pyrene
23. Dibenz[a,h]anthracene
24. Benzo[g,h,i]perylene



Learn More About Zebron Inferno GC Columns



Advanced ESC™ Bonding Technology

At high temperature ranges, the stability of standard GC columns deteriorates, resulting in increased bleed. Zebron's Engineered Self Cross-linking™ (ESC) bonding technology reinforces the stationary phase for enhanced column durability and extremely low bleed levels at high temperatures. The result: Inferno columns with the flexibility to perform for high temp oven ramps and bakeouts.

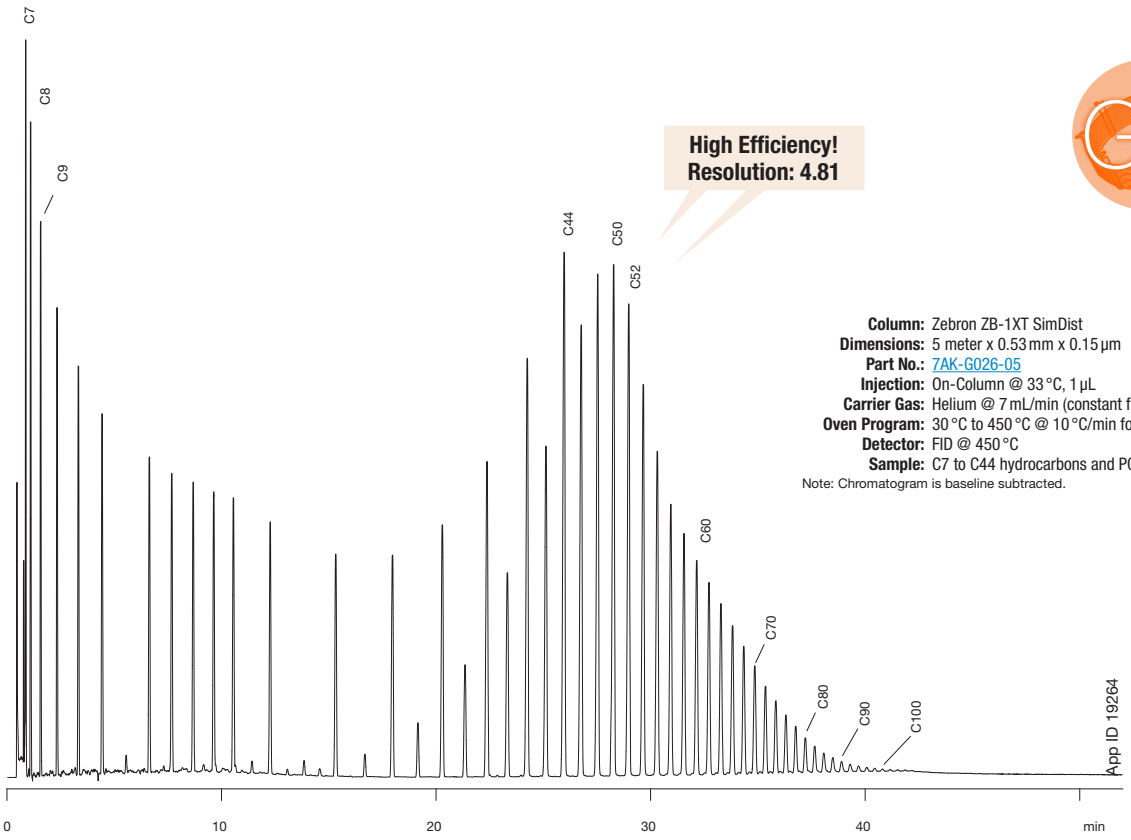
High Temperature Polyimide Coating

Standard polyimide resin pyrolyzes at temperatures above 360 °C, making the tubing unstable. Zebron Inferno columns use a temperature resistant polyimide resin that shows minimal thermal degradation, even at temperatures up to 430 °C*. This means longer column lifetime at elevated temperatures.

* Zebron ZB-1HT and ZB-5HT Inferno columns have an upper temperature limit of 430 °C.
Zebron ZB-35HT and ZB-XLB-HT Inferno columns have an upper temperature limit of 400 °C.

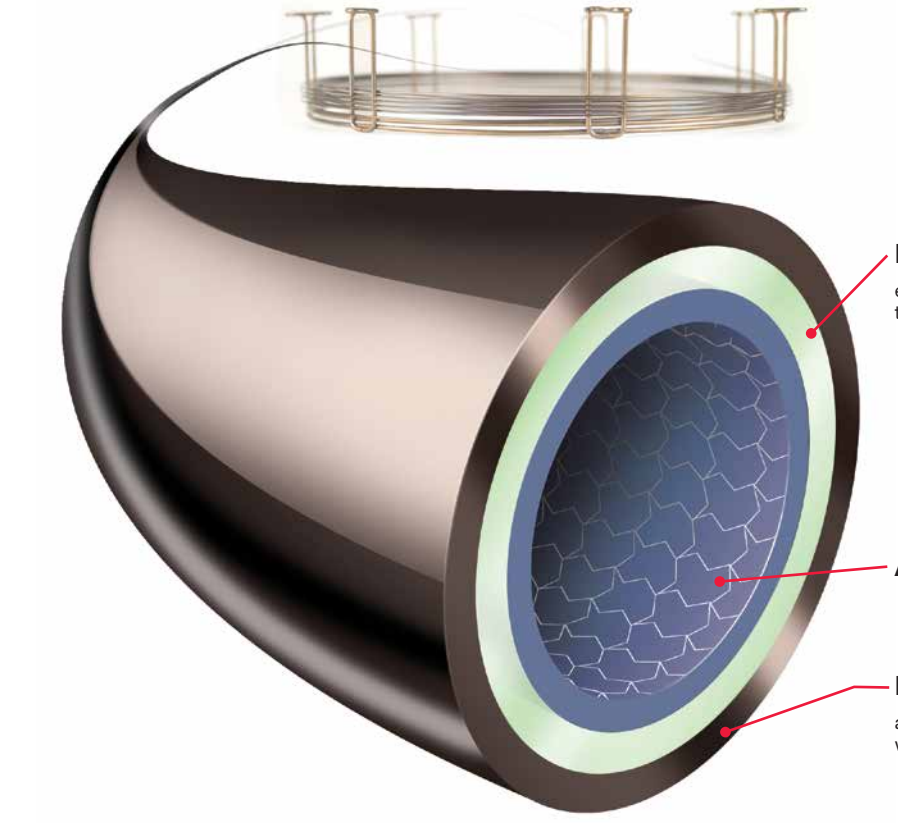
Hydrocarbons C7–C100+, High MW Hydrocarbon Waxes, Metal Column (ASTM Method D7169)

Using a Zebron™ ZB-1XT SimDist GC Column



Column: Zebron ZB-1XT SimDist
Dimensions: 5 meter x 0.53 mm x 0.15 µm
Part No.: 7AK-G026-05
Injection: On-Column @ 33 °C, 1 µL
Carrier Gas: Helium @ 7 mL/min (constant flow)
Oven Program: 30 °C to 450 °C @ 10 °C/min for 10 min
Detector: FID @ 450 °C
Sample: C7 to C44 hydrocarbons and POLYWAX® 655 in CS_2
Note: Chromatogram is baseline subtracted.

Learn more about Zebron XT SimDist Glass Infusion™ Technology for Improved Performance



Multi-layer Glass Infusion™
ensures a thick uniform surface that is consistent throughout the length of the column.

Advanced High Temperature Polymer

Rugged Metal Tubing
allows you to run methods up to 450 °C without becoming brittle or breaking.

* Zebron ZB-1HT and ZB-5HT Inferno columns have an upper temperature limit of 430 °C. Zebron ZB-35HT and ZB-XLB-HT Inferno columns have an upper temperature limit of 400 °C.

Rendered and Refined

Commodity and Specialty Chemicals

Refining process—aliphatic chemicals, solvents and alcohols

The components from crude oil, natural minerals, or cellulosic materials are rendered, refined, and then further reacted to create a variety of diverse chemicals. Many of the common chemicals have been around for quite some time, and there are still new chemicals being developed all the time. Almost every item that we use in our daily lives is created from the chemical industry.

Applications:

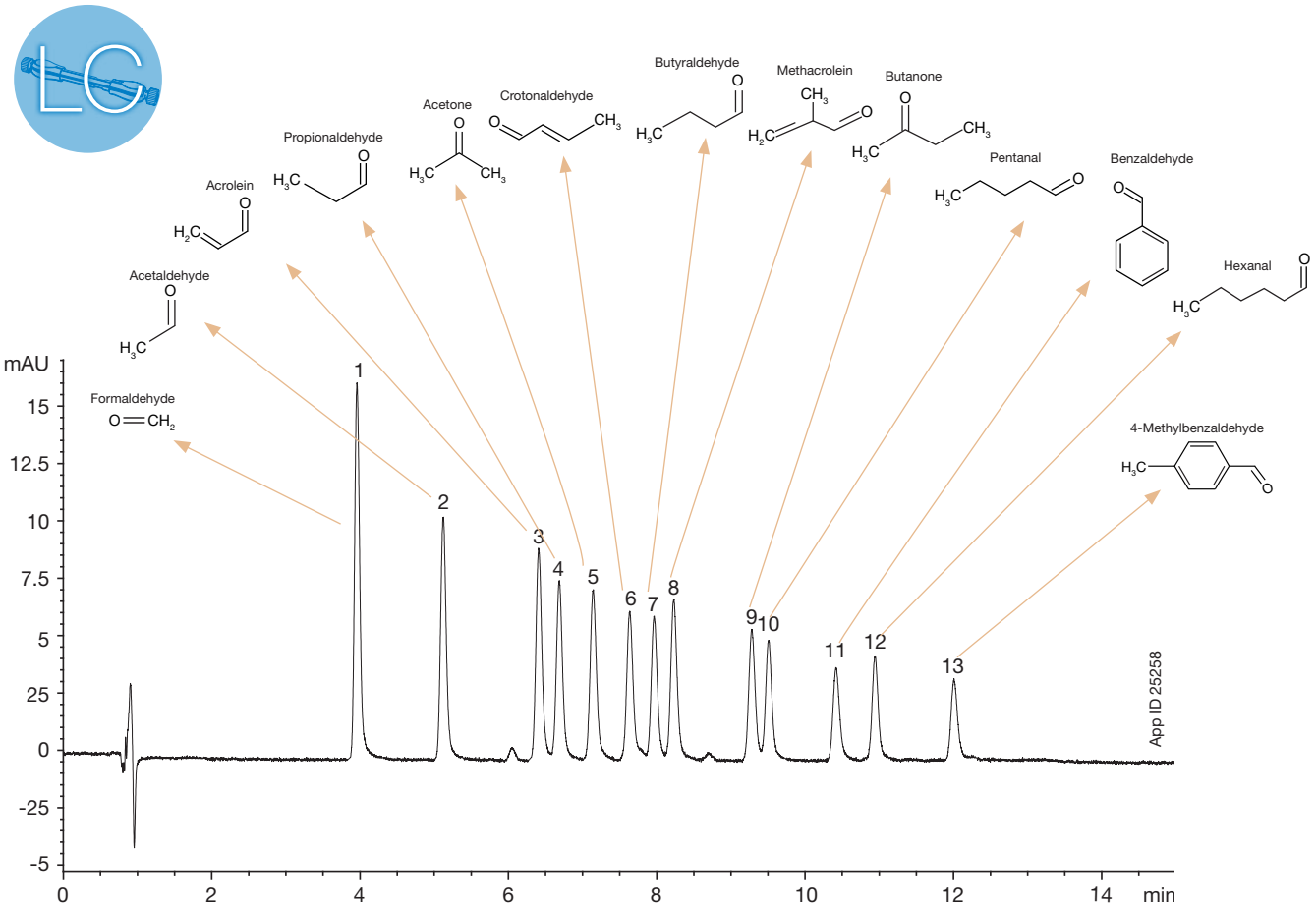
- Aldehydes
- Aromatic, Heterocyclic Nitroamine, and Nitramide Compounds
- BTEX
- Ketones
- Polar and Non-polar Solvents
- Halocarbons
- Sulfur Compounds
- Solvents
- Industrial Chemical Test Mix

Featured Applications

Aldehydes, 2,4-dinitrophenylhydrazine (DNPH) derivatized

Using a Kinetex® Biphenyl LC Column

In this application there is an enhanced retention and selectivity of 13 carbonyls due to aromatic π-π interactions along with hydrophobic and dipole-dipole interactions. The method uses the combined polar and non-polar selectivity of a Kinetex Biphenyl stationary phase to achieve improved chromatographic results. The high electron density created by the dual ring structure creates dipole-dipole interactions, giving enhanced retention for basic analytes. In addition, the Kinetex solid support is a superficially porous (core-shell) particle morphology that provides ultra-high column efficiency on any HPLC/UHPLC system.



Column: Kinetex 2.6 µm Biphenyl
Dimensions: 100 x 4.6 mm
Part No.: 00D-4622-E0
Mobile Phase: A: Water
B: Ethanol/Methanol (50:50)

Gradient:	**Time (min)**	**% B**
	0	60
	0.5	60
	12	75
	13	75
	13.5	60
	15	60

Flow Rate: 1.3 mL/min
Injection Volume: 5 µL

Temperature: 40 °C
Detection: UV @ 360 nm
Sample:
1. Formaldehyde
2. Acetaldehyde
3. Acrolein
4. Propionaldehyde
5. Acetone
6. Crotonaldehyde
7. Butyraldehyde
8. Butanone
9. Pentanal
10. Benzaldehyde
11. Hexanal
12. 4-Methylbenzaldehyde

Aromatic, Heterocyclic Nitroamine, and Nitramide Compounds

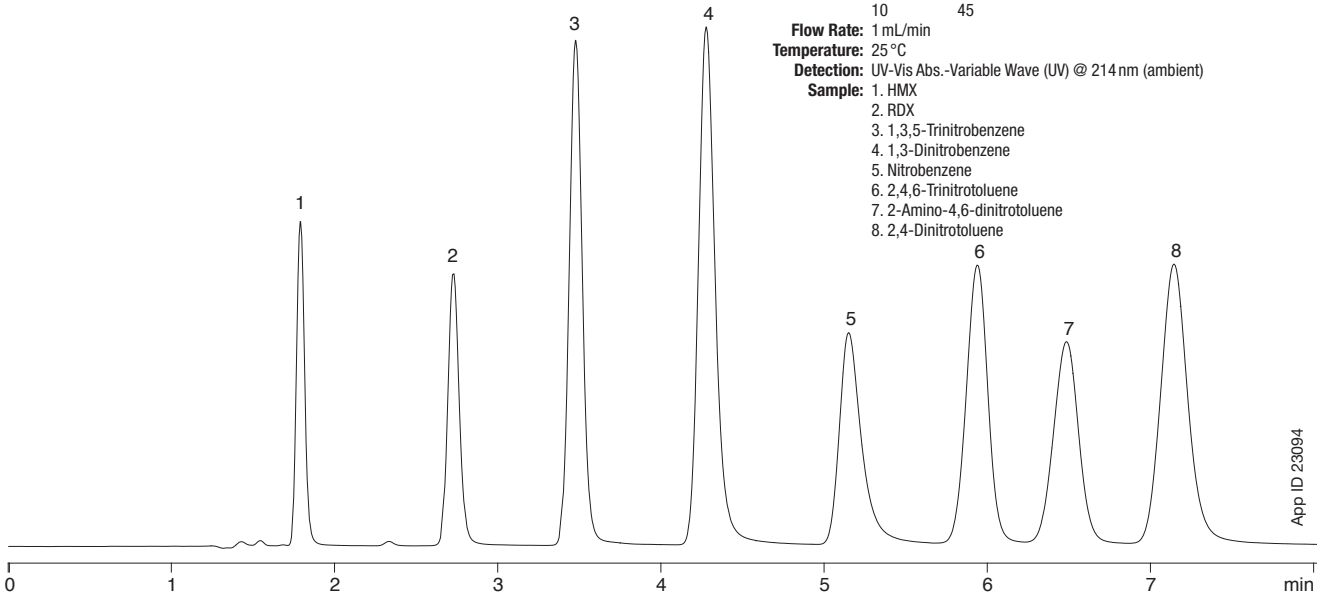
Using a Kinetex® EVO C18 LC Column

The Kinetex EVO C18 is a novel pH 1 to 12 stable core-shell media.

Column: Kinetex 5 µm EVO C18 100 Å
Dimensions: 150 x 4.6 mm
Part No.: 00F-4633-E0
Mobile Phase: A: Water
B: Methanol
Gradient:

Time (min)	% B
0	45
10	45

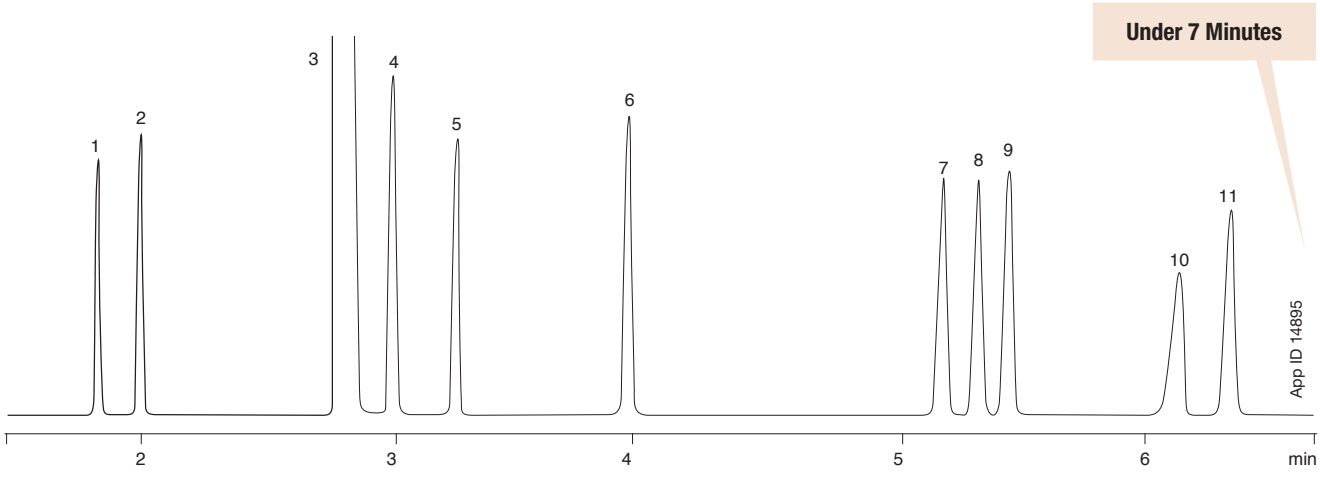
Flow Rate: 1 mL/min
Temperature: 25 °C
Detection: UV-Vis Abs.-Variable Wave (UV) @ 214 nm (ambient)
Sample:
1. HMX
2. RDX
3. 1,3,5-Trinitrobenzene
4. 1,3-Dinitrobenzene
5. Nitrobenzene
6. 2,4,6-Trinitrotoluene
7. 2-Amino-4,6-dinitrotoluene
8. 2,4-Dinitrotoluene



BTEX

Using a Zebron™ ZB-WAX GC Column

Zebron ZB-WAX is a high polarity PEG phase that is excellent for polar complex analytes. It retains analytes based on dipole-dipole interaction and resolves all BTEX compounds including specifically the o-, m-, p-xylenes.



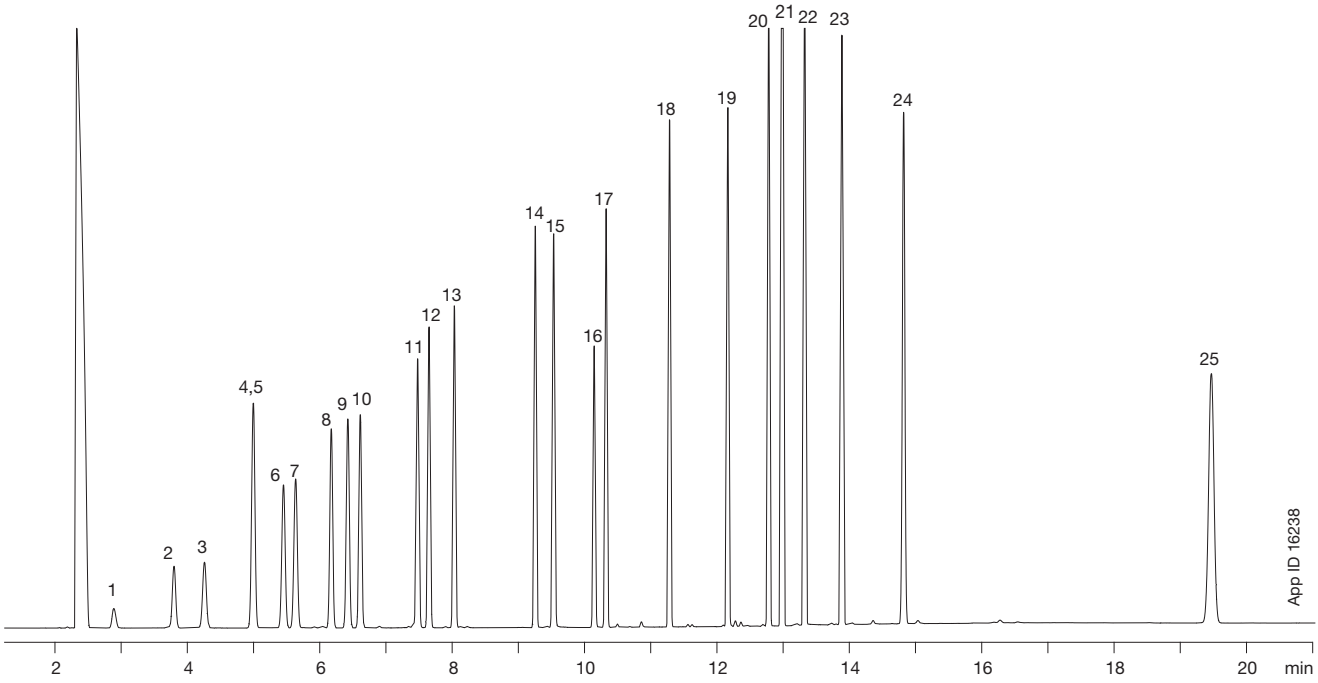
Column: Zebron ZB-WAX
Dimensions: 30 meter x 0.32 mm x 0.50 µm
Part No.: 7HM-G007-17
Injection: Split 20:1 @ 250 °C, 0.2 µL
Carrier Gas: Helium @ 2 mL/min (constant flow)
Oven Program: 60 °C to 75 °C @ 15 °C/min to 90 °C @ 3 °C/min (hold 3 min)
Detector: FID @ 300 °C

Sample:
1. Pentane
2. Heptane
3. Solvent (methylene chloride)
4. Benzene
5. Decane
6. Toluene
7. Ethylbenzene
8. p-Xylene
9. m-Xylene
10. Dodecane
11. o-Xylene

Ketones

Using a Zebron™ ZB-WAX*PLUS*™ GC Column

Zebron ZB-WAX*PLUS* is a 100 % aqueous stable PEG phase that is extremely inert for acidic compounds and has enhanced selectivity for low boiling solvents.



Column: Zebron ZB-WAX*PLUS*
Dimensions: 30 meters x 0.53 mm x 1 µm
Part No.: 7HK-G013-22
Injection: Split 10:1 @ 200 °C, 1 µL
Recommended Liner Zebron PLUS Straight Z-Liner™
Carrier Gas: Helium @ 4 mL/min (constant flow)
Oven Program: 40 °C for 0.5 min to 430 °C @ 20 °C/min for 10 min
Detector: Flame Ionization (FID) @ 220 °C

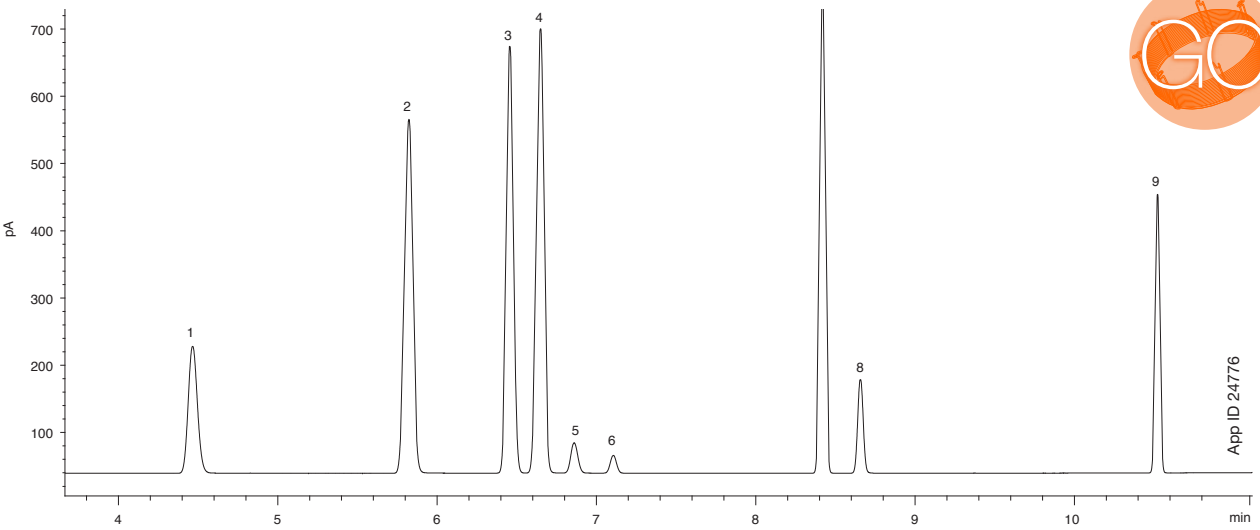
Sample: Note: Concentration per compound 100 ppm in Carbon disulfide

1. Acetone
2. 2-Butanone (MEK)
3. 3-Methyl-2-butanone
4. 2-Pentanone
5. 3-Pentanone
6. 4-Methyl-2-pentanone
7. 3-Methyl-2-pentanone
8. 3-Hexanone
9. 2-Methyl-3-hexanone
10. 2-Hexanone
11. 5-Methyl-2-hexanone
12. 3-Heptanone
13. 2-Heptanone
14. 2-Octanone
15. Cyclohexanone
16. 4-Hydroxy-4-methyl-2-pentanone
17. 2-Nonanone
18. 2-Decanone
19. 2-Undecanone
20. Acetophenone
21. 2-Dodecanone
22. Propiophenone
23. Butyrophenone
24. Valerophenone
25. Octanophenone

Polar and Non-polar Solvents

Using a Zebron™ ZB-624*PLUS*™ GC Column

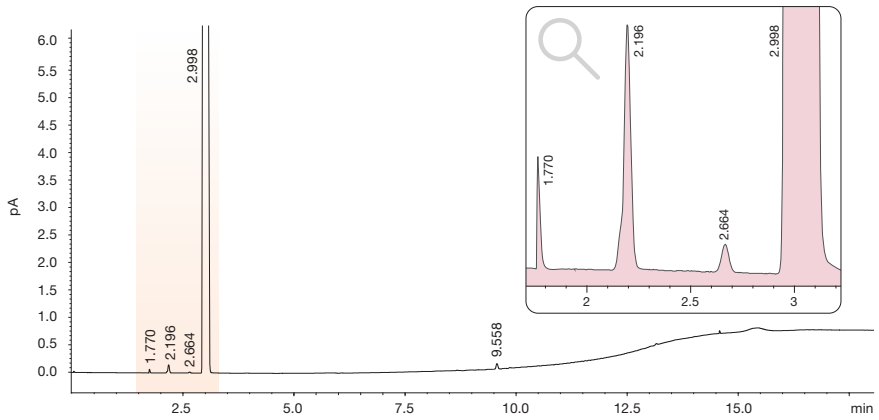
- Award-winning proprietary phase with enhanced peak shape for active compounds
- High selectivity for polar, non-polar, low and high boiling solvents
- High temperature stability (300/320 ºC)
- The unique “plus” deactivation process improves signal-to-noise levels and increases sensitivity for qualitative and quantitative analysis



Column: Zebron ZB-624*PLUS*
Dimensions: 30 meter x 0.32 mm x 1.80 µm
Part No.: 7HM-G040-31
Injection: Split 20:1 @ 200 °C, 1 µL
Recommended Liner: Zebron PLUS Straight Z-Liner™
Liner Part No.: AG2-0A03-05 (for Agilent® & Thermo Scientific® systems)
Carrier Gas: Helium @ 1 mL/min (constant flow)
Oven Program: 40 °C for 5 min to 260 °C @ 25 °C/min for 3 min
Detector: FID @ 250 °C
Sample:
1. Methanol
2. Ethanol
3. Acetone
4. IPA
5. Acetonitrile
6. DCM
7. Ethyl Acetate
8. THF
9. Toluene

Acetone Purity

Using a Zebron™ ZB-624*PLUS*™ GC Column

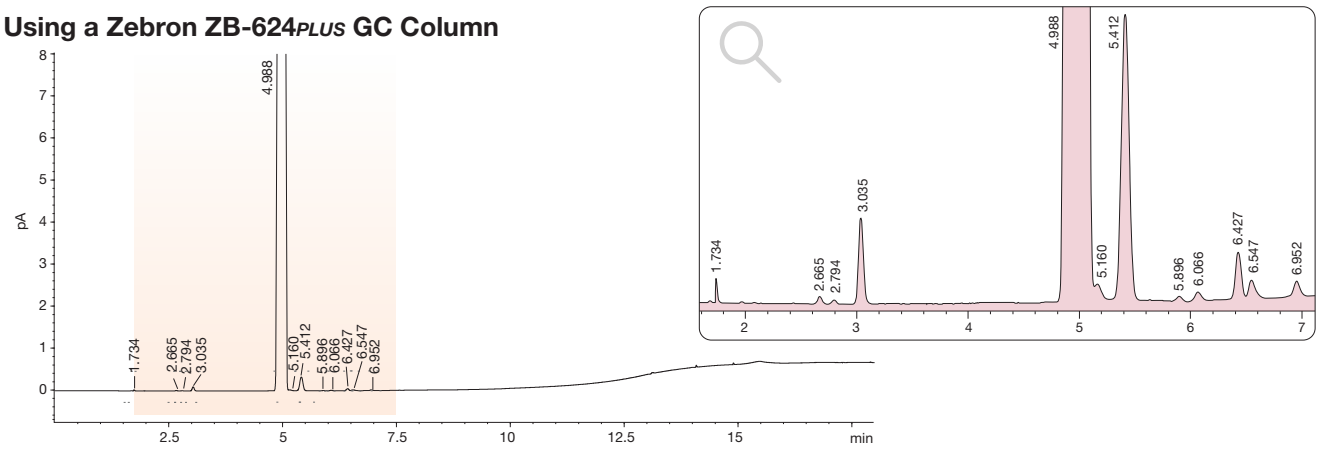


Same conditions for all separations:

Column: Zebron ZB-624*PLUS*
Dimensions: 30 meter x 0.53 mm x 3.0 µm
Part No.: 7HK-G040-36
Injection: Split 50:1 @ 250 °C, 1µL
Recommended Liner: Zebron PLUS Liner for Agilent® & Thermo®, 4 mm ID Straight Z-Liner™
Liner Part No.: AG2-0A03-05
Carrier Gas: Helium @ 3.9 mL/min (Constant Flow)
Oven Program: 60 °C for 5 min, 260 °C @ 25 °C/min for 5 min
Detection: FID @ 300 °C
Four Different Samples (In order): Acetone, Ethyl Acetate, Tetrahydrofuran, n,n-Dimethylformamide

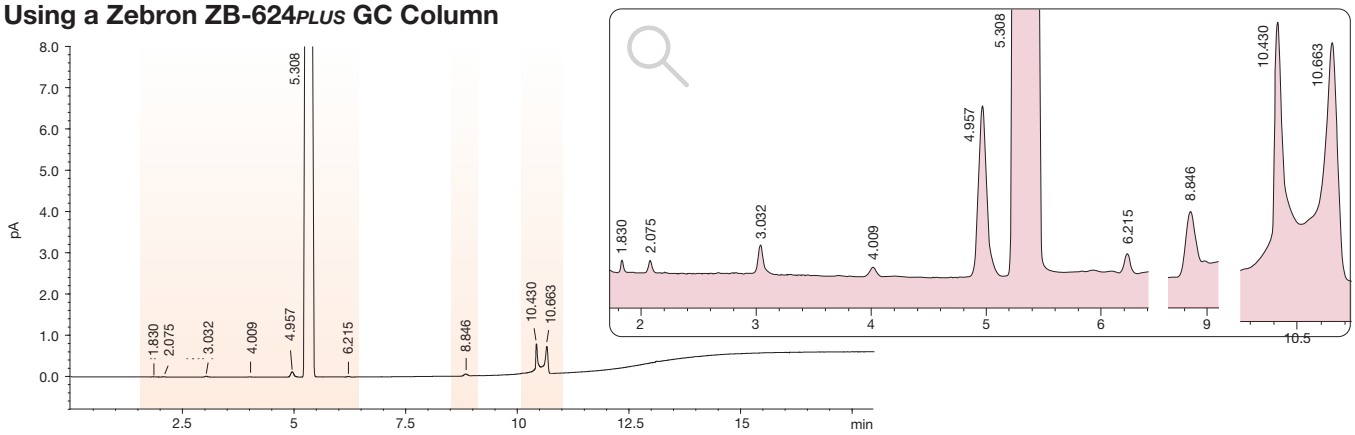
Ethyl Acetate Purity

Using a Zebron ZB-624*PLUS* GC Column



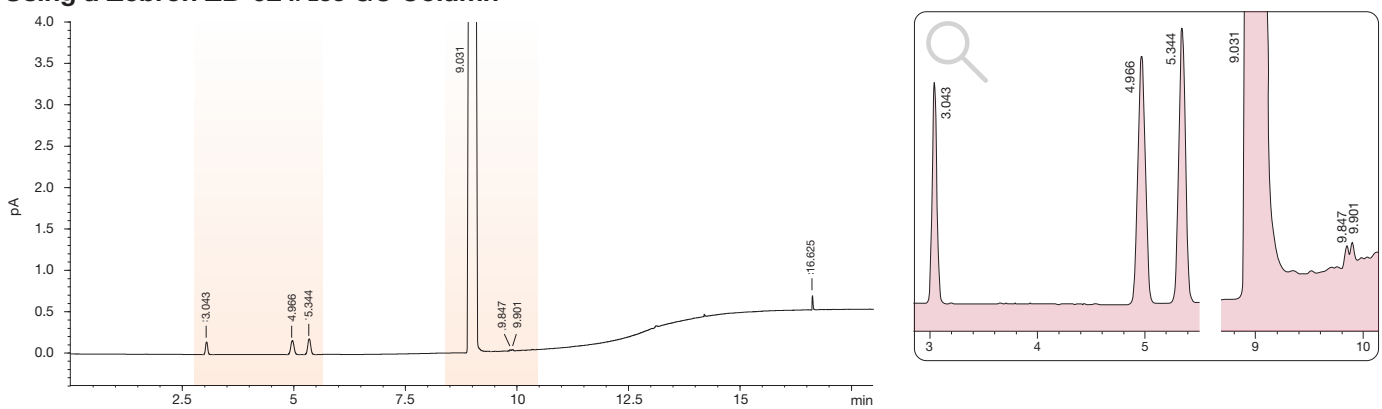
Tetrahydrofuran Purity

Using a Zebron ZB-624*PLUS* GC Column



n,n-Dimethylformamide Purity

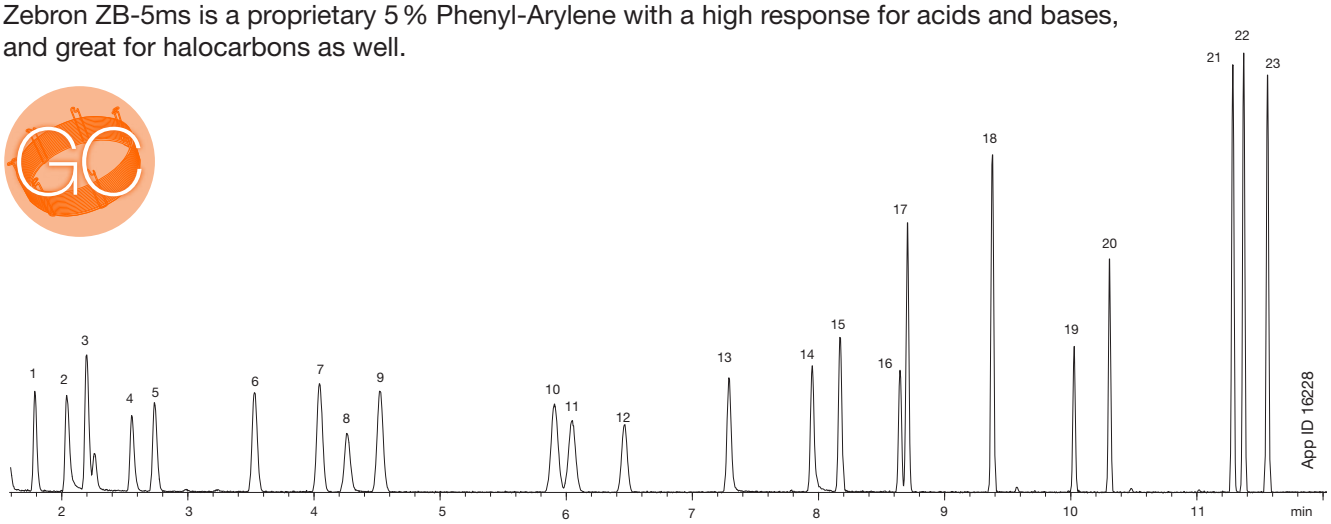
Using a Zebron ZB-624*PLUS* GC Column



Halocarbons

Using a Zebron™ ZB-5ms GC Column

Zebron ZB-5ms is a proprietary 5 % Phenyl-Arylene with a high response for acids and bases, and great for halocarbons as well.



Column: Zebron ZB-5ms
Dimensions: 30 meters x 0.32 mm x 1 µm
Part No.: 7HM-G010-22
Injection: Split 10:1 @ 200 °C, 1 µL
Recommended Liner Zebron PLUS Straight Z-Liner™
Carrier Gas: Helium @ 1.5 mL/min (constant flow)
Oven Program: 40 °C for 6 min to 200 °C @ 22 °C/min
Detector: Mass Selective (MSD) @ 200 °C

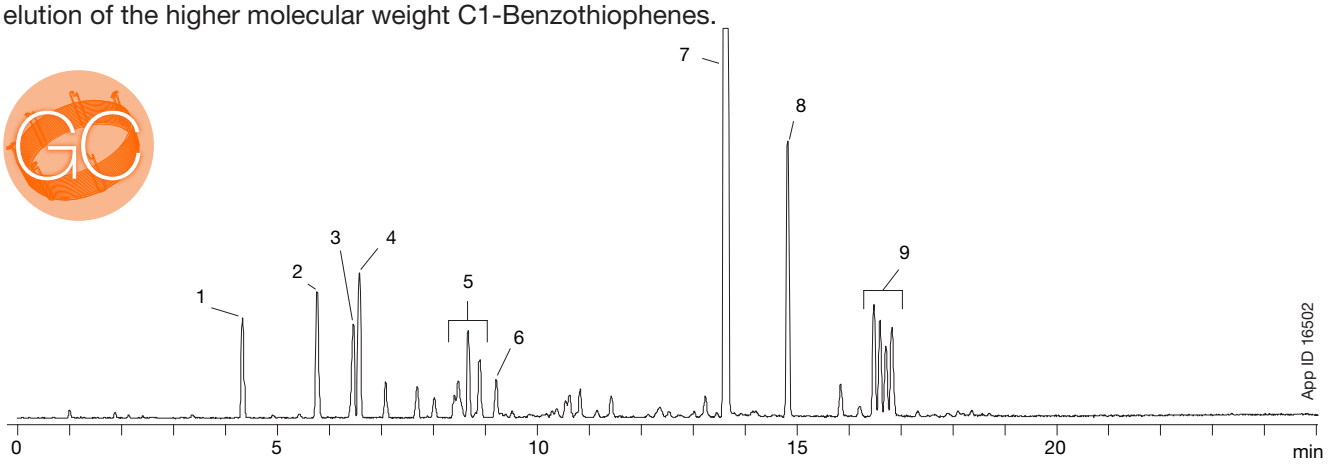
Sample: Note:The analytes are 100 ppm in methanol.

1. Trichlorofluoromethane
2. 1,1-Dichloroethene
3. Dichloromethane
4. 1,2-Dichloroethene
5. 1,1-Dichloroethane
6. Chloroform
7. 1,1,1-Trichloroethane
8. 1,2-Dichloroethane
9. Carbon tetrachloride
10. Trichloroethylene
11. 1,2-Dichloropropane
12. Bromodichloromethane
13. cis-1,3-Dichloro-1-propene
14. trans-1,3-Dichloro-1-propene
15. 1,1,2-Trichloroethane
16. Dibromochloromethane
17. Tetrachloroethylene
18. Chlorobenzene
19. Tribromomethane
20. 1,1,2,2-Tetrachloroethane
21. 1,3-Dichlorobenzene
22. 1,4-Dichlorobenzene
23. 1,2-Dichlorobenzene

Sulfur Compounds

Using a Zebron ZB-1 GC Column

The Zebron ZB-1 has a specially designed 100 % dimethylpolysiloxane stationary phase which provides low bleed in a thick film GC column and a secure inert platform for the van der Waals forces to create sharper peaks for the challenging sulfur compounds. It provides good retention of low boiling sulfur compounds and elution of the higher molecular weight C1-Benzothiophenes.



Column: Zebron ZB-1
Dimensions: 30 meter x 0.32 mm x 3.00 µm
Part No.: 7HM-G001-36
Injection: Split 10:1 @ 270 °C, 1 µL
Recommended Liner Zebron PLUS Straight Z-Liner™
Carrier Gas: Helium @ 2 mL/min (constant flow)
Oven Program: 50 °C for 1 min to 300 °C @ 10 °C/min for 3 min
Detector: Sulfur (SCD) @ 320 °C

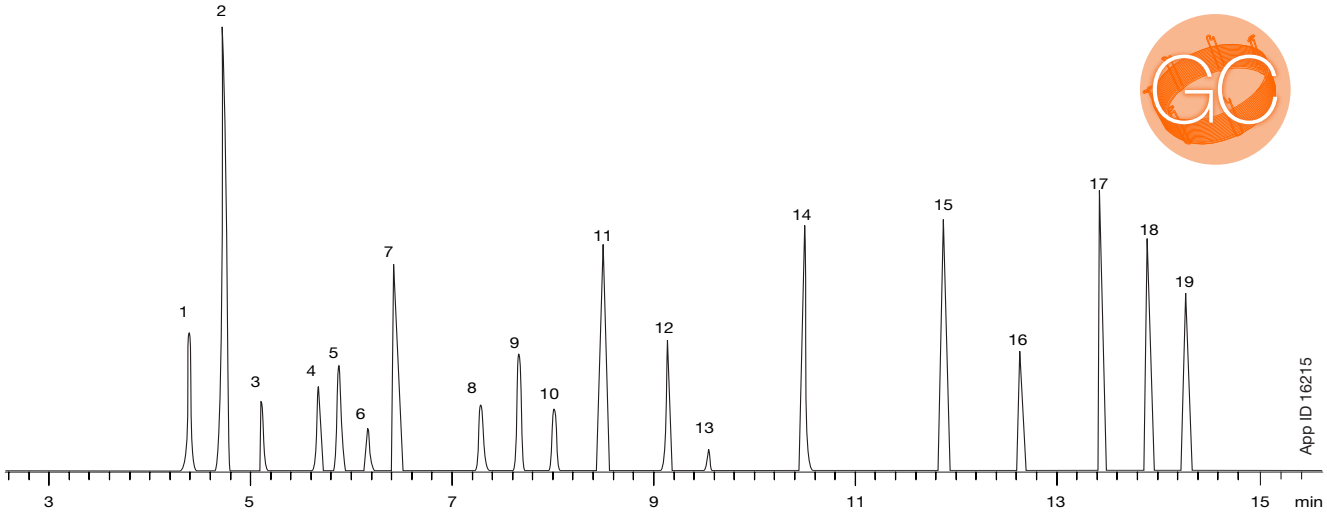
Sample: 1. Thiophene
2. Dimethyldisulfide
3. 2-Methyl-thiophene
4. 3-Methyl-thiophene
5. C2-Thiophenes
6. Diethylsulfide
7. Dibutylsulfide
8. Benzothiophene
9. C1-Benzothiophenes

Note:California Phase II Reference Fuel - 30 mg/kg total sulfur

Solvents

Using a Zebron™ ZB-FFAP GC Column

Zebron ZB-FFAP is a high polarity 100 % nitroterephthalic acid modified PEG phase which provides symmetric peak shape and excellent selectivity for polar compounds, like alcohols, aldehydes, ketones, and ethers.



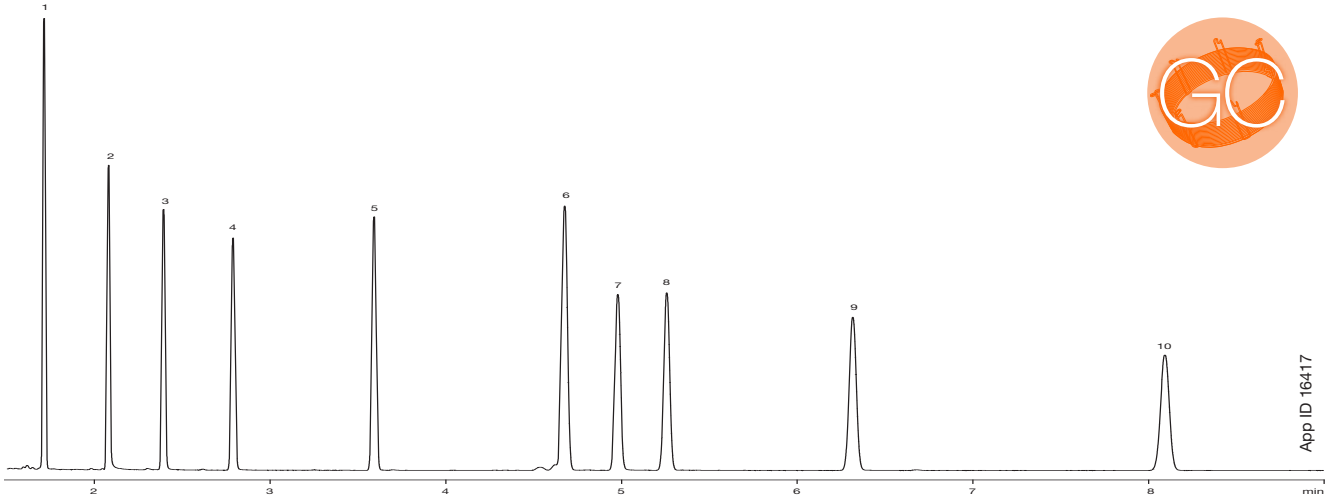
Column: Zebron ZB-FFAP
Dimensions: 30 meters x 0.25 mm x 0.25 µm
Part No.: 7HG-G009-11
Injection: Split 11.8:1 @ 225 °C, 1 µL
Recommended Liner Zebron PLUS Straight Z-Liner™
Carrier Gas: Helium @ 3.4 mL/min (constant flow)
Oven Program: 60 °C for 8 min to 150 °C @15 °C/min for 4 min
Detector: Flame Ionization (FID) @ 250 °C

Sample:
1. n-Hexane
2. Carbon disulfide
3. Acetone
4. Ethyl acetate
5. Methyl ethyl ketone (MEK)
6. Dichloromethane
7. Benzene
8. Trichloroethylene
9. Methyl isobutyl ketone
10. Perchloroethylene
11. Toluene
12. n-Butyl acetate
13. Undecane
14. Ethylbenzene
15. o-Xylene
16. PGMEAC
17. Styrene
18. 1,2,4-Trimethylbenzene
19. Cyclohexane

Industrial Chemical Test Mix

Using a Zebron ZB-XLB GC Column

Zebron ZB-XLB is a proprietary low polarity si-arylene column for unique selectivity.



Column: Zebron ZB-XLB
Dimensions: 30 meters x 0.25 mm x 0.25 µm
Part No.: 7HG-G019-11
Injection: Split 83:1 @ 250 °C, 1 µL
Recommended Liner Zebron PLUS Straight Z-Liner™
Carrier Gas: Hydrogen @ 1.2 mL/min (constant flow)
Oven Program: 40 °C for 0.5 min to 430 °C @ 20 °C/min for 10 min
Detector: 140 °C Isothermal

Sample:
1. Decane
2. 2-Ethylhexanoic acid
3. 1,6-Hexanediol
4. 4-Chlorophenol
5. Tridecane
6. 1-Methylnaphthalene
7. 1-Undecanol
8. Tetradecane
9. Dicyclohexylamine
10. Pentadecane

Aromatic Compounds

Phenomenex has great options for the separation of aromatic compounds for both LC and GC methods. Aromatic compounds primarily utilize π-π interactions offered from their double bonds for better retention and separation. The increase in selectivity correlates to the number of π electrons in the analyte, and in addition there will be secondary chemical and steric interfaces which will also be a factor.

Phenyl-Bonded Phases' Multiple Mode Retention Properties:

1. Aromatic π-π interaction
2. Weak Dipole
3. Hydrogen Bonding
4. Hydrophobic

Applications:

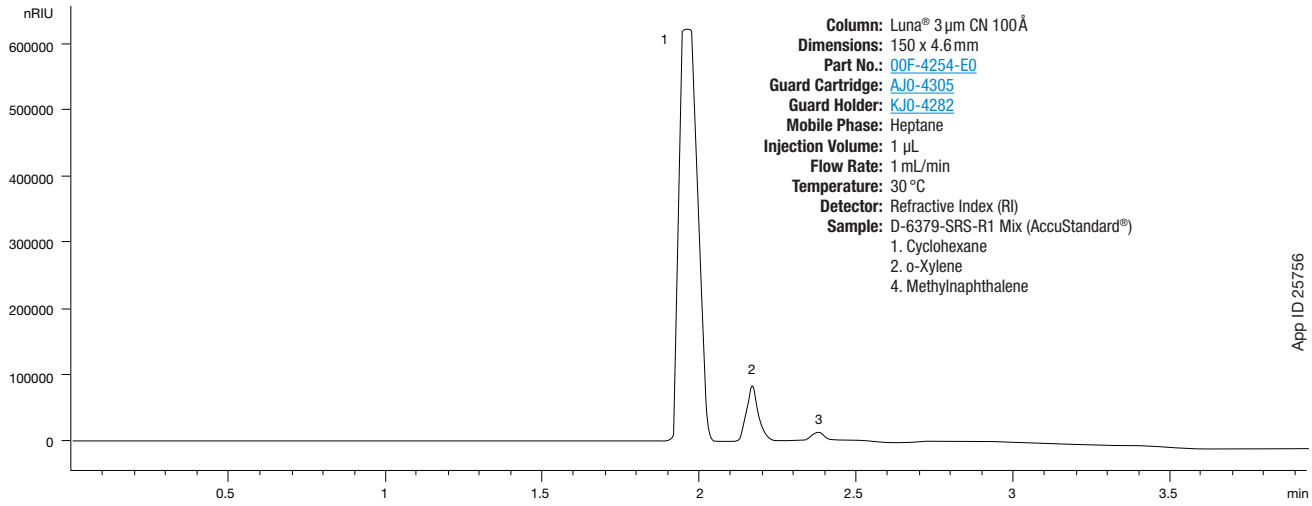
- Aviation Fuels and Petroleum Middle Distillates Test Mix
- Chlorobenzenes
- Aromatic Isomers
- Aromatic Acids
- Polybrominated Diphenyl Ethers (PBDE)
- Residual Solvents

Featured

Aviation Fuels and Petroleum Middle Distillates Test Mix

Using a Luna 3 µm CN LC Column

A polar phase with slight hydrophobic selectivity in reversed phase mode and moderate polar selectivity in normal phase mode. A batch to batch reliable phase with both strong ionic and dipolar chemical interactions.

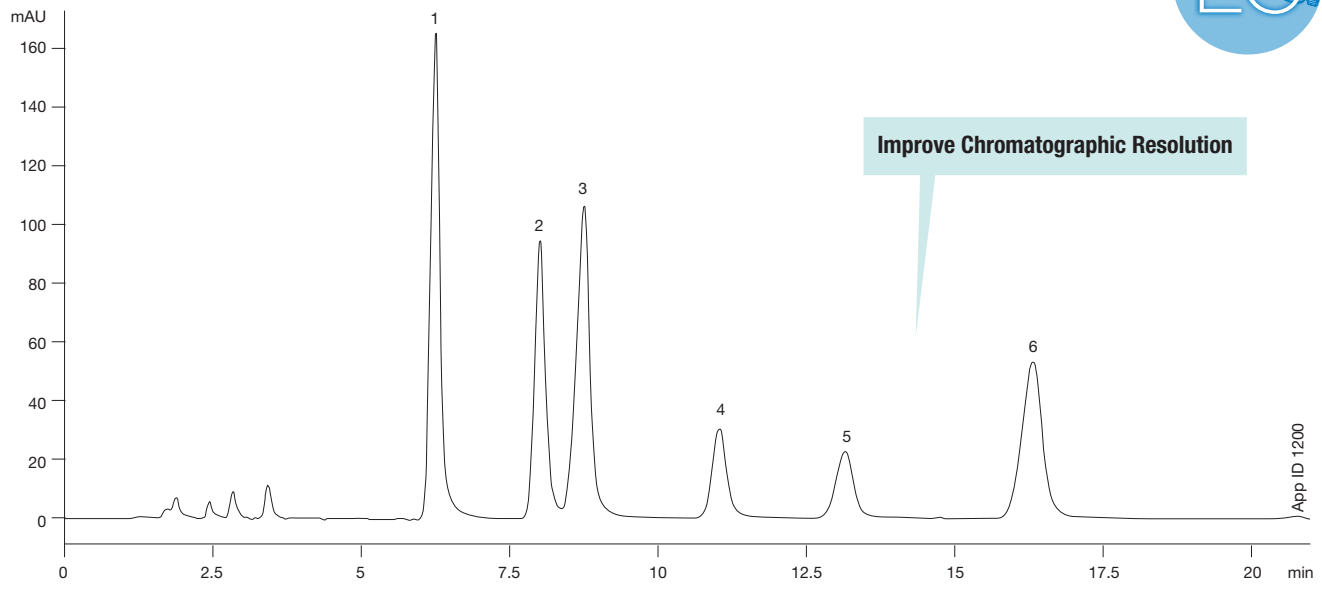


Column: Luna® 3 µm CN 100 Å
Dimensions: 150 x 4.6 mm
Part No.: 00F-4254-E0
Guard Cartridge: AJ0-4305
Guard Holder: KJ0-4282
Mobile Phase: Heptane
Injection Volume: 1 µL
Flow Rate: 1 mL/min
Temperature: 30 °C
Detector: Refractive Index (RI)
Sample: D-6379-SRS-R1 Mix (AccuStandard®)
1. Cyclohexane
2. o-Xylene
4. Methylnaphthalene

Chlorobenzenes

Using a Luna Phenyl-Hexyl LC Column

Luna Phenyl-Hexyl provides increased retention for polar aromatic compounds.



Column: Luna 5 µm Phenyl-Hexyl 100 Å
Dimensions: 150 x 4.6 mm
Part No.: 00F-4257-E0
Guard Cartridge: AJ0-4351
Guard Holder: KJ0-4282
Mobile Phase: A: Water
B: Acetonitrile

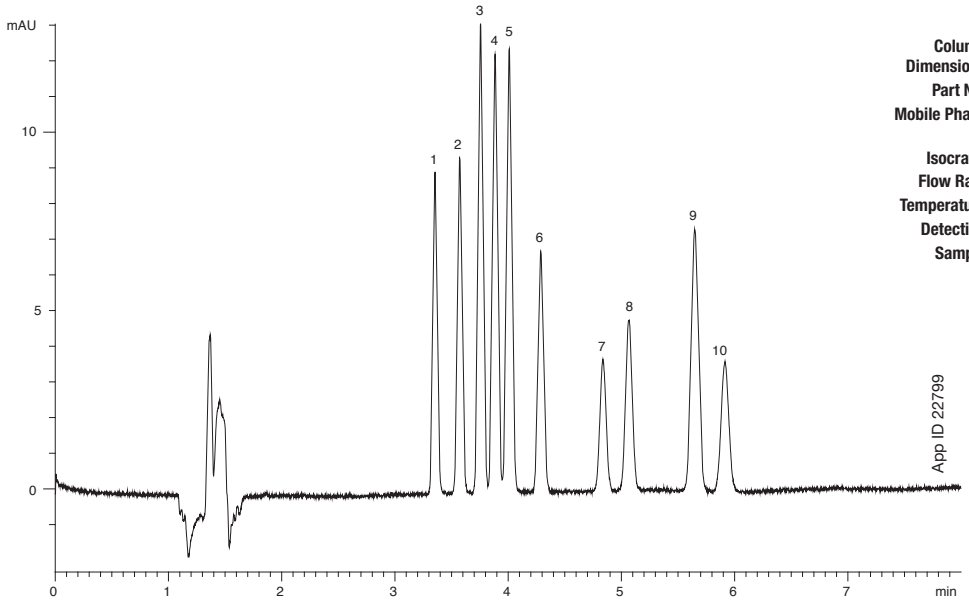
Gradient:	Time (min)	% B
	10	40
	10	55

Flow Rate: 1 mL/min
Temperature: 25 °C
Detection: UV-Vis Abs.-Variable Wave (UV) @ 254 nm (ambient)
Sample: 1. Chlorobenzene
2. 1,2-Dichlorobenzene
3. 1.4-Dichlorobenzene
4. 1,2,3-Trichlorobenzene
5. 1,3,5-Trichlorobenzene
6. 1,2,3,4-Tetrachlorobenzene

Aromatic Isomers

Using a Kinetex® F5 LC Column

Pentafluorophenylpropyl phase that is exceptional for halogenated, conjugated, isomeric, and/or highly polar compounds. Kinetex F5 has five interaction mechanisms: Aromatic (π-π), hydrophobic, electrostatic, steric/planar, and hydrogen bonding.

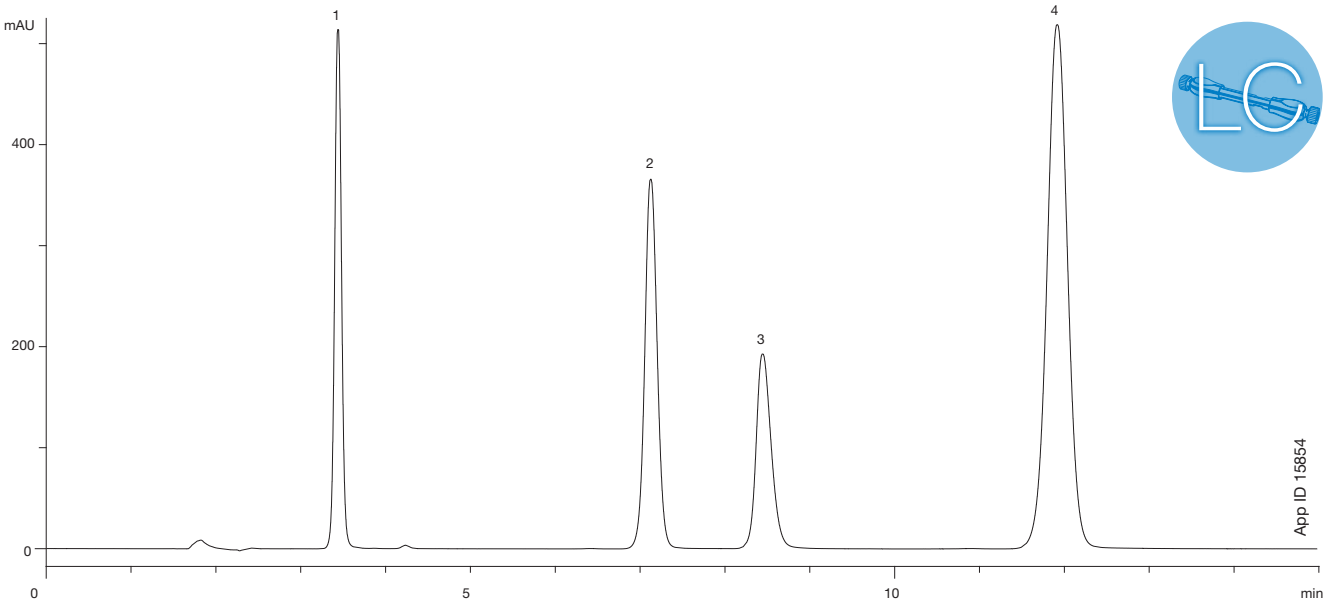


Column: Kinetex F5 2.6 µm
Dimensions: 150 x 4.6 mm
Part No.: 00F-4723-E0
Mobile Phase: A: 0.1 % TFA in Water
B: Acetonitrile
Isocratic: (A/B) 55:45
Flow Rate: 1 mL/min
Temperature: Ambient
Detection: UV @ 254 nm
Sample: 1. 3,4-Dimethylphenol
2. 3,5-Dimethylphenol
3. 2,3-Dimethylphenol
4. 2,5-Dimethylphenol
5. 2,6-Dimethylphenol
6. 2,6-Dichlorophenol
7. 2,5-Dichlorophenol
8. 3,4-Dichlorophenol
9. 2,4-Dibromophenol
10. 3,5-Dichlorophenol

Aromatic Acids

Using a Gemini® C6-Phenyl LC Column

Gemini C6-Phenyl is great for aromatic selectivity in pH 1-12 conditions with low bleed.



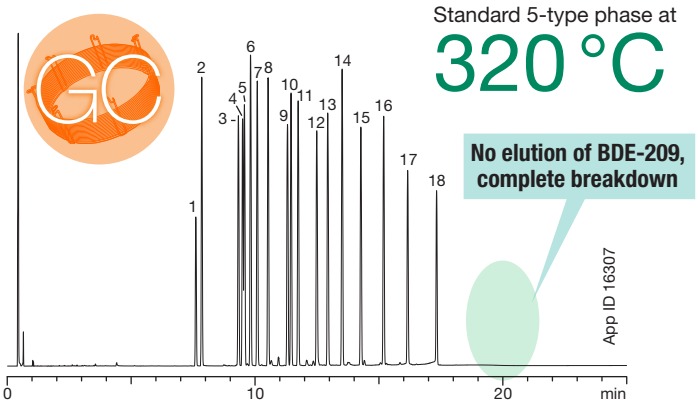
Column: Gemini® 5 µm C6-Phenyl 110 Å
Dimensions: 150 x 4.6 mm
Part No.: 00F-4444-E0
Guard Cartridge: AJ0-7915
Guard Holder: KJ0-4282
Mobile Phase: A: 20 mM Phosphate buffer pH 2.5 / Acetonitrile (75:25)
Gradient: Isocratic

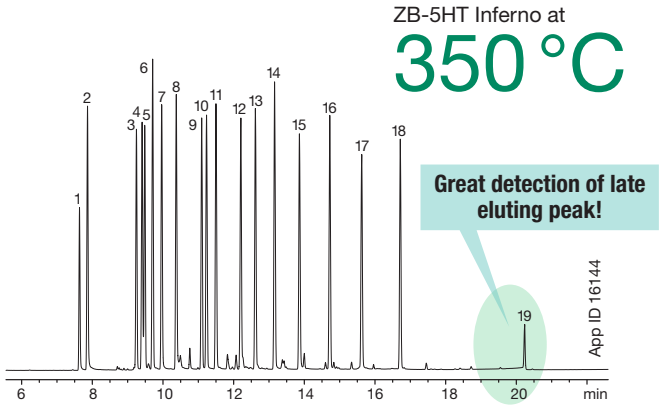
Flow Rate: 1 mL/min
Temperature: Ambient
Detection: UV-Vis Abs.-Variable Wave (UV) @ 254 nm (ambient)
Sample: 1. p-Hydroxybenzoic acid
2. Benzoic acid
3. Salicylic acid
4. p-Toluic acid

Polybrominated Diphenyl Ethers (PBDE)

Using a Zebron™ ZB-5HT Inferno™ GC Column

Zebron Inferno provides higher temperature run capability to elute the higher boiler compounds which also prevents carryover peaks. In a GC column, late eluting Polybrominated Diphenyl Ethers (PBDE) often break down and become difficult to detect. ZB-5HT Inferno™ columns have increased sensitivity for late eluting compounds and thus can easily detect these analytes, as well as separate them with the 5% phenyl phase.





Column: Standard 5-type phase
Dimensions: 15 meter x 0.25 mm x 0.10 µm
Injection: On-Column @ 73 °C, 0.5 µL
Carrier Gas: Helium @ 3.4 mL/min (constant flow)
Oven Program: 70 °C to 160 °C @ 25 °C/min to 320 °C @ 10 °C/min hold 10 min
Detector: ECD @ 340 °C
Sample: Sample was 2.5 ppm in isooctane

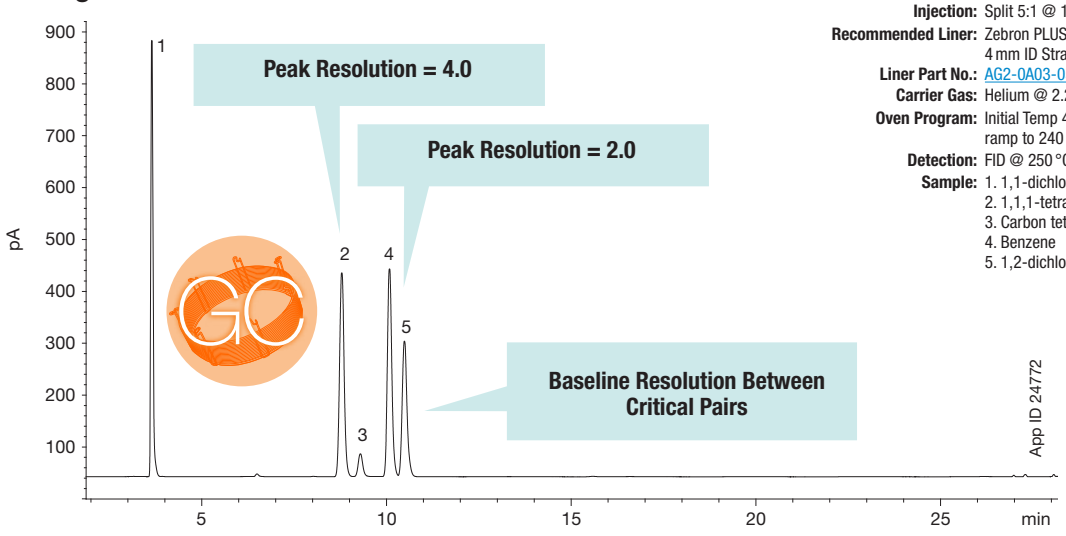
1. BDE-25
2. BDE-28
3. BDE-75
4. BDE-49
5. BDE-71
6. BDE-47
7. BDE-66
8. BDE-77
9. BDE-100
10. BDE-119
11. BDE-99
12. BDE-85
13. BDE-154
14. BDE-153
15. BDE-138
16. BDE-183
17. BDE-190
18. BDE-203

Column: Zebron ZB-5HT Inferno
Dimensions: 15 meter x 0.25 mm x 0.10 µm
Part No.: 7EG-G015-02
Injection: On-Column @ 73 °C, 0.5 µL
Carrier Gas: Helium @ 1.5 mL/min (constant flow)
Oven Program: 70 °C to 160 °C @ 25 °C/min to 350 °C @ 10 °C/min for 5 min
Detector: ECD @ 400 °C
Sample: Sample was 2.5 ppm in isooctane

1. BDE-25
2. BDE-28
3. BDE-75
4. BDE-49
5. BDE-71
6. BDE-47
7. BDE-66
8. BDE-77
9. BDE-100
10. BDE-119
11. BDE-99
12. BDE-85
13. BDE-154
14. BDE-153
15. BDE-138
16. BDE-183
17. BDE-190
18. BDE-203
19. BDE-209

Residual Solvents

Using a Zebron ZB-624*PLUS*™ GC Column



Column: Zebron ZB-624*PLUS*
Dimensions: 30 meter x 0.32 mm x 1.80 µm
Part No.: 7HM-G040-31
Injection: Split 5:1 @ 140 °C, 1 µL
Recommended Liner: Zebron PLUS Liner for Agilent® & Thermo®, 4 mm ID Straight Z-Liner™
Liner Part No.: AG2-0A03-05
Carrier Gas: Helium @ 2.2 mL/min (constant flow)
Oven Program: Initial Temp 40 °C for 20 minutes then ramp to 240 °C @ 10 °C/min
Detection: FID @ 250 °C
Sample: 1. 1,1-dichloroethene
2. 1,1,1-tetrachloride
3. Carbon tetrachloride
4. Benzene
5. 1,2-dichloroethene

Hey Litmus Paper, Why So Blue?

High pH— Basic Solutions

High pH applications can be a challenge for many LC phases, since high pH can dissolve silica and cause permanent damage to traditional silica-based columns. However in reverse phase when you operate at high pH, at least one and preferably two pH units above the pK_a of your base, then the basic compounds will be neutral and exhibit much greater hydrophobic retention compared compared with running at low pH. Acidic compounds, however will all be deprotonated at higher pH and their retention could be heavily influenced by any deprotonated residual silanol groups on the surface, and subsequently be difficult to retain or show poor peak shapes. For a reversed phase application, the retention for the uncharged basic compounds increases to provide an increase in separation along with superior peak shapes. Conversely, at a high pH when the acidic compounds are ionized and become hydrophilic then they tend to be better retained on normal and HILIC phases while less retained on non-polar reversed phase. To handle such high pH, Phenomenex has developed pH stable phases including the core-shell Kinetex® EVO and fully porous Gemini® LC column phases.

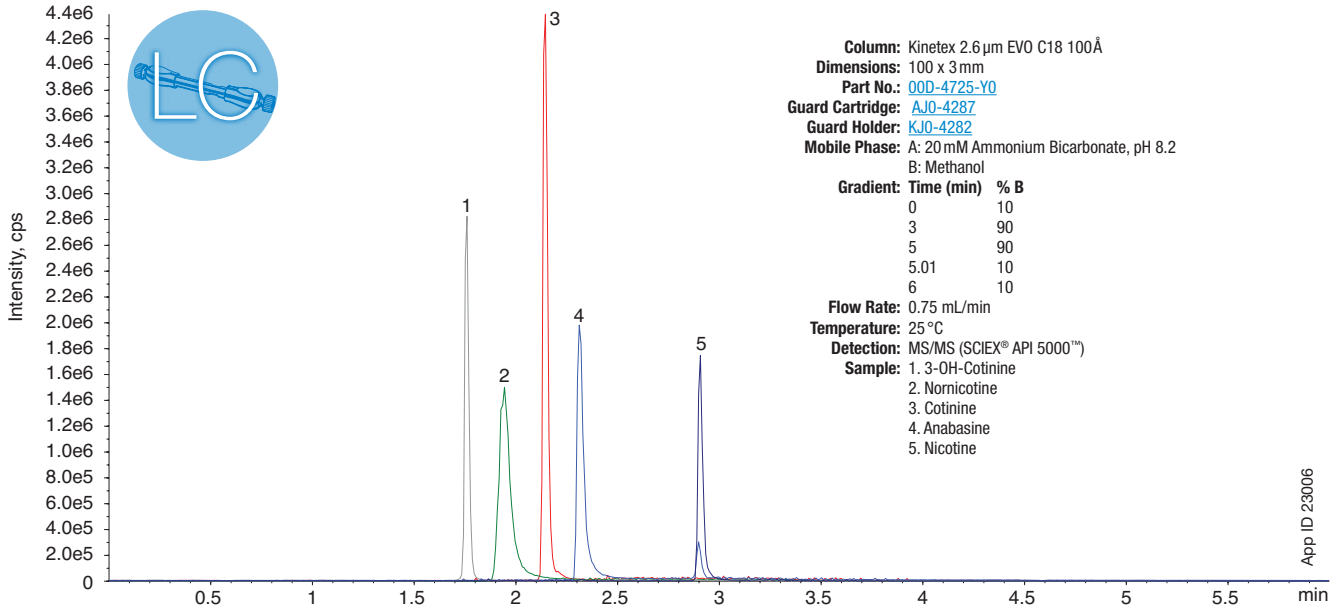
Applications:

- Nitrogenous Bases - Alkaloids
- Volatile Amines
- Ethanolamines
- Nitrosamines

Nitrogenous Bases—Alkaloids

Using a Kinetex® EVO LC Column

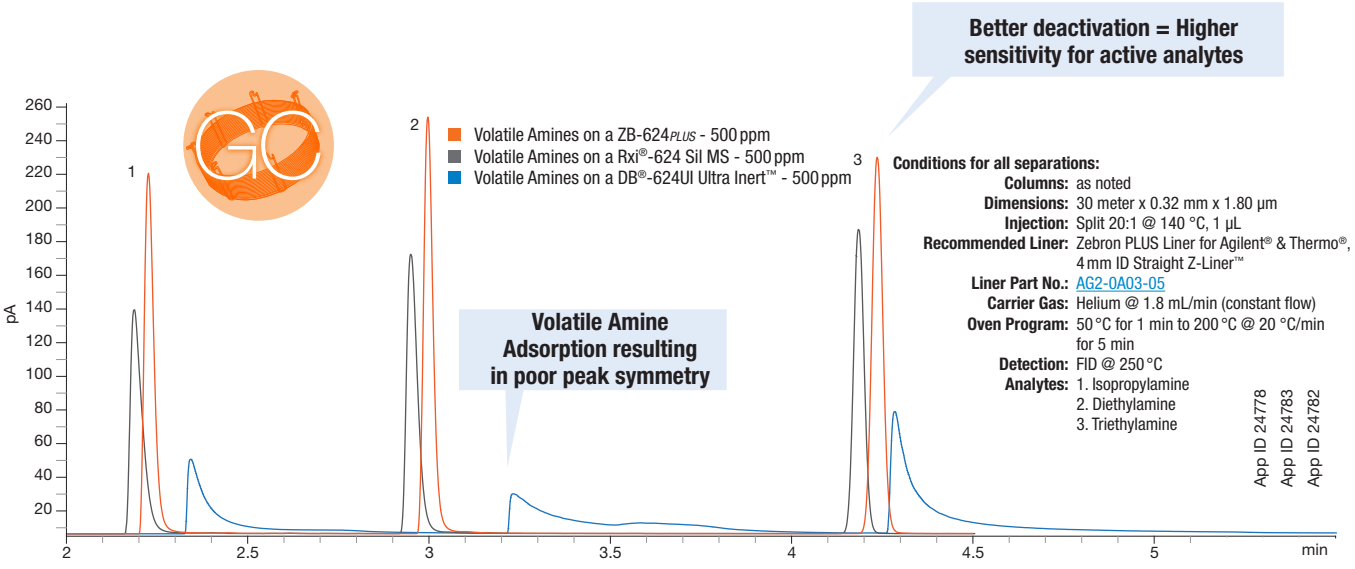
The Kinetex EVO was developed to thrive in robust methods from pH 1-12 to get improved peak shape for bases and easily reduce run times and increase sensitivity.



Volatile Amines

Comparison of Volatile amines on Various 624 Columns

Zebron™ ZB-624*PLUS*™ GC columns undergo a superior deactivation process which minimizes active compound adsorption leading to gains in peak response and shape. Volatile amines are challenging analytes for GC analysis. They can adsorb to even the smallest imperfections in fused silica which can create tailing peaks.

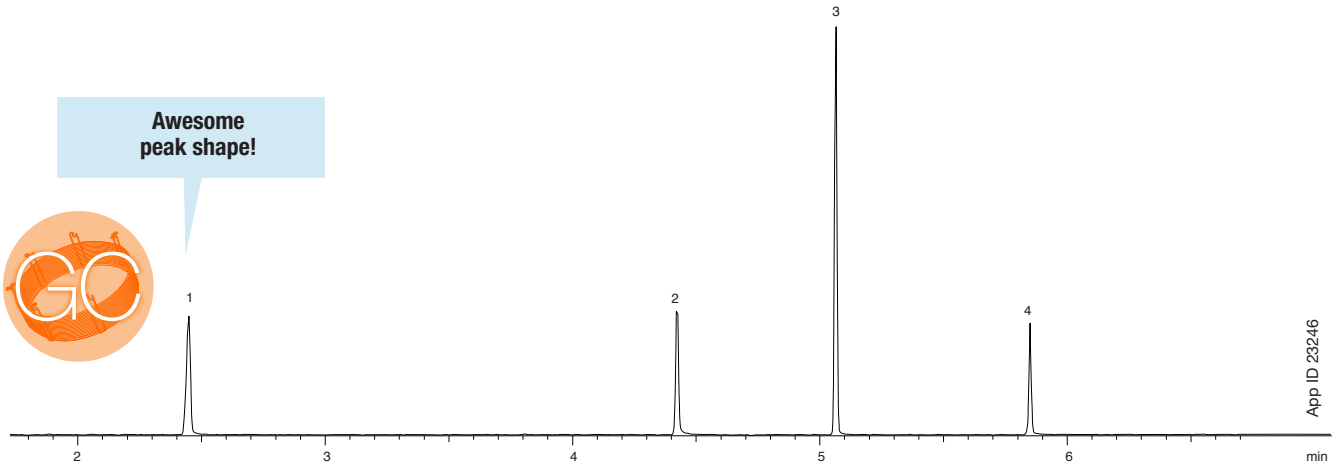


Comparative separations may not be representative of all applications.

Ethanolamines

Using a Zebron™ ZB-5MS*PLUS*™ GC Column

Zebron ZB-5MS*PLUS* has a specialized deactivation for its versatile 5 % phenyl-arylene selectivity with improved sensitivity with special low bleed (MS Certified).



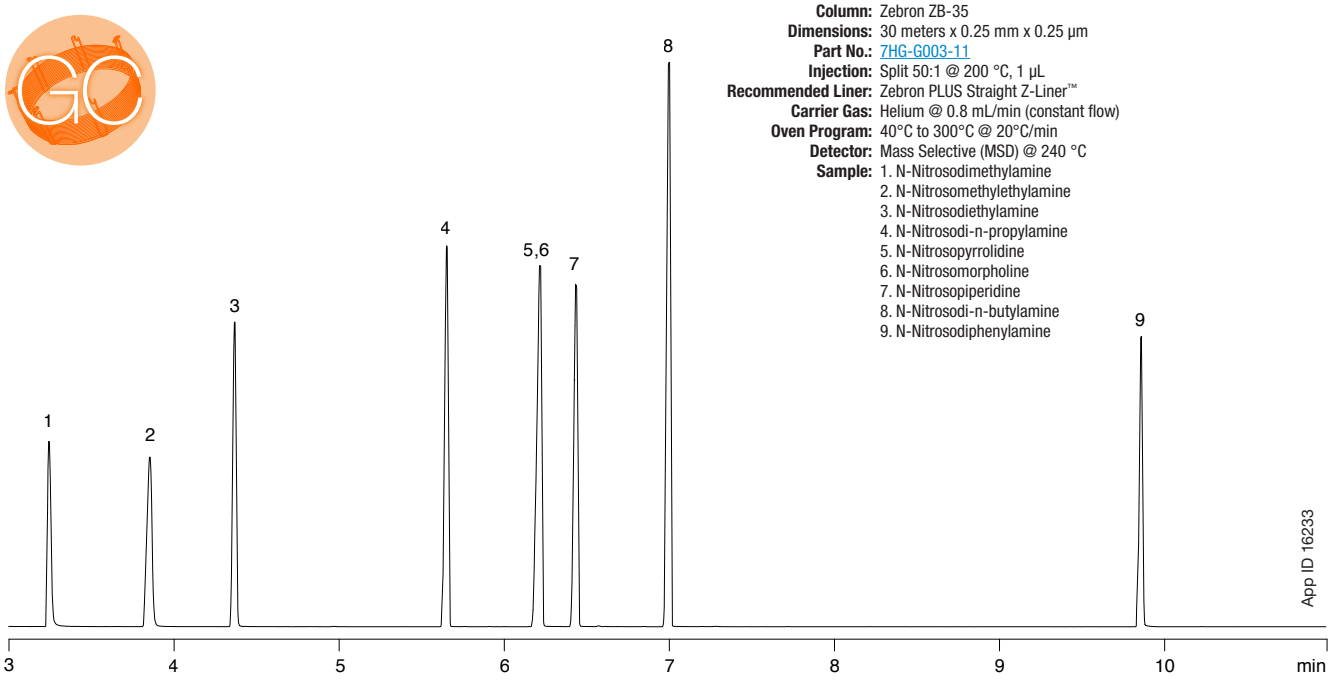
Column: Zebron ZB-5MS*PLUS*
Dimensions: 30 meter x 0.25 mm x 1.00 µm
Part No.: 7HG-G030-22
Injection: Split 200:1 @ 250 °C, 1 µL
Recommended Liner: Zebron PLUS Straight Z-Liner™
Carrier Gas: Helium @ 1.4 mL/min (constant flow)

Oven Program: 30 °C to 300 °C @ 40 °C/min
Detector: MSD @ 320 °C
Sample: 1. Monoethanolamine
2. Diethanolamine
3. Triethylene glycol monomethyl ether (IS)
4. Triethanolamine

Nitrosamines

Using a Zebron ZB-35 GC Column

Column: Zebron ZB-35
Dimensions: 30 meters x 0.25 mm x 0.25 µm
Part No.: 7HG-G003-11
Injection: Split 50:1 @ 200 °C, 1 µL
Recommended Liner: Zebron PLUS Straight Z-Liner™
Carrier Gas: Helium @ 0.8 mL/min (constant flow)
Oven Program: 40°C to 300°C @ 20°C/min
Detector: Mass Selective (MSD) @ 240 °C
Sample: 1. N-Nitrosodimethylamine
2. N-Nitrosomethylethylamine
3. N-Nitrosodiethylamine
4. N-Nitrosodi-n-propylamine
5. N-Nitrosopyrrolidine
6. N-Nitrosomorpholine
7. N-Nitrosopiperidine
8. N-Nitrosodi-n-butylamine
9. N-Nitrosodiphenylamine



The Acid Test

Low pH— Acidic Solutions

Organic acids are hydrophilic and polar in functionality, which can often prevent adequate retention or selectivity in a non-polar reversed phase column. In addition, the mobile phase pH can have a significant effect on retention of ionizable compounds such as organic acids. At a low pH below the pK_a, the acidic species in the mixture will be neutral and subsequently have higher hydrophobic retention whereas the basic compounds will all be charged. When the pH is low enough to fully protonate any residual silanol groups, then the basic compounds will generally have low hydrophobic retention with reverse phase. In the most extreme cases, it may be challenging to retain basic species at low pH on reverse phase columns that don't contain a polar moiety.

For very low pH environments there is also a concern that the silica-based phase ligands can hydrolyze and therefore change the retention capabilities. Phenomenex has a selection of columns that can operate at low pH levels to accommodate the variety of analysis requirements.

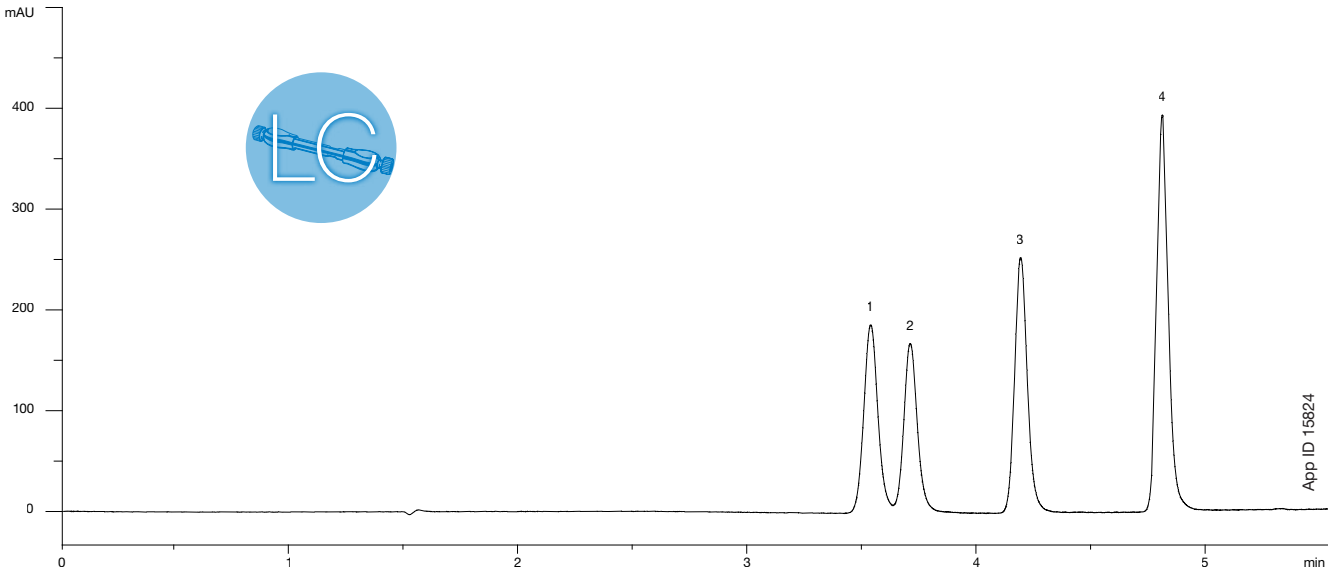
Applications:

- Organic Acids
- Fatty Acids

Organic Acids

Using a Gemini® C18 LC Column

Gemini columns are rugged, fully porous reversed phase HPLC columns that offer extended lifetime at extreme pH conditions and excellent stability for reproducible, high efficiency separations. Take full advantage of high and low pH conditions (pH 1-12) to manipulate selectivity.



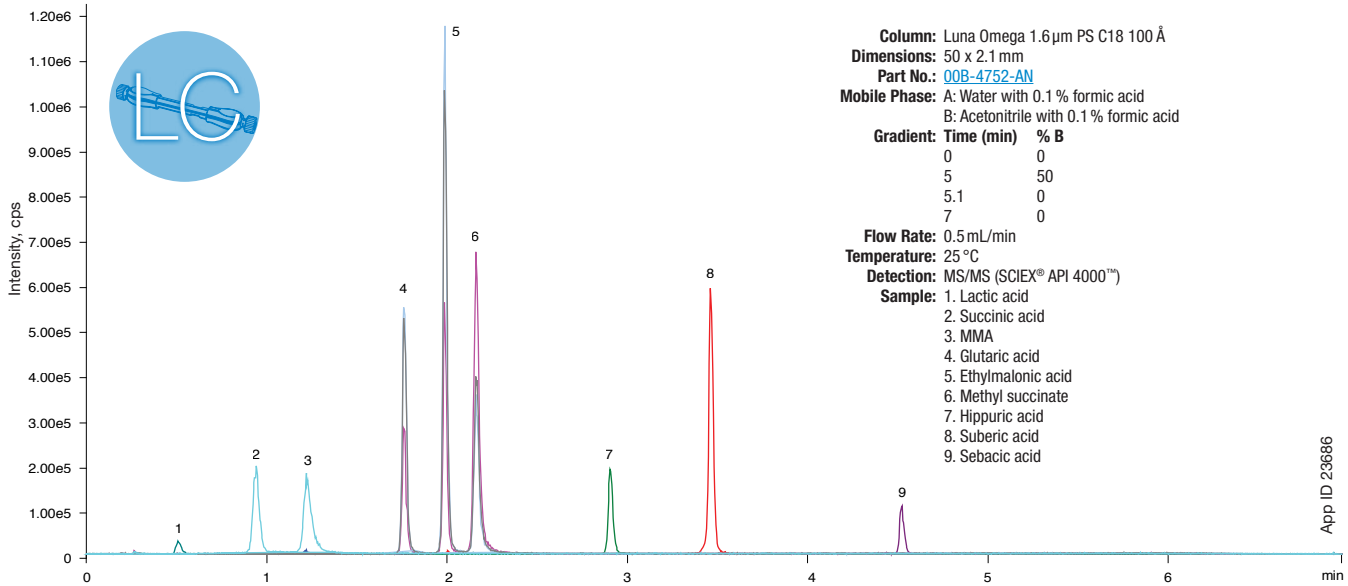
Column: Gemini 3 µm C18
Dimensions: 100 x 4.6 mm
Part No.: 00D-4439-E0
Mobile Phase: A: 20 mM Phosphate buffer, pH 3.2
B: Methanol

Gradient:	**Time (min)**	**% B**
	0	25
	5	75

Flow Rate: 1.0 mL/min
Temperature: Ambient
Detection: UV @ 225 nm (22 °C)
Sample: 1. Mandelic Acid
2. Hippuric Acid
3. 2-Methyl Hippuric Acid
4. 3-Methyl Hippuric Acid

Using a Luna® Omega PS C18 LC Column

Luna Omega PS C18 is a unique mixed-mode stationary phase that provides incredibly useful polar and non-polar retention. This mixed-mode selectivity allows for greater separation between compounds of varying functional groups.



Column: Luna Omega 1.6 µm PS C18 100 Å
Dimensions: 50 x 2.1 mm
Part No.: 00B-4752-AN
Mobile Phase: A: Water with 0.1 % formic acid
B: Acetonitrile with 0.1 % formic acid

Gradient:	**Time (min)**	**% B**
	0	0
	5	50
	5.1	0
	7	0

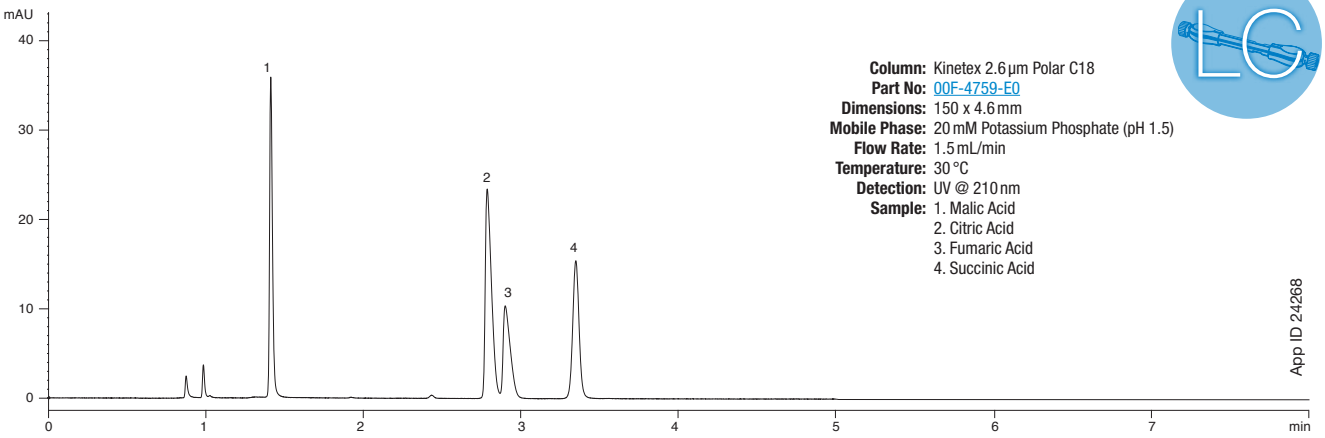
Flow Rate: 0.5 mL/min
Temperature: 25 °C
Detection: MS/MS (SCIEX® API 4000™)
Sample: 1. Lactic acid
2. Succinic acid
3. MMA
4. Glutaric acid
5. Ethylmalonic acid
6. Methyl succinate
7. Hippuric acid
8. Suberic acid
9. Sebacic acid

Organic Acids *(cont'd)*

Using a Kinetex™ Polar C18 LC Column

Kinetex Polar C18 is 100 % aqueous stable core-shell column with enhanced modified mixed-mode surface for retaining polar analytes in addition to the non-polar retention from the C18 ligands.

Kinetex Polar C18, with a 2.6 µm core-shell particle size and polar modified surface, can easily upgrade existing fully porous 5 µm and 3 µm methods to shorten run times, increase sensitivity, and even provide greater resolution with much higher efficiency levels.



Column: Kinetex 2.6 µm Polar C18
Part No: 00F-4759-E0
Dimensions: 150 x 4.6 mm
Mobile Phase: 20 mM Potassium Phosphate (pH 1.5)
Flow Rate: 1.5 mL/min
Temperature: 30 °C
Detection: UV @ 210 nm
Sample: 1. Malic Acid
2. Citric Acid
3. Fumaric Acid
4. Succinic Acid

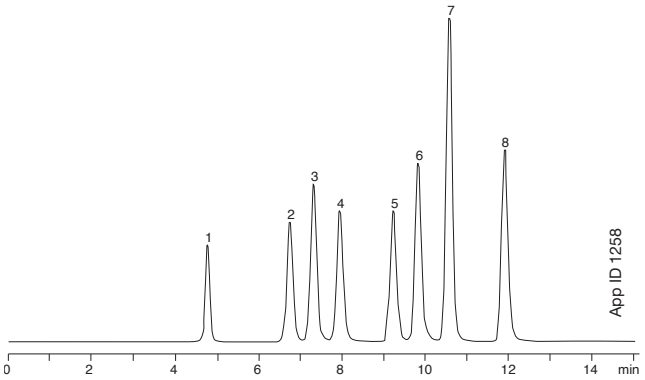
Using a Luna C8(2) LC Column

Columns: Luna 5 µm C8(2)
Dimensions: 150 x 4.6 mm
Part No.: 00F-4249-E0
Mobile Phase: A: Acetonitrile
B: Water (18 Mohms DI)

Gradient:	**Time (min)**	**% B**
	0	30
	10	20
	12	30
	16	30

Flow Rate: 0.3 mL/min
Detection: Evaporative Light Scattering (ELSD)
Temperature: 22 °C

Sample: 1. Lauric acid
2. Myristic acid
3. Palmitoleic acid
4. Linoleic acid
5. Palmitic acid
6. Oleic acid
7. Heptadecanoic acid
8. Stearic acid

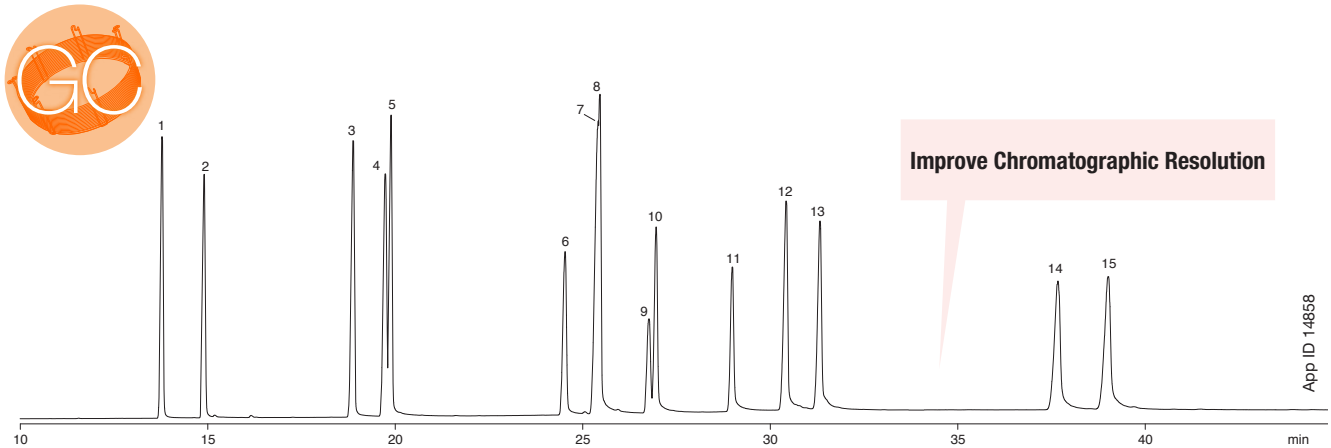


Comparative chromatograms may not be representative of all applications.

Fatty Acids

Using a Zebron™ ZB-FFAP GC Column

Zebron ZB-FFAP is a 100 % nitroterephthalic acid modified PEG high polarity column; excellent thermal and chemical stability that is especially suited for organic acids, free fatty acids, and alcohols



Column: Zebron ZB-FFAP
Dimensions: 60 meter x 0.25 mm x 0.25 µm
Part No.: 7KG-G009-11
Injection: Split 40:1 @ 220 °C, 0.2 µL
Recommended Liner: Zebron PLUS Single Taper with Wool, Part No.: AG2-0A13-05 (for Agilent systems)
Carrier Gas: Helium @ 2.4 mL/min (constant flow)
Oven Program: 200 °C to 260 °C @ 2 °C/min for 30 min
Detector: FID @ 250 °C

Sample: 2 mg/mL each in THF
1. Myristic Acid (C14:0)
2. Myristoleic Acid (C14:1c)
3. Palmitic Acid (C16:0)
4. Palmitelaidic Acid (C16:1t)
5. Palmitoleic Acid (C16:1c)
6. Stearic Acid (C18:0)
7. Elaidic Acid (C18:1t)
8. Oleic Acid (C18:1c)
9. Linolelaidic Acid (C18:2t)
10. Linoleic Acid (C18:2c)
11. Linolenic Acid (C18:3c)
12. Arachidic Acid (C20:0)
13. Gondonic Acid (C20:1c)
14. Behenic Acid (C22:0)
15. Erucic Acid (C22:1c)

Bringing it all together, we can all just get along.

Polymers and Phthalate Polymer Additives

Size exclusion chromatography (SEC) is a non-adsorptive separation process where retention occurs as the smaller analytes permeate through the polymer pores while the one's too large for the pores are excluded. This is a separation mode for determining a sample's molar mass distribution using their hydrodynamic volume.

It is common to use multiple columns in series to increase exclusion range and/or resolution, in either identical or different fixed pore columns.

There are two types of SEC:

- Gel Permeation Chromatography (GPC) is using an organic mobile phase
- Gel Filtration Chromatography (GFC) is using an aqueous mobile phase

Applications:

- Non-Aqueous Polymers
- Aqueous Polymers
- Phthalates, Polymer Additives

Gel Permeation Chromatography (GPC)

Selecting a GPC Column

The key to selecting a GPC column is the molecular weight range of the compounds being separated. Then the second decision weighs speed versus resolution. The following tables give you some guidance.

Aim	Mixed-Bed (Linear)	Fixed Pore
Maximum resolution		✓
Fast fingerprint over broad MW range	✓	
Known compound MW	✓	✓
Unknown compound MW	✓	

Sample Type	Molecular Weight	Phenogel Column
Small Organics	100–3 K 500–6 K 1 K–15 K	50 Å 100 Å 500 Å
Resins	1 K–75 K 5 K–500 K 10 K–1,000 K	10^3 Å 10^4 Å 10^5 Å
High MW Polymers	60 K–10,000 K 100–10,000 K	10^6 Å Linear (2)

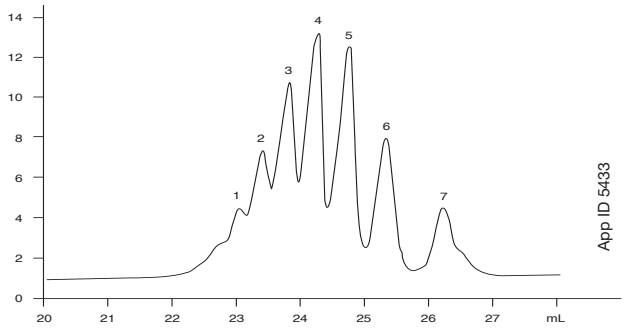
Phenogel™ Non-Aqueous GPC/SEC Columns

- Organic Size Exclusion/Gel Permeation for Polymer Analysis
- Highly cross-linked for mechanical and chemical stability
- Temperature stable to 140 °C
- Available in seven different pore sizes, ranging from 50 Å to 10^6 Å
- Optimized pore size distribution and packing for high resolution and tight linear calibration curves with excellent column-to-column reproducibility

Non-Aqueous Polymers

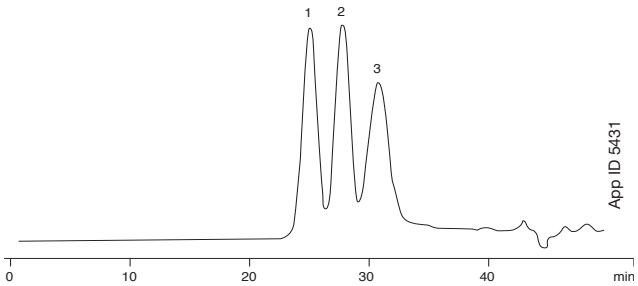
Polyethylene Glycol 330

Column: Phenogel 5 µm 50 Å, 100 Å, 500 Å
Dimensions: 300 x 7.8 mm
Part No.: 00H-0441-K0 (50 Å)
00H-0442-K0 (100 Å)
00H-0443-K0 (500 Å)
Solvent: THF
Flow Rate: 1.0 mL/min
Detection: Differential Refractometer
Injection Volume: 100 µL 0.25 % w/v
Temperature: Ambient
Sample: 1. dp7 546 MW
2. dp6 458 MW
3. dp5 370 MW
4. dp4 282 MW
5. dp3 194 MW
6. dp2 106 MW
7. dp1 62 MW



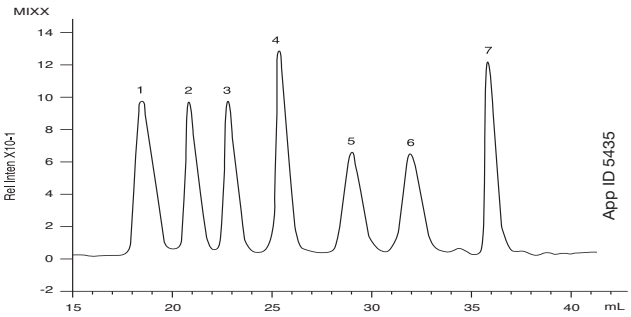
Polymethyl Methacrylates (Wide MW Range)

Column: Phenogel 5 µm 10^5 Å, 10^4 Å, 10^3 Å, 500 Å
Dimensions: 300 x 7.8 mm
Part No.: 00H-0446-K0 (10^5 Å)
00H-0445-K0 (10^4 Å)
00H-0444-K0 (10^3 Å)
00H-0443-K0 (500 Å)
Solvent: THF
Flow Rate: 1.0 mL/min
Detection: Differential Refractometer
Injection Volume: 100 µL 0.25 % w/v
Sample: 1. 700,000 MW
2. 107,000 MW
3. 27,000 MW



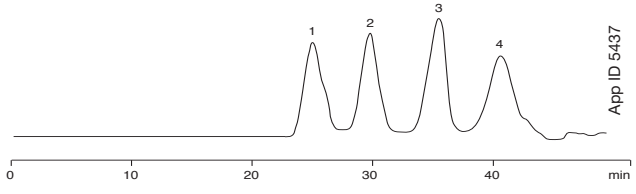
Polystyrenes (Wide MW Range)

Column: Phenogel 10 µm 10^5 Å, 10^4 Å, 10^3 Å
Dimensions: 300 x 7.8 mm
Part No.: 00H-0446-K0 (10^5 Å)
00H-0445-K0 (10^4 Å)
00H-0444-K0 (10^3 Å)
Solvent: THF
Flow Rate: 1.0 mL/min
Detection: Differential Refractometer
Injection Volume: 100 µL 0.25 % w/v
Temperature: Ambient
Sample: 1. 1,560,000 MW
2. 260,000 MW
3. 94,000 MW
4. 30,000 MW
5. 6,100 MW
6. 854 MW
7. 146 MW



Polybutadienes (Wide MW Range)

Column: Phenogel 5 µm 10^5 Å, 10^4 Å, 10^3 Å, 500 Å
Dimensions: 300 x 7.8 mm
Part No.: 00H-0446-K0 (10^5 Å)
00H-0445-K0 (10^4 Å)
00H-0444-K0 (10^3 Å)
00H-0443-K0 (500 Å)
Solvent: THF
Flow Rate: 1.0 mL/min
Detection: Differential Refractometer
Injection Volume: 100 µL 0.25 % w/v
Sample: 1. 420,000 MW
2. 24,000 MW
3. 2,500 MW
4. 500 MW



Gel Filtration Chromatography (GFC)

Using a PolySep™ GFC Column

Polymer-Based Aqueous GFC Columns for the Separation of Polymers, Oligomers, and Oligosaccharides

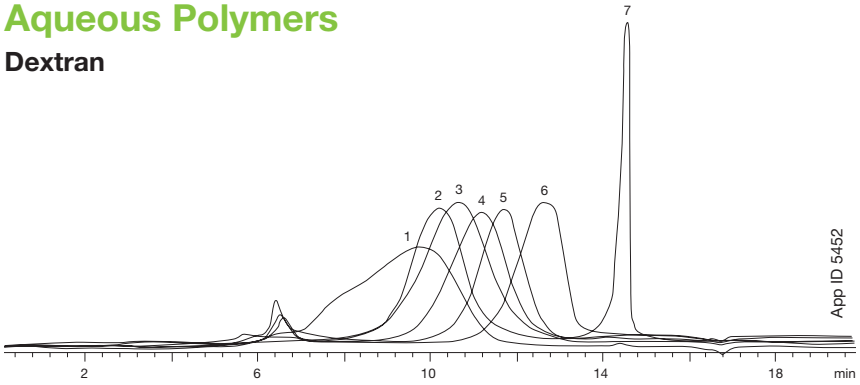
- Highly hydrophilic synthetic polymer phase
- Suitable for water-soluble polymers
- Very low nonspecific interaction with the separation matrix
- High efficiencies and good mechanical strength

PolySep-GFC-P Technical Data and Specifications

Phase:	1000	2000	3000	4000	5000	6000	Linear
Exclusion Limits in Daltons:							
PEG	2×10^3	9×10^3	5×10^4	2×10^5	2×10^6	1×10^7	1×10^7
Pullulans	3.5×10^3	1×10^4	1×10^5	3.5×10^5	4×10^6	2×10^7	2×10^7
Separation Range (Da)	20 - 3K	100 - 10K	250 - 75K	3K - 400 K	50K - 2M	100K - 15M	1K - 10M
Typical Efficiency Plates/meter	22,000	50,000	32,000	32,000	32,000	32,000	32,000
Maximum Organic Modifier:							
Methanol	20%	95%	70%	70%	70%	70%	70%
Acetonitrile	20%	70%	70%	70%	70%	70%	70%
pH Range	3.0 to 12.0						
Maximum Flow Rate	Depends on backpressure, do not exceed 1000 psi						
Column Hardware	Stainless steel or PEEK (Biocompatible hardware available upon request)						
Temperature	4 to 60 °C						
Maximum Salt	Maximum allowed 0.5 M with a flow rate not to exceed 0.5 mL/min						
Storage	For overnight, pump water at 0.2 mL/min, for longer storage use 0.05% NaN_3 in water or 10% methanol in water						
General	A guard column is recommended to improve column life						

Aqueous Polymers

Dextran



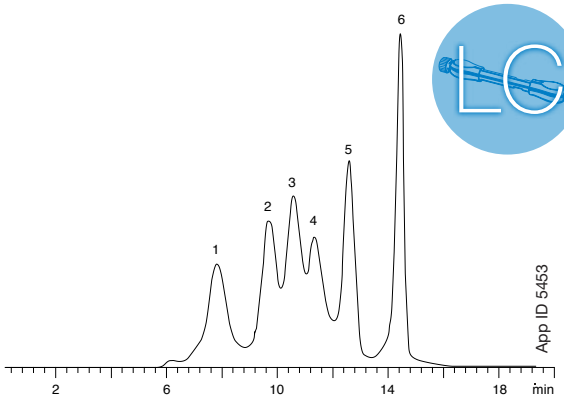
Column: PolySep-GFC-P4000
Dimensions: 300 x 7.8 mm
Part No.: CH0-9229
Mobile Phase: Water
Flow Rate: 0.8 mL/min
Detection: RI
Sample: 20 µL injected

1. Dextran	500 kDa
2. Dextran	110 kDa
3. Dextran	70 kDa
4. Dextran	40 kDa
5. Dextran	15 kDa
6. Dextran	6 kDa
7. Ethylene Glycol	62.07 Da

Polyethylene Standards

Column: PolySep-GFC-P4000
Dimensions: 300 x 7.8 mm
Part No.: 00H-3144-K0
Mobile Phase: Water
Flow Rate: 0.8 mL/min
Detection: RI
Sample: 20 µL injected

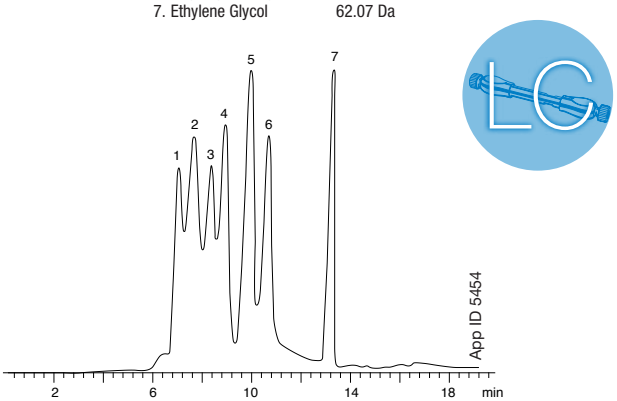
1. Polyethylene Oxide	305.4 kDa
2. Polyethylene Oxide	95.7 kDa
3. Polyethylene Oxide	31.8 kDa
4. Polyethylene Glycol	19.7 kDa
5. Polyethylene Glycol	3.4 kDa
6. Ethylene Glycol	62.07 Da



Polyethylene Oxide/Polyethylene Glycol

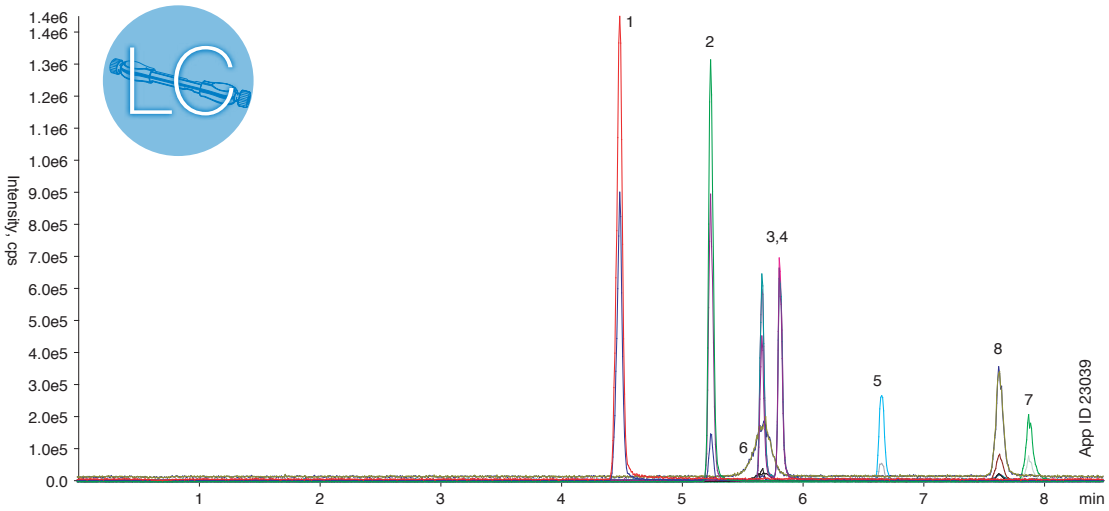
Column: PolySep-GFC-P3000
Dimensions: 300 x 7.8 mm
Part No.: 00H-3143-K0
Mobile Phase: Water
Flow Rate: 0.8 mL/min
Detection: RI
Sample: 10 µL injected

1. Polyethylene Oxide	62.6 kDa
2. Polyethylene Oxide	31.1 kDa
3. Polyethylene Glycol	19.7 kDa
4. Polyethylene Glycol	6.8 kDa
5. Polyethylene Glycol	3.4 kDa
6. Polyethylene Glycol	1.5 kDa
7. Ethylene Glycol	62.07 Da



Phthalates and Polymer Additives

Using a Kinetex® Biphenyl LC Column



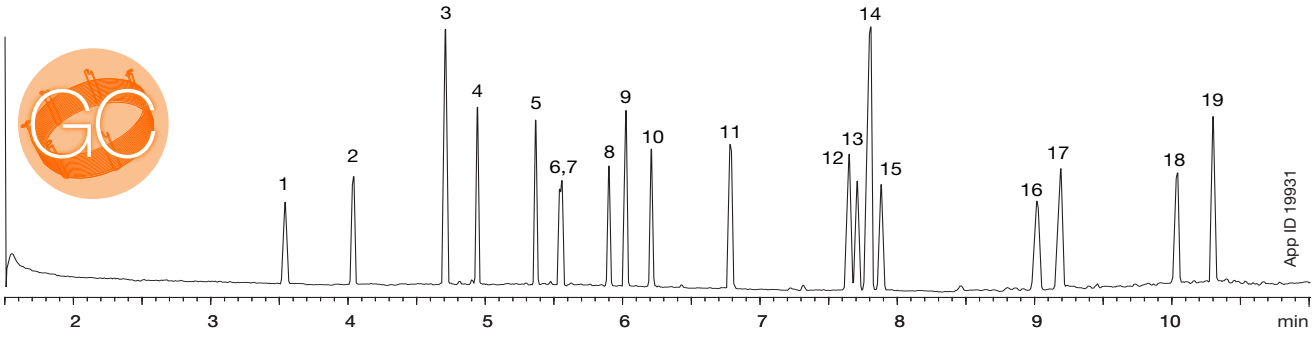
Column: Kinetex 2.6 µm Biphenyl
Dimensions: 50 x 3 mm
Part No.: 00B-4622-Y0
Mobile Phase: A: DI Water
B: Methanol

Gradient:	**Time (min)**	**% B**
	0	40
	5	90
	7	90
	7.01	40
	8.5	40

Flow Rate: 0.4 mL/min
Temperature: 25 °C
Detection: MS/MS
Sample: 1. Diethyl phthalate
2. Dipropyl phthalate
3. Diisobutyl phthalate
4. Dibutyl phthalate
5. Dicyclohexyl phthalate
6. Di-n-octyl phthalate
7. Chimassorb-81
8. Bis(2-ethylhexyl) phthalate

Using a Zebron™ ZB-50 GC Column

- 50 % Phenyl Intermediate Polarity for GC-MS
- Excellent for trace analysis with bleed-sensitive detectors



Column: Zebron ZB-50
Dimensions: 30 meters x 0.25 mm x 0.25 µm
Part No.: 7HG-G004-11
Injection: Split 10:1 @ 260 °C, 1 µL
Recommended Liner: Zebron PLUS Single Taper Z-Liner™ Part No.: AG2-0A13-05
Carrier Gas: Helium @ 1 mL/min (constant flow)
Oven Program: 135 °C to 275 °C @ 25 °C/min for 3.5 min to 340 °C @ 35 °C/min for 1 min
Detector: MSD @ 320 °C; 45-500 amu
Sample:
1. Dimethyl phthalate
2. Diethyl phthalate
3. Diallyl phthalate
4. Di-n-propyl phthalate
5. Di-n-butyl phthalate
6. Diisobutyl phthalate
7. Di-n-hexyl phthalate
8. Bis(2-methoxyethyl) phthalate
9. Di-n-pentyl phthalate
10. Bis(2-ethoxyethyl) phthalate
11. Di-(4-methyl-2-pentyl) phthalate
12. Bis(2-ethylhexyl) phthalate
13. Benzyl butyl phthalate
14. Di-n-heptyl phthalate
15. Bis(2-n-butoxyethyl) phthalate
16. Dicyclohexyl phthalate
17. Di-n-octyl phthalate
18. Diphenylhexyl phthalate
19. Di-n-nonyl phthalate
20. Diisononyl phthalate (not shown)
21. Diisodecyl phthalate (not shown)

LC Column Protection

KrudKatcher™ Ultra

- Fits virtually all UHPLC / HPLC columns 1.0 to 4.6 mm ID
- Pressure rated to 20,000 psi (1,375 bar)
- Extremely low dead volume minimizes sample peak dispersion

Contains an integrated 2.0 µm depth filter that efficiently removes microparticulates from the flow stream without contributing to system backpressure or dead volume (<0.2 µL).

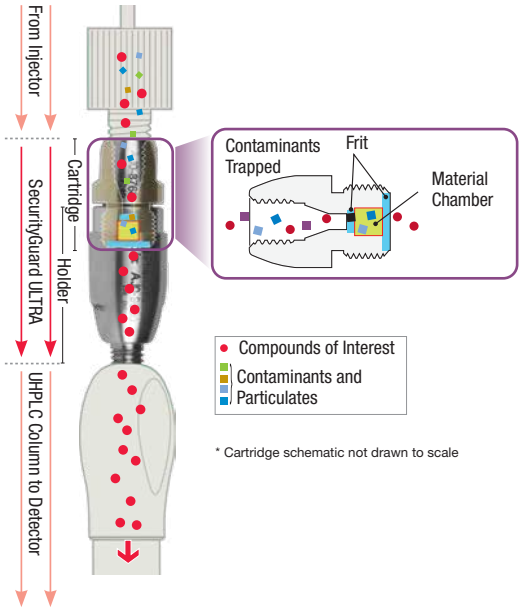
SecurityGuard

UHPLC

SecurityGuard ULTRA™ UHPLC Column Protection

Protect your UHPLC column from damaging contaminants and microparticulates with the SecurityGuard ULTRA guard cartridge system!

- Simple to use
- Extend column lifetime
- Fits virtually all manufacturers' columns 2.1 to 4.6 mm ID



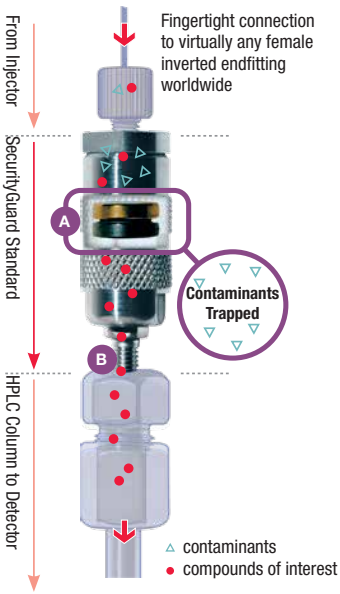
* Cartridge schematic not drawn to scale

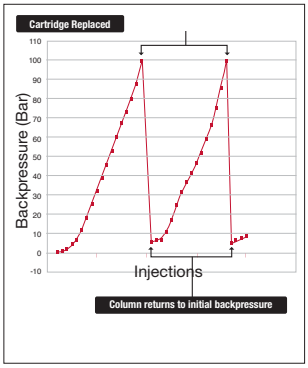
See it in action:
www.phenomenex.com/SecurityGuardULTRA

HPLC

SecurityGuard™ Column Protection

The SecurityGuard analytical cartridge holder (patented) directly finger-tightens into virtually any manufacturer's column endfitting. Contaminants are retained by an inexpensive disposable cartridge instead of damaging your valuable HPLC and SFC column investment. Simply replace SecurityGuard cartridges instead of your expensive columns. In this graph, once the expired SecurityGuard cartridge was replaced, the pressure immediately dropped and the column performance was restored allowing for extended column use.





Accelerated lifetime test using endogenous biomolecule matrix on a 5 µm 50 x 4.6 mm column with SecurityGuard cartridges. Backpressure values represent additional backpressure contributed by SecurityGuard.

A Cutaway view showing cartridge — can be easily inspected for contaminants

B Universal Fingertight connection to HPLC column — no wrenches required

GC Column Protection

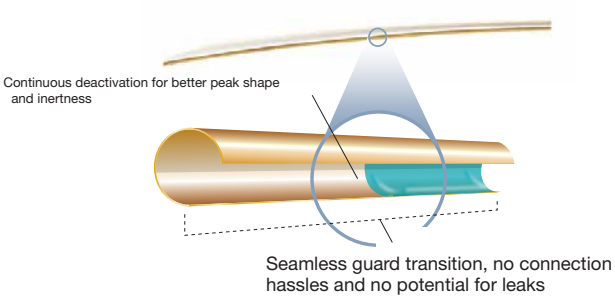
Guardian™ Integrated Guard Columns

Built-In Column Protection: No Leaks, No Worries!

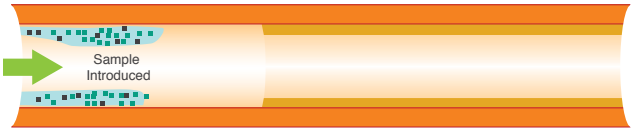
Why Choose Zebron™ With Guardian?

Guardian columns have the 2 m, 5 m or 10 m guard built directly into the analytical column in one continuous length of tubing. Unlike traditional guard columns, which are known to be difficult to seal and prone to leaking after normal column maintenance, the Guardian system provides the same inert column protection, but eliminates the possibility of leaks.

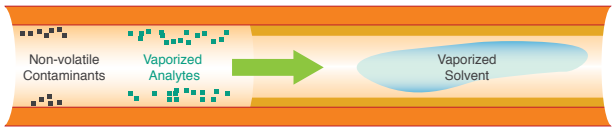
- Eliminate the potential for leaks
- Extend column life
- Improve analyte focusing for low boiling compounds
- Aggressively tested to ensure deactivation



How It Works



The sample is introduced onto the Guardian section of the column.



As temperature increases (oven ramp program), the sample is vaporized and moves unretained through the Guardian section of the column. Non-volatile contaminants are deposited on the Guardian section, better preserving the stationary phase and making it easier to trim contaminants off the front of the column.

When the analytes reach the stationary phase (analytical portion of the column), they are refocused, resulting in a narrower initial peak width. This can help improve resolution.

For additional parts and accessories, contact phenomenex or visit:

www.Phenomenex.com/livechat

Sample Preparation

Strata® Silica-Based SPE Sorbents

Tubes	1 mL (100/box)		3 mL (50/box)			6 mL (30/box)		
Phase	50 mg	100 mg	100 mg	200 mg	500 mg	200 mg	500 mg	1 g
C18-E	8B-S001-DAK	8B-S001-EAK	8B-S001-EBJ	8B-S001-FBJ	8B-S001-HBJ	8B-S001-FCH	8B-S001-HCH	8B-S001-JCH
C18-U	—	8B-S002-EAK	—	8B-S002-FBJ	8B-S002-HBJ	—	8B-S002-HCH	8B-S002-JCH
C18-T	—	8B-S004-EAK	—	8B-S004-FBJ	8B-S004-HBJ	—	8B-S004-HCH	8B-S004-JCH
C8	—	8B-S005-EAK	—	8B-S005-FBJ	8B-S005-HBJ	—	8B-S005-HCH	8B-S005-JCH
Phenyl	—	8B-S006-EAK	—	8B-S006-FBJ	8B-S006-HBJ	—	8B-S006-HCH	8B-S006-JCH
SCX	—	8B-S010-EAK	8B-S010-EBJ	8B-S010-FBJ	8B-S010-HBJ	—	8B-S010-HCH	8B-S010-JCH
WCX	—	8B-S027-EAK	—	8B-S027-FBJ	8B-S027-HBJ	—	8B-S027-HCH	8B-S027-JCH
SAX	—	8B-S008-EAK	8B-S008-EBJ	8B-S008-FBJ	8B-S008-HBJ	—	8B-S008-HCH	8B-S008-JCH
NH_2	—	8B-S009-EAK	—	8B-S009-FBJ	8B-S009-HBJ	—	8B-S009-HCH	8B-S009-JCH
CN	—	8B-S007-EAK	—	8B-S007-FBJ	8B-S007-HBJ	—	8B-S007-HCH	8B-S007-JCH
Si-1	—	8B-S012-EAK	—	8B-S012-FBJ	8B-S012-HBJ	—	8B-S012-HCH	8B-S012-JCH
Florisil®	—	—	—	—	8B-S013-HBJ	—	8B-S013-HCH	8B-S013-JCH
EPH	—	—	—	—	8B-S031-HBJ	—	—	—
AL-N	—	—	—	—	8B-S313-HBJ	—	—	8B-S313-JCH

Mixed-Mode SPE sorbents

Tubes	1 mL (100/box)		3 mL (50/box)			6 mL (30/box)		
Phase	—	100 mg	100 mg	150 mg	200 mg	200 mg	500 mg	—
Screen-C	—	8B-S016-EAK	8B-S016-EBJ	8B-S016-SBJ	8B-S016-FBJ	8B-S016-FCH	8B-S016-HCH	—
Screen-A	—	8B-S019-EAK	—	—	8B-S019-FBJ	8B-S019-FCH	8B-S019-HCH	—

Polymeric SPE sorbents

Tubes	1 mL (100/box)		3 mL (50/box)			6 mL (30/box)		
Phase	50 mg	100 mg	—	200 mg	500 mg	200 mg	500 mg	1 g
SDB-L	8B-S014-DAK	8B-S014-EAK	—	8B-S014-FBJ	8B-S014-HBJ	8B-S014-FCH	8B-S014-HCH	8B-S014-JCH

Strata®-X Polymer-Based SPE Sorbents

Tubes	1 mL (100/box)		3 mL (50/box)			6 mL (30/box)		
Phase	30 mg	60 mg	60 mg	200 mg	500 mg	100 mg	200 mg	500 mg
Strata-X	8B-S100-TAK	8B-S100-UAK	8B-S100-UBJ	8B-S100-FBJ	8B-S100-HBJ	8B-S100-ECH	8B-S100-FCH	8B-S100-HCH
Strata-X-C	8B-S029-TAK	—	8B-S029-UBJ	8B-S029-FBJ	8B-S029-HBJ	8B-S029-ECH	8B-S029-FCH	8B-S029-HCH
Strata-X-CW	8B-S035-TAK	—	8B-S035-UBJ	8B-S035-FBJ	8B-S035-HBJ	8B-S035-ECH	8B-S035-FCH	8B-S035-HCH
Strata-X-A	8B-S123-TAK	—	8B-S123-UBJ	8B-S123-FBJ	8B-S123-HBJ	8B-S123-ECH	8B-S123-FCH	8B-S123-HCH
Strata-X-AW	8B-S038-TAK	—	8B-S038-UBJ	8B-S038-FBJ	8B-S038-HBJ	8B-S038-ECH	8B-S038-FCH	8B-S038-HCH
Strata-XL	8B-S043-TAK	—	8B-S043-UBJ	8B-S043-FBJ	8B-S043-HBJ	8B-S043-ECH	8B-S043-FCH	8B-S043-HCH
Strata-XL-C	8B-S044-TAK	—	8B-S044-UBJ	8B-S044-FBJ	8B-S044-HBJ	8B-S044-ECH	8B-S044-FCH	8B-S044-HCH
Strata-XL-CW	8B-S052-TAK	—	8B-S052-UBJ	8B-S052-FBJ	8B-S052-HBJ	8B-S052-ECH	8B-S052-FCH	8B-S052-HCH
Strata-XL-A	8B-S053-TAK	—	8B-S053-UBJ	8B-S053-FBJ	8B-S053-HBJ	8B-S053-ECH	8B-S053-FCH	8B-S053-HCH
Strata-XL-AW	8B-S051-TAK	—	8B-S051-UBJ	8B-S051-FBJ	8B-S051-HBJ	8B-S051-ECH	8B-S051-FCH	8B-S051-HCH

Create a Customized SPE Method in Under 1 Minute!
www.phenomenex.com/MDTool

Additional phases, sizes, and formats available.
www.Phenomenex.com/SPE

LC Columns

Gemini

Rugged reversed phase HPLC columns that offer extended lifetime at extreme pH conditions and excellent stability for reproducible, high efficiency separations.

- Take full advantage of high and low pH conditions (pH 1-12) to manipulate selectivity
- Expect longer column lifetime with patented TWIN-NX™ technology
- For analytical and preparative separations of basic and acidic compounds

3 µm Microbore, Minibore and MidBore™ Columns (mm)										SecurityGuard™ Cartridges (mm)
Phases	50 x 1.0	20 x 2.0	30 x 2.0	50 x 2.0	100 x 2.0	150 x 2.0	50 x 3.0	100 x 3.0	150 x 3.0	4 x 2.0*
										/10pk
C18	00B-4439-A0	00M-4439-B0	00A-4439-B0	00B-4439-B0	00D-4439-B0	00F-4439-B0	00B-4439-Y0	00D-4439-Y0	00F-4439-Y0	AJ0-7596
C6-Phenyl	00B-4443-A0	—	00A-4443-B0	00B-4443-B0	00D-4443-B0	00F-4443-B0	00B-4443-Y0	00D-4443-Y0	00F-4443-Y0	AJ0-7914
NX-C18	00B-4453-A0	00M-4453-B0	00A-4453-B0	00B-4453-B0	00D-4453-B0	00F-4453-B0	00B-4453-Y0	00D-4453-Y0	00F-4453-Y0	AJ0-8367

for ID: 2.0-3.0 mm

3 µm Analytical Columns (mm)						SecurityGuard Cartridges (mm)
Phases	30 x 4.6	50 x 4.6	100 x 4.6	150 x 4.6	250 x 4.6	4 x 3.0*
						/10pk
C18	00A-4439-E0	00B-4439-E0	00D-4439-E0	00F-4439-E0	00G-4439-E0	AJ0-7597
C6-Phenyl	00A-4443-E0	00B-4443-E0	00D-4443-E0	00F-4443-E0	00G-4443-E0	AJ0-7915
NX-C18	—	00B-4453-E0	00D-4453-E0	00F-4453-E0	00G-4453-E0	AJ0-8368

for ID: 3.2-8.0 mm

5 µm Minibore and MidBore Columns (mm)									SecurityGuard Cartridges (mm)
Phases	30 x 2.0	50 x 2.0	150 x 2.0	250 x 2.0	50 x 3.0	100 x 3.0	150 x 3.0	250 x 3.0	4 x 2.0*
									/10pk
C18	00A-4435-B0	00B-4435-B0	00F-4435-B0	00G-4435-B0	00B-4435-Y0	00D-4435-Y0	00F-4435-Y0	00G-4435-Y0	AJ0-7596
C6-Phenyl	—	00B-4444-B0	00F-4444-B0	—	00B-4444-Y0	—	00F-4444-Y0	00G-4444-Y0	AJ0-7914
NX-C18	00A-4454-B0	00B-4454-B0	00F-4454-B0	—	00B-4454-Y0	00D-4454-Y0	00F-4454-Y0	00G-4454-Y0	AJ0-8367

for ID: 2.0-3.0 mm

5 µm Analytical Columns (mm)						SecurityGuard Cartridges (mm)
Phases	30 x 4.6	50 x 4.6	100 x 4.6	150 x 4.6	250 x 4.6	4 x 3.0*
						/10pk
C18	00A-4435-E0	00B-4435-E0	00D-4435-E0	00F-4435-E0	00G-4435-E0	AJ0-7597
C6-Phenyl	—	00B-4444-E0	00D-4444-E0	00F-4444-E0	00G-4444-E0	AJ0-7915
NX-C18	—	00B-4454-E0	00D-4454-E0	00F-4454-E0	00G-4454-E0	AJ0-8368

for ID: 3.2-8.0 mm

5 µm Semi-Prep Columns (mm)			SecurityGuard Cartridges (mm)
Phases	150 x 10	250 x 10	10 x 10‡
			/3pk
C18	00F-4435-N0	00G-4435-N0	AJ0-7598
C6-Phenyl	—	00G-4444-N0	AJ0-7314
NX-C18	00F-4454-N0	00G-4454-N0	AJ0-8369

for ID: 9-16 mm

*SecurityGuard™ Analytical Cartridges require holder, Part No.: KJ0-4282
‡SemiPrep SecurityGuard™ Cartridges require holder, Part No.: AJ0-9281

Additional dimensions available. Contact your Phenomenex HPLC Specialist for more information or visit www.phenomenex.com/gemini

LC Columns *(cont'd)*

KINETEX® Core-Shell Technology

Kinetex

- Solid core with porous shell for performance gains on any LC system
- Substitute 3 µm and 5 µm columns for 2-3x higher efficiency
- Obtain higher throughput without sacrificing resolution
- Reduce solvent consumption with faster analysis
- Reach lower levels of detection and quantitation

2.6 µm Minibore Columns (mm)						SecurityGuard™ ULTRA Cartridges‡
Phases	**30 x 2.1**	**50 x 2.1**	**75 x 2.1**	**100 x 2.1**	**150 x 2.1**	3/pk
EVO C18	00A-4725-AN	00B-4725-AN	—	00D-4725-AN	00F-4725-AN	AJ0-9298
PS C18	00A-4780-AN	00B-4780-AN	—	00D-4780-AN	00F-4780-AN	AJ0-8951
Polar C18	00A-4759-AN	00B-4759-AN	—	00D-4759-AN	00F-4759-AN	AJ0-9532
Biphenyl	00A-4622-AN	00B-4622-AN	—	00D-4622-AN	00F-4622-AN	AJ0-9209
XB-C18	00A-4496-AN	00B-4496-AN	00C-4496-AN	00D-4496-AN	00F-4496-AN	AJ0-8782
C18	00A-4462-AN	00B-4462-AN	00C-4462-AN	00D-4462-AN	00F-4462-AN	AJ0-8782
C8	00A-4497-AN	00B-4497-AN	00C-4497-AN	00D-4497-AN	00F-4497-AN	AJ0-8784
HILIC	00A-4461-AN	00B-4461-AN	00C-4461-AN	00D-4461-AN	00F-4461-AN	AJ0-8786
Phenyl-Hexyl	00A-4495-AN	00B-4495-AN	00C-4495-AN	00D-4495-AN	00F-4495-AN	AJ0-8788
F5	00A-4723-AN	00B-4723-AN	—	00D-4723-AN	00F-4723-AN	AJ0-9322
						for ID: 2.1 mm

2.6 µm MidBore™ Columns (mm)						SecurityGuard ULTRA Cartridges‡
Phases	**30 x 3.0**	**50 x 3.0**	**75 x 3.0**	**100 x 3.0**	**150 x 3.0**	3/pk
EVO C18	—	00B-4725-Y0	—	00D-4725-Y0	00F-4725-Y0	AJ0-9297
PS C18	00A-4780-Y0	00B-4780-Y0	—	00D-4780-Y0	00F-4780-Y0	AJ0-8950
Polar C18	—	00B-4759-Y0	—	00D-4759-Y0	00F-4759-Y0	AJ0-9531
Biphenyl	—	00B-4622-Y0	—	00D-4622-Y0	00F-4622-Y0	AJ0-9208
XB-C18	00A-4496-Y0	00B-4496-Y0	00C-4496-Y0	00D-4496-Y0	00F-4496-Y0	AJ0-8775
C18	00A-4462-Y0	00B-4462-Y0	00C-4462-Y0	00D-4462-Y0	00F-4462-Y0	AJ0-8775
C8	00A-4497-Y0	00B-4497-Y0	00C-4497-Y0	00D-4497-Y0	00F-4497-Y0	AJ0-8777
HILIC	00A-4461-Y0	—	—	—	00F-4461-Y0	AJ0-8779
Phenyl-Hexyl	—	00B-4495-Y0	—	00D-4495-Y0	00F-4495-Y0	AJ0-8781
F5	—	00B-4723-Y0	—	00D-4723-Y0	00F-4723-Y0	AJ0-9321
						for ID: 3.0 mm

2.6 µm Analytical Columns (mm)						SecurityGuard ULTRA Cartridges‡
Phases	**30 x 4.6**	**50 x 4.6**	**75 x 4.6**	**100 x 4.6**	**150 x 4.6**	3/pk
EVO C18	—	00B-4725-E0	—	00D-4725-E0	00F-4725-E0	AJ0-9296
PS C18	—	00B-4780-E0	—	00D-4780-E0	00F-4780-E0	AJ0-8949
Polar C18	—	00B-4759-E0	—	00D-4759-E0	00F-4759-E0	AJ0-9530
Biphenyl	—	00B-4622-E0	—	00D-4622-E0	00F-4622-E0	AJ0-9207
XB-C18	—	00B-4496-E0	00C-4496-E0	00D-4496-E0	00F-4496-E0	AJ0-8768
C18	00A-4462-E0	00B-4462-E0	00C-4462-E0	00D-4462-E0	00F-4462-E0	AJ0-8768
C8	—	00B-4497-E0	00C-4497-E0	00D-4497-E0	00F-4497-E0	AJ0-8770
HILIC	—	00B-4461-E0	00C-4461-E0	00D-4461-E0	00F-4461-E0	AJ0-8772
Phenyl-Hexyl	—	00B-4495-E0	00C-4495-E0	00D-4495-E0	00F-4495-E0	AJ0-8774
F5	—	00B-4723-E0	—	00D-4723-E0	00F-4723-E0	AJ0-9320
						for ID: 4.6 mm

‡ SecurityGuard ULTRA Cartridges require holder, Part No.: AJ0-9000

LC Columns *(cont'd)*

KINETEX® Core-Shell Technology

Kinetex *(cont'd)*

5 µm Minibore Columns (mm)					SecurityGuard ULTRA Cartridges‡
Phases	**30 x 2.1**	**50 x 2.1**	**100 x 2.1**	**150 x 2.1**	3/pk
EVO C18	00A-4633-AN	00B-4633-AN	00D-4633-AN	00F-4633-AN	AJ0-9298
F5	00A-4724-AN	00B-4724-AN	00D-4724-AN	00F-4724-AN	AJ0-9322
Biphenyl	00A-4627-AN	00B-4627-AN	00D-4627-AN	—	AJ0-9209
XB-C18	00A-4605-AN	00B-4605-AN	00D-4605-AN	—	AJ0-8782
C18	00A-4601-AN	00B-4601-AN	00D-4601-AN	00F-4601-AN	AJ0-8782
C8	—	00B-4608-AN	00D-4608-AN	—	AJ0-8784
Phenyl-Hexyl	—	00B-4603-AN	00D-4603-AN	—	AJ0-8788

for ID: 2.1 mm

5 µm MidBore Columns (mm)				SecurityGuard ULTRA Cartridges‡
Phases	**50 x 3.0**	**100 x 3.0**	**150 x 3.0**	3/pk
EVO C18	00B-4633-Y0	00D-4633-Y0	00F-4633-Y0	AJ0-9297
F5	00B-4724-Y0	00D-4724-Y0	00F-4724-Y0	AJ0-9321
Biphenyl	00B-4627-Y0	00D-4627-Y0	00F-4627-Y0	AJ0-9208
XB-C18	00B-4605-Y0	00D-4605-Y0	00F-4605-Y0	AJ0-8775
C18	00B-4601-Y0	00D-4601-Y0	00F-4601-Y0	AJ0-8775
C8	00B-4608-Y0	00D-4608-Y0	—	AJ0-8777
Phenyl-Hexyl	00B-4603-Y0	00D-4603-Y0	—	AJ0-8781

for ID: 3.0 mm

5 µm Analytical Columns (mm)					SecurityGuard ULTRA Cartridges‡
Phases	**50 x 4.6**	**100 x 4.6**	**150 x 4.6**	**250 x 4.6**	3/pk
EVO C18	00B-4633-E0	00D-4633-E0	00F-4633-E0	00G-4633-E0	AJ0-9296
F5	00B-4724-E0	00D-4724-E0	00F-4724-E0	00G-4724-E0	AJ0-9320
Biphenyl	00B-4627-E0	00D-4627-E0	00F-4627-E0	00G-4627-E0	AJ0-9207
XB-C18	00B-4605-E0	00D-4605-E0	00F-4605-E0	00G-4605-E0	AJ0-8768
C18	00B-4601-E0	00D-4601-E0	00F-4601-E0	00G-4601-E0	AJ0-8768
C8	00B-4608-E0	00D-4608-E0	00F-4608-E0	00G-4608-E0	AJ0-8770
Phenyl-Hexyl	00B-4603-E0	00D-4603-E0	00F-4603-E0	00G-4603-E0	AJ0-8774

for ID: 4.6 mm

‡ SecurityGuard ULTRA Cartridges require holder, Part No.: AJ0-9000

Available in sub-2 µm particle sizes. Additional dimensions available.

Contact your Phenomenex HPLC Specialist for more information or visit **www.phenomenex.com/kinetex**

LC Columns *(cont'd)*

Luna

explore LUNA®

- Exceptionally rugged fully porous phases
- Easy method scalability with 2.5 µm, 3 µm, 5 µm, 10 µm, 15 µm, and PREP Media
- Extensive batch traceability and reproducibility data supplied with every column

3 µm Microbore and Minibore Columns (mm)							SecurityGuard Cartridges (mm)
Phases	50 x 1.0	150 x 1.0	30 x 2.0	50 x 2.0	100 x 2.0	150 x 2.0	4 x 2.0*
							/10pk
Silica(2)	—	00F-4162-A0	—	00B-4162-B0	00D-4162-B0	00F-4162-B0	AJ0-4347
C8(2)	—	—	00A-4248-B0	00B-4248-B0	00D-4248-B0	00F-4248-B0	AJ0-4289
C18(2)	00B-4251-A0	00F-4251-A0	00A-4251-B0	00B-4251-B0	00D-4251-B0	00F-4251-B0	AJ0-4286
CN	—	—	—	00B-4254-B0	00D-4254-B0	00F-4254-B0	AJ0-4304
Phenyl-Hexyl	—	—	—	00B-4256-B0	00D-4256-B0	00F-4256-B0	AJ0-4350
NH_2	—	00F-4377-A0	00A-4377-B0	00B-4377-B0	00D-4377-B0	00F-4377-B0	AJ0-4301
HILIC	—	—	—	00B-4449-B0	00D-4449-B0	00F-4449-B0	AJ0-8328
PFP(2)	—	00F-4447-A0	00A-4447-B0	00B-4447-B0	00D-4447-B0	00F-4447-B0	AJ0-8326
							for ID: 2.0-3.0 mm

3 µm MidBore™ and Analytical Columns (mm)									SecurityGuard™ Cartridges (mm)	
Phases	30 x 3.0	50 x 3.0	150 x 3.0	30 x 4.6	50 x 4.6	75 x 4.6	100 x 4.6	150 x 4.6	4 x 2.0*	4 x 3.0*
									/10pk	/10pk
Silica(2)	—	00B-4162-Y0	00F-4162-Y0	00A-4162-E0	00B-4162-E0	—	00D-4162-E0	00F-4162-E0	AJ0-4347	AJ0-4348
C8(2)	00A-4248-Y0	00B-4248-Y0	00F-4248-Y0	00A-4248-E0	00B-4248-E0	00C-4248-E0	00D-4248-E0	00F-4248-E0	AJ0-4289	AJ0-4290
C18(2)	00A-4251-Y0	00B-4251-Y0	00F-4251-Y0	00A-4251-E0	00B-4251-E0	00C-4251-E0	00D-4251-E0	00F-4251-E0	AJ0-4286	AJ0-4287
CN	—	00B-4254-Y0	00F-4254-Y0	00A-4254-E0	00B-4254-E0	00C-4254-E0	00D-4254-E0	00F-4254-E0	AJ0-4304	AJ0-4305
Phenyl-Hexyl	—	00B-4256-Y0	00F-4256-Y0	—	00B-4256-E0	00C-4256-E0	00D-4256-E0	00F-4256-E0	AJ0-4350	AJ0-4351
NH_2	—	00B-4377-Y0	00F-4377-Y0	—	00B-4377-E0	—	00D-4377-E0	00F-4377-E0	AJ0-4301	AJ0-4302
HILIC	—	00B-4449-Y0	00F-4449-Y0	—	—	—	00D-4449-E0	00F-4449-E0	AJ0-8328	AJ0-8329
PFP(2)	—	00B-4447-Y0	00F-4447-Y0	—	00B-4447-E0	—	00D-4447-E0	00F-4447-E0	AJ0-8326	AJ0-8327
									for ID: 2.0-3.0 mm	3.2-8.0 mm

5 µm Microbore and Minibore Columns (mm)						SecurityGuard™ Cartridges (mm)
Phases	150 x 1.0	30 x 2.0	50 x 2.0	150 x 2.0	250 x 2.0	4 x 2.0*
						/10pk
Silica(2)	—	00A-4274-B0	00B-4274-B0	00F-4274-B0	00G-4274-B0	AJ0-4347
C5	—	00A-4043-B0	00B-4043-B0	00F-4043-B0	—	AJ0-4292
C8(2)	—	00A-4249-B0	00B-4249-B0	00F-4249-B0	00G-4249-B0	AJ0-4289
C18(2)	00F-4252-A0	00A-4252-B0	00B-4252-B0	00F-4252-B0	00G-4252-B0	AJ0-4286
CN	—	—	00B-4255-B0	00F-4255-B0	—	AJ0-4304
Phenyl-Hexyl	—	00A-4257-B0	00B-4257-B0	00F-4257-B0	00G-4257-B0	AJ0-4350
NH_2	—	00A-4378-B0	00B-4378-B0	00F-4378-B0	00G-4378-B0	AJ0-4301
PFP(2)	—	00A-4448-B0	00B-4448-B0	00F-4448-B0	—	AJ0-8326
						for ID: 2.0-3.0 mm

5 µm MidBore and Analytical Columns (mm)								SecurityGuard™ Cartridges (mm)	
Phases	30 x 3.0	50 x 3.0	150 x 3.0	250 x 3.0	30 x 4.6	50 x 4.6	75 x 4.6	4 x 2.0*	4 x 3.0*
								/10pk	/10pk
Silica(2)	—	—	—	—	—	00B-4274-E0	—	AJ0-4347	AJ0-4348
C5	—	—	00F-4043-Y0	—	—	00B-4043-E0	—	AJ0-4292	AJ0-4293
C8(2)	—	00B-4249-Y0	00F-4249-Y0	00G-4249-Y0	00A-4249-E0	00B-4249-E0	00C-4249-E0	AJ0-4289	AJ0-4290
C18(2)	00A-4252-Y0	00B-4252-Y0	00F-4252-Y0	00G-4252-Y0	00A-4252-E0	00B-4252-E0	00C-4252-E0	AJ0-4286	AJ0-4287
CN	—	—	00F-4255-Y0	00G-4255-Y0	00A-4255-E0	00B-4255-E0	00C-4255-E0	AJ0-4304	AJ0-4305
Phenyl-Hexyl	—	00B-4257-Y0	00F-4257-Y0	00G-4257-Y0	00A-4257-E0	00B-4257-E0	—	AJ0-4350	AJ0-4351
NH_2	—	00B-4378-Y0	00F-4378-Y0	00G-4378-Y0	—	00B-4378-E0	—	AJ0-4301	AJ0-4302
SCX	—	—	00F-4398-Y0	—	—	00B-4398-E0	—	AJ0-4307	AJ0-4308
HILIC	—	—	00F-4450-Y0	—	—	—	—	AJ0-8328	AJ0-8329
PFP(2)	—	—	00F-4448-Y0	—	—	00B-4448-E0	—	AJ0-8326	AJ0-8327
								for ID: 2.0-3.0 mm	3.2-8.0 mm

*SecurityGuard™ Analytical Cartridges require holder, Part No.: KJ0-4282

LC Columns *(cont'd)*

Luna *(cont'd)*

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5 µm Analytical and Semi-Prep Columns (mm)					SecurityGuard™ Cartridges (mm)	
Phases	**100 x 4.6**	**150 x 4.6**	**250 x 4.6**	**250 x 10**	**4 x 3.0***	**10 x 10‡**
					/10pk	/3pk
Silica(2)	00D-4274-E0	00F-4274-E0	00G-4274-E0	00G-4274-N0	AJ0-4348	AJ0-7223
C5	00D-4043-E0	00F-4043-E0	00G-4043-E0	00G-4043-N0	AJ0-4293	AJ0-7372
C8(2)	00D-4249-E0	00F-4249-E0	00G-4249-E0	00G-4249-N0	AJ0-4290	AJ0-7222
C18(2)	00D-4252-E0	00F-4252-E0	00G-4252-E0	00G-4252-N0	AJ0-4287	AJ0-7221
CN	00D-4255-E0	00F-4255-E0	00G-4255-E0	00G-4255-N0	AJ0-4305	AJ0-7313
Phenyl-Hexyl	00D-4257-E0	00F-4257-E0	00G-4257-E0	00G-4257-N0	AJ0-4351	AJ0-7314
NH_2	00D-4378-E0	00F-4378-E0	00G-4378-E0	00G-4378-N0	AJ0-4302	AJ0-7364
SCX	00D-4398-E0	00F-4398-E0	00G-4398-E0	00G-4398-N0	AJ0-4308	AJ0-7369
HILIC	00D-4450-E0	00F-4450-E0	00G-4450-E0	00G-4450-N0	AJ0-8329	AJ0-8902
PFP(2)	00D-4448-E0	00F-4448-E0	00G-4448-E0	00G-4448-N0	AJ0-8327	AJ0-8376
					for ID: 3.2-8.0 mm	9-16 mm

5 µm Axia™ Packed Preparative Columns (mm)								SecurityGuard™ Cartridges (mm)	
Phases	**50 x 21.2**	**100 x 21.2**	**150 x 21.2**	**250 x 21.2**	**50 x 30**	**100 x 30**	**250 x 30**	**15 x 21.2****	**15 x 30 ◆**
								/ea	/ea
Silica(2)	—	00D-4274-P0-AX	00F-4274-P0-AX	00G-4274-P0-AX	—	—	00G-4274-U0-AX	AJ0-7229	AJ0-8312
C5	—	—	—	00G-4043-P0-AX	—	—	—	—	—
C8(2)	—	—	00F-4249-P0-AX	00G-4249-P0-AX	—	00D-4249-U0-AX	—	AJ0-7840	AJ0-8302
C18(2)	00B-4252-P0-AX	00D-4252-P0-AX	00F-4252-P0-AX	00G-4252-P0-AX	00B-4252-U0-AX	00D-4252-U0-AX	00G-4252-U0-AX	AJ0-7839	AJ0-8301
CN	—	—	—	00G-4255-P0-AX	—	—	00G-4255-U0-AX	AJ0-8220	AJ0-8311
Phenyl-Hexyl	—	—	00F-4257-P0-AX	00G-4257-P0-AX	—	—	00G-4257-U0-AX	AJ0-7841	AJ0-8303
NH_2	—	—	00F-4378-P0-AX	00G-4378-P0-AX	—	—	—	AJ0-8162	AJ0-8309
PFP(2)	—	00D-4448-P0-AX	00F-4448-P0-AX	00G-4448-P0-AX	—	00D-4448-U0-AX	—	AJ0-8377	AJ0-8378
HILIC	—	00D-4450-P0-AX	00F-4450-P0-AX	00G-4450-P0-AX	—	—	00G-4450-U0-AX	AJ0-8829	AJ0-8830
								for ID: 18-29 mm	30-49 mm

10 µm Axia™ Packed Preparative Columns (mm) (continued)						SecurityGuard Cartridges (mm)	
Phases	**50 x 21.2**	**100 x 21.2**	**250 x 21.2**	**250 x 30**	**250 x 50**	**15 x 21.2****	**15 x 30 ◆**
						/ea	/ea
Silica(2)	—	—	00G-4091-P0-AX	00G-4091-U0-AX	00G-4091-V0-AX	AJ0-7229	AJ0-8312
C5	—	00D-4092-P0-AX	00G-4092-P0-AX	—	00G-4092-V0-AX	—	—
C8(2)	—	—	00G-4250-P0-AX	—	00G-4250-V0-AX	AJ0-7840	AJ0-8302
C18(2)	00B-4253-P0-AX	00D-4253-P0-AX	00G-4253-P0-AX	00G-4253-U0-AX	00G-4253-V0-AX	AJ0-7839	AJ0-8301
CN	—	—	00G-4300-P0-AX	—	—	AJ0-8220	AJ0-8311
Phenyl-Hexyl	—	—	00G-4285-P0-AX	00G-4285-U0-AX	—	AJ0-7841	AJ0-8303
NH_2	—	—	00G-4379-P0-AX	—	—	AJ0-8162	AJ0-8309
						for ID: 18-29 mm	30-49 mm

* SecurityGuard Analytical Cartridges require holder, Part No.: KJ0-4282
***SemiPREP SecurityGuard Cartridges require holder, Part No.: AJ0-9281
**PREP SecurityGuard Cartridges require holder, Part No.: AJ0-8223
◆ PREP SecurityGuard Cartridges require holder, Part No.: AJ0-8277

LC Columns *(cont'd)*

Luna Omega

An innovative yet rugged thermally modified fully porous UHPLC and HPLC silica particle architecture from a novel manufacturing process which implements a proprietary processing technique to gain greater particle inertness, a stronger particle morphology, and more consistent porosity.

explore LUNA® OMEGA

1.6 µm Microbore Columns (mm)			
Phases	**50 x 1.0**	**100 x 1.0**	**150 x 1.0**
Polar C18	00B-4748-A0	00D-4748-A0	00F-4748-A0
PS C18	00B-4752-A0	00D-4752-A0	—
C18	—	00D-4742-A0	00F-4742-A0

1.6 µm Minibore Columns (mm)					SecurityGuard™ ULTRA Cartridges‡
Phases	**30 x 2.1**	**50 x 2.1**	**100 x 2.1**	**150 x 2.1**	**3/pk**
Polar C18	00A-4748-AN	00B-4748-AN	00D-4748-AN	00F-4748-AN	AJ0-9505
PS C18	00A-4752-AN	00B-4752-AN	00D-4752-AN	00F-4752-AN	AJ0-9508
C18	00A-4742-AN	00B-4742-AN	00D-4742-AN	00F-4742-AN	AJ0-9502

for 2.1 mm ID

3 µm Capillary Columns (mm)							Trap Column
Phases	**50 x 0.30**	**100 x 0.30**	**150 x 0.30**	**50 x 0.50**	**100 x 0.50**	**150 x 0.50**	**20 x 0.30**
Polar C18	00B-4760-AC	00D-4760-AC	00F-4760-AC	00B-4760-AF	00D-4760-AF	00F-4760-AF	—
PS C18	00B-4758-AC	00D-4758-AC	00F-4758-AC	00B-4758-AF	00D-4758-AF	00F-4758-AF	05M-4758-AC

3 µm Minibore and MidBore™ Columns (mm)								SecurityGuard Cartridges (mm)
Phases	**30 x 2.1**	**50 x 2.1**	**100 x 2.1**	**150 x 2.1**	**50 x 3.0**	**100 x 3.0**	**150 x 3.0**	**4 x 2.0***
								/10 pk
Polar C18	00A-4760-AN	00B-4760-AN	00D-4760-AN	00F-4760-AN	00B-4760-Y0	00D-4760-Y0	00F-4760-Y0	AJ0-7600
PS C18	00A-4758-AN	00B-4758-AN	00D-4758-AN	00F-4758-AN	00B-4758-Y0	00D-4758-Y0	00F-4758-Y0	AJ0-7605
SUGAR	—	00B-4775-AN	00D-4775-AN	00F-4775-AN	—	—	00F-4775-Y0	AJ0-4496

for ID: 2.0-3.0 mm

3 µm Analytical Columns (mm)					SecurityGuard Cartridges (mm)
Phases	**50 x 4.6**	**100 x 4.6**	**150 x 4.6**	**250 x 4.6**	**4 x 3.0***
					/10 pk
Polar C18	00B-4760-E0	00D-4760-E0	00F-4760-E0	00G-4760-E0	AJ0-7601
PS C18	00B-4758-E0	00D-4758-E0	00F-4758-E0	00G-4758-E0	AJ0-7606
SUGAR	—	00D-4775-E0	00F-4775-E0	00G-4775-E0	AJ0-4495

for ID: 3.2-8.0 mm

5 µm Minibore and MidBore™ Columns (mm)							SecurityGuard Cartridges (mm)
Phases	**50 x 2.1**	**100 x 2.1**	**150 x 2.1**	**50 x 3.0**	**100 x 3.0**	**150 x 3.0**	**4 x 2.0***
							/10 pk
Polar C18	00B-4754-AN	00D-4754-AN	00F-4754-AN	00B-4754-Y0	00D-4754-Y0	00F-4754-Y0	AJ0-7600
PS C18	00B-4753-AN	00D-4753-AN	00F-4753-AN	00B-4753-Y0	00D-4753-Y0	00F-4753-Y0	AJ0-7605

for ID: 2.0 - 3.0 mm

5 µm Analytical Columns (mm)					SecurityGuard Cartridges (mm)
Phases	**50 x 4.6**	**100 x 4.6**	**150 x 4.6**	**250 x 4.6**	**4 x 3.0***
					/10 pk
Polar C18	00B-4754-E0	00D-4754-E0	00F-4754-E0	00G-4754-E0	AJ0-7601
PS C18	00B-4753-E0	00D-4753-E0	00F-4753-E0	00G-4753-E0	AJ0-7606

for ID: 3.2-8.0 mm

5 µm Semi-Preparative Columns (mm)		SecurityGuard Cartridges (mm)
Phases	**250 x 10**	**10 x 10****
		/3 pk
Polar C18	00G-4754-N0	AJ0-9519
PS C18	00G-4753-N0	AJ0-9520

for ID: 9-16 mm

5 µm Axia™ Packed Preparative Columns (mm)						SecurityGuard Cartridges (mm)	
Phases	**150 x 21.2**	**250 x 21.2**	**150 x 30**	**250 x 30**	**250 x 50**	**15 x 21.2****	**15 x 30.0•**
						/ea	/ea
Polar C18	00F-4754-P0-AX	00G-4754-P0-AX	00F-4754-U0-AX	00G-4754-U0-AX	00G-4754-V0-AX	AJ0-7603	AJ0-7604
PS C18	00F-4753-P0-AX	00G-4753-P0-AX	00F-4753-U0-AX	00G-4753-U0-AX	00G-4753-V0-AX	AJ0-7608	AJ0-7609
						for ID: 18-29 mm	for ID: 30-49 mm

‡ SecurityGuard ULTRA Cartridges require holder, Part No.: AJ0-9000
* SecurityGuard Analytical Cartridges require holder, Part No.: KJ0-4282
***SemiPREP SecurityGuard Cartridges require holder, Part No.: AJ0-9281

**PREP SecurityGuard Cartridges require holder, Part No.: AJ0-8223
• PREP SecurityGuard Cartridges require holder, Part No.: AJ0-8277

LC Columns *(cont'd)*

Phenogel™ Organic GPC/SEC

Phenogel

Organic GPC/SEC Columns

Organic size exclusion/gel permeation for polymer analysis. Highly cross-linked for mechanical and chemical stability.

5 µm Analytical Columns (mm)		Shipping Solvent			SecurityGuard™ Cartridges (mm)
		THF	Chloroform	DMF	
		300 x 7.8	300 x 7.8	300 x 7.8	4 x 3.0*
Pore Size	**MW Range**				/3pk
50 Å	100-3 K	00H-0441-K0	—	00H-0441-K0-DF	AJ0-9292
100 Å	500-6 K	00H-0442-K0	—	—	AJ0-9292
500 Å	1 K-15 K	00H-0443-K0	—	—	AJ0-9292
10^3 Å	1 K-75 K	00H-0444-K0	—	00H-0444-K0-DF	AJ0-9292
10^4 Å	5 K-500 K	00H-0445-K0	00H-0445-K0-CL	—	AJ0-9292
10^5 Å	10 K-1,000 K	00H-0446-K0	—	00H-0446-K0-DF	AJ0-9292
10^6 Å	60 K-10,000 K	00H-0447-K0	—	—	AJ0-9292
		300 x 7.8	300 x 7.8	300 x 7.8	4 x 3.0*
Mixed Beds					/3pk
Linear(2)	100-10,000 K	00H-3259-K0	00H-3259-K0-CL	00H-3259-K0-DF	AJ0-9292

for 3.2–8.0 mm ID

5 µm Narrow Bore (NB) Columns (mm)			SecurityGuard™ Cartridges (mm)
		300 x 4.6	4 x 3.0*
Pore Size	**MW Range**		/3pk
50 Å	100-3 K	00H-0441-E0	AJ0-9292
100 Å	500-6 K	00H-0442-E0	AJ0-9292
500 Å	1 K-15 K	00H-0443-E0	AJ0-9292
10^3 Å	1 K-75 K	00H-0444-E0	AJ0-9292
10^4 Å	5 K-500 K	00H-0445-E0	AJ0-9292
10^5 Å	10 K-1,000 K	00H-0446-E0	AJ0-9292
10^6 Å	60 K-10,000 K	00H-0447-E0	AJ0-9292
		300 x 4.6	4 x 3.0*
Mixed Beds			/3pk
Linear(2)	100-10,000 K	00H-3259-E0	AJ0-9292

for 3.2–8.0 mm ID

10 µm Analytical Columns (mm)			SecurityGuard™ Cartridges (mm)
		300 x 7.8	4 x 3.0*
Pore Size	**MW Range**		/3pk
50 Å	100-3 K	00H-0641-K0	AJ0-9292
100 Å	500-6 K	00H-0642-K0	AJ0-9292
500 Å	1 K-15 K	00H-0643-K0	AJ0-9292
10^3 Å	1 K-75 K	00H-0644-K0	AJ0-9292
10^4 Å	5 K-500 K	00H-0645-K0	AJ0-9292
10^5 Å	10 K-1,000 K	00H-0646-K0	AJ0-9292
10^6 Å	60 K-10,000 K	00H-0647-K0	AJ0-9292
		300 x 7.8	4 x 3.0*
Mixed Beds			/3pk
Linear(2)	100-10,000 K	00H-3260-K0	AJ0-9292

for 3.2–8.0 mm ID

5 µm Preparative Columns (mm)			Guards
		300 x 21.2	50 x 21.2
Pore Size	**MW Range**		
100 Å	500-6 K	00H-0442-P0	03B-0642-P0

10 µm Preparative Columns (mm)			Guards
		300 x 21.2	50 x 21.2
Pore Size	**MW Range**		
100 Å	500-6 K	00H-0642-P0	03B-0642-P0

Phenogel columns are routinely shipped in THF. However, columns are also available in commonly used solvents, Chloroform and DMF, for an additional charge for these shipping solvents. Please specify shipping solvent when ordering.

Phenogel Columns are a Recommended Alternative to:

Manufacturer	Columns
Agilent® (Polymer Labs)	PLgel™
Jordi Labs	Jordi Resolve™ RP DVB Column Jordi Resolve DVB 13µ GPC Columns Jordi Resolve DVB GPC Column
Polymer Standards Service (PSS)	SDV® GRAM PolarSil PFG POLEFIN®
Shodex®	GPC K-800 Series GPC KF-800 Series GPC KD-800 Series KF-200 Series
Tosoh Bioscience®	TSKgel® Hxl TSKgel Hhr
Waters®	Styragel® Ultrastyragel™ HSPgel™

Guard Cartridge Holder	
Part No.	**Description**
KJ0-4282	Reusable Holder (SecurityGuard Kit)

Column Union		
Part No.	**Description**	**Unit**
AQ0-8507	Zero Dead Union, SS, with 10-32 fittings	ea

Note: Additional union (AQ0-8507) may be necessary for SecurityGuard to fit in column oven with less than 30 cm length capacity.

Rezex

Organic GPC/SEC Columns

REZEX™ Carbohydrate and Organic Acid LC

Columns					Guards		SecurityGuard™ Cartridges (mm)
							4 x 3.0*
Description	Part No.	Cross Linkage	Ionic Form	Size (mm)	Part No.	Size (mm)	/10pk
RCM-Monosaccharide	00F-0130-K0	8 %	Calcium	150 x 7.8	03B-0130-K0	50 x 7.8	AJ0-4493
RCM-Monosaccharide	00H-0130-K0	8 %	Calcium	300 x 7.8	03B-0130-K0	50 x 7.8	AJ0-4493
RHM-Monosaccharide	00H-0132-K0	8 %	Hydrogen	300 x 7.8	03B-0132-K0	50 x 7.8	AJ0-4490
RAM-Carbohydrate	00H-0131-K0	8 %	Silver	300 x 7.8	—	—	AJ0-4491
RSO-Oligosaccharide	00P-0133-N0	4 %	Silver	200 x 10.0	03R-0133-N0	60 x 10.0	—
RNO-Oligosaccharide	00P-0137-N0	4 %	Sodium	200 x 10.0	03R-0137-N0	60 x 10.0	—
RPM-Monosaccharide	00H-0135-K0	8 %	Lead	300 x 7.8	03B-0135-K0	50 x 7.8	AJ0-4492
RPM-Monosaccharide	00D-0135-K0	8 %	Lead	100 x 7.8	03B-0135-K0	50 x 7.8	AJ0-4492
RNM-Carbohydrate	00H-0136-K0	8 %	Sodium	300 x 7.8	03B-0136-K0	50 x 7.8	—
ROA-Organic Acid	00F-0138-E0	8 %	Hydrogen	150 x 4.6	—	—	AJ0-4490
ROA-Organic Acid	00G-0138-E0	8 %	Hydrogen	250 x 4.6	—	—	AJ0-4490
ROA-Organic Acid	00F-0138-K0	8 %	Hydrogen	150 x 7.8	03B-0138-K0	50 x 7.8	AJ0-4490
ROA-Organic Acid	00H-0138-K0	8 %	Hydrogen	300 x 7.8	03B-0138-K0	50 x 7.8	AJ0-4490
RKP-Potassium	00H-3252-K0	8 %	Potassium	300 x 7.8	—	—	—
RFQ-Fast Acid	00D-0223-K0	8 %	Hydrogen	100 x 7.8	03B-0223-K0	50 x 7.8	AJ0-4490
RCU-USP Sugar Alcohols	00G-0130-D0	8 %	Calcium	250 x 4.0	03A-0130-D0	30 x 4.0	AJ0-4493

for ID: 3.2-8.0 mm

* SecurityGuard Analytical Cartridges require holder, Part No.: KJ0-4282

SecurityGuard

Guard Cartridge System

SecurityGuard™ Column Protection

Step 1: Choose column ID

Step 2: Match column phase

Choose your HPLC Column Internal Diameter, ID (mm):

2.0 - 3.0	3.2 - 8.0	9.0 - 16.0	18.0 - 29.0	30.0 - 49.0
Analytical		SemiPrep	PREP HPLC or SFC	
Use Cartridges (mm):				
4.0 x 2.0	4.0 x 3.0	10 x 10.0	15 x 21.2	15 x 30.0

Cartridges and Holders

Cartridges for General Purpose/Pharmaceutical		pH Stability	/10pk	/10pk	/3pk	ea	ea
C18	(ODS, Octadecyl)	1.5 - 10	AJ0-4286	AJ0-4287	AJ0-7221	AJ0-7839	AJ0-8301
C12	(Dodecyl)	1.5 - 10	AJ0-6073	AJ0-6074	AJ0-7275	AJ0-7842	AJ0-8304
C8	(MOS, Octyl)	1.5 - 10	AJ0-4289	AJ0-4290	AJ0-7222	AJ0-7840	AJ0-8302
C5	(Pentyl)	1.5 - 10	AJ0-4292	AJ0-4293	AJ0-7372	—	—
C1	(TMS)	2 - 9	—	AJ0-4299	—	—	—
Silica	—	—	AJ0-4347	AJ0-4348	AJ0-7223	AJ0-7229	AJ0-8312
HILIC	(HILIC)	1.5 - 8	AJ0-8328	AJ0-8329	AJ0-8902	—	—
NH_2	(Amino, Aminopropyl)	1.5 - 11	AJ0-4301	AJ0-4302	AJ0-7364	AJ0-8162	AJ0-8309
CN	(Cyano, Cyanopropyl)	2 - 7.5	AJ0-4304	AJ0-4305	AJ0-7313	AJ0-8220	AJ0-8311
Phenyl	(Phenylhexyl)	1.5 - 10	AJ0-4350	AJ0-4351	AJ0-7314	AJ0-7841	AJ0-8303
PFP(2)	(Pentafluorophenyl)	1.5 - 8	AJ0-8326	AJ0-8327	AJ0-8376	AJ0-8377	AJ0-8378
SCX	(SA, Strong Cation Exchanger)	2.5 - 7.5	AJ0-4307	AJ0-4308	—	—	AJ0-8596
SAX	(SB, Strong Anion Exchanger)	2.5 - 7.5	—	AJ0-4311	—	—	—
RP-1	(Reversed Phase - Polymer)	0 - 14	—	AJ0-5809	AJ0-7368	AJ0-8358	—
Polar-RP	(Ether-linked Phenyl)	1.5 - 7	AJ0-6075	AJ0-6076	AJ0-7276	AJ0-7845	—
Fusion-RP	(C18 Polar Embedded)	1.5 - 10	AJ0-7556	AJ0-7557	AJ0-7558	AJ0-7844	—
AQ C18	(Polar Endcapped C18)	1.5 - 7.5	AJ0-7510	AJ0-7511	AJ0-7512	AJ0-7843	AJ0-8305
Gemini®NX-C18	(C18 Twin-NX™ Technology)	1 - 12	AJ0-8367	AJ0-8368	AJ0-8369	AJ0-8370	AJ0-8371
Gemini C18	(C18 Twin™ Technology)	1 - 12	AJ0-7596	AJ0-7597	AJ0-7598	AJ0-7846	AJ0-8308
Gemini C6-Phenyl	(C6-Phenyl Twin Technology)	1 - 12	AJ0-7914	AJ0-7915	AJ0-9156	AJ0-9157	AJ0-9158
Luna® Omega Polar C18	(Polar Functional C18)	1.5 - 10	AJ0-7600	AJ0-7601	AJ0-9519	AJ0-7603	AJ0-7604
Luna Omega PS C18	(Mixed-Mode C18)	1.5 - 10	AJ0-7605	AJ0-7606	AJ0-9520	AJ0-7608	AJ0-7609

HPLC Guard Cartridge Holders (one-time purchase only)	/kit	/holder	/kit	/kit
Reusable Holder	KJ0-4282	AJ0-9281	AJ0-8223	AJ0-8277

SFC Guard Cartridge Holders	/kit	/holder	/kit	/kit
Reusable Holder	KJ0-4282	AJ0-9281	AJ0-8617	AJ0-8618

*For all core-shell and/or < 3 µm particle columns use 2.1 to 4.6 mm ID SecurityGuard ULTRA Holder and Cartridges

SecurityGuard ULTRA

SecurityGuard ULTRA™
UHPLC Column Protection

SecurityGuard ULTRA Cartridges

Material	Description	pH Stability	Column ID (mm) 2.1	3.0	4.6
Cartridges for General Purpose/ Pharmaceutical					
			/3pk	/3pk	/3pk
EVO C18	(ODS, Octadecyl)	1.0–12.0	AJ0-9298	AJ0-9297	AJ0-9296
C18	(ODS, Octadecyl)	1.5–8.5*	AJ0-8782	AJ0-8775	AJ0-8768
C8	(MOS, Octyl)	1.5–8.5*	AJ0-8784	AJ0-8777	AJ0-8770
PFP	(Pentafluorophenyl)	1.5–8.5	AJ0-8787	AJ0-8780	AJ0-8773
F5	(Pentafluorophenyl)	1.5–8.5	AJ0-9322	AJ0-9321	AJ0-9320
Biphenyl	(Biphenyl)	1.5–8.5*	AJ0-9209	AJ0-9208	AJ0-9207
Phenyl	(Phenylhexyl)	1.5–8.5*	AJ0-8788	AJ0-8781	AJ0-8774
HILIC	HILIC	2.0–7.5	AJ0-8786	AJ0-8779	AJ0-8772
Polar C18	(Polar Functional C18)	1.5–8.5*	AJ0-9532	AJ0-9531	AJ0-9530
Cartridges for General Purpose/Pharmaceutical (Fully Porous Columns)					
For fully porous columns like Luna® Omega (Phenomenex)					
C18	(ODS, Octadecyl)	1.5–8.5*	AJ0-9502	AJ0-9501	AJ0-9500
Polar C18	(Polar Functional C18)	1.5–8.5*	AJ0-9505	—	—
PS C18	(Positive Functional C18)	1.5–8.5*	AJ0-9508	—	—
Cartridges for Protein and Peptide Reversed Phase					
For use with columns like Aeris™ (Phenomenex)					
Widepore C18	(ODS, Octadecyl)	1.5–8.5*	AJ0-8783	—	AJ0-8769
Widepore C8	(MOS, Octyl)	1.5–8.5*	AJ0-8785	—	AJ0-8771
Widepore C4	(Butyl)	1.5–8.5*	AJ0-8899	—	AJ0-8901
Peptide C18	(ODS, Octadecyl)	1.5–8.5*	AJ0-8948	AJ0-8947	AJ0-8946
For use with columns like bioZen™ (Phenomenex)					
Glycan	(Amide Polyol)	2.0–7.5	AJ0-9800	—	—
Peptide PS-C18	(Positive Functional C18)	1.5–8.5	AJ0-9803	—	—
Peptide XB-C18	(ODS, Octadecyl)	1.5–9.0**	AJ0-9806	—	AJ0-9808
Intact C4	(Butyl)	1.5–9.0**	AJ0-9809	—	AJ0-9811
Intact XB-C18	(MOS, Octyl)	1.5–9.0**	AJ0-9812	—	AJ0-9814
SEC-2	(Silica)	1.5–8.5	—	—	AJ0-9850
SEC-3	(Silica)	1.5–8.5	—	—	AJ0-9851
Cartridges for Synthetic DNA / RNA Analysis					
For use with columns like Clarity® (Phenomenex)					
Oligo-MS C18	(ODS, Octadecyl)	1.5–8.5*	AJ0-9068	—	AJ0-9066
Oligo-XT	(ODS, Octadecyl)	1.0–12.0	AJ0-9515	—	AJ0-9514
Cartridges for Silica GFC (Gel Filtration Chromatography)					
(Aqueous SEC) For use with silica GFC columns such as Yarra™ (Phenomenex)					
X150	—	1.5–8.5	—	—	AJ0-9512
X300	—	1.5–8.5	—	—	AJ0-9513

*pH stable 1.5–8.5 under gradient conditions. pH stable 1.5–10 under isocratic conditions.
**pH range is 1.5–9 under gradient conditions. pH range is 1.5–10 under isocratic conditions.
AJ0-9000 is the universal holder designed for use with 2.1 mm, 3.0 mm and 4.6 mm ID cartridges.

Holder

Holder with cartridge, assembled

SecurityGuard ULTRA Cartridge Holder

Part No.	Description	Unit
AJ0-9000	SecurityGuard ULTRA Cartridge Holder	ea

Initial SecurityGuard ULTRA installation and cartridge replacement, requires 3 wrenches, which must be purchased separately: one 3/8 in. wrench (AQ0-8959; fits Kinetex, Aeris, and Oligo-MS column end-fittings), and two 5/16 in. wrenches (AQ0-8903; fits ULTRA cartridge and holder).

GC Columns

Zebron™ GC Columns

Zebron

Zebron ZB-Bioethanol

ID(mm)	df(µm)	Temp. Limits °C	Part No.
15-Meter			
0.25	1.00	-60 to 340/360	7EG-G020-22
30-Meter			
0.25	1.00	-60 to 340/360	7HG-G020-22

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-1*PLUS*™

ID(mm)	df(µm)	Temp. Limits °C	Part No.
15-Meter			
0.25	0.25	-60 to 360/370	7EG-G031-11
0.32	0.25	-60 to 360/370	7EM-G031-11
30-Meter			
0.25	0.10	-60 to 360/370	7HG-G031-02
0.25	0.25	-60 to 360/370	7HG-G031-11
0.32	0.25	-60 to 360/370	7HM-G031-11
60-Meter			
0.25	0.25	-60 to 360/370	7KG-G031-11
0.25	1.00	-60 to 360/370	7KG-G031-22
0.32	0.25	-60 to 360/370	7KM-G031-11

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-5MS*PLUS*™

ID(mm)	df(µm)	Temp. Limits °C	Part No.
15-Meter			
0.25	0.25	-60 to 325/350	7EG-G030-11
20-Meter			
0.18	0.18	-60 to 325/350	7FD-G030-08
0.18	0.36	-60 to 325/350	7FD-G030-53
30-Meter			
0.25	0.25	-60 to 325/350	7HG-G030-11
0.25	0.50	-60 to 325/350	7HG-G030-17
0.25	1.00	-60 to 325/350	7HG-G030-22
0.32	0.25	-60 to 325/350	7HM-G030-11
0.32	1.00	-60 to 325/350	7HM-G030-22
30-Meter with 5-Meter Guardian™ Integrated Guard			
0.25	0.25	-60 to 325/350	7HG-G030-11-GGA
30-Meter with 10-Meter Guardian Integrated Guard			
0.25	0.25	-60 to 325/350	7HG-G030-11-GGC
0.25	0.50	-60 to 325/350	7HG-G030-17-GGC
60-Meter			
0.25	0.25	-60 to 325/350	7KG-G030-11

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-1XT SimDist

ID(mm)	df(µm)	Temp. Limits °C	Part No.
5-Meter			
0.53	0.09	-60 to 450	7AK-G026-55
0.53	0.15	-60 to 450	7AK-G026-05
5-Meter with 2-Meter Guardian™ Integrated Guard			
0.53	0.09	-60 to 450	7AK-G026-55-GGT
0.53	0.15	-60 to 450	7AK-G026-05-GGT
10-Meter			
0.53	0.15	-60 to 450	7CK-G026-05
0.53	0.88	-60 to 450	7CK-G026-49
0.53	2.65	-60 to 400	7CK-G026-35
15-Meter			
0.53	0.25	-60 to 450	7EK-G026-11

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-5*PLUS*™

ID(mm)	df(µm)	Temp. Limits °C	Part No.
15-Meter			
0.25	0.25	-60 to 360/370	7EG-G032-11
30-Meter			
0.25	0.25	-60 to 360/370	7HG-G032-11
0.25	0.50	-60 to 360/370	7HG-G032-17
0.25	1.00	-60 to 360/370	7HG-G032-22
0.32	0.25	-60 to 360/370	7HM-G032-11
0.32	0.50	-60 to 360/370	7HM-G032-17
60-Meter			
0.25	0.25	-60 to 360/370	7KG-G032-11

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-WAX*PLUS*™

ID(mm)	df(µm)	Temp. Limits °C	Part No.
10-Meter			
0.10	0.10	20 to 250/260	7CB-G013-02
15-Meter			
0.25	0.25	20 to 250/260	7EG-G013-11
0.53	1.00	20 to 230/240	7EK-G013-22
20-Meter			
0.18	0.18	20 to 250/260	7FD-G013-08
30-Meter			
0.25	0.25	20 to 250/260	7HG-G013-11
0.25	0.50	20 to 250/260	7HG-G013-17
0.32	0.25	20 to 250/260	7HM-G013-11
0.32	0.50	20 to 250/260	7HM-G013-17
0.32	1.00	20 to 230/240	7HM-G013-22
0.53	1.00	20 to 230/240	7HK-G013-22
60-Meter			
0.25	0.15	20 to 250/260	7KG-G013-05
0.25	0.25	20 to 250/260	7KG-G013-11
0.25	0.50	20 to 250/260	7KG-G013-17
0.32	0.25	20 to 250/260	7KM-G013-11
0.32	0.50	20 to 250/260	7KM-G013-17
0.53	1.00	20 to 230/240	7KK-G013-22

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

GC Columns *(cont'd)*

Zebron™ GC Columns

Zebron

Zebron ZB-624*PLUS*™

ID(mm)	df(µm)	Temp. Limits °C	Part No.
20-Meter			
0.18	1.00	-20 to 300/320	7FD-G040-22
0.25	1.40	-20 to 300/320	7FG-G040-27
30-Meter			
0.25	1.40	-20 to 300/320	7HG-G040-27
0.32	1.80	-20 to 300/320	7HM-G040-31
0.53	3.00	-20 to 300/320	7HK-G040-36
60-Meter			
0.25	1.40	-20 to 300/320	7KG-G040-27
0.32	1.80	-20 to 300/320	7KM-G040-31
0.53	3.00	-20 to 300/320	7KK-G040-36
75-Meter			
0.53	3.00	-20 to 300/320	7LK-G040-36

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-5HT Inferno™

ID(mm)	df(µm)	Temp. Limits °C	Part No.
10-Meter with 2-Meter Spliced Guard (0.53 mm ID)			
0.32	0.10	-60 to 400/430	7CM-G015-02-GST
15-Meter			
0.25	0.10	-60 to 400/430	7EG-G015-02
0.25	0.25	-60 to 400/430	7EG-G015-11
0.32	0.10	-60 to 400/430	7EM-G015-02
0.32	0.25	-60 to 400/430	7EM-G015-11
0.53	0.15	-60 to 400	7EK-G015-05
15-Meter with 2-Meter Spliced Guard (0.53 mm ID)			
0.32	0.10	-60 to 400/430	7EM-G015-02-GST
20-Meter			
0.18	0.18	-60 to 400/430	7FD-G015-08
30-Meter			
0.25	0.10	-60 to 400/430	7HG-G015-02
0.25	0.25	-60 to 400/430	7HG-G015-11
0.32	0.10	-60 to 400/430	7HM-G015-02
0.32	0.25	-60 to 400/430	7HM-G015-11
0.53	0.15	-60 to 400	7HK-G015-05
60-Meter			
0.25	0.25	-60 to 400/430	7KG-G015-11

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-XLB-HT Inferno

ID(mm)	df(µm)	Temp. Limits °C	Part No.
15-Meter			
0.25	0.10	30 to 400	7EG-G024-02
0.25	0.25	30 to 400	7EG-G024-11
0.32	0.10	30 to 400	7EM-G024-02
20-Meter			
0.18	0.18	30 to 400	7FD-G024-08
30-Meter			
0.25	0.10	30 to 400	7HG-G024-02
0.25	0.25	30 to 400	7HG-G024-11
0.32	0.25	30 to 400	7HM-G024-11
60-Meter			
0.25	0.25	30 to 400	7KG-G024-11

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-1HT Inferno

ID(mm)	df(µm)	Temp. Limits °C	Part No.
5-Meter			
0.53	0.10	-60 to 400/430	7AK-G014-02
10-Meter			
0.32	0.25	-60 to 400/430	7CM-G014-11
15-Meter			
0.25	0.10	-60 to 400/430	7EG-G014-02
0.25	0.25	-60 to 400/430	7EG-G014-11
0.32	0.10	-60 to 400/430	7EM-G014-02
0.32	0.25	-60 to 400/430	7EM-G014-11
0.53	0.15	-60 to 400	7EK-G014-05
20-Meter			
0.18	0.18	-60 to 400/430	7FD-G014-08
30-Meter			
0.25	0.10	-60 to 400/430	7HG-G014-02
0.25	0.25	-60 to 400/430	7HG-G014-11
0.32	0.10	-60 to 400/430	7HM-G014-02
0.32	0.25	-60 to 400/430	7HM-G014-11
0.53	0.15	-60 to 400	7HK-G014-05

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-35HT Inferno

ID(mm)	df(µm)	Temp. Limits °C	Part No.
15-Meter			
0.25	0.10	40 to 400	7EG-G025-02
0.25	0.25	40 to 400	7EG-G025-11
0.32	0.25	40 to 400	7EM-G025-11
20-Meter			
0.18	0.18	40 to 400	7FD-G025-08
30-Meter			
0.25	0.10	40 to 400	7HG-G025-02
0.25	0.25	40 to 400	7HG-G025-11
0.32	0.25	40 to 400	7HM-G025-11

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

GC Columns *(cont'd)*

Zebron™ GC Columns

Zebron

Zebron ZB-1

ID(mm)	df(µm)	Temp. Limits °C	Part No.
10-Meter			
0.53	2.65	-60 to 340/360	7CK-G001-35
15-Meter			
0.25	0.10	-60 to 360/370	7EG-G001-02
0.25	0.25	-60 to 360/370	7EG-G001-11
0.25	1.00	-60 to 340/360	7EG-G001-22
0.32	0.25	-60 to 360/370	7EM-G001-11
0.32	1.00	-60 to 340/360	7EM-G001-22
0.53	0.15	-60 to 360/370	7EK-G001-05
0.53	0.50	-60 to 360/370	7EK-G001-17
0.53	1.50	-60 to 340/360	7EK-G001-28
30-Meter			
0.25	0.10	-60 to 360/370	7HG-G001-02
0.25	0.25	-60 to 360/370	7HG-G001-11
0.25	0.50	-60 to 360/370	7HG-G001-17
0.25	1.00	-60 to 340/360	7HG-G001-22
0.32	0.25	-60 to 360/370	7HM-G001-11
0.32	0.50	-60 to 360/370	7HM-G001-17
0.32	1.00	-60 to 340/360	7HM-G001-22
0.32	3.00	-60 to 340/360	7HM-G001-36
0.32	5.00	-60 to 340/360	7HM-G001-39
0.53	0.50	-60 to 360/370	7HK-G001-17
0.53	1.50	-60 to 340/360	7HK-G001-28
0.53	3.00	-60 to 340/360	7HK-G001-36
0.53	5.00	-60 to 340/360	7HK-G001-39
50-Meter			
0.25	0.50	-60 to 360/370	7JG-G001-17
60-Meter			
0.25	0.25	-60 to 360/370	7KG-G001-11
0.25	1.00	-60 to 340/360	7KG-G001-22
0.32	0.25	-60 to 360/370	7KM-G001-11
0.32	1.00	-60 to 340/360	7KM-G001-22
0.32	3.00	-60 to 340/360	7KM-G001-36
0.53	1.50	-60 to 340/360	7KK-G001-28
100-Meter			
0.25	0.50	-60 to 360/370	7MG-G001-17

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-5

ID(mm)	df(µm)	Temp. Limits °C	Part No.
15-Meter			
0.25	0.10	-60 to 360/370	7EG-G002-02
0.25	0.25	-60 to 360/370	7EG-G002-11
0.25	0.50	-60 to 360/370	7EG-G002-17
0.25	1.00	-60 to 340/360	7EG-G002-22
0.32	0.10	-60 to 360/370	7EM-G002-02
0.32	0.25	-60 to 360/370	7EM-G002-11
0.32	1.00	-60 to 340/360	7EM-G002-22
0.53	0.50	-60 to 360/370	7EK-G002-17
0.53	1.50	-60 to 340/360	7EK-G002-28
0.53	3.00	-60 to 340/360	7EK-G002-36
20-Meter			
0.18	0.18	-60 to 360/370	7FD-G002-08
30-Meter			
0.25	0.10	-60 to 360/370	7HG-G002-02
0.25	0.25	-60 to 360/370	7HG-G002-11
0.25	0.50	-60 to 360/370	7HG-G002-17
0.25	1.00	-60 to 340/360	7HG-G002-22
0.32	0.25	-60 to 360/370	7HM-G002-11
0.32	0.50	-60 to 360/370	7HM-G002-17
0.32	1.00	-60 to 340/360	7HM-G002-22
0.53	0.50	-60 to 360/370	7HK-G002-17
0.53	1.50	-60 to 340/360	7HK-G002-28
0.53	3.00	-60 to 340/360	7HK-G002-36
0.53	5.00	-60 to 340/360	7HK-G002-39
60-Meter			
0.25	0.10	-60 to 360/370	7KG-G002-02
0.25	0.25	-60 to 360/370	7KG-G002-11
0.25	0.50	-60 to 360/370	7KG-G002-17
0.25	1.00	-60 to 340/360	7KG-G002-22
0.32	0.25	-60 to 360/370	7KM-G002-11
0.32	1.00	-60 to 340/360	7KM-G002-22
0.53	1.50	-60 to 340/360	7KK-G002-28

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-5ms

ID(mm)	df(µm)	Temp. Limits °C	Part No.
10-Meter			
0.10	0.10	-60 to 325/350	7CB-G010-02
0.18	0.18	-60 to 325/350	7CD-G010-08
12-Meter			
0.20	0.33	-60 to 325/350	7DE-G010-14
15-Meter			
0.25	0.25	-60 to 325/350	7EG-G010-11
20-Meter			
0.18	0.18	-60 to 325/350	7FD-G010-08
0.18	0.32	-60 to 325/350	7FD-G010-51
0.18	0.36	-60 to 325/350	7FD-G010-53
25-Meter			
0.20	0.33	-60 to 325/350	7GE-G010-14
30-Meter			
0.25	0.25	-60 to 325/350	7HG-G010-11
0.25	0.50	-60 to 325/350	7HG-G010-17
0.25	1.00	-60 to 325/350	7HG-G010-22
0.32	0.25	-60 to 325/350	7HM-G010-11
0.32	0.50	-60 to 325/350	7HM-G010-17
0.32	1.00	-60 to 325/350	7HM-G010-22
60-Meter			
0.25	0.10	-60 to 325/350	7KG-G010-02
0.25	0.25	-60 to 325/350	7KG-G010-11
0.32	0.25	-60 to 325/350	7KM-G010-11

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-35

ID(mm)	df(µm)	Temp. Limits °C	Part No.
10-Meter			
0.10	0.10	40 to 340/360	7CB-G003-02
15-Meter			
0.25	0.25	40 to 340/360	7EG-G003-11
0.25	0.50	40 to 340/360	7EG-G003-17
0.53	1.00	40 to 340/360	7EK-G003-22
30-Meter			
0.25	0.25	40 to 340/360	7HG-G003-11
0.25	0.50	40 to 340/360	7HG-G003-17
0.32	0.25	40 to 340/360	7HM-G003-11
0.32	0.50	40 to 340/360	7HM-G003-17
0.53	0.50	40 to 340/360	7HK-G003-17
0.53	1.00	40 to 340/360	7HK-G003-22
60-Meter			
0.25	0.25	40 to 340/360	7KG-G003-11
0.32	0.25	40 to 340/360	7KM-G003-11

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

GC Columns *(cont'd)*

Zebron™ GC Columns

Zebron

Zebron ZB-50

ID(mm)	df(µm)	Temp. Limits °C	Part No.
10-Meter			
0.10	0.10	40 to 320/340	7CB-G004-02
0.53	2.00	40 to 320/340	7CK-G004-32
15-Meter			
0.25	0.15	40 to 320/340	7EG-G004-05
0.25	0.25	40 to 320/340	7EG-G004-11
0.32	0.25	40 to 320/340	7EM-G004-11
0.32	0.50	40 to 320/340	7EM-G004-17
0.53	1.00	40 to 320/340	7EK-G004-22
30-Meter			
0.25	0.25	40 to 320/340	7HG-G004-11
0.25	0.50	40 to 320/340	7HG-G004-17
0.32	0.25	40 to 320/340	7HM-G004-11
0.32	0.50	40 to 320/340	7HM-G004-17
0.53	1.00	40 to 320/340	7HK-G004-22
60-Meter			
0.25	0.25	40 to 320/340	7KG-G004-11
0.25	0.50	40 to 320/340	7KG-G004-17

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-1701

ID(mm)	df(µm)	Temp. Limits °C	Part No.
15-Meter			
0.25	0.25	-20 to 280/300	7EG-G006-11
0.32	0.25	-20 to 280/300	7EM-G006-11
30-Meter			
0.25	0.25	-20 to 280/300	7HG-G006-11
0.25	1.00	-20 to 260/280	7HG-G006-22
0.32	0.25	-20 to 280/300	7HM-G006-11
0.32	1.00	-20 to 260/280	7HM-G006-22
0.53	1.00	-20 to 260/280	7HK-G006-22
60-Meter			
0.25	0.25	-20 to 280/300	7KG-G006-11
0.32	0.25	-20 to 280/300	7KM-G006-11

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-FFAP

ID(mm)	df(µm)	Temp. Limits °C	Part No.
15-Meter			
0.25	0.25	40 to 250/260	7EG-G009-11
0.32	0.25	40 to 250/260	7EM-G009-11
0.32	0.50	40 to 250/260	7EM-G009-17
0.53	1.00	40 to 250/260	7EK-G009-22
30-Meter			
0.25	0.25	40 to 250/260	7HG-G009-11
0.32	0.25	40 to 250/260	7HM-G009-11
0.32	0.50	40 to 250/260	7HM-G009-17
0.32	1.00	40 to 250/260	7HM-G009-22
0.53	1.00	40 to 250/260	7HK-G009-22
50-Meter			
0.32	0.50	40 to 250/260	7JM-G009-17
60-Meter			
0.25	0.25	40 to 250/260	7KG-G009-11

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-624

ID(mm)	df(µm)	Temp. Limits °C	Part No.
20-Meter			
0.18	1.00	-20 to 260	7FD-G005-22
30-Meter			
0.25	1.40	-20 to 260	7HG-G005-27
0.32	1.80	-20 to 260	7HM-G005-31
0.53	3.00	-20 to 260	7HK-G005-36
60-Meter			
0.25	1.40	-20 to 260	7KG-G005-27
0.32	1.80	-20 to 260	7KM-G005-31
0.53	3.00	-20 to 260	7KK-G005-36
75-Meter			
0.53	3.00	-20 to 260	7LK-G005-36
105-Meter			
0.53	3.00	-20 to 260	7NK-G005-36

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

Zebron ZB-WAX

ID(mm)	df(µm)	Temp. Limits °C	Part No.
10-Meter			
0.10	0.10	40 to 250/260	7CB-G007-02
15-Meter			
0.25	0.25	40 to 250/260	7EG-G007-11
0.32	0.25	40 to 250/260	7EM-G007-11
0.32	0.50	40 to 250/260	7EM-G007-17
0.53	1.00	40 to 250/260	7EK-G007-22
20-Meter			
0.18	0.18	40 to 250/260	7FD-G007-08
30-Meter			
0.25	0.15	40 to 250/260	7HG-G007-05
0.25	0.25	40 to 250/260	7HG-G007-11
0.25	0.50	40 to 250/260	7HG-G007-17
0.25	1.00	40 to 250/260	7HG-G007-22
0.32	0.15	40 to 250/260	7HM-G007-05
0.32	0.25	40 to 250/260	7HM-G007-11
0.32	0.50	40 to 250/260	7HM-G007-17
0.53	0.50	40 to 250/260	7HK-G007-17
0.53	1.00	40 to 250/260	7HK-G007-22
60-Meter			
0.25	0.15	40 to 250/260	7KG-G007-05
0.25	0.25	40 to 250/260	7KG-G007-11
0.25	0.50	40 to 250/260	7KG-G007-17
0.32	0.25	40 to 250/260	7KM-G007-11
0.32	0.50	40 to 250/260	7KM-G007-17
0.53	1.00	40 to 250/260	7KK-G007-22

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

GC Columns *(cont'd)*

Zebron™ GC Columns

Zebron

Zebron ZB-XLB

ID(mm)	df(µm)	Temp. Limits °C	Part No.
10-Meter			
0.18	0.18	30 to 340/360	7CD-G019-08
15-Meter			
0.25	0.25	30 to 340/360	7EG-G019-11
20-Meter			
0.18	0.18	30 to 340/360	7FD-G019-08

Zebron ZB-XLB (cont'd)

ID(mm)	df(µm)	Temp. Limits °C	Part No.
30-Meter			
0.25	0.25	30 to 340/360	7HG-G019-11
0.25	0.50	30 to 340/360	7HG-G019-17
0.32	0.25	30 to 340/360	7HM-G019-11
0.32	0.50	30 to 340/360	7HM-G019-17
0.53	1.50	30 to 320/340	7HK-G019-28
60-Meter			
0.25	0.25	30 to 340/360	7KG-G019-11

Note: If you need a 5 in. cage, contact Technical support via Phenomenex.com/livechat or simply reach out to your Technical consultant. Conditions may apply. Agilent 6850, some SRI and process GC systems use only 5 in. cages.

GC Column Protection

Guardian™: Integrated Guard Columns

Zebron GC Column Phase	Dimensions	2m Guardian Part No.	5m Guardian Part No.	10m Guardian Part No.
ZB-1*PLUS*™	15 meter x 0.25 mm x 0.25 µm	—	—	7EG-G031-11-GGC
ZB-1*PLUS*	30 meter x 0.25 mm x 0.25 µm	—	7HG-G031-11-GGA	7HG-G031-11-GGC
ZB-1HT Inferno™	30 meter x 0.25 mm x 0.10 µm	—	7HG-G014-02-GGA	—
ZB-5ms	15 meter x 0.25 mm x 0.25 µm	—	—	7EG-G010-11-GGC
ZB-5ms	30 meter x 0.25 mm x 0.25 µm	—	7HG-G010-11-GGA	7HG-G010-11-GGC
ZB-5ms	30 meter x 0.25 mm x 0.50 µm	—	7HG-G010-17-GGA	7HG-G010-17-GGC
ZB-5ms	30 meter x 0.32 mm x 0.25 µm	—	7HM-G010-11-GGA	—
ZB-5ms	30 meter x 0.32 mm x 1.00 µm	—	7HM-G010-22-GGA	—
ZB-5MS*PLUS*™	30 meter x 0.25 mm x 0.25 µm	—	7HG-G030-11-GGA	7HG-G030-11-GGC
ZB-5MS*PLUS*	30 meter x 0.25 mm x 0.50 µm	—	—	7HG-G030-17-GGC
ZB-5	30 meter x 0.25 mm x 0.25 µm	—	7HG-G002-11-GGA	7HG-G002-11-GGC
ZB-5	30 meter x 0.25 mm x 0.50 µm	—	7HG-G002-17-GGA	7HG-G002-17-GGC
ZB-5	60 meter x 0.25 mm x 0.25 µm	—	7KG-G002-11-GGA	—
ZB-5HT Inferno	30 meter x 0.25 mm x 0.10 µm	—	7HG-G015-02-GGA	—
ZB-5HT Inferno	30 meter x 0.25 mm x 0.25 µm	—	7HG-G015-11-GGA	—
ZB-5*PLUS*™	20 meter x 0.18 mm x 0.18 µm	—	7FD-G032-08-GGA	—
ZB-5*PLUS*	30 meter x 0.25 mm x 0.10 µm	—	7HG-G032-02-GGA	—
ZB-5*PLUS*	30 meter x 0.25 mm x 0.25 µm	—	7HG-G032-11-GGA	—
ZB-50	10 meter x 0.18 mm x 0.18 µm	7CD-G004-08-GGT	—	—
ZB-MultiResidue™-1	30 meter x 0.25 mm x 0.25 µm	—	—	7HG-G016-11-GGC
ZB-SemiVolatiles	30 meter x 0.25 mm x 0.25 µm	—	7HG-G027-11-GGA	7HG-G027-11-GGC

Chemical Industry

LC & GC Separation Solutions Guide

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