# RESTEK LC Columns and Accessories


BGB GC | LC MS | CE

Pure Chromatography

www.bgb-shop.com/restek

# This is Restek LC

Restek has been perfecting the art and science of liquid chromatography (LC) for more than a quarter-century. Over that time, the burdens placed on LC systems and analysts have changed dramatically, especially with the adoption and explosive growth of LC-MS/MS in modern analytical laboratories. With each passing year, there is a higher demand for chromatography consumables to be reliable, to generate reproducible data, and to retain and resolve greater numbers of more difficult compounds. The employee-owners of Restek pride ourselves on being experts in chromatography, and we use our experience to help analysts like you solve the challenges you face on a daily basis in this rapidly shifting landscape.

Our state-of-the-art, high-quality lines of LC columns—Raptor, Force, and Roc—with industry-leading stationary phases have been designed and built to address the needs of not only today's markets, but also tomorrow's. Extensive testing, competitor benchmarking, and strict QC systems ensure that all of our columns will consistently produce the results you must have time and time again, now and in the future. We also offer instrument replacement parts that meet or even exceed the original manufacturer's performance. And, as it has been since the beginning, Restek is proud to be an independent company, and we will support every LC you have, regardless of who made it.

Whether you are in a high-throughput analytical laboratory with crushing deadlines and a rising backlog or in a research and development organization with a tight budget and towering goals, Restek is the partner you need to make your LC work flow.

We invite you to look through this highlighted selection of Restek LC columns and accessories. For more LC products, as well as GC, sample preparation, and more, be sure to visit **www.bgb-shop.com/restek**

***The Employee-Owners of Restek***

RESTEK

# Table of Contents



## Fast, Personalized, and Thorough Answers

Restek's highly diverse Technical Service team collectively represents hundreds of years of hands-on chromatography experience and specializes in providing information about Restek products, applications, instrument troubleshooting, method development, and more. For answers to your most challenging technical questions, just send us an email!

**Customers Inside the U.S.**
**support@restek.com**

**Customers Outside the U.S.**
Contact your local Restek representative or email
**support@restek.com**

# Rugged, Reproducible Columns from Restek Make Your LC Work Flow

Raptor LC Columns

**Overview:** SPP, or "core-shell," columns designed specifically to accelerate your analyses while maintaining reproducibility and ruggedness.

**Ideal for:** High-throughput LC-MS/MS.

**Instruments supported:**

- Agilent 1260 & 1200 RRLC
- Waters ACQUITY Arc
- Shimadzu Nexera XR (UFLCXR) & i-Series (LC-2040)

**See page:** 6.

**Learn more:** www.bgb-shop.com/raptor

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FORCE PERFORMANCE LC COLUMNS

**Overview:** Premium, long-lasting, and reproducible columns for HPLC and UHPLC; fully scalable from 1.8 µm to 3 µm to 5 µm.

**Ideal for:** Scaling methods between HPLC and UHPLC.

**Instruments supported:**

- Agilent 1290
- Waters ACQUITY H&I Class
- Shimadzu Nexera X2

**See page:** 48.

**Learn more:** www.bgb-shop.com/restek-forc

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Roc HPLC Columns

**Overview:** Solid and dependable columns made for exceptional value and traditional HPLC use, particularly with USP methods.

**Ideal for:** Compendia or routine, low-pressure use.

**Instruments supported:**

- Agilent 1100 & 1200
- Waters Alliance
- Shimadzu Prominence & i-Series (LC-2030)

**See page:** 58.

**Learn more:** www.bgb-shop.com/restek-roc

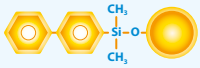
## Other LC Columns Available from Restek

**Ultra LC Columns:** Specialty phases and prep columns.
**Viva LC Columns:** Large porosity columns for biomolecule analysis.
**Allure LC Columns:** High-surface area silica and specialty phases.
Featuring Allure Acrylamide Columns on page 64.
**Pinnacle DB LC Columns:** Standard-phase UHPLC columns.
**Pinnacle II PAH Columns:** Specialty phase for analysis of polycyclic aromatic hydrocarbons (PAHs).

***Find them all at*** **www.bgb-shop.com/restek-lc**

# LC Stationary Phases with the Selectivity for Your Challenging and Complex Separations

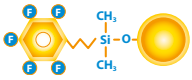
Whether your application calls for a straight-up C18 or for something with a little more "punch" like the time-tested and industry-first Restek Biphenyl, we have the phases you need. Huge analyte panels, isobars, isomers, structurally similar compounds, matrix interferences, and more—with Restek phases, you'll make quick work of any application. Here's a look at some of our most popular phases. Flip through this book for more.



### Time-Tested Restek Biphenyl Phase:

**The established choice for bioanalytical testing since 2005.**

See pages: 11, 53.



### Reliably Versatile Restek FluoroPhenyl Phase:

**Get the power of HILIC and RP modes in one LC column.**

See pages: 21, 55.

### Acid-Resistant Restek ARC-18 Phase:

**Ahead of the curve for large, multiclass lists by mass spec.**

See page: 16.

### General-Purpose Restek C18 Phase:

**Traditional end-capped C18 ideal for general-purpose use.**

See pages: 27, 54, 62.

### Rugged, MS-Friendly Restek HILIC-Si Phase:

**Simplify the switch to HILIC on both HPLC and UHPLC systems.**

See page: 31.

### Matrix-Resolving Restek EtG/EtS Phase:

**Separate analytes from interferences in a fast, 4-minute dilute-and-shoot method.**

See page: 38.

### Hybrid Retention Restek Polar X Phase:

**Reliably analyze a broad range of polar analytes.**

See pages: 44 to 46

# Protect the Most Expensive Consumable in Your Chromatographic Assay with Restek LC Guards

**EXP Direct Connect Holder & Guard Column Cartridges:**
For 3 and 5 µm Force & 1.8 µm, 2.7 and 5 µm Raptor LC Columns

**See pages:** 14, 20, 26, 30, 37, 56.

**UltraShield UHPLC PreColumn Filters:**
For 1.8 µm Force & Raptor LC Columns

**See pages:** 14, 20, 26, 30, 40, 56.

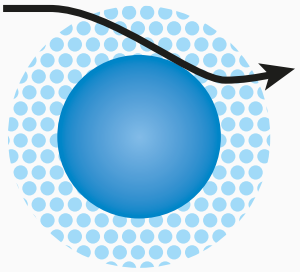
**Roc LC Guard Column Holder & Cart**
For Roc LC Columns

**See page:** 62.

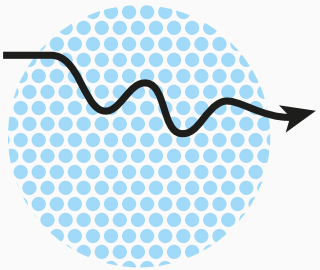
**Trident LC Column Protection System:**
For Ultra, Viva, Allure Acrylamide, and Pinnacle DB LC Columns

**See page:** 92.


## SPP or FPP?

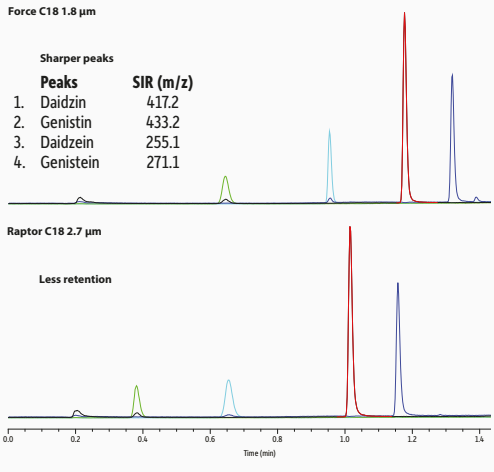


Superficially porous particles (SPP) are becoming increasingly popular for providing faster, more efficient analyses without UHPLC pressures. And when speed is your goal, Restek recommends the Raptor line of LC columns (**www.restek.com/raptor**).



However, retention is often just as important to sharpen peaks and increase sensitivity for mass spec, and when that is the case, fully porous particle (FPP) Force LC columns (**www.restek.com/force**) are ready to be put to work.

**Either way, Restek has a high-performing, reliable LC column for you.**




LC_FF0570

**Columns** Force C18 1.8 µm, 50 x 2.1 mm (cat# 9634252), max pressure = 500 bar and Raptor C18 2.7 µm, 50 x 2.1 mm (cat# 9304A52), max pressure = 225 bar, Temp.: 50 °C; **Sample** Custom mix, Diluent: Water, Conc.: 500 ng/mL, Inj. Vol.: 2 µL; **Mobile Phase** A: Water + 0.1% formic acid, B: Acetonitrile + 0.1% formic acid; **Gradient (%B):** 0.00 min (15%), 1.50 min (95%), 1.51 min (15%), 3.00 min (15%); **Flow:** 0.6 mL/min; **Detector:** MS; Interface: ESI+; **Instrument:** UHPLC.

# Raptor
LC Columns

*Selectivity Accelerated*

The speed of SPP with the resolution of USLC technology for fast, efficient method development that delivers:

- Drastically faster analysis times.
- Substantially improved resolution.
- Increased sample throughput with existing instrumentation.
- Dependable reproducibility.

**www.bgb-shop.com/raptor**

# Raptor SPP LC Columns—The Dawn of an Era

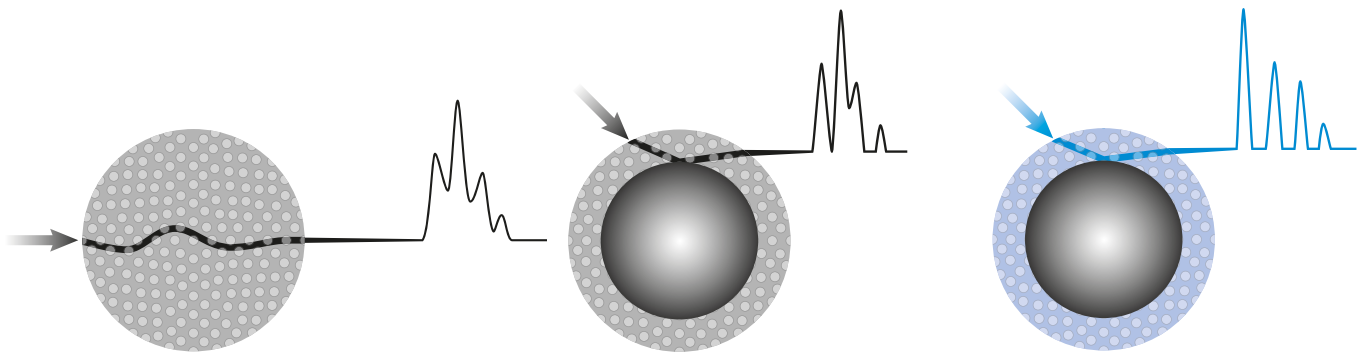
The efficiency of superficially porous particles (commonly referred to as SPP or "core-shell" particles) has been proven to provide fast separations with lower backpressures. This benefit helps customers achieve faster separations with their existing HPLC instruments. Coupled with small-particle technology, SPP particles also provide an efficiency boost to those running UHPLC when compared to fully porous particles. SPP particles feature a solid, impermeable core enveloped by a thin, porous layer of silica that decreases the diffusion path and reduces peak dispersion. As a result, they offer significantly higher efficiency than traditional fully porous particles of similar dimensions. Core-shell particles changed LC, but they were only the beginning....

## A New Species Has Evolved

Restek is proud to announce that SPP core-shell technology has evolved with the introduction of Raptor LC columns. Although column efficiency, which is boosted with superficially porous particles, considerably accelerates analysis time, it has little effect on resolution (i.e., peak separation). Selectivity, on the other hand, has a substantial impact on resolution, but shows minimal improvement in analysis times. Raptor LC columns bond rugged 1.8, 2.7, and 5 µm superficially porous particles with Restek's unique Ultra Selective Liquid Chromatography (USLC) phases to offer chromatographers the best of both worlds.

By being the first to combine the speed of SPP with the resolution of highly selective USLC technology, Raptor LC columns provide analysts with the most powerful tools available for fast and efficient method development. And, because they are from Restek, Raptor LC columns are backed by the manufacturing and quality systems you've come to trust along with the best Plus 1 service in the industry. Choose them for all of your valued assays to experience *Selectivity Accelerated*.

**Figure 1:** Only Raptor LC columns offer the higher efficiency of a superficially porous particle *plus* the improved resolution of USLC phases.



Fully porous particles with typical stationary phases show longer retention times and less resolution.

Ordinary superficially porous particles (SPP) with typical stationary phases show shorter retention times than fully porous particles, but still exhibit less resolution.

Only Raptor LC columns with highly selective USLC stationary phases show shorter retention times and greater resolution.

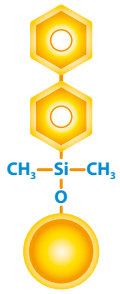
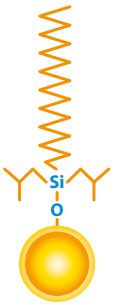
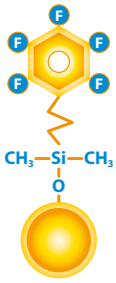
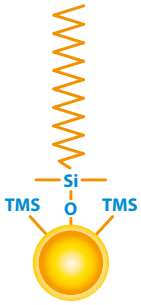
**Experience *Selectivity Accelerated*. Put Raptor LC columns and guards to the test today on your most challenging workflows.**

# Evolutionary Chromatography

It is only possible to fully utilize the efficiency of superficially porous particle technology when it is united with the power of USLC selectivity. With Raptor columns, you can speed up method development and enhance sample throughput. Using 2.7 and 5 µm columns, traditional HPLC instruments gain significant efficiency and selectivity improvements without the need to upgrade, and Raptor 1.8 µm LC columns can evolve UHPLC workflows by providing a one-two efficiency punch: superficially porous shells on small-core particles.

- Run faster and avoid lengthy gradient adjustments.
- Separate isobaric and hard-to-resolve compounds with ease.
- Avoid eluting compounds near the void volume and limit ion suppression.
- Skip the complex mobile phases and multiple method modifications.

## Raptor Family of LC Phases

| | Biphenyl | ARC-18 | FluoroPhenyl | C18 | HILIC-Si | EtG/EtS | Polar X |
|---|---|---|---|---|---|---|---|
| |  |  |  |  |  |  |  |
| **USP Phase Code** | L11 | L1 | L43 | L1 | L3 | n/a | n/a |
| **Stationary Phase Category** | Phenyl | C18, octadecylsilane | Pentafluorophenyl propyl | C18, octadecylsilane | bare silica | Proprietary | Proprietary |
| **Ligand Type** | Biphenyl | Sterically protected C18 | Fluorophenyl | End-capped C18 | none | Proprietary | Proprietary |
| **Particle Size** | 1.8 µm, 2.7 µm, or 5 µm superficially porous particle (SPP or "core-shell" particle) silica | 1.8 µm, 2.7 µm, or 5 µm superficially porous particle (SPP or "core-shell" particle) silica | 1.8 µm, 2.7 µm, or 5 µm superficially porous particle (SPP or "core-shell" particle) silica | 1.8 µm, 2.7 µm, or 5 µm superficially porous particle (SPP or "core-shell" particle) silica | 2.7 µm superficially porous particle (SPP or "core-shell" particle) silica | 2.7 µm superficially porous particle (SPP or "core-shell" particle) silica | 2.7 µm superficially porous particle (SPP or "core-shell" particle) silica |
| **Pore Size** | 90 Å | 90 Å | 90 Å | 90 Å | 90 Å | 90 Å | 90 Å |
| **Surface Area** | 125 $m^2$/g (1.8 µm), 130 $m^2$/g (2.7 µm), or 100 $m^2$/g (5 µm) | 125 $m^2$/g (1.8 µm), 130 $m^2$/g (2.7 µm), or 100 $m^2$/g (5 µm) | 125 $m^2$/g (1.8 µm), 130 $m^2$/g (2.7 µm), or 100 $m^2$/g (5 µm) | 125 $m^2$/g (1.8 µm), 130 $m^2$/g (2.7 µm), or 100 $m^2$/g (5 µm) | 130 $m^2$/g (2.7 µm) | 130 $m^2$/g (2.7 µm) | 130 $m^2$/g (2.7 µm) |
| **Carbon Load** | 7% (1.8 µm), 7% (2.7 µm), 5% (5 µm) | 7% (1.8 µm), 7% (2.7 µm), 5% (5 µm) | 4% (1.8 µm), 4% (2.7 µm), 3% (5 µm) | 9% (1.8 µm), 7% (2.7 µm), 5% (5 µm) | n/a | Proprietary | Proprietary |
| **End-Cap** | yes | no | no | yes | no | Proprietary | Proprietary |
| **pH Range** | 1.5–8.0 | 1.0–8.0 | 2.0–8.0 | 2.0–8.0 | 2.0–8.0 | 2.0–8.0 | 2.0–8.0 |
| **Maximum Temperature** | 80 °C | 80 °C | 80 °C | 80 °C | 80 °C | 80 °C | 60 °C |
| **Maximum Pressure** | 1034 bar/15,000 psi* (1.8 µm), 600 bar/8700 psi (2.7 µm); 400 bar/5800 psi (5 µm) | 1034 bar/15,000 psi* (1.8 µm), 600 bar/8700 psi (2.7 µm); 400 bar/5800 psi (5 µm) | 1034 bar/15,000 psi* (1.8 µm), 600 bar/8700 psi (2.7 µm); 400 bar/5800 psi (5 µm) | 1034 bar/15,000 psi* (1.8 µm), 600 bar/8700 psi (2.7 µm); 400 bar/5800 psi (5 µm) | 600 bar/8700 psi (2.7 µm) | 600 bar/8700 psi (2.7 µm) | 600 bar/8700 psi (2.7 µm) |

* For maximum lifetime, recommended maximum pressure for 1.8 µm particles is 830 bar/12,000 psi.

# Dissecting Raptor LC Columns

*A closer look at a new species*

## Adaptive Traits: Raptor LC Column

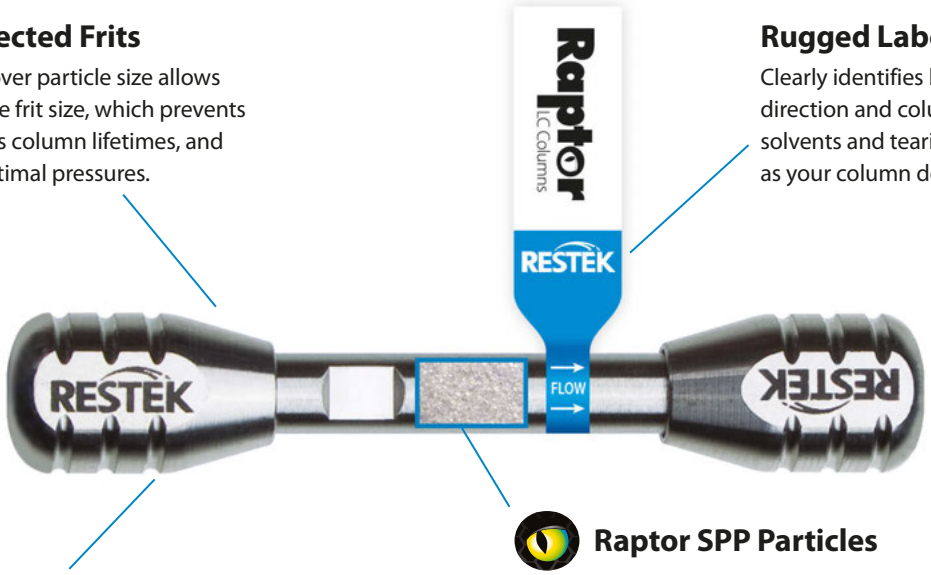
Restek's dedicated R&D group studied every aspect of superficially porous particles (commonly referred to as SPP or "core-shell" particles) to develop the bonding chemistries that are best suited to both the SPP construction and our highly selective USLC phases. But we didn't stop there. In addition to implementing a new, proprietary column-packing technique, we upgraded our LC column hardware. By looking at not only the particles, but also the packing and hardware, we have made sure that you will get repeatable, rugged performance from each and every Raptor LC column.

### Specially Selected Frits

Precision control over particle size allows the largest possible frit size, which prevents clogging, increases column lifetimes, and helps maintain optimal pressures.

### Rugged Label

Clearly identifies both flow direction and column; resists solvents and tearing to last as long as your column does.




### Proprietary Column-Packing Technique

Provides greater pressure stability and achieves higher linear velocities without sacrificing efficiency or lifetime; columns hold up under the rigors of UHPLC injection cycles.

### Raptor SPP Particles

**A Range of Robust Particles**
Accelerate traditional HPLC with 2.7 and 5 µm particles; boost UHPLC with 1.8 µm.

**Narrow Silica Distribution**
Ensures high efficiency and consistent flows.

**Updated Bonding and QC**
Guarantee retention time stability, run to run and column to column.

# Natural Protection

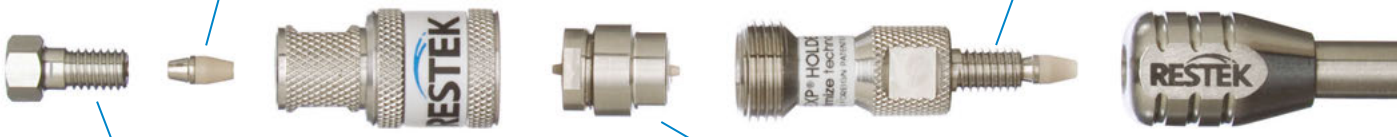
### Raptor EXP Guard Column— for All Raptor Columns

Regardless of its performance, lifespan, or frit size, the LC column is the most expensive consumable used for your chromatographic assay. To help protect your investment and further extend the life of our already-rugged Raptor LC columns, we have mated our new superficially porous particles with patented guard column hardware developed by Optimize Technologies. Great with any Raptor column to get ultimate protection from particulates and matrix contamination, especially when using dilute-and-shoot or other minimal sample preparation techniques.

**Patented Titanium Hybrid Ferrules**
Can be installed repeatedly without compromising high-pressure seal.

**Free-Turn Architecture**
Allows you to change cartridges without breaking inlet/outlet fluid connections—and without tools.

**Auto-Adjusting Connection**
Provides ZDV (zero dead volume) connection to any 10-32 female port.




**Flexible Design**
Replace nut with longer or even tool-free options (below) to best suit your needs.

**Unidirectional Raptor Cartridge**

**In-Tandem Development**
Made to pair perfectly with Raptor LC columns.

**Superior Packing Technique**
Withstands 1034 bar (UHPLC)/600 bar (2.7 µm)/400 bar (5 µm) operating pressures.

**Restek Quality**
Backed by the manufacturing and QC systems you trust.

**See page 76 for EXP fittings.**

**See pages 14, 20, 26, 30, 37, and 50 for Raptor guard column cartridges.**



24995

## UltraShield UHPLC PreColumn Filter — for 1.8 µm Raptor Columns

Pair 1.8 µm Raptor columns with an UltraShield filter instead of a guard cartridge to minimize extra column volume and maximize UHPLC sample throughput when using SPE, SLE, or other extensive sample preparations. They offer economical protection against microparticles with a negligible effect on column performance, and they are leak tight to 15,000 psi (1034 bar). Better yet, an UltraShield filter won't contribute to system backpressure band broadening.

| Porosity | qty. | cat.# |
|---|---|---|
| 0.5 µm frit | ea. | 24995 |
| 0.5 µm frit | 5-pk. | 24996 |
| 0.5 µm frit | 10-pk. | 24997 |
| 0.2 µm frit | ea. | 25809 |
| 0.2 µm frit | 5-pk. | 25810 |
| 0.2 µm frit | 10-pk. | 25811 |

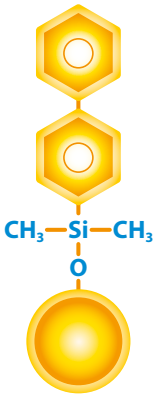
# The Raptor Biphenyl Column—Fast, Rugged Raptor Columns with Time-Tested Selectivity

With Raptor LC columns, Restek chemists became the first to combine the speed of 2.7 and 5 µm superficially porous particles (also known as SPP or "core-shell" particles) with the resolution of highly selective USLC technology, improving separations and speeding up analysis times with standard HPLC instruments. Raptor then evolved to bring that same improved speed, efficiency, and selectivity to UHPLC analyses by offering 1.8 µm particle columns. Learn more about Raptor LC columns at **www.bgb-shop.com/raptor**

Our top priority when developing our SPP line was to create a version of our innovative Biphenyl. The industry-leading Biphenyl is Restek's most popular LC stationary phase because it is particularly adept at separating compounds that are hard to resolve or that elute early on C18 and other phenyl chemistries. As a result, the rugged Raptor Biphenyl column is extremely useful for fast separations in bioanalytical testing applications such as drug and metabolite analyses, especially those that require a mass spectrometer (MS). Increasing retention of early-eluting compounds can limit ionization suppression, and the heightened selectivity helps eliminate the need for complex mobile phases that are not well suited for MS detection.

In 2005, Restek was the first to bring you the benefits of the Biphenyl ligand, and we have the experience to maximize the SPP performance of this premier phenyl chemistry for today's challenging workflows.

## Column Description:




**Stationary Phase Category:**
Phenyl (L11)

**Ligand Type:**
Biphenyl

**Particle:**
1.8 µm, 2.7 µm, or 5 µm superficially porous particle (SPP or "core-shell" particle) silica

**Pore Size:**
90 Å

**Surface Area:**
125 $m^2/g$ (1.8 µm),
130 $m^2/g$ (2.7 µm),
or 100 $m^2/g$ (5 µm)

**Recommended Usage:**
pH Range: 1.5–8.0

Maximum Temperature: 80 °C

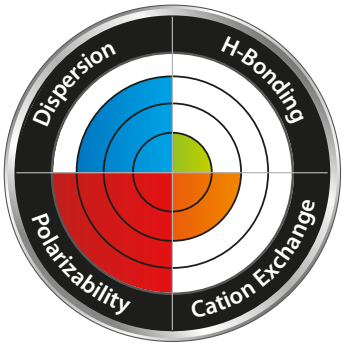
Maximum Pressure: 1034 bar/15,000 psi* (1.8 µm), 600 bar/8700 psi (2.7 µm); 400 bar/5800 psi (5 µm)

** For maximum lifetime, recommended maximum pressure for 1.8 µm particles is 830 bar/12,000 psi.*

**Properties:**
- Increased retention for dipolar, unsaturated, or conjugated solutes.
- Enhanced selectivity when used with methanolic mobile phase.
- Ideal for increasing sensitivity and selectivity in LC-MS analyses.

**Switch to a Biphenyl when:**
- You observe limited selectivity on a C18.
- You need to increase retention of hydrophilic aromatics.

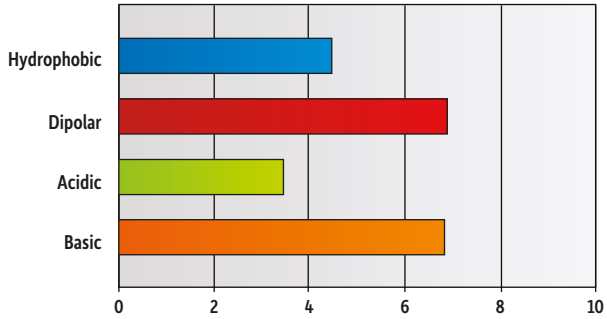
## Column Interaction Profile:


**Defining Solute Interactions:**
- Polarizability
- Dispersion

**Complementary Solute Interaction:**
- Cation exchange

## Solute Retention Profile:




**Target Analyte Structures:**
- Aromatic
- Dipolar

**Target Analyte Functionalities:**
- Hydrophilic aromatics
- Strong dipoles
- Lewis acids
- Dipolar, unsaturated, or conjugated compounds
- Fused-ring compounds with electron withdrawing groups

# The New Standard for Performance and Durability for SPP Core-Shell Columns

## Pressure Stability:

One of the greatest advantages of an SPP column is the ability to achieve fast, efficient separations by operating at higher linear velocities than are possible with a conventional fully porous particle column. However, these higher velocities can also result in higher backpressures. Raptor columns were designed to handle the increased pressures needed to achieve *Selectivity Accelerated*, and handle it far better than other SPP columns on the market (Figure 2).

## Reproducibility:

To help keep your productivity high and your lab budget low, we know that Raptor Biphenyl columns must produce exceptional selectivity and fast analysis times not just once, but every time. Ruggedness and repeatability are essential, which is why, from the silica and the bonding technique to the packing process and upgraded hardware, every decision that went into creating this column was made to ensure superlative reproducibility, from injection to injection (Figure 3) and from lot to lot (Figure 4). We also adopted new quality control (QC) specifications to guarantee the retention time stability you need for worry-free MRM analyses.

**Figure 2:** At high pressures, competitor phenyl-hexyl columns experience a quick and sharp drop-off in efficiency, but Raptor Biphenyl columns are unaffected to at least 3000 injections.

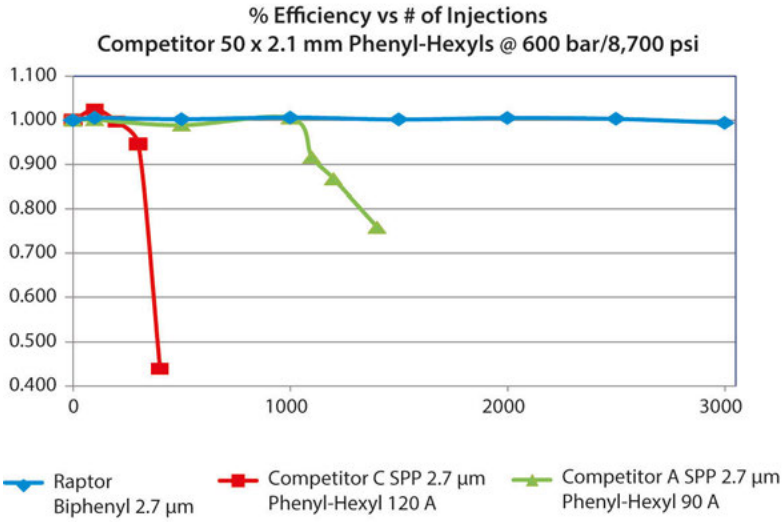
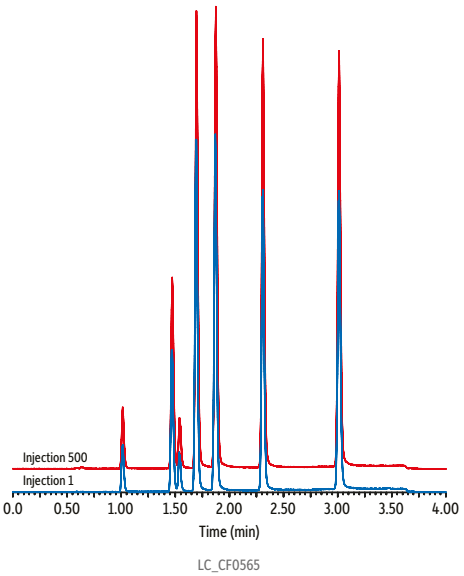


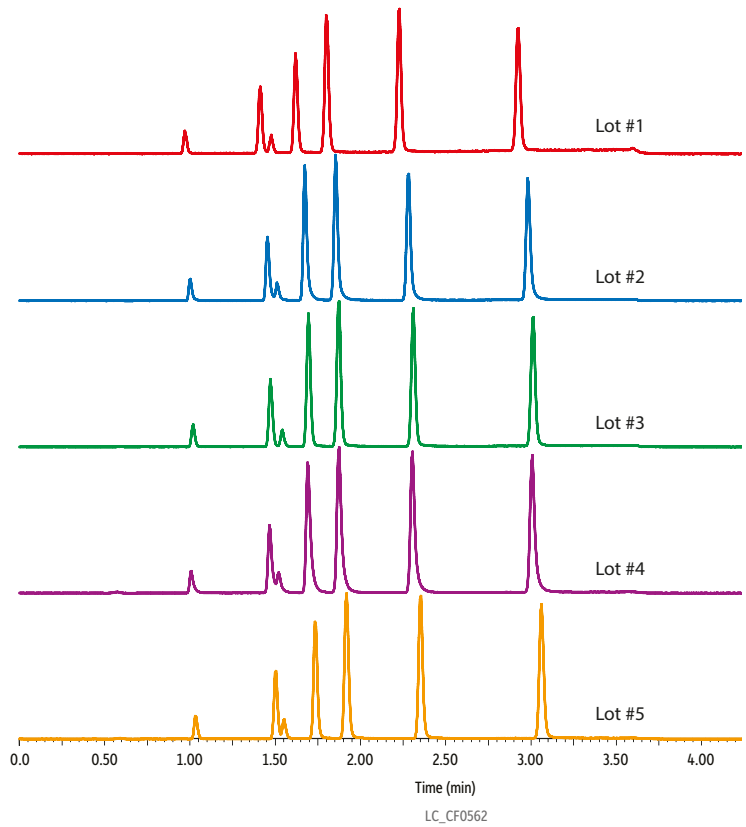

**Figure 3:** Even after hundreds of injections, a Raptor Biphenyl column will provide consistent, reliable data.




**Peaks**
1. Cortisol
2. 11-Deoxycortisol
3. Estradiol
4. Boldenone
5. Testosterone
6. Androstenedione
7. Progesterone

**Column:** Raptor Biphenyl (cat.# 9309A1E); Dimensions: 100 mm x 3.0 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 30 °C; **Sample:** Diluent: initial mobile phase; Conc.: 50 ng/mL; Inj. Vol.: 5 µL **Mobile Phase:** A: 0.1% formic acid in water, B: 0.1% formic acid in acetonitrile; **Gradient (%B):** 0.00 min (40%), 3.00 min (80%), 3.01 min (40%), 5.00 min (40%); **Flow:** 0.700 mL/min; **Detector:** Waters Xevo TQ-S; Ion Mode: ESI+; **Instrument:** Waters.

**Figure 4:** From one lot to the next, every Raptor Biphenyl column you purchase will perform the same.




**See Figure 3 for compound list and conditions.**

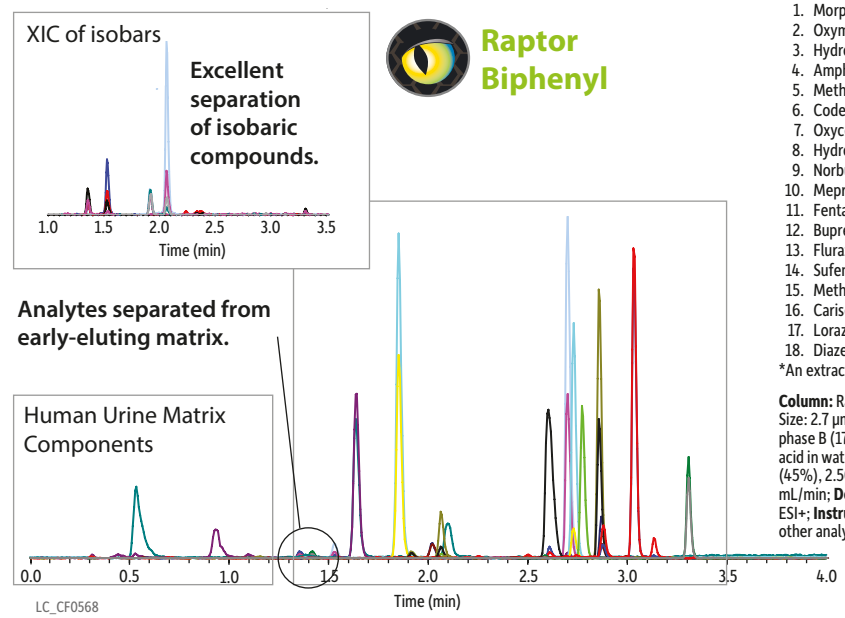
## Clinically Proven to Optimize Your Bioanalytical Workflows

For over a decade, the Restek Biphenyl has been the column of choice for clinical testing because of its ability to provide highly retentive, selective, and rugged reversed-phase separations of drugs and metabolites. By bringing the speed of SPP to the Biphenyl family, the Raptor Biphenyl provides clinical labs with an even faster option for a wide variety of clinical assays.

### Rugged Pain Panels from Urine in Under 3.5 Minutes

Pain panels can be difficult to optimize and reproduce due to the limited selectivity of C18 and phenyl-hexyl phases, but not on the Raptor Biphenyl. Complete your pain panel analysis with a 5-minute cycle time and complete isobaric resolution using Raptor Biphenyl columns (Figure 5). Popular competitor columns offer tailing peaks, longer run times, and coelutions; the Raptor Biphenyl exhibits the selectivity and performance needed for this critical analysis.

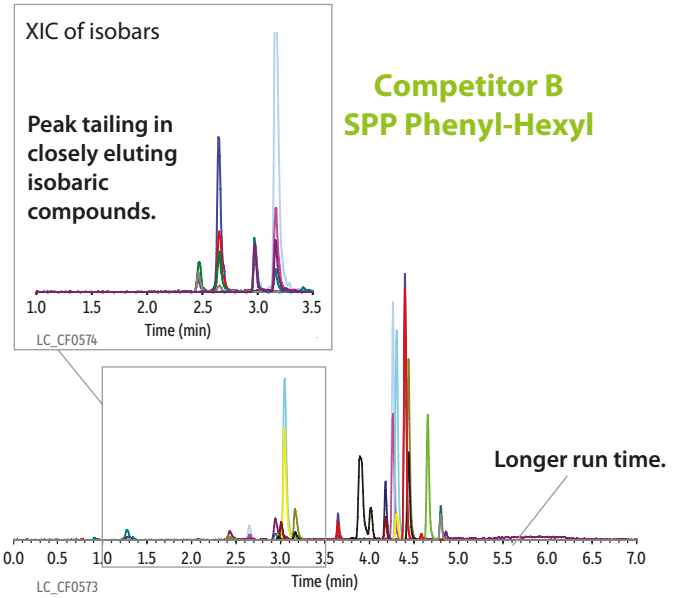
**Figure 5:** Raptor Biphenyl columns offer pain panel analyses with complete isobaric resolution in under 5 minutes!



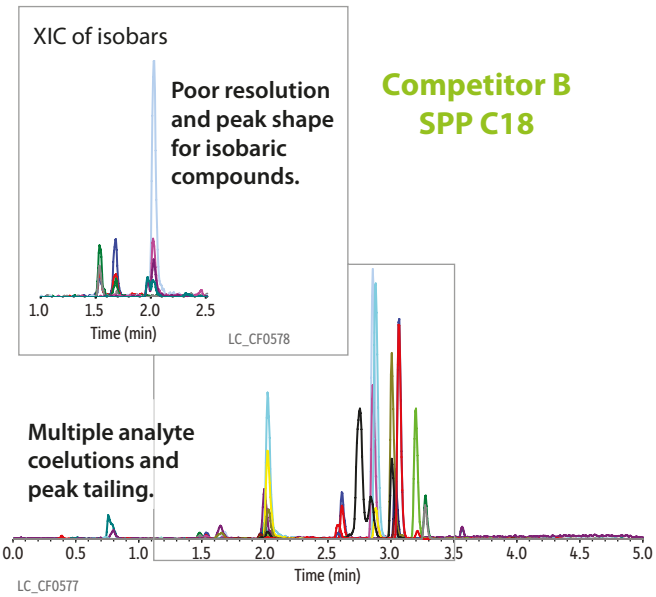

| | Peaks | $t_R$ (min) | Precursor ion | Product ion 1 | Product ion 2 |
|---|---|---|---|---|---|
| 1. | Morphine* | 1.34 | 286.2 | 152.3 | 165.3 |
| 2. | Oxymorphone | 1.40 | 302.1 | 227.3 | 198.2 |
| 3. | Hydromorphone* | 1.52 | 286.1 | 185.3 | 128.2 |
| 4. | Amphetamine | 1.62 | 136.0 | 91.3 | 119.2 |
| 5. | Methamphetamine | 1.84 | 150.0 | 91.2 | 119.3 |
| 6. | Codeine* | 1.91 | 300.2 | 165.4 | 153.2 |
| 7. | Oxycodone | 2.02 | 316.1 | 241.3 | 256.4 |
| 8. | Hydrocodone* | 2.06 | 300.1 | 199.3 | 128.3 |
| 9. | Norbuprenorphine | 2.59 | 414.1 | 83.4 | 101.0 |
| 10. | Meprobamate | 2.61 | 219.0 | 158.4 | 97.2 |
| 11. | Fentanyl | 2.70 | 337.2 | 188.4 | 105.2 |
| 12. | Buprenorphine | 2.70 | 468.3 | 396.4 | 414.5 |
| 13. | Flurazepam | 2.73 | 388.2 | 315.2 | 288.3 |
| 14. | Sufentanil | 2.77 | 387.2 | 238.5 | 111.3 |
| 15. | Methadone | 2.86 | 310.2 | 265.3 | 105.3 |
| 16. | Carisoprodol | 2.87 | 261.2 | 176.3 | 158.1 |
| 17. | Lorazepam | 3.03 | 321.0 | 275.4 | 303.1 |
| 18. | Diazepam | 3.31 | 285.1 | 193.2 | 153.9 |

*An extracted ion chromatogram (XIC) of the isobars is presented in the inset.

**Column:** Raptor Biphenyl (cat.# 9309A5E); Dimensions: 50 mm x 3.0 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 30 °C; **Sample:** Diluent: urine:mobile phase A:mobile phase B (17:76:7); Conc.: 10-100 ng/mL; Inj. Vol.: 10 µL **Mobile Phase:** A: 0.1% formic acid in water, B: 0.1% formic acid in methanol; **Gradient (%B):** 0.00 min (10%), 1.50 min (45%), 2.50 min (100%), 3.70 min (100%), 3.71 min (10%) 5.00 min (10%); **Flow:** 0.6 mL/min; **Detector:** AB SCIEX API 4000 MS/MS; Ion Source: TurboIonSpray; Ion Mode: ESI+; **Instrument:** API LC-MS/MS; **Notes:** Lorazepam was prepared at 100 ng/mL; all other analytes are 10 ng/mL.




**Column:** Competitor B SPP C18; Dimensions: 50 mm x 4.6 mm ID; Particle Size: 2.6 µm; Pore Size: 100 Å; Temp.: 22 °C; **Sample:** Diluent: urine:mobile phase A:mobile phase B (17:76:7); Conc.: 10-100 ng/mL; Inj. Vol.: 10 µL **Mobile Phase:** A: 10 mM ammonium formate in water, B: 0.1% formic acid in methanol; **Gradient (%B):** 0.00 min (5%), 4.00 min (100%), 5.00 min (100%), 5.10 min (5%), 7.00 min (5%); **Flow:** 0.6 mL/min; **Detector:** AB SCIEX API 4000 MS/MS; Ion Source: TurboIonSpray; Ion Mode: ESI+; **Instrument:** API LC-MS/MS; **Notes:** Lorazepam was prepared at 100 ng/mL; all other analytes are 10 ng/mL. **Note:** Column and conditions used were specifically recommended or published by the manufacturer for this assay.




**Column:** Competitor B SPP C18; Dimensions: 50 mm x 3.0 mm ID; Particle Size: 2.6 µm; Pore Size: 100 Å; Temp.: 25 °C; **Sample:** Diluent: urine:mobile phase A:mobile phase B (17:76:7); Conc.: 10-100 ng/mL; Inj. Vol.: 10 µL **Mobile Phase:** A: 10 mM ammonium formate in water, B: 0.1% formic acid in methanol; **Gradient (%B):** 0.00 min (5%), 3.00 min (100%), 4.00 min (100%), 4.10 min (5%), 5.00 min (5%); **Flow:** 0.5 mL/min; **Detector:** AB SCIEX API 4000 MS/MS; Ion Source: TurboIonSpray; Ion Mode: ESI+; **Instrument:** API LC-MS/MS; **Notes:** Lorazepam was prepared at 100 ng/mL; all other analytes are 10 ng/mL. **Note:** Column and conditions used were specifically recommended or published by the manufacturer for this assay.

# Accelerated Performance and Time-Tested Biphenyl Selectivity for Clinical Diagnostic, Pain, Pharma, and Environmental Labs

## Raptor Biphenyl LC Columns (USP L11)

| ID | Length | qty. | cat.# |
|---|---|---|---|
| **1.8 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9309232 |
| | 50 mm | ea. | 9309252 |
| | 100 mm | ea. | 9309212 |
| | 150 mm | ea. | 9309262 |
| 3.0 mm | 50 mm | ea. | 930925E |
| | 100 mm | ea. | 930921E |
| **2.7 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9309A32 |
| | 50 mm | ea. | 9309A52 |
| | 100 mm | ea. | 9309A12 |
| | 150 mm | ea. | 9309A62 |
| 3.0 mm | 30 mm | ea. | 9309A3E |
| | 50 mm | ea. | 9309A5E |
| | 100 mm | ea. | 9309A1E |
| | 150 mm | ea. | 9309A6E |
| 4.6 mm | 30 mm | ea. | 9309A35 |
| | 50 mm | ea. | 9309A55 |
| | 100 mm | ea. | 9309A15 |
| | 150 mm | ea. | 9309A65 |
| **5 µm Particles** | | | |
| 2.1 mm | 50 mm | ea. | 9309552 |
| | 100 mm | ea. | 9309512 |
| | 150 mm | ea. | 9309562 |
| 3.0 mm | 30 mm | ea. | 930953E |
| | 50 mm | ea. | 930955E |
| | 100 mm | ea. | 930951E |
| | 150 mm | ea. | 930956E |
| 4.6 mm | 50 mm | ea. | 9309555 |
| | 100 mm | ea. | 9309515 |
| | 150 mm | ea. | 9309565 |
| | 250 mm | ea. | 9309575 |

## EXP Reusable Fittings for HPLC & UHPLC

for 10-32 fittings and 1/16" tubing

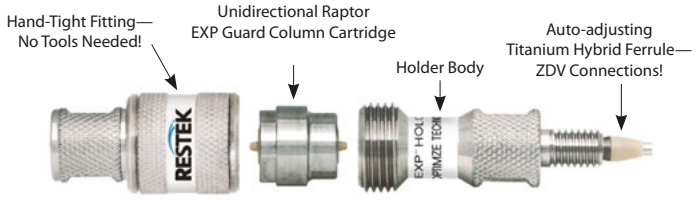
Effortlessly achieve 8700+ psi HPLC seals by hand! (Wrench tighten to 20,000+ psi.) Hybrid titanium/PEEK seal can be installed repeatedly without compromising your seal.

| Description | qty. | cat.# |
|---|---|---|
| EXP Hand-Tight Fitting (nut w/ferrule) | ea. | 25937 |
| | 10-pk. | 25938 |

Intellectual Property: optimizetech.com/patents

Experience *Selectivity Accelerated.*
Order the Raptor Biphenyl today at
**www.bgb-shop.com/raptor**

## Raptor EXP Guard Cartridges—for All Raptor Columns




Protect your investment, extend the life of our already-rugged LC columns, and change guard column cartridges by hand without breaking fluid connections—no tools needed! Great with any Raptor column to get ultimate protection from particulates and matrix contamination, especially when using dilute-and-shoot or other minimal sample preparation techniques.

### EXP Direct Connect Holder

| Description | qty. | cat.# |
|---|---|---|
| EXP Direct Connect Holder for EXP Guard Cartridges (includes hex-head fitting & 2 ferrules) | ea. | 25808 |

Maximum holder pressure: 20,000 psi (1400 bar)

### EXP In-Line Holder

| Description | qty. | cat.# |
|---|---|---|
| EXP In-Line Holder for EXP Guard Cartridges (includes hex-head fittings & 2 ferrules) | ea. | 25751 |

Intellectual Property: optimizetech.com/patents

### Raptor Biphenyl EXP Guard Column Cartridges

| Particle Size | Size | qty. | cat.# |
|---|---|---|---|
| UHPLC | 5 x 2.1 mm | 3-pk. | 9309U0252 |
| UHPLC | 5 x 3.0 mm | 3-pk. | 9309U0253 |
| 2.7 µm | 5 x 2.1 mm | 3-pk. | 9309A0252 |
| 2.7 µm | 5 x 3.0 mm | 3-pk. | 9309A0253 |
| 2.7 µm | 5 x 4.6 mm | 3-pk. | 9309A0250 |
| 5 µm | 5 x 2.1 mm | 3-pk. | 930950252 |
| 5 µm | 5 x 3.0 mm | 3-pk. | 930950253 |
| 5 µm | 5 x 4.6 mm | 3-pk. | 930950250 |

Maximum cartridge pressure: 1034 bar/15,000 psi* (UHPLC), 600 bar/8700 psi (2.7 µm); 400 bar/5800 psi (5 µm)
* For maximum lifetime, recommended maximum pressure for UHPLC particles is 830 bar/12,000 psi.

## UltraShield UHPLC PreColumn Filter—for 1.8 µm Raptor Columns

Pair 1.8 µm Raptor columns with an UltraShield filter instead of a guard cartridge to protect against particulates, minimize extra column volume, and maximize UHPLC sample throughput when using SPE, SLE, or other extensive sample preparations.

| Porosity | qty. | cat.# |
|---|---|---|
| 0.5 µm frit | ea. | 24995 |
| 0.5 µm frit | 5-pk. | 24996 |
| 0.5 µm frit | 10-pk. | 24997 |
| 0.2 µm frit | ea. | 25809 |
| 0.2 µm frit | 5-pk. | 25810 |
| 0.2 µm frit | 10-pk. | 25811 |


24995

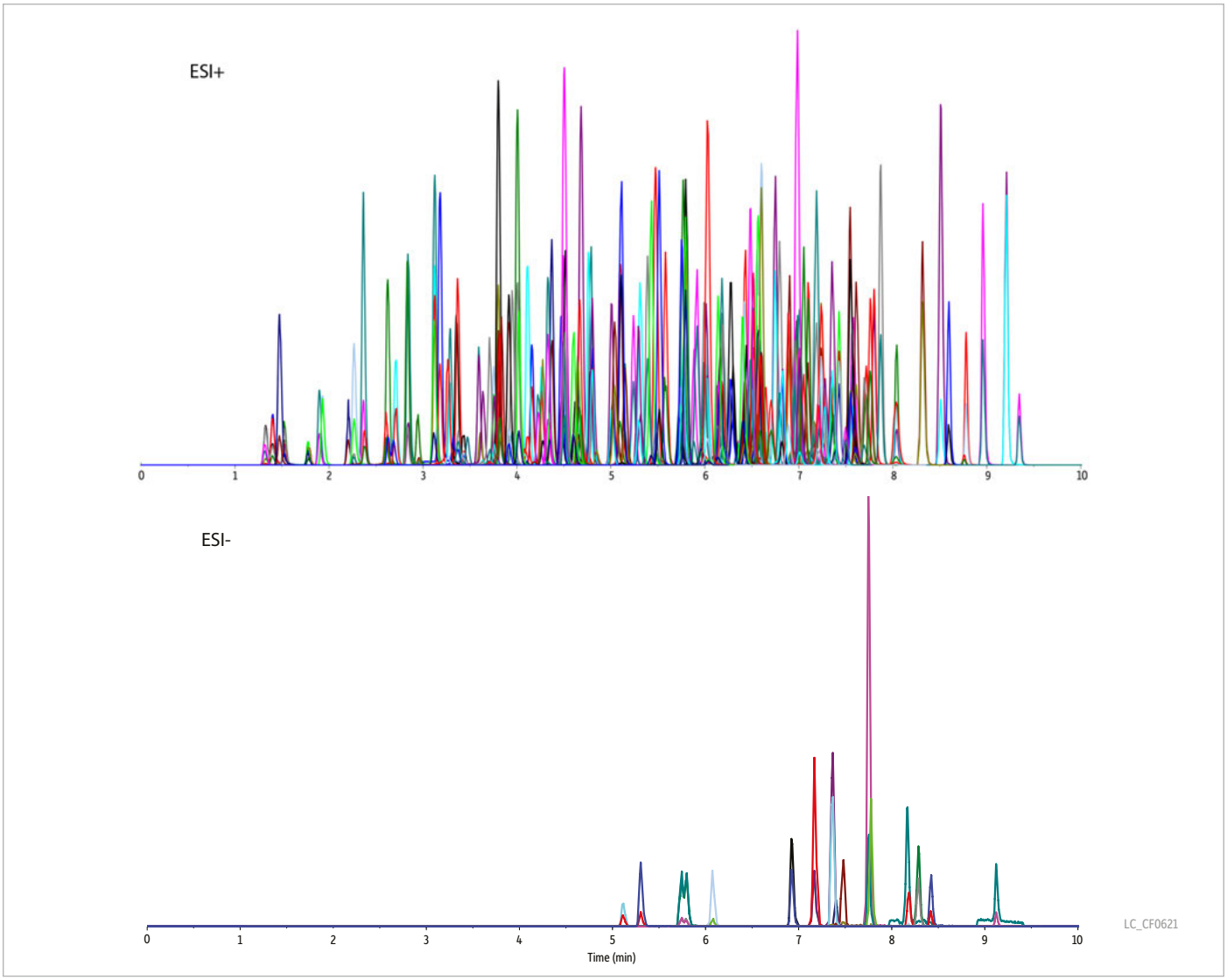
# Big Pain Assays Aren't a Big Pain with the Raptor Biphenyl LC Column

- 231 compounds, 40+ isobars, 10 drug classes, 22 ESI- compounds in 10 minutes with 1 column.
- A Raptor SPP LC column with time-tested Restek Biphenyl selectivity is the most versatile, multiclass-capable LC column available.
- Achieve excellent separation of critical isobars with no tailing peaks.
- Run fast and reliable high-throughput LC-MS/MS analyses with increased sensitivity using simple mobile phases.

The use of pain management drugs is steadily increasing. As a result, hospital and reference labs are seeing an increase in patient samples that must be screened for a wide variety of pain management drugs to prevent drug abuse and to ensure patient safety and adherence to their medication regimen. Therapeutic drug monitoring can be challenging due to the low cutoff levels, potential matrix interferences, and isobaric drug compounds. To address these challenges, many drug testing facilities are turning to liquid chromatography coupled with mass spectrometry (LC-MS/MS) for its increased speed, sensitivity, and specificity.

As shown in the analysis below, Restek's Raptor Biphenyl column is ideal for developing successful LC-MS/MS pain medication screening methodologies. With its exceptionally high retention and unique selectivity, 231 multiclass drug compounds and metabolites—including over 40 isobars—can be analyzed in just 10 minutes. In addition, separate panels have been optimized on the Raptor Biphenyl column specifically for opioids, antianxiety drugs, barbiturates, NSAIDs and analgesics, antidepressants, antiepileptics, antipsychotics, hallucinogens, and stimulants for use during confirmation and quantitative analyses.

For more information, compound list, and conditions, visit **www.restek.com/bigpain**



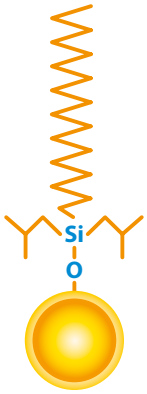
# The Raptor ARC-18 Column—Ahead of the Curve for Large, Multiclass Lists by Mass Spec

With Raptor LC columns, Restek chemists became the first to combine the speed of 2.7 and 5 µm superficially porous particles (also known as SPP or "core-shell" particles) with the resolution of highly selective USLC technology, improving separations and speeding up analysis times with standard HPLC instruments. Raptor then evolved to bring that same improved speed, efficiency, and selectivity to UHPLC analyses by offering 1.8 µm particle columns. Learn more about Raptor LC columns at **www.bgb-shop.com/raptor**

The birth of Restek's Raptor SPP LC column line began with the innovative Biphenyl phase, but it quickly grew to include a new Restek phase: the ARC-18. Designed and intended specifically for use on LC-MS/MS systems, the Raptor ARC-18 column features a well-balanced retention profile without the drawbacks of using an ordinary C18 in the harsh, acidic mobile phases needed for mass spectrometry (MS). Even after extended use in these low-pH (≤ 2.0) conditions, the sterically protected ARC-18 offers consistent retention, peak shape, and response for charged bases, neutral acids, small polar compounds, and more.

For the rapid analysis of large, multiclass assays by LC-MS/MS, the acid-resistant Raptor ARC-18 truly is *ahead of the curve.*

## Column Description:




**Stationary Phase Category:**
C18, octadecylsilane (L1)

**Ligand Type:**
Sterically protected C18

**Particle:**
1.8 µm, 2.7 µm, or 5 µm superficially porous particle (SPP or "core-shell" particle) silica

**Pore Size:**
90 Å

**Surface Area:**
125 $m^2/g$ (1.8 µm),
130 $m^2/g$ (2.7 µm),
or 100 $m^2/g$ (5 µm

**Recommended Usage:**
pH Range: 1.0–8.0

Maximum Temperature: 80 °C

Maximum Pressure: 1034 bar/15,000 psi* (1.8 µm), 600 bar/8700 psi (2.7 µm); 400 bar/5800 psi (5 µm)

** For maximum lifetime, recommended maximum pressure for 1.8 µm particles is 830 bar/12,000 psi.*

**Properties:**
- Well-balanced retention profile.
- Sterically protected to resist harsh, low-pH mobile phases.
- Ideal for use with sensitive detectors like mass spec.

**Switch to an ARC-18 when:**
- You are analyzing large, multiclass lists by LC-MS/MS.
- You require strongly acidic (pH 1–3) mobile phases.

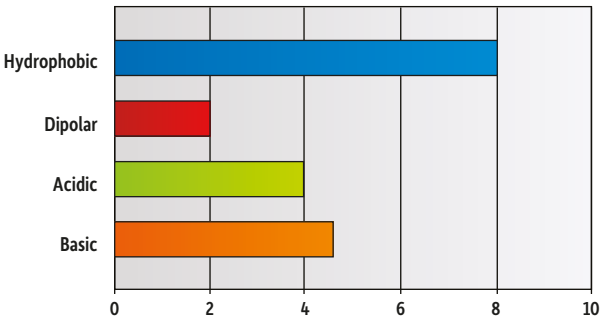
## Column Interaction Profile:



**Defining Solute Interaction:**
- Dispersion

**Complementary Solute Interactions:**
- Hydrogen bonding
- Cation exchange

## Solute Retention Profile:



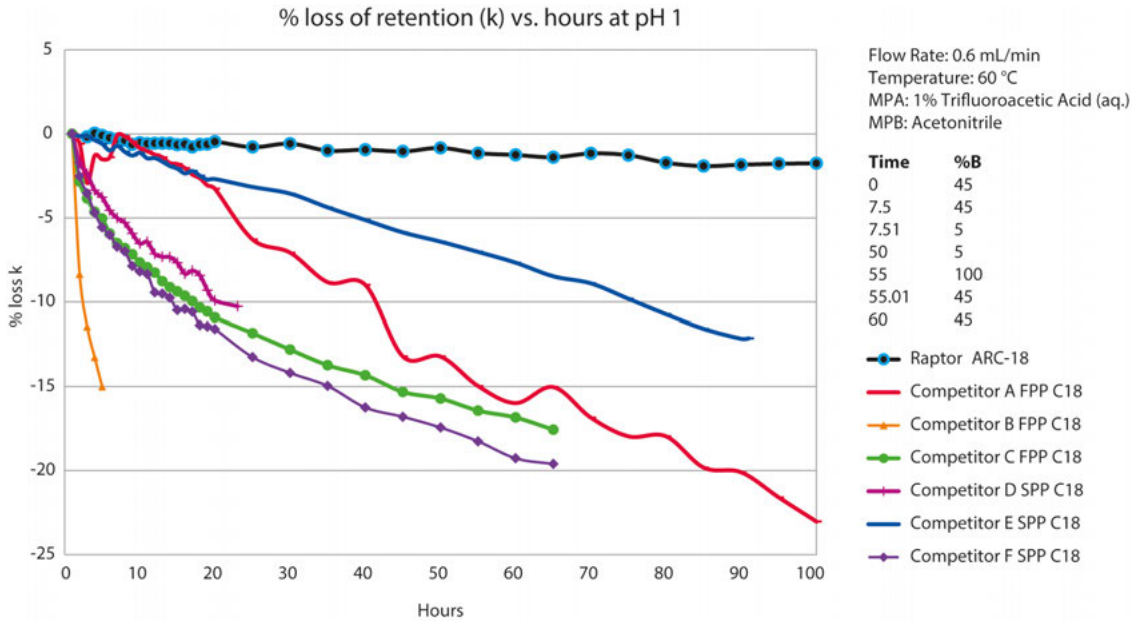

**Target Analyte Structure:**
- Hydrocarbons

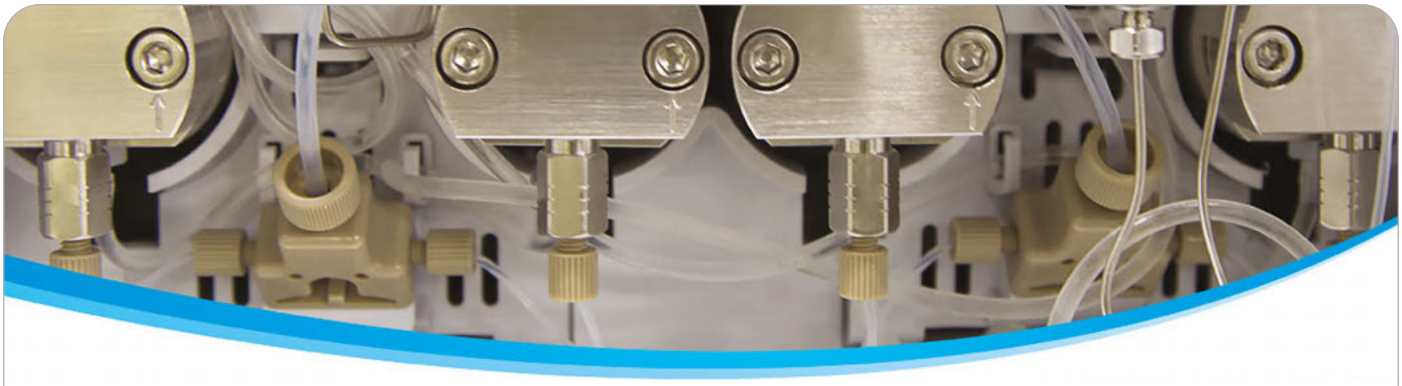
**Target Analyte Functionalities:**
- Hydrophobic compounds
- Protonated bases

## A Proprietary Bonded Phase Born for LC-MS/MS

The Raptor ARC-18 column was designed to stand up to even the harshest acidic MS conditions. It utilizes a proprietary bonding procedure that arranges our sterically protected ligand to resist acid hydrolysis, which reduces phase degradation and bleed. This cutting-edge column lets you increase ionization efficiency and boost sensitivity in your mass spec by using low-pH mobile phases—without the fear of retention drift over time. ARC-18 columns maintain a stable retention profile (Figure 6) in mobile phases well under pH 2.0.

**Figure 6:** Steric protection helps the Raptor ARC-18 column endure low-pH MS mobile phases without sacrificing retention.



## Keep Your LC Work Flowing with Restek Maintenance Supplies

Restek is a 100% employee-owned company and the last major independent provider of chromatography supplies in the industry. We proudly work with every analyst to keep any make or model of LC up and running its best, and our line of 100% guaranteed LC instrument replacement parts meets and often exceeds the original instrument manufacturer's performance. For seals, valves, lamps, and many more OEM-equivalent supplies, simply find your LC manufacturer below to get started.

**Agilent LCs:** See page 58.
**Shimadzu LCs:** See page 62.
**Waters ACQUITY LCs:** See page 65.
**Waters Alliance LCs:** See page 68.

For other instruments, visit **www.bgb-shop.com/restek-lc-accessories**

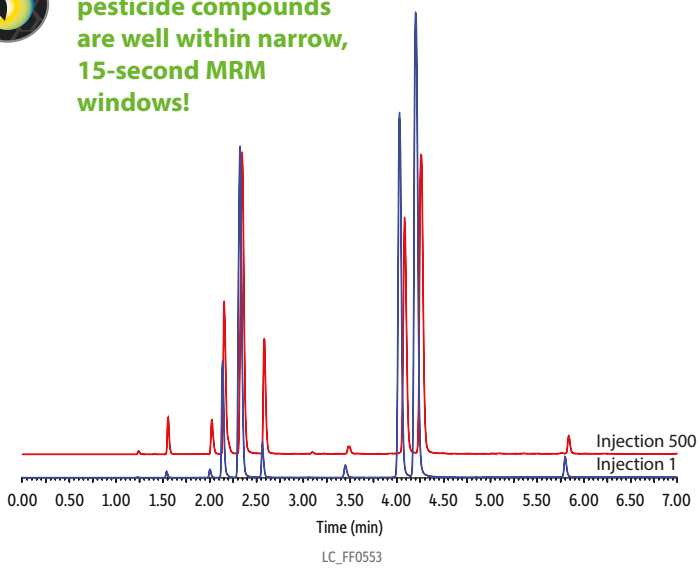
## The Standard for Reproducibility for SPP Core-Shell Columns

To keep your productivity high and your lab expenses low, Raptor ARC-18 columns must produce exceptional selectivity and fast analysis times not just once, but every time. Ruggedness and repeatability are essential, which is why, from the silica and the bonding technique to the packing process and upgraded hardware, every decision that went into creating this column was made to ensure superlative reproducibility, from injection to injection (Figure 7) and from lot to lot (Figure 8). We also adopted new quality control (QC) specifications to guarantee the retention time stability you need for worry-free analyses.

One of the greatest advantages of an SPP column is the ability to operate at higher linear velocities without losing efficiency as you would with a conventional fully porous particle column. But, these higher velocities can also generate higher backpressures that rob you of performance. Like all Raptor columns, our ARC-18 can handle increased pressures and handle them longer than other manufacturers' SPP columns, to help you achieve *Selectivity Accelerated* while offering outstanding reproducibility and maintaining efficiency—even in aggressive MS conditions.

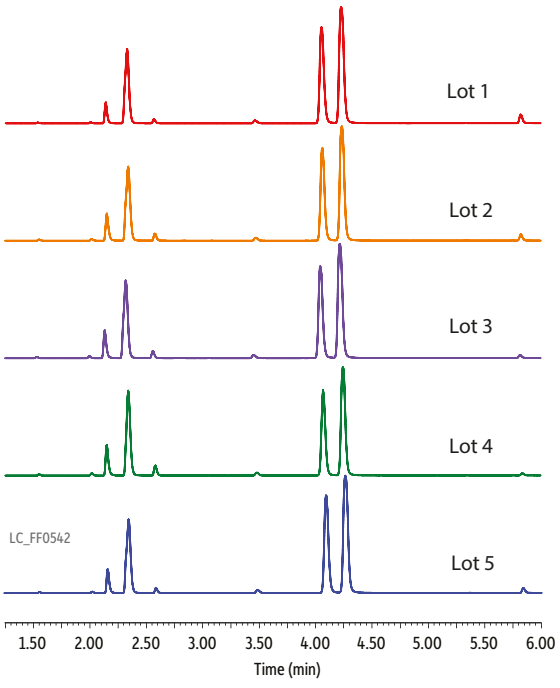
**Figure 7:** Even after hundreds of injections with a highly acidic mobile phase like 0.2% formic acid, a Raptor ARC-18 column will provide consistent, reliable data.

**After 500 injections, pesticide compounds are well within narrow, 15-second MRM windows!**




**Column:** Raptor ARC-18 (cat.# 9314A12); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 2.7 µm; Temp.: 50 °C; **Sample:** LC multiresidue pesticide standard #1 (cat.# 31972); Diluent: Water; Conc.: 20 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: Water + 2 mM ammonium formate + 0.2% formic acid, B: Methanol + 2 mM ammonium formate + 0.2% formic acid; **Gradient (%B):** 0.00 min (5%), 2.00 min (60%), 4.00 min (75%), 6.00 min (100%), 7.00 (100%), 7.01 min (5%), 9.50 (5%); **Flow:** 0.4 mL/min; **Detector:** Waters Xevo TQ-S; Ion Source: Waters Zspray ESI; Ion Mode: ESI+; Mode: MRM; **Instrument:** Waters ACQUITY UPLC I-Class.

**Figure 8:** From one lot to the next, every Raptor ARC-18 column you purchase will perform the same.




**Excellent lot-to-lot reproducibility helps ensure longevity for critical workflows.**

**Column:** Raptor ARC-18 (cat.# 9314A12); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 2.7 µm; Temp.: 50 °C; **Sample:** LC multiresidue pesticide standard #1 (cat.# 31972); Diluent: Water; Conc.: 20 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: Water + 2 mM ammonium formate + 0.2% formic acid, B: Methanol + 2 mM ammonium formate + 0.2% formic acid; Max Pressure: 525 bar; **Gradient (%B):** 0.00 min (5%), 2.00 min (60%), 4.00 min (75%), 6.00 min (100%), 7.00 (100%), 7.01 min (5%), 9.50 (5%); **Flow:** 0.4 mL/min; **Detector:** Waters Xevo TQ-S; Ion Source: Waters Zspray ESI; Ion Mode: ESI+; Mode: MRM; **Instrument:** Waters ACQUITY UPLC I-Class.

# Speed Up Challenging Analyses with Simple Mobile Phases and Methods

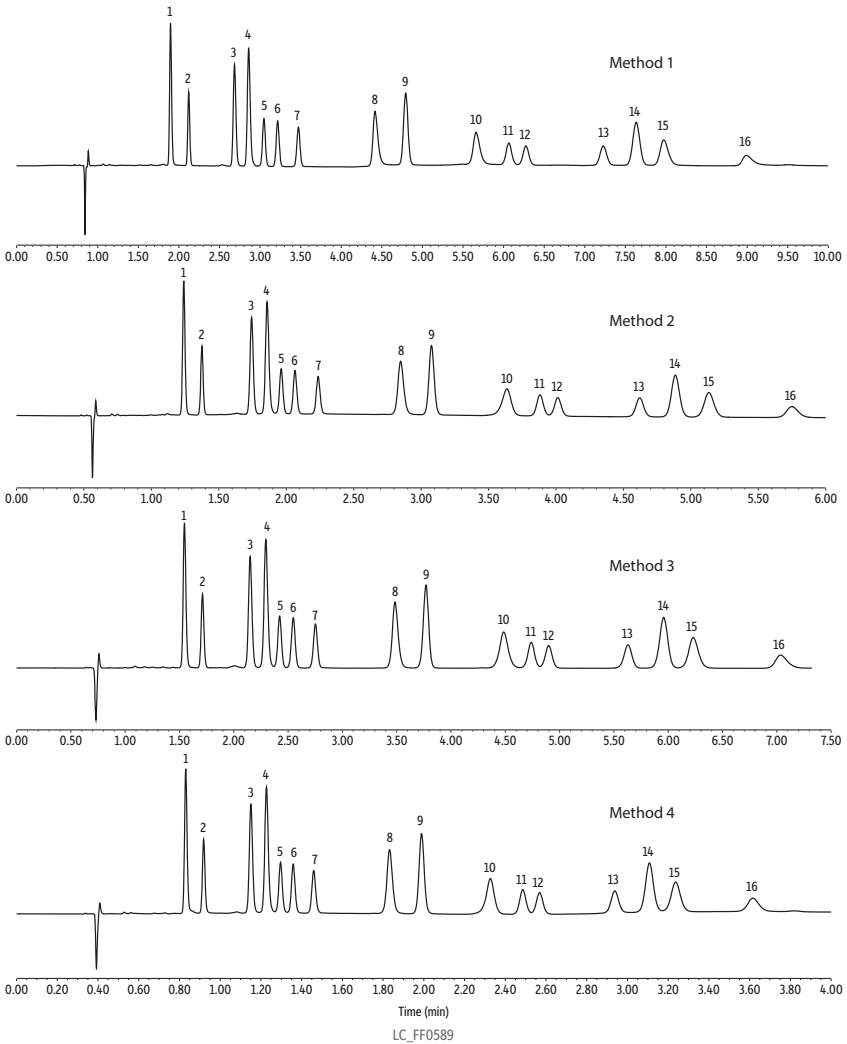
From food safety to bioanalytical work, whether you use traditional HPLC or UHPLC instruments, we're all looking to simplify setup while still getting reliable, reproducible data. Instead of wasting time and resources—and making your job harder in the process—you can greatly improve your productivity by selecting a better column for your existing instrumentation. By switching to a Raptor ARC-18 column for your LC-MS/MS analyses, you can increase your sample throughput and make your job easier by maintaining, or even improving, your data quality using simple mobile phases and method conditions on your existing instrumentation. Put the ARC-18 to work in your lab today to experience *Selectivity Accelerated!*

## Cannabinoids Analysis Across Methods and Instruments

Whether your lab is performing cost-effective, low-solvent analyses or fast UHPLC for high-throughput, use Raptor ARC-18 columns to fully resolve 16 common cannabinoids across cannabis methods (Figure 9). Because of its compatibility with MS-friendly mobile phases, these UV methods can also be easily transferred to your mass spectrometer. And, since ARC-18 is a Raptor column, it will hold up to extended use without losing selectivity or performance.

**Figure 9:** All four potency methods produce excellent results—demonstrating ARC-18's versatility.

| | Method 1 | Method 2 | Method 3 | Method 4 |
|---|---|---|---|---|
| **Column dimensions** | 150 x 4.6 mm, 2.7 µm | 150 x 3 mm, 2.7 µm | 150 x 2.1 mm, 2.7 µm | 100 x 3 mm, 1.8 µm |
| **Flow** | 1.5 mL/min | 1 mL/min | 0.4 mL/min | 1 mL/min |
| **Injection volume** | 5 µL | 2 µL | 2 µL | 1 µL |
| **Run time*** | 9 min | 6 min | 10 min | 4 min |
| **Use/benefits** | Standard HPLC | Fast HPLC | Solvent saver | Fast UHPLC |




| Peaks | $t_R$ (min) | Conc. (µg/mL) |
|---|---|---|
| 1. Cannabidivarinic acid (CBDVA) | 1.897 | 50 |
| 2. Cannabidivarin (CBDV) | 2.121 | 50 |
| 3. Cannabidiolic acid (CBDA) | 2.685 | 50 |
| 4. Cannabigerolic acid (CBGA) | 2.860 | 50 |
| 5. Cannabigerol (CBG) | 3.047 | 50 |
| 6. Cannabidiol (CBD) | 3.217 | 50 |
| 7. Tetrahydrocannabivarin (THCV) | 3.472 | 50 |
| 8. Tetrahydrocannabivarinic acid (THCVA) | 4.416 | 50 |
| 9. Cannabinol (CBN) | 4.794 | 50 |
| 10. Cannabinolic acid (CBNA) | 5.661 | 50 |
| 11. Δ9-Tetrahydrocannabinol (Δ9-THC) | 6.064 | 50 |
| 12. Δ8-Tetrahydrocannabinol (Δ8-THC) | 6.275 | 50 |
| 13. Cannabicyclol (CBL) | 7.228 | 50 |
| 14. Cannabichromene (CBC) | 7.634 | 50 |
| 15. Tetrahydrocannabinolic acid A (THCA-A) | 7.973 | 50 |
| 16. Cannabichromenic acid (CBCA) | 8.992 | 50 |

Retention times are for top chromatogram (Method 1).

| | |
|---|---|
| **Column** | |
| Temp.: | 30 °C |
| **Sample** | |
| Diluent: | 25:75 Water:acetonitrile |
| **Mobile Phase** | Water, 5 mM ammonium formate, 0.1% formic acid:Acetonitrile, 0.1% formic acid (25:75) |
| Flow: | 0.4-1.5 mL/min |
| **Detector** | UV/Vis @ 228 nm |
| **Instrument** | HPLC |

**Run times shown are for optimized conditions. When extra-column volume is increased, as in the experiments described here, run times may be extended to elute all compounds.*

# For Consistent Retention, Peak Shape, and Response with Mass Spec, Grab the Column that Thrives in Low pH Conditions

## Raptor ARC-18 LC Columns

| ID | Length | qty. | cat.# |
|---|---|---|---|
| **1.8 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9314232 |
| | 50 mm | ea. | 9314252 |
| | 100 mm | ea. | 9314212 |
| | 150 mm | ea. | 9314262 |
| 3.0 mm | 50 mm | ea. | 931425E |
| | 100 mm | ea. | 931421E |
| **2.7 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9314A32 |
| | 50 mm | ea. | 9314A52 |
| | 100 mm | ea. | 9314A12 |
| | 150 mm | ea. | 9314A62 |
| 3.0 mm | 30 mm | ea. | 9314A3E |
| | 50 mm | ea. | 9314A5E |
| | 100 mm | ea. | 9314A1E |
| | 150 mm | ea. | 9314A6E |
| 4.6 mm | 30 mm | ea. | 9314A35 |
| | 50 mm | ea. | 9314A55 |
| | 100 mm | ea. | 9314A15 |
| | 150 mm | ea. | 9314A65 |
| **5 µm Particles** | | | |
| 2.1 mm | 50 mm | ea. | 9314552 |
| | 100 mm | ea. | 9314512 |
| | 150 mm | ea. | 9314562 |
| 3.0 mm | 30 mm | ea. | 931453E |
| | 50 mm | ea. | 931455E |
| | 100 mm | ea. | 931451E |
| | 150 mm | ea. | 931456E |
| 4.6 mm | 50 mm | ea. | 9314555 |
| | 100 mm | ea. | 9314515 |
| | 150 mm | ea. | 9314565 |
| | 250 mm | ea. | 9314575 |

## EXP Reusable Fittings for HPLC & UHPLC

for 10-32 fittings and 1/16" tubing

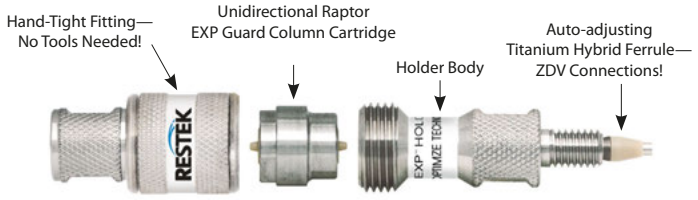
Effortlessly achieve 8700+ psi HPLC seals by hand! (Wrench tighten to 20,000+ psi.) Hybrid titanium/PEEK seal can be installed repeatedly without compromising your seal.

| Description | qty. | cat.# |
|---|---|---|
| EXP Hand-Tight Fitting (nut w/ferrule) | ea. | 25937 |
| | 10-pk. | 25938 |

Intellectual Property: optimizetech.com/patents

Experience *Selectivity Accelerated.*
Order the Raptor ARC-18 today at
**www.bgb-shop.com/raptor**

## Raptor EXP Guard Cartridges—for All Raptor Columns




Protect your investment, extend the life of our already-rugged LC columns, and change guard column cartridges by hand without breaking fluid connections—no tools needed! Great with any Raptor column to get ultimate protection from particulates and matrix contamination, especially when using dilute-and-shoot or other minimal sample preparation techniques.

### EXP Direct Connect Holder

| Description | qty. | cat.# |
|---|---|---|
| EXP Direct Connect Holder for EXP Guard Cartridges (includes hex-head fitting & 2 ferrules) | ea. | 25808 |

Maximum holder pressure: 20,000 psi (1400 bar)

### EXP In-Line Holder

| Description | qty. | cat.# |
|---|---|---|
| EXP In-Line Holder for EXP Guard Cartridges (includes hex-head fittings & 2 ferrules) | ea. | 25751 |

Intellectual Property: optimizetech.com/patents

### Raptor ARC-18 EXP Guard Column Cartridges

| Particle Size | Size | qty. | cat.# |
|---|---|---|---|
| UHPLC | 5 x 2.1 mm | 3-pk. | 9314U0252 |
| UHPLC | 5 x 3.0 mm | 3-pk. | 9314U0253 |
| 2.7 µm | 5 x 2.1 mm | 3-pk. | 9314A0252 |
| 2.7 µm | 5 x 3.0 mm | 3-pk. | 9314A0253 |
| 2.7 µm | 5 x 4.6 mm | 3-pk. | 9314A0250 |
| 5 µm | 5 x 2.1 mm | 3-pk. | 931450252 |
| 5 µm | 5 x 3.0 mm | 3-pk. | 931450253 |
| 5 µm | 5 x 4.6 mm | 3-pk. | 931450250 |

Maximum cartridge pressure: 1034 bar/15,000 psi* (UHPLC), 600 bar/8700 psi (2.7 µm); 400 bar/5800 psi (5 µm)
* For maximum lifetime, recommended maximum pressure for UHPLC particles is 830 bar/12,000 psi.

## UltraShield UHPLC PreColumn Filter—for 1.8 µm Raptor Columns

Pair 1.8 µm Raptor columns with an UltraShield filter instead of a guard cartridge to protect against particulates, minimize extra column volume, and maximize UHPLC sample throughput when using SPE, SLE, or other extensive sample preparations.

| Porosity | qty. | cat.# |
|---|---|---|
| 0.5 µm frit | ea. | 24995 |
| 0.5 µm frit | 5-pk. | 24996 |
| 0.5 µm frit | 10-pk. | 24997 |
| 0.2 µm frit | ea. | 25809 |
| 0.2 µm frit | 5-pk. | 25810 |
| 0.2 µm frit | 10-pk. | 25811 |


24995

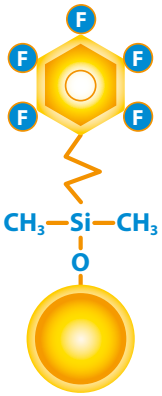
# The Raptor FluoroPhenyl Column—Get the Power of HILIC and RP Modes in One LC Column

With Raptor LC columns, Restek chemists became the first to combine the speed of 2.7 and 5 µm superficially porous particles (also known as SPP or "core-shell" particles) with the resolution of highly selective USLC technology, improving separations and speeding up analysis times with standard HPLC instruments. Raptor then evolved to bring that same improved speed, efficiency, and selectivity to UHPLC analyses by offering 1.8 µm particle columns. Learn more about Raptor LC columns at **www.bgb-shop.com/raptor**

With the addition of Raptor FluoroPhenyl columns, Restek further expanded the speed and reliability of Raptor column technology into the HILIC realm. Restek's Raptor FluoroPhenyl phase offers chromatographers the ability to run in reversed-phase or HILIC mode for a variety of compounds. The Restek Raptor FluoroPhenyl column is also amenable to LC-MS because it is extremely reliable and efficient with acidic mobile phases.

Switch to a Raptor FluoroPhenyl LC column for reliable performance in both reversed-phase and HILIC modes.

## Column Description:




**Stationary Phase Category:**
Pentafluorophenyl propyl (L43)

**Ligand Type:**
Fluorophenyl

**Particle:**
1.8 µm, 2.7 µm, or 5 µm superficially porous particle (SPP or "core-shell" particle) silica

**Pore Size:**
90 Å

**Surface Area:**
125 $m^2/g$ (1.8 µm),
130 $m^2/g$ (2.7 µm),
or 100 $m^2/g$ (5 µm

**Recommended Usage:**
pH Range: 2.0–8.0

Maximum Temperature: 80 °C

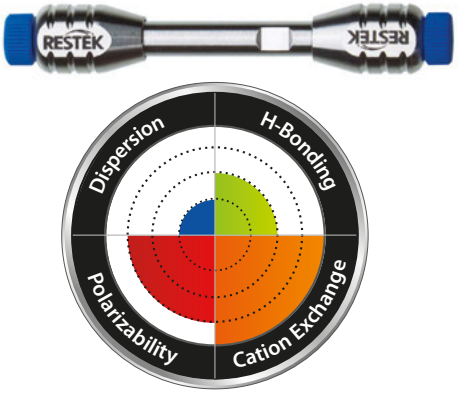
Maximum Pressure: 1034 bar/15,000 psi* (1.8 µm),
600 bar/8700 psi (2.7 µm); 400 bar/5800 psi (5 µm)

** For maximum lifetime, recommended maximum pressure for 1.8 µm particles is 830 bar/12,000 psi.*

**Properties:**
- Capable of both reversed-phase and HILIC separations.
- Ideal for increasing sensitivity and selectivity in LC-MS analyses.
- Offers increased retention for charged bases.

**Switch to a Raptor FluoroPhenyl LC column when:**
- You observe limited retention and selectivity on a C18 for basic compounds.
- You need increased retention of hydrophilic compounds.

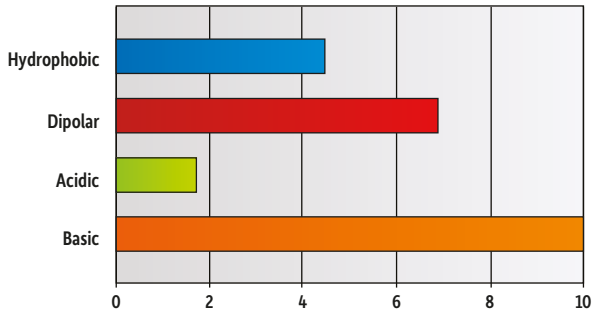
## Column Interaction Profile:




**Defining Solute Interaction:**
- Cation exchange

**Complementary Solute Interactions:**
- Polarizability
- Dispersion

## Solute Retention Profile:




**Target Analyte Structures:**
- Nitrogen-containing

**Target Analyte Functionalities:**
- Protonated amines
- Quaternary ammonium compounds
- Positively charged moieties
- Lewis bases

## Raptor FluoroPhenyl Columns: Rugged, Check—Reproducible, Double Check.

Of course, Raptor FluoroPhenyl columns are rugged; that is to be expected. And, they are exceptionally reproducible as well. Reproducibility can be an issue for fluorinated phenyl phases, which is why we engineered all our columns for dependable performance. Lot to lot, column to column, and injection to injection, every Raptor FluoroPhenyl column gives a consistent performance that you can count on: consider it done.

**Figure 10:** Raptor FluoroPhenyl columns maintain efficiency in any dimension or particle size—even at their maximum recommended operating pressures—so you can run at high linear velocities with confidence.

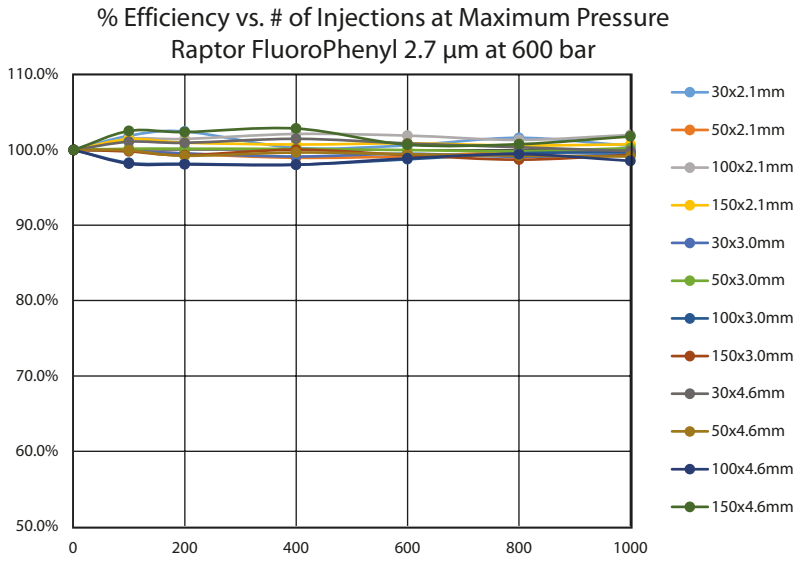
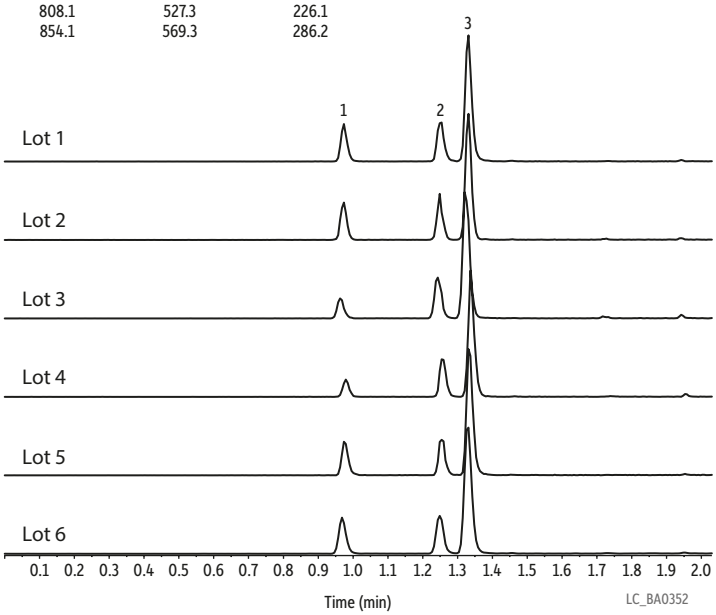



**Figure 11:** Strict quality control ensures Raptor FluoroPhenyl columns are exceptionally reproducible, so you get predictable performance from every column.

**Reliable, reproducible fluorophenyl column performance.**

| Peaks | $t_R$ (min) | Precursor Ion | Product Ion 1 | Product Ion 2 |
|---|---|---|---|---|
| 1. Baccatin III | 0.97 | 587.0 | 405.1 | 105.0 |
| 2. Docetaxel | 1.25 | 808.1 | 527.3 | 226.1 |
| 3. Paclitaxel | 1.33 | 854.1 | 569.3 | 286.2 |

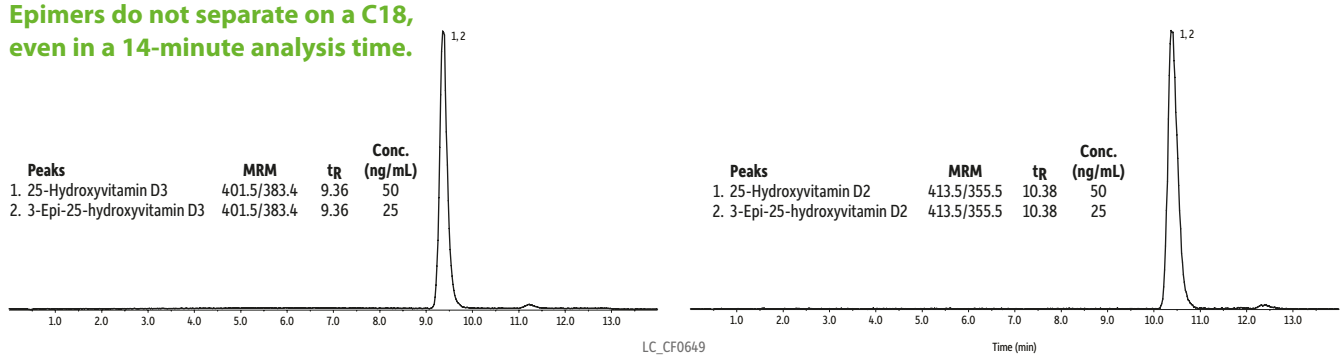



**Column:** Raptor FluoroPhenyl (cat.# 931955E); Dimensions: 50 mm x 3 mm ID, Particle Size: 5 µm; Temp.: 35 °C; **Sample:** Diluent: Water; Conc.: 100 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: 0.1% Formic acid in acetonitrile; **Gradient (%B):** 0.00 min (25% B), 2.00 (95% B), 2.01 (25% B), 3.50 (25% B); **Flow: 0.8 mL/min; Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument**: UHPLC.

## More Separating Power than a C18

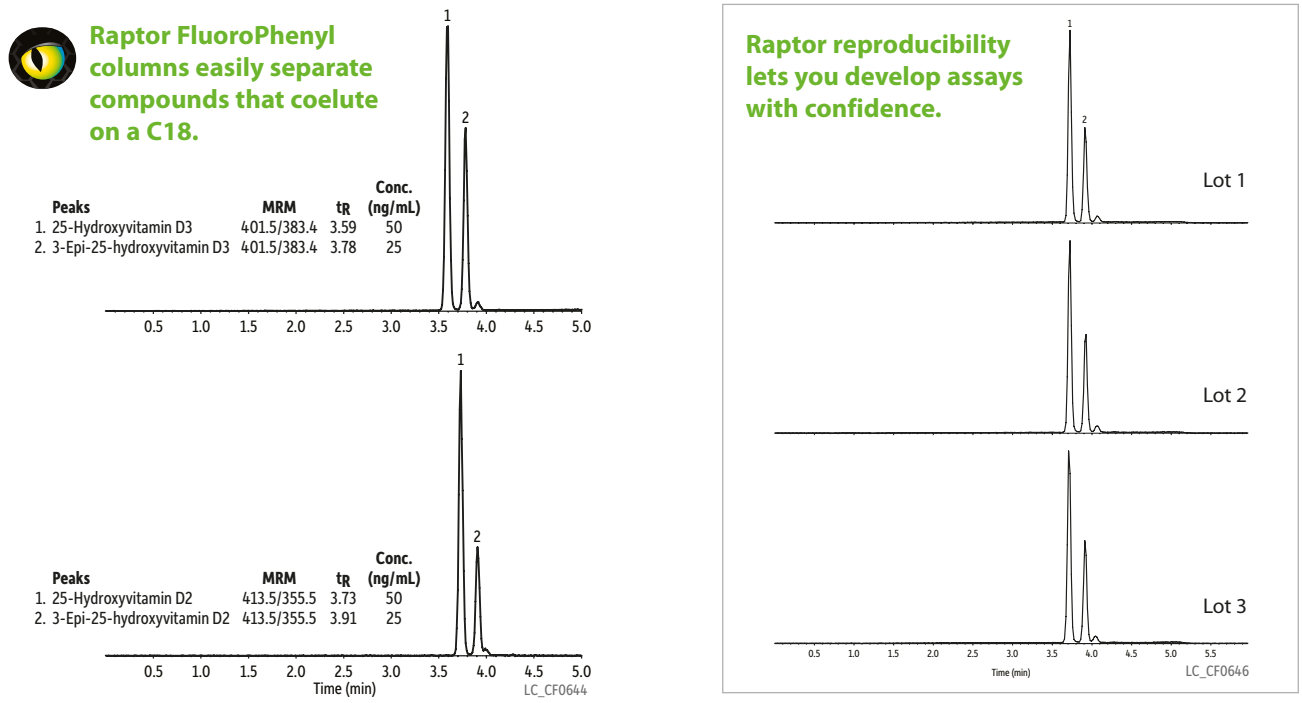
C18 columns work well for many compounds, but they just don't work for everything. Raptor FluoroPhenyl columns can provide greater selectivity and retention for analytes that are not easily separated by C18 phase chemistry. For example, interest in vitamin D status is on the rise in clinical diagnostics, but accurate analysis is only possible if the epimeric forms of both vitamin D2 and D3 25-hydroxy metabolites can be distinguished. Typical reversed-phase C18 columns cannot separate these isobaric epimers, which differ in bioactivity, but the new Raptor FluoroPhenyl column provides adequate chromatographic resolution so accurate results are generated and the proper diagnosis can be made.

**Figure 12:** Reversed-phase C18 columns do not have the right selectivity or retention mechanism to separate the epimers of vitamin D2 and D3 25-hydroxy metabolites.




**Column:** Raptor ARC-18 (cat.# 9314A12); Dimensions: 100 mm x 2.1 mm ID, Particle Size: 2.7 µm; Temp.: 30 °C; **Sample:** Diluent: Water:methanol (50:50); Conc.: 25-50 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: Methanol; **Gradient (%B):** 0.00 min (75% B), 4.00 (80% B), 12.00 (80% B), 12.10 (75% B); 14.00 (75% B); **Flow:** 0.5 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument**: HPLC.

**Figure 13:** Raptor FluoroPhenyl columns have the selectivity and retention you need to quickly and easily separate compounds that coelute on a C18, such as the epimeric forms of vitamin D2 and D3 25-hydroxy metabolites.

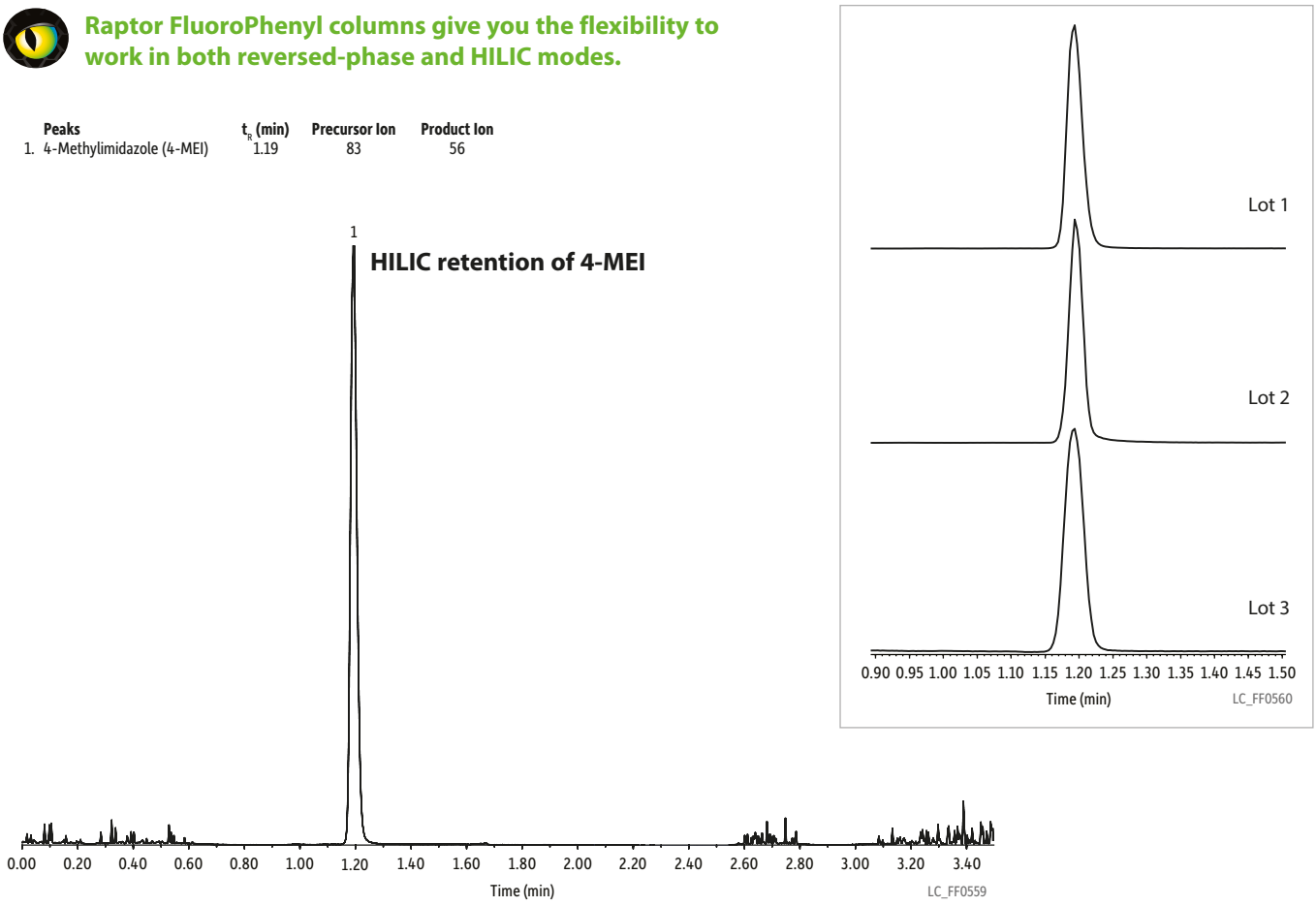



**Column:** Raptor FluoroPhenyl (cat.# 9319A1E); Dimensions: 100 mm x 3 mm ID, Particle Size: 2.7 µm; Temp.: 30 °C; **Sample:** Diluent: Water:methanol (50:50); Conc.: 25-50 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: Methanol; **Gradient (%B):** 0.00 min (75% B), 4.00 (85% B), 4.10 (100% B), 5.00 (100% B), 5.01 (75% B), 7.00 (75% B); **Flow:** 0.6 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument**: HPLC.

## Get the Power of HILIC and RP Modes in One LC Column

HILIC chromatography is becoming the go-to solution for compounds that are difficult to retain on a C18. The Raptor FluoroPhenyl column gives chromatographers the flexibility to evaluate compound retention in both reversed-phase and HILIC modes. The analysis of 4-methylimidazole (4-MEI), which is a byproduct of caramel coloring in foods and beverages, can be problematic by reversed-phase chromatography due to very limited retention. However, 4-MEI is well retained on a Raptor FluoroPhenyl column and can easily be analyzed using HILIC mode and simple LC and LC-MS/MS compatible mobile phases.

**Figure 14:** Sometimes, adequate retention cannot be obtained with a C18. The Raptor FluoroPhenyl column performs dependably in either HILIC or RP mode, so you can use the mode that is best for your analytes.




**Column:** Raptor FluoroPhenyl (cat.# 9319A52); Dimensions: 50 mm x 2.1 mm ID; Particle Size: 2.7 µm; Temp.: 35 °C; **Sample:** Diluent: Acetonitrile; Conc.: 100 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.1% Formic acid in water; B: 0.1% Formic acid in acetonitrile; **Gradient (%B):** 0.00 min (95% B), 2.00 (30% B), 2.01 (95% B), 3.50 (95% B); **Flow:** 0.6 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument:** UHPLC.

## Exceptional Selectivity for Clinical Analyses

The analysis of normetanephrine and metanephrine provides another example of the power of Raptor FluoroPhenyl columns for analyzing basic compounds. Accurately determining these metabolites of epinephrine/norepinephrine in plasma or urine is one of the best diagnostic tests for neuroendocrine tumors (pheochromocytomas). Normetanephrine and metanephrine are difficult to retain by typical C18 reversed-phase chromatography; however, the Raptor FluoroPhenyl column provides a simple, fast chromatographic solution to this challenging assay. The Raptor FluoroPhenyl column's unique combination of aromatic retention and cation exchange mechanisms are not provided by a C18 column and result in reliable, high-quality separations.

**Figure 15:** Rapid analysis of metanephrine and normetanephrine on a Raptor FluoroPhenyl column.

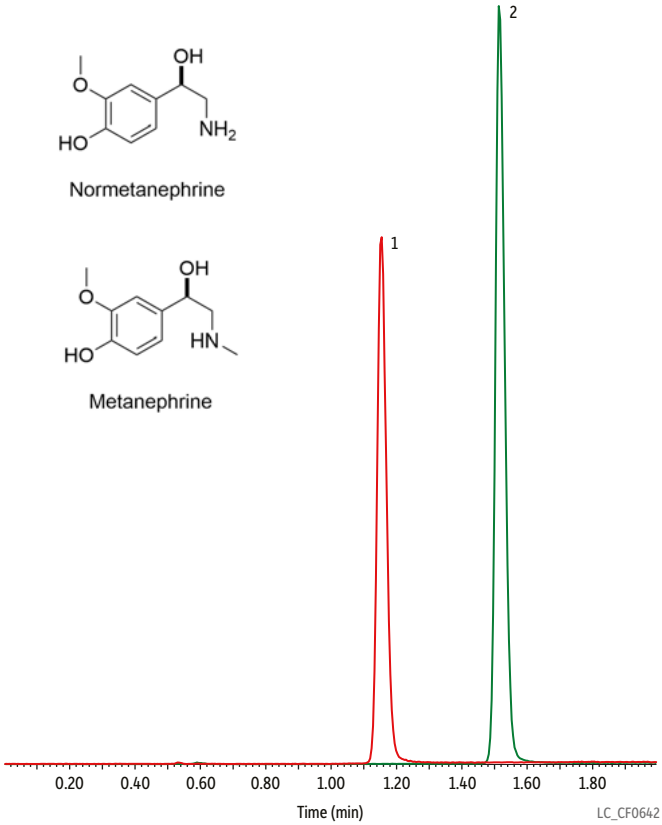
| Peaks | $t_R$ (min) | Precursor Ion | Product Ion 1 | Product Ion 2 |
|---|---|---|---|---|
| 1. Normetanephrine | 1.15 | 166.1 | 121.1 | 134.0 |
| 2. Metanephrine | 1.52 | 180.1 | 165.1 | 148.3 |

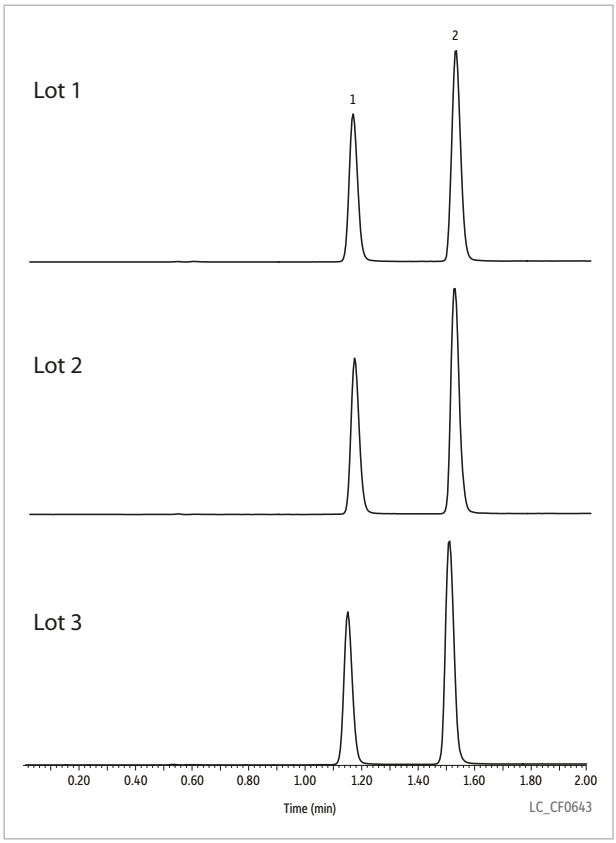



Normetanephrine




Metanephrine




**Column:** Raptor FluoroPhenyl (cat.# 9319A12); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 2.7 µm; Temp.: 30 °C; **Sample:** Diluent: Water; Conc.: 20 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A: 0.2% Formic acid in water; B: Methanol; **Gradient (%B):** 0.00 min (2% B), 2.00 (40% B), 2.01 (2% B), 6.00 (2% B); Flow: 0.4 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument**: UHPLC.

# Dependable Raptor FluoroPhenyl Columns Give You the Flexibility to Utse Both HILIC and RP Modes

## Raptor FluoroPhenyl LC Columns (USP L43)

| ID | Length | qty. | cat.# |
|---|---|---|---|
| **1.8 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9319232 |
| | 50 mm | ea. | 9319252 |
| | 100 mm | ea. | 9319212 |
| | 150 mm | ea. | 9319262 |
| 3.0 mm | 50 mm | ea. | 931925E |
| | 100 mm | ea. | 931921E |
| **2.7 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9319A32 |
| | 50 mm | ea. | 9319A52 |
| | 100 mm | ea. | 9319A12 |
| | 150 mm | ea. | 9319A62 |
| 3.0 mm | 30 mm | ea. | 9319A3E |
| | 50 mm | ea. | 9319A5E |
| | 100 mm | ea. | 9319A1E |
| | 150 mm | ea. | 9319A6E |
| 4.6 mm | 30 mm | ea. | 9319A35 |
| | 50 mm | ea. | 9319A55 |
| | 100 mm | ea. | 9319A15 |
| | 150 mm | ea. | 9319A65 |
| **5 µm Particles** | | | |
| 2.1 mm | 50 mm | ea. | 9319552 |
| | 100 mm | ea. | 9319512 |
| | 150 mm | ea. | 9319562 |
| 3.0 mm | 30 mm | ea. | 931953E |
| | 50 mm | ea. | 931955E |
| | 100 mm | ea. | 931951E |
| | 150 mm | ea. | 931956E |
| 4.6 mm | 50 mm | ea. | 9319555 |
| | 100 mm | ea. | 9319515 |
| | 150 mm | ea. | 9319565 |
| | 250 mm | ea. | 9319575 |

## EXP Reusable Fittings for HPLC & UHPLC

for 10-32 fittings and 1⁄16" tubing

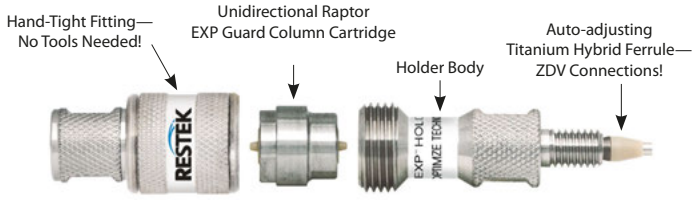
Effortlessly achieve 8700+ psi HPLC seals by hand! (Wrench tighten to 20,000+ psi.) Hybrid titanium/PEEK seal can be installed repeatedly without compromising your seal.

| Description | qty. | cat.# |
|---|---|---|
| EXP Hand-Tight Fitting (nut w/ferrule) | ea. | 25937 |
| | 10-pk. | 25938 |

Intellectual Property: optimizetech.com/patents

Experience *Selectivity Accelerated.*
Order the Raptor FluoroPhenyl today at **www.bgb-shop.com/raptor**

## Raptor EXP Guard Cartridges—for All Raptor Columns




Protect your investment, extend the life of our already-rugged LC columns, and change guard column cartridges by hand without breaking fluid connections—no tools needed! Great with any Raptor column to get ultimate protection from particulates and matrix contamination, especially when using dilute-and-shoot or other minimal sample preparation techniques.

### EXP Direct Connect Holder

| Description | qty. | cat.# |
|---|---|---|
| EXP Direct Connect Holder for EXP Guard Cartridges (includes hex-head fitting & 2 ferrules) | ea. | 25808 |

Maximum holder pressure: 20,000 psi (1400 bar)

### EXP In-Line Holder

| Description | qty. | cat.# |
|---|---|---|
| EXP In-Line Holder for EXP Guard Cartridges (includes hex-head fittings & 2 ferrules) | ea. | 25751 |

Intellectual Property: optimizetech.com/patents

### Raptor FluoroPhenyl EXP Guard Column Cartridges

| Particle Size | Size | qty. | cat.# |
|---|---|---|---|
| UHPLC | 5 x 2.1 mm | 3-pk. | 9319U0252 |
| UHPLC | 5 x 3.0 mm | 3-pk. | 9319U0253 |
| 2.7 µm | 5 x 2.1 mm | 3-pk. | 9319A0252 |
| 2.7 µm | 5 x 3.0 mm | 3-pk. | 9319A0253 |
| 2.7 µm | 5 x 4.6 mm | 3-pk. | 9319A0250 |
| 5 µm | 5 x 2.1 mm | 3-pk. | 931950252 |
| 5 µm | 5 x 3.0 mm | 3-pk. | 931950253 |
| 5 µm | 5 x 4.6 mm | 3-pk. | 931950250 |

Maximum cartridge pressure: 1034 bar/15,000 psi* (UHPLC), 600 bar/8700 psi (2.7 µm); 400 bar/5800 psi (5 µm)
* For maximum lifetime, recommended maximum pressure for UHPLC particles is 830 bar/12,000 psi.

## UltraShield UHPLC PreColumn Filter—for 1.8 µm Raptor Columns

Pair 1.8 µm Raptor columns with an UltraShield filter instead of a guard cartridge to protect against particulates, minimize extra column volume, and maximize UHPLC sample throughput when using SPE, SLE, or other extensive sample preparations.

| Porosity | qty. | cat.# |
|---|---|---|
| 0.5 µm frit | ea. | 24995 |
| 0.5 µm frit | 5-pk. | 24996 |
| 0.5 µm frit | 10-pk. | 24997 |
| 0.2 µm frit | ea. | 25809 |
| 0.2 µm frit | 5-pk. | 25810 |
| 0.2 µm frit | 10-pk. | 25811 |


24995

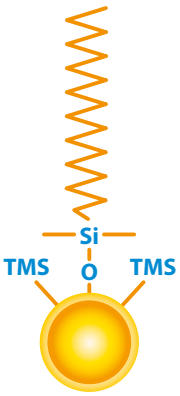
# The Raptor C18 Column—Raptor Speed, Efficiency, and Ruggedness in C18

With Raptor LC columns, Restek chemists became the first to combine the speed of 2.7 and 5 µm superficially porous particles (also known as SPP or "core-shell" particles) with the resolution of highly selective USLC technology, improving separations and speeding up analysis times with standard HPLC instruments. Raptor then evolved to bring that same improved speed, efficiency, and selectivity to UHPLC analyses by offering 1.8 µm particle columns. Learn more about Raptor LC columns at **www.bgb-shop.com/raptor**

Even though every LC lab has a cache of C18s, not all C18s are created equal. Because the chemistry tends to be similar, the silica support that carries this ubiquitous octadecylsilane phase becomes vitally important. When you need a general-purpose LC column, don't just grab any C18. Choose the speed, efficiency, and long-lasting ruggedness of the Raptor C18 SPP LC column.

The traditional end-capped Raptor C18 offers the highest hydrophobic retention of any Raptor phase, and it is compatible with a wide range of mobile phases from moderately acidic to neutral (pH 2–8). Whether for food safety, environmental, or bioanalytical analyses, this phase offers consistently excellent data quality in less time across myriad reversed-phase applications, matrices, and compound classes.

## Column Description:




**Stationary Phase Category:**
C18, octadecylsilane (L1)

**Ligand Type:**
End-capped C18

**Particle:**
1.8 µm, 2.7 µm, or 5 µm superficially porous particle (SPP or "core-shell" particle) silica

**Pore Size:**
90 Å

**Surface Area:**
125 $m^2/g$ (1.8 µm),
130 $m^2/g$ (2.7 µm),
or 100 $m^2/g$ (5 µm)

**Recommended Usage:**
pH Range: 2.0–8.0

Maximum Temperature: 80 °C

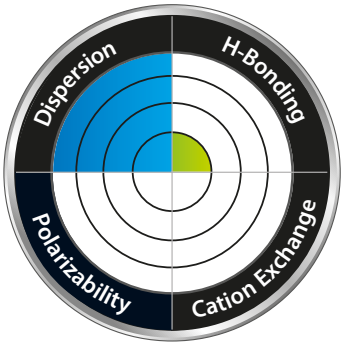
Maximum Pressure: 1034 bar/15,000 psi* (1.8 µm), 600 bar/8700 psi (2.7 µm); 400 bar/5800 psi (5 µm)

** For maximum lifetime, recommended maximum pressure for 1.8 µm particles is 830 bar/12,000 psi.*

**Properties:**
- Compatible with moderately acidic to neutral mobile phases (pH 2–8).
- Excellent data quality in food, environmental, bioanalytical, and other applications.

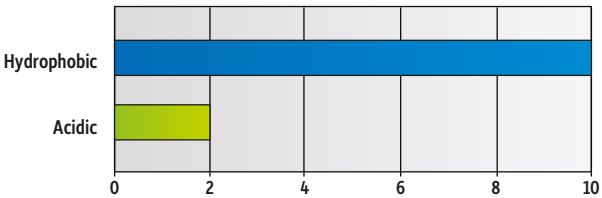
**Switch to a C18 when:**
- You need a general-purpose column for reversed-phase chromatography.
- You need to increase retention of hydrophobic compounds.

## Column Interaction Profile:


**Defining Solute Interaction:**
- Dispersion

## Solute Retention Profile:




**Target Analyte Structure:**
- Hydrocarbons

**Target Analyte Functionalities:**
- Hydrophobic compounds

## Raptor C18 Performance: Speed, Efficiency, and Ruggedness in Action

Raptor C18 columns provide outstanding dependability and data quality with high efficiency and peak symmetry, and they are built to exacting specifications that make your columns exceptionally consistent and improve their lifetime. To lower costs and improve profitability, you need columns to last longer, data to be reproducible, and existing HPLC instrumentation to run faster. Get there with the only general-purpose C18 that gives you *Selectivity Accelerated.*

**Figure 16:** Comparing 50 mm x 2.1 mm sub-2 µm C18 columns, Raptor columns maintain reliable performance past 1000 injections, consistently matching or beating the competition.

**Expect consistently high performance over 1000 injections**

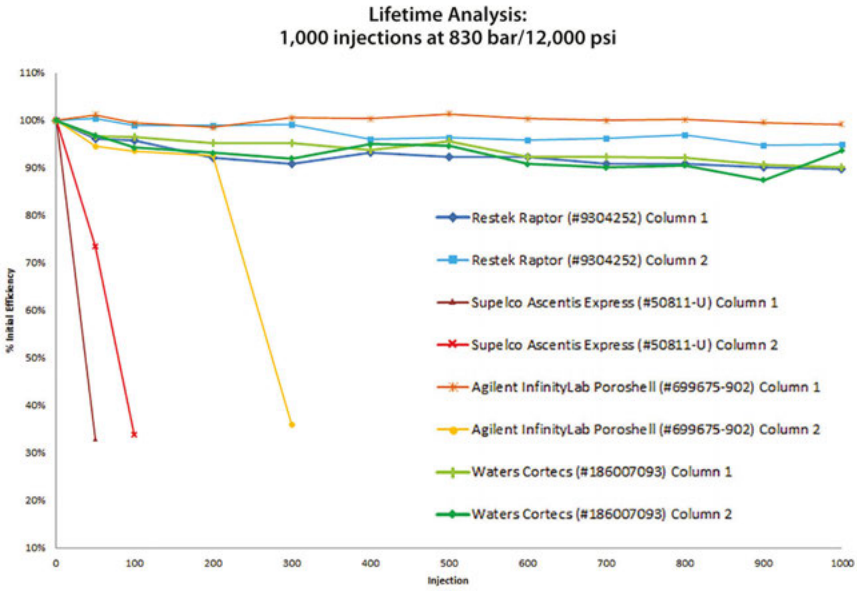
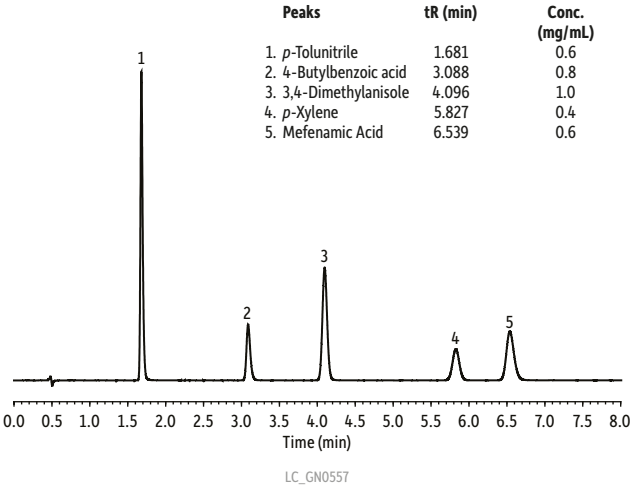



**Figure 17:** Raptor columns' stringent quality control (QC) specifications guarantee outstanding peak shape, even with active compounds, for superior data quality.

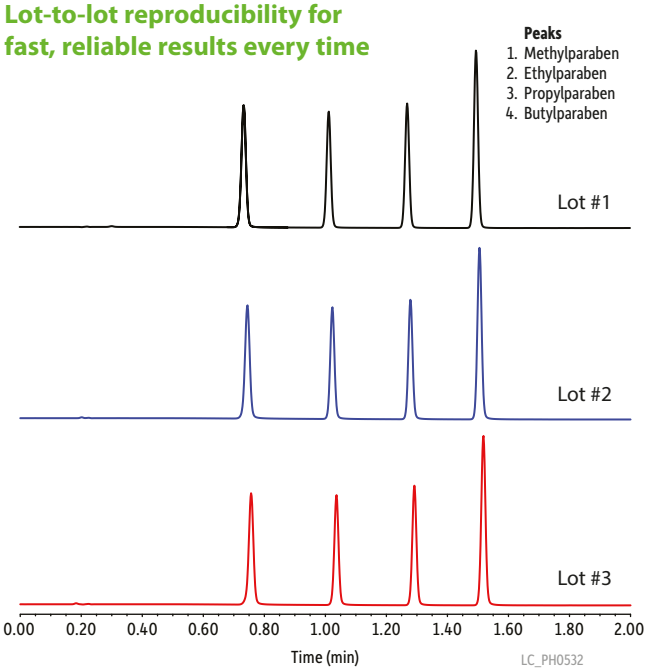
**Outstanding peak shapes for top-notch data**




**Column:** Raptor C18 (cat.# 9304A1E); Dimensions: 100 mm x 3 mm ID; Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 30 °C; **Sample:** Diluent: Acetonitrile:water:phosphoric acid (65:34:1); Inj. Vol.: 1 µL; **Mobile Phase:** A: 0.05% Formic acid in water, B: 0.05% Formic acid in acetonitrile; **Gradient (%B):** 0.00 min (45% B), 8.00 min (45% B); **Flow:** 0.8 mL/min; **Detector:** UV/Vis @ 220 nm; Cell Temp.: 40 °C; **Instrument:** HPLC.

**Figure 18:** Lot-to-lot reproducibility is the key to keeping your productivity high and budget low. You can expect the same exceptional performance from every Raptor C18 column you purchase.

**Lot-to-lot reproducibility for fast, reliable results every time**

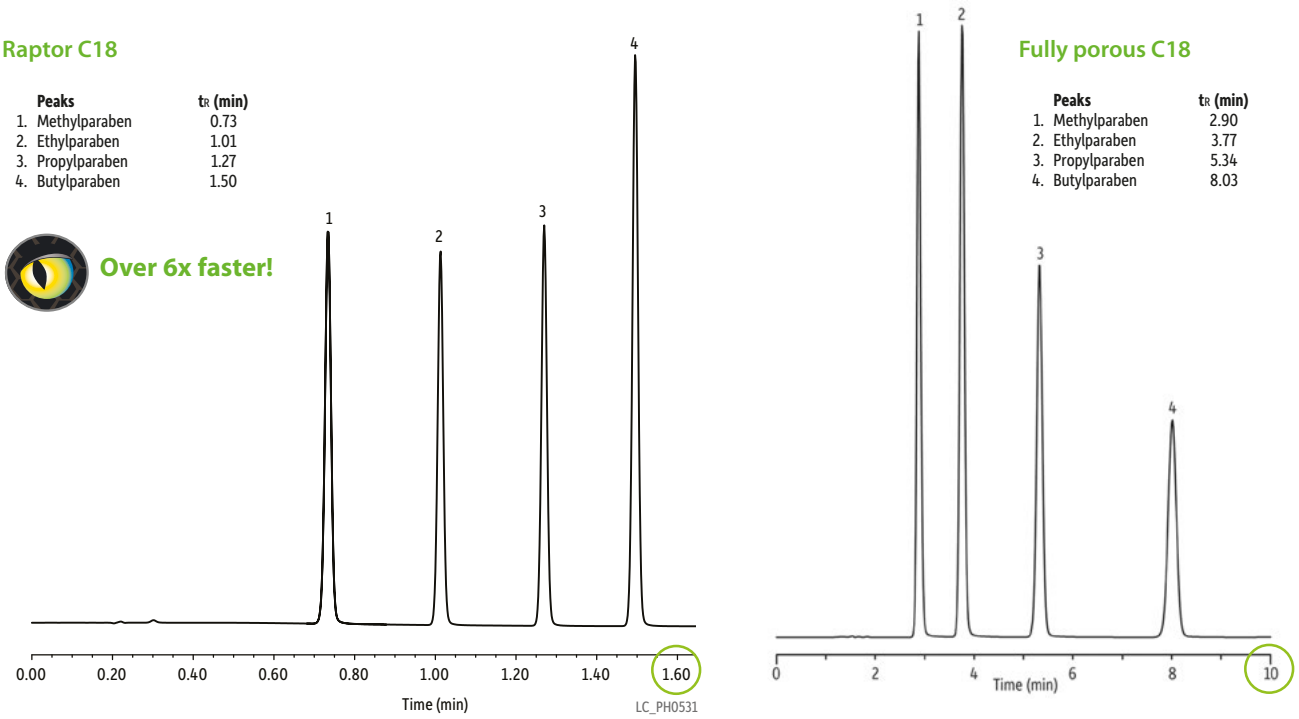



**Column:** Raptor C18 (cat.# 9304512); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 5 µm; Temp.: 40 °C; **Sample:** Conc.: 100 µg/mL in water; Inj. Vol.: 1 µL; **Mobile Phase:** A: Water, B: Acetonitrile; **Gradient** (%B): 0.00 min (20% B), 2.00 min (80% B), 2.01 min (20% B), 3.50 min (20% B); **Flow:** 1.0 mL/min; **Detector:** PDA @ 254 nm; **Instrument:** UHPLC.

## Boost Your Productivity with Raptor C18 Columns

When developing an assay, it is important to consider how productive your method will be. Because superficially porous, or "core-shell," particles are well known for very high efficiency with minimal backpressure, they are ideal for decreasing analysis time (Figure 19). With its general-purpose applicability and SPP core-shell particles, the Raptor C18 column lets you quickly develop faster methods, thereby boosting your productivity.

**Figure 19:** SPP particles, like those in the Raptor C18 column, are one important step towards total method optimization.




**Column:** Raptor C18 (cat.# 9304512); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 5 µm; Temp.: 40 °C; **Sample:** Conc.: 100 µg/mL in water; Inj. Vol.: 1 µL; **Mobile Phase:** A: Water B: Acetonitrile; **Gradient (%B):** 0.00 min (20% B), 2.00 min ;(80% B), 2.01 min (20% B), 3.50 min (20% B); **Flow:** 1.0 mL/min; **Detector:** PDA @ 254 nm; **Instrument:** UHPLC.

**Column:** Traditional fully porous C18; Dimensions: 150 mm x 4.6 mm ID; Particle Size: 5 µm; Pore Size: 100 Å; Temp.: Ambient; **Sample:** Diluent: Methanol; Conc.: 100 µg/mL each component; Inj. Vol.: 5 µL; **Mobile Phase:** 0.1% Acetic acid in water:acetonitrile (50:50); Flow: 1.0 mL/min; **Detector:** UV/Vis @ 254 nm.

# Lower Costs and Improve Profitability with the Only General-Purpose C18 That Gives You *Selectivity Accelerated*

## Raptor C18 LC Columns (USP L1)

| ID | Length | qty. | cat.# |
|---|---|---|---|
| **1.8 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9304232 |
| | 50 mm | ea. | 9304252 |
| | 100 mm | ea. | 9304212 |
| | 150 mm | ea. | 9304262 |
| 3.0 mm | 50 mm | ea. | 930425E |
| | 100 mm | ea. | 930421E |
| **2.7 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9304A32 |
| | 50 mm | ea. | 9304A52 |
| | 100 mm | ea. | 9304A12 |
| | 150 mm | ea. | 9304A62 |
| 3.0 mm | 30 mm | ea. | 9304A3E |
| | 50 mm | ea. | 9304A5E |
| | 100 mm | ea. | 9304A1E |
| | 150 mm | ea. | 9304A6E |
| 4.6 mm | 30 mm | ea. | 9304A35 |
| | 50 mm | ea. | 9304A55 |
| | 100 mm | ea. | 9304A15 |
| | 150 mm | ea. | 9304A65 |
| **5 µm Particles** | | | |
| 2.1 mm | 50 mm | ea. | 9304552 |
| | 100 mm | ea. | 9304512 |
| | 150 mm | ea. | 9304562 |
| 3.0 mm | 30 mm | ea. | 930453E |
| | 50 mm | ea. | 930455E |
| | 100 mm | ea. | 930451E |
| | 150 mm | ea. | 930456E |
| 4.6 mm | 50 mm | ea. | 9304555 |
| | 100 mm | ea. | 9304515 |
| | 150 mm | ea. | 9304565 |
| | 250 mm | ea. | 9304575 |

## EXP Reusable Fittings for HPLC & UHPLC

for 10-32 fittings and 1⁄16" tubing

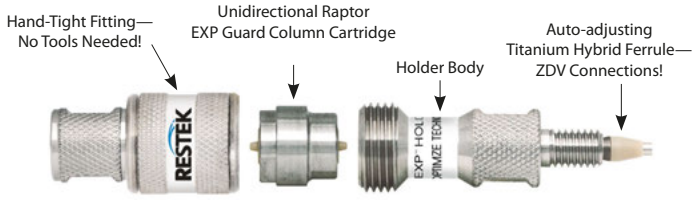
Effortlessly achieve 8700+ psi HPLC seals by hand! (Wrench tighten to 20,000+ psi.) Hybrid titanium/PEEK seal can be installed repeatedly without compromising your seal.

| Description | qty. | cat.# |
|---|---|---|
| EXP Hand-Tight Fitting (nut w/ferrule) | ea. | 25937 |
| | 10-pk. | 25938 |

Intellectual Property: optimizetech.com/patents

Experience *Selectivity Accelerated.*
Order the Raptor C18 today at
**www.bgb-shop.com/raptor**

## Raptor EXP Guard Cartridges—for All Raptor Columns




Protect your investment, extend the life of our already-rugged LC columns, and change guard column cartridges by hand without breaking fluid connections—no tools needed! Great with any Raptor column to get ultimate protection from particulates and matrix contamination, especially when using dilute-and-shoot or other minimal sample preparation techniques.

### EXP Direct Connect Holder

| Description | qty. | cat.# |
|---|---|---|
| EXP Direct Connect Holder for EXP Guard Cartridges (includes hex-head fitting & 2 ferrules) | ea. | 25808 |

Maximum holder pressure: 20,000 psi (1400 bar)

### EXP In-Line Holder

| Description | qty. | cat.# |
|---|---|---|
| EXP In-Line Holder for EXP Guard Cartridges (includes hex-head fittings & 2 ferrules) | ea. | 25751 |

Intellectual Property: optimizetech.com/patents

### Raptor C18 EXP Guard Column Cartridges

| Particle Size | Size | qty. | cat.# |
|---|---|---|---|
| UHPLC | 5 x 2.1 mm | 3-pk. | 9304U0252 |
| UHPLC | 5 x 3.0 mm | 3-pk. | 9304U0253 |
| 2.7 µm | 5 x 2.1 mm | 3-pk. | 9304A0252 |
| 2.7 µm | 5 x 3.0 mm | 3-pk. | 9304A0253 |
| 2.7 µm | 5 x 4.6 mm | 3-pk. | 9304A0250 |
| 5 µm | 5 x 2.1 mm | 3-pk. | 930450252 |
| 5 µm | 5 x 3.0 mm | 3-pk. | 930450253 |
| 5 µm | 5 x 4.6 mm | 3-pk. | 930450250 |

Maximum cartridge pressure: 1034 bar/15,000 psi* (UHPLC), 600 bar/8700 psi (2.7 µm); 400 bar/5800 psi (5 µm)
* For maximum lifetime, recommended maximum pressure for UHPLC particles is 830 bar/12,000 psi.

## UltraShield UHPLC PreColumn Filter—for 1.8 µm Raptor Columns

Pair 1.8 µm Raptor columns with an UltraShield filter instead of a guard cartridge to protect against particulates, minimize extra column volume, and maximize UHPLC sample throughput when using SPE, SLE, or other extensive sample preparations.

| UltraShield UHPLC PreColumn Filter | | |
|---|---|---|
| **Porosity** | **qty.** | **cat.#** |
| 0.5 µm frit | ea. | 24995 |
| 0.5 µm frit | 5-pk. | 24996 |
| 0.5 µm frit | 10-pk. | 24997 |
| 0.2 µm frit | ea. | 25809 |
| 0.2 µm frit | 5-pk. | 25810 |
| 0.2 µm frit | 10-pk. | 25811 |


24995

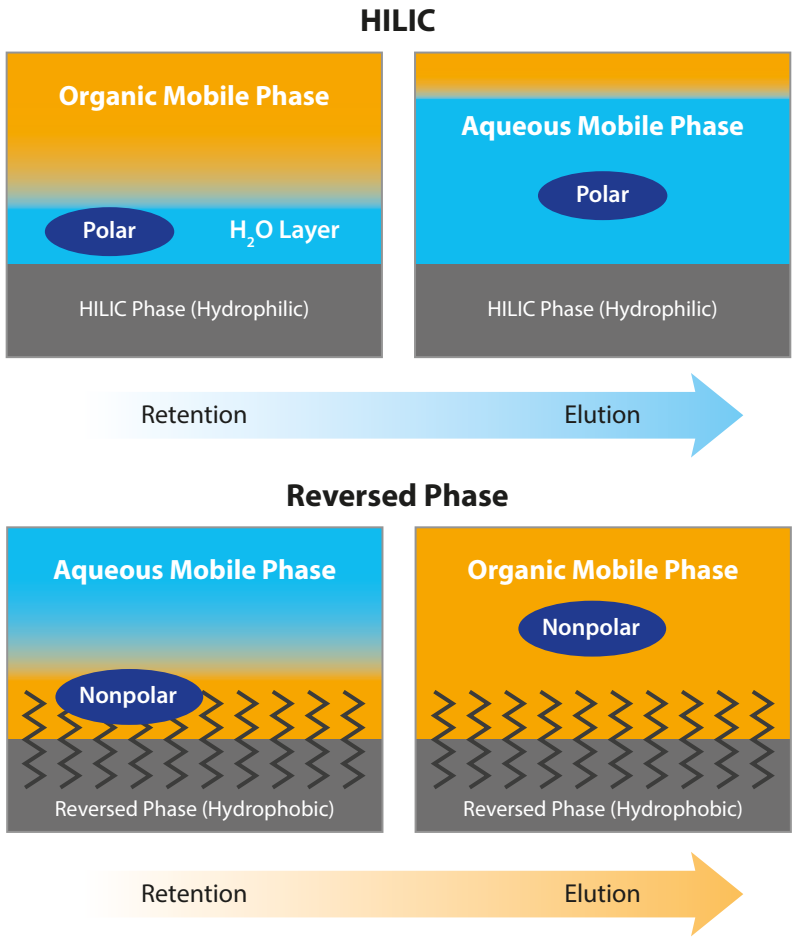
# The Raptor HILIC-Si Column—Simplify the Switch to HILIC

With Raptor LC columns, Restek chemists became the first to combine the speed of superficially porous particles (also known as SPP or "core-shell" particles) with the resolution of highly selective USLC technology. This new breed of chromatographic column allows you to more easily achieve peak separation and faster analysis times without expensive UHPLC instrumentation. Restek is extending the speed and reliability of Raptor to the HILIC realm with the addition of the Raptor HILIC-Si column.

Hydrophilic-interaction chromatography (HILIC) (1) is an increasingly popular alternative to reversed-phase LC for challenging polar analytes because it provides better retention of water-soluble compounds that are separated by polar differences (Figure 20). The Raptor HILIC-Si column simplifies the switch to HILIC because it delivers rugged Raptor performance, provides SPP column speed for faster analyses than traditional FPP silica columns, retains polar compounds without ion-pairing reagents, and is fully reliable, efficient, and selective with LC-MS compatible mobile phases.

## Order yours today at www.bgb-shop.com/raptor

**Figure 20:** Use HILIC when greater retention of polar analytes is needed. In HILIC mode, the aqueous mobile phase is the strong (or eluting) solvent versus the more familiar reversed-phase mode, where elution is the result of the organic solvent strength.




## Column Description:


**Pore Size:**
90 Å

**Particle:**
2.7 µm superficially porous particle (SPP or "core-shell" particle) silica

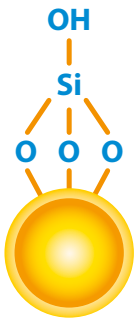
**Surface Area:**
130 $m^2/g$

**End-Cap:**
No

**Carbon Load:**
NA

**USP Phase Code:**
L3

**Phase Category:**
Bare silica




**Ligand Type:**
None

**Recommended Usage:**
pH Range: 2.0–8.0
Maximum Temperature: 80 °C
Maximum Pressure: 600 bar/8700 psi

**Properties:**
- Compatible with both HPLC and UHPLC instruments.
- Restek's 2.7 µm core-shell particles provide Raptor performance and the speed of SPP.

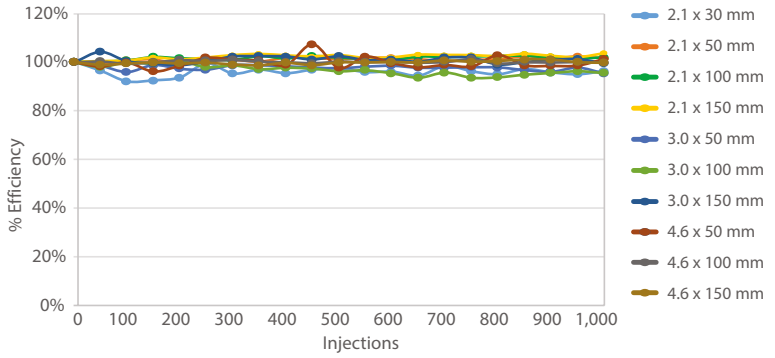
**Switch to a Raptor HILIC-Si LC column when:**
- Increased retention of small polar compounds is needed.
- You want to avoid using ion-pairing reagents.
- You want retention and sensitivity for hydrophilic compounds by LC-MS.

(1) A.J. Alpert, Hydrophilic-interaction chromatography for the separation of peptides, nucleic acids and other polar compounds, J. Chromatogr. 499 (1990) 177–196.

## Raptor Technology Ensures Rugged, Reproducible Performance in the HILIC Realm

Raptor LC columns are well known for their rugged dependability, and the new Raptor HILIC-Si column brings the consistency of Raptor performance to HILIC. Lot to lot, column to column, and injection to injection, every Raptor HILIC-Si column gives a consistent performance that you can count on (Figures 21 and 22). Simplify your move to HILIC with the reliability of Raptor HILIC-Si columns.

**Figure 21:** Raptor HILIC-Si columns maintain efficiency at any dimension, even at operating pressures up to 575 bar so you can run at high linear velocities with confidence.

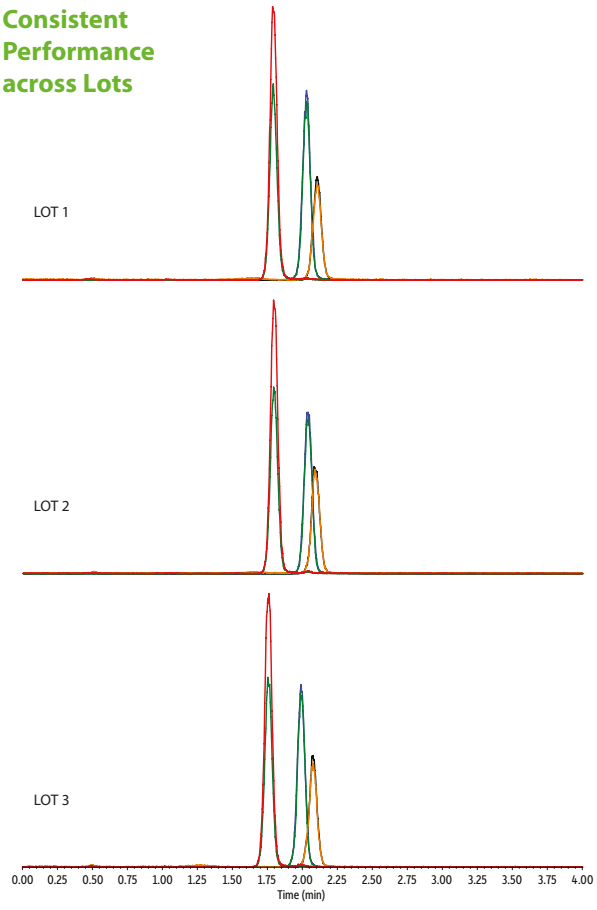



All testing performed using 2.7 µm Raptor HILIC-Si columns.

**Figure 22:** Strict quality control guarantees that rugged Raptor HILIC-Si columns provide reproducible results lot after lot and injection after injection.

| Peaks | Conc. (ng/mL) | Precursor Ion | Product Ion | Product Ion |
|---|---|---|---|---|
| 1. 3-Methoxytyramine | 1 | 151.00 | 119.00 | 91.02 |
| 2. Metanephrine | 1 | 179.94 | 148.22 | 165.01 |
| 3. Normetanephrine | 1 | 166.00 | 134.02 | 121.01 |

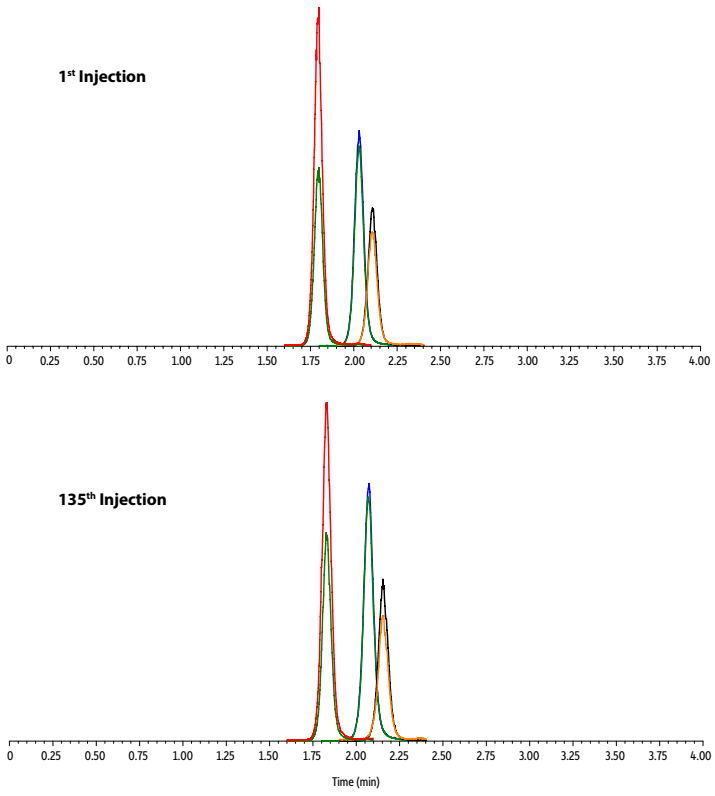
**Consistent Performance across Lots**




LC_CF0690_ 0691_0692

| Peaks | Conc. (ng/mL) | Precursor | Product Ion | Product Ion | 1st Injection (tR) | 135th Injection (tR) |
|---|---|---|---|---|---|---|
| 1. 3-Methoxytyramine | 1 | 151.00 | 119.00 | 91.02 | 1.80 | 1.83 |
| 2. Metanephrine | 1 | 179.94 | 148.22 | 165.01 | 2.03 | 2.07 |
| 3. Normetanephrine | 1 | 166.00 | 134.02 | 121.01 | 2.11 | 2.15 |

**Stable Results Injection after Injection**



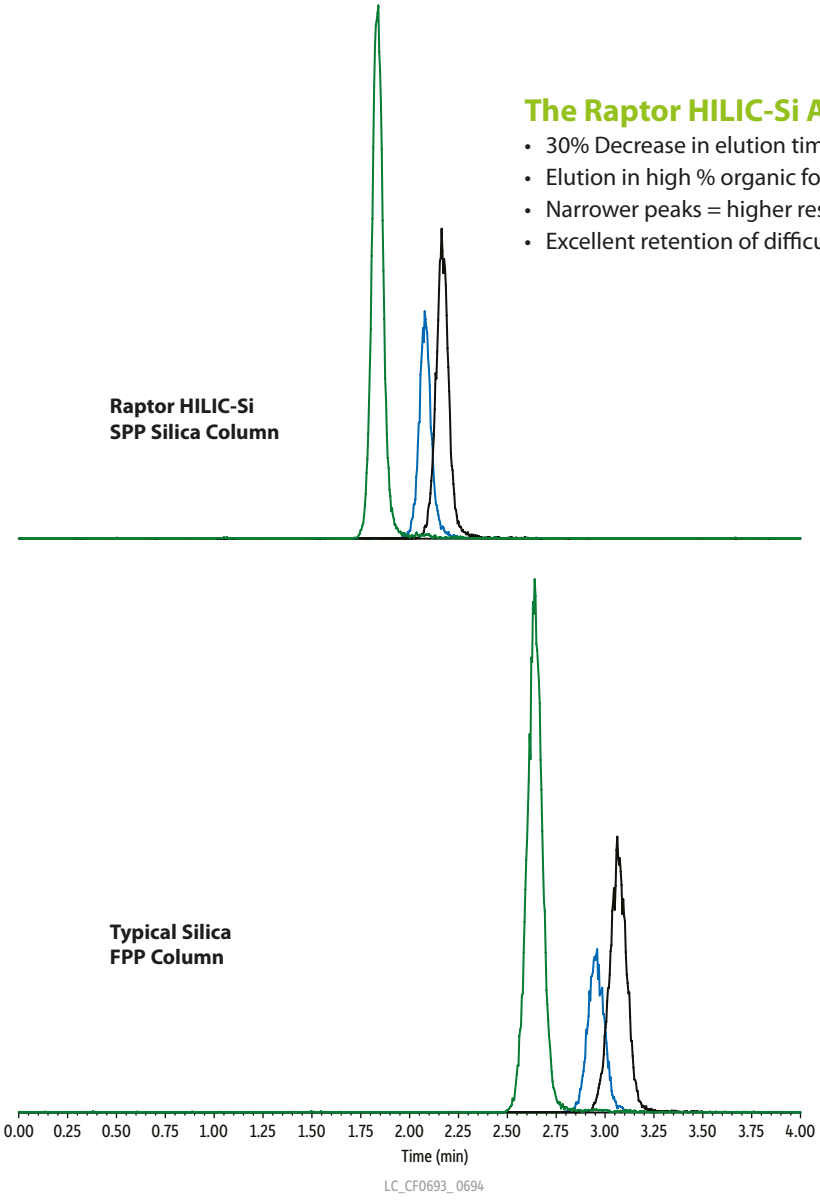

LC_CF0701

Column: Raptor HILIC-Si (cat.# 9310A52); Dimensions: 50 mm x 2.1 mm ID, Particle Size: 2.7 µm; Temp.: 30 °C; Sample: Diluent: Mobile phase A:mobile phase B (10:90); Conc.: 1 ng/mL; Inj. Vol.: 10 µL; Mobile Phase: A: Water, 100 mM ammonium formate, pH 3.0; B: Acetonitrile; Gradient (%B): 0.00 min (90% B), 5.00 (90% B); Flow: 0.3 mL/min; Detector: MS/MS; Ion Mode: ESI+; Mode: MRM; Instrument: UHPLC

## Raptor SPP + HILIC = More Speed, More Sensitivity

What makes Raptor HILIC-Si columns special? The answer is simple: you get the speed of a Raptor SPP column with the unique separating power of the HILIC retention mechanism. The benefits of superficially porous particles (SPP) are well known. SPP columns are characterized by a layer of porous silica bonded to a solid silica core, which gives faster, more efficient analyses. As shown in Figure 23, when you keep instrument parameters constant (flow, gradient, temperature) and compare a 3 µm fully porous particle (FPP) silica column to a 2.7 µm Raptor HILIC-Si SPP column, the benefits become clear. Raptor HILIC-Si columns combine faster analysis times with higher sensitivity so you can increase sample throughput and lower limits of quantification (LOQs) for difficult-to-retain polar analytes.

**Figure 23:** Raptor HILIC-Si columns provide the speed of SPP so you can analyze more samples per day.



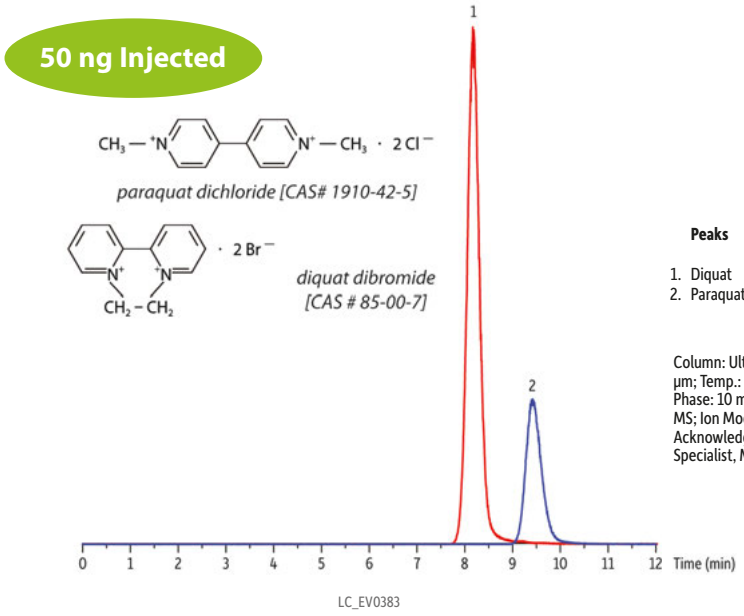

| Peaks | Conc. (ng/mL) | Precursor Ion | Product Ion | Raptor $t_R$ (min) | Typical $t_R$ (min) |
|---|---|---|---|---|---|
| 1. 3-Methoxytyramine | 1 | 151.00 | 119.00 | 1.84 | 2.64 |
| 2. Metanephrine | 1 | 179.94 | 148.22 | 2.08 | 2.96 |
| 3. Normetanephrine | 1 | 166.00 | 134.02 | 2.16 | 3.06 |

Raptor HILIC-Si SPP column (cat.# 9310A52) 50 mm x 2.1 mm ID, Particle Size: 2.7 µm; Typical silica FPP column, 50 mm x 2.1 mm ID, Particle Size: 3.0 µm; Temp.: 30 °C; Sample: Diluent: Mobile phase A:mobile phase B (10:90); Conc.: 1 ng/mL; Inj. Vol.: 10 µL; Mobile Phase: A: Water, 100 mM ammonium formate, pH 3.0; B: Acetonitrile; Gradient (%B): 0.00 min (90% B), 5.00 (90% B); Flow: 0.3 mL/min; Detector: MS/MS; Ion Mode: ESI+; Mode: MRM; Instrument: UHPLC

## Raptor HILIC-Si Performance Gains vs. RP: Say Good-bye to Ion-Pairing Reagents

HILIC methods are becoming more common as analysts search for better solutions to challenging reversed-phase (RP) analyses. But, when is HILIC a beneficial alternative to a standard RP approach? HILIC should be considered when analyzing small polar compounds that are difficult to retain in RP mode without the use of ion-pairing reagents in the mobile phase. For example, paraquat and diquat are highly charged quaternary amine herbicides that are often analyzed in RP mode using ion-pairing reagents (Figure 24). But, these reagents can contaminate your LC-MS/MS and require the system be taken off-line frequently for extensive cleaning. With Raptor HILIC-Si columns, ion-pairing reagents are not needed and paraquat and diquat are quickly retained and resolved with MS-friendly solvents and buffers so your instrument stays up and running longer (Figure 25).

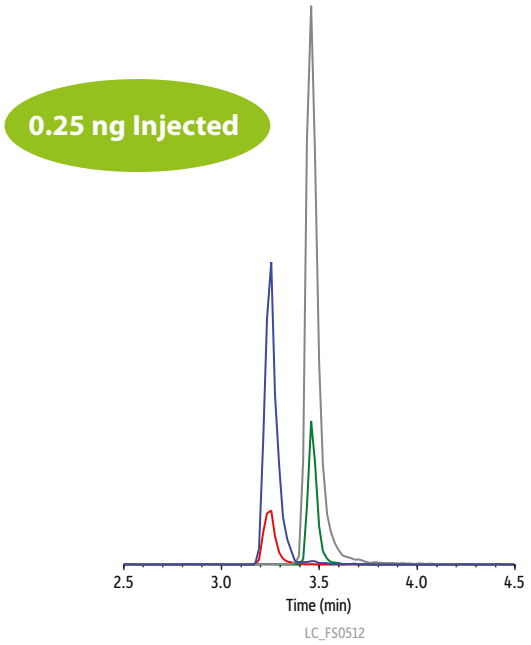
**Figure 24:** RP Analysis of Paraquat and Diquat with Ion-Pairing Mobile Phase Reagent




| Peaks | Precursor Ion (amu) | Fragment Ion (amu) | DP (V) | Collision Energy (eV) |
|---|---|---|---|---|
| 1. Diquat | 183 | 157 | 30 | 30 |
| 2. Paraquat | 185 | 170 | 20 | 20 |

Column: Ultra Quat (cat.# 9181352); Dimensions: 50 mm x 2.1 mm ID, Particle Size: 3.0 µm; Temp.: Ambient; Sample: Diluent: DI water; Conc.: 5 µg/mL; Inj. Vol.: 10 µL; Mobile Phase: 10 mM heptafluorobutyric acid:acetonitrile (95:5); Flow: 0.3 mL/min; Detector: MS/MS; Ion Mode: ESI+; Mode: MRM; Instrument: Applied Biosystems/MDS Sciex LC-MS/MS; Acknowledgement: Data courtesy of Houssain El Aribi, Ph.D., LC-MS Product and Application Specialist, MDS SCIEX, 71 Four Valley Drive, Concord, Ontario, Canada, L4K 4V8.

**Figure 25:** Raptor HILIC-Si Analysis of Paraquat and Diquat with MS-Friendly Mobile Phases




### The Raptor HILIC-Si Advantage

- 3x faster elution
- Inject 200x less for trace analysis
- No ion-pairing reagent—easier and better for LC-MS/MS!

| Peaks | $t_R$ (min) | Precursor Ion 1 | Product Ion 1 | Precursor Ion 2 | Product Ion 2 |
|---|---|---|---|---|---|
| 1. Diquat | 3.25 | 183.3 | 157.2 | 183.3 | 130.1 |
| 2. Paraquat | 3.46 | 185.3 | 170.3 | 171.3 | 77.2 |

Column: Raptor HILIC-Si (cat.# 9310A52); Dimensions: 50 mm x 2.1 mm ID, Particle Size: 2.7 µm; Temp.: 45 °C; Sample: Diluent: Mobile phase B; Conc.: 50 ng/mL; Inj. Vol.: 5 µL; Mobile Phase: A: Water, 50 mM ammonium formate, 0.5% formic acid; B: 25:75 Water:acetonitrile, 50 mM ammonium formate, 0.5% formic acid; Gradient (%B): 0.00 min (100% B), 4.00 (65% B), 4.01 min (100% B), 7.00 min (100% B); Flow: 0.6 mL/min; Detector: MS/MS; Ion Mode: ESI+; Mode: MRM; Instrument: HPLC

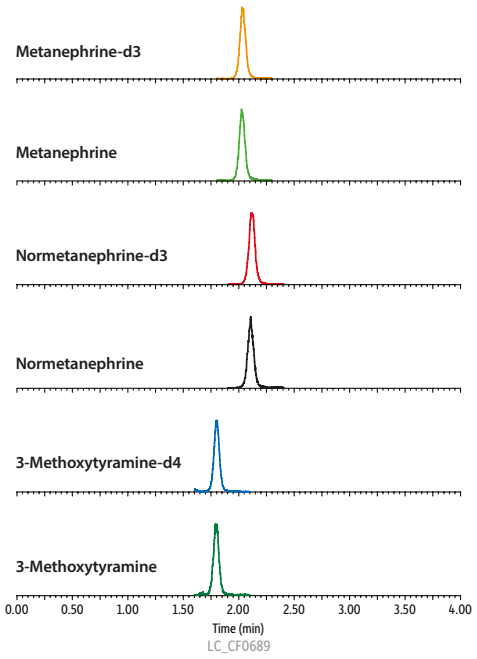
## Raptor HILIC-Si Improves the Performance of Your LC-MS/MS

One of the most striking ways that HILIC analyses differ from standard RP analyses is that in HILIC methods the aqueous mobile phase is the stronger solvent. It provides differential selectivity that helps retain small polar analytes until after the sample matrix has eluted. In addition, the higher concentration organic mobile phases used in HILIC methods improve solvent evaporation during electrospray ionization, leading to increased sensitivity for LC-MS/MS methods. The following applications illustrate the decrease in matrix interference and increase in LC-MS/MS sensitivity that can be obtained using HILIC conditions and a Raptor HILIC-Si column.

### *Monoamine Neurotransmitters and Metabolites*

Measurements of monoamine neurotransmitters and their metabolites in plasma and urine are commonly used for clinical diagnosis and monitoring of neuroblastoma and pheochromocytoma. Quantifying free metanephrine and normetanephrine is the most sensitive and accurate test for this purpose, but analysis of these polar compounds using reversed-phase LC is problematic due to very limited retention and poor sensitivity. As shown in Figure 26, these polar metabolites can be adequately retained on a Raptor HILIC-Si column and detected at 50 pg/mL in human plasma, providing the sensitivity needed for clinical purposes (Figure 26).

**Figure 26:** Trace-Level Metanephrine, Normetanephrine, and 3-Methoxytyramine in Human Plasma




**Even at 50 pg/mL, good signal-to-noise ratios mean lower LOQs and accurate results at trace levels.**

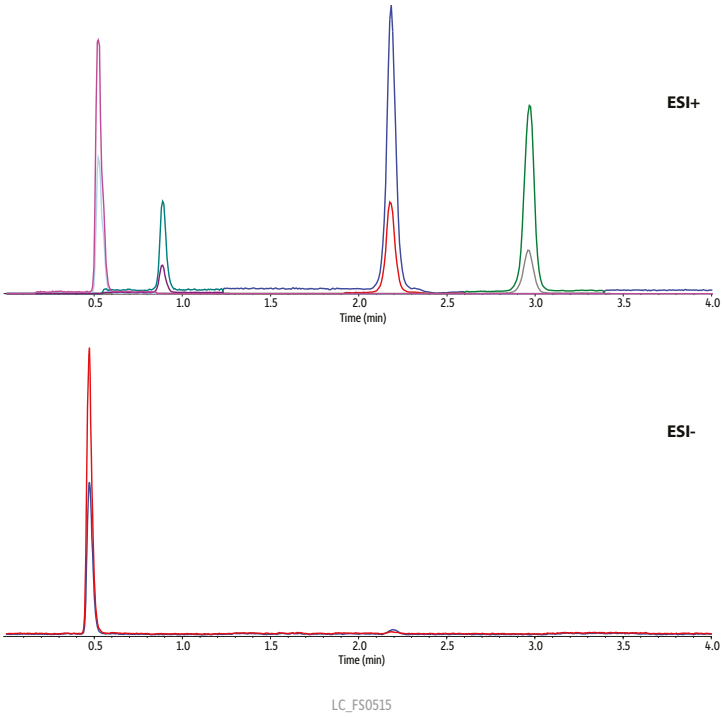
| Peaks | $t_R$ (min) | Conc. (pg/mL) | Precursor Ion | Product Ion |
|---|---|---|---|---|
| 1. 3-Methoxytyramine-d4 (IS) | 1.80 | 400 | 155.07 | 122.93 |
| 2. 3-Methoxytyramine | 1.80 | 50 | 151.00 | 119.00 |
| 3. Metanephrine-d3 (IS) | 2.03 | 200 | 183.00 | 151.15 |
| 4. Metanephrine | 2.03 | 50 | 179.94 | 148.22 |
| 5. Normetanephrine-d3 (IS) | 2.11 | 400 | 169.00 | 136.96 |
| 6. Normetanephrine | 2.11 | 50 | 166.00 | 134.02 |

Column: Raptor HILIC-Si (cat.# 9310A52); Dimensions: 50 mm x 2.1 mm ID, Particle Size: 2.7 µm; Temp.: 30 °C; Sample: Diluent: Mobile phase A:mobile phase B (10:90); Inj. Vol.: 10 µL; Mobile Phase: A: Water, 100 mM ammonium formate, pH 3.0; B: Acetonitrile; Gradient (%B): 0.00 min (90% B), 5.00 min (90% B); Flow: 0.3 mL/min; Detector: MS/MS; Ion Mode: ESI+; Mode: MRM; Instrument: UHPLC; Notes: For sample preparation details, enter chromatogram LC_CF0689 in the www.restek.com search.

*Food Adulterants*

Foods that contain a high protein content command a higher price, which can result in the illegal practice of food adulteration using nitrogen-rich compounds, such as melamine, to make the protein content appear higher than the actual value. Due to its potential for toxicity, testing for melamine and other structurally related compounds is required in many countries for foods, feed materials, and pharmaceutical components. The method shown in Figure 27 provides excellent retention of these highly polar analytes with a separation time of only 3.5 minutes and a complete cycle time of just 8 minutes using a Raptor HILIC-Si column.

**Figure 27:** Food Adulterants on Raptor HILIC-Si




**The Raptor HILIC-Si column simplifies the analysis of difficult-to-retain polar analytes, such as melamine and related compounds.**

| Peaks | $t_R$ (min) | Precursor Ion | Product Ion | Product Ion | Polarity |
|---|---|---|---|---|---|
| 1. Cyanuric acid | 0.47 | 127.8 | 84.9 | 42.1 | - |
| 2. Cyromazine | 0.52 | 167.0 | 68.2 | 85.1 | + |
| 3. Melamine | 0.89 | 127.2 | 85.0 | 68.3 | + |
| 4. Ammelide | 2.18 | 129.1 | 86.1 | 70.2 | + |
| 5. Ammeline | 2.97 | 128.2 | 86.2 | 69.1 | + |

Column: Raptor HILIC-Si (cat.# 9310A52); Dimensions: 50 mm x 2.1 mm ID, Particle Size: 2.7 µm; Temp.: 30 °C; Sample: Diluent: 5:95 Water:acetonitrile, 10 mM ammonium formate, 0.1% formic acid; Conc.: 25 ng/mL; Inj. Vol.: 5 µL; Mobile Phase: A: Water, 10 mM ammonium formate, 0.1% formic acid; B: 5:95 Water:acetonitrile, 10 mM ammonium formate, 0.1% formic acid; Gradient (%B): 0.00 min (100% B), 0.50 (100% B), 3.50 min (95% B), 3.51 min (100% B), 8.00 min (100% B); Flow: 0.6 mL/min; Detector: MS/MS; Ion Mode: ESI+/ESI-; Mode: Scheduled MRM; Instrument: HPLC

## Have More Questions about HILIC?

Our online frequently asked questions (FAQs) cover many common topics we cover in Technical Service on a regular basis! Get your answers at

**www.restek.com/HILIC-FAQ**

# Raptor HILIC-Si:
# Simplify the Switch to HILIC

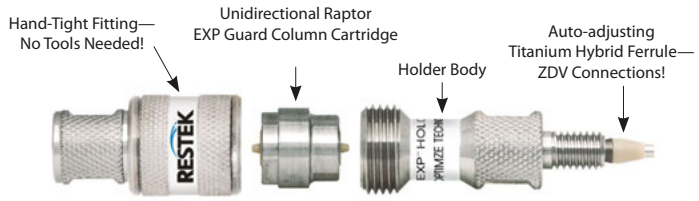
## Where's my 5 µm column?

Because HILIC methods use highly organic mobile phases, they generate very low backpressures. We've simplified your move to HILIC by offering the Raptor HILIC-Si column in a 2.7 µm particle size only. Our testing and applications development demonstrated that 2.7 µm columns offer higher efficiency than 5 µm columns, and they are compatible with any HPLC or UHPLC instrument you have in your lab.

### Raptor HILIC-Si LC Columns (USP L3)

| ID | Length | qty. | cat.# |
|---|---|---|---|
| 2.1 mm | 30 mm | ea. | 9310A32 |
| | 50 mm | ea. | 9310A52 |
| | 100 mm | ea. | 9310A12 |
| | 150 mm | ea. | 9310A62 |
| 3.0 mm | 50 mm | ea. | 9310A5E |
| | 100 mm | ea. | 9310A1E |
| | 150 mm | ea. | 9310A6E |
| 4.6 mm | 50 mm | ea. | 9310A55 |
| | 100 mm | ea. | 9310A15 |
| | 150 mm | ea. | 9310A65 |

### Raptor EXP Guard Cartridges—for All Raptor Columns




Protect your investment, extend the life of our already-rugged LC columns, and change guard column cartridges by hand without breaking fluid connections—no tools needed! Great with any Raptor column to get ultimate protection from particulates and matrix contamination, especially when using dilute-and-shoot or other minimal sample preparation techniques.

### EXP Direct Connect Holder

| Description | qty. | cat.# |
|---|---|---|
| EXP Direct Connect Holder for EXP Guard Cartridges (includes hex-head fitting & 2 ferrules) | ea. | 25808 |

Maximum holder pressure: 20,000 psi (1400 bar)

### EXP In-Line Holder

| Description | qty. | cat.# |
|---|---|---|
| EXP In-Line Holder for EXP Guard Cartridges (includes hex-head fittings & 2 ferrules) | ea. | 25751 |

Intellectual Property: optimizetech.com/patents

### Raptor HILIC-Si EXP Guard Column Cartridges

| Particle Size | Size | qty. | cat.# |
|---|---|---|---|
| 2.7 µm | 5 x 2.1 mm | 3-pk. | 9310A0252 |
| 2.7 µm | 5 x 3.0 mm | 3-pk. | 9310A0253 |
| 2.7 µm | 5 x 4.6 mm | 3-pk. | 9310A0250 |

Maximum cartridge pressure: 1034 bar/15,000 psi* (UHPLC), 600 bar/8700 psi (2.7 µm); 400 bar/5800 psi (5 µm)
* For maximum lifetime, recommended maximum pressure for UHPLC particles is 830 bar/12,000 psi.

Experience *Selectivity Accelerated.* Order the Raptor HILIC-Si today at **www.bgb-shop.com/raptor**

# The Raptor EtG/EtS Column—
# All Matrix Interferences Resolved

- Proven performance for accurate, reliable ethyl glucuronide (EtG) and ethyl sulfate (EtS) analysis.
- Strong retention consistently resolves analytes from matrix interferences.
- Long column lifetime ensures consistent performance injection after injection.
- Fast, 4-minute, dilute-and-shoot LC-MS/MS analysis supports high sample throughput.

Switch to a Raptor EtG/EtS column when you need consistent resolution of EtG and EtS from matrix interferences and long column lifetimes.

## Order yours today at **www.bgb-shop.com/raptor**

### Column Description:


**Pore Size:**
90 Å

**Particle:**
2.7 µm superficially porous particle (SPP or "core-shell" particle) silica

**Surface Area:**
130 $m^2/g$

**End-Cap:**
Proprietary

**Carbon Load:**
Proprietary

**USP Phase Code:**
NA

**Phase Category:**
Proprietary

**Ligand Type:**
Proprietary

**Recommended Usage:**
pH Range: 2.0–8.0

Maximum Temperature: 80 °C

Maximum Pressure: 600 bar/8700 psi

**Properties:**
- Resolution of EtG and EtS from matrix interferences.
- Increased retention of EtG and EtS compared to traditional phases.

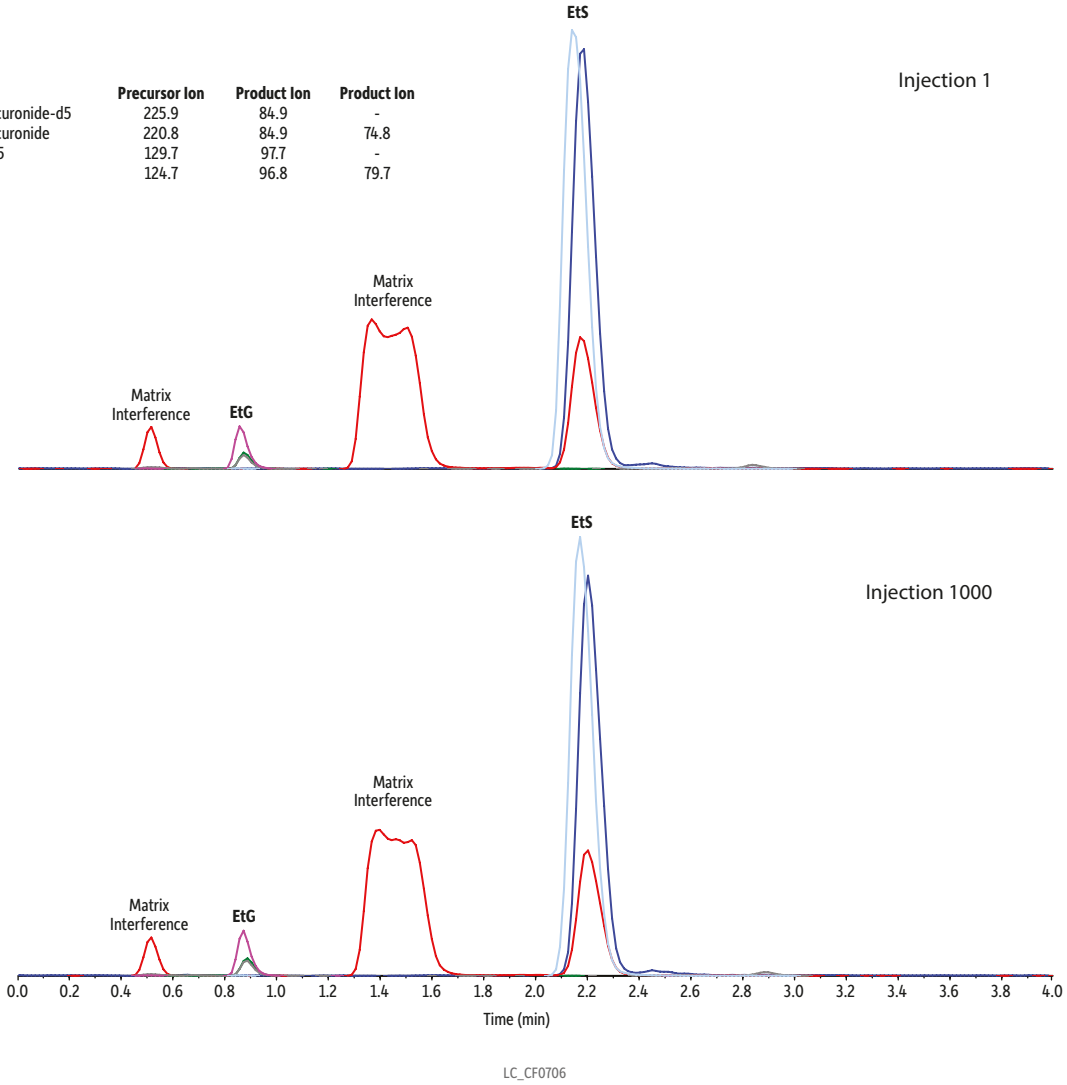
**Switch to a Raptor EtG/EtS when:**
- Other columns can't resolve EtG and EtS from matrix components.
- You need high-throughput EtG/EtS analysis.
- Low-level detection limits are desired.

## Definitive Results for Alcohol Monitoring

Restek has developed a new Raptor column that significantly improves EtG and EtS analysis for alcohol monitoring programs. The Raptor EtG/EtS column consistently retains and resolves these important biomarkers from matrix interferences, providing accurate, reliable results injection after injection (Figure 28). Dependable performance, a fast 4-minute analysis, and long column lifetime make this column ideal for high-throughput labs. Paired with our quality reference standards and the optimized, validated method shown below, Restek's Raptor EtG/EtS column is part of a complete solution that will help testing labs save time and increase certainty.

**Figure 28:** Rugged Raptor EtG/EtS columns provide complete resolution and consistent results even after 1,000 injections, allowing more samples to be analyzed between column changes.

| Peaks | Precursor Ion | Product Ion | Product Ion |
|---|---|---|---|
| 1. Ethyl-β-D-glucuronide-d5 | 225.9 | 84.9 | - |
| 2. Ethyl-β-D-glucuronide | 220.8 | 84.9 | 74.8 |
| 3. Ethyl sulfate-d5 | 129.7 | 97.7 | - |
| 4. Ethyl sulfate | 124.7 | 96.8 | 79.7 |




Column: Raptor EtG/EtS (cat.# 9325A12); Dimensions: 100 mm x 2.1 mm ID, Particle Size: 2.7 µm; Guard Column: UltraShield UHPLC precolumn filter, 0.2 µm frit (cat.# 25809); Temp.: 35 °C; Sample: A 500 ng/mL QC sample was prepared in urine. 50 µL of the sample was diluted with 950 µL of a working internal standard (25 ng/mL EtS-d5/100 ng/mL EtG-d5 in 0.1% formic acid in water). The sample was vortexed at 3,500 rpm for 10 seconds to mix. The sample was then centrifuged at 3,000 rpm for 5 minutes at 10 °C. The autosampler needle was adjusted to inject from the supernatant. Inj. Vol.: 10 µL; Mobile Phase: A: 0.1% Formic acid in water; B: 0.1% Formic acid in acetonitrile; Gradient (%B): 0.00 min (5% B), 2.50 min (35% B), 2.51 min (5% B), 4.00 (5% B); Flow: 0.5 mL/min; Detector: MS/MS; Ion Mode: ESI-; Mode: MRM; Instrument: HPLC; Notes: The following reference standards were used: ethyl-β-D-glucuronide (cat.# 34101), ethyl-β-D-glucuronide-d5 (cat.# 34102), ethyl sulfate sodium salt (cat.# 34103), ethyl sulfate-d5 sodium salt (cat.# 34104).

# Struggling with EtG/EtS matrix interferences? Here's your solution!

## Raptor EtG/EtS LC Column

- Proven performance for accurate, reliable ethyl glucuronide (EtG) and ethyl sulfate (EtS) analysis.
- Strong retention consistently resolves analytes from matrix interferences.
- Long column lifetime ensures consistent performance injection after injection.
- Fast, 4-minute, dilute-and-shoot LC-MS/MS analysis supports high sample throughput.
- Save time and increase certainty with Restek's definitive EtG/EtS method and quality reference standards.

| ID | Length | qty. | cat.# |
|---|---|---|---|
| 2.1 mm | 100 mm | ea. | 9325A12 |

## UltraShield UHPLC PreColumn Filter


24995

- Cost-effective protection for UHPLC systems.
- Reliable way to extend column lifetime.
- Minimize extra column volume and maximize UHPLC sample throughput vs. guard cartridges.
- Connects easily to any column with Parker-style ports; not compatible with Waters columns.
- Leak tight to 15,000 psi (1034 bar).
- 0.5 µm or 0.2 µm stainless steel frit in a stainless steel body with PEEK ferrule.

| Porosity | qty. | cat.# |
|---|---|---|
| 0.5 µm frit | ea. | 24995 |
| 0.5 µm frit | 5-pk. | 24996 |
| 0.5 µm frit | 10-pk. | 24997 |
| 0.2 µm frit | ea. | 25809 |
| 0.2 µm frit | 5-pk. | 25810 |
| 0.2 µm frit | 10-pk. | 25811 |

Experience *Selectivity Accelerated.*
Order the Raptor EtG/EtS today at
**www.bgb-shop.com/raptor**

## EtG and EtS Standards

- Alcohol metabolite biomarkers for monitoring alcohol consumption in urine samples.
- Available as unlabeled standards for instrument calibration and as deuterated internal standards for sample analysis.
- Verified composition and stability.
- Pair with Restek's definitive EtG/EtS method, and Raptor EtG/EtS LC column for accurate, reliable results.
- Certified reference materials (CRMs) manufactured and QC tested in ISO-accredited labs satisfy your ISO requirements.

### Ethyl sulfate sodium salt (EtS)

Ethyl sulfate sodium salt (EtS) (546-74-7)

| Description | CAS # | Conc. in Solvent | CRM? | Min Shelf Life on Ship Date | Max Shelf Life on Ship Date | Shipping Conditions | Storage Temp. | cat.#/ ea. |
|---|---|---|---|---|---|---|---|---|
| Ethyl sulfate sodium salt (EtS) | 546-74-7 | 1,000 µg/mL in methanol, 1 mL/ampul | Yes | 6 months | 36 months | Ambient | 0 °C or colder | 34103 |

### Ethyl sulfate-d5 sodium salt (EtS-d5)

Ethyl sulfate-d5 sodium salt (EtS-d5) (1329611-05-3)

| Description | CAS # | Conc. in Solvent | CRM? | Min Shelf Life on Ship Date | Max Shelf Life on Ship Date | Shipping Conditions | Storage Temp. | cat.#/ ea. |
|---|---|---|---|---|---|---|---|---|
| Ethyl sulfate-d5 sodium salt (EtS-d5) | 1329611-05-3 | 1,000 µg/mL in methanol, 1 mL/ampul | Yes | 6 months | 36 months | Ambient | 0 °C or colder | 34104 |

### Ethyl-β-D-glucuronide (EtG)

Ethyl-β-D-glucuronide (EtG) (17685-04-0)

| Description | CAS # | Conc. in Solvent | CRM? | Min Shelf Life on Ship Date | Max Shelf Life on Ship Date | Shipping Conditions | Storage Temp. | cat.#/ ea. |
|---|---|---|---|---|---|---|---|---|
| Ethyl-β-D-glucuronide (EtG) | 17685-04-0 | 1,000 µg/mL in methanol, 1 mL/ampul | Yes | 6 months | 36 months | Ambient | 0 °C or colder | 34101 |

### Ethyl-β-D-glucuronide-d5 (EtG-d5)

Ethyl-β-D-glucuronide-d5 (EtG-d5) (1135070-98-2)

| Description | CAS # | Conc. in Solvent | CRM? | Min Shelf Life on Ship Date | Max Shelf Life on Ship Date | Shipping Conditions | Storage Temp. | cat.#/ ea. |
|---|---|---|---|---|---|---|---|---|
| Ethyl-β-D-glucuronide-d5 (EtG-d5) | 1135070-98-2 | 1,000 µg/mL in methanol, 1 mL/ampul | Yes | 6 months | 36 months | Ambient | 0 °C or colder | 34102 |

# The Raptor Polar X Column—Simplify the Analysis of Polar Compounds

Analyzing polar compounds using liquid chromatography has historically been a challenge. Poor retention and peak shape, complex mobile phases that may not be MS-friendly, long equilibration times, low sensitivity, and sample derivatization are all complications that reduce lab efficiency and productivity. However, the development of a novel column that is specifically designed for the analysis of a broad range of polar compounds allows scientists to avoid these problems by taking advantage of the true power of chromatography.

## Providing the True Power of Chromatography

One of the most significant, yet least understood, aspects of method performance is the importance of using the proper stationary phase for a particular separation. For the analysis of polar compounds, reversed-phase columns do not provide adequate retention without the use of complex mobile phases or sample derivatization to compensate for the lack of effective interactions between the analytes and the column. But, by matching analytes to a stationary phase that provides purpose-built resolving power, you can avoid complex sample preparation procedures, save time and money, and reduce opportunities for error.

The Raptor Polar X stationary phase is specifically designed to selectively retain polar analytes through a balance of two retention mechanisms. This unique hybrid phase is ideal for analyzing a wide variety of polar compounds, especially when coupled with mass spectrometry. Simplify the analysis of polar compounds with the resolving power of Raptor Polar X columns from Restek.

### Column Description

**Pore Size:**
90 Å

**Particle:**
2.7 µm superficially porous particle (SPP or "core-shell" particle) silica

**Surface Area:**
130 $m^2/g$

**End-Cap:**
Proprietary

**Carbon Load:**
Proprietary

**USP Phase Code:**
NA

**Phase Category:**
Proprietary

**Ligand Type:**
Proprietary

**Recommended Usage:**

pH Range: 2.0–8.0

Maximum Temperature: 60 °C

Maximum Pressure: 600 bar/8700 psi

**Properties:**

- Excellent resolution and separation of a wide variety of polar compounds.
- Combines HILIC and ion-exchange retention mechanisms together in a single ligand.
- Broadly applicable for polar compound analysis spanning different industries and methods.

**Switch to a Raptor Polar X when:**

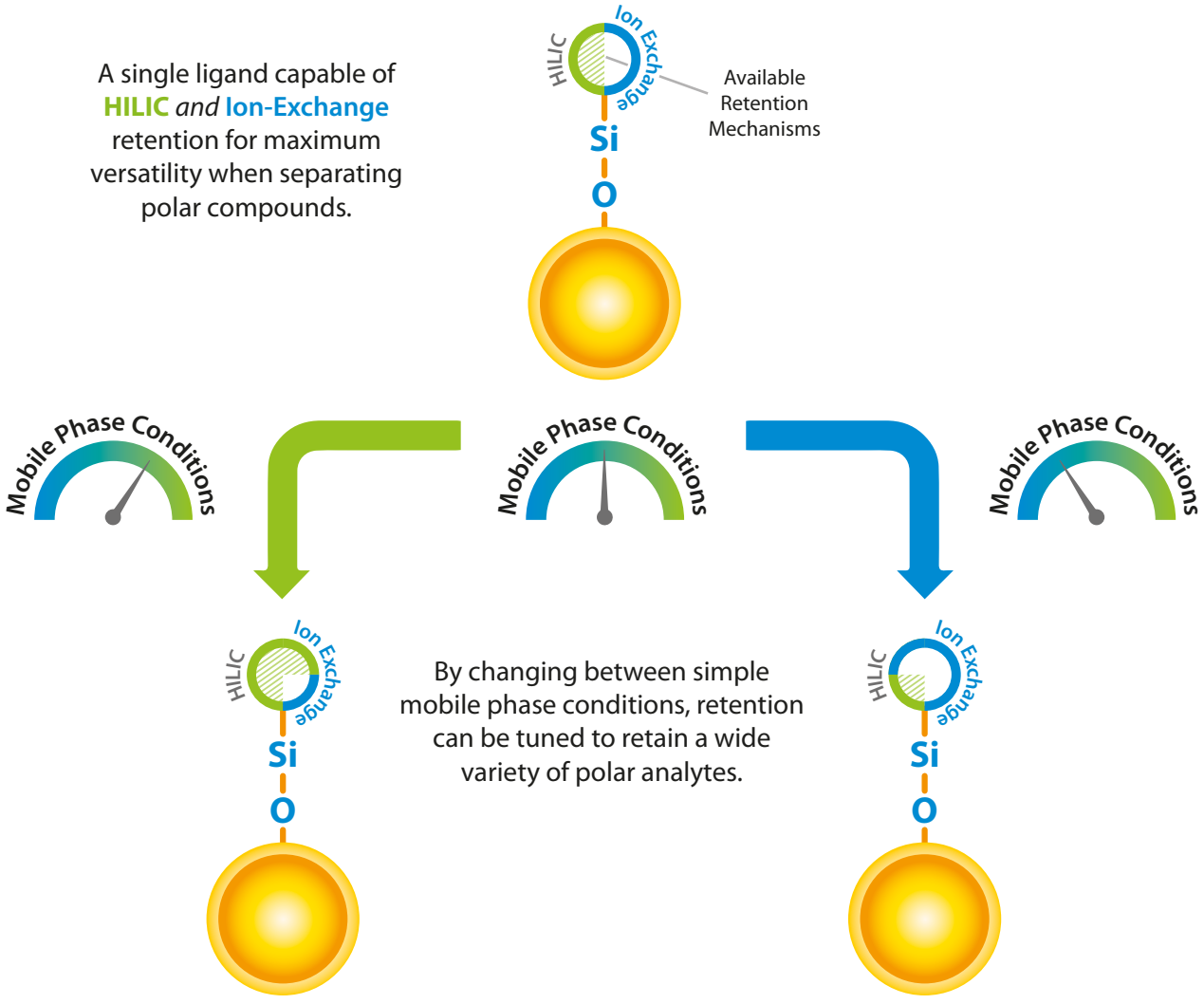
- You are analyzing neutral, acidic, basic, or permanently charged polar compounds.
- Performing LC-MS/MS analysis of polar compounds.
- You are struggling to retain or elute polar compounds and considering ion chromatography.

## Greater Than the Sum of Its Parts

Recognizing that the retention mechanisms most commonly used to retain polar compounds are hydrophilic interaction chromatography (HILIC) and ion-exchange approaches, Restek has developed a novel stationary phase chemistry that combines both modes on a single ligand. Because this unique ligand is bound to superficially porous particles, Raptor Polar X columns both reliably retain and efficiently separate a broad range of polar analytes.

Typical application-specific columns favor one retention mode over another, and gains made in the retention of one type of polar compound come at the expense of the performance for others. In contrast, with the Raptor Polar X column's patent-pending phase chemistry, two independent retention mechanisms are available for use, which provides truly balanced and flexible retention (Figure 29). Simple changes to mobile phase conditions allow analysts to switch between modes and selectively tune retention for the compounds of interest without needing long equilibration times before use or between samples.

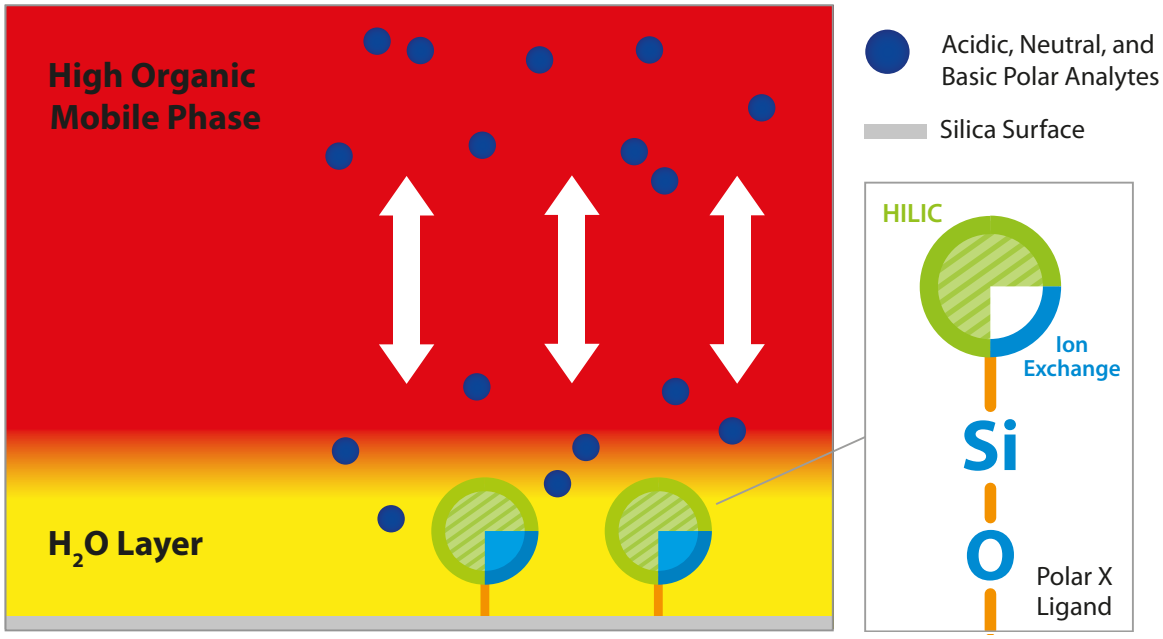
**Figure 29:** The Raptor Polar X column can quickly and easily be switched between polar retention modes by simple changes in mobile phase conditions, providing an unprecedented ability to retain and separate a wide variety of polar compounds, even in the same analysis.



## How It Works: Switching Retention Modes

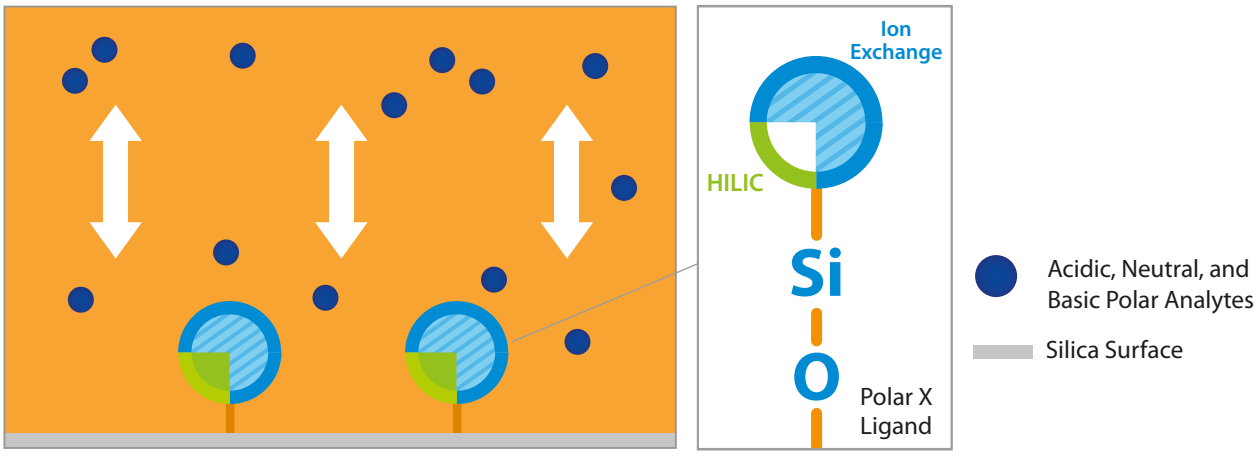
When using a mobile phase with a relatively high percentage of acetonitrile to water, a layer of water is formed at the surface of the silica into which polar compounds can partition. Partitioning into the water layer results in effective interactions between polar analytes and the ligand bound to the silica surface (Figure 30). The novel Raptor Polar X ligand chemistry makes this technique even easier, allowing for faster-than-ever column equilibration and re-equilibration. This means new columns are ready for use quickly, and sample throughput increases because less re-equilibration time is required between samples.

**Figure 30:** The rapid formation of a water layer at the silica surface allows a wide range of polar analytes to partition between the acetonitrile in the mobile phase and the water layer. This partitioning, along with interactions with the stationary phase, defines the HILIC retention mechanism.




For smaller polar compounds, these high-percentage acetonitrile conditions generate strong interactions between the analytes and the stationary phase, leading to excellent retention of small, highly polar, charged compounds. To fine-tune retention, simply increase the amount of water in the mobile phase. This will draw the charged, polar compounds into the mobile phase, effectively eluting them. When moving to a higher percent water mobile phase, the distinct HILIC partitioning retention will diminish and the stationary phase's ion-exchange characteristics will become the dominant retention mechanism (Figure 31).

**Figure 31:** Under mobile phase conditions with higher water content, ion-exchange mechanisms take over as the dominant mode of retention for the analysis of polar compounds.



# Well-Balanced Hybrid Retention Lets You Analyze More Compounds with a Single Method

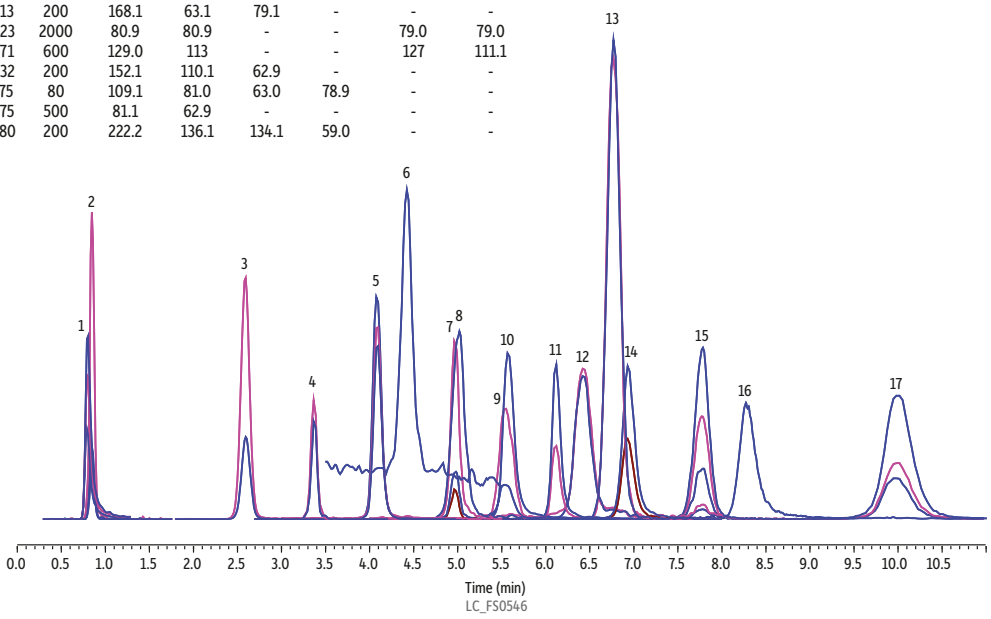
It is common for columns to specialize: to focus on a single type of interaction to the exclusion of others. This approach works well when the target analytes all share the same characteristics; however, polar compounds vary widely in their chemical traits. For the analysis of polar compounds, a specialized approach to column selection often means having to use multiple methods with different columns or conditions for each type of compound. As shown in the following examples, the hybrid phase chemistry of Raptor Polar X columns is a better alternative because the multimode retention profile allows a wide variety of target analytes to be analyzed in the same method.

## *QuPPe-Inspired List of Polar Contaminants*

The European **Q**uick **P**olar **P**esticides (QuPPe) method includes a range of polar analytes from anionic polar herbicides, such as glyphosate and related compounds, to a variety of oxychloro contaminants, including chlorate and perchlorate. As shown in Figure 32, the Raptor Polar X column retains and quickly separates this diverse mix with the last compound eluting around 10.5 minutes and a total run time of only 13 minutes. This separation is performed with simple unbuffered mobile phases, acidified with 0.5% formic acid to reduce peak broadening and tailing. The method demonstrated in Figure 32 was also able to separate compounds that have similar mass fragments, like AMPA from N-acetyl AMPA and fosetyl aluminum from phosphonic acid and phosphoric acid (a commonly observed matrix component and source of interference).

**Figure 32:** In this analysis of polar compounds, a diverse group of analytes can all be successfully separated in a single run with the uniquely balanced retention characteristics of the Raptor Polar X column.

| Peaks | $t_R$ (min) | Conc. (ng/mL) | Precursor Ion | Product Ion 1 | Product Ion 2 | Product Ion 3 | Precursor 2 | Product Ion 2 |
|---|---|---|---|---|---|---|---|---|
| 1. Aminomethylphosphonic acid (AMPA) | 0.805 | 200 | 110.1 | 79.1 | 63.1 | 81.1 | - | - |
| 2. Bialophos | 0.847 | 100 | 322.2 | 88.2 | 216.1 | 134.2 | - | - |
| 3. Perchlorate | 2.593 | 5 | 101.0 | 84.95 | - | - | 98.9 | 83 |
| 4. Glufosinate | 3.376 | 200 | 180.2 | 85.2 | 95.1 | - | - | - |
| 5. 3-(Methylphophinico) propionic acid (MPPA) | 4.076 | 100 | 151.0 | 63.0 | 107.1 | 133.2 | - | - |
| 6. Trifluoracetic acid (TFA) | 4.423 | 20 | 113.0 | 69.1 | 19.1 | - | - | - |
| 7. 2-Hydroxyethane phosphonic acid (HEPA) | 4.969 | 100 | 125.1 | 79.0 | 95.0 | 63 | - | - |
| 8. Difluoroacetic acid (DFA) | 5.018 | 200 | 95.0 | 51.1 | - | - | - | - |
| 9. Chlorate | 5.542 | 100 | 85.0 | 69.0 | - | - | 83.0 | 67.1 |
| 10. Ethephon | 5.564 | 200 | 143.1 | 107.2 | - | - | - | |
| 11. Glyphosate | 6.113 | 200 | 168.1 | 63.1 | 79.1 | - | - | - |
| 12. Bromide | 6.423 | 2000 | 80.9 | 80.9 | - | - | 79.0 | 79.0 |
| 13. Bromate | 6.771 | 600 | 129.0 | 113 | - | - | 127 | 111.1 |
| 14. N-acetyl AMPA | 6.932 | 200 | 152.1 | 110.1 | 62.9 | - | - | - |
| 15. Fosetyl aluminum | 7.775 | 80 | 109.1 | 81.0 | 63.0 | 78.9 | - | - |
| 16. Phosphonic acid | 8.275 | 500 | 81.1 | 62.9 | - | - | - | - |
| 17. N-acetyl glufosinate | 9.980 | 200 | 222.2 | 136.1 | 134.1 | 59.0 | - | - |




**Column:** Raptor Polar X (cat.# 9311A32); Dimensions: 30 mm x 2.1 mm ID, Particle Size: 2.7 µm; Pore Size: 90 Å; Temp.: 35 °C; **Sample:** Diluent: Water; Inj. Vol.: 1 µL; **Mobile Phase:** A: Water, 0.5% formic acid; B: Acetonitrile, 0.5% formic acid; Gradient (%B): 0.00 min (65% B), 5.0 min (10% B), 11.5 min (10% B), 11.51 min (65% B), 13 min (65% B); Flow: 0.5 mL/min; **Detector:** MS/MS; Ion Mode: ESI-; Mode: MRM; **Instrument:** UHPLC.

In addition to the Restek-developed method shown in Figure 32, Raptor Polar X analytical and guard columns were independently evaluated and included in the QuPPe method itself [1]. They are used in a method for the detection of a wide variety of polar pesticide by LC-MS/MS in negative ESI mode.

## *Underivatized Amino Acids*

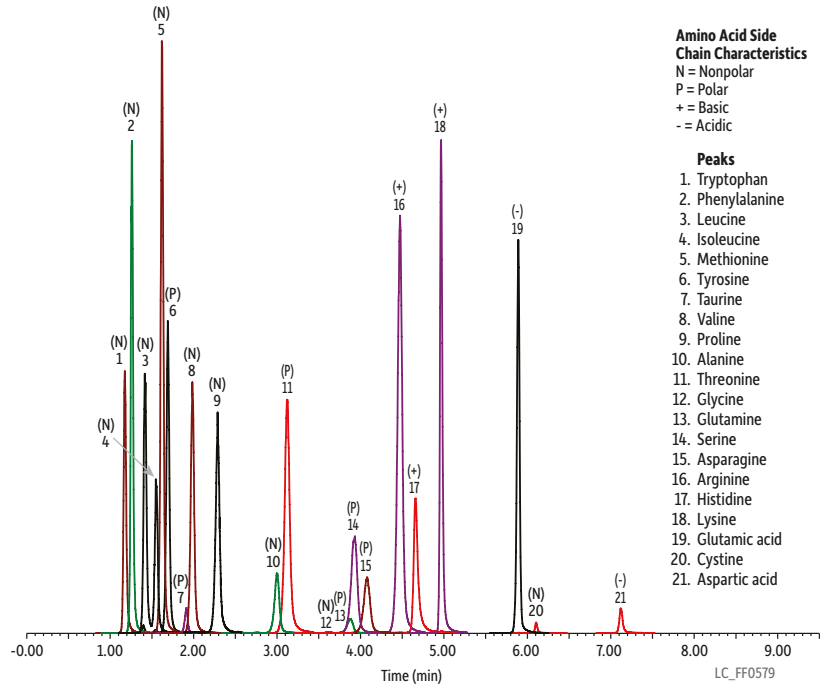
Amino acids are a diverse group of very polar compounds that are commonly analyzed with reversed-phase or ion-exchange chromatography using pre- or post-column derivatization. Direct analysis of underivatized amino acids is challenging due to limited retention and poor chromatographic performance. However, underivatized amino acids with nonpolar, polar, positively charged, and negatively charged side chains are all retained and easily separated in one method on a Raptor Polar X column. Figure 33 shows the analysis of 21 amino acids, including a taurine supplement, in a liquid baby formula matrix using a simple protein precipitation and direct analysis of the resulting extract.

## *Ultrashort- to Long-Chain PFAS*

The last illustration of the Raptor Polar X column's ability to maximize method productivity is an application that paves a path for future testing. Current LC-MS/MS methods for per- and polyfluoroalkyl substances (PFAS) analysis are focused on short-chain (C4-C6), long-chain (C8 and up), and alternative compounds and do not include emerging ultrashort-chain (C2 and C3) compounds. Typical reversed-phase methods for PFAS analysis do not have sufficient retention for ultrashort-chain PFAS; whereas, other methods based on anionic exchange often have too much retention, resulting in poor chromatographic performance. Because of the balanced retention mechanisms found in the Raptor Polar X column, ultrashort-chain PFAS and long chain PFAS can all be analyzed in a single 5-minute isocratic run (Figure 34).

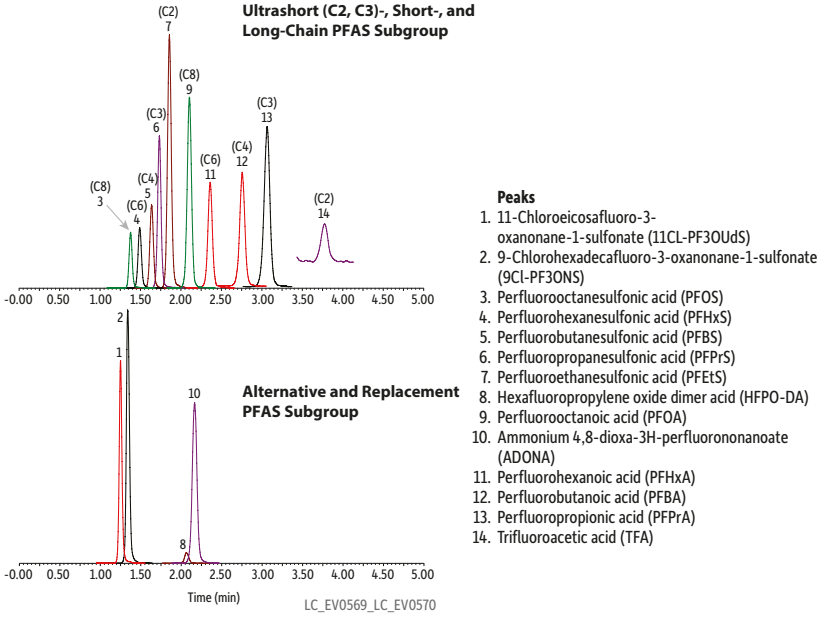
1. M. Anastassiades, A.-K. Wachtler, D. I. Kolberg, E. Eichhorn, H. Marks, A. Benkenstein, S. Zechmann; D. Mack, C. Wildgrube, A. Barth, I. Sigalov, S. Görlich, D. Dörk, G. Cerchia, Quick method for the analysis of highly polar pesticides in food involving extraction with acidified methanol and LC - or ICMS/MS Measurement - I. Food of Plant Origin (QuPPe-PO-Method)–Version 12 (published on EURL-SRM website on July 23, 2021). https://www.eurl-pesticides.eu/docs/public/tmplt_article.asp?LabID=200&CntID=1115&Theme_ID=1&Pdf=False&Lang=EN

**Figure 33:** Compounds with various polarities, such as these amino acids, can all be analyzed using the same method on a Raptor Polar X column.




**Column:** Raptor Polar X (cat.# 9311A12); Dimensions: 100 mm x 2.1 mm ID, Particle Size: 2.7 µm; Temp.: 30 °C; **Sample:** Diluent: 20:80 Water:acetonitrile, 0.01 N HCl; Conc.: Endogenous amino acids; Inj. Vol.: 5 µL; **Mobile Phase:** A: Water, 0.5% formic acid; B: 9:1 Acetonitrile:20 mM ammonium formate in water (pH 3.0) (The ammonium formate concentration is 20 mM relative to the total volume of mobile phase B. See preparation notes for instructions on diluting a 200 mM aqueous starting solution.); Gradient (%B): 0.00 min (88% B), 3.50 min (88% B), 8.00 min (30% B), 8.01 min (88% B), 10.0 min (88% B); Flow: 0.5 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument:** UHPLC; **Notes:** *Sample Preparation:* A 200 µL aliquot of protein hydrolysate formula (Similac ALIMENTUM) was mixed with 800 µL of acetonitrile and 10 µL of 1 N HCl. After centrifugation at 4000 rpm for 5 minutes, the supernatant was diluted 20-fold with 20:80 water:acetonitrile (0.01 N HCl) and injected for analysis. *Mobile Phase B Preparation:* To make 500 mL of mobile phase B, measure ~45 mL of water into a small beaker and add 1 mL of 10 M ammonium formate solution. Adjust pH to 3.0 by adding formic acid and then bring the volume to 50 mL with water. Combine this 50 mL ammonium formate solution (pH 3.0) with 450 mL of acetonitrile to complete the preparation.

**Figure 34:** Ultrashort-chain, legacy, and alternative PFAS analyzed with a single method on the novel Raptor Polar X stationary phase.




**Column:** Raptor Polar X (cat.# 9311A52); Dimensions: 50 mm x 2.1 mm ID, Particle Size: 2.7 µm; Temp.: 40 °C; **Sample:** Diluent: 50:50 Water:-methanol; Conc.: 400 ng/L; Inj. Vol.: 10 µL; **Mobile Phase:** A: Water, 10 mM ammonium formate, 0.05% formic acid; B: 60:40 Acetonitrile:methanol, 0.05% formic acid; Gradient (%B): 0.00 min (85% B),8.00 min (85% B); Flow: 0.5 mL/min; **Detector:** MS/MS; Ion Mode: ESI-; Mode: MRM; **Instrument:** UHPLC.


## Raptor Polar X LC Columns

- Reliably analyze a wide variety of polar analytes (acidic, basic, and neutral) without time-consuming derivatization or complex ion pairing.
- Switch between HILIC and ion-exchange retention modes with simple mobile phase changes and short equilibration times.
- 2.7 µm Raptor core-shell particles provide the speed of SPP with greater efficiency and capacity than 5 µm particles.
- Ideal for increasing sensitivity and selectivity in LC-MS analyses.

| ID | Length | qty. | cat.# |
|---|---|---|---|
| **2.7 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9311A32 |
| | 50 mm | ea. | 9311A52 |
| | 100 mm | ea. | 9311A12 |

## LC Passivation Solution

Methylenediphosphonic acid (Medronic Acid) (1984-15-2)

| Description | CAS # | Conc. in Solvent | cat.# |
|---|---|---|---|
| Methylenediphosphonic acid (Medronic Acid) | 1984-15-2 | 1,760 µg/mL, Methanol (HPLC grade)/Water (50:50), 1mL/ampul | 32475 (ea.) |

9311A0252

## Raptor EXP Guard Column Cartridges and EXP Direct Connect Holder

To help protect your investment and further extend the life of our already-rugged LC columns, Restek offers the patent-pending guard column hardware developed by Optimize Technologies. A Restek LC guard cartridge in an EXP direct connect holder is the ultimate in column protection, especially when using dilute-and-shoot or other limited sample preparation techniques.

| Description | Particle Size | Size | qty. | cat.# |
|---|---|---|---|---|
| Raptor Polar X EXP Guard Column Cartridge | 2.7 µm | 5 x 2.1 mm | 3-pk. | 9311A0252 |

Maximum cartridge pressure: 600 bar/8700 psi (2.7 µm)
Hybrid Ferrule U.S. Patent No. 8201854, EXP Holders U.S. Patent No. 8696902, EXP2 Wrench U.S. Patent No. D766055. Other U.S. and Foreign Patents Pending. The EXP, Free-Turn, and the Opti- prefix are registered trademarks of Optimize Technologies, Inc.

25808

| Description | qty. | cat.# |
|---|---|---|
| EXP Direct Connect Holder for EXP Guard Cartridges (includes hex-head fitting & 2 ferrules) | ea. | 25808 |

Maximum holder pressure: 20,000 psi (1,400 bar)
Hybrid Ferrule U.S. Patent No. 8201854, EXP Holders U.S. Patent No. 8696902, EXP2 Wrench U.S. Patent No. D766055. Other U.S. and Foreign Patents Pending. The EXP, Free-Turn, and the Opti- prefix are registered trademarks of Optimize Technologies, Inc.

25751

## EXP In-Line Holder

To help protect your investment and further extend the life of our already-rugged LC columns, Restek offers the patented guard column hardware developed by Optimize Technologies. A Restek LC guard cartridge in an EXP in-line holder is the ultimate in column protection, especially when using online trapping and preconcentration techniques.

| Description | qty. | cat.# |
|---|---|---|
| EXP In-Line Holder for EXP Guard Cartridges (includes hex-head fittings & 2 ferrules) | ea. | 25751 |

Intellectual Property: optimizetech.com/patents

# Notes:

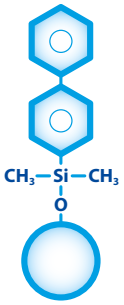
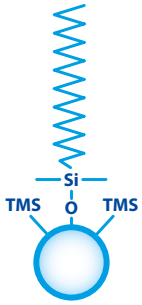
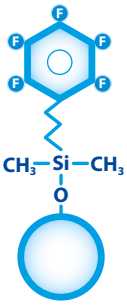
# Force Performance LC Columns—Apply Force to Your LC Methods

Restek's new Force performance LC columns give you the power to maximize instrument uptime, increase productivity, and transfer methods across your entire lab, from your trusted-but-aged HPLC to the cutting-edge UHPLC you just plumbed last week. This incredibly rugged and supremely consistent column line represents the culmination of our twenty-plus years in LC dedicated to continually improving our phase chemistries, our lot and lifetime testing, and our bonding and packing procedures.

- Long-lasting and reproducible—maintain stable retention times and peak shapes, even under the stress of elevated UHPLC pressures and rapid cycling.
- Fully scalable between 3 or 5 µm HPLC and 1.8 µm UHPLC—easily transfer and optimize methods without extensive calculations.
- Premium quality ensured by strict manufacturing and QC procedures—backed by the strength of our 100% Pure Satisfaction guarantee.

Meet today's workflow needs—and prepare for tomorrow's—by applying Force LC columns to all of your instrument platforms. Order yours today at **www.bgb-shop.com/restek-force**

## Available with Restek's most-popular and highly selective Biphenyl and FluoroPhenyl phases, as well as a general-purpose C18.

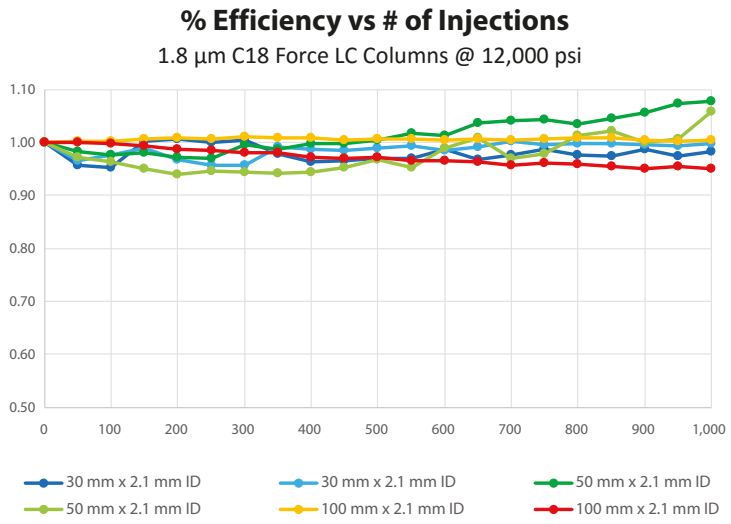
| | Biphenyl | C18 | FluoroPhenyl |
|---|---|---|---|
| |  |  |  |
| **USP Phase Code** | L11 | L1 | L43 |
| **Stationary Phase Category** | Phenyl | C18, octadecylsilane | Pentafluorophenyl propyl |
| **Ligand Type** | Biphenyl | End-capped C18 | Fluorophenyl |
| **Particle Size** | 1.8 µm, 3 µm, or 5 µm fully porous | 1.8 µm, 3 µm, or 5 µm fully porous | 1.8 µm, 3 µm, or 5 µm fully porous |
| **Pore Size** | 100 Å | 100 Å | 100 Å |
| **Surface Area** | 300 $m^2/g$ | 300 $m^2/g$ | 300 $m^2/g$ |
| **Carbon Load** | 15% | 20% | 10% |
| **End-Cap** | yes | yes | no |
| **pH Range** | 2.0 to 8.0 | 2.0 to 8.0 | 2.0 to 8.0 |
| **Maximum Temperature** | 80 °C | 80 °C | 80 °C |

# Apply Force to Your LC Methods...

## ... for Longer Column Life

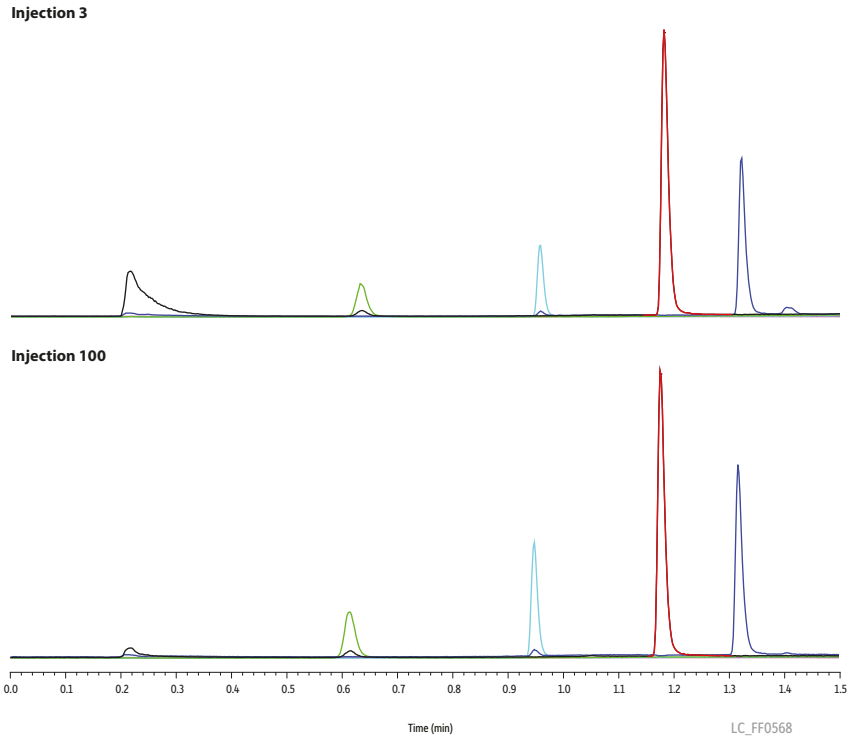
Elevated pressures and rapid pressure cycling put extreme stress on your LC column and shorten its life. And, when the demand to increase lab productivity meets the growing pressure limits of modern LCs and the faster cycle times of new methods, many competitor columns simply can't survive. Force LC columns from Restek are designed and manufactured to handle high-pressure, high-stress conditions. Whether you're running a 3 or 5 µm column on an older HPLC or a 1.8 µm on the newest UHPLC in your lab (Figures 35 and 36), your method will give you the same separation from one injection to the next when you trust your workflow to the extended lifetime of a Force LC column.

**Figure 35:** At over 10,000 psi, you may be used to seeing a drop in efficiency, but Force LC columns will take the pressure.




**1,000 injections and still going strong at high pressure.**

**Figure 36:** Rapid changes in pressure place more stress on a column than even high pressures can, but Force LC columns will handle repeated analyses with no change in separation.




**Stable retention times and peak shapes even with rapid cycling!**

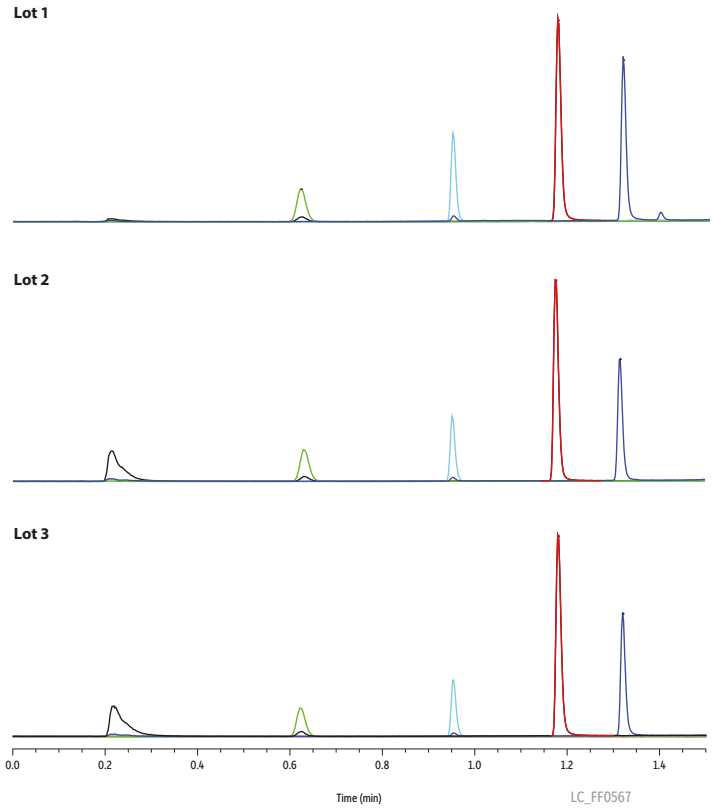
| | Peaks | SIR (m/z) |
|---|---|---|
| 1. | Daidzin | 417.2 |
| 2. | Genistin | 433.2 |
| 3. | Daidzein | 255.1 |
| 4. | Genistein | 271.1 |

**Column** Force C18 (cat.# 9634252), Dimensions:50 mm x 2.1 mm ID, Particle Size: 1.8 µm, Guard Column: UltraShield UHPLC precolumn filter 0.2 µm (cat.# 25810), Temp.: 50 °C; **Sample** Custom mix, Diluent: Water, Conc.: 500 ng/mL, Inj. Vol.: 2 µL; **Mobile Phase** A: Water + 0.1% formic acid, B: Acetonitrile + 0.1% formic acid; Gradient (%B): 0.00 min (15%), 1.50 min (95%), 1.51 min (15%), 3.00 min (15%); **Flow:** 0.6 mL/min; Max Pressure: 500 bar; **Detector:** MS; Interface: ESI+; **Instrument:** UHPLC.

# ... for Improved Reproducibility

Once you set up and validate a workflow, you move on to developing the next new method. You don't have time to repeatedly revisit past methods because your chosen column is giving you different results with each lot. Peak shapes and retention times need to be maintained over the lifetime of your workflow to ensure consistent results, reduce unplanned downtime, and preserve your own productivity. Force LC columns have the lot-to-lot reproducibility you need to rely on (Figure 37)—backed by Restek's strict QC system and our 100% Pure Satisfaction guarantee—so that you are free to focus your energy on what's next.

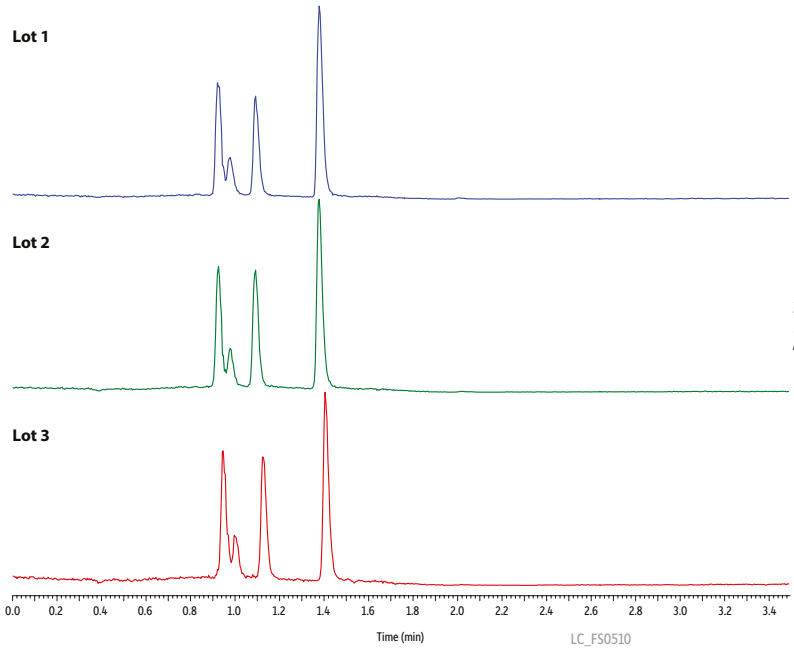
**Figure 37:** Whether a standard C18 or our FluoroPhenyl with its innovative new bonding process, each subsequent Force column you order will give you the same outstanding performance as the first.




**C18**

| | Peaks | SIR (m/z) |
|---|---|---|
| 1. | Daidzin | 417.2 |
| 2. | Genistin | 433.2 |
| 3. | Daidzein | 255.1 |
| 4. | Genistein | 271.1 |

**Column** Force C18 (cat.# 9634252), Dimensions: 50 mm x 2.1 mm ID, Particle Size: 1.8 µm, Temp.: 50 °C; **Sample** Custom mix, Diluent: Water, Conc.: 500 ng/mL, Inj. Vol.: 2 µL **Mobile Phase** A: Water + 0.1% formic acid, B: Acetonitrile + 0.1% formic acid; **Gradient (%B):** 0.00 min (15%), 1.50 min (95%), 1.51 min (15%), 3.00 min (15%); **Flow:** 0.6 mL/min; Max Pressure: 500 bar; **Detector:** MS; Interface: ESI+; **Instrument:** UHPLC.




**FluoroPhenyl**

| | Peaks | Precursor Ion | Product Ion | Product Ion |
|---|---|---|---|---|
| 1. | Nitrofurantoin | 239.1 | 121.9 | 95.0 |
| 2. | Nitrofurazone | 199.1 | 107.9 | 54.0 |
| 3. | Furazolidone | 226.2 | 95.0 | 67.0 |
| 4. | Nifuroxazide | 276.2 | 121.0 | 93.0 |

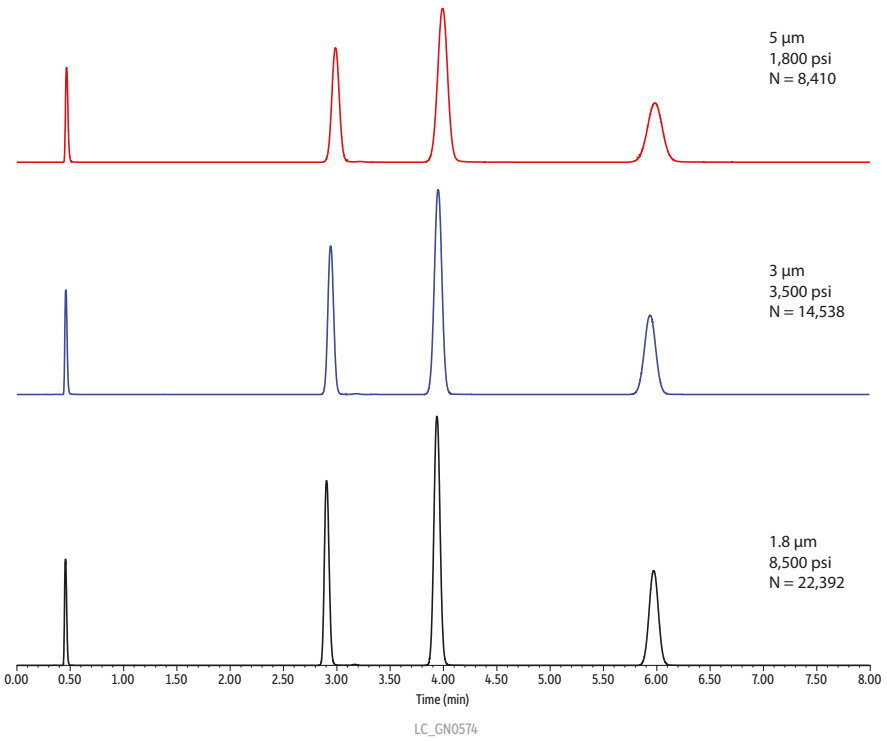
**Column** Force FluoroPhenyl (cat.# 9639252), Dimensions: 50 mm x 2.1 mm ID, Particle Size: 1.8 µm, Temp.: 40 °C; **Sample** Diluent: Water, Conc.: 50 ng/mL, Inj. Vol.: 5 µL; **Mobile Phase** A: 0.1% Acetic acid in water, B: Methanol; **Gradient (%B):** 0.00 min (30%), 1.50 min (95%), 1.51 min (30%), 3.50 min (30%); **Flow:** 0.4 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument:** UHPLC.

## ... for Complete Scalability

To accelerate time to market, analysts will often develop methods on fast UHPLC instruments using sub-2 µm particle columns. But, the methods must then be scaled to match the analysis time and pressure limitations of the traditional HPLCs and the 3 or 5 µm columns that will actually be doing the work. To make this transition easier and ensure consistent results, Force LC columns are available in three particle sizes that are manufactured on the same silica support with the same properties to reliably and easily provide the same separation on any instrument platform (Figure 38).

And, of course, it works both ways: fully scalable Force LC columns also make it easy to update conventional HPLC methods to UHPLC instruments to increase sample throughput and reduce solvent consumption and waste disposal costs.

**Figure 38:** With identical isocratic flow rates, 5, 3, and 1.8 µm Force columns still offer the same results. (If using a gradient, simple equations can help you adjust slope and time points.) Scaling doesn't get easier than that!



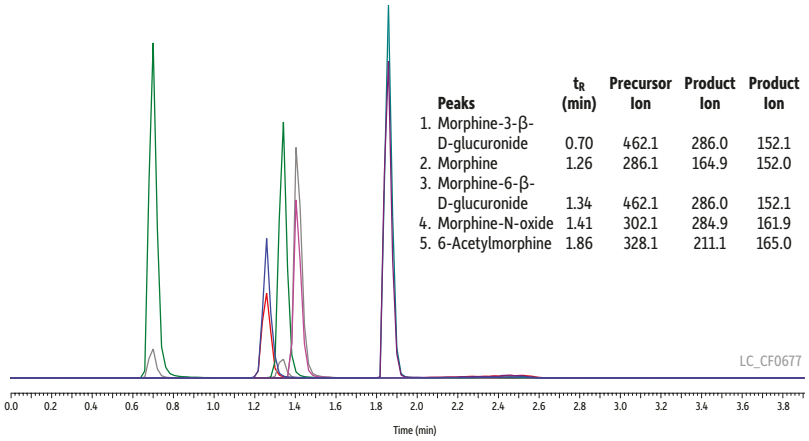

**Peak shape and plate number improve as particle size decreases—ideal for increased MS sensitivity!**

| Peaks | $t_R$ (min) |
|---|---|
| 1. Uracil | 0.456 |
| 2. Toluene | 2.904 |
| 3. Naphthalene | 3.939 |
| 4. Biphenyl | 5.971 |

**Column** Force, 100 x 2.1 mm (see above for particle sizes, Temp.: 30 °C; **Sample** UHPLC RP test mix, Diluent: Water:acetonitrile (50:50), Inj. Vol.: 2 µL; **Mobile Phase** A: Water, B: Acetonitrile; **Gradient (%B):** 0.00 min (55%), 8.00 min (55%); **Flow:** 0.4 mL/min; **Detector:** PDA @ 254 nm; **Instrument:** UHPLC.

# Force LC Columns at Work: *Time-Tested Restek Biphenyl Phase*

**Figure 39:** Whether for therapeutic drug monitoring or toxicology, Force Biphenyl columns were made for applications where fast, reliable identification of drugs and metabolites could be a matter of life and death.




| Peaks | $t_R$ (min) | Precursor Ion | Product Ion | Product Ion |
|---|---|---|---|---|
| 1. Morphine-3-β-D-glucuronide | 0.70 | 462.1 | 286.0 | 152.1 |
| 2. Morphine | 1.26 | 286.1 | 164.9 | 152.0 |
| 3. Morphine-6-β-D-glucuronide | 1.34 | 462.1 | 286.0 | 152.1 |
| 4. Morphine-N-oxide | 1.41 | 302.1 | 284.9 | 161.9 |
| 5. 6-Acetylmorphine | 1.86 | 328.1 | 211.1 | 165.0 |

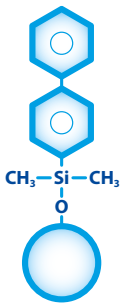
**Column** Force Biphenyl (cat.# 9629252), Dimensions: 50 mm x 2.1 mm ID, Particle Size: 1.8 µm, Temp.: 35 °C; **Sample** Diluent: 0.1% Formic acid in water, Conc.: 50 ng/mL, Inj. Vol.: 5 µL; **Mobile Phase** A: 0.1% Formic acid in water, B: 0.1% Formic acid in methanol; **Gradient (%B):** 0.00 min (15%), 0.50 min (15%), 2.00 min (70%), 2.01 min (15%), 4.00 min (15%); **Flow:** 0.5 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument:** UHPLC.

# Product Listing

## Force Biphenyl LC Columns (USP L11)

| ID | Length | qty. | cat.# |
|---|---|---|---|
| **1.8 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9629232 |
| | 50 mm | ea. | 9629252 |
| | 100 mm | ea. | 9629212 |
| 3.0 mm | 50 mm | ea. | 962925E |
| | 100 mm | ea. | 962921E |
| **3 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9629332 |
| | 50 mm | ea. | 9629352 |
| | 100 mm | ea. | 9629312 |
| | 150 mm | ea. | 9629362 |
| 3.0 mm | 50 mm | ea. | 962935E |
| | 100 mm | ea. | 962931E |
| | 150 mm | ea. | 962936E |
| 4.6 mm | 100 mm | ea. | 9629315 |
| | 150 mm | ea. | 9629365 |
| **5 µm Particles** | | | |
| 2.1 mm | 50 mm | ea. | 9629552 |
| | 100 mm | ea. | 9629512 |
| | 150 mm | ea. | 9629562 |
| 3.0 mm | 50 mm | ea. | 962955E |
| | 100 mm | ea. | 962951E |
| | 150 mm | ea. | 962956E |
| 4.6 mm | 100 mm | ea. | 9629515 |
| | 150 mm | ea. | 9629565 |
| | 250 mm | ea. | 9629575 |

Force EXP guard columns and UltraShield PreColumn filters, see page 56.




## The established choice for bioanalytical testing since 2005

- Separates compounds that other phenyl and C18 chemistries can't.
- Allows the use of simple, MS-friendly mobile phases.
- Restek's most popular LC phase.

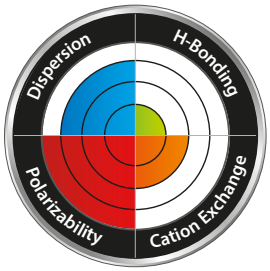
### Properties:

- Increased retention for dipolar, unsaturated, or conjugated solutes.
- Enhanced selectivity when used with methanolic mobile phase.
- Ideal for increasing sensitivity and selectivity in LC-MS analyses.

### Switch to a Biphenyl when:

- Limited selectivity is observed on a C18.
- You need to increase retention of hydrophilic aromatics.

### Column Interaction Profile:



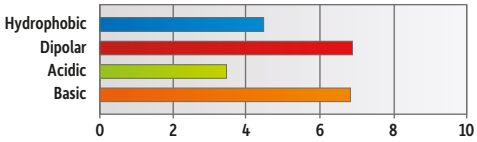

### Defining Solute Interactions:

- Polarizability
- Dispersion

### Complementary Solute Interaction:

- Cation exchange

### Solute Retention Profile:



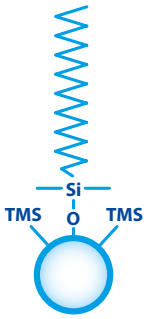

### Target Analyte Structures:

- Aromatic
- Dipolar

### Target Analyte Functionalities:

- Hydrophilic aromatics
- Strong dipoles
- Lewis acids
- Dipolar, unsaturated, or conjugated compounds
- Fused-ring compounds with electron withdrawing groups

# Force LC Columns at Work: *General-Purpose Restek C18 Phase*




## Force column dependability, scalability, and quality in a C18

- Wide pH range provides excellent data quality for many applications.
- Offers high hydrophobic retention.

### Properties:

- Compatible with moderately acidic to neutral mobile phases (pH 2–8).
- Excellent data quality in food, environmental, bioanalytical, and other applications.

### Switch to a C18 when:

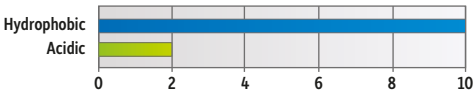
- You need a general-purpose column for reversed-phase chromatography.
- You need to increase retention of hydrophobic compounds.

### Column Interaction Profile:


### Defining Solute Interaction:

• Dispersion

### Solute Retention Profile:



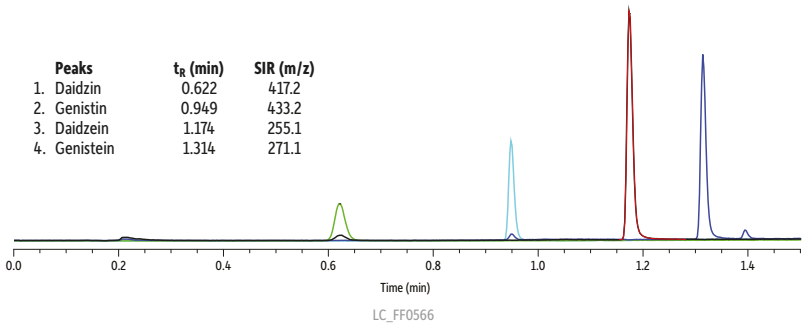

### Target Analyte Structure:

• Hydrocarbons

### Target Analyte Functionality:

• Hydrophobic compounds

**Figure 40:** A C18 is a common first choice for method developers, and as shown here for these isoflavones commonly found in nutraceuticals, a Force C18 column is the C18 to choose.




**Column** Force C18 (cat.# 9634252), Dimensions:50 mm x 2.1 mm ID, Particle Size: 1.8 µm, Temp.: 50 °C, **Sample** Custom mix, Diluent: Water, Inj. Vol.: 2 µL; **Mobile Phase** A: Water + 0.1% formic acid, B: Acetonitrile + 0.1% formic acid; **Gradient (%B):** 0.00 min (15%), 1.50 min (95%), 1.51 min (15%), 3.00 min (15%); **Flow:** 0.6 mL/min; Max Pressure: 500 bar; **Detector:** MS; Interface: ESI+; **Instrument:** UHPLC.

# Product Listing

### Force C18 LC Columns (USP L1)

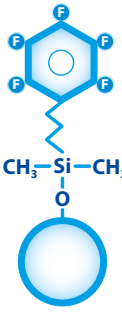
| ID | Length | qty. | cat.# |
|---|---|---|---|
| **1.8 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9634232 |
| | 50 mm | ea. | 9634252 |
| | 100 mm | ea. | 9634212 |
| 3.0 mm | 50 mm | ea. | 963425E |
| | 100 mm | ea. | 963421E |
| **3 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9634332 |
| | 50 mm | ea. | 9634352 |
| | 100 mm | ea. | 9634312 |
| | 150 mm | ea. | 9634362 |
| 3.0 mm | 50 mm | ea. | 963435E |
| | 100 mm | ea. | 963431E |
| | 150 mm | ea. | 963436E |
| 4.6 mm | 100 mm | ea. | 9634315 |
| | 150 mm | ea. | 9634365 |
| **5 µm Particles** | | | |
| 2.1 mm | 50 mm | ea. | 9634552 |
| | 100 mm | ea. | 9634512 |
| | 150 mm | ea. | 9634562 |
| 3.0 mm | 50 mm | ea. | 963455E |
| | 100 mm | ea. | 963451E |
| | 150 mm | ea. | 963456E |
| 4.6 mm | 100 mm | ea. | 9634515 |
| | 150 mm | ea. | 9634565 |
| | 250 mm | ea. | 9634575 |

# Product Listing

**Force FluoroPhenyl LC Columns** (USP L43)

| ID | Length | qty. | cat.# |
|---|---|---|---|
| **1.8 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9639232 |
| | 50 mm | ea. | 9639252 |
| | 100 mm | ea. | 9639212 |
| 3.0 mm | 50 mm | ea. | 963925E |
| | 100 mm | ea. | 963921E |
| **3 µm Particles** | | | |
| 2.1 mm | 30 mm | ea. | 9639332 |
| | 50 mm | ea. | 9639352 |
| | 100 mm | ea. | 9639312 |
| | 150 mm | ea. | 9639362 |
| 3.0 mm | 50 mm | ea. | 963935E |
| | 100 mm | ea. | 963931E |
| | 150 mm | ea. | 963936E |
| 4.6 mm | 100 mm | ea. | 9639315 |
| | 150 mm | ea. | 9639365 |
| **5 µm Particles** | | | |
| 2.1 mm | 50 mm | ea. | 9639552 |
| | 100 mm | ea. | 9639512 |
| | 150 mm | ea. | 9639562 |
| 3.0 mm | 50 mm | ea. | 963955E |
| | 100 mm | ea. | 963951E |
| | 150 mm | ea. | 963956E |
| 4.6 mm | 100 mm | ea. | 9639515 |
| | 150 mm | ea. | 9639565 |
| | 250 mm | ea. | 9639575 |

Force EXP guard columns and
UltraShield PreColumn filters, see page 56.




## Get the power of HILIC and RP modes in one LC column

- Capable of both reversed-phase and HILIC separations.
- Ideal for increasing sensitivity and selectivity in LC-MS analyses.
- Offers increased retention for charged bases.

### Properties:

- Capable of both reversed-phase and HILIC separations.
- Ideal for increasing sensitivity and selectivity in LC-MS analyses.
- Offers increased retention for charged bases.

### Switch to FluoroPhenyl when:

- Limited retention and selectivity are observed on a C18 for basic compounds.
- You need increased retention of hydrophilic compounds.

### Column Interaction Profile:

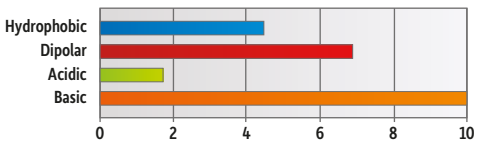

### Defining Solute Interactions:

- Cation exchange

### Complementary Solute Interaction:

- Polarizability
- Dispersion

### Solute Retention Profile:




### Target Analyte Structures:

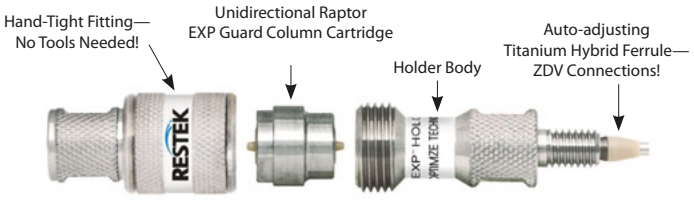
- Nitrogen

### Target Analyte Functionalities:

- Protonated amines
- Quaternary ammonium compounds
- Positively charged moieties
- Lewis bases

# Force LC Guard Columns

## Force EXP Guard Column Cartridges — *for 3 and 5 µm Force Columns*




Protect your investment and extend the life of our already-rugged LC columns and change guard column cartridges by hand without breaking fluid connections—no tools needed!

- Free-Turn architecture lets you change cartridges by hand without breaking inlet/outlet fluid connections—no tools needed.
- Patented titanium hybrid ferrules can be installed repeatedly without compromising high-pressure seal.
- Auto-adjusting design provides ZDV (zero dead volume) connection to any 10-32 female port.
- Guard column cartridges require EXP direct connect holder (cat.# 25808).
- Pair with EXP hand-tight fitting (cat.# 25937–25939) for tool-free installation.
- For use with 3 or 5 µm Force LC columns. For 1.8 µm Force columns, use a 0.2 µm UltraShield filter.

### Force EXP Guard Column Cartridges

| Description | Size | qty. | cat.# |
|---|---|---|---|
| Force Biphenyl EXP Guard Column Cartridge | 5 x 2.1 mm | 3-pk. | 962950252 |
| | 5 x 3.0 mm | 3-pk. | 962950253 |
| | 5 x 4.6 mm | 3-pk. | 962950250 |
| Force C18 EXP Guard Column Cartridge | 5 x 2.1 mm | 3-pk. | 963450252 |
| | 5 x 3.0 mm | 3-pk. | 963450253 |
| | 5 x 4.6 mm | 3-pk. | 963450250 |
| Force FluoroPhenyl EXP Guard Column Cartridge | 5 x 2.1 mm | 3-pk. | 963950252 |
| | 5 x 3.0 mm | 3-pk. | 963950253 |
| | 5 x 4.6 mm | 3-pk. | 963950250 |

Maximum cartridge pressure: 600 bar/8700 psi.
Intellectual Property: optimizetech.com/patents

### EXP Direct Connect Holder

| Description | qty. | cat.# |
|---|---|---|
| EXP Direct Connect Holder for EXP Guard Cartridges (includes hex-head fitting & 2 ferrules) | ea. | 25808 |

Intellectual Property: optimizetech.com/patents

### EXP In-Line Holder

| Description | qty. | cat.# |
|---|---|---|
| EXP In-Line Holder for EXP Guard Cartridges (includes hex-head fittings & 2 ferrules) | ea. | 25751 |

Intellectual Property: optimizetech.com/patents

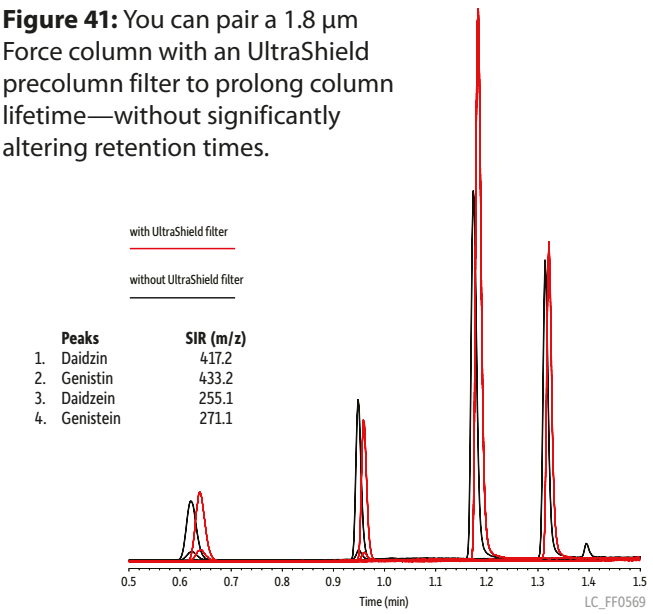
## UltraShield UHPLC PreColumn Filter — *for 1.8 µm Force Columns*

- Cost-effective protection for UHPLC systems.
- Reliable way to filter out particulates and extend column lifetime.
- Minimize extra column volume and maximize UHPLC sample throughput vs. guard cartridges.
- Connects easily to any column with Parker-style ports; not compatible with Waters columns.
- Leak tight to 15,000 psi (1,034 bar).
- 0.5 µm or 0.2 µm stainless-steel frit in a stainless-steel body with PEEK ferrule.

Specifications
Inlet/Outlet: Female/Male 10-32
Port Geometry: Parker ($^{1}/_{16}$ CPI)
Material: stainless steel, PEEK ferrule
Filter: 0.5 µm or 0.2 µm stainless steel
Pressure Rating: 15,000 psig (1,034 bar)
Wrench Flat: $^{5}/_{16}$"

Protecting your column is always recommended. Restek offers EXP guard column cartridges for our 3 and 5 µm Force LC columns, but for 1.8 µm columns, where the additional volume of a guard is an issue, reach for the UltraShield UHPLC PreColumn filter with 0.2 µm frit (Figure 41). Its minimal dead volume (1 µL) makes it recommended for UHPLC up to 15,000 psi.

**Figure 41:** You can pair a 1.8 µm Force column with an UltraShield precolumn filter to prolong column lifetime—without significantly altering retention times.




**Column** Force C18 (cat.# 9634252), Dimensions: 50 mm x 2.1 mm ID, Particle Size: 1.8 µm, Guard Column: UltraShield UHPLC precolumn filter 0.2 µm (cat.# 25810), Temp.: 50 °C; **Sample** Custom mix, Diluent: Water, Conc.: 500 ng/mL, Inj. Vol.: 2 µL; **Mobile Phase** A: Water + 0.1% formic acid, B: Acetonitrile + 0.1% formic acid;**Gradient (%B):** 0.00 min (15%), 1.50 min (95%), 1.51 min (15%), 3.00 min (15%); **Flow:** 0.6 mL/min; Max Pressure: 500 bar; **Detector:** MS; Interface: ESI+; **Instrument:** UHPLC.

### UltraShield UHPLC PreColumn Filter

| Porosity | qty. | cat.# |
|---|---|---|
| 0.5 µm frit | ea. | 24995 |
| 0.5 µm frit | 5-pk. | 24996 |
| 0.5 µm frit | 10-pk. | 24997 |
| 0.2 µm frit | ea. | 25809 |
| 0.2 µm frit | 5-pk. | 25810 |
| 0.2 µm frit | 10-pk. | 25811 |


25809

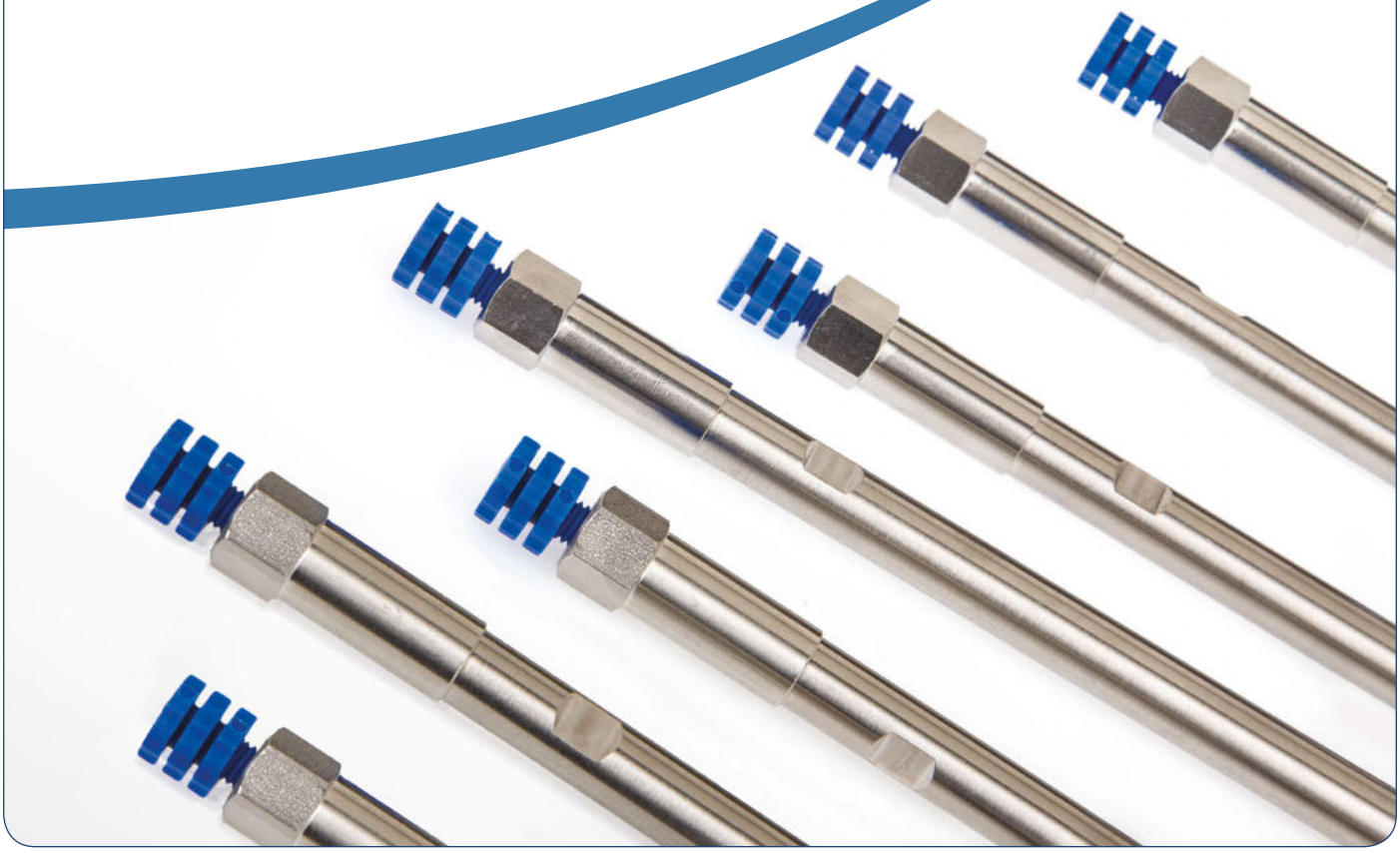
# Notes:

# Roc LC Columns

Get more of what you want, and less of what you don't, with the reliable cornerstone of your LC lab:

- Rugged, reproducible performance.
- Exceptional value.
- 5 phases covering 98% of USP methods.
- Minimal packaging for compact storage.

**www.bgb-shop.com/restek-roc**



# Roc LC Columns—The Reliable Cornerstone for Your LC Lab


- Conventional HPLC column built to be the cornerstone for your lab; pressure rated for any 400 bar HPLC system.
- Solid and reliable—delivers the peak shape, reproducibility, ruggedness, and performance you demand.
- Exceptional value for routine analyses and large-volume workflows—high-purity, fully porous silica backed by quality manufacturing features a variety of phases to fit most HPLC methods.
- Ideal for a wide range of applications from food to pharma; 5 phases cover 98% of USP methods.
- Newly designed minimal packaging for compact storage—download serial #-specific certificates of analysis at **www.restek.com/documentation**

**Get more of what you want, and less of what you don't, with Roc LC columns from Restek.**

Order today at **www.bgb-shop.com/restek-roc**

## Roc Family of LC Phases

| | C18 | C8 | Phenyl-Hexyl | Cyano | Silica |
|---|---|---|---|---|---|
| **USP Phase Code** | L1 | L7 | L11 | L10 | L3 |
| **Stationary Phase Category** | C18, octadecylsilane | C8, octylsilane | phenyl | cyano | bare silica |
| **Ligand Type** | monomeric C18 | monomeric C8 | phenyl-hexyl | cyanopropyl | n/a |
| **Particle Size** | 3 µm or 5 µm, spherical | 3 µm or 5 µm, spherical | 3 µm or 5 µm, spherical | 3 µm or 5 µm, spherical | 3 µm or 5 µm, spherical |
| **Pore Size** | 100 Å | 100 Å | 100 Å | 100 Å | 100 Å |
| **Surface Area** | 300 $m^2/g$ | 300 $m^2/g$ | 300 $m^2/g$ | 300 $m^2/g$ | 300 $m^2/g$ |
| **Carbon Load** | 20% | 12% | 15% | 8% | n/a |
| **End-Cap** | yes | yes | yes | yes | n/a |
| **pH Range** | 2.5 to 8.0 | 2.5 to 8.0 | 2.0 to 8.0 | 2.5 to 8.0 | 2.5 to 8.0 |
| **Maximum Temperature** | 80 °C | 80 °C | 80 °C | 80 °C | 80 °C |

# Roc On with These Dependable LC Columns

**Figure 42**: Over 1000 injections and Roc HPLC columns will still offer reliable performance, regardless of which dimension your method calls for.

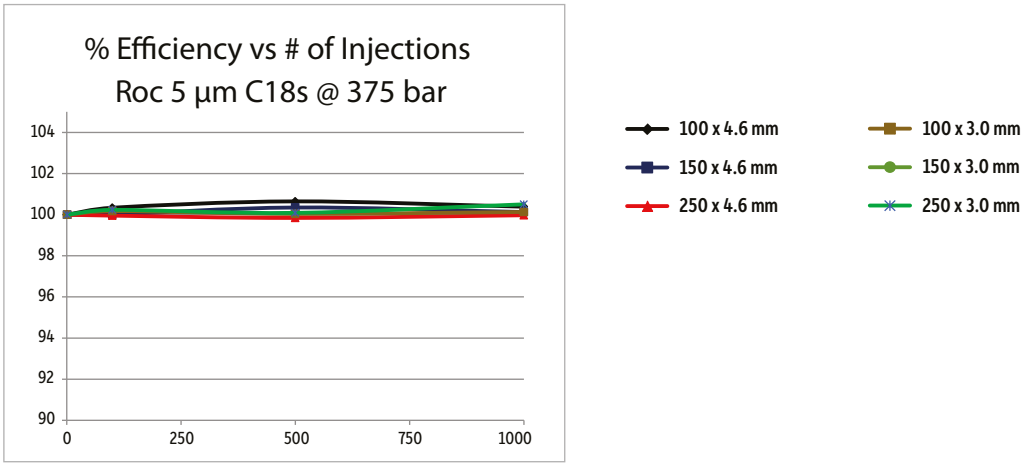
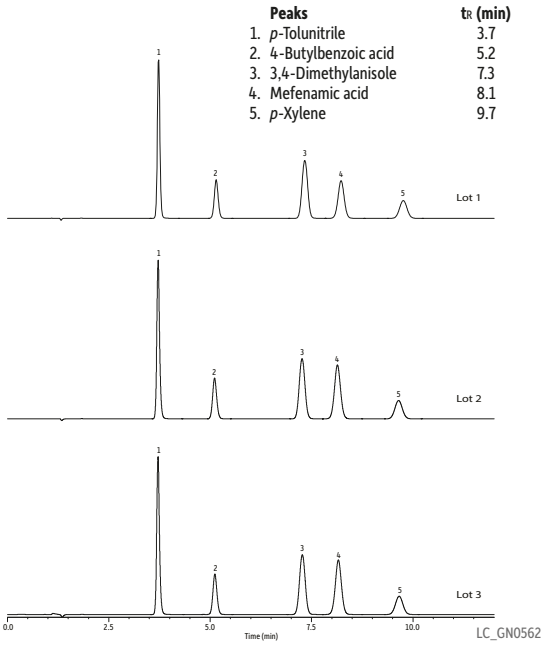


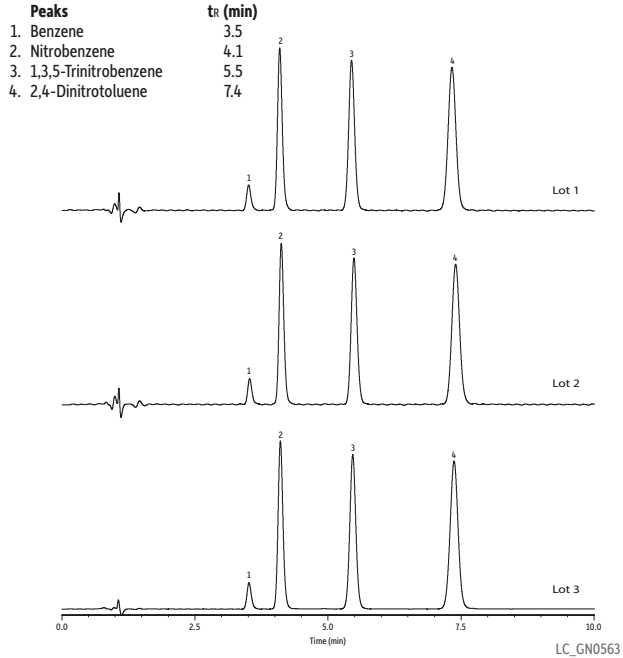

**Figure 43**: From one column to the next, one lot to the next, Roc columns provide results you can trust time and time again.

## Reversed Phase




**Column:** Roc C18 (cat.# 9534565); Dimensions: 150 mm x 4.6 mm ID; Particle Size: 5 µm; Pore Size: 100 Å; Temp.: 35 °C; Inj. Vol.: 5 µL; **Mobile Phase:** 0.05% Formic acid in water:0.05% formic acid in acetonitrile (40:60); Flow: 1.0 mL/min; **Detector:** UV/Vis @ 220 nm; Cell Temp: 35 °C; **Instrument:** HPLC.

## Normal Phase




**Column:** Roc Cyano (cat.# 953631E); Dimensions: 100 mm x 3.0 mm ID; Particle Size: 3 µm; Pore Size: 100 Å; Temp.: 40 °C; **Sample:** Inj. Vol.: 1 µL; **Mobile Phase:** Water:acetonitrile (80:20); Flow: 0.6 mL/min; **Detector:** UV/Vis @ 254 nm; Cell Temp.: 40 °C; **Instrument:** HPLC.

Find the entire Roc HPLC column line and order now at **www.bgb-shop.com/restek-roc**

# Roc LC Columns from Restek

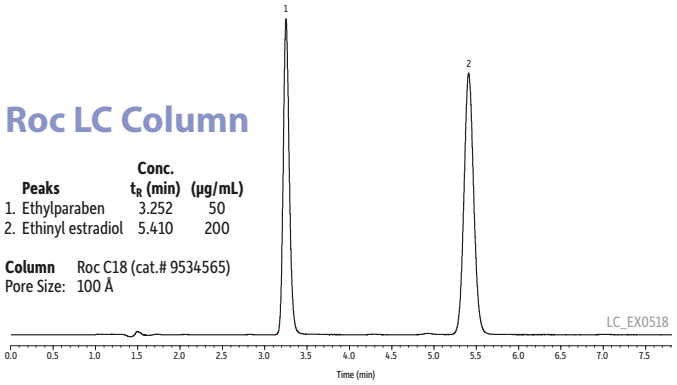
## Perform Better Than or Equal To Columns from Other Vendors

**Figure 44:** Count on Roc LC columns from Restek for outstanding chromatographic performance.

### Roc LC Column

| Peaks | $t_R$ (min) | Conc. (µg/mL) |
|---|---|---|
| 1. Ethylparaben | 3.252 | 50 |
| 2. Ethinyl estradiol | 5.410 | 200 |

**Column** Roc C18 (cat.# 9534565)
Pore Size: 100 Å

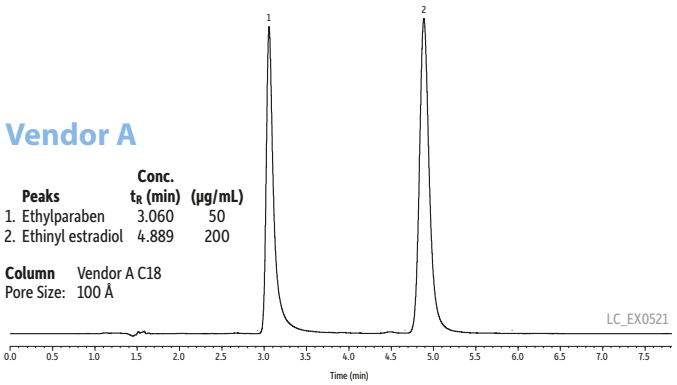



**Chromatographic conditions for Figure 38 (USP Monograph 38, Ethinyl Estradiol)**
All columns are C18 stationary phase (5 µm, 150 x 4.6 mm). Conditions are as follows. Mobile phase: water:acetonitrile (1:1); Flow rate: 1 mL/min; Injection volume: 25 µL; Instrument: HPLC with UV detector, 280 nm; Sample: 200 µg/mL ethinyl estradiol and 50 µg/mL ethylparaben in water:acetonitrile (1:1).

### Vendor A

| Peaks | $t_R$ (min) | Conc. (µg/mL) |
|---|---|---|
| 1. Ethylparaben | 3.060 | 50 |
| 2. Ethinyl estradiol | 4.889 | 200 |

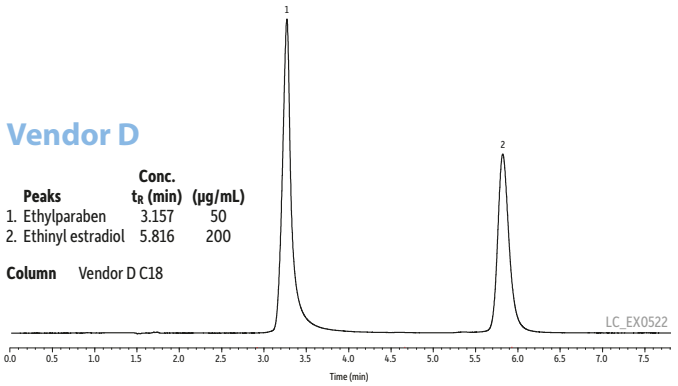
**Column** Vendor A C18
Pore Size: 100 Å




### Vendor D

| Peaks | $t_R$ (min) | Conc. (µg/mL) |
|---|---|---|
| 1. Ethylparaben | 3.157 | 50 |
| 2. Ethinyl estradiol | 5.816 | 200 |

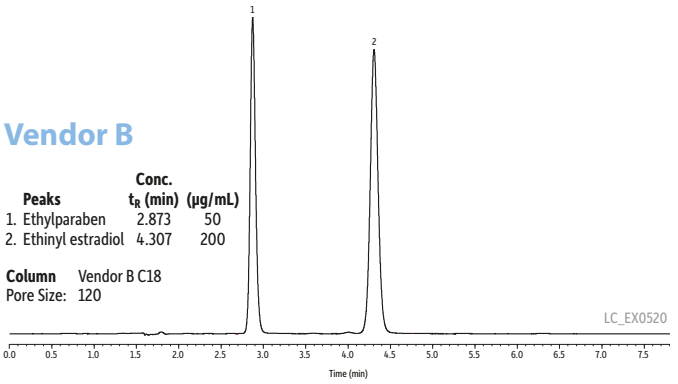
**Column** Vendor D C18




### Vendor B

| Peaks | $t_R$ (min) | Conc. (µg/mL) |
|---|---|---|
| 1. Ethylparaben | 2.873 | 50 |
| 2. Ethinyl estradiol | 4.307 | 200 |

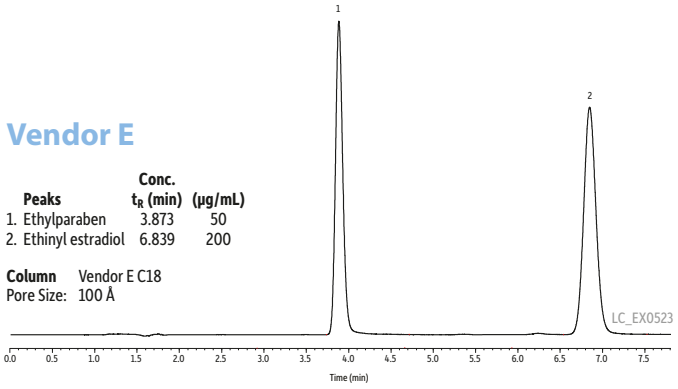
**Column** Vendor B C18
Pore Size: 120




### Vendor E

| Peaks | $t_R$ (min) | Conc. (µg/mL) |
|---|---|---|
| 1. Ethylparaben | 3.873 | 50 |
| 2. Ethinyl estradiol | 6.839 | 200 |

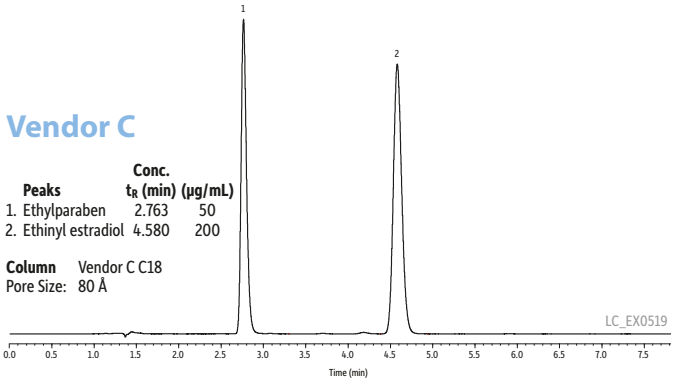
**Column** Vendor E C18
Pore Size: 100 Å



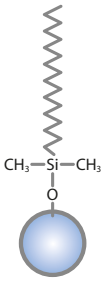

### Vendor C

| Peaks | $t_R$ (min) | Conc. (µg/mL) |
|---|---|---|
| 1. Ethylparaben | 2.763 | 50 |
| 2. Ethinyl estradiol | 4.580 | 200 |

**Column** Vendor C C18
Pore Size: 80 Å



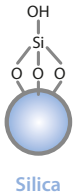
# Get Roc Solid Performance



C18

## Roc C18 HPLC Columns (USP L1)

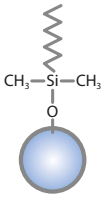
| ID | Length | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| **3 µm Particles** | | | | |
| 3.0 mm | 100 mm | ea. | | 953431E |
| | 150 mm | ea. | | 953436E |
| 4.6 mm | 100 mm | ea. | Grace 778487, 5129052 | 9534315 |
| | 150 mm | ea. | Grace 778560, 5129061 | 9534365 |
| **5 µm Particles** | | | | |
| 3.0 mm | 100 mm | ea. | | 953451E |
| | 150 mm | ea. | | 953456E |
| | 250 mm | ea. | | 953457E |
| 4.6 mm | 100 mm | ea. | | 9534515 |
| | 150 mm | ea. | Grace 778547, 5129056 | 9534565 |
| | 250 mm | ea. | Grace 778738, 5129080 | 9534575 |



Silica

## Roc Silica HPLC Columns (USP L3)

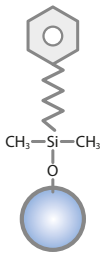
| ID | Length | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| **3 µm Particles** | | | | |
| 3.0 mm | 100 mm | ea. | | 953031E |
| | 150 mm | ea. | | 953036E |
| 4.6 mm | 100 mm | ea. | Grace 778383, 5129045 | 9530315 |
| | 150 mm | ea. | | 9530365 |
| **5 µm Particles** | | | | |
| 3.0 mm | 100 mm | ea. | | 953051E |
| | 150 mm | ea. | | 953056E |
| | 250 mm | ea. | | 953057E |
| 4.6 mm | 100 mm | ea. | | 9530515 |
| | 150 mm | ea. | Grace 778389, 5129046 | 9530565 |
| | 250 mm | ea. | Grace 778376, 5129042 | 9530575 |



C8

## Roc C8 HPLC Columns (USP L7)

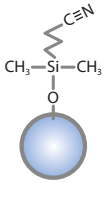
| ID | Length | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| **3 µm Particles** | | | | |
| 3.0 mm | 100 mm | ea. | | 953331E |
| | 150 mm | ea. | | 953336E |
| 4.6 mm | 100 mm | ea. | Grace 778563, 5129063 | 9533315 |
| | 150 mm | ea. | | 9533365 |
| **5 µm Particles** | | | | |
| 3.0 mm | 100 mm | ea. | | 953351E |
| | 150 mm | ea. | | 953356E |
| | 250 mm | ea. | | 953357E |
| 4.6 mm | 100 mm | ea. | | 9533515 |
| | 150 mm | ea. | | 9533565 |
| | 250 mm | ea. | Grace 287103, 5125975 | 9533575 |



Phenyl-Hexyl

## Roc Phenyl-Hexyl HPLC Columns (USP L11)

| ID | Length | qty. | cat.# |
|---|---|---|---|
| **3 µm Particles** | | | |
| 3.0 mm | 100 mm | ea. | 953531E |
| | 150 mm | ea. | 953536E |
| 4.6 mm | 100 mm | ea. | 9535315 |
| | 150 mm | ea. | 9535365 |
| **5 µm Particles** | | | |
| 3.0 mm | 100 mm | ea. | 953551E |
| | 150 mm | ea. | 953556E |
| | 250 mm | ea. | 953557E |
| 4.6 mm | 100 mm | ea. | 9535515 |
| | 150 mm | ea. | 9535565 |
| | 250 mm | ea. | 9535575 |



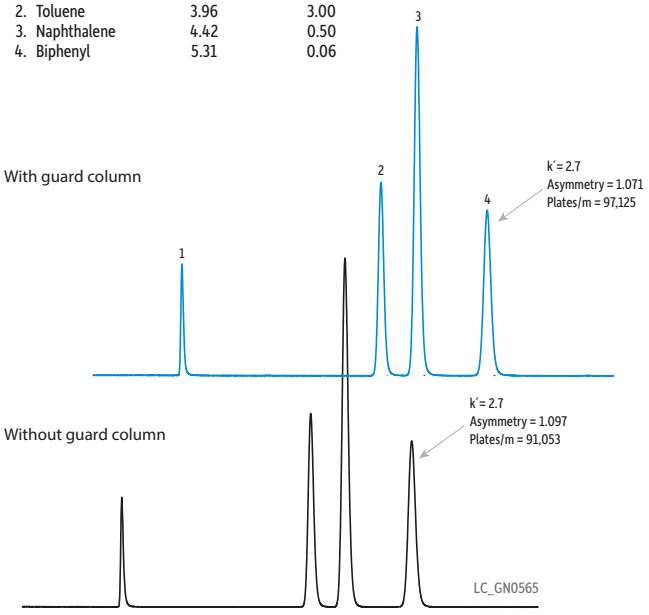
Cyano

## Roc Cyano HPLC Columns (USP L10)

| ID | Length | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| **3 µm Particles** | | | | |
| 3.0 mm | 100 mm | ea. | | 953631E |
| | 150 mm | ea. | | 953636E |
| 4.6 mm | 100 mm | ea. | | 9536315 |
| | 150 mm | ea. | Grace 287262, 5125997 | 9536365 |
| **5 µm Particles** | | | | |
| 3.0 mm | 100 mm | ea. | | 953651E |
| | 150 mm | ea. | | 953656E |
| | 250 mm | ea. | | 953657E |
| 4.6 mm | 100 mm | ea. | | 9536515 |
| | 150 mm | ea. | | 9536565 |
| | 250 mm | ea. | Grace 5129036, 7783611 | 9536575 |

**Figure 45:** Add a Roc LC guard to further extend the life of your analytical column without impacting your retention, peak shape, or efficiency.

| Peaks | $t_R$ (min) | Conc. (mg/mL) |
|---|---|---|
| 1. Uracil | 1.44 | 0.02 |
| 2. Toluene | 3.96 | 3.00 |
| 3. Naphthalene | 4.42 | 0.50 |
| 4. Biphenyl | 5.31 | 0.06 |




**Column:** Roc C8 (cat.# 9533565); Dimensions: 150 mm x 4.6 mm ID; Particle Size: 5 µm; Pore Size: 100 Å; **Guard Column:** Roc C8 10 mm, 4.0 mm ID, 5 µm (cat.# 953350210); Temp.: 30 °C; **Sample:** Custom mix; Diluent: 50:50 Acetonitrile:water; Inj. Vol.: 2 µL; **Mobile Phase:** A: Water, B: Acetonitrile; Gradient (%B): 0.00 min (70%), 8.00 min (70%); Flow: 1.0 mL/min; **Detector:** UV @ 254 nm; **Instrument:** HPLC.

## Roc LC Guard Column Cartridges

- Protect your Roc LC columns with minimal effect on retention, peak shape, or efficiency.
- Guard column cartridges require Roc guard column holder (cat.# 25812)

| Description | Size | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Roc Silica Guard Cartridge | 10 x 4.0 mm | 3-pk. | Grace 96401, 5130548 | 953050210 |
| Roc C8 Guard Cartridge | 10 x 4.0 mm | 3-pk. | Grace 96404, 5130551 | 953350210 |
| Roc C18 Guard Cartridge | 10 x 4.0 mm | 3-pk. | Grace 96403, 5130550 | 953450210 |
| Roc Phenyl-Hexyl Guard Cartridge | 10 x 4.0 mm | 3-pk. | | 953550210 |
| Roc Cyano Guard Cartridge | 10 x 4.0 mm | 3-pk. | Grace 96408, 5130555 | 953650210 |

## Roc LC Guard Column Holder

- Protect your Roc LC columns with minimal effect on retention, peak shape, or efficiency.
- Requires separate guard column cartridges (available from Restek).

| Description | qty. | cat.# |
|---|---|---|
| Roc LC Guard Column Holder for 10 x 4.0 mm Roc Guard Cartridges | ea. | 25812 |

## Replacement PEEK Ferrules for Roc LC Guard Column Holder

Replacement PEEK ferrules for use with the Roc LC guard column holder (sold separately).

| Description | qty. | cat.# |
|---|---|---|
| Replacement PEEK Ferrules for Roc LC Guard Column Holder | 3-pk. | 26391 |

Find the entire Roc HPLC column line and order now at **www.bgb-shop.com/restek-roc**

# The Allure Acrylamide Column - A Better Solution for Acrylamide Analysis

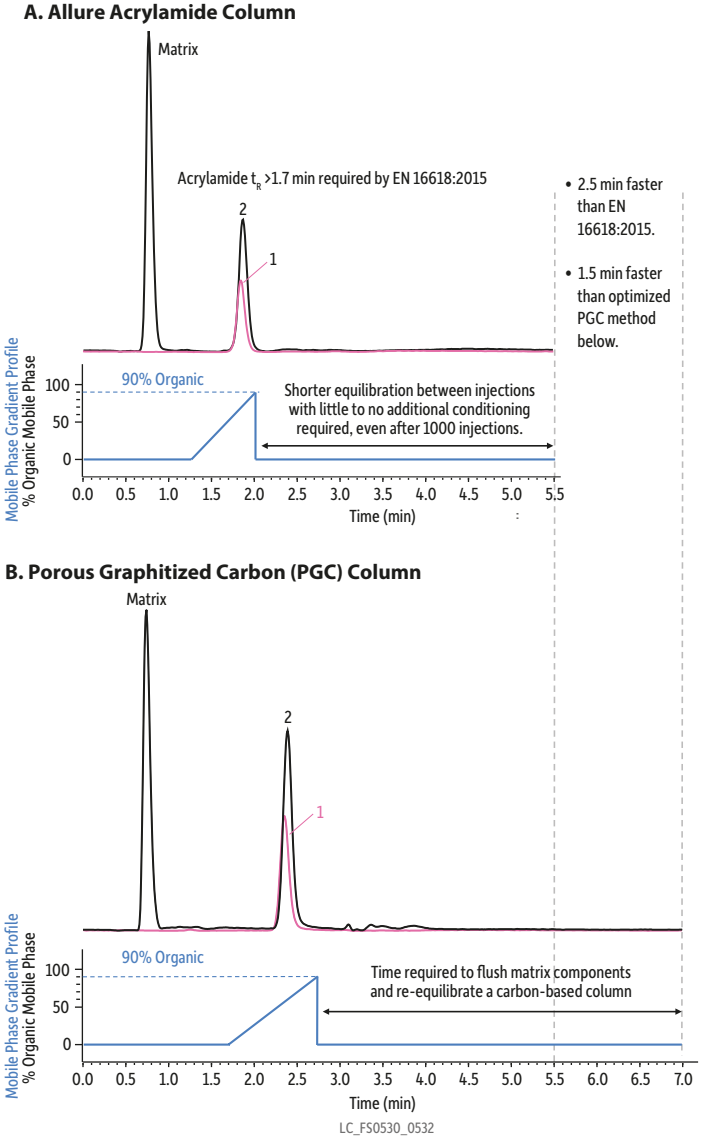
The analysis of acrylamide in food or drinking water is challenging because of sample complexity, matrix interferences, and the need to detect extremely low concentrations. Allure Acrylamide columns were developed specifically for this purpose and provide excellent retention characteristics for separating acrylamide from matrix components. Manufactured with small pore particles and a proprietary bonded stationary phase, they have a unique affinity for small polar molecules such as acrylamide.

In addition to Restek's specialized column chemistry, our application-specific formats, guard columns, and reference standards make it easier to ensure data quality, meet method requirements, and significantly increase sample throughput for acrylamide analysis.

***Two Column Formats for Optimal Application-Specific Performance***

- **50 x 2.1 mm** for faster analysis times and fewer column changes for food and drinking water with SPE sample prep.
- **150 x 3.0 mm** for using large volume injection to meet ppt-level sensitivity requirements for drinking water.

**Figure 46:** Labs can increase sample throughput using an Allure Acrylamide column because much less equilibration time is needed compared to a PGC column, even with a complex matrix like potato chips.




| Peaks | Conc. (ng/mL) | Precursor | Product |
|---|---|---|---|
| 1. Acrylamide-d3 (IS) | 200 | 75.1 | 58.1 |
| 2. Acrylamide | Endogenous | 72.1 | 55.1 |

| | |
|---|---|
| **Column** | See notes |
| Temp.: | 22 °C |
| **Sample** | Acrylamide-d3 |
| Diluent: | Water |
| Inj. Vol.: | 10 µL |
| **Mobile Phase** | A. 0.001% Formic acid in water, B. 0.001% formic acid in acetonitrile |
| **Detector** | MS/MS |
| Ion Mode: | ESI+ |
| Mode: | MRM |
| **Instrument** | HPLC |
| **Notes** | Extracted per EN 16618:2015 |

Weighed 2.0 g of homogenized potato chips into a 50 mL centrifuge tube. Added 40 mL water followed by the addition of internal standard. Shook by hand for 30 sec, by vortexer for 15 sec, and then on a mechanical shaker for 60 min set to maximum sample extraction agitation. Centrifuged in a refrigerated centrifuge at 10 °C, 3600 x g for 20 min. Removed the aqueous layer after centrifugation, taking care to avoid the top, fatty layer, or the solids at the bottom of the tube. Placed the aqueous extract in an appropriate container.

For cleanup, the first SPE cartridge (multimode SPE column with nonpolar, SAX, and SCX properties, 1000 mg/6 mL) was conditioned with 3 mL methanol and x2, 6 mL aliquots of water. Passed 10 mL of the aqueous extract through the column and collected eluate. For the next cleanup step, the second SPE cartridge (crosslinked polystyrene/poly-DVB SPE column, 500 mg/6 mL) was conditioned with 5 mL methanol and 5 mL water. Passed the eluate from the previous step entirely through the column. Rinsed the loaded cartridge once with 4 mL water and discarded the rinsing solvent. Eluted the acrylamide with 2 mL of 60% methanol in water. Collected the sample and transferred into an evaporation tube. Placed the tube in an evaporator at a temperature no higher than 40 °C to remove the methanol. Evaporated until the final volume was 0.5–0.8 mL using a gentle flow of nitrogen. Transferred the final sample into an autosampler vial and analyzed by LC-MS/MS.

**Column Details**
A. *Allure Acrylamide column:* 5 µm, 50 mm x 2.1 mm ID analytical column (cat.# 9167552) with 5 µm, 10 mm x 2.1 mm ID guard cartridge (cat.# 916750212).
B. *Porous graphitized carbon column:* 5 µm, 50 mm x 2.1 mm ID analytical column with 5 µm, 10 mm x 2.1 mm ID guard cartridge.

**Mobile Phase Gradients (%B)**
A. *Allure Acrylamide column:* 0.00 min (0%), 1.00 min (0%), 2.00 min (90%), 2.01 min (0%), 5.50 min (0%), flow = 0.4 mL/min.
B. *Porous graphitized carbon column:* 0.00 min (0%), 1.70 min (0%), 2.70 min (90%), 2.71 min (0%), 7.00 min (0%), flow = 0.4 mL/min.

# Improve Acrylamide Analysis with a Long-Lasting LC Column and a Cost-Effective Internal Standard

## Allure Acrylamide LC Column

The Allure Acrylamide LC column provides targeted acrylamide retention as well as improved isolation from matrix interferences to aid in low-level detection and quantitation in food or drinking water matrices. The Allure Acrylamide column is stable enough to last for hundreds of injections of difficult food matrices, such as potato chips/crisps or coffee, without significant loss of acrylamide peak shape or retention. The 150 x 3.0 mm column format accommodates large volume injections, which are used to reach the extremely low limits required for acrylamide in drinking water. The proprietary ligand and bonding process result in much greater stability and longer lifetime compared to carbon-based stationary phases, and an embedded polar group ensures compatibility with 100% aqueous mobile phases. The Allure Acrylamide column is ideal for analyzing acrylamide in drinking water, especially if large volume injections are used to increase sensitivity, and it also provides dependable performance for EN 16618:2015 and U.S. FDA draft procedures for food applications.

| ID | Length | qty. | cat.# |
|---|---|---|---|
| **5 µm Particles** | | | |
| 2.1 mm | 50 mm | ea. | 9167552 |
| 3.0 mm | 150 mm | ea. | 916756E |

## Allure Guard Cartridges

| Description | Particle Size | Size | qty. | cat.# |
|---|---|---|---|---|
| Allure Acrylamide Guard Cartridge | 5 µm | 10 x 2.1 mm | 3-pk. | 916750212 |

## Replacement Cap Frit Filters for Trident Guard Cartridges

Replacement guard cartridges can cost as much as an analytical column, so why not protect them, too? The removable cap frit filter in a Trident direct helps prevent clogged cartridges to extend the life of your column, your cartridge, and your budget.

- Use 2 mm cap frit filters with 1.0–2.1 mm ID analytical columns.
- Use 4 mm cap frit filters with 3.0–4.6 mm ID analytical columns.

| Description | ID | Porosity | qty. | cat.# |
|---|---|---|---|---|
| Replacement Cap Frit Filters | 4 mm | 2.0 µm | 5-pk. | 25022 |
| | 4 mm | 0.5 µm | 5-pk. | 25023 |
| | 2 mm | 2.0 µm | 5-pk. | 25057 |
| | 2 mm | 0.5 µm | 5-pk. | 25990 |

25023

## Replacement Trident PEEK Ferrules

| Description | qty. | cat.# |
|---|---|---|
| Replacement Trident PEEK Ferrules | 10-pk. | 27476 |


27470

## Trident LC Column Protection System

Redesigned to be more rugged and easier to use!

- Match your needs with three levels of protection: filter only, cartridge only, or filter and cartridge.
- Durable metal tip with replaceable PEEK ferrule means easy installation onto column without tools.
- Improved thread design and materials create an optimal seal that releases and reseals easily, allowing multiple installations without galling and binding.
- Easy-to-remove cap frit simplifies filter replacement.
- Direct connection eliminates tubing and connectors that increase system volume and leak potential.
- Low-dead-volume design has negligible effect on chromatography.

| Description | Type | Includes | qty. | cat.# |
|---|---|---|---|---|
| Trident LC Column Protection System | Level 1: Filter Holder Only | filter holder; cap frit filter (4 mm, 2.0 µm); and PEEK ferrule | ea. | 27470 |
| | Level 1: Filter Holder Only | filter holder; cap frit filter (4 mm, 2.0 µm); and PEEK ferrule | 4-pk. | 27471 |
| | Level 2: Cartridge Holder Only | cartridge holder and PEEK ferrule | ea. | 27472 |
| | Level 2: Cartridge Holder Only | cartridge holder and PEEK ferrule | 4-pk. | 27473 |
| | Level 3: Filter Holder and Cartridge Holder Power Pack | filter holder; cap frit filter (4 mm, 2.0 µm); cartridge holder; and PEEK ferrule | ea. | 27474 |
| | Level 3: Filter Holder and Cartridge Holder Power Pack | filter holder; cap frit filter (4 mm, 2.0 µm); cartridge holder; and PEEK ferrule | 4-pk. | 27475 |

* Fittings on all LC columns have 10-32 threads; however, seat depth varies. An improper seat will yield a poor connection and may affect chromatography. While all Restek LC columns will provide a zero-dead-volume connection when used with a properly installed Trident LC column protection system, analysts should consult the manufacturer for non-Restek column connections. A detailed discussion about port configurations can be found at https://www.restek.com/Pages/faq_lc

## Acrylamide

| Description | CAS # | Conc. in Solvent | CRM? | Max Shelf Life on Ship Date | Min Shelf Life on Ship Date | Shipping Conditions | Storage Temp. | cat.# |
|---|---|---|---|---|---|---|---|---|
| Acrylamide | 79-06-1 | 1000 µg/mL in methanol, 1 mL/ampul | Yes | 24 months | 6 months | Ambient | 0 °C or colder | 30494 (ea.) |

## Acrylamide-d3

Deuterium-labeled acrylamide is an excellent and cost-effective isotopically labeled internal standard choice for the analysis of acrylamide in food or environmental samples.

| Description | CAS # | Conc. in Solvent | CRM? | Max Shelf Life on Ship Date | Min Shelf Life on Ship Date | Shipping Conditions | Storage Temp. | cat.# |
|---|---|---|---|---|---|---|---|---|
| Acrylamide-d3 | 122775-19-3 | 500 µg/mL in acetonitrile, 5 mL/ampul | Yes | 24 months | 6 months | Ambient | 0 °C or colder | 30153 (ea.) |

# Notes:

# *Keep Your Lab Flowing:*

## Routine Maintenance Supplies for

# Agilent LCs

## Replace Every Month

26431

26392

### Bluestem Glass Solvent Filter

- Restek Bluestem glass solvent filter provides clean mobile phase to extend the life of columns and pump seals.
- 15 µm borosilicate glass frit sits lower than conventional glass filters to draw more mobile phase from each bottle.
- Blue filter stem allows instant visual confirmation of upright filter orientation.
- Connects to standard ⅛" OD (3.2 mm) PTFE tubing using your existing frit adaptor. For best performance, we recommend using Restek's frit adapter (sold separately as cat.# 26392).

Prevent the particulates and microbial growth in your LC solvents from entering your instrument with the new Restek Bluestem glass solvent filter.

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| Frit Adaptor, PTFE | 4-pk. | Agilent 5062-8517 | 26392 |
| Glass Solvent Filter, 15 µm frit | ea. | Agilent 5041-2168 | 26431 |

## Replace Every 3 Months

### Piston Seals

for Agilent HPLC Systems

Piston seals wear out over time and Restek is your best option for economical replacements. Choose our graphite-filled PTFE seals, which are best for organic solvents.

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Piston Seals, PTFE w/Graphite, Black | 1050, 1100, 1200 | 2-pk. | Agilent 5063-6589 | 22482 |
| | 1050, 1100, 1200 | 10-pk. | Agilent 5063-6589 | 22483 |
| Pump Block Piston Seal | 1050, 1100, 1200, 1220, 1260 | 2-pk. | Agilent 0905-1420 | 25918 |

### Rotor Seals

for Agilent HPLC Systems

| Description | Material | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Rotor Seal, 400 Bar, 2-Groove | | 1100, 1200 | ea. | Agilent 0100-1853 | 25275 |
| Rotor Seal (Rheodyne-Style), 3-Groove | | 1090 | ea. | Agilent 1535-4048 | 25349 |
| Rotor Seal, 2 Groove | PEEK | 1260 Infinity II | ea. | Agilent 5068-0209 | 25737 NEW! |
| Rotor Seal, 1200 Bar, 2-Position, 6-Port | | 1290 | ea. | Agilent 5068-0007 | 25768 |
| Rotor Seal (for binary pump purge valve head) | | 1290 | ea. | Agilent 5068-0005 | 25782 |

## PTFE Frits

for Agilent HPLC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Frits, PTFE | Agilent | 1050, 1100, 1200, 1220, 1260, 1290 | 5-pk. | Agilent 01018-22707 | 25466 |

## Outlet Cap & Gold Seal Assembly

for Agilent HPLC Systems

Caps and seals shipped unassembled.

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Outlet Cap & Gold Seal Assembly | Agilent | 1050, 1100, 1200, 1220, 1260, 1290 | 2-pk. | Agilent 5067-4728 | 25890 |

Note: Not compatible for use with Outlet Cap and Gold Seal Assembly Tool (cat.# 24989).

# Replace Every 6 Months

## Active Inlet Cartridge

for Agilent HPLC Systems

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Active Inlet Cartridge, 600 Bar | 1260, G1310B, G1311B, G1312B | ea. | Agilent G1312-60020 | 25766 |
| Active Inlet Cartridge, 400 Bar | 1050, 1100, 1200 | ea. | Agilent 5062-8562 | 26393 |

26393

## Outlet Check Valve

for Agilent HPLC Systems

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Outlet Check Valve | 1100, 1200, 1220, 1260 | ea. | Agilent G1312-60067 | 25765 |

25765

## Passive Inlet Valve

for Agilent 1220, 1260 LC Systems

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Passive Inlet Valve | 1100, 1200, 1220, 1260 | ea. | Agilent G1312-60066 | 25763 |

25763

## Inlet Valve

for Agilent HPLC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Inlet Valve | Agilent | 1290 | ea. | Agilent G4220-60022 | 25835 |

25835

## Seal Wash Kit, Binary Pump

for Agilent HPLC Systems

| Description | Model # | qty. | cat.# |
|---|---|---|---|
| Seal Wash Kit, Binary Pump (4 seals, 4 gaskets) | 1050, 1100, 1200 | kit | 25268 |

25268

25278

## Needle Assembly

for Agilent HPLC Systems

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Needle Assembly | 1100, 1200 | ea. | Agilent G1313-87201 | 25278 |
| Needle Assembly, 900 µL | 1100, 1200 | ea. | Agilent G1313-87202 | 25916 |

Note: Syringes and needles sold by Restek are intended for scientific research and laboratory use only and are not intended for human *in vivo* or animal use.

## Needle Seat Assembly

for Agilent HPLC Systems

| Description | Material | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Needle Seat, 0.12 mm ID, 0.8 mm OD, 600 bar | PEEK | 1200, G1367D/E | ea. | Agilent G1367-87012 | 25738 NEW! |
| Needle Seat, PEEK | | 1100, 1200, 1220, 1260, G1313A, G1392A/B | ea. | Agilent G1329-87017 | 25767 |
| Needle Seat, 0.17 mm ID, 0.8 mm OD, 600 bar | | 1260 | ea. | Agilent G1367-87017 | 25833 |
| Needle Seat Assembly, 0.12 mm ID | | 1290 | ea. | Agilent G4226-87012 | 25834 |

25750

## Needle Assembly

for Agilent 1260 and 1290 HPLC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Needle Assembly | Agilent | 1260, 1290 | ea. | Agilent G4226-87201 | 25750 |

# Replace Every 12 Months

25273

## Sapphire Pistons

for Agilent HPLC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Plunger Assembly | Agilent | 1050, 1100, 1200, 1220, 1260 | ea. | Agilent 5063-6586 | 25273 |

26424

## Stator Face Assembly

for Agilent HPLC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Stator Face Assembly | Agilent | 1100, 1200 | ea. | Agilent 0100-1851 | 26424 |

25917

## Isolation Seal

for Agilent 1100, 1200 HPLC Systems

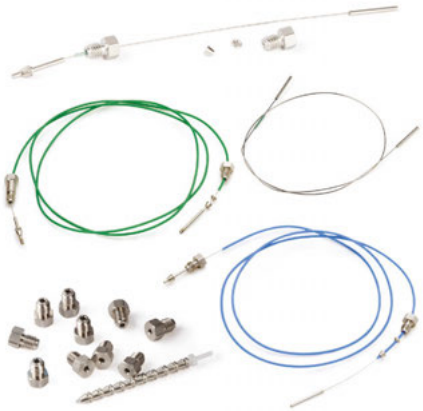
| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Isolation Seal for Injection Valve | Agilent | 1100, 1200 | ea. | Agilent 0100-1852 | 25917 |

# Don't Forget!

## Capillary Stainless-Steel Tubing Assemblies

for Agilent HPLC Systems

- Precut, micro-polished tubing and pre-seated fittings for quick, easy maintenance of your Agilent HPLC systems.
- Meet or exceed manufacturer's performance.



| Description | ID | Length | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|---|
| Capillary SS Tubing with Fittings | 0.17 mm | 800 mm | 1100 | ea. | Agilent 01048-87302 | 25740 |
| | 0.17 mm | 130 mm | 1090 | ea. | Agilent 01090-87305 | 26525 |
| | 0.17 mm | 800 mm | 1050 | ea. | Agilent 01078-87305 | 26526 |
| | 0.17 mm | 180 mm | 1100 | ea. | Agilent G1313-87305 | 26527 |
| | 0.25 mm | 700 mm | 1050 | ea. | Agilent 01018-67305 | 26528 |
| | 0.25 mm | 700 mm | 1050 | ea. | Agilent 01078-87306 | 26529 |
| Capillary SS Tubing | 0.17 mm | 105 mm | | ea. | Agilent 5021-1816 | 26531 |
| Mixing Capillary Assembly | | | 1100 | ea. | Agilent G1312-67302 | 26532 |
| Capillary SS Tubing, Valve to Metering Head | | | 1100 | ea. | Agilent G1313-87301 | 26533 |
| Capillary SS Tubing | 0.17 mm | 150 mm | | ea. | Agilent 5021-1817 | 26534 |
| | 0.17 mm | 280 mm | | ea. | Agilent 5021-1818 | 26535 |
| | 0.17 mm | 400 mm | | ea. | Agilent 5021-1819 | 26536 |
| $^{1}/_{16}$" Fitting, Front and Back Ferrules | | | | 10-pk. | Agilent 5062-2418 | 26537 |

## Autosampler Preventive Maintenance Kit

for Agilent 1100, 1200 HPLC Systems

25271

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Autosampler PM Kit includes: Rotor seal; piston seals (2); needle assembly; needle seat; finger caps (3) | 1100, 1200 | kit | Agilent G1313-68709 | 25271 |

## Lamps

for Agilent HPLC Systems

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Lamp, DAD G1315A, G1365A | 1100, 1200 (Compatible with 1260.) | ea. | Agilent 2140-0590 | 25261 |
| Lamp, VWD G1314A | 1100, 1200 | ea. | Agilent G1314-60100 | 25262 |
| 8453 Deuterium Lamp | | ea. | Agilent 2140-0605 | 25263 |
| Lamp, DAD Long-Life Deuterium (2,000 hours) | 1100, 1200 DAD | ea. | Agilent 5181-1530 | 25399 |
| Lamp, D2, DAD, RFID | 1220 DAD, 1260, G1315C/D, G1365C/D, G7115A, G7165A | ea. | Agilent 2140-0820 | 25764 |
| Lamp, D2, DAD, 8-Pin RFID | 1290, G4212A/B, G7117A/B/C/D | ea. | Agilent 5190-0917 | 25769 |
| Lamp, D2, VWD, RFID | G1314D, G1314E, G1314F, G7114A/B | ea. | Agilent G1314-60101 | 25770 |
| Lamp, D2, DAD | 1100 DAD, 1200 DAD | ea. | Agilent 5182-1530 | 25771 |
| Deuterium Lamp (2,000 hours) | 1100 DAD/MWD/1200 (Compatible with 1260.) | ea. | Agilent 2140-0813 | 25888 |

## This is just the beginning!

There are more RM supplies for your Agilent, as well as parts for PerkinElmer, Shimadzu, Thermo, Waters, and other LCs, at **www.bgb-shop.com/restek-lc-accessories**

# *Keep Your Lab Flowing:*

## Routine Maintenance Supplies for

# Shimadzu LCs

## Replace Every Month

26431

26392

### Bluestem Glass Solvent Filter

- Restek Bluestem glass solvent filter provides clean mobile phase to extend the life of columns and pump seals.
- 15 µm borosilicate glass frit sits lower than conventional glass filters to draw more mobile phase from each bottle.
- Blue filter stem allows instant visual confirmation of upright filter orientation.
- Connects to standard ⅛" OD (3.2 mm) PTFE tubing using your existing frit adaptor. For best performance, we recommend using Restek's frit adapter (sold separately as cat.# 26392).

Prevent the particulates and microbial growth in your LC solvents from entering your instrument with the new Restek Bluestem glass solvent filter.

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| Frit Adaptor, PTFE | 4-pk. | Agilent 5062-8517 | 26392 |
| Glass Solvent Filter, 15 µm frit | ea. | Agilent 5041-2168 | 26431 |

## Replace Every 3 Months

24985

25762

25760

### Plunger Seals

for Shimadzu LC Systems

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Plunger Seal, Black | LC-10AD, 10ADvp, LC-20AD/AB, LC-600, LC-2010 A/C HT, LC-9A | ea. | Shimadzu 228-35146-00 | 24980 |
| Plunger Seal, Gold | LC-10ADvp, LC-20AD/AB | ea. | Shimadzu 228-32628-00 | 24981 |
| Plunger Seal, Black | LC-10ATvp, LC-20AT, LC-HT, SIL-10ADvp, SIL-2010 A/C HT, SIL-20A/AC, SIL-HT | ea. | Shimadzu 228-35145-00 | 24985 |
| Plunger Seal, Polyethylene, Gold | LC-10Ai, 10AS, 10AT, 10ATvp, LC-20AR, LC-7A | ea. | Shimadzu 228-21975-00 | 25290 |
| Plunger Seal w/ Back Up Ring, Gold | LC-30AD | ea. | Shimadzu 228-52711-93 | 25760 |
| Plunger Seal, Gold | LC-20AD XR, LC-30ADSF, Nexera-i | ea. | Shimadzu 228-32628-91 | 25762 |

25469

24986

25773

25774

### Rotor Seals

for Shimadzu LC Systems

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Rotor Seal | SIL-10ADvp | ea. | Shimadzu 228-21217-97 | 24986 |
| Rotor Seal Assembly | SIL-10A, 10AXL, 10Ai | ea. | Shimadzu 228-21217-91 | 25469 |
| Rotor Seal, High-Pressure Valve (HPV) | SIL-30AC/ACMP | ea. | Shimadzu 228-52139-00 | 25773 |
| Rotor Seal, Low-Pressure Valve (LPV) | SIL-30AC/ACMP | ea. | Shimadzu 228-51922-00 | 25774 |

# Replace Every 6 Months

## Inlet Check Valves

for Shimadzu LC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Inlet Check Valve | Shimadzu | LC-10ADvp | ea. | Shimadzu 228-39093-92 | 24984 |
| | Shimadzu | LC-600, LC-9A, LC-10AD | ea. | Shimadzu 228-18522-91, 228-33492-91 | 25295 |
| | Shimadzu | i-Series, LC-20AD/AB, LC-20ADXR, LC-20AT (SEC in), LC-30ADSF, LC-40D | ea. | Shimadzu 228-48249-96 | 25754 |
| | Shimadzu | LC-30AD | ea. | Shimadzu 228-52964-95 | 25758 |
| | Shimadzu | LC-10AT, LC-10ATvp | ea. | Shimadzu 228-32166-91 | 26521 |

## Outlet Check Valves

for Shimadzu LC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Outlet Check Valve | Shimadzu | LC-10ADvp, LC-10ATvp | ea. | Shimadzu 228-34976-91 | 24983 |
| | Shimadzu | LC-600, LC-9A, LC-10AD, LC-10AT | ea. | Shimadzu 228-18522-92, 228-32531-92 | 25282 |
| | Shimadzu | LC-30AD | ea. | Shimadzu 228-53334-96 | 25759 |
| | Shimadzu | i-Series, LC-10ADvp, LC-10ATvp, LC-20AD/AB XR, LC-30ADSF | ea. | Shimadzu 228-45563-91, 228-45705-91 | 26427 |

## Needle Seal

for Shimadzu HPLC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Needle Seal, Vespel | Shimadzu | LC-2010A/C, SIL-10ADvp, SIL-10AXL | ea. | Shimadzu 228-33355-04 | 25468 |
| Needle Seal, PEEK | Shimadzu | SIL-30 | ea. | Shimadzu 228-53178-91 | 25778 |
| | Shimadzu | SIL-10ADvp, 10AXL, HT | ea. | Shimadzu 228-33355-01 | 25919 |
| | Shimadzu | SIL-2010A/C HT, 20A/AC | ea. | Shimadzu 228-42325-01 | 25920 |

# Replace Every 12 Months

## Sapphire Plungers

for Shimadzu HPLC Systems

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Plunger, w/ holder | LC-30AD | ea. | Shimadzu 228-52069-94 | 25779 |
| Sapphire Plunger | LC-20AT | ea. | Shimadzu 228-35009-93 | 25921 |
| | LC-10ADvp, LC-20AD/AB, LC-20ADXR, LC-30ADSF, LC-2010 | ea. | Shimadzu 228-34498-91, 228-35601-92, 228-35601-93 | 25922 |
| | LC-2010A/C HT, LC-HTSIL-10ADvp, SIL-20A/AC, SIL-20ACXR, SIL-20ACHT, SIL-30AC, SIL-30ACMP, SIL-HTa and SIL-HTc | ea. | Shimadzu 228-35010-91 | 25923 |


## Stator Assembly

for Shimadzu HPLC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Stator Assembly | Shimadzu | SIL-10A, 10AXL, 10Ai | ea. | Shimadzu 228-21220-91 | 25470 |


## Line Filter

for Shimadzu LC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Line Filter, Stainless Steel | Shimadzu | LC-30AD | ea. | Shimadzu 228-35871-99 | 25761 |

## *Don't Forget!*

25284

### Deuterium Lamps

for Shimadzu HPLC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Deuterium Lamp, Long-Life (2,000 hours)* | Shimadzu | SPD-10, 10A, 10AVvp, SPD-20A, SPD-20AV | ea. | Shimadzu 228-34016-02 | 25284 |

*Standard lamps have nominal 1,000-hour life.

## This is just the beginning!

There are more RM supplies for your Shimadzu, as well as parts for Agilent, PerkinElmer, Thermo, Waters, and other LCs, at **www.bgb-shop.com/restek-lc-accessories**

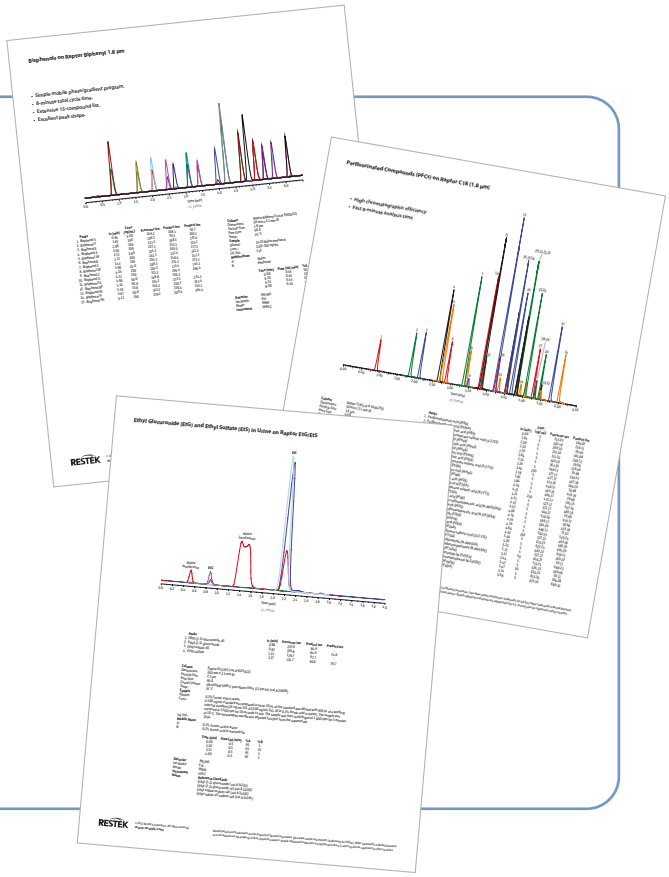
## Looking for LC Chromatograms? Find Them Online.

Restek's searchable chromatogram library is a comprehensive database of chromatograms by Restek chemists, partners, and customers.

- Search by compound name, synonym, CAS #, compound class, column name, catalog number, or keyword.
- Add search terms to refine your results.
- Use our quick filters to narrow your result set.

There are hundreds of LC chromatograms in our library—dive in today to find your ideal application.

**www.restek.com/chromatograms**



# *Keep Your Lab Flowing:*

## Routine Maintenance Supplies for

# Waters ACQUITY LCs

## Replace Every Month

### Bluestem Glass Solvent Filter

- Restek Bluestem glass solvent filter provides clean mobile phase to extend the life of columns and pump seals.
- 15 µm borosilicate glass frit sits lower than conventional glass filters to draw more mobile phase from each bottle.
- Blue filter stem allows instant visual confirmation of upright filter orientation.
- Connects to standard ⅛" OD (3.2 mm) PTFE tubing using your existing frit adaptor. For best performance, we recommend using Restek's frit adapter (sold separately as cat.# 26392).

Prevent the particulates and microbial growth in your LC solvents from entering your instrument with the new Restek Bluestem glass solvent filter.

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| Frit Adaptor, PTFE | 4-pk. | Agilent 5062-8517 | 26392 |
| Glass Solvent Filter, 15 µm frit | ea. | Agilent 5041-2168 | 26431 |

26431

26392

### Solvent Bottle Filters

for Waters ACQUITY and nanoACQUITY Systems

Meet or exceed original manufacturer's performance for less!

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Solvent Bottle Filters | Waters | ACQUITY | 7-pk. | Waters 700003616 | 25954 |

25954

## Replace Every 3 Months

### Head Plunger Seal Kits

for Waters HPLC Systems

| Description | Includes | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Head Plunger Seal Kit | head plunger seals (2), back-up washers (2) | ACQUITY, nanoACQUITY | kit | Waters 700002599 | 26428 |

26428

# Replace Every 6 Months


25735


25797


25798


25799

## Preventive Maintenance (PM) Kits

for Waters HPLC & ACQUITY UPLC Systems

| Description | Model # | Similar to Part # | cat.# |
|---|---|---|---|
| ACQUITY ISM Performance Maintenance Kit<br>mixer, plungers, check valve seals, and filters | ACQUITY ISM | Waters 201000286 | 25735 NEW! |
| ACQUITY BSM Pump Kit<br>in-line filter assembly, stainless steel frit; tube assembly, transducer to check valve; tube assembly, SSV to in-line filter; primary check valve (2); wash seal, float flanged, (2); head plunger seal kit (2); sapphire plungers, (2); air filter, pump; air filter, pump handle; mixer assembly, 50 µl; accumulator check valve, double ball & seat (2); solvent bottle filter, stainless steel (7); pump O-ring, (PTFE) | ACQUITY UPLC BSM | Waters 201000173 | 25797 |
| ACQUITY I2V BSM Pump Kit<br>Tube assembly, SSV to I2v; transducer to check valve, tube assembly, I2v; wash seal, float flanged (2); head plunger seal kit (2); sapphire plungers (2); air filter, pump; air filter, pump handle; mixer assembly, 50 µL; filter frit cartridge, stainless steel; accumulator check valve, double ball & seat (2); check valve cartridge (2); solvent bottle filter, stainless steel (7); pump O-ring, (PTFE) | ACQUITY UPLC I2V BSM | Waters 201000197 | 25798 |
| ACQUITY H-Class QSM Pump Kit<br>solvent bottle filter, stainless steel (5); 20 micron frit holder assembly; tube assembly, transducer to check valve; wash seal, float flanged (2); head plunger seal kit (2); sapphire plungers (2); check valve, double ball & seat (2); I2 check valve cartridge; air filter, door; pump O-ring, (PTFE); mixer assembly, 100 µL | ACQUITY H-CLASS QSM | Waters 201000233 | 25799 |


25955

## Primary Check Valve

for Waters ACQUITY and nanoACQUITY Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Primary Check Valve | Waters | ACQUITY, nanoACQUITY | 2-pk. | Waters 700002596 | 25955 |


25956

## Accumulator Check Valve (Double Ball & Seat)

for Waters ACQUITY and nanoACQUITY Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Accumulator Check Valve (Double Ball & Seat) | Waters | ACQUITY, nanoACQUITY | 2-pk. | Waters 700002968 | 25956 |

# Replace Every 12 Months

### Sapphire Plungers
for Waters ACQUITY and nanoACQUITY Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Sapphire Plunger | Waters | ACQUITY, nanoACQUITY | 2-pk. | Waters 700002600 | 25958 |


25958

### Pump O-Ring
for Waters ACQUITY and nanoACQUITY Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Pump O-Ring | Waters | ACQUITY, nanoACQUITY | ea. | Waters WAT076152 | 25951 |


25951

### Needle Assembly
for Waters ACQUITY and nanoACQUITY Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Needle Assembly, 0.010 mm ID | Waters | ACQUITY | ea. | Waters 700002644 | 25942 |


25942

### Needle Kit
for Waters ACQUITY and nanoACQUITY Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Needle Kit, 15 µL | Waters | ACQUITY H-class | kit | Waters 700005215 | 25777 |


25777

# Don't Forget!

### Lamps
for Waters Detectors

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Lamp, D2 w/ Chip | Waters | ACQUITY, ACQUITY UPC2 PDA, ACQUITY UPLC PDA, ACQUITY UPLC TUV | ea. | Waters 201000273, 700005269 | 25772 |
| Lamp, UV, Long Life (2,000 hours), D2 | Waters | ACQUITY PDA/TUV 2489/2998 | ea. | Waters 201000281 | 25775 |


25772


25775

## This is just the beginning!

There are more RM supplies for your Waters, as well as parts for Agilent, PerkinElmer, Shimadzu, Thermo, and other LCs, at **www.bgb-shop.com/restek-lc-accessories**

# *Keep Your Lab Flowing:*

## Routine Maintenance Supplies for

# Waters Alliance LCs

## Replace Every Month

26431

26392

### Bluestem Glass Solvent Filter

- Restek Bluestem glass solvent filter provides clean mobile phase to extend the life of columns and pump seals.
- 15 µm borosilicate glass frit sits lower than conventional glass filters to draw more mobile phase from each bottle.
- Blue filter stem allows instant visual confirmation of upright filter orientation.
- Connects to standard ⅛" OD (3.2 mm) PTFE tubing using your existing frit adaptor. For best performance, we recommend using Restek's frit adapter (sold separately as cat.# 26392).

Prevent the particulates and microbial growth in your LC solvents from entering your instrument with the new Restek Bluestem glass solvent filter.

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| Frit Adaptor, PTFE | 4-pk. | Agilent 5062-8517 | 26392 |
| Glass Solvent Filter, 15 µm frit | ea. | Agilent 5041-2168 | 26431 |

## Replace Every 3 Months

25280

### Vespel Rotor Seal

for Waters HPLC Systems: Rheodyne Style

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Vespel Rotor Seal | 1090, 7000, 7010, 7040, 7067 | ea. | Rheodyne 7010-039 | 25279 |
| | 7125, 7126, 7725, 7725i, 9725 | ea. | Rheodyne 7125-047 | 25280 |

25495

### Seal Pack Rebuild Kit (without Seal Wash Tube Assembly)

for Waters HPLC Systems

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Seal Pack Rebuild Kit, without Seal Wash Tube Assembly<br>Wash tube seal; seal wash tube; PTFE washer; filter retainer; lower wash seal frit; needle wash frit; TFE washer; needle; injector seal (2); compression screw; ferrule | 2690, 2695 | kit | Waters WAT271019 | 25495 |

26428

### Head Plunger Seal Kits

for Waters HPLC Systems

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Head Plunger Seals, Gold | 2690, 2695, 2790, 2795, 2796 | 2-pk. | Waters WAT270789, WAT270938 | 25387 |
| Head Plunger Seals, Black | 2690, 2695, 2790, 2795, 2796 | 2-pk. | Waters WAT271066 | 25388 |

# Replace Every 6 Months

## Preventive Maintenance (PM) Kits

for Waters HPLC & ACQUITY UPLC Systems

| Description | Model # | Similar to Part # | cat.# |
|---|---|---|---|
| **2690/2695 Pump & Autosampler PM Kit**<br>sapphire plungers (2); seal wash plunger seals (2); head plunger seals (2); wash tube seals (4); sparge diffuser; filter insert; face seals (4); solvent reservoir 10 µm filters (4); 250 µL syringe; check valve cartridges (2); wash tube seal; seal wash tube; PTFE washer; filter retainer; lower wash seal frit; needle wash frit; TFE washer; needle assembly; gold injector seals (2); stainless steel ferrule; compression screw; seal wash face seals (2) | Alliance 2690, 2695 | Waters WAT270944 | 25143 |
| **600 Pump PM Kit**<br>PerformancePLUS cartridges (4); sparge diffusers (4); Super Seals (2); solvent reservoir 10 µm filters (4); sapphire plungers (2); reference valve button; valve disk spacer; valve disk; TFE ball plug; TFE seat; ruby ball; inlet tube body assembly manifold insert; insert seal; belleville washers (2); flat washer | 600 Pump, 610 | Waters WAT052675 | 25144 |
| **717 Autosampler PM Kit**<br>seal pack assembly; tube assembly (0.020" ID); needle; needle compression screw; 0.062 stainless steel ferrule; precolumn filter assembly; filter insert; 250 µL WISP syringe | 717 Autosampler | Waters WAT052669 | 25145 |
| **1525 Pump PM Kit**<br>sapphire plungers (4); check valve cartridges (8); plunger seals (4); solvent reservoir 10 µm filters (2); reference valve button; valve disk spacer; valve disk | 1525 Pump | Waters 201000114 | 26430 |
| **515 Pump PM Kit**<br>PerformancePLUS check valves (4); sparge diffuser; solvent reservoir 10 µm filter; sapphire plungers (2); plunger seals (2); pivot inserts (2); pivot guides (2); washer (2); plunger springs (2); retaining rings (2) | 515 Pump | Waters WAT052587 | 26519 |


25143


25144


25145


26430


26519


### Check Valve Cartridges
for Waters HPLC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Check Valve Cartridge | Waters | 2690, 2695, 2790, 2795 | 2-pk. | Waters WAT270941 | 25373 |

### PerformancePLUS Check Valve Cartridge
for Waters HPLC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| PerformancePLUS Check Valve Cartridge | Waters | 1515, 1525, 2690, 2695, 2795, 510, 515, 600, 610 | 2-pk. | Waters 700000254 | 25370 |

## Replace Every 12 Months


### Sapphire Plungers
for Waters HPLC Systems

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Sapphire Plunger | Waters | M6KA, 1515, 1525, 510, 515, 590, 600, 610, LC Module 1 | ea. | Waters WAT025656, WAT069511 | 25381 |
| | Waters | 2690, 2695, 2790, 2795, 2796 | ea. | Waters WAT270488, WAT270959, WAT271067 | 25385 |
| | Waters | 616, 625, 626, 1525 Micro | ea. | Waters WAT031788 | 25420 |

## Don't Forget!


### Lamps
for Waters Detectors

| Description | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| Deuterium Lamp, Standard (1,000 hours) | 996, 2996 | ea. | Waters WAT052586 | 25408 |
| | 2487, 2488 | ea. | Waters WAS081142 | 25409 |
| Deuterium Lamp, Long Life (2,000 hours) | 486 | ea. | Grace 98028, 2109058; Waters WAT080678 | 25410 |

## This is just the beginning!

There are more RM supplies for your Waters, as well as parts for Agilent, PerkinElmer, Shimadzu, Thermo, and other LCs, at **www.bgb-shop.com/restek-lc-accessories**

# LC-MC Supplies

## Union for TIS Probe/APCI, $^{1}/_{16}$"

(for Sciex Turbo V Sources)

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Union for TIS Probe/APCI, $^{1}/_{16}$" | Sciex Turbo V Sources | 3200, 3500, 4500, 5500, 6500, API 4000 | ea. | Sciex 025348 | 25742 |

25742

## O-Ring (3/16" ID x $^{1}/_{16}$", Viton)

(for Sciex Turbo V Sources)

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| O-Ring (3/16" ID x $^{1}/_{16}$", Viton) | Sciex Turbo V Sources | 3200, 3500, 4500, 5000, 5500, 6500, API 4000 | ea. | Sciex 003403 | 25743 |

25743

## Spring

(for Sciex Turbo V Sources)

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Spring | Sciex Turbo V Sources | 3200, 3500, 4500, 5000, 5500, 6500, API 4000 | ea. | Sciex 026626 | 25744 |

25744

## ESI Electrode Gauge

(for Sciex Turbo V Sources)

- For installing/replacing the ESI electrode in Turbo V ion source probes.
- Designed to ensure the correct electrode exposure distance from the probe tip.
- Provides a quick-and-easy visual confirmation of electrode exposure.

| Description | Instrument | qty. | cat.# |
|---|---|---|---|
| ESI Electrode Gauge | Sciex Turbo V Ion Sources | ea. | 25832 |


25832

## Long-Life ESI Electrode

(for Sciex Turbo V Sources)

- Same chromatographic performance as original equipment.
- Rugged electrode lasts longer and requires fewer replacements.
- Ensures more instrument uptime for sample analysis.

View testing results and learn more today at www.restek.com/LongLifeESI

| Description | Instrument | Model # | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Long-Life ESI Electrode | Sciex Turbo V Ion Sources | API 3200, 3500, 4000, 4500, 5000, 5500+, 6500, and 6500+ | ea. | Sciex 025392 | 25831 |


25831

## LC-MS/MS Infusion Kit

Everything you need to put together your own LC-MS/MS infusion rig has been included in this kit. It can be used with any LC-MS/MS and syringe pump—you can even Tee-in your LC mobile phase for the best signal optimization.

The kit includes a removable luer lock syringe needle for drawing your sample from a vial, tubing, fittings, a flashlight to check your spray, and even a tubing cutter to customize the length.

All components are individually reorderable.

| Description | qty. | cat.# |
|---|---|---|
| LC-MS/MS Infusion Kit | kit | 25755 |

25755

# Safe and Simple Mobile Phase Management

## With Hub-Cap 4 Liter Bottle Tops and Other Restek Accessories

- Specifically designed for 4-liter bottles—less instrument downtime.
- Easiest, cleanest way to deliver mobile phases.
- Safer—contains solvent vapors better than films or tape.

**Without Hub-Cap**

***Messy, loose-fitting tapes and films allow solvent vapors into the lab.***

26541

### Hub-Cap 4-Liter Bottle Tops

Hub-Cap bottle tops are a great way to neatly keep your mobile phase lines where they belong. Use them instead of plastic paraffin film, aluminum foil, or tape on your mobile phase reservoirs.

| Description | qty. | cat.# |
|---|---|---|
| Hub-Cap (assembly of the bottle cap and plug) | kit | 26541 |
| Hub-Cap Multi-Pack | 3-pk. | 26542 |

### Mobi-Cap Adaptors

| Description | qty. | cat.# |
|---|---|---|
| Mobi-Cap Adaptor w/Hub-Cap | kit | 26551 |
| Mobi-Cap Adaptor (allows use of Hub-Cap w/GL-45 solvent bottles) | ea. | 27197 |
| Mobi-Cap Adaptor Multi-Pack | 3-pk. | 27198 |

26540

### Hub-Cap Adaptors

Allow the use of the Mobi-Cap Top with 4-liter solvent bottles.

| Description | qty. | cat.# |
|---|---|---|
| Hub-Cap Adaptor (allows use of the Mobi-Cap w/4 L solvent bottles) | ea. | 26538 |
| Hub-Cap Adaptor Multi-Pack | 3-pk. | 26539 |
| Hub-Cap Adaptor and Mobi-Cap (for use w/GL-45 solvent bottles) | kit | 26540 |

## Mobi-Cap GL-45 Bottle Tops

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| **2-Port: holes for (1) 1/16" and (1) 1/8" OD tubing** | | | |
| Mobi-Cap for GL-45 Threaded Bottles | ea. | VICI JR-S-11001 | 27835 |
| **3-Port: holes for (1) 1/16" and (2) 1/8" OD tubing** | | | |
| Mobi-Cap for GL-45 Threaded Bottles | ea. | Agilent 5063-6531; Grace 9541, 10973, 2106324, 5130238; VICI JR-S-11002 | 27836 |
| **4-Port: holes for (1) 1/16" and (3) 1/8" OD tubing** | | | |
| Mobi-Cap for GL-45 Threaded Bottles | ea. | VICI JR-S-11003 | 27837 |

**Component: Material**
Insert: PTFE
Closure: Polypropylene
O-ring: EPDM
Nuts: PPS
Ferrules: ETFE
Nut sleeves: Polypropylene

## Eco-Cap GL-45 Bottle Tops

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| Eco-Cap for GL-45 Threaded Bottles | ea. | VICI JR-9000-0007 | 27834 |

27834

**Component: Material**
Screw collar: Polypropylene
Pouring ring: Polypropylene
Eco-cap insert: ETFE
O-rings: EPDM
Luer plug: Polypropylene

## Mobi-Cap GL-45 Bottle Top Kits

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| Mobi-Cap GL-45 Bottle Top Kit | kit | VICI JR-9000-0002 | 27851 |
| Mobi-Cap GL-45 Bottle Top Kit with 1 L Bottle | kit | VICI JR-9000-0003 | 27852 |
| Mobi-Cap GL-45 Bottle Top Kit with 2 L Bottle | kit | VICI JR-9000-0004 | 27853 |

27851

## Bottle Top Valves and Filters

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| Inlet Valve (no filter) for Bottle Tops | ea. | VICI JR-S-20006 | 27838 |
| Inlet Valve with 4 mm Filter for Bottle Tops | ea. | VICI JR-S-20003 | 27839 |
| Inlet Valve with 15 mm Filter for Bottle Tops | ea. | VICI JR-S-20009 | 27840 |
| Outlet Valve with 4 mm Filter for Bottle Tops | ea. | VICI JR-S-20004 | 27841 |
| Replacement 15 mm Filter for Bottle Tops | ea. | VICI JR-S-20008 | 27842 |
| Replacement 4 mm Filter for Bottle Tops | ea. | VICI JR-S-20007 | 27843 |

**Filter Component: Filter Material**
Housing: Polypropylene
Filter: Cellulose, 0.2 µm
O-ring: EPDM

## PTFE Tubing

| Color | ID | OD | Length | Max Pressure | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|---|---|
| Natural | 0.094" (2.4 mm) | 1/8" | 3 m | 250 psi (18 bar) | ea. | Grace 20096, 3112413; VICI JR-T-4037-M3 | 27844 |
| Natural | 0.063" (1.6 mm) | 1/8" | 3 m | 500 psi (35 bar) | ea. | Grace 20063, 3112412; VICI JR-T-6800-M3 | 27845 |
| Natural | 0.094" (2.4 mm) | 1/8" | 10 m | 250 psi (18 bar) | ea. | VICI JR-T-4037-M10 | 27846 |
| Natural | 0.063" (1.6 mm) | 1/8" | 10 m | 500 psi (35 bar) | ea. | VICI JR-T-6800-M10 | 27847 |



27846

## Fittings and Ferrules for 1/8" & 1/16" Tubing

| Description | Max Pressure | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|
| PEEK Finger-Tight Fittings for 1/8" OD Tubing, 1/4-28 Threads | 500 psi (35 bar) | 10-pk. | | 25794 |
| ETFE Ferrules for PEEK Finger-Tight Fittings for 1/8" OD Tubing | | 10-pk. | | 25795 |
| PEEK Finger-Tight Fittings for 1/16" Tubing, 1/4-28 Threads | 1500 psi (105 bar) | 10-pk. | VICI JR-20124-10 | 27849 |
| ETFE Ferrules for PEEK Finger-Tight Fittings for 1/16" Tubing | | 10-pk. | VICI JR-041-10 | 27850 |

## Last Drop Mobile Phase Filter

| Description | Flow Capacity | Material | Porosity | Used with | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|---|---|
| **Flangeless Connector** | | | | | | | |
| Last Drop Filter | 1.2 mL/min | PTFE | 2.5 µm | 1/8" OD tubing | ea. | VICI JR-9000-0520F | 27820 |
| | 2.6 mL/min | PTFE | 5 µm | 1/8" OD tubing | ea. | VICI JR-9000-0521F | 27821 |
| | 3.5 mL/min | PTFE | 10 µm | 1/8" OD tubing | ea. | VICI JR-9000-0522F | 27822 |
| | 28 mL/min | Stainless Steel | 2 µm | 1/8" OD tubing | ea. | VICI JR-9000-0530F | 27823 |
| | 30 mL/min | Stainless Steel | 5 µm | 1/8" OD tubing | ea. | VICI JR-9000-0531F | 27824 |
| | 30 mL/min | Stainless Steel | 10 µm | 1/8" OD tubing | ea. | VICI JR-9000-0532F | 27825 |
| **Stepped Connector** | | | | | | | |
| Last Drop Filter | 1.2 mL/min | PTFE | 2.5 µm | 1.5/2.2/3.5 mm ID tubing | ea. | VICI JR-9000-0520 | 27814 |
| | 2.6 mL/min | PTFE | 5 µm | 1.5/2.2/3.5 mm ID tubing | ea. | VICI JR-9000-0521 | 27815 |
| | 3.5 mL/min | PTFE | 10 µm | 1.5/2.2/3.5 mm ID tubing | ea. | VICI JR-9000-0522 | 27816 |
| | 28 mL/min | Stainless Steel | 2 µm | 1.5/2.2/3.5 mm ID tubing | ea. | VICI JR-9000-0530 | 27817 |
| | 30 mL/min | Stainless Steel | 5 µm | 1.5/2.2/3.5 mm ID tubing | ea. | VICI JR-9000-0531 | 27818 |
| | 30 mL/min | Stainless Steel | 10 µm | 1.5/2.2/3.5 mm ID tubing | ea. | VICI JR-9000-0532 | 27819 |

Flow rates measured with methanol/water (1:1), ultrasonically degassed. Flow rates can vary with solvent and tubing ID.

## Mobile Phase Sparge Filters

| Description | Flow Capacity | Material | Porosity | Used with | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|---|---|
| Sparger Filter | 120 mL/min | Polyethylene | 20 µm | 1/8" OD tubing | ea. | VICI JR-32178 | 27826 |
| | 35 mL/min | Stainless Steel | 2 µm | 1/16" OD tubing | ea. | VICI JR-367016-2 | 27827 |
| | 35 mL/min | Stainless Steel | 10 µm | 1/16" OD tubing | ea. | VICI JR-367016-10 | 27828 |
| | 35 mL/min | Stainless Steel | 20 µm | 1/16" OD tubing | ea. | VICI JR-367016-20 | 27829 |
| | 35 mL/min | Stainless Steel | 2 µm | 1/8" OD tubing | ea. | VICI JR-367008-2 | 27830 |
| | 100 mL/min | Stainless Steel | 10 µm | 1/8" OD tubing | ea. | VICI JR-367008-10 | 27831 |
| | 120 mL/min | Stainless Steel | 20 µm | 1/8" OD tubing | ea. | VICI JR-367008-20 | 27832 |

Flow rates measured with methanol/water (1:1), ultrasonically degassed. Flow rates can vary with solvent and tubing ID.

## PEEK Plug for Bottle Top Adaptors

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| PEEK Plug, 1/4"-28 threads | 3-pk. | VICI JR-409 | 27848 |

27833

## Safety Exhaust Filter with Indicator

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| Safety Exhaust Filter with Indicator for Bottle Tops | ea. | VICI JR-S-20005 | 27833 |

## Hub-Cap Filter Kit for 4 L Bottles

Unscrew and lift off top.

Place membrane filter on top of grid.

Reattach top.

Connect vacuum line to side port.

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| Hub-Cap Filter Kit for 4 L bottles with GL-38 threads | kit | | 26395 |
| **Replacement Parts** | | | |
| Polypropylene Membrane Filters (hydrophobic), 47 mm, 0.45 µm | 100-pk. | | 26396 |
| Polypropylene Membrane Filters (hydrophobic), 47 mm, 0.22 µm | 100-pk. | | 26397 |
| Nylon Membrane Filters, 47 mm, 0.45 µm | 100-pk. | Grace 2024, 8604469 | 26398 |
| Nylon Membrane Filters, 47 mm, 0.22 µm | 100-pk. | Grace 2034, 2106718 | 26399 |
| Hub-Cap Filter Hose Barb | ea. | | 25925 |

Bottle not included.

26395

26396

26395
Bottle not included.

25925

**Assembles quickly and easily!**

## Waste Overflow Indicator for LC Systems

- Avoid messy pooling around mobile phase waste containers.
- Audible alarm instantly alerts user, preventing overflow.
- Compact, battery-operated unit.
- Available for 4-liter and GL-45 solvent bottles.

| Description | Certification/Compliance | qty. | cat.# |
|---|---|---|---|
| Waste Overflow Indicator for LC Systems, 4 Liter | CE | ea. | 26543 |
| Waste Overflow Indicator for LC Systems, GL-45 | CE | ea. | 26550 |
| **Replacement Batteries for Waste Overflow Indicator for LC Systems** | | | |
| Replacement AA Battery for the Waste Overflow Indicator | | ea. | 26544 |
| Replacement AA Batteries for the Waste Overflow Indicator | | 3-pk. | 26545 |

26550 26543
Bottle not included.


## Bluestem Glass Solvent Filter

- Restek Bluestem glass solvent filter provides clean mobile phase to extend the life of columns and pump seals.
- 15 µm borosilicate glass frit sits lower than conventional glass filters to draw more mobile phase from each bottle.
- Blue filter stem allows instant visual confirmation of upright filter orientation.
- Connects to standard ⅛" OD (3.2 mm) PTFE tubing using your existing frit adaptor. For best performance, we recommend using Restek's frit adapter (sold separately as cat.# 26392).

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| Frit Adaptor, PTFE | 4-pk. | Agilent 5062-8517 | 26392 |
| Glass Solvent Filter, 15 µm frit | ea. | Agilent 5041-2168 | 26431 |

26431

## Graduated Safety-Coated Bottles

| Description | qty. | cat.# |
|---|---|---|
| 1 L Graduated Safety-Coated Bottle – GL-45 threads | ea. | 25304 |
| 2 L Graduated Safety-Coated Bottle – GL-45 threads | ea. | 25305 |

25304

# EXP Connectors


25745

## EXP2 TI-LOK All-in-One (AIO) Reusable Fittings for HPLC & UHPLC

NEW!

for 10-32 fittings and $^{1}/_{16}$" tubing

- Titanium nut with integrated PEEK ferrule simplifies installation—one-piece design means no more lost ferrules.
- Convenient, built-in driver makes secure installations quick and easy.
- Allows easy 18,000 psi (1250 bar) seals without wrenches.
- Can be installed repeatedly without compromising high-pressure seal.
- Cutting-edge system provides zero-dead-volume (ZDV) connection to any 10-32 female port.
- Non-swaged ferrules mean vendor-specific tubing is not required.
- Suitable for both HPLC and UHPLC.
- Compatible with $^{1}/_{16}$" PEEK, PEEKsil, Hastelloy C, stainless-steel, and fused silica tubing.

| Description | qty. | cat.# |
|---|---|---|
| EXP2 TI-LOK All-in-One (AIO) Hand-Tight Fitting with Integral Ferrule (includes built-in driver) | ea. | 25745 |
| | 10-pk. | 25746 |

Intellectual Property: optimizetech.com/patents

25783

## EXP2 Reusable Fittings for HPLC & UHPLC

for 10-32 fittings and 1/16" tubing

- Unique nut driver allows easy 20,000+ psi seals without wrenches.*
- Patented ferrule can be installed repeatedly without compromising high-pressure seal.
- Precision design provides zero-dead-volume (ZDV) connection to any 10-32 port.
- Compact design fits in tight spaces, perfect for small oven compartments and six-port injection valves.
- Non-swaged ferrules mean vendor-specific tubing is not required.
- Suitable for both HPLC and UHPLC.

*Rated to 20,000+ psi (1400 bar) and tested to 30,000 psi (2068 bar).

| Description | qty. | cat.# |
|---|---|---|
| EXP2 Fitting (2 nuts, 2 ferrules, 1 driver) | 2-pk. | 25783 |
| EXP2 Fitting (10 nuts, 10 ferrules, 1 driver) | 10-pk. | 25784 |
| EXP2 Driver (driver only) | ea. | 25785 |

WARNING: Do not use EXP ferrules with standard nuts. Failure to use EXP fittings according to the included instructions may result in unsafe UHPLC connections and/or non-ZDV connections.
Intellectual Property: optimizetech.com/patents

## In Stock and Ready to Ship!

Find hundreds of other supplies & accessories for your LC at **www.bgb-shop.com/restek-lc-accessories**

## **EXP Reusable Fittings for HPLC & UHPLC** for 10-32 fittings and 1/16" tubing

EXP Hand-Tight Fittings

- Hand-tight fitting style achieves effortless HPLC seals—no tools needed for a 8700+ psi seal.
- Both hand-tight and hex-head styles wrench tighten for reliable UHPLC use up to 20,000+ psi!
- Patented ferrule can be installed repeatedly without compromising high-pressure seal.
- Hybrid design combines the durability of titanium with the sealing ability of PEEK.
- Cutting-edge system provides ZDV (zero dead volume) connection to any 10-32 female port.
- Compatible with 1/16" PEEK and stainless-steel tubing.

Restek is pleased to offer the reusable EXP fitting system from Optimize Technologies for the ultimate in easy, reliable LC connections!

The patented hybrid EXP ferrule combines the durability of titanium with the sealing ability of PEEK for a swage that can be reused over and over again. And, when you choose the hand-tight fitting style, the special EXP nut offers an effortless seal up to 8700+ psi (600+ bar)—no tools needed! For a reliable 20,000+ psi (1400+ bar) UHPLC connection with either fitting style, simply wrench tighten an extra ¼ to ½ turn.

EXP ferrules should only be used with genuine EXP nuts. When used with an EXP nut, the EXP ferrule provides repeated ZDV (zero dead volume) connections to any 10-32 female threaded port, including Restek LC columns, 6-port injection valves, and more. To accommodate varying port depths, simply hold the tubing fully bottomed in the port and tighten as instructed.

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| EXP Hand-Tight Fitting (nut w/ferrule) | ea. | | 25937 |
| | 10-pk. | Grace 5131702, AL32326 | 25938 |

Intellectual Property: optimizetech.com/patents

25937


25938

**WARNING:** Do not use EXP ferrules with standard nuts. Failure to use EXP fittings according to the included instructions may result in unsafe UHPLC connections and/or non-ZDV connections.

## **EXP Reusable Fittings for HPLC & UHPLC** for 10-32 fittings and 1/16" tubing

EXP Hex-Head Fittings

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| EXP Std. Hex-Head Fitting (nut w/ferrule) | ea. | | 25926 |
| | 10-pk. | | 25927 |
| EXP Short Hex-Head Fitting (nut w/ferrule) | ea. | | 25928 |
| | 10-pk. | Grace 5132954, Z226874 | 25929 |
| EXP Long Hex-Head Fitting (nut w/ferrule) | ea. | | 25930 |
| | 10-pk. | Grace 5132953, Z226866 | 25931 |

Intellectual Property: optimizetech.com/patents

## **EXP Reusable Fittings for HPLC & UHPLC** for 10-32 fittings and 1/16" tubing

EXP Hand-Tight Coupler

| Description | qty. | cat.# |
|---|---|---|
| EXP Hand-Tight Coupler (2 nuts, 2 ferrules, $^{1}/_{16}$" x 0.005" ID tubing) | ea. | 25940 |

Intellectual Property: optimizetech.com/patents

25940

## **EXP Reusable Fittings for HPLC & UHPLC** for 10-32 fittings and 1/16" tubing

EXP Titanium Hybrid Replacement Ferrules

| Description | qty. | cat.# |
|---|---|---|
| EXP Titanium Hybrid Ferrule | ea. | 25935 |
| | 10-pk. | 25936 |

Intellectual Property: optimizetech.com/patents

25935 25936

# Stainless Steel Tubing

27728

27730

27732

27734

## Stainless Steel Fittings for UHPLC

| Description | Material | Max Pressure | Type | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|---|
| **Cone-Style** | | | | | | |
| Valco-Style Ferrules | 316 Stainless Steel | 20,000 psi (1,375 bar) | Cone-Style | 5-pk. | VICI JR-ZF1S6 | 27730 |
| Rheodyne-Style Ferrules | 316 Stainless Steel | 7250 psi (500 bar) | Cone-Style | 5-pk. | VICI JR-59-5 | 27735 |
| **Long** | | | | | | |
| Valco-Style Nuts | 303 Stainless Steel | 20,000 psi (1,375 bar) | Long | 5-pk. | VICI JR-LZN1 | 27729 |
| Rheodyne-Style Nuts | 316 Stainless Steel | 7250 psi (500 bar) | Long | 5-pk. | VICI JR-58-5 | 27733 |
| **Medium** | | | | | | |
| Valco-Style Nuts | 303 Stainless Steel | 20,000 psi (1,375 bar) | Medium | 5-pk. | VICI JR-MZN1 | 27728 |
| Rheodyne-Style Nuts | 316 Stainless Steel | 7250 psi (500 bar) | Medium | 5-pk. | VICI JR-57-5 | 27732 |
| **Short** | | | | | | |
| Valco-Style Nuts | 303 Stainless Steel | 20,000 psi (1,375 bar) | Short | 5-pk. | VICI JR-ZN1 | 27727 |
| Rheodyne-Style Nuts | 316 Stainless Steel | 7250 psi (500 bar) | Short | 5-pk. | VICI JR-56-5 | 27731 |
| **Stepped-Style** | | | | | | |
| Rheodyne-Style Ferrules | 316 Stainless Steel | 7250 psi (500 bar) | Stepped-Style | 5-pk. | Grace 77511, 2108371; VICI JR-60-5 | 27734 |

27740

27743

27736

## Stainless Steel Unions, Tees, and Crosses for UHPLC

| Description | Max Pressure | Union Bore | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| Stainless Steel Union | 20,000 psi (1,375 bar) | 0.15 mm | ea. | VICI JR-ZU1XCS6 | 27736 |
| | 20,000 psi (1,375 bar) | 0.25 mm | ea. | VICI JR-ZU1CS6 | 27737 |
| | 20,000 psi (1,375 bar) | 0.75 mm | ea. | VICI JR-ZU1S6 | 27738 |
| | 20,000 psi (1,375 bar) | $^1/_{16}$" | ea. | VICI JR-ZU1T | 27739 |
| Stainless Steel Tee | 20,000 psi (1,375 bar) | 0.25 mm | ea. | VICI JR-ZT1C | 27740 |
| | 20,000 psi (1,375 bar) | 0.50 mm | ea. | VICI JR-ZT1M | 27741 |
| | 20,000 psi (1,375 bar) | 0.75 mm | ea. | VICI JR-ZT1 | 27742 |
| Stainless Steel Cross | 20,000 psi (1,375 bar) | 0.25 mm | ea. | VICI JR-ZX1C | 27743 |
| | 20,000 psi (1,375 bar) | 0.50 mm | ea. | VICI JR-ZX1M | 27744 |
| | 20,000 psi (1,375 bar) | 0.75 mm | ea. | VICI JR-ZX1 | 27745 |

27758

## Stainless Steel Tubing

| ID | OD | Length | Max Pressure | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|---|
| **Standard-Grade Tubing** | | | | | | |
| 0.005" (0.127 mm) | $^1/_{16}$" | 3 m | 27,580 psi (1,902 bar) | ea. | VICI JR-T-625-04-M3 | 27757 |
| 0.005" (0.127 mm) | $^1/_{16}$" | 10 m | 27,580 psi (1,902 bar) | ea. | VICI JR-T-625-04-M10 | 27758 |
| 0.007" (0.178 mm) | $^1/_{16}$" | 3 m | 26,610 psi (1,835 bar) | ea. | VICI JR-T-625-05-M3 | 27759 |
| 0.007" (0.178 mm) | $^1/_{16}$" | 10 m | 26,610 psi (1,835 bar) | ea. | VICI JR-T-625-05-M10 | 27760 |
| 0.010" (0.254 mm) | $^1/_{16}$" | 3 m | 25,160 psi (1,735 bar) | ea. | VICI JR-T-625-10-M3 | 27761 |
| 0.010" (0.254 mm) | $^1/_{16}$" | 10 m | 25,160 psi (1,735 bar) | ea. | VICI JR-T-625-10-M10 | 27762 |
| 0.020" (0.508 mm) | $^1/_{16}$" | 3 m | 20,230 psi (1,395 bar) | ea. | VICI JR-T-625-20-M3 | 27763 |
| 0.020" (0.508 mm) | $^1/_{16}$" | 10 m | 20,230 psi (1,395 bar) | ea. | VICI JR-T-625-20-M10 | 27764 |
| 0.030" (0.762 mm) | $^1/_{16}$" | 3 m | 15,480 psi (1,067 bar) | ea. | VICI JR-T-625-30-M3 | 27765 |
| 0.030" (0.762 mm) | $^1/_{16}$" | 10 m | 15,480 psi (1,067 bar) | ea. | VICI JR-T-625-30-M10 | 27766 |
| 0.040" (1.00 mm) | $^1/_{16}$" | 3 m | 10,645 psi (734 bar) | ea. | VICI JR-T-625-40-M3 | 27767 |
| 0.040" (1.00 mm) | $^1/_{16}$" | 10 m | 10,645 psi (734 bar) | ea. | VICI JR-T-625-40-M10 | 27768 |
| **Premium-Grade Tubing** | | | | | | |
| 0.005" (0.127 mm) | $^1/_{16}$" | 3 m | 27,580 psi (1,902 bar) | ea. | VICI JR-TSS105-M3 | 27769 |
| 0.005" (0.127 mm) | $^1/_{16}$" | 10 m | 27,580 psi (1,902 bar) | ea. | VICI JR-TSS105-M10 | 27770 |
| 0.007" (0.178 mm) | $^1/_{16}$" | 3 m | 26,610 psi (1,835 bar) | ea. | VICI JR-TSS107-M3 | 27771 |
| 0.007" (0.178 mm) | $^1/_{16}$" | 10 m | 26,610 psi (1,835 bar) | ea. | VICI JR-TSS107-M10 | 27772 |
| 0.010" (0.254 mm) | $^1/_{16}$" | 3 m | 25,160 psi (1,735 bar) | ea. | VICI JR-TSS110-M3 | 27773 |
| 0.010" (0.254 mm) | $^1/_{16}$" | 10 m | 25,160 psi (1,735 bar) | ea. | VICI JR-TSS110-M10 | 27774 |
| 0.020" (0.508 mm) | $^1/_{16}$" | 3 m | 20,230 psi (1,395 bar) | ea. | VICI JR-TSS120-M3 | 27775 |
| 0.020" (0.508 mm) | $^1/_{16}$" | 10 m | 20,230 psi (1,395 bar) | ea. | VICI JR-TSS120-M10 | 27776 |
| 0.030" (0.762 mm) | $^1/_{16}$" | 3 m | 15,480 psi (1,067 bar) | ea. | VICI JR-TSS130-M3 | 27777 |
| 0.030" (0.762 mm) | $^1/_{16}$" | 10 m | 15,480 psi (1,067 bar) | ea. | VICI JR-TSS130-M10 | 27778 |
| 0.040" (1.00 mm) | $^1/_{16}$" | 3 m | 10,645 psi (734 bar) | ea. | VICI JR-TSS140-M3 | 27779 |
| 0.040" (1.00 mm) | $^1/_{16}$" | 10 m | 10,645 psi (734 bar) | ea. | VICI JR-TSS140-M10 | 27780 |

## Flexible Premium Grade Stainless Steel Tubing

- Ideal for all plumbing in UHPLC systems.
- 1/32" OD tubing with 17 mm long, 1/16" laser-welded ends.
- Color bands for easy identification.
- 316 stainless steel.
- Tolerances: +/– 0.05 mm (.002") OD & +/– 0.025 mm (.001") ID.

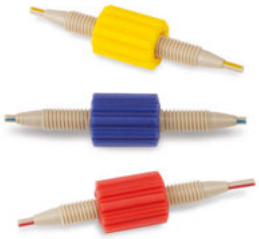
| Color | ID | OD | Length | Max Pressure | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|---|---|
| **Flexible Tubing with 1/16" Ends** | | | | | | | |
| Red | 0.005" (0.127 mm) | 1/32" | 105 mm | 27,580 psi (1,902 bar) | ea. | VICI JR-T-96005 | 27781 |
| Red | 0.005" (0.127 mm) | 1/32" | 150 mm | 27,580 psi (1,902 bar) | ea. | VICI JR-T-96010 | 27782 |
| Red | 0.005" (0.127 mm) | 1/32" | 200 mm | 27,580 psi (1,902 bar) | ea. | VICI JR-T-96015 | 27783 |
| Red | 0.005" (0.127 mm) | 1/32" | 280 mm | 27,580 psi (1,902 bar) | ea. | VICI JR-T-96020 | 27784 |
| Red | 0.005" (0.127 mm) | 1/32" | 400 mm | 27,580 psi (1,902 bar) | ea. | VICI JR-T-96025 | 27785 |
| Red | 0.005" (0.127 mm) | 1/32" | 600 mm | 27,580 psi (1,902 bar) | ea. | VICI JR-T-96030 | 27786 |
| Red | 0.005" (0.127 mm) | 1/32" | 700 mm | 27,580 psi (1,902 bar) | ea. | VICI JR-T-96035 | 27787 |
| Red | 0.005" (0.127 mm) | 1/32" | 800 mm | 27,580 psi (1,902 bar) | ea. | VICI JR-T-96040 | 27788 |
| Yellow | 0.007" (0.178 mm) | 1/32" | 105 mm | 26,610 psi (1,835 bar) | ea. | VICI JR-T-96105 | 27789 |
| Yellow | 0.007" (0.178 mm) | 1/32" | 150 mm | 26,610 psi (1,835 bar) | ea. | VICI JR-T-96110 | 27790 |
| Yellow | 0.007" (0.178 mm) | 1/32" | 200 mm | 26,610 psi (1,835 bar) | ea. | VICI JR-T-96115 | 27791 |
| Yellow | 0.007" (0.178 mm) | 1/32" | 280 mm | 26,610 psi (1,835 bar) | ea. | VICI JR-T-96120 | 27792 |
| Yellow | 0.007" (0.178 mm) | 1/32" | 400 mm | 26,610 psi (1,835 bar) | ea. | VICI JR-T-96125 | 27793 |
| Yellow | 0.007" (0.178 mm) | 1/32" | 600 mm | 26,610 psi (1,835 bar) | ea. | VICI JR-T-96130 | 27794 |
| Yellow | 0.007" (0.178 mm) | 1/32" | 700 mm | 26,610 psi (1,835 bar) | ea. | VICI JR-T-96135 | 27795 |
| Yellow | 0.007" (0.178 mm) | 1/32" | 800 mm | 26,610 psi (1,835 bar) | ea. | VICI JR-T-96140 | 27796 |
| Yellow | 0.007" (0.178 mm) | 1/32" | 900 mm | 26,610 psi (1,835 bar) | ea. | VICI JR-T-96145 | 27797 |
| Blue | 0.010" (0.254 mm) | 1/32" | 105 mm | 25,160 psi (1,735 bar) | ea. | VICI JR-T-96205 | 27798 |
| Blue | 0.010" (0.254 mm) | 1/32" | 150 mm | 25,160 psi (1,735 bar) | ea. | VICI JR-T-96210 | 27799 |
| Blue | 0.010" (0.254 mm) | 1/32" | 200 mm | 25,160 psi (1,735 bar) | ea. | VICI JR-T-96215 | 27800 |
| Blue | 0.010" (0.254 mm) | 1/32" | 280 mm | 25,160 psi (1,735 bar) | ea. | VICI JR-T-96220 | 27801 |
| Blue | 0.010" (0.254 mm) | 1/32" | 400 mm | 25,160 psi (1,735 bar) | ea. | VICI JR-T-96225 | 27802 |
| Blue | 0.010" (0.254 mm) | 1/32" | 600 mm | 25,160 psi (1,735 bar) | ea. | VICI JR-T-96230 | 27803 |
| Blue | 0.010" (0.254 mm) | 1/32" | 700 mm | 25,160 psi (1,735 bar) | ea. | VICI JR-T-96235 | 27804 |
| Blue | 0.010" (0.254 mm) | 1/32" | 800 mm | 25,160 psi (1,735 bar) | ea. | VICI JR-T-96240 | 27805 |
| Orange | 0.020" (0.508 mm) | 1/32" | 105 mm | 20,230 psi (1,395 bar) | ea. | VICI JR-T-96305 | 27806 |
| Orange | 0.020" (0.508 mm) | 1/32" | 150 mm | 20,230 psi (1,395 bar) | ea. | VICI JR-T-96310 | 27807 |
| Orange | 0.020" (0.508 mm) | 1/32" | 200 mm | 20,230 psi (1,395 bar) | ea. | VICI JR-T-96315 | 27808 |
| Orange | 0.020" (0.508 mm) | 1/32" | 280 mm | 20,230 psi (1,395 bar) | ea. | VICI JR-T-96320 | 27809 |
| Orange | 0.020" (0.508 mm) | 1/32" | 400 mm | 20,230 psi (1,395 bar) | ea. | VICI JR-T-96325 | 27810 |
| Orange | 0.020" (0.508 mm) | 1/32" | 600 mm | 20,230 psi (1,395 bar) | ea. | VICI JR-T-96330 | 27811 |
| Orange | 0.020" (0.508 mm) | 1/32" | 700 mm | 20,230 psi (1,395 bar) | ea. | VICI JR-T-96335 | 27812 |
| Orange | 0.020" (0.508 mm) | 1/32" | 800 mm | 20,230 psi (1,395 bar) | ea. | VICI JR-T-96340 | 27813 |

# PEEK Tubing, Connectors, and Fittings

## Universal 10-32 PEEK Column Connectors and Plugs

Universal PEEK connectors allow easy installation of all 1/16" tubing, including stainless steel, up to 5,000 psi (350 bar).

| Description | qty. | Similar to Part # | cat.# |
|---|---|---|---|
| PEEK Column Connector (beige, round body) | 10-pk. | Agilent 5063-6591; Grace 5132970, Z227250 | 25015 |
| PEEK Column Plug (black) | 10-pk. | | 25016 |
| PEEK Finger-Tight Fittings (blue, flat-sided) | 10-pk. | | 27710 |
| | 25-pk. | | 27711 |



## PEEK Column Couplers

| Description | Color | Max Pressure | Union Bore | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|---|
| PEEK Column Coupler | Red | 5000 psi (350 bar) | 0.13 mm | ea. | VICI JR-26501 | 27724 |
| | Yellow | 5000 psi (350 bar) | 0.17 mm | ea. | VICI JR-26502 | 27725 |
| | Blue | 5000 psi (350 bar) | 0.25 mm | ea. | VICI JR-26503 | 27726 |

25322

## Survival Kit for HPLC, PEEK

For start-up and maintenance in all HPLC systems.

**Kit includes:**

- PEEK Column Connector (beige, round body), 10-pk.
- PEEK Tubing, 1/16" OD x 0.005" ID x 3 m (red stripe), ea.
- PEEK Tubing, 1/16" OD x 0.007" ID x 3 m (yellow stripe), ea.
- PEEK Tubing, 1/16" OD x 0.010" ID x 3 m (blue stripe), ea.
- PEEK Tubing Elbow, 90°, 5-pk.
- PEEK Tubing Elbow, 180°, 5-pk.
- PTFE Tubing, 1/8" OD x 0.063" (1.6 mm) ID x ea.
- PTFE Tubing, 1/8" OD x 0.094" (2.4 mm) ID x ea.
- Tubing Clip, 5-pk.
- ValvTool Wrench, ea.
- Open-End Wrenches, 1/4" x 5/16", 2-pk.*
- Clean-Cut Tubing Cutter, ea.
- Replacement Blade for Clean-Cut Cutter, ea.
- PEEK Union Connector 1/16", 2-pk.
- Mobile Phase Sparge Filter, 2 µm, ea.
- Mobile Phase Sparge Filter, 10 µm, ea.

The PEEK Survival Kit is an invaluable parts kit that contains tubing, fittings, and tools essential for setting up and maintaining your HPLC system: PEEK tubing, connectors, and elbows; PTFE tubing; a tubing cutter and extra blades; a ValvTool wrench; open-end wrenches; and more.

| Description | qty. | cat.# |
|---|---|---|
| Survival Kit for HPLC | kit | 25322 |

*Kit contains 1 wrench, replacement (cat.# 20110) is a 2-pk.

## In Stock and Ready to Ship!

Find hundreds of other supplies & accessories for your LC at **www.bgb-shop.com/restek-lc-accessories**

## PPS Hex-Head Fittings for HPLC

| Description | Color | Max Pressure | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| PPS Hex-Head Fittings | Black | 5000 psi (350 bar) | 10-pk. | VICI JR-58000-5 | 27714 |


27714

## PEEK Hex-Head Fittings for HPLC

| Description | Color | Max Pressure | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| PEEK Hex-Head Fittings | Natural | 5000 psi (350 bar) | 10-pk. | VICI JR-55100-5 | 27712 |


27712

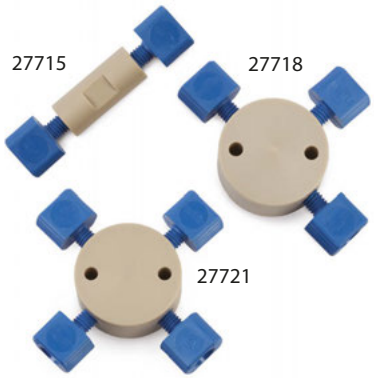
## PEEK-HT Hex-Head Fittings for HPLC and UHPLC

| Description | Color | Max Pressure | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| PEEK-HT Hex-Head Fittings with Driver | Natural | 10,000 psi (689 bar) | 10-pk. | VICI JR-5520N-10 | 27713 |


27713

## PEEK Unions, Tees, and Crosses for HPLC

| Description | Max Pressure | Union Bore | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|
| PEEK Union | 5000 psi (350 bar) | 0.25 mm | 2-pk. | Agilent 0100-2441; Grace 32141, 3112487; VICI JR-1061 | 27715 |
| | 5000 psi (350 bar) | 0.50 mm | 2-pk. | VICI JR-1066 | 27716 |
| | 5000 psi (350 bar) | 0.75 mm | 2-pk. | VICI JR-1067 | 27717 |
| PEEK Tee | 5000 psi (350 bar) | 0.25 mm | ea. | VICI JR-1030 | 27718 |
| | 5000 psi (350 bar) | 0.50 mm | ea. | VICI JR-1032 | 27719 |
| | 5000 psi (350 bar) | 0.75 mm | ea. | VICI JR-1033 | 27720 |
| PEEK Cross | 5000 psi (350 bar) | 0.25 mm | ea. | VICI JR-1040 | 27721 |
| | 5000 psi (350 bar) | 0.50 mm | ea. | VICI JR-1042 | 27722 |
| | 5000 psi (350 bar) | 0.75 mm | ea. | VICI JR-1043 | 27723 |




## PEEK Tubing

| Color | ID | OD | Length | Max Pressure | qty. | Similar to Part # | cat.# |
|---|---|---|---|---|---|---|---|
| Natural | 0.0025" | 1/16" | 1 m | 7000 psi | 3-pk. | VICI JR-T-5764-M1 | 27746 |
| Red Stripe | 0.005" | 1/16" | 3 m | 7000 psi | ea. | Agilent 5042-6461; Grace 5131751, AL35720; VICI JR-T-5999-M3 | 27747 |
| Red Stripe | 0.005" | 1/16" | 10 m | 7000 psi | ea. | VICI JT-T-5999-M10 | 27748 |
| Yellow Stripe | 0.007" | 1/16" | 3 m | 7000 psi | ea. | Agilent 0890-1763; Grace 5131753, AL35722; VICI JR-T-6000-M3 | 27749 |
| Yellow Stripe | 0.007" | 1/16" | 10 m | 7000 psi | ea. | VICI JR-T-6000-M10 | 27750 |
| Blue Stripe | 0.010" | 1/16" | 3 m | 5000 psi | ea. | Grace 5131759, AL35728; VICI JR-T-6001-M3 | 27751 |
| Blue Stripe | 0.010" | 1/16" | 10 m | 5000 psi | ea. | VICI JR-T-6001-M10 | 27752 |
| Orange Stripe | 0.020" | 1/16" | 3 m | 5000 psi | ea. | Grace 5131757, AL35726; VICI JR-T-6002-M3 | 27753 |
| Orange Stripe | 0.020" | 1/16" | 10 m | 5000 psi | ea. | VICI JR-T-6002-M10 | 27754 |
| Green Stripe | 0.030" | 1/16" | 3 m | 5000 psi | ea. | VICI JR-T-6003-M3 | 27755 |
| Green Stripe | 0.030" | 1/16" | 10 m | 5000 psi | ea. | VICI JR-T-6003-M10 | 27756 |


27746

# Well Plates & Mats

26494

## Well Plates

- Polypropylene plates with round-bottom wells reduce liquid retention; conical bottom provides optimal recovery of reagents.
- Nunc shared wall technology allows increased well volume for optimum storage capacity and improved mixing.
- Round well shape is ideal for applications that require vortexing.
- Ideal for sample collection, storage, sampling, and combinatorial chemistry and library applications.
- Fits most autosampler compartments.
- All microplates manufactured by Nunc meet the recommendation of American National Standards Institute (ANSI) (ANSI/SBS 1-2004).

| Description | Well Bottom | Well Shape | qty. | cat.# |
|---|---|---|---|---|
| 2.0 mL 96-Well Plates | round | round | case of 60 | 26492 |
| | round | round | 5-pk. | 26493 |
| 1.3 mL 96-Well Plates | round | round | case of 50 | 26494 |
| | round | round | 5-pk. | 26495 |
| 0.45 mL 96-Well Plates | conical | round | case of 120 | 26496 |
| | conical | round | 20-pk. | 26497 |

26498

## Universal Sealing Mats

- Protect contents and prevent carryover with preslit cap mats.
- Chemically resistant, silicone mats are excellent for compound storage to -80 °C.
- Preslit mats pierceable by autosampler needle, pipette tip, or probe.
- Universal mat for sealing 0.45, 1.3, and 2.0 mL plates.

| Description | qty. | cat.# |
|---|---|---|
| Universal Sealing Mat | case of 50 | 26498 |
| | 10-pk. | 26499 |

# Trident LC Column Protection

## for Ultra, Viva, Allure Acrylamide, and Pinnacle DB LC Columns

### Trident LC Column Protection System

Redesigned to be more rugged and easier to use!

- Match your needs with three levels of protection: filter only, cartridge only, or filter and cartridge.
- Durable metal tip with replaceable PEEK ferrule means easy installation onto column without tools.
- Improved thread design and materials create an optimal seal that releases and reseals easily, allowing multiple installations without galling and binding.
- Easy-to-remove cap frit simplifies filter replacement.
- Direct connection eliminates tubing and connectors that increase system volume and leak potential.
- Low-dead-volume design has negligible effect on chromatography.

27475

**Trident LC Column Protection System**

| Type | Includes | qty. | cat.# |
|---|---|---|---|
| Level 1: Filter Holder Only | filter holder; cap frit filter (4 mm, 2.0 µm); and PEEK ferrule | ea. | 27470 |
| Level 1: Filter Holder Only | filter holder; cap frit filter (4 mm, 2.0 µm); and PEEK ferrule | 4-pk. | 27471 |
| Level 2: Cartridge Holder Only | cartridge holder and PEEK ferrule | ea. | 27472 |
| Level 2: Cartridge Holder Only | cartridge holder and PEEK ferrule | 4-pk. | 27473 |
| Level 3: Filter Holder and Cartridge Holder Power Pack | filter holder; cap frit filter (4 mm, 2.0 µm); cartridge holder; and PEEK ferrule | ea. | 27474 |
| Level 3: Filter Holder and Cartridge Holder Power Pack | filter holder; cap frit filter (4 mm, 2.0 µm); cartridge holder; and PEEK ferrule | 4-pk. | 27475 |

* Fittings on all LC columns have 10-32 threads; however, seat depth varies. An improper seat will yield a poor connection and may affect chromatography. While all Restek LC columns will provide a zero-dead-volume connection when used with a properly installed Trident LC column protection system, analysts should consult the manufacturer for non-Restek column connections. A detailed discussion about port configurations can be found at https://www.restek.com/Pages/faq_lc

27471

27473

27475

## In Stock and Ready to Ship!

Find hundreds of other supplies & accessories for your LC at **www.bgb-shop.com/restek-lc-accessories**

# Tables and Reference

## Optimal Flow Rates

| | Optimal flow rate (mL/min)* | | | | | |
|---|---|---|---|---|---|---|
| Column ID (mm) | 1.8 µm dp | 3 µm dp | 5 µm dp | 1.8 µm Raptor | 2.7 µm Raptor | 5 µm Raptor |
| 4.6 | — | 1.5 | 1.0 | — | 1.6 | 1.0 |
| 3.2 | — | — | 0.5 | — | — | — |
| 3.0 | 1.1 | 0.6 | 0.4 | 1.0 | 0.7 | 0.4 |
| 2.1 | 0.5 | 0.3 | 0.2 | 0.5 | 0.3 | 0.2 |
| 1.0 | — | 0.07 | 0.05 | — | — | — |

* Optimal flow rates are mobile phase dependent; table above is provided as a guide.

## Common Classifications for LC Columns by Internal Diameter

| Classification | Internal Diameter |
|---|---|
| Capillary | <1.0 mm ID |
| Micro bore | 1.0 mm ID |
| Narrow bore | 2.1–3.0 mm ID |
| Standard bore | 3.2–4.6 mm ID |
| Semi-prep | 10–21.2 mm ID |
| Prep | 30–50 mm ID |

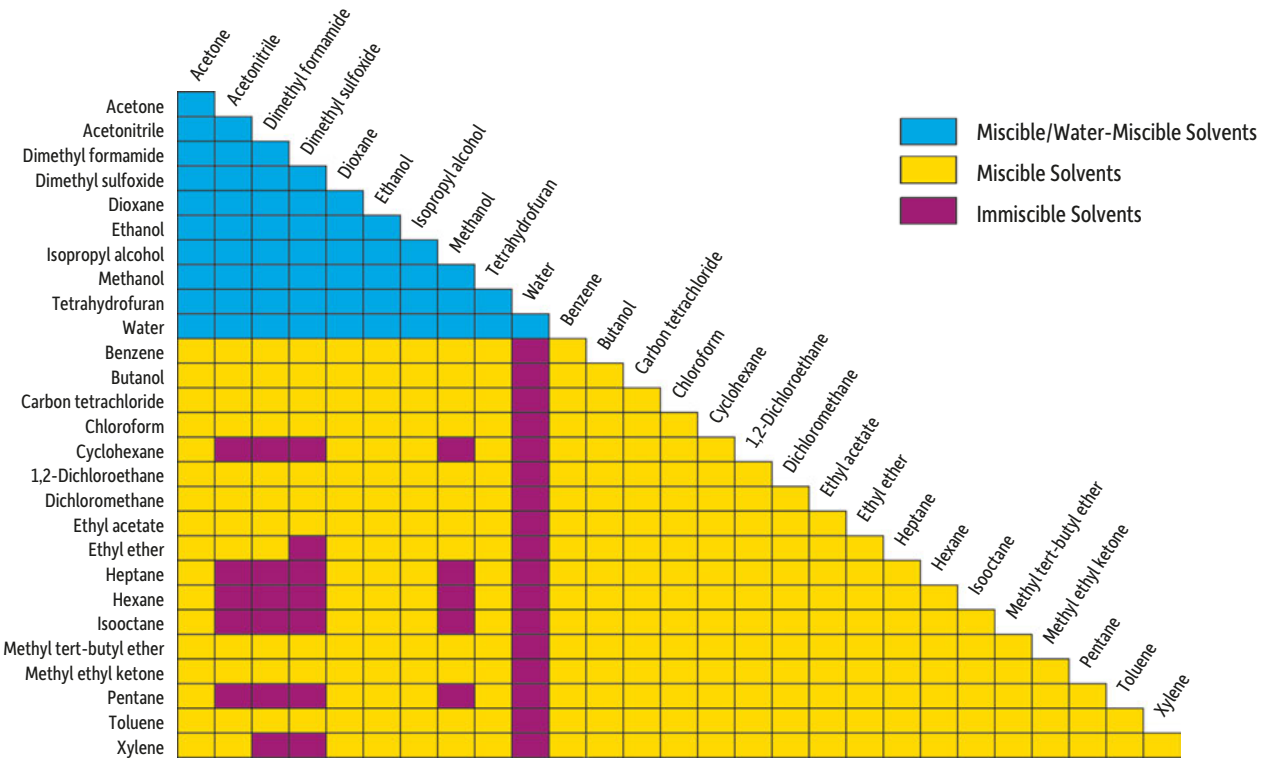
## HPLC Pump Pressure Conversion Table

| Pressure | psi | atm | kg/cm² | torr | kPa | bar | inches Hg |
|---|---|---|---|---|---|---|---|
| 1 psi = | 1 | 0.068 | 0.0703 | 51.713 | 6.8948 | 0.06895 | 2.0359 |
| 1 atm = | 14.696 | 1 | 1.0332 | 760 | 101.32 | 1.0133 | 29.921 |
| 1 kg/cm² = | 14.223 | 0.967 | 1 | 735.5 | 98.06 | 0.9806 | 28.958 |
| 1 torr = | 0.0193 | 0.00132 | 0.00136 | 1 | 0.1330 | 0.00133 | 0.0394 |
| 1 kPa = | 0.1450 | 0.00987 | 0.0102 | 7.52 | 1 | 0.0100 | 0.2962 |
| 1 bar = | 14.5038 | 0.9869 | 1.0197 | 751.88 | 100 | 1 | 29.5300 |
| 1 in Hg = | 0.49612 | 0.0334 | 0.0345 | 25.400 | 3.376 | 0.03376 | 1 |

To convert a pressure, multiply the units in the left-most column by the conversion factors listed in the columns to the right.

*For example:* 10 psi x 0.068 = 0.68 atm
10 bar x 29.5300 = 295.300 inches Hg

### Solvent Miscibility and Solubility



# LC Columns Physical Characteristics Chart

## UHPLC Columns

| Restek Column | End Cap? | Pore Size (Å) | Carbon Load (%) | Surface Area ($m^2/g$) | pH Range | Applications | Chromatographic Properties | Similar Phases | USP Code |
|---|---|---|---|---|---|---|---|---|---|
| **Raptor Biphenyl** | Y | 90 | 7 | 1.8 µm: 125 | 2.0 to 8.0 | Ideal for bioanalytical and forensic toxicology testing applications like therapeutic drug monitoring (TDM), drugs of abuse, and metabolite analyses with UHPLC-MS/MS. | Increased retention for dipolar, unsaturated, or conjugated compounds. Enhanced selectivity when used with methanolic mobile phase vs ACN. Provides increased peak capacity compared to fully porous particles for increased resolution of complex samples. | Ascentis Express Biphenyl (2.7µm), Kinetex Biphenyl | L11 |
| **Raptor ARC-18** | N | 90 | 7 | 1.8 µm: 125 | 1.0 to 8.0 | Recommended for high-throughput UHPLC-MS/MS applications with acidic mobile phases. Ideal for large, multiclass analyte lists including pesticides, vitamins, peptides, and amino acids. | Well-balanced retention profile emphasizing dispersion and hydrophobic interaction. Sterically protected ligand resists acid hydrolysis to withstand harsh, low-pH mobile phases used in UHPLC-MS/MS. | Ascentis Express Peptide ES-C18, Kinetex XB-C18, Poroshell 120 SB-C18, Accucore Vanquish C18+, Accucore XL C18 (1.5 µm) | L1 |
| **Raptor C18** | Y | 90 | 9 | 1.8 µm: 125 | 2.0 to 8.0 | The "go-to" phase for a variety of compound types provides excellent data quality for food safety and quality, environmental, bioanalytical, and other applications. | A traditional end-capped C18 ideal for general-purpose use in reversed-phase chromatography. Increased retention of hydrophobic compounds provides excellent data quality with methanol and ACN mobile phases. | Accucore Vanquish C18+, Accucore XL C18 (1.5 µm), Ascentis Express C18, Cortecs C18, Halo-2 C18, Kinetex C18, Poroshell 120 EC-C18 | L1 |
| **Raptor FluoroPhenyl** | N | 90 | 4 | 1.8 µm: 125 | 2.0 to 8.0 | Capable of running in reversed phase or HILIC mode for compounds like vitamin D epimers not well resolved on traditional C18 phases. Ideal for charged bases such as taxane drugs and other amine-containing compounds. | Electron-withdrawing fluorine atoms provide increased retention for charged bases. Reliable and efficient with acidic mobile phases for increasing selectivity and sensitivity in UHPLC-MS/MS analyses running in reversed phase or HILIC mode. | Ascentis Express F5, Halo 2 PFP, Kinetex F5, Poroshell PFP | L43 |
| **Force C18** | Y | 100 | 20 | 300 | 2.0 to 8.0 | Highly hydrophobic retention with a pH range of between 2.0 to 8.0. Suitable for the analysis of a wide range of compounds. | Traditional end-capped C18 ideal for general-purpose, reversed-phase use. Scalable from 1.8 µm to 3 µm to 5 µm for predictable method transfer from HPLC to UHPLC. | ACQUITY UPLC HSS C18, Develosil C18 (3 µm and 5 µm), Discovery C18, Hypersil Gold C18, Hypersil Gold Vanquish (1.9 µm), Inertsil ODS-2, Kromasil C18, LiChrospher RP-18, Luna C18, Luna Omega C18 (1.6 µm), Symmetry C18, Syncronis C18 (1.7 µm), Titan C18 (1.9 µm), Zorbax Eclipse Plus C18, Zorbax Eclipse XDB-C18, Zorbax RRHD Eclipse Plus C18 (1.8 µm), Zorbax RRHD Eclipse XDB-C18 (1.8 µm) | L1 |
| **Force Biphenyl** | Y | 100 | 15 | 300 | 2.0 to 8.0 | Ideal for bioanalytical testing applications like drug and metabolite analyses. Heightened selectivity and retention for compounds that are hard to resolve or elute early on C18 and other phenyl chemistries. | Increased retention for dipolar, unsaturated, or conjugated compounds. Enhanced selectivity when used with methanolic mobile phase vs ACN. Provides increased sensitivity and selectivity for LC-MS/MS analyses. Scalable from 1.8 µm to 3 µm to 5 µm for predictable method transfer from HPLC to UHPLC. | Unique | L11 |
| **Force FluoroPhenyl** | N | 100 | 10 | 300 | 2.0 to 8.0 | Reversed-phase or HILIC applications for a variety of compounds. Ideal for charged bases and other amine-containing compounds like xanthines and nitrofurans. | Electron-withdrawing fluorine atoms provide increased retention for charged bases. Reliable and efficient with acidic mobile phases for increasing selectivity and sensitivity in LC-MS/MS analyses running in reversed-phase or HILIC mode. Scalable from 1.8 µm to 3 µm to 5 µm for predictable method transfer from HPLC to UHPLC. | ACQUITY UPLC HSS PFP, Discovery HS F5, Hypersil Gold PFP, Hypersil Gold Vanquish PFP (1.9 µm), Luna PFP(2), Pursuit PFP, Titan PFP (1.9 µm) | L43 |
| **Pinnacle DB C18** | Y | 140 | 11 | 150 | 2.5 to 8.0 | Hydrophobic C18 phase suitable for analyses of a wide range of compounds, from acidic through slightly basic. | Highly base-deactivated spherical silica manufactured by Restek Monomeric C18 bonding. | Spherisorb ODS, Zorbax ODS | L1 |
| **Pinnacle DB Aqueous C18** | N | 140 | 6 | 150 | 2.5 to 8.0 | Ideal for applications that require highly aqueous mobile phases, such as organic acids and water-soluble vitamins. | Highly selective phase for polar analytes. Compatible with highly aqueous (up to 100%) mobile phases. Silica manufactured by Restek. | AQUA C18, Aquasil C18, Hypersil Gold AQ, YMC ODS-AQ | L1 |
| **Pinnacle DB Biphenyl** | Y | 140 | 8 | 150 | 2.5 to 8.0 | Excellent choice for the analysis of steroids, tetracyclines, drug metabolites, and other compounds that contain some degree of unsaturation. | Highly base-deactivated spherical silica manufactured by Restek. Unique reversed-phase material that displays both increased retention and selectivity for aromatic and/or unsaturated compounds when compared to conventional alkyl and phenyl phases. | Unique | L11 |
| **Pinnacle DB IBD** | N | 140 | Proprietary | 150 | 2.5 to 8.0 | A polar group assists in deactivating surface silanols and contributes to unique separation selectivities for acids, bases, zwitterions, and other polar compounds. | One of a group of intrinsically base-deactivated (IBD) phases, with a polar group within, or intrinsic to, the alkyl bonded phase. Provides unique selectivity and high level of base deactivation while reducing or eliminating the need for mobile phase additives. | Unique | L68 |
| **Pinnacle DB PFP Propyl** | Y | 140 | 6 | 150 | 2.5 to 8.0 | Exhibits excellent peak shapes for a wide range of compounds, including nucleosides, nucleotides, and halogenated compounds. | Highly base-deactivated spherical silica manufactured by Restek. Unique pentafluorophenyl phase with a propyl spacer. | Discovery HS F5 | L43 |
| **Pinnacle DB Silica** | N/A | 140 | N/A | 150 | 2.5 to 8.0 | Normal phase mode of separation. | Highly base-deactivated spherical silica manufactured by Restek. | Zorbax Silica | L3 |
| **Pinnacle DB PAH** | N | 140 | Proprietary | 150 | 2.5 to 8.0 | Ideal for polycyclic aromatic hydrocarbons. | Specifically designed to resolve complex mixtures of polycyclic aromatic hydrocarbons. | Unique | — |

## LC Columns Physical Characteristics Chart (cont.)

# HPLC Columns

| Restek Column | End Cap? | Pore Size (Å) | Carbon Load (%) | Surface Area ($m^2/g$) | pH Range | Applications | Chromatographic Properties | Similar Phases | USP Code |
|---|---|---|---|---|---|---|---|---|---|
| **Roc C18** | Y | 100 | 20 | 300 | 2.5 to 8.0 | General-purpose HPLC column for a variety of compounds from acidic to slightly basic. Ideal for high-volume workflows using USP or other compendial type methods. | A very retentive, high-purity ODS phase that exhibits excellent peak shape for a wide range of compounds. | Hypersil Gold C18, Luna C18, Reliant C18, Symmetry C18, Zorbax Eclipse C18, Zorbax Eclipse XDB C18 | L1 |
| **Roc C8** | Y | 100 | 12 | 300 | 2.5 to 8.0 | General-purpose HPLC column for a variety of compounds from acidic to slightly basic. Ideal for high-volume workflows using USP or other compendial-type methods. | The shorter alkyl chain results in less hydrophobic retention and improved basic peak shape over a traditional C18. | Eclipse Plus C8, Hypersil Gold C8, Luna C8, Symmetry C8, Zorbax Eclipse XDB C8 | L7 |
| **Roc Phenyl-Hexyl** | Y | 100 | 15 | 300 | 2.5 to 8.0 | General-purpose HPLC column ideal for high-volume workflows using USP or other compendial-type methods. Recommended for aromatic analytes and complex samples. | A phenyl ring attached to a 6-carbon chain provides alternate selectivity to straight-chain hydrocarbon phases. Analyte interaction profile includes both dispersion and aromatic polarizability. | Eclipse Plus Phenyl-Hexyl, Hypersil Gold Phenyl, Luna Phenyl-Hexyl, Zorbax Eclipse XDB-Phenyl | L11 |
| **Roc Cyano** | Y | 100 | 8 | 300 | 2.5 to 8.0 | Recommended for assays where alternate selectivity or confirmation to a C8 or C18 is desired. Also an excellent choice for protonated bases. Ideal for high-volume workflows using USP or other compendial-type methods. | Cyanopropyl silane that can be used in normal phase, reversed-phase, or HILIC modes. | Hypersil Cyano, Luna CN, XSelect CN, Zorbax Eclipse XDB-CN | L10 |
| **Roc Silica** | N/A | 100 | N/A | 300 | 2.5 to 8.0 | Small nonpolar compounds in normal phase mode, polar compounds like water-soluble vitamins, steroids, and organic acids in HILIC mode. | Base-deactivated for normal phase or HILIC separations. | Hypersil Gold Silica, Luna Silica, Pursuit XRs-Si | L3 |
| **Raptor Biphenyl** | Y | 90 | 7 (2.7 µm) | 2.7 µm: 130, 5 µm: 100 | 2.0 to 8.0 | Ideal for bioanalytical testing applications like drug and metabolite analyses. Heightened selectivity and retention for compounds that are hard to resolve or elute early on C18 and other phenyl chemistries. | Increased retention for dipolar, unsaturated, or conjugated solutes. Enhanced selectivity when used with methanolic mobile phase. Ideal for increasing sensitivity and selectivity in LC-MS analyses. | Ascentis Express, Express Biphenyl, AMT, Halo Biphenyl (2.7 µm), Kinetix Biphenyl, Thermal Accucore Biphenyl (2.6 µm) | L11 |
| | | | 5 (5 µm) | | | | | | |
| **Raptor ARC-18** | N | 90 | 7 (2.7 µm) | 2.7 µm: 130, 5 µm: 100 | 1.0 to 8.0 | Ideal for high-throughput LC-MS/MS applications with minimal sample preparation. Well-balanced retention profile for better detection and integration of large, multiclass analyte lists. | Well-balanced retention profile. Sterically protected and acid-resistant to withstand harsh, low-pH mobile phases. Ideal for use with sensitive detectors like mass spec. | Accucore XL C18, Ascentis Express Peptide ES-C18, Kinetex XB-C18, Poroshell 120 SB-C18 | L1 |
| | | | 5 (5 µm) | | | | | | |
| **Raptor C18** | Y | 90 | 7 (2.7 µm) | 2.7 µm: 130, 5 µm: 100 | 2.0 to 8.0 | A traditional end-capped C18 ideal for general-purpose use in reversed-phase chromatography. pH range (2–8) provides excellent data quality for many applications, matrices, and compounds. | Compatible with moderately acidic to neutral mobile phases (pH 2–8). Excellent data quality in food, environmental, bioanalytical, and other applications. | Accucore C18, Accucore RP-MS, ACE UltraCore Super C18, Ascentis Express C18, Cortecs C18, Halo 2.7 C18, Kinetex C18, Nucleoshell RP 18, Poroshell EC-C18, Sunshell C18 | L1 |
| | | | 5 (5 µm) | | | | | | |
| **Raptor FluoroPhenyl** | N | 90 | 4 (2.7 µm) | 2.7 µm: 130, 5 µm: 100 | 2.0 to 8.0 | HILIC applications and compounds like vitamin D epimers not well resolved on traditional C18 phases. Ideal for charged bases such as taxane drugs and other amine-containing compounds. | Electron-withdrawing fluorine atoms provide increased retention for charged bases. Reliable and efficient with acidic mobile phases for increasing selectivity and sensitivity in LCMS/MS analyses. | Accucore PFP, Ascentis Express F5, Halo 2.7 PFP, Kinetex PFP, Nucleoshell PFP, Poroshell PFP | L43 |
| | | | 3 (5 µm) | | | | | | |
| **Raptor HILIC-Si** | N/A | 90 | N/A | 130 | 2.0 to 8.0 | Ideal for small polar compounds, especially nitrogen-containing, which are protonated under high organic conditions. Recommended for the analysis of paraquat and diquat. | Retention of small polar molecules without ion-pairing reagents. | Accucore HILIC, Ascentis Express HILIC, Cortecs HILIC, Halo HILIC, Kinetex HILIC, Poroshell 120 HILIC | L3 |
| **Raptor Polar X** | Proprietary | 90 | Proprietary | 130 | 2.0 to 8.0 | Recommended for LC-MS/MS analysis of polar compounds. Ideal for analyzing glyphosate and other polar contaminants in the QuPPe method, underivatized amino acids, and ultra-short chain PFAS. | Excellent resolution and separation of a wide variety of polar compounds. Combines HILIC and ion-exchange retention mechanisms together in a single ligand. Broadly applicable for polar compound analysis spanning different industries and methods. | Unique | N/A |

## LC Columns Physical Characteristics Chart (cont.)

# HPLC Columns (cont.)

| Restek Column | End Cap? | Pore Size (Å) | Carbon Load (%) | Surface Area ($m^2/g$) | pH Range | Applications | Chromatographic Properties | Similar Phases | USP Code |
|---|---|---|---|---|---|---|---|---|---|
| **Ultra C1** | N/A | 100 | 5 | 300 | 2.5 to 8.0 | Alternative selectivity to Ultra C18 or C8 columns, especially for polar analytes. Shortest chain alkyl phase available for reversed-phase separations. | Exceptionally stable C1 packing resists hydrolysis, even under acidic mobile phase conditions. Least retentive reversed-phase hydrocarbon packing. | Spherisorb C1 | L13 |
| **Ultra C4** | Y | 100 | 9 | 300 | 2.5 to 8.0 | Ideal for peptides and small proteins. | Exceptionally stable C4 packing, with high bonding coverage and silanol base deactivation. Exhibits shorter retention than C18 or C8 phases. | Delta-Pak C4, Supelcosil Butyl (C4) | L26 |
| **Ultra C8** | Y | 100 | 12 | 300 | 2.5 to 8.0 | Selectivity and peak shape similar to Ultra C18, but less hydrophobic retention. | Very retentive, high-purity, base-deactivated reversed-phase packing that exhibits excellent peak shape for a wide range of compounds. | Eclipse Plus C8, Hypersil Gold C8, Luna C8, Symmetry C8, Zorbax Eclipse XDB C8 | L7 |
| **Ultra C18** | Y | 100 | 20 | 300 | 2.5 to 8.0 | Ideal for anilines, barbiturates, carbonyls, fat-soluble vitamins, fatty acids, glycerides, phthalates, PTH amino acids, steroids, other acids. | A very retentive, high-purity phase that exhibits excellent peak shape for a wide range of compounds. Recommended as a general-purpose, reversed-phase column. | Develosil C18, Discovery C18, Eclipse Plus C-18, Hypersil Gold C18, Inertsil ODS-2, Kromasil C18, LiChrospher RP-18, Luna C18, Symmetry C18, Zorbax Eclipse XDB-CB | L1 |
| **Ultra Aqueous C18** | N | 100 | 15 | 300 | 2.5 to 8.0 | Ideal for analyses that require >90% water in the mobile phase. Excellent for highly water-soluble or poorly organic-soluble compounds. Excellent for water-soluble vitamins and organic acids. | Highly retentive and selective for reversed-phase separations of polar analytes. Highly base deactivated. Compatible with highly aqueous (up to 100%) mobile phases. | AQUA C18, Aquasil C18, Hypersil Gold AQ, YMC ODS-AQ | L1 |
| **Ultra Biphenyl** | Y | 100 | 15 | 300 | 2.5 to 8.0 | An excellent choice for the analysis of steroids, tetracyclines, drug metabolites, and other compounds that contain some degree of unsaturation. | A unique reversed-phase material that exhibits both increased retention and selectivity for aromatic and/or unsaturated compounds, compared to conventional alkyl and phenyl phases. | Unique | L11 |
| **Ultra Aromax** | Y | 100 | 17 | 300 | 2.5 to 8.0 | A very suitable choice for analysis of steroids, tetracyclines, drug metabolites, and other compounds that contain some degree of unsaturation. | A unique reversed-phase material that exhibits superior retention and selectivity for aromatic and/or unsaturated compounds, compared to conventional alkyl and phenyl phases. This column is a great alternative to our Biphenyl phase when increased retention is required. | Unique | L11 |
| **Ultra IBD** | N | 100 | 12 | 300 | 2.5 to 8.0 | A polar group assists in deactivating surface silanols and contributes to unique separation selectivities for acids, bases, zwitterions, and other polar compounds. | One of a group of intrinsically base-deactivated (IBD) phases, with a polar group within, or intrinsic to, the alkyl bonded phase. Provides unique selectivity and high level of base deactivation while reducing or eliminating the need for mobile phase additives. | Discovery ABZ & ABZ+, Prism, SymmetryShield | L68 |
| **Ultra PFP Propyl** | Y | 100 | 11 | 300 | 2.5 to 8.0 | Highly retentive for basic analytes. An excellent phase for separating nucleosides, nucleotides, purines, pyrimidines, and halogenated compounds. | A pentafluorophenyl phase with a propyl spacer. | Discovery HS F5, Luna PFP(2), Pursuit PFP | L43 |
| **Ultra Cyano** | Y | 100 | 8 | 300 | 2.5 to 8.0 | Excellent for basic pharmaceuticals, steroids (normal or reversed-phase conditions), or other basic compounds. | High-purity cyano phase with reduced silanol activity. Often a better choice than C18 for basic pharmaceuticals. Cyano is the most stable bonded phase for normal phase mode. | Develosil Cyano, Hypersil Gold CN, Luna CN, Platinum CN, Zorbax Eclipse XDB-CN | L10 |
| **Ultra Amino** | N | 100 | 2 | 300 | 2.5 to 8.0 | Superior general-purpose amino phase. Ideal for carbohydrates. | Recommended for normal phase analyses of mono- and disaccharides and other similar compounds. Can also serve as a weak anion exchanger, with aqueous buffers. | Develosil NH2, Platinum Amino | L8 |
| **Ultra Silica** | N/A | 100 | N/A | 300 | 2.5 to 8.0 | Ideal for normal phase applications. | High-purity, high surface area. | — | L3 |
| **Pinnacle DB C8** | Y | 140 | 6 | 150 | 2.5 to 8.0 | Applications similar to Pinnacle DB C18, but with less hydrophobic retention. Less retention can be useful for shortening analysis time, if resolution is adequate. | Highly base-deactivated spherical silica manufactured by Restek. Monomeric C8 bonding. Similar to Pinnacle DB C18, but the shorter alkyl chain provides less hydrophobic retention. | Spherisorb C8, Zorbax C8 | L7 |
| **Pinnacle DB Cyano** | Y | 140 | 4 | 150 | 2.5 to 8.0 | Suitable for a wide range of compounds, from acidic through slightly basic. Also useful for confirmation of analyses on a C18 or C8 column. Can be used in normal phase or reversed-phase mode of separation. | Highly base-deactivated spherical silica manufactured by Restek Cyano bonding. | Spherisorb Cyano, Zorbax CN | L10 |

## LC Columns Physical Characteristics Chart (cont.)

# Specialty Columns

| Restek Column | End Cap? | Pore Size (Å) | Carbon Load (%) | Surface Area ($m^2/g$) | pH Range | Applications | Chromatographic Properties | Similar Phases | USP Code |
|---|---|---|---|---|---|---|---|---|---|
| **Raptor EtG/EtS** | — | 90 | Proprietary | 130 | 2.0 to 8.0 | Application-specific column for the analysis of ethanol metabolites ethyl glucuronide (EtG) and ethyl sulfate (EtS) in urine. | Reproducible retention of EtG and EtS resolved from matrix interferences. | Unique | — |
| **Allure Acrylamide** | N | 60 | Proprietary | 450 | 2.5 to 8.0 | Application-specific column for the analysis of acrylamide in food and drinking water. | A very high surface area particle combined with a proprietary bonded phase to offer unique retention for small polar molecules like acrylamide. | Unique | — |
| **Allure Silica** | N/A | 60 | N/A | 450 | 2.5 to 8.0 | Highly retentive phase for normal phase separation. Recommended for MOSH/MOAH analysis. | Highly retentive phase for normal phase separation of polar analytes. Very high surface area. | LiChrospher Si-60 (irregularly shaped particle), Maxsil Si (irregularly shaped particle) | L3 |
| **Allure AK** | Y | 60 | Proprietary | 450 | 2.5 to 8.0 | Ideal for the analysis of aldehydes and ketones as DNPH derivatives. | Highly retentive, highly selective phase, developed specifically for the analysis of aldehydes and ketones as DNPH derivatives. | Unique | — |
| **Allure Organic Acids** | N | 60 | Proprietary | 450 | 2.5 to 8.0 | Excellent resolution of challenging organic acids. | Single 30 cm column performs equally to two C18 columns in series. (AOAC Method 986.13) | Unique | — |
| **Pinnacle II PAH** | N | 110 | Proprietary | 180 | 2.5 to 8.0 | Maximum resolution of polycyclic aromatic hydrocarbons. | Proprietary stationary phase; resolves 16 PAHs in US EPA Method 610. Silica manufactured by Restek. | Unique | — |
| **Ultra Carbamate** | — | 100 | Proprietary | 300 | 2.5 to 8.0 | Rapid analysis of carbamates. | Proprietary stationary phase can process up to twice as many samples per hour, compared to a conventional C18 phase. | Unique | — |
| **Ultra Quat** | — | 100 | Proprietary | 300 | 2.5 to 8.0 | Proprietary phase for the analysis of quaternary amines. | High-purity silica. | Unique | — |

# Large Molecule Columns

| Restek Column | End Cap? | Pore Size (Å) | Carbon Load (%) | Surface Area ($m^2/g$) | pH Range | Applications | Chromatographic Properties | Similar Phases | USP Code |
|---|---|---|---|---|---|---|---|---|---|
| **Viva C4** | Y | 300 | 3.5 | 100 | 2.5 to 8.0 | Proteins and other higher molecular weight compounds. Less retentive than C18 and C8 phases. | Silica manufactured by Restek with a narrow distribution around the 300Å mean pore size for more surface interaction and analyte retention. | 208 TP C4, BioBasic 4, Jupiter 300 C4, Symmetry 300 C4, Synchropak C4 | L26 |
| **Viva C8** | Y | 300 | 5 | 100 | 2.5 to 8.0 | Proteins and other higher molecular weight compounds. Less retentive than C18 phase. | Silica manufactured by Restek with a narrow distribution around the 300Å mean pore size for more surface interaction and analyte retention. | 208 TP C8, BioBasic 8, Synchropak C8, Zorbax 300 OSB C8 | L7 |
| **Viva C18** | Y | 300 | 9 | 100 | 2.5 to 8.0 | Proteins and other higher molecular weight compounds. | Silica manufactured by Restek with a narrow distribution around the 300Å mean pore size for more surface interaction and analyte retention. | 208 TP C18, BioBasic 18, Jupiter 300 C18, Symmetry 300 C18, Synchropak C18, Zorbax 300 OSB C18 | L1 |
| **Viva Biphenyl** | Y | 300 | 7 | 100 | 2.5 to 8.0 | Exhibits excellent peak shape for a wide range of compounds; ideal for large molecule and biomolecule assays. | Silica manufactured by Restek with a narrow distribution around the 300Å mean pore size for more surface interaction and analyte retention. | Unique | L11 |
| **Viva PFP Propyl** | Y | 300 | 5 | 100 | 2.5 to 8.0 | Exhibits excellent peak shape for a wide range of compounds, including nucleosides, nucleotides, and halogenated compounds. | Silica manufactured by Restek with a narrow distribution around the 300Å mean pore size for more surface interaction and analyte retention. | Unique | L43 |
| **Viva Silica** | N/A | 300 | N/A | 100 | 2.5 to 8.0 | Normal phase applications for highly retained high molecular weight compounds. | Silica manufactured by Restek with a narrow distribution around the 300Å mean pore size for more surface interaction and analyte retention. | Unique | L3 |

# Notes:

# Find us at www.bgb-shop.com/restek

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