LC Columns

U.S. Pharmacopeia Cross-Reference

L1	Octadecyl silane chemically bonded to porous silica or ceramic microparticles; 1.7 to 10 µm in diameter or a monolithic rod. *Raptor™ ARC-18 (p. 158), Raptor™ C18 (p. 158), Pinnacle® DB Aqueous C18 (p. 163), Pinnacle® DB C18 (p. 166), Ultra Aqueous C18 (p. 169), Ultra C18 (p. 171), Viva C18 (p. 175)*
L3	Porous silica particles; 5 to 10 µm in diameter. *Pinnacle® DB Silica (p. 168), Ultra Silica (p. 174), Viva Silica (p. 177)*
L7	Octylsilane chemically bonded to totally porous silica particles; 1.7 to 10 µm in diameter. *Pinnacle® DB C8 (p. 167), Ultra C8 (p. 172), Viva C8 (p. 175)*
L8	An essentially monomolecular layer of aminopropylsilane chemically bonded to totally porous silica gel support; 3 to 10 µm in diameter. *Ultra Amino (p. 174)*
L10	Nitrile groups chemically bonded to porous silica particles; 3 to 10 µm in diameter. *Pinnacle® DB Cyano (p. 167), Ultra Cyano (p. 174)*
L11	Phenyl groups chemically bonded to porous silica particles; 1.7 to 10 µm in diameter. *Raptor™ Biphenyl (p. 157), Pinnacle® DB Biphenyl (p. 165), Ultra Biphenyl (p. 170), Ultra Aromax (p. 173), Viva Biphenyl (p. 176)*
L13	Trimethylsilane chemically bonded to porous silica particles; 3 to 10 µm in diameter. *Ultra C1 (p. 173)*
L26	Butyl silane chemically bonded to totally porous silica particles; 3 to 10 µm in diameter. *Ultra C4 (p.172), Viva C4 (p.176)*
L43	Pentafluorophenyl groups chemically bonded to silica particles by a propyl spacer; 5 to 10 µm in diameter. *Pinnacle® DB PFP Propyl (p. 166), Ultra PFP Propyl (p. 171), Viva PFP Propyl (p. 176)*
L68	Spherical, porous silica; 100 µm or less in diameter, the surface of which has been covalently modified with alkyl amide groups and not end-capped. *Pinnacle® DB IBD (p. 164), Ultra IBD (p. 169)*

Optimal Linear Velocities

Column ID (mm)	Optimal flow rate (mL/min)* 1.9 µm dp	3 µm dp	5 µm dp	2.7 µm Raptor™	5 µm Raptor™
4.6	—	1.5	1.0	1.6	1.0
3.2	—	0.7	0.5	0.8	0.5
3.0	1.1	0.6	0.4	0.7	0.4
2.1	0.5	0.3	0.2	0.3	0.2
1.0	—	0.07	0.05	0.08	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

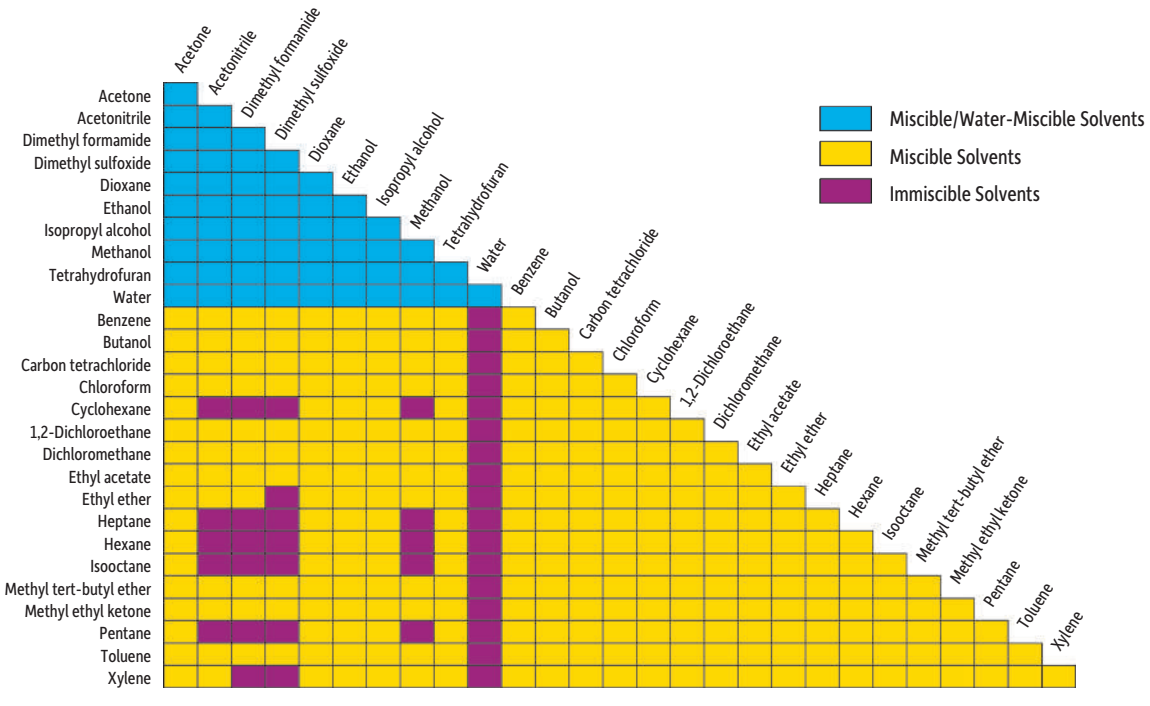
HPLC Pump Pressure Conversion Table

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



Raptor™ LC Columns

NEW!

SPP speed.
USLC® resolution.

A new species of column.

Restek is excited to announce the evolution of superficially porous particles with the introduction of Raptor™ LC columns and guards.

Superficially porous particles (commonly referred to as SPP or "core-shell" particles) changed the world of LC by dramatically boosting column efficiency and reducing analysis times, but they were only the beginning. With Raptor™ LC columns, Restek chemists have combined the speed of SPP with the resolution of highly selective USLC® technology. This new species of chromatographic column allows you to more easily achieve peak separation and faster analysis times without expensive UHPLC instrumentation.

- Higher efficiency for drastically faster analysis times.
- Better selectivity for substantially improved resolution.
- Increased sample throughput with existing HPLC instrumentation.
- Long-lasting ruggedness for dependable reproducibility.

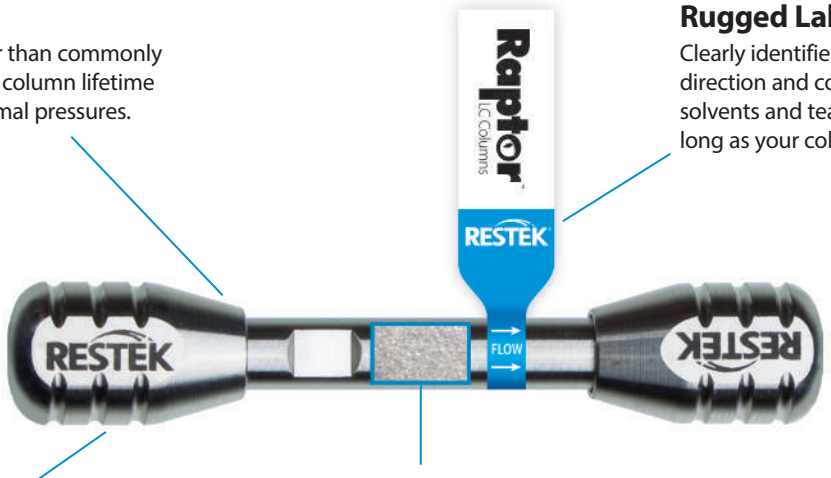
Selectivity Accelerated

Put Raptor™ LC columns and guards to the test on your most challenging workflows!

Dissecting the Raptor™ LC Column

Larger 2 µm Frit
Prevents clogging better than commonly used 0.5 µm frits; boosts column lifetime 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 (600 bar for 2.7 µm; 400 bar for 5 µm); achieves higher linear velocities without sacrificing efficiency or lifetime.

Raptor™ SPP Particles

Robust 2.7 and 5 µm Particles
Let you run high-speed analyses without UHPLC.

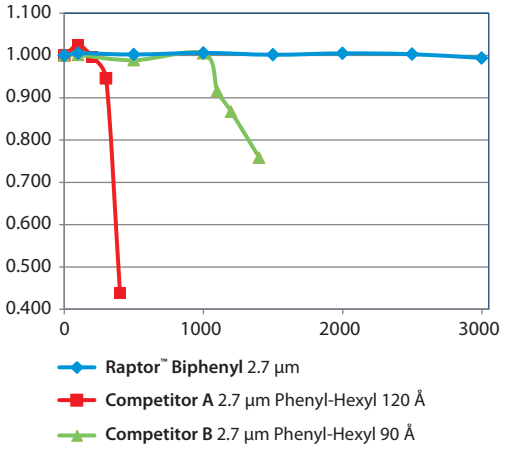
Narrow Silica Distribution
Ensures high efficiency and consistent flows.

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

Pressure Stability

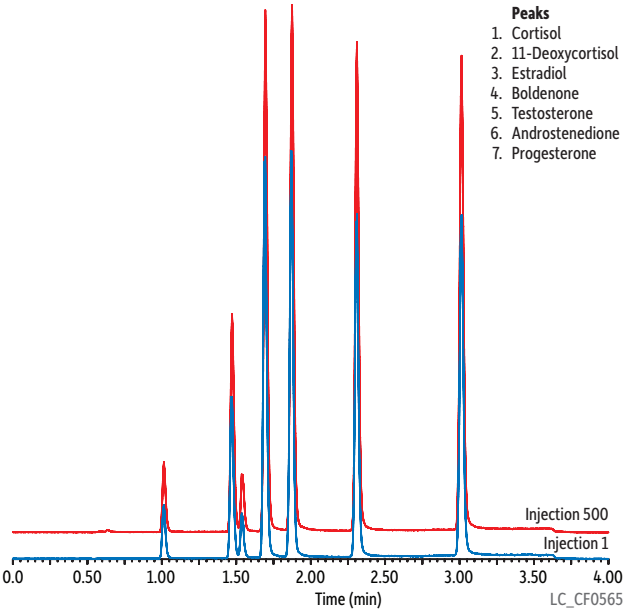
At high pressures, competitor phenyl-hexyl columns experience a quick and sharp drop-off in efficiency, but Raptor™ columns are unaffected to at least 3,000 injections.

% Efficiency vs # of Injections
Raptor™ 2.7 µm Column vs Competitor
50 x 2.1 mm Phenyl-Hexyls @ 600 bar



Reproducibility

Even after hundreds of injections, a Raptor™ column will provide consistent, reliable data.



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.

Raptor™ EXP® Guard Column

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 patent-pending guard column hardware developed by Optimize Technologies. A Raptor™ LC guard column cartridge in an EXP® direct connect holder is the ultimate in column protection.

Patented Titanium Hybrid Ferrules

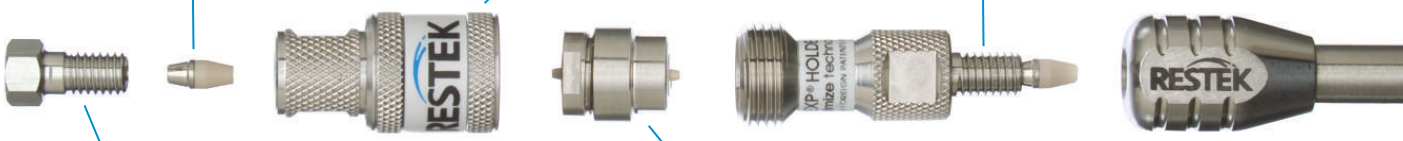
Can be installed repeatedly without compromising high-pressure seal.

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 to best suit your needs.

Unidirectional Raptor™ Cartridge

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

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

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

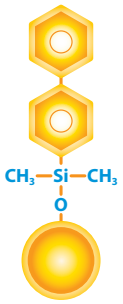
Raptor™ Biphenyl LC Columns (USP L11)

NEW!

Chromatographic Properties

The innovative 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 like 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.

Length	2.1 mm cat.#	price	3.0 mm cat.#	price	4.6 mm cat.#	price
2.7 µm Columns						
30 mm	9309A32	£362.25	9309A3E	£362.25	9309A35	£362.25
50 mm	9309A52	£393.75	9309A5E	£393.75	9309A55	£393.75
100 mm	9309A12	£425.25	9309A1E	£425.25	9309A15	£425.25
150 mm	9309A62	£456.75	9309A6E	£456.75	9309A65	£456.75
5 µm Columns						
30 mm	—		930953E	£349.15	—	
50 mm	9309552	£385.90	930955E	£385.90	9309555	£385.90
100 mm	9309512	£422.65	930951E	£422.65	9309515	£422.65
150 mm	9309562	£459.40	930956E	£459.40	9309565	£459.40
250 mm	—		—		9309575	£551.25



Column Characteristics:

Stationary Phase Category: Phenyl (L11)
Ligand Type: Biphenyl
Particle: 2.7 µm or 5 µm superficially porous silica (SPP or "core-shell")
Pore Size: 90 Å
Surface Area: 150 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: 600 bar / 8,700 psi (2.7 µm) or 400 bar / 5,800 psi (5 µm)

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.

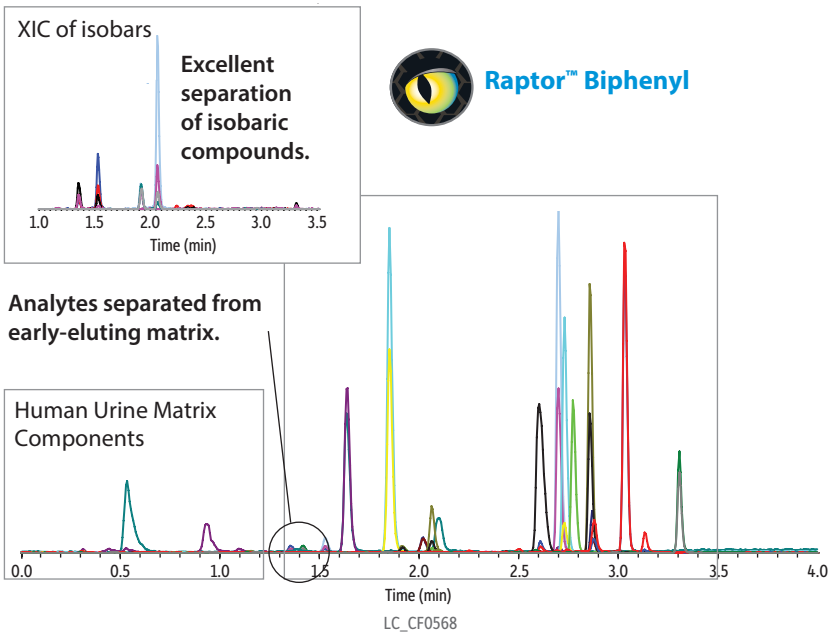
Switch to a Biphenyl when:

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

USLC® Column Interaction Profile

(See page 161 for more information.)

Pain Panel in Urine on Raptor™ Biphenyl (50 x 3.0 mm) by LC-MS/MS



LC_CF0568

For compound listing including isobars, visit **www.restek.com** and search for LC_CF0568.

Column
Dimensions: 50 mm x 3.0 mm ID
Particle Size: 2.7 µm
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: Water + 0.1% formic acid
B: Methanol + 0.1% formic acid

Time (min)	Flow (mL/min)	%A	%B
0.00	0.6	90	10
1.50	0.6	55	45
2.50	0.6	0	100
3.70	0.6	0	100
3.71	0.6	90	10
5.00	0.6	90	10

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.

Raptor™ ARC-18 LC Columns (USP L1)

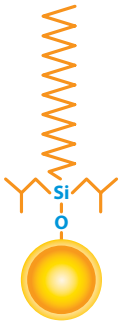
NEW!

Chromatographic Properties

Designed and intended specifically for use on LC-MS/MS systems, the Raptor™ ARC-18 column offers 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 Characteristics:

Stationary Phase Category: C18, octadecylsilane (L1)
Ligand Type: Sterically protected C18
Particle: 2.7 µm or 5 µm superficially porous silica (SPP or "core-shell")
Pore Size: 90 Å
Surface Area: 150 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: 600 bar / 8,700 psi (2.7 µm) or 400 bar / 5,800 psi (5 µm)



Properties:

- Well-balanced retention profile.
- Sterically protected and acid-resistant 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.
- Strongly acidic (pH 1–3) mobile phases are required.

USLC® Column Interaction Profile

(See page 161 for more information.)

Length	2.1 mm cat.#	price	3.0 mm cat.#	price	4.6 mm cat.#	price
2.7 µm Columns						
30 mm	9314A32	£362.25	9314A3E	£362.25	9314A35	£362.25
50 mm	9314A52	£393.75	9314A5E	£393.75	9314A55	£393.75
100 mm	9314A12	£425.25	9314A1E	£425.25	9314A15	£425.25
150 mm	9314A62	£456.75	9314A6E	£456.75	9314A65	£456.75
5 µm Columns						
30 mm	—		931453E	£349.15	—	
50 mm	9314552	£385.90	931455E	£385.90	9314555	£385.90
100 mm	9314512	£422.65	931451E	£422.65	9314515	£422.65
150 mm	9314562	£459.40	931456E	£459.40	9314565	£459.40
250 mm	—		—		9314575	£551.25

Raptor™ C18 LC Columns (USP L1)

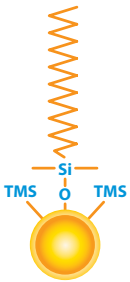
NEW!

Chromatographic Properties

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. This traditional end-capped 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 or environmental or bioanalytical analyses, this phase offers consistently excellent data quality in less time across myriad reversed-phase applications, matrices, and compound classes. 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*.

Column Characteristics:

Stationary Phase Category: C18, octadecylsilane (L1)
Ligand Type: End-capped C18
Particle: 2.7 µm or 5 µm superficially porous silica (SPP or "core-shell")
Pore Size: 90 Å
Surface Area: 150 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: 600 bar / 8,700 psi (2.7 µm) or 400 bar / 5,800 psi (5 µm)



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.

USLC® Column Interaction Profile

(See page 161 for more information.)

Length	2.1 mm cat.#	price	3.0 mm cat.#	price	4.6 mm cat.#	price
2.7 µm Columns						
30 mm	9304A32	£362.25	9304A3E	£362.25	9304A35	£362.25
50 mm	9304A52	£393.75	9304A5E	£393.75	9304A55	£393.75
100 mm	9304A12	£425.25	9304A1E	£425.25	9304A15	£425.25
150 mm	9304A62	£456.75	9304A6E	£456.75	9304A65	£456.75
5 µm Columns						
30 mm	—		930453E	£349.15	—	
50 mm	9304552	£385.90	930455E	£385.90	9304555	£385.90
100 mm	9304512	£422.65	930451E	£422.65	9304515	£422.65
150 mm	9304562	£459.40	930456E	£459.40	9304565	£459.40
250 mm	—		—		9304575	£551.25

Raptor™ EXP® Guard Column Cartridges

- 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.

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.

NEW!

Raptor™ EXP® Guard Column Cartridge

Learn more about the Raptor™ EXP® guard column on page 156!

Description	Particle Size	qty.	5 x 2.1 mm cat.#	5 x 3.0 mm cat.#	5 x 4.6 mm cat.#	price
Raptor ARC-18 EXP Guard Column Cartridge	2.7 µm	3-pk.	9314A0252	9314A0253	9314A0250	£334.70
Raptor ARC-18 EXP Guard Column Cartridge	5 µm	3-pk.	931450252	931450253	931450250	£334.70
Raptor Biphenyl EXP Guard Column Cartridge	2.7 µm	3-pk.	9309A0252	9309A0253	9309A0250	£334.70
Raptor Biphenyl EXP Guard Column Cartridge	5 µm	3-pk.	930950252	930950253	930950250	£334.70
Raptor C18 EXP Guard Column Cartridge	2.7 µm	3-pk.	9304A0252	9304A0253	9304A0250	£334.70
Raptor C18 EXP Guard Column Cartridge	5 µm	3-pk.	930450252	930450253	930450250	£334.70

Maximum cartridge pressure: 600 bar / 8,700 psi (2.7 µm) or 400 bar / 5,800 psi (5 µm)

EXP® Direct Connect Holder

NEW!

Description	qty.	cat.#	price
EXP Direct Connect Holder for EXP Guard Cartridges (includes hex-head fitting & 2 ferrules)	ea.	25808	£281.40

Maximum holder pressure: 20,000 psi (1,400 bar)

25808
EXP® Direct Connect Holder

also available

Hand-Tight Nut (cat.# 25937–25939)
Upgrade the supplied nut to install your Raptor™ EXP® guard column by hand—no tools needed.

Long Hex-Head Nut (cat.# 25934)
Extend the nut on your Raptor™ EXP® guard column for easier access in tight spaces—no more bumped knuckles.

EXP® Hand-Tight Coupler (cat.# 25940)
Achieve tool-free 8,700+ psi (600 bar) seals anywhere in your LC system with EXP® hand-tight couplers and connectors.

See **page 335** for more EXP® hex-head fittings, couplers, replacement parts, and more.

RESTEK® USLC®

Ultra Selective Liquid Chromatography™
www.restek.com/uslc

Ultra Selective Liquid Chromatography™ Technology

Choose Columns Fast. Develop Methods Faster.

What is Ultra Selective Liquid Chromatography™ (USLC®) technology? This technique is the directed application of orthogonal selectivity—the most influential factor affecting peak separation, or resolution—to provide the practicing chromatographer with the best tools for choosing columns fast and developing methods faster. Through our extensive study of reversed-phase chromatography, Restek created the widest range of selectivity in the industry using just four unique stationary phases: the USLC® column set. We also defined a simple approach to choosing a column with the appropriate selectivity for any application.

Selectivity Drives Separations

Quickly and effectively resolve analytes by understanding and controlling selectivity through USLC® technology.

One of the most significant, yet least understood, steps of method development is finding the proper stationary phase for a particular separation. As sample complexity increases, achieving adequate resolution between matrix components and target analytes becomes more difficult. Despite recent advancements in column format, such as sub-2-micron packings and pellicular particles, resolution can still be difficult to obtain because, while these formats can increase chromatographic efficiency and analysis speed, they do not significantly influence resolution. Selectivity, as shown in Equation 1, is the single most powerful factor affecting resolution, and it is largely dependent upon stationary phase composition.

Equation 1: Selectivity has the greatest mathematical effect on resolution.

$$R = \tfrac{1}{4}\sqrt{N} \times (k/[k+1]) \times (\alpha-1)$$

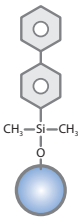
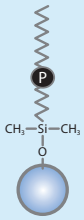
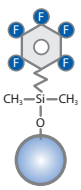
Efficiency *Retention Factor* *Selectivity*

Real Diversity in Phase Chemistry

A small set of defined orthogonal columns means faster separations and more robust methods.

While numerous bonded phases are available for reversed-phase chromatography, many (e.g., C8 and C18) are similar and offer only moderate changes in retention rather than significant differences in selectivity. Method development is less laborious and time-consuming when you use a full range of column selectivities, including orthogonal phase chemistries like polar-embedded, phenyl, and fluorophenyl columns. Restek has led the development of the unique USLC® column set across these phase classes to provide analysts with a more effective range of column selectivities and innovative column chemistries for method development. The USLC® column set (Figure 1) provides the widest range of reversed-phase selectivity available with just four columns and can be used to guide proper stationary phase selection—the least understood yet most significant part of method development.

Figure 1: Restek® columns offer the widest range of unique and effective phase chemistries to aid the chromatographer in choosing columns fast and developing methods faster.

Restek® USLC® Phase (column class)	**Aqueous C18** (alkyl)	**Biphenyl** (phenyl)	**IBD** (polar embedded)	**PFP Propyl** (fluorophenyl)
				
Ligand Type	Proprietary polar modified and functionally bonded C18	Unique Biphenyl	Proprietary polar functional embedded alkyl	Fluorophenyl
Properties	• General-purpose with a well-balanced retention profile. • Compatible with 100% aqueous mobile phases. • Ideal for multi-component LC-MS analyses.	• Increased retention for dipolar, unsaturated, or conjugated solutes. • Enhanced selectivity when used with protic (methanol) mobile phase. • Ideal for increasing sensitivity and selectivity in LC-MS analyses.	• Increased retention for acids and water-soluble compounds. • Compatible with 100% aqueous mobile phases. • Capable of both reversed-phase and HILIC separations.	• Increased retention for both charged bases and electronegative compounds. • Capable of both reversed-phase and HILIC separations. • Ideal for increasing sensitivity and selectivity in LC-MS analyses.

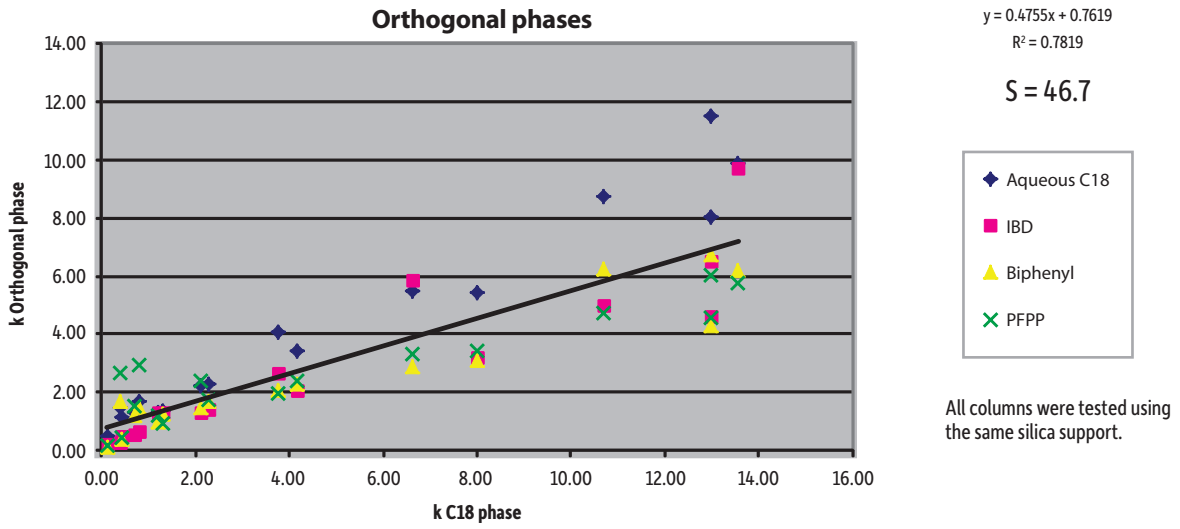
Evaluating and Extending Selectivity

The Restek® USLC® column set offers the highest range of alternate selectivity available.

The diverse selectivity provided by USLC® columns can be demonstrated empirically using the hydrophobic-subtraction model [1]. This model is a novel procedure for characterizing selectivity that uses test probes to define the solute and stationary phase interactions in reversed-phase separations. Restek is leading the commercial application of this model by implementing it in the development of USLC® bonded phases. To evaluate phase selectivity using the hydrophobic-subtraction model, the retention characteristics of the solute probes are compared across different phases relative to a C18 benchmark with all columns using the same silica base.

The resulting scatter plot is an excellent way to visualize selectivity. Stationary phases with similar selectivity show high linearity when graphed. However, stationary phases with alternate selectivity—even orthogonality—produce significant scatter around the regression line. The high degree of scatter shown in Figure 2 shows just how diverse the phases in the USLC® column set are. When we quantify column selectivity based on this correlation by calculating the selectivity (S) statistic [2], the resulting value of 46.7 shows that the USLC® column set truly has the highest range of selectivity available.

Figure 2: Restek has extended the selectivity range for commercially available columns and defined a column set—the four USLC® phases—that is ideal for fast column choice and faster method development.



References

[1] L.R. Snyder, J.W. Dolan, P.W. Carr, *The Hydrophobic-Subtraction Model of Reversed-Phase Column Selectivity*, J. Chromatogr. A 1060 (2004) 77.

[2] U.D. Neue, J.E. O'Gara, A. Mendez, *Selectivity in Reversed-Phase Separations Influence of the Stationary Phase*, J. Chromatogr. A 1127 (2006) 161.

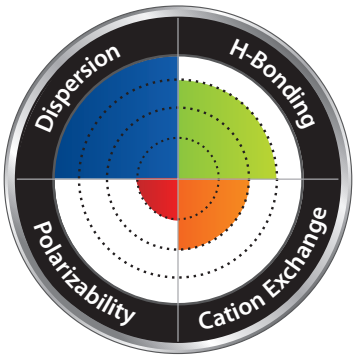
USLC® Column Interaction Profile

Put simply, selectivity is the retention of one compound relative to another. Therefore, because solutes will be retained to different degrees by different molecular interactions, we can fundamentally define a column's selectivity based on the molecular interactions it delivers.

Each USLC® column is optimized for a different chemical interaction. The pie chart provided for each USLC® stationary phase in this catalog (Figure 3) identifies the same four molecular interactions (color coded to correspond to the retention of a different solute type). The more rings shown for a given interaction, the more significant a role it plays in defining solute retention.

If you know what type of column interaction you need for your analysis, use these charts to select your USLC® column.

Figure 3: A look at a sample USLC® column interaction profile.



USLC® Columns
Choose Columns Fast.
Develop Methods Faster.

www.restek.com/uslc

USLC® Method Development Toolbox

- Ultra Selective Liquid Chromatography™ (USLC®) method development toolbox contains all four USLC® stationary phases in one convenient package.
- Available for UHPLC (1.9 µm) and HPLC (3 or 5 µm) in 50, 100, or 150 mm lengths.
- Included selection guide makes it even easier to pick the right column the first time.

Description	Size	Includes	qty.	cat.#	price
Pinnacle DB USLC Method Development Toolbox	1.9 µm, 2.1 mm x 50 mm	(1) each: Biphenyl (9409252), Aqueous C18 (9418252), IBD (9425252), PFP Propyl (9419252)	kit	25800	£1,677
Pinnacle DB USLC Method Development Toolbox	1.9 µm, 2.1 mm x 100 mm	(1) each: Biphenyl (9409212), Aqueous C18 (9418212), IBD (9425212), PFP Propyl (9419212)	kit	25807	£1,964
Ultra USLC Method Development Toolbox	3 µm, 2.1 mm x 50 mm	(1) each: Biphenyl (9109352), Aqueous C18 (9178352), IBD (9175352), PFP Propyl (9179352)	kit	25801	£1,385
Ultra USLC Method Development Toolbox	3 µm, 2.1 mm x 100 mm	(1) each: Biphenyl (9109312), Aqueous C18 (9178312), IBD (9175312), PFP Propyl (9179312)	kit	25802	£1,493
Ultra USLC Method Development Toolbox	3 µm, 3.0 mm x 100 mm	(1) each: Biphenyl (910931E), Aqueous C18 (917831E), IBD (917531E), PFP Propyl (917931E)	kit	25803	£1,429
Ultra USLC Method Development Toolbox	5 µm, 2.1 mm x 50 mm	(1) each: Biphenyl (9109552), Aqueous C18 (9178552), IBD (9175552), PFP Propyl (9179552)	kit	25804	£1,292
Ultra USLC Method Development Toolbox	5 µm, 2.1 mm x 100 mm	(1) each: Biphenyl (9109512), Aqueous C18 (9178512), IBD (9175512), PFP Propyl (9179512)	kit	25805	£1,385
Ultra USLC Method Development Toolbox	5 µm, 4.6 mm x 150 mm	(1) each: Biphenyl (9109565), Aqueous C18 (9178565), IBD (9175565), PFP Propyl (9179565)	kit	25806	£1,493

Mobile Phase Management 101

Neatly Keep Mobile Phase Lines Where They Belong

Hub-Cap Bottle Tops and Adaptors
See **page 340**.

Transfer and Filter Mobile Phase in a Single Step

Hub-Cap Filters
See **page 341**.

Extend Column Life

Bluestem Glass Solvent Filter
See **page 343**.

Avoid Messy Spills Around Mobile Phase Waste Containers

Waste Overflow Indicator
See **page 341**.

Prepare and Maintain Mobile Phases Without Dissolved Gas or Unnecessary Costs

Mobile Phase Sparge Filter
See **page 342**.

Pinnacle® DB Columns: 1.9, 3, or 5 µm particles; 140 Å pore size

Restek® Pinnacle® DB columns are built for optimal UHPLC performance.

Pinnacle® DB columns are 100% manufactured by Restek in our Bellefonte, Pennsylvania, facility. Because performance begins with the support, our Pinnacle® DB UHPLC columns start with base-deactivated spherical silica that is optimized for UHPLC stability. From there, we bond them with a wide variety of phases to give chromatographers a stable and selective column. Get the most out of your UHPLC system. Combine selectivity and efficiency by using Restek® Pinnacle® DB UHPLC columns.

Pinnacle® DB Aqueous C18 Columns (USP L1)

Restek-manufactured silica

Chromatographic Properties

The Restek® Aqueous C18 is a rugged, reversed-phase column with a well-balanced retention profile. It can effectively retain more types of solutes than a conventional C18 and is ideal for multicomponent LC-MS analyses. The general-purpose Aqueous C18 boasts high reproducibility and compatibility with many mobile phase conditions—even 100% aqueous. And when used with a gradient, it eliminates the all-too-common issue of multiple compounds eluting near the column void time.

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
1.9 µm Columns						
30 mm	9418232	£330.15	—		—	
50 mm	9418252	£345.25	—		—	
100 mm	9418212	£388.75	—		—	
3 µm Columns						
30 mm	9418332	£240.05	941833E	£319.25	9418335	£240.05
50 mm	9418352	£250.15	941835E	£332.65	9418355	£250.15
100 mm	9418312	£268.40	941831E	£356.95	9418315	£268.40
150 mm	9418362	£283.50	941836E	£377.10	9418365	£283.50
5 µm Columns						
30 mm	9418532	£207.30	941853E	£275.70	9418535	£207.30
50 mm	9418552	£231.85	941855E	£308.35	9418555	£231.85
100 mm	9418512	£250.15	941851E	£332.65	9418515	£250.15
150 mm	9418562	£268.40	941856E	£356.95	9418565	£268.40
200 mm	9418522	£272.80	941852E	£362.85	9418525	£272.80
250 mm	9418572	£287.30	941857E	£382.10	9418575	£287.30

Column Characteristics:

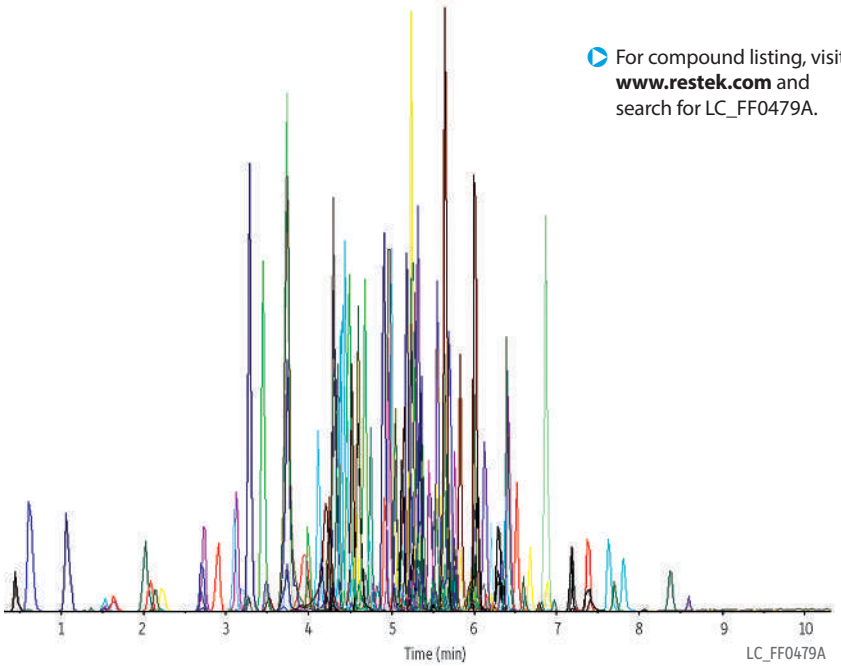
particle size:	1.9 µm, 3 µm, or 5 µm, spherical
pore size:	140 Å
carbon load:	6%
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L1
phase category:	modified C18
ligand type:	proprietary polar modified and functionally bonded C18

Aqueous C18

USLC® Column Interaction Profile

(See page 161 for more information.)

Pesticides on Pinnacle® DB Aqueous C18 (LC-MS/MS, ESI+)



For compound listing, visit **www.restek.com** and search for LC_FF0479A.

Column	Pinnacle® DB Aqueous C18 (cat.# 9418252)
Dimensions:	50 mm x 2.1 mm ID
Particle Size:	1.9 µm
Pore Size:	140 Å
Temp.:	35 °C
Sample	multicomponent pesticide standard
Diluent:	water
Conc.:	33.3 ppb each pesticide
Inj. Vol.:	5 µL
Mobile Phase	
A:	10 mM NH_4OAc in water
B:	10 mM NH_4OAc in methanol

Time (min)	%B
0	10
1	10
8	90
10	90
11	10

Flow:	0.60 mL/min
Max Pressure:	~517 bar
Detector	Applied Biosystems/MDS Sciex LC-MS/MS
Model #:	4000 QTRAP® LC-MS/MS system
Ion Source:	TurboIonSpray®
Ion Spray Voltage:	5 kV
Gas 1:	40 psi (275.8 kPa)
Gas 2:	60 psi (413.7 kPa)
Source Temp.:	500 °C
Instrument	Shimadzu UFLCXR

Pinnacle® DB IBD UHPLC Columns (USP L68)

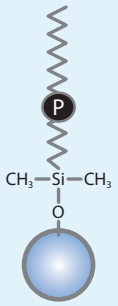
Restek-manufactured silica

Chromatographic Properties

The Restek® IBD is a polar-embedded column that acts as a strong hydrogen bonder and may be the most versatile column available today. With a unique polar group, this column is very retentive and selective for acids. It also provides symmetrical peak shape for strong bases. Restek's IBD is compatible with 100% aqueous mobile phases and can be used under reversed-phase or HILIC conditions to retain very polar, ionic compounds in highly organic mobile phases.

Column Characteristics:

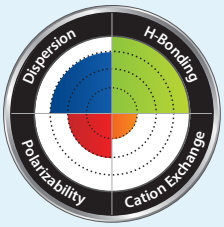
particle size:	1.9 µm, spherical
pore size:	140 Å
end-cap:	no
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L68
phase category:	polar-embedded alkyl
ligand type:	proprietary polar functional embedded alkyl



IBD

USLC® Column Interaction Profile

(See page 161 for more information.)



Length	2.1 mm ID cat.#	price
1.9 µm Columns		
30 mm	9425232	£330.15
50 mm	9425252	£345.25
100 mm	9425212	£388.75

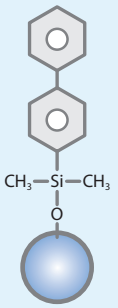
Restek-manufactured silica

Pinnacle® DB Biphenyl Columns (USP L11)

Chromatographic Properties

Since 2005, the Restek® Biphenyl has offered a greater degree of dispersion than conventional phenyls and a greater degree of polarizability than phenyl hexyls, creating higher selectivity and a greater range of usability. Because of these heightened interactions, this column shows substantial increases in retention—especially for dipolar, unsaturated, or conjugated solutes—and enhanced orthogonal selectivity when using methanol mobile phases. It is ideal for increasing sensitivity and selectivity in LC-MS analyses.

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
1.9 µm Columns						
30 mm	9409232	£330.15	—		—	
50 mm	9409252	£345.25	—		—	
100 mm	9409212	£388.75	—		—	
3 µm Columns						
30 mm	9409332	£240.05	940933E	£319.25	9409335	£240.05
50 mm	9409352	£250.15	940935E	£332.65	9409355	£250.15
100 mm	9409312	£268.40	940931E	£356.95	9409315	£268.40
150 mm	9409362	£283.50	940936E	£377.10	9409365	£283.50
5 µm Columns						
30 mm	9409532	£207.30	940953E	£275.70	9409535	£207.30
50 mm	9409552	£231.85	940955E	£308.35	9409555	£231.85
100 mm	9409512	£250.15	940951E	£332.65	9409515	£250.15
150 mm	9409562	£268.40	940956E	£356.95	9409565	£268.40
200 mm	9409522	£272.80	940952E	£362.85	9409525	£272.80
250 mm	9409572	£287.30	940957E	£382.10	9409575	£287.30



Biphenyl

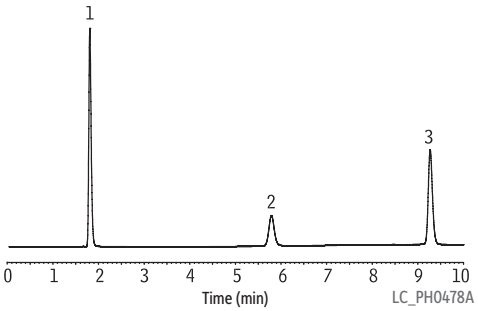
Column Characteristics:

particle size:	1.9 µm, 3 µm, or 5 µm, spherical
pore size:	140 Å
carbon load:	8%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase:	L11
phase category:	phenyl
ligand type:	unique Biphenyl

USLC® Column Interaction Profile

(See page 161 for more information.)

NSAIDs on Pinnacle® DB Biphenyl



Peaks
1. Uracil (void marker)
2. Tenoxicam
3. Sulfinpyrazone

Column Pinnacle® DB Biphenyl (cat.# 9409565)
Dimensions: 150 mm x 4.6 mm ID
Particle Size: 5 µm
Pore Size: 140 Å
Temp.: 30 °C
Sample
Diluent: 0.1% formic acid in water:methanol (40:60)
Conc.: 100 µg/mL each component (see peak list)
Inj. Vol.: 10 µL
Mobile Phase
A: 0.1% formic acid in water
B: methanol

Time (min)	%B
0.00	60
2.0	60
8.0	90
20.0	90
20.1	60

Flow: 1.0 mL/min
Detector UV/Vis @ 254 nm
Instrument Shimadzu Prominence

Pinnacle® DB PFP Propyl Columns (USP L43)

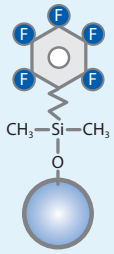
Restek-manufactured silica

Chromatographic Properties

The Restek® PFP Propyl is a great choice for the retention and selectivity of charged bases, electronegative compounds, and amine-containing compounds. Unlike a conventional cyano column, the Restek® PFP Propyl is much more amenable to LC-MS because it is more reliable and efficient with acidic mobile phases. This versatile column is also compatible with highly aqueous mobile phases and HILIC separations.

Column Characteristics:

particle size:	1.9 µm, 3 µm, or 5 µm, spherical
pore size:	140 Å
carbon load:	6%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L43
phase category:	fluorophenyl propyl
ligand type:	pentafluorophenyl propyl



PFP Propyl

USLC® Column Interaction Profile
(See page 161 for more information.)

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
1.9 µm Columns						
30 mm	9419232	£330.15	—		—	
50 mm	9419252	£345.25	—		—	
100 mm	9419212	£388.75	—		—	
3 µm Columns						
30 mm	9419332	£243.85	941933E	£324.30	9419335	£243.85
50 mm	9419352	£253.30	941935E	£336.85	9419355	£253.30
100 mm	9419312	£272.80	941931E	£362.85	9419315	£272.80
150 mm	9419362	£287.30	941936E	£382.10	9419365	£287.30
5 µm Columns						
30 mm	9419532	£210.45	941953E	£279.90	9419535	£210.45
50 mm	9419552	£240.05	941955E	£319.25	9419555	£240.05
100 mm	9419512	£253.30	941951E	£336.85	9419515	£253.30
150 mm	9419562	£272.80	941956E	£362.85	9419565	£272.80
200 mm	9419522	£279.75	941952E	£372.05	9419525	£279.75
250 mm	9419572	£293.60	941957E	£390.50	9419575	£293.60

Pinnacle® DB C18 Columns (USP L1)

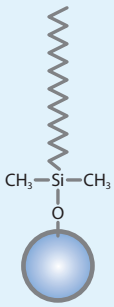
Restek-manufactured silica

Chromatographic Properties

The general-purpose Restek® C18 is a conventional monomeric octadecylsilane column suitable for analyses of a wide range of compounds from acidic through slightly basic.

Column Characteristics:

particle size:	1.9 µm, 3 µm, or 5 µm, spherical
pore size:	140 Å
carbon load:	11%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L1
phase category:	C18, octadecylsilane
ligand type:	monomeric C18



C18

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
1.9 µm Columns						
30 mm	9414232	£330.15	—		—	
50 mm	9414252	£345.25	—		—	
100 mm	9414212	£388.75	—		—	
3 µm Columns						
30 mm	9414332	£240.05	941433E	£319.25	9414335	£240.05
50 mm	9414352	£250.15	941435E	£332.65	9414355	£250.15
100 mm	9414312	£268.40	941431E	£356.95	9414315	£268.40
5 µm Columns						
30 mm	9414532	£207.30	941453E	£275.70	9414535	£207.30
50 mm	9414552	£231.85	941455E	£308.35	9414555	£231.85
100 mm	9414512	£250.15	941451E	£332.65	9414515	£250.15
150 mm	9414562	£268.40	941456E	£356.95	9414565	£268.40
200 mm	9414522	£272.80	941452E	£362.85	9414525	£272.80
250 mm	9414572	£287.30	941457E	£382.10	9414575	£287.30

also available

Trident Direct Guard Column System

See page 189.

Looking for an equivalent column?

Restek has extensively studied column selectivity and can provide you with an accurate recommendation. Please contact Restek® Technical Support or your local Restek® representative.

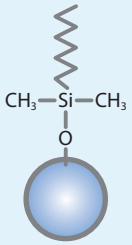
Pinnacle® DB C8 Columns (USP L7)

Restek-manufactured silica

Chromatographic Properties

Our C8 is a conventional monomeric octylsilane column offering a shorter alkyl chain to provide less hydrophobic retention and improved basic peak shape over a traditional C18 phase. Like our C18, this general-purpose Restek® C8 is suitable for a wide range of compounds from acidic through slightly basic.

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
1.9 µm Columns						
30 mm	9413232	£330.15	—		—	
50 mm	9413252	£345.25	—		—	
100 mm	9413212	£388.75	—		—	
3 µm Columns						
30 mm	9413332	£240.05	941333E	£319.25	9413335	£240.05
50 mm	9413352	£250.15	941335E	£332.65	9413355	£250.15
100 mm	9413312	£268.40	941331E	£356.95	9413315	£268.40
5 µm Columns						
30 mm	9413532	£207.30	941353E	£275.70	9413535	£207.30
50 mm	9413552	£231.85	941355E	£308.35	9413555	£231.85
100 mm	9413512	£250.15	941351E	£332.65	9413515	£250.15
150 mm	9413562	£268.40	941356E	£356.95	9413565	£268.40
200 mm	9413522	£272.80	941352E	£362.85	9413525	£272.80
250 mm	9413572	£287.30	941357E	£382.10	9413575	£287.30



Column Characteristics:

particle size:	1.9 µm, 3 µm, or 5 µm, spherical
pore size:	140 Å
carbon load:	6%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L7
phase category:	C8, octylsilane
ligand type:	monomeric C8

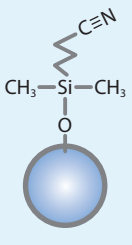
Pinnacle® DB Cyano Columns (USP L10)

Restek-manufactured silica

Chromatographic Properties

The Restek® Cyano is a traditional monomeric cyanopropylsilane that is recommended for assays where alternate selectivity, or confirmation, to a C18 or C8 column is desired. It can be used in normal-phase, reversed-phase (best with mobile phase pH between 5 and 7), and HILIC modes. It is an excellent choice for the analysis of protonated bases.

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
1.9 µm Columns						
30 mm	9416232	£330.15	—		—	
50 mm	9416252	£345.25	—		—	
100 mm	9416212	£388.75	—		—	
5 µm Columns						
30 mm	9416532	£207.30	941653E	£275.70	9416535	£207.30
50 mm	9416552	£231.85	941655E	£308.35	9416555	£231.85
100 mm	9416512	£250.15	941651E	£332.65	9416515	£250.15
150 mm	9416562	£268.40	941656E	£356.95	9416565	£268.40
200 mm	9416522	£272.80	941652E	£362.85	9416525	£272.80
250 mm	9416572	£287.30	941657E	£382.10	9416575	£287.30



Column Characteristics:

particle size:	1.9 µm or 5 µm, spherical
pore size:	140 Å
carbon load:	4%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L10
phase category:	cyano
ligand type:	cyanopropylsilane

Whether it's on our new Raptor™ SPP or the proven Pinnacle® DB and Ultra supports, Restek's LC Manufacturing group bonds our silica with stationary phases that offer maximum selectivity and reliability.

Pinnacle® DB Silica Columns (USP L3)

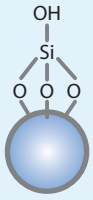
Restek-manufactured silica

Chromatographic Properties

Base-deactivated spherical silica is useful for normal-phase or HILIC separations.

Column Characteristics:

particle size:	1.9 µm, 3 µm, or 5 µm, spherical
pore size:	140 Å
end-cap:	no
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L3
phase category:	bare silica
ligand type:	none



Silica

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
1.9 µm Columns						
30 mm	9410232	£330.15	—		—	
50 mm	9410252	£345.25	—		—	
100 mm	9410212	£388.75	—		—	
3 µm Columns						
30 mm	9410332	£240.05	941033E	£319.25	9410335	£240.05
50 mm	9410352	£250.15	941035E	£332.65	9410355	£250.15
100 mm	9410312	£268.40	941031E	£356.95	9410315	£268.40
150 mm	9410362	£283.50	941036E	£377.10	9410365	£283.50
5 µm Columns						
30 mm	9410532	£207.30	941053E	£275.70	9410535	£207.30
50 mm	9410552	£231.85	941055E	£308.35	9410555	£231.85
100 mm	9410512	£250.15	941051E	£332.65	9410515	£250.15
150 mm	9410562	£268.40	941056E	£356.95	9410565	£268.40
200 mm	9410522	£272.80	941052E	£362.85	9410525	£272.80
250 mm	9410572	£287.30	941057E	£382.10	9410575	£287.30

Pinnacle® DB PAH UHPLC Columns

Restek-manufactured silica

Chromatographic Properties

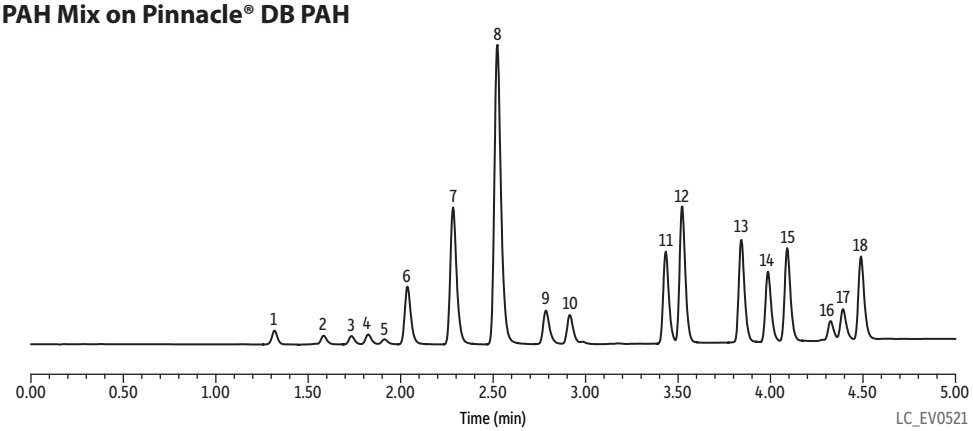
Specifically designed to resolve complex mixtures of polycyclic aromatic hydrocarbons (PAHs). Get complete resolution of all 16 EPA 610 PAHs, plus two other routinely analyzed PAH compounds, in less than five minutes to greatly reduce run times and increase sample throughput.

Column Characteristics:

particle size:	1.9 µm, spherical
pore size:	140 Å
end-cap:	no
pH range:	2.5 to 8
temperature limit:	80 °C

Length	2.1 mm ID cat.#	price
1.9 µm Columns		
30 mm	9470232	£330.15
50 mm	9470252	£345.25
100 mm	9470212	£388.75

PAH Mix on Pinnacle® DB PAH



Peaks
1. Naphthalene
2. Acenaphthylene
3. 1-Methylnaphthalene
4. 2-Methylnaphthalene
5. Acenaphthene
6. Fluorene
7. Phenanthrene
8. Anthracene
9. Fluoranthene
10. Pyrene
11. Benzo[a]anthracene
12. Chrysene
13. Benzo[b]fluoranthene
14. Benzo[k]fluoranthene
15. Benzo[a]pyrene
16. Dibenzo[a,h]anthracene
17. Benzo[ghi]perylene
18. Indeno[1,2,3-cd]pyrene

Column	Pinnacle® DB PAH (cat.# 9470252)
Dimensions:	50 mm x 2.1 mm ID
Particle Size:	1.9 µm
Pore Size:	140 Å
Temp.:	30 °C
Sample	EPA Method 8310 PAH Mixture (cat.# 31841)
Diluent:	acetonitrile
Conc.:	10 µg/mL
Inj. Vol.:	1 µL

Mobile Phase
A: water
B: acetonitrile

Time (min)	Flow (mL/min)	%A	%B
0	0.8	60	40
2	0.8	40	60
4	0.8	0	100
4.5	0.8	0	100
4.51	0.8	60	40
5	0.8	60	40

Max Pressure: 724 bar
Detector Photo diode array @ 254, 4.8 nm
Instrument Waters

Ultra HPLC Columns: 3 or 5 µm particles; 100 Å pore size

The Ultra line represents Restek's broadest selection of stationary phases on a single silica support. Made of high-purity, type-B silica that minimizes activity and creates high-density bonding, these columns are designed for selective and reliable HPLC applications.

Ultra Aqueous C18 Columns (USP L1)

Chromatographic Properties

The Restek® Aqueous C18 is a rugged, reversed-phase column with a well-balanced retention profile. It can effectively retain more types of solutes than a conventional C18 and is ideal for multicomponent LC-MS analyses. The general-purpose Aqueous C18 boasts high reproducibility and compatibility with many mobile phase conditions—even 100% aqueous. And when used with a gradient, it eliminates the all-too-common issue of multiple compounds eluting near the column void time.

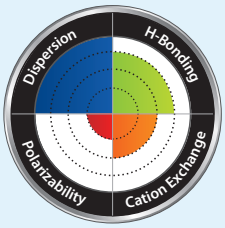
Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns						
30 mm	9178332	£364.50	917833E	£364.50	9178335	£364.50
50 mm	9178352	£364.50	917835E	£364.50	9178355	£364.50
100 mm	9178312	£392.15	917831E	£376.25	9178315	£392.15
150 mm	9178362	£407.25	917836E	£439.10	9178365	£407.25
5 µm Columns						
30 mm	9178532	£340.20	917853E	£340.20	9178535	£340.20
50 mm	9178552	£340.20	917855E	£340.20	9178555	£340.20
100 mm	9178512	£364.50	917851E	£364.50	9178515	£364.50
150 mm	9178562	£392.15	917856E	£392.15	9178565	£392.15
200 mm	9178522	£416.45	917852E	£416.45	9178525	£416.45
250 mm	9178572	£444.95	917857E	£444.95	9178575	£444.95

Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
carbon load:	15%
end-cap:	no
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L1
phase category:	modified C18
ligand type:	proprietary polar modified and functionally bonded C18

Aqueous C18

USLC® Column Interaction Profile
(See page 161 for more information.)

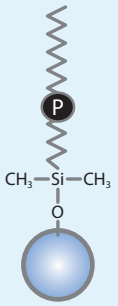


Ultra IBD Columns (USP L68)

Chromatographic Properties

The Restek® IBD is a polar-embedded column that acts as a strong hydrogen bonder and may be the most versatile column available today. With a unique polar group, this column is very retentive and selective for acids. It also provides symmetrical peak shape for strong bases. Restek's IBD is compatible with 100% aqueous mobile phases and can be used under reversed-phase or HILIC conditions to retain very polar, ionic compounds in highly organic mobile phases.

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns						
30 mm	9175332	£364.50	917533E	£364.50	9175335	£364.50
50 mm	9175352	£364.50	917535E	£348.60	9175355	£364.50
100 mm	9175312	£392.15	917531E	£376.25	9175315	£392.15
150 mm	9175362	£407.25	917536E	£407.25	9175365	£407.25
5 µm Columns						
30 mm	9175532	£340.20	917553E	£340.20	9175535	£340.20
50 mm	9175552	£340.20	917555E	£340.20	9175555	£340.20
100 mm	9175512	£364.50	917551E	£364.50	9175515	£364.50
150 mm	9175562	£392.15	917556E	£392.15	9175565	£392.15
200 mm	9175522	£416.45	917552E	£416.45	9175525	£416.45
250 mm	9175572	£444.95	917557E	£444.95	9175575	£444.95



Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
carbon load:	12%
end-cap:	no
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L68
phase category:	polar-embedded alkyl
ligand type:	proprietary polar functional embedded alkyl

IBD

USLC® Column Interaction Profile
(See page 161 for more information.)

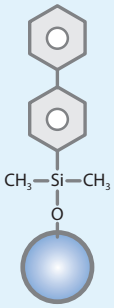
Ultra Biphenyl Columns (USP L11)

Chromatographic Properties

Since 2005, the Restek® Biphenyl has offered a greater degree of dispersion than conventional phenyls and a greater degree of polarizability than phenyl hexyls, creating higher selectivity and a greater range of usability. Because of these heightened interactions, this column shows substantial increases in retention—especially for dipolar, unsaturated, or conjugated solutes—and enhanced orthogonal selectivity when using methanol mobile phases. It is ideal for increasing sensitivity and selectivity in LC-MS analyses.

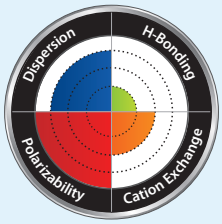
Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
carbon load:	15%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase:	L11
phase category:	phenyl
ligand type:	unique Biphenyl



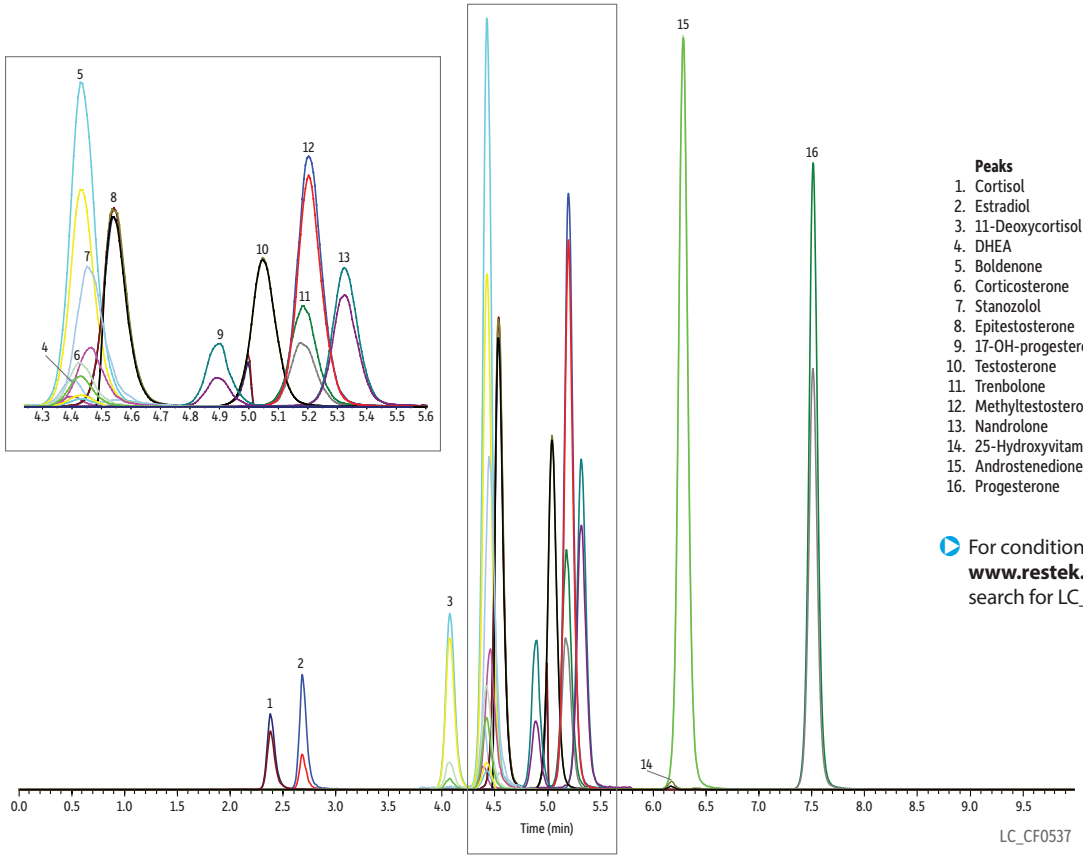
USLC® Column Interaction Profile

(See page 161 for more information.)



Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns						
30 mm	9109332	£361.15	910933E	£361.15	9109335	£361.15
50 mm	9109352	£361.15	910935E	£361.15	9109355	£361.15
100 mm	9109312	£389.65	910931E	£376.25	9109315	£389.65
150 mm	9109362	£455	910936E	£455	9109365	£455
5 µm Columns						
30 mm	9109532	£338.55	910953E	£338.55	9109535	£338.55
50 mm	9109552	£338.55	910955E	£338.55	9109555	£338.55
100 mm	9109512	£361.15	910951E	£361.15	9109515	£361.15
150 mm	9109562	£389.65	910956E	£389.65	9109565	£389.65
200 mm	9109522	£417.30	910952E	£417.30	9109525	£417.30
250 mm	9109572	£445.80	910957E	£445.80	9109575	£445.80

Steroid Panel Analysis on the Ultra Biphenyl



Peaks	tR (min)
1. Cortisol	2.3
2. Estradiol	2.6
3. 11-Deoxycortisol	4.0
4. DHEA	4.3
5. Boldenone	4.4
6. Corticosterone	4.4
7. Stanozolol	4.4
8. Epitestosterone	4.5
9. 17-OH-progesterone	4.8
10. Testosterone	5.0
11. Trenbolone	5.1
12. Methyltestosterone	5.1
13. Nandrolone	5.3
14. 25-Hydroxyvitamin D3	6.1
15. Androstenedione	6.2
16. Progesterone	7.5

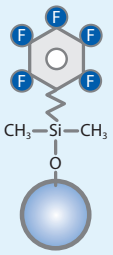
For conditions, visit **www.restek.com** and search for LC_CF0537.

Ultra PFP Propyl Columns (USP L43)

Chromatographic Properties

The Restek® PFP Propyl is a great choice for the retention and selectivity of charged bases, electronegative compounds, and amine-containing compounds. Unlike a conventional cyano column, the Restek® PFP Propyl is much more amenable to LC-MS because it is more reliable and efficient with acidic mobile phases. This versatile column is also compatible with highly aqueous mobile phases and HILIC separations.

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns						
30 mm	9179332	£368.70	917933E	£368.70	9179335	£368.70
50 mm	9179352	£368.70	917935E	£348.60	9179355	£368.70
100 mm	9179312	£397.20	917931E	£376.25	9179315	£397.20
150 mm	9179362	£426.50	917936E	£426.50	9179365	£397.20
5 µm Columns						
30 mm	9179532	£344.40	917953E	£344.40	9179535	£344.40
50 mm	9179552	£344.40	917955E	£344.40	9179555	£344.40
100 mm	9179512	£368.70	917951E	£368.70	9179515	£368.70
150 mm	9179562	£397.20	917956E	£397.20	9179565	£397.20
200 mm	9179522	£426.50	917952E	£426.50	9179525	£426.50
250 mm	9179572	£455	917957E	£455	9179575	£455



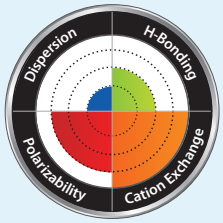
Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
carbon load:	11%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L43
phase category:	fluorophenyl propyl
ligand type:	pentafluorophenyl propyl

PFP Propyl

USLC® Column Interaction Profile

(See page 161 for more information.)

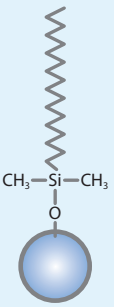


Ultra C18 Columns (USP L1)

Chromatographic Properties

The general-purpose Restek® C18 is a conventional monomeric octadecylsilane column suitable for analyses of a wide range of compounds from acidic through slightly basic.

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns								
30 mm	9174332	£353.60	917433E	£353.60	—		9174335	£353.60
50 mm	9174352	£353.60	917435E	£353.60	—		9174355	£353.60
100 mm	9174312	£377.90	917431E	£377.90	—		9174315	£377.90
150 mm	9174362	£407.25	917436E	£407.25	—		9174365	£407.25
5 µm Columns								
30 mm	9174532	£325.15	917453E	£325.15	—		9174535	£325.15
50 mm	9174552	£325.15	917455E	£325.15	—		9174555	£325.15
100 mm	9174512	£353.60	917451E	£353.60	9174514	£353.60	9174515	£353.60
150 mm	9174562	£377.90	917456E	£377.90	9174564	£377.90	9174565	£377.90
200 mm	9174522	£407.25	917452E	£407.25	—		9174525	£407.25
250 mm	9174572	£434.90	917457E	£434.90	—		9174575	£434.90



Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
carbon load:	20%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L1
phase category:	C18, octadecylsilane
ligand type:	monomeric C18

C18

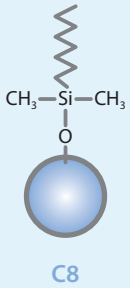
Ultra C8 Columns (USP L7)

Chromatographic Properties

Our C8 is a conventional monomeric octylsilane column offering a shorter alkyl chain to provide less hydrophobic retention and improved basic peak shape over a traditional C18 phase. Like our C18, this general-purpose Restek® C8 is suitable for a wide range of compounds from acidic through slightly basic.

Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
carbon load:	12%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L7
phase category:	C8, octylsilane
ligand type:	monomeric C8



Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns								
30 mm	9103332	£353.60	910333E	£353.60	—		9103335	£353.60
50 mm	9103352	£353.60	910335E	£353.60	—		9103355	£353.60
100 mm	9103312	£377.90	910331E	£377.90	—		9103315	£377.90
150 mm	9103362	£407.25	910336E	£407.25	—		9103365	£407.25
5 µm Columns								
30 mm	9103532	£325.15	910353E	£325.15	—		9103535	£325.15
50 mm	9103552	£325.15	910355E	£325.15	—		9103555	£325.15
100 mm	9103512	£353.60	910351E	£353.60	9103514	£353.60	9103515	£353.60
150 mm	9103562	£377.90	910356E	£377.90	9103564	£377.90	9103565	£377.90
200 mm	9103522	£407.25	910352E	£407.25	—		9103525	£407.25
250 mm	9103572	£434.90	910357E	£434.90	—		9103575	£434.90

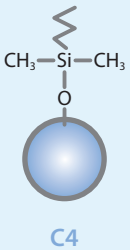
Ultra C4 Columns (USP L26)

Chromatographic Properties

Exceptionally stable C4 packing with high bonding coverage and base deactivation. Less retention than C18 or C8 phases.

Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
carbon load:	9%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L26
phase category:	C4, butylsilane
ligand type:	monomeric C4



Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns						
30 mm	9102332	£353.60	910233E	£353.60	9102335	£353.60
50 mm	9102352	£353.60	910235E	£353.60	9102355	£353.60
100 mm	9102312	£377.90	910231E	£377.90	9102315	£377.90
150 mm	9102362	£407.25	910236E	£407.25	9102365	£407.25
5 µm Columns						
30 mm	9102532	£325.15	910253E	£325.15	9102535	£325.15
50 mm	9102552	£325.15	910255E	£325.15	9102555	£325.15
100 mm	9102512	£353.60	910251E	£353.60	9102515	£353.60
150 mm	9102562	£377.90	910256E	£377.90	9102565	£377.90
200 mm	9102522	£407.25	910252E	£407.25	9102525	£407.25
250 mm	9102572	£434.90	910257E	£434.90	9102575	£434.90

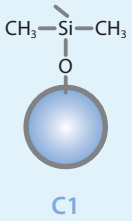
Our LC Manufacturing experts follow tightly controlled processes to ensure that you receive robust and reliable columns every time you order from Restek.

Ultra C1 Columns (USP L13)

Chromatographic Properties

This exceptionally stable C1 phase features our least-retentive reversed-phase hydrocarbon packing.

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns						
30 mm	9101332	£353.60	910133E	£353.60	9101335	£353.60
50 mm	9101352	£353.60	910135E	£353.60	9101355	£353.60
100 mm	9101312	£377.90	910131E	£377.90	9101315	£377.90
150 mm	9101362	£407.25	910136E	£407.25	9101365	£407.25
5 µm Columns						
30 mm	9101532	£325.15	910153E	£325.15	9101535	£325.15
50 mm	9101552	£325.15	910155E	£325.15	9101555	£325.15
100 mm	9101512	£353.60	910151E	£353.60	9101515	£353.60
150 mm	9101562	£377.90	910156E	£377.90	9101565	£377.90
200 mm	9101522	£407.25	910152E	£407.25	9101525	£407.25
250 mm	9101572	£434.90	910157E	£434.90	9101575	£434.90



Column Characteristics:

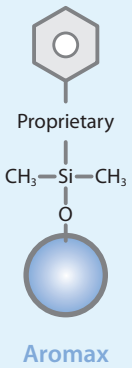
particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
carbon load:	5%
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L13
phase category:	trimethylsilane
ligand type:	monomeric C1

Ultra Aromax Columns (USP L11)

Chromatographic Properties

Ultra Aromax is a unique reversed-phase material that exhibits extreme retention and selectivity for aromatic and/or unsaturated compounds. This column is a great alternative to our Biphenyl phase when increased retention is required, and it's an excellent choice for gradient LC-MS analyses when conventional columns are not giving adequate retention or selectivity.

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns						
30 mm	9127332	£361.15	912733E	£361.15	9127335	£361.15
50 mm	9127352	£361.15	912735E	£361.15	9127355	£361.15
100 mm	9127312	£389.65	912731E	£389.65	9127315	£389.65
150 mm	9127362	£455	912736E	£455	9127365	£455
5 µm Columns						
30 mm	9127532	£338.55	912753E	£338.55	9127535	£338.55
50 mm	9127552	£338.55	912755E	£338.55	9127555	£338.55
100 mm	9127512	£361.15	912751E	£361.15	9127515	£361.15
150 mm	9127562	£389.65	912756E	£389.65	9127565	£389.65
200 mm	9127522	£417.30	912752E	£417.30	9127525	£417.30
250 mm	9127572	£445.80	912757E	£445.80	9127575	£445.80



Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
carbon load:	17%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L11
phase category:	phenyl
ligand type:	proprietary phenyl ligand

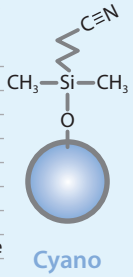
Ultra Cyano Columns (USP L10)

Chromatographic Properties

The Restek® Cyano is a traditional monomeric cyanopropylsilane that is recommended for assays where alternate selectivity, or confirmation, to a C18 or C8 column is desired. It can be used in normal-phase, reversed-phase (best with mobile phase pH between 5 and 7), and HILIC modes. It is an excellent choice for the analysis of protonated bases.

Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
carbon load:	8%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L10
phase category:	cyano
ligand type:	cyanopropylsilane



Cyano

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns						
30 mm	9106332	£353.60	910633E	£353.60	9106335	£353.60
50 mm	9106352	£353.60	910635E	£353.60	9106355	£353.60
100 mm	9106312	£377.90	910631E	£377.90	9106315	£377.90
150 mm	9106362	£407.25	910636E	£407.25	9106365	£407.25
5 µm Columns						
30 mm	9106532	£325.15	910653E	£325.15	9106535	£325.15
50 mm	9106552	£325.15	910655E	£325.15	9106555	£325.15
100 mm	9106512	£353.60	910651E	£353.60	9106515	£353.60
150 mm	9106562	£377.90	910656E	£377.90	9106565	£377.90
200 mm	9106522	£407.25	910652E	£407.25	9106525	£407.25
250 mm	9106572	£434.90	910657E	£434.90	9106575	£434.90

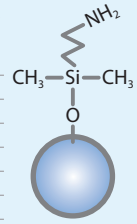
Ultra Amino Columns (USP L8)

Chromatographic Properties

The general-purpose Restek® Amino is an aminopropylsilane that offers reproducible retention and efficiency. It is a great choice for the normal-phase or HILIC analysis of simple sugars.

Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
carbon load:	2%
end-cap:	no
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L8
phase category:	amino
ligand type:	aminopropylsilane



Amino

Length	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns				
30 mm	910733E	£353.60	9107335	£353.60
50 mm	910735E	£353.60	9107355	£353.60
100 mm	910731E	£377.90	9107315	£377.90
150 mm	910736E	£407.25	9107365	£407.25
5 µm Columns				
30 mm	910753E	£325.15	9107535	£325.15
50 mm	910755E	£325.15	9107555	£325.15
100 mm	910751E	£353.60	9107515	£353.60
150 mm	910756E	£377.90	9107565	£377.90
200 mm	910752E	£407.25	9107525	£407.25
250 mm	910757E	£434.90	9107575	£434.90

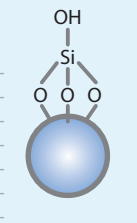
Ultra Silica Columns (USP L3)

Chromatographic Properties

Base-deactivated spherical silica is useful for normal-phase or HILIC separations.

Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
end-cap:	no
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L3
phase category:	bare silica
ligand type:	none



Silica

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns						
30 mm	9100332	£353.60	910033E	£353.60	9100335	£353.60
50 mm	9100352	£353.60	910035E	£353.60	9100355	£353.60
100 mm	9100312	£377.90	910031E	£377.90	9100315	£377.90
150 mm	9100362	£407.25	910036E	£407.25	9100365	£407.25
5 µm Columns						
30 mm	9100532	£325.15	910053E	£325.15	9100535	£325.15
50 mm	9100552	£325.15	910055E	£325.15	9100555	£325.15
100 mm	9100512	£353.60	910051E	£353.60	9100515	£353.60
150 mm	9100562	£377.90	910056E	£377.90	9100565	£377.90
200 mm	9100522	£407.25	910052E	£407.25	9100525	£407.25
250 mm	9100572	£434.90	910057E	£434.90	9100575	£434.90

Viva HPLC Columns: 3 or 5 µm particles; 300 Å pore size

Restek-manufactured silica

- Excellent for separating peptides or proteins.
- Rugged, spherical particles with 300 Å pore size.
- High proportion of pore/surface area available to large molecules.

Viva columns are based on a wide pore material we designed for optimal large-molecule separations. In developing Viva silica, we found that although many commercial wide-pore silicas meet the standard 300 Å mean pore size, most have very broad distributions about this mean, with a significant portion of their pore volume falling below 150 Å. This means a large portion of the surface area is unavailable to larger molecules. Viva columns have a narrow distribution around the mean pore size, permitting a larger portion of the silica surface to play a role in the separation.

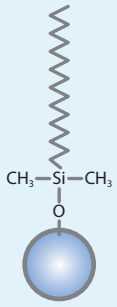
Viva C18 Columns (USP L1)

Restek-manufactured silica

Chromatographic Properties

The general-purpose Restek® C18 is a conventional monomeric octadecylsilane column suitable for analyses of a wide range of compounds from acidic through slightly basic.

Length	1.0 mm ID cat.#	price	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns								
30 mm	9514331	£416.45	9514332	£401.40	951433E	£401.40	9514335	£401.40
50 mm	9514351	£416.45	9514352	£401.40	951435E	£401.40	9514355	£401.40
100 mm	9514311	£444.95	9514312	£416.45	951431E	£430.70	9514315	£430.70
150 mm	9514361	£478.45	9514362	£463.40	951436E	£463.40	9514365	£463.40
5 µm Columns								
30 mm	9514531	£344.40	9514532	£325.15	951453E	£325.15	9514535	£325.15
50 mm	9514551	£344.40	9514552	£325.15	951455E	£325.15	9514555	£325.15
100 mm	9514511	£372.90	9514512	£353.60	951451E	£353.60	9514515	£353.60
150 mm	9514561	£401.40	9514562	£382.95	951456E	£382.95	9514565	£382.95
200 mm	9514521	£430.70	9514522	£407.25	951452E	£407.25	9514525	£407.25
250 mm	9514571	£455	9514572	£434.90	951457E	£434.90	9514575	£434.90



C18

Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	300 Å
carbon load:	9%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L1
phase category:	C18, octadecylsilane
ligand type:	monomeric C18

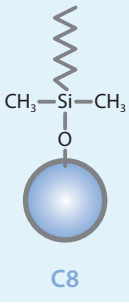
Viva C8 Columns (USP L7)

Restek-manufactured silica

Chromatographic Properties

Our C8 is a conventional monomeric octylsilane column offering a shorter alkyl chain to provide less hydrophobic retention and improved basic peak shape over a traditional C18 phase. Like our C18, this general-purpose Restek® C8 is suitable for a wide range of compounds from acidic through slightly basic.

Length	1.0 mm ID cat.#	price	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
5 µm Columns								
30 mm	9513531	£344.40	9513532	£325.15	951353E	£325.15	9513535	£325.15
50 mm	9513551	£344.40	9513552	£325.15	951355E	£325.15	9513555	£325.15
100 mm	9513511	£372.90	9513512	£353.60	951351E	£353.60	9513515	£353.60
150 mm	9513561	£401.40	9513562	£382.95	951356E	£382.95	9513565	£382.95
200 mm	9513521	£430.70	9513522	£407.25	951352E	£407.25	9513525	£407.25
250 mm	9513571	£455	9513572	£434.90	951357E	£434.90	9513575	£434.90



C8

Column Characteristics:

particle size:	5 µm, spherical
pore size:	300 Å
carbon load:	5%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L7
phase category:	C8, octylsilane
ligand type:	monomeric C8

Viva C4 Columns (USP L26)

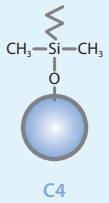
Restek-manufactured silica

Chromatographic Properties

Base-deactivated, wide-pore packing exhibits excellent peak shape for a wide range of compounds. Less retention in reversed-phase assays than Viva C18 or Viva C8.

Column Characteristics:

particle size:	5 µm, spherical
pore size:	300 Å
carbon load:	3.5%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L26
phase category:	C4, butylsilane
ligand type:	monomeric C4



C4

Length	1.0 mm ID cat.#	price	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
5 µm Columns								
30 mm	9512531	£344.40	9512532	£325.15	951253E	£325.15	9512535	£325.15
50 mm	9512551	£344.40	9512552	£325.15	951255E	£325.15	9512555	£325.15
100 mm	9512511	£372.90	9512512	£353.60	951251E	£353.60	9512515	£353.60
150 mm	9512561	£401.40	9512562	£382.95	951256E	£382.95	9512565	£382.95
200 mm	9512521	£430.70	9512522	£407.25	951252E	£407.25	9512525	£407.25
250 mm	9512571	£455	9512572	£434.90	951257E	£434.90	9512575	£434.90

Viva Biphenyl Columns (USP L11)

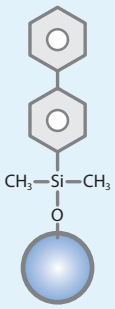
Restek-manufactured silica

Chromatographic Properties

Since 2005, the Restek® Biphenyl has offered a greater degree of dispersion than conventional phenyls and a greater degree of polarizability than phenyl hexyls, creating higher selectivity and a greater range of usability. Because of these heightened interactions, this column shows substantial increases in retention—especially for dipolar, unsaturated, or conjugated solutes—and enhanced orthogonal selectivity when using methanol mobile phases. It is ideal for increasing sensitivity and selectivity in LC-MS analyses.

Column Characteristics:

particle size:	5 µm, spherical
pore size:	300 Å
carbon load:	7%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase:	L11
phase category:	phenyl
ligand type:	unique Biphenyl



Biphenyl

Length	1.0 mm ID cat.#	price	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
5 µm Columns								
30 mm	9516531	£344.40	9516532	£325.15	951653E	£325.15	9516535	£325.15
50 mm	9516551	£344.40	9516552	£325.15	951655E	£325.15	9516555	£325.15
100 mm	9516511	£372.90	9516512	£353.60	951651E	£353.60	9516515	£353.60
150 mm	9516561	£401.40	9516562	£382.95	951656E	£382.95	9516565	£382.95
200 mm	9516521	£430.70	9516522	£407.25	951652E	£407.25	9516525	£407.25
250 mm	9516571	£455	9516572	£434.90	951657E	£434.90	9516575	£434.90

Viva PFP Propyl Columns (USP L43)

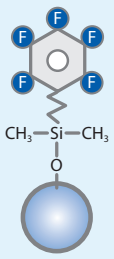
Restek-manufactured silica

Chromatographic Properties

The Restek® PFP Propyl is a great choice for the retention and selectivity of charged bases, electronegative compounds, and amine-containing compounds. Unlike a conventional cyano column, the Restek® PFP Propyl is much more amenable to LC-MS because it is more reliable and efficient with acidic mobile phases. This versatile column is also compatible with highly aqueous mobile phases and HILIC separations.

Column Characteristics:

particle size:	5 µm, spherical
pore size:	300 Å
carbon load:	5%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L43
phase category:	fluorophenyl propyl
ligand type:	pentafluorophenyl propyl



PFP Propyl

Length	1.0 mm ID cat.#	price	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
5 µm Columns								
30 mm	9519531	£353.60	9519532	£330.15	951953E	£330.15	9519535	£330.15
50 mm	9519551	£353.60	9519552	£330.15	951955E	£330.15	9519555	£330.15
100 mm	9519511	£382.95	9519512	£358.65	951951E	£358.65	9519515	£358.65
150 mm	9519561	£411.45	9519562	£387.15	951956E	£387.15	9519565	£387.15
200 mm	9519521	£434.90	9519522	£416.45	951952E	£416.45	9519525	£416.45
250 mm	9519571	£463.40	9519572	£439.10	951957E	£439.10	9519575	£439.10

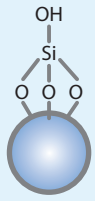
Viva Silica Columns (USP L3)

Restek-manufactured silica

Chromatographic Properties

Base-deactivated spherical silica is useful for normal-phase or HILIC separations.

Length	1.0 mm ID cat.#	price	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
5 µm Columns								
30 mm	9510531	£344.40	9510532	£325.15	951053E	£325.15	9510535	£325.15
50 mm	9510551	£344.40	9510552	£325.15	951055E	£325.15	9510555	£325.15
100 mm	9510511	£372.90	9510512	£353.60	951051E	£353.60	9510515	£353.60
150 mm	9510561	£401.40	9510562	£382.95	951056E	£382.95	9510565	£382.95
200 mm	9510521	£430.70	9510522	£407.25	951052E	£407.25	9510525	£407.25
250 mm	9510571	£455	9510572	£434.90	951057E	£434.90	9510575	£434.90



Silica

Column Characteristics:

particle size:	5 µm, spherical
pore size:	300 Å
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L3
phase category:	bare silica
ligand type:	none

Application-Specific LC Phases

Restek-manufactured silica

Pinnacle® II PAH HPLC Columns

Column Characteristics:

particle size:	4 µm, spherical
pore size:	110 Å
end-cap:	no
pH range:	2.5 to 8
temperature limit:	80 °C

Chromatographic Properties

Developed specifically for challenging analyses of polycyclic aromatic hydrocarbons (PAHs). The Pinnacle® II PAH stationary phase incorporates a proprietary C18 bonding that enables unique shape selectivity to baseline-resolve all 16 PAHs listed in U.S. EPA Method 610 plus two other routinely analyzed PAH compounds. Every lot of Pinnacle® II PAH bonded phase material is tested to ensure baseline resolution of the Method 610 PAHs using a simple water/acetonitrile mobile phase gradient. Further, because we make Pinnacle® II PAH columns using our own silica, we have greater control over quality and reproducibility. If you are analyzing PAHs using HPLC, Pinnacle® II PAH columns are a reliable, cost-effective choice.

Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
4 µm Columns						
50 mm	9219452	£282.25	921945E	£375.40	9219455	£282.25
100 mm	9219412	£299.90	921941E	£398.85	9219415	£299.90
150 mm	9219462	£303.70	921946E	£329	9219465	£303.70
200 mm	9219422	£322.60	921942E	£429.05	9219425	£322.60
250 mm	9219472	£336.45	921947E	£447.45	9219475	£336.45

Pinnacle® II PAH Guard Cartridges

Guard Cartridges	3-pk. (10 x 2.1 mm)	3-pk. (10 x 4.0 mm)	price
Pinnacle II PAH Guard Cartridge	921950212	921950210	£147.30

Pinnacle® DB PAH UHPLC Columns

Restek-manufactured silica

Chromatographic Properties

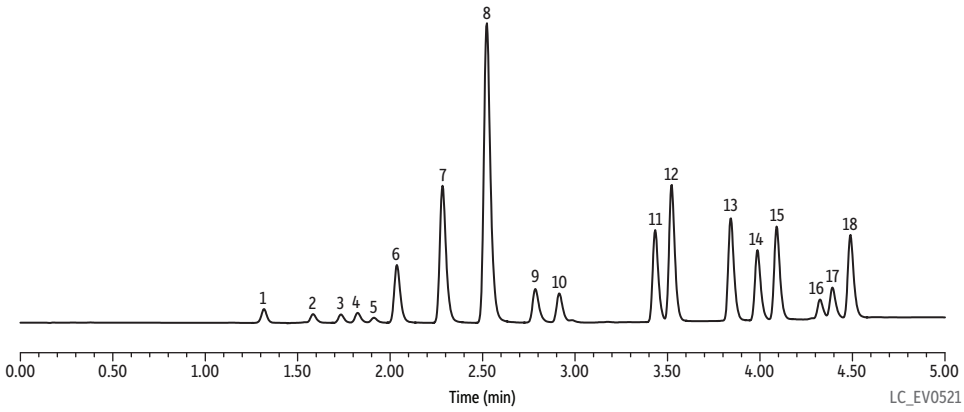
Specifically designed to resolve complex mixtures of polycyclic aromatic hydrocarbons (PAHs). Get complete resolution of all 16 EPA 610 PAHs, plus two other routinely analyzed PAH compounds, in less than five minutes to greatly reduce run times and increase sample throughput.

Length	2.1 mm ID cat.#	price
1.9 µm Columns		
30 mm	9470232	£330.15
50 mm	9470252	£345.25
100 mm	9470212	£388.75

Column Characteristics:

particle size:	1.9 µm, spherical
pore size:	140 Å
end-cap:	no
pH range:	2.5 to 8
temperature limit:	80 °C

PAH Mix on Pinnacle® DB PAH



Column Pinnacle® DB PAH (cat.# 9470252)
Dimensions: 50 mm x 2.1 mm ID
Particle Size: 1.9 µm
Pore Size: 140 Å
Temp.: 30 °C
Sample EPA Method 8310 PAH Mixture (cat.# 31841)
Diluent: acetonitrile
Conc.: 10 µg/mL
Inj. Vol.: 1 µL
Mobile Phase
A: water
B: acetonitrile

Time (min)	Flow (mL/min)	%A	%B
0	0.8	60	40
2	0.8	40	60
4	0.8	0	100
4.5	0.8	0	100
4.51	0.8	60	40
5	0.8	60	40

Max Pressure: 724 bar
Detector Photo diode array @ 254, 4.8 nm
Instrument Waters

Peaks
1. Naphthalene
2. Acenaphthylene
3. 1-Methylnaphthalene
4. 2-Methylnaphthalene
5. Acenaphthene
6. Fluorene
7. Phenanthrene
8. Anthracene
9. Fluoranthene
10. Pyrene
11. Benzo[a]anthracene
12. Chrysene
13. Benzo[b]fluoranthene
14. Benzo[k]fluoranthene
15. Benzo[a]pyrene
16. Dibenzo[a,h]anthracene
17. Benzo[ghi]perylene
18. Indeno[1,2,3-cd]pyrene

Allure® AK Columns

Chromatographic Properties

This highly retentive, highly selective phase—unique to Restek—was developed specifically for the analysis of aldehydes and ketones as DNPH derivatives. Allure® AK is a reversed-phase HPLC material that has the unique ability to separate all 13 carbonyl compounds specified in California Air Resources Board (CARB) Method #1004 using a simple acetonitrile/water gradient. Other columns require long analysis times or the use of tetrahydrofuran.

Column Characteristics:

particle size:	5 µm, spherical
pore size:	60 Å
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C

Length	3.2 mm ID cat.#	price	4.6 mm ID cat.#	price
5 µm Columns with Trident Integral Inlet Fittings				
200 mm	9159523-700	£635.45	9159525-700	£635.45

Allure® AK Guard Cartridge

Guard Cartridges	3-pk. (10 x 4.0 mm)	price
Allure AK Guard Cartridge	915950210	£167.60

Allure® Organic Acids Columns

Chromatographic Properties

Allure® Organic Acids columns provide enhanced retention and selectivity for polar organic acids, allowing the separation to be performed on a single 30 cm column. An Allure® Organic Acids column effectively resolves key organic acids such as tartaric and quinic acids using the chromatographic conditions specified in AOAC method 986.13. Retention is stable and reproducible, even with the 100% aqueous mobile phase specified in the AOAC method.

Column Characteristics:

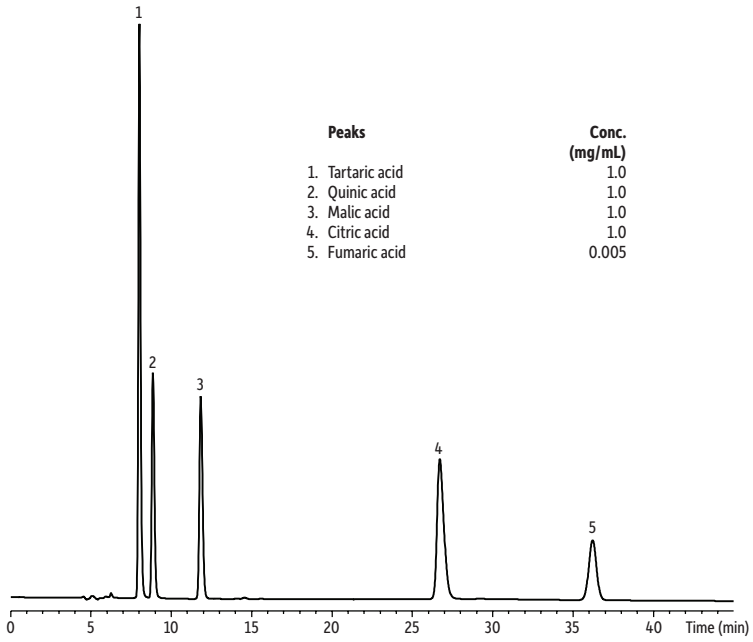
particle size:	5 µm, spherical
pore size:	60 Å
end-cap:	no
pH range:	2.5 to 8
temperature limit:	80 °C

Length	3.0 mm ID cat.#	price	4.6 mm ID cat.#	price
5 µm Column				
150 mm	916556E	£574.60	9165565	£574.60
250 mm	—		9165575	£611.85
300 mm	—		9165585	£628.15

Allure® Organic Acids Guard Cartridges

Guard Cartridges	3-pk. (10 x 2.1 mm)	3-pk. (10 x 4.0 mm)	price
Allure Organic Acids Guard Cartridge	916550212	916550210	£167.60

Organic Acids Standard on Allure® Organic Acids



Peaks	Conc. (mg/mL)
1. Tartaric acid	1.0
2. Quinic acid	1.0
3. Malic acid	1.0
4. Citric acid	1.0
5. Fumaric acid	0.005

LC_0238

Column	Allure® Organic Acids (cat.# 9165585)
Dimensions:	300 mm x 4.6 mm ID
Particle Size:	5 µm
Pore Size:	60 Å
Temp.:	ambient
Sample	standard solution
Diluent:	water
Inj. Vol.:	10.0 µL
Mobile Phase	100 mM phosphate buffer, pH 2.5
Flow:	0.5 mL/min
Detector	UV/Vis @ 226 nm

Ultra Carbamate Columns

Chromatographic Properties

Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
pH range:	2.5 to 8
temperature limit:	80 °C

Restek chemists developed the Ultra Carbamate column specifically for carbamates analysis. The unique packing separates 10 target carbamates in just over 10 minutes. The column is compatible with fluorescence or LC-MS detection.* An Ultra Carbamate column can process as many as three samples per hour, versus less than two samples per hour on a general-purpose C18 column. In addition to increased sample throughput, this much faster analysis will significantly reduce solvent usage—and the costs of disposing of solvent waste.

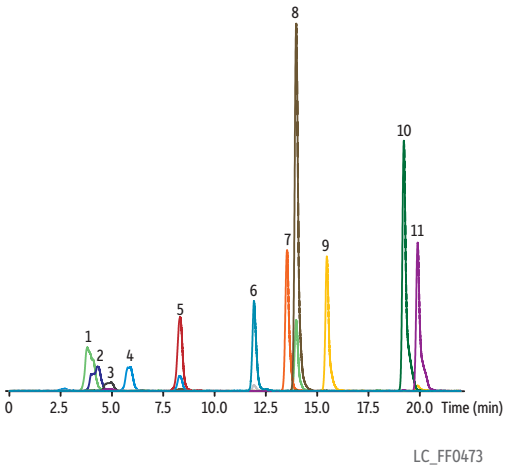
Length	2.1 mm ID cat.#	price	3.0 mm ID cat.#	price	4.0 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Columns								
50 mm	9177352	£439.10	917735E	£444.95	9177354	£444.95	9177355	£459.20
100 mm	9177312	£450	917731E	£459.20	—		9177315	£463.40
5 µm Columns								
250 mm	—		—		—		9177575	£439.10

*For post-column derivatization/fluorescence detection applications using a 4.6 mm ID column, the total system dead volume, including the post-column reactor, must be less than 650 µL. For standard post-column reactor systems, we recommend a 250 mm x 4.6 mm, 5 µm column. Contact Restek® Technical Service or your local Restek® representative for more information.

Ultra Carbamate Guard Cartridges

Guard Cartridges	3-pk. (10 x 2.1 mm)	3-pk. (10 x 4.0 mm)	price
Ultra Carbamate Guard Cartridge	917750212	917750210	£167.60

Carbamates on Ultra Carbamate



LC_FF0473

Peaks
1. Aldicarb sulfone
2. Aldicarb sulfoxide
3. Oxamyl
4. Methomyl
5. 3-Hydroxycarbofuran
6. Aldicarb
7. Propoxur
8. Carbofurane
9. Carbaryl
10. Methiocarb
11. BDMC (IS)

Column Ultra Carbamate (cat.# 9177352)
Dimensions: 50 mm x 2.1 mm ID
Particle Size: 3 µm
Pore Size: 100 Å
Temp.: ambient
Sample 531.1 Carbamate Pesticide Calibration Mixture (cat.# 32273)
4-bromo-3,5-dimethylphenyl-N-methylcarbamate (BDMC) (cat.# 32274)
Diluent: methanol
Conc.: 50 µg/mL
Inj. Vol.: 1 µL
Mobile Phase
A: 2 mM ammonium acetate:methanol (v/v, 90/10)
B: 2 mM ammonium acetate:methanol (v/v, 10/90)

Time (min)	%A	%B
0.00	80	20
20	0	100
25	0	100

Flow: 0.2 mL/min
Detector LECO Unique® TOFMS
Run Length: 25 min
Ionization Source Type: high flow ESI
Ion Mode: positive
Desolvation Temp.: 130 °C
Nebulizing Pressure: 100 kPa
Desolvation Gas (N_2): 4 L/min
Interface Temp.: 120 °C
Nozzle Voltage: 62 V
Capillary Voltage: 2.75 kV
Instrument Agilent 1100
Acknowledgement LECO Corporation

Ultra Quat Columns

Chromatographic Properties

A retentive, high-purity, base-deactivated, reversed-phase packing. Ideal for the analysis of paraquat and diquat or other quaternary amines.

Length	2.1 mm ID cat.#	price	4.6 mm ID cat.#	price
3 µm Column				
50 mm	9181352	£353.60	—	
5 µm Column				
150 mm	—		9181565	£475.10

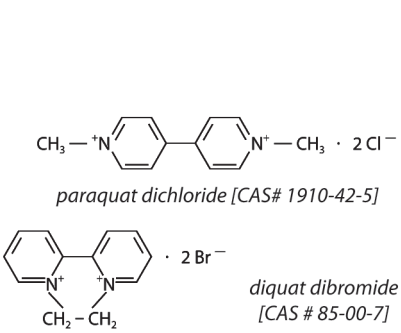
Column Characteristics:

particle size:	3 µm or 5 µm, spherical
pore size:	100 Å
pH range:	2.5 to 8
temperature limit:	80 °C

Ultra Quat Guard Cartridges

Guard Cartridges	3-pk. (10 x 2.1 mm)	3-pk. (10 x 4.0 mm)	price
Ultra Quat Guard Cartridge	918150212	918150210	£167.60

Paraquat and Diquat on Ultra Quat



paraquat dichloride [CAS# 1910-42-5]

diquat dibromide [CAS # 85-00-7]

Fast, sensitive LC-MS/MS analysis!

Peaks	Precursor Ion (amu)	Fragment Ion (amu)	DP (V)	Collision Energy (eV)
1. Diquat	183+	157+	30	30
2. Paraquat	93 (2+)	171+	20	20

Column	Ultra Quat (cat.# 9181352)
Dimensions:	50 mm x 2.1 mm ID
Particle Size:	3 µm
Pore Size:	100 Å
Temp.:	ambient
Sample	
Diluent:	DI Water
Conc.:	5 µg/mL each component
Inj. Vol.:	10 µL
Mobile Phase	10 mM heptafluorobutyric acid:acetonitrile (95:5)
Flow:	0.3 mL/min
Detector	Applied Biosystems/MDS Sciex LC-MS/MS
Model #:	API 3200™ MS/MS system
Ion Source:	Electrospray
Ion Mode:	ESI+
Ion Spray Voltage:	5.5 kV
Curtain Gas:	15 psi (103.4 kPa)
Gas 1:	70 psi (482.6 kPa)
Gas 2:	60 psi (413.7 kPa)
Source Temp.:	600 °C
Mode:	MRM
Dwell Time:	200 ms
Instrument	Applied Biosystems/MDS Sciex LC-MS/MS System
Notes	Collision exit potential: 3V Q1/Q3: unit resolution
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

Ultra Preparative Columns

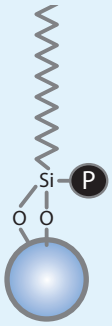
Using Restek® Ultra columns for preparative applications can save you time, solvents, and money. By utilizing the right phase for your prep analysis, you can make sure your peaks are resolved and your compounds are pure. The Ultra line has high loading and features high-purity silica.

USLC® Phases for Preparative HPLC

Ultra Aqueous C18 HPLC Prep Columns

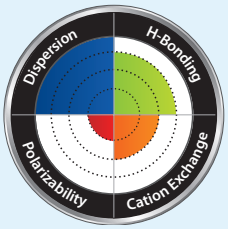
Column Characteristics:

particle size:	5 µm, spherical
pore size:	100 Å
carbon load:	15%
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L1
phase category:	modified C18
ligand type:	proprietary polar modified and functionally bonded C18



Aqueous C18

USLC® Column Interaction Profile
(See page 161 for more information.)



Chromatographic Properties

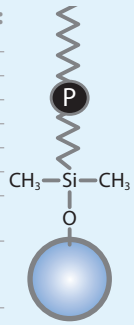
The Restek® Aqueous C18 is a rugged, reversed-phase column with a well-balanced retention profile. It can effectively retain more types of solutes than a conventional C18 and is ideal for multicomponent LC-MS analyses. The general-purpose Aqueous C18 boasts high reproducibility and compatibility with many mobile phase conditions—even 100% aqueous. And when used with a gradient, it eliminates the all-too-common issue of multiple compounds eluting near the column void time.

Length	10 mm ID cat.#	price	21.2 mm ID cat.#	price	30 mm ID cat.#	price
5 µm Columns						
50 mm	9178557	enquire	9178558	enquire	9178559	enquire
100 mm	9178517	enquire	9178518	enquire	9178519	enquire
150 mm	9178567	enquire	9178568	enquire	9178569	enquire
250 mm	9178577	enquire	9178578	enquire	9178579	enquire

Ultra IBD HPLC Prep Columns

Column Characteristics:

particle size:	5 µm, spherical
pore size:	100 Å
carbon load:	12%
end-cap:	no
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L68
phase category:	polar embedded alkyl
ligand type:	proprietary polar functional embedded alkyl



IBD

USLC® Column Interaction Profile
(See page 161 for more information.)

Chromatographic Properties

The Restek® IBD is a polar-embedded column that acts as a strong hydrogen bonder and may be the most versatile column available today. With a unique polar group, this column is very retentive and selective for acids. It also provides symmetrical peak shape for strong bases. Restek's IBD is compatible with 100% aqueous mobile phases and can be used under reversed-phase or HILIC conditions to retain very polar, ionic compounds in highly organic mobile phases.

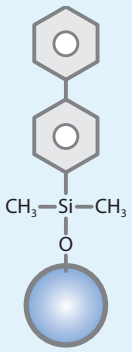
Length	10 mm ID cat.#	price	21.2 mm ID cat.#	price	30 mm ID cat.#	price
5 µm Columns						
50 mm	9175557	enquire	9175558	enquire	9175559	enquire
100 mm	9175517	enquire	9175518	enquire	9175519	enquire
150 mm	9175567	enquire	9175568	enquire	9175569	enquire
250 mm	9175577	enquire	9175578	enquire	9175579	enquire

Ultra Biphenyl Prep Columns

Chromatographic Properties

Since 2005, the Restek® Biphenyl has offered a greater degree of dispersion than conventional phenyls and a greater degree of polarizability than phenyl hexyls, creating higher selectivity and a greater range of usability. Because of these heightened interactions, this column shows substantial increases in retention—especially for dipolar, unsaturated, or conjugated solutes—and enhanced orthogonal selectivity when using methanol mobile phases. It is ideal for increasing sensitivity and selectivity in LC-MS analyses.

Length	10 mm ID cat.#	price	21.2 mm ID cat.#	price	30 mm ID cat.#	price
5 µm Columns						
50 mm	9109557	enquire	9109558	enquire	9109559	enquire
100 mm	9109517	enquire	9109518	enquire	9109519	enquire
150 mm	9109567	enquire	9109568	enquire	9109569	enquire
250 mm	9109577	enquire	9109578	enquire	9109579	enquire



Column Characteristics:

particle size:	5 µm, spherical
pore size:	100 Å
carbon load:	15%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase:	L11
phase category:	phenyl
ligand type:	unique Biphenyl

Biphenyl

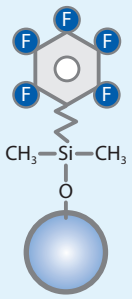
USLC® Column Interaction Profile
(See page 161 for more information.)

Ultra PFP Propyl Prep Columns

Chromatographic Properties

The Restek® PFP Propyl is a great choice for the retention and selectivity of charged bases, electronegative compounds, and amine-containing compounds. Unlike a conventional cyano column, the Restek® PFP Propyl is much more amenable to LC-MS because it is more reliable and efficient with acidic mobile phases. This versatile column is also compatible with highly aqueous mobile phases and HILIC separations.

Length	10 mm ID cat.#	price	21.2 mm ID cat.#	price	30 mm ID cat.#	price
5 µm Columns						
50 mm	9179557	enquire	9179558	enquire	9179559	enquire
100 mm	9179517	enquire	9179518	enquire	9179519	enquire
150 mm	9179567	enquire	9179568	enquire	9179569	enquire
250 mm	9179577	enquire	9179578	enquire	9179579	enquire



Column Characteristics:

particle size:	5 µm, spherical
pore size:	100 Å
carbon load:	11%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L43
phase category:	fluorophenyl propyl
ligand type:	pentafluoro-phenyl propyl

PFP Propyl

USLC® Column Interaction Profile
(See page 161 for more information.)

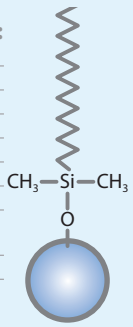
Before You Buy a Prep Column...

PLEASE NOTE: We strongly recommend ordering a semi-prep or prep column only after evaluating the desired separation on an equivalent analytical-scale column. Because we cannot reuse a column or the silica it contains once it has left our facility, we cannot accept returns of large-scale columns.

Traditional Phases for Preparative HPLC

Column Characteristics:

particle size:	5 µm, spherical
pore size:	100 Å
carbon load:	20%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L1
phase category:	C18, octadecylsilane
ligand type:	monomeric C18



C18

Ultra C18 HPLC Prep Columns

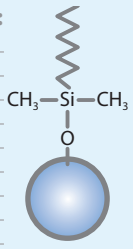
Chromatographic Properties

The general-purpose Restek® C18 is a conventional monomeric octadecylsilane column suitable for analyses of a wide range of compounds from acidic through slightly basic.

Length	10 mm ID cat.#	price	21.2 mm ID cat.#	price	30 mm ID cat.#	price
5 µm Columns						
50 mm	9174557	enquire	9174558	enquire	9174559	enquire
100 mm	9174517	enquire	9174518	enquire	9174519	enquire
150 mm	9174567	enquire	9174568	enquire	9174569	enquire
250 mm	9174577	enquire	9174578	enquire	9174579	enquire

Column Characteristics:

particle size:	5 µm, spherical
pore size:	100 Å
carbon load:	12%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L7
phase category:	C8, octylsilane
ligand type:	monomeric C8



C8

Ultra C8 HPLC Prep Columns

Chromatographic Properties

Our C8 is a conventional monomeric octylsilane column offering a shorter alkyl chain to provide less hydrophobic retention and improved basic peak shape over a traditional C18 phase. Like our C18, this general-purpose Restek® C8 is suitable for a wide range of compounds from acidic through slightly basic.

Length	10 mm ID cat.#	price	21.2 mm ID cat.#	price	30 mm ID cat.#	price
5 µm Columns						
50 mm	9103557	enquire	9103558	enquire	9103559	enquire
100 mm	9103517	enquire	9103518	enquire	9103519	enquire
150 mm	9103567	enquire	9103568	enquire	9103569	enquire
250 mm	9103577	enquire	9103578	enquire	9103579	enquire

Before You Buy a Prep Column...

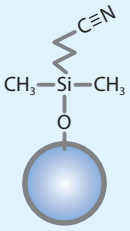
PLEASE NOTE: We strongly recommend ordering a semi-prep or prep column only after evaluating the desired separation on an equivalent analytical-scale column. Because we cannot reuse a column or the silica it contains once it has left our facility, we cannot accept returns of large-scale columns.

Ultra Cyano HPLC Prep Columns

Chromatographic Properties

The Restek® Cyano is a traditional monomeric cyanopropylsilane that is recommended for assays where alternate selectivity, or confirmation, to a C18 or C8 column is desired. It can be used in normal-phase, reversed-phase (best with mobile phase pH between 5 and 7), and HILIC modes. It is an excellent choice for the analysis of protonated bases.

Length	10 mm ID cat.#	price	21.2 mm ID cat.#	price	30 mm ID cat.#	price
5 µm Columns						
50 mm	9106557	enquire	9106558	enquire	9106559	enquire
100 mm	9106517	enquire	9106518	enquire	9106519	enquire
150 mm	9106567	enquire	9106568	enquire	9106569	enquire
250 mm	9106577	enquire	9106578	enquire	9106579	enquire



Cyano

Column Characteristics:

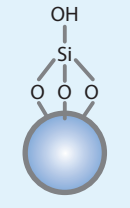
particle size:	5 µm, spherical
pore size:	100 Å
carbon load:	8%
end-cap:	yes
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L10
phase category:	cyano
ligand type:	cyanopropyl silane

Ultra Silica HPLC Prep Columns

Chromatographic Properties

Base-deactivated spherical silica is useful for normal-phase or HILIC separations.

Length	10 mm ID cat.#	price	21.2 mm ID cat.#	price	30 mm ID cat.#	price
5 µm Columns						
50 mm	9100557	enquire	9100558	enquire	9100559	enquire
100 mm	9100517	enquire	9100518	enquire	9100519	enquire
150 mm	9100567	enquire	9100568	enquire	9100569	enquire
250 mm	9100577	enquire	9100578	enquire	9100579	enquire



Silica

Column Characteristics:

particle size:	5 µm, spherical
pore size:	100 Å
end-cap:	no
pH range:	2.5 to 8
temperature limit:	80 °C
USP phase code:	L3
phase category:	bare silica
ligand type:	none

Ultra Bulk Packing Materials (5 µm)

Use our bulk packing materials to pack your own columns!

- Prepare your own columns in conventional or custom dimensions.
- Consistent, high-quality materials.

Our extensive QC program ensures the high quality and reproducibility of these silicas. You can be confident that you are getting consistent, high-quality product when you source your silica from Restek.

Use these materials for easy scale-up to preparative chromatography or for packing your own columns.

Description	qty.	cat.#	1-99 bottles	≥100 bottles
5 µm Ultra Bulk Packing Materials				
Ultra C1 Bulk Packing	10 g/btl.	91015	£639.60/btl	£664.75/btl
Ultra C4 Bulk Packing	10 g/btl.	91025	£639.60/btl	£664.75/btl
Ultra C8 Bulk Packing	10 g/btl.	91035	£639.60/btl	£664.75/btl
Ultra C18 Bulk Packing	10 g/btl.	91745	£639.60/btl	£664.75/btl
Ultra Amino Bulk Packing	10 g/btl.	91075	£639.60/btl	£664.75/btl
Ultra Cyano Bulk Packing	10 g/btl.	91065	£639.60/btl	£664.75/btl
Ultra Silica Bulk Packing	10 g/btl.	91005	£639.60/btl	£664.75/btl

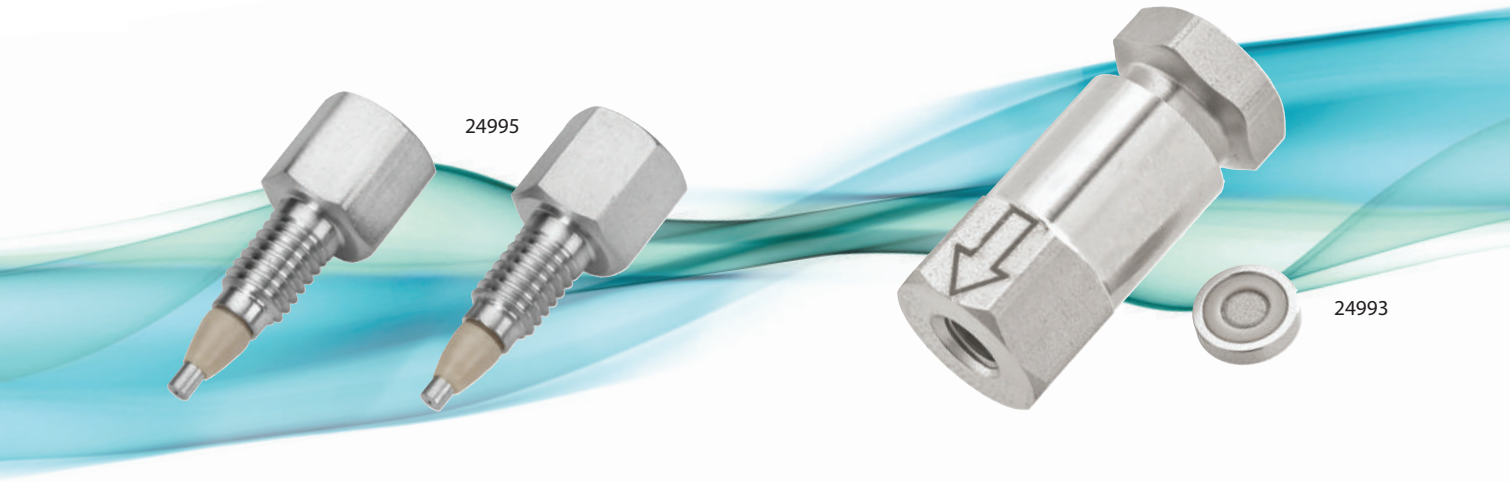
also available

Other stationary phases and particle sizes are also available in bulk; call Customer Service or your local Restek® representative for details.

Protect Your Column and Your UHPLC Performance With UltraShield and UltraLine UHPLC Filters

A cost-effective way to extend the lifetime of any UHPLC column without sacrificing your UHPLC performance on any LC system

Use with any UHPLC system



UltraShield UHPLC PreColumn Filter

- Cost-effective protection for UHPLC systems.
- Reliable way to extend column lifetime.
- Universal fit—connects easily to any brand column.
- Leak-tight to 15,000 psi (1,034 bar).
- 0.5 µm or 0.2 µm titanium frit in a stainless steel body with PEEK ferrule.

Specifications:

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

Description	Filter Porosity	qty.	cat.#	price
UltraShield UHPLC PreColumn Filter	0.5 µm frit	ea.	24995	£64.10
		5-pk.	24996	£244.55
		10-pk.	24997	£461.80
UltraShield UHPLC PreColumn Filter	0.2 µm frit	ea.	25809	£50
		5-pk.	25810	£225.85
		10-pk.	25811	£400.75

UltraLine UHPLC In-Line Filter

- In-line design installs easily with standard fittings.
- Cost-effective protection for UHPLC systems.
- Reliable way to extend column lifetime.
- Leak-tight to 15,000 psi (1,034 bar).
- Replaceable 0.5 µm stainless steel frit in stainless steel body.

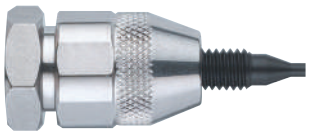
Specifications:

Inlet/Outlet:	Female/Female 10-32
Port Geometry:	Parker ($^{1}/_{16}$ CPI)
Material:	Stainless steel housing
Filter:	0.5 µm stainless steel, 0.125" W x 0.062" T, 5 µL volume
Pressure Rating:	15,000 psig (1,034 bar)
Wrench Flat:	$^{3}/_{8}$"

Description	qty.	cat.#	price
UltraLine UHPLC In-Line Filter (In-Line Assembly with Filter)	ea.	24993	£160.25
UltraLine Replacement Filters	5-pk.	24994	£76

Trident Direct Guard Cartridge System Easy to Use, Low Dead Volume—
The Ultimate Combination of Convenience and Column Protection

Unlike "one size fits all" guard systems, the Trident direct system gives you the power to select the right level of protection for your analysis. The system offers three levels of protection, with a variety of bonded phases to match your analytical column. The economical, leak-free cartridge design provides an unprecedented combination of convenience, economy, and reliability. The foundation of the Trident direct system is a reusable direct connect holder that easily attaches to any HPLC column using CPI- or Waters-style end fittings.* The system is available in configurations to match different protection levels: filter only, guard cartridge holder without filter, and guard cartridge holder with filter. The guard cartridges (see page 191) are available in 2.1 and 4.0 mm ID and are interchangeable within the holder.



25082

Filter:
Protection against particulate matter.

25084

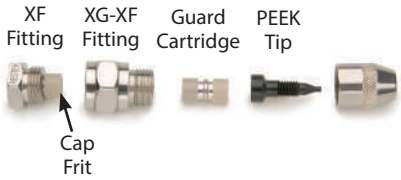
Guard Cartridge and Filter:
Protection against particulate matter *and* moderate protection against irreversibly adsorbed compounds.

Description	qty.	cat.#	price
High-pressure filter	ea.	25082	£100.55
10 mm guard cartridge holder without filter	ea.	25083	£100.55
10 mm guard cartridge holder with filter	ea.	25084	£123.60
PEEK tip for Waters-style end fittings	ea.	25088	£15.75
PEEK tip for standard fittings	ea.	25087	£15.75

*The standard PEEK tip in Trident direct systems is compatible with Parker, Upchurch Scientific, Valco, and other CPI-style fittings. To use Trident direct systems with Waters-style end fittings, replace the tip with cat.# 25088.

Trident direct 10 mm guard cartridge holder with filter

Components



Assembled

Installed onto column

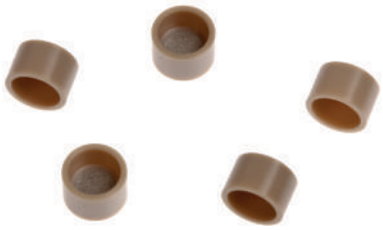
See page 191 for a full selection of Trident HPLC guard cartridges.

Double the Protection With Cap Frits!

Replacement Cap Frits 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 in a Trident direct helps prevent clogged cartridges to extend the life of your column, your cartridge, and your budget.

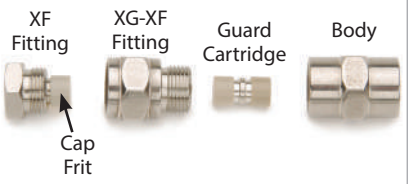
Description	ID	Porosity	qty.	cat.#	price
Replacement Cap Frits	4 mm	2.0 µm	5-pk.	25022	£34.60
Replacement Cap Frits	4 mm	0.5 µm	5-pk.	25023	£39.85
Replacement Cap Frits	2 mm	2.0 µm	5-pk.	25057	£39.85
Replacement Cap Frits	2 mm	0.5 µm	5-pk.	25990	£39.85



25022

Trident in-line 10 mm guard cartridge holder with filter

Components



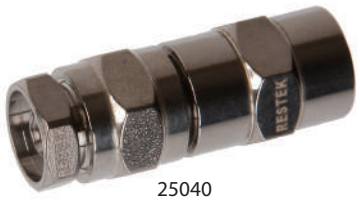
Assembled

Installed onto column

Trident HPLC In-Line Guard Cartridge Holders

A Trident in-line guard cartridge holder can be used with almost any HPLC column by connecting it with a short piece of 1/16" tubing, appropriate nuts and ferrules, or finger-tight fittings. The system can be used with Restek® columns, or with columns from other manufacturers. Holders are available for 10 mm guard cartridges (see page 191). Purchase with or without a prefilter, which provides added protection against the particles that can shorten the lifetime of the guard cartridge.

25021



25040

Description	qty.	cat.#	price
Holder for 10 mm guard cartridge	ea.	25021	£66
Holder with filter for 10 mm guard cartridge	ea.	25040	£89.05
Frit-Type In-Line Filter, 2.0 µm	ea.	25041	£63.90

For HPLC tubing, visit **www.restek.com/LCacc**

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

EXP® Hand-Tight Coupler

25940

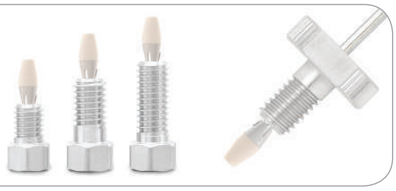
Description	qty.	cat.#	price
EXP Hand-Tight Coupler (2 Nuts, 2 Ferrules, 1/16" x 0.005" ID Tubing)	ea.	25940	£86

Hybrid Ferrule U.S. Patent No. 8201854, Optimize Technologies. Optimize Technologies EXP Holders are Patent Pending. Other U.S. and Foreign Patents Pending. The Opti- prefix is a registered trademark of Optimize Technologies, Inc.

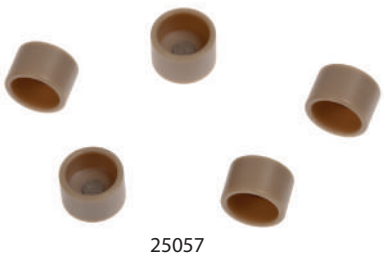
also available

Our entire EXP® fitting selection.

See **page 335**.



Double the Protection With Cap Frits!



25057

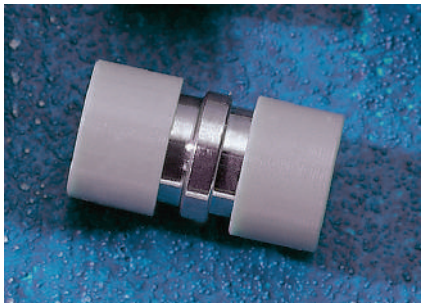
Replacement Cap Frits for Trident Guard Cartridges

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

Description	ID	Porosity	qty.	cat.#	price
Replacement Cap Frits	4 mm	2.0 µm	5-pk.	25022	£34.60
Replacement Cap Frits	4 mm	0.5 µm	5-pk.	25023	£39.85
Replacement Cap Frits	2 mm	2.0 µm	5-pk.	25057	£39.85
Replacement Cap Frits	2 mm	0.5 µm	5-pk.	25990	£39.85

Trident HPLC Guard Cartridges

Description	3-pk. (10 x 2.1 mm)	3-pk. (10 x 4.0 mm)	price
Pinnacle DB Guard Cartridges			
Pinnacle DB C18 Guard Cartridge	941450212	941450210	£126.80
Pinnacle DB C8 Guard Cartridge	941350212	941350210	£126.80
Pinnacle DB Aqueous C18 Guard Cartridge	941850212	941850210	£126.80
Pinnacle DB Biphenyl Guard Cartridge	940950212	940950210	£126.80
Pinnacle DB PFP Propyl Guard Cartridge	941950212	941950210	£126.80
Pinnacle DB Cyano Guard Cartridge	941650212	941650210	£126.80
Pinnacle DB Silica Guard Cartridge	941050212	941050210	£126.80
Ultra Guard Cartridges			
Ultra C18 Guard Cartridge	917450212	917450210	£167.60
Ultra C8 Guard Cartridge	910350212	910350210	£167.60
Ultra C4 Guard Cartridge	910250212	910250210	£167.60
Ultra C1 Guard Cartridge	910150212	910150210	£167.60
Ultra Aromax Guard Cartridge	912750212	912750210	£164.45
Ultra Aqueous C18 Guard Cartridge	917850212	917850210	£167.60
Ultra Biphenyl Guard Cartridge	910950212	910950210	£164.45
Ultra IBD Guard Cartridge	917550212	917550210	£167.60
Ultra PFP Propyl Guard Cartridge	917950212	917950210	£167.60
Ultra Cyano Guard Cartridge	910650212	910650210	£167.60
Ultra Amino Guard Cartridge	—	910750210	£167.60
Ultra Silica Guard Cartridge	910050212	910050210	£167.60
Viva Guard Cartridges			
Viva C18 Guard Cartridge	951450212	951450210	£167.60
Viva C8 Guard Cartridge	951350212	951350210	£167.60
Viva C4 Guard Cartridge	951250212	951250210	£167.60
Viva Biphenyl Guard Cartridge	951650212	951650210	£167.60
Viva PFP Propyl Guard Cartridge	951950212	951950210	£167.60
Viva Silica Guard Cartridge	951050212	951050210	£167.60



Trident HPLC Guard Cartridge