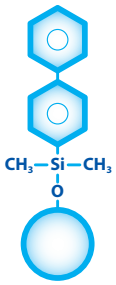
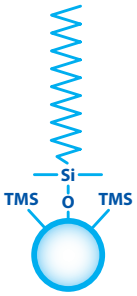
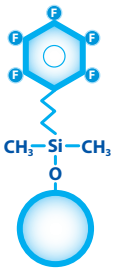
Force Performance LC Columns from Restek

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

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

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

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

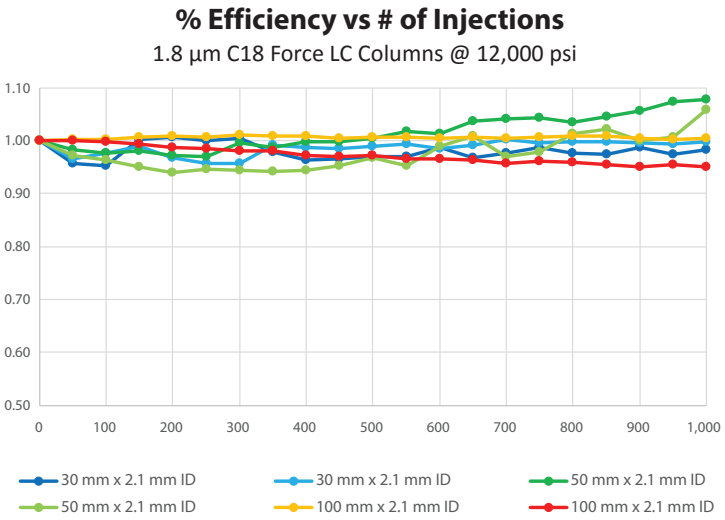
	Biphenyl	C18	FluoroPhenyl
			
USP Phase Code	L11	L1	L43
Stationary Phase Category	Phenyl	C18, octadecylsilane	Pentafluorophenyl propyl
Ligand Type	Biphenyl	End-capped C18	Fluorophenyl
Particle Size	1.8 µm, 3 µm, or 5 µm fully porous	1.8 µm, 3 µm, or 5 µm fully porous	1.8 µm, 3 µm, or 5 µm fully porous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

Apply Force to Your LC Methods...

... for Longer Column Life

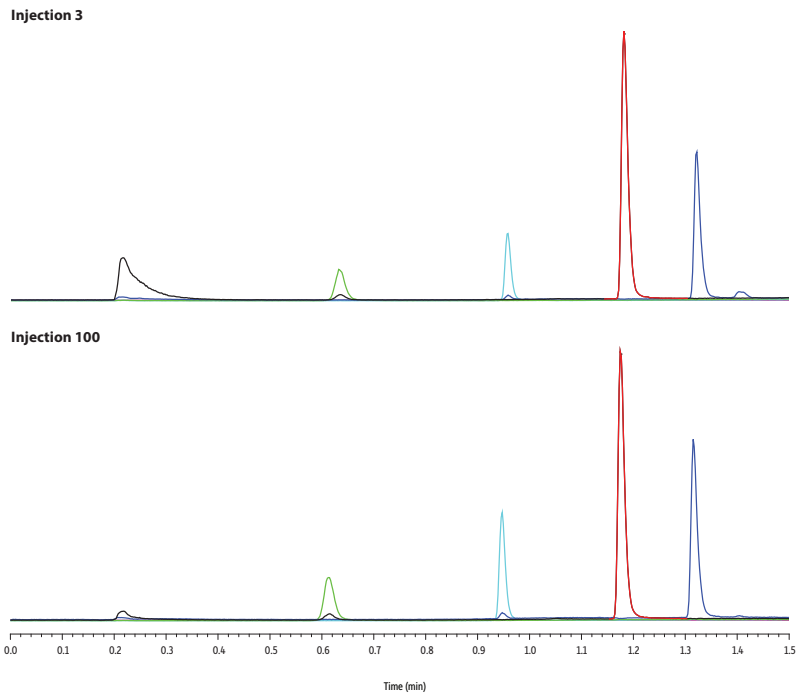
Elevated pressures and rapid pressure cycling put extreme stress on your LC column and shorten its life. And when the demand to increase lab productivity meets the growing pressure limits of modern LCs and the faster cycle times of new methods, many competitor columns simply can't survive. Force LC columns from Restek are designed and manufactured to handle high-pressure, high-stress conditions. Whether you're running a 3 or 5 µm column on an older HPLC or a 1.8 µm on the newest UHPLC in your lab (Figures 1 & 2), your method will give you the same separation from one injection to the next when you trust your workflow to the extended lifetime of a Force LC column.

Figure 1: At over 10,000 psi, you may be used to seeing a drop in efficiency, but Force LC columns will take the pressure.



1000 injections and still going strong at high pressure.

Figure 2: Rapid changes in pressure place more stress on a column than even high pressures can, but Force LC columns will handle repeated analyses with no change in separation.



Stable retention times and peak shapes even with rapid cycling!

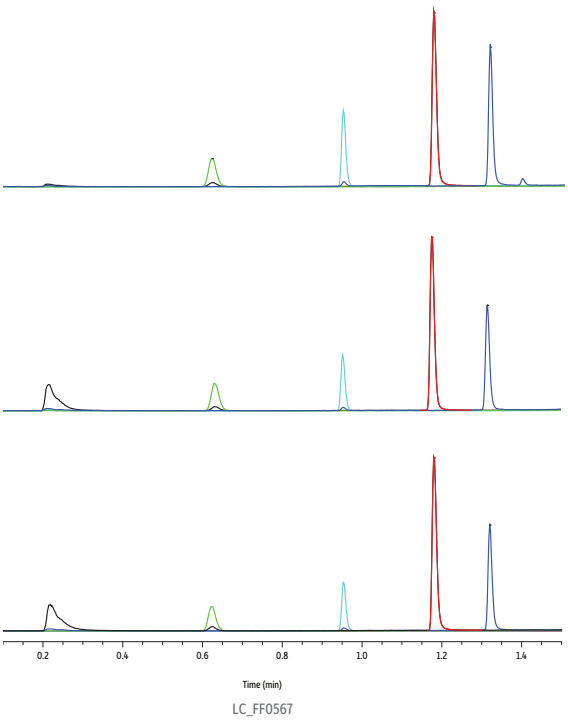
	Peaks	SIR (m/z)
1.	Daidzin	417.2
2.	Genistin	433.2
3.	Daidzein	255.1
4.	Genistein	271.1

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

... for Improved Reproducibility

Once you set up and validate a workflow, you move on to developing the next new method. You don't have time to repeatedly revisit past methods because your chosen column is giving you different results with each lot. Peak shapes and retention times need to be maintained over the lifetime of your workflow to ensure consistent results, reduce unplanned downtime, and preserve your own productivity. Force LC columns have the lot-to-lot reproducibility you need to rely on (Figure 3)—backed by Restek's strict QC system and our 100% Pure Satisfaction guarantee—so that you are free to focus your energy on what's next.

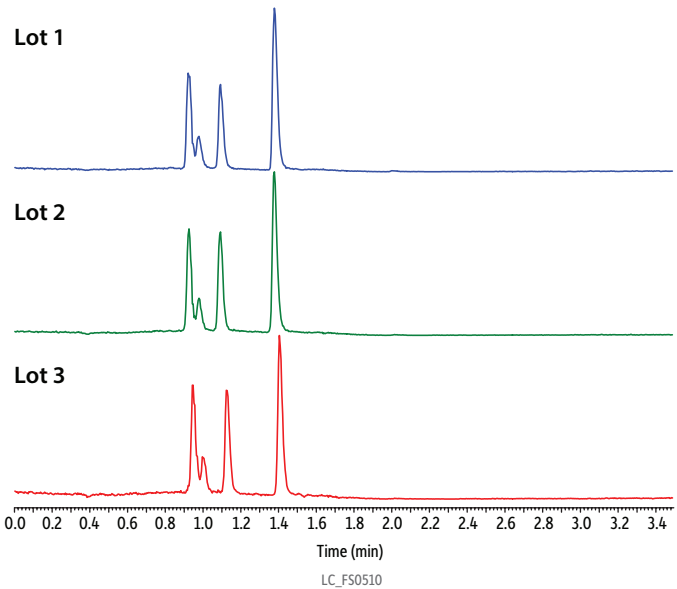
Figure 3: Whether a standard C18 or our FluoroPhenyl with its innovative new bonding process, each subsequent Force column you order will give you the same outstanding performance as the first.



C18

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

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



FluoroPhenyl

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

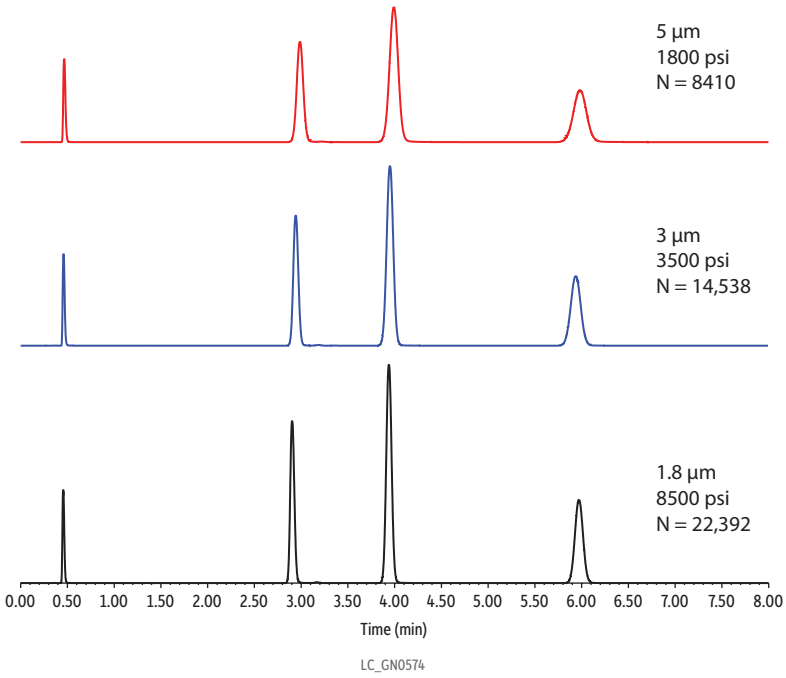
Column: Force FluoroPhenyl (cat.# 9639252); Dimensions: 50 mm x 2.1 mm ID; Particle Size: 1.8 µm; Temp.: 40 °C; **Sample:** Diluent: Water; Conc.: 50 ng/mL; Inj. Vol.: 5 µL; Mobile Phase: A. 0.1% Acetic acid in water, B. Methanol; **Gradient (%B):** 0.00 min (30%); 1.50 min (95%); 1.51 min (30%); 3.50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

... for Complete Scalability

To accelerate time to market, analysts will often develop methods on fast UHPLC instruments using sub-2 µm particle columns. But the methods must then be scaled to match the analysis time and pressure limitations of the traditional HPLCs and the 3 or 5 µm columns that will actually be doing the work. To make this transition easier and ensure consistent results, Force LC columns are available in three particle sizes that are manufactured on the same silica support with the same properties to reliably and easily provide the same separation on any instrument platform (Figure 4).

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

Figure 4: With identical isocratic flow rates, 5, 3, and 1.8 µm Force columns still offer the same results. (If using a gradient, simple equations can help you adjust slope and time points.) Scaling doesn't get easier than that!

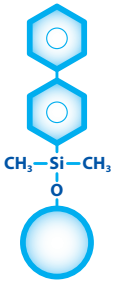


Peak shape and plate number improve as particle size decreases—ideal for increased MS sensitivity!

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

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

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



The established choice for pharmaceutical testing since 2005

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

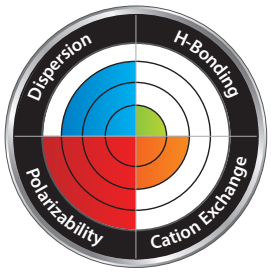
Properties:

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

Switch to a Biphenyl when:

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

Column Interaction Profile:



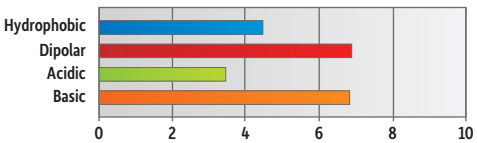
Defining Solute Interactions:

- **Polarizability**
- **Dispersion**

Complementary Solute Interaction:

- **Cation exchange**

Solute Retention Profile:



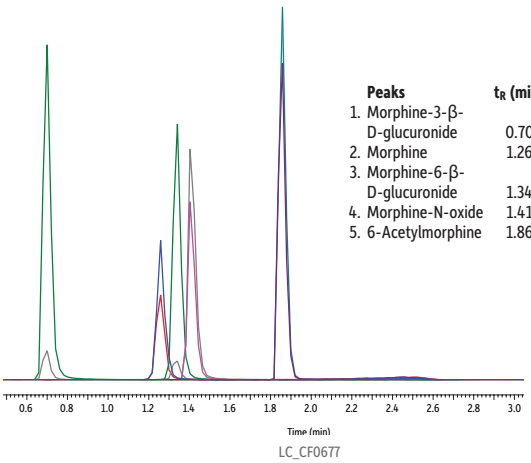
Target Analyte Structures:

- **Aromatic**
- **Dipolar**

Target Analyte Functionalities:

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

Figure 5: Whether for therapeutic drug monitoring or toxicology, Force Biphenyl columns were made for applications where fast, reliable identification of drugs and metabolites could be a matter of life and death.

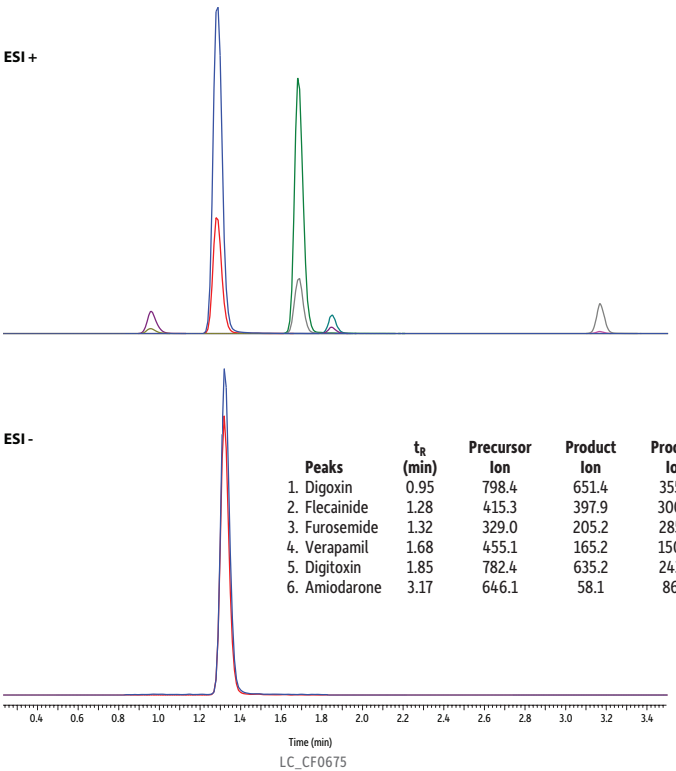


Peaks	t_R (min)	Precursor Ion	Product Ion	Product Ion
1. Morphine-3-β-D-glucuronide	0.70	462.1	286.0	152.1
2. Morphine	1.26	286.1	164.9	152.0
3. Morphine-6-β-D-glucuronide	1.34	462.1	286.0	152.1
4. Morphine-N-oxide	1.41	302.1	284.9	161.9
5. 6-Acetylmorphine	1.86	328.1	211.1	165.0

LC_CF0677

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

Figure 6: Accurate quantification is critical for cardiac drugs due to their narrow therapeutic range, and the Restek Biphenyl phase on a Force LC column is the ideal choice.



Peaks	t_R (min)	Precursor Ion	Product Ion	Product Ion	Polarity
1. Digoxin	0.95	798.4	651.4	355.1	+
2. Flecainide	1.28	415.3	397.9	300.9	+
3. Furosemide	1.32	329.0	205.2	285.1	-
4. Verapamil	1.68	455.1	165.2	150.0	+
5. Digitoxin	1.85	782.4	635.2	243.1	+
6. Amiodarone	3.17	646.1	58.1	86.2	+

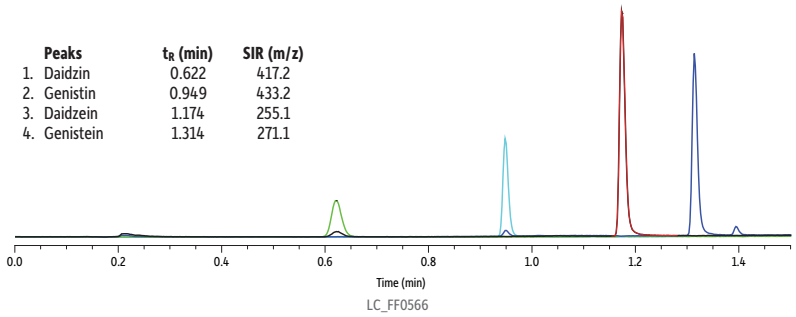
LC_CF0675

Column: Force Biphenyl (cat.# 9629252); Dimensions: 50 mm x 2.1 mm ID; Particle Size: 1.8 µm; Temp.: 40 °C; **Sample:** Diluent: Water:acetonitrile (90:10); Conc.: 100 ng/mL; Inj. Vol.: 2 µL; **Mobile Phase:** A. Water + 5 mM ammonium formate + 0.1% formic acid, B: Acetonitrile + 0.1% formic acid; **Gradient (%B):** 0.00 min (40%); 3.50 min (95%); 3.51 min (40%); 5.5 min (40%); **Flow:** 0.3 mL/min; **Detector:** MS/MS; Ion Mode: ESI+/ESI-; Mode: Scheduled MRM; **Instrument:** UHPLC.

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

Figure 7: A C18 is a common first choice for method developers, and as shown here for these isoflavones commonly found in nutraceuticals, a Force C18 column is the C18 to choose.

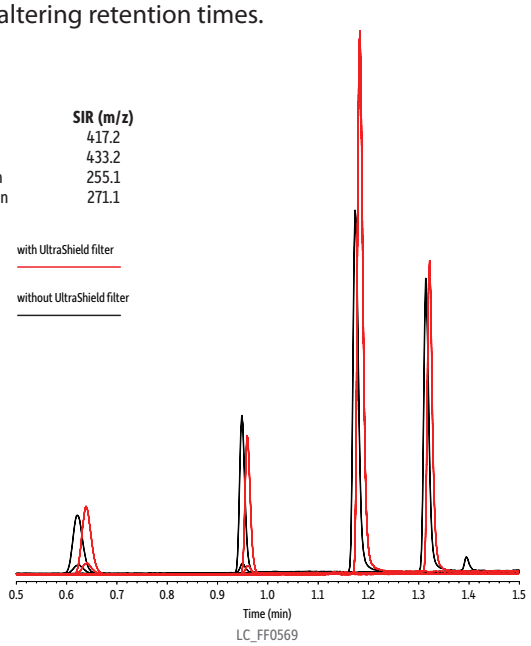
Peaks	t_R (min)	SIR (m/z)
1. Daidzin	0.622	417.2
2. Genistin	0.949	433.2
3. Daidzein	1.174	255.1
4. Genistein	1.314	271.1



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

Figure 8: You can pair a 1.8 µm Force column with an UltraShield UHPLC PreColumn filter to prolong column lifetime—without significantly altering retention times.

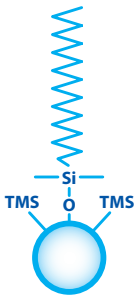
Peaks	SIR (m/z)
1. Daidzin	417.2
2. Genistin	433.2
3. Daidzein	255.1
4. Genistein	271.1



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

Small-Particle Column Protection

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



Force column dependability, scalability, and quality in a C18

- Wide pH range provides excellent data quality for many applications.
- High carbon load (20%) offers high hydrophobic retention.

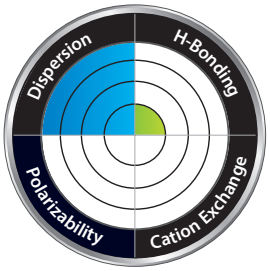
Properties:

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

Switch to a C18 when:

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

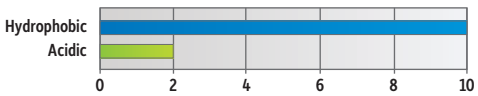
Column Interaction Profile:



Defining Solute Interaction:

- **Dispersion**

Solute Retention Profile:



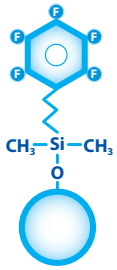
Target Analyte Structure:

- **Hydrocarbons**

Target Analyte Functionality:

- **Hydrophobic compounds**

Force LC Columns at Work: *Reliably Versatile Restek FluoroPhenyl Phase*



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

- Retains hydrophobic, polar, and aromatic compounds.
- Has orthogonal selectivity to a C18.
- Exceptionally reproducible—predictable performance from every column.

Properties:

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

Switch to FluoroPhenyl when:

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

Column Interaction Profile:

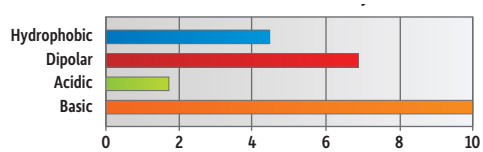
Defining Solute Interactions:

• Cation exchange

Complementary Solute Interaction:

• Polarizability
• Dispersion

Solute Retention Profile:



Target Analyte Structures:

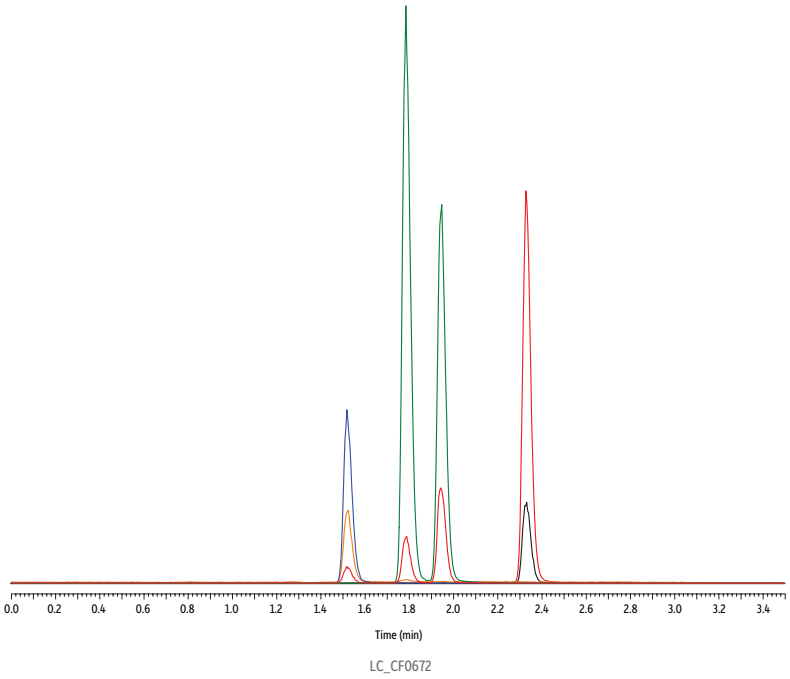
• Nitrogen

Target Analyte Functionalities:

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

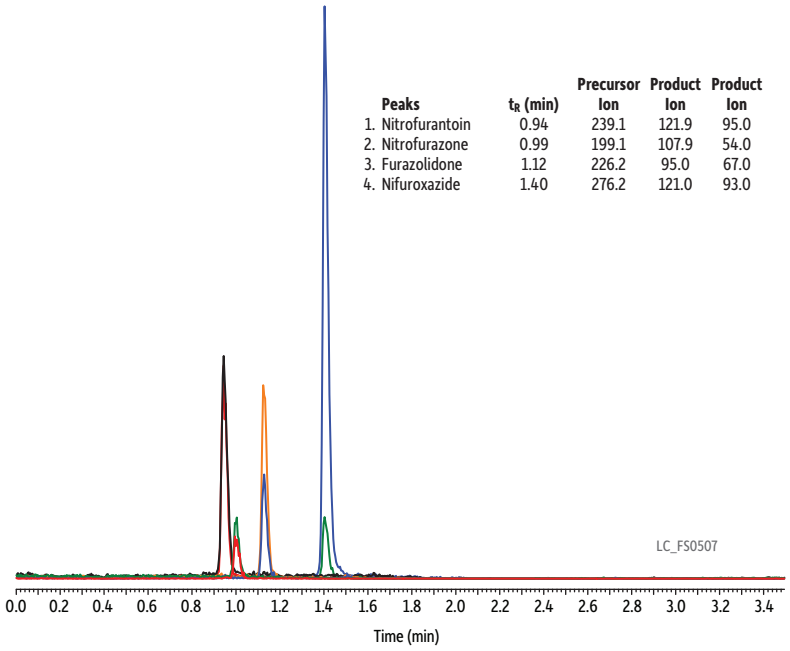
Figure 9: Xanthine analysis can be performed in clinical settings, in sports to target misuse, or even in food analyses. A Force FluoroPhenyl column offers fast, simultaneous analysis of multiple compounds including isobars paraxanthine and theophylline.

Peaks	t_R (min)	Conc. (µg/mL)	Precursor Ion	Product Ion	Product Ion
1. Theobromine	1.53	50	181.13	137.95	163.01
2. Theophylline	1.79	50	181.13	124.02	96.03
3. Paraxanthine	1.95	50	181.13	124.02	96.03
4. Caffeine	2.33	50	195.09	138.01	110.03



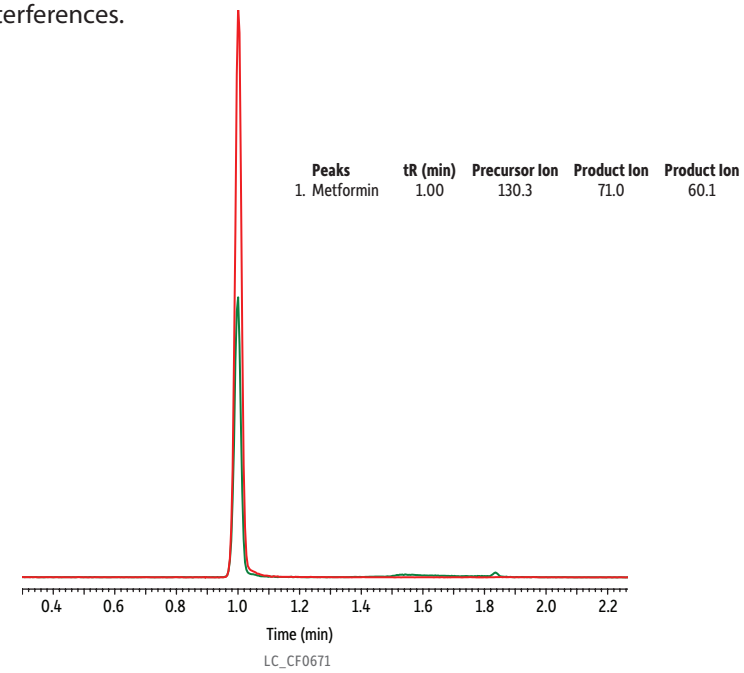
Column: Force FluoroPhenyl (cat.# 9639212); Dimensions: 100 mm x 2.1 mm ID; Particle Size: 1.8 µm; Temp.: 40 °C **Sample:** Diluent: 70:30 Water:methanol; Conc.: 50 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A. 0.1% Formic acid in water, B. Methanol; **Gradient (%B):** 0.00 min (30%); 2.5 min (70%); 3.0 min (100%); 3.01 min (30%); 5.0 min (30%); **Flow:** 0.3 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument:** UHPLC.

Figure 10: Restek's Force FluoroPhenyl column makes quick and effective work of nitrofurans, which are often used in animal feed as antibiotics/antimicrobials but are also banned in many regions.



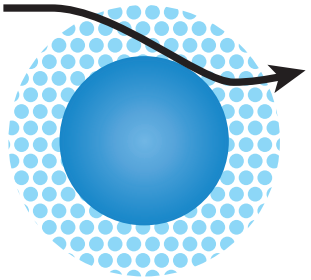
Column: Force FluoroPhenyl (cat.# 9639252); Dimensions: 50 mm x 2.1 mm ID; Particle Size: 1.8 µm; Temp.: 40 °C; **Sample:** Diluent: Water; Conc.: 50 ng/mL; Inj. Vol.: 5 µL; **Mobile Phase:** A. 0.1% Acetic acid in water, B. Methanol; **Gradient (%B):** 0.00 min (30%); 1.50 min (95%); 1.51 min (30%);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

Figure 11: A common antidiabetic, metformin is difficult to retain using typical reversed-phase conditions, but with its HILIC capability, a Force FluoroPhenyl column provides suitable results in less than 3 minutes and reduces potential ion suppression caused by early-eluting matrix interferences.

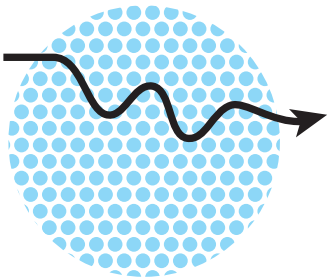


Column: Force FluoroPhenyl (cat.# 9639252); Dimensions: 50 mm x 2.1 mm ID; Particle Size: 1.8 µm; Temp.: 40 °C; **Sample:** Diluent: Acetonitrile; Conc.: 100 ng/mL; Inj. Vol.: 2 µL; **Mobile Phase:** A. 0.1% Formic acid in water, B. 0.1% Formic acid in acetonitrile; **Gradient (%B):** 0.00 min (70%); 1.5 min (10%); 1.51 min (70%); 2.5 min (70%); **Flow:** 0.6 mL/min; **Detector:** MS/MS; Ion Mode: ESI+; Mode: MRM; **Instrument:** UHPLC.

SPP or FPP?

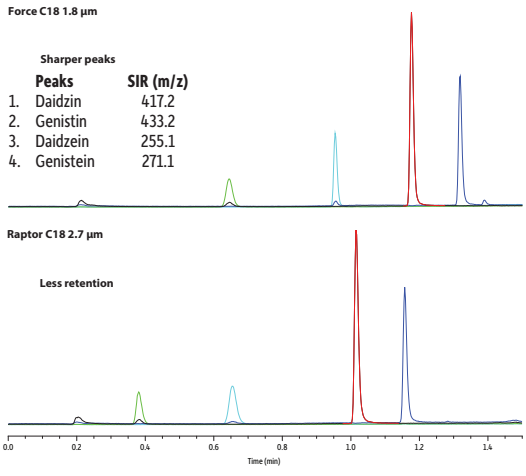


Superficially porous particles (SPP) are becoming increasingly popular for providing faster, more efficient analyses without UHPLC pressures. And when speed is your goal, Restek recommends the Raptor line of LC columns (**www.restek.com/raptor**).



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

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

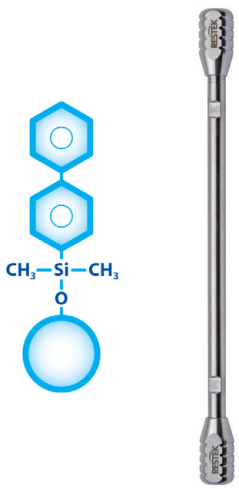


Columns: Force C18 1.8 µm, 50 x 2.1 mm (cat# 9634252); max pressure = 500 bar and Raptor C18 2.7 µm, 50 x 2.1 mm (cat# 9304A52); max pressure = 225 bar; Temp.: 50 °C; **Sample:** Custom mix; Diluent: Water; Conc.: 500 ng/mL; Inj. Vol.: 2 µL; **Mobile Phase:** A. Water + 0.1% formic acid, B. Acetonitrile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

Force Biphenyl LC Columns (USP L11)

- Ideal for bioanalytical testing applications like drug and metabolite analyses.
- Heightened selectivity and retention for compounds that are hard to resolve or elute early on C18 and other phenyl chemistries.
- Limits ionization suppression and allows simple, MS-friendly mobile phases.
- Restek's most popular LC stationary phase.

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, Biphenyl columns are extremely useful for 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.



Stationary Phase Category: Phenyl (L11)
Ligand Type: Biphenyl
Particle: 1.8 µm, 3 µm, or 5 µm fully porous silica
Pore Size: 100 Å
Carbon Load: 15%
End-Cap: yes
Surface Area: 300 m^2/g
Recommended Usage:
pH Range: 2.0–8.0
Maximum Temperature: 80 °C
Maximum Pressure: 1034 bar/15,000 psi* (1.8 µm), 600 bar/8700 psi (3 µm); 400 bar/5800 psi (5 µm)
* For maximum lifetime, recommended maximum pressure for 1.8 µm particles is 830 bar/12,000 psi.

Properties:

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

Switch to a Biphenyl when:

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

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

Force Inert Biphenyl HPLC Columns

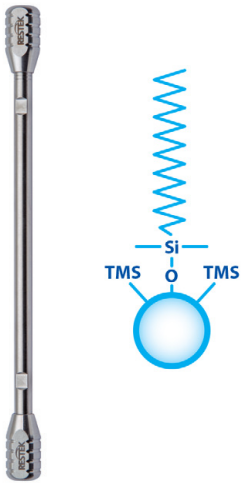
- Inert LC column technology reduces nonspecific binding of chelating analytes, enabling sensitive analysis and smooth integration of peaks.
- Ideal for the analysis of metal-sensitive compounds, such as mycotoxins.
- Increased response and analyte recovery, allowing lower detection limits.
- Improved peak shape without additional passivation or mobile phase additives.
- Part of Restek's Force Biphenyl column line featuring 3 µm fully porous silica.

ID	Length	Particle Size	Units	Cat.#
2.1 mm	100	3 µm	ea.	9629312-T
3.0 mm	100	3 µm	ea.	962931E-T
2.1 mm	50	3 µm	ea.	9629352-T
3.0 mm	50	3 µm	ea.	962935E-T

Force C18 LC Columns (USP L1)

- A traditional end-capped C18 ideal for general-purpose use in reversed-phase chromatography.
- Wide pH range (2–8) provides excellent data quality for many applications, matrices, and compounds.
- Offers high hydrophobic retention.

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.



Stationary Phase Category: C18, octadecylsilane (L1)
Ligand Type: End-capped C18
Particle: 1.8 µm, 3 µm, or 5 µm fully porous silica
Pore Size: 100 Å
Carbon Load: 20%
End-Cap: yes
Surface Area: 300 m^2/g
Recommended Usage:
pH Range: 2.0–8.0
Maximum Temperature: 80 °C
Maximum Pressure: 1034 bar/15,000 psi* (1.8 µm), 600 bar/8700 psi (3 µm); 400 bar/5800 psi (5 µm)
* For maximum lifetime, recommended maximum pressure for 1.8 µm particles is 830 bar/12,000 psi.

Properties:

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

Switch to a C18 when:

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

ID	Length	qty.	cat.#
1.8 µm Particles Force C18 LC Column			
2.1 mm	30 mm	ea.	9634232
	50 mm	ea.	9634252
	100 mm	ea.	9634212
3.0 mm	50 mm	ea.	963425E
	100 mm	ea.	963421E
3 µm Particles Force C18 LC Column			
2.1 mm	30 mm	ea.	9634332
	50 mm	ea.	9634352
	100 mm	ea.	9634312
	150 mm	ea.	9634362
3.0 mm	50 mm	ea.	963435E
	100 mm	ea.	963431E
	150 mm	ea.	963436E
4.6 mm	100 mm	ea.	9634315
	150 mm	ea.	9634365
5 µm Particles Force C18 LC Column			
2.1 mm	50 mm	ea.	9634552
	100 mm	ea.	9634512
	150 mm	ea.	9634562
3.0 mm	50 mm	ea.	963455E
	100 mm	ea.	963451E
	150 mm	ea.	963456E
4.6 mm	100 mm	ea.	9634515
	150 mm	ea.	9634565
	250 mm	ea.	9634575

Force FluoroPhenyl LC Columns (USP L43)

- Retains hydrophobic, polar, and aromatic compounds.
- Has orthogonal selectivity to a C18.
- Exceptionally reproducible—predictable performance from every column.

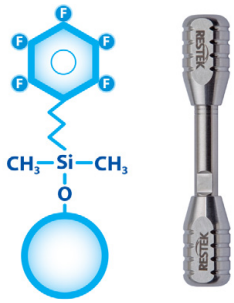
Restek's FluoroPhenyl phase offers chromatographers the ability to run in reversed-phase or HILIC mode for a variety of compounds. Restek's FluoroPhenyl columns are also amenable to LC-MS because they are extremely reliable and efficient with acidic mobile phases.

Stationary Phase Category: Pentafluorophenyl propyl (L43)
Ligand Type: Fluorophenyl
Particle: 1.8 µm, 3 µm, or 5 µm fully porous silica
Pore Size: 100 Å
Carbon Load: 10%
End-Cap: no
Surface Area: 300 m^2/g
Recommended Usage:
pH Range: 2.0–8.0
Maximum Temperature: 80 °C
Maximum Pressure: 1034 bar/15,000 psi* (1.8 µm), 600 bar/8700 psi (3 µm); 400 bar/5800 psi (5 µm)
* For maximum lifetime, recommended maximum pressure for 1.8 µm particles is 830 bar/12,000 psi.
Properties:

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

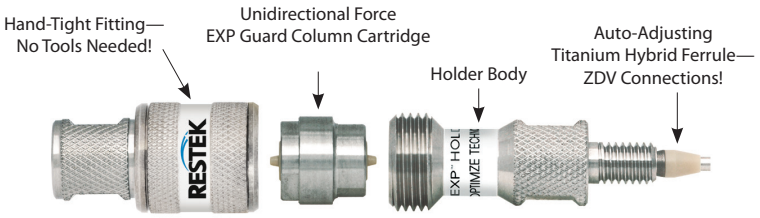
Switch to a FluoroPhenyl LC column when:

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



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

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



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

- Free-Turn architecture lets you change cartridges by hand without breaking inlet/outlet fluid connections—no tools needed.
- Patented titanium hybrid ferrules can be installed repeatedly without compromising high-pressure seal.
- Auto-adjusting design provides ZDV (zero dead volume) connection to any 10-32 female port.
- Guard column cartridges require EXP direct connect holder (cat.# 25808).
- Pair with EXP hand-tight fitting (cat.# 25937–25938) for tool-free installation.
- For use with 3 or 5 µm Force LC columns. For 1.8 µm Force columns, use a 0.2 µm UltraShield filter.

Apply Force LC columns to all of your HPLC and UHPLC instrument platforms at www.restek.com/force

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

ordering notes

Certificates of analysis for new Restek LC columns are now provided electronically. To view and download, visit www.restek.com/documentation then enter your cat.# and serial #.

25808

Force EXP Guard Column Cartridges

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

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

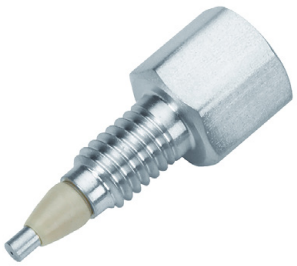
EXP Direct Connect Holder

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

Intellectual Property: optimizetech.com/patents
Maximum holder pressure: 20,000 psi (1400 bar).

UltraShield UHPLC PreColumn Filter

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



24995

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

Specifications
Inlet/Outlet: Female/Male 10-32
Port Geometry: Parker ($^{1}/_{16}$ CPI)
Material: stainless steel, PEEK ferrule
Filter: 0.5 µm or 0.2 µm stainless steel
Pressure Rating: 15,000 psig (1034 bar)
Wrench Flat: $^{5}/_{16}$"

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

EXP Hand-Tight Fittings

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

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

25937

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

Intellectual Property: optimizetech.com/patents