## **Raptor LC Columns Phase Overview**

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

## What sets our Raptor Core-Shell columns apart?

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

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



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



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



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





See the complete **Raptor phase** overview







Our Raptor phases at a glance	Biph	cH, Si-o- CH, cH,	Go-to choice for unsaturated and aromatic compounds.		-18	Provides optimal stability under highly acidic conditions.	Fluorol	Phenyl CH, I Si-O- CH,	Robust PFPP phase boasting excellent RP and HILIC separations.	C1	8 Si-o- TMS	General-use workhorse for a wide range of analyses.
USP Code	L11			L1		L43			L1			
Stationary Phase Category	Phenyl			C18, octadecylsilane			Pentafluorophenylpropyl			C18, octadecylsilane		
Ligand Type	Biphenyl			Sterically protected C18		Fluorophenyl			End-capped C18			
Particle Size in µm	1.8	2.7	5	1.8	2.7	5	1.8	2.7	5	1.8	2.7	5
Base Material	Core-Shell particles made of high purity silica			Core-Shell particles made of high purity silica			Core-Shell particles made of high purity silica			Core-Shell particles made of high purity silica		
Pore Size in Å	90			90		90			90			
Surface Area in m²/g	125	130	100	125	130	100	125	130	100	125	130	100
Carbon Load in %	7	7	5	7	7	5	4	4	3	9	7	5
End Cap	yes			no		no		yes				
pH Range	2.0-8.0			1.0-8.0		2.0-8.0			2.0-8.0			
Maximum Temperature in °C	80			80			80			80		
Maximum Pressure in bar/psi	1000/15000 *	600/8700	400/5800	1000/15000 *	600/8700	400/5800	1000/15000 *	600/8700	400/5800	1000/15000 *	600/8700	400/5800

\* For maximum lifetime during continuous operation a maximum pressure of 830 bar/12,000 psi is recommended.

Properties	Increased retention for aromatic and unsaturated compounds; ideal selectivity for difficult isomer separations; limits ionization suppression and allows simple, MS-friendly mobile phases; enhanced selectivity when used with methanolic mobile phase.	Optimal stability in acidic conditions; no shorter retention times due to phase degradation as with conventional C18 phases; balanced retention profile, distributes analytes evenly across the gradient; ideal for multicomponent methods with LC-MS/MS.	Increased retention for charged bases; capable of both RP and HILIC separations; steric selectivity (e.g., vitamin D epimers); more stable, more robust, and more reproducible than older pentafluorophenylpropyl phases; increased sensitivity in LC-MS analyses.	C18 phase with classical end capping (TMS); stable, robust, reproducible; universally applicable where hydrophobic interactions are required.
Switch to the respective Raptor phase, when you	observe that compounds are hard to resolve or elute early on C18 or other phenyl chemistries. need to increase retention of hydrophilic aromatics.	analyze large, multiclass lists by LC-MS/MS. require strongly acidic (pH 1-3) mobile phases. want to achieve fast separations with long column lifetimes at low pH.	observe limited retention and selectivity on a C18 for basic compounds. need increased retention of hydrophilic compounds. want to achieve a better sensitivity by switching from RP to HILIC mode.	are looking for a hydrophobic phase with first-class. separation performance and long lifetime.
Application examples	Drugs and metabolites; pharmaceuticals; nutraceuticals; bio- markers (for example amphetamines, analgesics, antibiotics, antidepressants, antiepileptics, antipsychotics, anxiolytics, barbiturates, betablockers, benzodiazepines, cannabinoids, (along with synthetical cannabinoids and their metabolites); catecholamines and metabolites; drugs of abuse; fentanyl; hallucinogens; hormones; immunosuppressants; nicotine/ cotinine; NSAR/NSAIDS; opiates; psilocin and psilocybin; serotonin; steroids/corticoids; sulfonamides; THC; vitamins); bisphenols; mycotoxins; nitroaromatics/explosives, sweet- eners. To view all available Raptor Biphenyl applications and litera- ture visit www.restek.com/Apps-RB	Aflatoxins; aldehydes/ketones (DNPH), amino acids (FMOC); anthocyanidins; cannabinoids/hemp analysis; flavonoids; polyphenols; pesticides; pyrrolizidine alkaloids; resveratrol in wine; explosives; statins; fat-soluble vitamins; vitamin D metabolites; vitamin K. To view all available Raptor ARC-18 applications and literature visit www.restek.com/Apps-RA	Chemotherapeutics/cytostatics; hydroxyvitamin D2/D3 (epimer separation); metanephrines; 4-methylimidazol (4-MEI); mycotoxins; phosphatidylethanol (PEth); taxanes; warfarin. To view all available Raptor FluoroPhenyl applications and literature visit www.restek.com/Apps-RF	Aldehydes/Ketones (DNPH); d & I amphetamines (DNPA Derivatives); antibiotics (amphenicol, cephalosporines, quinolones, macrolides, penicillin, streptogamins, sulfonamides, tetracyclines); barbiturates; bile acids; flavonols; herbicides; parabens; poly - and perfluorinated compounds (PFAS); veterinary drugs. To view all available Raptor C18 applications and literature visit www.restek.com/Apps-RC

Our Raptor phases at a glance	C8 All the features of a C18 with even faster analysis times.	HILIC-Si HO-Si-O- O- O- O- O- O- O- O- O- O- O- O- O-	Polar X Tailored for highly polar compounds without derivatization or ion pairing.	EtG/EtS P-Si-O- Specialty column for (EtG) and ethyl sulfate (EtS) analysis.		
USP Code	L7	L3	_	_		
Stationary Phase Category	C8, octadecylsilane	Silica	proprietary	proprietary		
Ligand Type	Sterically protected C8	_	proprietary	proprietary		
Particle Size in µm	2.7	2.7	2.7	2.7		
Base Material	Core-Shell particles made of high purity silica	Core-Shell particles made of high purity silica	Core-Shell particles made of high purity silica	Core-Shell particles made of high purity silica		
Pore Size in Å	90	90	90	90		
Surface Area in m²/g	130	130	130	130		
Carbon Load in %	4.6		proprietary	proprietary		
End-Cap	yes		proprietary	proprietary		
pH Range	2.0-8.0	2.0-8.0	2.0-8.0	2.0-8.0		
Maximum Temperature in °C	80	80	60	40		
Maximum Pressure in bar/psi	600/8700	600/8700	600/8700	600/8700		

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 C8 is suitable for a wide range of compounds from acidic through slightly basic.	Increased retention of polar compounds without ion-pairing reagents.	For analyzing a wide variety of very polar analytes (acidic, basic, and neutral) without derivatization or ion pairing; switch between HILIC and ion-exchange retention modes with simple mobile phase changes and short equilibration times.	Proven performance for accurate, reliable ethyl glucuronide (EtG) and ethyl sulfate (EtS) analysis; strong retention consistently resolves analytes from matrix interferences; long column lifetime ensures consistent performance injection after injection; fast, 4-minute, dilute-and-shoot LC-MS/MS analysis supports high sample throughput.
Switch to the respective Raptor phase, when you	are looking for less retention of nonpolar analytes. want faster analysis times than a C18.	need more retention and resolution of hydrophilic, polar analytes without using ion pairing reagents. need increasing sensitivity and selectivity in LC-MS analyses.	<ul> <li> need more retention for polar compounds without derivatization or ion-pairing.</li> <li> are looking for a HILIC phase with short equilibration times.</li> <li> need increasing sensitivity and selectivity in LC-MS analyses.</li> </ul>	other columns can't resolve EtG and EtS from matrix components. you need high-throughput EtG/EtS analysis. low-level detection limits are desired.
Application examples	Ideal choice for PEth analysis.	Acylcarnitines and amino acids; creatine/creatinine; folate deficiency biomarkers; melamine and related substances; metanephrine and other adrenaline metabolites; quaternary amines; psilocybin. To view all available Raptor HILIC-Si applications and literature visit www.restek.com/Apps-RHS	Amino acids (underivatized); B-vitamins; QuPPe (Quick Polar Pesticides) method (Glyphosate, AMPA, etc.); ultrashort to long-chain PFAS. To view all available Raptor Polar X applications and literature visit www.restek.com/Apps-RPX	Ethyl glucuronide (EtG) and ethyl sulfate (EtS). To view all available Raptor Polar X applications and literature visit www.restek.com/Apps-ETG

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