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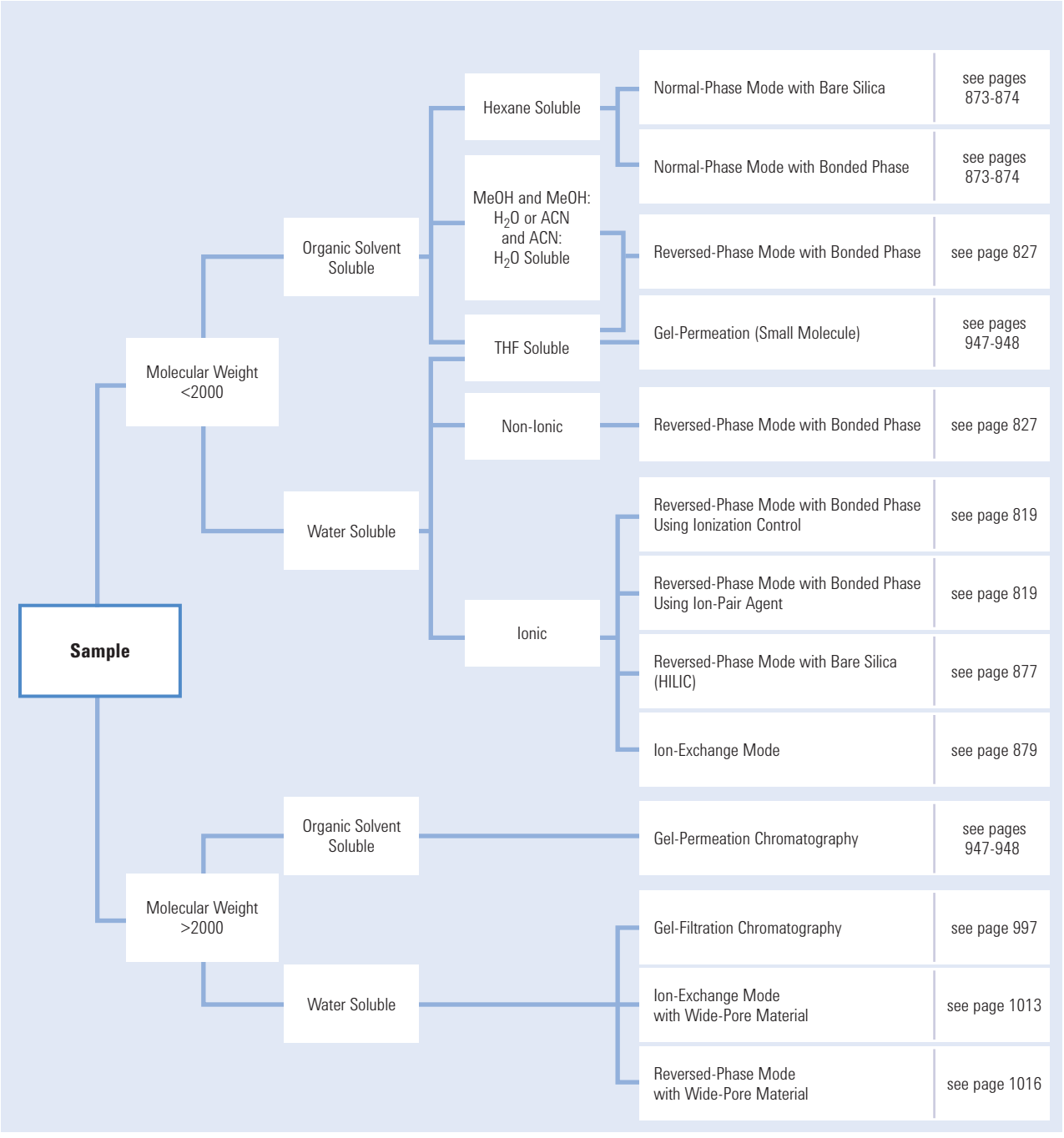
LC and LC/MS Columns

HPLC Column Selection

To use the column selection guide diagram below, simply follow the path for your analyte and mobile phase. At the far right, follow your final column selection to the pages indicated.



Adapted with permission from "Practical HPLC Methodology and Applications," Brian A. Bidlingmeyer, John Wiley & Sons, Inc., New York, p. 109

Column and Mobile Phase Guidelines: Reversed Phase

HPLC columns consist of two parts: the column chemistry and hardware. For the proper column chemistry, consult the catalog section for each type of bonded phase. For choosing column hardware and particle sizes, consult the section on column sizes and rapid separations, including Agilent ZORBAX Rapid Resolution HT, Solvent Saver, Capillary and PrepHT columns.

Pore Size Selection

Choose a column packing with small pore (60-120Å) if the solute molecular weight is less than about 5000. Otherwise, use column packing with the 300Å pore size.

Particle Size Selection

The typical particle size for HPLC columns is 5 µm with 3.5 µm and smaller now common in method development. If high-speed analyses or higher resolution analyses are required, packing with 1.8 µm and 2-3 µm particles can be used. Shorter columns with these particles can produce faster high-resolution separations, with the 1.8 µm particle size providing the highest efficiency and 2.7 µm superficially porous providing similar results. With 1.8, 2.7, 3.5 and 5 µm particle sizes to choose from, start with the smallest particle size for your HPLC or UHPLC – 400 bar, 600 bar, or 1200 bar – to achieve the best results.

Column Configuration

Choosing the best column size for method development has changed dramatically in the past few years. Smaller 3.0 mm ID or 2.1 mm ID columns are now used more than 4.6 mm ID to lower solvent use and achieve compatibility with MS detectors. And shorter 50, 75 and 100 mm long columns can be a great starting choice, with longer columns used only when more resolution is needed or when 3.5 and 5 µm particle sizes are used.

Silica Type and Bonded Phase

Base Material

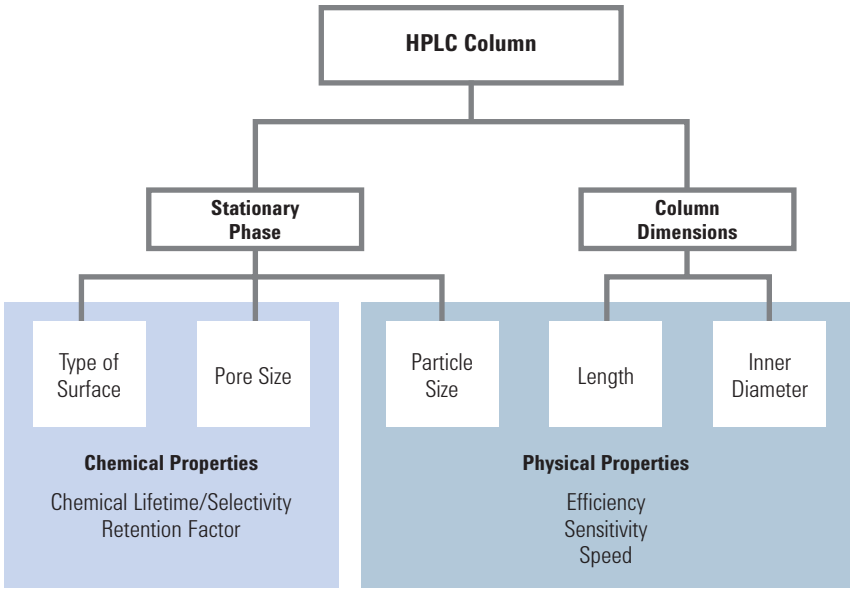
The base material for an LC column is most often high purity silica material with totally porous particles such as that used in most Agilent ZORBAX columns. However, more choices are available, including polymer material with high pH stability used in PLRP-S columns and superficially porous silica particles such as those used in Poroshell 120 columns. The high purity Type B silicas, including the ZORBAX Rx-Sil used in ZORBAX Eclipse Plus, and superficially porous Poroshell 120, are an excellent first choice for most methods. Type A silicas, such as ZORBAX SIL, used in Original ZORBAX columns, are still manufactured and used in many methods.

Bonded Phase

A good first choice for bonded phase is C18 or C8, and the recommended starting column choices are Eclipse Plus C18 or Poroshell 120 EC-C18. These two choices provide excellent peak shape and can be used over the pH range 2-9, accommodating most typical LC and LC/MS mobile phases. If the sample solutes of interest are not adequately separated on these columns, CN and Phenyl columns – including Phenyl, Phenyl-Hexyl and Diphenyl – may offer significant differences in selectivity from straight-chain alkyl phases to effect the separation.

pH and Mobile Phase

The choice of mobile phase for a reversed-phase system starts with selecting the organic modifier. Acetonitrile is the most commonly used organic modifier. However, selectivity differences and sample retention will vary significantly among mobile phases containing acetonitrile, methanol, and tetrahydrofuran (THF). Sample solubility is likely to differ in such solvents and dictate use of a specific solvent or solvents. UV detection at certain wavelengths is not possible with certain modifiers (e.g., methanol at 200 nm).

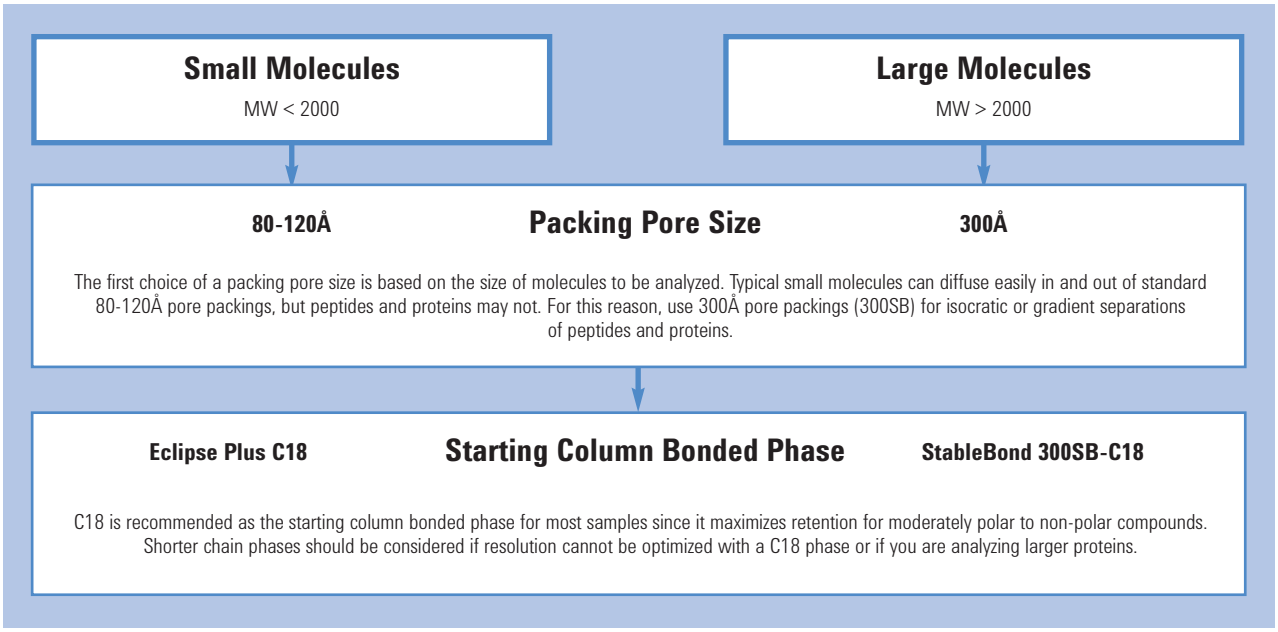


Column Choice Relative to Application Objective

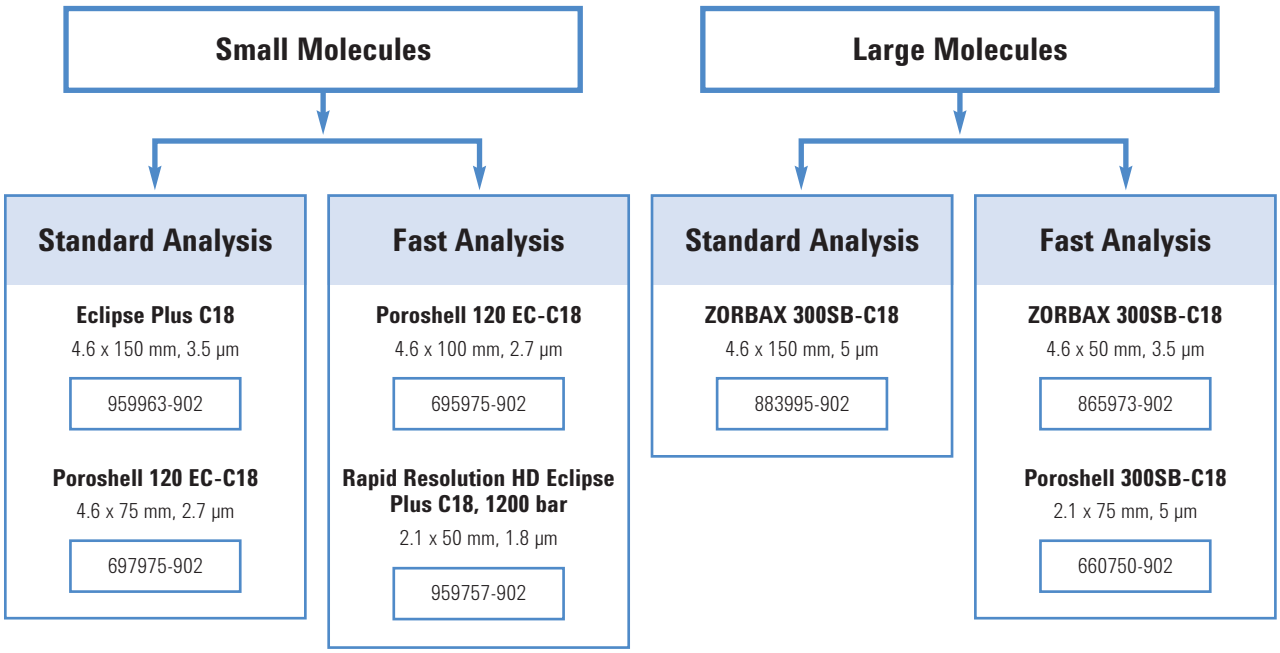
Application	Objective Column Diameter (mm)
Very high sensitivity, LC/MS, peptides and proteins	0.1, 0.075
Very high sensitivity, limited sample, LC/MS, peptides and proteins	0.3, 0.5
High sensitivity, limited sample, LC/MS	1.0
Save solvent; special low-volume instrumentation is available	2.1
Special detectors, e.g., mass spec	2.1
High sensitivity, limited sample	2.1
Save solvent; standard HPLC equipment available, LC/MS	3.0
Standard separations	4.6
Small-scale (mg) preparative separations	9.4
Large-scale preparative separations (100 mg-gram)	21.2
Large-scale preparative separations (up to 100 mg-gram)	30, 50

Consult the Column Hardware section for guard column configurations

Recommended Column Choices for Method Development



Starting Column Choices



USP Designations

The US Pharmacopeia (USP) is a standard source for many pharmaceutical methods that specifies columns by packing materials rather than by manufacturer. Listed below are the recommended Agilent Technologies HPLC columns suitable for most LC methods listed with the USP.

USP Method	USP Packing Materials	Column	Particle Size (µm)	Page No.
L1	Octadecyl silane chemically bonded to porous silica or ceramic micro-particles, 1.5 to 10 µm in diameter	Poroshell 120 EC-C18	2.7	822
		Poroshell 120 SB-C18	2.7	822
		ZORBAX Eclipse Plus C18	1.8, 3.5, 5	827
		ZORBAX Eclipse XDB-C18	1.8, 3.5, 5, 7	831
		ZORBAX SB-C18	1.8, 3.5, 5, 7	838
		ZORBAX Rx-C18	3.5, 5	854
		ZORBAX Extend-C18	1.8, 3.5, 5, 7	850
		ZORBAX ODS	3.5, 5, 7	870
		ZORBAX ODS classic	5	870
		Pursuit XRs C18	3, 5, 10	862
		Pursuit C18	3, 5, 10	860
		Polaris C18-A	3, 5, 10	867
		Polaris C18-Ether	3, 5	867
		SepTech ST60 C18	10	928
		SepTech ST150 C18	10	928
L2	Octadecyl silane chemically bonded to porous silica gel of a controlled surface porosity that has been bonded to a solid spherical core, 30 to 50 µm in diameter	N/A		
L3	Porous silica particles, 5 to 10 µm in diameter	ZORBAX SIL	5	873
		ZORBAX Rx-Sil	3.5, 5	873
		Pursuit XRs Si	3, 5, 10	862
		Polaris Si-A	5, 10	867
		MicroSpher Si	5	
		Microsorb 100 Si	5	
L4	Silica gel of controlled surface porosity bonded to a solid spherical core, 30 to 50 µm in diameter			
L5	Alumina of controlled surface porosity bonded to a solid spherical core, 30 to 50 µm in diameter	N/A		
L6	Strong cation-exchange packing: sulfonated fluorocarbon polymer coated on a solid spherical core, 30 to 50 µm in diameter	N/A		

(Continued)

USP Method	USP Packing Materials	Column	Particle Size (µm)	Page No.
L7	Octyl silane chemically bonded to totally porous microsilica particles, 1.5 to 10 µm in diameter	Poroshell 120 EC-C8	2.7	822
		ZORBAX Eclipse Plus C8	1.8, 3.5, 5	827
		ZORBAX Eclipse XDB-C8	1.8, 3.5, 5, 7	831
		ZORBAX SB-C8	1.8, 3.5, 5, 7	838
		ZORBAX Rx-C8	1.8, 3.5, 5, 7	854
		ZORBAX C8	5	870
		Pursuit XRs C8	3, 5, 10	856
		Pursuit C8	3, 5, 10	856
		Polaris C8-A	3, 5	865
		Polaris C8-Ether	3, 5	865
		Microsorb 100 C8	5	
L8	An essentially monomolecular layer of aminopropylsilane chemically bonded to totally porous silica gel support, 10 µm in diameter	ZORBAX NH2	5	873
		Polaris NH2	5	865
		Microsorb 100 Amino	5	
L9	10 µm irregular, totally porous silica gel having a chemically bonded, strongly acidic cation exchange coating	ZORBAX SCX	5 spherical	879
L10	Nitrile groups chemically bonded to porous silica particles, 3 to 10 µm in diameter	ZORBAX CN	5	873
		ZORBAX SB-CN	3.5, 5	838
		ZORBAX Eclipse XDB-CN	3.5, 5	831
		Microsorb 100 Cyano	5	
L13	Trimethylsilane chemically bonded to porous silica particles, 3 to 10 µm in diameter	ZORBAX TMS	5	
L14	Silica gel 10 µm in diameter with a chemically bonded, strongly basic quaternary ammonium anion exchange coating	ZORBAX SAX	5	879
		IonoSpher A		
L15	Hexyl silane chemically bonded to totally porous silica particles, 3 to 10 µm in diameter	MetaSil C6		
L16	Dimethyl silane chemically bonded to totally porous silica particles, 3 to 10 µm in diameter	N/A		
L17	Strong cation exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the hydrogen form, 7 to 11 µm in diameter	Hi-Plex H	8	881
L18	Amino and cyano groups chemically bonded to porous silica particles, 5 to 10 µm in diameter	N/A		
L19	Strong cation exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the calcium form, 9 µm in diameter	Hi-Plex Ca	8	881
		Hi-Plex Ca (Duo)	8	881
L20	Dihydroxypropane groups chemically bonded to porous silica particles, 3 to 10 µm in diameter	LiChrospher Diol	5	

(Continued)

USP Method	USP Packing Materials	Column	Particle Size (µm)	Page No.
L21	A rigid, spherical styrene-divinylbenzene copolymer, 5 to 10 µm in diameter	PLgel	3, 5, 10, 20	947
		PLRP-S 100Å	3, 5, 8	1027
		PLRP-S 300Å	3, 5, 8	1027
		PLRP-S 1000Å	5, 8	1027
L22	A cation exchange resin made of porous polystyrene gel with sulfonic acid groups, about 10 µm in size	Hi-Plex H	8	881
L23	An ion exchange resin made of porous polymethacrylate or polyacrylate gel with quaternary ammonium groups, about 10 µm in size	N/A		
L24	A semi-rigid hydrophilic gel consisting of vinyl polymers with numerous hydroxyl groups on the matrix surface, 32 to 63 µm in diameter	N/A		
L25	Packing having the capacity to separate compounds with a MW range from 1,000 to 5,000 da (as determined by the polyethylene oxide), applied to neutral, ionic and cationic water-soluble polymers	PL aquagel-OH	5, 8	974
L26	Butyl silane chemically bonded to totally porous silica particles, 5 to 10 µm in diameter	MicroSorb C4	5	
L27	Porous silica particles, 30 to 50 µm in diameter	Bondesil Silica		204
L28	A multifunctional support, which consists of a high purity, 100Å, spherical silica substrate that has been bonded with anionic (amine) functionality in addition to conventional reversed-phase C8 functionality	N/A		
L29	Gamma alumina, reversed phase, low carbon percentage by weight, alumina-based polybutadiene spherical particles, 5 µm diameter with a pore diameter of 80Å	N/A		
L30	Ethyl silane chemically bonded to a totally porous silica particle, 3 to 10 µm in diameter	N/A		
L31	A strong anion-exchange resin-quaternary amine bonded on latex particles attached to a core of 8.5 µm macroporous particles having a pore size of 2000Å and consisting of ethylvinylbenzene cross-linked with 55% divinylbenzene	N/A		
L32	A chiral ligand-exchange packing L-proline copper complex covalently bonded to irregularly shaped silica particles, 5 to 10 µm in diameter	N/A		
L33	Packing having the capacity to separate proteins by molecular size over a range of 4,000 to 400,000 da. It is spherical, silica-based, and processed to provide pH stability	ZORBAX GF-250	4	1001
		Bio SEC-3	3	997
		Bio SEC-5	5	999

(Continued)

USP Method	USP Packing Materials	Column	Particle Size (µm)	Page No.
L34	Strong cation exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the lead form, 9 µm in diameter	Hi-Plex Pb	8	881
L35	A zirconium-stabilized spherical silica packing with a hydrophilic (diol-type) molecular monolayer bonded phase	ZORBAX GF-250	4	1001
		ZORBAX GF-450	6	1001
L36	L-Phenylgylcine-3,5-dinitrobenzoyl on 5 µm amino propyl silica	N/A		
L37	Polymethacrylate gel packing having the capacity to separate proteins by molecular size over a range of 2,000 to 4,000 da MW	N/A		
L38	Methacrylate-based size exclusion packing for water solubles	N/A		
L39	Hydrophilic polyhydroxymethacrylate gel of totally porous spherical resin	N/A		
L40	Cellulose tris-3,5-dimethylphenylcarbamate coated porous silica particles, 5 to 20 µm in diameter	N/A		
L41	Immobilized alpha-acid glyco-protein on spherical silica particles, 5 µm in diameter	N/A		
L42	Octylsilane and octadecylsilane groups chemically bonded to porous silica particles	N/A		
L43	Pentafluorophenyl groups chemically bonded to silica particles 5 to 10 µm in diameter	Pursuit PFP	3, 5	856
L44	A multifunctional support, which consists of a high purity, 60Å spherical silica substrate, that has been bonded with a cationic exchanger, sulfonic acid functionality in addition to a conventional reversed phase C8 functionality	N/A		
L45	Beta cyclodextrin bonded to porous silica particles, 5 to 10 µm in diameter	ChiraDex Chiral	5	915
L46	Polystyrene/divinylbenzene substrate agglomerated with quaternary amine functionalized latex beads, 10 µm in diameter	N/A		
L47	High capacity anion exchange microporous substrate, fully functionalized with a trimethyl-amine group, 8 µm in diameter	N/A		
L48	Sulfonated, cross-linked polystyrene with an outer layer of submicron, porous, anion-exchange microbeads, 15 µm in diameter	N/A		
L49	Amylose tris-3,5-dimethylphenyl-carabamate-coated, porous, spherical, silica particles, 5 to 10 µm in diameter	N/A		

(Continued)

USP Method	USP Packing Materials	Column	Particle Size (µm)	Page No.
L50	A strong cation exchange resin made of porous silica with sulfopropyl groups, 5 to 10 µm in diameter	ZORBAX 300SCX	5	879
L51	A reversed-phase packing made by coating a thin layer of polybutadiene on to spherical porous zirconia particles, 3 to 10 µm in diameter	N/A		
L52	Multifunction resin with reversed-phase retention and strong anion-exchange functionalities. The resin consists of ethylvinyl-benzene, 55% cross-linked with divinylbenzene copolymer, 3 to 15 µm in diameter, and a surface area of not less than 350m2/g, substrate is coated with quaternary ammonium functionalized latex particles consisting of styrene cross-linked with divinylbenzene.	N/A		
L53	An anion-exchange resin consisting of rigid, spherical styrene-divinylbenzene copolymer with trimethylammonium groups at a loading of about 2 meq per g, 3 to 29 µm in diameter	Bio SAX	3, 5, 10	1006
L54	Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the sodium form, about 7 to 11 µm diameter	N/A		
L55	Weak cation-exchange resin consisting of ethylvinylbenzene, 55% cross-linked with divinylbenzene copolymer, 3 to 15 µm diameter. Substrate is surface grafted with carboxylic acid and/or phosphoric acid functionalized monomers. Capacity not less than 500 µeq/column	N/A		
L56	Propyl silane chemically bonded to totally porous silica particles, 3 to 10 µm in diameter	SB-C3	3, 5	838
L57	A chiral-recognition protein, ovomucoid, chemically bonded to silica particles, about 5 µm in diameter, with a pore size of 120 angstroms	Ultron ES-OVM	5	913
L58	Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the sodium form, about 6 to 30 µm in diameter	Hi-Plex Na	10	881
		Hi-Plex Na (Octo)	8	881
L59	Packing having the capacity to separate proteins by molecular weight over the range of 5 to 7000 kDa. It is spherical (5-10 µm), silica-based, and processed to provide hydrophilic characteristics and pH stability	N/A		
L60	Spherical, porous silica gel, 10 µm or less in diameter, the surface of which has been covalently modified with alkyl amide groups and endcapped	Bonus-RP	1.8, 3.5, 5	846
		Polaris Amide-C18	3, 5	865

CARTRIDGE COLUMN SYSTEMS

Cartridge Selection Guide

Icon*	Type of Cartridge	Features	Benefits
AC	Agilent HPLC Cartridge	Can reverse collets in the end fitting to add guard cartridges	Inexpensive Extends column lifetime Permits rapid column changes Can use 2, 3, 4 and 4.6 mm cartridges
		Cartridges have a unique filter and sieve at each end	Helps prevent blockage
ZGC	ZORBAX Guard Cartridge: Standalone system	High efficiency, standalone, low dead volume cartridge	Seals up to 400 bar
		Polymeric cartridge designed for leak-tight seals against metal surfaces	No gaskets required More solvent-resistant than PEEK
		Reusable fittings	Adapt for connections to 1/16 in. LC fittings
RR	ZORBAX Rapid Resolution and Rapid Resolution HT Cartridge Columns: 3.5 µm and 1.8 µm packings, standalone system	For high throughput LC/MS, LC/MS/MS and combinatorial separations	
		Packed with Eclipse XDB for pH use from 2-9 Packed with StableBond for low pH use	For all analyte types Low bleed
		Sold individually or as three-packs	
P	ZORBAX Semi-Preparative Guard HPLC Hardware Kit: Standalone system	Easy, low-dead-volume assembly	Seals up to 2000 psi (135 bar, 13.5 MPa)
		Tubing (polyphenylene sulfone) designed for leak-tight seals against metal surfaces	No gaskets required
		Reusable fittings	Adapt for connections to 1/16 in. LC fittings
PI	ZORBAX and Agilent Prep Preparative Cartridge Column and Guard HPLC System: Standalone and integral hardware options	Easy, low-dead-volume assembly	Extends column lifetime
		Reusable fittings	Permits rapid column changes
		Hardware options for integral and external guards	Can use with 21.2 and 30 mm ID columns
CS	ChromSep Column Hardware: Complete systems and replacement cartridges	Easy, no-dead-volume assembly	Economical format No tools required Modular flexibility

*Look for these icons on subsequent pages to help you select the proper guard cartridges and columns.

Cartridge/Guard Cartridge Systems Compatibility Guide*

Icon	Column Type	Guard Cartridge Holder	ID (mm)	Phases
AC	Cartridge column cartridge holder 5021-1845 	Guard cartridge (internal system) cartridge holder 5021-1845 	2.0 3.0 4.0 4.6	Asahipak LiChrospher Nucleosil Purospher Superspher ZORBAX
ZGC	Standard fitting 	Column guard cartridge (standalone) cartridge holder 820999-901 	2.1 3.0 4.6	ZORBAX
RR	Rapid Resolution cartridge holder 820555-901 	No guard cartridge holder	4.6	ZORBAX
P	Semi-preparative column 	Semi-prep guard cartridge (standalone) cartridge holder 840140-901 	9.4	ZORBAX
PI	PrepHT	Guard cartridge 820444-901 	21.2	ZORBAX Agilent Prep

*Standalone guard cartridges fit all cartridge and standard fitting columns available from Agilent. All columns without icons are standard fitting columns.

Look for this icon identifying Agilent cartridge columns in column ordering tables

Cartridge Column Systems

Agilent offers a variety of popular HPLC packing materials in economical, easy-to-use cartridge configurations.

Agilent Cartridge System

Agilent's flexible cartridge system has been thoroughly tested to ensure that the design and hardware meet Agilent's quality standards. Finger-tight connections allow rapid column changes without removing capillaries from end fittings. The same convenient, easy-to-use cartridge holder accommodates 2, 3, 4 and 4.6 mm diameter cartridges of varying lengths. The cartridge columns have a unique filter and sieve at each end that help prevent blockage.

By reversing the collets in the end fitting, an inexpensive guard cartridge can be added to further extend column lifetime.

Guard cartridge installed

No guard cartridge installed

Hardware

Description	Unit	Part No.
Cartridge holder for 2, 3, 4 and 4.6 mm ID cartridges	2/pk	5021-1845
Replacement filters for 4 and 4.6 mm ID cartridges	10/pk	5063-6574
Replacement filters for 2 and 3 mm ID cartridges	10/pk	5063-6519
Mounting tool for replacement filters		5021-1846
Replacement collets	2/pk	5021-1849

Tips & Tools

More information is a click away. We have a variety of educational primers, application notes, maintenance guides, and literature available from Agilent for free.

This icon identifies standalone guard cartridges for ZORBAX analytical columns

ZORBAX High Performance Guard Cartridge

The ZORBAX High Performance Guard Cartridge series has been developed to provide convenient, cost-effective protection for high performance analytical columns. The cartridge components assemble quickly and easily to provide a high efficiency, low dead volume column that seals, with hand tightening, up to 5000 psi (340 bar) or 3000 psi with a PEEK fitting.

The reusable guard column end fitting with integrated 1/16 in. OD tubing adapts the cartridge guard column for direct connection to standard 1/16 in. LC fittings and provides a standalone guard column system for 2.1 to 4.6 mm ID columns. There are two different end fitting options to allow the use of other connecting tubing.

The polymeric guard cartridges used in this holder are specifically designed to make leak-tight seals against metal surfaces without requiring gaskets. This polymeric material (polyphenylenesulfone) is also more solvent resistant than PEEK.

Guard cartridges are available for almost every ZORBAX bonded phase and can be found in the ordering information for each type of column.

Hardware

Description	Part No.
Guard fittings kit Includes low-volume guard holder, inlet end fitting (2), outlet end fitting with integrated column connector, and PEEK fingertight fitting	820999-901
Inlet end fitting, also used as alternate outlet end fitting	820340-001
Exit end fitting with integrated column connector	820345-001
1/16 in. finger-tight PEEK fitting, 2/pk	0100-1516
Perfluoro-Elastomer Seals, 2/pk	820370-901

Rapid Resolution and Rapid Resolution HT Cartridge Columns are marked with this icon

Rapid Resolution and Rapid Resolution HT Cartridge Column System (400 bar)

For fast, clean high throughput LC/MS, LC/MS/MS and combinatorial separations, we recommend ZORBAX Rapid Resolution (3.5 µm) and Rapid Resolution HT (1.8 µm) Cartridge Columns. These cartridges are packed with ZORBAX Eclipse and StableBond bonded phases that provide excellent separations.

Cartridge dimensions are 4.6 x 15 mm, 4.6 x 30 mm or 4.6 x 50 mm and 2.1 x 15 mm, 2.1 x 30 mm or 2.1 x 50 mm. All 15 and 30 mm cartridges are available in both Eclipse and StableBond phases in both the 3.5 µm and the very high efficiency 1.8 µm particles. The 1.8 µm particles are available as 50 mm cartridges and as 50 mm columns with fixed endfittings. Choose the Eclipse XDB bonded phases for most methods and when using LC/MS mobile phase additives such as formic acid or acetic acid. The StableBond phases are ideal for different selectivity and for long lifetime with TFA-containing mobile phases. Additional bonded phases can be packed upon request.

These economical and easy-to-use cartridge columns are offered individually and in convenient three-packs.

One cartridge holder kit includes all components for use with Rapid Resolution or Rapid Resolution HT columns.

Hardware

Description	Part No.
Hardware Kit for RR and RRHT Cartridges Includes cartridge holder 15 mm, cartridge holder 30 mm, cartridge holder 50 mm (1 ea), and end fitting assemblies (2)	820555-901
Cartridge holder, 15 mm	820315-015
Cartridge holder, 30 mm	820330-030
Cartridge holder, 50 mm	820320-050
Perfluoro-Elastomer Seals, 2/pk	820370-901
End fitting assembly, two required for one system	820311-001

P

This icon identifies preparative guard columns

Preparative guard system

ZORBAX Semi-Preparative Guard Column Hardware Kit

The ZORBAX Semi-Preparative Guard Column has been developed to provide convenient, cost-effective protection for high-performance lab-scale semi-preparative columns. The cartridge components assemble quickly and easily to provide a high-efficiency, low-dead-volume column that seals at pressures up to 2000 psi (135 bar, 13.5 MPa).

The guard column housing made from polyphenylene sulfone is specifically engineered to make leak-tight seals against metal surfaces, without requiring gaskets. The reusable guard-column end fittings adapt the cartridge guard column for connection to standard 1/16 in. LC fittings and provide a standalone guard column system. The ZORBAX materials used in preparative cartridges are matched with chemistry chosen for compatibility with a wide range of applications.

Hardware

Description	Part No.
Preparative guard column hardware kit* Includes inlet fitting, outlet end fitting, column connector	840140-901

*The semi-preparative guard column hardware is available only as a kit.

PI

This icon identifies prep preparative cartridge and guard columns

Guard Cartridge, 820444-901

Prep external guard hardware kit, assembled, 420420-901

ZORBAX PrepHT and Agilent Prep Preparative Cartridge and Guard Column Hardware

The ZORBAX PrepHT and Agilent Prep Preparative Cartridge and Guard Column hardware kits have been developed to provide a convenient preparative 21.2 mm ID cartridge design. The 21.2 mm ID preparative cartridge columns (actual ID 17 mm to fit into holder) are reusable and allow rapid change of column lengths from 50 to 250 mm for optimizing sample loadability. This easy-to-use cartridge hardware design is used for both ZORBAX PrepHT and Agilent Prep materials and can be finger-tightened up to 5000 psi (350 bar).

The cartridge hardware can be used standalone or with an integral guard column. The integral guard column holder is a stainless steel body and is used with a PTFE sealing gasket to ensure a tight, leak-free and extremely low-dead-volume seal against the 21.2 mm ID cartridge body. The external guard system seals finger-tight up to 2000 psi (135 bar). The reusable guard holder is ready-to-use with standard 1/16 in. LC fittings. Both ZORBAX and Agilent Prep guard cartridges are available to use with this holder and are selected to match the preparative column used in the application.

The 21.2 mm ID guard columns can be used with 30 mm ID Agilent Prep columns. For this application, select the external preparative guard column hardware kit.

PrepHT Columns are easy to use

PrepHT cartridge columns have a unique design that makes them easy to install and seal finger-tight up to 5000 psi. The cartridge design allows for an integral guard column to be used, which prolongs the life of the purification column. This cartridge configuration is economical to use since the column cartridge and/or the guard cartridges are replaced independently. The end fittings are used many times.

Hardware

Description	Part No.
PrepHT cartridge column hardware Includes cartridge column end fittings (2), polymeric seals (2)	820400-901
PrepHT guard column hardware kit Includes guard column end fitting, polymeric seal, and seal insertion tool (seal holder and seal pusher)	820444-901
Agilent Prep external guard hardware kit, Includes guard holder, guard column end fitting, polymeric seal (2), seal insertion tool, and connector tubing	420420-901
Replacement polymeric seals, 2/pk	820385-901

CS

This icon identifies ChromSep column hardware

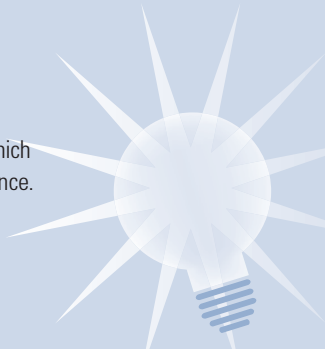
ChromSep HPLC Column Hardware

The ChromSep system combines simplicity with extraordinary flexibility and considerable savings on column and operating costs. The ChromSep 316 stainless steel column-housing hardware is a durable one-time investment. Once you have purchased the complete basic system of a holder, analytical cartridge and guard column, you will only need to replace the cartridges or replacement guard columns, both of which are available in economical packages: 3-pack analytical column replacements and 5-pack guard column replacements for added value.

Unlike other modular column systems, ChromSep is extremely flexible. Column housings are available in lengths of 10, 30, 50, 100, 150 and 250 mm, and cartridges are available in various IDs ranging from 2 to 4.6 mm. You can use any combination of cartridge columns to match the column length with the separation you need and minimize your analysis time.

Tips & Tools

Guard columns and filters help protect your column and instrument from particulates that can cause blockages, which increase system pressure and negatively impact performance.



HPLC Column Protection

Column Protection

Guard columns and in-line filters are inexpensive and easy-to-use tools for column protection. They can improve the accuracy of your results and improve analytical column lifetime while enhancing reliability. Column protection is available for all sizes of columns with any particle size packed into the column.

Guard Columns

Guard columns provide protection against contamination with minimal impact on column efficiency. Prepacked ZORBAX cartridge columns are available for most types of ZORBAX material. Guard cartridges are available in different internal diameters to provide high efficiency protection to all types of columns. Guard columns are also available for many non-Zorbax columns. See the respective column listings for available guard columns.

Low Volume In-line Filters

Low volume in-line filters are recommended for every column and provide column protection from particulate materials. An in-line filter will increase analytical column lifetime by preventing particulates (from unfiltered samples and/or eluents) from plugging the analytical column frit. Using guard columns can compromise the efficiency of very low volume columns and/or columns with very small particle sizes. For these columns, low volume in-line filters are strongly recommended. A small, 0.5 µm frit should be used to maximize column efficiency.

Replacement Column Inlet Frits

If HPLC columns are used without a guard column on in-line precolumn filters, the analytical column may become plugged. Due to the high efficiency packing processes used today, replacing the column inlet frit is discouraged. Column efficiency may be compromised if the frit is replaced. PEEK-encapsulated replacement frits are available for ZORBAX columns packing in 2.1, 3.0, 4.6, and 9.4 mm standard column hardware.

Replacement Inlet Frits (PEEK Encapsulated) for Standard Hardware Columns

Description	Diameter (mm)	Unit	Part No.
Narrow Bore	2.1	10/pk	280959-904
Solvent Saver	3.0	1/ea	280959-006
Analytical	4.6	10/pk	280959-905
Semi-Preparative	9.4	1/ea	280959-001

Agilent ZORBAX Silica

ZORBAX Silica Manufacturing Process – the Making of a Rugged, High-Purity Silica

All Agilent ZORBAX columns are built from porous silica microspheres (PSM) based on silica sols. The silica particle is made of tiny, solid sol microparticles agglutinated in a patented polymerization process, then fused together at very high temperatures to form the final particle (Figure 1). These strong, durable silica particles are called ZORBAX Rx-SIL or ZORBAX SIL and are the base silicas for ZORBAX columns.

The ZORBAX Rx-SIL process produces ultra-pure (99.995%) particles, with very low metal content. The final silica particle is fully hydroxylated and of low acidity. The Rx-SIL process also allows careful and reproducible control of pore size and particle size. These key features – purity (low acidity), strength, and careful control of pore and particle size – are critical to excellent chromatographic results and are the building blocks of superior ZORBAX bonded phases.

The table compares the processes used to make the ZORBAX Rx-SIL particles to a second process – the Xerogel process – commonly used to make silica particles for HPLC columns. To produce silica with the key features that maximizes chromatographic performance – purity, strength, controlled pore and particle size, plus higher pH resistance – the Agilent ZORBAX process is an excellent choice.

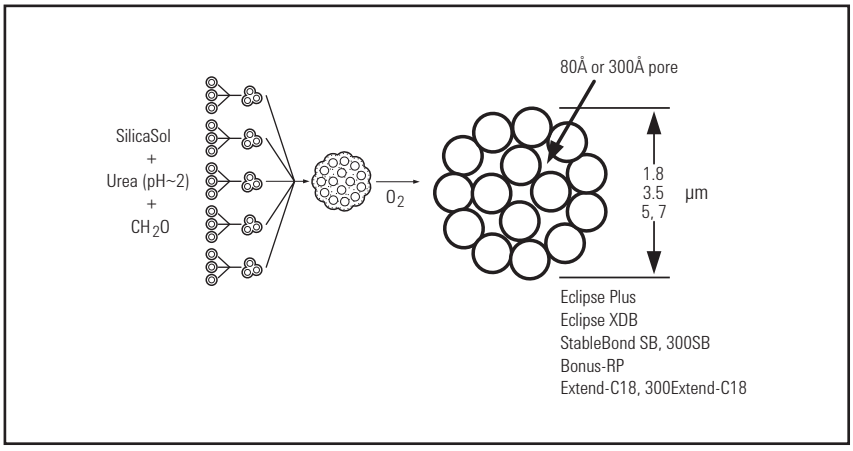
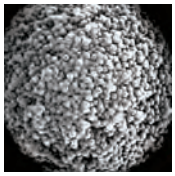
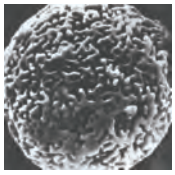


Figure 1. Formation of ZORBAX porous silica particles



ZORBAX Rx-SIL uniform sub particles



Xerogel "sponge-like" polymeric network

Characteristics of ZORBAX Rx-SIL and a Contrasting Type of Silica

Structure	ZORBAX Rx-SIL (Sol-type)	Xerogel (SIL-type)
Purity	High (99.995%)	Low to High
Strength	High	Moderate
Pore Size, Particle Size Distribution	Narrow	Broad
Pore Size/Surface Area	80Å/180 m^2/g	100Å/300 m^2/g
Porosity (%)	60	70
High pH Resistance	Good	Poor

The Benefit of Silica Purity – Reduced Peak Tailing

Peak tailing of basic compounds can be a major chromatographic problem. Peak tailing reduces chromatographic efficiency and the accuracy and precision of results. The major cause of peak tailing is interactions between analytes and the silica surface (Figure 2). Typically the presence of acidic silanol sites on the silica surface cause this type of peak tailing. Trace metals in silica increase silanol acidity and peak asymmetry. These silanol interactions are reduced or eliminated by choosing a less acidic, ultra pure (99.995%) silica, such as ZORBAX Rx-SIL. The improvement in chromatography is dramatic. Figure 3 shows the reduction in peak tailing for a basic analyte using ZORBAX Rx-SIL versus a more acidic silica.

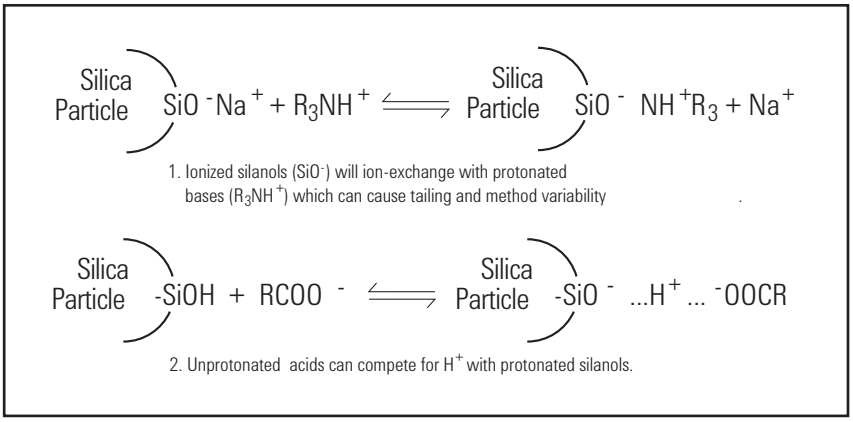


Figure 2. Potential secondary interactions with silica silanols and ionizable compounds

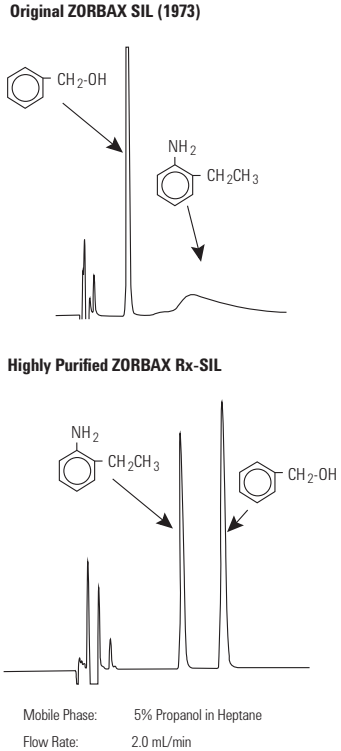


Figure 3. Chromatographic improvement using highly purified ZORBAX Rx-SIL

The Benefits of Strong Particles – Greater Efficiency and Durability

During the silica manufacturing process, the agglutinated sol particles are sintered for increased strength. This improved mechanical stability allows ZORBAX columns to be packed at high pressures when needed – up to 14,000-15,000 psi. This results in a packed column with an exceptionally stable column bed that will not compress under normal or even high operating pressures – up to 18,000 psi (1200 bar). This packed bed stability increases column lifetime using ZORBAX 1.8, 3.5, 5 or 7 um particles. When ZORBAX Rapid Resolution HD or HT 1.8 µm and Rapid Resolution 3.5 µm silica particles are used as the underlying support, high speed, high efficiency chromatography is possible without compromising column lifetime.

The Benefits of Careful Pore Size and Particle Size Control – High Efficiency and Better Reproducibility with More Column Choices

Accurate and closely monitored particle and pore size control for ZORBAX Rx-SIL produces reproducible retention behavior from column-to-column and lot-to-lot. The narrow, consistent particle size distribution of ZORBAX Rx-SIL particles maximizes efficiency and column bed stability. Column pressure is never unusually high due to "fines" – smaller particles at the low end of the particle size distribution. Accurate and precise control of particle size allows specific 1.8, 3.5, 5 and 7 µm particles to be produced. The small 3.5 µm and 1.8 µm particle sizes are the basis for the Rapid Resolution and Rapid Resolution HD and HT, high-speed analysis columns designed to maximize resolution in shorter column lengths – ideal for LC/MS or any application demanding shorter analysis times. The 5 µm particles are an industry standard and provide high resolution in a wide variety of column dimensions. This particle size also provides high efficiency in a short preparative configuration – the PrepHT column – because careful particle size control means consistent pressure expectations within normal operating limits. The 7 µm particle size provides the ideal balance between efficiency and operating pressure for longer preparative columns.

ZORBAX Rx-SIL – The Foundation for Many Bonded Phases

With such strong performance characteristics, ZORBAX Rx-SIL particles have been developed into many effective bonded phases for solving key analytical problems. These include columns that can be used at extremes of pH, unmatched by any other silica-based columns. Because silica-based columns have different limitations at low and high pH, specific bonded-phase chemistries are required to provide longer column life over different pH ranges. As a result, Agilent ZORBAX RP-HPLC bonded phases are designed to give extended column lifetime and reproducibility in the pH ranges that provide optimum and long-lasting resolution, all starting with high performance ZORBAX Rx-SIL.

AGILENT COLUMNS FOR ANALYTICAL HPLC

Achieve excellent peak shape and resolution – and eliminate "false starts"

Good news for analysts who do not have time to "make columns work" for a particular application: Agilent columns let you choose the right column based on your sample and mobile phase – eliminating any guesswork.

Additionally, Agilent's ZORBAX silica is manufactured by Agilent – not purchased from outside suppliers. And that means we control every step of the manufacturing process, ensuring lot-to-lot consistency, superior performance, and long-term, reliable results.

In this section, you will find a diverse range of columns designed for optimum resolution over a wide pH range, including:

- Poroshell 120 HPLC Columns
- ZORBAX Reversed-Phase HPLC Columns
- Pursuit HPLC Columns
- Polaris HPLC Columns
- ZORBAX Normal-Phase HPLC Columns
- ZORBAX and Hi-Plex Ion Exchange HPLC Columns
- ZORBAX Method Development and Validation Kits

Tips & Tools

All ZORBAX and Poroshell conventional columns (non-cartridge) come with a QC chromatogram. Run a standard sample of QC components or key analytes from your lab on each new column before use, and keep this chromatogram in your log book. Periodically re-run this test to see how your column has aged.

Agilent Reversed-Phase Columns

The following table summarizes the unique bonding chemistry of ZORBAX RP-HPLC columns. Each is designed for long column lifetime and resolution that lasts.

Agilent RP-HPLC Column Chemistry

Modern Columns*	Silica Type	Particle Type	Endcapping	Side Group Structure on Silane	Polar Group	Page No.
Poroshell 120 EC	B	Superficially porous	Double	Dimethyl	None	822
Poroshell 120 SB	B	Superficially porous	None	Diisobutyl	None	822
Eclipse Plus	B	Totally porous	Double	Dimethyl	None	827
Eclipse XDB	B	Totally porous	Double	Dimethyl	None	831
StableBond	B	Totally porous	None	Diisopropyl (C8, C3, CN, phenyl), diisobutyl (C18)	None	838
Bonus-RP	B	Totally porous	Triple	Diisopropyl	Amide	846
Extend-C18	B	Totally porous	Double	Unique bidentate structure	None	850
Rx-C18	B	Totally porous	None	Dimethyl	None	854
Pursuit	B	Totally porous	Single	Dimethyl	None	856
Pursuit XRs	B	Totally porous	Single	Dimethyl	None	862
Polaris A	B	Totally porous	Single	Dimethyl	Yes	865
Polaris Ether	B	Totally porous	Single	Dimethyl	Ether	865
Polaris Amide	B	Totally porous	Single	Dimethyl	Amide	925
Original ZORBAX Columns**						
ZORBAX	A	Totally porous	Single	Dimethyl	None	870
ZORBAX ODS Classic	A	Totally porous	None	Dimethyl	None	870

*Type B silica: low acidity, low metal content; these bonded phases use ZORBAX Rx-SIL

**Type A silica: more acidic, higher metal content

Quick Guide to Agilent Reversed-Phase Bonded Phases

Modern RP-HPLC Columns	Recommended Uses and Applications	Page No.
Poroshell 120	• Superficially porous particles for high efficiency at low pressure • Sub-2 µm efficiency with a 2.7 µm particle • Endcapped and non-endcapped C18 and C8 phases for selectivity optimization • Compatible with 400 bar and 600 bar LC's	822
Eclipse Plus	• Excellent first choice for method development • Long life from pH 2-9 for reliable separations of basic, acidic and neutral compounds • Superior peak shape with basic compounds • High resolution and efficiency with 1.8, 3.5 and 5 µm columns • Rigorous QA/QC testing for greater long-term reproducibility	827
Eclipse XDB	• Four selectivity choices for flexible method development • High performance over a wide pH range (2-9) • Good peak shape for acids, bases and neutrals • Long lifetime with extra dense bonding and double endcapping • Fast, ultra-fast, and high resolution separations using 1.8 and 3.5 µm columns • Choices from capillary to prep	831
StableBond (SB)	• Basic, acidic, neutral compounds • Exceptional stability at low pH (1-2) • Use of high temperature (up to 90°C for C18, 80°C for C8, C3, Phenyl, CN, and Aq) and low pH as an added selectivity tool • Widest selection of bonded phases for different selectivity (C18, C8, C3, CN, Phenyl, Aq) • Uses mobile phases for LC/MS with formic acid, acetic acid, or TFA • Uses mobile phases with TFA for peptide and protein separation • Rapid separations using 1.8 and 3.5 µm columns	838
Bonus-RP	• Separating basic compounds in higher aqueous mobile phases • General separation of basic, neutral, acidic compounds at mid-range pH or low pH; especially stable at low pH • Separating peptides for different selectivity • Rapid separations using 3.5 µm columns	846

(Continued)

Quick Guide to Agilent Reversed-Phase Bonded Phases

Modern RP-HPLC Columns	Recommended Uses and Applications	Page No.
Extend-C18	• Separating basic compounds above their pKa in free base form; separation of basic, acidic, neutral compounds at high pH; up to pH 11.5 • Uses ammonium hydroxide as mobile phase additive with LC/MS with small molecules or peptides • Separating at high, mid-range and low pH for selectivity changes • Rapid separations using 3.5 µm columns	850
ZORBAX Rx	• General separation of basic, acidic and neutral compounds at low pH with different selectivity than SB columns • Rx-C8 is the same as SB-C8	854
Pursuit	• Good separations of a wide range of analytes • Diphenyl and Pentafluorophenyl bonded phases for unique selectivity • 200Å pore size for separations of larger molecules	856
Pursuit XRs	• High carbon load for excellent retention and resolution • Basic, acidic, and neutral compounds • Unique diphenyl bonded phase for separations based on pi-pi selectivity	862
Polaris A	• Good for polar acids, polar bases and non-polar compounds • High aqueous compatibility	865
Polaris Ether	• Additional selectivity for H-bond donors • High aqueous compatibility • No "phase collapse"	865

Original ZORBAX Columns	Recommended Uses and Applications	Page No.
ZORBAX	• General separation of basic, acidic, neutral compounds at low pH with different selectivity than SB columns; higher number of active silanols than SB • "Mixed mode" separation at more neutral pH values	870
ZORBAX ODS Classic (non-endcapped)	• General separation of basic, acidic, neutral compounds at mid-range to low pH with different selectivity than SB or XDB columns	870

Poroshell 120

- Up to 90% of the efficiency of sub-2 µm
- 2X the efficiency of 3.5 µm
- Up to 50% less pressure than sub-2 µm columns
- Ideal for use up to 600 bar for HPLC and UHPLC
- Three bonded phases with excellent selectivity and peak shape

Agilent Poroshell 120 columns are a 2.7 µm particle with a 1.7 µm solid core and 0.5 µm porous outer layer. This small particle size provides high efficiency, similar to sub-2 µm columns, but with 40-50% less pressure. These high efficiency, high resolution columns can be used on any type of LC. The porous outer layer and solid core limit diffusion distance and improve separation speed while the narrow particle size distribution improves efficiency and resolution. The solid core limits diffusion distance and improves separation speed. The columns can support high pressure and multiple columns can be used for the highest resolution and efficiency possible. The same principles are used in Poroshell 300 columns, ideal for fast, high resolution separations of biomolecules.

Column Specifications

Bonded Phase	Pore Size	Temp. Limits	pH Range	Endcapped	Carbon Load
SB-C18	120Å	90°C	1.0-8.0	No	8%
EC-C18	120Å	60°C	2.0-8.0	Double	10%
EC-C8	120Å	60°C	2.0-8.0	Double	5%

Specifications represent typical values only.

Tips & Tools

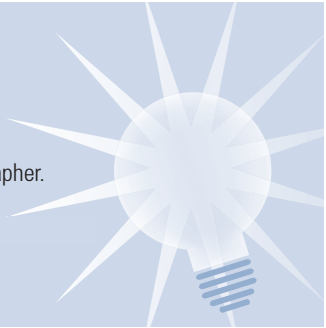
Method transfer from a conventional 3.5 or 5 µm column is easy, and often requires only minor adjustments to your method and no revalidation.

Poroshell 120

Description	Size (mm)	Particle Size (µm)	SB-C18 USP L1	EC-C18 USP L1	EC-C8 USP L7
Analytical	4.6 x 150	2.7	683975-902	693975-902	693975-906
Analytical	4.6 x 100	2.7	685975-902	695975-902	695975-906
Analytical	4.6 x 75	2.7	687975-902	697975-902	697975-906
Analytical	4.6 x 50	2.7	689975-902	699975-902	699975-906
Analytical	4.6 x 30	2.7	681975-902	691975-902	691975-906
Solvent Saver	3.0 x 150	2.7	683975-302	693975-302	693975-306
Solvent Saver	3.0 x 100	2.7	685975-302	695975-302	695975-306
Solvent Saver	3.0 x 75	2.7	687975-302	697975-302	697975-306
Solvent Saver	3.0 x 50	2.7	689975-302	699975-302	699975-306
Solvent Saver	3.0 x 30	2.7	681975-302	691975-302	691975-306
Narrow Bore	2.1 x 150	2.7	683775-902	693775-902	693775-906
Narrow Bore	2.1 x 100	2.7	685775-902	695775-902	695775-906
Narrow Bore	2.1 x 75	2.7	687775-902	697775-902	697775-906
Narrow Bore	2.1 x 50	2.7	689775-902	699775-902	699775-906
Narrow Bore	2.1 x 30	2.7	681775-902	691775-902	691775-906

Tips & Tools

Agilent offers a variety of e-Seminars and on-site training to help you learn how to be a more effective chromatographer.



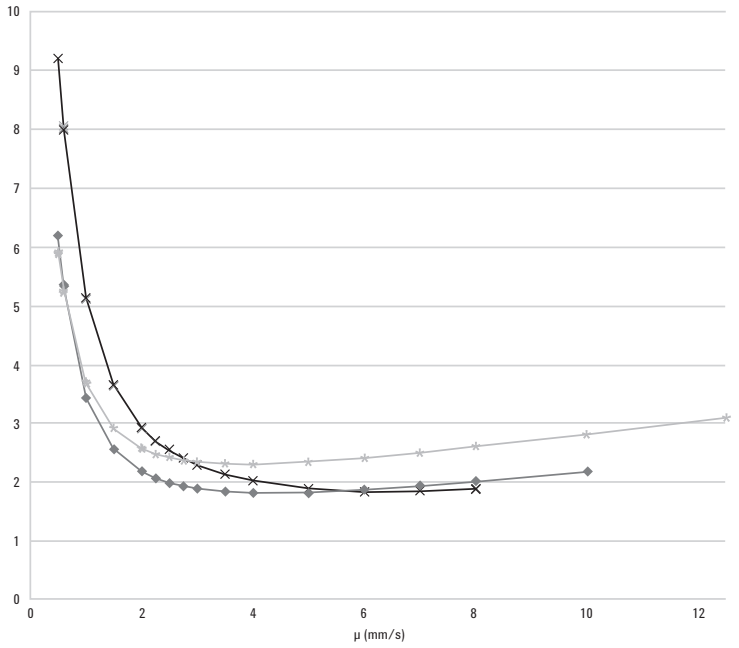
Superficially porous particles provide similar performance to sub-2 µm particles

This Van Deemter curve shows that Poroshell 120 – a superficially porous, 2.7 µm particle column – can deliver reduced plate heights similar to a 1.8 µm column for similar efficiency.

× **Agilent Poroshell 120 EC-C18**
3.0 x 100 mm, 2.7 µm
(USCFX01009)
P/N 695975-302

◆ **Agilent ZORBAX Eclipse Plus C18**
3.0 x 100 mm, 1.8 µm
(USUYB01455)
P/N 959964-302

* **Agilent ZORBAX Eclipse Plus C18**
3.0 x 100 mm, 3.5 µm
(USUXV01435)
P/N 959961-302

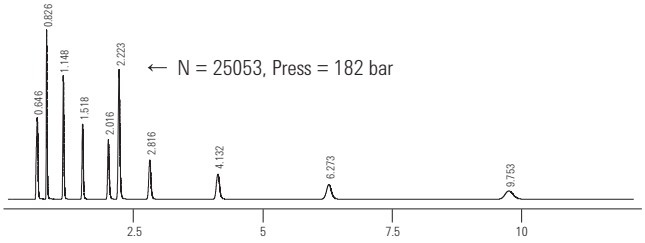


UHPLC efficiency at HPLC pressures

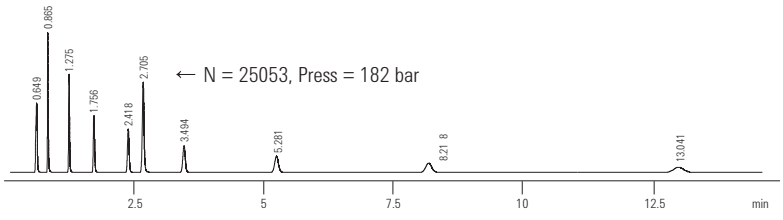
Column A:	**Poroshell 120 EC-C18 695975-302 3 x 100 mm, 2.7 µm**
Column B:	**Eclipse Plus C18 959964-302 3.0 x 100 mm, 1.8 µm**
Mobile Phase:	60% Acetonitrile:40% Water
Flow Rate:	0.58 mL/min
Temperature:	60°C
Injection Volume:	4 µL
Detector:	DAD Sig = 254,4 nm Ref = 360,100 nm
Sample:	(PN 5188-6529) spiked w/50 µL 2 mg/mL Thiourea in water/acetonitrile (65:35)

For this sample of neutral alkylphenones, the Poroshell 120 column delivered >90% of the efficiency attained by the 1.8 µm column. Also note that the pressure on the Poroshell 120 column is about 50% of the pressure on the 1.8 µm column.

A Agilent Poroshell 120 EC-C18, 3.0 x 100 mm, 2.7 µm
PN 695975-302



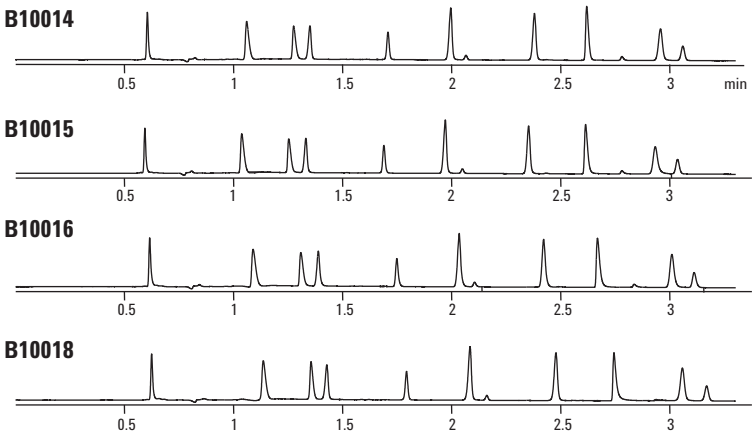
B Agilent Eclipse Plus C18, 3.0 x 100 mm, 1.8 µm
PN 959964-302



The simpler the manufacturing process, the more consistent the column

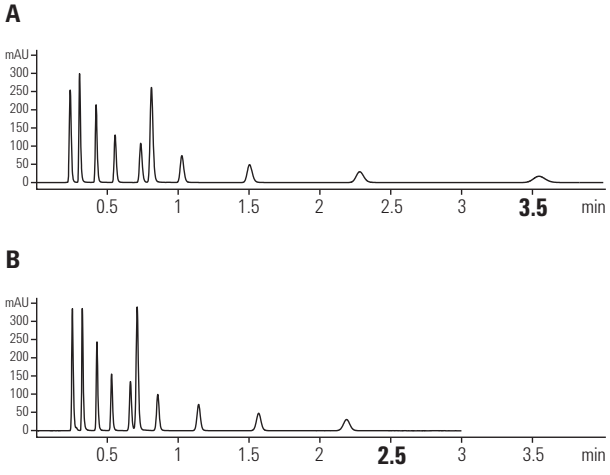
A single-step shell process creates a highly reproducible column, as you can see in this lot-to-lot comparison.

Agilent Poroshell 120 EC-C18
4.6 x 100 mm, 2.7 µm
P/N 695975-902 – from 4 Different Lots



Poroshell 120 EC-C8 is less retentive for faster analysis of non-polar compounds

Column A:	**Poroshell 120 EC-C18 699975-302 3 x 50 mm, 2.7 µm**
Column B:	**Poroshell 120 EC-C8 699975-306 3.0 x 50 mm, 2.7 µm**
Mobile Phase:	60% CH_3CN:40% H_2O
Flow Rate:	0.85 mL/min
Temperature:	26°C
Detector:	254 nm
Sample:	2 µL of RRLC Checkout Sample (PN 5188-6529), alkylphenones

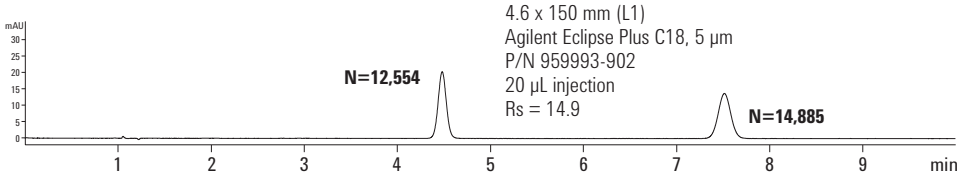


USP method for Naproxen tablets – 4.5X faster analysis on Agilent Poroshell 120 at HPLC pressures

Mobile Phase: 50:49:1 MeCN:H_2O Acetic Acid
Flow Rate: 1.2 mL/min

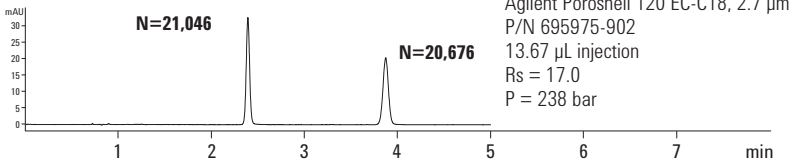
1. Naproxen
2. Butyrophenone

This Naproxen separation demonstrates how easy it can be to convert a method to Poroshell 120 columns without changing the flow rate or mobile phase.



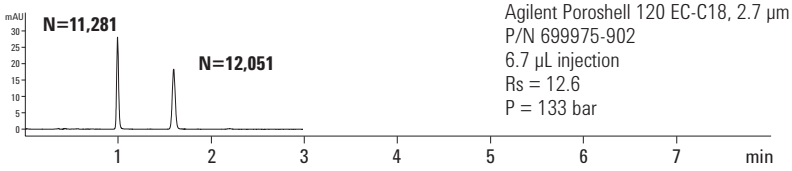
4.6 x 150 mm (L1)
Agilent Eclipse Plus C18, 5 µm
P/N 959993-902
20 µL injection
Rs = 14.9

2X Faster



4.6 x 100 mm (L1)
Agilent Poroshell 120 EC-C18, 2.7 µm
P/N 695975-902
13.67 µL injection
Rs = 17.0
P = 238 bar

4.5X Faster



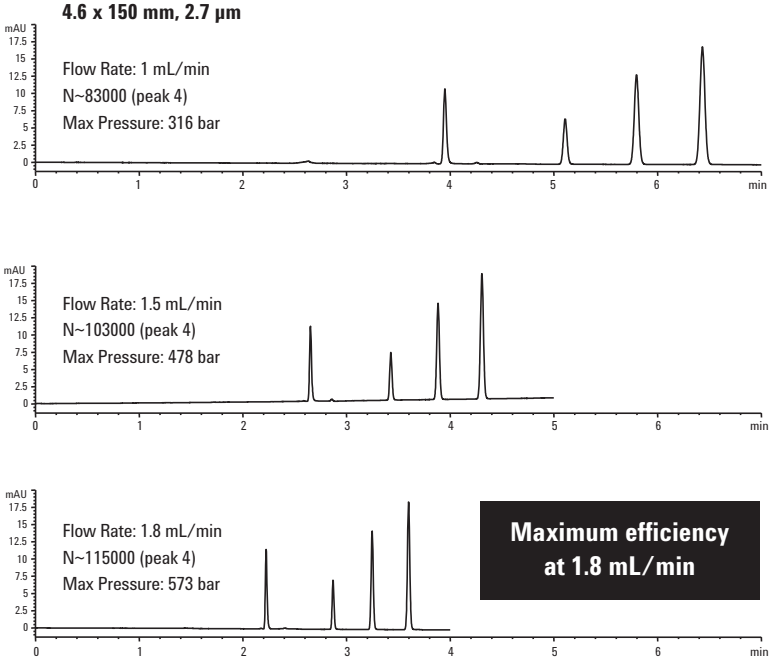
4.6 x 50 mm (L1)
Agilent Poroshell 120 EC-C18, 2.7 µm
P/N 699975-902
6.7 µL injection
Rs = 12.6
P = 133 bar

Agilent Poroshell 120 columns in series deliver the highest efficiency at HPLC and UHPLC pressures

Because low backpressure is one of the advantages of Poroshell 120 columns, you can couple several columns in series to achieve the highest separation power per unit time. This enables better separation of complex samples.

Peak #	Compound	Plates	k'
2	Acetophenone	114120	0.29
3	Benzene	109931	0.46
4	Touene	114800	0.65

3 Agilent Poroshell 120 EC-C18 columns in series
693975-902
4.6 x 150 mm, 2.7 µm



Maximum efficiency at 1.8 mL/min

ZORBAX Eclipse Plus

- Excellent peak shape for basic compounds
- High level of performance – peak shape, efficiency, resolution, and lifetime – with all sample types: acids, bases and neutrals
- Superior reproducibility with more rigorous QA/QC testing
- Improved, patented silica manufacturing with start-to-finish product control
- Available in 1.8, 3.5 and 5 µm particle sizes for all analytical, high resolution, and fast LC analyses

Agilent ZORBAX Eclipse Plus columns provide the ultimate in performance for silica-based columns. Peak shape is excellent for the most challenging basic compounds, improving efficiency and resolution with these sample types. These results are achieved by improvements in the silica manufacturing and bonding technology, which is completely controlled by Agilent.

Because of their high level of performance, Eclipse Plus columns are the ideal first choice for method development of all samples. If you need to achieve fast method development and superior productivity, then choose a column with high-resolution 1.8 µm particles. For standard methods, conventional 5 µm and Rapid Resolution 3.5 µm columns are your best choice. With all particle sizes, easy method transfer is possible.

With more rigorous QA and QC testing, column lot-to-lot reproducibility is also improved, resulting in long-term reliable results for all analyses.

Column Specifications

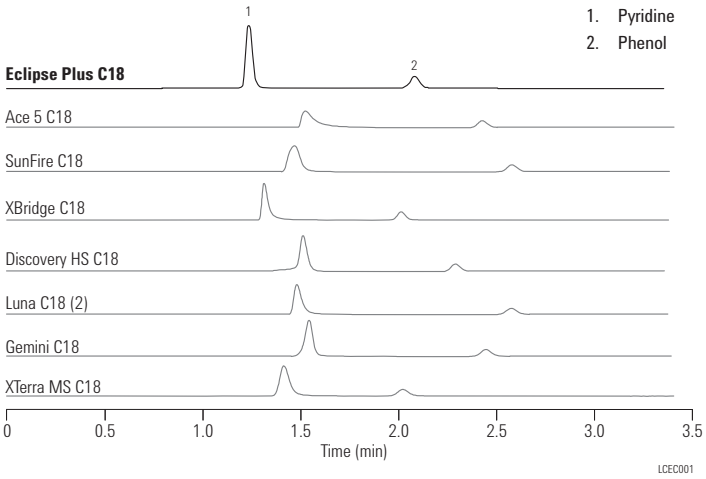
Bonded Phase	Pore Size	Surface Area	Temp. Limits	pH Range*	Endcapped	Carbon Load
ZORBAX Eclipse Plus C18	95Å	160 m^2/g	60°C	2.0-9.0	Double	9%
ZORBAX Eclipse Plus C8	95Å	160 m^2/g	60°C	2.0-9.0	Double	7%
ZORBAX Eclipse PAH	95Å	160 m^2/g	60°C	2.0-8.0	No	14%
ZORBAX Eclipse Plus Phenyl-Hexyl	95Å	160 m^2/g	60°C	2.0-8.0	Double	9%

Specifications represent typical values only.

*Column lifetime will be reduced significantly at pH >7 and temperature >40°C. At pH 6-9, highest column stability for all silica based columns is obtained by operating at temperatures <40°C and using lower buffer concentrations in range of 0.01-0.02 M, especially with phosphate and carbonate buffers.

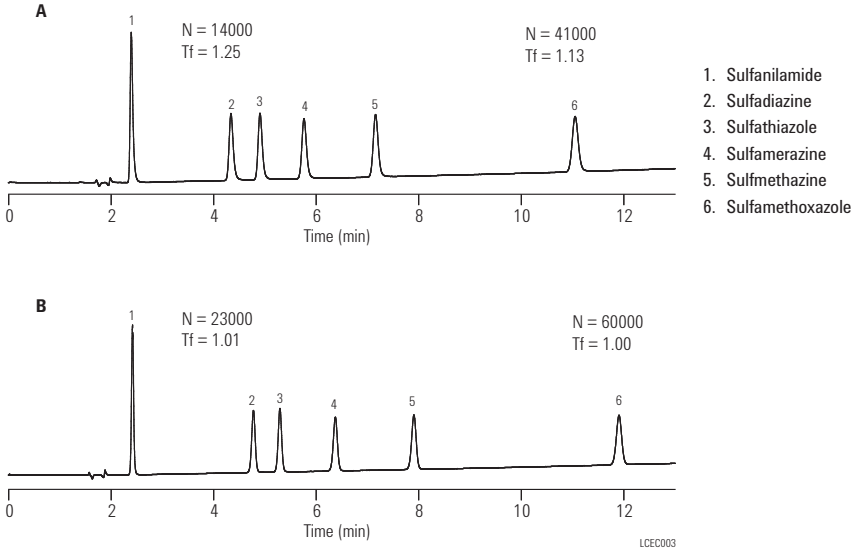
ZORBAX Eclipse Plus: Best Peak Shape in the Industry Without Tailing

Column: **Eclipse Plus C18**
959996-902
4.6 x 100 mm, 5 µm
Mobile Phase: A: 60% Water
B: 40% Acetonitrile
Flow Rate: 1.0 mL/min
Temperature: Ambient
Detector: UV 254 nm
Publication: 5989-4934EN
Sample: Pyridine, Phenol



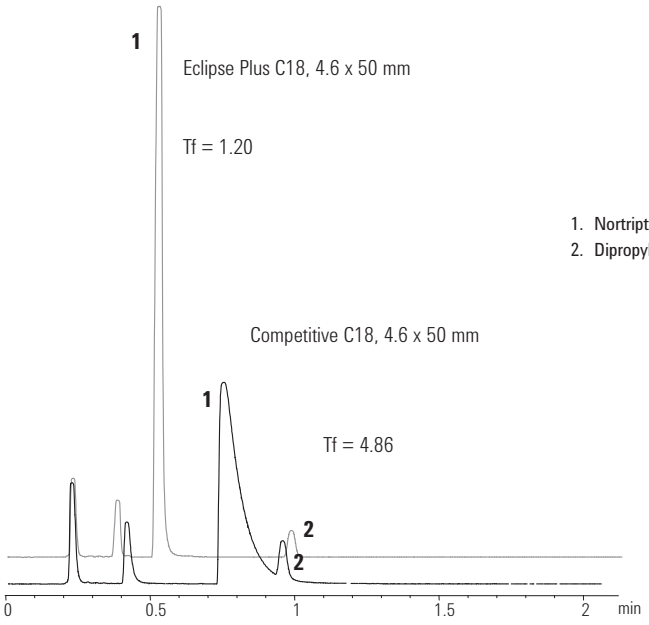
Peak Shape and Efficiency are Better with ZORBAX Eclipse Plus

Column A: **XBridge C18, 4.6 x 150 mm, 5 µm**
Column B: **Eclipse Plus C18**
959993-902
4.6 x 150 mm, 5 µm
Mobile Phase: A: 0.1% formic acid
B: 0.1% formic acid in ACN
Flow Rate: 1.0 mL/min
Gradient: 0.0 min 10% B
15 min 30% B
Temperature: 40°C
Detector: UV 254 nm
Publication: 5989-4934EN
Sample: Sulfonamides



Eliminate Tailing and Maximize Resolution with Eclipse Plus Columns

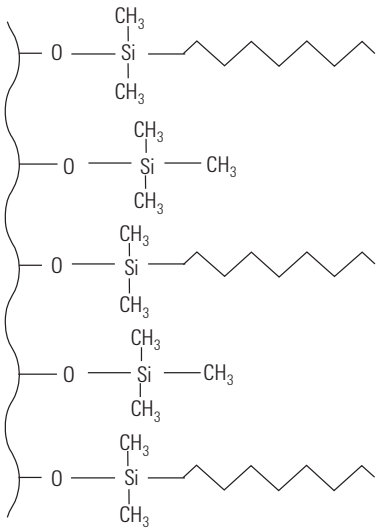
Column A: **Eclipse Plus C18, 4.6 x 50 mm**
Column B: **Competitive C18, 4.6 x 50 mm**
Mobile Phase: 65% ACN:35% 25 mM phosphate buffer (pH 7.4)



Superior peak shape and better selectivity with Eclipse Plus means more resolution, easier quantitation and better results in your separations.

ZORBAX Eclipse Plus

Hardware	Description	Size (mm)	Particle Size (µm)	Eclipse Plus C18 USP L1	Eclipse Plus C8 USP L7	Eclipse Plus Phenyl-Hexyl USP L11	Eclipse PAH USP L1
	Analytical	4.6 x 250	5	959990-902	959990-906	959990-912	959990-918
	Analytical	4.6 x 150	5	959993-902	959993-906	959993-912	959993-918
	Analytical	4.6 x 100	5	959996-902	959996-906	959996-912	959996-918
	Analytical	4.6 x 50	5	959946-902	959946-906		
	Rapid Resolution	4.6 x 150	3.5	959963-902	959963-906	959963-912	959963-918
	Rapid Resolution	4.6 x 100	3.5	959961-902	959961-906	959961-912	959961-918
	Rapid Resolution	4.6 x 75	3.5	959933-902	959933-906	959933-912	
	Rapid Resolution	4.6 x 50	3.5	959943-902	959943-906	959943-912	959943-918
	Rapid Resolution	4.6 x 30	3.5	959936-902	959936-906	959936-912	
	Rapid Resolution HT, 600 bar	4.6 x 100	1.8	959964-902	959964-906	959964-912	959964-918
	Rapid Resolution HT, 600 bar	4.6 x 75	1.8	959951-902			
	Rapid Resolution HT, 600 bar	4.6 x 50	1.8	959941-902	959941-906	959941-912	959941-918
	Rapid Resolution HT, 600 bar	4.6 x 30	1.8	959931-902	959931-906	959931-912	959931-918
	Solvent Saver	3.0 x 250	5				959990-318
	Solvent Saver	3.0 x 150	5	959993-302	959993-306		
	Solvent Saver Plus	3.0 x 150	3.5	959963-302	959963-306	959963-312	
	Solvent Saver Plus	3.0 x 100	3.5	959961-302	959961-306	959961-312	
	Solvent Saver RRHD, 1200 bar	3.0 x 150	1.8	959759-302	959759-306		
	Solvent Saver RRHD, 1200 bar	3.0 x 100	1.8	959758-302	959758-306		
	Solvent Saver RRHD, 1200 bar	3.0 x 50	1.8	959757-302	959757-306		
	Solvent Saver HT, 600 bar	3.0 x 100	1.8	959964-302	959964-306	959964-312	
	Solvent Saver HT, 600 bar	3.0 x 50	1.8	959941-302	959941-306	959941-312	
	Narrow Bore	2.1 x 250	5				959790-918
	Narrow Bore	2.1 x 150	5	959701-902	959701-906	959701-912	959701-918
	Narrow Bore	2.1 x 50	5	959746-902	959746-906		
	Narrow Bore RR	2.1 x 150	3.5	959763-902	959763-906	959763-912	
	Narrow Bore RR	2.1 x 100	3.5	959793-902	959793-906	959793-912	959793-918
	Narrow Bore RR	2.1 x 50	3.5	959743-902	959743-906	959743-912	
	Narrow Bore RR	2.1 x 30	3.5	959733-902	959733-906	959733-912	
	Narrow Bore RRHD, 1200 bar	2.1 x 150	1.8	959759-902	959759-906		
	Narrow Bore RRHD, 1200 bar	2.1 x 100	1.8	959758-902	959758-906		
	Narrow Bore RRHD, 1200 bar	2.1 x 50	1.8	959757-902	959757-906		
	Narrow Bore RRHT, 600 bar	2.1 x 100	1.8	959764-902	959764-906	959764-912	959764-918
	Narrow Bore RRHT, 600 bar	2.1 x 50	1.8	959741-902	959741-906	959741-912	959741-918
	Narrow Bore RRHT, 600 bar	2.1 x 30	1.8	959731-902	959731-906	959731-912	
ZGC	Guard Cartridges, 4/pk	4.6 x 12.5	5	820950-936	820950-937	820950-938	820950-939
ZGC	Guard Cartridges, 4/pk	2.1 x 12.5	5	821125-936	821125-937	821125-938	821125-939
ZGC	Guard Hardware Kit			820999-901	820999-901	820999-901	820999-901



eXtra Densely Bonded and Double Endcapped Eclipse XDB Bonded Phase

ZORBAX Eclipse XDB

- Four selectivity choices for method development optimization
- Good peak shape for basic, acidic and neutral compounds
- High performance over a wide pH range – pH 2-9
- Particle sizes from 1.8 µm to 7 µm
- Long lifetime with extra dense bonding and double endcapping

Agilent ZORBAX Eclipse XDB columns – C18, C8, Phenyl and CN – provide four bonded phase choices for method development optimization. These columns provide good peak shape over a wide pH range (2-9) for additional method development flexibility with one family of columns. Eclipse XDB columns can be used for method development at low pH (2-3) and the same column can be used for method development in the mid pH (6-8) region. In the mid pH region residual silanols are more active and tailing interactions are more likely. To overcome these interactions, Eclipse XDB columns are eXtra Densely Bonded and double endcapped through a proprietary process to cover as many active silanols as possible. The result is superior peak shape of basic compounds from pH 2-9. Eclipse XDB columns are available in 1.8, 3.5, 5 and 7 µm particle sizes for high speed, high resolution, analytical and prep scale separations.

Column Specifications

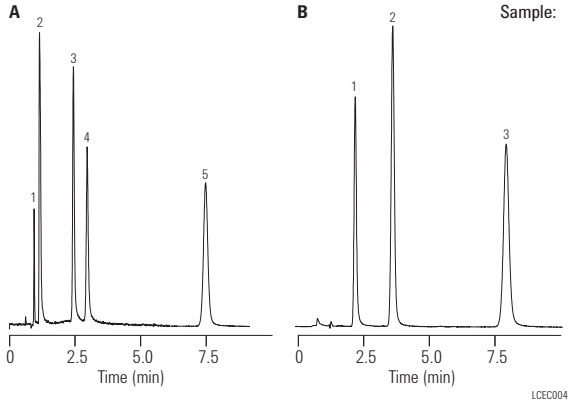
Bonded Phase	Pore Size	Surface Area	Temp. Limits	pH Range*	Endcapped	Carbon Load
ZORBAX Eclipse XDB-C18	80Å	180 m^2/g	60°C	2.0-9.0	Double	10%
ZORBAX Eclipse XDB-C8	80Å	180 m^2/g	60°C	2.0-9.0	Double	7.6%
ZORBAX Eclipse XDB-Phenyl	80Å	180 m^2/g	60°C	2.0-9.0	Double	7.2%
ZORBAX Eclipse XDB-CN	80Å	180 m^2/g	60°C	2.0-8.0	Double	4.3%

Specifications represent typical values only.

*Eclipse XDB columns are designed for operation over a wide pH range.At pH 6-9, highest columns stability for all silica based columns is achieved by operating at temperatures <40°C and using low buffer concentrations in the range of 0.01-0.02 M.

Good Peak Shape Over a Wide pH Range with ZORBAX Eclipse XDB

Column: **Eclipse XDB-C8**
993967-906
4.6 x 150 mm, 5 µm
Mobile Phase: A: pH 3.0 75% 25 mM phosphate buffer
25% ACN
B: pH 7.0 90% 20 mM phosphate
10% ACN
Flow Rate: 1.5 mL/min
Temperature: 40°C



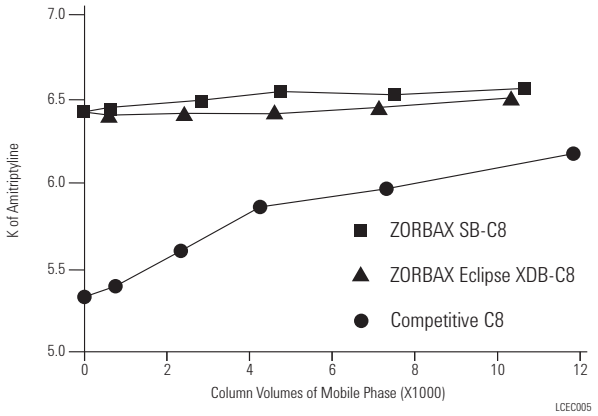
Sample: A:
1. Maleate
2. Doxylamine
3. Chlorpheniramine
4. Triprolidine
5. Diphenhydramine

B:
1. Procainamide
2. N-acetylprocainamide
3. N-propionylprocainamide

ZORBAX Eclipse XDB columns provide good peak shape over a wide pH range and are an excellent choice for method development from pH 2-9.

Column Stability Testing at pH 3 and 60°C

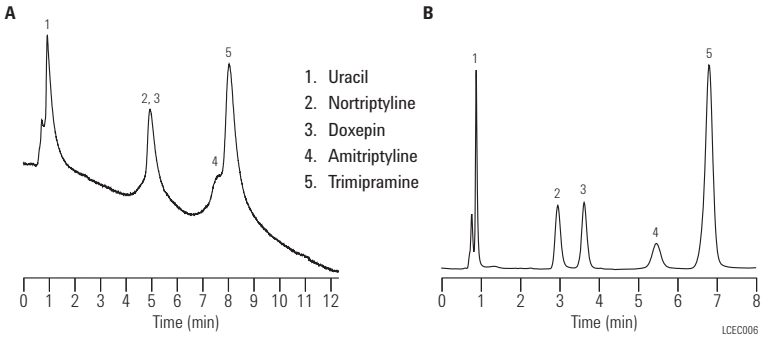
Column: **ZORBAX SB-C8**
883975-906
4.6 x 150 mm, 5 µm
Column: **Eclipse XDB-C8**
993967-906
4.6 x 150 mm, 5 µm
Mobile Phase: Purge Conditions:
70% 50 mM NaAc-HCl, pH 3.0
30% ACN
Retention Test Conditions:
65% Methanol
35% Water
Flow Rate: 1.0 mL/min
Temperature: 60°C
Sample: Tricyclic Antidepressants



Eclipse XDB columns are stable over a wide pH range. At low pH an Eclipse endcapped column is extremely stable and shows equivalent stability to a non-endcapped column, SB-C8, at pH 3. The columns were purged with a pH 3 mobile phase at 60°C. Then they were tested with a strongly basic compound to determine if the endcapping or bonded phase had been hydrolyzed from the silica surface. The Eclipse XDB column was very stable, as shown by the consistency of the retention of amitriptyline over the 12,000 column volumes of the test. Another endcapped column shows less stability under these same conditions.

Column Stability Testing at pH 7.0

Column A:	**Competitive C8 SIL-type After 1826 Column Volumes**
Column B:	**Eclipse XDB-C8 993967-906 4.6 x 150 mm, 5 µm Sol-type After 1843 Column Volumes**
Mobile Phase:	60% ACN 40% 250 mM Phosphate Buffer, pH 7.0
Flow Rate:	1.5 mL/min
Temperature:	60°C
Sample:	Tricyclic Antidepressants

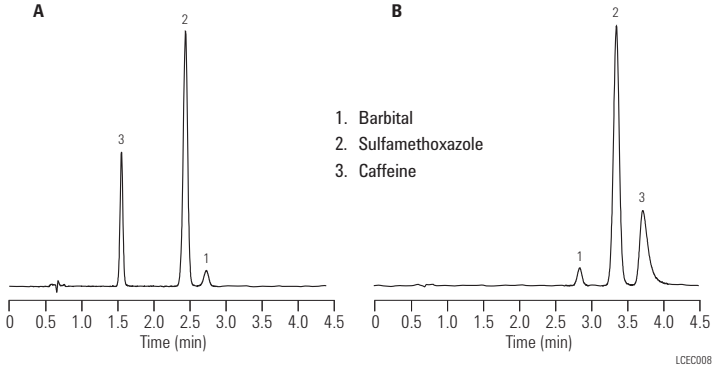


Double endcapping, dense bonding and the durable Rx-Sil particles (sol-type) combine to provide long lifetime at pH 7 when compared to single endcapped sil-gel columns used here. The conditions used for this test – high temperature (60°C) and high salt concentration (250 mM), accelerate the dissolution of silica, causing premature failure of the sil-gel type column.

Selectivity Changes for Basic Compounds with Eclipse XDB and StableBond

Column A:	**Eclipse XDB-C8 966967-906 4.6 x 75 mm, 3.5 µm**
Column B:	**ZORBAX Rx/SB-C8 866953-906 4.6 x 75 mm, 3.5 µm**
Mobile Phase:	70% 25 mM NaH_2PO_4, pH 3.0 30% Methanol
Flow Rate:	1.0 mL/min
Temperature:	35°C

Eclipse XDB and StableBond columns are based on the same silica but have different bonding and endcapping. Therefore, they can have very different selectivity for the same sample under the same conditions, as this example shows.



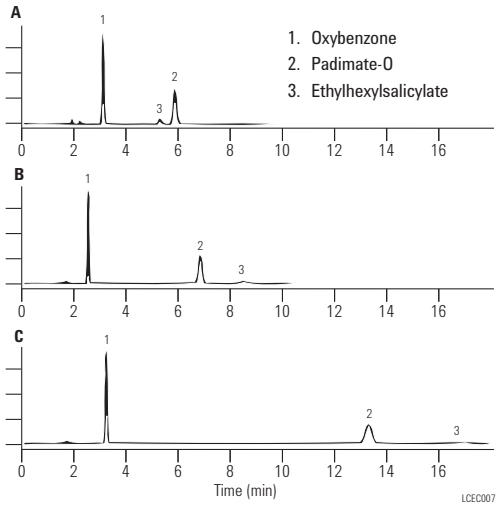
Optimize Separations with Eclipse XDB Selectivity Options: Analysis of Sunscreens

Column A: **Eclipse XDB-Phenyl 963967-912 4.6 x 150 mm, 3.5 µm**

Column B: **Eclipse XDB-C8 963967-906 4.6 x 150 mm, 3.5 µm**

Column C: **Eclipse XDB-C18 963967-902 4.6 x 150 mm, 3.5 µm**

Mobile Phase:	15% H_2O:85% MeOH
Flow Rate:	1.0 mL/min
Temperature:	35°C
Sample:	Sunscreens



This separation of sunscreens on all three Eclipse XDB bonded phases – C18, C8 and Phenyl – shows that different bonded phases can be used to optimize a separation. While all three bonded phases provide an adequate separation, the Eclipse XDB-Phenyl provides a different peak elution order and a much shorter overall analysis time. All three bonded phases also provide excellent peak shape with no mobile phase additives.

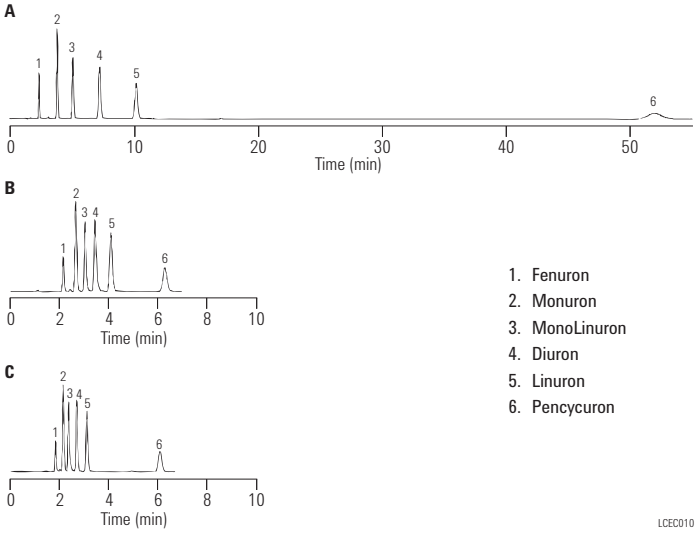
Selectivity for Urea Pesticides

Column A: **Eclipse XDB-C18 993967-902 4.6 x 150 mm, 5 µm**

Column B: **Eclipse XDB-CN 993967-905 4.6 x 150 mm, 5 µm**

Column C: **Eclipse XDB-C18 993967-902 4.6 x 150 mm, 5 µm**

Mobile Phase:	A. 60:40 MeOH:Water B. 60:40 MeOH:Water C. 77:23 MeOH:Water
Flow Rate:	1.0 mL/min
Temperature:	25°C
Sample:	Urea pesticides



The Eclipse XDB-CN column reduces retention time and provides good selectivity for Urea pesticides when compared to an Eclipse XDB-C18 column.

ZORBAX Eclipse XDB

Hardware	Description	Size (mm)	Particle Size (µm)	Eclipse XDB-C18 USP L1	Eclipse XDB-C8 USP L7	Eclipse XDB-Phenyl USP L11	Eclipse XDB-CN USP L10
Standard Columns (no special hardware required)							
	Semi-Preparative	9.4 x 250	5	990967-202	990967-206		
	Analytical	4.6 x 250	5	990967-902	990967-906	990967-912	990967-905
	Analytical	4.6 x 150	5	993967-902	993967-906	993967-912	993967-905
	Analytical	4.6 x 50	5	946975-902	946975-906		
	Rapid Resolution	4.6 x 150	3.5	963967-902	963967-906	963967-912	963967-905
	Rapid Resolution	4.6 x 100	3.5	961967-902	961967-906		961967-905
	Rapid Resolution	4.6 x 75	3.5	966967-902	966967-906	966967-912	966967-905
	Rapid Resolution	4.6 x 50	3.5	935967-902	935967-906	935967-912	
	Rapid Resolution	4.6 x 30	3.5	934967-902	934967-906		
	Rapid Resolution	4.6 x 20	3.5	932967-902	932967-906		
	Rapid Resolution HT, 600 bar	4.6 x 100	1.8	928975-902	928975-906		
	Rapid Resolution HT, 600 bar	4.6 x 50	1.8	927975-902	927975-906		
	Rapid Resolution HT, 600 bar	4.6 x 30	1.8	924975-902	924975-906		
	Rapid Resolution HT, 600 bar	4.6 x 20	1.8	926975-902	926975-906		
	Solvent Saver	3.0 x 250	5	990967-302	990967-306	990967-312	990967-305
	Solvent Saver	3.0 x 150	5	993967-302	993967-306	993967-312	993967-305
	Solvent Saver Plus	3.0 x 150	3.5	963954-302	963954-306	963954-312	963954-305
	Solvent Saver Plus	3.0 x 100	3.5	961967-302	961967-306	961967-312	
	Solvent Saver Plus	3.0 x 75	3.5	966954-302			
	Solvent Saver RRHD, 1200 bar	3.0 x 150	1.8	981759-302			
	Solvent Saver RRHD, 1200 bar	3.0 x 100	1.8	981758-302			
	Solvent Saver RRHD, 1200 bar	3.0 x 50	1.8	981757-302			
	Solvent Saver HT, 600 bar	3.0 x 100	1.8	928975-302	928975-306		
	Solvent Saver HT, 600 bar	3.0 x 50	1.8	927975-302	927975-306		
	Solvent Saver HT, 600 bar	3.0 x 30	1.8	924975-302	924975-306		
	Solvent Saver HT, 600 bar	3.0 x 20	1.8	926975-302	926975-306		
	Narrow Bore	2.1 x 150	5	993700-902	993700-906	993700-912	993700-905
	Narrow Bore	2.1 x 50	5	960967-902	960967-906	960967-912	960967-905
	Narrow Bore RR	2.1 x 150	3.5	930990-902	930990-906		
	Narrow Bore RR	2.1 x 100	3.5	961753-902	961753-906		961753-905
	Narrow Bore RR	2.1 x 75	3.5	966735-902			
	Narrow Bore RR	2.1 x 50	3.5	971700-902	971700-906		
	Narrow Bore RR	2.1 x 30	3.5	974700-902	974700-906		
	Narrow Bore RR	2.1 x 20	3.5	972700-902	972700-906		
	Narrow Bore RRHD, 1200 bar	2.1 x 150	1.8	981759-902			
	Narrow Bore RRHD, 1200 bar	2.1 x 100	1.8	981758-902			
	Narrow Bore RRHD, 1200 bar	2.1 x 50	1.8	981757-902			

(Continued)

ZORBAX Eclipse XDB

Hardware	Description	Size (mm)	Particle Size (µm)	Eclipse XDB-C18 USP L1	Eclipse XDB-C8 USP L7	Eclipse XDB-Phenyl USP L11	Eclipse XDB-CN USP L10
Standard Columns (no special hardware required)							
	Narrow Bore RRHT, 600 bar	2.1 x 100	1.8	928700-902	928700-906		
	Narrow Bore RRHT, 600 bar	2.1 x 50	1.8	927700-902	927700-906		
	Narrow Bore RRHT, 600 bar	2.1 x 30	1.8	924700-902	924700-906		
	Narrow Bore RRHT, 600 bar	2.1 x 20	1.8	926700-902	926700-906		
	MicroBore RR	1.0 x 150	3.5	963600-902	963600-906		
	MicroBore RR	1.0 x 50	3.5	965600-902	965600-906		
	MicroBore RR	1.0 x 30	3.5	961600-902	961600-906		
	MicroBore Guard, 3/pk	1.0 x 17	5	5185-5921	5185-5921		
ZGC	Guard Cartridges, 4/pk	4.6 x 12.5	5	820950-925	820950-926	820950-927	820950-935
ZGC	Guard Cartridges, 4/pk	2.1 x 12.5	5	821125-926	821125-926	821125-926	821125-935
ZGC	Guard Hardware Kit			820999-901	820999-901	820999-901	820999-901
PrepHT Cartridge Columns (require endfittings kit 820400-901)							
PI	PrepHT Cartridge	21.2 x 250	7	977250-102	977250-106		
PI	PrepHT Cartridge	21.2 x 150	7	977150-102	977150-106		
PI	PrepHT Cartridge	21.2 x 150	5	970150-902	970150-906		
PI	PrepHT Cartridge	21.2 x 100	5	970100-902	970100-906		
PI	PrepHT Cartridge	21.2 x 50	5	970050-902	970050-906		
PI	PrepHT Guard Cartridge	17 x 7.5	5	820212-925	820212-926		
PI	Guard Cartridge Hardware			820444-901	820444-901		
PI	PrepHT endfittings, 2/pk			820400-901	820400-901		

Unless indicated, column pressure limit is 400 bar.

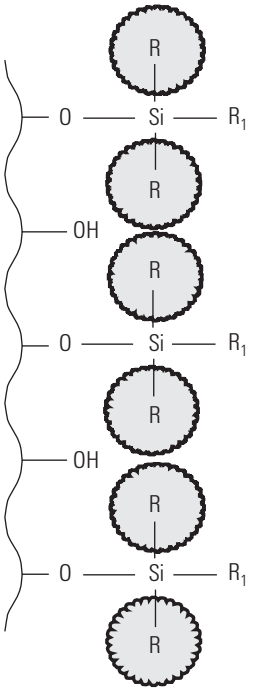
ZORBAX Eclipse XDB

Hardware	Description	Size (mm)	Particle Size (µm)	Eclipse XDB-C18 USP L1	Eclipse XDB-C8 USP L7
Agilent Cartridge Columns (require hardware kit 5021-1845)					
AC	Analytical	4.6 x 250	5	7995118-585	7995108-585
AC	Analytical	4.6 x 150	5	7995118-595	7995108-595
AC	Rapid Resolution	4.6 x 75	3.5	7995118-344	7995108-344
AC	Solvent Saver Plus	3.0 x 75	3.5	7995230-344	
	Guard Cartridges, 10/pk	4.0 x 4	5	7995118-504	7995118-504
	Cartridge Holder, 5021-1845			5021-1845	5021-1845

(Continued)

ZORBAX Eclipse XDB

Hardware	Description	Size (mm)	Particle Size (µm)	Eclipse XDB-C18 USP L1	Eclipse XDB-C8 USP L7
Standard Columns (no special hardware required)					
	Rapid Resolution HT	4.6 x 50	1.8	922975-902	922975-906
	Rapid Resolution HT, 3/pk	4.6 x 50	1.8	922975-932	
	Narrow Bore RRHT	2.1 x 50	1.8	922700-902	
	Narrow Bore RRHT, 3/pk	2.1 x 50	1.8	922700-932	
Rapid Resolution HT Cartridges (require hardware kit 820555-901)					
RR	Rapid Resolution Cartridge	4.6 x 30	3.5	933975-902	933975-906
RR	Rapid Resolution Cartridge, 3/pk	4.6 x 30	3.5	933975-932	933975-936
RR	Rapid Resolution Cartridge	4.6 x 15	3.5	931975-902	931975-906
RR	Rapid Resolution Cartridge, 3/pk	4.6 x 15	3.5	931975-932	931975-936
RR	Rapid Resolution Cartridge	2.1 x 30	3.5	973700-902	973700-906
RR	Rapid Resolution Cartridge, 3/pk	2.1 x 30	3.5	973700-932	973700-936
RR	Rapid Resolution Cartridge	2.1 x 15	3.5	975700-902	975700-906
RR	Rapid Resolution Cartridge, 3/pk	2.1 x 15	3.5	975700-932	975700-936
RR	Rapid Resolution HT Cartridge	4.6 x 50	1.8	925975-902	
RR	Rapid Resolution HT Cartridge, 3/pk	4.6 x 50	1.8	925975-932	
RR	Rapid Resolution HT Cartridge	4.6 x 30	1.8	923975-902	
RR	Rapid Resolution HT Cartridge, 3/pk	4.6 x 30	1.8	923975-932	
RR	Rapid Resolution HT Cartridge	4.6 x 15	1.8	921975-902	
RR	Rapid Resolution HT Cartridge, 3/pk	4.6 x 15	1.8	921975-932	
RR	Rapid Resolution HT Cartridge	2.1 x 50	1.8	925700-902	
RR	Rapid Resolution HT Cartridge, 3/pk	2.1 x 50	1.8	925700-932	
RR	Rapid Resolution HT Cartridge	2.1 x 30	1.8	923700-902	
RR	Rapid Resolution HT Cartridge, 3/pk	2.1 x 30	1.8	923700-932	
RR	Rapid Resolution HT Cartridge	2.1 x 15	1.8	921700-902	
RR	Rapid Resolution HT Cartridge, 3/pk	2.1 x 15	1.8	921700-932	
RR	Hardware Kit for RR and RRHT Cartridges			820555-901	
Capillary Glass-lined Columns					
	Capillary	0.5 x 250	5	5064-8286	
	Capillary	0.5 x 150	5	5064-8287	
	Capillary RR	0.5 x 150	3.5	5064-8288	
	Capillary RR	0.5 x 35	3.5	5064-8298	
	Capillary	0.3 x 250	5	5064-8269	
	Capillary	0.3 x 150	5	5064-8291	
	Capillary RR	0.3 x 150	3.5	5064-8271	
	Capillary	0.5 x 35	5	5064-8296	
	Capillary	0.3 x 35	5	5064-8297	



Sterically Protected StableBond Bonded Phase

ZORBAX 80Å StableBond

- Longest column lifetime and best reproducibility for low pH separations – down to pH 1
- Patented stable column chemistry allows use at high temperature and low pH without degradation
- Six different bonded phases provide broad selectivity – SB-C18, SB-C8, SB-CN, SB-Phenyl, SB-C3, and SB-Aq
- High purity (Type B) silica for good peak shape

Agilent ZORBAX StableBond columns use patented, unique, nonfunctional silanes with bulky diisobutyl (SB-C18) or diisopropyl (SB-C8, SB-C3, SB-Phenyl, SB-CN, and SB-Aq) side chain groups that sterically protect the key siloxane bond to the silica surface from hydrolytic attack at low pH. StableBond packing materials are not endcapped in order to provide exceptional stability and to maximize lifetime and reproducibility under acidic mobile phase conditions. The high purity, low acidity silica provides excellent peak shape with acidic, basic and neutral compounds making StableBond columns an excellent choice for low pH method development. ZORBAX StableBond columns are compatible with all common mobile phases, including very high aqueous mobile phases.

Column Specifications

Bonded Phase	Pore Size	Surface Area	Temp. Limits*	pH Range*	Endcapped	Carbon Load
ZORBAX SB-C18	80Å	180 m^2/g	90°C	0.8-8.0	No	10%
ZORBAX SB-C8	80Å	180 m^2/g	80°C	1.0-8.0	No	5.5%
ZORBAX SB-C3	80Å	180 m^2/g	80°C	1.0-8.0	No	4%
ZORBAX SB-Phenyl	80Å	180 m^2/g	80°C	1.0-8.0	No	5.5%
ZORBAX SB-CN	80Å	180 m^2/g	80°C	1.0-8.0	No	4%
ZORBAX SB-Aq	80Å	180 m^2/g	80°C	1.0-8.0	No	proprietary

Specifications represent typical values only.

*StableBond columns are designed for optimal use at low pH. At pH 6-8, highest column stability for all silica-based columns is obtained by operating at temperatures <40°C and using lower buffer concentrations in the range of 0.01-0.02 M. At mid-range pH, Eclipse Plus, Eclipse XDB and Bonus-RP are recommended.

StableBond SB-C18 Shows Excellent Stability at Low pH and High Temperature (pH 0.8, 90°C)

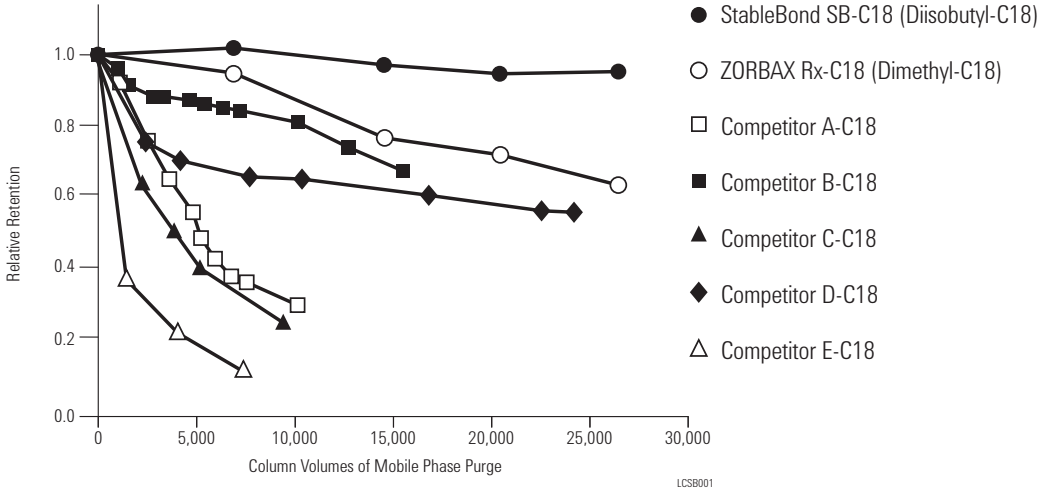
Column: **ZORBAX SB-C18**
883975-902
4.6 x 150 mm, 5 µm

Column: **ZORBAX Rx-C18**
883967-902
4.6 x 150 mm, 5 µm

Mobile Phase: 50% Methanol/50% Water with 1.0% TFA
Test Solute: Toluene

Temperature: 90°C

As an indicator of column breakdown, retention time of toluene was measured after purging the column with mobile phase. Only the StableBond SB-C18 is unchanged after three working months of use under these very low pH (0.8) and high temperature (90°C) conditions. ZORBAX Rx-C18 also provides a stable matrix, and can be used as an alternative selectivity to StableBond SB-C18.

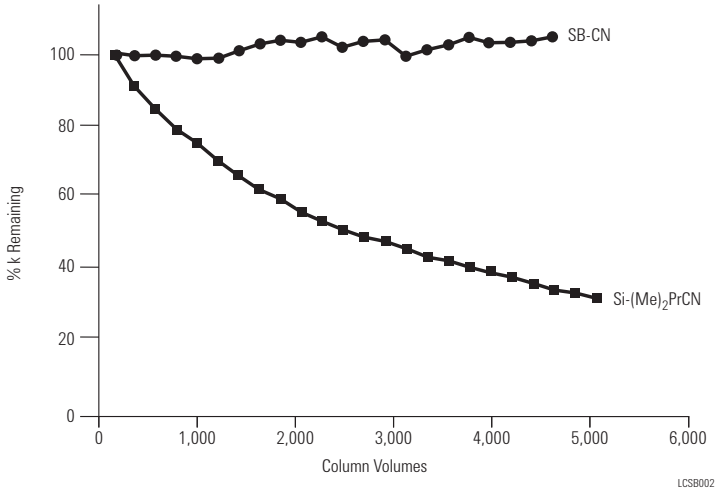


Shorter Chain ZORBAX SB-CN is also Stable at Low pH (pH 2.0, 50°C)

Column: **ZORBAX SB-CN**
883975-905
4.6 x 150 mm, 5 µm

Mobile Phase: 0.1% TFA, pH 2:ACN
Flow Rate: 1 mL/min
Gradient: 0-100% ACN
Temperature: 50°C
Sample: 1-phenylheptane @ 50% AC/50% Water with 0.1% TFA

ZORBAX StableBond SB-CN and other short chain StableBond bonded phases are also exceptionally stable at low pH. Conventional dimethyl CN and similar bonded phases lack this stability.



SB-CN Optimizes Retention and Resolution

Column A: **ZORBAX SB-C18**
866953-902
4.6 x 75 mm, 3.5 µm

Column B: **ZORBAX SB-CN**
866953-905
4.6 x 75 mm, 3.5 µm

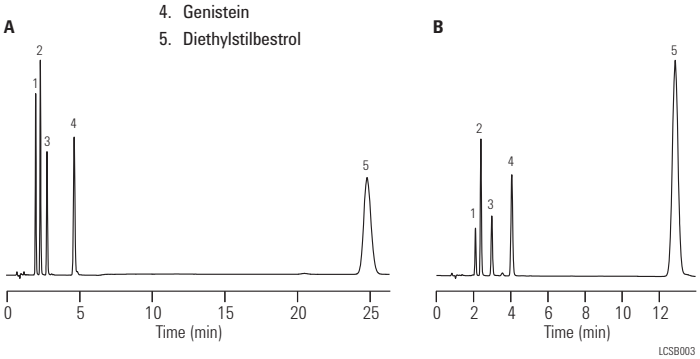
Mobile Phase: 30% ACN
70% 25mM NaH_2PO_4, pH 2.5

Flow Rate: 1.0 mL/min

Temperature: 35°C

The SB-CN column is used here to reduce analysis time by 50%. The retention of the most hydrophobic analyte is cut in half. At the same time retention of the more polar, early eluting peaks increases slightly.

1. Estriol
2. Daidzen
3. Quercetin
4. Genistein
5. Diethylstilbestrol



Five Different Bonded Phases Provide Selectivity Options

Column A: **ZORBAX SB-C18**
883975-902
4.6 x 150 mm, 5 µm

Column B: **ZORBAX SB-C8**
883975-906
4.6 x 150 mm, 5 µm

Column C: **ZORBAX SB-C3**
883975-909
4.6 x 150 mm, 5 µm

Column D: **ZORBAX SB-Phenyl**
883975-912
4.6 x 150 mm, 5 µm

Column E: **ZORBAX SB-CN**
883975-905
4.6 x 150 mm, 5 µm

Mobile Phase: 0-100% B in 18.8 min
A: 50 mM NaH_2PO_4,
pH 2.5 in 95% H_2O / 5% ACN
B: 50 mM NaH_2PO_4,
pH 2.5 in 47% H_2O / 53% ACN

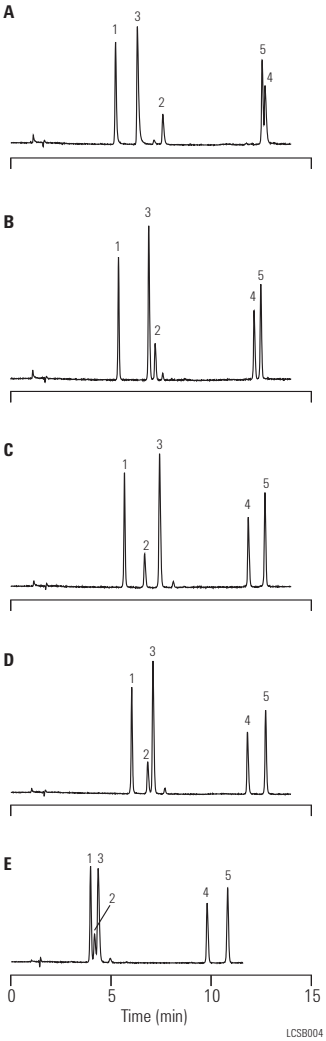
Flow Rate: 1.0 mL/min

Temperature: 26°C

Detector: 254 nm

Sample: 1. Procaine
2. Lidocaine
3. d-Cinchonine
4. Butacaine
5. Tetracaine

SB-C3 is just one of the five different StableBond selectivity choices. In this example, optimum resolution is obtained with SB-C3. All are based on the same high purity Rx-SIL. Selectivity changes are therefore dependent only on the bonded phases, making method development more reliable.



ZORBAX 80Å StableBond

Hardware	Description	Size (mm)	Particle Size (µm)	SB-C18 USP L1	SB-C8 USP L7	SB-CN USP L10	SB-C3 USP L56	SB-Phenyl USP L11	SB-Aq
Standard Columns (no special hardware required)									
	Semi-Preparative	9.4 x 250	5	880975-202	880967-201	880975-205	880975-209	880975-212	
	Semi-Preparative	9.4 x 150	5	883975-202					
	Semi-Preparative	9.4 x 100	5	884975-202					
	Semi-Preparative	9.4 x 50	5	846975-202					
	Analytical	4.6 x 250	5	880975-902	880975-906	880975-905	880975-909	880975-912	880975-914
	Analytical	4.6 x 150	5	883975-902	883975-906	883975-905	883975-909	883975-912	883975-914
	Analytical	4.6 x 50	5	846975-902	846975-906				846975-914
	Rapid Resolution	4.6 x 250	3.5	884950-567					
	Rapid Resolution	4.6 x 150	3.5	863953-902	863953-906	863953-905		863953-912	863953-914
	Rapid Resolution	4.6 x 100	3.5	861953-902	861953-906	861953-905		861953-912	861953-914
	Rapid Resolution	4.6 x 75	3.5	866953-902	866953-906	866953-905		866953-912	866953-914
	Rapid Resolution	4.6 x 50	3.5	835975-902	835975-906	835975-905		835975-912	835975-914
	Rapid Resolution	4.6 x 30	3.5	834975-902	834975-906				
	Rapid Resolution	4.6 x 20	3.5	832975-902	832975-906				
	Rapid Resolution HT, 600 bar	4.6 x 150	1.8	829975-902	829975-906	829975-905		829975-912	829975-914
	Rapid Resolution HT, 600 bar	4.6 x 100	1.8	828975-902	828975-906	828975-905		828975-912	828975-914
	Rapid Resolution HT, 600 bar	4.6 x 50	1.8	827975-901	827975-906	827975-905		827975-912	827975-914
	Rapid Resolution HT, 600 bar	4.6 x 30	1.8	824975-902	824975-906	824975-905		824975-912	824975-914
	Rapid Resolution HT, 600 bar	4.6 x 20	1.8	826975-902	826975-906				
	Solvent Saver	3.0 x 250	5	880975-302	880975-306	880975-305	880975-309	880975-312	880975-314
	Solvent Saver	3.0 x 150	5	883975-302	883975-306	883975-305	883975-309	883975-312	883975-314
	Solvent Saver Plus	3.0 x 150	3.5	863954-302	863954-306	863954-305		863954-312	863954-314
	Solvent Saver Plus	3.0 x 100	3.5	861954-302	861954-306	861954-305	861954-309	861954-312	861954-314
	Solvent Saver Plus	3.0 x 75	3.5	866953-302					

Unless indicated, column pressure limit is 400 bar.

(Continued)

ZORBAX 80Å StableBond

Hardware	Description	Size (mm)	Particle Size (µm)	SB-C18 USP L1	SB-C8 USP L7	SB-CN USP L10	SB-C3 USP L56	SB-Phenyl USP L11	SB-Aq
Standard Columns (no special hardware required)									
	Solvent Saver RRHD, 1200 bar	3.0 x 150	1.8	859700-302	859700-306				
	Solvent Saver RRHD, 1200 bar	3.0 x 100	1.8	858700-302	858700-306	858700-305		858700-312	
	Solvent Saver RRHD, 1200 bar	3.0 x 50	1.8	857700-302	857700-306	857700-305		857700-312	
	Solvent Saver HT, 600 bar	3.0 x 150	1.8	829975-302	829975-306	829975-305		829975-312	
	Solvent Saver HT, 600 bar	3.0 x 100	1.8	828975-302	828975-306	828975-305	828975-309	828975-312	828975-314
	Solvent Saver HT, 600 bar	3.0 x 50	1.8	827975-302	827975-306	827975-305			
	Solvent Saver HT, 600 bar	3.0 x 30	1.8	824975-302	824975-306	824975-305		827975-312	827975-314
	Solvent Saver HT, 600 bar	3.0 x 20	1.8	826975-302	826975-306				
	Narrow Bore	2.1 x 150	5	883700-922	883700-906	883700-905	883700-909	883700-912	
	Narrow Bore	2.1 x 50	5	860975-902	860975-906	860975-905	860975-909	860975-912	860975-914
	Narrow Bore RR	2.1 x 150	3.5	830990-902	830990-906				830990-914
	Narrow Bore RR	2.1 x 100	3.5	861753-902	861753-906	861753-905		861753-912	861753-914
	Narrow Bore RR	2.1 x 75	3.5	866735-902					
	Narrow Bore RR	2.1 x 50	3.5	871700-902	871700-906				871700-914
	Narrow Bore RR	2.1 x 30	3.5	874700-902	874700-906				
	Narrow Bore RR	2.1 x 20	3.5	872700-902	872700-906				
	Narrow Bore RRHD, 1200 bar	2.1 x 150	1.8	859700-902	859700-906	859700-905		859700-912	
	Narrow Bore RRHD, 1200 bar	2.1 x 100	1.8	858700-902	858700-906	858700-905		858700-912	
	Narrow Bore RRHD, 1200 bar	2.1 x 50	1.8	857700-902	857700-906	857700-905		857700-912	

Unless indicated, column pressure limit is 400 bar.

(Continued)

ZORBAX 80Å StableBond

Hardware	Description	Size (mm)	Particle Size (µm)	SB-C18 USP L1	SB-C8 USP L7	SB-CN USP L10	SB-C3 USP L56	SB-Phenyl USP L11	SB-Aq
Standard Columns (no special hardware required)									
	Narrow Bore RRHT, 600 bar	2.1 x 150	1.8	820700-902	820700-906	820700-905		820700-912	
	Narrow Bore RRHT, 600 bar	2.1 x 100	1.8	828700-902	828700-906	828700-905		828700-912	828700-914
	Narrow Bore RRHT, 600 bar	2.1 x 50	1.8	827700-902	827700-906	827700-905		827700-912	827700-914
	Narrow Bore RRHT, 600 bar	2.1 x 30	1.8	824700-902	824700-906	824700-905		824700-912	824700-914
	Narrow Bore RRHT, 600 bar	2.1 x 20	1.8	826700-902	826700-906				
	MicroBore RR	1.0 x 150	3.5	863600-902	863600-906	863600-905			
	MicroBore RR	1.0 x 50	3.5	865600-902	865600-906				
	MicroBore RR	1.0 x 30	3.5	861600-902	861600-906				
	MicroBore Guard, 3/pk	1.0 x 17	5	5185-5920	5185-5920				
P	Guard Cartridge, 2/pk	9.4 x 15	7	820675-115	820675-115	820675-124	820675-124	820675-115	
ZGC	Guard Cartridge, 4/pk	4.6 x 12.5	5	820950-920	820950-915	820950-916	820950-922	820950-917	820950-933
ZGC	Guard Cartridge, 4/pk	2.1 x 12.5	5	821125-915	821125-915	821125-924	821125-924	821125-915	821125-933
P	Guard Hardware Kit	9.4 x 15	0	840140-901	840140-901	840140-901	840140-901	840140-901	
ZGC	Guard Hardware Kit			820999-901	820999-901	820999-901	820999-901	820999-901	820999-901
PrepHT Cartridge Columns (require endfittings kit 820400-901)									
PI	PrepHT Cartridge	21.2 x 250	7	877250-102	877250-106	877250-105		877250-112	877250-114
PI	PrepHT Cartridge	21.2 x 150	7	877150-102	877150-106				877150-114
PI	PrepHT Cartridge	21.2 x 150	5	870150-902	870150-906				870150-914
PI	PrepHT Cartridge	21.2 x 100	5	870100-902	870100-906				870100-914
PI	PrepHT Cartridge	21.2 x 50	5	870050-902	870050-906				870050-914
PI	PrepHT Guard Cartridge, 2/pk	17 x 7.5	5	820212-920	820212-915	820212-915		820212-915	820212-933
	Guard Cartridge Hardware			820444-901	820444-901	820444-901	820444-901	820444-901	820444-901
	PrepHT endfittings, 2/pk			820400-901	820400-901	820400-901	820400-901	820400-901	820400-901

Unless indicated, column pressure limit is 400 bar.

ZORBAX 80Å StableBond

Hardware	Description	Size (mm)	Particle Size (µm)	SB-C18 USP L1	SB-C8 USP L7	SB-Phenyl USP L11
Agilent Cartridge Columns (require hardware kit 5021-1845)						
AC	Analytical	4.6 x 250	5	7995218-585	7995208-585	
AC	Analytical	4.6 x 150	5	7995218-595	7995208-595	
AC	Rapid Resolution	4.6 x 75	3.5	7995218-344	7995208-344	
AC	Guard Cartridges, 10/pk	4.0 x 4	5	7995118-504	7995118-504	
AC	Cartridge Holder, 5021-1845			5021-1845	5021-1845	
Standard Columns (no special hardware required)						
AC	Rapid Resolution HT	4.6 x 50	1.8	822975-902	822975-906	
AC	Rapid Resolution HT, 3/pk	4.6 x 50	1.8	822975-932		
AC	Narrow Bore RRHT	2.1 x 50	1.8	822700-902		
AC	Narrow Bore RRHT, 3/pk	2.1 x 50	1.8	822700-932		
Rapid Resolution Cartridges (require hardware kit 820555-901)						
RR	Rapid Resolution Cartridge	4.6 x 30	3.5	833975-902	833975-906	833975-912
RR	Rapid Resolution Cartridge, 3/pk	4.6 x 30	3.5	833975-932	833975-936	
RR	Rapid Resolution Cartridge	4.6 x 15	3.5	831975-902	831975-906	
RR	Rapid Resolution Cartridge, 3/pk	4.6 x 15	3.5	831975-932	831975-936	
RR	Rapid Resolution Cartridge	2.1 x 30	3.5	873700-902	873700-906	
RR	Rapid Resolution Cartridge, 3/pk	2.1 x 30	3.5	873700-932	873700-936	
RR	Rapid Resolution Cartridge	2.1 x 15	3.5	875700-902	875700-906	
RR	Rapid Resolution Cartridge, 3/pk	2.1 x 15	3.5	875700-932	875700-936	

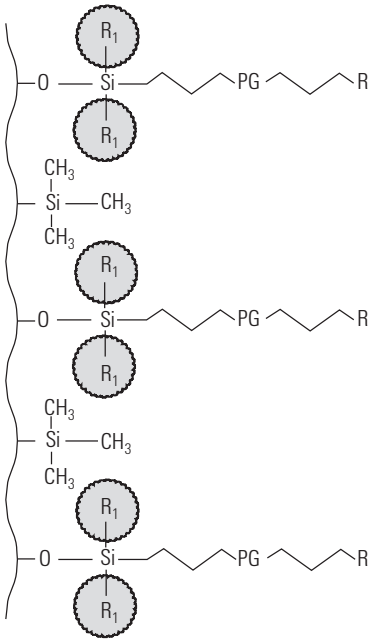
(Continued)

ZORBAX 80Å StableBond

Hardware	Description	Size (mm)	Particle Size (µm)	SB-C18 USP L1	SB-C8 USP L7	SB-Phenyl USP L11
Rapid Resolution HT Cartridges (require hardware kit 820555-901)						
RR	Rapid Resolution HT Cartridge	4.6 x 50	1.8	825975-902		
RR	Rapid Resolution HT Cartridge, 3/pk	4.6 x 50	1.8	825975-932		
RR	Rapid Resolution HT Cartridge	4.6 x 30	1.8	823975-902		
RR	Rapid Resolution HT Cartridge, 3/pk	4.6 x 30	1.8	823975-932		
RR	Rapid Resolution HT Cartridge	4.6 x 15	1.8	821975-902		
RR	Rapid Resolution HT Cartridge, 3/pk	4.6 x 15	1.8	821975-932		
RR	Rapid Resolution HT Cartridge	2.1 x 50	1.8	825700-902		
RR	Rapid Resolution HT Cartridge, 3/pk	2.1 x 50	1.8	825700-932		
RR	Rapid Resolution HT Cartridge	2.1 x 30	1.8	823700-902		
RR	Rapid Resolution HT Cartridge, 3/pk	2.1 x 30	1.8	823700-932		
RR	Rapid Resolution HT Cartridge	2.1 x 15	1.8	821700-902		
RR	Rapid Resolution HT Cartridge, 3/pk	2.1 x 15	1.8	821700-932		
RR	Hardware Kit for RR and RRHT Cartridges			820555-901		

ZORBAX 80Å StableBond

Description	Size (mm)	Particle Size (µm)	SB-C18 USP L1
Capillary Glass-lined Columns			
Capillary	0.5 x 250	5	5064-8258
Capillary	0.5 x 150	5	5064-8256
Capillary	0.5 x 35	5	5064-8254
Capillary RR	0.5 x 150	3.5	5064-8262
Capillary RR	0.5 x 35	3.5	5064-8260
Capillary	0.3 x 250	5	5064-8257
Capillary	0.3 x 150	5	5064-8255
Capillary	0.3 x 35	5	5064-8253
Capillary RR	0.3 x 150	3.5	5064-8261



Unique, Polar Alkyl Bonus-RP Bonded Phase

ZORBAX Bonus-RP

- Excellent peak shape for challenging basic compounds at low and mid pH
- Unique reversed-phase selectivity
- Novel bonding technology with embedded polar group and steric protection
- Usable in 100% aqueous mobile phases

The Agilent ZORBAX Bonus-RP column has a polar amide group embedded in a long alkyl chain. This novel bonding reduces interactions between basic compounds and the silica support, improving peak shape for the most difficult basic compounds. Peak shape and column lifetime are further improved by triple endcapping. In addition, diisopropyl side groups provide steric protection against acid hydrolysis for good lifetime at low pH. The Bonus-RP column provides an alternate selectivity to C18 and C8 alkyl bonded phases.

Column Specifications

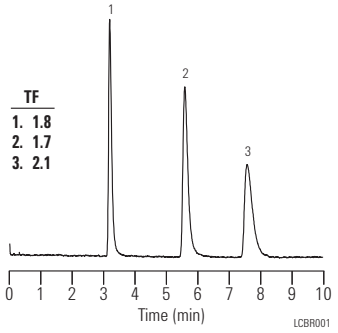
Bonded Phase	Pore Size	Surface Area	Temp. Limits*	pH Range	Endcapped	Carbon Load
ZORBAX Bonus-RP	80Å	180 m^2/g	60°C	2.0-9.0	Triple	9.5%

Specifications represent typical values only.

*Temperature limits are 60°C up to pH 8, 40°C from pH 8-9.

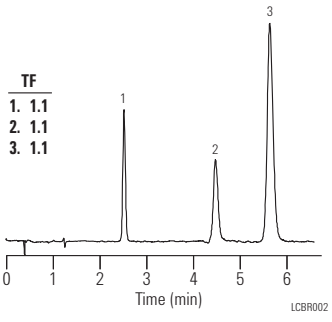
Improved Peak Shape of Basic Compounds Using Bonus-RP

Column: **Alkyl-C8**
4.6 x 150 mm, 5 µm
Mobile Phase: 75% 25 mM NH_4OAc, pH 5.5
25% ACN
Flow Rate: 1.5 mL/min
Temperature: 40°C
Detector: 254 nm



1. Doxylamine
2. Chlorpheniramine
3. Triprolidine

Column: **ZORBAX Bonus-RP**
883668-901
4.6 x 150 mm, 5 µm
Mobile Phase: 80% 25 mM NH_4OAc, pH 5.5
20% ACN
Flow Rate: 1.5 mL/min
Temperature: 40°C
Detector: 254 nm

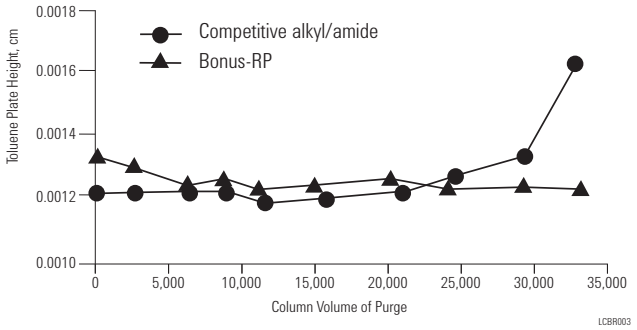


1. Doxylamine
2. Chlorpheniramine
3. Triprolidine

Bonus-RP eliminates peak tailing of these basic compounds in comparison to a typical alkyl C8 bonded phase. In the mid-pH region, residual silanols can interact more strongly with basic compounds to cause peak tailing. The polar group in the Bonus-RP bonded phase eliminates peak tailing of these basic compounds by reducing interactions with residual silanols.

ZORBAX Bonus-RP is Stable at Low and Mid pH

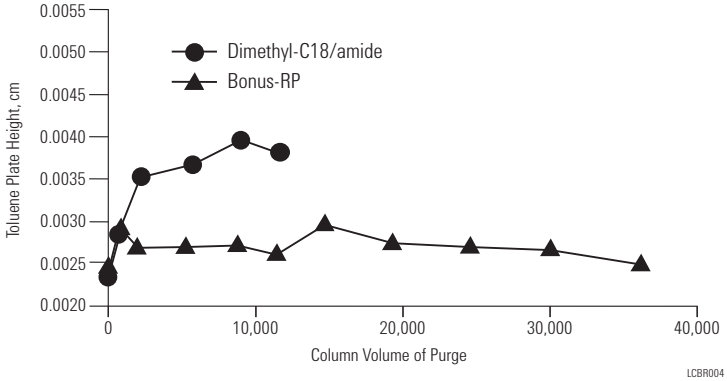
Column: **ZORBAX Bonus-RP**
883668-901
4.6 x 150 mm, 5 µm
Mobile Phase: 60% 25 mM Phosphate Buffer, pH 7.0:40% ACN
Flow Rate: 1.5 mL/min
Temperature: 23°C



Triple endcapping of Bonus-RP enhances stability at pH 7. Each 10,000 column volume is equivalent to approximately one working month.

Dimethyl-C18/amide, Bonus-RP

Column: **ZORBAX Bonus-RP**
883668-901
4.6 x 150 mm, 5 µm
Mobile Phase: Aging: 50% MeOH 50% 0.1% TFA
Test: 80% MeOH 20% H_2O
Flow Rate: 1.0 mL/min
Temperature: Aging: 60°C
Test: 23°C

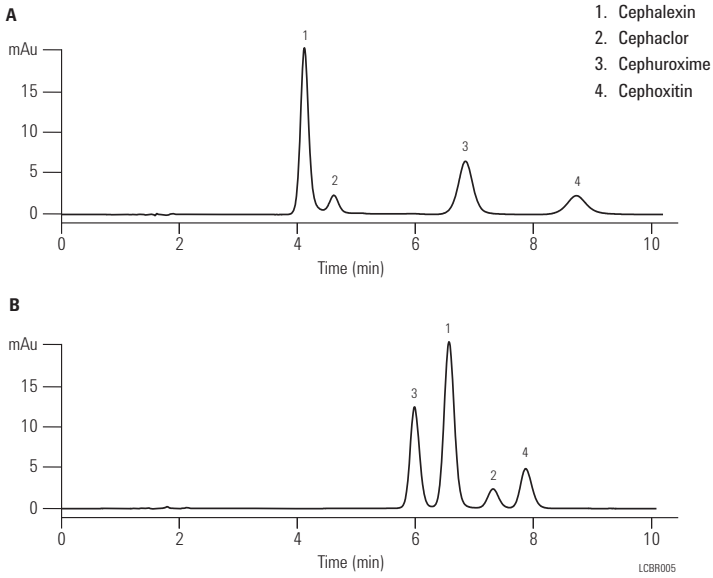


Sterically protecting side groups provide good low pH stability and longer column lifetime than similar polar alkyl bonded phases.

ZORBAX Bonus-RP Provides Unique Selectivity

Column A:	**ZORBAX Bonus-RP 883668-901 4.6 x 150 mm, 5 µm**
Column B:	**Eclipse XDB-C8 993967-906 4.6 x 150 mm, 5 µm**
Mobile Phase:	75% 25 mM Na Citrate, pH 6 25% MeOH
Flow Rate:	1.0 mL/min
Temperature:	Ambient
Detector:	254 nm
Sample:	3 µL Cephalosporins

Peak elution order can change dramatically when using Bonus-RP. In this example, the elution order of the first three peaks changes.



ZORBAX Bonus-RP

Hardware Description	Size (mm)	Particle Size (µm)	Bonus-RP USP L60
Standard Columns (no special hardware required)			
Analytical	4.6 x 250	5	880668-901
Analytical	4.6 x 150	5	883668-901
Rapid Resolution	4.6 x 250	3.5	884950-577
Rapid Resolution	4.6 x 150	3.5	863668-901
Rapid Resolution	4.6 x 100	3.5	864668-901
Rapid Resolution	4.6 x 75	3.5	866668-901
Rapid Resolution	4.6 x 50	3.5	835668-901
Rapid Resolution HT, 600 bar	4.6 x 100	1.8	828668-901
Rapid Resolution HT, 600 bar	4.6 x 75	1.8	830668-901
Rapid Resolution HT, 600 bar	4.6 x 50	1.8	827668-901

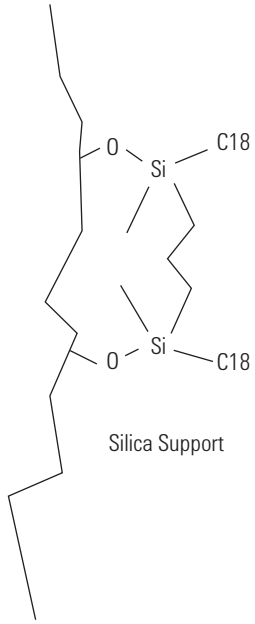
Unless indicated, column pressure limit is 400 bar.

(Continued)

ZORBAX Bonus-RP

Hardware	Description	Size (mm)	Particle Size (µm)	Bonus-RP USP L60
Standard Columns (no special hardware required)				
	Solvent Saver	3.0 x 250	5	880668-301
	Solvent Saver	3.0 x 150	5	883668-301
	Solvent Saver Plus	3.0 x 150	3.5	863668-301
	Solvent Saver Plus	3.0 x 100	3.5	864668-301
	Solvent Saver HT, 600 bar	3.0 x 100	1.8	828668-301
	Solvent Saver HT, 600 bar	3.0 x 50	1.8	827668-301
	Narrow Bore	2.1 x 150	5	883725-901
	Narrow Bore	2.1 x 50	5	861971-901
	Narrow Bore RR	2.1 x 150	3.5	863700-901
	Narrow Bore RR	2.1 x 100	3.5	861768-901
	Narrow Bore RR	2.1 x 50	3.5	861700-901
	Narrow Bore RRHT, 600 bar	2.1 x 100	1.8	828768-901
	Narrow Bore RRHT, 600 bar	2.1 x 50	1.8	827768-901
	MicroBore RR	1.0 x 150	3.5	863608-901
	MicroBore RR	1.0 x 50	3.5	865608-901
	MicroBore RR	1.0 x 30	3.5	861608-901
	MicroBore Guard, 3/pk	1.0 x 17	5	5185-5922
ZGC	Guard Cartridge, 4/pk	4.6 x 12.5	5	820950-928
ZGC	Guard Cartridge, 4/pk	2.1 x 12.5	5	821125-928
ZGC	Guard Hardware Kit			820999-901
PrepHT Cartridge Columns (require endfittings kit 820400-901)				
PI	PrepHT Cartridge	21.2 x 250	7	878250-101
PI	PrepHT Cartridge	21.2 x 150	7	878150-101
PI	PrepHT Cartridge	21.2 x 150	5	868150-901
PI	PrepHT Cartridge	21.2 x 100	5	868100-901
PI	PrepHT Cartridge	21.2 x 50	5	868050-901
PI	PrepHT endfittings, 2/pk			820400-901
PI	PrepHT Guard Cartridge, 2/pk	17 x 7.5	5	820212-928
PI	Guard Cartridge Hardware			820444-901

Unless indicated, column pressure limit is 400 bar.



Novel Bidentate C18-C18 Bonding for Extend C-18 Bonded Phase

ZORBAX 80Å Extend-C18

- High efficiency and long life at high pH – up to pH 11.5
- Unique bidentate bonding and double endcapping provides high pH stability
- More efficiency and better peak shape than polymer-based columns
- Improve retention, resolution and peak shape of basic compounds
- High sensitivity for LC/MS separations of peptides

The Agilent ZORBAX Extend-C18 column uses a novel bidentate C18-C18 bonding technology to make it possible to develop high-resolution separations at high pH with a silica-based column. At high pH, non-charged basic compounds will not interact with the underlying silica. The result is high efficiency separations with superior peak shape and improved resolution. High pH separations are also the best choice for compounds that are more stable or more soluble in high pH solutions. Some of the mobile phase buffer options for high pH include triethylamine, pyrrolidine, glycine, borate and ammonium hydroxide. Ammonium hydroxide at pH 10.5 is an excellent mobile phase modifier for the LC/MS of peptides and small molecules with improved sensitivity compared with TFA containing mobile phase at low pH. The Extend-C18 column is stable from pH 2-11.5 with good peak shape for all types of compounds. Extend-C18 columns also provide an additional selectivity choice at low pH.

Column Specifications

Bonded Phase	Pore Size	Surface Area	Temp. Limits*	pH Range**	Endcapped	Carbon Load
ZORBAX Extend-C18	80Å	180 m^2/g	60°C	2.0-11.5	Double	12.5%

Specifications represent typical values only.

*Temperature limits are 60°C up to pH 8, 40°C from pH 8-11.5.

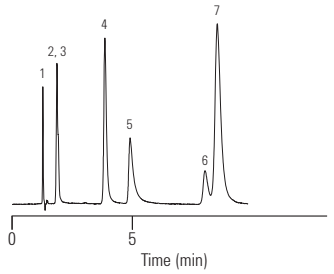
**Above pH 6 highest column stability for all silica based columns is obtained by reducing the operating temperature to 40°C or below and using lower buffer concentrations (0.01-0.02 M) or organic buffers.

Basic Antihistamines on Extend-C18 at High pH

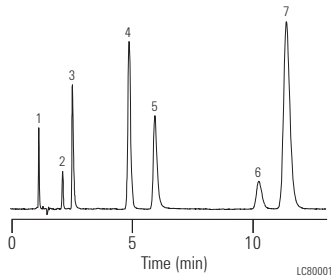
Column: **ZORBAX Extend-C18**
773450-902
4.6 x 150 mm, 5 µm
Mobile Phase: pH 7:
30% 20 mM Na_2HPO_4 70% MeOH
pH 11:
30% 20 mM TEA 70% MeOH
Flow Rate: 1.0 mL/min
Temperature: Ambient
Detector: 254 nm
Sample: Antihistamines

Pseudoephedrine and scopolamine are difficult to retain at low and mid pH. Pseudoephedrine is often analyzed by ion exchange methods. The Extend-C18 column retains these compounds in a noncharged form at high pH and improves resolution.

pH 7



pH 11



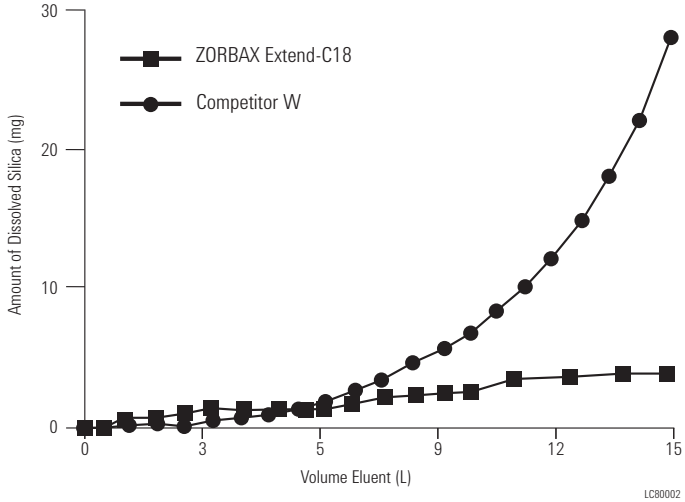
LC80001

1. Maleate
2. Scopolamine
3. Pseudoephedrine
4. Doxylamine
5. Chlorpheniramine
6. Triprolidine
7. Diphenhydramine

Long Life at High pH with Extend-C18

Column: **ZORBAX Extend-C18**
773450-902
4.6 x 150 mm, 5 µm
Mobile Phase: 20% Methanol
80% 0.1 M Carbonate Buffer, pH 10.0
Flow Rate: 1.0 mL/min
Temperature: Ambient

At high pH, columns will fail due to silica dissolution. The example here shows extended lifetime of ZORBAX Extend-C18 at high pH in comparison to competitor W. This was measured by the amount of dissolved silica.

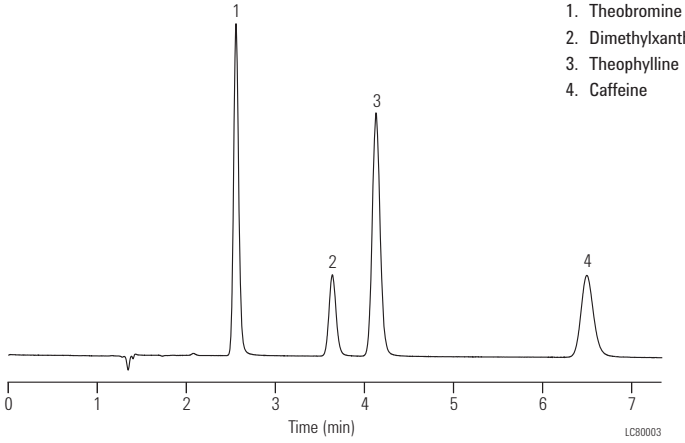


LC80002

Extend-C18 Provides Good Peak Shape at Low pH

Column: **ZORBAX Extend-C18**
773450-902
4.6 x 150 mm, 5 µm

Mobile Phase: 80% 25 mM NaH_2PO_4, pH 3.0
20% Methanol
Flow Rate: 1.0 mL/min
Temperature: 35°C
Detector: 254 nm
Sample: Basic Compounds



1. Theobromine
2. Dimethylxanthine
3. Theophylline
4. Caffeine

These basic compounds are separated on the Extend-C18 at low pH with excellent peak shape. The Extend-C18 column can be used at high and low pH.

ZORBAX 80Å Extend-C18

Hardware Description	Size (mm)	Particle Size (µm)	Extend-C18 USP L1
Standard Columns (no special hardware required)			
Analytical	4.6 x 250	5	770450-902
Analytical	4.6 x 150	5	773450-902
Analytical	4.6 x 50	5	746450-902
Rapid Resolution	4.6 x 150	3.5	763953-902
Rapid Resolution	4.6 x 100	3.5	764953-902
Rapid Resolution	4.6 x 75	3.5	766953-902
Rapid Resolution	4.6 x 50	3.5	735953-902
Rapid Resolution HT, 600 bar	4.6 x 100	1.8	728975-902
Rapid Resolution HT, 600 bar	4.6 x 50	1.8	727975-902
Rapid Resolution HT, 600 bar	4.6 x 30	1.8	724975-902
Rapid Resolution HT, 600 bar	4.6 x 20	1.8	726975-902
Solvent Saver	3.0 x 250	5	770450-302
Solvent Saver	3.0 x 150	5	773450-302
Solvent Saver Plus	3.0 x 150	3.5	763954-302
Solvent Saver Plus	3.0 x 100	3.5	764953-302
Solvent Saver Plus	3.0 x 50	3.5	735954-302

Unless indicated, column pressure limit is 400 bar.

(Continued)

ZORBAX 80Å Extend-C18

Hardware	Description	Size (mm)	Particle Size (µm)	Extend-C18 USP L1
Standard Columns (no special hardware required)				
	Solvent Saver RRHD, 1200 bar	3.0 x 100	1.8	758700-302
	Solvent Saver RRHD, 1200 bar	3.0 x 50	1.8	757700-302
	Solvent Saver HT, 600 bar	3.0 x 100	1.8	728975-302
	Solvent Saver HT, 600 bar	3.0 x 50	1.8	727975-302
	Solvent Saver HT, 600 bar	3.0 x 30	1.8	724975-302
	Solvent Saver HT, 600 bar	3.0 x 20	1.8	726975-302
	Narrow Bore	2.1 x 150	5	773700-902
	Narrow Bore	2.1 x 50	5	760450-902
	Narrow Bore RR	2.1 x 100	3.5	761753-902
	Narrow Bore RR	2.1 x 50	3.5	735700-902
	Narrow Bore RRHD, 1200 bar	2.1 x 150	1.8	759700-902
	Narrow Bore RRHD, 1200 bar	2.1 x 100	1.8	758700-902
	Narrow Bore RRHD, 1200 bar	2.1 x 50	1.8	757700-902
	Narrow Bore RRHT, 600 bar	2.1 x 100	1.8	728700-902
	Narrow Bore RRHT, 600 bar	2.1 x 50	1.8	727700-902
	Narrow Bore RRHT, 600 bar	2.1 x 30	1.8	724700-902
	Narrow Bore RRHT, 600 bar	2.1 x 20	1.8	726700-902
	MicroBore RR	1.0 x 150	3.5	763600-902
	MicroBore RR	1.0 x 50	3.5	765600-902
	MicroBore RR	1.0 x 30	3.5	761600-902
	MicroBore Guard, 3/pk	1.0 x 17	5	5185-5923
ZGC	Guard Cartridge, 4/pk	4.6 x 12.5	5	820950-930
ZGC	Guard Cartridge, 4/pk	2.1 x 12.5	5	821125-930
ZGC	Guard Hardware Kit			820999-901
PrepHT Cartridge Columns (require endfittings kit 820400-901)				
PI	PrepHT Cartridge	21.2 x 150	5	770150-902
PI	PrepHT	21.2 x 100	5	770100-902
PI	PrepHT	21.2 x 50	5	770050-902
PI	PrepHT endfittings, 2/pk			820400-901
PI	PrepHT Guard Cartridge, 2/pk	17 x 7.5	5	820212-930
PI	Guard Cartridge Hardware			820444-901

Unless indicated, column pressure limit is 400 bar.

ZORBAX Rx

- Recommended for alternate selectivity at low pH relative to Eclipse XDB-C18 and StableBond SB-C18; for higher temperature applications, StableBond is recommended
- Higher carbon load than SB-C18 columns (12% vs. 10%).
- High stability and good peak shape for low pH applications (up to pH 8)
- Manufactured using dimethyloctadecylsilane and non-endcapped
- Same product as SB-C8

Column Specifications

Bonded Phase	Pore Size	Surface Area	Temp. Limits	pH Range*	Endcapped	Carbon Load
ZORBAX Rx-C18	80Å	180 m^2/g	60°C	2.0-8.0	No	12%
ZORBAX Rx-C8	80Å	180 m^2/g	80°C	1.0-8.0	No	5.5%

Specifications represent typical values only.

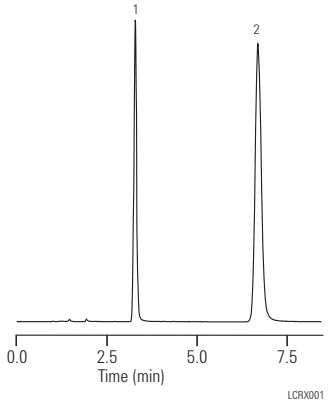
*At pH 6-9 highest column stability for all silica based columns is obtained by operating at temperatures <40°C and using lower buffer concentrations in the range of 0.01-0.02 M.

Analysis of Diazepam on Rx-C18

Column: **ZORBAX Rx-C18**
880967-302
3.0 x 250 mm, 5 µm

Mobile Phase: 35% H_2O:65% MeOH

Flow Rate: 0.5 mL/min



1. Ethylparaben
2. Diazepam

An Rx-C18 column is used for this USP analysis of diazepam and the internal standard ethylparaben. The Solvent Saver 3.0 mm ID Rx-C18 column reduces solvent usage by 60% over what would be used if the analysis was done on a 4.6 x 250 mm column.

ZORBAX Rx

Hardware	Description	Size (mm)	Particle Size (µm)	Rx-C18 USP L1	Rx-C8 USP L7*
	Semi-Preparative	9.4 x 250	5	880967-202	880967-201
	Analytical	4.6 x 250	5	880967-902	880967-901
	Analytical	4.6 x 150	5	883967-902	883967-901
	Rapid Resolution	4.6 x 150	3.5	863967-902	
	Rapid Resolution	4.6 x 100	3.5	861967-902	
	Rapid Resolution	4.6 x 75	3.5	866967-902	
	Solvent Saver	3.0 x 250	5	880967-302	
	Solvent Saver	3.0 x 150	5	883967-302	
	Solvent Saver Plus	3.0 x 150	3.5	863967-302	
	Solvent Saver Plus	3.0 x 100	3.5	861967-302	
	Narrow Bore	2.1 x 150	5	883700-902	
	Narrow Bore RR	2.1 x 100	3.5	861767-902	
P	Guard Cartridge, 2/pk	9.4 x 15	7	820675-115	820675-115
ZGC	Guard Cartridge, 4/pk	4.6 x 12.5	5	820950-914	820950-913
ZGC	Guard Cartridge, 4/pk	2.1 x 12.5	5	821125-915	821125-915
P	Guard Hardware Kit	9.4 x 15		840140-901	840140-901
ZGC	Guard Hardware Kit			820999-901	820999-901
PrepHT Cartridge Columns (require endfittings kit 820400-901)					
PI	PrepHT Cartridge	21.2 x 250	7	877967-102	877250-106
PI	PrepHT Cartridge	21.2 x 150	7		877150-106
PI	PrepHT Cartridge	21.2 x 150	5		870150-906
PI	PrepHT Cartridge	21.2 x 100	5		870100-906
PI	PrepHT Cartridge	21.2 x 50	5		870050-906
PI	PrepHT Guard Cartridge, 2/pk		5	820212-914	820212-915
PI	Guard Cartridge Hardware			820444-901	820444-901
PI	PrepHT endfittings, 2/pk			820400-901	820400-901

*Rx-C8 is the same product as SB-C8. For other sizes and configurations, see the ZORBAX StableBond section.
Turn to pages 841–848.

Pursuit HPLC Columns

Beginning in drug discovery and drug metabolism, Pursuit columns are ideal for analyzing lead compounds and biological samples. The column's performance is due to the unique combination of advanced bonding chemistry and ultra-high purity silica. These factors combine to provide rapid separations with excellent first time resolution and symmetrical peaks for polar compounds, whether at pH 1.5 or 10. Additionally, the need for ion pairing agents such as TFA is often eliminated, thus maximizing the performance of single and parallel multi-channel LC/MS systems.

Culminating in QC, Pursuit is ideal for implementing dependable trouble-free analysis of raw materials and approved drugs. Rigorous control and validation of each step in the manufacturing process ensures column reproducibility. With Pursuit your laboratory can spend its energy on producing results.

Special selectivities such as Pursuit PFP (for very polar compounds) and Pursuit PAH (environmental) give you the extra selectivities you need for your most challenging applications.

Pursuit

For LC/MS and high throughput applications. Built on the larger 200Å pore size silica, high ligand density delivers up to 40% faster separations without sacrificing resolution. This is accomplished by optimizing mass transfer with the larger pore size.

Pursuit XRs

For performance in analytical R&D, QC and preparative applications. Combining high ligand density with a 100Å pore size, high surface area silica, Pursuit XRs columns are designed to increase productivity, as they offer maximum loadability, excellent stability and easy scalability while maintaining superior resolution.

Pursuit XRs$^{Ultra\ 2.8}$

For the ultimate in speed and good resolution on any instrument, we designed the Pursuit XRs$^{Ultra\ 2.8}$ around an optimized 2.8 µm particle and an advanced packing procedure. Now you can decrease your run time while maintaining resolution. Lower backpressure allows high flow rates to be used, and the 2.8 µm particles of ultra-pure silica delivers 10-15% higher efficiency than 3 µm columns.

Pursuit UPS$^{2.4}$

For maximum efficiency, particularly in high viscosity solvent separations. With an optimized 2.4 µm particle, Pursuit UPS columns offer approximately 50% lower backpressure compared to sub-2 µm columns, delivering higher speed and resolution without the need for ultra-high pressure equipment.

Pursuit UPS$^{1.9}$

Pursuit UPS$^{1.9}$ columns deliver sub-2 µm efficiencies when sensitivity, resolution, and throughput are critical. These columns excel under the high pressures and fast gradients demanded by today's pharmaceutical industry, up to a pressure limit of 1000 bar.

Column Specifications

Bonded Phase	Pore Size	Surface Area	pH Range	Endcapped	Carbon Load	Pore Volume	Ligand Coverage
Pursuit C18	200Å	200 m^2/g	1.5-10	Yes	12.9%	1.1 mL/g	3.5 µmol/m^2
Pursuit C8	200Å	200 m^2/g	1.5-10	Yes	7.4%	1.1 mL/g	3.8 µmol/m^2
Pursuit Diphenyl	200Å	200 m^2/g	1.5-8.0	Yes	7.3%	1.1 mL/g	2.8 µmol/m^2
Pursuit PFP	200Å	200 m^2/g	1.5-10	Yes	6.3%	1.1 mL/g	3.4 µmol/m^2
Pursuit PAH	200Å	200 m^2/g	1.5-10	Yes		1.1 mL/g	
Pursuit XRs C18	100Å	440 m^2/g	1.5-10	Yes	22%	1.1 mL/g	2.9 µmol/m^2
Pursuit XRs C8	100Å	440 m^2/g	1.5-10	Yes	15%	1.1 mL/g	3.7 µmol/m^2
Pursuit XRs Diphenyl	100Å	440 m^2/g	1.5-8.0	Yes	14.6%	1.1 mL/g	2.6 µmol/m^2
Pursuit XRs Si	100Å	440 m^2/g	1.5-10	Yes		1.1 mL/g	
Pursuit XRs$^{Ultra\ 2.8}$ C18	100Å	440 m^2/g	1.5-10	Yes	23.2%	1.1 mL/g	3.2 µmol/m^2
Pursuit XRs$^{Ultra\ 2.8}$ C8	100Å	440 m^2/g	1.5-10	Yes	15%	1.1 mL/g	3.7 µmol/m^2
Pursuit XRs$^{Ultra\ 2.8}$ Diphenyl	100Å	440 m^2/g	1.5-8.0	Yes	14.6%	1.1 mL/g	2.6 µmol/m^2
Pursuit UPS$^{2.4}$ C18	100Å	350 m^2/g	1.5-10	Yes	21%	0.9 mL/g	2.5 µmol/m^2
Pursuit UPS$^{1.9}$ C18	100Å	350 m^2/g	1.5-10	Yes	21%	0.9 mL/g	3.0 µmol/m^2

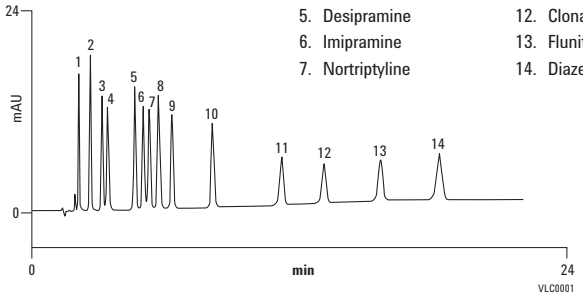
Specifications represent typical values only.

Tricyclic antidepressants and benzodiazepines

Column: **Pursuit XRs C18**
A6000150X046
4.6 x 150 mm, 5 µm

Mobile Phase: A: Water+0.1% HCOOH
B: MeCN+0.1% HCOOH
Gradient: 30-40% B in 15 min, hold at 40% B for 15 min
Flow Rate: 1.0 mL/min
Temperature: Ambient
Detector: UV, 254 nm

1. 7-Aminoclonazepam
2. 7-Aminoflunitrazepam
3. Nordoxepin
4. Doxepin
5. Desipramine
6. Imipramine
7. Nortriptyline
8. Amitriptyline
9. Trimipramine
10. Clomipramine
11. Nordiazepam
12. Clonazepam
13. Flunitrazepam
14. Diazepam



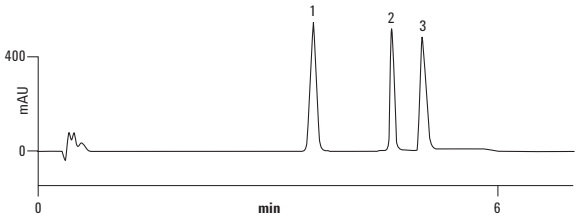
Mechanical stability of Pursuit XRs

Column: **Pursuit XRs C18**
A6000050X020
2.0 x 50 mm, 5 µm

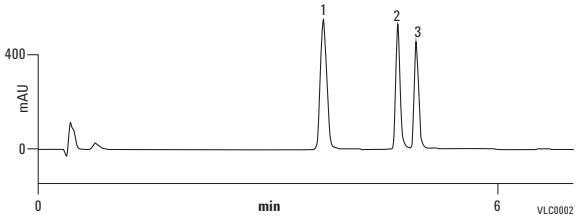
Sample: DMSO mix
Mobile Phase: A: MeOH:water, 10:90 + 0.1% HCOOH
B: MeOH:water, 90:10 + 0.1% HCOOH
Gradient: 0-100% B in 3 min, back to 0% B
in 0.5 min, hold at 0% B for 3.5 min
Flow Rate: 0.4 mL/min
Temperature: Ambient
Detector: UV, 254 nm

1. 4-Methoxybenzenesulfonamide
2. Methyl 3-aminothiophene-2-carboxylate
3. Trimipramine

Injection 1

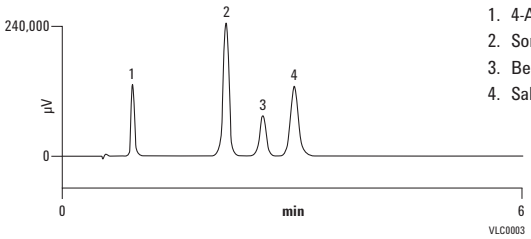


Injection 5000



Antifungals

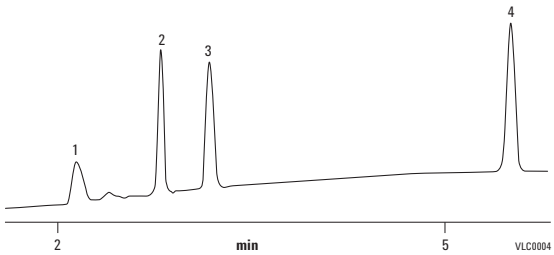
Column: **Pursuit XRs$^{Ultra\ 2.8}$ Diphenyl**
A7521050X020
2 x 50 mm, 2.8 µm
Mobile Phase: Water+0.1% HCOOH:MeCN+0.1% HCOOH, 80:20
Flow Rate: 0.4 mL/min
Temperature: Ambient
Detector: UV, 254 nm



1. 4-Aminobenzoic acid
2. Sorbic acid
3. Benzoic acid
4. Salicylic acid

Liquid chromatography phase test mixture (LPTM) on Pursuit C8

Column: **Pursuit C8**
A3031050X020
2.0 x 50 mm, 3 µm
Mobile Phase: A: 0.05% HCOOH in water
B: 0.05% HCOOH in MeCN
Flow Rate: 0.6 mL/min
Detector: UV, 220 nm



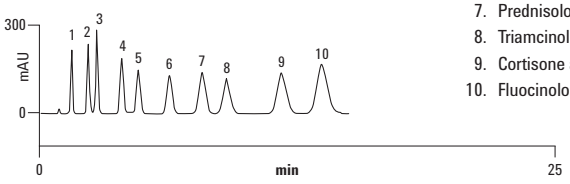
1. Aspartame
2. Cortisone
3. Reserpine
4. Dioctyl phthalate

Adrenocorticosteroids on Pursuit PFP and C18

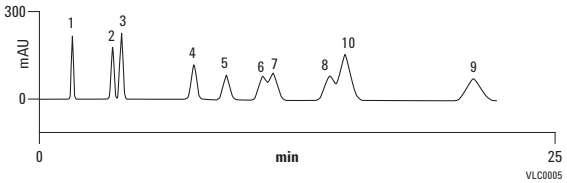
Mobile Phase: MeCN:water, 22.5:77.5
Flow Rate: 1.5 mL/min
Temperature: Ambient
Detector: UV, 240 nm

1. Triamcinolone
2. Prednisolone
3. Cortisone
4. Methylprednisolone
5. Corticosterone
6. Beclomethasone
7. Prednisolone acetate
8. Triamcinolone acetonide
9. Cortisone acetate
10. Fluocinolone acetonide

Pursuit PFP



Pursuit C18



Pursuit HPLC Columns

Size (mm)	Particle Size (µm)	Pursuit C18 USP L1	Pursuit C8 USP L7	Pursuit Diphenyl	Pursuit PFP	Pursuit PAH USP L1
50 x 250	10	A3002250X500	A3032250X500			
21.2 x 250	10	A3002250X212	A3032250X212			
21.2 x 150	10	A3002150X212				
21.2 x 250	5	A3000250X212			A3050250X212	
21.2 x 150	5	A3000150X212			A3050150X212	
21.2 x 100	5			A3040100X212		
10 x 250	10	A3002250X100	A3032250X100			
10 x 150	5	A3000150X100			A3050150X100	
10 x 250	5	A3000250X100	A3030250X100		A3050250X100	
4.6 x 250	10	A3002250X046	A3032250X046			
4.6 x 150	10	A3002150X046	A3032150X046			
4.6 x 100	10					
4.6 x 250	5	A3000250X046	A3030250X046	A3040250X046	A3050250X046	A7000250X046
4.6 x 150	5	A3000150X046	A3030150X046	A3040150X046	A3050150X046	A7000150X046
4.6 x 100	5	A3000100X046	A3030100X046	A3040100X046	A3050100X046	
4.6 x 50	5	A3000050X046	A3030150X046	A3040050X046	A3050050X046	
4.6 x 250	3	A3001250X046	A3031250X046	A3041250X046	A3051250X046	
4.6 x 150	3	A3001150X046	A3031150X046	A3041150X046	A3051150X046	
4.6 x 100	3	A3001100X046	A3031100X046	A3041100X046	A3051100X046	A7001100X046
4.6 x 50	3	A3001050X046		A3041050X046	A3051050X046	
4.6 x 30	3	A3001030X046				
4.0 x 250	5	A3000250X040				
4.0 x 125	5	A3000125X040				
3.9 x 300	10	A3002300X039				
3.9 x 300	5	A3000300X039				
3.9 x 150	5	A3000150X039				
3.0 x 250	5	A3000250X030		A3040250X030		
3.0 x 150	5	A3000150X030		A3040150X030	A3050150X030	
3.0 x 100	5	A3000100X030			A3050100X030	
3.0 x 250	3	A3001250X030				
3.0 x 150	3	A3001150X030		A3041150X030	A3051150X030	
3.0 x 100	3	A3001100X030		A3041100X030	A3051100X030	A7001100X030
3.0 x 50	3	A3001050X030		A3041050X030	A3051050X030	
2.0 x 250	5	A3000250X020				
2.0 x 150	5	A3000150X020	A3030150X020	A3040150X020		

(Continued)

Pursuit HPLC Columns

Size (mm)	Particle Size (µm)	Pursuit C18 USP L1	Pursuit C8 USP L7	Pursuit Diphenyl	Pursuit PFP	Pursuit PAH USP L1
2.0 x 100	5	A3000100X020	A3030100X020	A3040100X020	A3050100X020	
2.0 x 50	5	A3000050X020	A3030050X020	A3040050X020	A3050050X020	
2.0 x 30	5	A3000030X020		A3040030X020	A3050030X020	
2.0 x 20	5	A3000020X020			A3050020X020	
2.0 x 250	3	A3001250X020		A3041250X020		
2.0 x 200	3			A3041200X020		
2.0 x 150	3	A3001150X020	A3031150X020	A3041150X020	A3051150X020	
2.0 x 100	3	A3001100X020	A3031100X020	A3041100X020	A3051100X020	A7001100X020
2.0 x 50	3	A3001050X020	A3031050X020	A3041050X020	A3051050X020	
2.0 x 30	3	A3001030X020	A3031030X020	A3041030X020	A3051030X020	
2.0 x 20	3	A3001020X020		A3041020X020	A3051020X020	

Pursuit ChromSep Complete Cartridge Systems

Hardware	Size (mm)	Particle Size (µm)	Pursuit C18 USP L1	Pursuit C8 USP L7	Pursuit PAH USP L1
CS	4.6 x 250	5	A3000250C046	A3030250C046	A7000250C046
CS	4.6 x 250	3		A3031250C046	
CS	4.6 x 150	5	A3000150C046	A3030150C046	A7000150C046
CS	4.6 x 100	5	A3000100C046	A3030100C046	
CS	4.6 x 150	3	A3001150C046	A3031150C046	A7001150C046
CS	4.6 x 100	3	A3001100C046	A3031100C046	A7001100C046
CS	4.6 x 50	3	A3001050C046		
CS	3.0 x 250	5	A3000250C030		
CS	3.0 x 150	5	A3000150C030		
CS	3.0 x 100	5	A3000100C030		A7000100C030
CS	3.0 x 150	3	A3001150C030		
CS	3.0 x 100	3	A3001100C030		
CS	2.0 x 250	5	A3000250C020		
CS	2.0 x 150	5	A3000150C020	A3030150C020	
CS	2.0 x 100	5	A3000100C020		
CS	2.0 x 150	3	A3001150C020		
CS	2.0 x 100	3	A3001100C020		
CS	2.0 x 50	3	A3001050C020		

Pursuit ChromSep Replacement Cartridges

Hardware	Size (mm)	Particle Size (µm)	Unit	Pursuit C18 USP L1	Pursuit C8 USP L7	Pursuit PAH USP L1
CS	4.6 x 250	5				A7000250R046
			3/pk			A7000250T046
CS	4.6 x 150	5		A3000150R046	A3030150R046	A7000150R046
			3/pk	A3000150T046	A3030150T046	A7000150T046
CS	4.6 x 150	3			A3031150R046	A7001150R046
			3/pk		A3031150T046	A7001150T046
CS	4.6 x 100	3				A7001100R046
			3/pk			A7001100T046
CS	4.6 x 50	3		A3001050R046		
			3/pk	A3001050T046		
CS	3.0 x 150	5		A3000150R030		
			3/pk	A3000150T030		
CS	3.0 x 100	5		A3000100R030		A7000100R030
			3/pk	A3000100T030		A7000100T030
CS	3.0 x 150	3		A3001150R030		
			3/pk	A3001150T030		
CS	3.0 x 100	3		A3001100R030		A7001100R030
			3/pk	A3001100T030		A7001100T030
CS	2.0 x 50	3			A3031050R020	
			3/pk		A3031050T020	

Pursuit XRs HPLC Columns

Size (mm)	Particle Size (µm)	Pursuit XRs C18 USP L1	Pursuit XRs C8 USP L7	Pursuit XRs Diphenyl	Pursuit XRs Si USP L3
50.0 x 250	10	A6002250X500		A6002250X500	A6004250X500
30.0 x 250	5	A6000250X300			A6004250X300
30.0 x 150	5	A6000150X300		A6020150X300	
30.0 x 100	5	A6000100X300			
30.0 x 50	5	A6000050X300			
21.2 x 250	10	A6002250X212	A6012250X212		A6004250X212
21.2 x 250	5	A6000250X212		A6020250X212	
21.2 x 150	5	A6000150X212			
21.2 x 100	5	A6000100X212		A6020100X212	
21.2 x 50	5	A6000050X212			
21.2 x 30	5	A6000030X212			

(Continued)

Pursuit XRs HPLC Columns

Size (mm)	Particle Size (µm)	Pursuit XRs C18 USP L1	Pursuit XRs C8 USP L7	Pursuit XRs Diphenyl	Pursuit XRs Si USP L3
10.0 x 250	10	A6002250X100			A6004250X100
10.0 x 250	5	A6000250X100		A6020250X100	
10.0 x 150	5	A6000150X100			
10.0 x 50	5	A6000050X100			
10.0 x 150	3			A6021150X100	
4.6 x 250	10	A6002250X046			A6004250X046
4.6 x 50	10	A6002050X046S			
4.6 x 250	5	A6000250X046	A6010250X046	A6020250X046	
4.6 x 150	5	A6000150X046	A6010150X046	A6020150X046	
4.6 x 100	5	A6000100X046	A6010100X046	A6020100X046	A6006100X046
4.6 x 50	5	A6000050X046		A6020050X046	A6006050X046
4.6 x 250	3	A6001250X046		A6021250X046	
4.6 x 150	3	A6001150X046	A6010150X046	A6021150X046	
4.6 x 100	3	A6001100X046	A6011100X046	A6021100X046	A6005100X046
4.6 x 50	3	A6001050X046	A6011050X046	A6021050X046	A6005050X046
4.6 x 30	3	A6001030X046		A6021030X046	
4.0 x 250	5	A6000250X040	A6010250X040		
4.0 x 150	5	A6000150X040	A6010150X040		
3.0 x 250	5	A6000250X030			
3.0 x 150	5	A6000150X030			
3.0 x 100	5	A6000100X030			
3.0 x 150	3	A6001150X030		A6021150X030	
3.0 x 100	3	A6001100X030		A6021100X030	
3.0 x 50	3	A6001050X030		A6021050X030	
3.0 x 30	3	A6001030X030			
2.1 x 100	5				A6006100X021
2.0 x 250	5	A6000250X020		A6020250X020	
2.0 x 150	5	A6000150X020	A6010150X020	A6020150X020	
2.0 x 100	5	A6000100X020	A6010100X020		
2.0 x 50	5	A6000050X020	A6010050X020	A6020050X020	
2.0 x 30	5	A6000030X020			
2.0 x 250	3	A6001250X020		A6021250X020	
2.0 x 150	3	A6001150X020	A6011150X020	A6021150X020	
2.0 x 100	3	A6001100X020	A6011100X020	A6021100X020	
2.0 x 50	3	A6001050X020	A6011050X020	A6021050X020	A6005050X020
2.0 x 30	3			A6021030X020	
2.0 x 20	3	A6001020X020			
1.0 x 150	3	A6001150X010			
1.0 x 100	3	A6001100X010		A6021100X010	

Pursuit XRs$^{Ultra\ 2.8}$ HPLC Columns

Size (mm)	Particle Size (µm)	Pursuit XRs$^{Ultra\ 2.8}$ C18	Pursuit XRs$^{Ultra\ 2.8}$ C8	Pursuit XRs$^{Ultra\ 2.8}$ Diphenyl
3.0 x 150	2.8	A7501150X030	A7511150X030	
3.0 x 100	2.8	A7501100X030		
2.0 x 150	2.8	A7501150X020		
2.0 x 100	2.8	A7501100X020	A7511100X020	A7521100X020
2.0 x 50	2.8	A7501050X020	A7511050X020	A7521050X020
2.0 x 30	2.8	A7501030X020	A7511030X020	A7521030X020

Pursuit UPS$^{2.4}$ HPLC Columns

Size (mm)	Particle Size (µm)	Pursuit UPS$^{2.4}$
3.0 x 100	2.4	A8100100X030H
3.0 x 50	2.4	A8100050X030H
2.0 x 100	2.4	A8100100X020H
2.0 x 50	2.4	A8100050X020H
2.0 x 30	2.4	A8100030X020H

Pursuit UPS$^{1.9}$ HPLC Columns

Size (mm)	Particle Size (µm)	Pursuit UPS$^{1.9}$ C18	Pursuit UPS$^{1.9}$ Diphenyl
3.0 x 100	1.9	A8000100X030H	A8020100X030H
3.0 x 50	1.9	A8000050X030H	A8020050X030H
2.0 x 100	1.9	A8000100X020H	A8020100X020H
2.0 x 50	1.9	A8000050X020H	A8020050X020H
2.0 x 30	1.9	A8000030X020H	A8020030X020H

Polaris HPLC Columns

In areas like drug discovery where target compounds are increasingly polar, it is critical to have a reverse phase column that performs well under aqueous conditions. Retention is critical, but cannot come with troublesome secondary interactions. Likewise, phase collapse and shifting retention times need to be avoided. The answer is our Polaris line of polar-modified columns.

From the collapse-resistant pore structure of our base silica, to the "wettability" engineered into the bonded phases, Polaris columns have been designed for high aqueous conditions. The combination of high phase density bonding, ultra pure silica, and silanol shielding leads to excellent peak shape among polar-modified columns.

As a family, Polaris offers a variety of polar modifications in both C18 and C8 chemistries.

Polaris C18-A

Polaris C18-A is the best starting place for separations where the benefits of polar-modified columns are desired. The polar modifications of C18-A help it avoid poor peak shape and retention issues in low organic conditions.

Polaris C8-A

Polaris C8-A offers an alternative selectivity to standard C8 phases and has a lower hydrophobicity than Polaris C18-A, making it ideal for polar samples, or faster overall analysis times.

Polaris C18-Ether

Polaris C18-Ether offers an alternative selectivity to Polaris C18-A and standard C18 phases, and typically delivers increased retention of polar compounds away from the void volume.

Polaris C8-Ether

Polaris C8-Ether offers an alternative selectivity to Polaris C8-A with particular utility for hydrogen bonding compounds.

Column Specifications

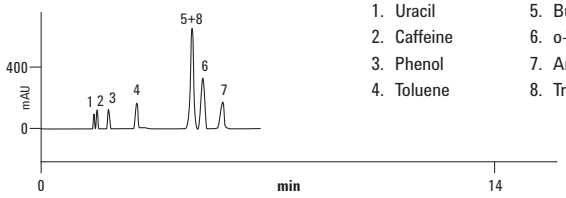
Bonded Phase	Pore Size	Surface Area	Carbon Load	Endcapped	Pore Volume	Ligand Coverage
Polaris C18-A	180Å	200 m^2/g	13.8%	Yes	1.1 cm^3/g	3.9 µmol/m^2
Polaris C8-A	180Å	200 m^2/g	7.4%	Yes	1.1 cm^3/g	4.8 µmol/m^2
Polaris C18-Ether	180Å	200 m^2/g	12.1%	Yes	1.1 cm^3/g	3.3 µmol/m^2
Polaris C8-Ether	180Å	200 m^2/g	7.1%	Yes	1.1 cm^3/g	4.5 µmol/m^2

Specifications represent typical values only.

Selectivity text mix for Polaris columns

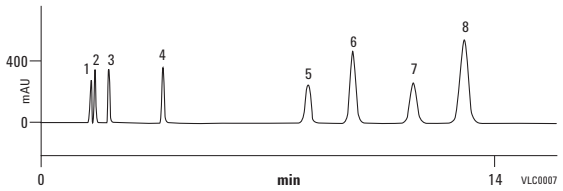
Mobile Phase: MeCN:water 70:30
Flow Rate: 1.0 mL/min
Temperature: Ambient
Detector: UV, 254 nm

Polaris C8-A



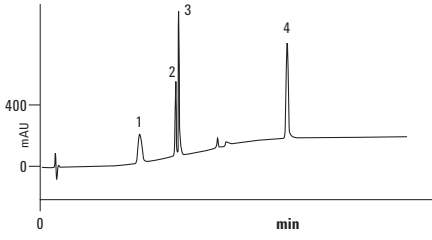
1. Uracil
2. Caffeine
3. Phenol
4. Toluene
5. Butylbenzene
6. o-Terphenyl
7. Amylbenzene
8. Triphenylene

Polaris C18-A



LC/MS performance test mix for Polaris C8-A

Column: **Polaris C8-A**
A2011030X030
3.0 x 30 mm, 3 µm
Mobile Phase: A: Water+0.05% HCOOH
B: MeCN+0.05% HCOOH
Gradient: 5-90% B in 3 min and hold for 4 min
Flow Rate: 0.6 mL/min
Temperature: Ambient
Detector: UV, 220 nm



1. Aspartame
2. Cortisone
3. Reserpine
4. Dioctyl phthalate

Polaris HPLC Columns

Size (mm)	Particle Size (µm)	Polaris C18-A	Polaris C8-A	Polaris C18-Ether	Polaris C8-Ether	Polaris NH2	Polaris Si-A
50 x 250	10	A2002250X500					A2004250X500
30 x 100	5	A2000100X300					
21.2 x 250	10	A2002250X212					A2004250X212
21.2 x 250	5	A2000250X212	A2010250X212	A2020250X212	A2030250X212	A2013250X212	A2003250X212
21.2 x 150	5	A2000150X212					A2003150X046
21.2 x 100	5	A2000100X212					
21.2 x 50	5						A2003050X212
10 x 250	5	A2000250X100		A2020250X100	A2030250X100	A2013250X100	
10 x 50	3			A2021050X100			
4.6 x 250	10	A2002250X046					A2003250X046
4.6 x 250	5	A2000250X046	A2010250X046	A2020250X046	A2030250X046	A2013250X046	
4.6 x 200	5	A2000200X046					
4.6 x 150	5	A2000150X046	A2010150X046	A2020150X046	A2030150X046	A2013150X046	A2003150X046
4.6 x 100	5	A2000100X046	A2010100X046			A2013100X046	A2003100X046
4.6 x 50	5	A2000050X046		A2020050X046		A2013050X046	A2003050X046
4.6 x 30	5	A2000030X046					
4.6 x 250	3	A2001250X046		A2021250X046	A2031250X046	A2014250X046	A2005250X046
4.6 x 150	3	A2001150X046	A2011150X046			A2014150X046	A2005150X046
4.6 x 100	3	A2001100X046	A2011100X046			A2014100X046	A2005100X046
4.6 x 75	3	A2001075X046	A2011075X046				
4.6 x 50	3	A2001050X046		A2021050X046	A2031050X046	A2014050X046	A2005050X046
4.6 x 30	3	A2001030X046					
4.0 x 250	5	A2000250X040				A2013250X040	A2003250X040
4.0 x 150	5	A2000150X040				A2013150X040	A2003150X040
4.0 x 125	5					A2013125X040	A2003125X040
3.0 x 250	5	A2000250X030				A2013250X030	A2005250X046
3.0 x 150	5	A2000150X030		A2020150X030		A2013150X030	A2003150X030
3.0 x 100	5	A2000100X030				A2013100X030	A2003100X030
3.0 x 50	5	A2000050X030					A2003050X030
3.0 x 250	3	A2001250X030				A2014250X030	A2003250X030
3.0 x 200	3	A2001200X030					
3.0 x 150	3	A2001150X030		A2021150X030		A2014150X030	A2005150X030
3.0 x 100	3	A2001100X030				A2014100X030	A2005100X030
3.0 x 50	3	A2001050X030		A2021050X030	A2031050X030	A2014050X030	A2005050X030
3.0 x 30	3	A2001030X030	A2011030X030				

(Continued)

Polaris HPLC Columns

Size (mm)	Particle Size (µm)	Polaris C18-A	Polaris C8-A	Polaris C18-Ether	Polaris C8-Ether	Polaris NH2	Polaris Si-A
2.0 x 250	5	A2000250X020		A2020250X020	A2030250X020	A2013250X020	A2003250X020
2.0 x 150	5	A2000150X020	A2010150X020	A2020150X020	A2030150X020	A2013150X020	A2003150X020
2.0 x 100	5	A2000100X020				A2013100X020	A2003100X020
2.0 x 50	5	A2000050X020	A2010050X020	A2020050X020	A2030050X020	A2013050X020	A2003050X020
2.0 x 30	5	A2000030X020				A2013030X020	A2003030X020
2.0 x 20	5	A2000020X020				A2013020X020	A2003020X020
2.0 x 250	3	A2001250X020	A2011250X020	A2021250X020	A2031250X020	A2014250X020	A2005250X020
2.0 x 150	3	A2001150X020	A2011150X020	A2021150X020	A2031150X020	A2014150X020	A2005150X020
2.0 x 100	3	A2001100X020		A2021100X020	A2031100X020	A2014100X020	A2005100X020
2.0 x 75	3			A2021075X020			
2.0 x 50	3	A2001050X020	A2011050X020	A2021050X020	A2031050X020	A2014050X020	A2005050X020
2.0 x 30	3	A2001030X020		A2021050X020		A2014030X020	A2005030X020
2.0 x 20	3	A2001020X020				A2014020X020	A2005020X020

Polaris ChromSep Complete Cartridge Systems

Hardware	Size (mm)	Particle Size (µm)	Polaris C18-A
CS	4.6 x 250	5	A2000250C046
CS	4.6 x 150	5	A2000150C046
CS	4.6 x 100	5	A2000100C046
CS	4.6 x 250	3	A2001250C046
CS	4.6 x 150	3	A2001150C046
CS	3.0 x 250	5	A2000250C030
CS	3.0 x 100	5	A2000100C030
CS	2.0 x 100	5	A2000100C020
CS	2.0 x 150	3	A2001150C020
CS	2.0 x 100	3	A2001100C020
CS	2.0 x 50	3	A2001050C020

Polaris ChromSep Replacement Cartridges

Hardware	Size (mm)	Particle Size (µm)	Unit	Polaris C18-A
CS	4.6 x 250	5		A2000250R046
			3/pk	A2000250T046
CS	4.6 x 150	5		A2000150R046
			3/pk	A2000150T046
CS	4.6 x 100	5		A2000100R046
			3/pk	A2000100T046
CS	4.6 x 150	3		A2001150R046
			3/pk	A2001150T046
CS	4.6 x 100	3		A2001100R046
			3/pk	A2001100T046
CS	3.0 x 150	5		A2000150R030
			3/pk	A2000150T030
CS	3.0 x 100	5		A2000100R030
			3/pk	A2000100T030
CS	3.0 x 100	3		A2001100R030
			3/pk	A2001100T030
CS	2.0 x 150	3		A2001150R020
			3/pk	A2001150T020
CS	2.0 x 50	3		A2001050R020
			3/pk	A2001050T020

ZORBAX Original Reversed-Phase Columns

Agilent Original ZORBAX columns are made with Type A silica and are useful for many applications of acidic or neutral compounds. These columns have a higher activity level and are therefore useful for separating isomers (e.g. cis-trans, geometric) or other compounds where silanol activity enhances selectivity. These columns are used in many established methods.

ZORBAX Original Reversed Phase Columns

Hardware	Description	Size (mm)	Particle Size (µm)	ODS (C18) USP L1	C8 USP L7	Phenyl USP L11	CN USP L10	TMS USP L13
Standard Columns (no special hardware required)								
	Semi-Preparative	9.4 x 250	5	880952-202	880952-206			
	Analytical (Endcapped)	4.6 x 250	5	880952-702	880952-706	880952-712	884950-507	880952-710
	Analytical (Non-endcapped)	4.6 x 250	5	884950-543				
	Analytical	4.6 x 150	5	883952-702	883952-706	883952-712	884950-526	883952-710
	Solvent Saver	3.0 x 250	5	880952-302				
	Solvent Saver	3.0 x 150	5	883952-302				
Guard Columns (hardware required)								
P	Guard Cartridge, 2/pk	9.4 x 15	7	820675-115	820675-115	820675-115	820675-124	
ZGC	Guard Cartridge, 4/pk	4.6 x 12.5	5	820950-902	820950-906	820950-912	820950-905	820950-924
P	Guard Hardware Kit			840140-901	840140-901	840140-901	840140-901	840140-901
ZGC	Guard Hardware Kit			820999-901	820999-901	820999-901	820999-901	820999-901
PrepHT Cartridge Columns (require endfittings kit 820400-901)								
PT	PrepHT Cartridge	21.2 x 250	7	877952-102	877952-106		877952-105	
PT	PrepHT endfittings, 2/pk			820400-901	820400-901		820400-901	

Agilent TC-C18(2) and HC-C18(2)

TC-C18(2)

Agilent TC-C18(2) is the ideal choice for complex natural product extract samples, traditional medicines and environmental samples or any sample where you need to analyze mixtures of polar and non-polar compounds, including strong basic compounds.

- Lower carbon load – 12%
- Ideal for polar compounds and gradient separations that start at low % organic or cover a wide organic range
- Good choice for samples dissolved in water, or mostly water
- Use with most common mobile phases, including formic acid, acetic acid, trifluoroacetic acid (TFA) and phosphate buffers with acetonitrile and methanol as the organic modifiers
- Excellent performance from pH 2-8

HC-C18(2)

Agilent HC-C18(2) is a more retentive C18 with a higher carbon load. An excellent value alternative to other high carbon load columns, it also provides superior peak shape for basic compounds.

- Higher carbon load – 17% – provides greater retention for moderately polar and non-polar compounds
- Ideal for non-polar compounds and separations that start at mid-level % organic (at least greater than 10% organic)
- Good choice for industrial samples or samples dissolved in organic/mostly organic solvents
- Stable over a very wide pH range (2-9) for maximum flexibility

Column Specifications						
Bonded Phase	**Pore Size**	**Surface Area**	**Temp. Limits**	**pH Range***	**Endcapped**	**Carbon Load**
TC-C18 (2)	170Å	290 m^2/g	60°C	2.0-8.0	Yes	12%
HC-C18 (2)	170Å	290 m^2/g	60°C	2.0-9.0	Yes	17%

Specifications represent typical values only.

Agilent HC-C18(2) and TC-C18(2)

Description	Size (mm)	Particle Size (µm)	Part No.
Agilent HC-C18(2)	4.6 x 250	5	588905-902
Agilent HC-C18(2)	4.6 x 150	5	588915-902
Agilent TC-C18(2)	4.6 x 250	5	588925-902
Agilent TC-C18(2)	4.6 x 150	5	588935-902
Agilent HC-C18(2) guards, 2/pk	4.6 x 12.5	5	520518-904
Agilent TC-C18(2) guards, 2/pk	4.6 x 12.5	5	520518-905
Guard Hardware Kit			820999-901

Normal-Phase Columns

ZORBAX Normal-Phase Columns

For normal-phase chromatography, the Agilent ZORBAX product line offers a choice of bonded and non-bonded silica packings.

ZORBAX Rx-SIL

- Made from highly pure (>99.995%) porous silica microspheres (pore size is the space between the solid silica microparticles)
- Available in 1.8 and 5 µm particle sizes
- Stronger than other silica types
- Less acidic than ZORBAX-SIL, lower metal content
- Low acidity and low metal content make ZORBAX Rx-SIL ideal for normal-phase separation of polar compounds that exhibit poor peak symmetry on more acidic silica
- Useful for very hydrophilic compounds with high organic mobile phases in HILIC mode

ZORBAX Eclipse XDB-CN

- Made from highly pure Rx-SIL
- Excellent choice for normal-phase applications with basic compounds
- Equilibrates more rapidly than ZORBAX Rx-SIL and is used for many of the same normal-phase applications

Pursuit XRs Silica is another choice for normal-phase chromatography. For more information, see page 862–863.

ZORBAX CN

- Cyanopropyldimethylsilane monolayer bonded to ZORBAX SIL
- Equilibrates more rapidly than ZORBAX SIL, and used for many of the same normal-phase applications
- Less prone to fouling and less water sensitive than silica

ZORBAX NH2

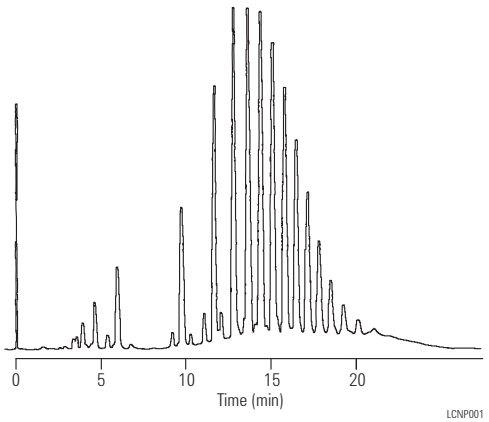
- Amino-propyl silane phase bonded to ZORBAX SIL
- Used for normal-phase and weak anion-exchange, and reversed-phase HPLC of polar compounds
- Vitamins A and D are separated in the normal-phase mode
- Carbohydrates and sugars are separated in the reversed-phase mode

Column Specifications

Bonded Phase	Pore Size	Surface Area	pH Range	Endcapped	Carbon Load
ZORBAX Rx-SIL	80Å	180 m^2/g	0-8.0	No	
ZORBAX Eclipse XDB-CN	80Å	180 m^2/g	2.0-8.0	Yes	4.3%
ZORBAX SIL	70Å	300 m^2/g	0-8.0	No	
ZORBAX CN	70Å	300 m^2/g	2.0-7.0	Yes	7%
ZORBAX NH_2	70Å	300 m^2/g	2.0-7.0	Yes	4%

High Resolution Normal-Phase Separation of Octylphenoxy Ethanol Surfactant on ZORBAX CN

Column:	**ZORBAX CN** **880952-705** **4.6 x 250 mm, 5 µm**
Mobile Phase:	Primary: Heptane Secondary: 2-Methoxyethanol/Isopropanol (50/50)
Flow Rate:	2 mL/min
Gradient:	2-20% Secondary in 10 min., Linear Hold at 20%
Temperature:	50°C
Detector:	278 nm
Sample:	Octylphenoxy (polyethylene oxy) Ethanol Surfactant (n= 10)



Normal-Phase Columns Based on ZORBAX Rx-SIL

Hardware	Description	Size (mm)	Particle Size (µm)	Rx-SIL USP L3	Eclipse XDB-CN USP L10
Standard Columns (no special hardware required)					
	Semi-Prep	9.4 x 250	5	880975-201	
	Analytical	4.6 x 250	5	880975-901	990967-905*
	Analytical	4.6 x 150	5	883975-901	993967-905*
	Rapid Resolution HT, 600 bar	4.6 x 100	1.8	828975-901	
	Rapid Resolution HT, 600 bar	4.6 x 50	1.8	827975-901	
	Rapid Resolution HT, 600 bar	3.0 x 100	1.8	828975-301	
	Rapid Resolution HT, 600 bar	3.0 x 50	1.8	827975-301	
	Narrow Bore	2.1 x 150	5	883700-901	993700-905*
	Rapid Resolution HT, 600 bar	2.1 x 100	1.8	828700-901	
	Rapid Resolution HT, 600 bar	2.1 x 50	1.8	827700-901	
Guard Columns (hardware required)					
P	Guard Cartridge, 2/pk	9.4 x 15	5	820675-119	
ZGC	Guard Cartridges, 4/pk	4.6 x 12.5	5	820950-919	820950-935
ZGC	Guard Cartridge, 4/pk	2.1 x 12.5	5	821125-919	821125-935
P	Guard Hardware Kit	9.4 x 15	0	840140-901	
ZGC	Guard Hardware Kit			820999-901	820999-901
PrepHT Cartridge Columns (require endfittings kit 820400-901)					
PHT	PrepHT Cartridge	21.2 x 250	7	877250-101	
PHT	PrepHT Cartridge	21.2 x 250	7		
PHT	PrepHT endfittings, 2/pk			820400-901	
PHT	PrepHT Guard Cartridge, 2/pk	17 x 7.5	5	820212-919	
PHT	Guard Cartridge Hardware			820444-901	

*These columns ship containing reversed-phase solvents. Flush with isopropanol before using normal-phase solvents. These columns can also be used in HILIC mode.

Normal-Phase Columns Based on ZORBAX Original SIL

Hardware	Description	Size (mm)	Particle Size (µm)	SIL USP L3	CN USP L10	NH2 USP L8	Carbohydrate Analysis
Standard Columns (no special hardware required)							
	Semi-Prep	9.4 x 250	5	880952-201	880952-205	880952-208	
	Analytical	4.6 x 250	5	880952-701	880952-705	880952-708	840300-908
	Analytical	4.6 x 150	5	883952-701	883952-705	883952-708	843300-908
	Narrow Bore	2.1 x 50	5			860700-708	
Guard Columns (hardware required)							
P	Guard Cartridge, 2/pk	9.4 x 15	5	820675-119	820675-111	820675-111	
ZGC	Guard Cartridges, 4/pk	4.6 x 12.5	5	820950-901	820950-905	820950-908	820950-908
ZGC	Guard Cartridge, 4/pk	2.1 x 12.5	5				
P	Guard Hardware Kit	9.4 x 15		840140-901	840140-901	840140-901	
ZGC	Guard Hardware Kit			820999-901	820999-901	820999-901	820888-901
PrepHT Cartridge Columns (require endfittings kit 820400-901)							
PT	PrepHT Cartridge	21.2 x 250	7	877952-101			
PT	PrepHT Cartridge	21.2 x 250	7		877952-105	877952-108	
PT	PrepHT endfittings, 2/pk			820400-901	820400-901	820400-901	
PT	PrepHT Guard Cartridge, 2/pk	17 x 7.5	5				
PT	Guard Cartridge Hardware						

ZORBAX HILIC Plus

- HILIC column for good retention of small, polar analytes
- Based on Eclipse Plus silica for excellent peak shape
- High sensitivity for LC/MS applications
- Recommended for EPA Method 1694

Agilent ZORBAX HILIC Plus columns are for use in hydrophilic interaction chromatography (HILIC) applications, which are typically used for the retention and resolution of small polar compounds. HILIC Plus columns are non-bonded silica columns based on the high performance silica used in ZORBAX Eclipse Plus columns. This silica provides excellent peak shape, critical for many polar, basic analytes. These columns ship prepared for use in HILIC mode – containing acetonitrile:water – in order to reduce the extensive equilibration typically required for HILIC separations. HILIC Plus columns are available in a 3.5 µm particle size for high resolution and in 2.1 and 4.6 mm ID for compatibility with mass spectrometers or with standard UV detectors.

Column Specifications

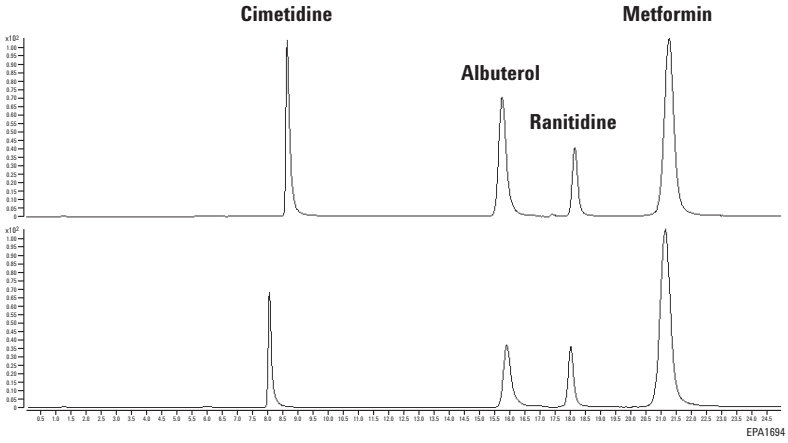
Bonded Phase	Pore Size	Surface Area	pH Range
Non-bonded silica	95Å	160 m^2/g	0-8.0

Specifications represent typical values only.

Separation of Group 4 Analytes in EPA 1694 on ZORBAX HILIC Plus Column

Column:	**ZORBAX HILIC Plus 959793-901 2.1 x 100 mm, 3.5 µm**
Mobile Phase:	90% Acetontrile:10% Water
Flow Rate:	0.25 mL/min
Gradient:	Linear gradient to 55% acetonitrile in 7 min Held at 55%
Temperature:	25°C

Duplicate runs for column USCJP0004;
10 min equilibration between two runs



ZORBAX HILIC Plus

Description	Size (mm)	Particle Size (µm)	Part No.
Analytical	4.6 x 100	3.5	959961-901
Analytical	4.6 x 50	3.5	959943-901
Narrow Bore	2.1 x 100	3.5	959793-901
Narrow Bore	2.1 x 50	3.5	959743-901

Ion Exchange Columns

ZORBAX Ion Exchange Columns – SAX and SCX

- ZORBAX SAX and 300SCX columns are based on rugged ZORBAX silica
- Stable from pH 2-7
- Provide high efficiency, rapid separations
- Compatible with organic mobile phase modifiers

Agilent ZORBAX Strong Ion Exchange columns are available as both Strong Anion Exchange (SAX) and Strong Cation Exchange (300SCX) columns. Each column is packed with bonded, 5 µm, spherical silica particles for optimum efficiency.

ZORBAX SAX packing has a permanently bonded quaternary amine. A trifunctional organo-silane reagent is used in producing this packing to maximize its stability with aqueous mobile phases. This column is ideal for separation of water-soluble compounds such as aromatic and aliphatic carboxylic acids and sulfonic acids.

ZORBAX SCX packing has 300Å pore size silica particles chemically bonded to an aromatic sulfonic acid group. This column is used for separations of basic, water-soluble compounds and bio-molecules.

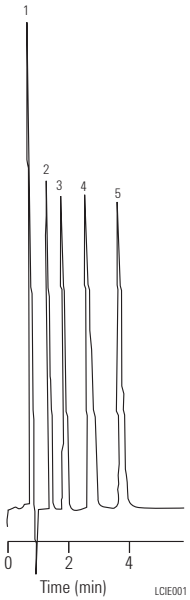
Column Specifications

Bonded Phase	Pore Size	Surface Area	pH Range	Functionality	Max Pressure
ZORBAX SAX	70Å	300 m^2/g	2.0-7.0	Quaternary amine	350 bar
ZORBAX 300SCX	300Å	50 m^2/g	2.0-7.0	Sulfonic acid	350 bar

Specifications represent typical values only.

Cough/Cold Remedies on ZORBAX 300SCX

Column:	**ZORBAX 300SCX** **880952-704** **4.6 x 250 mm, 5 µm**
Mobile Phase:	100 mM NaH_2PO_4 (pH 6.5)
Flow Rate:	3 mL/min
Temperature:	20°C
Detector:	210 nm
Sample:	Cold remedies



1. Pyrilamine
2. Theophylline
3. Glyceryl Guaicolate
4. Caffeine
5. Phenylephrine

ZORBAX Ion Exchange Columns – SAX and SCX

Description	Size (mm)	Particle Size (µm)	SAX	300SCX
Semi-preparative	9.4 x 250	5	880952-203	880952-204
Analytical	4.6 x 250	5	880952-703	880952-704
Analytical	4.6 x 150	5	883952-703	883952-704
Analytical	4.6 x 50	5		846952-704
Solvent Saver	3.0 x 50	5		860700-304
Narrow Bore	2.1 x 150	5		883700-704
Narrow Bore	2.1 x 50	5		860700-704
Guard Cartridge, 4/pk	4.6 x 12.5	6	820950-903	820950-904
Guard Hardware Kit			820888-901	820888-901

Hi-Plex HPLC Columns

- Preferred separation mechanism for the analysis of carbohydrates and oligosaccharides
- Matched to the USP definitions of media types L17, L19, L34 and L58
- Ideal for isocratic separations using water or dilute acid as the eluent

Hi-Plex columns are ion exchange or ligand exchange columns used predominantly for the separation of carbohydrates and organic acids. These columns are the preferred separation mechanism for the analysis of simple sugars, alcohols, oligosaccharides and organic acids in foodstuffs, but they can be used for the separation of other compounds as well.

The range comprises a 4% cross-linked resin for the analysis of oligosaccharides and an 8% cross-linked resin, with lower exclusion limit, for mono-, di- and tri-saccharide analysis. For carbohydrate and alcohol investigations, Hi-Plex columns use isocratic conditions with water as the eluent and temperature as the main variable for control of resolution. The exception is the Hi-Plex Na (Octo), which is used with sodium hydroxide eluents when pulsed amperometric detection (PAD) is employed.

Column Specifications

Bonded Phase	Temperature Range	Flow Rate (mL/min)	Eluent
Hi-Plex Ca	80-90°C	0.6	Water
Hi-Plex Ca USP L19	80-90°C	0.3	Water
Hi-Plex Pb	70-90°C	0.6	Water
Hi-Plex H for carbohydrates	60-70°C	0.6	Water
Hi-Plex H for organic acids	40-60°C	0.6	Dilute Acid
Hi-Plex Ca (Duo)	80-90°C	0.6	Water
Hi-Plex K	80-90°C	0.6	Water
Hi-Plex Na (Octo)	80-90°C	0.6	Water, Sodium Hydroxide
Hi-Plex Na	80-90°C	0.3	Water

Hi-Plex Column Selection

USP methods specify the type of HPLC media and column dimensions which should be used for the analysis. The Hi-Plex product range has four materials that comply with USP definitions.

Media Type L17

Strong cation exchange resin consisting of sulfonated, cross-linked styrene-divinylbenzene copolymer in the hydrogen form, 7 to 11 µm in diameter – Hi-Plex H.

Media Type L19

Strong cation exchange resin consisting of sulfonated, cross-linked styrene-divinylbenzene copolymer in the calcium form, 9 µm in diameter – Hi-Plex Ca and Hi-Plex Ca (Duo).

Media Type L34

Strong cation exchange resin consisting of sulfonated, cross-linked styrene-divinylbenzene copolymer in the lead form, about 9 µm in diameter – Hi-Plex Pb.

Media Type L58

Strong cation exchange resin consisting of sulfonated, cross-linked styrene-divinylbenzene copolymer in the sodium form, 6 to 30 µm diameter – Hi-Plex Na and Hi-Plex Na (Octo).

In addition to the standard column sizes, the media is also packed in specific column dimensions for different USP methods, including sugar alcohol analysis.

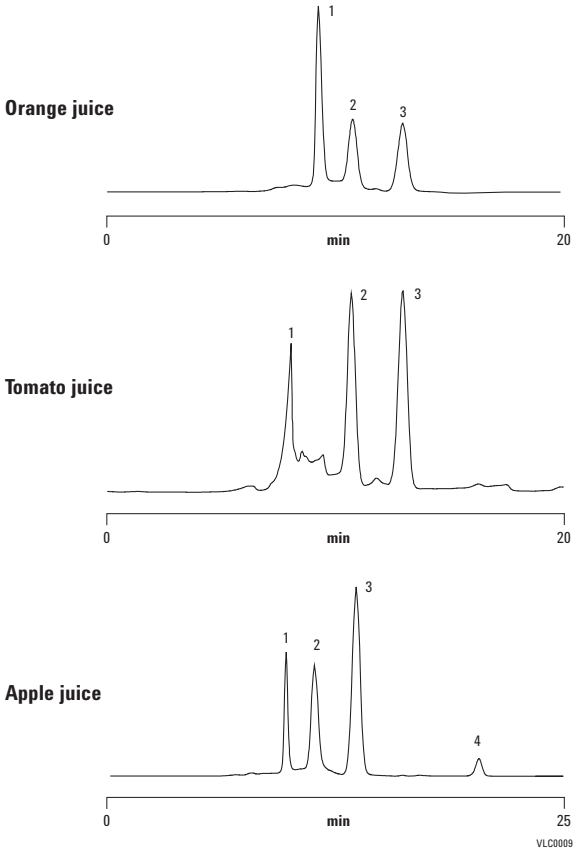
For some application areas there are several column options, and the choice of the most appropriate Hi-Plex media will depend on sample matrix and exact carbohydrate composition.

Hi-Plex Column Selection	
Application Area	**Recommended Column**
USP Methods Specifying L17 Media	Hi-Plex H
USP Methods Specifying L19 Media	Hi-Plex Ca and Hi-Plex Ca (Duo)
USP Methods Specifying L34 Media	Hi-Plex Pb
USP Methods Specifying L58 Media	Hi-Plex Na and Hi-Plex Na (Octo)
Mono- and Disaccharides	Hi-Plex Ca
	Hi-Plex Pb
	Hi-Plex H
	Hi-Plex Na (Octo)
Anomer Separations	Hi-Plex Ca
Organic Acids	Hi-Plex H
Alcohols	Hi-Plex Ca
	Hi-Plex K
	Hi-Plex H
	Hi-Plex Pb
Adulteration of Food and Beverages	Hi-Plex Ca and Hi-Plex Pb
Food Additives	Hi-Plex Ca and Hi-Plex Pb
Dairy Products	Hi-Plex Ca and Hi-Plex H
Sweetened Dairy Products	Hi-Plex Pb
Confectionery	Hi-Plex Ca and Hi-Plex Pb
Fruit Juice	Hi-Plex Ca
Wine	Hi-Plex H
Wood Pulp Hydrolysates (cellulose/hemi-cellulose)	Hi-Plex Pb
Fermentation Monitoring	Hi-Plex H
Oligosaccharides	Hi-Plex Na
Samples with High Salt Content (molasses)	Hi-Plex Na (Octo)
Oligosaccharides <Dp5 with Monosaccharides	Hi-Plex Ca (Duo)
Corn Syrups	Hi-Plex Na

Analysis of fruit juice

Column: **Hi-Plex Ca**
PL1170-6810
7.7 x 300 mm, 8 µm

Mobile Phase: Water
Flow Rate: 0.6 mL/min
Temperature: 85°C
Detector: RI

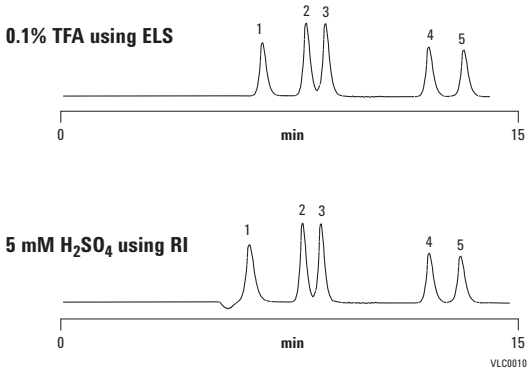


1. Sucrose
2. Glucose
3. Fructose
4. Sorbitol

Organic acid analysis

Column: **Hi-Plex H**
PL1170-6830
7.7 x 300 mm, 8 µm

Mobile Phase: Water with acid as specified
Flow Rate: 0.6 mL/min
Temperature: 60°C
Detector: ELS (neb=80°C, evap=90°C, gas=0.7 SLM), RI

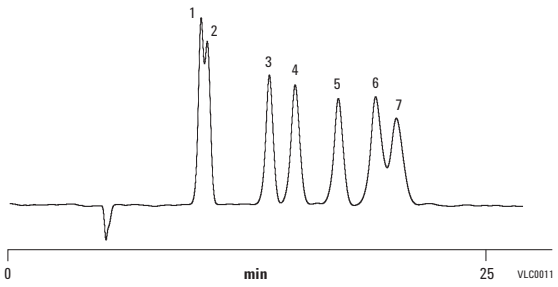


1. Oxalic acid
2. Citric acid
3. Tartaric acid
4. Succinic acid
5. Lactic acid

USP methods for sugar alcohols

Column: **Hi-Plex Ca USP L19**
PL1570-5810
4.0 x 250 mm, 8 µm

Mobile Phase: Water
Flow Rate: 0.3 mL/min
Temperature: 60°C
Detector: RI

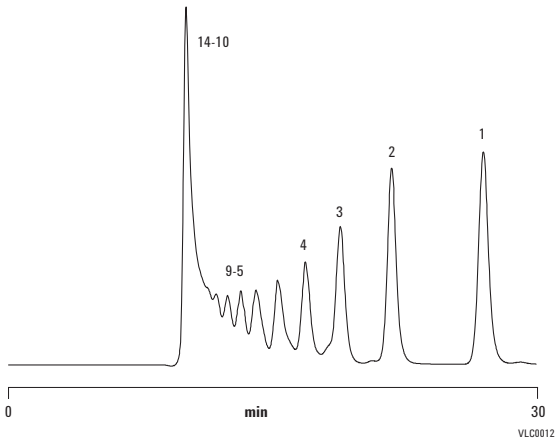


1. Iso-erythritol
2. Adonitol
3. Arabitol
4. Mannitol
5. Xylitol
6. Dulcitol
7. Sorbitol

Corn syrup, Hi-Plex

Column: **Hi-Plex Na**
PL1171-6140
7.7 x 300 mm, 10 µm

Mobile Phase: Water
Pressure: 11 bar
Flow Rate: 0.3 mL/min
Temperature: 80°C
Detector: RI



1. Dp1
2. Dp2
3. Dp3
4. Dp4
5. Dp5
6. Dp6
7. Dp7
8. Dp8
9. Dp9
10. Dp10
11. Dp11
12. Dp12
13. Dp13
14. Dp14

Hi-Plex HPLC Columns

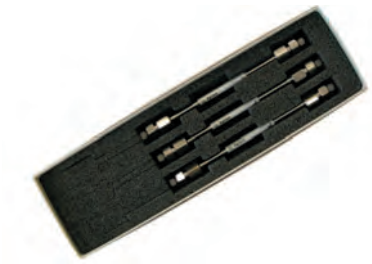
Description	Size (mm)	Particle Size (µm)	Crosslink Content (%)	Counter Ion	Part No.
Hi-Plex Ca USP L19	4.0 x 250	8	8	Ca^{2+}	PL1570-5810
Hi-Plex Ca (Duo)	6.5 x 300	8	8	Ca^{2+}	PL1F70-6850
Hi-Plex Ca	7.7 x 300	8	8	Ca^{2+}	PL1170-6810
Hi-Plex Pb USP L34	7.7 x 100	8	8	Pb^{2+}	PL1170-2820
Hi-Plex Pb	7.7 x 300	8	8	Pb^{2+}	PL1170-6820
Hi-Plex K	7.7 x 300	8	8	K^{+}	PL1170-6860
Hi-Plex H	6.5 x 300	8	8	H^{+}	PL1F70-6830
Hi-Plex H	7.7 x 300	8	8	H^{+}	PL1170-6830
Hi-Plex H USP L17	7.7 x 100	8	8	H^{+}	PL1170-2823
Hi-Plex Na	7.7 x 300	10	4	Na^{+}	PL1171-6140
Hi-Plex Na (Octo)	7.7 x 300	8	8	Na^{+}	PL1170-6840

Hi-Plex Guard Columns

Description	Size (mm)	Particle Size (µm)	Crosslink Content (%)	Counter Ion	Part No.
Hi-Plex Ca	7.7 x 50	8	8	Ca^{2+}	PL1170-1810
Hi-Plex Ca (Duo)	7.7 x 50	8	8	Ca^{2+}	PL1170-1850
Hi-Plex Pb	7.7 x 50	8	8	Pb^{2+}	PL1170-1820
Hi-Plex K	7.7 x 50	8	8	K^{+}	PL1170-1860
Hi-Plex H	7.7 x 50	8	8	H^{+}	PL1170-1830
Hi-Plex Na	7.7 x 50	10	4	Na^{+}	PL1171-1140
Hi-Plex Na (Octo)	7.5 x 50	8	8	Na^{+}	PL1170-1840

Hi-Plex Guard Cartridges, 2/pk

Description	Size (mm)	Particle Size (µm)	Crosslink Content (%)	Counter Ion	Part No.
Hi-Plex Ca	7.7 x 50	8	8	Ca^{2+}	PL1170-1810
Hi-Plex Ca	3.0 x 0.5	8	8	Ca^{2+}	PL1670-0810
Hi-Plex Ca (Duo)	3.0 x 0.5	8	8	Ca^{2+}	PL1670-0850
Hi-Plex Pb	3.0 x 0.5	8	8	Pb^{2+}	PL1670-0820
Hi-Plex K	3.0 x 0.5	8	8	K^{+}	PL1670-0860
Hi-Plex H	3.0 x 0.5	8	8	H^{+}	PL1670-0830
Hi-Plex Na	3.0 x 0.5	10	4	Na^{+}	PL1671-0140
Hi-Plex Na (Octo)	3.0 x 0.5	8	8	Na^{+}	PL1670-0840
Guard cartridge holder for 5 x 3 mm cartridges					PL1310-0016



Kits for Analytical HPLC

ZORBAX Method Development Kits

Agilent offers a series of kits that allow for fast method development at an attractive price. Each kit contains 3 columns. Six new kits have been added and are recommended for use with the new Agilent Automated Method Development LC. Several of these kits contain Rapid Resolution HT (1.8 µm) columns in a variety of bonded phases for easy method optimization and several kits contain Rapid Resolution (3.5 µm) columns in the same variety of bonded phases. These kits contain some of the Eclipse Plus family of columns for excellent peak shape and optimum performance with a wide variety of compounds.

ZORBAX Method Development Kits
Recommended for use with the Agilent Automated Method Development LC System

Description	Part No.
Rapid Resolution HT (RRHT) Selectivity Method Development Kit, 2.1 mm ID Includes 2.1 x 50 mm, 1.8 µm, 600 bar columns: one each Eclipse Plus C18, Eclipse Plus Phenyl-Hexyl and Bonus-RP	5190-1431
Rapid Resolution HT (RRHT) pH Method Development Kit, 2.1 mm ID Includes 2.1 x 50 mm, 1.8 µm, 600 bar columns: one each Eclipse Plus C18, SB-C18 and Extend-C18	5190-1432
Rapid Resolution HT (RRHT) Selectivity Method Development Kit, 4.6 mm ID Includes 4.6 x 50 mm, 1.8 µm, 600 bar columns: one each Eclipse Plus C18, Eclipse Plus Phenyl-Hexyl and Bonus-RP	5190-1433
Rapid Resolution HT (RRHT) pH Method Development Kit, 4.6 mm ID Includes 4.6 x 50 mm, 1.8 µm, 600 bar columns: one each Eclipse Plus C18, SB-C18 and Extend-C18	5190-1434
Rapid Resolution Selectivity Method Development Kit, 4.6 mm ID Includes 4.6 x 100 mm, 3.5 µm columns: one each Eclipse Plus C18, Eclipse Plus Phenyl-Hexyl and Bonus-RP	5190-1435
Rapid Resolution pH Method Development Kit, 4.6 mm ID Includes 4.6 x 100 mm, 3.5 µm columns: one each Eclipse Plus C18, SB-C18 and Extend-C18	5190-1436

ZORBAX Method Development Kits

Description	Part No.
StableBond Method Development Kit Includes 4.6 x 150 mm, 5 µm columns; one each: SB-C18, SB-CN and SB-Phenyl phases	5183-4624
Fast StableBond Method Development Kit Includes 4.6 x 75 mm, 3.5 µm columns; one each: SB-C18, SB-CN and SB-Phenyl phases	5183-4625
Eclipse XDB Method Development Kit Includes 4.6 x 150 mm, 5 µm columns; one each: XDB-C18, XDB-C8, XDB-Phenyl phases	5183-4626
Fast Eclipse XDB Method Development Kit Includes 4.6 x 75 mm, 3.5 µm columns; one each: XDB-C18, XDB-C8 and XDB-Phenyl phases	5183-4627
pH Method Development Kit Includes 4.6 x 150 mm, 5 µm columns; one each: SB-C18, XDB-C18 and Extend-C18 phases	5185-5807
Fast pH Method Development Kit Includes 4.6 x 75 mm, 3.5 µm columns; one each: SB-C18, XDB-C18 and Extend-C18 phases	5185-5808
Aqueous Method Development Kit Includes 4.6 x 150 mm, 5 µm columns; one each: SB-Aq, Bonus RP and SB-C18	5185-5809
Fast Aqueous Method Development Kit Includes 4.6 x 75 mm, 3.5 µm columns; one each: SB-Aq, Bonus RP and SB-C18	5185-5810

ZORBAX Cartridge Column Starter Kits

Hardware	Description	Part No.
	ZORBAX C18 Kit Includes one 4.6 x 150 mm, 5 µm Eclipse XDB-C18 column; one 4.6 x 150 mm, 5 µm StableBond C18 column; cartridge holder; mounting tool; replacement filter (2/pk); and open-end wrench	5183-2021
	ZORBAX C8 Kit Includes one 4.6 x 150 mm, 5 µm Eclipse XDB-C8 column; one 4.6 x 150 mm, 5 µm StableBond C8 column; cartridge holder; mounting tool; replacement filter (2/pk); and open-end wrench	5183-2022

ZORBAX Method Validation Kits

ZORBAX Method Validation Kits are supplied to customers who need the same HPLC column type (bonded phase, particle size, configuration) but from different manufacturing lots. To request columns from different lots, contact Agilent Technologies or your local Agilent Authorized Distributor using the following procedure:

- Request Validation Kits (columns from different lots) by using Part Number 899999-888
- Indicate the Part Number of the current column you are using
- Indicate the Lot Number of the current column you are using
- Indicate the number of additional columns needed from different lots (example: you have a current column and may need two additional lots)

Custom HPLC Column Ordering

Columns not listed can be easily ordered using the following procedure:

- Request a Special Products Quotation (SPQ) using Part Number 899999-999
- Indicate column dimensions (example: 4.6 x 50 mm); bonded phase type (example: StableBond C3); particle size (example: 5 µm); and pore size (example: 80Å)

Custom columns are priced with a minimal surcharge over the price of stocked columns.

AGILENT COLUMNS FOR SPECIAL HPLC APPLICATIONS

Reproducible results for UHPLC and high-throughput LC

No matter how many samples you have, or how complex they may be, you need to feel confident that you can achieve reproducible results without wasting valuable time testing different columns and configurations.

The following column families deliver industry-leading performance for specific measurement and purification challenges:

- ZORBAX Rapid Resolution High Definition (RRHD) Columns
- ZORBAX Rapid Resolution High Throughput (RRHT) Columns
- ZORBAX Solvent Saver Columns
- Chiral HPLC Columns
- Other Specialty HPLC Columns

Tips & Tools

Poroshell 120 columns are ideal for up to 600 bar for UHPLC and use up to 50% less pressure than sub 2 µm columns.

Turn to page 822.

UHPLC Columns

Agilent has UHPLC columns for systems with pressure limits up to 600 and 1200 bar to match all Agilent LC systems and for use on other UHPLCs. These columns provide the resolution and fast results expected for ultra high performance liquid chromatography.

- **ZORBAX Rapid Resolution High Throughput** – 1.8 µm columns for up to 600 bar
- **ZORBAX Rapid Resolution High Definition** – 1.8 µm columns for up to 1200 bar and the Agilent 1290 Infinity LC
- **Agilent Poroshell 120** – 2.7 µm superficially porous columns for up to 600 bar
  Turn to page 822.
- **Pursuit UPS** – 1.9 and 2.4 µm columns for up to 1000 bar UHPLCs
  Turn to page 864.

ZORBAX Rapid Resolution High Definition 1.8 µm

- High pressure (1200 bar) columns for optimum results with the 1290 Infinity LC or other UHPLC instruments
- 1.8 µm particles deliver maximum resolution for the most defined separations
- Available in ZORBAX Eclipse Plus C18 for superior peak shape and ZORBAX StableBond C18 for alternate selectivity and low pH stability
- Achieve the same selectivity on 3.5 and 5 µm ZORBAX columns with the same bonded phase for compatibility with any LC

ZORBAX Rapid Resolution High Definition (RRHD) columns are an expansion of the ZORBAX 1.8 µm particle column line. The new RRHD columns use improved packing processes to achieve stability up to 1200 bar for use with the Agilent 1290 Infinity LC or other UHPLC instruments. RRHD 1.8 µm columns are available in 50, 100 and 150 mm lengths for fast or high resolution – truly high definition – separations of your most complex samples.

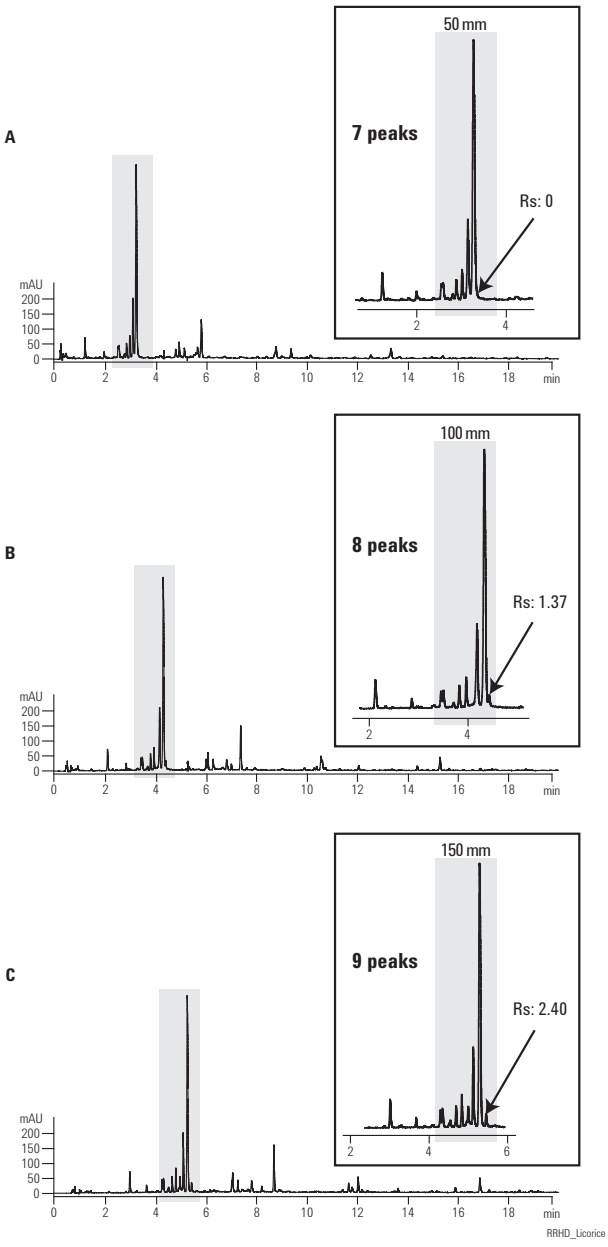
Column Specifications

Bonded Phase	Pore Size	Surface Area	pH Range	Endcapped
ZORBAX Eclipse Plus C18	95Å	160 m^2/g	2.0-9.0	Yes
ZORBAX SB-C18	80Å	180 m^2/g	1.0-8.0*	No
ZORBAX SB-C8	80Å	180 m^2/g	1.8-8.0*	No

*StableBond columns are designed for optimal use at low pH. At pH 6-8 highest column stability for all silica based columns is obtained by operating at temperatures <40°C and using lower buffer concentrations – 10-20 mM. For pH 6-8 select the Eclipse Plus C18 column.

Separation of Licorice Root on RRHD Columns

Column A:	**ZORBAX RRHD SB-C18 857700-902 2.1 x 50 mm, 1.8 µm**
Column B:	**858700-902 2.1 x 100 mm, 1.8 µm**
Column C:	**859700-902 2.1 x 150 mm, 1.8 µm**
Mobile Phase:	10-100% B/30 min A: 0.1% formic acid (fa) B: acetonitrile with 0.1% fa
Flow Rate:	F = 0.4 mL/min
Gradient:	30 minute gradient on each length
Temperature:	Ambient
Detector:	280 nm UV
Instrument:	1290 Infinity LC

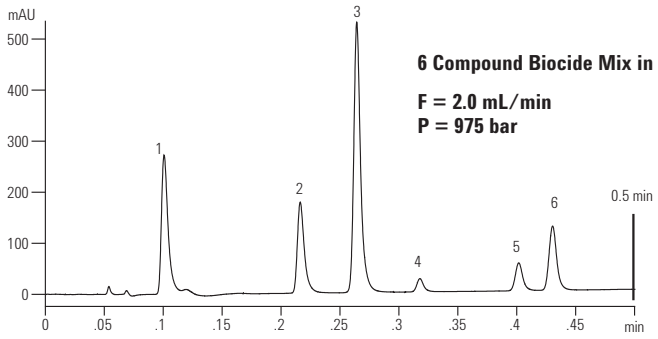


Sub-1 Minute Separations with RRHD Columns

Column: **ZORBAX RRHD SB-C18**
857700-902
2.1 x 50 mm, 1.8 µm

Gradient: H_2O (0.05% trifluoroacetic acid)/10-40% ACN/1min
Temperature: 60°C
Injection Volume: 0.5 µL x 100 ppm each
Detector Wavelength: 275 nm
Data Rate: 160 Hz

1. 2-methyl-4-isothiazolin-3-one
2. 5-chloro-2-methyl-4-isothiazolin-3-one
3. Carbendazim
4. Benzisothiiazol-3(2H)-one
5. 2-phenoxyethanol
6. Methylparaben



6 Compound Biocide Mix in 0.5 min

F = 2.0 mL/min
P = 975 bar

RRHDSub1m

Rapid Resolution HD Columns for High Pressure Use (Maximum Pressure: 1200 bar)

Description	Size (mm)	Particle Size (µm)	Eclipse Plus C18 USP L1	Eclipse Plus C8 USP L7	SB-C18 USP L1	SB-C8 USP L7	SB-CN USP L10	SB-Phenyl USP L11	Extend-C18 USP L1	Eclipse XDB-C18 USP L1
Solvent Saver RRHD, 1200 bar	3.0 x 150	1.8	959759-302	959759-306	859700-302	859700-306			759700-302	981759-302
Solvent Saver RRHD, 1200 bar	3.0 x 100	1.8	959758-302	959758-306	858700-302	858700-306	858700-305	858700-905	758700-302	981758-302
Solvent Saver RRHD, 1200 bar	3.0 x 50	1.8	959757-302	959757-306	857700-302	857700-306	857700-305	857700-312	757700-302	981757-302
Narrow Bore RRHD, 1200 bar	2.1 x 150	1.8	959759-902	959759-906	859700-902	859700-906	859700-905	859700-912	759700-902	981759-902
Narrow Bore RRHD, 1200 bar	2.1 x 100	1.8	959758-902	959758-906	858700-902	858700-906	858700-905	858700-912	758700-902	981758-902
Narrow Bore RRHD, 1200 bar	2.1 x 50	1.8	959757-902	959757-906	857700-902	857700-906	857700-905	857700-912	757700-902	981757-902

ZORBAX Rapid Resolution High Throughput 1.8 µm

- High pressure (600 bar) columns for ultra high speed or maximum resolution analyses with Rapid Resolution HT columns packed with totally porous, 1.8 µm packings
- Carefully engineered particles deliver maximum resolution at 25% less pressure than other sub- 2 µm materials
- Reduce analysis time by up to 95%
- Develop HPLC methods more quickly
- Securely transfer conventional methods with over 140 RRHT column choices
- Analyze complex samples on shorter columns faster and maximize peak capacity
- Matching selectivity in 3.5, 5 and 7 µm particle sizes for complete method scalability
- Short (50 mm long and less) column can be used on some conventional LCs

Agilent ZORBAX Rapid Resolution HT (1.8 µm) columns use a totally porous, 1.8 µm particle to provide maximum resolution in fast, ultra-fast and high resolution analyses. You can reduce analysis time by up to 95% in comparison to 250 mm length columns. With more than 140 RRHT column choices, including the new high performance ZORBAX Eclipse Plus and many other ZORBAX column choices (Eclipse XDB, StableBond, Extend, Bonus-RP), methods can be developed quickly or securely transferred to a smaller particle size column with no loss in resolution. The small particle size provides double the efficiency of a 3.5 µm column in the same column length, providing the highest efficiency and resolution possible. This permits the analysis of complex samples on shorter columns with the highest resolution and peak capacity. The 1.8 µm Rapid Resolution HT columns take high-speed, high-resolution HPLC to a new level.

The 600 bar columns can be used with the Agilent 1200 Rapid Resolution LC up to this high pressure limit. In addition, the shorter columns can be used on many other LC's, including the Agilent 1200 and 1100 by using the RRHT-1100 conversion kits to maximize performance.

1100 Series Conversion Kits for Fast LC

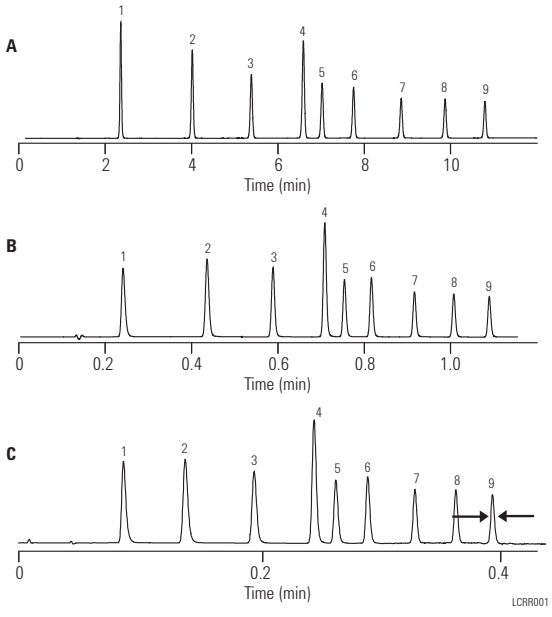
These kits make it easy to convert your Agilent 1100 system with a binary pump to a lower-volume system for RRHT LC columns. Each kit contains all capillaries, a flow cell, starter columns, and detailed instructions for system conversion. Note: you will still be able to use your converted 1100 for standard methods and columns.

1100 Series Conversion Kits for Fast LC

Kit Selection	Description	Part No.
For Variable Wavelength Detectors (VWD)	Columns: 4.6 x 50 mm, 1.8 µm (3) Flow Cell for VWD, 5 µL capillaries, µ-LC inline filter	5188-5323
For Diode Array Detectors (DAD & DAD SL) and Multiple Wavelength Detectors (MWD)	Columns: 4.6 x 50 mm, 1.8 µm (2) Flow Cell for DAD, 5 µL capillaries, µ-LC inline filter	5188-5324
For Diode Array Detector and Mass Spec	Columns: 2.1 x 50 mm, 1.8 µm (2) Flow Cell for DAD, 1.7 µL capillaries, ZDV union	5188-5328

Rapid Resolution HT: Up to 20X Faster

Column A:	**ZORBAX SB-C18 883975-902 4.6 x 150 mm, 5 µm**
Column B:	**ZORBAX SB-C18 827700-902 2.1 x 50 mm, 1.8 µm**
Column C:	**ZORBAX SB-C18 827700-902 2.1 x 50 mm, 1.8 µm**
Mobile Phase:	A: H_2O B: ACN
Gradient:	0.0 min 50% B A: 11 min 100% B B: 1.2 min 100% B C: 0.4 min 100% B
Flow Rate:	A: 1.2 mL/min B: 1.0 mL/min C: 2.4 mL/min
Temperature:	A: 40°C B: 40°C C: 95°C
Detector:	UV 254 nm
Sample:	Alkylphenones



1. C_3-Alkylphenone
2. C_4-Alkylphenone
3. C_5-Alkylphenone
4. C_6-Alkylphenone
5. C_7-Alkylphenone
6. C_8-Alkylphenone
7. C_9-Alkylphenone
8. C_{10}-Alkylphenone
9. C_{12}-Alkylphenone

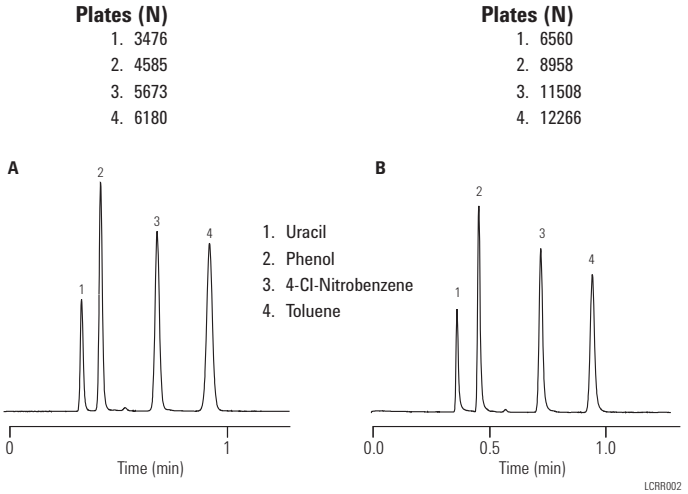
Rapid Resolution HT Provides Double the Efficiency of Rapid Resolution Columns

Column A: **ZORBAX SB-C18**
835975-902
4.6 x 50 mm, 3.5 µm

Column B: **ZORBAX SB-C18**
827975-901
4.6 x 50 mm, 1.8 µm

Mobile Phase: 25% Water, 75% MeOH
Flow Rate: 1.5 mL/min
Temperature: Ambient
Detector: 254 nm

This figure shows that Rapid Resolution HT columns can provide double the efficiency of a 3.5 µm column in the same column length. This high efficiency can be used for very high-resolution, high throughput analyses.



Reduce Analysis Time Dramatically with Rapid Resolution HT Columns

Column A: **Eclipse XDB-C18**
990967-902
4.6 x 250 mm, 5 µm

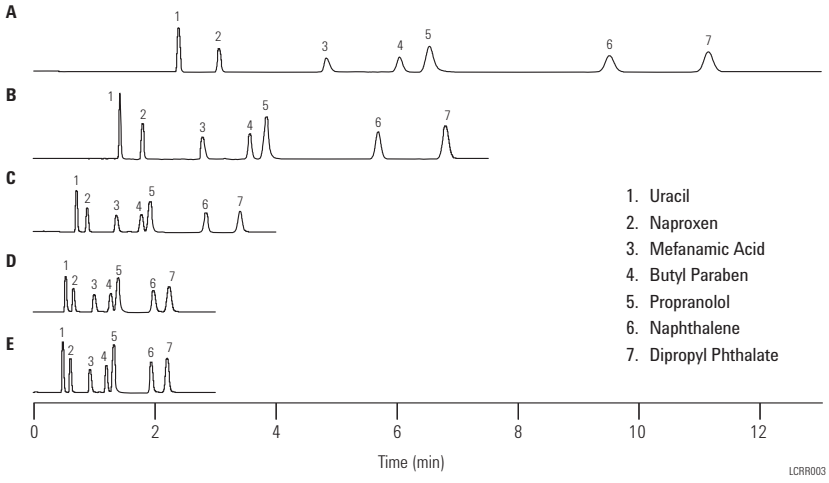
Column B: **Eclipse XDB-C18**
963967-902
4.6 x 150 mm, 3.5 µm

Column C: **Eclipse XDB-C18**
966967-902
4.6 x 75 mm, 3.5 µm

Column D: **ZORBAX Eclipse XDB-C18**
935967-902
4.6 x 50 mm, 3.5 µm

Column E: **Eclipse XDB-C18**
925975-902
4.6 x 50 mm, 1.8 µm

Mobile Phase: 73% MeOH:27% 20 mM Phosphate Buffer, pH 7.0
Flow Rate: 1 mL/min
Temperature: Ambient
Detector: 254 nm



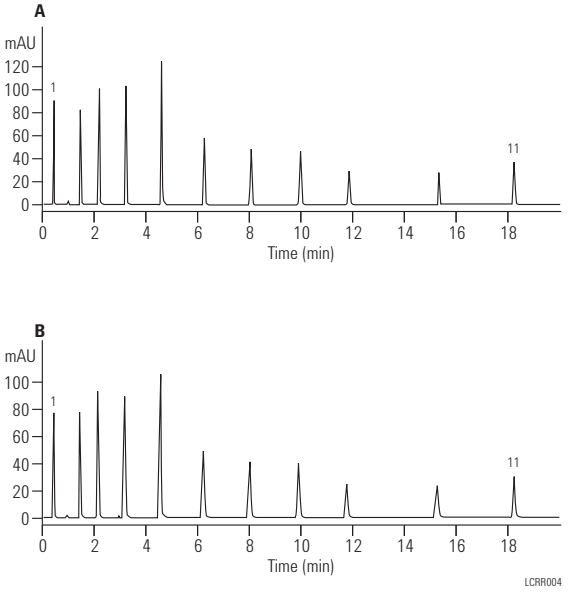
This figure shows the dramatic reduction in analysis time made possible by using Rapid Resolution HT columns. Chromatogram A shows a separation that takes 11.5 minutes on a 25 cm, 5 µm column. Rapid Resolution (3.5 µm) columns, shown in chromatogram B and C, reduce analysis time substantially, but with a slight compromise in resolution. The Rapid Resolution HT column reduces analysis time to 2.2 minutes, an 80% reduction, while still maintaining baseline resolution.

Increase Peak Capacity with RRHT Columns

Column A: **Eclipse XDB-C8**
928700-906
2.1 x 100 mm, 1.8 µm

Column B: **Eclipse XDB-C18**
961753-902
2.1 x 100 mm, 3.5 µm

Mobile Phase:	A: H_2O
	B: ACN
Peak capacity:	A: 461
	B: 343
Flow Rate:	0.5 mL/min
Gradient:	0.0 min 50% B
	20.0 min 100% B
Temperature:	40°C
Detector:	UV 254 nm
Sample:	Alkylphenones

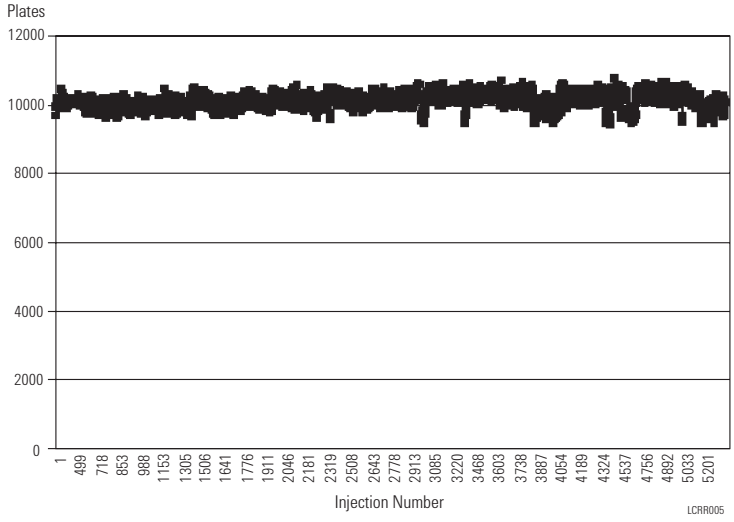


1. Uracil
2. C_3-Alkylphenone
3. C_4-Alkylphenone
4. C_5-Alkylphenone
5. C_6-Alkylphenone
6. C_7-Alkylphenone
7. C_8-Alkylphenone
8. C_9-Alkylphenone
9. C_{10}-Alkylphenone
10. C_{12}-Alkylphenone
11. C_{14}-Alkylphenone

Long Lifetime of RRHT Columns at Elevated Temperatures

Column: **ZORBAX SB-C18**
827700-902
2.1 x 50 mm, 1.8 µm

Mobile Phase:	A: 60% H_2O
	B: 40% ACN
Flow Rate:	1 mL/min
Temperature:	80°C
Detector:	UV 254 nm
Sample:	QC Test Mix



Rapid Resolution HT Columns for High Pressure Use (Maximum Pressure: 600 bar, 9000 psi)

Description	Size (mm)	Particle Size (µm)	Eclipse Plus C18 USP L1	Eclipse Plus C8 USP L7	Eclipse Plus Phenyl-Hexyl USP L11	Eclipse PAH USP L1	Eclipse XDB-C18 USP L1	Eclipse XDB-C8 USP L7	Extend-C18 USP L1
Rapid Resolution HT, 600 bar	4.6 x 150	1.8	959994-902						
Rapid Resolution HT, 600 bar	4.6 x 100	1.8	959964-902	959964-906	959964-912	959964-918	928975-902		728975-902
Rapid Resolution HT, 600 bar	4.6 x 75	1.8	959951-902						
Rapid Resolution HT, 600 bar	4.6 x 50	1.8	959941-902	959941-906	959941-912	959941-918	927975-902	927975-906	727975-902
Rapid Resolution HT, 600 bar	4.6 x 30	1.8	959931-902	959931-906	959931-912	959931-918	924975-902	924975-906	724975-902
Rapid Resolution HT, 600 bar	4.6 x 20	1.8					926975-902	926975-906	726975-902
Solvent Saver HT, 600 bar	3.0 x 100	1.8	959964-302	959964-306	959964-312		928975-302		728975-302
Solvent Saver HT, 600 bar	3.0 x 50	1.8	959941-302	959941-306	959941-312		927975-302	927975-306	727975-302
Solvent Saver HT, 600 bar	3.0 x 30	1.8					924975-302	924975-306	724975-302
Solvent Saver HT, 600 bar	3.0 x 20	1.8					926975-302	926975-306	726975-302
Narrow Bore RRHT, 600 bar	2.1 x 150	1.8	959794-902						
Narrow Bore RRHT, 600 bar	2.1 x 100	1.8	959764-902	959764-906	959764-912	959764-918	928700-902	928700-906	728700-902
Narrow Bore RRHT, 600 bar	2.1 x 50	1.8	959741-902	959741-906	959741-912	959741-918	927700-902	927700-906	727700-902
Narrow Bore RRHT, 600 bar	2.1 x 30	1.8	959731-902	959731-906	959731-912		924700-902	924700-906	724700-902
Narrow Bore RRHT, 600 bar	2.1 x 20	1.8					926700-902	926700-906	726700-902

Rapid Resolution HT Columns for High Pressure Use (Maximum Pressure: 600 bar, 9000 psi)

Description	Size (mm)	Particle Size (µm)	SB-C18 USP L1	SB-C8 USP L7	SB-Phenyl USP L11	SB-CN USP L10	SB-Aq	Rx-SIL USP L3	Bonus-RP USP L60
Rapid Resolution HT, 600 bar	4.6 x 150	1.8	829975-902	829975-906	829975-912	829975-905	829975-914		
Rapid Resolution HT, 600 bar	4.6 x 100	1.8	828975-902	828975-906	828975-912	828975-905	828975-914	828975-901	828668-901
Rapid Resolution HT, 600 bar	4.6 x 75	1.8		830975-906					830668-901
Rapid Resolution HT, 600 bar	4.6 x 50	1.8	827975-901	827975-906	827975-912	827975-905	827975-914	827975-901	827668-901
Rapid Resolution HT, 600 bar	4.6 x 30	1.8	824975-902	824975-906	824975-912	824975-905	824975-914		
Rapid Resolution HT, 600 bar	4.6 x 20	1.8	826975-902	826975-906					
Solvent Saver HT, 600 bar	3.0 x 150	1.8	829975-302	829975-306	829975-312	829975-305			
Solvent Saver HT, 600 bar	3.0 x 100	1.8	828975-302	828975-306	828975-312	828975-305	828975-314	828975-301	828668-301
Solvent Saver HT, 600 bar	3.0 x 50	1.8	827975-302	827975-306	827975-312	827975-305	827975-314	827975-301	827668-301
Solvent Saver HT, 600 bar	3.0 x 30	1.8	824975-302	824975-306		824975-305			
Solvent Saver HT, 600 bar	3.0 x 20	1.8	826975-302	826975-306					
Narrow Bore RRHT, 600 bar	2.1 x 150	1.8	820700-902	820700-906	820700-912	820700-905			
Narrow Bore RRHT, 600 bar	2.1 x 100	1.8	828700-902	828700-906	828700-912	828700-905	828700-914	828700-901	828768-901
Narrow Bore RRHT, 600 bar	2.1 x 50	1.8	827700-902	827700-906	827700-912	827700-905	827700-914	827700-901	827768-901
Narrow Bore RRHT, 600 bar	2.1 x 30	1.8	824700-902	824700-906	824700-912	824700-905	824700-914		
Narrow Bore RRHT, 600 bar	2.1 x 20	1.8	826700-902	826700-906					

Rapid Resolution HT Columns and Cartridges (Maximum Pressure: 400 bar, 6000 psi)

Hardware	Description	Size (mm)	Particle Size (µm)	Eclipse XDB-C18 USP L1	Eclipse XDB-C8 USP L7	SB-C18 USP L1	SB-C8 USP L7	Extend-C18 USP L1
	Rapid Resolution HT	4.6 x 50	1.8	922975-902	922975-906	922975-902	822975-906	722975-902
	Rapid Resolution HT, 3/pk	4.6 x 50	1.8	922975-932		922975-932		
	Narrow Bore RRHT	2.1 x 50	1.8	922700-902		922700-902		
	Narrow Bore RRHT, 3/pk	2.1 x 50	1.8	922700-932		922700-932		
Rapid Resolution HT Cartridges (require hardware kit 820555-901)								
RR	Rapid Resolution HT Cartridge	4.6 x 50	1.8	925975-902		825975-902		
RR	Rapid Resolution HT Cartridge, 3/pk	4.6 x 50	1.8	925975-932		825975-932		
RR	Rapid Resolution HT Cartridge	2.1 x 50	1.8	925700-902		825700-902		
RR	Rapid Resolution HT Cartridge, 3/pk	2.1 x 50	1.8	925700-932		825700-932		
RR	Rapid Resolution HT Cartridge	4.6 x 30	1.8	923975-902		823975-902		
RR	Rapid Resolution HT Cartridge, 3/pk	4.6 x 30	1.8	923975-932		823975-932		
RR	Rapid Resolution HT Cartridge	2.1 x 30	1.8	923700-902		823700-902		
RR	Rapid Resolution HT Cartridge, 3/pk	2.1 x 30	1.8	923700-932		823700-932		
RR	Rapid Resolution HT Cartridge	4.6 x 15	1.8	921975-902		821975-902		
RR	Rapid Resolution HT Cartridge, 3/pk	4.6 x 15	1.8	921975-932		821975-932		
RR	Rapid Resolution HT Cartridge	2.1 x 15	1.8	921700-902		821700-902		
RR	Rapid Resolution HT Cartridge, 3/pk	2.1 x 15	1.8	921700-932		821700-932		
RR	Hardware Kit for RR and RRHT Cartridges			820555-901		820555-901		

Other Specialty Columns

ZORBAX Carbohydrate Analysis Columns

- Reproducible – each lot of this application-specific aminopropyl column packing material is use-tested for specific monosaccharide and disaccharide separations
- Efficient – uses ZORBAX porous silica microsphere technology; silica manufacturing, bonding and packing are all performed in Agilent's ISO 9001 facilities
- Flexible – can handle high volume injections – as much as 50 µL on a 4.6 x 150 mm column
- Recommended for use with refractive index detectors (RID)

Column Specifications

Bonded Phase	Pore Size	Surface Area	pH Range	Endcapped	Carbon Load
ZORBAX Carbohydrate	70Å	300 m^2/g	2.0-8.0	No	3.5%

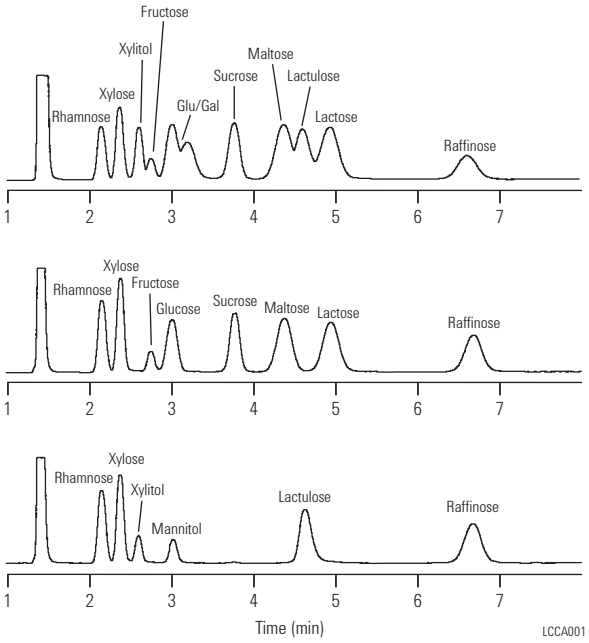
Specifications represent typical values only.

ZORBAX Carbohydrate Analysis Columns

Description	Size (mm)	Particle Size (µm)	Part No.
ZORBAX Carbohydrate Analysis column	4.6 x 250	5	840300-908
ZORBAX Carbohydrate Analysis column	4.6 x 150	5	843300-908
ZORBAX NH_2 Guard Catridges, 4/pk	4.6 x 12.5	5	820950-908
Guard Hardware Kit			820999-901

Separation of Simple-Sugar and Sugar-Alcohol Standards

Column:	**ZORBAX Carbohydrate Analysis 843300-908 4.6 x 150 mm, 5 µm**
Mobile Phase:	75% ACN/25% H_2O
Flow Rate:	2 mL/min
Temperature:	30°C
Detector:	RID
	Det. Temp: 30°C
Sample:	Rhamnose, Xylose, Xylitol, Lactulose, Raffinose (54 µg each) Fructose (10 µg), Glucose, Sucrose (36 µg each) Maltose, Lactose (6 µg each), Inj. = 6.3 µL
	Rhamnose, Xylose, Raffinose (54 µg each), Fructose (10 µg) Glucose, Sucrose (36 µg each), Maltose, Lactose (60 µg each) Inj. = 6.3 µL
	Sample: (54 µg each), Inj. = 6.3 µL



ZORBAX Eclipse Amino Acid Analysis (AAA) Columns

- High resolution and rapid analysis of 24 amino acids
- Tested for amino acid analysis
- Uses well-known OPA and FMOC precolumn derivatization chemistry
- Easily automated using a detailed online, derivatization protocol available for use with Agilent 1100/1200 autosampler

The Agilent ZORBAX Eclipse AAA high efficiency column rapidly separates amino acids following an updated and improved protocol. Total analysis from injection-to-injection can be achieved in as little as 14 min. (9 min. analysis time) on shorter, 7.5 cm length columns and 24 min. (18 min. analysis time) on the 15 cm column length. Exceptional sensitivity (5-50 pmol with DAD, FLD) and reliability are achieved using both OPA and FMOC derivatization chemistries in one fully automated procedure using the Agilent 1100/1200 HPLC instrument.

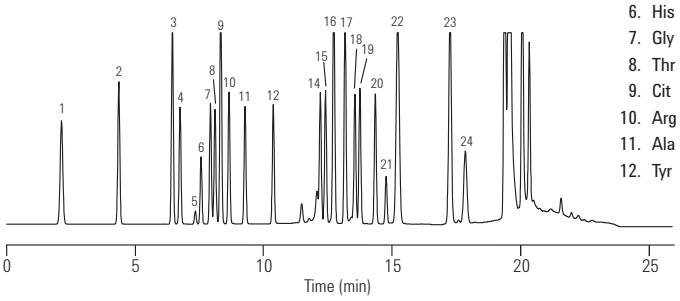
ZORBAX Eclipse Amino Acid Analysis (AAA) Columns

Hardware	Description	Size (mm)	Particle Size (µm)	Part No.
	Analytical routine sensitivity	4.6 x 150	5	993400-902
	Analytical routine sensitivity, high-resolution using FLD	4.6 x 150	3.5	963400-902
	Analytical routine sensitivity, high-throughput	4.6 x 75	3.5	966400-902
	Solvent Saver high sensitivity, high resolution	3.0 x 150	3.5	961400-302
ZGC	Guard Catridges, 4/pk	4.6 x 12.5	5	820950-931
ZGC	Guard Hardware Kit			820999-901

High Resolution of 24 Amino Acids Using ZORBAX Eclipse AAA Protocol

Column:	**ZORBAX Eclipse AAA 963400-902 4.6 x 150 mm, 3.5 µm**
Mobile Phase:	A: 40 mM Na_2HPO_4, pH 7.8
	B: ACN:MeOH:Water, 45:45:10 v/v
Flow Rate:	2 mL/min
Temperature:	40°C
Detector:	Fluorescence
Sample:	24 Amino Acids

This high resolution separation of 24 amino acids is done in 18 minutes. If the Rapid Resolution 4.6 x 75 mm Eclipse AAA column is selected, these amino acids are resolved in 9 minutes.



1. Asp
2. Glu
3. Asn
4. Ser
5. Gln
6. His
7. Gly
8. Thr
9. Cit
10. Arg
11. Ala
12. Tyr
13. Cys
14. Val
15. Met
16. Nva
17. Trp
18. Phe
19. Ile
20. Leu
21. Lys
22. Hyp
23. Sar
24. Pro

Amino Acid Standards

Each amino acid standard contains the following amino acids:

- Glycine
- L-cystine
- L-histidine
- L-tyrosine
- L-leucine
- L-methionine
- L-serine
- L-alanine
- L-phenylalanine
- L-glutamic acid
- L-proline
- L-isoleucine
- L-arginine
- L-threonine
- L-valine
- L-lysine
- L-aspartic acid

Amino Acid Standards, 10 x 1 mL ampoules*

Description	Part No.
1 nmol/µL	5061-3330
250 pmol/µL	5061-3331
100 pmol/µL	5061-3332
25 pmol/µL	5061-3333
10 pmol/µL	5061-3334
Amino acids supplement kit Includes 1 g each of norvaline, sarcosine, asparagine, glutamine, tryptophan, and 4-hydroxyproline	5062-2478

*Consider shelf-life and buy limited quantities, P/N 5062-2478 ships as 1 g vials

Amino Acid Separations Reagents

Description	Part No.
OPA reagent, 10 mg/mL each in 0.4 M borate buffer o-phthalaldehyde (OPA) and 3-mercaptopropionic acid, 6 x 1 mL ampoules	5061-3335
FMOC reagent, 2.5 mg/mL in acetonitrile, 9-fluorenylmethylchloroformate, 1 mL, 10 ampoules	5061-3337
Borate buffer, 100 mL	5061-3339
DTDPA (Dithiodiproprionic) reagent, for analysis of cysteine, 5 g	5062-2479

ZORBAX Eclipse PAH

- High resolution separation of 16 PAHs in EPA Method 610
- Extensive range of particle sizes (1.8, 3.5 and 5 µm) and sizes for fast and high resolution separations
- Each batch of material is specifically tested with PAHs for maximum reproducibility under expected operating conditions
- Excellent performance using the high quality, improved silica of Eclipse Plus columns
- Good for applications requiring "shape selectivity" or the separation of geometric isomers

Agilent ZORBAX Eclipse PAH columns are recommended for the separation of polycyclic aromatic hydrocarbons. PAHs are considered priority pollutants and the analysis of these potentially carcinogenic compounds in water, soil and food is of major importance. Eclipse PAH columns separate all 16 PAHS in EPA method 610 quickly and with high resolution.

Column Specifications

Bonded Phase	Pore Size	Surface Area	Temp. Limits	pH Range	Endcapped	Carbon Load
ZORBAX Eclipse PAH	95Å	160 m^2/g	60°C	2.0-8.0	No	14%

Specifications represent typical values only.

ZORBAX Eclipse PAH

Hardware	Description	Size (mm)	Particle Size (µm)	Eclipse PAH USP L1
	Analytical	4.6 x 250	5	959990-918
	Analytical	4.6 x 150	5	959993-918
	Analytical	4.6 x 100	5	959996-918
	Rapid Resolution	4.6 x 150	3.5	959963-918
	Rapid Resolution	4.6 x 100	3.5	959961-918
	Rapid Resolution	4.6 x 50	3.5	959943-918
	Rapid Resolution HT, 600 bar	4.6 x 100	1.8	959964-918
	Rapid Resolution HT, 600 bar	4.6 x 50	1.8	959941-918
	Rapid Resolution HT, 600 bar	4.6 x 30	1.8	959931-918
	Solvent Saver	3.0 x 250	5	959990-318
	Narrow Bore	2.1 x 250	5	959790-918
	Narrow Bore	2.1 x 150	5	959701-918
	Narrow Bore RR	2.1 x 100	3.5	959793-918
	Narrow Bore RRHT, 600 bar	2.1 x 100	1.8	959764-918
	Narrow Bore RRHT, 600 bar	2.1 x 50	1.8	959741-918
ZGC	Guard Cartridges, 4/pk	4.6 x 12.5	5	820950-939
ZGC	Guard Cartridges, 4/pk	2.1 x 12.5	5	821125-939
ZGC	Guard Hardware Kit			820999-901

High Resolution and Fast Analysis on RRHT Eclipse PAH Column

Column: **Eclipse PAH 959941-918 4.6 x 50 mm, 1.8 µm**

Mobile Phase: A: Water; B: Acetonitrile

Gradient:

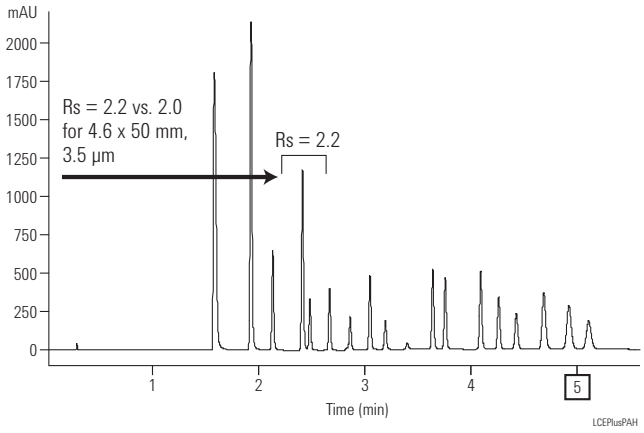
Time (Min)	% B
0.00	40
3.5	100
5.2	100
5.5	40
6.5	40

Flow Rate: 2.0 mL/min

Temperature: 25°C

Detector: DAD 220, 4 nm No Ref. DAD Stop Time = 6.0 min

Stop Time = 7.0



Pursuit PAH

- Fast analysis times for higher throughput
- Complete resolution of PAHs for easy integration
- Reproducible columns for rugged method development

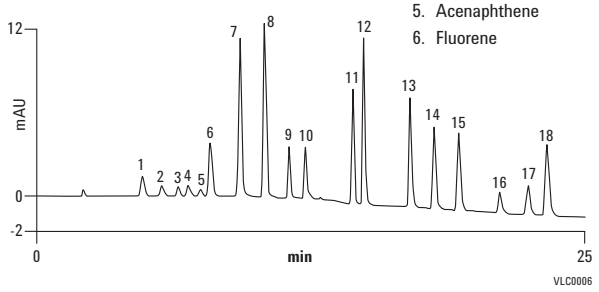
Agilent Pursuit PAH columns are based on a specially tailored, polymerically bonded C18 phase designed for the complete resolution of polycyclic aromatic hydrocarbons (PAHs). Using the 100 x 4.6 mm Pursuit 3 µm PAH column, all 16 components of the PAH mixture defined by EPA Method 610 can be fully resolved in less than ten minutes. Separation of critical pairs is maintained, while run times are reduced by as much as a factor of two.

Pursuit PAH

Hardware	Dimensions	Particle Size (µm)	Part No.
	4.6 x 250	5	A7000250X046
	4.6 x 150	5	A7000150X046
	4.6 x 100	3	A7001100X046
	3.0 x 100	3	A7001100X030
	2.0 x 100	3	A7001100X020
Pursuit PAH ChromSep Complete Cartridge Systems			
CS	4.6 x 250	5	A7000250C046
CS	4.6 x 150	5	A7000150C046
CS	4.6 x 150	3	A7001150C046
CS	4.6 x 100	3	A7001100C046
CS	3.0 x 100	5	A7000100C030

Polycyclic aromatic hydrocarbons according to Florida Administrative Code (Pre 9/97) 62.770

Column: **Pursuit PAH A7001100X046 4.6 x 100 mm, 3 µm**
Sample: PAH test mix
Temperature: 25°C
Detector: UV, 254 nm



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

ZORBAX Solvent Saver

- Provide 60% reduction in mobile phase usage and waste generation compared to a 4.6 mm ID column
- Provide 2- to 3-fold signal-to-noise (S/N ratio) improvement
- Deliver optimal LC/MS performance at intermediate flow rates
- Can be used with most conventional LC instrument configurations without modification
- Solvent Saver columns are available in 1.8, 3.5 and 5 µm particle sizes

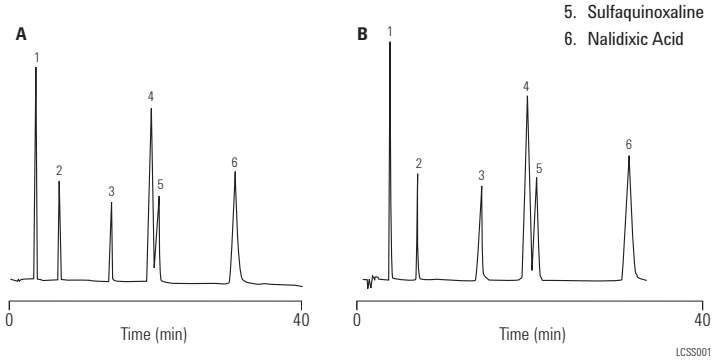
Agilent ZORBAX Solvent Saver columns have a 3.0 mm ID, which is ideal for reducing solvent usage by 50% compared to 4.6 mm ID columns. Also ideal for LC/MS, with a typical flow rate of 0.5 mL/min, these columns are compatible with almost all LC interfaces. Solvent Saver columns improve sensitivity 2 to 3 times over 4.6 mm ID columns and can be used with conventional HPLC instruments.

Solvent Saver Columns Provide up to 60% Reduction in Solvent Use and Waste

Column A:	**ZORBAX SB-C18** **883975-902** **4.6 x 150 mm, 5 µm**
Column B:	**ZORBAX SB-C18** **883975-302** **3.0 x 150 mm, 5 µm**
Mobile Phase:	20% ACN:80% 0.2 M Na_2HPO_4 + 0.1 M Citric Acid, pH 2.6
Temperature:	Ambient
Sample:	Antibacterials

This separation of antibacterials on 4.6 and 3.0 mm ID columns shows that solvent use is reduced by 50% simply by changing to a Solvent Saver column with no change in the chromatography, dramatically reducing the cost of analyses.

Less solvent consumption, less waste



1. Sulfamerazine
2. Furazolidone
3. Oxolinic Acid
4. Sulfadimethoxine
5. Sulfaquinoxaline
6. Nalidixic Acid

Solvent Saver Columns Increase Sensitivity

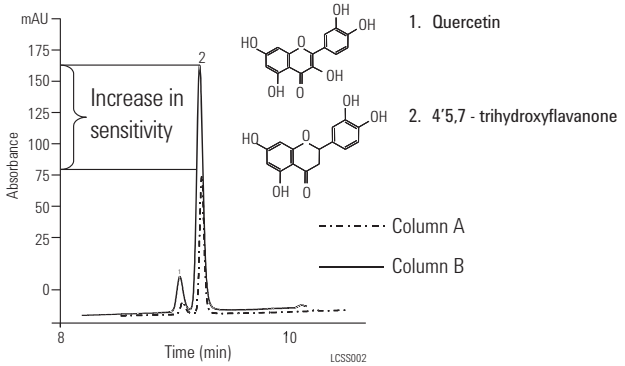
Column A: **ZORBAX SB-C18**
863953-902
4.6 x 150 mm, 3.5 µm

Column B: **ZORBAX SB-C18**
863954-302
3.0 x 150 mm, 3.5 µm

Mobile Phase: 25% Methanol:
75% 0.4% Formic Acid

Detector: 254 nm

This figure shows sensitivity is increased 2-3 times with Solvent Saver columns compared to 4.6 mm ID columns when the same mass sample is injected. No change in the HPLC instrumentation is required to see the sensitivity improvements.



Solvent Saver Columns are Ideal for LC/MS

Column: **ZORBAX SB-C18**
861954-302
3.0 x 100 mm, 3.5 µm

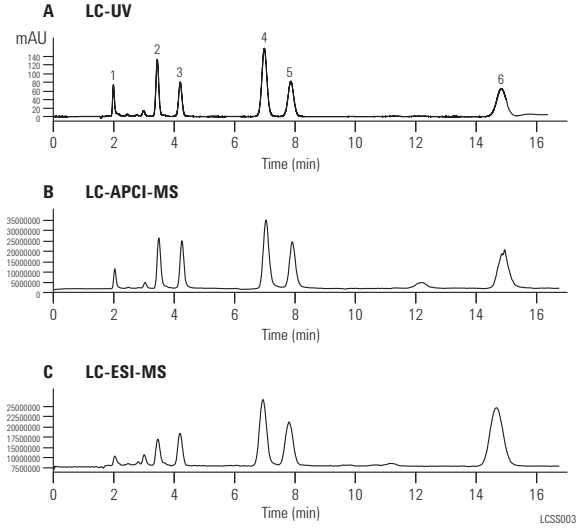
Mobile Phase: A: 70% Methanol+0.4% Formic Acid
B: 30% Water+0.4% Formic Acid

Flow Rate: 0.425 mL/min

Detector: A: UV 254 nm
B: Positive Ion APCI
C: Positive Ion Electrospray

Sample: Steroids

Solvent Saver columns are ideal for LC/MS because the typical 0.5 mL/min flow rate allows samples to be evaluated and analyzed without changing columns when the MS interface is changed from electrospray to APCI.



1. Triamcinolone
2. Hydrocortisone
3. Cortisone acetate
4. Deoxycorticosterone
5. Hydroxyprogesterone
6. Progesterone

ZORBAX Eclipse Plus

Description	Size (mm)	Particle Size (µm)	Eclipse Plus C18 USP L1	Eclipse Plus C8 USP L7	Eclipse Plus Phenyl-Hexyl USP L11	Eclipse PAH USP L1
Solvent Saver	3.0 x 250	5				959990-318
Solvent Saver	3.0 x 150	5	959993-302	959993-306		
Solvent Saver Plus	3.0 x 150	3.5	959963-302	959963-306	959963-312	
Solvent Saver Plus	3.0 x 100	3.5	959961-302	959961-306	959961-312	
Solvent Saver RRHD, 1200 bar	3.0 x 150	1.8	959759-302	959759-306		
Solvent Saver RRHD, 1200 bar	3.0 x 100	1.8	959758-302	959758-306		
Solvent Saver RRHD, 1200 bar	3.0 x 50	1.8	959757-302	959757-306		
Solvent Saver HT, 600 bar	3.0 x 100	1.8	959964-302	959964-306	959964-312	
Solvent Saver HT, 600 bar	3.0 x 50	1.8	959941-302	959941-306	959941-312	

ZORBAX 80Å Eclipse XDB

Description	Size (mm)	Particle Size (µm)	Eclipse XDB-C18 USP L1	Eclipse XDB-C8 USP L7	Eclipse XDB-Phenyl USP L11	Eclipse XDB-CN USP L10
Solvent Saver	3.0 x 250	5	990967-302	990967-306	990967-312	990967-305
Solvent Saver	3.0 x 150	5	993967-302	993967-306	993967-312	993967-905
Solvent Saver Plus	3.0 x 150	3.5	963954-302	963954-306	963954-305	963954-305
Solvent Saver Plus	3.0 x 100	3.5	961967-302	961967-306	961967-312	
Solvent Saver Plus	3.0 x 75	3.5	966954-302			
Solvent Saver RRHD, 1200 bar	3.0 x 150	1.8	981759-302			
Solvent Saver RRHD, 1200 bar	3.0 x 100	1.8	981758-302			
Solvent Saver RRHD, 1200 bar	3.0 x 50	1.8	981757-302			
Solvent Saver HT, 600 bar	3.0 x 100	1.8	928975-302	928975-306		
Solvent Saver HT, 600 bar	3.0 x 50	1.8	927975-302	927975-306		
Solvent Saver HT, 600 bar	3.0 x 30	1.8	924975-302	924975-306		
Solvent Saver HT, 600 bar	3.0 x 20	1.8	926975-302	926975-306		

ZORBAX 80Å StableBond

Description	Size (mm)	Particle Size (µm)	SB-C18 USP L1	SB-C8 USP L7	SB-CN USP L10	SB-C3 USP L56	SB-Phenyl USP L11	SB-Aq
Solvent Saver	3.0 x 250	5	880975-302	880975-306	880975-305	880975-309	880975-312	880975-314
Solvent Saver	3.0 x 150	5	883975-302	883975-306	883975-305	883975-309	883975-312	883975-314
Solvent Saver Plus	3.0 x 150	3.5	863954-302	863954-306	863954-305	863954-309	863954-312	863954-314
Solvent Saver Plus	3.0 x 100	3.5	861954-302	861954-306	861954-305	861954-309	861954-312	861954-314
Solvent Saver Plus	3.0 x 75	3.5	866953-302					

(Continued)

ZORBAX 80Å StableBond

Description	Size (mm)	Particle Size (µm)	SB-C18 USP L1	SB-C8 USP L7	SB-CN USP L10	SB-C3 USP L56	SB-Phenyl USP L11	SB-Aq
Solvent Saver RRHD, 1200 bar	3.0 x 150	1.8	859700-302	859700-306				
Solvent Saver RRHD, 1200 bar	3.0 x 100	1.8	858700-302	858700-306	858700-305		858700-312	
Solvent Saver RRHD, 1200 bar	3.0 x 50	1.8	857700-302	857700-306	857700-305		857700-312	
Solvent Saver HT, 600 bar	3.0 x 150	1.8	829975-302	829975-306	829975-305		829975-312	
Solvent Saver HT, 600 bar	3.0 x 100	1.8	828975-302	828975-306	828975-305	828975-309	828975-312	828975-314
Solvent Saver HT, 600 bar	3.0 x 50	1.8	827975-302	827975-306	827975-305			
Solvent Saver HT, 600 bar	3.0 x 30	1.8	824975-302	824975-306	824975-305		827975-312	827975-314
Solvent Saver HT, 600 bar	3.0 x 20	1.8	826975-302	826975-306				

ZORBAX 300Å StableBond

Description	Size (mm)	Particle Size (µm)	300SB-C18 USP L1	300SB-C8 USP L7	300SB-CN USP L10	300SB-C3 USP L56
Solvent Saver Plus	3.0 x 150	3.5	863974-302	863974-306	863974-309	863974-309
Solvent Saver Plus	3.0 x 100	3.5		861973-306		
Solvent Saver Plus	3.0 x 75	3.5	866953-302			

ZORBAX 80Å Bonus-RP and Rx

Description	Size (mm)	Particle Size (µm)	Bonus-RP USP L60	Rx-C18 USP L1	Rx-C8 USP L7
Solvent Saver	3.0 x 250	5	880668-301	880967-302	880975-306
Solvent Saver	3.0 x 150	5	883668-301	883967-302	883975-306
Solvent Saver Plus	3.0 x 150	3.5	863668-301	863967-302	863954-306
Solvent Saver Plus	3.0 x 100	3.5	864668-301	861967-302	861954-306

ZORBAX 80Å Extend-C18

Description	Size (mm)	Particle Size (µm)	Extend-C18 USP L1
Solvent Saver	3.0 x 250	5	770450-302
Solvent Saver	3.0 x 150	5	773450-302
Solvent Saver Plus	3.0 x 150	3.5	763954-302
Solvent Saver Plus	3.0 x 100	3.5	764953-302
Solvent Saver Plus	3.0 x 50	3.5	735954-302

Chiral HPLC Columns

Ultron ES Chiral Columns

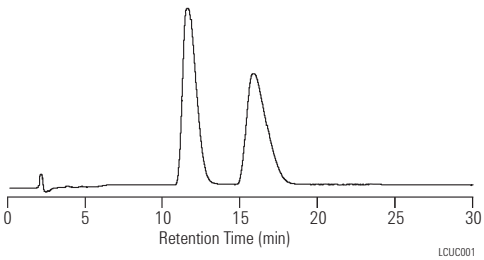
- Direct racemic separations without derivatization
- Use Ultron ES-OVM as the USP L57 choice and to separate enantiomers of acidic and basic pharmaceuticals, such as hexobarbital, ibuprofen, and profenamine
- Ultron ES-Pepsin Chiral columns are best suited to separate basic compounds that are difficult to separate with other chiral columns
- ES-OVM and ES-Pepsin columns contain 120Å, 5 µm silica particles bonded with an ovomucoid protein and pepsin protein, respectively
- Both types of chiral columns are usable with reversed-phase mobile phases such as acetonitrile or ethanol and phosphate buffer

Ultron ES Chiral columns are immobilized protein columns that feature numerous chiral recognition sites for enantiomeric separations of dozens of chiral compounds. They are engineered with two complementary protein-based chiral stationary phases, making them an excellent choice for the HPLC separation of enantiomers without derivatization – including a growing number of drug substances of interest.

Separation of Enantiomers of Fluoxetine (Prozac)

Column:	**Ultron ES-OVM Chiral 702111651 4.6 x 150 mm, 5 µm**
Mobile Phase:	25:75 (v/v) EtOH/20 mM KH_2PO_4, pH 5.5 (adjusted with NaOH)
Temperature:	Ambient
Detector:	UV (225 nm)
Sample:	Mixture Fluoxetine (Prozac) entantiomers

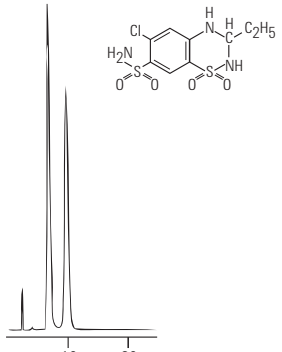
Courtesy of D. S. Risley and V. S. Sharp of Lilly Research Laboratories, Eli Lilly and Co.



Separation of Ethiazide (diuretic drug) on ULTRON ES-OVM Column

Column: **Ultron ES-OVM Chiral 702111651 4.6 x 150 mm, 5 µm**

Mobile Phase: 20 mM KH_2PO_4 (pH 4.6)
Flow Rate: 1 mL/min
Temperature: 25°C
Detector: 220 nm



LCUC002

Chiral Separation of Warfarin Enantiomers R and S Limit of Quantitation %RSD at 100 fg/mL

Column: **Ultron ES-OVM Chiral 702111610 2.0 x 150 mm, 5 µm**

Temperature: 30°C
Injection Volume: 5 µL
Autosampler Temperature: 10°C
Needle Wash: Flush port (50:25:25 H_2O, IPA:MeOH:H_2O, 5 seconds)
Mobile Phase: 83% A = H_2O + 5mM Ammonium Formate
17% B = ACN
Flow Rate: 0.5 mL/min
Stop time: 7.0 min
MS Conditions: Agilent 6410A Triple Quadrupole LC/MS/MS with MultiMode Source
Ion Mode: ESI, Negative

Source Conditions

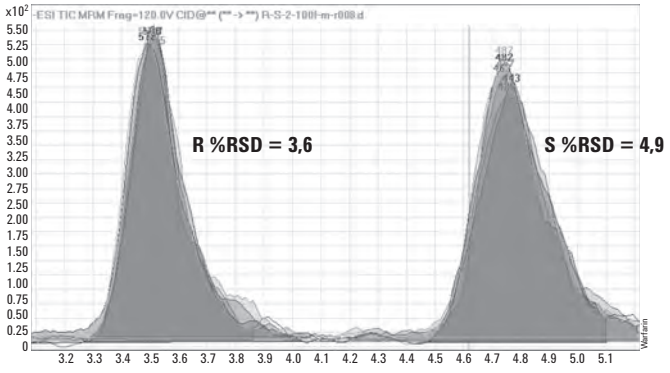
Capillary Voltage: 2000 V
Drying Gas (nitrogen): 5 L/min
Drying Gas Temperature: 300°C
Nebulizer Gas (nitrogen): 40 psi
Vaporizer: 200°C

Product Ion Scan

Mass Range: 50-500 m/z
Scan Speed: 500 msec

MRM acquisition (Q1 peak width = 1.2 and Q2 peak width = 0.70 amu)

Delta EMV: 1000V



Counts vs. Acquisition Time

Ultron ES Chiral Columns

Description	Size (mm)	Particle Size (µm)	ES-OVM USP L57	ES-Pepsin
Semi-Prep	10 x 150	5	722111723	
Analytical	4.6 x 250	10	724111653	
Analytical	4.6 x 150	5	702111651	822111651
Analytical, with Guard	4.6 x 150	5	702111651A	822111631A
Narrow Bore	2.0 x 150	5	702111610	
Guard Column	4.0 x 10	5	712111630	832111630

ChiraDex Chiral Columns

- For routine separation of enantiomers
- Available as ChiraDex cartridge columns
- Novel manufacturing process bonds β-cyclodextrin to spherical 5 µm silica gel by means of a chemical spacer
- Enantiomeric separations have been achieved with ChiraDex using simple nonchiral solvent systems such as MeOH/water, MeOH/buffer, and ACN/TEAA

ChiraDex Chiral Columns

Hardware	Description	Size (mm)	Particle Size (µm)	Part No.
AC	Cartridge Column	4.0 x 250	5	79925CB-584
AC	Cartridge Holder, 5021-1845			5021-1845

PREPARATIVE HPLC COLUMNS AND FLASH CHROMATOGRAPHY

Agilent provides a range of preparative columns for direct scale-up of analytical separations or preparative scale purification of organic compounds. Preparative LC columns are used when resolution is critical and high-efficiency columns are key. Column choices range from semi-prep to several inches in internal diameter for use on analytical and preparative HPLC systems.

Flash chromatography can be used to purify reaction products and isolate target compounds. This is a popular purification technique for fast results and high throughput with many samples. Flash columns have larger particle sizes and lower pressure than traditional HPLC columns. They are often disposable and very cost-effective. Corresponding flash systems are available for convenient use of flash cartridges.

Some choices shown in this section include the following:

- **ZORBAX PrepHT** – ideal for analytical to preparative separations on ZORBAX phases where resolution is critical
- **Agilent Prep** – cost-effective preparative separation choice and are available in 21.2, 30 and 50 mm ID sizes with matching scalar columns in either 5 or 10 µm particle sizes
- **Dynamax Preparative** – use a modular design with dynamic axial compression to eliminate column voids and are available with cost-effective, high-capacity packing materials
- **High Efficiency Purification** – range of Pursuit and Polaris HPLC materials for small molecule separations
- **Load & Lock Preparative HPLC** – enable you to quickly and easily pack your own preparative high efficiency columns
- **SuperFlash Purification** – maximum recovery of of high purity compounds every time
- **Flash F75/F150 Cartridges** – designed for routine, quick purification of several grams or more of your target compounds

ZORBAX PrepHT

- Easy scale-up from analytical to preparative scale with ZORBAX phases
- Fast preparative separations, up to 2000 mg
- 5 to 7 µm particles for high efficiency and high yield
- Easy to install finger-tight connections seal up to 5000 psi/350 bar

High purity, high recovery and high throughput can be easily achieved with Agilent ZORBAX PrepHT columns. These are available in a variety of bonded phases – Eclipse XDB, StableBond, Bonus-RP, and Extend-C18 – for optimized resolution and loadability under any conditions.

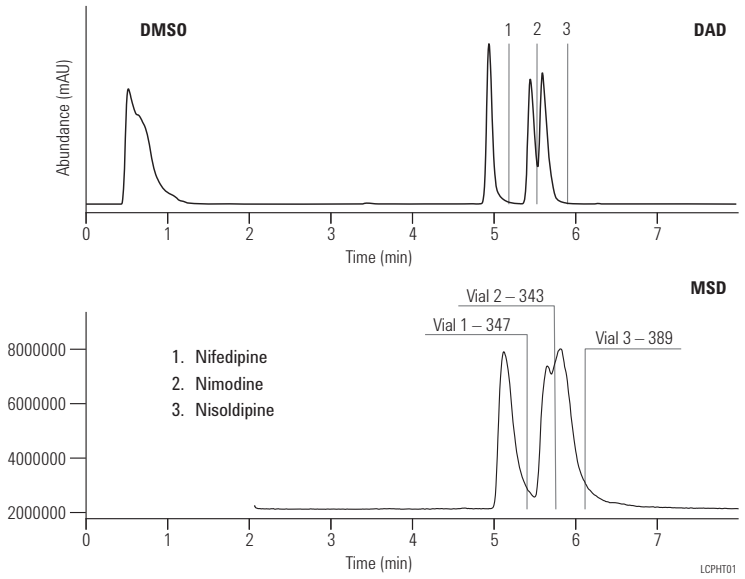
ZORBAX PrepHT columns are packed with 5 and 7 µm particle sizes for very high resolution. The high resolution allows high loadability, high yield, and high purity of compounds. The larger diameter columns and mechanically stronger ZORBAX particles allow for flow rates up to 100 mL/min, thus increasing throughput.

ZORBAX PrepHT columns are designed for rapid scale-up from analytical to preparative scale without losing resolution. For complex separations on larger columns (21.2 mm ID, 150 mm length and longer), Agilent has carefully chosen the 7 µm particle size to achieve a balance between high efficiency and high loadability.

High Purity and High Recovery with ZORBAX PrepHT Columns

Sample: Antianginal drugs

Mass-based fraction collection using ZORBAX SB-C18 column shows high purity and high recovery of each compound (Application Note publication number 5988-7113EN). The separation of the three antianginal drugs was successfully done in a single run with high recovery and >90% purity. Separations up to 2000 mg are possible depending on the complexity of separation.



	Amount Nifedipin [mg]	Amount Nifmodipin [mg]	Amount Nifsoldipin [mg]		
Fraction 1	18.90	0.11	0.16	Purity Nifedipin	98.6%
Fraction 2	0.29	17.66	0.77	Purity Nifmodipin	94.4%
Fraction 3	0.49	1.66	18.36	Purity Nifsoldipin	89.5%
Recovery [mg]	19.68	19.43	19.29		
Recovery [%]	101.3	102.0	101.9		

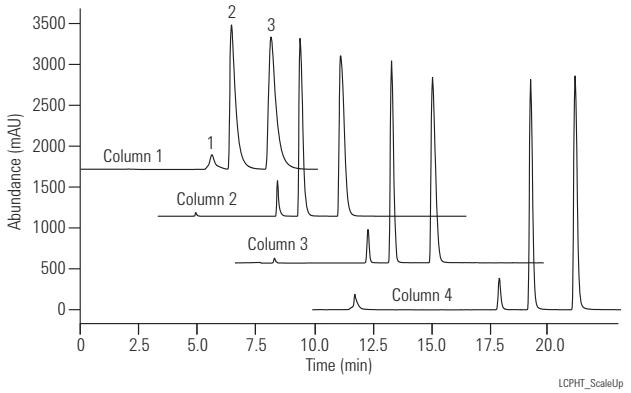
ZORBAX PrepHT columns are designed for rapid scale-up from analytical to preparative scale without losing resolution. For complex separations for larger columns (21.2 mm ID and higher, 150 mm length and higher), Agilent has carefully chosen the 7 µm particle size to achieve a balance between high efficiency and high loadability.

Scale-Up from Analytical to Prep ZORBAX SB-C18 Columns Using the Same Pump

Column	Size	Flow (mL/min)	Injection (µL)	Detector Cell	Part No.
Column 1	50 x 150 mm	100	2200	0.3 mm quartz	Custom Column
Column 2	21.2 x 150 mm	18	400	0.3 mm quartz	877150-102
Column 3	9.4 x 150 mm	3.5	80	0.3 mm quartz	883975-202
Column 4	4.6 x 150 mm	0.85	2.0	3 mm SST	883975-902

Using the same 1100 pump, a scale-up from 4.6 mm to 50 mm ID was possible without any loss of resolution. This increases throughput by reducing the time required for redeveloping and adjusting the method.

Scale-Up to PrepHT



1. Theobromine
2. Theophylline
3. Caffeine

ZORBAX PrepHT 80ÅStableBond (require hardware 820400-901)

Hardware	Description	Size (mm)	Particle Size (µm)	SB-C18 USP L1	SB-C8 USP L7	SB-Aq	SB-CN USP L10	SB-Phenyl USP L11
PI	PrepHT Cartridge	21.2 x 250	7	877250-102	877250-106	877250-114	877250-105	877250-112
PI	PrepHT Cartridge	21.2 x 150	7	877150-102	877150-106	877150-114		
PI	PrepHT Cartridge	21.2 x 150	5	870150-902	870150-906	870150-914		
PI	PrepHT Cartridge	21.2 x 100	5	870100-902	870100-906	870100-914		
PI	PrepHT Cartridge	21.2 x 50	5	870050-902	870050-906	870050-914		
PI	PrepHT Guard Cartridge, 2/pk	17 x 7.5	5	820212-920	820212-915	820212-933	820212-933	820212-915

ZORBAX PrepHT 300ÅStableBond (require hardware 820400-901)

Hardware	Description	Size (mm)	Particle Size (µm)	300SB-C18 USP L1	300SB-C8 USP L7	300SB-C3 USP L56	300SB-CN USP L10
PI	PrepHT Cartridge	21.2 x 250	7	897250-102	897250-106	897250-109	897250-105
PI	PrepHT Cartridge	21.2 x 150	7	897150-102	897150-106	897150-109	
PI	PrepHT Cartridge	21.2 x 150	5	895150-902	895150-906	895150-909	
PI	PrepHT Cartridge	21.2 x 100	5	895100-902	895100-906	895100-909	
PI	PrepHT Cartridge	21.2 x 50	5	895050-902	895050-906	895050-909	
PI	PrepHT Guard Cartridge, 2/pk	17 x 7.5	5	820212-921	820212-918	820212-924	820212-924
	Guard Cartridge Hardware Includes guard column end fitting, polymeric seal, and seal insertion tool (seal holder and seal pusher)			820444-901	820444-901	820444-901	820444-901
	PrepHT endfittings, 2/pk			820400-901	820400-901	820400-901	820400-901

ZORBAX PrepHT Original (require hardware 820400-901)

Hardware	Description	Size (mm)	Particle Size (µm)	ODS (C18) USP L1	C8 USP L7	CN USP L10	NH2 USP L8	SIL USP L3
PI	PrepHT Cartridge	21.2 x 250	7	877952-102	877952-106	877952-105	877952-108	877952-101
	PrepHT endfittings, 2/pk			820400-901	820400-901	820400-901	820400-901	820400-901

ZORBAX PrepHT Eclipse XDB (require hardware 820400-901)

Hardware	Description	Size (mm)	Particle Size (µm)	Eclipse XDB-C18 USP L1	Eclipse XDB-C8 USP L7
PI	PrepHT Cartridge	21.2 x 250	7	977250-102	977250-106
PI	PrepHT Cartridge	21.2 x 150	7	977150-102	977150-106
PI	PrepHT Cartridge	21.2 x 150	5	970150-902	970150-906
PI	PrepHT Cartridge	21.2 x 100	5	970100-902	970100-906
PI	PrepHT Cartridge	21.2 x 50	5	970050-902	970050-906
PI	PrepHT Guard Cartridge, 2/pk	17 x 7.5	5	820212-925	820212-926
	Guard Cartridge Hardware Includes guard column end fitting, polymeric seal, and seal insertion tool (seal holder and seal pusher)			820444-901	820444-901
	PrepHT endfittings, 2/pk			820400-901	820400-901

ZORBAX PrepHT Bonus-RP and Extend-C18 (require hardware 820400-901)

Hardware	Description	Size (mm)	Particle Size (µm)	Bonus-RP USP L60	Extend-C18 USP L1
PI	PrepHT Cartridge	21.2 x 250	7	878250-101	
PI	PrepHT Cartridge	21.2 x 150	7	878150-101	
PI	PrepHT Cartridge	21.2 x 150	5	868150-901	770150-902
PI	PrepHT Cartridge	21.2 x 100	5	868100-901	770100-902
PI	PrepHT Cartridge	21.2 x 50	5	868050-901	770050-902
PI	PrepHT Guard Cartridge, 2/pk	17 x 7.5	5	820212-928	820212-930
	Guard Cartridge Hardware Includes guard column end fitting, polymeric seal, and seal insertion tool (seal holder and seal pusher)			820444-901	820444-901
	PrepHT endfittings, 2/pk			820400-901	820400-901

ZORBAX PrepHT Rx-SIL (require hardware 820400-901)

Hardware	Description	Size (mm)	Particle Size (µm)	Rx-SIL USP L3	Rx-C18 USP L1
PI	PrepHT Cartridge	21.2 x 250	7	877250-101	
PI	PrepHT Cartridge	21.2 x 250	7		877967-102
PI	PrepHT Guard Cartridge, 2/pk	17 x 7.5	5	820212-919	820212-914
	Guard Cartridge Hardware Includes guard column end fitting, polymeric seal, and seal insertion tool (seal holder and seal pusher)			820444-901	820444-901
	PrepHT endfittings, 2/pk			820400-901	820400-901

ZORBAX PrepHT Accessories

Hardware	Description	Part No.
PI	Guard Cartridge Hardware	820444-901
PI	PrepHT endfittings, 2/pk	820400-901
PI	Replacement Seals	820385-901

Agilent Prep LC Columns

- High loadability for maximum sample purification
- Easy scalability from 4.6 up to 50 mm ID for rapid method development
- High throughput 21.2 mm ID cartridges for fast purification
- Exceptional column stability and loadability up to pH 10

Agilent Prep LC columns are designed for high loadability to purify milligram to gram quantities of products. Preparative sized columns are available in 21.2, 30, and 50 mm internal diameters with lengths ranging from 50-250 mm. Columns are available in 5 and 10 µm particle sizes with very high efficiency in every dimension. These column choices accommodate almost every preparative sample.

Agilent Prep 21.2 mm ID columns are available with Agilent's Preparative Cartridge Hardware. This reliable cartridge hardware makes it simple to use columns with different lengths to increase sample load. Guard columns are easily integrated onto these columns, providing superior protection of the analysis column. Analytical size 4.6 mm ID scalar columns are available for method development and optimization prior to scaling up to larger columns. Bulk material is also available.

Agilent Prep columns are available in a C18 bonded phase suitable for purification of a wide variety of non-polar and polar compounds. Unbonded silica columns are also available.

Column Specifications

Bonded Phase	Pore Size	Surface Area	Temp. Limits	pH Range	Endcapped	Carbon Load
C18	100Å	400 m^2/g	60°C*	2.0-10.0	Single	24%
Silica	100Å	400 m^2/g	**	1.0-8.0	N/A	N/A

Specifications represent typical values only.

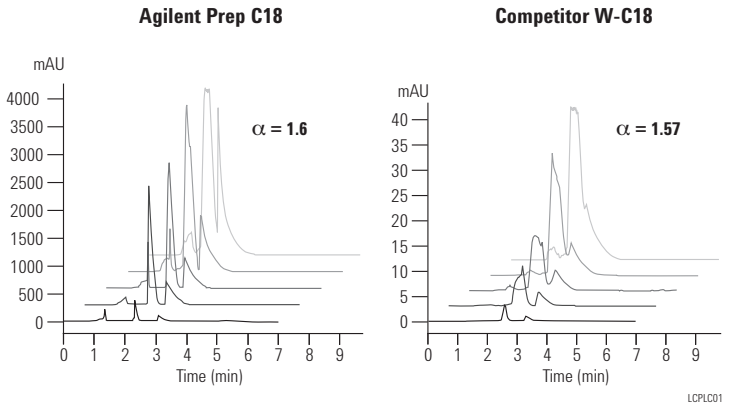
*Temperature limits are 60°C up to pH 8, 40°C from pH 8-10.

**Temperature limits for bare silica are determined by the pH of the mobile phase.

Superior Loadability on Agilent Prep C18 with Basic Compounds

Column:	**Agilent Prep C18**
	443905-902
	4.6 x 150 mm, 5 µm
Mobile Phase:	50% 0.1%TFA:50% ACN
Flow Rate:	1 mL/min
Sample:	10 µL
	Doxepin/Amitriptyline
	0.5-50 mg/mL

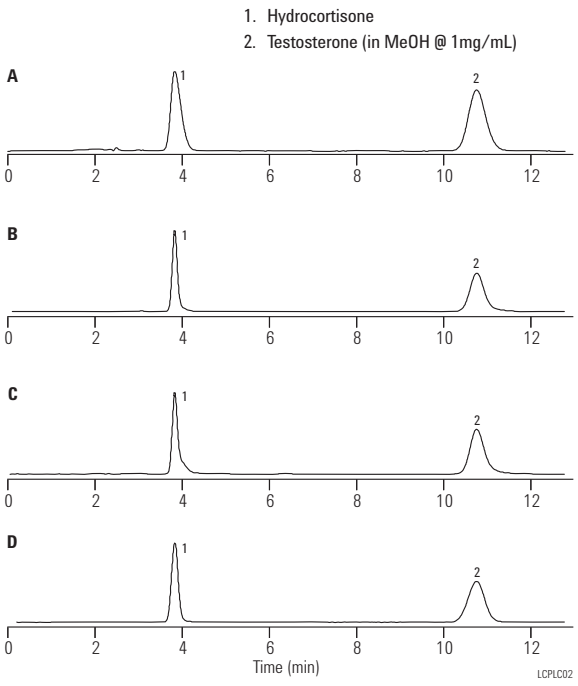
Agilent Prep columns show better resolution and loadability than competitor columns.



Steroids: Easy Scalability Using Agilent Prep Columns

Column A:	**Agilent Prep C18**
	443905-902
	4.6 x 150 mm, 5 µm
Column B:	**443905-102**
	21.2 x 150 mm, 5 µm
Column C:	**413910-302**
	30.0 x 150 mm, 10 µm
Column D:	**413910-502**
	50.0 x 150 mm, 10 µm
Mobile Phase:	55% Water:45% ACN
Flow Rate:	0.7 mL/min
	14.87 mL/min
	29.77 mL/min
	85.37 mL/min
Temperature:	Ambient
Detector:	240 nm
Sample:	2 µL
	42.4 µL
	170 µL
	488 µL

Agilent Prep C18 shows excellent scalability, making method transfer simple and predictable.



Agilent Prep LC Columns

Hardware	Description	Size (mm)	Particle Size (µm)	C18	Silica
Standard Columns (no special hardware required)					
	Scalar	4.6 x 250	10	440910-902	440910-901
	Scalar	4.6 x 150	10	443910-902	443910-901
	Scalar	4.6 x 100	10	449910-902	
	Scalar	4.6 x 250	5	440905-902	440905-901
	Scalar	4.6 x 150	5	443905-902	443905-901
	Scalar	4.6 x 100	5	449905-902	449905-901
	Scalar	4.6 x 50	5	446905-902	446905-901
PrepHT Cartridge Columns (require endfittings kit 820400-901)*					
PL	PrepHT	21.2 x 250	10	410910-102	410910-101
PL	PrepHT	21.2 x 150	10	413910-102	413910-101
PL	PrepHT	21.2 x 50	10	446910-102	
PL	PrepHT	21.2 x 150	5	443905-102	443905-101
PL	PrepHT	21.2 x 100	5	449905-102	449905-101
PL	PrepHT	21.2 x 50	5	446905-102	446905-101
PL	PrepHT endfittings, 2/pk			820400-901	820400-901
Standard Columns (no special hardware required)					
	Prep 30	30.0 x 250	10	410910-302	410910-301
	Prep 30	30.0 x 150	10	413910-302	413910-301
	Prep 30	30.0 x 100	10	419910-302	419910-301
	Prep 30	30.0 x 100	5	449905-302	449905-301
	Prep 30	30.0 x 50	5	446905-302	446905-301
	Prep 50	50.0 x 250	10	410910-502	410910-501
	Prep 50	50.0 x 150	10	413910-502	413910-501
	Prep 50	50.0 x 100	10	419910-502	419910-501
	Prep 50	50.0 x 100	5	449905-502	449905-501
Guard Columns (hardware required)					
PL	PrepHT Guard Cartridges, 2/pk	21.2 x 10	10	420212-902	420212-901
PL	Guard Cartridge Hardware			820444-901	820444-901
PL	PrepHT External Guard Hardware Kit			420420-901	420420-901
	Bulk Packing (1kg)		10	420910-902	420910-901

*All PrepHT cartridge columns require hardware kit P/N 820400-901. If a guard column is desired for the 21.2 mm ID columns, the PrepHT Guard Hardware Kit, P/N 820444-901, is also required. If the guard column is used on a 30 mm ID column then the external guard column hardware kit, P/N 420420-901, is required.

High Efficiency Purification for Small Molecule Separations

- Small column sizes for high-speed media selection, method development and purification
- Comprehensive range of selectivities
- Packed columns and bulk media

Agilent offers a range of high efficiency, small particle silica and polymeric HPLC materials. These are pre-packed preparative columns and bulk media for reverse phase, normal phase and ion exchange purification. A range of pore sizes is available, providing maximum capacity for all applications, from small molecules to biological macromolecules.

Small Molecule Separations

Separation	Media Characterization	Column
Hydrophobic	Highest Mass Loading	Pursuit XRs 100Å C18 Pursuit XRs 100Å C8
	Hydrophobic Work Horse	Pursuit 200Å C18 Pursuit 200Å C8
	Aromatic/Double Bonds	Pursuit 200Å Diphenyl
Hydrophilic	Polar Selectivity	Polaris 200Å C18-A Polaris 200Å C8-A
	H-bond Accepting	Polaris 200Å C18-Ether Polaris 200Å C8-Ether
	Reverse or Normal-Phase	Polaris 200Å NH2
	H-bonding	Polaris 200Å Amide-C8
	Normal-Phase Organic Soluble	Pursuit XRs Si Pursuit XRs Diol
Extreme Conditions	pH Extremes/High Temperatures	PLRP-S 100Å, 8 µm

Pursuit High Efficiency XRs Columns for Small Molecule Separations

Size (mm)	Particle Size (µm)	XRs C18	XRs C8	XRs Diphenyl	XRs Diol	XRs Si
21.2 x 250	10	A6002250X212				A6004250X100
21.2 x 250	5	A6000250X212		A6020250X212	A3040250X212	
21.2 x 100	5		A6010100X212			
10.0 x 250	10	A6002250X100				
10.0 x 250	5	A6000250X100		A6020250X100		
High Efficiency Bulk Media						
100 g	10	A6002100G	A6012100G			A6004100G

Pursuit High Efficiency Columns for Small Molecule Separations

Size (mm)	Particle Size (µm)	C18	C8	Diphenyl	PFP
21.2 x 250	10	A6002250X212	A3032250X212	A3042250X212	
21.2 x 250	5	A3000250X212	A3030250X212	A3040250X212	A3050250X212
10.0 x 250	10	A6002250X100	A3032250X100	A3042250X100	
10.0 x 250	5	A3000250X100	A3030250X100	A3040250X100	A3050250X100

Polaris High Efficiency Columns for Small Molecule Separations

Size (mm)	Particle Size (µm)	C18-A	C18-Ether	Amide C18	C8-A	C8-Ether	NH2	Si-A
21.2 x 250	10	A2002250X212		A2008250X212				A2004250X212
21.2 x 250	5	A2000250X212	A2030250X212	A2006250X212	A2010250X212	A2030250X212	A2013250X212	A2003250X212
10.0 x 250	10			A2008250X100				
10.0 x 250	5	A2000250X100	A2020250X100	A2006250X100	A2010250X100	A2030250X100	A2013250X100	

Dynamax Preparative HPLC Columns

- Modular design with reusable end fittings reduces hardware costs
- Three internal diameters – 10, 21.4 and 41.4 mm – for easy scale-up
- Integral guard column option for longer column lifetimes with complex samples

The Dynamax preparative column hardware utilizes a patented dynamic axial compression (DAC) design and is the ideal format for the development and optimization of a high throughput or high yield purification. The DAC principle of operation maintains packed bed integrity and improves column performance over an extended period of time with a reduction in operating costs.

Agilent offers Dynamax columns as compression modules (cartridges) onto which separate axial compression end fittings are fitted. This provides a means of eliminating voids that may form at the column inlet during use and also enables the end fittings to be reused. When changing the column it is only necessary to replace the compression module with one of a similar internal diameter.

There are three options when configuring a Dynamax column. To simplify choice, end fittings kits are available for each of the configurations. Kit #1 contains the end fittings for using the Dynamax column without a guard module. Kit #2 contains all the parts needed to operate with a protective guard module. There is also a guard coupling assembly parts kit to upgrade Kit #1 to Kit #2. When the guard column is used as a short preparative column only the standalone guard holder is needed.

SepTech ST60 10-C18 and SepTech ST150 10-C18 media designed for high performance separations at high capacity are available in the Dynamax format for rapid method development and small-scale separations.

Dynamax Column Hardware Kits

Description	ID (mm)	Part No.
End fittings kit #1	10	R000083810
	21.4	R000083820
	41.4	R000083840
End fittings kit #2	10	R000083812
	21.4	R000083822
	41.4	R000083842
Guard coupling assembly Upgrades kit #1 to kit #2	10	R000083811
	21.4	R000083821
	41.4	R000083841
Standalone guard holder	10	R000083814
	21.4	R000083824
	41.4	R000083844

SepTech C18 Reverse Phase Media

- Symmetrical peaks improve yield of high purity product
- High capacity delivers maximum throughput
- Narrow particle size distribution improves packed bed stability

SepTech media has been developed specifically for prep to process HPLC, from the definition of the base silica particle, pore sizes, pore volume, specific surface area, mechanical strength and particle size distribution through to the bonding chemistry, ligand density and end capping. The result is two products: SepTech ST60 10-C18 – optimized for small molecule purifications, and SepTech ST150 10-C18 – the preferred option for larger, natural molecules and biomolecules.

The high level of batch-to-batch reproducibility and particle integrity give consistent performance and ease of column packing, which are essential for minimizing production downtime. SepTech media helps you meet the demands of a robust and economical process by purifying the maximum amount of product at the required purity in the shortest period of time.

Column Specifications

Characteristics	SepTech ST60 10-C18	SepTech ST150 10-C18
Nominal Particle Size	10 µm	10 µm
Nominal Pore Size	60Å	150Å
Nominal Distribution	<2 d90/d10	<2 d90/d10
Shape	Spherical	Spherical
Silica Purity	99.999%	99.999%
Chemistry	Octadecyl	Octadecyl
End Capping	Yes	Yes
Carbon Load	25%	15%
Ligand Coverage	3.5 µmol/m^2	3.8 µmol/m^2
Working pH Range	1.5-10	1.5-10

SepTech ST60 10-C18

Description	Size (mm)	Part No.
Method Development Column	4.6 x 250	A8060250X046
Dynamax Packed Cartridge Module	10 x 50	A8060050DG100
	10 x 250	A8060250DM100
	21.2 x 50	A8060050DG214
	21.2 x 250	A8060250DM214
	41.4 x 50	A8060050DG414
	41.4 x 250	A8060250DM414
Bulk media	100 g	A80600100G
	1 kg	A8060001KG

SepTech ST150 10-C18

Description	Size (mm)	Part No.
Method Development Column	4.6 x 250	A8150250X046
Dynamax Packed Cartridge Module	10 x 50	A8150050DG100
	10 x 250	A8150250DM100
	21.2 x 50	A8150050DG214
	21.2 x 250	A8150250DM214
	41.4 x 50	A8150050DG414
	41.4 x 250	A8150250DM414
Bulk media	100 g	A81500100G
	1 kg	A8150001KG

FlowTrap

- Reduced dry-down times improve productivity
- Desalting in situ preserves compound integrity
- Retentive sorbent handles a wide range of sample pH and pKa

FlowTrap columns contain ultra-retentive, high capacity, and hydrophobic polymeric material that captures and concentrates small molecules. Once trapped, the desired analyte can be back eluted using a small volume of volatile organic solvent, affording simple compound isolation. FlowTrap columns give you excellent retention and easy elution. The efficiency of the packed bed delivers superior reproducibility and can be used for up to 500 flow-trapping cycles when run under optimized conditions.

With FlowTrap you can solvent switch from a high volume of water-based HPLC eluent to a low volume of volatile solvent, dramatically reducing the evaporation times needed for compound isolation. Ion pairing reagents such as TFA can be removed from the compound during trapping, allowing the isolation of free-base compounds and reducing the risk of potential compound hydrolysis.

FlowTrap is available in standard HPLC column hardware covering a range of column sizes that handle seamless scale-up as compound batch sizes increase. Using FlowTrap columns will help you dramatically reduce dry-down times, increasing throughput for compound recovery.

FlowTrap

Size (mm)	Capacity Range (mg)*	Part No.
4.6 x 150	50	PL1560-3M07
7.5 x 150	50-150	PL1160-3M07
10.0 x 150	150-200	PL1060-3M07
21.2 x 150	200-400	PL1E60-3M07

*Recommendation only, based on representative loading studies. Capacity will vary according to compound type and eluent constitution.

Metronidazole TFA removal

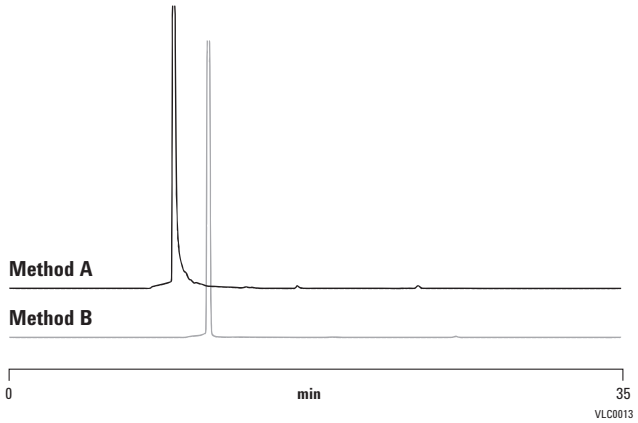
Column: **FlowTrap**
PL1560-3M07
4.6 x 150 mm, µm

Mobile Phase: Metronidazole (12 mL) @ 2 mg/mL in water + 0.1% TFA
Caffeine @ 2 mg/mL in water + 0.1% TFA

Detector: UV, 280 nm

Wash Conditions: Method A: R.O. water flow rate: 4 mL/min for 4 min
Method B: 2 M NH_3, flow rate: (4 mL/min) for 2 min then R.O. water, flow rate: (4 mL/min) for 4 min

Elution: 100% CH_3CN over 5 min flow rate: (4 mL/min)



Load & Lock Preparative HPLC Systems

Agilent offers a complete range of Load & Lock column systems for laboratory and process preparative LC. They are designed to enable you to easily and quickly pack your own preparative high efficiency columns. This is the right solution for applications ranging in scale from discovery (milligrams) to production (multi-kilos) of pharmaceutical compounds, peptides, and natural products. Our Load & Lock columns have a unique fluid/sample distribution system to maximize productivity. It is the only system that provides dynamic axial compression (DAC) and static "locked" axial compression (SAC) and is designed for easy operation to deliver greater convenience.

Laboratory Load & Lock Columns

- Mobile packing station supports three different column sizes
- Runs on compressed air with no need for a power supply
- Quick and easy packing and unpacking within minutes

Agilent's laboratory scale Load & Lock columns combine excellent packed-bed stability with enhanced flow distribution to deliver the highest quality purification possible with maximum speed, flexibility and ease of operation. Three different column sizes are supported: 1 in., 2 in. and 3 in. ID. Because the station is powered by compressed air, it is the perfect solution for hazardous environments. The quick-release single bolt clamp offers speedy and easy packing and unpacking within minutes.

Load & Lock Preparative HPLC Systems

Description	Water Jacket	Size (mm)	Part No.
Load & Lock 4001 Column	No	25 x 500	PCG93LL500X25
	Yes	25 x 500	PCG93LL500X25WJ
	Spare parts kit		PCG931AAKIT
Load & Lock 4002 Column	No	50 x 500	PCG93LL500X50
	Yes	50 x 500	PCG93LL500X50WJ
	Spare parts kit		PCG932AAKIT
Load & Lock 4003 Column	No	75 x 500	PCG93LL500X75
	Yes	75 x 500	PCG93LL500X75WJ
	Spare parts kit		PCG933AAKIT
Mobile packing station (air driven hydraulic)			PCG93LLSTAND123

Flash Chromatography

- Isolate compounds from synthesis mixtures quickly and easily
- Maximize compound purity and recovery with superior purification columns
- Enhance gradient accuracy with solid loading system

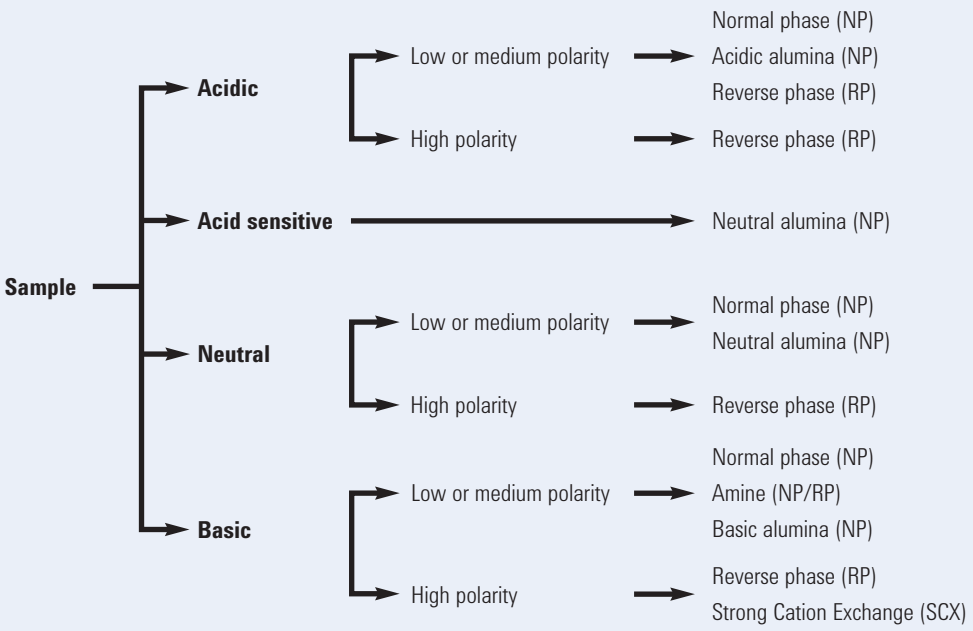
Flash chromatography purifies reaction products to isolate the target compound. Flash columns are designed for purification. Every element has been thought out, custom designed and carefully manufactured for excellent purification performance, time after time.

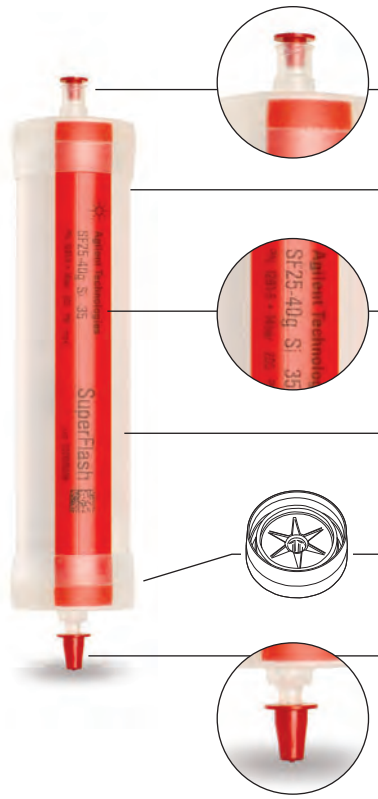
SuperFlash Purification Columns

- Sixteen standard sizes plus customized sizes for a wide application range
- Short, wide columns for speed and long, thin columns for resolution
- Flat packaging for stock room organization and supply visibility to maintain inventory

Each element of the SuperFlash compound purification column, with our patented and patent-pending technologies, delivers optimal performance, offering maximum recovery of high purity compounds time after time. Our columns, available in Si 50, Si 35, C18, PLRP-S and SCX for normal and reverse phase separations, and a variety of other sorbents, eliminate the common problems of leaking, size limitations, complicated connections and poor compound separation. Instead, you receive a cost-effective, high performance disposable column specifically designed for delivering convenient, efficient separations.

Media selection





Standard Female Luer Lock

Easily connects to any system or to a DASi injection cartridge.

Unitized Construction

Patent pending unitized construction hermetically seals the column into a single unit to eliminate leaking up to 200 psi.

Identification Stripe

Solvent proof (laser etched/no ink) red stripe includes data on column specifications and helpful information for reordering. Normal-phase columns have a red stripe, while reversed-phase columns have a blue stripe.

Solvent Resistant Column Body

The column body and cap design use a material that does not swell, warp or crack under prolonged solvent contact.

Dispersion Channels

Load sample evenly onto the column.

Standard Male Luer Lock

Male luer outlet attaches to any system.

Solvent Polarity		
Polarity Index at 20°C		**Solvent**
Non-polar	0.0	Heptane
	0.0	Hexane
	0.0	Pentane
	0.2	Cyclohexane
	1.0	Trichloroethylene
	1.6	Carbon tetrachloride
	2.8	di-Ethyl ether
	3.1	Dichloromethane
	3.9	Propan-2-ol
	4.0	Propan-1-ol
	4.0	Tetrahydrofuran
	4.1	Chloroform
	5.1	Acetone
	5.1	Methanol
	5.2	Ethanol
	5.8	Acetonitrile
Polar	9.0	Water

SuperFlash Notes

This information applies to the following SuperFlash ordering tables.

- Maximum pressure for all columns is 14 bar (200 psi).
- Obey pressure maximum limits marked on every column. Confirm the instrument has been set to the appropriate maximum pressure before attaching column.
- Dimensions are for sorbent bed diameter x overall column length.
- Flow rates up to 40% higher than the recommended normal operating flow rates may be used to reduce equilibration times.
- Sample loading values are suggested. Results may vary with specific samples.

Normal Phase (NP)

SuperFlash Si 50

Model	Diameter x Length (mm)	Particle Size (µm)	Flow Rate (mL/min)	Sample Load	Unit	Part No.
SF10 - 4 g	14.2 x 95	50	18	40 - 400 mg	8/pk	AX1368-8
SF10 - 8 g	14.2 x 136	50	18	80 - 800 mg	8/pk	AX1403-8
SF15 - 12 g	20.8 x 112	50	30	120 mg - 1.2 g	7/pk	AX1369-7
SF15 - 24 g	20.8 x 175	50	30	240 mg - 2.4 g	7/pk	AX1404-7
SF25 - 40 g	28.2 x 164	50	40	400 mg - 4 g	6/pk	AX1281-6
SF25 - 60 g	28.2 x 214	50	40	600 mg - 6 g	6/pk	AX1212-6
SF25 - 80 g	28.2 x 280	50	40	800 mg - 8 g	6/pk	AX1213-6
SF25 - 120 g	28.2 x 388	50	40	1.2 - 12 g	6/pk	AX1214-6
SF25 - 160 g	28.2 x 507	50	40	1.6 - 16 g	6/pk	AX1215-6
SF40 - 80 g	40.6 x 158	50	85	800 mg - 8 g	4/pk	AX1356-4
SF40 - 120 g	40.6 x 202	50	85	1.2 - 11.5 g	4/pk	AX1216-4
SF40 - 150 g	40.6 x 257	50	85	1.5 - 15 g	4/pk	AX1217-4
SF40 - 240 g	40.6 x 371	50	85	2.4 - 24 g	4/pk	AX1218-4
SF65 - 200 g	66 x 156	50	100	2 - 20 g	3/pk	AX1357-3
SF65 - 400 g	66 x 256	50	100	4 - 40 g	3/pk	AX1219-3
SF65 - 600 g	66 x 365	50	100	6 - 60 g	3/pk	AX1220-3

SuperFlash Si 35

Model	Diameter x Length (mm)	Particle Size (µm)	Flow Rate (mL/min)	Sample Load	Unit	Part No.
SF10 - 4 g	14.2 x 95	35	18	40 - 400 mg	8/pk	AX1370-8
SF10 - 8 g	14.2 x 136	35	18	80 - 800 mg	8/pk	AX1407-8
SF15 - 12 g	20.8 x 112	35	30	120 mg - 1.2 g	7/pk	AX1371-7
SF15 - 24 g	20.8 x 175	35	30	240 mg - 2.4 g	7/pk	AX1408-7
SF25 - 40 g	28.2 x 164	35	40	400 mg - 4 g	6/pk	AX1393-6
SF25 - 60 g	28.2 x 215	35	40	600 mg - 6 g	6/pk	AX1292-6
SF25 - 80 g	28.2 x 280	35	40	800 mg - 8 g	6/pk	AX1293-6
SF25 - 120 g	28.2 x 388	35	40	1.2 - 12 g	6/pk	AX1294-6
SF25 -160 g	40.6 x 507	35	40	1.6 - 16 g	6/pk	AX1295-6
SF40 - 80 g	40.6 x 158	35	85	800 mg - 8 g	4/pk	AX1405-4
SF40 - 115 g	40.6 x 202	35	85	1.2 - 11.5 g	4/pk	AX1296-4
SF40 - 150 g	40.6 x 257	35	85	1.5 - 15 g	4/pk	AX1297-4
SF40 - 240 g	40.6 x 371	35	85	2.4 - 24 g	4/pk	AX1298-4
SF65 - 200 g	66 x 156	35	100	2 - 20 g	3/pk	AX1406-3
SF65 - 400 g	66 x 256	35	100	4 - 40 g	3/pk	AX1299-3
SF65 - 600 g	66 x 365	35	100	6 - 60 g	3/pk	AX1300-3

SuperFlash Aminopropyl – NH2

Model	Diameter x Length (mm)	Particle Size (µm)	Flow Rate (mL/min)	Unit	Part No.
SF10 - 5 g	14.2 x 96	40	18	1/pk	AX1374-1
SF10 - 10 g	14.2 x 136	40	18	1/pk	AX1511-1
SF15 - 15 g	20.8 x 113	40	30	1/pk	AX1375-1
SF15 - 30 g	20.8 x 174	40	30	1/pk	AX1512-1
SF25 - 50 g	28.2 x 163	40	40	1/pk	AX1311-1
SF25 - 75 g	28.2 x 220	40	40	1/pk	AX1376-1
SF25 - 100 g	28.2 x 277	40	40	1/pk	AX1377-1
SF25 - 150 g	28.2 x 391	40	40	1/pk	AX1378-1
SF25 -200 g	28.2 x 506	40	40	1/pk	AX1379-1
SF40 - 100 g	40.6 x 159	40	85	1/pk	AX1380-1
SF40 - 150 g	40.6 x 207	40	85	1/pk	AX1316-1
SF40 - 200 g	40.6 x 255	40	85	1/pk	AX1317-1
SF40 - 300 g	40.6 x 379	40	85	1/pk	AX1381-1
SF65 - 250 g	66 x 157	40	100	1/pk	AX1382-1
SF65 - 500 g	66 x 262	40	100	1/pk	AX1319-1
SF65 - 750 g	66 x 365	40	100	1/pk	AX1383-1

Strong Cation Exchange (SCX)

SuperFlash SCX

Model	Diameter x Length (mm)	Particle Size (µm)	Flow Rate (mL/min)	Unit	Part No.
SF10 - 5 g	14.2 x 49	50	18	8/pk	AX2130-8
SF10 - 8 g	14.2 x 81	50	18	8/pk	AX2135-8
SF15 - 14 g	20.8 x 63	50	30	7/pk	AX2140-7
SF15 - 25 g	20.8 x 114	50	30	7/pk	AX2145-7
SF25 - 45 g	28.2 x 114	50	40	6/pk	AX2150-6
SF25 - 70 g	28.2 x 186	50	40	6/pk	AX2155-6
SF25 - 80 g	28.2 x 206	50	40	6/pk	AX2160-6
SF25 - 120 g	28.2 x 308	50	40	6/pk	AX2165-6
SF25 - 160 g	28.2 x 414	50	40	6/pk	AX2170-6
SF40 - 80 g	40.6 x 99	50	85	4/pk	AX2175-4
SF40 - 125 g	40.6 x 153	50	85	4/pk	AX2180-4
SF40 - 160 g	40.6 x 208	50	85	4/pk	AX2185-4
SF40 - 245 g	40.6 x 299	50	85	4/pk	AX2190-4
SF65 - 250 g	66 x 118	50	100	3/pk	AX2195-3
SF65 - 440 g	66 x 204	50	100	3/pk	AX2200-3
SF65 - 650 g	66 x 302	50	100	3/pk	AX2205-3

Reversed Phase (RP)

SuperFlash PLRP-S

Model	Diameter x Length (mm)	Particle Size (µm)	Flow Rate (mL/min)	Sample Load	Unit	Part No.
SF10 - 2.5 g	14.2 x 95	50	12	15 - 60 mg	1/pk	AX2250-1
SF10 - 4 g	14.2 x 127	50	12	25 - 100 mg	1/pk	AX2255-1
SF15 - 7 g	20.8 x 112	50	20	41 - 167 mg	1/pk	AX2260-1
SF15 - 13 g	20.8 x 163	50	20	75 - 300 mg	1/pk	AX2265-1
SF25 - 24 g	28.2 x 163	50	30	138 - 500 mg	1/pk	AX2270-1
SF25 - 38 g	28.2 x 235	50	30	188 - 750 mg	1/pk	AX2275-1
SF25 - 42 g	28.2 x 255	50	30	250 mg - 1 g	1/pk	AX2280-1
SF25 - 63 g	28.2 x 357	50	30	375 mg - 1.5 g	1/pk	AX2285-1
SF25 - 85 g	28.2 x 463	50	30	500 mg - 2 g	1/pk	AX2290-1
SF40 - 42 g	40.6 x 148	50	50	250 mg - 1 g	1/pk	AX2295-1
SF40 - 65 g	40.6 x 202	50	50	375 mg - 1.5 g	1/pk	AX2300-1
SF40 - 90 g	40.6 x 257	50	50	500 mg - 2 g	1/pk	AX2305-1
SF40 - 130 g	40.6 x 348	50	50	750 mg - 3 g	1/pk	AX2310-1
SF65 - 133 g	66 x 170	50	65	750 mg - 3 g	1/pk	AX2315-1
SF65 - 230 g	66 x 256	50	65	1.4 - 5.4 g	1/pk	AX2320-1
SF65 - 340 g	66 x 354	50	65	2 - 8 g	1/pk	AX2325-1

SuperFlash C18

Model	Diameter x Length (mm)	Particle Size (µm)	Flow Rate (mL/min)	Sample Load	Unit	Part No.
SF10 - 5 g	14.2 x 95	50	12	15 - 60 mg	1/pk	AX1372-1
SF10 - 10 g	14.2 x 127	50	12	25 - 100 mg	1/pk	AX1409-1
SF15 - 16 g	20.8 x 112	50	20	41 - 167 mg	1/pk	AX1373-1
SF15 - 30 g	20.8 x 163	50	20	75 - 300 mg	1/pk	AX1410-1
SF25 - 55 g	28.2 x 163	50	30	138 - 500 mg	1/pk	AX1394-1
SF25 - 75 g	28.2 x 235	50	30	188 - 750 mg	1/pk	AX1302-1
SF25 - 100 g	28.2 x 255	50	30	250 mg - 1 g	1/pk	AX1303-1
SF25 - 150 g	28.2 x 357	50	30	375 mg - 1.5 g	1/pk	AX1304-1
SF25 - 200 g	28.2 x 463	50	30	500 mg - 2 g	1/pk	AX1305-1
SF40 - 100 g	40.6 x 148	50	50	250 mg - 1 g	1/pk	AX1411-1
SF40 - 150 g	40.6 x 202	50	50	375 mg - 1.5 g	1/pk	AX1306-1
SF40 - 205 g	40.6 x 257	50	50	500 mg - 2 g	1/pk	AX1307-1
SF40 - 300 g	40.6 x 348	50	50	750 mg - 3 g	1/pk	AX1308-1
SF65 - 300 g	66 x 172	50	65	750 mg - 3 g	1/pk	AX1412-1
SF65 - 540 g	66 x 256	50	65	1.4 - 5.4 g	1/pk	AX1309-1
SF65 - 800 g	66 x 354	50	65	2 - 8 g	1/pk	AX1310-1

Normal Phase (NP) Alumina

SuperFlash Alumina

Model	Diameter x Length (mm)	Particle Size (µm)	Sample Load	Unit	Alumina Neutral	Alumina Acidic	Alumina Basic
SF10 - 8 g	14.2 x 95	125	80 - 400 mg	8/pk	AX1448-8	AX1474-8	AX1450-8
SF10 - 16 g	14.2 x 136	125	150 - 750 mg	8/pk	AX1477-8	AX1494-8	AX1476-8
SF15 - 24 g	20.8 x 112	125	230 mg - 1.2 g	7/pk	AX1466-7	AX1495-7	AX1467-7
SF15 - 48 g	20.8 x 175	125	450 mg - 2.2 g	7/pk	AX1468-7	AX1496-7	AX1469-7
SF25 - 80 g	28.2 x 163	125	750 mg - 2.2 g	6/pk	AX1449-6	AX1497-6	AX1478-6
SF25 - 120 g	28.2 x 215	125	1.1 - 5.5 g	6/pk	AX1481-6	AX1498-6	AX1480-6
SF25 - 160 g	28.2 x 280	125	1.5 - 7.5 g	6/pk	AX1483-6	AX1499-6	AX1482-6
SF25 - 240 g	28.2 x 388	125	2.2 - 11 g	6/pk	AX1462-6	AX1500-6	AX1464-6
SF25 - 320 g	28.2 x 507	125	3 - 15 g	6/pk	AX1485-6	AX1501-6	AX1484-6
SF40 - 160 g	40.6 x 158	125	1.5 - 7.5 g	4/pk	AX1487-4	AX1502-4	AX1486-4
SF40 - 230 g	40.6 x 214	125	2.2 - 11 g	4/pk	AX1489-4	AX1503-4	AX1488-4
SF40 - 300 g	40.6 x 256	125	2.8 - 10 g	4/pk	AX1438-4	AX1504-4	AX1437-4
SF40 - 480 g	40.6 x 388	125	4.5 - 22.5 g	4/pk	AX1473-4	AX1505-4	AX1479-4
SF65 - 400 g	66 x 157	125	3.7 - 18.5 g	3/pk	AX1463-3	AX1506-3	AX1465-3
SF65 - 800 g	66 x 262	125	7.5 - 37.5 g	3/pk	AX1491-3	AX1507-3	AX1490-3
SF65 - 1200 g	66 x 365	125	11.2 - 56 g	3/pk	AX1493-3	AX1508-3	AX1492-3

Flash F75/F150 Cartridges

- Available in a variety of sizes for development systems
- Convenient sorbents to meet your needs
- Consistent packing for less channelling and fraction dilution

If you regularly purify more than a few grams of compound, Flash F75/F150 cartridges deliver the convenience and compatibility you need. The cartridges are packed with silica for normal phase separations and silica C18 for reverse phase purifications. For development scale they are available in different bed diameters and bed masses to provide solutions for a range of sample sizes.

Flash F75 Cartridges

Model	Sorbent	Unit	Part No.
F75S - 200 g	Si 50	2/pk	AX0346-2
F75S - 200 g	Si 50	10/pk	AX0346-10
F75S - 200 g	Si 35	2/pk	AX1363-2
F75S - 200 g	Si 35	10/pk	AX1363-10
F75S - 300 g	C18	1/pk	AX0349-1
F75M - 400 g	Si 50	2/pk	AX0347-2
F75M - 400 g	Si 35	10/pk	AX0347-10
F75M - 400 g	Si 35	2/pk	AX1364-2
F75M - 400 g	Si 35	10/pk	AX1364-10
F75M - 600 g	C18	1/pk	AX0350-1
F75L - 800 g	Si 50	2/pk	AX0348-2
F75L - 800 g	Si 50	10/pk	AX0348-10
F75L - 800 g	Si 35	2/pk	AX1352-2
F75L - 800 g	Si 35	10/pk	AX1352-10
F75L - 1.2 kg	C18	1/pk	AX0351-1
F75XL - 1.6 kg	Si 50	2/pk	AX1178-2

Flash F150 Cartridges

Model	Sorbent	Unit	Part No.
F150M - 2.5 kg	Si 50	2/pk	AX0355-2
F150M - 2.5 kg	Si 50	10/pk	AX0355-10
F150M - 2.5 kg	Si 35	2/pk	AX1360-2
F150M - 2.5 kg	Si 35	10/pk	AX1360-10
F150M - 3.9 kg	C18	1/pk	AX0357-1
F150L - 5 kg	Si 50	2/pk	AX0356-2
F150L - 5 kg	Si 50	10/pk	AX0356-10
F150L - 5 kg	Si 35	2/pk	AX1361-2
F150L - 5 kg	Si 35	10/pk	AX1361-10
F150L - 9 kg	C18	1/pk	AX0414-1

DASi Sample Loading Module

- For even loading of low solubility and high viscosity compounds
- Modules are available in three sizes to match your sample needs
- Adjustable plunger eliminates dead volume and maintains gradient accuracy
- Provides security as a guard column for high-cost, specialty-sorbent columns

DASi Module Kits

Description	Part No.
DASi 12 module kit Includes five empty cartridges and two Si 50, 5 g packed cartridges	AX1238-1
DASi 35 module kit Includes five empty cartridges, two Si 50, 5 g packed cartridges and two Si 50, 10 g packed cartridges	AX1237-1
DASi 65 module kit Includes five empty cartridges, two Si 50, 5 g packed cartridges, two Si 50, 15 g packed cartridges and two Si 50, 25 g packed cartridges	AX1236-1
DASi 12, 35 and 65 module kit	AX1239-1

Each module kit contains plunger assembly and appropriate DASi Si Cartridge Sampler Kit

DASi Si Cartridge Sampler Pack

Description	Part No.
DASi 12 cartridge sampler pack	AX1266-1
DASi 35 cartridge sampler pack	AX1263-1
DASi 65 cartridge sampler pack	AX1252-1

DASi Module (showing one pre-packed cartridge)

Standard Female Luer Lock

Easily connect the DASi to any system with a female Luer lock top fitting.

Patent Pending Locking Mechanism

Easily push piston down. Assembly will remain in position until released.

Adjustable Plunger Head

Eliminates dead volume to maintain the superior gradient accuracy of the 971-FP instrument (especially important for DCM/methanol solvent combination).

Sample Cartridge

Solvent compatible cartridge body does not swell, warp, or crack under prolonged solvent contact.

Dispersion Channels

Distribute solvent evenly on the sample bed for tight, thin separation bands.

Standard Male Luer Lock

Male Luer outlet attaches to any system or to the top of a SuperFlash column.

Flash Purification

- Excellent purification performance of UV-active compounds at different wavelengths
- Eliminates uncontrolled sample loss to ensure sample security and retention
- Method-guiding functionality optimizes solvent, column and gradient options to increase efficiency and flexibility
- Ready-to-Run technology reduces downtime

The 971-FP system enhances productivity through its ready-to-run technology that eliminates warmup time, performs self diagnostics to ensure proper operation, supplies helpful navigation run start software and introduces walk-away start features like system auto-prime and sample auto-inject. The instrument incorporates the latest compound separation innovations, and contains new sample security and retention technology.

Solutions

Description	Part No.
971-FP multiple wavelength UV flash chromatography workstation Includes advanced features pack (AFP)	AX1600-1
971-FP single wavelength UV flash chromatography workstation	AX1605-1

Instrument Supplies

Agilent offers several accessories to support the 971-FP, including a Multi-column Controller to connect additional stations for uninterrupted column operation. The Advanced Feature Package (AFP) offers uninterrupted solvent supply, waste level monitoring and feedback, Guide Me functionality and dynamic run queues for multi-column control capacity. A high-speed processor and advanced operating software are integral to the AFP. The integral fume enclosure traps solvent fumes for use in areas without hoods (requires a 4 in. or greater exhaust ventilation connection), and the solvent bottle safety tray provides additional support of storing 4 L solvent bottles.

Instrument Supplies

Description	Part No.
MCC2 – Multi-column controller	AX1426-1
Advanced feature package (AFP)	AX1440-1
Integral fume enclosure	AX1429-1
Solvent bottle safety tray	AX1441-1

Accessory Racks

A variety of accessory racks for the 971-FP, all with radio frequency identification (RFID), is available.

Accessory Racks

Description	Part No.
13 x 100 mm rack, holds 90 tubes	AX1442-1
16 x 100 mm rack, holds 60 tubes	AX1443-1
16 x 150 mm rack, holds 60 tubes	AX1444-1
18 x 150 mm rack, holds 40 tubes	AX1446-1
25 x 150 mm rack, holds 24 tubes	AX1447-1

GPC/SEC COLUMNS AND CALIBRANTS

Agilent delivers leading solutions for characterizing and separating polymers by GPC/SEC. We manufacture all components for accurate polymer analysis, including columns and standards.

With the addition of Varian in 2010, Agilent greatly expanded its GPC/SEC portfolio to include the highly respected PLgel, PolarGel, PlusPore, and PL aquagel-OH column families, as well as an extensive line of polymer standards for GPC/SEC.

If you're currently using one of these part numbers for GPC/SEC columns or standards, reorder using the new part number listed below:

Cross Reference Guide for GPC/SEC Columns & Standards

If you're using...			Reorder this...
Part No.	**Description**	**Size (mm)**	**New Part No.**
Organic GPC			
79911GP-110	PLgel 10 µm guard	7.5 x 50	PL1110-1120
79911GP-510	PLgel 5 µm guard	7.5 x 50	PL1110-1520
79911GP-MXB	PLgel 10 µm MIXED-B	7.5 x 300	PL1110-6100
79911GP-100	PLgel 10 µm 50Å	7.5 x 300	PL1110-6115
79911GP-101	PLgel 10 µm 100Å	7.5 x 300	PL1110-6120
79911GP-102	PLgel 10 µm 500Å	7.5 x 300	PL1110-6125
79911GP-103	PLgel 10 µm 10^3Å	7.5 x 300	PL1110-6130
79911GP-104	PLgel 10 µm 10^4Å	7.5 x 300	PL1110-6140
79911GP-105	PLgel 10 µm 10^5Å	7.5 x 300	PL1110-6150
79911GP-106	PLgel 10 µm 10^6Å	7.5 x 300	PL1110-6160
79911GP-MXA	PLgel 20 µm MIXED-A	7.5 x 300	PL1110-6200
79911GP-MXE	PLgel 3 µm MIXED-E	7.5 x 300	PL1110-6300
79911GP-MXC	PLgel 5 µm MIXED-C	7.5 x 300	PL1110-6500
79911GP-MXD	PLgel 5 µm MIXED-D	7.5 x 300	PL1110-6504
79911GP-500	PLgel 5 µm 50Å	7.5 x 300	PL1110-6515
79911GP-501	PLgel 5 µm 100Å	7.5 x 300	PL1110-6520
79911GP-502	PLgel 5 µm 500Å	7.5 x 300	PL1110-6525
79911GP-503	PLgel 5 µm 10^3Å	7.5 x 300	PL1110-6530
79911GP-504	PLgel 5 µm 10^4Å	7.5 x 300	PL1110-6540
79911GP-505	PLgel 5 µm 10^5Å	7.5 x 300	PL1110-6550

(Continued)

Cross Reference Guide for GPC/SEC Columns & Standards

If you're using...			Reorder this...
Part No.	**Description**	**Size (mm)**	**New Part No.**
Aqueous SEC of Polymers			
79911GF-083	PL aquagel-OH 30 8 µm	7.5 x 300	PL1120-6830
79911GF-080	PL aquagel-OH 8 µm guard	7.5 x 50	PL1149-1840
79911GF-MXA	PL aquagel-OH MIXED-H 8 µm	7.5 x 300	PL1149-6800
79911GF-084	PL aquagel-OH 40 8 µm	7.5 x 300	PL1149-6840
79911GF-085	PL aquagel-OH 50 8 µm	7.5 x 300	PL1149-6850
79911GF-086	PL aquagel-OH 60 8 µm	7.5 x 300	PL1149-6860
Polymer Standards for GPC/SEC			
79911-60500	S-L-10 polystyrene calibration kit, 10 x 0.5 g		PL2010-0101
79911-60501	S-M-10 polystyrene calibration kit, 10 x 0.5 g		PL2010-0100
79911-60502	S-H-10 polystyrene calibration kit, 10 x 0.5 g		PL2010-0103
5064-8281	EasiVial PS-H, pre-weighted calibration kit		PL2010-0201
1535-4545	Polyethylene glycol/oxide calibration kits, PEG-10, 10 x 0.5 g		PL2070-0100
5064-8280	EasiVial PEG/PEO, pre-weighted calibration kit		PL2080-0201
1535-4546	Polyacrylic acid - Na salt calibration kit, PAA-10, 10 x 0.2 g		PL2140-0100

Organic GPC

PLgel GPC Columns

- Robust performance under the most exacting conditions
- Temperature stability up to 220°C
- Solvent compatibility allows easy and rapid transfer between solvents of varying polarity

PLgel materials have high pore volume and high efficiency to maximize resolution. Their unequalled solvent compatibility makes for easy transfer between polar and non-polar eluents, and outstanding physical rigidity provides extended lifetimes that minimize downtime.

The key to successful GPC separations is the correct choice of columns. The comprehensive range of PLgel products has been designed to cover virtually all organic solvent-based polymer analysis application areas, and to make selection of the correct column, solvent and calibration standard fast and reliable.

PLgel is a highly cross-linked, porous polystyrene/divinylbenzene matrix, which is recognized as a market leader in GPC column technology. PLgel is manufactured to ISO 9001:2000 and benefits from comprehensive QC/QA for total reproducibility, batch-to-batch and column-to-column.

Solvent Compatibility	
Solvent Polarity	**Solvent**
6.0	Perfluoroalkane
7.3	Hexane
8.2	Cyclohexane
8.9	Toluene
9.1	Ethyl acetate
9.1	Tetrahydrofuran (THF)
9.3	Chloroform
9.3	Methyl ethyl ketone (MEK)
9.7	Dichloromethane
9.8	Dichloroethene
9.9	Acetone
10.0	o-Dichlorobenzene (o-DCB)
10.0	Trichlorobenzene (TCB)
10.2	m-Cresol
10.2	o-Chlorophenol (o-CP)
10.7	Pyridine
10.8	Dimethyl acetamide (DMAc)
11.3	n-Methyl pyrolidone (NMP)
12.0	Dimethyl sulfoxide (DMSO)
12.1	Dimethyl formamide (DMF)

PLgel MIXED Columns

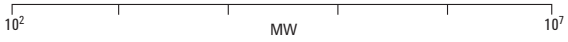
The PLgel MIXED range greatly simplifies column selection for easy decision making. Using these mixed columns you can eliminate mismatched column sets and spurious peaks for more reliable results. Every column contains a mixture of individual pore size materials, accurately blended to cover a specified broad range of molecular weight with a linear calibration to eliminate column mismatch. Simply add extra columns for even greater resolution.

Column Specifications

Column	Linear MW Operating Range (g/mol)	Guaranteed Column Efficiency	Typical Pressure	Maximum Flow Rate	Maximum Pressure	Maximum Temperature
MIXED-A	2,000-40,000,000	> 17,000 p/m	1 mL/min (7.5 mm ID): ≈ 3 bar (44 psi) per 300 mm 0.3 mL/min (4.6 mm ID): ≈ 2.4 bar (35 psi) per 250 mm (THF @ 20°C, TCB @ 140°C)	7.5 mm ID: 1.5 mL/min 4.6 mm ID: 0.5 mL/min	150 bar (2175 psi)	220°C
MIXED-B	500-10,000,000	> 35,000 p/m	1 mL/min (7.5 mm ID): ≈ 10 bar (145 psi) per 300 mm 0.3 mL/min (4.6 mm ID): ≈ 8 bar (116 psi) per 250 mm (THF @ 20°C, TCB @ 140°C)	7.5 mm ID: 1.5 mL/min 4.6 mm ID: 0.5 mL/min	150 bar (2175 psi)	220°C
MIXED-C	200-2,000,000	> 50,000 p/m	1 mL/min (7.5 mm ID): ≈ 30 bar (435 psi) per 300 mm 0.3 mL/min (4.6 mm ID): ≈ 24 bar (348 psi) per 250 mm (THF @ 20°C, TCB @ 140°C)	7.5 mm ID: 1.5 mL/min 4.6 mm ID: 0.5 mL/min	150 bar (2175 psi)	150°C
MIXED-D	200-400,000	> 50,000 p/m	1 mL/min (7.5 mm ID): ≈ 30 bar (435 psi) per 300 mm 0.3 mL/min (4.6 mm ID): ≈ 24 bar (348 psi) per 250 mm (THF @ 20°C, TCB @ 140°C)	7.5 mm ID: 1.5 mL/min 4.6 mm ID: 0.5 mL/min	150 bar (2175 psi)	150°C
MIXED-E	up to 30,0000	7.5 x 300 mm: > 80,000 p/m 4.6 x 250 mm: > 70,000 p/m	1 mL/min (7.5 mm ID): ≈ 50 bar (725 psi) per 300 mm 0.3 mL/min (4.6 mm ID): ≈ 42 bar (609 psi) per 250 mm (THF @ 20°C)	7.5 mm ID: 1.5 mL/min 4.6 mm ID: 0.5 mL/min	180 bar (2611 psi)	110°C

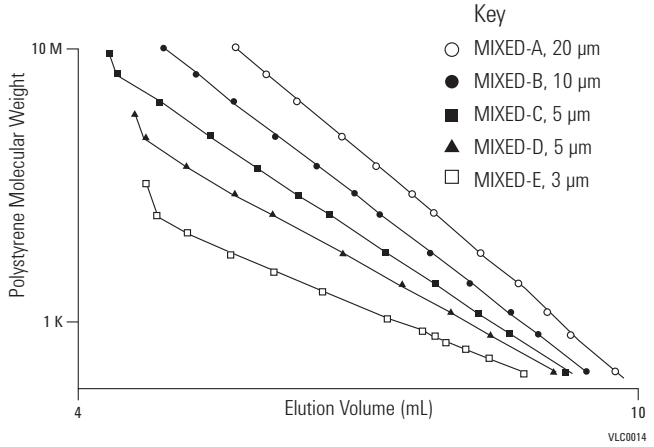
PLgel MIXED Column Selection Guide

UHMW polymer distributions	PLgel MIXED-A, 20 µm
High MW polymers, demanding eluents	PLgel MIXED-B, 10 µm
Mid range MW polymers, high resolution	PLgel MIXED-C, 5 µm
Resins, condensation polymers	PLgel MIXED-D, 5 µm
Low MW resins, prepolymers	PLgel MIXED-E, 3 µm



PLgel MIXED Gel Calibration Curves

MIXED gel calibration curves are designed to be linear over a specified molecular weight range, ensuring that the same degree of resolution is achieved across the full operating range of the column. The particle size of the packing and porosity of a particular MIXED gel column are carefully matched to the MW range and application, thus optimizing performance and eliminating the effects of shear degradation. Resolution in GPC is controlled by the slope of the calibration curve and the particle size of the packing material. Agilent has scientifically determined the minimum number of MIXED gel columns required to perform accurate MWD determinations based on specific resolution (Rsp). Thus you can have complete confidence in the accuracy and precision of the calculated data.



Reference: Meehan, E. (1998) Size exclusion chromatography columns from Polymer Laboratories. In: Chi-San Wu (Ed.) Column Handbook for Size Exclusion Chromatography. Academic Press, New York, USA.

PLgel MIXED Columns

Description	Size (mm)	Part No.
PLgel 20 µm MIXED-A	7.5 x 300	PL1110-6200
PLgel 10 µm MIXED-B	7.5 x 300	PL1110-6100
PLgel 5 µm MIXED-C	7.5 x 300	PL1110-6500
PLgel 5 µm MIXED-D	7.5 x 300	PL1110-6504
PLgel 3 µm MIXED-E	7.5 x 300	PL1110-6300

PLgel MIXED Guards

Size (mm)	Particle Size (µm)	Part No.
7.5 x 50	20	PL1110-1220
7.5 x 50	10	PL1110-1120
7.5 x 50	5	PL1110-1520
7.5 x 50	3	PL1110-1320

PLgel MIXED-LS Columns

- Obtain an instant improvement in data quality
- No need for conditioning, saving time and solvent costs
- Maximize the potential of light scattering detectors

The PLgel MIXED-LS series is a PS/DVB packing using an innovative proprietary suspension polymerization technique to virtually eliminate nano-particle leakage. A startling improvement is achieved immediately in the quality of light scattering data obtained with PLgel MIXED-LS columns in place of conventional GPC columns. The light scattering chromatograms shown here were obtained after flushing the columns for one hour in THF at 1 mL/min. A polystyrene standard (Mp 210,000) was injected at 1 mg/mL in order to illustrate the dramatic improvement in signal-to-noise with the PLgel MIXED-LS column.

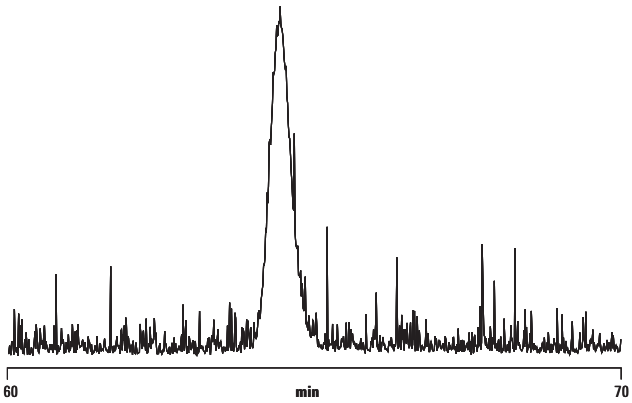
The performance of PLgel MIXED-LS columns has been matched to PLgel 20 µm MIXED-A and PLgel 10 µm MIXED-B columns in terms of calibration, column efficiency, wide solvent compatibility and operating temperature. MIXED-LS are also ideal for online viscosity detection, minimizing the risk of capillary blockage, and can be used with regular PLgel guard columns that are packed with rigid low pore size gels with no particle bleed.

PLgel MIXED-LS Columns

Description	Size (mm)	Linear MW Operating Range (g/mol) (PS)	Guaranteed Efficiency (p/m)	Part No.
PLgel 10 µm MIXED-B LS	7.5 x 300	500-10,000,000	> 35,000	PL1110-6100LS
PLgel 10 µm guard	7.5 x 50			PL1110-1120
PLgel 20 µm MIXED-A LS	7.5 x 300	2,000-40,000,000	> 17,000	PL1110-6200LS
PLgel guard 20 µm	7.5 x 50			PL1110-1220

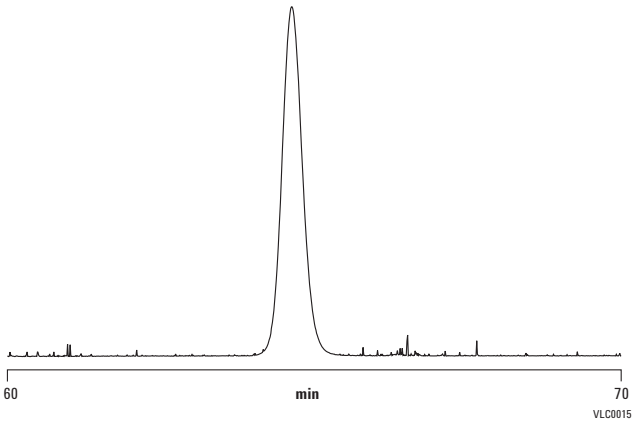
Conventional GPC column

Column: **Conventional GPC column**
Mobile Phase: THF
Flow Rate: 1.0 mL/min
Detector: LS



PLgel LS column

Column: **PLgel 10 µm MIXED-B LS**
PL1110-6100LS
7.5 x 300 mm, 10 µm
Mobile Phase: THF
Flow Rate: 1.0 mL/min
Detector: LS



PLgel MiniMIX Columns

- Use about 70% less solvent and save money
- Store less solvent and increase operator safety
- High performance comparable to Agilent's conventional ID columns

For reduced solvent cost and consumption, use industry standard PLgel MiniMIX mixed gel columns in 250 x 4.6 mm narrow bore dimensions. These narrow bore columns offer high performance, excellent solvent compatibility and mechanical stability. PLgel MiniMIX columns can be used with conventional GPC equipment.

To maintain the same linear velocity through the column, the volumetric flow rate must be reduced to 0.3 mL/min in line with the column cross sectional area, resulting in significantly lower solvent consumption. Sample loading should also be scaled down in line with reduced column volume, and system dead volume should be minimized to avoid excessive band broadening.

PLgel MiniMIX Columns

Description	Size (mm)	Linear MW Operating Range (g/mol) (PS)	Guaranteed Efficiency (p/m)	Part No.
PLgel 20 µm MiniMIX-A	4.6 x 250	2,000-40,000,000	> 17,000	PL1510-5200
PLgel 20 µm MiniMIX-A guard	4.6 x 50			PL1510-1200
PLgel 10 µm MiniMIX-B	4.6 x 250	500-10,000,000	> 35,000	PL1510-5100
Plgel 10 µm MiniMIX-B guard	4.6 x 50			PL1510-1100
PLgel 5 µm MiniMIX-C	4.6 x 250	200-2,000,000	> 50,000	PL1510-5500
PLgel 5 µm MiniMIX-C guard	4.6 x 50			PL1510-1500
PLgel 5 µm MiniMIX-D	4.6 x 250	200-400,000	> 50,000	PL1510-5504
PLgel 5 µm MiniMIX-D guard	4.6 x 50			PL1510-1504
PLgel 3 µm MiniMIX-E	4.6 x 250	up to 30,000	> 70,000	PL1510-5300
PLgel 3 µm MiniMIX-E guard	4.6 x 50			PL1510-1300

PLgel Individual Pore Size Columns

- Very high efficiency improves productivity
- Choose the optimum column for a perfect match of performance and application
- Fast analysis with fewer columns saves time and money

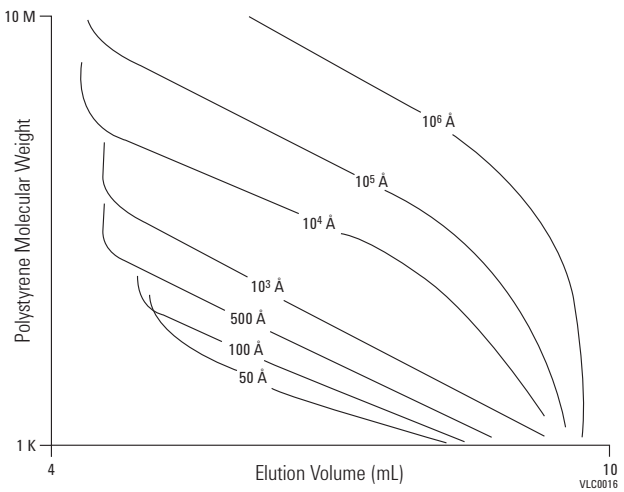
Individual pore size GPC columns offer high resolution over a specific molecular weight range. The linear portion of the calibration curve, where the slope is at its shallowest, defines the MW region over which optimum resolution will be achieved.

PLgel Individual Pore Size Columns

Size (mm)	Particle Size (µm)	Pore Size (Å)	Linear MW Operating Range (g/mol) (PS)	Guaranteed Efficiency (p/m)	Part No.
7.5 x 300	3	100	up to 4,000	> 100,000	PL1110-6320
7.5 x 300	5	50	up to 2,000	> 60,000	PL1110-6515
7.5 x 300	5	100	up to 4,000	> 60,000	PL1110-6520
7.5 x 300	5	500	500-30,000	> 60,000	PL1110-6525
7.5 x 300	5	10^3	500-60,000	> 50,000	PL1110-6530
7.5 x 300	5	10^4	10,000-600,000	> 50,000	PL1110-6540
7.5 x 300	5	10^5	60,000-2,000,000	> 50,000	PL1110-6550
7.5 x 300	10	50	up to 2,000	> 35,000	PL1110-6115
7.5 x 300	10	100	500-30,000	> 35,000	PL1110-6120
7.5 x 300	10	500	500-30,000	> 35,000	PL1110-6125
7.5 x 300	10	10^3	500-60,000	> 35,000	PL1110-6130
7.5 x 300	10	10^4	500-60,000	> 35,000	PL1110-6140
7.5 x 300	10	10^5	10,000-600,000	> 35,000	PL1110-6150
7.5 x 300	10	10^6	60,000-2,000,000	> 35,000	PL1110-6160

Calibration curves

Calibrant: Polystyrene
Mobile Phase: THF
Flow Rate: 1.0 mL/min



PLgel Preparative Columns

- Excellent column efficiency provides optimum resolution
- High loading can isolate mg amounts for further study
- Over 10 times scale up permits efficient quantification

Preparative GPC is generally employed to fractionate polymers, isolate components in a polymer formulation or simplify mixtures of relatively small molecules in complex matrices. Mixtures of materials are easily separated on the basis of size, preferably in a low boiling organic solvent. They are then collected as a series of discrete fractions and isolated by simple evaporation of the solvent.

PLgel preparative columns are packed with the same rigid, high performance media as the analytical columns. The 10 µm particle provides high column efficiency (> 25,000 p/m) for optimum resolution and loading characteristics. PLgel 25 mm ID preparative columns offer over 10 times scale-up compared to the 7.5 mm analytical columns. The increased ID and column volume permit even higher loading. With low molecular weight materials, sample concentration can also be significantly increased, enabling production of milligram quantities of very pure material. The actual loading is ultimately controlled by the sample and its molecular weight.

PLgel Preparative Columns

Size (mm)	Particle Size (µm)	Pore Size (Å)	Linear MW Operating Range (g/mol) (PS)	Part No.
25 x 300	10	50	up to 2,000	PL1210-6115
25 x 300	10	10	up to 4,000	PL1210-6120
25 x 300	10	500	500-30,000	PL1210-6125
25 x 300	10	10^3	500-60,000	PL1210-6130
25 x 300	10	10^4	10,000-600,000	PL1210-6140
25 x 300	10	10^5	60,000-2,000,000	PL1210-6150
25 x 300	10	10^6	600,000-10,000,000	PL1210-6160
MIXED-B 25 x 300	10		500-10,000,000	PL1210-6100
MIXED-D 25 x 300	10		200-400,000	PL1210-6104
Prep guard 25 x 25				PL1210-1120

Columns for Special GPC/SEC Applications

EnviroPrep

- High sample loading ensures effective trace analysis
- Simple clean-up procedure saves sample preparation costs
- Optimized particle size distribution provides high resolution

EnviroPrep columns permit a simple, one stage clean-up as part of a methodology to determine pesticides in many organic matrices. The higher molecular weight fractions such as lipids, polymers, natural resins and dispersed high molecular weight components are easily eliminated in the GPC analysis.

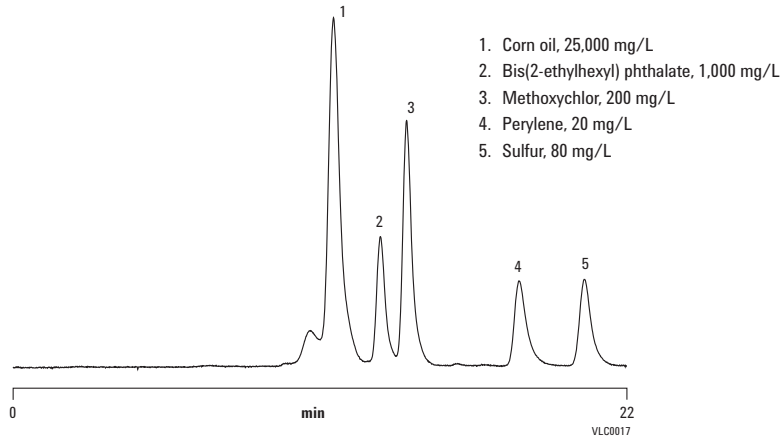
Preparative GPC for soil extract clean-up is described in EPA Method 3640A using 300 x 25 mm and 150 x 25 mm columns to give higher sample loading and fraction yields, which is particularly useful for low levels of pollutants. Low pore size EnviroPrep columns are ideal for this method. The columns have 10 µm particles with 100Å pore sizes for high resolution, with an exclusion limit of 4000 MW. The preparative columns offer good resolution and high loading through optimization of the particle size distribution.

EnviroPrep

Size (mm)	Part No.
21.2 x 150	PL1E10-3120EPA
25 x 150	PL1210-3120EPA
21.2 x 300	PL1E10-6120EPA
25 x 300	PL1210-6120EPA

Columns for sample clean-up

Column:	**EnviroPrep PL1210-6120EPA 25 x 300**
Column:	**PL1210-3120EPA 25 x 150**
Mobile Phase:	DCM
Flow Rate:	10 mL/min
Detector:	UV, 254 nm



PLgel Olexis

- Optimized design for polyolefin analysis
- High temperature capability
- High resolution with no damage from sample shear provides clean separations

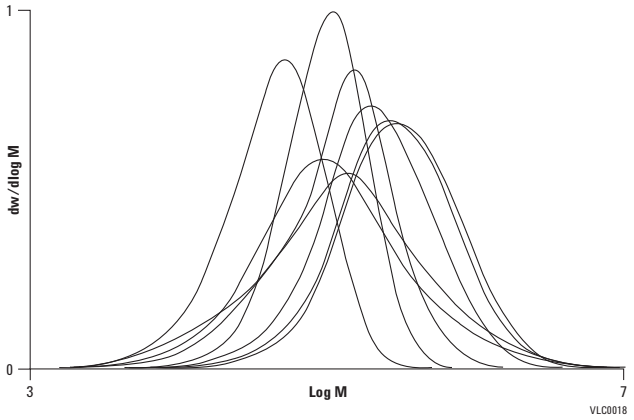
PLgel Olexis is designed for the analysis of very high molecular weight polymers, specifically polyolefins. The column resolves up to 100,000,000 g/mol (polystyrene in THF), and is packed with 13 µm particles to optimize efficiency and resolution without the risk of sample shear degradation during analysis. The packing of PLgel Olexis has the mechanical stability and robustness expected from a PLgel column, and so it is able to operate up to 220°C for the analysis of highly crystalline materials.

PLgel Olexis

Description	Size (mm)	Part No.
PLgel Olexis	7.5 x 300	PL1110-6400
PLgel Olexis guard	7.5 x 50	PL1110-1400

PLgel Olexis reveals true modalities across the range of polyolefins

Column:	**3 x PLgel Olexis, 7.5 x 300 mm PL1110-6400**
Mobile Phase:	Trichlorobenzene + 0.0125% BHT
Flow Rate:	1.0 mL/min
Injection Volume:	200 µL
Temperature:	160°C
Detector:	PL-GPC 220 (RI)



PL HFIPgel

- Optimized separation range delivers high performance with no artifacts
- Highly durable packing prolongs column lifetime
- Low operating pressure reduces system wear and unnecessary downtimes

Hexafluoroisopropanol (HFIP) is used as a solvent in GPC for the analysis of important industrial polymers such as polyesters, polyamides and polylactide/glycolide copolymers. For greatly improved performance in extremely polar solvents such as HFIP and trifluoroethanol, we have developed novel "multipore" technology to produce PL HFIPgel, a PS/DVB packing featuring a monodisperse particle size, high pore volume and high resolution.

Using PL HFIPgel avoids issues associated with conventional packing and HFIP, such as excessive curvature of calibration curves, dislocations/shoulders on peaks for polydisperse samples and poor resolution in the low MW region.

Column efficiency is guaranteed > 30,000 p/m and the columns are very durable, with a maximum operating pressure of 145 bar (2030 psi). They are packed and tested in methanol but shipped ready-to-use in HFIP.

PL HFIPgel columns with 7.5 mm ID normally operate at 1 mL/min. However, the 4.6 mm ID columns run at 0.3 mL/min, providing a 70% reduction in solvent consumption with consequent savings in the cost of buying and disposing of solvents.

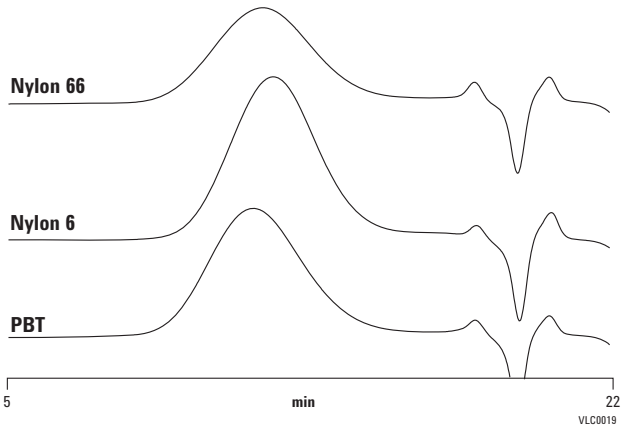
PL HFIPgel

Description	Size (mm)	Part No.
PL HFIPgel	4.6 x 250	PL1514-5900HFIP
PL HFIPgel	7.5 x 300	PL1114-6900HFIP
PL HFIPgel guard	7.5 x 50	PL1114-1900HFIP
PL HFIPgel guard	4.6 x 50	PL1514-1900HFIP

Polyamides

Column: **2 x PL HFIPgel, 7.5 x 300 mm**
PL1110-6400

Mobile Phase: HFIP + 20mM NaTFAc
Flow Rate: 1.0 mL/min
Temperature: 40°C
Detector: PL-GPC 50 Plus (RI)



PL Rapide

- Analysis in less than ten minutes saves time
- Significantly increased sample throughput improves efficiency
- Reduced solvent consumption and disposal costs save money
- Available in L, M and H versions for low, medium and high molecular weights; available in F version for flow injection analysis

Rapid GPC is an excellent tool for screening polymer MWD for trend analysis. Short PL Rapide columns reduce analysis times while maintaining the excellent solvent compatibility and mechanical stability of all GPC columns from Agilent.

PL Rapide columns are ideal for high speed applications such as high throughput screening, process monitoring, or tracking changes in MW distributions, where time is the most critical factor in the analysis. Packed with high quality gels, these columns cover the complete spectrum of molecular weights and are available for the analysis of both organic and water soluble polymers. Key features include high pore volume and high resolution packing materials, no special system requirements, choice of molecular weight resolving range, wide solvent compatibility, and excellent mechanical stability.

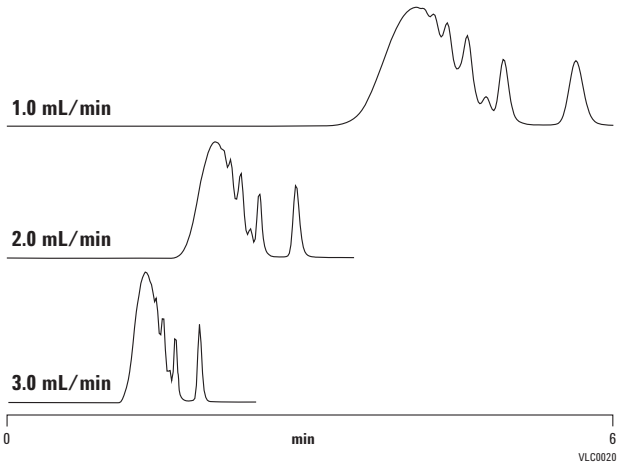
PL Rapide

Description	Size (mm)	MW Range (g/mol)	Guaranteed Efficiency (p/m)	Part No.
PL Rapide H	7.5 x 150	500-10,000,000	> 35,000	PL1113-3100
	10 x 100			PL1013-2100
PL Rapide M	7.5 x 150	200-2,000,000	> 60,000	PL1113-3500
	10 x 100			PL1013-2500
PL Rapide L	7.5 x 150	200-400,000	> 80,000	PL1113-3300
	10 x 100			PL1013-2300
PL Rapide F	7.5 x 150	up to 4,500	> 55,000	PL1113-3120
	10 x 100	up to 4,000	> 40,000	PL1013-2120
PL Rapide Aqua H	7.5 x 150	100-10,000,000	> 35,000	PL1149-3800
	10 x 100			PL1049-2800
PL Rapide Aqua L	7.5 x 150	100-30,000	> 35,000	PL1120-3830
	10 x 100			PL1020-2830

Resin analysis by rapid GPC

Column: **PL Rapide L**
PL1013-2300
10 x 100 mm

Sample: Epoxy resin
Mobile Phase: THF
Flow Rate: 1.0 , 2.0 and 3.0 mL/min
Detector: UV, 254 nm



PolarGel

- Medium polarity surface and high mechanical stability
- Operate in a wide range of solvents and solvent combinations
- Available in two resolving ranges, PolarGel-L and PolarGel-M

The PolarGel range is ideal for use with polar solvents, such as dimethyl formamide (DMF) and dimethyl sulfoxide (DMSO), and for solvent combinations such as tetrahydrofuran with water. These eluents are very useful in GPC/SEC to separate polar materials, such as polar resins, modified polysaccharides or complex polar polymers that are difficult to analyze in traditional SEC solvents, such as tetrahydrofuran alone. PolarGel-L is used for low molecular weight polar polymers and PolarGel-M for high MW polar polymers.

With polar polymers, highly polar groups can lead to non-specific interactions and secondary separation mechanisms when using polar solvents and traditional non-polar styrene/divinylbenzene columns. Additives and/or column conditioning are normally required to reduce these interactions. PolarGel has no need for these interventions, and also avoids the interactions and secondary effects that produce chromatogram distortions.

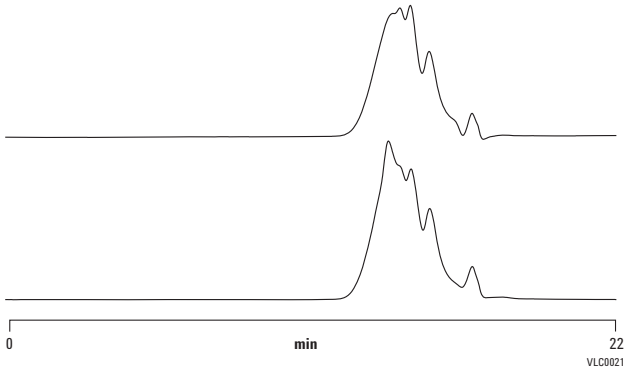
These PolarGel "mixed bed" columns have a medium polarity surface and high mechanical stability. They are capable of operating in a wide range of solvents and solvent combinations, greatly enhancing your ability to analyze polar polymers that are not necessarily water soluble. PolarGel is available in two resolving ranges to meet your precise requirements.

PolarGel

Description	Size (mm)	Part No.
PolarGel-L	7.5 x 300	PL1117-6830
PolarGel-L guard	7.5 x 50	PL1117-1830
PolarGel-L repair gel		PL1417-0830
PolarGel-M	7.5 x 300	PL1117-6800
PolarGel-M guard	7.5 x 50	PL1117-1800
PolarGel-M repair gel		PL1417-0800

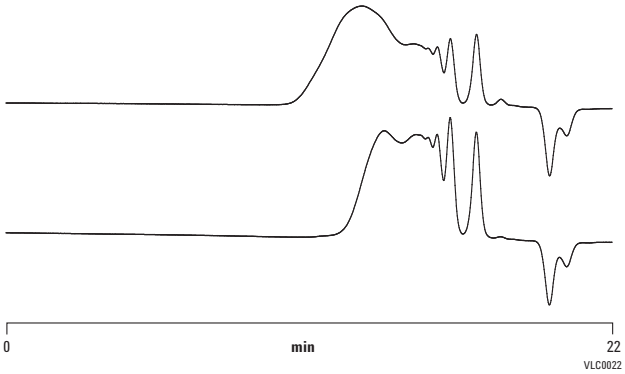
Two samples of melamine resin analyzed by PolarGel-L

Column:	**2 x PolarGel-L, 300 x 7.5 mm PL1117-6830**
Mobile Phase:	Dimethylacetamide + 0.1% LiBr
Flow Rate:	1.0 mL/min
Injection Volume:	100 µL
Detector:	Agilent PL-GPC 220 (RI)



Excellent separation of two phenol formaldehyde resins with PolarGel-M

Column:	**2 x PolarGel-M, 300 x 7.5 mm PL1117-6800**
Mobile Phase:	0.2% (w/v) DMF & 0.1% LiBr to reduce sample aggregation
Flow Rate:	1.0 mL/min
Injection Volume:	100 µL
Detector:	Agilent PL-GPC 50 (RI)



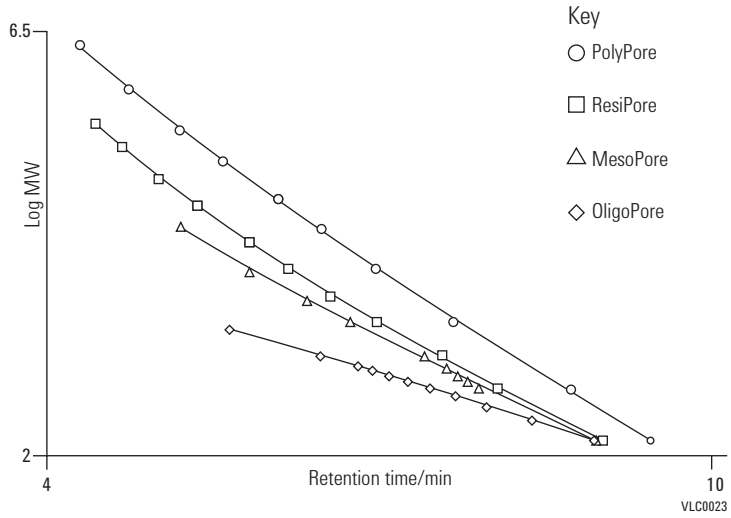
PlusPore

The PlusPore range has an increased pore volume that provides high resolution for specific applications. The high stability media permits the use of a wide range of organic solvents with accuracy and precision so that there is no distortion of the MW distribution shape.

The PlusPore series of columns has been specifically designed for high resolution GPC, and represents the very latest in GPC column technology. These novel packing materials are based on the industry standard, highly cross-linked polystyrene/divinylbenzene (PS/DVB), for the widest applicability and solvent compatibility. Each is made using a novel polymerization process to produce particles that exhibit a specific, controlled pore structure for optimum GPC performance. Typical applications include resins, condensation polymers, prepolymers, and oligomers.

For high resolution polymer analysis, the PolyPore, ResiPore, MesoPore and OligoPore columns of the PlusPore product series exhibit a wide pore size distribution with near linear calibration curves covering an extended molecular weight range. These so-called "multipore" structures have increased pore volume compared to regular PS/DVB packing materials. This results in very high resolution GPC columns designed for specific application areas. The highly cross-linked porous particles provide excellent chemical and physical stability and permit easy transfer across the full range of organic solvents with little change in the shape of the calibration curve or the efficiency of the columns. As this multipore column technology does not require the combination of individual pore size packing materials, the result is high accuracy and precision without any artifacts in the shape of the molecular weight distribution.

PlusPore calibration curves



PlusPore Selection Guide

Column	MW Range (g/mol) (PS)	Nominal Particle Size (µm)	Typical Efficiency (p/m)	Recommended Calibrants	Frit Porosity (µm)
PolyPore	200-2,000,000	5	> 60,000	EasiCal PS-1or EasiVial PS-H	2
ResiPore	200-400,000	3	> 80,000	EasiCal PS-2 or EasiVial PS-M	2
MesoPore	up to 25,000	3	> 80,000	Polystyrene S-L-10 Kit	2
OligoPore	up to 4,500	6	> 55,000	Polystyrene S-L2-10 Kit	2

PolyPore

- Routine polymer analysis with very high resolution
- Wide operating range simplifies column choice
- Low particle size extracts maximum information from the analyte

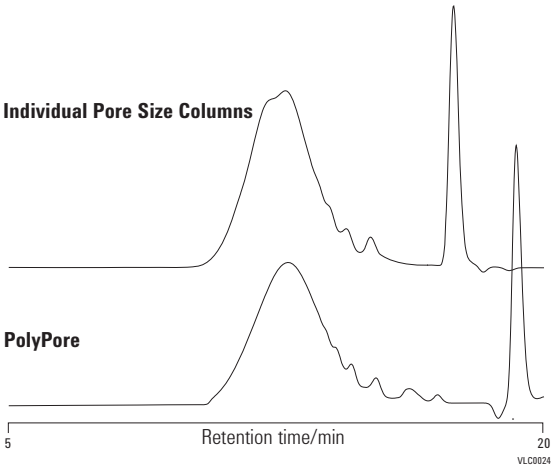
PolyPore columns have been specifically developed to give unrivaled resolution for the analysis of polymers with broad molecular weight distributions. With a wide operating range covering many decades of molecular weight, PolyPore columns combine a low 5 µm particle size with extremely high pore volume to give the highest possible resolution, ensuring the most detailed information possible from your analysis.

PolyPore

Description	Size (mm)	Part No.
PolyPore	7.5 x 300	PL1113-6500
PolyPore guard	7.5 x 50	PL1113-1500

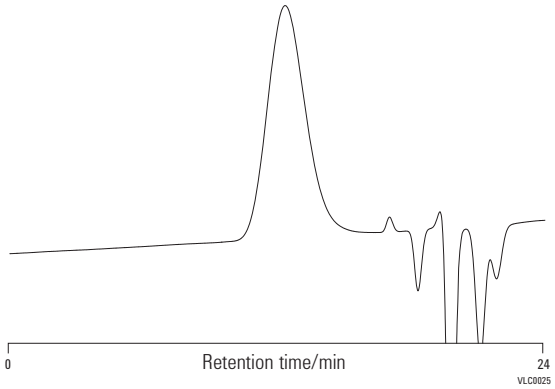
Comparison of PolyPore with conventional individual pore size GPC columns

Column:	**2 x PolyPore, 300 x 7.5 mm PL1113-6500**
Sample:	High MW Resin
Mobile Phase:	THF
Flow Rate:	1.0 mL/min
Injection Volume:	100 µL
Detector:	Agilent PL-GPC 50 (RI)



Polymethylmethacrylate in DMF

Column:	**2 x PolyPore, 7.5 x 300 mm PL1113-6500**
Sample:	Commercial PMMA
Mobile Phase:	DMF + 0.1% LiBr
Flow Rate:	1.0 mL/min
Temperature:	80°C
Injection Volume:	100 µL
Detector:	Agilent PL-GPC 50 (RI)



ResiPore

- Efficient separation of complex molecular weight distributions
- Reveals oligomer content to provide a true representation of the sample
- High pore volume extracts maximum information from the analyte

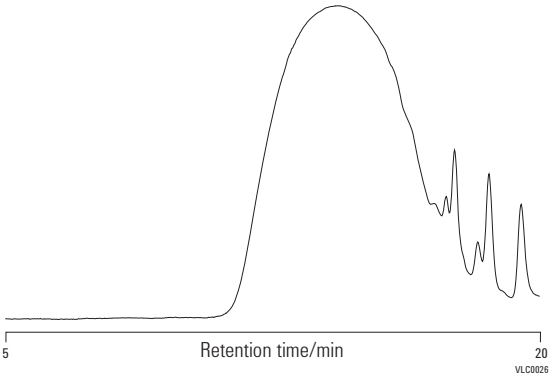
ResiPore columns are the ideal choice for the analysis of resins and condensation polymers with complex molecular weight distributions that include oligomer content. By combining a low 3 µm particle size and high pore volume, high efficiency ResiPore columns offer maximum resolution of these intermediate molecular weight polymers.

ResiPore

Description	Size (mm)	Part No.
ResiPore	7.5 x 300	PL1113-6300
ResiPore guard	7.5 x 50	PL1113-1300

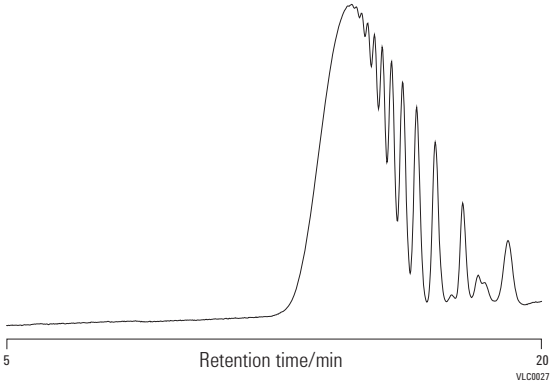
Alkyd resin

Column:	**2 x ResiPore, 7.5 x 300 mm PL1113-6500**
Mobile Phase:	THF
Flow Rate:	1.0 mL/min
Injection Volume:	20 µL
Detector:	UV, 254 nm



Polyester

Column:	**2 x ResiPore, 7.5 x 300 mm PL1113-6500**
Mobile Phase:	THF
Flow Rate:	1.0 mL/min
Injection Volume:	20 µL
Detector:	UV, 254 nm



MesoPore

- Full solvent compatibility with no detrimental effect on efficiency
- Low particle size extracts maximum information from the analyte
- No MWD dislocations so the distribution is an accurate representation of the sample

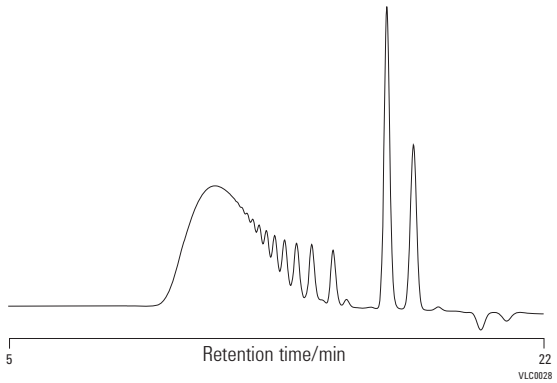
MesoPore columns have been specifically designed to provide optimum results in the analysis of prepolymers, i.e. polymeric materials with a large oligomeric component. By combining a 3 µm particle size with high pore volume, MesoPore columns give the highest resolution separations for the analysis of low molecular weight polymers, such as prepolymers, resins, polyols and siloxanes.

MesoPore

Description	Size (mm)	Part No.
MesoPore	7.5 x 300	PL1113-6325
MesoPore guard	7.5 x 50	PL1113-1325

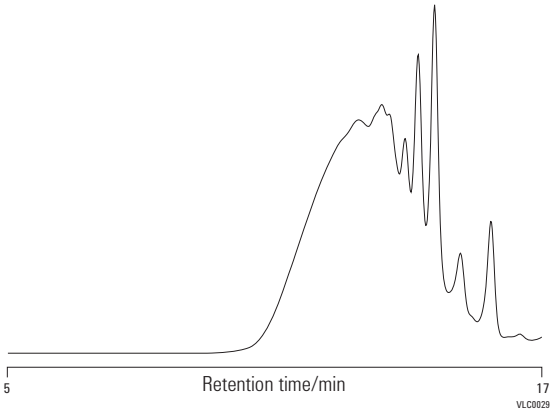
Polyurethanes

Column: **2 x MesoPore, 7.5 x 300 mm PL1113-6500**
Mobile Phase: THF
Flow Rate: 1.0 mL/min
Injection Volume: 20 µL
Detector: Agilent PL-GPC 50 (RI)



Polyesterimide

Column: **2 x MesoPore, 7.5 x 300 mm PL1113-6500**
Mobile Phase: THF
Flow Rate: 1.0 mL/min
Injection Volume: 20 µL
Detector: Agilent PL-GPC 50 (RI)



OligoPore

- Near linear calibration curve for best accuracy and precision
- Very stable media allows for a wide choice of solvents
- Isolation of individual fractions reveals more information from whole samples

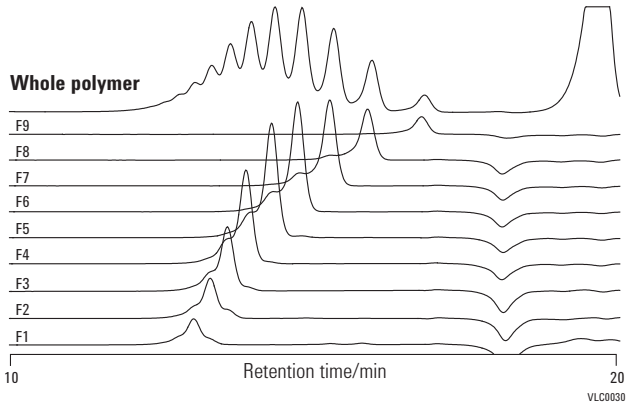
OligoPore columns have been developed from an innovative new media that exhibits significantly increased pore volumes compared to conventional low pore size GPC columns. The outcome is higher resolution in the oligomeric region. The 300 x 25 mm preparative column offers high resolution at greatly increased loading for effective isolation of individual components. Oligomer fractions collected from the OligoPore preparative column can then be re-injected on analytical columns to check for the purity of the fractions and for comparison with the whole sample.

OligoPore

Description	Size (mm)	Part No.
OligoPore	25 x 300	PL1213-6520
OligoPore	7.5 x 300	PL1113-6520
OligoPore guard	7.5 x 50	PL1113-1320

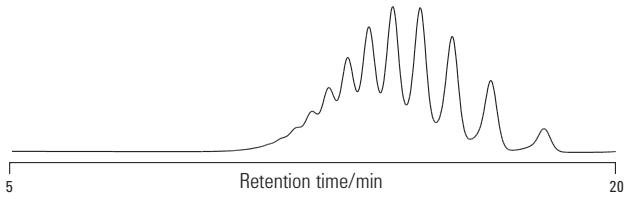
Analysis of low molecular weight polystyrene and oligomer fractions collected from OligoPore preparative columns

Column:	**2 x OligoPore, 7.5 x 300 mm PL1113-6500**
Mobile Phase:	THF
Flow Rate:	1.0 mL/min
Detector:	UV



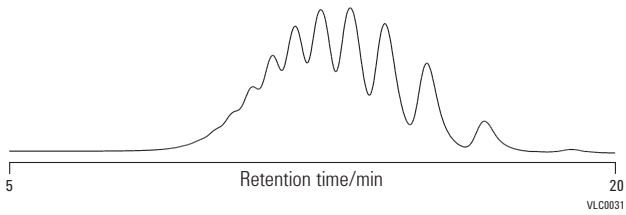
Analytical separation of low molecular weight polystyrene

Column:	**2 x OligoPore, 7.5 x 300 mm PL1113-6500**
Mobile Phase:	THF
Flow Rate:	1.0 mL/min
Loading:	0.2%, 100 mL
Detector:	UV



Preparative separation of low molecular weight polystyrene

Column:	**2 x OligoPore, 25 x 300 mm PL1113-6500**
Mobile Phase:	THF
Flow Rate:	10.0 mL/min
Loading:	2.0%, 2 mL
Detector:	UV



Aqueous SEC of Polymers

PL aquagel-OH SEC

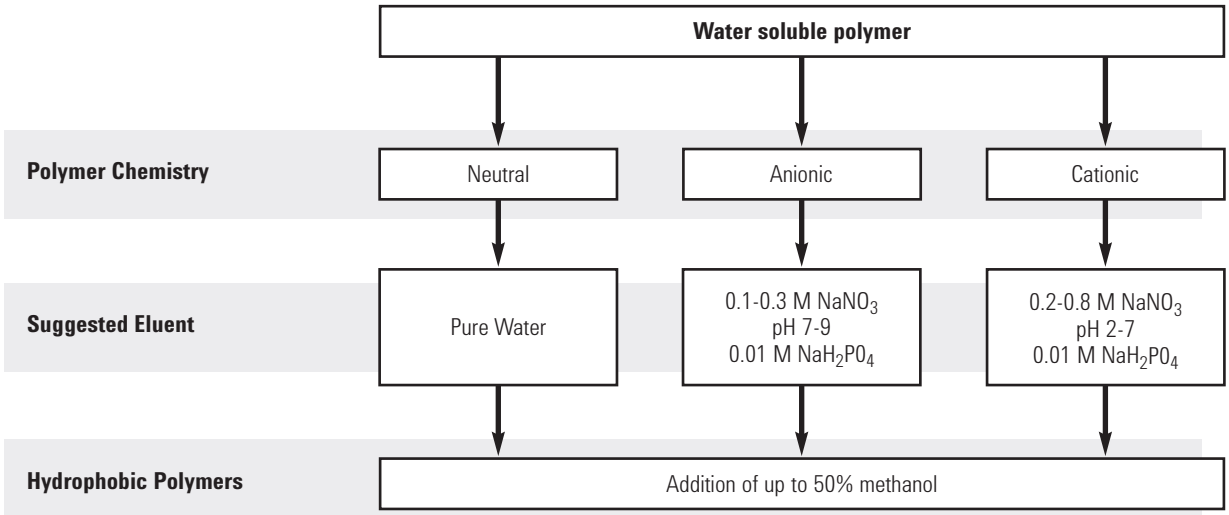
Aqueous size exclusion chromatography (SEC) is widely used for the determination of molecular weight distributions of a variety of synthetic and naturally occurring water-soluble polymers, and separations of oligomers and small molecules. The requirement to eliminate ionic and hydrophobic effects makes aqueous SEC very demanding.

The PL aquagel-OH series provides a chemically and physically stable matrix for reliable aqueous SEC separations. The columns are packed with macroporous copolymer beads with an extremely hydrophilic polyhydroxyl functionality. The "neutral" surface and the capability to operate across a wide range of eluent conditions provide for high performance analyses of compounds with neutral, ionic and hydrophobic moieties, alone or in combination. PL aquagel-OH is available for analytical and preparative applications.

Optimizing Conditions for Aqueous SEC with PL aquagel-OH Columns

Due to the complex nature of water-soluble polymers, it is often necessary to modify the eluent in order to avoid sample-to-sample and sample-to-column interactions which can result in poor aqueous SEC separations. The excellent stability of the PL aquagel-OH packing material allows the eluent to be tailored to suit the polymer, while retaining the high column efficiency. For ionic interactions, the eluent can be modified by the addition of salt and/or the adjustment of pH. For water soluble polymers with a hydrophobic character, only the addition of a weak organic solvent (methanol) is required to inhibit hydrophobic interactions.

Guide to eluent selection for PL aquagel-OH applications



PL aquagel-OH Column Selection Guide

Sample Type	Typical Applications	Recommended Column Sets
Low MW polymers and oligomers	Surfactants, oligosaccharides, PEGs, lignosulfonates, polyacrylates	2 or 3 30, 20 PL aquagel-OH 8 µm, or PL aquagel-OH 20 5 µm, or PL aquagel-OH MIXED-M 8 µm
Polydisperse synthetic or naturally occurring polymers	Polysaccharides, PVA, cellulose derivatives, PEO, polyacrylic acid	2 or 3 PL aquagel-OH MIXED-H 8 µm, or PL aquagel-OH 60/50/40 8 µm
Very high MW polymers	Polyacrylamides, hyaluronic acids, CMC, starches, gums	PL aquagel-OH 60/50/40 15 µm in series

Tips & Tools

Buffers in a stored column may crystallize and cause damage. Flush the column with water containing a small amount of sodium azide to prevent biological growth.

PL aquagel-OH Analytical

- Highly stable matrix ensures reliable separations, even with modified eluents
- MIXED columns cover a wide range of molecular weights, simplifying column selection
- Highly versatile for neutral, polar, anionic and cationic samples

The PL aquagel-OH analytical series has a pH range of 2-10, compatibility with organic solvent (up to 50% methanol), mechanical stability up to 140 bar (2030 psi) and low column operating pressures.

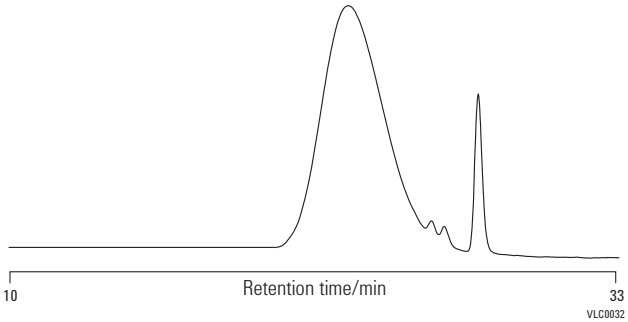
PL aquagel-OH Analytical

Description	Size (mm)	MW Range (g/mol) (PEG/PEO)	Guaranteed Efficiency (p/m)	Part No.
PL aquagel-OH 20 5 µm	7.5 x 300	100-20,000	> 55,000	PL1120-6520
PL aquagel-OH 20 8 µm	7.5 x 300	100-20,000	> 35,000	PL1149-6820
PL aquagel-OH 30 8 µm	7.5 x 300	100-30,000	> 35,000	PL1120-6830
PL aquagel-OH 40 8 µm	7.5 x 300	10,000-200,000	> 35,000	PL1149-6840
PL aquagel-OH 40 15 µm	7.5 x 300	10,000-200,000	> 15,000	PL1149-6240
PL aquagel-OH 50 8 µm	7.5 x 300	50,000-1,000,000	> 35,000	PL1149-6850
PL aquagel-OH 50 15 µm	7.5 x 300	50,000-1,000,000	> 15,000	PL1149-6250
PL aquagel-OH 60 8 µm	7.5 x 300	200,000 - > 10,000,000	> 35,000	PL1149-6860
PL aquagel-OH 60 15 µm	7.5 x 300	200,000 - > 10,000,000	> 15,000	PL1149-6260
PL aquagel-OH MIXED-H 8 µm	7.5 x 300	100-10,000,000	> 35,000	PL1149-6800
PL aquagel-OH MIXED-M 8 µm	7.5 x 300	100-10,000,000	> 35,000	PL1149-6801
PL aquagel-OH 10 µm guard	25 x 25			PL1249-1120
PL aquagel-OH 5 µm guard	7.5 x 50			PL1149-1530
PL aquagel-OH 8 µm guard	7.5 x 50			PL1149-1840

Polyvinyl alcohol

Column: **3 x PL aquagel-OH MIXED**
PL1149-6800
7.5 x 300 mm, 8 µm

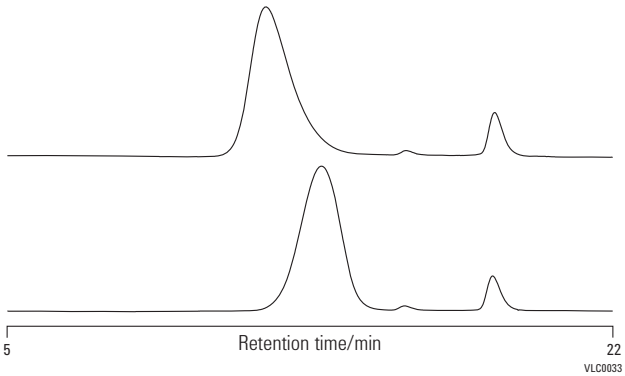
Mobile Phase: 0.2 M $NaNO_3$, 0.01 M NaH_2PO_4, pH 7
Flow Rate: 1.0 mL/min
Detector: Agilent PL-GPC 50 (RI)



Heparin

Column: **2 x PL aquagel-OH 30**
PL1120-6830
7.5 x 300 mm, 8 µm

Mobile Phase: 0.2 M $NaNO_3$, 0.01 M NaH_2PO_4, pH 7
Flow Rate: 1.0 mL/min
Detector: Agilent PL-GPC 50 (RI)



Hyaluronic acid

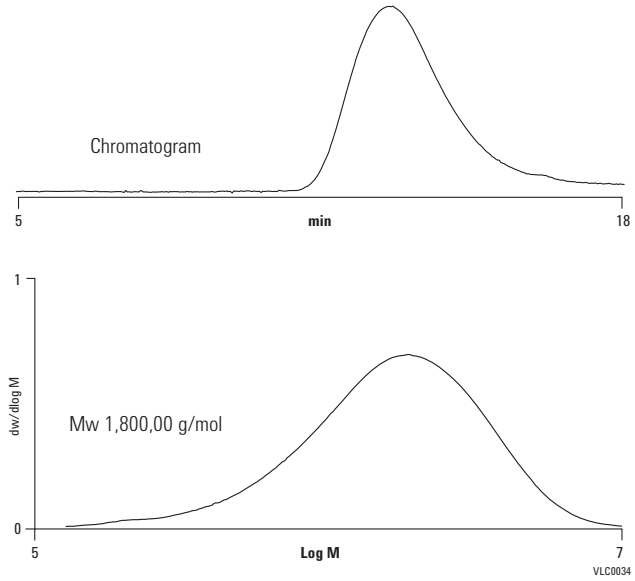
Column: **PL aquagel-OH 60 15 µm PL1149-6260 7.5 x 300 mm, 15 µm**

Column: **PL aquagel-OH 40 15 µm PL1149-6240 7.5 x 300 mm, 15 µm**

Mobile Phase: 0.2 M $NaNO_3$, 0.01 M NaH_2PO_4, pH 7

Flow Rate: 1.0 mL/min

Detector: Agilent PL-GPC 50 (RI)



Differences in composition of two alkyl naphthalene sulfonates

Column: **2 x PL aquagel-OH 20 PL1120-6520 7.5 x 300 mm, 5 µm**

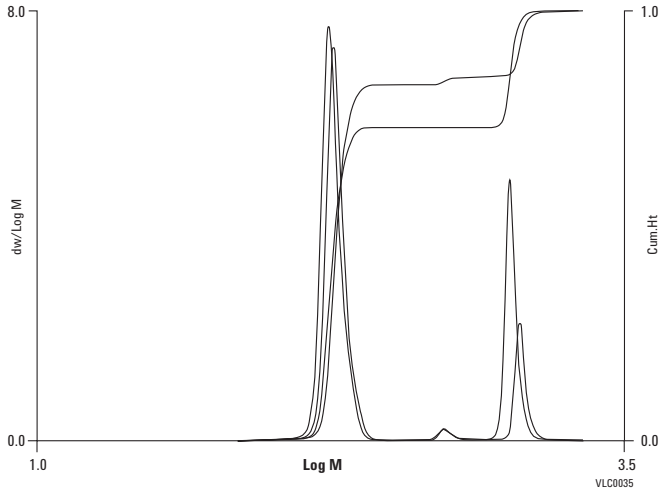
Mobile Phase: 0.25 M ammonium formate in water

Flow Rate: 1.0 mL/min

Injection Volume: 20 µL

Software: Cirrus GPC module for Galaxie CDS

Detector: ELS (neb=30°C, evap=30°C, gas=1.4 SLM)



PL aquagel-OH Preparative

- Up to 10 times scale-up maximizes yield
- High loading maximizes sample throughput
- Carefully chosen particle size provides optimum resolution

Preparative SEC is used for the fractionation of a wide variety of water-soluble samples based on their size in solution. The technique is applied to the fractionation of disperse polymers or to isolate components in a polymer formulation.

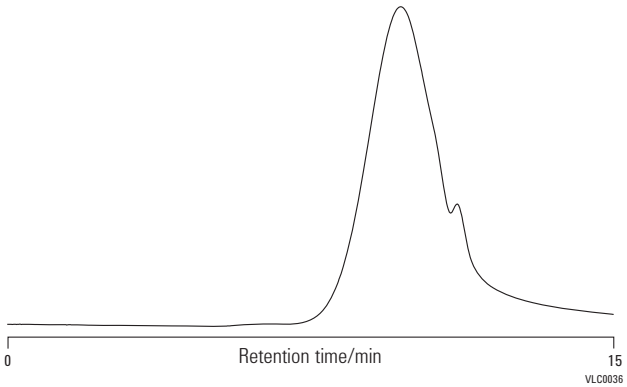
Preparative PL aquagel-OH columns and associated guard columns enable rapid and convenient scale-up from analytical separations. The 25 mm ID prep column offers at least a 10 times scale-up in loading from the 7.5 mm ID analytical columns. Typically, a 10 mL/min flow rate results in a separation time of ten minutes with a 300 mm column. The columns are packed with the same robust macroporous particles as the analytical column range. The 8 µm article size provides optimum resolution and loading characteristics with column efficiency > 20,000 plates/m.

PL aquagel-OH Preparative

Description	Size (mm)	MW Range (g/mol) (PEG/PEO)	Part No.
PL aquagel-OH 30 8 µm	25 x 300	100-30,000	PL1220-6130
PL aquagel-OH 40 8 µm	25 x 300	10,000-200,000	PL1249-6140
PL aquagel-OH 50 8 µm	25 x 300	50,000-1,000,000	PL1249-6150
PL aquagel-OH MIXED 8 µm	25 x 300	100-10,000,000	PL1249-6100
PL aquagel-OH 10 µm guard	25 x 25		PL1249-1120

Polyvinyl alcohol

Column:	**PL aquagel-OH 40 8 µm** **PL1249-6140** **25 x 300 mm, 8 µm**
Mobile Phase:	0.2 M $NaNO_3$, 0.01 M NaH_2PO_4, pH 7
Flow Rate:	10.0 mL/min
Loading:	10 mg/mL, 2 mL
Detector:	Agilent PL-GPC 50 (RI)



GPC Column Accessories

Description	Unit	Part No.
Frit removal tool for threaded columns only	1/pk	PL1310-0001
2 µm frit kit for threaded columns, 7.5 mm ID	5/pk	PL1310-0002
5 µm frit kit for threaded columns, 7.5 mm ID	5/pk	PL1310-0012
10 µm frit kit for threaded columns, 7.5 mm ID	5/pk	PL1310-0036
PLgel column repair gel, 10 µm	1/pk	PL1410-0101
PLgel column repair gel, 5 µm	1/pk	PL1410-0501
Column connecting nuts, 1/16 in. tube	5/pk	PL1310-0007
Tubing ferrules, 1/16 in. tube	5/pk	PL1310-0008
Connecting tubing, 10 cm length, 0.01 in. ID	10/pk	PL1310-0048
LDV intercolumn stainless steel connector	1/pk	PL1310-0005

Polymer Standards for GPC/SEC

Polymer standards from Agilent are the ideal reference materials for generating accurate, reliable GPC/SEC column calibrations, with the assurance of the ISO 9001:2000 quality standard. Additional applications for our highly characterized homopolymers and copolymers exhibiting unique characteristics are as model polymers for research and analytical method development.

Agilent manufactures the highest quality polymer standards with extremely narrow polydispersity and the widest molecular weight range commercially available. These quality polymer standards are supplied with extensive characterization data utilizing a variety of independent techniques (e.g. light scattering and viscometry) and high performance GPC to verify polydispersity and assign that all important peak molecular weight (Mp).

Our comprehensive range of EasiVial, EasiCal and traditional calibration kits has been specifically designed to cover all molecular weight ranges for organic and aqueous GPC/SEC applications. We provide you with the widest choice to maximize your specific characterization needs. In addition, we supply other polymers as individual molecular weights, and broad distribution polymers for system validation or broad standard calibration procedures.

Calibration Kits

Agilent offers a wide range of polymer standards kits for conventional GPC/SEC column calibration or for calibrating light scattering and viscometry detectors. The kits are in boxed sets of ten different polymer standards covering a particular molecular weight range, to be used with organic and aqueous, medium polarity and polar solvents. Every individual polymer has its own Certificate of Analysis of the analytical conditions and values, such as Mp needed for constructing a calibration plot. The polymers are chosen to give equidistant calibration points on a logarithmic MW scale, providing a more uniform calibration curve.

Individual Polymer Molecular Weights

We design our individual standards to have the narrowest molecular weight distribution commercially available. Additionally, they cover the widest molecular weight range, from 162-15 million MW. The current polystyrene nominal molecular weight of 15 million MW has a polydispersity ≤1.10. These standards are generally available in 1, 5 and 10 g quantities, and each comes with its own Certificate of Analysis detailing analysis conditions and relevant data.

GPC/SEC Standards Selection Guide

Polymer Type	Individual MW	Calibration Kits	EasiCal	EasiVial	Type of GPC/SEC
Polystyrene	◆	◆	◆	◆	Organic
Polymethylmethacrylate	◆	◆		◆	Organic
Polyethylene	◆	◆			Organic
Polyethylene glycol (PEG)	◆	◆		◆	Organic/Aqueous
Polyethylene oxide (PEO)	◆	◆		◆	Organic/Aqueous
Pullulan polysaccharide	◆	◆			Organic/Aqueous
Polyacrylic acid Na salt	◆	◆			Aqueous

EasiVial

- Eliminates tedious weighing procedures to improve calibration accuracy
- Reduces solvent dispensing to limit risks associated with handling solvents
- For conventional and multi-detector GPC to maximize applicability

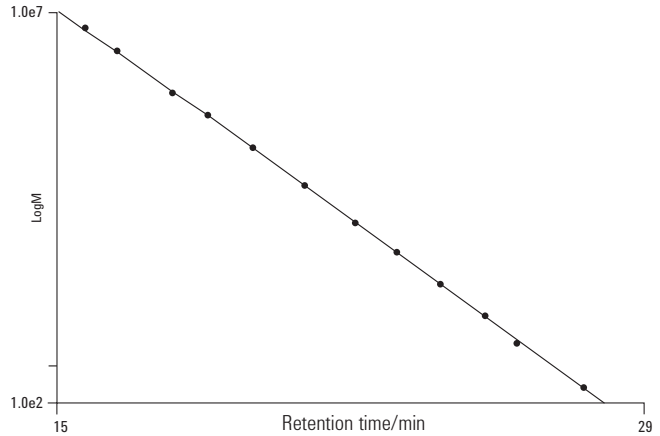
For organic and aqueous GPC/SEC column calibration, this premier product is the quickest and most convenient method to deliver an accurate 12-point column calibration.

The key to achieving baseline separation from polymer mixtures, therefore eliminating doubt and errors, is in selecting only the narrowest polydispersity polymers. This is where Agilent polymer standards excel and deliver, as shown in the chromatograms.

The EasiVial standards kit is a pre-prepared, time saving product for rapid and reliable GPC column calibration. EasiVial kits contain three vials, each with a mixture of four accurately pre-weighed polymer standards, providing a 12-point GPC calibration in just three injections. The mass of each polymer in the vial is accurately known, so that upon addition of a fixed volume of eluent, the solution is prepared at a precise concentration. EasiVial is ideal for both conventional and multi-detector GPC calibration. Simply prepare and manually inject, or transfer to autosampler vials, or place directly into a compatible autosampler.

Every EasiVial kit contains 30 vials (ten of each type) that are color-coded for easy identification and are available in 4 or 2 mL vials making them suitable for most autosamplers. The kits are available for polystyrene (PS), polymethylmethacrylate (PMMA), polyethylene glycol/oxide (PEG/PEO) and polyethylene glycol (PEG). For added value, a Tri-Pack (90 vials) is offered, extending reproducibility.

Polystyrene calibration generated with EasiVials



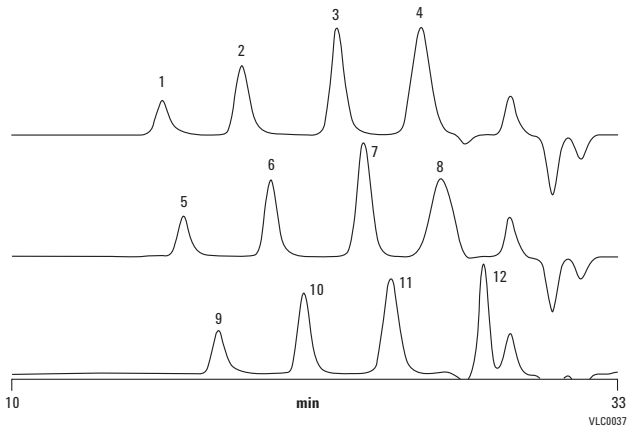
EasiVial Pre-weighed Calibration Kits

Description	Range of Nominal Mp (g/mol)	Vial Volume (mL)	Unit	Part No.
EasiVial PEG/PEO	100-1,200,000	2	30/pk	PL2080-0201
EasiVial PEG/PEO	100-1,200,000	4	30/pk	PL2080-0200
EasiVial PEG	106-35,000	2	30/pk	PL2070-0201
EasiVial PEG	106-35,000	4	30/pk	PL2070-0200
EasiVial PM	600-2,000,000	2	30/pk	PL2020-0201
EasiVial PM	600-2,000,000	4	30/pk	PL2020-0200
EasiVial PS-H	162-6,000,000	2	30/pk	PL2010-0201
EasiVial PS-H	162-6,000,000	4	30/pk	PL2010-0200
EasiVial PS-M	162-400,000	2	30/pk	PL2010-0301
EasiVial PS-M	162-400,000	4	30/pk	PL2010-0300
EasiVial PS-L	162-40,000	2	30/pk	PL2010-0401
EasiVial PS-L	162-40,000	4	30/pk	PL2010-0400
PEG/PEO Tri-Pack		2	90/pk	PL2080-0202
PEG/PEO Tri-Pack		4	90/pk	PL2080-0203
PEG Tri-Pack		2	90/pk	PL2070-0202
PEG Tri-Pack		4	90/pk	PL2070-0203
PMMA Tri-Pack		2	90/pk	PL2020-0202
PMMA Tri-Pack		4	90/pk	PL2020-0203
PS-H Tri-Pack		2	90/pk	PL2010-0202
PS-H Tri-Pack		4	90/pk	PL2010-0203
PS-L Tri-Pack		3	90/pk	PL2010-0402
PS-L Tri-Pack		4	90/pk	PL2010-0403

EasiVial PS-H

Column: **3 x PLgel MIXED-B, 10 µm**
PL1110-6100
7.5 x 300 mm, 10 µm

Mobile Phase: THF
Flow Rate: 1.0 mL/min
Temperature: 40°C
Detector: PL-GPC 220 (RI)



1. 6,035,000
2. 483,000
3. 19,720
4. 1,260
5. 3,053,000
6. 84,900
7. 8,450
8. 580
9. 915,000
10. 60,450
11. 3,370
12. 162

EasiCal

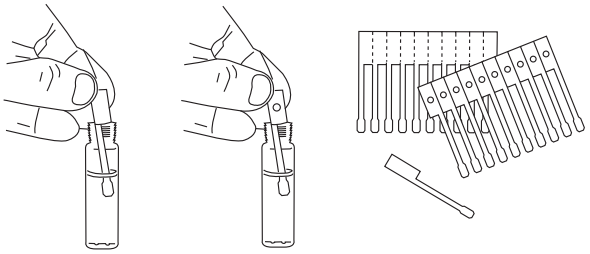
- Easy three-step process with no fuss
- Cost-effective format saves money
- Only two injections for improved productivity

The EasiCal system for organic solvents consists of two different combs, each with ten detachable spatulas, supporting a mixture of five polymer standards. The thin film of polymer (approximately 5 mg) on the tip of the PTFE spatulas rapidly dissolves when immersed in eluent to provide two GPC/SEC calibration solutions. A single pack provides ten spatulas of each type, with MWs selected to provide equidistant calibration points for greater accuracy.

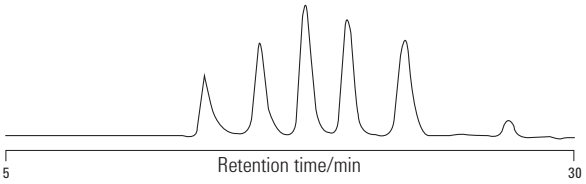
EasiCal Pre-prepared Polystyrene Kits

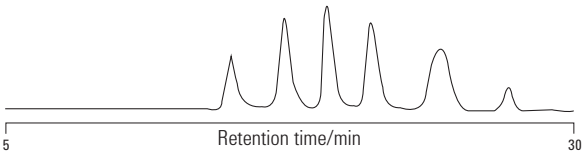
Description	Range of Nominal Mp (g/mol)	Unit	Part No.
Polystyrene PS-1	580-7,500,000	1/pk	PL2010-0501
		5/pk	PL2010-0505
Polystyrene PS-2	580-400,000	1/pk	PL2010-0601
		5/pk	PL2010-0605

Column calibration for GPC/SEC is as easy as 1, 2, 3...

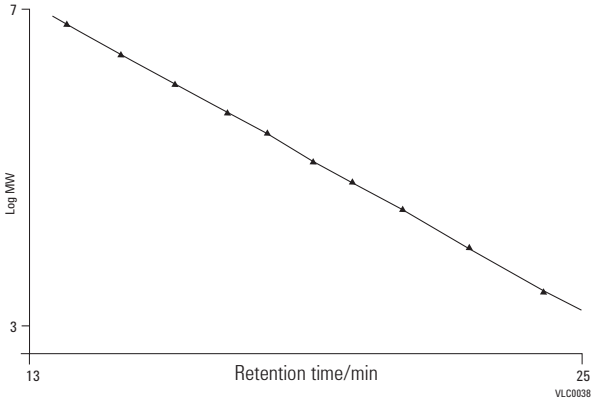


1. Place one spatula of each type into appropriate volume of solvent.





2. Chromatograph each solution; only two injections required



3. Generate a 10-point calibration

Polystyrene

- Compatible with most organic solvents
- Certificate of Analysis meets international protocols
- Calibration capability for virtually all applications

Polystyrene standards are the first choice for many organic solvents, either for conventional GPC column calibration or for calibrating light scattering and viscosity detectors. Our organic polymers cover a range from 162-15 million MW, with MWs selected to provide equidistant calibration points for greater accuracy. Every kit contains 0.5 g of ten different molecular weight standards.

Calibration Kits

Description	Range of Nominal Mp (g/mol)	Part No.
S-H-10, 10 x 0.5 g	300,000-15,000,000	PL2010-0103
S-H2-10, 10 x 0.5 g	1,000-15,000,000	PL2010-0104
S-M-10, 10 x 0.5 g	580-3,000,000	PL2010-0100
S-M2-10, 10 x 0.5 g	580-300,000	PL2010-0102
S-L-10, 10 x 0.5 g	162-20,000	PL2010-0101
S-L2-10, 10 x 0.5 g	162-4,500	PL2010-0105

Individual Polymer Molecular Weights

Polymer Nominal Mp (g/mol)	Nominal Mw/Mn	1 g Part No.	5 g Part No.	10 g Part No.
162	1.00	PL2012-1001	PL2012-1005	PL2012-1010
370	1.11	PL2012-0001	PL2012-0005	PL2012-0010
580	1.11	PL2012-2001	PL2012-2005	PL2012-2010
1,000	1.09	PL2012-3001	PL2012-3005	PL2012-3010
1,300	1.07	PL2012-4001	PL2012-4005	PL2012-4010
2,000	1.05	PL2012-5001	PL2012-5005	PL2012-5010
3,000	1.04	PL2012-6001	PL2012-6005	PL2012-6010
5,000	1.03	PL2012-7001	PL2012-7005	PL2012-7010
7,000	1.04	PL2012-8001	PL2012-8005	PL2012-8010
10,000	1.02	PL2012-9001	PL2012-9005	PL2012-9010
20,000	1.02	PL2013-1001	PL2013-1005	PL2013-1010
30,000	1.02	PL2013-2001	PL2013-2005	PL2013-2010
50,000	1.03	PL2013-3001	PL2013-3005	PL2013-3010
70,000	1.03	PL2013-4001	PL2013-4005	PL2013-4010
100,000	1.02	PL2013-5001	PL2013-5005	PL2013-5010
130,000	1.01	PL2013-6001	PL2013-6005	PL2013-6010
200,000	1.05	PL2013-7001	PL2013-7005	PL2013-7010
300,000	1.03	PL2013-8001	PL2013-8005	PL2013-8010
500,000	1.03	PL2013-9001	PL2013-9005	PL2013-9010
700,000	1.03	PL2014-0001	PL2014-0005	PL2014-0010
1,000,000	1.05	PL2014-1001	PL2014-1005	PL2014-1010
1,500,000	1.04	PL2014-2001	PL2014-2005	PL2014-2010
2,000,000	1.04	PL2014-3001	PL2014-3005	PL2014-3010
2,500,000	1.05	PL2014-4001	PL2014-4005	PL2014-4010
4,000,000	1.04	PL2014-6001	PL2014-6005	PL2014-6010
7,000,000	1.04	PL2014-7001	PL2014-7005	PL2014-7010
10,000,000	1.06	PL2014-8001	PL2014-8005	PL2014-8010
15,000,000	1.06	PL2014-9001	PL2014-9005	PL2014-9010

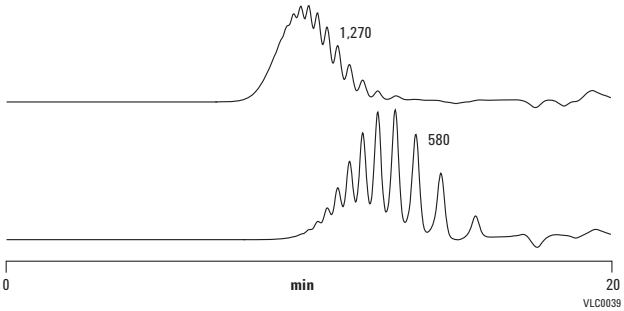
Polystyrene standards

Column: **2 x OligoPore PL1113-6520 7.5 x 300**

Mobile Phase: THF

Flow Rate: 1.0 mL/min

Detector: Agilent PL-GPC 50 (RI)



Polymethylmethacrylate

- Many solvent options increase applicability
- Stringent quality control improves performance
- Proprietary manufacturing methods ensure consistent supply

Polymethylmethacrylate (PMMA) standards are extremely versatile as they can be used for organic GPC with a wide range of medium polarity eluents, such as tetrahydrofuran, toluene, methyl ethyl ketone, and ethyl acetate. They also work well with more polar organic eluents, for example dimethylformamide, dimethylacetamide, and hexafluoroisopropanol. The MWs are selected to provide equidistant calibration points for greater accuracy, covering from 600-1.5 million MW. Every kit contains 0.5 g of ten different molecular weight standards.

Calibration Kits

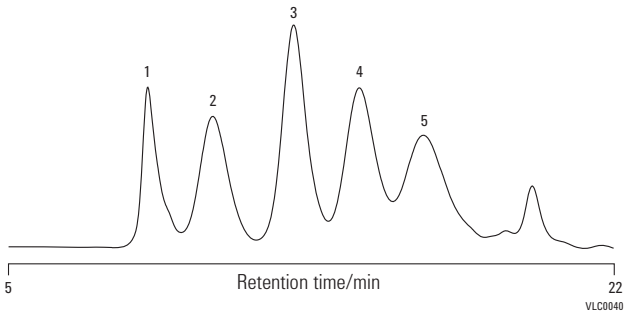
Description	Range of Nominal Mp (g/mol)	Part No.
M-L-10, 10 x 0.5 g	600-50,000	PL2020-0100
M-M-10, 10 x 0.5 g	1,000-1,500,000	PL2020-0101

Individual Polymer Molecular Weights

Polymer Nominal Mp (g/mol)	Nominal Mw/Mn	1 g Part No.	5 g Part No.	10 g Part No.
500	1.19	PL2022-2001	PL2022-2005	PL2022-2010
1,000	1.26	PL2022-3001	PL2022-3005	PL2022-3010
2,000	1.08	PL2022-5001	PL2022-5005	PL2022-5010
3,000	1.08	PL2022-6001	PL2022-6005	PL2022-6010
5,000	1.09	PL2022-7001	PL2022-7005	PL2022-7010
7,000	1.08	PL2022-8001	PL2022-8005	PL2022-8010
10,000	1.03	PL2022-9001	PL2022-9005	PL2022-9010
13,000	1.03	PL2023-0001	PL2023-0005	PL2023-0010
20,000	1.03	PL2023-1001	PL2023-1005	PL2023-1010
30,000	1.02	PL2023-2001	PL2023-2005	PL2023-2010
50,000	1.02	PL2023-3001	PL2023-3005	PL2023-3010
70,000	1.02	PL2023-4001	PL2023-4005	PL2023-4010
100,000	1.02	PL2023-5001	PL2023-5005	PL2023-5010
130,000	1.05	PL2023-6001	PL2023-6005	PL2023-6010
200,000	1.02	PL2023-7001	PL2023-7005	PL2023-7010
300,000	1.02	PL2023-8001	PL2023-8005	PL2023-8010
500,000	1.06	PL2023-9001	PL2023-9005	PL2023-9010
700,000	1.03	PL2024-0001	PL2024-0005	PL2024-0010
1,000,000	1.09	PL2024-1001	PL2024-1005	PL2024-1010
15,000,000	1.09	PL2024-2001	PL2024-2005	PL2024-2010

Polymethylmethacrylate standards

Column: **2 x PL HFIPgel PL1114-6900HFIP 7.5 x 300**
Mobile Phase: HFIP + 20 mM NaTFAc
Flow Rate: 1.0 mL/min
Temperature: 40°C
Detector: Agilent PL-GPC 50 (RI)



1. 790,000
2. 144,000
3. 28,900
4. 5,720
5. 1,020

Polyethylene Glycol/Oxide

- Simple-to-use kit form
- Combines glycols and oxides to extend the MW range and cover more applications
- MWs selected to provide equidistant calibration points for greater accuracy

These hydrophilic polymers are suitable for both aqueous SEC and organic GPC using the majority of polar organic solvents. The oxides are available in high molecular weights, while the glycols cover the lower molecular weight range. The two types are chemically similar so they can be used together across a wider molecular weight range, with aqueous and organic polymers from 106-1 million MW. Every kit contains 0.2 g or 0.5 g of ten different molecular weight standards.

Calibration Kits

Description	Range of Nominal Mp (g/mol)	Part No.
PEG-10, 10 x 0.5 g	106-20,000	PL2070-0100
PEO-10, 10 x 0.5 g	20,000-1,000,000	PL2080-0101

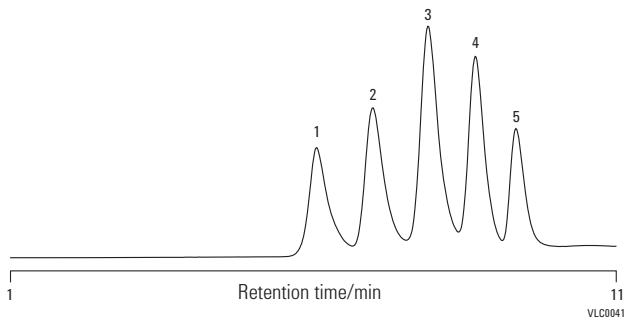
Individual Polymer Molecular Weights

Polymer Nominal Mp (g/mol)	Nominal Mw/Mn	1 g Part No.	5 g Part No.	10 g Part No.
Polyethylene Glycol				
106	1.00	PL2070-1001	PL2070-1005	PL2070-1010
194	1.00	PL2070-2001	PL2070-2005	PL2070-2010
238	1.00	PL2071-2001	PL2071-2005	PL2071-2010
282	1.00	PL2071-3001	PL2071-3005	PL2071-3010
420	1.09	PL2070-3001	PL2070-3005	PL2070-3010
600	1.06	PL2070-4001	PL2070-4005	PL2070-4010
1,000	1.04	PL2070-5001	PL2070-5005	PL2070-5010
1,500	1.04	PL2070-6001	PL2070-6005	PL2070-6010
4,000	1.03	PL2070-7001	PL2070-7005	PL2070-7010
7,000	1.04	PL2070-8001	PL2070-8005	PL2070-8010
10,000	1.05	PL2070-9001	PL2070-9005	PL2070-9010
13,000	1.07	PL2071-0001	PL2071-0005	PL2071-0010
20,000	1.07	PL2071-1001	PL2071-1005	PL2071-1010
Polyethylene Oxide				
20,000	1.05	PL2083-1001	PL2083-1005	PL2083-1010
30,000	1.07	PL2083-2001	PL2083-2005	PL2083-2010
50,000	1.05	PL2083-3001	PL2083-3005	PL2083-3010
70,000	1.05	PL2083-4001	PL2083-4005	PL2083-4010
100,000	1.06	PL2083-5001	PL2083-5005	PL2083-5010
130,000	1.07	PL2083-6001	PL2083-6005	PL2083-6010
200,000	1.07	PL2083-7001	PL2083-7005	PL2083-7010
300,000	1.07	PL2083-8001	PL2083-8005	PL2083-8010
500,000	1.06	PL2083-9001	PL2083-9005	PL2083-9010
700,000	1.07	PL2084-0001	PL2084-0005	PL2084-0010
1,000,000	1.12	PL2084-1001	PL2084-1005	PL2084-1010
1,500,000	1.13	PL2084-2001	PL2084-2005	PL2084-2010

Polyethylene Glycol/Oxide standards

Column: **PL aquagel-OH MIXED-H 8 µm**
PL1149-6800
7.5 x 300 mm, 8 µm

Mobile Phase: Water
Flow Rate: 1.0 mL/min
Detector: Agilent PL-GPC 50 (RI)



1. 1,702,000
2. 120,000
3. 12,600
4. 1,470
5. 106

Polysaccharides

- Comprehensive format provides full MW range in one handy kit
- Also available as individual standards

The pullulan polysaccharides kit consists of several simple sugars with relatively narrow polydispersity linear macromolecules of maltotriose units.

Calibration Kits

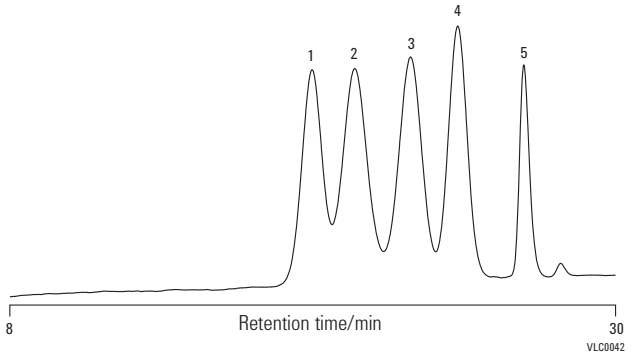
Description	Range of Nominal Mp (g/mol)	Part No.
SAC-10, 10 x 0.2 g	180-700,000	PL2090-0100

Individual Polymer Molecular Weights

Polymer Nominal Mp (g/mol)	Unit	Part No.
1,500	0.2 g	PL2091-2000
2,000	0.2 g	PL2091-3000
3,000	0.2 g	PL2091-4000
5,000	0.5 g	PL2090-1000
20,000	0.5 g	PL2090-3000
50,000	0.5 g	PL2090-4000
100,000	0.5 g	PL2090-5000
200,000	0.5 g	PL2090-6000
700,000	0.5 g	PL2090-8000
1,660,000	0.2 g	PL2091-1000

Pullulan polysaccharide standards

Column: **3 x PL aquagel-OH MIXED PL1149-6800 7.5 x 300 mm, 8 µm**
Mobile Phase: 0.2 M $NaNO_3$, 0.01 M NaH_2PO_4, pH 7
Flow Rate: 1.0 mL/min
Detector: Agilent PL-GPC 50 (RI)



1. 788,000
2. 212,000
3. 47,300
4. 11,800
5. 667

Polyethylene

- Robust particles provide reliable high temperature calibrations
- Two linear molecular weight ranges maximize choice
- Short chain branching kit, for FT-IR calibration and TREF/CRYSTAF reference

Linear polyethylene standards with low polydispersities (1.01 to 1.9) deliver accurate GPC/SEC calibration curves, from 170-1.5 million MW. The E-MW-10 kit is recommended for polyolefins, and is designed for direct column calibration in solvents such as trichlorobenzene and o-dichlorobenzene from 135-180°C. Every kit contains 0.1 or 0.2 g of ten different molecular weight standards.

Short chain branching standards

Determination of short chain branching (SCB) as a function of MWD in polyethylene is now possible using high temperature GPC coupled with FT-IR. This series of well-characterized polyethylene SCB standards is a valuable reference set for temperature rising elution fractionation/crystallization analysis fractionation (TREF/CRYSTAF).

Calibration Kits

Description	Range of Nominal Mp (g/mol)	Part No.
E-M-10, 10 x 0.2 g	170-120,000	PL2650-0101
E-MW-10, 10 x 0.1 g	5,000-1,500,000	PL2650-0102
Polyethylene Short Chain Branching Calibration Kit	**Range of Polmyer Nominal Methyl/ 1000 Total Carbons (NMR)**	**Part No.**
E-SCB, 10 x 0.1 g	1.27-62.50	PL2650-0103

Individual Polymer Molecular Weights

Polymer Nominal Mp (g/mol)	Nominal Mw/Mn	Unit	Part No.
170	1.00	1 g	PL2650-8001
282	1.00	1 g	PL2650-9001
394	1.00	1 g	PL2650-0001
540	1.09	1 g	PL2650-4001
750	1.18	1 g	PL2650-1001
1,100	1.09	1 g	PL2650-2001
2,155	1.14	1 g	PL2650-3001
14,000	1.2	0.2 g	PL2650-5000
32,000	1.11	0.2 g	PL2650-6000
120,000	1.19	0.2 g	PL2650-7000
Polyethylene Broad MWD Individual Molecular Weights			
250,000	9.50	1 g	PL2660-7001
Polyethylene Broad MWD/SCB Individual Molecular Weights			
35,000	5.0	0.2 g	PL2660-8001
400,000	5.0	0.2 g	PL2660-9001

Polyacrylic Acid

- Compatible with all aqueous columns for wide applicability
- Aqueous polymers 1,000-1 million MW
- Well-characterized Mp values ensure wide utility

Calibration Kits

Description	Range of Nominal Mp (g/mol)	Part No.
PAA-10, 10 x 0.2 g	1,000-1,000,000	PL2140-0100

Individual Polymer Molecular Weights

Polymer Nominal Mp (g/mol)	0.2 g Part No.	1 g Part No.
1,000	PL2142-3000	PL2142-3001
2,000	PL2142-5000	PL2142-5001
3,000	PL2142-6000	PL2142-6001
5,000	PL2142-7000	PL2142-7001
7,000	PL2142-8000	PL2142-8001
13,000	PL2143-0000	PL2143-0101
30,000	PL2143-2000	PL2143-2001
50,000	PL2143-3000	PL2143-3001
70,000	PL2143-4000	PL2143-4001
100,000	PL2143-5000	PL2143-5001
130,000	PL2143-6000	PL2143-6001
200,000	PL2143-7000	PL2143-7001
300,000	PL2143-8000	PL2143-8001
500,000	PL2143-9000	PL2143-9001
700,000	PL2144-0000	PL2144-0101
1,000,000	PL2144-1000	PL2144-1001
1,500,000	PL2144-2000	PL2144-2001
2,000,000	PL2144-3000	PL2144-3001

Methoxy Polyethylene Glycols (MPEGs)

Agilent offers a range of highly characterized, very narrow polydispersity methoxy polyethylene glycols (MPEGs). These very pure polymers are ideal as molecular weight reference materials or for further modification where cross-linking should be avoided.

Methoxy Polyethylene Glycols (MPEGs)

Polymer Nominal Mp (g/mol)	Nominal Mw/Mn	Part No.
5,000	1.03	PL2570-5001
10,000	1.05	PL2571-0001
20000	1.05	PL2572-0001
30,000	1.06	PL2573-0001
40,000	1.06	PL2574-0001
50,000	1.06	PL2575-0001

AGILENT BIOSOLUTIONS AND COLUMNS FOR BIOLOGIC CHARACTERIZATION

Is your lab ready for the ever-increasing number and variety of HPLC applications for biocharacterization and analysis of biomolecules?

Basic peptide separations. High-sensitivity, high-resolution amino acid analyses. Fast size exclusion separations of antibodies. The number of bio-HPLC applications continues to grow at an unprecedented rate. Agilent's durable and reproducible line of silica and polymeric bio-HPLC columns can help meet your lab's evolving needs for performance and speed.

On the following pages, you will find key facts and specifications for the following columns for bio-HPLC:

- Size Exclusion Columns
- Ion Exchange Columns
- Reversed-Phase Columns for Proteins
- Capillary, Nano and MicroBore Columns
- Preparative HPLC Columns
- Oligo Solutions

Size Exclusion Columns

Agilent Bio SEC-3 HPLC Columns

- Exceptional loading capacity, stability, and reproducibility for size-based, bio-molecule separations
- Sharper peaks, higher resolution, and better protein recovery
- Faster separations than large-particle SEC columns
- Compatibility with most aqueous buffers
- Excellent stability in high-salt and low-salt conditions

Agilent Bio SEC-3 HPLC columns are a breakthrough technology for size exclusion chromatography (SEC). They are packed with spherical, narrowly dispersed 3 µm silica particles coated with a proprietary hydrophilic layer. This thin polymeric layer is chemically bonded to pure, mechanically stable silica under controlled conditions, ensuring a highly efficient size exclusion particle.

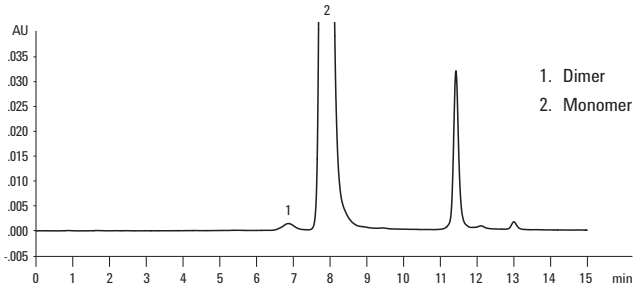
Agilent Bio SEC-3 HPLC columns are available in 100Å, 150Å and 300Å pore sizes to accommodate most peptide and protein size exclusion separations.

Column Specifications	
Column phase	Size Exclusion
Packing	Spherical, high purity, porous silica with a hydrophilic polymeric coating
Particle size	3 µm
Pore structure	100Å, 150Å, 300Å
Column exclusion limits (in Daltons)	100Å MW range: 100-100,000 150Å MW range: 500-150,000 300Å MW range: 5,000-1,250,000
pH stability	2-8.5
Operating temperature limit	Recommended range: 10-30°C Maximum: 80°C
Operating pressure limit	Recommended operating pressure: 137 bar (2,000 psi) Maximum pressure: 240 bar (3,500 psi)
Mobile phase compatibility	Recommended: 150 mM phosphate buffer, pH 7.0 Other aqueous buffers with high and low salt can be used
Working flow rate	0.1-1.25 mL/min for 7.8 mm ID columns 0.1-0.4 mL/min for 4.6 mm ID columns

Aggregation Analysis of a Humanized Monoclonal Antibody

Column: **Bio SEC-3, 300Å**
5190-2511
7.8 x 300 mm, 3 µm
Mobile Phase: 150 mM Phosphate, pH 7
Flow Rate: 1.0 mL/min
Temperature: Ambient
Sample: Monoclonal antibody (10 µL, 5 mg/mL)

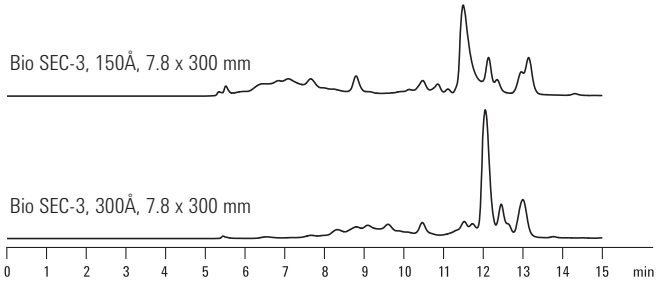
Agilent Bio SEC-3 HPLC columns provide baseline separation of the antibody aggregate and monomer peaks in 15 minutes.



Separation of E. coli Lysate

Column: **Bio SEC-3, 150Å**
5190-2506
7.8 x 300 mm, 3 µm
Column: **Bio SEC-3, 300Å**
5190-2511
7.8 x 300 mm, 3 µm
Mobile Phase: 0.15 M Phosphate, pH 7.0
Flow Rate: 1.0 mL/min
Temperature: Ambient
Detector: UV 214 nm
Injection: 10 µL
Sample: E. coli lysate (2.5 mg/mL)

Separation of E. coli lysate on 150Å and 300Å Agilent Bio SEC-3 HPLC columns. The smaller pore size 150Å column provides better resolution of smaller proteins.



Agilent Bio SEC-3 HPLC Columns

Size (mm)	Particle Size (µm)	Bio SEC-3 100Å	Bio SEC-3 150Å	Bio SEC-3 300Å
7.8 x 300	3	5190-2501	5190-2506	5190-2511
7.8 x 150	3	5190-2502	5190-2507	5190-2512
4.6 x 300	3	5190-2503	5190-2508	5190-2513
4.6 x 150	3	5190-2504	5190-2509	5190-2514
7.8 x 50, Guard	3	5190-2505	5190-2510	5190-2515

Agilent Bio SEC-5 HPLC Columns

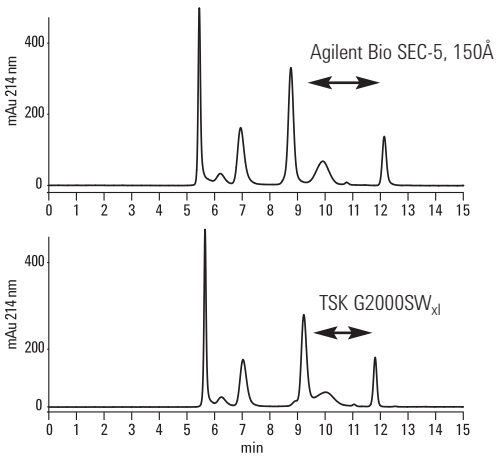
- Maximum recovery for a broad range of size-based, biomolecule separations
- Outstanding reproducibility and column lifetime
- Excellent stability, even under high-pH, high-salt, and low-salt conditions
- Compatibility with most aqueous buffers

Agilent Bio SEC-5 HPLC columns are packed with 5 µm silica particles coated with a proprietary, neutral, hydrophilic layer for maximum efficiency and stability. Our specially designed packing also provides high pore volume, improving both peak capacity and resolution.

Bio SEC-5 columns are available in 5 µm particles with 100Å, 150Å, 300Å, 500Å, 1000Å, and 2000Å nominal pore sizes.

Column Specifications	
Column phase	Size Exclusion
Packing	Spherical, high purity, porous silica with a hydrophilic polymeric coating
Particle size	5 µm
Pore structure	100Å, 150Å, 300Å, 500Å, 1000Å, 2000Å
Column exclusion limits (in Daltons)	100Å MW range: 100-100,000 150Å MW range: 500-150,000 300Å MW range: 5,000-1,250,000 500Å MW range: 15,000-5,000,000 1000Å MW range: 50,000-7,500,000 2000Å MW range: >10,000,000
pH stability	2-8.5
Operating temperature limit	Recommended range: 10-30°C Maximum: 80°C
Operating pressure limit	Recommended operating pressure: 137 bar (2,000 psi) Maximum pressure: 240 bar (3,500 psi)
Mobile phase compatibility	Recommended: 150 mM phosphate buffer, pH 7.0 Other aqueous buffers with high and low salt can be used
Working flow rate	0.1-1.25 mL/min for 7.8 mm ID columns 0.1-0.4 mL/min for 4.6 mm ID columns

Side-by-side Comparison



1. Thyroglobulin, 5.43 min
2. BSA dimer, 6.19 min
3. BSA monomer, 6.93 min
4. Ribonuclease A, 8.74 min
5. Poly-DL-alanine (1-5 kDa), 9.90 min
6. Uracil, 12.13 min

1. Thyroglobulin, 5.64 min
2. BSA dimer, 6.23 min
3. BSA monomer, 7.02 min
4. Ribonuclease A, 9.22 min
5. Poly-DL-alanine (1-5 kDa), 10.02 min
6. Uracil, 11.81 min

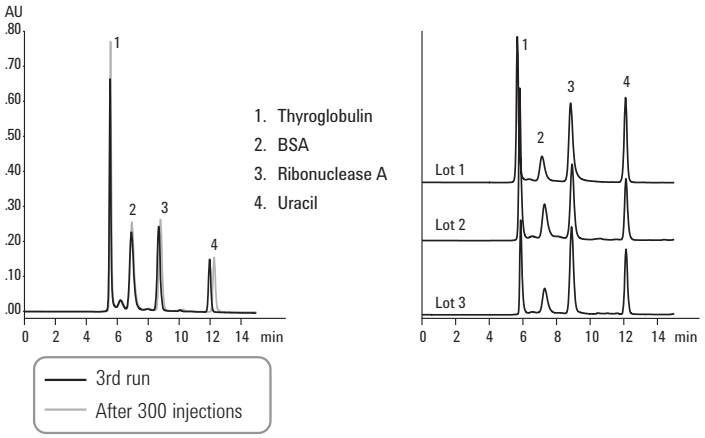
Separation of a protein mixture on an Agilent Bio SEC-5 HPLC column and a Tosoh TSK-Gel column. Notice the sharper peaks and better resolution on the Agilent Bio SEC-5 HPLC column.

Exceptional Lot-to-lot Reproducibility

Column: **Bio SEC-5, 150Å**
5190-2521
7.8 x 300 mm, 5 µm

Mobile Phase: 150 mM Phosphate Buffer, pH 7.0

The four protein mixture shows excellent retention time reproducibility over 300 injections and on three columns from different manufacturing lots.



Agilent Bio SEC-5 HPLC Columns

Size (mm)	Particle Size (µm)	Bio SEC-5 100Å	Bio SEC-5 150Å	Bio SEC-5 300Å	Bio SEC-5 500Å	Bio SEC-5 1000Å	Bio SEC-5 2000Å
7.8 x 300	5	5190-2516	5190-2521	5190-2526	5190-2531	5190-2536	5190-2541
7.8 x 150	5	5190-2517	5190-2522	5190-2527	5190-2532	5190-2537	5190-2542
4.6 x 300	5	5190-2518	5190-2523	5190-2528	5190-2533	5190-2538	5190-2543
4.6 x 150	5	5190-2519	5190-2524	5190-2529	5190-2534	5190-2539	5190-2544
7.8 x 50, Guard	5	5190-2520	5190-2525	5190-2530	5190-2535	5190-2540	5190-2545

ZORBAX GF-250 and GF-450 Gel Filtration Columns

- High efficiency and reproducibility with short analysis time
- Hydrophilic diol bonded phase for good protein recovery
- Compatible with organic modifiers and denaturants
- Wide usable pH range (3-8)

Agilent ZORBAX GF-250 and GF-450 size exclusion (gel filtration) columns are ideal for the size separations of proteins and other biomolecules. The separation range is 4,000-900,000 for globular proteins when using GF-250 and GF-450 columns in series. The GF-250/GF-450 size exclusion columns have a hydrophilic diol bonded phase for high recovery of proteins (typically >90%) and a unique zirconia modification of the silica for a pH operating range from 3-8. The GF-250 and GF-450 columns are packed with precisely sized porous silica microspheres with narrow pore size and particle size distributions. The result is a highly efficient, rugged and reproducible size exclusion column for separations of proteins with flow rates of up to 3 mL/min. These columns are compatible with organic modifiers (<25%) and denaturants in the mobile phase to eliminate protein aggregation for proper size determination. Some common applications include separations of protein monomers, dimers and aggregates, desalting, protein molecular weight estimation and separations of modified proteins.

Column Specifications

Bonded Phase	Pore Size	Particle Size	MW Range	Surface Area	pH Range	Flow Rate	Max Pressure
ZORBAX GF-250	150Å	4 µm	4,000-400,000	140 m^2/g	3.0-8.0	<3.0 mL/min	350 bar
ZORBAX GF-450	300Å	6 µm	10,000-900,000	50 m^2/g	3.0-8.0	<3.0 mL/min	350 bar

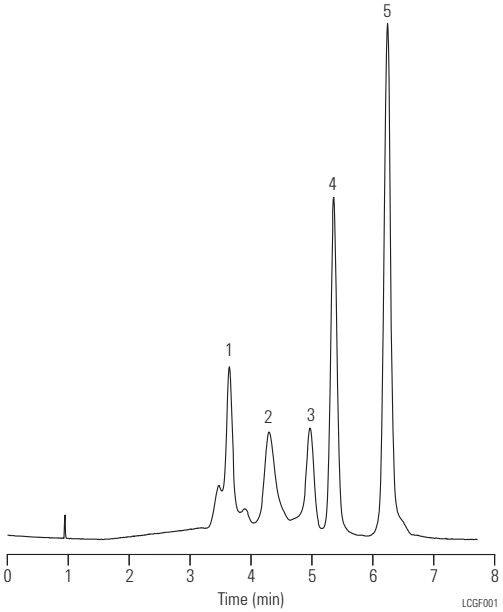
Specifications represent typical values only.

Separation of Protein Standards on the ZORBAX GF-250 SEC Column

Column: **ZORBAX GF-250**
884973-901
9.4 x 250 mm, 4 µm

Mobile Phase: 200 mM Sodium Phosphate, pH 7.0
Flow Rate: 2 mL/min
Temperature: Ambient
Detector: 254 nm
Sample: BioRad Gel Filtration Standards for Size Exclusion
1. Thyroglobulin 670,000 Da
2. Bovine Gamma Globulin 158,000 Da
3. Chicken Ovalbumin 44,000 Da
4. Equine Myoglobin 17,000 Da
5. Vitamin B-12 1,350 Da

The protein standards separated here are a commonly selected set of standards. The ZORBAX GF-250 column shows excellent resolution for this sample. Additional resolution of the thyroglobulin can be obtained by adding the GF-450 column in series.



High-Speed Size Exclusion Separations 1

Column: **ZORBAX GF-450**
884973-902
9.4 x 250 mm, 6 µm

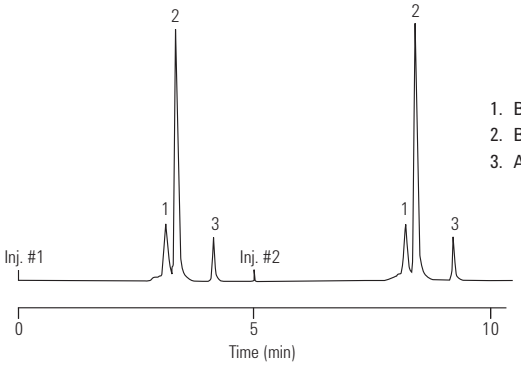
Mobile Phase: PBS (phosphate buffered saline), pH 7.4
Flow Rate: 3 mL/min
Temperature: Ambient
Detector: 220 nm
Sample: BSA and BSA Dimers

High-Speed Size Exclusion Separations 2

Column: **ZORBAX GF-450**
884973-902
9.4 x 250 mm, 6 µm

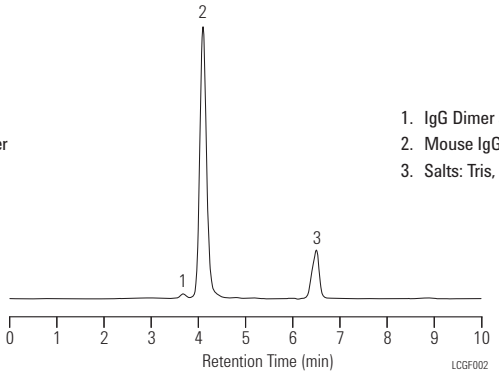
Mobile Phase: 200 mM Na Phosphate Monobasic pH 7.0/0.1% Azide
Flow Rate: 2 mL/min
Detector: 225 nm
Sample: 10 µg in 50 mM Sodium Phosphate pH 7.0

BSA and BSA Dimers (duplicate injections)



1. BSA dimer
2. BSA monomer
3. Azide

Antibody Separation



1. IgG Dimer and Aggregate
2. Mouse IgG 1K (MOPC 31C)
3. Salts: Tris, Na_2HPO_4, NaCl

ZORBAX GF-250 (USP L33) and GF-450 (USP L35) Gel Filtration Columns

Hardware	Description	Size (mm)	Particle Size (µm)	Part No.
	GF-250, 150Å	9.4 x 250	4	884973-901
	GF-250, 150Å	4.6 x 250	4	884973-701
	GF-450, 300Å	9.4 x 250	6	884973-902
Guard Columns (hardware required)				
P	GF-250 Diol, Guard Cartridge, 2/pk	9.4 x 15	6	820675-111
ZGC	GF-250 Diol, Guard Cartridge, 4/pk	4.6 x 12.5	6	820950-911
P	GF-450 Diol, Guard Cartridge, 2/pk	9.4 x 15	6	820675-111
ZGC	GF-250 Diol, Guard Cartridge, 4/pk	4.6 x 12.5	6	820950-911
P	Guard Hardware Kit			840140-901
ZGC	Guard Hardware Kit			820999-901
PrepHT Columns				
PL	PrepHT GF-250, 150Å	21.2 x 250	6	877974-901
PL	PrepHT GF-450, 300Å	21.2 x 250	6	877974-910
PL	PrepHT endfittings, 2/pk			820400-901
PL	PrepHT GF-250, Guard Cartridge, 2/pk	17 x 7.5	5	820212-911
PL	PrepHT GF-450, Guard Cartridge, 2/pk	17 x 7.5	5	820212-911
PL	Guard Cartridge Hardware			820444-901

Ion Exchange Columns

Agilent Bio MAb HPLC Columns

- A packing support composed of a rigid, spherical, highly cross-linked polystyrene divinylbenzene (PS/DVB) non-porous bead
- Particles grafted with a hydrophilic, polymeric layer, virtually eliminating non-specific binding of antibody proteins
- Particles use a different process to layer the weak cation exchange phase to the particle making it a higher density than the Agilent Bio WCX column particles

Thorough characterization of monoclonal antibodies includes the identification and monitoring of acidic and basic isoforms. Agilent Bio MAb HPLC columns feature a unique resin specifically designed for high-resolution, charge-based separations of monoclonal antibodies.

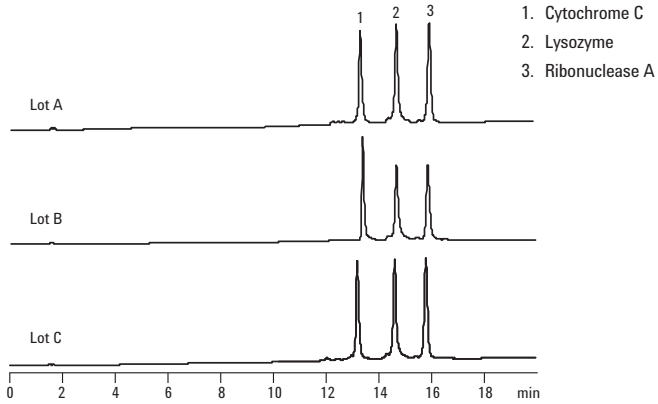
Bio MAb columns are available in 1.7, 3, 5 and 10 µm sizes, providing higher resolution with smaller particles.

Column Specifications	
Column phase	Weak Cation Exchange (carboxylate)
Packing	Non-porous, poly(styrene divinylbenzene) (PS/DVB), grafted hydrophilic coating and bonded with a uniform, weak cation exchange layer
Particle size	1.7, 3, 5 and 10 µm
Pore structure	Non-porous
pH stability	2-12
Operating temperature limit	80°C
Column hardware operating pressure limit	600 bar (8,700 psi) for stainless steel column hardware 400 bar (5,800 psi) for PEEK column hardware
Particle operating pressure limit	275 bar (4,000 psi) for 10 µm particles 413 bar (6,000 psi) for 5 µm particles 551 bar (8,000 psi) for 3 µm particles 689 bar (10,000 psi) for 1.7 µm particles
Mobile phase compatibility	Compatible with aqueous solution buffers, acetonitrile/acetone/methanol and water mixtures. Commonly used buffers: phosphate, tris, MES and acetate.
Working flow rate	Typical 0.1-1.0 mL/min for a 4.6 mm ID column or 2.1 mm I.D. column; always start a low flow rate and set default to the maximum hardware and/or particle pressure, whichever is lower.

Virtually Eliminate Retention Time Variations

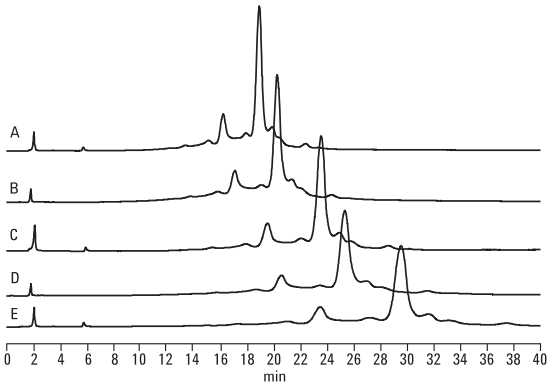
Column: **Bio MAb, stainless steel 5190-2413 4.6 x 250 mm, 10 µm**
Mobile Phase: A: 10 mM phosphate, pH 6.0
B: A + 1.0 M NaCl
Flow Rate: 1.0 mL/min
Gradient: 0-100% B in 42 min
Temperature: 25°C
Detector: UV 214 nm

The combination of well-controlled resin production, column surface chemistry, and column packing virtually eliminates retention time variations from column-to-column and lot-to-lot.



Isoform Characterization of a Monoclonal Antibody

Column: **Bio MAb, stainless steel 5190-2413 4.6 x 250 mm, 10 µm**
Mobile Phase: A: 10 mM phosphate, pH 7.5
B: A + 0.1M NaCl
Flow Rate: 0.8 mL/min
Gradient: A: 15-75% B in 30 min
B: 15-65% B in 30 min
C: 15-55% B in 30 min
D: 15-47.5% B in 30 min
E: 15-40% B in 30 min
Temperature: 25°C
Detector: UV 214 nm
Sample: Monoclonal antibody



Optimization of method conditions for the isoform characterization of a monoclonal antibody. Changes in the gradient conditions sharpen peaks and increase resolution of acidic and basic isoforms.

Agilent Bio MAb HPLC Columns

Size (mm)	Particle Size (µm)	Bio MAb PEEK	Bio MAb Stainless Steel
4.6 x 250	10	5190-2415	5190-2413
4.6 x 50, Guard	10	5190-2416	
4.6 x 250	5	5190-2407	5190-2405
4.6 x 50, Guard	5	5190-2408	
4.6 x 50	3		5190-2403
4.6 x 50	1.7		5190-2401
4.0 x 10, Guard	10		5190-2414
4.0 x 10, Guard	5		5190-2406
4.0 x 10, Guard	3		5190-2404
4.0 x 10, Guard	1.7		5190-2402
2.1 x 250	10	5190-2419	
2.1 x 50, Guard	10	5190-2420	
2.1 x 250	5	5190-2411	
2.1 x 50, Guard	5	5190-2412	

Agilent Bio IEX HPLC Columns

- Highly cross-linked and rigid nonporous poly(styrene divinylbenzene) (PS/DVB) particles are grafted with a hydrophilic, polymeric layer, eliminating nonspecific binding
- Uniform, densely packed ion exchange functional groups are chemically bonded to the hydrophilic layer (multiple ion exchange groups per anchoring) to increase column capacity
- Particles, coating and bonding are resistant to high pressures, promoting higher resolution and faster separations
- Multiple ion-exchange groups are captured on one anchoring to increase capacity

Agilent Bio IEX HPLC columns are packed with polymeric, nonporous, ion exchange particles and are designed for high resolution, high recovery and highly efficient separations of peptides, oligonucleotides and proteins.

The Bio IEX family offers strong cation exchange (SCX), weak cation exchange (WCX), strong anion exchange (SAX) and weak anion exchange (WAX) phases. All phases are available in 1.7, 3, 5 and 10 µm non-porous particles sizes.

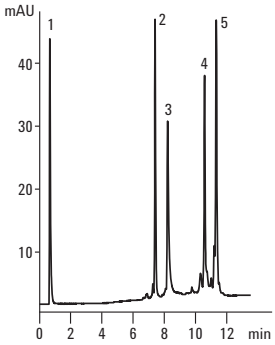
Column Specifications				
Column phase	SCX (Strong cation exchange) – SO_3H WCX (Weak cation exchange) – COOH SAX (Strong anion exchange) – $N(CH_3)_3$ WAX (Weak anion exchange) – $N(C_2H_5)_2$			
Packing	Non-porous, poly(styrene divinylbenzene) (PS/DVB), grafted hydrophilic coating and bonded with a uniform, ion exchange layer			
Particle size	1.7, 3, 5 and 10 µm			
Pore structure	Non-porous			
pH stability	2-12			
Operating temperature limit	80°C			
Column hardware operating pressure limit	600 bar (8,700 psi) for stainless steel column hardware 400 bar (5,800 psi) for PEEK column hardware			
Particle operating pressure limit	275 bar (4,000 psi) for 10 µm particles 413 bar (6,000 psi) for 5 µm particles 551 bar (8,000 psi) for 3 µm particles 689 bar (10,000 psi) for 1.7 µm particles			
Mobile phase compatibility	Compatible with aqueous solution buffers, acetonitrile/acetone/methanol and water mixtures. Commonly used buffers: phosphate, tris, MES and acetate			
Working flow rate	Typical 0.1-1.0 mL/min for a 4.6 mm ID column or 2.1 mm I.D. column; always start a low flow rate and set default to the maximum hardware and/or particle pressure, whichever is lower.			
Dynamic binding capacity		**NP3**	**NP5**	**NP10**
	SCX	53 mg/mL	38 mg/mL	20 mg/mL
	WCX	19 mg/mL	15 mg/mL	10 mg/mL
	SAX	35 mg/mL	28 mg/mL	17 mg/mL
	WAX	26 mg/mL	18 mg/mL	12 mg/mL

Exceptional Separating Power

Column: **Agilent Bio SCX, stainless steel**
5190-2423
4.6 x 50 mm, 3 µm

Buffer: 10 mM Phosphate, pH 6.0
Flow Rate: 0.5 mL/min
Gradient: 0-1.0 M NaCl, 15 min
Detector: 280 nm

The hydrophilic, polymeric layer and densely packed ion exchange functional groups provide extremely sharp peak shapes and high resolution of a mixture of proteins with a broad range of isoelectric points (pI).



1. Ovalbumin, 4.6 pI
2. Ribonuclease A, 8.7 pI
3. Cytochrome C, 9.6 pI
4. Aprotinin, 10.0 pI
5. Lysozyme, 11.0 pI

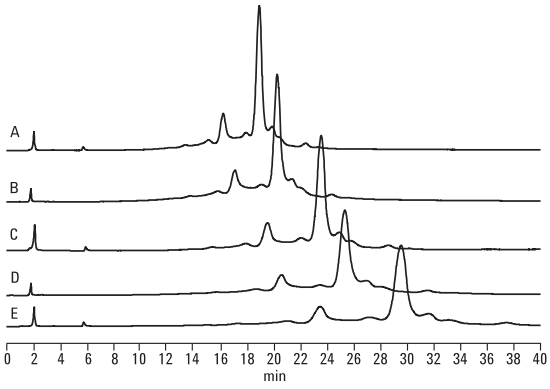
N > 100,000/50 mm for Lysozyme

Resolving Ovalbumin and BSA using Agilent Bio SAX

Column: **Agilent Bio SAX, stainless steel**
5190-2463
4.6 x 50 mm, 3 µm

Buffer: 20 mM Tris, pH 8.0
Flow Rate: 0.5 mL/min
Gradient: 0-0.3 M NaCl (15 min)
Backpressure: 1,600 psi
Detector: 214 nm

Isoforms and impurities of both ovalbumin and BSA can easily be resolved when an Agilent Bio SAX NP3 (3 µm particle) column is used.



Agilent Bio IEX HPLC Columns, PEEK

Size (mm)	Particle Size (µm)	Bio SCX Part No.	Bio WCX Part No.	Bio SAX Part No.	Bio WAX Part No.
4.6 x 250	10	5190-2435	5190-2455	5190-2475	5190-2495
4.6 x 50, Guard	10	5190-2436	5190-2456	5190-2476	5190-2496
4.6 x 250	5	5190-2427	5190-2447	5190-2467	5190-2487
4.6 x 50, Guard	5	5190-2428	5190-2448	5190-2468	5190-2488
2.1 x 250	10	5190-2439	5190-2459	5190-2479	5190-2499
2.1 x 50, Guard	10	5190-2440	5190-2460	5190-2480	5190-2500
2.1 x 250	5	5190-2431	5190-2451	5190-2471	5190-2491
2.1 x 50, Guard	5	5190-2432	5190-2452	5190-2472	5190-2492

Agilent Bio IEX HPLC Columns, Stainless Steel

Size (mm)	Particle Size (µm)	Bio SCX Part No.	Bio WCX Part No.	Bio SAX Part No.	Bio WAX Part No.
4.6 x 250	10	5190-2433	5190-2453	5190-2473	5190-2493
4.6 x 250	5	5190-2425	5190-2445	5190-2465	5190-2485
4.6 x 50	3	5190-2423	5190-2443	5190-2463	5190-2483
4.6 x 50	1.7	5190-2421	5190-2441	5190-2461	5190-2481
4.0 x 10, Guard	10	5190-2434	5190-2454	5190-2474	5190-2494
4.0 x 10, Guard	5	5190-2426	5190-2446	5190-2466	5190-2486
4.0 x 10, Guard	3	5190-2424	5190-2444	5190-2464	5190-2484
4.0 x 10, Guard	1.7	5190-2422	5190-2442	5190-2462	5190-2482

Agilent Bio-Monolith HPLC Columns

- Polymer-based, monolith HPLC columns designed for macro bio-molecule separations
- Flow-rate independent separations; no diffusion, no pores and no void volume make transport between mobile and stationary phase very rapid
- Monolith disk is 5.2 mm x 4.95 mm (100 µL column volume) with continuous channels, eliminating diffusion mass transfer
- Extremely fast separations speed up method development time and decrease costs. Locking in method parameters takes significantly less time and buffer

Agilent Bio-Monolith HPLC columns provide high resolution and rapid separations of antibodies (IgG, IgM), plasmid DNA, viruses, phages and other macro bio-molecules. The product family offers strong cation exchange, strong and weak anion exchange and Protein A phases. Bio-Monolith HPLC columns are compatible with HPLC and preparative LC systems, including Agilent 1100 and 1200 HPLC systems.

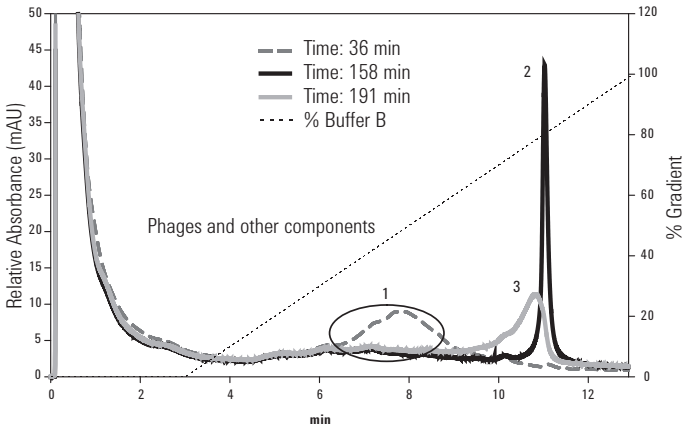
Column Specifications	
Dimensions	5.2 mm x 4.95 mm
Column volume	100 µL
Maximum pressure	150 bar (15 MPa, 2200 psi)
Temperature min/max	Working: 4°C-40°C
	Storage: 4°C-30°C
Recommended pH	Working range: 2-13
	Cleaning-in-place: 1-14
Materials of construction	Hardware: Stainless steel
	Packing: poly (glycidyl methacrylate-co-ethylene dimethacrylate) highly porous monolith
Color ring identifier	Bio-Monolith QA: Blue
	Bio-Monolith DEAE: Green
	Bio-Monolith SO_3: Red
	Bio-Monolith Protein A: White
Shelf life/expiration date	Protein A: 12 months
	SO_3, QA, DEAE: 24-36 months

Agilent Bio-Monolith HPLC Column Selection Guide

Column	Description	Key Applications	Part No.
Bio-Monolith QA	The quaternary amine bonded phase (Strong Anion Exchange) is fully charged over a working pH range of 2-13, binding negatively charged bio-molecules.	• Adenovirus process monitoring and quality control • IgM purification monitoring and quality control • Monitoring DNA impurity removal • Monitoring endotoxin removal • HSA Purity	5069-3635
Bio-Monolith DEAE	The diethylaminoethyl bonded phase (Weak Anion Exchange) offers increased selectivity of bio-molecules with negative charge over a working pH range of 3-9.	• Process monitoring and quality control of bacteriophage manufacturing and purification • Process monitoring and quality control of plasmid DNA purification	5069-3636
Bio-Monolith SO_3	The sulfonyl bonded phase (Strong Cation Exchange) is fully charged over a working pH range of 2-13, binding positively charged bio-molecules.	• Fast and high resolution analytical separations of large molecules such as proteins and antibodies • Hemoglobin A1c fast analytics	5069-3637
Bio-Monolith Protein A	The Protein A affinity column is designed for the analytical separation of all IgG (human and mouse), except for IgG class3.	• Quantitative determination of IgG (fermentation titer calculation)	5069-3639

Bio-Monolith DEAE Column Monitors Phage Production During Fermentation

Column:	**DEAE** **5069-3636** **5.2 x 4.95 mm**
Mobile Phase:	A: 125 mM Phosphate buffer, pH 7.0 B: 125 mM Phosphate buffer + 1 M NaCl, pH 7.0
Flow Rate:	1 mL/min
Gradient:	100% buffer A (2.5 min) 0-100% buffer B (10 min) 100% buffer A (2 min)
Detector:	UV at 280 nm
Instrument:	High pressure gradient HPLC system, Agilent 1200



As phage proliferation progresses, the genomic DNA (gDNA) concentration increases as the host cells are being lysed. In the late stages of fermentation, gDNA begins to degrade into fragments. These gDNA fragments cannot be easily removed by purification media, therefore it is critical to stop the fermentation cycle prior to the degradation of the genomic DNA. The chromatogram above represents three samples taken from the bioreactor at 36, 158 and 191 minutes. Peak 1 represents phage, media and host cells, peak 2 the intact gDNA and peak 3 the fragmented gDNA.

ZORBAX Bio-SCX Series II

ZORBAX has Bio-SCX Series II columns designed for optimized 2-D separations of peptides and proteins using LC/MS. This packing is based on ultra-pure 3.5 µm ZORBAX silica particles, bonded with a bio-friendly polymer that is functionalized with sulfonic acid groups. This gives strong retention and good peak shape in the ion exchange step of 2-D analysis of peptides and proteins.

Column Specifications

Bonded Phase	Pore Size	Surface Area	pH Range	Functionality	Max Pressure
ZORBAX Bio-SCX Series II	300Å	90 m^2/g	2.5-8.5	Sulfonic acid	350 bar

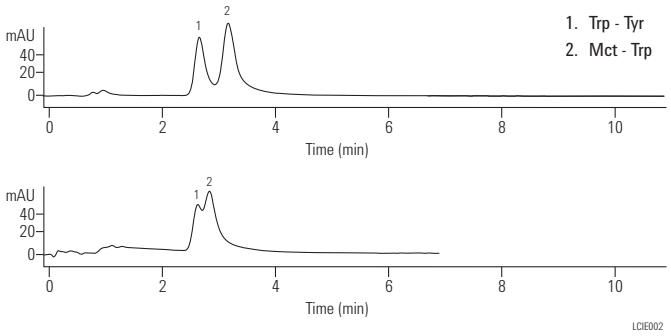
ZORBAX Bio-SCX Series II

Description	Size (mm)	Particle Size (µm)	Bio-SCX Series II
Capillary	0.3 x 35	3.5	5065-9912
Capillary	0.8 x 50	3.5	5065-9942
Guard Cartridge, 4/pk	4.6 x 12.5	6	820950-903
Guard Hardware Kit			820888-901

ZORBAX Bio-SCX Series II Provides More Retention of Small Peptides

Column: **ZORBAX Bio SCX Series II 5065-9912 0.3 x 35 mm, 3.5 µm**
Mobile Phase: 95% 40 mM NaCl: 5% ACN, 0.3% Formic Acid
Flow Rate: 5 µL/min
Detector: 230 nm
Sample: Synthetic Dipeptides

The new ZORBAX Bio-SCX Series II column retains smaller peptides more strongly than some other SCX columns. The result is increased resolution of more hydrophilic peptides fragments and more accurate identification when these columns are used in 2-D HPLC analysis.



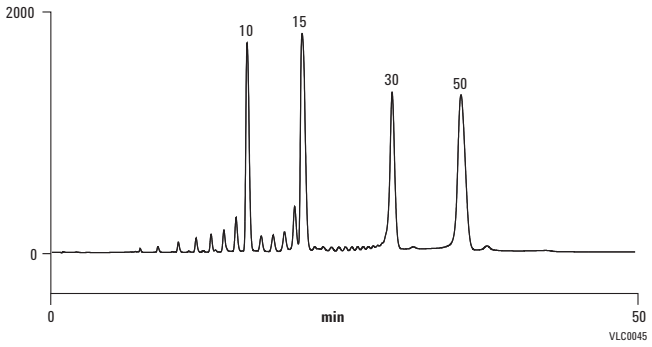
PL-SAX Strong Anion Exchange Columns

- Small particles deliver excellent chromatographic performance
- Wide range of particle sizes for flexible analysis to scale-up purification
- Exceptional stability for long column lifetime

PL-SAX -$N(CH_3)_3$+ is ideal for the anion exchange HPLC separations of proteins and deprotected synthetic oligonucleotides under denaturing conditions. The strong anion exchange functionality, covalently linked to a chemically stable polymer, extends the operating pH range. In addition, the anion exchange capacity is independent of pH. For synthetic oligonucleotides, separations using denaturing conditions of temperature, organic solvent, and high pH are all possible. PL-SAX delivers improved chromatography for self-complementary or G-rich sequences that may associate to form aggregates or hairpin structures. The 5 µm material provides high efficiency separations of n and n-1 sequences. A wide range of particle sizes and column geometries permits analysis and scale-up to purification. The strong anion exchange functionality provides a material with exceptional chemical and thermal stability, even with sodium hydroxide eluents, leading to long column lifetime.

High resolution separation of a Poly-T-Oligonucleotide size standard spiked with 10mer, 15mer, 30mer and 50mer (main peaks)

Column:	**PL-SAX 1000Å** **PL1551-1802** **4.6 x 50 mm, 8 µm**
Mobile Phase:	A: 7:93 v/v ACN: 0.1 M TEAA, pH 8.5 B: 7:93 v/v ACN: 0.1 M TEAA, 1 M ammonium chloride, pH 8.5
Gradient:	0-40% B in 10 min, followed by 40-70% B in 14 min and 70-100% B in 25 min
Flow Rate:	1.5 mL/min
Temperature:	60°C
Detector:	UV, 220 nm



PL-SAX Strong Anion Exchange Columns

Size (mm)	Particle Size (µm)	PL-SAX 1000Å	PL-SAX 4000Å
7.5 x 150	8	PL1151-3802	PL1151-3803
7.5 x 50	8	PL1151-1802	PL1151-1803
4.6 x 250	30	PL1551-5702	PL1551-5703
4.6 x 150	30	PL1551-3702	PL1551-3703
4.6 x 250	10	PL1551-5102	PL1551-5103
4.6 x 150	10	PL1551-3102	PL1551-3103
4.6 x 150	8	PL1551-3802	PL1551-3803
4.6 x 50	8	PL1551-1802	PL1551-1803
4.6 x 50	5	PL1551-1502	PL1551-1503
2.1 x 150	8	PL1951-3802	PL1951-3803
2.1 x 50	8	PL1951-1802	PL1951-1803
2.1 x 50	5	PL1951-1502	PL1951-1503

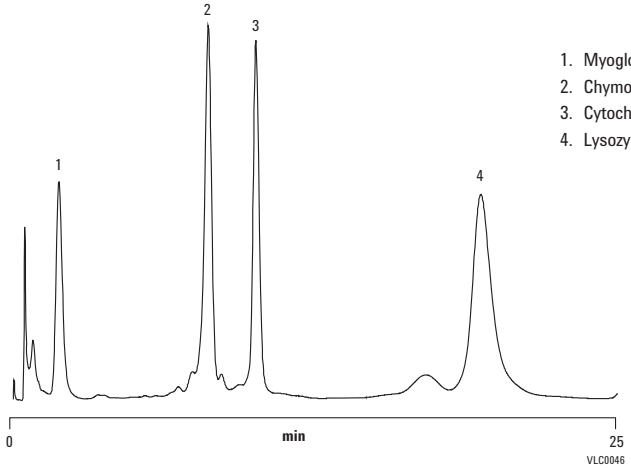
PL-SCX Strong Cation Exchange Columns

- Optimal design for effective separation of biomolecules
- Pore sizes allow use of a range of solute sizes
- Exceptional stability for long column lifetime

PL-SCX -SO_3- is a macroporous PS/DVB matrix with a very hydrophilic coating and strong cation exchange functionality. This process is controlled to provide the optimum density of strong cation exchange moieties for the analysis, separation and purification of a wide range of biomolecules, from small peptides to large proteins. Two pore sizes are available, 1000Å and 4000Å, to provide good mass transfer characteristics for a range of solute sizes. The 5 µm media delivers separations at higher resolution with the 30 µm media used for medium pressure liquid chromatography.

Standard protein separation

Column:	**PL-SCX 1000Å PL1545-1502 4.6 x 50 mm, 5 µm**
Mobile Phase:	A: 20 mM KH_2PO_4, pH 6.0
	B: A + 1 M NaCl
Gradient:	0-100% B in 20 min
Flow Rate:	1.0 mL/min
Detector:	UV, 280 nm



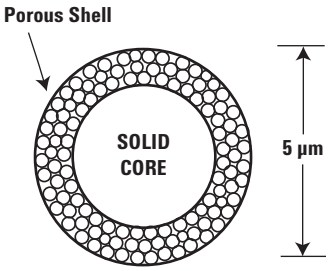
1. Myoglobin
2. Chymotrypsinogen A
3. Cytochrome C
4. Lysozyme

PL-SCX Strong Cation Exchange Columns

Size (mm)	Particle Size (µm)	PL-SCX 1000Å	PL-SCX 4000Å
7.5 x 50	8	PL1145-1802	PL1145-1803
4.6 x 250	30	PL1545-5702	PL1545-5703
4.6 x 150	30	PL1545-3702	PL1545-3703
4.6 x 250	10	PL1545-5102	PL1545-5103
4.6 x 150	10	PL1545-3102	PL1545-3103
4.6 x 150	8	PL1545-3802	PL1545-3803
4.6 x 50	8	PL1545-1802	PL1545-1803
4.6 x 50	5	PL1545-1502	PL1545-1503
2.1 x 150	8	PL1945-3802	PL1945-3803
2.1 x 50	8	PL1945-1802	PL1945-1803
2.1 x 50	5	PL1945-1502	PL1945-1503

Reversed-Phase Columns for Proteins and Peptides

Poroshell 300



- High-resolution separations of biomolecules with superficially porous particles
- High efficiency and recovery with proteins (up to 1,000 kDa) and monoclonal antibodies
- Achieve long lifetime at low pH with Poroshell 300SB; at high pH with 300Extend-C18
- Optimize recovery and selectivity with four different bonded phases – 300SB-C18, 300SB-C8, 300SB-C3, and 300Extend-C18

Agilent Poroshell 300 columns are ideal for fast separations of proteins and peptides because the superficially porous particle allows for fast flow rates to be used while maintaining sharp, efficient peaks. Peptides and proteins are typically separated slowly to reduce the potential peak broadening of these slow diffusing analytes. However, Poroshell columns use a superficially porous particle made with a thin layer of porous silica on a solid core of silica, reducing the diffusion distance for proteins making practical rapid HPLC separations of peptides and proteins up to 500-1,000 kDA. Poroshell columns bonded with StableBond bonded phases provide excellent stability and selectivity choices with TFA and formic acid mobile phases. The Poroshell 300Extend-C18 column can be used from pH 2-11 for unique separations. These columns can be used for analytical protein separations as well as LC/MS separations.

Column Specifications

Bonded Phase	Pore Size	Temp. Limits*	pH Range	Endcapped
Poroshell 300SB-C18, C8, C3	300Å	90°C	1.0-8.0	No
Poroshell 300Extend-C18	300Å	40°C above pH 8 60°C below pH 8	2.0-11.0	Yes

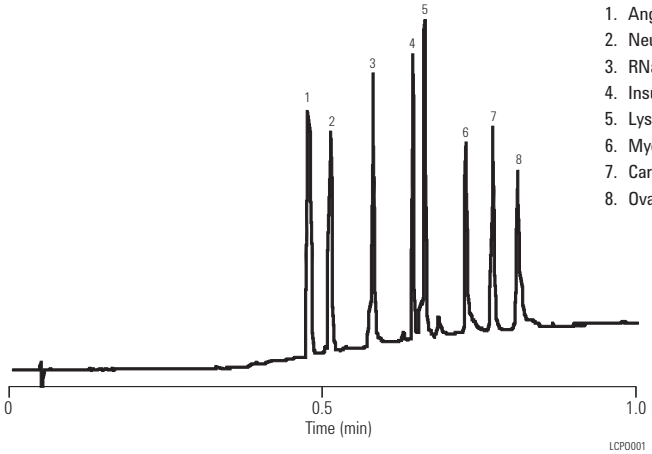
Specifications represent typical values only.

*300StableBond columns are designed for optimal use at low pH. At pH 6-8, highest column stability for all silica-based columns is obtained by operating at temperatures <40°C and using low buffer concentrations in the range of 0.01-0.02 M. At mid or high pH, 300Extend-C18 is recommended.

Poroshell 300 Columns Separate Proteins and Peptides in Seconds

Column:	**Poroshell 300SB-C18** **660750-902** **2.1 x 75 mm, 5 µm**
Mobile Phase:	A: 0.1% TFA in H_20
	B: 0.07% TFA in ACN
Flow Rate:	3.0 mL/min
Gradient:	5-100% B in 1.0 min
Temperature:	70°C, 260 bar pressure
Detector:	215 nm
Sample:	Proteins and Peptides

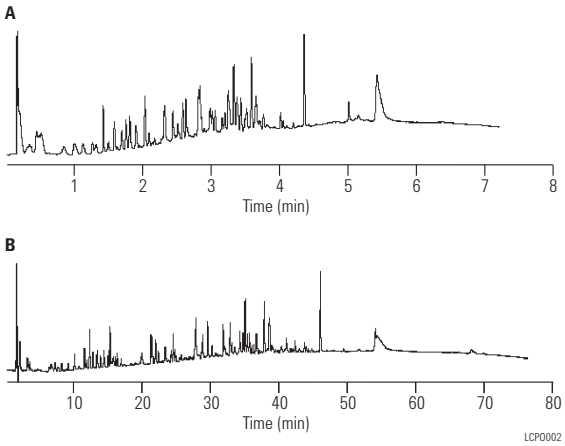
This separation of eight polypeptides and proteins is completed in less than 60 seconds. Each peak is sharp and efficient.



1. Angiotensin II
2. Neurotensin
3. RNase
4. Insulin
5. Lysozyme
6. Myoglobin
7. Carbonic Anhydrase
8. Ovalbumin

Reduce Peptide Map Analysis Time by 90% with Poroshell 300SB

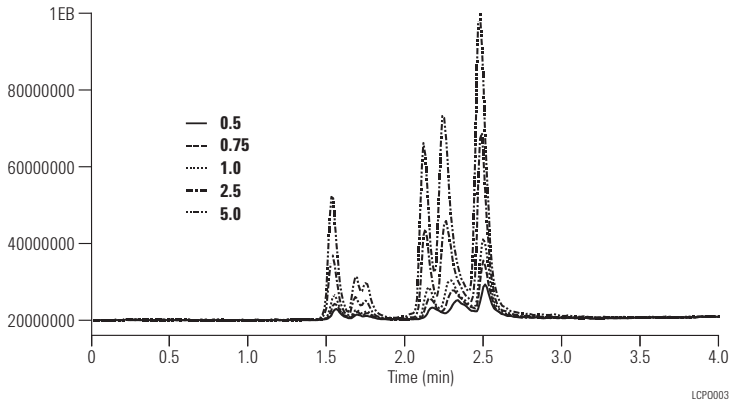
Column A:	**Poroshell 300SB-C18** **660750-902** **2.1 x 75 mm, 5 µm**
Column B:	**ZORBAX 300SB-C18** **883750-902** **2.1 x 150 mm, 5 µm**
Mobile Phase:	A: 95% H_2O, 5% ACN, 0.1% TFA
	B: 5% H_2O, 95% ACN, 0.07% TFA
Flow Rate:	1 mL/min
	0.208 mL/min
Gradient:	0-100% B = 12 min
	0-100% B = 120 min
Temperature:	70°C
Sample:	20 µL (0.22 µg/1 µL)
	BSA Tryptic Digest
	(15 hours, 70 pmol)



A single chromatographic run of a protein tryptic digest can require one hour or more to complete. With Poroshell columns, the same complex separation can be completed in 1/10th the time.

MicroBore Poroshell 300 Columns Provide Maximum Sensitivity for LC/MS

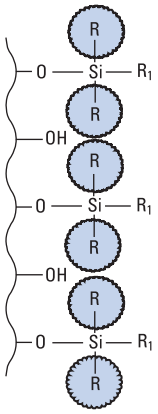
Column:	**Poroshell 300SB-C18 661750-902 1.0 x 75 mm, 5 µm**
Mobile Phase:	A: Water + 0.1% Formic Acid B: ACN + 0.1% Formic Acid
Flow Rate:	600 µL/min
Gradient:	20-100% B in 5.5 min
Temperature:	80°C
MS Conditions:	LC/MS: Pos. Ion ESI – Vcap 6000 V Drying Gas Flow: 12 L/min Drying Gas Temperature: 350°C Nebulizer: 45 psi Fragmentor Volatage: 140 V Scan: 600-2500 Stepsize: 0.15 amu Peak width: 0.06 min
Sample:	1 µL



With narrow bore diameters of 2.1 mm, 1.0 mm, and 0.5 mm, Poroshell columns make an ideal LC/MS partner. When the sample is very limited, the 1.0 mm or 0.5 mm ID Poroshell columns are an excellent choice for high sensitivity LC/MS analyses. Sensitive MS molecular weight determinations are possible with as little as 0.5 to 5 pmole of protein on Poroshell columns. Poroshell columns have also been used for rapid MS identification of intact proteins, even in the presence of stabilizers and tissue culture media.

Poroshell 300

Hardware	Description	Size (mm)	Particle Size (µm)	Poroshell 300SB-C18	Poroshell 300SB-C8	Poroshell 300SB-C3	Poroshell 300Extend-C18
	Narrow Bore	2.1 x 75	5	660750-902	660750-906	660750-909	670750-902
	MicroBore	1.0 x 75	5	661750-902	661750-906	661750-909	671750-902
	Capillary	0.5 x 75	5		5065-4468		
ZGC	Guard Cartridge, 4/pk	2.1 x 12.5	5	821075-920	821075-918	821075-924	
ZGC	Guard Hardware Kit			820999-901	820999-901	820999-901	
	MicroBore Guard, 3/pk	1.0 x 17	5	5185-5968	5185-5968	5185-5968	5185-5968



Sterically Protected 300StableBond Bonded Phase

ZORBAX 300Å StableBond

Agilent ZORBAX 300StableBond columns are an ideal choice for the reproducible separations of proteins and peptides for two key reasons. First, wide-pore, 300Å columns are necessary for an efficient separation of proteins and peptides, or other large molecules, in order to allow these analytes to completely access the bonded phase. Second, 300StableBond columns are unmatched in their durability at low pH, such as with TFA-containing mobile phases typically used for protein and peptide separations. For LC/MS separations at low pH, 300StableBond columns can also be used with formic acid and acetic acid mobile phase modifiers. These columns are available in four different bonded phases (C18, C8, C3, and CN) for selectivity and recovery optimization of proteins and polypeptides. To further increase sample recovery and improve efficiency for difficult proteins, 300StableBond columns can be used up to 80-90°C. 300SB-C18 and 300SB-C8 columns are an ideal choice for complex protein and protein digest separations. These columns are available in capillary (0.3 and 0.5 mm ID) and nano (0.075 and 0.10 mm ID) dimensions for reversed-phase LC/MS separations of protein digests. Capillary and nano columns can be used for either 1-D or 2-D proteomics separations.

Column Specifications

Bonded Phase	Pore Size	Surface Area	Temp. Limits*	pH Range*	Endcapped	Carbon Load
ZORBAX 300SB-C18	300Å	45 m^2/g	90°C	1.0-8.0	No	2.8%
ZORBAX 300SB-C8	300Å	45 m^2/g	80°C	1.0-8.0	No	1.5%
ZORBAX 300SB-C3	300Å	45 m^2/g	80°C	1.0-8.0	No	1.1%
ZORBAX 300SB-CN	300Å	45 m^2/g	80°C	1.0-8.0	No	1.2%

Specifications represent typical values only.

*300StableBond columns are designed for optimal use at low pH. At pH 6-8, highest column stability for all silica-based columns is obtained by operating at temperatures <40°C and using low buffer concentrations in the range of 0.01-0.02 M. At mid or high pH, 300Extend-C18 is recommended.

Tips & Tools

Typical mobile phases for protein and peptide separations combine a very low pH with TFA (or other acids) to solubilize proteins. StableBond columns have extremely long lifetimes under these conditions. They are available in 300Å pore size for proteins up to 100-500 kDa, or 80Å pore size for peptides below 4000 Da.

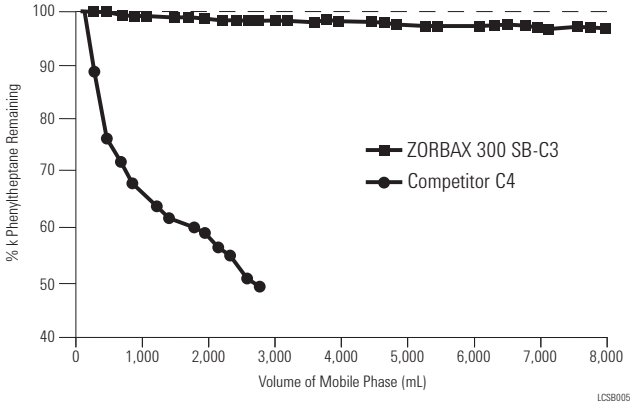
Short-Chain ZORBAX 300SB-C3 is Stable at Low pH, High Temperature

Column: **ZORBAX 300SB-C3**
883995-909
4.6 x 150 mm, 5 µm

Mobile Phase: Gradients 0-100% B in 80 min
A: 0.5% TFA in Water
B: 0.5% TFA in Acetonitrile
Isocratic Retention Test Conditions:
1-phenylheptane 50% A, 50% B

Flow Rate: 1.0 mL/min

Temperature: 60°C



Four Different 300SB Bonded Phases Optimize Separation of Large Polypeptides

Column A: **ZORBAX 300SB-C18**
883995-902
4.6 x 150 mm, 5 µm

Column B: **ZORBAX 300SB-C8**
883995-906
4.6 x 150 mm, 5 µm

Column C: **ZORBAX 300SB-C3**
883995-909
4.6 x 150 mm, 5 µm

Column D: **ZORBAX 300SB-CN**
883995-905
4.6 x 150 mm, 5 µm

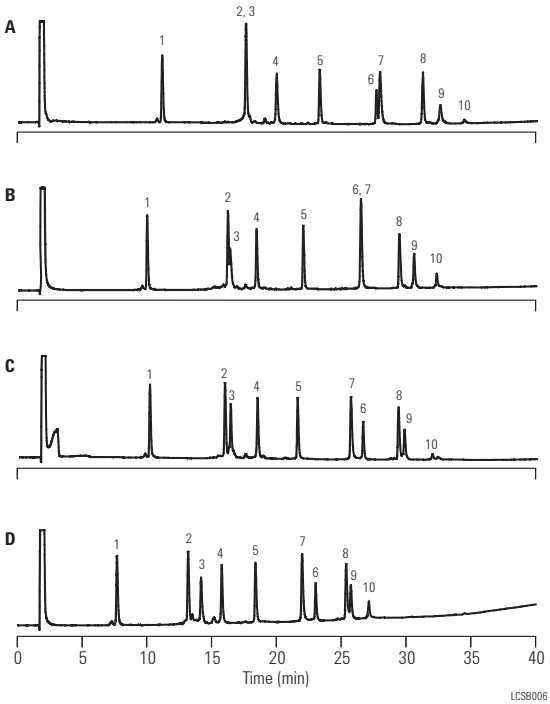
Mobile Phase: Linear Gradient, 25 - 70% B in 40 min
A: 0.1% TFA in Water
B: 0.09% TFA in 80% Acetonitrile/20% Water

Flow Rate: 1.0 mL/min

Temperature: 60°C

Sample: 3 µg each protein

The 300SB-C18, C8, C3, and CN bonded phases all provide a different separation of this group of polypeptides. This adds an important parameter for quickly optimizing protein separations. The 300SB-CN column offers unique selectivity for more hydrophilic polypeptides.

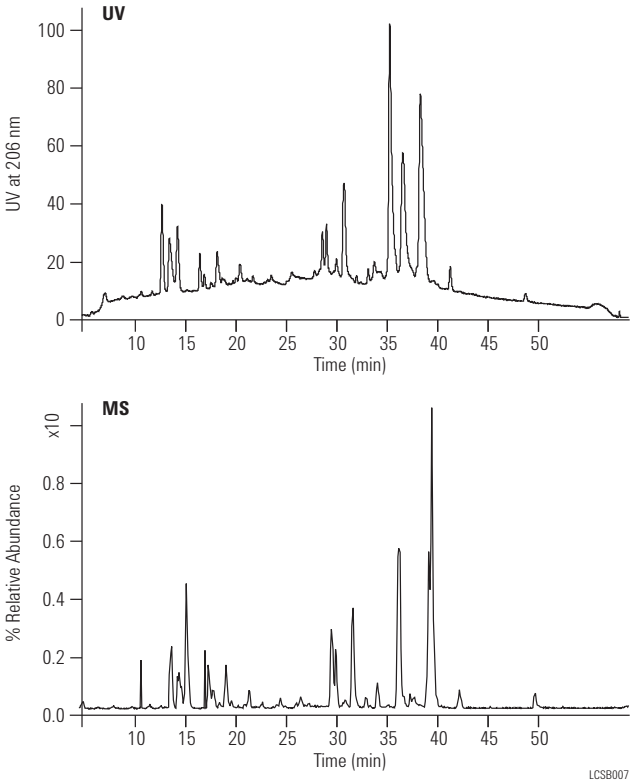


1. RNase
2. Insulin
3. Cytochrome C
4. Lysozyme
5. Parvalbumin
6. CDR
7. Myoglobin
8. Carbonic Anhydrase
9. S-100β
10. S-100α

Capillary Columns for HPLC Analyses with UV and MS Detection

Column:	**ZORBAX 300SB-C18** **5064-8263** **0.3 x 150 mm, 5 µm**
Mobile Phase:	5-55% B in 50 min, to 85% B from 55-57 min A: 0.1% Formic Acid in Water B: 0.1% Formic Acid in ACN
Flow Rate:	5.5 µL/min
Detector:	206 nm
MS Conditions:	LC/MS: Pos. Ion ESI with LC/MSD trap-Vcap 4000 V Drying Gas Flow: 7 L/min Drying Gas Temperature: 250°C Nebulizer: 15 psi Capillary Exit Volt: 50 V Max Accum Time: 300 ms Total Averages: 3 Isolation Width: 3 m/z Frag Ampitude: 1.0 V
Sample:	100 nL Beta Casein Digest (4 pmol)

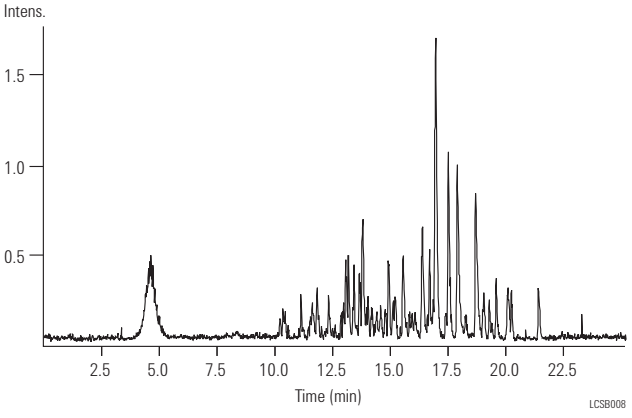
A ZORBAX 300SB-C18 capillary column (0.3 mm ID) is used for the separation of the protein digest. Detection is by both UV and Electrospray MS. MS detection can be used for identification of peptide fragments.



ZORBAX Nano Columns For High Sensitivity Protein Digest Analysis by LC/MS

Column:	**ZORBAX 300SB-C18** **5065-9911** **0.075 x 150 mm, 3.5 µm**
Mobile Phase:	A: Water + 0.1% Formic Acid, B: ACN + 0.1% Formic Acid
Flow Rate:	600 nL/min
Gradient:	2% B to 52% B in 25 min
Detector:	Positive Ion Nano Electrospray MS
Sample:	100 fm (1 µl) Digest of 8 Proteins

A ZORBAX nano HPLC column, 0.075 mm ID, is used for high sensitivity LC/MS analysis of a protein digest sample.



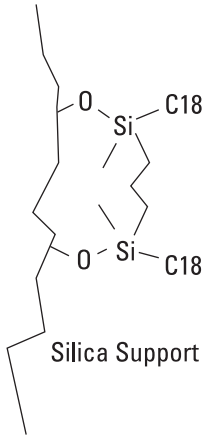
ZORBAX 300Å StableBond

Hardware	Description	Size (mm)	Particle Size (µm)	300SB-C18 USP L1	300SB-C8 USP L7	300SB-CN USP L10	300SB-C3 USP L56
Standard Columns (no special hardware required)							
	Semi-Preparative	9.4 x 250	5	880995-202	880995-206	880995-205	880995-209
	Analytical	4.6 x 250	5	880995-902	880995-906	880995-905	880995-909
	Analytical	4.6 x 150	5	883995-902	883995-906	883995-905	883995-909
	Analytical	4.6 x 50	5	860950-902	860950-906	860950-905	860950-909
	Rapid Resolution	4.6 x 150	3.5	863973-902	863973-906	863973-905	863973-909
	Rapid Resolution	4.6 x 100	3.5	861973-902	861973-906		
	Rapid Resolution	4.6 x 50	3.5	865973-902	865973-906	865973-905	865973-909
	Solvent Saver Plus	3.0 x 150	3.5	863974-302	863974-306		863974-309
	Solvent Saver Plus	3.0 x 100	3.5		861973-306		
	Narrow Bore	2.1 x 250	5	881750-902			
	Narrow Bore	2.1 x 150	5	883750-902	883750-906	883750-905	883750-909
	Narrow Bore RR	2.1 x 150	3.5		863750-906		
	Narrow Bore RR	2.1 x 100	3.5	861775-902	861775-906		
	Narrow Bore RR	2.1 x 50	3.5	865750-902	865750-906		
	MicroBore	1.0 x 250	5	861630-902			
	MicroBore RR	1.0 x 150	3.5	863630-902	863630-906		
	MicroBore RR	1.0 x 50	3.5	865630-902	865630-906		
	MicroBore Guard, 3/pk	1.0 x 17	5	5185-5920	5185-5920		
P	Guard Cartridge, 2/pk	9.4 x 15	7	820675-124	820675-124	820675-124	820675-124
ZGC	Guard Cartridge, 4/pk	4.6 x 12.5	5	820950-921	820950-918	820950-923	820950-924
ZGC	Guard Cartridge, 4/pk	2.1 x 12.5	5	821125-918	821125-918	821125-924	821125-924
P	Guard Hardware Kit			840140-901	840140-901	840140-901	840140-901
ZGC	Guard Hardware Kit			820999-901	820999-901	820999-901	820999-901

(Continued)

ZORBAX 300Å StableBond

Hardware	Description	Size (mm)	Particle Size (µm)	300SB-C18 USP L1	300SB-C8 USP L7	300SB-CN USP L10	300SB-C3 USP L56
PrepHT Cartridge Columns (require endfittings kit 820400-901)							
PI	PrepHT Cartridge	21.2 x 250	7	897250-102	897250-106	897250-105	897250-109
PI	PrepHT Cartridge	21.2 x 150	7	897150-102	897150-106		897150-109
PI	PrepHT Cartridge	21.2 x 150	5	895150-902	895150-906		895150-909
PI	PrepHT Cartridge	21.2 x 100	5	895100-902	895100-906		895100-909
PI	PrepHT Cartridge	21.2 x 50	5	895050-902	895050-906		895050-909
PI	PrepHT endfittings, 2/pk			820400-901	820400-901	820400-901	820400-901
PI	PrepHT Guard Cartridge, 2/pk	17 x 7.5	5	820212-921	820212-918	820212-924	820212-924
PI	Guard Cartridge Hardware			820444-901	820444-901	820444-901	820444-901
Capillary Glass-lined Columns							
	Capillary	0.5 x 250	5	5064-8266			
	Capillary	0.5 x 150	5	5064-8264			
	Capillary	0.5 x 35	5	5064-8294			
	Capillary RR	0.5 x 150	3.5	5064-8268			
	Capillary RR	0.5 x 35	3.5	5065-4459			
	Capillary	0.3 x 250	5	5064-8265			
	Capillary	0.3 x 150	5	5064-8263			
	Capillary	0.3 x 35	5	5064-8295			
	Capillary RR	0.3 x 150	3.5	5064-8267	5065-4460		
	Capillary RR	0.3 x 100	3.5	5064-8259	5065-4461		
	Capillary RR	0.3 x 35	3.5	5064-8270	5065-4462		
	Capillary RR	0.3 x 50	3.5	5064-8300	5065-4463		
Nano Columns (PEEK fused silica)							
	Nano RR	0.1 x 150	3.5	5065-9910			
	Nano RR	0.075 x 150	3.5	5065-9911			
	Nano RR	0.075 x 50	3.5	5065-9924	5065-9923		
	Trap/Guard, 5/pk	0.3 x 5	5	5065-9913	5065-9914		
	Trap/Guard Hardware kit			5065-9915	5065-9915		



Novel Bidentate C18-C18 Bonding for Extend-C18 Bonded Phase

ZORBAX 300Å Extend-C18

- Rugged, high and low pH separations of polypeptides and peptides from pH 2-11.5
- Different selectivity possible at high and low pH
- High efficiency and good recovery of hydrophobic peptides at high pH
- Ideal for LC/MS with ammonium-hydroxide-modified mobile phase

Agilent ZORBAX 300Extend C-18 is a wide-pore HPLC column for high efficiency separations of peptides from pH 2-11.5. The unique, bidentate bonded phase provides excellent lifetime and reproducibility at high and low pH. At high pH, retention and selectivity of peptides and polypeptides can change dramatically as a result of changes in charge on molecules. Excellent recoveries of hydrophobic polypeptides have been achieved at room temperature and high pH. LC/MS sensitivity of peptides and polypeptides can also be improved at high pH using a simple ammonium-hydroxide-containing mobile phase.

Column Specifications

Bonded Phase	Pore Size	Surface Area	Temp. Limits*	pH Range	Endcapped	Carbon Load
ZORBAX 300Extend-C18	300Å	45 m^2/g	60°C	2.0-11.5	Double	4%

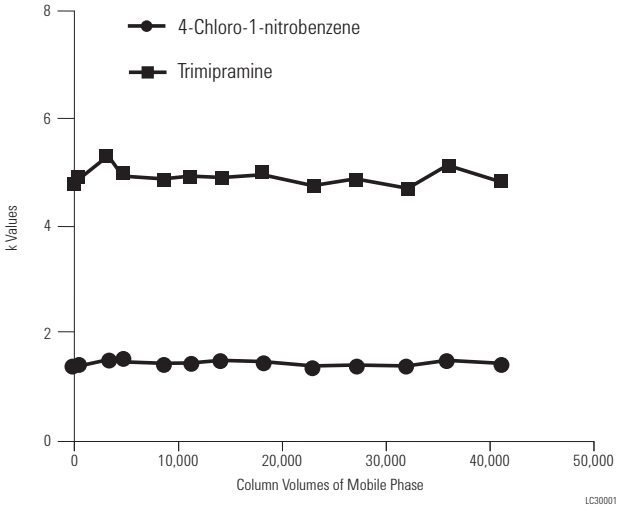
Specifications represent typical values only.

*Temperature limits are 60°C up to pH 8, 40°C from pH 8-11.5.

Long Life at High pH with 300Extend-C18

Column: **ZORBAX Extend-C18**
773450-902
4.6 x 150 mm, 5 µm
Mobile Phase: 20% 20 mM NH_4OH, pH 10.5
80% Methanol
Flow Rate: 1.5 mL/min
Temperature: Aging 24°C
Tests 40°C

Each 10,000 column volume is approximately one working month.



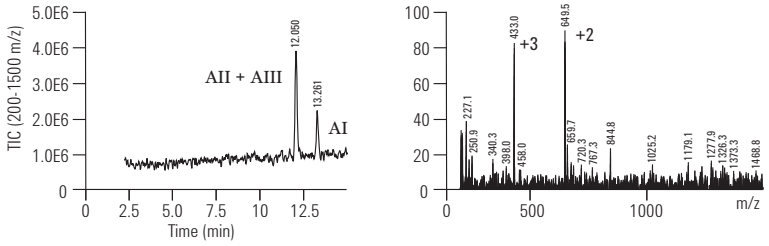
LC/MS Analysis of Angiotensin on Extend-C18

Column: **ZORBAX Extend-C18**
773700-902
2.1 x 150 mm, 5 µm

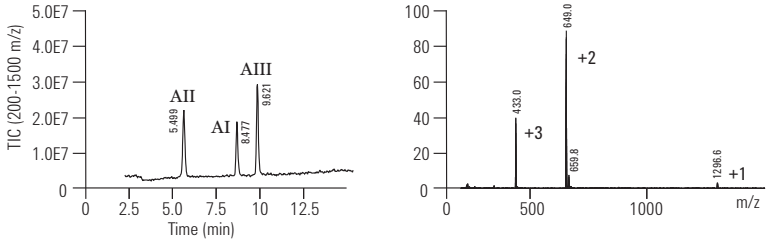
Mobile Phase: Acidic Conditions:
A: 0.1% TFA in water
B: 0.085% TFA in 80% acetonitrile (ACN)
Basic Conditions:
A: 10 mM NH_4OH in water
B: 10 mM NH_4OH in 80% ACN

Flow Rate: 0.2 mL/min
Gradient: 15-50% B in 15 min
Temperature: 35°C
MS Conditions: Pos. Ion ESI- Vf 70 V, Vcap 4.5 kV, N2- 35 psi, 12 L/min., 325°C
Sample: 2.5 µL sample (50 pmol each) Angiotensin I, II, III

A
Angiotensin I
Max: 10889
Low pH



B
Angiotensin I
Max: 367225
High pH



LC30003

Both small and large peptides demonstrate selectivity changes at high and low pH. At high pH, due to a change in charge, all three Angiotensins can be resolved. In addition, the spectral clarity of Angiotensin I is dramatically improved at high pH with the ammonium hydroxide mobile phase. The Extend-C18 column can be used for the analysis of small peptides at high pH as well.

Reference: B.E. Boyes. Separation and Analysis of Peptides at High pH Using RP-HPLC/ESI-MS, 4th WCBP, San Francisco, CA, Jan. 2000.

ZORBAX 300Å Extend-C18

Hardware	Description	Size (mm)	Particle Size (µm)	Part No.
	Analytical	4.6 x 250	5	770995-902
	Analytical	4.6 x 150	5	773995-902
	Rapid Resolution	4.6 x 150	3.5	763973-902
	Rapid Resolution	4.6 x 100	3.5	761973-902
	Rapid Resolution	4.6 x 50	3.5	765973-902
	Narrow Bore RR	2.1 x 150	3.5	763750-902
	Narrow Bore RR	2.1 x 100	3.5	761775-902
	Narrow Bore RR	2.1 x 50	3.5	765750-902
ZGC	Guard Cartridge, 4/pk	4.6 x 12.5	5	820950-932
ZGC	Guard Cartridge, 4/pk	2.1 x 12.5	5	821125-932
ZGC	Guard Hardware Kit		0	820888-901
Capillary Glass-lined Columns				
	Capillary RR	0.3 x 150	3.5	5065-4464
	Capillary RR	0.3 x 100	3.5	5065-4465
	Capillary RR	0.3 x 75	3.5	5065-4466
	Capillary RR	0.3 x 50	3.5	5065-4467

PLRP-S HPLC Columns

- Contain durable and resilient particles that deliver reproducible results over longer lifetimes
- Thermally and chemically stable
- Comply with USP L21 designation
- Used in bioscience, chemical, clinical research, energy, environmental, food and agriculture, material science and pharmaceutical industries

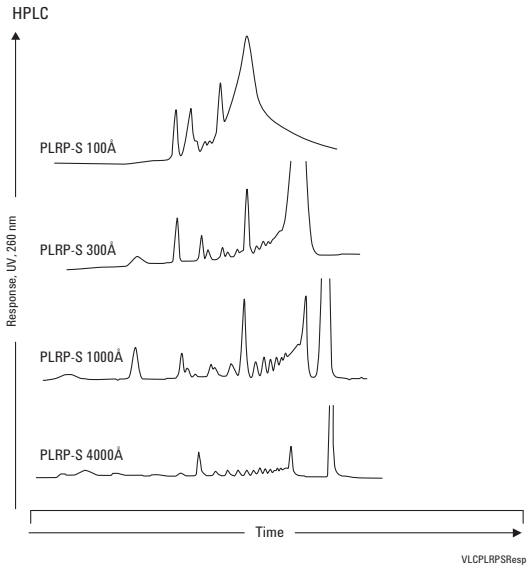
The PLRP-S family of columns consists of a range of pore sizes and particle sizes, all with identical chemistry and fundamental adsorptive characteristics. The particles are inherently hydrophobic, therefore no bonded phase, alkyl ligand is required for reverse phase separations. This gives a highly reproducible material that is free from silanols and heavy metal ions. Columns within the extensive product range are suitable for nano/capillary separations, including both bottom-up and top-down proteomics, analytical separations, and preparative purifications. In addition, process columns can be packed with bulk media.

Column Specifications	
pH Range	1-14
Buffer Content	Unlimited
Organic Modifier	1-100%
Temperature Limits	200°C
Maximum Pressure	5-8 µm: 3000 psi (210 bar)
	3 µm: 4000 psi (300 bar)

PLRP-S Applications	
Pore Size	**Application**
100Å	Small molecules/synthetic biomolecules
300Å	Recombinant peptides/proteins
1000Å	Large proteins
4000Å	DNA/high speed

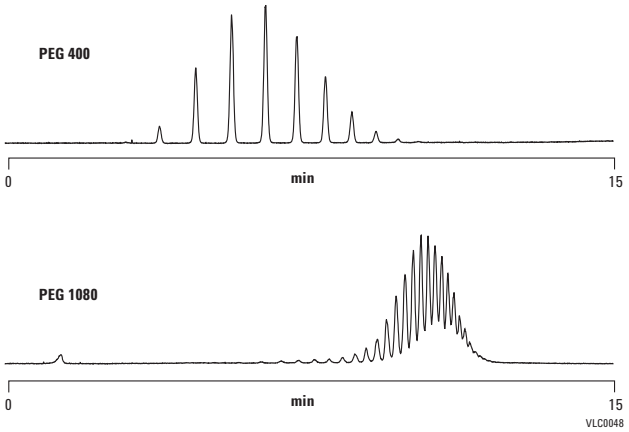
HPLC of 25 bp DNA ladder

Column: **PLRP-S, 2.1 x 150 mm**
Mobile Phase: A: 0.1 M TEAA
B: 0.1 M TEAA in 50% water:50% ACN
Flow Rate: 200 µL/min
Gradient: 12.5-50% B in 150 min



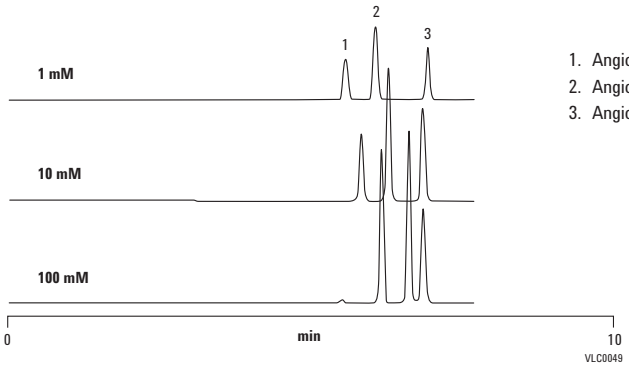
Polyethylene glycols

Column: **PLRP-S 100Å**
PL1111-3500
4.6 x 150 mm, 5 µm
Mobile Phase: A: Water
B: ACN
Gradient: 10-30% B in 12 min, held at 30% B for 3 min
Flow Rate: 1.0 mL/min
Injection Volume: 10 µL
Sample Conc: 1 mg/mL
Detector: ELS (neb=50°C, evap=70°C, gas=1.6 SLM)



Exploiting chemical stability: NH_4OH concentration

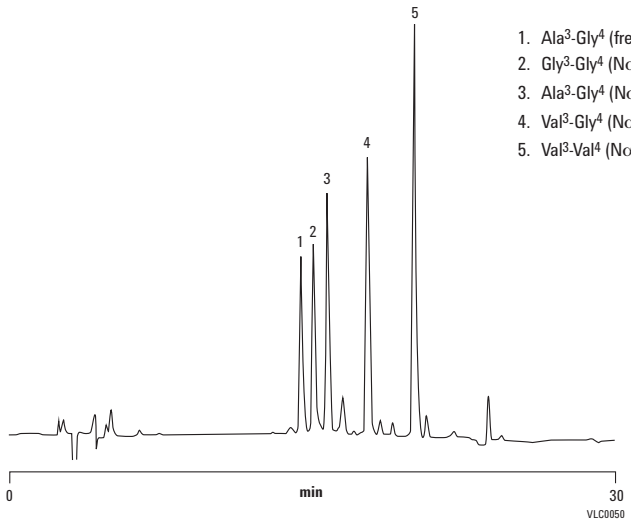
Column:	**PLRP-S 100Å** **PL1512-5500** **4.6 x 250 mm, 5 µm**
Mobile Phase:	A: NH_4OH (various mM) in water B: NH_4OH (various mM) in ACN
Gradient:	Linear 10-100% B in 15 min
Flow Rate:	1.0 mL/min
Detector:	ELS (neb=80°C, evap=85°C, gas=1.0 SLM)



1. Angiotensin II
2. Angiotensin I
3. Angiotensin III

Alberta Peptide Institute test mix

Column:	**PLRP-S 100Å** **PL1512-5500** **4.6 x 250 mm, 5 µm**
Mobile Phase:	A: 0.1% TFA in 99% water:1% ACN B: 0.1% TFA in 70% water:30% ACN
Gradient:	0-100% B in 30 min
Flow Rate:	1.0 mL/min
Detector:	UV, 220 nm



1. Ala^3-Gly^4 (free amino)
2. Gly^3-Gly^4 (Nα-acetylated)
3. Ala^3-Gly^4 (Nα-acetylated)
4. Val^3-Gly^4 (Nα-acetylated)
5. Val^3-Val^4 (Nα-acetylated)

Large fibrous proteins

Column: **PLRP-S 300Å**
PL1512-3801
4.6 x 150 mm, 8 µm

Column: **PLRP-S 1000Å**
PL1512-3802
4.6 x 150 mm, 8 µm

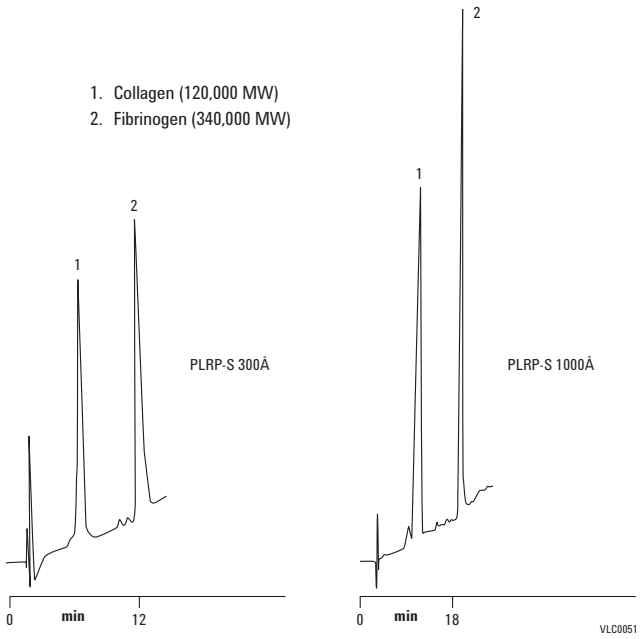
Mobile Phase: A: 0.25% TFA in water
B: 0.25% TFA in 5% water:95% ACN

Flow Rate: 1.0 mL/min

Gradient: 20-60% B in 15 min

Detector: UV, 220 nm

1. Collagen (120,000 MW)
2. Fibrinogen (340,000 MW)



PLRP-S HPLC Columns

Size (mm)	Particle Size (µm)	PLRP-S 100Å	PLRP-S 300Å	PLRP-S 1000Å	PLRP-S 4000Å
4.6 x 250	8	PL1512-5800	PL1512-5801	PL1512-5802	
4.6 x 150	8	PL1512-3800	PL1512-3801	PL1512-3802	PL1512-3803
4.6 x 50	8		PL1512-1801	PL1512-1802	PL1512-1803
4.6 x 250	5	PL1512-5500	PL1512-5501		
4.6 x 150	5	PL1111-3500	PL1512-3501		
4.6 x 50	5	PL1512-1500	PL1512-1501	PL1512-1502	PL1512-1503
4.6 x 150	3	PL1512-3300	PL1512-3301		
4.6 x 50	3	PL1512-1300	PL1512-1301		
2.1 x 250	8		PL1912-5801		
2.1 x 150	8		PL1912-3801	PL1912-3802	PL1912-3803
2.1 x 50	8		PL1912-1801	PL1912-1802	PL1912-1803
2.1 x 250	5	PL1912-5500	PL1912-5501		
2.1 x 150	5	PL1912-3500	PL1912-3501		
2.1 x 50	5	PL1912-1500	PL1912-1501	PL1912-1502	PL1912-1503
2.1 x 150	3	PL1912-3300	PL1912-3301		
2.1 x 50	3	PL1912-1300	PL1912-1301		
PLRP-S Guard Cartridges for 5 x 3 mm, 2/pk		PL1612-1801	PL1612-1801	PL1612-1801	PL1612-1801
Guard cartridge holder for 5 x 3 mm cartridges		PL1310-0016	PL1310-0016	PL1310-0016	PL1310-0016

Capillary, Nano and MicroBore Columns

ZORBAX Capillary and Nano

- Highest sensitivity for your smallest sample sizes
- Compatible with all LC/MS interfaces
- Internal diameters of 0.5, 0.3, 0.1, and 0.075 mm
- Packings/phases for both small and large molecules (80Å and 300Å pore sizes, respectively)
- Ideal for 1-D and 2-D (proteomics) applications

Agilent ZORBAX Capillary (0.5 and 0.3 mm ID) and Nano (0.1 and 0.075 mm ID) columns are now available in a wide variety of phases, pore sizes, and dimensions. These columns are ideal for very sample-limited applications because they provide enhanced sensitivity by reducing on-column sample dilution. This high sensitivity can be provided with exceptional reproducibility using Agilent columns and low dispersion HPLC instruments. The fastest growing application for capillary and nano columns is 2-D LC/MS for complex proteomics samples. Agilent provides all the columns needed for the 2-D separation – the SCX columns for the first dimension, the reversed-phase trapping column, and the reversed-phase column for the second dimension.

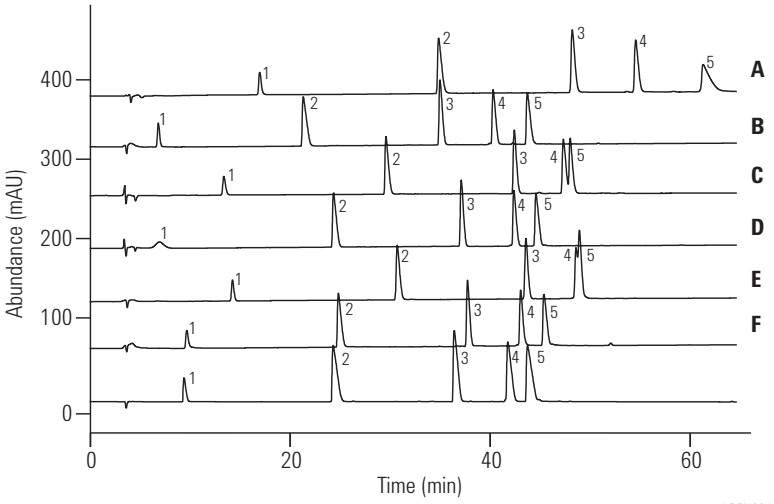
Separation of Peptides on Capillary Columns

Column A:	**ZORBAX 300SB-C8 5065-4460 0.3 x 150 mm, 3.5 µm**	**Column D:**	**ZORBAX SB-C18 5064-8255 0.3 x 150 mm, 5 µm**
Column B:	**ZORBAX Eclipse XDB-C18 5064-8291 0.3 x 150 mm, 5 µm**	**Column E:**	**ZORBAX 300SB-C18 5064-8267 0.3 x 150 mm, 3.5 µm**
Column C:	**ZORBAX Eclipse XDB-C18 5064-8291 0.3 x 150 mm, 5 µm**	**Column F:**	**ZORBAX 300Extend-C18 5065-4464 0.3 x 150 mm, 3.5 µm**

Mobile Phase: Water + 0.05% TFA, pH = 2.2 = A
Acetonitrile + 0.045% TFA = B
Gradient 0.5% B/min at 0 min = 1% B,
at 60 min = 31% B, at 70 min = 50% B, at 75 min = 85% B,
at 80 min = 85% B, at 81 min = 1% B, at 110 min = 1% B

Flow Rate: 5.5 µL/min
Low Solvent Consumption:
200-500 µL/min
Temperature: 30°C
Detector: 206/10 nm, ref 450/80 nm

Sample: 0.1 µL, automatic delay volume reduction was activated Peptides



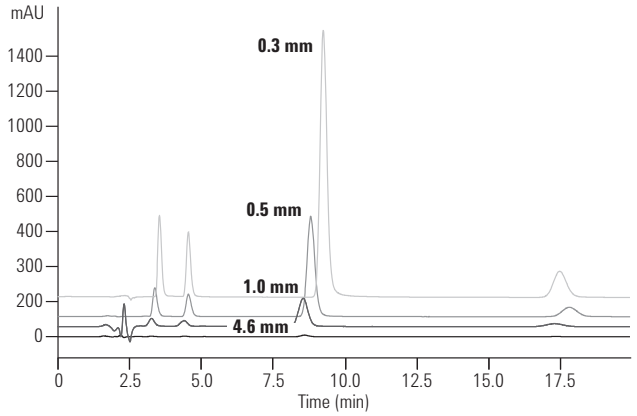
LCCN001

1. Gly-Tyr, 5 ng/100 nL
2. Val-Tyr-Val, 20 ng/100 nL
3. Met Enkephalin, 28 ng/100 nL
4. Low Enkephalin, 20 ng/100 nL
5. Angiotensin II, 20 ng/100 nL

This example shows a peptide standard mixture separated on a variety of ZORBAX capillary columns. These chromatograms demonstrate the wide range of selectivities available, which can be used to optimize your specific separation.

High Sensitivity with Capillary Columns

Column:	**ZORBAX SB-C18 5064-8255 0.3 x 150 mm, 5 µm**
Column:	**ZORBAX SB-C18 5064-8256 0.5 x 150 mm, 5 µm**
Column:	**ZORBAX SB-C18 863600-902 1.0 x 150 mm, 3.5 µm**
Column:	**ZORBAX SB-C18 883975-902 4.6 x 150 mm, 5 µm**
Sample:	200 ng Biphenyl



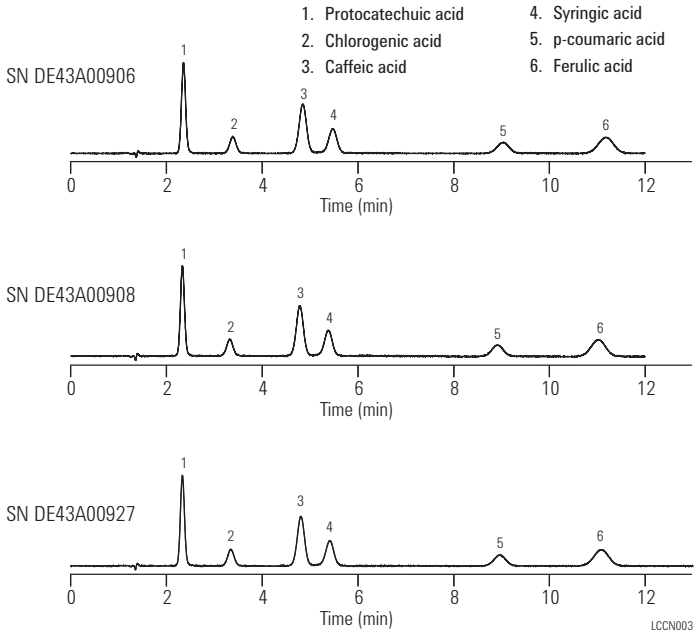
LCCN002

Sample-limited applications require capillary column dimensions to minimize on-column sample dilution and to enhance sensitivity. The 0.3 mm capillary in this example provides 100 times more sensitivity than the standard 4.6 mm column. Nanobore (0.1 mm-0.075 mm ID) columns can provide up to 2000 times more sensitivity for your most limited sample applications.

Excellent Column-to-Column Reproducibility with Agilent Capillary Columns

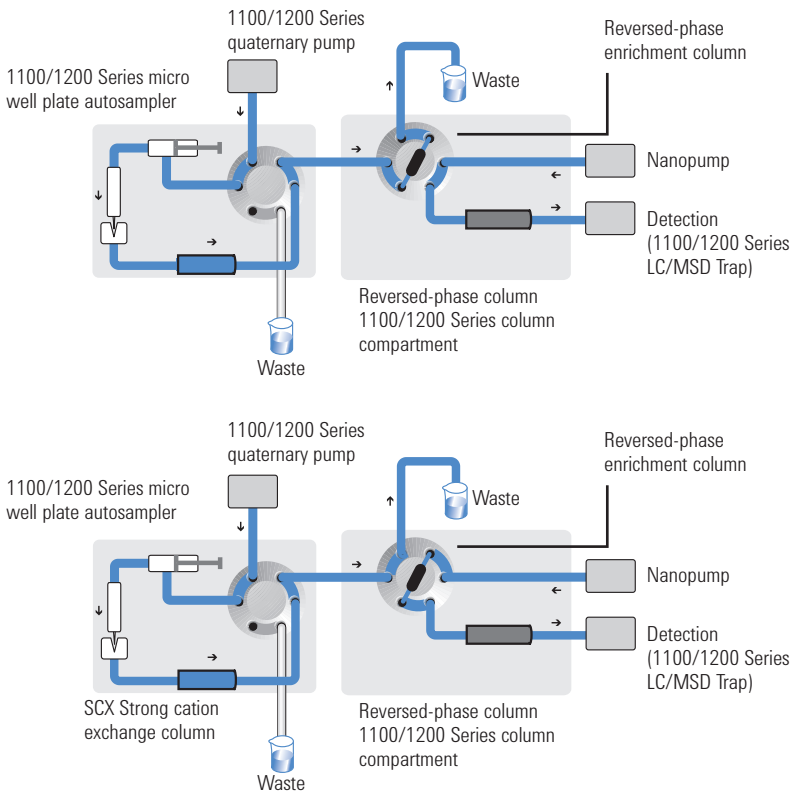
Column:	**ZORBAX SB-C18** **5064-8256** **0.5 x 150 mm, 5 µm**
Mobile Phase:	A: 75% H_2O with 0.4% formic acid B: 25% MeOH with 0.4% formic acid
Flow Rate:	20 µL/min
Temperature:	25°C
Sample:	0.1 µL Polar organic acids

Excellent reproducibility is seen for a separation of polar organic acids on three different StableBond-C18, 0.5 x 150 mm, 5 µm columns. Retention (k) varied less than 0.8% RSD and selectivity (α) varied less than 0.4% RSD.



2-D LC/MS Analyses Using ZORBAX Capillary and Nano LC Columns

Typical Column Configuration for 2-D HPLC



Flow path of the Agilent 1100 Series Nanoflow Proteomics Solution system.
1. Sample loading, elution from SCX and trapping on enrichment column
2. Valve switch in column compartment, elution from enrichment column; separation on RP, and MS anaylsis

Proteins in a Complex Sample by 2-D HPLC with Nano HPLC Columns

Column: **ZORBAX 300SB-C18**
5065-9913
0.3 x 5 mm, 5 µm

Column: **ZORBAX 300SB-C18**
5065-9911
0.075 x 150 mm, 3.5 µm

Mobile Phase: Quaternary Pump: 3% Acetonitrile/0.1% Formic Acid
Nanopump: A = Water, 0.1% Formic Acid, B = ACN, 0.1% Formic Acid

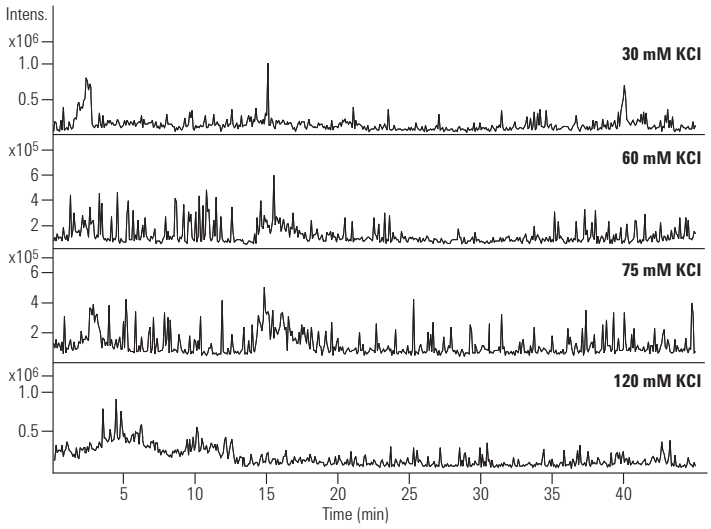
Flow Rate: Quaternary Pump: 30 µL/min
Nanopump: 300 nL/min

Gradient: Quaternary Pump: Isocratic
Nanopump:
6 min = 3% B, 120 min = 60% B, 125 min = 80% B, 130 min = 80% B, 131 min = 3% B, 140 min = 3% B

MS Conditions: Source: Nano ESI, drying gas flow: 5 L/min, drying gas temp: 225°C
Ion Trap: Skim: 1:35 V, cap exit offset: 115 V, octopole 1:12 V, octopole 2:3.5 V, trap drive: 80 V. ICC: on, averages: 4, max accu time: 150 ms; target 60.000, ion mode positive, MS/MS mode.

Sample: Tryptic Digest of bovine serum albumin
Volume: 1 to 8 µL
Salt Step Elution: 8 mL of 10 mM-100 mM KCl (10 mM increments), 125 mM, 150 mM, 200 mM, 300 mM, 500 mM, 1 M.

Tryptic digest of bovine serum albumin (BSA). The base peak chromatograms show a selection of fractions from a 2-D HPLC separation. Single chromatograms represent peptides from BSA eluting at a given salt concentration followed by enrichment and reversed-phase chromatography.



ZORBAX HPLC Capillary Columns (glass-lined stainless steel)

Description	Size (mm)	Particle Size (µm)	SB-C18	Eclipse XDB-C18	300SB-C18	300SB-C8	Poroshell 300SB-C8	300Extend C18	Bio-SCX Series II
Capillary	0.8 x 50	3.5							5065-9942
Capillary	0.5 x 250	5	5064-8258	5064-8286	5064-8266				
Capillary	0.5 x 150	5	5064-8256	5064-8287	5064-8264				
Capillary	0.5 x 75	5					5065-4468		
Capillary	0.5 x 35	5	5064-8254	5064-8296	5064-8294				
Capillary RR	0.5 x 35	3.5	5064-8260	5064-8298	5065-4459				
Capillary	0.3 x 250	5	5064-8257	5064-8269	5064-8265				
Capillary	0.3 x 150	5	5064-8255	5064-8291	5064-8263				
Capillary	0.3 x 35	5	5064-8253	5064-8297	5064-8295				
Capillary	0.3 x 35	3.5							5065-9912
Capillary RR	0.3 x 150	3.5	5064-8261	5064-8271	5064-8267	5065-4460		5065-4464	
Capillary RR	0.3 x 100	3.5			5064-8259	5065-4461		5065-4465	
Capillary RR	0.3 x 75	3.5			5064-8270	5065-4462		5065-4466	
Capillary RR	0.3 x 50	3.5			5064-8300	5065-4463		5065-4467	
Replacement Screens, 10/pk			5065-4427	5065-4427	5065-4427	5065-4427	5065-4427	5065-4427	

ZORBAX Nano HPLC Columns (PEEK)

Description	Size (mm)	Particle Size (µm)	300SB-C18 USP L1	300SB-C8 USP L7
Nano RR	0.1 x 150	3.5	5065-9910	
Nano RR	0.075 x 150	3.5	5065-9911	
Nano RR	0.075 x 50	3.5	5065-9924	5065-9923
Trap/Guard, 5/pk	0.3 x 5	5	5065-9913	5065-9914
Trap/Guard Hardware kit			5065-9915	5065-9915

ZORBAX MicroBore (1.0 mm ID)

- High sensitivity for small sample sizes
- Compatible with LC/MS interfaces
- Wide variety of bonded phases

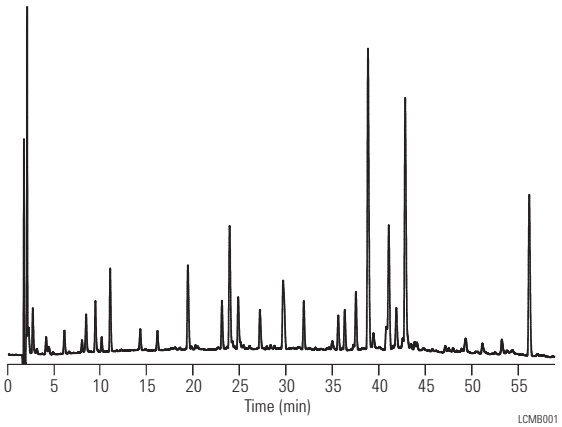
Agilent ZORBAX MicroBore (1.0 mm ID) columns are often a good choice when sample sizes are limited. They can improve detection limits 5 times over 2.1 mm ID columns when the same sample mass is used. This increase in sensitivity can be critical. MicroBore columns use low flow rates (typically ~ 50 µL/min). Therefore, these columns are ideal for use with detectors requiring low flow rates such as some mass spectrometers and with capillary LC systems.

MicroBore columns perform optimally with HPLC systems purchased or modified for microbore use. A wide variety of bonded phases is available for use up to 400 bar including StableBond SB-C18, SB-C8, 300SB-C18; Eclipse XDB-C18 and XDB-C8; Bonus RP, Extend C-18; and Poroshell columns. Guard columns are also now available with an adjustable tube stop depth to provide a perfect zero dead volume connection every time.

Separation of a Tryptic Digest on ZORBAX MicroBore 300SB-C18

Column:	**ZORBAX 300SB-C18 863630-902 1.0 x 150 mm, 3.5 µm**
Mobile Phase:	Gradient: 2-60% B in 60 Min.
	A: 0.1% TFA
	B: 0.075% TFA/80% ACN
Flow Rate:	50 µL/min
Temperature:	50°C
Detector:	215 nm
Sample:	2 µL
	Tryptic Digest of rhGH

This example of a tryptic digest separated on a MicroBore column demonstrates the high sensitivity and resolution possible with 1.0 mm ID columns.



ZORBAX MicroBore (1.0 mm ID)

Description	Size (mm)	Particle Size (µm)	SB-C18 USP L1	SB-C8 USP L7	300SB-C18 USP L1	300SB-C8 USP L7
MicroBore	1.0 x 250	5			861630-902	
MicroBore RR	1.0 x 150	3.5	863600-902	863600-906	863630-902	863630-906
MicroBore RR	1.0 x 50	3.5	865600-902	865600-906	865630-902	865630-906
MicroBore RR	1.0 x 30	3.5	861600-902	861600-906		
MicroBore Guard, 3/pk	1.0 x 17	5	5185-5920	5185-5920	5185-5920	5185-5920

Description	Size (mm)	Particle Size (µm)	Eclipse XDB-C18 USP L1	Eclipse XDB-C8 USP L7	Bonus-RP USP L60	Extend-C18 USP L1
MicroBore RR	1.0 x 150	3.5	963600-902	963600-906	863608-901	763600-902
MicroBore RR	1.0 x 50	3.5	965600-902	965600-906	865608-901	765600-902
MicroBore RR	1.0 x 30	3.5	961600-902	961600-906	861608-901	761600-902
MicroBore Guard, 3/pk	1.0 x 17	5	5185-5921	5185-5921	5185-5922	5185-5923

Description	Size (mm)	Particle Size (µm)	Poroshell 300SB-C18	Poroshell 300SB-C8	Poroshell 300SB-C3	Poroshell 300Extend-C18
MicroBore	1.0 x 75	5	661750-902	661750-906	661750-909	671750-902
MicroBore Guard, 3/pk	1.0 x 17	5	5185-5968	5185-5968	5185-5968	

Preparative HPLC Columns

PLRP-S for Reverse Phase Prep to Process

- Discovery stage to multi-kg cGMP production reduces method development time
- Chemical stability for separations, sanitation and regeneration increases selectivity and column lifetime
- Single batch packing of multiple columns reduces system down time and validation costs

The PLRP-S media, rigid poly(styrene/divinylbenzene) particles, are available in a range of pore sizes for small molecule, synthetic biomolecule and macromolecule purification. Their thermal and chemical stability makes them ideal for purifications that require extreme conditions for sample preparation, compound elution and column regeneration.

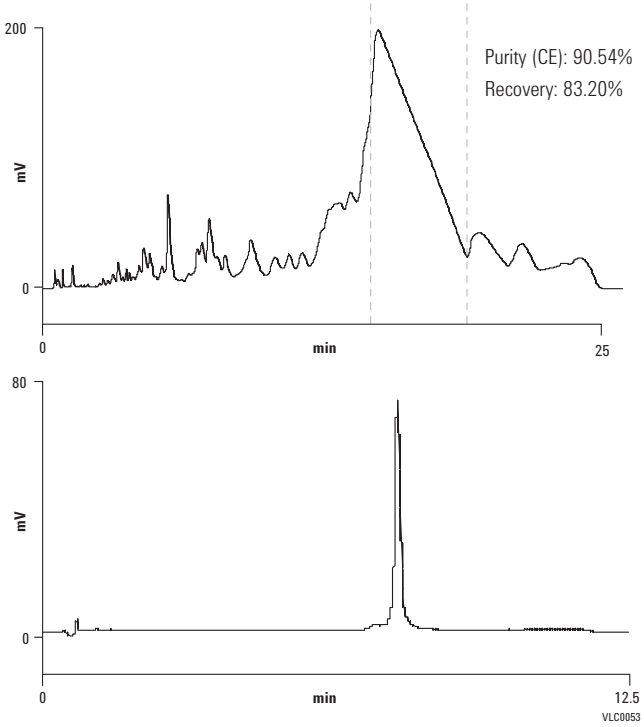
Capacity and resolution are two key parameters for maximizing the throughput of a purification. With a wide choice of pore sizes and extended range of operating conditions, PLRP-S provides more options to achieve the optimum process. Particle sizes range from 3 µm to 50 µm for scale-up from the µg/mg discovery stage to multi-kg cGMP production. Excellent chemical stability, up to 1 M NaOH, permits sanitation and regeneration that increase column lifetime. Finished product batch sizes of up to 600 L are available, providing single batch packing of multiple columns.

As part of our commitment to quality and continuity of supply, all manufacturing is carried out under a fully documented process. A Type II Drug Master File and regulatory support files are available for process materials, and facility audits are routinely conducted.

PLRP-S Prep to Process Application Guide

	PLRP-S Media Pore Size			
Application	**100Å**	**300Å**	**1000Å**	**4000Å**
Synthetic biomolecules, peptides and oligonucleotides	♦	♦		
Recombinant biomolecules, peptides and proteins	♦	♦		
Large biomolecules, antibodies, DNA fragments			♦	♦
Small molecules, unstable compounds including metal sensitivity	♦			

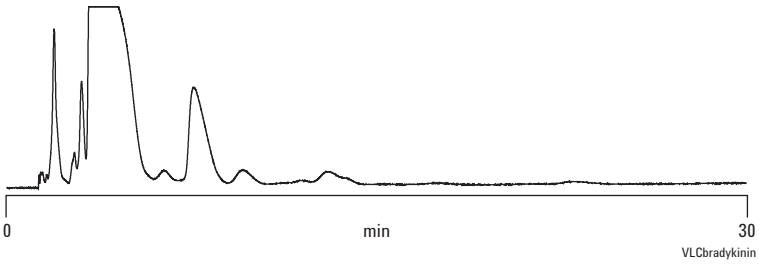
Purification of a 25mer trityl-off oligonucleotide and analytical quantitation of the fraction using PLRP-S 100Å, 4.6 x 50 mm



Crude bradykinin prep load

Column: **PLRP-S 100Å**
PL1512-5100
4.6 x 250 mm, 10 µm

Sample: 30 µL containing 1.5 mg of crude peptide
Mobile Phase: 0.1% TFA in 21% ACN:79% water
Flow Rate: 1 mL/min (360 cm/hr)



Prep to Process PLRP-S

Size (mm)	Particle Size (µm)	PLRP-S 100Å	PLRP-S 300Å	PLRP-S 1000Å	PLRP-S 4000Å
50 x 300	8	PL1712-6800	PL1712-6801		
50 x 150	30			PL1712-3702	PL1712-3703
50 x 150	15-20	PL1712-3200	PL1712-3201		
50 x 150	10-15	PL1712-3400	PL1712-3401		
50 x 150	10	PL1712-3100	PL1712-3101	PL1712-3102	PL1712-3103
50 x 150	8	PL1712-3800	PL1712-3801		
25 x 300	15-20	PL1212-6200	PL1212-6201		
25 x 300	10-15	PL1212-6400	PL1212-6401		
25 x 300	10	PL1212-6100	PL1212-6101		
25 x 300	8	PL1212-6800	PL1212-6801		
25 x 150	30			PL1212-3702	PL1212-3703
25 x 150	10	PL1212-3100	PL1212-3101	PL1712-3102	PL1712-3103
25 x 150	8	PL1212-3800	PL1212-3801		
25 x 50	10			PL1212-1102	PL1212-1103
Prep to Process Evaluation PLRP-S					
4.6 x 250	30			PL1512-5702	PL1512-5703
4.6 x 250	15-20	PL1512-5200	PL1512-5201		
4.6 x 250	10-15	PL1512-5400	PL1512-5401		
4.6 x 250	10	PL1512-5100	PL1512-5101	PL1512-5102	PL1512-5103
4.6 x 250	8	PL1512-5800	PL1512-5801		
4.6 x 150	30			PL1512-3702	PL1512-3703
4.6 x 150	15-20	PL1512-3200	PL1512-3201		
4.6 x 150	10-15		PL1512-3401		
4.6 x 150	10	PL1512-3100	PL1512-3101	PL1512-3102	PL1512-3103
4.6 x 150	8	PL1512-3800	PL1512-3801		

PLRP-S Bulk Media

Particle Size (µm)	Unit	PLRP-S 100Å	PLRP-S 200Å	PLRP-S 300Å	PLRP-S 1000Å	PLRP-S 4000Å
50	1 kg	PL1412-6K00	PL1412-6K05	PL1412-6K01	PL1412-6K02	
	100 g	PL1412-4K00	PL1412-4K05	PL1412-4K01	PL1412-4K02	
30	1 kg				PL1412-6702	PL1412-6703
	100 g				PL1412-4702	PL1412-4703
15-20	1 kg	PL1412-6200		PL1412-6201		
	100 g	PL1412-4200		PL1412-4201		
10-15	1 kg	PL1412-6400		PL1412-6401		
	100 g	PL1412-4400		PL1412-4401		
10	1 kg	PL1412-6100		PL1412-6101	PL1412-6102	PL1412-6103
	100 g	PL1412-4100		PL1412-4101	PL1412-4102	PL1412-4103
8	1 kg	PL1412-6800		PL1412-6801		

PL-SAX and PL-SCX for Prep to Process

- Ion exchange purifications over a wider pH range extend applications
- HPLC flow rates and rapid equilibration reduce purification cycle times
- Large pore size for improved mass transfer delivers high speed, high resolution purifications

These rigid, strong ion exchange materials are extremely hydrophilic and are designed for purification of biomolecules. The PL-SAX and PL-SCX materials are totally polymeric and are chemically and thermally stable over a full range of HPLC conditions. The strong ion exchange functionalities, covalently linked to a chemically stable polymer, facilitate ion exchange purifications over a wider pH range. This stability can be exploited for column sanitation and clean-up. Thermal stability also enables the use of denaturing conditions and stabilizing/solubilizing agents for the purification of target compounds that may associate or degrade under the purification conditions, such as the purification of synthetic oligonucleotides with self-complementary sequences.

Both the 1000Å and 4000Å wide-pore materials are mechanically stable and robust and can be operated over a wide range of linear velocities, with fast loading of dilute solutions and wash cycles. HPLC flow rates and rapid equilibration reduces purification cycle times.

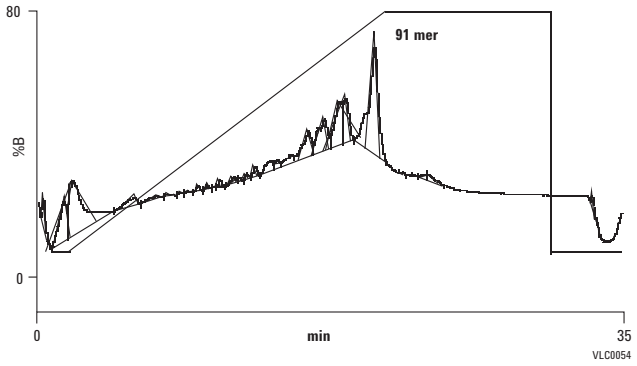
Packing in dynamic axial compression (DAC) column hardware is straightforward and high efficiency columns are achieved with excellent reproducibility and lifetimes. The 1000Å pore size is for high-capacity purifications and the 4000Å gigaporous particles with improved mass transfer are intended for large biomolecules and high-speed, high-resolution purifications.

Column Specifications

	PL-SAX	PL-SCX
Matrix	Fully polymeric	Fully polymeric
Pore Sizes	1000Å, 4000Å	1000Å, 4000Å
Particle Sizes	10 µm, 30 µm	10 µm, 30 µm
Bead Form	Rigid spherical	Rigid spherical
Functionality	Quaternary amine	Sulfonic acid
Pressure Stability	3000 psi	3000 psi
Temperature Stability	80°C	80°C
pH Range	1 to 14	1 to 14
Eluent Compatibility	All anion exchange buffers	All cation exchange buffers
Packed Bed Density	0.39 g/mL	0.39 g/mL

Purification of a large oligonucleotide

Column:	**PL-SAX 1000Å, 8 µm**
Mobile Phase:	A: 93% 0.1 M TEAA, pH 7:7% ACN
	B: 93% 0.1 M TEAA, 3.24 M ammonium acetate, pH 7:7% ACN
Gradient:	0-100% B in 20 min
Flow Rate:	1.5 mL/min
Temperature:	60°C
Detector:	UV, 290 nm



Prep to Process PL-SAX and PL-SCX

Dimensions	Particle Size (µm)	PL-SAX 1000Å	PL-SAX 4000Å	PL-SCX 1000Å	PL-SCX 4000Å
100 x 300	30	PL1851-3102	PL1851-3103	PL1845-3102	PL1845-3103
100 x 300	10	PL1851-2102	PL1851-2103	PL1845-2102	PL1845-2103
50 x 150	30	PL1751-3702	PL1751-3703	PL1745-3702	PL1745-3703
50 x 150	10	PL1751-3102	PL1751-3103	PL1745-3102	PL1745-3103
25 x 150	30	PL1251-3702	PL1251-3703	PL1245-3702	PL1245-3703
25 x 150	10	PL1251-3102	PL1251-3103	PL1245-3102	PL1245-3103
25 x 50	10	PL1251-1102	PL1251-1103	PL1245-1102	PL1245-1103
7.5 x 150	8	PL1151-3802	PL1151-3803		
7.5 x 50	8	PL1151-1802	PL1151-1803	PL1145-1802	PL1145-1803
4.6 x 250	30	PL1551-5702	PL1551-5703	PL1545-5702	PL1545-5703
4.6 x 250	10	PL1551-5102	PL1551-5103	PL1545-5102	PL1545-5103
4.6 x 150	30	PL1551-3702	PL1551-3703	PL1545-3702	PL1545-3703
4.6 x 150	10	PL1551-3102	PL1551-3103	PL1545-3102	PL1545-3103

PL-SAX and PL-SCX Bulk Media

Particle Size (µm)	Unit	PL-SAX 1000Å	PL-SAX 4000Å	PL-SCX 1000Å	PL-SCX 4000Å
30	1 kg	PL1451-6702	PL1451-6703	PL1445-6702	PL1445-6703
	100 g	PL1451-4702	PL1451-4703	PL1445-4702	PL1445-4703
10	1 kg	PL1451-6102	PL1451-6103	PL1445-6102	PL1445-6103
	100 g	PL1451-4102	PL1451-4103	PL1445-4102	PL1445-4103

High Efficiency Purification for Biomolecule Separations

- Small column sizes for high-speed media selection, method development and purification
- Comprehensive range of selectivities
- Packed columns and bulk media

Agilent offers a range of high-efficiency, small-particle polymeric HPLC materials. These are pre-packed preparative columns and bulk media for reverse phase, normal phase and ion exchange purification. A range of pore sizes is available that provides maximum capacity for all applications, from small molecules through biological macromolecules.

Biomolecule Separations

Sample	Separation	Column
Synthetic Peptides	Reverse Phase	VariTide RPC PLRP-S 100Å, 10 µm PLRP-S 300Å, 8 µm
Synthetic Peptides	Anion Exchange	PL-SAX 1000Å, 8 µm
Recombinant Peptides and Proteins	Reverse Phase	PLRP-S 100Å, 10 µm PLRP-S 300Å, 8 µm PLRP-S 1000Å, 8 µm
	Anion Exchange	PL-SAX 1000Å, 8 µm
	Cation Exchange	PL-SCX 1000Å, 8 µm
Macromolecular Plasmids	Reverse Phase	PLRP-S 4000Å, 8 µm
	Anion Exchange	PL-SAX 4000Å, 8 µm

High Efficiency Purification for Biomolecule Separations

Size (mm)	Particle Size (µm)	PLRP-S 100Å	PLRP-S 300Å	PL-SAX 1000Å	PL-SAX 4000Å	PL-SCX 1000Å	PL-SCX 4000Å	VariTide RPC
100 x 300	10			PL1851-2102	PL1851-2103	PL1845-2102	PL1845-2103	
100 x 300	8	PL1812-6800	PL1812-6801					
50 x 300	8	PL1712-6800	PL1712-6801					
25 x 300	8	PL1212-6800	PL1212-6801					
7.5 x 300	8	PL1112-6800	PL1112-6801	PL1112-6802				
7.5 x 150	8			PL1112-3802				
7.5 x 50	8			PL1112-1802	PL1112-1803			
21.2 x 250								PL1E12-5A05
10 x 250								PL1012-5A05
High Efficiency Bulk Media								
100 g	10	PL1412-4100	PL1412-4101	PL1451-4102	PL1451-4103	PL1445-4102	PL1445-4103	PL1412-4A05
1 kg	10	PL1412-6100	PL1412-6101	PL1451-6102	PL1451-6103	PL1445-6102	PL1445-6103	PL1412-6A05

Peptide Solutions

VariPep Peptide Solutions

VariPep is a cost-effective solution for the production of synthetic peptides. This portfolio of products lets you manage the cost and efficiency of high-volume synthetic peptide production, from µg to g scale. These products provide a solution for peptide houses that manufacture small quantities of hundreds/thousands of peptides where manufacturing time is the economic driving force. VariPep includes the following products:

- **StratoSpheres:** Highest quality supports for peptide synthesis
- **VariTide RPC:** A universal RP-HPLC column for synthetic peptide purification
- **VariPure IPE:** A unique material for ion-pair extraction

StratoSpheres

- Very high yields maximize productivity
- Reduce cost of raw materials
- High reproducibility, batch after batch

From the extensive range of StratoSpheres resins, those designed specifically for solid phase synthesis of peptides have been selected for inclusion in the VariPep portfolio. StratoSpheres particles are manufactured using a proprietary technique, which ensures exceptional control and reproducibility of loading. This has the benefit of giving exceptional yields of peptide product and reducing raw material costs.

Resins are available for producing both peptide acids and peptide amides using Fmoc- and Bmoc-chemistries. To simplify the synthesis, some Stratospheres products can be purchased with the first amino acid pre-attached.

StratoSpheres

Description	Loading (mmol/g: µm)	Unit	Part No.
Peptide Acids			
Boc-chemistry, PL-CMS	1.0: 75-150	5 g	PL1461-1799*
		25 g	PL1461-3799*
Fmoc-chemistry, PL-Wang	0.9: 75-150	5 g	PL1463-1799*
		25 g	PL1463-3799*
Fmoc-chemistry (mild cleavage), PL Cl-Trt-Cl	1.4: 75-150	5 g	PL3473-1799
		25 g	PL3473-3799
Peptide Amides			
Boc-chemistry, PL-MBHA	1.1: 75-150	5 g	PL3484-1799*
		25 g	PL3484-3799*
Fmoc-chemistry, PL-Rink	0.7: 75-150	5 g	PL1467-1799*
		25 g	PL1467-3799*
Fmoc-chemistry (mild cleavage), PL-Sieber	0.6: 75-150	5 g	PL3483-1799
		25 g	PL3483-3799

*Also available with first amino acid attached

VariTide RPC Columns

- A single column to cover the full range of synthetic peptides
- Small particle size for maximum efficiency, even with 1 and 2 in. prep columns
- Bulk media to pack 1 and 2 in. prep columns for the purification of mg to g quantities

VariTide RPC columns and media are part of the VariPep Peptide Solution. This is the recommended option for cost-effective separation and purification of synthetic peptides using generic methods.

VariTide RPC Columns

Size (mm)	Part No.
21.2 x 250	PL1E12-5A05
10 x 250	PL1012-5A05
4.6 x 250	PL1512-5A05

VariTide RPC Bulk Media

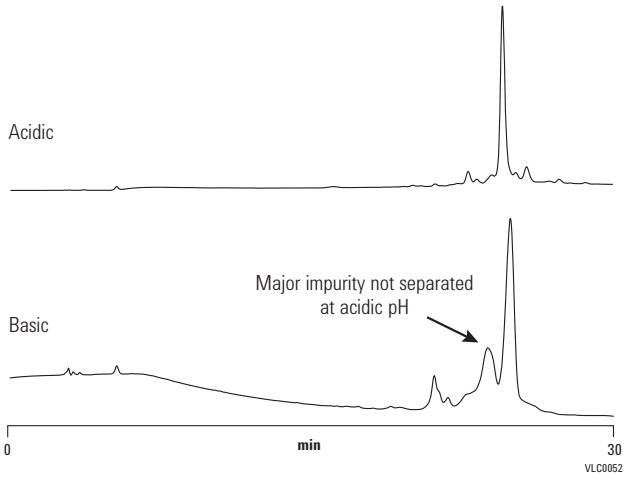
Description	Part No.
100 g	PL1412-4A05
1 kg	PL1412-6A05

Crude peptide screen

Column: **VariTide RPC PL1512-5A05 4.6 x 250**

Mobile Phase: **Acidic**
A: 0.1% TFA in 95% water: 5% ACN
B: 0.1% TFA in 50% water: 50% ACN
Basic
A: 5% ACN, 95% 20 mm ammonium carbonate pH 9.5
B: 50% ACN, 50% 20 mm ammonium carbonate pH 9.5

Flow Rate: 1.0 mL/min (360 cm/h)
Gradient: 0-100% B in 30 min
Detector: UV, 220 nm



VariPure IPE

- Pre-packed for convenience
- Removal of ion-pairing agents for improved productivity
- High performance and economy for excellent efficiency

VariPure IPE is a polymer-supported quaternary-amine resin with a bicarbonate counter ion, designed for removing acidic ion-pair reagents, such as trifluoracetic acid (TFA), formic acid or acetic acid. VariPure IPE is a high performance and economical acid removal material conveniently supplied as pre-packed SPE type devices. The particle size, capacity and device geometry are matched to provide sufficient residence time to achieve effective ion-air extraction under gravity flow. For acid labile peptides, removal of the ion-pairing agent prevents acid degradation of the peptide during post-HPLC work-up, and increases the yield of purified product.

VariPure IPE

Loading	Counter-ion Removal Capacity	Unit	Part No.
100 mg per 3 mL tube	~ 5 mL 0.1% TFA	50/pk	PL3540-D603VP
500 mg per 6 mL tube	~ 25 mL 0.1% TFA	50/pk	PL3540-C603VP
1 g per 20 mL tube	~ 50 mL 0.1% TFA	25/pk	PL3540-P603VP
25 g			PL3549-3603VP

Oligo Solutions

StratoSpheres DNA Synthesis Cartridges

- Greater yields of full length products than controlled-pore glass
- Inert support prevents side reactions and improves quality of the end product
- 1000Å pore size permits synthesis of longer oligonucleotide sequences, up to 70mer
- Certificate of Analysis offered for every batch

StratoSpheres DNA Synthesis Cartridges make it easy to obtain high-quality synthetic DNA oligonucleotides. The high-yielding polystyrene packing delivers more full-length product than conventional controlled-pore glass supports. In addition, the hydrophobic nature of the polystyrene promotes coupling and minimizes non-specific binding to maximize production efficiency. These high-throughput cartridges deliver very economical oligonucleotide synthesis, and provide the high performance expected from macroporous polystyrene supports. StratoSpheres DNA synthesis cartridges deliver maximum flexibility in high-throughput environments.

StratoSpheres DNA Cartridges

Description	Size (nmol)	Part No.
StratoSpheres DNA DMT bz dA	40	PL3554-1602dAbz
	200	PL3554-4602dAbz
StratoSpheres DNA DMT bz dC	40	PL3554-1602dCbz
	200	PL3554-4602dCbz
StratoSpheres DNA DMT ac dC	40	PL3554-1602dCac
	200	PL3554-4602dCac
StratoSpheres DNA DMT ibu dG	40	PL3554-1602dGibu
	200	PL3554-4602dGibu
StratoSpheres DNA DMT dmf dG	40	PL3554-1602dGdmf
	200	PL3554-4602dGdmf
StratoSpheres DNA DMT dT	40	PL3554-1602dT
	200	PL3554-4602dT

TOP Cartridges

- Superior yield and purity come from proprietary polymeric resins and optimized buffers
- Typical yield is more than 85% and typical purity is over 90%, eliminating the need for multiple sample-loading steps
- Agilent TOP cartridges use up to two thirds less reagent than products from other vendors

TOP, TOP-DNA and TOP-RNA cartridges provide a high-throughput, simple, cost-effective solution for DNA and RNA oligonucleotide purification. The TOP product range incorporates a unique 96-well plate with removable tubes, streamlined gravity flow or vacuum procedure, and proprietary polymeric resin. Agilent's innovative technology delivers superior yield and purity for standard oligos up to 1 µmol synthesis scale and up to 150mer in length. Flexibility is assured from a choice of simple gravity flow (for walk-away and low initial setup cost) or vacuum procedure (for fast turnaround – less than 15 minutes for the entire purification process). Up to 10 minutes drying time between each step is permissible with no effect on purification results (drying time after the acetonitrile conditioning step should be kept to a minimum).

TOP-DNA Cartridges

- Fast throughput improves production efficiency
- Pre-HPLC "sample prep" ability maximizes utility
- Gravity (TOP) or vacuum flow (TOP-DNA) ensures flexibility

TOP-DNA is a high-throughput, simple, fast, cost-effective solution that purifies oligos up to 150-mer in length. Its high binding capacity can purify DNA oligos from 200 nmol to 1 µmol synthesis scales. TOP-DNA can also be used for sample preparation before HPLC purification for very high quality oligos in large-scale analysis. The proprietary polymeric resin is compatible with direct loading of AMA deprotected oligo solutions.

TOP-RNA Cartridges

- A complete solution for RNA oligo purification to enhance productivity
- High throughput and automation friendly, freeing up operator time
- Less reagent use reduces operating costs

With TOP-RNA you can purify short and long RNA oligos, siRNA to 21-mer and long RNA to 60-80 mer. The high binding capacity purifies RNA oligos up to 1 µmol. The proprietary polymeric resin and validated protocol allow deprotection of 2'hydroxyl group without removal of the 5′ trityl group.

TOP, TOP-DNA and TOP-RNA Cartridges

Description	Sorbent Mass (mg)	Volume (mL)	Unit	Part No.
TOP-RNA well plate tubes for 1 µmol scale	100	1.8	96/pk	7573915C
TOP-DNA well plate tubes for 1 µmol scale	150	1.8	96/pk	7572915C
TOP-DNA well plate tubes for 1 µmol scale	150	1.8	20 x 96/pk	7572915B
TOP well plate tubes for 50 nmol scale	25	1.8	96/pk	75719025
TOP well plate tubes for 200 nmol scale	50	1.8	96/pk	75719050
TOP well plate tubes for 200 nmol scale, high capacity	100	1.8	96/pk	7571901C
TOP well plate tubes for 200 nmol scale, vacuum compatible	150	1.8	96/pk	7561915C
TOP well plate tubes for 200 nmol scale, vacuum compatible	150	1.8	15 x 96/pk	7571915B
96-well collection plate		2.0	25/pk	WA77015200
96-well collection plate		750 µL	25/pk	WA77015750
96-well plate sealing mat			50/pk	5133005
Disposable waste tray			25/pk	5133001
TOP reusable base plate				75400001

LC AND LC/MS TROUBLESHOOTING

HPLC Troubleshooting

Symptom Type	Possible Cause	Solution
Baseline disturbance at void time	Positive/negative – Difference in refractive index of injection solvent	Use mobile phase for sample solvent
Detector leaks	Plugged inlet frit	Replace seals/gaskets
Drifting baseline	Positive direction – Contaminant buildup/elution	Flush column, cleanup sample, use pure solvents
	Positive/negative – Difference in refractive index of injection solvent	Use mobile phase for sample solvent
	Negative direction (gradient) – Absorbance of "A" mobile phase solvent	Use non-absorbing or HPLC-grade or better solvent
	Positive direction (gradient) – Absorbance of "B" mobile phase solvent	Use non-absorbing or HPLC-grade or better solvent
	Random – Temperature changes	Insulate column and tubing
	Random – Temperature changes	Thermostat column and tubing
	Wavy or undulating – Temperature changes in room	Monitor room temperature and control
Ghost peaks	Peaks from previous injection	Flush column to remove contaminants
	Contamination	Sample cleanup or pre-fractionation
	Unknown interferences in samples	Sample cleanup or pre-fractionation
	Ion pair – Upset equilibrium	Prepare sample in actual mobile phase to minimize disturbance
	Peptide mapping – Oxidation of TFA	Prepare fresh daily; use anti-oxidant
	Reversed phase – Contaminated water	Check suitablity of water by running different amount through reversed phase column and measure peak height with elution; use HPLC grade solvents
	Spikes – Bubbles in solvent	De-gas solvents
High column backpressure	Column blockage with irrev, adsorbed sample	Better sample cleanup; use guard column
	Mobile phase viscosity too high	Use lower viscosity solvents or higher temperature
	Particle size too small	Use larger d_p packing
	Plugged inlet frit	Replace column
	Plugged inlet frit	Reverse solvent flow
Leak	Subtle – White powder at fitting/loose fitting	Tighten fitting, cut tubing, or replace ferrule
Leak, injection valve	Catastrophic – Worn valve rotor	Replace rotor in valve
Leak, column or other fittings	Catastrophic – Loose fittings	Tighten or replace fitting
Leak, pump	Catastrophic – Pump seal failure	Replace pump seal

(Continued)

HPLC Troubleshooting

Symptom Type	Possible Cause	Solution
Negative peaks	RI detector – solute refractive index less than solvent	No problem; reverse polarity to make positive
	UV detector – solute absorbance less than mobile phase	Use mobile phase with lower UV absorbance; do not recycle solvent too long
Noisy baseline	Random – Contaminant buildup	Flush column; cleanup sample; use HPLC-grade solvent
	Continuous – Detector lamp problem	Replace UV lamp (lasts 1000 hrs)
	Occasional – External electrical interference	Use voltage stabilizer for LC system
	Sample volume too large	Injection volume should be 1/6 when mobile phase used for injection
Peak doubling	Injection solvent too strong	Use weaker injection solvent or mobile phase
	Blocked frit	Replace and use 0.5 µm porosity in-line filter
	Column void or channeling	Replace column; for some columns, fill in void with packing
	Unswept injector flowpath	Replace injector rotor
	Void at head of column	Replace column, top off column with packing
	Column overloaded with sample	Use higher capacity stationary phase Increase column diameter Decrease sample size
	Single peak – interfering components	Sample cleanup; prefractionation
Peak tailing	Beginning of peak doubling	See "peak doubling"
	Unswept dead volumes	Minimize number of connections Ensure injector seal is tight Ensure fittings are properly seated
	Basic compounds – Silanol interactions	Choose endcapped bonded phase Switch to polymeric phase
	Basic substances – Silanol interactions	Use stronger mobile phase or add competing base (e.g. TMA)
	Silica-based – Column degradation	Use speciality column; polymeric column or sterically protected

(Continued)

HPLC Troubleshooting

Symptom Type	Possible Cause	Solution
Peaks are broad	Injection volume too large	Decrease solvent strength of injection solvent to focus solute
	Peak dispersion in injector valve	Introduce air bubble in front/back of sample to decrease dispersion
	Sampling rate of data system too slow	Increase frequency of sampling
	Slow detector time constant	Adjust time constant to match peak width
	Mobile phase viscosity too high	Increase column temperature
	Detector cell volume too large	Use smallest possible cell volume with no heat exchanger in system
	Injector volume too large	Decrease injection volume
	Long retention times	Use gradient elution or stronger mobile phase
Pressure fluctuation	Leaky check valve	Replace check valve
	Pump seal leaks	Replace pump seals
	Buildup of particulates	Filter sample; in-line filter; filter mobile phase
Pressure increasing	Buildup of particulates	Filter sample; in-line filter; filter mobile phase
	Water/organic systems – buffer precipitation	Test buffer-organic mixtures; ensure compatibilty
Retention beyond total permeation volume	Size exclusion – Specific interactions	Add mobile phase modifiers or change solvent
Retention times changing	Column temperature varying	Thermostat column; insulate column; ensure lab temperature constant
	Equilibration time insufficient with gradient run or changes in isocratic mobile phase	Make sure at least 10 column volumes pass through column after solvent change or gradient conclusion
	Selective evaporation of mobile phase component	Less vigorous helium sparging; keep solvent reservoirs covered; prepare fresh mobile phase
	Buffer capacity insufficient	Use >20 mM concentration of buffer
	Inconsistent on-line mobile phase mixing	Ensure gradient system delivering constant composition; check vs. manual prep of mobile phase
	Contamination buildup	Occasionally flush column with strong solvent to remove contaminants
	First few injections – Adsorption on active sites	Condition column by initial injection of concentrated sample

(Continued)

HPLC Troubleshooting		
Symptom Type	**Possible Cause**	**Solution**
Retention times decreasing	Flow rate increasing	Check pump to make sure correct; if not, reset
	Column overloaded with sample	Decrease sample size
	Loss of bonded stationary phase	Keep mobile phase pH between 2 and 8.5
Retention times increasing	Flow rate is slowing	Fix leaks in liquid lines, replace pump seals, check for pump cavitation or air bubbles
	Active sites on silica packing	Use mobile phase modifier
	Loss of bonded stationary phase	Keep mobile phase pH between 2 and 8.5
	Mobile phase composition changing	Make sure mobile phase container is covered
	Active sites on silica packing	Add competing base to mobile phase
	Active sites on silica packing	Use higher coverage packing for stationary phase
Sensitivity problem	Peaks are outside of linear range of detector	Dilute/concentrate to bring into linear region
	First few sample injections – Absorption of sample in loop or column	Condition loop/column with concentrated sample
	Autosampler flow lines blocked	Check flow and make sure no blockages
	Injector sample loop underfilled	Make sure that loop is overfilled with sample
	Sample-related losses during preparation	Use internal standard during sample prep; optimize sample prep method
Slow column equilibration times (ion pairing)	Equilibration time slow for long-chain ion pairing reagents	Use shorter alkyl chain ion-pair reagent

LC/MS Troubleshooting	
Symptom Type	**Solution**
No peaks	Spray from the nebulizer
	Make sure capillary voltage is set correctly
	Make sure LC/MSD is tuned correctly
	Make sure LC/MSD pressures are within normal ranges
	Check drying gas flow and temperature
	Make sure fragmentor is set correctly
Poor mass accuracy	Recalibrate the mass axis
	Make sure ions used for tuning span mass range of sample ions and show strong stable signals
Low signal	Check the solution chemistry; make sure solvent is appropriate for sample
	Make sure sample is fresh and has been stored correctly
	Make sure LC/MSD is tuned correctly
	Check the nebulizer condition
	Clean the capillary entrance
	Check the capillary for damage and contamination
Unstable signal	Make sure drying gas flow and temperature are correct for the solvent flow
	Make sure solvent is throroughly degassed
	Make sure LC backpressure is steady; this indicates a steady solvent flow

(Continued)

LC/MS Troubleshooting

Symptom Type	Solution
High spectral noise	Use appropriate mass filter values
	Check spray shape; nebulizer may be damaged or set incorrectly
	Make sure drying gas flow and temperature are correct for the solvent flow
	Make sure solvent is throroughly degassed
	Make sure LC backpressure is steady; this indicates a steady solvent flow
	If you are using water as part of the mobile phase, make sure it is de-ionized (>18MW)
Droplets, not spray, exiting the nebulizer	Make sure nebulizing gas pressure is set high enough for the LC flow
	Check position of needle in nebulizer
	Stop solvent flow and remove nebulizer assembly
	Examine end of nebulizer for damage
No flow	Make sure LC is on and there is sufficient solvent in correct bottle
	Check for LC error messages
	Check for blockages
	Repair or replace any blocked components
	Check for leaks
	Make sure MS stream selector valve is set to LC to MSD
Undesired fragmentation	(APCI vs. Electrospray)
	APCI temperature is too high
	Fragmentor voltage is set too high

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Россия (495)268-04-70
Киргизия (996)312-96-26-47
Казахстан (7172)727-132

afr@nt-rt.ru || https://agilent.nt-rt.ru/