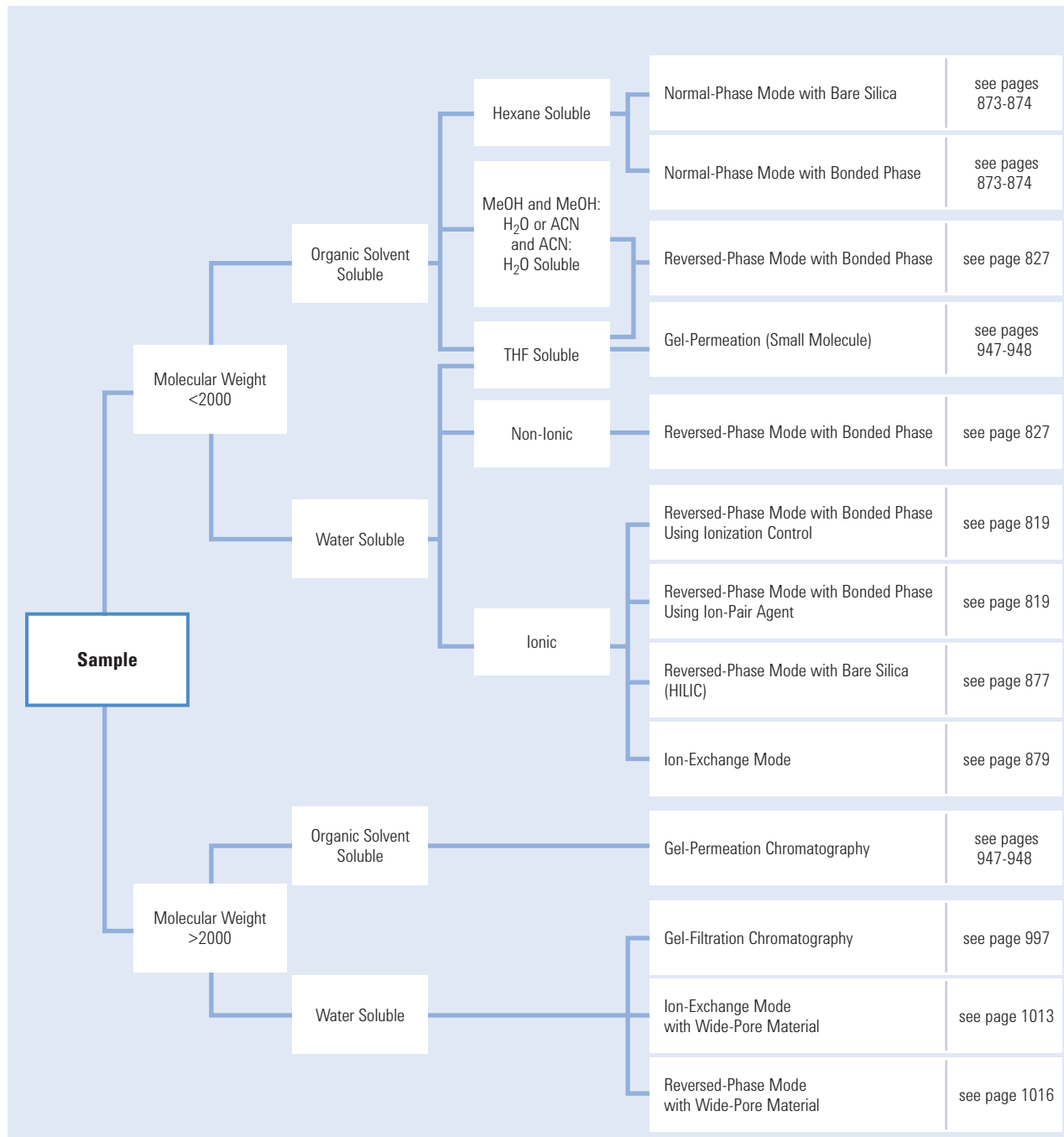


## LC and LC/MS Columns

### 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.

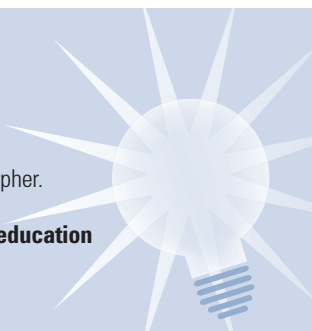
## pH and Mobile Phase

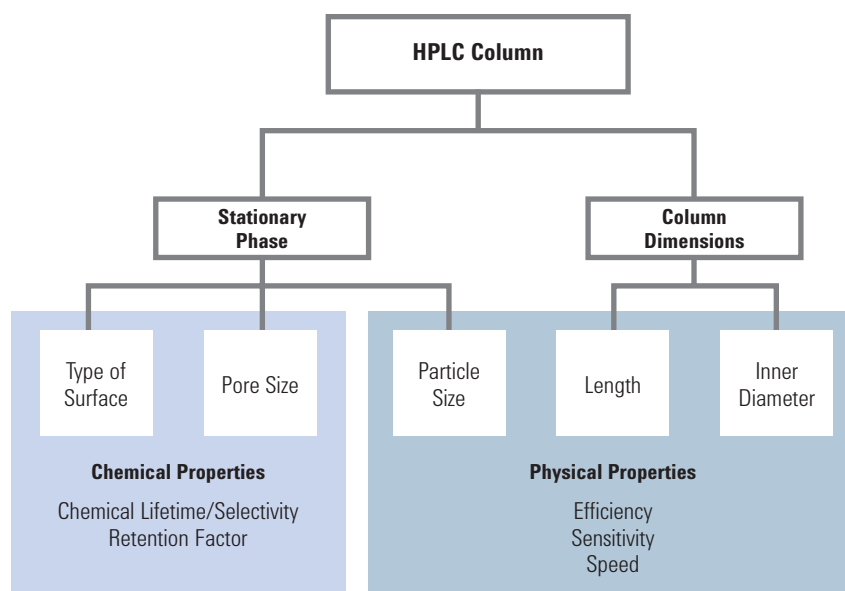
The choice of mobile phase for a reversed-phase system starts with selecting the organic modifier. Acetonitrile is the most commonly used organic modifier. However, selectivity differences and sample retention will vary significantly among mobile phases containing acetonitrile, methanol, and tetrahydrofuran (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).

### Tips & Tools

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

For more information, visit [www.agilent.com/chem/education](http://www.agilent.com/chem/education)



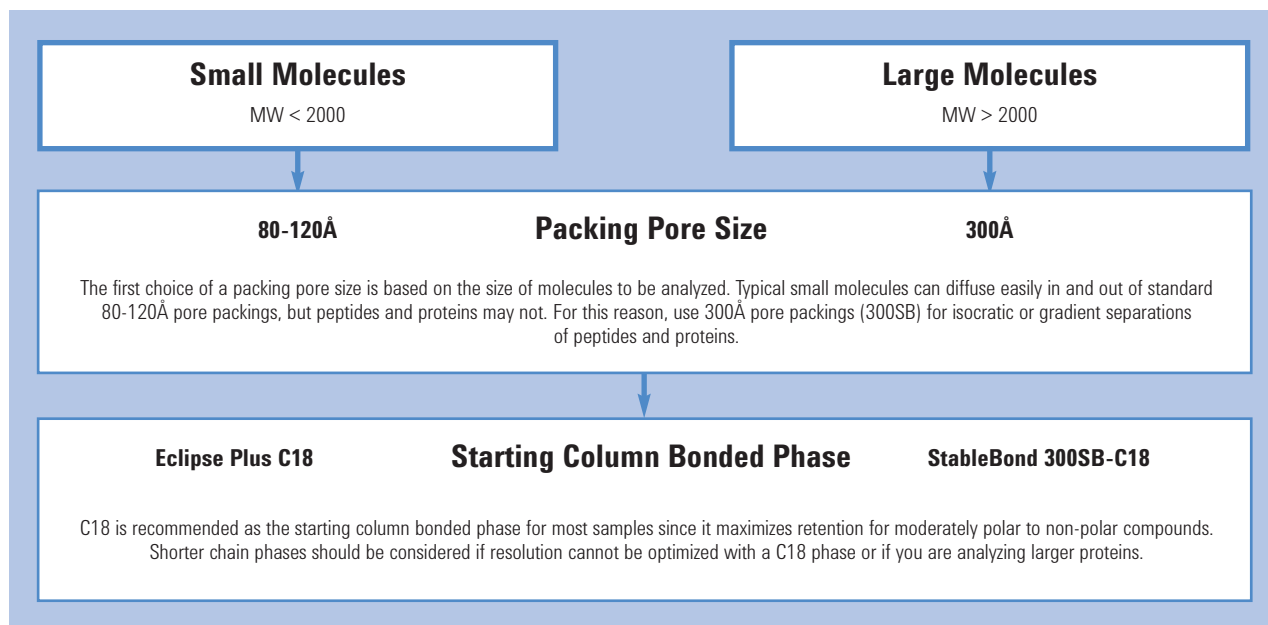


### Column Choice Relative to Application Objective

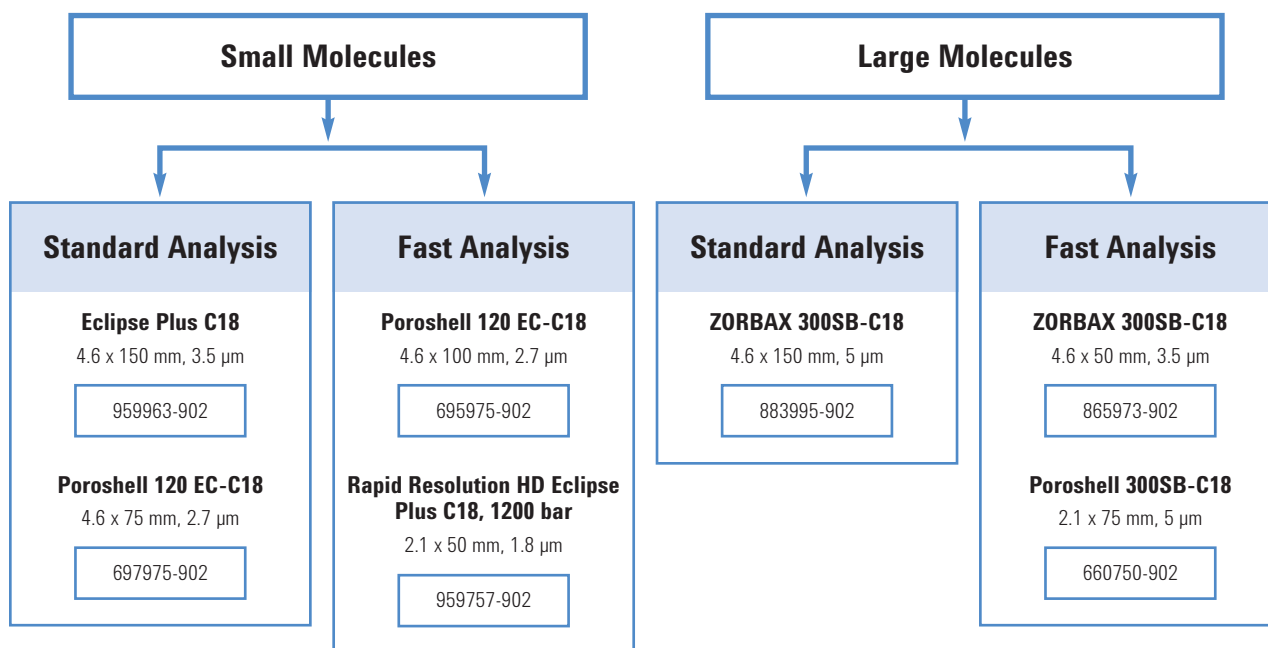
| Application                                                         | Objective Column Diameter (mm) |
|---------------------------------------------------------------------|--------------------------------|
| Very high sensitivity, LC/MS, peptides and proteins                 | 0.1, 0.075                     |
| 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-Phenylglycine-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 350m <sup>2</sup> /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                                                                                                        |
|    | Agilent HPLC Cartridge                                                                                                  | Can reverse collets in the end fitting to add guard cartridges                      | Inexpensive<br>Extends column lifetime<br>Permits rapid column changes<br>Can use 2, 3, 4 and 4.6 mm cartridges |
|                                                                                     |                                                                                                                         | Cartridges have a unique filter and sieve at each end                               | Helps prevent blockage                                                                                          |
|    | ZORBAX Guard Cartridge:<br>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<br>More solvent-resistant than PEEK                                                         |
|                                                                                     |                                                                                                                         | Reusable fittings                                                                   | Adapt for connections to 1/16 in. LC fittings                                                                   |
|    | ZORBAX Rapid Resolution and Rapid Resolution HT Cartridge Columns:<br>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                                         | For all analyte types                                                                                           |
|                                                                                     |                                                                                                                         | Packed with StableBond for low pH use                                               | Low bleed                                                                                                       |
|  | ZORBAX Semi-Preparative Guard HPLC Hardware Kit:<br>Standalone system                                                   | Sold individually or as three-packs                                                 |                                                                                                                 |
|                                                                                     |                                                                                                                         | 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                                                                                             |
|  | ZORBAX and Agilent Prep Preparative Cartridge Column and Guard HPLC System:<br>Standalone and integral hardware options | Reusable fittings                                                                   | Adapt for connections to 1/16 in. LC fittings                                                                   |
|                                                                                     |                                                                                                                         | Easy, low-dead-volume assembly                                                      | Extends column lifetime                                                                                         |
|                                                                                     |                                                                                                                         | Hardware options for integral and external guards                                   | Permits rapid column changes<br>Can use with 21.2 and 30 mm ID columns                                          |
|  | ChromSep Column Hardware:<br>Complete systems and replacement cartridges                                                |                                                                                     |                                                                                                                 |
|                                                                                     |                                                                                                                         | Easy, no-dead-volume assembly                                                       | Economical format                                                                                               |
|                                                                                     |                                                                                                                         |                                                                                     | No tools required<br>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                                                                    |
|-------------------------------------------------------------------------------------|-------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------|
|    | Cartridge column cartridge holder<br>5021-1845  | Guard cartridge (internal system) cartridge holder<br>5021-1845                      | 2.0<br>3.0<br>4.0<br>4.6 | Asahipak<br>LiChrospher<br>Nucleosil<br>Purospher<br>Superspher<br>ZORBAX |
|    |                                                 |    |                          |                                                                           |
|    | Standard fitting                                | Column guard cartridge (standalone)<br>cartridge holder<br>820999-901                | 2.1<br>3.0<br>4.6        | ZORBAX                                                                    |
|    |                                                 |    |                          |                                                                           |
|    | Rapid Resolution cartridge holder<br>820555-901 | No guard cartridge holder                                                            | 4.6                      | ZORBAX                                                                    |
|   |                                                 |                                                                                      |                          |                                                                           |
|  | Semi-preparative column                         | Semi-prep guard cartridge (standalone)<br>cartridge holder<br>840140-901             | 9.4                      | ZORBAX                                                                    |
|  |                                                 |  |                          |                                                                           |
|  | PrepHT                                          | Guard cartridge<br>820444-901                                                        | 21.2                     | ZORBAX<br>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.

To learn more, visit [www.agilent.com/chem/OnlineLibrary](http://www.agilent.com/chem/OnlineLibrary)





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<br>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  $\mu$ m) and Rapid Resolution HT (1.8  $\mu$ m) 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  $\mu$ m and the very high efficiency 1.8  $\mu$ m particles. The 1.8  $\mu$ m 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<br>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 |



This icon identifies preparative guard columns

## 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.



Preparative guard system

### Hardware

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

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





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**

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



This icon identifies ChromSep column hardware

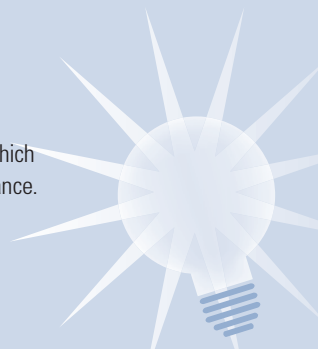
## ChromSep HPLC Column Hardware

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. Learn more about this common problem at [www.agilent.com/chem/lctroubleshooting](http://www.agilent.com/chem/lctroubleshooting)



# 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  $\mu\text{m}$  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.

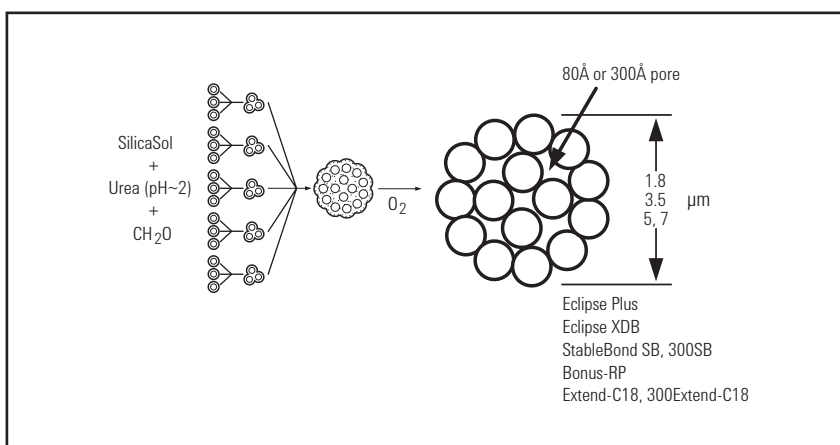
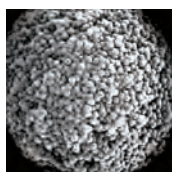
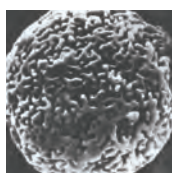


Figure 1. Formation of ZORBAX porous silica particles



ZORBAX Rx-SIL uniform sub particles



Xerogel "sponge-like" polymeric network

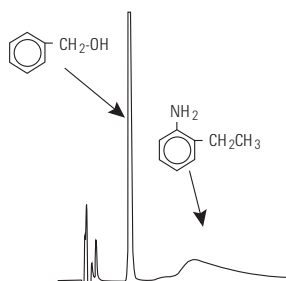
### Characteristics of ZORBAX Rx-SIL and a Contrasting Type of Silica

| 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 <sup>2</sup> /g | 100Å/300 m <sup>2</sup> /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.

Original ZORBAX SIL (1973)



Highly Purified ZORBAX Rx-SIL

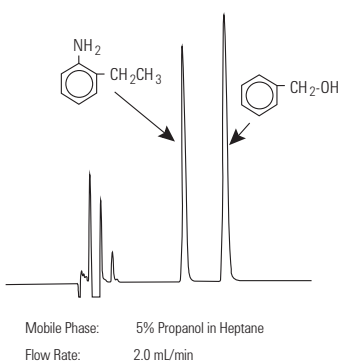


Figure 3. Chromatographic improvement using highly purified ZORBAX Rx-SIL

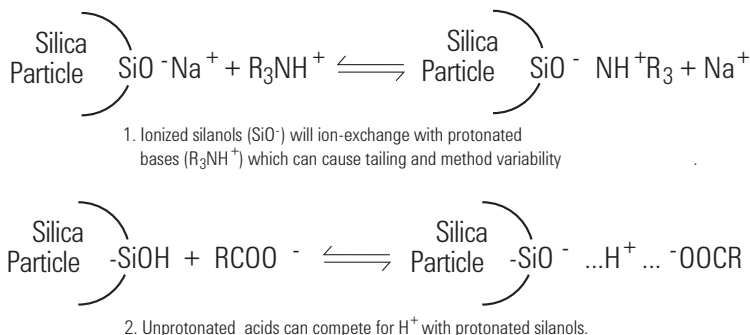


Figure 2. Potential secondary interactions with silica silanols and ionizable compounds

## **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  $\mu\text{m}$  particles. When ZORBAX Rapid Resolution HD or HT 1.8  $\mu\text{m}$  and Rapid Resolution 3.5  $\mu\text{m}$  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  $\mu\text{m}$  particles to be produced. The small 3.5  $\mu\text{m}$  and 1.8  $\mu\text{m}$  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  $\mu\text{m}$  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  $\mu\text{m}$  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

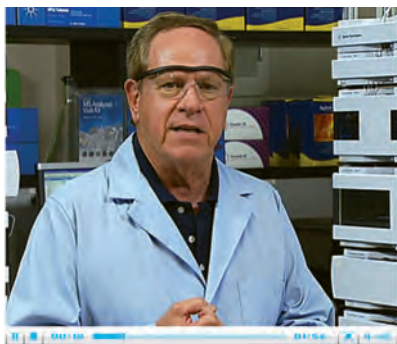
#### Achieve excellent peak shape and resolution — and eliminate "false starts"

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. Learn how this can help with troubleshooting issues by watching the videos at [www.agilent.com/chem/lctroubleshooting](http://www.agilent.com/chem/lctroubleshooting)



## 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      |
| <b>Original ZORBAX Columns**</b> |             |                      |            |                                                    |             |          |
| 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          | <ul style="list-style-type: none"> <li>• Superficially porous particles for high efficiency at low pressure</li> <li>• Sub-2 <math>\mu\text{m}</math> efficiency with a 2.7 <math>\mu\text{m}</math> particle</li> <li>• Endcapped and non-endcapped C18 and C8 phases for selectivity optimization</li> <li>• Compatible with 400 bar and 600 bar LC's</li> </ul>                                                                                                                                                                                                                                                      | 822      |
| Eclipse Plus           | <ul style="list-style-type: none"> <li>• Excellent first choice for method development</li> <li>• Long life from pH 2-9 for reliable separations of basic, acidic and neutral compounds</li> <li>• Superior peak shape with basic compounds</li> <li>• High resolution and efficiency with 1.8, 3.5 and 5 <math>\mu\text{m}</math> columns</li> <li>• Rigorous QA/QC testing for greater long-term reproducibility</li> </ul>                                                                                                                                                                                           | 827      |
| Eclipse XDB            | <ul style="list-style-type: none"> <li>• Four selectivity choices for flexible method development</li> <li>• High performance over a wide pH range (2-9)</li> <li>• Good peak shape for acids, bases and neutrals</li> <li>• Long lifetime with extra dense bonding and double endcapping</li> <li>• Fast, ultra-fast, and high resolution separations using 1.8 and 3.5 <math>\mu\text{m}</math> columns</li> <li>• Choices from capillary to prep</li> </ul>                                                                                                                                                          | 831      |
| StableBond (SB)        | <ul style="list-style-type: none"> <li>• Basic, acidic, neutral compounds</li> <li>• Exceptional stability at low pH (1-2)</li> <li>• 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</li> <li>• Widest selection of bonded phases for different selectivity (C18, C8, C3, CN, Phenyl, Aq)</li> <li>• Uses mobile phases for LC/MS with formic acid, acetic acid, or TFA</li> <li>• Uses mobile phases with TFA for peptide and protein separation</li> <li>• Rapid separations using 1.8 and 3.5 <math>\mu\text{m}</math> columns</li> </ul> | 838      |
| Bonus-RP               | <ul style="list-style-type: none"> <li>• Separating basic compounds in higher aqueous mobile phases</li> <li>• General separation of basic, neutral, acidic compounds at mid-range pH or low pH; especially stable at low pH</li> <li>• Separating peptides for different selectivity</li> <li>• Rapid separations using 3.5 <math>\mu\text{m}</math> columns</li> </ul>                                                                                                                                                                                                                                                | 846      |

(Continued)

## Quick Guide to Agilent Reversed-Phase Bonded Phases

| <b>Modern RP-HPLC Columns</b>     |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Columns</b>                    | <b>Recommended Uses and Applications</b>                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Page No.</b> |
| Extend-C18                        | <ul style="list-style-type: none"> <li>• Separating basic compounds above their pKa in free base form; separation of basic, acidic, neutral compounds at high pH; up to pH 11.5</li> <li>• Uses ammonium hydroxide as mobile phase additive with LC/MS with small molecules or peptides</li> <li>• Separating at high, mid-range and low pH for selectivity changes</li> <li>• Rapid separations using 3.5 <math>\mu</math>m columns</li> </ul> | 850             |
| ZORBAX Rx                         | <ul style="list-style-type: none"> <li>• General separation of basic, acidic and neutral compounds at low pH with different selectivity than SB columns</li> <li>• Rx-C8 is the same as SB-C8</li> </ul>                                                                                                                                                                                                                                        | 854             |
| Pursuit                           | <ul style="list-style-type: none"> <li>• Good separations of a wide range of analytes</li> <li>• Diphenyl and Pentafluorophenyl bonded phases for unique selectivity</li> <li>• 200Å pore size for separations of larger molecules</li> </ul>                                                                                                                                                                                                   | 856             |
| Pursuit XRs                       | <ul style="list-style-type: none"> <li>• High carbon load for excellent retention and resolution</li> <li>• Basic, acidic, and neutral compounds</li> <li>• Unique diphenyl bonded phase for separations based on pi-pi selectivity</li> </ul>                                                                                                                                                                                                  | 862             |
| Polaris A                         | <ul style="list-style-type: none"> <li>• Good for polar acids, polar bases and non-polar compounds</li> <li>• High aqueous compatibility</li> </ul>                                                                                                                                                                                                                                                                                             | 865             |
| Polaris Ether                     | <ul style="list-style-type: none"> <li>• Additional selectivity for H-bond donors</li> <li>• High aqueous compatibility</li> <li>• No "phase collapse"</li> </ul>                                                                                                                                                                                                                                                                               | 865             |
| <b>Original ZORBAX Columns</b>    |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |
| <b>Columns</b>                    | <b>Recommended Uses and Applications</b>                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Page No.</b> |
| ZORBAX                            | <ul style="list-style-type: none"> <li>• General separation of basic, acidic, neutral compounds at low pH with different selectivity than SB columns; higher number of active silanols than SB</li> <li>• "Mixed mode" separation at more neutral pH values</li> </ul>                                                                                                                                                                          | 870             |
| ZORBAX ODS Classic (non-encapped) | <ul style="list-style-type: none"> <li>• General separation of basic, acidic, neutral compounds at mid-range to low pH with different selectivity than SB or XDB columns</li> </ul>                                                                                                                                                                                                                                                             | 870             |



## Poroshell 120

- Up to 90% of the efficiency of sub-2  $\mu\text{m}$
- 2X the efficiency of 3.5  $\mu\text{m}$
- Up to 50% less pressure than sub-2  $\mu\text{m}$  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  $\mu\text{m}$  particle with a 1.7  $\mu\text{m}$  solid core and 0.5  $\mu\text{m}$  porous outer layer. This small particle size provides high efficiency, similar to sub-2  $\mu\text{m}$  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

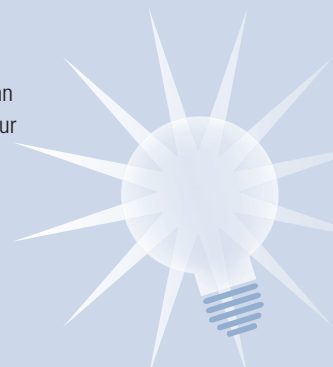
| Bonded Phase | Pore Size | Temp. Limits | pH Range | Endcapped | Carbon Load |
|--------------|-----------|--------------|----------|-----------|-------------|
| SB-C18       | 120Å      | 90°C         | 1.0-8.0  | No        | 8%          |
| EC-C18       | 120Å      | 60°C         | 2.0-8.0  | Double    | 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  $\mu\text{m}$  column is easy, and often requires only minor adjustments to your method and no revalidation. Learn more at [www.agilent.com/chem/poroshell120video](http://www.agilent.com/chem/poroshell120video)



**Poroshell 120**

| <b>Description</b> | <b>Size (mm)</b> | <b>Particle Size (µm)</b> | <b>SB-C18 USP L1</b> | <b>EC-C18 USP L1</b> | <b>EC-C8 USP L7</b> |
|--------------------|------------------|---------------------------|----------------------|----------------------|---------------------|
| 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.

For more information, visit [www.agilent.com/chem/education](http://www.agilent.com/chem/education)

## Superficially porous particles provide similar performance to sub-2 $\mu\text{m}$ particles

This Van Deemter curve shows that Poroshell 120 – a superficially porous, 2.7  $\mu\text{m}$  particle column – can deliver reduced plate heights similar to a 1.8  $\mu\text{m}$  column for similar efficiency.

✕ **Agilent Poroshell 120 EC-C18**

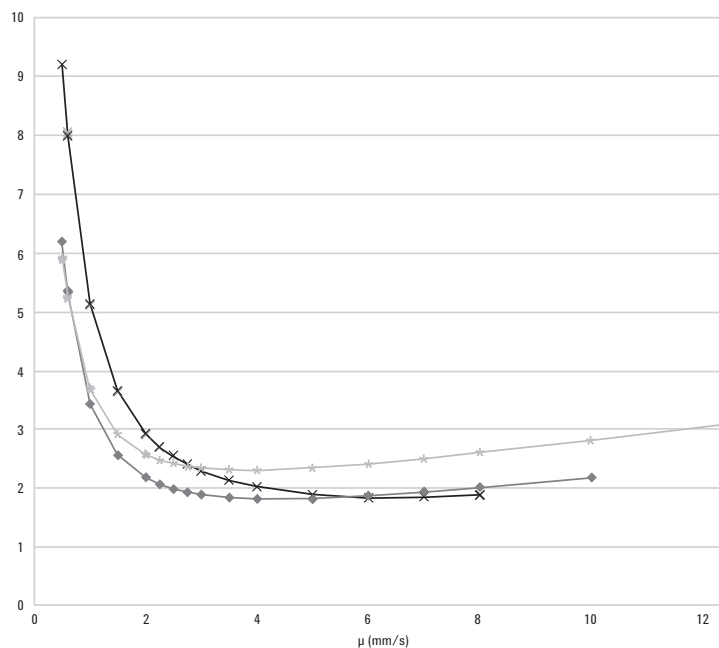
3.0 x 100 mm, 2.7  $\mu\text{m}$   
(USCFX01009)  
P/N 695975-302

◆ **Agilent ZORBAX Eclipse Plus C18**

3.0 x 100 mm, 1.8  $\mu\text{m}$   
(USUYB01455)  
P/N 959964-302

\* **Agilent ZORBAX Eclipse Plus C18**

3.0 x 100 mm, 3.5  $\mu\text{m}$   
(USUXV01435)  
P/N 959961-302



## UHPLC efficiency at HPLC pressures

**Column A: Poroshell 120 EC-C18**

695975-302  
3 x 100 mm, 2.7  $\mu\text{m}$

**Column B: Eclipse Plus C18**

959964-302  
3.0 x 100 mm, 1.8  $\mu\text{m}$

Mobile Phase: 60% Acetonitrile:40% Water

Flow Rate: 0.58 mL/min

Temperature: 60°C

Injection Volume: 4  $\mu\text{L}$

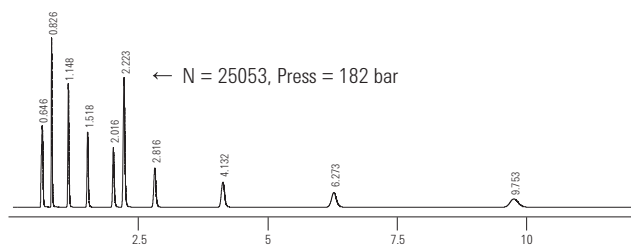
Detector: DAD Sig = 254.4 nm

Ref = 360,100 nm

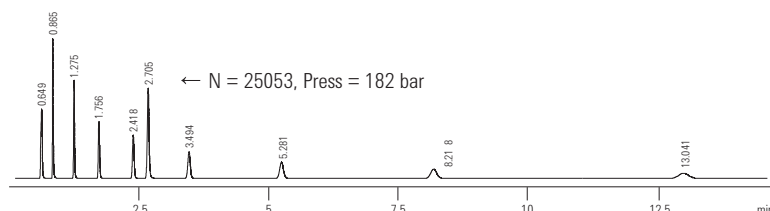
Sample: (PN 5188-6529) spiked w/50  $\mu\text{L}$

2 mg/mL Thiourea in  
water/acetonitrile (65:35)

**A** Agilent Poroshell 120 EC-C18, 3.0 x 100 mm, 2.7  $\mu\text{m}$   
PN 695975-302



**B** Agilent Eclipse Plus C18, 3.0 x 100 mm, 1.8  $\mu\text{m}$   
PN 959964-302

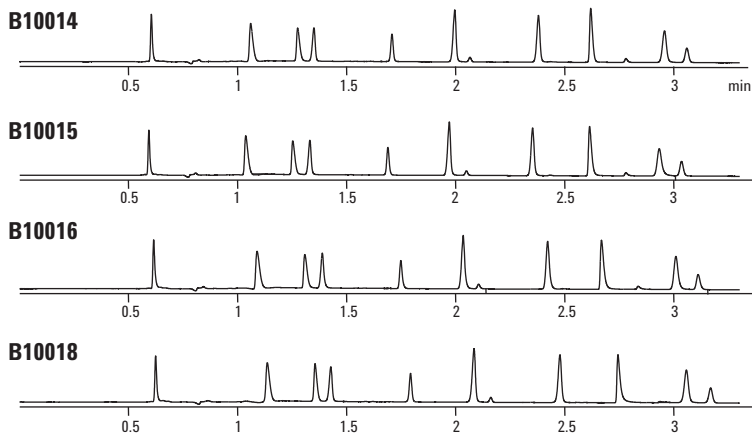


For this sample of neutral alkylphenones, the Poroshell 120 column delivered >90% of the efficiency attained by the 1.8  $\mu\text{m}$  column. Also note that the pressure on the Poroshell 120 column is about 50% of the pressure on the 1.8  $\mu\text{m}$  column.

**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  $\mu$ m  
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  $\mu$ m

**Column B:** Poroshell 120 EC-C8  
699975-306  
3.0 x 50 mm, 2.7  $\mu$ m

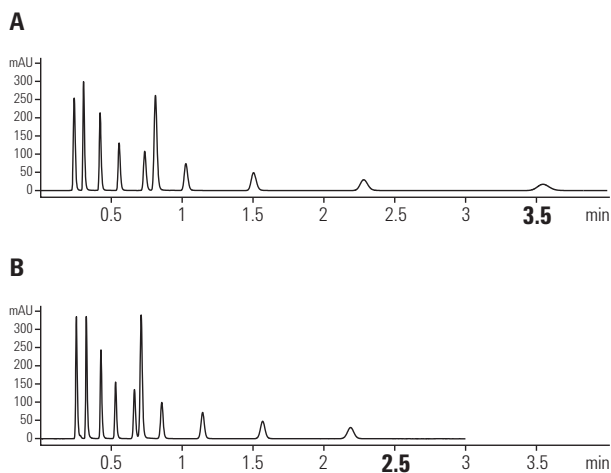
Mobile Phase: 60% CH<sub>3</sub>CN:40% H<sub>2</sub>O

Flow Rate: 0.85 mL/min

Temperature: 26°C

Detector: 254 nm

Sample: 2  $\mu$ L of RRLC Checkout Sample  
(PN 5188-6529), alkylphenones

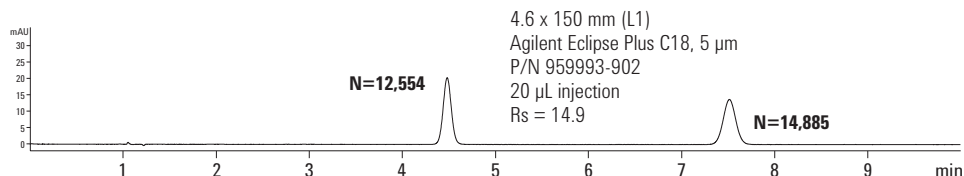


## USP method for Naproxen tablets – 4.5X faster analysis on Agilent Poroshell 120 at HPLC pressures

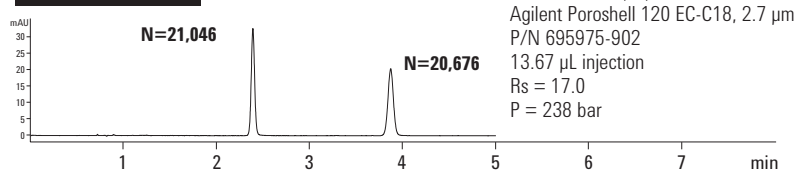
Mobile Phase: 50:49:1 MeCN:H<sub>2</sub>O  
Acetic Acid  
Flow Rate: 1.2 mL/min

1. Naproxen
2. Butyrophenone

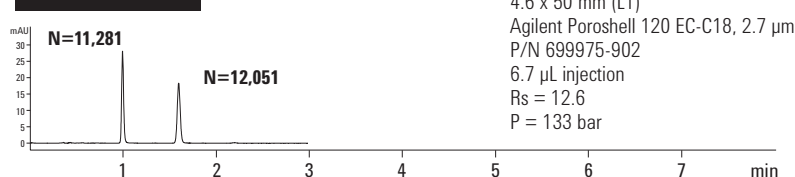
This Naproxen separation demonstrates how easy it can be to convert a method to Poroshell 120 columns without changing the flow rate or mobile phase.



### 2X Faster



### 4.5X Faster

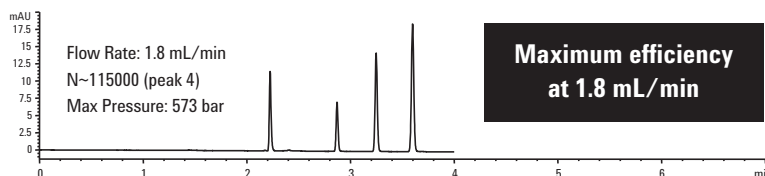
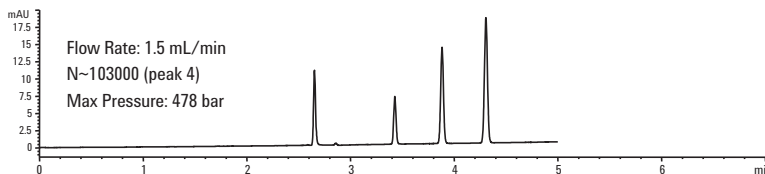
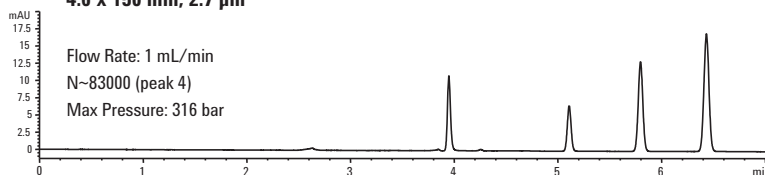


## Agilent Poroshell 120 columns in series deliver the highest efficiency at HPLC and UHPLC pressures

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**

LC2011\_120



## 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  $\mu\text{m}$  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  $\mu\text{m}$  particles. For standard methods, conventional 5  $\mu\text{m}$  and Rapid Resolution 3.5  $\mu\text{m}$  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 <sup>2</sup> /g | 60°C         | 2.0-9.0   | Double    | 9%          |
| ZORBAX Eclipse Plus C8           | 95Å       | 160 m <sup>2</sup> /g | 60°C         | 2.0-9.0   | Double    | 7%          |
| ZORBAX Eclipse PAH               | 95Å       | 160 m <sup>2</sup> /g | 60°C         | 2.0-8.0   | No        | 14%         |
| ZORBAX Eclipse Plus Phenyl-Hexyl | 95Å       | 160 m <sup>2</sup> /g | 60°C         | 2.0-8.0   | Double    | 9%          |

Specifications represent typical values only.

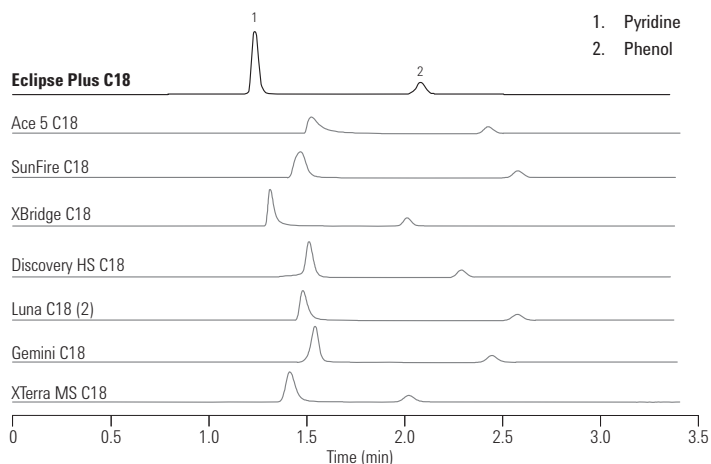
\*Column lifetime will be reduced significantly at pH >7 and temperature >40°C. At pH 6-9, highest column stability for all silica based columns is obtained by operating at temperatures <40°C and using lower buffer concentrations in range of 0.01-0.02 M, especially with phosphate and carbonate buffers.



## 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



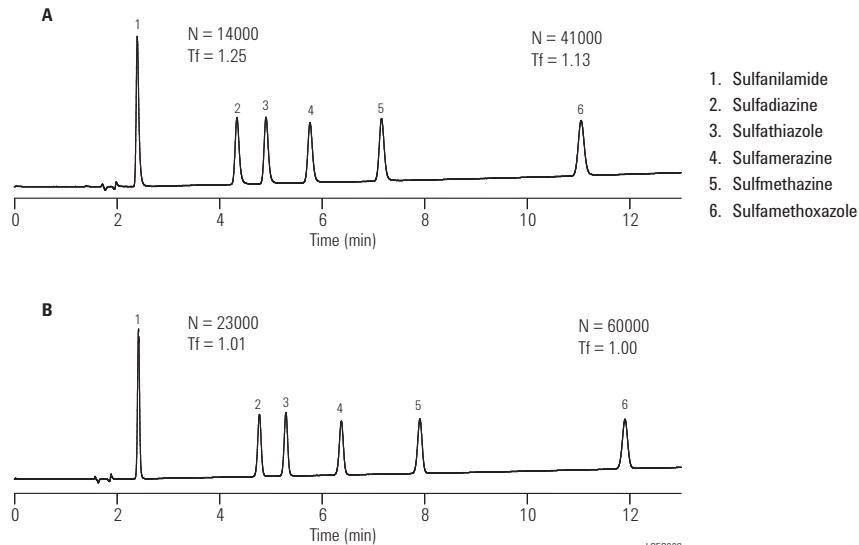
LCEC001

## 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

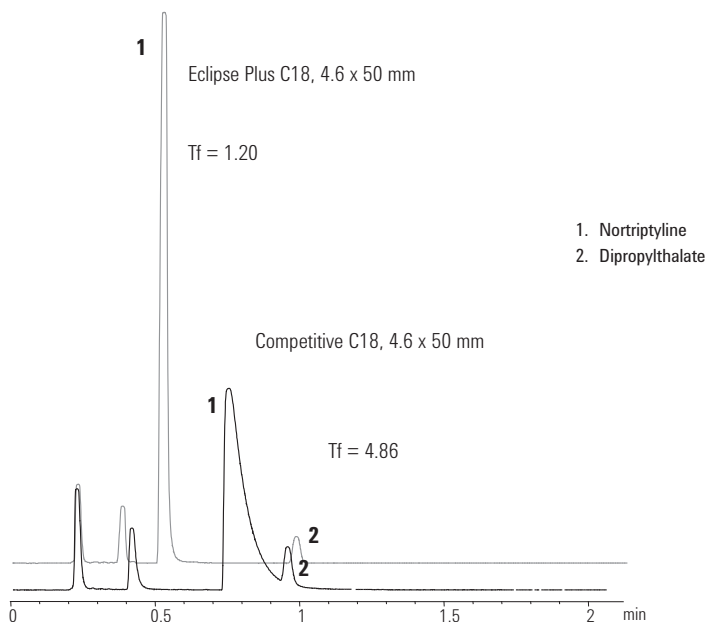


LCEC003

**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.

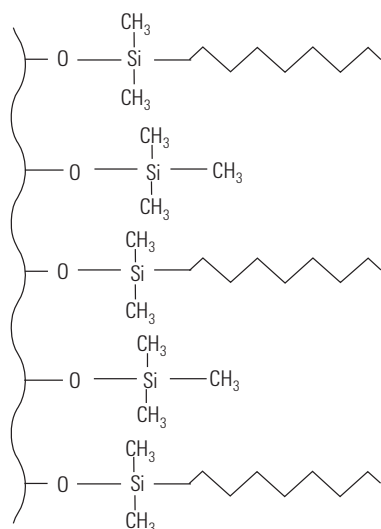
**Tips & Tools**

To learn more about Agilent's complete portfolio of services, please visit [www.agilent.com/chem/services](http://www.agilent.com/chem/services)



## 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                        |                    |
|  | Guard Cartridges, 4/pk       | 4.6 x 12.5 | 5                  | 820950-936              | 820950-937             | 820950-938                        | 820950-939         |
|  | Guard Cartridges, 4/pk       | 2.1 x 12.5 | 5                  | 821125-936              | 821125-937             | 821125-938                        | 821125-939         |
|  | 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  $\mu\text{m}$  to 7  $\mu\text{m}$
- 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  $\mu\text{m}$  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 <sup>2</sup> /g | 60°C         | 2.0-9.0   | Double    | 10%         |
| ZORBAX Eclipse XDB-C8     | 80Å       | 180 m <sup>2</sup> /g | 60°C         | 2.0-9.0   | Double    | 7.6%        |
| ZORBAX Eclipse XDB-Phenyl | 80Å       | 180 m <sup>2</sup> /g | 60°C         | 2.0-9.0   | Double    | 7.2%        |
| ZORBAX Eclipse XDB-CN     | 80Å       | 180 m <sup>2</sup> /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.

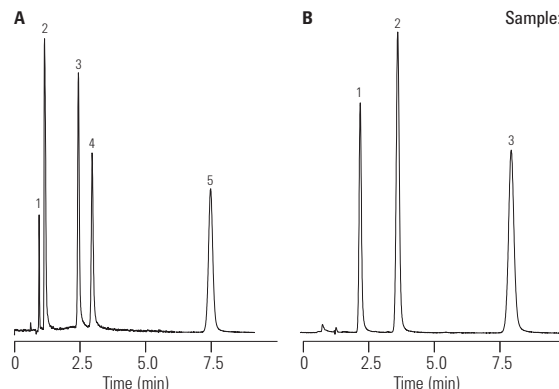
## Good Peak Shape Over a Wide pH Range with ZORBAX Eclipse XDB

**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.

LCEC004

## 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

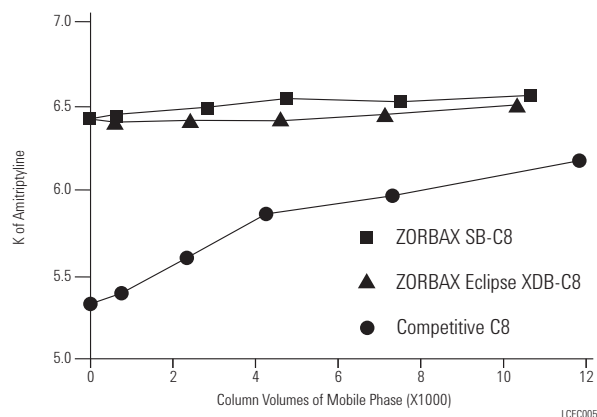
**Mobile Phase:** Purge Conditions:  
70% 50 mM NaAc-HCl, pH 3.0  
30% ACN

**Retention Test Conditions:**  
65% Methanol  
35% Water

**Flow Rate:** 1.0 mL/min

**Temperature:** 60°C

**Sample:** Tricyclic Antidepressants



LCEC005

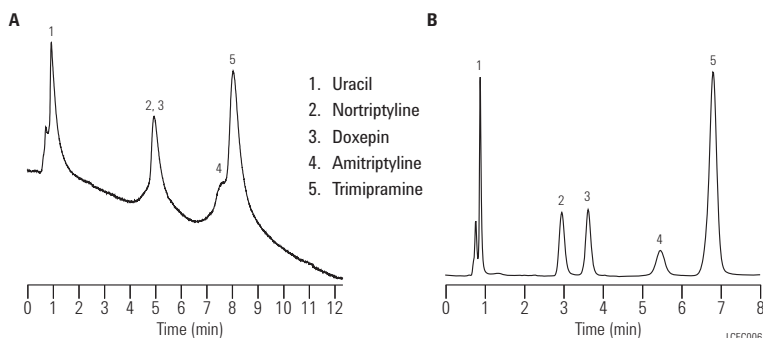
Eclipse XDB columns are stable over a wide pH range. At low pH an Eclipse endcapped column is extremely stable and shows equivalent stability to a non-endcapped column, SB-C8, at pH 3. The columns were purged with a pH 3 mobile phase at 60°C. Then they were tested with a strongly basic compound to determine 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



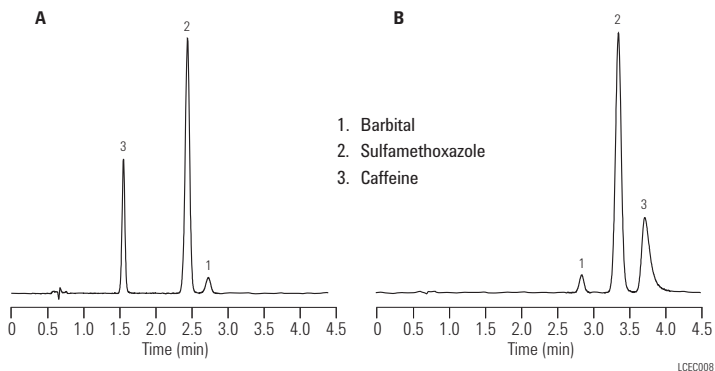
Double endcapping, dense bonding and the durable Rx-Sil particles (sol-type) combine to provide long lifetime at pH 7 when compared to single endcapped sil-gel columns used here. The conditions used for this test – high temperature (60°C) and high salt concentration (250 mM), accelerate the dissolution 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<sub>2</sub>PO<sub>4</sub>, 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

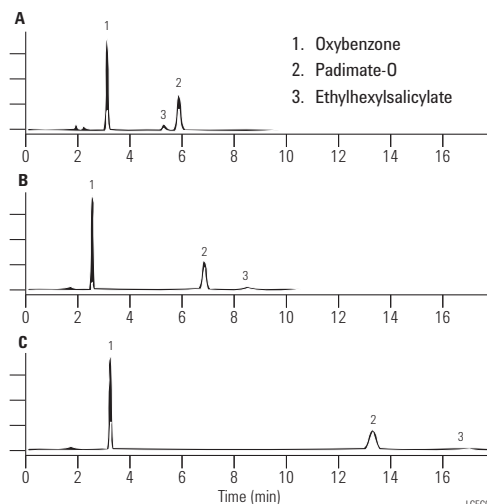
**Column A:** Eclipse XDB-Phenyl  
963967-912  
4.6 x 150 mm, 3.5  $\mu$ m

**Column B:** Eclipse XDB-C8  
963967-906  
4.6 x 150 mm, 3.5  $\mu$ m

**Column C:** Eclipse XDB-C18  
963967-902  
4.6 x 150 mm, 3.5  $\mu$ m

Mobile Phase: 15% H<sub>2</sub>O: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  $\mu$ m

**Column B:** Eclipse XDB-CN  
993967-905  
4.6 x 150 mm, 5  $\mu$ m

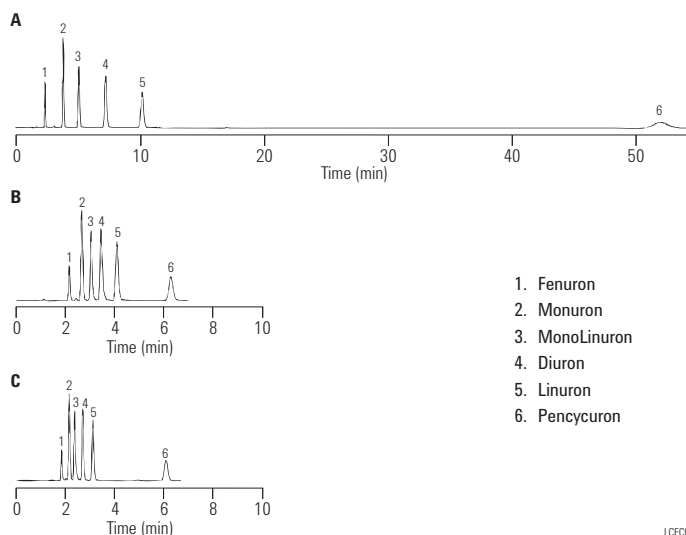
**Column C:** Eclipse XDB-C18  
993967-902  
4.6 x 150 mm, 5  $\mu$ m

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<br>XDB-C18<br>USP L1 | Eclipse<br>XDB-C8<br>USP L7 | Eclipse<br>XDB-Phenyl<br>USP L11 | Eclipse<br>XDB-CN<br>USP L10 |
|--------------------------------------------------------|-----------|--------------------|------------------------------|-----------------------------|----------------------------------|------------------------------|
| <b>Standard Columns (no special hardware required)</b> |           |                    |                              |                             |                                  |                              |
| 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<br>XDB-C18<br>USP L1 | Eclipse<br>XDB-C8<br>USP L7 | Eclipse<br>XDB-Phenyl<br>USP L11 | Eclipse<br>XDB-CN<br>USP L10 |
|-------------------------------------------------------------------------------------|---------------------------|------------|--------------------|------------------------------|-----------------------------|----------------------------------|------------------------------|
| <b>Standard Columns (no special hardware required)</b>                              |                           |            |                    |                              |                             |                                  |                              |
|                                                                                     | 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                   |                                  |                              |
|    | Guard Cartridges, 4/pk    | 4.6 x 12.5 | 5                  | 820950-925                   | 820950-926                  | 820950-927                       | 820950-935                   |
|    | Guard Cartridges, 4/pk    | 2.1 x 12.5 | 5                  | 821125-926                   | 821125-926                  | 821125-926                       | 821125-935                   |
|    | Guard Hardware Kit        |            |                    | 820999-901                   | 820999-901                  | 820999-901                       | 820999-901                   |
| <b>PrepHT Cartridge Columns (require endfittings kit 820400-901)</b>                |                           |            |                    |                              |                             |                                  |                              |
|    | PrepHT Cartridge          | 21.2 x 250 | 7                  | 977250-102                   | 977250-106                  |                                  |                              |
|    | PrepHT Cartridge          | 21.2 x 150 | 7                  | 977150-102                   | 977150-106                  |                                  |                              |
|    | PrepHT Cartridge          | 21.2 x 150 | 5                  | 970150-902                   | 970150-906                  |                                  |                              |
|    | PrepHT Cartridge          | 21.2 x 100 | 5                  | 970100-902                   | 970100-906                  |                                  |                              |
|    | PrepHT Cartridge          | 21.2 x 50  | 5                  | 970050-902                   | 970050-906                  |                                  |                              |
|    | PrepHT Guard Cartridge    | 17 x 7.5   | 5                  | 820212-925                   | 820212-926                  |                                  |                              |
|  | Guard Cartridge Hardware  |            |                    | 820444-901                   | 820444-901                  |                                  |                              |
|  | PrepHT endfittings, 2/pk  |            |                    | 820400-901                   | 820400-901                  |                                  |                              |

Unless indicated, column pressure limit is 400 bar.

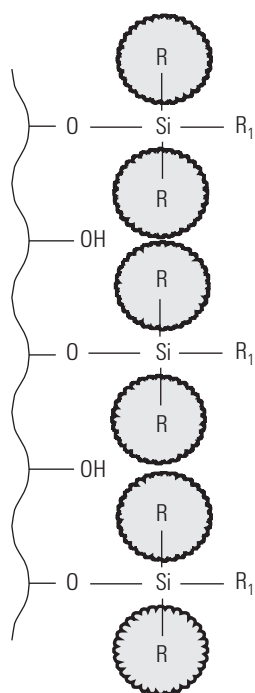
## ZORBAX Eclipse XDB

| Hardware                                                                            | Description                 | Size (mm) | Particle Size (µm) | Eclipse<br>XDB-C18<br>USP L1 | Eclipse<br>XDB-C8<br>USP L7 |
|-------------------------------------------------------------------------------------|-----------------------------|-----------|--------------------|------------------------------|-----------------------------|
| <b>Agilent Cartridge Columns (require hardware kit 5021-1845)</b>                   |                             |           |                    |                              |                             |
|  | Analytical                  | 4.6 x 250 | 5                  | 7995118-585                  | 7995108-585                 |
|  | Analytical                  | 4.6 x 150 | 5                  | 7995118-595                  | 7995108-595                 |
|  | Rapid Resolution            | 4.6 x 75  | 3.5                | 7995118-344                  | 7995108-344                 |
|  | 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<br>XDB-C18<br>USP L1 | Eclipse<br>XDB-C8<br>USP L7 |
|-------------------------------------------------------------------------|-----------------------------------------|-----------|--------------------|------------------------------|-----------------------------|
| <b>Standard Columns (no special hardware required)</b>                  |                                         |           |                    |                              |                             |
|                                                                         | 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                   |                             |
| <b>Rapid Resolution HT Cartridges (require hardware kit 820555-901)</b> |                                         |           |                    |                              |                             |
| 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                   |                             |
| <b>Capillary Glass-lined Columns</b>                                    |                                         |           |                    |                              |                             |
|                                                                         | 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 <sup>2</sup> /g | 90°C          | 0.8-8.0   | No        | 10%         |
| ZORBAX SB-C8     | 80Å       | 180 m <sup>2</sup> /g | 80°C          | 1.0-8.0   | No        | 5.5%        |
| ZORBAX SB-C3     | 80Å       | 180 m <sup>2</sup> /g | 80°C          | 1.0-8.0   | No        | 4%          |
| ZORBAX SB-Phenyl | 80Å       | 180 m <sup>2</sup> /g | 80°C          | 1.0-8.0   | No        | 5.5%        |
| ZORBAX SB-CN     | 80Å       | 180 m <sup>2</sup> /g | 80°C          | 1.0-8.0   | No        | 4%          |
| ZORBAX SB-Aq     | 80Å       | 180 m <sup>2</sup> /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)

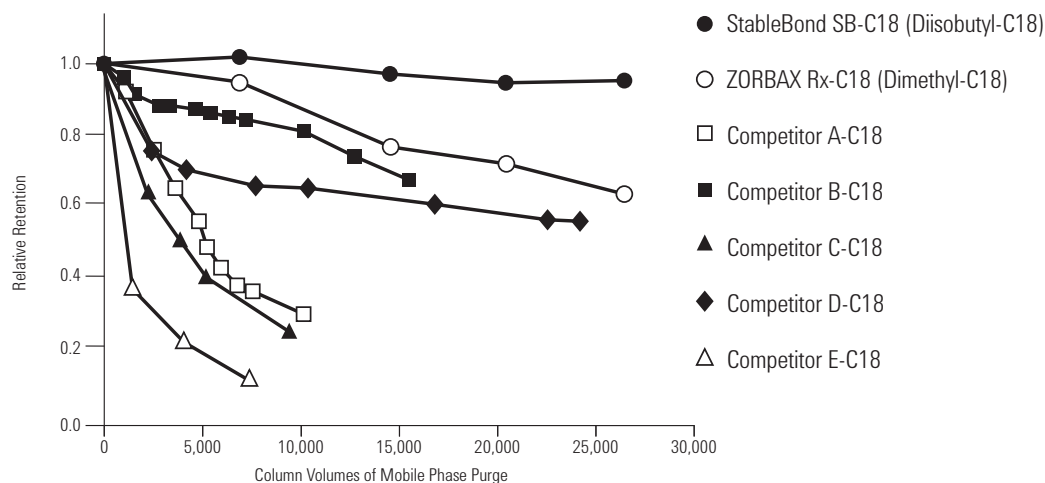
Column: **ZORBAX SB-C18**  
**883975-902**  
**4.6 x 150 mm, 5 µm**

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.



LCSB001

### 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

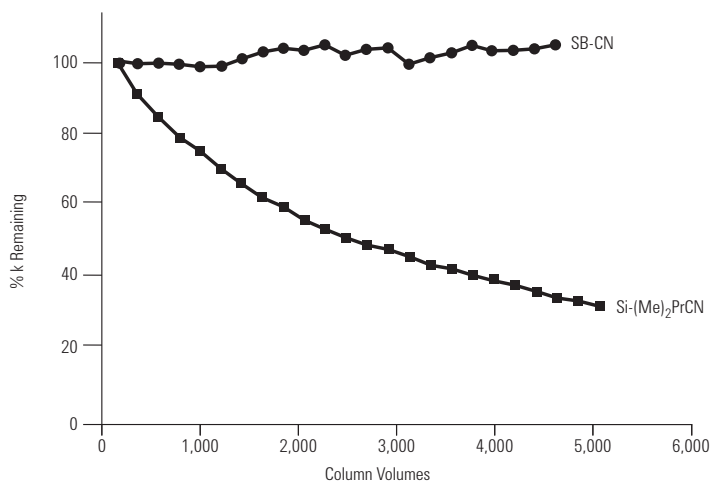
Flow Rate: 1 mL/min

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.



LCSB002

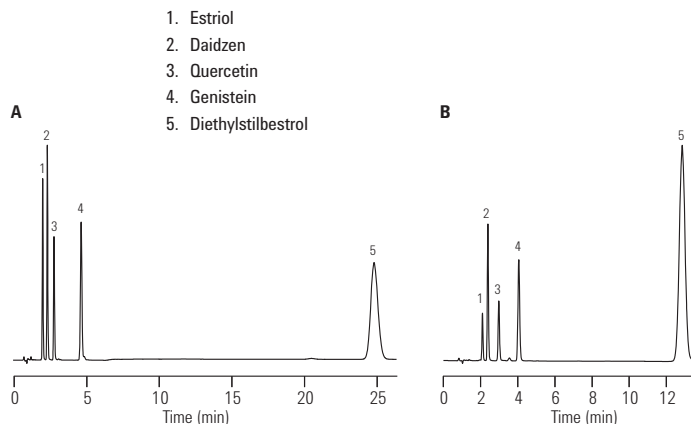
## SB-CN Optimizes Retention and Resolution

**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<sub>2</sub>PO<sub>4</sub>, 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.



## 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

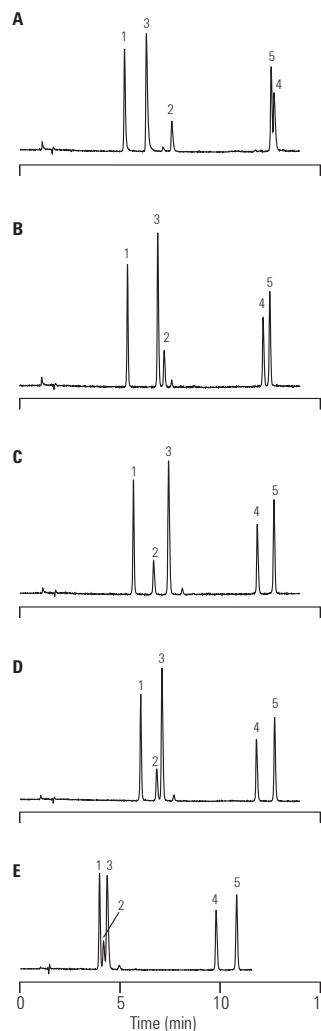
**Mobile Phase:** 0-100% B in 18.8 min  
A: 50 mM NaH<sub>2</sub>PO<sub>4</sub>,  
pH 2.5 in 95% H<sub>2</sub>O / 5% ACN  
B: 50 mM NaH<sub>2</sub>PO<sub>4</sub>,  
pH 2.5 in 47% H<sub>2</sub>O / 53% ACN

**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      |
|--------------------------------------------------------|-----------|--------------------|---------------|--------------|---------------|---------------|-------------------|------------|
| <b>Standard Columns (no special hardware required)</b> |           |                    |               |              |               |               |                   |            |
| 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      |
|--------------------------------------------------------|-----------|--------------------|---------------|--------------|---------------|---------------|-------------------|------------|
| <b>Standard Columns (no special hardware required)</b> |           |                    |               |              |               |               |                   |            |
| 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      |
|-------------------------------------------------------------------------------------|------------------------------|------------|--------------------|---------------|--------------|---------------|---------------|-------------------|------------|
| <b>Standard Columns (no special hardware required)</b>                              |                              |            |                    |               |              |               |               |                   |            |
|                                                                                     | 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    |               |               |                   |            |
|    | Guard Cartridge, 2/pk        | 9.4 x 15   | 7                  | 820675-115    | 820675-115   | 820675-124    | 820675-124    | 820675-115        |            |
|    | Guard Cartridge, 4/pk        | 4.6 x 12.5 | 5                  | 820950-920    | 820950-915   | 820950-916    | 820950-922    | 820950-917        | 820950-933 |
|    | Guard Cartridge, 4/pk        | 2.1 x 12.5 | 5                  | 821125-915    | 821125-915   | 821125-924    | 821125-924    | 821125-915        | 821125-933 |
|    | Guard Hardware Kit           | 9.4 x 15   | 0                  | 840140-901    | 840140-901   | 840140-901    | 840140-901    | 840140-901        |            |
|   | Guard Hardware Kit           |            |                    | 820999-901    | 820999-901   | 820999-901    | 820999-901    | 820999-901        | 820999-901 |
| <b>PrepHT Cartridge Columns (require endfittings kit 820400-901)</b>                |                              |            |                    |               |              |               |               |                   |            |
|  | PrepHT Cartridge             | 21.2 x 250 | 7                  | 877250-102    | 877250-106   | 877250-105    |               | 877250-112        | 877250-114 |
|  | PrepHT Cartridge             | 21.2 x 150 | 7                  | 877150-102    | 877150-106   |               |               |                   | 877150-114 |
|  | PrepHT Cartridge             | 21.2 x 150 | 5                  | 870150-902    | 870150-906   |               |               |                   | 870150-914 |
|  | PrepHT Cartridge             | 21.2 x 100 | 5                  | 870100-902    | 870100-906   |               |               |                   | 870100-914 |
|  | PrepHT Cartridge             | 21.2 x 50  | 5                  | 870050-902    | 870050-906   |               |               |                   | 870050-914 |
|  | 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<br>USP L1 | SB-C8<br>USP L7 | SB-Phenyl<br>USP L11 |
|-------------------------------------------------------------------------------------|----------------------------------|-----------|--------------------|------------------|-----------------|----------------------|
| <b>Agilent Cartridge Columns (require hardware kit 5021-1845)</b>                   |                                  |           |                    |                  |                 |                      |
|    | Analytical                       | 4.6 x 250 | 5                  | 7995218-585      | 7995208-585     |                      |
|    | Analytical                       | 4.6 x 150 | 5                  | 7995218-595      | 7995208-595     |                      |
|    | Rapid Resolution                 | 4.6 x 75  | 3.5                | 7995218-344      | 7995208-344     |                      |
|    | Guard Cartridges, 10/pk          | 4.0 x 4   | 5                  | 7995118-504      | 7995118-504     |                      |
|    | Cartridge Holder, 5021-1845      |           |                    | 5021-1845        | 5021-1845       |                      |
| <b>Standard Columns (no special hardware required)</b>                              |                                  |           |                    |                  |                 |                      |
|    | Rapid Resolution HT              | 4.6 x 50  | 1.8                | 822975-902       | 822975-906      |                      |
|    | Rapid Resolution HT, 3/pk        | 4.6 x 50  | 1.8                | 822975-932       |                 |                      |
|    | Narrow Bore RRHT                 | 2.1 x 50  | 1.8                | 822700-902       |                 |                      |
|    | Narrow Bore RRHT, 3/pk           | 2.1 x 50  | 1.8                | 822700-932       |                 |                      |
| <b>Rapid Resolution Cartridges (require hardware kit 820555-901)</b>                |                                  |           |                    |                  |                 |                      |
|    | Rapid Resolution Cartridge       | 4.6 x 30  | 3.5                | 833975-902       | 833975-906      | 833975-912           |
|    | Rapid Resolution Cartridge, 3/pk | 4.6 x 30  | 3.5                | 833975-932       | 833975-936      |                      |
|    | Rapid Resolution Cartridge       | 4.6 x 15  | 3.5                | 831975-902       | 831975-906      |                      |
|   | Rapid Resolution Cartridge, 3/pk | 4.6 x 15  | 3.5                | 831975-932       | 831975-936      |                      |
|  | Rapid Resolution Cartridge       | 2.1 x 30  | 3.5                | 873700-902       | 873700-906      |                      |
|  | Rapid Resolution Cartridge, 3/pk | 2.1 x 30  | 3.5                | 873700-932       | 873700-936      |                      |
|  | Rapid Resolution Cartridge       | 2.1 x 15  | 3.5                | 875700-902       | 875700-906      |                      |
|  | Rapid Resolution Cartridge, 3/pk | 2.1 x 15  | 3.5                | 875700-932       | 875700-936      |                      |

(Continued)

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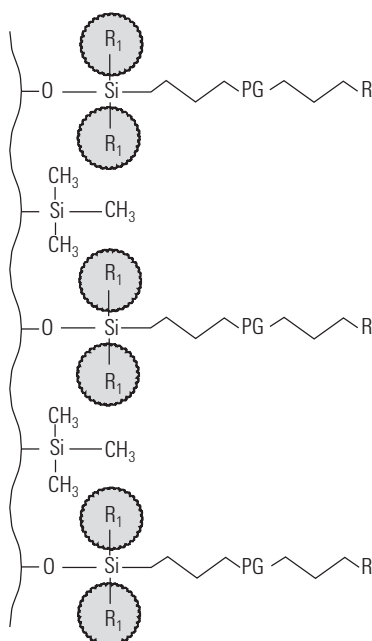


**ZORBAX 80Å StableBond**

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

**ZORBAX 80Å StableBond**

| Description                          | Size (mm) | Particle Size (µm) | SB-C18<br>USP L1 |
|--------------------------------------|-----------|--------------------|------------------|
| <b>Capillary Glass-lined Columns</b> |           |                    |                  |
| 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 <sup>2</sup> /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

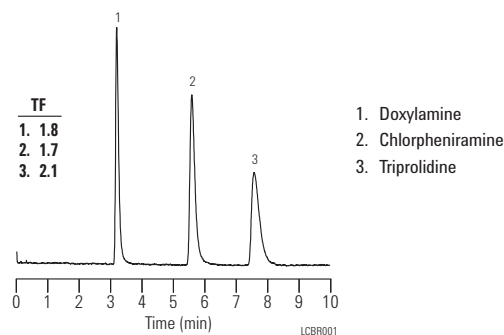
Mobile Phase: 75% 25 mM NH<sub>4</sub>OAc, pH 5.5

25% ACN

Flow Rate: 1.5 mL/min

Temperature: 40°C

Detector: 254 nm



#### Column: ZORBAX Bonus-RP

883668-901

4.6 x 150 mm, 5 µm

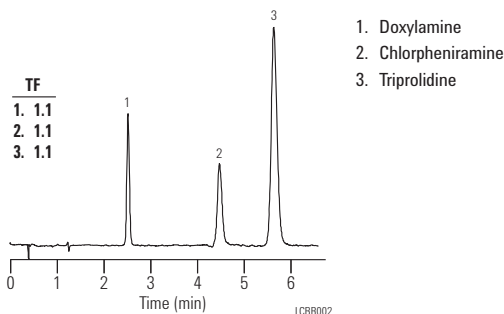
Mobile Phase: 80% 25 mM NH<sub>4</sub>OAc, pH 5.5

20% ACN

Flow Rate: 1.5 mL/min

Temperature: 40°C

Detector: 254 nm



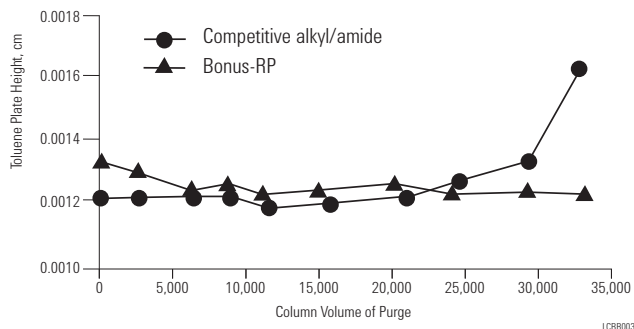
Bonus-RP eliminates peak tailing of these basic compounds in comparison to a typical alkyl C8 bonded phase. In the mid-pH region, residual silanols can interact more strongly with basic compounds to cause peak tailing. The polar group in the Bonus-RP bonded phase eliminates peak tailing of these basic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

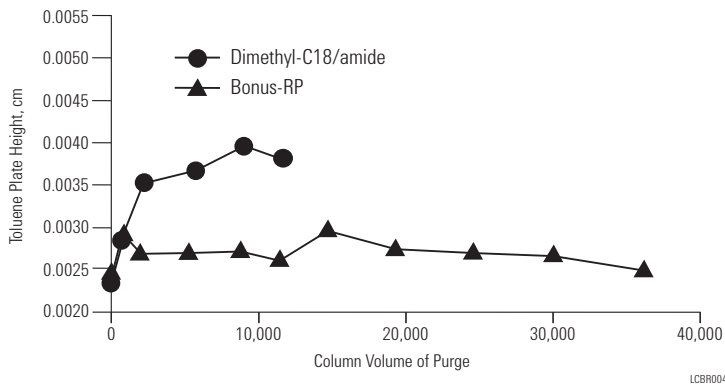
**Dimethyl-C18/amide, Bonus-RP**

**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<sub>2</sub>O

**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.

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**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

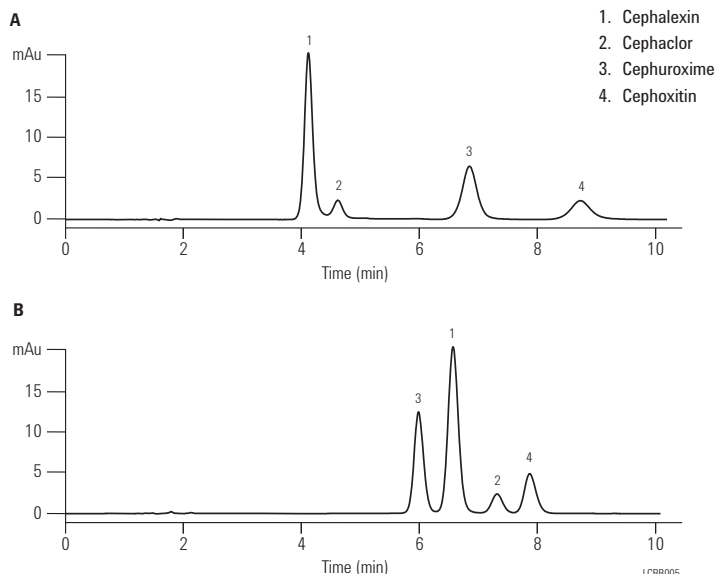
**Flow Rate:** 1.0 mL/min

**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 |
|--------------------------------------------------------|-----------|--------------------|------------------|
| <b>Standard Columns (no special hardware required)</b> |           |                    |                  |
| 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       |

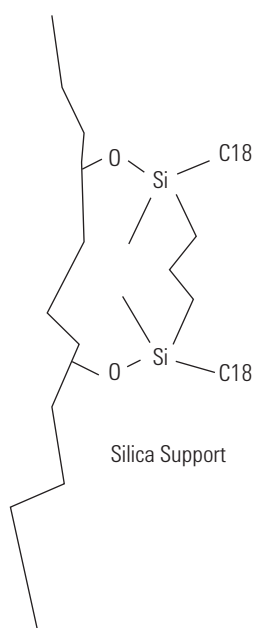
Unless indicated, column pressure limit is 400 bar.

(Continued)

**ZORBAX Bonus-RP**

| Hardware Description                                                                                             | Size (mm)  | Particle Size (µm) | Bonus-RP USP L60 |
|------------------------------------------------------------------------------------------------------------------|------------|--------------------|------------------|
| <b>Standard Columns (no special hardware required)</b>                                                           |            |                    |                  |
| 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        |
|  Guard Cartridge, 4/pk          | 4.6 x 12.5 | 5                  | 820950-928       |
|  Guard Cartridge, 4/pk         | 2.1 x 12.5 | 5                  | 821125-928       |
|  Guard Hardware Kit           |            |                    | 820999-901       |
| <b>PrepHT Cartridge Columns (require endfittings kit 820400-901)</b>                                             |            |                    |                  |
|  PrepHT Cartridge             | 21.2 x 250 | 7                  | 878250-101       |
|  PrepHT Cartridge             | 21.2 x 150 | 7                  | 878150-101       |
|  PrepHT Cartridge             | 21.2 x 150 | 5                  | 868150-901       |
|  PrepHT Cartridge             | 21.2 x 100 | 5                  | 868100-901       |
|  PrepHT Cartridge             | 21.2 x 50  | 5                  | 868050-901       |
|  PrepHT endfittings, 2/pk     |            |                    | 820400-901       |
|  PrepHT Guard Cartridge, 2/pk | 17 x 7.5   | 5                  | 820212-928       |
|  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 <sup>2</sup> /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.

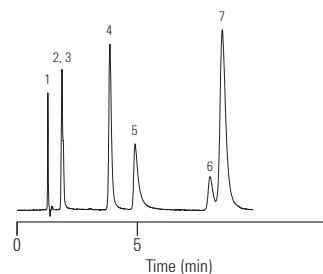
\*\*Above pH 6 highest column stability for all silica based columns is obtained by reducing the operating temperature to 40°C or below and using lower buffer concentrations (0.01-0.02 M) or organic buffers.

**Basic Antihistamines on Extend-C18 at High pH**

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

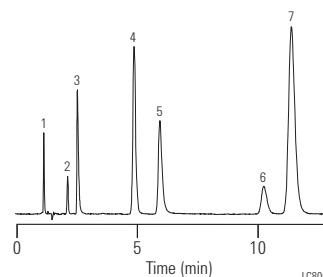
**Mobile Phase:** pH 7:  
30% 20 mM Na<sub>2</sub>HPO<sub>4</sub> 70% MeOH  
pH 11:  
30% 20 mM TEA 70% MeOH

**Flow Rate:** 1.0 mL/min  
**Temperature:** Ambient  
**Detector:** 254 nm  
**Sample:** Antihistamines

**pH 7**

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

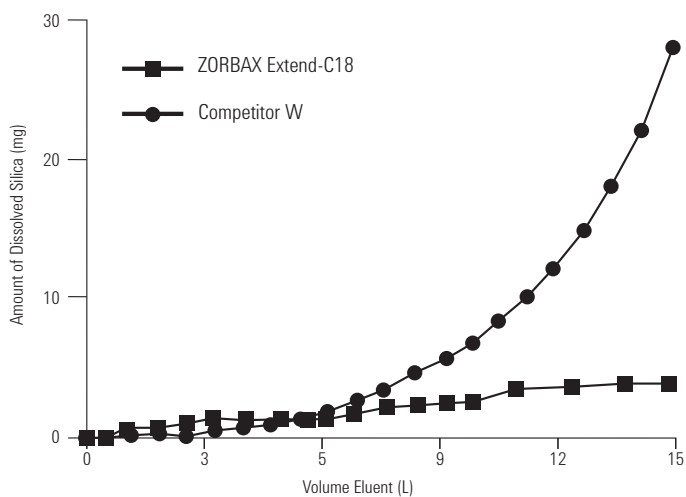
Pseudoephedrine and scopolamine are difficult to retain at low and mid pH. Pseudoephedrine is often analyzed by ion exchange methods. The Extend-C18 column retains these compounds in a noncharged form at high pH and improves resolution.

**pH 11****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.



**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<sub>2</sub>PO<sub>4</sub>, pH 3.0  
20% Methanol

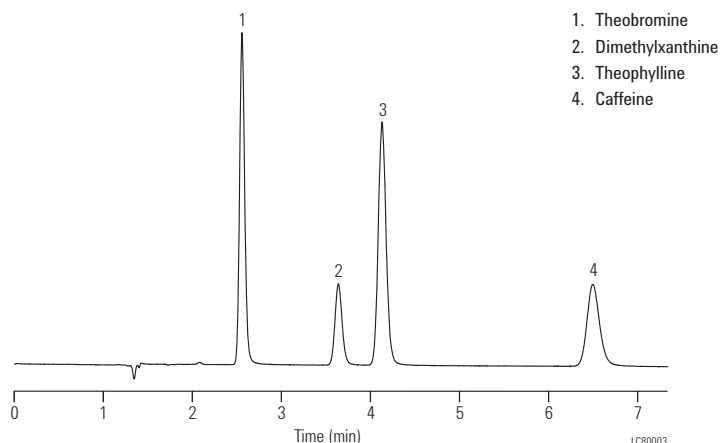
**Flow Rate:** 1.0 mL/min

**Temperature:** 35°C

**Detector:** 254 nm

**Sample:** Basic Compounds

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<br>USP L1 |
|--------------------------------------------------------|-----------|--------------------|----------------------|
| <b>Standard Columns (no special hardware required)</b> |           |                    |                      |
| 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<br>USP L1 |
|------------------------------------------------------------------------------------------------------------------|------------|--------------------|----------------------|
| <b>Standard Columns (no special hardware required)</b>                                                           |            |                    |                      |
| 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            |
|  Guard Cartridge, 4/pk        | 4.6 x 12.5 | 5                  | 820950-930           |
|  Guard Cartridge, 4/pk        | 2.1 x 12.5 | 5                  | 821125-930           |
|  Guard Hardware Kit           |            |                    | 820999-901           |
| <b>PrepHT Cartridge Columns (require endfittings kit 820400-901)</b>                                             |            |                    |                      |
|  PrepHT Cartridge             | 21.2 x 150 | 5                  | 770150-902           |
|  PrepHT                       | 21.2 x 100 | 5                  | 770100-902           |
|  PrepHT                       | 21.2 x 50  | 5                  | 770050-902           |
|  PrepHT endfittings, 2/pk     |            |                    | 820400-901           |
|  PrepHT Guard Cartridge, 2/pk | 17 x 7.5   | 5                  | 820212-930           |
|  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-encapped
- 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 <sup>2</sup> /g | 60°C         | 2.0-8.0   | No        | 12%         |
| ZORBAX Rx-C8  | 80Å       | 180 m <sup>2</sup> /g | 80°C         | 1.0-8.0   | No        | 5.5%        |

Specifications represent typical values only.

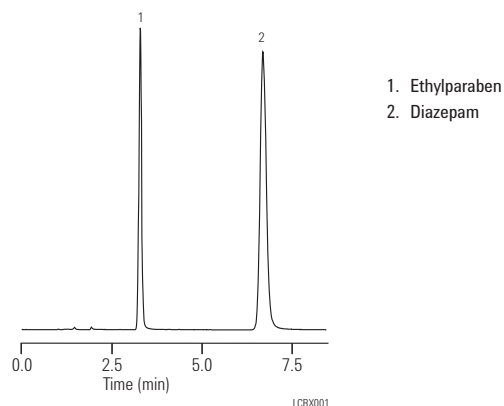
\*At pH 6-9 highest column stability for all silica based columns is obtained by operating at temperatures <40°C and using lower buffer concentrations in the range of 0.01-0.02 M.

## Analysis of Diazepam on Rx-C18

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

Mobile Phase: 35% H<sub>2</sub>O:65% MeOH  
Flow Rate: 0.5 mL/min

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    |               |
|    | Guard Cartridge, 2/pk        | 9.4 x 15   | 7                  | 820675-115    | 820675-115    |
|    | Guard Cartridge, 4/pk        | 4.6 x 12.5 | 5                  | 820950-914    | 820950-913    |
|    | Guard Cartridge, 4/pk        | 2.1 x 12.5 | 5                  | 821125-915    | 821125-915    |
|    | Guard Hardware Kit           | 9.4 x 15   |                    | 840140-901    | 840140-901    |
|    | Guard Hardware Kit           |            |                    | 820999-901    | 820999-901    |
| <b>PrepHT Cartridge Columns (require endfittings kit 820400-901)</b>                |                              |            |                    |               |               |
|    | PrepHT Cartridge             | 21.2 x 250 | 7                  | 877967-102    | 877250-106    |
|   | PrepHT Cartridge             | 21.2 x 150 | 7                  |               | 877150-106    |
|  | PrepHT Cartridge             | 21.2 x 150 | 5                  |               | 870150-906    |
|  | PrepHT Cartridge             | 21.2 x 100 | 5                  |               | 870100-906    |
|  | PrepHT Cartridge             | 21.2 x 50  | 5                  |               | 870050-906    |
|  | PrepHT Guard Cartridge, 2/pk |            | 5                  | 820212-914    | 820212-915    |
|  | Guard Cartridge Hardware     |            |                    | 820444-901    | 820444-901    |
|  | 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.

#### 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.

To learn more, visit [www.agilent.com/chem/OnlineLibrary](http://www.agilent.com/chem/OnlineLibrary)



### Pursuit XRs<sup>Ultra</sup> 2.8

For the ultimate in speed and good resolution on any instrument, we designed the Pursuit XRs<sup>Ultra</sup> 2.8 around an optimized 2.8  $\mu\text{m}$  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  $\mu\text{m}$  particles of ultra-pure silica delivers 10-15% higher efficiency than 3  $\mu\text{m}$  columns.

### Pursuit UPS<sup>2.4</sup>

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

### Pursuit UPS<sup>1.9</sup>

Pursuit UPS<sup>1.9</sup> columns deliver sub-2  $\mu\text{m}$  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 <sup>2</sup> /g | 1.5-10   | Yes       | 12.9%       | 1.1 mL/g    | 3.5 $\mu\text{mol}/\text{m}^2$ |
| Pursuit C8                                | 200Å      | 200 m <sup>2</sup> /g | 1.5-10   | Yes       | 7.4%        | 1.1 mL/g    | 3.8 $\mu\text{mol}/\text{m}^2$ |
| Pursuit Diphenyl                          | 200Å      | 200 m <sup>2</sup> /g | 1.5-8.0  | Yes       | 7.3%        | 1.1 mL/g    | 2.8 $\mu\text{mol}/\text{m}^2$ |
| Pursuit PFP                               | 200Å      | 200 m <sup>2</sup> /g | 1.5-10   | Yes       | 6.3%        | 1.1 mL/g    | 3.4 $\mu\text{mol}/\text{m}^2$ |
| Pursuit PAH                               | 200Å      | 200 m <sup>2</sup> /g | 1.5-10   | Yes       |             | 1.1 mL/g    |                                |
| Pursuit XRs C18                           | 100Å      | 440 m <sup>2</sup> /g | 1.5-10   | Yes       | 22%         | 1.1 mL/g    | 2.9 $\mu\text{mol}/\text{m}^2$ |
| Pursuit XRs C8                            | 100Å      | 440 m <sup>2</sup> /g | 1.5-10   | Yes       | 15%         | 1.1 mL/g    | 3.7 $\mu\text{mol}/\text{m}^2$ |
| Pursuit XRs Diphenyl                      | 100Å      | 440 m <sup>2</sup> /g | 1.5-8.0  | Yes       | 14.6%       | 1.1 mL/g    | 2.6 $\mu\text{mol}/\text{m}^2$ |
| Pursuit XRs Si                            | 100Å      | 440 m <sup>2</sup> /g | 1.5-10   | Yes       |             | 1.1 mL/g    |                                |
| Pursuit XRs <sup>Ultra</sup> 2.8 C18      | 100Å      | 440 m <sup>2</sup> /g | 1.5-10   | Yes       | 23.2%       | 1.1 mL/g    | 3.2 $\mu\text{mol}/\text{m}^2$ |
| Pursuit XRs <sup>Ultra</sup> 2.8 C8       | 100Å      | 440 m <sup>2</sup> /g | 1.5-10   | Yes       | 15%         | 1.1 mL/g    | 3.7 $\mu\text{mol}/\text{m}^2$ |
| Pursuit XRs <sup>Ultra</sup> 2.8 Diphenyl | 100Å      | 440 m <sup>2</sup> /g | 1.5-8.0  | Yes       | 14.6%       | 1.1 mL/g    | 2.6 $\mu\text{mol}/\text{m}^2$ |
| Pursuit UPS <sup>2.4</sup> C18            | 100Å      | 350 m <sup>2</sup> /g | 1.5-10   | Yes       | 21%         | 0.9 mL/g    | 2.5 $\mu\text{mol}/\text{m}^2$ |
| Pursuit UPS <sup>1.9</sup> C18            | 100Å      | 350 m <sup>2</sup> /g | 1.5-10   | Yes       | 21%         | 0.9 mL/g    | 3.0 $\mu\text{mol}/\text{m}^2$ |

Specifications represent typical values only.

## Tricyclic antidepressants and benzodiazepines

**Column:** Pursuit XR<sup>®</sup> C18  
A6000150X046  
4.6 x 150 mm, 5 µm

**Mobile Phase:** A: Water+0.1% HCOOH  
B: MeCN+0.1% HCOOH

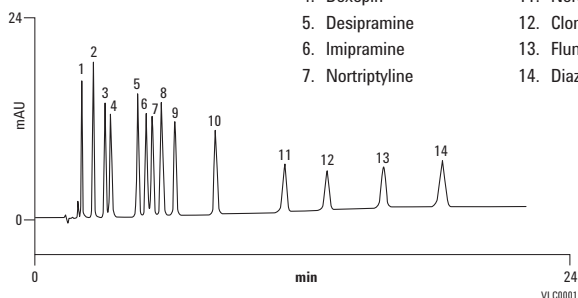
**Gradient:** 30-40% B in 15 min, hold at 40% B for 15 min

**Flow Rate:** 1.0 mL/min

**Temperature:** Ambient

**Detector:** UV, 254 nm

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



## Mechanical stability of Pursuit XR<sup>®</sup>s

**Column:** Pursuit XR<sup>®</sup> 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

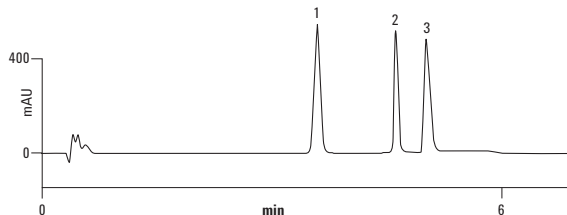
**Flow Rate:** 0.4 mL/min

**Temperature:** Ambient

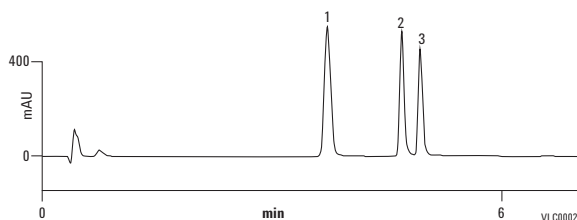
**Detector:** UV, 254 nm

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

Injection 1



Injection 5000



**Antifungals**

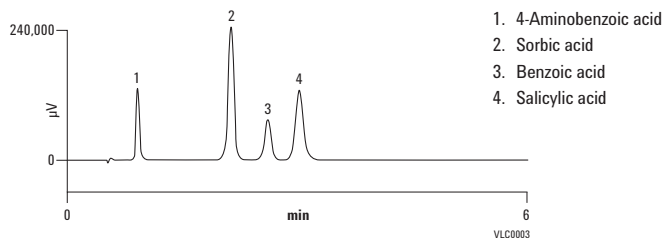
**Column:** Pursuit XR<sup>Ultra</sup> 2.8 Diphenyl  
A7521050X020  
2 x 50 mm, 2.8 µm

**Mobile Phase:** Water+0.1% HCOOH:MeCN+0.1%  
HCOOH, 80:20

**Flow Rate:** 0.4 mL/min

**Temperature:** Ambient

**Detector:** UV, 254 nm

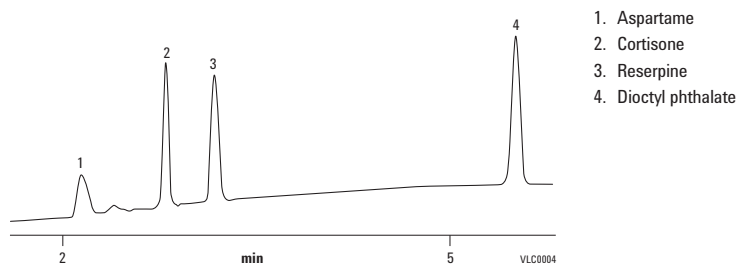
**Liquid chromatography phase test mixture (LPTM) on Pursuit C8**

**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

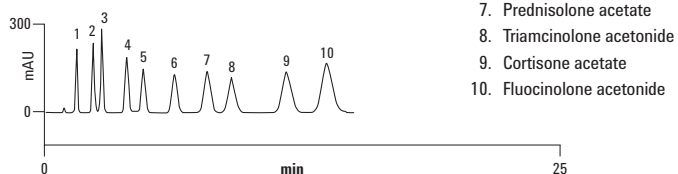
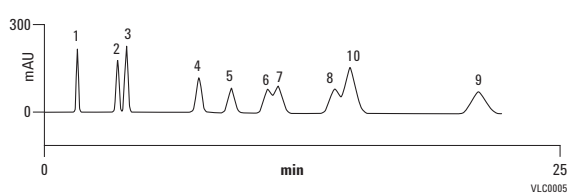
**Adrenocorticosteroids on Pursuit PFP and C18**

**Mobile Phase:** MeCN:water, 22.5:77.5

**Flow Rate:** 1.5 mL/min

**Temperature:** Ambient

**Detector:** UV, 240 nm

**Pursuit PFP****Pursuit C18**



## Pursuit HPLC Columns

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

## Pursuit ChromSep Replacement Cartridges

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

## Pursuit XRs HPLC Columns

| Size (mm)  | Particle Size (µm) | Pursuit XRs C18<br>USP L1 | Pursuit XRs C8<br>USP L7 | Pursuit XRs Diphenyl | Pursuit XRs Si<br>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 XR<sup>s</sup>Ultra 2.8 HPLC Columns**

| Size (mm) | Particle Size (µm) | Pursuit XR <sup>s</sup> Ultra 2.8 C18 | Pursuit XR <sup>s</sup> Ultra 2.8 C8 | Pursuit XR <sup>s</sup> Ultra 2.8 Diphenyl |
|-----------|--------------------|---------------------------------------|--------------------------------------|--------------------------------------------|
| 3.0 x 150 | 2.8                | A7501150X030                          | A75111150X030                        |                                            |
| 3.0 x 100 | 2.8                | A7501100X030                          |                                      |                                            |
| 2.0 x 150 | 2.8                | A7501150X020                          |                                      |                                            |
| 2.0 x 100 | 2.8                | A7501100X020                          | A75111100X020                        | A7521100X020                               |
| 2.0 x 50  | 2.8                | A7501050X020                          | A7511050X020                         | A7521050X020                               |
| 2.0 x 30  | 2.8                | A7501030X020                          | A7511030X020                         | A7521030X020                               |

**Pursuit UPS<sup>2.4</sup> HPLC Columns**

| Size (mm) | Particle Size (µm) | Pursuit UPS <sup>2.4</sup> |
|-----------|--------------------|----------------------------|
| 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<sup>1.9</sup> HPLC Columns**

| Size (mm) | Particle Size (µm) | Pursuit UPS <sup>1.9</sup> C18 | Pursuit UPS <sup>1.9</sup> 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                       |

**Tips & Tools**

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

For more information, visit [www.agilent.com/chem/education](http://www.agilent.com/chem/education)



## 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

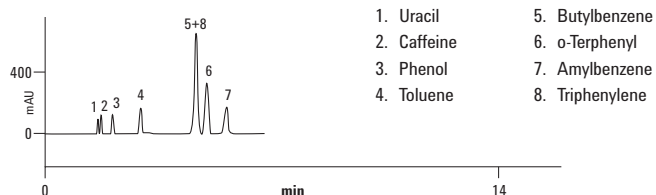
| Bonded Phase      | Pore Size | Surface Area          | Carbon Load | Endcapped | Pore Volume            | Ligand Coverage         |
|-------------------|-----------|-----------------------|-------------|-----------|------------------------|-------------------------|
| Polaris C18-A     | 180Å    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

Specifications represent typical values only.

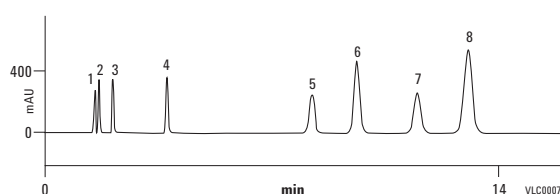
## Selectivity test mix for Polaris columns

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

## Polaris C8-A

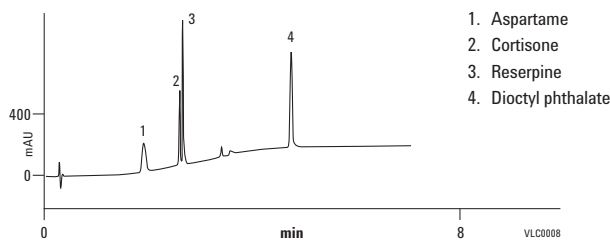


## Polaris C18-A



## 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



## 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 |

## Tips &amp; Tools

To learn more about Agilent's complete portfolio of services, please visit [www.agilent.com/chem/services](http://www.agilent.com/chem/services)



**Polaris ChromSep Complete Cartridge Systems**

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

**Polaris ChromSep Replacement Cartridges**

| Hardware                                                                            | Size (mm) | Particle Size (µm) | Unit | Polaris C18-A |
|-------------------------------------------------------------------------------------|-----------|--------------------|------|---------------|
|    | 4.6 x 250 | 5                  |      | A2000250R046  |
|                                                                                     |           |                    | 3/pk | A2000250T046  |
|    | 4.6 x 150 | 5                  |      | A2000150R046  |
|                                                                                     |           |                    | 3/pk | A2000150T046  |
|  | 4.6 x 100 | 5                  |      | A2000100R046  |
|                                                                                     |           |                    | 3/pk | A2000100T046  |
|  | 4.6 x 150 | 3                  |      | A2001150R046  |
|                                                                                     |           |                    | 3/pk | A2001150T046  |
|  | 4.6 x 100 | 3                  |      | A2001100R046  |
|                                                                                     |           |                    | 3/pk | A2001100T046  |
|  | 3.0 x 150 | 5                  |      | A2000150R030  |
|                                                                                     |           |                    | 3/pk | A2000150T030  |
|  | 3.0 x 100 | 5                  |      | A2000100R030  |
|                                                                                     |           |                    | 3/pk | A2000100T030  |
|  | 3.0 x 100 | 3                  |      | A2001100R030  |
|                                                                                     |           |                    | 3/pk | A2001100T030  |
|  | 2.0 x 150 | 3                  |      | A2001150R020  |
|                                                                                     |           |                    | 3/pk | A2001150T020  |
|  | 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 |
|-------------------------------------------------------------------------------------|----------------------------|------------|--------------------|------------------|------------|----------------|------------|-------------|
| <b>Standard Columns (no special hardware required)</b>                              |                            |            |                    |                  |            |                |            |             |
|                                                                                     | 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       |            |                |            |             |
| <b>Guard Columns (hardware required)</b>                                            |                            |            |                    |                  |            |                |            |             |
|    | Guard Cartridge, 2/pk      | 9.4 x 15   | 7                  | 820675-115       | 820675-115 | 820675-115     | 820675-124 |             |
|    | Guard Cartridge, 4/pk      | 4.6 x 12.5 | 5                  | 820950-902       | 820950-906 | 820950-912     | 820950-905 | 820950-924  |
|    | Guard Hardware Kit         |            |                    | 840140-901       | 840140-901 | 840140-901     | 840140-901 | 840140-901  |
|    | Guard Hardware Kit         |            |                    | 820999-901       | 820999-901 | 820999-901     | 820999-901 | 820999-901  |
| <b>PrepHT Cartridge Columns (require endfittings kit 820400-901)</b>                |                            |            |                    |                  |            |                |            |             |
|  | PrepHT Cartridge           | 21.2 x 250 | 7                  | 877952-102       | 877952-106 |                | 877952-105 |             |
|  | 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 <sup>2</sup> /g | 60°C         | 2.0-8.0   | Yes       | 12%         |
| HC-C18 (2)   | 170Å      | 290 m <sup>2</sup> /g | 60°C         | 2.0-9.0   | Yes       | 17%         |

Specifications represent typical values only.

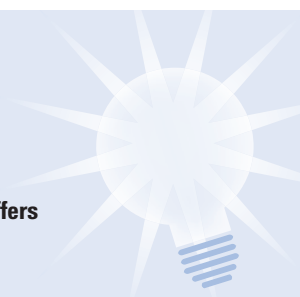
## Agilent HC-C18(2) and TC-C18(2)

| 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 |

## Tips &amp; Tools

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## 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  $\mu\text{m}$  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

- Cyanopropyl dimethylsilane 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 <sup>2</sup> /g | 0-8.0    | No        |             |
| ZORBAX Eclipse XDB-CN  | 80Å       | 180 m <sup>2</sup> /g | 2.0-8.0  | Yes       | 4.3%        |
| ZORBAX SIL             | 70Å       | 300 m <sup>2</sup> /g | 0-8.0    | No        |             |
| ZORBAX CN              | 70Å       | 300 m <sup>2</sup> /g | 2.0-7.0  | Yes       | 7%          |
| ZORBAX NH <sub>2</sub> | 70Å       | 300 m <sup>2</sup> /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)

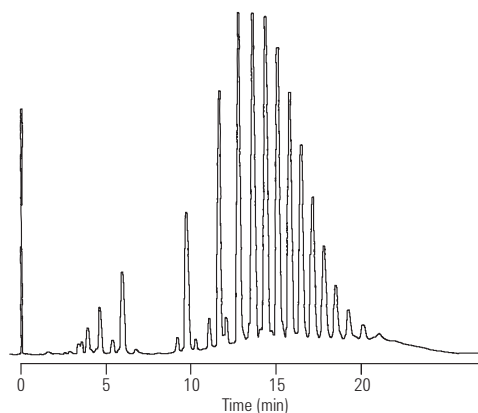
**Flow Rate:** 2 mL/min

**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)



LCN001

## Normal-Phase Columns Based on ZORBAX Rx-SIL

| Hardware                                                                            | Description                  | Size (mm)  | Particle Size (μm) | Rx-SIL<br>USP L3 | Eclipse<br>XDB-CN<br>USP L10 |
|-------------------------------------------------------------------------------------|------------------------------|------------|--------------------|------------------|------------------------------|
| <b>Standard Columns (no special hardware required)</b>                              |                              |            |                    |                  |                              |
|                                                                                     | 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       |                              |
| <b>Guard Columns (hardware required)</b>                                            |                              |            |                    |                  |                              |
|    | Guard Cartridge, 2/pk        | 9.4 x 15   | 5                  | 820675-119       |                              |
|    | Guard Cartridges, 4/pk       | 4.6 x 12.5 | 5                  | 820950-919       | 820950-935                   |
|    | Guard Cartridge, 4/pk        | 2.1 x 12.5 | 5                  | 821125-919       | 821125-935                   |
|    | Guard Hardware Kit           | 9.4 x 15   | 0                  | 840140-901       |                              |
|    | Guard Hardware Kit           |            |                    | 820999-901       | 820999-901                   |
| <b>PrepHT Cartridge Columns (require endfittings kit 820400-901)</b>                |                              |            |                    |                  |                              |
|   | PrepHT Cartridge             | 21.2 x 250 | 7                  | 877250-101       |                              |
|  | PrepHT Cartridge             | 21.2 x 250 | 7                  |                  |                              |
|  | PrepHT endfittings, 2/pk     |            |                    | 820400-901       |                              |
|  | PrepHT Guard Cartridge, 2/pk | 17 x 7.5   | 5                  | 820212-919       |                              |
|  | 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 |
|----------------------------------------------------------------------------------------------------------------|------------|--------------------|------------|------------|------------|-----------------------|
| <b>Standard Columns (no special hardware required)</b>                                                         |            |                    |            |            |            |                       |
| 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 |                       |
| <b>Guard Columns (hardware required)</b>                                                                       |            |                    |            |            |            |                       |
|  Guard Cartridge, 2/pk        | 9.4 x 15   | 5                  | 820675-119 | 820675-111 | 820675-111 |                       |
|  Guard Cartridges, 4/pk       | 4.6 x 12.5 | 5                  | 820950-901 | 820950-905 | 820950-908 | 820950-908            |
|  Guard Cartridge, 4/pk        | 2.1 x 12.5 | 5                  |            |            |            |                       |
|  Guard Hardware Kit           | 9.4 x 15   |                    | 840140-901 | 840140-901 | 840140-901 |                       |
|  Guard Hardware Kit           |            |                    | 820999-901 | 820999-901 | 820999-901 | 820888-901            |
| <b>PrepHT Cartridge Columns (require endfittings kit 820400-901)</b>                                           |            |                    |            |            |            |                       |
|  PrepHT Cartridge             | 21.2 x 250 | 7                  | 877952-101 |            |            |                       |
|  PrepHT Cartridge             | 21.2 x 250 | 7                  |            | 877952-105 | 877952-108 |                       |
|  PrepHT endfittings, 2/pk     |            |                    | 820400-901 | 820400-901 | 820400-901 |                       |
|  PrepHT Guard Cartridge, 2/pk | 17 x 7.5   | 5                  |            |            |            |                       |
|  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  $\mu\text{m}$  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 <sup>2</sup> /g | 0-8.0    |

Specifications represent typical values only.

### 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.

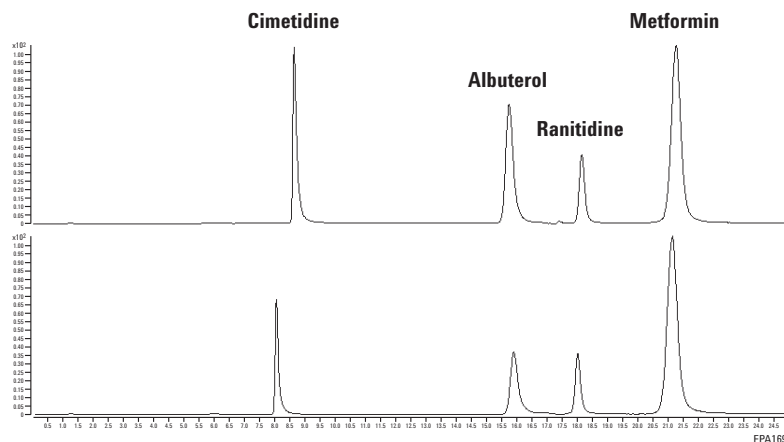
To learn more, visit [www.agilent.com/chem/OnlineLibrary](http://www.agilent.com/chem/OnlineLibrary)



**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  $\mu$ m**  
**Mobile Phase:** 90% Acetonitrile: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 ( $\mu$ m) | 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  $\mu\text{m}$ , 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.

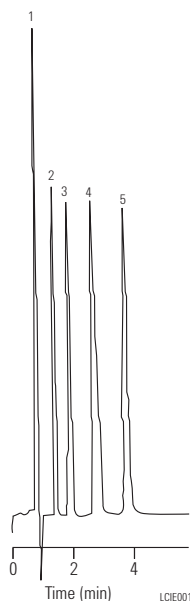
#### Column Specifications

| Bonded Phase  | Pore Size | Surface Area          | pH Range | Functionality    | Max Pressure |
|---------------|-----------|-----------------------|----------|------------------|--------------|
| ZORBAX SAX    | 70Å       | 300 m <sup>2</sup> /g | 2.0-7.0  | Quaternary amine | 350 bar      |
| ZORBAX 300SCX | 300Å      | 50 m <sup>2</sup> /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<sub>2</sub>PO<sub>4</sub> (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  $\mu\text{m}$  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  $\mu\text{m}$  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  $\mu\text{m}$  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  $\mu\text{m}$  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.

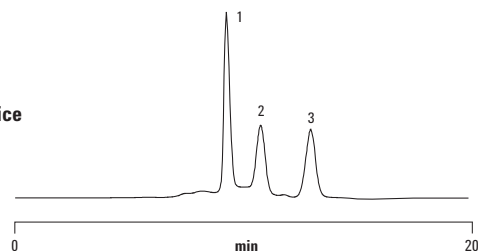
| Hi-Plex Column Selection                          |                                  |
|---------------------------------------------------|----------------------------------|
| Application Area                                  | Recommended Column               |
| USP Methods Specifying L17 Media                  | 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                       |



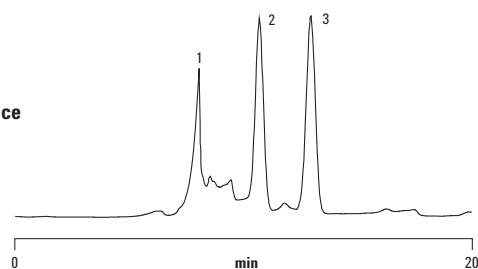
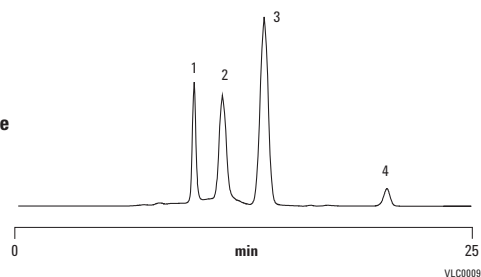
**Analysis of fruit juice**

**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

**Orange juice**

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

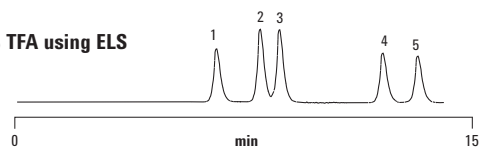
**Tomato juice****Apple juice**

VLC0009

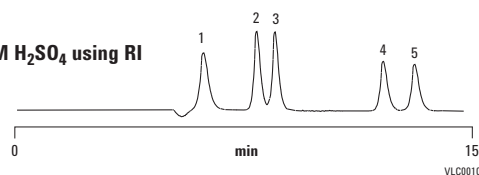
**Organic acid analysis**

**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

**0.1% TFA using ELS**

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

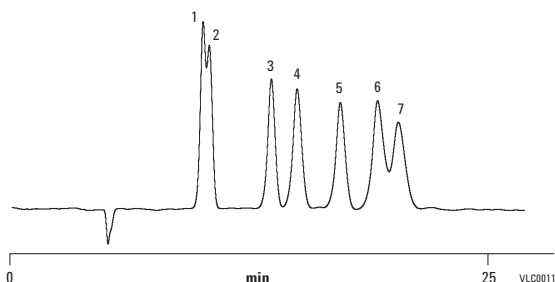
**5 mM H<sub>2</sub>SO<sub>4</sub> using RI**

VLC0010

**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

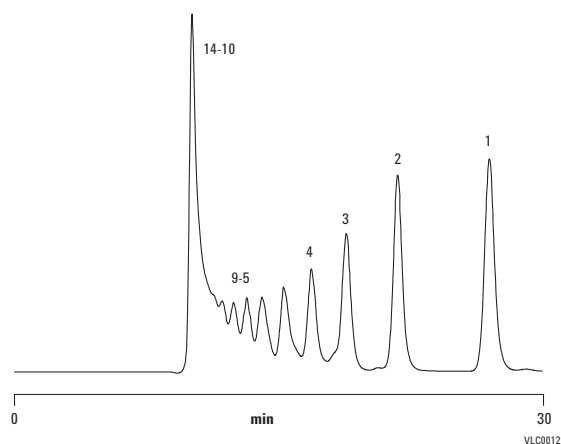


1. Iso-erythritol
2. Adonitol
3. Arabitol
4. Mannitol
5. Xylitol
6. Dulcitol
7. Sorbitol

**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**

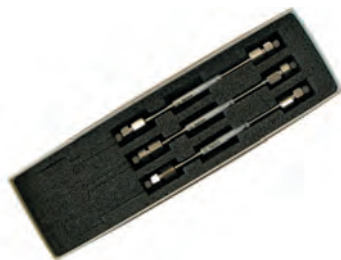
| Description        | Size (mm) | Particle Size (µm) | Crosslink Content (%) | Counter Ion      | Part No.    |
|--------------------|-----------|--------------------|-----------------------|------------------|-------------|
| Hi-Plex Ca USP L19 | 4.0 x 250 | 8                  | 8                     | Ca <sup>2+</sup> | PL1570-5810 |
| Hi-Plex Ca (Duo)   | 6.5 x 300 | 8                  | 8                     | Ca <sup>2+</sup> | PL1F70-6850 |
| Hi-Plex Ca         | 7.7 x 300 | 8                  | 8                     | Ca <sup>2+</sup> | PL1170-6810 |
| Hi-Plex Pb USP L34 | 7.7 x 100 | 8                  | 8                     | Pb <sup>2+</sup> | PL1170-2820 |
| Hi-Plex Pb         | 7.7 x 300 | 8                  | 8                     | Pb <sup>2+</sup> | PL1170-6820 |
| Hi-Plex K          | 7.7 x 300 | 8                  | 8                     | K <sup>+</sup>   | PL1170-6860 |
| Hi-Plex H          | 6.5 x 300 | 8                  | 8                     | H <sup>+</sup>   | PL1F70-6830 |
| Hi-Plex H          | 7.7 x 300 | 8                  | 8                     | H <sup>+</sup>   | PL1170-6830 |
| Hi-Plex H USP L17  | 7.7 x 100 | 8                  | 8                     | H <sup>+</sup>   | PL1170-2823 |
| Hi-Plex Na         | 7.7 x 300 | 10                 | 4                     | Na <sup>+</sup>  | PL1171-6140 |
| Hi-Plex Na (Octo)  | 7.7 x 300 | 8                  | 8                     | Na <sup>+</sup>  | 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 <sup>2+</sup> | PL1170-1810 |
| Hi-Plex Ca (Duo)  | 7.7 x 50  | 8                  | 8                     | Ca <sup>2+</sup> | PL1170-1850 |
| Hi-Plex Pb        | 7.7 x 50  | 8                  | 8                     | Pb <sup>2+</sup> | PL1170-1820 |
| Hi-Plex K         | 7.7 x 50  | 8                  | 8                     | K <sup>+</sup>   | PL1170-1860 |
| Hi-Plex H         | 7.7 x 50  | 8                  | 8                     | H <sup>+</sup>   | PL1170-1830 |
| Hi-Plex Na        | 7.7 x 50  | 10                 | 4                     | Na <sup>+</sup>  | PL1171-1140 |
| Hi-Plex Na (Octo) | 7.5 x 50  | 8                  | 8                     | Na <sup>+</sup>  | 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 <sup>2+</sup> | PL1170-1810 |
| Hi-Plex Ca                                     | 3.0 x 0.5 | 8                  | 8                     | Ca <sup>2+</sup> | PL1670-0810 |
| Hi-Plex Ca (Duo)                               | 3.0 x 0.5 | 8                  | 8                     | Ca <sup>2+</sup> | PL1670-0850 |
| Hi-Plex Pb                                     | 3.0 x 0.5 | 8                  | 8                     | Pb <sup>2+</sup> | PL1670-0820 |
| Hi-Plex K                                      | 3.0 x 0.5 | 8                  | 8                     | K <sup>+</sup>   | PL1670-0860 |
| Hi-Plex H                                      | 3.0 x 0.5 | 8                  | 8                     | H <sup>+</sup>   | PL1670-0830 |
| Hi-Plex Na                                     | 3.0 x 0.5 | 10                 | 4                     | Na <sup>+</sup>  | PL1671-0140 |
| Hi-Plex Na (Octo)                              | 3.0 x 0.5 | 8                  | 8                     | Na <sup>+</sup>  | 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  $\mu\text{m}$ ) columns in a variety of bonded phases for easy method optimization and several kits contain Rapid Resolution (3.5  $\mu\text{m}$ ) 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**

| <b>Description</b>                                                                                                                                                                                       | <b>Part No.</b> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Rapid Resolution HT (RRHT) Selectivity Method Development Kit, 2.1 mm ID<br>Includes 2.1 x 50 mm, 1.8 $\mu\text{m}$ , 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<br>Includes 2.1 x 50 mm, 1.8 $\mu\text{m}$ , 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<br>Includes 4.6 x 50 mm, 1.8 $\mu\text{m}$ , 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<br>Includes 4.6 x 50 mm, 1.8 $\mu\text{m}$ , 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<br>Includes 4.6 x 100 mm, 3.5 $\mu\text{m}$ 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<br>Includes 4.6 x 100 mm, 3.5 $\mu\text{m}$ columns: one each Eclipse Plus C18, SB-C18 and Extend-C18                                              | 5190-1436       |

**ZORBAX Method Development Kits**

| <b>Description</b>                                                                                                               | <b>Part No.</b> |
|----------------------------------------------------------------------------------------------------------------------------------|-----------------|
| StableBond Method Development Kit<br>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<br>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<br>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<br>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<br>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<br>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<br>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<br>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**

| <b>Hardware Description</b>                                                                                                                                                                                                                                                                 | <b>Part No.</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
|  ZORBAX C18 Kit<br>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<br>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)
- Please fax your request to **(302) 993-5354** or email to **cag\_sales-na@agilent.com**. You will receive a quote from your Customer Service Representative within 1-2 business days. Delivery for your custom column is usually 3 weeks or less from the time your order is placed, depending on lot availability.

### Tips & Tools

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

For more information, visit [www.agilent.com/chem/education](http://www.agilent.com/chem/education)



### 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  $\mu\text{m}$ ); and pore size (example: 80Å)
- Please fax your request to **(302) 993-5354** or email to **cag\_sales-na@agilent.com**. You will receive a quote from your Customer Service Representative within 1-2 business days. Delivery for your custom column is usually 3 weeks or less from the time your order is placed, depending on lot availability.

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

#### Tips & Tools

Request custom LC columns online at  
**[www.agilent.com/chem/customlccol](http://www.agilent.com/chem/customlccol)**



## ■ 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:

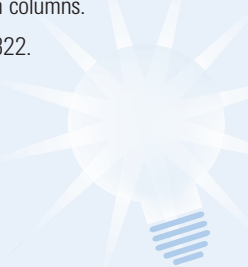
- ZORBAX Rapid Resolution High Definition (RRHD) Columns
- ZORBAX Rapid Resolution High Throughput (RRHT) Columns
- ZORBAX Solvent Saver Columns
- Chiral HPLC Columns
- Other Specialty HPLC Columns



**Tips & Tools**

Poroshell 120 columns are ideal for up to 600 bar for UHPLC and use up to 50% less pressure than sub 2  $\mu\text{m}$  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  $\mu\text{m}$  columns for up to 600 bar
- **ZORBAX Rapid Resolution High Definition** – 1.8  $\mu\text{m}$  columns for up to 1200 bar and the Agilent 1290 Infinity LC
- **Agilent Poroshell 120** – 2.7  $\mu\text{m}$  superficially porous columns for up to 600 bar  
Turn to page 822.
- **Pursuit UPS** – 1.9 and 2.4  $\mu\text{m}$  columns for up to 1000 bar UHPLCs  
Turn to page 864.

## ZORBAX Rapid Resolution High Definition 1.8 $\mu\text{m}$

- High pressure (1200 bar) columns for optimum results with the 1290 Infinity LC or other UHPLC instruments
- 1.8  $\mu\text{m}$  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  $\mu\text{m}$  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  $\mu\text{m}$  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  $\mu\text{m}$  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 <sup>2</sup> /g | 2.0-9.0  | Yes       |
| ZORBAX SB-C18           | 80Å       | 180 m <sup>2</sup> /g | 1.0-8.0* | No        |
| ZORBAX SB-C8            | 80Å       | 180 m <sup>2</sup> /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  $\mu$ m

**Column B:** 858700-902

2.1 x 100 mm, 1.8  $\mu$ m

**Column C:** 859700-902

2.1 x 150 mm, 1.8  $\mu$ m

**Mobile Phase:** 10-100% B/30 min

A: 0.1% formic acid (fa)

B: acetonitrile with 0.1% fa

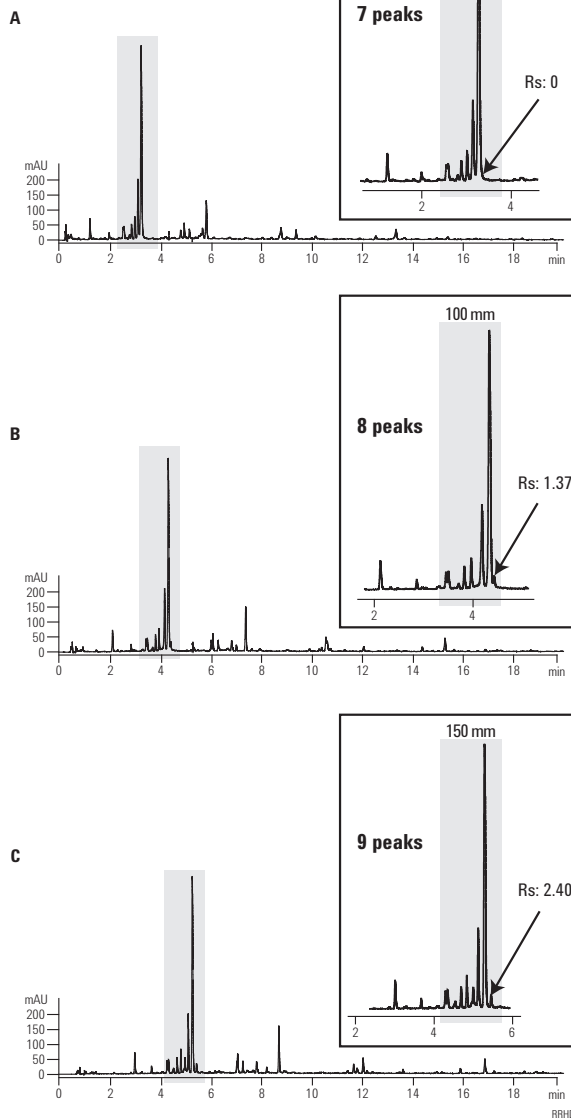
**Flow Rate:** F = 0.4 mL/min

**Gradient:** 30 minute gradient on each length

**Temperature:** Ambient

**Detector:** 280 nm UV

**Instrument:** 1290 Infinity LC

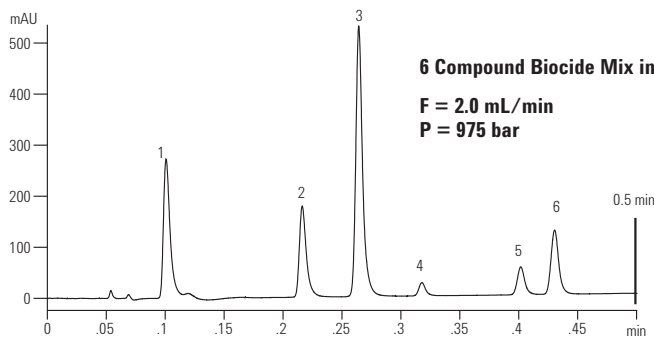


## Sub-1 Minute Separations with RRHD Columns

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

**Gradient:** H<sub>2</sub>O (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. Benzisothiazol-3(2H)-one
5. 2-phenoxyethanol
6. Methylparaben



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 $\mu$ m (3)<br>Flow Cell for VWD, 5 $\mu$ L capillaries, $\mu$ -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 $\mu$ m (2)<br>Flow Cell for DAD, 5 $\mu$ L capillaries, $\mu$ -LC inline filter | 5188-5324 |
| For Diode Array Detector and Mass Spec                                           | Columns: 2.1 x 50 mm, 1.8 $\mu$ m (2)<br>Flow Cell for DAD, 1.7 $\mu$ L 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  $\mu$ m

**Column B:** ZORBAX SB-C18  
827700-902  
2.1 x 50 mm, 1.8  $\mu$ m

**Column C:** ZORBAX SB-C18  
827700-902  
2.1 x 50 mm, 1.8  $\mu$ m

**Mobile Phase:**  
A: H<sub>2</sub>O  
B: ACN

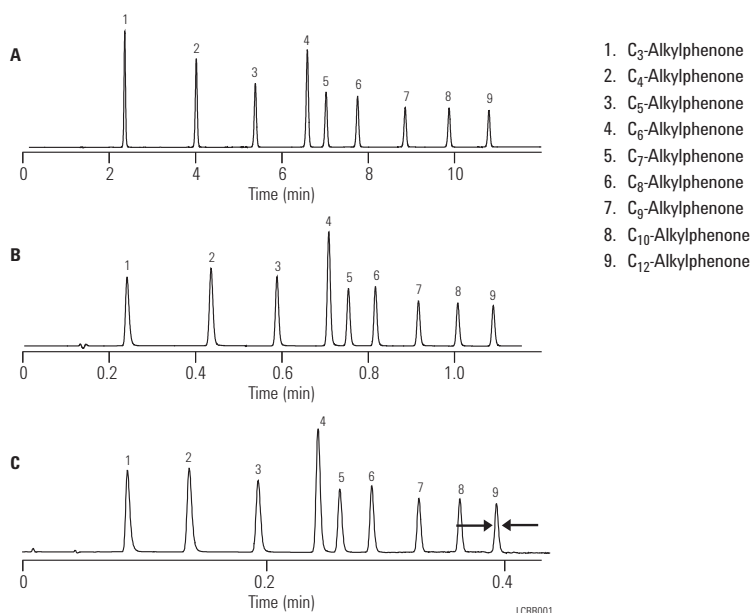
**Gradient:**  
0.0 min 50% B  
A: 11 min 100% B  
B: 1.2 min 100% B  
C: 0.4 min 100% B

**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



### 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  $\mu$ m

**Column B:** ZORBAX SB-C18  
827975-901  
4.6 x 50 mm, 1.8  $\mu$ m

Mobile Phase: 25% Water, 75% MeOH

Flow Rate: 1.5 mL/min

Temperature: Ambient

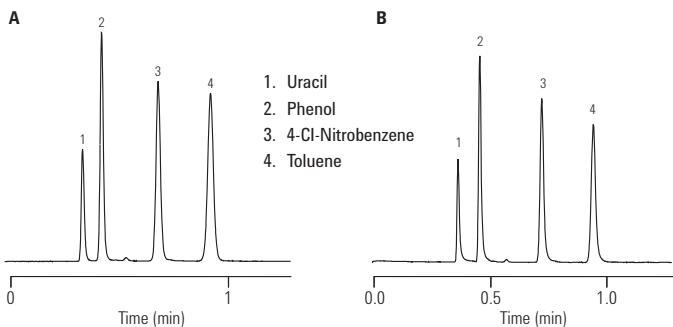
Detector: 254 nm

#### Plates (N)

1. 3476
2. 4585
3. 5673
4. 6180

#### Plates (N)

1. 6560
2. 8958
3. 11508
4. 12266



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

LCRR002

### Reduce Analysis Time Dramatically with Rapid Resolution HT Columns

**Column A:** Eclipse XDB-C18  
990967-902  
4.6 x 250 mm, 5  $\mu$ m

**Column B:** Eclipse XDB-C18  
963967-902  
4.6 x 150 mm, 3.5  $\mu$ m

**Column C:** Eclipse XDB-C18  
966967-902  
4.6 x 75 mm, 3.5  $\mu$ m

**Column D:** ZORBAX Eclipse XDB-C18  
935967-902  
4.6 x 50 mm, 3.5  $\mu$ m

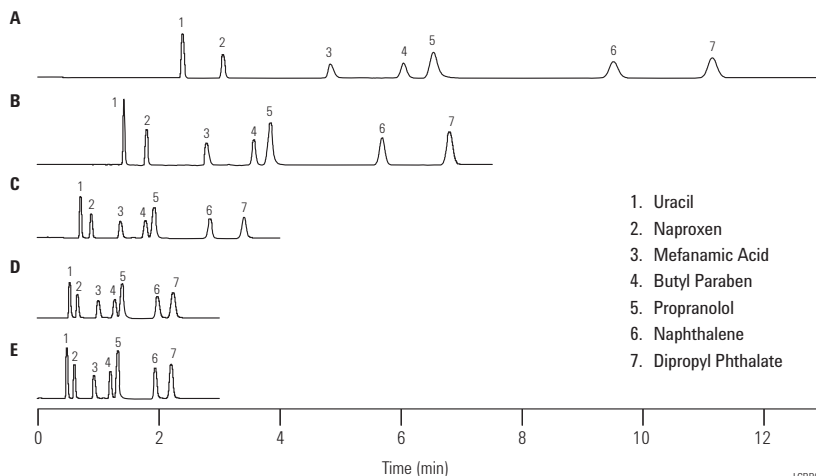
**Column E:** Eclipse XDB-C18  
925975-902  
4.6 x 50 mm, 1.8  $\mu$ m

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  $\mu$ m column. Rapid Resolution (3.5  $\mu$ m) 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.

LCRR003

## Increase Peak Capacity with RRHT Columns

**Column A:** Eclipse XDB-C8  
928700-906  
2.1 x 100 mm, 1.8  $\mu$ m

**Column B:** Eclipse XDB-C18  
961753-902  
2.1 x 100 mm, 3.5  $\mu$ m

Mobile Phase: A: H<sub>2</sub>O

B: ACN

Peak capacity: A: 461

B: 343

Flow Rate: 0.5 mL/min

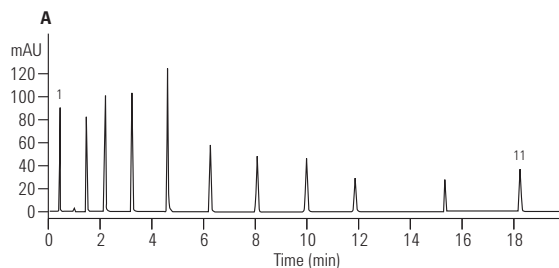
Gradient: 0.0 min 50% B

20.0 min 100% B

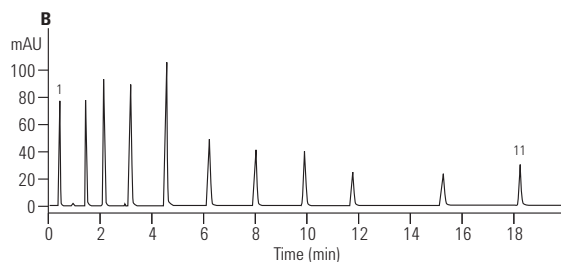
Temperature: 40°C

Detector: UV 254 nm

Sample: Alkylphenones



1. Uracil
2. C<sub>3</sub>-Alkylphenone
3. C<sub>4</sub>-Alkylphenone
4. C<sub>5</sub>-Alkylphenone
5. C<sub>6</sub>-Alkylphenone
6. C<sub>7</sub>-Alkylphenone
7. C<sub>8</sub>-Alkylphenone
8. C<sub>9</sub>-Alkylphenone
9. C<sub>10</sub>-Alkylphenone
10. C<sub>12</sub>-Alkylphenone
11. C<sub>14</sub>-Alkylphenone



LCRR004

## Long Lifetime of RRHT Columns at Elevated Temperatures

**Column:** ZORBAX SB-C18  
827700-902  
2.1 x 50 mm, 1.8  $\mu$ m

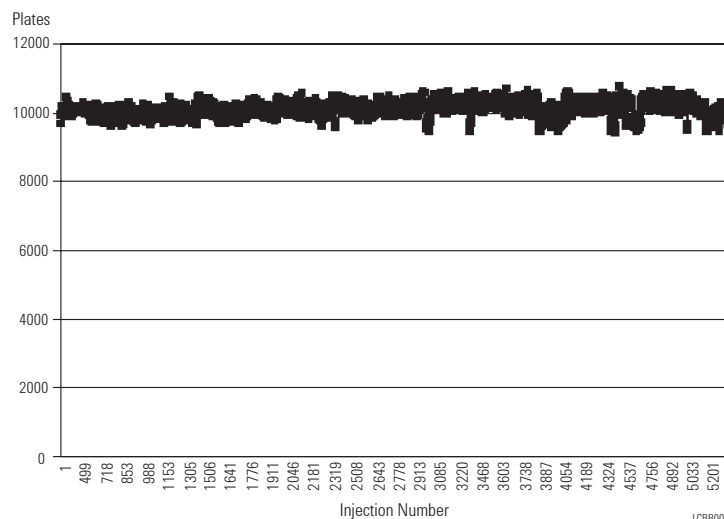
Mobile Phase: A: 60% H<sub>2</sub>O  
B: 40% ACN

Flow Rate: 1 mL/min

Temperature: 80°C

Detector: UV 254 nm

Sample: QC Test Mix



LCRR005

**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)**

| <b>Description</b>           | <b>Size (mm)</b> | <b>Particle Size (µm)</b> | <b>SB-C18 USP L1</b> | <b>SB-C8 USP L7</b> | <b>SB-Phenyl USP L11</b> | <b>SB-CN USP L10</b> | <b>SB-Aq</b> | <b>Rx-SIL USP L3</b> | <b>Bonus-RP USP L60</b> |
|------------------------------|------------------|---------------------------|----------------------|---------------------|--------------------------|----------------------|--------------|----------------------|-------------------------|
| 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    |              |                   |
| <b>Rapid Resolution HT Cartridges (require hardware kit 820555-901)</b>             |                                         |           |                    |                        |                       |               |              |                   |
|    | Rapid Resolution HT Cartridge           | 4.6 x 50  | 1.8                | 925975-902             |                       | 825975-902    |              |                   |
|    | Rapid Resolution HT Cartridge, 3/pk     | 4.6 x 50  | 1.8                | 925975-932             |                       | 825975-932    |              |                   |
|    | Rapid Resolution HT Cartridge           | 2.1 x 50  | 1.8                | 925700-902             |                       | 825700-902    |              |                   |
|    | Rapid Resolution HT Cartridge, 3/pk     | 2.1 x 50  | 1.8                | 925700-932             |                       | 825700-932    |              |                   |
|    | Rapid Resolution HT Cartridge           | 4.6 x 30  | 1.8                | 923975-902             |                       | 823975-902    |              |                   |
|    | Rapid Resolution HT Cartridge, 3/pk     | 4.6 x 30  | 1.8                | 923975-932             |                       | 823975-932    |              |                   |
|    | Rapid Resolution HT Cartridge           | 2.1 x 30  | 1.8                | 923700-902             |                       | 823700-902    |              |                   |
|    | Rapid Resolution HT Cartridge, 3/pk     | 2.1 x 30  | 1.8                | 923700-932             |                       | 823700-932    |              |                   |
|    | Rapid Resolution HT Cartridge           | 4.6 x 15  | 1.8                | 921975-902             |                       | 821975-902    |              |                   |
|    | Rapid Resolution HT Cartridge, 3/pk     | 4.6 x 15  | 1.8                | 921975-932             |                       | 821975-932    |              |                   |
|  | Rapid Resolution HT Cartridge           | 2.1 x 15  | 1.8                | 921700-902             |                       | 821700-902    |              |                   |
|  | Rapid Resolution HT Cartridge, 3/pk     | 2.1 x 15  | 1.8                | 921700-932             |                       | 821700-932    |              |                   |
|  | 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  $\mu$ L 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 <sup>2</sup> /g | 2.0-8.0  | No        | 3.5%        |

Specifications represent typical values only.

#### ZORBAX Carbohydrate Analysis Columns

| Description                                   | Size (mm)  | Particle Size ( $\mu$ m) | 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 <sub>2</sub> Guard Cartridges, 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<sub>2</sub>O

**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)

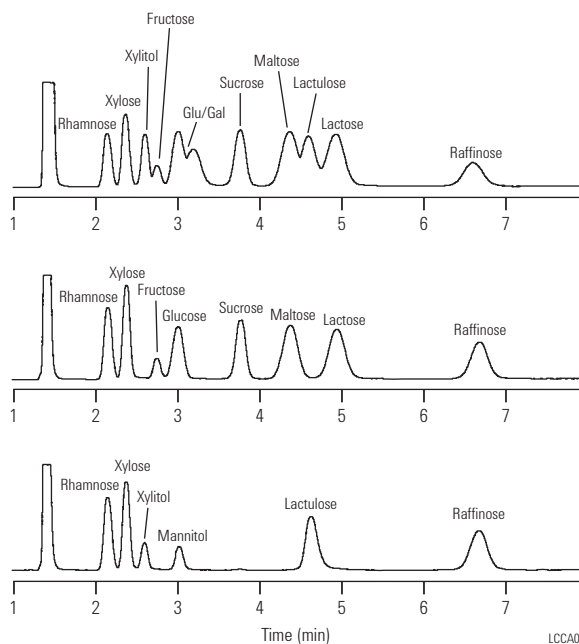
Maltose, Lactose (6 µg each), Inj. = 6.3 µL

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



### Tips & Tools

Don't forget, we have special offers throughout the year.

To learn more, visit [www.agilent.com/chem/specialoffers](http://www.agilent.com/chem/specialoffers)

## 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 |
|  | Guard Cartridges, 4/pk                                    | 4.6 x 12.5 | 5                  | 820950-931 |
|  | 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<sub>2</sub>HPO<sub>4</sub>, pH 7.8  
B: ACN:MeOH:Water,  
45:45:10 v/v

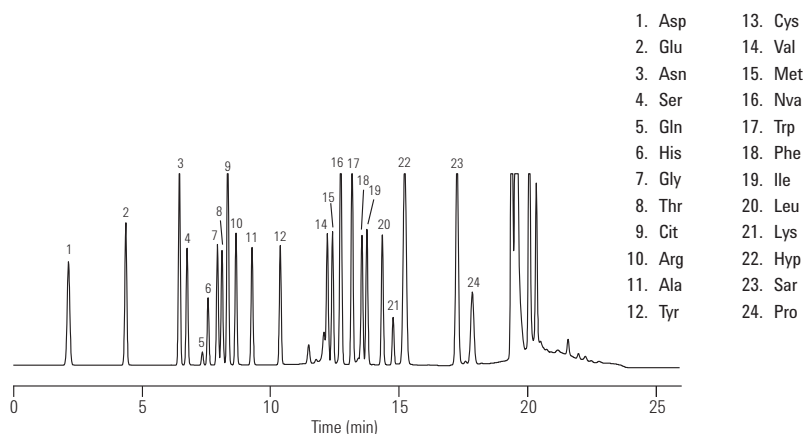
**Flow Rate:** 2 mL/min

**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.



LCPAH01

### 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<br>Includes 1 g each of norvaline, sarcosine, asparagine, glutamine, tryptophan,<br>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)<br>and 3-mercaptopropionic acid, 6 x 1 mL ampoules | 5061-3335 |
| FMOC reagent, 2.5 mg/mL in acetonitrile, 9-fluorenylmethylchloroformate,<br>1 mL, 10 ampoules                               | 5061-3337 |
| Borate buffer, 100 mL                                                                                                       | 5061-3339 |
| DTDPA (Dithiodipropionic) 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  $\mu\text{m}$ ) 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 <sup>2</sup> /g | 60°C         | 2.0-8.0  | No        | 14%         |

Specifications represent typical values only.

### 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.

To learn more, visit [www.agilent.com/chem/OnlineLibrary](http://www.agilent.com/chem/OnlineLibrary)



## 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         |
|  Guard Cartridges, 4/pk | 4.6 x 12.5 | 5                  | 820950-939         |
|  Guard Cartridges, 4/pk | 2.1 x 12.5 | 5                  | 821125-939         |
|  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:**

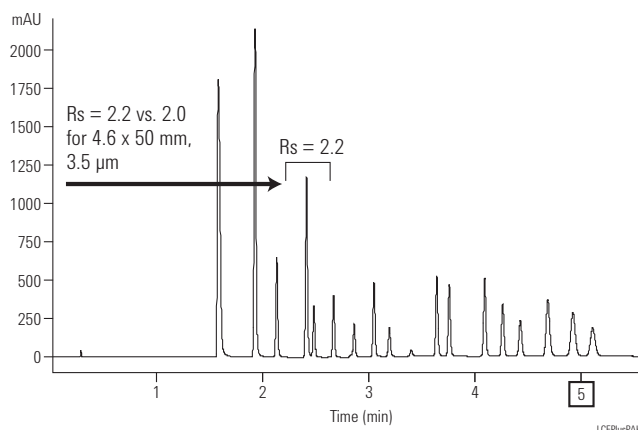
| Time (Min) | % B |
|------------|-----|
| 0.00       | 40  |
| 3.5        | 100 |
| 5.2        | 100 |
| 5.5        | 40  |
| 6.5        | 40  |

**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  $\mu$ m 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.

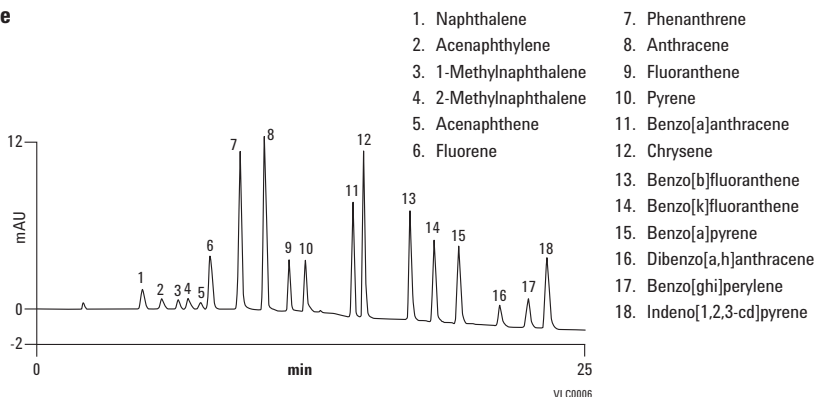
### Pursuit PAH

| Hardware                                               | Dimensions | Particle Size ( $\mu$ m) | 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 |
| <b>Pursuit PAH ChromSep Complete Cartridge Systems</b> |            |                          |              |
| <b>CS</b>                                              | 4.6 x 250  | 5                        | A7000250C046 |
| <b>CS</b>                                              | 4.6 x 150  | 5                        | A7000150C046 |
| <b>CS</b>                                              | 4.6 x 150  | 3                        | A7001150C046 |
| <b>CS</b>                                              | 4.6 x 100  | 3                        | A7001100C046 |
| <b>CS</b>                                              | 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  $\mu$ m

**Sample:** PAH test mix  
**Temperature:** 25°C  
**Detector:** UV, 254 nm





## 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

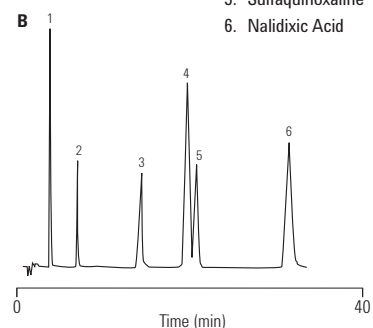
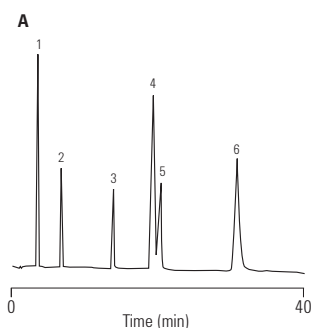
Mobile Phase: 20% ACN:80% 0.2 M Na<sub>2</sub>HPO<sub>4</sub>  
+ 0.1 M Citric Acid, pH 2.6

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

LCSS001

## Solvent Saver Columns Increase Sensitivity

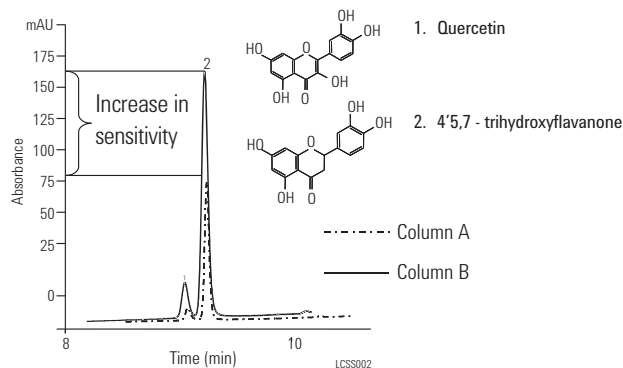
**Column A:** ZORBAX SB-C18  
863953-902  
4.6 x 150 mm, 3.5  $\mu$ m

**Column B:** ZORBAX SB-C18  
863954-302  
3.0 x 150 mm, 3.5  $\mu$ m

**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  $\mu$ m

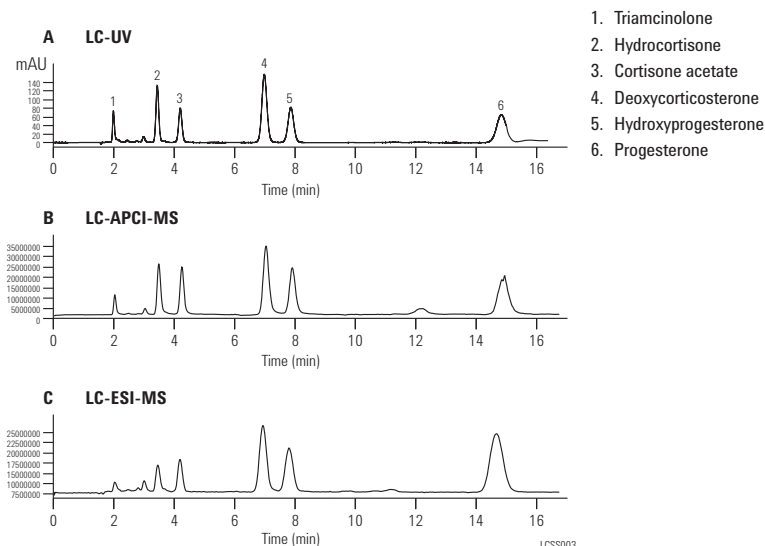
**Mobile Phase:** A: 70% Methanol+0.4% Formic Acid  
B: 30% Water+0.4% Formic Acid

**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.



**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)

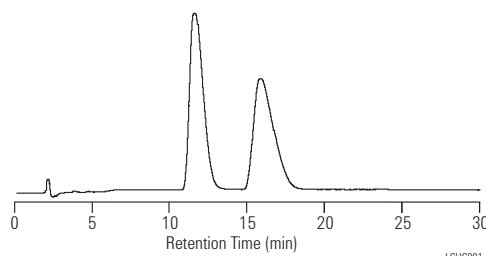
**Column:** Ultron ES-OVM Chiral  
702111651  
4.6 x 150 mm, 5 µm

**Mobile Phase:** 25:75 (v/v) EtOH/20 mM KH<sub>2</sub>PO<sub>4</sub>, pH 5.5  
(adjusted with NaOH)

**Temperature:** Ambient

**Detector:** UV (225 nm)

**Sample:** Mixture Fluoxetine (Prozac) enantiomers



*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

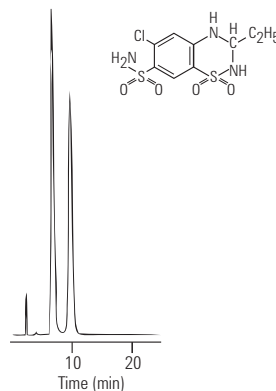
**Column:** Ultron ES-OVM Chiral  
702111651  
4.6 x 150 mm, 5 µm

Mobile Phase: 20 mM KH<sub>2</sub>PO<sub>4</sub> (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: 10°C

Temperature:

Needle Wash: Flush port (50:25:25 H<sub>2</sub>O,  
IPA:MeOH:H<sub>2</sub>O, 5 seconds)

Mobile Phase: 83% A = H<sub>2</sub>O + 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

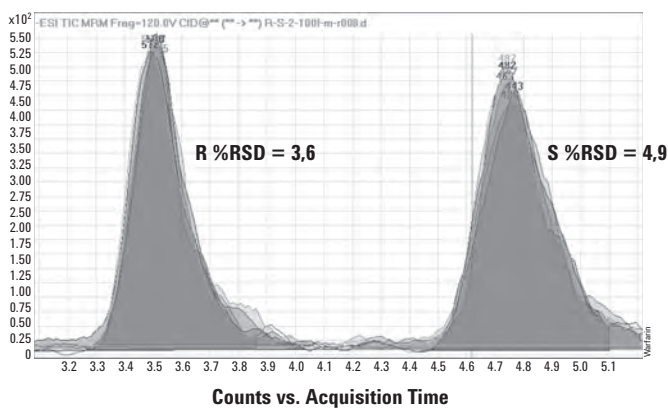
### Product Ion Scan

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



## Ultron ES Chiral Columns

| Description            | Size (mm) | Particle Size (µm) | ES-OVM<br>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  $\beta$ -cyclodextrin to spherical 5  $\mu$ m 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

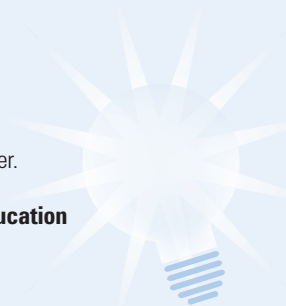
### ChiraDex Chiral Columns

| Hardware                                                                          | Description                 | Size (mm) | Particle Size ( $\mu$ m) | Part No.    |
|-----------------------------------------------------------------------------------|-----------------------------|-----------|--------------------------|-------------|
|  | Cartridge Column            | 4.0 x 250 | 5                        | 79925CB-584 |
|  | Cartridge Holder, 5021-1845 |           |                          | 5021-1845   |

### Tips & Tools

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

For more information, visit [www.agilent.com/chem/education](http://www.agilent.com/chem/education)





## ■ 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  $\mu$ m 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 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  $\mu\text{m}$  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.

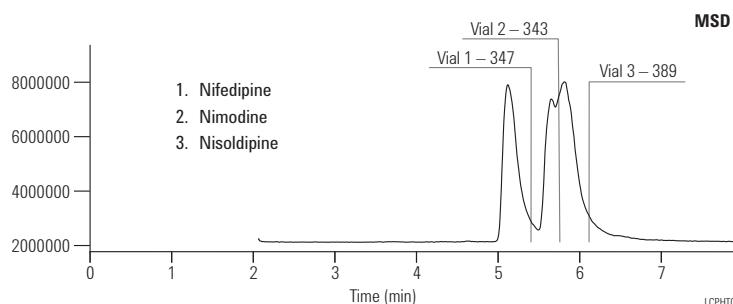
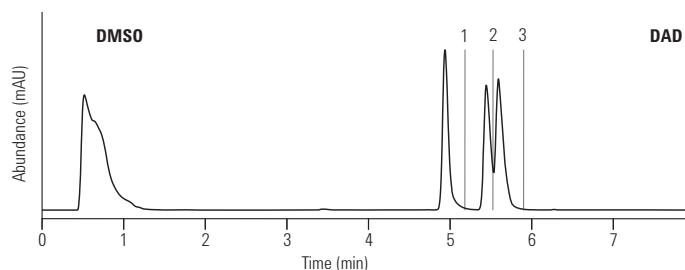
ZORBAX PrepHT columns are packed with 5 and 7  $\mu\text{m}$  particle sizes for very high resolution. The high resolution allows high loadability, high yield, and high purity of compounds. The larger diameter columns and mechanically stronger ZORBAX particles allow for flow rates up to 100 mL/min, thus 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  $\mu\text{m}$  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] |                    |       |
|----------------------|-----------------------|------------------------|-------------------------|--------------------|-------|
| <b>Fraction 1</b>    | 18.90                 | 0.11                   | 0.16                    | Purity Nifedipin   | 98.6% |
| <b>Fraction 2</b>    | 0.29                  | 17.66                  | 0.77                    | Purity Nifmodipin  | 94.4% |
| <b>Fraction 3</b>    | 0.49                  | 1.66                   | 18.36                   | Purity Nifsoldipin | 89.5% |
| <b>Recovery [mg]</b> | 19.68                 | 19.43                  | 19.29                   |                    |       |
| <b>Recovery [%]</b>  | 101.3                 | 102.0                  | 101.9                   |                    |       |

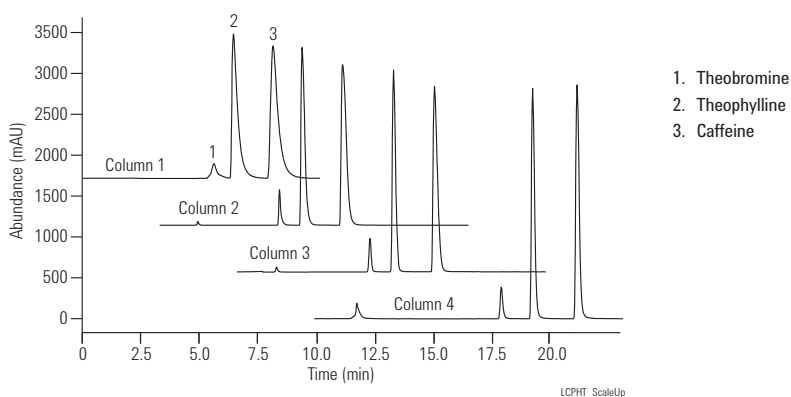
ZORBAX PrepHT columns are designed for rapid scale-up from analytical to preparative scale without losing resolution. For complex separations for larger columns (21.2 mm ID and higher, 150 mm length and higher), Agilent has carefully chosen the 7  $\mu$ m particle size to achieve a balance between high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

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

| Column   | Size          | Flow<br>(mL/min) | Injection<br>( $\mu$ L) | 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



**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 |
|-----------------------------------------------------------------------------------|------------------------------|------------|--------------------|---------------|--------------|------------|---------------|-------------------|
|  | PrepHT Cartridge             | 21.2 x 250 | 7                  | 877250-102    | 877250-106   | 877250-114 | 877250-105    | 877250-112        |
|  | PrepHT Cartridge             | 21.2 x 150 | 7                  | 877150-102    | 877150-106   | 877150-114 |               |                   |
|  | PrepHT Cartridge             | 21.2 x 150 | 5                  | 870150-902    | 870150-906   | 870150-914 |               |                   |
|  | PrepHT Cartridge             | 21.2 x 100 | 5                  | 870100-902    | 870100-906   | 870100-914 |               |                   |
|  | PrepHT Cartridge             | 21.2 x 50  | 5                  | 870050-902    | 870050-906   | 870050-914 |               |                   |
|  | 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 |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|------------|--------------------|------------------|-----------------|------------------|------------------|
|  | PrepHT Cartridge                                                                                         | 21.2 x 250 | 7                  | 897250-102       | 897250-106      | 897250-109       | 897250-105       |
|  | PrepHT Cartridge                                                                                         | 21.2 x 150 | 7                  | 897150-102       | 897150-106      | 897150-109       |                  |
|  | PrepHT Cartridge                                                                                         | 21.2 x 150 | 5                  | 895150-902       | 895150-906      | 895150-909       |                  |
|  | PrepHT Cartridge                                                                                         | 21.2 x 100 | 5                  | 895100-902       | 895100-906      | 895100-909       |                  |
|  | PrepHT Cartridge                                                                                         | 21.2 x 50  | 5                  | 895050-902       | 895050-906      | 895050-909       |                  |
|  | PrepHT Guard Cartridge, 2/pk                                                                             | 17 x 7.5   | 5                  | 820212-921       | 820212-918      | 820212-924       | 820212-924       |
|                                                                                   | Guard Cartridge Hardware                                                                                 |            |                    | 820444-901       | 820444-901      | 820444-901       | 820444-901       |
|                                                                                   | Includes guard column end fitting, polymeric seal, and seal insertion tool (seal holder and seal pusher) |            |                    |                  |                 |                  |                  |
|                                                                                   | 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 |
|-------------------------------------------------------------------------------------|--------------------------|------------|--------------------|------------------|------------|------------|------------|------------|
|  | 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 |
|--------------------------------------------------------------------------------------------------------------------------------------|------------|--------------------|------------------------|-----------------------|
|  PrepHT Cartridge                                   | 21.2 x 250 | 7                  | 977250-102             | 977250-106            |
|  PrepHT Cartridge                                   | 21.2 x 150 | 7                  | 977150-102             | 977150-106            |
|  PrepHT Cartridge                                   | 21.2 x 150 | 5                  | 970150-902             | 970150-906            |
|  PrepHT Cartridge                                   | 21.2 x 100 | 5                  | 970100-902             | 970100-906            |
|  PrepHT Cartridge                                   | 21.2 x 50  | 5                  | 970050-902             | 970050-906            |
|  PrepHT Guard Cartridge, 2/pk                       | 17 x 7.5   | 5                  | 820212-925             | 820212-926            |
| Guard Cartridge Hardware<br>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 |
|--------------------------------------------------------------------------------------------------------------------------------------|------------|--------------------|------------------|-------------------|
|  PrepHT Cartridge                                   | 21.2 x 250 | 7                  | 878250-101       |                   |
|  PrepHT Cartridge                                   | 21.2 x 150 | 7                  | 878150-101       |                   |
|  PrepHT Cartridge                                   | 21.2 x 150 | 5                  | 868150-901       | 770150-902        |
|  PrepHT Cartridge                                   | 21.2 x 100 | 5                  | 868100-901       | 770100-902        |
|  PrepHT Cartridge                                  | 21.2 x 50  | 5                  | 868050-901       | 770050-902        |
|  PrepHT Guard Cartridge, 2/pk                     | 17 x 7.5   | 5                  | 820212-928       | 820212-930        |
| Guard Cartridge Hardware<br>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 |
|--------------------------------------------------------------------------------------------------------------------------------------|------------|--------------------|---------------|---------------|
|  PrepHT Cartridge                                 | 21.2 x 250 | 7                  | 877250-101    |               |
|  PrepHT Cartridge                                 | 21.2 x 250 | 7                  |               | 877967-102    |
|  PrepHT Guard Cartridge, 2/pk                     | 17 x 7.5   | 5                  | 820212-919    | 820212-914    |
| Guard Cartridge Hardware<br>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.   |
|--------------------------------------------------------------------------------------------------------------|------------|
|  Guard Cartridge Hardware | 820444-901 |
|  PrepHT endfittings, 2/pk | 820400-901 |
|  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  $\mu\text{m}$  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 <sup>2</sup> /g | 60°C*        | 2.0-10.0 | Single    | 24%         |
| Silica       | 100Å      | 400 m <sup>2</sup> /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

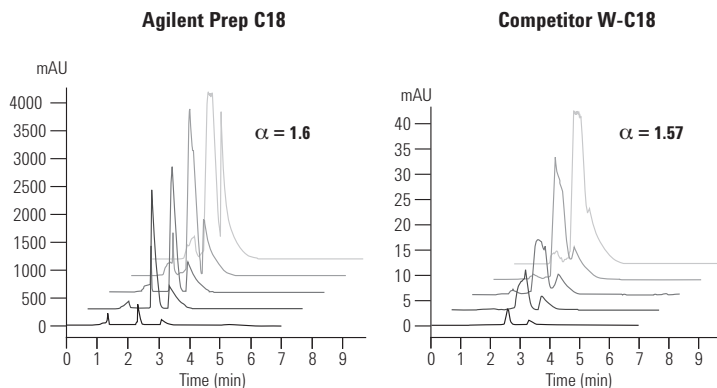
**Column:** Agilent Prep C18  
443905-902  
4.6 x 150 mm, 5  $\mu$ m

**Mobile Phase:** 50% 0.1%TFA:50% ACN

**Flow Rate:** 1 mL/min

**Sample:** 10  $\mu$ L  
Doxepin/Amitriptyline  
0.5-50 mg/mL

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



LCPLC01

## Steroids: Easy Scalability Using Agilent Prep Columns

**Column A:** Agilent Prep C18  
443905-902  
4.6 x 150 mm, 5  $\mu$ m

**Column B:** 443905-102  
21.2 x 150 mm, 5  $\mu$ m

**Column C:** 413910-302  
30.0 x 150 mm, 10  $\mu$ m

**Column D:** 413910-502  
50.0 x 150 mm, 10  $\mu$ m

**Mobile Phase:** 55% Water:45% ACN

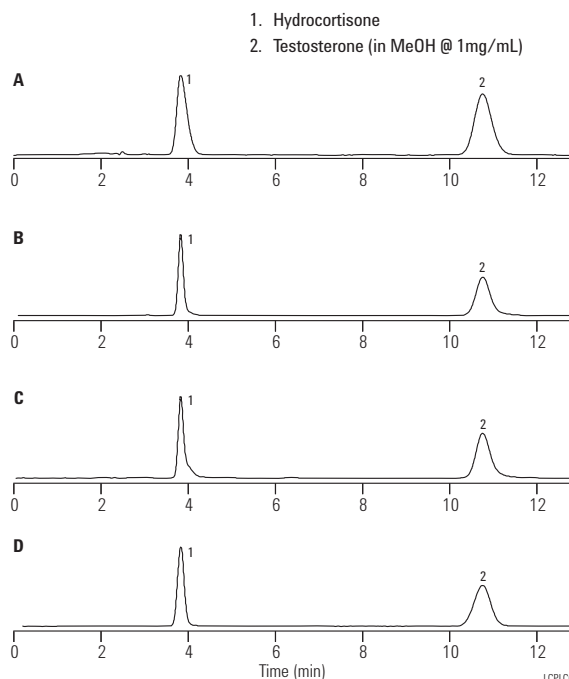
**Flow Rate:** 0.7 mL/min  
14.87 mL/min  
29.77 mL/min  
85.37 mL/min

**Temperature:** Ambient

**Detector:** 240 nm

**Sample:** 2  $\mu$ L  
42.4  $\mu$ L  
170  $\mu$ L  
488  $\mu$ L

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



LCPLC02



**Agilent Prep LC Columns**

| Hardware                                                                            | Description                        | Size (mm)  | Particle Size (µm) | C18        | Silica     |
|-------------------------------------------------------------------------------------|------------------------------------|------------|--------------------|------------|------------|
| <b>Standard Columns (no special hardware required)</b>                              |                                    |            |                    |            |            |
|                                                                                     | 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 |
| <b>PrepHT Cartridge Columns (require endfittings kit 820400-901)*</b>               |                                    |            |                    |            |            |
|    | PrepHT                             | 21.2 x 250 | 10                 | 410910-102 | 410910-101 |
|    | PrepHT                             | 21.2 x 150 | 10                 | 413910-102 | 413910-101 |
|    | PrepHT                             | 21.2 x 50  | 10                 | 446910-102 |            |
|    | PrepHT                             | 21.2 x 150 | 5                  | 443905-102 | 443905-101 |
|    | PrepHT                             | 21.2 x 100 | 5                  | 449905-102 | 449905-101 |
|    | PrepHT                             | 21.2 x 50  | 5                  | 446905-102 | 446905-101 |
|    | PrepHT endfittings, 2/pk           |            |                    | 820400-901 | 820400-901 |
| <b>Standard Columns (no special hardware required)</b>                              |                                    |            |                    |            |            |
|                                                                                     | 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 |
| <b>Guard Columns (hardware required)</b>                                            |                                    |            |                    |            |            |
|  | PrepHT Guard Cartridges, 2/pk      | 21.2 x 10  | 10                 | 420212-902 | 420212-901 |
|  | Guard Cartridge Hardware           |            |                    | 820444-901 | 820444-901 |
|  | 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<br>Pursuit XRs 100Å C8     |
|                    | Hydrophobic Work Horse        | Pursuit 200Å C18<br>Pursuit 200Å C8             |
|                    | Aromatic/Double Bonds         | Pursuit 200Å Diphenyl                           |
| Hydrophilic        | Polar Selectivity             | Polaris 200Å C18-A<br>Polaris 200Å C8-A         |
|                    | H-bond Accepting              | Polaris 200Å C18-Ether<br>Polaris 200Å C8-Ether |
|                    | Reverse or Normal-Phase       | Polaris 200Å NH2                                |
|                    | H-bonding                     | Polaris 200Å Amide-C8                           |
|                    | Normal-Phase Organic Soluble  | Pursuit XRs Si<br>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 |              |              |
| <b>High Efficiency Bulk Media</b> |                    |              |              |              |              |              |
| 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   | 10      | R000083811 |
| Upgrades kit #1 to kit #2 | 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 $\mu\text{m}$               | 10 $\mu\text{m}$               |
| 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 $\mu\text{mol}/\text{m}^2$ | 3.8 $\mu\text{mol}/\text{m}^2$ |
| 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    |

**Tips & Tools**

Don't forget, we have special offers throughout the year.

To learn more, visit [www.agilent.com/chem/specialoffers](http://www.agilent.com/chem/specialoffers)

### 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.

#### 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.

To learn more, visit [www.agilent.com/chem/OnlineLibrary](http://www.agilent.com/chem/OnlineLibrary)



**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**

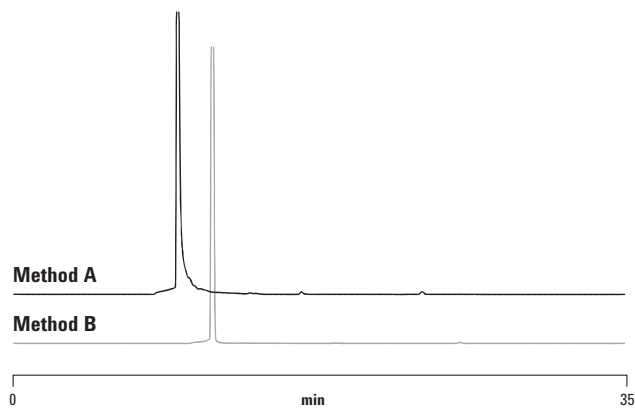
**Column:** FlowTrap  
PL1560-3M07  
4.6 x 150 mm,  $\mu$ m

**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  $\text{NH}_3$ , flow rate: (4 mL/min) for 2 min then  
R.O. water, flow rate: (4 mL/min) for 4 min

**Elution:** 100%  $\text{CH}_3\text{CN}$  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.

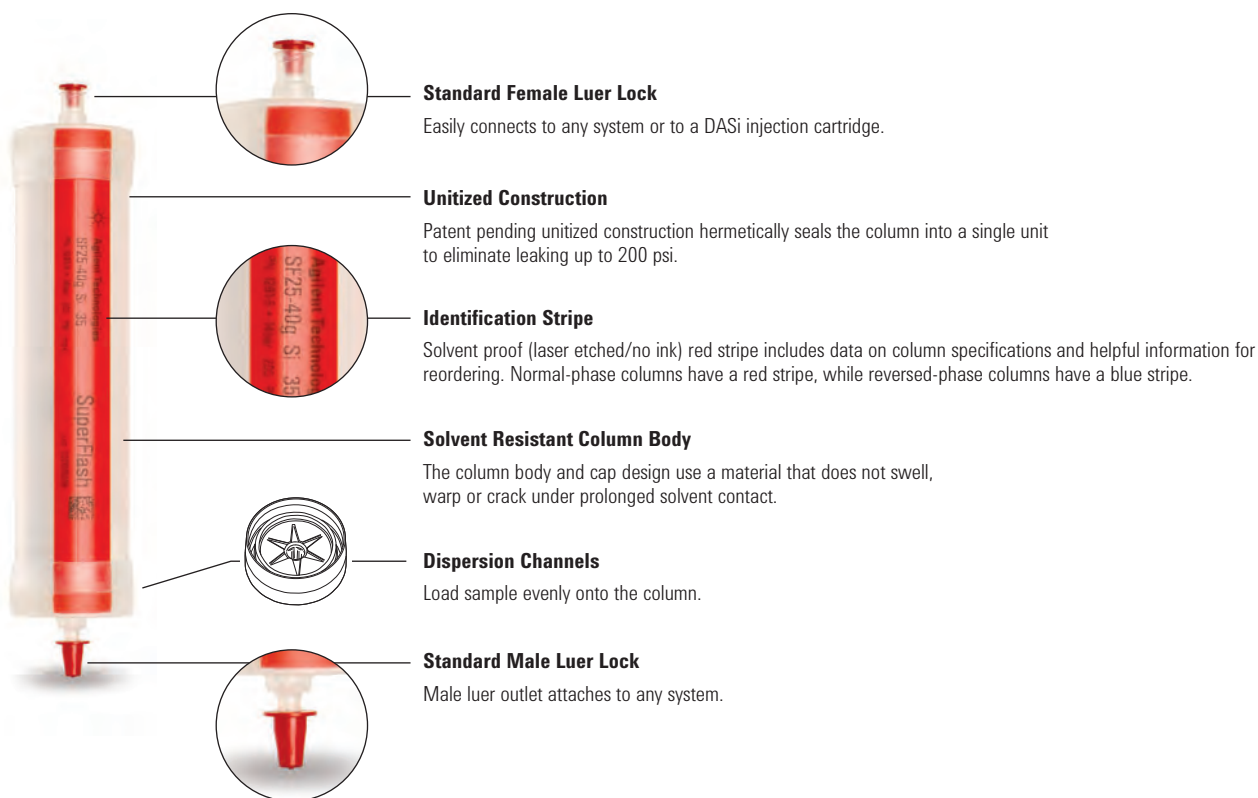
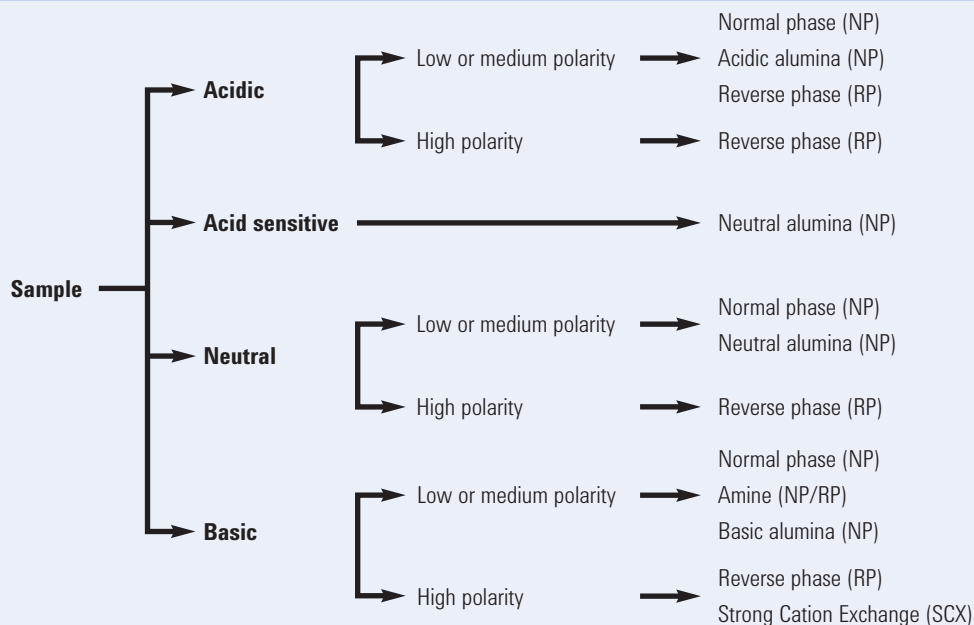


### SuperFlash Purification Columns

- 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



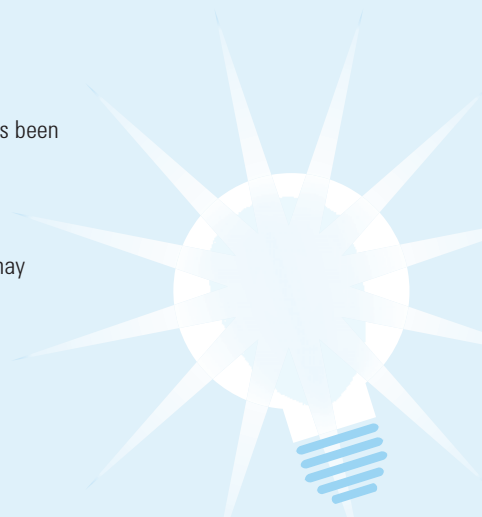
| Solvent Polarity                                   |     |                      |
|----------------------------------------------------|-----|----------------------|
| Polarity Index at 20°C                             |     | Solvent              |
| <div>Non-polar</div> <div>↓</div> <div>Polar</div> | 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         |
|                                                    | 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

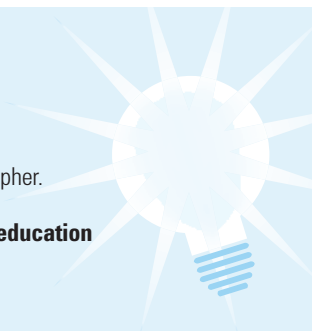
### SuperFlash Alumina

| 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      |

### Tips & Tools

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

For more information, visit [www.agilent.com/chem/education](http://www.agilent.com/chem/education)



## 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                                                                                                                        | AX1238-1 |
| Includes five empty cartridges and two Si 50, 5 g packed cartridges                                                                       |          |
| DASi 35 module kit                                                                                                                        | AX1237-1 |
| Includes five empty cartridges, two Si 50, 5 g packed cartridges and two Si 50, 10 g packed cartridges                                    |          |
| DASi 65 module kit                                                                                                                        | AX1236-1 |
| 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 |          |
| 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<br>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. |
| <b>Organic GPC</b> |                                    |                 |              |
| 79911GP-110        | PLgel 10 $\mu$ m guard             | 7.5 x 50        | PL1110-1120  |
| 79911GP-510        | PLgel 5 $\mu$ m guard              | 7.5 x 50        | PL1110-1520  |
| 79911GP-MXB        | PLgel 10 $\mu$ m MIXED-B           | 7.5 x 300       | PL1110-6100  |
| 79911GP-100        | PLgel 10 $\mu$ m 50Å               | 7.5 x 300       | PL1110-6115  |
| 79911GP-101        | PLgel 10 $\mu$ m 100Å              | 7.5 x 300       | PL1110-6120  |
| 79911GP-102        | PLgel 10 $\mu$ m 500Å              | 7.5 x 300       | PL1110-6125  |
| 79911GP-103        | PLgel 10 $\mu$ m 10 <sup>3</sup> Å | 7.5 x 300       | PL1110-6130  |
| 79911GP-104        | PLgel 10 $\mu$ m 10 <sup>4</sup> Å | 7.5 x 300       | PL1110-6140  |
| 79911GP-105        | PLgel 10 $\mu$ m 10 <sup>5</sup> Å | 7.5 x 300       | PL1110-6150  |
| 79911GP-106        | PLgel 10 $\mu$ m 10 <sup>6</sup> Å | 7.5 x 300       | PL1110-6160  |
| 79911GP-MXA        | PLgel 20 $\mu$ m MIXED-A           | 7.5 x 300       | PL1110-6200  |
| 79911GP-MXE        | PLgel 3 $\mu$ m MIXED-E            | 7.5 x 300       | PL1110-6300  |
| 79911GP-MXC        | PLgel 5 $\mu$ m MIXED-C            | 7.5 x 300       | PL1110-6500  |
| 79911GP-MXD        | PLgel 5 $\mu$ m MIXED-D            | 7.5 x 300       | PL1110-6504  |
| 79911GP-500        | PLgel 5 $\mu$ m 50Å                | 7.5 x 300       | PL1110-6515  |
| 79911GP-501        | PLgel 5 $\mu$ m 100Å               | 7.5 x 300       | PL1110-6520  |
| 79911GP-502        | PLgel 5 $\mu$ m 500Å               | 7.5 x 300       | PL1110-6525  |
| 79911GP-503        | PLgel 5 $\mu$ m 10 <sup>3</sup> Å  | 7.5 x 300       | PL1110-6530  |
| 79911GP-504        | PLgel 5 $\mu$ m 10 <sup>4</sup> Å  | 7.5 x 300       | PL1110-6540  |
| 79911GP-505        | PLgel 5 $\mu$ m 10 <sup>5</sup> Å  | 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.    |
| <b>Aqueous SEC of Polymers</b>       |                                                                |           |                 |
| 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     |
| <b>Polymer Standards for GPC/SEC</b> |                                                                |           |                 |
| 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.

#### 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.

To learn more, visit [www.agilent.com/chem/OnlineLibrary](http://www.agilent.com/chem/OnlineLibrary)





**Solvent Compatibility**

| <b>Solvent Polarity</b> | <b>Solvent</b>             |
|-------------------------|----------------------------|
| 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 pyrrolidone (NMP) |
| 12.0                    | Dimethyl sulfoxide (DMSO)  |
| 12.1                    | Dimethyl formamide (DMF)   |

**Tips & Tools**

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## 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

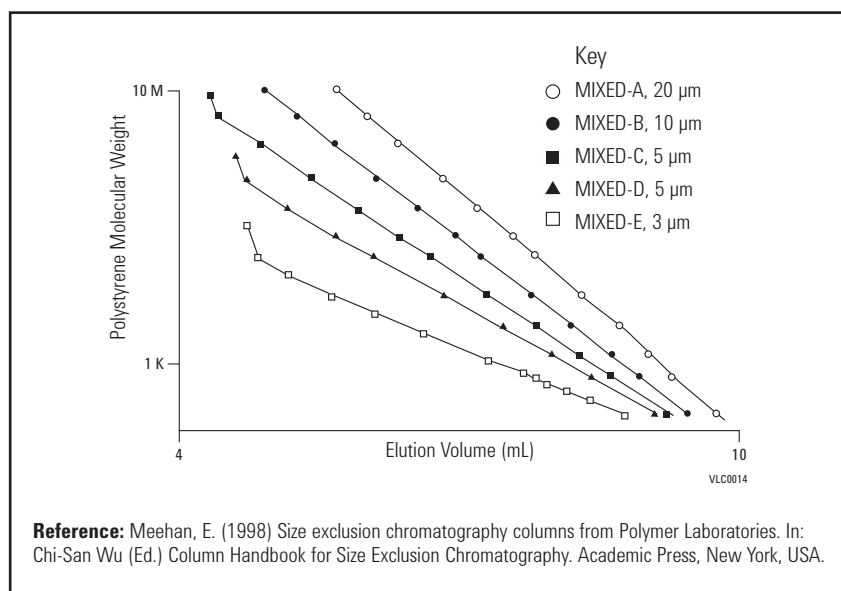
| Column  | Linear MW Operating Range (g/mol) | Guaranteed Column Efficiency                                   | Typical Pressure                                                                                                                                | Maximum Flow Rate                        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

## PLgel MIXED Column Selection Guide

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

## 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.



**PLgel MIXED Columns**

| <b>Description</b>  | <b>Size (mm)</b> | <b>Part No.</b> |
|---------------------|------------------|-----------------|
| 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**

| <b>Size (mm)</b> | <b>Particle Size (µm)</b> | <b>Part No.</b> |
|------------------|---------------------------|-----------------|
| 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  $\mu\text{m}$  MIXED-A and PLgel 10  $\mu\text{m}$  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

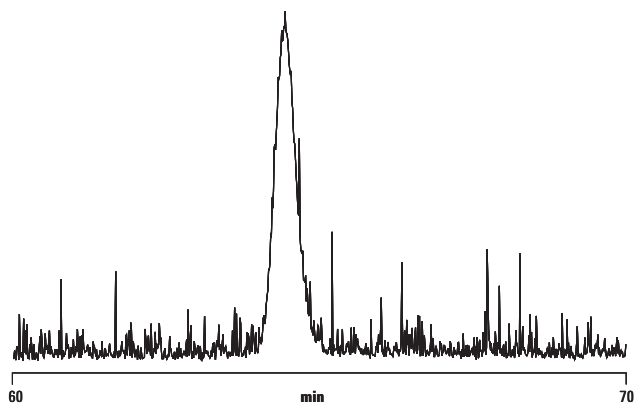
| Description                       | Size (mm) | Linear MW<br>Operating Range<br>(g/mol) (PS) | Guaranteed<br>Efficiency<br>(p/m) | Part No.      |
|-----------------------------------|-----------|----------------------------------------------|-----------------------------------|---------------|
| PLgel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

**Conventional GPC column****Column:** Conventional GPC column

Mobile Phase: THF

Flow Rate: 1.0 mL/min

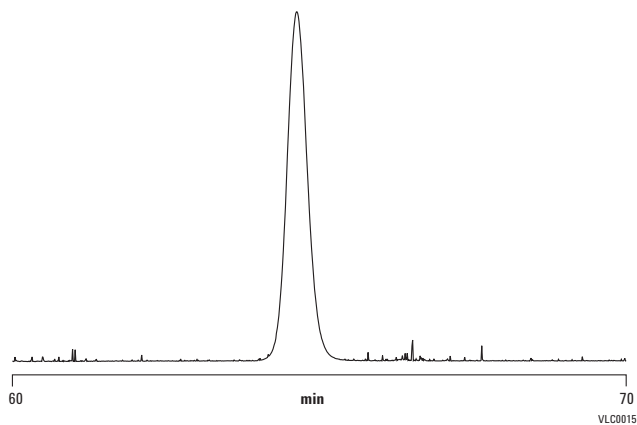
Detector: LS

**PLgel LS column****Column:** PLgel 10  $\mu$ m MIXED-B LS  
PL1110-6100LS  
7.5 x 300 mm, 10  $\mu$ m

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<br>Operating Range<br>(g/mol) (PS) | Guaranteed<br>Efficiency<br>(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

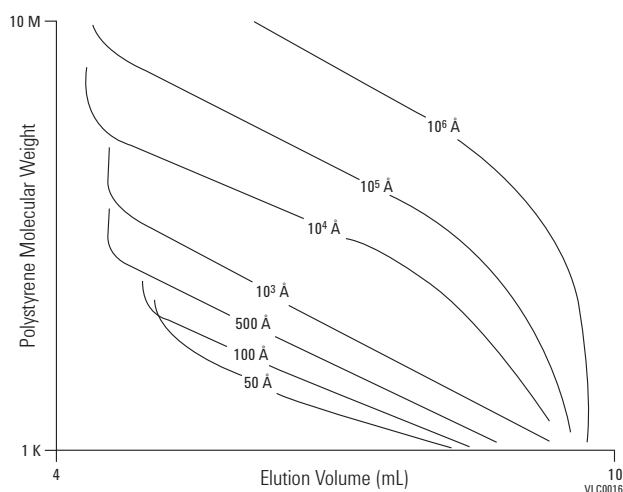
Individual pore size GPC columns offer high resolution over a specific molecular weight range. The linear portion of the calibration curve, where the slope is at its shallowest, defines the MW region over which optimum resolution will be achieved.

### 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 <sup>3</sup> | 500-60,000                             | > 50,000                    | PL1110-6530 |
| 7.5 x 300 | 5                  | 10 <sup>4</sup> | 10,000-600,000                         | > 50,000                    | PL1110-6540 |
| 7.5 x 300 | 5                  | 10 <sup>5</sup> | 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 <sup>3</sup> | 500-60,000                             | > 35,000                    | PL1110-6130 |
| 7.5 x 300 | 10                 | 10 <sup>4</sup> | 500-60,000                             | > 35,000                    | PL1110-6140 |
| 7.5 x 300 | 10                 | 10 <sup>5</sup> | 10,000-600,000                         | > 35,000                    | PL1110-6150 |
| 7.5 x 300 | 10                 | 10 <sup>6</sup> | 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  $\mu\text{m}$  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 ( $\mu\text{m}$ ) | Pore Size ( $\text{\AA}$ ) | Linear MW<br>Operating Range<br>(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<br>25 x 300   | 10                              |                            | 500-10,000,000                               | PL1210-6100 |
| MIXED-D<br>25 x 300   | 10                              |                            | 200-400,000                                  | PL1210-6104 |
| Prep guard<br>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  $\mu\text{m}$  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

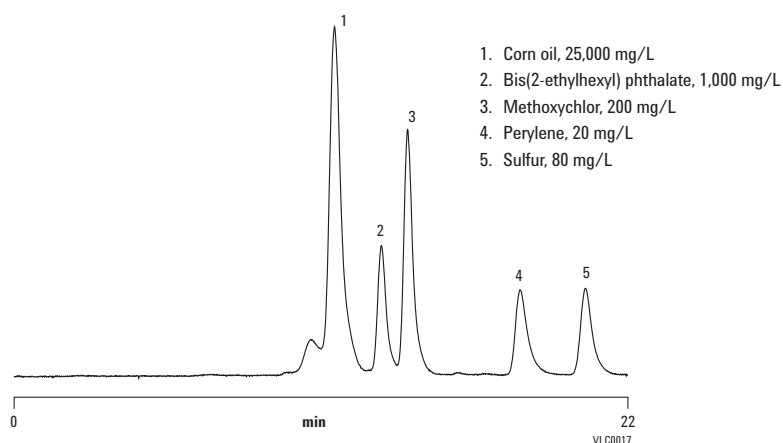
| Size (mm)  | Part No.       |
|------------|----------------|
| 21.2 x 150 | PL1E10-3120EPA |
| 25 x 150   | PL1210-3120EPA |
| 21.2 x 300 | PL1E10-6120EPA |
| 25 x 300   | PL1210-6120EPA |

#### 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  $\mu\text{m}$  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.

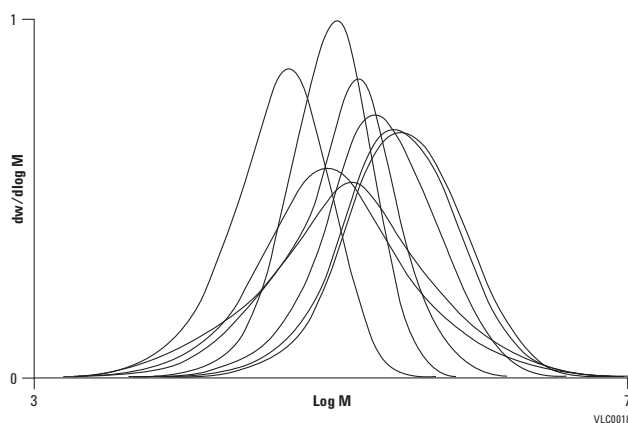
### PLgel Olexis

| 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  $\mu\text{L}$   
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**

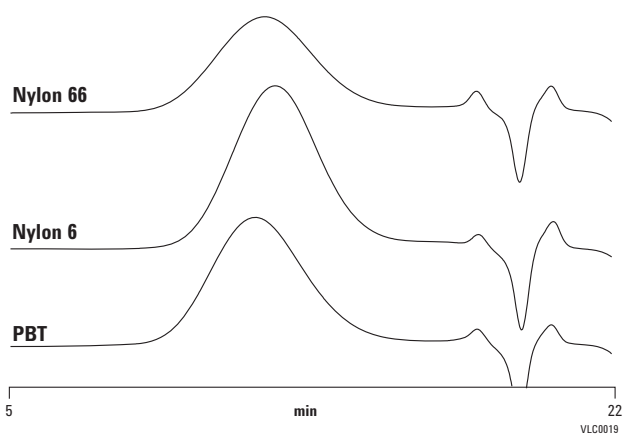
**Column:** 2 x PL HFIPgel, 7.5 x 300 mm  
PL1110-6400

**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.

### Tips & Tools

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

For more information, visit [www.agilent.com/chem/education](http://www.agilent.com/chem/education)

## PL Rapide

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

### Resin analysis by rapid GPC

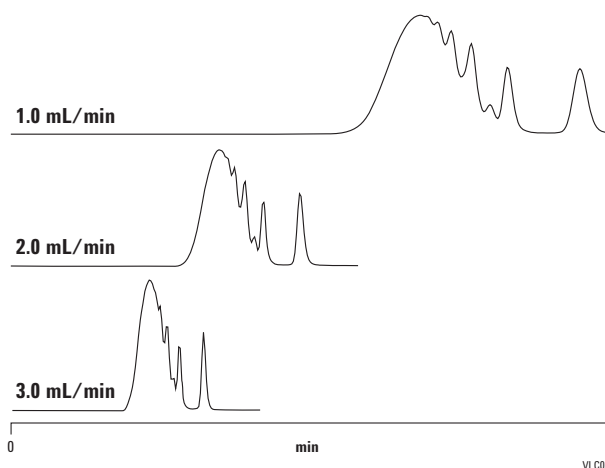
**Column:** PL Rapide L  
PL1013-2300  
10 x 100 mm

**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

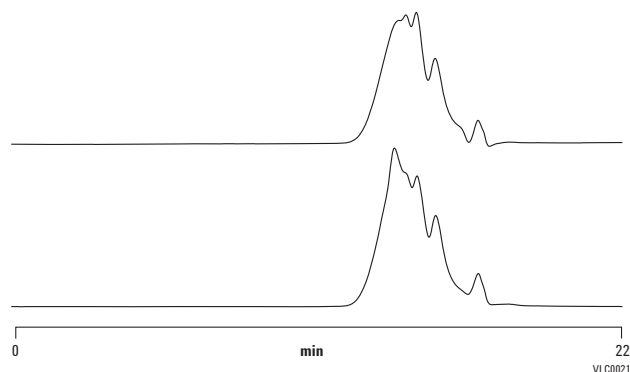
**Column:** 2 x PolarGel-L, 300 x 7.5 mm  
PL1117-6830

**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

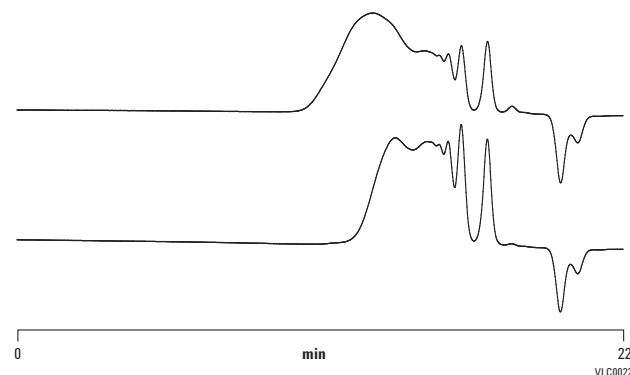
**Column:** 2 x PolarGel-M, 300 x 7.5 mm  
PL1117-6800

**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)

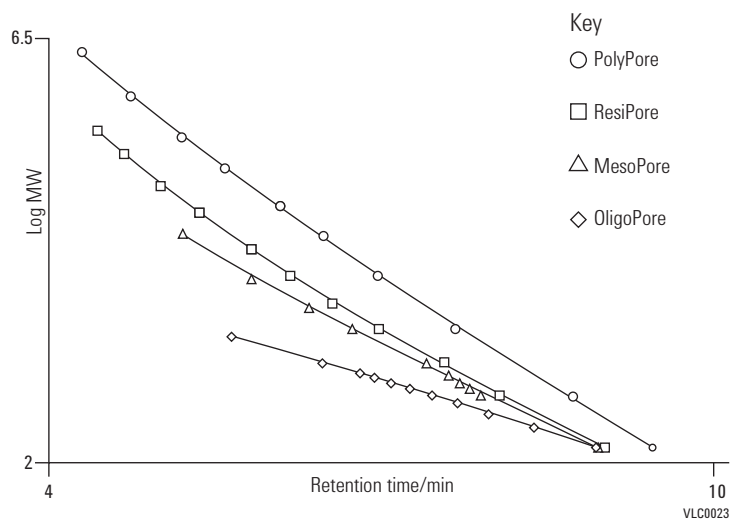


## PlusPore

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-1 or 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  $\mu\text{m}$  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 |

### 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.

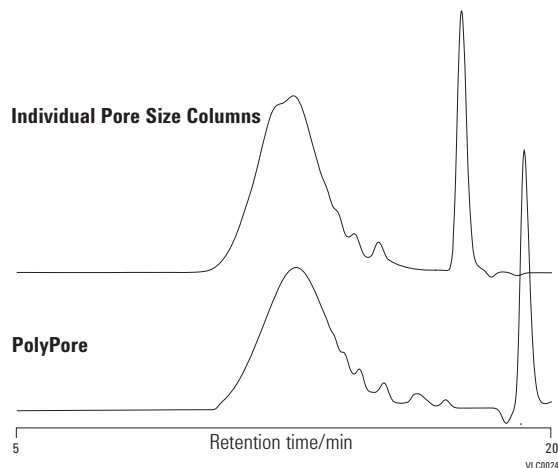
To learn more, visit [www.agilent.com/chem/OnlineLibrary](http://www.agilent.com/chem/OnlineLibrary)



## 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  $\mu\text{m}$  particle size and high pore volume, high efficiency ResiPore columns offer maximum resolution of these intermediate molecular weight polymers.

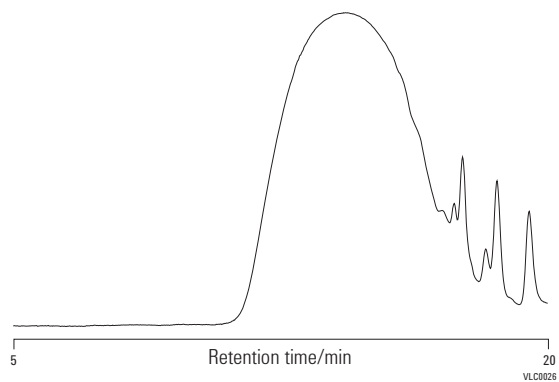
### ResiPore

| 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

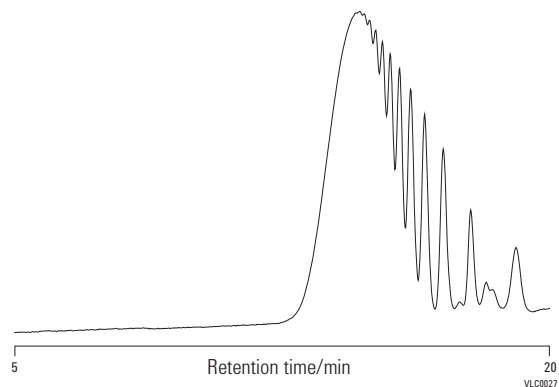
Mobile Phase: THF  
Flow Rate: 1.0 mL/min  
Injection Volume: 20  $\mu$ L  
Detector: UV, 254 nm



## Polyester

**Column:** 2 x ResiPore, 7.5 x 300 mm  
PL1113-6500

Mobile Phase: THF  
Flow Rate: 1.0 mL/min  
Injection Volume: 20  $\mu$ L  
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  $\mu\text{m}$  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.

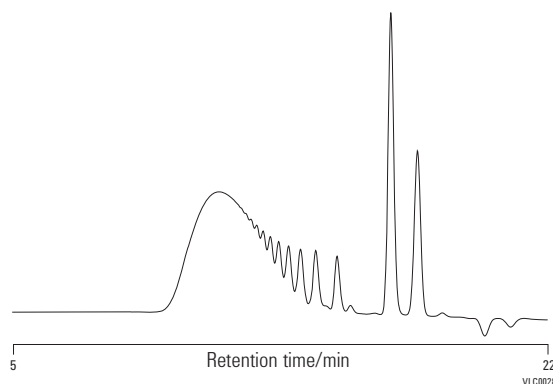
### MesoPore

| 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

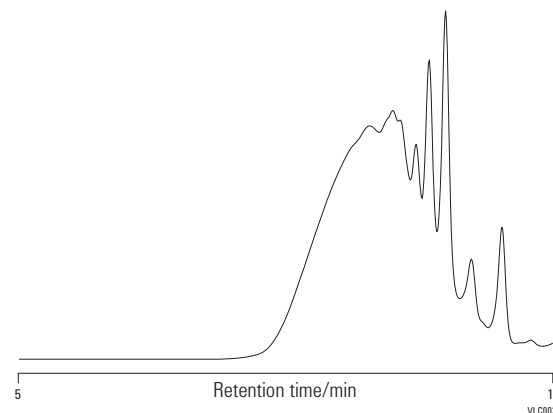
Mobile Phase: THF  
Flow Rate: 1.0 mL/min  
Injection Volume: 20  $\mu\text{L}$   
Detector: Agilent PL-GPC 50 (RI)



#### Polyesterimide

**Column:** 2 x MesoPore, 7.5 x 300 mm  
PL1113-6500

Mobile Phase: THF  
Flow Rate: 1.0 mL/min  
Injection Volume: 20  $\mu\text{L}$   
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 |

### Tips & Tools

Don't forget, we have special offers throughout the year.

To learn more, visit [www.agilent.com/chem/specialoffers](http://www.agilent.com/chem/specialoffers)



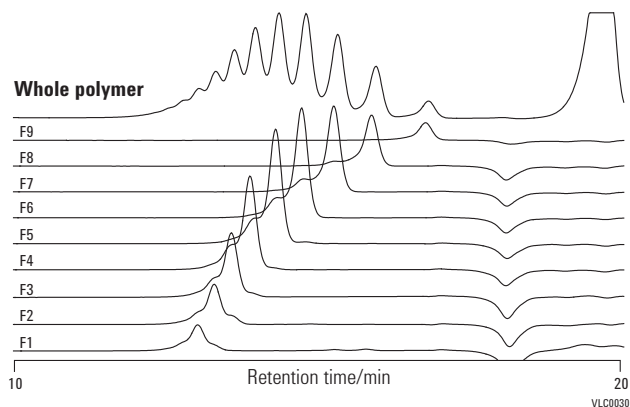
**Analysis of low molecular weight polystyrene and oligomer fractions collected from OligoPore preparative columns**

**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**

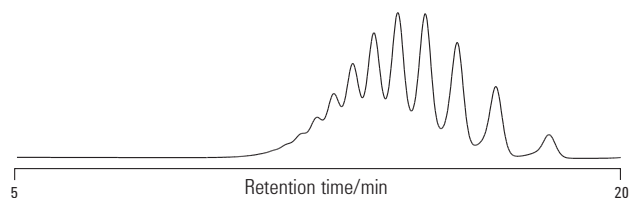
**Column:** 2 x OligoPore, 7.5 x 300 mm  
PL1113-6500

**Mobile Phase:** THF

**Flow Rate:** 1.0 mL/min

**Loading:** 0.2%, 100 mL

**Detector:** UV



**Preparative separation of low molecular weight polystyrene**

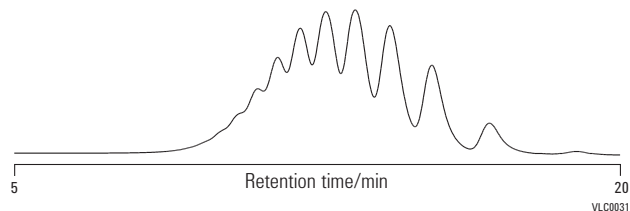
**Column:** 2 x OligoPore, 25 x 300 mm  
PL1113-6500

**Mobile Phase:** THF

**Flow Rate:** 10.0 mL/min

**Loading:** 2.0%, 2 mL

**Detector:** UV



## Aqueous SEC of Polymers

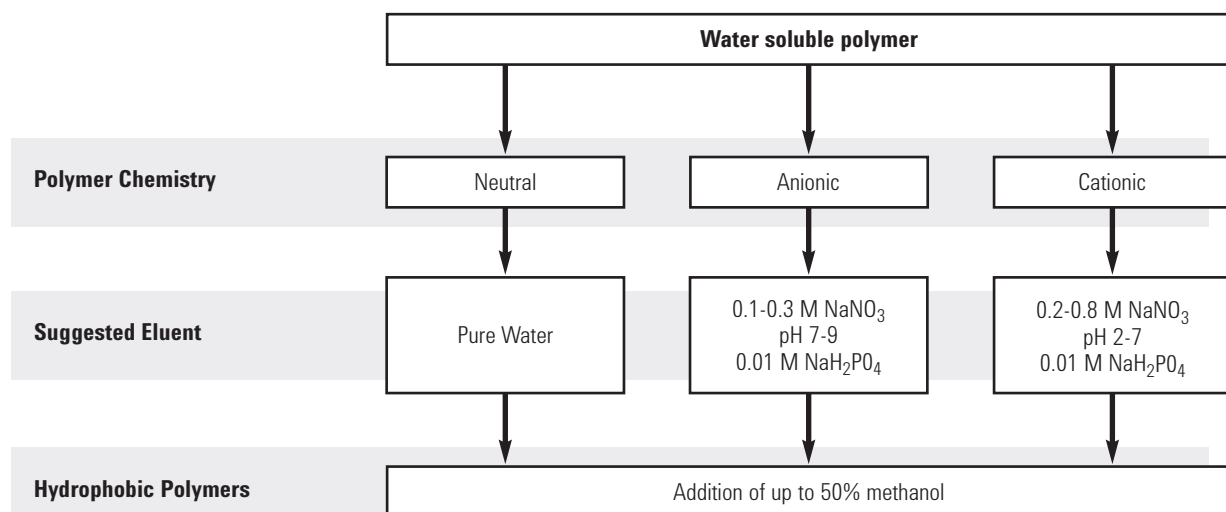
### PL aquagel-OH SEC

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

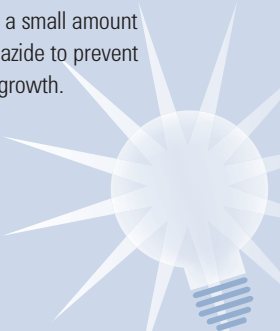
Due to the complex nature of water-soluble polymers, it is often necessary to modify the eluent in order to avoid sample-to-sample and sample-to-column interactions which can result in poor aqueous SEC separations. The excellent stability of the PL aquagel-OH packing material allows the eluent to be 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<br>PL aquagel-OH 8 µm, or<br>PL aquagel-OH 20 5 µm, or<br>PL aquagel-OH MIXED-M 8 µm |
| Polydisperse synthetic or naturally occurring polymers | Polysaccharides, PVA, cellulose derivatives, PEO, polyacrylic acid  | 2 or 3<br>PL aquagel-OH MIXED-H 8 µm, or<br>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<br>(g/mol) (PEG/PEO) | Guaranteed<br>Efficiency<br>(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<br>MIXED-H 8 µm | 7.5 x 300 | 100-10,000,000                | > 35,000                          | PL1149-6800 |
| PL aquagel-OH<br>MIXED-M 8 µm | 7.5 x 300 | 100-10,000,000                | > 35,000                          | PL1149-6801 |
| PL aquagel-OH<br>10 µm guard  | 25 x 25   |                               |                                   | PL1249-1120 |
| PL aquagel-OH<br>5 µm guard   | 7.5 x 50  |                               |                                   | PL1149-1530 |
| PL aquagel-OH<br>8 µm guard   | 7.5 x 50  |                               |                                   | PL1149-1840 |

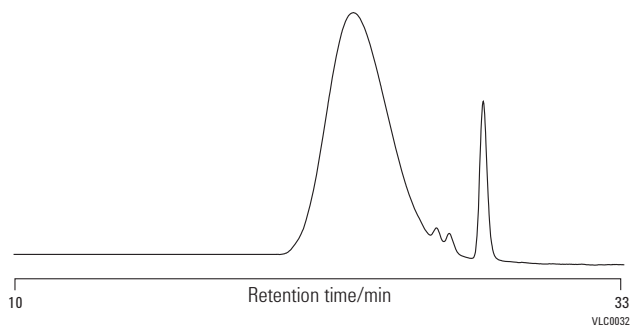
**Polyvinyl alcohol**

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

Mobile Phase: 0.2 M NaNO<sub>3</sub>, 0.01 M NaH<sub>2</sub>PO<sub>4</sub>, pH 7

Flow Rate: 1.0 mL/min

Detector: Agilent PL-GPC 50 (RI)

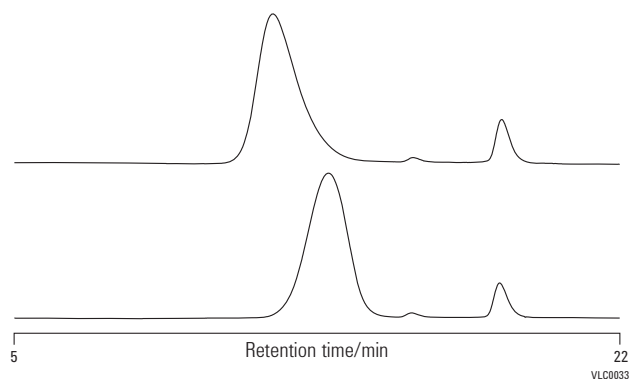
**Heparin**

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

Mobile Phase: 0.2 M NaNO<sub>3</sub>, 0.01 M NaH<sub>2</sub>PO<sub>4</sub>, pH 7

Flow Rate: 1.0 mL/min

Detector: Agilent PL-GPC 50 (RI)



## Hyaluronic acid

**Column:** PL aquagel-OH 60 15  $\mu\text{m}$   
PL1149-6260

7.5 x 300 mm, 15  $\mu\text{m}$

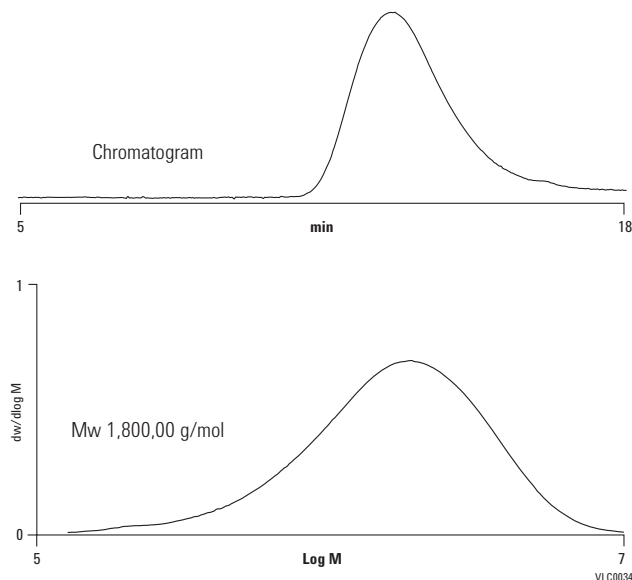
**Column:** PL aquagel-OH 40 15  $\mu\text{m}$   
PL1149-6240

7.5 x 300 mm, 15  $\mu\text{m}$

**Mobile Phase:** 0.2 M  $\text{NaNO}_3$ , 0.01 M  $\text{NaH}_2\text{PO}_4$ , 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  $\mu\text{m}$

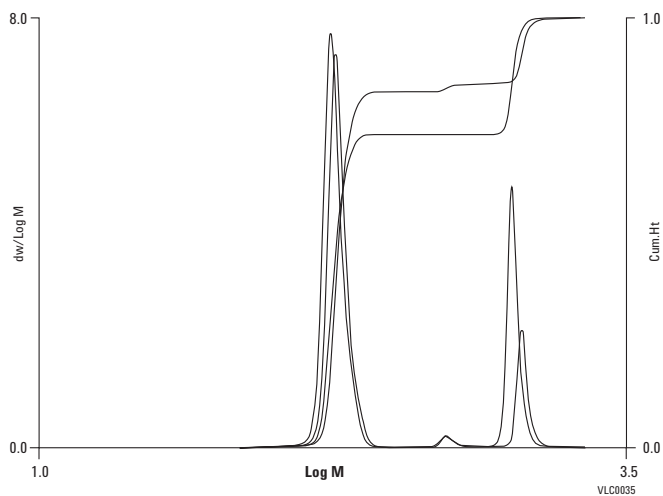
**Mobile Phase:** 0.25 M ammonium formate in water

**Flow Rate:** 1.0 mL/min

**Injection Volume:** 20  $\mu\text{L}$

**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  $\mu$ m particle size provides optimum resolution and loading characteristics with column efficiency > 20,000 plates/m.

### PL aquagel-OH Preparative

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



## Polyvinyl alcohol

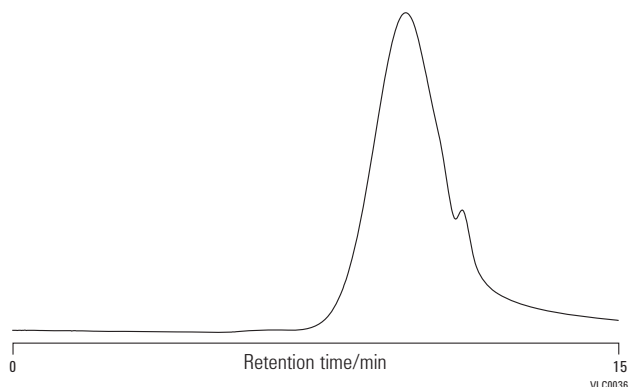
**Column:** PL aquagel-OH 40 8 µm  
PL1249-6140  
25 x 300 mm, 8 µm

**Mobile Phase:** 0.2 M NaNO<sub>3</sub>, 0.01 M NaH<sub>2</sub>PO<sub>4</sub>, 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  $M_p$  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  $\leq 1.10$ . 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

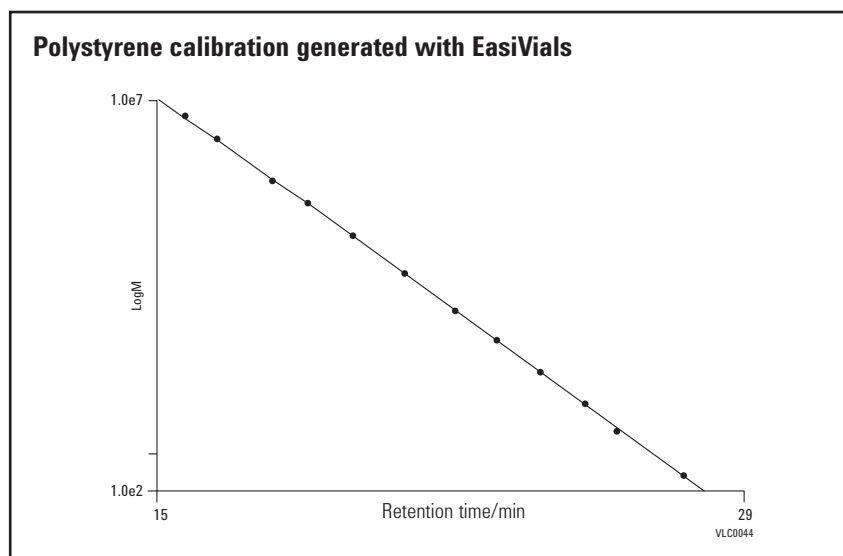
- Eliminates tedious weighing procedures to improve calibration accuracy
- Reduces solvent dispensing to limit risks associated with handling solvents
- For conventional and multi-detector GPC to maximize applicability

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.



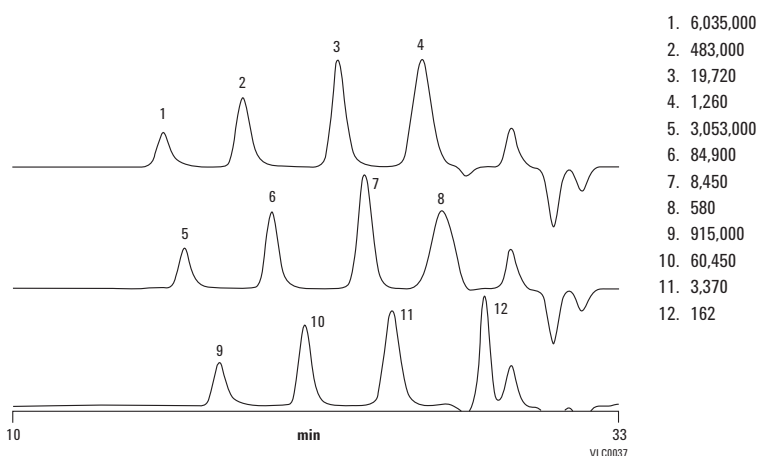
## EasiVial Pre-weighed Calibration Kits

| 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)



## EasiCal

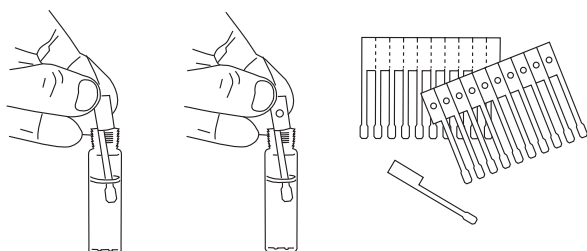
- Easy three-step process with no fuss
- Cost-effective format saves money
- Only two injections for improved productivity

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.

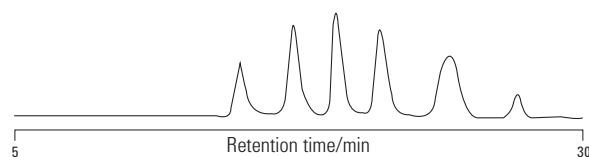
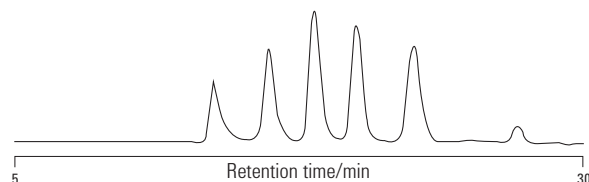
### EasiCal Pre-prepared Polystyrene Kits

| 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 |

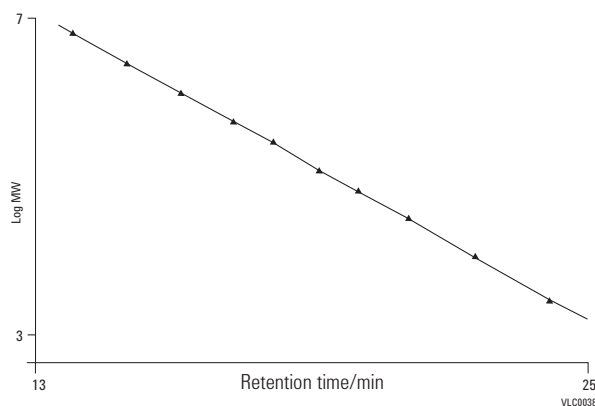
### Column calibration for GPC/SEC is as easy as 1, 2, 3...



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 |

### 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.

To learn more, visit [www.agilent.com/chem/OnlineLibrary](http://www.agilent.com/chem/OnlineLibrary)



## Individual Polymer Molecular Weights

| Polymer Nominal Mw<br>(g/mol) | Nominal Mw/Mn | 1 g<br>Part No. | 5 g<br>Part No. | 10 g<br>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      |

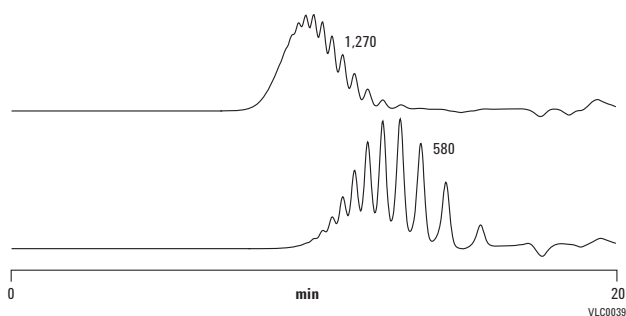
## Polystyrene standards

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

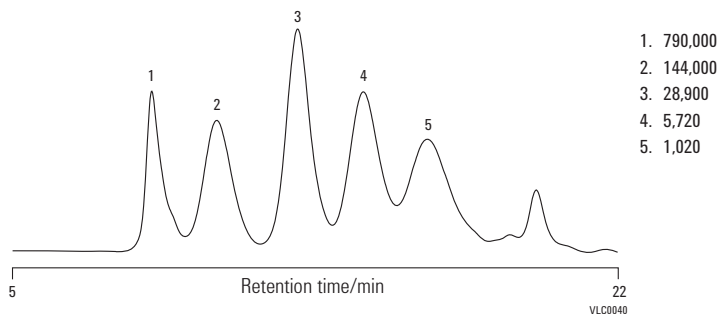
Column: 2 x PL HFIPgel  
PL1114-6900HFIP  
7.5 x 300

Mobile Phase: HFIP + 20 mM NaTFAc

Flow Rate: 1.0 mL/min

Temperature: 40°C

Detector: Agilent PL-GPC 50 (RI)



## 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 Mw<br>(g/mol) | Nominal Mw/Mn | 1 g<br>Part No. | 5 g<br>Part No. | 10 g<br>Part No. |
|-------------------------------|---------------|-----------------|-----------------|------------------|
| <b>Polyethylene Glycol</b>    |               |                 |                 |                  |
| 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      |
| <b>Polyethylene Oxide</b>     |               |                 |                 |                  |
| 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      |

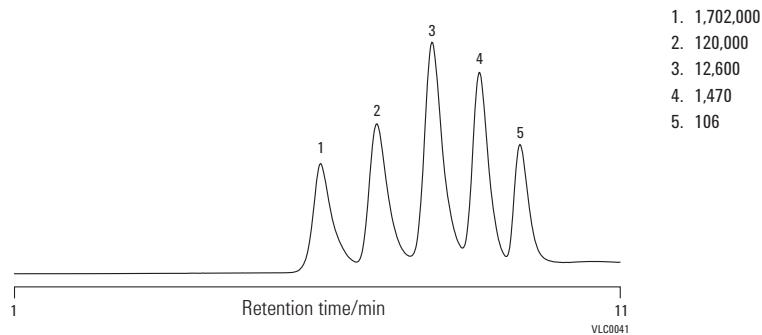
## Polyethylene Glycol/Oxide standards

Column: PL aquagel-OH MIXED-H 8  $\mu$ m  
 PL1149-6800  
 7.5 x 300 mm, 8  $\mu$ m

Mobile Phase: Water

Flow Rate: 1.0 mL/min

Detector: Agilent PL-GPC 50 (RI)



## 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 |

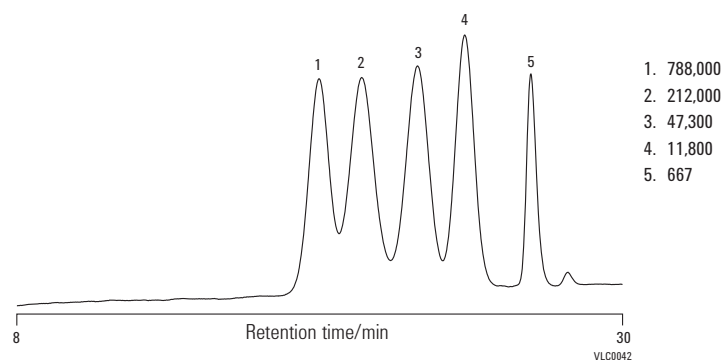
#### Pullulan polysaccharide standards

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

**Mobile Phase:** 0.2 M NaNO<sub>3</sub>, 0.01 M NaH<sub>2</sub>PO<sub>4</sub>, pH 7

**Flow Rate:** 1.0 mL/min

**Detector:** Agilent PL-GPC 50 (RI)



## 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 Polymer Nominal Methyl/<br>1000 Total Carbons (NMR) | Part No.    |
| E-SCB, 10 x 0.1 g                                  | 1.27-62.50                                                   | PL2650-0103 |

**Individual Polymer Molecular Weights**

| <b>Polymer Nominal Mp (g/mol)</b>                              | <b>Nominal Mw/Mn</b> | <b>Unit</b> | <b>Part No.</b> |
|----------------------------------------------------------------|----------------------|-------------|-----------------|
| 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     |
| <b>Polyethylene Broad MWD Individual Molecular Weights</b>     |                      |             |                 |
| 250,000                                                        | 9.50                 | 1 g         | PL2660-7001     |
| <b>Polyethylene Broad MWD/SCB Individual Molecular Weights</b> |                      |             |                 |
| 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**

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

**Individual Polymer Molecular Weights**

| <b>Polymer Nominal Mp (g/mol)</b> | <b>0.2 g<br/>Part No.</b> | <b>1 g<br/>Part No.</b> |
|-----------------------------------|---------------------------|-------------------------|
| 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)**

| <b>Polymer Nominal Mp (g/mol)</b> | <b>Nominal Mw/Mn</b> | <b>Part No.</b> |
|-----------------------------------|----------------------|-----------------|
| 5,000                             | 1.03                 | PL2570-5001     |
| 10,000                            | 1.05                 | PL2571-0001     |
| 20,000                            | 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  $\mu\text{m}$  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                       |                                                                                                          |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------|
| <b>Column phase</b>                         | Size Exclusion                                                                                           |
| <b>Packing</b>                              | Spherical, high purity, porous silica with a hydrophilic polymeric coating                               |
| <b>Particle size</b>                        | 3 $\mu\text{m}$                                                                                          |
| <b>Pore structure</b>                       | 100Å, 150Å, 300Å                                                                                         |
| <b>Column exclusion limits (in Daltons)</b> | 100Å MW range: 100-100,000<br>150Å MW range: 500-150,000<br>300Å MW range: 5,000-1,250,000               |
| <b>pH stability</b>                         | 2-8.5                                                                                                    |
| <b>Operating temperature limit</b>          | Recommended range: 10-30°C<br>Maximum: 80°C                                                              |
| <b>Operating pressure limit</b>             | Recommended operating pressure: 137 bar (2,000 psi)<br>Maximum pressure: 240 bar (3,500 psi)             |
| <b>Mobile phase compatibility</b>           | Recommended: 150 mM phosphate buffer, pH 7.0<br>Other aqueous buffers with high and low salt can be used |
| <b>Working flow rate</b>                    | 0.1-1.25 mL/min for 7.8 mm ID columns<br>0.1-0.4 mL/min for 4.6 mm ID columns                            |

## Aggregation Analysis of a Humanized Monoclonal Antibody

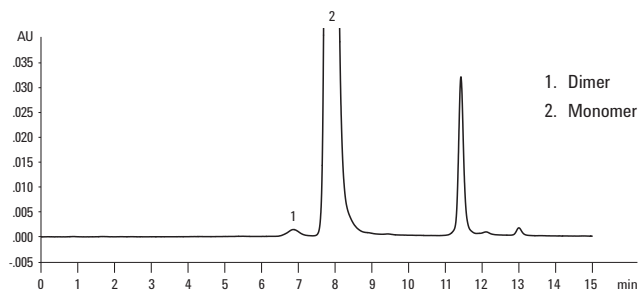
**Column:** Bio SEC-3, 300Å  
5190-2511  
7.8 x 300 mm, 3 µm

**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

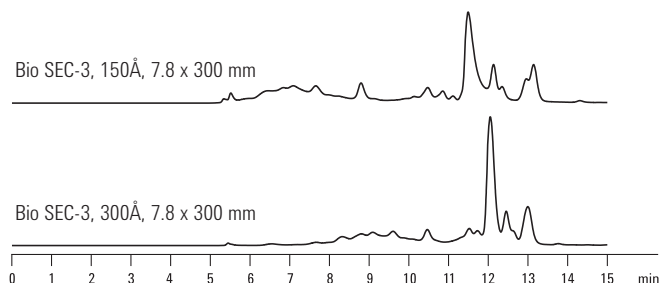
**Flow Rate:** 1.0 mL/min

**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<br>100Å | Bio SEC-3<br>150Å | Bio SEC-3<br>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

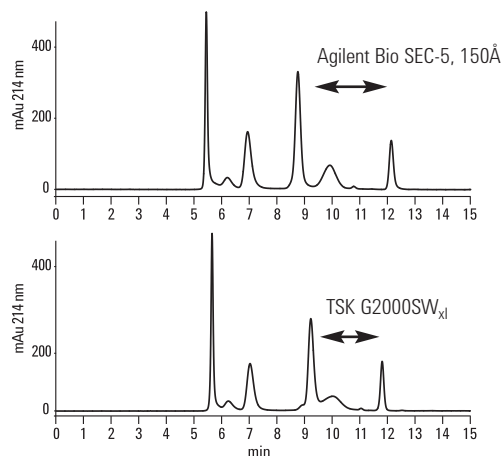
- Maximum recovery for a broad range of size-based, biomolecule separations
- Outstanding reproducibility and column lifetime
- Excellent stability, even under high-pH, high-salt, and low-salt conditions
- Compatibility with most aqueous buffers

Agilent Bio SEC-5 HPLC columns are packed with 5  $\mu\text{m}$  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  $\mu\text{m}$  particles with 100Å, 150Å, 300Å, 500Å, 1000Å, and 2000Å nominal pore sizes.

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

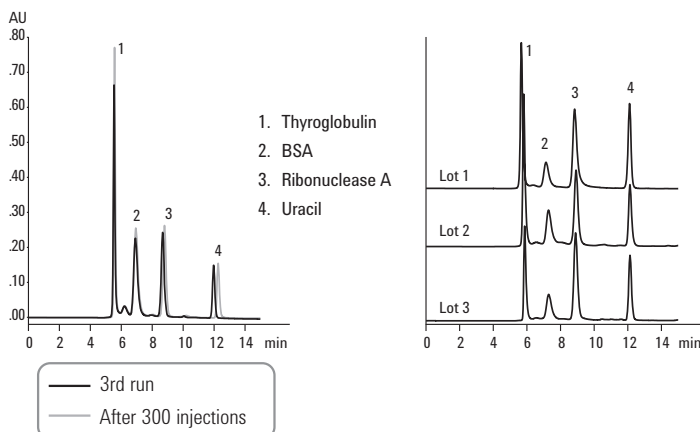
Separation of a protein mixture on an Agilent Bio SEC-5 HPLC column and a Tosoh TSK-Gel column. Notice the sharper peaks and better resolution on the Agilent Bio SEC-5 HPLC column.

## 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 <sup>2</sup> /g | 3.0-8.0  | <3.0 mL/min | 350 bar      |
| ZORBAX GF-450 | 300Å      | 6 µm          | 10,000-900,000 | 50 m <sup>2</sup> /g  | 3.0-8.0  | <3.0 mL/min | 350 bar      |

Specifications represent typical values only.

### Tips & Tools

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

For more information, visit [www.agilent.com/chem/education](http://www.agilent.com/chem/education)

## 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

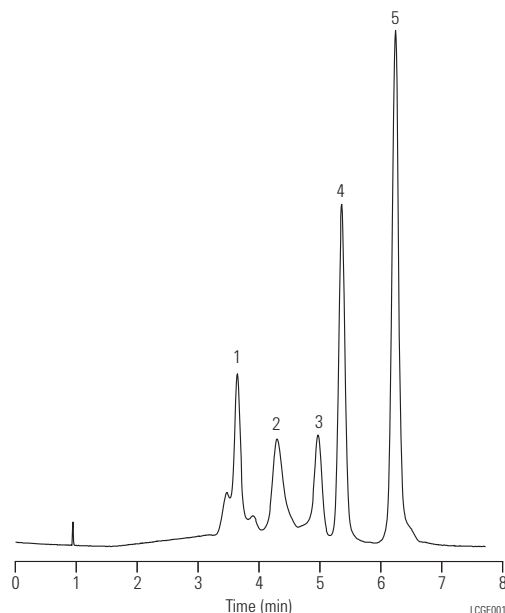
**Temperature:** Ambient

**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

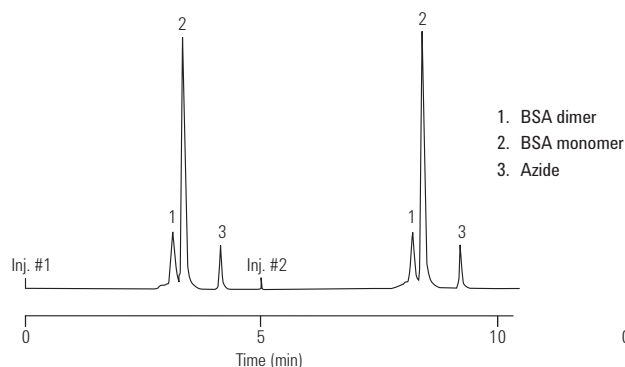
**Flow Rate:** 3 mL/min

**Temperature:** Ambient

**Detector:** 220 nm

**Sample:** BSA and BSA Dimers

### BSA and BSA Dimers (duplicate injections)



## High-Speed Size Exclusion Separations 2

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

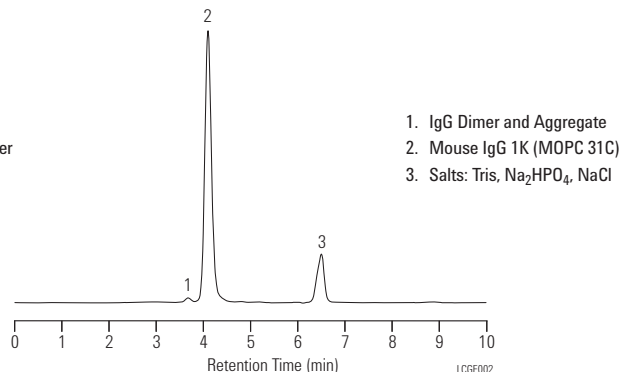
**Mobile Phase:** 200 mM Na Phosphate Monobasic pH 7.0/0.1% Azide

**Flow Rate:** 2 mL/min

**Detector:** 225 nm

**Sample:** 10 µg in 50 mM Sodium Phosphate pH 7.0

### Antibody Separation



**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 |
| <b>Guard Columns (hardware required)</b>                                          |                                      |            |                    |            |
|  | GF-250 Diol, Guard Cartridge, 2/pk   | 9.4 x 15   | 6                  | 820675-111 |
|  | GF-250 Diol, Guard Cartridge, 4/pk   | 4.6 x 12.5 | 6                  | 820950-911 |
|  | GF-450 Diol, Guard Cartridge, 2/pk   | 9.4 x 15   | 6                  | 820675-111 |
|  | GF-250 Diol, Guard Cartridge, 4/pk   | 4.6 x 12.5 | 6                  | 820950-911 |
|  | Guard Hardware Kit                   |            |                    | 840140-901 |
|  | Guard Hardware Kit                   |            |                    | 820999-901 |
| <b>PrepHT Columns</b>                                                             |                                      |            |                    |            |
|  | PrepHT GF-250, 150Å                  | 21.2 x 250 | 6                  | 877974-901 |
|  | PrepHT GF-450, 300Å                  | 21.2 x 250 | 6                  | 877974-910 |
|  | PrepHT endfittings, 2/pk             |            |                    | 820400-901 |
|  | PrepHT GF-250, Guard Cartridge, 2/pk | 17 x 7.5   | 5                  | 820212-911 |
|  | PrepHT GF-450, Guard Cartridge, 2/pk | 17 x 7.5   | 5                  | 820212-911 |
|  | 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  $\mu\text{m}$  sizes, providing higher resolution with smaller particles.

#### Column Specifications

|                                                 |                                                                                                                                                                                                                      |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Column phase</b>                             | Weak Cation Exchange (carboxylate)                                                                                                                                                                                   |
| <b>Packing</b>                                  | Non-porous, poly(styrene divinylbenzene) (PS/DVB), grafted hydrophilic coating and bonded with a uniform, weak cation exchange layer                                                                                 |
| <b>Particle size</b>                            | 1.7, 3, 5 and 10 $\mu\text{m}$                                                                                                                                                                                       |
| <b>Pore structure</b>                           | Non-porous                                                                                                                                                                                                           |
| <b>pH stability</b>                             | 2-12                                                                                                                                                                                                                 |
| <b>Operating temperature limit</b>              | 80°C                                                                                                                                                                                                                 |
| <b>Column hardware operating pressure limit</b> | 600 bar (8,700 psi) for stainless steel column hardware<br>400 bar (5,800 psi) for PEEK column hardware                                                                                                              |
| <b>Particle operating pressure limit</b>        | 275 bar (4,000 psi) for 10 $\mu\text{m}$ particles<br>413 bar (6,000 psi) for 5 $\mu\text{m}$ particles<br>551 bar (8,000 psi) for 3 $\mu\text{m}$ particles<br>689 bar (10,000 psi) for 1.7 $\mu\text{m}$ particles |
| <b>Mobile phase compatibility</b>               | Compatible with aqueous solution buffers, acetonitrile/acetone/methanol and water mixtures. Commonly used buffers: phosphate, tris, MES and acetate.                                                                 |
| <b>Working flow rate</b>                        | 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

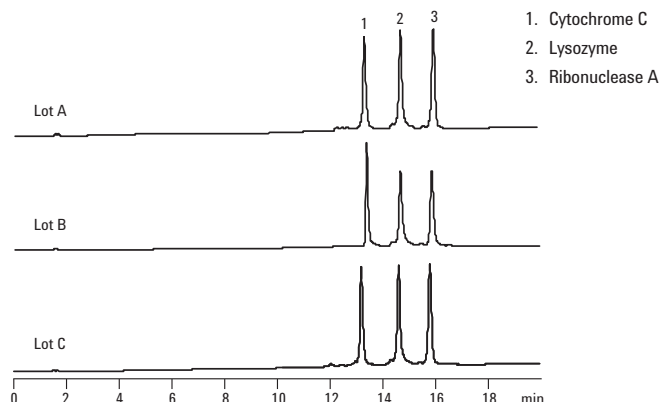
**Flow Rate:** 1.0 mL/min

**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

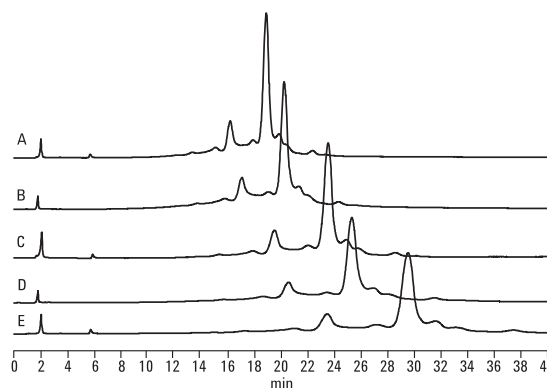
D: 15-47.5% B in 30 min

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  $\mu\text{m}$  non-porous particles sizes.

### 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.

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## Column Specifications

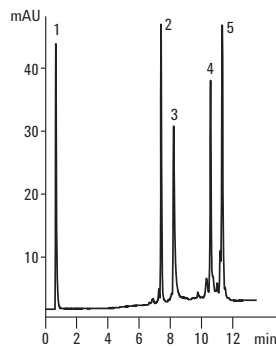
|                                                 |                                                                                                                                                                                                                                 |             |            |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------|
| <b>Column phase</b>                             | SCX (Strong cation exchange) – $\text{SO}_3\text{H}$<br>WCX (Weak cation exchange) – $\text{COOH}$<br>SAX (Strong anion exchange) – $\text{N}(\text{CH}_3)_3$<br>WAX (Weak anion exchange) – $\text{N}(\text{C}_2\text{H}_5)_2$ |             |            |
| <b>Packing</b>                                  | Non-porous, poly(styrene divinylbenzene) (PS/DVB), grafted hydrophilic coating and bonded with a uniform, ion exchange layer                                                                                                    |             |            |
| <b>Particle size</b>                            | 1.7, 3, 5 and 10 $\mu\text{m}$                                                                                                                                                                                                  |             |            |
| <b>Pore structure</b>                           | Non-porous                                                                                                                                                                                                                      |             |            |
| <b>pH stability</b>                             | 2-12                                                                                                                                                                                                                            |             |            |
| <b>Operating temperature limit</b>              | 80°C                                                                                                                                                                                                                            |             |            |
| <b>Column hardware operating pressure limit</b> | 600 bar (8,700 psi) for stainless steel column hardware<br>400 bar (5,800 psi) for PEEK column hardware                                                                                                                         |             |            |
| <b>Particle operating pressure limit</b>        | 275 bar (4,000 psi) for 10 $\mu\text{m}$ particles<br>413 bar (6,000 psi) for 5 $\mu\text{m}$ particles<br>551 bar (8,000 psi) for 3 $\mu\text{m}$ particles<br>689 bar (10,000 psi) for 1.7 $\mu\text{m}$ particles            |             |            |
| <b>Mobile phase compatibility</b>               | Compatible with aqueous solution buffers, acetonitrile/acetone/methanol and water mixtures. Commonly used buffers: phosphate, tris, MES and acetate                                                                             |             |            |
| <b>Working flow rate</b>                        | 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.                                         |             |            |
| <b>Dynamic binding capacity</b>                 |                                                                                                                                                                                                                                 | <b>NP3</b>  | <b>NP5</b> |
|                                                 |                                                                                                                                                                                                                                 | <b>NP10</b> |            |
|                                                 | SCX                                                                                                                                                                                                                             | 53 mg/mL    | 38 mg/mL   |
|                                                 | WCX                                                                                                                                                                                                                             | 19 mg/mL    | 15 mg/mL   |
|                                                 | SAX                                                                                                                                                                                                                             | 35 mg/mL    | 28 mg/mL   |
|                                                 | WAX                                                                                                                                                                                                                             | 26 mg/mL    | 18 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).



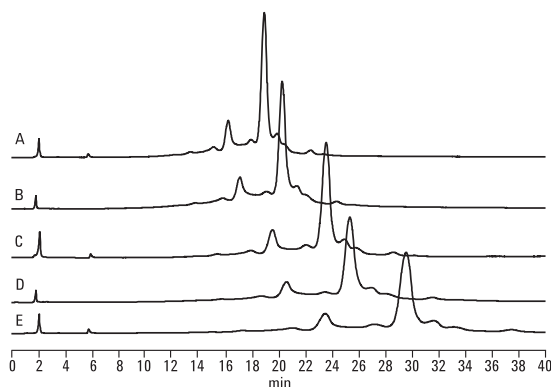
1. Ovalbumin, 4.6 pI
  2. Ribonuclease A, 8.7 pI
  3. Cytochrome C, 9.6 pI
  4. Aprotinin, 10.0 pI
  5. Lysozyme, 11.0 pI
- N > 100,000/50 mm for Lysozyme

## 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        |

**Tips & Tools**

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## 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  $\mu$ L 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

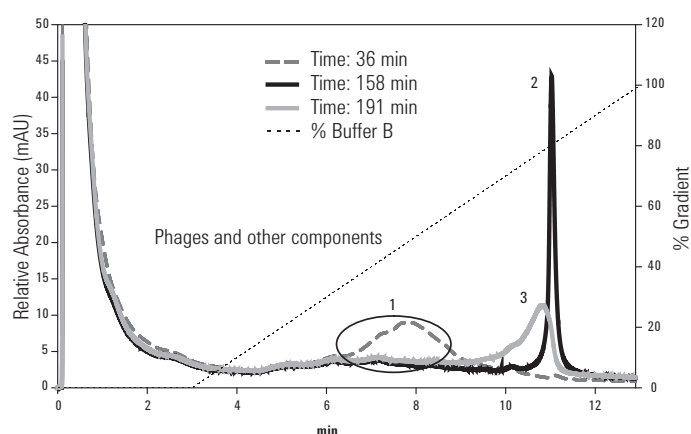
|                                   |                                                                                         |
|-----------------------------------|-----------------------------------------------------------------------------------------|
| <b>Dimensions</b>                 | 5.2 mm x 4.95 mm                                                                        |
| <b>Column volume</b>              | 100 $\mu$ L                                                                             |
| <b>Maximum pressure</b>           | 150 bar (15 MPa, 2200 psi)                                                              |
| <b>Temperature min/max</b>        | Working: 4°C-40°C                                                                       |
|                                   | Storage: 4°C-30°C                                                                       |
| <b>Recommended pH</b>             | Working range: 2-13                                                                     |
|                                   | Cleaning-in-place: 1-14                                                                 |
| <b>Materials of construction</b>  | Hardware: Stainless steel                                                               |
|                                   | Packing: poly (glycidyl methacrylate-co-ethylene dimethacrylate) highly porous monolith |
| <b>Color ring identifier</b>      | Bio-Monolith QA: Blue                                                                   |
|                                   | Bio-Monolith DEAE: Green                                                                |
|                                   | Bio-Monolith SO <sub>3</sub> : Red                                                      |
|                                   | Bio-Monolith Protein A: White                                                           |
| <b>Shelf life/expiration date</b> | Protein A: 12 months                                                                    |
|                                   | SO <sub>3</sub> , 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.       | <ul style="list-style-type: none"> <li>Adenovirus process monitoring and quality control</li> <li>IgM purification monitoring and quality control</li> <li>Monitoring DNA impurity removal</li> <li>Monitoring endotoxin removal</li> <li>HSA Purity</li> </ul> | 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. | <ul style="list-style-type: none"> <li>Process monitoring and quality control of bacteriophage manufacturing and purification</li> <li>Process monitoring and quality control of plasmid DNA purification</li> </ul>                                            | 5069-3636 |
| Bio-Monolith SO <sub>3</sub> | The sulfonyl bonded phase (Strong Cation Exchange) is fully charged over a working pH range of 2-13, binding positively charged bio-molecules.              | <ul style="list-style-type: none"> <li>Fast and high resolution analytical separations of large molecules such as proteins and antibodies</li> <li>Hemoglobin A1c fast analytics</li> </ul>                                                                     | 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.                                | <ul style="list-style-type: none"> <li>Quantitative determination of IgG (fermentation titer calculation)</li> </ul>                                                                                                                                            | 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 <sup>2</sup> /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

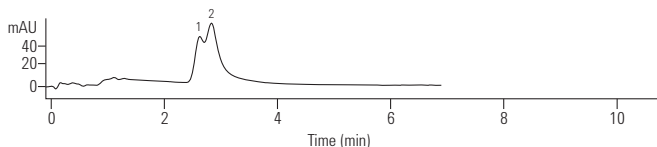
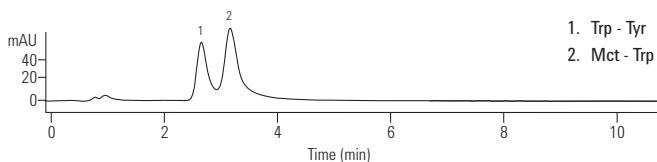
**Mobile Phase:** 95% 40 mM NaCl: 5% ACN,  
0.3% Formic Acid

**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.



LC0602

## 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  $\mu m$  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  $\mu m$

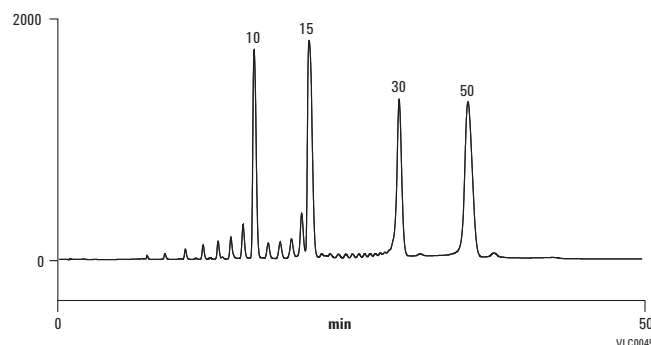
**Mobile Phase:** A: 7:93 v/v ACN: 0.1 M TEAA, pH 8.5  
B: 7:93 v/v ACN: 0.1 M TEAA, 1 M ammonium chloride, pH 8.5

**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-SAX and PL-SCX columns are also available for Prep to Process.

Turn to page 1042.

## 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<sub>3</sub><sup>-</sup> 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

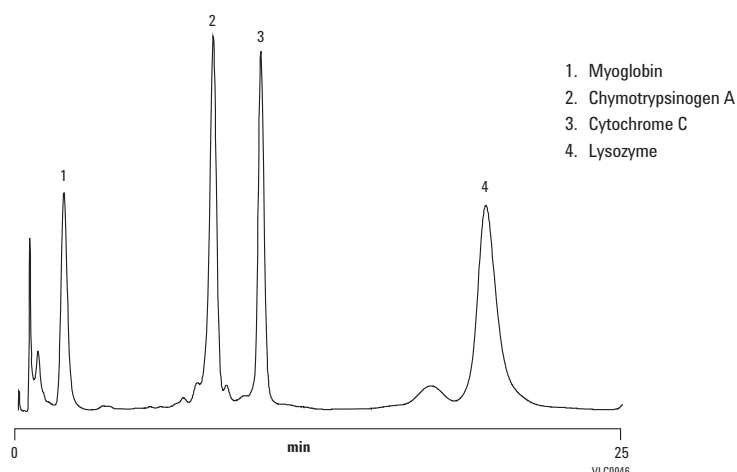
**Column:** PL-SCX 1000Å  
PL1545-1502  
4.6 x 50 mm, 5 µm

**Mobile Phase:** A: 20 mM KH<sub>2</sub>PO<sub>4</sub>, 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



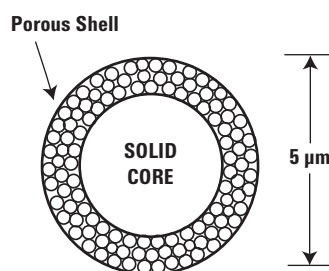
### PL-SCX Strong Cation Exchange Columns

| 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 |
|------------------------------------|-----------|------------------------------------|----------|-----------|
| <b>Poroshell 300SB-C18, C8, C3</b> | 300Å      | 90°C                               | 1.0-8.0  | No        |
| <b>Poroshell 300Extend-C18</b>     | 300Å      | 40°C above pH 8<br>60°C below pH 8 | 2.0-11.0 | Yes       |

Specifications represent typical values only.

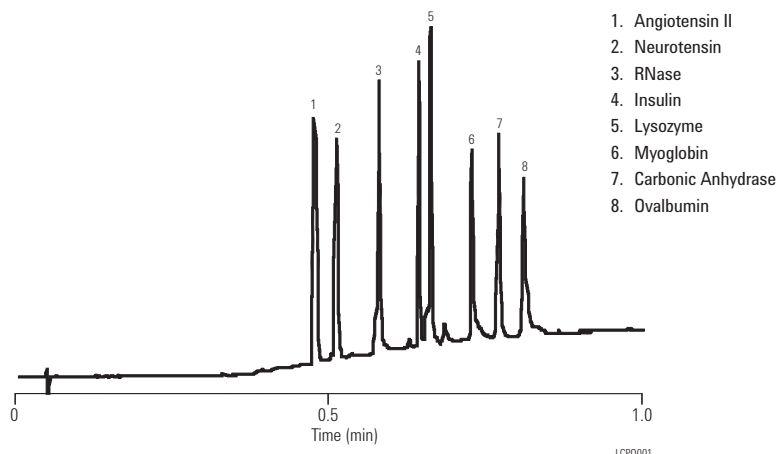
\*300StableBond columns are designed for optimal use at low pH. At pH 6-8, highest column stability for all silica-based columns is obtained by operating at temperatures <40°C and using low buffer concentrations in the range of 0.01-0.02 M. At mid or high pH, 300Extend-C18 is recommended.

## 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<sub>2</sub>O  
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.

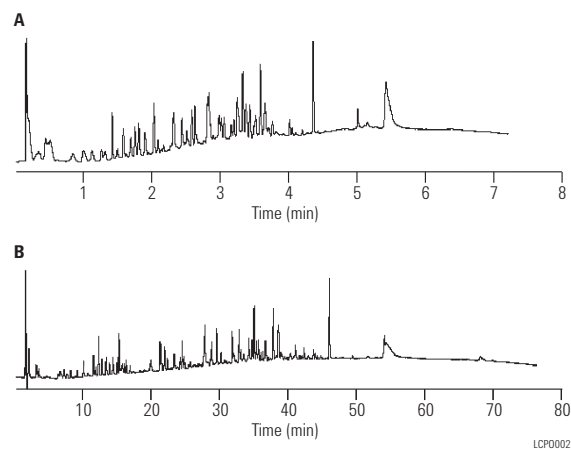


## Reduce Peptide Map Analysis Time by 90% with Poroshell 300SB

**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<sub>2</sub>O, 5% ACN, 0.1% TFA  
B: 5% H<sub>2</sub>O, 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

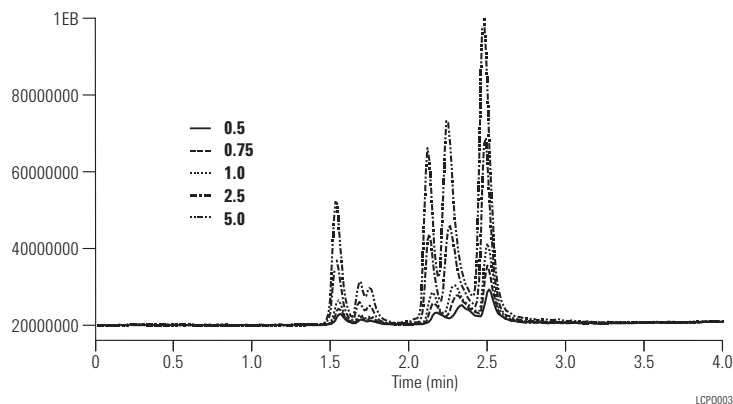
Fragmentor Volatage: 140 V

Scan: 600-2500

Stepsize: 0.15 amu

Peak width: 0.06 min

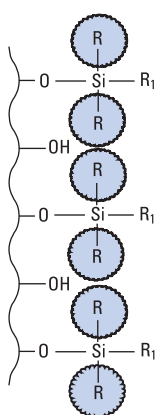
**Sample:** 1 µL



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          |                    |                         |
|  Guard Cartridge, 4/pk | 2.1 x 12.5 | 5                  | 821075-920          | 821075-918         | 821075-924         |                         |
|  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

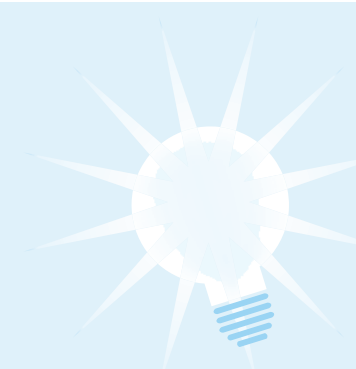
| Bonded Phase     | Pore Size | Surface Area         | Temp. Limits* | pH Range* | Endcapped | Carbon Load |
|------------------|-----------|----------------------|---------------|-----------|-----------|-------------|
| ZORBAX 300SB-C18 | 300Å      | 45 m <sup>2</sup> /g | 90°C          | 1.0-8.0   | No        | 2.8%        |
| ZORBAX 300SB-C8  | 300Å      | 45 m <sup>2</sup> /g | 80°C          | 1.0-8.0   | No        | 1.5%        |
| ZORBAX 300SB-C3  | 300Å      | 45 m <sup>2</sup> /g | 80°C          | 1.0-8.0   | No        | 1.1%        |
| ZORBAX 300SB-CN  | 300Å      | 45 m <sup>2</sup> /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

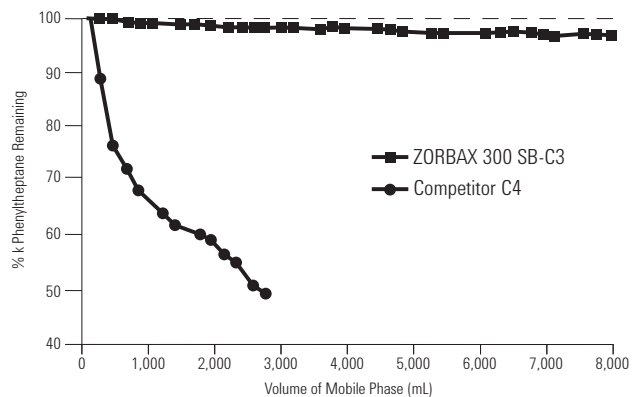
**Column:** ZORBAX 300SB-C3  
883995-909  
4.6 x 150 mm, 5 µm

**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

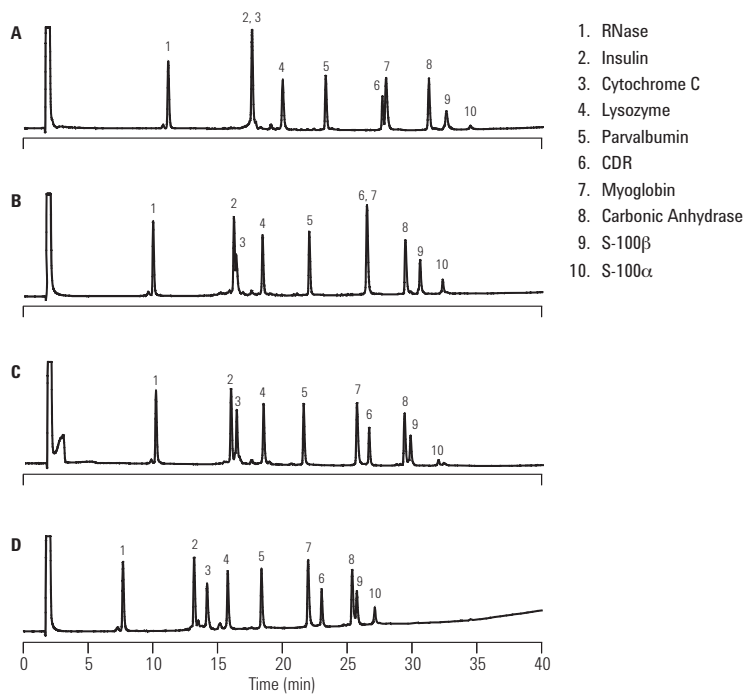
**Column D:** ZORBAX 300SB-CN  
883995-905  
4.6 x 150 mm, 5 µm

**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.

### 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

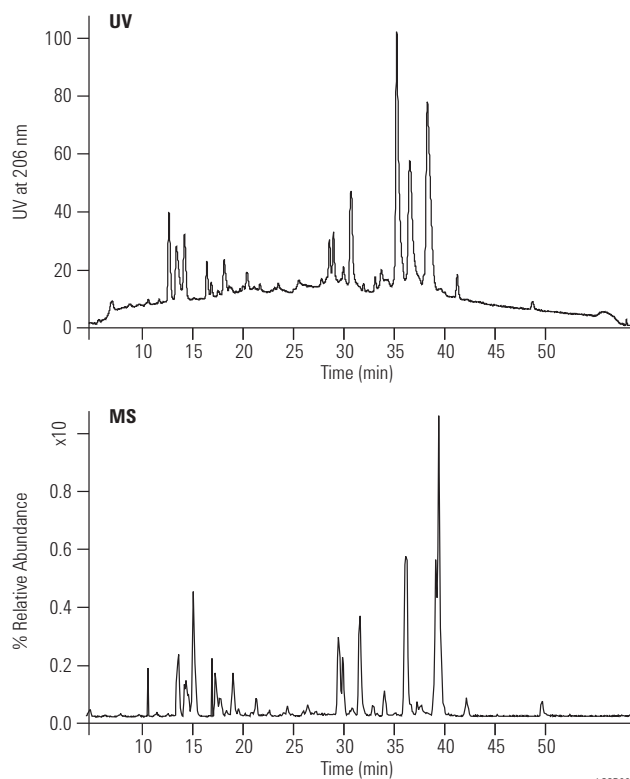
**Flow Rate:** 5.5 µL/min

**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 Amplitude: 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

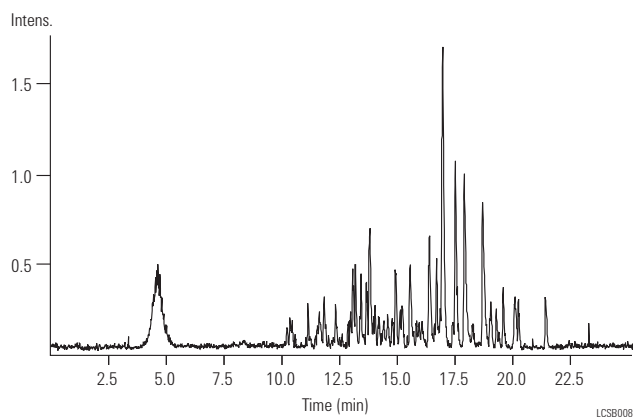
**Flow Rate:** 600 nL/min

**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.



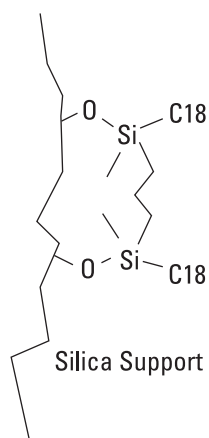
**ZORBAX 300Å StableBond**

| Hardware Description                                                                                      | Size (mm)  | Particle Size (µm) | 300SB-C18<br>USP L1 | 300SB-C8<br>USP L7 | 300SB-CN<br>USP L10 | 300SB-C3<br>USP L56 |
|-----------------------------------------------------------------------------------------------------------|------------|--------------------|---------------------|--------------------|---------------------|---------------------|
| <b>Standard Columns (no special hardware required)</b>                                                    |            |                    |                     |                    |                     |                     |
| 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          |                     |                     |
|  Guard Cartridge, 2/pk  | 9.4 x 15   | 7                  | 820675-124          | 820675-124         | 820675-124          | 820675-124          |
|  Guard Cartridge, 4/pk | 4.6 x 12.5 | 5                  | 820950-921          | 820950-918         | 820950-923          | 820950-924          |
|  Guard Cartridge, 4/pk | 2.1 x 12.5 | 5                  | 821125-918          | 821125-918         | 821125-924          | 821125-924          |
|  Guard Hardware Kit    |            |                    | 840140-901          | 840140-901         | 840140-901          | 840140-901          |
|  Guard Hardware Kit    |            |                    | 820999-901          | 820999-901         | 820999-901          | 820999-901          |

(Continued)

**ZORBAX 300Å StableBond**

| Hardware Description                                                                                           | Size (mm)   | Particle Size (µm) | 300SB-C18<br>USP L1 | 300SB-C8<br>USP L7 | 300SB-CN<br>USP L10 | 300SB-C3<br>USP L56 |
|----------------------------------------------------------------------------------------------------------------|-------------|--------------------|---------------------|--------------------|---------------------|---------------------|
| <b>PrepHT Cartridge Columns (require endfittings kit 820400-901)</b>                                           |             |                    |                     |                    |                     |                     |
|  PrepHT Cartridge             | 21.2 x 250  | 7                  | 897250-102          | 897250-106         | 897250-105          | 897250-109          |
|  PrepHT Cartridge             | 21.2 x 150  | 7                  | 897150-102          | 897150-106         |                     | 897150-109          |
|  PrepHT Cartridge             | 21.2 x 150  | 5                  | 895150-902          | 895150-906         |                     | 895150-909          |
|  PrepHT Cartridge             | 21.2 x 100  | 5                  | 895100-902          | 895100-906         |                     | 895100-909          |
|  PrepHT Cartridge             | 21.2 x 50   | 5                  | 895050-902          | 895050-906         |                     | 895050-909          |
|  PrepHT endfittings, 2/pk     |             |                    | 820400-901          | 820400-901         | 820400-901          | 820400-901          |
|  PrepHT Guard Cartridge, 2/pk | 17 x 7.5    | 5                  | 820212-921          | 820212-918         | 820212-924          | 820212-924          |
|  Guard Cartridge Hardware     |             |                    | 820444-901          | 820444-901         | 820444-901          | 820444-901          |
| <b>Capillary Glass-lined Columns</b>                                                                           |             |                    |                     |                    |                     |                     |
| 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          |                     |                     |
| <b>Nano Columns (PEEK fused silica)</b>                                                                        |             |                    |                     |                    |                     |                     |
| 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 <sup>2</sup> /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

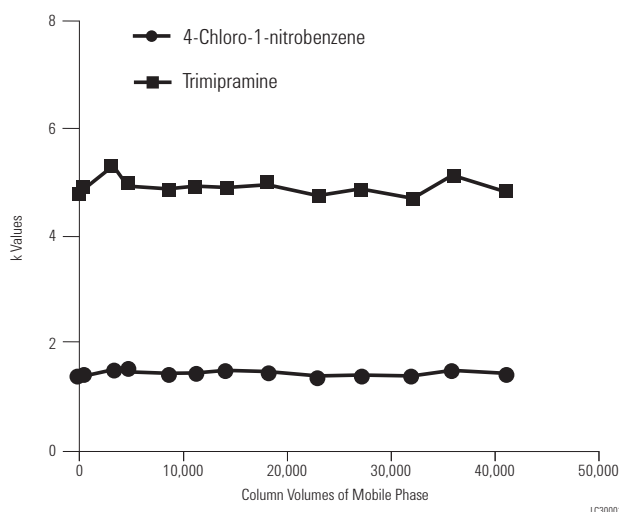
**Column:** ZORBAX Extend-C18  
773450-902  
4.6 x 150 mm, 5 µm

**Mobile Phase:** 20% 20 mM NH<sub>4</sub>OH, 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.



LC30001

# LC/MS Analysis of Angiotensin on Extend-C18

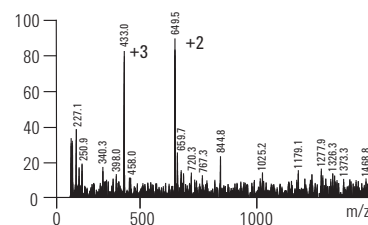
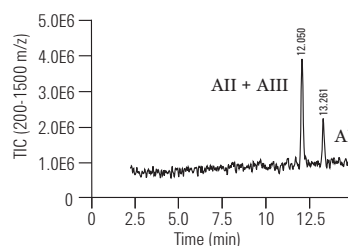
**Column:** ZORBAX Extend-C18  
773700-902

2.1 x 150 mm, 5 µm

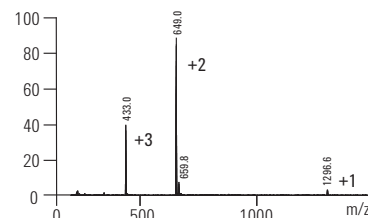
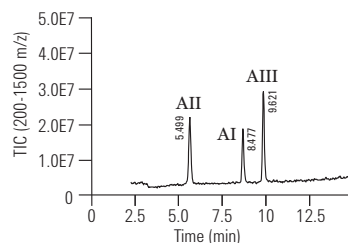
**Mobile Phase:** Acidic Conditions:  
A: 0.1% TFA in water  
B: 0.085% TFA in 80% acetonitrile (ACN)  
Basic Conditions:  
A: 10 mM NH<sub>4</sub>OH in water  
B: 10 mM NH<sub>4</sub>OH in 80% ACN

**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 |
|  | Guard Cartridge, 4/pk | 4.6 x 12.5 | 5                  | 820950-932 |
|  | Guard Cartridge, 4/pk | 2.1 x 12.5 | 5                  | 821125-932 |
|  | Guard Hardware Kit    |            | 0                  | 820888-901 |
| <b>Capillary Glass-lined Columns</b>                                              |                       |            |                    |            |
|                                                                                   | 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  |

**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.

To learn more, visit [www.agilent.com/chem/OnlineLibrary](http://www.agilent.com/chem/OnlineLibrary)



## 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

|                           |                                                        |
|---------------------------|--------------------------------------------------------|
| <b>pH Range</b>           | 1-14                                                   |
| <b>Buffer Content</b>     | Unlimited                                              |
| <b>Organic Modifier</b>   | 1-100%                                                 |
| <b>Temperature Limits</b> | 200°C                                                  |
| <b>Maximum Pressure</b>   | 5-8 µm: 3000 psi (210 bar)<br>3 µm: 4000 psi (300 bar) |

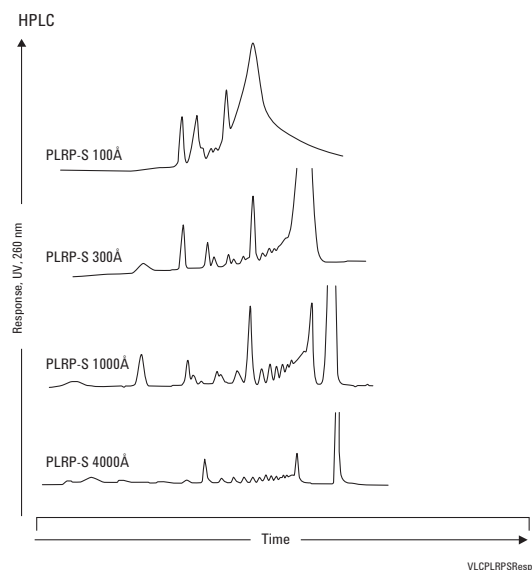
### PLRP-S Applications

| <b>Pore Size</b> | <b>Application</b>                     |
|------------------|----------------------------------------|
| 100Å             | Small molecules/synthetic biomolecules |
| 300Å             | Recombinant peptides/proteins          |
| 1000Å            | Large proteins                         |
| 4000Å            | DNA/high speed                         |



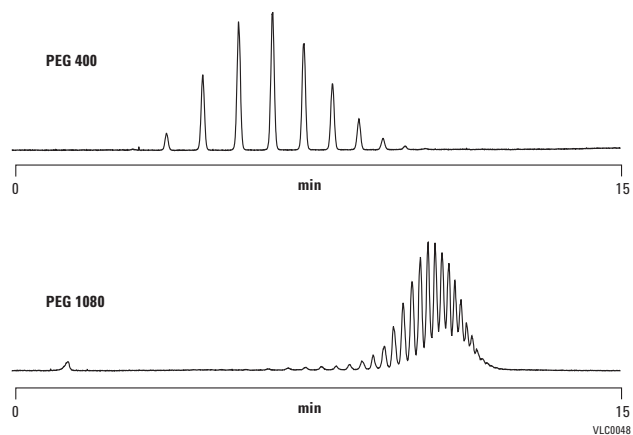
## HPLC of 25 bp DNA ladder

**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  $\mu$ L/min  
**Gradient:** 12.5-50% B in 150 min



## Polyethylene glycols

**Column:** PLRP-S 100Å  
 PL1111-3500  
 4.6 x 150 mm, 5  $\mu$ m  
**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  $\mu$ L  
**Sample Conc:** 1 mg/mL  
**Detector:** ELS (neb=50°C, evap=70°C, gas=1.6 SLM)



### Exploiting chemical stability: NH<sub>4</sub>OH concentration

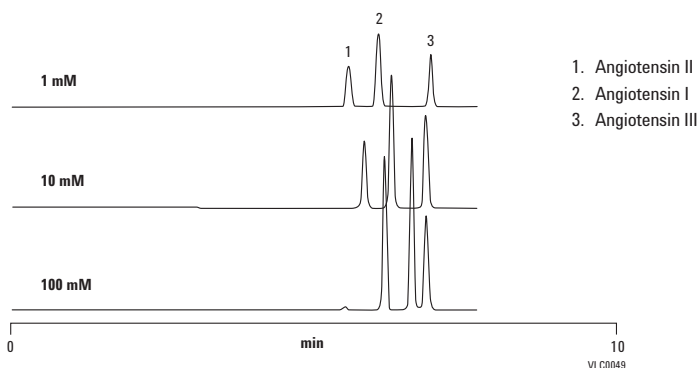
**Column:** PLRP-S 100Å  
PL1512-5500  
4.6 x 250 mm, 5 µm

**Mobile Phase:** A: NH<sub>4</sub>OH (various mM) in water  
B: NH<sub>4</sub>OH (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)



### Alberta Peptide Institute test mix

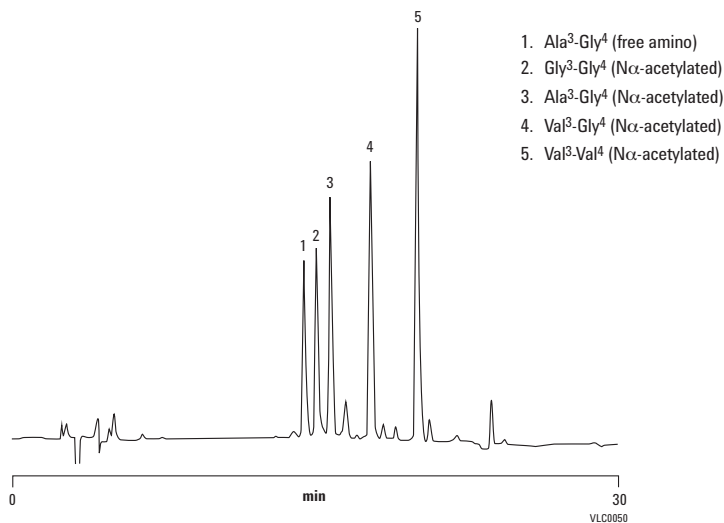
**Column:** PLRP-S 100Å  
PL1512-5500  
4.6 x 250 mm, 5 µm

**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



## Large fibrous proteins

**Column:** PLRP-S 300Å  
PL1512-3801  
4.6 x 150 mm, 8 µm

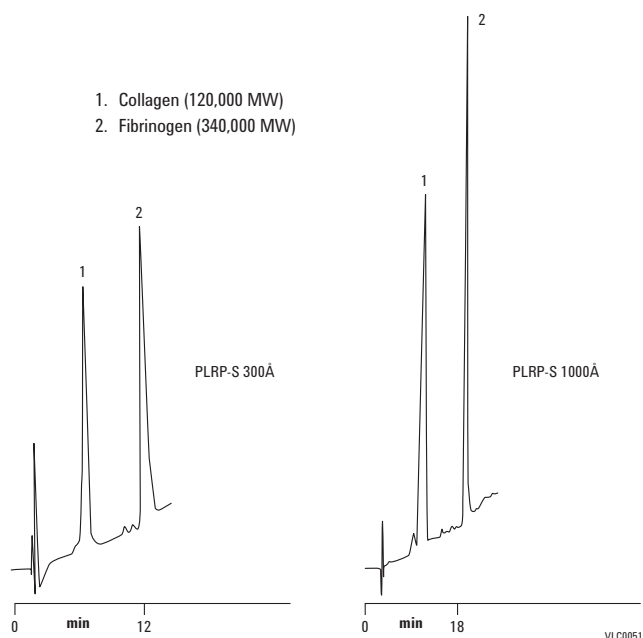
**Column:** PLRP-S 1000Å  
PL1512-3802  
4.6 x 150 mm, 8 µm

**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



## 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.

#### Tips & Tools

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

For more information, visit [www.agilent.com/chem/education](http://www.agilent.com/chem/education)

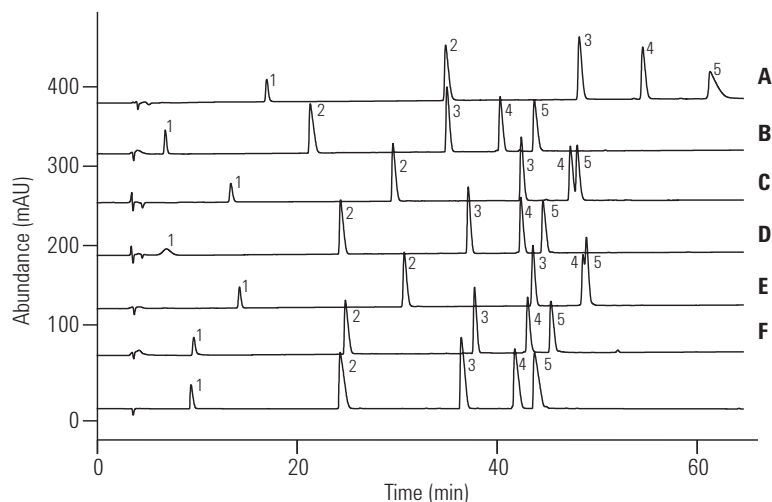
## Separation of Peptides on Capillary Columns

|                  |                                                                                |                  |                                                                                |
|------------------|--------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------------|
| <b>Column A:</b> | <b>ZORBAX 300SB-C8</b><br><b>5065-4460</b><br><b>0.3 x 150 mm, 3.5 µm</b>      | <b>Column D:</b> | <b>ZORBAX SB-C18</b><br><b>5064-8255</b><br><b>0.3 x 150 mm, 5 µm</b>          |
| <b>Column B:</b> | <b>ZORBAX Eclipse XDB-C18</b><br><b>5064-8291</b><br><b>0.3 x 150 mm, 5 µm</b> | <b>Column E:</b> | <b>ZORBAX 300SB-C18</b><br><b>5064-8267</b><br><b>0.3 x 150 mm, 3.5 µm</b>     |
| <b>Column C:</b> | <b>ZORBAX Eclipse XDB-C18</b><br><b>5064-8291</b><br><b>0.3 x 150 mm, 5 µm</b> | <b>Column F:</b> | <b>ZORBAX 300Extend-C18</b><br><b>5065-4464</b><br><b>0.3 x 150 mm, 3.5 µm</b> |

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



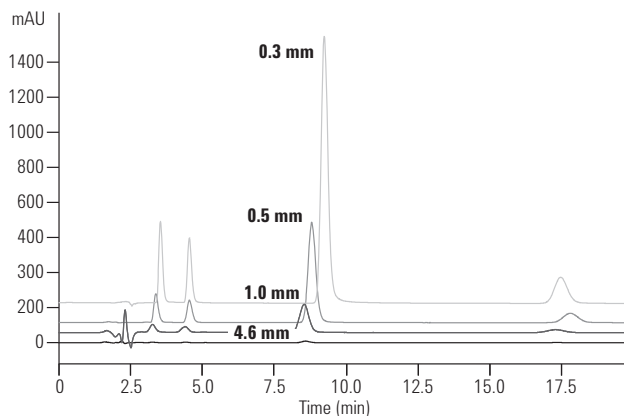
1. Gly-Tyr, 5 ng/100 nL
2. Val-Tyr-Val, 20 ng/100 nL
3. Met Enkephalin, 28 ng/100 nL
4. Low Enkephalin, 20 ng/100 nL
5. Angiotensin II, 20 ng/100 nL

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.

LCCN001

## High Sensitivity with Capillary Columns

|                |                                                                          |
|----------------|--------------------------------------------------------------------------|
| <b>Column:</b> | <b>ZORBAX SB-C18</b><br><b>5064-8255</b><br><b>0.3 x 150 mm, 5 µm</b>    |
| <b>Column:</b> | <b>ZORBAX SB-C18</b><br><b>5064-8256</b><br><b>0.5 x 150 mm, 5 µm</b>    |
| <b>Column:</b> | <b>ZORBAX SB-C18</b><br><b>863600-902</b><br><b>1.0 x 150 mm, 3.5 µm</b> |
| <b>Column:</b> | <b>ZORBAX SB-C18</b><br><b>883975-902</b><br><b>4.6 x 150 mm, 5 µm</b>   |
| <b>Sample:</b> | 200 ng Biphenyl                                                          |



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.

LCCN002

### Excellent Column-to-Column Reproducibility with Agilent Capillary Columns

**Column:** ZORBAX SB-C18  
5064-8256  
0.5 x 150 mm, 5  $\mu$ m

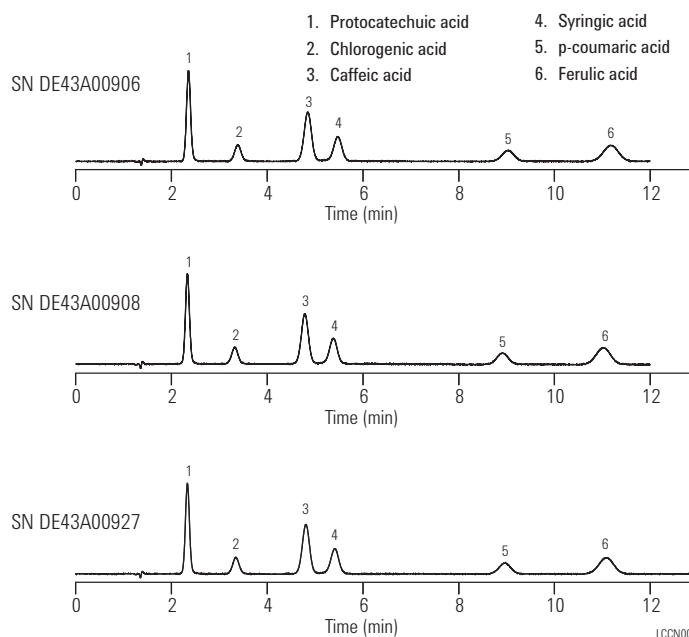
**Mobile Phase:** A: 75% H<sub>2</sub>O with 0.4% formic acid  
B: 25% MeOH with 0.4% formic acid

**Flow Rate:** 20  $\mu$ L/min

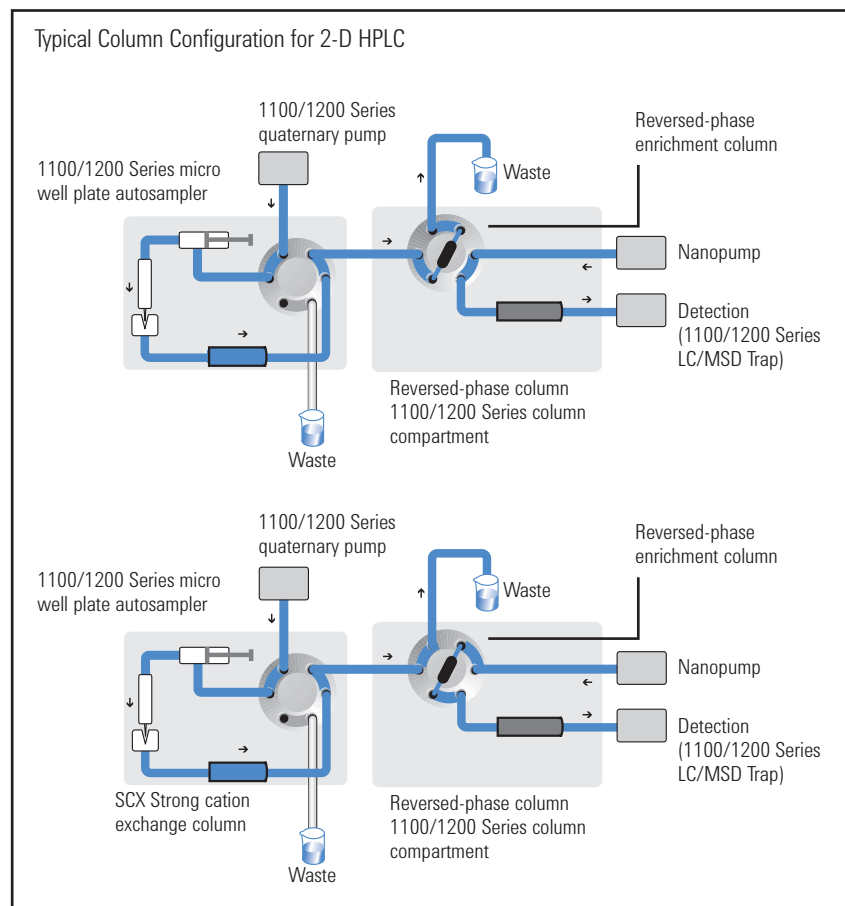
**Temperature:** 25°C

**Sample:** 0.1  $\mu$ L  
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  $\mu$ m columns. Retention (k) varied less than 0.8% RSD and selectivity ( $\alpha$ ) varied less than 0.4% RSD.



## 2-D LC/MS Analyses Using ZORBAX Capillary and Nano LC Columns



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 analysis

### 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

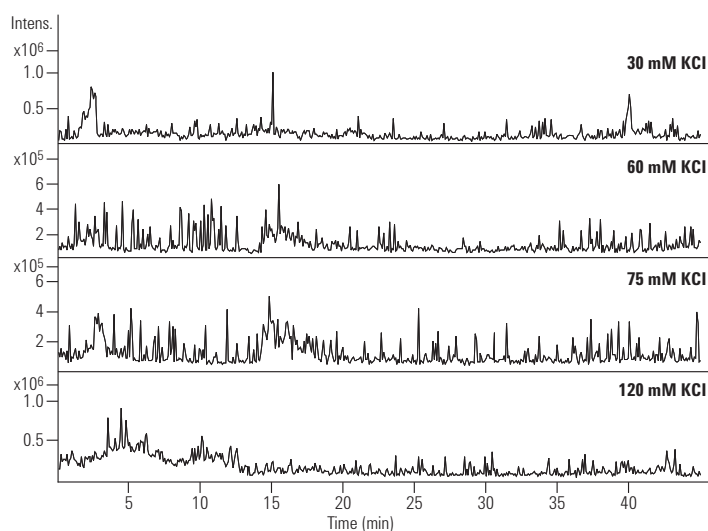
**Flow Rate:** Quaternary Pump: 30 µL/min  
Nanopump: 300 nL/min

**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.



LCCN004



**ZORBAX HPLC Capillary Columns (glass-lined stainless steel)**

| Description                   | Size (mm) | Particle Size (µm) | SB-C18    | Eclipse<br>XDB-C18 | 300SB-C18 | 300SB-C8  | Poroshell<br>300SB-C8 | 300Extend<br>C18 | Bio-SCX<br>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<br>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<br>USP L1 | 300SB-C8<br>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  $\mu\text{L}/\text{min}$ ). 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  $\mu\text{m}$

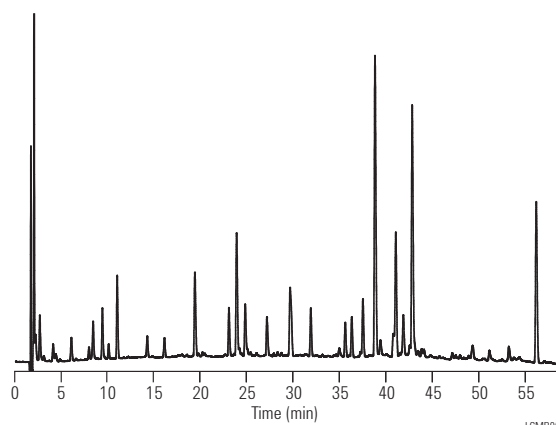
**Mobile Phase:** Gradient: 2-60% B in 60 Min.  
A: 0.1% TFA  
B: 0.075% TFA/80% ACN

**Flow Rate:** 50  $\mu\text{L}/\text{min}$

**Temperature:** 50°C

**Detector:** 215 nm

**Sample:** 2  $\mu\text{L}$   
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)**

| <b>Description</b>    | <b>Size (mm)</b> | <b>Particle Size (µm)</b> | <b>SB-C18<br/>USP L1</b>              | <b>SB-C8<br/>USP L7</b>              | <b>300SB-C18<br/>USP L1</b>   | <b>300SB-C8<br/>USP L7</b>         |
|-----------------------|------------------|---------------------------|---------------------------------------|--------------------------------------|-------------------------------|------------------------------------|
| 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                          |
| <b>Description</b>    | <b>Size (mm)</b> | <b>Particle Size (µm)</b> | <b>Eclipse<br/>XDB-C18<br/>USP L1</b> | <b>Eclipse<br/>XDB-C8<br/>USP L7</b> | <b>Bonus-RP<br/>USP L60</b>   | <b>Extend-C18<br/>USP L1</b>       |
| 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                          |
| <b>Description</b>    | <b>Size (mm)</b> | <b>Particle Size (µm)</b> | <b>Poroshell<br/>300SB-C18</b>        | <b>Poroshell<br/>300SB-C8</b>        | <b>Poroshell<br/>300SB-C3</b> | <b>Poroshell<br/>300Extend-C18</b> |
| 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.

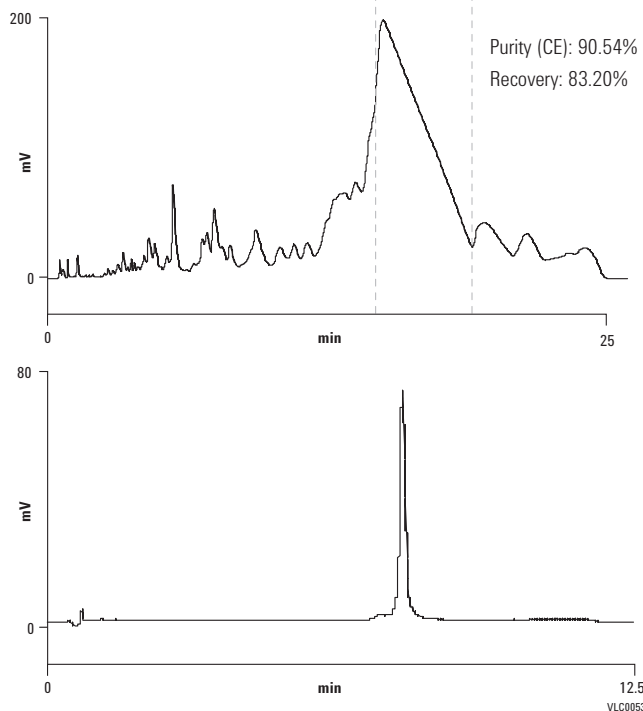
Capacity and resolution are two key parameters for maximizing the throughput of a purification. With a wide choice of pore sizes and extended range of operating conditions, PLRP-S provides more options to achieve the optimum process. Particle sizes range from 3  $\mu\text{m}$  to 50  $\mu\text{m}$  for scale-up from the  $\mu\text{g}/\text{mg}$  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

| Application                                                     | PLRP-S Media Pore Size |      |       |       |
|-----------------------------------------------------------------|------------------------|------|-------|-------|
|                                                                 | 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



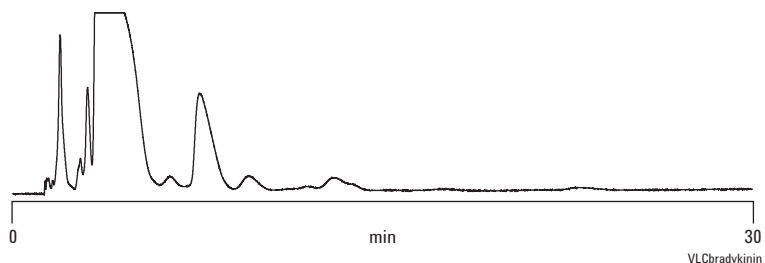
## Crude bradykinin prep load

**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 | PL1212-3102  | PL1212-3103  |
| 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.

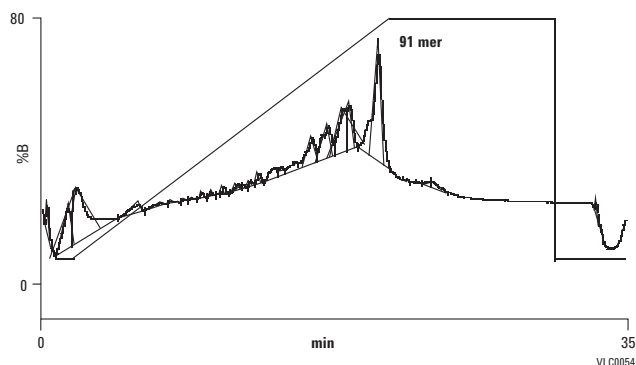
Packing in dynamic axial compression (DAC) column hardware is straightforward and high efficiency columns are achieved with excellent reproducibility and lifetimes. The 1000Å pore size is for high-capacity purifications and the 4000Å gigaporous particles with improved mass transfer are intended for large biomolecules and high-speed, high-resolution purifications.

### Column Specifications

|                              | PL-SAX                     | PL-SCX                      |
|------------------------------|----------------------------|-----------------------------|
| <b>Matrix</b>                | Fully polymeric            | Fully polymeric             |
| <b>Pore Sizes</b>            | 1000Å, 4000Å               | 1000Å, 4000Å                |
| <b>Particle Sizes</b>        | 10 µm, 30 µm               | 10 µm, 30 µm                |
| <b>Bead Form</b>             | Rigid spherical            | Rigid spherical             |
| <b>Functionality</b>         | Quaternary amine           | Sulfonic acid               |
| <b>Pressure Stability</b>    | 3000 psi                   | 3000 psi                    |
| <b>Temperature Stability</b> | 80°C                       | 80°C                        |
| <b>pH Range</b>              | 1 to 14                    | 1 to 14                     |
| <b>Eluent Compatibility</b>  | All anion exchange buffers | All cation exchange buffers |
| <b>Packed Bed Density</b>    | 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  |
| <b>High Efficiency Bulk Media</b> |                    |             |             |              |              |              |              |              |
| 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  $\mu\text{g}$  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

#### 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.

To learn more, visit [www.agilent.com/chem/OnlineLibrary](http://www.agilent.com/chem/OnlineLibrary)

## 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<br>(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

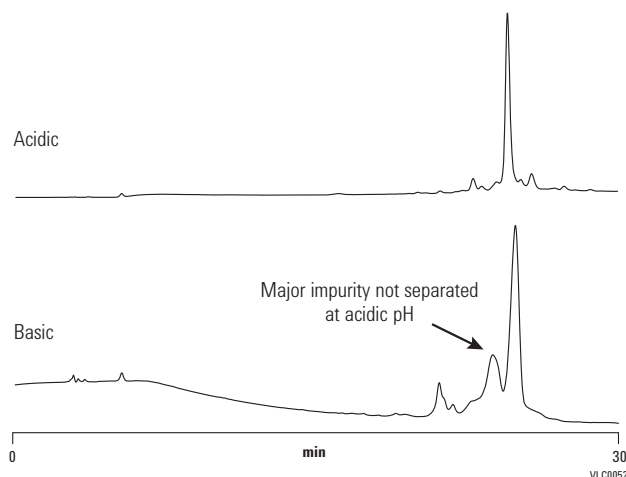
**Mobile Phase:** **Acidic**  
A: 0.1% TFA in 95% water: 5% ACN  
B: 0.1% TFA in 50% water: 50% ACN

**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 trifluoroacetic 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

| <b>Loading</b>       | <b>Counter-ion<br/>Removal Capacity</b> | <b>Unit</b> | <b>Part No.</b> |
|----------------------|-----------------------------------------|-------------|-----------------|
| 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  $\mu$ mol 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  $\mu$ mol 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.

#### Tips & Tools

Don't forget, we have special offers throughout the year.

To learn more, visit [www.agilent.com/chem/specialoffers](http://www.agilent.com/chem/specialoffers)



## 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  $\mu$ mol. 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<br>Mass (mg) | Volume (mL) | Unit       | Part No.   |
|---------------------------------------------------------------|----------------------|-------------|------------|------------|
| TOP-RNA well plate tubes<br>for 1 $\mu$ mol scale             | 100                  | 1.8         | 96/pk      | 7573915C   |
| TOP-DNA well plate tubes<br>for 1 $\mu$ mol scale             | 150                  | 1.8         | 96/pk      | 7572915C   |
| TOP-DNA well plate tubes<br>for 1 $\mu$ mol 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<br>scale, high capacity     | 100                  | 1.8         | 96/pk      | 7571901C   |
| TOP well plate tubes for 200 nmol scale,<br>vacuum compatible | 150                  | 1.8         | 96/pk      | 7561915C   |
| TOP well plate tubes for 200 nmol scale,<br>vacuum compatible | 150                  | 1.8         | 15 x 96/pk | 7571915B   |
| 96-well collection plate                                      |                      | 2.0         | 25/pk      | WA77015200 |
| 96-well collection plate                                      |                      | 750 $\mu$ L | 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 suitability 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<br>Increase column diameter<br>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<br>Ensure injector seal is tight<br>Ensure fittings are properly seated |
|                | Basic compounds – Silanol interactions                  | Choose endcapped bonded phase<br>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 compatibility                                                   |
| 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**

| <b>Symptom Type</b>                           | <b>Possible Cause</b>                                                   | <b>Solution</b>                                                                         |
|-----------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 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 –<br>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                                                                 |
| Unstable signal       | Check the capillary for damage and contamination                                             |
|                       | Make sure drying gas flow and temperature are correct for the solvent flow                   |
|                       | Make sure solvent is thoroughly degassed                                                     |
|                       | Make sure LC backpressure is steady; this indicates a steady solvent flow                    |

(Continued)

## 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.

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| 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 thoroughly 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                                                     |

### Tips & Tools

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