**Thermo Scientific**
Chromatography Columns
and Consumables 2014-2015

# Your world of chromatography

Thermo SCIENTIFIC

predictability

# **LC Columns** and Accessories

As a leader in LC column technology including silica, polymer and porous graphitic carbon manufacturing, bonded phase production and column packing for over 35 years, you can rely on the quality of Thermo Scientific HPLC products. Here we showcase our latest and most comprehensive range of innovative columns, accessories and equipment for fast LC, analytical HPLC and biomolecule separations.

## Section Contents



## Featured Products

### Accucore Columns
Ultimate core performance - speed and selectivity combined

PAGE 4-042

### Syncronis Columns
Consistent, reproducible separations, column after column, time after time

PAGE 4-074

### Hypersil GOLD Columns
Outstanding peak shape for your separations

PAGE 4-024


### MAbPac Columns
Unrivalled resolution and efficiency in the analysis of protein variants

PAGE 4-126

### Acclaim PepMap Columns
The standard for peptide separations in proteomics

PAGE 4-149


### Viper Connectors
Simple, dead volume free plumbing of HPLC and UHPLC systems

PAGE 4-158

# LC Column Selection

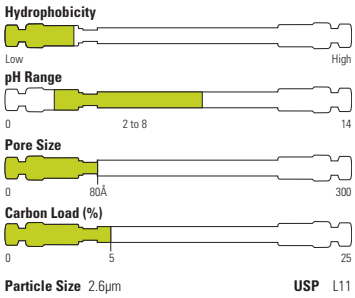
Information in the following section will help you make an informed decision on the appropriate HPLC column for your application, based on stationary phase use, analyte properties, LC-MS requirements or USP specifications. You will also find a useful table of Thermo Scientific phases with specifications, as well as recommended Thermo Scientific alternatives for other popular columns.

Refer to the **Advanced User Graphic** (AUG) on the corresponding product page (illustrated to the right) for more help and information on general purpose column selection.

The AUG will show you Hydrophobicity which gives the relative retention on the column. Generally, the higher the hydrophobicity, the greater the retention of neutral compounds and the higher the organic content in the mobile phase. A lower value indicates a need for higher aqueous mobile phases to achieve comparable retention and resolution. The recommended pH Range for the column is illustrated, outside of which column lifetimes will diminish.

The Pore Size is shown, with larger pore size columns being more applicable to larger analytes such as proteins or peptides. The percentage Carbon Load is related to the hydrophobicity. Below the icon, you will see the particle sizes available, as well as the USP code. These graphics are designed to allow you to quickly compare the main characteristics of multiple stationary phases, allowing you to choose quickly the most appropriate stationary phase for your analysis.

For additional help in column selection, please see the back cover to contact our expert Technical Support and tap into our expertise to help make the best choice for your application.




*Advanced User Graphic (AUG)*

## Common HPLC Phases and Their Uses

| Common Name | Alternative Name | Functional Group | Normal Phase | Reverse Phase | Ion Exchange | HILIC | Application |
|---|---|---|---|---|---|---|---|
| Silica | Silica | -OH | • | | | • | Non-polar and moderately polar organic compounds. |
| C1 | SAS | $-(CH_3)_3$ | | • | | | Least retentive of all alkyl group bonded phases for non-polar solutes. Typically used for moderately polar and multi-functional compounds. |
| C4 | Butyl | $-C_4H_9$ | | • | | | Shorter retention than C8, C18. Separation of peptides and proteins. |
| C8 | MOS | $-C_8H_{17}$ | | • | | | Less retentive than C18; normally used for small peptides and proteins, pharmaceuticals, steroids, environmental samples. |
| C18 | ODS | $-C_{18}H_{37}$ | | • | | | Most retentive of the alkyl-bonded phases. Used widely for pharmaceuticals, steroids, fatty acids, phthalates, environmental etc. |
| Cyano | CPS, CN | $-(CH_2)_3CN$ | • | • | | | Unique selectivity for polar compounds, more suitable than base silica for normal phase gradient separations. When used in reversed phase, the selectivity is different to that of the C8 and C18 phases. Useful for a wide range of pharmaceutical applications and for mixtures of very different solutes. |
| Amino | APS | $-(CH_2)_3NH_2$ | • | • | • | • | **HILIC:** Carbohydrate analysis and other polar compounds. **Weak anion exchange:** anions and organic acids. **Normal Phase:** Alternative selectivity to silica. Good for aromatics. |
| Phenyl | | $-(CH_3)C_6H_5$ | | • | | | Aromatic compounds and moderately polar compounds. |
| Pentafluo-rophenyl | PFP | $-C_6F_5$ | | • | | | Extra selectivity and retention for halogenated, polar compounds and isomers. |
| Diol | | $-(CH_2)_{20}$ $CH_2(CH_2OH)_2$ | • | • | | • | **Reversed Phase:** Proteins, peptides. **Normal Phase:** Similar selectivity to silica, but less polar. |
| SCX | Strong Cation Exchanger | $-RSO_3H-$ | | | • | | Organic bases. |
| SAX | Strong Anion Exchanger | $-RN+(CH_3)_3$ | | | • | | Organic acids, nucleotides and nucleosides. |
| AX | Anion Exchanger Polyethyleneimine (PEI) | $-(CH_2CH_2NH-)_n$ | | | • | | Organic acids, nucleotides and oligonucleotides. |
| Porous graphitic carbon | PGC | 100% carbon | • | • | | | Particularly useful for the separation of highly polar compounds that are difficult to retain using conventional silica based columns; separation of structurally similar compounds (e.g., isomers, diastereoisomers). |

# HPLC Stationary Phase Column Selection

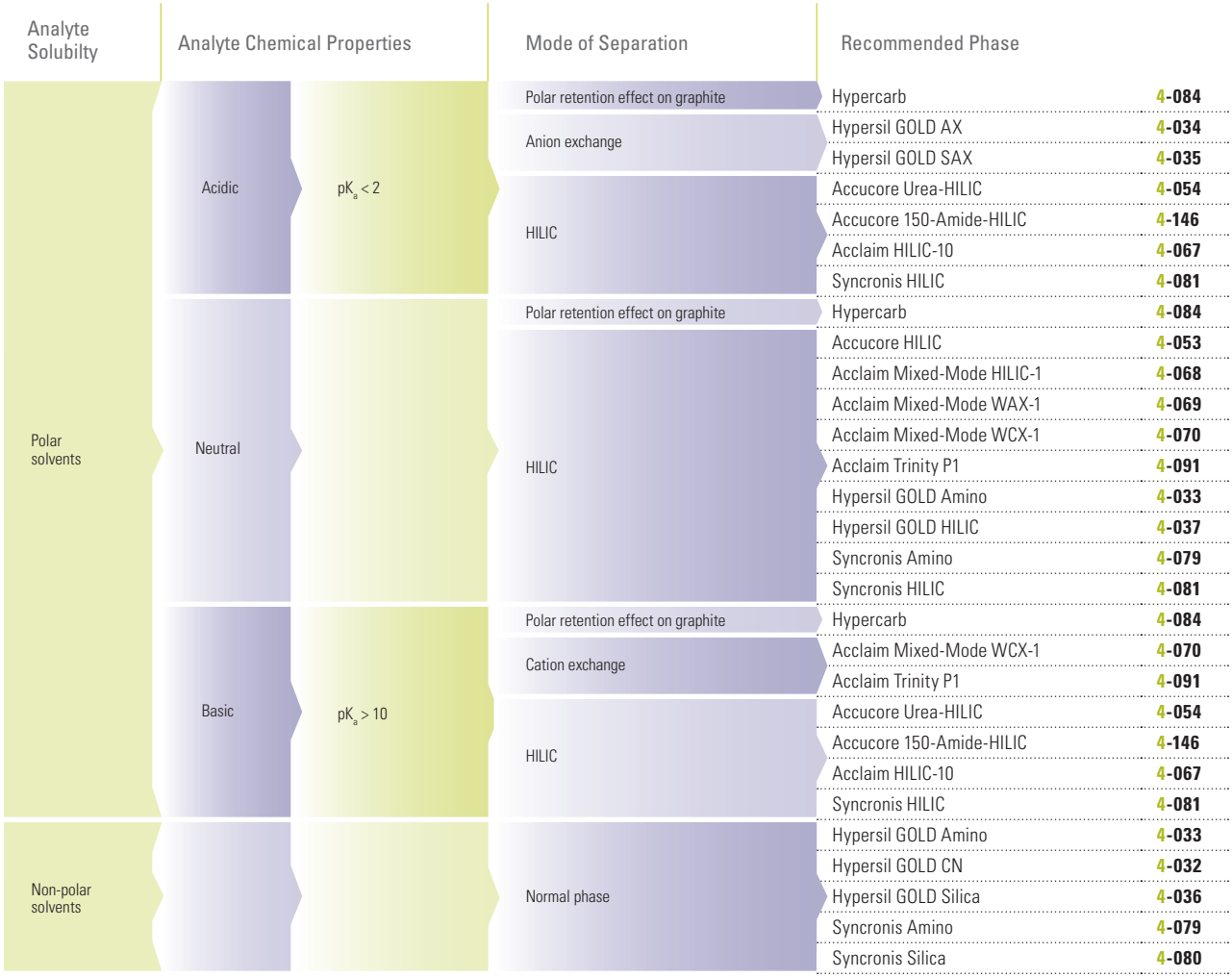
Before beginning a new analysis, consider the physical and chemical properties of the analyte(s), the mode of analysis and how the analyte(s) will interact with the surface of the chromatographic phase. To aid column selection, the following guide may be useful.

## Non-polar

| Analyte Solubilty | Analyte Chemical Properties | | Mode of Separation | Recommended Phase | |
|---|---|---|---|---|---|
| Polar solvents | Acidic | $pK_a > 2$ | Anion exchange / Reversed-phase mixed mode | Acclaim Mixed-Mode WAX-1 | 4-069 |
| | | | | Acclaim Trinity P1 | 4-091 |
| | Neutral | Non-polar | Reversed phase | Accucore C18 | 4-045 |
| | | | | Accucore RP-MS | 4-044 |
| | | | | Accucore C8 | 4-046 |
| | | | | Accucore C30 | 4-052 |
| | | | | Accucore Phenyl-Hexyl | 4-049 |
| | | | | Acclaim 120 C18 | 4-061 |
| | | | | Acclaim 120 C8 | 4-062 |
| | | | | Acclaim C30 | 4-064 |
| | | | | Acclaim Phenyl-1 | 4-063 |
| | | | | Hypersil GOLD | 4-026 |
| | | | | Hypersil GOLD C8 | 4-027 |
| | | | | Hypersil GOLD C4 | 4-028 |
| | | | | Syncronis C18 | 4-075 |
| | | | | Syncronis C8 | 4-076 |
| | | Moderately-polar | Reversed phase | Accucore aQ | 4-047 |
| | | | | Accucore Polar Premium | 4-048 |
| | | | | Accucore PFP | 4-051 |
| | | | | Accucore Phenyl-X | 4-050 |
| | | | | Acclaim PolarAdvantage | 4-065 |
| | | | | Acclaim PolarAdvantage II | 4-066 |
| | | | | Hypersil GOLD aQ | 4-029 |
| | | | | Hypersil GOLD PFP | 4-030 |
| | | | | Hypersil GOLD Phenyl | 4-031 |
| | | | | Syncronis aQ | 4-077 |
| | | | | Syncronis Phenyl | 4-078 |
| | Basic | $pK_a < 10$ | Reversed phase | Accucore C18 | 4-045 |
| | | | | Accucore RP-MS | 4-044 |
| | | | | Accucore C8 | 4-046 |
| | | | | Accucore C30 | 4-052 |
| | | | | Accucore Phenyl-Hexyl | 4-049 |
| | | | | Acclaim 120 C18 | 4-061 |
| | | | | Acclaim 120 C8 | 4-062 |
| | | | | Acclaim C30 | 4-064 |
| | | | | Acclaim Phenyl-1 | 4-063 |
| | | | | Hypersil GOLD | 4-026 |
| | | | | Hypersil GOLD C8 | 4-027 |
| | | | | Hypersil GOLD C4 | 4-028 |
| | | | | Syncronis C18 | 4-075 |
| | | | | Syncronis C8 | 4-076 |
| | | | Cation exchange / Reversed-phase mixed mode | Acclaim Mixed-Mode WCX-1 | 4-070 |
| | | | | Acclaim Trinity P1 | 4-091 |

# HPLC Stationary Phase Column Selection *continued*

## Polar




The above table recommends columns for the separation of small molecule analytes. Column recommendations for the separation of biomolecules can be found in the table on page **4-111**

# Column Format Selection for LC-MS

The Thermo Scientific range offers a broad array of column designs and stationary phases optimized for LC-MS applications. Use the following table to help you choose your column format to best meet your application needs. A variety of HPLC column hardware configurations are available, designed to give superior results for high speed, high sensitivity, high efficiency and convenience. A wide range of particle and monolithic stationary phases allows choices for optimized selectivity.

### Column Hardware Selection for LC-MS

| LC-MS Application | Column Hardware Design | Description |
|---|---|---|
| High throughput analysis | Javelin HTS columns | Direct-connection columns<br>Slim design, 20mm length, 1mm to 4.6mm ID |
| High sensitivity analysis | Acclaim PepMap nano, capillary and micro columns | Nano, capillary and micro columns 0.075mm to 1mm ID; 50 to 250mm length<br>nanoViper format offers fingertight dead volume free connection to 1000 bar |
| Proteomics analysis | EASY-Spray columns | Combined column/emitter design with nanoViper connection.<br>Heated flexible silica columns 50µm and 75µm ID; 150 to 500mm length |
| | Acclaim PepMap nano columns, Accucore nano columns, nanoViper | nanoViper offers fingertight dead volume free connection to 1000 bar<br>Flexible silica columns 50µm and 75µm ID; 50 to 500mm length<br>Trap column 20mm x 100µm ID |
| | Acclaim PepMap nano columns, classic | Flexible silica columns 50µm and 75µm ID; 50 to 500mm length<br>Trap column 20mm x 100µm ID |
| | EASY-Column | Flexible silica columns 100mm x 75µm<br>Trap column 20mm x 100µm ID |
| | PepSwift monolithic columns | Flexible fused silica columns, nanoViper connections<br>100µm to 500µm ID, 50 to 250mm length<br>Trap columns 5mm x 200µm ID |

Various HPLC columns, throughout this LC section, can also be used for LC-MS application. Typical flow rates and MS source compatibility for these columns are shown in the table on the next page

# Column Selection for LC-MS *continued*

## Packed column selection for LC-MS

| Analyte Molecular Weight | Sample Polarity | Interface Ionization | Relative Sensitivity | Column ID (mm) | Flow Rate (µL/min) | Column Hardware |
|---|---|---|---|---|---|---|
| < 1000 Da | Low | APCI | Low | 4.6, 4.0, 3.0 | 2000 – 200 | Javelin HTS, Analytical |
| | | | High | 2.1, 1.0 | 200 – 50 | Analytical, Javelin HTS |
| | Medium | APCI | Low | 4.6, 4.0, 3.0 | 2000 – 200 | Javelin HTS, Analytical |
| | | | High | 2.1, 1.0 | 200 – 50 | Analytical, Javelin HTS |
| | | ESI | Low | 2.1, 1.0 | 200 – 50 | Analytical, Javelin HTS |
| | | | High | 1.0 – 0.3 | 50 – 5 | Acclaim PepMap (RSLC) capillary and micro |
| | | | | 0.2 – 0.05 | 2 – 0.2 | EASY-Spray column, EASY-Column, Acclaim PepMap (RSLC) nano, Accucore nano |
| | High (or ionizable) | ESI | Low | 2.1, 1.0 | 200 – 50 | Analytical, Javelin HTS |
| | | | High | 1.0 – 0.3 | 50 – 5 | Acclaim PepMap (RSLC) capillary and micro |
| | | | | 0.2 – 0.05 | 2 – 0.2 | EASY-Spray column, EASY-Column, Acclaim PepMap (RSLC) nano, Accucore nano |
| > 1000 Da | | ESI | Low | 2.1, 1.0 | 200 – 50 | Analytical, Javelin HTS |
| | | | High | 1.0 – 0.3 | 50 – 5 | Acclaim PepMap (RSLC) capillary and micro |
| | | | | 0.2 – 0.05 | 2 – 0.2 | EASY-Spray column, EASY-Column, Acclaim PepMap (RSLC) nano, Accucore nano |

## Monolith columns for LC-MS

| Analyte Molecular Weight | Column ID (mm) | Flow Rate (µL/min) | Column Hardware |
|---|---|---|---|
| < 1000 Da | 0.1, 0.2, 0.5 | 0.7 – 25 | PepSwift Monolith |
| > 1000 Da | 1.0 | 40 – 200 | ProSwift Monolith |

ProSwift is also available in larger IDs for high throughput applications.

# HPLC Column Selection by U.S. Pharmacopeia Specifications*

| USP Code | Description | Recommended Phase | Page |
|---|---|---|---|
| **L1** | Octadecyl silane (C18) chemically bonded to porous or ceramic microparticles, 1.5 to 10µm in diameter, or a monolithic rod | Acclaim 120 C18 | **4-061** |
| | | Acclaim 300 C18 | **4-142** |
| | | Accucore C18 | **4-045** |
| | | Accucore aQ | **4-047** |
| | | Accucore 150-C18 | **4-144** |
| | | Accucore XL C18 | **4-056** |
| | | BioBasic 18 | **4-140** |
| | | Hypersil GOLD | **4-026** |
| | | Hypersil GOLD aQ | **4-029** |
| | | Acclaim PepMap 100 C18 | **4-149** |
| | | Syncronis C18 | **4-075** |
| | | Syncronis aQ | **4-077** |
| **L3** | Porous silica particles, 1.5 to 10µm in diameter, or a monolithic rod | Accucore HILIC | **4-053** |
| | | Hypersil GOLD Silica | **4-036** |
| | | Syncronis Silica | **4-080** |
| **L7** | Octyl silane chemically bonded to totally or superficially porous silica particles, 1.5 to 10µm in diameter, or a monolithic rod | Acclaim 120 C8 | **4-061** |
| | | Accucore C8 | **4-046** |
| | | Accucore XL C8 | **4-057** |
| | | BioBasic 8 | **4-140** |
| | | Hypersil GOLD C8 | **4-027** |
| | | Acclaim PepMap 100 C8 | **4-150** |
| | | Syncronis C8 | **4-076** |
| **L8** | An essentially monomolecular layer of aminopropylsilane chemically bonded to totally porous silica gel support, 1.5 to 10µm in diameter | Hypersil GOLD Amino | **4-033** |
| | | Syncronis Amino | **4-079** |
| **L10** | Nitrile groups chemically bonded to porous silica particles, 1.5 to 10µm in diameter | Hypersil GOLD CN | **4-032** |
| **L11** | Phenyl groups chemically bonded to porous silica particles, 1.5 to 10µm in diameter | Accucore Phenyl-Hexyl | **4-049** |
| | | Hypersil GOLD Phenyl | **4-031** |
| | | Syncronis Phenyl | **4-078** |
| **L13** | Trimethylsilane chemically bonded to porous silica particles, 3 to 10µm in diameter | BETASIL C1 | Inquire |
| | | Hypersil SAS | **4-107** |
| **L14** | Silica gel having a chemically bonded, strongly basic quaternary ammonium anion exchange coating, 5 to 10µm in diameter | Hypersil GOLD SAX | **4-035** |
| | | Hypersil SAX | **4-109** |
| **L15** | Hexylsilane (C6) chemically bonded to totally porous silica particles, 3 to 10µm in diameter | BETASIL C6 | Inquire |

# HPLC Column Selection by U.S. Pharmacopeia Specifications* *continued*

| USP Code | Description | Recommended Phase | Page |
|---|---|---|---|
| **L17** | Strong cation exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the hydrogen form, 6 to 12µm in diameter | HyperREZ XP Carbohydrate $H^+$ | **4-156** |
| | | HyperREZ XP Organic Acids | **4-156** |
| **L19** | Strong cation exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the calcium form, about 9µm in diameter | HyperREZ XP Carbohydrate $Ca^{2+}$ | **4-156** |
| | | HyperREZ XP Sugar Alcohols | **4-156** |
| **L20** | Dihydroxypropane groups chemically bonded to porous silica or hybrid particles, 1.5 to 10µm in diameter | BETASIL Diol | Inquire |
| **L26** | Butyl silane chemically bonded to totally porous silica particles, 1.5 to 10µm in diameter | Accucore 150-C4 | **4-145** |
| | | BioBasic 4 | **4-140** |
| | | Hypersil GOLD C4 | **4-028** |
| | | Acclaim PepMap 300 C4 | **4-149** |
| **L33** | Packing having the capacity to separate dextrans by molecular size over a range of 4,000 to 500,000 daltons. It is spherical, silica-based, and processed to provide pH stability | BioBasic SEC 120 | **4-139** |
| | | BioBasic SEC 300 | **4-139** |
| | | BioBasic SEC 1000 | **4-139** |
| | | MAbPac SEC-1 | **4-129** |
| **L34** | Strong cation exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the lead form, 7 to 9µm in diameter | HyperREZ XP Carbohydrate $Pb^{2+}$ | **4-156** |
| **L43** | Pentafluorophenyl groups chemically bonded to silica particles by a propyl spacer, 1.5 to 10µm in diameter | Accucore PFP | **4-051** |
| | | Hypersil GOLD PFP | **4-030** |
| **L46** | Polystyrene/divinylbenzene substrate agglomerated with quaternary amine functionalized latex beads about 9 to 11um in diameter | OmniPac PAX-100 | **4-103** |
| **L50** | Multifunction resin with reverse-phase retention and strong anion-exchange functionalities. The resin consists of ethylvinylbenzene, 55% cross-linked with divinylbenzene copolymer, 3 to 15µm in diameter, and a surface area of not less than 350$m^2$ per g. Substrate is coated with quaternary ammonium functionalized latex particles consisting of styrene cross-linked with divinylbenzene | OmniPac PAX-500 | **4-103** |
| **L52** | A strong cation exchange resin made of porous silica with sulfopropyl groups 5 to 10µm in diameter | BioBasic SCX | **4-141** |
| **L58** | Strong cation exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the sodium form, about 6 to 30µm in diameter | HyperREZ XP Carbohydrate $Na^+$ | **4-156** |
| **L59** | Packing for the size exclusion separation of proteins (separation by molecular weight) over the range of 5 to 7,000 kDa. The packing is spherical, 1.5 to 10um, silica or hybrid packing with a hydrophilic coating | BioBasic SEC 300 (5µm) | **4-139** |
| | | MAbPac SEC-1 | **4-129** |
| **L60** | Spherical, porous silica gel, 10µm or less in diameter, the surface of which has been covalently modified with alkyl amide groups and endcapped | Acclaim PolarAdvantage | **4-065** |
| | | Acclaim PolarAdvantage II | **4-066** |
| | | Accucore Polar Premium | **4-048** |
| **L62** | C30 silane bonded phase on a fully porous spherical silica, 3 to 15µm in diameter | Acclaim C30 | **4-064** |
| | | Accucore C30 | **4-052** |
| **L78** | A silane ligand that consists of both reversed-phase (an alkyl chain longer than C8) and anion-exchange (primary, secondary, tertiary or quaternary amino groups) functional groups chemically bonded to porous or non-porous or ceramic micro-particles, 1.0 to 50µm in diameter or a monolithic rod | Acclaim Mixed-Mode WAX-1 | **4-069** |

*These are the recommended Thermo Scientific HPLC columns for various USP categories although other columns for each category are also available.

# Thermo Scientific HPLC Phases

The tables below list Thermo Scientific HPLC sorbents offered for small molecules separations.
For Thermo Scientific phases for the separations of biomolecules see page 4-112.
Please also refer to the Advanced User Graphic (AUG) for each HPLC phase on the pages indicated.

| Phase | Particle Type | Particle Size (µm) | Pore Size (Å) | Nominal Surface Area ($m^2/g$) | % Carbon | Endcapping | USP Code | Phase Code | Page |
|---|---|---|---|---|---|---|---|---|---|
| **Acclaim Phases** | | | | | | | | | |
| 120 C18 | Spherical, fully porous silica | 2.2, 3, 5 | 120 | 300 | 18 | Yes | L1 | – | **4-061** |
| 300 C18 | Spherical, fully porous silica | 3 | 300 | 100 | 8 | Yes | L1 | – | **4-142** |
| 120 C8 | Spherical, fully porous silica | 2.2, 3, 5 | 120 | 300 | 11 | Yes | L7 | – | **4-062** |
| Phenyl-1 | Spherical, fully porous silica | 3 | 120 | 300 | 13 | Yes | L11 | – | **4-063** |
| C30 | Spherical, fully porous silica | 3, 5 | 200 | 200 | 13 | Proprietary | L62 | – | **4-064** |
| PA | Spherical, fully porous silica | 2.2, 3, 5 | 120 | 300 | 16 | Yes | L60 | – | **4-065** |
| PA II | Spherical, fully porous silica | 2.2, 3, 5 | 120 | 300 | 16 | Yes | L60 | – | **4-066** |
| HILIC-10 | Spherical, fully porous silica | 3 | 120 | 300 | 8 | Yes | – | – | **4-067** |
| Trinity P1 | Nano polymer silica hybrid | 3 | 300 | 100 | – | Proprietary | – | – | **4-091** |
| Trinity P2 | Nano polymer silica hybrid | 3 | 300 | 100 | – | Proprietary | – | – | **4-092** |
| Trinity Q1 | Nano polymer silica hybrid | 3 | 300 | 300 | – | Proprietary | – | – | **4-099** |
| Mixed Mode HILIC-1 | Spherical, fully porous silica | 3 | 120 | 300 | – | Proprietary | – | – | **4-068** |
| Mixed Mode WAX-1 | Spherical, fully porous silica | 3, 5 | 120 | 300 | – | Proprietary | – | – | **4-069** |
| Mixed Mode WCX-1 | Spherical, fully porous silica | 3, 5 | 120 | 300 | – | Proprietary | L78 | – | **4-070** |
| Organic Acid | Spherical, fully porous silica | 3, 5 | 120 | 300 | – | Yes | – | – | **4-093** |
| Surfactant | Spherical, fully porous silica | 3, 5 | 120 | 300 | – | Yes | – | – | **4-094** |
| Surfactant Plus | Spherical, fully porous silica | 3, 5 | 120 | 300 | – | Yes | – | – | **4-095** |
| Explosives | Spherical, fully porous silica | 3, 5 | 120 | 300 | – | Yes | – | – | **4-097** |
| Carbamate | Spherical, fully porous silica | 3, 5 | 120 | 300 | – | Yes | – | – | **4-100** |
| Carbonyl C18 | Spherical, fully porous silica | 2.2 | 120 | 300 | – | Yes | – | – | **4-101** |
| SEC | Spherical, resin | 5, 7 | 300 | 1000 | – | – | – | – | **4-088** |
| **Accucore Phases** | | | | | | | | | |
| RP-MS | Spherical, solid core silica | 2.6 | 80 | 130 | 7 | Yes | – | 176 | **4-044** |
| C18 | Spherical, solid core silica | 2.6 | 80 | 130 | 9 | Yes | L1 | 171 | **4-045** |
| C8 | Spherical, solid core silica | 2.6 | 80 | 130 | 5 | Yes | L7 | 172 | **4-046** |
| aQ | Spherical, solid core silica | 2.6 | 80 | 130 | 9 | Polar | L1 | 173 | **4-047** |
| Polar Premium | Spherical, solid core silica | 2.6 | 150 | 90 | 8 | Yes | L60 | 280 | **4-048** |
| Phenyl-Hexyl | Spherical, solid core silica | 2.6 | 80 | 130 | 5 | Yes | L11 | 179 | **4-049** |
| Phenyl-X | Spherical, solid core silica | 2.6 | 80 | 130 | 6 | Yes | – | 279 | **4-050** |
| PFP | Spherical, solid core silica | 2.6 | 80 | 130 | 5 | Yes | L43 | 174 | **4-051** |
| C30 | Spherical, solid core silica | 2.6 | 150 | 90 | 5 | Yes | L62 | 278 | **4-052** |
| HILIC | Spherical, solid core silica | 2.6 | 80 | 130 | – | – | L3 | 175 | **4-053** |
| Urea-HILIC | Spherical, solid core silica | 2.6 | 80 | 130 | – | – | – | 277 | **4-054** |
| **Accucore XL Phases** | | | | | | | | | |
| C18 | Spherical, solid core silica | 4 | 80 | 90 | 7 | Yes | L1 | 741 | **4-056** |
| C8 | Spherical, solid core silica | 4 | 80 | 90 | 4 | Yes | L7 | 742 | **4-057** |

# Thermo Scientific HPLC Phases *continued*

| Phase | Particle Type | Particle Size (µm) | Pore Size (Å) | Nominal Surface Area ($m^2/g$) | % Carbon | Endcapping | USP Code | Phase Code | Page |
|---|---|---|---|---|---|---|---|---|---|
| **Hypercarb Phase** | | | | | | | | | |
| Hypercarb | Spherical, porous graphitic carbon | 3, 5 | 250 | 120 | 100 | – | – | 350 | **4-084** |
| **Hypersil Phases** | | | | | | | | | |
| ODS (C18) | Spherical, fully porous silica | 3, 5 | 120 | 170 | 10 | Yes | L1 | 301 | **4-106** |
| ODS-2 (C18) | Spherical, fully porous silica | 3, 5 | 80 | 220 | 11 | Yes | L1 | 316 | **4-107** |
| MOS (C8) | Spherical, fully porous silica | 3, 5 | 120 | 170 | 6.5 | No | L7 | 302 | **4-107** |
| MOS-2 (C8) | Spherical, fully porous silica | 5 | 120 | 170 | 6.5 | Yes | L7 | 303 | **4-107** |
| SAS (C1) | Spherical, fully porous silica | 5 | 120 | 170 | 2.5 | Yes | L13 | 305 | **4-107** |
| Phenyl | Spherical, fully porous silica | 5 | 120 | 170 | 5 | No | L11 | 309 | **4-108** |
| Phenyl-2 | Spherical, fully porous silica | 5 | 120 | 170 | 5 | Yes | L11 | 319 | **4-108** |
| CPS | Spherical, fully porous silica | 3, 5 | 120 | 170 | 4 | No | L10 | 308 | **4-108** |
| CPS-2 | Spherical, fully porous silica | 5 | 120 | 170 | 4 | Yes | L10 | 318 | **4-108** |
| APS-2 | Spherical, fully porous silica | 3, 5 | 120 | 170 | 1.9 | No | L8 | 307 | **4-108** |
| Silica | Spherical, fully porous silica | 3, 5 | 120 | 170 | – | – | L3 | 300 | **4-109** |
| SAX | Spherical, fully porous silica | 5 | 120 | 170 | 2.5 | Yes | L14 | 341 | **4-109** |
| **Hypersil BDS Phases** | | | | | | | | | |
| C18 | Spherical, fully porous silica | 2.4, 3, 5 | 130 | 170 | 11 | Yes | L1 | 281 | **4-105** |
| C8 | Spherical, fully porous silica | 2.4, 3, 5 | 130 | 170 | 7 | Yes | L7 | 282 | **4-105** |
| Phenyl | Spherical, fully porous silica | 3, 5 | 130 | 170 | 5 | Yes | L11 | 289 | **4-105** |
| Cyano | Spherical, fully porous silica | 3, 5 | 130 | 170 | 4 | Yes | L10 | 288 | **4-105** |
| **Hypersil GOLD Phases** | | | | | | | | | |
| C18 selectivity | Spherical, fully porous silica | 1.9, 3, 5, 12 | 175 | 220 | 10 | Yes | L1 | 250 | **4-026** |
| C8 | Spherical, fully porous silica | 1.9, 3, 5 | 175 | 220 | 8 | Yes | L7 | 252 | **4-027** |
| C4 | Spherical, fully porous silica | 1.9, 3, 5 | 175 | 220 | 5 | Yes | L26 | 255 | **4-028** |
| aQ | Spherical, fully porous silica | 1.9, 3, 5 | 175 | 220 | 12 | Polar | L1 | 253 | **4-029** |
| PFP | Spherical, fully porous silica | 1.9, 3, 5 | 175 | 220 | 8 | Yes | L43 | 254 | **4-030** |
| Phenyl | Spherical, fully porous silica | 1.9, 3, 5 | 175 | 220 | 8.5 | Yes | L11 | 259 | **4-031** |
| CN (Cyano) | Spherical, fully porous silica | 1.9, 3, 5 | 175 | 220 | 4 | Yes | L10 | 258 | **4-032** |
| Amino | Spherical, fully porous silica | 1.9, 3, 5 | 175 | 220 | 2 | Yes | L8 | 257 | **4-033** |
| AX | Spherical, fully porous silica | 1.9, 3, 5 | 175 | 220 | 6 | No | – | 261 | **4-034** |
| SAX | Spherical, fully porous silica | 1.9, 3, 5 | 175 | 220 | 2.5 | Yes | L14 | 263 | **4-035** |
| Silica | Spherical, fully porous silica | 1.9, 3, 5 | 175 | 220 | – | – | L3 | 251 | **4-036** |
| HILIC | Spherical, fully porous silica | 1.9, 3, 5 | 175 | 220 | 6 | No | – | 265 | **4-037** |
| **Hypersil Green Phase** | | | | | | | | | |
| PAH | Spherical, fully porous silica | 3, 5 | 120 | 170 | 13.5 | Yes | – | 311 | **4-102** |
| **Syncronis Phases** | | | | | | | | | |
| C18 | Spherical, fully porous silica | 1.7, 3, 5 | 100 | 320 | 16 | Yes | L1 | 971 | **4-075** |
| C8 | Spherical, fully porous silica | 1.7, 3, 5 | 100 | 320 | 10 | Yes | L7 | 972 | **4-076** |
| aQ | Spherical, fully porous silica | 1.7, 3, 5 | 100 | 320 | 19 | Polar | L1 | 973 | **4-077** |
| Phenyl | Spherical, fully porous silica | 1.7, 3, 5 | 100 | 320 | 11 | Yes | L11 | 979 | **4-078** |
| Amino | Spherical, fully porous silica | 1.7, 3, 5 | 100 | 320 | 4 | Yes | L8 | 977 | **4-079** |
| Silica | Spherical, fully porous silica | 1.7, 3, 5 | 100 | 320 | – | – | L3 | 970 | **4-080** |
| HILIC | Spherical, fully porous silica | 1.7, 3, 5 | 100 | 320 | 5 | – | – | 975 | **4-081** |

# HPLC Column Selection by Manufacturer

To find a suitable Thermo Scientific alternative to another manufacturer's columns, refer to the selection guide below. The Thermo Scientific alternative phases are selected based on a combination of physical and chemical similarities as well as mode of retention. These alternatives are not guaranteed to provide the same retention or selectivity, but should be suitably similar in character to allow a similar or improved separation to be achieved with some method optimization. The user should refer to the individual phase information to ensure that the characteristics of the alternative match the requirements of their separation.

The following table is not complete in terms of manufacturer or products offered. Although every effort is made to ensure that the product information provided is as accurate as possible, some errors may occur in collation and transcription. We cannot accept any responsibility for the use of the following information.

| Phase | Manufacturer | Pore Size (Å) | Area ($m^2/g$) | % Carbon | Recommended Thermo Scientific Alternative | Page |
|---|---|---|---|---|---|---|
| ACE C18 | ACT | 100 | 300 | 15.5 | Syncronis C18 | 4-075 |
| ACE C8 | ACT | 100 | 300 | 9 | Syncronis C8 | 4-076 |
| ACE Phenyl | ACT | 100 | 300 | 9.5 | Syncronis Phenyl | 4-078 |
| ACE AQ | ACT | 100 | 300 | 14 | Syncronis aQ | 4-077 |
| ACE C18-300 | ACT | 300 | 100 | 9 | BioBasic 18 | 4-140 |
| ACE C8-300 | ACT | 300 | 100 | 5 | BioBasic 8 | 4-140 |
| ACE C4-300 | ACT | 300 | 100 | 2.6 | BioBasic 4 | 4-140 |
| ACQUITY UPLC™ BEH HILIC | Waters | 130 | 185 | – | Hypersil GOLD Silica (1.9µm) | 4-036 |
| ACQUITY UPLC HSS C18 | Waters | 100 | 230 | 15 | Hypersil GOLD (1.9µm) | 4-026 |
| ACQUITY UPLC BEH C18 | Waters | 130 | 185 | 18 | Hypersil GOLD (1.9µm) | 4-026 |
| ACQUITY UPLC BEH C8 | Waters | 130 | 185 | 13 | Hypersil GOLD C8 (1.9µm) | 4-027 |
| ACQUITY UPLC BEH Phenyl | Waters | 130 | 185 | 15 | Hypersil GOLD Phenyl (1.9µm) | 4-031 |
| ACQUITY UPLC HSS T3 | Waters | 100 | 230 | 11 | Hypersil GOLD aQ (1.9µm) | 4-029 |
| Aeris PEPTIDE XB-C18 | Phenomenex | 100 | 200 | – | Accucore 150-C18 | 4-144 |
| Aeris WIDEPORE XB-C18 | Phenomenex | 200 | 25 | – | Accucore 150-C18 | 4-144 |
| Aeris WIDEPORE XB-C8 | Phenomenex | 200 | 25 | – | Accuccore 150-C4 | 4-145 |
| Aeris WIDEPORE XB-C4 | Phenomenex | 200 | 25 | – | Accuccore 150-C4 | 4-145 |
| Alltima™ HP C18 | Grace | 190 | 200 | 12 | Hypersil GOLD | 4-026 |
| Alltima HP C18 AQ | Grace | 100 | 450 | 20 | Hypersil GOLD aQ | 4-029 |
| Alltima HP C18 HiLoad | Grace | 100 | 450 | 24 | Syncronis C18 | 4-075 |
| Alltima HP C8 | Grace | 190 | 200 | 8 | Hypersil GOLD C8 | 4-027 |
| Alltima HP CN | Grace | 190 | 200 | 4 | Hypersil GOLD CN | 4-032 |
| Alltima HP Silica | Grace | 190 | 200 | – | Hypersil GOLD Silica | 4-036 |
| Aminex™ HPX42C | Bio-Rad | – | – | – | HyperREZ XP Carbohydrate $Ca^{2+}$ | 4-156 |
| Aminex HPX72S | Bio-Rad | – | – | – | HyperREZ XP Carbohydrate $H^+$ | 4-156 |
| Aminex HPX87C | Bio-Rad | – | – | – | HyperREZ XP Carbohydrate $Ca^{2+}$ | 4-156 |
| Aminex HPX87H | Bio-Rad | – | – | – | HyperREZ XP Carbohydrate $H^+$ | 4-156 |
| Aminex HPX87N | Bio-Rad | – | – | – | HyperREZ XP Carbohydrate $Na^+$ | 4-156 |
| Aminex HPX87P | Bio-Rad | – | – | – | HyperREZ XP Carbohydrate $Pb^{2+}$ | 4-156 |
| AQUA™ C18 | Phenomenex | 125 | 320 | 15 | Hypersil GOLD aQ | 4-029 |
| Ascentis™ C18 | Supelco | 100 | 450 | 25 | Syncronis C18 | 4-075 |
| Ascentis C8 | Supelco | 100 | 450 | 15 | Syncronis C8 | 4-076 |
| Ascentis Express C18 | Supelco | 90 | 150 | – | Accucore C18 | 4-045 |
| Ascentis Express C8 | Supelco | 90 | 150 | – | Accucore C8 | 4-046 |
| Ascentis Express F5 | Supelco | 90 | 150 | – | Accucore PFP | 4-051 |
| Ascentis Express HILIC | Supelco | 90 | 150 | – | Accucore HILIC | 4-053 |
| Ascentis Express Phenyl-Hexyl | Supelco | 90 | 150 | – | Accucore Phenyl-Hexyl | 4-049 |
| Ascentis Express RP-Amide | Supelco | 90 | 150 | – | Accucore Polar Premium | 4-048 |
| Ascentis Express Peptide ES-C18 | Supelco | 160 | 80 | – | Accucore 150-C18 | 4-144 |
| Ascentis Phenyl | Supelco | 100 | 450 | 19 | Syncronis Phenyl | 4-078 |

# HPLC Column Selection by Manufacturer *continued*

| Phase | Manufacturer | Pore Size (Å) | Area ($m^2/g$) | % Carbon | Recommended Thermo Scientific Alternative | Page |
|---|---|---|---|---|---|---|
| Atlantis™ dC18 | Waters | 100 | 330 | 12 | Acclaim Polar Advantage II | 4-066 |
| Atlantis T3 | Waters | 100 | 300 | 14 | Hypersil GOLD | 4-026 |
| Atlantis HILIC Silica | Waters | 100 | 300 | – | Hypersil GOLD Silica | 4-036 |
| Atlantis dC18 | Waters | 100 | 330 | 12 | Hypersil GOLD aQ | 4-029 |
| Capcell Core C18 | Shiseido | 90 | 150 | 7 | Accucore C18 | 4-045 |
| Capcell Pak C18 AQ | Shiseido | 120 | 300 | 11 | Acclaim Polar Advantage II | 4-066 |
| Cortecs C18 | Waters | 90 | 100 | 6.6 | Accucore C18 | 4-045 |
| Cortecs C18+ | Waters | 90 | 100 | 5.7 | Accucore Polar Premium | 4-048 |
| Cortecs HILIC | Waters | 90 | 100 | – | Accucore HILIC | 4-053 |
| Discovery™ BIO Wide Pore C18 | Supelco | 300 | – | – | BioBasic 18 | 4-140 |
| Discovery BIO Wide Pore C8 | Supelco | 300 | – | – | BioBasic 8 | 4-140 |
| Discovery C18 | Supelco | 180 | 200 | 14 | Hypersil GOLD | 4-026 |
| Discovery C8 | Supelco | 180 | 200 | – | Hypersil GOLD C8 | 4-027 |
| Discovery Cyano | Supelco | 180 | 200 | – | Hypersil GOLD CN | 4-032 |
| Gemini™ C18 | Phenomenex | 110 | 375 | 14 | Hypersil GOLD | 4-026 |
| Halo C18 | AMT | 90 | 150 | – | Accucore C18 | 4-045 |
| Halo C8 | AMT | 90 | 150 | – | Accucore C8 | 4-046 |
| Halo HILIC | AMT | 90 | 150 | – | Accucore HILIC | 4-053 |
| Halo PFP | AMT | 90 | 150 | – | Accucore PFP | 4-051 |
| Halo Phenyl-Hexyl | AMT | 90 | 150 | – | Accucore Phenyl-Hexyl | 4-049 |
| Halo RP-Amide | AMT | 90 | 150 | – | Accucore Polar Premium | 4-048 |
| HALO Peptide ES-C18 | AMT | 160 | 80 | – | Accucore 150-C18 | 4-144 |
| Inertsil™ C4 | GL Sciences | 150 | 320 | 8 | Hypersil GOLD C4 | 4-028 |
| Inertsil C8 | GL Sciences | 150 | 320 | 11 | Syncronis C8 | 4-076 |
| Inertsil ODS3V | GL Sciences | 100 | 450 | 15 | Syncronis C18 | 4-075 |
| Inertsil Phenyl | GL Sciences | 150 | 320 | 10 | Syncronis Phenyl | 4-078 |
| Inertsil Silica | GL Sciences | 150 | 320 | – | Syncronis Silica | 4-080 |
| J'Sphere M80 | YMC | 80 | – | 14 | Acclaim PolarAdvantage II | 4-066 |
| Jupiter™ C18 | Phenomenex | 300 | 170 | 13 | BioBasic 18 | 4-140 |
| Jupiter C4 | Phenomenex | 300 | 170 | 5 | BioBasic C4 | 4-140 |
| Kinetex C18 | Phenomenex | 100 | – | 12 | Accucore C18 | 4-045 |
| Kinetex C8 | Phenomenex | 100 | – | 10 | Accucore C8 | 4-046 |
| Kinetex HILIC | Phenomenex | 100 | – | – | Accucore HILIC | 4-053 |
| Kinetex PFP | Phenomenex | 100 | – | 9 | Accucore PFP | 4-051 |
| Kinetex Phenyl-Hexyl | Phenomenex | 100 | – | – | Accucore Phenyl-Hexyl | 4-049 |
| Kinetex XB-C18 | Phenomenex | 100 | – | 12 | Accucore C18 | 4-045 |
| Kromasil C18 | Akzo-Nobel | 100 | 340 | 19 | Syncronis C18 | 4-075 |
| Kromasil C4 | Akzo-Nobel | 100 | 340 | 8 | Hypersil GOLD C4 | 4-028 |
| Kromasil Silica | Akzo-Nobel | 100 | 340 | – | Syncronis Silica | 4-080 |
| LiChrospher™ CN | Merck | 100 | 350 | 7 | Hypersil GOLD CN | 4-032 |
| LiChrospher Diol | Merck | 100 | 350 | – | BETASIL Diol | Inquire |
| LiChrospher $NH_2$ | Merck | 100 | 350 | 5 | Syncronis Amino | 4-079 |
| LiChrospher RP 18 | Merck | 100 | 350 | 21 | Syncronis C18 | 4-075 |
| LiChrospher RP-18e | Merck | 100 | 350 | 22 | Syncronis C18 | 4-075 |
| LiChrospher RP-8 | Merck | 100 | 350 | 13 | Syncronis C8 | 4-076 |
| LiChrospher RP-8e | Merck | 100 | 350 | 13 | Syncronis C8 | 4-076 |
| Luna™ C18 (2) | Phenomenex | 100 | 400 | 18 | Syncronis C18 | 4-075 |
| Luna C8 (2) | Phenomenex | 100 | 400 | 14 | Syncronis C8 | 4-076 |
| Luna CN | Phenomenex | 100 | 400 | – | Hypersil GOLD CN | 4-032 |
| Luna HILIC | Phenomenex | 200 | 200 | 5.7 | BETASIL Diol | Inquire |
| Luna NH2 | Phenomenex | 100 | 400 | 10 | Syncronis Amino | 4-079 |
| Luna PFP (2) | Phenomenex | 100 | 400 | 5.7 | Hypersil GOLD PFP | 4-030 |

| Phase | Manufacturer | Pore Size (Å) | Area ($m^2/g$) | % Carbon | Recommended Thermo Scientific Alternative | Page |
|---|---|---|---|---|---|---|
| Luna SCX | Phenomenex | 100 | 400 | – | BioBasic SCX | 4-141 |
| Luna Silica (2) | Phenomenex | 100 | 400 | – | Syncronis Silica | 4-080 |
| µBondapak™ C18 | Waters | 125 | 330 | 10 | Hypersil GOLD | 4-026 |
| µBondapak CN | Waters | 125 | 330 | – | Hypersil GOLD CN | 4-032 |
| µBondapak $NH_2$ | Waters | 125 | 330 | 4 | Hypersil APS-2 | 4-108 |
| µBondapak Phenyl | Waters | 125 | 330 | – | Hypersil GOLD Phenyl | 4-031 |
| Nova-Pak™ (HR) C18 | Waters | 60 | 120 | 7 | Hypersil GOLD | 4-026 |
| Nova-Pak C8 | Waters | 60 | 120 | – | Hypersil GOLD C8 | 4-027 |
| Nova-Pak CN | Waters | 60 | 120 | – | Hypersil GOLD CN | 4-032 |
| Nova-Pak Phenyl | Waters | 60 | 120 | 5 | Hypersil GOLD Phenyl | 4-031 |
| Nova-Pak Silica | Waters | 60 | 120 | – | Hypersil GOLD Silica | 4-036 |
| NUCLEODUR™ C18 EC | Macherey-Nagel | 110 | 340 | 18 | Syncronis C18 | 4-075 |
| NUCLEODUR C18 Gravity | Macherey-Nagel | 110 | 340 | 18 | Syncronis C18 | 4-075 |
| NUCLEODUR CN | Macherey-Nagel | 110 | 340 | 7 | Hypersil GOLD CN | 4-032 |
| NUCLEODUR Pyramid | Macherey-Nagel | 110 | 340 | 14 | Syncronis aQ | 4-077 |
| Nucleoshell™ RP 18 | Macherey-Nagel | 90 | 130 | 7.5 | Accucore C18 | 4-045 |
| Nucleoshell Phenyl-Hexyl | Macherey-Nagel | 90 | 130 | 4.5 | Accucore Phenyl-Hexyl | 4-049 |
| Nucleoshell PFP | Macherey-Nagel | 90 | 130 | 3 | Accucore PFP | 4-051 |
| Nucleosil™ 100 C18 | Macherey-Nagel | 100 | 350 | 17 | Syncronis C18 | 4-075 |
| Nucleosil 100 C18 AB | Macherey-Nagel | 100 | 350 | 24 | Syncronis C18 | 4-075 |
| Nucleosil 100 $C_6H_5$ | Macherey-Nagel | 100 | 350 | – | Syncronis Phenyl | 4-078 |
| Nucleosil 100 C8 | Macherey-Nagel | 100 | 350 | 9 | Syncronis C8 | 4-076 |
| Nucleosil 100 CN | Macherey-Nagel | 100 | 350 | – | Hypersil GOLD CN | 4-032 |
| Nucleosil 100 $N(CH_3)_2$ | Macherey-Nagel | 100 | 350 | – | Hypersil SAX | 4-109 |
| Nucleosil 100 $NH_2$ | Macherey-Nagel | 100 | 350 | 4 | Syncronis Amino | 4-079 |
| Nucleosil 100 OH | Macherey-Nagel | 100 | 350 | – | BETASIL Diol | Inquire |
| Nucleosil 100 SA | Macherey-Nagel | 100 | 350 | 7 | BioBasic SCX | 4-141 |
| Nucleosil 100 SB | Macherey-Nagel | 100 | 350 | 10 | Hypersil GOLD SAX | 4-035 |
| Nucleosil 300 C18 | Macherey-Nagel | 300 | 100 | 7 | BioBasic 18 | 4-140 |
| Nucleosil 300 C4 | Macherey-Nagel | 300 | 100 | – | BioBasic 4 | 4-140 |
| Nucleosil 300 $C_6H_5$ | Macherey-Nagel | 300 | 100 | – | BioBasic Phenyl | Inquire |
| Nucleosil 300 C8 | Macherey-Nagel | 300 | 100 | – | BioBasic 8 | 4-140 |
| Nucleosil 300 CN | Macherey-Nagel | 300 | 100 | – | BioBasic CN | Inquire |
| Pinnacle™ C1 | Restek | 120 | 170 | 2 | Hypersil SAS | 4-107 |
| Pinnacle C18 | Restek | 120 | 170 | 10 | Hypersil GOLD | 4-026 |
| Pinnacle C4 | Restek | 120 | 170 | 4 | Hypersil GOLD C4 | 4-028 |
| Pinnacle CN | Restek | 120 | 170 | 5 | Hypersil GOLD CN | 4-032 |
| Pinnacle DB C18 | Restek | 140 | – | 11 | Hypersil GOLD | 4-026 |
| Pinnacle DB C18 1.9µm | Restek | 140 | – | 11 | Hypersil GOLD (1.9µm) | 4-026 |
| Pinnacle DB C8 | Restek | 140 | – | 6 | Hypersil GOLD C8 | 4-027 |
| Pinnacle DB Cyano | Restek | 140 | – | 4 | Hypersil GOLD CN | 4-032 |
| Pinnacle DB Phenyl | Restek | 140 | – | 5 | Hypersil GOLD Phenyl | 4-031 |
| Pinnacle IBD | Restek | 120 | 170 | – | Hypersil GOLD | 4-026 |
| Pinnacle $NH_2$ | Restek | 120 | 170 | 2 | Hypersil GOLD Amino | 4-033 |
| Pinnacle Phenyl | Restek | 120 | 170 | 5 | Hypersil GOLD Phenyl | 4-031 |
| Pinnacle SAX | Restek | 120 | 170 | 3 | Hypersil GOLD SAX | 4-035 |
| Pinnacle Silica | Restek | 120 | 170 | – | Hypersil GOLD Silica | 4-036 |
| Pinnacle Ultra C18 | Restek | 100 | – | 20 | Syncronis C18 | 4-075 |
| Pinnacle Wide Pore C4 | Restek | 300 | – | 2 | BioBasic 4 | 4-140 |
| Poroshell™ 120 EC-C18 | Agilent | 120 | 120 | 8 | Accucore C18 | 4-045 |
| Poroshell 120 EC-C8 | Agilent | 120 | 120 | 5 | Accucore C8 | 4-046 |
| Poroshell 120 SB-C18 | Agilent | 120 | 120 | 7.5 | Accucore C18 | 4-045 |
| Poroshell 120 SB-Aq | Agilent | 120 | 130 | – | Accucore aQ | 4-047 |

# HPLC Column Selection by Manufacturer *continued*

| Phase | Manufacturer | Pore Size (Å) | Area ($m^2/g$) | % Carbon | Recommended Thermo Scientific Alternative | Page |
|---|---|---|---|---|---|---|
| Poroshell 120 Phenyl-Hexyl | Agilent | 120 | 130 | 9 | Accucore Phenyl-Hexyl | 4-049 |
| Poroshell 120 Bonus-RP | Agilent | 120 | 130 | 9.5 | Accucore Polar Premium | 4-048 |
| Poroshell SB-C18 | Agilent | 300 | 45 | 2.8 | Accucore 150-C18 | 4-144 |
| Poroshell Extend-C18 | Agilent | 300 | 45 | 4 | Accucore 150-C18 | 4-144 |
| Poroshell 300 SB-C8 | Agilent | 300 | 45 | 1.5 | Accucore 150-C4 | 4-145 |
| Poroshell 300 SB-C3 | Agilent | 300 | 45 | 1.1 | Accucore 150-C4 | 4-145 |
| Primesep™ | SieLC | – | – | – | Acclaim Mixed-Mode Columns | 4-068 |
| Prodigy™ C8 | Phenomenex | 150 | 310 | 13 | Syncronis C8 | 4-076 |
| Prodigy ODS2 | Phenomenex | 150 | 310 | 18 | Syncronis C18 | 4-075 |
| Prodigy ODS-3 | Phenomenex | 100 | 450 | 16 | Syncronis C18 | 4-075 |
| Prodigy ODS-3V | Phenomenex | 100 | 450 | 16 | Hypersil GOLD | 4-026 |
| Prodigy Phenyl-3 | Phenomenex | 100 | 450 | 10 | Syncronis Phenyl | 4-078 |
| Purospher™ RP-18 | Merck | 60 | 500 | – | Hypersil GOLD | 4-026 |
| Purospher STAR-8e | Merck | 120 | 300 | – | Hypersil GOLD C8 | 4-027 |
| Purospher STAR RP-18e | Merck | 120 | 300 | – | Hypersil GOLD | 4-026 |
| Waters™ Spherisorb™ C1 | Waters | 80 | 200 | 2 | Hypersil SAS | 4-107 |
| Waters Spherisorb C6 | Waters | 80 | 200 | 5 | BETASIL C6 | Inquire |
| Waters Spherisorb C8 | Waters | 80 | 200 | 6 | Hypersil GOLD C8 | 4-027 |
| Waters Spherisorb CN | Waters | 80 | 200 | 3 | Hypersil GOLD CN | 4-032 |
| Waters Spherisorb $NH_2$ | Waters | 80 | 200 | 2 | Hypersil APS-2 | 4-108 |
| Waters Spherisorb ODS1 | Waters | 80 | 200 | 6 | Hypersil GOLD | 4-026 |
| Waters Spherisorb ODS2 | Waters | 80 | 200 | 12 | Hypersil GOLD | 4-026 |
| Waters Spherisorb ODSB | Waters | 80 | 200 | 12 | Hypersil GOLD | 4-026 |
| Waters Spherisorb Phenyl | Waters | 80 | 200 | 3 | Hypersil GOLD Phenyl | 4-031 |
| Waters Spherisorb SAX | Waters | 80 | 200 | – | Hypersil SAX | 4-109 |
| Waters Spherisorb SCX | Waters | 80 | 200 | – | BioBasic SCX | 4-141 |
| Waters Spherisorb W (silica) | Waters | 80 | 200 | – | Hypersil GOLD Silica | 4-036 |
| SunFire™ C18 | Waters | 90 | 340 | 16 | Syncronis C18 | 4-075 |
| SunFire C8 | Waters | 90 | 340 | 16 | Syncronis C8 | 4-076 |
| SunShell™ C18 | ChromaNik | 90 | 150 | 7 | Accucore C18 | 4-045 |
| SunShell C8 | ChromaNik | 90 | 150 | 4.5 | Accucore C8 | 4-046 |
| SunShell PFP | ChromaNik | 90 | 150 | 4.5 | Accucore PFP | 4-051 |
| Supelcosil™ LC-1 | Supelco | 120 | 170 | – | Hypersil SAS | 4-107 |
| Supelcosil LC-18 | Supelco | 120 | 170 | 11 | Hypersil GOLD | 4-026 |
| Supelcosil LC-18DB | Supelco | 120 | 170 | 11 | Hypersil GOLD | 4-026 |
| Supelcosil LC-8 | Supelco | 120 | 170 | – | Hypersil GOLD C8 | 4-027 |
| Supelcosil LC-CN | Supelco | 120 | 170 | – | Hypersil GOLD CN | 4-032 |
| Supelcosil LC-$NH_2$ | Supelco | 120 | 170 | – | Hypersil GOLD Amino | 4-033 |
| Supelcosil LC-Si | Supelco | 120 | 170 | – | Hypersil GOLD Silica | 4-036 |
| Symmetry™ C18 | Waters | 100 | 335 | 19 | Syncronis C18 | 4-075 |
| Symmetry C8 | Waters | 100 | 335 | 12 | Syncronis C8 | 4-076 |
| Synergi™ Hydro-RP | Phenomenex | 80 | 475 | 19 | Syncronis aQ | 4-077 |
| TSKgel™ G2000SW (incl XL) | Tosoh | 125 | – | – | BioBasic SEC 120 | 4-139 |
| TSKgel Octyl-80TS | Tosoh | 80 | 200 | 11 | Hypersil GOLD C8 | 4-027 |
| TSKgel ODS-120A | Tosoh | 120 | 200 | 22 | Hypersil GOLD | 4-026 |
| TSKgel ODS-120T | Tosoh | 120 | 200 | 22 | Syncronis C18 | 4-075 |
| TSKgel ODS-80TM | Tosoh | 80 | 200 | 15 | Hypersil GOLD | 4-026 |
| TSKgel Super Octyl | Tosoh | 110 | – | 5 | Hypersil GOLD C8 | 4-027 |
| TSKgel Super ODS | Tosoh | 110 | – | 8 | Hypersil GOLD | 4-026 |
| TSKgel Super Phenyl | Tosoh | 110 | – | 3 | Hypersil GOLD Phenyl | 4-031 |
| TSKgel SuperSW3000 | Tosoh | 250 | – | – | BioBasic SEC 300 | 4-139 |

| Phase | Manufacturer | Pore Size (Å) | Area ($m^2/g$) | % Carbon | Recommended Thermo Scientific Alternative | Page |
|---|---|---|---|---|---|---|
| Vydac™ 201SP C18 | Grace | 90 | – | – | Hypersil GOLD | 4-026 |
| Vydac 201SP Selectapore 90M C18 | Grace | 90 | 250 | – | Hypersil GOLD | 4-026 |
| Vydac 201TP C18 | Grace | 300 | – | – | BioBasic 18 | 4-140 |
| Vydac 202TP C18 | Grace | 300 | – | – | BioBasic 18 | 4-140 |
| Vydac 208TP C8 | Grace | 300 | – | – | BioBasic 8 | 4-140 |
| Vydac 214TP | Grace | 300 | – | – | BioBasic 4 | 4-140 |
| Vydac 218TP | Grace | 300 | – | – | BioBasic 18 | 4-140 |
| Vydac 218WP Selectapore 300M C18 | Grace | 300 | 70 | – | BioBasic 18 | 4-140 |
| XBridge™ C18 | Waters | – | – | – | Hypersil GOLD | 4-026 |
| XBridge C8 | Waters | – | – | – | Hypersil GOLD C8 | 4-027 |
| XBridge HILIC | Waters | 130 | 185 | – | Hypersil GOLD Silica | 4-036 |
| XBridge Phenyl | Waters | – | – | – | Hypersil GOLD Phenyl | 4-031 |
| XTerra™ MS C18 | Waters | 125 | 180 | 16 | Hypersil GOLD | 4-026 |
| XTerra MS C8 | Waters | 125 | 180 | 12 | Hypersil GOLD C8 | 4-027 |
| YMCbasic™ | YMC | – | – | – | Hypersil GOLD C8 | 4-027 |
| YMC-Pack™ C4 | YMC | 120 | 300 | 7 | HyPURITY C4 | 4-109 |
| YMC-Pack C8 | YMC | 120 | 300 | 10 | Acclaim C8 | 4-062 |
| YMC-Pack CN | YMC | 120 | 300 | 7 | Hypersil GOLD CN | 4-032 |
| YMC-Pack Diol | YMC | 120 | 300 | – | BETASIL Diol | Inquire |
| YMC-Pack $NH_2$ | YMC | 120 | – | – | Hypersil GOLD Amino | 4-033 |
| YMC-Pack ODS AQ | YMC | 120 | 300 | 16 | Syncronis aQ | 4-077 |
| YMC-Pack ODS-A | YMC | 120 | 300 | 17 | Syncronis C18 | 4-075 |
| YMC-Pack ODS-A | YMC | 300 | 150 | 6 | BioBasic 18 | 4-140 |
| YMC-Pack Phenyl | YMC | 120 | 300 | 9 | Syncronis Phenyl | 4-078 |
| YMC-Pack Pro C18 | YMC | 120 | 350 | 16 | Syncronis C18 | 4-075 |
| YMC-Pack Silica | YMC | 120 | – | – | Syncronis Silica | 4-080 |
| YMC-Pack TMS (C1) | YMC | 120 | 300 | 4 | BETASIL C1 | Inquire |
| Zorbax™ Eclipse XDB C18 | Agilent | 80 | 180 | 10 | Hypersil GOLD | 4-026 |
| Zorbax Eclipse XDB C8 | Agilent | 80 | 180 | 8 | Hypersil GOLD C8 | 4-027 |
| Zorbax Eclipse XDB Phenyl | Agilent | 80 | 180 | 8 | Hypersil GOLD Phenyl | 4-031 |
| Zorbax Eclipse Plus C18 | Agilent | 95 | 160 | 8 | Hypersil GOLD | 4-026 |
| Zorbax Eclipse Plus C8 | Agilent | 95 | 160 | 6 | Hypersil GOLD C8 | 4-027 |
| Zorbax RRHT Eclipse Plus C18 | Agilent | 95 | 160 | 8 | Hypersil GOLD (1.9µm) | 4-026 |
| Zorbax RRHT Eclipse Plus C8 | Agilent | 95 | 160 | 6 | Hypersil GOLD C8 (1.9µm) | 4-027 |
| Zorbax RRHT Eclipse XDB-C18 | Agilent | 80 | 180 | 10 | Hypersil GOLD (1.9µm) | 4-026 |
| Zorbax RRHT Eclipse XDB-C8 | Agilent | 80 | 180 | 7.5 | Hypersil GOLD C8 (1.9µm) | 4-027 |
| Zorbax RRHT SB-CN | Agilent | 80 | 180 | 4 | Hypersil GOLD CN (1.9µm) | 4-032 |
| Zorbax SB Aq | Agilent | 80 | 180 | – | Hypersil GOLD aQ | 4-029 |
| Zorbax SB C18 | Agilent | 80 | 180 | 10 | Hypersil GOLD | 4-026 |
| Zorbax SB C18 | Agilent | 300 | 45 | 3 | BioBasic 18 | 4-140 |
| Zorbax SB C8 | Agilent | 80 | 180 | 6 | Hypersil GOLD C8 | 4-027 |
| Zorbax SB C8 | Agilent | 300 | 45 | 2 | BioBasic 8 | 4-140 |
| Zorbax SB CN | Agilent | 80 | 180 | 4 | Hypersil GOLD CN | 4-032 |
| Zorbax SB Phenyl | Agilent | 80 | 180 | 6 | Hypersil GOLD Phenyl | 4-031 |

# Thermo Scientific LC Columns

## Column Protection

Extend column lifetime and improve performance

- Guards and filters to protect your analytical column
- Economical extension of column lifetime
- Multiple formats for optimum performance and efficiency
- Drop-in designs for quick and easy guard and filter replacement
- UHPLC Filter cartridges and holder to protect Hypersil GOLD 1.9µm columns

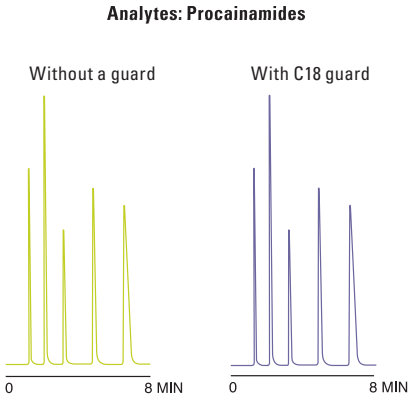
To extend the lifetime and performance of your analytical and preparative columns, we recommend that they be protected from contamination by sample and solvent debris and interferences from the sample matrix. The most cost-effective and efficient way of trapping these unwanted system components is by use of a filter or packed guards. Column performance should not be affected by adding a guard or filter unit to the HPLC system. The chromatogram shown demonstrates how the column's chromatographic performance is unaffected by the addition of a guard unit during the analysis of procainamides.

### Guard and Filter Selection

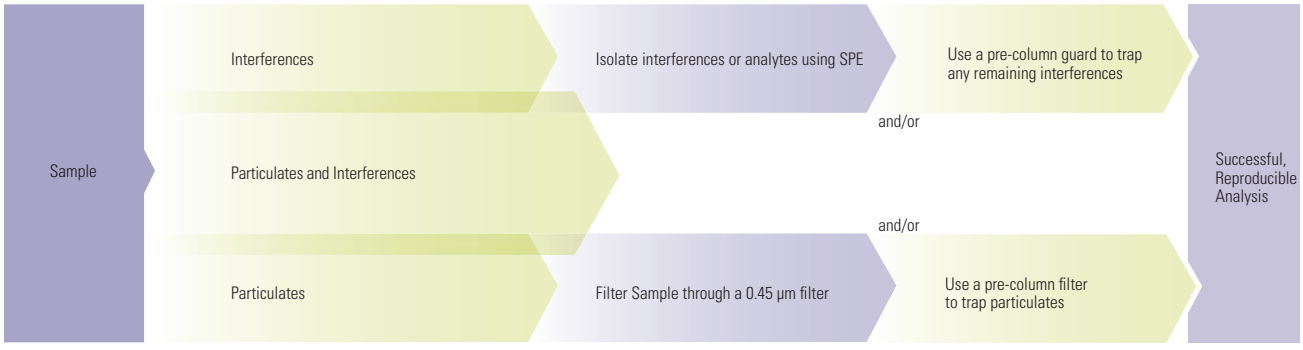
Guard columns are positioned between the injector and the analytical column, removing strongly adsorbed sample components before the sample reaches the analytical column. The simple rule of thumb in guard selection is to choose one that matches your analytical column. The internal diameters should match as closely as possible, and the packing material should be the same particle size and chemistry as the analytical column. If a guard cartridge system is used, the replacement of the packed cartridges should be simple and fast.

Pre-column filters are positioned between the solvent inlet filter and the column inlet. They are designed to trap particulate matter from the fluid path. They do not remove sample interferences or contaminants that are dissolved in the fluid path. These units are designed to be wholly disposable or have replaceable filters in a re-useable holder.

Replaceable 0.2µm Thermo Scientific UHLPC filter cartridges protect Hypersil GOLD 1.9µm and Syncronis 1.7µm columns against particles, enhancing column lifetime. Its low dead volume design maintains chromatographic performance without degrading peak shape and causes minimal efficiency loss through dispersion. The UHPLC filter adds a minimal increase in backpressure, so can be fitted to any length column.




*Peak resolution and shape are unaffected by the addition of a guard column*




*Choosing a guard or filter based on sample make-up*

# Drop-in Guard Cartridges

Drop-in guard cartridges offer convenience, economy and effective protection for extending column lifetime

- The 10mm design offers maximum protection with minimal increase in retention
- Fit Thermo Scientific™ UNIGUARD™ direct connection and stand alone holders

## Drop-in Guard Cartridges Ordering Guide

| Particle Size (µm) | Length (mm) | 1.0mm ID | 2.1mm ID | 3.0mm ID | 4.0/4.6mm ID | Quantity |
|---|---|---|---|---|---|---|
| **Hypersil GOLD** | | | | | | |
| 3 | 10 | **25003-011001** | **25003-012101** | **25003-013001** | **25003-014001** | 4 Pack |
| 5 | 10 | **25005-011001** | **25005-012101** | **25005-013001** | **25005-014001** | 4 Pack |
| **Hypersil GOLD C8** | | | | | | |
| 3 | 10 | **25203-011001** | **25203-012101** | **25203-013001** | **25203-014001** | 4 Pack |
| 5 | 10 | **25205-011001** | **25205-012101** | **25205-013001** | **25205-014001** | 4 Pack |
| **Hypersil GOLD aQ** | | | | | | |
| 3 | 10 | **25303-011001** | **25303-012101** | **25303-013001** | **25303-014001** | 4 Pack |
| 5 | 10 | **25305-011001** | **25305-012101** | **25305-013001** | **25305-014001** | 4 Pack |
| **Hypersil GOLD PFP** | | | | | | |
| 3 | 10 | **25403-011001** | **25403-012101** | **25403-013001** | **25403-014001** | 4 Pack |
| 5 | 10 | **25405-011001** | **25405-012101** | **25405-013001** | **25405-014001** | 4 Pack |
| **Hypersil GOLD CN** | | | | | | |
| 3 | 10 | **25803-011001** | **25803-012101** | **25803-013001** | **25803-014001** | 4 Pack |
| 5 | 10 | **25805-011001** | **25805-012101** | **25805-013001** | **25805-014001** | 4 Pack |
| **Hypersil GOLD Phenyl** | | | | | | |
| 3 | 10 | **25903-011001** | **25903-012101** | **25903-013001** | **25903-014001** | 4 Pack |
| 5 | 10 | **25905-011001** | **25905-012101** | **25905-013001** | **25905-014001** | 4 Pack |
| **Accucore XL C18** | | | | | | |
| 4 | 10 | – | **74104-012101** | **74104-013001** | **74104-014001** | 4 Pack |
| **Accucore XL C8** | | | | | | |
| 4 | 10 | – | **74204-012101** | **74204-013001** | **74204-014001** | 4 Pack |
| **Syncronis C18** | | | | | | |
| 5 | 10 | – | **97105-012101** | **97105-013001** | **97105-014001** | 4 Pack |
| **Syncronis C8** | | | | | | |
| 5 | 10 | – | **97205-012101** | **97205-013001** | **97205-014001** | 4 Pack |
| **Syncronis aQ** | | | | | | |
| 5 | 10 | – | **97305-012101** | **97305-013001** | **97305-014001** | 4 Pack |
| **Syncronis Phenyl** | | | | | | |
| 5 | 10 | – | **97905-012101** | **97905-013001** | **97905-014001** | 4 Pack |
| **Hypercarb** | | | | | | |
| 3 | 10 | **35003-011001** | **35003-012101** | **35003-013001** | **35003-014001** | 2 Pack |
| 5 | 10 | **35005-011001** | **35005-012101** | **35005-013001** | **35005-014001** | 2 Pack |

This table provides a sample of the guard cartridges for the most popular Thermo Scientific HPLC stationary phases. Drop-in guard cartridges are available in other Thermo Scientific phases. For information on guard cartridges for other Thermo Scientific phases, please consult the appropriate section of the catalogue or contact Customer Services for more information.

# Defender Guard Cartridges

Thermo Scientific™ Defender™ Guard Cartridges have been designed specifically to work with high speed, high efficiency separations.

### Accucore Defender Guard Cartridges (4/pk) Ordering Guide

| Description | Particle Size (µm) | Length (mm) | 2.1mm ID |
|---|---|---|---|
| Accucore RP-MS | 2.6 | 10 | **17626-012105** |
| Accucore C18 | 2.6 | 10 | **17126-012105** |
| Accucore C8 | 2.6 | 10 | **17226-012105** |
| Accucore aQ | 2.6 | 10 | **17326-012105** |
| Accucore Polar Premium | 2.6 | 10 | **28026-012105** |
| Accucore Phenyl-Hexyl | 2.6 | 10 | **17926-012105** |
| Accucore Phenyl-X | 2.6 | 10 | **27926-012105** |

| Description | Particle Size (µm) | Length (mm) | 2.1mm ID |
|---|---|---|---|
| Accucore PFP | 2.6 | 10 | **17426-012105** |
| Accucore C30 | 2.6 | 10 | **27826-012105** |
| Accucore HILIC | 2.6 | 10 | **17526-012105** |
| Accucore Urea-HILIC | 2.6 | 10 | **27726-012105** |
| Accucore 150-C18 | 2.6 | 10 | **16126-012105** |
| Accucore 150-C4 | 2.6 | 10 | **16526-012105** |
| Accucore 150-Amide-HILIC | 2.6 | 10 | **16726-012105** |

Other guard column dimension are available in some Accucore phases. Please call your local Customer Service for more information.

# UNIGUARD Direct-Connection Guard Cartridge Holders

Reusable, stainless steel guard cartridge holders that match directly to the analytical column inlet – eliminating requirement for extra fittings

- With PEEK 1/16in male outlet that fits most columns
- 1/16in female inlet can be used with various standard fittings

### UNIGUARD Direct-Connection Guard Cartridge Holders Ordering Guide

| Description | 1.0mm ID | 2.1mm ID | 3.0mm ID | 4.0/4.6mm ID | Quantity |
|---|---|---|---|---|---|
| UNIGUARD Drop-In /Defender Guard Cartridge Holder | **851-00** | **852-00** | **852-00** | **850-00** | 1 Each |
| Standard Replacement Tip | **850-RT** | **850-RT** | **850-RT** | **850-RT** | 1 Each |
| Waters Columns Replacement Tip | **850-WT** | **850-WT** | **850-WT** | **850-WT** | 1 Each |

# Acclaim Guards Cartridges

Thermo Scientific™ Acclaim™ Guard Cartridges are available in the same packing and internal diameters as the Acclaim analytical column chemistries. A re-usable holder allows for easy cartridge replacement; extending the life of the analytical column.

# Acclaim Guard Cartridges Ordering Guide

### Acclaim Guard Cartridge Ordering Guide (2/pk)

| Particle Size (µm) | Length (mm) | ID (mm) | 120 C18 | 120 C8 | Polar Advantage | Polar Advantage II | C30 | Mixed-Mode HILIC-1 | Mixed-Mode WAX-1 | Mixed-Mode WCX-1 |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 10 | 2.1 | **069689** | **069688** | **069691** | **069692** | **075722** | **069694** | **069686** | **085455** |
| | | 3.0 | **071981** | **071979** | **071983** | **071985** | **075721** | **071913** | **071909** | **071911** |
| | | 4.6 | **069695** | **069696** | **069698** | **069699** | **075720** | **069706** | **069704** | **069705** |

### Acclaim Guard Cartridge Ordering Guide (2/pk) *continued*

| Description | Particle Size (µm) | Length (mm) | 2.1mm ID | 3.0mm ID | 4.6mm ID |
|---|---|---|---|---|---|
| Phenyl-1 | 3 | 10 | **079934** | **071974** | **071973** |
| HILIC-10 | 5 | 10 | **074263** | **074261** | **074262** |

### Acclaim Specialty Column Guard Cartridge Ordering Guide (2/pk)

| Description | Particle Size (µm) | Length (mm) | 2.1mm ID | 3.0mm ID | 4.6mm ID |
|---|---|---|---|---|---|
| Acclaim Trinity P1 | 3 | 10 | **071391** | **071390** | – |
| Acclaim Trinity P2 | 3 | 10 | **085435** | **085436** | – |
| Acclaim Trinity Q1 | 5 | 10 | **079719** | **079720** | – |
| Acclaim Organic Acid | 5 | 10 | – | **071987** | **069700** |
| Acclaim Surfactant Plus | 5 | 10 | **082773** | **078959** | **078960** |
| Acclaim Surfactant | 5 | 10 | **069693** | **071991** | **069701** |
| Acclaim Explosives E1 | 5 | 10 | – | – | **069702** |
| Acclaim Explosives E2 | 5 | 10 | – | **071989** | **069703** |
| Acclaim Carbamate | 5 | 10 | **072930** | **072929** | **072928** |
| Acclaim Carbonyl C18 | 5 | 10 | **079012** | **079013** | **079014** |

### Acclaim Guard Holder Ordering Guide

| Format | Cat. No. |
|---|---|
| Acclaim Guard Cartridge Holder V-2 | **069580** |
| Acclaim Guard Kit (Holder and coupler) V-2 | **069707** |
| Guard to Analytical Column Coupler V-2 | **074188** |

## Javelin Direct-Connection Column Filters

One-piece filter protects HPLC systems

- Direct-connection design for maximum efficiency
- Replace entire disposable filter unit for easy changes
- Recommended for use as dedicated filters for a column rather than the HPLC system
- 1/16in CPI tip attaches directly to HPLC column inlet without tubing or wrenches
- 0.5µm porosity

### Javelin Direct-Connection Column Filter Ordering Guide

| Description | 2.1mm ID | 3.0mm ID | 4.0/4.6mm ID | Quantity |
|---|---|---|---|---|
| Javelin Column Filter | **88200** | **88700** | **88400** | 4 Pack |

## ColumnSaver Precolumn Filters

Filter mesh size 2µm

### ColumnSaver Precolumn Filters Ordering Guide

| Filter Mesh Size (µm) | Cat. No | Quantity |
|---|---|---|
| 2 | **60140-412** | 10 Pack |

## UNIFILTER Direct-Connection HPLC Filter Systems

Quickly replaced for minimal down time

- Replaceable 0.5µm drop-in filter enhances column lifetime and improved performance
- Holder attached directly to the inlet of your analytical system for maximum convenience

### UNIFILTER Direct-Connection HPLC Filter Systems Ordering Guide

| Description | 2.1/3.0mm ID | 4.0/4.6mm ID | Quantity |
|---|---|---|---|
| UNIFILTER Direct Connection Holder | **27002** | **27000** | 1 Each |
| Replacement Filter, 0.5µm | **22016** | **22150** | 1 Each |
| Replacement Filter, 0.5µm | **22017** | **22155** | 5 Pack |
| Replacement Tip, CPI, Standard | **850-RT** | **850-RT** | 1 Each |
| Replacement Tip, Waters End-fitting | **850-WT** | **850-WT** | 1 Each |

## UHPLC Filter

Column protection for Hypersil GOLD 1.9µm and Syncronis 1.7µm columns without compromising performance


- Low volume filter cartridge design
- Maintain peak shape
- Minimal efficiency loss through dispersion

### UHPLC Filter Ordering Guide

| Description | Cat. No. | Quantity |
|---|---|---|
| UHPLC Direct Connect Filter Holder | **27006** | 1 Each |
| 2.1mm ID Replacement Filter Cartridge, 0.2µm | **22180** | 5 Pack |
| 1.0mm ID Replacement Filter Cartridge, 0.2µm | **22185** | 5 Pack |

## Notes

# Thermo Scientific Columns for Fast and Analytical HPLC

The Thermo Scientific LC column portfolio offers a comprehensive range of high quality options for fast and analytical HPLC.

The table below shows our major column families with details of relative hydrophobicity, key attributes and how the attributes are achieved. Use this table and the information in the subsequent catalogue pages to find the best Thermo Scientific LC columns for your separation needs.

| Hydrophobicity | | Key Attribute | Achieved through |
|---|---|---|---|
| Low | **Accucore Columns** Page 4-042  | Ultimate Performance | • 2.6 and 4µm solid core silica particles<br>• Core Enhanced Technology |
| | **Hypersil GOLD Columns** Page 4-024  | Selectivity & Peak Shape | • 1.9, 3, 5 and 12µm ultra-high purity silica particles<br>• Wide range of conventional phases |
| Medium/High | **Acclaim Columns** Page 4-060  | Traditional, Speciality & Application Specific | • 2.2, 3 and 5µm ultra-pure silica particles<br>• Innovative and unique bonded phases |
| High | **Syncronis Columns** Page 4-074  | Ruggedness & Reproducibility | • 1.7, 3 and 5µm high surface area silica particles<br>• Dense bonding, double endcapping, rigorous testing |
| Very High | **Hypercarb Columns** Page 4-084  | Extended Separation Capabilities | • 3 and 5µm 100% porous graphitic carbon particles<br>• Polar retention effect on graphite (PREG) |

# Principles of Fast LC

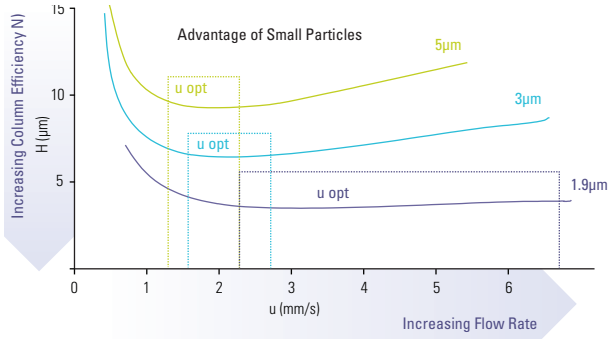
## Effect of particle size and type

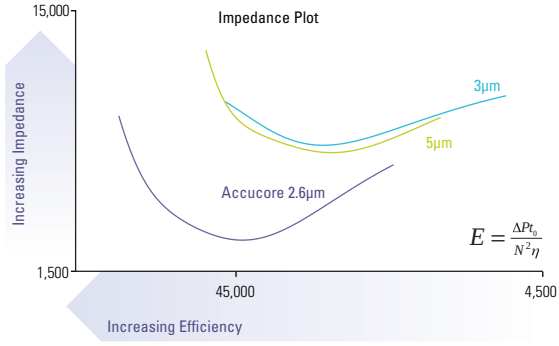
It is now well established that columns packed with smaller diameter particles generate higher efficiencies over a wider range of flow rates than larger particle columns – as shown in the plot below.

An alternative to small diameter particles is the Core Enhanced Technology used in Accucore HPLC columns. As shown in the impedance plot below, Accucore columns generate higher efficiencies in shorter times than columns packed with 5µm or 3µm particles and does so at low backpressures.

$$E = \frac{\Delta P t_0}{N^2 \eta}$$

E Impedance
ΔP Backpressure
$t_0$ Retention time of unretained peak
N Efficiency
η Mobile phase viscosity



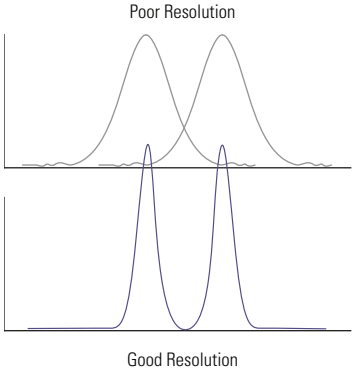

## Speed and Resolution

The general chromatographic resolution equation shows that resolution is directly proportional to efficiency. High efficiencies across a wider range of linear velocities mean that shorter columns and/or faster flow rates can be used to increase the speed of separations without sacrificing resolution.

The resolution equation also shows that a wide range of different bonded phases, each offering a different selectivity, is a useful way to improve resolution.

$$R_S = \frac{1}{4}\frac{(\alpha - 1)}{\alpha}\sqrt{N}\frac{k'}{1 + k'}$$

α Selectivity
$N$ Efficiency
$k'$ Capacity factor




## Peak Capacity

As an alternative to speeding up analysis the excellent resolution offered by high efficiency columns can also be used to improve complex separations through an increase in peak capacity – the number of peaks that can be separated in a given gradient time.

$$n_c = 1 + \left(\frac{t_g}{W}\right)$$

$n_c$ Peak capacity
$t_g$ Gradient time
$W$ Peak width (10% height)

## Sensitivity

According to the formula shown below, sensitivity is increased in high efficiency separations by increasing the concentration of the peak and thus the detector signal to noise ratio.

$$c_{max} \propto \frac{\sqrt{N}\, V_i}{L\, d_c^2 (1 + k')}$$

$c_{max}$ Concentration at peak apex
$N$ Efficiency
$V_i$ Injection volume
$L$ Column length
$d_c$ Column internal diameter
$k'$ Capacity factor

## Miniaturization

The sensitivity formula also shows that peak concentration can be increased through the use of shorter columns and more importantly, with narrower column internal diameters.

When transferring a method to a different column geometry adjustments must be made to the following parameters:

- Flow Rate
- Injection Volume
- Gradient Profile

A convenient method transfer tool is available at the Chromatography Resource Center (www.thermoscientific.com/crc).

## Optimization

In order to preserve high efficiency, and therefore resolution and sensitivity, the HPLC system in use should be optimized to reduce any potential causes of peak broadening.
See page **4-231** for details of this optimization.

# Thermo Scientific Hypersil GOLD HPLC Columns

Outstanding peak shape for your separations

- Excellent peak symmetry
- Narrow peaks for outstanding efficiency
- Increased sensitivity and improved resolution
- Variety of chemistries
- 1.9 to 12µm particles

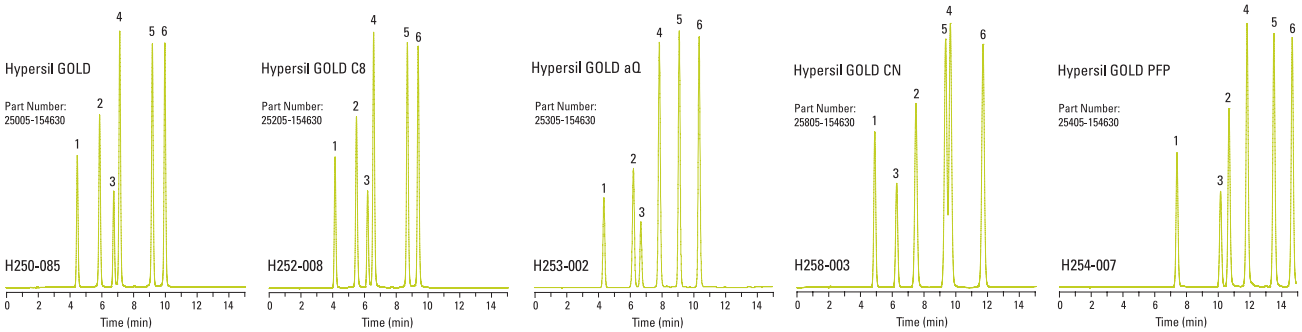
Thermo Scientific™ Hypersil GOLD™ columns are exceptionally reproducible for reliable chromatography, column after column. This allows the user to be confident that assays developed with Hypersil GOLD columns will be robust and stable for the life of the assay, making them an ideal choice for new method development. Built on more than 35 years of experience in product development and manufacturing of HPLC media and columns, we successfully continue to extend the capabilities of this state-of-the-art family of columns, designed for improved chromatography. Hypersil GOLD columns are manufactured in ISO 9001:2008 accredited laboratories under strict protocols using a robust manufacturing procedure and extensive quality control testing.

## Improved Selectivity, Resolution and Productivity

Hypersil GOLD columns are available in an array of chemistries to optimize separations and maximize productivity:

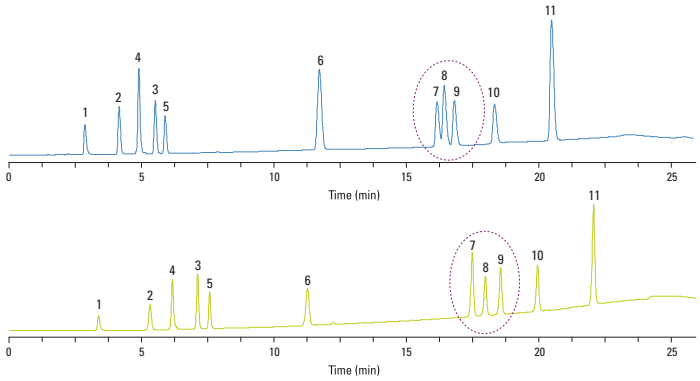
- **Hypersil GOLD** offers outstanding peak shape using generic gradients with C18 selectivity
- **Hypersil GOLD C8** offers similar selectivity but with less retention
- **Hypersil GOLD aQ** can be used for challenging reverse phase separations employing highly aqueous mobile phases
- **Hypersil GOLD PFP** can offer alternative selectivity in reverse phase applications
- **Hypersil GOLD Phenyl** offers alternative selectivity and is particularly suitable for aromatic and moderately polar compounds
- **Hypersil GOLD CN** can be used for both reversed and normal phase separations
- **Hypersil GOLD C4** has short alkyl chain length, low hydrophobicity column for less retention
- **Hypersil GOLD Amino** demonstrates excellent chromatographic properties in three modes: weak anion exchange, reversed phase and normal phase.
- **Hypersil GOLD AX** can be used to separate proteins, peptides, other anionic species and polar molecules
- **Hypersil GOLD SAX** is a highly stable silica-based quarternary amine strong anion exchange column, designed for aqueous mobile phase
- **Hypersil GOLD Silica** is a powerful and efficient tool in the chromatography of non-polar and moderately polar organic compounds by normal phase
- **Hypersil GOLD HILIC** columns retain polar analytes that are problematic using reversed phase columns

These chemistries offer alternative selectivities in the same column family, providing enhanced retention or changes in elution order for flexibility in method development. Each phase is made with the same care and attention to quality that defines all Thermo Scientific columns.



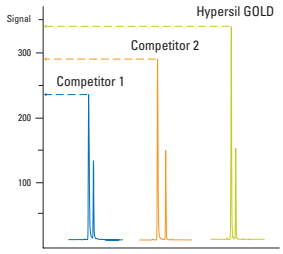

**Hypersil GOLD, 5µm, 150 x 4.6mm**

| | |
|---|---|
| Mobile Phase: | A: H2O + 0.1% Formic acid<br>B: MeOH + 0.1% Formic acid |
| Gradient: | 20 to 50% B in 15 min |
| Flow Rate: | 1mL/min |
| Detection: | UV at 280nm |
| Temperature: | 25°C |
| Sample: | 1. Catechin<br>2. Epigallocatechin Gallate<br>3. Epicatechin<br>4. Gallocatechin Gallate<br>5. Epicatechin Gallate<br>6. Catechin Gallate |




*Resolution of analytes is improved using a Hypersil GOLD column.*

*Data courtesy of M. Euerby, AstraZeneca, Charnwood, UK.*




*The improved peak symmetry provides additional peak height to increase sensitivity of analysis of trace components.*

## Solutions for High Throughput Screening, Capillary to Preparative Analysis

Hypersil GOLD columns are available in particle sizes and column designs to meet all separation needs, including improved resolution, enhanced sensitivity and faster analyses. From 1.9µm to 12µm particles, Hypersil GOLD columns offer chromatographic solutions with consistent separations and performance. Specialized hardware includes Thermo Scientific™ KAPPA™ capillary columns, PicoFrit™ and IntegraFrit nanobore columns, Thermo Scientific™ Javelin™ HTS direct-connection columns and Thermo Scientific™ DASH™ HTS columns, designed for high throughput screening.

## Improved Sensitivity

Good peak shape means greater sensitivity. When peaks exhibit tailing, peak height is reduced causing the sensitivity of the analysis to be compromised. The more symmetrical the chromatographic peaks, the more confidence you derive from your data. Using Hypersil GOLD columns, peak height is enhanced and peak integration calculations are optimized.

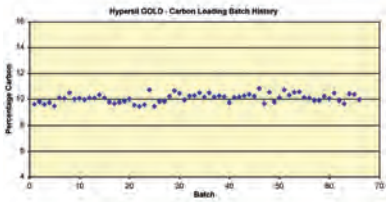
Enhanced peak height can be particularly critical when low concentrations of an analyte are present, for example in an impurity assay. The increase in sensitivity gained with the Hypersil GOLD columns over competitor C18 columns is illustrated above.

## Enhanced Resolution

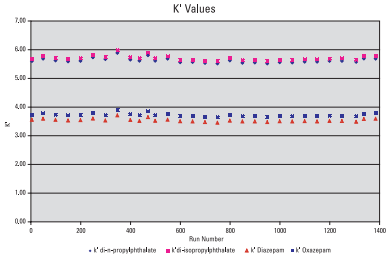
Robust assay development requires a clear definition of resolution expectations. Narrow symmetrical chromatographic peaks ensure that optimum resolution is achieved. Obtaining narrow peak widths is especially challenging for basic pharmaceutical compounds. The figure above shows how Hypersil GOLD columns provide excellent resolution between critical pairs, aiding in separation of closely related species.

## pH Stability

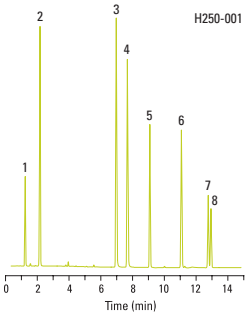
Hypersil GOLD columns are well suited to extended pH applications. Hypersil GOLD columns have been shown to produce robust assays at high pH. At low pH, excellent column stability and reproducibility are illustrated.



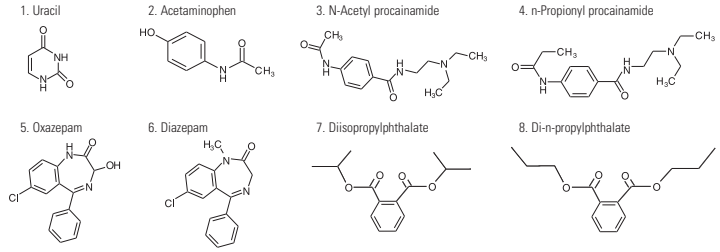

*Excellent reproducibility is illustrated with the percent carbon on the Hypersil GOLD media*




*Stability of Hypersil GOLD columns at low pH. No loss of retention after 28L of mobile phase in 19.5 days of analysis.*




| Dimensions: | 5µm, 150 x 4.6mm |
|---|---|
| Part Number: | 25005-154630 |
| Mobile Phase: | A: 0.1% ammonia pH 10.6<br>B: MeOH + 0.1% ammonia |
| Gradient: | 5 – 100% B in 15 min |
| Flow: | 1.0mL/min |
| Injection: | 10µL |
| Detection: | UV at 254nm |
| Temperature: | 30°C |

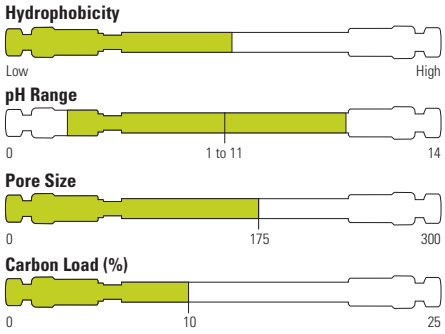



*High pH stability assay (pH 10.6) of Hypersil GOLD columns*

# Hypersil GOLD

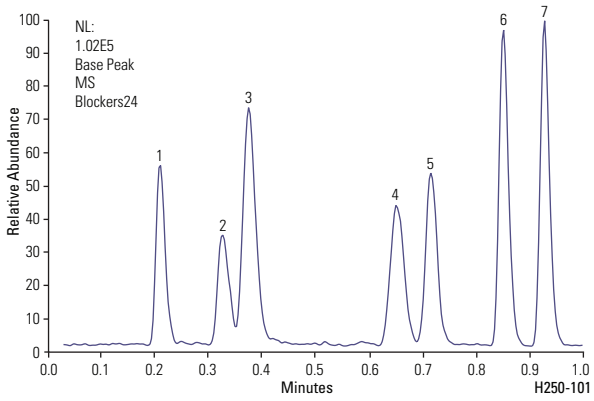
Endcapped, ultrapure, silica-based columns with exceptional peak shape and resolution for HPLC and LC/MS

- Significant reduction in peak tailing while retaining C18 selectivity
- Excellent resolution, efficiency and sensitivity
- Confidence in the accuracy and quality of analytical data




**Particle Size** 1.9µm, 3µm, 5µm, 12µm **USP** L1

**Seven β-blockers in 1 minute**



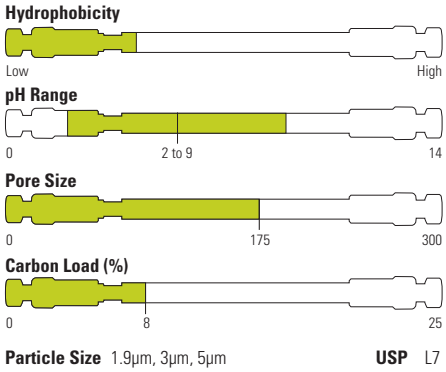

**Column: 1.9µm Hypersil GOLD 20 x 2.1mm**
**Part Number: 25002-022130**

| | |
|---|---|
| Mobile phase: | A – $H_2O$+0.1%formic acid |
| | B – MeCN+0.1%formic acid |
| Gradient: | 15 to 100% B in 1min |
| Flow rate: | 0.5ml/min |
| Temperature: | 30°C |
| Detection: | +ESI |
| System: | Thermo Scientific™Surveyor™ MSQ |
| Analytes: | 1. Atenolol |
| | 2. Nadolol |
| | 3. Pindolol |
| | 4. Timolol |
| | 5. Metoprolol |
| | 6. Oxprenolol |
| | 7. Propanolol |

# Hypersil GOLD C8

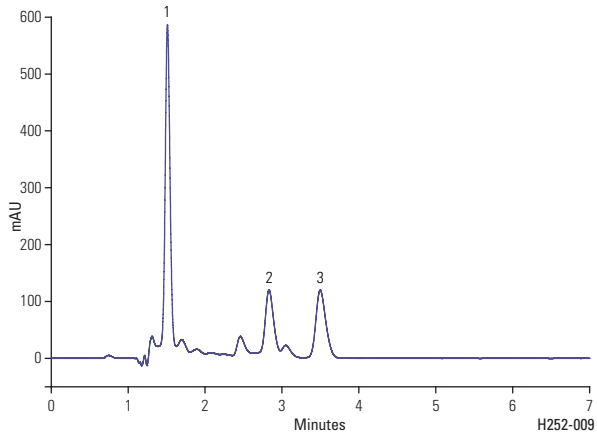
Recommended for analytes with medium hydrophobicity or when a less hydrophobic phase is required to obtain optimum retention

- Similar selectivity to C18 columns but with reduced retention
- Lower hydrophobicity, allowing compounds to elute quicker
- Faster separations
- Excellent peak shape
- High efficiency
- Outstanding sensitivity




**Particle Size** 1.9µm, 3µm, 5µm **USP** L7

**β-carotene**



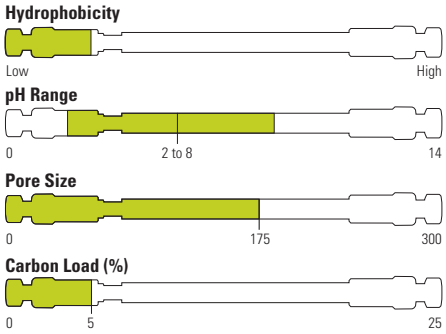

**Column: Hypersil GOLD C8, 5µm, 150 x 4.6mm**
**Part Number: 25205-154630**

| | |
|---|---|
| Mobile phase: | MeOH |
| Flow rate: | 1.5mL/min |
| Temperature: | 25°C |
| Detection: | UV @ 450 nm |
| Analytes: | 1. Lutein<br>2. Lycopene<br>3. β-Carotene |

# Hypersil GOLD C4

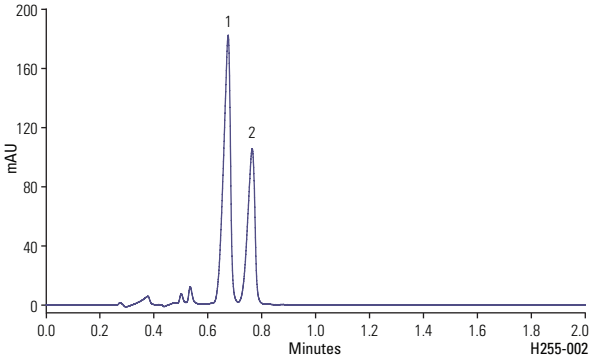
Lower hydrophobicity than C18 or C8 recommended for very hydrophobic analytes

- Lower hydrophobicity
- Faster separations
- Excellent peak shape
- High efficiency
- Outstanding sensitivity




**Particle Size** 1.9µm, 3µm, 5µm **USP** L26

### Fatty acids



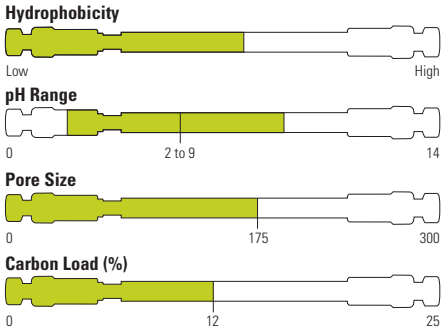

**Column: Hypersil GOLD C4 1.9µm, 100 x 2.1mm**
**Part Number: 25502-102130**

| | |
|---|---|
| Mobile phase: | $H_2O$ / MeCN (20:80) |
| Flow rate: | 0.55mL/min |
| Temperature: | 30°C |
| Detection: | 200 nm |
| Injection volume: | 1µL |
| Sample: | 1. Linolenic acid<br>2. Linoleic acid |

# Hypersil GOLD aQ

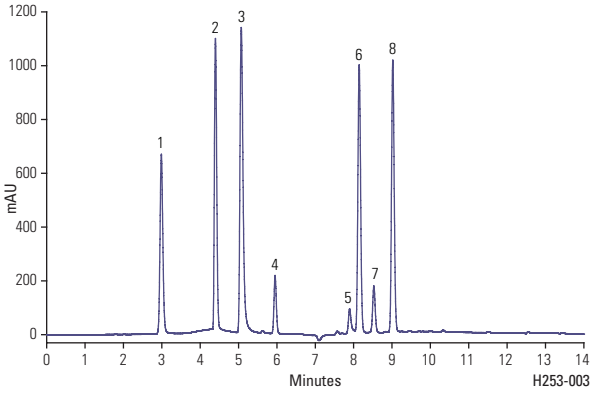
Hypersil GOLD aQ polar endcapped C18 columns provide a controlled interaction mechanism by which polar analytes can be retained and resolved

- Polar endcapped C18 phase for alternative selectivity
- Retention and resolution of polar analytes
- Excellent peak shape
- Stable in 100% aqueous mobile phases




**Particle Size** 1.9µm, 3µm, 5µm **USP** L1

### Water soluble vitamins



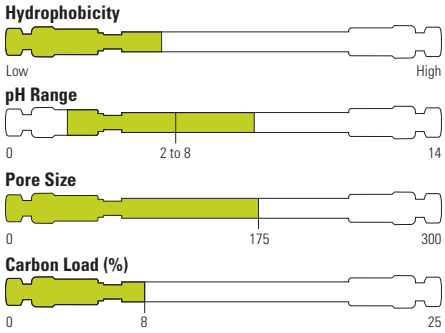

**Column: Hypersil GOLD aQ, 5µm, 150 x 4.6mm**
**Part Number: 25305-154630**

| | |
|---|---|
| Mobile phase: | A: 50 mM $KH_2PO_4$, pH 3.5<br>B: MeOH |
| Gradient: | 0 – 100% B in 15 min |
| Flow Rate: | 1mL/min |
| Detection: | UV @ 205nm |
| Sample: | 1. Vitamin B1 (thiamine)<br>2. Vitamin B6 (pyridoxine)<br>3. Vitamin B3 (nicotinamide)<br>4. Vitamin B5 (pantothenic acid)<br>5. Folic Acid<br>6. Vitamin B12 (cyanocobalamin)<br>7. Vitamin H (biotin)<br>8. Vitamin B2 (riboflavin) |

# Hypersil GOLD PFP

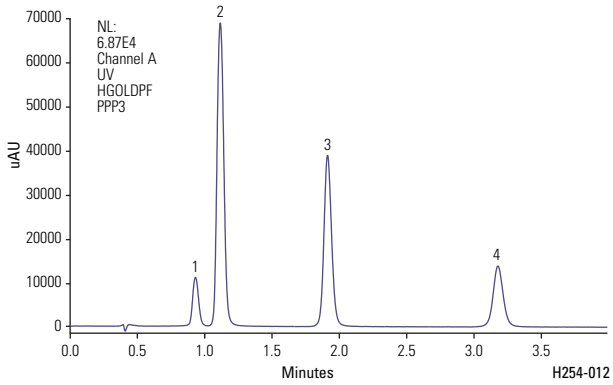
Introduction of a fluorine group into the stationary phase causes significant changes in solute-stationary phase interaction

- The fluorine atoms around the phenyl ring enhance pi-pi interactions with aromatic molecules
- Alternative selectivity to C18
- Extra retention for halogenated species
- Selectivity for non-halogenated polar compounds
- Excellent peak shape and sensitivity




**Particle Size** 1.9µm, 3µm, 5µm **USP** L43

### Polyphenols



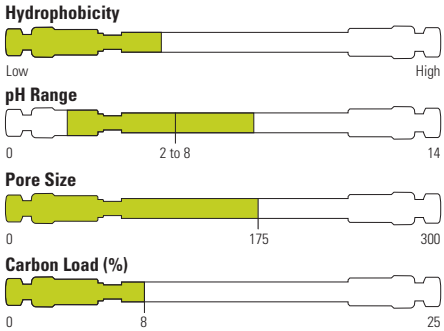

**Column: Hypersil GOLD PFP 1.9µm, 50 x 2.1mm**
**Part Number: 25402-052130**

| | |
|---|---|
| Mobile phase: | 0.1% Acetic Acid |
| Flow rate: | 0.5mL/min |
| Temperature: | 25°C |
| Detection: | UV @ 280nm (2µL Flow Cell) |
| Injection Volume: | 0.5µL |
| Sample: | 1. Pyrogallol<br>2. Hydroquinone<br>3. Resorcinol<br>4. Phenol |

# Hypersil GOLD Phenyl

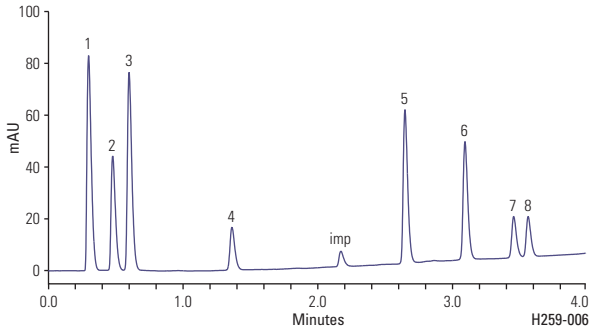
Contains a C4 linker which allows for superior alignment of the phenyl ring with aromatic molecules

- Enhanced pi-pi interactions with aromatics
- Moderate hydrophobicity
- Outstanding peak shape and sensitivity




**Particle Size** 1.9µm, 3µm, 5µm **USP** L11

### Antidepressants



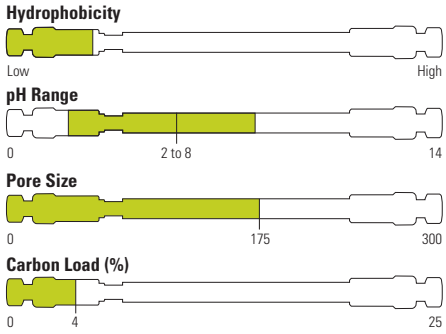

**Column: Hypersil GOLD Phenyl**
**1.9µm, 50 x 2.1mm**
**Part Number: 25902-052130**

| | |
|---|---|
| Mobile phase: | A – 0.1% Formic acid |
| | B – 0.1% Formic acid in MeCN |
| Gradient: 10 – 60% B in 3.4mins, 60 - 90% B in 0.24 min | |
| Flow rate: | 0.5mL/min |
| Temperature: | 60°C |
| Injection Volume: | 0.7µL |
| Detection: | UV @ 225 and 254 nm |
| Analytes: | 1. Uracil<br>2. Acetaminophen<br>3. p-Hydroxybenzoic acid<br>4. o-Hydroxybenzoic acid<br>5. Oxazepam<br>6. Diazepam<br>7. Di-isopropyl phthalate<br>8. Di-n-propyl phthalate |

# Hypersil GOLD CN

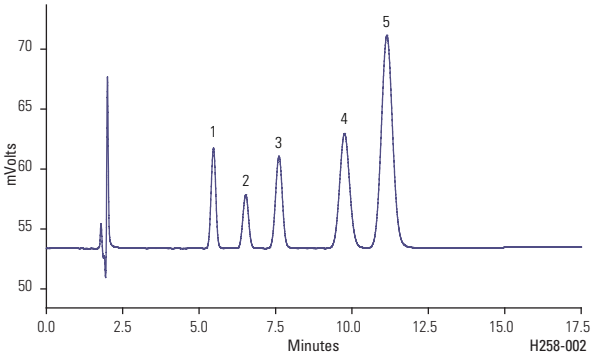
Hypersil GOLD CN columns can be used for both normal phase and reversed phase separations

- Provide alternative selectivity with lower hydrophobicity
- Excellent peak shape
- Outstanding senstivity
- Less retention for faster analysis




**Particle Size** 1.9µm, 3µm, 5µm **USP** L10

## Organic acids



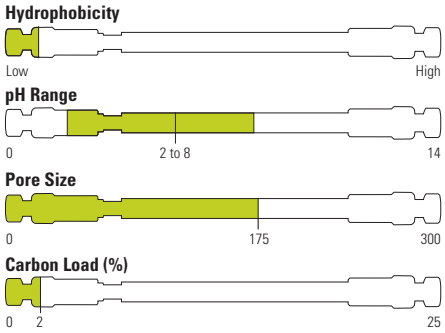

**Column: Hypersil GOLD CN, 5µm, 150 x 4.6mm**
**Part Number: 25805-154630**

| | |
|---|---|
| Mobile Phase: | A: 25 mM $KH_2PO_4$ pH2<br>B: MeOH |
| Isocratic: | 95% A: 5% B |
| Flow Rate: | 1.5mL/min |
| Temperature: | 25°C |
| Detection: | UV @ 230nm |
| Sample: | 1. 4-Fluorobenzoic<br>2. o-Toluic Acid<br>3. p-Toluic Acid<br>4. 2,4,6-Trimethylbenzoic Acid<br>5. 2,5-Dimethylbenzoic Acid |

# Hypersil GOLD Amino

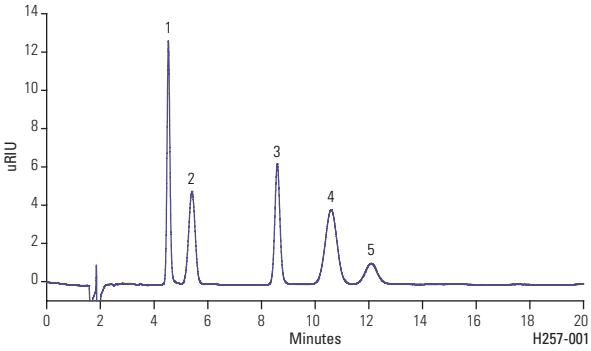
A high performance aminopropyl phase that gives excellent chromatographic properties in three modes: weak anion exchange, reversed phase and normal phase

- Retains anions and organic acids in weak anion exchange
- Excellent for carbohydrate analysis in reversed phase
- Alternative selectivity to silica columns in normal phase chromatography
- Outstanding peak shape and sensitivity




**Particle Size** 1.9µm, 3µm, 5µm **USP** L8

**Sugars**



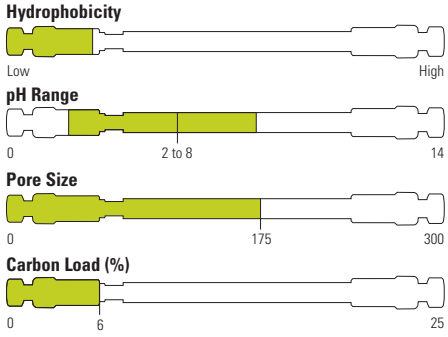

**Column: Hypersil GOLD Amino, 5µm, 150 x 4.6mm**
**Part Number: 25705-154630**

| | |
|---|---|
| Mobile Phase: | MeCN/Water (80:20) |
| Flow Rate: | 1.2mL/min |
| Temperature: | 35°C |
| Detection: | RI |
| Injection volume: | 20 µL |
| Sample: | 1. Fructose<br>2. Glucose<br>3. Sucrose<br>4. Maltose<br>5. Lactose |

# Hypersil GOLD AX

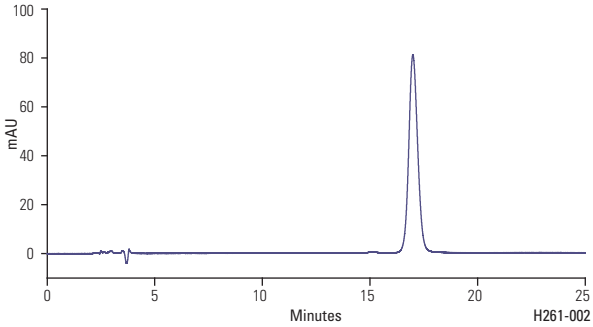
A novel polymeric amine ligand bonded to highly pure base deactivated silica

- Weak anion exchange phase for multiple charged species
- Suitable for HILIC retention and separation of highly polar molecules
- Higher efficiency than polymer based ion exchange columns
- Outstanding peak shape and selectivity




**Particle Size** 1.9µm, 3µm, 5µm

**Vitamin C**



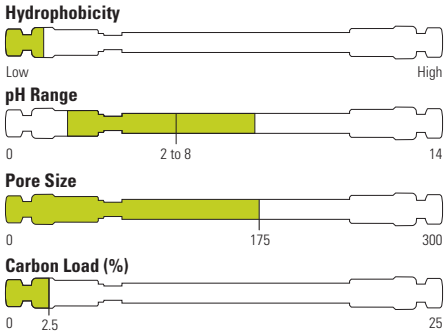

**Column: Hypersil GOLD AX, 5µm, 100 x 4.6mm**
**Part Number: 26105-104630**

| | |
|---|---|
| Mobile Phase: | 100 mM Ammonium Acetate pH 6.8/ MeCN (30:70) |
| Flow Rate: | 0.5mL/min |
| Temperature: | 30°C |
| Detection: | UV @ 240nm |
| Injection volume: | 50µL |

# Hypersil GOLD SAX

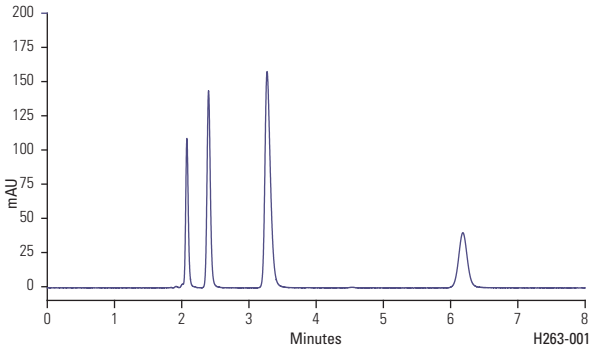
A highly stable quaternary amine strong anion exchange column for aqueous and low pH mobile phases

- High stability to aqueous and low pH mobile phases
- Ideally suited to the analysis of smaller organic molecules including nucleotides and organic acids
- Outstanding peak shape and sensitivity



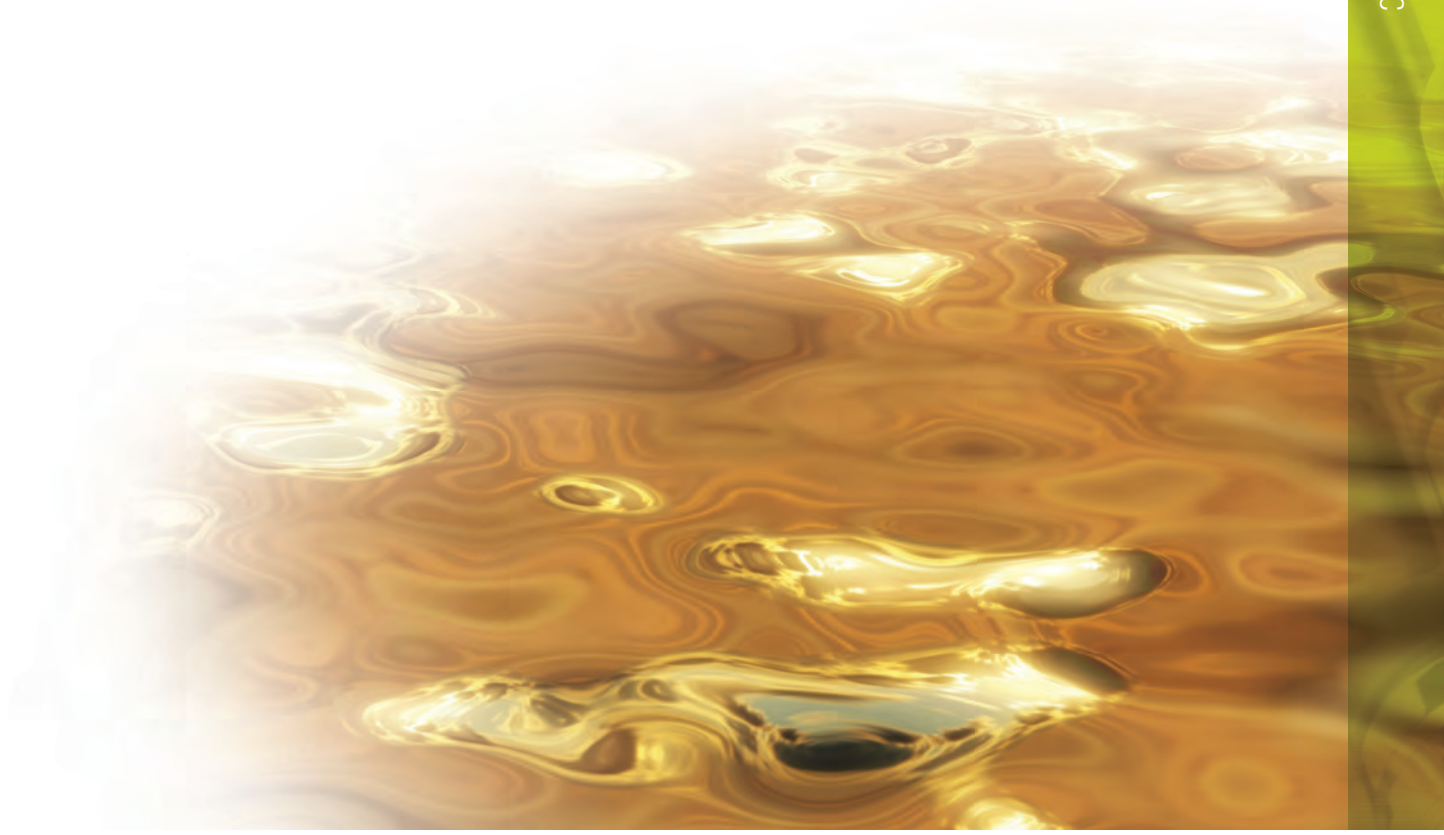

**Particle Size** 1.9µm, 3µm, 5µm **USP** L14

## Monophosphates




**Column: Hypersil GOLD SAX, 5µm, 150 x 4.6mm**
**Part Number: 26105-154630**

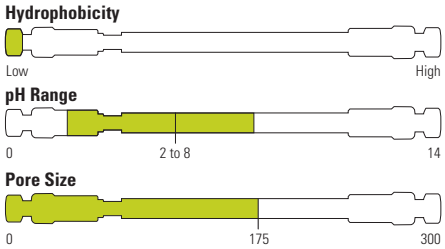
| | |
|---|---|
| Mobile Phase: | Aqueous $KH_2PO_4$ (50 mM, pH 3) |
| Flow Rate: | 1.0mL min-1 |
| Temperature: | 40°C |
| Detection: | UV @ 254nm |
| Injection volume: | 10µL |



# Hypersil GOLD Silica

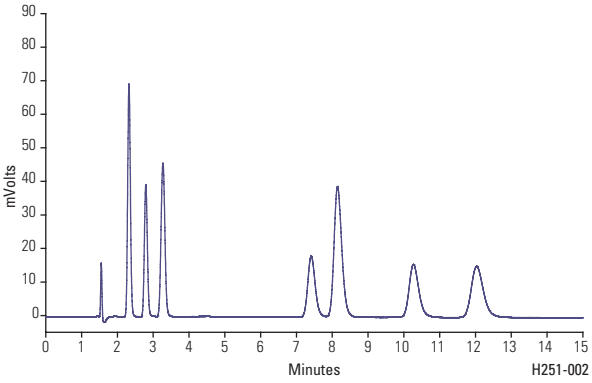
Unbonded, highly pure base deactivated silica media that is the backbone of the Hypersil GOLD range of columns

- Highly pure base deactivated silica media
- Outstanding peak shape and senstivity




**Particle Size** 1.9µm, 3µm, 5µm **USP** L3

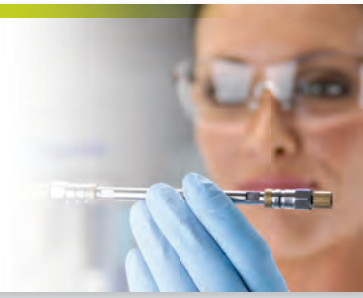
**Steroids**




**Column: Hypersil GOLD Silica, 5µm, 150 x 4.6mm**
**Part Number: 25105-154630**

| | |
|---|---|
| Mobile Phase: | 19:1 (v/v) n-C6H14/EtOH |
| Flow Rate: | 1.5mL min-1 |
| Temperature: | 30°C |
| Detection: | UV @ 254nm |
| Injection volume: | 5µL |
| Sample: | 1. Progesterone |
| | 2. 21-Hydroxyprogesterone-21-acetate |
| | 3. 17-a-Hydroxyprogesterone |
| | 4. Cortisone |
| | 5. 11-a-Hydroxyprogesterone |
| | 6. Corticosterone |
| | 7. Hydrocortisone |

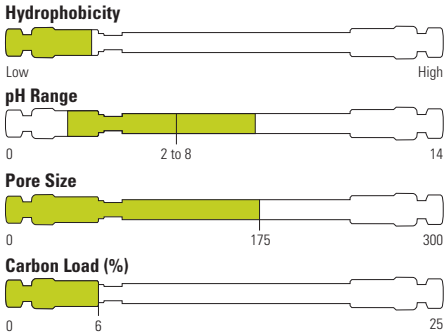
*The Hypersil GOLD web page contains the latest news, applications and downloads for the Hypersil GOLD HPLC column range. Visit:*
***www.thermoscientific.com/hypersilgold***



# Hypersil GOLD HILIC

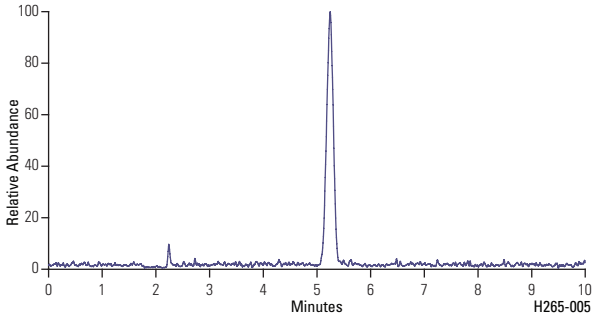
Hypersil GOLD HILIC retains and separates polar analytes that are problematic using reversed phase columns

- Alternative selectivity to C18
- Improved sensitivity for MS detection
- Alternative to ion-pair or derivatisation
- Outstanding peak shape and selectivity




**Particle Size** 1.9µm, 3µm, 5µm

**Urea**




**Column: Hypersil GOLD HILIC, 5µm, 150 x 4.6mm**
**Part Number: 26505-154630**

| | |
|---|---|
| Mobile Phase: | $H_2O$/MeCN (10:90) + 0.1% formic adic |
| Flow Rate: | 0.6mL/min |
| Temperature: | 30°C |
| Detection: | +ESI |
| Injection volume: | 1µL (made up in mobile phase) |
| Sample: | 1. Urea |

# Hypersil GOLD Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | GOLD | C8 | aQ | PFP |
|---|---|---|---|---|---|---|---|
| 1.9 | UHPLC Column | 20 | 2.1 | **25002-022130** | **25202-022130** | **25302-022130** | **25402-022130** |
| | | 30 | 1.0 | **25002-031030** | – | – | – |
| | | | 2.1 | **25002-032130** | **25202-032130** | **25302-032130** | **25402-032130** |
| | | 50 | 1.0 | **25002-051030** | **25202-051030** | **25302-051030** | **25402-051030** |
| | | | 2.1 | **25002-052130** | **25202-052130** | **25302-052130** | **25402-052130** |
| | | | 3.0 | **25002-053030** | **25202-053030** | **25302-053030** | **25402-053030** |
| | | | 4.6 | **25002-054630** | **25202-054630** | **25302-054630** | **25402-054630** |
| | | 100 | 1.0 | **25002-101030** | **25202-101030** | **25302-101030** | **25402-101030** |
| | | | 2.1 | **25002-102130** | **25202-102130** | **25302-102130** | **25402-102130** |
| | | | 3.0 | **25002-103030** | **25202-103030** | **25302-103030** | **25402-103030** |
| | | 150 | 2.1 | **25002-152130** | **25202-152130** | **25302-152130** | **25402-152130** |
| | | 200 | 2.1 | **25002-202130** | **25202-202130** | **25302-202130** | **25402-202130** |
| 3 | Drop-in Guard (4/pk) | 10 | 1.0 | **25003-011001** | **25203-011001** | **25303-011001** | **25403-011001** |
| | | | 2.1 | **25003-012101** | **25203-012101** | **25303-012101** | **25403-012101** |
| | | | 3.0 | **25003-013001** | **25203-013001** | **25303-013001** | **25403-013001** |
| | | | 4.0/4.6 | **25003-014001** | **25203-014001** | **25303-014001** | **25403-014001** |
| | HPLC Column | 30 | 2.1 | **25003-032130** | **25203-032130** | **25303-032130** | **25403-032130** |
| | | | 3.0 | **25003-033030** | **25203-033030** | **25303-033030** | **25403-033030** |
| | | | 4.6 | **25003-034630** | **25203-034630** | **25303-034630** | **25403-034630** |
| | | 50 | 2.1 | **25003-052130** | **25203-052130** | **25303-052130** | **25403-052130** |
| | | | 3.0 | **25003-053030** | **25203-053030** | **25303-053030** | **25403-053030** |
| | | | 4.0 | **25003-054030** | **25203-054030** | **25303-054030** | **25403-054030** |
| | | | 4.6 | **25003-054630** | **25203-054630** | **25303-054630** | **25403-054630** |
| | | 100 | 1.0 | **25003-101030** | **25203-101030** | **25303-101030** | **25403-101030** |
| | | | 2.1 | **25003-102130** | **25203-102130** | **25303-102130** | **25403-102130** |
| | | | 3.0 | **25003-103030** | **25203-103030** | **25303-103030** | **25403-103030** |
| | | | 4.0 | **25003-104030** | **25203-104030** | **25303-104030** | **25403-104030** |
| | | | 4.6 | **25003-104630** | **25203-104630** | **25303-104630** | **25403-104630** |
| | | 150 | 1.0 | **25003-151030** | **25203-151030** | **25303-151030** | **25403-151030** |
| | | | 2.1 | **25003-152130** | **25203-152130** | **25303-152130** | **25403-152130** |
| | | | 3.0 | **25003-153030** | **25203-153030** | **25303-153030** | **25403-153030** |
| | | | 4.0 | **25003-154030** | **25203-154030** | **25303-154030** | **25403-154030** |
| | | | 4.6 | **25003-154630** | **25203-154630** | **25303-154630** | **25403-154630** |
| 5 | Drop-in Guard (4/pk) | 10 | 2.1 | **25005-012101** | **25205-012101** | **25305-012101** | **25405-012101** |
| | | | 3.0 | **25005-013001** | **25205-013001** | **25305-013001** | **25405-013001** |
| | | | 4.0/4.6 | **25005-014001** | **25205-014001** | **25305-014001** | **25405-014001** |
| | HPLC Column | 30 | 2.1 | **25005-032130** | – | – | – |
| | | | 3.0 | **25005-033030** | – | – | – |
| | | | 4.6 | **25005-034630** | – | – | – |
| | | 50 | 2.1 | **25005-052130** | **25205-052130** | **25305-052130** | **25405-052130** |
| | | | 3.0 | **25005-053030** | **25205-053030** | **25305-053030** | **25405-053030** |
| | | | 4.6 | **25005-054630** | **25205-054630** | **25305-054630** | **25405-054630** |
| | | 100 | 2.1 | **25005-102130** | **25205-102130** | **25305-102130** | **25405-102130** |
| | | | 3.0 | **25005-103030** | **25205-103030** | **25305-103030** | **25405-103030** |
| | | | 4.6 | **25005-104630** | **25205-104630** | **25305-104630** | **25405-104630** |
| | | 150 | 2.1 | **25005-152130** | **25205-152130** | **25305-152130** | **25405-152130** |
| | | | 3.0 | **25005-153030** | **25205-153030** | **25305-153030** | **25405-153030** |
| | | | 4.0 | **25005-154030** | **25205-154030** | **25305-154030** | **25405-154030** |
| | | | 4.6 | **25005-154630** | **25205-154630** | **25305-154630** | **25405-154630** |
| | | 250 | 2.1 | **25005-252130** | **25205-252130** | **25305-252130** | **25405-252130** |
| | | | 3.0 | **25005-253030** | **25205-253030** | **25305-253030** | **25405-253030** |
| | | | 4.0 | **25005-254030** | **25205-254030** | **25305-254030** | **25405-254030** |
| | | | 4.6 | **25005-254630** | **25205-254630** | **25305-254630** | **25405-254630** |

| C4 | Phenyl | CN | Amino | AX | SAX | Silica | HILIC |
|---|---|---|---|---|---|---|---|
| – | – | – | – | – | – | – | – |
| – | – | – | – | – | – | – | – |
| – | – | – | – | – | – | – | – |
| – | – | – | – | – | – | – | – |
| **25502-052130** | **25902-052130** | **25802-052130** | **25702-052130** | **26102-052130** | **26302-052130** | **25102-052130** | **26502-052130** |
| – | – | – | – | – | – | – | – |
| – | – | – | – | – | – | – | – |
| – | – | – | – | – | – | – | – |
| **25502-102130** | **25902-102130** | **25802-102130** | **25702-102130** | **26102-102130** | **26302-102130** | **25102-102130** | **26502-102130** |
| – | – | – | – | – | – | – | – |
| **25502-152130** | **25902-152130** | **25802-152130** | **25702-152130** | **26102-152130** | **26302-152130** | **25102-152130** | **26502-152130** |
| **25502-202130** | **25902-202130** | **25802-202130** | **25702-202130** | **26102-202130** | **26302-202130** | **25102-202130** | **26502-202130** |
| **25503-011001** | **25903-011001** | **25803-011001** | **25703-011001** | **26103-011001** | **26303-011001** | **25103-011001** | **26503-011001** |
| **25503-012101** | **25903-012101** | **25803-012101** | **25703-012101** | **26103-012101** | **26303-012101** | **25103-012101** | **26503-012101** |
| **25503-013001** | **25903-013001** | **25803-013001** | **25703-013001** | **26103-013001** | **26303-013001** | **25103-013001** | **26503-013001** |
| **25503-014001** | **25903-014001** | **25803-014001** | **25703-014001** | **26103-014001** | **26303-014001** | **25103-014001** | **26503-014001** |
| **25503-032130** | **25903-032130** | **25803-032130** | **25703-032130** | **26103-032130** | **26303-032130** | **25103-032130** | **26503-032130** |
| – | – | – | – | – | – | – | – |
| **25503-034630** | **25903-034630** | **25803-034630** | **25703-034630** | **26103-034630** | **26303-034630** | **25103-034630** | **26503-034630** |
| **25503-052130** | **25903-052130** | **25803-052130** | **25703-052130** | **26103-052130** | **26303-052130** | **25103-052130** | **26503-052130** |
| – | – | – | – | – | – | – | – |
| – | – | – | – | – | – | – | – |
| – | – | – | – | – | – | – | – |
| – | – | – | – | – | – | – | – |
| **25503-102130** | **25903-102130** | **25803-102130** | **25703-102130** | **26103-102130** | **26303-102130** | **25103-102130** | **26503-102130** |
| **25503-103030** | **25903-103030** | **25803-103030** | **25703-103030** | **26103-103030** | **26303-103030** | **25103-103030** | **26503-103030** |
| – | – | – | – | – | – | – | – |
| **25503-104630** | **25903-104630** | **25803-104630** | **25703-104630** | **26103-104630** | **26303-104630** | **25103-104630** | **26503-104630** |
| **25503-151030** | **25903-151030** | **25803-151030** | **25703-151030** | **26103-151030** | **26303-151030** | **25103-151030** | **26503-151030** |
| **25503-152130** | **25903-152130** | **25803-152130** | **25703-152130** | **26103-152130** | **26303-152130** | **25103-152130** | **26503-152130** |
| **25503-153030** | **25903-153030** | **25803-153030** | **25703-153030** | **26103-153030** | **26303-153030** | **25103-153030** | **26503-153030** |
| – | – | – | – | – | – | – | – |
| **25503-154630** | **25903-154630** | **25803-154630** | **25703-154630** | **26103-154630** | **26303-154630** | **25103-154630** | **26503-154630** |
| **25505-012101** | **25905-012101** | **25805-012101** | **25705-012101** | **26105-012101** | **26305-012101** | **25105-012101** | **26505-012101** |
| **25505-013001** | **25905-013001** | **25805-013001** | **25705-013001** | **26105-013001** | **26305-013001** | **25105-013001** | **26505-013001** |
| **25505-014001** | **25905-014001** | **25805-014001** | **25705-014001** | **26105-014001** | **26305-014001** | **25105-014001** | **26505-014001** |
| – | – | – | – | – | – | – | – |
| – | – | – | – | – | – | – | – |
| – | – | – | – | – | – | – | – |
| **25505-052130** | **25905-052130** | **25805-052130** | **25705-052130** | **26105-052130** | **26305-052130** | **25105-052130** | **26505-052130** |
| – | – | – | – | – | – | – | – |
| **25505-054630** | **25905-054630** | **25805-054630** | **25705-054630** | **26105-054630** | **26305-054630** | **25105-054630** | **26505-054630** |
| **25505-102130** | **25905-102130** | **25805-102130** | **25705-102130** | **26105-102130** | **26305-102130** | **25105-102130** | **26505-102130** |
| **25505-103030** | **25905-103030** | **25805-103030** | **25705-103030** | **26105-103030** | **26305-103030** | **25105-103030** | **26505-103030** |
| **25505-104630** | **25905-104630** | **25805-104630** | **25705-104630** | **26105-104630** | **26305-104630** | **25105-104630** | **26505-104630** |
| **25505-152130** | **25905-152130** | **25805-152130** | **25705-152130** | **26105-152130** | **26305-152130** | **25105-152130** | **26505-152130** |
| – | – | – | – | – | – | – | – |
| – | – | – | – | – | – | – | – |
| **25505-154630** | **25905-154630** | **25805-154630** | **25705-154630** | **26105-154630** | **26305-154630** | **25105-154630** | **26505-154630** |
| **25505-252130** | **25905-252130** | **25805-252130** | **25705-252130** | **26105-252130** | **26305-252130** | **25105-252130** | **26505-252130** |
| **25505-253030** | **25905-253030** | **25805-253030** | **25705-253030** | **26105-253030** | **26305-253030** | **25105-253030** | **26505-253030** |
| **25505-254030** | **25905-254030** | **25805-254030** | **25705-254030** | **26105-254030** | **26305-254030** | **25105-254030** | **26505-254030** |
| **25505-254630** | **25905-254630** | **25805-254630** | **25705-254630** | **26105-254630** | **26305-254630** | **25105-254630** | **26505-254630** |

# Hypersil GOLD Ordering Guide *continued*

| Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|
| UNIGUARD Guard Cartridge Holder | 10 | 1.0 | **851-00** |
| | | 2.1 | **852-00** |
| | | 3.0 | **852-00** |
| | | 4.0/4.6 | **850-00** |

| Particle Size (µm) | Format | Length (mm) | ID (mm) | GOLD |
|---|---|---|---|---|
| 1.9 | Javelin HTS Column (3/pk) | 10 | 2.1 | **25002-012135** |
| 5 | Javelin HTS Column (3/pk) | 20 | 4.0 | **25005-024035** |

| Particle Size (µm) | Format | Length (mm) | ID (mm) | GOLD | aQ | PFP |
|---|---|---|---|---|---|---|
| 5 | Preparative Guard Cartridge (3/pk) | 10 | 10 | **25005-019023** | **25305-019023** | **25405-019023** |
| | | | 20 | **25005-019223** | **25305-019223** | **25405-019223** |
| | Preparative HPLC Column | 50 | 10 | **25005-059070** | **25305-059070** | **25405-059070** |
| | | | 21 | **25005-059270** | **25305-059270** | **25405-059270** |
| | | | 30 | **25005-059370** | **25305-059370** | **25405-059370** |
| | | | 50 | **25005-059570** | **25305-059570** | **25405-059570** |
| | | 100 | 10 | **25005-109070** | **25305-109070** | **25405-109070** |
| | | | 21 | **25005-109270** | **25305-109270** | **25405-109270** |
| | | | 30 | **25005-109370** | **25305-109370** | **25405-109370** |
| | | | 50 | **25005-109570** | **25305-109570** | **25405-109570** |
| | | 150 | 10 | **25005-159070** | **25305-159070** | **25405-159070** |
| | | | 21 | **25005-159270** | **25305-159270** | **25405-159270** |
| | | | 30 | **25005-159370** | **25305-159370** | **25405-159370** |
| | | | 50 | **25005-159570** | **25305-159570** | **25405-159570** |
| | | 250 | 10 | **25005-259070** | **25305-259070** | **25405-259070** |
| | | | 21 | **25005-259270** | **25305-259270** | **25405-259270** |
| | | | 30 | **25005-259370** | **25305-259370** | **25405-259370** |
| | | | 50 | **25005-259570** | **25305-259570** | **25405-259570** |
| 12 | Preparative Guard Cartridge (3/pk) | 10 | 10 | **25012-019023** | – | – |
| | | | 20 | **25012-019223** | – | – |
| | Preparative HPLC Column | 50 | 10 | **25012-059070** | – | – |
| | | | 21 | **25012-059270** | – | – |
| | | | 30 | **25012-059370** | – | – |
| | | | 50 | **25012-059570** | – | – |
| | | 100 | 10 | **25012-109070** | – | – |
| | | | 21 | **25012-109270** | – | – |
| | | | 30 | **25012-109370** | – | – |
| | | | 50 | **25012-109570** | – | – |
| | | 150 | 10 | **25012-159070** | – | – |
| | | | 21 | **25012-159270** | – | – |
| | | | 30 | **25012-159370** | – | – |
| | | | 50 | **25012-159570** | – | – |
| | | 250 | 10 | **25012-259070** | – | – |
| | | | 21 | **25012-259270** | – | – |
| | | | 30 | **25012-259370** | – | – |
| | | | 50 | **25012-259570** | – | – |

| Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|
| Preparative Guard Cartridge Holder | 10 | 10 | **C-1000** |
| | | 20 | **854-00** |

## Notes

# Thermo Scientific Accucore HPLC Columns

## Ultimate Core Performance – Speed and Selectivity Combined

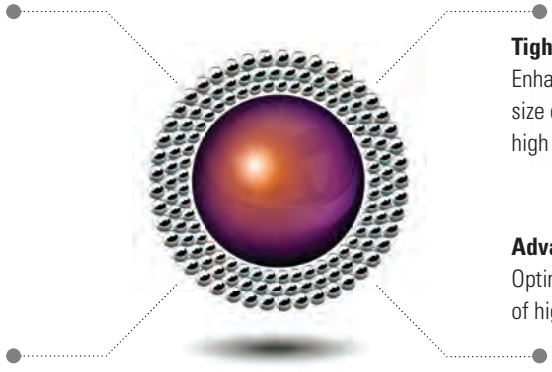
Founded on state-of-the-art Core Enhanced Technology™ and utilizing vast experience in phase bonding and packing, Thermo Scientific™ Accucore™ HPLC columns provide a unique chromatography solution to enhance laboratory workflow and efficiency. Available in a wide range of stationary phase selectivities and compatible with almost any instrument, these columns provide an excellent return on investment.

Containing solid core particles, which are engineered to a diameter of 2.6µm and a very narrow particle size distribution; Accucore HPLC columns allows high speed, high resolution separation, with back pressures significantly lower than those associated with UHPLC. Eleven different stationary phases bonded using advanced technology and packed with highly controlled automated processes result in highly reproducible, rugged columns that offer a wide range of selectivities to meet all your separation needs.


### The key components of Core Enhanced Technology

**Solid Core Particles**
With a solid central core and porous outer layer, these particles generate high speed, high resolution separations without excessive backpressure

**Automated Packing Process**
Enhanced automated procedures ensure that all columns are packed with the highest quality

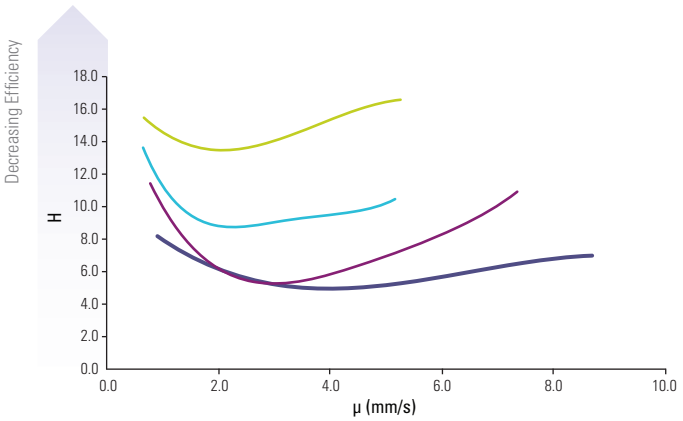


**Tight Control of Particle Diameter**
Enhanced selection process keeps particle size distribution to a minimum and produces high efficiency columns

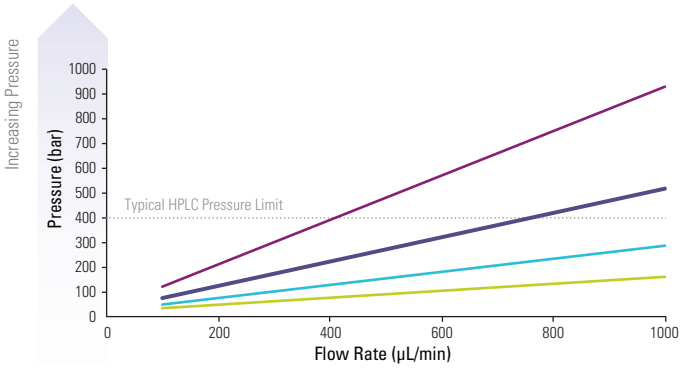
**Advanced Bonding Technology**
Optimized phase bonding creates a series of high coverage, robust phases

View product information and application notes

*The Accucore web page contains the latest news, applications and downloads for the Accucore HPLC column range. Visit it at:*
***www.thermoscientific.com/accucore***




Accucore HPLC columns are more efficient than 5μm and 3μm columns.




**Column dimensions: 100 x 2.1mn**

Accucore HPLC columns achieve this efficiency without excessive backpressure

## Accucore 2.6μm HPLC Columns Optimum Conditions and Ratings

| Column ID (mm) | Optimum Flow Rate | Maximum Inj. Volume | Backpressure Rating | Temperature Rating |
|---|---|---|---|---|
| 2.1 | 400μL/min | 1μL | 1000 bar | 70°C |
| 3.0 | 800μL/min | 3μL | 1000 bar | 70°C |
| 4.6 | 1800μL/min | 5μL | 1000 bar | 70°C |

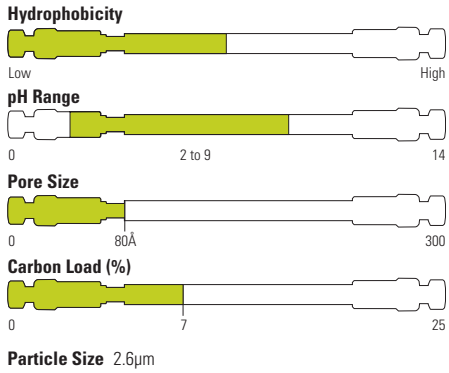
# Accucore RP-MS

- Optimized for MS detection
- Excellent peak shapes
- Excellent combination of speed and efficiency

Accucore RP-MS uses an optimized alkyl chain length for more effective coverage of the silica surface. This coverage results in a significant reduction in non-hydrophobic interactions and thus highly efficient peaks with very low tailing.

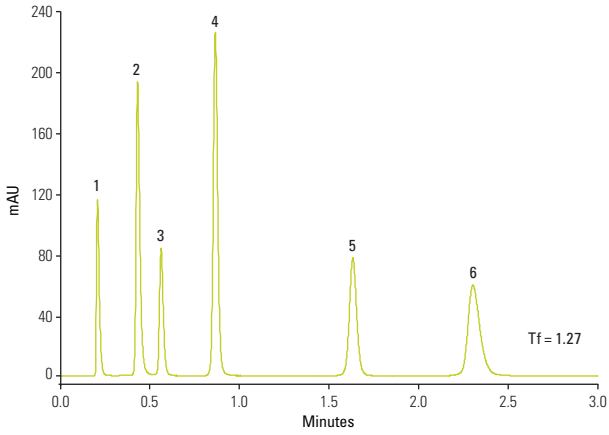
RP-MS offers slightly lower retention than C18 and this combined with high efficiencies and low peak tailing make this the phase of choice for use with MS detection.

The selectivity offered by Accucore RP-MS matches that of C18 columns.




**Particle Size** 2.6µm

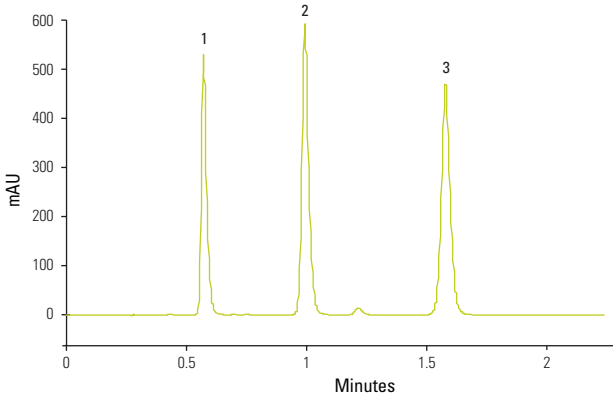
## Bases




**Accucore RP-MS 2.6µm, 50mm x 2.1mm**

| | |
|---|---|
| Mobile phase: | 65% Methanol / 35% 25mM Potassium Phosphate pH7.0 |
| Flow rate: | 500µL/min |
| Temperature: | 30°C |
| Detection: | UV at 215nm |
| Injection volume: | 1µL |
| Back pressure: | 232 bar |
| Analytes: | 1.Uracil<br>2. Propranolol<br>3. Butylparaben<br>4. Naphthalene<br>5. Acenaphthene<br>6. Amitriptyline |

## Testosterones




**Accucore RP-MS 2.6µm, 100mm x 2.1mm**

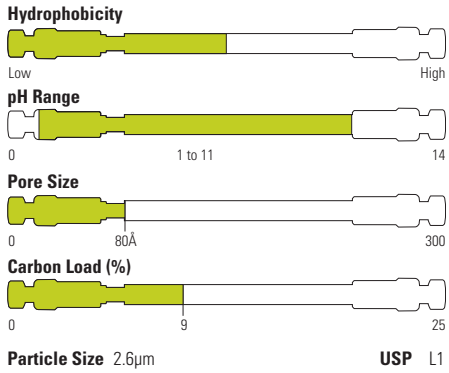
| | |
|---|---|
| Mobile phase: | 60:40 (v/v) Water / Acetonitrile |
| Flow rate: | 0.6mL/min |
| Temperature: | 40°C |
| Detection: | UV at 254nm |
| Injection volume: | 1µL |
| Analytes: | 1. 11-Ketotestosterone<br>2. 19-Nortestosterone (Nandrolone)<br>3. Epitestosterone |

# Accucore C18

- Optimum retention of non-polar compounds
- Hydrophobic interaction mechanism
- Separates a broad range of analytes

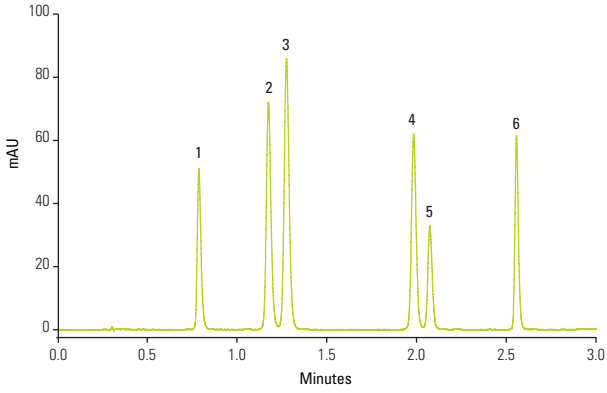
The carbon loading of Accucore C18 phase provides high retention of non-polar analytes via a predominantly hydrophobic interaction mechanism.

The highly retentive nature of Accucore C18 phase means that it can be used to separate a broad range of analytes.



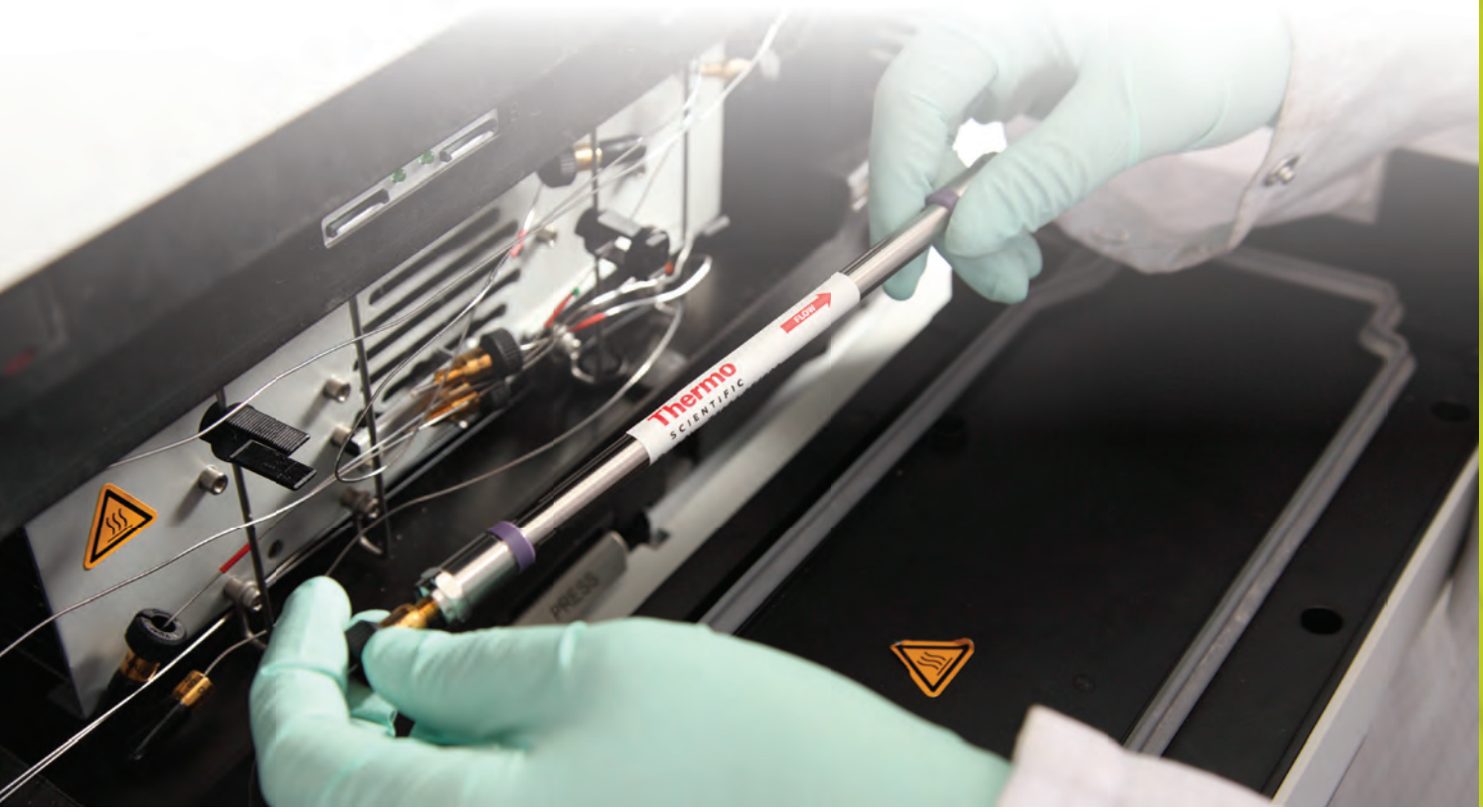

**Particle Size** 2.6µm **USP** L1

**Triazines**




**Accucore C18 2.6µm, 50mm x 2.1mm**

| | |
|---|---|
| Mobile phase: | A – Water ; B – Acetonitrile |
| Gradient: | Time (min) %B<br>1.0 35<br>2.5 70 |
| Flow rate: | 600µL/min |
| Temperature: | 25°C |
| Detection: | UV at 280nm |
| Injection volume: | 2µL |
| Backpressure: | 298 bar |
| Analytes: | 1. Simazine<br>2. Simetryn<br>3. Atrazine<br>4. Ametryn<br>5. Propazine<br>6. Prometryn |

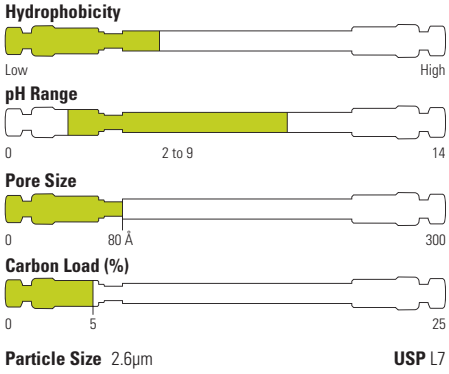


# Accucore C8

- Lower hydrophobic retention
- Complementary steric selectivity to C18
- Low levels of secondary interactions
- Recommended for moderately polar analytes

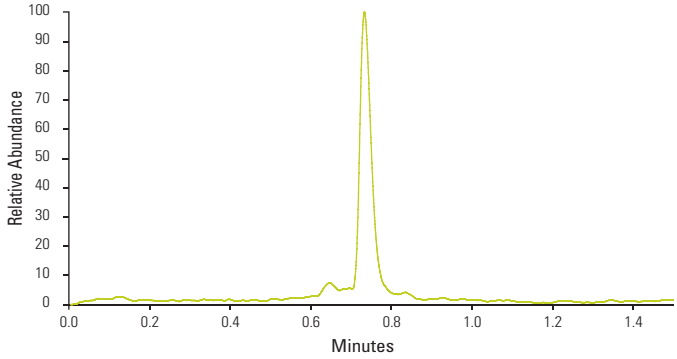
Accucore C8 HPLC columns offer lower hydrophobic retention than columns packed with longer alkyl chain length material, such as C18, and are therefore recommended for analytes with medium hydrophobicity or when a less hydrophobic phase provides optimum retention.

The low levels of secondary interactions demonstrated in the phase characterization are the result of excellent bonded phase coverage and allow users of Accucore C8 HPLC columns to benefit from excellent peak shapes.




**Particle Size** 2.6µm **USP** L7

**Testosterone**




**Accucore C8 2.6µm, 50 x 2.1mm**

| | |
|---|---|
| Mobile phase A: | water + 0.1% formic acid |
| Mobile phase B: | acetonitrile + 0.1% formic acid |
| Gradient: | 5–95 % B in 0.8 minutes |
| Flow: | 1500 µL/min |
| Temperature: | 60 °C |
| Injection: | 5µL |
| Detection: | ESI-MS/MS%RSD Peak area |

| | |
|---|---|
| Retention time (tR /min) | 0.73 |
| %RSD tR | 0.22 |
| %RSD Area | 3.01 |

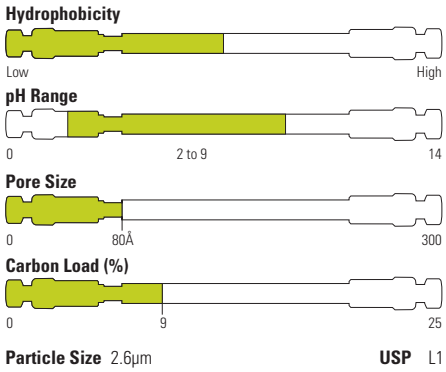
**Data from six injections.**

# Accucore aQ

- Retention and resolution of polar analytes
- Polar endcapped C18 stationary phase for alternative selectivity
- Ideal for highly aqueous mobile phases

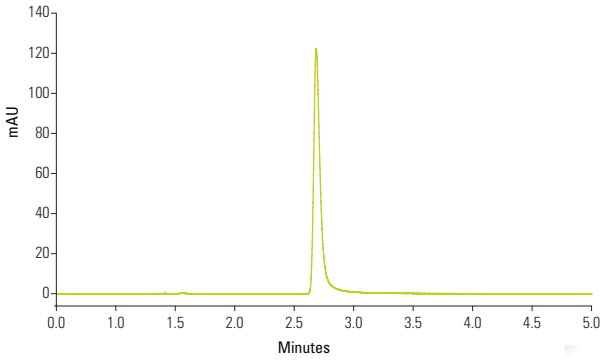
The polar functional group used to endcap Accucore aQ phase provides an additional controlled interaction mechanism by which polar compounds can be retained and resolved, making Accucore aQ phase ideal for the quantitative analysis of trace levels of polar analytes.

The wettability of reversed phase media can be increased by the introduction of polar functional groups. The polar endcapping of Accucore aQ media also makes it usable in 100% aqueous mobile phases without the risk of loss of performance or poor stability.




**Particle Size** 2.6µm **USP** L1

**Lamivudine (USP)**




**Accucore aQ 2.6µm, 50mm x 2.1mm**

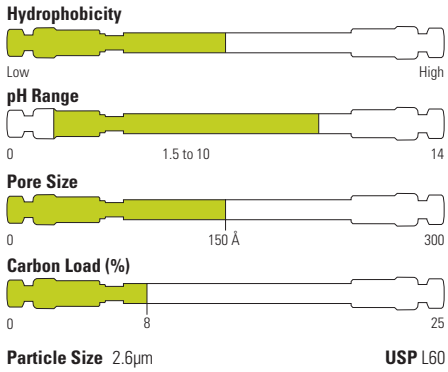
| | |
|---|---|
| Mobile phase: | 95:5 (v/v) Ammonium Acetate, pH 3.80 / Methanol |
| Flow rate: | 200µL/min |
| Temperature: | 35°C |
| Detection: | UV at 277nm |
| Injection volume: | 1µL |
| Analytes: | Lamivudine |
| Asymmetry | 1.36 |
| %RSD $t_r$ | 0.00 |
| %RSD Peak area | 1.72 |

(%RSD calculated from 6 replicate injections)

**USP acceptance criteria:** % RSD ($t_r$, Peak Area) <2.0

# Accucore Polar Premium

- Rugged amide-embedded C18 phase
- Selectivity complementary to conventional C18 phases
- Stable over a wide pH range and compatible with 100% aqueous mobile phase

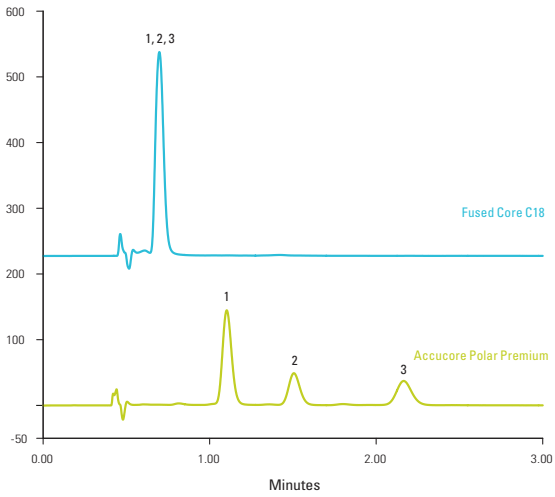



**Particle Size** 2.6µm **USP** L60

Accucore Polar Premium is an exceptionally rugged polar embedded reverse phase material that offers high efficiency, wider operating pH range and unique selectivity complementary to standard C18 phases.

The specially designed bonded phase is stable from pH 1.5 to 10.5 and will not undergo phase collapse in 100% aqueous mobile phase.

**Curcuminoids (Tumeric)**



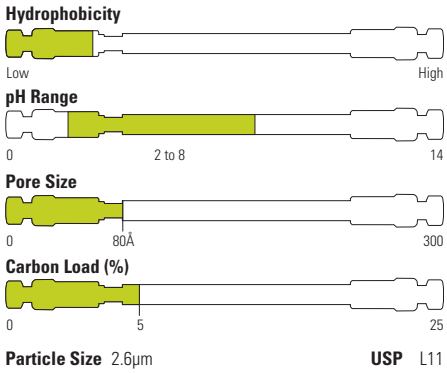

**Accucore Polar Premium 2.6µm, 100 x 3.0mm**
**Fused Core C18, 100 x 3.0 mm**

| | |
|---|---|
| Mobile phase: | methanol : 10mM phosphoric acid, 80 : 20 |
| Flow: | 800 µL/min |
| Temperature: | 40 °C |
| Injection: | 6µL |
| Detection: | UV at 428nm |
| Analytes: | 1. Curcumin<br>2. Desmethoxycurcumin<br>3. Bis-desmethoxycurcumin |

The Accucore Polar Premium HPLC column provides desirable selectivity that resolves the major and minor component under simple isocratic conditions in less than three minutes, while the C18 columns fail to separate these components.

# Accucore Phenyl-Hexyl

- Mixed-mode selectivity for aromatic and moderately polar analytes
- Enhanced Pi-pi interactions with aromatics
- Moderate hydrophobicity

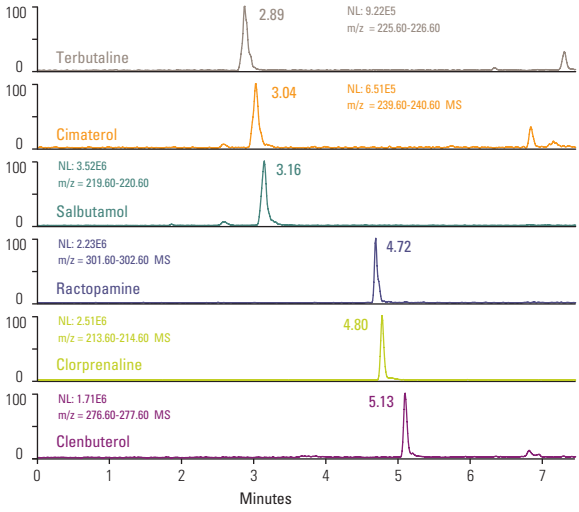



**Particle Size** 2.6µm **USP** L11

The C6 chain in Accucore Phenyl-Hexyl phase exhibits classical RP retention and selectivity, while the phenyl ring can add special selectivity by interacting with polar groups within the solutes. This results in a mixed-mode separation mechanism. The reduced hydrophobicity of this phase makes it ideal for the separation of very non-polar compounds.

The Phenyl-Hexyl phase should be selected for complex samples where some peaks are well resolved on a conventional alkyl phases, but are not well resolved on a conventional phenyl phase, or when other peaks are well resolved on a phenyl phase, but not well resolved on a conventional alkyl phase.

**Beta-agonists**




**Accucore Phenyl-Hexyl 2.6µm, 100mm x 2.1mm**

| | |
|---|---|
| Mobile phase: | A – Ammonium acetate 5mM, pH 4 |
| | B – Acetonitrile |
| Gradient: | Time (min) %B |
| | 0 5 |
| | 1 5 |
| | 10 100 |
| Flow rate: | 0.25mL/min |
| Temperature: | 40°C |
| Detection: | +ESI-MS (45°C, 4.5kV, 60V, scan 150 – 350) |
| Injection volume: | 1µL |
| Backpressure: | 120 bar (at t0) |

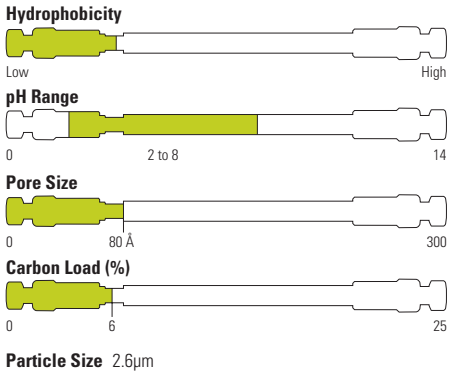
# Accucore Phenyl-X

- Unique reversed-phase shape selectivity
- Enhanced selectivity for aromatic compounds
- Compatible with highly aqueous mobile phases
- Robust, high-efficiency, low column bleed

The proprietary Accucore Phenyl-X alkyl aromatic bonded phase provides a unique selectivity when compared to other reversed phase materials such as C18 or Phenyl.

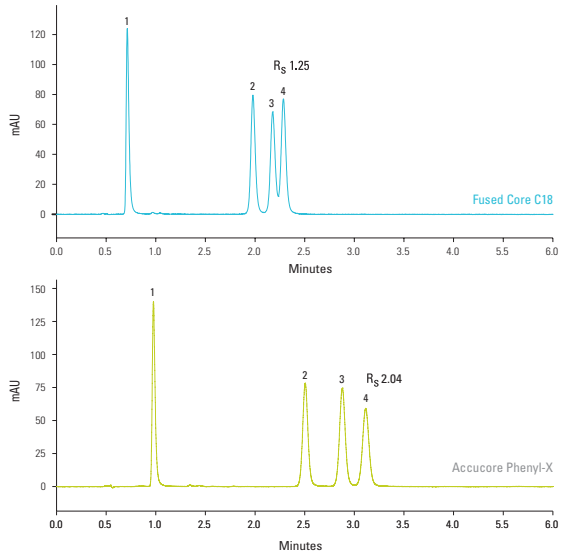
Phenyl-X exhibits particularly high aromatic selectivity.

The advanced design of the bonded phase makes it compatible with highly aqueous mobile phases and robust, demonstrating very low bleed.




**Particle Size** 2.6µm

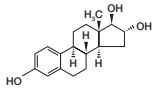
## Estrogens



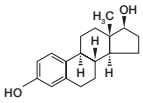

**Accucore Phenyl-X 2.6µm, 100 x 2.1mm**
**Fused Core C18, 100 x 2.1mm**

| | |
|---|---|
| Mobile phase: | 15:40:45 (v/v) acetonitrile: methanol : water |
| Flow: | 400 µL/min |
| Temperature: | 40 °C |
| Injection: | 1µL |
| Detection: | UV at 220nm |
| Wash solvent: | Same as mobile phase |

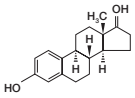
1. Estriol (E3)



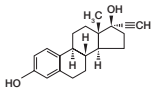
2. Estradiol (E2)



3. Estrone (E1)



4. Ethynylestradiol

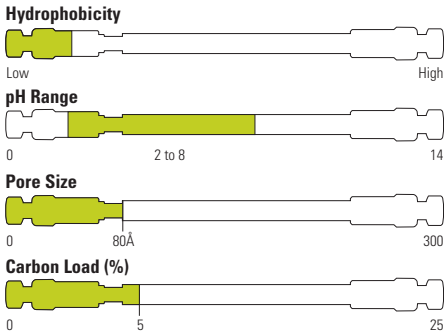


# Accucore PFP

- Alternative selectivity to C18
- Extra retention for halogenated species
- Unique selectivity for non-halogenated polar compounds

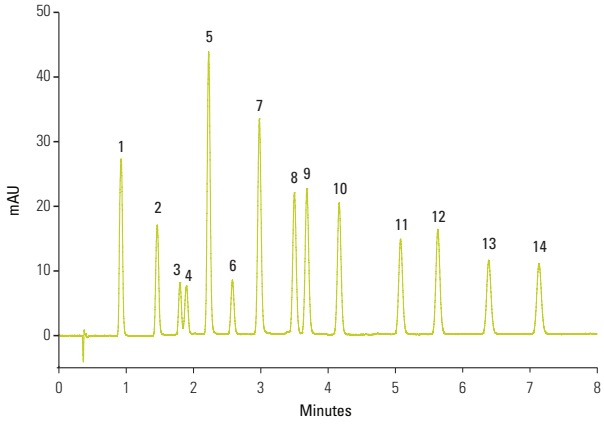
The introduction of fluorine groups into the Accucore PFP (pentafluorophenyl) stationary phase causes significant changes in solute-stationary phase interactions. This can lead to extra retention and selectivity for positional isomers of halogenated compounds.

PFP Columns are also well suited to the selective analysis of non-halogenated compounds, in particular polar compounds containing hydroxyl, carboxyl, nitro, or other polar groups. High selectivity is often most apparent when the functional groups are located on an aromatic or other rigid ring system.




**Particle Size** 2.6µm **USP** L43

### Positional isomers




**Accucore PFP 2.6µm, 50mm x 2.1mm**

| | |
|---|---|
| Mobile phase: | A – 0.1% Formic Acid in Water |
| Mobile phase: | A – 0.1% Formic Acid in Acetonitrile |
| Gradient: | 15-30%B in 7 minutes |
| Flow rate: | 600µL/min |
| Temperature: | 50°C |
| Detection: | UV at 270nm |
| Injection volume: | 2µL |

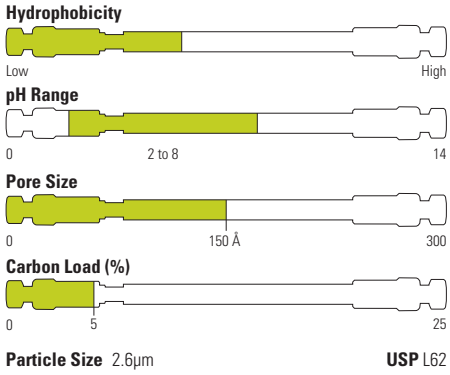
1. 3,4 – Dimethoxyphenol
2. 2,6 – Dimethoxyphenol
3. 2,6 – Difluorophenol
4. 3,5 – Dimethoxyphenol
5. 2,4 – Difluorophenol
6. 2,3 – Difluorophenol
7. 3,4 – Difluorophenol
8. 3,5 – Dimethylphenol
9. 2,6 – Dimethylphenol
10. 2,6 – Dichlorophenol
11. 4 – Chloro-3-Methylphenol
12. 4 – Chloro-2-Methylphenol
13. 3,4 – Dichlorophenol
14. 3,5 – Dichlorophenol

# Accucore C30

- Ideal for separation of hydrophobic, long alkyl chain compounds
- High shape selectivity for structurally related isomers
- Excellent aqueous-compatibility

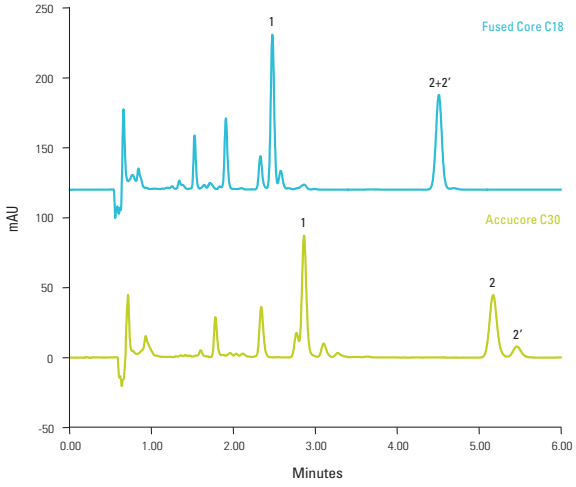
Accucore C30 offers high shape selectivity for hydrophobic, long chain, structurally related isomers, for example carotenoids and steroids. This is a different form of shape selectivity from that measured in the SS phase characterisation test.

It is also an excellent alternative to normal-phase columns for lipid analysis. The optimized bonding density of the long alkyl chains facilitated by a wider pore diameter particle result in a phase that is stable even in highly aqueous mobile phases.




**Particle Size** 2.6µm **USP** L62

## Vitamin K isomers




**Accucore C30 2.6µm, 100 x 3.0mm Fused Core C18, 100 x 3.0mm**

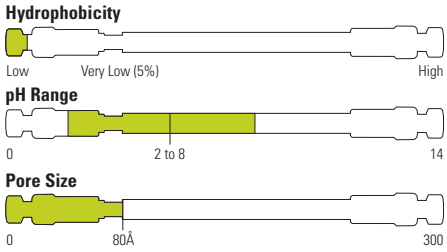
| | |
|---|---|
| **Mobile phase:** | methanol: 2mM ammonium acetate, 98:2 |
| **Flow:** | 650µL/min |
| **Temperature:** | **20 °C** |
| Injection: | 5µL |
| Detection: | UV at 250nm |

Accucore C30 shows better separation for vitamin K1 isomers than the C18 column.

Chromatogram showing the separation of Vitamin K compounds
Minutes 1-Vitamin K2, 2-Vitamin K1 (trans isomer), 2'-Vitamin K1 (cis isomer)

# Accucore HILIC

- Enhanced retention of polar and hydrophilic analytes
- Alternative selectivity to C18 without ion-pair or derivatization



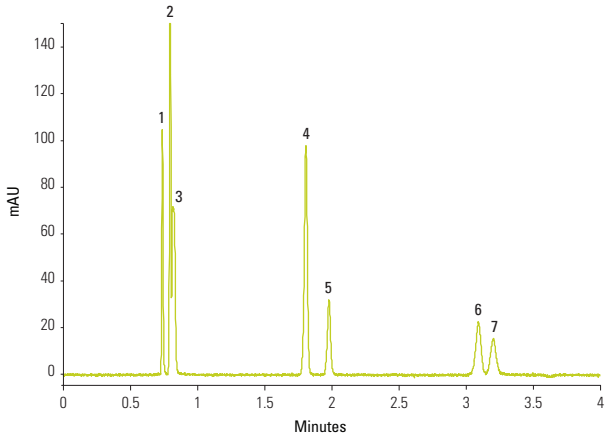

**Particle Size** 2.6µm **USP** L3

In HILIC mode the separation occurs through two mechanisms. The primary mechanism is a partitioning effect due to the enriched water layer around the polar or charged substrate material. The secondary mechanism involves interaction between the analyte and the active surface moiety.

Analyte properties that govern retention with HILIC phases are acidity/basicity, which determines hydrogen bonding, and polarizability which determines dipole-dipole interactions.

The highly organic mobile phases used with Accucore HILIC phase ensure efficient desolvation in ESI MS detection, which in turn leads to improved sensitivity.

**Catecholamines**




**Accucore HILIC 2.6µm, 50mm x 2.1mm**

| | |
|---|---|
| Mobile phase: | 85:15 Acetonitrile:100mM Ammonium Formate, pH 3.2 |
| Flow rate: | 2mL/min |
| Temperature: | 40°C |
| Detection: | UV at 280nm |
| Injection volume: | 5µL |
| Backpressure: | 157 bar |
| Analytes: | 1. Catechol<br>2. 5-HIAA<br>3. DOPAC<br>4. Serotonin<br>5. L-tyrosine<br>6. Dopamine<br>7. L-DOPA |

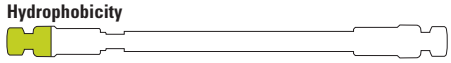
# Accucore Urea-HILIC

- Bonded hydrophilic stationary phase
- Unique selectivity compared to other HILIC phases
- Low ion exchange activity

Accucore Urea-HILIC has an alternative selectivity and lower ion exchange activity than other HILIC phases.

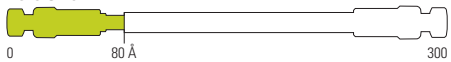
The bonded hydrophilic stationary phase provides retention of broad range of polar analytes using up to 20% aqueous mobile phase.

**Hydrophobicity**



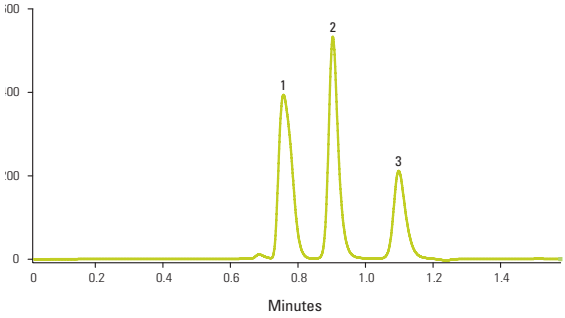

**pH Range**


**Pore Size**




**Particle Size** 2.6µm

### Analgesic compounds




**Accucore Urea-HILIC 2.6µm, 100 x 2.1mm**

| | |
|---|---|
| **Mobile phase:** | composition 10:80:10, A : B : C |
| | A: water |
| | B: acetonitrile |
| | C: 100 mM ammonium acetate adjusted to pH 4.9 |
| **Flow:** | 300 µL/min |
| Run Time: | 2 minutes |
| **Temperature:** | **35 °C** |
| Injection: | 2 µL into 10 µL partial loop mode. |
| Injection wash solvent: | water:acetonitrile 20:80 |
| Detection: | UV at 230 nm |
| Backpressure: | 71 bar |

| | Acetaminophen | | Salicylic acid | | | Aspirin | | |
|---|---|---|---|---|---|---|---|---|
| | $t_R$ | $A_s$ | $t_R$ | $A_s$ | $R_s$ | $t_R$ | $A_s$ | $R_s$ |
| Mean | 0.760 | 1.474 | 0.908 | 1.303 | 2.359 | 1.100 | 1.318 | 3.264 |
| CV % | 0.00 | 1.17 | 0.48 | 0.92 | 0.49 | 0.00 | 0.63 | 0.48 |

Data from eight replicate analyses of a mixture of acetaminophen, salicylic acid and aspirin

Retention time ($t_R$), peak asymmetry ($A_s$), peak resolution ($R_s$)

# Accucore XL HPLC Columns

Based on Core Enhanced Technology using 4µm solid core particles, Accucore XL HPLC columns allow users of conventional HPLC methods to enjoy performance far beyond that of columns packed with 5µm, 4µm or even 3µm fully porous particles. Very high separation efficiencies using standard HPLC instruments and conditions provide increased peak resolution and lower limits of detection. An ultra-stable packed bed results in exceptionally robust columns that demonstrate excellent retention and response reproducibility.

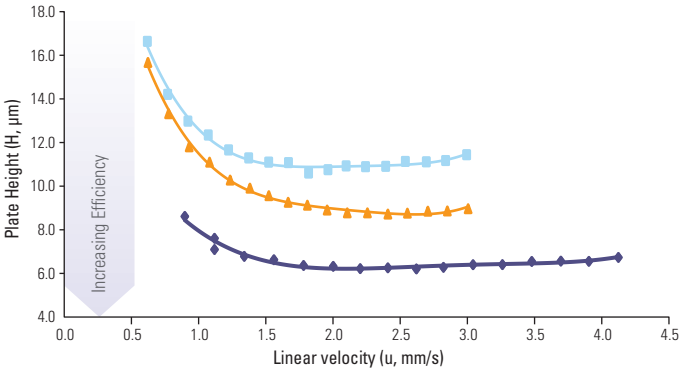
## 4µm Solid Core Particles for all Users

The 4µm solid core particles used in Accucore XL HPLC columns have been specifically designed to get the optimum chromatographic performance from conventional HPLC instruments.

- Very high efficiencies
- Little decrease in efficiency as flow rate is increased
- Moderate backpressures

### Efficiency

Accucore XL HPLC columns generate higher efficiencies than columns packed with 5µm and 3µm fully porous material – as shown in the van Deemter curve below.




Fully porous C18, 5µm

Fully porous C18, 3µm

**Accucore XL C18, 4µm**

**Identical instrument and method conditions for all columns**

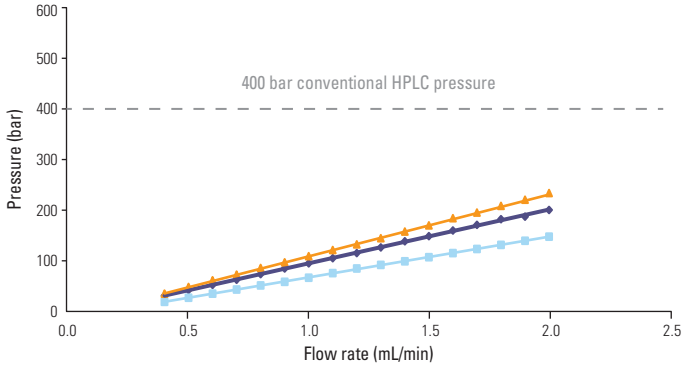
| | |
|---|---|
| Dimensions: | 150 x 4.6mm |
| Mobile Phase: | 50% water: 50% acetonitrile |
| Temperature: | 30°C |
| Injection Volume: | 1µL |
| Detection: | UV at 254nm (0.1s rise time, 20 Hz) |
| Sample: | o-xylene |

*• 75% higher efficiency than 5µm fully porous*

*• 50% higher efficiency than 3µm fully porous*

## Backpressure

Accucore XL HPLC columns generate reasonable backpressures, moderately higher than fully porous 5µm and lower than fully porous 3µm, that are compatible with conventional HPLC instruments.




Fully porous C18, 5µm
Fully porous C18, 3µm
**Accucore XL C18, 4µm**

**Identical instrument and method conditions for all columns**

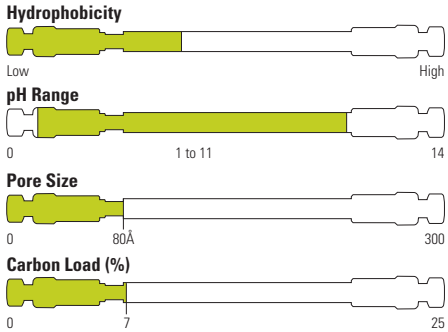
| | |
|---|---|
| Dimensions: | 150 x 4.6mm |
| Mobile Phase: | 50% water : 50% acetonitrile |
| Temperature: | 30°C |

*• Backpressures between those generated by 3µm and 5µm fully porous particles*
*• Within conventional HPLC instrumentation pressure limit – even at high flow rates*

# Accucore XL C18

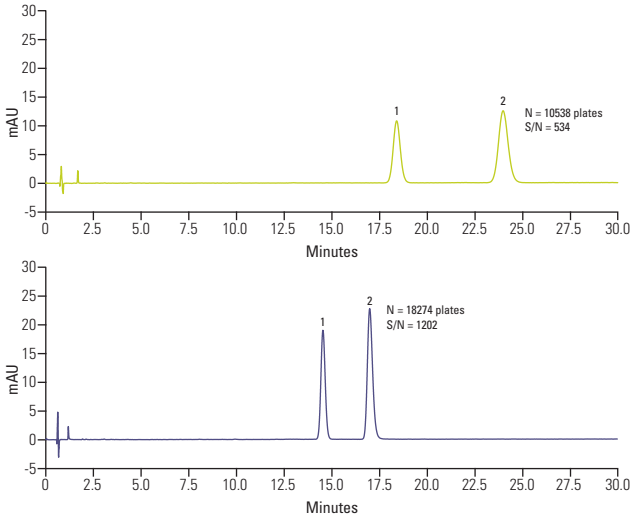
- Optimum retention of non-polar compounds
- Hydrophobic interaction mechanism
- Separates a broad range of analytes

The carbon loading of Accucore XL C18 provides high retention of non-polar analytes via a predominantly hydrophobic interaction mechanism. The highly retentive nature of the phase means that it can be used to separate a broad range of analytes.




**Particle Size** 4µm **USP** L1

### Ibuprofen and Valerophenone (USP)




**Accucore XL C18 4µm, 150 x 4.6mm**
**Fully porous C18 5µm, 150 x 4.6mm**

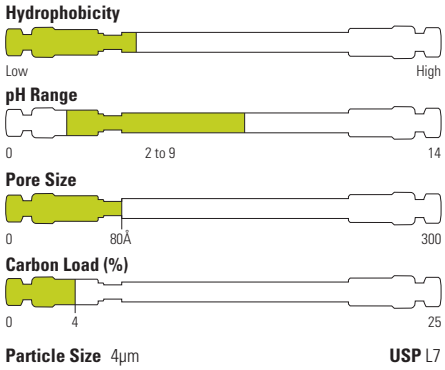
| | |
|---|---|
| Mobile phase: | 66.3:33.7 (v/v) water with phosphoric acid, pH 2.5:methanol |
| Flow rate: | 2mL/min |
| Temperature: | 30°C |
| Detection: | UV at 214nm |
| Injection volume: | 5µL |
| Analytes: | 1. Valerophenone<br>2. Ibuprofen |

*• 73% higher efficiency*
*• 125% higher sensitivity*

# Accucore XL C8

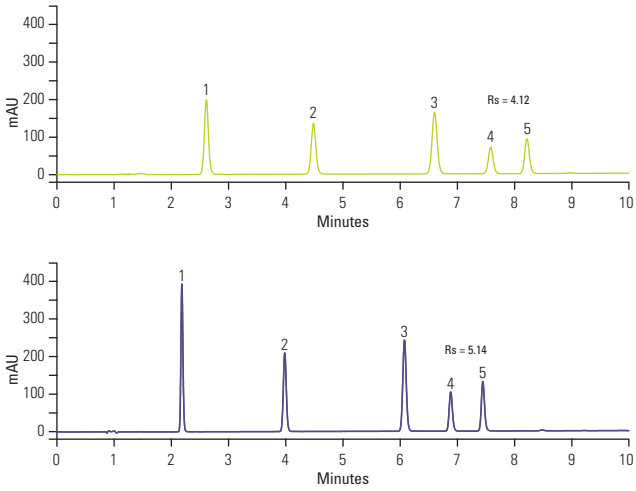
- Similar selectivity to C18 with lower retention
- Recommended for analytes with moderate hydrophobicity

Accucore XL C8 offers lower hydrophobic retention than columns packed with longer alkyl chain length material, such as C18. It is then therefore recommended for analytes with moderate hydrophobicity, or when a less hydrophobic phase provides optimum retention.




**Particle Size** 4µm **USP** L7

### Endocrine Disruptors







**Accucore XL C8 4µm, 150 x 4.6mm**
**Fully porous C8 5µm, 150 x 4.6mm**

| | | |
|---|---|---|
| Mobile phase A: | water | |
| Mobile phase B: | acetonitrile | |
| Gradient: | Time (min) | % B |
| | 0.0 | 25 |
| | 20.0 | 70 |
| | 20.1 | 75 |
| | 25.0 | 25 |
| Flow rate: | 1.5mL/min | |
| Temperature: | 25°C | |
| Detection: | UV at 220nm | |
| Injection volume: | 5µL | |
| Analytes | 1. Desethyl Atrazine | |
| | 2. Simazine | |
| | 3. Atrazine | |
| | 4. Diuron | |
| | 5. Bisphenol A | |

*• 31% better resolution of critical pair*

*• 37% narrower peaks*

*• 226% higher sensitivity*

# Accucore Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | RP-MS | C18 | C8 | aQ |
|---|---|---|---|---|---|---|---|
| 2.6 | Defender Guard (4/pk) | 10 | 2.1 | **17626-012105** | **17126-012105** | **17226-012105** | **17326-012105** |
| | | | 3.0 | **17626-013005** | **17126-013005** | **17226-013005** | **17326-013005** |
| | | | 4.6 | **17626-014005** | **17126-014005** | **17226-014005** | **17326-014005** |
| | HPLC Column | 30 | 2.1 | **17626-032130** | **17126-032130** | **17226-032130** | **17326-032130** |
| | | 50 | 2.1 | **17626-052130** | **17126-052130** | **17226-052130** | **17326-052130** |
| | | | 3.0 | **17626-053030** | **17126-053030** | **17226-053030** | **17326-053030** |
| | | | 4.6 | **17626-054630** | **17126-054630** | **17226-054630** | **17326-054630** |
| | | 100 | 2.1 | **17626-102130** | **17126-102130** | **17226-102130** | **17326-102130** |
| | | | 3.0 | **17626-103030** | **17126-103030** | **17226-103030** | **17326-103030** |
| | | | 4.6 | **17626-104630** | **17126-104630** | **17226-104630** | **17326-104630** |
| | | 150 | 2.1 | **17626-152130** | **17126-152130** | **17226-152130** | **17326-152130** |
| | | | 3.0 | **17626-153030** | **17126-153030** | **17226-153030** | **17326-153030** |
| | | | 4.6 | **17626-154630** | **17126-154630** | **17226-154630** | **17326-154630** |
| | | 250 | 2.1 | – | – | – | – |

| Particle Size (µm) | Format | Length (mm) | ID (mm) | C18 | C8 |
|---|---|---|---|---|---|
| 4 | Drop-in Guard (4/pk) | 10 | 2.1 | **74104-012101** | **74204-012101** |
| | | | 3.0 | **74104-013001** | **74204-013001** |
| | | | 4.6 | **74104-014001** | **74204-014001** |
| | HPLC Column | 50 | 2.1 | **74104-052130** | **74204-052130** |
| | | | 3.0 | **74104-053030** | **74204-053030** |
| | | | 4.6 | **74104-054630** | **74204-054630** |
| | | 100 | 2.1 | **74104-102130** | **74204-102130** |
| | | | 3.0 | **74104-103030** | **74204-103030** |
| | | | 4.6 | **74104-104630** | **74204-104630** |
| | | 150 | 2.1 | **74104-152130** | **74204-152130** |
| | | | 3.0 | **74104-153030** | **74204-153030** |
| | | | 4.6 | **74104-154630** | **74204-154630** |
| | | 250 | 2.1 | **74104-252130** | **74204-252130** |
| | | | 3.0 | **74104-253030** | **74204-253030** |
| | | | 4.6 | **74104-254630** | **74204-254630** |

| Polar Premium | Phenyl-Hexyl | Phenyl-X | PFP | C30 | HILIC | Urea-HILIC |
|---|---|---|---|---|---|---|
| **28026-012105** | **17926-012105** | **27926-012105** | **17426-012105** | **27826-012105** | **17526-012105** | **27726-012105** |
| – | **17926-013005** | – | **17426-013005** | – | **17526-013005** | – |
| – | **17926-014005** | – | **17426-014005** | – | **17526-014005** | – |
| – | **17926-032130** | – | **17426-032130** | – | **17526-032130** | – |
| **28026-052130** | **17926-052130** | **27926-052130** | **17426-052130** | **27826-052130** | **17526-052130** | **27726-052130** |
| **28026-053030** | **17926-053030** | **27926-053030** | **17426-053030** | **27826-053030** | **17526-053030** | **27726-053030** |
| **28026-054630** | **17926-054630** | **27926-054630** | **17426-054630** | **27826-054630** | **17526-054630** | **27726-054630** |
| **28026-102130** | **17926-102130** | **27926-102130** | **17426-102130** | **27826-102130** | **17526-102130** | **27726-102130** |
| **28026-103030** | **17926-103030** | **27926-103030** | **17426-103030** | **27826-103030** | **17526-103030** | **27726-103030** |
| **28026-104630** | **17926-104630** | **27926-104630** | **17426-104630** | **27826-104630** | **17526-104630** | **27726-104630** |
| **28026-152130** | **17926-152130** | **27926-152130** | **17426-152130** | **27826-152130** | **17526-152130** | **27726-152130** |
| **28026-153030** | **17926-153030** | **27926-153030** | **17426-153030** | **27826-153030** | **17526-153030** | **27726-153030** |
| **28026-154630** | **17926-154630** | **27926-154630** | **17426-154630** | **27826-154630** | **17526-154630** | **27726-154630** |
| **28026-252130** | – | **27926-252130** | – | **27826-252130** | – | **27726-252130** |

| Format | Length (mm) | ID (mm) | **Cat. No.** |
|---|---|---|---|
| UNIGUARD Guard Cartridge Holder | 10 | 2.1 | **852-00** |
| | | 3.0 | **852-00** |
| | | 4.6 | **850-00** |

| Particle Size (µm) | Length (mm) | ID (mm) | Format | Validation | Narrow Selectivity | Wide Selectivity | Polar Selectivity |
|---|---|---|---|---|---|---|---|
| 2.6 | 50 | 2.1 | 3-column Kit | **17126-052130-3V** | **17X26-052130-3VA** | **17X26-052130-3VB** | **17X26-052130-3VC** |
| | 100 | | | **17126-102130-3V** | **17X26-102130-3VA** | **17X26-102130-3VB** | **17X26-102130-3VC** |
| | 150 | | | **17126-152130-3V** | **17X26-152130-3VA** | **17X26-152130-3VB** | **17X26-152130-3VC** |
| | | | Kit contains | C18 | C18 | C18 | aQ |
| | | | | C18 | RP-MS | Phenyl-Hexyl | PFP |
| | | | | C18 | aQ | PFP | HILIC |

# Thermo Scientific Acclaim HPLC Columns

Optimal selectivity through innovative chemistry

- Novel and proprietary surface chemistries for diversified selectivities
- Ultrapure, porous, spherical silica
- High efficiencies
- Low silanol activity for good basic analyte peak shapes
- Reproducible and reliable manufacturing process

Thermo Scientific™ Acclaim™ columns are based on high-purity, porous silica particles, with advanced and innovative column bonding technologies. This provides complementary selectivity, high column efficiencies, and symmetrical peaks. Acclaim columns meet the high standards set by modern HPLC and LC-MS methods and are used in applications such as pharmaceutical, environmental, food and beverage, chemical, and consumer products. General reversed-phase, HILIC and Specialty phases are available. Acclaim RSLC columns, with a particle size of 2.2µm, are designed for use with UHPLC systems.

## Reliability and Durability

Quality and reliability are essential to a successful analysis. The Acclaim columns are thoroughly tested individually, so that chromatographers can have full confidence in them. Manufacturing starts with an ultrapure silica substrate, using only carefully selected lots with narrow ranges of physical parameters. By design, the bonding processes are clean and repeatable with no unexpected changes in performance. Each batch of bonded silica receives a full suite of validation tests appropriate to its intended use. The bonded silica is packed in precision-polished 316 stainless steel hardware using highly reliable processes. Each packed column is tested to ensure the same great performance every time.

The quality assurance reports for silica lot validation and column performance explain the test protocols, list the specifications, and show the actual chromatograms.

## Performance Indicators

Acclaim columns have been designed to meet the high quality standard needed in laboratories today. The innovative surface chemistries deliver exceptional peak efficiencies for a broad range of analytes. To ensure optimal performance, all Acclaim products are thoroughly characterized using a number of performance indicators, including surface coverage of the bonded phase, metal contamination, steric selectivity, column polarity, column hydrophobicity, and low silanol activity for bases. The specialty columns are also application-tested for their specific analysis, to ensure that each lot of bonded silica provides high-performance separations.

## Reversed-phase Columns

**Acclaim 120 C18:** High-density, monolayer C18 reversed-phase columns for exceptional resolution in a variety of applications.

**Acclaim 120 C8:** High-density monolayer C8 reversed-phase column.

**Acclaim Phenyl-1:** A unique reversed-phase column for the superior separation of aromatic compounds with enhanced hydrolytic stability.

**Acclaim C30:** Designed to provide high shape selectivity for separation of hydrophobic structurally related isomers.

**Acclaim PolarAdvantage:** Sulfonamide-embedded column for separating a wide variety of analytes.

**Acclaim PolarAdvantage II:** Amide-embedded reversed-phase columns with enhanced hydrolytic stability.

## Size-exclusion Columns

**Acclaim SEC Columns:** Polymeric columns designed for separating water soluble polymers and oligomers in the MW range of 100 to 1,000,000 Daltons.

## Hydrophilic Interaction Columns

**Acclaim HILIC-10:** Designed for separating hydrophilic compounds

## Acclaim Trinity P1 and P2 columns:

Unique trimodal surface chemistry provides simultaneous reversed-phase, anion and cation exchange capability for unparalleled chromatographic performance and maximum flexibility in adjusting selectivity (see Specialty Columns).

## Mixed-Mode Columns

Mixed-mode columns provide a unique, adjustable selectivity tool, using variation in pH, ionic strength, or organic modifier to influence the separation selectivity of acids, bases, zwitterions and neutral molecules.

**Acclaim Mixed-Mode HILIC-1:** Combines both reversed-phase and hydrophilic interaction liquid chromatography (HILIC) properties.

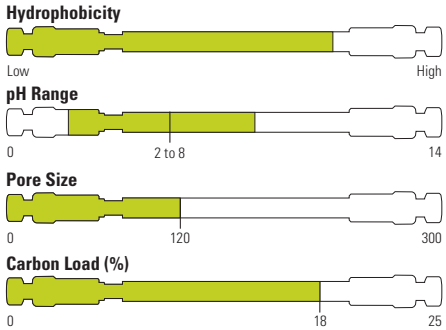
**Acclaim Mixed-Mode WAX-1:** High-density monolayer that incorporates both reversed-phase and weak anion exchange properties.

**Acclaim Mixed-Mode WCX-1:** Reversed-phase and cation exchange combined in a single column.

# Acclaim 120 C18

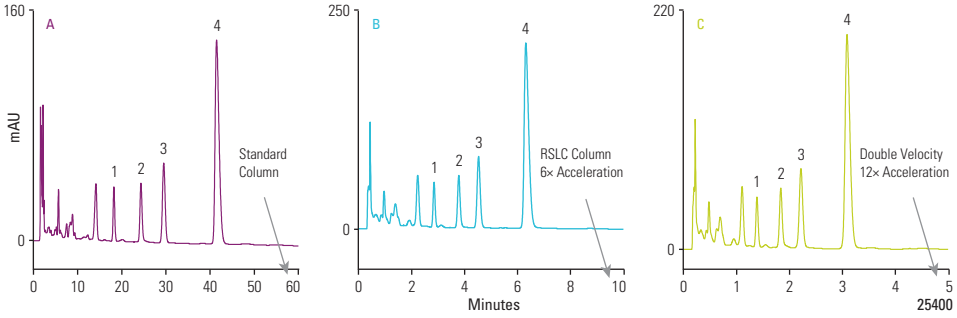
High performance reversed-phase columns for reproducible results

- High hydrophobic retention
- Excellent efficiencies for maximum resolution
- Low silanol activity for excellent peak shapes for basic analytes
- Reproducible manufacturing practices for reproducible column-to-column performance
- Extremely low bleed, fully compatible with MS
- Available in 2.2, 3 and 5µm particle size




**Particle Size** 2.2µm, 3µm, 5µm **USP** L1

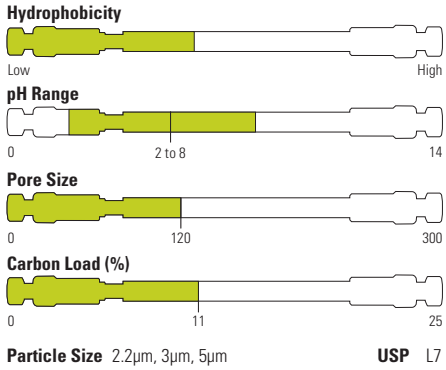
The Acclaim 120 columns are for high resolution reversed-phase separations. The very high surface coverage and very low metal content together result in columns with excellent efficiencies. These columns provide exceptional performance for a variety of applications in the pharmaceutical, chemical, environmental, and food separations areas.




| | |
|---|---|
| **Column:** | **A: Acclaim 120 C18, 5µm, 4.6 × 150mm**<br>**B, C: Acclaim RSLC C18, .2µm, 2.1 × 50mm** |
| Mobile Phase: | 200mM HOAc in 10% (v/v) MeOH |
| Flow: | A: 1.00mL/min<br>B: 0.41mL/min<br>C: 0.82mL/min |
| Temperature: | 20°C |
| Injection: | A: 10µL<br>B: 1.2µL<br>C: 1.2µL |
| Detector: | UV, 254 nm,<br>A: 1 Hz data rate<br>B: 5 Hz data rate<br>C: 10 Hz data rate |
| Peaks: | 1. p-Hydroxybenzoic acid<br>2. p-Hydroxybenzaldehyde<br>3. Vanillic acid<br>4. Vanillin |
| Sample: | Commercial vanilla extract in 40% ethanol, filtered |
| Reference: | AOAC Official Method 990.25 |

# Acclaim 120 C8

High performance reversed-phase columns with intermediate hydrophobic retention

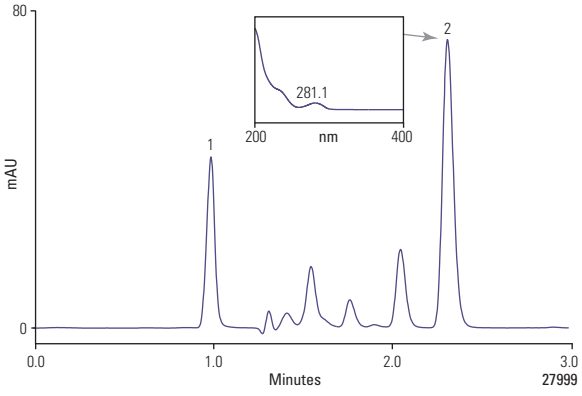



**Particle Size** 2.2µm, 3µm, 5µm **USP** L7

- Low silanol activity for excellent peak shapes for basic analytes
- Excellent column efficiencies
- LC-MS compatible
- Reproducible manufacturing practices for reproducible column-to-column performance
- Available in 2.2, 3 and 5µm particle size

Acclaim 120 C8 reversed-phase columns feature densely bonded monolayer C8 ligands on a high-purity, spherical porous silica substrate. The columns are a well-characterized line of LC/MS compatible C8 phases with very high surface coverage and extremely low silanol activity. These columns provide exceptional performance for a variety of applications in the pharmaceutical, environmental, food and many other industrial sectors.

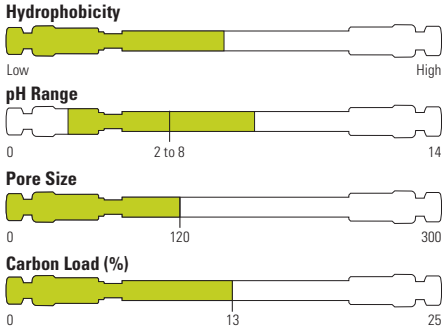
**Triclosan in toothpaste**




| **Column:** | **Acclaim RSLC C8, 2.2µm** |
|---|---|
| Dimension: | 2.1 × 100mm |
| HPLC System: | UltiMate 3000 RSLC |
| Buffer: | 2mM Ammonium acetate pH 5 |
| Mobile Phase: | Isocratic, 15% buffer, 85% methanol (v/v) |
| Flow Rate: | 0.200mL/min |
| Inj. Volume: | 1.0µL |
| Temperature: | 50°C |
| Detection: | Diode array detector, 281nm, 10Hz, 0.1 s resp. time and spectra 200–400 nm |
| Samples: | Toothpaste containing 0.3% triclosan |
| Preparation: | 1.0g Toothpaste + 1.0mL of 7.5mg/mL magnesium sulfate + methanol to make 25mL. Sonicate and filter. |
| Peaks: | 1. Saccharin<br>2. Triclosan |

# Acclaim Phenyl-1

A unique reversed-phase column with high aromatic selectivity




**Particle Size** 3µm, 5µm **USP** L11

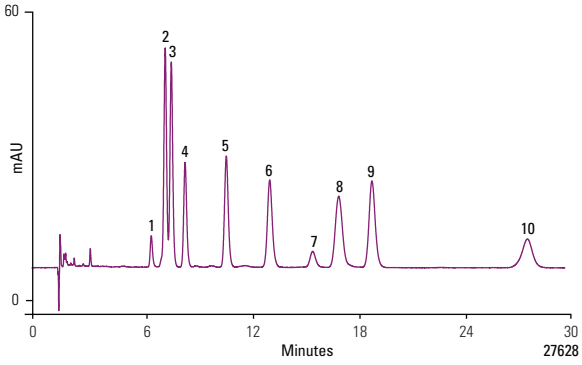
- High aromatic selectivity
- High hydrophobic retention
- Unique and complementary selectivity compared to any other phenyl type column
- Compatibility with highly aqueous mobile phase
- High efficiency and rugged packing

Acclaim Phenyl-1 columns provide unique selectivity of aromatic compounds for superior chromatographic performance.

This column has a higher π-π interaction than other phenyl phases and provides unique selectivity for aromatic compounds while maintaining sufficient hydrophobic interaction and aqueous compatibility for superior chromatographic performance.

The Acclaim Phenyl-1 column can be used in a wide range of applications in pharmaceutical, environmental, food testing and product-quality testing. This column is ideally suited for the analysis of aromatic analytes; some examples include glucocorticosteroids, estrogens, fat-soluble vitamins and phospholipids.

**Separation of fat-soluble vitamins**

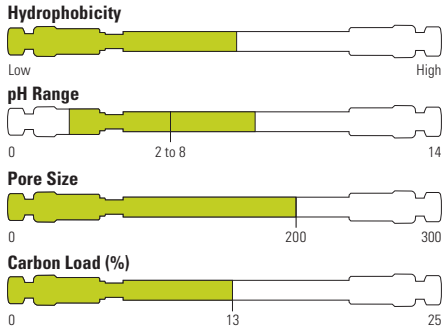



**Column: Acclaim Phenyl-1, 3µm**

| | |
|---|---|
| Dimension: | 3 × 150mm |
| Mobile Phase: | Methanol/water v/v 90/10 |
| Temperature: | 30°C |
| Flow Rate: | 0.5mL/min |
| Inj. Volume: | 2µL |
| Detection: | UV at 220nm |
| Peaks: | (100 ppm each)<br>1. Retinol acetate (vitamin A acetate)<br>2. Vitamin D2<br>3. Vitamin D3<br>4. delta-Tocopherol<br>5. gamma-Tocopherol<br>6. alpha-Tocopherol (vitamin E)<br>7. Impurity (unknown)<br>8. Vitamin E acetate<br>9. Vitamin K2<br>10. Vitamin K1 |

# Acclaim C30

Columns for separating structurally related isomers

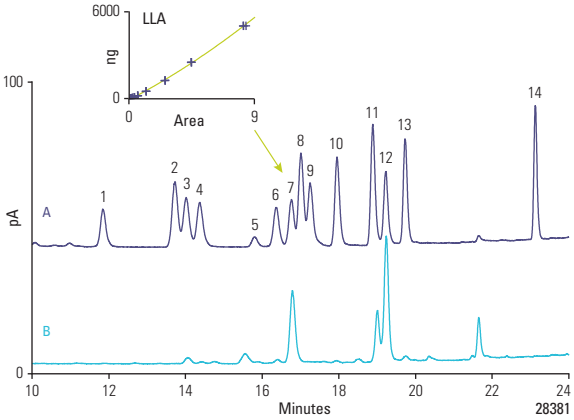



**Particle Size** 3µm, 5µm **USP** L62

- High shape selectivity
- Unique selectivity complementary to other reversed-phase columns
- Compatibility with highly aqueous mobile phase
- High-quality: low column bleed, high efficiency and rugged packing

The Acclaim C30 is designed to provide high shape selectivity for separating hydrophobic structural related isomers and unique selectivity complementary to other reversed-phase columns (e.g. C18).

### Omega fatty acids

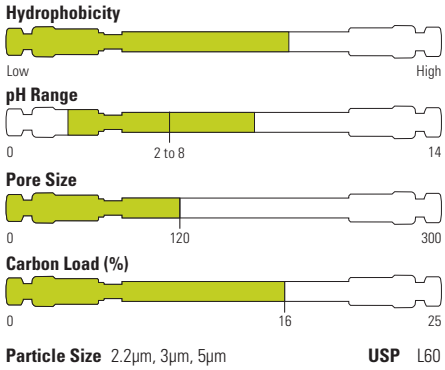



**Column: Acclaim C30, 5µm (4.6 × 150mm)**

| | | | |
|---|---|---|---|
| LC System: | UltiMate 3000 RS, Dual Gradient | | |
| Mobile Phases: | A. Water:formic acid:mobile phase B 900:3.6:100 (v/v)<br>B. Acetone:acetonitrile:THF:formic acid 675:225:100:4(v/v) | | |
| Gradient: | Time (min) | %A | %B |
| | 0 | 100 | 0 |
| | 1 | 40 | 60 |
| | 13 | 30 | 70 |
| | 22 | 5 | 95 |
| | 24 | 5 | 95 |
| | 29 | 100 | 0 |
| | 32 | 100 | 0 |
| Flow Rate: | 1.00mL/min | | |
| Temperature: | 30°C | | |
| Inj. Volume: | 2µL | | |
| Detection: | Corona ultra, nebulizer 15°C, filter high | | |
| Samples: | A. Standards in isopropanol<br>B. Saponified chicken fat | | |
| Peaks: | 1. SDA<br>2. EPA<br>3. ALA<br>4. GLA<br>5. DHA<br>6. Arach.<br>7. LLA | | |

# Acclaim PolarAdvantage

Novel polar-embedded reversed-phase columns with unique selectivity



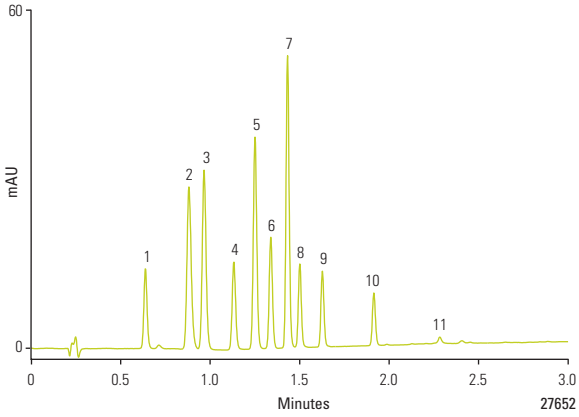

**Particle Size** 2.2µm, 3µm, 5µm **USP** L60

- Selectivity complementary to the C18 column
- Low silanol activity for excellent peak shape with basic compounds
- Compatible with 100% aqueous mobile phase
- High selectivity for hydrophobic aromatic molecules
- Wide range of applications
- Available in 2.2, 3 and 5µm

Acclaim PolarAdvantage (PA) columns feature a patented bonding column chemistry that incorporates a polar sulfonamide group with an ether linkage near the silica surface. This unique chemistry provides low silanol activity, compatibility with 100% aqueous mobile phase. The Acclaim PA column offers great separation power to resolve a wide variety of polar and nonpolar analytes and supports LC/MS analysis.

Acclaim PA columns provide unique selectivity, good peak shape for acidic, basic, and neutral analytes, and full compatibility with 100% aqueous conditions. Applications include pharmaceutical, environmental, life science, food testing, and product-quality testing.

### EPA 604 phenols

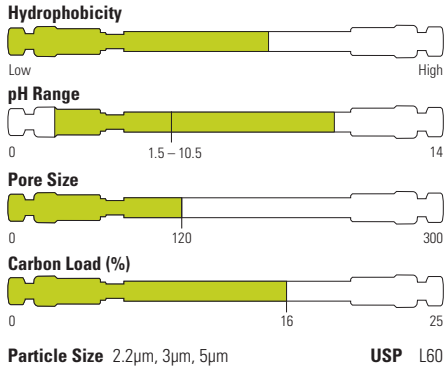



**Column: Acclaim RSLC PolarAdvantage, 2.2µm**

| | |
|---|---|
| Dimensions: 3 × 50mm | |
| System: UltiMate 3000 RSLC | |
| Mobile Phases: | A: 10mM formic acid + 10mM ammonium formate, pH 3.75 ± 0.05<br>B: Acetonitrile |
| Gradient Time (min): | -1.5 0.0 0.3 2.6 3.0<br>%A 70 70 70 10 10<br>%B 30 30 30 90 90 |
| Flow Rate: | 1.25mL/min |
| Temperature: | 30°C |
| Injection Volume: | 0.5µL |
| Detection: | UV at 280nm, 10Hz, 0.5s resp. time |
| Sample: | Calibration mix, 50µg/mL in water |
| Peaks: | 1. Phenol<br>2. 2,4-Dinitrophenol<br>3. 4-Nitrophenol<br>4. 2-Chlorophenol<br>5. 2-Nitrophenol<br>6. 2,4-Dimethylphenol<br>7. 4,6-Dinitro-2-methylphenol<br>8. 4-Chloro-3-methylphenol<br>9. 2,4-Dichlorophenol<br>10. 2,4,6-Trichlorophenol<br>11. Pentachlorophenol |

# Acclaim PolarAdvantage II

## Complementary selectivity and enhanced hydrolytic stability



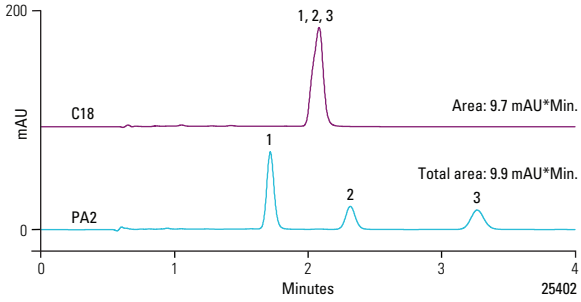

**Particle Size** 2.2µm, 3µm, 5µm **USP** L60

- Unique selectivity complementary to the C18 column
- Novel polar-embedded column chemistry for hydrolytic stability
- Compatible with 100% aqueous mobile phase
- Low bleed for MS compatibility
- Wide range of applications
- Available in 2.2, 3 and 5µm

Acclaim PolarAdvantage II (PA2) columns feature a patented surface chemistry that incorporates an amide-embedded polar group and multi-point attachment between the ligands and the silica surface. This unique chemistry provides enhanced hydrolytic stability from pH 1.5-10 with 100% aqueous mobile phases and exhibits high reversed-phase capacity, with selectivity complementary to conventional C18 columns.

The Acclaim PA2 column is specifically designed to withstand high pH conditions, making it a good choice for the separation of both basic and acidic analytes.

### Turmeric



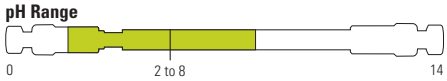

| **Columns:** | **Acclaim RSLC 120 C18**<br>**Acclaim RSLC PA2** |
|---|---|
| Dimensions: | 2.2µm, 2.1 × 100mm |
| Mobile Phase: | A: 15mM $H_3PO_4$<br>B: Methanol |
| Isocratic: | C18: 70% B (v/v)<br>PA2: 80% B (v/v) |
| Flow: | 0.41mL/min |
| Temperature: | 30°C |
| Detector: | UV, 428nm |
| Sample: | Turmeric extract |
| Peaks: | 1. Curcumin<br>2. Demethoxycurcumin<br>3. Bis-demethoxycurcumin |

# Acclaim HILIC-10

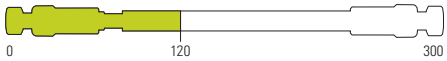
Designed with unique selectivity for hydrophilic molecules

**Hydrophobicity**


**pH Range**




**Pore Size**

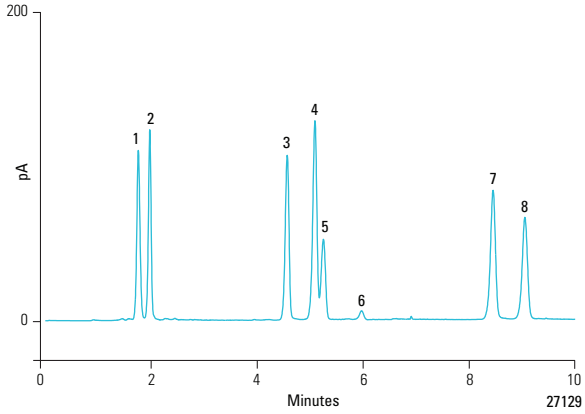



**Particle Size** 3µm, 5µm

- Retains highly polar molecules that are not retained by reversed-phase chromatography
- Unique selectivity, complementary to reversed-phase columns
- Hydrolytically stable
- Rugged column packing
- Broad application range

The Acclaim HILIC-10 column is designed for separating highly hydrophilic molecules by Hydrophilic Interaction Liquid Chromatography (HILIC). This column is based on high-purity spherical porous silica covalently modified with a proprietary hydrophilic layer.

**Glycerides**

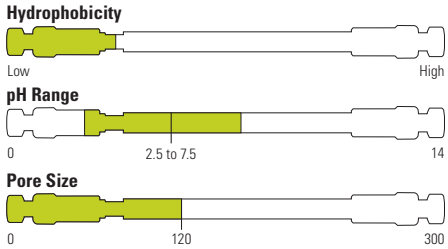



**Column: Acclaim HILIC-10, 3µm**

| | |
|---|---|
| Dimensions: | 3 × 150mm |
| Mobile Phase: | A: Heptane<br>B: 2-Propanol/acetic acid 99.5:0.5 |
| Step Elution (min): | –6.0 0.0 0.5 4.0 10.0<br>%A 99 99 96 87 87<br>%B 1 1 4 13 13 |
| Flow Rate: | 0.50mL/min |
| Temperature: | 25°C |
| Inj. Volume: | 4µL |
| Detector: | Corona ultra, nebulizer 15°C |
| Peaks: | 1. Tristearin<br>2. Trilaurin<br>3. Distearin isomer 1<br>4. Dilaurin isomer 1<br>5. Distearin isomer 2<br>6. Dilaurin isomer 2<br>7. Monostearin<br>8. Monolaurin |

# Acclaim Mixed-Mode HILIC-1

Uniquely designed for both reversed-phase and HILIC operations



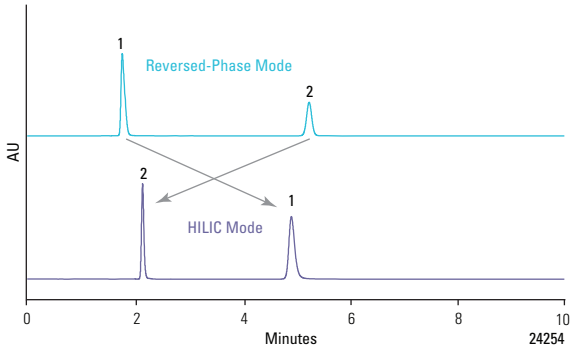

**Particle Size** 3µm, 5µm

- Can operate in both RP and HILIC modes
- Retains highly polar molecules
- Unique selectivity complementary to RP columns
- Broader application range compared with conventional diol-based columns
- High-efficiency column for high-resolution separations

The Acclaim Mixed-Mode HILIC-1 column features a unique, high-efficiency, silica-based HPLC mixed-mode stationary phase that combines both reversed-phase (RP) and hydrophilic interaction liquid chromatography (HILIC) properties. This combination allows both hydrophobic interaction and hydrophilic interaction to be utilized to optimize separations.

The Acclaim Mixed-Mode HILIC-1 stationary phase consists of a hydrophobic alkyl chain with a diol group at the terminus. The hydrophobic moiety provides reversed-phase retention and the terminal diol group facilitates hydrophilic interactions. This unique combination results in the adjustable selectivity, making Acclaim Mixed-Mode HILIC-1 separate mixtures that would be impossible for a C18 column. This column is suitable for a broad range of applications, including non-ionic ethoxylated surfactants, drug metabolites, lipids, polyethylene glycols (PEGs), ethoxylated surfactants, and more.

### Cytosine and naphthalene

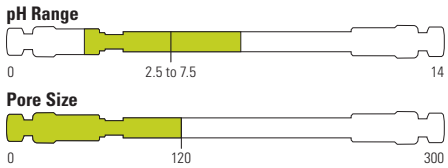



**Column: Acclaim Mixed-Mode HILIC-1, 5µm**

| | |
|---|---|
| Dimensions: | 4.6 × 150mm |
| Mobile Phase: | $CH_3CN$/0.1 M $NH_4OAc$, pH 5.2<br>v/v 52/48 for RP mode<br>v/v 92/8 for HILIC mode |
| Temperature: | 30°C |
| Flow Rate: | 1mL/min |
| Inj. Volume: | 10µL |
| Detection: | UV at 254nm |
| Peaks: | 1. Cytosine (100 ppm)<br>2. Naphthalene (100 ppm) |

# Acclaim Mixed-Mode WAX-1

Designed for separating anionic molecules; with powerful adjustable selectivity control



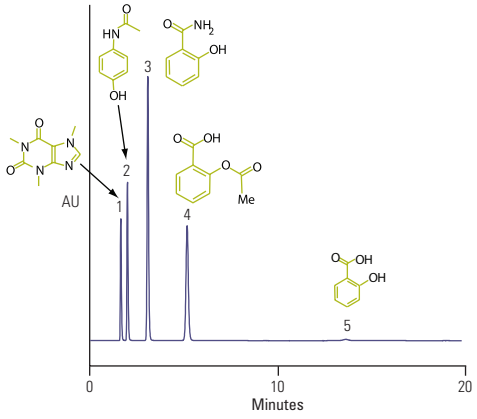

**Particle Size** 3µm, 5µm **USP** L78

- Adjustable selectivity
- Selectivity orthogonal to reversed-phase (RP) columns
- Ideal selectivity for anionic molecules
- Excellent column efficiency and peak asymmetry
- Multimode retention mechanisms: reversed-phase, weak anion exchange, and HILIC modes

The Acclaim Mixed-Mode WAX-1 is a novel, high-efficiency silica HPLC column that combines hydrophobic and weak anion exchange characteristics. Its unique chemistry results in a multimode separation mechanism that includes reversed-phase, anion exchange, and HILIC interactions. Selectivity can be adjusted by changing ionic strength, pH, or organic solvent content.

The Acclaim Mixed-Mode WAX-1 surface consists of a hydrophobic alkyl chain with a tertiary amine group at the terminus. The hydrophobic moiety provides reversed-phase retention and the terminal amino group facilitates electrostatic interactions.

**Pain relief medicine**

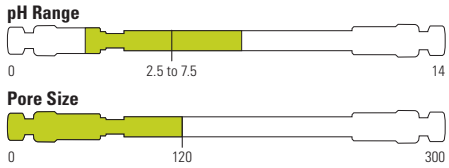



**Column: Acclaim Mixed-Mode WAX-1, 5µm**

| | |
|---|---|
| Dimensions: | 4.6 × 150mm |
| Mobile Phase: | 40/60 v/v Acetonitrile/buffer |
| | (6.8 g potassium monophosphate and 0.5 g pyrophosphate in 1000 g D.I. $H_2O$, pH is adjusted to 6.0 with NaOH) |
| Temperature: | 30°C |
| Flow Rate: | 1mL/min |
| Inj. Volume: | 1µL |
| Detection: | UV, 220nm |
| Peaks: | 1. Caffeine<br>2. Acetaminophen<br>3. Salicylamide<br>4. Acetyl salicylic acid (Aspirin)<br>5. Salicylic acid |

# Acclaim Mixed-Mode WCX-1

Designed for separating cationic molecules with adjustable selectivity control



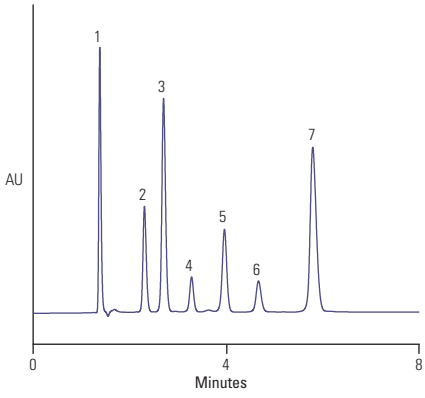

**Particle Size** 3µm, 5µm

- Adjustable selectivity
- Ideal selectivity for separating basic molecules
- Selectivity complementary to C18 RP columns
- Multimode separation mechanism: reversed-phase, weak cation exchange, anion-exclusion and HILIC

The Acclaim Mixed-Mode WCX-1 is a novel, high-efficiency, silica-based column, manufactured by bonding a specially designed proprietary ligand with both hydrophobic and weak cation exchange properties. Selectivity of ionizable and neutral compounds can be controlled independently or simultaneously by tuning mobile phase ionic strength, pH or organic modifier. This column therefore can separate using multiple separation modes: reversed-phase, cation exchange, and normal-phase/ HILIC.

Basic compounds are important in a variety of industrial applications, including pharmaceutical, chemical, consumer products, foods and beverages, and more. The Acclaim Mixed-Mode WCX-1 not only retains basic molecules (from highly hydrophilic to highly hydrophobic), but also separates them with symmetrical peak shapes and excellent efficiency.

### Pharmaceutical counterions




**Column: Acclaim Mixed-Mode WCX-1, 5µm**
**Dimension: 4.6 × 150mm**

| | |
|---|---|
| Mobile Phase: | 40/60 v/v $CH_3CN/NH_4OAc$, pH 5.2 (20 mM total) |
| Temperature: | 30°C |
| Flow Rate: | 1mL/min |
| Inj. Volume: | 5µL |
| Detection: | UV (225 nm) |
| Peaks: | 1. Maleate 50µg/mL<br>2. Ketoprofen 30µg/mL<br>3. Naproxen 30µg/mL<br>4. Hydrocortisone 60µg/mL<br>5. Dexamethasone 60µg/mL<br>6. Oxprenolol 300µg/mL<br>7. Timolol 250µg/mL |

# Acclaim Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | 120 C18 | 120 C8 | PolarAdvantage | PolarAdvantage II |
|---|---|---|---|---|---|---|---|
| 2.2 | RSLC Column | 30 | 2.1 | **071400** | **072614** | **072621** | **071402** |
| | | | 3.0 | **071606** | **072618** | **072625** | **071609** |
| | | 50 | 2.1 | **068981** | **072615** | **072622** | **068989** |
| | | | 3.0 | **071605** | **072619** | **072626** | **071608** |
| | | 75 | 3.0 | **075697** | **075696** | **075698** | **075699** |
| | | 100 | 2.1 | **068982** | **072616** | **072623** | **068990** |
| | | | 3.0 | **071604** | **072620** | **072627** | **071607** |
| | | 150 | 2.1 | **071399** | **072617** | **072624** | **071401** |
| | | 250 | 2.1 | **074812** | **074811** | **074813** | **074814** |
| 3 | HPLC Column | 33 | 3.0 | **066272** | – | **066274** | **066276** |
| | | 50 | 2.1 | **059128** | **059122** | **063174** | **077999** |
| | | | 3.0 | **068971** | – | **068972** | **068973** |
| | | | 4.6 | **059131** | **059125** | – | **063189** |
| | | 75 | 3.0 | **066273** | – | **066275** | **066277** |
| | | 100 | 2.1 | **059129** | **059123** | **061316** | **077998** |
| | | | 3.0 | **076186** | **076184** | **076214** | **078000** |
| | | | 4.6 | **059132** | **059126** | **076216** | **078001** |
| | | 150 | 2.1 | **059130** | **059124** | **061317** | **063187** |
| | | | 3.0 | **063691** | **068970** | **063693** | **063705** |
| | | | 4.6 | **059133** | **059127** | **061318** | **063191** |
| | | 250 | 2.1 | **076187** | **076185** | **076215** | **077997** |
| | | | 3.0 | **070077** | **070078** | **070079** | **070080** |
| 5 | Guard Cartridge | 10 | 2.1 | **069689** | **069688** | **069691** | **069692** |
| | | | 3.0 | **071981** | **071979** | **071983** | **071985** |
| | | | 4.6 | **069695** | **069696** | **069698** | **069699** |
| | HPLC Column | 50 | 2.1 | **059142** | **059134** | – | – |
| | | | 4.6 | **059146** | **059138** | **061319** | – |
| | | 100 | 2.1 | **059143** | **059135** | – | – |
| | | | 4.6 | **059147** | **059139** | – | – |
| | | 150 | 2.1 | **059144** | **059136** | – | – |
| | | | 4.6 | **059148** | **059140** | **061320** | **063197** |
| | | 250 | 2.1 | **059145** | **059137** | – | – |
| | | | 4.6 | **059149** | **059141** | **061321** | **063199** |

| Format | Cat. No. |
|---|---|
| Acclaim Guard Cartridge Holder | **069580** |
| Acclaim Guard Cartridge-Column Coupler | **074188** |
| Acclaim Guard Kit (Holder and Coupler) | **069707** |

# Acclaim Ordering Guide *continued*

## Acclaim Phenyl-1 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Phenyl-1 |
|---|---|---|---|---|
| 3 | Guard Cartridge | 10 | 2.1 | **079934** |
| | | | 3.0 | **071974** |
| | | | 4.6 | **071973** |
| | HPLC Column | 50 | 2.1 | **078016** |
| | | | 3.0 | **071972** |
| | | | 4.6 | **078018** |
| | | 100 | 2.1 | **078015** |
| | | | 3.0 | **074693** |
| | | | 4.6 | **078017** |
| | | 150 | 2.1 | **071971** |
| | | | 3.0 | **071970** |
| | | | 4.6 | **071969** |
| | | 250 | 2.1 | **078014** |
| | | | 3.0 | **074694** |
| 5 | HPLC Column | 150 | 2.1 | **079698** |
| | | | 4.6 | **088016** |
| | | 250 | 4.6 | **079697** |

## Acclaim C30 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | C30 |
|---|---|---|---|---|
| 3 | HPLC Column | 50 | 2.1 | **078666** |
| | | | 3.0 | **078663** |
| | | | 4.6 | **078661** |
| | | 100 | 2.1 | **078665** |
| | | | 4.6 | **078660** |
| | | 150 | 2.1 | **075725** |
| | | | 3.0 | **075724** |
| | | | 4.6 | **075723** |
| | | 250 | 2.1 | **078664** |
| | | | 3.0 | **075726** |
| 5 | Guard Cartridge | 10 | 2.1 | **075722** |
| | | | 3.0 | **075721** |
| | | | 4.6 | **075720** |
| | HPLC Column | 150 | 4.6 | **075719** |
| | | 250 | 4.6 | **075718** |

## Acclaim HILIC-10 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | HILIC-10 |
|---|---|---|---|---|
| 3 | HPLC Column | 150 | 2.1 | **074259** |
| | | | 3.0 | **074258** |
| | | | 4.6 | **074257** |
| 5 | Guard Cartridge | 10 | 2.1 | **074263** |
| | | | 3.0 | **074261** |
| | | | 4.6 | **074262** |

## Acclaim Mixed-Mode Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | HILIC-1 | WAX-1 | WCX-1 |
|---|---|---|---|---|---|---|
| 3 | HPLC Column | 50 | 3.0 | **071912** | **071908** | **071910** |
| | | 150 | 2.1 | **070091** | **070089** | **070093** |
| | | | 3.0 | **070090** | **070088** | **070092** |
| 5 | Guard Cartridge | 10 | 2.1 | **069694** | **069686** | **085455** |
| | | | 3.0 | **071913** | **071909** | **071911** |
| | | | 4.6 | **069706** | **069704** | **069705** |
| | HPLC Column | 150 | 2.1 | **066847** | **067084** | **068371** |
| | | | 4.6 | **066843** | **064984** | **068353** |
| | | 250 | 4.6 | **066844** | **064985** | **068352** |

## Notes

# Thermo Scientific Syncronis HPLC Columns

Consistent Reproducible Separations, Column after Column, Time after Time.
Extensive testing and strong quality control procedures ensure the consistency of Syncronis HPLC columns – column after column.

- Thermo Scientific™ Syncronis™ HPLC columns are manufactured, packed and tested in ISO9000 accredited facilities. Each lot of silica is tested for the physical properties of the silica support and only released for production if it meets the stringent test specifications.
- Syncronis columns are based on highly pure 100Å silica, with a surface area of 320$m^2$/g, compared to 200$m^2$/g for typical silica based material. This greater surface area ensures good retention of analytes having a range of hydrophobicity, away from the solvent front.
- Available in three particle sizes: 1.7µm for rapid UHPLC separations plus 3µm and 5µm for the more traditional HPLC analysis.
- Syncronis reversed phase columns are densely bonded and double endcapped to minimize the number of residual silanols available to interact with basic analytes.
- Each batch of chromatographic media packed into Syncronis columns is put through a series of diagnostic chromatographic tests, based on those developed by Tanaka[1] to ensure consistent, predictable separations. These tests rigorously probe interactions between analytes and the stationary phase, measuring hydrophobicity, shape selectivity and secondary interactions with bases, acids and chelators.
- Enhanced, automated packing methods drive consistency even further and every column is individually tested to ensure that it meets the required quality.

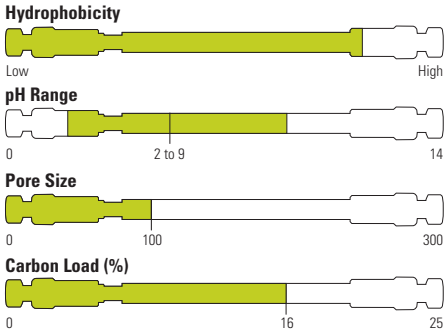
View product information and application notes

*For full details on the Syncronis column range, please request or view a copy of our Syncronis technical guide*
***www.thermoscientific.com/syncronis***

# Syncronis C18

Syncronis C18 columns deliver consistent predictable separations, column after column, time after time

- Highly pure, high surface area silica
- High carbon load for increased retention
- Double endcapped for extra surface coverage
- Highly inert towards basic compounds
- Rigorously tested to ensure quality

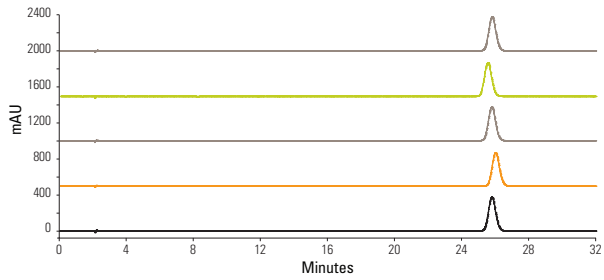



**Particle Size** 1.7µm, 3µm, 5µm **USP** L1

When developing a new method, one of the most important goals for the chromatographer is to achieve a consistent, reproducible separation. The selection of a highly reproducible HPLC column is essential to attaining this goal.

Syncronis C18 columns show excellent column to column reproducibility, as illustrated here by the analysis of zidovudine using five separate columns. The reproducibility in terms of retention time and peak area is less than or equal to 0.5%, column to column.

**Ziovudine**




**Column: Syncronis C18, 5µm, 150mm x 4.6mm**

| | |
|---|---|
| Mobile phase: | Water:Methanol (4:1) |
| Flow rate: | 1.0mL min-1 |
| Temperature: | 25°C |
| Detection: | 265nm |
| Injection volume: | 10µL |

1. Zidovudine

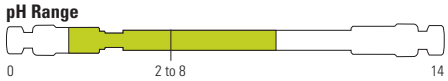
# Syncronis C8

Reduces hydrophobic interactions allowing compounds to elute quicker from the column. Recommended for analytes with medium hydrophobicity or when a less hydrophobic phase is required to obtain optimum retention

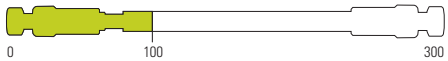
- Highly pure, high surface area silica
- Less hydrophobic than Syncronis C18
- Double endcapped for extra surface coverage
- Rigorously tested to ensure quality

**Hydrophobicity**

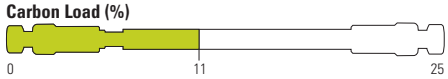

**pH Range**




**Pore Size**

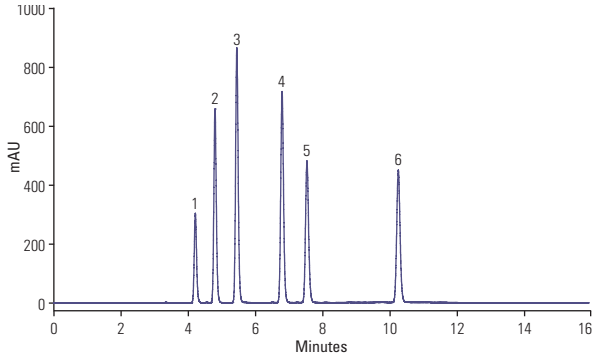



**Carbon Load (%)**




**Particle Size** 1.7µm, 3µm, 5µm **USP** L7

## Uron herbicides



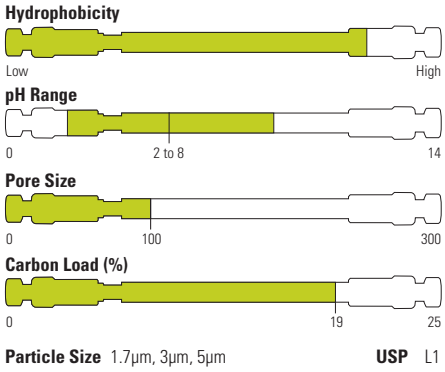

**Column: Syncronis C8, 5µm, 150mm x 4.6mm**

| | |
|---|---|
| Mobile phase: | A: Water<br>B: Acetonitrile |
| Gradient: | 35 to 60% B in 10 minutes |
| Flow rate: | 1.0mL/min |
| Temperature: | 30°C |
| Detection: | 240nm |
| Injection volume.: | 20µL |
| | 1. Tebuthiuron<br>2. Metoxuron<br>3. Monuron<br>4. Chlorotoluron<br>5. Diuron<br>6. Linuron |

# Syncronis aQ

Polar endcapped Syncronis aQ columns provide a controlled interaction mechanism that retains and resolves polar analytes. Stable in 100% aqueous mobile phase

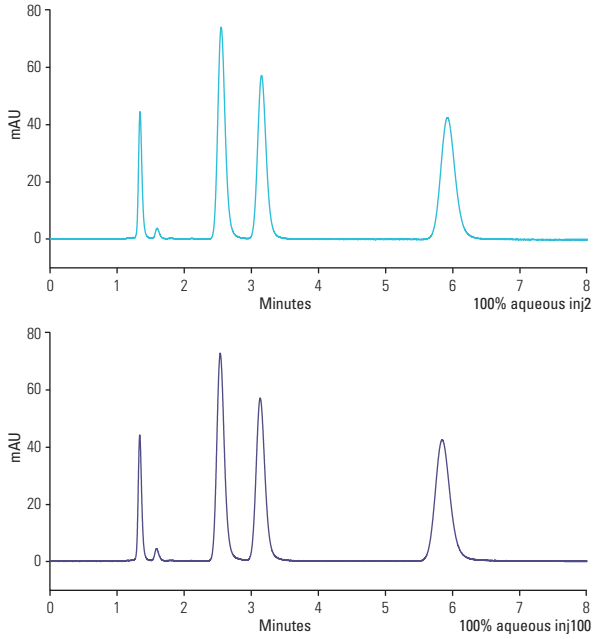
- Stable in 100% aqueous mobile phase
- Enhanced retention of polar compounds
- Rigorously tested to ensure quality




**Particle Size** 1.7µm, 3µm, 5µm **USP** L1

In comparison to a conventionally endcapped C18, the Syncronis aQ polar end-capped C18 stationary phase exhibits superior stability towards aqueous mobile phase. Syncronis aQ shows no degradation in performance after 100 injections in a buffered 100% aqueous eluent.

**Stability of Syncronis aQ in 100% aqueous mobile phase**




**Column: Syncronis aQ, 5µm, 100mm x 4.6mm**

| | |
|---|---|
| Mobile phase: | 50mM Aqueous $K_2HPO_4$ (pH 6) |
| Flow rate: | 0.7mL/min |
| Temperature: | 30°C |
| Detection: | 260nm |
| Injection volume: | 2µL |
| 1. Cytidine-5′-diphosphate | |
| 2. Adenosine-5′-triphosphate | |
| 3. Adenosine-5′-diphosphate | |
| 4. Adenosine-5′-monophosphate | |

# Syncronis Phenyl

Provides an alternative to Syncronis C18 and is particularly useful for retention of aromatic compounds

- Alternative selectivity to Syncronis C18
- Double endcapped for extra surface coverage
- Highly inert towards basic compounds
- Rigorously tested to ensure quality

**Hydrophobicity**

Low — High

**pH Range**

0 — 2 to 8 — 14

**Pore Size**

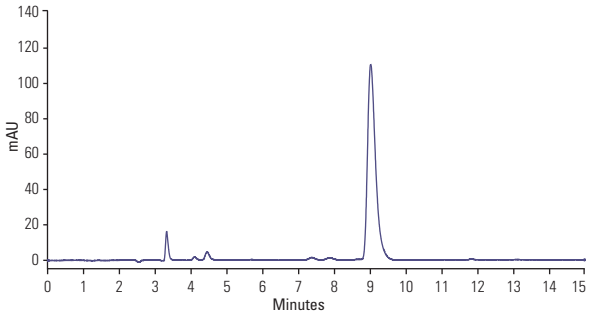
0 — 100 — 300

**Carbon Load (%)**

0 — 11 — 25

**Particle Size** 1.7µm, 3µm, 5µm **USP** L11

**Oxacillin sodium (USP)**

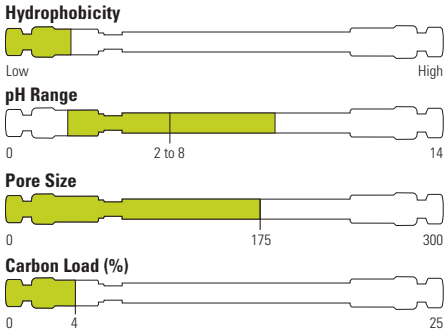



**Column: Syncronis Phenyl, 5µm, 300mm x 4.0mm**
Mobile phase: Phosphate Buffer: MeCN:MeOH (70:30:10)
Flow rate: 1.0mL/min (2mL/min in USP method)
Temperature: 25°C
Detection: 225nm
Injection volume: 10µL
1. Oxacillin Sodium (0.11mg/mL)

# Syncronis Amino

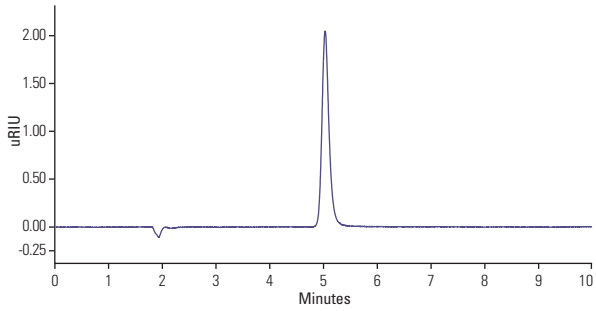
Provides a versatile aminopropyl phase that gives excellent chromatographic properties in four modes: weak anion exchange, reversed phase, normal phase and HILIC

- Highly pure, high surface area silica
- Double endcapped for extra surface coverage
- Rigorously tested to ensure quality




**Particle Size** 1.7µm, 3µm, 5µm **USP** L8

**Lactulose**



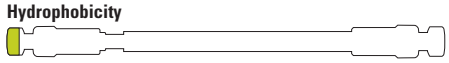

**Column: Syncronis Amino 5µm, 150mm x 4.6mm**
Mobile phase: Water: MeCN (30:70)
Flow rate: 1.0mL/min
Temperature: 35°C
Detection: RI
Injection volume: 5µL
1. Lactulose

# Syncronis Silica

Serves as a powerful and efficient tool for the chromatography of moderately polar organic compounds by normal phase chromatography

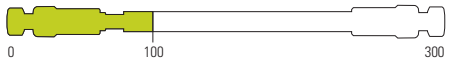
- Highly pure, high surface area silica
- Excellent reproducibility for normal phase chromatography
- Rigorously tested to ensure quality

**Hydrophobicity**



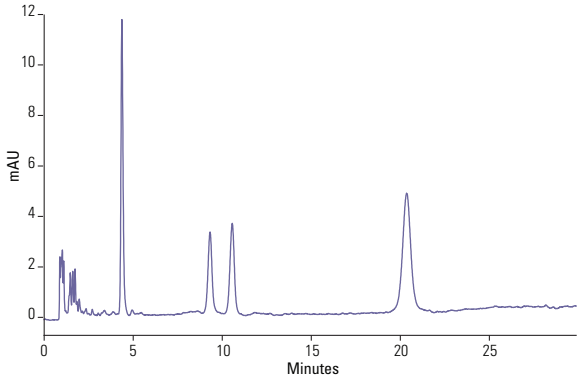

**pH Range**


**Pore Size**




**Particle Size** 1.7µm, 3µm, 5µm **USP** L3

**Tocopherols**




**Column: Syncronis Silica 5µm, 150 x 4.6mm**
**Part Number: 97005-154630**

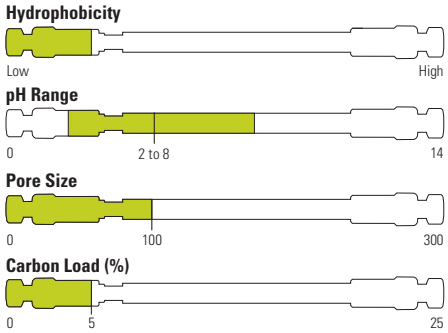
| | |
|---|---|
| Mobile phase: | Hexane +0.2% propan-2-ol (IPA) |
| Flow rate: | 2.0mL/min |
| Temperature: | 40°C |
| Detection: | 254nm |
| Injection volume: | 10µL |

Sample:
Mixture of standards (200-1000 ug/ml) of the following:
α-tocopherol
β -tocopherol
γ -tocopherol
δ-tocopherol

# Syncronis HILIC

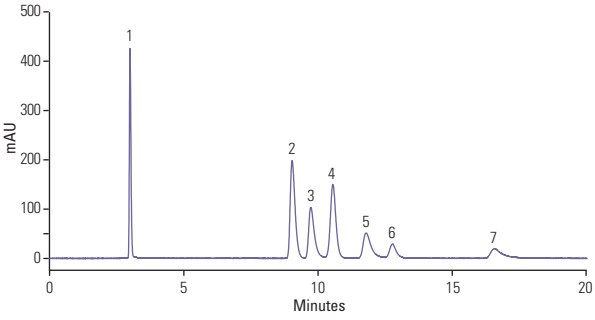
Provides enhanced retention of polar and hydrophilic analytes

- Alternative selectivity to Syncronis C18
- Improved sensitivity with MS detection
- No need for ion-pair or derivatisation
- Outstanding peak shape and sensitivity
- Highly pure, high surface area silica particles
- Neutral (uncharged), highly polar surface




**Particle Size** 1.7µm, 3µm, 5µm

**Catecholamines**




**Column: Syncronis HILIC, 5µm, 250 x 4.6mm**
**Part Number: 97505-254630**

Mobile phase: water : acetonitrile : 200mM ammonium formate (10.5 : 84.5 : 5)

| | |
|---|---|
| Flow rate: | 1.0mL/min |
| Temperature: | 40°C |
| Detection: | 280nm |
| Injection volume: | 5µL |
| Sample: | 1. catechol<br>2. 5-HIAA<br>3. DOPAC<br>4. serotonin<br>5. tyrosine<br>6. dopamine<br>7. L-DOPA |

# Syncronis Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | C18 | C8 | aQ | Phenyl |
|---|---|---|---|---|---|---|---|
| 1.7 | UHPLC Column | 30 | 2.1 | **97102-032130** | – | – | – |
| | | 50 | 2.1 | **97102-052130** | **97202-052130** | **97302-052130** | **97902-052130** |
| | | | 3.0 | **97102-053030** | – | – | – |
| | | | 4.6 | **97102-054630** | **97202-054630** | **97302-054630** | **97902-054630** |
| | | 100 | 2.1 | **97102-102130** | **97202-102130** | **97302-102130** | **97902-102130** |
| | | | 3.0 | **97102-103030** | **97202-103030** | **97302-103030** | **97902-103030** |
| 3 | HPLC Column | 30 | 2.1 | **97103-032130** | – | – | – |
| | | 50 | 2.1 | **97103-052130** | **97203-052130** | **97303-052130** | **97903-052130** |
| | | | 3.0 | **97103-053030** | – | – | – |
| | | | 4.6 | **97103-054630** | – | – | – |
| | | 100 | 2.1 | **97103-102130** | – | – | – |
| | | | 3.0 | **97103-103030** | **97203-103030** | **97303-103030** | - |
| | | | 4.6 | **97103-104630** | **97203-104630** | **97303-104630** | **97903-104630** |
| | | 150 | 2.1 | **97103-152130** | – | – | – |
| | | | 4.6 | **97103-154630** | **97203-154630** | **97303-154630** | **97903-154630** |
| 5 | Drop-in Guard (4/pk) | 10 | 2.1 | **97105-012101** | **97205-012101** | **97305-012101** | **97905-012101** |
| | | | 3.0 | **97105-013001** | **97205-013001** | **97305-013001** | **97905-013001** |
| | | | 4.0/4.6 | **97105-014001** | **97205-014001** | **97305-014001** | **97905-014001** |
| | HPLC Column | 30 | 2.1 | **97105-032130** | **97205-032130** | **97305-032130** | **97905-032130** |
| | | 50 | 2.1 | **97105-052130** | **97205-052130** | **97305-052130** | **97905-052130** |
| | | | 3.0 | **97105-053030** | **97205-053030** | **97305-053030** | **97905-053030** |
| | | | 4.6 | **97105-054630** | **97205-054630** | **97305-054630** | **97905-054630** |
| | | 100 | 2.1 | **97105-102130** | **97205-102130** | **97305-102130** | **97905-102130** |
| | | | 3.0 | **97105-103030** | **97205-103030** | **97305-103030** | **97905-103030** |
| | | | 4.6 | **97105-104630** | **97205-104630** | **97305-104630** | **97905-104630** |
| | | 150 | 2.1 | **97105-152130** | **97205-152130** | **97305-152130** | **97905-152130** |
| | | | 3.0 | **97105-153030** | **97205-153030** | **97305-153030** | **97905-153030** |
| | | | 4.0 | **97105-154030** | **97205-154030** | **97305-154030** | **97905-154030** |
| | | | 4.6 | **97105-154630** | **97205-154630** | **97305-154630** | **97905-154630** |
| | | 250 | 2.1 | **97105-252130** | – | – | – |
| | | | 3.0 | **97105-253030** | **97205-253030** | **97305-253030** | **97905-253030** |
| | | | 4.0 | **97105-254030** | **97205-254030** | **97305-254030** | **97905-254030** |
| | | | 4.6 | **97105-254630** | **97205-254630** | **97305-254630** | **97905-254630** |

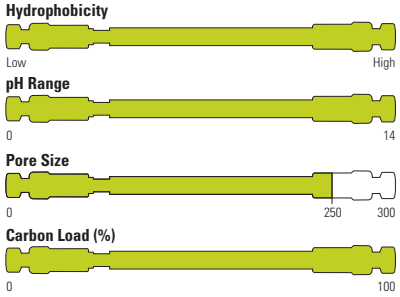
| Format | Length (mm) | ID (mm) | **Cat. No.** |
|---|---|---|---|
| UNIGUARD Guard Cartridge Holder | 10 | 2.1 | **852-00** |
| | | 3.0 | **852-00** |
| | | 4.0/4.6 | **850-00** |

| Amino | Silica | HILIC |
|---|---|---|
| – | – | – |
| **97702-052130** | **97002-052130** | **97502-052130** |
| – | – | – |
| **97702-054630** | **97002-054630** | **97502-054630** |
| **97702-102130** | **97002-102130** | **97502-102130** |
| **97702-103030** | **97002-103030** | **97502-103030** |
| – | – | – |
| **97703-052130** | **97003-052130** | **97503-052130** |
| – | – | – |
| – | – | – |
| – | – | – |
| - | – | – |
| **97703-104630** | **97003-104630** | **97503-104630** |
| – | – | **97503-152130** |
| **97703-154630** | **97003-154630** | **97503-154630** |
| **97705-012101** | **97005-012101** | **97505-012101** |
| **97705-013001** | **97005-013001** | **97505-013001** |
| **97705-014001** | **97005-014001** | **97505-014001** |
| **97705-032130** | **97005-032130** | **97505-032130** |
| **97705-052130** | **97005-052130** | **97505-052130** |
| **97705-053030** | **97005-053030** | **97505-053030** |
| **97705-054630** | **97005-054630** | **97505-054630** |
| **97705-102130** | **97005-102130** | **97505-102130** |
| **97705-103030** | **97005-103030** | **97505-103030** |
| **97705-104630** | **97005-104630** | **97505-104630** |
| **97705-152130** | **97005-152130** | **97505-152130** |
| **97705-153030** | **97005-153030** | **97505-153030** |
| **97705-154030** | **97005-154030** | **97505-154030** |
| **97705-154630** | **97005-154630** | **97505-154630** |
| – | – | – |
| **97705-253030** | **97005-253030** | **97505-253030** |
| **97705-254030** | **97005-254030** | **97505-254030** |
| **97705-254630** | **97005-254630** | **97505-254630** |

# Thermo Scientific Hypercarb HPLC Columns

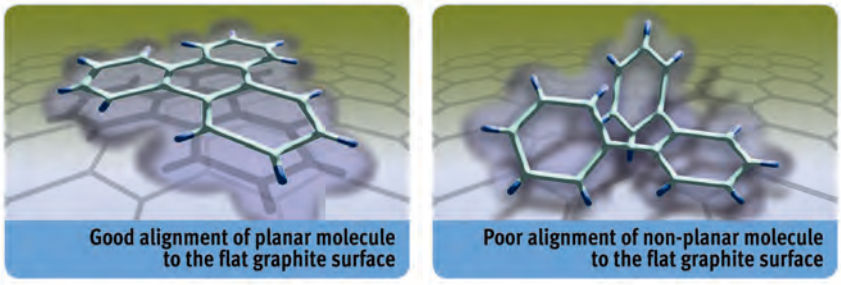
100% porous graphitic carbon for extended separation capabilities

- Exceptional retention of very polar analytes
- Separates structurally related substances
- pH stable from 0 to 14
- Ideal for high temperature applications

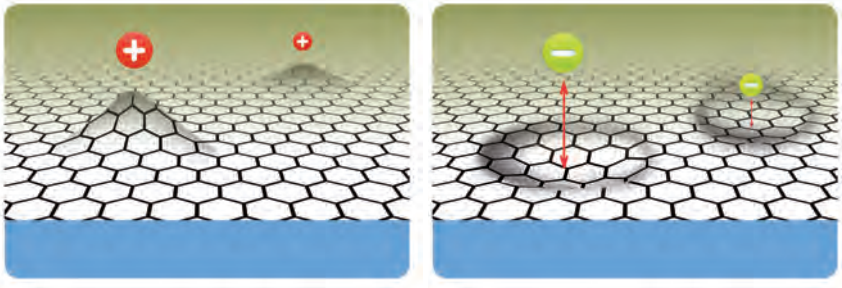



**Particle Size** 3µm, 5µm, 7µm

Porous Graphitic Carbon (PGC) is a unique stationary phase composed of flat sheets of hexagonally arranged carbon atoms with a satisfied valence, as in a very large polynuclear aromatic molecule. Thermo Scientific™ Hypercarb™ columns are unlike traditional silica bonded phases in both its structure and retentive properties, allowing for total pH stability and the retention and separation of highly polar species. Hypercarb columns are ideally suited to solve "problem" separations, in both reversed phase and normal phase HPLC and LC/MS applications.




*Schematic representation of molecular area of a planar and non-planar molecule interacting with the Hypercarb surface*



*Schematic representation of a point charge approaching the Hypercarb surface*

## Retention and Resolution

The mechanism of interaction is very dependent upon both the polarity and planarity (shape) of the solute. These specific interaction mechanisms allow the successful retention and resolution of analytes that cannot be separated by typical reversed phase HPLC. Removal of complex buffering systems or ion-pair reagents, and use of increased organic modifier concentration for polar analytes allows greater compatibility with detection techniques such as MS.

The overall retention on Hypercarb columns is a combination of two mechanisms:

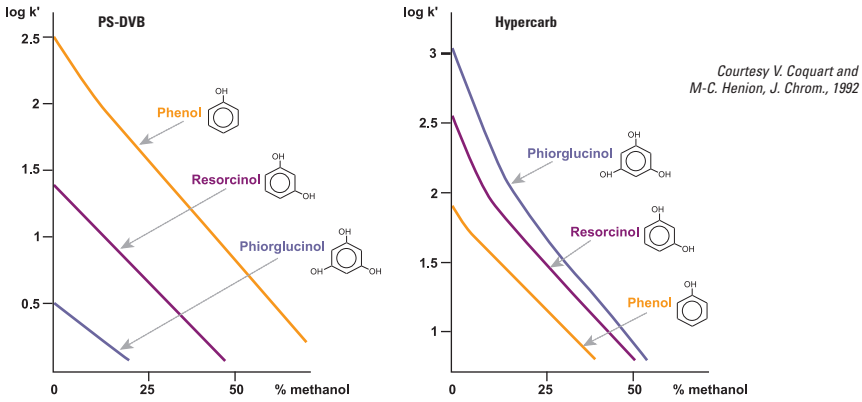
**1) Adsorption:** The strength of analyte interactions with Hypercarb columns is largely dependent on the molecular area in contact with the graphite surface, and also on the type and positioning of the functional groups in relation to the graphite surface at the points of contact. The approach of a planar and a non-planar molecule to the Hypercarb surface is shown in the diagrams above. The strength of the interaction depends upon the size and orientation of the molecular area that is able to come in contact with the flat graphite surface. More planar molecules will show more retention than rigid molecules with a 3-dimensional spatial arrangement.

**2) Charge induced interactions of a polar analyte with the polarizable surface of graphite:** The second mechanism, charge-induced dipole, is illustrated above and accounts for the strong retention exhibited by polar analytes. As the polar group with a permanent dipole approaches the surface, an induced dipole is formed, increasing the attraction between the analyte and graphite surface. These charges should not be confused with the overall ionic charge of the molecule, such as a basic compound ionized in acidic pH conditions. The charge-induced dipole mechanism is strictly due to the interaction of the electrostatic charge of the polar molecule with the graphite surface.

The strong mechanisms of interaction with Hypercarb columns usually allows for shorter columns to be used during the method development process. In most cases, 100mm length columns or shorter are sufficient for a separation.

## Increased Retention of Polar Analytes

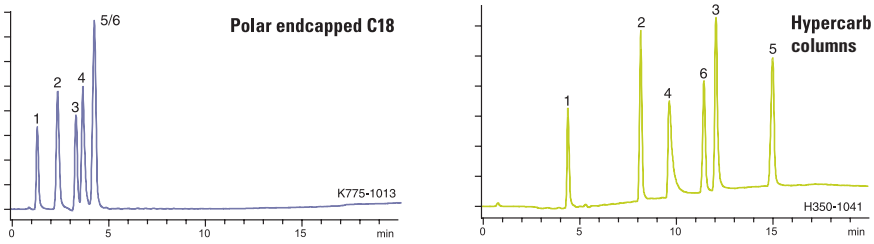
In typical reversed phase chromatography, the retention of an analyte is directly related to its hydrophobicity: the more hydrophobic the analyte, the longer its retention. Conversely, as the polarity of the analyte increases, analyte-solvent interactions begin to dominate and retention is reduced. This observation holds true for the majority of reversed phase systems. An exception to this rule is Hypercarb columns, for which retention may in some cases increase as the polarity of the analyte increases, illustrated to the right. This phenomenon is referred to as the "polar retention effect on graphite" (PREG). This property makes Hypercarb columns particularly useful for the separation of highly polar compounds (with logP as low as -4) that are normally difficult to retain and resolve on silica-based alkyl chain phases. The retention of very polar solutes on Hypercarb columns can be achieved without ion pair reagents or complex mobile phase conditions, as illustrated in the chromatogram below.




*Retention on Hypercarb columns increases as polarity of the analyte increases, which is the opposite of typical reversed phase materials such as PS-DVB*

## Extended pH Range

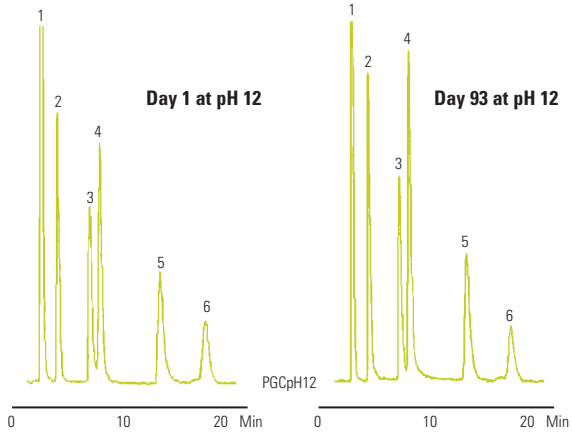
One of the other key benefits of Hypercarb columns is the extreme stability of the phase to chemical or physical attack. Due to the unique characteristics of the media, it can withstand chemical attack across the entire pH range of 0 to 14, allowing applications to be run at pH levels that are incompatible with typical silica-based columns. Hypercarb columns offer more choice in buffer selection while handling both high temperature and high pressure.




*Additional retention is achieved for polar compounds using a Hypercarb column compared to a polar endcapped C18. Note also the change in elution order.*

**Hypercarb column, 5µm, 100 x 0.32mm**
Part Number: 35005-100365

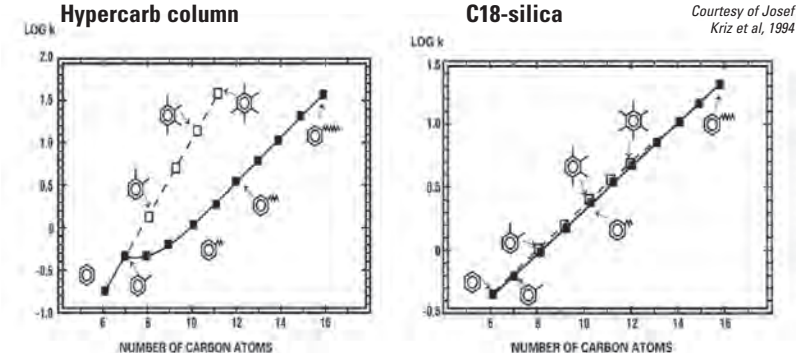
| | |
|---|---|
| Mobile Phase: | A: $H_2O$ + 0.1% formic acid |
| | B: ACN + 0.1% formic acid |
| Gradient: | 0 to 25% B in 15 minutes |
| Flow Rate: | 8µL/min |
| Temperature: | 25°C |
| Detection: | UV at 254nm |
| Analytes: | 1. Cytosine<br>2. Uracil<br>3. Guanine<br>4. Adenine<br>5. Xanthine<br>6. Thymine |



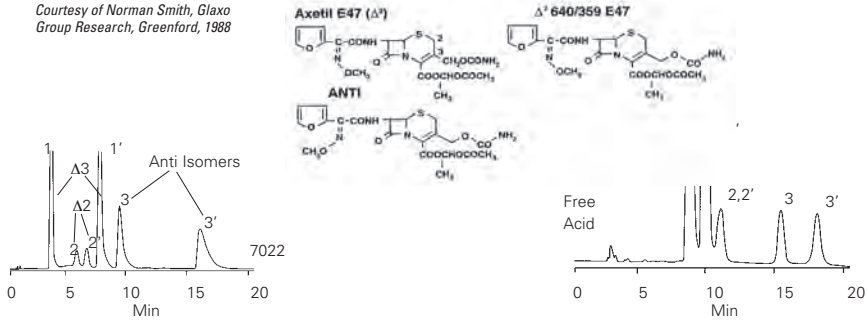

**Hypercarb column, 5µm, 100 x 4.6mm**

| | |
|---|---|
| Part Number: | 35005-104630 |
| Mobile Phase: | MeOH:$H_2O$ |
| Isocratic: | 70:30 |
| Flow Rate: | 0.7mL/min |
| Detection: | UV at 254nm |
| Sample: | 1. Acetone<br>2. Phenol<br>3. p-Cresol<br>4. Anisol<br>5. Phenetole<br>6. 3,5 -Xylenol |

*Hypercarb column stability at pH 12: retention and selectivity do not change even after 93 days of storage in 0.1M NaOH/MeOH*




*Comparison of methyl and methylene group selectivity on C18 and Hypercarb columns*




**Hypercarb column, 5µm, 100 x 4.6mm**

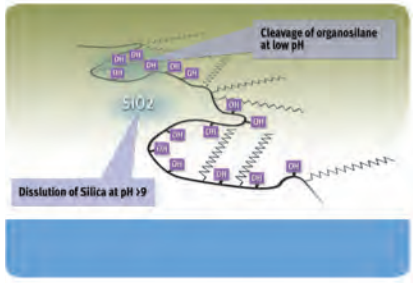
| | |
|---|---|
| Part Number: | 35005-104630 |
| Mobile Phase: | ACN:$H_2O$:MeOH:Dioxan |
| Isocratic: | 38:20:35:10 |
| Flow Rate: | 1mL/min |
| Detector: | UV at 254nm |

**Hypersil SAS, 5µm, 200 x 4.6mm**

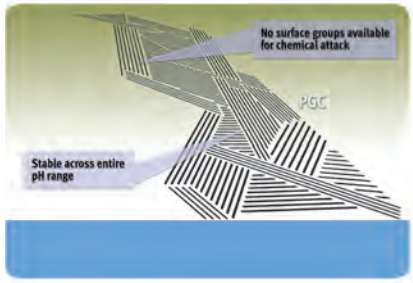
| | |
|---|---|
| Part Number: | 30505-204630 |
| Mobile Phase: | MeOH:0.05M $NH_4H_2PO_4$ |
| Isocratic: | 38:62 |
| Flow Rate: | 1mL/min |
| Detector: | UV at 254nm |

*Separation of geometric isomers of Axetil: comparison of a Hypercarb and bonded silica column*

**Typical C18 silica**




**Hypercarb**




*Surface comparison between C18 bonded silica and Hypercarb porous graphitic carbon*

## Resolution of Structurally Related Compounds

By virtue of the nature of the surface and the way solute shape affects retention, Hypercarb columns can differentiate between closely related analytes such as isomers and homologous series. Where no discrimination between methylene and methyl groups is observed using a traditional C18 column, considerable resolving power is observed with Hypercarb columns, as shown above. The differentiation of analytes is based on their fit to the graphite surface, allowing for the chromatographic resolution of compounds that are very similar in structure as shown above with the resolution of diastereomers of the antibiotic Axetil. The Hypercarb column provides both a significant improvement in separation over the silica-based column originally used, as well as a change in elution order.

## Ideal for Reversed Phase LC/MS of Polar Compounds

Reversed phase-LC/MS analysis of very polar compounds is challenging because the typical hydrophobic stationary phases when combined with the most suitable mobile phases for MS detection do not provide the necessary retention to resolve and quantify these compounds.

A Hypercarb column overcomes these challenges because it:

- Retains and separates very polar compounds using "MS friendly" mobile phases such as 0.1% formic or acetic acid and low concentrations of volatile buffers such as ammonium acetate or ammonium formate
- Can be used with high concentrations of organic modifiers in the mobile phase, which improves nebulization in atmospheric pressure ionization techniques, improving the sensitivity of the analysis.
- Allows shorter column lengths and smaller diameters to be used without compromising peak capacity, often with increased sensitivity. The flow rates used with narrowbore and capillary columns are more compatible with MS techniques.
- Is stable with any mobile phase and produces no phase bleed issues because the Hypercarb column's porous graphitic surface is not modified.

# Hypercarb Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 3 | Drop-in Guard (4/pk) | 10 | 1.0 | **35003-011001** |
| | | | 2.1 | **35003-012101** |
| | | | 3.0 | **35003-013001** |
| | | | 4.6 | **35003-014001** |
| | HPLC Column | 30 | 1.0 | **35003-031030** |
| | | | 2.1 | **35003-032130** |
| | | | 3.0 | **35003-033030** |
| | | 50 | 1.0 | **35003-051030** |
| | | | 2.1 | **35003-052130** |
| | | | 3.0 | **35003-053030** |
| | | | 4.6 | **35003-054630** |
| | | 100 | 1.0 | **35003-101030** |
| | | | 2.1 | **35003-102130** |
| | | | 3.0 | **35003-103030** |
| | | | 4.6 | **35003-104630** |
| | | 150 | 2.1 | **35003-152130** |
| | | | 3.0 | **35003-153030** |
| | | | 4.6 | **35003-154630** |
| | High Temperature HPLC Column | 30 | 2.1 | **35003-032146** |
| | | 50 | 2.1 | **35003-052146** |
| | | | 4.6 | **35003-054646** |
| | | 100 | 1.0 | **35003-101046** |
| | | | 2.1 | **35003-102146** |
| | | | 3.0 | **35003-103046** |
| | | | 4.6 | **35003-104646** |
| 5 | Drop-in Guard (4/pk) | 10 | 1.0 | **35005-011001** |
| | | | 2.1 | **35005-012101** |
| | | | 3.0 | **35005-013001** |
| | | | 4.6 | **35005-014001** |
| | HPLC Column | 30 | 2.1 | **35005-032130** |
| | | | 3.0 | **35005-033030** |
| | | | 4.6 | **35005-034630** |
| | | 50 | 1.0 | **35005-051030** |
| | | | 2.1 | **35005-052130** |
| | | | 3.0 | **35005-053030** |
| | | | 4.6 | **35005-054630** |
| | | 100 | 1.0 | **35005-101030** |
| | | | 2.1 | **35005-102130** |
| | | | 3.0 | **35005-103030** |
| | | | 4.6 | **35005-104630** |
| | | 150 | 1.0 | **35005-151030** |
| | | | 2.1 | **35005-152130** |
| | | | 3.0 | **35005-153030** |
| | | | 4.6 | **35005-154630** |
| | High Temperature HPLC Column | 30 | 2.1 | **35005-032146** |
| | | | 4.6 | **35005-034646** |
| | | 50 | 2.1 | **35005-052146** |
| | | | 4.6 | **35005-054646** |
| | | 100 | 2.1 | **35005-102146** |
| | | | 4.6 | **35005-104646** |
| | Javelin HTS Column | 20 | 2.1 | **35005-022135** |
| | Preparative HPLC Column | 100 | 10 | **35005-109070** |
| | | | 21.2 | **35005-109270** |
| | | | 30 | **35005-109370** |
| | | 150 | 10 | **35005-159070** |
| | | | 21.2 | **35005-159270** |

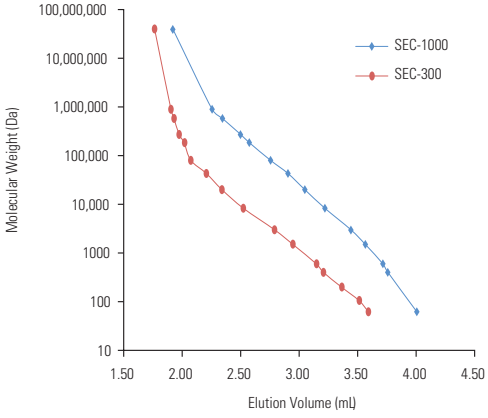
| Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|
| UNIGUARD Guard Cartridge Holder | 10 | 1.0 | **851-00** |
| | | 2.1 | **852-00** |
| | | 3.0 | **852-00** |
| | | 4.6 | **850-00** |

# Acclaim Size Exclusion Chromatography (SEC)

## High Performance SEC Columns for Analysis of Water Soluble Polymers

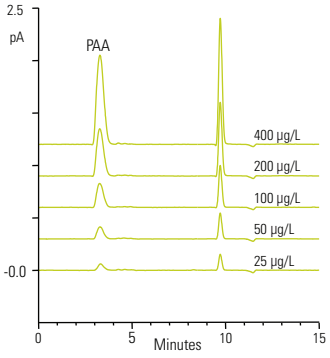
- Proprietary mono-dispersed multi-pore hydrophilic resin: no inflection points in calibration curve
- SEC-300 calibrated from 100 to 50,000 Daltons
- SEC-1000 calibrated from 1,000 to 1,000,000 Daltons
- Availability of small particle sizes packed in 4.6 x 300mm dimension allows for high-resolution analysis at reduced solvent consumption
- Stable surface bonding with low column bleed and compatibility with UV, RI, MS, ELSD and Thermo Scientific™ Dionex™ Corona™ Charged Aerosol Detectors

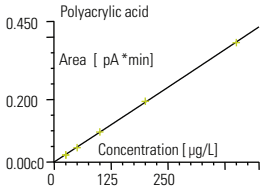
Thermo Scientific™ Acclaim™ SEC-300 and SEC-1000 are a family of resin based, high performance size exclusion chromatography columns specifically designed for the separation of water soluble polymers and oligomers. Acclaim SEC columns are available in two sizes to cover a broad molecular weight range: 5µm, 300 Å for Acclaim SEC-300 and 7µm, 1000 Å for Acclaim SEC-1000.




| **Columns:** | **Acclaim SEC-300**<br>**Acclaim SEC-1000** |
|---|---|
| Dimensions: | 4.6 x 300mm |
| Mobile Phases: | 10mM sodium perchlorate |
| Flow rate: | 0.35mL/min |
| Temperature: | 25°C |
| Injection Volume: | 50µL |
| Detection: | RI |
| Samples: | (0.03% - 0.1% in mobile phase) dextran (MW 5,000,000-40,000,000), PEO (MW 895,000, 580,000, 272,000, 185,000, 80,000, 43,000, and 20,000), PEG (MW 8,300, 3,000, 1,500, 600, 400 and 200), diethylene glycol (MW 106 and ethylene glycol (MW 62) |

## Polyacrylic acid using size-exclusion chromatography with charged-aerosol detection




**HPLC Conditions**

Column: Acclaim SEC-300

| | |
|---|---|
| Dimensions: | 5µm, 4.6 x 300mm |
| System: | UltiMate 3000 RS |
| Mobile Phases: | A: Acetonitrile |
| | B: Water |
| Isocratic: | 10:90 |
| Flow rate: | 0.35mL/min |
| Injection: | 35µL |
| Temperature: | 30°C |
| Detection: | Corona III; evaporator 55°C, Engine 40 °C, 2 Hz, filter 5, power function 1.20 |
| Peaks: | 1. PAA standards in water |

## Acclaim SEC Ordering Guide

| Description | Particle Size (µm) | Format | Length (mm) | 4.6 mm ID | 7.8 mm ID |
|---|---|---|---|---|---|
| Acclaim SEC-300 | 5 | Guard | 33 | **082740** | – |
| | | HPLC Column | 150 | – | **079726** |
| | | | 300 | **079723** | **079725** |
| Acclaim SEC-1000 | 7 | Guard | 33 | **082739** | – |
| | | HPLC Column | 150 | – | **079722** |
| | | | 300 | **079724** | **079721** |

# Thermo Scientific Application Specific LC Columns

Innovative chemistries tailored for challenging and critically important applications

- Acclaim Trinity P1 and P2 for API and counterion analysis
- Acclaim Organic Acid for fast organic acid analysis
- Acclaim Surfactant and Surfactant Plus columns for separation of surfactants
- Acclaim Explosives for separation of explosive residues
- Acclaim Trinity Q1 for diquat and paraquat analysis
- Acclaim Carbamate for the separation of carbamate insecticides
- Acclaim Carbonyl C18 for aldehyde and ketone separation
- Hypersil Green PAH for polyaromatic hydrocarbon analysis


Thermo Scientific application specific columns are based on novel and unique chemistries and provide superior resolution with ease-of-use.

### Acclaim Trinity P1 and P2

Application specific columns designed for the simultaneous separation of pharmaceutical drug substances and counterion analysis, as well as mixtures of acidic, basic, and neutral drugs.

### Acclaim Organic Acid

Designed for separation of hydrophilic, aliphatic, and aromatic organic acids.

### Acclaim Surfactant and Surfactant Plus

The most versatile commercially-available column specifically for the separation of all classes of surfactants.

### Acclaim Explosives

Optimized column chemistry for baseline separation of all 14 explosives in EPA Method 8330, with complementary selectivity.

### Acclaim Trinity Q1

Unique, high-efficiency, silica-based columns designed for the separation of the herbicides diquat and paraquat.

### Acclaim Carbamate

A specifically column for the separation of carbamate pesticide specified in US EPA Method 531.2.

### Acclaim Carbonyl C18

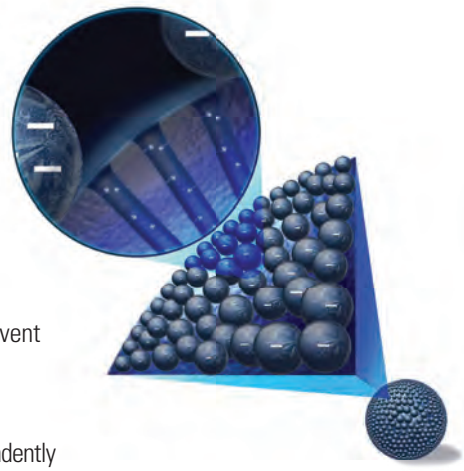
Designed for separating DNPH derivatives of aldehydes and ketones in air, water and soil using CARB Method 1004, EPA Method 554, EPA Method 8315 and related methods.

### Hypersil Green PAH

Specially tailored alkyl bonded silica with a high carbon loading, designed specifically for the analysis of polyaromatic hydrocarbons (PAHs), specified in EPA Method 610.

# Acclaim Trinity P1

Most innovative advancement in mixed mode column technology:
reverse-phase, anion- and cation exchange functionality on a single support



- Ideal selectivity for simultaneous separation of API and counterion
- Adjustable selectivity by mobile phase ionic strength, electrolyte type, pH, and organic solvent
- Low bleed; compatible with MS, CAD and ELSD.
- Retention of hydrophilic ionic and ionizable analytes without ion-pairing reagents
- Greater flexibility in method development: each retention mechanisms can be controlled independently

The Thermo Scientific™ Acclaim™ Trinity™ P1 HPLC column is designed with unique multimode surface chemistry ideal for the simultaneous separation of drugs and their counterions. The surface chemistry concurrently provides reversed-phase, cation exchange, and anion exchange functionalities. The result is maximum flexibility in method development. Separations can be optimized easily by adjusting the chromatographic parameters (mobile phase pH, ionic strength, and organic strength).

The Acclaim Trinity P1 stationary phase, based on this Nanopolymer Silica Hybrid (NSH) technology, consists of high-purity porous, spherical 3µm silica particles, coated with charged nanopolymer beads. The unique surface chemistry includes an inner-pore area modified with an organic layer that provides both reversed phase and anion exchange properties. The outer-pore surface, conversely, is modified with cation exchange functionality.

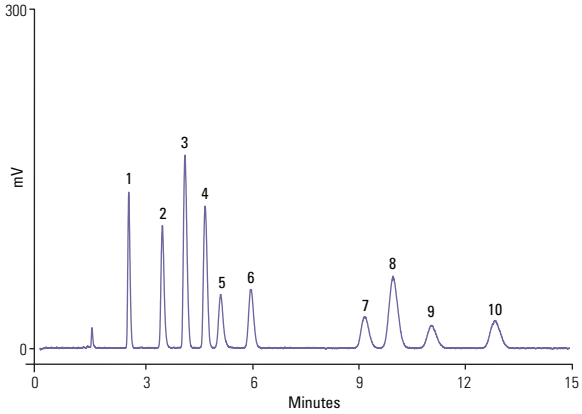
## Acclaim Trinity P1 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.1mm ID | 3.0mm ID |
|---|---|---|---|---|
| 3 | Guard Cartridges (2/pk) | 10 | **071391** | **071390** |
| | HPLC Column | 50 | **075565** | **071388** |
| | | 100 | **071389** | **071387** |
| | | 150 | **075564** | **075563** |

## Acclaim Guard Holder Ordering Guide

| Format | Cat. No. |
|---|---|
| Acclaim SST Guard Cartridge Holder V-2 | **069580** |
| Acclaim Guard Kit (Holder and coupler) V-2 | **069707** |
| Guard to Analytical Column Coupler V-2 | **074188** |

### Simultaneous separation of pharmaceutical counterions




**Column: Acclaim Trinity P1, 3µm**

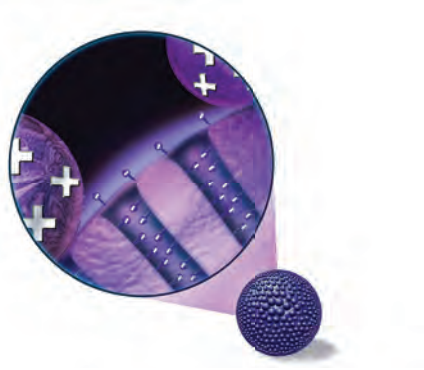
| | |
|---|---|
| Dimensions: | 3.0 × 100mm |
| Mobile Phase: | 60/40 v/v $CH_3CN$/20mM (total) $NH_4OAc$, pH 5 |
| Temperature: | 30°C |
| Flow Rate: | 0.5mL/min |
| Inj. Volume: | 2µL |
| Detection: | Corona ultra (Gain = 100 pA; Filter = med; Neb Temp = 30°C) |

Peaks: (50 to 100ppm)

1. Choline
2. Tromethamine
3. Sodium
4. Potassium
5. Meglumine
6. Mesylate
7. Nitrate
8. Chloride
9. Bromide
10. Iodide

# Acclaim Trinity P2

Most innovative mixed-mode column technology; hydrophilic interaction, HILIC, anion exchange and cation exchange functionalities

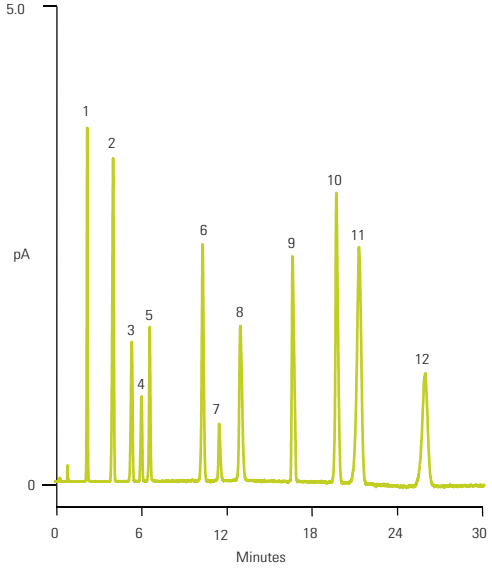


- Ideal for separating pharmaceutical counterions, including monovalent and divalent cations or anions
- Selectivity complementary to the Trinity P1 column
- Low column bleed, compatible with CAD and MS
- Hydrolytically stable
- High efficiency

The Acclaim Trinity P2 is a unique, high-efficiency, silica-based column specifically designed for separation of pharmaceutical counterions, including monovalent and divalent cations or anions.

The Acclaim Trinity P2 column is based on NSH technology, which consists of high-purity porous spherical silica particles coated with charged nanopolymer particles. The inner-pore area of the silica bead is modified with a covalently bonded organic layer that provides cation-exchange retention, while the outer surface is modified with anion-exchange nano-polymer beads. This chemistry ensures spatial separation of the anion-exchange and cation-exchange regions. Acclaim Trinity P2 column is aimed to complement Acclaim Trinity P1 to provide a total solution for pharmaceutical counter ion analysis by HPLC.

**Pharmaceutical-related anions and cations**




**Column: Acclaim Trinity P2, 3µm**

| | |
|---|---|
| Dimensions: | 3.0 x 100 mm |
| Mobile phase: | D.I. water and 100 mM NH4OFm, pH 3.65 gradient |
| Temperature: | 30°C |
| Flow rate: | 0.60 mL/min |
| Injection volume: | 2µL |
| Detection: | Corona Veo Charged Aerosol Detector |
| Samples: | 0.02 – 0.10 mg/mL each in D.I. water |
| Peaks: | 1. Phosphate<br>2. Sodium<br>3. Potassium<br>4. Chloride<br>5. Malate<br>6. Bromide<br>7. Nitrate<br>8. Citrate<br>9. Fumarate<br>10. Sulfate<br>11. Magnesium<br>12. Calcium |

| Time (min) | $H_2O$ | 0.1 M Ammonium formate, pH3.65 |
|---|---|---|
| -10 | 0.760 | 1.474 |
| 0 | 80 | 20 |
| 2 | 80 | 20 |
| 22 | 0 | 100 |
| 30 | 0 | 100 |

## Acclaim Trinity P2 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.1 mm ID | 3.0 mm ID |
|---|---|---|---|---|
| 3 | Guard Cartridges (2/pk) | 10 | **085435** | **085436** |
| | HPLC Column | 50 | **085431** | **085433** |
| | | 100 | **085432** | **085434** |

## Acclaim Guard Holder Ordering Guide

| Format | Cat. No. |
|---|---|
| Acclaim Guard Cartridge Holder V-2 | **069580** |
| Acclaim Guard Kit (Holder and coupler) V-2 | **069707** |
| Guard to Analytical Column Coupler V-2 | **074188** |

# Acclaim Organic Acid

Optimized and application-tested for the analysis of hydrophilic organic acids

- Use-tested to guarantee consistent hydrophilic organic acid separations
- Compatible with 100% aqueous mobile phases
- Hydrolytic stability at low-pH conditions
- Ideal selectivity for separating a wide spectrum of organic acids
- Excellent column efficiency and peak shapes for organic acids

The Acclaim Organic Acid (OA) is a silica-based reversed-phase column designed for high-efficiency, high-throughput organic acids analysis. It offers unparalleled performance for separating hydroxyl aliphatic and aromatic organic acids.

The Acclaim OA is the recommended column for determining small hydrophilic organic acids, C1 to C7 aliphatic acids, and hydrophilic aromatic acid and is also valuable for the analysis and quality assurance of food and beverage products, pharmaceutical preparations, plating baths, and manufacturing chemicals, chemical intermediates, and environmental samples.

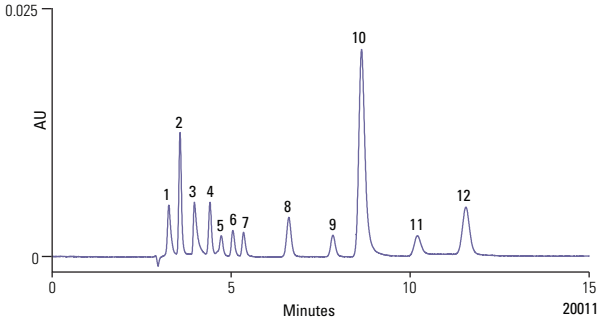
## Acclaim Organic Acid Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.1mm ID | 3.0mm ID | 4.0mm ID |
|---|---|---|---|---|---|
| 3 | HPLC Column | 150 | **070087** | **070086** | – |
| 5 | Guard Cartridges (2/pk) | 10 | – | **071987** | **069700** |
| | HPLC Column | 150 | – | – | **062903** |
| | | 250 | – | – | **062902** |

## Acclaim Guard Holder Ordering Guide

| Format | Cat. No. |
|---|---|
| Acclaim SST Guard Cartridge Holder V-2 | **069580** |
| Acclaim Guard Kit (Holder and coupler) V-2 | **069707** |
| Guard to Analytical Column Coupler V-2 | **074188** |

### Hydrophilic organic acids




**Column: Acclaim OA, 5µm, 4 × 250mm**

| | |
|---|---|
| Mobile phase: | 100mM $Na_2SO_4$, pH 2.65 (adjusted with methanesulfonic acid) |
| Temperature: | 30°C |
| Flow rate: | 0.6mL/min |
| Injection volume: | 5µL |
| Detection: | UV, 210nm |
| Peaks: | 1. Oxalic acid 15mg/L (ppm)<br>2. Tartaric acid 120<br>3. Formic acid 180<br>4. Malic acid 120<br>5. iso-Citric acid 120<br>6. Lactic acid 180<br>7. Acetic acid 120<br>8. Citric acid 120<br>9. Succinic acid 120<br>10. Fumaric acid 7<br>11. cis-Aconitic acid *<br>12. trans-Aconitic acid * |

* 7ppm total for cis and trans isomers

# Acclaim Surfactant

Excellent performance for separating a broad range of surfactants

- Ideal selectivity for separation of anionic, nonionic, cationic and amphoteric surfactants
- Excellent peak shapes, especially for cationic surfactants
- Compatible with highly aqueous mobile phases
- Improved resolution for ethoxylated surfactants
- Rugged separations under a variety of conditions

The Acclaim Surfactant columns are the first generation high-efficiency, silica-based columns designed specifically for separating a wide variety of surfactants, including anionic, cationic, nonionic, and amphoteric surfactants using UV, ELSD or RI detection.
As a consequence of its novel chemistry, this column exhibits a unique polarity that provides significantly improved resolution for individual oligomers of ethoxylated surfactants compared with conventional C18 columns.

Acclaim Surfactant columns are also resistant to dewetting under highly aqueous mobile phase conditions, and thus can be used to provide excellent resolution between strongly hydrophilic compounds, such as isomers of xylene sulfonate.

Surfactants are widely used in industrial, agricultural, and pharmaceutical markets, in products as diverse as pesticides, detergents powders, petroleum products, cosmetics, and pharmaceuticals. The Acclaim Surfactant column was designed specifically for HPLC separation of these surfactants.

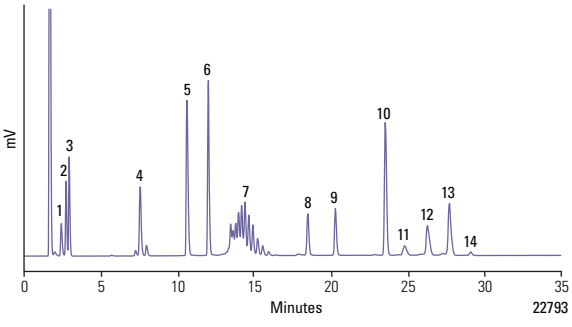
## Acclaim Surfactant Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.1mm ID | 3.0mm ID | 4.6mm ID |
|---|---|---|---|---|---|
| 3 | HPLC Column | 150 | **070085** | **070084** | – |
| 5 | Guard Cartridges (2/pk) | 10 | **069693** | **071991** | **069701** |
| | HPLC Column | 150 | **068123** | – | **063201** |
| | | 250 | – | – | **063203** |

## Acclaim Guard Holder Ordering Guide

| Description | Cat. No. |
|---|---|
| Acclaim SST Guard Cartridge Holder V-2 | **069580** |
| Acclaim Guard Kit (Holder and coupler) V-2 | **069707** |
| Guard to Analytical Column Coupler V-2 | **074188** |

### Inorganic anion, hydrotropes, cationic, nonionic, amphoteric, and anionic surfactants

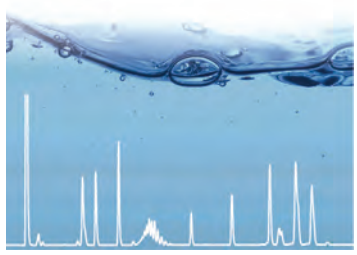



| Column: | Acclaim Surfactant, 5µm |
|---|---|
| Dimensions: | 4.6 × 150mm |
| Mobile Phase: | (A) $CH_3CN$, (B) 0.1 M $NH_4OAc$, pH 5.4 |
| Gradient: | 25% to 85% A in 25min, then hold 85% A for 10min |
| Temperature: | 30°C |
| Flow Rate: | 1mL/min |
| Inj. Volume: | 25µL |
| Detection: | ELS detector |

Peaks:
1. Chloride
2. Bromide
3. Nitrate
4. Xylene sulfonate
5. Laurylpyridinium chloride
6. Lauryldimethylbenzyl-ammonium chloride
7. Triton X-100
8. Cetyl betaine
9. Decyl sulfate
10. Dodecyl sulfate
11. $C_{10}$-LAS
12. $C_{11}$-LAS
13. $C_{12}$-LAS
14. $C_{13}$-LAS

# Acclaim Surfactant Plus

## Column of Choice for Surfactant Analysis using Higher Sensitivity Detection: Performance, Versatility, Throughput

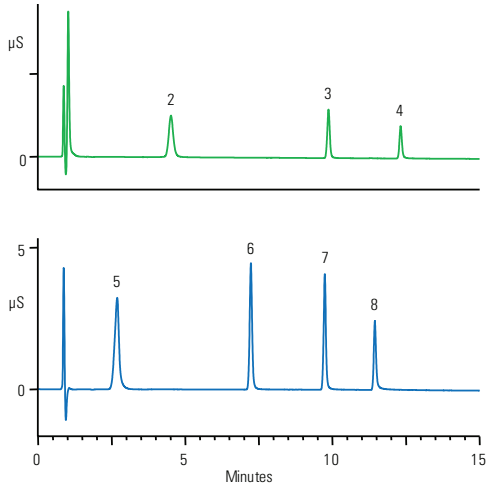


- Ideal selectivity for simultaneous separation of anionic, nonionic, cationic, and amphoteric surfactants
- Compatible with multiple detectors including MS, CAD, ELSD and UV
- Well suited for the determination of cationic surfactants
- High efficiency and fast analysis
- Rugged separations under a variety of conditions

Acclaim Surfactant Plus is a new generation of columns offering improved performance and higher throughput for analyzing surfactants. They have similar selectivity to the Acclaim Surfactant columns, but have been designed with exceptionally low bleed for use with charged aerosol detectors (CAD) and mass spectrometers (MS). These columns can be used to separate a wide variety of surfactants including anionic, cationic, nonionic and amphoteric surfactants.

Additionally, these columns can be used with evaporative light scattering detectors (ELSD), suppressed conductivity detectors (SCD), and UV-Vis detectors (UV). They are resistant to dewetting under highly aqueous mobile phase conditions, and thus can be used to provide excellent resolution between strongly hydrophilic compounds, such as isomers of xylene sulfonate. Non-metallic PEEK hardware is available for best compatibility with Dionex ion chromatography systems.

**Cationic surfactants**




| **Column:** | **Acclaim Surfactant Plus, 3µm** |
|---|---|
| Dimensions: | 3.0 × 150 mm |
| System: | ICS 3000 |
| Mobile phases: | A: Acetonitrile<br>B: 100mM Formic acid<br>C: Water |

Gradient:

| Time (min) | %A | %B | %C |
|---|---|---|---|
| -12 | 5 | 5 | 90 |
| 0 | 5 | 5 | 90 |
| 12 | 40 | 5 | 55 |
| 20 | 40 | 5 | 55 |

| | |
|---|---|
| Flow Rate: | 0.5 mL/min |
| Injection: | 5 µL |
| Temperature: | 25°C |
| Detection: | Conductivity with blank subtraction |
| Suppressor: | CSRS300-2mm (external water<br>1.0 mL/min, current = 8 mA) |

Peaks:
1. Tetrabutylammonium
2. Tetrapentylammonium
3. Tetrahexylammonium
4. Tetraheptylammonium
5. Decyl-trimethylammonium
6. Dodecyl-trimethylammonium
7. Tetradecyl-trimethylammonium
8. Hexadecyl-trimethylammonium

## Acclaim Surfactant Plus Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.1mm | 3.0 mm | 4.6 mm | 4.0 mm PEEK |
|---|---|---|---|---|---|---|
| 3 | HPLC Column | 100 | **078955** | **078952** | – | – |
| | | 150 | **078954** | **078951** | **078950** | – |
| | | 250 | **078953** | – | – | – |
| 5 | Guard Cartridges (2/pk) | 10 | **078960** | **078959** | **082773** | – |
| | HPLC Column | 250 | – | – | **082767** | – |
| | | 150 | – | – | **082768** | **078956** |

## Acclaim Guard Holder Ordering Guide

| Description | Cat. No. |
|---|---|
| Acclaim SST Guard Cartridge Holder V-2 | **069580** |
| Acclaim Guard Kit (Holder and coupler) V-2 | **069707** |
| Guard to Analytical Column Coupler V-2 | **074188** |

# Acclaim Explosives

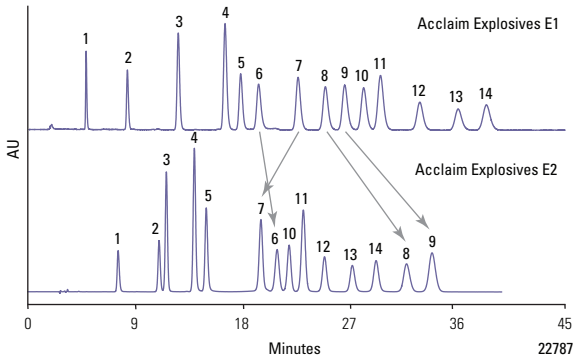
The best solution for explosives analysis (EPA Method 8330)

- Both Acclaim E1 and E2 columns provide baseline resolution of all 14 compounds targeted by EPA Method 8330
- E2 columns available in 2.2, 3 and 5µm particle size
- The E1 and E2 columns have mutually complementary selectivity
- Simple isocratic elution conditions
- Rugged columns with good lot-to-lot reproducibility

Acclaim Explosives E1 and E2 columns are specifically designed to resolve all 14 explosives listed in EPA SW-846 Method 8330: Nitroaromatics and Nitramines by HPLC. The novel and unique chemistries of these columns provide superior resolution with complementary selectivities.

The Acclaim Explosives E1 is recommended for use as a direct replacement for ODS columns for the primary analysis. The Acclaim Explosives E2 may be used as either a primary or a confirmatory column. The unique selectivity and versatility of Acclaim Explosives E2 column provides a wider application range, including the analysis of explosives beyond U.S. EPA Method 8330 (ISO22478).

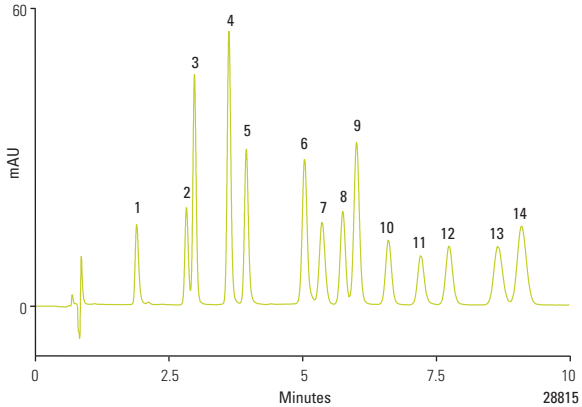
**Complimentary baseline separation of 14 target compounds listed in EPA SW-846 method 8330**




**Column: 5µm, 4.6 x 250mm**

| | |
|---|---|
| Column: | 5µm, 4.6 x 250mm |
| Eluent: | EPA 8330 mix, 50 ppm each |
| Temperature: | 30 °C |
| Flow Rate: | 1 mL/min |
| Inj. Volume: | 5µL |
| Detection: | UV, 254nm |
| Peaks: | 1. HMX<br>2. RDX<br>3. 1,3,5-Trinitrobenzene<br>4. 1,3-Dinitrobenzene<br>5. Nitrobenzene<br>6. Tetryl<br>7. 2,4,6-Trinitrotoluene<br>8. 4-Amino-2,6-Dinitrotoluene<br>9. 2-Amino-4,6-Dinitrotoluene<br>0. 2,6-Dinitrotoluene<br>11. 2,4-Dinitrotoluene<br>12. 2-Nitrotoluene<br>13. 4-Nitrotoluene<br>14. 3-Nitrotoluene |

**Rapid determination of EPA 8330A explosives**




**Column: Acclaim RSLC Explosives E2, 2.2µm**

| | |
|---|---|
| Dimension: | 2.1 × 100mm |
| HPLC System: | UltiMate 3000 RSLC HPG |
| Mobile Phases: | Methanol:water 48:52 (v/v) |
| Flow Rate: | 0.34mL/min (293 bar) |
| Injection Vol.: | 1µL |
| Temperature: | 31°C |
| Detection: | UV at 254nm, 10 Hz, 0.4 s resp. time |
| Sample: | Calibration mix, 25µg/mL in 50% acetontrile |
| Peaks: | 1. HMX<br>2. RDX<br>3. 1,3,5-TNB<br>4. 3,5-DNB<br>5. NB<br>6. 2,4,6-TNT<br>7. Tetryl<br>8. 2,6-DNT<br>9. 2,4-DNT<br>10. 2-NT<br>11. 4-NT<br>12. 3-NT<br>13. 4-Am-2,6-DNT<br>14. 2-Am-4,6-DNT |

# Acclaim Explosives Ordering Guide

## Acclaim Explosives E1 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.1mm ID | 3.0mm ID | 4.6mm ID |
|---|---|---|---|---|---|
| 5 | Guard Cartridges (2/pk) | 10 | – | – | **069702** |
| | HPLC Column | 250 | – | – | **064305** |

## Acclaim Explosives E2 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.1mm ID | 3.0mm ID | 4.6mm ID |
|---|---|---|---|---|---|
| 2.2 | RSLC Column | 100 | **076225** | **076227** | – |
| | | 150 | **076226** | – | – |
| 3 | HPLC Column | 150 | **070083** | **070082** | – |
| | | 250 | – | **070081** | – |
| 5 | Guard Cartridges (2/pk) | 10 | – | **071989** | **069703** |
| | HPLC Column | 250 | – | – | **064309** |

## Acclaim Guard Holder Ordering Guide

| Description | Cat. No. |
|---|---|
| Acclaim SST Guard Cartridge Holder V-2 | **069580** |
| Acclaim Guard Kit (Holder and coupler) V-2 | **069707** |
| Guard to Analytical Column Coupler V-2 | **074188** |

## Acclaim Explosives Kit Ordering Guide

| Description | Cat. No. |
|---|---|
| E1 and E2 HPLC Columns (4.6 x 250mm)<br>E1 and E2 Guard Cartridges (4.6 x 10mm), pkg of 2 | **064312** |

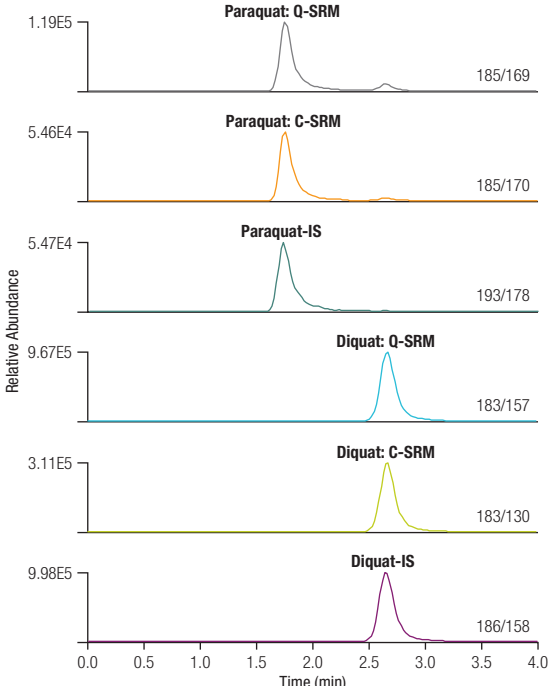
# Acclaim Trinity Q1

For Trace Analysis of Diquat and Paraquat

- Excellent resolution of diquat and paraquat
- Good peak shape
- Fast analysis
- LC/MS compatibility
- No ion-pairing reagent needed
- Easy to use

Acclaim Trinity Q1 columns are unique, high-efficiency, silica-based columns designed for the separation of the herbicides diquat and paraquat. These herbicides are toxic and residues are monitored in drinking water, wastewater and agricultural products. The Acclaim Trinity Q1 column is a tri-mode (WCX, WAX, RP), column based on Nano-polymer Silica Hybrid technology. It offers unmatched high-resolution and high-throughput trace analysis of the herbicides diquat and paraquat by LC-MS/MS and LC-UV methods.

### Diquat and paraquat




**Chromatographic Conditions**

| | |
|---|---|
| System: | Thermo Scientific Dionex UltiMate 3000 RSLC system |
| Column: | **Acclaim Trinity Q1, 3µm** |
| Column Temp: | Ambient |
| Mobile Phase: | 25% Ammonium Acetate (100 mM, pH 5.0); 75% Acetonitrile |
| Flow Rate: | 0.5 mL/min |
| Injection: | 5µL |

**Mass Spectrometric Conditions**

| | |
|---|---|
| System: | Thermo Scientific Quantum TSQ Access MAX Quadrupole Mass Spectrometer |
| Interface: | Heated Electrospary Ionization with HESI II probe |
| Spray Voltage: | 1500 V |
| Vaporizer Temp: | 400 °C |
| Sheath Gas Pressure: | 70 |
| Aux Gas Pressure: | 10 |
| Capillary Temp: | 350 °C |
| Quantitation Mode: | Selected Reaction Monitoring (SRM) |

| Scan Events | Precursor | Quantitative SRM (CID) | Confirmative SRM (CID) |
|---|---|---|---|
| Paraquat | 185 | 169 (27) | 170 (17) |
| Paraquat-$d_6$ | 193 | 178 (17) | |
| Diquat | 183 | 157 (22) | 130 (31) |
| Diquat-$d_3$ | 186 | 158 (22) | |

## Acclaim Trinity Q1 Ordering Guide

| Particle Size | | Length (mm) | 3.0 mm ID | 2.1 mm ID |
|---|---|---|---|---|
| 3 | HPLC Column | 50 | **079716** | **079718** |
| 5 | Guard Cartridges (2/pk) | 10 | **079719** | **079720** |

# Acclaim Carbamate

Designed for baseline separation of carbamate pesticides specified in US EPA Method 531.2

- Baseline separation of carbamate pesticides specified in US EPA Method 531.2
- Use with either LC/postcolumn derivatization/fluorescence or LC/MS detection
- Available in 2.2, 3 and 5µm particle size
- Compatible with both binary (methanol/water) and ternary (acetonitrile/methanol/water) mobile phase gradients
- High-efficiency, extremely low column bleed, and rugged column packing

Acclaim Carbamate columns are designed for baseline separation of carbamates (*N*-methylcarbamate and *N*-methylcarbamoyloxime pesticides) specified in US EPA Method 531.2. Carbamate pesticides are widely used throughout the world.
Drinking water and raw surface water is monitored for the presence of carbamate pesticides and related compounds using an established EPA Method 531.2 that uses HPLC with postcolumn derivatization. LC-MS is the method of choice for the ultimate sensitivity.

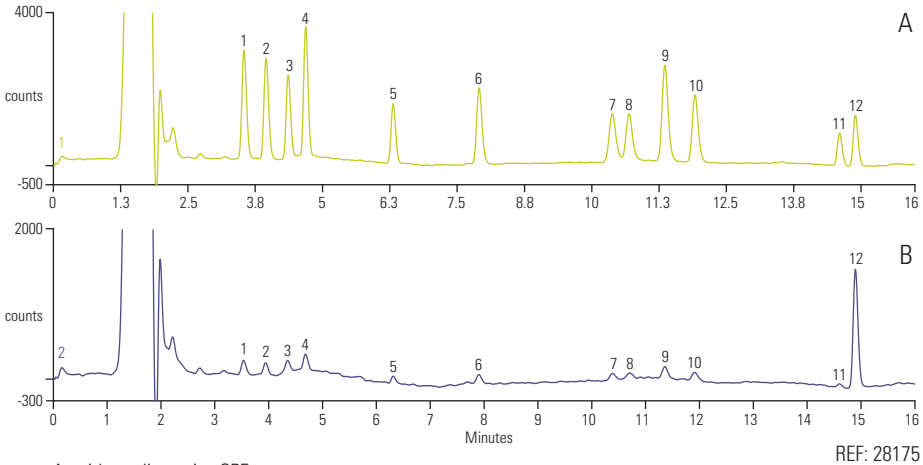
## Acclaim Carbamate Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.1mm ID | 3.0mm ID | 4.6mm ID |
|---|---|---|---|---|---|
| 2.2 | RSLC Column | 100 | **075597** | – | – |
| | | 150 | **075596** | – | – |
| 3 | Guard Cartridges (2/pk) | 10 | **072930** | **072929** | **072928** |
| | HPLC Column | 150 | **072927** | **072926** | **072925** |
| 5 | HPLC Column | 250 | – | – | **072924** |

## Acclaim Guard Holder Ordering Guide

| Description | Cat. No. |
|---|---|
| Acclaim SST Guard Cartridge Holder V-2 | **069580** |
| Acclaim Guard Kit (Holder and coupler) V-2 | **069707** |
| Guard to Analytical Column Coupler V-2 | **074188** |

**Carbamate standard - spiked rice samples**




REF: 28175

A: without dispersive SPE
B: with dispersive SPE using PSA

**Column: Acclaim Carbamate, 3.0 × 150mm, 3µm**

| | |
|---|---|
| Mobile Phase: | Methanol–$H_2O$ |
| In Gradient: | Methanol, -4.0–0.0 min, 14%; 2.0 min, 20%; 8.0 min, 40%; 13.6–16 min, 70% |
| Temperature: | 50 °C |
| Flow Rate: | 0.9mL/min |
| Injection Volume: | 250µL |
| Standard Concentration: | 0.4µg/L for each component |
| Postcolumn Reagent 1: | 0.2% NaOH, first reaction coil at 100 °C |
| Postcolumn Reagent 2: | OPA regent, second reaction coil at room temperature |
| Flow Rate of Reagents 1 and 2: | 0.3mL/min |
| Fluorescence Detection: | Excitation/330nm and Emission/465nm |
| Peaks: | 1. Aldicarb sulfoxide<br>2. Aldicarb sulfone<br>3. Oxamyl<br>4. Methomyl<br>5. 3-Hydroxy carbofuran<br>6. Aldicarb<br>7. Propoxur<br>8. Carbofuran<br>9. Carbaryl<br>10. 1-Naphthol<br>11. Methiocarb<br>12. BDMC (I.S.) |

# Acclaim Carbonyl C18

A silica-based, reversed-phase column designed specifically for separating DNPH derivatives of aldehydes and ketones

- Ideal selectivity for baseline resolution of DNPH derivatives of aldehydes and ketones regulated by various official methods, including EPA 554, EPA 8315, EPA 1667, EPA TO-11, and CARB 1004
- High efficiency for UHPLC performance
- Rugged columns with good lot-to-lot reproducibility
- Proven robust methods

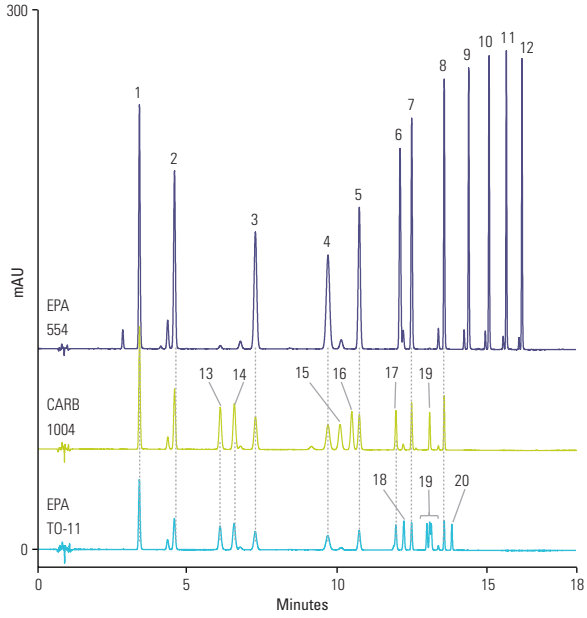
Acclaim Carbonyl C18 columns are silica-based reversed phase columns designed specifically for separating DNPH derivatives of aldehydes and ketones. They exhibit superior resolution compared with other commercially available columns.

Aldehydes and ketones are common pollutants in air and water. The analytical difficulties that need to be overcome include their volatility, their reactivity, and their modest UV absorption. The reaction with dinitrophenylhydrazine (DNPH) is a convenient means of trapping, stabilizing, and tagging these substances. Several standard methods have been developed to apply this chemistry to various environmental situations. Some of the better known ones include CARB 1004 for vehicle exhaust, EPA 554 for drinking water, EPA 1667 for pharmaceutical wastewater, and EPA 8315 for general wastewater.

## Acclaim Carbonyl C18 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.1mm ID | 3.0mm ID | 4.6mm ID |
|---|---|---|---|---|---|
| 2.2 | RSLC Column | 100 | **077972** | **077974** | – |
| | | 150 | **077973** | – | – |
| 3 | HPLC Column | 150 | **079011** | **079010** | – |
| | | 250 | – | **079009** | – |
| 5 | Guard Cartridge (2/pk) | 10 | **079012** | **079013** | **079014** |
| | HPLC Column | 150 | – | – | **079008** |
| | | 250 | – | – | **083214** |

### DNPH aldehydes and ketones




**Column: Acclaim Carbonyl RSLC, 2.2µm**
**Dimension: 2.1 × 150mm**

Mobile Phases: A: D.I. water
B: Acetonitrile

| | | | | | | |
|---|---|---|---|---|---|---|
| Gradient (min): | | -4.5 | 0.0 | 8.3 | 15.0 | 18.0 |
| | %A | 48 | 48 | 48 | 0 | 0 |
| | %B | 52 | 52 | 52 | 100 | 100 |

| | |
|---|---|
| Flow Rate: | 0.400mL/min |
| Injection: | 1µL |
| Temperature: | 28°C |
| Detection: | UV at 360nm (data collection rate at 25Hz) |
| Samples: | Calibration mixes diluted in methanol |
| Peaks: | 1. Formaldehyde DNPH<br>2. Acetaldehyde DNPH<br>3. Propionaldehyde DNPH<br>4. Crotonaldehyde DNPH<br>5. Butyraldehyde DNPH<br>6. Cyclohexanone DNPH<br>7. Valeraldehyde DNPH<br>8. Hexanal DNPH<br>9. Heptanal DNPH<br>10. Octanal DNPH<br>11. Nonanal DNPH<br>12. Decanal DNPH<br>13. Acetone DNPH<br>14. Acrolein DNPH<br>15. Butanone DNPH<br>16. Methacrolein DNPH<br>17. Benzaldehyde DNPH<br>18. Isovaleraldehyde DNPH<br>19. Tolualdehyde DNPH<br>20. Xylylaldehyde DNPH |

# Hypersil Green PAH

Specially tailored alkyl bonded silica with a high carbon loading, designed specifically for the analysis of polyaromatic hydrocarbons (PAHs)

- Optimized for EPA Method 610
- Rapid analysis of 16 PAHs in 4 minutes using short, fast columns
- Available in 3µm and 5µm particle size and variety of column dimensions

## Hypersil Green PAH Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 3 | Guard Cartridge | 10 | 2.1 | **31103-012101** |
| | | | 3.0 | **31103-013001** |
| | | | 4.6 | **31103-014001** |
| | HPLC Column | 100 | 2.1 | **31103-102130** |
| | | | 3.0 | **31103-103030** |
| | | | 4.6 | **31103-104630** |
| | HPLC Column | 150 | 2.1 | **31103-152130** |
| | | | 4.6 | **31103-154630** |
| 5 | Guard Cartridge | 10 | 4.6 | **31105-014001** |
| | HPLC Column | 100 | 4.6 | **31105-104630** |
| | | 150 | 4.6 | **31105-154630** |
| | | 250 | 4.6 | **31105-254630** |

# Dionex OmniPac

DVB polymer columns for combined ion exchange and reversed-phase separations

- Acid, base and solvent compatible, pH 0 to 14
- Ideal for the separation of high molecular weight organic acids
- Delivers optimal separation of very hydrophobic anions
- Delivers optimal separation of halogenated anions
- Provides simultaneous separation of neutral and ionic species
- Unique selectivity for polar and ionic organic analytes
- Delivers optimal separation of organic, hydrophobic, and halogenated cations

Thermo Scientific™ Dionex™ OmniPac™ PAX-100 columns are used to separate hydrophobic anionic analytes such as larger organic acids. The Dionex OmniPac PAX-500 column simultaneously separates anionic and neutral species. The Dionex OmniPac PCX-100 column separates low-molecular-weight hydrophobic cations. The Dionex OmniPac PCX-500 column simultaneously separates cationic and neutral species in a single run.

The Dionex OmniPac PAX- and PCX-100 and 500 are latex-based columns. Both PAX columns have an ion exchange capacity of about 40 µeq per column, providing equivalent anion exchange separations. The PCX columns have a capacity of approximately 120 µeq per column. The PAX- and PCX-500 columns separate analytes through both ion exchange and reversed-phase mechanisms, due to their higher reversed-phase capacity relative to the PAX- and PCX-100 columns.

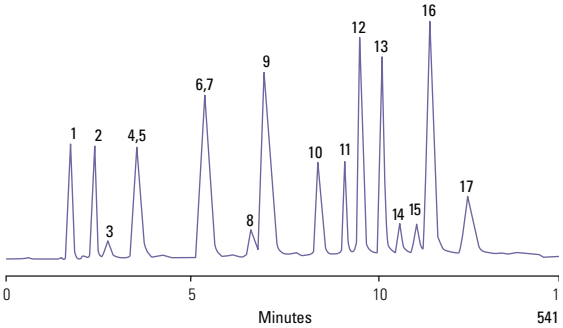
## Dionex OmniPac Anion Exchange Ordering Guide

| Description | Porosity | Length (mm) | 4.0mm ID |
|---|---|---|---|
| PAX-100 | microporous | 50 | **042151** |
| | | 250 | **042150** |
| PAX-500 | macroporous | 50 | **042153** |
| | | 250 | **042152** |

## Dionex OmniPac Cation Exchange Ordering Guide

| Description | Porosity | Length (mm) | 4.0mm ID |
|---|---|---|---|
| PCX-100 | microporous | 50 | **042193** |
| | | 250 | **042189** |
| PCX-500 | macroporous | 50 | **042195** |
| | | 250 | **042191** |

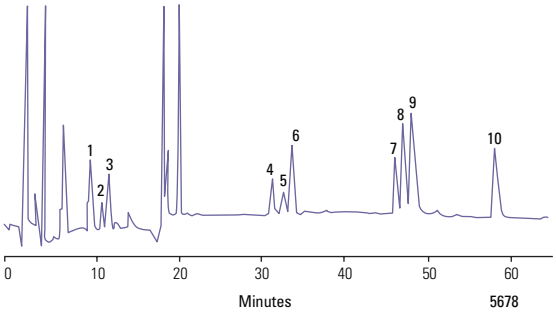
**Gradient separation of nitrogen-containing compounds**




**Column: Dionex OmniPac PCX-500 (4 × 250mm)**

| | |
|---|---|
| Eluent: | Acetonitrile/Sodium Chloride/Hydrochloric Acid Gradient |
| Flow Rate: | 1.0mL/min |
| Detection: | UV, 254nm |
| Peaks: | 1. Orotic Acid<br>2. 4-Hydroxybenzamide<br>3. Luminol Impurity<br>4. Luminol<br>5. Pyridine<br>6. PABA<br>7. 2,2'-Bipyridine<br>8. p-Phenylenediamine<br>9. Naphthylamine<br>10. Nitrobenzoic Acid<br>11. Tribenzylamine<br>12. p-Nitroaniline<br>13. 2,4-Dinitroaniline<br>14. Dibenzylamine<br>15. N-Methyl-N-nitrosoaniline<br>16. 4-Chloro-2-nitroaniline<br>17. 2,6-Dichloro-4-nitroaniline |

**Gradient separation of inositol mono-, di-, tri-, and tetraphosphates**




**Column: Dionex OmniPac PAX-100 (4 x 250mm)**

| | |
|---|---|
| Eluent: Isopropanol / Sodium Hydroxide Gradient | |
| Flow Rate: | 1.0mL/min |
| Detection: | Suppressed Conductivity (Baseline Subtracted) |
| Peaks: | 1. Ins (2) P<br>2. Ins (1) P<br>3. Ins (4) P<br>4. Ins (1,4) P2<br>5. Ins (2,4) P2<br>6. Ins (4,5) P2<br>7. Ins (1,3,4) P3<br>8. Ins (1,4,5) P3<br>9. Ins (2,4,5) P3<br>10. Ins (1,4,5,6) P4 |

# Dionex IonPac NS1 and NS2

## Polymeric Reversed-Phase Column Ideal for the Separation of Hydrophobic, Ionizable Compounds

The Thermo Scientific™ Dionex™ IonPac™ NS1-10µm and NS1-5µm columns are packed with a neutral, macroporous, high-surface-area, ethylvinylbenzene polymer crosslinked with 55% divinylbenzene. This resin makes the NS1 resistant to solvents, acids, and bases, and permits the use of eluent from pH 0 to 14. The Dionex IonPac NS1 column is the column of choice for routine ion pair chromatography.

IonPac NS2 is a silica-based column for mobile-phase ion chromatography (MPIC) applications using eluents containing trifluoroacetic acid (TFA), heptafluorobutyric acid (HFBA), or tetrabutylammonium borate (TBAB). It provides high performance analysis for hydrophobic amines and hydrophobic acids using suppressed conductivity detection.

- Excellent resolution
- Good peak shape
- Ideal for separation of large molecules that carry localized charges, such as surfactants
- Compatible with acids, bases, and solvent from pH 0 to 14
- Can also be used for traditional polymeric reversed-phase applications
- Utilize ion-pair chromatography for difficult separations

### Dionex IonPac NS1 and NS2 Ordering Guide

| Description | Particle Size (µm) | Format | Length (mm) | 2.0mm ID | 4.0mm ID |
|---|---|---|---|---|---|
| IonPac NS1 | 5 | HPLC Column | 150 | – | **039568** |
| | 10 | Guard Column | 35 | **SP4356** | **039567** |
| | | HPLC Column | 250 | **SP4354** | **035321** |
| IonPac NS2 | 5 | Guard Column | 35 | – | **SP6907** |
| | | HPLC Column | 150 | – | **SP6906** |
| | | | 250 | – | **SP6905** |

# Hypersil BDS

A good choice for robust, general-purpose columns

## Hypersil BDS Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | C18 | C8 | Phenyl | CN |
|---|---|---|---|---|---|---|---|
| 2.4 | Drop-in Guard (4/pk) | 10 | 2.1 | **28102-012101** | **28202-012101** | – | – |
| | | | 4.0/4.6 | **28102-014001** | **28202-014001** | – | – |
| | | 50 | 2.1 | **28102-052130** | **28202-052130** | – | – |
| | | | 4.6 | **28102-054630** | **28202-054630** | – | – |
| | | 100 | 2.1 | **28102-102130** | **28202-102130** | – | – |
| | | | 4.6 | **28102-104630** | **28202-104630** | – | – |
| | | 150 | 2.1 | **28102-152130** | **28202-152130** | – | – |
| | | | 4.6 | **28102-154630** | **28202-154630** | – | – |
| 3 | Drop-in Guard (4/pk) | 10 | 2.1 | **28103-012101** | **28203-012101** | **28903-012101** | **28803-012101** |
| | | | 3.0 | **28103-013001** | **28203-013001** | – | – |
| | | | 4.0/4.6 | **28103-014001** | **28203-014001** | **28903-014001** | **28803-014001** |
| | HPLC Column | 30 | 2.1 | **28103-032130** | – | – | – |
| | | 50 | 2.1 | **28103-052130** | **28203-052130** | **28903-052130** | **28803-052130** |
| | | | 3.0 | **28103-053030** | – | – | – |
| | | | 4.6 | **28103-054630** | **28203-054630** | – | – |
| | | 100 | 2.1 | **28103-102130** | – | – | – |
| | | | 3.0 | **28103-103030** | – | – | – |
| | | | 4.0 | **28103-104030** | – | – | – |
| | | | 4.6 | **28103-104630** | **28203-104630** | – | – |
| | | 150 | 2.1 | **28103-152130** | – | – | – |
| | | | 3.0 | **28103-153030** | **28203-153030** | – | – |
| | | | 4.0 | **28103-154030** | – | – | – |
| | | | 4.6 | **28103-154630** | **28203-154630** | **28903-154630** | **28803-154630** |
| 5 | Drop-in Guard (4/pk) | 10 | 2.1 | **28105-012101** | **28205-012101** | – | – |
| | | | 3.0 | **28105-013001** | **28205-013001** | – | – |
| | | | 4.0/4.6 | **28105-014001** | **28205-014001** | **28905-014001** | **28805-014001** |
| | HPLC Column | 50 | 2.1 | **28105-052130** | **28205-052130** | – | – |
| | | | 3.0 | **28105-053030** | **28205-053030** | – | – |
| | | | 4.6 | **28105-054630** | **28205-054630** | – | – |
| | | 100 | 2.1 | **28105-102130** | **28205-102130** | – | – |
| | | | 3.0 | **28105-103030** | – | – | – |
| | | | 4.0 | **28105-104030** | – | – | – |
| | | | 4.6 | **28105-104630** | **28205-104630** | – | – |
| | | 125 | 3.0 | **28105-123030** | – | – | – |
| | | | 4.0 | **28105-124030** | – | – | – |
| | | | 4.6 | **28105-124630** | – | – | – |
| | | 150 | 2.1 | **28105-152130** | – | – | – |
| | | | 3.0 | **28105-153030** | – | – | – |
| | | | 4.0 | **28105-154030** | **28205-154030** | – | – |
| | | | 4.6 | **28105-154630** | **28205-154630** | **28905-154630** | **28805-154630** |
| | | 250 | 2.1 | **28105-252130** | – | – | – |
| | | | 3.0 | **28105-253030** | – | – | – |
| | | | 4.0 | **28105-254030** | **28205-254030** | **28905-254030** | – |
| | | | 4.6 | **28105-254630** | **28205-254630** | **28905-254630** | **28805-254630** |

| Format | Length (mm) | ID (mm) | **Cat. No.** |
|---|---|---|---|
| UNIGUARD Guard Cartridge Holder | 10 | 1.0 | **851-00** |
| | | 2.1 | **852-00** |
| | | 3.0 | **852-00** |
| | | 4.0/4.6 | **850-00** |

# Hypersil Classical

A global standard for many existing methods

## Hypersil ODS Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 3 | Drop-in Guard (4/pk) | 10 | 2.1 | **30103-012101** |
| | | | 3.0 | **30103-013001** |
| | | | 4.0/4.6 | **30103-014001** |
| | HPLC Column | 50 | 2.1 | **30103-052130** |
| | | | 3.0 | **30103-053030** |
| | | | 4.6 | **30103-054630** |
| | | 100 | 2.1 | **30103-102130** |
| | | | 3.0 | **30103-103030** |
| | | | 4.0 | **30103-104030** |
| | | | 4.6 | **30103-104630** |
| | | 125 | 2.1 | **30103-122130** |
| | | | 4.0 | **30103-124030** |
| | | | 4.6 | **30103-124630** |
| | | 150 | 2.1 | **30103-152130** |
| | | | 3.0 | **30103-153030** |
| | | | 4.0 | **30103-154030** |
| | | | 4.6 | **30103-154630** |
| | | 250 | 2.1 | **30103-252130** |
| | | | 3.0 | **30103-253030** |
| | | | 4.0 | **30103-254030** |
| | | | 4.6 | **30103-254630** |
| 5 | Drop-in Guard (4/pk) | 10 | 2.1 | **30105-012101** |
| | | | 3.0 | **30105-013001** |
| | | | 4.0/4.6 | **30105-014001** |
| | HPLC Column | 50 | 2.1 | **30105-052130** |
| | | | 3.0 | **30105-053030** |
| | | | 4.6 | **30105-054630** |
| | | 100 | 2.1 | **30105-102130** |
| | | | 3.0 | **30105-103030** |
| | | | 4.0 | **30105-104030** |
| | | | 4.6 | **30105-104630** |
| | | 125 | 2.1 | **30105-122130** |
| | | | 3.0 | **30105-123030** |
| | | | 4.0 | **30105-124030** |
| | | | 4.6 | **30105-124630** |
| | | 150 | 2.1 | **30105-152130** |
| | | | 3.0 | **30105-153030** |
| | | | 4.0 | **30105-154030** |
| | | | 4.6 | **30105-154630** |
| | | 200 | 2.1 | **30105-202130** |
| | | | 4.0 | **30105-204030** |
| | | | 4.6 | **30105-204630** |
| | | 250 | 2.1 | **30105-252130** |
| | | | 3.0 | **30105-253030** |
| | | | 4.0 | **30105-254030** |
| | | | 4.6 | **30105-254630** |

## Hypersil ODS-2 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 3 | Drop-in Guard (4/pk) | 10 | 4.0/4.6 | **31603-014001** |
| | HPLC Column | 50 | 4.6 | **31603-054630** |
| | | 100 | 4.0 | **31603-104030** |
| | | | 4.6 | **31603-104630** |
| | | 150 | 4.6 | **31603-154630** |
| 5 | Drop-in Guard (4/pk) | 10 | 4.0/4.6 | **31605-014001** |
| | HPLC Column | 50 | 4.6 | **31605-054630** |
| | | 100 | 4.6 | **31605-104630** |
| | | 150 | 4.6 | **31605-154630** |
| | | 250 | 4.0 | **31605-254030** |
| | | | 4.6 | **31605-254630** |

## Hypersil MOS (C8) Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 5 | Drop-in Guard (4/pk) | 10 | 4.0/4.6 | **30205-014001** |
| | HPLC Column | 50 | 4.6 | **30205-054630** |
| | | 100 | 4.6 | **30205-104630** |
| | | 150 | 4.6 | **30205-154630** |
| | | 250 | 4.0 | **30205-254030** |
| | | | 4.6 | **30205-254630** |

## Hypersil MOS-2 (C8) Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 5 | Drop-in Guard (4/pk) | 10 | 4.0/4.6 | **30305-014001** |
| | HPLC Column | 150 | 4.6 | **30305-154630** |
| | | 250 | 4.0 | **30305-254030** |
| | | | 4.6 | **30305-254630** |

## Hypersil SAS (C1) Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 5 | Drop-in Guard (4/pk) | 10 | 4.0/4.6 | **30505-014001** |
| | HPLC Column | 150 | 4.6 | **30505-154630** |
| | | 250 | 4.6 | **30505-254630** |

# Hypersil Classical *continued*

## Hypersil Phenyl Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 5 | Drop-in Guard (4/pk) | 10 | 4.0/4.6 | **30905-014001** |
| | HPLC Column | 50 | 4.6 | **30905-054630** |
| | | 100 | 4.6 | **30905-104630** |
| | | 150 | 4.6 | **30905-154630** |
| | | 250 | 4.0 | **30905-254030** |
| | | | 4.6 | **30905-254630** |

## Hypersil Phenyl-2 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 5 | Drop-in Guard (4/pk) | 10 | 4.0/4.6 | **31905-014001** |
| | HPLC Column | 150 | 4.6 | **31905-154630** |
| | | 250 | 4.6 | **31905-254630** |

## Hypersil CPS Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 3 | Drop-in Guard (4/pk) | 10 | 4.0/4.6 | **30803-014001** |
| | HPLC Column | 150 | 4.6 | **30803-154630** |
| 5 | Drop-in Guard (4/pk) | 10 | 4.0/4.6 | **30805-014001** |
| | HPLC Column | 150 | 4.6 | **30805-154630** |
| | | 250 | 4.0 | **30805-254030** |
| | | | 4.6 | **30805-254630** |

## Hypersil CPS-2 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 5 | Drop-in Guard (4/pk) | 10 | 4.0/4.6 | **31905-014001** |
| | HPLC Column | 150 | 4.6 | **31905-154630** |
| | | 250 | 4.6 | **31905-254630** |

## Hypersil APS-2 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 3 | Drop-in Guard (4/pk) | 10 | 2.1 | **30703-012101** |
| | | | 4.0/4.6 | **30703-014001** |
| | HPLC Column | 50 | 2.1 | **30703-052130** |
| | | | 4.6 | **30703-054630** |
| | | 100 | 2.1 | **30703-102130** |
| | | 150 | 2.1 | **30703-152130** |
| | | | 4.6 | **30703-154630** |
| 5 | Drop-in Guard (4/pk) | 10 | 3.0 | **30705-013001** |
| | | | 4.0/4.6 | **30705-014001** |
| | HPLC Column | 100 | 3.0 | **30705-103030** |
| | | | 4.6 | **30705-104630** |
| | | 150 | 4.6 | **30705-154630** |
| | | 250 | 4.0 | **30705-254030** |
| | | | 4.6 | **30705-254630** |

### Hypersil Silica Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 3 | Drop-in Guard (4/pk) | 10 | 2.1 | **30003-012101** |
| | | | 3.0 | **30003-013001** |
| | | | 4.0/4.6 | **30003-014001** |
| | HPLC Column | 50 | 2.1 | **30003-052130** |
| | | | 3.0 | **30003-053030** |
| | | | 4.6 | **30003-054630** |
| | | 150 | 4.6 | **30003-154630** |
| 5 | Drop-in Guard (4/pk) | 10 | 3.0 | **30005-013001** |
| | | | 4.0/4.6 | **30005-014001** |
| | HPLC Column | 50 | 4.6 | **30005-054630** |
| | | 100 | 4.6 | **30005-104630** |
| | | 150 | 4.6 | **30005-154630** |
| | | 250 | 4.0 | **30005-254030** |
| | | | 4.6 | **30005-254630** |

### Hypersil SAX Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|
| 5 | Drop-in Guard (4/pk) | 10 | 2.1 | **34105-012101** |
| | | | 3.0 | **34105-013001** |
| | | | 4.0/4.6 | **34105-014001** |
| | HPLC Column | 50 | 2.1 | **34105-052130** |
| | | 150 | 4.6 | **34105-154630** |
| | | 250 | 3.0 | **34105-253030** |
| | | | 4.6 | **34105-254630** |

## Other HPLC Columns

### Aquasil HPLC Columns

Thermo Scientific™ Aquasil™ HPLC Columns are available in limited dimensions. Please contact Customer Service for more details.

### BetaBasic HPLC Columns

Thermo Scientific™ BetaBasic™ HPLC Columns are available in limited dimensions. Please contact Customer Service for more details.

### BETASIL HPLC Columns

Thermo Scientific™ BETASIL™ HPLC Columns are available in limited dimensions. Please contact Customer Service for more details.

### HyPurity HPLC Columns

Thermo Scientific™ HyPurity™ HPLC Columns are available in limited dimensions. Please contact Customer Service for more details.

# Thermo Scientific LC Columns for Biomolecules

The diversity of biological samples in terms of compound structure and properties coupled with matrix complexity demands a range of sample separation modes, column chemistries, column configurations and detection techniques for their effective characterization. Thermo Scientific addresses these needs with a range of silica and polymeric columns specifically designed to handle the unique rigors of the analysis of proteins, peptides, oligonucleotides and other biomolecules.

## Columns for proteins

### Reversed Phase

Thermo Scientific™ BioBasic™ reversed-phase columns provide superior chromatography because the extra dense bonding chemistry used for these packings produce a highly stable, reproducible surface for reliable results. BioBasic reversed phase packings are available in C18, C8 and C4, chemistries.

Acclaim 300 C18 features 3µm silica particles for rapid analysis of complex protein digests. Compared to 5µm column packings, the smaller particles support increased flow rates and shallower gradients on shorter columns, for faster separation analysis.

Thermo Scientific™ ProSwift™ RP monolith columns uniquely provide the advantages of high resolution at exceptionally high flow rates for fast protein separation analysis.

### Ion Exchange

Thermo Scientific™ ProPac™ and Thermo Scientific™ MAbPac™ ion exchange columns are based on a pellicular nonporous core particles providing exceptionally high resolution and efficiency for separations of protein variants, resolving isoforms that differ by a single charged residue. A hydrophilic layer prevents unwanted secondary interactions, and a grafted cation exchange surface provides pH-based selectivity control and fast mass transfer for high-efficiency separation and moderate capacity. ProPac WCX and MAbPac SCX columns are specifically developed for monoclonal separation and analytical characterization. Applications include protein variants in a variety of matrices, such as biopharmaceuticals and diary products. MAbPac columns are specifically designed for the analysis of monoclonal antibody variants.

BioBasic AX and BioBasic SCX ion exchange columns demonstrate superior reproducibility, both column-to-column and batch-to-batch because the 5µm, 300Å silica provides high efficiency. Both phases provide superior performance for proteins, peptides and nucleic acids using protein friendly ion exchange conditions.

ProSwift ion exchange monoliths provide an excellent alternative to porous or non porous ion exchange media. They offer increased loading capacity compared to pellicular phases combined with excellent resolution compared to traditional porous ion exchange media.

### Size Exclusion

BioBasic SEC columns, based on silica with a proprietary polymeric coating, offer the mechanical stability of silica-based size exclusion columns with higher efficiencies than that of polymer-based columns. Four pore sizes (60Å, 120Å, 300Å, 1000Å) are available, making them ideal for molecular weight determination of peptides, proteins and water soluble polymers. They can also be used for sample clean-up prior to other analyses.

MAbPac SEC-1 (300Å 5µm silica) is a size exclusion chromatography (SEC) column specifically designed for separation and characterization of monoclonal antibodies (MAb) and their aggregates, as well as the analysis of Fab and Fc fragments resulting from proteolysis.

### Hydrophobic Interaction

The ProPac HIC-10 column is a high-resolution, high-capacity, 300Å, 5µm silica-based HIC column that provides excellent high resolution separations of proteins and variants for analytical and preparative applications. ProPac HIC columns provide exceptional hydrolytic stability under the highly aqueous conditions used in HIC.

### Affinity

The MAbPac Protein A column is a unique non-porous polymeric column designed for fast, accurate determination of monoclonal antibody titer analysis from harvest cell culture. The ProPac IMAC-10 is a high-resolution analytical and semipreparative column for separation of proteins and peptides by immobilized metal affinity chromatography. It is packed with 10µm, nonporous, polymeric beads coated with a hydrophilic layer, then grafted with poly(IDA) chains.

The ProSwift ConA-1S affinity monolith column is unsurpassed for fast, highly efficient enrichment and purification of Concanavalin A (Con A) binding glycans, glycopeptides, and glycoproteins containing high-mannose regions.

## Columns for oligonucleotides

Thermo Scientific™ DNAPac™ strong anion exchange columns provide industry-leading resolution for analysis and purification of synthetic oligonucleotides. DNAPac columns can resolve full length oligonucleotides from n–1, n+1, and other failure sequences not possible with other columns.

Thermo Scientific™ DNASwift™ a strong anion exchange monolith column that provides exceptionally high oligonucleotide purity. This semipreparative column incorporates the high resolution and selectivity of the DNAPac column, with increased loading capacity.

## Columns for carbohydrates

Thermo Scientific™ GlycanPac™ AXH-1 and AXR-1 columns are HPLC columns designed for the simultaneous separation of glycans by charge, size and polarity. Separating either flourescently labeled or native glycans.

## Columns for proteomics

### Nano, capillary and micro columns

Thermo Scientific™ Acclaim™ PepMap™ and PepMap RSLC columns are specially designed for high-resolution analyses of tryptic, natural, and synthetic peptides. The columns are often applied for LC-MS/MS peptide mapping for protein identification, biomarker discovery, and systems biology. Due to their high loading capacity, the columns are exceptionally suitable for the analysis of low abundant peptides in complex proteomics samples. Acclaim PepMap Trap columns are typically applied for the desalting and preconcentration of peptides before LC separation with MS detection. The columns are designed to provide the highest efficiencies for one dimensional peptide mapping experiments and 2D-LC analyses. Thermo Scientific™ PepSwift™ monolithic columns are specially designed for fast separation and identification of proteins and peptides using nano and capillary LC coupled to MS.

Using highly pure chromatographic media and biocompatible, metal-free fused silica capillaries, Thermo Scientific™ EASY-Column™ capillary LC columns are produced with a focus on design simplicity and strict quality control. As a result, they deliver outstanding chromatographic performance on any nano LC system.

Thermo Scientific™ EASY-Spray™ columns provide a fully integrated and temperature controlled combined column-emitter design with only a single nanoViper connection between the LC and the MS ion source. This dead volume reduction is a critical component in helping to deliver state of the art performance with ease of use.


## Bio Columns Selection Guide

| Analyte | Mode of Analysis | Recommended Column | |
|---|---|---|---|
| Monoclonal antibodies and Proteins | Size Exclusion | BioBasic SEC | 4-139 |
| | | MAbPac SEC-1 | 4-129 |
| | Ion Exchange | BioBasic AX | 4-141 |
| | | ProPac SCX-10, WCX-10, SAX-10, WAX-10, SCX-20 | 4-116 |
| | | MAbPac SCX-10, MAbPac SCX-10 RS | 4-127 |
| | | ProSwift IEX | 4-123 |
| | Reversed Phase | BioBasic 18, 8, 4 | 4-140 |
| | | Acclaim 300 C18 | 4-142 |
| | | Accucore 150-C18, 150-C4 | 4-144 |
| | | ProSwift RP | 4-124 |
| | Hydrophobic Interaction | ProPac HIC-10 | 4-121 |
| | Affinity | MAbPac Protein A | 4-126 |
| | | ProPac IMAC-10 | 4-122 |
| | | ProSwift ConA-1S | 4-125 |
| Peptides | Proteomics | Acclaim PepMap | 4-149 |
| | | PepSwift | 4-154 |
| | | EASY-Column | 4-155 |
| | | EASY-Spray Columns | 4-153 |
| | Analytical | BioBasic 18, 8, 4 | 4-140 |
| | | Acclaim 300 | 4-142 |
| | Preparative | BioBasic | Inquire |
| Amino Acids (derivatized) | Ion Exchange | AminoPac PA10 | Inquire |
| | Reversed phase | Hypersil GOLD | 4-026 |
| Amino Acids (underivatized) | Ion Exchange | AminoPac PA10 | Inquire |
| | Reversed phase | Hypercarb | 4-084 |
| Nucleotides | Anion Exchange | BioBasic AX | 4-141 |
| | Polar retention | Hypercarb | 4-084 |
| Oligonucleotides | Ion Exchange | BioBasic AX | 4-141 |
| | | DNAPac PA100, PA200, PA200 RS | 4-134 |
| | | DNASwift | 4-137 |
| Carbohydrates | Ligand Exchange | HyperREZ XP | 4-056 |
| | Ion Exchange | CarboPac | Inquire |
| | Mixed Mode | GlycanPac AXH-1 | 4-032 |
| | HILIC | Acclaim HILIC | 4-067 |
| | | Hypersil GOLD HILIC | 4-037 |
| | | Syncronis HILIC | 4-081 |
| | | Accucore 150-Amide-HILIC | 4-146 |
| | Polar retention | Hypercarb | 4-084 |

View product information and application notes

# HPLC Phases for Biomolecules

## Silica-based Reversed Phase and Ion Exchange Phases

| Phase | Particle Type | Particle Size (µm) | Pore Size (Å) | Nominal Surface Area ($m^2/g$) | % Carbon | Endcapping | USP Code | Phase Code | Page |
|---|---|---|---|---|---|---|---|---|---|
| **Acclaim Phase** | | | | | | | | | |
| 300 C18 | Spherical, fully porous silica | 3 | 300 | 100 | 8 | Yes | L1 | – | **4-142** |
| **Acclaim PepMap Phases** | | | | | | | | | |
| 100 C18 | Spherical, fully porous silica | 2, 3, 5 | 100 | 300 | 15 | Yes | L1 | – | **4-149** |
| 300 C18 | Spherical, fully porous silica | 5 | 300 | 100 | 9 | Yes | L1 | – | **4-149** |
| 100 C8 | Spherical, fully porous silica | 3, 5 | 100 | 300 | 9 | Yes | L7 | – | **4-149** |
| 300 C4 | Spherical, fully porous silica | 5 | 300 | 300 | 3 | Yes | L26 | – | **4-149** |
| **Accucore Phases** | | | | | | | | | |
| 150-C18 | Spherical, solid core silica | 2.6 | 150 | 80 | 7 | Yes | L1 | 161 | **4-144** |
| 150-C4 | Spherical, solid core silica | 2.6 | 150 | 80 | 2 | Yes | L26 | 165 | **4-145** |
| 150-Amide-HILIC | Spherical, solid core silica | 2.6 | 150 | 80 | – | – | – | 167 | **4-146** |
| **BioBasic Phases** | | | | | | | | | |
| 18 | Spherical, fully porous silica | 5 | 300 | 100 | 9 | Yes | L1 | 721 | **4-140** |
| 8 | Spherical, fully porous silica | 5 | 300 | 100 | 5 | Yes | L7 | 722 | **4-140** |
| 4 | Spherical, fully porous silica | 5 | 300 | 100 | 4 | Yes | L26 | 723 | **4-140** |
| AX | Spherical, fully porous silica | 5 | 300 | 100 | 3 | No | – | 731 | **4-141** |
| SCX | Spherical, fully porous silica | 5 | 300 | 100 | 3 | No | L52 | 733 | **4-141** |

# Columns for Protein Separations

## Silica-based Size Exclusion Chromatography Phases

| Phase | SEC Type | Particle Type | Particle Size (µm) | Pore Size (Å) | Exclusion Limit Operating Range (kDa) | USP Code | Phase Code | Page |
|---|---|---|---|---|---|---|---|---|
| **BioBasic Phases** | | | | | | | | |
| SEC 60 | Aqueous | Spherical, fully porous silica | 5 | 60 | 0.1 – 6 | – | 733 | **4-139** |
| SEC 120 | Aqueous | Spherical, fully porous silica | 5 | 120 | 0.1 – 50 | L33 | 734 | **4-139** |
| SEC 300 | Aqueous | Spherical, fully porous silica | 5 | 300 | 1 – 500 | L33, L59 | 735 | **4-139** |
| SEC 1000 | Aqueous | Spherical, fully porous silica | 5 | 1000 | 20 – 4000 | L33 | 736 | **4-139** |

## Silica-based Hydrophobic Interaction Chromatography Phases

| Column | Phase | Target Applications | Base Matrix Material | Particle Size (µm) | Pore Size (Å) | Nominal Surface Area ($m^2/g$) | Breakthrough Capacity | Solvent Compatibility | pH Range |
|---|---|---|---|---|---|---|---|---|---|
| ProPac HIC-10 | Hydrophobic Interaction | High resolution separations of proteins and protein variants | Spherical, porous ultrapure silica with amide/ethyl surface chemistry | 5 | 300 | 100 | 340mg lysozyme per 7.8 x 75mm column | Ammonium sulfate/phosphate salts, organic solvent for cleanup | 2.5-7.5 |

*Search our database of thousands of applications*
***www.thermoscientific.com/chromatography***

## Polymeric Ion Exchange, Reversed Phase and Affinity Columns

| Column | Phase | Target Applications | Base Matrix Material | Functional Groups | Breakthrough Capacity | Recommended Flow Rate | Solvent Compatibility | Maximum Backpressure | pH Range |
|---|---|---|---|---|---|---|---|---|---|
| ProPac WCX-10 | Weak Cation Exchange | High resolution separations of proteins and protein variants | Ethylvinylbenzene cross linked with 55% divinylbenzene 10µm nonporous particles | Carboxylate | 6mg/mL lysozyme | 0.2-2.0 mL/min | 80% ACN, acetone. Incompatable with alcohols and MeOH | 3000psi (21 MPa) | 2.0-12 |
| ProPac SCX-10 | Strong Cation Exchange | High resolution separations of proteins and protein variants | Ethylvinylbenzene cross linked with 55% divinylbenzene 10µm nonporous particles | Sulfonate | 3mg/mL lysozyme | 0.2-2.0 mL/min | 80% ACN, acetone, MeOH | 3000psi (21 MPa) | 2.0-12 |
| ProPac SCX-20 | Strong Cation Exchange | High Resolution separations of proteins and protein variants | Divinlybenzene 10µm nonporous particles | Sulfonic | 20µg/mL Dynamic capacity | 0.2-2.0 mL/min | 50% acetonitrile | 3000psi (21 MPa) | 2.0-12 |
| ProPac WAX-10 | Weak Anion Exchange | High resolution separations of proteins and protein variants | Ethylvinylbenzene cross linked with 55% divinylbenzene 10µm nonporous particles | Tertiary amine | 5mg/mL BSA | 0.2-2.0 mL/min | 80% ACN, acetone, MeOH, | 3000psi (21 MPa) | 2.0-12 |
| ProPac SAX-10 | Strong Anion Exchange | High resolution separations of proteins and protein variants | Ethylvinylbenzene cross linked with 55% divinylbenzene 10µm nonporous particles | Quaternary ammonium | 15mg/mL BSA | 0.2-2.0 mL/min | 80% ACN, acetone, MeOH | 3000psi (21 MPa) | 2.0-12 |
| ProSwift RP-1S | Reversed Phase | Fast protein analysis with high resolution of large peptides to medium proteins | Monolith; polystyrene-divinylbenzene | Phenyl | 5.5mg/mL Insulin | 2.0-4 .0 mL/min | Most common organic solvents | 2800psi (19.2 MPa) | 1.0-14 |
| ProSwift RP-2H | Reversed Phase | Fast protein analysis with high resolution over a wide size range | Monolith; polystyrene-divinylbenzene | Phenyl | 1.0mg/mL Lysozyme | 1.0-10 mL/min | Most common organic solvents | 2800psi (19.3 MPa) | 1.0-14 |
| ProSwift RP-3U | Reversed Phase | Fast protein analysis with high resolution of large proteins | Monolith; polystyrene-divinylbenzene | Phenyl | 0.5mg/mL Lysozyme | 1.0-16 mL/min | Most common organic solvents | 2800psi (19.3 MPa) | 1.0-14 |
| ProSwift RP-4H | Reversed Phase | Fast protein analysis with high resolution | Monolith; polystyrene-divinylbenzene | Phenyl | 2.3mg/mL Lysozyme | 0.1-0.3 mL/min | Most common organic Solvents | 1500psi | 1.0-14 |
| ProSwift SAX-1S | Strong Anion Exchange | Fast protein analysis with high resolution | Monolith; polymethacrylate | Quaternary amine | 18mg/mL BSA | 0.5-1.5 (4.6mm) | Most common organic solvents | 1000psi (4.6mm) 2000psi (1.0mm) | 2.0-12 |
| ProSwift SCX-1S | Strong Cation Exchange | Fast protein analysis with high resolution | Monolith; polymethacrylate | Sulfonic acid | 30mg/mL Lysozyme | 0.5-1.5 mL/min (4.6mm) | Most common organic solvents | 1000psi (4.6mm) | 2.0-12 |
| ProSwift WAX-1S | Weak Anion Exchange | Fast protein analysis with high resolution | Monolith; polymethacrylate | Tertiary amine (DEAE) | 18mg/mL BSA | 0.5-1.5 mL/min (4.6mm) | Most common organic solvents | 1000psi (4.6mm) 2000psi (1.0mm) | 2.0-12 |
| ProSwift WCX-1S | Weak Cation Exchange | Fast protein analysis with high resolution | Monolith; polymethacrylate | Carboxylic acid | 23mg/mL Lysozyme | 0.5-1.5mL/min (4.6mm), 0.05-0.20 | Most common organic solvents | 1000psi (4.6mm) 2000psi (1.0mm) | 2.0-12 |
| ProPac IMAC-10 | Immobilized Metal Affinity | High resolution separation of certain metal-binding proteins and peptides | Polystyrene divinylbenzene 10µm nonporous particles | Poly (IDA) grafts | >60mg lysozyme/mL gel (4x250mm) | 1.0mL/min | EtOH, urea, NaCl, non-ionic detergents, glycerol, acetic acid, guanidine HCl | 3000psi (21MPa) | 2.0-12 |
| ProSwift ConA-1S | Affinity | Concanavalin A binding (high-mannose) glycans, glycopeptides and proteins | Monolith; polymethacrylate | Concanavalin A ligands | 12-16mg of protein | 0-1.0mL/min | Up to 10% methanol | 2000psi | 5.0-8 |

# Columns for Monoclonal Antibody Separations

## Polymeric Ion Exchange Columns

| Phase | IEX Type | Particle Type | Particle Size (µm) | Pore Size (Å) | Dynamic Capacity | Recommended Flow Rate | Solvent Compatibility | Maximum Backpressure | pH Range | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| MAbPac SCX-10 | Strong cation exchange (sulfonic) | Polymeric, Highly crosslinked DVB | 3, 5, 10 | non-porous | MAbPac SCX-10 PEEK 3µm: 60µg/mL 5µm: 40µg/mL 10µm: 20µg/mL MAbPac SCX-10 RS 5µm: 40 µg/mL | 0.2-2.0mL/min (Depending on the particle size and column pressure limits) | 50% Acetonitrile | 3000psi (21MPa) RS columns 7000psi | 2.0-12 | 4-127 |
| ProPac WCX-10 | Weak cation exchange (carboxylate) | Polymeric, Non-porous DVB | 10 | non-porous | 6mg/mL | 0.2-2.0mL/min | 80% ACN, acetone. Incompatible with alcohols including methanol | 3000psi (21MPa) | 2.0-12 | |

## Silica-based Size Exclusion Chromatography Columns

| Phase | SEC Type | Particle Type | Particle Size (µm) | Pore Size (Å) | Exclusion Limit Operating Range (kDa) | USP Code | Page |
|---|---|---|---|---|---|---|---|
| MAbPac SEC-1 | Aqueous | Spherical, fully porous silica | 5 | 300 | 1-500 | L33, L59 | 4-129 |

## Affinity Columns

| Phase | Affinity ligand | Particle Type | Particle Size (µm) | Pore Size (Å) | Capacity | Recommended Flow Rate | Maximum temperature | Maximum Backpressure | pH Range | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| MAbPac Protein A | Protein A | Polymeric | 12 | non-porous | 100µg IgG/ column | < 2.5 | 30 | 1000 | 2.5-7.5 | 4-126 |

# Columns for Carbohydrate Separations

## Polymeric Ligand Exchange Columns

| Phase | Particle Type | Particle Size (µm) | Pore Size (Å) | Nominal Surface Area ($m^2/g$) | % Carbon | Endcapping | USP Code | Phase Code | Page |
|---|---|---|---|---|---|---|---|---|---|
| **HyperREZ XP Phases** | | | | | | | | | |
| Carbohydrate $H^+$ | Spherical, polymer | 8 | – | – | – | – | L17 | 690 | 4-156 |
| Carbohydrate $Pb^{2+}$ | Spherical, polymer | 8 | – | – | – | – | L34 | 691 | 4-156 |
| Carbohydrate $Ca^{2+}$ | Spherical, polymer | 8 | – | – | – | – | L19 | 692 | 4-156 |
| Carbohydrate $Na^+$ | Spherical, polymer | 10 | – | – | – | – | – | 693 | 4-156 |
| Organic Acid | Spherical, polymer | 8 | – | – | – | – | L17 | 696 | 4-156 |
| Sugar Alcohol | Spherical, polymer | 8 | – | – | – | – | L19 | 697 | 4-156 |

## Silica-based HILIC and Mixed-Mode Columns

| Phase | Particle Type | Particle Size (µm) | Pore Size (Å) | Nominal Surface Area ($m^2/g$) | % Carbon | Endcapping | USP Code | Phase Code | Page |
|---|---|---|---|---|---|---|---|---|---|
| **GlycanPac Phases** | | | | | | | | | |
| AXH-1 | Spherical, fully porous silica | 1.9 | 175 | 220 | - | Yes | - | - | 4-132 |
| AXH-1 | Spherical, fully porous silica | 3 | 120 | 300 | - | Yes | - | - | 4-132 |
| **Accucore Phase** | | | | | | | | | |
| 150-Amide-HILIC | Spherical, solid core silica | 2.6 | 150 | 80 | - | - | - | 167 | 4-156 |

### Monolithic Affinity Columns

| Phase | Particle Type | Particle Size (µm) | Pore Size (Å) | Nominal Surface Area ($m^2/g$) | % Carbon | Endcapping | USP Code | Phase Code | Page |
|---|---|---|---|---|---|---|---|---|---|
| **ProSwift Phases** | | | | | | | | | |
| ConA-1S | Concanavalin A binding (high mannose) glycans, glycopeptides and proteins | "Monolith; | 175 | 220 | - | Yes | - | - | 4-125 |

## Columns for Oligonucleotide Separations

| Column | Target Applications | Base Matrix Material | Substrate Crosslinking | Latex Crosslinking | Capacity | Recommended Eluents | Recommended Flow Rate | Solvent Compatibility | Maximum Backpressure | pH Range |
|---|---|---|---|---|---|---|---|---|---|---|
| DNAPac PA100 | High resolution separations of single and double stranded DNA or RNA oligonucleotides | 13µm diameter nonporous substrate agglomerated with alkyl quaternary ammonium functionalized latex 100nm MicroBeads | 55% | 5% | 40µeq | Hydroxide or sodium and lithium salts of Chloride or Perchlorate | 1.5mL/min | 0-100% | 4000psi (28MPa) | 2-12.5 |
| DNAPac PA200 | Improved high resolution separations of single and double stranded DNA or RNA orthogonal to DNAPac PA100 | 8µm diameter nonporous substrate agglomerated with alkyl quaternary ammonium functionalized latex 130nm MicroBeads | 55% | 5% | 40µeq | Hydroxide, acetate/ or sodium and lithium salts of Chloride or Perchlorate | 1.2mL/min | 0-100% | 4000psi (28MPa) | 2-12.5 |
| DNAPac PA200 RS | UHPLC-resolution separations of single and double stranded DNA or RNA Best available resolution | 4µm diameter nonporous substrate agglomerated with alkyl quaternary ammonium functionalized latex 130nm MicroBeads | 55% | 5% | 40µeq | Hydroxide, acetate/ hydroxide or sodium and lithium salts of Chloride or Perchlorate | 1.3mL/min | 0-100% | 10,000 psi (69MPa) | 2-12.5 |
| DNASwift | High resolution separations for purification of oligonucleotides Highest latex-based capacity | Monolith; polymethacrylate substrate agglomerated with quaternary amine functionalized latex | 70% | 3% | 8mg, of a 20 mer oligonucleotide | $NaClO_4$ and NaCl | 0.5-2.5mL | Most Common Organic Solvents | 1500psi, 10MPa | 6.0-12.4 |

# ProPac WCX-10 and SCX-10

Weak and strong cation exchange columns are based on a nonporous core particle providing exceptionally high resolution and efficiency for separations of protein variants

- Characterization and quality control assessment of monoclonal antibodies and other proteins
- Unequalled high resolution separations
- High-efficiency peaks
- Unmatched column-to-column and lot-to-lot reproducibility
- Useful for characterization of related protein variants including deamidation and MAb lysine truncation variants
- ProPac WCX-10 is a weak cation exchanger with a carboxylate functional groups
- ProPac SCX-10 is a strong cation exchange column with sulfonate functional groups

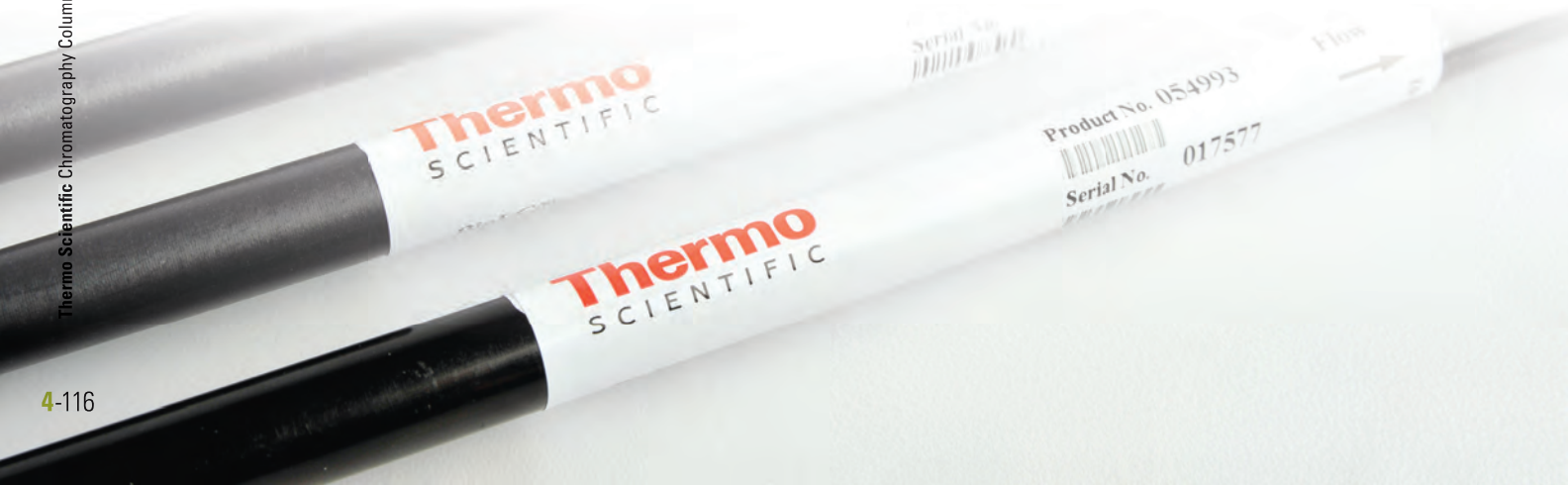
ProPac WCX-10 and SCX-10 columns can resolve isoforms that differ by a single charged residue. A hydrophilic layer prevents unwanted secondary interactions, and a grafted cation exchange surface provides pH-based selectivity control and fast mass transfer for high-efficiency separation and moderate capacity.

## ProPac WCX-10 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.0mm ID | 4.0mm ID | 9.0mm ID | 22.0mm ID |
|---|---|---|---|---|---|---|
| 10 | Guard Column | 50 | **063480** | **054994** | – | – |
| | HPLC Column | 50 | – | **074600** | – | – |
| | | 100 | – | **SP5829** | – | – |
| | | 150 | – | **SP6703** | – | – |
| | | 250 | **063472** | **054993** | **063474** | **SP5482** |

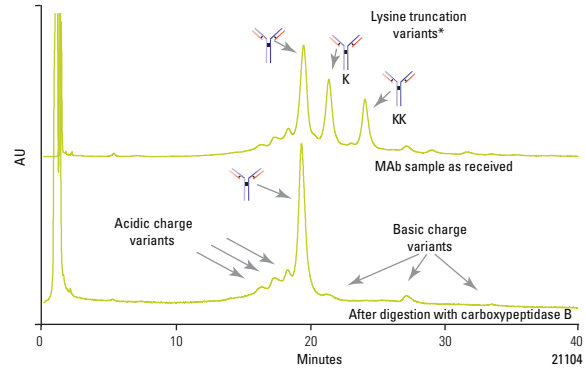
## ProPac SCX-10 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.0mm ID | 4.0mm ID | 9.0mm ID | 22.0mm ID |
|---|---|---|---|---|---|---|
| 10 | Guard Column | 50 | **063462** | **079930** | – | – |
| | HPLC Column | 250 | **063456** | **054995** | **063700** | **SP5522** |



# ProPac WCX-10 and SCX-10 *continued*

## MAb lysine truncation variants




**Column: ProPac WCX-10 , 4 x 250mm**

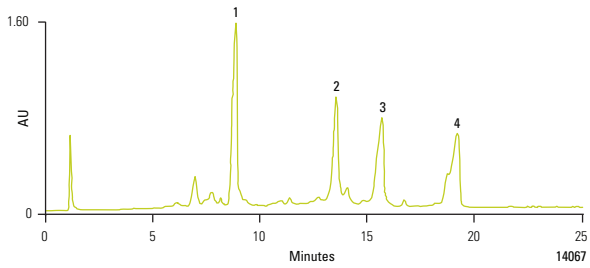
| | |
|---|---|
| Eluents: | (E1) 20mM MES<br>+ 115mM NaCl<br>+ 1mM EDTA, pH 5.5<br>(E2) 20mM MES<br>+ 145mM NaCl<br>+ 1mM EDTA, pH 5.5 |

| Gradient: | t (min) | %E1 | %E2 |
|---|---|---|---|
| | 0 | 100 | 0 |
| | 2 | 100 | 0 |
| | 40 | 0 | 100 |
| | 60 | 0 | 100 |

| | |
|---|---|
| Sample: | MAb |
| Flow Rate: | 1.0mL/min |
| λ: | 280nm |

* Peak assignment supported by data from R.J. Harris, et.al, *J.Chromatogr., A* ***1995****,705*, 129–134. and Carboxypeptidase B digest.

## Hemoglobin variants




**Column: ProPac SCX-10, 4 × 250mm**

| | |
|---|---|
| Eluent: | A) 20mM Sodium phosphate, 4mM Potassium cyanide, pH 6<br>B) 1 M Sodium chloride in water<br>C) Water |

| Gradient: | Time | %A | %B | %C |
|---|---|---|---|---|
| | Init | 50 | 0 | 50 |
| | 30 min | 50 | 50 | 0 |

| | |
|---|---|
| Flow Rate: | 1mL/min |
| Inj. Vol.: | 10µL |
| Detection: | 220nm |
| Sample: | 1. Fetal hemoglobin<br>2. Hemoglobin<br>3. Sickle cell hemoglobin<br>4. Hemoglobin C |

## ProPac Kits Ordering Guide

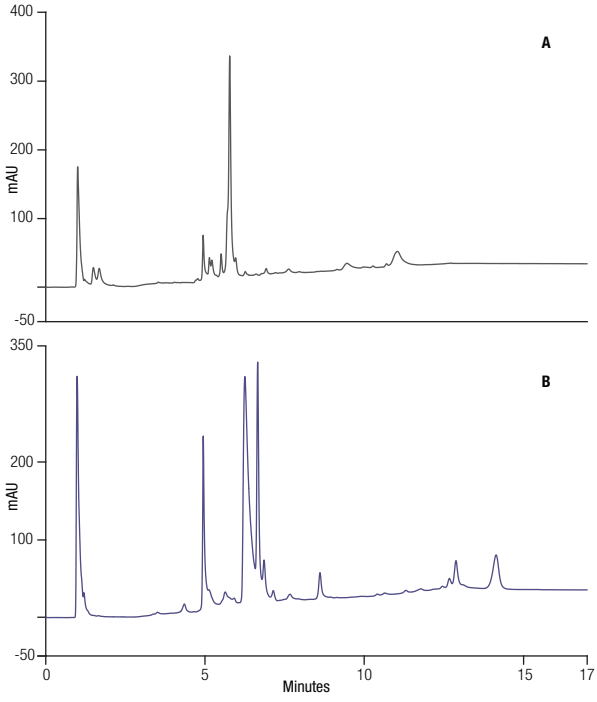
| Part Number | Phase Description | Set Contents | Column Dimensions |
|---|---|---|---|
| **SP5731** | ProPac WAX-10 Lot Select Column Set | 3 columns from 1 lot of resin | 250 x 4mm |
| **SP5732** | ProPac WAX-10 Lot Select Column Set | 3 lots of resin, 1 column from each lot | 250 x 4mm |
| **SP5729** | ProPac SAX-10 Lot Select Column Set | 3 columns from 1 lot of resin | 250 x 4mm |
| **SP5730** | ProPac SAX-10 Lot Select Column Set | 3 lots of resin, 1 column from each lot | 250 x 4mm |
| **SP5512** | ProPac WCX-10 Lot Select Column Set | 3 columns from 1 lot of resin | 250 x 4mm |
| **SP5513** | ProPac WCX-10 Lot Select Column Set | 3 lots of resin, 1 column from each lot | 250 x 4mm |
| **SP5727** | ProPac SCX-10 Lot Select Column Set | 3 columns from 1 lot of resin | 250 x 4mm |
| **SP5728** | ProPac SCX-10 Lot Select Column Set | 3 lots of resin, 1 column from each lot | 250 x 4mm |

# ProPac SCX-20 Columns

The ProPac SCX-20 column is a strong cation exchange (SCX) column designed specifically to provide high-resolution separations of proteins. The stationary phase is composed of 10µm, non-porous, solvent compatible resin beads that are uniformly coated with a highly hydrophilic layer to reduce non-specific interactions between the bead surface and the biopolymer.

- Grafted cation-exchange surface provides pH-based selectivity control
- Fast mass transfer for high-efficiency separation

**Snake venoms from naja naja and Russell's viper**




**Column: ProPac SCX-20, 4 × 250mm**

| | |
|---|---|
| Eluent A: | 20mM Tris pH 7.3 |
| Eluent B: | 0.5M NaCl in Eluent A |
| Gradient: | 1–100% B in 10 min |
| Inj. Volume: | 10µL |
| Temperature: | 30°C |
| Detection: | UV, 214nm |
| Samples: | A. Snake Venom (Naja naja) 1mg/mL<br>B. Snake Venom (Russell's viper) 1mg/mL |

## ProPac SCX-20 Ordering Guide

| Particle Size (µm) | Description | Length (mm) | 4.0mm ID |
|---|---|---|---|
| 10 | Guard Column | 50 | **074643** |
| | HPLC Column | 250 | **074628** |

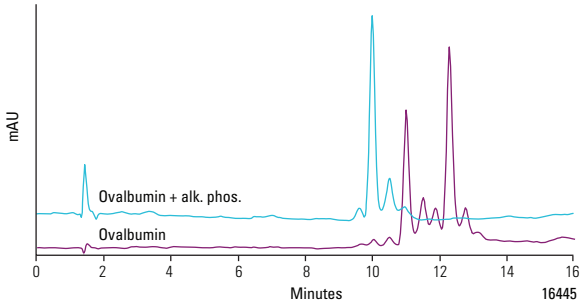
# ProPac WAX-10 and SAX-10

Weak and strong anion exchange columns are based on a nonporous core particle providing unequalled high resolution and efficiency in the separations of protein variants

- Unequalled resolution
- High-efficiency peaks
- Useful for characterization and quality control assessment of closely-related protein variants
- Supports separation of proteins that differ by as little as one amino acid residue
- Neutral hydrophilic coat that eliminates protein-resin hydrophobic interactions
- Superior lot-to-lot and column-to-column reproducibility
- ProPac WAX-10 column is a weak anion exchanger with a tertiary amine functional group
- ProPac SAX-10 is a strong anion exchange column with quaternary amine functional group

These columns can resolve protein isoforms that differ by as little as one charged residue. A hydrophilic layer prevents unwanted secondary interactions and a grafted anion exchange surface provides pH based selectivity control and fast mass transfer for high peak efficiency and resolution separations.

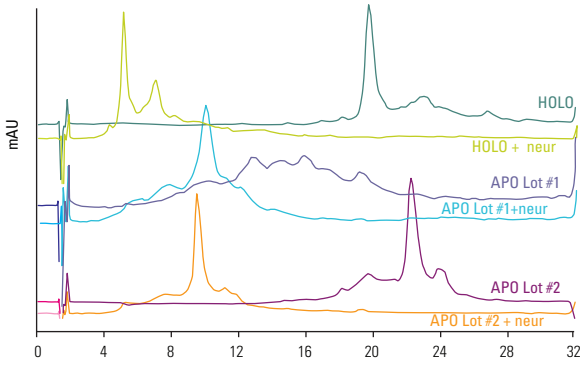
**Resolution of phosphorylation variants of ovalbumin**




**Column: ProPac SAX-10, 4 x 250mm**

| | |
|---|---|
| Eluents: | A) Water<br>B) 2.0 M NaCl<br>C) 0.1 M Tris/HCl (pH 8.5) |
| Gradient: | Time %A %B %C<br>Init 80 0 20<br>15 min 67.5 12.5 20 |
| Flow Rate: | 1.0mL/min |
| Inj.Volume: | 30µL |
| Detection: | 214nm |
| Sample: | Ovalbumin before and after alkaline phosphatase treatment |

**Effect of sialylation on transferrin chromatography**




**Columns: ProPac SAX-10, 4 × 250mm**

| | |
|---|---|
| Eluents: | A) Water<br>B) 2.0 M NaCl<br>C) 0.2 M Tris/HCl (pH 9) |
| Gradient: | Time %A %B %C<br>Init 87 3 10<br>30 min 83 7 10 |
| Flow Rate: | 1.0mL/min |
| Inj. Volume: | 50µL |
| Detection: | 214nm |
| Samples: | HOLO (iron rich) and APO (iron poor) human transferrin samples before and after neuraminidase treatment. Digestions were carried out overnight at 37 C in sodium acetate buffer at pH 5. |

### ProPac WAX-10 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.0mm ID | 4.0mm ID | 9.0mm ID | 22.0mm ID |
|---|---|---|---|---|---|---|
| 10 | Guard Column | 50 | **063470** | **055150** | – | – |
| | HPLC Column | 250 | **063464** | **054999** | **063707** | **SP5598** |

### ProPac SAX-10 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.0mm ID | 4.0mm ID | 9.0mm ID | 22.0mm ID |
|---|---|---|---|---|---|---|
| 10 | Guard Column | 50 | **063454** | **054998** | – | – |
| | HPLC Column | 250 | **063448** | **054997** | **063703** | **SP5594** |

## ProPac PA1

For hydrophilic anionic protein separations

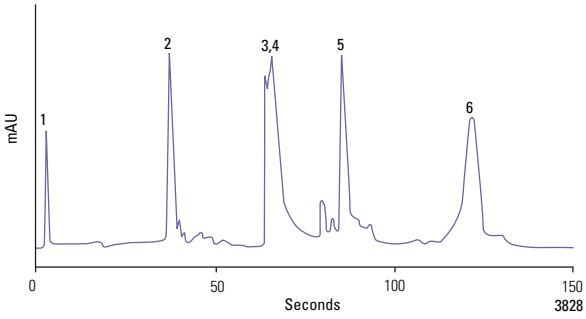
- Good for hydrophilic proteins and peptides
- Ideal for high-resolution separations of proteins with pI values from 3 to 11
- Available in semipreparative format
- Pellicular packing ensures high-efficiency and fast mass transport

The ProPac PA1 column supports the analysis and purification of hydrophilic anionic proteins and peptides.

### ProPac PA1 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 4.0mm ID | 9.0mm ID |
|---|---|---|---|---|
| 10 | Guard Column | 50 | **039657** | – |
| | HPLC Column | 250 | **039658** | **040137** |

**Gradient separation of protein standards**




**Column: ProPac PA1 (4 × 50mm)**

| | |
|---|---|
| Eluent: | 10 to 350mM NaCl in 1.0mM Tris, pH 8.2 |
| Flow Rate: | 5mL/min |
| Detection: | UV, 280nm |
| Peaks: | 1. Horseheart Myoglobin 33µg<br>2. Contaminant –<br>3,4. Conalbumin 66<br>5. Ovalbumin 66<br>6. Soybean Trysin Inhibitor 66 |

# ProPac HIC-10

Hydrophobic Interaction Chromatography columns for the high resolution separation of proteins and peptides

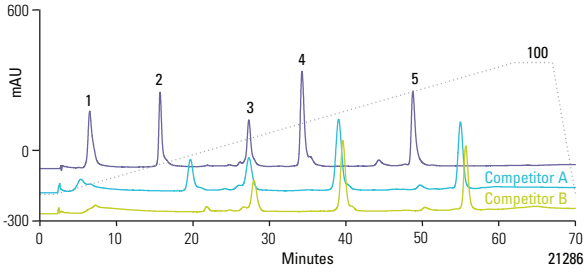
- High-resolution HPLC separation of proteins, protein variants and peptides
- Proteins are separated under non-denaturing conditions
- High protein loading capacity for protein purification applications
- Wide range of applications
- Based on 5µm ultra high purity spherical silica gel particles with 300Å pores

The ProPac HIC-10 column is a high-resolution, high-capacity, silica-based HIC column that provides excellent separations of proteins and variants for analytical and preparative applications. ProPac HIC columns provide exceptional hydrolytic stability under the highly aqueous conditions used in HIC.

## ProPac HIC-10 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.1mm ID | 4.6mm ID | 7.8mm ID |
|---|---|---|---|---|---|
| 5 | HPLC Column | 75 | – | – | **063665** |
| | | 100 | **063653** | **063655** | – |
| | | 250 | – | **074197** | – |

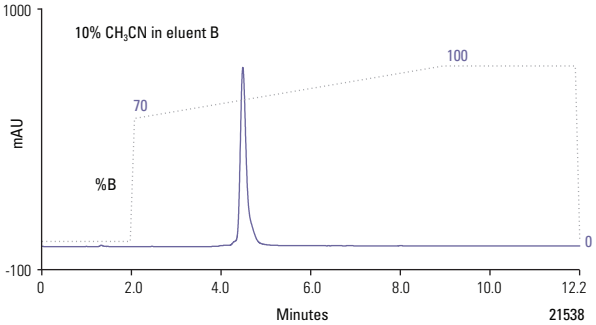
### Protein mixture




**Column: 7.5 × 75mm (Competitors A and B); 7.8 × 75mm (ProPac HIC-10)**

| | |
|---|---|
| Flow: | 1.0mL/min |
| WVL: | 214nm |
| Eluents: | (A) 2 M $(NH_4)2\,SO_4$ in 0.1 M $NaH_2PO_4$ (pH 7.0)<br>(B) 0.1 M $NaH_2PO_4$ (pH 7.0) |
| Sample: | Mixture of proteins<br>(1mg/mL each final after 1:1 dilution with eluent A) |
| Inj. Volume: | 20µL |
| Order of elution: | 1. Cytochrome c<br>2. Myoglobin<br>3. Ribonuclease A<br>4. Lysozyme<br>5. Chymotrypsinogen |

### Monoclonal antibody




**Column: ProPac® HIC-10, 4.6 × 100mm**

| | |
|---|---|
| Eluents: | (A) 0.5 M $(NH_4)_2\,SO_4$ in 0.1M $NaH_2PO_4$ (pH 7.0)<br>(B) 0.1 M $NaH_2PO_4$ (pH 7.0) |
| Gradient: | 70–100% B in 15 min |
| Flow: | 1mL/min |
| Inj. Volume: | 5µL (25µg) |
| Detection: | UV, 214nm |
| Sample: | MAb 50µL (50mg/mL)<br>+ 450µL Eluent B |

# ProPac IMAC-10

Immobilized Metal Affinity Chromatography (IMAC) column for analytical and semipreparative protein and peptide applications

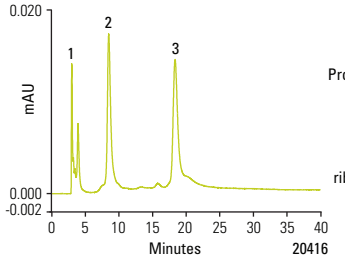
- High-purity separations of metal-binding proteins
- State-of-the-art technology for reusable columns with metal tailored specificity
- Resolve target proteins using a single column in a high-resolution gradient run
- Retention control by imidazole concentration or pH gradient
- High loading capacity for protein purification applications
- Wide range of metal-specific applications

The ProPac IMAC-10 is a high-resolution analytical and semipreparative column for separation of proteins and peptides by immobilized metal affinity chromatography

## ProPac IMAC-10 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 1.0mm ID | 2.0mm ID | 4.0mm ID | 9.0mm ID | 22.0mm ID |
|---|---|---|---|---|---|---|---|
| 10 | Loading Column | 50 | – | – | **063667** | **063710** | – |
| | | 250 | – | – | – | **063718** | – |
| | HPLC Column | 50 | **063617** | **063272** | **063276** | **063615** | – |
| | | 250 | – | **063274** | **063278** | **063280** | **063282** |

### Standard proteins with surface-exposed histidines

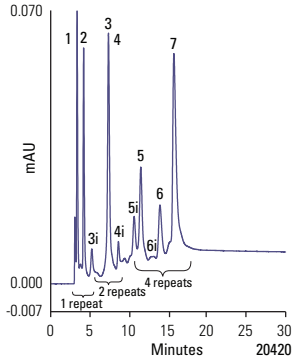




**Column: ProPac IMAC-10 (4mm x 250mm)**

| | | |
|---|---|---|
| E1: 20mM MES + 0.5 M NaCl, pH = 7.5 | | |
| E2: E1 + 100mM imidazole, pH = 7.5 | | |
| Gradient: | t (min) | %E1 |
| | 0 | 96 |
| | 15 | 0 curve 7 |
| | 40 | 0 |
| Inject Vol: | 15µL | |
| Sample: | 1. 0.25mg/mL ribonuclease A | |
| | 2. 1.00mg/mL myoglobin | |
| | 3. 1.50mg/mL carbonic anhydrase | |
| Flow Rate: | 0.5mL/min | |
| Wavelength: | 280nm | |

### Prion-related peptides





**Column: ProPac IMAC-10 (4 × 250mm)**

| | |
|---|---|
| Eluent: | (E1) 20mM HEPES + 0.5 M NaCl, pH = 7.5 |
| | (E2) E1 + 50mM imidazole, pH = 7.5 |
| Gradient: | t (min) %A |
| | 0 95 |
| | 10 0 curve 7 |
| | 30 0 |
| Inj. Volume: | 15µL |
| Sample: | Prion-derived peptides |
| Flow Rate: | 0.5mL/min |
| Wavelength: | 280nm |

| Peak | # Sequence |
|---|---|
| 1 | PHGGGWGQ |
| 2 | PHGXGWGQ |
| 3 | KKRPKP(PHGGGWGQ)$_2$ |
| 4 | KKRP(PHGXGWGQ)$_2$ |
| 5 | KKRPKPWGQ(PHGGGWGQ)$_4$ |
| 6 | WGQ(PHGGGWGQ)$_4$ |
| 7 | WGA(PHGGGWGA)$_4$ |

X = sarcosine (N-methyglycine)

# ProSwift IEX

## Monolith IEX columns for high-resolution and fast protein analysis

ProSwift IEX monoliths provide excellent resolving power at high mass loading combined with fast analysis capability

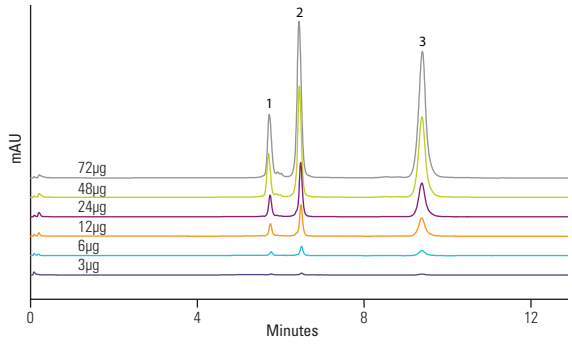
- High resolution
- High loading capacity
- Fast analysis
- Wide range of operational flow rates
- Excellent stability over a wide pH range
- Outstanding reproducibility and ruggedness

ProSwift polymer monolith (poly(Meth)acrylate) media are uniquely suited for separation of proteins. Each monolith is a single cylindrical, sponge-like polymer rod containing an uninterrupted, interconnected network of flow-through channels of a specific pore size. These large channels combined with the monolith's nonporous surfaces result in fast mass-transfer, high-resolution, and fast protein separations. The unique globular morphology of the polymer medium provides its high capacity.

### ProSwift Ion Exchange Monolith Ordering Guide

| Functional Group | Length (mm) | 1.0mm ID | 4.6mm ID |
|---|---|---|---|
| WAX-1S | 50 | **066642** | **064294** |
| WCX-1S | 50 | **066643** | **064295** |
| SAX-1S | 50 | **068459** | **064293** |
| SCX-1S | 50 | **071977** | **066765** |

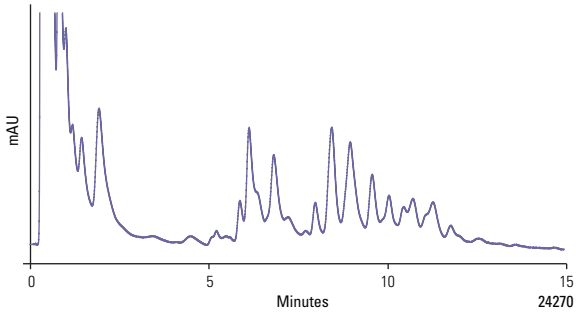
### Dynamic protein loading capacity of ProSwift WCX-1S 1 × 50mm




**Column: ProSwift WCX-1S, 1 × 50mm**

| | |
|---|---|
| Eluents: | A. 10mM Sodium phosphate (pH 7.6)<br>B. 1 M NaCl in eluent A |
| Gradient: | 0% B for 2 min, 0–85% B in 7.5 min,<br>85% B for 3 min |
| Flow Rate: | 0.2mL/min |
| Inj. Volume: | 1–24µL |
| Temperature: | 30°C |
| Detection: | UV, 280nm |
| Sample: | Protein mix, 1mg/mL each |
| Peaks: | 1. Ribonuclease A<br>2. Cytochrome C<br>3. Lysozyme |

### Protein separation

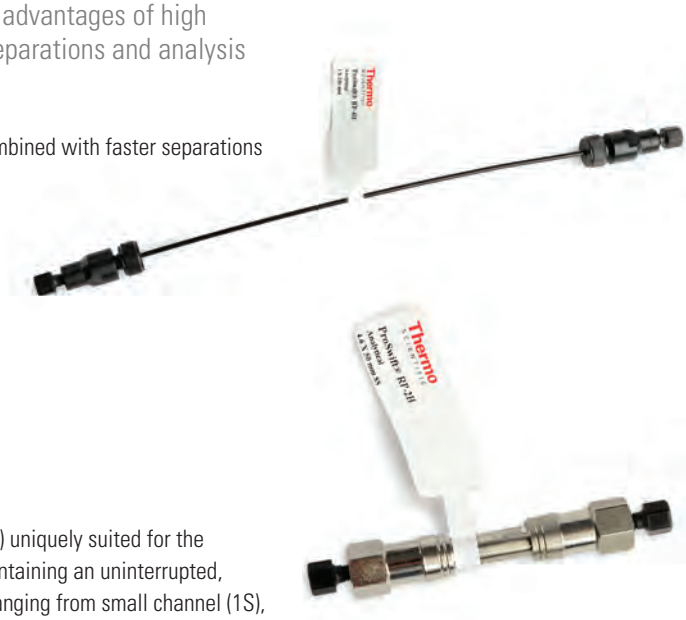



**Column: ProSwift WAX-1S, 1 × 50mm**

| | |
|---|---|
| Eluents: | A. 10mM Tris, pH 7.6<br>B. 1 M NaCl in 10mM Tris, pH 7.6 |
| Gradient: | 5 to 55% of B in 13 min,<br>hold for 2 min |
| Flow Rate: | 0.2mL/min |
| Temperature: | 30°C |
| Detection: | UV, 280nm |
| Inj. Volume: | 1.3µL |
| Sample: | 1.25mg/mL *E. coli* protein |

# ProSwift RP

Reversed-phase monolith columns that uniquely provide the advantages of high resolution at exceptionally high flow rates for fast protein separations and analysis



Deliver the outstanding resolving power of nonporous analytical media combined with faster separations and analysis than any bead based columns available.

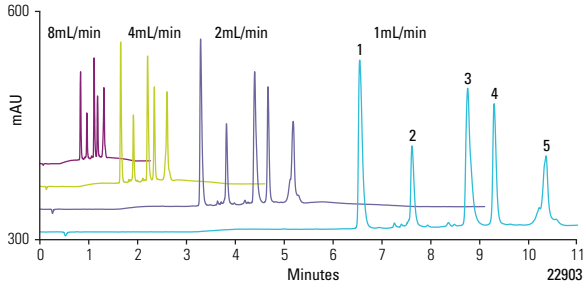
- High resolution at high speed
- Highest operational flow rates available
- High throughput and improved productivity
- Excellent stability over a wide pH range of 1 to 14
- Outstanding reproducibility and ruggedness
- High stringent wash compatible, for example, 1 M NaOH
- High loading capacity

ProSwift polymer reversed-phase monolith media are (polyStyrene-co-DVB) uniquely suited for the separation of proteins. Each monolith is a single cylindrical polymer rod containing an uninterrupted, interconnected network of flow-through channels of a specific pore size; ranging from small channel (1S), medium size channels (2H & 4H) to very large channel (3U) sizes. These channels and the monolith's nonporous surfaces result in fast mass transfer for high-resolution and fast protein separations. The channels also produce low backpressure, allowing the use of higher linear velocities with minimal loss of resolution.

## ProSwift RP Ordering Guide

| Functional Group | Length (mm) | 1.0mm ID | 4.6mm ID |
|---|---|---|---|
| RP-1S | 50 | – | **064297** |
| RP-2H | 50 | – | **064296** |
| RP-3U | 50 | – | **064298** |
| RP-4H | 50 | **069477** | – |
| RP-4H | 250 | **066640** | – |

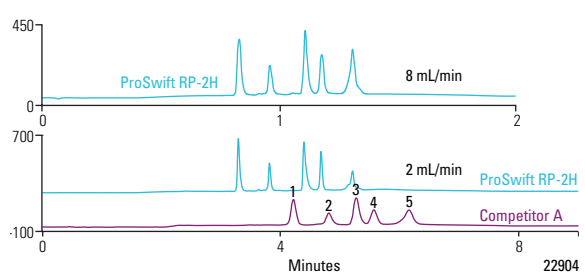
### Proteins




**Column: ProSwift RP-2H (4.6 × 50mm)**

| | |
|---|---|
| Flow Rate: | 1, 2, 4, or 8mL/min |
| Eluents: | (A) DI $H_2O$/$CH_3CN$ (95:5; V/V) + 0.1% TFA<br>(B) DI $H_2O$/$CH_3CN$ (5:95; V/V) + 0.1% TFA |
| Gradient: | 1mL/min: 1-75% B in 12 min<br>2mL/min: 1-75% B in 6 min<br>4mL/min: 1-75% B in 3 min<br>8mL/min: 1-75% B in 1.5 min |
| UV Detection: | 214nm |
| Sample: | Mixture of five proteins |
| Inj. Volume: | 5µL |
| Order of Elution: | 1. Ribonuclease A 1.5mg/mL<br>2. Cytochrome C 0.5<br>3. BSA 1.5<br>4. Carbonic anhydrase 0.9<br>5. Ovalbumin 1.5 |

### Competitive comparison




| | |
|---|---|
| **Columns:** | **1. ProSwift RP-2H, 4.6 × 50mm**<br>**2. Competitor A, 4.6 × 100mm, 15µm** |
| Eluents: | (A) DI $H_2O$/$CH_3CN$ (95:5; V/V) + 0.1% TFA<br>(B) DI $H_2O$/$CH_3CN$ (5:95; V/V) + 0.1% TFA |
| Gradient: | 2mL/min: 1-75% B in 6 min<br>8mL/min: 1-75% B in 1. min |
| Flow Rate: | 2 or 8mL/min |
| Inj. Volume: | 5µL |
| Temperature: | 30°C |
| Detection: | UV, 214nm |
| Sample: | Mixture of five proteins |
| Peaks: | 1. Ribonuclease A 1.5mg/mL<br>2. Cytochrome C 0.5<br>3. BSA 1.5<br>4. Carbonic anhydrase 0.9<br>5. Ovalbumin 1.5 |

# ProSwift ConA-1S

For the highly efficient enrichment and purification of Con A binding glycans and glycoconjugates

The ProSwift ConA-1S affinity monolith column is unsurpassed for fast, highly efficient enrichment and purification of Concanavalin A (Con A) binding glycans, glycopeptides, and glycoproteins.

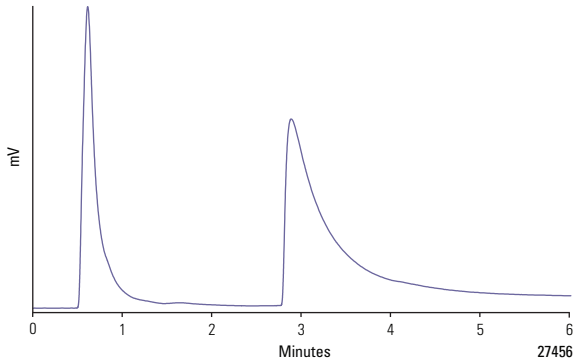
- Highly efficient enrichment and purification through high-mannose-Con A binding
- Highly purified glycan and glycoconjugate products
- High capacity and ligand density
- High sample recovery
- Low elution volumes
- Fast separations
- HPLC compatible
- Reusable for over one hundred purifications

The HPLC compatible ProSwift ConA-1S affinity column maintains the specificity and selectivity for Con A binding glycans and glycoconjugates. The high capacity monolith (poly(meth)acrylate) and ligand density of the ProSwift ConA-1S column facilitates the highly efficient enrichment of samples and can purify up to 2mg of glycoproteins. The high peak efficiency monolith (poly(meth)acrylate) column produces sharp, narrow peaks resulting in low elution volumes of highly concentrated products. The column is reusable, and many enrichments and purifications are possible with minimal loss of capacity.

## ProSwift ConA-1S Ordering Guide

| Functional Group | Length (mm) | 5.0mm ID |
|---|---|---|
| ConA-1S | 50 | **074148** |

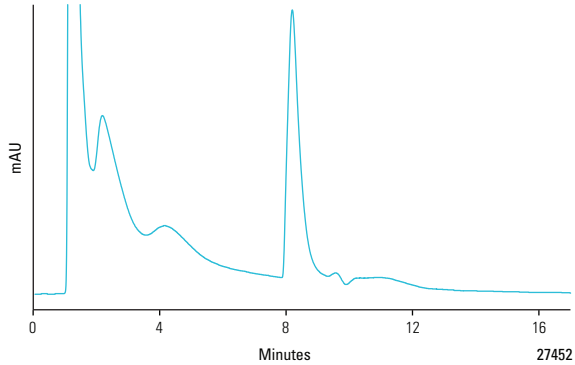
### Fast, highly efficient enrichment and purification of a group of fluorescently labeled glycans




**Column: ProSwift ConA-1S (5 x 50mm)**

| | |
|---|---|
| Flow rate: | 1.0mL/min |
| Eluent A: | 50mM NaOAc, 0.2M NaCl, pH 5.3, with 1mM $CaCl_2$ and 1mM $MnCl_2$ |
| Eluent B: | 100mM α-methyl mannoside in eluent A |
| Gradient: | 0% B for 2 min, 0-100% B in 0.5 min, 100% B for 3.5 min |
| Temperature: | 25°C |
| Sample: | 2-AB labeled serum protein N-glycans |
| Detection: | Fluorescence, EM at 420nm |

### Glycopeptide enrichment

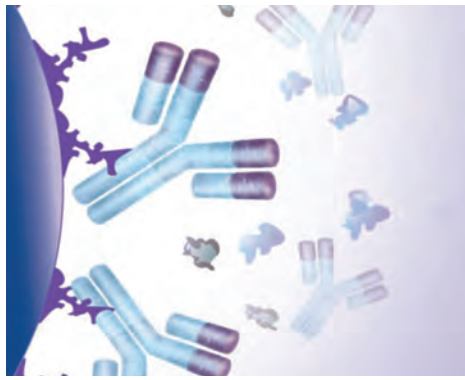



**Column: ProSwift ConA (5 x 50mm)**

| | |
|---|---|
| Eluent A: | 50mM NaOAc, 0.2 M NaCl, pH 5.3, with 1mM $CaCl_2$, 1mM $MgCl_2$ |
| Eluent B: | 100mM α-methyl-mannopyranoside in eluent A |
| Flow Rate: | 0.5mL/min |
| Temperature: | 25°C |
| Detection: | UV 214nm |
| Sample: | Trypsin digested HRP peptides |
| Inj. Volume: | 40µL |
| Gradient: | 100% A from 0–5 min, 100% B from 6–15 min, 100% A from 16–25 min |

# MAbPac Protein A Column

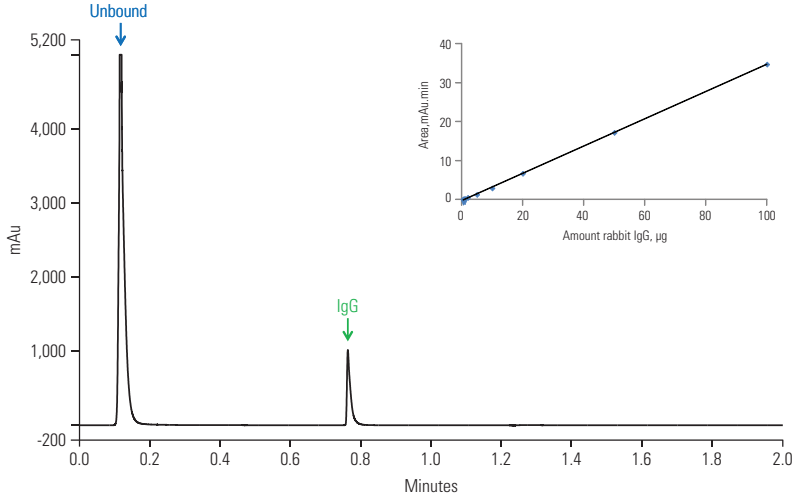
## Fast MAb titer analysis



The Thermo Scientific MAbPac Protein A column is an affinity column designed to provide fast monoclonal antibody (MAb) titer analysis of samples such as harvest cell cultures (HCC). This HPLC column offers high throughput and accurate analysis through a combination of low back pressure and high efficiency. The MAbPac Protein A column format allows rapid automation of loading, binding, elution and collection using Thermo Scientific biocompatible systems. The column is based on a novel non-porous polymeric resin consisting of a divinylbenzene core and a hydrophilic surface, optimized for affinity separation.

- High efficiency column
- Rugged
- Excellent sample recovery
- Designed for ease of use and automation

**Harvest cell culture titer analysis**




**Column: MAbPac Protein A, (4 × 35mm)**

| | |
|---|---|
| Flow Rate: | 2 mL/min |
| Eluent A: | 50mM Sodium Phosphate, 150mM NaCl, 5% acetonitrile, pH 7.5 |
| Eluent B: | 50mM Sodium Phosphate, 150mM NaCl,5% acetonitrile, pH 2.5 |
| Gradient: | 0% B for 0.2 mins, 100% B for 0.60 mins,0% B for 1.20 mins |
| Temperature: | 30°C |
| Detection: | 280 nm |
| Injection volume: | 10µL |
| Sample: | MAb B, 5mg/mL Harvest Cell Culture |

## MAbPac Protein A Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 4.0 mm ID |
|---|---|---|---|
| 12 | HPLC Column | 35 | **082539** |

# MAbPac SCX-10

Strong cation exchange column designed specifically for the high-resolution, high efficiency analysis of monoclonal antibodies and associated variants

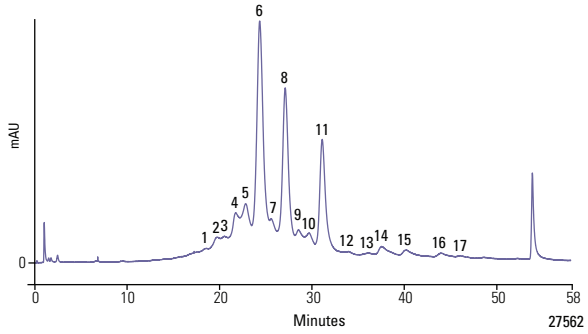
- Exceptionally high resolution for monoclonal antibody variants
- High efficiency
- Ideal for characterization and quality control assessment of monoclonal antibodies
- Unmatched column-to-column and lot-to-lot reproducibility
- Hydrophobic interactions essentially eliminated
- Ideal for stability studies
- Meets the regulatory requirements for biopharmaceutical characterization

The unique nonporous pellicular resin provides exceptionally high resolving power, permitting the separation of monoclonal antibody variants that differ by as little as one charged residue. Hydrophobic interactions with the resin are essentially eliminated for very efficient peaks.

## MAbPac SCX-10 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.0mm ID | 4.0mm ID | 9.0mm ID |
|---|---|---|---|---|---|
| 3 | HPLC Column | 50 | – | **077907** | – |
| 5 | HPLC Column | 50 | – | **078656** | – |
| | | 150 | – | **085198** | – |
| | | 250 | – | **078655** | – |
| 10 | Guard Column | 50 | **075749** | **074631** | – |
| | HPLC Column | 50 | – | **075603** | – |
| | | 150 | – | **075602** | – |
| | | 250 | **075604** | **074625** | **SP6866** |

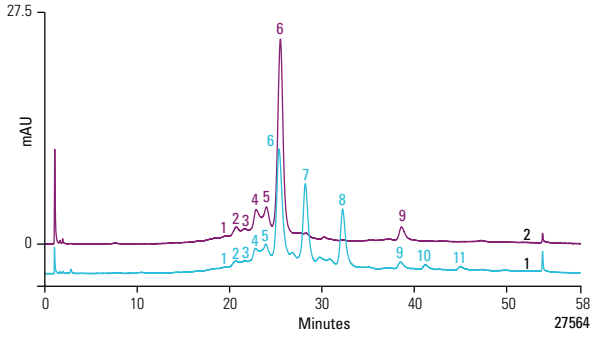
### High resolution separations of monoclonal antibody variants




**Column: MAbPac SCX-10 (4 × 250mm)**

| | |
|---|---|
| Eluents: | A. 20mM MES (pH 5.6) + 60mM NaCl<br>B. 20mM MES (pH 5.6) + 300mM NaCl |
| Gradient: | 15–36% B in 50 min |
| Flow Rate: | 1mL/min |
| Temperature: | 30°C |
| Inj. Volume: | 10µL |
| Detection: | UV at 280nm |
| Sample: | MAb B, 5mg/mL |
| Peaks 1–5: | Acidic variants |
| Peaks 6, 8, 11: | C-Terminal Lys variants |
| Peaks 12–17: | Basic variants |

### Baseline resolution of C-terminal lysine variants of a monoclonal antibody




**Column: MAbPac SCX-10 (4 × 250mm)**

| | |
|---|---|
| Eluents: | A. 20mM MES (pH 5.6) + 60mM NaCl<br>B. 20mM MES (pH 5.6) + 300mM NaCl |
| Gradient: | 15–36% B in 50 min |
| Flow Rate: | 1mL/min |
| Temperature: | 30°C |
| Inj. Volume: | 5µL |
| Detection: | UV at 280nm |
| Samples: | 1. MAb B, 900µg in 100µL (no carboxypeptidase)<br>2. MAb B, 900µg in 100µL + carboxypeptidase, 50µg, incubation at 37°C for 3 h |
| Both Chromatograms: | Peaks 1–5: Acidic variants |
| Sample 1: | Peaks 6-8: C-Terminal lysine truncation variants of main peak<br>Peaks 9–11: C-Terminal lysine truncation variants of minor variant peak |
| Sample 2: | Peak 6 results from peaks 6, 7, and 8 after CBP treatment. Peak 9 results from peaks 9, 10, and 11 afer CBP treatment |

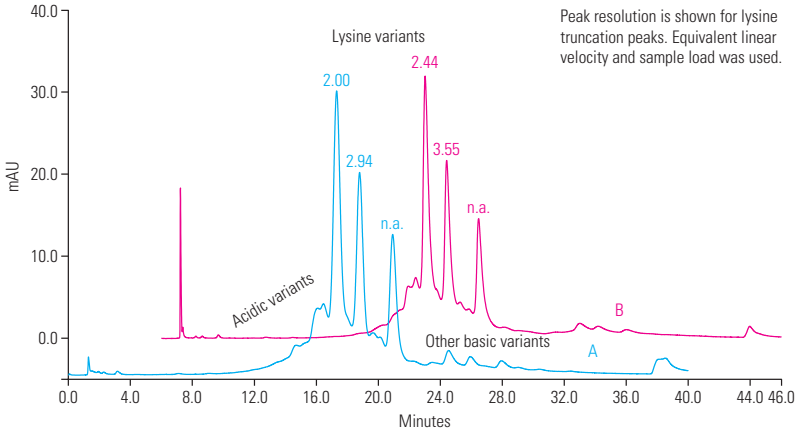
# MAbPac SCX-10 RS Columns

BioRS, strong cation exchange column designed for monoclonal antibodies and associated variants

- UHPLC, high throughput analysis
- Specially developed bio-inert PEEK lined stainless steel column hardware
- High pressure compatibility
- Suitable for operation up to 7,000 psi

Higher resolution and throughput of MAb charge variant UHPLC separations can be achieved using the small particle MAbPac strong cation-exchange phase with specially developed bio-inert PEEK lined stainless steel column hardware. These columns take advantage of smaller resin size as well as longer column length to maximize the resolution of MAb variant separation, and are suitable for operation up to 7,000 psi. Higher pressure compatibility of the column hardware allows use of high flow rates for faster separation

**Improved MAb resolution**




Peak resolution is shown for lysine truncation peaks. Equivalent linear velocity and sample load was used.

**Column: MAbPac SCX, 5µm**

| | |
|---|---|
| Dimension: | 4.6 × 250mm |
| Sample: | MAb 5mg/mL |
| Injection Volume: | 15µL |
| Eluent A: | 20 mM MES pH 5.6 + 60 mM |
| Eluent B: | 20 mM MES pH 5.6 + 300 mM NaCl |
| Flow Rate: | 1.5 mL/min |
| Column backpressure: | ~8900Psi |
| A: | Gradient: 33-53% B in 30 min |
| B: | Gradient: 33-53% in 20 min |

## MAbPac SCX-10 RS Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 4.6 mm ID |
|---|---|---|---|
| 5 | BioRS Column | 50 | **082674** |
| | | 150 | **085209** |
| | | 250 | **082673** |

# MAbPac SEC-1

A size exclusion chromatography (SEC) column specifically designed for the high resolution separation and characterization of monoclonal antibodies (MAb) and their aggregates

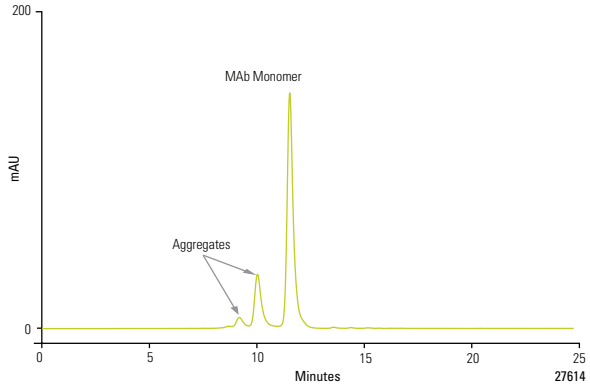
- Anaylsis of monoclonal antibodies (MAb) and their aggregates
- Analysis of MAb Fab and Fc fragments.
- Hydrophilic bonded layer for minimal nondesired interactions between the biomolecules and the stationary phase
- Nonmetallic and Biocompatible PEEK housing eliminates metal contamination from the column hardware
- Stable surface bonding leads to low column bleed and compatibility with MS, ELSD and Corona CAD detection
- Reproducible and rugged
- Superior performance for the analysis of monoclonal antibodies, even using high and low-salt concentrations

The stationary phase is packed in bio-inert PEEK format and is compatible with different eluent conditions containing both low and high concentrations of salt in mobile phases, and mass spectrometry friendly volatile eluents.

## MAbPac SEC-1 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 4.0mm ID |
|---|---|---|---|
| 5 | Guard Column | 50 | **074697** |
| | HPLC Column | 150 | **075592** |
| | | 300 | **074696** |

### Monoclonal antibody aggregate separation




**Column: MAbPac SEC-1, 5µm**

| | |
|---|---|
| Dimension: | 4.0 × 300mm (PEEK) |
| Mobile Phase: | 0.3 M NaCl in 50mM phosphate buffer pH 6.8 |
| Temperature: | 30°C |
| Flow Rate: | 0.20mL/min |
| Inj. Volume: | 2µL |
| Detection: | UV, 280nm |
| Sample: | MAb (10mg/mL) |

# Monoclonal Antibody Characterization and Analysis Kits

## MAb Charge Variant Analysis IEX Column Kit

MAb Charge Variant Analysis IEX Column Kit includes two ion-exchange (IEX) specialty columns for MAb charge variants analysis. This kit is a convenient starter kit for researchers at the beginning of MAb analysis projects, and facilitates the screening of two columns for determination of the best column for their specific monoclonal antibody sample.

Included in the Kit:

- ProPac WCX-10 Analytical column, 4 × 250mm (P/N 054993), a weak cation-exchange column, the industry standard for high-resolution, high-efficiency analysis of monoclonal antibodies and associated variants
- MAbPac SCX-10 Analytical column, 4 × 250mm (P/N 074625), a strong cation-exchange column designed specifically for high-resolution, high-efficiency analysis of monoclonal antibodies and associated variants

### MAb Charge Variants Kit Ordering Guide

| Description | Cat. No. |
|---|---|
| MAb Charge Variants Analysis IEX Column Kit | **076196** |

# MAb Analysis IEX and SEC Column Kit

The MAb Analysis IEX and SEC Column Kit includes two columns: an ion-exchange (IEX) column and a size-exclusion (SEC) column. This kit is a convenient starter and column replacement kit for MAb analysis projects.

Included in the kit:

- MAbPac SCX-10 Analytical column, 4 × 250mm (P/N 074625), a strong cation-exchange column designed specifically for high-resolution, high-efficiency analysis of monoclonal antibodies and associated variants.
- MAbPac SEC-1 Analytical column, 4 × 300mm (P/N 074696), a size-exclusion column designed for separating monoclonal antibody (MAb) monomers, aggregates, and fragments.

### MAb Analysis Kit Ordering Guide

| Description | Cat. No. |
|---|---|
| MAb Analysis IEX and SEC Column Kit | **076197** |

# Thermo Scientific pH Gradient Buffers

## Simple method development for charge variant characterization

The Thermo Scientific pH gradient platform accelerates method development and facilitates method transfer to QA/QC for a wide range of protein and MAb charge variants through a generic LC-based approach to charge variant characterization.

- Patented buffer formulations enable fast, robust and reproducible pH gradients that are simple to optimize and easily automated
- Ready to use with existing LC columns and systems, without the need for time consuming mobile phase adjustments
- Applicable to the majority of MAbs

Thermo Scientific pH buffer concentrates used in the pH gradient platform can be purchased individually or as a pair, in quantities of 125mL or 250mL. For added convenience, the 125mL buffers can also be bundled with columns in a number of specifically preconfigured kits

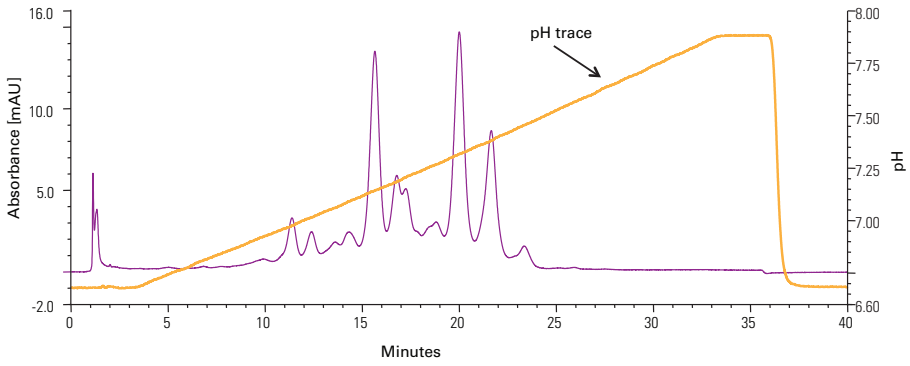
- The CX-1pH gradient starter kit contains 125mL each of buffers A and B, plus a MAbPac SCX-10, 10µm, 4 × 250mm column
- The CX-1 pH gradient high throughput kit contains 125mL each of buffers A and B, plus a MAbPac SCX-10, 5µm, 4 × 50mm column
- The CX-1 pH gradient high resolution kit contains 125mL each of buffers A and B, plus a MAbPac SCX-10, 5µm, 4 × 250mm column

For the ultimate flexibility, the preconfigured kits are also available as platforms, including the pH Designer Software.The options are listed in the table below:

### pH Gradient Buffers Ordering Guide

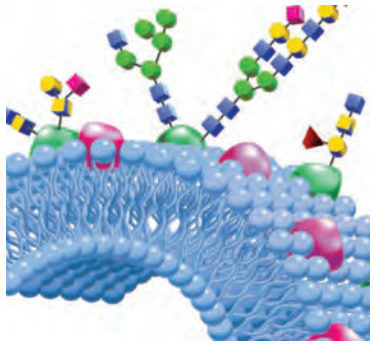
| Description | Cat. No. |
|---|---|
| CX-1 pH Gradient Buffer A (pH 5.6), 125mL | **083273** |
| CX-1 pH Gradient Buffer B (pH 10.2), 125mL | **083275** |
| CX-1 pH Gradient Buffer Kit (pH 5.6 to 10.2), 125mL | **083274** |
| CX-1 pH Gradient Buffer A (pH 5.6), 250mL | **085346** |
| CX-1 pH Gradient Buffer B (pH 10.2), 250mL | **085348** |
| CX-1 pH Gradient Buffer Kit (pH 5.6 to 10.2), 250mL | **085349** |
| CX-1 pH Gradient Starter Kit (pH 5.6 to 10.2), 125mL | **083381** |
| CX-1 pH Gradient High Throughput Kit (pH 5.6 to 10.2), 125mL | **083378** |
| CX-1 pH Gradient High Resolution Kit (pH 5.6 to 10.2), 125mL | **083272** |
| CX-1 pH Gradient Starter Platform (pH 5.6 to 10.2), 125mL | **083380** |
| CX-1 pH Gradient High Throughput Platform (pH 5.6 to 10.2), 125mL | **083376** |
| CX-1 pH Gradient High Resolution Platform (pH 5.6 to 10.2), 125mL | **083270** |
| pH Designer Software | **085022** |

**Optimiztion of MAb charge variant separation using a linear pH gradient: 25% B (pH 6.75) to 50% B (pH 7.9)**



# GlycanPac AXH-1 Column

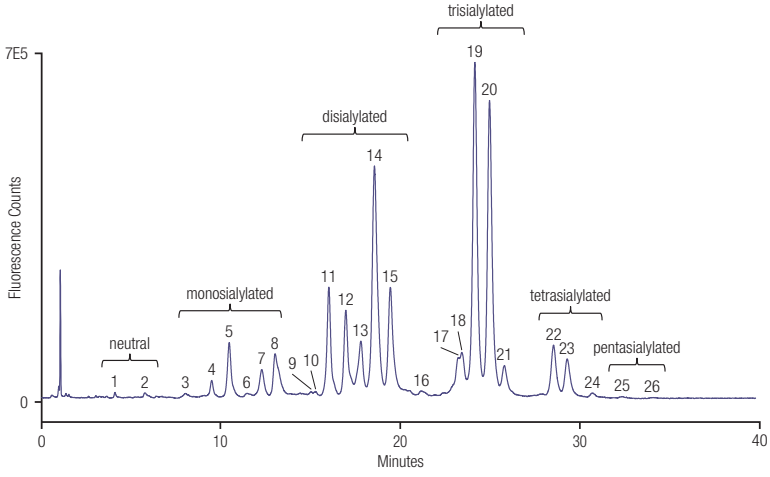
## High-Resolution Columns for Glycan Analysis



- Unique glycan selectivity based on charge, size and polarity
- Excellent resolution for both native and labeled glycans
- Useful for both high-resolution glycan profile characterization and easy quantification of glycans based on charge
- Compatible with fluorescence and MS detection methods
- High chromatographic efficiency and excellent column stability

Thermo Scientific™ GlycanPac™ AXH-1 is a high-performance, silica-based HPLC column for simultaneous separation of glycans by charge, size and polarity. It is designed for high-resolution and high-throughput analysis with unique selectivity for biologically important glycans, either labeled or native, by LC-fluorescence and LC-MS methods.

**Separation of 2AB labeled N-glycans from bovine fetuin by charge, size and polarity**




**Column: GlycanPac AXH-1 (1.9µm)**

| | |
|---|---|
| Dimension: | 2.1 × 150mm |
| Mobile Phase | A: Acetonitrile (100%)<br>B: Water<br>C: Ammonium formate (100mM, pH = 4.4) |
| Flow Rate: | 0.4mL/min |
| Injection Vol.: | 50 Pmoles |
| Temperature: | 30 °C |
| Detection: | Fluorescence at 320/420nm |
| Sample: | 2AB labeled N-glycan from bovine fetuin |

| Time (min) | % A | % B | % C | Flow (mL/min) | Curve |
|---|---|---|---|---|---|
| -10 | 78 | 20 | 2 | 0.4 | 5 |
| 0 | 78 | 20 | 2 | 0.4 | 5 |
| 30 | 70 | 20 | 10 | 0.4 | 5 |
| 35 | 60 | 20 | 20 | 0.4 | 5 |
| 40 | 50 | 20 | 30 | 0.4 | 5 |

## GlycanPac AXH-1 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.1 mm ID | 3.0 mm ID | 4.6 mm ID |
|---|---|---|---|---|---|
| 1.9 | UHPLC Column | 100 | **082473** | – | – |
| | | 150 | **082472** | – | – |
| | | 250 | **082521** | – | – |
| 3 | Guard Cartridges (2/pk) | 10 | **082476** | **082475** | **082474** |
| | HPLC Column | 150 | **082470** | **082469** | **082468** |

## Acclaim Guard Holder Ordering Guide

| Description | Cat. No. |
|---|---|
| Acclaim Guard Cartridge Holder V-2 | **069580** |
| Acclaim Guard Kit (Holder and coupler) V-2 | **069707** |
| Guard to Analytical Column Coupler V-2 | **074188** |

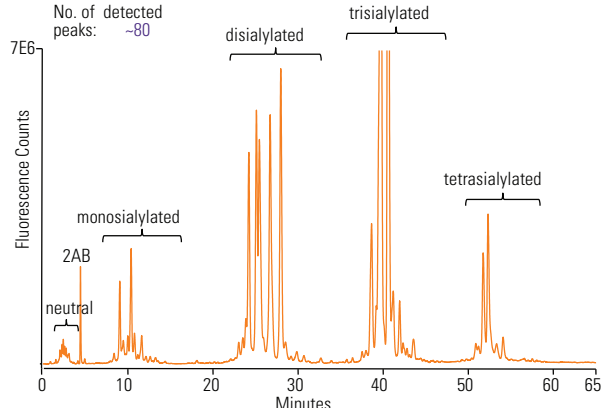
# GlycanPac AXR-1

Ultra-high resolution UHPLC columns for glycan analysis

- Excellent glycan selectivity based on hydrophobicity, charge, size, and isomerization
- High resolution for isomeric glycans
- Compatibility with fluorescence and MS detection methods
- High column efficiency and stability
- Ideal tool for qualitative, quantitative and structural analysis of glycans

The GlycanPac AXR-1 column, based on 1.9µm, high-purity and spherical silica substrates, combines both weak anion-exchange (WAX) and reversed-phase (RP) retention mechanisms for optimal selectivity and ultra-high resolution for glycan separation. The WAX functionality separates glycans based on charge, and RP property facilitates high resolution for glycans of the same charge according to their hydrophobicity, branching and isomerization. As the result, the GlycanPac AXR-1 column provides unparalleled resolutions for complex charged glycans.

**Separation of 2AB labeled N-glycans from bovine fetuin using GlycanPac AXR-1**




**Column: GlycanPac AXR-1, 1.9µm**

| | |
|---|---|
| Dimension: | 2.1 × 150mm |
| Mobile phase: | A: acetonitrile<br>B: D.I. water<br>C: ammonium formate (100 mM, pH =4.4) |
| Flow Rate: | 0.4 mL/min |
| Temperature: | 40 °C |
| Injection Vol.: | 100 pmoles |
| Detection: | fluorescence at 320/420nm |
| Sample: | 2AB labeled N-glycan from bovine fetuin |

| Time (min) | % A | % B | % C | Curve |
|---|---|---|---|---|
| -10 | 0 | 95 | 5 | 5 |
| 0 | 0 | 95 | 5 | 5 |
| 1 | 0 | 95 | 5 | 5 |
| 30 | 1 | 74 | 25 | 5 |
| 65 | 20 | 50 | 30 | 5 |

## GlycanPac AXR-1 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.1 mm ID |
|---|---|---|---|
| 1.9 | UHPLC Column | 150 | **088136** |
| | | 250 | **088135** |

# DNAPac PA100

A strong anion exchange column developed to provide high-resolution analysis and purification of synthetic oligonucleotides

- High-resolution oligonucleotide separations
- Capable of n, n-1 resolution for oligonucleotides
- Resolves oligonucleotides with secondary structures
- Compatible with solvent, high pH or high temperatures
- Analyzes phosphorothioate-based clinical samples
- Provides easy scale-up from 2.0mm to 22mm ID column (>100x)

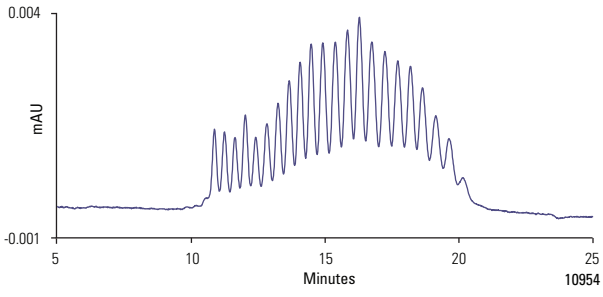
The DNAPac PA100 is a high-resolution anion-exchange column that provides single-base resolution. It is stable under denaturing conditions, rugged, reliable, and can be readily scaled up. The DNAPac PA100 is a 13 µm pellicular, nonporous polymeric resin with bound quaternary amine-functionalized Thermo Scientific™ Dionex™ MicroBeads™. The rapid mass-transport characteristics of this resin result in very high-resolution oligonucleotide separations.

DNAPac PA100 can resolve full length from n–1, n+1, and other failure sequences.

## DNAPac PA100 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.0mm ID | 4.0mm ID | 9.0mm ID | 22.0mm ID |
|---|---|---|---|---|---|---|
| 13 | Guard Column | 50 | **SP4016** | **043018** | **SP4511** | **SP4513** |
| | HPLC Column | 250 | **SP3686** | **043010** | **043011** | **SP2091** |

### Oligonucleotides




**Column: DNAPac PA100**

| | |
|---|---|
| Eluent: | 410-510mM NaCl in 25mM Tris-Cl, pH 8.0 |
| Flow Rate: | 1.5mL/min |
| Detection: | UV, 260nm |
| Sample: | $pd(A)_{40-60}$ |

# DNAPac PA200

The DNAPac PA200 is a strong anion exchange column developed to provide best-resolution for analysis and purification of synthetic oligonucleotides

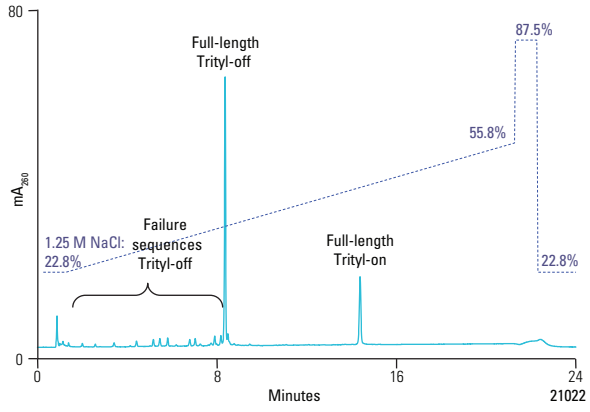
- Industry leading resolution for oligonucleotide separations
- Achieve n, n-1 resolution for oligonucleotides
- Resolve oligonucleotides with secondary structures
- Assay phosphorothioate purity
- Selectivity control with eluent pH, salt, and solvent
- Resolve RNA with aberrant (2', 5') links from normal SS-RNA
- Separate individual phosphorothioate diastereoisomers
- HR/AM AXLC/MS via automated desalting


The DNAPac PA200 is packed with a pellicular anion-exchange resin composed of an 8 µm diameter nonporous polymeric substrate to which quaternary amine-functionalized Dionex MicroBeads are bound. The rapid mass transport characteristics of this resin result in high-resolution oligonucleotide separations. DNAPac PA200 can resolve full length from n–1, n+1, and other failure sequences not possible with other columns.

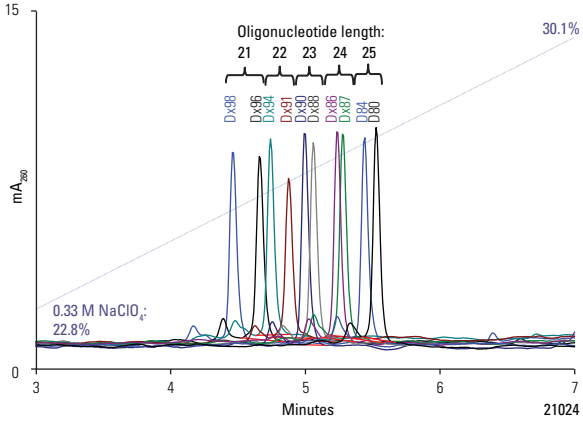
## DNAPac PA200 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.0mm ID | 4.0mm ID | 9.0mm ID | 22.0mm ID |
|---|---|---|---|---|---|---|
| 8 | Guard Column | 50 | **063423** | **062998** | **063419** | **SP6731** |
| | HPLC Column | 250 | **063425** | **063000** | **063421** | **SP6734** |

**Target, failure and trityl-on oligonucleotides**




**Separation of oligonucleotides by length**




**Column: DNAPac® PA200**

| | |
|---|---|
| Eluent: | $NaClO_4$, pH 6.5 with 20% $CH_3CN$ |
| Flow Rate: | 1.2mL/min |
| Inj. Volume: | 8µL |
| Detection: | UV, 260nm |

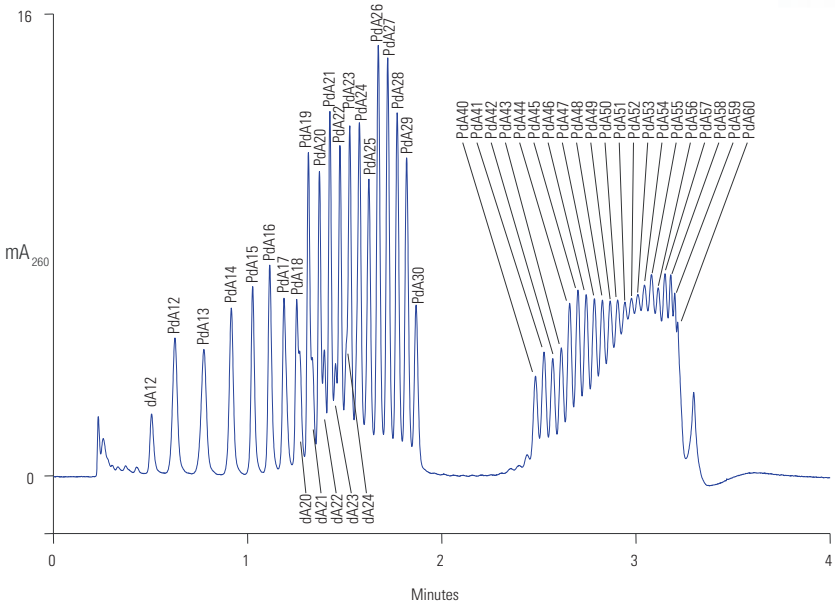
# DNAPac PA200 RS

## UHPLC Solutions for Nucleic Acid Analysis

DNAPac PA200 RS columns are packed with smaller, 4 µm particles, for improved resolution and better performance. The smaller particles also allow shorter columns to provide significantly higher throughput. These columns are packed in bioinert PEEK-lined stainless steel (SST) bodies, designed to protect from unwanted interactions of eluents and analytes with metals, while maintaining 10,000 psi stability. They columns offer exceptional resolution of oligonucleotides, including isomer separations; and are able to resolve full length oligonucleotides from n-1 and n+1 oligonucleotides and other failure sequences.

- Provide single base resolution of oligonucleotides
- Higher efficiency to improve resolution
- Improved throughput
- Ruggedness consistent with the DNAPac PA200 column line.
- 10,000 psi stable

**Partial resolution of 46 oligonucleotides**




**Column: DNAPac PA200 RS, 4.6 x 50mm**

| | |
|---|---|
| Eluent: A | 20 mM Tris pH 8 |
| Eluent B: | A + 1.25 M NaCl |
| Temp: | 30 °C |
| Flow Rate: | 1.30 mL/min |
| Inj. (µL): | 2.5 µL |
| Detection: | 28–43% B in 4 CV* (2.56 min) curve 3** |
| Sample: | PdA12–30, 40–60 |

*CV = column volumes
**Curve 3 indicates continuously changing gradient, asymptotically approaching a maximum salt concentration. Programed in Chromeleon 6.8.

## DNAPac PA200 RS Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 4.6 mm ID |
|---|---|---|---|
| 4 | BioRS column | 50 | **082508** |
| | | 150 | **082509** |
| | | 250 | **082510** |

# DNASwift SAX-1S

A strong anion exchange monolith column that provides improved capacity and industry-leading oligonucleotide yield-purity performance.


This semipreparative column incorporates selectivity control of the DNAPac column, providing unsurpassed purity and yields.

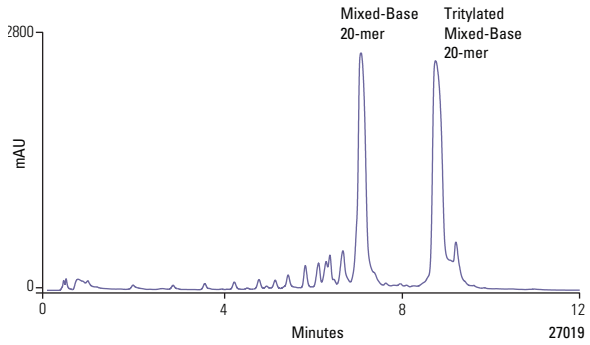
- Micromole purifications in a 5cm column body
- Substantial capacity in a small format
- Tunable selectivity control, the DNAPac columns, for high resolution
- Compatible with high pH mobile phases, solvents, or high temperatures
- Ideal for therapeutic and diagnostic oligonucleotide research
- Purify difficult oligonucleotide products
- Use in combination with the DNAPac for industry leading purification and characterisation of oligonucleotide products

The DNASwift column is a unique porous polymer monolith coated with functionalized latex nanobeads, optimized for oligonucleotide separations. The monolith, a polymer cylinder with interconnected flow through channels, provides fast mass transfer, low back pressure (for increased flow rates), very high capacity, and refined selectivity control.

## DNASwift SAX-1S Ordering Guide

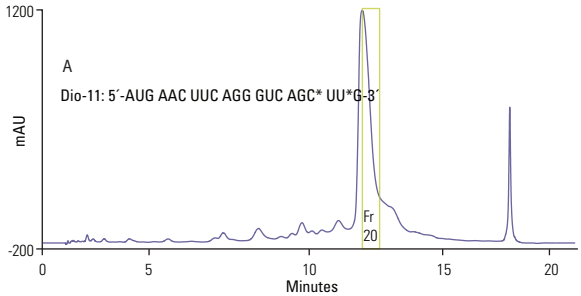
| Functional Group | Length (mm) | 5.0mm ID |
|---|---|---|
| SAX-1S | 150 | **066766** |

### Tritylated oligonucleotide




| **Column:** | **DNASwift SAX-1S, 5 × 150mm** |
|---|---|
| Mobile Phases: | A: 15mM Tris, pH 8 |
| | B: 15mM Tris, pH 8, 1.25 M NaCl |
| Gradient: | 8–64% B in 10 min |
| Flow Rate: | 1.5mL/min |
| Inj. Volume: | 20µL |
| Detection: | UV at 260nm |
| | Prep Cell (2mm path length) |
| Sample: | Derivatized mixed-base 20mer, 20mg/mL |

### Purification of a 21-base RNA Sample with aberrant 2' -5" linkages at the 1 and 3 positions from the 3" end




| Column: | DNASwift SAX-1S, 5 × 150mm |
|---|---|
| Eluents: | A. 40mM Tris, pH 7 |
| | B. 40mM Tris, pH 7 + 1.25 M NaCl |
| Gradient: | 26–42% B in 10 column volumes |
| Flow Rate: | 1.5mL/min |
| Inj. Amount: | 125µg |
| Temperature: | 30°C |
| Detection: | UV at 260nm |

## Notes

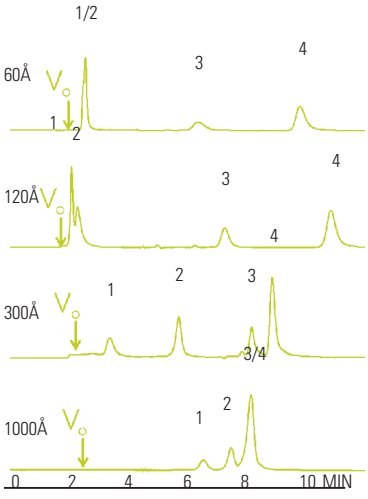
# BioBasic SEC Columns

Superior separation of water soluble compounds

- Covers separation of analytes over a wide molecular weight range
- Long column life and high column efficiencies
- Simple mechanism of interaction based on molecular size and shape
- Ideal for sample clean-up
- Straightforward method development, simple mobile phases

## BioBasic SEC Ordering Guide

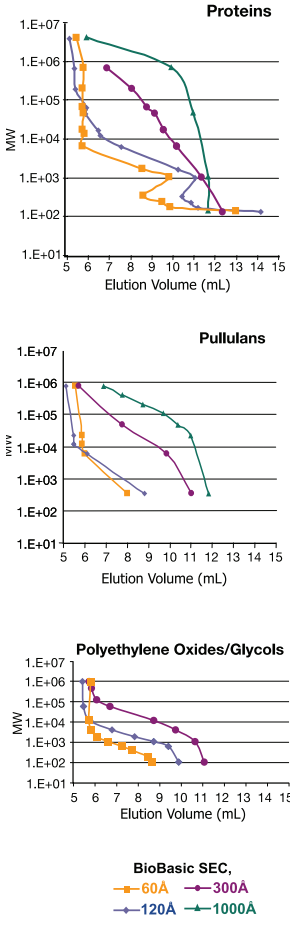
| Pore Size (Å) | Description | ID (mm) | Length (mm) | Cat. No. |
|---|---|---|---|---|
| **BioBasic SEC 60** | | | | |
| 60 | Guard | 7.8 | 30 | **73305-037821** |
| | HPLC Column | 7.8 | 150 | **73305-157846** |
| | HPLC Column | 7.8 | 300 | **73305-307846** |
| **BioBasic SEC 120** | | | | |
| 120 | Guard | 7.8 | 30 | **73405-037821** |
| | HPLC Column | 7.8 | 150 | **73405-157846** |
| | HPLC Column | 7.8 | 300 | **73405-307846** |
| **BioBasic SEC 300** | | | | |
| 300 | Guard | 7.8 | 30 | **73505-037821** |
| | HPLC Column | 7.8 | 150 | **73505-157846** |
| | HPLC Column | 7.8 | 300 | **73505-307846** |
| **BioBasic SEC 1000** | | | | |
| 1000 | Guard | 7.8 | 30 | **73605-037821** |
| | HPLC Column | 7.8 | 150 | **73605-157846** |
| | HPLC Column | 7.8 | 300 | **73605-307846** |




*Effect of pore size on SEC resolution*

**Columns: BioBasic SEC, 5µm, 300 x 7.8mm**

| | |
|---|---|
| Eluent: | 0.1M $KH_2PO_4$ pH 7 |
| Flow: | 1.0mL/min |
| Detector: | UV at 254nm |
| Injection: | 20µL |
| Sample: | 1. Thyroglobulin (MW669,00)<br>2. Ovalbumin (MW 45,000)<br>3. Angiotensin II (MW 1,046)<br>4. PABA ($V_m$) (MW 137) |

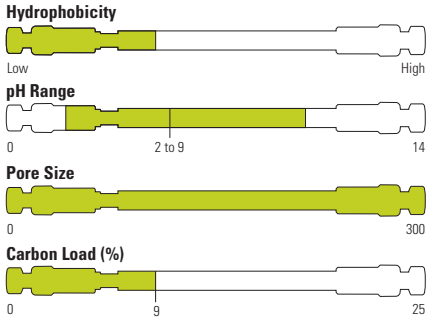



*Molecular weight calibration curves*

## BioBasic 18

Outstanding separation of small to medium peptides

- 300Å pore size for maximum performance with biomolecules
- High peak capacity stationary phase
- Outstanding reproducibility, efficiency and column lifetime
- Excellent for LC-MS separations

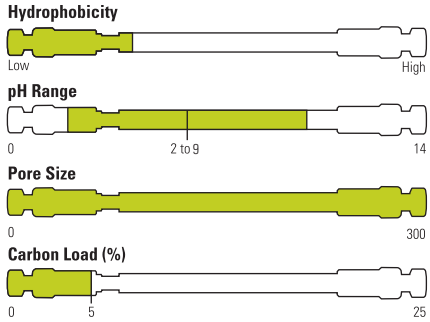



**Particle Size** 5µm, 10µm **USP** L1

## BioBasic 8

Optimized for the separation of a wide range of peptides

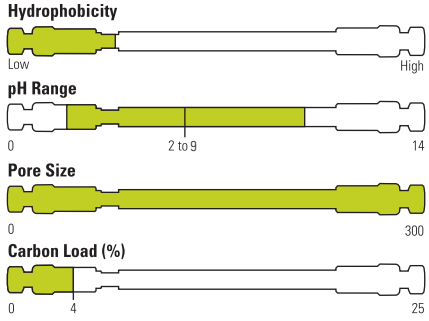
- 300Å pore size for improved biomolecule analysis
- An excellent starting column for protein and peptide analysis
- Outstanding reproducibility, efficiency and column lifetime
- Excellent for LC-MS separations




**Particle Size** 5µm **USP** L7

## BioBasic 4

- Based on 300Å silica for outstanding biomolecule performance
- Lower carbon load for optimal retention of larger peptides and proteins
- Outstanding reproducibility, efficiency and column lifetime
- Excellent for LC-MS separations

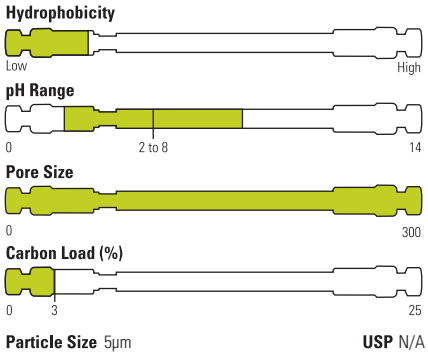



**Particle Size** 5µm **USP** L26

## BioBasic AX

Optimized for the separation of proteins, peptides, other anionic species and polar molecules

- Weak anion exchange phase for multiple charged species
- 300Å pore size for enhanced protein and peptide separations
- Suitable for HILIC retention and separation of highly polar molecules
- Superb stability under demanding pH conditions

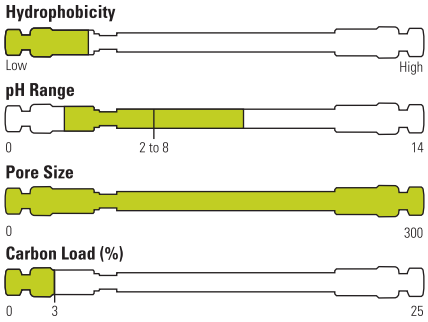



**Particle Size** 5µm **USP** N/A

## BioBasic SCX

For the separation of proteins, peptides, and other cationic species

- Strong cation exchange phase based on sulfonic acid chemistry
- Separation and retention of basic and other cationic species
- 300Å pore size for enhanced protein and peptide separations
- Outstanding stability under demanding pH conditions




**Particle Size** 5µm **USP** L52

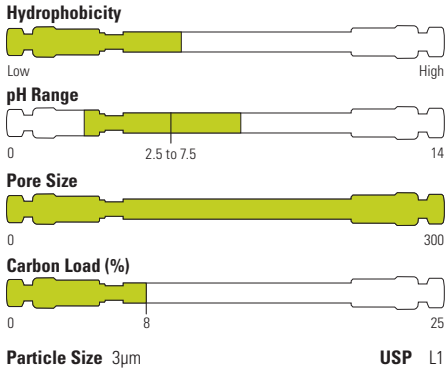
### BioBasic Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | C18 | C8 | C4 | AX | SCX |
|---|---|---|---|---|---|---|---|---|
| 5 | Drop-in Guard (4/pk) | 10 | 1.0 | **72105-011001** | **72205-011001** | **72305-011001** | **73105-011001** | **73205-011001** |
| | | | 2.1 | **72105-012101** | **72205-012101** | **72305-012101** | **73105-012101** | **73205-012101** |
| | | | 3.0 | **72105-013001** | **72205-013001** | **72305-013001** | **73105-013001** | **73205-013001** |
| | | | 4.0/4.6 | **72105-014001** | **72205-014001** | **72305-014001** | **73105-014001** | **73205-014001** |
| | HPLC Column | 50 | 1.0 | **72105-051030** | **72205-051030** | **72305-051030** | **73105-051030** | **73205-051030** |
| | | | 2.1 | **72105-052130** | **72205-052130** | **72305-052130** | **73105-052130** | **73205-052130** |
| | | | 3.0 | – | – | – | **73105-053030** | **73205-053030** |
| | | | 4.6 | – | – | – | **73105-054630** | **73205-054630** |
| | | 100 | 1.0 | **72105-101030** | **72205-101030** | **72305-101030** | **73105-101030** | **73205-101030** |
| | | | 2.1 | **72105-102130** | **72205-102130** | **72305-102130** | **73105-102130** | **73205-102130** |
| | | | 3.0 | **72105-103030** | **72205-103030** | **72305-103030** | **73105-103030** | **73205-103030** |
| | | | 4.6 | **72105-104630** | **72205-104630** | **72305-104630** | **73105-104630** | **73205-104630** |
| | | 150 | 1.0 | **72105-151030** | **72205-151030** | **72305-151030** | **73105-151030** | **73205-151030** |
| | | | 2.1 | **72105-152130** | **72205-152130** | **72305-152130** | **73105-152130** | **73205-152130** |
| | | | 3.0 | – | – | – | **73105-153030** | **73205-153030** |
| | | | 4.6 | **72105-154630** | **72205-154630** | **72305-154630** | **73105-154630** | **73205-154630** |
| | | 250 | 1.0 | **72105-251030** | **72205-251030** | **72305-251030** | **73105-251030** | **73205-251030** |
| | | | 2.1 | **72105-252130** | **72205-252130** | **72305-252130** | **73105-252130** | **73205-252130** |
| | | | 4.6 | **72105-254630** | **72205-254630** | **72305-254630** | **73105-254630** | **73205-254630** |

| Format | Length (mm) | ID (mm) | **Cat. No.** |
|---|---|---|---|
| UNIGUARD Guard Cartridge Holder | 10 | 1.0 | **851-00** |
| | | 2.1 | **852-00** |
| | | 3.0 | **852-00** |
| | | 4.0/4.6 | **850-00** |

# Acclaim 300 C18

High-resolution reversed-phase separation of proteins and peptides




**Particle Size** 3µm **USP** L1

- Designed for high-resolution peptide mapping and protein separations
- High-efficiency 3µm spherical silica substrate
- High-performance bonding chemistry on 300Å pore silica
- Application tested for suitability in peptide mapping
- Reproducible for dependable results
- LC-MS compatible
- Ultrapure silica with low metal content and exhaustive bonding and endcapping

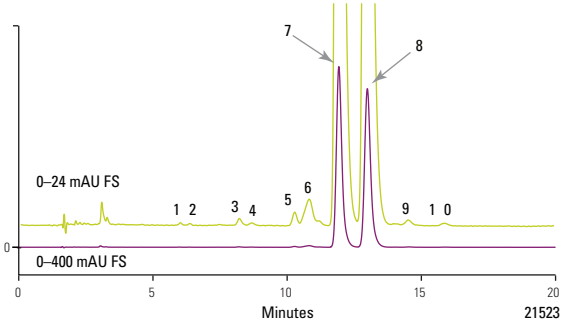
## Acclaim 300 C18 Ordering Guide

| Particle Size (µm) | Format | Length (mm) | 2.1mm ID | 3.0mm ID | 4.6mm ID |
|---|---|---|---|---|---|
| 3 | HPLC Column | 50 | **060263** | – | **060265** |
| | | 150 | **060264** | **063684** | **060266** |
| 5 | Guard Cartridges (2/pk) | 10 | **069690** | **075721** | **069697** |

## Acclaim Guard Holder Ordering Guide

| Description | Cat. No. |
|---|---|
| Acclaim SST Guard Cartridge Holder V-2 | **069580** |
| Acclaim Guard Kit (Holder and coupler) V-2 | **069707** |
| Guard to Analytical Column Coupler V-2 | **074188** |

### Budesonide and related substances




**Column: Acclaim 300 C18 3.0µm, 4.6 x 150mm**

| | |
|---|---|
| Pump: | Summit P580 HPG/4 |
| Mobile Phase: | (A) Acetonitrile:ethanol 15:1<br>(B) 0.1% phosphoric acid<br>Isocratic 66% B |
| Flow: | 1.0mL/min |
| Temperature: | 30°C |
| Injection: | ASI-100 autosampler, 15µL |
| Detector: | UVD 340U; UV at 240nm |
| Sample: | Budesonide, 500µg/mL after three days |
| Peaks: | 7, 8. Budesonide epimers, 99% |

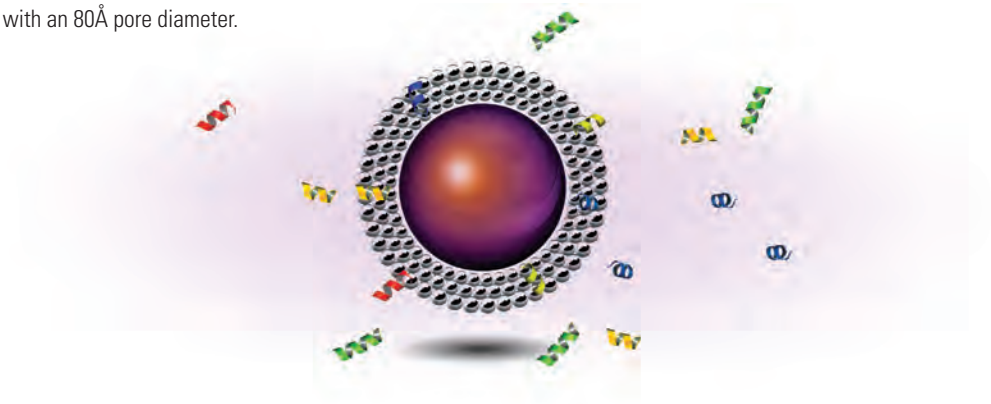
Reference: Hou S, Hindle M, Byron PR; *J. Pharm. Biomed. Analy.* **2001** 24:371-80.

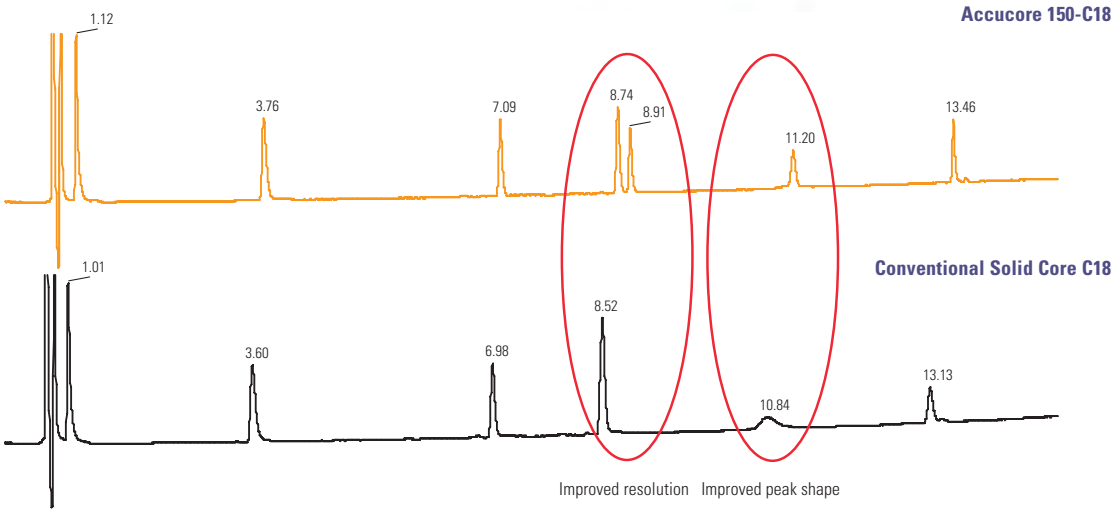
# Accucore Columns for Biomolecules

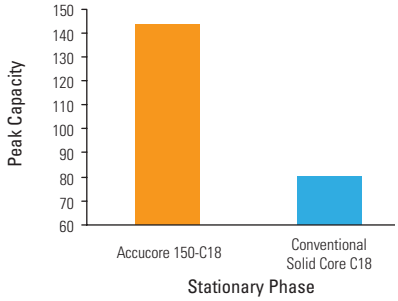
## Ultimate Core Performance for Biomolecule Separations

The range of Accucore HPLC columns packed with 150Å pore diameter particles allow biomolecule separations to benefit from the superb resolution and high speed enabled by the Core Enhanced Technology™ that Accucore columns are based on. The 150Å pore diameter solid core particles used in the Accucore 150-C18, 150-C4 and 150-Amide-HILIC columns are designed specifically to provide the optimum combination of retention and resolution for biomolecules.

The chromatograms below show the improved resolution and peak shapes achieved with Accucore 150-C18 compared to a C18 solid core phase with an 80Å pore diameter.






### Peak Capacity Comparison

Sharper peaks result in a significantly higher peak capacity for 150-C18 compared to the conventional solid core C18 column.

### Accucore 2.6µm 150Å HPLC and nanoLC Columns Optimum Conditions and Ratings

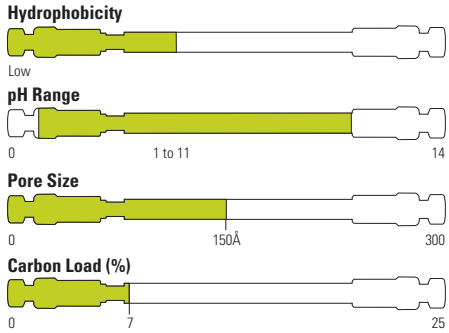
| Column ID | Optimum Flow Rate | Backpressure Rating | Temperature Rating |
|---|---|---|---|
| 75µm | 300nL/min | 800 bar | 70°C |
| 2.1mm | 400µL/min | 1000 bar | 70°C |
| 3.0mm | 800µL/min | 1000 bar | 70°C |
| 4.6mm | 1800µL/min | 1000 bar | 70°C |

# Accucore 150-C18

- Designed for the separation of peptides
- Outstanding resolution
- 150Å pore diameter material

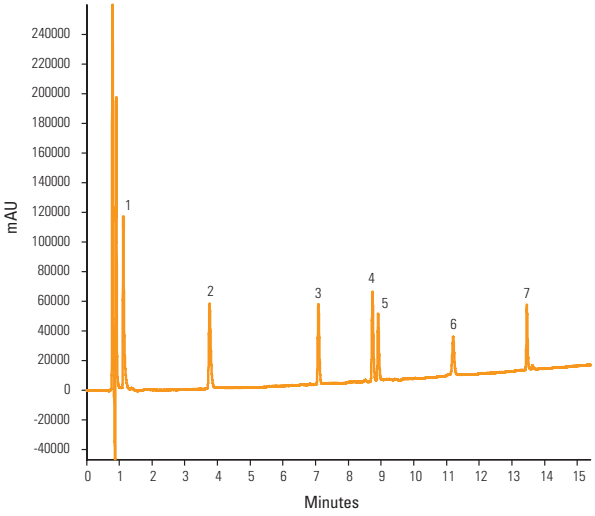
Higher peak capacities facilitate increased peptide identifications. Accucore 150-C18 provides much narrower peak widths, therefore significantly higher peak capacity than a column packed with <2µm wide pore fully porous C18.

Precision of retention times is critical for reliable analysis. The Accucore 150-C18 column exhibits excellent retention time reproducibility.




**Particle Size** 2.6µm **USP** L1

## Peptide separations



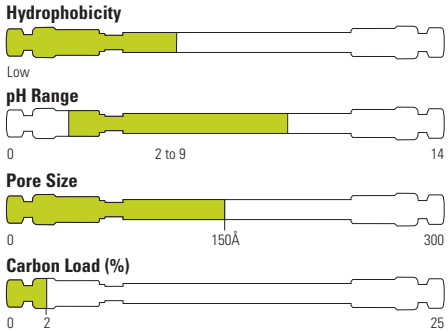

**Column: Accucore 150-C18 2.6µm, 100 x 2.1mm**

| | |
|---|---|
| Mobile phase A: | 0.1% TFA in 10:90 acetonitrile:water |
| Mobile phase B: | 0.1% TFA in 70:30 acetonitrile:water |
| Gradient: | 0-50% B over 15 min; hold for 2 min; drop to 0% in 0.1 min; hold at 0% B for 5 min |
| Flow: | 300µL/min |
| Temperature: | 35°C |
| Injection: | 5µL |
| Detection: | UV (220nm) |
| Peaks: | 1. Glycine-Tyrosine<br>2 . Valine-Tyrosine-Valine<br>3. Met-Enkephalin<br>4. Angiotensin III<br>5. Leu-Enkephalin<br>6. Ribonuclease A<br>7. Insulin |

# Accucore 150-C4

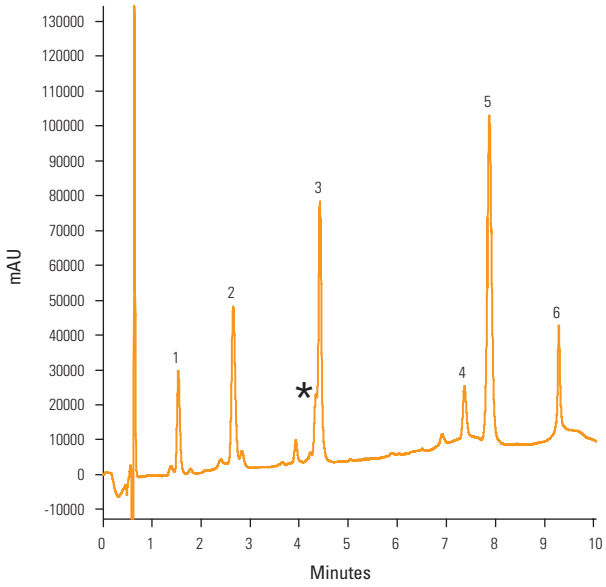
- Significantly lower hydrophobic retention than C18
- Ideal for retention of proteins and larger peptides

Accucore 150-C4 provides significantly sharper and higher peaks than a column packed with 5µm wide pore fully porous C4, thus offering better resolution and sensitivity. The Accucore 150-C4 also performs better than a column packed with <2µm wide pore fully porous C4 and generates only a fraction of the backpressure.




**Particle Size** 2.6µm **USP** L26

**Intact proteins**

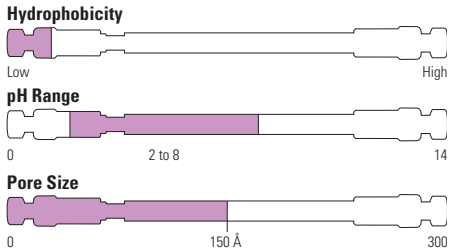



**Column: Accucore 150-C4 2.6µm, 100 x 2.1mm**

| | |
|---|---|
| Mobile phase A: | 0.1% TFA in 30:70 acetonitrile:water |
| Mobile phase B: | 0.1% TFA in 98:2 acetonitrile:water |
| Gradient: | 0-30% B over 8 mins<br>30-95% B over 2 mins<br>95% B hold for 1 min<br>0% B hold for 4 mins |
| Flow: | 400µL/min |
| Temperature: | 40°C |
| Injection: | 2µL 10pmol/µL solution |
| Detection: | UV (214 and 280nm) |
| Peaks: | 1. Insulin<br>2. Cytochrome C<br>3. Lysozyme<br>4. Myoglobin<br>5. Carbonic anhydrase<br>6. Ovalbumin<br>* Carbonic anhydrase impurity |

# Accucore 150-Amide-HILIC

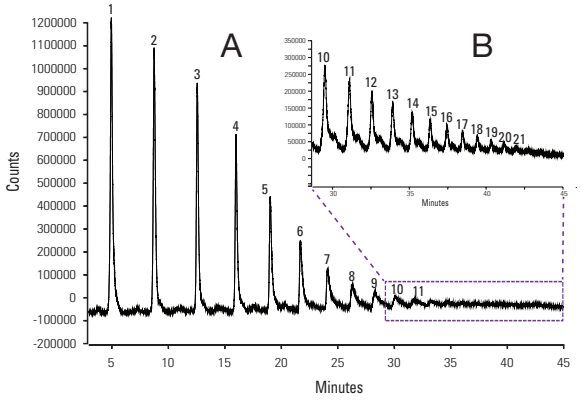
- Amide phase bonded onto 150 Å pore diameter solid core particles
- High retention of a broad range of hydrophilic analytes in HILIC mode
- Recommended for hydrophilic biomolecules such as glycans




**Particle Size** 2.6µm

The amide bonded phases provide strong hydrogen bonding interaction between the stationary phase and the analytes, resulting in unique selectivity compared to other HILIC phases. Combined with larger pore size of the solid core particles, Accucore 150-Amide-HILIC is well suited for separating a variety of hydrophilic molecules, including carbohydrates and peptides. As a result the Accucore 150-Amide-HILIC is an excellent choice for glycan separations.

### 2-AB labelled dextran ladder



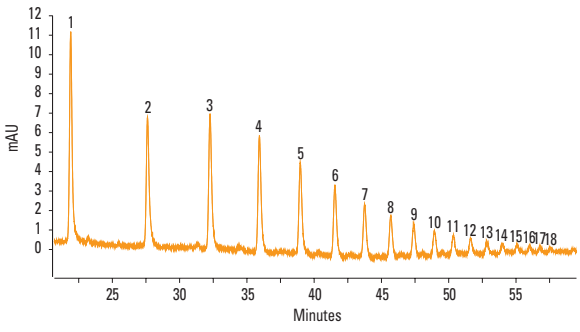

(A) 2 µL injection of sample, where 11 glycans were separated.

(B) 5 µL injection of sample, zoomed-in to the later part of the gradient rise. A further 10 glycans were detected.

**Column: Accucore 150-Amide-HILIC, 2.6µm, 100 x 2.1mm**

| | |
|---|---|
| Mobile phase A: | acetonitrile |
| Mobile phase B: | 50 mM ammonium formate, pH 4.5 |
| Gradient: | 20–50 % B in 40.0 minutes<br>50 % B for 5.0 minutes<br>50–20 % B in 0.5 minutes<br>50 % B for 4.5 minutes |
| Flow: | 500 µL/min |
| Backpressure at starting conditions: | 110 bar |
| Run time: | 50 minutes |
| Temperature: | 60 °C |
| Injection: | 2µL to 5µL of sample. |
| Injection wash solvent: | 80:20 (v/v) acetonitrile:water. |
| Fluorescence detector acquisition parameters: | 330nm excitation wavelength; 420nm emission wavelength; acquisition start after 3 min from gradient start. |

### 2-AB labelled dextran ladder




**Column: Accucore 150-Amide-HILIC 2.6µm, 150mm x 75µm**

| | |
|---|---|
| Mobile phase A: | 98:2 (v/v) acetonitrile: water |
| Mobile phase B: | 2:98 (v/v) acetonitrile: water |
| Gradient: | 0–50 %B in 50 minutes<br>50 % B for 8 minutes |
| Flow: | 200 nL/min |
| Temperature: | 40 °C |
| Backpressure: | 60 bar (100% A) |
| Sample Pick-up: | 0.5µL at 20 µL/min |
| Sample Loading: | 1µL at 280 bar |
| Detection: | UV (240 and 33 nm) |

# Accucore Columns for Biomolecules Ordering Guide

| Particle Size (µm) | Format | Length (mm) | ID (mm) | 150-C18 | 150-C4 | 150-Amide-HILIC |
|---|---|---|---|---|---|---|
| 2.6 | Defender Guard (4/pk) | 10 | 2.1 | **16126-012105** | **16526-012105** | **16726-012105** |
| | | | 3.0 | **16126-013005** | **16526-013005** | **16726-013005** |
| | | | 4.6 | **16126-014005** | **16526-014005** | **16726-014005** |
| | HPLC Column | 30 | 2.1 | **16126-032130** | **16526-032130** | – |
| | | | 3.0 | **16126-033030** | **16526-033030** | – |
| | | | 4.6 | **16126-034630** | **16526-034630** | – |
| | | 50 | 2.1 | **16126-052130** | **16526-052130** | **16726-052130** |
| | | | 3.0 | **16126-053030** | **16526-053030** | **16726-053030** |
| | | | 4.6 | **16126-054630** | **16526-054630** | **16726-054630** |
| | | 100 | 2.1 | **16126-102130** | **16526-102130** | **16726-102130** |
| | | | 3.0 | **16126-103030** | **16526-103030** | **16726-103030** |
| | | | 4.6 | **16126-104630** | **16526-104630** | **16726-104630** |
| | | 150 | 2.1 | **16126-152130** | **16526-152130** | **16726-152130** |
| | | | 3.0 | **16126-153030** | **16526-153030** | **16726-153030** |
| | | | 4.6 | **16126-154630** | **16526-154630** | **16726-154630** |
| | | 250 | 2.1 | – | – | **16726-252130** |

| Format | Length (mm) | ID (mm) | **Cat. No.** |
|---|---|---|---|
| UNIGUARD Guard Cartridge Holder | 10 | 2.1 | **852-00** |
| | | 3.0 | **852-00** |
| | | 4.6 | **850-00** |

# Nano, Capillary and Micro LC Columns

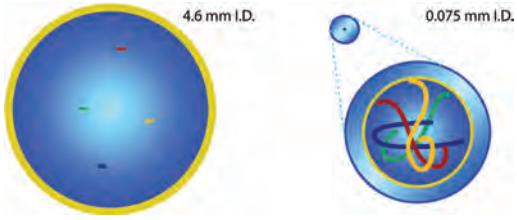
## Introduction

Nano, capillary and micro columns are ideal in cases where the sample amount is limited. The (theoretical) sensitivity increase of these LC columns is obtained by introducing the limited sample amounts in an environment with a low internal volume. This will result in a sensitivity gain that is dependent on the internal diameter, as shown in the table below. The best known use is the application of nano LC columns in proteomics, but certainly the concentrating effects of capillary and micro columns are beneficial in e.g. metabolomics or facilitation of LC-MS interfacing.

Loadability

| Name | Internal Diameter | Theoretical Sensitivity | Predominant application area |
|---|---|---|---|
| **Conventional** | 4.6mm | 1 | Small molecules, pharma |
| **Narrowbore** | 2.1mm | 5 | DMPK, Metabolomics, LC-MS |
| **Micro** | 1.0mm | 21 | Protein prefractionation |
| **Capillary** | 300µm | 235 | Peptide prefractionation |
| **Nano** | 75µm | 3761 | Proteomics |

Sensitivity




## Formats

Our columns come in a variety of formats. We offer most chemistries in nano (75µm), capillary (300µm) and micro (1000µm) internal diameter. In addition, different lengths are available to allow tuning for throughput with short micro columns or high resolution and sensitivity with 50cm long nano columns. However most importantly, Thermo Scientific™ Dionex™ nanoViper™ fingertight fitting system has now become the standard column format for our nano, capillary, and micro LC columns. nanoViper fingertight connections eliminate the assembly of PEEK sleeve connections, allowing tool-free nano-LC connections. They are capable of withstanding pressures up to a 1000 bar, offering the same levels of performance with improved ease of use.

Our trap columns come in two formats as well, the nano trap design, features a single capillary with the trap column at the end. These are ideal for high resolution separation of relatively clean samples or samples with hydrophilic peptides. The cartridge based trap columns are use at higher flow rates and have a wider ID. These are ideal for large sample amounts and when sample quality demands more robustness. For more details on trap columns, please check the RSLCnano standard applications manual.

Thermo Scientific EASY-Spray columns minimize the impact of dead volumes through the use of specifically designed columns in which the separation column, column heater, high-voltage electrode, and emitter are integrated in a ready-made assembly which incorporates a nanoViper connector. Eliminating imperfect connections makes it far easier to achieve state-of-the-art nanospray performance and data.

## Chemistries

The most common "sample limited" sources are from biological origin and involve the analysis of peptides and proteins. It is for that reason that our nano, capillary and micro column portfolio has a strong focus on column chemistries for peptides and proteins.

The Acclaim PepMap range (C18, C8, C4) has been the benchmark for nano LC peptide analysis for many years. The Acclaim PepMap RSLC (C18, 2µm particle) range builds on this heritage improving peptide separation capabilities. Acclaim PepMap columns are available in 100 and 300Å pore size to accommodate a wide range of peptides and proteins. In addition to these hallmark columns our range also includes monolithic columns that are capable of separating both proteins and peptides with very high efficiency. Our portfolio is completed by a selection of columns that are applicable as the first dimension in a multidimensional approach.

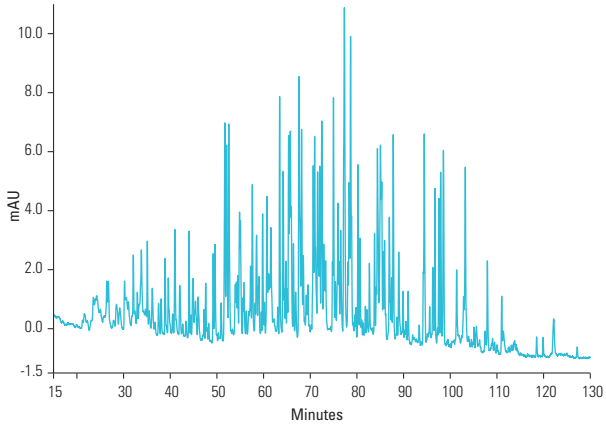
## Acclaim PepMap C18 100Å

The standard for peptide separations in proteomics

- High resolution protein identification for biomarker discovery, verification or any other analysis
- Highest sensitivity in LC-MS
- Quality control by factory testing all columns

Acclaim PepMap and Acclaim PepMap RSLC columns are specially designed for high-resolution analyses of tryptic, natural, and synthetic peptides. The columns are often applied for LC-MS/MS peptide mapping for protein identification, biomarker discovery, and systems biology. Due to their high loading capacity, the columns are exceptionally suitable for the analysis of low abundant peptides in complex proteomics samples.

**Protein mixture digest**




| **Column: Acclaim PepMap C18 3µm (75um ID x 50cm)** | |
|---|---|
| Flow Rate: | 300 nL/min |
| Mobile Phase: | A: water + 0.1% formic acid<br>B: water/acetonitrile 20/80 v/v% + 0.08% formic acid |
| Gradient: | 4–55% B in 120min, 5 min wash |
| Detection: | UV, 214nm |
| Sample: | Protein mixture digest |
| Temperature: | 35°C |

## Acclaim PepMap C8, 100Å

An excellent alternative to Acclaim PepMap 100Å C18, when separating very hydrophobic peptides (e.g., non-tryptic peptides)

## Acclaim PepMap C4, 300Å

Ideal for the separation of larger hydrophobic peptides and proteins, providing higher recoveries

## Acclaim PepMap C18, 300Å

Wide pore version allows larger peptides and proteins

## Accucore 150-C18

Designed to give narrow peaks and high peak capacity for peptide separations

## Accucore 150-C4

Ideal for high resolution protein separations

## Accucore 150-Amide-HILIC

Well suited for separating a variety of hydrophilic molecules, including carbohydrates and peptides

# Separation Columns

## Acclaim PepMap C18 100Å Ordering Guide

| | | nanoViper Column | | | | Classic Column |
|---|---|---|---|---|---|---|
| Particle size (µm) | Length (mm) | 50µm ID | 75µm ID | 300µm ID | 1000µm ID | 75µm ID |
| 2 | 50 | **164561** | **164563** | **164560** | **164454** | – |
| | 150 | **164562** | **164534** | **164537** | **164711** | – |
| | 250 | **164709** | **164536** | – | – | – |
| | 500 | **164710** | **164540** | – | – | – |
| 3 | 50 | **164712** | **164567** | **164716** | **164717** | |
| | 150 | **164713** | **164568** | **164571** | **164572** | **160321** |
| | 250 | **164714** | **164569** | – | – | **164261** |
| | 500 | **164715** | **164570** | – | – | – |
| 5 | 50 | – | – | **164901** | **164899** | – |
| | 150 | – | – | **164902** | **164900** | **160323** |
| | 250 | – | – | – | – | **160326** |

## Acclaim PepMap C8 100Å Ordering Guide

| | | nanoViper Column | | | | Classic Column |
|---|---|---|---|---|---|---|
| Particle size (µm) | Length (mm) | 50µm ID | 75µm ID | 300µm ID | 1000µm ID | 75µm ID |
| 3 | 150 | – | **164706** | **164722** | **164723** | **161185** |

## Acclaim PepMap C4 300Å Ordering Guide

| | | nanoViper Column | | | | Classic Column |
|---|---|---|---|---|---|---|
| Particle size (µm) | Length (mm) | 50µm ID | 75µm ID | 300µm ID | 1000µm ID | 75µm ID |
| 5 | 150 | – | **164707** | **164720** | **164721** | **163579** |

## Acclaim PepMap C18 300 Å Ordering Guide

| | | nanoViper Column | | | | Classic Column |
|---|---|---|---|---|---|---|
| Particle size (µm) | Length (mm) | 50µm ID | 75µm ID | 300µm ID | 1000µm ID | 75µm ID |
| 5 | 150 | – | **164708** | **164718** | **164719** | **163574** |

## Accucore 150-C18 Ordering Guide

| | | nanoViper Column |
|---|---|---|
| Particle size (µm) | Length (mm) | 75µm ID |
| 2.6 | 150 | **16126-157569** |
| | 500 | **16126-507569** |

## Accucore 150-C4 Ordering Guide

| | | nanoViper Column |
|---|---|---|
| Particle size (µm) | Length (mm) | 75µm ID |
| 2.6 | 150 | **16526-157569** |
| | 500 | **16526-507569** |

## Accucore 150-Amide-HILIC Ordering Guide

| | | nanoViper Column |
|---|---|---|
| Particle size (µm) | Length (mm) | 75µm ID |
| 2.6 | 150 | **16726-157569** |

# Trap columns – nano trap design

### Acclaim PepMap C18 100Å Ordering Guide

| Type | Part number | Particle Size | ID | Bed Length (mm) | Total Length | Quantity |
|---|---|---|---|---|---|---|
| nanoViper Column | **164535** | 3 | 75 | 20 | 150 | 2 |
| | **164705** | 3 | 75 | 20 | 70 | 2 |
| | **164564** | 5 | 100 | 20 | 150 | 2 |
| Classic Column | **164197** | 5 | 100 | 10 | 150 | 2 |
| | **164199** | 5 | 100 | 20 | 150 | 2 |
| | **164213** | 5 | 200 | 20 | 150 | 2 |

Note: 164705 is a shorter total length used for vented column set up for example with EASY nLC 1000

# Trap Columns – Cartridge (Set of 5)

### Acclaim PepMap C18 100Å Ordering Guide

| Length (mm) | 300µm ID | 1000µm ID |
|---|---|---|
| 5 | **160454** | **160434** |
| 15 | – | **160438** |

### Acclaim PepMap C8 100Å Ordering Guide

| Length (mm) | 300µm ID |
|---|---|
| 5 | **161194** |

### Acclaim PepMap C4 300Å Ordering Guide

| Length (mm) | 300µm ID |
|---|---|
| 5 | **163591** |

### Acclaim PepMap C18 300Å Ordering Guide

| Length (mm) | 300µm ID |
|---|---|
| 5 | **163589** |

### Accucore 150-C18 Ordering Guide

| Length (mm) | 300µm ID |
|---|---|
| 5 | **16126-900379** |

### Accucore 150-C4 Ordering Guide

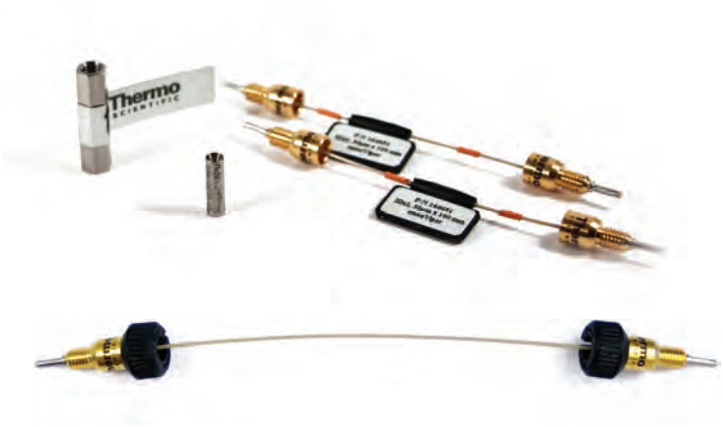
| Length (mm) | 300µm ID |
|---|---|
| 5 | **16526-900379** |

### Accucore 150-Amide-HILIC Ordering Guide

| Length (mm) | 300µm ID |
|---|---|
| 5 | **16726-900379** |

### µ-Precolumn™ holder, 5mm, with 30µm ID connecting tubing, nanoViper fittings

| Length (mm) | 300µm ID |
|---|---|
| 5 | **164649** |



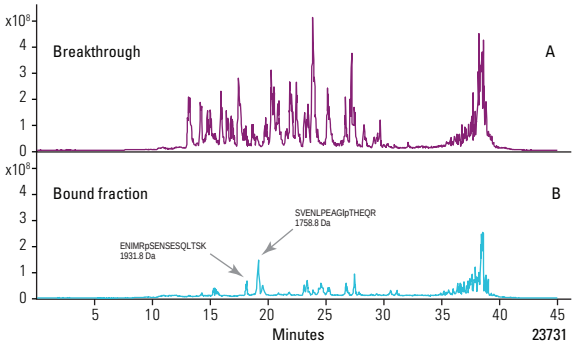
# 1st dimension columns for 2D separations

Improving separation efficiency can be achieved by adding a column to the setup for multidimensional analysis. There are dedicated application kits which utilize either SCX or RP as the first dimension. A TiO2 trapping column can be added to the application for phosphopeptide analysis. Check the RSLCnano standard applications manual on the Thermo Scientific website for more information on 2D separations.

## 1st dimension columns Ordering Guide

| Chemistry | Part Number | Description | Application |
|---|---|---|---|
| SCX | **164565** | 300µm ID x 10cm, packed with Poros 10 S, nanoViper column | 2D Salt plugs (6720.0325) |
| | **164566** | 1.0mm ID x 15cm, packed with Polysulfoethyl ASP, 5µm, 300Å, nanoViper column | Automated off-line 2D LC of Peptides, micro SCX x nano RP (6720.0330) |
| RP | **164592** | 300µm ID x 15cm, packed with Acclaim PA2, nanoViper column | Automated off-line 2D LC, Cap RP (basic) x Nan RP (acidic) (6720.0335) |
| TiO2 | **164205** | 100µm ID x 1cm packed with TiO2 | Phosphopeptide analysis |
| | **164215** | 200µm ID x 1cm packed with TiO2 | Phosphopeptide analysis |

### Isolation of two synthethic phosphopeptides from a BSA tryptic digest




**Trap Column: 200µm ID x 1cm, packed with $TiO_2$, 5µm**
**100µm ID x 1cm, packed with Acclaim PepMap C18, 5µm**

| | |
|---|---|
| Separation Column: | Acclaim PepMap C18, 3µm |
| Dimensions: | 75µm x 15cm |
| Loading Solvent: | 0.05% HFBA in DI $H_2O$ |
| Wash Solvent: | 0.01% HFBA in DI $H_2O$ |
| Mobile Phases: | (A) 0.05% TFA in DI $H_2O$<br>(B) 0.04% TFA in acetronitrile/ DI $H_2O$ (80:20 v/v) |
| Gradient: | 3–40% acetonitrile in 30 min |
| $TiO_2$ Trap Eluent: | 250mM $NH_4HCO_3$ in DI $H_2O$, pH 9.0 |
| Flow Rate: | 300nL/min |
| Loading Flow: | 8µL/min |
| Inj. Volume: | 5µL |
| Detection: | MS |

# EASY-Spray Columns

Nanoflow LC-MS utilizes very narrow fused silica columns and as a result, even the slightest inconsistency in column connection can result in leaks and dead volumes and are a frequent source of poor data, causing unstable spray and a significant loss in performance. Trouble-shooting connection issues can be difficult and time consuming, even for experts.

Thermo Scientific™ EASY-Spray™ columns address the aforementioned issues by incorporating high-performance nanobore columns and integrating them within a radical new design.

Packed with either C18 for peptide separations or with selected wide pore phases and monoliths for the separation of intact proteins, e.g. top-down proteomics or the structural identification of biotherapeutics, the "plug and spray" approach delivers state of the art performance in a simple to use format, making research routine.

### Acclaim PepMap C18 100Å Ordering Guide

| Particle size (µm) | Length (mm) | 50µm ID | 75µm ID |
|---|---|---|---|
| 2 | 150 | **ES801** | – |
| | 250 | – | **ES802** |
| | 500 | – | **ES803** |
| 3 | 150 | – | **ES800** |

### Accucore C4 150Å Ordering Guide

| Particle size (µm) | Length (mm) | | 75µm ID |
|---|---|---|---|
| 2.6 | 150 | – | **ES811** |

### Acclaim PepMap C18 300Å Ordering Guide

| Particle size (µm) | Length (mm) | | 75µm ID |
|---|---|---|---|
| 5 | 150 | – | **ES812** |

### PepSwift Ordering Guide

| Length (mm) | | 200µm ID |
|---|---|---|
| 250 | – | **ES810** |

# EASY-Spray Emitters

EASY-Spray emitters are integrated devices consisting of a sprayer coupled with a transfer line. The EASY-Spray benefits of pre-made connections, as well as the easy installation in the MS ion source can now be exploited in cases where no chromatography is required, for example when tuning the mass spectrometer.


### EASY-Spray Emitters Ordering Guide

| Description | Cat. No. |
|---|---|
| EASY-Spray emitter, nanoflow (Emitter ID 7µm, Transfer line ID 20µm, Transfer line length 500mm) | **ES791** |
| EASY-Spray emitter, microflow (Emitter ID 20µm, Transfer line ID 75µm, Transfer line length 500mm) | **ES792** |

# PepSwift and ProSwift (PS-DVB) Capillary and Micro HPLC Columns

- High-resolution for protein identification, biomarker discovery, and systems biology
- High-speed peptide and protein separations (<15 min)
- Highest sensitivity for LC/MS
- Highest column-to-column reproducibility
- Wide range of column IDs and lengths available
- Superior lifetime
- nanoViper fittings for easy column installation

PepSwift and ProSwift monolithic columns are specially designed for fast and high-resolution LC/MS analysis in protein identification, biomarker discovery, and systems biology. Based on a polystyrene divinylbenzene copolymer, the monolithic structure offers a high-quality alternative to traditional microparticulate sorbents, providing important advantages to the chromatographic separation. High-sensitivity proteomics and biotech applications are easily performed using these columns.

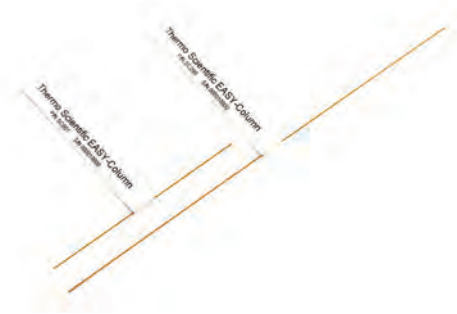
PepSwift Precolumns can be used for preconcentration and desalting of samples consisting of peptides and proteins without negative impact on the chromatographic performance or recovery of the compounds. Various ion-pairing agents can be used in the loading solvent and/or mobile phases to change the selectivity of the separation or improve the trapping efficiency.

## PepSwift and ProSwift, nanoViper Ordering Guide

| | PepSwift | | | ProSwift |
|---|---|---|---|---|
| Length (mm) | 100µm ID | 200µm ID | 500µm ID | 1000µm ID |
| 5 | – | **164558** | – | – |
| 50 | **164584** | **164557** | **164585** | **164586** |
| 250 | **164543** | **164542** | – | – |

# EASY-Columns

Excellence in nanoscale separations



- Compatible with any nanoscale HPLC system
- Optimized for online LC-MS
- Quality control on every column
- Simple, flexible design

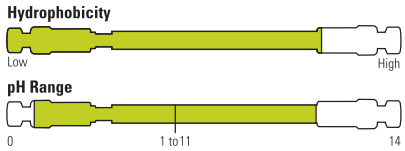
Using highly pure chromatographic media and biocompatible, metal-free fused silica capillaries, Thermo Scientific™ EASY-Column™ capillary LC columns are produced with a focus on design simplicity and strict quality control. As a result, EASY-Column capillary LC columns deliver outstanding chromatographic performance on any nano LC system.

## EASY-Columns Ordering Guide

| Description | Quantity | Cat. No. |
|---|---|---|
| EASY-Column, 2cm, ID 100µm, 5µm, C18-A1 (Trap column) | 3 | **SC001** |
| EASY-Column, 10cm, ID 75µm, 3µm, C18-A2 (Analytical column) | 1 | **SC200** |
| EASY-Column, 10cm, ID 75µm, 3µm, C18-A2 (Analytical column) | 3 | **SC2003** |
| HPLC-to-Column Connector kit Zero-dead-volume union (1/32in OD tubing), 10x SC603 | 1 | **SC600** |
| A/B mixing tee & Venting Tee for two-column setup Nanoliter-dead-volume tee (1/32in OD tubing), 10 sleeves for 360µm OD fused silica (10xSC603). | 1 | **SC601** |
| Connector Kit for two-column setup Zero-dead-volume union (1/32in OD tubing), Nanoliter-dead-volume tee (1/32 inch OD tubing), 10x SC603 | 1 | **SC602** |
| Sleeves (2cm, 1/32in OD) for 360µm OD fused silica | 30 | **SC603** |

# HyperREZ XP

## Polymer-based columns for carbohydrate analysis



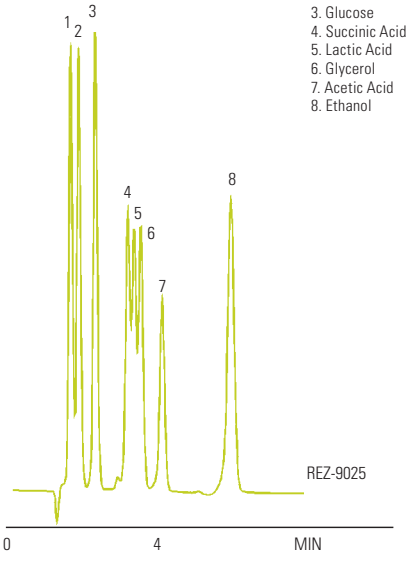

**Particle Size** 8µm, 10µm

- Designed for the determination of carbohydrates, saccharides, organic acids, and alcohols
- Efficient and reproducible monodisperse particles
- Stable for long column lifetimes even at low pH and high temperatures

Thermo Scientific™ HyperREZ™ XP Carbohydrate columns are based on a monodisperse resin with a 4 or 8% divinylbenzene content, and provide an ideal medium for the analysis of carbohydrates and organic acids. Unlike silica based columns they are stable at low pH, allowing the use of dilute acid as a mobile phase. The columns can also be run at elevated temperatures, for faster analysis and improved resolution of some closely eluting analytes. The columns can easily be regenerated for increased column lifetime. Control of the degree of cross-linking of the gel provides a size exclusion mode of operation in addition to the ligand exchange interactions with the metal ion associated with the sulfonated resin. Selectivity differences arise from the interactions of the different counter-ion forms with the hydroxyl groups on the analyte molecules. HyperREZ XP columns are available in $H^+$, $Ca^{2+}$, $Pb^{2+}$, and $Na^+$ forms, enabling you to choose the appropriate counter-ion to meet your application requirements. Refer to the tables below to help choose the best column based on application area or retention times. HyperREZ XP columns are also available in dedicated organic acid and sugar alcohol forms.

**HyperREZ XP Organic Acids, 8µm, 100 x 7.7mm**

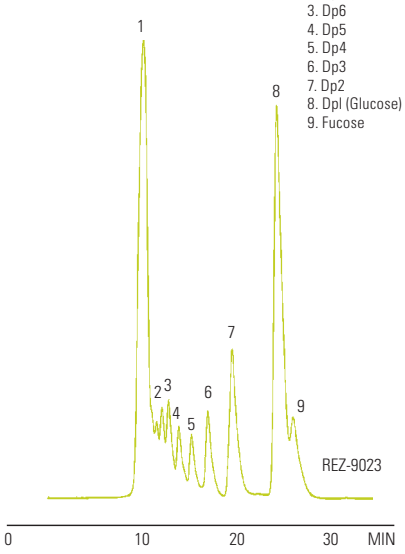
| | |
|---|---|
| Part Number: | 69608-107780 |
| Eluent: | 0.0001mM $H_2SO_4$ |
| Flow Rate: | 0.7mL/min |
| Temperature: | 57°C |
| Detector: | RI |
| Sample: | 1. Maltotriose<br>2. Maltose<br>3. Glucose<br>4. Succinic Acid<br>5. Lactic Acid<br>6. Glycerol<br>7. Acetic Acid<br>8. Ethanol |




*Products of fermentation, including organic acids, sugars and alcohols, can be separated using a HyperREZ XP Organic Acids column*

**HyperREZ XP Carbohydrate $Na^+$, 10µm, 300 x 7.7mm**

| | |
|---|---|
| Part Number: | 69310-307780 |
| Eluent: | $H_2O$ |
| Flow Rate: | 0.3mL/min |
| Temperature: | 80°C |
| Detector: | RI |
| Sample: | 1. Dp8<br>2. Dp7<br>3. Dp6<br>4. Dp5<br>5. Dp4<br>6. Dp3<br>7. Dp2<br>8. Dpl (Glucose)<br>9. Fucose |




*Analysis of sports drink using a HyperREZ XP Carbohydrate $Na^+$ column*

| Phase | Particle Size (µm) | Porosity |
|---|---|---|
| HyperREZ XP Carbohydrate $H^+$ Counter-ion | 8 | 8% cross linkage |
| HyperREZ XP Carbohydrate $Pb^{2+}$ Counter-ion | 8 | 8% cross linkage |
| HyperREZ XP Carbohydrate $Ca^{2+}$ Counter-ion | 8 | 8% cross linkage |
| HyperREZ XP Carbohydrate $Na^+$ Counter-ion | 10 | 4% cross linkage |
| HyperREZ XP Organic Acids | 8 | 8% cross linkage |
| HyperREZ XP Sugar Alcohols | 8 | 8% cross linkage |

| Column Type | Application Areas |
|---|---|
| HyperREZ XP $Ca^{2+}$ | Adulteration of food & beverages, confectionary, disaccharides, food additives |
| | Alcohols, dairy products, fermentation, wine |
| | Anomer separation |
| HyperREZ XP $Pb^{2+}$ | Fruit juice, monosaccharides |
| HyperREZ XP $H^+$ | Alcohols, dairy products, fermentation, wine |
| | Oligosaccharides, glycoprotein constituents, organic acids, fermentation products |
| HyperREZ XP $Na^+$ | Corn syrup |

## HyperREZ XP Ordering Guide

| | Particle Size (µm) | Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|---|---|
| HyperREZ XP Carbohydrate H+ | 8 | Guard Cartridge (2/pk) | 5 | 3.0 | **69008-903027** |
| | | Guard Column | 50 | 7.7 | **69008-057726** |
| | | HPLC Column | 300 | 7.7 | **69008-307780** |
| HyperREZ XP Carbohydrate Ca2+ | 8 | Guard Cartridge (2/pk) | 5 | 3.0 | **69208-903027** |
| | | Guard Column | 50 | 7.7 | **69208-057726** |
| | | HPLC Column | 300 | 7.7 | **69208-307780** |
| HyperREZ XP Carbohydrate Pb2+ | 8 | Guard Cartridge (2/pk) | 5 | 3.0 | **69108-903027** |
| | | Guard Column | 50 | 7.7 | **69108-057726** |
| | | HPLC Column | 300 | 7.7 | **69108-307780** |
| HyperREZ XP Carbohydrate Na+ | 10 | Guard Cartridge (2/pk) | 5 | 3.0 | **69310-903027** |
| | | Guard Column | 50 | 7.7 | **69310-057726** |
| | | HPLC Column | 300 | 7.7 | **69310-307780** |
| HyperREZ XP Organic Acids | 8 | Guard Cartridge (2/pk) | 5 | 3.0 | **69008-903027** |
| | | Guard Column | – | – | Inquire |
| | | HPLC Column | 100 | 7.7 | **69608-107780** |
| HyperREZ XP Sugar Alcohols | 8 | Guard Cartridge (2/pk) | 5 | 3.0 | **69208-903027** |
| | | Guard Column | – | – | Inquire |
| | | HPLC Column | 300 | 7.7 | **69708-254030** |

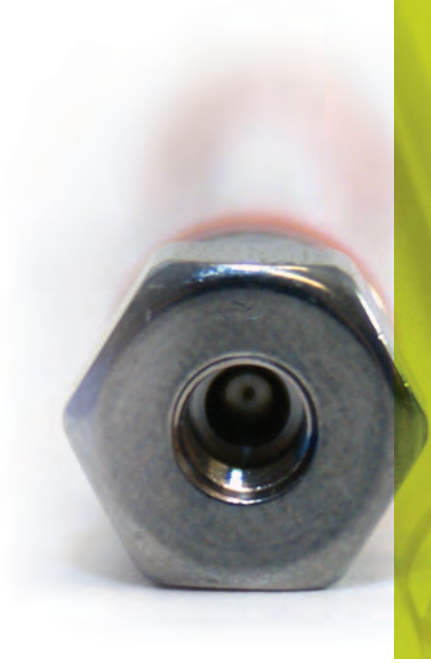
| Format | Length (mm) | ID (mm) | Cat. No. |
|---|---|---|---|
| HyperRez Guard Cartridge Holder | 5 | 3 | **60002-354** |

## Retention Times of Common Saccharides (min)

| Saccharide | $H^+$ | $Ca^{2+}$ | $Pb^{2+}$ |
|---|---|---|---|
| Adonitol | 11.5 | 14.9 | 20.4 |
| Arabinose | 11.4 | 13.6 | 19.4 |
| Erythritol | 12.7 | 15.6 | 20.3 |
| Fructose | 10.6 | 13.5 | 19.3 |
| Fucose | 12.2 | 13.7 | 17.1 |
| Galactose | 1.07 | 12.2 | 15.6 |
| Glucose | 9.9 | 11.1 | 13.9 |
| Glycerol | 14.1 | 16.1 | 19.5 |
| Lactose | 8.6 | 9.7 | 12.8 |
| Maltose | 8.4 | 9.5 | 12.5 |
| Maltotriose | 7.7 | 8.7 | 11.9 |
| Mannitol | 11.0 | 17.3 | 28.9 |
| Mannose | 1.5 | 12.5 | 16.7 |
| Raffinose | 8.2 | 8.6 | 11.4 |
| Sorbitol | 11.1 | 20.7 | N/A |
| Sucrose | 9.8 | 9.4 | 11.9 |
| Xylose | 10.6 | 12.0 | 15.0 |

| **Conditions:** | **Column: 300 x 7.7mm** |
|---|---|
| Mobile Phase: | $H_2O$ |
| Flow Rate: | 0.6mL/min |
| Detection: | RI |
| Temperature: | 75°C ($H^+$) |
| | 85°C ($Ca^{2+}$) |
| | 80°C ($Pb^{2+}$) |

Note: partial hydrolysis may occur with some saccharides using $H^+$.



# Thermo Scientific LC Accessories

## Viper Fingertight Fittings

Provides ease of use and dead-volume free plumbing of every conventional HPLC and UHPLC system


- Provides virtually zero-dead volume fingertight connections
- Supports operating pressures up to 1250 bar (18,130 psi)
- Available in different lengths: 65mm and from 150 to 950mm in 100mm steps
- Available in different inner diameters: 0.1mm (0.004in), 0.13mm (0.005in) or 0.18mm (0.007in)
- Easy to use due to stainless steel or biocompatible MP35N™ capillaries (1/32in OD) and fingertight design
- Works with virtually any valve and column from any manufacturer
- Fits narrow connections such as 10-port valves and enables mixed use with different designs

The Thermo Scientific™ Dionex™ Viper™ fingertight fitting system provides ease of use and virtually dead-volume free plumbing of every conventional HPLC and modern UHPLC system. Together with flexible stainless steel (SST) or biocompatible MP35N® capillaries, it opens a new dimension in liquid chromatography. The Viper system improves chromatographic results, independent of various different connection geometries and system backpressures. Connecting LC modules, valves, and columns quickly and easily without tools is simple with the Viper system.

Extra column volumes in HPLC have the most detrimental effects on the separation efficiency of an LC system and must be minimized. Conventional fittings tightened by hand or using tools have considerable drawbacks which can compromise efficiency. The Viper fitting system overcomes these drawbacks by design, working without ferrules to reduce the dead volume of any fluidic connection to virtually zero. The Viper system unifies robust performance, ease of use, acceptable lifetime, and universal compatibility with virtually all different valves and columns for HPLC system users. All Thermo Scientific™ Dionex™ UltiMate™ 3000 XRS, RS, BioRS and SD systems are equipped with Viper fingertight fitting system as a standard.

### Viper Fingertight Fitting Systems – SST and Biocompatible MP35N

| Length (mm) | 0.1mm ID, SST | 0.1mm ID, MP35N | 0.13mm ID, SST | 0.18mm ID, SST | 0.18mm ID, MP35N |
|---|---|---|---|---|---|
| 65 | **6040.2207** | **6042.2306** | **6040.2307** | **6040.2357** | – |
| 150 | **6040.2215** | **6042.2320** | **6040.2315** | **6040.2360** | – |
| 250 | **6040.2225** | **6042.2330** | **6040.2325** | **6040.2385** | **6042.2315** |
| 350 | **6040.2235** | **6042.2340** | **6040.2335** | **6040.2375** | **6042.2327** |
| 450 | **6040.2245** | **6042.2350** | **6040.2345** | **6040.2365** | **6042.2337** |
| 550 | **6040.2255** | **6042.2360** | **6040.2305** | **6040.2355** | **6042.2365** |
| 650 | **6040.2265** | – | **6040.2310** | **6040.2395** | – |
| 750 | – | – | **6040.2320** | **6040.2370** | **6042.2355** |
| 850 | – | – | **6040.2330** | **6040.2380** | – |
| 950 | – | – | **6040.2350** | **6040.2390** | **6042.2375** |

### Viper Accessories

| Description | **Cat. No.** | Quantity |
|---|---|---|
| Plug, SST | **6040.2303** | 1 Each |
| Union, SST | **6040.2304** | 1 Each |


# Viper Fingertight Fittings Kits for UltiMate 3000 Systems

### Viper Fingertight Fitting Kits for UltiMate 3000 systems

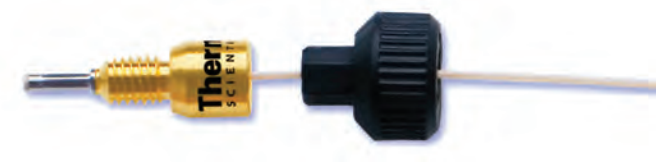
| Description | SD Systems | RS Systems |
|---|---|---|
| Viper Capillary Kit for ISO, LPG or DGP pumps | **6040.2302** | **6040.2301** |
| Viper Capillary Kit for HPG pumps | **6040.2309** | **6040.2308** |
| Viper Capillary Kit for biocompatible RSLC systems | – | **6841.2301** |
| On-line SPE Solution Kit for x2 Dual Standard or RSLC systems | **6040.2802** | **6040.2801** |
| Tandem Operation Solution Kit for x2 Dual Standard or RSLC systems | **6040.2804** | **6040.2803** |
| Application Switching Solution Kit for x2 Dual Standard or RSLC systems | **6040.2806** | **6040.2805** |
| Parallel Setup Solution Kit for x2 Dual Standard or RSLC systems | **6040.2810** | **6040.2809** |
| Inverse Gradient Kit for x2 Dual Standard or RSLC systems | **6040.2819** | **6040.2820** |
| Automated Method Scouting Solution Kit for Standard or RSLC systems | **6040.2808** | **6040.2807** |
| MS Connection Kit for MS-frontends with WPS autosampler, excluding UV detection | **6720.0355** | **6720.0370** |
| MS Connection Kit for MS-frontends with WPS autosampler, including UV detection | **6720.0365** | **6720.0375** |
| MS Connection Kit for MS-frontends with HPG-RS pump and OAS autosampler excluding UV detection | – | **6720.0372** |
| MS Connection Kit for MS-frontends with HPG-RS pump and OAS autosampler including UV detection | – | **6720.0377** |

| Description | XRS Systems |
|---|---|
| Viper Capillary Kit for standalone system with with WPS autosampler | **6043.2301** |
| Viper Capillary Kit for standalone system with with OAS autosampler | **6845.2301A** |
| MS Connection Kit for MS-frontends with WPS autosampler excluding UV detection | **6720.0380** |
| MS Connection Kit for MS-frontends with WPS autosampler including UV detection | **6720.0385** |
| MS Connection Kit for MS-frontends with LPG-XRS pump and OAS autosampler excluding UV detection | **6720.0372** |
| MS Connection Kit for MS-frontends with LPG-XRS pump and OAS autosampler including UV detection | **6720.0377** |

An overview of all UltiMate 3000 systems can be found in the Instruments spare parts section on **4-209**.

# nanoViper Fingertight Fittings

The Thermo Scientific™ Dionex™ nanoViper™ fingertight UHPLC fitting system is virtually dead volume-free by design. It offers nano LC connections that never fail and brings a peace of mind appreciated by novices, as well as the most experienced users.



- Provides virtually zero-dead-volume connections
- Compatible with backpressures up to 1000 bar (14,500 psi)
- Suitable for temperatures up to 80°C
- Easy to use 1/32" PEEK sheathed fused silica and fingertight design
- Works with virtually any valve, and any column, from any manufacturer
- Paves the way for the easy, tool-free nano, capillary and micro LC setup of any application
- nanoViper fingertight fittings allow you to configure your nano, capillary, and micro LC application completely tool free.

Classical connections in nano LC involve either PEEKsil™ or fused silica in PEEK™ sleeves. These connections consist of a nut, ferrule, sleeve, and fused silica, which all need to be assembled correctly. The sealing is at the ferrule, which theoretically leaves a large potential dead volume. Apart from the risk of dead volume (an extreme case indicated above), there is also a risk of damaging the fused silica tubing or column at the point where the ferrule is compressed. The ferrule has to hold the tubing in the sleeve and seal of the connection.

The nanoViper connections come preassembled and high pressure tested. The fittings do not “grab” the tubing at a single point. It seals at the tip and not with a ferrule. Nor does it “grab” the tubing at a single point. It is this feature that gives nanoViper fittings their UHPLC, virtually dead-volume-free capabilities. The theoretical performance effect between the two example chromatograms below is about 20% increase in peak capacity.

### nanoViper Fingertight Fittings

| Length (mm) | Orange 20µm ID | Brown 50µm ID | Black 75µm ID | Red 100µm ID | Purple 150µm ID |
|---|---|---|---|---|---|
| 70 | **6041.5120** | **6041.5123** | **6041.5126** | **6041.5820** | **6041.5817** |
| 150 | **6041.5121** | **6041.5124** | **6041.5127** | **6041.5811** | **6041.5818** |
| 250 | – | – | **6041.5730** | **6041.5812** | **6041.5819** |
| 350 | **6041.5240** | **6041.5540** | **6041.5735** | **6041.5813** | **6041.5820** |
| 450 | – | – | – | **6041.5814** | **6041.5821** |
| 550 | **6041.5260** | **6041.5560** | **6041.5760** | **6041.5815** | **6041.5822** |
| 650 | **6041.5275** | **6041.5575** | **6041.5775** | – | – |
| 750 | **6041.5280** | **6041.5580** | **6041.5780** | **6041.5816** | **6041.5823** |
| 950 | **6041.5122** | **6041.5125** | **6041.5128** | – | – |

### Trap Column Cartridges Holders with nanoViper Fittings

| Description | Cartridge Length (mm) | Fitting ID (µm) | **Cat. No.** |
|---|---|---|---|
| µ-Precolumn holder for trap cartridges with 2 x 100mm length nanoViper fittings | 5 | 30 | **164649** |
| | 15 | 75 | **164650** |

### Sample Loops with nanoViper Fittings

| Volume (µL) | **Cat. No.** | Quantity |
|---|---|---|
| 1 | **6826.2401** | 1 Each |
| 5 | **6826.2405** | 1 Each |
| 10 | **6826.2410** | 1 Each |
| 20 | **6826.2420** | 1 Each |
| 50 | **6826.2450** | 1 Each |
| 125 | **6826.2412** | 1 Each |

## nanoViper Application Kits

nanoViper fittings are also included in tubing and application kits designed for use with the UltiMate 3000 RSLCnano systems.

### nanoViper Fitting Kits for UltiMate 3000 RSLCnano Systems

| Description | Tubing | Samples | Trap Column | Separation Column | RSLCnano Systems |
|---|---|---|---|---|---|
| Direct Injection nano LC Kit | Y | Y | – | Y | **6720.0300** |
| Direct Injection capillary LC Kit | Y | Y | – | Y | **6720.0305** |
| Preconcentration nano LC kit | Y | Y | Y | Y | **6720.0310** |
| Preconcentration capillary LC kit | Y | Y | Y | Y | **6720.0315** |
| Preconcentration monolithic LC kit | Y | Y | Y | Y | **6720.0320** |
| 2D salt plugs kit | Y | Y | Y | Y | **6720.0325** |
| Automated off line SCX-RP peptides kit | Y | Y | Y | Y | **6720.0330** |
| Automated off line RP-RP peptides kit | Y | Y | Y | Y | **6720.0340** |
| Tandem nano LC kit | Y | Y | Y | Y | **6720.0335** |
| FLM nanoViper tubing kit (All tubing for nano LC preconcentration) | Y | – | – | – | **6041.5100** |
| MS connection kit | Y | – | – | – | **6720.0345** |
| EASY-Spray connection kit (Supports direct injection as well as preconcetration) | Y | Y | Y | – | **6720.0395** |

# SLIPFREE Connectors

Universal self-adjusting connections

- Void-free and leak-free by pushing tubing and ferrule into the end-fitting
- Compatible with all column end-fittings
- Stainless-steel threads
- Fingertight connections to 10,000psi

## SLIPFREE Ferrules

| Material | Cat. No. | Quantity |
|---|---|---|
| PEEK | **36023** | 1 Each |
| Vespel | **36024** | 1 Each |
| Kel-F | **36025** | 1 Each |

## SLIPFREE Connectors, Single

| | Length (cm) | 0.005in ID | 0.010in ID | 0.020in ID |
|---|---|---|---|---|
| **Single** | | | | |
|  | 6 | **30106** | **31106** | **32106** |
| | 10 | **30110** | **31110** | **32110** |
| | 20 | **30120** | **31120** | **32120** |
| | 30 | **30130** | **31130** | **32130** |
| | 50 | **30150** | – | – |
| **Single Flexible** | | | | |
|  | 10.5 | **30111-FLEX** | **39111-FLEX** | – |
| | 15 | **30115-FLEX** | **39115-FLEX** | – |
| | 28 | **30128-FLEX** | **39128-FLEX** | – |
| | 40 | **30140-FLEX** | **39140-FLEX** | – |
| | 50 | **30150-FLEX** | – | – |
| | 60 | **30160-FLEX** | – | – |
| **Single PEEK Collared** | | | | |
|  | 6 | **30306** | **31306** | **32306** |
| | 10 | **30310** | **31310** | **32310** |
| | 20 | **30320** | **31320** | **32320** |
| **Single Long-neck** | | | | |
|  | 10 | **30510** | **31510** | – |
| | 20 | **30520** | **31520** | **32520** |

## SLIPFREE Connectors, Double

| | Length (cm) | 0.005in ID | 0.010in ID | 0.020in ID |
|---|---|---|---|---|
| **Double** | | | | |
|  | 6 | **30206** | **31206** | **32206** |
| | 10 | **30210** | **31210** | **32210** |
| | 20 | **30220** | **31220** | **32220** |
| | 30 | **30230** | **31230** | **32230** |
| | 40 | **30240** | – | – |
| **Double Flexible** | | | | |
|  | 10.5 | **30211-FLEX** | **39211-FLEX** | – |
| | 15 | **30215-FLEX** | **39215-FLEX** | – |
| | 28 | **30228-FLEX** | **39228-FLEX** | – |
| | 40 | **30240-FLEX** | **39240-FLEX** | – |
| **Double PEEK Collared** | | | | |
|  | 6 | **30406** | **31406** | **32406** |
| | 10 | **30410** | **31410** | **32410** |
| | 20 | **30420** | **31420** | **32420** |
| **Double Long-neck** | | | | |
|  | 10 | **31710** | **32710** | – |
| | 20 | **31720** | **32720** | – |

## PTFE One-Piece Column Connector

Excellent for high-throughput screening and quick connection

- Fingertight, leak-free connection of analytical and guard columns with 10-32 threads
- Minimizes dead volume
- Inert and biocompatible material

### PEEK One-Piece Column Connector

| Description | Cat. No. | Quantity |
|---|---|---|
| One Piece Coupler | **60170-370** | 1 Each |

## Solvent Inlet Filters

Feature a large surface area for a long lifetime

- 10µm inlet filters for longer lifetime
- No tools required for replacement

### Solvent Inlet Filters for UltiMate 3000 Systems

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| Filter frit, porosity 10µm, V4A stainless steel | UltiMate 3000 pumps | **6268.0110** | 10 Each |
| Filter frit, porosity 10µm, titanium | UltiMate 3000 pumps | **6268.0111** | 10 Each |
| Filter holder | UltiMate 3000 pumps | **6268.0115** | 6 Each |
| Solvent supply line, 1.5 x 3.0 x 1000mm | UltiMate 3000 pumps | **6030.2548** | 1 Each |

## Bottom-of-the-Bottle solvent filters

- Efficient draw
- 100% PTFE polymer, including 2µm filters
- Built-in helium sparge port and frit

### Solvent Filters for HPLC Systems

| | Type | For Use with | Cat. No. | Quantity |
|---|---|---|---|---|
|  | Stainless Steel | Fit 1/16in OD tube to 1/8in OD plastic tubing | **A-302** | 1 Each |
|  | Stainless Steel | Fit to 1/8in OD plastic tubing using 1/8in PP nut | **A-302A** | 1 Each |
|  | Bottom-of-the-Bottle | 3/16in OD plastic tubing | **A-436** | 1 Each |
| | Bottom-of-the-Bottle | 1/8in OD tubing | **A-437** | 1 Each |

# High Pressure Stainless Steel Nuts and Ferrules

Accommodate a wide range of configurations

- Designed for 10-32 port configurations
- Burr and contaminant free

### Thermo Scientific High Pressure Stainless Steel Nuts and Ferrules

| | Type | Cat. No. | Quantity |
|---|---|---|---|
|  | 10-32 thread nut with ferrule | **F-190** | 1 Each |
| | Replacement PEEK Ferrules | **F-192x** | 10 Pack |
|  | Male hex nut | **U-400x** | 10 Pack |
| | Universal ferrules, 0.625in | **U-401x** | 10 Pack |
|  | Valco male hex nut, 10-32 thread | **U-320x** | 10 Pack |
|  | Valco ferrules, 0.625in | **U-321x** | 10 Pack |
|  | Male hex nut, Waters compatible | **U-410x** | 10 Pack |

# Reducing Union for Preparative Columns

Connects 30 to 50mm ID preparative columns to 1/16in tubing

- Stainless steel construction
- 1.0mm bore
- Without frit

### Reducing Union for Preparative Column

| Description | Cat. No. | Quantity |
|---|---|---|
| 1/8in to 1/16in Reducing Union for Preparative Column | **60182-357** | 1 Each |

# PEEK Fingertight Fittings

Machined for reliability and ease of use

- Resist cracking, breaking, thread stripping and leaking in both low and high pressure applications
- Biocompatible for a broad range of applications

### PEEK Fingertight Fittings

| | Type | Cat. No. | Quantity |
|---|---|---|---|
|  | One-piece Fingertight Fitting, 1/16in, 0.37in head | **F-120x** | 10 Pack |
|  | One-Piece Long Fingertight Fitting, 1/16in, 0.37in head | **F-130x** | 10 Pack |
|  | One-Piece PEEK Fingertight Fitting, 1/32in, 0.25in head | **M-645x** | 10 Pack |
|  | Two-Piece Fingertight Wing Nut with Ferrule, 1/16in | **F-300x** | 10 Pack |
|  | Replacement PEEK Ferrules | **F-142x** | 10 Pack |
|  | Column End Plugs, 1/16in, 10-32 coned, Delrin, Black | **U-467BLKx** | 10 Pack |
| | Column End Plugs, 1/16in, 10-32 coned, Delrin, Red | **U-467Rx** | 10 Pack |

# Viper Unions

Suitable only for direct connection of two Viper capillaries

| Description | Cat. No. | Quantity |
|---|---|---|
| Viper union, stainless steel | **6040.2304** | 1 Each |

# Stainless Steel Unions, Tees and Crosses

Well-suited to high pressure applications

- Absolute zero or low dead volume formats
- Includes two stainless steel nuts and ferrules

### Stainless Steel Unions, Tees and Crosses

| | Description | Through Hole (in) | Swept Volume (µL) | Cat. No. | Quantity |
|---|---|---|---|---|---|
|  | Union, stainless steel, Upchurch Scientific/Parker fittings compatible, includes 2 stainless steel nuts and ferrules | 0.010 | 0.025 | **U-435** | 1 Each |
|  | Union, stainless steel, Upchurch Scientific/Parker fittings compatible, includes 2 stainless steel nuts and ferrules | 0.020 | 0.134 | **U-402** | 1 Each |
|  | Union, stainless steel, Upchurch Scientific/Parker fittings compatible, includes 2 stainless steel nuts and ferrules | 0.050 | 0.836 | **U-437** | 1 Each |
|  | Union, stainless steel, Upchurch Scientific/Parker fittings compatible, includes 2 stainless steel nuts and ferrules | 0.062 | ~0.0 | **U-438** | 1 Each |
|  | Union, stainless steel, Waters fittings compatible, includes 2 stainless steel nuts and ferrules | 0.020 | 0.129 | **U-412** | 1 Each |
|  | Union, stainless steel, Valco fittings compatible, includes 2 stainless steel nuts and ferrules | 0.020 | 0.103 | **U-322** | 1 Each |
|  | Tee, stainless steel, 10-32 fittings for use with 1/16in OD tubing | 0.020 | 0.57 | **U-428** | 1 Each |
|  | Cross, stainless steel, 10-32 fittings for use with 1/16in OD tubing | 0.020 | 0.72 | **U-430** | 1 Each |

# PEEK Unions, Tees and Crosses

Well-suited to high pressure applications

- Absolute zero or low dead volume formats
- Biocompatible

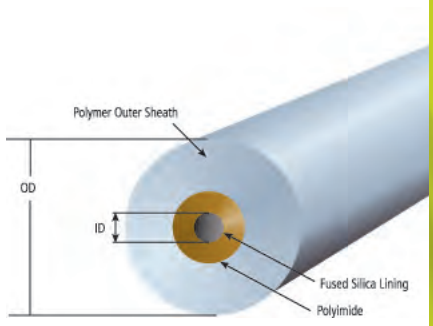
## PEEK and PEEK Lined Unions, Tees and Crosses

| | Description | Through Hole (in) | Swept Volume (µL) | Cat. No. | Quantity |
|---|---|---|---|---|---|
|  | Union, PEEK polymer, includes two PEEK 2-piece fittings | 0.010 | 0.070 | **P-742** | 1 Each |
| | Union, PEEK polymer, includes two PEEK 2-piece fittings | 0.020 | 0.28 | **P-704** | 1 Each |
|  | Tee, PEEK, 10-32 fittings for use with 1/16in OD tubing, includes three 10-32 PEEK double-winged nuts | 0.020 | 0.57 | **P-727** | 1 Each |
|  | PEEK, 10-32 fittings for use with 1/16in OD tubing, includes four 10-32 PEEK double-winged nuts | 0.020 | 0.72 | **P-729** | 1 Each |

# PEEKsil Capillary Tubing

Excellent chemical compatibility and very low carryover

- Precision-bore fused silica tubing coated with 1/16in OD PEEK covering
- Usable in most standard chromatography systems
- Withstands high pressures
- Smooth internal surface for excellent flow characteristics
- Tubing is stiff: not recommended for uses requiring tubing bends
- Precut lengths only: cutting in the lab may damage tubing




### PEEKsil Capillary Tubing

| ID (in) | Length (cm) | Cat. No. | Quantity |
|---|---|---|---|
| 0.002 | 10 | **60182-500** | 5 Pack |
| | 20 | **60182-501** | 5 Pack |
| | 50 | **60182-502** | 2 Pack |
| 0.004 | 10 | **60182-503** | 5 Pack |
| | 20 | **60182-504** | 5 Pack |
| | 50 | **60182-505** | 2 Pack |
| 0.007 | 10 | **60182-506** | 5 Pack |
| | 20 | **60182-507** | 5 Pack |
| | 50 | **60182-508** | 2 Pack |

**Applications:**

- HPLC
- LC-MS

# PEEK Sleeves for Fused Silica Capillary Tubing

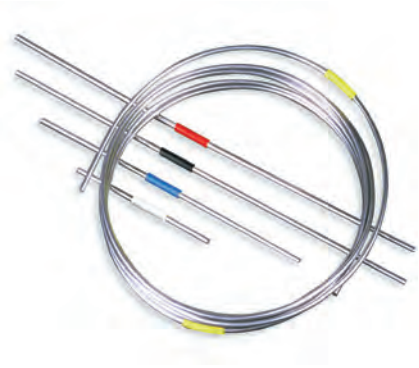
Withstands high pressures

### 1/16in OD PEEK Sleeves for Fused Silica Capillary Tubing

| ID (in) | Color | Cat. No. | Quantity |
|---|---|---|---|
| 0.008 | Yellow | **F-227** | 1 Each |
| 0.010 | Blue | **F-228** | 1 Each |
| 0.012 | Natural | **F-229** | 1 Each |
| 0.015 | Orange | **F-230** | 1 Each |
| 0.021 | Natural | **F-231** | 1 Each |
| 0.030 | Natural | **F-232** | 1 Each |

# 316 Stainless Steel Capillary Tubing

Cleaned, polished, passivated and ready-to-use



- Suitable for ultra high pressure applications
- Wide chemical compatibilty
- Prefinished, square, burr-free ends and interiors to minimize dead volume connections
- Not recommended for biological samples
- Rough internal surface may lead to sample carryover

## 316 Stainless Steel Capillary Tubing

| ID (in) | Length (cm) | Color | Cat. No. | Quantity |
|---|---|---|---|---|
| **1/16in OD Precut Tubing** | | | | |
| 0.005 | 5 | Red | **U-152** | 1 Each |
| | 10 | Red | **U-153** | 1 Each |
| | 20 | Red | **U-154** | 1 Each |
| | 30 | Red | **U-155** | 1 Each |
| | 50 | Red | **U-156** | 1 Each |
| | 100 | Red | **U-157** | 1 Each |
| 0.007 | 5 | Black | **U-126** | 1 Each |
| | 10 | Black | **U-127** | 1 Each |
| | 20 | Black | **U-128** | 1 Each |
| | 30 | Black | **U-129** | 1 Each |
| | 50 | Black | **U-130** | 1 Each |
| | 100 | Black | **U-131** | 1 Each |
| 0.010 | 5 | Blue | **U-111** | 1 Each |
| | 10 | Blue | **U-112** | 1 Each |
| | 20 | Blue | **U-113** | 1 Each |
| | 30 | Blue | **U-114** | 1 Each |
| | 50 | Blue | **U-132** | 1 Each |
| | 100 | Blue | **U-133** | 1 Each |
| **1/32in OD Precut Tubing with 1/16in Sleeves** | | | | |
| 0.005 | 10.5 | Red | **30011-FLEX** | 1 Each |
| | 15 | Red | **30015-FLEX** | 1 Each |
| | 28 | Red | **30028-FLEX** | 1 Each |
| | 40 | Red | **30040-FLEX** | 1 Each |
| 0.007 | 10.5 | Yellow | **39011-FLEX** | 1 Each |
| | 15 | Yellow | **39015-FLEX** | 1 Each |
| | 28 | Yellow | **39028-FLEX** | 1 Each |
| | 40 | Yellow | **39040-FLEX** | 1 Each |

## 1/16in 316 Stainless Steel Tubing, 5-Foot Coil

| ID (in) | Cat. No. | Quantity |
|---|---|---|
| 0.005 | **U-158** | 1 Each |
| 0.007 | **U-108** | 1 Each |
| 0.010 | **U-106** | 1 Each |
| 0.020 | **U-105** | 1 Each |
| 0.030 | **U-107** | 1 Each |
| 0.040 | **U-144** | 1 Each |
| 0.046 | **U-151** | 1 Each |

# PEEK Capillary Tubing

Pre-cut and color-coded for easy identification and use

- Broad chemical compatibility
- Biocompatible
- Easily cut to desired length
- Appropriate for many HPLC applications
- Resistant to most organic solvents, but nitric acid, sulfuric acid, dichloromethane, THF and DMSO are not recommended

## 1/16in OD Precut PEEK Tubing

| ID (in) | Length (cm) | Color | **Cat. No.** | Quantity |
|---|---|---|---|---|
| 0.003 | 5 | Natural | **37003-5** | 1 Each |
| | 10 | Natural | **37003-10** | 1 Each |
| | 20 | Natural | **37003-20** | 1 Each |
| | 30 | Natural | **37003-30** | 1 Each |
| | 50 | Natural | **37003-50** | 1 Each |
| | 100 | Natural | **37003-100** | 1 Each |
| 0.005 | 5 | Red | **37005-5** | 1 Each |
| | 10 | Red | **37005-10** | 1 Each |
| | 20 | Red | **37005-20** | 1 Each |
| | 30 | Red | **37005-30** | 1 Each |
| | 50 | Red | **37005-50** | 1 Each |
| | 100 | Red | **37005-100** | 1 Each |
| 0.007 | 5 | Yellow | **37007-5** | 1 Each |
| | 10 | Yellow | **37007-10** | 1 Each |
| | 20 | Yellow | **37007-20** | 1 Each |
| | 30 | Yellow | **37007-30** | 1 Each |
| | 50 | Yellow | **37007-50** | 1 Each |
| | 100 | Yellow | **37007-100** | 1 Each |
| 0.010 | 5 | Blue | **37010-5** | 1 Each |
| | 10 | Blue | **37010-10** | 1 Each |
| | 20 | Blue | **37010-20** | 1 Each |
| | 30 | Blue | **37010-30** | 1 Each |
| | 50 | Blue | **37010-50** | 1 Each |
| | 100 | Blue | **37010-100** | 1 Each |
| 0.020 | 5 | Orange | **37020-5** | 1 Each |
| | 10 | Orange | **37020-10** | 1 Each |
| | 20 | Orange | **37020-20** | 1 Each |
| | 30 | Orange | **37020-30** | 1 Each |
| | 50 | Orange | **37020-50** | 1 Each |
| | 100 | Orange | **37020-100** | 1 Each |

## 1/16in OD PEEK Tubing, 5-Foot Coil

| ID (in) | **Cat. No.** | Quantity |
|---|---|---|
| 0.003 | **37003** | 1 Each |
| 0.005 | **37005** | 1 Each |
| 0.007 | **37007** | 1 Each |
| 0.010 | **37010** | 1 Each |
| 0.020 | **37020** | 1 Each |
| 0.030 | **37030** | 1 Each |
| 0.040 | **37040** | 1 Each |

## Polymer Tubing Cutter

Produces a flat, 90°, burr-free end

- Compatible with rigid polymeric tubing
- Guide holes for 1/16in and 1/8in tubing

### Polymer Tubing Cutter

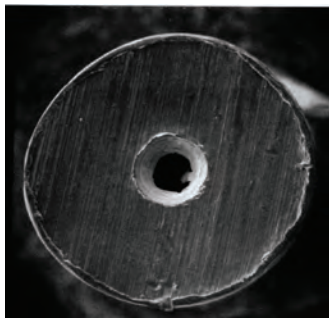
| Description | Cat. No. | Quantity |
|---|---|---|
| Polymeric Tubing Cutter | **A-327** | 1 Each |
| Replacement blades | **A-328** | 5 Pack |

## Terry Tool Tubing Cutters

Produce clean, 90° cuts of stainless steel tubing


### Terry Tool Tubing Cutters

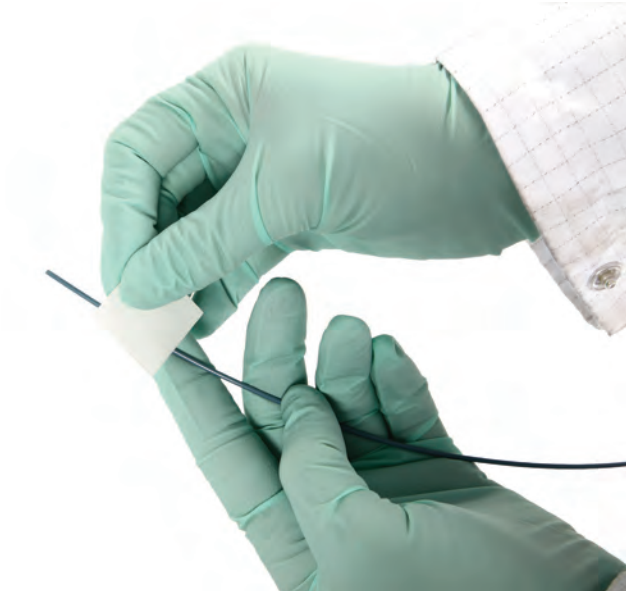
| Description | Cat. No. | Quantity |
|---|---|---|
| 1/16in stainless steel tubing | **60182-509** | 1 Each |
| 1/8in stainless steel tubing | **60182-510** | 1 Each |



## Fused Silica Cutter

### Fused Silica Cutter

| Description | Cat. No. | Quantity |
|---|---|---|
| Cutter for fused silica capillaries | **6720.0016** | 1 Each |



## Rheodyne 7725 and 7725i Sample Injectors

Allow continuous flow between the load and inject positions to protect against pressure shock

- Stainless steel construction
- Make-Before-Break (MBB) design
- Can use partial filling for zero sample waste or complete filling for better reproducibility
- Inject 1µL to 5mL with high accuracy and precision
- 7725i features a position sensing switch for a reproducible start signal

### Rheodyne 7725 and 7725i Sample Injectors

| Model | Mode | Features | **Cat. No.** | Quantity |
|---|---|---|---|---|
| 7725 | Dual | Continuous flow | **7725** | 1 Each |
| 7725i | Dual | Continuous flow, position sensing switch | **7725i** | 1 Each |

## Rheodyne 9725 and 9725i Sample Injectors

Allow continuous flow between the load and inject positions to protect against pressure shock

- Biocompatible PEEK construction
- Make-Before-Break (MBB) design
- Can use partial filling for zero sample waste or complete filling for better reproducibility
- Inject 1µL to 5mL with high accuracy and precision
- 9725i features a position sensing switch for a reproducible start signal

### Rheodyne 9725 and 9725i Sample Injectors

| Model | Mode | Features | **Cat. No.** | Quantity |
|---|---|---|---|---|
| 9725 | Dual | Continuous flow | **9725** | 1 Each |
| 9725i | Dual | Continuous flow, position sensing switch | **9725i** | 1 Each |

## Rheodyne 8125 Low-dispersion Microscale Injector

Designed for use with 1 and 2mm ID HPLC columns

- Can use partial filling for zero sample waste or complete filling for better reproducibility
- Position sensing switch provides reproducible start signal
- Suitable for use with 5 to 50µL sample loops

### Rheodyne 8125 Low-dispersion Microscale Injector

| Model | Mode | Features | **Cat. No.** | Quantity |
|---|---|---|---|---|
| 8125 | Dual | Continuous flow | **8125** | 1 Each |

# Rheodyne 7010 Sample Injector

Single-mode sample injector designed for the complete filling method

### Rheodyne 7010 Sample Injector

| Model | Mode | Features | Cat. No. | Quantity |
|---|---|---|---|---|
| 7010 | Single | Complete filling method | **7010** | 1 Each |

**Compatible with:**

sample loop sizes 5µL to 20mL

# Rheodyne 9010 Sample Injector

Single-mode sample injector designed for the complete filling method

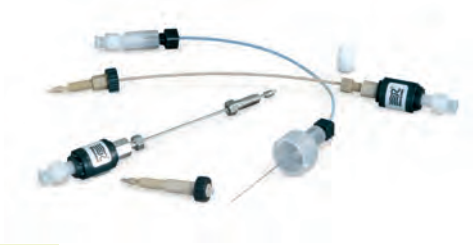
- Compatible with sample loop sizes 5µL to 10mL
- PEEK stator
- Position sensing switch provides a reproducible start signal

### Rheodyne 9010 Sample Injector

| Model | Mode | Features | Cat. No. | Quantity |
|---|---|---|---|---|
| 9010 | Single | Continuous flow, position sensing switch | **9010** | 1 Each |

# Rheodyne Ports for Injectors

Suitable for popular Rheodyne injector models



### Rheodyne Ports for Rheodyne Injectors Models 7010 and 9010

| For Use with Rheodyne Model | Cat. No. | Quantity |
|---|---|---|
| 7010 Filler Port, Stainless Steel | **7012** | 1 Each |
| 9010 Filler Port, PEEK | **9012** | 1 Each |
| 9010 Needle Port, PEEK | **9013** | 1 Each |

# Rheodyne Sample Loops

For Rheodyne sample injectors in stainless steel or biocompatible PEEK

### PEEK and Stainless Steel Sample Loops

| Description | Volume | ID (mm / in) | Cat. No. | Quantity |
|---|---|---|---|---|
| Sample loops for 7010 and 7125 injectors, Stainless Steel | 5µL | 0.18 / 0.007 | **7020** | 1 Each |
| | 10µL | 0.30 / 0.012 | **7021** | 1 Each |
| | 20µL | 0.30 / 0.012 | **7022** | 1 Each |
| | 50µL | 0.51 / 0.020 | **7023** | 1 Each |
| | 100µL | 0.51 / 0.020 | **7024** | 1 Each |
| | 200µL | 0.76 / 0.030 | **7025** | 1 Each |
| | 500µL | 0.76 / 0.030 | **7026** | 1 Each |
| | 1mL | 0.76 / 0.030 | **7027** | 1 Each |
| | 5mL | 1.0 / 0.040 | **7029** | 1 Each |
| Sample loops for 7725 and 7725i injectors Stainless Steel | 5µL | 0.18 / 0.007 | **7755-020** | 1 Each |
| | 10µL | 0.30 / 0.012 | **7755-021** | 1 Each |
| | 20µL | 0.30 / 0.012 | **7755-022** | 1 Each |
| | 50µL | 0.51 / 0.020 | **7755-023** | 1 Each |
| Sample loops for 8125 injectors, Stainless Steel | 5µL | 0.20 / 0.008 | **8020** | 1 Each |
| | 10µL | 0.20 / 0.008 | **8021** | 1 Each |
| | 20µL | 0.25 / 0.010 | **8022** | 1 Each |
| | 50µL | 0.30 / 0.012 | **8023** | 1 Each |
| Sample loops for 9010 and 9725 injectors, PEEK | 2µL | Internal | **7755-015** | 1 Each |
| | 5µL | 0.18 / 0.007 | **9055-020** | 1 Each |
| | 10µL | 0.25 / 0.010 | **9055-021** | 1 Each |
| | 20µL | 0.25 / 0.010 | **9055-022** | 1 Each |
| | 50µL | 0.51 / 0.020 | **9055-023** | 1 Each |
| | 100µL | 0.51 / 0.020 | **9055-024** | 1 Each |
| | 200µL | 0.51 / 0.020 | **9055-025** | 1 Each |
| | 500µL | 0.76 / 0.030 | **9055-026** | 1 Each |
| | 1mL | 0.76 / 0.030 | **9055-027** | 1 Each |
| | 5mL | 0.76 / 0.030 | **9055-029** | 1 Each |
| Sample loops for 9725 and 9725i injectors, PEEK | 5µL | 0.18 / 0.007 | **9055-020** | 1 Each |
| | 10µL | 0.25 / 0.010 | **9055-021** | 1 Each |
| | 20µL | 0.25 / 0.010 | **9055-022** | 1 Each |
| | 50µL | 0.51 / 0.020 | **9055-023** | 1 Each |

# RheBuild Kits

Maintain Rheodyne valves and injectors

### RheBuild Kits

| For Use with Rheodyne Models | Cat. No. | Quantity |
|---|---|---|
| 3725/3725i/3725-038/3725i-038 | **3725-999** | 1 Each |
| 7010/7000 | **7010-999** | 1 Each |
| 7125/7126 | **7125-999** | 1 Each |
| 7410 | **7410-999** | 1 Each |
| 7520/7526 | **7520-999** | 1 Each |
| 7725/7725i/7726 | **7725-999** | 1 Each |
| 8125/8126 | **8125-999** | 1 Each |
| 9125/9126 | **9125-999** | 1 Each |

# Rheodyne Suction Needle Adapter

For use with Rheodyne sample injectors

### Rheodyne Suction Needle Adapter

| For Use with | Cat. No. | Quantity |
|---|---|---|
| Rheodyne Injector Models 9725 and 9725i | **9125-076** | 1 Each |

# Rheodyne Replacement Rotor Seals for Injectors

Suitable for popular Rheodyne injector models

### Rheodyne Replacement Rotor Seals for Injectors

| For Use with Rheodyne Models | Cat. No. | Quantity |
|---|---|---|
| **Vespel Seals** | | |
| 7000/7010/7040/7067 | **7010-039** | 1 Each |
| 7030 | **7030-003** | 1 Each |
| 7060/7066 | **7060-070** | 1 Each |
| 7125/7126 | **7125-047** | 1 Each |
| 7410 | **7410-038** | 1 Each |
| 7413 | **7413-013** | 1 Each |
| 8125/8126 | **8125-038** | 1 Each |
| **Tefzel Seals** | | |
| 7000/7010/7040 | **7010-071** | 1 Each |
| 7030 | **7030-015** | 1 Each |
| 7060/7066/9060 | **7060-074** | 1 Each |
| 7410 | **7410-075** | 1 Each |
| 7125/7126 | **7125-079** | 1 Each |
| 8125 | **8125-097** | 1 Each |
| 9010 | **9010-051** | 1 Each |
| 9125 | **9125-082** | 1 Each |
| **PEEK Seals** | | |
| 3725/3725i/3725-038/3725i-038 | **3725-018** | 1 Each |

# Rheodyne Stators

Suitable for popular Rheodyne injector models

### Rheodyne Stators

| For Use with Rheodyne Models | Cat. No. | Quantity |
|---|---|---|
| 7000/7010/7030/7040/7125 | **7010-040** | 1 Each |
| 7010-087/7125-081 | **7010-066** | 1 Each |
| 7060/7066 | **7060-039** | 1 Each |
| 7410/7413 | **7410-041** | 1 Each |
| 9010/9030/9125 | **9125-043** | 1 Each |
| 9060 | **9060-016** | 1 Each |
| 7725 | **7725-010** | 1 Each |
| 8125/8126 | **8125-098** | 1 Each |

### Rheodyne Stator Face Assemblies

| For Use with Rheodyne Models | Cat. No. | Quantity |
|---|---|---|
| 3725/3725i/3725-038/3725i-038 | **3725-039** | 1 Each |
| 7125 | **7125-067** | 1 Each |
| 8125 | **8125-074** | 1 Each |
| 9125/9010/9030 | **8125-094** | 1 Each |
| 9060 | **9060-015** | 1 Each |
| 9725 | **7725-026** | 1 Each |

# Rheodyne Injection Port Needle Cleaner

For use with Rheodyne sample injectors

### Rheodyne Injection Port Needle Cleaner

| For Use with | Cat. No. | Quantity |
|---|---|---|
| Rheodyne injectors | **7125-054** | 1 Each |

# Rheodyne Valve Mounting Brackets

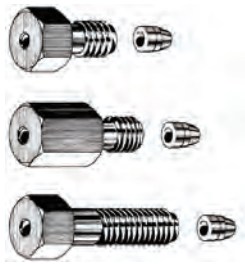
For use with Rheodyne sample injectors

### Rheodyne Injection Port Needle Cleaner

| For Use with | Cat. No. | Quantity |
|---|---|---|
| Angle bracket | **7160-010** | 1 Each |
| Mouting panel | **7160** | 1 Each |

# RheFlex High Pressure Fittings

Precision machined from 316 stainless steel



### RheFlex High Pressure Fittings

| | Type | Cat. No. | Quantity |
|---|---|---|---|
|  | Short Fittings Set | **6000-109** | 5 Pack |
| | Short Fittings Set | **6000-209** | 10 Pack |
|  | Long Fittings Set | **6000-111** | 5 Pack |
| | Long Fittings Set | **6000-211** | 10 Pack |
|  | Extra Long Fittings Set | **6000-162** | 5 Pack |
| | Extra Long Fittings Set | **6000-262** | 10 Pack |
|  | 1/16in Ferrule | **6000-110** | 5 Pack |
| | 1/16in Ferrule | **6000-210** | 10 Pack |
|  | 0.5mm Ferrule for Model 8125 | **8125-084** | 1 Each |

# RheFlex Two-Piece PEEK Fittings

Provide inert, metal-free connections

- Slotted back-side of the ferrule is squeezed down onto the tube by the mating conical surface of the nut
- May be used on 1/16in metal or plastic tubing reliably up to 5000 psi
- Reusable ferrule and nut

### RheFlex Two-Piece PEEK Fittings

| Type | Cat. No. | Quantity |
|---|---|---|
| Fitting set, standard length | **6000-054** | 5 Pack |
| Fitting set, short | **6000-055** | 5 Pack |
| Fitting set, X-long | **6000-066** | 1 Each |
| Replacement ferrules | **6000-051** | 5 Pack |

# Cheminert Model C2 Microbore Injector

Can be used as an injector or switching valve

- 1/16in fittings
- 0.010in ports
- Available in 6-port or 10-port configurations
- Available with manual or microelectric actuator

### Cheminert Model C2 Microbore Injector

| Description | Sample Volume | Cat. No. | Quantity |
|---|---|---|---|
| Model C2 injector, N60 stainless stator, 5µLloop, manual | 6 ports | **C2-1006** | 1 Each |
| | 10 ports | **C2-1000** | 1 Each |
| Model C2 injector, N60 stainless stator, 5µL loop, microelectric actuator | 6 ports | **C2-1006EH** | 1 Each |
| | 10 ports | **C2-1000EP** | 1 Each |
| Sample injector loops, stainless steel | 2µL | **CSL2** | 1 Each |
| | 5µL | **CSL5** | 1 Each |
| | 10µL | **CSL10** | 1 Each |
| | 20µL | **CSL20** | 1 Each |
| | 50µL | **CSL50** | 1 Each |
| | 100µL | **CSL100** | 1 Each |
| Model C4 injector, PAEK stator, 5µL loop, microelectric actuator | 6 ports | **C2-1346EH** | 1 Each |
| | 10 ports | **C2-1340EP** | 1 Each |
| Sample injector loops, PAEK | 5µL | **CZSL5PK** | 1 Each |
| | 10µL | **CZSL10PK** | 1 Each |
| | 50µL | **CZSL50PK** | 1 Each |
| | 100µL | **CZSL100PK** | 1 Each |

# Valco Injector Model C6W

| Description | Volume | Cat. No. | Quantity |
|---|---|---|---|
| Model C6W injector, six 0.016in ports, manual | 20µL loop | **C6W** | 1 Each |
| Model EPC6W injector, six 0.016in ports, microelectric actuator | 20µL loop | **EPC6W** | 1 Each |
| Replacement rotor | – | **SSAC6W** | 1 Each |
| Sample injector loop, stainless steel | 2µL | **SL2CW** | 1 Each |
| Sample injector loop, stainless steel | 5µL | **SL5CW** | 1 Each |
| Sample injector loop, stainless steel | 10µL | **SL10CW** | 1 Each |
| Sample injector loop, stainless steel | 20µL | **SL20CW** | 1 Each |
| Sample injector loop, stainless steel | 50µL | **SL50CW** | 1 Each |
| Sample injector loop, stainless steel | 100µL | **SL100CW** | 1 Each |

# Valco Accessories

| Description | Volume | Cat. No. | Quantity |
|---|---|---|---|
| Valco syringe ports | 22 ga. needles; 1/16in fittings | **VISF-1** | 1 Each |
| Valco syringe ports | 22 ga. 2in needles | **VISF-2** | 1 Each |
| Valco Nuts and Ferrules | 1/16in standard nut | **ZN1-10** | 10 Pack |
| Valco Nuts and Ferrules | 1/16in long nut | **LZN1-10** | 10 Pack |
| Valco Nuts and Ferrules | 1/16in SS ferrule | **ZF1-10** | 10 Pack |

# HPLC Syringes

Syringes and needles for Thermo Scientific LC instruments

## Syringes for UltiMate 3000 Instruments

| Volume (µL) | Instrument | Cat. No. | Quantity |
|---|---|---|---|
| 25 | All WPS-3000 variants | **6822.0001** | 1 Each |
| 100 | All WPS-3000 variants | **6822.0002** | 1 Each |
| 250 | All WPS-3000 and ACC-3000 variants, except the WPS-3000TXRS | **6822.0003** | 1 Each |
| 500 | All WPS-3000 variants, except the WPS-3000TXRS | **6822.0004** | 1 Each |
| 1000 | All WPS-3000 and ACC-3000 variants, except the WPS-3000TXRS | **6822.0005** | 1 Each |

## Syringes for Thermo Scientific Instruments

| Volume (µL) | Needle Type | Length (mm) | Gauge | Instrument | Cat. No. | Quantity |
|---|---|---|---|---|---|---|
| 250 | Removable | 50 | 22 | LCQ | **365ILT21** | 1 Each |
| 500 | Removable | 50 | 22 | LCQ | **365JLT41** | 1 Each |
| 250 | – | – | – | AS1000, AS3000 | **365ILT91** | 1 Each |
| 500 | – | – | – | AS1000, AS3000 | **365JLT61** | 1 Each |
| 2500 | – | – | – | AS3000, AS3500 | **365LLT81** | 1 Each |

## Mass Spectrometry Replacement ESI Probe Needles

| Instrument | Cat. No. | Quantity |
|---|---|---|
| LCQ, XP, DECA, Advantage | **365RNLT1** | 1 Each |
| LCQ MS | **365RNLT2** | 1 Each |
| LCQ XSQ | **365RNLT3** | 1 Each |

# LC Syringes for Manual Injection valves

Easy, accurate and reproducible manual injection

- Square tip to prevent damage to the injector
- Wide range of volumes
- Precision made from borosilicate glass and stainless steel
- Robust design and easy-to-read markings

## Gas Tight Syringes for Rheodyne / Valco Injectors

| Volume (µL) | Needle Type | Length (mm) | Gauge | Tip Style | **Cat. No.** | Quantity |
|---|---|---|---|---|---|---|
| 10 | Removable | 50 | 22 | 90° Blunt End | **365DLG21** | 1 Each |
| 25 | Removable | 50 | 22 | 90° Blunt End | **365FLG31** | 1 Each |
| 50 | Removable | 50 | 22 | 90° Blunt End | **365GLG41** | 1 Each |
| 100 | Removable | 50 | 22 | 90° Blunt End | **365HLG51** | 1 Each |
| 250 | Removable | 50 | 22 | 90° Blunt End | **365ILG61** | 1 Each |
| 500 | Removable | 50 | 22 | 90° Blunt End | **365JLG71** | 1 Each |

## Replacement Needles

| Replacement Needle for Syringe | **Cat. No.** | Quantity |
|---|---|---|
| 365DLG21 | **365RNL15** | 5 Pack |
| 365FLG31 | **365RNL25** | 5 Pack |
| 365GLG41 | **365RNL25** | 5 Pack |
| 365HLG51 | **365RNL25** | 5 Pack |
| 365ILG61 | **365RNL25** | 5 Pack |
| 365JLG71 | **365RNL25** | 5 Pack |

## Gas Tight Syringes for Rheodyne / Valco Injectors

| Volume (µL) | Needle Type | Length (mm) | Gauge | Tip Style | **Cat. No.** | Quantity |
|---|---|---|---|---|---|---|
| 10 | Fixed | 50 | 22 | 90° Blunt End | **365DL263** | 1 Each |
| 25 | Fixed | 50 | 22 | 90° Blunt End | **365F6315** | 1 Each |
| 50 | Fixed | 50 | 22 | 90° Blunt End | **365G6316** | 1 Each |
| 100 | Fixed | 50 | 22 | 90° Blunt End | **365H6317** | 1 Each |
| 250 | Fixed | 50 | 22 | 90° Blunt End | **365ILG61** | 1 Each |
| 500 | Fixed | 50 | 22 | 90° Blunt End | **365J6319** | 1 Each |

## Syringes for Rheodyne / Valco Injectors

| Volume (µL) | Needle Type | Length (mm) | Gauge | Tip Style | **Cat. No.** | Quantity |
|---|---|---|---|---|---|---|
| 5 | Fixed | 50 | 22 | 90° Blunt End | **365CL221** | 1 Each |
| 10 | Fixed | 50 | 22 | 90° Blunt End | **365DL231** | 1 Each |
| 25 | Fixed | 50 | 22 | 90° Blunt End | **365FL241** | 1 Each |
| 50 | Fixed | 50 | 22 | 90° Blunt End | **365GL251** | 1 Each |
| 100 | Fixed | 50 | 22 | 90° Blunt End | **365HL261** | 1 Each |
| 250 | Fixed | 50 | 22 | 90° Blunt End | **365IL271** | 1 Each |
| 500 | Fixed | 50 | 22 | 90° Blunt End | **365JL281** | 1 Each |

# Other LC Syringes

- Instrument specific syringes
- Luer-Lok syringes ideal for priming
- Macro volume sampling syringes suitable for liquid or gas samples

## Syringes for CTC Instruments

| Volume (µL) | Needle Type | Length (mm) | Gauge | Tip Style | Cat. No. | Quantity |
|---|---|---|---|---|---|---|
| 10 | Fixed | 50 | 22 | – | **365DL991** | 1 Each |
| 25 | Fixed | 50 | 22 | – | **365FL715** | 1 Each |
| 50 | Fixed | 50 | 22 | – | **365GL810** | 1 Each |
| 100 | Fixed | 50 | 22 | – | **365HL331** | 1 Each |

## Replacement Plungers

| Replacement Plunger for Syringe | Cat. No. | Quantity |
|---|---|---|
| 365DL991 | **365RP532** | 1 Each |
| 365FL715 | **365RP922** | 1 Each |

## Syringes for Waters Instruments

| Volume (µL) | Needle Type | Length (mm) | Gauge | Tip Style | Cat. No. | Quantity |
|---|---|---|---|---|---|---|
| 1 | Fixed | 70 | 26s | Bevel | **365BL443** | 1 Each |
| 1 | Fixed | 70 | 26s | 90° Blunt End | **365BL447** | 1 Each |

## PTFE Luer-Lok Syringes

| Volume (mL) | Needle Type | Length (mm) | Gauge | Tip Style | Cat. No. | Quantity |
|---|---|---|---|---|---|---|
| 1 | – | – | – | – | **365KL531** | 1 Each |
| 2.5 | – | – | – | – | **365LL541** | 1 Each |
| 5 | – | – | – | – | **365ML551** | 1 Each |
| 10 | – | – | – | – | **365NL561** | 1 Each |
| 25 | – | – | – | – | **365PL571** | 1 Each |

## Needles for Luer-Lok Priming Syringes

| | Length (mm) | Gauge | Tip Style | Cat. No. | Quantity |
|---|---|---|---|---|---|
| | 50 | 22 | 90° Blunt End | **365RNL22** | 2 Pack |

## Syringes for Macro Volume Sampling

| Volume (mL) | Needle Type | Length (mm) | Gauge | Tip Style | Cat. No. | Quantity |
|---|---|---|---|---|---|---|
| 1 | Fxed | 50 | 22s | Bevel | **365K3051** | 1 Each |
| 2.5 | Fxed | 50 | 22s | Bevel | **365LL375** | 1 Each |
| 5 | Fxed | 50 | 22s | Bevel | **365M5212** | 1 Each |
| 10 | Fxed | 50 | 22s | Bevel | **365N5214** | 1 Each |

# Detector Lamps

## Detector Lamps for UltiMate 3000 Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| Deuterium Lamp | MWD-3000(RS), DAD-3000(RS), VWD-3100 and VWD-3400RS | **6074.1110** | 1 Each |
| Tungsten Lamp | MWD-3000(RS), DAD-3000(RS), VWD-3100 and VWD-3400RS | **6074.2000** | 1 Each |

## Detector Lamps for Thermo Scientific Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| Deuterium Lamp | SP8400/SP8430/SP8440/SP8450/SP8480/SP8490 | **DSP-901** | 1 Each |
| | SP8480XR/SP8773XR | **DSP-907** | 1 Each |
| | Linear UV100/UV200/UV1000/UV2000/UV3000/ Focus/Spectrochrom | **DSP-908** | 1 Each |

## Detector Lamps for Agilent Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| Deuterium Lamp | Agilent HP1040/HP1050 (G1306A) DAD/HP 1050 DA (1050 MWD)/ HP MW (79854A) / HP 1090 (75880A) DAD | **DHP-901** | 1 Each |
| | HP 1080/HP 1081/HP1081B/HP1082B/HP1084/HP1084B | **DHP-902** | 1 Each |
| | HP 1050 VW (79853C) | **DHP-903** | 1 Each |
| | HP 8450/8450A | **DHP-909** | 1 Each |
| | HP 1100 (G1314) VW | **DHP-910** | 1 Each |
| | HP 1100 (G1315A) DAD | **DHP-911** | 1 Each |
| | HP 8453 | **DHP-912** | 1 Each |
| | HP 8452 A DAD/HP 8452A Opt 002 | **DHP-913** | 1 Each |
| Xenon Lamp | HP 1046/HP1046A | **DHP-906** | 1 Each |
| LL Deuterium Lamp | Agilent 1100 VWD long life | **DHP-910LL** | 1 Each |
| | Agilent 1100 DAD long life | **DHP-911LL** | 1 Each |

## Detector Lamps for Merck-Hitachi Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| Deuterium Lamp | 101/102/111 | **DHI-901** | 1 Each |
| | 100-10/100-40/100-50/100-60 | **DHI-902** | 1 Each |
| | 150-20/200/220/300/330/340/2000/3000/4000/ L2500/L3000/L4000/L-4500 | **DHI-903** | 1 Each |
| | L4200/L4250/L4500 | **DHI-908** | 1 Each |
| | LaChrom L4720/L4520/L7400/L450 | **DHI-910** | 1 Each |
| Xenon Lamp | Hitachi fluorescence detectors F1000/2000/4000 Series | **DHI-911** | 1 Each |

*Our applications team is regularly presenting at key events, download one of our recent posters.*
***www.thermoscientific.com/chromatography***

## Detector Lamps for PerkinElmer Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| Deuterium Lamp | Lambda 3/7/9 | **DPE-903** | 1 Each |
| | 360/460/560 | **DPE-906** | 1 Each |
| | Integral 2000/Integral 4000/LC55/LC65/LC85/LC95 | **DPE-911** | 1 Each |
| | LC-90/LC-290 | **DPE-913** | 1 Each |
| | Lambda 2/2S/10/11 and others | **DPE-914** | 1 Each |
| | Series 200 DAD | **DPE-915** | 1 Each |
| Tungsten Lamp | Lambda 2/2S/10/11 and others | **DPE-908** | 1 Each |

## Detector Lamps for Shimadzu Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| Deuterium Lamp | UV120/UV160/UV160A/UV240/UV260/UV265 | **DSH-901** | 1 Each |
| | SPD-2A/SPD-3/SPD-4 | **DSH-902** | 1 Each |
| | D300L/UV200S | **DSH-903** | 1 Each |
| | SPD 6A/SPD-6AV | **DSH-916** | 1 Each |
| | SPD 10A/SPD 10AS/SPD-10AV/SPD-10AVP | **DSH-917** | 1 Each |
| | SPD-M10AVP PDA | **DSH-918** | 1 Each |
| Xenon Lamp | Shimadzu RF530/RF510 | **DSH-912** | 1 Each |
| | Shimadzu RF540/RF535/RF551/RF500 | **DSH-913** | 1 Each |
| | Shimadzu RF1501.5301/5000 | **DSH-914** | 1 Each |
| | RF10A RF10AX | **DSH-915** | 1 Each |
| LL Deuterium Lamp | Shimadzu SPD-10 Series long life | **DSH-918LL** | 1 Each |

## Detector Lamps for Varian Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| Deuterium Lamp | UV 2050 | **DVA-901** | 1 Each |
| | UV 50/Varichrom | **DVA-903** | 1 Each |
| | UV100/UV200 | **DVA-904** | 1 Each |
| | UV5/2550 | **DVA-905** | 1 Each |
| | LC5000/LC5500 | **DVA-906** | 1 Each |
| | Star 9050 | **DVA-907** | 1 Each |
| | ProStar 340/345 UV/Vis | **DVA-909** | 1 Each |

## Detector Lamps for Waters Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| Mercury Lamp | 440/441/490 | **DWA-901** | 1 Each |
| Deuterium Lamp | 480/481/480LC/481LC/Lambda Max/LC1 | **DWA-910** | 1 Each |
| | 484 | **DWA-915** | 1 Each |
| | 486 | **DWA-918** | 1 Each |
| | 2486 | **DWA-918LC** | 1 Each |
| | 996 PDA/2996 | **DWA-921** | 1 Each |
| | 990/991/994 PDA | **DWA-926** | 1 Each |
| | 2487 Dual Wavelength/2488 | **DWA-930** | 1 Each |
| Tungsten Lamp | RI/R401/R403/R404 | **DWA-911** | 1 Each |
| Cadmium Lamp | 440/441/490 | **DWA-912** | 1 Each |
| Zinc Lamp | 440/441/490 | **DWA-913** | 1 Each |
| Xenon Lamp | 470/475/2475 Lamp only | **DWA-923** | 1 Each |
| | 474 | **DWA-929** | 1 Each |
| LL Deuterium Lamp | Waters 996 | **DWA-921LL** | 1 Each |
| | Waters Alliance 2487/2488 | **DWA-930LL** | 1 Each |

# Pump Spares

## Pump Spares for UltiMate 3000 Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| **Maintenance Kits** | | | |
| Maintenance Kit for ISO-3100SD | ISO-3100SD | **6040.1950** | 1 Each |
| Maintenance Kit for LPG-3400SD | LPG-3400SD | **6040.1951** | 1 Each |
| Maintenance Kit for DGP-3600SD | DGP-3600SD | **6040.1952** | 1 Each |
| Maintenance Kit for HPG-3x00SD | HPG-3x00SD | **6040.1953** | 1 Each |
| Maintenance Kit for LPG-3400RS | LPG-3400RS | **6040.1954A** | 1 Each |
| Maintenance Kit for DGP-3600RS | DGP-3600RS | **6040.1955A** | 1 Each |
| Maintenance Kit for HPG-3x00RS | HPG-3x00RS | **6040.1956A** | 1 Each |
| Maintenance Kit for LPG-3400XRS | LPG-3400XRS | **6043.1954** | 1 Each |
| **Pistons** | | | |
| Pistons, sapphire | SD, RS, BM pumps | **6040.0042** | 2 Each |
| Pistons, sapphire | LPG-3400XRS pump | **6043.0169** | 1 Each |
| **Piston Seals** | | | |
| Piston Seals, RP | SD, RS pumps | **6040.0304** | 2 Each |
| Piston Seals, NP | SD, RS pumps | **6040.0306** | 2 Each |
| Piston Seal | LPG-3400XRS pump | **6043.0295** | 1 Each |
| **Check Valves** | | | |
| Check valve, sapphire, cardridge type | SD, RS, BX, BM pumps | **6041.2300** | 1 Each |
| Check valve, ZrO ceramics, cardridge type | SD, RS, BX, BM pumps | **6041.2301** | 1 Each |
| Check valve, sapphire, cardridge type | LPG-3400XRS pump | **6043.0145** | 1 Each |

## Pump Spares for Thermo Scientific Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| **Pistons** | | | |
| Piston | Accela pump | **00201-11328** | 2 Each |
| Piston, sapphire | Accela pump | **00950-01-00126** | 2 Each |
| **Piston Seals** | | | |
| Secondary piston seal (wash seal) | Accela pump | **00950-01-00128** | 2 Each |
| Piston Seal Black | Surveyor LC | **SFS-220** | 1 Each |
| Piston Seal Yellow | Surveyor LC | **SFS-220G** | 1 Each |
| Wash Seal White | Surveyor LC | **SFS-230** | 1 Each |
| Piston Seal Black | Surveyor MS | **SFS-320** | 1 Each |
| Piston Seal Clear | Surveyor MS | **SFS-320U** | 1 Each |
| Wash Seal clear | Surveyor MS | **SFS-330** | 1 Each |
| **Check Valves** | | | |
| Outlet Check Valve | Accela pump | **00950-01-00131** | 1 Each |
| Inlet Check Valve | Accela pump | **00950-01-00130** | 1 Each |
| Inlet Check Valve Assembly – Cartridge Type | Surveyor LC | **SFS-3001** | 1 Each |
| Outlet Check Valve Assembly – Cartridge Type | Surveyor LC | **SFS-3002** | 1 Each |
| Inlet/Outlet Check Valve Cartridge | Surveyor MS | **SFS-6001C** | 1 Each |

## Pump Spares for Agilent Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| **Pistons** | | | |
| Piston Assembly Sapphire | 1090 | **SHP-200** | 1 Each |
| Piston Assembly Sapphire | 1050 and 1100 | **SHP-400** | 1 Each |
| **Piston Seals** | | | |
| Piston Seal Yellow | 1050, 1090 and 1100 | **SHP-220G** | 1 Each |
| Piston Seal Black | 1050 and 1100 | **SHP-420K** | 1 Each |
| **Check Valves and Spares** | | | |
| Replacement Inlet/Outlet Check Valve Cartridge | 1090 | **SHP-5002** | 1 Each |
| Inlet/Outlet Check Valve Assembly | 1090 | **SHP-5001** | 1 Each |

## Pump Spares for PerkinElmer Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| **Pistons** | | | |
| HP Piston Assembly Sapphire | Series 200, 400, 410, 620, Model 250, Integral 4000 | **SOT-PE600** | 1 Each |
| HP Piston Assembly Sapphire | Series 200, 400, 410, 620, Model 250, Integral 4000 | **SOT-PE500** | 1 Each |
| **Piston Seals** | | | |
| HP Piston Seal Grey | Series 200, 400, 410, 620, Model 250, Integral 4000 | **SOT-PE220** | 1 Each |
| HP Piston Seal Yellow | Series 200, 400, 410, 620, Model 250, Integral 4000 | **SOT-PE220G** | 1 Each |
| LP Piston Seal Black | Series 200, 400, 410, 620, Model 250, Integral 4000 | **SOT-PE320** | 1 Each |
| LP Piston Seal Yellow | Series 200, 400, 410, 620, Model 250, Integral 4000 | **SOT-PE320G** | 1 Each |
| **Check Valves and Spares** | | | |
| Inlet/Intermediate Check Valve Assembly | Series 200, 400, 410, 620, Model 250, Integral 4000 | **SOT-PE3001** | 1 Each |
| Outlet Check Valve Assembly | Series 200, 400, 410, 620, Model 250, Integral 4000 | **SOT-PE3002** | 1 Each |

## Pump Spares for Varian Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| **Pistons** | | | |
| Piston Assembly Sapphire | 5000, 5500, 5600 | **SOT-VA200** | 1 Each |
| Piston Assembly Sapphire | 2010, 2210, 2510 | **SOT-VA400** | 1 Each |
| **Piston Seals** | | | |
| Piston Seal Black | 5000, 5500, 5600 | **SOT-VA220** | 1 Each |
| Piston Seal Black | 2010, 2210, 2510 | **SOT-VA320** | 1 Each |
| Piston Seal Yellow | 2010, 2210, 2510 | **SOT-VA320G** | 1 Each |
| **Check Valves and Spares** | | | |
| Inlet Check Valve Assembly | 2010, 2210, 2510 | **SVA-3001** | 1 Each |
| Outlet Check Valve Assembly | 2010, 2210, 2510 | **SVA-3002** | 1 Each |

# Pump Spares *continued*

## Pump Spares for Shimadzu Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| **Pistons** | | | |
| Piston Assembly Sapphire | LC-10 AS, LC-6, LC-6A | **SOT-SH200** | 1 Each |
| Piston Assembly Sapphire | LC-9, LC-10AD, LC-600 | **SOT-SH202** | 1 Each |
| **Piston Seals** | | | |
| Piston Seal Yellow | LC-10 AT | **SOT-SH-100-01** | 1 Each |
| Wash Seal White | LC-10 AT | **SOT-SH-100-02** | 1 Each |
| Piston Seal Grey | LC-3, LC-4, LC-5, LC-6, LC-6A, LC-10 AS | **SOT-SH220** | 1 Each |
| Wash Seal White | LC-3, LC-4, LC-5, LC-6, LC-6A, LC-10 AS | **SOT-SH220G** | 1 Each |
| Piston Seal Yellow | LC-3, LC-4, LC-5, LC-6, LC-6A, LC-10 AS | **SOT-SH520G** | 1 Each |
| Piston Seal Grey | LC-9, LC-10AD, LC-600 | **SOT-SH420** | 1 Each |
| Piston Seal Black | LC-10 ATvp | **SOT-SH520** | 1 Each |
| **Check Valves and Spares** | | | |
| Inlet Check Valve Assembly | LC-3, LC-4, LC-5, LC-6, LC-6A, LC-10 AS | **SOT-SSH3001** | 1 Each |
| Outlet Check Valve Assembly | LC-3, LC-4, LC-5, LC-6, LC-6A, LC-10 AS | **SOT-SSH3002** | 1 Each |
| Inlet Check Valve Assembly – Cartridge Type | LC-9, LC-10AD, LC-600 | **SSH-6001** | 1 Each |
| Outlet Check Valve Assembly – Cartridge Type | LC-9, LC-10AD, LC-600 | **SSH-6002** | 1 Each |

## Pump Spares for Waters Instruments

| Description | Model | Cat. No. | Quantity |
|---|---|---|---|
| **Pistons** | | | |
| Piston Assembly Sapphire | M510, M590, M600, M610 M6000 | **SWA-WA200** | 1 Each |
| Piston Assembly Ruby | M510, M590, M600, M610 M6000 | **SWA-WA200R** | 1 Each |
| Piston Assembly Sapphire | M45, M501 | **SWA-WA205** | 1 Each |
| Piston Assembly Sapphire | M515 | **SWA-WA800** | 1 Each |
| Piston Assembly Sapphire | Alliance 2690 | **SWA-WA900** | 1 Each |
| **Piston Seals** | | | |
| Piston Seal Black | M45, M501, M510, M590, M600, M610 M6000 | **SWA-WA220** | 1 Each |
| Piston Seal Yellow | M45, M501, M510, M590, M600, M610 M6000 | **SWA-WA220G** | 1 Each |
| Piston Seal Grey | M510EF, M590EF, M600EF, M610EF, M6000EF | **SWA-WA600S** | 1 Each |
| Piston Seal Black | M515 | **SWA-WA820** | 1 Each |
| Piston Seal Yellow | M515 | **SWA-WA820G** | 1 Each |
| Piston Seal Black | Alliance 2690 | **SWA-WA920** | 1 Each |
| Piston Seal Yellow | Alliance 2690 | **SWA-WA920G** | 1 Each |
| **Check Valves and Spares** | | | |
| Inlet Check Valve Assembly | M45, M501, M510, M590, M600, M610 M6000 | **SWA-3201** | 1 Each |
| Outlet Check Valve Assembly Actuator Type | M45, M501, M510, M590, M600, M610 M6000 | **SWA-3202** | 1 Each |
| Outlet Check Valve | M45, M501, M510, M590, M600, M610 M6000 | **SWA-3202B** | 1 Each |
| Inlet Check Valve Repair Kit | M510, M590, M600, M610 M6000 | **SWA-3212** | 1 Each |
| Outlet Check Valve Assembly Actuator Type | M45, M501, M510, M590, M600, M610 M6000 | **SWA-3402** | 1 Each |
| Outlet Check Valve Assembly Ball & Seat Type | M45, M501, M510, M590, M600, M610 M6000 | **SWA-3402B** | 1 Each |
| Inlet Check Valve Assembly | M510EF, M590EF, M600EF, M610EF, M6000EF | **SWA-4107** | 1 Each |
| Inlet Check Valve Repair Kit | M510EF, M590EF, M600EF, M610EF, M6000EF | **SWA-4123** | 1 Each |
| Inlet Check Valve Assembly | M515 | **SWA-8001** | 1 Each |
| Outlet Check Valve Assembly | M515 | **SWA-8002** | 1 Each |
| Check Valve Cartridge | Alliance 2690 | **SWA-9001** | 1 Each |

# Dionex ICS-900 Ion Chromatography Systems

Routinely Analyze Multiple Anions or Cations in 10-15 Minutes

- Sensitive, stable, heated conductivity detection for precise results
- Compatibility with a broad range of polymeric separation columns for unparalleled application flexibility and reliability
- Thermo Scientific™ Dionex™ Chromeleon™ SE allows control of a single Thermo Scientific Dionex ICS-900 with an autosampler


**The Dionex ICS-900** is an integrated, single-channel ion chromatography system designed to run specific isocratic anion and cation applications. The system uses Thermo Scientific™ Dionex™ MMS™ 300 membrane suppression with Displacement Chemical Regeneration (DCR) technology for low noise and stable baselines. Each ICS-900 system has an all-polymeric flow path with a reliable dual piston pump, high-pressure pulse damper, electrically actuated PEEK™ valve, and a temperature-controlled conductivity cell.

### Dionex ICS-900 Key Features:

- Dionex MMS 300 membrane suppression with DCR technology for drift-free baseline and ease-of-use
- Wide pump flow rate range to support 2, 3, and 4mm isocratic anion and cation columns
- Dual-piston, serial-pumping system with PEEK™ flow path for low maintenance costs and maximum up-time
- All-polymeric flow pathway to eliminate contamination and corrosion
- Chromeleon Chromatography Data System software for full control, quality integration, and versatile reports to exceed all your data processing needs
- USB connectivity for fast, trouble-free instrument connection and configuration

### Dionex ICS-900 Physical Specifications

Dimensions (h × w × d):
33 × 24 × 40cm (13 × 9.5 × 15.75in)

Weight 10kg (22lbs)

Power Requirements:
100 - 240 VAC, 50–60Hz, autoranging

**The AS-DV** autosampler is a low-cost, metal-free, rugged, automated sample loading device designed especially for ion chromatography applications. The random access and sample preparation capabilities provide easily automated sample introduction to the chromatograph. Its new software control provides high flexibility to select the optimum injection parameters for filling injection loops or loading concentrator columns.

### AS-DV Key Features:

- Full loop and concentrator loading
- Optional 6-port or 10-port valve for automated sample preparation or sample injection
- Random access
- Chromeleon control provides high flexibility to select the optimum injection parameters
- 0.5mL and 5.0mL polymeric vials with optional filter caps
- Automatic switching power supply for universal input voltage
- Sample Overlap injections for increased productivity

### AS-DV Autosampler Specifications

Dimensions (h × w × d):
23 × 45 × 56cm (9 × 17.5 × 22in)

Weight: 16 kg (35 lbs)

Power Requirements:
100 - 240 VAC, 50–60Hz, autoranging

## Dionex ICS-900 Ion Chromatography System Bundles

| Description | Cat. No. |
|---|---|
| Dionex ICS-900 IC System for Anions with AS-DV Autosampler and Chromeleon Software | **078028** |
| Dionex ICS-900 IC System for Cations with AS-DV Autosampler and Chromeleon Software | **078029** |

Contact Customer Service for details of replacement columns and reagents for the Dionex ICS-900

### The Anion Bundle includes:

- Dionex ICS-900 Ion Chromatography System
- AS-DV Autosampler
- Chromeleon 7 SE Software
- AS22 4mm Consumables Bundle:
  - 1- Dionex IonPac AS22 4mm, 064141
  - 1- Dionex IonPac AG22 4mm, 064139
  - 1- Thermo Scientific™ Dionex™ AMMS™ 300 Anion MicroMembrane™ Suppressor 4mm, 064558
  - 1- Dionex AMMS III Regenerant Concentrate, 4 pack, 057555
  - 1- Dionex ICS-900 DCR Anion Regenerant 2L Bottle, 057712
  - 1- AS22 Eluent Concentrate, 0670

### The Cation Bundle includes:

- Dionex ICS-900 Ion Chromatography System
- AS-DV Autosampler
- Chromeleon 7 SE Software
- CS12A 4mm Consumables Bundle:
  - 1- Dionex IonPac CS12A 4mm, 046073
  - 1- Dionex IonPac CG12A 4mm, 046074
  - 1- Thermo Scientific™ Dionex™ CMMS™ 300 Cation MicroMembrane Suppressor 4mm, 064560
  - 1- Dionex CMMS III Regenerant Concentrate, 4 pack, 057556
  - 1- Dionex ICS-900 DCR Cation Regenerant 2L Bottle, 057713
  - 1- CS12A Eluent Concentrate, 057562

# HOT POCKET and COOL POCKET Column Temperature Controllers

Wrap-around column temperature control systems


- Easy to install and use with a variety of column lengths
- Dual display of both actual and set point temperature
- HOT POCKET range from just above ambient to 85°C
- COOL POCKET range from 5°C to 55°C
- Explore sample selectivity and stability on both sides of ambient

## Column Heating and Cooling in an Efficient, Compact Design

The Thermo Scientific™ HOT POCKET™ and Thermo Scientific™ COOL POCKET™ Column Temperature Controllers have a unique, space saving design for the efficient control of HPLC column temperature using a novel, soft, wrap-around sealing mantle. The mantle is wrapped directly onto the column, in situ, in horizontal, vertical, or slant position. The standard size accepts column lengths up to 300mm, and columns up to 150mm can be used with the short HOT POCKET model. The inserts also allow the use of guard columns or the optional eluent pre-heater. The inserts are modular, allowing them to be easily removed or rearranged for your specific column configuration. Special inserts are available for larger or smaller diameter columns. The temperature is set on the Temperature Controller Unit, which is permanently attached to the heater/cooler. Both the actual temperature and the user selected set point are simultaneously displayed on the LED controller display.

## HOT POCKET Column Heater

The HOT POCKET Column Heater has a temperature range of just above ambient to 85°C with excellent control, allowing validation of HPLC methods at accurate temperatures. HPLC method ruggedness can be investigated by exploring the sensitivity of a separation to temperature changes. The HOT POCKET is available in a standard size to accommodate column combinations up to 300mm in length, and a short version for columns up to 150mm.

It is easy to install a column into the HOT POCKET or COOL POCKET. Depending upon column length and auxiliary fixtures such as a guard column or eluent pre-heater, some of the inserts may have to be rearranged or removed through the special slot at one end. Rotate the inserts so that the groove in each is positioned in the open part of the channel. Columns are simply placed into the inserts, which are then rotated to lock the column into the channel. The insulated mantle is wrapped around the column with a Velcro™ closure.

## COOL POCKET Temperature Controller

The COOL POCKET Temperature Controller provides efficient control of the temperature of HPLC columns both above and below ambient, with an operational temperature range of 5°C to 55°C. The COOL POCKET Temperature Controller is ideal for chiral applications where a lower temperature may give better separation of enantiomers or other closely related compounds. It also allows you to validate HPLC methods at accurate temperatures near ambient and check HPLC method ruggedness by exploring the sensitivity of your separation to temperature changes on both sides of ambient.

# HOT POCKET Column Heaters, Eluent Preheater/Precooler and COOL POCKET Chiller

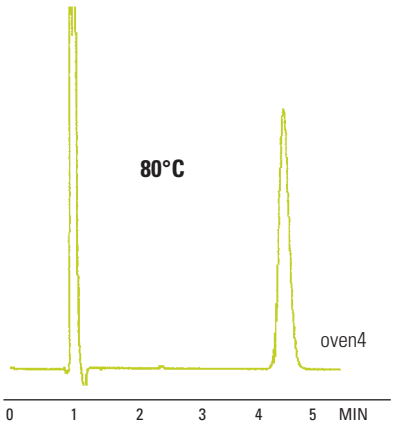
Column heating or cooling in a compact, efficient design

- The Eluent Pre-Heater provides a dramatic improvement in chromatography as demonstrated by the USP method for enalapril maleate at 80°C
- For preheating or precooling the mobile phase before it enters column
- Use in temperatures above 50°C or below 15°C
- 0.005in ID

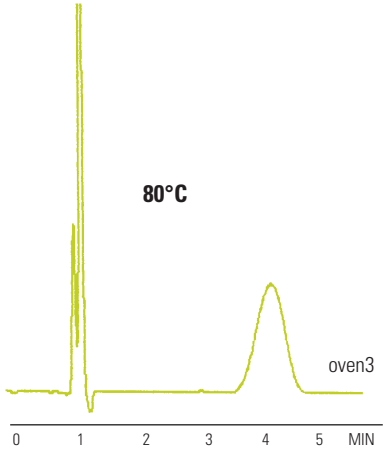
## Product Specifications

| | HOT POCKET | COOL POCKET |
|---|---|---|
| Operating Range | 5°C above ambient to 85°C | 5°C to 55°C |
| Display | Dual LED displays of actual and set point temperatures in °C | |
| Temperature Accuracy | ± 2°C over entire range | ± 2°C over entire range |
| Temperature Repeatability | ± 1°C | ± 1°C |
| Temperature Stability | ± 0.1°C | ± 0.1°C |
| Time to Stabilization (from ambient) | 85°C in less than 30 minutes | 55°C in 25 minutes, 5°C in 20 minutes |
| Column Capacity | Standard: up to 3/8in OD and up to 300mm in length and end-fittings up to 19mm OD (250mm length column with guard or eluent pre-heater in addition to column) Short (HOT POCKET only): up to 150mm total length (100mm column plus guard or pre-heater) | |
| Controller Dimensions | 2.8 x 4.0 x 6.5in | 2.8 x 4.0 x 6.5in |
| Mantle Dimensions | Standard: 1.5 x 1.5 x 17in | Standard: 1.5 x 4.0 x 17in Short: 1.5 x 1.5 x 12in |
| Power Cord | 3 foot retractable coil cord | 3 foot retractable coil cord |
| Weight | 1lb enclosure (3lb total with power supply) | 2lb enclosure (4lb total with power supply) |
| Power | 24 VAC, 25 Watts maximum | 15 VDC, 20 Watts maximum |

**With Eluent Pre-heater**




**Without Eluent Pre-heater**




*Effect of eluent pre-heater on efficiency*

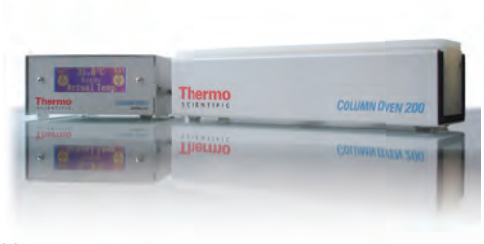
*Data courtesy of Dr. Richard F. Myer, Quantitative Technologies, Inc., Whitehouse, NJ*

## HOT POCKET Column Heaters, Eluent Preheater/Precooler and COOL POCKET Chiller

| Description | Cat. No. | Quantity |
|---|---|---|
| HOT POCKET Column Heater | **92016** | 1 Each |
| HOT POCKET Column Heater – short version | **92016-150** | 1 Each |
| COOL POCKET Column Chiller | **92017** | 1 Each |
| Eluent Preheater/Precooler | **92018** | 1 Each |

# ColumnOven

Exact temperature control for LC columns




- Temperature control from ambient to 90°C
- Fits up to four columns in one compartment
- Compatible with CTC autosamplers and Thermo Scientific Mass Spectrometer ion sources

## Product Description

The Thermo Scientific ColumnOven delivers efficient temperature control of HPLC columns. With exact temperature control to +/- 0.1°C, ColumnOven provides the highest levels of reproducibility and stability. Temperatures up to 90°C can significantly reduce backpressure when using columns packed with sub 2µm particle sizes, allowing the use of higher flow rates to accelerate the chromatography. ColumnOven 200 can accommodate up to 4 analytical HPLC columns with lengths up to 150mm while ColumnOven 300 can accommodate up to 4 analytical columns with lengths up to 250mm.

## Options

Optional mounts allow ColumnOven to be secured to a CTC PAL® autosampler and many Thermo Scientific Mass Spectrometer ion sources.

The optional software package includes a standalone version (Windows™ compatible) and drivers for Thermo Scientific™ XCalibur™ and other instrument control software.

An optional heat exchanger can be used as a connection / transfer line between injection port and column.

## Product Specifications

| Description | ColumnOven 200 | ColumnOven 300 |
|---|---|---|
| Column oven dimensions: | 212mm x 40mm x 46mm | 312mm x 40mm x 46mm |
| Column oven dimensions (with mounted heat shield): | 212mm x 62mm x 52mm | 312mm x 62mm x 52mm |
| Thermostated column compartment: | 200mm x 21mm x 21mm | 300mm x 21mm x 21mm |
| Remote control | LAN or serial port | LAN or serial port |
| Power supply | 110 - 240 VAC | 110 - 240 VAC |
| Temperature control: | Ambient to 90°C in 0.1°C increments | Ambient to 90°C in 0.1°C increments |
| Temperature stability: | +/- 0.1°C | +/- 0.1°C |

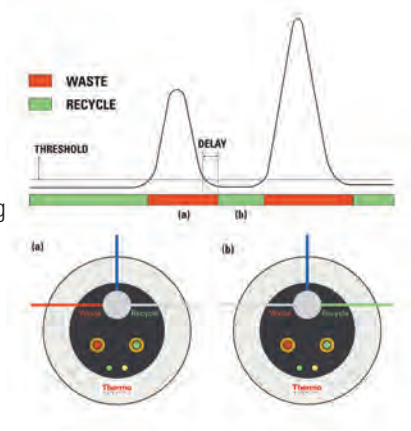
## Thermo Scientific ColumnOven

| Description | Cat. No. |
|---|---|
| ColumnOven 200 | **66001-020** |
| CTC Mount | **66001-021** |
| Thermo MS Mount | **66001-022** |
| ABI MS Mount | **66001-023** |
| Heat Exchanger | **66001-024** |
| Heat Exchanger (low volume) | **66001-025** |
| Software drivers | **66001-026** |
| ColumnOven 300 | **66001-030** |

# SRS Pro Solvent Recycling System

Reduce mobile phase consumption by up to 90%

- Continuously monitors the output signal of the chromatographic detector, recycling the mobile phase to the solvent reservoir when the baseline is below a certain preset threshold
- Easy-to-use software is provided to configure system parameters, perform on-line monitoring and audit trail facilities
- No power adapter is required as the solvent saver is powered directly from the chromatography data system PC through a USB connection
- Recycles the mobile phase only if switched on: in case of power failure the valve remains in the waste position and the mobile phase in the reservoir remains uncontaminated
- Analog input allows unipolar or bipolar operation of the device within a range of ±1V with an analog-to-digital converter
- TTL/contact closure for the device can be configured as start, auto-zero or valve position control input




(a) - At start of 1st waste run
(b) - After delay

## Operational Principle

- If the input signal level exceeds this threshold value, the SRS Pro redirects the eluent flow to waste (a), taking account of the transport time from the detector to the switching valve
- When the signal returns below the threshold (b), the SRS Pro again waits for the transport delay and then switches the mobile phase back to the reservoir
- Autosampler injection marker connected to the SRS Pro zeroes signal input at the moment of injection

## Compatible with:

Any HPLC detector

## Product Specifications

| | |
|---|---|
| **Data Rate** | 1Hz |
| **Wetted Material** | PEEK |
| **Power Source** | USB port of PC |
| **Max. Pressure** | 30psi/0.2MPa |
| **Requires** | 1 free USB port, MS-Windows XP/2000/Vista |

## SRS Pro Solvent Recycling System

| Description | Cat. No. | Quantity |
|---|---|---|
| SRS Pro solvent recycling system | **66001-001** | 1 Each |

# SDG Pro Solvent Degasser

For gas-free HPLC solvents


- High efficiency in-line system
- Reliable, continuous operation
- Quick equilibration and short startup times
- Removes dissolved gases from solvents
- Used to degas the mobile phase for HPLC and can be employed in other applications where gases may interfere with the use of the system (such as an autotitrator)

## Product Specifications

| | |
|---|---|
| **General** | |
| Channels | 4 independent |
| Mode of Degassing | Gas permeation through a fluoropolymer tube |
| Maximum Flow Rate | 10mL/min |
| Degassing Capacity | ~2ppm at 1mL/min |
| Dead Volume | ~480µL per channel for standard channel |
| Materials Contacting Solvents | PEEK, Glass-filled PTFE, Teflon AF |
| **Power** | |
| Power Requirement if using supplied AC Adapter | 100 – 240 VAC (±10%), 1A, 50 to 60Hz (±3Hz) |
| Power Requirement if not using supplied AC Adapter | 15 – 24 VDC at 0.85 A maximum (0.5 A typical) |
| Wall Sockets | 4 supplied with AC adapter, interchangeable: North America/Japan, U.K., Continental Europe, Australia |
| Installation Over-Voltage Category | II |
| **Validation Output** | |
| Signal | 5mVDC / 1mm Hg absolute from 20 to 800mm Hg (0.100 VDC at 20mm Hg; 4.000 VDC at 800mm Hg) |
| Accuracy | ±1.0% of reading ±0.010 VDC from 20 to 800mm Hg |
| **Operating Conditions** | |
| Ambient Temperature | 10 to 35°C |
| Ambient Relative Humidity (RH) | 20 to 80 % RH (without condensation) |
| Altitude | 0 to 2000 Meters |
| Indoor vs. Outdoor Use | Indoor |
| Pollution Degree | 2 |
| **Storage Conditions** | |
| Ambient Temperature | -20 to +60°C |
| Ambient Relative Humidity | 20 to 80% RH (without condensation) |
| Altitude | 0 to 12000M |
| **Physical** | |
| Dimensions | Height: 127mm (5.0in) Width: 73mm (2.8in) Depth: 250mm (9.8in) |
| Weight | 2.7kg (6lb). |

## SDG Pro

| Description | Cat. No. | Quantity |
|---|---|---|
| SDG Pro degasser | **66001-010** | 1 Each |

# Thermo Scientific Liquid Chromatography Reagents

## Introduction to HPLC Ion Pair Reagents

High-purity reagents with the selectivity needed for good separation.

In the past, reverse-phase HPLC analysis of highly charged acidic and basic compounds was frustrating and resulted in poor resolution. Important biomolecules such as amino acids, peptides, organic acids, polyamines and catecholamines had to be separated by ion exchange or by suppression techniques.

Thermo Scientific Ion Pair Reagents enable you to quickly and efficiently analyze charged compounds using reverse-phase techniques. Our ion pair reagents are simply dissolved in the HPLC solvent system, resulting in the formation of stable chromatographic complexes that can be separated using reverse-phase columns.

By using the correct ion pair reagents, you achieve:

- Increased or decreased retention, permitting controlled selectivity
- Resolution of complex ionic mixtures without using ion exchange columns
- Improved peak symmetry

### Reverse-phase ion pair chromatography theories

Two principal theories have been proposed to explain reverse-phase ion pair chromatography. In the first theory, small polar ion pair reagents react with the ionized solute, forming neutral ion pairs. The second theorizes that an active ion exchange surface is produced in which long chain, nonpolar anions and cations are absorbed by the hydrophobic stationary phase.

To optimize chromatographic separations in ion pair elution systems, high-purity reagents of exceptional optical transparency are needed. Ion Pair Reagents are specially purified for ion pair chromatography and provide the selectivity needed for good separations.

# Derivatization and Visualization Reagents for HPLC

Designed to provide selectivity and improve sensitivity.

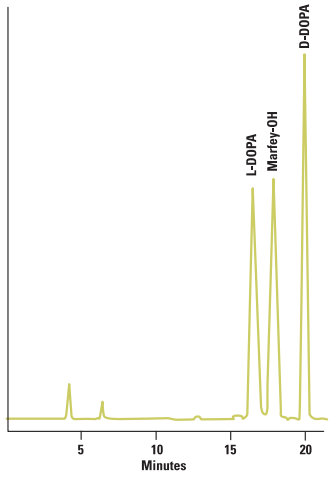
The lack of a universal HPLC detector that provides high sensitivity (as well as some degree of selectivity) established the need for suitable derivatization procedures. Derivatization is the chemical modification of an existing compound, producing a new compound that has properties more suitable for a specific analytical procedure. It is an analytical tool that can be used to provide both selectivity and improved sensitivity.

### There are several requirements for derivatization protocol:

1. At least one acidic, polar functional group must be available for reaction on the parent compound.
2. A single derivative should be formed per parent compound.
3. The reaction should be reproducible under the given time and reaction conditions.
4. The reaction should proceed quickly and easily under mild conditions.
5. The reaction byproducts (if any) should not interfere with the chromatography, or with detection of the sample.

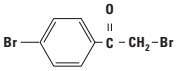
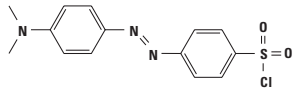
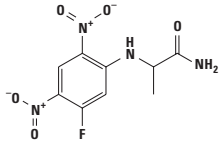
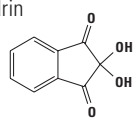
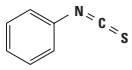
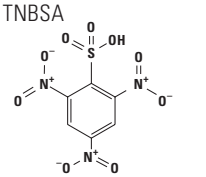
Pre- and post-chromatographic techniques are both used in HPLC derivatization. In addition, off-line and on-line reactions have been employed with both techniques. Pre-chromatographic (or pre-column techniques) offer more than greater selectivity and sensitivity in detection. Pre-column techniques can be used to enhance stability, improve resolution, improve peak symmetry and increase or decrease retention of solutes. FDAA (Marfey's Reagent) allows separation and quantification of optical isomers of amino acids (Figure 2). Post-chromatographic (or post-column) techniques are used primarily to provide selectivity and improve sensitivity.

We offer a variety of HPLC detection reagents for pre- and post-chromatographic techniques. All compounds and formulations are purified for chromatography, minimizing artifact formation.




**Separation of D- and L-DOPA on 100mm x 4.6mm C18**
Conditions: A – 0.05 M triethylamine phosphate, pH 3.0;
B – acetonitrile.
Linear gradient: 10 to 40% B in 45 minutes, 2.0mL/minute, 25˚C, 340nm

# Derivatization Reagents for HPLC

| Functional Group | Description | Detection* | Page | Comments |
|---|---|---|---|---|
| Carboxylic Acid  | *p*-Bromophenacylate  | UV | **4-201** | Formulation of 1.0mmol/ml p-bromophenacyl bromide and 0.005mmol/ml crown ether in acetonitrile; pre-column; nanomole detection levels: $\lambda_{max}$ = 260nm[1-7] |
| Primary Amine  | Dabsyl Chloride  | Vis | **4-204** | 4-N, N-dimethylaminoazobenzene-4'-sulfonyl chloride (dabsyl chloride); pre-column; nanomole detection levels: $\lambda_{max}$ = 436nm[8-14] |
| | FDAA, Marfey's Reagent  | UV | **4-200** | 1-fluoro-2,4-dinitrophenyl-5-L-alanine amide (FDAA); pre-column; nanomole detection levels: $\lambda_{max}$ = 340nm. For chiral separations of amino acids.[15, 28-29] |
| | Ninhydrin  | Vis | **4-203** | Post-column; nanomole detection levels: $\lambda_{max}$ = 570nm[22] |
| | PITC  | UV | **4-204** | Phenylisothiocyanate (PITC); pre-column; picomole detection levels: $\lambda_{max}$ = 254nm[23-24] |
| | TNBSA  TNBSA MW 293.17 | EC, UV | **4-201** | 2,4,6-Trinitrobenzene-sulfonic acid (TNBSA); pre- or post-column; nanomole detection levels with EC and UV, GC - 0.85V; $\lambda_{max}$ = 250nm[25-26] |
| Secondary Amine  | Ninhydrin (see structure above) | Vis | **4-203** | Post-column; nanomole detection levels: $\lambda_{max}$ = 440nm[22] |
| | PITC (see structure above) | UV | **4-204** | Phenylisothiocyanate (PITC); pre-column; picomole detection levels: $\lambda_{max}$ = 254nm[23-24] |

*EC = electrochemical; F = fluorescence; UV = ultraviolet; Vis = visible.


**References**

1. Durst, H.D., *et al.* (1975). *Anal. Chem.* **47,** 1797.
2. Borch, R.F., *et al.* (1975). *Anal. Chem.* **47,** 2437.
3. Grushka, E. *et al.* (1975). *J. Chromatogr.* **112,** 673.
4. Fitzpatrick, F.A. (1976). *Anal. Chem.* **48,** 499.
5. Nagels, L., *et al.* (1980). *J. Chromatogr.* **190,** 411.
6. Ahmed, M.S., *et al.* (1980). *J. Chromatogr.* **192,** 387.
7. Pierce Technical Bulletin: Preparation of Phenacyl and *p*-Bromophenacyl Derivatives for HPLC.
8. Stocchi, V., *et al.* (1985). *J. Chromatogr.* **349,** 77-82.
9. Chang, J.Y., *et al.* (1981). *Biochem. J.* **199,** 547-555.
10. Chang, J.Y., *et al.* (1982). *Biochem. J.* **203,** 803-806.
11. Vendrell, J., *et al.* (1986). *J. Chromatogr.* **358,** 401-413.
12. Chang, J.Y., *et al.* (1984). *J. Chromatogr.* **295,** 193-200.
13. Lin J.K., *et al.* (1980). *Anal. Chem.* **52,** 630-635.
14. Chang, J.Y., *et al.* (1981). *FEBS Letters* **132,** 117-120.
15. Marfey, P. (1984). *Carlsberg Res. Comm.* **49,** 591-596.
16. Jones, B.N. and Gilligan, J.P. (1983). *Amer. Biotech. Lab.* **12,** 46-51.
17. Fiedler, H.P., *et al.* (1986). *J. Chromatogr.* **353,** 201-206.
18. Fried, V.A., *et al.* (1985). *Anal. Biochem.* **146,** 271-276.
19. Jones, B.N., *et al.* (1983). *J. Chromatogr.* **266,** 471-482.
20. Seaver, S.S., *et al.* (Sept./Oct. 1984). *Biotechniques* 254-260.
21. Böhlen, P., *et al.* (1979). *Anal. Biochem.* **94,** 313-321.
22. Stein, W.H. and Moore, S. (1949). *Cold Spring Harbor Symp. Quant. Bio.* **14,** 179.
23. Heinrickson, R.L. and Meredith, S.C. (1984). *Anal. Biochem.* 137, 65-74.
24. Scholze, H. (1985). *J. Chromatogr.* **350,** 453-460.
25. Caudill, W.L., *et al.* (1982). *J. Chromatogr.* **227,** 331.
26. Caudill, W.L., *et al.* (1982). *Bioanalytical System's Current Separations* **4(4),** 59.
27. Andrews, J.L., *et al.* (1982). *Arch. Biochem. Biophys.* **214,** 386-396.
28. Aberhart, D.J., *et al.* (1985). *Anal. Biochem.* **151,** 88-91.
29. Szokan, G., *et al.* (1988). *J. Chromatogr.* **444,** 115-122.

# Developments in Amino Acid Analysis

Improvements in amino acid analysis by ion exchange chromatography have involved the analytical system, as well as the instrumentation. Systems have been developed (by varying buffer pH or ionic strength) that work to displace the amino acids into discrete bands. The buffer systems are compatible with single- or two-column analysis of amino acids found in protein hydrolyzates or physiological fluids. Buffer systems are determined by the counter ion used (sodium or lithium) and by the method of buffer changes introduced to the resin (step changes or gradient elution).[9-15] The most commonly used buffering component, citrate, is suitable for solutions below pH7.[16] Buffers are prepared either with citric acid or an alkali salt.

Unfortunately, for high-sensitivity work, citric acid is a significant contributor to amino acid contamination. Therefore, to achieve consistent analyses, it is essential to use high-purity reagents for buffer preparation.

Alternatives to ion exchange are available for the separation of amino acids. Because amino acid analysis is one of the basic protein chemistry tools available, more rapid and sensitive methods for separation and quantitation are desirable.[17] Several pre-column derivatization methods using reverse-phase HPLC have been developed.

Two of the most widely used of these methods involve the formation of dansyl[18-19] or o-phthalaldehyde (OPA)[20-24] derivatives of amino acids prior to HPLC analysis. Both methods offer greater sensitivity and shorter analysis time than post-column derivatization techniques. Other methods include the quantitative derivatization of amino acids with phenylisothiocyanate (PITC) and the separation and quantitation of the resulting phenylthiocarbonyl derivatives via HPLC. These derivatives are stable enough to eliminate in-line derivatization.

Note: Please refer to page **3-122** for details of references

# Sample Preparation and Hydrolysis

The extraction and purification of proteins play an important role in determining amino acid content. These methods are based on one or more of their physical characteristics (e.g., solubility, molecular size, charge, polarity and specific covalent or noncovalent interactions).

### The techniques commonly used to separate proteins and peptides include:

- Reverse-phase HPLC
- Polyacrylamide gel electrophoresis
- Gel filtration
- Ion exchange chromatography
- Affinity chromatography
- The table below provides a more detailed list of methods for fractionating peptide mixtures.[25]

### Hydrolysis

Most protein samples require some form of chemical treatment before their component amino acids are suitable for analysis. Protein and peptide samples must be hydrolyzed to free amino acids from peptide linkages. Acids (usually HCl) are the most widely used agents for hydrolyzing proteins.

A simplified hydrolysis procedure involves refluxing the protein with excess HCl, then removing the excess acid in vacuum.[26] The lyophilized protein then is suspended in constant boiling 6 N HCl and introduced into the hydrolysis tube. The sample is frozen by immersing the tube in dry ice and acetone. Before sealing, the tube is evacuated to avoid formation of cysteic acid, methionine sulfoxide and chlorotyrosine.[27] This procedure minimizes decomposition of reduced S-carboxymethylcysteine and analyzes S-carboxymethylated proteins. Hydrolysis is conducted at 110°C (with the temperature accurately controlled) for 20-70 hours by Moore and Stein's method.[28] After hydrolysis, residual HCl is removed in a rotary evaporator. The residue is dissolved in water and brought to the appropriate pH for addition to the analyzer column.[28]

### Methods for the fractionation of peptide mixtures.

| Technique | Properties of Peptide Molecules Exploited |
|---|---|
| Centrifugation | Solubility |
| Size exclusion chromatography | Size |
| Ion exchange chromatography | Charge, with some influence of polarity |
| Paper electrophoresis | Charge and size |
| Paper chromatography | Polarity |
| Thin layer electrophoresis | Charge and size |
| Thin layer chromatography | Polarity |
| Polyacrylamide gel electrophoresis | Charge and size |
| High-performance liquid chromatography (HPLC) | Polarity |
| Gas chromatography | Volatility of derivatives |
| Counter-current extraction | Polarity; sometimes specific interactions |
| Affinity chromatography | Specific interactions |
| Covalent chromatography or irreversible binding | Disulfide bond formation; reactivity of homoserine lactone |

**References**

1. Braconnot, H. (1820). *Ann. Chem. Phys.* **13**, 113.
2. Mulder, G.J. (1848). *J. Prakt. Chem.* **38**, 294.
3. Kjeldahl, J.G.C.T. (1883). *Z. Anal. Chem.* **22**, 366.
4. Rattenbury, J.M. (1981). *Amino Acid Analysis,* Ellow Horwood, publisher, Chicester, England, Chapter 1.
5. Martin, A.J.P. and Synge, R.L.M. (1941). *Biochem. J.* **35**, 1358.
6. Elsden, S.R. and Synge, R.L.M. (1944). *Proc. Biochem. Soc. IX.*
7. Synge, R.L.M. (1944). *Biochem. J.* **38**, 285.
8. Stein, W.H. and Moore, S. (1949). *Cold Spring Harbor Symposia Quant. Biol.* **14**, 179.
9. Liao, T.H., *et al.* (1973). *Anal. Chem.* **45**, 2286.
10. Hare, P.E. (1972). *Space Life Sciences* **3**, 354.
11. Dus, K., *et al.* (1966). *Anal. Biochem.* **14**, 41.
12. Thomson, A.R. and Miles, B.J. (1964). *Nature* **203**, 483.
13. Robinson, G.W. (1975). *J. Chromatogr.* **3**, 416.
14. Benson, J.V. (1972). *Anal. Biochem.* **50**, 477.
15. Benson, J.V. and Patterson, J.A. (1965). *Anal. Chem.* **37**, 1108.
16. Bates, R.G. and Pinching, G.D. (1949). *J. Amer. Chem. Soc.* **71**, 1274.
17. Jones, B.N. and Gilligan, J.P. (1983). *American Biotech. Lab.* December, 46-51.
18. Weidmeier, V.T., *et al.* (1982). *J. Chromatogr.* **231**, 410-417
19. DeJong, C., *et al.* (1982). *J. Chromatogr.* **241**, 345-359.
20. Lindroth, P. and Mopper, K. (1979). *Anal. Chem.* **51**, 1667-1674.
21. Jones, B.N., *et al.* (1981). *J. Liq. Chromatogr.* **4**, 565-586.
22. Turnell, D.C. and Cooper, J.D.H. (1982). *Clin. Chem.* **28**, 527-531.
23. Umagat, H., *et al.* (1982). *J. Chromatogr.* **241**, 324-334.
24. Jones, B.N. and Gilligan, J.P. (1983). *J. Chromatogr.* **266**, 471-482.
25. Allen, G. (1981). Laboratory Techniques in Biochemistry and Molecular Biology, T.S. Work and R.H. Burdon, Eds., Elsevier/North-Holland, Biomedical Press.
26. Moore, S. and Stein, W.H. (1963). *Meth. Enzymol.* **6**, 819.
27. Eveleigh, J.W. and Winter, G.D. (1970). Protein Sequence Determination, S.B. Needleman, Ed., Springer-Verlag, pp. 92-95.
28. Moore and Stein, *op. cit.*

# HPLC Ion Pair Reagents

## Heptafluorobutyric Acid

Ion-pair reagent for the reverse-phase HPLC separation of proteins and peptides

- Typical purity is 99.7% by GC; <0.1% water
- Sequencing reagent for classical and automated Edman degradation of peptides and proteins
- Density: 1.645
- B.P. 120°C
- Packaged under nitrogen in amber glass ampules or bottles
- Clear, colorless liquid

### Heptafluorobutyric Acid

| Description | Quantity | | Cat. No. | Quantity |
|---|---|---|---|---|
| Heptafluorobutyric Acid, Sequencing Grade | 100mL | X | **TS-25003** | 1 Each |
| Heptafluorobutyric Acid, HPLC Grade | 10 x 1mL ampules | | **TS-53104** | 1 Pack |

1. Hearn, M.T.W. and Hancock, W.S. (1979). *Trends Biochem. Sci.* **4,** N58-N62.
2. Bennett, H.P.J., et al. (1980). *J. Liquid Chromatogr.* **3,** 1353-1366.
3. Bennett, H.P., et al. (1981). *Biochemistry.* **20,** 4530-4538.

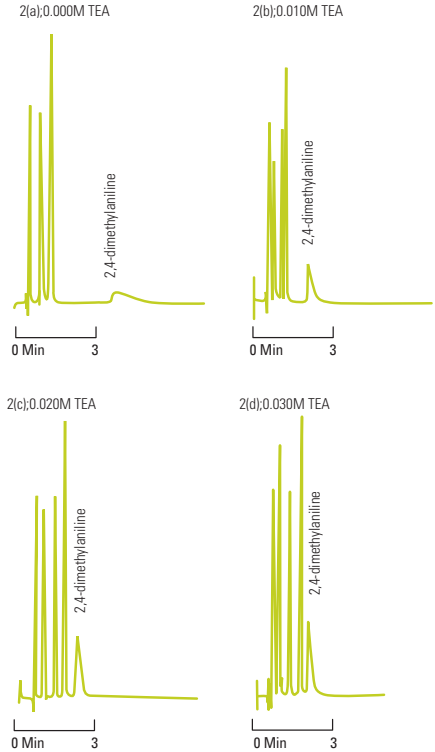
X in the ordering table indicates that hazardous shipping charges apply.

## Triethylamine (TEA)

Ideal for HPLC separation and analysis of peptides

Triethylamine is an ion-pairing reagent that alters selectivity in reverse-phase HPLC separations. By pairing with peptides, it effectively sharpens peaks, resulting in improved peak resolution.

- 99.5% triethylamine purity, allowing sensitive peptide detection at low UV wavelengths in reverse-phase HPLC peptide separation systems
- Packaged in amber glass bottles with protective PTFE-lined fluorocarbon caps for reagent integrity
- Has a low UV absorbance to provide the most sensitive detection across all wavelengths




### Properties of Triethylamine

- Alternate names TEA, Diethylethanamine
- Molecular formula $C_6H_{15}N$
- Molecular weight 101.19
- Density 0.726g/mL

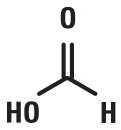
### Triethylamine (TEA)

| Description | Quantity | | Cat. No. | Quantity |
|---|---|---|---|---|
| Triethylamine, HPLC Grade | 25g | | **TS-53101** | 1 Each |
| Triethylamine, Sequencing Grade | 100g | X | **TS-25108** | 1 Each |

X in the ordering table indicates that hazardous shipping charges apply.

# Formic Acid Ampules

Well-suited for HPLC and mass spectrometry applications




**Formic Acid**
MW 46.03

Formic acid is a component found in reverse-phase mobile phases to provide protons for LC/MS analysis. The presence of a low concentration of formic acid in the mobile phase is also know to improve the peak shapes of the resulting separation. Unlike trifluoroacetic acid (TFA), formic acid is not an ion-pairing reagent, and it does not suppress MS ionization of polypeptides when used as a mobile phase component.

- Prescored, nitrogen-flushed, amber glass to protect formic acid from light and moisture
- 99% purity for consistent LC baselines and no interference introduced into LC and mass spectrometry applications
- Convenient format simplifies preparation of gradient and isocratic mobile phases containing 0.1% (v/v) formic acid in water or acetonitrile
- Contents of a single vial in a final volume of 1L solvent yields a mobile phase of the most common formic acid concentration

### Formic Acid Ampules

| Description | Quantity | **Cat. No.** | Quantity |
|---|---|---|---|
| Formic Acid 99+% | 10 x 1mL ampules | **TS-28905** | 1 Each |

For complex peptide separations, the key to success can be to vary selectivity. Varying mobile phase composition on the same column can change selectivity enough to resolve peptide that would otherwise overlap. The TFA concentration is usually specified as 0.1% for reverse-phase HPLC of peptides. For reproducible separations from run-to-run or from lab-to-lab, it is essential to make concentrations the same.

# Derivation and Visualization Reagents for HPLC

## Trifluoracetic Acid (TFA)

Routinely used ion-pairing agent in reversed-phase peptide separations

- Purity: >99.5% TFA and exceptional clarity allows sensitive, nondestructive peptide detection at low UV wavelengths
- High-performance packaging: Packaged under nitrogen in amber glass with protective TFE-lined fluorocarbon caps to ensure TFA integrity
- Choice of formats for convenience: 1mL ampules can prepare 1L of 0.1% v/v TFA solution for the mobile phase in reverse-phase chromatography in moments

### Trifluoracetic Acid (TFA)

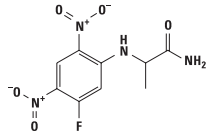
| Description | Quantity | | Cat. No. | Quantity |
|---|---|---|---|---|
| Trifluoracetic Acid, Sequencing Grade | 500mL | X | **TS-28901** | 1 Each |
| Trifluoracetic Acid, Sequencing Grade | 100g | X | **TS-28903** | 1 Each |
| Trifluoracetic Acid, Sequencing Grade | 10 × 1mL | X | **TS-28904** | 1 Pack |
| Trifluoracetic Acid, Sequencing Grade | 1g | X | **TS-28902** | 1 Each |

X in the ordering table indicates that hazardous shipping charges apply.

## FDAA, Marfey's Reagent

Makes separation and quantitation of optical isomers of amino acids by reverse-phase chromatography quick and easy

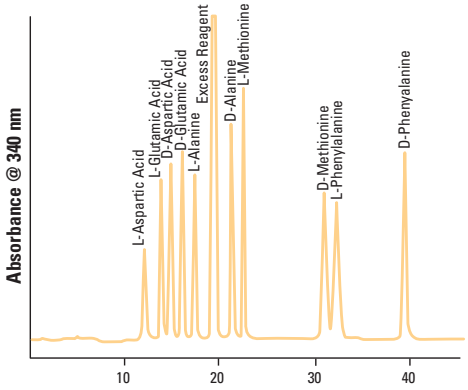
- Optical isomers of amino acids derivatization complete in just 90 minutes
- Derivatives have an absorption coefficient of ~3 x $10^4$
- Derivatives can be detected by UV at 340nm with picomole sensitivity



**FDAA**
**(Marfey's Reagent)**
MW 272.19

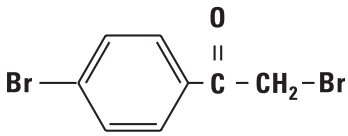
### FDAA, Marfey's Reagent

| Description | Quantity | Cat. No. | Quantity |
|---|---|---|---|
| FDAA, Marfey's Reagent | 50mg | **TS-48895** | 1 Each |



## p-Bromophenacylate Reagent

Gives quantitative yields with few or no side reactions




***p*-Bromophenacylate**
MW 277.94

- Premixing of phenacylbromide and crown ether is not necessary
- Derivatization is both rapid and quantitative, with yields of >95% in 15 to 20 minutes at 80°C
- Excess reactants do not interfere
- Large excess of alkylating reagent is not necessary
- Small amounts of water or alcohol do not interfere
- If isolation is desired, products are usually crystalline

### p-Bromophenacylate Reagent

| Description | Quantity | Cat. No. | Quantity |
|---|---|---|---|
| p-Bromophenacylate Reagent | 10mL | **TS-48891** | 1 Each |

1. Durst, H.D., et al. (1975). *Anal. Chem.* **47**, 1797.
2. Borch, R.F., et al. 1975). *Anal. Chem.* **47**, 2437.
3. Grushka, E., et al. (1975). *J. Chromatogr.* **112**, 673.
4. Fitzpatrick, F.A., et al. (1976). *Anal. Chem.* **48**, 499.

## TNBSA (Trinitrobenzene Sulfonic Acid)

An excellent choice for spectrophotometric detection

- Couples with primary amines, sulfhydryls and hydrazides in aqueous solution at pH 8, without undesirable side reactions
- Excellent for solution or solid phase analysis
- Suitable for qualitative and quantitative estimation of biomolecules; including amino acids, eptides or proteins
- Chromogenic, $O_{max}$ = 335nm
- Reacts readily with primary amino groups of amino acids in aqueous format at pH 8 to form yellow adducts
- No colored derivatives are formed with secondary amino acids proline and hydroxyproline
- Colored derivatives are monitored at 345nm and have extinction coefficients in range of 1-1.5 x $10^4$

### TNBSA

| Description | Quantity | | Cat. No. | Quantity |
|---|---|---|---|---|
| TNBSA | 100mL | X | **TS-28997** | 1 Each |

1. Goodwin, J.F. and Choi, S-Y. (1970). *Clinical Chemistry.* **16**, 24-31.
2. Snyder, S.L. and Sobocinski, P.Z. *(1975). Anal. Biochem.* **64**, 284-288.
3. Drozdovskaya, N.R., et. al. (1982). *FEBS Lett.* **150**, 385.
4. Takahashi, S., et al. (1984). *Chem. Lett. (Jpn).* **1**, 127

X in the ordering table indicates that hazardous shipping charges apply.

# Hydrolysis Reagents

## Constant Boiling (6N) Hydrochloric Acid

Sequencing-grade reagent for total protein hydrolysis

- Hydrolyzes peptides in 6 hours at 150°C
- Specially purified to give ninhydrin-negative blank on hydrolysis
- Packaged in prescored ampules to eliminate contamination and ensure product integrity

### Constant Boiling (6N) Hydrochloric Acid

| Description | Quantity | Cat. No. | Quantity |
|---|---|---|---|
| Hydrochloric Acid 6N | 10 × 1mL | **TS-24308** | 1 Pack |


1. **Eveleigh, J.W. and Winter, G.D. (1970).** *Protein Sequence Determination, Ed Needleham, S.B., Springer-Verlag,* **pp. 92-95.**
2. **Blankenship, et al. (1989).** *High-sensitivity amino acid analysis by derivatization with o-Phthaldialdehyde and 9-Fluorescence detection: applications in protein structure determination. Anal. Biochem.* **178, 227-232.**
3. **Hurley, J.B., et al. (1984).** *Isolation and characterization of a cDNA clone for the subunit of bovine retinal transducin. Proc. Natl. Acad. Sci. USA.* **81, 6948-6952.**
4. **Lee, K. et al. (1979).** *Derivatization of cysteine and cystine for fluorescence amino acid analysis with the o-Phthaldialdehyde/2-mercaptoethanol reagent. J. Biol. Chem.* **July 25, 6248-6251.**


## Amino Acid Standard H

High-purity calibration standard for protein hydrolysates

- Uses L-form configuration to permit standardization of microbial and other assays
- Molar concentration verified by conventional amino acid analysis methods
- With the exception of cystine, each amino acid is supplied at a concentration of 2.5µmoles/mL in 0.1N HCl

**The following amino acids are included in Amino Acid Standard H:**

L-alanine, Ammonia [(NH4)2SO4], L-Arginine, L-Aspartic Acid, L-Cystine, L-Glutamic Acid, Glycine, L-Histidine, L-Isoleucine, L-Leucine, L-Lysine•HCl, L-Methionine, L-Phenylalanine, L-Proline, L-Serine, L-Threonine, L-Tyrosine, L-Valine.

### Amino Acid Standard H

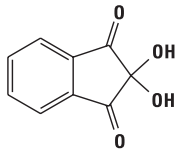
| Description | Quantity | Cat. No. | Quantity |
|---|---|---|---|
| Amino Acid Standard H | 10 × 1mL | **TS-20088** | 1 Pack |

When kept frozen, an unopened vial has an indefinite storage life. Once the seal is broken, the reagent has a maximum storage life of six months. Store frozen between uses.

# Amino Acid Detection Reagents

## Ninhydrin

The reagent of choice for detection of amino acids




**Ninhydrin**
MW 178.14

- Used in amino acid chromatography
- Offers superb color response and low blank
- Indefinitely stable and requires no refrigeration

### Ninhydrin

| Description | Quantity | Cat. No. | Quantity |
|---|---|---|---|
| Ninhydrin | 500g | **TS-21003** | 1 Each |

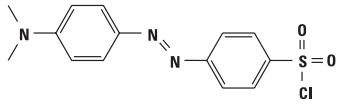
1. Stein, W.H. and Moore, S. (1949). *Cold Spring Harbor Symp. Quant. Biol.* **14**, 179.
2. Moore, S. (1968). *Amino acid analysis: aqueous dimethyl sulfoxide as solvent for the ninhydrin reaction. J. Biol. Chem.* **243(23)**, 6281-6283.
3. James, L.B. (1978). *Amino acid analysis: ninhydrin reaction with titanous chloride. J. Chromatogr.* **152**, 298-300.

Indefinitely stable. No refrigeration required. Keep bottle tightly sealed. Avoid exposure to direct sunlight and ammonia.

# High-Purity Pre-Column Derivatization Reagents

## Dabsyl Chloride

Recrystallized twice



**Dabsyl Chloride**
MW 323.80

- For the precolumn derivatization and detection of amino acids in visible light down to sub-picomolar levels
- Analysis of 10-30ng of protein hydrolysates
- Analysis of peptides and determination of C-terminal sequence of polypeptides
- Analysis of phosphoamino and amino acid amides
- Analysis of amino acid neurotransmitters in mouse brain

### Dabsyl Chloride

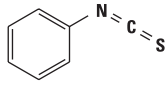
| Description | Quantity | | Cat. No. | Quantity |
|---|---|---|---|---|
| Dabsyl Chloride (4-N,N Dimethylaminoazobenzene-4-sulfonyl chloride) | 500g | X | **TS-21720** | 1 Each |


1. Chang, J.Y., et al. (1981). *Biochem. J.* **199**, *547-555.*
2. Chang, J.Y., et al. (1982). *Biochem. J.* **199**, *803-806.*
3. Chang, J.Y. (1984). *J. Chromatogr.* **295**, *193-200.*
4. Chang, J.Y., et al. (1981). *FEBS Lett.* **132**, *117-120.*
5. Vendrell, J. et al. (1986). *J. Chromatogr.* **358**, *401-413.*
6. Lin, J.K., et al. (1980). *Clin. Chem.* **26**, *579-583.*
7. Chang, J.Y., et al. (1983). *Methods. Enzymol.* **92**, *41-48.*
8. Stocchi, V., et al. (1985). *J. Chromatogr.* **349**, *77-82.*


X in the ordering table indicates that hazardous shipping charges apply.

## PITC (Phenylisothiocyanate)

High-purity reagent for pre-column quantitative derivatization of amino acids by reverse-phase HPLC



**PITC**
**Edman's Reagent**
MW 135.19

- Also known as Edman's Reagent
- Reacts readily with amino acids in 5 to 10 minutes at room temperature
- Resulting phenylthiocarbamyl derivatives can be separated and quantified in 30 minutes using reverse-phase HPLC to produce stable products with all amino acids including proline

### PITC (Phenylisothiocyanate)

| Description | Quantity | Cat. No. | Quantity |
|---|---|---|---|
| PITC (Edman's Reagent) | 10 × 1mL | **TS-26922** | 1 Pack |


1. Heinrikson, R.L. and Meridith, S.C. (1984). *Anal. Biochem.* **136**, 65-74.
2. Scholze, H. (1985). *J. Chromatogr.* **350**, 453-460.
3. Janssen, et al. (1986). *Chromatogr.* **22(7-12)**.
   Evert, R.F. (1986). *Anal. Biochem.* **154**, 431-435.

# HPLC and Spectrophotometric Grade Solvents

Ultrapure solvents are carefully packed for thorough protection

- Distilled in glass, filtered through 0.2µm TFE membranes and packed in solvent-rinsed, amber glass bottles
- TFE-lined screw caps seal bottles

### Acetonitrile, HPLC Grade, Physical Properties

- UV Cutoff: 190nm
- Optical Absorbance: <0.02 at 220nm
- Refractive Index at 25°C: 1.342

### Water, HPLC Grade, Physical Properties

- UV Cutoff: 190nm
- Optical Absorbance: <0.005 at 220nm
- Refractive Index at 25°C: 1.332

### Dimethylformamide (DMF), Sequencing Grade, Physical Properties

- $HCON(CH_3)_2$
- Purity (GC): ≥99%
- MW: 73.09
- Density: 0.944
- B.P. 153°C
- Water: 0.1%

### Dimethylsulfoxide (DMSO), Sequencing Grade, Physical Properties

- $C_2H_6OS$
- Purity (GC): >99.5%
- MW: 78.13
- Density: 1.101
- Water: ≤0.2%

### Pyridine

- $C_5H_5N$
- Purity (GC): ≥99%
- MW: 79.10
- Density: 0.978
- B.P. 115°C

### HPLC and Spectrophotometric Grade Solvents

| Description | Quantity | | Cat. No. | Quantity |
|---|---|---|---|---|
| Acetonitrile | 1L | X | **TS-51101** | 1 Each |
| Water | 1L | | **TS-51140** | 1 Each |
| Dimethylformamide (DMF) | 50mL | X | **TS-20673** | 1 Each |
| Dimethyl sulfoxide (DMSO) | 950mL | X | **TS-20688** | 1 Each |
| Pyridine | 100g | X | **TS-25104** | 1 Each |

X in the ordering table indicates that hazardous shipping charges apply.

# Peptide Standards

## Peptide Retention Standard

Allows accurate prediction of elution time for peptides of known amino acid composition up to 20 residues in length

- Save time in peptide purification
- Simplify identification of specific peptides in a complex mixture
- Increase the efficiency of predicting peptide elution profiles
- Determine the relative order of peptide elution of a complex mixture
- Predict the HPLC retention time for peptides of known amino acid composition on reverse phase HPLC columns
- Monitor column performance: efficiency, selectivity and resolution during column ageing
- Compare reverse-phase columns from different manufacturers
- Evaluate reverse-phase supports of varying n-alkyl chain lengths and ligand densities

Retention times are predicted by totaling the values that represent the contribution in minutes of each amino acid residue and the peptide terminal groups. Retention time is dependent upon the molecular weight of the peptide. The effect on retention is relatively unimportant with a small peptide, but it increases with the size of the molecule. The accuracy of predicting peptide retention time significantly decreases beyond 20 residues. To ensure accuracy, a peptide standard is used to correct for instrument variation, column aging, n-alkyl chain length variation and ligand density.

### Peptide Retention Standard

| Description | Quantity | Cat. No. | Quantity |
|---|---|---|---|
| Peptide Retention Standard, S1-S5 | 1 vial | **TS-31700** | 1 Each |

1. Guo, D., et al. (1985). *P*roceedings of the Ninth American Peptide Symposium, Published by Thermo Fisher Scientific, Rockford, Illinois, page 23.
2. Guo, D., et al. (1986). *J. Chromatogr.* **359**, 499-517.
3. Guo, D., et al. (1986). *J. Chromatogr.* **359**, 519-532.
4. Mant, C.T. and Hodges, R.S. (1986). *L.C. Magazine Liq. Chrom. and HPLC* **4(3)**, 250.
5. Guo, D., et al. (1987). *J. Chromatogr.* **386**, 205-222.

## Peptide Retention Time Calibration Mixture

Heavy peptide mixture for column assessment and prediction of peptide retention times

- Assessment of chromatography and MS instrument performance
- Prediction of peptide retention across multiple instrument platforms
- Prediction of peptide retention time from sequence using calculated hydrophobicity factor
- Optimization of scheduled MS acquisition windows for improving quantification and increased multiplexing
- Internal standard to normalise for variation in retention times and peak intensities between runs

### Thermo Scientific Peptide Retention Time Calibration Mixture

| Description | Quantity | Cat. No. | Quantity |
|---|---|---|---|
| Peptide Retention Time Calibration Mixture, 0.5pmol/µL | 50µL | **TS-88320** | 1 Each |
| Peptide Retention Time Calibration Mixture, 5pmol/µL | 200µL | **TS-88321** | 1 Each |

## Dionex Ion Standard Concentrates

- The Dionex IonPac ready-to-use ion standards are designed for routine anion or cation determinations
- All standards are traceable to NIST Standard Reference Materials
- Shipped with a Certificate of Analysis verifying the concentration

| Description | Volume (mL) | Cat. No. |
|---|---|---|
| Combined Five Anion Standard | 100 | **037157** |
| Combined Seven Anion Standard I | 50 | **056933** |
| Combined Seven Anion Standard II | 100 | **057590** |
| Fluoride Standard (1000mg/L) | 100 | **037158** |
| Chloride Standard (1000mg/L) | 100 | **037159** |
| Sulfate Standard (1000mg/L) | 100 | **037160** |
| Combined Six Cation Standard-I | 50 | **040187** |
| Combined Six Cation Standard-II | 50 | **046070** |

## MS Standard Concentrates

- MS standards for validation and calibration of the MSQ System

| Description | Cat. No. |
|---|---|
| Kit of 2 standards for performance validation in ESI and APCI modes | **061496** |
| Standard for Mass Calibration (All MSQ Models) | **062917** |

## Perchlorate Internal Standard

- For the quantification of perchlorate at low parts-per-trillion levels using mass spectrometric detection. Contains stable-labeled perchlorate (1mg/L).

| Description | Cat. No. |
|---|---|
| Perchlorate-ISTD. $^{18}O$ Internal Standard for Perchlorate | **062923** |

## Haloacetic Acid Internal Standards

- Ready-to-use internal standards for haloacetic acid analysis using electrospray-mass spectrometric detection
- Stable-labeled internal standards prepared in MTBE (methyl-t-butyl ether), 1mL ampule plus empty vial

| Description | Volume (mL) | Cat. No. |
|---|---|---|
| Monochloroacetic Acid -2-13C Internal Standard, 1000mg/L in MtBE | 1 | **069406** |
| Monobromoacetic Acid -1-13C Internal Standard, 1000mg/L in MtBE | 1 | **069407** |
| Dichloroacetic Acid -2-13C Internal Standard, 1000mg/L in MtBE | 1 | **069408** |
| Trichloroacetic Acid -2-13C Internal Standard, 1000mg/L in MtBE | 1 | **069409** |

## Ion Pairing Reagents

- Highly purified ion-pairing reagents are used in mobile phase ion chromatography (MPIC), combining reversed-phase ion-pair chromatography with chemical suppression

| Description | Volume (mL) | Cat. No. |
|---|---|---|
| Tetrabutylammonium hydroxide (TBAOH) | 500 | **035360** |
| Tetrapropylammonium hydroxide (TPAOH) | 500 | **035363** |
| Hexanesulfonic acid (HSA) | 500 | **035361** |
| Octanesulfonic acid (OSA) | 500 | **035362** |

# LC and LC-MS Instrument Accessories, Consumables and Spare Parts

Our liquid chromatographs and mass spectrometers advance scientific knowledge, enable drug discovery, improve manufacturing processes, and protect people and the environment. When your instrument is maintained with Thermo Scientific parts, you can expect the best results and highest productivity, keeping your research or processes moving smoothly.

# Thermo Scientific Dionex UltiMate 3000 Systems Portfolio

## Basic Automated System

The Thermo Scientific™ Dionex™ UltiMate™ 3000 Basic Automated System is optimized for reliability and ease-of-use with routine LC applications, and also offers full UHPLC compatibility. The ACC-3000 Autosampler Column Compartment is at the heart of the system. Its unique instrument design combines a rugged sample injection principle with a powerful column oven.

## Standard (SD) LC Systems

UltiMate 3000 Standard (SD) Systems are designed to meet current and future challenges. System components provide low extra-column and gradient delay volume for high separation efficiency and low gradient response times, as well as superior mixing performance. They offer full support of all HPLC applications and provide UHPLC compatibility – allowing you to move to UHPLC whenever you are ready.

## Rapid Separation (RS) LC Systems

UltiMate 3000 Rapid Separation (RS) Systems provides unrivaled performance and flexibility in UHPLC. Precision-engineered instrumentation, advanced data processing, and highly optimized chemistries meet all chromatographic performance challenges. With an outstanding product portfolio, UltiMate 3000 RS Systems offers industry leading versatility covering the maximum range of UHPLC applications, while keeping fully compatible to conventional LC.

## Biocompatible Rapid Separation (BioRS) LC Systems

UltiMate 3000 Biocompatible Rapid Separation (BioRS) Systems are powered by UltiMate 3000 Rapid Separation technology to support the high pressures required for the separation of bioanalytes on high resolution bio UHPLC columns. This state-of-the-art technology combined with a biocompatible, low-dispersion flow path, provides the highest peak capacity and sensitivity for complex samples, whether proteins, peptides, or biotherapeutics. Bio UHPLC enables faster gradients and shorter run times compared to conventional Bio LC analysis. This results in increased sample throughput in typical modes of biochromatography.

## x2 Dual Rapid Separation LC Systems

UltiMate 3000 x2 Dual LC Systems are the ideal choice to maximize sample throughput of conventional HPLC and UHPLC separations by combining the flexibility of ternary solvent selection with the productivity and performance of x2 Dual technology.

Advanced chromatographic techniques such as parallel, tandem, and two-dimensional LC become a realistic and practical option, even at ultrahigh speed. Operate conventional or ultrahigh speed applications, increase sample throughput, achieve higher chromatographic resolutions, or automate tedious sample preparation steps such as analyte enrichment or matrix elimination.

## XRS LC Systems

UltiMate 3000 XRS Systems are highly LC/MS optimized quaternary UHPLC systems and the best choice for ultrahigh resolution and high speed UHPLC MS-frontend solutions. This system is the ideal solution for high sample throughput and ultra high resolution chromatography.

# Accessories, Consumables and Spare Parts for UltiMate 3000 Instruments

### Accessories for the Use with UltiMate 3000 Instruments

| Description | Quantity | Cat. No. |
|---|---|---|
| Drainage kit for UltiMate 3000 systems | 1 | **6040.0005** |
| Menu pen | 1 | **6300.0100** |
| Installation tool for Viper capillaries with torque toothing | 1 | **6040.2314** |
| HPLC Troubleshooting Guide poster | 1 | **6040.0050** |

## UltiMate 3000 Solvent Racks

### Consumables and Spare Parts for UltiMate 3000 Solvent Racks

| Description | Quantity | Cat. No. |
|---|---|---|
| Solvent supply line (analytical) | 1 | **6030.2548** |
| Solvent supply line from analytical degasser to pump head | 1 | **6030.2546** |
| Bottle cap for solvent reservoirs | 4 | **6270.0013** |
| Caps and retaining guides for solvent bottles (5 caps and 10 retaining guides) | 1 | **6030.9101** |
| Degasser Channel Upgrade Kit for SRD | 1 | **6035.0089** |
| External power supply unit | 1 | **6510.0004** |

Also use our HPLC Troubleshooting Guide as a Mobile App for iPhone, Android and Windows phones.

# UltiMate 3000 Pumps

## Accessories for the Use with UltiMate 3000 Pumps

| Description | Quantity | Cat. No. | For use with | | | | |
|---|---|---|---|---|---|---|---|
| | | | SD pumps | RS pumps | BM pumps | XRS pumps | BX pumps |
| Filter holder for solvent filter | 6 | **6268.0115** | X | X | X | | |
| Filter holder for solvent filter | 2 | **6268.0116** | | | | | X |
| Filter frit (SST, porosity: 10µm) | 10 | **6268.0110** | X | X | | | |
| Filter frit (Ti, biocompatible, porosity: 10µm) | 10 | **6828.0111** | | X | X | | X |
| Filter frit (PEEK, porosity: 10µm) | 10 | **6828.0117** | | | X | | |
| Solvent lines kit with filter frits (SST, porosity: 20µm) | 1 | **6043.8109** | | | | X | |

## Spare Parts for UltiMate 3000 Pumps

| Description | Quantity | Cat. No. | For use with | | | | |
|---|---|---|---|---|---|---|---|
| | | | SD pumps | RS pumps | BM pumps | XRS pumps | BX pumps |
| **Check Valves** | | | | | | | |
| Check valve, cartridge (ceramics) for the inlet and outlet valve | 1 | **6041.2301** | X | X | X | | X |
| Check valve cartridge for the inlet and outlet valve | 1 | **6043.0145** | | | | X | |
| **Pistons** | | | | | | | |
| Pistons (sapphire) | 2 | **6040.0042** | X | X | X | | |
| Pistons (ceramics) | 2 | **6040.0842** | | | | | X |
| Pistons (sapphire) | 2 | **6043.0169** | | | | X | |
| **Piston Seals** | | | | | | | |
| Piston seal (in plate of seal wash system) Normal Phase | 2 | **6040.0306** | X | X | X | | |
| Piston seal kit (in plate of seal wash system) Reversed Phase (2 seals and 1 support ring) | 1 | **6040.9010** | | | | | X |
| Piston seal (main piston seal) Reversed Phase | 2 | **6040.0304** | X | | | | |
| Piston seal (main piston seal) Reversed Phase | 2 | **6266.0305** | | X | | | |
| Piston seal kit (main piston seal) Reversed Phase (2 seals and 1 support ring) | 1 | **6025.2012** | | | X | | |
| Piston seal kit (main piston seal) Reversed Phase (2 seals and 1 support ring) | 1 | **6040.9010** | | | | | X |
| Piston seal kit (main piston seal) Normal Phase (2 seals and 1 support ring) | 1 | **6040.9011** | | | | | X |
| Piston seal kit Reversed phase (2 primary piston seals and 2 secondary piston seals) | 1 | **6043.0295** | | | | X | |
| **Support Rings** | | | | | | | |
| Support ring for pistons seals | 2 | **6040.0012** | X | X | | | |
| Support ring/pistons seal kit Reversed Phase (2 piston seals and 1 support ring) | 1 | **6025.2012** | | | X | | |
| Support ring/pistons seal kit Reversed Phase (2 seals and 1 support ring) | 1 | **6040.9010** | | | | | X |
| Support ring/pistons seal kit Normal phase (2 seals and 1 support ring) | 1 | **6040.9011** | | | | | X |

## Manual Sample Injection Valves for the Use with UltiMate 3000 Pumps

| Description | Quantity | Cat. No. |
|---|---|---|
| Manual injection valve kit, pressures > 50 MPa | 1 | **6040.0610** |
| Manual injection valve kit, biocompatible, pressures > 34 MPa | 1 | **6042.0600** |
| Motorized manual injection valve kit | 1 | **6040.0110** |
| Mounting kit for manual injection valve | 1 | **6040.0611** |
| **Syringe for use with the manual injection valve** | | |
| 100µL syringe | 1 | **6035.0665** |
| 5mL syringe | 1 | **6035.0670** |
| 1mL syringe | 1 | **6040.0620** |

## Mixing Systems for the Use with UltiMate 3000 Pumps

| | | Cat. No. | |
|---|---|---|---|
| Description | Quantity | SD pumps[1] | RS pumps |
| Mixer for 35µL mixing volume | 1 | **6040.5000** | **6042.5000** |
| Mixer for 100µL mixing volume | 1 | **6040.5100** | **6042.5100** |
| Mixer for 200µL mixing volume | 1 | **6040.5110** | |
| Mixer for 400µL mixing volume | 1 | **6040.5310** | |
| Mixer for 800µL mixing volume | 1 | **6040.5750** | |
| Mixer for 1550µL mixing volume | 1 | **6040.5450** | |

[1]except ISO-3100

## Normal Phase Upgrade Kits for UltiMate 3000 Pumps

| Description | Quantity | Cat. No. |
|---|---|---|
| Normal Phase Kit for HPG-3200BX | 1 | **6040.1975** |
| Normal Phase Kit for SD pumps | 1 | **6040.1972** |

## Maintenance Kits for UltiMate 3000 Pumps

| Description | Quantity | SD pumps | RS pumps | BM pumps | XRS pumps | BX pumps |
|---|---|---|---|---|---|---|
| Maintenance kit for ISO-3100 | 1 | **6040.1950** | – | **6042.1950** | – | – |
| Maintenance kit for HPG-3x00 | 1 | **6040.1953** | **6040.1956A** | – | – | – |
| Maintenance kit for LPG-3400 | 1 | **6040.1951** | **6040.1954A** | **6042.1951** | **6043.1954** | **6042.1954**(NP)<br>**6042.1953**(RP) |
| Maintenance kit for DGP-3600 | 1 | **6040.1952** | **6040.1955A** | **6042.1952** | – | – |

# UltiMate 3000 Autosamplers

## Sample Racks for the Use with UltiMate 3000 WPS Autosamplers and UltiMate 3000 ACC Autosampler Column Compartments

| Description | Quantity | Cat. No. | For use with WPS | For use with ACC |
|---|---|---|---|---|
| **Sample Racks** | | | | |
| Sample Rack (10 position and/or normal well plates) for 10mL vials, 22.5mm×46mm | 1 | **6820.4086** | X | X |
| Sample Rack (22 position) for 4mL vials, 15mm×45mm, cylindrical | 1 | **6820.4084** | X | X |
| Sample Rack (40 position) for 2mL vials, 12mm×32mm, cylindrical | 1 | **6820.4070** | X | X |
| Sample Rack (40 position and/or normal well plates) for 1.1mL vials, 12mm×32mm, conical | 1 | **6820.4087** | X | X |
| Sample Rack (40 position) for 0.5mL Eppendorf tubes | 1 | **6820.4096** | X | X |
| Sample Rack (40 position) for 1.5mL Eppendorf tubes | 1 | **6820.4094** | X | X |
| Sample Rack (72 position and/or normal well plates) for 1.2mL vials, 8mm×40mm, cylindrical | 1 | **6820.4090** | X | X |
| Sample Rack (72 position and/or normal well plates) for 0.3mL vials, 8mm OD, cylindrical | 1 | **6820.4091** | X | X |
| Sample Rack (72 position) for 0.3mL micro dialysis vials | 1 | **6820.4097** | X | X |
| **Support Racks for Well Plates** | | | | |
| Support rack for deep well plates (34 – 46mm high) | 1 | **6820.4079** | X | |
| Support rack for deep well plates (30 – 36mm high, 96 or 384 wells) | 1 | **6820.4083** | X | |
| Support rack for deep well plates (20 – 32mm high, 96 or 384 wells) | 1 | **6820.4089** | X | |

Find the Thermo Fisher Scientific Vials and Closures portfolio on page **2-001**.

## Optional Accessories for the Use with UltiMate 3000 WPS-3000 Split Loop Autosamplers

| Description | Quantity | Cat. No. | For use with: WPS-3000TXRS/ WPS-3000(T) RS | WPS-3000TBRS | WPS-3000(T) SL Analytical | WPS-3000TBSL | WPS-3000(T) SL Semiprep |
|---|---|---|---|---|---|---|---|
| **Needles** | | | | | | | |
| Needle (SST) Viper compatible | 1 | **6820.2432** | X/X | | X | | |
| Needle (ceramic) Viper compatible | 1 | **6841.2420** | | X | | | |
| Needle (SST) | 1 | **6820.2403** | | | | X | |
| Needle (SST) | 1 | **6820.2419** | | | | | X |
| **Needle Seat Capillaries** | | | | | | | |
| Needle seat capillary, 3.1µL, Viper (SST) | 1 | **6820.2464** | X/X | | X | | |
| Needle seat capillary, 3.1µL, Viper (PEEK) | 1 | **6827.2408** | | | | X | |
| Needle seat capillary, 3.1µL, Viper (MP35N™) | 1 | **6841.2464** | | X | | | |
| Needle seat capillary, 1µL, Viper (MP35N) | 1 | **6841.2472** | | X | | | |
| Needle seat capillary, 1µL, Viper (SST) | 1 | **6820.2472** | X/– | | | | |
| Needle seat capillary, 24µL, Viper (SST) | 1 | **6820.2409** | | | | | X |
| **Sample Loops - SST** | | | | | | | |
| 25µL Sample loop, Viper | 1 | **6820.2452** | X/X | | X | | |
| 100µL Sample loop, Viper | 1 | **6820.2451** | X/X | | X | | |
| 250µL Sample loop, Viper | 1 | **6820.2453** | –/X | | X | | |
| 500µL Sample loop, Viper | 1 | **6820.2454** | –/X | | X | | |
| 1000µL Sample loop | 1 | **6820.2429** | | | | | X |
| **Sample Loops – MP35N** | | | | | | | |
| 25µL Sample loop, Viper | 1 | **6841.2452** | | X | | | |
| 100µL Sample loop, Viper | 1 | **6841.2451** | | X | | | |
| 250µL Sample loop, Viper | 1 | **6841.2453** | | X | | | |
| 500µL Sample loop, Viper | 1 | **6841.2454** | | X | | | |
| **Sample Loops – PEEK** | | | | | | | |
| 100µL Sample loop | 1 | **6820.2431** | | | | X | |
| **Buffer Loops** | | | | | | | |
| Buffer loop, 100µL, Viper (SST) | 1 | **6820.2466** | X/X | | X | X | |
| Buffer loop, 100µL, Viper (MP35N) | 1 | **6841.2466** | | X | | | |
| Buffer loop, > 250µL, Viper (SST) | 1 | **6820.2468** | | | | | X |
| Buffer loop, > 250µL, Viper (MP35N) | 1 | **6841.2468** | | X | | | |
| **Syringes** | | | | | | | |
| 25µL Syringe | 1 | **6822.0001** | X/X | X | X | X | X |
| 100µL Syringe | 1 | **6822.0002** | X/X | X | X | X | X |
| 250µL Syringe | 1 | **6822.0003** | X/X | X | X | X | X |
| 500µL Syringe | 1 | **6822.0004** | X/X | X | X | X | X |
| 1000µL Syringe | 1 | **6822.0005** | X/X | X | X | X | X |
| 2500µL Syringe | 1 | **6822.0006** | X/X | X | X | X | X |

## Injection Volume Kits for the Use with UltiMate 3000 WPS-3000 Split Loop Autosamplers

| Description | Quantity | Cat. No. | For use with: WPS-3000(T)RS | WPS-3000TBRS | WPS-3000(T)SL Analytical | WPS-3000(T)SL Semiprep |
|---|---|---|---|---|---|---|
| Injection volume kit (250µL), Viper | 1 | **6822.2442** | X | | X | |
| Injection volume kit (250µL), Viper | 1 | **6841.2442** | | X | | |
| Injection volume kit (500µL), Viper | 1 | **6822.2443** | X | | X | |
| Injection volume kit (500µL), Viper | 1 | **6841.2443** | | X | | |
| Injection volume kit (1000µL) | 1 | **6822.2436** | | | | X |

## Optional Accessories for the Use with UltiMate 3000 WPS-3000 Pulled Loop Autosamplers

| Description | Quantity | Cat. No. | For use with | | | |
|---|---|---|---|---|---|---|
| | | | WPS-3000(T)PL RS Nano/Cap | WPS-3000TBPL Analytical | WPS-3000TFC | WPS-3000TBFC |
| **Modification Kits** | | | | | | |
| Nano/Cap modification kit | 1 | **6824.0030** | | | X | |
| Nano/Cap modification kit | 1 | **6825.0030** | | | | X |
| Upgrade kit PAEK | 1 | **6821.0045** | X | | | |
| Front cover, transparent | 1 | **6820.1427** | X | X | X | X |
| **Needles** | | | | | | |
| 2.4µL Needle, nanoViper | 1 | **6820.3010** | X | | X[1] | X[1] |
| 3.6µL Needle, Viper | 1 | **6820.3023** | X | X | X[1] | X[1] |
| 15µL Needle, Viper | 1 | **6820.3025** | X[2] | X | X | X |
| 15µL Needle, nanoViper | 1 | **6820.3115** | X[2] | X | X | X |
| **Sample Loops – nanoViper** | | | | | | |
| 1µL Sample loop, nanoViper | 1 | **6826.2401** | X | | X[1] | X[1] |
| 5µL Sample loop, nanoViper | 1 | **6826.2405** | X | | X[1] | X[1] |
| 10µL Sample loop, nanoViper | 1 | **6826.2410** | X | | X[1] | X[1] |
| 20µL Sample loop, nanoViper | 1 | **6826.2420** | X | | X[1] | X[1] |
| 50µL Sample loop, nanoViper[2] | 1 | **6826.2450** | X | X | X | X |
| 125µL Sample loop, nanoViper[2] | 1 | **6826.2412** | X | X | X | X |
| **Sample Loops – SST** | | | | | | |
| 50µL Sample loop | 1 | **6824.0019** | | | X | |
| 250µL Sample loop | 1 | **6824.0020** | | | X | |
| **Sample Loops – PEEK** | | | | | | |
| 5µL Sample loop | 1 | **6823.0016** | X | X | | X |
| 10µL Sample loop | 1 | **6823.0017** | X | X | | X |
| 20µL Sample loop | 1 | **6823.0018** | X | X | | X |
| 50µL Sample loop | 1 | **6823.0019** | X[2] | X | | X |
| 125µL Sample loop | 1 | **6821.0032** | X[2] | X | | X |
| 250µL Sample loop | 1 | **6823.0020** | | X | | X |
| **Buffer Tubings** | | | | | | |
| 50 µL Buffer tubing (SST) | 1 | **6820.0019** | X | | X[1] | |
| 50 µL Buffer tubing (PEEK/PTFE) | 1 | **6821.0019** | X[3] | | | X[1] |
| 500 µL Buffer tubing (SST) | 1 | **6820.0020** | X | | X | |
| 500 µL Buffer tubing (PEEK/PTFE) | 1 | **6821.0020** | X[3] | X | | X |
| 1000 µL Buffer tubing (SST) | 1 | **6820.0056** | | | X | |
| 1000 µL Buffer tubing (PEEK/PTFE) | 1 | **6821.0022** | | X | | X |
| 2000 µL Buffer tubing (SST) | 1 | **6820.0021** | X | | | |
| 2000 µL Buffer tubing (PEEK/PTFE) | 1 | **6821.0021** | X[3] | | | |
| **Syringes** | | | | | | |
| 25µl Syringe | 1 | **6822.0001** | X | | X[1] | X[1] |
| 100µl Syringe | 1 | **6822.0002** | X | X | X | X |
| 250µl Syringe | 1 | **6822.0003** | X[4] | X | X | X |
| 500µl Syringe | 1 | **6822.0004** | X[4] | | | |
| 1000µl Syringe | 1 | **6822.0005** | X[4] | | | |
| Syringe upgrade kit (250µL)[4] | 1 | **6820.0031** | X | | | |
| Syringe upgrade kit (250µL, biocompatible version)[4] | 1 | **6821.0031** | X[3] | | | |
| **Bridges** | | | | | | |
| 1µL Bridge (PEEKsil) | 1 | **6824.0015** | | | X[1] | |
| 1µL Bridge (PEEKsil) | 1 | **6825.0015** | | | | X[1] |
| 6.2µL Bridge (PEEK) | 1 | **6824.0016** | | | X | |
| 6.2µL Bridge (PEEK) | 1 | **6825.0016** | | | | X |

Find recommended combinations for syringes, buffer tubings and sample loops on page **4-218**.

1. Can be used for Nano/Cap/Mic applications only if Nano/Cap modification kit is previously installed
2. For analytical applications only, please use the smaller sample loops for Nano/Cap
3. Can be mounted only when PAEK Upgrade Kit is previously installed
4. For analytical applications only, please use the smaller syringes for Nano/Cap

## Recommended Syringes, Buffer Tubings and Sample Loops Combinations for the Use with UltiMate 3000 WPS-3000(T)PL RS Nano/Cap, WPS-3000(T)BPL Analytical, WPS-3000TFC and WPS-3000TBFC Autosamplers

| Recommended Combinations | | |
|---|---|---|
| **Syringe** | **Buffer Tubing** | **Sample Loop** |
| WPS-3000(T)PL RS Nano/Cap | | |
| 25µL | 50µL | 1µL, 5µL |
| 100µL | 500µL | 10µL, 20µL |
| 250µL | 500µL | 50µL, 125µL |
| WPS-3000TBPL Analytical | | |
| 100µL | 500µL | 5µL, 10µL, 20µL, 50µL |
| 250µL | 1000µL | 125µL, 250µL |
| WPS-3000TFC and WPS-3000TBFC Analytical *(with Nano/Cap Modification Kit)* | | |
| *25µL* | *50µL* | *1µL, 5µL* |
| 100µL | 500µL | 5µL, 10µL, 20µL, 50µL |
| 250µL | 500µL | 50µL, 125µL |
| 250µL | 1000µL | 250µL |

## Accessories and Spare Parts for the Use with UltiMate 3000 OAS-3x00 Open Autosamplers

| Description | Quantity | Cat. No. |
|---|---|---|
| Holding loop (FEP) with needle adapter mounted | 1 | **6845.0034** |
| Holding loop kit (FEP) | 1 | **6845.0035** |
| Holding loop (SST) | 1 | **6845.0029** |
| 2µL Sample loop for Cheminert injection valve | 1 | **755.CSL2** |
| 20µL Sample loop for Cheminert injection valve | 1 | **755.CSL20** |
| 100µL Sample loop for Cheminert injection valve | 1 | **755.CSL100** |
| 100µL Syringe | 1 | **6845.0062** |
| Sample tray (VT54) for 2mL vials (54 positions per tray) | 6 | **6845.0055** |

## Accessories and Spare Parts for the Use with ACC-3000(T) Autosampler Column Compartments

| Description | Quantity | Cat. No. |
|---|---|---|
| Adapter for 5-position holder to be used for 2mL vials | 1 | **6820.4092** |
| Adapter for vial pusher for uncapped 10mL vials | 1 | **6820.2402** |
| Needle | 1 | **6820.2403** |
| Buffer tubing, >250µL, Viper | 1 | **6820.2468** |
| 20µL Sample loop, Viper | 1 | **6830.2414** |
| 50µL Sample loop, Viper | 1 | **6830.2416** |
| 200µL Sample loop, Viper | 1 | **6830.2418** |
| 250µL Syringe | 1 | **6822.0003** |
| 1000µL Syringe | 1 | **6822.0005** |
| Front cover, transparent | 1 | **6820.1427** |

# UltiMate 3000 Thermostatted Column Compartments

## Accessories for the Use with UltiMate 3000 TCC-3000(RS) Thermostatted Column Compartments

| Description | Quantity | Cat. No. |
|---|---|---|
| 1µL Pre-column heater, Viper (SST) | 1 | **6722.0510** |
| 2µL Pre-column heater, Viper (SST) | 1 | **6722.0530** |
| 7µL Pre-column heater, Viper (SST) | 1 | **6722.0540** |
| 11µL Pre-column heater, Viper (SST) | 1 | **6722.0550** |
| Post-column cooler insert, Viper (SST) | 1 | **6730.0008** |
| Column clip for columns with an outer diameter < 8mm | 6 | **6722.0290** |
| Column clip for columns with an outer diameter of 8-12mm | 6 | **6722.0280** |

## Optional Column Switching Valves for the Use with UltiMate 3000 TCC-3000RS/SD Thermostatted Column Compartments

| | | Biocompatible | | | Non biocompatible | | |
|---|---|---|---|---|---|---|---|
| | | TitanHP™ | | TitanHT™ | TitanHP™ | TitanHT™ | |
| Description | Quantity | < 34 MPa (5000 psi) | < 41 MPa (6000 psi) | < 103 MPa (15000 psi) | < 41 MPa (6000 psi) | < 103 MPa (15000 psi) | <125 MPa (18130 psi) |
| **Valve Drives** | | | | | | | |
| Valve Drive (Actuator) for right side installation | 1 | **6730.0003** | | **6730.0001** | **6730.0003** | **6730.0001** | |
| Valve Drive (Actuator) for left side installation | 1 | **6730.0004** | | **6730.0002** | **6730.0004** | **6730.0002** | |
| **Pods** | | | | | | | |
| Pod, 2-position, 6-port | 1 | **6723.9013 (PEEK)** | – | **6730.0031 (Ti)** | **6722.9013 (SST)** | **6730.0006 (SST)** | – |
| Pod, 2-position, 10-port | 1 | **6723.9023 (PEEK)** | – | **6730.0032 (Ti)** | **6722.9023 (SST)** | **6730.0026 (SST)** | – |
| Pod, 6-position, 7-port | 1 | – | **6722.9035 (Ti)** | **6730.0030 (Ti)** | – | **6730.0016 (SST)** | **6730.0050 (SST)** |

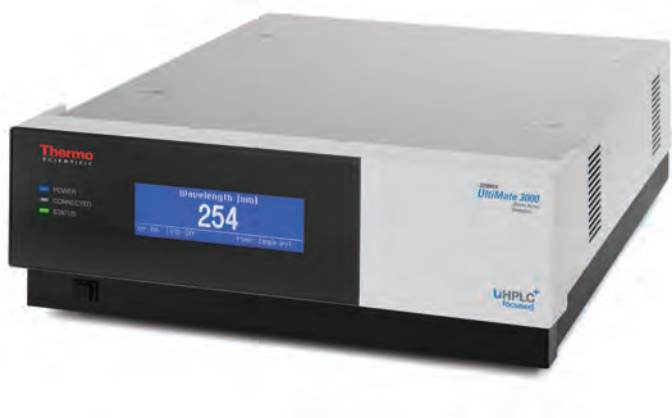
# UltiMate 3000 Detectors

## Flow Cells for UltiMate 3000 DAD-3000(RS), MWD-3000(RS), VWD-3x00(RS) and FLD-3x00(RS) Detectors

| Description | Quantity | Cat. No. | DAD-3000(RS) MWD-3000(RS) | VWD-3x00(RS) | FLD-3x00(RS) |
|---|---|---|---|---|---|
| Analytical flow cell (13µL, SST, 12 MPa) | 1 | **6082.0100** | X | | |
| Semi-analytical flow cell (5µL, SST, 12 MPa) | 1 | **6082.0200** | X | | |
| Semi-micro flow cell (2.5µL, SST, 12 MPa) | 1 | **6082.0300** | X | | |
| Analytical flow cell (13µL, PEEK, 5 MPa) | 1 | **6082.0400** | X | | |
| Semi-micro flow cell (2.5µL, PEEK, 5 MPa) | 1 | **6082.0500** | X | | |
| Semipreparative flow cell (0.7µL, PEEK, 10 MPa) | 1 | **6082.0600** | X | | |
| Flow cell, analytical (11µL, SST, 12 MPa) | 1 | **6074.0250** | | X | |
| Flow cell, semi-micro (2.5µL, SST, 12 MPa) | 1 | **6074.0360** | | X | |
| Flow cell, analytical (11µL, PEEK, 5 MPa) | 1 | **6074.0200** | | X | |
| Flow cell, semi-micro (2.5µL, PEEK, 5 MPa) | 1 | **6074.0300** | | X | |
| Flow cell, semi-preparative (0.7µL, PEEK, 10 MPa) | 1 | **6074.0320** | | X | |
| Flow cell, Mic (180nL, fused silica, 20 MPa) | 1 | **6074.0290** | | X | |
| Flow cell, capillary (45nL, fused silica, 20 MPa) | 1 | **6074.0280** | | X | |
| Flow cell, nano (3nL, fused silica, 20 MPa) | 1 | **6074.0270** | | X | |
| UV monitor, ultra-low dispersion (45nL, fused silica, 30 MPa) | 1 | **6074.0285** | | X | |
| Flow cell, dummy | 1 | **6074.0190** | | X | |
| Flow cell, analytical (8µL, SST, 2 MPa) | 1 | **6078.4230** | | | X |
| Flow cell, micro (2µL, SST, 4 MPa) | 1 | **6078.4330** | | | X |

## Accessories and Spare Parts for UltiMate 3000 Optical Detectors

| Description | Quantity | Cat. No. | DAD-3000(RS) MWD-3000(RS) | VWD-3x00(RS) | FLD-3x00(RS) |
|---|---|---|---|---|---|
| Deuterium lamp | 1 | **6074.1110** | X | X | |
| Tungsten lamp | 1 | **6074.2000** | X | X | |
| DAC board | 1 | **6082.0305** | X | X | X |
| DAC cable (analog out) | 1 | **6074.0002** | X | X | |



## Accessories and Spare Parts for the Use with the UltiMate 3000 PCM-3000 pH and Conductivity Monitor

| Description | Quantity | Cat. No. |
|---|---|---|
| pH flow cell, 28µL (PEEK) | 1 | **6082.2030** |
| pH electrode for PCM-3000 | 1 | **6082.2020** |
| Dummy electrode for PCM-3000 | 1 | **6082.2042** |
| Conductivity flow cell, 21µL (Ti) | 1 | **6082.2060** |

## Accessories and Spare Parts for the Use with the UltiMate 3000 ECD-3000RS Detectors

| Description | Quantity | Cat. No. |
|---|---|---|
| In-Line Filter Kit with Graphite Filter Elements | 1 | **70-0893** |
| In-Line Filter Kit with PEEK Filter Elements | 1 | **70-4093** |
| Filter Element (Graphite) | 5 | **70-0898** |
| Filter Element (PEEK) | 5 | **70-3824** |
| Amperometric Cell 6041RS ultra (25nL or 50nL, glassy carbon or boron-doped diamond, 1.4 MPa) | 1 | **6070.3000** |
| Gasket for Amperometric Cell 6041RS (25nL, boPET) | 5 | **6070.2528** |
| Gasket for Amperometric Cell 6041RS (50nL, boPET) | 5 | **6070.2529** |
| Working Electrode for Amperometric Cell 6041RS (boron-doped diamond, BDD) | 1 | **6070.3100** |
| Working Electrode for Amperometric Cell 6041RS (glassy carbon, GC) | 1 | **6070.3200** |
| Coulometric Cell 6011RS ultra (7.06µL, micro-porous graphite carbon, 4 MPa) | 1 | **6070.2400** |
| Potentiostat Module, dual channel DC | 1 | **6070.1400** |
| Cell Simulator – SimulatorRS | 1 | **6070.4100** |
| Cell Simulator – QualifierRS | 1 | **6070.4200** |

## Accessories and Spare Parts for the Use with Charged Aerosol Detectors

| Description | Quantity | Cat. No. | Corona CAD | Corona ultra RS |
|---|---|---|---|---|
| Gas Filter Assembly (HEPA/Carbon) | 1 | **70-6224** | X | X |
| Corona Waste Bottle Cap Assembly | 1 | **70-7754** | X | X |
| Bottle, 5.0 L Waste (Compatible with 70-7754 only) | 1 | **70-7751** | X | X |
| Filter-HPLC Inline | 1 | **70-4538** | X | X |
| Drain/Vent Tubing Assembly | 1 | **70-7115** | X | X |
| Gas Inlet Tubing (¼") | 1 | **70-6260** | X | X |
| Gas Exhaust Hose Assembly | 1 | **70-6261** | X | X |
| Maintenance Kit for Nitrogen Generator | 1 | **70-6230** | X | X |
| Corona ultra RS Waste Level Detector Assembly | 1 | **70-9363R** | | X |

# UltiMate 3000 Automated Fraction Collector

## Sample Racks and Accessories for the Use with the UltiMate 3000 AFC-3000

| Description | Quantity | Cat. No. |
|---|---|---|
| **Sample Racks** | | |
| Sample Rack (10 position) for 10mL vials, 22mm × 45mm | 1 | **6820.4086** |
| Sample Rack (22 position) for 4mL vials, 15mm × 45mm | 1 | **6820.4084** |
| Sample Rack (40 position) vfr 2mL vials, 12mm × 32mm | 1 | **6820.4070** |
| Sample Rack (21 position) for 50mL tubes, 30mm × 100mm | 1 | **6702.0021** |
| Sample Rack (24 position) for 30mL tubes, 24mm × 100mm | 1 | **6702.0024** |
| Sample Rack (40 position) for 20mL tubes, 20mm × 100mm | 1 | **6702.0040** |
| Sample Rack (60 position) for 14mL tubes, 16mm × 100mm | 1 | **6702.0060** |
| Sample Rack (90 position) for 8mL tubes, 13mm × 100mm | 1 | **6702.0090** |
| Sample Rack (36 position) for Foxy vials, scintillation vials, 28mm OD | 1 | **5701.2025** |
| Sample Rack (60 position) for Foxy vials, 1.5mL | 1 | **5701.2023** |
| Sample Rack (72 position) for Foxy mini tubes, 18mm OD | 1 | **5701.2024** |
| Positioning pins for Foxy racks | 2 | **6702.9006** |
| Funnel rack | 1 | **6702.1021** |
| Adapter for 4 WPS racks | 1 | **6702.0100** |
| Adapter for 4 well plates | 1 | **6702.0200** |
| Adapter for 2 well plates (Foxy Jr./R1) | 1 | **5701.2021** |
| **Accessories** | | |
| Diverter valve, 0.4mm ID drop former, and tubing ("Kit for low flow rates") | 1 | **6702.0300** |
| Drop former, 1mm ID SST, including grounding cable ("Kit for normal-phase LC") | 1 | **6702.0400** |

Find the Vials and Closures portfolio on page **2-001**.

# UltiMate 3000 RSLC Nano System

The UltiMate 3000 RSLCnano System was developed with throughput in mind. The robust, continuous direct-flow delivery is designed for interruption-free analysis. The wide flowpressure footprint enables the application of UHPLC to the nano scale, allowing analysts to tune for the highest resolution or the fastest analysis time, even for tryptic peptide samples of utmost complexity. Configurable for speed, separation power, or sensitivity, the UltiMate 3000 RSLCnano is the only system to deliver all.

### Consumables and Spare Parts for UltiMate 3000 RSLC Nano Systems

| Description | Quantity | Cat. No. |
|---|---|---|
| Maintenance kit for NCS-3500RS loading pump | 1 | **6042.1951** |
| Check valve cartridge, ceramics (for both the inlet and outlet valve) for the NC pump and loading pump | 1 | **6041.2301** |
| Column switching valve; 2-position, 6-port valve | 1 | **6041.0004** |
| Column switching valve; 2-position, 10-port valve | 1 | **6041.0001** |
| Flow meter, biocompatible with flow selector for nano LC (50 – 1000nL/min) | 1 | **6041.7901A** |
| Flow meter, biocompatible with flow selector for capillary LC (0.5 – 10µL/min) | 1 | **6041.7902A** |
| Flow meter, biocompatible with flow selector for micro LC (5 – 50µL/min) | 1 | **6041.7903A** |
| Flow selector for nano LC (50 – 1000nL/min) | 1 | **6041.0002** |
| Flow selector for capillary LC (0.5 – 10µL/min) | 1 | **6041.0003** |
| Flow selector for micro LC (5 – 50µL/min) | 1 | **6041.0014** |
| Mixer kit (8µL) for capillary LC | 1 | **6041.7130** |
| Piston (sapphire) | 2 | **6040.0042** |
| Piston seal (in plate of seal wash system), NP, for NC pump and loading pump | 1 | **6040.0306** |
| Piston seal (main piston seal), RP, for NC pump and loading pump | 2 | **6266.0305** |
| Support ring for main piston seal for NC pump and loading pump | 2 | **6040.0012** |
| Pump head, entire assembly, for NC pump | 1 | **6041.1901A** |
| Pump head, entire assembly, for loading pump | 1 | **6041.1902** |
| Rear seal wash system, seals | 1 | **6040.2208** |
| Column installation/capillary clips kit (6 column clips, 2 clips to attach capillaries routed from top to bottom through the column chamber) | 1 | **6041.0011** |
| Tubing from proportioning valve to pump head, loading pump (with fittings) | 2 | **6040.3023** |

# EASY-nLC 1000 Liquid Chromatograph

Thermo Scientific™ EASY-nLC 1000 Liquid Chromatograph provides effortless split-free, nano-flow UHPLC performance up to 1000 bar with minimal investment. Dual in-line flow sensors before mixing gives uncompromising gradient precision.

Identify more peptides and increase productivity with higher pressure without compromising reliability and robustness.

### Common replacement parts for EASY-nLC 1000 Systems

| Description | Cat. No. |
|---|---|
| Pump Piston Seal Replacement Kit (contains four spring-energized piston seals and a piston seal tool) | **LC510** |
| Valve rotor seal (contains one rotor seal) | **LC228** |
| Autosampler needle, ASC model | **LC302** |
| Column Out solvent line | **LC560** |
| Waste In solvent line | **LC562** |
| Flow sensor filters (contains four flow sensor filters) | **LC542** |

# Accessories, Consumables and Spare Parts for Thermo Scientific Accela High Speed LC

## Accela Accessory Kits

| Description | Quantity | Cat. No. |
|---|---|---|
| Accela Pump accessory kit | 1 | **60157-62001** |
| LC/MS system solvent interconnect kit | 1 | **F5050-010** |
| Kit, maintenance, Accela Pump | 1 | **60157-62002** |
| Kit, Seal, Accela Pump | 1 | **60157-62003** |
| Accela Autosampler Accessory Kit | 1 | **60357-62001** |
| Accela PDA Detector accessory kit | 1 | **60257-62001** |

## Accela Autosampler Consumables

| Description | Quantity | Cat. No. |
|---|---|---|
| Assembly, needle, inert | 1 | **60357-60017** |
| Assembly, needle tubing | 1 | **60053-60102** |
| Assembly, wash bottle kit | 1 | **60053-60041** |
| Assembly, syringe valve | 1 | **A3692-010** |
| Assembly, transfer tube, 0.012in ID | 1 | **60053-60014** |
| Cooling Adapter, 96 well | 1 | **60053-20002** |
| Filter, flush solvent | 1 | **A4258-010** |
| Grease, Silicon/Teflon (for lead screw) | 1 | **00301-01910** |
| Kit, maintenance Accela Autosampler | 1 | **60357-62002** |
| Kit, needle tubing | 1 | **60053-62043** |
| Kit, wash bottle | 1 | **60053-62009** |
| Ferrule Front, Swagelok | 1 | **00101-08-00001** |
| Ferrule Back, Swagelok | 1 | **00101-08-00002** |
| Lubricant, Triflow | 1 | **1611-0030** |
| Nut, compression, long, 10-32, 1/16in OD tube | 1 | **00101-07-00001** |
| Port, needle | 1 | **60053-20031** |
| Syringe, concentric, 100µL | 1 | **F1100-010** |
| Syringe, concentric, 250µL | 1 | **F1100-020** |
| Syringe, concentric, 500µL | 1 | **F1100-030** |
| Plunger, replacement, concentric, 100µL | 1 | **F1123-010** |
| Plunger, replacement, concentric, 250µL | 1 | **F1123-020** |
| Plunger, replacement, concentric, 500µL | 1 | **F1123-030** |
| Reservoir vials, 16mL | 1 | **00301-07527** |
| Retainer, needle port (injection port) | 1 | **60053-10035** |
| Syringe, standard, 2500µL (with needle tubing ext) | 1 | **60053-62002** |
| Syringe, 2.5mL | 1 | **60053-60006** |
| Sample Loop, 5µL | 1 | **00109-99-00007** |
| Sample Loop, 10µL | 1 | **00109-99-00008** |
| Sample Loop, 20µL | 1 | **00109-99-00009** |
| Sample Loop, 25µL | 1 | **00109-99-00010** |
| Sample Loop, 50µL | 1 | **00109-99-00011** |
| Sample Loop, 100µL | 1 | **00109-99-00012** |
| Sample Loop, 500µL | 1 | **00109-99-00013** |
| Sample Loop, 1000µL | 1 | **00109-99-00014** |
| Stripper | 1 | **F1034-010** |
| Valve, injector | 1 | **00110-03-00013** |
| Seal, Rotor | 1 | **00109-99-00021** |
| Rotor, Valco injection valve | 1 | **00110-03-00019** |
| Tubing assembly, 2.5mL syringe | 1 | **60053-60005** |

## Accela Open Autosampler Consumables

| Kit Description | Cat. No. |
|---|---|
| Kit, asp tube, Accela Open A/S, RoHS PAL DilAspKit | **00950-01-00311** |
| Loop, hldg, dlw, Accela Open A/S, RoHS PAL DLWLoop | **00950-01-00317** |
| Screw, syringe, Accela Open A/S, RoHS PAL DLW Screw | **00950-01-00322** |
| Tool, needle, Accela Open A/S, RoHS PAL DLW NdTool | **00950-01-00323** |
| Holder, needle, dlw, Accela Open A/S, RoHS PAL DLWNHA | **00950-01-00324** |
| Syringe, dlw, Accela Open A/S, RoHS SyrC DLW 100-R | **00950-01-00325** |
| Plunger, syringe, dlw, Accela Open A/S, RoHS PLG DLW 100 | **00950-01-00326** |
| Holder, needle, dlw, Accela Open A/S, RoHS PAL DLWPlg | **00950-01-00327** |
| Needle kit, dlw, 3PK, Accela Open A/S, RoHS PAL DLWNdl | **00950-01-00328** |
| Kit, dlw replament, Accela Open A/S, RoHS PAL DLW Option | **00950-01-00330** |
| Kit, insert, dlw, Accela Open A/S, RoHS PAL DLW Insert | **00950-01-00334** |
| Tube, waste, dlw, Accela Open A/S, RoHS PAL TubeWaste | **00950-01-00335** |
| Valve, inject, 18K, Accela Open A/S, RoH N/A | **00950-01-00336** |
| Rotor, Inj Valve, VALCO 18KPSI, RoHS C72-16R6 | **00110-03-00019** |
| Stator Inj Valve, VALCO 18KPSI, RoHS C72V-6C96 | **00950-01-00337** |

## Accela PDA Accessories

| Description | Quantity | Cat. No. |
|---|---|---|
| Filter Wheel for linearity calibration, (5 position; 1 cuvette with perchloric acid blank and 4 cuvettes with different concentrations of potassium dichromate in perchloric acid solution, NIST traceable) | 1 | **803264** |
| 10mm flowcell assembly, with inlet/outlet tubing and fittings (1cm LightPipe) | 1 | **803265-01** |
| Flowcell Assembly, with inlet/outlet tubing and fittings (5cm Lightpipe) | 1 | **803237-01** |
| Backpressure regulator | 1 | **802259** |
| FingerTight PEEK Ferrule Nuts | 1 | **2522-0285** |
| Inlet tubing, with insulation, PEEK 1/16 x 0.005in ID (red) | 1 | **803260** |
| Outlet tubing, PEEK 1/16 x 0.01in ID (blue) | 1 | **703950** |

## Accela Pump Liquid Displacement Assembly Parts

| Description | Material | Quantity | Cat.No. |
|---|---|---|---|
| Seal, film, PEEK, Accela pump | PEEK | 4 | **00950-01-00122** |
| Seal, high pressure, GFP, Accela pump | PTFE/GFP/Ti | 2 | **00950-01-00129** |
| Valve, check, outlet, Accela pump | Ti/ruby/sapphire | 1 | **00950-01-00131** |
| Valve, check, inlet, Accela pump | Ti/ruby/sapphire | 1 | **00950-01-00130** |
| Cartridge, blind, inlet, Accela pump | PEEK | 1 | **00950-01-00120** |
| Piston, sapphire | Sapphire | 2 | **00950-01-00126** |
| Secondary piston seal (wash seal) | PE/SS | 2 | **00950-01-00128** |

## Accela 1250 Pump Liquid Displacement Assembly

| Description | Quantity | Cat. No. |
|---|---|---|
| UHP PEEK sealing ring | 5 | **00950-01-00284** |
| Check valve, Titanium and ruby | 2 | **00110-05110** |
| Piston unit, sapphire | 2 | **00950-01-00126** |
| Secondary piston seal (GFP) | 2 | **00950-01-00129** |
| Primary piston seal (GFP) | 2 | **00950-01-00129** |

## Accela 600 Pump Spare Parts

| Description | Quantity | Cat. No. |
|---|---|---|
| O-ring, 2.69mm x 1.14mm, perfluor | 1 | **00950-01-00286** |
| Kit, inlet tubing, Accela 600 pump | 1 | **60157-62008** |
| Mixer, static, 65µL, Accela 600 pump, RoHS | 1 | **00950-01-00292** |
| Seal, H/P | 2 | **00107-18110** |
| Piston, 1/8", TZP | 2 | **00201-11324** |
| Valve, check | 2 | **00110-05110** |
| Seal, face, PEEK, check valve | 5 | **00950-01-10013** |
| Seal, piston, secondary | 2 | **00107-18114** |

# Accessories, Consumables and Spare Parts for Thermo Scientific LC-MS Systems

## Ion Traps and Orbitrap Series

Thermo Scientific™ Orbitrap™ LC-MS systems are the recognized standards for high-resolution, accurate-mass measurements.

Orbitrap LC-MS technology routinely delivers the superior mass resolution and mass accuracy necessary to reduce analysis times and increase confidence in results. This makes it the platform of choice for the most confident protein and metabolite identification, characterization and quantitation. Combined with superior dynamic range and unsurpassed sensitivity, Orbitrap systems are the only mass spectrometers capable of providing all four benefits at the same time, without compromise.

With market and technology leadership for over 25 years, we offer ion trap LC-MS systems for every application and budget. Ion trap LC-MS systems offer unique capabilities such as $MS^n$ and data-dependent analysis along with excellent full-scan sensitivity to provide routine detection and rapid identification of low-level analytes. Ion trap systems support a variety of applications from compound identification and routine HPLC detection through the most demanding analyses of low-level components in complex biological matrices.

## TSQ Series Triple Quadrupole LC-MS

Robust triple-stage quadrupole LC-MS systems enable ultra-sensitive quantitation of target compounds in complex matrices.

TSQ Series triple-stage quadrupole LC-MS systems offer a wide range of capabilities. From the value-conscious Thermo Scientific™ TSQ Endura™ LC-MS to the precise Thermo Scientific™ TSQ Quantiva™ LC-MS, our mass spectrometers couple perfectly with our HPLC, UHPLC, and nano-LCs to easily accommodate complex matrices encountered in a variety of applications.

## MSQ Plus Single Quadrupole LC-MS

Our single quadrupole LC-MS system offers superior ease-of-use and modest price and space requirements.

The system can be used with both HPLC and IC systems in a wide range of applications and methodologies.

# Ion Traps and Orbitrap Series

## API Source Components

| Description | Cat. No. |
|---|---|
| USI ESI probe | **OPTON-20011** |
| USI APCI probe | **OPTON-20012** |
| Capillary heater cage assembly, for LTQ & LTQ XL | **97055-60040** |
| Capillary heater cage assembly, for the LXQ & LCQ Fleet | **97055-60181** |

## Accessory Kits

| Description | Cat. No. |
|---|---|
| TSQ Quantum forepump kit (used with LTQ series) | **70111-62014** |
| Hose and accessories kit, LTQ & LTQ XL | **97055-62007** |
| Hose, single mechanical pump accessory, LXQ & LCQ Fleet | **97055-60135** |
| LTQ series ship kit | **70111-62033** |
| Accessory Kit, LTQ/LTQ XL | **97055-62044** |
| Accessory Kit, LXQ & LCQ Fleet | **97055-62045** |

## Chemicals

| Description | Cat. No. |
|---|---|
| LCQ chemicals kit, for LTQ & LCQ series | **97000-62042** |
| Met-Arg-Phe-Ala, 20mg | **00301-07709** |
| Ultramark 1621 | **00301-12200** |
| Caffeine, 1mg/mL | **00301-12310** |
| Reserpine, 1g | **00301-12901** |

## Pressure Gauges

| Description | Cat. No. |
|---|---|
| Ion gauge | **00105-01525** |
| Ion gauge o-ring, 0.737id 3/32 THK Viton | **00107-10056** |

## Metal Needle Kits

| Description | Cat. No. |
|---|---|
| 32-Gauge metal needle kit for high flow LC flow rates between 5µL/min to 400µL/min Uses 32-gauge needle, (P/N 00950-00954) | **OPTON-53003** |
| 34-Gauge metal needle kit for low flow LC flow rates between 500nL/min to 10µL/min Uses 34-gauge needle, (P/N 97144-20040) | **OPTON-30004** |

## Fittings, Ferrules, Sample Loops and Tubing

| Description | Cat. No. |
|---|---|
| Fitting, HPLC, adaptor 10-32 x 1/4 PEEK | **00101-18080** |
| Fitting, nut, fingertight, HPLC, 10-32, PEEK | **00101-18081** |
| Fitting, fingertight, 2, Upchurch | **00101-18195** |
| Fitting, flangeless, 1/8in, Delrin, green | **00101-18198** |
| Fitting, flangeless, 1/8in, Delrin, blue | **00101-18200** |
| Fitting, plug, 1/4-28, Tefzel | **00101-18075** |
| Nut, LC, 1/16in, ss, Rheodyne | **2522-0066** |
| Ferrule, LC, 1/16in, ss, Rheodyne | **2522-3830** |
| Ferrule, 0.008in ID, Kel-F HPLC | **00101-18114** |
| Ferrule, 0.012in ID, Kel-F HPLC | **00101-18116** |
| Ferrule, 0.016in ID, PEEK, HPLC | **00101-18120** |
| Ferrule, Fingertight 2, Upchurch | **00101-18196** |
| Ferrule, 1/8in, Tefzel | **00101-18199** |
| Fitting, grounding union, 1/16, ss | **00101-18182** |
| Fitting, LC union, 0.010in orifice, PEEK | **00101-18202** |
| Fitting, LC TEE union, 0.020in orifice, PEEK | **00101-18204** |
| 5µL sample loop, ss | **00110-22026** |
| 10µL sample loop, ss | **00110-22012** |
| 20µL sample loop, ss | **00110-22028** |
| 50µL sample loop, ss | **207180** |
| 100µL sample loop, ss | **00110-22018** |
| 500µL sample loop, ss | **00110-22020** |
| 1mL sample loop, ss | **00110-22022** |
| Tubing, 0.15mm ID x 0.39mm OD fused-silica capillary for APCI sample tube | **00106-10498** |
| Tubing, 0.10mm ID x 0.19mm OD fused-silica capillary for ESI sample tube | **00106-10499** |
| Tubing, 0.05mm ID x 0.19mm OD fused-silica capillary for ESI sample tube for low flow up to 200µL/min | **00106-10502** |
| Tubing, 0.1mm ID x 0.363mm OD fused-silica capillary for infusion line | **00106-10504** |
| Tubing, 0.075mm ID x 0.3193mm OD fused-silica capillary for low flow applications instead of metal needle | **00106-10511** |
| Teflon tube, .03in ID x 1/16in OD for syringe adapter assembly | **00301-22915** |
| Tubing, 1in ID x 3/16in, Tygon | **00301-22922** |
| Hose, 1.5in ID, PVC reinforced | **00301-24163** |

# TSQ Series Triple Quadrupole LC-MS

## Chemicals

| Description | Quantity | Cat. No. |
|---|---|---|
| Cesium iodide | 1 x 1g vial | **HAZMAT-01-00004** |
| TSQ Quantum AM calibration kit | 1 | **70111-62029S** |
| Reserpine | 1 x 1g vial | **00301-12901** |
| Polytyrosine-1,3,6 calibration solution (liquid) | 1 x 20mL | **00301-22924** |
| Polytyrosine-1,3,6 calibration standard (solid) | 1 | **00301-22925** |
| FC43 calibration liquid | 1 vial | **50010-30059** |
| Syringe Adapter Kit for infusion of calibrant | 1 | **70005-62011** |

## Ion Transfer Tubes, Seals and O-rings

| Description | Quantity | Cat. No. |
|---|---|---|
| TSQ Quantiva | 1 | **80100-20641** |
| TSQ Endura | 1 | **70005-20606** |
| TSQ Quantum Access | 1 | **70111-20972** |
| TSQ Quantum Ultra, Ultra AM & Ultra EMR | 1 | **97055-20199** |
| TSQ Quantum Discovery Max | 1 | **70111-20396** |
| TSQ Quantum, Quantum AM & Quantum Discovery | 1 | **70111-20100** |
| TSQ Vantage, Vantage AM & Vantage EMR | 1 | **70005-20423** |
| Seal for ion transfer tube (TSQ Quantiva) | 1 | **70005-20922** |
| Graphite vespel o-ring (not TSQ Quantiva) | 1 | **97055-20442** |

## Metal Needle Kits

| Description | Quantity | Cat. No. |
|---|---|---|
| Metal Needle Insert Standard Flow (TSQ Quantiva and TSQ Endura) | 1 | **80000-60317** |
| Metal Needle Insert Low Flow (TSQ Quantiva and TSQ Endura) | 1 | **80000-60152** |
| 32-Gauge Metal Needle Insert<br>LC Flow rates between 5µL/min to 2000µL/min<br>Contains Metal Needle PN 70005-20434 | 1 | **OPTON-53010** |
| 34-Gauge Metal Needle Insert<br>LC Flow rates between 1µL/min to 10µL/min<br>Contains Metal Needle PN 70005-20483 | 1 | **OPTON-53011** |
| High flow metal needle kit | 1 | **OPTON-20004** |
| Low flow metal needle kit | 1 | **OPTON-20005** |
| High flow metal needle kit | 1 | **OPTON-20016** |
| Low flow metal needle kit | 1 | **OPTON-20017** |
| High flow metal needle kit | 1 | **OPTON-53003** |
| Low flow metal needle kit | 1 | **OPTON-30004** |
| H-ESI metal needle kit | 1 | **OPTON-20034** |

## MS Maintenance Kit

| Description | Quantity | Cat. No. |
|---|---|---|
| MS maintenance kit | 1 | **70111-62032** |
| Ferrule, 0.008 ID, Kel-F (for fused silica sample tube) | 2 | **00101-18114** |
| Tubing, fused-silica, 0.10 ID x 0.19 OD (fused silica sample tube) | 6ft | **00106-10499** |
| O-ring, Viton, 0.125 ID x 1/16 (for source mount assembly gas connections) | 2 | **00107-02550** |
| Fitting, HPLC, 10-32, short one-piece, 10/pk, RoHS | 3 | **00109-99-00016** |
| Oil, vacuum pump, 1 liter | 3 | **00301-15101** |
| Syringe, 500µL, Gastight | 1 | **00301-19016** |
| Tubing, PEEK, 0.005in ID x 1/16in OD, red | 3ft | **00301-22912** |
| Tube, Teflon, 0.03in ID x 1/16in OD (for syringe adapter) | 0.1ft | **00301-22915** |
| Polytyrosine-1,3,6 calibration standard (liquid) | 1 | **00301-22924** |
| Screw, 6-32 x 3/8 (used to secure front panels to chassis) | 2 | **00405-63266** |
| Screw, 6-32 x 5/16 (used to secure side panels and EMI shield to chassis) | 2 | **00407-63205** |
| Screw, 4 x 6mm (used to secure PS2 and PS3 to chassis) | 2 | **00407-90000** |
| Screw, 8-32 x 3/8 (used to secure top cover to chassis) | 2 | **00415-83206** |
| O-ring, graphite Vespel (for ion transfer tube) | 1 | **97055-20442** |

## ESI Needles and Needle Seal

| Description | Quantity | Cat. No. |
|---|---|---|
| ESI needle | 1 | **00950-00990** |
| ESI needle seal | 1 | **00950-00952** |
| H-ESI needle | 1 | **97055-20273** |
| H-ESI needle seal | 1 | **97055-20271** |

## Viper Fittings (for grounded union to sprayer/probe)

| Description | Cat. No. |
|---|---|
| Viper Capillary, 65 µm x 150 mm PEEK | **6041.5615** |
| Viper Capillary, 130 µm x 150 mm PEEK | **6041.5616** |
| Viper Kit, 65 µm x 150mm PEEK (5 capillaries) | **6041.5601** |
| Viper Kit, 130 µm x 150mm PEEK (5 capillaries) | **6041.5602** |

## Pump Oil

| Description | Cat. No. |
|---|---|
| Pump oil for Sogevac sv65 mechanical pump | **HAZMAT-01-00063** |

# MSQ Plus Single Quadrupole LC-MS

## MSQ Plus Kits

| Description | Quantity | Cat. No. |
|---|---|---|
| Annual Maintenance Kit* | 1 | **60111-62014** |
| Probe Heater Repair Kit – insulating teflon parts | 1 | **60111-62010** |
| Surveyor MSQ Test Kit | 1 | **FM104284** |

*The Consumables Kit contains the non-liquid parts required for the upkeep of your MSQ Plus MS Detector including source O-rings, entrance cones, esi/apci capillaries, cone wash assembly, esi probe repair supplies, turbo oil wick

## Consumables and General Spares

| Description | Quantity | Cat. No. |
|---|---|---|
| Probe repair supplies: APCI probe capillary | 1 | **FM102594** |
| ESI probe capillary | 1 | **FM102598** |
| PEEK tube insert For API probe | 1 pk (12) | **FM102591** |
| Graphite 1/16in Vespel ferrule | 1 pk (10) | **6070119** |
| ESI ceramic sleeve | 1 | **FM103394** |
| Calibration solution MSQ version 1.4 and higher | 1 | **60111-01001** |
| Calibration solution MSQ classic version 1.0 | 1 | **FM104285** |
| Titanium entrance cone complete with O-ring | 1 | **60111-60049** |
| Cone wash nozzle assembly | 1 | **FM102521** |
| Cone wash nozzle O-ring | 1pk (10) | **FM101464** |
| Entrance cone spare O-ring | 1pk (10) | **5711000** |
| Exit (Extraction) cone | 1 | **FM102263** |
| Swage connector for 6mm nitrogen tubing | 1 | **00101-02-00006** |
| 6mm x 1/4in NPT nitrogen fitting | 1 | **00103-02-00001** |
| 6mm Teflon tubing for nitrogen supply | Per foot | **00109-99-00004** |
| Pfeiffer turbo replacement oil wick | 1 | **00950-01116** |
| Edwards vacuum pump oil | 1 liter | **00301-15102** |
| ESI probe complete | 1 | **FM102595** |
| APCI probe complete | 1 | **FM102587** |
| Probe heater assembly | 1 | **60111-60023** |
| Vacuum exhaust hose, blue, 1in ID | Per foot | **00301-08301** |
| Hexapole screws – 3 required | 1 | **60111-20055** |
| USB cable 2m | 1 | **00302-99-00008** |
| APCI corona pin needle | 1 | **70005-98033** |

## Software

| Description | Cat. No. |
|---|---|
| Upgrade to MSQ 2.0 with Xcalibur 2.0 includes LC Devices 2.02 | **OPTON-20432** |
| Validation MSQ Plus on Xcalibur 2.0 – MS only | **OPTON-09015** |

## Method Transfer to Accucore 2.6 µm Columns

Containing solid core particles, which are engineered to a diameter of 2.6µm and a very narrow particle size distribution; Accucore HPLC columns allows high speed, high resolution separation, with back pressures significantly lower than those associated with sub-2µm fully porous particles.

When transferring methods from conventional HPLC to a solid core column several approaches can be taken, depending on the analytical needs. If column dimensions are maintained and the particle characteristics, design and diameter, are changed then an improvement in efficiency and, therefore, sensitivity, resolution and peak capacity is obtained. A second approach is to change not only particle characteristics but also column dimensions, which has the benefit of further reducing analysis time and increasing sensitivity.

An understanding of some practical calculations can help to achieve the correct scaling and maintain a consistent assay profile between the original and transferred method. An identical approach can be used when transferring a conventional HPLC analysis to a UHPLC method using columns packed with sub-2µm fully porous particles such as Hypersil GOLD 1.9µm and Syncronis 1.7µm.

There are three main considerations when transferring a method to a shorter column using different particles: Scaling the flow rate, adjusting the injection volume and adjusting the gradient profile. These are discussed in more detail below.*

### 1. Scale the Flow Rate

To maintain an equivalent separation when transferring a method it is important to keep the linear velocity constant between the original and new method. The linear velocity is related to the flow rate, internal diameter of the column and particle size. A simple equation can be derived to calculate the flow rate ($F_2$) required for the new method. This is shown below, normalized for particle size.

$$\mathbf{F_2 = F_1 \times (d_{c2}^2 / d_{c1}^2) \times (d_{p1} / d_{p2})}$$

$F_1$ – original flow rate (mL/min)
$d_{c1}$ – original column internal diameter (mm)
$d_{p1}$ – original column particle size (µm)
$d_{c2}$ – new column internal diameter (mm)
$d_{p2}$ – new column particle size (µm)

### 2. Adjust the Injection Volume

Because sub-3µm solid core based methods are most often transferred to smaller volume columns, the same injection volume will take up a larger proportion of the new column, possibly leading to band broadening or potentially overloading the column. It is therefore important to scale down the injection volume to match the change in column volume. Once again, a simple equation can be used to calculate the injection volume ($V_{i2}$) required for the new method.

$$\mathbf{V_{i2} = V_{i1} \times (d_{c2}^2 \times L_2 / d_{c1}^2 \times L_1)}$$

$V_{i1}$ – original injection volume (µL)
$d_{c1}$ – original column internal diameter (mm)
$L_1$ – original column length (mm)
$V_{i2}$ – new injection volume (µL)
$d_{c2}$ – new column internal diameter (mm)
$L_2$ – new column length (mm)

### 3. Adjust the Gradient Profile

Geometrical transfer of the gradient requires calculation of the number of column volumes of mobile phase in each segment (time interval) of the gradient in the original method to ensure that the new calculated gradient takes place over the same number of column volumes, for the new column.

The following calculation should be performed for each time segment of the gradient, including column re-equilibration. It takes into consideration the void volume of each column ($V_c$, calculation described below), the flow rate in the original method and the flow rate in the new method (calculated in step 1 above) and the time segment in the original method.

$$\mathbf{t_{g2} = t_{g1} \times (V_{c2}/V_{c1}) \times (F_1/F_2)}$$

$t_{g1}$ – Time segment in original gradient (min)
$t_{g2}$ – Time segment in new gradient (min)
$V_{c1}$ – Original column void volume (mL)
$V_{c2}$ – New column void volume (mL)
$F_1$ – Original flow rate (mL/min)
$F_2$ – New flow rate (mL/min)

The void volume of the column is the volume that is not taken up by the stationary phase (approximately 68% of the column volume):

$$\mathbf{V_c = 0.68 \times \pi \times r^2 \times L}$$

$V_c$ – column volume (mL)
L – column length (cm)
r – column radius (cm)

An example of a method transferred following steps 1 to 3 above is illustrated in the following table:

| **Column:** Fully porous 5 µm, 150 x 4.6mm | | **Column:** Accucore RP-MS 2.6 µm, 100 x 2.1mm | | **Column:** Accucore RP-MS 2.6µm, 50 x 2.1mm | |
|---|---|---|---|---|---|
| **Flow rate (mL/min)** | 1.00 | **Flow rate (mL/min)** | 0.4 | **Flow rate (mL/min)** | 0.4 |
| **Inj. volume (µL)** | 1 | **Inj. volume (µL)** | 1.4 | **Inj. volume (µL)** | 0.7 |
| Gradient Time (min) | %B | Gradient Time (min) | %B | Gradient Time (min) | %B |
| 0.0 | 35.0 | 0.0 | 35.0 | 0.0 | 35.0 |
| 10.0 | 60.0 | 3.5 | 60.0 | 1.7 | 60.0 |
| 11.0 | 35.0 | 3.8 | 35.0 | 1.9 | 35.0 |
| 17.0 | 35.0 | 6.0 | 35.0 | 3.0 | 35.0 |
| **Backpressure** | 59 | **Backpressure** | 218 | **Backpressure** | 120 |
| **Resolution** | 2.6 | **Resolution** | 2.5 | **Resolution** | 1.5 |
| **Run Time (minutes)** | 17.0 | **Run Time (minutes)** | 6.0 | **Run Time (minutes)** | 3.0 |
| **Solvent Used (mL)** | 17 | **Solvent Used (mL)** | 2.4 | **Solvent Used (mL)** | 1.2 |

Method transfer conditions from HPLC (150 x 4.6mm, 5µm columns) to Accucore (100 x 2.1mm, 2.6µm and 50 x 2.1mm, 2.6µm columns).
*We offer a convenient method transfer calculator at the Chromatography Resource Center (www.thermoscientific.com/crc)

## System Considerations

To obtain the best data using fast chromatography it is critical that the LC instrument system is optimized to operate under these conditions. All system components for the assay should be considered. System volume (connecting tubing ID and length, injection volume, flow cell volume in UV) must be minimized, detector time constant and sampling rate need to be carefully selected, and when running fast gradients pump dwell volume needs to be minimal.

## Minimizing System Volume

Excess system volume gives rise to band broadening, which has a detrimental effect on the chromatographic performance. This can arise from the column, the autosampler, the tubing connecting the column to injector and detector and in the detector flow cell. The extra column effects become more significant for scaled down separations because of the smaller column volumes and for less retained peaks which have a lower peak volume making it even more critical to minimize extra column dispersion.

## Detector Sampling Rate

With 1.9µm particles, operating parameters can be optimized to give fast analysis. This results in narrow chromatographic peaks which may be of the order of 1-2 seconds or less in width. It is important to scan the detector (whether it is UV or MS) fast enough to achieve optimum peak definition, otherwise resolution, efficiency and analytical accuracy will be compromised.

## Dwell Volume

The HPLC pump dwell volume is particularly important when running high speed applications using fast gradients, typical of high throughput separations on small particle packed columns. This is because the pump dwell volume affects the time it takes for the gradient to reach the head of the column. If we consider a method using a flow rate of 0.4mL/min and a fast gradient of 1 minute, the theoretical gradient reaches the column immediately. A pump with a 65µL dwell volume will get the gradient onto the column in 9.75 seconds. A traditional quaternary pump with a dwell volume of 800µL will take 2 minutes to get the gradient to the column. When running rapid gradients this is too slow and it may become necessary to introduce an isocratic hold at the end of the gradient to allow elution of the analytes.

# Scaling Down a Method

## Reasons to Scale Down a HPLC or LC/MS Method

There are applications where it is desirable to scale down a method without transferring the method to U-HPLC. These reasons may be to:

- Maximize sensitivity when small amounts of sample are available
- Make flow rate compatible with ionization technique in MS detection
- Reduce costs by reducing solvent consumption

## Transfer Method to a Narrower Column

Reducing the scale of a separation by reducing the column internal diameter may be necessary when transferring a method from UV to MS detection, or when only very small amounts of sample are available, such as in drug discovery or proteomics. In the first case ionization technique or source design determines the best flow rate range (see table above) and in the latter case, method sensitivity is maximized because solutes elute in more concentrated chromatographic bands.

If all other method parameters (column length and particle size, column chemistry, mobile phase composition, gradient range and time, separation temperature) are kept unchanged, the change to a narrower column only requires adjustment of the flow rate.

$$\mathbf{F_2 = F_1 \times (d_{c2}/d_{c1})^2}$$

$F_1$ – original flow rate (to be reduced)
$F_2$ – new flow rate
$d_{c1}$ – original column internal diameter
$d_{c2}$ – new column internal diameter

This is applicable to both isocratic and gradient methods. The new method should produce a chromatogram with identical resolution and identical run time. If small changes in retention times and resolution are observed this is generally caused by system dwell volume (discussed below).

## Typical Flow Rates for Analytical, Narrowbore, Capillary and Nanobore Columns (5µm Particles)

| Column ID (mm) | Flow Rate Range (µL/min) | Optimum Flow Rate[1] (µL/min) | Recommended Injection Volume[2] (µL) | API Source |
|---|---|---|---|---|
| 4.6 | 1000 – 1500 | 1250 | 30 | APCI or High flow ESI |
| 3.0 | 400 – 600 | 500 | 10 | APCI or High flow ESI |
| 2.1 | 200 – 300 | 250 | 5 | APCI or Micro-ESI |
| 1.0 | 40 – 60 | 50 | 1 | Micro-ESI |
| 0.5 | 10 – 25 | 12 | 0.35 | Micro-ESI |
| 0.32 | 4 – 10 | 5 | 0.15 | Micro-ESI |
| 0.18 | 1 – 3 | 2 | 0.05 | Micro-ESI |
| 0.1 | 0.4 – 1 | 0.5 | 0.015 | Nanospray |
| 0.075 | 0.2 – 0.5 | 0.3 | 0.01 | Nanospray |

1. Recommended for good efficiency and moderate pressure. Higher flow rates may lead to column voids. Lower flow rates are recommended for washing column bed or changing solvents.
2. Estimates based on negligible loss of efficiency and isocratic elution with sample solvent identical to mobile phase. Larger volumes can be introduced under gradient conditions or using weaker sample solvent.

## Transfer Method to a Shorter Column

In gradient elution, the simplest way to reduce the method cycle time is to reduce the column length. If all other method parameters (column ID and particle size, column chemistry, mobile phase composition, gradient range, flow rate, separation temperature) are kept unchanged the only requirement is to change the gradient time using the equation below, where gradient time is reduced by the same factor as the reduction in column volume.

$$\mathbf{t_{g1}/V_{c1} = t_{g2}/V_{c2}}$$

$t_{g1}$ – gradient time in original method (min)
$t_{g2}$ – gradient time in new method (min)
$V_{c1}$ – original column volume (mL)
$V_{c2}$ – new column volume (mL)

Column volume $V_c$ (mL) can be estimated using:

$$\mathbf{V_c = 0.68 \times \pi \times r^2 \times L}$$

$V_c$ – column volume (mL)
L – column length (cm)
r – column radius (cm)

## Dwell Volume

Dwell volume is just as important when scaling down a method as for method transfer to U-HPLC. The effect of dwell volume on the separation is more significant when narrow columns are used at low flow rates. For instance, if the system has a dwell volume of 2.0mL and a 4.6mm ID column is run at 1mL/min, it takes 2 minutes for the gradient to reach the head of the column; however, if a 2.1mm ID column is used with a 0.4mL/min flow rate it will take 5 minutes for the gradient to reach the column. In high throughput gradient separations using small volume columns, dwell volume causes an increase in run times and longer re-equilibration time between runs.

Several approaches can be taken to minimize these effects:

- Select a pump with a small gradient delay volume (e.g., Thermo Scientific Accela high speed LC system has a delay volume of only 65µL);
- Delay sample injection until gradient has reached the head of the column;
- Set the pump at a higher flow rate and split the flow before the column.

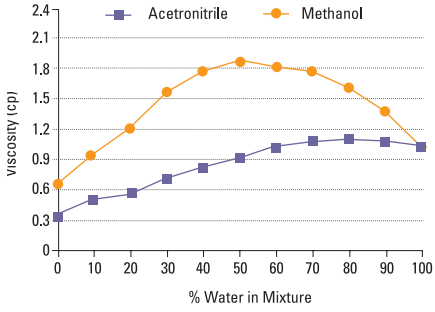
# Scaling Up a Method

## Reasons to Scale Up an HPLC Method

- Increase method capacity
- Isolation and purification of target compounds
- Increase sample throughput

Analytical methods may require scale up to preparative sizes to isolate and purify compounds from mixtures. In choosing the best column and packing material for your preparative application, consider the selectivity and loadability of the media as well as column dimensions, to give the results you need most quickly or economically. We have established a strong reputation for the manufacture and supply of high quality preparative silicas and bonded phases, designed to give the same levels of performance and reproducibility as our popular analytical silica ranges such as the Thermo Scientific Hypersil phases.

Scale up is easiest when starting from an analytical column packed with smaller particle size media offering the same selectivity as the larger particle size preparative media. The leading families of Thermo Scientific phases are offered in various sizes to complement lab scale operations and facilitate the scale up to preparative chromatography. Scout columns, typically 250 x 4.6mm packed with the media of interest can also be used to develop the separation. Once the method is finalized on the smaller column, a scaling factor can be applied.




*Mobile phase viscosity changes with composition*

## Scaling Up to a Preparative Column

Flow rate and column load scaling are only required when changing the internal diameter of the column. The scaling of flow rates allows peak retention times to remain relatively constant between columns with different internal diameters. The typical solvent flow rate through a column is dependent on its internal diameter and the particle size of the column packing material. This scaling factor can also be used to estimate the loading capacity of a given column. Assuming column length is a constant, the scale factor can be calculated using the following formula:

**Scale Factor = $d_{c2}^2/d_{c1}^2$**

$d_{c1}$ – original column internal diameter (mm)
$d_{c2}$ – new column internal diameter (mm)

The column loading capacity and flow rate required for the new larger ID columns can be calculated using this factor.

## Column Backpressure

Column operating backpressure is affected by column length, internal diameter, media particle size, temperature, solvent properties and solvent flow rate. It can also be affected by the use of gradients, where the pressure may vary with solvent composition. Typical operating backpressure for columns or cartridges can be calculated using the following equation:

$$\text{Pressure (atm)} = \frac{2.1 \times \Phi \times L \times \eta}{d_p^2 \times d^2}$$

$\Phi$ = column impedance
(1000 for 4.6mm ID columns)
L = column length (mm)
$d_p$ = particle diameter (µm)
d = column diameter (mm)
$\eta$ = mobile phase viscosity (centipoises)

The mobile phase viscosity varies with composition. As an example, the figure above shows how water viscosity varies with the addition of methanol or acetonitrile. This variability is a critical component in maximizing throughput with respect to the chromatography instrumentation being used.

*Discover eVol XR for precise and accurate dispensing*

**PAGE 1-062**

### Selecting the Media

Media selection for your preparative separation is important. Choose media that has a narrow particle size distribution which will provide high efficiency columns with a low back pressure, since there are no 'fines' to block frits or impede flow. The uniformly spherical particles, with narrow pore size distribution, apparent in Thermo Scientific preparative columns, provide reproducible performance and a longer column life. Media that is available in a range of particle sizes offers choice for scale up applications with controlled selectivity. We offers a range of choices for preparative media in several particle sizes to tailor the media to your application.

### High Load and High Retention – HyperPrep HS

Materials with higher surface area can offer increased loadability. This drive to maximize surface area must be undertaken in a considered manner particularly with regard to particle pore diameter and pore volume. Too high a pore volume will compromise stability and robustness of the bed and too small a pore diameter will influence mass transfer at the expense of efficiency. The high surface area provides enhanced retention of polar compounds. A high carbon loading gives a robust, stable phase. Please contact Technical Support for more information on Thermo Scientific HyperPrep columns and media.

### Peak Shape – Hypersil GOLD Media

In analytical HPLC, the use of packings based on highly pure silica has been shown to improve peak shape. Our highly developed and reproducible manufacturing processes ensure that our leading analytical brand of Hypersil GOLD media is also available in a range of particle sizes suitable for preparative LC without compromise on performance.

### Polar Compounds and Isomers – Hypercarb Columns, Hypersil GOLD aQ

Often when dealing with very polar compounds, achieving sufficient retention can be a challenge. We are able to offer a variety of choices to overcome this common problem: The polar endcapping on Hypersil GOLD aQ provides a controlled interaction mechanism by which moderately polar compounds can be retained. Hypersil GOLD AX can be used in HILIC mode to provide retention of polar compounds. Hypercarb columns offer truly orthogonal selectivity to C18 in reversed phase LC and can be used to retain highly polar compounds. Hypercarb columns can also be used to differentiate between very closely related compounds including geometric and positional isomers.

### Peptides and Proteins – BioBasic and Hypersil GOLD Media

When it comes to the analysis of peptides, the correct selection of packing material becomes ever more important. When deciding on which pore size of packing material to use in the analysis of a polypeptide mix, molecular weight and hydrophobicity of the peptides must be taken into account. Our breadth of silica offerings allow the chromatographer to obtain the best resolution using materials with pore diameters in the 100 to 300Å range. A general rule is that hydrophilic peptides with a molecular weight of less than 2000 daltons can be analyzed using a lower pore volume media, such as Hypersil GOLD media. Above this molecular weight, access to small pores is restricted, and separations tend to be inefficient. For hydrophobic peptides with a molecular weight greater than 2000, a 300Å media such as Thermo Scientific BioBasic is recommended. For the separation of small or hydrophilic peptides, a 100Å material such as HyperPrep HS may give better resolution.

# HPLC Troubleshooting

Before you start any troubleshooting, it is essential to observe safe laboratory practices. Know the chemical and physical properties of any solvents used and have the appropriate Material Safety Data Sheets (MSDSs) readily available. All electrically powered instruments should be shut down and unplugged before starting. Eye protection should also be worn.

The following table lists common HPLC problems encountered, the possible causes and solutions for your quick reference.

| Symptom | Cause | Action |
|---|---|---|
| **Pressure Related Problems** | | |
| Low Pressure | Low viscosity mobile phase. | Confirm expected pressure using the Kozeny-Carmen or similar equation. |
| | Piston seals leaking. | Check for evidence of leaking or wear and replace where necessary. |
| | Leak in system. | Check for and replace any leaking tubing or fittings. |
| | Air in solvent lines or pump. | Ensure that the reservoirs and solvent lines are fully primed and the purge valve is fully closed. |
| High Pressure | High viscosity mobile phase. | Confirm expected pressure using the Kozeny-Carmen or similar equation. |
| | Pump flow-rate malfunction. | Contact manufacturer. |
| | Tubing blocked. | Working backwards from detector outlet, check source of blockage and replace item as necessary. |
| | Guard blocked. | Replace guard cartridge. |
| | Sample precipitation. | Consider sample clarification steps such as filtration or SPE. |
| | Detector blockage. | Clean the flow cell according to the manufacturer's instructions. |
| **Baseline Related Problems** | | |
| Fluctuating Baseline | System not equilibrated. | Equilibrate the column with 10 volumes of mobile phase. |
| | Bubbles in flow cell. | Degas the mobile phase and pass degassed solvent through the flow-cell. Do not exceed the cell's pressure limit. |
| | Contaminated guard. | Replace the guard cartridge. |
| | Contaminated column. | Wash the column using an appropriate solvent. If this does not resolve the problem, replace the column. |
| | Detector contamination. | Clean the flow cell according to the manufacturer's instructions. |
| | Contaminated solvents. | Use freshly prepared solvents of HPLC grade. |
| | Old detector lamp. | Replace the lamp, particularly when this has been in use for > 2000 hours. |
| Sloping Baseline | Contaminated solvents. | Use freshly prepared solvents of HPLC grade. |
| | Gradient mobile phase. | Consider purer solvents or higher wavelengths. Otherwise, this is normal. |
| | System not equilibrated. | Equilibrate the column with 10 volumes of mobile phase. |
| | Leak in system. | Check for and replace any leaking tubing or fittings. |
| | Temperature fluctuations. | Use a thermostatically controlled column oven. |
| | Contaminated column. | Wash the column using an appropriate solvent. Ensure that a gradient method has a wash period at the end. |
| | Pump not mixing solvents properly. | Where being used, ensure that the proportioning valve is mixing the solvents correctly. If the method is isocratic, blend the solvents manually. |
| | Blocked solvent reservoir frits. | Ultrasonicate the reservoir frits in water and then methanol. |
| | Old detector lamp. | Replace the lamp, particularly when this has been in use for > 2000 hours. |
| **Peak Shape Problems** | | |
| Broad Peaks | System not equilibrated. | Equilibrate the column with 10 volumes of mobile phase. |
| | Injection solvent too strong. | Ensure that the injection solvent is the same or weaker strength than the mobile phase. |
| | Injection volume too high. | Reduce the injection volume to avoid overload. Typically injection volumes of < 40% of the expected peak width should be used. |
| | Injected mass too high. | Reduce the sample concentration to avoid mass overload. |
| | Extra column volume too high. | Reduce diameter and length of connecting tubing. Reduce the volume of the flow cell where possible. |
| | Temperature fluctuations. | Use a thermostatically controlled column oven. Higher temperatures will produce sharper peaks. |
| | Old guard cartridge. | Replace the guard cartridge. |
| | Old column. | Do not use columns that have been used with ion-pair reagents for reverse-phase methods. Old columns give much lower efficiencies than new columns. Replace the column if necessary. |
| | Contaminated column. | Wash the column using an appropriate solvent. If this does not resolve the problem, replace the column. |
| | Voided column. | Replace the column. Do not use outside the recommended pH range. |
| Double Peaks | Old guard cartridge. | Replace the guard cartridge. |
| | Contaminated column. | Wash the column using an appropriate solvent. If this does not resolve the problem, replace the column. |
| | Voided column. | Replace the column. Do not use outside the recommended pH range. |
| Negative Peaks | Contaminated solvents. | Use freshly prepared solvents of HPLC grade. |
| | Wrongly wired detector. | Check the signal polarity from the detector to the recording device. |
| | Unbalanced RI detector optics. | Refer to manufacturer's instructions. |
| | Ion pair method. | Inject the sample in the mobile phase. |

| Symptom | Cause | Action |
|---|---|---|
| **Peak Shape Problems** | | |
| Flat topped Peaks | Detector overload. | Reduce the sample concentration. |
| | Detector set-up. | Check the detector attenuation and re-zero. |
| Tailing Peaks | Old guard cartridge. | Replace the guard cartridge. |
| | Injection solvent too strong. | Ensure that the injection solvent is the same or weaker strength than the mobile phase. |
| | Injection volume too high. | Reduce the injection volume to avoid overload. Typically injection volumes of < 40% of the expected peak width should be used. |
| | Injected mass too high. | Reduce the sample concentration to avoid mass overload. |
| | Old column. | Do not use columns that have been used with ion-pair reagents for reversed phase methods. Old columns give much lower efficiencies than new columns. Replace the column if necessary. |
| | Contaminated column. | Wash the column using an appropriate solvent. If this does not resolve the problem, replace the column. |
| | Voided column. | Replace the column. Do not use outside the recommended pH range. |
| Fronting Peaks | Old or damaged column. | Replace the column. |
| **Peak Size and Retention Problems** | | |
| Small Peaks | Degraded sample. | Inject a fresh sample. |
| | Low analyte concentration. | Increase the analyte concentration. |
| | Detector set-up. | Check the detector attenuation and re-zero. |
| | No wash solvent. | Check that the solvent wash reservoir is filled with a miscible solvent and that the injector is set to wash between injections. |
| | Damaged or blocked syringe. | Replace the syringe. |
| | Incorrect amount injected. | Check injector loop size and that no more than 50% of this volume is used for partial loop injections. |
| | Viscous injection solvent. | Reduce syringe draw-time. |
| | Old detector lamp. | Replace the lamp, particularly when this has been in use for > 2000 hours. |
| No Peaks | Sample vial empty. | Fill sample vial. |
| | Leak in system. | Check for and replace any leaking tubing or fittings. |
| | Pump not mixing solvents properly. | Where being used, ensure that the proportioning valve is mixing the solvents correctly. If the method is isocratic, blend the solvents manually. |
| | Damaged or blocked syringe. | Replace the syringe. |
| | Different dwell volume. | For gradient methods, check that the dwell volume of any new system is not very different from any previous system. Apply a final hold time if necessary. |
| | Old detector lamp. | Replace the lamp, particularly when this has been in use for > 2000 hours. |
| Missing Peaks | Degraded sample. | Inject a fresh sample. |
| | Immiscible mobile phase. | Check that any solvent already in the column is miscible with the mobile phase. Flush with propan-2-ol or ethanol where necessary. |
| | Fluctuations in pH. | Buffer the mobile phase so that retention of ionizable compounds is controlled. |
| Extra Peaks | Degraded sample. | Inject a fresh sample. |
| | Contaminated solvents. | Use freshly prepared solvents of HPLC grade. Gradient methods often show 'ghost-peaks'. |
| | Immiscible mobile phase. | Check that any solvent already in the column is miscible with the mobile phase. Flush with propan-2-ol or ethanol where necessary. |
| | Fluctuations in pH. | Buffer the mobile phase so that retention of ionizable compounds is controlled. |
| | Contaminated guard cartridge. | Replace the guard cartridge. |
| | Contaminated column. | Wash the column using an appropriate solvent. If this does not resolve the problem , replace the column. |
| Varying Retention | System not equilibrated. | Equilibrate the column with 10 volumes of mobile phase. |
| | Leak in system. | Check for and replace any leaking tubing or fittings. |
| | Temperature fluctuations. | Use a thermostatically controlled column oven. |
| | Contaminated column. | Wash the column using an appropriate solvent. If this does not resolve the problem, replace the column. |
| | Blocked solvent reservoir frits. | Ultrasonicate the reservoir frits in water and then methanol. |
| | Pump not mixing solvents properly. | Where being used, ensure that the proportioning valve is mixing the solvents correctly. If the method is isocratic, blend the solvents manually. |
| | Contaminated solvents. | Use freshly prepared solvents of HPLC grade. |
| | Different dwell volume. | For gradient methods, check that the dwell volume of any new system is not very different from any previous system. Apply a final hold time if necessary. |
| | Piston seals leaking. | Check for evidence of leaking or wear and replace where necessary. |
| | Air in solvent lines or pump. | Ensure that the reservoirs and solvent lines are fully primed and that the purge valve is fully closed. |

For more information, please request Successful HPLC Operation – A Troubleshooting Guide, TG20094.

# HPLC Definitions and Equations

## Backpressure

The pressure required to pump the mobile phase through the column. It is related to mobile phase viscosity (η), flow rate (F), column length (L) and diameter ($d_c$), and particle size ($d_p$) by the following equation:

$$\text{Pressure Drop (psi)} = \frac{250\, L \eta F}{d_p^2 d_c^2}$$

L = column length (cm)
η = viscosity
F = flow rate (mL/min)
$d_p$ = particle diameter (µm)
$d_c$ = column internal diameter (cm)

## Capacity Factor (k)

Expression that measures the degree of retention of an analyte relative to an unretained peak, where $t_R$ is the retention time for the sample peak and $t_0$ is the retention time for an unretained peak. A measurement of capacity will help determine whether retention shifts are due to the column (capacity factor is changing with retention time changes) or the system (capacity factor remains constant with retention time changes).

$$k = \frac{t_R - t_0}{t_0}$$

## Efficiency *(N)*

Also number of theoretical plates. A measure of peak band spreading determined by various methods, some of which are sensitive to peak asymmetry. The most common are shown here, with the ones most sensitive to peak shape shown first:

**5-Sigma** $N = 25(t_R/W)^2$
W = peak width at 4.4% peak height

**4-Sigma or Tangential** $N = 16(t_R/W)^2$
W = tangential peak width or 13.4% peak height

**Half-Height** $N = 5.54(t_R/W)^2$
W = peak width at 50% peak height

## Elution Volume *($V_R$)*

Refers to the volume of mobile phase required to elute a solute from the column at maximum concentration (apex).

$$V_R = F \cdot t_R$$

where F is flow rate in volume/time and $t_R$ is the retention time for the peak of interest.

## HETP

Height equivalent to a theoretical plate. A carryover from distillation theory: a measure of a column's efficiency. For a typical well-packed HPLC column with 5µm particles, HETP (or *H*) values are usually between 0.01 and 0.03mm.

$$\text{HETP} = L/N$$

where L is column length in millimeters and *N* is the number of theoretical plates.

## Linear Velocity

The flow rate normalized by the column cross section. This effects column performance and is directly related to column pressure. Linear velocity is given by the following equation where L is column length and $t_0$ is the breakthrough time of an unretained peak:

$$\mu = \frac{L}{t_0}$$

## Resolution *($R_s$)*

The ability of a column to separate chromatographic peaks. Resolution can be improved by increasing column length, decreasing particle size, changing temperature, changing the eluent or stationary phase.

$$R_s = \frac{1}{4}\sqrt{N}\left(\frac{k}{1+k}\right)\left(\frac{\alpha - 1}{\alpha}\right)$$

It can also be expressed in terms of the separation of the apex of two peaks divided by the tangential width average of the peaks:

$$R_s = \frac{(t_2 - t_1)}{0.5(W_1 + W_2)}$$

## Selectivity (α)

A thermodynamic factor that is a measure of relative retention of two substances, fixed by a certain stationary phase and mobile phase composition. Where $k_1$ and $k_2$ are the respective capacity factors.

$$\alpha = \frac{k_2}{k_1}$$

## Tailing Factor (T)

A measure of the symmetry of a peak, given by the following equation where $W_{0.05}$ is the peak width at 5% height and f is the distance from peak front to apex point at 5% height. Ideally, peaks should be Gaussian in shape or totally symmetrical.

$$T = W_{0.05}/2f$$

## van Deemter Equation

An equation used to explain band broadening in chromatography. The equation represents the height equivalent of a theoretical plate (H) and has three terms. The A term is used to describe eddy diffusion, which allows for the different paths a solute may follow when passing over particles of different sizes.

The B term is for the contribution caused by molecular diffusion or longitudinal diffusion of the solute while passing through the column. The C term is the contribution of mass transfer and allows for the finite rate of transfer of the solute between the stationary phase and mobile phase. u is the linear velocity of the mobile phase as it passes through the column.

$$H = A + \frac{B}{u} + Cu$$

# Selecting the Right Buffer

A partial list of common buffers and their corresponding pH values is shown in the Common Buffer Systems table. Perhaps the most common HPLC buffer is some form of phosphoric acid. Remember that a true buffer should have the ability to resist pH change when a sample is introduced at a different pH, and that buffer capacity is only 100% at the pK value of the acid or base. At pH 4, phosphate is a poor buffer and would change rapidly toward one of its $pK_a$ values if a more acidic or basic sample were introduced.

As a rule, one should work within ±1pH unit of the buffer $pK_a$ value for good pH control of the mobile phase. Adequate buffer concentrations for HPLC tend to be in the 10-100 millimolar level depending on the size and nature of the sample, as well as the column packing material. Phases based on highly pure silica with robust bondings such as the Hypersil GOLD range, are often more compatible with dilute buffers than traditional packings.

When control at a lower pH (2-3) is desired, phosphate, or stronger organic acids such as TFA or acetic acid, are commonly used. If control at pH 4-5 is desired, an organic acid buffer such as acetate or citrate should be considered in place of phosphate.

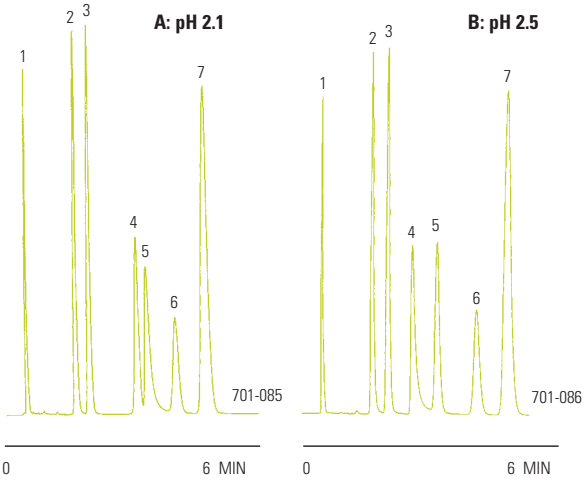
The figure to the right shows the importance of choosing the correct pH for a separation. Even slight changes in pH, either from measuring errors, mixing complications with the pump, or atmospheric water adsorption into the mobile phase, can alter any method if not properly buffered.

Care should be taken when choosing a buffer and organic modifier mixture to ensure that a solution of the two does not produce a solid salt which could cause blockages and system contamination.

Buffers should always be flushed from the analytical column and instrument after use to avoid salts being deposited on delicate frits etc.

### Common Buffer Systems

| Buffer | | $pK_a$ | Useful pH Range | MS-Compatible |
|---|---|---|---|---|
| TFA | | 0.30 | | Yes |
| Phosphate | $pK_1$ | 2.1 | 1.1 – 3.1 | No |
| | $pK_2$ | 7.2 | 6.2 – 8.2 | No |
| | $pK_3$ | 12.3 | 11.3 – 13.3 | No |
| Citrate | $pK_1$ | 3.1 | 2.1 – 4.1 | No |
| | $pK_2$ | 4.7 | 3.7 – 5.7 | No |
| | $pK_3$ | 5.4 | 4.4 – 6.4 | No |
| Formate | | 3.8 | 2.8 – 4.8 | Yes |
| Acetate | | 4.8 | 3.8 – 5.8 | Yes |
| Tris Base (Trizma, THAM) | | 8.3 | 7.3 – 9.3 | Yes |
| Ammonia | | 9.2 | 8.2 – 10.2 | Yes |
| Borate | | 9.2 | 8.2 – 10.2 | No |
| Diethylamine | | 10.5 | 9.5 – 11.5 | Yes |
| Carbonate | $pK_1$ | 6.4 | 5.4 – 7.4 | Yes |
| | $pK_2$ | 10.3 | 9.3 – 11.3 | Yes |
| Triethanolamine | | 7.80 | | Yes |




**BETASIL C18, 5µm, 50 x 4.6mm**

| | |
|---|---|
| Part Number: | 70105-054630 |
| Eluent: | 50% ACN / 50% 25mM $KH_2PO_4$ at pH indicated |
| Flow Rate: | 0.8mL/min |
| Detector: | UV @ 220nm |
| Sample: | 1. Uracil<br>2. Tolmetin<br>3. Naproxin<br>4. Fenoprofen<br>5. Diflunisal<br>6. Indometacin<br>7. Ibruprofen |

*Effect of small changes in pH on the separation of mildly ionizable compounds*

# Buffer Selection for LC/MS

Buffer choice will be very dependent on the analyte and the instrumentation used. Ideally, LC/MS applications should use a volatile buffer as this will not form a contaminating deposit on the source. Inorganic acids, involatile buffers and ion-pair reagents should all be avoided. Typical LC/MS buffers include:

- Ammonium acetate/formate/hydrogen carbonate (< 50mM)
- Formic/acetic acid (0.01 – 1% v/v)
- Trifluoroacetic acid (< 0.1% v/v)
- Trialkylamine (< 0.1% v/v) and aqueous ammonia type bases
- TRIS
- BIS-TRIS propane

**Note:** There are LC/MS instruments available, for example the Thermo Scientific Surveyor MSQ LC/MS, which incorporate a self-cleaning mechanism to reduce the build up of inorganic buffers on the source during routine use. Care should still be taken not to purposefully over-contaminate the instrument source as this will lead to operating difficulties.

# Preparation of Mobile Phases

Correct solvent preparation is very important. It can save vast amounts of time spent troubleshooting spurious peaks, baseline noise etc.

## Quality

All reagents and solvents should be of the highest quality. HPLC grade reagents may cost slightly more than lower grade reagents, but the difference in purity is marked. HPLC grade reagents contain no impurities to produce spurious peaks in a chromatogram baseline whereas lower grade reagents do contain trace levels of impurities, which may produce spurious baseline peaks.

Ensure that any water used in buffer preparation is of the highest purity. Deionized water often contains trace levels of organic compounds and therefore is not recommended for HPLC use. Ultra pure HPLC water (18mΩ resistivity) is generated by passing deionized water through an ion exchange bed. Modern water purification instruments use this mechanism to produce water of suitable quality in high volumes. Preferably, HPLC grade water can be purchased from solvent suppliers.

**Important:** Do not store HPLC grade water in plastic containers. Additives in the plastic may leach into the water and contaminate it. Always store HPLC grade water in glass containers.

## Buffers

All buffers should be prepared freshly on the day required. This practice ensures that the buffer pH is unaffected by prolonged storage and that there is no microbial growth present. Changes in pH and microbial growth will affect chromatography.

If buffer solutions are stored, be aware that they have a finite lifetime. Refer to pharmacopoeia monographs or similar for further guidance on buffer shelf life.

Buffer reagents can contain a stabilizing agent, for example, sodium metabisulphite. These stabilizing agents often affect the optical and chromatographic behavior of buffer solutions, so it is often worth buying reagents that contain no stabilizer. Containers of solid reagent are easily contaminated by repeated use. For this reason, we recommend that reagents be purchased in low container weights.

## Filtration

Ideally, all HPLC solvents should be filtered through a 0.45µm filter before use This removes any particulate matter that may cause blockages. After filtration, the solvents should be stored in a covered reservoir to prevent re-contamination with dust etc.

Filtering HPLC solvents will benefit both your chromatography and the wear and tear of the HPLC system. Pump plungers, seals and check valves will perform better and lifetimes will be maximized.

## Degassing

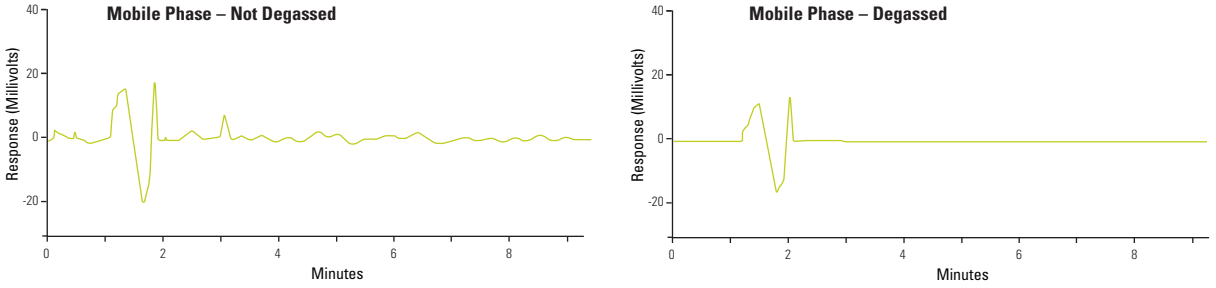
Before the freshly prepared mobile phase is pumped around the HPLC system, it should be thoroughly degassed to remove all dissolved gasses. Dissolved gas can be removed from solution by:

- Bubbling with helium
- Sonication
- Vacuum filtration

If the mobile phase is not degassed, air bubbles can form in the low pressure of the detector cell resulting in problems with system instability, spurious baseline peaks etc.

The most efficient form of degassing is bubbling with helium or another low solubility gas. If this method is available, we recommend that the mobile phase is continually degassed at very low levels throughout the analysis. This will inhibit the re-adsorption of gases over the analysis time.

**Note:** Ensure that the solvent reservoir has a vent to the atmosphere to prevent the build up of pressure inside the reservoir.




*Baseline noise from gas in mobile phase*

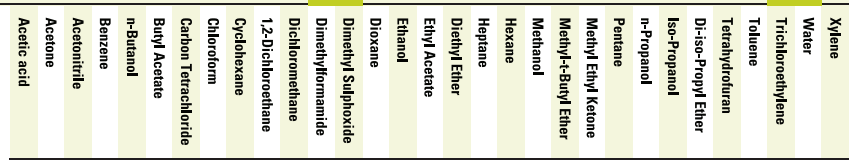
# Solvent Properties (vs Silica Gel) and Miscibility

## Solvent Properties and Miscibility

| Solvent Strength | Polarity Index | UV Cutoff (nm) | Refractive index | Viscosity (cP, 20°C) | Boiling point (°C) | Water solubility (W/W%) | Solvent |
|---|---|---|---|---|---|---|---|
| 0.01 | 0.1 | 215 | 1.391 | 0.50 | 99 | 0.0002 | **Isooctane** |
| 0.04 | 0.0 | 200 | 1.410 | 0.92 | 174 | 0.01 | **n-Decane** |
| 0.05 | 0.1 | 200 | 1.407 | 0.44 | 49 | 0.01 | **Cyclopentane** |
| 0.1 | 1.0 | 220 | 1.402 | 0.45 | 78 | 0.11 | **1-Chlorobutane** |
| 0.21 | 2.1 | 220 | 1.397 | 0.64 | 142 | 0.19 | **n-Butyl Ether** |
| 0.28 | 2.4 | 220 | 1.368 | 0.37 | 68 | 0.62 | **Isopropyl Ether** |
| 0.42 | 3.1 | 233 | 1.424 | 0.44 | 40 | 1.6 | **Methylene Chloride** |
| 0.43 | 4.2 | 334 | 1.396 | 0.51 | 117 | - | **Methyl Butyl Ketone** |
| 0.47 | 4.7 | 320 | 1.451 | 2.00 | 156 | - | **Cyclohexanone** |
| 0.55 | 5.5 | 210 | 1.402 | 1.72 | 125 | Miscible | **Methoxyethanol** |
| 0.6 | 4.5 | 260 | 1.362 | 0.37 | 57 | - | **Methyl Acetate** |
| 0.64 | 6.0 | 380 | 1.344 | 0.67 | 101 | 2.1 | **Nitromethane** |
| 0.65 | 6.5 | 268 | 1.438 | 0.84 | 166 | Miscible | **N,N'-Dimethylacetamide** |
| 0.69 | 6.0 | 265 | 1.447 | 1.65 | 182 | - | **N-Methylformamide** |
| 1.11 | 6.9 | 210 | 1.432 | 19.9 | 198 | Miscible | **Ethylene Glycol** |
| 2 | 6.0 | 260 | 1.372 | 1.26 | 118 | Miscible | **Acetic acid** |
| 0.56 | 5.1 | 330 | 1.359 | 0.36 | 56 | Miscible | **Acetone** |
| 0.65 | 5.8 | 190 | 1.344 | 0.38 | 82 | Miscible | **Acetonitrile** |
| - | 2.7 | 238 | 1.501 | 0.65 | 80 | 0.18 | **Benzene** |
| 0.39 | 3.9 | 215 | 1.399 | 2.98 | 117 | 7.8 | **n-Butanol** |
| - | 4.0 | 254 | 1.394 | 0.73 | 126 | 0.43 | **Butyl Acetate** |
| - | 1.6 | 263 | 1.460 | 0.97 | 77 | 0.08 | **Carbon Tetrachloride** |
| 0.4 | 4.1 | 245 | 1.446 | 0.57 | 61 | 0.815 | **Chloroform** |
| 0.04 | 0.2 | 200 | 1.427 | 1.00 | 81 | 0.01 | **Cyclohexane** |
| - | 3.5 | 228 | 1.445 | 0.79 | 83 | 0.81 | **1,2-Dichloroethane** |
| - | 3.1 | 233 | 1.424 | 0.44 | 40 | 1.3 | **Dichloromethane** |
| 0.64 | 6.4 | 268 | 1.431 | 0.92 | 153 | Miscible | **N-N' Dimethylformamide** |
| 0.62 | 7.2 | 268 | 1.478 | 2.24 | 189 | Miscible | **Dimethyl Sulphoxide** |
| 0.56 | 4.8 | 215 | 1.422 | 1.37 | 101 | Miscible | **Dioxane** |
| 0.88 | 4.3 | 210 | 1.361 | 1.20 | 79 | Miscible | **Ethanol** |
| 0.58 | 4.4 | 256 | 1.372 | 0.45 | 77 | 8.7 | **Ethyl Acetate** |
| - | 2.8 | 218 | 1.352 | 0.23 | 35 | 6.89 | **Diethyl Ether** |
| 0.01 | 0.1 | 200 | 1.388 | 0.40 | 98 | 0.0004 | **n-Heptane** |
| 0.01 | 0.1 | 200 | 1.375 | 0.31 | 69 | 0.0012 | **n-Hexane** |
| 0.95 | 5.1 | 205 | 1.329 | 0.55 | 65 | Miscible | **Methanol** |
| 0.35 | 2.5 | 210 | 1.369 | 0.27 | 55 | 4.8 | **Methyl-t-Butyl Ether** |
| 0.51 | 4.7 | 329 | 1.379 | 0.43 | 80 | 24 | **Methyl Ethyl Ketone** |
| - | 0.0 | 190 | 1.358 | 0.23 | 36 | 0.004 | **Pentane** |
| 0.82 | 4.0 | 210 | 1.385 | 2.30 | 97 | Miscible | **n-Propanol** |
| 0.82 | 3.9 | 205 | 1.378 | 2.40 | 82 | Miscible | **Iso-Propanol** |
| - | 2.2 | 220 | 1.368 | 0.37 | 68 | - | **Di-iso-Propyl Ether** |
| 0.45 | 4.0 | 212 | 1.407 | 0.55 | 66 | Miscible | **Tetrahydrofuran** |
| 0.29 | 2.4 | 284 | 1.496 | 0.59 | 111 | 0.05 | **Toluene** |
| - | 1.0 | 273 | 1.477 | 0.57 | 87 | 0.11 | **Trichloroethylene** |
| 2 | 10.2 | 190 | 1.000 | 1.00 | 100 | - | **Water** |
| 0.26 | 2.5 | 288 | 1.506 | 0.81 | 144 | 0.018 | **o-Xylene** |

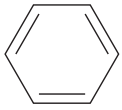
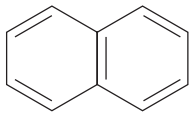
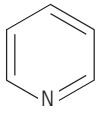
**Data Sourced from:** CRC Handbook of Chemistry and Physics - 73rd Edition
The Merck Index - 12th Edition
High Purity Solvent Guide, Burdick & Jackson Laboratories, Inc.
The HPLC Solvent Guide, 2nd Edition, Paul C Sadek
HPLC Columns, Theory, Technology & Practice, Uwe D Neue
Fisher Solvent Table

**Immiscible**
Those squares shaded as "immiscible" refer to solvent mixes where, in some proportions, two phases will be produced



# Chromophore Detection Wavelengths

Chromophores are light absorbing groups. Their behavior is used to allow the detection of analytes. They have one or more detection wavelengths, each of which has a molar adsorbtivity associated with it. The information contained in the following table is intended as a guide to common chromophores. It is not an exhaustive list.

| Chromophore | | λmax (nm) | εmax (L/m/cm) |
|---|---|---|---|
| Acetylide | -C==C- | 175 – 180 | 6,000 |
| Aldehyde | -CHO | 210 | Strong |
| | | 280 – 300 | 11 – 18 |
| Amine | $-NH_2$ | 195 | 2,800 |
| Azidin | > C=N- | 190 | 5,000 |
| Azo | -N=N- | 285 – 400 | 3 – 25 |
| Benzene |  | 184 | 46,700 |
| | | 202 | 6,900 |
| | | 255 | 170 |
| Carboxyl | -COOH | 200 – 210 | 50 – 70 |
| Ester | -COOR | 205 | 50 |
| Ether | -O- | 185 | 1,000 |
| Ethylene | -C=C- | 190 | 8,000 |
| Ketone | > C=O | 195 | 1,000 |
| | | 270 – 285 | 18 – 30 |
| Napthalene |  | 220 | 112,000 |
| | | 275 | 175 |
| | | 312 | 5,600 |
| Nitrate | $-ONO_2$ | 270 | 12 |
| | $-(C=C)-_2$ acyclic | 210 – 230 | 21,000 |
| | $-(C=C)_3$ | 260 | 35,000 |
| | C=C-C=C | 219 | 6,500 |
| | C=C-C=N | 220 | 23,000 |
| | C=C-C=O | 210 – 250 | 10,000 – 20,000 |
| | $C=C-NO_2$ | 300 – 350 | Weak |
| Nitrile | -C==N | 160 | – |
| | -ONO | 220 – 230 | 1,000 – 2,000 |
| | | 300 – 400 | 10 |
| Nitro | $-NO_2$ | 210 | Strong |
| Nitroso | -N=O | 302 | 100 |
| Oxime | -NOH | 190 | 5,000 |
| Pyridine |   | 174 | 80,000 |
| | | 195 | 6,000 |
| | | 251 | 1,700 |
| Sulfone | $-SO_2-$ | 180 | Very strong |
| Sulfoxide | > S-O | 210 | 1,500 |
| Thioether | -S- | 194 | 4,600 |
| | 215 | 1,600 | |
| Thiol | -SH | 195 | 1,400 |

# Column Cleaning and Regeneration

Testing of column performance can be undertaken using the experimental conditions in the test certificate provided with the column. The column efficiency, capacity factor, etc. should be measured at the start and end of the clean-up procedure to ensure that it has been performed successfully and has improved the column performance.

In all instances, the volume of solvent used is 40 – 60 column volumes unless otherwise stated. Ensure that no buffers or samples are present on the column and that the solvent used prior to the clean up is miscible with the first wash solvent. After the clean up, ensure that the test mobile phase is miscible with the last solvent in the column.

## Normal Phase Media

1. Flush with tetrahydrofuran
2. Flush with methanol
3. Flush with tetrahydrofuran
4. Flush with methylene chloride
5. Flush with benzene-free n-hexane

## Reversed Phase Media

1. Flush with HPLC grade water; inject 4 aliquots of 200µL DMSO during this flush
2. Flush with methanol
3. Flush with chloroform
4. Flush with methanol

## Anion Exchange Media

1. Flush with HPLC grade water
2. Flush with gradient of 50mM to 1M appropriate buffer solution
3. Flush with HPLC grade water
4. Flush with methanol
5. Flush with chloroform

## Cation Exchange Media

1. Flush with HPLC grade water; inject 4 aliquots of 200µL DMSO during this flush
2. Flush with tetrahydrofuran

## Protein Size Exclusion Media

There are two wash/regeneration procedures associated with the removal of contaminants from protein size exclusion media.

### Weakly Retained Proteins

1. Flush with 30mL 0.1M pH 3.0 phosphate buffer

### Strongly Retained Proteins

1. Flush for 60 minutes using a 100% water to 100% acetonitrile gradient

## Porous Graphitic Carbon

There are four wash or regeneration procedures associated with porous graphitic carbon. The one(s) used will depend on the analytes and solvents that have been used with the column

### Acid/Base Regeneration

Suitable for ionized species analyzed in strongly aqueous mobile phases.

1. Invert the column
2. Flush with 50mL tetrahydrofuran:water (1:1) containing 0.1% trifluoroacetic acid
3. Flush with 50mL tetrahydrofuran:water (1:1) containing 0.1% triethylamine or sodium hydroxide
4. Flush with 50mL tetrahydrofuran:water (1:1) containing 0.1% trifluoroacetic acid
5. Flush column with 70 column volumes of THF
6. Flush with methanol/water (95:5) to re-equilibrate
7. Re-invert the column

Author: R. Plumb – Glaxo, UK

### Strong Organic Regeneration

Suitable for applications involving polar and/ or ionized species analyzed in aqueous mobile phases.

1. Flush with 50mL acetone
2. Flush with 120mL dibutylether
3. Flush with 50mL acetone
4. Flush with aqueous mobile phase until equilibrated

### Normal Phase Regeneration

Suitable for applications running predominantly in normal phase mobile phases.

1. Flush with 50mL dichloromethane
2. Flush with 50mL methanol
3. Flush with 50mL water
4. Flush with 50mL 0.1M hydrochloric acid
5. Flush with 50mL water
6. Flush with 50mL methanol
7. Flush with 50mL dichloromethane
8. Flush with mobile phase until equilibrated

Author: A. Karlsson – Uppsala, Sweden

### Removal of TFA and DEA

TFA and DEA have the potential to adsorb to the surface of porous graphitic carbon; after using these additives in the mobile phase, regeneration of the column should be undertaken to ensure the original Hypercarb selectivity and optimum performance will always be achieved. The regeneration is as follows:

1. Removal of TFA: Flush column with 70 column volumes of THF.
2. Removal of DEA: Set column oven to 75°C and flush column with 120 column volumes of ACN.

## Polymeric Media with Metallic Counter Ions

There are three types of regeneration available for polymeric columns with metal counter ion. Details of each procedure are listed in the following table.

| Column Type | Metal Contamination | Organic Contamination | Column Cleaning |
|---|---|---|---|
| Hydrogen Counter Ion | Pump in reverse flow mode at 0.1mL/min with 0.1M $H_2SO_4$ @ 25°C for 4 to 16 hr | Pump in reverse flow mode at 0.1mL/min with 20:80 ACN: $H_2O$ @ 25°C for 4 hr | Pump in reverse flow mode at 0.1mL/min with 20:80 ACN: 0.01M $H_2SO_4$ @ 65°C for 4 hr |
| Calcium Counter Ion | Pump in reverse flow mode at 0.1mL/min with 0.1M $Ca(NO_3)_2$ @ pH 6.3 and 85°C for 4 to 16 hr | Pump in reverse flow mode at 0.1mL/min with 20:80 ACN:$H_2O$ @ 25°C for 4 hr | Pump in reverse flow mode at 0.1mL/min with 20:80 ACN:$H_2O$ @ 25°C for 4 hr |
| Sodium Counter Ion | Pump in reverse flow mode at 0.1mL/min with 0.1M $NaNO_3$ @ 85°C for 4 to 16 hr | Pump in reverse flow mode at 0.1mL/min with 20:80 ACN:$H_2O$ @ 25°C for 4 hr | Pump in reverse flow mode at 0.1mL/min with 20:80 ACN:$H_2O$ @ 25°C for 4 hr |
| Lead Counter Ion | Pump in reverse flow mode at 0.1mL/min with 0.1M $Pb(NO_3)_2$ @ pH 5.3 and 85°C for 4 to 16 hr | Pump in reverse flow mode at 0.1mL/min with 20:80 ACN: $H_2O$ @ 25°C for 4 hr | Pump in reverse flow mode at 0.1mL/min with 20:80 ACN: $H_2O$ @ 25°C for 4 hr |

# Resources
## for Chromatographers

### Chromatography Resource Center

Our web-based resource center provides technical support, applications, technical tips and literature to help move your separations forward.
Visit **www.thermoscientific.com/chromatography**

## How to order

**USA and Canada**
800 332 3331
865 354 4616 fax

**France**
+33 (0)1 60 92 48 34
+33 (0)1 60 92 49 00 fax
ConsommableslcgcfR@thermofisher.com

**Germany**
+49 (0) 2423 9431 -20 or -21
+49 (0) 6103 408 1111 fax
lcgc.consumables.DE@thermofisher.com

**United Kingdom**
+44 1928 534110
+44 1928 534001 fax
lcgc.consumables@thermofisher.com

**China**
+86 800 810 5118
or +86 400 650 5118
Shanghai: +86 21 68654588
Bejing: +86 10 84193588
Guangzhou: +86 20 83145188
analyze.cn@thermofisher.com

**India**
+91 22 6742 9494
+91 22 6742 9495 fax
analyze.in@thermofisher.com

**Japan**
0120 753 670 (free call domestic)
0120 753 671 fax
analyze.jp@thermofisher.com

**Thermo Fisher Scientific Australia Pty Ltd**
1300 735 292 (free call domestic)
1800 067 639 fax
AUinfo@thermofisher.com

**Thermo Fisher Scientific New Zealand Ltd**
0800 933 966 (free call domestic)
0800 329 246 fax
nzinfo@thermofisher.com

**All Other Enquiries**
+44 (0) 1928 534 050
+44 (0) 1928 534 049 fax
salesorders.columns.uk@thermofisher.com

## Technical Support

For advice and support, please visit our website:
**www.thermoscientific.com/chromexpert**

For more information visit: **www.thermoscientific.com/chromatography**



Thermo SCIENTIFIC
Part of Thermo Fisher Scientific

BR20834_E 01/14S