SHIMADZU
Excellence in Science

S-COS-B18B
#2021 Issue

# Shimadzu Consumables Catalogue

SHIMADZU
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S-COS-B18B #2021 Issue

CoreFocus

The Smart Choice In Consumables SHIMADZU

For over 140 years, Shimadzu has continued to be your trusted partner by providing leading-edge analytical instruments. Now we further support your success through borderless delivery of the high quality consumable products that solve everyday challenges. All this is for the pursuit of our corporate philosophy "Contributing to Society through Science and Technology".

# Table of Contents


## HPLC COLUMNS

Column Selection Guide ....A-2
Selection by USP Code ....A-7

### CORESHELL COLUMN VELOX SERIES

Velox C18 ....A-10
Velox SP-C18 ....A-10
Velox Biphenyl ....A-12
Velox PFPP ....A-12
Velox HILIC ....A-13

### ORGANIC SILICA HYBRID SCEPTER SERIES

Scepter C18 ....A-16
Scepter HD-C18 ....A-17
Scepter C8 ....A-18
Scepter PFPP ....A-19
Scepter Pheny l ....A-20
Scepter Diol-HILIC ....A-21
Scepter C4 ....A-22

### ARATA SERIES

Arata C18 ....A-25
Arata Peptide C18 ....A-26

### GENERAL PURPOSE COLUMNS

### XR-ODS SERIES

XR-ODS ....A-28
XR-C8 ....A-28
XR-Phenyl ....A-28
XR SIL ....A-28
XR-ODS II ....A-30
XR-ODS III ....A-30

### VP SERIES

VP-ODS ....A-32
VP-C8 ....A-32
VP-Phenyl ....A-32

### MAqC-ODS ....A-36

### G SERIES

GIST C18 ....A-38
GIST C18-AQ ....A-40
GISS C18 ....A-42
GIS C18 ....A-44
GIS C18-P ....A-46
GIS RP-Shield ....A-48
GWS C18 ....A-49
GIST C8 ....A-50
GIST Phenyl ....A-52
GIST Phenyl-Hexyl ....A-54
GIST PFPP ....A-56
GIS HILIC ....A-58
GIST NH2 ....A-60
GIST Amide ....A-62
GIS CN ....A-64
Solar C18 ....A-66
Solar C8 ....A-66
FC-ODS ....A-67

### PREPARATIVE COLUMNS

PREP Series ....A-69
G Series ....A-69
UC Series ....A-71
Ultron VX Series ....A-72
STR-ODS Series ....A-72

### MIXED-MODE COLUMNS

Shimadzu Redual™ Columns ....A-73

### BIO LC COLUMNS

Scepter C4 ....A-74
Bio Series ....A-76
Arata Peptide C18 ....A-77
Bio HIC--Butyl ....A-78

### MICROSCALE COLUMNS

MC C18 ....A-79
MC PLONAS Series ....A-80
Trap Columns ....A-82

### SIZE EXCLUSION CHROMATOGRAPHY COLUMNS

GPC Series ....A-83
Diol Series ....A-85

### METAL FREE COLUMNS

Scepter Series ....A-86
G Series ....A-87
Mastro™ Series ....A-88

### SFC COLUMNS

UC Series ....A-90

### DEDICATED COLUMNS

Cannabis Analysis ....A-94
Analysis of Amino Acids ....A-95
Analysis of Sugar and Organic Acid ....A-96
Analysis of Organic Acids ....A-98
Analysis of Nucleotides, Oligonucleotides and Proteins ....A-99
Intact Amino Acid Analysis ....A-100

### ION CHROMATOGRAPHY COLUMNS

IC Series ....A-101
Ultron PS-80H ....A-105

### PRETREATMENT COLUMNS

MAYI Series ....A-106
SPC Series ....A-108

### CHIRAL COLUMNS ULTRON SERIES

Ultron ES-OVM ....A-110
Ultron ES-OVM-C ....A-110
Ultron ES-OVM-3 ....A-110
Ultron ES-PEPSIN ....A-111
Ultron ES-BSA ....A-111
Ultron ES-CD ....A-112
Ultron ES-PhCD ....A-112

### LIGAND EXCHANGE COLUMNS ULTRON SERIES

Ultron PS-80N ....A-113
Ultron PS-80C ....A-113
Ultron PS-80P ....A-113
Ultron CI ....A-114
Ultron CL ....A-114

### ULTRON SERIES

Ultron VX-SIL ....A-115
Ultron VX-ODS ....A-116
Ultron VX-Octyl ....A-117
Ultron AF-HILIC-DA ....A-118

### STR-ODS SERIES

STR-ODS-II ....A-119
STR ODS-M ....A-120

### MOBILE PHASE CLEANER FOR UHPLC/HPLC

Ghost Trap DS/DS-HP ....A-121
GLC Suction Filter 2 ....A-122

### FITTINGS ....A-123

## VIALS AND ACCESSORIES

VIALS ....B-2
SOLVENT KITS ....B-19
SAMPLE PREPARATION ....B-21

## GC COLUMNS AND ACCESSORIES

GC COLUMN CROSS-REFERENCE ....C-4
GC CAPILLARY COLUMNS ....C-6
GC PACKED COLUMNS ....C-51
SYRINGES ....C-57
GLASS INSERT ....C-67
FERRULES ....C-70
SEPTUMS ....C-72
SPME ARROW ....C-73
SPME FIBER ....C-74

## GAS FLTRATION ....D-1

## SPECTRUM CONSUMABLES ....E-1

APPENDIX I ....F-1

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# UHPLC/HPLC Columns and LC Accessories

# Column Selection Guide

## Selection by Support Materials

**Packing Materials**

- **Silica Gel Type**
  - Shim-pack XR, VP, MAqC-ODS, G Series, FC-ODS, Velox Series, Arata C18
  - Shim-pack UC Series
  - Shim-pack Diol Series
  - Shim-pack WAX/WCX Series
- **Organic Silica Hybrid**
  - Shim-pack Scepter Series
- **Polymer Type**
  - Shim-pack GPC Series
  - Shim-pack IC Series
  - Shim-pack Amino, SCR, ISA/ISC Series

## Selection by Separation Modes

**Silica Gel Type**

- **Reversed Phase**
  - ODS/C18 (Shim-pack XR, VP, MAqC, G, FC Series, Velox, Scepter)
  - Shim-pack GIST C18-AQ
  - Shim-pack GIS C18-P
  - Shim-pack GIS RP-Shield
  - C8 (Shim-pack XR, VP, G Series)
  - Phenyl (Shim-pack XR, VP, G Series)
  - Shim-pack GIST Phenyl-Hexyl
  - Shim-pack Velox Biphenyl
  - Shim-pack Velox PFPP, Shim-pack Scepter PFPP

  } Low molecular-weight compounds
- **Normal Phase**
  - Shim-pack GIS CN ..... Steroid hormones
  - Shim-pack XR-SIL ..... Phospholipids
  - Shim-pack GIST NH2 ..... Saccharides, tocopherols
- **HILIC Mode**
  - Shim-pack GIS HILIC, Velox HILIC, Scepter HILIC ..... Polar compounds
- **Ion Exchange**
  - Shim-pack WAX (weakly basic anion exchange) ..... Nucleotides, proteins
  - Shim-pack WCX (weakly acidic cation exchange) ..... Proteins
- **Gel Filtration**
  - Shim-pack Diol Series ..... Proteins
  - Shim-pack Bio Diol Series ..... MAb, oligonuclestides, carbonydrates, proteins

**Polymer Type**

- **Ion Exchange**
  - Shim-pack IC Series ..... Inorganic ions
  - Shim-pack Amino, ISC Series ..... Amino acids, guanidines
  - Shim-pack ISA Series ..... Saccharides
  - Shim-pack Bio IEX ..... Peptides, oligonuclestides, biopharmaceutical, proteins, nucleic acids
- **Ion Exclusion**
  - Shim-pack SCR-101H, SCR-102H ..... Organic acids
  - Shim-pack Fast-OA ..... Organic acids
- **GPC**
  - Shim-pack GPC Series ..... Synthetic high polymers

## Selection by Column Particle Sizes

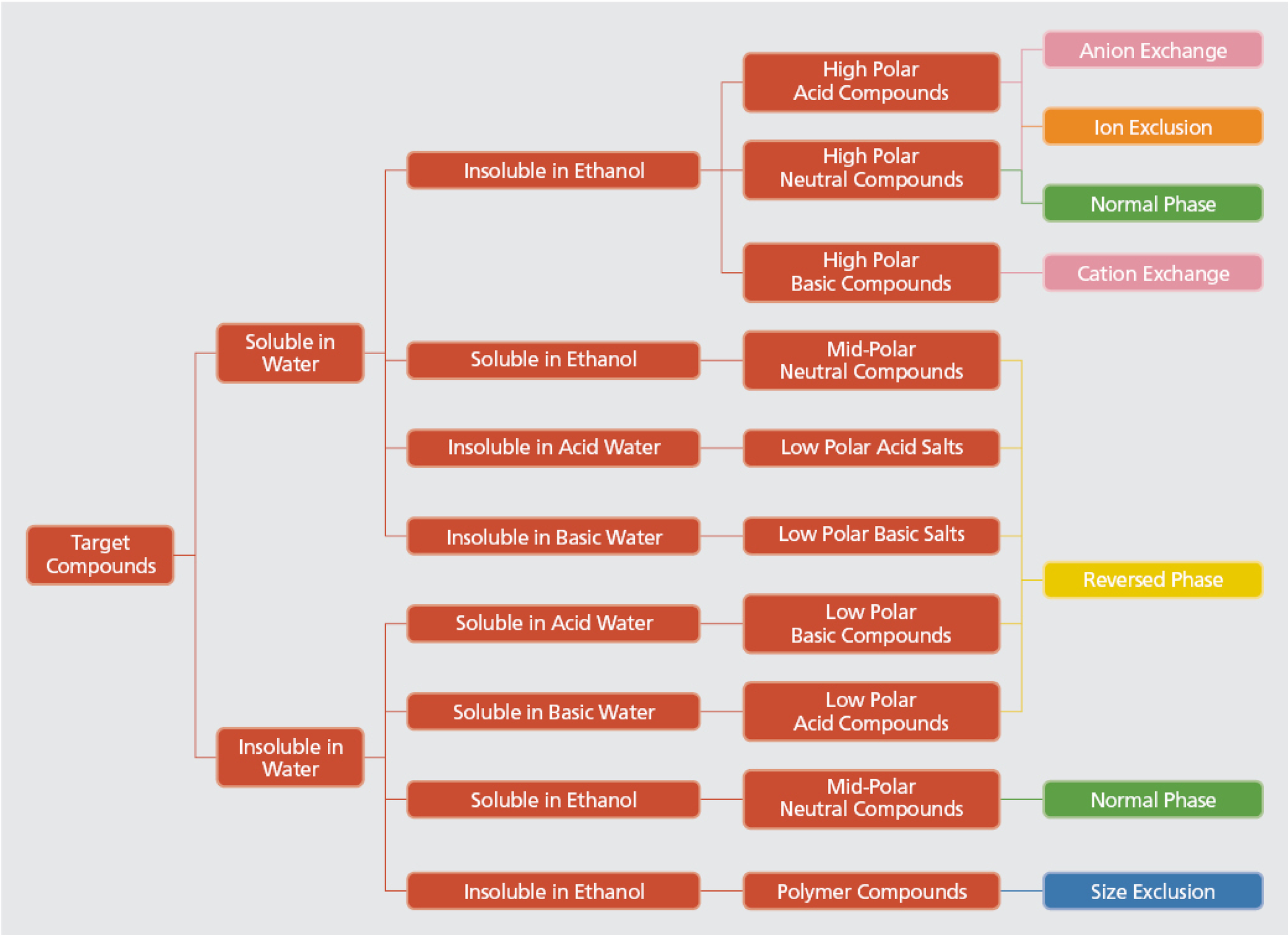
- HPLC Columns
  - Analytical Columns
    - High-Speed Analysis
      - 1.6 µm, 2.2 µm — Shim-pack XR-ODS III, Arata C18
      - 1.8 µm, 2.7 µm — Shim-pack Velox Series
      - 1.9 µm, 2 µm, 2.2 µm, 3 µm — Shim-pack G, XR Series, Scepter Series
    - Conventional Analysis
      - ≥3 µm — Shim-pack VP, MAqC-ODS, G Series, FC-ODS, Arata C18, Velox Series, Scepter Series
  - Preparative Columns
    - 5 µm, 10 µm — Shim-pack G Series, Scepter Series
    - 15 µm — Shim-pack PREP Series

## Selection of ODS columns

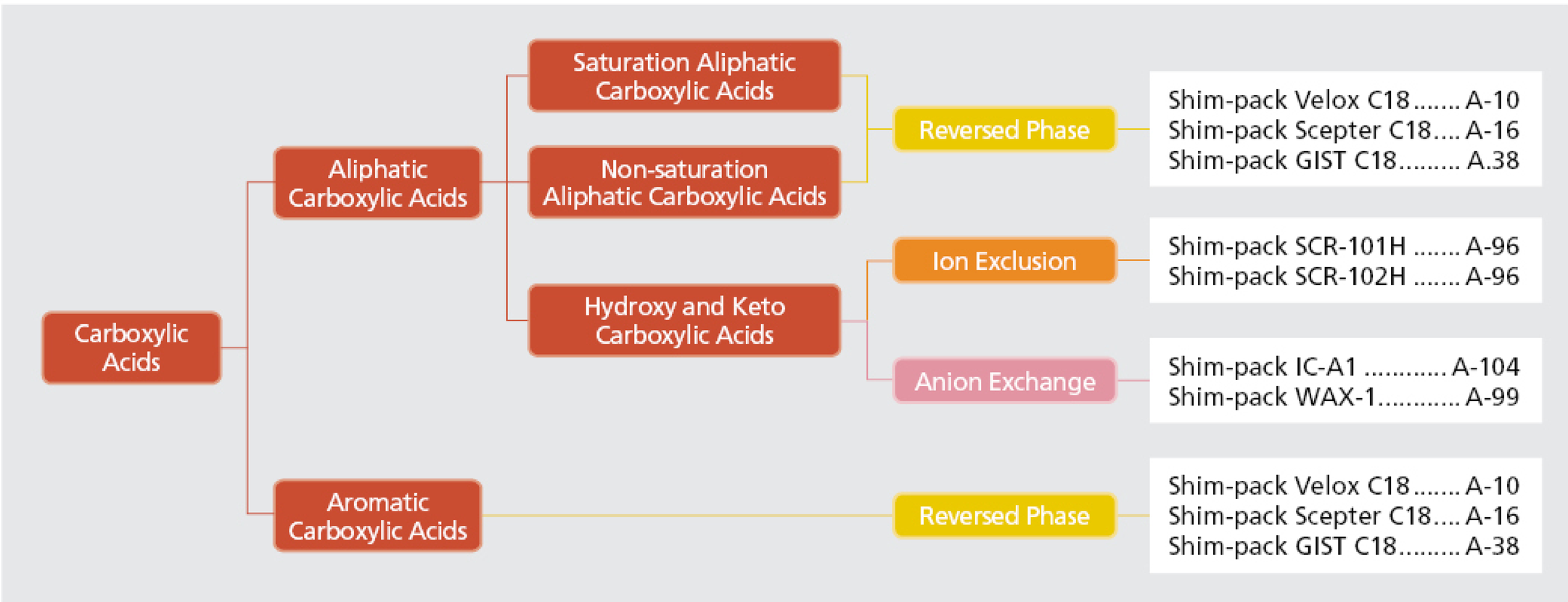
- High-Speed Analysis
  - With Certificate of Compliance for Validation
    - Shim-pack XR-ODS (Pressure tolerance: 35MPa) ..... A-28
    - Shim-pack XR-ODS II (Pressure tolerance: 60MPa) ..... A-30
    - Shim-pack XR-ODS III (Pressure tolerance: 100MPa) ..... A-30
  - Wider pH Range
    - Shim-pack Scepter C18 / HD-C18 (pH range: 1 - 12) ..... A-16
    - Shim-pack GIST/GIST-HP C18 (pH range: 1 - 10) ..... A-38
  - Rapid Separation and Wider pH Range
    - Shim-pack GISS/GISS-HP C18 (pH range: 1 - 10) ..... A-42
  - Stronger Retentivity
    - Shim-pack Scepter C18 / HD-C18 ..... A-16
    - Shim-pack GIS/GIS-HP C18 ..... A-44
  - Strong Retentivity of Highly Polar Compounds
    - Shim-pack GIST/GIST-HP C18-AQ ..... A-38
- Conventional Analysis
  - With Certificate of Compliance for Validation
    - Shim-pack VP-ODS ..... A-32
  - Wider pH Range
    - Shim-pack Scepter C18 / HD-C18 (pH range: 1 - 12) ..... A-16
    - Shim-pack GIST C18 (pH range: 1 - 10) ..... A-38
  - Stronger Retentivity
    - Shim-pack GIS C18 ..... A-44
    - Shim-pack FC-ODS (pH range: 1.5 - 9) ..... A-67
    - Shim-pack Scepter HD C18 ..... A-17
  - Higher Steric Selectivity
    - Shim-pack GIS C18-P ..... A-46
  - Different Elution Pattern
    - Shim-pack GIS RP-Shield ..... A-48
  - Higher Cost-Performance
    - Shim-pack GWS C18 ..... A-49
  - Strong Retentivity of Basic Compounds
    - Shim-pack MAqC-ODS ..... A-36

# Column Selection Guide

## Column Selection by Target Compounds




## Column Selection by Target Compounds



## Column Selection by Target Compounds

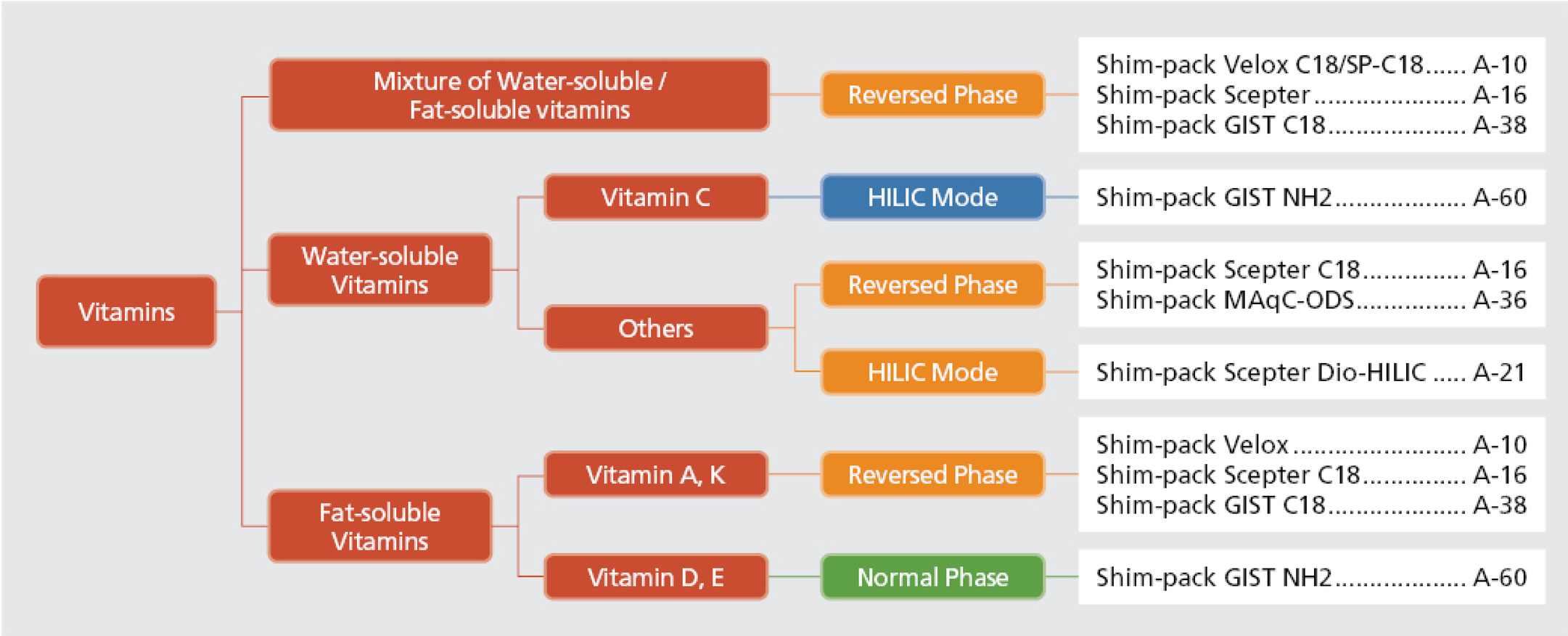
- **Amino Acids**
  - **Free Amino Acids**
    - **HILIC Mode**
      - Shim-pack Scepter Dio-HILIC ..... A-21
    - **Cation Exchange**
      - Shim-pack AMINO-LI ..... A-95 (Post-column derivation fluorescing with OPA)
  - **Protein-hydrolyzed Amino Acids**
    - **Cation Exchange**
      - Shim-pack AMINO-NA ..... A-95 (Post-column derivation fluorescing with OPA)
    - **Reversed Phase (Pre-column derivatization)**
      - Shim-pack Velox C18 ..... A-10
      - Shim-pack Scepter C18 ..... A-16
      - Shim-pack GIST C18 ..... A-38
    - **Reversed Phase + Ion Pair**
      - Shim-pack Velox C18 ..... A-10
      - Shim-pack Scepter C18 ..... A-16
      - Shim-pack GIST C18 ..... A-38

- **Peptides Proteins**
  - **Peptides**
    - **Reversed Phase**
      - Shim-pack Velox C18 ..... A-10
      - Shim-pack Scepter C18 ..... A-16
      - Shim-pack Arata Peptide C18 ..... A-27
      - Shim-pack GIST C18 ..... A-38
      - Shim-pack GISS C18 ..... A-42
  - **Proteins**
    - **Reversed Phase**
      - Shim-pack Scepter C4 ..... A-22
    - **Gel Filtration**
      - Shim-pack Diol Series ..... A-85
      - Shim-pack Bio Diol ..... A-77
    - **Cation Exchange**
      - Shim-pack Bio IEX SP/SP-NP ..... A-77
      - Shim-pack WCX-1 ..... A-99
    - **Anion Exchange**
      - Shim-pack Bio IEX Q/Q-NP ..... A-77
      - Shim-pack WAX-2 ..... A-99
    - **Hydrophobic Interaction**
      - Shim-pack Bio HIC ..... A-133

- **Sugars**
  - **Monosaccharides**
    - **HILIC Mode**
      - Shim-pack GIST NH2 ..... A-60
    - **Gel Filtration + Ligand Exchange**
      - Shim-pack SCR-101N/C/P ..... A-96
  - **Mono- to tri-saccharides**
    - **Anion Exchange**
      - Shim-pack ISA-07 ..... A-97
  - **Oligosaccharides**
    - **HILIC Mode**
      - Shim-pack GIST NH2 ..... A-60
  - **Derivatized Sugars**
    - **Reversed Phase**
      - Shim-pack Velox C18 ..... A-10
      - Shim-pack Scepter C18 ..... A-16
      - Shim-pack GIST C18 ..... A-38

# Column Selection Guide

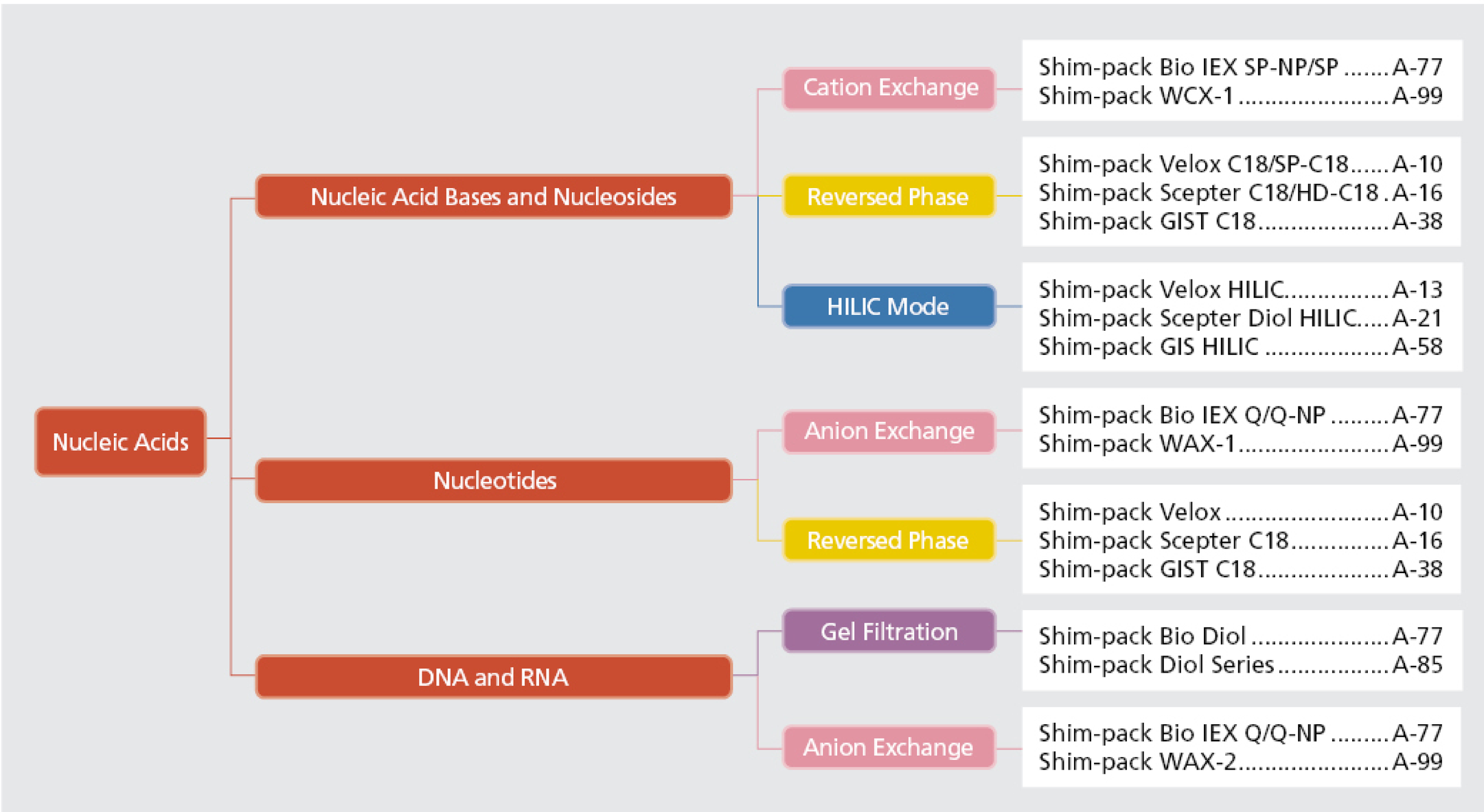
## Column Selection by Target Compounds




| Water-soluble Vitamins | |
|---|---|
| Vitamin B1 (thiamin) | UV (270 nm)<br>RF (Post-column derivatization) |
| Vitamin B2 (riboflavin) | UV (270 nm)<br>RF (Post-column derivatization) |
| Vitamin B3 (niacin) | UV (260 nm) |
| Vitamin B5 (pantothenic acid) | UV (205 nm) |
| Vitamin B6 (pyridoxine) | UV (290 nm) |
| Vitamin B12 (cyanocobalamine) | UV (280 nm) |
| Vitamin BT (carnitine) | UV (210 nm)<br>RI |
| Vitamin C (ascorbic acid) | UV (245 nm) |
| Vitamin H (biotin) | UV (210 nm) |
| Vitamin M (folic acid) | UV (280 nm) |
| Vitamin P (hesperidin) | UV (265 nm) |

| Fat-soluble Vitamins | |
|---|---|
| Vitamin A (retinol) | UV (325 nm)<br>RF (Ex. 340 nm, Em. 460 nm) |
| Vitamin D | UV (265 nm) |
| Vitamin E (tocopherol) | UV (295 nm)<br>RF (Ex. 295 nm, Em. 325 nm) |
| Vitamin K | UV (250 nm)<br>RF (Post-column derivatization) |

* The above wavelength values are approximate values. It is possible to be influenced by the state of mobile phase.



# Selection by USP

| USP Code | Packing | Shim-pack HPLC Columns | Page |
|---|---|---|---|
| L1 | Octadecyl silane chemically bonded to porous or non-porous silica or ceramic micro-particles, 1.5 to 10 µm in diameter, or a monolithic rod. | Shim-pack Velox C18 | A-10 |
| | | Shim-pack Velox SP-C18 | A-11 |
| | | Shim-pack Scepter C18 | A-16 |
| | | Shim-pack Scepter HD-C18 | A-17 |
| | | Shim-pack Arata C18 | A-25 |
| | | Shim-pack XR-ODS | A-28 |
| | | Shim-pack XR-ODS II | A-30 |
| | | Shim-pack XR-ODS III | A-30 |
| | | Shim-pack VP-ODS | A-32 |
| | | Shim-pack GIST C18 | A-38 |
| | | Shim-pack GIST C18-AQ | A-40 |
| | | Shim-pack GISS C18 | A-42 |
| | | Shim-pack GIS C18 | A-44 |
| | | Shim-pack GIS C18-P | A-46 |
| | | Shim-pack GIS RP-Shield | A-48 |
| | | Shim-pack GWS C18 | A-49 |
| | | Shim-pack Solar C18 | A-66 |
| | | Shim-pack FC-ODS | A-67 |
| | | Shim-pack UC GIS II | A-90 |
| | | Mastro2™ C18 | A-88 |
| | | ULTRON VX-ODS | A-116 |
| | | STR ODS-II | A-119 |
| | | STR ODS-M | A-120 |
| L3 | Porous silica particles, 1.5 to 10 µm in diameter, or a monolithic silica rod. | Shim-pack Velox HILIC | A-13 |
| | | Shim-pack XR-SIL | A-28 |
| | | Shim-pack UC Sil | A-90 |
| | | Shim-pack UC Sil II | A-91 |
| | | ULTRON VX-SIL | A-115 |
| L7 | Octylsilane chemically bonded to totally or superficially porous silica particles, 1.5 to 10 µm in diameter, or a monolithic silica rod. | Shim-pack Scepter C8 | A-18 |
| | | Shim-pack XR-C8 | A-28 |
| | | Shim-pack VP-C8 | A-33 |
| | | Shim-pack GIST C8 | A-50 |
| | | Shim-pack Solar C8 | A-66 |
| | | ULTRON VX-Octyl | A-117 |
| L8 | An essentially monomolecular layer of aminopropylsilane chemically bonded to totally porous silica gel support, 1.5 to 10 µm in diameter, or a monolithic silica rod. | Shim-pack GIST NH2 | A-60 |
| | | Shim-pack UC NH2 | A-90 |
| L10 | Nitrile groups chemically bonded to porous silica particles, 1.5 to 10 µm in diameter, or a monolithic silica rod. | Shim-pack GIS CN | A-64 |
| | | Shim-pack UC CN | A-90 |
| L11 | Phenyl groups chemically bonded to porous silica particles, 1.5 to 10 µm in diameter, or a monolithic silica rod. | Shim-pack Velox Biphenyl | A-12 |
| | | Shim-pack Scepter Phenyl | A-20 |
| | | Shim-pack XR-Phenyl | A-28 |
| | | Shim-pack VP-Phenyl | A-32 |
| | | Shim-pack GIST Phenyl | A-52 |
| | | Shim-pack GIST Phenyl-Hexyl | A-54 |
| | | Shim-pack UC Phenyl | A-90 |
| L17 | Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the hydrogen form, 6 to 12 µm in diameter. | Shim-pack SCR-101H | A-96 |
| | | ULTRON PS-80H | A-105 |
| L19 | Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the calcium form, 5 - 15 µm in diameter. | Shim-pack SCR-101C | A-96 |
| | | ULTRON PS-80C | A-113 |
| L20 | Dihydroxypropane groups chemically bonded to porous silica or hybrid particles, 1.5 to 10 µm in diameter, or a monolithic silica rod. | Shim-pack Scepter Diol-HILIC | A-21 |
| | | Shim-pack GIS HILIC | A-58 |
| | | Shim-pack UC Diol | A-90 |
| | | Shim-pack UC Diol II | A-91 |
| | | Shim-pack Diol-150 | A-85 |
| | | Shim-pack Diol-300 | A-85 |
| | | Shim-pack Bio Diol | A-77 |
| L21 | A rigid, spherical styrene-divinylbenzene copolymer, 3 to 30 µm in diameter. | Shim-pack GPC Series | A-83 |
| L22 | A cation-exchange resin made of porous polystyrene gel with sulfonic acid groups, 5 - 15 µm in diameter. | Shim-pack IC-C1 | A-101 |
| | | Shim-pack AMINO-LI | A-95 |
| | | Shim-pack AMINO-NA | A-95 |
| | | Shim-pack ISC | A-97 |
| L23 | An anion-exchange resin made of porous polymethacrylate or polyacrylate gel with quartenary ammonium groups, 7 - 12 µm in size. | Shim-pack IC-A1 | A-104 |
| L26 | Butyl silane chemically bonded to totally porous silica particles, 1.5 to 10 µm in diameter. | Shim-pack Scepter C4 | A-22 |
| L33 | Packing having the capacity to separate dextrans by molecular size over a range of 4,000 to 500,000 Da. It is spherical, silica-based, and processed to provide pH stability. | Shim-pack Bio Diol | A-77 |
| L34 | Strong cation exchange resin consisting of sulfonated crosslinked styrene-divinylbenzene copolymer in the lead form, 9µm in diameter. | ULTRON PS-80P | A-113 |
| L43 | Pentafluorophenyl groups chemically bonded to silica particles by a propyl spacer, 1.5 to 10 µm in diameter. | Shim-pack Velox PFPP | A-12 |
| | | Shim-pack Scepter PFPP | A-19 |
| | | Shim-pack GIST PFPP | A-56 |
| | | Mastro2™ PFP | A-88 |
| L45 | Beta cyclodextrin bonded to porous silica particles, 5 to 10 µm in diameter. | ULTRON ES-CD | A-112 |
| | | ULTRON ES-PhCD | A-112 |
| L57 | A chiral-recognition protein, ovomucoid, chemically bonded to silica particles, about 5 µm in diameter, with a pore size of 120 Å. | ULTRON ES-OVM | A-110 |
| L58 | Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the sodium form, about 6 to 30 µm diameter. | Shim-pack SCR-101N | A-96 |
| | | ULTRON PS-80N | A-113 |
| L59 | Packing for the size-exclusion separations of proteins (separation by molecular weight) over the range of 5 to 7000 kDa. The packing is spherical 1.5 - 10 µm, silica or hybrid packing with a hydrophilic coating. | Shim-pack Diol-150 | A-85 |
| | | Shim-pack Diol-300 | A-85 |
| | | Shim-pack Bio Diol | A-77 |
| L68 | Spherical, porous silica, 10 µm or less in diameter, the surface of which has been covalently modified with alkyl amide groups and not endcapped. | Shim-pack GIST Amide | A-62 |
| L101 | Cholesteryl groups bonded to porous or non-porous silica or ceramic micro-particles, 1.5 to 10 µm in diameter, or a monolithic rod. | Shim-pack UC-Choles | A-91 |
| L104 | Triazole groups chemically bonded to porous silica particles, 1.5 to 10 µm in diameter. | Shim-pack UC-Triazole | A-91 |

# Maximize LC Separation Performance with Core Shell Technology

Designed to maximize performance of LC systems, Shimadzu's Shim-pack Velox columns with core shell technology enable you to achieve increased separations and faster analysis times on any LC platform.

Whether developing a high efficiency LC separation method, transferring an existing method for increased throughput while maintaining resolution, or are trying to improve the resolution of a complex separation, Shim-pack Velox columns will satisfy your needs.

Column ruggedness is critical to any LC analysis and Shim-pack Velox core-shell columns deliver excellent column lifetime for even the most challenging sample matrices.

## Shim-pack Velox column will deliver

- Increased resolution with maximum efficiency → improving separation and detection
- Faster separation without sacrificing performance → maximizing laboratory productivity and reducing cost of analysis
- Increased sample throughput → reducing overall analysis time
- Superior ruggedness → reducing cost of analysis
- Excellent reproducibility → maintaining analysis and data integrity

## Column Selection Guide for Different LC Platforms

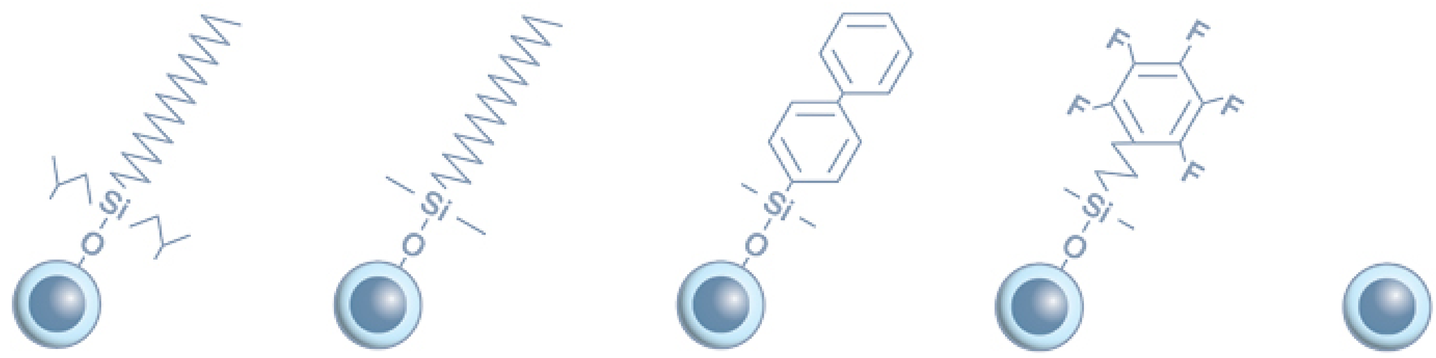
Column particle sizes and column volumes affect chromatography results significantly if the column configuration does not match the LC system. As column particle size is reduced, or the column volume (ID and/or the length of the columns) decreases, the necessity for a lower dispersion system is increased.

Choosing the optimal column configuration for your LC system allows you to achieve improved chromatography. The following table summarizes the starting recommendations of column configuration for each LC system.

| | Prominence | Prominence-i plus | Nexera XR | Nexera-i plus | Nexera X2 |
|---|---|---|---|---|---|
| LC System | HPLC | | UHPLC-like | UHPLC | |
| Particle size | 2.7 µm & 5 µm | | 2.7 µm | 1.8 µm & 2.7 µm | |
| Column I.D. | 4.6 mm (3.0 mm) | | 3.0 mm (2.1 mm) | 2.1 mm | |
| Column Length | 100-250 mm | | 50-100 mm | 150 mm | |

## Column Chemistries

Combining highly efficient core shell particle technology with a wide range of surface chemistries provides you with the best opportunity for optimal resolution. With different chemistry characteristics, Shim-pack Velox columns are suitable for use in a wide variety of applications and challenging separations.

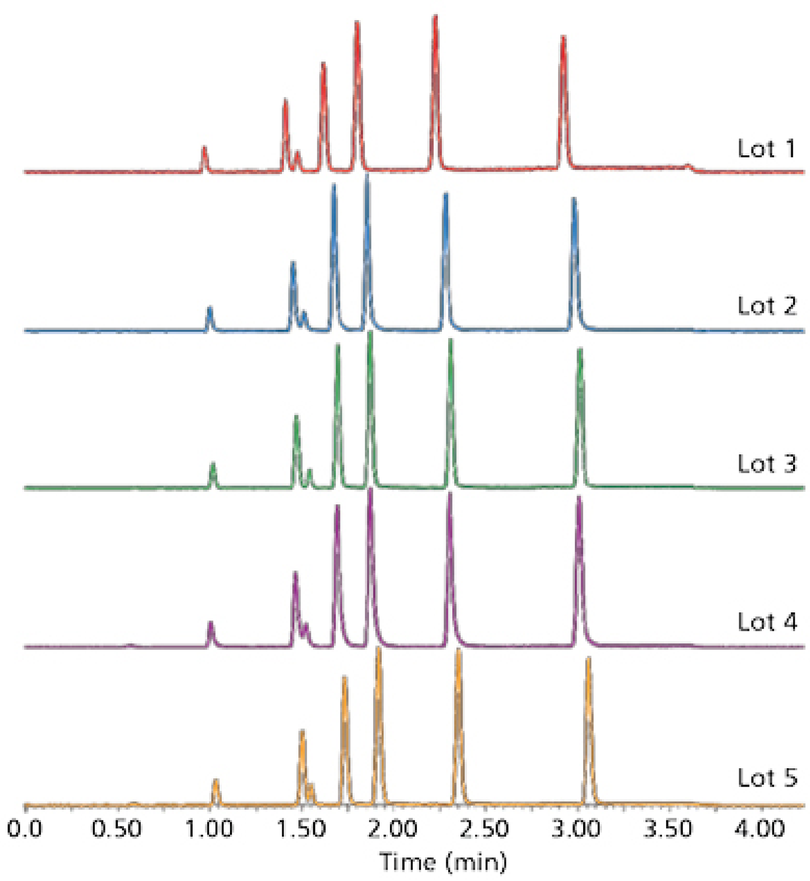


| | | SP-C18 | C18 | Biphenyl | PFPP | HILIC |
|---|---|---|---|---|---|---|
| USP Classification | | L1 | L1 | L11 | L43 | L3 |
| Ligand type | | Sterically protected C18 | C18 | Biphenyl | Pentafluorophenyl propyl | None |
| Particle Size (µm) | | 1.8, 2.7, 5 | 1.8, 2.7, 5 | 1.8, 2.7, 5 | 1.8, 2.7, 5 | 2.7 |
| Pore size (Å) | | 90 | 90 | 90 | 90 | 90 |
| Suraface Area | 1.8 µm | 125 $m^2/g$ | 125 $m^2/g$ | 125 $m^2/g$ | 125 $m^2/g$ | - |
| | 2.7 µm | 130 $m^2/g$ | 130 $m^2/g$ | 130 $m^2/g$ | 130 $m^2/g$ | 130 $m^2/g$ |
| | 5 µm | 100 $m^2/g$ | 100 $m^2/g$ | 100 $m^2/g$ | 100 $m^2/g$ | - |
| Carbon Load | 1.8 µm | 7 % | 9 % | 7 % | 4 % | - |
| | 2.7 µm | 7 % | 7 % | 7 % | 4 % | NA |
| | 5 µm | 5 % | 5 % | 5 % | 3 % | - |
| End-Cap | | No | YES | YES | No | No |
| pH range | | 1.0-8.0 | 2.0-8.0 | 1.5-8.0 | 2.0-8.0 | 2.0-8.0 |
| Max Pressure | 1.8 µm | 100 MPa* | 100 MPa* | 100 MPa* | 100 MPa* | - |
| | 2.7 µm | 60 MPa | 60 MPa | 60 MPa | 60 MPa | 60 MPa |
| | 5 µm | 40 MPa | 40 MPa | 40 MPa | 40 MPa | - |

* For maximum lifetime, recommended maximum pressure for 1.8 µm particles is 80MPa.

## Lot to Lot Reproducibility

We understand that lot to lot consistent performance of columns is required to maximize your laboratory performance. From one lot to the next, every Shim-pack Velox column you purchase will perform consistently.




**Compounds (50 ng/mL)**

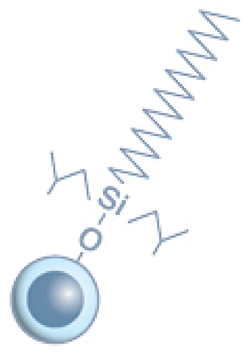
1. Cortisol
2. 11-Deoxycortisol
3. Estradiol
4. Boldenone
5. Testosterone
6. Androstenedione
7. Progesterone

**Conditions**

| | | |
|---|---|---|
| **Column** | : | Shim-pack Velox Biphenyl 2.7 µm, 3.0×100 mm (P/N: 227-32016-03 ) |
| **Flow Rate** | : | 0.7 mL/min |
| **Column Temp.** | : | 30 °C |
| **Sample Dilulent** | : | Initial mobile phase |
| **Injection Volume** | : | 5 µL |
| **Mobile Phase A** | : | 0.1 % formic acid in water |
| **Mobile Phase B** | : | 0.1 % formic acid in acetonitrile Gradient: 40 % B (0 min) 80 % B (3 min) |

## Shim-pack Velox SP-C18

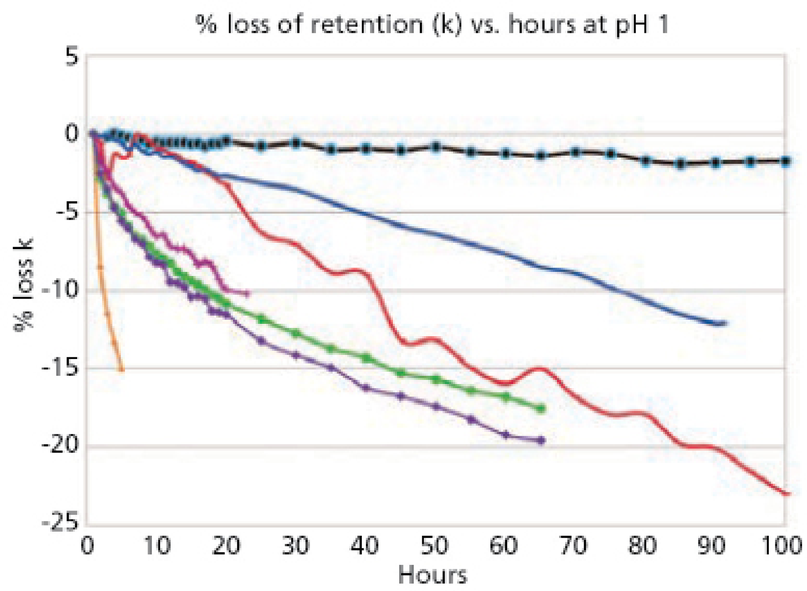
Designed and intended specifically for use under low pH condition, Shim-pack Velox SP (Sterically Protected)-C18 offers a well balanced retention profile with a long life time even under harsh, acidic condition needed for LC/MS(/MS) analysis.



- Sterically protected to resist strongly acidic (pH 1-8) mobile phase condition
- Well balanced retention profile
- Suitable for LC/MS(/MS) analysis

## Low pH Stability

Sterically protected ligand provides extended low pH stability for the core shell particle. Shim-pack Velox SP-C18 columns maintain a stable retention profile under strongly acidic mobile phase condition (pH1) .



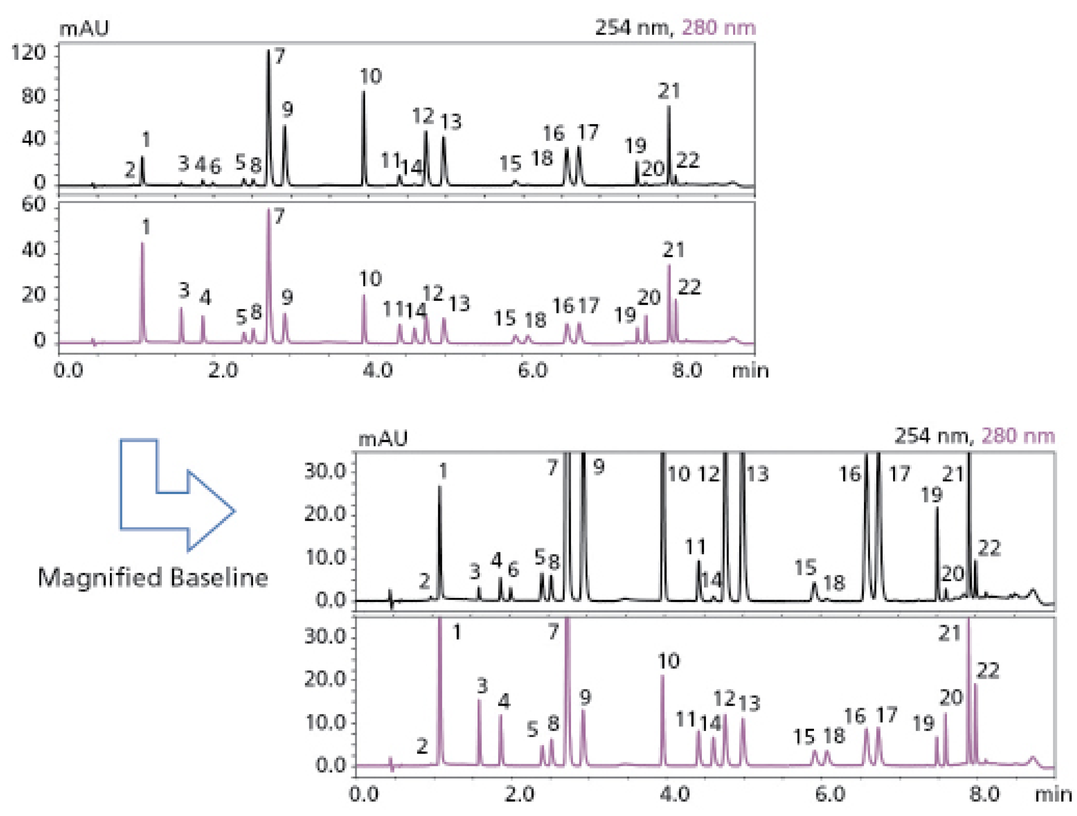

**Conditions**

| | | |
|---|---|---|
| **Flow Rate** | : | 0.6 mL/min |
| **Column Temp.** | : | 60 °C |
| **Mobile Phase A** | : | 0.1 % TFA in water |
| **Mobile Phase B** | : | Acetonitrile |
| **Gradient** | : | 45 % B (0 min – 7.5 min) → 5 % B (7.51 min – 50 min)<br>100 % B (55 min ) → 45 % B (55.01 min → 60 min) |

- Shim-pack Velox SP-C18 Brand A FPP C18
- Brand B FPP C18
- Brand C FPP C18
- Brand D Core-shell C18
- Brand E Core-shell C18
- Brand F Core-shell C18

## Simultaneous Analysis of 22 Preservative Agents

More than 20 compounds used as the preservative agent for industrial products like foods and cosmetics can can be separated by Shim-pack Velox SP-C18. The simultaneous determination and quantitation of multiple target compounds are possible in a wide range of commercial product within acceptable analytical times.




**Preservative agents**

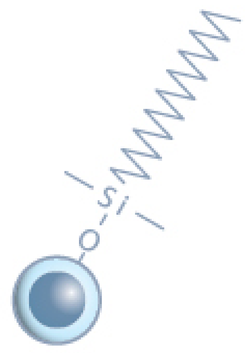
1. 2-methyl-4-Isothiazolin-3-one
2. 2-Bromo-2-Nitro-1,3-propanediol
3. Salicylic Acid
4. Isothiazolinones
5. Benzoic Acid
6. Benzyl Alcohol
7. Sorbic Acid
8. 2-Phenoxyethanol
9. Methyl Paraben
10. Ethyl Paraben
11. Methyl Benzoate
12. Isopropyl Paraben
13. Propyl Paraben
14. 4-Chloro-3-Methylphenol
15. Ethyl Benzoate
16. Isobutyl 4-Hydroxybenzoate
17. Butyl Paraben
18. Chloroxylenol
19. Phenyl Benzoate
20. Clorofene
21. Triclocarban
22. Triclosan

**LC Conditions**

| | | |
|---|---|---|
| **Column** | : | Shim-pack Velox SP-C18, 2.7 µm, 3.0×100 mm<br>(PN: 227-32004-03) |
| **Flow Rate** | : | 1.0 mL/min |
| **Column Temp.** | : | 45 °C |
| **Mobile Phase A** | : | NaH2PO4 aq. (25 mM, pH3.8) |
| **Mobile Phase B** | : | MeOH/ACN = 9/1 |
| **Gradient** | : | 8 %B (0 min ) → 30 % B (0.7 min – 2.7 min)<br>47 % B (2.71 min – 5min ) → 52 % B (6 min)<br>80 %B (7 min – 8 min) → 8 %B (9.01 min -10 min) |
| **Injection Volume** | : | 1 µL |
| **Conc.** | : | 50 mg/L |

## Shim-pack Velox SP-C18

Shim-pack Velox C18 is a traditional end-capped C18-bonded phase which offers the highest hydrophobic retention of any Shim-pack Velox phases and is applicable to a wide range of applications such as pharmaceutical, food, environmental and clinical and neutrals at moderately low and mid-range pH.



- General purpose column for reversed-phase chromatography
- Highest hydrophobic retention among Shim-pack Velox series
- Compatible with moderately acidic to neutral mobile phases (pH 2-8)

## Method Transfer for Cyanocobalamin Analysis within the USP Allowable Adjustment

The assay of cyanocobalamin (a synthetic form of vitamin B12) with 5 µm fully-porous ODS column described in the USP monograph is transferred to a new method with Shim-pack Velox C18 2.7 µm column, within USP allowable adjustments. Analytical time and solvent consumption can be saved with transferred methods while meeting the requirements of system suitability.

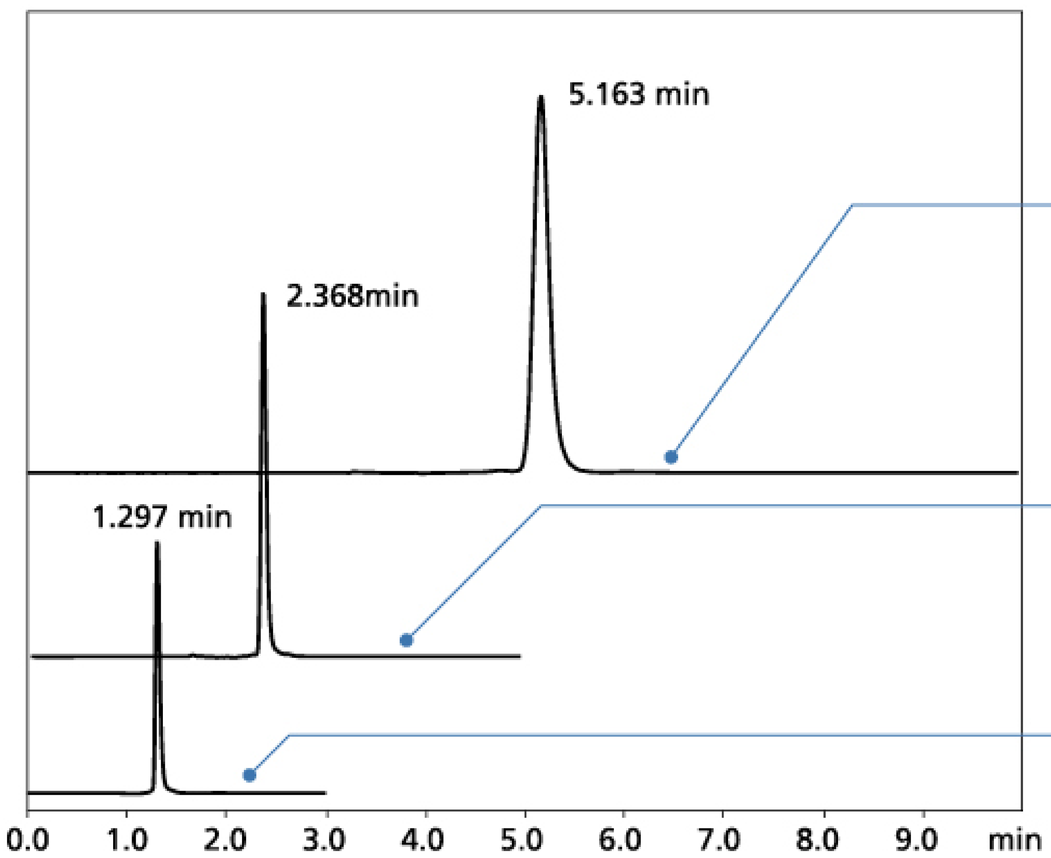
**USP requirement of Chromatography <621>**

When the column size is changed, the following conditions should be met;

1) *L/dp* ratio : within -25 % to +50 %
   or
   Number of theoretical plates (N): within -25 % to +50 % (For SPP)
2) Flow rate : *Based on particle size and internal diameter and ±50%

$$* F_2 = F_1 \times \frac{dc_2^2 \times dp_1}{dc_1^2 \times dp_2}$$

*L* : Column length
*dp* : Particle size
*F* : Flow rate
*dc* : Internal diameter of the column




**Original Method**
**Column** : Shim-pack VP-ODS (5 µm, 4.6×150 mm)
**Flow rate** : 0.5 mL/min
**Injection Volume** : 100 µL
**Column temp.** : 25 °C
**Detection** : UV 361 nm

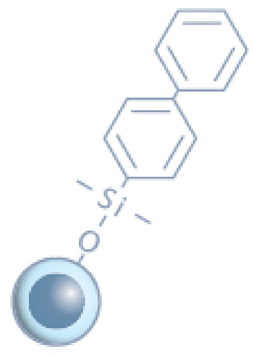
**Faster Method**
**Column** : Shim-pack Velox C18 (2.7 µm, 4.6×100 mm)
**Flow rate** : 0.50 mL/min
**Injection Volume** : 67 µL
**Column temp.** : 25 °C
**Detection** : UV 361 nm

**Optimized Method**
**Column** : Shim-pack Velox C18 (2.7 µm, 4.6×100 mm)
**Flow rate** : 0.93 mL/min
**Injection Volume** : 67 µL
**Column temp.** : 25 °C
**Detection** : UV 361 nm

| Column | L/dp | Flow rate (mL/min) | N | System suitability test result (Requirement: %RSD < 2.0 %) |
|---|---|---|---|---|
| VP-ODS (5 µm, 4.6×150 mm) | 30,000 | 0.50 | 5,244 | tR: 0.025 %<br>Area: 0.175 % (n=6) |
| Velox C18 (2.7 µm, 4.6×100 mm) | 37,037 (+23 %) | 0.50 | 9,497 (+81 %) | tR: 0.035 %<br>Area: 0.103 % (n=6) |
| | | 0.93 | 4,466 (-15 %) | tR: 0.084 %<br>Area: 0.220 % (n=6) |

## Shim-pack Velox Biphenyl

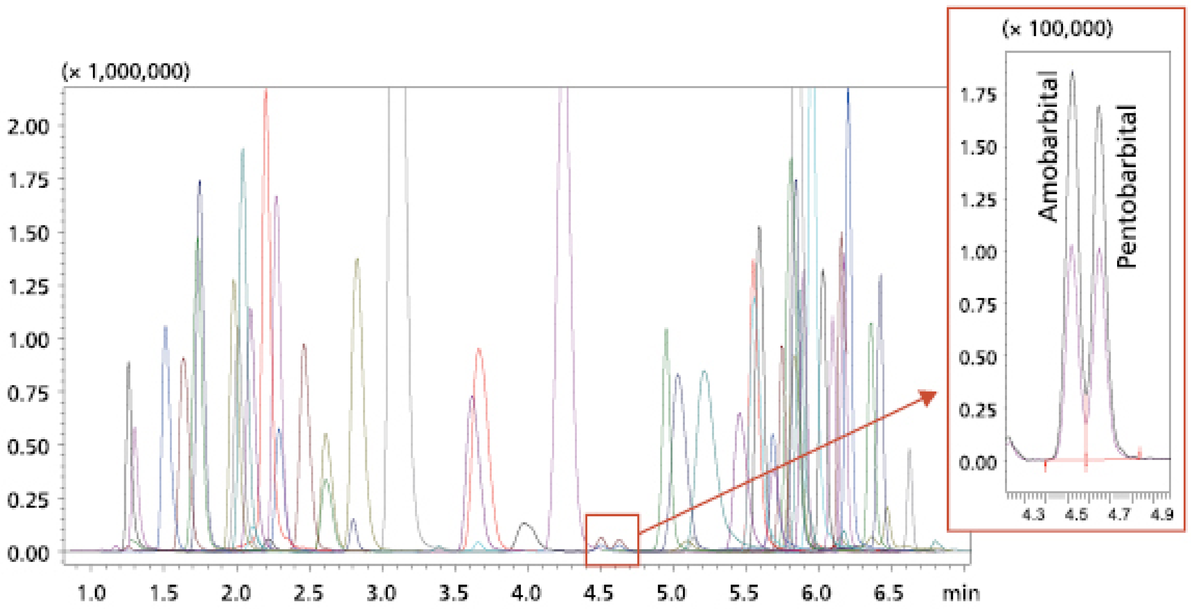
Shim-pack Velox Biphenyl provides enhanced retention of aromatic compounds. It is useful for fast separations in bioanalytical applications due to the increased retention of early eluting analytes such as dipolar, unsaturated and conjugated analytes.



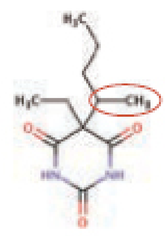
- Complementary selectivity to alkyl phases
- Enhanced separation of aromatic compounds
- Ideal for increasing sensitivity and selectivity in LC/MS(/MS) analysis

### Separating the Structural Isomers

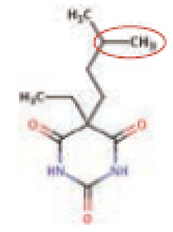
Even under the condition where 56 drugs of abuse and metabolites in human urine are quantitated within 10 minutes, two structural isomers, amobarmital and pentobarbital, which have been historically difficult to separate due to their similarity in chemical structures, could be relatively well resolved with shim-pack Velox Biphenyl column.




Chromatogram of 56 compounds in human urine spiked at the cut off concentration



**Amobarbital**
5-ethyl-5-(3-methylbutyl)-1,3-diazinane-2,4,6-trione



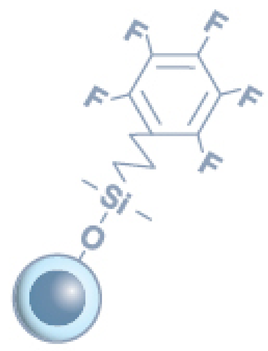
**Pentobarbital**
5-ethyl-5-pentan-2-yl-1,3-diazinane-2,4,6-trione

**Conditions**

| | | |
|---|---|---|
| **System** | : | Nexera UHPLC System / LCMS-8050 |
| **Column** | : | Shim-pack Velox Biphenyl 2.7 µm, 2.1 mm × 100 mm (PN: 227-32015-03) |
| **Column Temp.** | : | 30 °C |
| **Flow Rate** | : | 0.5 mL/min |
| **Mobile Phase A** | : | 0.15 mM ammonium fluoride in water |
| **Mobile Phase B** | : | Methanol |
| **Gradient** | : | 20 % B (0 min) → 48 % B (1.5 min) → 53 % B (4 min)<br>100 %B (6 min - 7.5 min) → 20 % B (7.51 min - 9.5 min) |
| **Sample preparation** | : | Enzymatically hydrolyzed human urine was spiked with target compounds between 10 - 1000 % of the required cut off concentration. Samples were subsequently diluted 5x with 0.1 % formic acid. |

## Shim-pack Velox PFPP

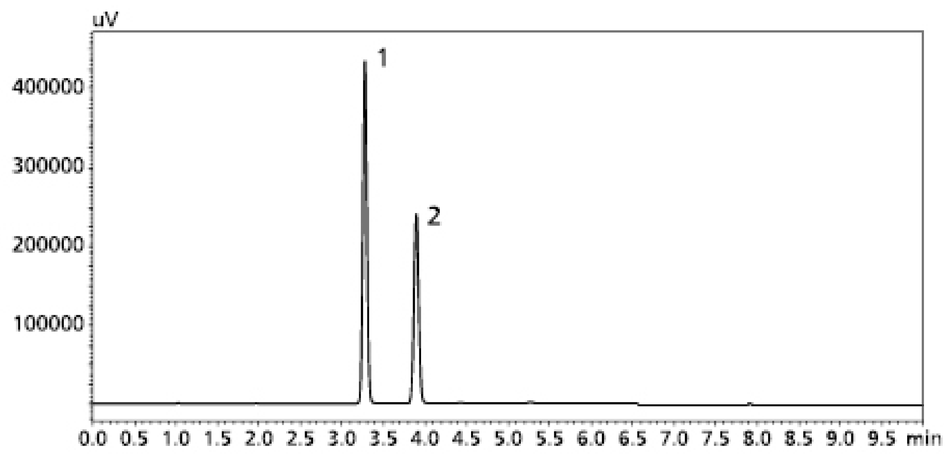
Shim-pack Velox PFPP (Pentafluorophenylpropyl) provides an alternative selectivity to C18 columns and is suitable for the analysis of halogenated compounds, positional isomers and charged bases.



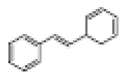
- Alternative selectivity to C18 columns
- Suitable for positional isomers and halogenated compounds
- Offers increased retention for charged bases

### Good Separation of Cis / Trans Stilbene

Cis and trans isomers of stilbene that are difficult to resolve with an ODS column due to their similarity in hydrophobicity can be well separated with Shim-pack Velox PFPP column.



1. cis-Stilbene



2. trans-Stilbene

**LC Conditions**

| | | |
|---|---|---|
| **Column** | : | Shim-pack Velox PFPP, 2.7 µm, 3.0×100 mm (PN: 227-32022-04) |
| **Column Temp.** | : | 40 °C |
| **Flow Rate** | : | 0.4 mL/min |
| **Mobile Phase** | : | Methanol/Water = 9/1 |
| **Detection** | : | UV 254 nm |
| **Sample** | : | 1. cis-Stilbene, 2. trans-Stilbene |
| **Injection Volume** | : | 1 µL |

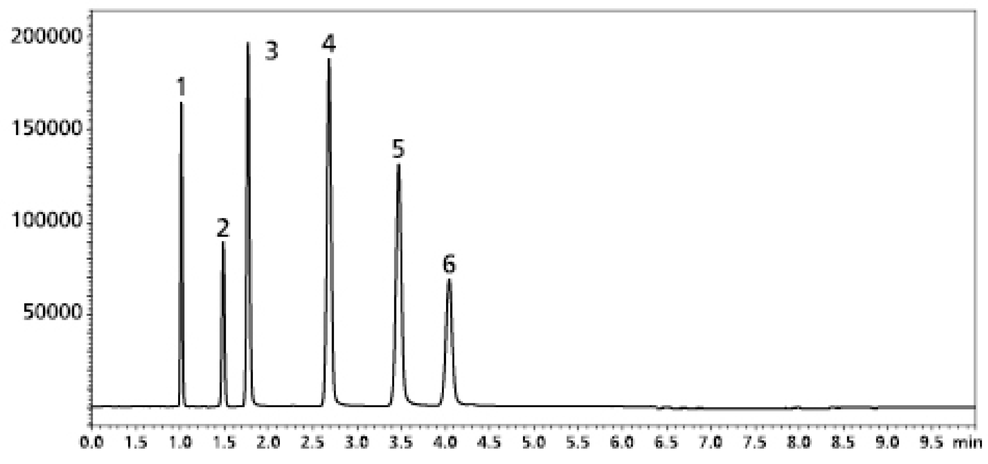
## Shim-pack Velox HILIC

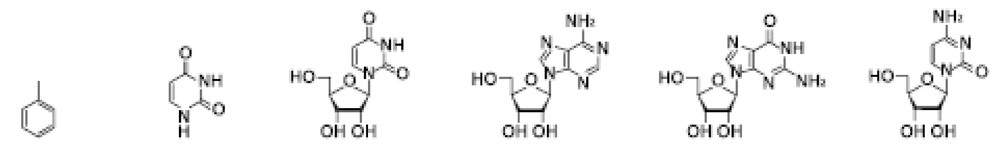
Hydrophilic interaction chromatography (HILIC) is an increasingly popular separation mode that can be used to improve the retention of challenging polar analytes. Shim-pack Velox HILIC using unbonded core shell particles is specifically designed for this application.

- Orthogonal selectivity to reversed phase chromatography
- Increased retention of polar analytes
- Increased MS sensitivity
- Direct compatibility with sample preparation eluates

### Retention of Nucleosides

Nucleosides are polar molecules that are not well retained on reversed phase LC columns due to their hydrophilic nature are well retained and separated with Shim-pack Velox HILIC column.



1. Toluene 2. Uracil 3. Uridine 4. Adenosine 5. Guanosine 6. Cytidine

**LC Conditions**

| | | |
|---|---|---|
| **Column** | : | Shim-pack Velox HILIC, 2.7 µm, 3.0×100 mm (PN: 227-32026-02) |
| **Column Temp.** | : | 30 °C |
| **Flow Rate** | : | 0.4 mL/min |
| **Mobile Phase** | : | Acetonitrile/20mM AcONH4aq.=9/1 |
| **Detection** | : | UV 254 nm |
| **Sample** | : | 1. Toluene, 2. Uracil, 3. Uridine, 4. Adenosine, 5. Guanosine, 6. Cytidine |
| **Injection Volume** | : | 1 µL |

### Shim-pack Velox 1.8 µm Columns

| Chemistry | SP-C18 | | C18 | | Biphenyl | | PFPP | |
|---|---|---|---|---|---|---|---|---|
| I.D. (mm) / Length (mm) | 2.1 | 3.0 | 2.1 | 3.0 | 2.1 | 3.0 | 2.1 | 3.0 |
| 30 | 227-32001-01 | - | 227-32007-01 | - | 227-32013-01 | - | 227-32019-01 | - |
| 50 | 227-32001-02 | 227-32002-01 | 227-32007-02 | 227-32008-01 | 227-32013-02 | 227-32014-01 | 227-32019-02 | 227-32020-01 |
| 100 | 227-32001-03 | 227-32002-02 | 227-32007-03 | 227-32008-02 | 227-32013-03 | 227-32014-02 | 227-32019-03 | 227-32020-02 |
| 150 | 227-32001-04 | - | 227-32007-04 | - | 227-32013-04 | - | 227-32019-04 | - |

### Shim-pack Velox 2.7 µm Columns

| Chemistry | SP-C18 | | | C18 | | | Biphenyl | | |
|---|---|---|---|---|---|---|---|---|---|
| I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | 2.1 | 3.0 | 4.6 | 2.1 | 3.0 | 4.6 |
| 30 | 227-32003-01 | 227-32004-01 | 227-32005-01 | 227-32009-01 | 227-32010-01 | 227-32011-01 | 227-32015-01 | 227-32016-01 | 227-32017-01 |
| 50 | 227-32003-02 | 227-32004-02 | 227-32005-02 | 227-32009-02 | 227-32010-02 | 227-32011-02 | 227-32015-02 | 227-32016-02 | 227-32017-02 |
| 100 | 227-32003-03 | 227-32004-03 | 227-32005-03 | 227-32009-03 | 227-32010-03 | 227-32011-03 | 227-32015-03 | 227-32016-03 | 227-32017-03 |
| 150 | 227-32003-04 | 227-32004-04 | 227-32005-04 | 227-32009-04 | 227-32010-04 | 227-32011-04 | 227-32015-04 | 227-32016-04 | 227-32017-04 |

| Chemistry | PFPP | | | HILIC | | |
|---|---|---|---|---|---|---|
| I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | 2.1 | 3.0 | 4.6 |
| 30 | 227-32021-01 | 227-32022-01 | 227-32023-01 | 227-32025-01 | - | - |
| 50 | 227-32021-02 | 227-32022-02 | 227-32023-02 | 227-32025-02 | 227-32026-01 | 227-32027-01 |
| 100 | 227-32021-03 | 227-32022-03 | 227-32023-03 | 227-32025-03 | 227-32026-02 | 227-32027-02 |
| 150 | 227-32021-04 | 227-32022-04 | 227-32023-04 | 227-32025-04 | 227-32026-03 | 227-32027-03 |

# Core Shell Columns

### Shim-pack Velox 5 µm Columns

| Chemistry | SP-C18 | C18 | Biphenyl | PFPP |
|---|---|---|---|---|
| I.D. (mm) / Length (mm) | 4.6 | | | |
| 30 | 227-32006-01 | 227-32012-01 | 227-32018-01 | 227-32024-01 |
| 50 | 227-32006-02 | 227-32012-02 | 227-32018-02 | 227-32024-02 |
| 100 | 227-32006-03 | 227-32012-03 | 227-32018-03 | 227-32024-03 |
| 150 | 227-32006-04 | 227-32012-04 | 227-32018-04 | 227-32024-04 |

### Shim-pack Velox EXP Guard Column Cartridge (3 pk)

| Type | 1.8 µm | | | | 2.7 µm | | | | |
|---|---|---|---|---|---|---|---|---|---|
| I.D. x L (mm) | SP-C18 | C18 | Biphenyl | PFPP | SP-C18 | C18 | Biphenyl | PFPP | HILIC |
| 2.1 x 5 | 227-32028-01 | 227-32031-01 | 227-32034-01 | 227-32037-01 | 227-32029-01 | 227-32032-01 | 227-32035-01 | 227-32038-01 | 227-32040-01 |
| 3.0 x 5 | 227-32028-02 | 227-32031-02 | 227-32034-02 | 227-32037-02 | 227-32029-02 | 227-32032-02 | 227-32035-02 | 227-32038-02 | 227-32040-02 |
| 4.6 x 5 | - | - | - | - | 227-32029-03 | 227-32032-03 | 227-32035-03 | 227-32038-03 | 227-32040-03 |

| Type | 5 µm | | | |
|---|---|---|---|---|
| I.D. x L (mm) | SP-C18 | C18 | Biphenyl | PFPP |
| 4.6 x 5 | 227-32030-01 | 227-32033-01 | 227-32036-01 | 227-32039-01 |

*Shim-pack Velox EXP Direct Connect Holder : 227-32041-01

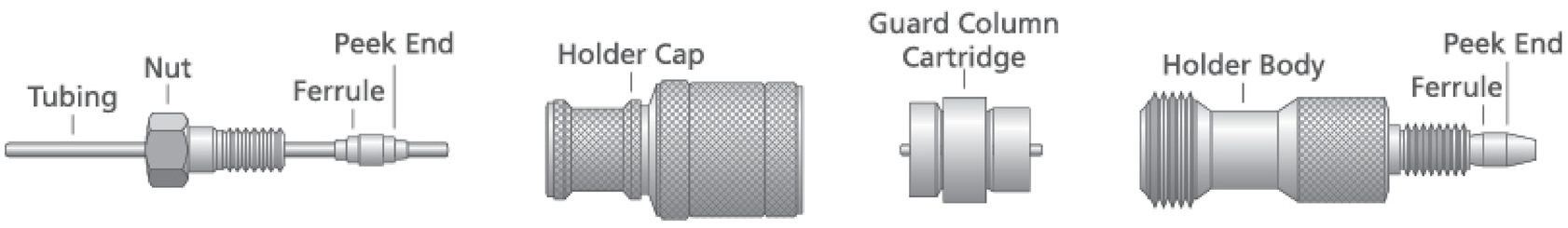
### Shim-pack Velox UHPLC Pre-column (0.2 µm)

| | |
|---|---|
| 1pc | 227-32042-01 |
| 5pcs | 227-32042-02 |
| 10pcs | 227-32042-03 |

*For more pre-column options, please refer to page 110

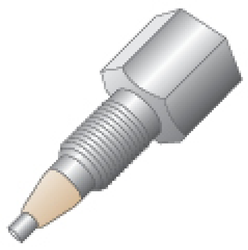
## Shim-pack Velox EXP Guard Column

Free-turning architecture lets you change cartridges by hand without breaking inlet / outlet fluid connections — no tools needed.
Guard column cartridges require Shim-pack Velox EXP Direct Connect Holder (227-32041-01)




## Shim-pack Velox UHPLC Precolumn Filter (0.2 µm)

To minimize extra column volume and maximize UHPLC sample throughput with SPE, SLE, or other sample preparation techniques, pair 1.8 µm Shim-pack Velox UHPLC columns with an Shim-pack Velox UHPLC Precolumn filter instead of a guard cartridge.



## Shim-pack Scepter LC Columns

### Excellent stability & performance could be achieved under a wide range of LC conditions

Excellent stability and performance could be achieved under a wide range of LC conditions with Shim-pack Scepter LC columns, which are the next generation organic silica hybrid based columns. With different chemistry characteristics, Shim-pack Scepter columns are effective for method development/scouting with suitability for use in a wide variety of applications.

With different particle sizes (1.9 µm, 3 µm, 5 µm) and different column dimensions, Shim-pack Scepter LC columns are fully scalable between UHPLC, HPLC and preparative LC making method transfer seamless between different laboratory instrumentation.

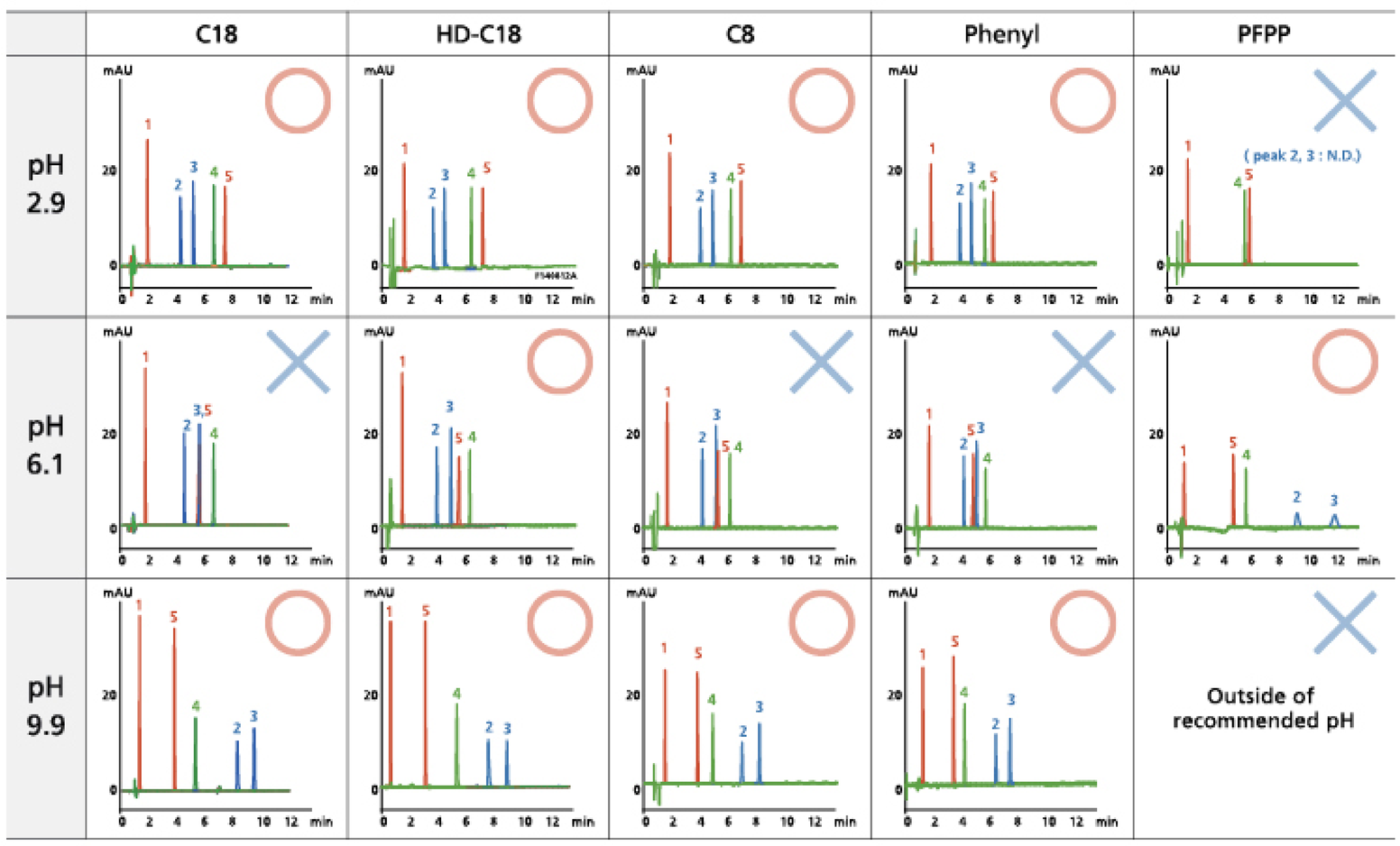
### Shim-pack Scepter Chemistries

| Shim-pack Scepter | Reversed Phase | | | | | | HILIC |
|---|---|---|---|---|---|---|---|
| | C18 | HD-C18 | C8 | Pheny | PFPP | C4 | Diol-HILIC |
| Ligand Type | Trifunctional C18<br>Generic Purpose Type | Trifunctional C18<br>High Density Type | Trifunctional C8 | Trifunctional Phenylbutyl | Trifunctional Pentafluorophenylpropyl | Butyl group | Trifunctional Dihydroxypropyl |
| Particle | Organic Silica Hybrid | | | | | | |
| Particle Size | 1.9 µm, 3 µm, 5 µm | | | | | | |
| Pore Size | 12 nm | 8 nm | 12 nm | | | 30 nm | 12 nm |
| End Capping | Proprietary | | | | None | Proprietary | None |
| pH Range | 1 - 12 | | | 1 - 10 | 1 - 8 | 1 - 10 | 2 - 10 |
| 100% aqueous condition | Yes | No | No | Yes | Yes | No | N/A |
| USP Classification | L1 | L1 | L7 | L11 | L43 | L26 | L20 |

### Method Scouting Utilize excellent stability & performance under a wide range of LC conditions

With excellent stability under a wide range of LC conditions, Shim-pack Scepter LC columns are effective for method scouting combining mobile phase pH and organic modifier.

Comparison of Chromatograms using Gradient condition with Acetonitrile




**Analytes**

1. Saccharin (pKa = 2.2)
2. Dextromethorphan (pKa = 8.3)
3. Amitriptyline (pKa = 9.4)
4. N-Butyl paraben (pKa = 8.3)
5. Ibupurofen (pKa = 4.4)

For Shim-pack Scepter C4, please refer to page A-22

# Shim-pack Scepter C18

## Analytical columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.0 | 2.1 | 3.0 | 4.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|---|---|
| 1.9 | 20 | 227-31011-01 | 227-31012-01 | - | - | - | 100 |
| | 30 | 227-31011-02 | 227-31012-02 | - | - | - | |
| | 50 | 227-31011-03 | 227-31012-03 | 227-31013-01 | - | - | |
| | 75 | 227-31011-04 | 227-31012-04 | 227-31013-02 | - | - | |
| | 100 | 227-31011-05 | 227-31012-05 | 227-31013-03 | - | - | |
| | 150 | 227-31011-06 | 227-31012-06 | 227-31013-04 | - | - | |
| 3 | 20 | - | 227-31014-01 | - | - | - | 45 |
| | 33 | - | 227-31014-02 | - | - | 227-31016-01 | |
| | 50 | - | 227-31014-03 | 227-31015-01 | - | 227-31016-02 | |
| | 75 | - | 227-31014-04 | 227-31015-02 | - | 227-31016-03 | |
| | 100 | - | 227-31014-05 | 227-31015-03 | - | 227-31016-04 | |
| | 150 | - | 227-31014-06 | 227-31015-04 | - | 227-31016-05 | |
| | 250 | - | - | - | - | 227-31016-06 | |
| 5 | 20 | - | 227-31017-01 | - | - | - | 45 |
| | 33 | - | 227-31017-02 | - | - | 227-31020-01 | |
| | 50 | - | 227-31017-03 | 227-31018-01 | - | 227-31020-02 | |
| | 75 | - | 227-31017-04 | 227-31018-02 | - | 227-31020-03 | |
| | 100 | - | 227-31017-05 | 227-31018-03 | - | 227-31020-04 | |
| | 150 | - | 227-31017-06 | 227-31018-04 | 227-31019-01 | 227-31020-05 | |
| | 250 | - | - | - | 227-31019-02 | 227-31020-06 | |

## Analytical Guard cartridge columns and holder

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.0 | Holder |
|---|---|---|---|---|---|
| 1.9 | 5 | 227-31120-01 | 227-31120-02 | - | 227-31170-01 |
| 3 | 10 | 227-31121-01 | 227-31122-01 | 227-31123-01 | 227-31172-03 |
| | 20 | 227-31121-02 | 227-31122-02 | 227-31123-02 | 227-31172-04 |
| 5 | 10 | 227-31124-01 | 227-31125-01 | 227-31126-01 | 227-31172-03 |
| | 20 | 227-31124-02 | 227-31125-02 | 227-31126-02 | 227-31172-04 |

## Preparative columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10.0 | 20.0 | 30.0 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 5 | 50 | - | 227-31102-01 | 227-31103-01 | 30 |
| | 75 | - | - | 227-31103-02 | |
| | 100 | - | 227-31102-02 | 227-31103-03 | |
| | 150 | 227-31101-01 | 227-31102-03 | 227-31103-04 | |
| | 250 | 227-31101-02 | 227-31102-04 | 227-31103-05 | |

## Prep Guard cartridge columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10.0 | Holder |
|---|---|---|---|
| 5 | 10 | 227-31127-01 | 227-31171-01 |

# Shim-pack Scepter HD-C18

## Analytical columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.0 | 2.1 | 3.0 | 4.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|---|---|
| 1.9 | 20 | 227-31025-01 | 227-31026-01 | - | - | - | 100 |
| | 30 | 227-31025-02 | 227-31026-02 | - | - | - | |
| | 50 | 227-31025-03 | 227-31026-03 | 227-31027-01 | - | - | |
| | 75 | 227-31025-04 | 227-31026-04 | 227-31027-02 | - | - | |
| | 100 | 227-31025-05 | 227-31026-05 | 227-31027-03 | - | - | |
| | 150 | 227-31025-06 | 227-31026-06 | 227-31027-04 | - | - | |
| 3 | 20 | - | 227-31028-01 | - | - | - | 45 |
| | 33 | - | 227-31028-02 | - | - | 227-31030-01 | |
| | 50 | - | 227-31028-03 | 227-31029-01 | - | 227-31030-02 | |
| | 75 | - | 227-31028-04 | 227-31029-02 | - | 227-31030-03 | |
| | 100 | - | 227-31028-05 | 227-31029-03 | - | 227-31030-04 | |
| | 150 | - | 227-31028-06 | 227-31029-04 | - | 227-31030-05 | |
| | 250 | - | - | - | - | 227-31030-06 | |
| 5 | 20 | - | 227-31031-01 | - | - | - | 45 |
| | 33 | - | 227-31021-01 | - | - | 227-31024-01 | |
| | 50 | - | 227-31021-02 | 227-31022-01 | - | 227-31024-02 | |
| | 75 | - | 227-31021-03 | 227-31022-02 | - | 227-31024-03 | |
| | 100 | - | 227-31021-04 | 227-31022-03 | - | 227-31024-04 | |
| | 150 | - | 227-31021-05 | 227-31022-04 | 227-31023-01 | 227-31024-05 | |
| | 250 | - | - | - | 227-31023-02 | 227-31024-06 | |

## Analytical Guard cartridge columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.0 | Holder |
|---|---|---|---|---|---|
| 1.9 | 5 | 227-31128-01 | 227-31128-02 | - | 227-31170-01 |
| 3 | 10 | 227-31129-01 | 227-31130-01 | 227-31131-01 | 227-31172-03 |
| | 20 | 227-31129-02 | 227-31130-02 | 227-31131-02 | 227-31172-04 |
| 5 | 10 | 227-31132-01 | 227-31133-01 | 227-31134-01 | 227-31172-03 |
| | 20 | 227-31132-02 | 227-31133-02 | 227-31134-02 | 227-31172-04 |

## Preparative columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10.0 | 20.0 | 30.0 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 5 | 50 | - | 227-31105-01 | 227-31106-01 | 30 |
| | 75 | - | - | 227-31106-02 | |
| | 100 | - | 227-31105-02 | 227-31106-03 | |
| | 150 | 227-31104-01 | 227-31105-03 | 227-31106-04 | |
| | 250 | 227-31104-02 | 227-31105-04 | 227-31106-05 | |

## Prep Guard cartridge columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10.0 | Holder |
|---|---|---|---|
| 5 | 10 | 227-31135-01 | 227-31171-01 |

# Shim-pack Scepter C8

## Analytical columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.0 | 2.1 | 3.0 | 4.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|---|---|
| 1.9 | 20 | 227-31032-01 | 227-31033-01 | - | - | - | 100 |
| | 30 | 227-31032-02 | 227-31033-02 | - | - | - | |
| | 50 | 227-31032-03 | 227-31033-03 | 227-31034-01 | - | - | |
| | 75 | 227-31032-04 | 227-31033-04 | 227-31034-02 | - | - | |
| | 100 | 227-31032-05 | 227-31033-05 | 227-31034-03 | - | - | |
| | 150 | 227-31032-06 | 227-31033-06 | 227-31034-04 | - | - | |
| 3 | 20 | - | 227-31035-01 | - | - | - | 45 |
| | 33 | - | 227-31035-02 | - | - | 227-31037-01 | |
| | 50 | - | 227-31035-03 | 227-31036-01 | - | 227-31037-02 | |
| | 75 | - | 227-31035-04 | 227-31036-02 | - | 227-31037-03 | |
| | 100 | - | 227-31035-05 | 227-31036-03 | - | 227-31037-04 | |
| | 150 | - | 227-31035-06 | 227-31036-04 | - | 227-31037-05 | |
| | 250 | - | - | - | - | 227-31037-06 | |
| 5 | 20 | - | 227-31038-01 | - | - | - | 45 |
| | 33 | - | 227-31038-02 | - | - | 227-31041-01 | |
| | 50 | - | 227-31038-03 | 227-31039-01 | - | 227-31041-02 | |
| | 75 | - | 227-31038-04 | 227-31039-02 | - | 227-31041-03 | |
| | 100 | - | 227-31038-05 | 227-31039-03 | - | 227-31041-04 | |
| | 150 | - | 227-31038-06 | 227-31039-04 | 227-31040-01 | 227-31041-05 | |
| | 250 | - | - | - | 227-31040-02 | 227-31041-06 | |

## Analytical Guard cartridge columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.0 | Holder |
|---|---|---|---|---|---|
| 1.9 | 5 | 227-31136-01 | 227-31136-02 | - | 227-31170-01 |
| 3 | 10 | 227-31137-01 | 227-31138-01 | 227-31139-01 | 227-31172-03 |
| | 20 | 227-31137-02 | 227-31138-02 | 227-31139-02 | 227-31172-04 |
| 5 | 10 | 227-31140-01 | 227-31141-01 | 227-31142-01 | 227-31172-03 |
| | 20 | 227-31140-02 | 227-31141-02 | 227-31142-02 | 227-31172-04 |

## Preparative columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10.0 | 20.0 | 30.0 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 5 | 50 | - | 227-31108-01 | 227-31109-01 | 30 |
| | 75 | - | - | 227-31109-02 | |
| | 100 | - | 227-31108-02 | 227-31109-03 | |
| | 150 | 227-31107-01 | 227-31108-03 | 227-31109-04 | |
| | 250 | 227-31107-02 | 227-31108-04 | 227-31109-05 | |

## Prep Guard cartridge columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10.0 | Holder |
|---|---|---|---|
| 5 | 10 | 227-31143-01 | 227-31171-01 |

# Shim-pack Scepter PFPP

## Analytical columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.0 | 2.1 | 3.0 | 4.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|---|---|
| 1.9 | 20 | 227-31052-05 | 227-31053-01 | - | - | - | 100 |
| | 30 | 227-31052-06 | 227-31053-02 | - | - | - | |
| | 50 | 227-31052-01 | 227-31053-03 | 227-31054-01 | - | - | |
| | 75 | 227-31052-02 | 227-31053-04 | 227-31054-02 | - | - | |
| | 100 | 227-31052-03 | 227-31053-05 | 227-31054-03 | - | - | |
| | 150 | 227-31052-04 | 227-31053-06 | 227-31054-04 | - | - | |
| 3 | 20 | - | 227-31055-01 | - | - | - | 45 |
| | 33 | - | 227-31055-02 | - | - | 227-31057-01 | |
| | 50 | - | 227-31055-03 | 227-31056-01 | - | 227-31057-02 | |
| | 75 | - | 227-31055-04 | 227-31056-02 | - | 227-31057-03 | |
| | 100 | - | 227-31055-05 | 227-31056-03 | - | 227-31057-04 | |
| | 150 | - | 227-31055-06 | 227-31056-04 | - | 227-31057-05 | |
| | 250 | - | - | - | - | 227-31057-06 | |
| 5 | 20 | - | 227-31058-01 | - | - | - | 45 |
| | 33 | - | 227-31058-02 | - | - | 227-31061-01 | |
| | 50 | - | 227-31058-03 | 227-31059-01 | - | 227-31061-02 | |
| | 75 | - | 227-31058-04 | 227-31059-02 | - | 227-31061-03 | |
| | 100 | - | 227-31058-05 | 227-31059-03 | - | 227-31061-04 | |
| | 150 | - | 227-31058-06 | 227-31059-04 | 227-31060-01 | 227-31061-05 | |
| | 250 | - | - | - | 227-31060-02 | 227-31061-06 | |

## Analytical Guard cartridge columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.0 | Holder |
|---|---|---|---|---|---|
| 1.9 | 5 | 227-31150-01 | 227-31150-02 | - | 227-31170-01 |
| 3 | 10 | 227-31151-01 | 227-31152-01 | 227-31153-01 | 227-31172-03 |
| | 20 | 227-31151-02 | 227-31152-02 | 227-31153-02 | 227-31172-04 |
| 5 | 10 | 227-31154-01 | 227-31155-01 | 227-31156-01 | 227-31172-03 |
| | 20 | 227-31154-02 | 227-31155-02 | 227-31156-02 | 227-31172-04 |

## Preparative columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10.0 | 20.0 | 30.0 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 5 | 50 | - | 227-31111-01 | 227-31112-01 | 30 |
| | 75 | - | - | 227-31112-02 | |
| | 100 | - | 227-31111-02 | 227-31112-03 | |
| | 150 | 227-31110-01 | 227-31111-03 | 227-31112-04 | |
| | 250 | 227-31110-02 | 227-31111-04 | 227-31112-05 | |

## Prep Guard cartridge columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10.0 | Holder |
|---|---|---|---|
| 5 | 10 | 227-31157-01 | 227-31171-01 |

# Shim-pack Scepter Phenyl

## Analytical columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.0 | 2.1 | 3.0 | 4.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|---|---|
| 1.9 | 20 | 227-31062-05 | 227-31063-01 | - | - | - | 100 |
| | 30 | 227-31062-06 | 227-31063-02 | - | - | - | |
| | 50 | 227-31062-01 | 227-31063-03 | 227-31064-01 | - | - | |
| | 75 | 227-31062-02 | 227-31063-04 | 227-31064-02 | - | - | |
| | 100 | 227-31062-03 | 227-31063-05 | 227-31064-03 | - | - | |
| | 150 | 227-31062-04 | 227-31063-06 | 227-31064-04 | - | - | |
| 3 | 20 | - | 227-31065-01 | - | - | - | 45 |
| | 33 | - | 227-31065-02 | - | - | 227-31067-01 | |
| | 50 | - | 227-31065-03 | 227-31056-01 | - | 227-31067-02 | |
| | 75 | - | 227-31065-04 | 227-31066-02 | - | 227-31067-03 | |
| | 100 | - | 227-31065-05 | 227-31066-03 | - | 227-31067-04 | |
| | 150 | - | 227-31065-06 | 227-31066-04 | - | 227-31067-05 | |
| | 250 | - | - | - | - | 227-31067-06 | |
| 5 | 20 | - | 227-31068-01 | - | - | - | 45 |
| | 33 | - | 227-31068-02 | - | - | 227-31071-01 | |
| | 50 | - | 227-31068-03 | 227-31069-01 | - | 227-31071-02 | |
| | 75 | - | 227-31068-04 | 227-31069-02 | - | 227-31071-03 | |
| | 100 | - | 227-31068-05 | 227-31069-03 | - | 227-31071-04 | |
| | 150 | - | 227-31068-06 | 227-31069-04 | 227-31070-01 | 227-31071-05 | |
| | 250 | - | - | - | 227-31070-02 | 227-31071-06 | |

## Analytical Guard cartridge columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.0 | Holder |
|---|---|---|---|---|---|
| 1.9 | 5 | 227-31158-01 | 227-31158-02 | - | 227-31170-01 |
| 3 | 10 | 227-31159-01 | 227-31160-01 | 227-31161-01 | 227-31172-03 |
| | 20 | 227-31159-02 | 227-31160-02 | 227-31161-02 | 227-31172-04 |
| 5 | 10 | 227-31162-01 | 227-31163-01 | 227-31164-01 | 227-31172-03 |
| | 20 | 227-31162-02 | 227-31163-02 | 227-31164-02 | 227-31172-04 |

## Preparative columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10.0 | 20.0 | 30.0 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 5 | 50 | - | 227-31114-01 | 227-31115-01 | 30 |
| | 75 | - | - | 227-31115-02 | |
| | 100 | - | 227-31114-02 | 227-31115-03 | |
| | 150 | 227-31113-01 | 227-31114-03 | 227-31115-04 | |
| | 250 | 227-31113-02 | 227-31114-04 | 227-31115-05 | |

## Prep Guard cartridge columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10.0 | Holder |
|---|---|---|---|
| 5 | 10 | 227-31165-01 | 227-31171-01 |

## Diol-HILIC

### Analytical columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.0 | 2.1 | 3.0 | 4.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|---|---|
| 1.9 | 20 | - | - | - | - | - | 100 |
| | 30 | - | - | - | - | - | |
| | 50 | 227-31042-03 | 227-31043-03 | 227-31044-03 | - | - | |
| | 75 | 227-31042-01 | 227-31043-01 | 227-31044-01 | - | - | |
| | 100 | 227-31042-02 | 227-31043-02 | 227-31044-02 | - | - | |
| | 150 | - | - | - | - | - | |
| 3 | 20 | - | 227-31045-01 | - | - | - | 45 |
| | 33 | - | 227-31045-02 | - | - | 227-31047-01 | |
| | 50 | - | 227-31045-03 | 227-31046-01 | - | 227-31047-02 | |
| | 75 | - | 227-31045-04 | 227-31046-02 | - | 227-31047-03 | |
| | 100 | - | 227-31045-05 | 227-31046-03 | - | 227-31047-04 | |
| | 150 | - | 227-31045-06 | 227-31046-04 | - | 227-31047-05 | |
| | 250 | - | - | - | - | 227-31047-06 | |
| 5 | 20 | - | 227-31048-01 | - | - | - | 45 |
| | 33 | - | 227-31048-02 | - | - | 227-31051-01 | |
| | 50 | - | 227-31048-03 | 227-31049-01 | - | 227-31051-02 | |
| | 75 | - | 227-31048-04 | 227-31049-02 | - | 227-31051-03 | |
| | 100 | - | 227-31048-05 | 227-31049-03 | - | 227-31051-04 | |
| | 150 | - | 227-31048-06 | 227-31049-04 | 227-31050-01 | 227-31051-05 | |
| | 250 | - | - | - | 227-31050-02 | 227-31051-06 | |

### Analytical Guard cartridge columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.0 | Holder |
|---|---|---|---|---|---|
| 3 | 10 | 227-31144-01 | 227-31145-01 | 227-31146-01 | 227-31172-03 |
| | 20 | 227-31144-02 | 227-31145-02 | 227-31146-02 | 227-31172-04 |
| 5 | 10 | 227-31147-01 | 227-31148-01 | 227-31149-01 | 227-31172-03 |
| | 20 | 227-31147-02 | 227-31148-02 | 227-31149-02 | 227-31172-04 |

# Shim-pack Scepter C4

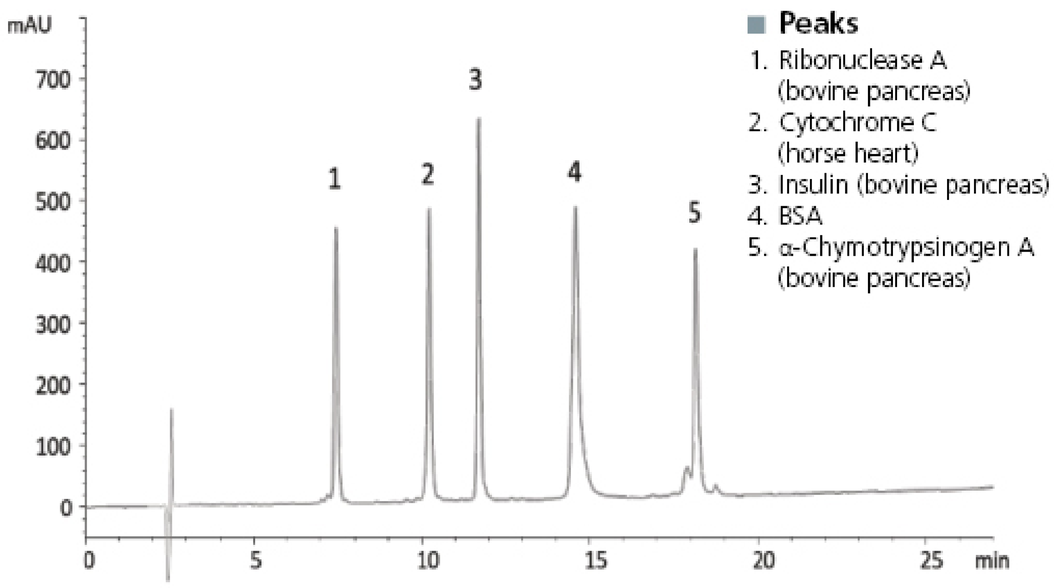
## Design for biomolecules separations

Shim-pack Scepter C4 is a wide-bore C4 column that uses an organic silica hybrid base which is suitable for separation of proteins such as monoclonal antibodies. The column can be used for analysis of proteins with a molecular weight of up to approximately 150,000 and is suitable for analysis of antibodies as it is very stable even under acidic or high-temperature conditions because an organic silica hybrid base is used. It is also effective for high-sensitivity analysis on LC/MS as it provides good peak shapes even when using a formic acid mobile phase with low ion paring effect. In addition, it is effective for separation of highly-hydrophobic proteins, nucleotides and small molecules that are hard to separate using a regular C18 column.

| Bonded Phase | Butyl Groups |
|---|---|
| Particle Size | 1.9µm, 3µm, 5µm |
| Pore Size | 30 nm |
| End-capping | Yes |
| pH Range | 1 to 10 |
| USP Code | L26 |

## Analysis Examples

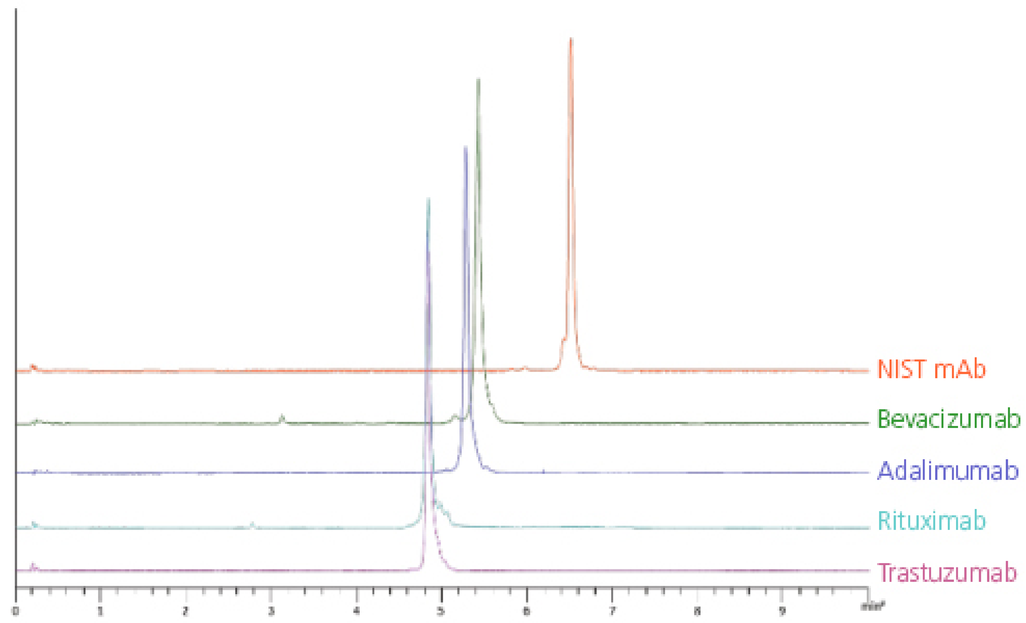
**Analysis of Proteins**




**Conditions**

| | |
|---|---|
| **Column** | : Shim-pack Scepter C4 (5 µm, 150 x 3.0 mm I.D.) (P/N: 227-31181-04) |
| **Mobile Phase** | : A) Water/TFA (100/0.1)<br>B) Acetonitrile/TFA (100/0.1)<br>20-60%B (0-27 min), 90%B (27-35 min), 20%B (35-50 min) |
| **Flow Rate** | : 0.4 mL/min |
| **Col. Temp.** | : 70 °C |
| **Detection** | : UV at 220 nm |
| **Injection Vol.** | : 10 µL (0.25 – 0.50 mg/mL) Column |

**Analysis of Monoclonal Antibodies**




**Conditions**

| | |
|---|---|
| **Column** | : Shim-pack Scepter C4 (1.9 µm, 50 x 2.1 mm I.D.) (P/N: 227-31175-03) |
| **Mobile Phase** | : A) Water/TFA (100/0.1)<br>B) Acetonitrile/TFA (100/0.1)<br>25-45%B (0-10 min) |
| **Flow Rate** | : 0.4 mL/min |
| **Col. Temp.** | : 80 °C |
| **Detection** | : UV at 280 nm |
| **Injection Vol.** | : 2 µL |
| **Sample Conc.** | : 0.2 mg/mL |

## Analytical columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|---|
| 1.9 | 20 | 227-31175-01 | - | - | - | 100 |
| | 30 | 227-31175-02 | 227-30817-02 | - | - | |
| | 50 | 227-31175-03 | 227-31176-01 | - | - | |
| | 100 | 227-31175-04 | 227-31176-02 | - | - | |
| | 125 | 227-31175-05 | 227-31176-03 | - | - | |
| | 150 | 227-31175-06 | 227-31176-04 | - | - | |
| 3 | 20 | 227-31177-01 | - | - | - | 45 |
| | 33 | 227-31177-02 | - | - | 227-31179-01 | |
| | 50 | 227-31177-03 | 227-31178-01 | - | 227-31179-02 | |
| | 75 | 227-31177-04 | 227-31178-02 | - | 227-31179-03 | |
| | 100 | 227-31177-05 | 227-31178-03 | - | 227-31179-04 | |
| | 150 | 227-31177-06 | 227-31178-04 | - | 227-31179-05 | |
| | 250 | - | - | - | 227-31179-06 | |
| 5 | 20 | 227-31180-01 | - | - | - | 45 |
| | 33 | 227-31180-02 | - | - | 227-31183-01 | |
| | 50 | 227-31180-03 | 227-31181-01 | - | 227-31183-02 | |
| | 75 | 227-31180-04 | 227-31181-02 | - | 227-31183-03 | |
| | 100 | 227-31180-05 | 227-31181-03 | 227-31182-01 | 227-31183-04 | |
| | 150 | 227-31180-06 | 227-31181-04 | 227-31182-02 | 227-31183-05 | |
| | 250 | - | - | - | 227-31183-06 | |

## Analytical Guard cartridge columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.0 | Holder |
|---|---|---|---|---|---|
| 1.9 | 5 | 227-31187-01 | 227-31187-02 | - | 227-31170-01 |
| 3 | 10 | 227-31188-01 | 227-31189-01 | 227-31190-01 | 227-31172-01 |
| | 20 | 227-31188-02 | 227-31189-02 | 227-31190-02 | 227-31172-02 |
| 5 | 10 | 227-31191-01 | 227-31192-01 | 227-31193-01 | 227-31172-01 |
| | 20 | 227-31191-02 | 227-31192-02 | 227-31193-02 | 227-31172-02 |

## Preparative columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10 | 20 | 30 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 5 | 50 | - | 227-31185-01 | 227-31186-01 | 30 |
| | 75 | - | - | 227-31186-02 | |
| | 100 | - | 227-31185-02 | 227-31186-03 | |
| | 150 | 227-31184-01 | 227-31185-03 | 227-31186-04 | |
| | 250 | 227-31184-02 | 227-31185-04 | 227-31186-05 | |

## Preparative guard cartridges columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10 | 20 | 30 | Holder |
|---|---|---|---|---|---|
| 5 | 10 | 227-31194-01 | 227-31195-01 | 227-31196-01 | 227-31171-01 |

# Shim-pack Arata LC Columns

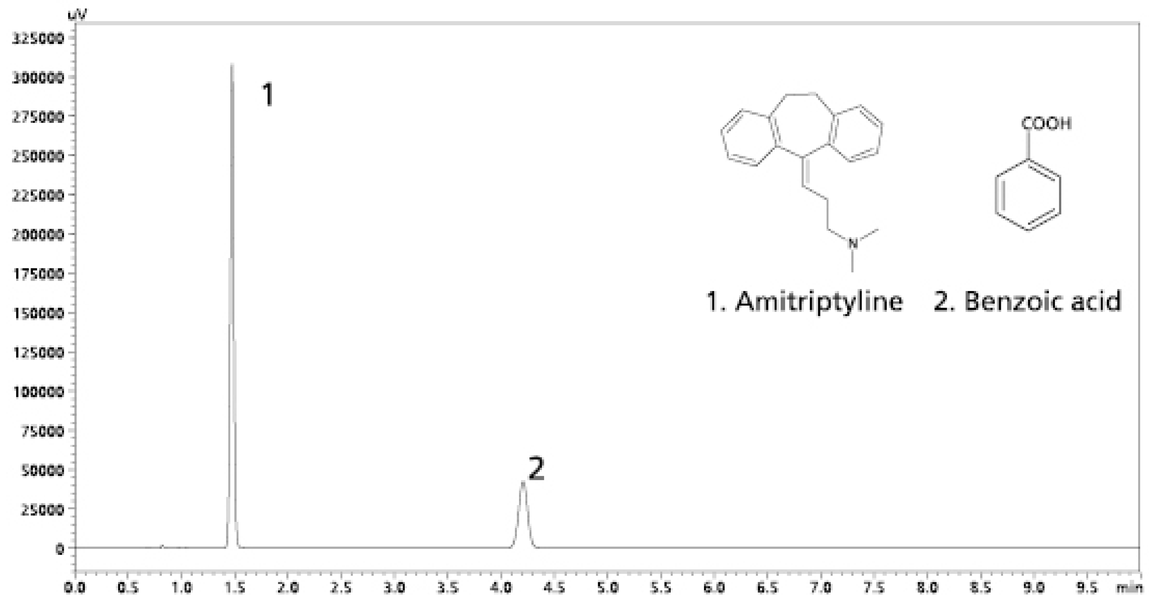
## Unprecedented Resolution and Peak Shape of Basic Compounds

Even for LC columns that claim to be designed for basic compounds, adequate resolution often can not be obtained due to problems such as leading of highly polar basic compounds, peak shape deterioration of acidic compounds, or long equilibration time required for low ionic strength acidic mobile phase.

All of these issues have been solved with Shim-pack Arata that was specifically designed to give unmatched peak shape for basic compounds.

## Unmatched Peak Shape (Elegantly Designed for A Wide Range of Compounds)

Unmatched peak shape of basic compounds could be achieved while maintaining good peak shape for acidic compounds with Shim-pack Arata LC columns. Even with low ionic strength acidic mobile phase, such as 0.1% formic acid containing mobile phase, excellent peak shape of both amitriptyline (a basic compound) and benzoic acid (an acidic compound) could be achieved.




Analysis of Amitriptyline and Benzoic Acid with The Mobile Phase with 0.1% Formic Acid

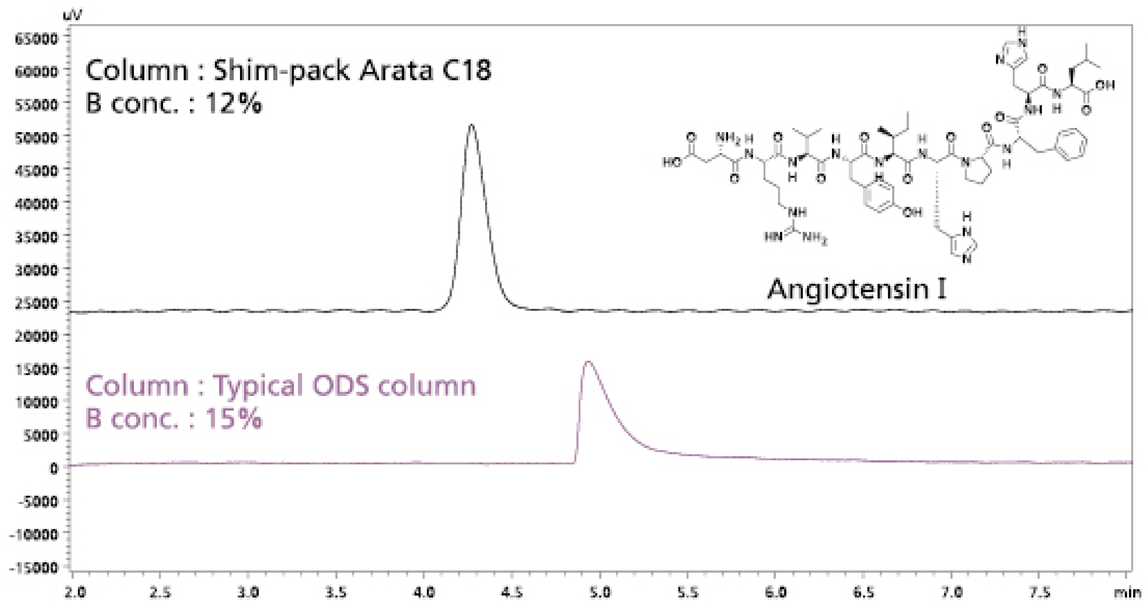
**Analytical Conditions**

| | | |
|---|---|---|
| **Column** | : | Shim-pack Arata C18 |
| **Mobile Phase** | : | 0.1% HCOOH in H2O / CH3CN = 70 / 30 |
| **Flow Rate** | : | 0.4 mL/min |
| **Detection** | : | 254 nm |
| **Column Temp.** | : | 40 °C |
| **Inj. Volume** | : | 2 µL |

* Gel Lot QC test analytical condition

## Excellent Separation Performance for Peptides (Even with Weak Ion Paring Acids)

In order to obtain good peak shape of peptides under reversed phase chromatography, TFA containing mobile phases are frequently used which the ion pairing effect is relatively strong. However, TFA could cause ion suppression in LC/MS (/MS) analysis. Excellent peak shape and separation performance for peptides could be achieved on the Shim-pack Arata LC column even with 0.1 % formic acid (weak ion paring acid) containing mobile phase.




Analysis of Angiotensin I Using Isocratic Mobile Phase
with 0.1% Formic Acid (Shim-pack Arata C18 vs. Typical ODS)

**Analytical Conditions**

| | | |
|---|---|---|
| **Column** | : | Shim-pack Arata C18 |
| Mobile Phase | : | A: 0.1% HCOOH in H2O |
| | : | B: 0.1% HCOOH in CH3CN |
| Flow Rate | : | 0.4 mL/min |
| Detection | : | 214 nm |
| Column Temp. | : | 40 °C |
| Inj. Volume | : | 1 µL |
| Sample | : | Angiotensin |
| Vial | : | TORAST-H™ Bio Vial |

* Gel Lot QC test analytical condition

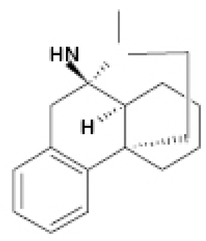
| Column | Asymmetry |
|---|---|
| Shim-pack Arata C18 | 1.26 |
| Typical ODS column | 6.94 |

* Peptide is usually analyzed using gradient condition. Isocratic condition was used for this application in order to show the difference of LC columns more clearly. Result using gradient condition on Shim-pack Arata C18 was also evaluated and it was confirmed that angiotensin was fully eluted from the column with isocratic condition.

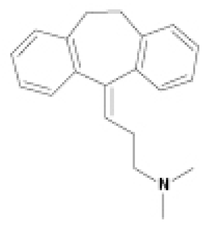
** Acetonitrile concentration was adjusted in order that the retention time of peptide on each column become similar.

## Rapid Equilibration (Even with Low Ionic Strength Acidic Mobile Phases)

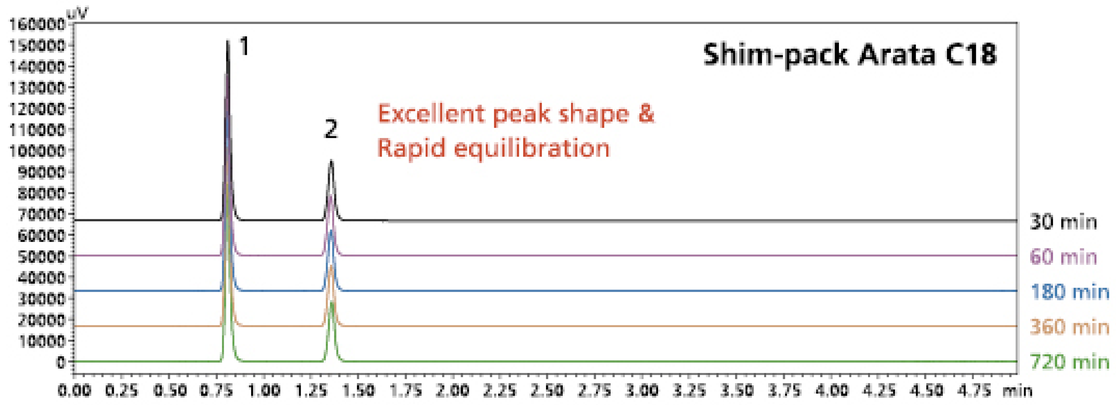
When analyzing basic compounds on a typical ODS column with low ionic strength acidic mobile phase, peak shape and long equilibration times are common problems. Shim-pack Arata LC columns can be rapidly equilibrated in low ionic strength acidic mobile phases yielding excellent peak shape and stable retention times.




1. Dextromethorphan



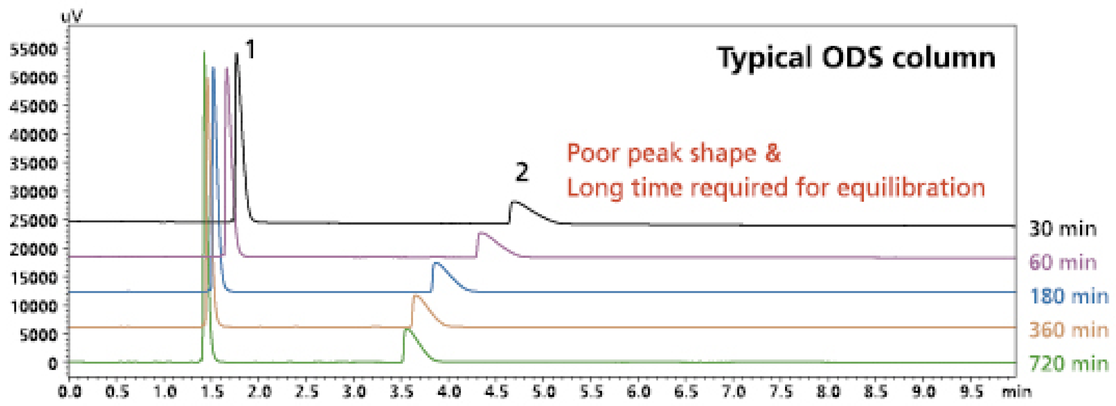

2. Amitriptyline




■ **Analytical Conditions**

| | | |
|---|---|---|
| **Instruments** | : | NexeraX2MP_M30A (STD Cell) |
| **Column** | : | Shim-pack Arata C18 (3.0 × 75 mm, 2.2 µm)<br>Typical ODS column (3.0 × 75 mm, sub 2 µm), |
| **Mobile Phase** | : | 0.1% HCOOH in H2O / CH3CN = 70 / 30 |
| **Flow Rate** | : | 0.4 mL/min |
| **Detection** | : | 280 nm |
| **Column Temp.** | : | 40 °C |
| **Inj. Volume** | : | 2 µL |
| **Sample** | : | Amitriptyline, Dextromethorphan |

| | Compounds | Equilibration Time (min) | 10 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | CV(%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Dextromethorphan | Retention Time (min) | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.2 |
| | | Symmetry Factor | 1.20 | 1.19 | 1.19 | 1.18 | 1.18 | 1.18 | 1.18 | 1.18 | 1.18 | 1.18 | 0.6 |
| 2 | Amitriptyline | Retention Time (min) | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 0.3 |
| | | Symmetry Factor | 1.06 | 1.07 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 0.3 |




* Both were new columns (shipping solvent : acetonitrile) and equilibrated with mobile phase without any conditioning. Basic drugs were analyzed after a certain period of time of equilibration and RT and symmetry factor of the drugs were compared.

| | Compounds | Equilibration Time (min) | 10 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | CV(%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Dextromethorphan | Retention Time (min) | 1.9 | 1.8 | 1.7 | 1.6 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 | 10.4 |
| | | Symmetry Factor | 3.28 | 3.14 | 3.01 | 2.70 | 2.63 | 2.56 | 2.51 | 2.49 | 2.56 | 2.49 | 10.2 |
| 2 | Amitriptyline | Retention Time (min) | 5.3 | 4.7 | 4.3 | 4.0 | 3.9 | 3.8 | 3.7 | 3.6 | 3.5 | 3.6 | 13.5 |
| | | Symmetry Factor | 4.23 | 4.23 | 4.35 | 4.22 | 4.13 | 4.17 | 4.09 | 4.02 | 3.99 | 3.90 | 3.1 |

Comparison of Column Equilibration in The Mobile Phase with 0.1% Formic Acid (Shim-pack Arata C18 vs. Typical ODS Column)

## Shim-pack Arata C18

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.0 | 3.0 | 4.6 |
|---|---|---|---|---|
| 2.2 | 50 | 227-32801-01 | 227-32802-01 | - |
| | 75 | 227-32801-02 | 227-32802-02 | - |
| | 100 | 227-32801-03 | 227-32802-03 | - |
| | 150 | 227-32801-04 | 227-32802-04 | 227-32805-04 |
| | 250 | - | - | 227-32805-05 |
| 5.0 | 50 | 227-32803-01 | 227-32804-01 | 227-32805-01 |
| | 75 | 227-32803-02 | 227-32804-02 | 227-32805-02 |
| | 100 | 227-32803-03 | 227-32804-03 | 227-32805-03 |
| | 150 | 227-32803-04 | 227-32804-04 | 227-32805-04 |
| | 250 | - | - | 227-32805-05 |

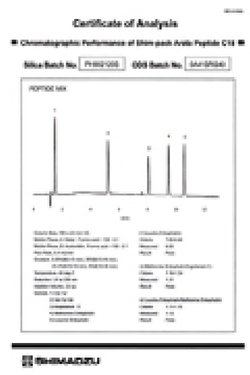
# Shim-pack Arata Peptide Columns

## Excellent Seperation Performance of Peptides

Typically, in order to obtain good peak shape of peptides under reversed phase chromatography, TFA containing mobile phases are frequently used which the ion pairing effect is relatively strong. However, TFA could cause ion suppression in LC/MS(/MS) analysis. Excellent peak shape and separation performance for peptides could be achieved on the Shim-pack Arata LC column even under formic acid (weak ion paring acid) containing mobile phase conditions, which are suitable for LC/MS(/MS) without the use of typical ion pairing agents.

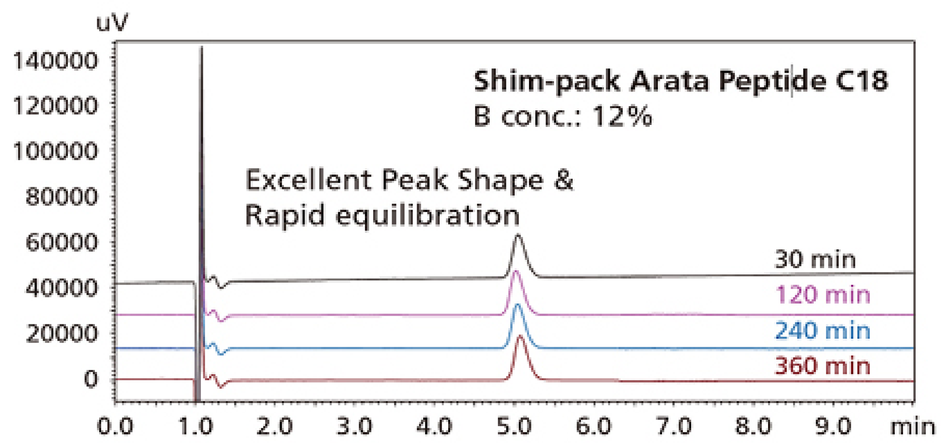
## Increased Assurance of Peptide Analysis ~ Shim-pack Arata Peptide C 18 column ~

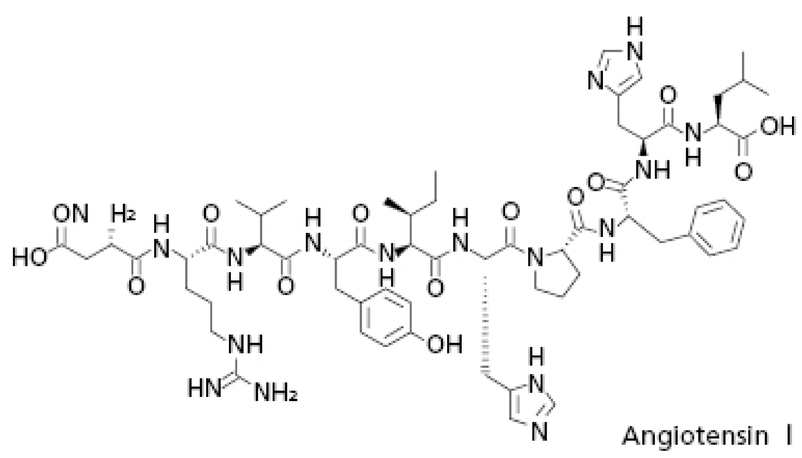
In order to ensure lot-to-lot reproducibility in peptide analysis, each lot of Shim-pack Arata Peptide C18material is tested using a mixture of peptide standards in addition to the standard Shim-pack Arata C18 lot QCtest. This test is carried out under severe condition using 0.1 % formic acid mobile phase to help ensure consistent column performance for requirements of customers under regulated requirements.use of typical ion pairing agents.



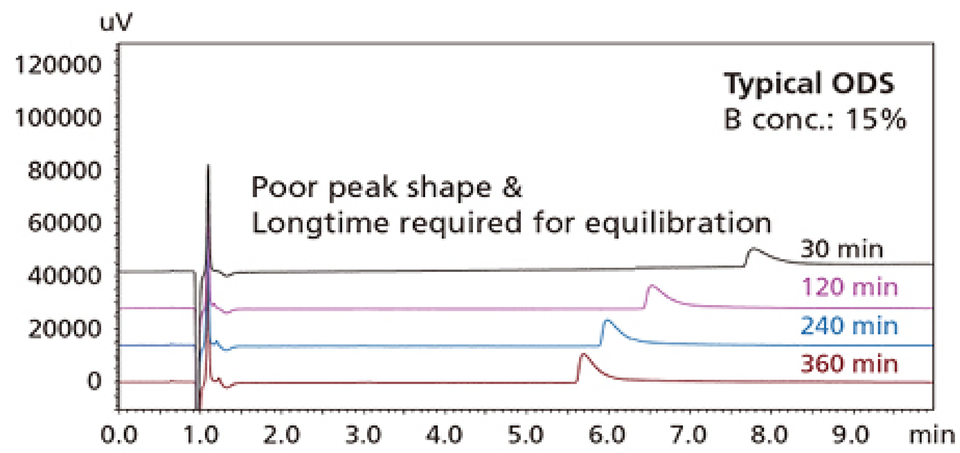

## Excellent Seperation Performance of Peptides

When analyzing peptides on a typical ODS column with 0.1% formic acid mobile phase, not only poor peak shape but also long equilibration time required to obtain stable retention times and area is a common problem. Shim-pack Arata Peptide C18 columnscan be rapidly equilibrated even in 0.1% formic acid containing mobile phase, achieving excellent peak shape, stable retention andarea of peptides at the same time.




| Compounds | Equilibration time (min) | 30 | 60 | 120 | 180 | 240 | 360 | CV |
|---|---|---|---|---|---|---|---|---|
| Angiotensin I | Retention time (min) | 5.05 | 5.03 | 5.03 | 5.03 | 5.04 | 5.06 | 0.3 |
| | Symmetry factor | 1.26 | 1.24 | 1.25 | 1.25 | 1.24 | 1.25 | 0.4 |
| | Area | $2.17\times10^5$ | $2.13\times10^5$ | $2.26\times10^5$ | $2.25\times10^5$ | $2.23\times10^5$ | $2.24\times10^5$ | 1.9 |




Analytical Conditions
LC system : NexeraX2 MP_SPD20A (Semi-micro Cell)
LC column :
Shim-pack Arata Peptide C18 (3.0 × 75 mm, 2.2 µm)
Typical ODS (3.0 × 75 mm, Sub 2 µm)
Mobile Phase A : 0.1% HCOOH in H2O
Mobile Phase B : 0.1% HCOOH in CH3CN
Flow rate : 0.4 mL/min

Detection : 214 nm
Column temp. : 40 °C
Injection volume : 1 µL
Sample : Angiotensin I
Vial : Torast-H Bio Vial

*Peptide is usually analyzed using gradient conditions. Isocratic condition was used for this application in order to show the difference of LC columns more clearly. Acetonitrile concentration was adjusted in order that the retention time of peptide on each column become similar.

| Compounds | Equilibration time (min) | 30 | 60 | 120 | 180 | 240 | 360 | CV |
|---|---|---|---|---|---|---|---|---|
| Angiotensin I | Retention time (min) | 7.78 | 7.15 | 6.53 | 6.20 | 5.98 | 5.82 | 11.0 |
| | Symmetry factor | 4.89 | 4.38 | 4.85 | 4.87 | 4.93 | 4.92 | 3.9 |
| | Area | $1.65\times10^5$ | $1.58\times10^5$ | $1.76\times10^5$ | $1.78\times10^5$ | $1.83\times10^5$ | $1.84\times10^5$ | 5.3 |

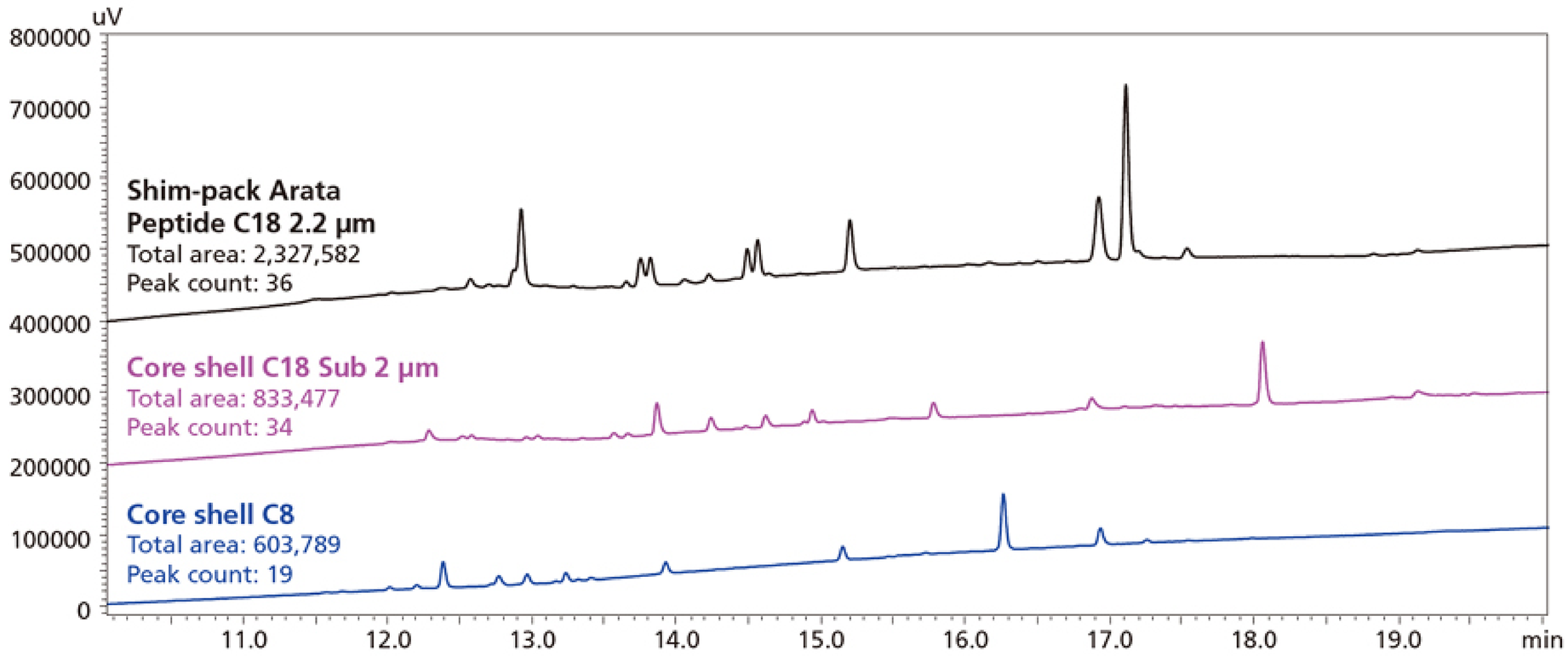
Both columns were new columns (shipping solvent: acetonitrile) and equilibrated with mobile phase without any conditioning. Angiotensin I was analyzed after a certain period of equilibration and retention time, symmetry factor and area of Angiotensin I were compared. The typical ODS showed poor peak symmetry and unstable retention time even after 360 minutes of equilibration. In contrast, Shim-pack Arata peptide C18 already showed stable retention after 30 minutes of equilibration and excellent peak shape was obtained.

# High Peptide Recovery enabled by Shim-pack Arata technology

Since the adsorption of peptides to particles is minimized, high recovery of peptides is ensured and excellent peptide analysis can be provided by Shim-pack Arata Peptide C18 column.

## Analysis of Tryptic Digest of Myoglobin

Peptides are known to show non-specific adsorption to particles of LC columns. A Shim-pack Arata Peptide C18 column showed high recovery of peptides.




Analytical Conditions

LC System : NexeraX2MP_M30A (STD Cell)
LC Column : Shim-pack Arata Peptide C18 (2.0 × 150 mm, 2.2 µm)
Core shell Peptide C18 (2.1×150 mm, sub 2 µm)
Core shell C8 (2.1 ×150 mm, sub 4 µm)
Mobile Phase A : 0.1% HCOOH in H2O
Mobile Phase B : 0.1% HCOOH in CH3CN
Gradient : 2%B (0-5 min)→45%B (20 min)→100%B (20.01 – 25 min)
→2%B (25.01 – 30 min)

Detection : 214 nm
Column temp. : 40 °C
Injection volume : 1 µL
Sample : Angiotensin I
Vial : Torast-H Bio Vial

Tryptic digest of myoglobin was analyzed using Shim-pack Arata Peptide C18 (2.2 µm), Core shell C18 (sub 2 µm) and a Core shell C8 (sub 4 µm). Compared to the other two columns, Shim-pack Arata Peptide C18 showed significantly larger peak area, which suggests that higher recovery could be obtained with Shim-pack Arata Peptide C18 column.

### Shim-pack Arata Peptide C18

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.0 |
|---|---|---|
| 2.2 | 50 | 227-32806-01 |
| | 100 | 227-32806-02 |
| | 150 | 227-32806-03 |

# Shim-pack XR Series

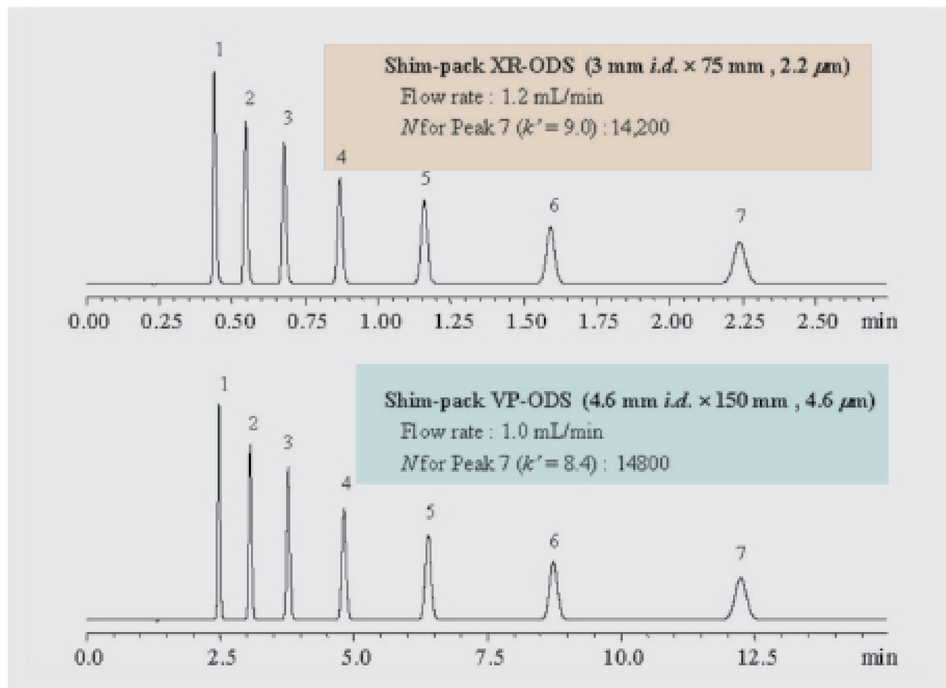
## Shim-pack XR Series Columns Offer Versatility and Fast Analysis

Shim-pack XR Series columns use a 2.2 µm packing particle size and offer a skillful balance between resolution efficiency and pressure. An XR Series column provides resolution equivalent to a general-purpose column with 5 µm packing particle size (Shim-pack VP-ODS), but significantly reduces the analysis time. The pressure on the column under many analysis conditions does not exceed 35 MPa. Consequently, ultrafast analysis can be comfortably performed on an existing instrument.

| | Shim-pack XR-ODS | Shim-pack XR-C8 | Shim-pack XR-Phenyl | Shim-pack XR-SIL |
|---|---|---|---|---|
| Particle Size (µm) | 2.2 | 2.2 | 2.2 | 2.2 |
| Pore Size (nm) | 12 | 12 | 12 | 12 |
| Surface Area (m2/g) | 340 | 340 | 340 | 340 |
| Carbon Loading | 18% | 11% | 11% | – |
| Pressure Tolerance (MPa) | 35 | 35 | 35 | 20 |
| Pore Volume (mL/g) | 1.05 | 1.05 | 1.05 | 1.05 |
| End-capping | Yes | Yes | Yes | – |
| Bonding Type | Monomeric | Monomeric | Monomeric | – |
| pH Range | 2 - 7.5 | 2 - 7.5 | 2 - 7.5 | – |
| USP Code | L1 | L7 | L11 | L3 |

### Shim-pack XR-ODS Permits Simple Switching from Conventional Analysis

The two chromatograms to the right show differences in analysis times when using different columns. The lower chromatogram is the result of analysis using a Shimadzu Shim-pack VP-ODS general-purpose column. The upper chromatogram is from analysis with a Shim-pack XR-ODS fast analysis column. As both Shim-pack VP-ODS and Shim-pack XR-ODS offer identical resolution properties, Shim-pack XR-ODS maintains the resolution while significantly reducing analysis times.




For more information of smooth transfer of methods from high-speed analysis to conventional analysis, please refer to page A-34

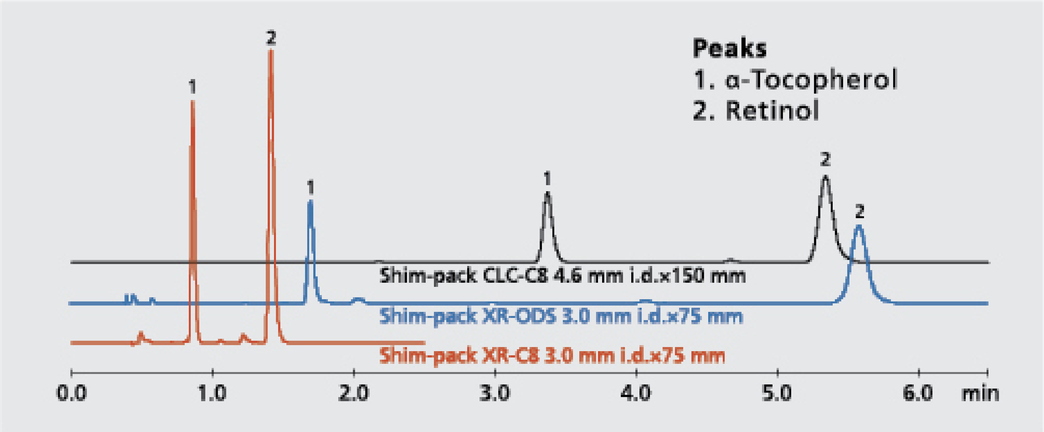
### Shim-pack XR Series Comprehensive Product Range

In addition to the versatile Shim-pack XR-ODS that is bonded with the C18 group, the comprehensive Shim-pack XR Series product range includes the Shim-pack XR-C8 that is bonded with the C8 group to give different retention behavior to ODS, Shim-pack XR-Phenyl that is bonded with the phenylpropyl group, and the normal-phase Shim-pack XR-SIL silica column that achieves higher speeds.

## Analysis Examples

### Analysis of Fat-Soluble Vitamins

The fat-soluble vitamins E (tocopherol) and A (retinol) were analyzed. The Shim-pack XR-C8 column achieves higher speed than a conventional C8 column.

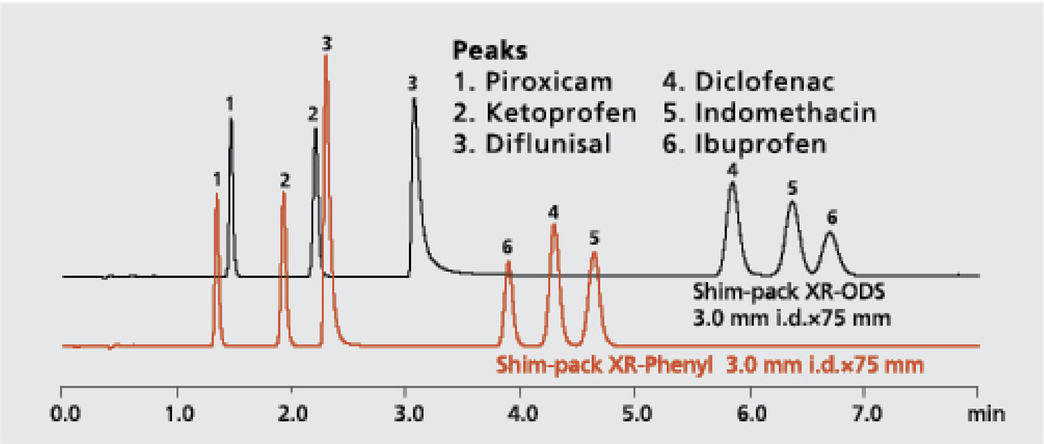



■ **Conditions**

| | |
|---|---|
| **Column** | : Shim-pack XR-C8 (75 mmL. × 3.0 mmI.D., 2.2 µm) (P/N: 228-59902-93) |
| **Mobile Phase** | : Methanol |
| **Flow Rate** | : 1.0 mL/min |
| **Col. Temp.** | : 40 °C |
| **Detection** | : UV 290 nm |

### Analysis of Non-Steroidal Anti-Inflammatory Drug

The column was switched from Shim-pack XR-ODS to Shim-pack XR-Phenyl to improve the resolution.
The difference in retention properties between the ODS group and the phenylpropyl group improves the peak shape, controls the resolution, and reduces the analysis time.

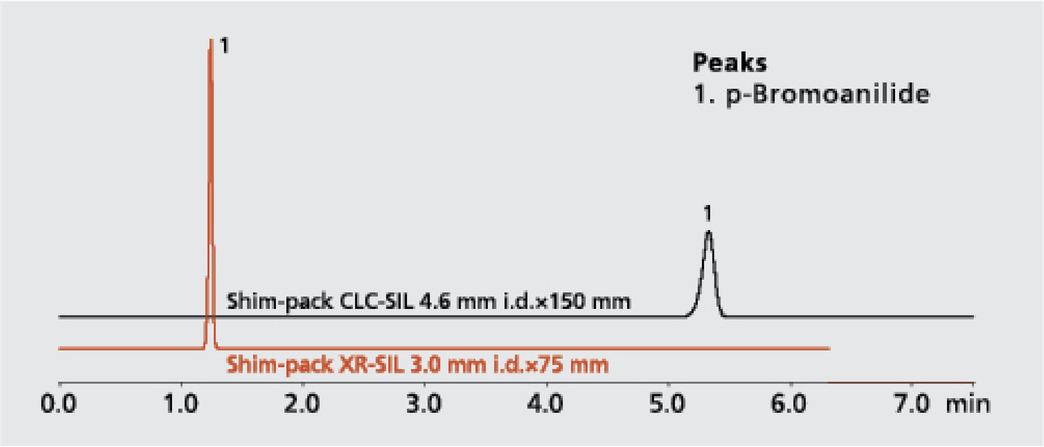



■ **Conditions**

| | |
|---|---|
| **Column** | : Shim-pack XR-Phenyl (75 mmL. × 3.0 mmI.D., 2.2 µm) (P/N: 228-59904-93) |
| **Mobile Phase** | : A) 20 mmol/L Phosphate buffer solution (pH 2.5)<br>B) Acetonitrile<br>A/B = 30/20 (v/v) |
| **Flow Rate** | : 1.0 mL/min |
| **Col. Temp.** | : 40 °C |
| **Detection** | : UV 220 nm |

### Fast Normal-Phase Analysis

Organic solvents are used as the mobile phase for normal-phase analysis. Due to environmental considerations, it is necessary to reduce the consumption of mobile phase compared with normal reversed-phase analysis. The Shim-pack XR-SIL silica column increases the speed of normal-phase analysis while reducing the consumption of mobile phase. In this example, the analysis time is reduced by 80 % while maintaining the flow rate, thereby reducing the overall mobile phase consumption to 20 % or less.




■ **Conditions**

| | |
|---|---|
| **Column** | : Shim-pack XR-SIL (75 mmL. × 3.0 mmI.D., 2.2 µm) (P/N: 228-59906-92) |
| **Mobile Phase** | : Hexane / Ethanol = 90/10 (v/v) |
| **Flow Rate** | : 1.0 mL/min |
| **Col. Temp.** | : 40 °C |
| **Detection** | : UV 254 nm |

# Shim-pack XR Series

## Shim-pack XR Series, Shim-pack XR-ODS II and XR-ODS III High-Pressure Columns for Higher Resolution and Sensitivity

While the Shim-pack XR-ODS II and XR-ODS III use the same 2.2 µm packing particle size as the Shim-pack XR Series columns, they have higher 60 and 100MPa pressure tolerance. This allows them to achieve high-resolution fast analysis in a long column using a water/methanol mobile phase. This column significantly extends the range of applications of high-resolution fast analysis to include analysis near room temperature. The Shim-pack XR-ODSII and XR-ODS III columns are ideal for the Nexera UHPLC or Prominence UFLC. This combination achieves both faster speed and higher resolution.

| | Shim-pack XR-ODS II | Shim-pack XR-ODS III | |
|---|---|---|---|
| Length (mm) | 30, 50, 75, 100, 150 | 50, 75 | 150, 200 |
| Particle Size (µm) | 2.2 | 1.6 | 2.2 |
| Pore Size (nm) | 8 | 7.5 | 8 |
| Surface Area (m2/g) | 470 | 500 | 470 |
| Carbon Loading | 20% | 22% | 20% |
| Pressure Tolerance (MPa) | 60 | 100 | 100 |
| Pore Volume (mL/g) | 1 | 0.95 | 1 |
| End-capping | Yes | Yes | Yes |
| Bonding Type | Monomeric | Monomeric | Monomeric |
| pH Range | 2 - 7.5 | 2 - 7.5 | 2 - 7.5 |
| USP Code | L1 | L1 | L1 |

### Extensive product range, including 1.5 mmI.D. column to reduce mobile phase consumption

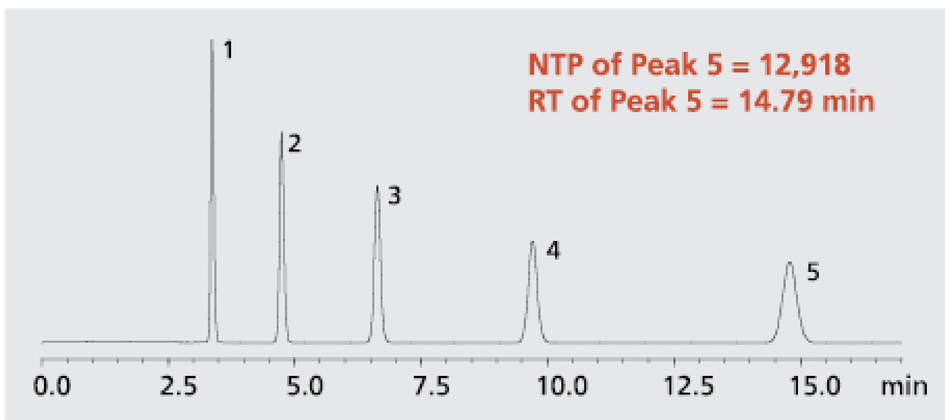
The Shim-pack XR-ODS II range includes a 1.5 mmI.D. model in addition to normal 2 mm and 3 mmI.D. columns. With an optimal flow rate of 0.2 to 0.3 mL/min, the 1.5 mmI.D. column offers the optimal flow rate for LC/MS and reduces mobile phase consumption.

### Select a column to suit your purpose, whether shorter analysis times or high resolution

The Shim-pack XR-ODS III lineup features two columns: a short one utilizing a packing material with a particle size of 1.6 µm and a long one utilizing a 2.2 µm particle size, which is equivalent to the conventional XR column. This extensive lineup allows users to select a column according to analysis objectives, whether it's a short size to further shorten analysis times, or a long size to achieve high resolution while retaining the ease of use of the conventional XR column.

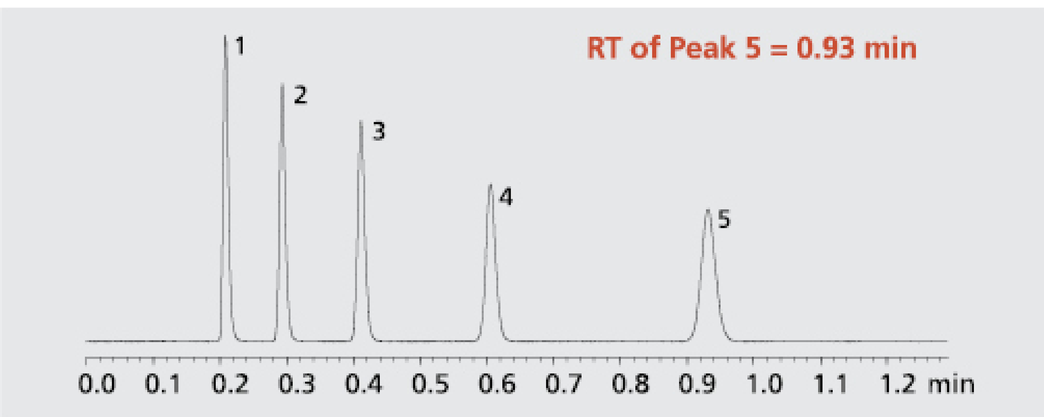
Shim-pack VP-ODS (150 mmL. × 4.6 mmI.D., 5 µm, P/N: 228-34937-91)

**Peaks**
1. Acetophenone
2. Propiophenone
3. Butyrophenone
4. Valerophenone
5. Hexanophenone



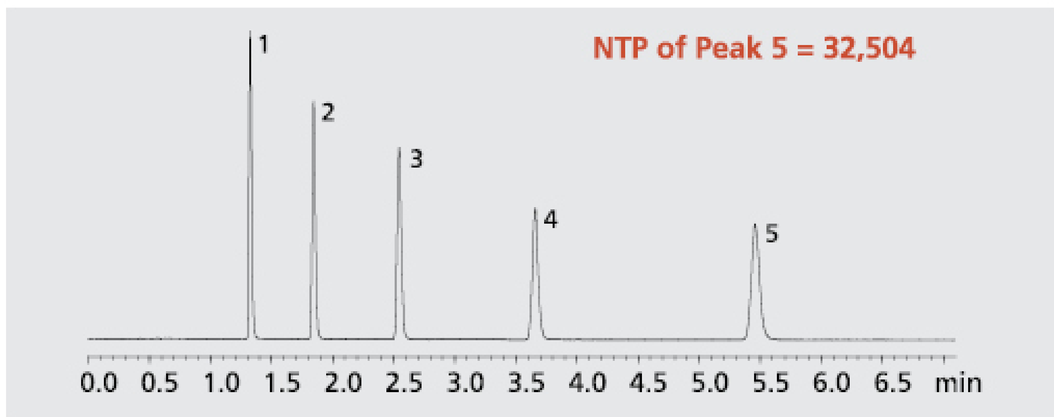

**Conditions**
Mobile Phase : 55 % Aqueous Acetonitrile Solution
Flow Rate : 1.0 mL/min
Col. Temp. : 40 °C
Injection Vol. : 5 µL

Shim-pack XR-ODS III (50 mmL. × 2 mmI.D., 1.6 µm, P/N: 228-59922-91)




**Conditions**
Mobile Phase : 55 % Aqueous Acetonitrile Solution
Flow Rate : 1.1 mL/min
Col. Temp. : 40 °C
Injection Vol. : 5 µL

Shim-pack XR-ODS III (200 mmL. × 2 mmI.D., 2.2 µm, P/N: 228-59910-92)




**Conditions**
Mobile Phase : 55 % Aqueous Acetonitrile Solution
Flow Rate : 0.6 mL/min
Col. Temp. : 50 °C
Injection Vol. : 5 µL

## Product Information

| Column | Particle Size (µm) | I.D. (mm) / Length (mm) | 1.5 | 2.0 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|---|---|
| Shim-pack XR-ODS | 2.2 | 20 | - | 228-50459-91 | - | - | 35 |
| | | 30 | - | 228-41605-91 | 228-41606-91 | 228-41607-91 | |
| | | 50 | - | 228-41605-92 | 228-41606-92 | 228-41607-92 | |
| | | 75 | - | 228-41605-93 | 228-41606-93 | 228-41607-93 | |
| | | 100 | - | 228-41605-94 | 228-41606-94 | 228-41607-94 | |
| Shim-pack XR-C8 | 2.2 | 30 | - | 228-59901-91 | 228-59902-91 | - | 35 |
| | | 50 | - | 228-59901-92 | 228-59902-92 | - | |
| | | 75 | - | 228-59901-93 | 228-59902-93 | - | |
| | | 100 | - | 228-59901-94 | 228-59902-94 | - | |
| Shim-pack XR-Phenyl | 2.2 | 30 | - | 228-59903-91 | 228-59904-91 | - | 35 |
| | | 50 | - | 228-59903-92 | 228-59904-92 | - | |
| | | 75 | - | 228-59903-93 | 228-59904-93 | - | |
| | | 100 | - | 228-59903-94 | 228-59904-94 | - | |
| Shim-pack XR-Sil | 2.2 | 50 | - | 228-59905-91 | 228-59906-91 | - | 20 |
| | | 75 | - | 228-59905-92 | 228-59906-92 | - | |
| | | 100 | - | 228-59905-93 | 228-59906-93 | - | |
| Shim-pack XR-ODS II | 2.2 | 30 | 228-59907-91 | - | - | - | 60 |
| | | 50 | 228-59907-92 | 228-41623-94 | - | - | |
| | | 75 | 228-59907-93 | 228-41623-91 | 228-41624-91 | - | |
| | | 100 | 228-59907-94 | 228-41623-92 | 228-41624-92 | - | |
| | | 150 | 228-59907-95 | 228-41623-93 | 228-41624-93 | - | |
| Shim-pack XR-ODS III | 1.6 | 50 | - | 228-59922-91 | - | - | 100 |
| | | 75 | - | 228-59922-92 | - | - | |
| | 2.2 | 150 | - | 228-59910-91 | - | - | |
| | | 200 | - | 228-59910-92 | - | - | |

For Pre-column Filters, please refer to page A-123

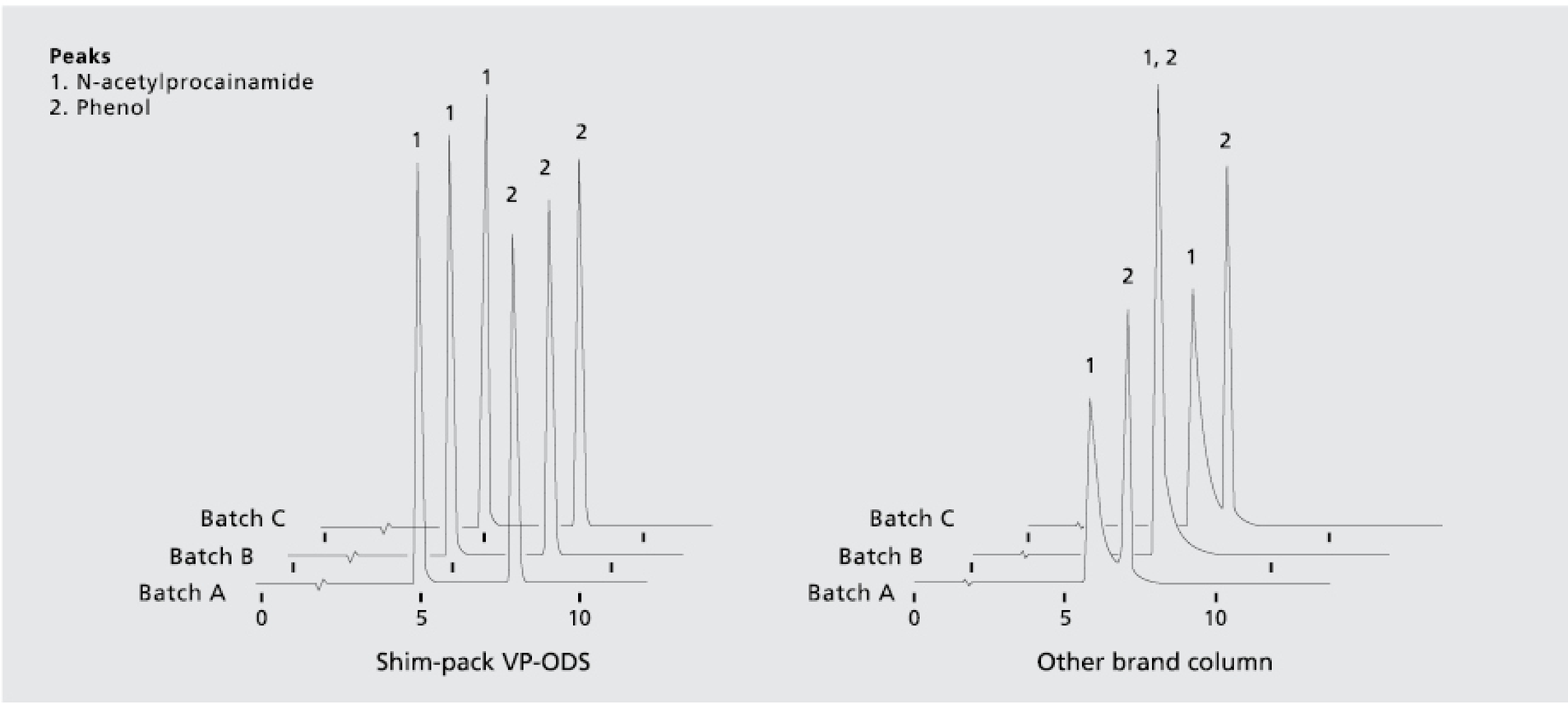
# Shim-pack VP Series

Shim-pack VP series is designed for the development and validation of analytical methods.

| | Shim-pack VP-ODS | Shim-pack VP-C8 | Shim-pack VP-Phenyl |
|---|---|---|---|
| Particle Size (µm) | 5 | 5 | 5 |
| Pore Size (nm) | 12 | 12 | 12 |
| Surface Area (m2/g) | 410 | 410 | 410 |
| Carbon Loading | 20% | 12.5% | 12.3% |
| Pressure Tolerance (MPa) | Approx. 20 | Approx. 20 | Approx. 20 |
| Pore Volume (mL/g) | 1.25 | 1.25 | 1.25 |
| End-capping | Yes | Yes | Yes |
| Bonding Type | Monomeric | Monomeric | Monomeric |
| pH Range | 2 - 7.5 | 2 - 7.5 | 2 - 7.5 |
| USP Code | L1 | L7 | L11 |

## Strict Manufacturing Uniformity

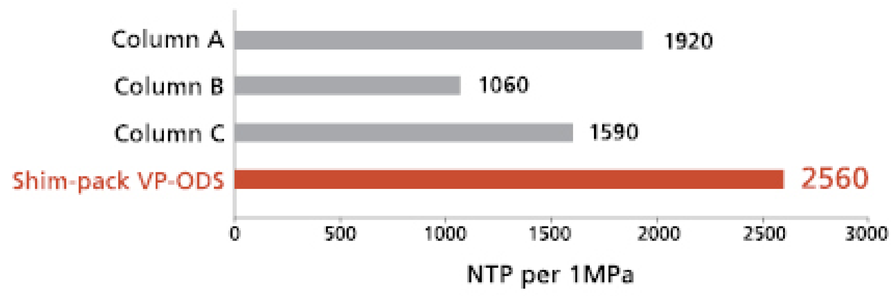
Shim-pack VP series ensures high column-to-column performance reproducibility, which is ideal for method development and validation. Silica-bases, surface treatment and packing procedures are subjected to a strict array of quality criteria tests and controlled respectively. Each column is delivered together with Certificate of Compliance and Column Performance Report.




Comparison of reproducibility between three batches of silica-based materials

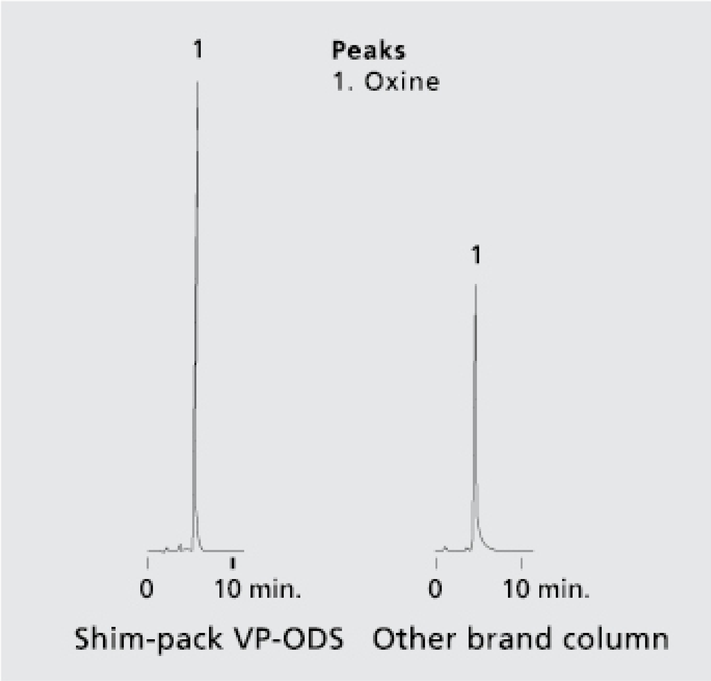
## Balance of Column Efficiency and Column Backpressure

Shim-pack VP series achieves a higher column efficiency while maintaining low pressure. It provides superior performance shown by NTP (Number of Theoretical Plates) per 1MPa.

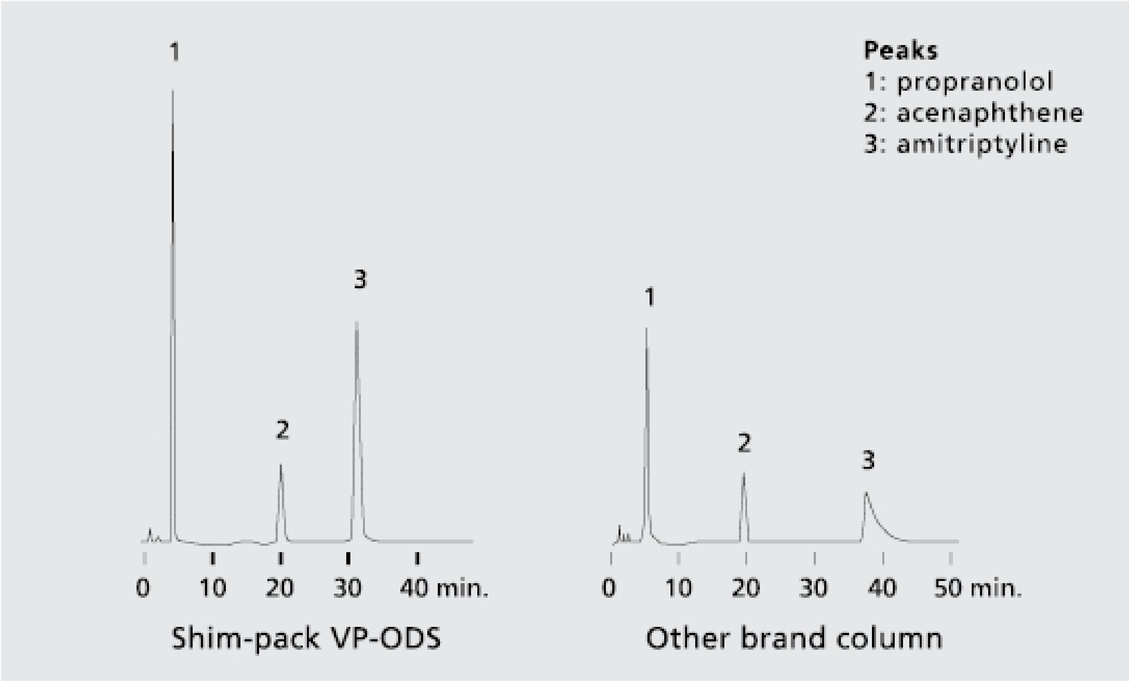



Column Size: 4.6 x 150 mm, Mobile Phase: Methanol/Water=70/30, Flow Rate: 1.0 mL/min., Sample: Naphthalene

## Excellent Peak Shape




Packing materials with less metal impurities achieve excellent peak shape of coordination compounds.




Completed end-capping achieves excellent peak shape of basic compounds.

## Product Information

### Analytical Columns

| Column | Particle Size (µm) | I.D. (mm) / Length (mm) | 2.0 | 4.6 | 6.0 |
|---|---|---|---|---|---|
| Shim-pack VP-ODS | 5 | 50 | - | 228-36849-91 | - |
| | | 150 | 228-34937-94 | 228-34937-91 | 228-34937-93 |
| | | 250 | 228-34937-95 | 228-34937-92 | - |
| Shim-pack VP-C8 | 5 | 150 | 228-59927-93 | 228-59927-91 | - |
| | | 250 | 228-59927-94 | 228-59927-92 | - |
| Shim-pack VP-Phenyl | 5 | 150 | 228-59928-93 | 228-59928-91 | - |
| | | 250 | 228-59928-94 | 228-59928-92 | - |

### Cartridge Guard Columns

| Column | I.D. (mm) / Length (mm) | 2.0 | 4.6 |
|---|---|---|---|
| Guard Column Holder | - | 228-34938-94 | 228-34938-92 |
| GVP-ODS Cartridges (2 pcs) | 5 | 228-34938-93 | - |
| | 10 | - | 228-34938-91 |

# Shim-pack VP Series

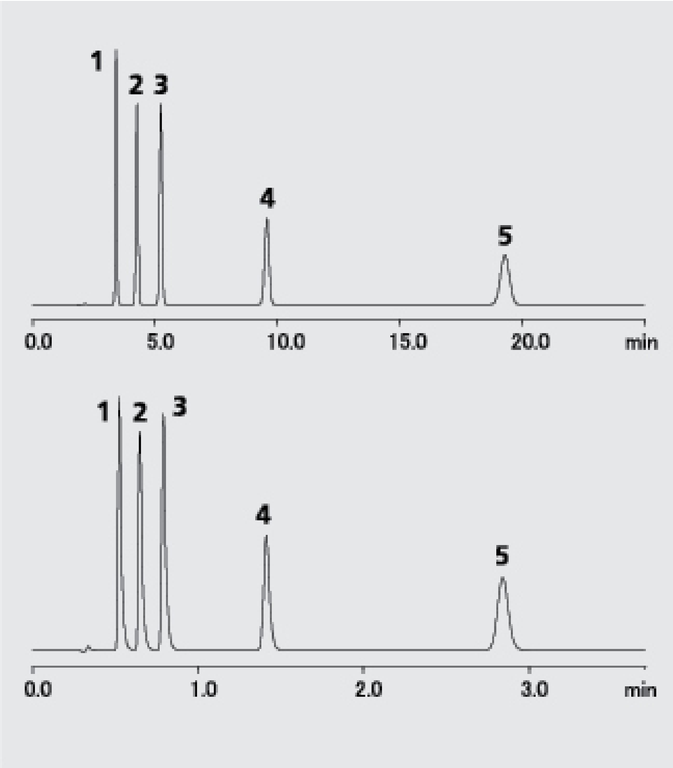
## Smooth Transfer of Methods from High-Speed Analysis to Conventional Analysis

By using the Shim-pack VP series of conventional columns in combination with the Shim-pack XR series of high-speed columns, which offer the equivalent separation performance, it is possible to perform method development via high-speed analysis, and then smoothly transfer to conventional analysis. Utilizing these columns with Nexera Method Scouting provides strong support for method development.

### Example of High-Speed/Conventional Analysis Using Columns with Equivalent Retention Behavior

Examples of analysis with the Shim-pack VP and Shim-pack XR columns are shown below. In each example, analysis was achieved while maintaining essentially the same relative retention time. In method transfer, this equivalency is important, making the combination of the Shim-pack VP series and Shim-pack XR series optimal for method development.

**Example of the Batch Analysis of 6 Sulfa Drugs**




■ **Conditions**

**Column** : Top : Shim-pack VP-ODS (150 mmL. × 4.6 mmI.D., 5 µm) (P/N: 228-34937-91)
Bottom : Shim-pack XR-ODS (50 mmL. × 3.0 mmI.D., 2.2 µm) (P/N: 228-41606-92)

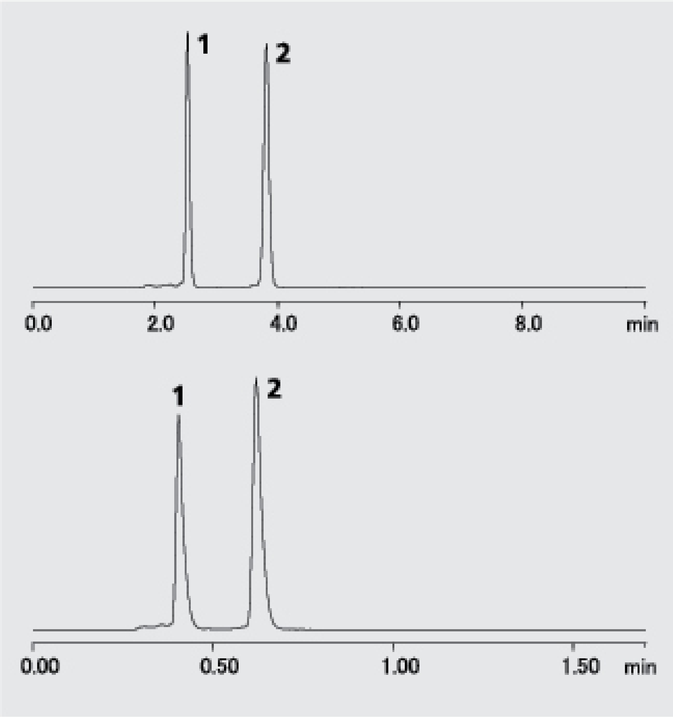
**Mobile Phase** : A) 0.1 % formic acid
B) Acetonitrile
A/B = 8/2 (v/v)

**Flow Rate** : Top : 1.0 mL/min
Bottom : 1.0 mL/min

**Relative Retention Times**

| Peak | Shim-pack VP-ODS | Shim-pack XR-ODS |
|---|---|---|
| 1. Sulfadiamine | 1.000 | 1.000 |
| 2. Sulfamerazine | 1.252 | 1.238 |
| 3. Sulfadimidine | 1.537 | 1.509 |
| 4. Sulfamethoxazole | 2.809 | 2.699 |
| 5. Sulfaquinoxaline | 5.668 | 5.432 |

**Example of the Analysis of Fat-Soluble Vitamins**




■ **Conditions**

**Column** : Top : Shim-pack VP-C8 (150 mmL. × 4.6 mmI.D., 5 µm) (P/N: 228-59927-91)
Bottom : Shim-pack XR-C8 (50 mmL. × 3.0 mmI.D., 2.2 µm) (P/N: 228-59902-92)

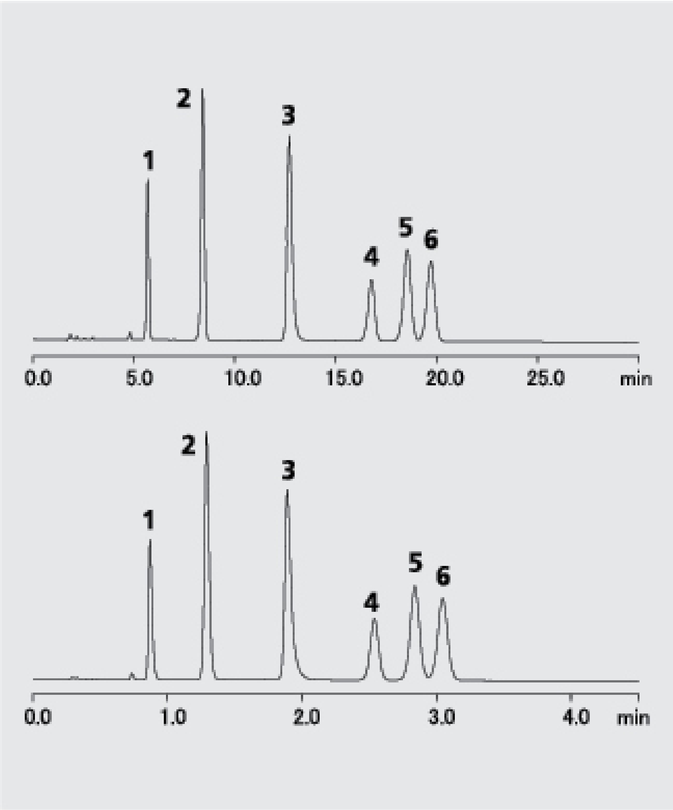
**Mobile Phase** : Methanol

**Flow Rate** : Top : 1.0 mL/min
Bottom : 1.0 mL/min

**Relative Retention Times**

| Peak | Shim-pack VP-C8 | Shim-pack XR-C8 |
|---|---|---|
| 1. Retinol | 1.000 | 1.000 |
| 2. α±-tocopherol | 1.509 | 1.531 |

## Example of the Batch Analysis of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)




**Conditions**

**Column** : Top : Shim-pack VP-Phenyl (150 mmL. × 4.6 mmI.D., 5 µm) (P/N: 228-59928-91)
Bottom : Shim-pack XR-Phenyl (50 mmL. × 3.0 mmI.D., 2.2 µm) (P/N: 228-59904-92)

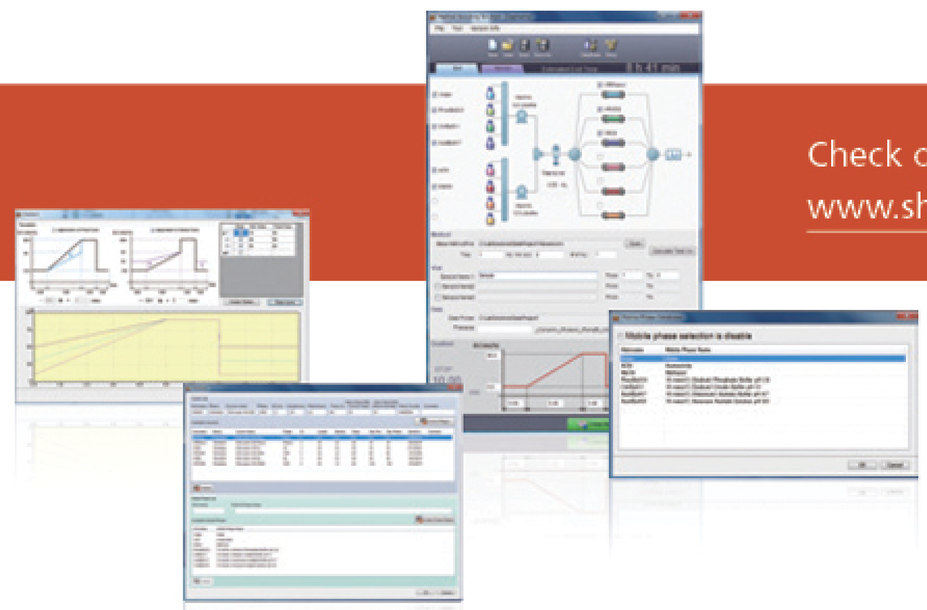
**Mobile Phase** : A) 20 mmol/L Phosphoric acid (Na) buffer (pH 2.5)
B) Acetonitrile
A/B = 3/7 (v/v)

**Flow Rate** : Top : 1.0 mL/min
Bottom : 1.0 mL/min

**Relative Retention Times**

| Peak | Shim-pack VP-Phenyl | Shim-pack XR-Phenyl |
|---|---|---|
| 1. Piroxicam | 1.000 | 1.000 |
| 2. Ketoprofen | 1.480 | 1.483 |
| 3. Diflunisal | 2.233 | 2.172 |
| 4. Diclofenac | 2.949 | 2.916 |
| 5. Indomethacin | 3.263 | 3.262 |
| 6. Ibuprofen | 3.470 | 3.501 |

Columns with the same size but different bonded phases are available as a set for the purpose of method development.
Please contact your local Shimadzu representative for details.



Check out the Nexera Method Scouting System at
www.shimadzu.com/an/hplc

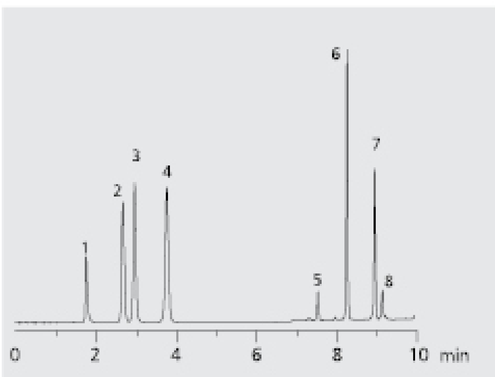
# Shim-pack MAqC-ODS

Shim-pack MAqC-ODS I reversed-phase columns are packed with a silica gel containing metal and bonded octadecylsilyl group. In addition to the hydrophobic characteristics of the ODS, the metal content also provides cation-exchange effects. This increases the retention of basic compounds. Therefore, this allows use with only a buffer solution as the mobile phase for analyses that previously required using an ion pair reagent and enables using gradient elution. These characteristics are especially beneficial for analyzing water soluble vitamins and pharmaceuticals that contain a large amount of basic compounds.

## Example of Simultaneous Analysis of Water Soluble Vitamins

Water soluble vitamins contain many highly polar basic components, which are known to exhibit weak retention in the reversed-phase mode. Consequently, with typical ODS columns, such as the Shim-pack VP-ODS, an ion pair reagent is added to the mobile phase for analysis. However, using an ion pair reagent makes gradient elution difficult, resulting in peak broadening for components that take longer to elute and making it difficult to improve sensitivity. In addition, the effort required to prepare the mobile phases and condition the column is also an issue. However, because the Shim-pack MAqC-ODS I enables using gradient elution, it can shorten analysis times and result in sharp peaks even for components that elute slowly. For example, riboflavin, which elutes as the final peak with a typical ODS column, is detected with approx. 2.3 times higher sensitivity by the Shim-pack MAqC-ODS I.

### Shim-pack MAqC-ODS I

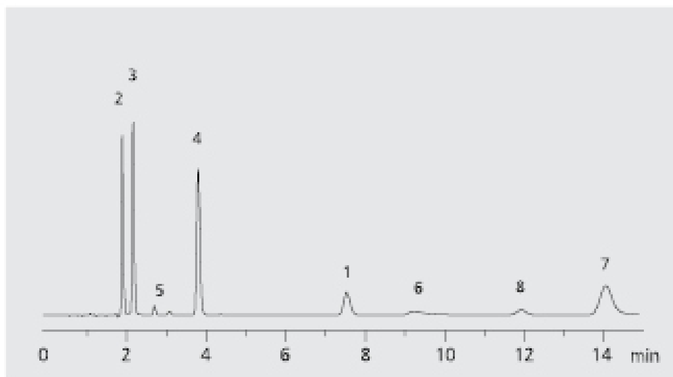



■ Peaks
1. Thiamine
2. Niacin
3. Nicotinamide
4. Pyridoxine
5. Ca Pantothenate
6. Folic acid
7. Riboflavin
8. Biotin

■ **Conditions**

**Column** : Shim-pack MAqC-ODS I (150 mmL. × 4.6 mmI.D., 5 µm) (P/N: 228-59936-91)
**Mobile Phase** : A) 10 mmol/L phosphate (Na) buffer solution (pH 2.6)
B) Acetonitrile
A/B = 99/1 - 2.5min - 99/1 - 7.5min - 50/50 - 0.01min - 99/1 - 5 min
**Flow Rate** : 1.2 mL/min
**Col. Temp.** : 40 °C
**Detection** : UV 210 nm
**Injection Vol.** : 10 µL

### Shim-pack VP-ODS



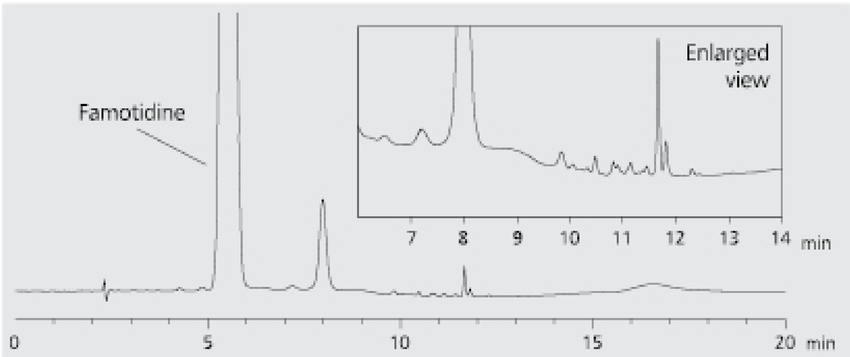

■ **Conditions**

**Column** : Shim-pack VP-ODS (150 mmL. × 4.6 mmI.D., 5 µm) (P/N: 228-34937-91)
**Mobile Phase** : A) 100 mmol/L phosphate (Na) buffer solution (pH 2.1) containing 0.8 mmol/L sodium 1-octanesulfonate
B) Acetonitrile
A/B = 10/1 (v/v)
**Flow Rate** : 1.2 mL/min
**Col. Temp.** : 40 °C
**Detection** : UV 210 nm
**Injection Vol.** : 10 µL

## Example of Analyzing Impurities in a Pharmaceutical

Many pharmaceuticals are basic compounds. The majority of impurities in pharmaceuticals, such as unreacted ingredients, by-products, and decomposition products, are highly polar basic substances. Consequently, analyzing impurity peaks using LC/MS can be difficult if a non-volatile ion pair reagent is contained. In the following example of analyzing famotidine, using a Co-Sense for LC/MS automatic pretreatment system to desalt the mobile phase used with the Shim-pack MAqC-ODS I column enabled analysis by LC/MS. While a typical ODS column (Shim-pack VP-ODS) detects 12 types of impurities, the Shim-pack MAqC-ODS I detects 20 types of impurities due to separation specificity and gradient elution.

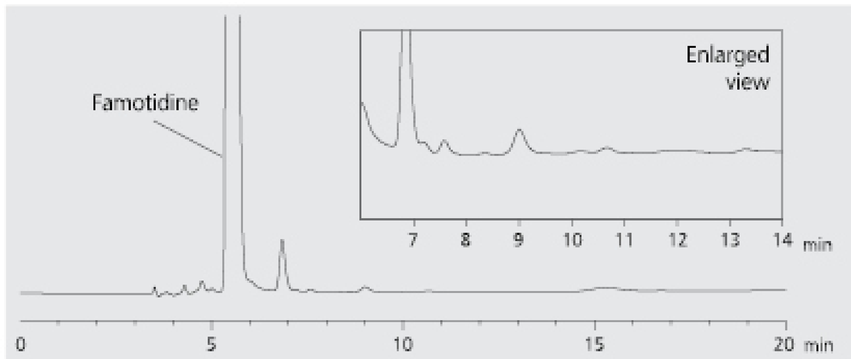
### Shim-pack MAqC-ODS I




■ **Conditions**

**Column** : Shim-pack MAqC-ODS I (150 mmL. × 4.6 mmI.D., 5 µm) (P/N: 228-59936-91)
**Mobile Phase** : A) 10 mmol/L phosphate (Na) buffer solution (pH 2.6)
B) Acetonitrile
A/B = 92/8 - 5min - 92/8 - 7min - 50/50 - 0.01min - 92/8 - 8 min
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 25 °C
**Detection** : UV 254 nm
**Injection Vol.** : 5 µL

### Shim-pack VP-ODS

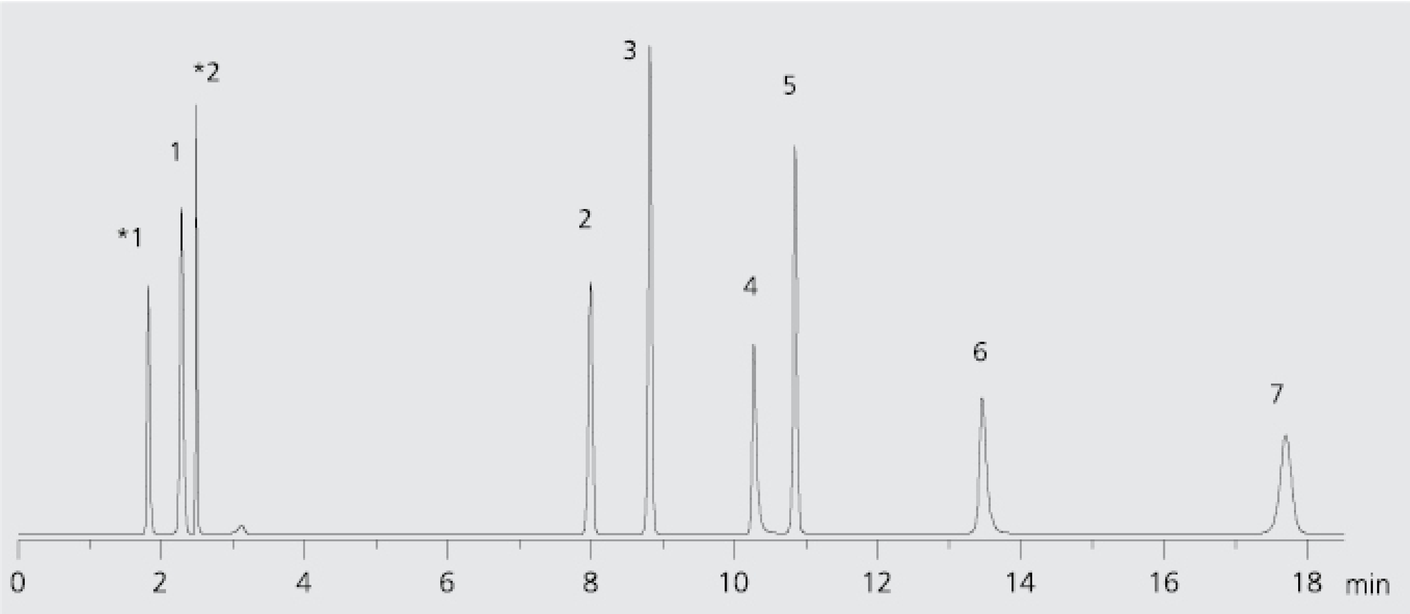



■ **Conditions**

**Column** : Shim-pack VP-ODS (150 mmL. × 4.6 mmI.D., 5 µm) (P/N: 228-34937-91)
**Mobile Phase** : 2 g of sodium 1-heptanesulfonate was dissolved in 900 mL of water and acetic acid (100) was added to produce a pH of 3.0. Then water was added to make 1000 mL. 240 mL of acetonitrile and 40 mL of methanol were added to this solution.
**Flow Rate** : 0.5 mL/min
**Col. Temp.** : 25 °C
**Detection** : UV 254 nm
**Injection Vol.** : 5 µL

## Example of Analyzing a Cold Remedy

Gradient elution with a Shim-pack MAqC-ODS I column was used for simultaneous analysis of components contained in an over-the-counter commercial cold remedy. The ability to use gradient elution enables the acquisition of sharp peaks, even for components that eluted slowly, similar to the water soluble vitamin and drug impurity examples on the prior page.




**Peaks**

1. Thiamine
2. Acetaminophen
3. Caffeine
4. Chlorpheniramine
5. Ethenzamide
6. Isopropylantipyrine
7. Ibuprofen

*1 Nitric acid
*2 Maleic acid

**Conditions**

| | |
|---|---|
| **Column** | : Shim-pack MAqC-ODS I (150 mmL. × 4.6 mmI.D., 5 µm) (P/N: 228-59936-91) |
| **Mobile Phase** | : A) 20 mmol/L phosphate (Na) buffer solution (pH 2.5)<br>B) Acetonitrile<br>A/B = 99/1 - 2min – 99/1 – 6min – 50/50 – 10min – 50/50 - 0.01min - 99/1 - 5 min |
| **Flow Rate** | : 1.0 mL/min |
| **Col. Temp.** | : 40 °C |
| **Detection** | : UV 220 nm |
| **Injection Vol.** | : 10 µL |

More Free Literature at www.shimadzu.com/an

## Product Information

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.0 | 4.6 |
|---|---|---|---|
| 5 | 150 | 228-59936-94 | 228-59936-91 |

* To use this column efficiently:
1) To increase the retention of basic compounds, please use a buffer solution within the pH 2 to 4 range.
2) In the case of a basic substance tailing, it may be possible to improve the peak shape by increasing the salt concentration of a buffer solution.
3) The elution of basic compounds is faster by increasing the salt concentration, and it is possible to adjust retention by salt concentration.

This product developed by collaboration with Eisai Co., Ltd.

# Shim-pack GIST C18

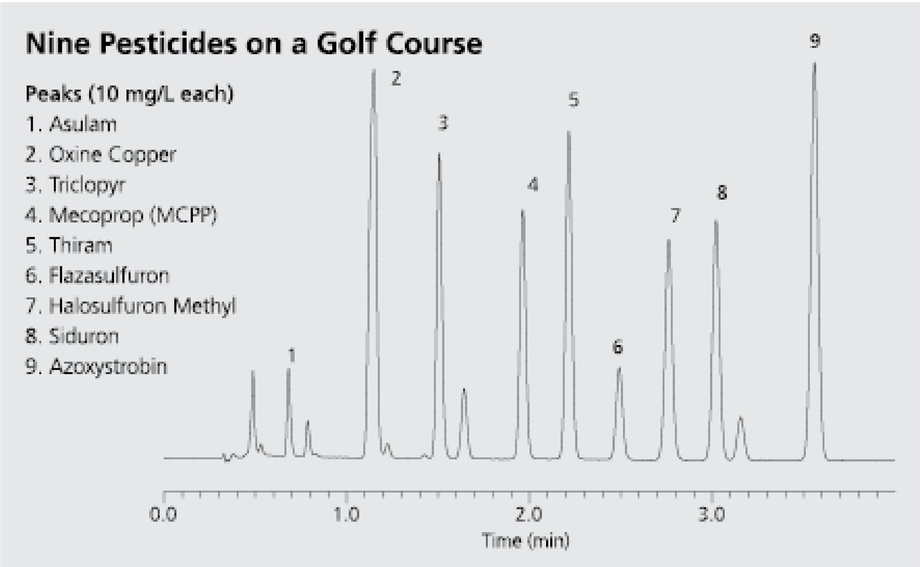
## Ultra High Inertness, High Durability

Shim-pack GIST C18 has superior inertness, which improves analysis precision and increases column durability. In addition, it can be used to analyze strong ionic compounds and difficult to absorb samples, which helps to obtain symmetrical peaks and high reproducibility.

Furthermore, because of the new silica gel, Shim-pack GIST C18 is suitable for wider pH (1-10) analysis at a consistent performance. This enables use of a silica-based column under alkaline conditions.

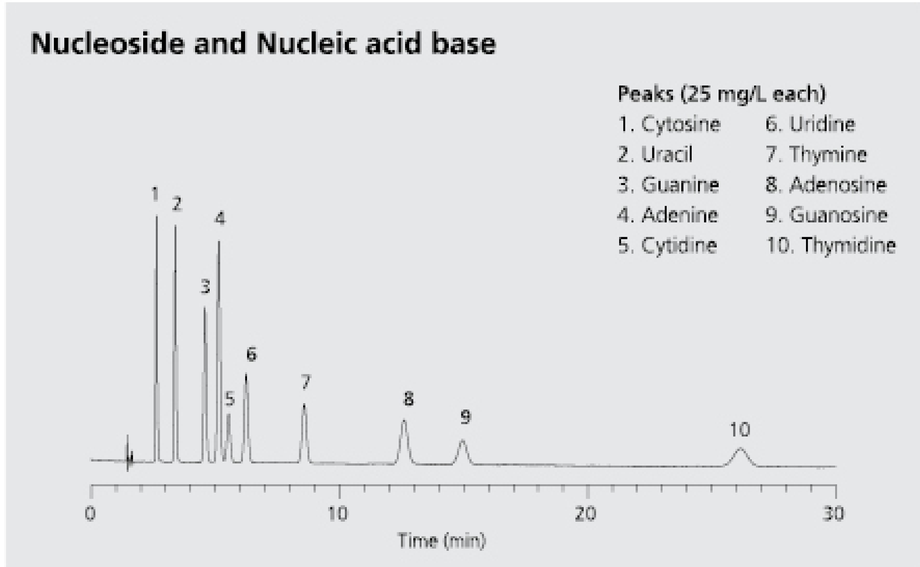
| | |
|---|---|
| Bonded Phase | Octadecyl Groups |
| Particle Size | 2 µm, 3 µm, 5 µm |
| Pore Size | 10 nm |
| Surface Area | 350 m²/g |
| Carbon Loading | 14 % |
| End-capping | Yes |
| pH Range | 1 to 10 |
| USP Code | L1 |

## Analysis Examples




**Conditions**

**Column** : Shim-pack GIST-HP C18 (150 mmL. × 3.0 mmI.D., 3 µm) (P/N: 227-30040-05)
**Mobile Phase** : A) 50 mM KH2PO4 (pH 3.5, H3PO4)
B) Acetonitrile
A/B = 60/40 - 4 min - 40/60
**Flow Rate** : 1.5 mL/min
**Col. Temp.** : 40 °C
**Detection** : UV 235 nm
**Injection Vol.** : 5.0 µL




**Conditions**

**Column** : Shim-pack GIST C18 (150 mmL. × 4.6 mmI.D., 5 µm) (P/N: 227-30017-07)
**Mobile Phase** : 0.1 mol/L Ammonium phosphate, 0.2 mol/L Sodium perchlorate buffer solution (pH 2.0)
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 40 °C
**Detection** : UV 260 nm
**Injection Vol.** : 1 µL

### Analytical Columns

| Particle Size (µm) | Length (mm) \ I.D. (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 3 | 20 | - | - | 227-30008-01 | 227-30009-01 | 227-30010-01 | 227-30011-01 |
| | 30 | 227-30006-01 | 227-30007-01 | 227-30008-02 | 227-30009-02 | 227-30010-02 | 227-30011-02 |
| | 50 | 227-30006-02 | 227-30007-02 | 227-30008-03 | 227-30009-03 | 227-30010-03 | 227-30011-03 |
| | 75 | 227-30006-03 | 227-30007-03 | 227-30008-04 | 227-30009-04 | 227-30010-04 | 227-30011-04 |
| | 100 | 227-30006-04 | 227-30007-04 | 227-30008-05 | 227-30009-05 | 227-30010-05 | 227-30011-05 |
| | 125 | - | - | 227-30008-06 | 227-30009-06 | 227-30010-06 | 227-30011-06 |
| | 150 | 227-30006-05 | 227-30007-05 | 227-30008-07 | 227-30009-07 | 227-30010-07 | 227-30011-07 |
| | 250 | 227-30006-06 | 227-30007-06 | 227-30008-08 | 227-30009-08 | 227-30010-08 | 227-30011-08 |
| 5 | 20 | - | - | 227-30014-01 | 227-30015-01 | 227-30016-01 | 227-30017-01 |
| | 30 | 227-30012-01 | 227-30013-01 | 227-30014-02 | 227-30015-02 | 227-30016-02 | 227-30017-02 |
| | 50 | 227-30012-02 | 227-30013-02 | 227-30014-03 | 227-30015-03 | 227-30016-03 | 227-30017-03 |
| | 75 | 227-30012-03 | 227-30013-03 | 227-30014-04 | 227-30015-04 | 227-30016-04 | 227-30017-04 |
| | 100 | 227-30012-04 | 227-30013-04 | 227-30014-05 | 227-30015-05 | 227-30016-05 | 227-30017-05 |
| | 125 | - | - | 227-30014-06 | 227-30015-06 | 227-30016-06 | 227-30017-06 |
| | 150 | 227-30012-05 | 227-30013-05 | 227-30014-07 | 227-30015-07 | 227-30016-07 | 227-30017-07 |
| | 250 | 227-30012-06 | 227-30013-06 | 227-30014-08 | 227-30015-08 | 227-30016-08 | 227-30017-08 |

## Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30023-01 | 227-30024-01 | 227-30025-01 | 227-30027-01 | 227-30532-01 |
| | 20 | - | - | 227-30026-01 | 227-30028-01 | 227-30532-02 |
| 5 | 10 | 227-30029-01 | 227-30030-01 | 227-30031-01 | 227-30032-03 | 227-30532-01 |
| | 20 | - | - | 227-30032-01 | 227-30033-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 |
| 3 | 10 | 227-30023-02 | 227-30024-02 | 227-30025-02 | 227-30027-02 |
| | 20 | - | - | 227-30026-02 | 227-30028-02 |
| 5 | 10 | 227-30029-02 | 227-30030-02 | 227-30031-02 | 227-30032-04 |
| | 20 | - | - | 227-30032-02 | 227-30033-02 |

## Pre-column Type Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|---|---|---|
| 3 | 10 | - | - | - | - | 227-30906-01 | - | 20 |
| | 33 | - | - | 227-30904-01 | 227-30905-01 | 227-30906-02 | 227-30907-01 | |
| | 50 | 227-30903-01 | 227-30903-02 | 227-30904-02 | 227-30905-02 | 227-30906-03 | 227-30907-02 | |
| 5 | 10 | - | - | - | - | 227-30912-01 | - | |
| | 33 | 227-30908-01 | 227-30909-01 | 227-30910-01 | 227-30911-01 | 227-30912-02 | 227-30913-01 | |
| | 50 | 227-30908-02 | 227-30909-02 | 227-30910-02 | 227-30911-02 | 227-30912-03 | 227-30913-02 | |

## Analytical Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 2 | 30 | 227-30001-01 | 227-30002-01 | - | 50 |
| | 50 | 227-30001-02 | 227-30002-02 | - | |
| | 75 | 227-30001-03 | 227-30002-03 | - | |
| | 100 | 227-30001-04 | 227-30002-04 | - | 80 |
| | 150 | 227-30001-05 | 227-30002-05 | - | |
| 3 | 30 | 227-30039-01 | 227-30040-01 | 227-30041-01 | 50 |
| | 50 | 227-30039-02 | 227-30040-02 | 227-30041-02 | |
| | 75 | 227-30039-03 | 227-30040-03 | 227-30041-03 | |
| | 100 | 227-30039-04 | 227-30040-04 | 227-30041-04 | |
| | 150 | 227-30039-05 | 227-30040-05 | 227-30041-05 | |
| | 250 | 227-30039-06 | 227-30040-06 | 227-30041-06 | |

## Cartridge Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | Pressure Tolerance (MPa) | Holder |
|---|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | | |
| 2 | 10 | 227-30042-01 | 227-30043-01 | 227-30044-01 | 80 | 227-30533-01 |
| 3 | 10 | 227-30045-01 | 227-30046-01 | 227-30047-01 | | |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | |
| 2 | 10 | 227-30042-02 | 227-30043-02 | 227-30044-02 | 80 |
| 3 | 10 | 227-30045-02 | 227-30046-02 | 227-30047-02 | |

## Pre-column Type Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 2 | 30 | 227-30771-01 | 227-30772-01 | 227-30773-01 | 80 |
| 3 | | 227-30774-01 | 227-30775-01 | 227-30776-01 | 50 |

# Shim-pack GIST C18-AQ

## Excellent Retentivity of Highly Polar Compounds

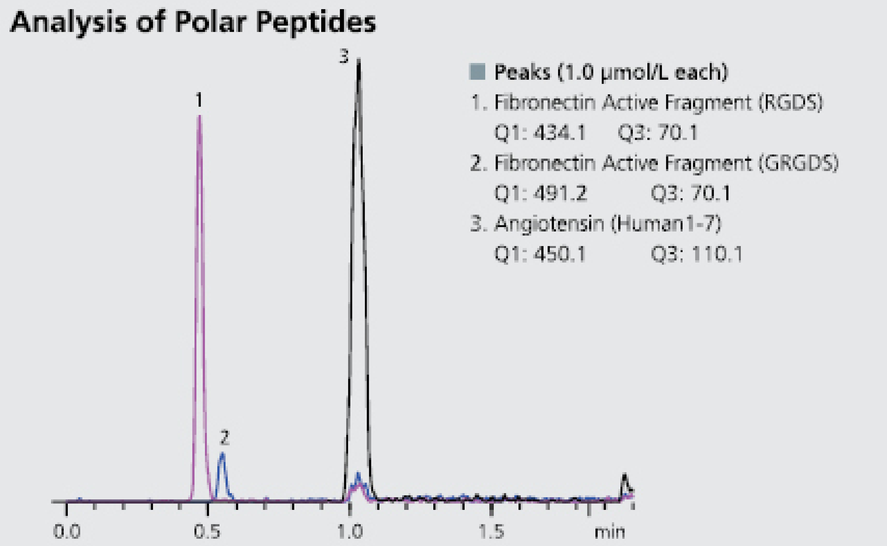
Shim-pack GIST C18-AQ achieves strong retention of hydrophilic highly polar compounds compared to general C18 columns, while maintaining high inertness and durability in highly or 100% aqueous mobile phases.

Shim-pack GIST C18-AQ is also able to reduce the absorption of basic and acidic compounds and achieve superior peak shapes in the analysis of metal complexes.

| | |
|---|---|
| Bonded Phase | Octadecyl Groups |
| Particle Size | 1.9 µm, 3 µm, 5 µm |
| Pore Size | 10 nm |
| Surface Area | 350 m²/g |
| Carbon Loading | 13 % |
| End-capping | Yes |
| pH Range | 1 to 10 |
| USP Code | L1, L96 |

## Analysis Examples

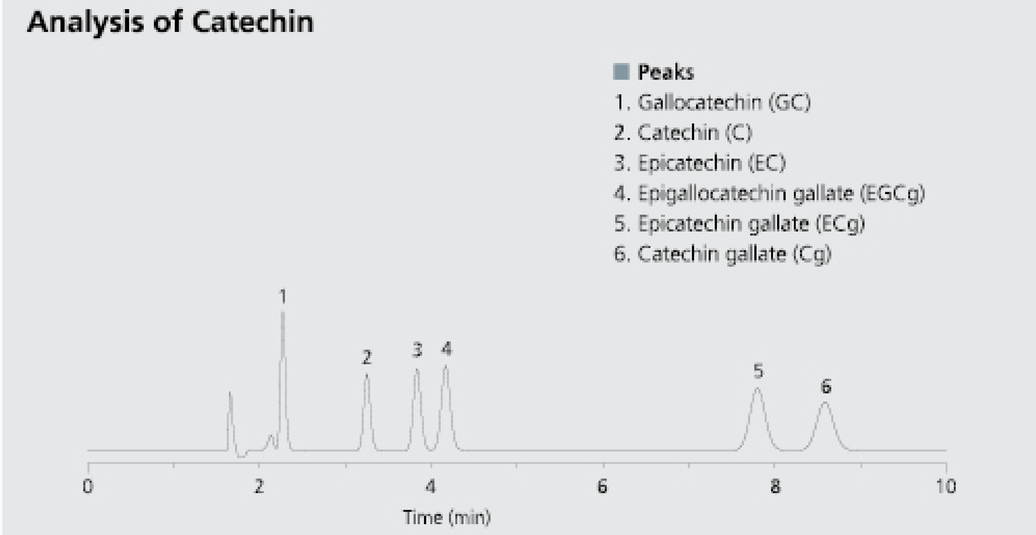
**Analysis of Polar Peptides**




**Conditions**

Column : Shim-pack GIST C18-AQ (100 mmL.× 2.1 mmI.D., 1.9 µm) (P/N: 227-30807-02)
Mobile Phase : A) 0.1 % Formic acid in Water
B) Acetonitrile
A/B = 100/0 - 0.2 min - 100/0 - 0.5 min - 15/85 - 1.5 min - 15/85 - 1.52 min - 100/0 - 2.5 min - 100/0 (v/v)
Flow Rate : 0.8 mL/min
Col. Temp. : 40 °C
Detection : LC/MS/MS (LCMS-8030, ESI, Positive, SRM)
Injection Vol. : 2 µL

**Analysis of Catechin**




**Conditions**

Column : Shim-pack GIST C18-AQ (150 mmL. × 4.6 mmI.D., 5 µm) (P/N: 227-30742-07)
Mobile Phase : A) 0.1 % Formic acid in Water
B) Acetonitrile
A/B = 80/20 (v/v)
Flow Rate : 1.0 mL/min
Col. Temp. : 40 °C
Detection : UV 280 nm

### Analytical Columns

| Particle Size (µm) | Length (mm) \ I.D. (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 3 | 20 | - | - | 227-30721-01 | 227-30722-01 | 227-30723-01 | 227-30724-01 |
| | 30 | 227-30719-01 | 227-30720-01 | 227-30721-02 | 227-30722-02 | 227-30723-02 | 227-30724-02 |
| | 50 | 227-30719-02 | 227-30720-02 | 227-30721-03 | 227-30722-03 | 227-30723-03 | 227-30724-03 |
| | 75 | 227-30719-03 | 227-30720-03 | 227-30721-04 | 227-30722-04 | 227-30723-04 | 227-30724-04 |
| | 100 | 227-30719-04 | 227-30720-04 | 227-30721-05 | 227-30722-05 | 227-30723-05 | 227-30724-05 |
| | 125 | - | - | 227-30721-06 | 227-30722-06 | 227-30723-06 | 227-30724-06 |
| | 150 | 227-30719-05 | 227-30720-05 | 227-30721-07 | 227-30722-07 | 227-30723-07 | 227-30724-07 |
| | 250 | 227-30719-06 | 227-30720-06 | 227-30721-08 | 227-30722-08 | 227-30723-08 | 227-30724-08 |
| 5 | 20 | - | - | 227-30739-01 | 227-30740-01 | 227-30741-01 | 227-30742-01 |
| | 30 | 227-30737-01 | 227-30738-01 | 227-30739-02 | 227-30740-02 | 227-30741-02 | 227-30742-02 |
| | 50 | 227-30737-02 | 227-30738-02 | 227-30739-03 | 227-30740-03 | 227-30741-03 | 227-30742-03 |
| | 75 | 227-30737-03 | 227-30738-03 | 227-30739-04 | 227-30740-04 | 227-30741-04 | 227-30742-04 |
| | 100 | 227-30737-04 | 227-30738-04 | 227-30739-05 | 227-30740-05 | 227-30741-05 | 227-30742-05 |
| | 125 | - | - | 227-30739-06 | 227-30740-06 | 227-30741-06 | 227-30742-06 |
| | 150 | 227-30737-05 | 227-30738-05 | 227-30739-07 | 227-30740-07 | 227-30741-07 | 227-30742-07 |
| | 250 | 227-30737-06 | 227-30738-06 | 227-30739-08 | 227-30740-08 | 227-30741-08 | 227-30742-08 |

## Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30731-01 | 227-30732-01 | 227-30733-01 | 227-30735-01 | 227-30532-01 |
| | 20 | - | - | 227-30734-01 | 227-30736-01 | 227-30532-02 |
| 5 | 10 | 227-30759-01 | 227-30760-01 | 227-30761-01 | 227-30763-01 | 227-30532-01 |
| | 20 | - | - | 227-30762-01 | 227-30764-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 |
| 3 | 10 | 227-30731-02 | 227-30732-02 | 227-30733-02 | 227-30735-02 |
| | 20 | - | - | 227-30734-02 | 227-30736-02 |
| 5 | 10 | 227-30759-02 | 227-30760-02 | 227-30761-02 | 227-30763-02 |
| | 20 | - | - | 227-30762-02 | 227-30764-02 |

## Analytical Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 1.9 | 50 | 227-30807-01 | 227-30808-01 | - | 50 |
| | 100 | 227-30807-02 | 227-30808-02 | - | 80 |
| | 150 | 227-30807-03 | 227-30808-03 | - | |
| 3 | 30 | - | 227-30766-01 | 227-30767-01 | 50 |
| | 50 | 227-30765-01 | 227-30766-02 | 227-30767-02 | |
| | 75 | 227-30765-02 | 227-30766-03 | 227-30767-03 | |
| | 100 | 227-30765-03 | 227-30766-04 | 227-30767-04 | |
| | 150 | 227-30765-04 | 227-30766-05 | 227-30767-05 | |
| | 250 | 227-30765-05 | 227-30766-06 | 227-30767-06 | |

## Cartridge Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | Pressure Tolerance (MPa) | Holder |
|---|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | | |
| 1.9 | 10 | 227-30809-01 | 227-30810-01 | 227-30811-01 | 80 | 227-30533-01 |
| 3 | 10 | 227-30768-01 | 227-30769-01 | 227-30770-01 | | |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | |
| 1.9 | 10 | 227-30809-02 | 227-30810-02 | 227-30811-02 | 80 |
| 3 | 10 | 227-30768-02 | 227-30769-02 | 227-30770-02 | |

## Pre-column Type Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 3 | 30 | 227-30801-01 | 227-30802-01 | 227-30803-01 | 50 |

# Shim-pack GISS C18

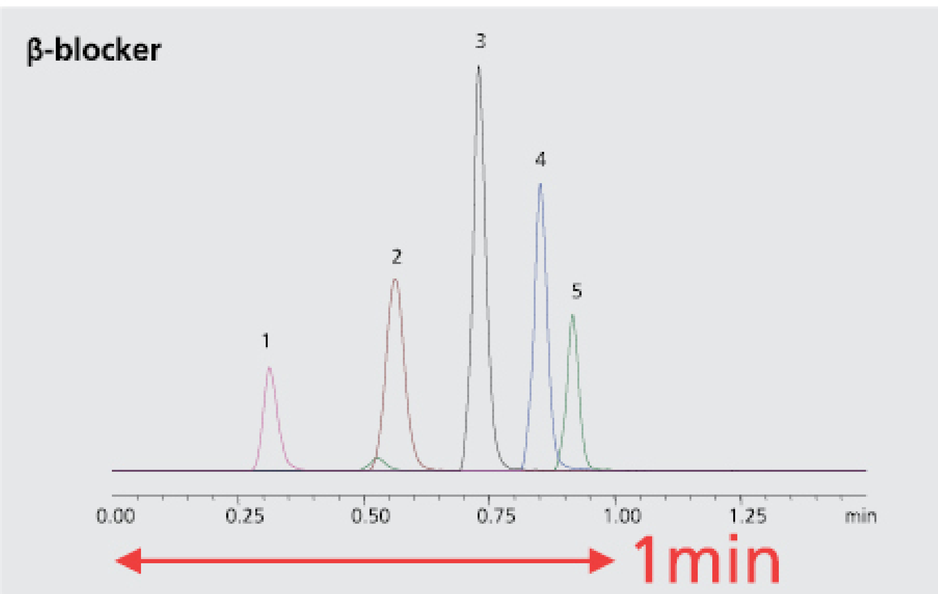
## Ideal for Rapid Analysis

Shim-pack GISS C18 maintains the same ultra-high inertness and wider pH range as the Shim-pack GIST C18, while providing rapid separations with symmetrical peaks.

The optimization of surface area, pore size and chemical bonding delivers superior peak shapes. It is ideal for LC/MS/MS analysis and enables MS-compatible buffers to be used due to extremely inert silica gel.

| | |
|---|---|
| Bonded Phase | Octadecyl Groups |
| Particle Size | 1.9 µm, 3 µm, 5 µm |
| Pore Size | 20 nm |
| Surface Area | 200 m²/g |
| Carbon Loading | 9 % |
| End-capping | Yes |
| pH Range | 1 to 10 |
| USP Code | L1 |

## Analysis Examples




**Peaks (100 µg/L each)**

| | Q1 > Q3 |
|---|---|
| 1. Acebutolol | 337.10 > 116.05 (+) |
| 2. Atenolol | 267.25 > 145.00 (+) |
| 3. Labetalol | 329.00 > 161.95 (+) |
| 4. Nadolol | 310.05 > 254.00 (+) |
| 5. Pindolol | 249.80 > 116.00 (+) |

**Conditions**

**Column** : Shim-pack GISS C18 (50 mmL × 2.1 mmI.D., 1.9 µm) (P/N: 227-30048-01)
**Mobile Phase** : A) 10 mM Ammonium Formate in Water
B) 10 mM Ammonium Formate in Methanol
A/B = 70/30 - 0.3 min - 40/60 - 0.5 min - 0/100 - 0.1 min - 0/100 - 0.01 min - 70/30 - 0.5 min - 70/30, v/v
**Flow Rate** : 0.6 mL/min
**Col. Temp.** : 40 °C
**Detection** : LC/MS/MS (ESI, Positive, Negative MRM)

### Analytical Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 3 | 30 | 227-30050-01 | 227-30051-01 | 227-30052-01 | 227-30053-01 | 227-30054-01 | 227-30055-01 |
| | 50 | 227-30050-02 | 227-30051-02 | 227-30052-02 | 227-30053-02 | 227-30054-02 | 227-30055-02 |
| | 75 | 227-30050-03 | 227-30051-03 | 227-30052-03 | 227-30053-03 | 227-30054-03 | 227-30055-03 |
| | 100 | 227-30050-04 | 227-30051-04 | 227-30052-04 | 227-30053-04 | 227-30054-04 | 227-30055-04 |
| | 125 | - | - | 227-30052-05 | 227-30053-05 | 227-30054-05 | 227-30055-05 |
| | 150 | 227-30050-05 | 227-30051-05 | 227-30052-06 | 227-30053-06 | 227-30054-06 | 227-30055-06 |
| | 250 | 227-30050-06 | 227-30051-06 | 227-30052-07 | 227-30053-07 | 227-30054-07 | 227-30055-07 |
| 5 | 30 | 227-30056-01 | 227-30057-01 | 227-30058-01 | 227-30059-01 | 227-30060-01 | 227-30061-01 |
| | 50 | 227-30056-02 | 227-30057-02 | 227-30058-02 | 227-30059-02 | 227-30060-02 | 227-30061-02 |
| | 75 | 227-30056-03 | 227-30057-03 | 227-30058-03 | 227-30059-03 | 227-30060-03 | 227-30061-03 |
| | 100 | 227-30056-04 | 227-30057-04 | 227-30058-04 | 227-30059-04 | 227-30060-04 | 227-30061-04 |
| | 125 | - | - | 227-30058-05 | 227-30059-05 | 227-30060-05 | 227-30061-05 |
| | 150 | 227-30056-05 | 227-30057-05 | 227-30058-06 | 227-30059-06 | 227-30060-06 | 227-30061-06 |
| | 250 | 227-30056-06 | 227-30057-06 | 227-30058-07 | 227-30059-07 | 227-30060-07 | 227-30061-07 |

## Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30067-01 | 227-30068-01 | 227-30069-01 | 227-30070-01 | 227-30532-01 |
| | 20 | - | - | 227-30071-01 | 227-30072-01 | 227-30532-02 |
| 5 | 10 | 227-30073-01 | 227-30074-01 | 227-30075-01 | 227-30077-01 | 227-30532-01 |
| | 20 | - | - | 227-30076-01 | 227-30078-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 |
| 3 | 10 | 227-30067-02 | 227-30068-02 | 227-30069-02 | 227-30070-02 |
| | 20 | - | - | 227-30071-02 | 227-30072-02 |
| 5 | 10 | 227-30073-02 | 227-30074-02 | 227-30075-02 | 227-30077-02 |
| | 20 | - | - | 227-30076-02 | 227-30078-02 |

## Analytical Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 1.9 | 50 | 227-30048-01 | 227-30049-01 | - | 50 |
| | 100 | 227-30048-02 | 227-30049-02 | - | 80 |
| | 150 | 227-30048-03 | 227-30049-03 | - | |
| 3 | 50 | 227-30084-01 | 227-30085-01 | 227-30086-01 | 50 |
| | 100 | 227-30084-02 | 227-30085-02 | 227-30086-02 | |
| | 150 | 227-30084-03 | 227-30085-03 | 227-30086-03 | |
| | 250 | 227-30084-04 | 227-30085-04 | 227-30086-04 | |

## Cartridge Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | Pressure Tolerance (MPa) | Holder |
|---|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | | |
| 1.9 | 10 | 227-30087-01 | 227-30088-01 | 227-30089-01 | 80 | 227-30533-01 |
| 3 | 10 | 227-30090-01 | 227-30091-01 | 227-30092-01 | | |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | |
| 1.9 | 10 | 227-30087-02 | 227-30088-02 | 227-30089-02 | 80 |
| 3 | 10 | 227-30090-02 | 227-30091-02 | 227-30092-02 | |

## Pre-column Type Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 1.9 | 30 | 227-30777-01 | 227-30778-01 | 227-30779-01 | 80 |
| 3 | | 227-30780-01 | 227-30781-01 | 227-30782-01 | 50 |

# Shim-pack GIS C18

## High Retentivity, Lower Column Back Pressure

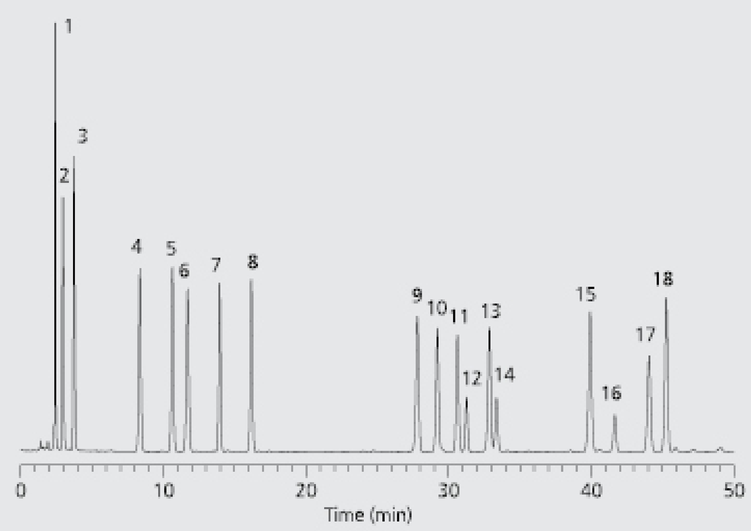
Widely used octadecyl bonded silica gel enables the Shim-pack GIS C18 to have strong hydrophobic interaction and low absorption of ionic compounds. In addition, highly uniform particles ensure stable mobile phase delivery and outstanding low pressure.

Shim-pack GIS C18 is ideal for preparative separations. Higher surface area silica and strong retentivity provide high preparative loading capacity without sacrificing peak shape.

| | |
|---|---|
| Bonded Phase | Octadecyl Groups |
| Particle Size | 2µm, 3µm, 4µm, 5µm, 10µm |
| Pore Size | 10 nm |
| Surface Area | 450 m²/g |
| Carbon Loading | 15% |
| End-capping | Yes |
| pH Range | 2 to 7.5 |
| USP Code | L1 |

## Analysis Examples

**Food Dyes**




**Peaks**

| | | | |
|---|---|---|---|
| 1. Tartrazine | 7.6 mg/L | 10. Ponceau SX | 5.3 mg/L |
| 2. Amaranth | 3.8 mg/L | 11. Orange I | 5.3 mg/L |
| 3. Ingigocarmine | 7.6 mg/L | 12. Fast green FCF | 3.0 mg/L |
| 4. New coccine | 3.8 mg/L | 13. Brilliant blue FCF | 3.0 mg/L |
| 5. Sunset Yellow FCF | 5.3 mg/L | 14. Ponceau 3R | 7.6 mg/L |
| 6. Naphthol Yellow S | 7.6 mg/L | 15. Erythrosine | 5.3 mg/L |
| 7. Uranine | 3.8 mg/L | 16. Azure Blue VX | 3.0 mg/L |
| 8. Allura Red AC | 5.3 mg/L | 17. Orange II | 7.6 mg/L |
| 9. Ponceau R | 7.6 mg/L | 18. Acid red | 3.0 mg/L |

**Conditions**

**Column** : Shim-pack GIS C18 (150 mmL. × 4.6 mmI.D, 4 µm) (P/N: 227-30100-07)
**Mobile Phase** : A) 10 mmol/L Disodium phosphate buffer solution (pH 6.9)
B) Acetonitrile
A/B = 90/10 - 50 min - 65/35
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 40 °C
**Detection** : UV 270 nm
**Injection Vol.** : 10 µL

### Analytical Columns

| Particle Size (µm) | Length (mm) \ I.D. (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 3 | 33 | 227-30095-01 | 227-30096-01 | 227-30096-05 | 227-30096-12 | 227-30096-19 | 227-30096-26 |
| | 50 | 227-30095-02 | 227-30096-02 | 227-30096-06 | 227-30096-13 | 227-30096-20 | 227-30096-27 |
| | 75 | 227-30095-03 | 227-30096-03 | 227-30096-07 | 227-30096-14 | 227-30096-21 | 227-30096-28 |
| | 100 | 227-30095-04 | 227-30096-04 | 227-30096-08 | 227-30096-15 | 227-30096-22 | 227-30096-29 |
| | 125 | - | - | 227-30096-09 | 227-30096-16 | 227-30096-23 | 227-30096-30 |
| | 150 | - | - | 227-30096-10 | 227-30096-17 | 227-30096-24 | 227-30096-31 |
| | 250 | - | - | 227-30096-11 | 227-30096-18 | 227-30096-25 | 227-30096-32 |
| 4 | 30 | - | - | 227-30097-01 | 227-30098-01 | 227-30099-01 | 227-30100-01 |
| | 33 | - | - | 227-30097-02 | 227-30098-02 | 227-30099-02 | 227-30100-02 |
| | 50 | - | - | 227-30097-03 | 227-30098-03 | 227-30099-03 | 227-30100-03 |
| | 75 | - | - | 227-30097-04 | 227-30098-04 | 227-30099-04 | 227-30100-04 |
| | 100 | - | - | 227-30097-05 | 227-30098-05 | 227-30099-05 | 227-30100-05 |
| | 125 | - | - | 227-30097-06 | 227-30098-06 | 227-30099-06 | 227-30100-06 |
| | 150 | - | - | 227-30097-07 | 227-30098-07 | 227-30099-07 | 227-30100-07 |
| | 250 | - | - | 227-30097-08 | 227-30098-08 | 227-30099-08 | 227-30100-08 |
| 5 | 30 | - | - | 227-30103-01 | 227-30104-01 | 227-30105-01 | 227-30106-01 |
| | 33 | 227-30101-01 | 227-30102-01 | 227-30103-02 | 227-30104-02 | 227-30105-02 | 227-30106-02 |
| | 50 | 227-30101-02 | 227-30102-02 | 227-30103-03 | 227-30104-03 | 227-30105-03 | 227-30106-03 |
| | 75 | 227-30101-03 | 227-30102-03 | 227-30103-04 | 227-30104-04 | 227-30105-04 | 227-30106-04 |
| | 100 | 227-30101-04 | 227-30102-04 | 227-30103-05 | 227-30104-05 | 227-30105-05 | 227-30106-05 |
| | 125 | - | - | 227-30103-06 | 227-30104-06 | 227-30105-06 | 227-30106-06 |
| | 150 | 227-30101-05 | 227-30102-05 | 227-30103-07 | 227-30104-07 | 227-30105-07 | 227-30106-07 |
| | 250 | 227-30101-06 | 227-30102-06 | 227-30103-08 | 227-30104-08 | 227-30105-08 | 227-30106-08 |

## Analytical Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 3.9 | 4.0 | 4.6 |
|---|---|---|---|---|
| 5 | 300 | 227-30812-01 | - | - |
| 7 | 250 | - | 227-30813-01 | - |
| 10 | 150 | - | 227-30111-01 | 227-30112-01 |
| | 250 | - | 227-30111-02 | 227-30112-02 |
| | 300 | 227-30814-01 | - | - |

## Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30117-01 | 227-30118-01 | 227-30119-01 | 227-30121-01 | 227-30532-01 |
| | 20 | - | - | 227-30120-01 | 227-30123-01 | 227-30532-02 |
| 4 | 10 | 227-30124-01 | 227-30125-01 | 227-30126-01 | 227-30128-01 | 227-30532-01 |
| | 20 | - | - | 227-30127-01 | 227-30129-01 | 227-30532-02 |
| 5 | 10 | 227-30130-01 | 227-30131-01 | 227-30132-01 | 227-30134-01 | 227-30532-01 |
| | 20 | - | - | 227-30133-01 | 227-30135-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 |
| 3 | 10 | 227-30117-02 | 227-30118-02 | 227-30119-02 | 227-30122-02 |
| | 20 | - | - | 227-30120-02 | 227-30123-02 |
| 4 | 10 | 227-30124-02 | 227-30125-02 | 227-30126-02 | 227-30128-02 |
| | 20 | - | - | 227-30127-02 | 227-30129-02 |
| 5 | 10 | 227-30130-02 | 227-30131-02 | 227-30132-02 | 227-30134-02 |
| | 20 | - | - | 227-30133-02 | 227-30135-02 |

## Analytical Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 2 | 30 | 227-30093-01 | 227-30094-01 | - | 50 |
| | 50 | 227-30093-02 | 227-30094-02 | - | |
| | 75 | 227-30093-03 | 227-30094-03 | - | |
| | 100 | 227-30093-04 | 227-30094-04 | - | 80 |
| | 150 | 227-30093-05 | 227-30094-05 | - | |
| 3 | 30 | 227-30149-01 | 227-30150-01 | 227-30151-01 | 50 |
| | 50 | 227-30149-02 | 227-30150-02 | 227-30151-02 | |
| | 75 | 227-30149-03 | 227-30150-03 | 227-30151-03 | |
| | 100 | 227-30149-04 | 227-30150-04 | 227-30151-04 | |
| | 150 | 227-30149-05 | 227-30150-05 | 227-30151-05 | |
| | 250 | 227-30149-06 | 227-30150-06 | 227-30151-06 | |

## Cartridge Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | Pressure Tolerance (MPa) | Holder |
|---|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | | |
| 2 | 10 | 227-30152-01 | 227-30153-01 | 227-30154-01 | 80 | 227-30533-01 |
| 3 | 10 | 227-30155-01 | 227-30156-01 | 227-30157-01 | | |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | |
| 2 | 10 | 227-30152-02 | 227-30153-02 | 227-30154-02 | 80 |
| 3 | 10 | 227-30155-02 | 227-30156-02 | 227-30157-02 | |

## Pre-column Type Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 2 | 30 | 227-30783-01 | 227-30784-01 | 227-30785-01 | 80 |
| 3 | | 227-30786-01 | 227-30787-01 | 227-30788-01 | 50 |

# Shim-pack GIS C18-P

## High Steric Selectivity

Shim-pack GIS C18-P is designed with a polymerically bonded octadecy group, which provides high steric selectivity for separation of planar and non-planar compounds. It achieves complete baseline separation of structurally similar compounds such as vitamin D2 and D3 because of the planarity recognition capability.

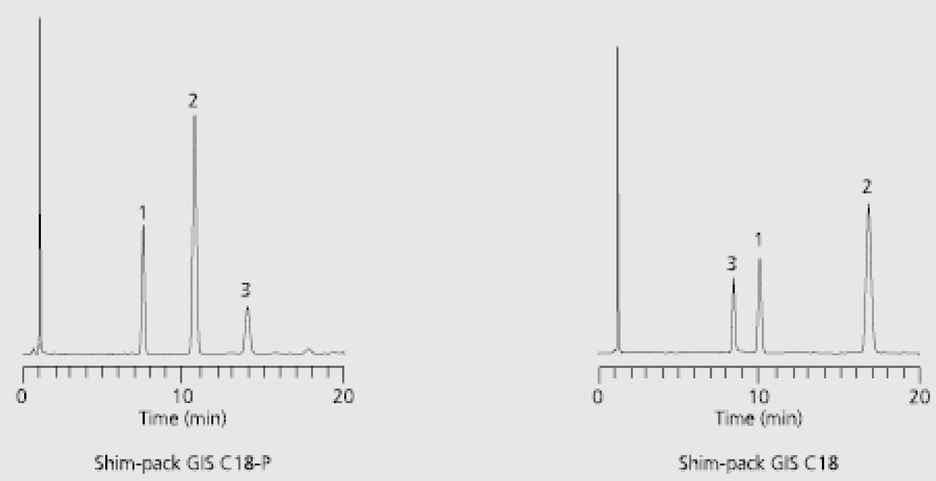
Shim-pack GIS C18-P is also ideal for the HPLC analysis of 16 PAH compounds listed as target pollutants by the U.S. EPA.

| | |
|---|---|
| Bonded Phase | Octadecyl Groups |
| Particle Size | 3 µm, 5 µm |
| Pore Size | 10 nm |
| Surface Area | 450 m²/g |
| Carbon Loading | 29 % |
| End-capping | - |
| pH Range | 2 - 7.5 |
| USP Code | L1 |

### Analysis Examples

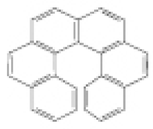
Due to increased retention of planar structural compounds, Shim-pack GIS C18-P shows different selectivity compared to Shim-pack GIS C18.

**Analysis of Planar and Non-planar Compounds**

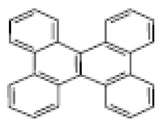



**Peaks**

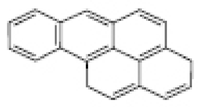
1. Phenanthro[3,4-c]phenanthrene (PhPh)



2. Tetrabenzonaphthalene (TBN)



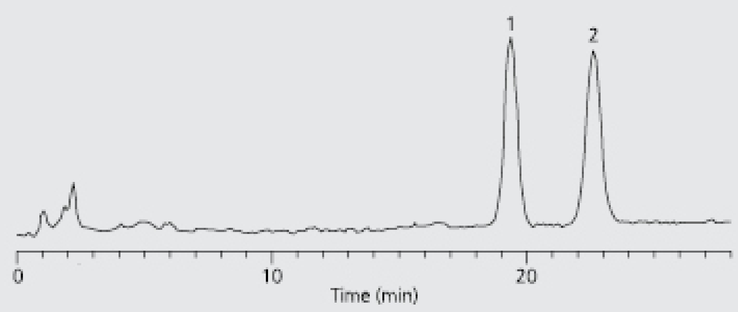
3. Benzo[a]pyrene (BaP)



**Conditions**

**Column** : 250 mmL. × 4.6 mmI.D., 5 µm
**Mobile Phase** : A) Water
B) Acetonitrile
A/B = 15/85 (v/v)
**Flow Rate** : 2.0 mL/min
**Col. Temp.** : 30 °C
**Detection** : UV 254 nm
**Samples** : Standard Reference Material 869

**Analysis of Vitamin D in Food**




**Peaks (100 µg/L each)**

1. Vitamin D2 (Calciferol)
2. Vitamin D3 (Cholecarciferol)

**Conditions**

**Column** : Shim-pack GIS C18-P (250 mmL. × 4.6 mmI.D., 5 µm)
(P/N: 227-30557-07)
**Mobile Phase** : Acetonitrile
**Flow Rate** : 1.5 mL/min
**Col. Temp.** : 40 °C
**Detection** : UV 265 nm
**Injection Vol.** : 200 µL

## Analytical Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 3 | 30 | - | - | 227-30536-01 | 227-30537-01 | 227-30538-01 | 227-30539-01 |
| | 33 | 227-30534-01 | 227-30535-01 | 227-30536-02 | 227-30537-02 | 227-30538-02 | 227-30539-02 |
| | 50 | 227-30534-02 | 227-30535-02 | 227-30536-03 | 227-30537-03 | 227-30538-03 | 227-30539-03 |
| | 75 | 227-30534-03 | 227-30535-03 | 227-30536-04 | 227-30537-04 | 227-30538-04 | 227-30539-04 |
| | 100 | 227-30534-04 | 227-30535-04 | 227-30536-05 | 227-30537-05 | 227-30538-05 | 227-30539-05 |
| | 150 | 227-30534-05 | 227-30535-05 | 227-30536-06 | 227-30537-06 | 227-30538-06 | 227-30539-06 |
| | 250 | 227-30534-06 | 227-30535-06 | 227-30536-07 | 227-30537-07 | 227-30538-07 | 227-30539-07 |
| 5 | 30 | - | - | 227-30554-01 | 227-30555-01 | 227-30556-01 | 227-30557-01 |
| | 33 | 227-30552-01 | 227-30553-01 | 227-30554-02 | 227-30555-02 | 227-30556-02 | 227-30557-02 |
| | 50 | 227-30552-02 | 227-30553-02 | 227-30554-03 | 227-30555-03 | 227-30556-03 | 227-30557-03 |
| | 75 | 227-30552-03 | 227-30553-03 | 227-30554-04 | 227-30555-04 | 227-30556-04 | 227-30557-04 |
| | 100 | 227-30552-04 | 227-30553-04 | 227-30554-05 | 227-30555-05 | 227-30556-05 | 227-30557-05 |
| | 150 | 227-30552-05 | 227-30553-05 | 227-30554-06 | 227-30555-06 | 227-30556-06 | 227-30557-06 |
| | 250 | 227-30552-06 | 227-30553-06 | 227-30554-07 | 227-30555-07 | 227-30556-07 | 227-30557-07 |

## Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 21.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30546-01 | 227-30547-01 | 227-30548-01 | 227-30550-01 | 227-30532-01 |
| | 20 | - | - | 227-30549-01 | 227-30551-01 | 227-30532-02 |
| 5 | 10 | 227-30578-01 | 227-30579-01 | 227-30580-01 | 227-30582-01 | 227-30532-01 |
| | 20 | - | - | 227-30581-01 | 227-30583-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 |
| 3 | 10 | 227-30546-02 | 227-30547-02 | 227-30548-02 | 227-30550-02 |
| | 20 | - | - | 227-30549-02 | 227-30551-02 |
| 5 | 10 | 227-30578-02 | 227-30579-02 | 227-30580-02 | 227-30582-02 |
| | 20 | - | - | 227-30581-02 | 227-30583-02 |

For preparative columns, please refer to page A-69

# Shim-pack GIS RP-Shield

## Embedded with a Polar Functional Group

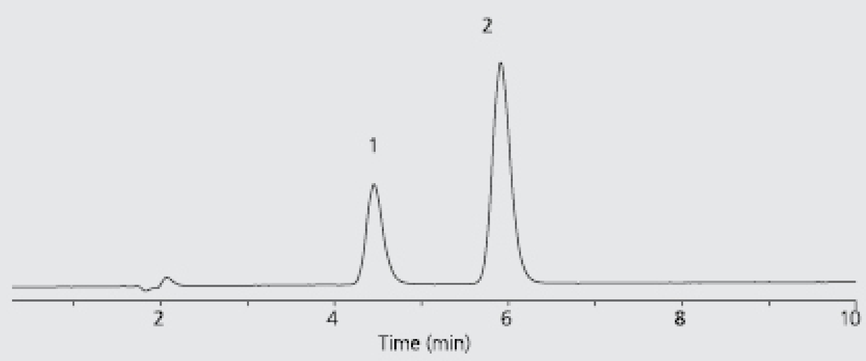
Shim-pack GIS RP-Shield contains a polar functional group embedded between silica surface and an octadecyl group, making it stable in 100% aqueous mobile phases without phase collapse. The embedded polar functional group is also extremely base deactivated, which enables the column to provide superior peak shape for acids.

Shim-pack GIS RP-Shield provides unique selectivity as hydrogen bonding interactions, making it suitable for separations that cannot be achieved by other modes, such as hydrophobic interactions or π-π interactions.

| | |
|---|---|
| Bonded Phase | Octadecyl Groups |
| Particle Size | 5 µm |
| Pore Size | 10 nm |
| Surface Area | 450 m²/g |
| Carbon Loading | 9 % |
| End-capping | - |
| pH Range | 2 - 7.5 |
| USP Code | L1 |

## Analysis Examples

**Analysis of Phenoxyacetic Acid and Benzoic Acid**




**Peaks**
1. Phenoxyacetic acid
2. Benzoic acid

**Conditions**

**Column** : Shim-pack GIS RP-Shield (150 mmL. × 3.0 mmI.D., 5 µm) (P/N: 227-30587-06)
**Mobile Phase** : A) 0.1 % Formic acid in Water
B) Acetonitrile
A/B = 50/50 (v/v)
**Flow Rate** : 0.4 mL/min
**Col. Temp.** : 40 °C
**Detection** : UV 254 nm

### Analytical Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 5 | 30 | - | - | 227-30586-01 | 227-30587-01 | 227-30588-01 | 227-30589-01 |
| | 33 | 227-30584-01 | 227-30585-01 | 227-30586-02 | 227-30587-02 | 227-30588-02 | 227-30589-02 |
| | 50 | 227-30584-02 | 227-30585-02 | 227-30586-03 | 227-30587-03 | 227-30588-03 | 227-30589-03 |
| | 75 | 227-30584-03 | 227-30585-03 | 227-30586-04 | 227-30587-04 | 227-30588-04 | 227-30589-04 |
| | 100 | 227-30584-04 | 227-30585-04 | 227-30586-05 | 227-30587-05 | 227-30588-05 | 227-30589-05 |
| | 150 | 227-30584-05 | 227-30585-05 | 227-30586-06 | 227-30587-06 | 227-30588-06 | 227-30589-06 |
| | 250 | 227-30584-06 | 227-30585-06 | 227-30586-07 | 227-30587-07 | 227-30588-07 | 227-30589-07 |

### Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 5 | 10 | 227-30612-01 | 227-30613-01 | 227-30614-01 | 227-30616-01 | 227-30532-01 |
| | 20 | - | - | 227-30615-01 | 227-30617-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 |
| 5 | 10 | 227-30612-02 | 227-30613-02 | 227-30614-02 | 227-30616-02 |
| | 20 | - | - | 227-30615-02 | 227-30617-02 |

# Shim-pack GWS C18

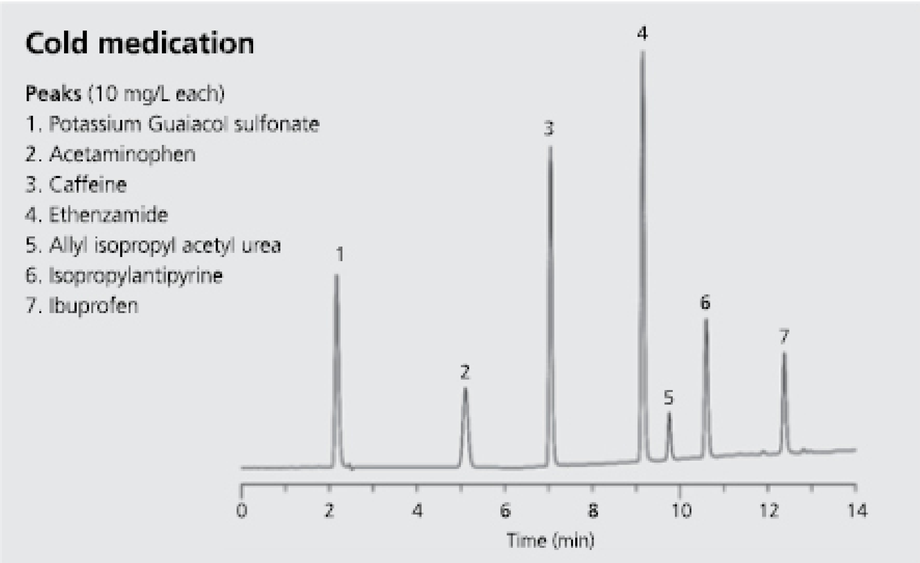
## Economical Choice

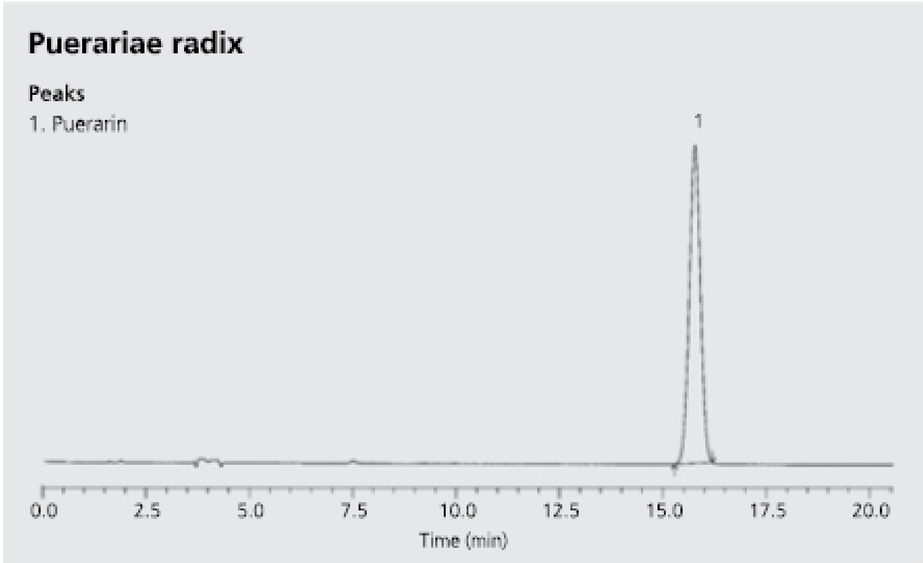
Shim-pack GWS C18 is packed with high-purity silica gel. A uniform pore size ensures low pressure, while complete end-capping makes it possible for analysis of acidic or basic compounds.

Shim-pack GWS series is an ideal choice for cost control.

| | |
|---|---|
| Bonded Phase | Octadecyl Groups |
| Particle Size | 5 µm |
| Pore Size | 10 nm |
| Surface Area | 450 m²/g |
| Carbon Loading | 9.5 % |
| End-capping | Yes |
| pH Range | 2 to 7.5 |
| USP Code | L1 |

## Analysis Examples




**Conditions**

**Column** : Shim-pack GWS C18 (150 mmL. × 4.6 mmI.D., 5 µm) (P/N: 227-30158-01)
**Mobile Phase** : A) 0.1 % Phosphoric acid in Water
B) Acetonitrile
A/B = 90/10 - 2 min - 90/10 - 10 min - 0/100
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 40 °C
**Detection** : UV 210 nm
**Injection Vol.** : 10 µL

**Conditions**

**Column** : Shim-pack GWS C18 (250 mmL. × 4.6 mmI.D., 5 µm) (P/N: 227-30158-03)
**Mobile Phase** : A) Water
B) Acetonitrile
A/B = 89/11
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 20 °C
**Detection** : UV 250 nm
**Injection Vol.** : 10 µL

### Analytical Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 4.6 |
|---|---|---|
| 5 | 150 | 227-30158-01 |
| | 200 | 227-30158-02 |
| | 250 | 227-30158-03 |

### Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | Holder | Cartridge Guard Column (2pcs) and Holder |
|---|---|---|---|---|
| | | 4.0 | | 4.0 |
| 5 | 10 | 227-30159-01 | 227-30532-01 | 227-30159-02 |

# Shim-pack GIST C8

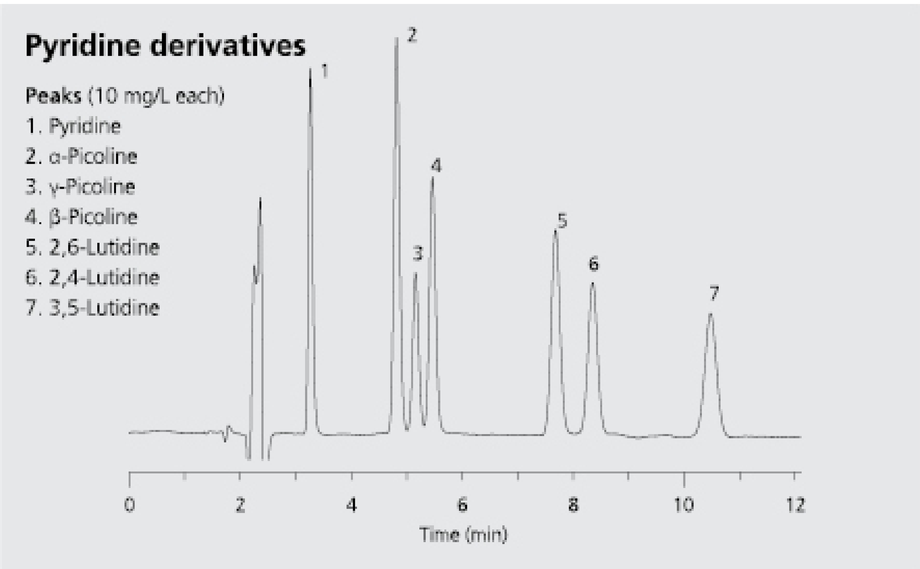
## Ultra-High Inertness, High Durability

Shim-pack GIST C8 is packed with high-purity porous spherical silica for delivering the same extreme inertness to elute either basic or acidic compounds without undesired adsorption. Low retentivity and no sample adsorption enable analysis of natural samples.

Shim-pack GIST C8 is the ideal choice for the rapid analysis of hydrophobic compounds.

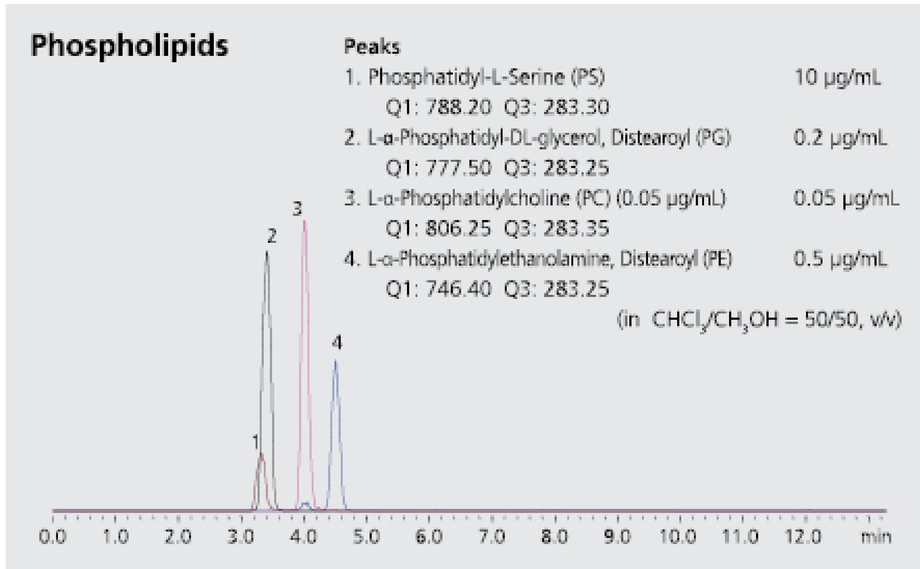
| | |
|---|---|
| Bonded Phase | Octyl Group |
| Particle Size | 2 µm, 3 µm, 5 µm |
| Pore Size | 10 nm |
| Surface Area | 350 m²/g |
| Carbon Loading | 8 % |
| End-capping | Yes |
| pH Range | 1 to 10 |
| USP Code | L7 |

## Analysis Examples




**Conditions**

**Column** : Shim-pack GIST C8 (150 mmL. × 4.6 mmI.D., 5 µm) (P/N: 227-30137-07)
**Mobile Phase** : A) 10 mmol/L Disodium phosphate buffer solution (pH 8.0)
B) Tetrahydrofuran
A/B = 87/13, v/v
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 40 °C
**Detection** : UV 260 nm
**Injection Vol.** : 5 µL




**Conditions**

**Column** : Shim-pack GIST C8 (150 mmL. × 2.1 mmI.D., 3 µm) (P/N: 227-30164-07)
**Mobile Phase** : 0.1 % Formic acid, 5 mmol/L Ammonium formate in Methanol
**Flow Rate** : 0.2 mL/min
**Col. Temp.** : 40 °C
**Detection** : LC/MS/MS (ESI, Negative, MRM)
**Injection Vol.** : 2 µL

### Analytical Columns

| Particle Size (µm) | Length (mm) \ I.D. (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 3 | 20 | - | - | 227-30164-01 | 227-30165-01 | 227-30166-01 | 227-30167-01 |
| | 30 | 227-30162-01 | 227-30163-01 | 227-30164-02 | 227-30165-02 | 227-30166-02 | 227-30167-02 |
| | 50 | 227-30162-02 | 227-30163-02 | 227-30164-03 | 227-30165-03 | 227-30166-03 | 227-30167-03 |
| | 75 | 227-30162-03 | 227-30163-03 | 227-30164-04 | 227-30165-04 | 227-30166-04 | 227-30167-04 |
| | 100 | 227-30162-04 | 227-30163-04 | 227-30164-05 | 227-30165-05 | 227-30166-05 | 227-30167-05 |
| | 125 | - | - | 227-30164-06 | 227-30165-06 | 227-30166-06 | 227-30167-06 |
| | 150 | 227-30162-05 | 227-30163-05 | 227-30164-07 | 227-30165-07 | 227-30166-07 | 227-30167-07 |
| | 250 | 227-30162-06 | 227-30163-06 | 227-30164-08 | 227-30165-08 | 227-30166-08 | 227-30167-08 |
| 5 | 20 | - | - | 227-30170-01 | 227-30171-01 | 227-30172-01 | 227-30173-01 |
| | 30 | 227-30168-01 | 227-30169-01 | 227-30170-02 | 227-30171-02 | 227-30172-03 | 227-30173-02 |
| | 50 | 227-30168-02 | 227-30169-02 | 227-30170-03 | 227-30171-03 | 227-30172-04 | 227-30173-03 |
| | 75 | 227-30168-03 | 227-30169-03 | 227-30170-04 | 227-30171-04 | 227-30172-05 | 227-30173-04 |
| | 100 | 227-30168-04 | 227-30169-04 | 227-30170-05 | 227-30171-05 | 227-30172-06 | 227-30173-05 |
| | 125 | - | - | 227-30170-06 | 227-30171-06 | 227-30172-07 | 227-30173-06 |
| | 150 | 227-30168-05 | 227-30169-05 | 227-30170-07 | 227-30171-07 | 227-30172-08 | 227-30173-07 |
| | 250 | 227-30168-06 | 227-30169-06 | 227-30170-08 | 227-30171-08 | 227-30172-09 | 227-30173-09 |

## Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30179-01 | 227-30180-01 | 227-30181-01 | 227-30183-01 | 227-30532-01 |
| | 20 | - | - | 227-30182-01 | 227-30184-01 | 227-30532-02 |
| 5 | 10 | 227-30185-01 | 227-30187-01 | 227-30188-01 | 227-30190-01 | 227-30532-01 |
| | 20 | - | - | 227-30189-01 | 227-30191-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 |
| 3 | 10 | 227-30179-02 | 227-30180-02 | 227-30181-02 | 227-30183-02 |
| | 20 | - | - | 227-30182-02 | 227-30184-02 |
| 5 | 10 | 227-30186-02 | 227-30187-02 | 227-30188-02 | 227-30190-02 |
| | 20 | - | - | 227-30189-02 | 227-30192-02 |

## Analytical Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 2 | 30 | 227-30160-01 | 227-30161-01 | - | 50 |
| | 50 | 227-30160-02 | 227-30161-02 | - | |
| | 75 | 227-30160-03 | 227-30161-03 | - | |
| | 100 | 227-30160-04 | 227-30161-04 | - | 80 |
| | 150 | 227-30160-05 | 227-30161-05 | - | |
| 3 | 30 | 227-30198-01 | 227-30199-01 | 227-30200-01 | 50 |
| | 50 | 227-30198-02 | 227-30199-02 | 227-30200-02 | |
| | 75 | 227-30198-03 | 227-30199-03 | 227-30200-03 | |
| | 100 | 227-30198-04 | 227-30199-04 | 227-30200-04 | |
| | 150 | 227-30198-05 | 227-30199-05 | 227-30200-05 | |
| | 250 | 227-30198-06 | 227-30199-06 | 227-30200-06 | |

## Cartridge Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | Pressure Tolerance (MPa) | Holder |
|---|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | | |
| 2 | 10 | 227-30201-01 | 227-30202-01 | 227-30203-01 | 80 | 227-30533-01 |
| 3 | 10 | 227-30204-01 | 227-30205-01 | 227-30206-01 | | |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | |
| 2 | 10 | 227-30201-02 | 227-30202-02 | 227-30203-02 | 80 |
| 3 | 10 | 227-30204-02 | 227-30205-02 | 227-30206-02 | |

## Pre-column Type Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 2 | 30 | 227-30789-01 | 227-30790-01 | 227-30791-01 | 80 |
| 3 | | 227-30792-01 | 227-30793-01 | 227-30794-01 | 50 |

# Shim-pack GIST Phenyl

## Extremely Strong π-π Interactions

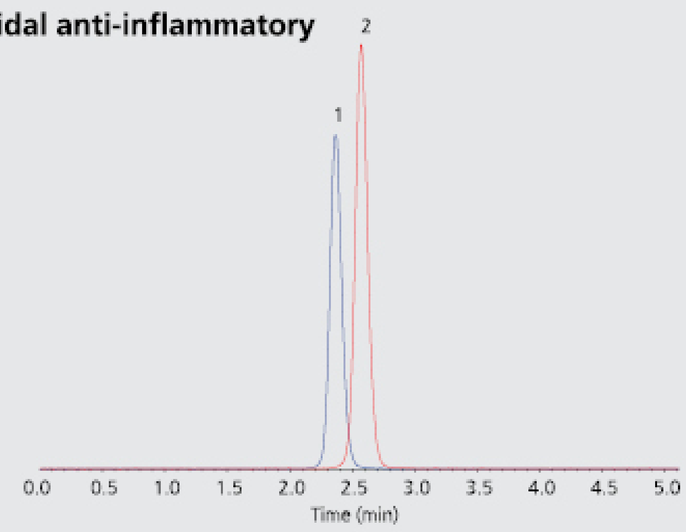
The extremely unique phase characteristics of Shim-pack GIST Phenyl are critical to resolving compounds that could not be separated with a C18 or C8 phase column.

In addition to π-π interactions, Shim-pack GIS Phenyl provides hydrogen bonding secondary interactions, which results in retaining polar compounds at the same time. As the phenyl groups are directly bonded to the silica gel, Shim-pack GIS Phenyl is also capable of the analysis of structural isomers due to its high stereo-selectivity.

| | |
|---|---|
| Bonded Phase | Phenyl Group |
| Particle Size | 2 µm, 3 µm, 5 µm |
| Pore Size | 10 nm |
| Surface Area | 350 m²/g |
| Carbon Loading | 10 % |
| End-capping | - |
| pH Range | 2 to 7.5 |
| USP Code | L11 |

## Analysis Examples

**Steroidal anti-inflammatory drug**




**Peaks (0.1 mg/L each)**
1. Hydrocortisone
2. Prednisolone

**Conditions**

**Column** : Shim-pack GIST Phenyl (50 mmL. × 2.1 mmI.D., 2 µm) (P/N: 227-30207-02)
**Mobile Phase** : A) 0.05 % Formic acid in Water
B) 0.05 % Formic acid in Methanol
A/B = 60/40, v/v
**Flow Rate** : 0.6 mL/min
**Col. Temp.** : 40 °C
**Detection** : LC/MS/MS (ESI, Positive, MRM)
**Injection Vol.** : 5 µL

### Analytical Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 3 | 20 | - | - | 227-30211-01 | 227-30212-01 | 227-30213-01 | 227-30214-01 |
| | 30 | 227-30209-01 | 227-30210-01 | 227-30211-02 | 227-30212-02 | 227-30213-02 | 227-30214-02 |
| | 50 | 227-30209-02 | 227-30210-02 | 227-30211-03 | 227-30212-03 | 227-30213-03 | 227-30214-03 |
| | 75 | 227-30209-03 | 227-30210-03 | 227-30211-04 | 227-30212-04 | 227-30213-04 | 227-30214-04 |
| | 100 | 227-30209-04 | 227-30210-04 | 227-30211-05 | 227-30212-05 | 227-30213-05 | 227-30214-05 |
| | 150 | 227-30209-05 | 227-30210-05 | 227-30211-06 | 227-30212-06 | 227-30213-06 | 227-30214-06 |
| | 250 | 227-30209-06 | 227-30210-06 | 227-30211-07 | 227-30212-07 | 227-30213-07 | 227-30214-07 |
| 5 | 20 | - | - | 227-30217-01 | 227-30218-01 | 227-30219-01 | 227-30220-01 |
| | 30 | 227-30215-01 | 227-30216-01 | 227-30217-02 | 227-30218-02 | 227-30219-02 | 227-30220-02 |
| | 50 | 227-30215-02 | 227-30216-02 | 227-30217-03 | 227-30218-03 | 227-30219-03 | 227-30220-03 |
| | 75 | 227-30215-03 | 227-30216-03 | 227-30217-04 | 227-30218-04 | 227-30219-04 | 227-30220-04 |
| | 100 | 227-30215-04 | 227-30216-04 | 227-30217-05 | 227-30218-05 | 227-30219-05 | 227-30220-05 |
| | 150 | 227-30215-05 | 227-30216-05 | 227-30217-06 | 227-30218-06 | 227-30219-06 | 227-30220-06 |
| | 250 | 227-30215-06 | 227-30216-06 | 227-30217-07 | 227-30218-07 | 227-30219-07 | 227-30220-08 |

## Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30226-01 | 227-30227-01 | 227-30228-01 | 227-30230-01 | 227-30532-01 |
| | 20 | - | - | 227-30229-01 | 227-30231-01 | 227-30532-02 |
| 5 | 10 | 227-30232-01 | 227-30233-01 | 227-30234-01 | 227-30236-01 | 227-30532-01 |
| | 20 | - | - | 227-30235-01 | 227-30237-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 |
| 3 | 10 | 227-30226-02 | 227-30227-02 | 227-30228-02 | 227-30230-02 |
| | 20 | - | - | 227-30229-02 | 227-30231-02 |
| 5 | 10 | 227-30232-02 | 227-30233-02 | 227-30234-02 | 227-30236-02 |
| | 20 | - | - | 227-30235-02 | 227-30237-02 |

## Analytical Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 2 | 30 | 227-30207-01 | 227-30208-01 | - | 50 |
| | 50 | 227-30207-02 | 227-30208-02 | - | |
| | 75 | 227-30207-03 | 227-30208-03 | - | |
| | 100 | 227-30207-04 | 227-30208-04 | - | 80 |
| | 150 | 227-30207-05 | 227-30208-05 | - | |
| 3 | 30 | 227-30243-01 | 227-30244-01 | 227-30245-01 | 50 |
| | 50 | 227-30243-02 | 227-30244-02 | 227-30245-02 | |
| | 75 | 227-30243-03 | 227-30244-03 | 227-30245-03 | |
| | 100 | 227-30243-04 | 227-30244-04 | 227-30245-04 | |
| | 150 | 227-30243-05 | 227-30244-05 | 227-30245-05 | |
| | 250 | 227-30243-06 | 227-30244-06 | 227-30245-06 | |

## Cartridge Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | Pressure Tolerance (MPa) | Holder |
|---|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | | |
| 2 | 10 | 227-30246-01 | 227-30247-01 | 227-30248-01 | 80 | 227-30533-01 |
| 3 | 10 | 227-30249-01 | 227-30250-01 | 227-30251-01 | | |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | |
| 2 | 10 | 227-30246-02 | 227-30247-02 | 227-30248-02 | 80 |
| 3 | 10 | 227-30249-02 | 227-30250-02 | 227-30251-02 | |

## Pre-column Type Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 2 | 30 | 227-30795-01 | 227-30796-01 | 227-30797-01 | 80 |
| 3 | | 227-30798-01 | 227-30799-01 | 227-30800-01 | 50 |

# Shim-pack GIST Phenyl-Hexyl

## Alternative Selectivity to C18 Columns

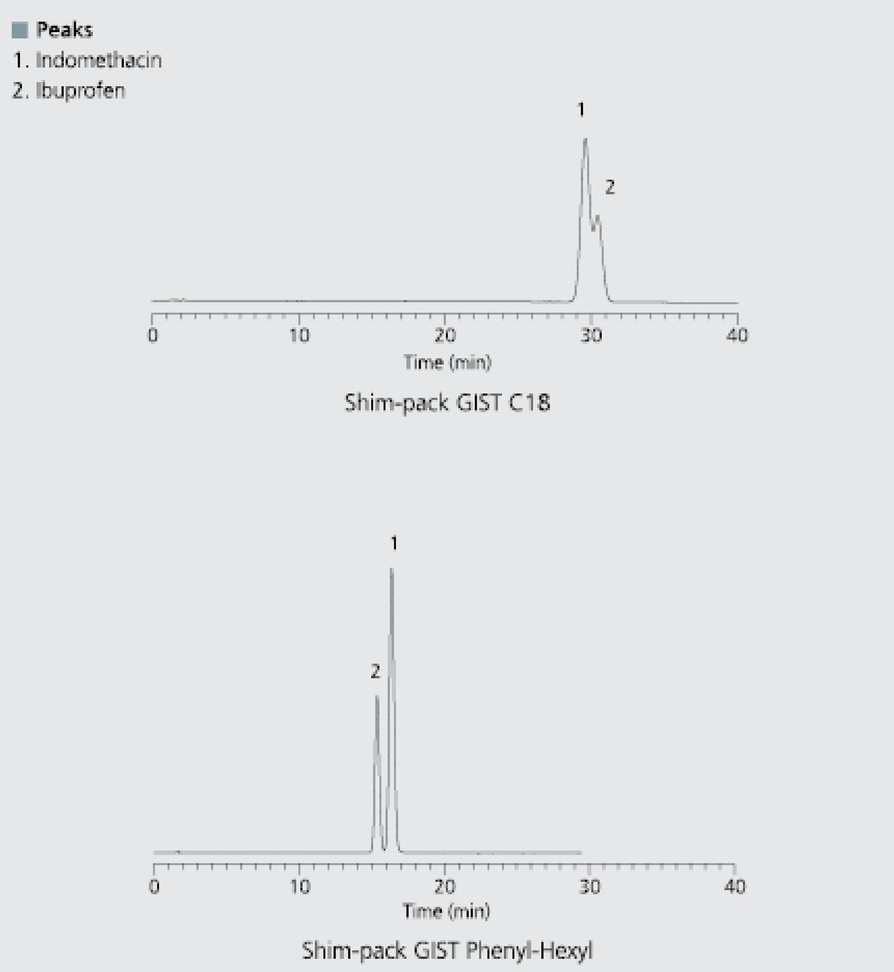
Shim-pack GIST Phenyl-Hexyl columns are bonded with a phenyl ring together with a hexyl (C6) chain, which provides complementary selectivity to straight alkyl-chain columns due to its π-π interactions and hydrophobic interactions. Furthermore, Shim-pack GIST Phenyl-Hexyl maintains the same ultra-high inertness, wide pH range and high durability as the Shim-pack GIST C18, achieving stronger retention than other phenyl columns as well as reducing or eliminating adsorption of polar compounds.

| | |
|---|---|
| Bonded Phase | Phenylhexyl Groups |
| Particle Size | 3 µm, 5 µm |
| Pore Size | 10 nm |
| Surface Area | 350 m²/g |
| Carbon Loading | 9 % |
| End-capping | Yes |
| pH Range | 1 to 10 |
| USP Code | L11 |

## Analysis Examples

**Different Selectivity to Shim-pack GIST C18**

Analysis of Analgesic Drugs

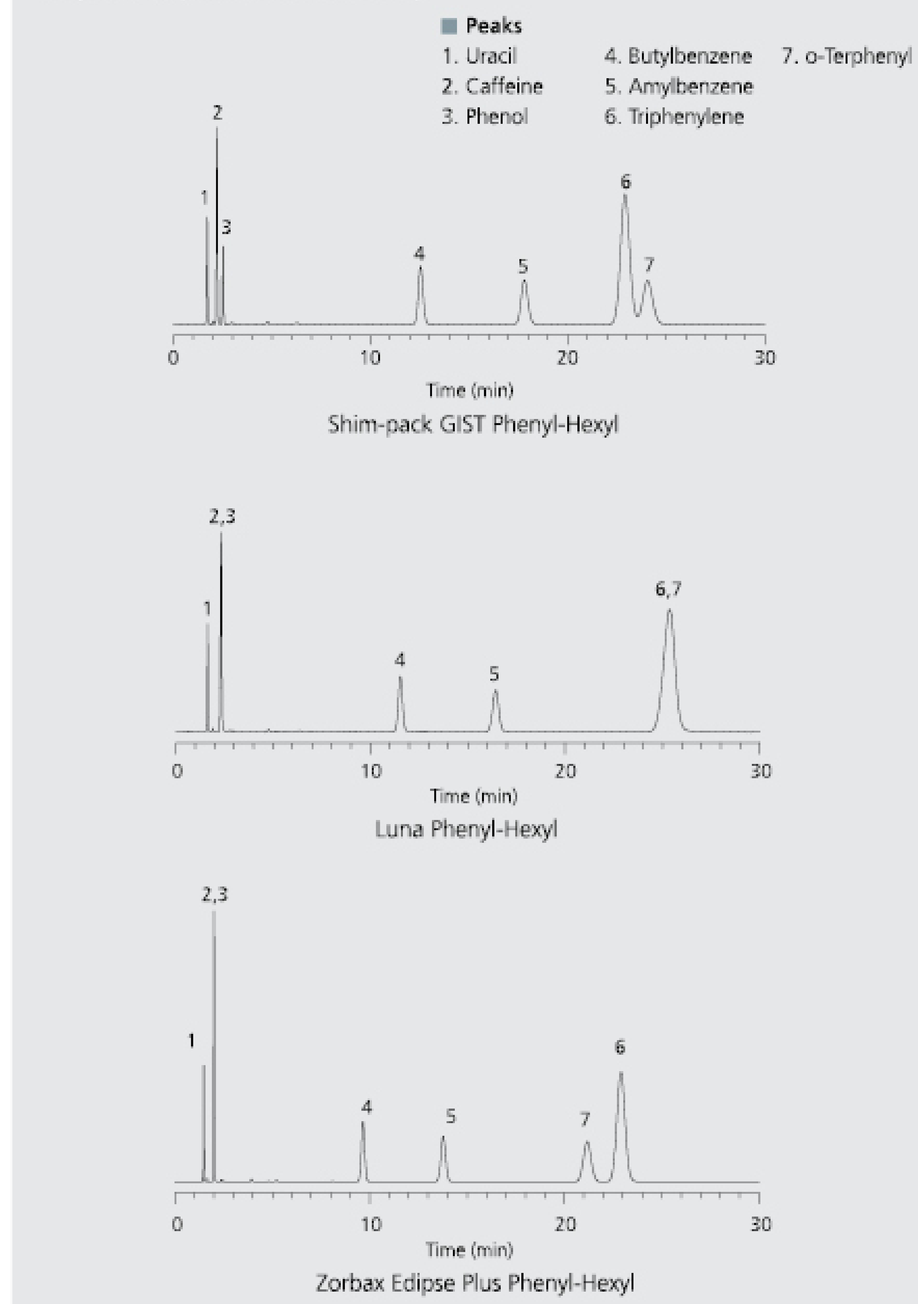



**Conditions**

| | |
|---|---|
| Column | : 150 mmL. × 4.6 mmI.D., 5 µm |
| Mobile Phase | : A) Acetonitrile<br>B) 25 mmol/L Monopotassium phosphate buffer solution (pH 3.0) |
| Flow Rate | : A/B=45/55 (v/v) |
| Col. Temp. | : 40 °C |
| Detection | : UV 230 nm |

**Stronger Retentivity Than Other Phenyl Phase**

Analysis of Samples for Column Selectivity




**Conditions**

| | |
|---|---|
| Column | : 150 mmL. × 4.6 mmI.D., 5 µm |
| Mobile Phase | : A) Water<br>B) Methanol<br>A/B = 30/70 (v/v) |
| Flow Rate | : 1.0 mL/min |
| Col. Temp. | : 40 °C |
| Detection | : UV 254 nm |

## Analytical Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 3 | 30 | 227-30667-01 | 227-30668-01 | 227-30669-01 | 227-30670-01 | 227-30671-01 | 227-30672-01 |
| | 50 | 227-30667-02 | 227-30668-02 | 227-30669-02 | 227-30670-02 | 227-30671-02 | 227-30672-02 |
| | 75 | 227-30667-03 | 227-30668-03 | 227-30669-03 | 227-30670-03 | 227-30671-03 | 227-30672-03 |
| | 100 | 227-30667-04 | 227-30668-04 | 227-30669-04 | 227-30670-04 | 227-30671-04 | 227-30672-04 |
| | 150 | 227-30667-05 | 227-30668-05 | 227-30669-05 | 227-30670-05 | 227-30671-05 | 227-30672-05 |
| | 250 | 227-30667-06 | 227-30668-06 | 227-30669-06 | 227-30670-06 | 227-30671-06 | 227-30672-06 |
| 5 | 30 | 227-30685-01 | 227-30686-01 | 227-30687-01 | 227-30688-01 | 227-30689-01 | 227-30690-01 |
| | 50 | 227-30685-02 | 227-30686-02 | 227-30687-02 | 227-30688-02 | 227-30689-02 | 227-30690-02 |
| | 75 | 227-30685-03 | 227-30686-03 | 227-30687-03 | 227-30688-03 | 227-30689-03 | 227-30690-03 |
| | 100 | 227-30685-04 | 227-30686-04 | 227-30687-04 | 227-30688-04 | 227-30689-04 | 227-30690-04 |
| | 150 | 227-30685-05 | 227-30686-05 | 227-30687-05 | 227-30688-05 | 227-30689-05 | 227-30690-05 |
| | 250 | 227-30685-06 | 227-30686-06 | 227-30687-06 | 227-30688-06 | 227-30689-06 | 227-30690-06 |

## Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30679-01 | 227-30680-01 | 227-30681-01 | 227-30683-01 | 227-30532-01 |
| | 20 | - | - | 227-30682-01 | 227-30684-01 | 227-30532-02 |
| 5 | 10 | 227-30707-01 | 227-30708-01 | 227-30709-01 | 227-30711-01 | 227-30532-01 |
| | 20 | - | - | 227-30710-01 | 227-30712-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | |
| 3 | 10 | 227-30679-02 | 227-30680-02 | 227-30681-02 | 227-30683-02 |
| | 20 | - | - | 227-30682-02 | 227-30684-02 |
| 5 | 10 | 227-30707-02 | 227-30708-02 | 227-30709-02 | 227-30711-02 |
| | 20 | - | - | 227-30710-02 | 227-30712-02 |

## Analytical Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 3 | 30 | - | 227-30714-01 | 227-30715-01 | 50 |
| | 50 | 227-30713-01 | 227-30714-02 | 227-30715-02 | |
| | 70 | 227-30713-02 | 227-30714-03 | 227-30715-03 | |
| | 100 | 227-30713-03 | 227-30714-04 | 227-30715-04 | |
| | 150 | 227-30713-04 | 227-30714-05 | 227-30715-05 | |
| | 250 | 227-30713-05 | 227-30714-06 | 227-30715-06 | |

## Cartridge Guard Columns (High Pressure series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | Pressure Tolerance (MPa) | Holder |
|---|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | | |
| 3 | 10 | 227-30716-01 | 227-30717-01 | 227-30718-01 | 80 | 227-30533-01 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 3.0 | |
| 3 | 10 | 227-30716-02 | 227-30717-02 | 227-30718-02 | 80 |

## Pre-column Type Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 3 | 30 | 227-30804-01 | 227-30805-01 | 227-30806-01 | 50 |

# Shim-pack GIST PFPP

## Strong retention for highly polar basic compounds

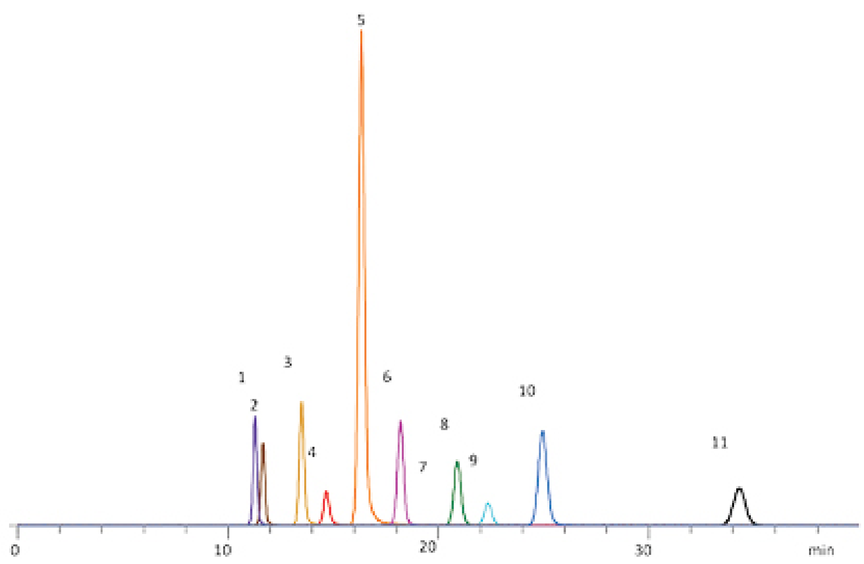
Different from other Shim-pack Series PFPP (pentafluorophenylpropyl) columns, this PFPP column is end-capped so it provides a different selectivity. Durability is a challenge for PFPP columns. However, Shim-pack GIST PFPP provides both high durability, which is a characteristic of the Shim-pack GIST Series, and separation characteristics of PFPP via a unique, advanced end-capping technology.

Generally, PFPP columns retain more highly polar basic compounds. This is more prominent in Shim-pack GIST PFPP and it also provides an extremely high retention performance when compared to other commercially-available PFPP columns.

| | |
|---|---|
| Bonded Phase | Pentafluorophenyl propyl Group |
| Particle Size | 3µm, 5µm |
| Pore Size | 10 nm |
| Surface Area | 350 m²/g |
| Carbon Loading | 10 % |
| End-capping | No |
| pH Range | 2 to 7.5 |
| USP Code | L43 |

## Analysis Examples

### Analysis of Antihistamines




**Peaks (100 µg/L each)**

1. Ketotifen
2. Epinastine
3. Chlorpheniramine
4. Cetirizine
5. Triprolidine
6. Hydroxyzine
7. Fexofenadine
8. Azelastine
9. Loratidine
10. Homoclorcyclizine
11. Clemastine

**Conditions**

**Column** : Shim-pack GIST-HP PFPP (3 µm, 150 x 2.1 mm I.D.) (P/N: 227-30890-05)
**Mobile Phase** : A) Acetonitrile
B) 0.1% Formic acid in water
A/B = 40/60, v/v
**Flow Rate** : 0.2 mL/min
**Col. Temp.** : 40 °C
**Detection** : LCMS-8030 Plus (ESI, Positive, SRM)
**Injection Vol.** : 1 µL
**Sample** : Standard

### Analytical Columns

| Particle Size (µm) | Length (mm) \ I.D. (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 3 | 20 | - | - | 227-30858-01 | 227-30859-01 | 227-30860-01 | 227-30861-01 |
| | 30 | 227-30856-01 | 227-30857-01 | 227-30858-02 | 227-30859-02 | 227-30860-02 | 227-30861-02 |
| | 50 | 227-30856-02 | 227-30857-02 | 227-30858-03 | 227-30859-03 | 227-30860-03 | 227-30861-03 |
| | 75 | 227-30856-03 | 227-30857-03 | 227-30858-04 | 227-30859-04 | 227-30860-04 | 227-30861-04 |
| | 100 | 227-30856-04 | 227-30857-04 | 227-30858-05 | 227-30859-05 | 227-30860-05 | 227-30861-05 |
| | 125 | - | - | 227-30858-06 | 227-30859-06 | 227-30860-06 | 227-30861-06 |
| | 150 | 227-30856-05 | 227-30857-05 | 227-30858-07 | 227-30859-07 | 227-30860-07 | 227-30861-07 |
| | 250 | 227-30856-06 | 227-30857-06 | 227-30858-08 | 227-30859-08 | 227-30860-08 | 227-30861-08 |
| 5 | 20 | - | - | 227-30864-01 | 227-30865-01 | 227-30866-01 | 227-30867-01 |
| | 30 | 227-30862-01 | 227-30863-01 | 227-30864-02 | 227-30865-02 | 227-30866-02 | 227-30867-02 |
| | 50 | 227-30862-02 | 227-30863-02 | 227-30864-03 | 227-30865-03 | 227-30866-03 | 227-30867-03 |
| | 75 | 227-30862-03 | 227-30863-03 | 227-30864-04 | 227-30865-04 | 227-30866-04 | 227-30867-04 |
| | 100 | 227-30862-04 | 227-30863-04 | 227-30864-05 | 227-30865-05 | 227-30866-05 | 227-30867-05 |
| | 125 | - | - | 227-30864-06 | 227-30865-06 | 227-30866-06 | 227-30867-06 |
| | 150 | 227-30862-05 | 227-30863-05 | 227-30864-07 | 227-30865-07 | 227-30866-07 | 227-30867-07 |
| | 250 | 227-30862-06 | 227-30863-06 | 227-30864-08 | 227-30865-08 | 227-30866-08 | 227-30867-08 |

## Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30873-01 | 227-30874-01 | 227-30875-01 | 227-30877-01 | 227-30532-01 |
| | 20 | - | - | 227-30876-01 | 227-30878-01 | 227-30532-02 |
| 5 | 10 | 227-30879-01 | 227-30880-01 | 227-30881-01 | 227-30883-01 | 227-30532-01 |
| | 20 | - | - | 227-30882-01 | 227-30884-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 |
| 3 | 10 | 227-30873-02 | 227-30874-02 | 227-30875-02 | 227-30877-02 |
| | 20 | - | - | 227-30876-02 | 227-30878-02 |
| 5 | 10 | 227-30879-02 | 227-30880-02 | 227-30881-02 | 227-30883-02 |
| | 20 | - | - | 227-30882-02 | 227-30884-02 |

## Analytical Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 3 | 20 | 227-30890-01 | - | - | 50 |
| | 30 | - | 227-30891-01 | 227-30892-01 | |
| | 50 | 227-30890-02 | 227-30891-02 | 227-30892-02 | |
| | 75 | 227-30890-03 | 227-30891-03 | 227-30892-03 | |
| | 100 | 227-30890-04 | 227-30891-04 | 227-30892-04 | |
| | 150 | 227-30890-05 | 227-30891-05 | 227-30892-05 | |
| | 250 | 227-30890-06 | 227-30891-06 | 227-30892-06 | |

## Cartridge Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | Pressure Tolerance (MPa) | Holder |
|---|---|---|---|---|---|---|
| | | 1.5 | 2.1 | 4.0 | | |
| 3 | 10 | 227-30893-01 | 227-30894-01 | 227-30895-01 | 80 | 227-30533-01 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| | | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30893-02 | 227-30894-02 | 227-30895-02 | 80 |

# Shim-pack GIS HILIC

## Ideal for the Separation of Highly Polar Basic Compounds

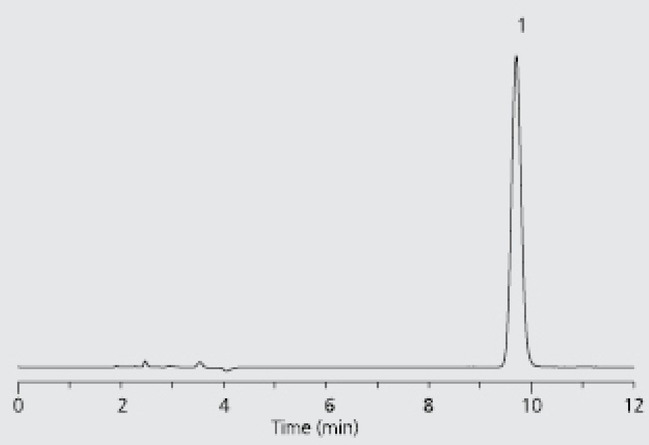
Shim-pack GIS HILIC is designed for Hydrophilic Interaction Liquid Chromatography (HILIC). It is chemically bonded with a diol group, which provides excellent peak shape for basic and neutral polar compounds.

In addition, HILIC is a variation of normal phase mode. It is capable of using organic solvents mixed with water as mobile phase, while normal phase mode uses non-aqueous organic solvents. In HILIC, the higher the organic concentration in the solvents, the greater is the retention of highly polar compounds.

| | |
|---|---|
| Bonded Phase | Diol Groups |
| Particle Size | 3 µm, 5 µm |
| Pore Size | 10 nm |
| Surface Area | 450 m²/g |
| Carbon Loading | 20 % |
| End-capping | - |
| pH Range | 2 to 7.5 |
| USP Code | L20 |

## Analysis Examples

**Analysis of Allantoin**

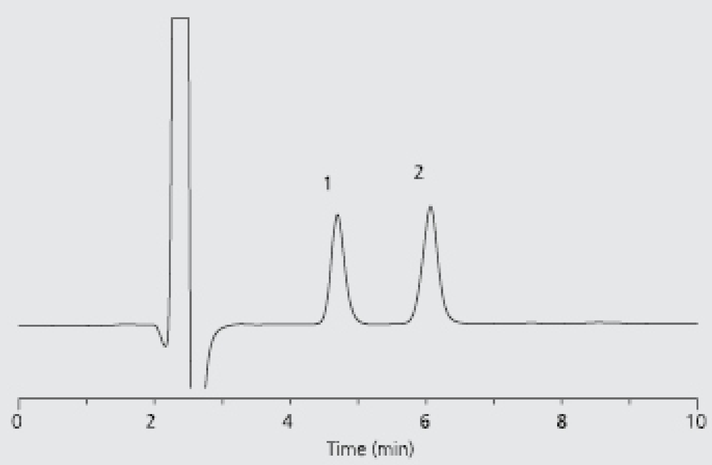



**Peaks**
1. Allantoin

**Conditions**

| | |
|---|---|
| **Column** | : Shim-pack GIS HILIC (250 mmL. × 3.0 mmI.D., 5 µm) (P/N: 227-30639-07) |
| **Mobile Phase** | : A) 10 mmol/L Ammonium acetate<br>B) Acetonitrile<br>A/B = 5/95 (v/v) |
| **Flow Rate** | : 0.4 mL/min |
| **Col. Temp.** | : 40 °C |
| **Detection** | : UV 210 nm |

**Analysis of Taurine and Inositol**




**Peaks (500 mg/L each)**
1. Taurine
2. Inositol

**Conditions**

| | |
|---|---|
| **Column** | : Shim-pack GIS HILIC (150 mmL. × 3.0 mmI.D., 5 µm) (P/N: 227-30639-06) |
| **Mobile Phase** | : A) Water<br>B) Acetonitrile<br>A/B = 20/80 (v/v) |
| **Flow Rate** | : 0.4 mL/min |
| **Col. Temp.** | : 40 °C |
| **Detection** | : RID (35 °C, positive) |
| **Injection Vol.** | : 20 µL |

## Analytical Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 3 | 30 | - | - | 227-30620-01 | 227-30621-01 | 227-30622-01 | 227-30623-01 |
| | 33 | 227-30618-01 | 227-30619-01 | 227-30620-02 | 227-30621-02 | 227-30622-02 | 227-30623-02 |
| | 50 | 227-30618-02 | 227-30619-02 | 227-30620-03 | 227-30621-03 | 227-30622-03 | 227-30623-03 |
| | 75 | 227-30618-03 | 227-30619-03 | 227-30620-04 | 227-30621-04 | 227-30622-04 | 227-30623-04 |
| | 100 | 227-30618-04 | 227-30619-04 | 227-30620-05 | 227-30621-05 | 227-30622-05 | 227-30623-05 |
| | 150 | 227-30618-05 | 227-30619-05 | 227-30620-06 | 227-30621-06 | 227-30622-06 | 227-30623-06 |
| | 250 | 227-30618-06 | 227-30619-06 | 227-30620-07 | 227-30621-07 | 227-30622-07 | 227-30623-07 |
| 5 | 30 | - | - | 227-30638-01 | 227-30639-01 | 227-30640-01 | 227-30641-01 |
| | 33 | 227-30636-01 | 227-30637-01 | 227-30638-02 | 227-30639-02 | 227-30640-02 | 227-30641-02 |
| | 50 | 227-30636-02 | 227-30637-02 | 227-30638-03 | 227-30639-03 | 227-30640-03 | 227-30641-03 |
| | 75 | 227-30636-03 | 227-30637-03 | 227-30638-04 | 227-30639-04 | 227-30640-04 | 227-30641-04 |
| | 100 | 227-30636-04 | 227-30637-04 | 227-30638-05 | 227-30639-05 | 227-30640-05 | 227-30641-05 |
| | 150 | 227-30636-05 | 227-30637-05 | 227-30638-06 | 227-30639-06 | 227-30640-06 | 227-30641-06 |
| | 250 | 227-30636-06 | 227-30637-06 | 227-30638-07 | 227-30639-07 | 227-30640-07 | 227-30641-07 |

## Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30630-01 | 227-30631-01 | 227-30632-01 | 227-30634-01 | 227-30532-01 |
| | 20 | - | - | 227-30633-01 | 227-30635-01 | 227-30532-02 |
| 5 | 10 | 227-30661-01 | 227-30662-01 | 227-30663-01 | 227-30665-01 | 227-30532-01 |
| | 20 | - | - | 227-30664-01 | 227-30666-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 |
| 3 | 10 | 227-30630-02 | 227-30631-02 | 227-30632-02 | 227-30634-02 |
| | 20 | | | 227-30633-02 | 227-30635-02 |
| 5 | 10 | 227-30661-02 | 227-30662-02 | 227-30663-02 | 227-30665-02 |
| | 20 | | | 227-30664-02 | 227-30666-02 |

For preparative columns, please refer to page A-69

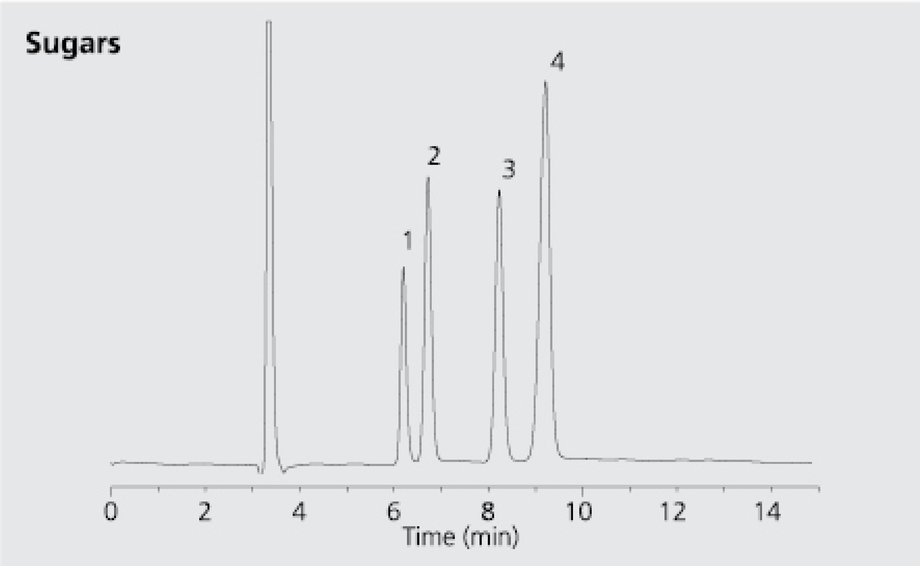
# Shim-pack GIST NH2

## Ideal for Sugar Analysis

New high-purity porous spherical silica chemically bonded with the aminopropyl group ensures the superior stability of Shim-pack GIST NH2. It is capable of the analysis of vitamin E or simultaneous analysis of sugars that are hard to separate in reversed phase mode. In addition, due to being primarily amine-bound, Shim-pack GIST NH2 can analyze sugars with no separation of anomers, even under low-temperature conditions. Furthermore, Shim-pack GIST NH2 delivers highly reliable reproducibility and stability with accurate qualitative and quantitative results.

| | |
|---|---|
| Bonded Phase | Aminopropyl Group |
| Particle Size | 3 µm, 5 µm |
| Pore Size | 10 nm |
| Surface Area | 350 m²/g |
| Carbon Loading | 7 % |
| End-capping | - |
| pH Range | 2 to 7.5 |
| USP Code | L8 |

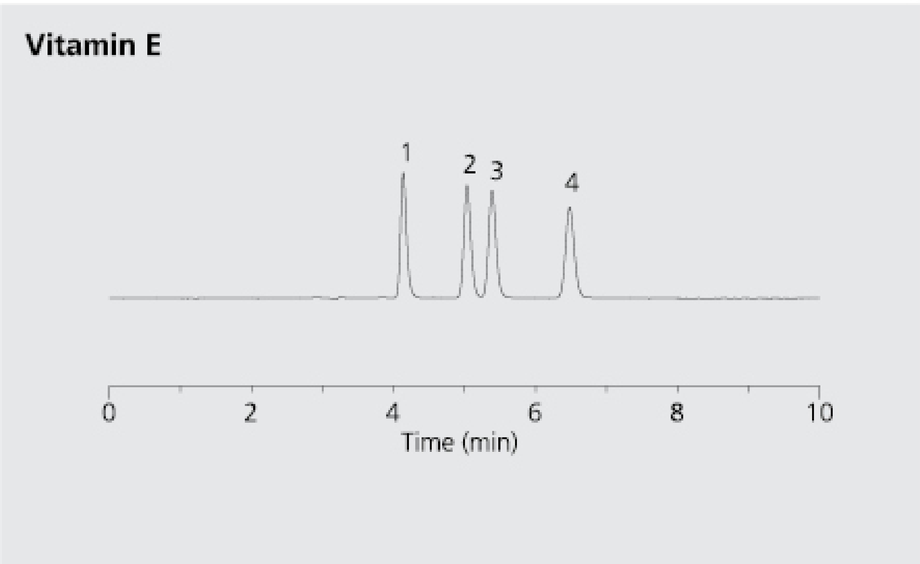
## Analysis Examples




**Peaks**
1. Fructose
2. Glucose
3. Sucrose
4. Maltose

**Conditions**

**Column** : Shim-pack GIST NH2 (250 mmL. × 4.6 mmI.D., 5 µm) (P/N: 227-30302-08)
**Mobile Phase** : A) Water
B) Acetonitrile
A/B = 25/75, v/v
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 40 °C
**Detection** : RID
**Injection Vol.** : 5 µL




**Peaks (25 mg/L each)**
1. α-Tocopherol
2. β-Tocopherol
3. γ-Tocopherol
4. δ-Tocopherol

**Conditions**

**Column** : Shim-pack GIST NH2 (250 mmL. × 4.6 mmI.D., 5 µm) (P/N: 227-30302-08)
**Mobile Phase** : A) *n*-Hexane
B) Ethyl acetate
A/B = 70/30, v/v
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 40 °C
**Detection** : UV 290 nm
**Injection Vol.** : 10 µL

## Analytical Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 3 | 20 | - | - | 227-30293-01 | 227-30294-01 | 227-30295-01 | 227-30296-01 |
| | 30 | 227-30291-01 | 227-30292-01 | 227-30293-02 | 227-30294-02 | 227-30295-02 | 227-30296-02 |
| | 50 | 227-30291-02 | 227-30292-02 | 227-30293-03 | 227-30294-03 | 227-30295-03 | 227-30296-03 |
| | 75 | 227-30291-03 | 227-30292-03 | 227-30293-04 | 227-30294-04 | 227-30295-04 | 227-30296-04 |
| | 100 | 227-30291-04 | 227-30292-04 | 227-30293-05 | 227-30294-05 | 227-30295-05 | 227-30296-05 |
| | 150 | 227-30291-05 | 227-30292-05 | 227-30293-06 | 227-30294-06 | 227-30295-06 | 227-30296-06 |
| | 250 | 227-30291-06 | 227-30292-06 | 227-30293-07 | 227-30294-07 | 227-30295-07 | 227-30296-07 |
| 5 | 20 | - | - | 227-30299-01 | 227-30300-01 | 227-30301-01 | 227-30302-01 |
| | 30 | 227-30297-01 | 227-30298-01 | 227-30299-02 | 227-30300-02 | 227-30301-02 | 227-30302-02 |
| | 50 | 227-30297-02 | 227-30298-02 | 227-30299-03 | 227-30300-03 | 227-30301-03 | 227-30302-03 |
| | 75 | 227-30297-03 | 227-30298-03 | 227-30299-04 | 227-30300-04 | 227-30301-04 | 227-30302-04 |
| | 100 | 227-30297-04 | 227-30298-04 | 227-30299-05 | 227-30300-05 | 227-30301-05 | 227-30302-05 |
| | 150 | 227-30297-05 | 227-30298-05 | 227-30299-06 | 227-30300-06 | 227-30301-06 | 227-30302-06 |
| | 250 | 227-30297-06 | 227-30298-06 | 227-30299-07 | 227-30300-07 | 227-30301-07 | 227-30302-08 |

## Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30308-01 | 227-30308-03 | 227-30309-01 | 227-30310-01 | 227-30532-01 |
| 5 | 10 | 227-30311-01 | 227-30312-01 | 227-30313-01 | 227-30315-01 | |
| | 20 | - | - | 227-30314-01 | 227-30316-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 |
| 3 | 10 | 227-30308-02 | 227-30308-04 | 227-30309-02 | 227-30310-02 |
| 5 | 10 | 227-30311-02 | 227-30312-02 | 227-30313-02 | 227-30315-02 |
| | 20 | - | - | 227-30314-02 | 227-30316-02 |

# Shim-pack GIST Amide

## Strong retention of polar compounds

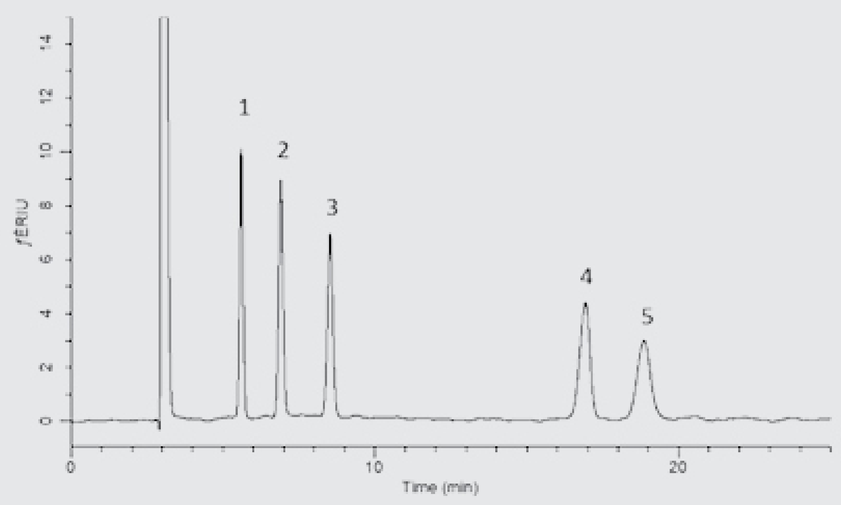
This is the amide type HILIC column in the Shim-pack Series. It shows stronger retention of polar compounds than other HILIC columns such as unmodified silica and Diol type and it provides a different selectivity. It is also highly durable, which is a characteristic of the Shim-pack GIST Series.

In addition to analysis of oligosaccharides and glycans, Amide type HILIC columns are often used as general HILIC columns as they are applicable to a wide range of samples.

| | |
|---|---|
| Bonded Phase | Amide (Carbamoyl) Groups |
| Particle Size | 3µm, 5µm |
| Pore Size | 10 nm |
| Surface Area | 350 m²/g |
| Carbon Loading | 15 % |
| End-capping | No |
| pH Range | 2 to 8.5 |
| USP Code | L68 |

## Analysis Examples

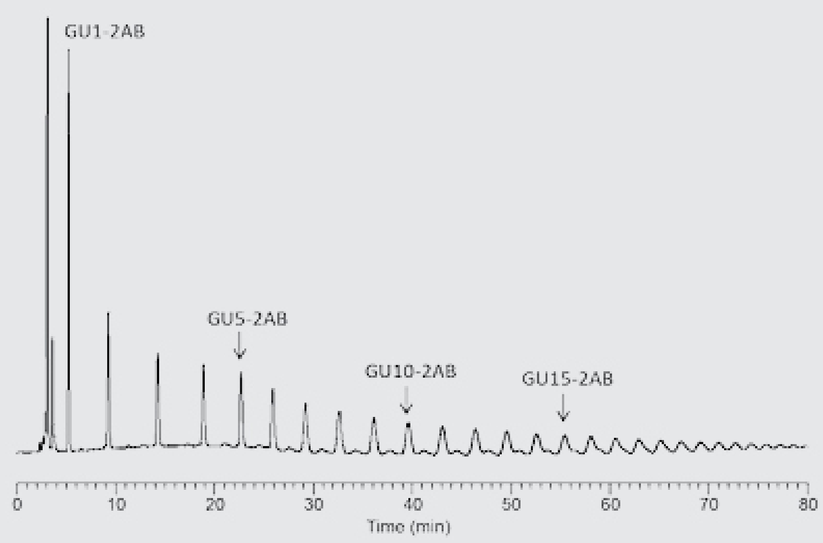
**Analysis of Sugar Alcohol**




**Conditions**

**Column** : Shim-pack GIST Amide (5 µm, 250 x 4.6 mm I.D.) (P/N: 227-30827-07)
**Mobile Phase** : Acetonitrile/Water = 80/20, v/v
**Flow Rate** : 1 mL/min
**Col. Temp.** : 40 °C
**Detection** : RI
**Injection Vol.** : 10 µL

**Analysis of Oligosaccharides derivatized with 2-AB**




**Conditions**

**Column** : Shim-pack GIST Amide (5 µm, 250 x 4.6 mm I.D.) (P/N: 227-30827-07)
**Mobile Phase** : Acetonitrile
B) 50 mM HCOONH4 (pH 4.4, HCOOH)
A/B = 80/20 – 20 min – 65/35 – 60 min – 50/50 – 10 min – 50/50 (v/v)
**Flow Rate** : 1 mL/min
**Col. Temp.** : 50 °C
**Detection** : RI
**Injection Vol.** : 25 µL
**Sample** : 2-AB Labeled Glucose Homopolymer Ladder

## Analytical Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 3 | 30 | 227-30816-01 | 227-30817-01 | 227-30818-01 | 227-30819-01 | 227-30820-01 | 227-30821-01 |
| | 50 | 227-30816-02 | 227-30817-02 | 227-30818-02 | 227-30819-02 | 227-30820-02 | 227-30821-02 |
| | 75 | 227-30816-03 | 227-30817-03 | 227-30818-03 | 227-30819-03 | 227-30820-03 | 227-30821-03 |
| | 100 | 227-30816-04 | 227-30817-04 | 227-30818-04 | 227-30819-04 | 227-30820-04 | 227-30821-04 |
| | 125 | - | - | 227-30818-05 | 227-30819-05 | 227-30820-05 | 227-30821-05 |
| | 150 | 227-30816-05 | 227-30817-05 | 227-30818-06 | 227-30819-06 | 227-30820-06 | 227-30821-06 |
| | 250 | 227-30816-06 | 227-30817-06 | 227-30818-07 | 227-30819-07 | 227-30820-07 | 227-30821-07 |
| 5 | 30 | 227-30822-01 | 227-30823-01 | 227-30824-01 | 227-30825-01 | 227-30826-01 | 227-30827-01 |
| | 50 | 227-30822-02 | 227-30823-02 | 227-30824-02 | 227-30825-02 | 227-30826-02 | 227-30827-02 |
| | 75 | 227-30822-03 | 227-30823-03 | 227-30824-03 | 227-30825-03 | 227-30826-03 | 227-30827-03 |
| | 100 | 227-30822-04 | 227-30823-04 | 227-30824-04 | 227-30825-04 | 227-30826-04 | 227-30827-04 |
| | 125 | - | - | 227-30824-05 | 227-30825-05 | 227-30826-05 | 227-30827-05 |
| | 150 | 227-30822-05 | 227-30823-05 | 227-30824-06 | 227-30825-06 | 227-30826-06 | 227-30827-06 |
| | 250 | 227-30822-06 | 227-30823-06 | 227-30824-07 | 227-30825-07 | 227-30826-07 | 227-30827-07 |

## Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30833-01 | 227-30834-01 | 227-30835-01 | 227-30837-01 | 227-30532-01 |
| | 20 | - | - | 227-30836-01 | 227-30838-01 | 227-30532-02 |
| 5 | 10 | 227-30839-01 | 227-30840-01 | 227-30841-01 | 227-30843-01 | 227-30532-01 |
| | 20 | - | - | 227-30842-01 | 227-30844-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 |
| 3 | 10 | 227-30833-02 | 227-30834-02 | 227-30835-02 | 227-30837-02 |
| | 20 | - | - | 227-30836-02 | 227-30838-02 |
| 5 | 10 | 227-30839-02 | 227-30840-02 | 227-30841-02 | 227-30843-02 |
| | 20 | - | - | 227-30842-02 | 227-30844-02 |

## Pre-column Type Guard Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | Pressure Tolerance (MPa) |
|---|---|---|---|---|
| 1.9 | 30 | 227-30947-01 | 227-30948-01 | 80 |
| | 50 | 227-30947-02 | 227-30948-02 | |
| | 75 | 227-30947-03 | 227-30948-03 | |
| | 100 | 227-30947-04 | 227-30948-04 | |
| | 150 | 227-30947-05 | 227-30948-05 | |

## Cartridge Guard Column (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | Pressure Tolerance (MPa) | Holder |
|---|---|---|---|---|---|
| | | 2.1 | 3.0 | | |
| 1.9 | 10 | 227-30949-01 | 227-30950-01 | 80 | 227-30950-01 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | Pressure Tolerance (MPa) |
|---|---|---|---|---|
| | | 2.1 | 3.0 | |
| 1.9 | 10 | 227-30949-02 | 227-30950-02 | 80 |

# Shim-pack GIS CN

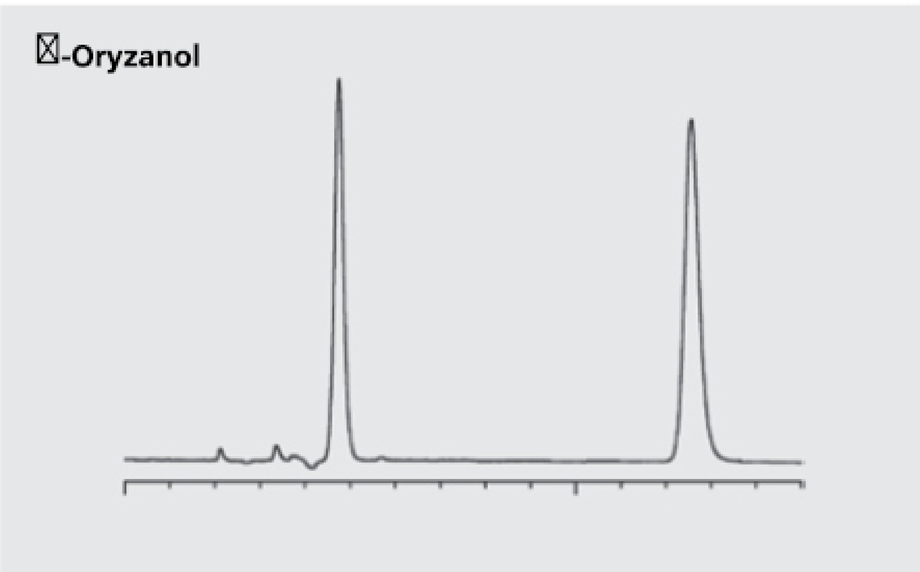
## Suitable in Either Reversed Phase or Normal Phase Mode

Shim-pack GIS CN is capable of either normal phase or reversed phase analysis. Cyanopropryl groups bonded to silica gel with high density increases the difference recognition of hydrophilicity and the stability. Due to no end-capping, it is capable of analysis utilizing cyano group characteristics.

In reversed phase mode, separation can be achieved for those compounds that could not be separated on straight-chain-alkyl columns, such as C18 or C8 bonded phases. When using the column for reversed phase mode, fully equilibrate the column before use.

| | |
|---|---|
| Bonded Phase | Cyanopropryl Group |
| Particle Size | 3 µm, 5 µm |
| Pore Size | 10 nm |
| Surface Area | 450 m²/g |
| Carbon Loading | 14 % |
| End-capping | - |
| pH Range | 2 to 7.5 |
| USP Code | L10 |

### Analysis Examples

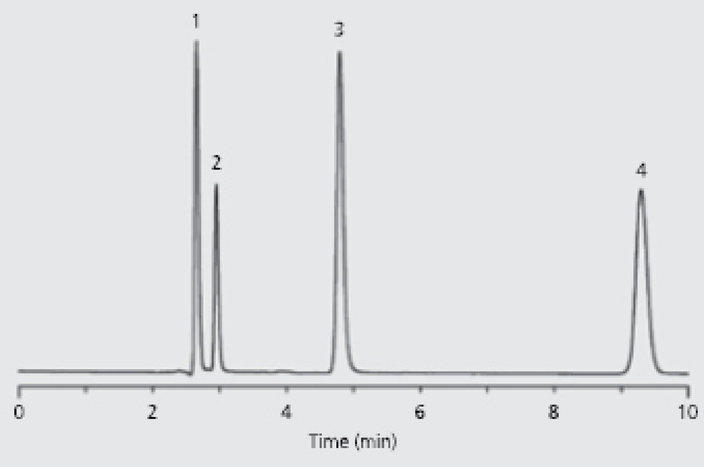



**Peaks**
1. gamma-oryzanol
2. vanillin

**Conditions**

**Column** : Shim-pack GIS CN (150 mmL. × 4.6 mmI.D, 5 µm) (P/N: 227-30263-06)
**Mobile Phase** : A) Hexane
B) 2-Propanol
C) Acetic acid
A/B/C = 94/5/1 (v/v/v)
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 30 °C
**Detection** : UV 320 nm
**Injection Vol.** : 1 µL

**Free Amino acids and Organic acids**




**Peaks**
1. Asparagine • $H_2O$ (0.75 mg/mL)
2. Aspartic acid (0.75 mg/mL)
3. Fumaric acid (0.01 mg/mL)
4. Maleic acid (0.01 mg/mL)

**Conditions**

**Column** : Shim-pack GIS CN (250 mmL. × 4.6 mmI.D., 5 µm) (P/N: 227-30263-07)
**Mobile Phase** : 20 mmol/L Monopotassium phosphate buffer solution (pH 4.0)
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 40 °C
**Detection** : UV 210 nm
**Injection Vol.** : 5 µL

## Analytical Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---|---|---|---|---|---|---|---|
| 3 | 30 | - | - | 227-30254-01 | 227-30255-01 | 227-30256-01 | 227-30257-01 |
| | 33 | 227-30252-01 | 227-30253-01 | 227-30254-02 | 227-30255-02 | 227-30256-02 | 227-30257-02 |
| | 50 | 227-30252-02 | 227-30253-02 | 227-30254-03 | 227-30255-03 | 227-30256-03 | 227-30257-03 |
| | 75 | 227-30252-03 | 227-30253-03 | 227-30254-04 | 227-30255-04 | 227-30256-04 | 227-30257-04 |
| | 100 | 227-30252-04 | 227-30253-04 | 227-30254-05 | 227-30255-05 | 227-30256-05 | 227-30257-05 |
| | 150 | 227-30252-05 | 227-30253-05 | 227-30254-06 | 227-30255-06 | 227-30256-06 | 227-30257-06 |
| | 250 | 227-30252-06 | 227-30253-06 | 227-30254-07 | 227-30255-07 | 227-30256-07 | 227-30257-07 |
| 5 | 30 | - | - | 227-30260-01 | 227-30261-01 | 227-30262-01 | 227-30263-01 |
| | 33 | 227-30258-01 | 227-30259-01 | 227-30260-02 | 227-30261-02 | 227-30262-02 | 227-30263-02 |
| | 50 | 227-30258-02 | 227-30259-02 | 227-30260-03 | 227-30261-03 | 227-30262-03 | 227-30263-03 |
| | 75 | 227-30258-03 | 227-30259-03 | 227-30260-04 | 227-30261-04 | 227-30262-04 | 227-30263-04 |
| | 100 | 227-30258-04 | 227-30259-04 | 227-30260-05 | 227-30261-05 | 227-30262-05 | 227-30263-05 |
| | 150 | 227-30258-05 | 227-30259-05 | 227-30260-06 | 227-30261-06 | 227-30262-06 | 227-30263-06 |
| | 250 | 227-30258-06 | 227-30259-06 | 227-30260-07 | 227-30261-07 | 227-30262-07 | 227-30263-07 |

## Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) | | | | Holder |
|---|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | 227-30270-01 | 227-30271-01 | 227-30272-01 | 227-30274-01 | 227-30532-01 |
| | 20 | - | - | 227-30273-01 | 227-30275-01 | 227-30532-02 |
| 5 | 10 | 227-30276-01 | 227-30277-01 | 227-30278-01 | 227-30280-01 | 227-30532-01 |
| | 20 | - | - | 227-30279-01 | 227-30281-01 | 227-30532-02 |

| Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2pcs) and Holder | | | |
|---|---|---|---|---|---|
| | | 1.0 | 1.5 | 3.0 | 4.0 |
| 3 | 10 | 227-30270-02 | 227-30271-02 | 227-30272-02 | 227-30274-02 |
| | 20 | - | - | 227-30273-02 | 227-30275-02 |
| 5 | 10 | 227-30276-02 | 227-30277-02 | 227-30278-02 | 227-30280-02 |
| | 20 | - | - | 227-30279-02 | 227-30281-02 |

# Shim-pack Solar

## Good hydrophobic retention, low absorption of ionic compounds

Shim-pack Solar C18 and C8 columns are packed with high purity silica gel or inertness. The silica gel has higher surface area and fully end-capped with good hydrophobic retention, low absorption of ionic compounds and good peak shapes. Highly uniform particles ensure stable mobile phase delivery and low pressure. The Shim-pack Solar LC columns have a wide pH range of 2 to 9, suitable for a wide range of method development.

| | Solar C18 | Solar C8 |
|---|---|---|
| Bonded Phase | Octadecyl Groups | Octyl Groups |
| Analysis Mode | Reversed Phase | Reversed Phase |
| Particle Size | 5 µm | 5 µm |
| Max. Operating Pressure | 20 MPa | 20 MPa |
| Carbon Loading | 15% | 9% |
| Pore Size | 1.0mL/g | 1.0mL/g |
| End Cap | Y | Y |
| pH Range | 2-9 | 2-9 |
| USP Code | L1 | L7 |

### Analytical Columns

| Particle Size (µm) | I.D. (mm) | Length (mm) | Solar C18 | Solar C8 |
|---|---|---|---|---|
| 5 | 4.6 | 150 | 227-30600-01 | 227-30601-01 |
| | | 250 | 227-30600-02 | 227-30601-02 |

# Shim-pack FC-ODS

## Shortens the Analysis Time Using a Conventional System

Shim-pack FC-ODS is an ideal column to shorten your analysis time using conventional HPLC. Its innovative surface structure and optimized packing method also enable outstanding resolution. Particle size is 3 µm, but the performance of a Shim-pack FC-ODS is equivalent to a 2 µm column while the resolution is twice as that of a 5 µm column. Therefore, Shim-pack FC-ODS can not only shorten analysis times, but also provide a higher number of theoretical plates.

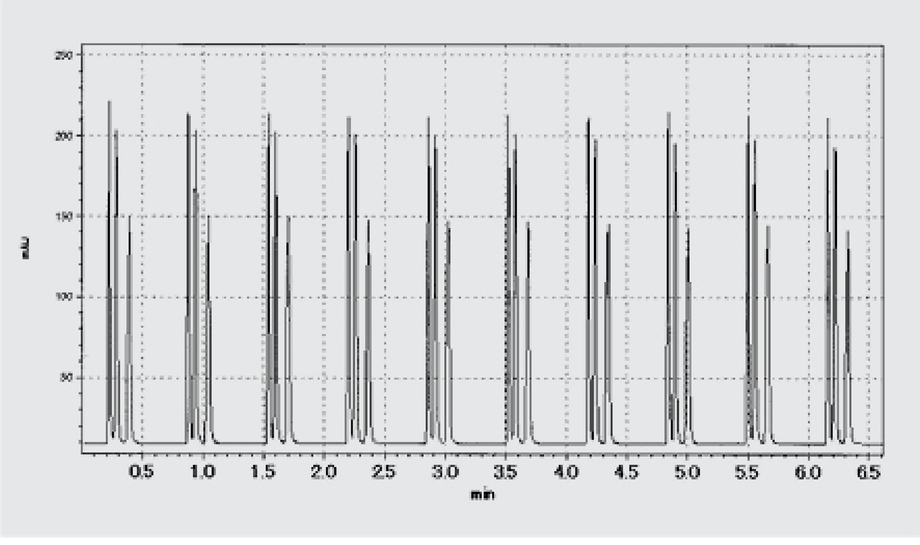
| | |
|---|---|
| Particle Size | 3 µm |
| Pore Size | 12 nm |
| Surface Area | 315 $m^2/g$ |
| Carbon Loading | 18% |
| Pressure Tolerance | 20 MPa |
| Pore Volume | 1 mL/g |
| End-capping | Yes |
| Bonding Type | Monomeric |
| pH Range | 1.5 - 9 |
| USP Code | L1 |

### Analysis Examples

Shim-pack FC-ODS separates components by hydrophobic interaction like other ODS columns. It is possible to change to Shim-pack FC-ODS from other ODS columns under the same analytical conditions. On the other hand, hydrophilic interaction (hydrogen bond, coordination bond) has been restricted to a minimum, which ensures significant efficiency when analyzing basic compounds. In addition, Shim-pack FC-ODS has higher steric selectivity (capability to recognize the difference of steric structures), making it possible to separate some components that are difficult to retain in other ODS columns.
Shim-pack FC-ODS is available in three lengths to suit analysis objectives.

- **30mm**
  Recommended for use in high-throughput analysis of samples that do not have a complex matrix.
- **75mm**
  Recommended for shortening the analysis time to that of a 150 mm column. Because Shim-pack FC-ODS retains a similar number of theoretical plates as a 150 mm column, it is possible to obtain the same result within about half of the time without changing the conditions. (In the case of gradient analysis, it is necessary to change the concentration.)
- **150mm**
  Recommended for analyzing samples that are difficult to be retained in other 150 mm ODS columns.

**High-Throughput Analysis**



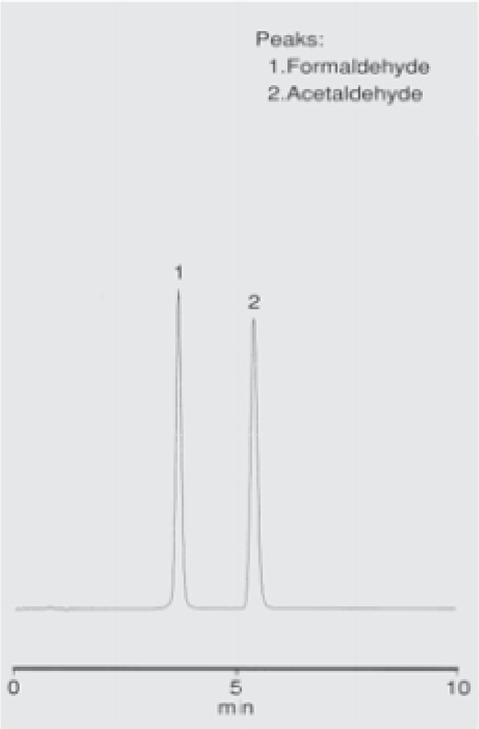

10 times repeated analysis in 6.5 minutes is possible.

**Conditions**

| | |
|---|---|
| **Column** | : Shim-pack FC-ODS (30 mmL. × 4.6 mmI.D., 3 µm) (P/N: 228-40511-91) |
| **Mobile Phase** | : Water/Acetonitrile = 55/45 (v/v) |
| **Flow Rate** | : 3.0 mL/min (Column Pressure ca.8MPa) |
| **Col. Temp.** | : 50 °C |
| **Detection** | : 254 nm Response 1, AuxRNG×2 |
| **Instrument** | : LC-2010+C-R8A |

# Shim-pack FC-ODS

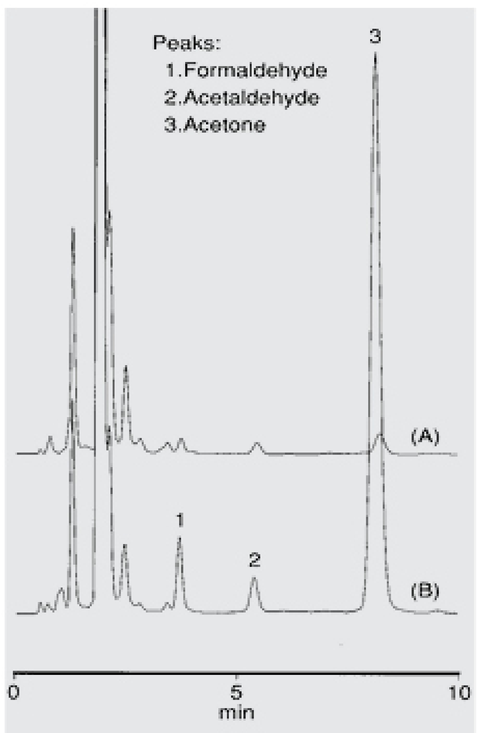
**High-speed analysis of 2,4-DNPH derivatized aldehydes / ketones**



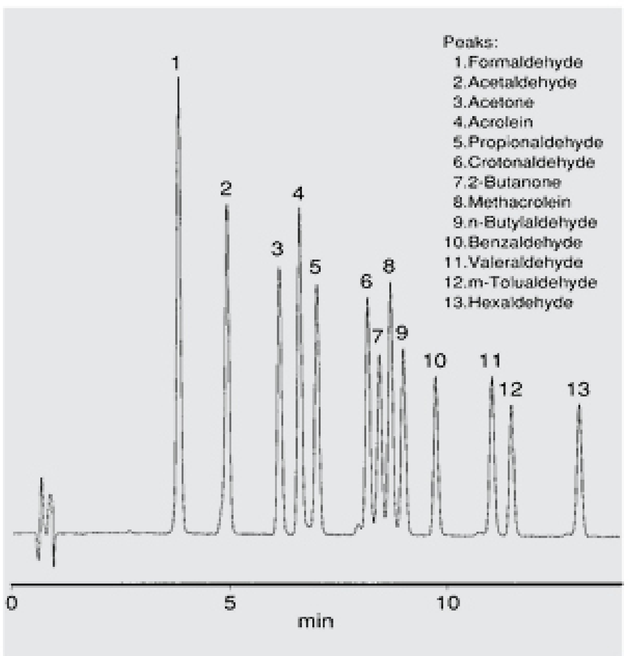

Chromatogram of Standard Sample (formaldehyde 0.35µg/mL, acetaldehyde 0.55µg/mL, 10µL injected)

■ **Conditions**

| | | |
|---|---|---|
| **Column** | : | Shim-pack FC-ODS (75 mmL. × 4.6 mmI.D., 3 µm) (P/N: 228-40511-92) |
| **Mobile Phase** | : | Water/Acetonitrile = 55/45 (v/v) |
| **Flow Rate** | : | 1.0 mL/min |
| **Col. Temp.** | : | 40 °C |
| **Detection** | : | UV 360 nm |



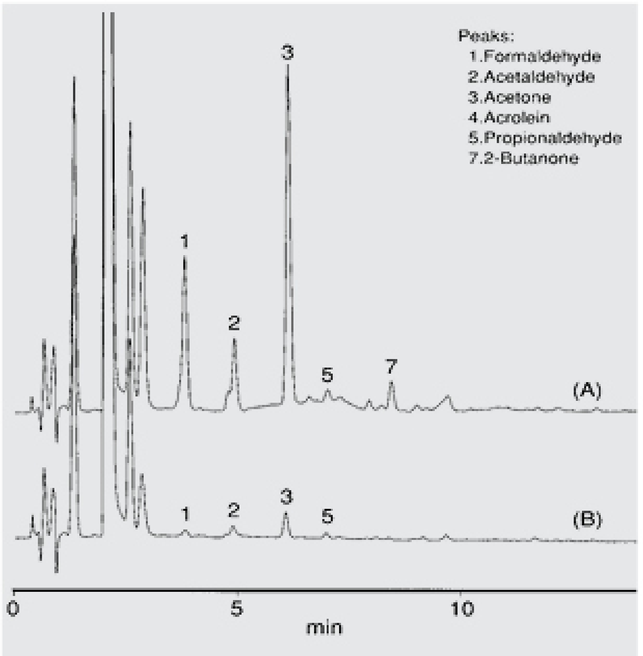

Chromatograms of Environmental Air (A) and Indoor Air at Laboratory (B)




Chromatogram of Standard Sample (each 0.3 ug/mL as carbonyl compounds, 10uL injection)

■ **Conditions**

| | | |
|---|---|---|
| **Column** | : | Shim-pack FC-ODS (75 mmL. × 4.6 mmI.D., 3 µm) (P/N: 228-40511-92) |
| **Mobile Phase** | : | A) Water/Tetrahydrofuran = 8/2 (v/v)<br>B) Acetonitrile<br>A/B = 80/20 - 14min - 40/60 - 0.01min - 80/20 - 6min |
| **Flow Rate** | : | 1.2 mL/min |
| **Col. Temp.** | : | 40 °C |
| **Detection** | : | UV 365 nm |




Chromatograms of Indoor Air at Laboratory (A) and Operation blank (B)

## ■ Product Information

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.0 | 4.6 |
|---|---|---|---|
| 3 | 30 | - | 228-40511-91 |
| | 75 | 228-40511-94 | 228-40511-92 |
| | 150 | 228-40511-95 | 228-40511-93 |

# Shim-pack PREP Series

## Shim-pack PREP Series

Shim-pack PREP series is packed with fully porous spherical silica particles on which respective stationary phases are chemically bonded. (Except the PREP-SIL which is packed with silica particles without any surface treatment.)

The residual silanol groups are end-capped by the unique silylation method (except the PREP-SIL).

| Column | Particle Size (µm) | I.D. (mm) / Length (mm) | 20 | 30 | Guard Column | |
|---|---|---|---|---|---|---|
| Shim-pack PREP-ODS | 15 | 250 | 228-00815-91 | 228-18319-91 | 228-18246-92 | 228-18321-91 |
| Shim-pack PREP-C8 | 15 | 250 | 228-00816-91 | - | 228-18248-92 | - |
| Shim-pack PREP-CN | 15 | 250 | 228-00818-91 | - | 228-18266-92 | - |
| Shim-pack PREP-SIL | 15 | 250 | 228-00814-91 | - | 228-18270-92 | - |
| Shim-pack PREP-NH2 | 15 | 250 | 228-17879-91 | - | 228-18268-92 | - |

## Shim-pack G Series

Shim-pack G series is also available in preparative columns. (For information of analytical columns, please refer to page 34.)

| Column | Particle Size (µm) | I.D. (mm) / Length (mm) | 6.0 | 7.6 | 10 | 14 | 20 |
|---|---|---|---|---|---|---|---|
| Shim-pack GIST C18 | 5 | 50 | 227-30018-01 | 227-30019-01 | 227-30020-01 | 227-30021-01 | 227-30022-01 |
| | | 100 | 227-30018-02 | 227-30019-02 | 227-30020-02 | 227-30021-02 | 227-30022-02 |
| | | 150 | 227-30018-03 | 227-30019-03 | 227-30020-03 | 227-30021-03 | 227-30022-03 |
| | | 250 | 227-30018-04 | 227-30019-04 | 227-30020-04 | 227-30021-04 | 227-30022-04 |
| └ Guard Column | 5 | 50 | 227-30034-01 | 227-30035-01 | 227-30036-01 | 227-30037-01 | 227-30038-01 |
| Shim-pack GIST C18-AQ | 5 | 50 | 227-30743-01 | 227-30744-01 | 227-30745-01 | 227-30746-01 | 227-30747-01 |
| | | 100 | 227-30743-02 | 227-30744-02 | 227-30745-02 | 227-30746-02 | 227-30747-02 |
| | | 150 | 227-30743-03 | 227-30744-03 | 227-30745-03 | 227-30746-03 | 227-30747-03 |
| | | 250 | 227-30743-04 | 227-30744-04 | 227-30745-04 | 227-30746-04 | 227-30747-04 |
| └ Guard Column | 5 | 50 | 227-30748-01 | 227-30749-01 | 227-30750-01 | 227-30751-01 | 227-30752-01 |
| Shim-pack GISS C18 | 5 | 50 | 227-30062-01 | 227-30063-01 | 227-30064-01 | 227-30065-01 | 227-30066-01 |
| | | 100 | 227-30062-02 | 227-30063-02 | 227-30064-02 | 227-30065-02 | 227-30066-02 |
| | | 150 | 227-30062-03 | 227-30063-03 | 227-30064-03 | 227-30065-03 | 227-30066-03 |
| | | 250 | 227-30062-04 | 227-30063-04 | 227-30064-04 | 227-30065-04 | 227-30066-04 |
| └ Guard Column | 5 | 50 | 227-30079-01 | 227-30080-01 | 227-30081-01 | 227-30082-01 | 227-30083-01 |
| Shim-pack GIST C8 | 5 | 50 | 227-30174-01 | 227-30175-01 | 227-30176-01 | 227-30177-01 | 227-30178-01 |
| | | 100 | 227-30174-02 | 227-30175-02 | 227-30176-02 | 227-30177-02 | 227-30178-02 |
| | | 150 | 227-30174-03 | 227-30175-03 | 227-30176-03 | 227-30177-03 | 227-30178-03 |
| | | 250 | 227-30174-04 | 227-30175-04 | 227-30176-04 | 227-30177-04 | 227-30178-04 |
| └ Guard Column | 5 | 50 | 227-30193-01 | 227-30194-01 | 227-30195-01 | 227-30196-01 | 227-30197-01 |
| Shim-pack GIST Phenyl | 5 | 50 | 227-30221-01 | 227-30222-01 | 227-30223-01 | 227-30224-01 | 227-30225-01 |
| | | 100 | 227-30221-02 | 227-30222-02 | 227-30223-02 | 227-30224-02 | 227-30225-02 |
| | | 150 | 227-30221-03 | 227-30222-03 | 227-30223-03 | 227-30224-03 | 227-30225-03 |
| | | 250 | 227-30221-04 | 227-30222-04 | 227-30223-04 | 227-30224-04 | 227-30225-04 |
| └ Guard Column | 5 | 50 | 227-30238-01 | 227-30239-01 | 227-30240-01 | 227-30241-01 | 227-30242-01 |
| Shim-pack GIST Phenyl-Hexyl | 5 | 50 | 227-30691-01 | 227-30692-01 | 227-30693-01 | 227-30694-01 | 227-30695-01 |
| | | 100 | 227-30691-02 | 227-30692-02 | 227-30693-02 | 227-30694-02 | 227-30695-02 |
| | | 150 | 227-30691-03 | 227-30692-03 | 227-30693-03 | 227-30694-03 | 227-30695-03 |
| | | 250 | 227-30691-04 | 227-30692-04 | 227-30693-04 | 227-30694-04 | 227-30695-04 |
| └ Guard Column | 5 | 50 | 227-30696-01 | 227-30697-01 | 227-30698-01 | 227-30699-01 | 227-30700-01 |
| Shim-pack GIST NH2 | 5 | 50 | 227-30303-01 | 227-30304-01 | 227-30305-01 | 227-30306-01 | 227-30307-01 |
| | | 100 | 227-30303-02 | 227-30304-02 | 227-30305-02 | 227-30306-02 | 227-30307-02 |
| | | 150 | 227-30303-03 | 227-30304-03 | 227-30305-03 | 227-30306-03 | 227-30307-03 |
| | | 250 | 227-30303-04 | 227-30304-04 | 227-30305-04 | 227-30306-04 | 227-30307-04 |
| └ Guard Column | 5 | 50 | 227-30317-01 | 227-30318-01 | 227-30319-01 | 227-30320-01 | 227-30321-01 |

## Shim-pack G Series

| Column | Particle Size (µm) | I.D. (mm) / Length (mm) | 6.0 | 7.6 | 10 | 14 | 20 |
|---|---|---|---|---|---|---|---|
| Shim-pack GIS C18 | 5 | 50 | 227-30107-01 | 227-30107-05 | 227-30108-01 | 227-30108-05 | 227-30109-01 |
| | | 100 | 227-30107-04 | 227-30107-06 | 227-30108-02 | 227-30108-08 | 227-30109-02 |
| | | 150 | 227-30107-02 | 227-30107-07 | 227-30108-03 | 227-30108-06 | 227-30109-03 |
| | | 250 | 227-30107-03 | 227-30107-08 | 227-30108-04 | 227-30108-07 | 227-30109-04 |
| | 10 | 50 | - | - | 227-30113-01 | 227-30114-01 | 227-30115-01 |
| | | 100 | - | - | 227-30113-02 | 227-30114-02 | 227-30115-02 |
| | | 150 | - | - | 227-30113-03 | 227-30114-03 | 227-30115-03 |
| | | 250 | - | - | 227-30113-04 | 227-30114-04 | 227-30115-04 |
| └ Guard Column | 5 | 50 | 227-30137-01 | 227-30138-01 | 227-30139-01 | 227-30140-01 | 227-30141-01 |
| | 10 | 50 | - | - | 227-30144-01 | 227-30145-01 | 227-30146-01 |
| Shim-pack GIS C18-P | 5 | 50 | 227-30558-01 | 227-30559-01 | 227-30560-01 | 227-30561-01 | 227-30562-01 |
| | | 100 | 227-30558-02 | 227-30559-02 | 227-30560-02 | 227-30561-02 | 227-30562-02 |
| | | 150 | 227-30558-03 | 227-30559-03 | 227-30560-03 | 227-30561-03 | 227-30562-03 |
| | | 250 | 227-30558-04 | 227-30559-04 | 227-30560-04 | 227-30561-04 | 227-30562-04 |
| └ Guard Column | 5 | 50 | 227-30565-01 | 227-30566-01 | 227-30567-01 | 227-30568-01 | 227-30569-01 |
| Shim-pack GIS RP-Shield | 5 | 50 | 227-30590-01 | 227-30591-01 | 227-30592-01 | 227-30593-01 | 227-30594-01 |
| | | 100 | 227-30590-02 | 227-30591-02 | 227-30592-02 | 227-30593-02 | 227-30594-02 |
| | | 150 | 227-30590-03 | 227-30591-03 | 227-30592-03 | 227-30593-03 | 227-30594-03 |
| | | 250 | 227-30590-04 | 227-30591-04 | 227-30592-04 | 227-30593-04 | 227-30594-04 |
| └ Guard Column | 5 | 50 | 227-30597-01 | 227-30598-01 | 227-30599-01 | 227-30602-01 | 227-30603-01 |
| Shim-pack GIS HILIC | 5 | 50 | 227-30642-01 | 227-30643-01 | 227-30644-01 | 227-30645-01 | 227-30646-01 |
| | | 100 | 227-30642-02 | 227-30643-02 | 227-30644-02 | 227-30645-02 | 227-30646-02 |
| | | 150 | 227-30642-03 | 227-30643-03 | 227-30644-03 | 227-30645-03 | 227-30646-03 |
| | | 250 | 227-30642-04 | 227-30643-04 | 227-30644-04 | 227-30645-04 | 227-30646-04 |
| └ Guard Column | 5 | 50 | 227-30648-01 | 227-30649-01 | 227-30650-01 | 227-30651-01 | 227-30652-01 |
| Shim-pack GIS CN | 5 | 50 | 227-30264-01 | 227-30265-01 | 227-30266-01 | 227-30267-01 | 227-30268-01 |
| | | 100 | 227-30264-02 | 227-30265-02 | 227-30266-02 | 227-30267-02 | 227-30268-02 |
| | | 150 | 227-30264-03 | 227-30265-03 | 227-30266-03 | 227-30267-03 | 227-30268-03 |
| | | 250 | 227-30264-04 | 227-30265-04 | 227-30266-04 | 227-30267-04 | 227-30268-04 |
| └ Guard Column | 5 | 50 | 227-30284-01 | 227-30285-01 | 227-30286-01 | 227-30287-01 | 227-30288-01 |

| Column | Particle Size (µm) | I.D. (mm) / Length (mm) | 30 | 50 |
|---|---|---|---|---|
| Shim-pack GIS C18 | 5 | 50 | 227-30110-01 | - |
| | | 100 | 227-30110-02 | - |
| | | 150 | 227-30110-03 | - |
| | | 250 | 227-30110-04 | 227-30110-05 |
| | 10 | 50 | 227-30116-01 | - |
| | | 100 | 227-30116-02 | - |
| | | 150 | 227-30116-03 | - |
| | | 250 | 227-30116-04 | 227-30116-05 |
| └ Guard Column | 5 | 50* | 227-30142-01 | 227-30143-01 |
| | 10 | 50* | 227-30147-01 | 227-30148-01 |
| Shim-pack GIS C18-P | 5 | 50 | 227-30563-01 | - |
| | | 250 | 227-30563-02 | 227-30564-01 |
| └ Guard Column | 5 | 50* | 227-30570-01 | 227-30571-01 |
| Shim-pack GIS RP-Shield | 5 | 50 | 227-30595-01 | - |
| | | 250 | 227-30595-02 | 227-30596-01 |
| └ Guard Column | 5 | 50* | 227-30604-01 | 227-30605-01 |
| Shim-pack GIS HILIC | 5 | 50 | 227-30647-01 | - |
| | | 250 | 227-30647-02 | 227-30647-03 |
| └ Guard Column | 5 | 50* | 227-30653-01 | 227-30654-01 |
| Shim-pack GIS CN | 5 | 50 | 227-30269-01 | - |
| | | 250 | 227-30269-02 | 227-30269-03 |
| └ Guard Column | 5 | 50* | 227-30289-01 | 227-30290-01 |

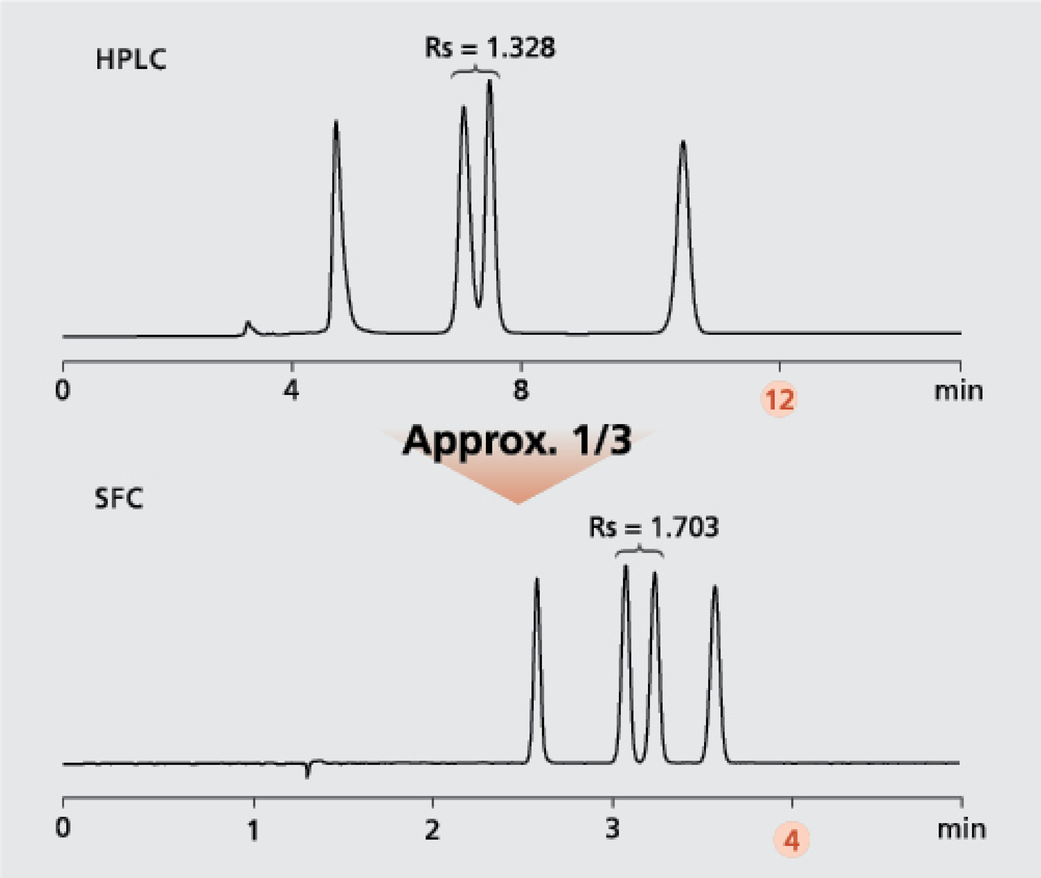
* Length of guard columns for 50 mm I.D. preparative columns is 75 mm.

# Shim-pack UC Series

## Analysis Examples

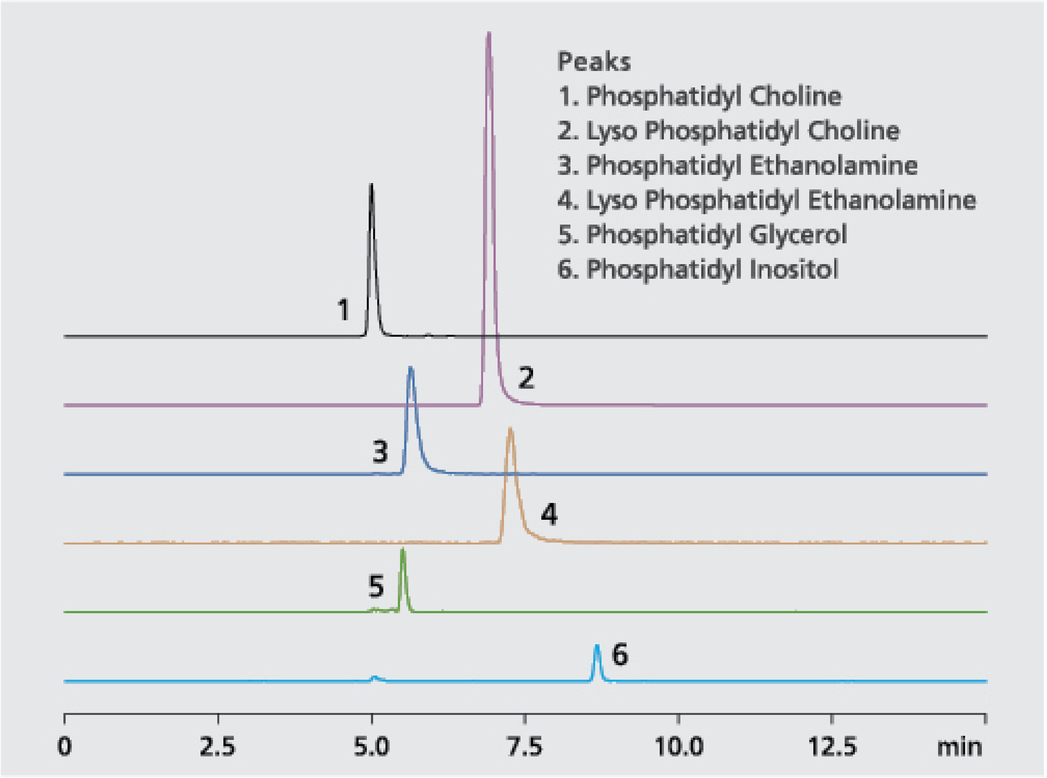
### Tocopherol Isomers

Isomers and structurally similar compounds that are difficult to separate can be analyzed by Nexera UC and Shim-pack UC series at a high speed. In the example below, four kinds of tocopherol isomers were analyzed by Nexera UC and Shim-pack UC Sil. As shown below, analysis time was reduced to one-third the time analysis takes with a conventional HPLC method while resolution was improved.




Comparison of retention and resolution of tocopherol isomers between LC conditions and SFC ones

### Phospholipid Classes




The example above shows the result of the analysis of phospholipid classes using Shim-pack UC Diol with Nexera UC. The ODS-based Shim-pack UC GIS II can also be used to analyze molecular species of phospholipids with the same modifiers. Nexera UC and Shim-pack UC series are ideal for analyzing complex samples.

## Preparative Columns

| Column | Particle Size (µm) | I.D. (mm) / Length (mm) | 10 | 20 | 28 |
|---|---|---|---|---|---|
| Shim-pack UC-HyP | 5 | 250 | 227-32600-03 | 227-32600-04 | 227-32600-05 |
| └ Guard Column | 5 | 20 | 227-32600-06 | - | - |
| Shim-pack UC-Py | 5 | 250 | 227-32601-03 | 227-32601-04 | 227-32601-05 |
| └ Guard Column | 5 | 20 | 227-32601-06 | - | - |
| Shim-pack UC-PBr | 5 | 250 | 227-32602-03 | 227-32602-04 | 227-32602-05 |
| └ Guard Column | 5 | 20 | 227-32602-06 | - | - |
| Shim-pack UC-Choles | 5 | 250 | 227-32603-03 | 227-32603-04 | 227-32603-05 |
| └ Guard Column | 5 | 20 | 227-32603-06 | - | - |
| Shim-pack UC-PyE | 5 | 250 | 227-32604-03 | 227-32604-04 | 227-32604-05 |
| └ Guard Column | 5 | 20 | 227-32604-06 | - | - |
| Shim-pack UC-Triazole | 5 | 250 | 227-32605-03 | 227-32605-04 | 227-32605-05 |
| └ Guard Column | 5 | 20 | 227-32605-06 | - | - |
| Shim-pack UC-Sil II | 5 | 250 | 227-32607-03 | 227-32607-04 | 227-32607-05 |
| └ Guard Column | 5 | 20 | 227-32607-06 | - | - |
| Shim-pack UC-Diol II | 5 | 250 | 227-32606-03 | 227-32606-04 | 227-32606-05 |

## Shim-pack Ultron VX Series

| Column | Particle Size (µm) | I.D (mm) | Length (mm) 250 | Guard Column |
|---|---|---|---|---|
| VX-SIL | 5 | 20.0 | 226-80016-01 | 226-80032-01 (15 x 8.0 mm) |
| | 10 | 20.0 | 226-80024-01 | 226-80033-01 (10 x 4.0 mm) 226-80034-01 (15 x 8.0 mm) |
| | 10 | 30.0 | 226-80025-01 | |
| | 10 | 50.0 | 226-80026-01 | |
| | 15 | 4.6 | 226-80027-01 | 226-80035-01 (10 x 4.0 mm) 226-80036-01 (5 x 8.0 mm) |
| | 15 | 20.0 | 226-80028-01 | |
| | 15 | 30.0 | 226-80029-01 | |
| | 15 | 50.0 | 226-80030-01 | |
| VX-ODS | 5 | 20.0 | 226-80044-01 | 226-80060-01 (15 x 8.0 mm) |
| | 10 | 20.0 | 226-80052-01 | 226-80062-01 (15 x 8.0 mm) |
| | | 30.0 | 226-80053-01 | |
| | | 50 | 226-80054-01 | |
| | 15 | 4.6 | 226-80055-01 | 226-80063-01 (10 x 4.0 mm) 226-80064-01 (15 x 8.0 mm) |
| | | 20.0 | 226-80056-01 | |
| | | 30.0 | 226-80057-01 | |
| | | 50.0 | 226-80058-01 | |

## Shim-pack STR-ODS Series

| Column | Particle Size (µm) | I.D (mm) | Length (mm) 250 | Guard Column |
|---|---|---|---|---|
| STR ODS-II | 5 | 20.0 | 226-80087-01 | 226-80088-91 (50 x 20.0 mm) |

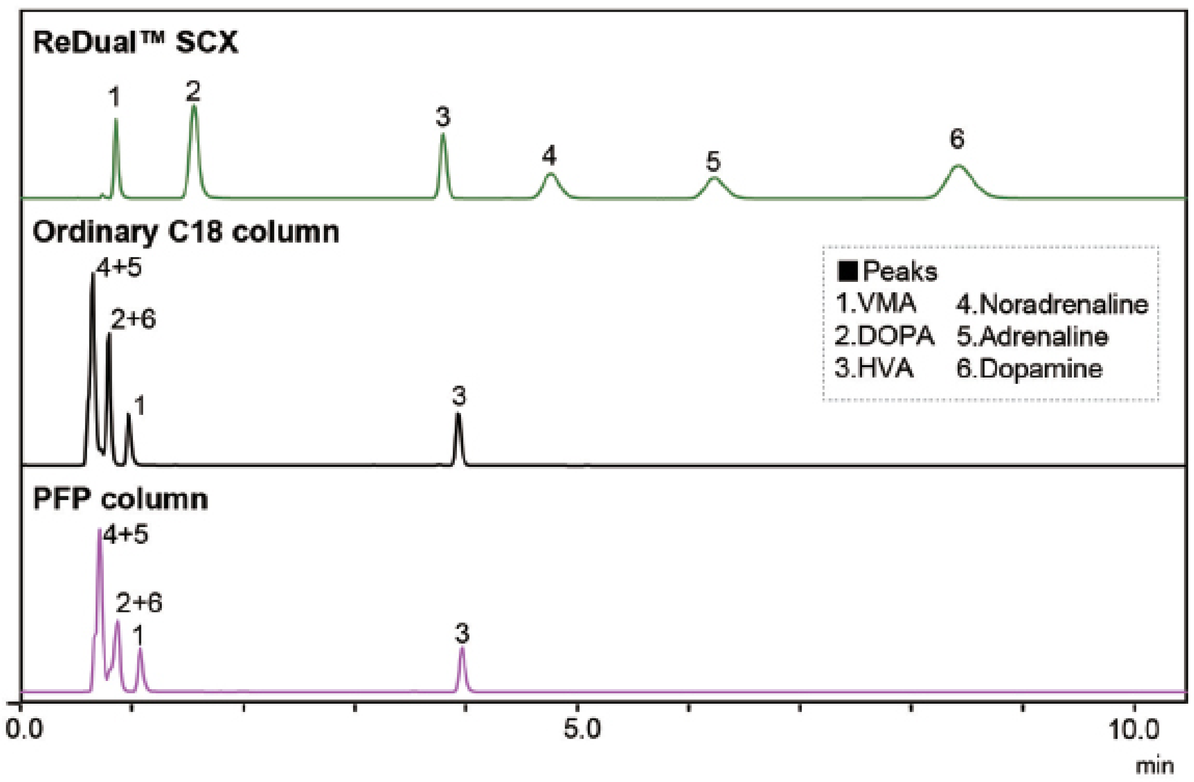
# Mixed-Mode Columns

## Shimadzu Redual™ LC column

The Shimadzu Redual™ LC columns are mixed-mode (reversed phase-Ion exchange) LC columns. These columns can be used to separate ionic compounds without the need of ion-pairing reagents. Highly recommended for LCMS applications

There are three types of Redual LC columns:

1. ReDual™ SCX-C18 - for basic compounds by C18 + SCX
2. ReDual™ CX-C18 - for basic compounds by C18 + WCX
3. ReDual™ AX-C18 - for acidic compounds by C18 + SAX




**Column** : Redual SCX (50 mmL. × 4.6 mmI.D., 5µm) (P/N: SSOT-G20029)
**Mobile Phase** : A: 20 mmol/L Ammonium Formate (pH 3.5)
B: Acetonitrile
B conc. 10% (0-2 min) to 70% (7-10 min)
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 25 °C
**Detection** : UV 280 nm
**Injection Vol.** : 5 µL

| Column | Particle Size (µm) | I.D (mm) | Length | | |
|---|---|---|---|---|---|
| | | | 50 mm | 100 mm | 150 mm |
| ReDual AX-C18 | 3 | 2.0 | SSOT-G20001 | SSOT-G20002 | SSOT-G20003 |
| | | 4.6 | SSOT-G20004 | - | SSOT-G20005 |
| | 5 | 2.0 | SSOT-G20006 | SSOT-G20007 | SSOT-G20008 |
| | | 4.6 | SSOT-G20009 | - | SSOT-G20010 |
| ReDual CX-C18 | 3 | 2.0 | SSOT-G20011 | SSOT-G20012 | SSOT-G20013 |
| | | 4.6 | SSOT-G20014 | - | SSOT-G20015 |
| | 5 | 2.0 | SSOT-G20016 | SSOT-G20017 | SSOT-G20018 |
| | | 4.6 | SSOT-G20019 | - | SSOT-G20020 |
| ReDual SCX-C18 | 3 | 2.0 | SSOT-G20021 | SSOT-G20022 | SSOT-G20023 |
| | | 4.6 | SSOT-G20024 | - | SSOT-G20025 |
| | 5 | 2.0 | SSOT-G20026 | SSOT-G20027 | SSOT-G20028 |
| | | 4.6 | SSOT-G20029 | - | SSOT-G20030 |

# Shim-pack Scepter C4

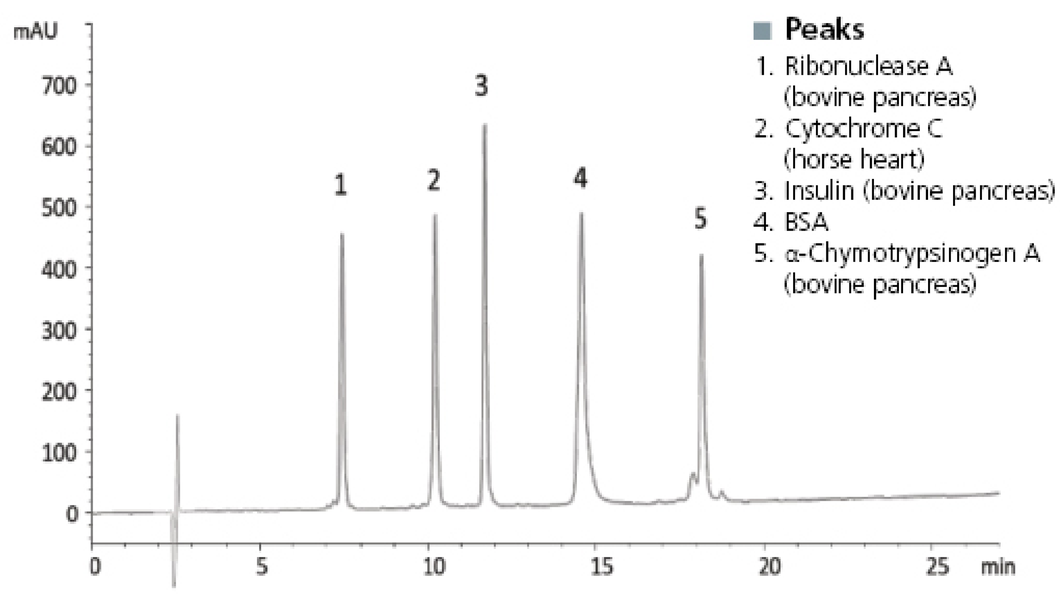
## Design for biomolecules separations

Shim-pack Scepter C4 is a wide-bore C4 column that uses an organic silica hybrid base which is suitable for separation of proteins such as monoclonal antibodies. The column can be used for analysis of proteins with a molecular weight of up to approximately 150,000 and is suitable for analysis of antibodies as it is very stable even under acidic or high-temperature conditions because an organic silica hybrid base is used. It is also effective for high-sensitivity analysis on LC/MS as it provides good peak shapes even when using a formic acid mobile phase with low ion paring effect. In addition, it is effective for separation of highly-hydrophobic proteins, nucleotides and small molecules that are hard to separate using a regular C18 column.

| Bonded Phase | Butyl Groups |
|---|---|
| Particle Size | 1.9µm, 3µm, 5µm |
| Pore Size | 30 nm |
| End-capping | Yes |
| pH Range | 1 to 10 |
| USP Code | L26 |

## Analysis Examples

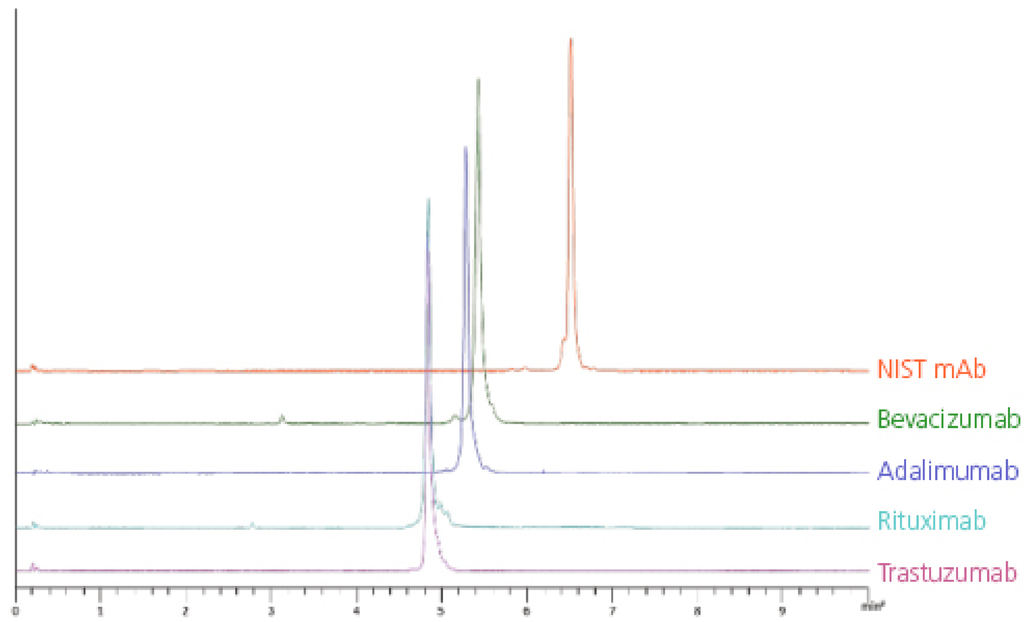
**Analysis of Proteins**




**Conditions**

| | |
|---|---|
| **Column** | : Shim-pack Scepter C4 (5 µm, 150 x 3.0 mm I.D.) (P/N: 227-31181-04) |
| **Mobile Phase** | : A) Water/TFA (100/0.1)<br>B) Acetonitrile/TFA (100/0.1)<br>20-60%B (0-27 min), 90%B (27-35 min), 20%B (35-50 min) |
| **Flow Rate** | : 0.4 mL/min |
| **Col. Temp.** | : 70 °C |
| **Detection** | : UV at 220 nm |
| **Injection Vol.** | : 10 µL (0.25 – 0.50 mg/mL) Column |

**Analysis of Monoclonal Antibodies**




**Conditions**

| | |
|---|---|
| **Column** | : Shim-pack Scepter C4 (1.9 µm, 50 x 2.1 mm I.D.) (P/N: 227-31175-03) |
| **Mobile Phase** | : A) Water/TFA (100/0.1)<br>B) Acetonitrile/TFA (100/0.1)<br>25-45%B (0-10 min) |
| **Flow Rate** | : 0.4 mL/min |
| **Col. Temp.** | : 80 °C |
| **Detection** | : UV at 280 nm |
| **Injection Vol.** | : 2 µL |
| **Sample Conc.** | : 0.2 mg/mL |

## Analytical Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.0 | 4.6 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|---|
| 1.9 | 20 | 227-31175-01 | - | - | - | 100 |
| | 30 | 227-31175-02 | 227-30817-02 | - | - | |
| | 50 | 227-31175-03 | 227-31176-01 | - | - | |
| | 100 | 227-31175-04 | 227-31176-02 | - | - | |
| | 125 | 227-31175-05 | 227-31176-03 | - | - | |
| | 150 | 227-31175-06 | 227-31176-04 | - | - | |
| 3 | 20 | 227-31177-01 | - | - | - | 45 |
| | 33 | 227-31177-02 | - | - | 227-31179-01 | |
| | 50 | 227-31177-03 | 227-31178-01 | - | 227-31179-02 | |
| | 75 | 227-31177-04 | 227-31178-02 | - | 227-31179-03 | |
| | 100 | 227-31177-05 | 227-31178-03 | - | 227-31179-04 | |
| | 150 | 227-31177-06 | 227-31178-04 | - | 227-31179-05 | |
| | 250 | - | - | - | 227-31179-06 | |
| 5 | 20 | 227-31180-01 | - | - | - | 45 |
| | 33 | 227-31180-02 | - | - | 227-31183-01 | |
| | 50 | 227-31180-03 | 227-31181-01 | - | 227-31183-02 | |
| | 75 | 227-31180-04 | 227-31181-02 | - | 227-31183-03 | |
| | 100 | 227-31180-05 | 227-31181-03 | 227-31182-01 | 227-31183-04 | |
| | 150 | 227-31180-06 | 227-31181-04 | 227-31182-02 | 227-31183-05 | |
| | 250 | - | - | - | 227-31183-06 | |

## Analytical guard cartridges columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 3.0 | 4.0 | Holder |
|---|---|---|---|---|---|
| 1.9 | 5 | 227-31187-01 | 227-31187-02 | - | 227-31170-01 |
| 3 | 10 | 227-31188-01 | 227-31189-01 | 227-31190-01 | 227-31172-01 |
| | 20 | 227-31188-02 | 227-31189-02 | 227-31190-02 | 227-31172-02 |
| 5 | 10 | 227-31191-01 | 227-31192-01 | 227-31193-01 | 227-31172-01 |
| | 20 | 227-31191-02 | 227-31192-02 | 227-31193-02 | 227-31172-02 |

## Preparative Columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10 | 20 | 30 | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| 5 | 50 | - | 227-31185-01 | 227-31186-01 | 30 |
| | 75 | - | - | 227-31186-02 | |
| | 100 | - | 227-31185-02 | 227-31186-03 | |
| | 150 | 227-31184-01 | 227-31185-03 | 227-31186-04 | |
| | 250 | 227-31184-02 | 227-31185-04 | 227-31186-05 | |

## Preparative guard cartridges columns

| Particle Size (µm) | I.D. (mm) / Length (mm) | 10 | 20 | 30 | Holder |
|---|---|---|---|---|---|
| 5 | 10 | 227-31194-01 | 227-31195-01 | 227-31196-01 | 227-31171-01 |

# Shim-pack Bio LC Columns

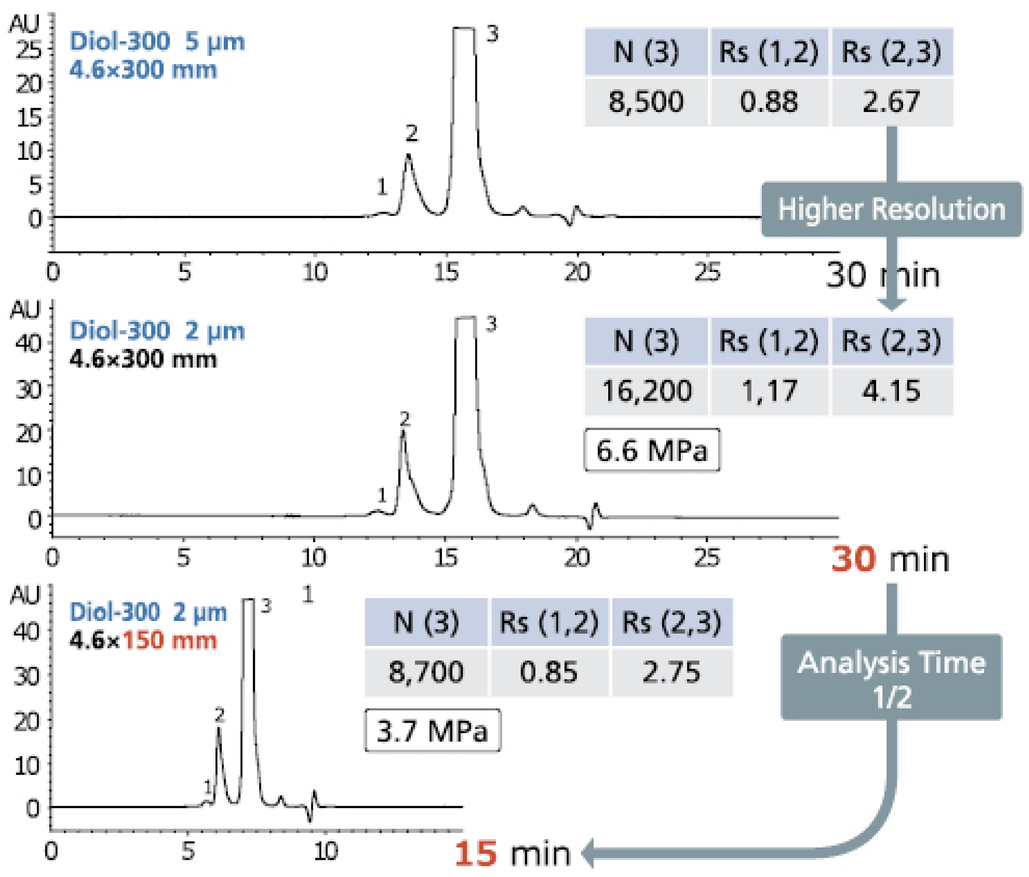
## Solution for Analysis of Peptides, Oligonucleotides and Biopharmaceuticals

The accurate analysis of biopharmaceuticals compounds is required for developing higher quality biopharmaceuticals. Shim-pack Bio Diol and IEX columns will improve the accuracy of the characterization of peptides, oligonucleotide and biopharmaceuticals.

### Shim-pack Bio Diol : Size Exclusion Chromatography Columns

With different pore sizes, Shim-pack Bio Diol LC columns are effective for analysis of aggregates and fragments of mAb, oligonucleotides and carbohydrates.

Rapid mAb Aggregate Analysis using 2µm Shim-pack Diol-300 column




| Shim-pack Bio Diol | Diol-60 | Diol-120 | Diol-200 | Diol-300 |
|---|---|---|---|---|
| Particle | Silica | | | |
| Ligand | Dihydroxypropyl(Diol) | | | |
| Particle Size | 3 µm, 5 µm | | 2 µm, 3 µm, 5 µm | |
| Pore Size | 6 nm | 12 nm | 20 nm | 30 nm |
| pH Range | 5.0 - 7.5 | | | |
| Molecular | below 10,000 | 1,000 - 100,000 | 5,000 - 300,000 | 20,000 - 1,000,000 |

By reducing the particle size from 5 µm to 2 µm, the resolution between aggregates and monomers was greatly improved. Furthermore, by reducing the column length from 300 mm to 150 mm using a 2 µm particle, 50% less run time was achieved, while maintaining resolution as compared to the original method with a 5 µm, 4.6×300 mm column.

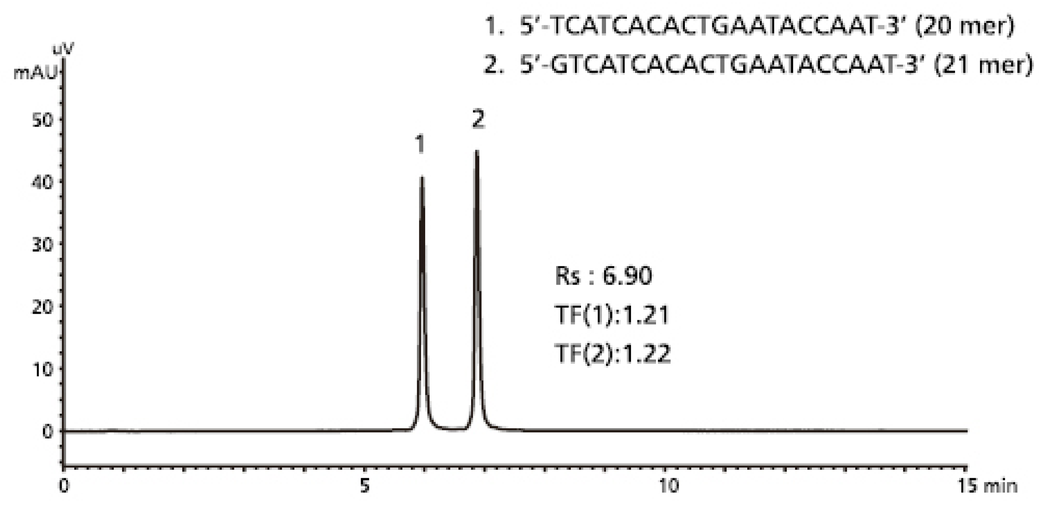
**Conditions**

**Column** : Shim-pack Bio Diol-300
**Eluent** : 0.1 M KH2PO4-K2HPO4 (pH 7.0) with 0.2 M NaCl
**Flow rate** : 0.2 mL/min
**Column Temp.** : Ambient
**Detection** : UV 280 nm
**Sample** : Humanized monoclonal IgG1

### Shim-pack Bio IEX : Ion Exchange Chromatography Columns

Shim-pack Bio IEX Columns are available in Q (quaternary ammonium) and SP (sulfopropyl) chemistries and are based on porous (Q and SP columns) and non-porous (Q-NP and SP-NP columns) hydrophilic polymers with low nonspecific adsorption. The porous particles offer excellent binding capacity with exceptionally high efficiency and the non-porous particles offer high efficiency and exceptional resolution.

Rapid mAb Aggregate Analysis using 2µm Shim-pack Diol-300 column




| Shim-pack Bio IEX | Q-NP | SP-NP | Q | SP |
|---|---|---|---|---|
| Particle | hydrophilic non-porous polymer | | hydrophilic porous polymer | |
| Particle Size | 3 µm, 5 µm | | 5 µm | |
| Ligand | - $CH_2N^+(CH_3)_3$ | - $(CH_2)_3SO_3^-$ | - $CH_2N^+(CH_3)_3$ | - $(CH_2)_3SO_3^-$ |
| pH Range | 2 - 12 | | | |

**Conditions**

**Column** : Shim-pack Bio IEX Q-NP 5 µm, 4.6×100 mm (P/N : 227-31003-03)
**Mobile Phase A** : 10 mM NaOH
**Mobile Phase B** : 10 mM NaOH with 1.0 M NaClO4
**Gradient** : 25 55%B (0-15 min), 100%B (15-20 min)
**Flow Rate** : 1.0 mL/min
**Column Temp.** : 25 °C
**Detection** : UV 260 nm
**Inj. Volume** : 4 µL (5 nmol/mL)

## Shim-pack Bio Diol Columns

| Particle Size | 2 µm | | 3 µm | | | |
|---|---|---|---|---|---|---|
| Chemistry / Column Dimension | Diol-200 | Diol-300 | Diol-60 | Diol-120 | Diol-200 | Diol-300 |
| 4.6×150 mm | 227-31009-01 | 227-31010-01 | | | | |
| 4.6×300 mm | 227-31009-02 | 227-31010-02 | 227-31007-01 | 227-31008-01 | 227-31009-03 | 227-31010-03 |
| Max. Pressure | 45 MPa | | 20 MPa | | | |

| Particle Size | 5 µm | | | |
|---|---|---|---|---|
| Chemistry / Column Dimension | Diol-60 | Diol-120 | Diol-200 | Diol-300 |
| 4.6×300 mm | 227-31007-02 | 227-31008-02 | 227-31009-04 | 227-31010-04 |
| 8.0×300 mm | 227-31007-03 | 227-31008-03 | 227-31009-05 | 227-31010-05 |
| 8.0×30 mm (Guard Column) | 227-31007-04 | 227-31008-04 | 227-31009-06 | 227-31010-06 |
| Max. Pressure | 20 MPa | | | |
| 20×300 mm | 227-31097-01 | 227-31098-01 | 227-31099-01 | 227-31100-01 |
| 20×500 mm | 227-31097-02 | 227-31098-02 | 227-31099-02 | 227-31100-02 |
| 20×50 mm (Guard Column) | 227-31116-01 | 227-31117-01 | 227-31118-01 | 227-31119-01 |
| Max. Pressure | 10 MPa | | | |

## Shim-pack Bio IEX Columns

| Shim-pack Bio IEX | Q-NP | | SP-NP | | Q | SP |
|---|---|---|---|---|---|---|
| Porality | Non-Porous | | | | Porous | |
| Chemistry / Column Dimension | 3 µm | 5 µm | 3 µm | 5 µm | 5 µm | |
| 4.6×30 mm | 227-31002-01 | 227-31003-01 | 227-31005-01 | 227-31006-01 | 227-31001-01 | 227-31004-01 |
| 4.6×50 mm | 227-31002-02 | 227-31003-02 | 227-31005-02 | 227-31006-02 | 227-31001-02 | 227-31004-02 |
| 4.6×100 mm | 227-31002-03 | 227-31003-03 | 227-31005-03 | 227-31006-03 | 227-31001-03 | 227-31004-03 |

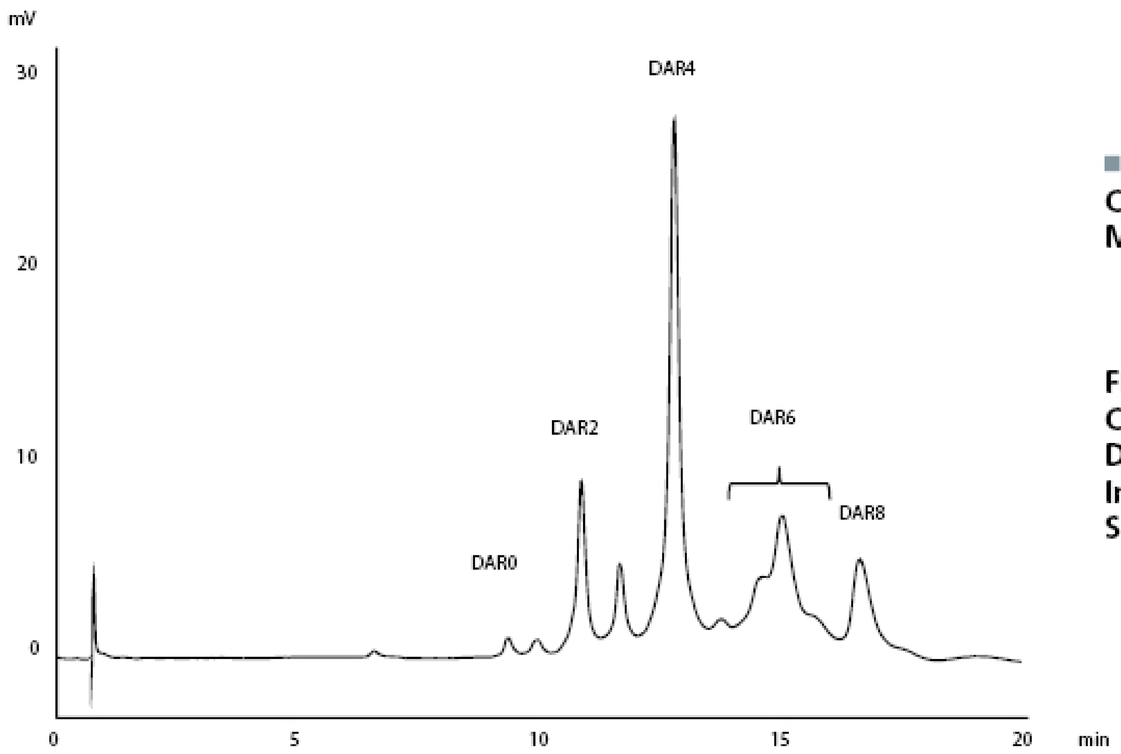
## Shim-pack Arata Peptide C18

| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.0 |
|---|---|---|
| 2.2 | 50 | 227-32806-01 |
| | 100 | 227-32806-02 |
| | 150 | 227-32806-03 |

# Shim-pack Bio HIC: Hydrophobic Interaction Chromatography Column

Antibody-drug conjugate (ADC) is a next-generation antibody drug that is expected to provide strong effects in a wide range of therapeutic treatments as compared to existing chemotherapeutic agents. The drug-to-antibody ratio (DAR) indicates the ratio of addition of the drug that directly influences both efficacy and potential toxicity of ADCs. Analysis of DAR is extremely important when judging important quality attributes of ADCs as it may significantly affect properties such as stability and agglutination. Hydrophobic interaction chromatography (HIC) is suitable for separation of analytes with slightly different hydrophobic properties such as antibody-drug conjugates (ADCs) with a different drug-to-antibody ratio (DAR). Using the Shim-pack Bio HIC, the DAR of ADCs can be analysed with a high separation capacity.

**Drug to Antibody Ratio (DAR) analysis of ADCs**




**Conditions**

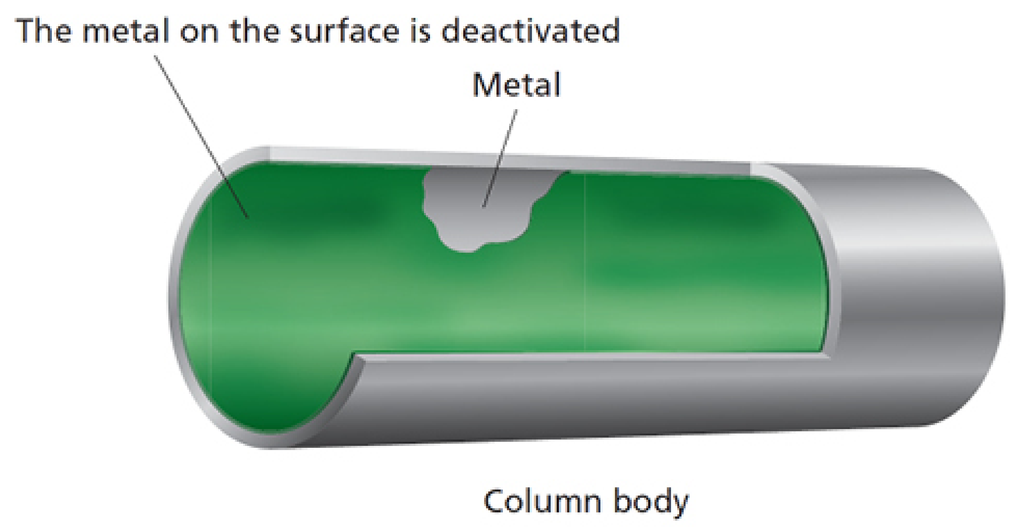
| | |
|---|---|
| **Column** | : Shim-pack Bio HIC, 4 µm, 4.6×100mm |
| **Mobile Phase** | : A) 50 mM $NaH_2PO_4$-$Na_2HPO_4$ (pH 7.0) containing 1.5 M $(NH_4)_2SO_4$/2-propanol (95/5)<br>B) 50 mM $NaH_2PO_4$-$Na_2HPO_4$ (pH 7.0)/2-propanol (80/20)<br>0%B (0-1 min), 0-100%B (1-15 min), 100%B (15-20 min) |
| **Flow Rate** | : 1.0 mL/min |
| **Col. Temp.** | : 25 °C |
| **Detection** | : UV at 280 nm |
| **Injection Vol.** | : 5 µL |
| **Sample** | : Cystein-conjugated ADC mimic (5 mg/mL) |

**Shim-pack Bio HIC Butyl**

| P/N | Dimensions |
|---|---|
| 227-31174-01 | 4 µm, 100 x 4.6 mm I.D |

# Microscale Columns

## Shim-pack ™ MC C18




### Versatility

- Shim-pack MC C18 column with 1.9 µm UHPLC particle achieves excellent seperation and peak shape.
- The high pressure rating of 70 MPa llows these columns to be compatible with a range of mobile phase flow rates from 1 to dozens of µL per minute.
- The metal coordinative adsorption is suppressed by deactivating the column parts in contact with the solution.
- Both small and large molecule compounds, such as peptides, can be analyzed.
- Excellent durability can be achieved even if the biological sample analysis.

## Shim-pack MC PLONAS Series

Shim-pack MC PLONAS 90Å 2.7 µm

### Superior Performances with Superficially Porous Particles (SPP)

- Shim-pack MC PLONAS 2.7 µm columns reduce the back pressure yet maintain teh performance of a sub 2 µm fully porous particle column. The pressure limit is 40 MPa.
- Achieve lower LODs and LOQs, better resolution, and greater reproductibility using the unique superficially porous particle found in Shim-pack MC PLONAS.
- An array of pore sizes designed to meet the needs of any application.
- Increased ruggedness because of larger porosity frits resulting in less clogging compared to competitor columns.
- Excellent column-to-column and lot-to-lot reproducibility.

# Shim-pack MC PLONAS Series

| Bonded Phase | Features and Benefits | Target Analytes |
|---|---|---|
| C18<br>(dimethyloctadecylsilane) | Suitable for a broad range of analytes | Diverse analytes ranging from polar to non polar |
| Aqueous-C18 (polar modified) | • Compatible with 100% aqueoumobile phases<br>• Enhanced retention for polar molecules | Acids, bases, polar analytes |
| C8<br>(dimethyloctylsilane) | Suitable for a broad range of analytes | Diverse analytes ranging from polar to non-polar |
| Biphenyl<br>(dimethylbiphenyl) | • Complementary selectivity to alkyl phases<br>• Enhanced selectivity for aromatic compounds | Electron-poor molecules, aromatic or unsaturated compounds (ketones, nitriles, alkenes) |
| PFPP<br>(pentafluro-phenylpropylsilane | • Complementary selectivity to alkyl phases<br>• Enhanced selectivity for stereoisomers<br>• Can be used in reversed phase and HILIC modes | Electron-rich compounds, aromatics, unsaturated compounds with double and/or triple bonds |
| HILIC<br>(bare silica) | Can also be used in normal-phase modes | Polar and highly polar acids, bases, and neutrals, especially with log P < 0.5 |

## Order information

### Analytical Columns

#### Shim-pack MC PLONAS Series (particle size 2.7 µm)

| Part Number | Bonded Phase | Diameter (mm) | Length (mm) |
|---|---|---|---|
| 227-32100-01 | C18 | 0.2 | 50 |
| 227-32100-11 | | 0.3 | |
| 227-32100-02 | | 0.2 | 100 |
| 227-32100-12 | | 0.3 | |
| 227-32100-03 | | 0.2 | 150 |
| 227-32100-13 | | 0.3 | |
| 227-32102-01 | AQ-C18 | 0.2 | 50 |
| 227-32102-11 | | 0.3 | |
| 227-32102-02 | | 0.2 | 100 |
| 227-32102-12 | | 0.3 | |
| 227-32102-03 | | 0.2 | 150 |
| 227-32102-13 | | 0.3 | |
| 227-32101-01 | C8 | 0.2 | 50 |
| 227-32101-11 | | 0.3 | |
| 227-32101-02 | | 0.2 | 100 |
| 227-32101-12 | | 0.3 | |
| 227-32101-03 | | 0.2 | 150 |
| 227-32101-13 | | 0.3 | |

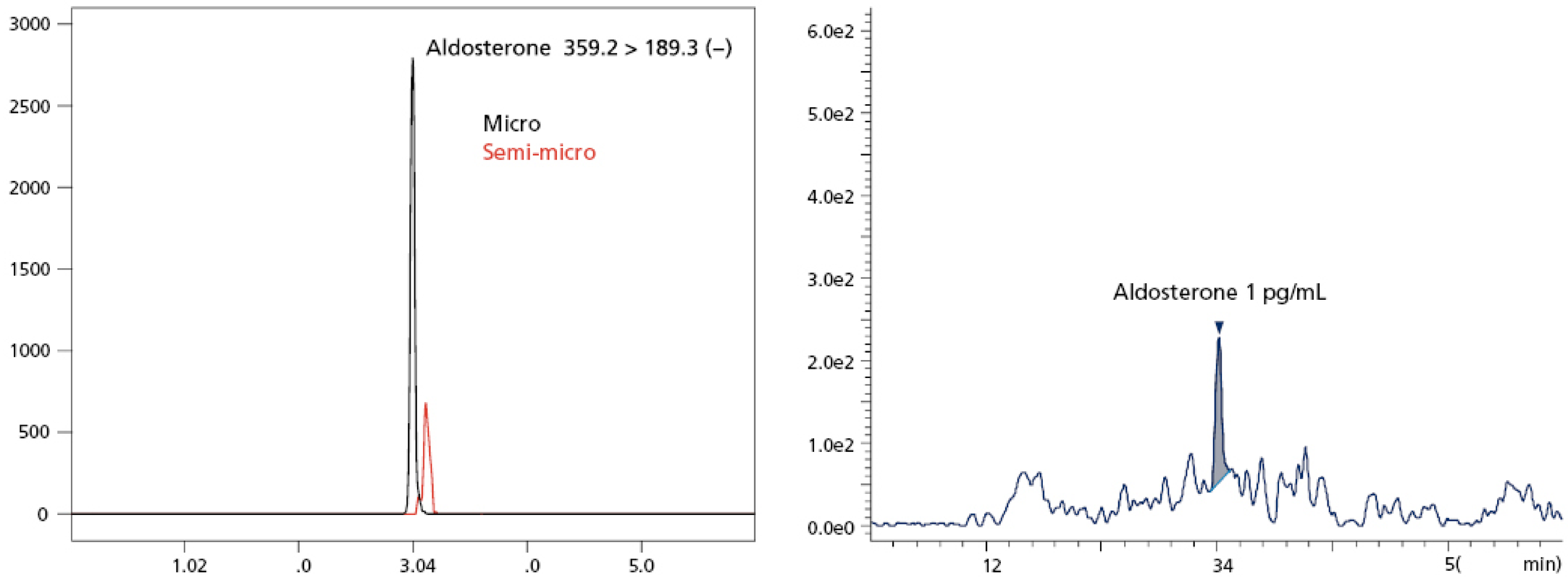
| Part Number | Bonded Phase | Diameter (mm) | Length (mm) |
|---|---|---|---|
| 227-32104-01 | Biphenyl | 0.2 | 50 |
| 227-32104-11 | | 0.3 | |
| 227-32104-02 | | 0.2 | 100 |
| 227-32104-12 | | 0.3 | |
| 227-32104-03 | | 0.2 | 150 |
| 227-32104-13 | | 0.3 | |
| 227-32103-01 | PFPP | 0.2 | 50 |
| 227-32103-11 | | 0.3 | |
| 227-32103-02 | | 0.2 | 100 |
| 227-32103-12 | | 0.3 | |
| 227-32103-03 | | 0.2 | 150 |
| 227-32103-13 | | 0.3 | |
| 227-32105-01 | HILIC | 0.2 | 50 |
| 227-32105-11 | | 0.3 | |
| 227-32105-02 | | 0.2 | 100 |
| 227-32105-12 | | 0.3 | |
| 227-32105-03 | | 0.2 | 150 |
| 227-32105-13 | | 0.3 | |

#### Shim-pack MC C18 (particle size 1.9 µm)

| Part Number | Bonded Phase | Diameter (mm) | Length (mm) |
|---|---|---|---|
| 228-59937-91 | C18 | 0.3 | 50 |
| 228-59937-93 | | 0.175 | |
| 228-59937-95 | | 0.15 | |

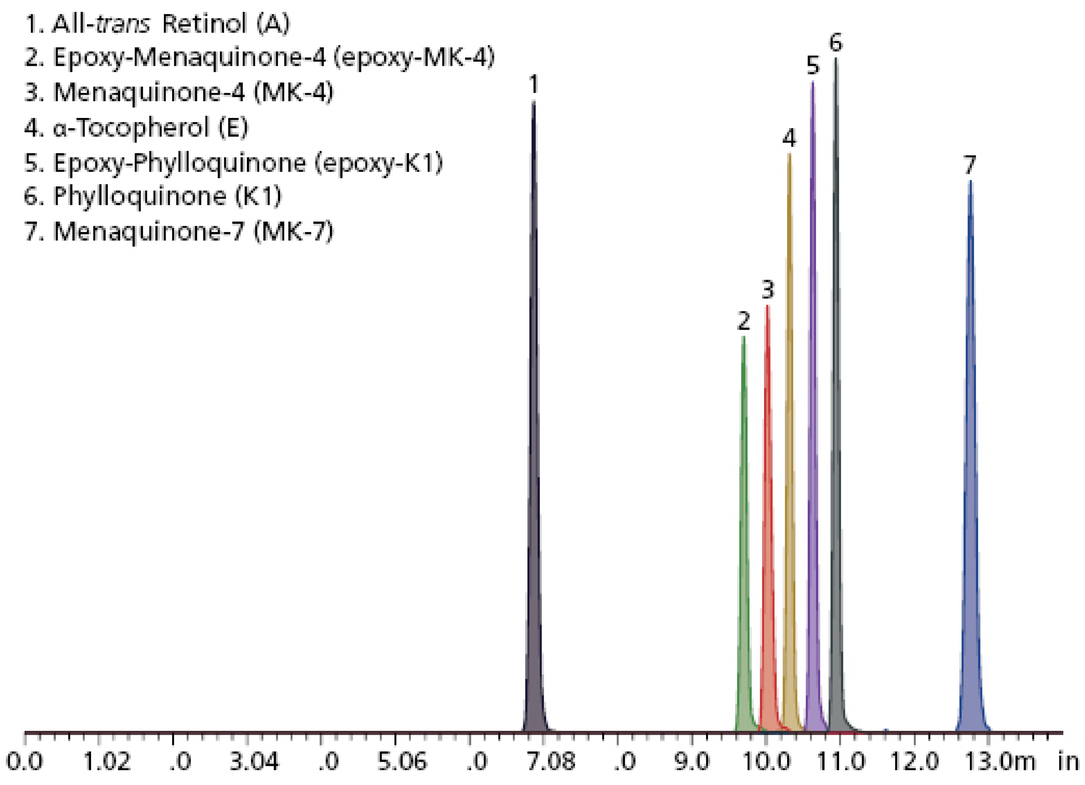
Various molecules give an increase in the peak intensity on Nexera Mikros™ LC-MS/MS platform with an MC PLONAS column.

## Shim-pack MC PLONAS C18




Column : Shim-pack MC PLONAS C18 (0.2 mm I.D. x 100 mm L., 2.7 µm)
*Semi-micro data acquired with the 2.1 mm I.D. column which has the same chemical profile as an MC PLONAS column.
Mobile phase : A: Water, B: Methanol, gradient elution
Flow rate: : 4 µm/min
Temperature : 50 °C
Injection volume : 1 µL
MS detection : LCMS-8060, with Micro-ESI source, ESI (-)

## Shim-pack MC PLONAS C8




20 pg on column
* each peak is in full scale intensity

Column : Shim-pack MC PLONAS C8 (0.2 mm I.D. x 100 mm L., 2.7 µm)
Mobile phase : A: Ammonium acetate aq.
B: Ammonium acetate in methanol, gradient elution
Flow rate : 4 µL/min
Temperature : 50 °C
Injection volume : 1 µL
MS detection : LCMS-8060, with Micro-ESI source, ESI (-)

# Shim-pack Trap Columns

## Trap Columns Wide Portfolio

- Shim -pack MCT C18/C8

  70 MPa pressure imitation and a unique modification on the column inner surface protects against absorption of the molecule.

- Shim -pack MCT LC18/LC8

  A small-volume cartridge column with 40 MPa pressure limit. Useful in reducing the gradient delay for a low flow rate.

## Order information

### Shim-pack MCT series

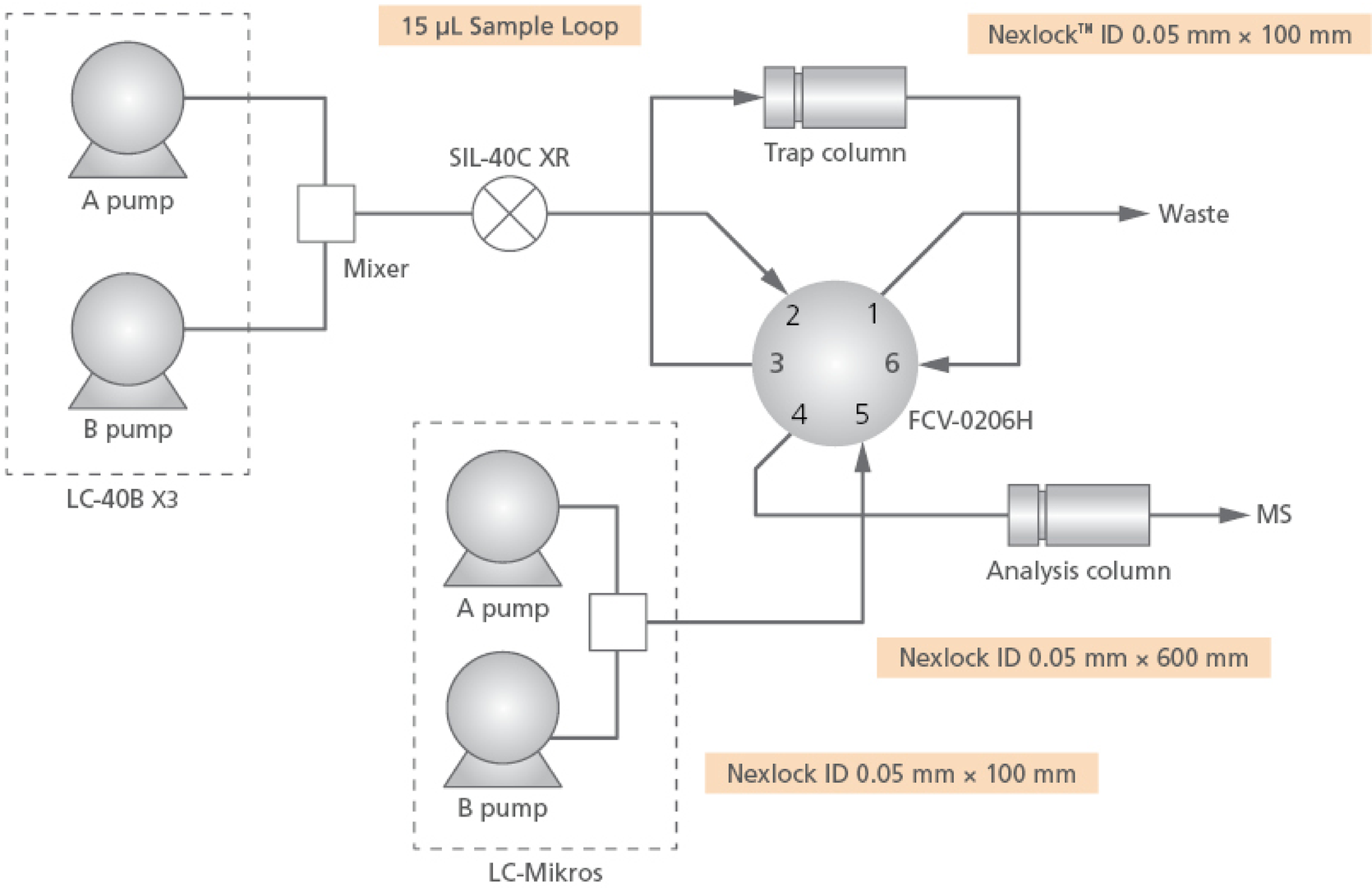
| Part Number | Bonded Phase | Diameter (mm) | Length (mm) |
|---|---|---|---|
| 228-59938-91 | C18 | 0.3 | 35 |
| 228-59938-92 | | 0.5 | |
| 228-59939-91 | C8 | 0.3 | 35 |
| 228-59939-92 | | 0.5 | |

### Shim-pack MCT L series (particle size 5 µm)

| Part Number | Bonded Phase | Diameter (mm) | Length (mm) |
|---|---|---|---|
| 227-32701-01 | Trap column holder for Shim-pack MCT L | | |
| 227-32702-01 | C18 | 0.3 | 5 |
| 227-32703-01 | C8 | 0.5 | |

## Nexer Mikros: Trap and Elute Confirguration

The trap and elute system can be constructed by using a dedicated piping kit (228-71751-42).



# Shim-pack GPC Series

Shim-pack GPC series columns are used for the determination of tetrahydrofuran (800 Series), chloroform (800C Series), and dimethylformamide (800D series).

The technique of GPC does not utilize such chemical reactions as partition, adsorption, and ion exchange, but a physical reaction consisting of a separation based on molecular size of the sample components. Therefore, this method is suitable for the measurement of molecular weight distribution of high polymers and oligomers.

Shim-pack GPC series are packed with polystyrene polymers with respective degrees of cross-linking in order to meet exact analysis requirements, ranging from analysis of high polymers to that of oligomers. GPC-80M (80MC, 80MD) are mixed gel columns.

## Determination of Tetrahydrofuran

### Analytical Columns

| Column | Exclusion Limit (polystyrene) | Dimensions (Length × I.D., mm) | P/N |
|---|---|---|---|
| Shim-pack GPC-801 | $1.5 \times 10^3$ | 300 × 8.0 | 228-20803-91 |
| Shim-pack GPC-802 | $5 \times 10^3$ | 300 × 8.0 | 228-20804-91 |
| Shim-pack GPC-8025 | $2 \times 10^4$ | 300 × 8.0 | 228-20805-91 |
| Shim-pack GPC-803 | $7 \times 10^4$ | 300 × 8.0 | 228-20806-91 |
| Shim-pack GPC-804 | $4 \times 10^5$ | 300 × 8.0 | 228-20807-91 |
| Shim-pack GPC-805 | $4 \times 10^6$ | 300 × 8.0 | 228-20808-91 |
| Shim-pack GPC-806 | $4 \times 10^7$ | 300 × 8.0 | 228-20809-91 |
| Shim-pack GPC-80M | $4 \times 10^7$, Mixed gel | 300 × 8.0 | 228-20810-91 |

### Guard Columns

| Guard Column | Dimensions (Length × I.D., mm) | P/N |
|---|---|---|
| Shim-pack GPC-800P | 10 × 4.6 | 228-20812-91 |

## Determination of Chloroform

### Analytical Columns

| Column | Exclusion Limit (polystyrene) | Dimensions (Length × I.D., mm) | P/N |
|---|---|---|---|
| Shim-pack GPC-801C | $1.5 \times 10^3$ | 300 × 8.0 | 228-20803-92 |
| Shim-pack GPC-802C | $5 \times 10^3$ | 300 × 8.0 | 228-20804-92 |
| Shim-pack GPC-8025C | $2 \times 10^4$ | 300 × 8.0 | 228-20805-92 |
| Shim-pack GPC-803C | $7 \times 10^4$ | 300 × 8.0 | 228-20806-92 |
| Shim-pack GPC-804C | $4 \times 10^5$ | 300 × 8.0 | 228-20807-92 |
| Shim-pack GPC-805C | $4 \times 10^6$ | 300 × 8.0 | 228-20808-92 |
| Shim-pack GPC-806C | $4 \times 10^7$ | 300 × 8.0 | 228-20809-92 |
| Shim-pack GPC-80MC | $4 \times 10^7$, Mixed gel | 300 × 8.0 | 228-20810-92 |

### Guard Columns

| Guard Column | Dimensions (Length × I.D., mm) | P/N |
|---|---|---|
| Shim-pack GPC-800CP | 10 × 4.6 | 228-20812-92 |

# Shim-pack GPC Series

## Determination of Dimethylformamide

### Analytical Columns

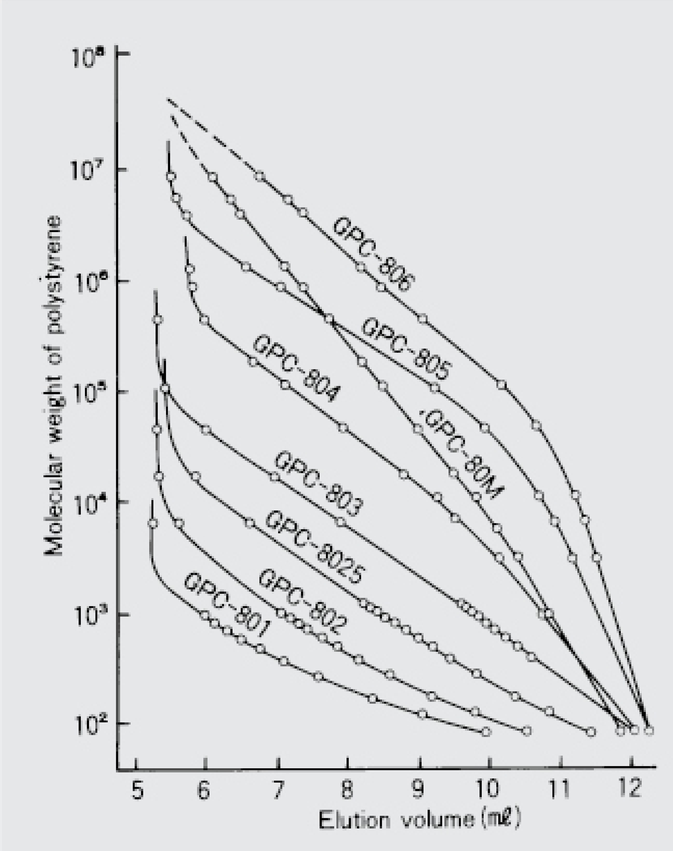
| Column | Exclusion Limit (polystyrene) | Dimensions (Length × I.D., mm) | P/N |
|---|---|---|---|
| Shim-pack GPC-801D | $1.5 \times 10^3$ | 300 × 8.0 | 228-20803-93 |
| Shim-pack GPC-802D | $5 \times 10^3$ | 300 × 8.0 | 228-20804-93 |
| Shim-pack GPC-8025D | $2 \times 10^4$ | 300 × 8.0 | 228-20805-93 |
| Shim-pack GPC-803D | $7 \times 10^4$ | 300 × 8.0 | 228-20806-93 |
| Shim-pack GPC-804D | $4 \times 10^5$ | 300 × 8.0 | 228-20807-93 |
| Shim-pack GPC-805D | $4 \times 10^6$ | 300 × 8.0 | 228-20808-93 |
| Shim-pack GPC-806D | $4 \times 10^7$ | 300 × 8.0 | 228-20809-93 |
| Shim-pack GPC-80MD | $4 \times 10^7$, Mixed gel | 300 × 8.0 | 228-20810-93 |

### Guard Columns

| Guard Column | Dimensions (Length × I.D., mm) | P/N |
|---|---|---|
| Shim-pack GPC-800DP | 10 × 4.6 | 228-20812-93 |

## Analysis Examples

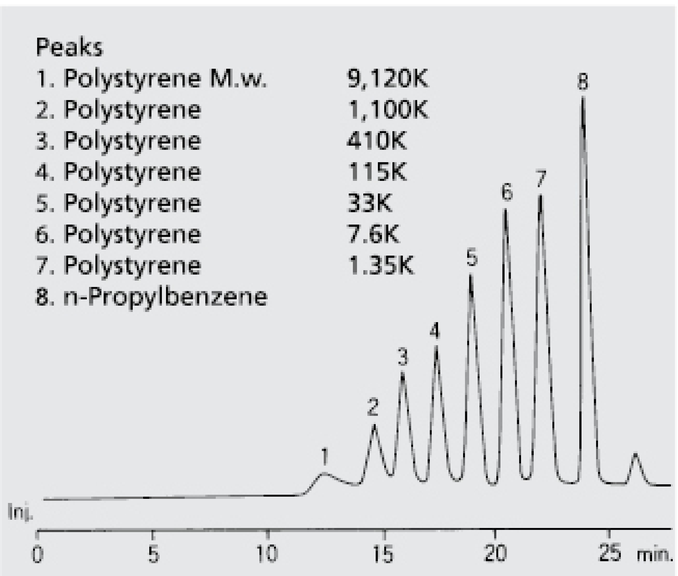
### Calibration Curves




**Conditions**

**Mobile Phase** : Tetrahydrofuran
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : Ambient
**Detection** : UV 254 nm

### Analysis of Polystyrene Standard




**Conditions**

**Column** : Shim-pack GPC-80M (2 columns in series) (P/N: 228-20810-91)
**Mobile Phase** : Tetrahydrofuran
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : Ambient
**Detection** : UV 254 nm

# Shim-pack Diol Series

Shim-pack Diol series is a kind of gel filtration chromatography (GFC) column. GFC is used to separate water-soluble high polymers such as polysaccharides, proteins, and nucleic acids according to their molecular sizes by using hydrophilic packing materials and aqueous mobile phase.

Shim-pack Diol series is packed with porous spherical silica gel chemically bonded with a hydroxyl group. Due to the hydrophilic hydroxyl group, Shim-pack Diol series can be used in high-speed GFC and provide sharp peaks during the analysis of protein and biochemicals (such as enzymes).

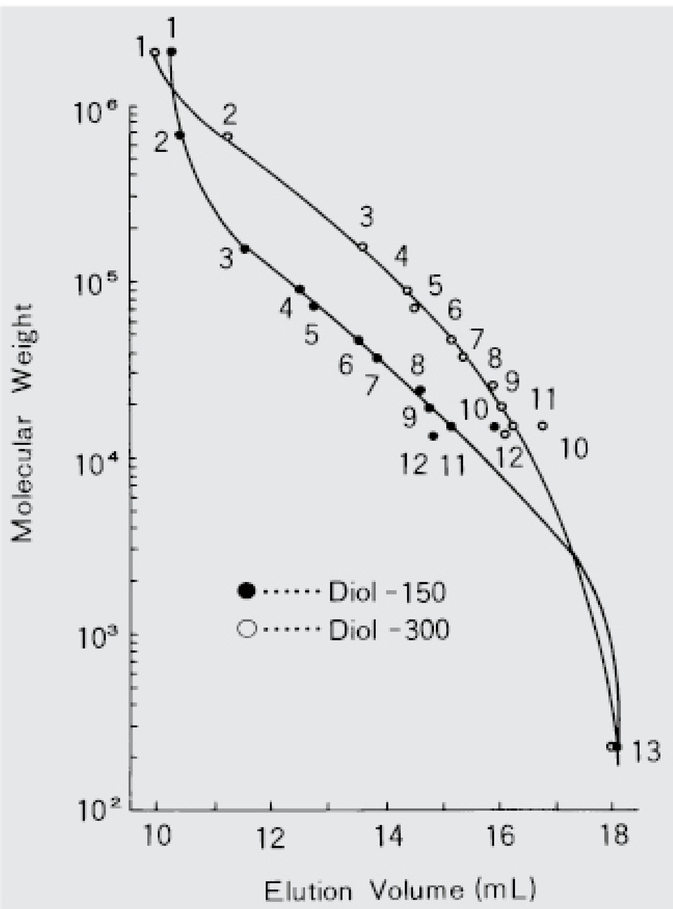
## Product Information

| Column | Stationary Phase | Particle Size (µm) | Dimensions (Length × I.D., mm) | P/N |
|---|---|---|---|---|
| Shim-pack Diol-150 | Diol group | 5 | 250 × 7.9 | 228-14775-91 |
| | | | 500 × 7.9 | 228-14775-92 |
| Shim-pack Diol-300 | Diol group | 5 | 250 × 7.9 | 228-14776-91 |
| | | | 500 × 7.9 | 228-14776-92 |
| Pre-column Diol * | Diol group | 10 | 50 × 4.0 | 228-16367-91 |

* Installed between the liquid pump and the sample injector to protect the Shim-pack Diol column.

## Analysis Examples

### Calibration Curves



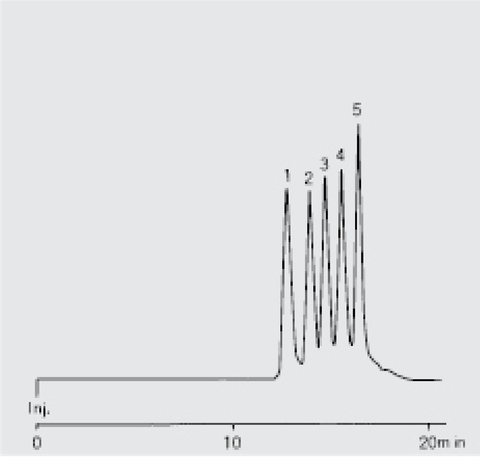

**Peaks**

1. Blue dextran 2000
2. Thyroglobulin
3. γ-Globulin
4. Transferrin
5. Human serum albumin
6. Ovalbumin
7. β-Lactoglobulin
8. Chymotrypsin
9. Myoglobin
10. Lysozyme
11. Ribonuclease A
12. Cytochrome C
13. Gly-Tyr

**Conditions**

**Column** : Shim-pack Diol Series (500 mmL × 7.9 mmI.D., 5 µm)
**Mobile Phase** : A) 10mM phosphate buffer solution (pH 7)
B) 0.2M sodium sulfate
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : Ambient
**Detection** : UV 280 nm

### Analysis of Protein Standard




**Peaks**

1. Glutamate dehydrogenase
2. Lactate dehydrogenase
3. Enolase
4. Adenylate kinase
5. Cytochrome C

**Conditions**

**Column** : Shim-pack Diol-300 (500 mmL × 7.9 mmI.D., 5 µm)
(P/N: 228-14776-92)
**Mobile Phase** : A) 10mM phosphate buffer solution (pH 7)
B) 0.1M sodium chloride
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : Ambient
**Detection** : UV 280 nm

# Metal Free Columns

## Shim-pack Scepter Series

### Analytical Columns

| Chemistry | | C18 | | HD-C18 | | C8 | |
|---|---|---|---|---|---|---|---|
| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 4.6 | 2.1 | 4.6 | 2.1 | 4.6 |
| 1.9 | 50 | 227-31072-01 | - | 227-31173-01 | - | 227-31166-01 | - |
| | 100 | 227-31072-02 | - | 227-31173-02 | - | 227-31166-02 | - |
| | 150 | - | - | - | - | 227-31166-03 | - |
| 3 | 50 | 227-31073-01 | 227-31074-01 | 227-31077-01 | 227-31078-01 | 227-31081-01 | 227-31082-01 |
| | 100 | 227-31073-02 | 227-31074-02 | 227-31077-02 | 227-31078-02 | 227-31081-02 | 227-31082-02 |
| | 150 | 227-31073-03 | 227-31074-03 | - | 227-31078-03 | 227-31081-03 | 227-31082-03 |
| 3 | 50 | 227-31075-01 | 227-31076-01 | 227-31079-01 | 227-31080-01 | 227-31083-01 | 227-31084-01 |
| | 100 | 227-31075-02 | 227-31076-02 | 227-31079-02 | 227-31080-02 | 227-31083-02 | 227-31084-02 |
| | 150 | - | 227-31076-03 | - | 227-31080-03 | 227-31083-03 | 227-31084-03 |

| Chemistry | | C4-300 | | Phenyl | | PFPP | |
|---|---|---|---|---|---|---|---|
| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 4.6 | 2.1 | 4.6 | 2.1 | 4.6 |
| 1.9 | 50 | 227-31197-01 | - | 227-31169-01 | - | 227-31168-01 | - |
| | 100 | 227-31197-02 | - | 227-31169-02 | - | 227-31168-02 | - |
| | 150 | 227-31197-03 | - | - | - | - | - |
| 3 | 50 | 227-31198-01 | 227-31199-01 | 227-31093-01 | 227-31094-03 | 227-31089-01 | 227-31090-03 |
| | 100 | 227-31198-02 | 227-31199-02 | 227-31093-02 | 227-31094-01 | 227-31089-02 | 227-31090-01 |
| | 150 | 227-31198-03 | 227-31199-03 | - | 227-31094-02 | - | 227-31090-02 |
| 3 | 50 | 227-31200-01 | 227-31201-01 | 227-31095-01 | 227-31096-01 | 227-31091-01 | 227-31092-01 |
| | 100 | 227-31200-02 | 227-31201-02 | 227-31095-02 | 227-31096-02 | 227-31091-02 | 227-31092-02 |
| | 150 | 227-31200-03 | 227-31201-03 | - | 227-31096-03 | - | 227-31092-03 |

| Chemistry | | Diol-HILIC | |
|---|---|---|---|
| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 4.6 |
| 1.9 | 50 | 227-31167-01 | - |
| | 100 | 227-31167-02 | - |
| | 150 | - | - |
| 3 | 50 | 227-31085-01 | 227-31086-01 |
| | 100 | 227-31085-02 | 227-31086-02 |
| | 150 | - | 227-31086-03 |
| 3 | 50 | 227-31087-01 | 227-31088-03 |
| | 100 | 227-31087-02 | 227-31088-01 |
| | 150 | - | 227-31088-02 |

# Metal Free Columns

## Shim-pack G Series

### Analytical Columns

| Chemistry | | GIST C18 | | GIST C18-AQ | GISS C18 | | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|---|---|
| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 4.6 | 2.1 | 2.1 | 4.6 | |
| 1.9 or 2 | 50 | 227-30914-01 | 227-30915-01 | 227-30936-01 | 227-30922-01 | 227-30923-01 | 80 |
| | 100 | 227-30914-02 | 227-30915-02 | 227-30936-02 | 227-30922-02 | 227-30923-02 | |
| | 150 | 227-30914-03 | 227-30915-03 | 227-30936-03 | - | 227-30923-03 | |
| 3 | 50 | 227-30916-01 | 227-30917-01 | 227-30938-01 | 227-30924-01 | 227-30925-01 | 50 |
| | 100 | 227-30916-02 | 227-30917-02 | 227-30938-02 | 227-30924-02 | 227-30925-02 | |
| | 150 | 227-30916-03 | 227-30917-03 | 227-30938-03 | 227-30924-03 | 227-30925-03 | |
| | 250 | 227-30916-04 | 227-30917-04 | 227-30938-04 | 227-30924-04 | 227-30925-04 | |
| 3 | 50 | 227-30918-01 | 227-30919-01 | 227-30940-01 | 227-30926-01 | 227-30927-01 | 20 |
| | 100 | 227-30918-02 | 227-30919-02 | 227-30940-02 | 227-30926-02 | 227-30927-02 | |
| | 150 | 227-30918-03 | 227-30919-03 | 227-30940-03 | 227-30926-03 | 227-30927-03 | |
| | 250 | 227-30918-04 | 227-30919-04 | 227-30940-04 | 227-30926-04 | 227-30927-04 | |

| Chemistry | | GISS C8 | | GIST PFPP | | GIST Amide | | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|---|---|---|
| Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 4.6 | 2.1 | 4.6 | 2.1 | 4.6 | |
| 1.9 or 2 | 50 | 227-30928-01 | 227-30929-01 | - | - | 227-30951-01 | - | 80 |
| | 100 | 227-30928-02 | 227-30929-02 | - | - | 227-30951-02 | - | |
| | 150 | - | 227-30929-03 | - | - | 227-30951-03 | - | |
| 3 | 50 | 227-30930-01 | 227-30931-01 | 227-30896-01 | 227-30897-01 | 227-30850-01 | 227-30851-01 | 50 |
| | 100 | 227-30930-02 | 227-30931-02 | 227-30896-02 | 227-30897-02 | 227-30850-02 | 227-30851-02 | |
| | 150 | 227-30930-03 | 227-30931-03 | 227-30896-03 | 227-30897-03 | 227-30850-03 | 227-30851-03 | |
| | 250 | 227-30930-04 | 227-30931-04 | 227-30896-04 | 227-30897-04 | 227-30850-04 | 227-30851-04 | |
| 3 | 50 | 227-30932-01 | 227-30933-01 | 227-30898-01 | 227-30899-01 | 227-30852-01 | 227-30853-01 | 20 |
| | 100 | 227-30932-02 | 227-30933-02 | 227-30898-02 | 227-30899-02 | 227-30852-02 | 227-30853-02 | |
| | 150 | 227-30932-03 | 227-30933-03 | 227-30898-03 | 227-30899-03 | 227-30852-03 | 227-30853-03 | |
| | 250 | 227-30932-04 | 227-30933-04 | 227-30898-04 | 227-30899-04 | 227-30852-04 | 227-30853-04 | |

### Cartridge Guard Columns

| Chemistry | Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2 pcs) | | Pressure Tolerance (MPa) | Holder |
|---|---|---|---|---|---|---|
| | | | 2.1 | 3.0 | | |
| GIST C18 | 5 | 10 | 227-30920-01 | 227-30921-01 | 20 | 227-30944-01 |
| GIST C18-AQ | | | 227-30942-01 | 227-30943-01 | | |
| GISS C18 | | | 227-30934-01 | 227-30935-01 | | |
| GISS C8 | | | 227-30945-01 | 227-30946-01 | | |
| GIST PFPP | | | 227-30900-01 | 227-30901-01 | | |
| GIST Amide | | | 227-30854-01 | 227-30855-01 | | |

| Chemistry | Particle Size (µm) | I.D. (mm) / Length (mm) | Cartridge Guard Column (2 pcs) and Holder | | Pressure Tolerance (MPa) |
|---|---|---|---|---|---|
| | | | 2.1 | 3.0 | |
| GIST C18 | 5 | 10 | 227-30920-02 | 227-30921-02 | 20 |
| GIST C18-AQ | | | 227-30942-02 | 227-30943-02 | |
| GISS C18 | | | 227-30934-02 | 227-30935-02 | |
| GISS C8 | | | 227-30945-02 | 227-30946-02 | |
| GIST PFPP | | | 227-30900-02 | 227-30901-02 | |
| GIST Amide | | | 227-30854-02 | 227-30855-02 | |

# Mastro™ LC Series

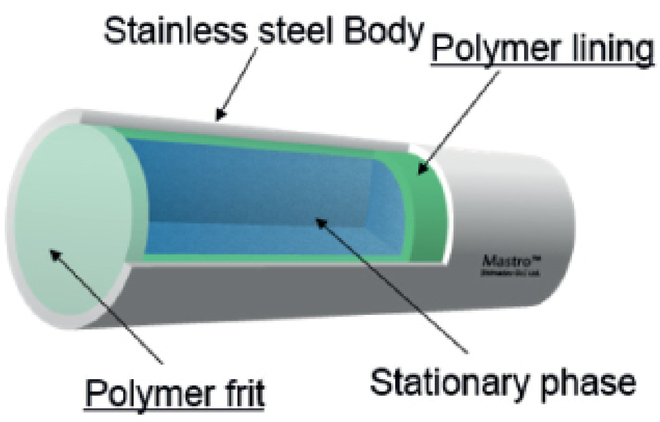
High pressure tolerance metal free column, best solution for chelating compound

| | Mastro2 C18 | Mastro2 PFP | Mastro SP |
|---|---|---|---|
| Mode | ODS | PFP | ODS + SAX |
| Particle Size | 2.2 um, 5.0um | 3.0 um | 5.0 um |
| Max. Press. | 40 MPa (2.2 um),<br>15 MPa (5.0 um) | 40 MPa (100 mm),<br>50 MPa (150 mm) | 20 MPa |
| Max. Temp. | 80 °C (*1) | | 40 °C |
| pH range | 2 to 7.5 (*2) | | 2.5 to 7.5 |
| I.D. (mm) | 2.0 | | 2.1 |
| Length (mm) | 50, 100, 150 | 100, 150 | 100 |

(*1) When mixtures of water or acidic aqueous solution (pH 3 or greater) and acetonitrile are used.
(*2) Optimum lifetime is obtained at pH 2.5 – pH 7.0 and at 40°C or less when a buffer is used.

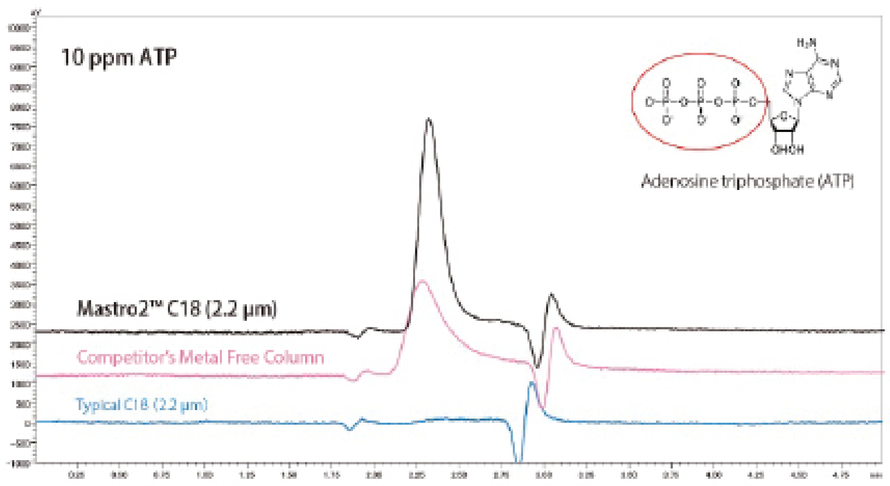
## Features

- Manufactured with polymer lining and inlet/outlet frits, Mastro™ range of LC columns are an excellent choice for compounds which have phosphate group, or compounds which chelate binding to metal.
- Mastro™ LC columns is controlled activated of stainless by special internal coating.
- Highly recommended for LCMS applications in which inertness is critical.




# Mastro2™ C18

Comparing the SUS body column, the inert body column of other companies, and the Mastro2 ™ column using a phosphate group-containing compound, not only the area value of Mastro2 ™ increases, but also the variability is extremely small from the obtained CV value. In addition, since the peak shape is good, the S / N is large and the detection sensitivity is improved.




**Analytical condition**

| | |
|---|---|
| **Instruments** | : Nexera Bio |
| **Column** | : Mastro2 ™ or Typical C18 (150 mmL. X 2.0 mm ID)<br>Competitor (150 mmL. X 2.1 mm ID) |
| **Mobile phase** | : 10 mM $HCOONH_4$ in $H_2O$ / $CH_3CN$ = 95/5 |
| **Flow rate** | : 0.2 mL / min |
| **Detection** | : UV 254 nm |
| **Column Oven** | : 40°C |
| **Injection vol.** | : 1 µL |

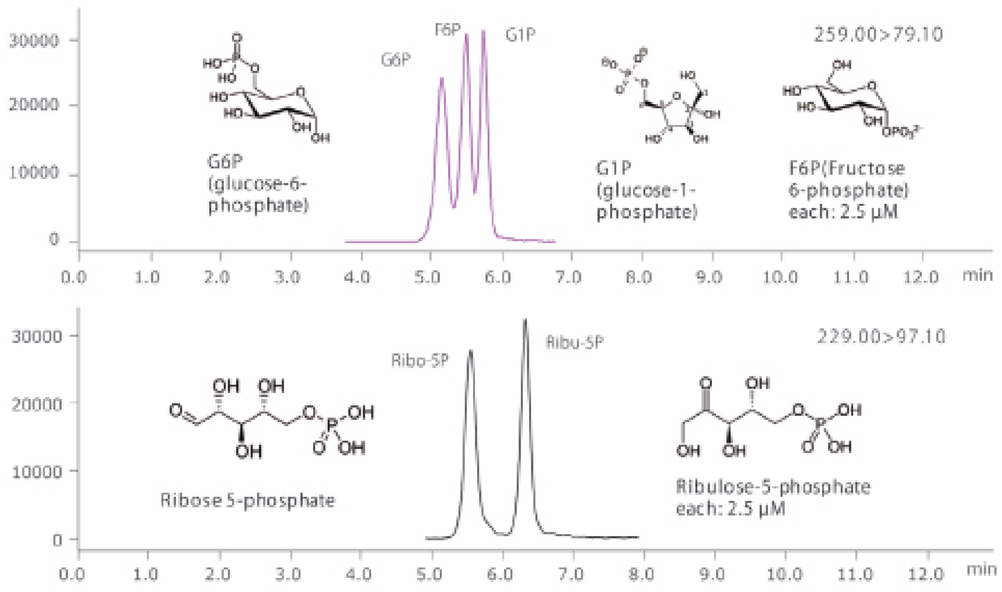
Unlike other products, Mastro2 ™ has a structure that does not generate metal chelates because all liquid contact parts are PEEK resin. In addition, a line-up of 2.2 µm microparticles is introduced as the PEEK resin parts are designed to be resistant to deformation even under high pressure.

| | Area average (n=3) | CV | Asymmetry | S/N |
|---|---|---|---|---|
| Mastro2™ C18 | 50482 | 0.4 | 1.47 | 109 |
| Competitor's Metal Free Column | 38481 | 4.5 | 1.83 | 46 |
| Typical C18 | No Data | – | – | – |

| Particle Size (µm) | I.D (mm) | Length | | |
|---|---|---|---|---|
| | | 50 mm | 100 mm | 150 mm |
| 2.2 | 2.0 | 370-01003-44 | 370-01003-64 | 370-01003-84 |
| 5.0 | | 370-01007-44 | 370-01007-64 | 370-01007-84 |

# Mastro™ SP

Ion-paring reagents are required to analyze the highly-polar compound such as phosphate groups. However, ion-paring reagents are not ideal for LCMS applications as they as difficult to remove from the flow lines. Mastro™ SP columns are ideal for the analysis of such compounds without the use of ion-paring reagents.




■ **Analytical condition**

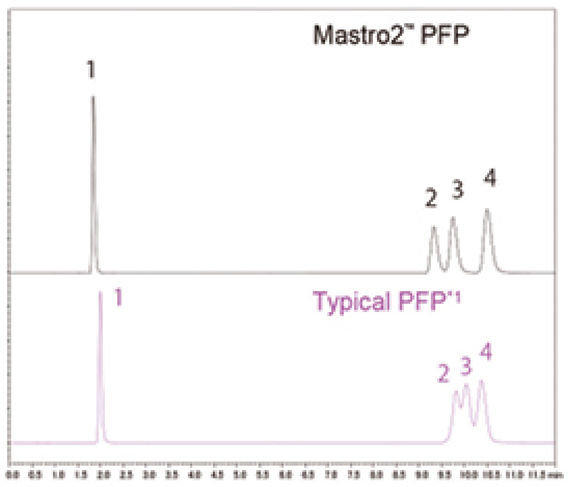
**Instruments** : Shimadzu Nexera/LCMS-8050
**Column** : Mastro™ SP (2.1 mmI.D × 100 mmL., 5 µm)
**Mobile phase** : A) 10 mM Ammonium acetate/ACN=90/10
**Mobile phase** : B) 50 mM Ammonium acetate/ACN=80/20
0% B (0-4.0 min) ⇒ 60% B (9.0 min)
⇒ 00% B (11.0-20.0 min)
⇒ 0% B (20.1-25.0 min)
**T. Flow** : 0.5 mL/min
**Nebulizing gas** : 3.0 L/min
**Drying gas** : 12 L/min
**DL Temp.** : 250 °C
**BH Temp.** : 400 °C
**Injection Vol.** : 3 µL

| Particle Size (µm) | I.D (mm) | Length |
|---|---|---|
| | | 100 mm |
| 5.0 | 2.1 | SSOT-G10005 |

# Mastro2™ PFP

Mastro2 PFP is the column packed with PFP (Penta Fluoro Phenyl) that has high retention capability. Generally, PFP columns have efficiency for retaining and separating regioisomers and halogen compounds that are difficult to be analysed with C18 column.

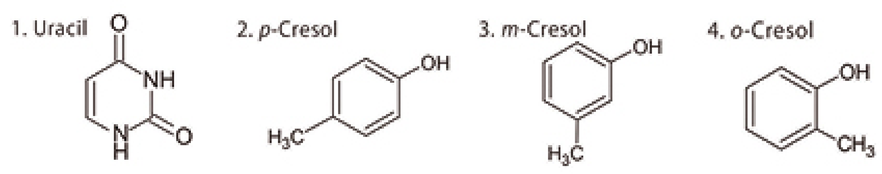
## ■ Separation of cresol




■ **Analytical conditions**

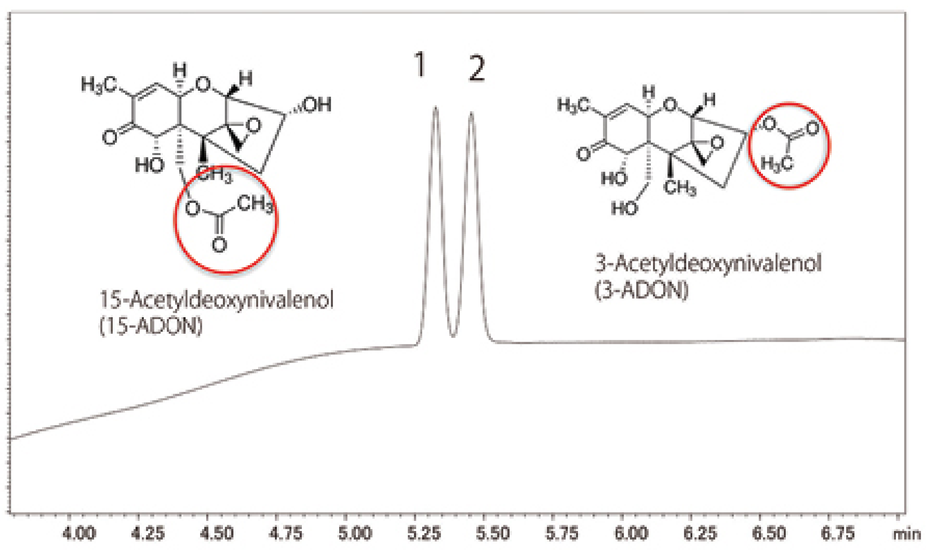
**Instrument** : NexeraX2_SPD20A(Semi-micro cell)
**Column** : Mastro2™ PFP (150 mmL. × 2.0 mm I.D. 3 µm)
Typical PFP*1 (150 mmL. × 2.1 mm I.D. 3 µm)
**Mobile phase** : $H_2O$ / $CH_3OH$ = 60 / 40
**Flow rate** : 0.2 mL/min
**Detection** : UV 254 nm
**Column oven** : 40 °C
**Sample** : 1. Uracil, 2. p-Cresol, 3. m-Cresol, 4. o-Cresol

**1 Metal free column*




| | Mastro2™ PFP | Typical PFP |
|---|---|---|
| α2,3 | 1.06 | 1.10 |
| α3,4 | 1.10 | 1.82 |
| Rs1 | 1.50 | 0.59 |
| Rs2 | 2.50 | 0.92 |

## ■ Mycotoxin components (3-ADON, 15-ADON) analysis




■ **Analytical conditions**

**Instrument** : NexeraX2_SPD20A (Semi-micro cell)
**Column** : Mastro2™ PFP (150 mm L, × 2.0 mm I.D. 3 µm)
**Mobile phase** : A) 10 mM $CH_3COONH_4$ in $H_2O$
B) 2% $CH_3COOH$ in $CH_3OH$
Gradient condition
**Flow rate** : 0.4 mL/min
**Detection** : UV 254 nm
**Column oven** : 40 °C
**Sample** : 1. 15-ADON, 2. 3-ADON

| Particle Size (µm) | I.D (mm) | Length | |
|---|---|---|---|
| | | 100 mm | 150 mm |
| 3.0 | 2.0 | 370-01015-64 | 370-01015-84 |

# Shim-pack UC Series

## Packed Columns for Supercritical Fluid Chromatograph

When conducting analysis with the Nexera UC supercritical fluid chromatography system, because diffusion of the sample band in the mobile phase is high compared with liquid chromatography, separation behavior changes significantly depending on the types of columns used. Shim-pack UC series was designed with a variety of stationary phases, making it suitable for analysis of various compounds.

### Achieve high speed and high performance

Shim-pack UC series offers various stationary phases suitable for the mobile phase of high diffusion and low-viscosity liquid carbon dioxide. Analysis time can be reduced at a high flow rate without impairing the separation performance. In addition, analysis speed, which is limited in HPLC, can be increased.

### Wide range of stationary phases meets diverse needs

Shim-pack UC series was designed with eight types of stationary phases and sizes to meet diverse research and development needs.

### High durability and stable reproducibility

Shim-pack UC series achieves high inertness for improved analysis precision and increased column durability. Its uniform silica surface and stable chemical modification also ensure high analysis reproducibility.

| | Shim-pack UC RP | Shim-pack UC GIS II | Shim-pack UC Phenyl | Shim-pack UC CN |
|---|---|---|---|---|
| Bonded Phase | Octadecyl Groups + Polar Functional Group | Octadecyl Groups | Phenyl Groups | Cyanopropryl Groups |
| Particle Size (µm) | 3, 5 | 3, 5 | 3, 5 | 3, 5 |
| Pore Size (nm) | 10 | 10 | 10 | 10 |
| Surface Area (m2/g) | 450 | 450 | 450 | 450 |
| Carbon Loading | 9% | 11% | 9.5% | 14% |
| Pressure Tolerance (MPa) | 50 (3µm), 30 (5µm) | 50 (3µm), 30 (5µm) | 50 (3µm), 30 (5µm) | 50 (3µm), 30 (5µm) |
| Pore Volume (mL/g) | 1.05 | 1.05 | 1.05 | 1.05 |
| End-capping | - | Yes | - | - |
| pH Range | 2 - 7.5 | 2 - 7.5 | 2 - 7.5 | 2 - 7.5 |
| USP Code | L1 | L1 | L11 | L10 |

| | Shim-pack UC Diol | Shim-pack UC Sil | Shim-pack UC Amide | Shim-pack UC NH2 |
|---|---|---|---|---|
| Bonded Phase | Diol Group | - | Carbamoyl Groups | Aminopropyl Groups |
| Particle Size (µm) | 3, 5 | 3, 5 | 3, 5 | 3, 5 |
| Pore Size (nm) | 10 | 10 | 10 | 10 |
| Surface Area (m2/g) | 450 | 450 | 450 | 450 |
| Carbon Loading | 20% | - | 18% | 8% |
| Pressure Tolerance (MPa) | 50 (3µm), 30 (5µm) | 50 (3µm), 30 (5µm) | 50 (3µm), 30 (5µm) | 50 (3µm), 30 (5µm) |
| Pore Volume (mL/g) | 1.05 | 1.05 | 1.05 | 1.05 |
| End-capping | - | - | - | - |
| pH Range | 2 - 7.5 | 2 - 7.5 | 2 - 7.5 | 2 - 7.5 |
| USP Code | L20 | L3 | - | L8 |

| | Shim-pack UC-Diol II | Shim-pack UC-Sil II | Shim-pack UC-Choles | Shim-pack UC-PBr |
|---|---|---|---|---|
| Bonded Phase | Diol Group | - | Cholesteryl Groups | Pentabromobenzyl Group |
| Particle Size (µm) | 3, 5 | 3, 5 | 3, 5 | 3, 5 |
| Pore Size (nm) | 12 | 12 | 12 | 12 |
| Surface area ($m^2/g$) | 340 (3µm), 300 (5µm) | 340 (3µm), 300 (5µm) | 340 (3µm), 300 (5µm) | 340 (3µm), 300 (5µm) |
| Carbon Loading (%) | - | - | 20 | 8 |
| Pressure Tolerance (MPa) | 50 (3µm), 30 (5µm) | 50 (3µm), 30 (5µm) | 50 (3µm), 30 (5µm) | 50 (3µm), 30 (5µm) |
| Pore volume (mL/g) | 1.00 (3µm), 0.90 (5µm) | 1.00 (3µm), 0.90 (5µm) | 1.00 (3µm), 0.90 (5µm) | 1.00 (3µm), 0.90 (5µm) |
| End-capping | - | - | Yes | Yes |
| pH Range | 2 - 7.5 | - | 2 - 7.5 | 2 - 7.5 |
| USP Code | L20 | L3 | L101 | - |

| | Shim-pack UC-PyE | Shim-pack UC-HyP | Shim-pack UC-Py | Shim-pack UC-Triazole |
|---|---|---|---|---|
| Bonded Phase | Pyrenylethyl Group | 3-Hydroxyphenyl Group | Pyridinyl Group | Triazolyl group |
| Particle Size (µm) | 3, 5 | 3, 5 | 3, 5 | 3, 5 |
| Pore Size (nm) | 12 | 12 | 12 | 12 |
| Surface area ($m^2/g$) | 340 (3µm), 300 (5µm) | 340 (3µm), 300 (5µm) | 340 (3µm), 300 (5µm) | 340 (3µm), 300 (5µm) |
| Carbon Loading (%) | 18 | - | - | - |
| Pressure Tolerance (MPa) | 50 (3µm), 30 (5µm) | 50 (3µm), 30 (5µm) | 50 (3µm), 30 (5µm) | 50 (3µm), 30 (5µm) |
| Pore volume (mL/g) | 1.00 (3µm), 0.90 (5µm) | 1.00 (3µm), 0.90 (5µm) | 1.00 (3µm), 0.90 (5µm) | 1.00 (3µm), 0.90 (5µm) |
| End-capping | Yes | Yes | Yes | - |
| pH Range | 2 - 7.5 | - | - | 2 - 7.5 |
| USP Code | - | - | - | L104 |

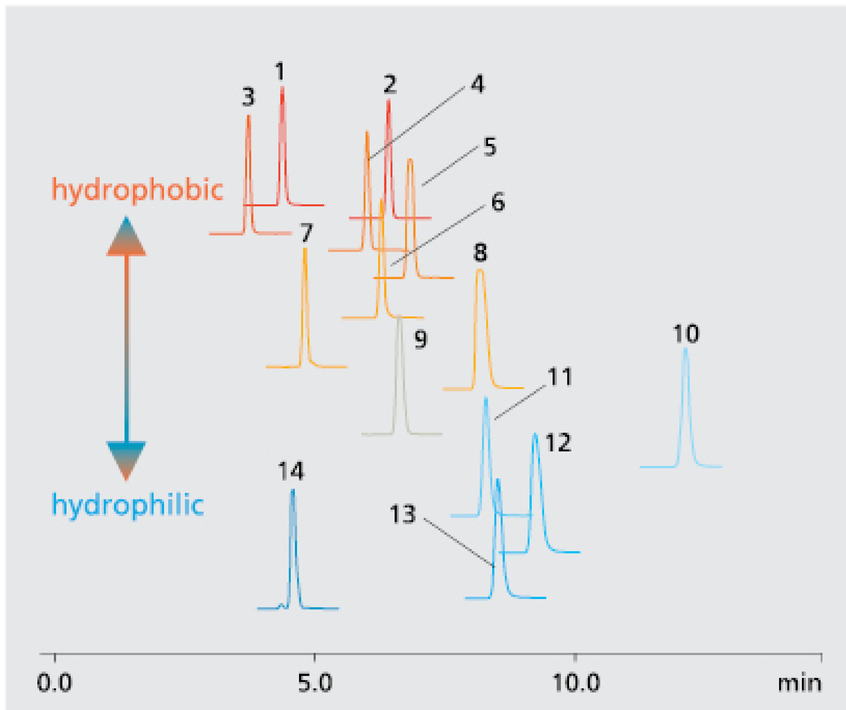
## Analysis Examples

### Multiple Pesticides with a Wide Polarity Range

Simultaneous analysis of multiple pesticides with a wide polarity range from hydrophobic to hydrophilic has been achieved using the Nexera UC and Shim-pack UC RP. Shim-pack UC RP contains a polar functional group embedded between the silica surface and the C18 group. This allows the column to analyze a wide range of components from hydrophobic to hydrophilic ones.

Simultaneous analysis of multiple components can now be performed more efficiently using the Nexera UC and Shim-pack UC series.

| No. | Components | log P |
|---|---|---|
| 1 | Carbofuran | 7.4 |
| 2 | Ethofenprox | 6.9 |
| 3 | Fenpropathrin | 6.0 |
| 4 | Pyriproxyfen | 5.0 |
| 5 | Pyraclostrobin | 4.0 |
| 6 | Linuron | 3.0 |
| 7 | Aminocarb | 1.9 |
| 8 | Ethoxysulfuron | 1.0 |
| 9 | Halosulfuron methyl | 0.0 |
| 10 | Bentazone | –0.5 |
| 11 | Chlorsulfuron | –1.0 |
| 12 | Rimsulfuron | –1.5 |
| 13 | Nicosulfuron | –1.8 |
| 14 | Vamidothion | –4.2 |



# Shim-pack UC Series

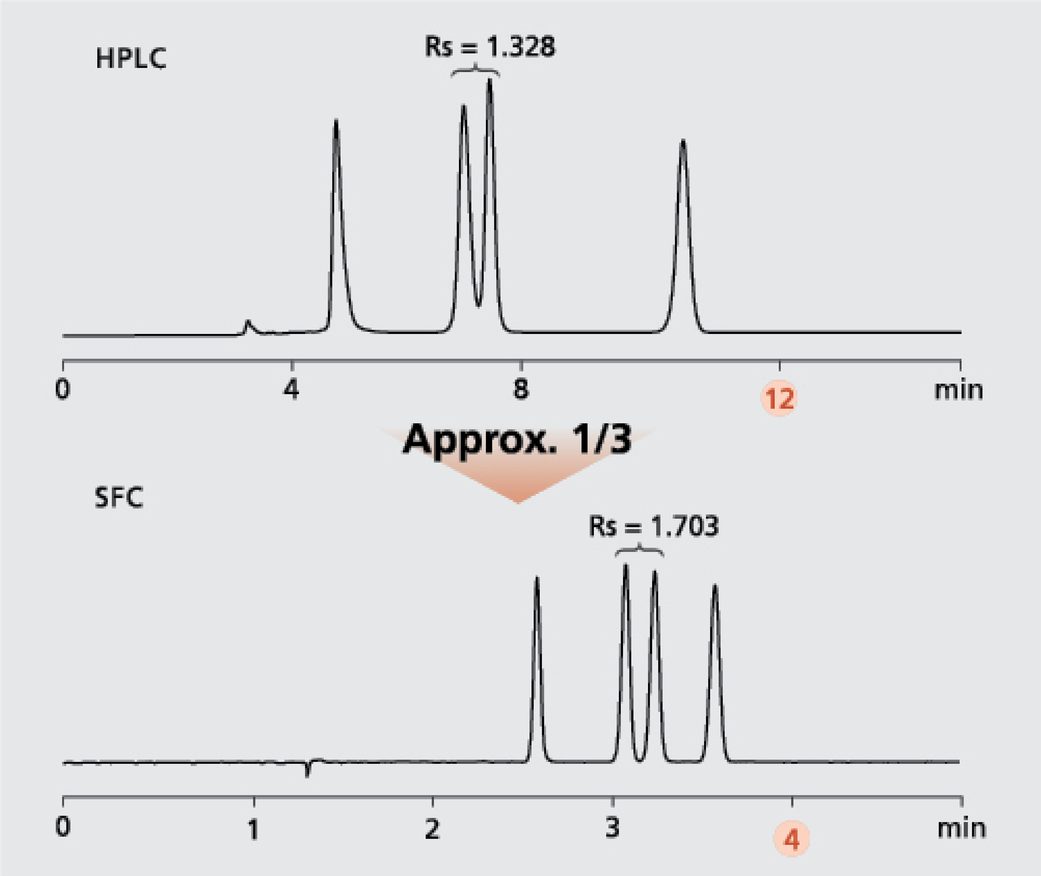
## Analytical Columns

| Column | Particle Size (µm) | I.D. (mm) / Length (mm) | 2.1 | 4.6 |
|---|---|---|---|---|
| Shim-pack UC RP | 3 | 150 | 227-30400-03 | 227-30401-03 |
| | | 250 | 227-30400-04 | 227-30401-04 |
| | 5 | 150 | 227-30402-03 | 227-30403-03 |
| | | 250 | 227-30402-04 | 227-30403-04 |
| Shim-pack UC GIS II | 3 | 150 | 227-30404-03 | 227-30405-03 |
| | | 250 | 227-30404-04 | 227-30405-04 |
| | 5 | 150 | 227-30406-03 | 227-30407-03 |
| | | 250 | 227-30406-04 | 227-30407-04 |
| Shim-pack UC Phenyl | 3 | 150 | 227-30424-03 | 227-30425-03 |
| | | 250 | 227-30424-04 | 227-30425-04 |
| | 5 | 150 | 227-30426-03 | 227-30427-03 |
| | | 250 | 227-30426-04 | 227-30427-04 |
| Shim-pack UC CN | 3 | 150 | 227-30428-03 | 227-30429-03 |
| | | 250 | 227-30428-04 | 227-30429-04 |
| | 5 | 150 | 227-30430-03 | 227-30431-03 |
| | | 250 | 227-30430-04 | 227-30431-04 |
| Shim-pack UC Diol | 3 | 150 | 227-30408-03 | 227-30409-03 |
| | | 250 | 227-30408-04 | 227-30409-04 |
| | 5 | 150 | 227-30410-03 | 227-30411-03 |
| | | 250 | 227-30410-04 | 227-30411-04 |
| Shim-pack UC Sil | 3 | 150 | 227-30412-03 | 227-30413-03 |
| | | 250 | 227-30412-04 | 227-30413-04 |
| | 5 | 150 | 227-30414-03 | 227-30415-03 |
| | | 250 | 227-30414-04 | 227-30415-04 |
| Shim-pack UC Amide | 3 | 150 | 227-30416-03 | 227-30417-03 |
| | | 250 | 227-30416-04 | 227-30417-04 |
| | 5 | 150 | 227-30418-03 | 227-30419-03 |
| | | 250 | 227-30418-04 | 227-30419-04 |
| Shim-pack UC NH2 | 3 | 150 | 227-30420-03 | 227-30421-03 |
| | | 250 | 227-30420-04 | 227-30421-04 |
| | 5 | 150 | 227-30422-03 | 227-30423-03 |
| | | 250 | 227-30422-04 | 227-30423-04 |
| Shim-pack UC-HyP | 3 | 150 | 227-32600-01 | - |
| | 5 | 250 | - | 227-32600-02 |
| Shim-pack UC-Py | 3 | 150 | 227-32601-01 | - |
| | 5 | 250 | - | 227-32601-02 |
| Shim-pack UC-PBr | 3 | 150 | 227-32602-01 | - |
| | 5 | 250 | - | 227-32602-02 |
| Shim-pack UC-Choles | 3 | 150 | 227-32603-01 | - |
| | 5 | 250 | - | 227-32603-02 |
| Shim-pack UC-PyE | 3 | 150 | 227-32604-01 | - |
| | 5 | 250 | - | 227-32604-02 |
| Shim-pack UC-Triazole | 3 | 150 | 227-32605-01 | - |
| | 5 | 250 | - | 227-32605-02 |
| Shim-pack UC-Sil II | 3 | 150 | 227-32607-01 | - |
| | 5 | 250 | - | 227-32607-02 |
| Shim-pack UC-Diol II | 3 | 150 | 227-32606-01 | - |
| | 5 | 250 | - | 227-32606-02 |

## Analysis Examples

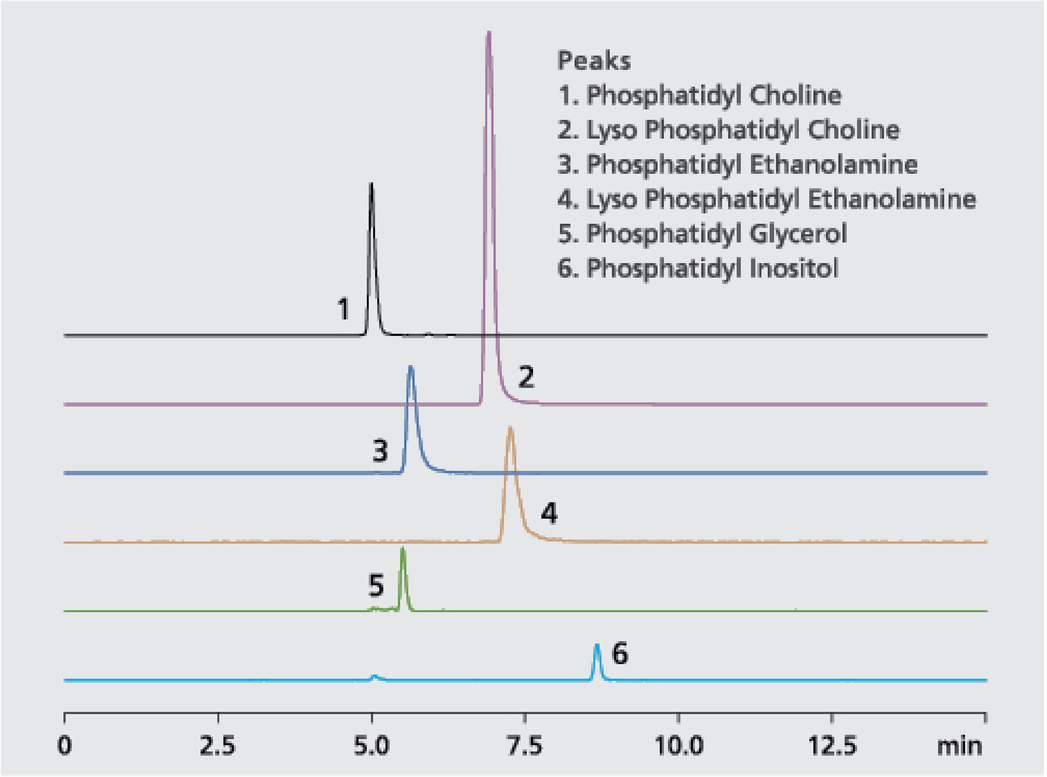
### Tocopherol Isomers

Isomers and structurally similar compounds that are difficult to separate can be analyzed by Nexera UC and Shim-pack UC series at a high speed. In the example below, four kinds of tocopherol isomers were analyzed by Nexera UC and Shim-pack UC Sil. As shown below, analysis time was reduced to one-third the time analysis takes with a conventional HPLC method while resolution was improved.




Comparison of retention and resolution of tocopherol isomers between LC conditions and SFC ones

### Phospholipid Classes




The example above shows the result of the analysis of phospholipid classes using Shim-pack UC Diol with Nexera UC. The ODS-based Shim-pack UC GIS II can also be used to analyze molecular species of phospholipids with the same modifiers. Nexera UC and Shim-pack UC series are ideal for analyzing complex samples.

## Preparative Columns

| Column | Particle Size (µm) | I.D. (mm) / Length (mm) | 10 | 20 | 28 |
|---|---|---|---|---|---|
| Shim-pack UC-HyP | 5 | 250 | 227-32600-03 | 227-32600-04 | 227-32600-05 |
| └ Guard Column | 5 | 20 | 227-32600-06 | - | - |
| Shim-pack UC-Py | 5 | 250 | 227-32601-03 | 227-32601-04 | 227-32601-05 |
| └ Guard Column | 5 | 20 | 227-32601-06 | - | - |
| Shim-pack UC-PBr | 5 | 250 | 227-32602-03 | 227-32602-04 | 227-32602-05 |
| └ Guard Column | 5 | 20 | 227-32602-06 | - | - |
| Shim-pack UC-Choles | 5 | 250 | 227-32603-03 | 227-32603-04 | 227-32603-05 |
| └ Guard Column | 5 | 20 | 227-32603-06 | - | - |
| Shim-pack UC-PyE | 5 | 250 | 227-32604-03 | 227-32604-04 | 227-32604-05 |
| └ Guard Column | 5 | 20 | 227-32604-06 | - | - |
| Shim-pack UC-Triazole | 5 | 250 | 227-32605-03 | 227-32605-04 | 227-32605-05 |
| └ Guard Column | 5 | 20 | 227-32605-06 | - | - |
| Shim-pack UC-Sil II | 5 | 250 | 227-32607-03 | 227-32607-04 | 227-32607-05 |
| └ Guard Column | 5 | 20 | 227-32607-06 | - | - |
| Shim-pack UC-Diol II | 5 | 250 | 227-32606-03 | 227-32606-04 | 227-32606-05 |

# Cannabis Analysis Columns

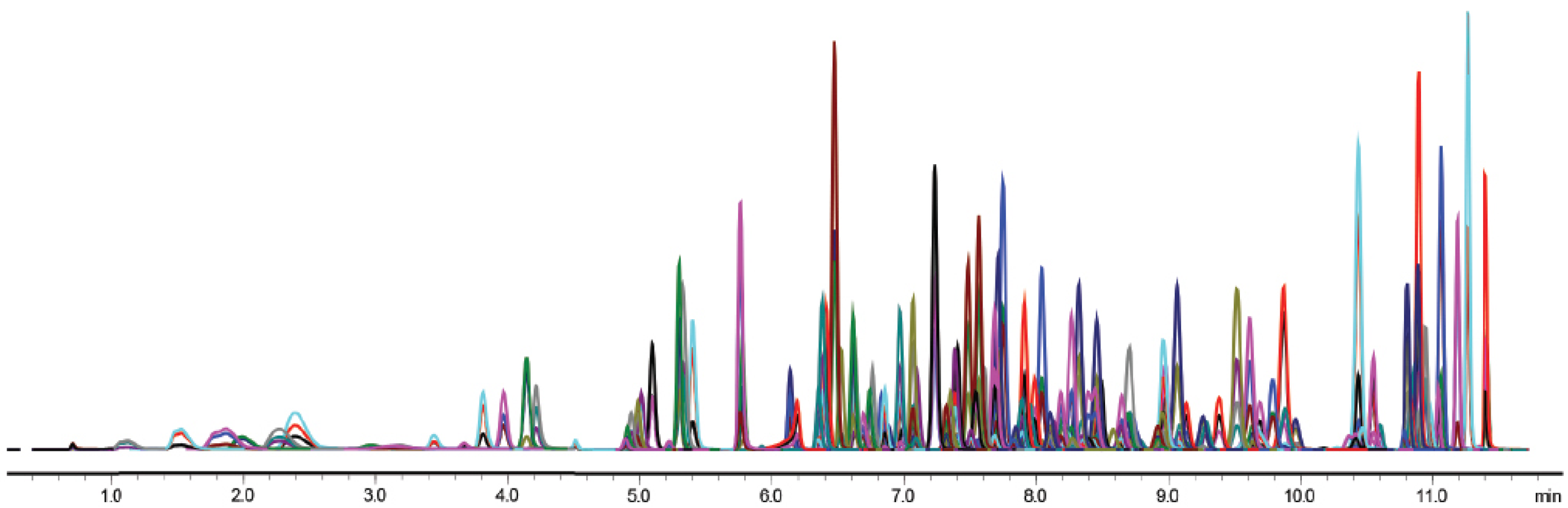
## NexLeaf® Columns

### Separating the Impossible

NexLeaf®, a superficially porous series of HPLC columns engineered to achieve the ultimate in resolution and sensitivity in the most challenging cannabis matrix. Each NexLeaf® column has both analytical and guard columns available.

## NexLeaf® for Pesticides

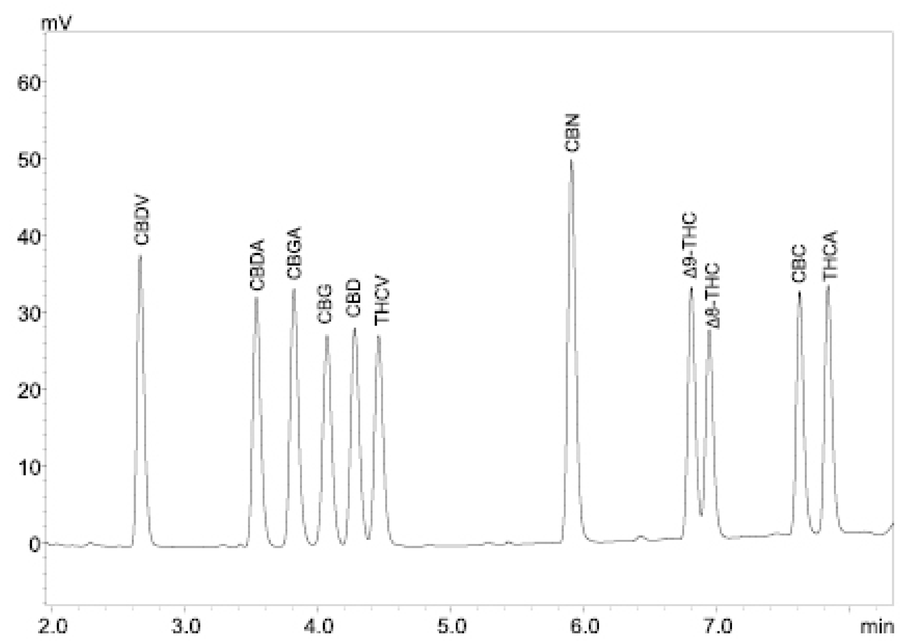
Provides the Ultimate separation for all your multi-residue pesticide analysis needs.




## NexLeaf® CBX™ for Potency

Designed for the best separations of cannabinoids allowing for accurate potency determination of each analyte.

| Part Number | Description |
|---|---|
| 220-91525-70 | NexLeaf CBX for Potency, 2.7µm, 4.6 X 150mm |
| 220-91525-71 | NexLeaf CBX for Potency, 2.7µm, 2.1 X 100mm |
| 220-91525-72 | NexLeaf CBX for Potency, 2.7µm, Guard Cartridge, 3/pk |
| 220-91525-73 | NexLeaf Guard Column Cartridge Holder |
| 220-91525-74 | NexLeaf for Pesticides, 2.7µm, 2.1 X 150mm |

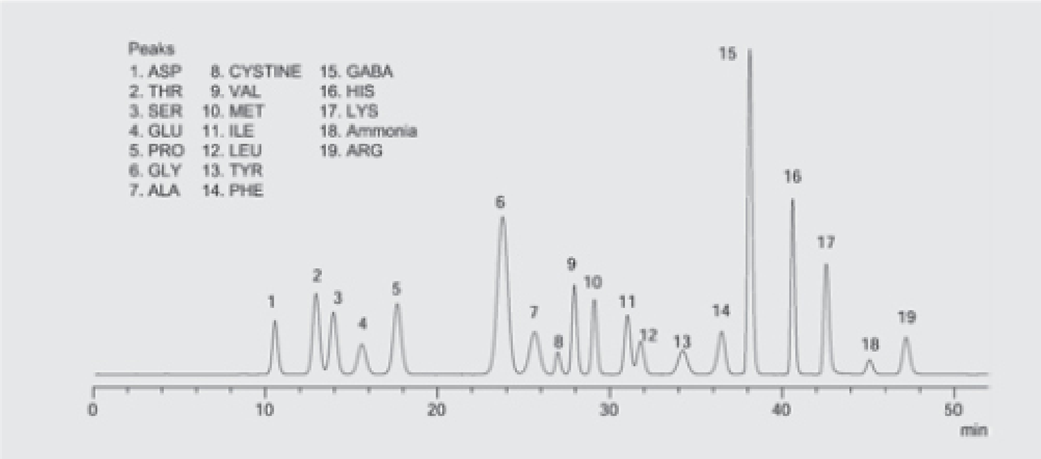


# Analysis of Amino Acids

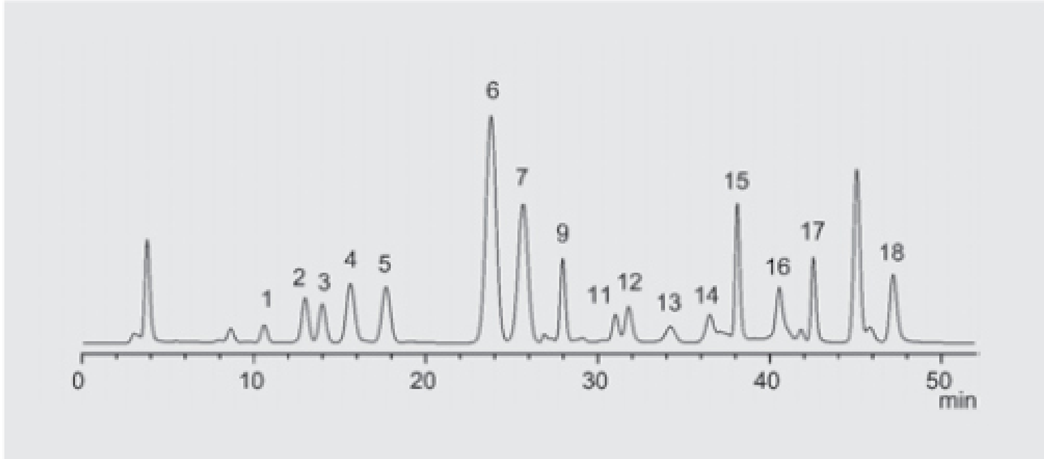
## Shim-pack Amino Series

### Examples of Cation Analysis

Shim-pack Amino series uses polystyrene gel as solid support, making it possible to utilize both electrostatic reaction and hydrophobic reaction. It is ideal for the analysis of amino acids.




Analysis of Amino Acid Standard



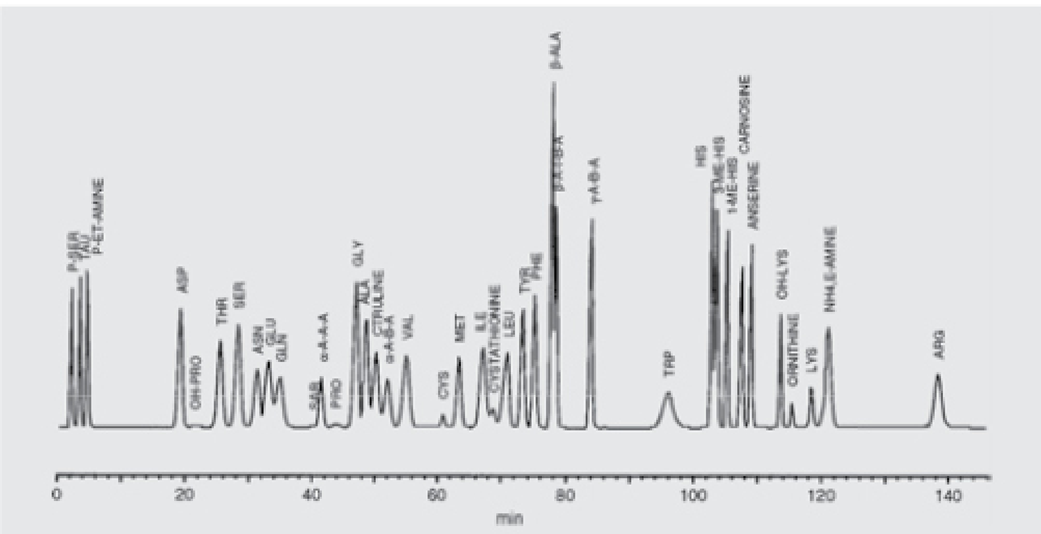

Analysis of Vinegar

**Conditions**

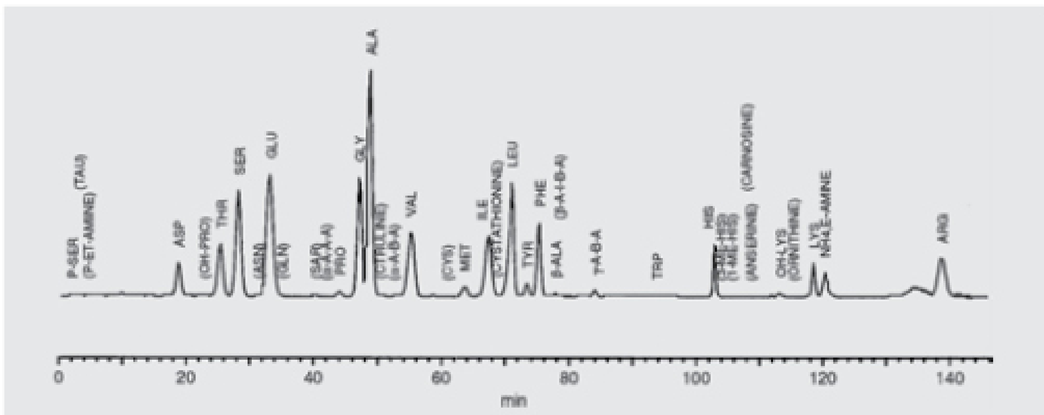
| | |
|---|---|
| **Column** | : Shim-pack Amino-Na (100 mmL × 6.0 mmI.D., 5 µm) (P/N: 228-18837-91) |
| **Mobile Phase** | : Mobile phase kit for amino acid analysis (Na Type) (P/N: 228-21195-94) |
| **Flow Rate** | : 0.4 mL/min |
| **Col. Temp.** | : 60 °C |
| **Detection** | : RF (Post-column derivation) |

**Peaks**

| | | | |
|---|---|---|---|
| 1. ASP | 6. GLY | 11. ILE | 16. HIS |
| 2. THR | 7. ALA | 12. LEU | 17. LYS |
| 3. SER | 8. CYSTINE | 13. TYR | 18. ARG |
| 4. GLU | 9. VAL | 14. PHE | |
| 5. PRO | 10. MET | 15. GABA | |




Simultaneous Analysis of 38 Amino Acids




Analysis of Soy Sauce

**Conditions**

| | |
|---|---|
| **Column** | : Shim-pack Amino-Li (100 mmL × 6.0 mmI.D., 5 µm) (P/N: 228-18837-92) |
| **Mobile Phase** | : Mobile phase kit for amino acid analysis (Li Type) (P/N: 228-21195-95) |
| **Flow Rate** | : 0.6 mL/min |
| **Col. Temp.** | : 39 °C |
| **Detection** | : RF-10AXL Ex. 350 nm, Em. 450 nm |

## Product Information

| Column | Stationary Phase | Particle Size (µm) | Dimensions (Length × I.D., mm) | P/N | Guard Column |
|---|---|---|---|---|---|
| Shim-pack AMINO-NA | Na type sulfone group | 5 | 100 × 6.0 | 228-18837-91 | 228-18837-93 * |
| Shim-pack AMINO-LI | Li type sulfone group | 5 | 100 × 6.0 | 228-18837-92 | - |

* Dedicated for the analysis of cyanide. Please do not use it in the analysis of amino acids.

In the analysis of amino acids, the following trap columns are required.

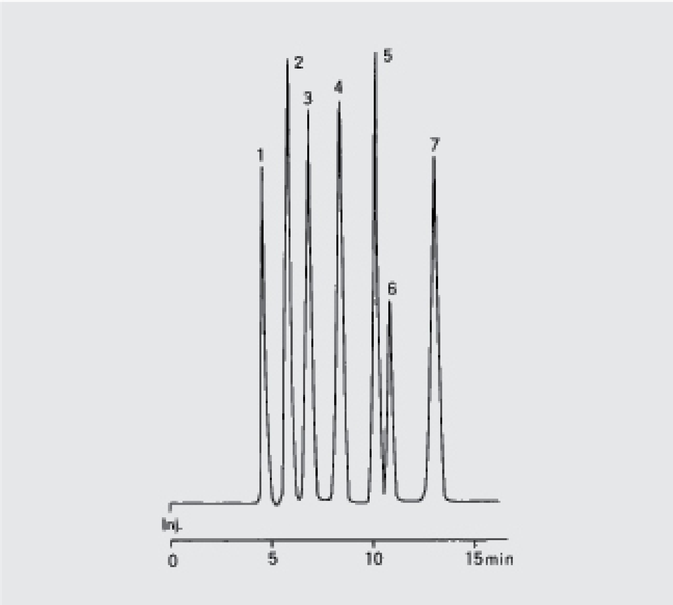
| Description | Dimensions (Length × I.D., mm) | P/N |
|---|---|---|
| ISC-30/S 0504 NA (For trapping Na type ammonia) | 50 × 4.0 | 228-14206-91 |
| ISC-30/S 0504 LI (For trapping Li type ammonia) | 50 × 4.0 | 228-00821-91 |

# Analysis of Sugar and Organic Acid

## Shim-pack SCR Series

Shim-pack SCR-101N/C/P are suitable for the analysis of monosaccharides. Since the samples are separated under a mixed mode of gel filtration and ligand exchange, the selectivity differs depending on the type of cation.

Shim-pack SCR-101H and SCR-102H are ion exclusion chromatography columns, using H type sulfonated styrene polymer as stationary phase. They are ideal for analysis of organic acids using an acid aqueous solution (e.g. aqueous solution of perchloric acid) as mobile phase.



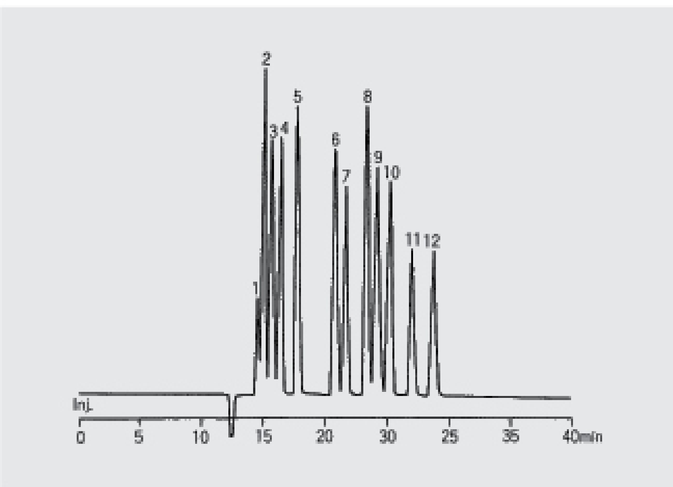

Analysis of Saccharide Standard

**Peaks**

1. PEG 4000
2. Maltose
3. Glucose
4. Fructose
5. Glycerol
6. Ethanol
7. Sorbitol

**Conditions**

| | |
|---|---|
| **Column** | : Shim-pack SCR-101C (300 mmL × 7.9 mmI.D., 10 µm) (P/N: 228-17889-91) |
| **Mobile Phase** | : Water |
| **Flow Rate** | : 1.0 mL/min |
| **Col. Temp.** | : 80 °C |
| **Detection** | : RID |




Analysis of Organic Acids

**Peaks**

1. Phosphoric acid
2. α-Ketoglutaric acid
3. Citric acid
4. Pyruvic acid
5. Malic acid
6. Succinio acid
7. Lactic acid
8. Formic acid
9. Fumaric acid
10. Acetic acid
11. Levulinic acid
12. Pyroglutamic acid

**Conditions**

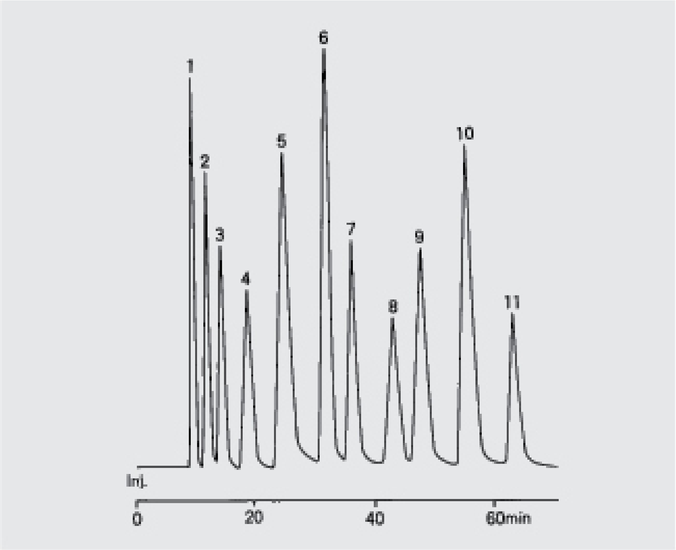
| | |
|---|---|
| **Column** | : Shim-pack SCR-102H (2 columns in series) (P/N: 228-17893-91) |
| **Mobile Phase** | : 5 mM p-Toluene sulfonic acids aqueous solution |
| **Flow Rate** | : 0.8 mL/min |
| **Col. Temp.** | : 40 °C |
| **Detection** | : CDD (pH buffer organic acids analysis system) |

## Product Information

| Column | Stationary Phase | Particle Size (µm) | Dimensions (Length × I.D., mm) | P/N | Guard Column |
|---|---|---|---|---|---|
| Shim-pack SCR-101N | Na type sulfone group | 10 | 300 × 7.9 | 228-07730-92 | 228-09619-92 |
| Shim-pack SCR-101C | Ca type sulfone group | 10 | 300 × 7.9 | 228-17889-91 | 228-17891-91 |
| Shim-pack SCR-101P | Pb type sulfone group | 10 | 300 × 7.9 | 228-17890-91 | 228-17892-91 |
| Shim-pack SCR-101H | H type sulfone group | 10 | 300 × 7.9 | 228-07730-93 | 228-09619-93 |
| Shim-pack SCR-102H | H type sulfone group | 7 | 300 × 8.0 | 228-17893-91 | 228-17924-91 |

## Shim-pack ISA/ISC Series

Shim-pack ISA/ISC series uses polystyrene gel as solid support, making it possible to utilize both electrostatic reaction and hydrophobic reaction. They are suitable for the analysis of sugars (ISA) and guanidiono compounds (ISC-05).




Analysis of Saccharides Standards

**Peaks**

1. Sucrose
2. Cellobiose
3. Maltose
4. Lactose
5. Rhamnose
6. Ribose
7. Mannose
8. Fructose
9. Galactose
10. Xylose
11. Giucose

**Conditions**

**Column** : Shim-pack ISA-07/S2504 (250 mmL × 4.0 mmI.D., 7 µm) (P/N: 228-09699-91)
**Mobile Phase** : Potassium borate buffer solution
gradient elution
**Flow Rate** : 0.6 mL/min
**Col. Temp.** : 65 °C
**Detection** : RF EX. 348 nm, Em. 430 nm
(Post-column derivatization with arginine)

## Product Information

| Column | Stationary Phase | Particle Size (µm) | Dimensions (Length × I.D., mm) | P/N | Guard Column |
|---|---|---|---|---|---|
| Shim-pack ISA-07/S 2504 | Quaternery ammonium group | 7 | 250 × 4.0 | 228-09699-91 | 228-00823-91 |
| Shim-pack ISC-05/S 0504 | Na type sulfone group | 5 | 38 × 4.6 | 228-09700-91 | 228-00802-91 |
| Shim-pack ISC-07/S 1504 | Na type sulfone group | 7 | 150 × 4.0 | 228-09328-91 | |
| Shim-pack ISC-07/S 1504 Li | Li type sulfone group | 7 | 150 × 4.0 | 228-00796-91 | 228-00797-91 |

Check out more Application Systems at
www.shimadzu.com/an/hplc

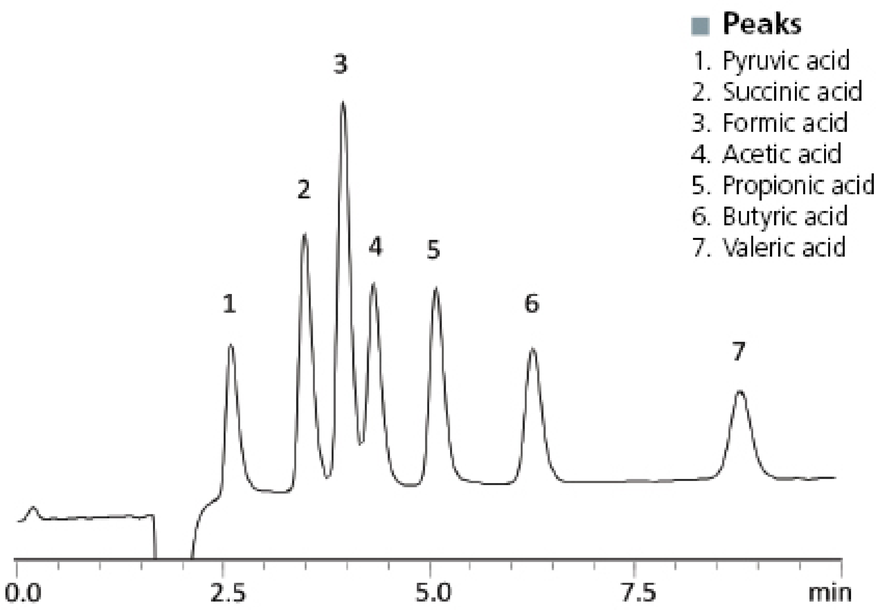
# Shim-pack Fast-OA

## High-speed analysis of organic acids

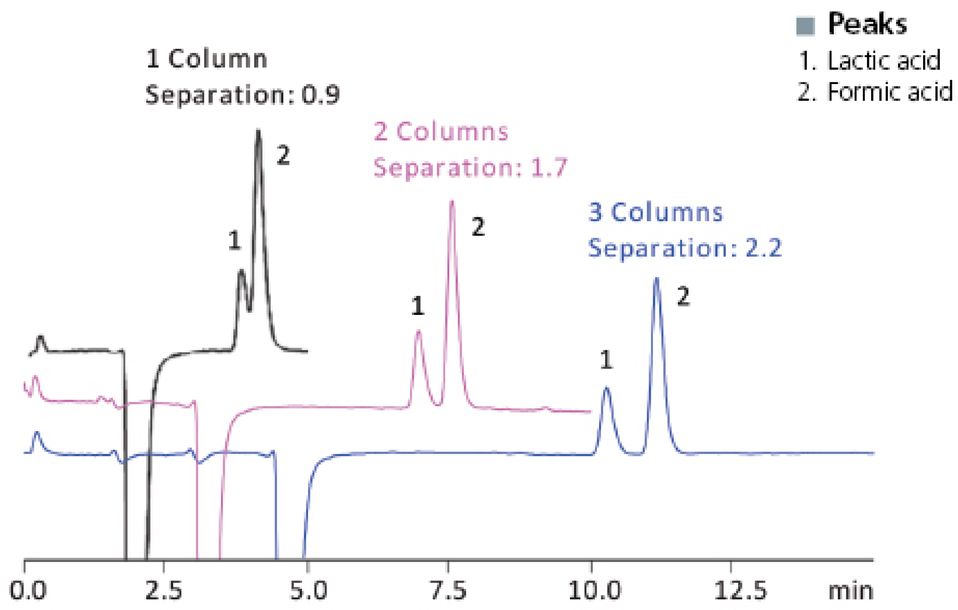
Shim-pack Fast-OA columns are packed with an ion-exclusion polymer, and utilizing an acidic mobile phase, can separate mixture solutions based on the pKa value of each sample component. The Shim-pack Fast-OA is a column for the high speed analysis of organic acids. It can separate multiple organic acids in a short time and supports real-time monitoring of their concentration levels.

### Analysis Examples

**Analysis of Short-Chain Fatty Acids**




**Improved Separation: Columns in Series**




Because the column design is optimized for the high-speed analysis of organic acids, even short-chain fatty acids such as valeric acid are eluted within 10 minutes. If separation with one column is not enough, up to three Shim-pack Fast-OA columns can be connected in series to improve the separation

**Conditions**

| | | |
|---|---|---|
| **Column** | : | Shim-pack Fast-OA (P/N: 228-59942-41) + Shim-pack Fast-OA (G) (P/N: 228-59942-42) |
| **Mobile Phase** | : | 5 mmol/L p-Toluenesulfonic acid |
| **pH buffering solution** | : | 5 mmol/L p-Toluenesulfonic acid, 20 mmol/L Bis- Tris, 0.1 mmol/L EDTA |
| **Flow Rate** | : | 0.8 mL/min |
| **Detection** | : | Conductivity Detector (CDD-10AVP) |

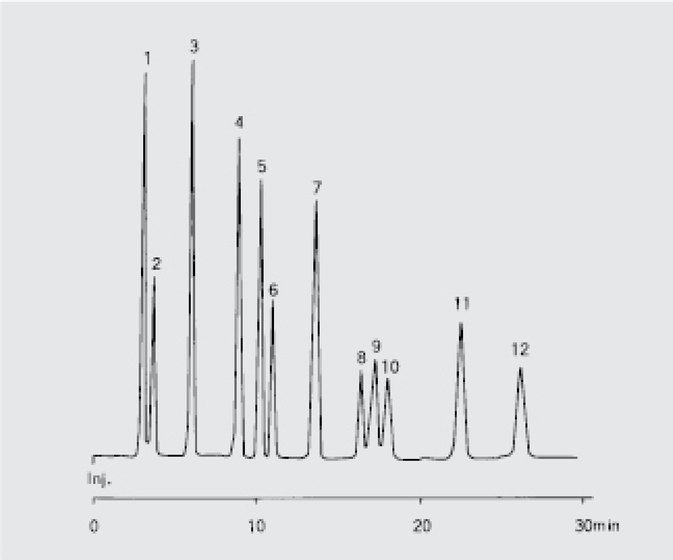
## Product Information

| Product Name | Length x I.D. | Part Number |
|---|---|---|
| Shim-pack Fast OA | 100 mm x 7.8 mm | 228-59942-41 |
| Guard column + Holder | 10 mm x 4.0 mm | 228-59942-42 |
| Guard column (4 pcs) | 10 mm x 4.0 mm | 228-59942-43 |

# Analysis of Nucleotides, Oligonucleotides and Protein

## Shim-pack WAX/WCX Series

Shim-pack WAX/WCX series columns are chemically-bonded hydrophilic silica gel based ion exchange columns. Shim-pack WAX-1 is ideal for analysis of nucleotides and oligonucleotides while Shim-pack WAX-2 and WCX-1 is ideal for analysis of proteins.



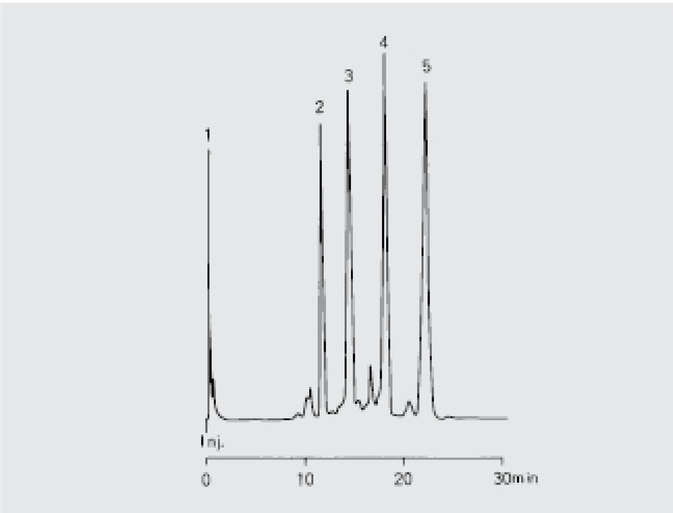

Analysis of Mononucleotides

**Peaks**

1. UMP
2. CMP
3. AMP
4. GMP
5. UDP
6. CDP
7. ADP
8. UTP
9. GDP
10. CTP
11. ATP
12. GTP

**Conditions**

**Column** : Shim-pack WAX-1 (50 mmL × 4.0 mmI.D., 3 µm) (P/N: 228-16225-91)
**Mobile Phase** : A) 20mM phosphate buffer solution (pH 7)
B) 480mM phosphoric acid buffer solution (pH 6.85)
gradient elution
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 45 °C
**Detection** : UV 260 nm




Analysis of Protein Standard

**Peaks**

1. Ovalbumin
2. Myoglobin
3. α-Chymotrypsinogen A
4. Ribonuclease A
5. Lysozyme

**Conditions**

**Column** : Shim-pack WCX-1 (50 mmL × 4.0 mmI.D., 5 µm) (P/N: 228-16366-91)
**Mobile Phase** : A) 20mM phosphate buffer solution (pH 6.0)
B) Sodium sulfate
gradient elution
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : Ambient
**Detection** : UV 415 nm

## Product Information

| Column | Stationary Phase | Particle Size (µm) | Dimensions (Length × I.D., mm) | P/N |
|---|---|---|---|---|
| Shim-pack WAX-1 | Tertiary amino group | 3 | 50 × 4.0 | 228-16225-91 |
| Shim-pack WAX-1 | Tertiary amino group | 3 | 150 × 4.6 | 228-16225-92 |
| Shim-pack WAX-1T | Tertiary amino group | 3 | 50 × 4.6 | 228-18257-91 |
| Shim-pack WAX-2 | Tertiary amino group | 5 | 50 × 4.0 | 228-16365-91 |
| Shim-pack WCX-1 | Carboxyl group | 5 | 50 × 4.0 | 228-16366-91 |
| Pre-column Diol * | Diol group | 10 | 50 × 4.0 | 228-16367-91 |

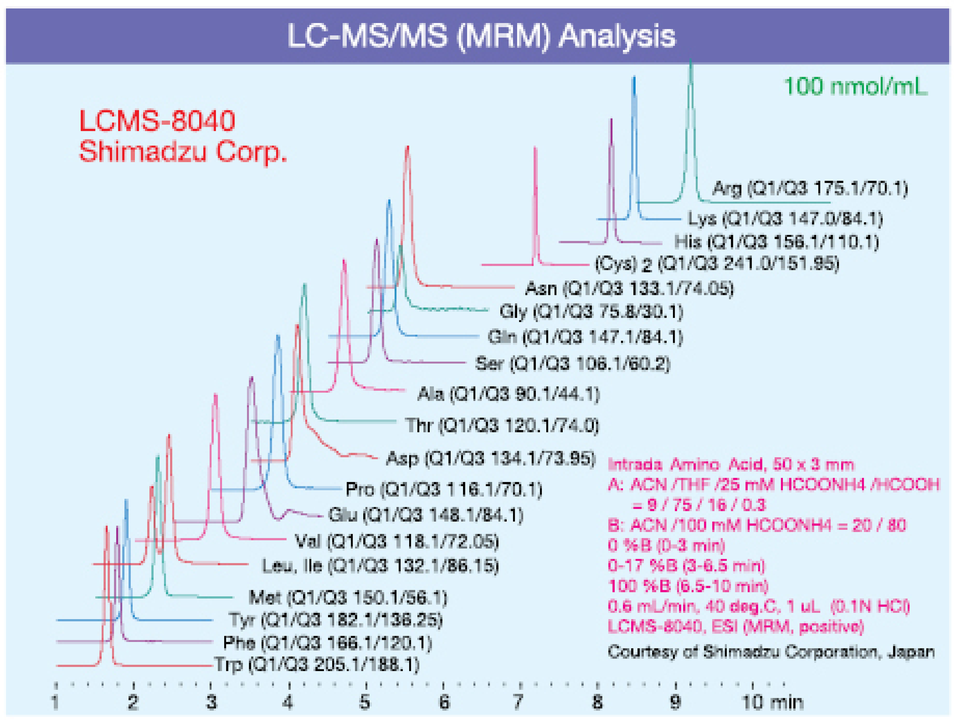
* Installed between the liquid pump and the sample injector to protect the column.

# Intrada Amino Acid column

The world's first specialty column for intact amino acid analysis via LC-MS Compatible with conventional LC-MS, providing fast and easy amino acid analysis without sample derivatization. Ability to separate isobaric amino acids such as Leu and Ile. High-throughput (<1 minute) analysis for selected amino acids, 5-10 minutes for standard amino acids analysis.

## Features

- For analysis of amino acids that couples well with MS detection and does not require use of an amino acid analysis system:
- When coupled to LCMS the Intrada Amino Acid column achieves high-throughput analysis without requiring tedious pre- or post-labeling methods
- Use of various column dimensions can aid in optimizing analytical time and resolution for different amino acid samples
- Separation of leucine and isoleucine isomers, GABA isomers and dipeptides analysis is now possible
- Separation free amino acids in mixtures
- Study protein amino acid composition
- Isolate amino acid bio-markers




| Particle Size (µm) | Length/ mm | ID | | |
|---|---|---|---|---|
| | | 1 mm | 2 mm | 3 mm |
| 3 | 10 | - | APAIMT-WAA20 | APAIMT-WAA30 |
| | 20 | - | APAIMT-WAA29 | APAIMT-WAA39 |
| | 30 | APAIMT-WAA11 | APAIMT-WAA21 | APAIMT-WAA31 |
| | 50 | APAIMT-WAA12 | APAIMT-WAA22 | APAIMT-WAA32 |
| | 75 | APAIMT-WAA13 | APAIMT-WAA23 | APAIMT-WAA33 |
| | 100 | APAIMT-WAA14 | APAIMT-WAA24 | APAIMT-WAA34 |
| | 150 | APAIMT-WAA15 | APAIMT-WAA25 | APAIMT-WAA35 |
| | 250 | APAIMT-WAA16 | APAIMT-WAA26 | APAIMT-WAA36 |

# Ion Chromatography Columns

## Shim-pack IC Series

Ion chromatography (IC) is used for analysis of inorganic and organic ions. It is categorized as suppressor IC and non-suppressor IC. Non-suppressor IC is composed of a conventional HPLC system combined with a conductivity detector, while suppressor IC requires an extra suppressor.

| | | | |
|---|---|---|---|
| Non-Suppressor Type | Anion Analysis | Shim-pack IC-A1 | Capable of analyzing inorganic anions. Compatible with acid or basic mobile phases of wide pH range. |
| | | Shim-pack IC-A3 | Provides outstanding separation efficiency in the analysis of inorganic anions and acid ions, especially when weakly acid mobile phase is used. |
| | Cation Analysis | Shim-pack IC-C1 | Capable of analyzing cations such as alkaline metal ions, alkali earth metal ions, transition metal ions, rare earth metal ions, and alkyl amines. |
| | | Shim-pack IC-C4 | Capable of simultaneous analysis of alkali metal ions and alkaline earth metal ions. Enhances the separation of sodium and ammonium ions. |
| Suppressor Type | Anion Analysis | Shim-pack IC-SA2 | Capable of determining fluoride ions, chloride ions, nitrite ions, bromide ions, nitrate ions, phosphate ions and sulfuric acid ions. |
| | | Shim-pack IC-SA3 | Provides high-resolution performance when analyzing fluoride ions, chloride ions, nitrous acid ions, bromide ions, nitric acid ions, phosphate ions and sulfuric acid ions as well as chlorous acid ions, chloric acid ions and bromic acid ions. |
| | Cation Analysis | Shim-pack IC-SC1 | Also can be used in non-suppressor IC. Suitable for the analysis of water quality. |

# Shim-pack IC Series

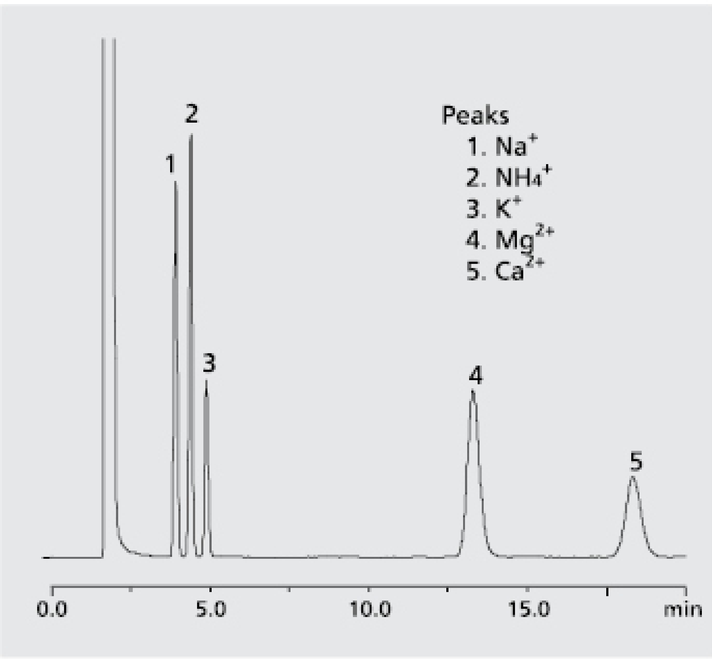
## Analysis Examples

### Examples of Cation Analysis

Shim-pack IC-C4 is a cation analysis column for non-suppressor IC. Because the pH of the mobile phase can be changed by selecting a different combination of acid and base in eluent, non-suppressor IC enables various kinds of analysis.

**High Resolution of Na+ and NH4+**

High resolution of Na+ and NH4+ has been achieved by improving the peak shape of Na+. The influence on the peak shape of NH4+ from a high concentration of Na+ has been reduced, making it possible to analyze tap water of normal concentration under standard mobile phase conditions. The resolution can be further improved by using a mobile phase treated with 18-crown-6 additive.



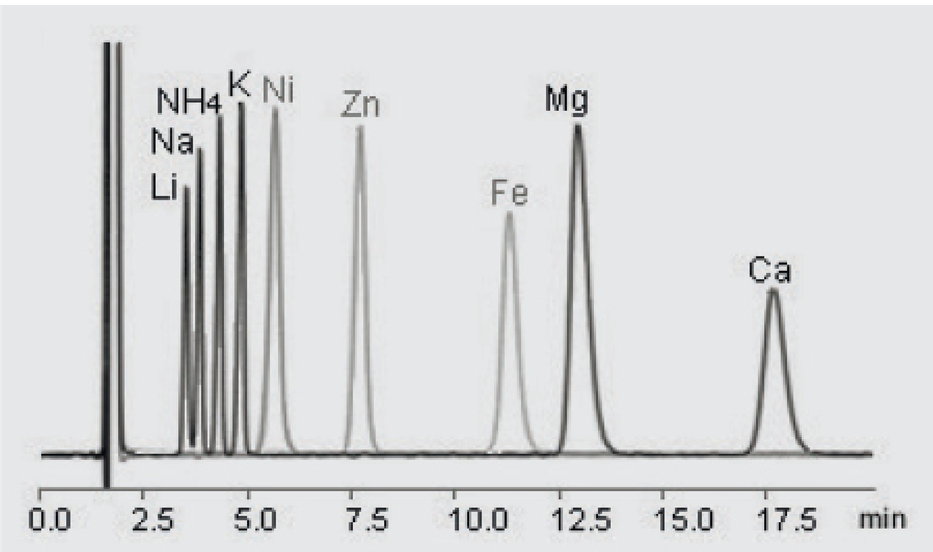

Analyses of a Standard Mixture of 5 Cations

**Conditions**

| | |
|---|---|
| **Column** | : Shim-pack IC-C4 (150 mmL × 4.6 mmI.D., 7 µm) (P/N: 228-41616-91) |
| **Mobile Phase** | : 2.5 mmol/L oxalic acid |
| **Flow Rate** | : 1.0 mL/min |
| **Col. Temp.** | : 40 °C |
| **Detection** | : CDD |
| **Injection Vol.** | : 50 µL |

**Flexible Mobile Phase Selection**

Due to the features of non-suppressor IC, flexible mobile phase composition can be used. Besides normal inorganic cations, Shim-pack IC-C4 is capable of analyzing transition metals by using a mixed mobile phase.



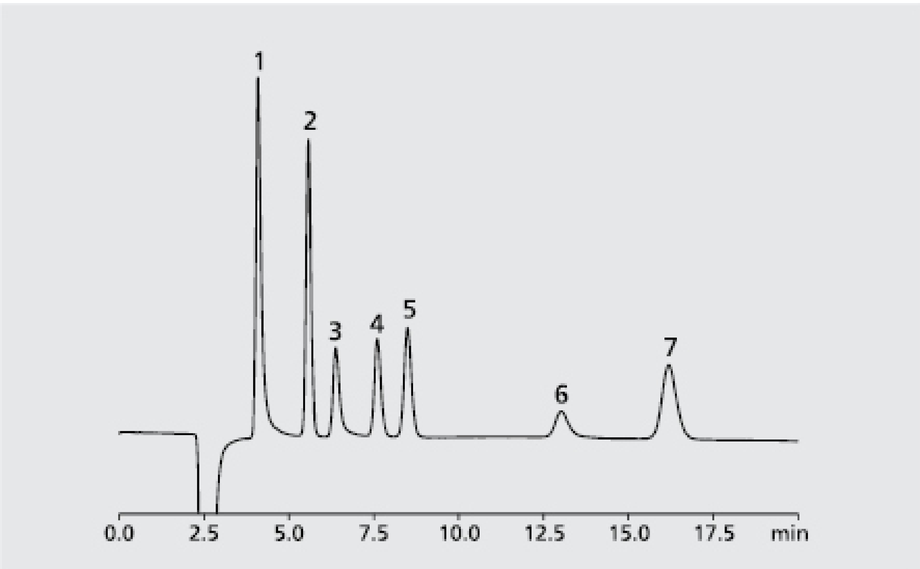

**Conditions**

| | |
|---|---|
| **Column** | : Shim-pack IC-C4 (150 mmL × 4.6 mmI.D., 7 µm) (P/N: 228-41616-91) |
| **Mobile Phase** | : A) 2.5 mmol/L oxalic acid<br>B) 2.5 mmol/L methanesulfonic acid<br>A/B = 60/40 (v/v) |
| **Flow Rate** | : 1.0 mL/min |
| **Col. Temp.** | : 40 °C |
| **Detection** | : CDD |
| **Injection Vol.** | : 50 µL |

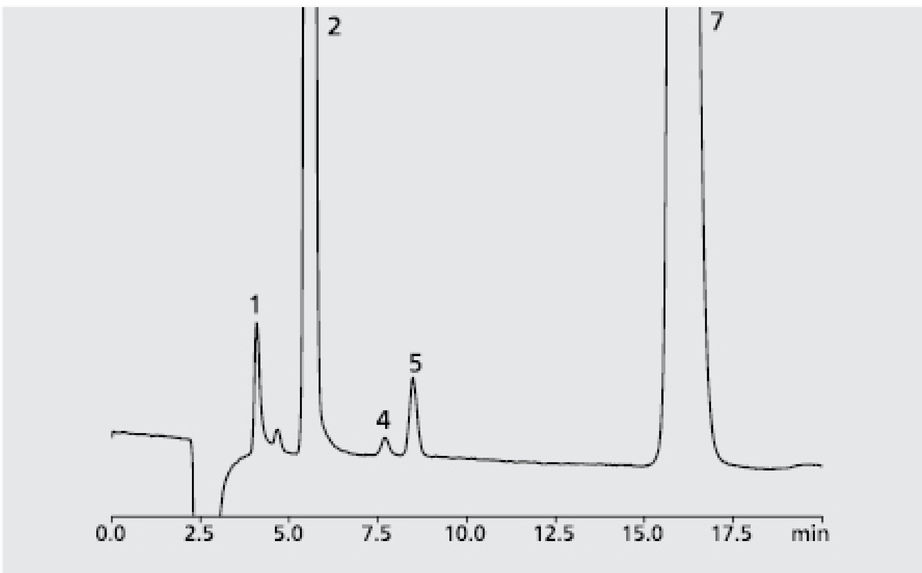
## Analysis of Anions in Water

Shim-pack IC-SA2 was developed for anion analysis with a Shimadzu Ion Chromatograph HIC-SP (suppressor type). It is capable of analyzing fluoride ions, chloride ions, nitrite ions, bromide ions, nitrate ions, phosphate ions, sulfate ions, etc., making it possible to be used in both tap water and environmental water analysis.

### Analysis Examples




Analysis of Standard Anion Samples




Analysis of Tap Water

**Conditions**

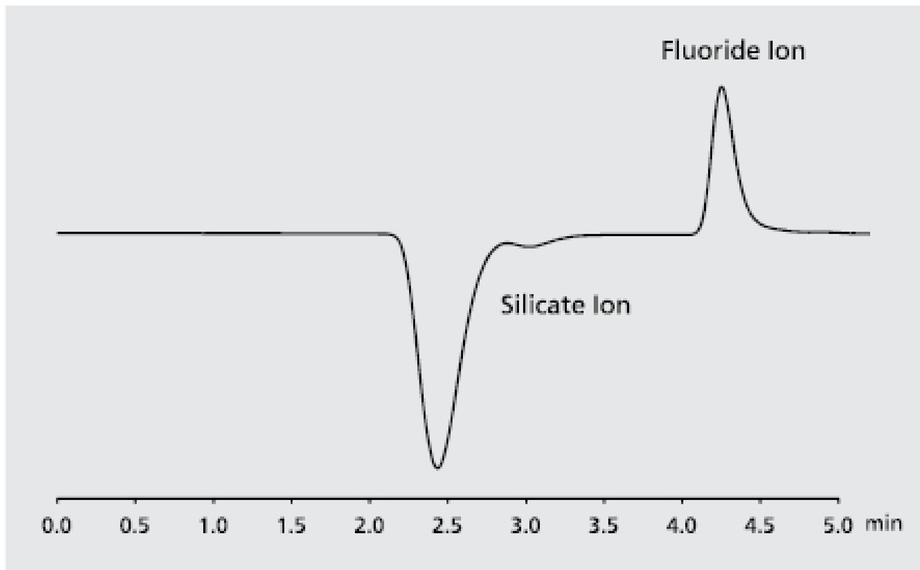
| | |
|---|---|
| **Column** | : Shim-pack IC-SA2 (250 mmL. × 4.0 mmI.D.) (P/N: 228-38983-91) |
| **Mobile Phase** | : A) 12 mmol/L sodium hydrogen carbonate<br>B) 0.6 mmol/L sodium carbonate<br>A/B = 60/40 (v/v) |
| **Flow Rate** | : 1.0 mL/min |
| **Col. Temp.** | : 30 °C |
| **Detection** | : CDD |
| **Injection Vol.** | : 50 µL |

**Peaks (1 mg/L each)**

1. F
2. Cl
3. $NO_2$
4. Br
5. $NO_3$
6. $PO_4$
7. $SO_4$

**High-Resolution Determination of the Components in Water-Quality Analysis**

Environmental water and mineral water usually contain silicate. In this kind of analysis, although the water sample contains a large amount of silicic acid, fluoride ions can still be separated and determined with high resolution (same mobile phase as above was used).



## Product Information

| Column | Stationary Phase | Particle Size (µm) | Dimensions (Length × I.D., mm) | P/N | Guard Column |
|---|---|---|---|---|---|
| Shim-pack IC-A1 | Quaternary ammonium group | 12.5 | 100 × 4.6 | 228-17733-91 | 228-17734-91 |
| Shim-pack IC-A3 | Quaternary ammonium group | 5 | 150 × 4.6 | 228-31076-91 | 228-31076-92 |
| Shim-pack IC-A3 (S) *1 | Quaternary ammonium group | 5 | 150 × 2.0 | 228-33366-91 | |
| Shim-pack IC-C1 *2 | Sulfone group | 10 | 150 × 5.0 | 228-17737-91 | 228-17738-91 |
| Shim-pack IC-C1 PEEK | Sulfone group | 10 | 100 × 4.6 | 228-33497-91 | 228-33497-92 |
| Shim-pack IC-C4 | Carboxyl group | 7 | 150 × 4.6 | 228-41616-91 | 228-59900-91 (Cartridge + Holder) |
| | | | | | 228-59900-92 (Cartridge only) |
| Shim-pack IC-SA2 | Quaternary ammonium group | 9 | 250 × 4.0 | 228-38983-91 | 228-38983-92 |
| Shim-pack IC-SA3 | Quaternary ammonium group | 5 | 250 × 4.0 | 228-41600-91 | 228-41600-92 |
| Shim-pack IC-SC1 | Carboxylic group | 6 | 150 × 4.6 | 228-36605-91 | 228-36605-92 |

*1 Shim-pack IC(S) series are for semi-micro LC. PIA-1000 is required.
*2 During the analysis of alkali metal ions with the Shim-pack IC-C1, it is recommended to use a pre-column Shim-pack IC-PC1 (P/N:228-17744-91) installed between the liquid pump and the sample injector.

More Free Literature at www.shimadzu.com/an

# Shim-pack Ultron PS-Series

## Shim-pack ULTRON PS-80H

Shim-pack ULTRON PS-80H columns are HPLC columns packed with a sulfonic acid type polystyrene cation exchange resin designed for organic acid analyses.

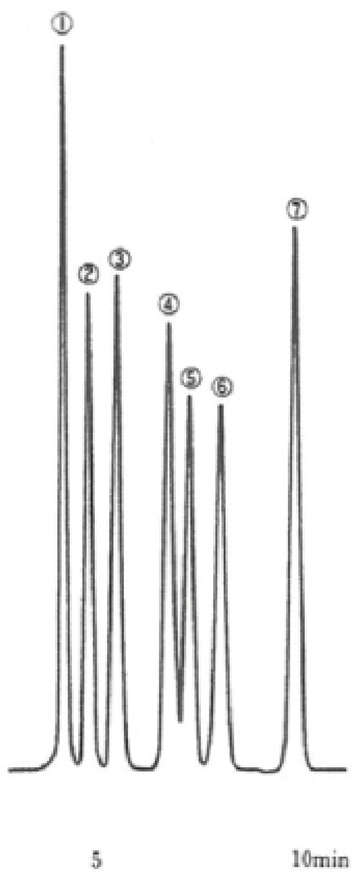
- Utilize electrostatic repulsion interactions.
- Display excellent retention reproducibility.
- Durable due to the use of a mechanically strong polymer gel.
- ph range pH 2-6
- USP L17

Applications: Aliphatic, aromatic organic acids / Alcohols, aldehydes, diols / Monitoring of fermentation processes

Fittings: Waters compatible

Maximum operating pressure: 40 kgf/cm²

Maximum operating temperature: 90°C




**Elution Position of Sugar and Sugar Alcohol for PS-80N**

1. Dextran T-10
2. Lactose
3. Galactose
4. Ethanol
5. Raffinose
6. Glucose
7. Arabinose

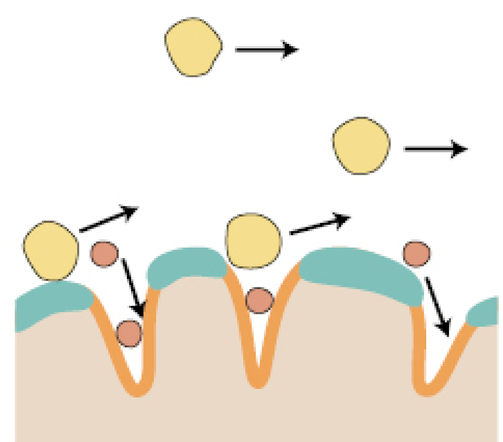
**Column** : ULTRON PS-80N, 300 mm x 8.0 mm I.D. (P/N: 226-80001-01)
**Mobile Phase** : $H_2O$
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 60 °C
**Detection** : RI, 16x10-5 RIUFS

| Column | Particle Size (µm) | I.D (mm) | Length (mm) | | | Guard column (50 x 8.0) |
|---|---|---|---|---|---|---|
| | | | 250 | 300 | 500 | |
| PS-80H | 10 | 8.0 | - | 226-80001-01 | - | 226-80003-91 |
| | | 2.0 | 226-80002-01 | - | - | - |

# Shim-pack MAYI Series

Due to optimized particle size and a newly developed coating technology, the MAYI series online pretreatment column is highly effective in deproteinization and offers long-term stability. It provides excellent reproducibility even for continuous analysis of multiple analytes.

## How the Shim-pack MAYI Series Works



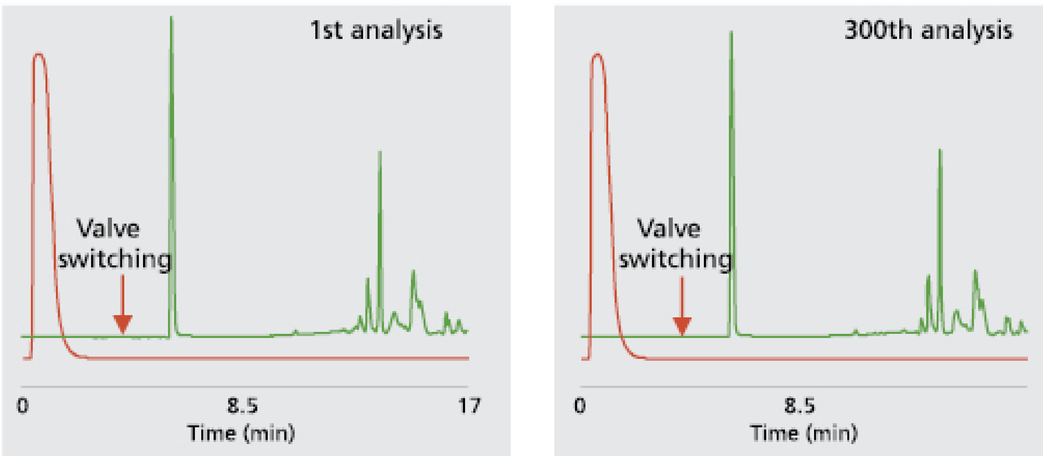
The outer surfaces of silica gel (50 µm) are coated with a hydrophilic polymer, so that only the interior of pores are chemically modified by octadecyl radicals (ODS). Since proteins and other macromolecules cannot enter the pores and are blocked by the hydrophilic polymer on the outer surfaces, they are quickly eluted without being retained by the ODS solid phase. In contrast, pharmaceuticals and other induced low molecular weight compounds penetrate the pores and are retained by the inner surfaces of the stationary phase.

## Quick and Reliable Protein Removal

The newly developed hydrophilic polymer coating technology quickly and reliably removes macromolecules, such as protein, from injected biological samples to achieve high recovery rates for target components. In addition to securely protecting analytical columns and LC/MS interfaces, this also helps reduce the time required for finishing the analysis.

## Outstanding Durability

Due to the polymer coating technology and particle size optimization, stable data can be obtained for long periods. The figure below shows results from 300 consecutive injections of 100 µL of blood plasma. No decrease in the deproteinization rate or degradation of peak shape was observed.




Comparison of 1st and 300th Analyses

**Conditions**

| | | |
|---|---|---|
| **Samples** | : | Isopropylantipyrine added Blood plasma<br>Sample solution: 0.1% phosphoric acid and acetonitrile mixture (95:5)<br>Dilution: 8 times |
| **Detection** | : | Analysis: 275 nm, Blood plasma matrix: 280 nm |
| **Injection Vol.** | : | 100 µL |

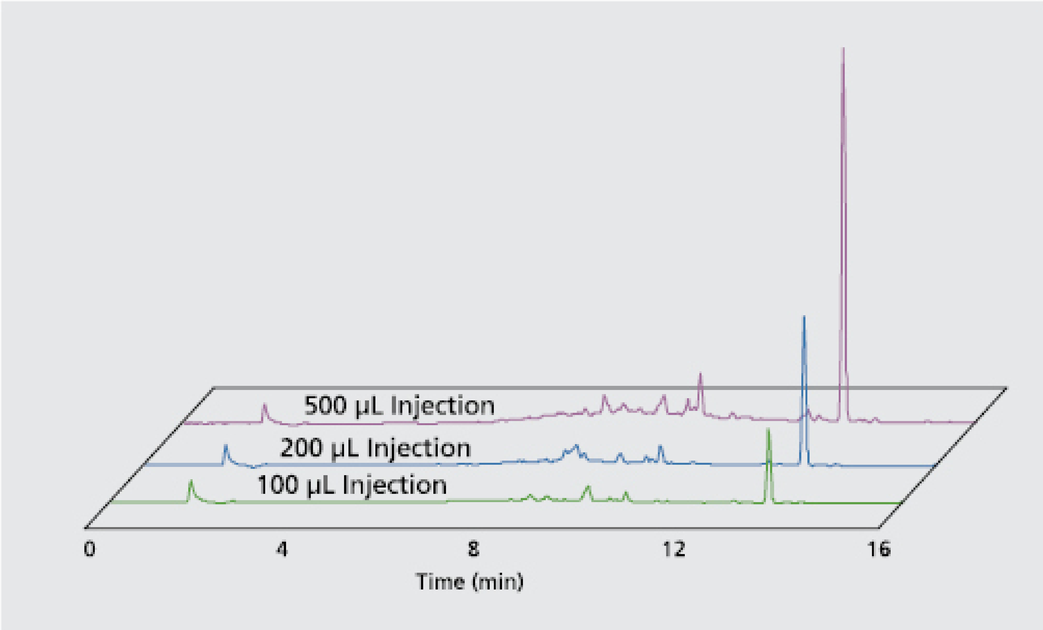
## Stable Trap Even for Large Injection Volumes

The Shim-pack MAYI-ODS column provides stable component recovery rates and protein removal, even when injecting large volumes. Even when 500 µL of blood plasma was directly injected, a high recovery rate was obtained and no peak distortion was observed.

**Conditions**

**Samples** : Indomethacin added Blood plasma
Sample solution: 0.1% phosphoric acid and acetonitrile mixture (95:5)
Dilution: 8 times

**Detection** : UV 315 nm




Comparison Data for Injecting 100, 200, and 500 µL

## Product Information

| Column | Stationary Phase | Separation Mode |
|---|---|---|
| Shim-pack MAYI-ODS(G) | Octadecyl group | Strongest retentivity in reversed phase mode |
| Shim-pack MAYI-C14(G) | Tetradecyl group | Retentivity next to ODS in reversed phase mode |
| Shim-pack MAYI-C8(G) | Octyl group | Retentivity next to C14 in reversed phase mode |
| Shim-pack MAYI-C4(G) | Butyl group | Retentivity next to C8 in reversed phase mode |
| Shim-pack MAYI-C1(G) | Methyl group | Weakest retentivity in reversed phase mode |
| Shim-pack MAYI-SCX(G) | Sulfonic acid group | Strong acid cation exchange mode |
| Shim-pack MAYI-SAX(G) | Trimethylammonium group | Weakly basic anion exchange mode |

### Cartridge

| Column | Particle Size (µm) | Dimensions (Length × I.D., mm) | P/N |
|---|---|---|---|
| Shim-pack MAYI-ODS | 50 | 5 × 2.0 | 228-40835-93 |
| | | 10 × 2.0 | 228-40835-95 |
| | | 10 × 4.6 | 228-40835-91 |
| | | 30 × 4.6 | 228-40835-97 |
| Shim-pack MAYI-C1 | 50 | 10 × 4.6 | 228-46185-91 |
| Shim-pack MAYI-C4 | 50 | 10 × 4.6 | 228-46186-91 |
| Shim-pack MAYI-C8 | 50 | 10 × 4.6 | 228-46187-91 |
| Shim-pack MAYI-C14 | 50 | 10 × 4.6 | 228-46188-91 |
| Shim-pack MAYI-SAX | 50 | 10 × 4.6 | 228-45366-91 |
| | | 30 × 4.6 | 228-45366-93 |
| Shim-pack MAYI-SCX | 50 | 10 × 4.6 | 228-45370-91 |
| | | 30 × 4.6 | 228-45370-93 |

### Column Holder

| Dimensions (Length × I.D., mm) | P/N |
|---|---|
| 5 × 2.0 | 228-34938-94 |
| 10 × 2.0 | 228-34938-98 |
| 10 × 4.6 | 228-34938-92 |
| 30 × 4.6 | 228-34938-96 |

# Shim-pack SPC Series

Shim-pack SPC series is specifically developed for online sample preparation systems that utilize a column switching method.

Shim-pack SPC-RP column is packed with polymer particles and used for reversed phase LC.

Shim-pack SPC-AE1 column is packed with fully porous silica gel particles on which weakly basic anion exchange functions are chemically bonded.

## Product Information

| Column | Stationary Phase | Separation Mode | Particle Size (µm) | Dimensions (Length × I.D., mm) | P/N |
|---|---|---|---|---|---|
| Shim-pack SPC-RP3 | Polymer | Reversed phase | 9 | 30 × 4.0 | 228-33713-91 |
| Shim-pack SPC-RP2 | Polymer | Reversed phase | 10 | 10 × 4.6 | 228-18838-91 |
| Shim-pack SPC-AE1 | Tertiary amino group | Anion exchange | 10 | 10 × 4.0 | 228-17990-91 |

Check out Online Sample Preparation Co-Sense Series at
www.shimadzu.com/an/hplc

# Ultron Series LC Columns

| Separation Mode | Column | USP Code | Application |
|---|---|---|---|
| Chiral Separation Chromatography | ULTRON ES-OVM | L57 | Optical Isomers of Medicines, Pesticides |
| | ULTRON ES-PEPSIN | - | |
| | ULTRON ES-BSA | - | |
| | ULTRON ES-CD | L45 | |
| | ULTRON ES-PhCD | L45 | |
| Ion Exclusion Chromatography | ULTRON PS-80H | L17 | Organic Acids and Alcohols |
| Ligand Exchange Chromatography | ULTRON PS-80N | L58 | Monosaccharides, Disaccharides, Alditol |
| | ULTRON PS-80C | L19 | |
| | ULTRON PS-80P | L34 | |
| | ULTRON CI | - | Inositol |
| | ULTRON CL | - | Glucuronic Acid |
| Normal-phase Chromatography | ULTRON VX-SIL | L3 | Phosphorus Liquid |
| Reversed-phase Chromatography | ULTRON VX-ODS | L1 | Pharmaceutical Compounds, General Organic Substances, Food Additives, Pesticides, Fatty Acids and Catecholamines |
| | ULTRON VX-Octyl | L7 | |
| | STR ODS-II | L1 | |
| | STR ODS-M | L1 | |

# Ultron ES-Series

The ULTRON ES series are columns for enantiomer separation. Columns which are packed with protein immobilized silica (ULTRON ES-OVM, ULTRON ES-PEPSIN, ULTRON ES-BSA) and chemically bonded cyclodextrin (ULTRON ES-CD, ULTRON ES-PhCD).

## ULTRON ES-OVM, ULTRON ES-OVM-C

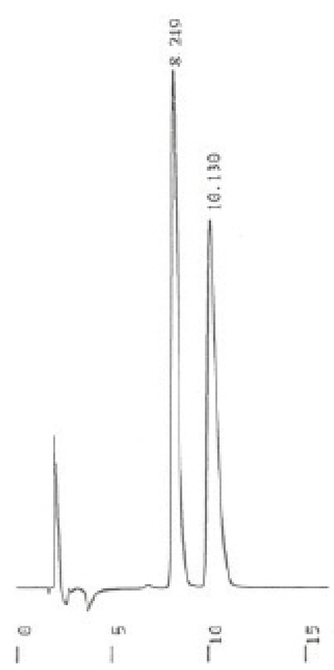
- A chiral separation column immobilized with ovomucoid which is a strong protein for denaturation
- Display a wide range of chiral recognition.
- No sample pretreatment required for chiral separations.
- Can be used for reversed-phase analyses.
- Trace analyses possible (several nanograms).
- [ULTRON ES-OVM-C]
  Clopidogrel bisulfate evaluation conditions based on USP standards employed for shipping inspections.
- [ULTRON ES-OVM-C]
  Low viscosity 30% acetonitrile aqueous solution used as column storage solvent.
- USP L57

Applications: Pharmaceuticals/Pesticides/Organic synthetic compounds

## ULTRON ES-OVM-3

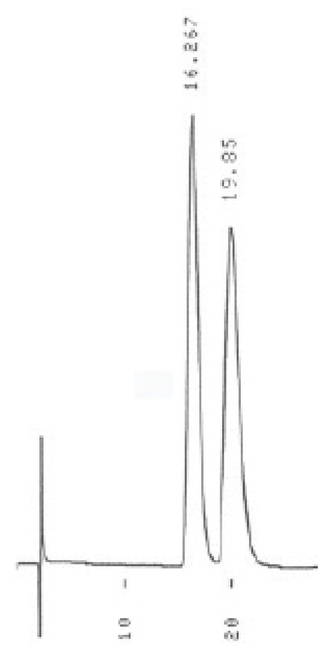
- Maximum operating pressure of 30 MPa.
- Can be used in LC/MS systems as well.
- Employs a 3 μm packing material for higher peak resolution and theoretical plate numbers.
- Enables significant reductions in analysis times while maintaining high theoretical plate numbers.
- Enables further improvements in performance with optimization of LC system tubing and flow cells.
- 9 column length and inner diameter combinations available.
- USP L57

Applications: Pharmaceuticals/Pesticides/Organic synthetic compounds




**Skeletal Muscle Relaxants: Chlorphenesin**

| | |
|---|---|
| **Column** | : ULTRON ES-OVM<br>150 mm x 4.6 mm I.D. |
| **Mobile Phase** | : 20 mM KH2PO4 (pH 5.5) |
| **Flow Rate** | : 1.0 mL/min |
| **Col. Temp.** | : 25 °C |
| **Detection** | : UV-220 nm |




**Drugs in Peptic Ulcer: Proglumide**

| | |
|---|---|
| **Column** | : ULTRON ES-OVM<br>150 mm x 4.6 mm I.D. |
| **Mobile Phase** | : 20 mM KH2PO4 (pH 4.6) /<br>C2H5OH = 100 / 20 |
| **Flow Rate** | : 1.0 mL/min |
| **Col. Temp.** | : 25 °C |
| **Detection** | : UV-220 nm |

## ULTRON ES-PEPSIN

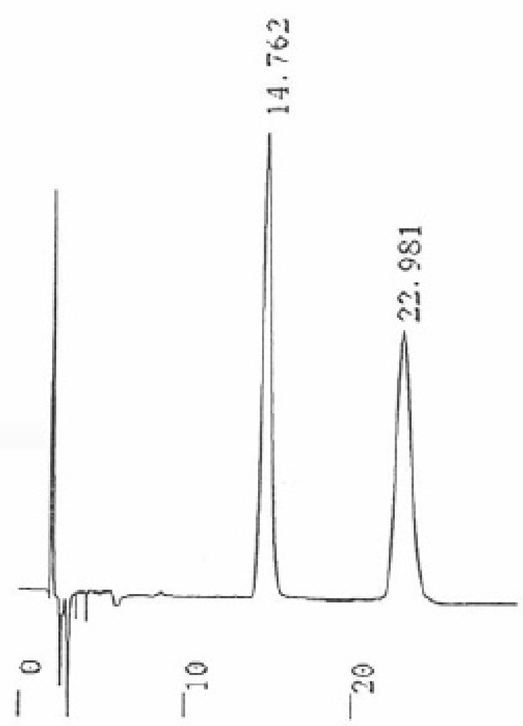
- An enantiomer separation column immobilized with pepsin which is the polypeptide dialytic enzyme of the pig stomach mucous membrane origin.
- Displays superior performance with respect to chiral separations of aminoalcohol pharmaceuticals such as beta blockers.
- No sample pretreatment required for chiral separations.
- Can be used for reversed-phase analyses.
- Trace analyses possible (several nanograms).

Applications: Pharmaceuticals/Pesticides/Organic synthetic compound

## ULTRON ES-BSA

- Employs bovine serum albumin, which is chemically bonded to the base material in an extremely stable manner.
- Provides superior chiral separations of acidic compounds such as arylpropionic acid pharmaceuticals.
- No sample pretreatment required for chiral separations.
- Can be used for reversed-phase analyses.
- Trace analyses possible (several nanograms).

Applications: Pharmaceuticals/Pesticides/Organic synthetic compound




**Antiinflammatories : Ibuprofen**

| | | |
|---|---|---|
| **Column** | : | ULTRON ES-BSA, 150 mm x 4.6 mm I.D |
| **Mobile Phase** | : | 20 mM KH2PO4 (pH 7.0) / 1-Propanol / Caprylic Acid = 98 / 2 / 0.08 |
| **Flow Rate** | : | 1.0 mL/min |
| **Col. Temp.** | : | 25 °C |
| **Detection** | : | UV-220 nm |

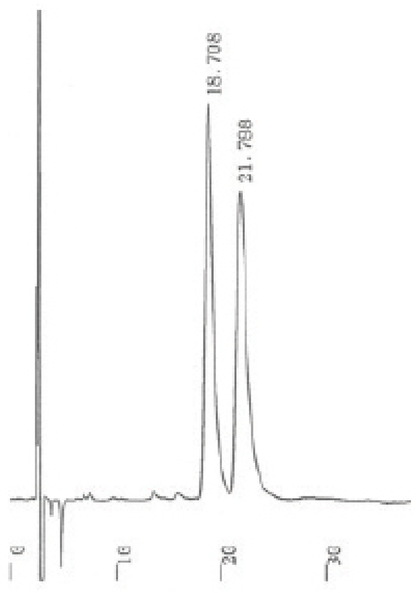
# Chiral Separation Columns

## ULTRON ES-CD, ULTRON ES-PhCD

ULTRON ES-CD and ULTRON ES-PhCD are enantiomeric separation columns chemically bonded with β-cyclodextrin (CD) and phenylcarbamated⊠-cyclodextrin (PhCD), respectively.

- Capable of chiral separations of hydrophobic cyclic compounds.
- Both reverse and normal phase eluents can be used.
- Chiral separations of a wide range of compounds are possible using these two types of columns.
- Display superior stability and durability.
- USP L45

Applications: Pharmaceuticals/Pesticides/Organic synthetic compounds




■ ⊠-Blockers: Arotinolol

| | |
|---|---|
| **Column** | : ULTRON ES-PhCD 150 mm x 6.0 mm I.D. |
| **Mobile Phase** | : 20 mM KH2PO4 (pH 4.6) / CH3CN = 75 / 25 |
| **Flow Rate** | : 1.2 mL/min |
| **Col. Temp.** | : 25 °C |
| **Detection** | : UV-220 nm |

■ ⊠-Blockers: Alprenolol

| | |
|---|---|
| **Column** | : ULTRON ES-PhCD 150 mm x 6.0 mm I.D. |
| **Mobile Phase** | : 20 mM KH2PO4 (pH 4.6) / CH3CN = 80 / 20 |
| **Flow Rate** | : 1.2 mL/min |
| **Col. Temp.** | : 25 °C |
| **Detection** | : UV-220 nm |

| Column | Particle Size (µm) | I.D (mm) | Length (mm) | | | | Guard Column |
|---|---|---|---|---|---|---|---|
| | | | 50 | 100 | 150 | 250 | |
| ES-OVM | 3 | 2.1 | APASHI-0013 | APASHI-0016 | APASHI-0019 | - | - |
| | | 3.0 | APASHI-0014 | APASHI-0017 | APASHI-0020 | - | - |
| | | 4.6 | APASHI-0015 | APASHI-0018 | APASHI-0021 | - | - |
| | 5 | 2.0 | - | - | APASHI-0001 | - | APASHI-0005 (5um 10x4.0) |
| | | 4.6 | - | - | APASHI-0002 | - | |
| ES-OVM-C | 5 | 4.6 | - | - | APASHI-0003 | - | |
| | | 6.0 | - | - | APASHI-0004 | - | |
| | 10 | 4.6 | - | - | APASHI-0006 | - | APASHI-0008 (10um 15x8.0) |
| ES-OVM-C (prep) | 10 | 20.0 | - | - | - | APASHI-0007 | |
| ES-PEPSIN | 5 | 4.6 | - | - | APASHI-0022 | - | APASHI-0023 (5um 10x4.0) |
| ES-BSA | 5 | 4.6 | - | - | APASHI-0024 | - | APASHI-0025 (5um 10x4.0) |
| ES-CD | 5 | 2.0 | - | - | APASHI-0026 | | - |
| | | 6.0 | - | - | APASHI-0027 | - | APASHI-0028 (5um 10×4.0) |
| ES-PhCD | 5 | 2.0 | - | - | APASHI-0033 | - | APASHI-0035 (5um 10×4.0) |
| ES-PhCD-T | 5 | 6.0 | - | - | APASHI-0034 | - | |

| Guard Cartridges (2 pcs) | Particle Size (µm) | I.D (mm) | Length (mm) | | Holder (With Adaptor) |
|---|---|---|---|---|---|
| | | | 5 | 10 | |
| ES-OVM | 5 | 2.0 | APASHI-0009 | - | APASHI-0011 |
| | | 4.6 | - | APASHI-0010 | APASHI-0012 |
| ES-CD | 5 | 2.0 | APASHI-0029 | - | APASHI-0031 |
| | | 4.6 | - | APASHI-0030 | APASHI-0032 |
| ES-PhCD | 5 | 2.0 | APASHI-0036 | - | APASHI-0038 |
| | | 4.6 | - | APASHI-0037 | APASHI-0039 |

# Shim-pack Ultron PS-Series

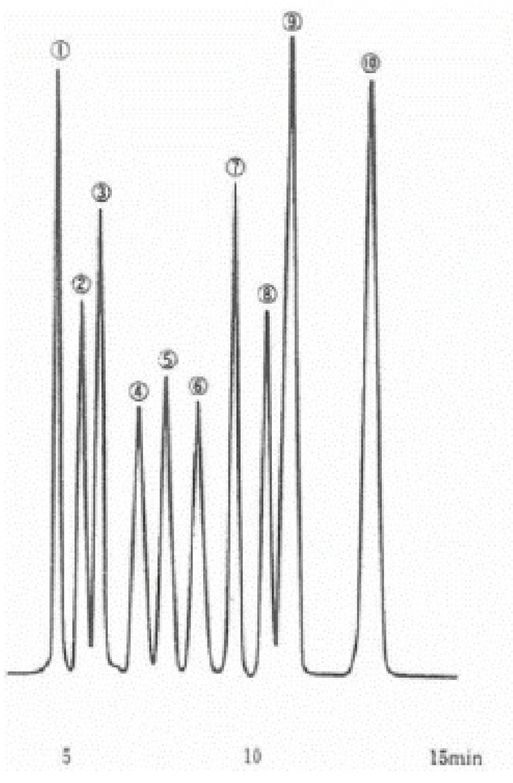
## Shim-pack ULTRON PS-80N, ULTRON PS-80C, ULTRON PS-80P

The Shim-pack ULTRON PS series are HPLC columns packed with sulfonic acid type polystyrene cation exchange resin for sugar and sugar alcohol analysis.

| Column | PS-80N | PS-80C | PS-80P |
|---|---|---|---|
| Type | Na type | Ca type | Pb type |
| USP Code | L58 | L19 | L34 |
| Max. Operation Pressure | 4.0 MPa | 4.0 MPa | 4.0 MPa |
| Max. Operation Temperature | 80 °C | 90 °C | 90 °C |
| pH Range | pH 6 - 12 | pH 6 - 7.5 | pH 6 - 7.5 |

- PS series columns are effective for quantitative analyses because saccharides are not adsorbed on matrices.
- PS series columns use aqueous mobile phases.
- Durable due to the use of a mechanically strong polymer gel.

Applications: Oligosaccharides, disaccharides, monosaccharides / Sugar alcohols / Monitoring of fermentation hydrolysis of polysaccharides




**Elution Position of Sugar and Sugar Alcohol for PS-80C**

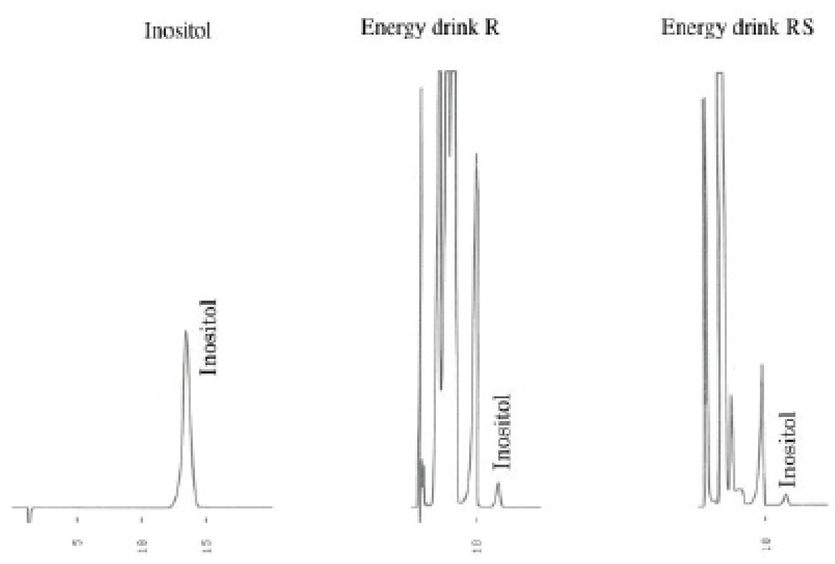
1. Dextran T-10
2. Raffinose
3. Sucrose
4. Glucose
5. Galactose
6. Fructose
7. Adonitol
8. Glycerol
9. Ethanol + Mannitol
10. Xylitol +Sorbitol

**Column** : ULTRON PS-80C, 300 mm x 8.0 mm I.D.
**Mobile Phase** : $H_2O$
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 80 °C
**Detection** : RI, 16x10-5 RIUFS
**Sample** : ea. 10 uL/mL

| Column | Particle Size (µm) | I.D (mm) | Length (mm) | | | Guard column (50 x 8.0) |
|---|---|---|---|---|---|---|
| | | | 250 | 300 | 500 | |
| PS-80N | 10 | 8.0 | - | 226-80004-01 | 226-80005-01 | 226-80006-91 |
| PS-80C | 10 | 8.0 | - | 226-80007-01 | - | 226-80008-91 |
| PS-80P | 10 | 8.0 | - | 226-80009-01 | - | 226-80010-91 |

## Shim-pack ULTRON CI

- A strong cation exchange polymer packed HPLC column designed for analyses of inositol.
- Provides excellent quantitative analyses of inositol in energy drinks.
- Displays good retention reproducibility.
- Polymer beads possess good mechanical strength.
- Maximum operating pressure is 8.0 MPa.
- Maximum operating temperature is 90°C.



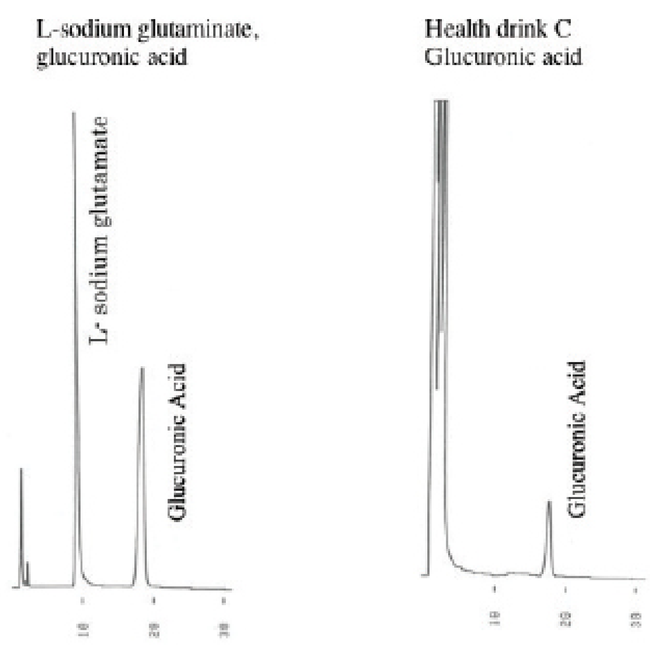

**Inositol in Health Drink**

| | |
|---|---|
| **Column** | : ULTRON CI, 200mm x 4.6mm I.D |
| **Mobile Phase** | : CH3CN/H2O = 60/40 |
| **Flow Rate** | : 1.0 mL/min |
| **Col. Temp.** | : 40 °C |
| **Detection** | : RI |

| Column | I.D (mm) | Length (mm) |
|---|---|---|
| | | 250 |
| ULTRON CI | 4.6 | 226-80011-01 |

## Shim-pack ULTRON CL

- A strong anion exchange polymer packed HPLC column for glucuronic acid.
- Provides excellent quantitative analyses of glucuronic acid in energy drinks.
- Displays good retention reproducibility.
- Polymer beads possess good mechanical strength.
- Maximum operating pressure is 8.0 MPa.
- Maximum operating temperature is 70°C.




**Glucuronic acid in Health Drink**

| | |
|---|---|
| **Column** | : ULTRON CL, 150mm x 4.6mm I.D |
| **Mobile Phase** | : 20 mM KH2PO4 |
| **Flow Rate** | : 0.8 mL/min |
| **Col. Temp.** | : 70 °C |
| **Detection** | : UV-210 nm |

| Column | I.D (mm) | Length (mm) |
|---|---|---|
| | | 150 |
| ULTRON CL | 4.0 | 226-80012-01 |

# Shim-pack Ultron VX Series

## Shim-pack ULTRON VX-SIL

Shim-pack ULTRON VX-SIL columns use high purity silica gel (SiO2 99.99% or higher), thereby reducing sample absorption by metal oxides to the lowest possible levels.

The use of the spherical silica particles reduced column back pressure and prolong column life time.

| | |
|---|---|
| Bonded Phase | - |
| Particle Size | 5 µm |
| Pore Size | 12 nm |
| Surface Area | 300 m²/g |
| USP Code | L3 |

| Column | Particle Size (µm) | I.D (mm) | Length (mm) | | Guard column |
|---|---|---|---|---|---|
| | | | 150 | 250 | |
| VX-SIL (Analytical) | 5 | 4.6 | 226-80013-01 | 226-80014-01 | 226-80031-01 (10 x 4.0 mm) |
| | 5 | 6.0 | 226-80015-01 | - | |
| | 10 | 4.6 | 226-80021-01 | 226-80022-01 | - |
| | 10 | 6.0 | 226-80023-01 | - | - |
| VX-SIL (Preparative) | 5 | 20.0 | - | 226-80016-01 | 226-80032-01 (15 x 8.0 mm) |
| | 10 | 20.0 | - | 226-80024-01 | 226-80033-01 (10 x 4.0 mm) |
| | 10 | 30.0 | - | 226-80025-01 | |
| | 10 | 50.0 | - | 226-80026-01 | 226-80034-01 (15 x 8.0 mm) |
| | 15 | 4.6 | - | 226-80027-01 | 226-80035-01 (10 x 4.0 mm) |
| | 15 | 20.0 | - | 226-80028-01 | |
| | 15 | 30.0 | - | 226-80029-01 | 226-80036-01 (15 x 8.0 mm) |
| | 15 | 50.0 | - | 226-80030-01 | |
| VX-SIL (Narrow Bore) | 5 | 2.0 | 226-80017-01 | 226-80018-01 | - |
| | 5 | 1.0 | 226-80019-01 | 226-80020-01 | - |

| Guard cartridges (2 pcs) | Particle Size (µm) | I.D (mm) | Length (mm) | | Holder (With adaptor) |
|---|---|---|---|---|---|
| | | | 5 | 10 | |
| VX-SIL | 5 | 2.0 | 226-80037-91 | - | 226-80039-91 |
| | | 4.6 | - | 226-80038-91 | 226-80040-91 |

# Shim-pack Ultron VX Series

## Shim-pack ULTRON VX-ODS

Shim-pack ULTRON VX-ODS is reversed-phase column having monomeric octadecyl group. The bare silica of ULTRON VX-ODS is the same of ULTRON VX-SIL. Our excellent end-capping technology (secondary silylation) lead to the reduction of the influence of the residual silanol groups.

| | |
|---|---|
| Bonded Phase | Octadecyl Group |
| Particle Size | 5 µm, 10 µm, 15 µm |
| Pore Size | 12 nm |
| Specific Surface | 300 $m^2/g$ |
| Carbon content | 16 % |
| End-cap | Yes |
| USP Code | L1 |

### Reproducibility between column lots

ULTRON VX-ODS columns are checked using stringent quality control in each manufacturing process.
Only ULTRON VX-ODS columns that pass repeated testing during the manufacturing processes are shipped to customers. k' and α values obtained using ULTRON VX-ODS columns display only extremely small differences between lots. ULTRON VX-ODS columns also display excellent reproducibility and stability in other tests between column lots.

### Stereoselectivity, distribution equilibria

ULTRON VX-ODS columns, which have monolayers of octadecyl groups, display excellent stereoselectivity with respect to sample molecules. Distribution equilibria are reached rapidly when performing gradient elutions and when mobile phases are changed.

### Pressure resistance

Because ULTRON VX-ODS columns use spherical silica gel, they display excellent pressure resistance, and stable separations can be achieved even at fast mobile phase flow rates.

| Column | Particle Size (µm) | I.D (mm) | Length (mm) | | Guard column |
|---|---|---|---|---|---|
| | | | 150 | 250 | |
| VX-ODS (for Analytical) | 5 | 4.6 | 226-80041-01 | 226-80042-01 | 226-80059-01 (10 x 4.0 mm) |
| | | 6.0 | 226-80043-01 | - | |
| | 10 | 4.6 | 226-80049-01 | 226-80050-01 | 226-80061-01 (10 x 4.0 mm) |
| | | 6.0 | 226-80051-01 | - | - |
| VX-ODS (Narrow Bore) | 5 | 2.0 | 226-80045-01 | 226-80046-01 | - |
| | | 1.0 | 226-80047-01 | 226-80048-01 | - |
| VX-ODS (for Preparative) | 5 | 20.0 | - | 226-80044-01 | 226-80060-01 (15 x 8.0 mm) |
| | 10 | 20.0 | - | 226-80052-01 | 226-80062-01 (15 x 8.0 mm) |
| | | 30.0 | - | 226-80053-01 | |
| | | 50 | - | 226-80054-01 | |
| | 15 | 4.6 | - | 226-80055-01 | 226-80063-01 (10 x 4.0 mm) |
| | | 20.0 | - | 226-80056-01 | |
| | | 30.0 | - | 226-80057-01 | 226-80064-01 (15 x 8.0 mm) |
| | | 50.0 | - | 226-80058-01 | |

| Guard cartridges (2 pcs) | Particle Size (µm) | I.D (mm) | Length (mm) | | Holder (With adaptor) |
|---|---|---|---|---|---|
| | | | 5 | 10 | |
| VX-ODS | 5 | 2.0 | 226-80065-91 | - | 226-80067-91 |
| | | 4.6 | - | 226-80066-91 | 226-80068-91 |

## Shim-pack ULTRON VX-Octyl

We have utilized the highly refined synthesizing technology used to manufacture ULTRON VX-ODS columns to produce the ULTRON VX-Octyl column.

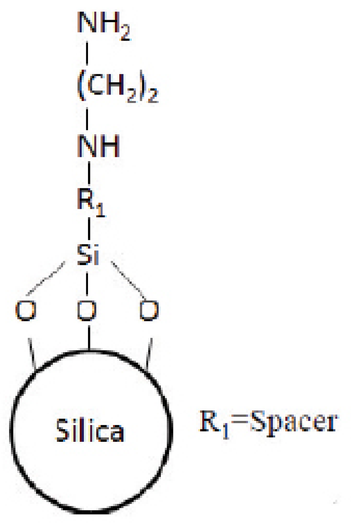
- Column lifetime is greatly improved.
- ULTRON VX-Octyl columns have very low variations between lots and display excellent reproducibility.
- ULTRON VX-Octyl columns provide shorter analysis times than ODS columns and can also maintain high separation capacities.
- Volumes of organic solvents can be reduced.
- Because distribution equilibriums can be achieved quickly and adsorbed materials can be eluted easily in comparison with ODS columns, these columns are perfect for gradient elutions.
- USP L07

Applications: Pharmaceutical compounds / pesticides / chemical compounds / food products / environmental compounds, etc.

| Column | Particle Size (µm) | I.D (mm) | Length (mm) | | Guard column |
|---|---|---|---|---|---|
| | | | 150 | 250 | |
| VX-Octyl (for Analytical) | 5 | 4.6 | 226-80069-01 | 226-80070-01 | 226-80072-91 (10 x 4.0 mm) |
| VX-Octyl (for preparative) | 5 | 20.0 | - | 226-80071-01 | 226-80073-91 (15 x 8.0 mm) |

## Shim-pack Ultron AF-HILIC-DA

Shim-pack ULTRON AF-HILIC-DA is the latest addition to the ULTRON series. By introducing a new amino group via a spacer, this column has greatly improved retention while maintaining the characteristics of an amino column. This column also shows selectivity for different separations




- Diamine (primary and secondary) is introduced in packing material that is based on silica gel.
- The retention of polar compounds is strong and have a variety of separation selectivities.
- Have anion exchange as same as amino column

Applications: Separation selectivity of nucleobase and nucleoside

| Column | I.D (mm) | Length (mm) | |
|---|---|---|---|
| | | 100 | 150 |
| ULTRON AF-HILIC-DA | 4.6 | 226-80105-01 | 226-80106-01 |

# Shim-pack STR-ODS Series

## Shim-pack STR ODS-II

- The effects of metal oxides are suppressed to a minimum due to the use of highly-purified silica gel as a base material in the STR series.
- STR series columns are durable due to the use of mechanically strong silica gel.
- STR series columns are highly resistant to acidic and basic mobile phases.
- STR series columns are easy to operate and display high levels of performance due to low analytical operating pressures.
- Excellent end capping technology provides sharp peak shapes for basic and acidic compounds, and for samples which form complexes with metals.

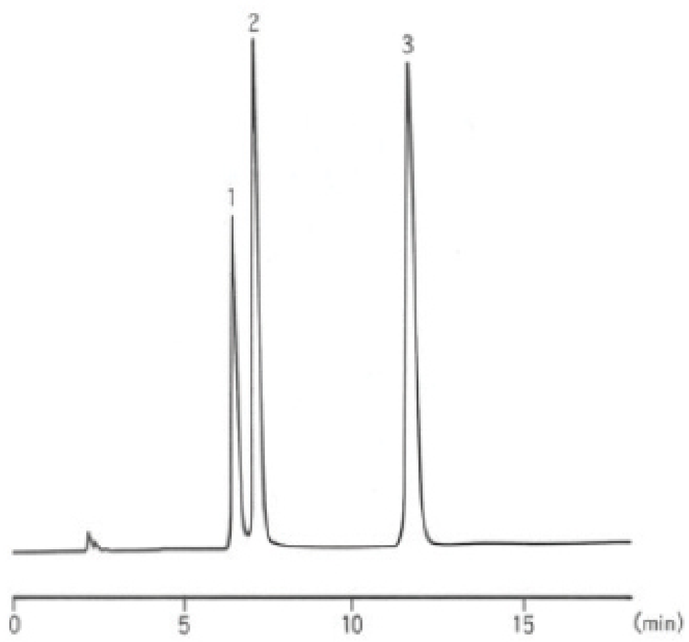
| | |
|---|---|
| Bonded Phase | Octadecyl Group |
| Particle Size | 5 µm |
| Particle Shape | Spherical Porous Silica Gel |
| Pore Size | 12 nm |
| Specific Surface | 320 $m^2/g$ |
| End-Cap | Yes |
| Carbon content | 17 % |
| USP Code | L1 |

| Column | Particle Size (µm) | I.D (mm) | Length (mm) | | | Guard column |
|---|---|---|---|---|---|---|
| | | | 100 | 150 | 250 | |
| STR ODS-II (Narrow Bore) | 5 | 2.0 | - | 226-80074-01 | 226-80075-01 | - |
| STR ODS-II (for Analytical) | 5 | 3.0 | - | 226-80076-01 | 226-80077-01 | - |
| | | 4.0 | 226-80078-01 | 226-80079-01 | 226-80080-01 | 226-80084-91 (10 x 4.0 mm) |
| | | 4.6 | - | 226-80081-01 | 226-80082-01 | 226-80085-91 (10 x 4.6 mm) |
| | | 6.0 | - | 226-80083-01 | - | 226-80086-91 (10 x 6.0 mm) |
| STR ODS-II (for Preparative) | 5 | 20.0 | - | - | 226-80087-01 | 226-80088-91 (50 x 20.0 mm) |
| STR ODS-II PEEK (for Analytical) | 5 | 4.6 | | 226-80089-01 | 226-80090-01 | 226-80091-91 (10 x 4.0 mm) |

| Guard cartridges (2 pcs) | Particle Size (µm) | I.D (mm) | Length (mm) | | Holder (With adaptor) |
|---|---|---|---|---|---|
| | | | 5 | 10 | |
| STR ODS-II | 5 | 2.0 | 226-80092-91 | - | 226-80095-91 |
| | | 3.0 | - | 226-80093-91 | 226-80096-91 |
| | | 4.6 | - | 226-80094-91 | 226-80097-91 |

## Shim-pack STR ODS-M

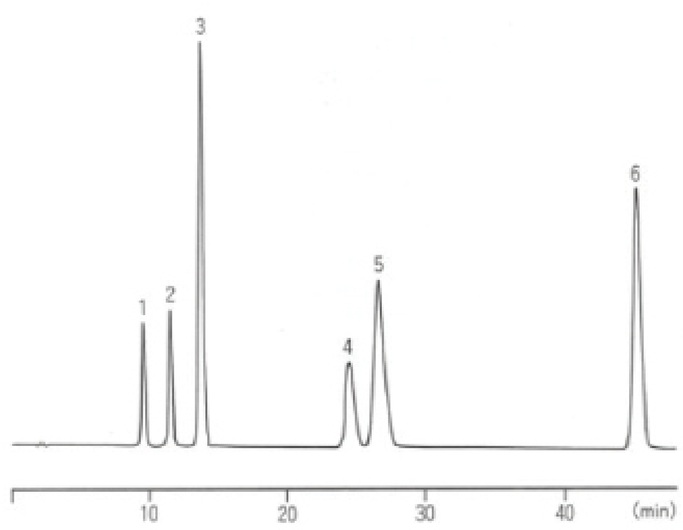
| | |
|---|---|
| Bonded Phase | Octadecyl Group |
| Particle Size | 5 µm |
| Particle Shape | Perfectly spherical porous silica gel |
| Pore Size | 10 nm |
| Specific Surface | 350 m²/g |
| End-Cap | Yes |
| Carbon content | 15 % |
| USP Code | L1 |




**AMP, ADP, ATP**

1. Adenosine 5'-Monophosphate
2. Adenosine 5'-Diphosphate
3. Adenosine 5'-Triphosphate

**Column** : STR ODS-M, 150 mm x 4.6 mm, I.D. (226-80100-01)
**Mobile Phase** : 30 mM 2-Diethylaminoethanol is contained
20 mM Citric Acid Aqueous Solution
**Flow Rate** : 0.8 mL/min
**Col. Temp.** : 40 °C
**Detection** : UV-260 nm




**Caffeine and Catechin**

1. Epigallocatechin
2. Catechin
3. Caffeine
4. Epigallocatechin Gallate
5. Epicatechin
6. Epicatechin Gallate

**Column** : STR ODS-M, 150 mm x 4.6 mm, I.D. (226-80100-01)
**Mobile Phase** : A: 10 mM-Phosphate Buffer (pH2.6)
B: CH3CN
7 % B → 7 % B (30 min) 12 % B (30.01 min) → 12 % B (45 min) → 50 % B (45.01 min ) → 50 % B (50 min) → 7 % B (50.01 min) → 7 % B (80 min)
**Flow Rate** : 1.0 mL/min
**Col. Temp.** : 45 °C
**Detection** : UV-280 nm (0.64 AUFS)

| Column | Particle Size (µm) | I.D (mm) | Length (mm) | | | |
|---|---|---|---|---|---|---|
| | | | 10 | 50 | 150 | 250 |
| STR ODS-M | 5 | 4.0 | 226-80103-01 | 226-80104-01 | 226-80098-01 | 226-80099-01 |
| | | 4.6 | - | - | 226-80100-01 | 226-80101-01 |
| | | 6.0 | - | - | 226-80102-01 | - |

# Mobile Phase Cleaner for UHPLC/HPLC

## Ghost Trap DS/DS-HP

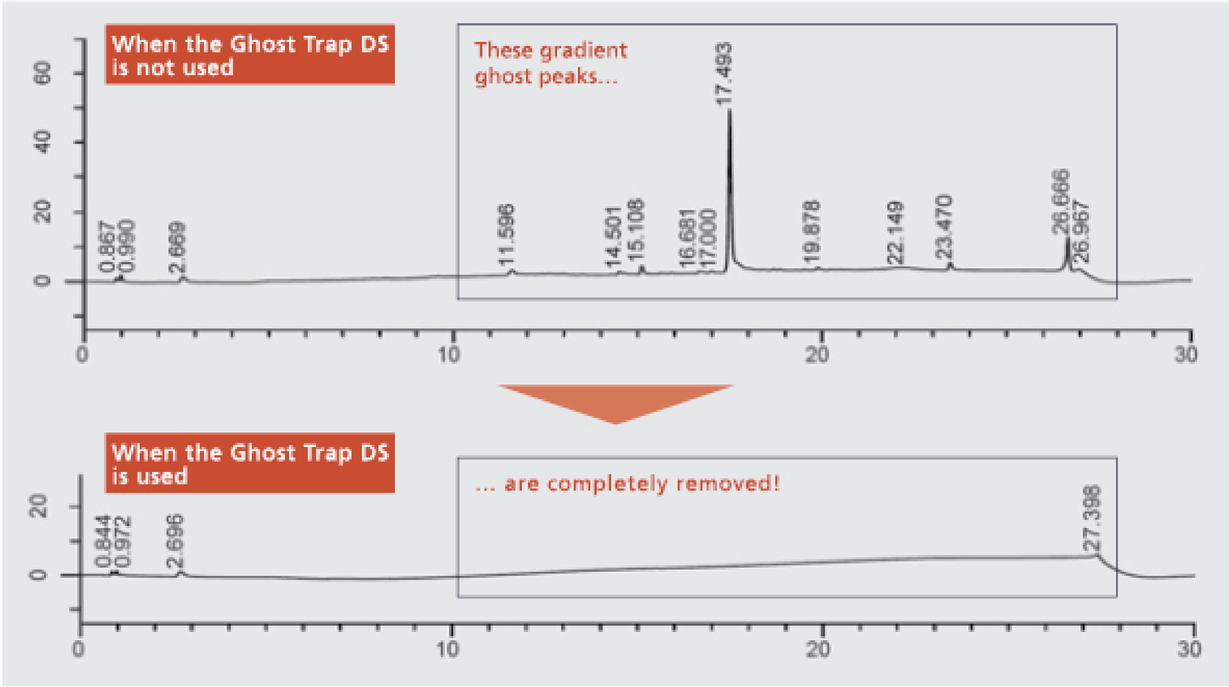
A new high-pressure model for the elimination of impurities from organic solvents has been added to the Ghost Trap DS* lineup. The Ghost Trap DS was co-developed with Daiichi Sankyo Co., Ltd. It has been designed to effectively adsorb impurities in the mobile phase in order to reduce the time required for method development and impurity analysis.

The 100 MPa pressure tolerance of the Ghost Trap DS-HP allows it to be used with UHPLC systems. This permits the effective use of the Ghost Trap DS for method development by UHPLC and subsequent transfer to conventional analysis.

* DS: Abbreviation of Daiichi Sankyo (D) and Shimadzu (S)

## Consistently Traps Impurities, Even in Organic Solvents

A major feature of the Ghost Trap DS is the ability to remove impurities, even in organic solvents. When the Ghost Trap DS is installed between the gradient mixer and autosampler in reversed phase gradient analysis, it can trap impurities from the piping and gradient mixer in addition to those from the mobile phase. The example on the right shows that it can effectively trap impurities in mobile phase when the Ghost Trap DS is installed just downstream of the gradient mixer.




Example of removing ghost peaks by Ghost Trap DS
(The data is provided by Daiichi Sankyo Co., Ltd.)

**Column** : ODS column
**Mobile Phase** : A) 25 mmol/L Phosphate (Potassium) buffer solution (pH 4.0) / Acetonitrile = 9/1
B) Water/Acetonitrile = 1/9
**Flow Rate** : 0.65 mL/min
**Col. Temp.** : 45 °C
**Detection** : UV 210 nm

## Product Information

| Item | P/N | Description | Dimensions | Internal Volume *1 | Pressure Tolerance |
|---|---|---|---|---|---|
| Ghost Trap DS | 228-59921-91 | Cartridge (2pcs) | 30 mmL. × 7.6 mmI.D. | Approx. 700 µL | 35 MPa |
| | 228-59921-92 | Cartridge (2pcs) + Holder | | | |
| | 228-59921-93 | Cartridge (2pcs) | 4.0 mmI.D. × 20 mmL. | Approx. 150 µL | |
| | 228-59921-94 | Cartridge (2pcs) + Holder | | | |
| Ghost Trap DS-HP | 228-59931-91 | Packed type | 2.1 mmI.D. × 30 mmL. | Approx. 60 µL | 100 MPa |

*1 Note that a delay volume equivalent to the internal volume of the product occurs if the product is installed downstream of the gradient mixer or the confluence of two pumps.
* The product service life differs according to analysis conditions, such as the mobile phase used.
* In analysis using an ion-pairing reagent, the ion-pairing reagent may be retained in the product, influencing the retention time and peak shape.
* Before connecting the analytical column, be sure to thoroughly clean the flow path with mobile phase (close to the final concentration for gradient analysis).
* Note that some impurities may not be removed.
* When performing high-pressure analysis exceeding 35 MPa with a UHPLC system, connect the gradient mixer to the Ghost Trap DS-HP with a pipe for UHPLC (e.g.228-53137-97).

# GLC Suction Filter 2

## ■ HPLC Suction filter with mobile phase cleaning function

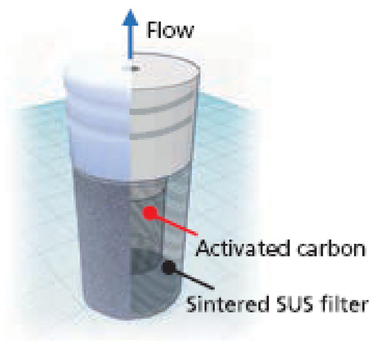
**Features**

- Removes contaminants from the mobile phase.
- Does not affect gradient delay* to install this product in front o fthe pump (see Fig. 2).
- Available for LCMS due to low bleed.

(*The delay form the time a gradient begins to be produced in the pump to when it reaches the column inlet).

The GLC Suction Filter 2 is packed with activated carbon which acts as a chemcal trap and removes contaminants present in the mobile phase.
This product is easy to install and user-replaceable.

Note: Connect 3.0mm outer diameter suction tube when you use this product.




i. 1. Structure o
the GLC Suction Filter 2

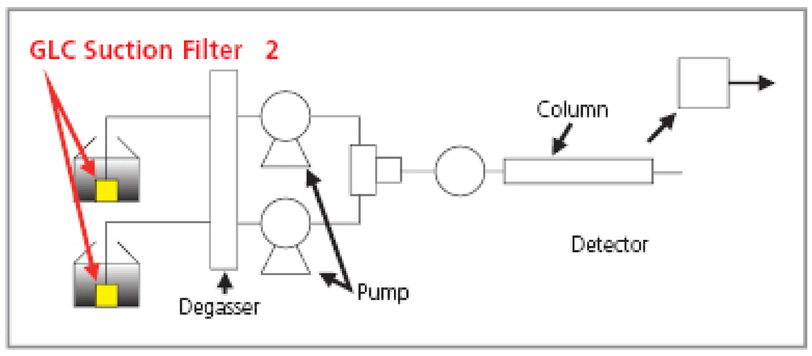
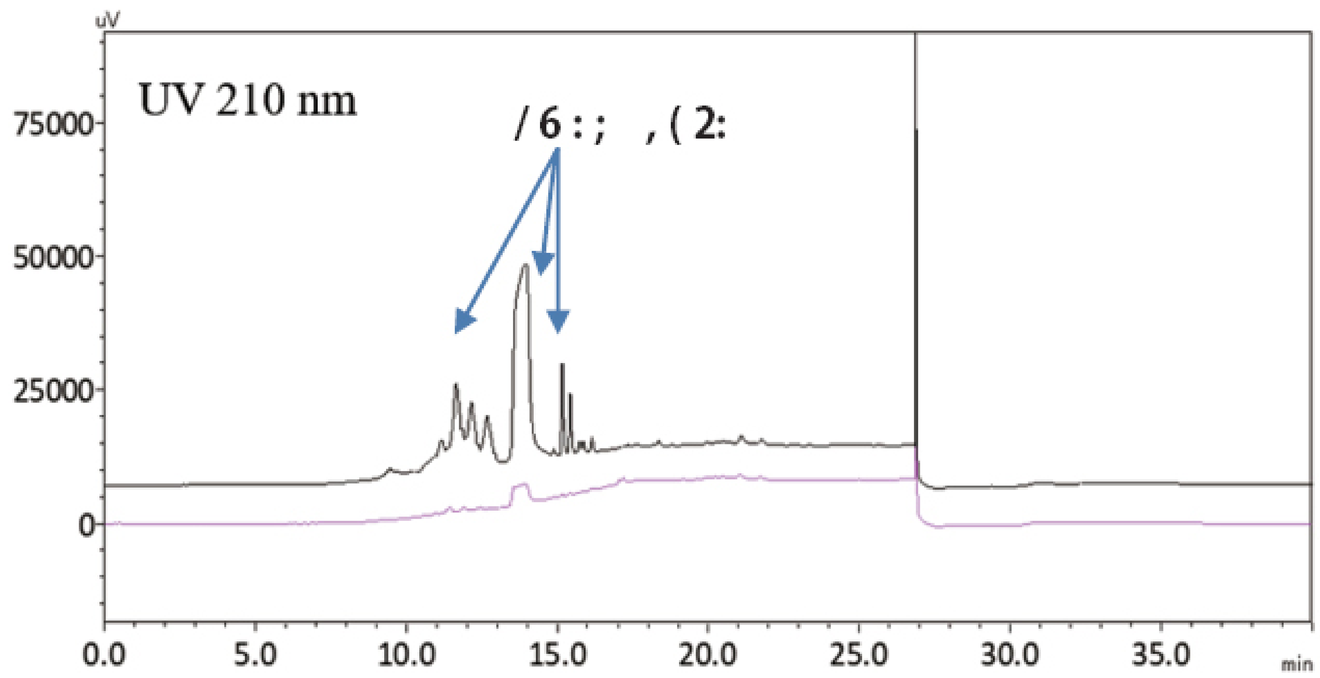



Fig. 2. Attachment position

# Removal of contaminants in mobile phase (LC/UV)

## ■ e.g. Removal of contaminants caused due to the storage of the mobile phase

Ghost peaks are contaminant peaks that appear even when no sample is injected. One of the causes for ghost peaks is contamination in mobile phase due to improper storage or from external sources. We prepared contaminated ultrapure water that was stored in a plastic container (polyethylene) at room temperature for two weeks. Ghost peaks were observed when using the contaminated water as mobile phase. After installing the GLC Suction Filter 2, the previously observed ghost peaks were eliminated.




— Normal Suction Filter
— GLC Suction Filter 2

**Analytical Conditions**

| | |
|---|---|
| Instruments | : Nexera XR |
| Column | : Shim-pack VP-ODS (150 x 4.6 mm I.D.) |
| Mobile phase: | A ; Contaminated ultrapure water<br>B ; Acetonitrile |
| Time prog. | : B Conc. 20% (0-5 min.) →<br>95% (5-25 min.) →<br>20% (25.01-40 min.) |
| Flow rate | : 1 mL /min. |

**Product Informatio n**

| Description | P/N | Spec | Qty. |
|---|---|---|---|
| GLC Suction Filter 2 | 370-02010-01 | Connecting tube: 3.0mm outer diameter suction tube<br>Internal volume: 0.7 mL<br>Pore size:10µm | 1 |

Please read the manual carefully and condition this product before use.

* The suction tube is not included.
* When using ion-pair reagents in the mobile phase, the ion-pair reagents may be adsorbed to this product and may affect the retention time and peak shape.
* Bleeding from this product may be seen.
* This product does not remove all contaminants.
* When the activated carbon reaches breakthrough, "ghost peaks" derived from mobile phase contaminants may be detected. In this case, replace the product.
* The recommended replacement period is after passing 60L of mobile phase or 1 year after use.

## Ultrashield UHPLC/HPLC Pre-column Filter

any column and is leak tight to 15,000 psi (1034 bar).

| Part number | Description | Porosity | Pack Size |
|---|---|---|---|
| 226-50000-01 | Ultrashield UHPLC/HPLC Pre-Column Filter | 0.5µm | 1 |
| 226-50000-03 | Ultrashield UHPLC/HPLC Pre-Column Filter | 0.5µm | 3 |
| 226-50000-10 | Ultrashield UHPLC/HPLC Pre-Column Filter | 0.5µm | 10 |
| 226-50001-05 | Pre-Column replacement frit | 0.2µm | 5 |
| 226-50001-99 | Holder for Pre-Column replacement frit | - | 1 |

*226-50000-01*
*Ultrashield UHPLC/HPLC Pre-Column Filter*

*226-50001-99*
*Holder for Pre-Column replacement frit*

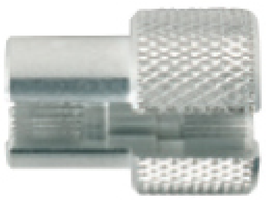
*226-50001-05*
*Pre-Column replacement frit*

Use the tightening tool to tighten standard short/long knurl-headed nut like the peek fitting below.

| Part number | Description | Pack size |
|---|---|---|
| 226-50000-01 | Ultrashield HPLC Pre-Column Filter | 1 |
| 226-50106-02 | Peek fitting | 2 |
| 226-50000-99 | Tightening Tool | 1 |

*Pre-Column Filter*

*Peek Fitting*



*Tightening Tool*

# Fittings for HPLC And UHPLC

These innovative fittings solve all of the difficulties of cumbersome LC plumbing issues. Forget cutting old fittings off your SS tubing. Throw away your spanners, make column changes in seconds.

## Pressure rated up to 25,000 psi (1,720 bar)

- Patent pending innovative design
- Capable of up to ten repeat assembly cycles with no impact on pressure holding ability or carry-over;
- Available in multiple threaded configurations for use with 1/16 in (1.6 mm) and 1/32 in (0.79 mm) OD tubing
- Materials of construction: Stainless Steel and Proprietary PEEK™ polymer blend (PK)

Shimadzu introduces an innovative line of UHP & VHP fittings, designed to withstand extreme pressures. This patent-pending line of ground-breaking fitting systems is perfect for use within the increasingly demanding requirements of today's high performance analytical systems. The fittings are reusable when following the proper tightening torque specification. With a polymer front ferrule, there is no damage to the tubing or receiving port, also increasing the life of these components.

| Type of Fitting | Picture | Can be reused (re swaged) | Pressure rating | Spanner tightened | Tubing used on | Suitable for | One or two piece system |
|---|---|---|---|---|---|---|---|
| Ultra-High Pressure Fitting. Stainless Steel nut with patented PEEK polymer blend ferrule.<br><br>**226-50100-02 (2pcs)**<br>**226-50100-10 (10pcs)** | | Yes | 25,000 psi / 1,720 bar | Yes<br>8mm hex spanner | S/S | All high pressure 1/16" S/S fittings up to 25,000 psi. | Separate nut and "captured" ferrule. |
| Ultra-High Pressure Fitting<br>Long bodied version of one above for injection valves.<br><br>**226-50101-02 (2pcs)**<br>**226-50101-10 (10pcs)** | | Yes | 25,000 psi / 1,720 bar | Yes<br>8mm hex spanner | S/S | Particularly suitable for LC injection ports. | Separate nut and "captured" ferrule. |
| Ultra-High Pressure Fitting<br>With fingertight head and integrated ferule, 10-32 thread.<br><br>**226-50104-02 (2pcs)**<br>**226-50104-10 (10pcs)** | | Yes | 25,000 psi / 1,720 bar | Finger tightened. | S/S and PEEK | All fittings up to 25,000 psi.<br>Good fitting especially for changing columns-fast and reusable with no spanners. | Two piece-<br>S/S nut and "captured" PEEK polymer blend ferrule. |
| Finger 1 – Peek One piece, cone tip, 10-32 thread.<br><br>**226-50106-02 (2pcs)**<br>**226-50106-10 (10pcs)** | | Yes | 12,000 psi / 827 bar | Finger tightened with handheld tightening tool. | S/S and PEEK | All fittings up to 12,000 psi.<br>Good fitting for when you are in a hurry. | Single piece PEEK |

CoreFocus
SHIMADZU

# Vials & Accessories

## Features of Shimadzu vials and septa

- 1st hydrolytic class glass
- Vials are packaged in a cleanroom
- Contamination-free septa production

### Screw vials, 100/pack

| Part number | 226-54110-11 | 226-54110-01 | 226-54220-11 | 226-54220-01 | 226-54305-01 |
|---|---|---|---|---|---|
| Type | Clear, screw vial | Clear, screw vial | Clear, screw vial | Clear, screw vial | Clear, screw vial with integrated 0.2mL micro-insert, top bonded |
| Write on spot | √ | X | √ | X | √ |
| Min. Vol / uL | 200 | 200 | 200 | 200 | 25 |
| Max. Vol / mL | 1.5 | 1.5 | 1.5 | 1.5 | 0.2 |
| Dimension | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm |
| Size | ND 9, wide opening | ND 9, wide opening | ND 8, small opening | ND 8, small opening | ND 9, wide opening |

| Part number | 226-54301-01 | 226-54111-11 | 226-54111-01 | 226-54221-11 | 226-54222-01 |
|---|---|---|---|---|---|
| Type | Clear, microliter screw vial | Amber, screw vial | Amber, screw vial | Amber, screw vial | Amber, screw vial |
| Write on spot | X | √ | X | √ | X |
| Min. Vol / uL | 30 | 200 | 200 | 200 | 200 |
| Max. Vol / mL | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| Dimension | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm |
| Size | ND 9, wide opening | ND 9, wide opening | ND 9, wide opening | ND 8, small opening | ND 8, small opening |

| Part number | 226-54307-01 | 226-54312-01 | 226-54313-01 | 226-54308-01 | 226-54309-01 |
|---|---|---|---|---|---|
| Type | Clear, 0.9mL LabTotal Recovery vial | Clear, 0.9mL Microliter screw vial | Clear, 1.0mL Total Microliter screw vial | Amber, screw vial with integrated 0.2mL micro-insert, base bonded | Clear, screw vial with integrated 0.2mL micro-insert, base bonded |
| Write on spot | X | √ | X | X | X |
| Min. Vol / uL | 25 | 25 | 25 | 30 | 30 |
| Max. Vol / mL | 1.1 | 1.1 | 1.3 | 0.3 | 0.3 |
| Dimension | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm |
| Size | ND 9, wide opening | NP 9, wide opening | NP 9, wide opening | ND 9, wide opening | ND 9, wide opening |

## ND9 screw plastic micro-vials, 100/pack

Plastic vials offer low binding for proteins and peptides and are the best choice for Ion Chromatography. Specially made for customers concerned about broken glass.

| Part number | 226-54310-01 | 226-54311-01 | 226-54302-01 | 226-54303-01 | 226-54304-01 |
|---|---|---|---|---|---|
| Type | 1.5ml PP screw clear vial, slightly concave shaped bottom | 1.5ml PP screw amber vial, slightly concave shaped bottom | PP micro-vial, transparent | TPX micro-vial, crystal clear | PP micro-vial, amber |
| Write on spot | x | x | X | X | X |
| Min. Vol / uL | 200 | 200 | 30 | 30 | 30 |
| Max. Vol / mL | 1.5 | 1.5 | 0.25 | 0.25 | 0.25 |
| Dimension | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm |
| Size | ND 9, wide opening | ND 9, wide opening | ND 9, wide opening | ND 9, wide opening | ND 9, wide opening |

## Caps/Septa for 1.5mL screw vials, 100/pack

Temperature limit for PTFE/Rubber septa: -40°C up to 110°C
Temperature limit for PTFE/Silicone septa: -60°C up to 200°C
Temperature limit for PTFE/Silicone/PTFE septa: -60°C up to 200°C

| Part number | Cap | Septa Material | Septa Thickness | Septa Durometer | Size | Picture |
|---|---|---|---|---|---|---|
| 226-54112-01 | Blue PP, centre hole | PTFE/Rubber | 1.0 mm | 45° shore A | ND 9 | |
| 226-54113-01 | Blue PP, centre hole | PTFE/Silicone, ultra-clean | 1.0 mm | 55° shore A | ND 9 | |
| 226-84131-01 | Blue PP, centre hole | PTFE/Silicone * | 1.3 mm | 45° shore A | ND 9 | |
| 226-54114-01 | Blue PP, centre hole | PTFE/Silicone/PTFE | 1.0 mm | 45° shore A | ND 9 | |
| 226-84129-01 | Blue PP, centre hole | PTFE/Silicone, Slit | 1.0 mm | 55° shore A | ND 9 | |
| 226-54113-02 | Blue PP, centre hole | PTFE/Silicone, Slit * | 1.3 mm | 45° shore A | ND 9 | |
| 226-84130-01 | Blue PP, centre hole | PTFE/Silicone, pre-cut (Y) | 1.0 mm | 55° shore A | ND 9 | |
| 226-84128-01 | Gold Magnetic, centre hole | PTFE/Silicone, ultra-clean | 1.0 mm | 55° shore A | ND 9 | |
| 226-84132-01 | Blue PP, closed top | PTFE/Silicone, ultra-clean | 1.0 mm | 55° shore A | ND 9 | |
| 226-84220-01 | Black PP, centre hole | PTFE/Silicone, ultra-clean | 1.3 mm | 45° shore A | ND 8 | |
| 226-84221-01 | Black PP, centre hole | PTFE/Silicone, ultra-clean | 1.3 mm | 55° shore A | ND 8 | |
| 226-54221-01 | Black PP, closed top | PTFE/Silicone, ultra-clean | 1.3 mm | 45° shore A | ND 8 | |
| 226-54221-02 | Black PP, closed top | - | - | - | ND 8 | |
| 226-54221-03 | - | PTFE/Silicone | 1.3 mm | 45° shore A | ND 8 | |

* UltraBond seal, cap & septa form an inseparable unit, so that septa cannot fall out.

## 1.5mL screw vial kit, including vial, cap and septa, 100/pack

| Kit part number | Vial | Vial part number | Septa material | Cap/Septa part number |
|---|---|---|---|---|
| 226-54110-31 | Clear with write on spot | 226-54110-11 | PTFE/Silicone, ultra-clean | 226-54113-01 |
| 226-54110-41 | Clear | 226-54110-01 | PTFE/Silicone, ultra-clean | 226-54113-01 |
| 226-54110-51 | Clear | 226-54110-01 | PTFE/Rubber | 226-54112-01 |
| 226-54111-41 | Amber with write on spot | 226-54111-11 | PTFE/Silicone, ultra-clean | 226-54113-01 |
| 226-54111-31 | Amber | 226-54111-01 | PTFE/Silicone, ultra-clean | 226-54113-01 |
| 226-54111-51 | Amber | 226-54111-01 | PTFE/Rubber | 226-54112-01 |

## Micro-insert for 1.5mL screw vials, 100/pack

| Part number | Min. sample vol | Max. sample vol | Usage | Assembled plastic spring | Type | Picture |
|---|---|---|---|---|---|---|
| 226-84201-11 | 30 uL | 250 uL | ND9 wide opening vials | √ | Conical | |
| 226-84202-11 | 25 uL | 150 uL | ND8 small opening vials | √ | Conical | |
| 226-84203-11 | 40 uL | 350 uL | ND9 wide opening vials | X | Flat bottom | |
| 226-84204-11 | 40 uL | 260 uL | ND8 small opening vials | X | Flat bottom | |

*1.5 mL amber screw vial kit*

*1.5 mL clear screw vial kit*

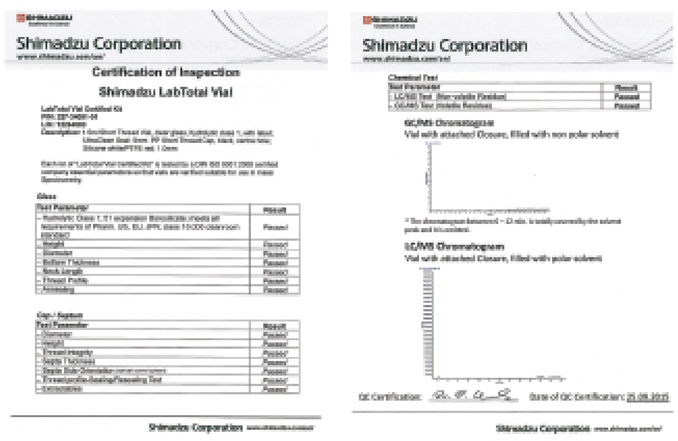
# Shimadzu LabTotal Vial MS Certified Kit

- Reduces the Adsorption of Basic Compounds on the Surface of the Glass Vial.
  – This improves quantitative accuracy in the analysis of trace basic compounds.
- Quality certificate proving suitability to LCMS / GCMS
  – This product can be used as a vial for high-sensitivity analysis in GCMS and LCMS
- Wide Mouth with Preset Cap and Septum Improves Ease of Use
  – This shortens the time needed for sample preparation and reduces human error.

| Part number | Description |
|---|---|
| 227-34001-01 | LabTotal Vial Certified Kit for LCMS, 100/pk |
| 227-34001-02 | Blue PP cap, Silicone white/PTFE red for LabTotal vial LCMS, 50/pk |
| 226-84340-01 | Black PP cap, Silicone white/PTFE red for LabTotal vial LCMS, 100/pk |
| 227-34002-01 | LabTotal Vial Certified Kit for GCMS, 100/pk |

## Mass Spec Quality Certificate Provided

This confirms that there was an absence of elution components from the vial in random inspections using LC/MS and GC/MS. Therefore, this product can be used with confidence, with no concern for ghost peaks originating from the vial.




# Shimadzu LabTotal Recovery Vial kit

- Shimadzu LabTotal Recovery vials offers maximum recovery for GC and HPLC/UHPLC with a residual volume <1uL for valuable samples
- Minimun working volume 25uL up to 1.6mL (Maximum possible volume) for reproducible results
- Can be used as a concentration vial, because the solid glass bottom offers excellent heat transfer and vial-stability.
- Compactible with universal autosampler
- Available in Deactivated, HPLC/GC and Mass Spec certified kits

| Kit part number | Vial | Vial part number | Septa material | Cap/Septa part number | Kit Type |
|---|---|---|---|---|---|
| 226-54307-31 | 0.9mL Recovery vial | 226-54307-01 | Silicone beige/PTFE white* | 226-84131-01 | - |
| 226-55001-71 | | | | | Deactivated |
| 226-55001-81 | | | | | HPLC/GC certified |
| 226-55001-91 | | | | | MS certified |
| 226-54308-31 | | | Silicone beige/PTFE white pre-slit* | 226-54113-02 | - |
| 226-55002-71 | | | | | Deactivated |
| 226-55002-81 | | | | | HPLC/GC certified |
| 226-55002-91 | | | | | MS certified |

*UltraBond seal, cap & septa form an inseparable unit, so that septa cannot fall out.

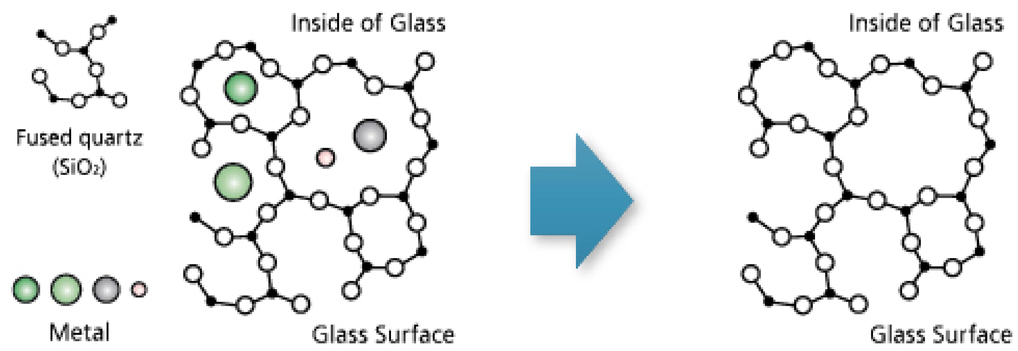
# TORAST-H Glass Vial

## Features

- Low adsorption vessels treated specially
- Minimized adsorption of bases, acids and neutrals
- Superior quality control

## TORAST -H Glass Technology eliminates the risk of adsorption to the glass surface of the vials

Glass, the material of vials, contains metal oxides. Oxides of metals have a high ionizing tendency to be Si-O-M (metal silanolate), which may cause ionic adsorption with basic compounds in the sample. TORAST-H Glass Technology uses special processing to remove metals from the glass and suppress adsorption of basic compounds.

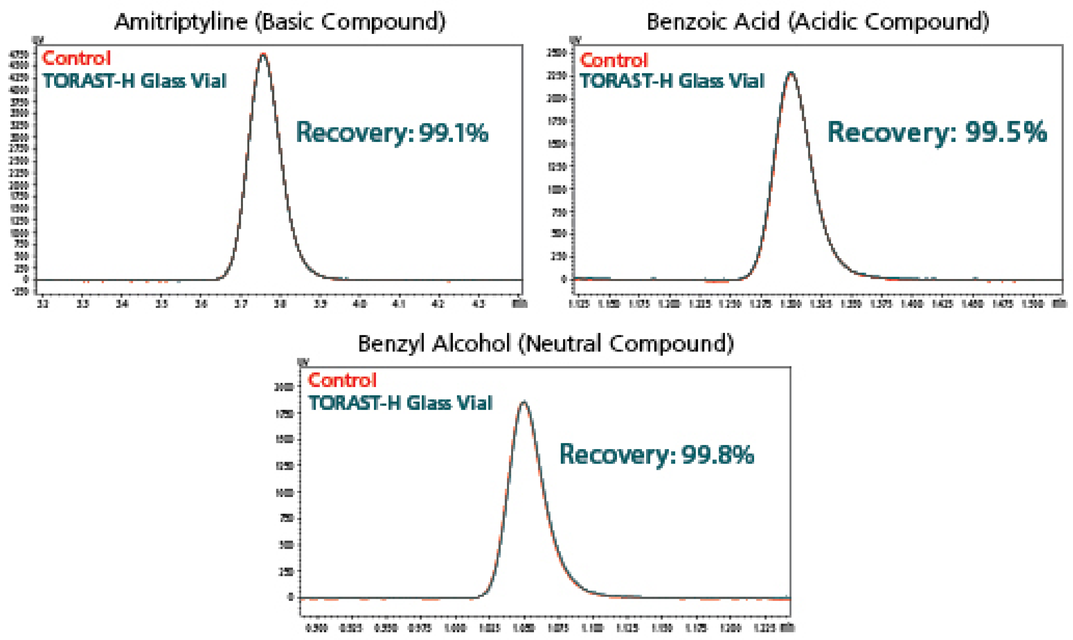



Conventional Vials (including metal)

TORAST-H Glass Vial

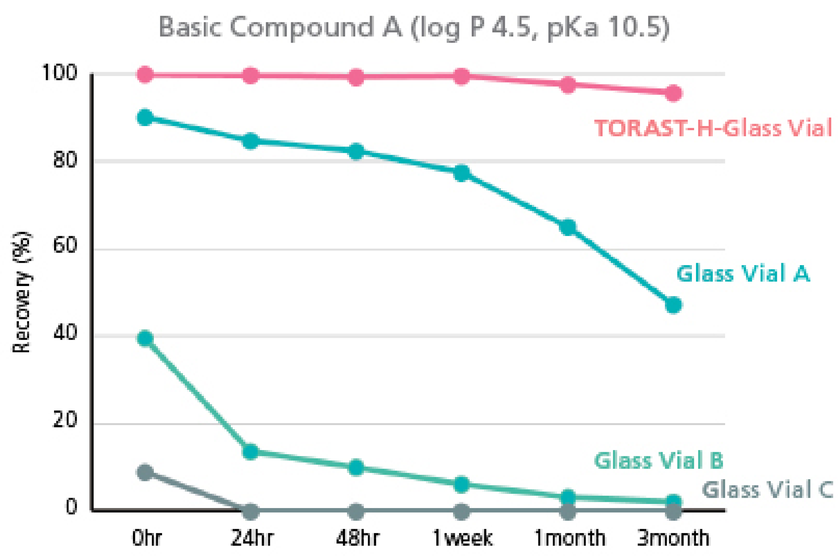
## Minimized adsorption of bases, acids & neutrals

In general, giving a positive charge to the glass surface suppresses the adsorption of the basic compounds, but conversely, it causes the adsorption of the acidic compounds. TORAST-H Glass Vials minimize adsorption of both types of compounds.




## Low adsorption for long-term storage

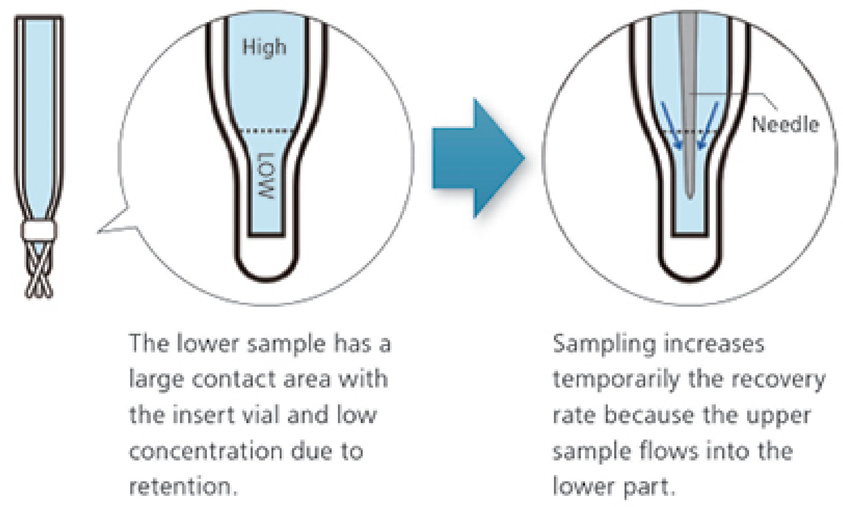
When a sample is stored in a general vial for a long time, the sample may adsorb into the surface of the vial, causing the reproducibility to be poor. The TORAST-H Glass Vial contains low adsorption characteristics that makes it excellent for long term sample storage.

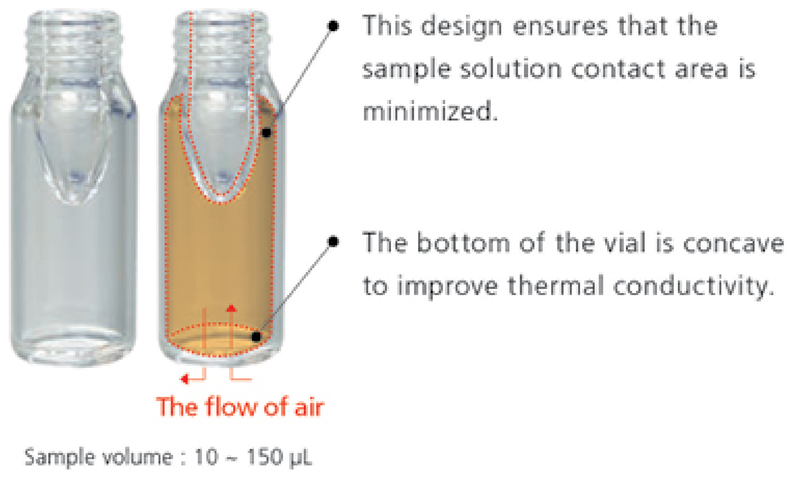



Adsorption test for long-term storage

## Small-Volume Vials

Insert vials (small capacity) may produce concentration gradients at the top and bottom due to sample adsorption, causing variation over time.

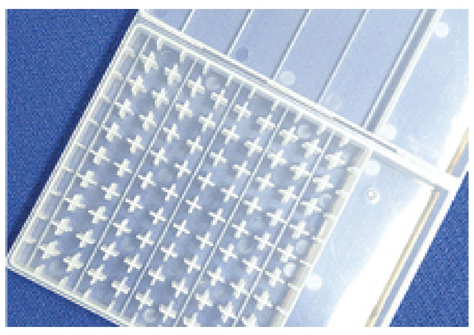



Small-volume vials have a large contact area; therefore, the rate of loss due to adsorption is greater than with a standard vial. TORAST-H Glass Vials shows dramatically less adsorption compared to other small-volume glass vials.

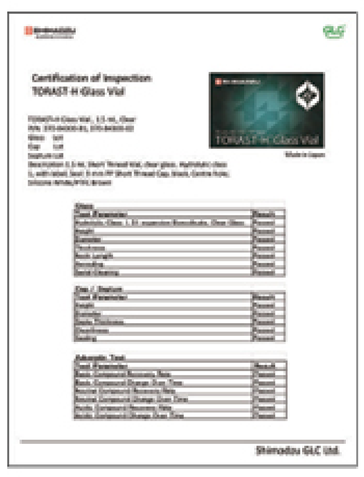
## Medical Grade Packaging Materials

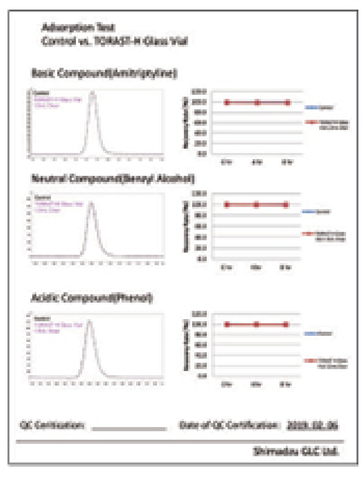
Reduce the adhesion of organic substances from the packaging and the formation of organic layers.



## Superior Quality Control

- Hydrolytic Class 1; 51 expansion Borosilicate
- Comes with quality certificates for lot management.
- Shape inspection of vials, septa and caps.
- Low adsorption performance testing for basic, acidic and neutral compounds.




## Product Information

| P/N | Color | Volume | Cap | Septa | Qty |
|---|---|---|---|---|---|
| 370-04300-01 | Clear Glass | 1.5 mL | Screw, Black | PTFE/Silicone | 100 |
| 370-04300-02 | | | | Preslit PTFE/Silicone | |
| 370-04300-03 | Amber Glass | | | PTFE/Silicone | |
| 370-04300-04 | | | | Preslit PTFE/Silicone | |
| 370-04301-01 | Clear Glass | 150 µL | | PTFE/Silicone | |
| 370-04301-02 | | | | Preslit PTFE/Silicone | |
| 370-04301-03 | Amber Glass | | | PTFE/Silicone | |
| 370-04301-04 | | | | Preslit PTFE/Silicone | |

* Avoid sunlight and store at room temperature.

# TORAST-H Bio Vial

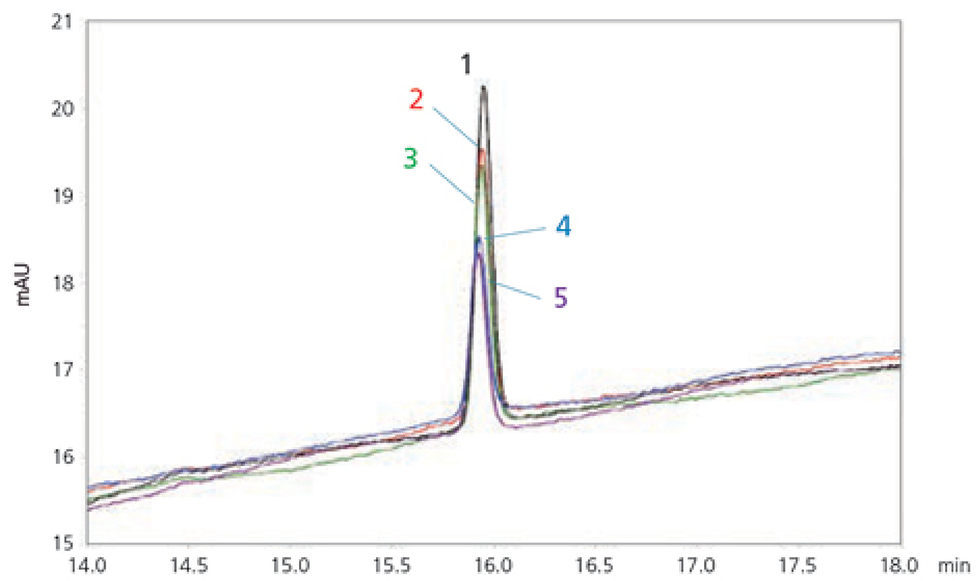
## Features

- Prevents the adsorption of organic compounds
- Reduces the adsorptive loss of the precious sample
- Ideal for peptide and basic compounds analysis

## Reduces the adsorption of peptides

The peptide used as a medium molecule pharmaceutical product is likely to be adsorbed on the polypropylene resin by the hydrophobic interaction. The TORAST-H Bio Vial prevents the adsorption of organic compounds.

| No. | Vial Type | Sample Vol. (µL) | Recovery (%) |
|---|---|---|---|
| 1 | TORAST-H Bio VIal | 200 | 100 |
| 2 | Glass Vial by Company A | 1500 | 81.1 |
| 3 | Glass Vial by Company B | 1500 | 78 |
| 4 | PP Vial by Company B | 200 | 52.1 |
| 5 | PP Vial by Company C | 200 | 53.3 |




Adsorption test on Ghrelin with various type of vials

## Product Information

| Name | P/N | Volume (µL) | Material | Qty./Unit |
|---|---|---|---|---|
| TORAST-H Bio Vial with cap | 370-04350-00 | 300 | Polypropylene | 100 |

# TORAST-H 96well 500 RU

## Features

- Low adsorption polypropylene 96-well plate
- Prevents the adsorption of organic compounds
- Reduces the adsorption loss of the precious sample
- Ideal for peptide and basic compounds analysis

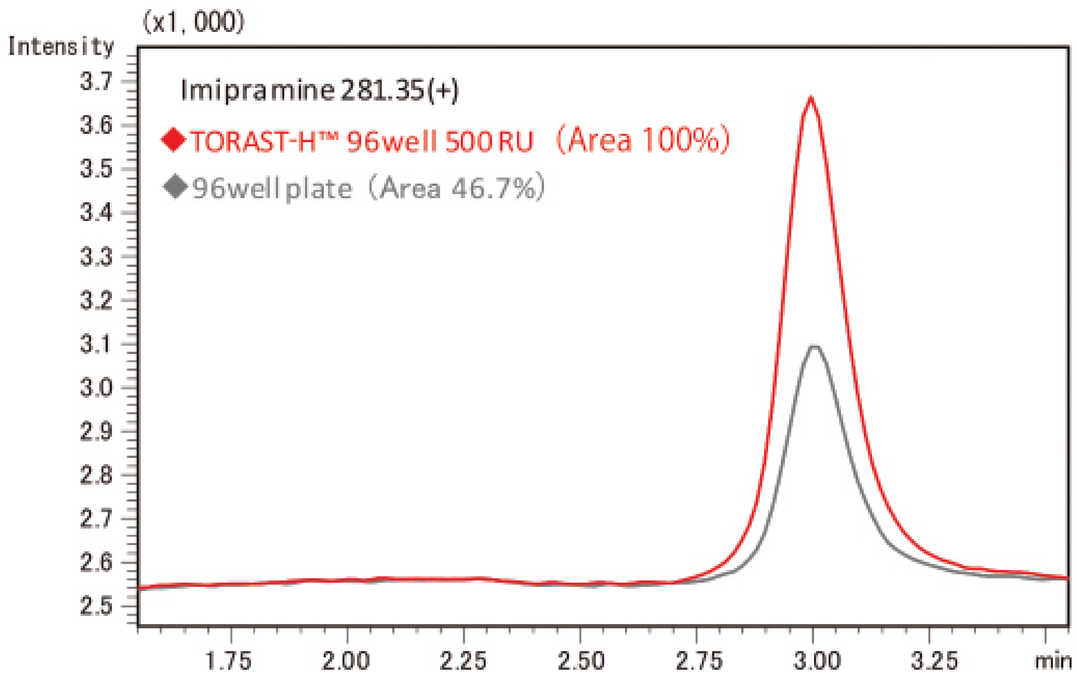
## Adsorption Test of Imipramine

Imipramine is used in the treatment of depression and is a hydrophilic and basic compound. (logP: 4.28, pKa: 9.2).

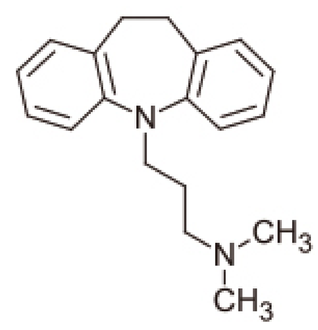
The chromatogram below shows a comparison of the Imipramine peak area with non-coated polypropylene 96-well plate compared to TORAST-H™ 96- well plates.

Non-coated polypropylene 96-well plate show hydrophobic adsorption within the well.

TORAST-H 96well 500 RU plates significantly improved the peak area by preventing the adsorption within the wells. This result indicates that TORAST-H 96well 500 RU well plate is effective in preventing adsorption.



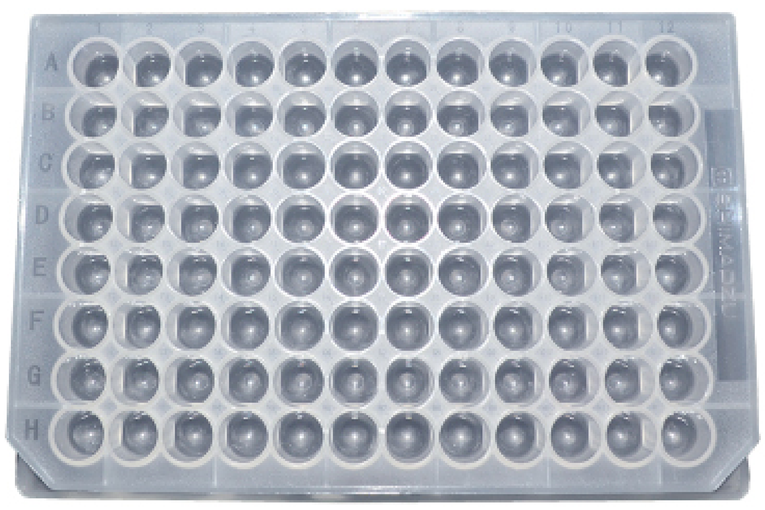

**Sample** : Imipramine (1 ng/mL)
**Instruments** : Nexera-i, LCMS-2020
**Mobile Phase** : 10 mM Ammonioum Acetate in Water : MeCN =40:60_Isocratic flow
**Flow Rate** : 0.2 mL/min



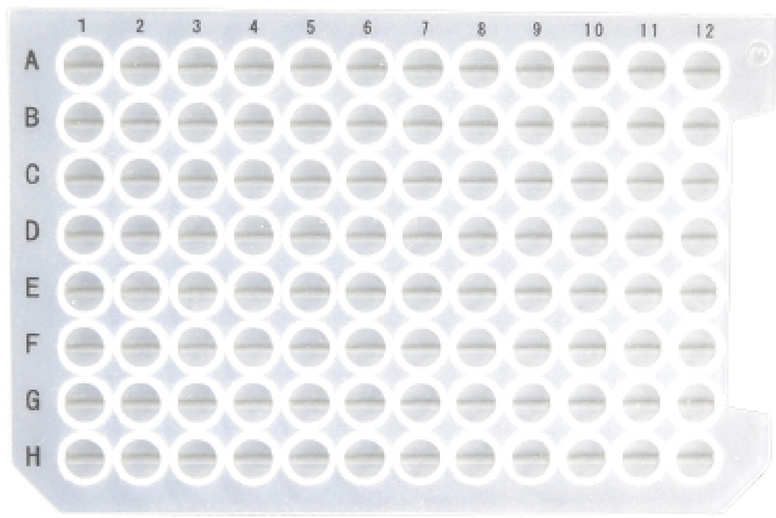

Imipramine  Molecular Weight : 280.4

## Product Information

| Name | P/N | Volume (µL) | Material | Qty./Unit |
|---|---|---|---|---|
| TORAST-H 96well 500 RU | 370-04100-01 | 500 | Polypropylene | 10 |
| TORAST 96well Silicon Mat | 370-04020-01 | - | Silicon | 50 |



*TORAST-H 96 well 500 RU*



*TORAST-H 96 well Silicon Mat*

## 1.5mL crimp vials, 100/pack

| Part number | 226-54120-11 | 226-54120-01 | 226-54306-01 | 226-54121-11 | 226-54121-01 |
|---|---|---|---|---|---|
| Type | Clear, crimp vial | Clear, crimp vial | Clear, crimp vial with integrated 0.2mL micro-insert, top bonded | Amber, crimp vial | Amber, crimp vial |
| Write on spot | √ | X | √ | √ | X |
| Min. Vol / uL | 200 | 200 | 25 | 200 | 200 |
| Max. Vol / mL | 1.5 | 1.5 | 0.21 | 1.5 | 1.5 |
| Dimension | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm | 32 x 11.6mm |
| Size | ND 11 | ND 11 | ND 11 | ND 11 | ND 11 |

## Caps/Septa for 1.5mL crimp vials, 100/pack

Temperature limit for PTFE/Rubber septa: -40°C up to 110°C
Temperature limit for PTFE/Silicone septa: -60°C up to 200°C
Temperature limit for PTFE/Silicone/PTFE septa: -60°C up to 200°C

| Part number | Cap | Septa Material | Septa Thickness | Septa Durometer | Picture |
|---|---|---|---|---|---|
| 226-54123-01 | Silver Aluminum | PTFE/Silicone, ultra-Clean | 1.3 mm | 45° shore A | |
| 226-54124-01 | Silver Aluminum | PTFE/rubber | 1.0 mm | 45° shore A | |
| 226-84125-01 | Blue Aluminum | PTFE/rubber | 1.0 mm | 45° shore A | |
| 226-84126-01 | Red Aluminum | PTFE/rubber | 1.0 mm | 45° shore A | |
| 226-54127-01 | Green Aluminum | PTFE/rubber | 1.0 mm | 45° shore A | |
| 226-54128-01 | Gold magnetic | Silicone/PTFE | 1.3 mm | 45° shore A | |
| 226-54129-01 | Gold magnetic | PTFE/ Silicone/PTFE | 1.0 mm | 45° shore A | |
| 226-54125-01 | – | Silicone/PTFE | 1.5 mm | 55° shore A | |
| 226-54129-02 | – | PTFE/ Silicone/PTFE | 1.0 mm | 45° shore A | |
| 226-54128-02 | – | Silicone/PTFE | 1.3 mm | 45° shore A | |

## 1.5mL crimp vial kit, including vial, cap and septa, 100/pack

| Kit part number | Vial | Vial part number | Septa material | Cap/Septa part number |
|---|---|---|---|---|
| 226-54120-51 | Clear with write on spot | 226-54120-11 | PTFE/Silicone, ultra-Clean | 226-54123-01 |
| 226-54120-31 | Clear | 226-54120-01 | PTFE/Silicone, ultra-Clean | 226-54123-01 |
| 226-54120-61 | Clear | 226-54120-01 | PTFE/rubber | 226-54124-01 |
| 226-54121-51 | Amber with write on spot | 226-54121-11 | PTFE/Silicone, ultra-Clean | 226-54123-01 |
| 226-54121-31 | Amber | 226-54121-01 | PTFE/Silicone, ultra-Clean | 226-54123-01 |
| 226-54121-41 | Amber | 226-54121-01 | PTFE/rubber | 226-54124-01 |

## Micro-insert for 1.5mL crimp vials, 100/pack

| Part number | Min. sample vol | Max. sample vol | Usage | Assembled plastic spring | Type | Picture |
|---|---|---|---|---|---|---|
| 226-84201-11 | 30 uL | 250 ul | ND9 & ND11 vials | √ | Conical | |
| 226-84203-11 | 40 uL | 350 uL | ND9 & ND11 vials | X | Flat bottom | |

## Crimper/Decapper for 1.5mL crimp vials

| Part number | Description |
|---|---|
| 226-84001-00 | 11mm Crimper |
| 226-84011-00 | 11mm Decapper |

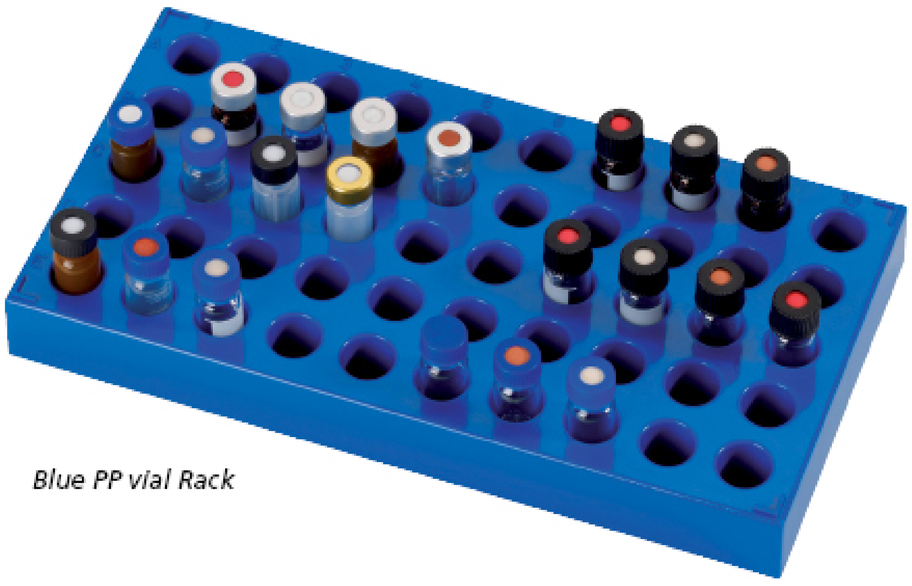
## Vial racks for 1.5mL vials

| Part number | Type | Dimension | Cavities |
|---|---|---|---|
| 226-84902-10 | Acrylic | 173 x 95 x 20 mm | 50 |
| 226-84903-10 | Blue PP | 200 x 105 x 17 mm | 50 |

## Shell vials, 100/pack

| Part number | 226-84203-01 | 226-84204-01 |
|---|---|---|
| Min. Vol / uL | 100 | 100 |
| Max. Vol / mL | 1.0 | 1.0 |
| Dimension | 40 x 8.2mm | 40 x 8.2mm |

*11mm crimper & decapper*



*Blue PP vial Rack*

## 4mL screw vials, 100/pack

| Part number | 226-84410-01 | 226-84410-21 | 226-84411-01 | 226-84411-21 |
|---|---|---|---|---|
| Type | Clear, screw | Clear, screw | Amber, screw | Amber, screw |
| Write on spot | √ | X | √ | X |
| Min. Vol / uL | 800 | 800 | 800 | 800 |
| Max. Vol / mL | 4.1 | 4.1 | 4.1 | 4.1 |
| Dimension | 45 x 14.7mm | 45 x 14.7mm | 45 x 14.7mm | 45 x 14.7mm |
| Size | ND 13 | ND 13 | ND 13 | ND 13 |

## Caps/Septa for 4mL vials, 100/pack

Temperature limit for Silicone/PTFE septa: -60°C up to 200°C

| Part number | Cap | Septa Material | Septa Thickness | Septa Durometer | Picture |
|---|---|---|---|---|---|
| 226-84413-01 | Black PP closed top | Silicone/PTFE | 1.5 mm | 55° shore A | |
| 226-84413-02 | Black PP open top | Silicone/PTFE | 1.5 mm | 55° shore A | |
| 226-84415-01 | White PP open top | - | - | - | |
| 226-84414-01 | - | Silicone/PTFE | 1.5 mm | 55° shore A | |

## 4mL screw vial kit, including vial, cap and septa, 100/pack

| Kit part number | Vial | Vial part number | Cap / Septa | Cap/Septa part number |
|---|---|---|---|---|
| 226-84410-31 | Clear with write on spot | 226-84410-01 | Closed top, Silicone/PTFE | 226-84413-01 |
| 226-84410-41 | Clear | 226-84410-21 | Closed top, Silicone/PTFE | 226-84413-01 |
| 226-84412-31 | Clear | 226-84410-21 | Open top, Silicone/PTFE | 226-84413-02 |
| 226-84411-31 | Amber with write on spot | 226-84411-01 | Closed top, Silicone/PTFE | 226-84413-01 |
| 226-84411-41 | Amber | 226-84411-21 | Closed top, Silicone/PTFE | 226-84413-01 |

## 10mL and 20mL Headspace screw vials, 100/pack

| Part number | 226-84521-01 | 226-84521-21 | 226-84510-01 | 226-84510-21 |
|---|---|---|---|---|
| Volume / mL | 10 | 10 | 20 | 20 |
| Type | Round bottom | Round bottom | Round bottom | Round bottom |
| Dimension | 46 x 22.5mm | 46 x 22.5mm | 75.5 x 22.5mm | 75.5 x 22.5mm |
| For use on instrument | CTC Combi PAL (Varian, Gerstel, Atas, Shimadzu), Agilent, PerkinElmer* | | | |

For TurboMatrix™ 16, 40 and 110, produced after 01.09.2006

## Caps/septa for 10mL and 20mL screw vials

Temperature limit for PTFE/Silicone septa: -60°C up to 200°C
Temperature limit for Butyl/PTFE septa: -40°C up to 120°C

| Part number | Cap | Septa Material | Septa Thickness | Septa Durometer | Picture |
|---|---|---|---|---|---|
| 226-84513-01 | Magnetic Screw | Silicone/PTFE | 1.3 mm | 45° shore A | |
| 226-84514-01 | Magnetic Screw | Silicone/PTFE | 1.5 mm | 55° shore A | |
| 226-84519-01 | Magnetic Screw | Silicone/PTFE | 1.3 mm | 45° shore A | |
| 226-84524-01 | Magnetic Screw | Silicone/PTFE, Pre-cut(*) | 1.5 mm | 55° shore A | |
| 226-84516-01 | Magnetic Screw | Butyl/PTFE | 1.6 mm | 55° shore A | |
| 226-84515-01 | - | Silicone/PTFE | 1.3 mm | 45° shore A | |
| 226-84517-01 | - | Butyl/PTFE | 1.6 mm | 55° shore A | |
| 226-84518-01 | - | Silicone/PTFE | 1.5 mm | 55° shore A | |

## 20mL screw vial kit, including vial, cap and septa, 100/pack

| Kit part number | Vial | Vial part number | Cap / Septa | Cap/Septa part number |
|---|---|---|---|---|
| 226-84510-31 | Clear | 226-84510-01 | Magnetic Screw, Silicone/ PTFE | 226-84513-01 |

## 10mL and 20mL Headspace crimp vials, 100/pack

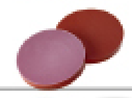
| Part number | 226-84520-00 | 226-84521-00 | 226-84520-01 | 226-84520-21 |
|---|---|---|---|---|
| Volume / mL | 10 | 10 | 20 | 20 |
| Type | Round bottom | Round bottom | Round bottom | Round bottom |
| Dimension | 46 x 22.5mm | 46 x 22.5mm | 75.5 x 22.5mm | 75.5 x 22.5mm |
| For use on instrument | Carlo Erba, CTC PAL (Varian, Gerstel, Atas, Shimadzu), Fisons, Varian, Thermo Scientific | | CTC PAL (Varian, Gerstel, Atas, Shimadzu), Thermo Scientific TriPlus HS ** | |

** not suitable for Thermo Scientific HS250/HS500

## 10mL and 20mL Headspace crimp vials, 100/pack

| Part number | 226-84522-01 | 226-84520-02 | 226-84523-01 |
|---|---|---|---|
| Volume / mL | 20 | 20 | 20 |
| Type | Flat bottom | Round bottom | Round bottom |
| Dimension | 75.5 x 22.5mm | 75.5 x 23mm | 75.5 x 23mm |
| For use on instrument | Agilent, Carlo Erba, DANI, Fisons | PerkinElmer, Tekmar | |

## Caps/septa for 10mL and 20mL crimp vials

| Part number | Cap | Septa Material | Septa Thickness | Septa Durometer | Temperature limit | Picture |
|---|---|---|---|---|---|---|
| 226-84523-11 | Gold magnetic | Silicone/PTFE, ultra-clean | 3.0 mm | 45° shore A | -60°C up to 200°C | |
| 226-84524-11 | Aluminum pressure release | Silicone/PTFE, ultra-clean | 3.0 mm | 45° shore A | -60°C up to 200°C | |
| 226-84525-11 | Aluminum silver | Silicone/PTFE, ultra-clean | 3.0 mm | 45° shore A | -60°C up to 200°C | |
| 226-84531-11 | Aluminum silver | Butyl/PTFE | 3.0 mm | 50° shore A | -40°C up to 120°C | |
| 226-84526-11 | Aluminum pressure release | Butyl/PTFE | 3.0 mm | 50° shore A | -40°C up to 120°C | |
| 226-84540-11 | Aluminum silver | Silicone/PTFE (HT quality) | 3.2 mm | 45° shore A | -60°C up to 200°C | |
| 226-84530-11 | Aluminum silver 5mm centre hole | Silicone/PTFE, ultra-clean | 3.0 mm | 45° shore A | Up to 300°C | |
| 226-84541-11 | Magnetic Bimetal | Silicone/PTFE | 3.0 mm | 55° shore A | -60°C up to 200°C | |
| 226-84527-11 | - | Silicone/PTFE, ultra-clean | 3.1 mm | 45° shore A | Up to 250°C | |
| 226-84528-11 | - | Silicone/PTFE, ultra-clean | 3.0 mm | 45° shore A | Up to 300°C |  |
| 226-84529-11 | Aluminum silver | - | - | - | - | |

## 20mL crimp vial kit, including vial, cap and septa, 100/pack

| Kit part number | Vial | Vial part number | Cap / Septa | Cap/Septa part number |
|---|---|---|---|---|
| 226-84520-31 | Clear | 226-84520-01 | Gold magnetic, Silicone/ PTFE, ultra-clean | 226-84523-11 |
| 226-84521-31 | Clear | 226-84520-01 | Aluminum pressure release, Silicone/PTFE, ultra-clean | 226-84524-11 |

## Headspace Wash Kit

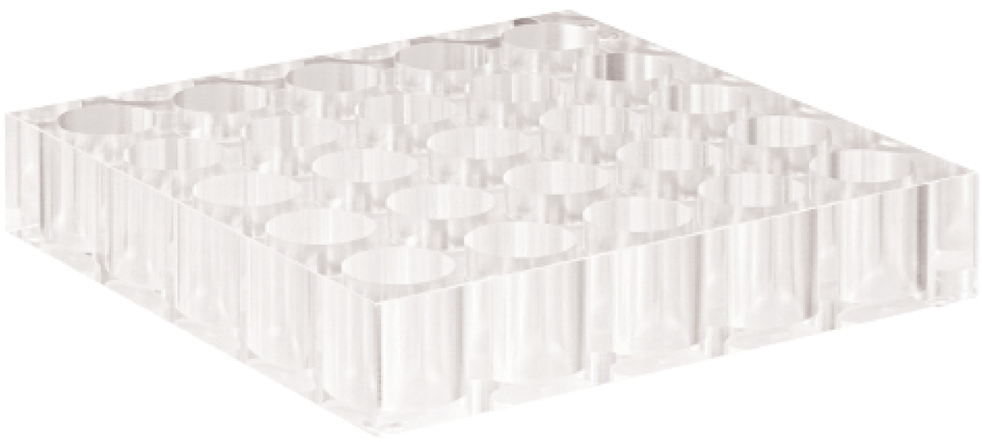
| Part number | Vial type | Cap Type | Septa Material | Pack size |
|---|---|---|---|---|
| 226-84600-00 | 10mL crimp vial | PE Snap Cap | Silicone/PTFE, Y-slitted | 25 |

## Vial rack for 10mL and 20mL vials

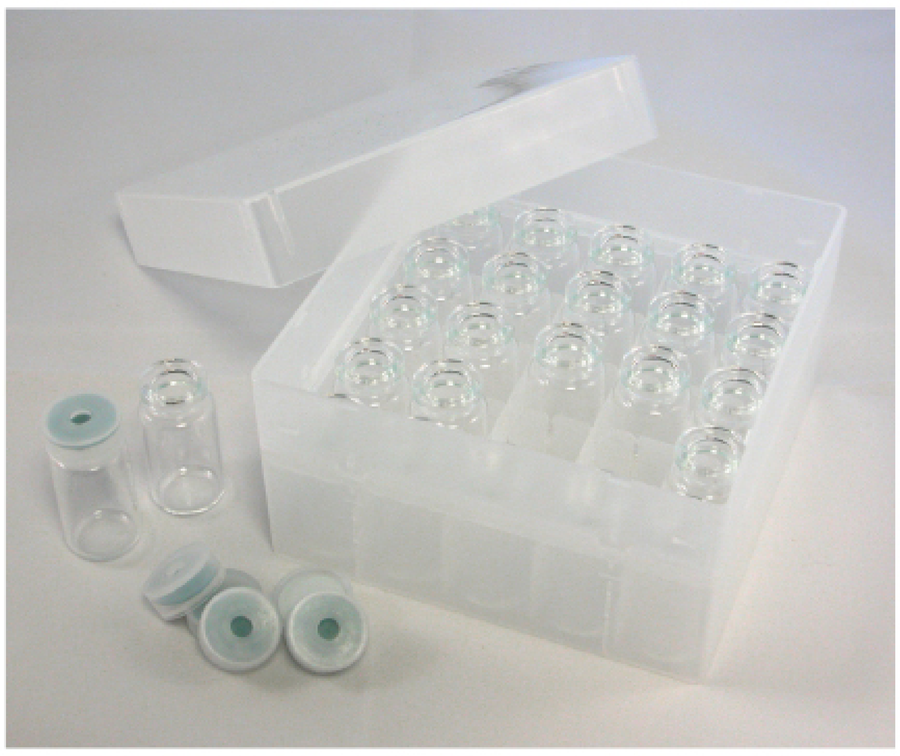
| Part number | Type | Dimension | Cavities |
|---|---|---|---|
| 226-84901-10 | Acrylic | 160 x 160 x 30mm | 25 |

## Crimper/Decapper for 10mL and 20mL crimp vials

| Part number | Description |
|---|---|
| 226-84002-00 | 20mm Crimper |
| 226-84012-00 | 20mm Decapper |



*Acrylic vial rack*



*Headspace wash kit*

# EPA vials

Shimadzu EPA vials are manufactured from 1st hydrolytic class glass, meeting EPA requirement. The flat bottomed EPA screw vials are available in 20 mL, 30 mL, 40 mL and 60 mL sizes in either clear or amber for light sensitive samples. Both injection and solid storage caps pre-assembled with septa are available for these vials. We recommend Ultrabond seals caps where the cap and septa form an inseparable unit, avoiding the issue of septa falling out or pushing into the vial. EPA vials and caps are sold separately in 100 per pack. Convenience vial kits with vials and pre-assembled caps are also available.

## EPA screw vials, 100/pack

| Part number | Volume | Vial | Size |
|---|---|---|---|
| 226-84531-01 | 20 mL | Clear | ND 24 |
| 226-84532-01 | 20 mL | Amber | ND 24 |
| 226-84537-01 | 30 mL | Clear | ND 24 |
| 226-84537-21 | 30 mL | Amber | ND 24 |
| 226-84538-01 | 40 mL | Clear | ND 24 |
| 226-84538-21 | 40 mL | Amber | ND 24 |
| 226-84539-01 | 60 mL | Clear | ND 24 |
| 226-84539-21 | 60 mL | Amber | ND 24 |

## Caps/septa for EPA screw vials, 100/pack

| Part number | Cap | Septa Material | Septa Thickness | Septa Durometer | Picture |
|---|---|---|---|---|---|
| 226-84533-11 | White PP, centre hole | Silicone/PTFE (EPA-Quality) | 3.2 mm | 45° shore A | |
| 226-84534-11 | White PP, closed top | Silicone/PTFE (EPA-Quality) | 3.2 mm | 45° shore A | |
| 226-84535-11 | White PP, centre hole | Silicone/PTFE (EPA-Quality) * | 3.2 mm | 45° shore A | |
| 226-84537-11 | White PP, closed top | Butyl/PTFE | 2.5 mm | 55° shore A | |
| 226-84538-11 | White PP, centre hole | Butyl/PTFE | 2.5 mm | 55° shore A | |
| 226-84536-11 | - | Silicone/PTFE (EPA-Quality) | 3.2 mm | 45° shore A | |

* UltraBond seal, cap & septa form an inseparable unit, so that septa cannot fall out.

## EPA screw vial kit, including vial, cap and septa, 100/pack

| Kit part number | Vial | Vial part number | Septa material | Cap/Septa part number |
|---|---|---|---|---|
| 226-84531-31 | 20 mL clear | 226-84531-01 | Centre hole, Silicone/PTFE (EPA-Quality) | 226-84533-11 |
| 226-84532-31 | 20 mL clear | 226-84531-01 | Closed top, Silicone/PTFE (EPA-Quality) | 226-84534-11 |
| 226-84533-31 | 20 mL clear | 226-84531-01 | Centre hole, Silicone/PTFE (EPA-Quality) * | 226-84535-11 |
| 266-84537-31 | 30 mL clear | 226-84537-01 | Centre hole, Silicone/PTFE (EPA-Quality) * | 226-84535-11 |
| 226-84538-31 | 40 mL clear | 226-84538-01 | Centre hole, Silicone/PTFE (EPA-Quality) | 226-84533-11 |

* UltraBond seal, cap & septa form an inseparable unit, so that septa cannot fall out.

## Storage screw vials and caps, 100/pack

| Part number | Volume | Vial | Size | Cap/Septa part number | Cap Material | Septa Material |
|---|---|---|---|---|---|---|
| 226-54220-01 | 1.5 mL | Clear | ND 8 | 226-54221-01 | PP Black closed top | Silicone/PTFE |
| 226-54222-01 | 1.5 mL | Amber | ND 8 | 226-54221-01 | PP Black closed top | Silicone/PTFE |
| 226-84410-21 | 4 mL | Clear | ND 13 | 226-84413-01 | PP Black closed top | Silicone/PTFE |
| 226-84411-21 | 4 mL | Amber | ND 13 | 226-84413-01 | PP Black closed top | Silicone/PTFE |
| 226-84416-01 | 8 mL | Clear | ND 15 | 226-84416-02 | PP Black closed top | Silicone/PTFE |
| 226-84416-21 | 8 mL | Amber | ND 15 | 226-84416-02 | PP Black closed top | Silicone/PTFE |
| 226-84417-01 | 12 mL | Clear | ND 15 | 226-84416-02 | PP Black closed top | Silicone/PTFE |
| 226-84417-21 | 12 mL | Amber | ND 15 | 226-84416-02 | PP Black closed top | Silicone/PTFE |
| 226-84418-01 | 16 mL | Clear | ND 18 | 226-84418-02 | PP Black closed top | Silicone/PTFE |

## 40mL TOC Vial Certified Kits, 72/pack

| Part number | Description | Remarks |
|---|---|---|
| 226-50580-00 | 40mL TOC Vial Certified Kit, incl. cap and 0.068" Silicon/PTFE septa | Comes with certificate certified <10ppb Carbon, meets USP Method 643 |
| 226-50581-00 | 40mL TOC Vial Certified Kit, incl. cap and 0.125" Silicon/PTFE septa | |
| 226-50582-00 | 40mL TOC Vial Certified Kit, incl. cap and 0.125" Silicon/PTFE septa,with dust covers | Each vial has an individual dust cover |

## 40mL TOC Vial Kits Separate Components

| Part number | Description | Consist of |
|---|---|---|
| 226-50585-00 | 40mL TOC clear vial, 144/pack | - |
| 226-50586-00 | PP Cap, centre hole, with 0.125" Silicon/PTFE septa, for 40mL vial, 72/pack | 226-50587-00 & 226-50588-00 |
| 226-50587-00 | PP cap, centre hole, for 40mL vials, 72/pack | - |
| 226-50588-00 | Septa only, 0.125" Silicon/PTFE, for 40mL vial, 72/pack | - |
| 226-50589-00 | PP Caps, with welded 0.068" Silicon/PTFE septa, for 40mL vial, 72/pack | - |

# Dedicated Pretreatment Vials for CLAM-2000

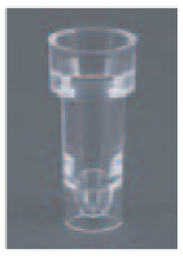
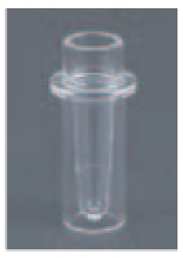
CLAM-2000 is compatible with dedicated disposable pretreatment vials from Shimadzu. Filtration and Collection vials are used as a pair.

| Part number | Description | | |
|---|---|---|---|
| 241-16531-41 | Vial set | Set of 100 | * Sold as a set |
| 241-16531-42 | Vial set | Set of 500 | * Sold as a set |

Dedicated Filtration Vial

Dedicated Collection Vial

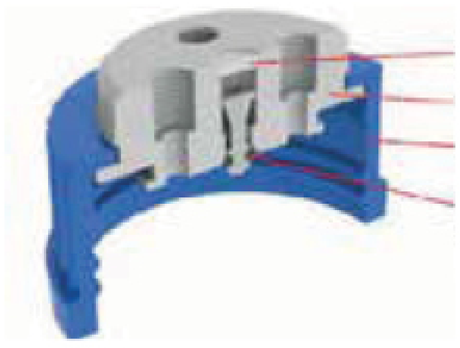
## Specifications of Applicable Sample and Reagent Vials

| | | |
|---|---|---|
| Sample Containers | 13 mm body diameter × 75 mm tall<br>Examples: BD brand Vacutainer blood collection tubes<br>Terumo brand Venoject II blood collection tubes<br>Nipro brand Neotube blood collection tubes, etc. | |
| | 2 mL cup<br>P/N 038-00180 Sample Cup, 1270016HIT |  |
| | X Micro-volume cup<br>P/N 241-94045-01 Sample Cup, Micro |  |
| Reagent Vials | 2 mL vial<br>P/N 038-00083-01 Vial, 2.0mL Glass Shell Vial | |
| | 6 mL vial<br>P/N 038-00199-04 Vial, SCREW NO.2-C | |
| | 12 mL vial<br>P/N 038-00199-06 Vial, SCREW NO.4-C | |

# Solvent Safety Caps Kit

## Features

- Minimize release of solvent odors
- One-way emission control valve allows air to enter the reservoir as solvent is removed
- Valve opens at a low 0.07psi to minimize back pressure




| Part number | | Description | Consists of | |
|---|---|---|---|---|
| ① | 226-50318-00 | 4 Ports bottle cap, 1 pc | - | |
| ② | 226-50319-00 | 2 Ports Bottle Cap, 1 pc | - | |
| ③ | 226-50315-01 | Plug, ¼-28, Virgin PTFE, 1pc | - | |
| ④ | 226-50316-01 | Tubing Connection, 1/8" OD tubing, Blue Polypropylene fitting, Yellow Tefzel ferrule, 1pc | - | |
| ⑤ | 226-50318-01 | 4 Ports Bottle Caps Kit | 226-50315-00 | Plug, ¼-28, Virgin PTFE, 2 pcs |
| | | | 226-50316-00 | Tubing Connection, 1/8" OD tubing, Blue Polypropylene fitting, Yellow Tefzel ferrule, 4 pcs |
| | | | 226-50318-00 | Safety Bottle Cap, 1pc |
| ⑥ | 226-50319-01 | 2 Ports Bottle Caps Kit | 226-50315-01 | Plug, ¼-28, Virgin PTFE, 1 pc s |
| | | | 226-50316-02 | Tubing Connection, 1/8" OD tubing, Blue Polypropylene fitting, Yellow Tefzel ferrule, 2 pcs |
| | | | 226-50319-00 | Safety 2 Ports Bottle Cap, 1pc |

①

②

③

④

⑤

⑥

# LC/LCMS Solvent Waste Kit

## Features

- Enclose your LC solvents in the reagent bottles and trap solvent vapours in the waste container
- Collect solvent waste and reduce solvent emissions from HPLC and other laboratory instruments
- Convert an open, venting waste collection point to a "Closed System"
- Can be used with a broad array of standard laboratory solvent container
- Designed for ease of use and adaptability

①

②

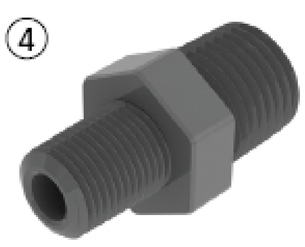
A colour marker label at the top of the indicator tube, marked "EXPOSED," shows the colour at which the indicator has been fully exposed. When the colour approximates this label, the filter should be changed. If the indicator changes to a light yellow colour, it designates a prolonged exposure to solvent and should be replaced immediately.

| Part number | | Description | Consists of |
|---|---|---|---|
| ① | 226-50330-00 | LC Solvent Waste Kit | GL45 safety cap manifold, exhaust filter, colour indicator, basic tubing connections and one DIN45, 6 litre, HDPE Jerrycan. |
| ② | 226-50350-00 | LCMS Ion Source Waste Kit | PTFE GL45/DIN45 cap with (2) barbs for 1/2" ID tubing and one DIN45, 6 litre, HDPE Jerrycan. |
| ③ | 226-50336-00 | Activated Carbon exhaust filter for organic solvents | |
| ③ | 226-50337-00 | COLOR INDICATOR for activated carbon vapor filters | |
| ④ | 226-50338-00 | Exhaust Filter Adapter to 1/8" NPT port, 1pc | |
| ⑤ | 226-50342-00 | Bottle Thread Adapter, S40 (Merck) female to GL45 male, polypropylene, 1pc | |

③

Carbon exhaust filter
with color indicator

④



⑤

# Vacuum Filtration System

## 47 mm, Glass Filtration Set

- Unique filtration adaptor design can connect with GL45 storage bottle.
- Can filtrate and store solution directly in GL45 storage bottle without the need of being transferred from the -filtering flask.

Application: Purification of organic, corrosive liquid such as solvent (mobile phase) for HPLC analysis.

## PTFE Coated Chemical Resistant Vacuum Pump

- No air pollution, maintenance free
  Rocker 300C vacuum pumps are driven by diaphragm, without the need of lubricant, regular oil changes and maintenance with no oil pollution.
- Good chemical resistance
  The diaphragm chamber of Rocker 300C is coated with PTFE and the SS # 316 valve plate can offer good resistance to a wide range of corrosive gases
- Thermal protection device
  Every motor of Rocker series pumps has a built-in thermal protection device to shut of the pump automatically when overheated and then resume working when the temperature cools down.
- International safety certification
  CE certification

Application: Vacuum filtration, Solid-Phase Extraction (SPE), Solvent purification

| Part number | Item |
|---|---|
| 226-82000-00 | 47mm Glass Filtration Set |
| 226-82000-01 | PTFE Coated Chemical Resistant Vacuum Pump |
| 226-82000-31 | 47mm Glass Filtration set with pump |

Glass Filtration Set

| | |
|---|---|
| Filter funnel | Borosilicate glass |
| Funnel support base | Borosilicate glass |
| Membrane support | Sintered glass |
| Clamp | Anodized aluminum |
| Filtration Adaptor | PP (Autoclavable) |
| Storage Bottle | Borosilicate glass |
| Funnel capacity | 300 mL |
| Flask capacity | 1000 mL |
| Filter diameter | 47 mm |
| Effective filtration area | 9.6 $cm^2$ |
| Hose barb | 5/16 inch (8 mm) |

Vacuum Pump

| | |
|---|---|
| Voltage | 220V/50Hz |
| Max. power | 60 W |
| Max. current | 0.3 A |
| Max. vacuum | - 630 mmHg |
| Max. flow rate | 20 l/min |
| Dimension (LxWxH) | 28.5x13.5x20.4 cm |

## Solvent bottle and cap kit

### Solvent bottle kit includes:

- 1 cap, GL45 thread, with three ports
- Safety-coated glass bottle 1L
- Polypropylene male Luer plug

| Part number | Description | Pack size |
|---|---|---|
| 226-88585-31 | Solvent bottles with caps and accessories | 5 |
| 226-88583-01 | Cap with accessories | 4 |
| 226-88585-02 | Solvent bottle 1L | 5 |

## Membrane and Syringe Filters, 100/pack

| Type | Material | Pore Size / um | | Diameter | | | |
|---|---|---|---|---|---|---|---|
| | | | 4mm* | 13mm | 25mm | 33mm | 47mm* |
| Syringe filter | Nylon | 0.22 | 226-82104-22 | 226-82113-22 | 226-52125-22 | 226-82133-22 | |
| | | 0.45 | 226-82104-45 | 226-82113-45 | 226-52125-45 | 226-82133-45 | |
| | Hydrophobic PTFE | 0.22 | 226-82204-22 | 226-82213-22 | 226-52225-22 | 226-82233-22 | |
| | | 0.45 | 226-82204-45 | 226-82213-45 | 226-52225-45 | 226-82233-45 | |
| | Hydrophilic PTFE | 0.22 | 226-82604-22 | 226-82613-22 | 226-82625-22 | 226-82633-22 | |
| | | 0.45 | 226-82604-45 | 226-82613-45 | 226-82625-45 | 226-82633-45 | |
| | CA | 0.22 | 226-82504-22 | 226-82513-22 | 226-82525-22 | 226-82533-22 | |
| | | 0.45 | 226-82504-45 | 226-82513-45 | 226-82525-45 | 226-82533-45 | |
| | PES | 0.22 | 226-82404-22 | 226-82413-22 | 226-82425-22 | 226-82433-22 | |
| | | 0.45 | 226-82404-45 | 226-82413-45 | 226-82425-45 | 226-82433-45 | |
| | PVDF | 0.22 | 226-82304-22 | 226-82313-22 | 226-82325-22 | 226-82333-22 | |
| | | 0.45 | 226-82304-45 | 226-82313-45 | 226-82325-45 | 226-82333-45 | |
| | MCE | 0.22 | 226-82704-22 | 226-82713-22 | 226-82725-22 | 226-82733-22 | |
| | | 0.45 | 226-82704-45 | 226-82713-45 | 226-82725-45 | 226-82733-45 | |
| Membrane filter | Nylon | 0.22 | | 226-52113-22 | 226-82125-22 | | 226-82147-22 |
| | | 0.45 | | 226-52113-45 | 226-82125-45 | | 226-52147-45 |
| | Hydrophobic PTFE | 0.22 | | 226-52213-22 | 226-82225-22 | | 226-82247-22 |
| | | 0.45 | | 226-52213-45 | 226-82225-45 | | 226-52247-45 |
| | PES | 0.22 | | 226-52413-22 | 226-52425-22 | | 226-52447-22 |
| | | 0.45 | | 226-52413-45 | 226-52425-45 | | 226-52447-45 |
| | PVDF | 0.22 | | 226-52313-22 | 226-52325-22 | | 226-52347-22 |
| | | 0.45 | | 226-52313-45 | 226-52325-45 | | 226-52347-45 |

* 200/pack

CoreFocus
SHIMADZU

# GC Columns and Consumables

# GC Columns

## The Shimadzu offers a wide range of GC columns:

### Fused silica capillary

Suitable for general purpose through to specific GC and GC/MS application.

- SH-I
- SH-PolarWax, SH-FAME

### PLOT – Fused silica and metal

Ideal for efficient, reproducible analyses of permanent gases, solvents, and hydrocarbons

- SH-Alumina BOND/NaSO4, Alumina BOND/KCl
- SH-Msieve 5A
- SH-Q-BOND, SH-U-BOND
- SH-Silica

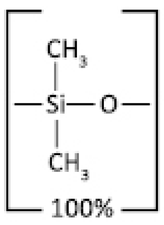
### MXT – Metal capillary

Ideal for High-Temperature GC Analysis. General-purpose column for drugs, solvent impurities, pesticides, hydrocarbons, PCB congeners (e.g., Aroclor mixes), essential oils, and semi-volatiles.

Shimadzu GC columns undergo rigorous testing to ensure they provide you with the best separation possible. Every GC column is tested at the maximum operating temperature for the column, and specific tests are undertaken based on the application the column is targeted for. This means you can be confident of a reliable separation, column after column.

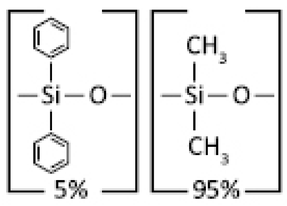
Structures, polarities, properties, and uses for Shimadzu capillary column phases, in order of increasing polarity

SH-I-1Ms, SH-1HT,
SH-I-1
Dimethyl polysiloxane



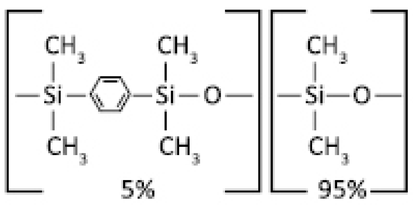

Similar to: (100%-methyl)-polysiloxane Polarity: nonpolar
Uses: solvents, petroleum products, pharmaceutical samples, waxes

SH-I-5Ms, SH-I-5HT,
SH-5, SH-5MS
Diphenyl dimethyl polysiloxane



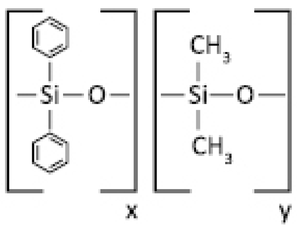

Similar to: (5%-phenyl)-methylpolysiloxane Polarity: slightly polar
Uses: flavors, environmental, aromatic hydrocarbons

SH-I-5Sil MS
1,4-bis(dimethylsiloxy)phenylene dimethyl polysiloxane



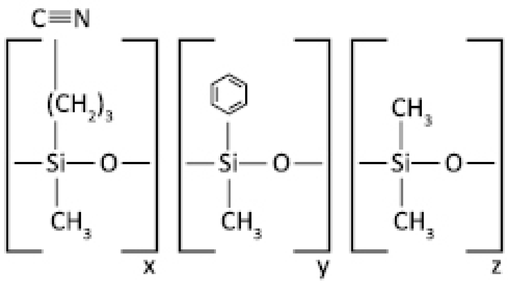

Similar to: (5%-phenyl)-methylpolysiloxane Polarity: slightly polar
Uses: flavors, environmental, pesticides, PCBs, aromatic hydrocarbons

SH-20, SH-25
Diphenyl dimethyl polysiloxane



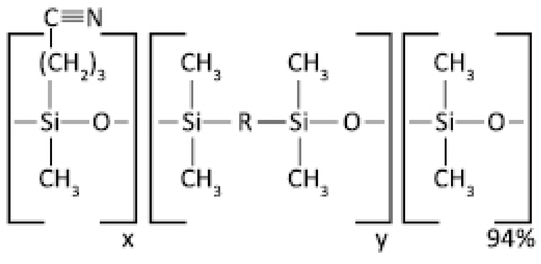

Similar to: (20%-phenyl)-methylpolysiloxane Polarity: slightly polar
Uses: volatile compounds, alcohols

SH-1301, SH-624
Cyanopropylmethyl phenylmethl polysiloxane



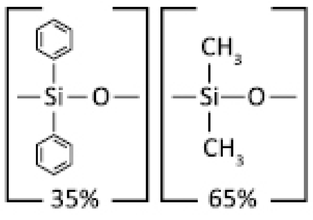

Similar to: (6%-cyanopropylphenyl)-methylpolysiloxane
Polarity: intermediately polar
Uses: volatile compounds, insecticides

SH-I-624Sil MS



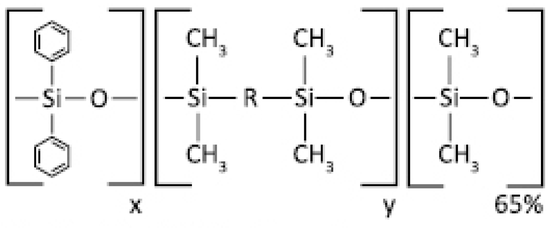

Similar to: (6%-cyanopropylphenyl)-methylpolysiloxane
Polarity: intermediately polar
Uses: volatile compounds, insecticides, residue solvents in pharmaceutical products

SH-35
Diphenyl dimethyl polysiloxane



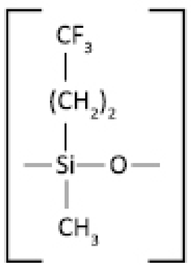

Similar to: (35%-phenyl)-methylpolysiloxane
Polarity: intermediately polar
Uses: pesticides, PCBs, amines, nitrogen-containing herbicides

SH-I-35Sil MS



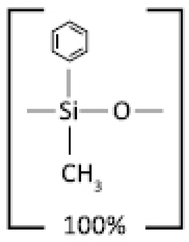

Similar to: (35%-phenyl)-methylpolysiloxane Polarity: intermediately polar
Uses: pesticides, PCBs, amines, nitrogen-containing herbicides

SH-200
Trifluoropropylmethyl polysiloxane



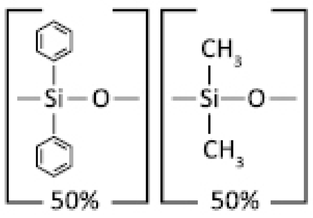
Similar to: (trifluoropropyl)-methylpolysiloxane
Polarity: selective for lone pair electrons Uses: environmental, solvents, Freon® gases, drugs, ketones, alcohols

SH-50
Phenyl methyl polysiloxane



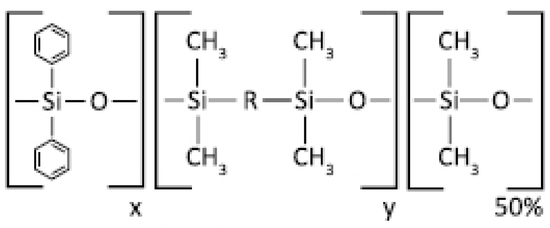

Similar to: (50%-phenyl)-methylpolysiloxane Polarity: intermediately polar
Uses: FAMEs, carbohydrates

SH-I-17
Diphenyl dimethyl polysiloxane



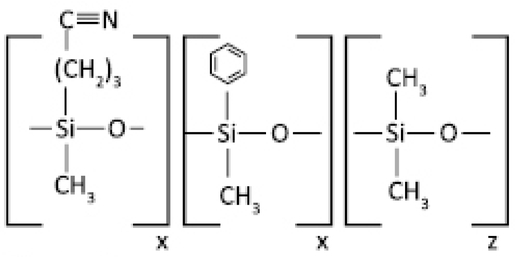

Similar to: (50%-phenyl)-methylpolysiloxane
Polarity: intermediately polar
Uses: triglycerides, phthalate esters, steroids, phenols

SH-I-17Sil MS



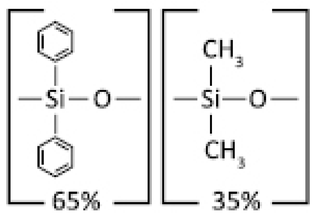

Similar to: (50%-phenyl)-methylpolysiloxane Polarity: intermediately polar
Uses: triglycerides, phthalate esters, steroids, phenols

SH-1701



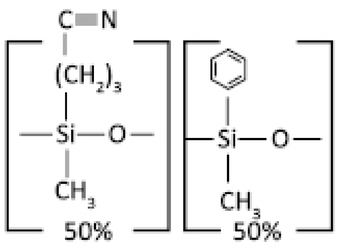

Similar to: (14%-cyanopropylphenyl)-methylpolysiloxane
Polarity: intermediately polar
Uses: pesticides, PCBs, alcohols, oxygenates

SH-65
Diphenyl dimethyl polysiloxane



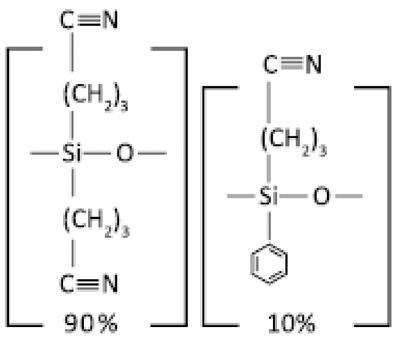

Similar to: (65%-phenyl)-methylpolysiloxane Polarity: intermediately polar
Uses: triglycerides, rosin acids, free fatty acids

SH-225
Cyanopropylmethyl phenylmethyl polysiloxane



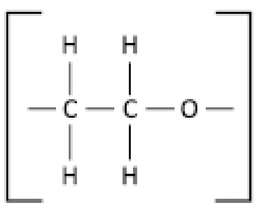

Similar to: (50%-cyanopropylmethyl)-methylphenylpolysiloxane
Polarity: polar
Uses: FAMEs, carbohydrates

SH-2330
Biscyanopropyl cyanopropylphenyl polysiloxane




Similar to: (95%-cyanopropyl)-phenyl polysiloxane Polarity: polar
Uses: cis/trans FAMEs, dioxin isomers, rosin acids

SH-PolarWax, SH-Wax
Polyethylene glycol



Polarity: polar
Uses: FAMEs, flavors, acids, amines, solvents, xylene isomers

**Structures, polarities, and properties also apply to metal MXT® stationary phases.

# Capillary Columns

Cross-Reference

| Shimadzu | Stationary Phase | USP | Similar Phases | | | | | | Page |
|---|---|---|---|---|---|---|---|---|---|
| | | | Agilent | Supelco | SGE | Phenomenex | Quadrex | Alltech | |
| **High-Performance Columns** | | | | | | | | | |
| SH-I-1MS | 100% dimethyl polysiloxane | G1, G2, G38 | HP-1ms UI, HP-1ms, DB-1ms UI, DB-1ms, Ultra-1, VF-1ms | SPB-1, Equity-1 | BP-1 | ZB-1, ZB-1ms | 007-1 | AT-1ms | C-6 |
| SH-I-1HT | 100% dimethyl polysiloxane | – | DB-1HT | – | – | ZB-1HT Inferno | | AT-1ht | C-8 |
| SH-I-5MS | 5% diphenyl / 95% dimethyl polysiloxane | G27, G36 | HP-5ms UI, HP-5ms, DB-5, Ultra-2, CP Sil 8 CB | SPB-5, Equity-5 | BP-5 | ZB-5, ZB-5MSi | 007-5 | AT-5ms | C-7 |
| SH-I-5HT | 5% diphenyl / 95% dimethyl polysiloxane | – | DB-5HT, VF-5HT | – | HT-5 | ZB-5HT Inferno | – | – | C-8 |
| SH-I-5Sil MS | 1,4-bis(dimethylsiloxy)phenylene dimethyl polysiloxane | – | DB-5ms UI, DB-5ms, VF-5ms | SLB-5ms | BPX-5 | ZB-5MS, ZB-Semi-Volatiles | 007-5MS | – | C-9 |
| SH-I-XLB | Unique phase | – | DB-XLB, VF-Xms | – | – | ZB-MR1, ZB-XLB | – | – | C-10 |
| SH-I-17 | 50% diphenyl / 50% dimethyl polysiloxane | G3 | HP-17, DB-17, DB-17HT, DB-608 | SPB-17 | – | ZB-50 | – | – | C-11 |
| SH-I-35Sil MS | Similar to 35% phenyl methyl polysiloxane | – | DB-35ms, DB-35ms UI, VF-35ms | – | BPX-35 | ZB-MR2 | – | – | C-11 |
| SH-I-17Sil MS | Similar to 50% phenyl methyl polysiloxane | G3, G17 | DB-17ms, VF-17ms, | – | BPX-50 | – | – | – | C-12 |
| SH-I-PAH | Ideal for EFSA PAH4 analysis | – | – | – | – | – | – | – | C-12 |
| SH-I-624Sil MS | Similar to 6% cyanopropylphenyl / 94% dimethyl polysiloxane | G43 | HP-624, DB-624, VF-624ms, CP-Select | – | BP-624 | – | – | – | C-13 |
| SH-I-1301Sil MS | Similar to 6% cyanopropylphenyl / 94% dimethyl polysiloxane | – | VF-1301ms | – | – | – | – | – | C-14 |
| **General Purpose Columns** | | | | | | | | | |
| SH-1 | 100% dimethyl polysiloxane | G1, G2, G38 | HP-1, DB-1, CP-Sil 5 CB | SPB-1 | BP-1 | ZB-1 | 007-1 | AT-1, EC-1 | C-15 |
| SH-5 | 5% diphenyl / 95% dimethyl polysiloxane | G27, G36 | HP-5, DB-5, CP-Sil 8 CB | SPB-5 | BP-5 | ZB-5 | 007-5 | AT-5, EC-5 | C-16 |
| SH-5MS | 5% diphenyl / 95% dimethyl polysiloxane | G27, G36 | HP-5, DB-5, CP Sil 8 CB | SPB-5 | BP-5 | ZB-5 | 007-5 | AT-5, EC-5 | C-17 |
| SH-20 | 20% diphenyl / 80% dimethyl polysiloxane | G28, G32 | – | SPB-20 | – | – | 007-20 | AT-20, EC-20 | C-18 |
| SH-25 | 25% diphenyl / 75% dimethyl polysiloxane | – | – | – | – | – | – | – | C-18 |
| SH-35 / SH-35MS | 35% diphenyl / 65% dimethyl polysiloxane | G42 | HP-35, DB-35 | SPB-35, SPB-608 | BPX-35, BPX-608 | ZB-35 | 007-35 | AT-35, AT-35ms | C-19 |
| SH-50 | 100% methyl phenyl polysiloxane | G3 | HP-50+, CP-Sil 24 CB | SPB-50 | BPX-50 | – | 007-17 | AT-50 | C-20 |
| SH-65 | 65% diphenyl / 35% dimethyl polysiloxane | – | – | – | – | – | 007-65HT | – | C-20 |
| SH-1301 | 6% cyanopropylphenyl / 94% dimethyl polysiloxane | G43 | DB-1301, CP-1301 | SPB-1301 | BP-624 | ZB-624 | 007-1301 | AT-1301 | C-21 |
| SH-624 | 6% cyanopropylphenyl / 94% dimethyl polysiloxane | G43 | HP-624, DB-624, DB-624 UI, VF-624ms | SPB-624 | BP-624 | ZB-624 | 007-624 | AT-624 | C-21 |
| SH-1701 | 14% cyanopropylphenyl / 86% dimethyl polysiloxane | G46 | DB-1701P, DB-1701, CP Sil 19 CB, VF-1701ms, VF-1701 Pesticides | Equity-1701 | BP-10 | ZB-1701, ZB-1701P | 007-1701 | AT-1701 | C-22 |

| Shimadzu | Stationary Phase | USP | Similar Phases | | | | | | Page |
|---|---|---|---|---|---|---|---|---|---|
| | | | Agilent | Supelco | SGE | Phenomenex | Quadrex | Alltech | |
| SH-200 / SH-200MS | Trifluoropropylmethyl polysiloxane | G6 | DB-210, DB-200, VF-200ms | – | – | – | – | AT-210 | C-23 |
| SH-225 | 50% cyanopropylmethyl / 50% phenylmethyl polysiloxane | G7, G19 | DB-225, DB-225MS, CP-Sil 43 CB | SPB-225 | BP-225 | – | 007-225 | AT-225 | C-25 |
| SH-2330 | 90% biscyanopropyl / 10% cyanopropylphenyl polysiloxane (Non-bonded) | G8, G48 | DB-23, VF-23ms | SP-2330, SP-2331, SP-2380 | BPX-70 | – | 007-23 | AT-Silar90 | C-25 |
| SH-2560 | Biscyanopropyl polysiloxane | – | HP-88, CP-Sil 88 | SP-2560 | – | – | – | – | C-26 |
| SH-Wax | Polyethylene glycol | G14, G15, G16, G20, G39 | DB-Wax, CP-Wax 52 CB | – | BP-20 | ZB-Wax | 007-CW | AT-WAXms, EC-WAX | C-27 |
| SH-PolarWax | Polyethylene glycol | G14, G15, G16, G20, G39 | HP-INNOWax, CP-Wax 52 CB, VF-WAX MS | Supelcowax-10 | – | ZB-Wax Plus | – | AT-WAX | C-28 |
| **Dedicated Columns** | | | | | | | | | |
| SH-1614 | Ideal for analysis of PBDE | – | – | – | – | – | – | – | C-29 |
| SH-OPP2 | Ideal for analysis of organophosphorus pesticides | – | – | – | – | – | – | – | C-30 |
| SH-CLP / SH-CLP II | Ideal for analysis of organochlorine pesticides | – | DB-CLP1 / DB-CLP2 | – | – | ZB-CLP1 ZB-CLP2 | – | – | C-31 |
| SH-VMS | Ideal for analysis of volatile organic pollutants | – | – | – | – | – | – | – | C-32 |
| SH-VRX | | – | DB-VRX | – | – | – | – | – | C-33 |
| SH-PCB | Ideal for analysis of PCB congeners | – | – | – | – | – | – | – | C-33 |
| SH-BAC Plus 1 / SH-BAC Plus 2 | Ideal for analysis of alcohol compounds in blood | – | DB-ALC1 / DB-ALC2 | – | – | ZB-BAC-1 / ZB-BAC-2 | – | – | C-34 |
| SH-FAME | Ideal for analysis of FAMEs | G16 | Select FAME | Omegawax | – | – | – | AT-AquaWax, AT-FAME | C-35 |
| SH-Volatil Amin | Ideal for analysis of volatile amines | – | – | – | – | – | – | – | C-35 |
| SH-5 Amine / SH-35 Amine | Ideal for analysis of amines | – | – | – | – | – | – | – | C-36 |
| SH-PolarD | Ideal for analysis of free acid | G25, G35 | HP-FFAP, DB-FFAP, VF-DA, CP-Wax 58 FFAP CB | SPB-1000, Nukol | BP-21 | ZB-FFAP | 007-FFAP | AT-AquaWax-DA, AT-1000, EC-1000 | C-37 |
| SH-PolarX | Ideal for analysis of amines | – | CAM, CP-Wax 51 for Amines | Carbowax Amine | – | – | – | AT-CAM | C-38 |
| **PLOT Columns** | | | | | | | | | |
| SH-Silica BOND | Bonded silica | – | GS-GasPRO, CP-SilicaPLOT | – | – | – | – | – | C-39 |
| SH-Alumina BOND / Na2SO4 | Aluminum oxide with Na2SO4 deactivation | – | GS-Alumina, CP-Al2O3/ Na2SO4 | Alumina sulfate PLOT | – | – | – | AT-Alumina | C-40 |
| SH-Alumina BOND / KCl | Aluminum oxide with KCl deactivation | – | GS-Alumina KCl, HP-PLOT Al2O3 KCl, CP-Al2O3/KCl | Alumina chloride PLOT | – | – | PLT-AL2O3 | – | C-40 |
| SH-Msieve 5A | Molecular Sieve 5A | – | HP-PLOT Molesieve, CP-Molsieve 5A | Mol Sieve 5A PLOT | – | – | PLT-5A | AT-Mole Sieve | C-41 |
| SH-Q-BOND | 100% divinylbenzene porous polymer | – | HP-PLOT Q, CP-PoraPLOT Q, CP-PoraBOND Q | Supel-Q PLOT | – | – | PLT-Q | AT-Q | C-42 |
| SH-U-BOND | Divinylbenzene ethylene glycol / dimethylacrylate porous polymer | – | HP-PLOT U, CP-PoraPLOT U, CP-PoraBOND U | – | – | – | – | – | C-42 |
| **Metal Columns** | | | | | | | | | |
| SH-MetalX-1 | 100% dimethyl polysiloxane | G1, G2, G38 | DB-PS1 | – | – | – | UAC-1 | – | C-43 |
| SH-MetalX-5 | 5% diphenyl / 95% dimethyl polysiloxane | G27, G36 | DB-PS5, VF-5ht UltiMetal | – | – | – | UAC-5 | – | C-43 |
| SH-MetalX-1701 | Similar to (14%-cyanopropylphenyl)-methylpolysiloxane | G46 | DB-PS1701 | – | – | – | – | – | C-43 |
| SH-MetalX-WAX | Carbowax polyethylene glycol | G14, G15, G16, G20, G39 | DB-PSWAX | – | – | – | UAC-CW | – | C-43 |
| SH-MetalX Biodiesel TG | Propietary phase | – | Bioiesel, Select Biodiesel | MET-Biodiesel | – | ZB-Bioethanol | – | – | C-43 |

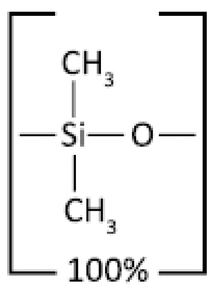
# Capillary Columns

High-Performance Columns

## SH-I-1MS

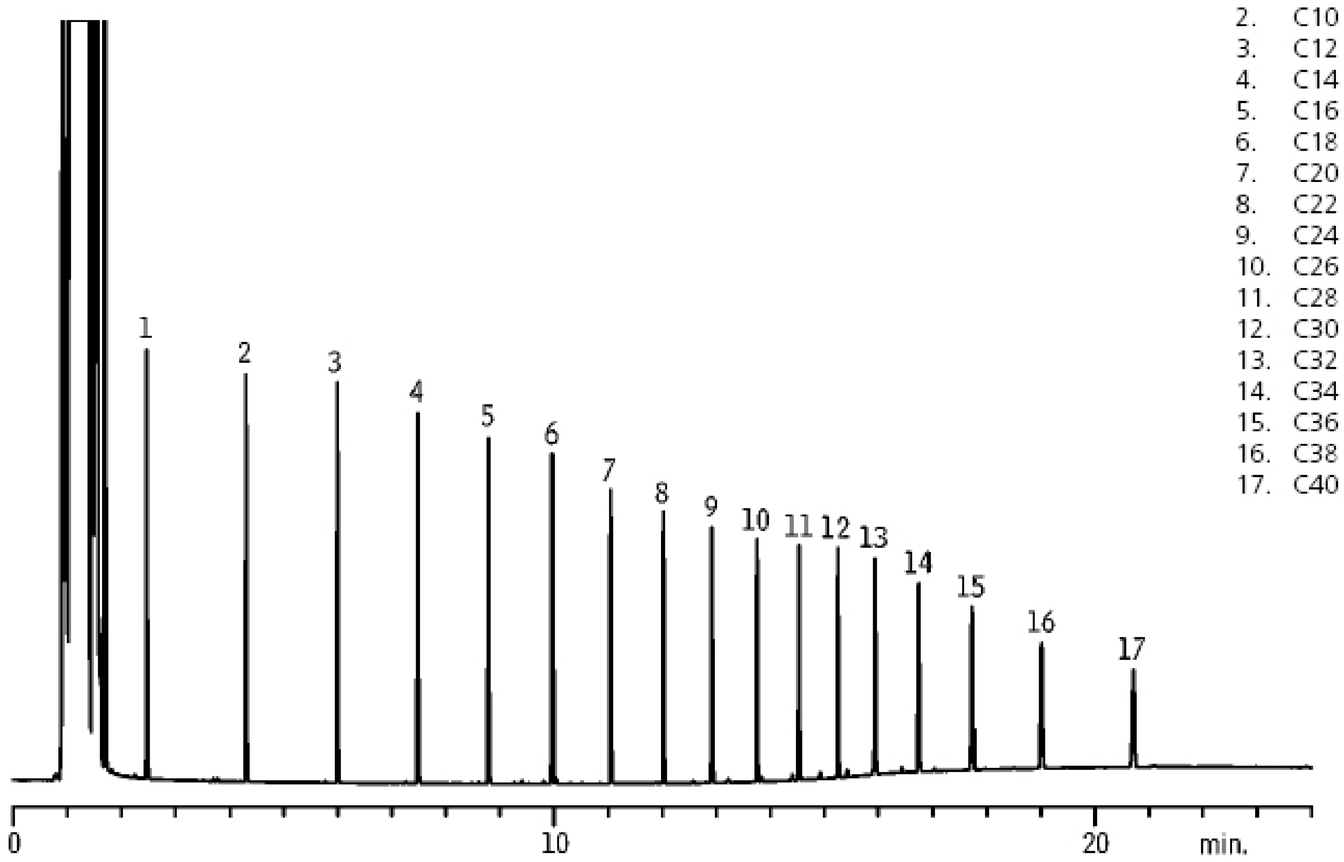
- Non-polar phase: Crossbond™ 100% dimethyl polysiloxane
- Tested and guaranteed for ultra-low bleed; improved signal-to-noise ratio for better sensitivity and mass spectral integrity.
- General-purpose columns for arson accelerants, essential oils, hydrocarbons, pesticides, PCB congeners (e.g., Aroclor mixes), sulfur compounds, amines, solvent impurities, simulated distillation, oxygenates, gasoline range organics (GRO), refinery gases.
- Equivalent to USP G2 phase.
- Similar phases: HP-1ms UI, HP-1ms, DB-1ms UI, DB-1ms, Ultra-1, VF-1ms, SPB-1, Equity-1

SH-I-1MS Structure




| ID | df | Temp. Range | 20 m | 25 m | 50 m |
|---|---|---|---|---|---|
| 0.15 mm | 0.15 µm | -60 to 330/350 °C | 227-36001-01 | – | – |
| | 2.00 µm | -60 to 330/350 °C | 227-36002-01 | – | – |
| 0.18 mm | 0.18 µm | -60 to 330/350 °C | 221-75921-20 | – | – |
| | 0.36 µm | -60 to 330/350 °C | 227-36003-01 | – | – |
| 0.20 mm | 0.33 µm | -60 to 330/350 °C | – | 227-36004-01 | 227-36004-02 |
| **ID** | **df** | **Temp. Range** | **15 m** | **30 m** | **60 m** |
| 0.25 mm | 0.25 µm | -60 to 330/350 °C | 227-36005-01 | 221-75923-30 | 227-36005-02 |
| | 0.50 µm | -60 to 330/350 °C | 227-36006-01 | 227-36006-02 | 221-75924-60 |
| | 1.00 µm | -60 to 330/350 °C | 227-36007-01 | 227-36007-02 | 227-36007-03 |
| 0.32 mm | 0.25 µm | -60 to 330/350 °C | 227-36008-01 | 221-75926-30 | 227-36008-02 |
| | 0.50 µm | -60 to 330/350 °C | 227-36009-01 | 227-36009-02 | 227-36009-03 |
| | 1.00 µm | -60 to 330/350 °C | – | 227-36010-01 | 221-75928-60 |
| | 4.00 µm | -60 to 330/350 °C | – | 227-36011-01 | – |
| 0.53 mm | 0.50 µm | -60 to 330/350 °C | 227-36012-01 | 227-36012-02 | – |
| | 1.00 µm | -60 to 330/350 °C | 227-36013-01 | 227-36013-02 | – |
| | 1.50 µm | -60 to 330/350 °C | 227-36014-01 | 227-36014-02 | 227-36014-03 |

# Petroleum Hydrocarbons (TPH)




**Peaks**

1. C8
2. C10
3. C12
4. C14
5. C16
6. C18
7. C20
8. C22
9. C24
10. C26
11. C28
12. C30
13. C32
14. C34
15. C36
16. C38
17. C40

**Conditions**

**Instrument** : GC-2010
**Column** : SH-I-1Ms, 20 m, 0.18 mm ID, 0.18 µm (P/N: 221-75921-20)
**Sample** : Florida TRPH Standard, 500 µg/mL each component in hexane
**Inj. Vol.** : 0.5 µL, split (split ratio 20:1)
**Inj. Temp** : 275 °C
**Carrier Gas** : Hydrogen, constant linear velocity mode, 55 cm/sec.
**Oven Temp** : 40 °C (hold 1 min) to 330 °C at 20 °C/min (hold 10 min)
**Detector** : FID, 350 °C

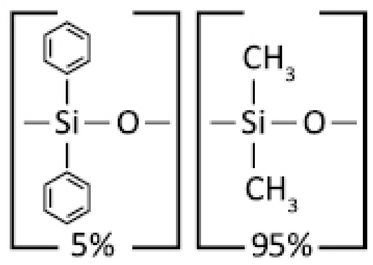
# Capillary Columns

High-Performance Columns

## SH-I-5MS

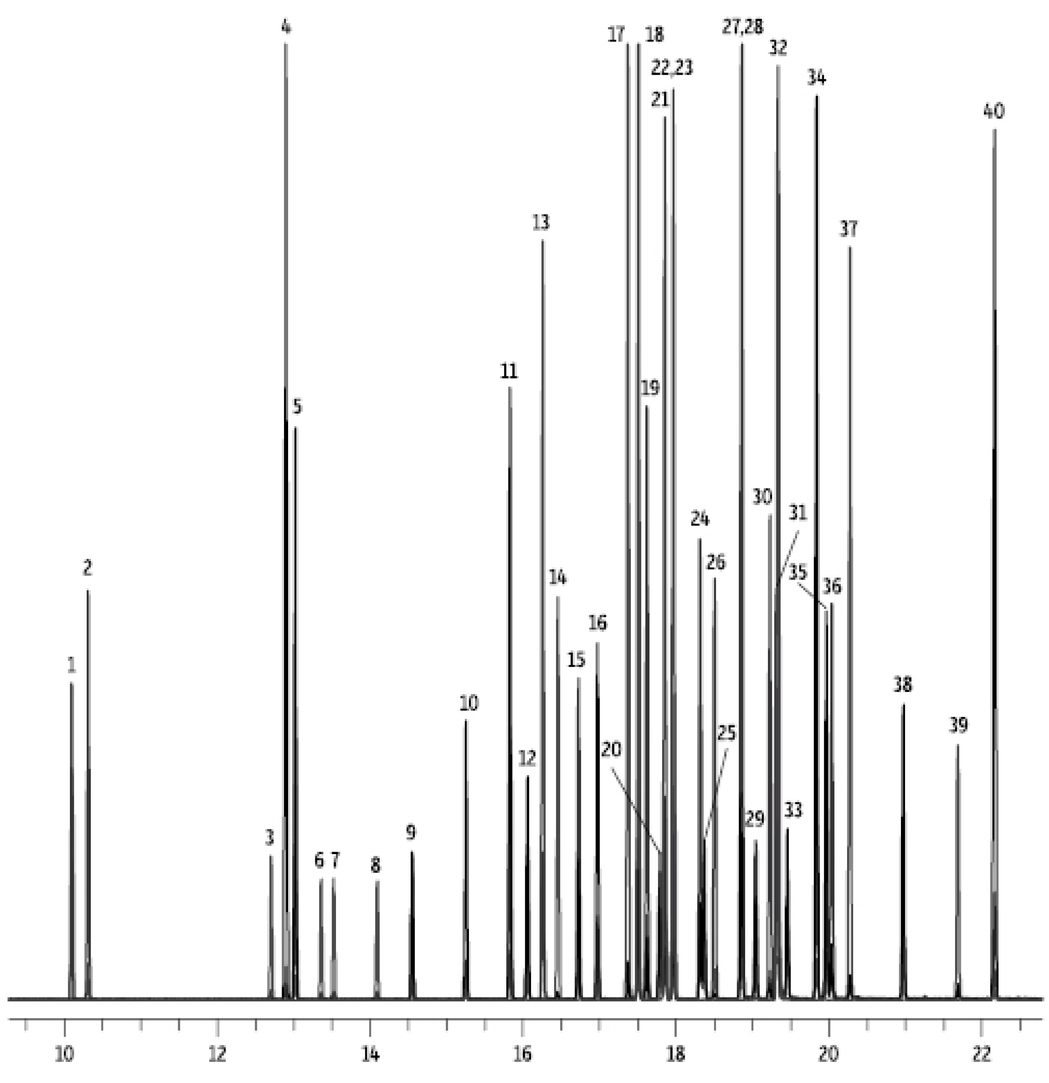
- Low-polarity phase: Crossbond™ 5% diphenyl / 95% dimethyl polysiloxane
- Tested and guaranteed for ultra-low bleed; improved signal-to-noise ratio for better sensitivity and mass spectral integrity.
- General-purpose columns for semi-volatiles, phenols, amines, residual solvents, drugs of abuse, pesticides, PCB congeners (e.g., Aroclor mixes), solvent impurities.
- Equivalent to USP G27 and G36 phases.
- Similar phases: HP-5ms UI, HP-5ms, DB-5, Ultra-2, CP Sil 8 CB, SPB-5, Equity-5

SH-I-5MS Structure




| ID | df | Temp. Range | 20 m | 25 m | 50 m |
|---|---|---|---|---|---|
| 0.18 mm | 0.18 µm | -60 to 330/350 °C | 227-36015-01 | – | – |
| | 0.30 µm | -60 to 330/350 °C | 227-36016-01 | – | – |
| | 0.36 µm | -60 to 330/350 °C | 227-36017-01 | – | – |
| 0.20 mm | 0.33 µm | -60 to 330/350 °C | – | 227-36018-01 | 227-36018-02 |
| **ID** | **df** | **Temp. Range** | **15 m** | **30 m** | **60 m** |
| 0.25 mm | 0.25 µm | -60 to 330/350 °C | 221-75940-15 | 221-75940-30 | 227-36019-01 |
| | 0.40 µm | -60 to 330/350 °C | – | 227-36020-01 | – |
| | 0.50 µm | -60 to 330/350 °C | 227-36021-01 | 221-75941-30 | 221-75942-60 |
| | 1.00 µm | -60 to 330/350 °C | 227-36022-01 | 227-36022-02 | 227-36022-03 |
| 0.32 mm | 0.25 µm | -60 to 330/350 °C | 227-36023-01 | 221-75943-30 | 227-36023-02 |
| | 0.50 µm | -60 to 330/350 °C | 227-36024-01 | 221-75944-30 | 227-36024-02 |
| | 1.00 µm | -60 to 330/350 °C | 227-36025-01 | 227-36025-02 | 227-36025-03 |
| 0.53 mm | 0.25 µm | -60 to 330/350 °C | 227-36026-01 | 227-36026-02 | – |
| | 0.50 µm | -60 to 330/350 °C | 227-36027-01 | 227-36027-02 | – |
| | 1.00 µm | -60 to 330/350 °C | 227-36028-01 | 227-36028-02 | – |
| | 1.50 µm | -60 to 330/350 °C | 227-36029-01 | 227-36029-02 | – |

# GC Multiresidue Pesticide




**Peaks**

1. Chloroneb
2. Pentachlorobenzene
3. alpha-BHC
4. Hexachlorobenzene
5. Pentachloroanisole
6. beta-BHC
7. gamma-BHC (Lindane)
8. delta-BHC
9. Endosulfan ether
10. Heptachlor
11. Pentachlorothioanisole
12. Aldrin
13. 4,4'-Dichlorobenzophenone
14. Fenson
15. Isodrin
16. Heptachlor epoxide (Isomer B)
17. Chlorbenside
18. *trans*-Chlordane
19. 2,4'-DDE
20. Endosulfan I
21. *cis*-Chlordane
22. *trans*-Nonachlor
23. Chlorfenson (Ovex)
24. 4,4'-DDE
25. Dieldrin
26. 2,4'-DDD
27. Endrin
28. Ethylan (Perthane)
29. Endosulfan II
30. 4,4'-DDD
31. 2,4'-DDT
32. *cis*-Nonachlor
33. Endrin aldehyde
34. 4,4'-Methoxychlor olefin
35. Endosulfan sulfate
36. 4,4'-DDT
37. 2,4'-Methoxychlor
38. Endrin ketone
39. Tetradifon
40. Mirex

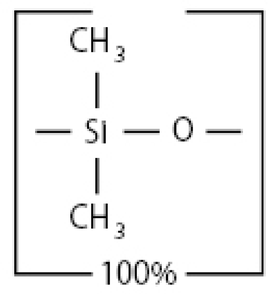
**Conditions**

**Column** : SH-I-5MS, 30 m, 0.25 mm ID, 0.25 um (P/N: 221-75940-30)
**Inj. Vol.** : 1 µL split (split ratio 50:1)
**Inj. Temp** : 250 °C
**Oven Temp** : 90 °C (hold 1 min) to 330 °C at 8.5 °C/min (hold 5 min)
**Carrier Gas** : He, constant flow rate 1.4 mL/min
**Detector** : MS-QP
Transfer Line Temp: 290 °C
Source Temp: 325 °C
Solvent Delay Time: 5 min
Ionization: EI

## SH-I-1HT

- Non-polar phase: Crossbond™ 100% dimethyl polysiloxane
- 40% longer lifetime from specially designed fused silica tubing.
- Columns processed for high-temperature applications, such as high molecular weight hydrocarbons.
- Similar phases: DB-1HT, AT-1ht

SH-I-1HT Structure

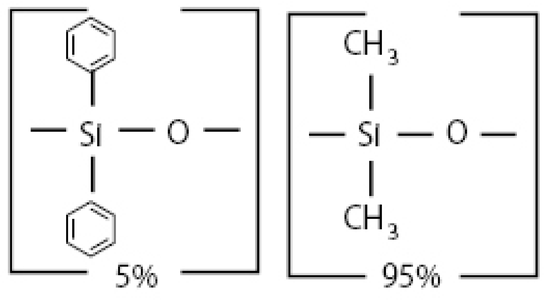



| ID | df | Temp. Range | 15 m | 30 m |
|---|---|---|---|---|
| 0.25 mm | 0.10 µm | -60 to 400 °C | 227-36087-01 | 227-36087-02 |
| | 0.25 µm | -60 to 400 °C | – | 227-36088-01 |
| 0.32 mm | 0.10 µm | -60 to 400 °C | 227-36089-01 | 227-36089-02 |
| | 0.25 µm | -60 to 400 °C | – | 227-36090-01 |

## SH-I-5HT

- Low-polarity phase: Crossbond™ 5% diphenyl / 95% dimethyl polysiloxane
- 40% longer lifetime from specially designed fused silica tubing.
- Columns processed for high-temperature applications, such as mineral oil.
- Similar phases: DB-5HT, VF-5HT

SH-I-5HT Structure

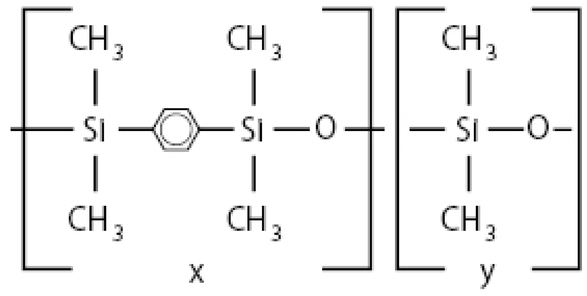



| ID | df | Temp. Range | 15 m | 30 m |
|---|---|---|---|---|
| 0.25 mm | 0.10 µm | -60 to 400 °C | 221-75933-15 | 227-36091-01 |
| | 0.25 µm | -60 to 400 °C | 227-36092-01 | 221-75934-30 |
| 0.32 mm | 0.10 µm | -60 to 400 °C | 227-36093-01 | 227-36093-02 |
| | 0.25 µm | -60 to 400 °C | – | 227-36094-01 |
| 0.53 mm | 0.15 µm | -60 to 380/400 °C | – | 227-36095-01 |

## SH-I-5Sil MS

- Low-polarity phase: Crossbond™ silarylene phase 1,4-bis(dimethylsiloxy)phenylene dimethyl polysiloxane
- Engineered to be a low-bleed GCMS column.
- Excellent inertness for active compounds.
- General-purpose columns—ideal for GCMS analysis of semi-volatiles, polycyclic aromatic compounds, chlorinated hydrocarbons, phthalates, phenols, amines, organochlorine pesticides, organophosphorus pesticides, drugs, solvent impurities, and hydrocarbons.
- Similar phases: DB-5ms UI, DB-5ms, VF-5ms, SLB-5ms

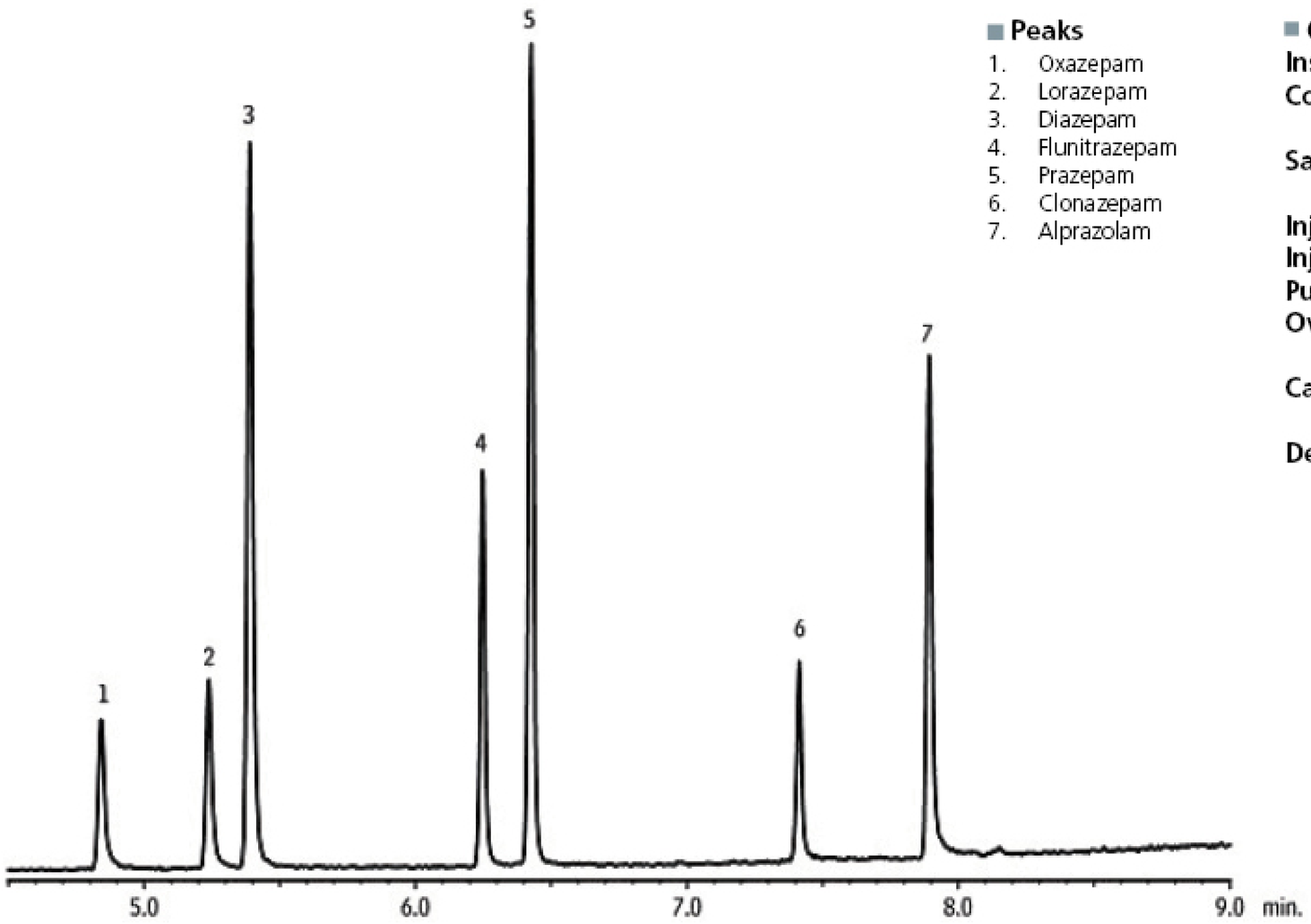
SH-I-5Sil MS Structure




For SH-I-5Sil MS columns with Integra-Guard™ column, please refer to page C-44.

| ID | df | Temp. Range | 10 m | 20 m | 40 m | 60 m |
|---|---|---|---|---|---|---|
| 0.10 mm | 0.10 µm | -60 to 320/350 °C | 227-36317-01 | – | – | – |
| 0.15 mm | 0.15 µm | -60 to 320/350 °C | – | 227-36030-01 | – | – |
| | 2.00 µm | -60 to 320/350 °C | – | 227-36031-01 | – | – |
| 0.18 mm | 0.10 µm | -60 to 320/350 °C | – | – | – | 227-36032-01 |
| | 0.18 µm | -60 to 320/350 °C | – | 227-36033-01 | 227-36033-02 | – |
| | 0.36 µm | -60 to 320/350 °C | – | 227-36034-01 | – | – |
| **ID** | **df** | **Temp. Range** | | **15 m** | **30 m** | **60 m** |
| 0.25 mm | 0.10 µm | -60 to 320/350 °C | – | 227-36035-01 | 227-36035-02 | – |
| | 0.25 µm | -60 to 320/350 °C | – | 227-36036-01 | 221-75954-30 | 227-36036-02 |
| | 0.50 µm | -60 to 320/350 °C | – | 227-36037-01 | 227-36037-02 | – |
| | 1.00 µm | -60 to 320/350 °C | – | 227-36038-01 | 221-75956-30 | 227-36038-02 |
| 0.32 mm | 0.25 µm | -60 to 320/350 °C | – | 227-36039-01 | 227-36039-02 | – |
| | 0.50 µm | -60 to 320/350 °C | – | – | 227-36040-01 | – |
| | 1.00 µm | -60 to 320/350 °C | – | – | 227-36041-01 | – |
| 0.53 mm | 1.50 µm | -60 to 320/330 °C | – | – | 227-36032-02 | – |

## Benzodiazepines




**Peaks**

1. Oxazepam
2. Lorazepam
3. Diazepam
4. Flunitrazepam
5. Prazepam
6. Clonazepam
7. Alprazolam

**Conditions**

**Instrument** : GCMS-QP2010
**Column** : SH-I-5Sil MS, 30 m, 0.25 mm ID, 0.25 µm (P/N: 221-75954-30)
**Sample** : Diluent: Butyl chloride
Conc.: 15 µg/mL
**Inj. Vol.** : 1 µL splitless (hold 1 min)
**Inj. Temp** : 280 °C
**Purge Flow** : 32.2 mL/min (20:1 split)
**Oven Temp** : 200 °C to 330 °C at 15 °C/min (hold 3 min)
**Carrier Gas** : He, constant linear velocity mode, 50 cm/sec.
**Detector** : MS-QP
Transfer Line Temp: 280 °C
Source Temp: 200 °C
Solvent Delay Time: 4 min
Tune: PFTBA
Ionization: EI
Scan Range: 50-350

## SH-I-XLB

- Low-polarity proprietary phase
- General-purpose columns exhibiting extremely low bleed. Ideal for many GCMS applications, including pesticides, PCB congeners (e.g., Aroclor mixes), PAHs.
- Unique selectivity.
- Similar phases: DB-XLB, VF-Xms

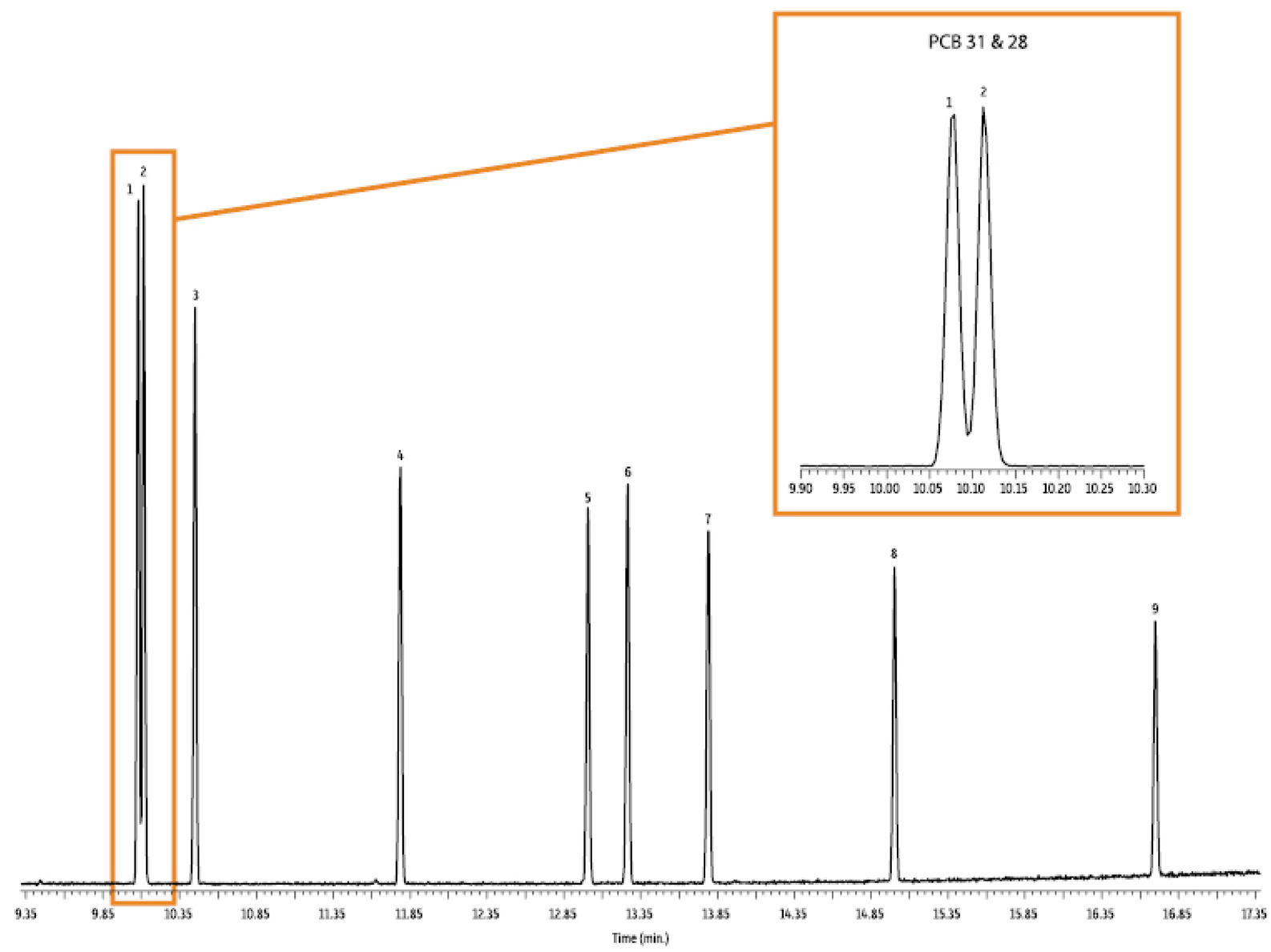
| ID | df | Temp. Range | 20 m | 30 m | 60 m |
|---|---|---|---|---|---|
| 0.18 mm | 0.18 µm | 30 to 340/360 °C | 227-36309-01 | – | – |
| 0.25 mm | 0.10 µm | 30 to 340/360 °C | – | 227-36042-01 | – |
| | 0.25 µm | 30 to 340/360 °C | – | 227-36043-01 | 227-36043-02 |
| | 0.50 µm | 30 to 340/360 °C | – | 227-36044-01 | – |
| | 1.00 µm | 30 to 340/360 °C | – | 227-36045-01 | – |
| 0.32 mm | 0.25 µm | 30 to 340/360 °C | – | 227-36046-01 | 227-36046-02 |
| | 0.50 µm | 30 to 340/360 °C | – | 227-36047-01 | – |
| | 1.00 µm | 30 to 340/360 °C | – | 227-36048-01 | – |
| 0.53 mm | 0.50 µm | 30 to 320/360 °C | – | 227-36049-01 | – |
| | 1.50 µm | 30 to 320/360 °C | – | 227-36050-01 | – |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

## EU PCB Congeners

**Peaks**

1. PCB 31
2. PCB 28
3. PCB 52
4. PCB 101
5. PCB 118
6. PCB 153
7. PCB 138
8. PCB 180
9. PCB 194



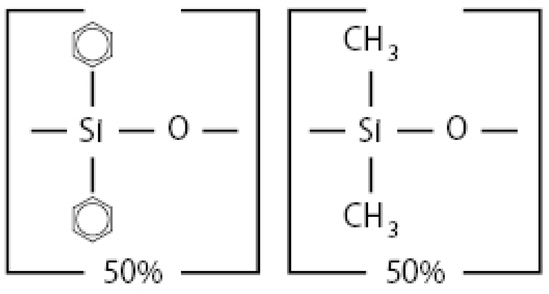

**Conditions**

**Column** : SH-I-XLB, 30 m, 0.25 mm ID, 0.25 µm (P/N: 227-36043-01)
**Sample** : PCB congener standard
Diluent: Dichloromethane
Conc.: 3.5 ppm
**Inj. Vol.** : 0.5 µL splitless (hold 1.75 min)
**Inj. Temp** : 300 °C
**Purge Flow** : 50 mL/min
**Oven Temp** : 40 °C (hold 2 min) to 240 °C at 30 °C/min (hold 2 min) to 340 °C at 10 °C/min (hold 5 min)
**Carrier Gas** : He, constant flow rate 1 mL/min
**Detector** : MS-QP
Transfer Line Temp: 300 °C
Source Temp: 280 °C
Ionization: EI
Scan Range: 45-550

## SH-I-17

- Mid-polarity phase: Crossbond™ 50% diphenyl / 50% dimethyl polysiloxane
- General-purpose columns for pesticides, herbicides, rosin acids, phthalate esters, triglycerides, sterols.
- Similar phases: HP-17, DB-17, DB-17HT, DB-608, SPB-17

SH-I-17 Structure

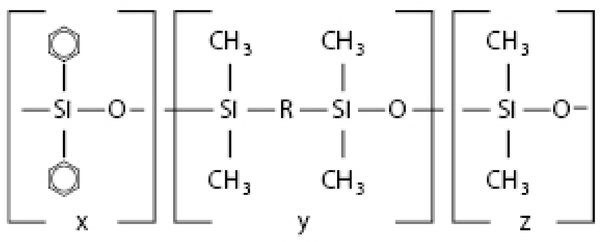



| ID | df | Temp. Range | 20 m | 30 m |
|---|---|---|---|---|
| 0.18 mm | 0.18 µm | 40 to 280/320 °C | 227-36061-01 | – |
| 0.25 mm | 0.25 µm | 40 to 280/320 °C | – | 221-75907-30 |
| | 0.50 µm | 40 to 280/320 °C | – | 227-36062-01 |
| | 1.00 µm | 40 to 280/320 °C | – | 227-36063-01 |
| 0.32 mm | 0.25 µm | 40 to 280/320 °C | – | 227-36064-01 |
| | 0.50 µm | 40 to 280/320 °C | – | 227-36065-01 |
| | 1.00 µm | 40 to 280/320 °C | – | 227-36066-01 |
| 0.53 mm | 0.25 µm | 40 to 280/320 °C | – | 227-36067-01 |
| | 0.50 µm | 40 to 280/320 °C | – | 227-36068-01 |
| | 0.83 µm | 40 to 280/320 °C | – | 227-36069-01 |
| | 1.00 µm | 40 to 280/320 °C | – | 221-76193-30 |
| | 1.50 µm | 40 to 280/320 °C | – | 227-36070-01 |

## SH-I-35Sil MS

- Mid-polarity: Crossbond™ phase (similar to 35% phenyl methyl polysiloxane)
- Very low-bleed phase for GCMS analysis.
- Special selectivity and excellent inertness for substituted polar compounds, such as drugs, pesticides, herbicides, PCBs, phenols, etc.
- Provides superior separation for cannabinoids.
- Similar phases: DB-35ms, DB-35ms UI, VF-35ms

SH-I-35Sil MS Structure

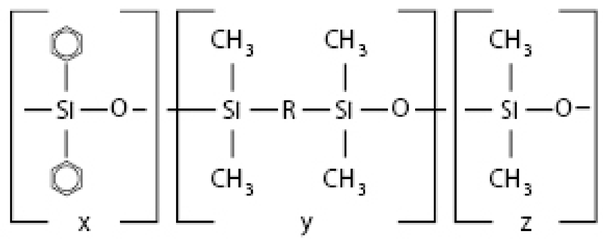



| ID | df | Temp. Range | 15 m | 30 m |
|---|---|---|---|---|
| 0.25 mm | 0.25 µm | 50 to 340/360 °C | 227-36051-01 | 227-36051-02 |
| | 0.50 µm | 50 to 340/360 °C | 227-36052-01 | 227-36052-02 |
| | 1.00 µm | 50 to 320/340 °C | 227-36053-01 | 227-36053-02 |
| 0.32 mm | 0.25 µm | 50 to 340/360 °C | 227-36054-01 | 227-36054-02 |
| | 0.50 µm | 50 to 340/360 °C | 227-36055-01 | 227-36055-02 |
| | 1.00 µm | 50 to 320/340 °C | 227-36056-01 | 227-36056-02 |
| 0.53 mm | 0.50 µm | 50 to 340/360 °C | 227-36057-01 | 227-36057-02 |
| | 1.00 µm | 50 to 325/340 °C | 227-36058-01 | 227-36058-02 |
| | 1.50 µm | 50 to 310/330 °C | 227-36059-01 | 227-36059-02 |
| | 3.00 µm | 50 to 280/300 °C | 227-36060-01 | 227-36060-02 |

## SH-I-17Sil MS

- Mid-polarity Crossbond™ phase (similar to 50% phenyl methyl polysiloxane)
- Low bleed for use with sensitive detectors, such as MS.
- Excellent inertness and selectivity for active environmental compounds, such as PAHs.
- Equivalent to USP G3 phase.
- Similar phases: DB-17ms, HP-17, DB-17, VF-17ms, CP-Sil 24 CB

SH-I-17Sil MS Structure




| ID | df | Temp. Range | 30 m | 60 m |
|---|---|---|---|---|
| 0.25 mm | 0.25 µm | 40 to 340/360 °C | 221-75916-30 | 227-36071-01 |
| 0.32 mm | 0.25 µm | 40 to 340/360 °C | 227-36072-01 | – |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

## SH-I-PAH

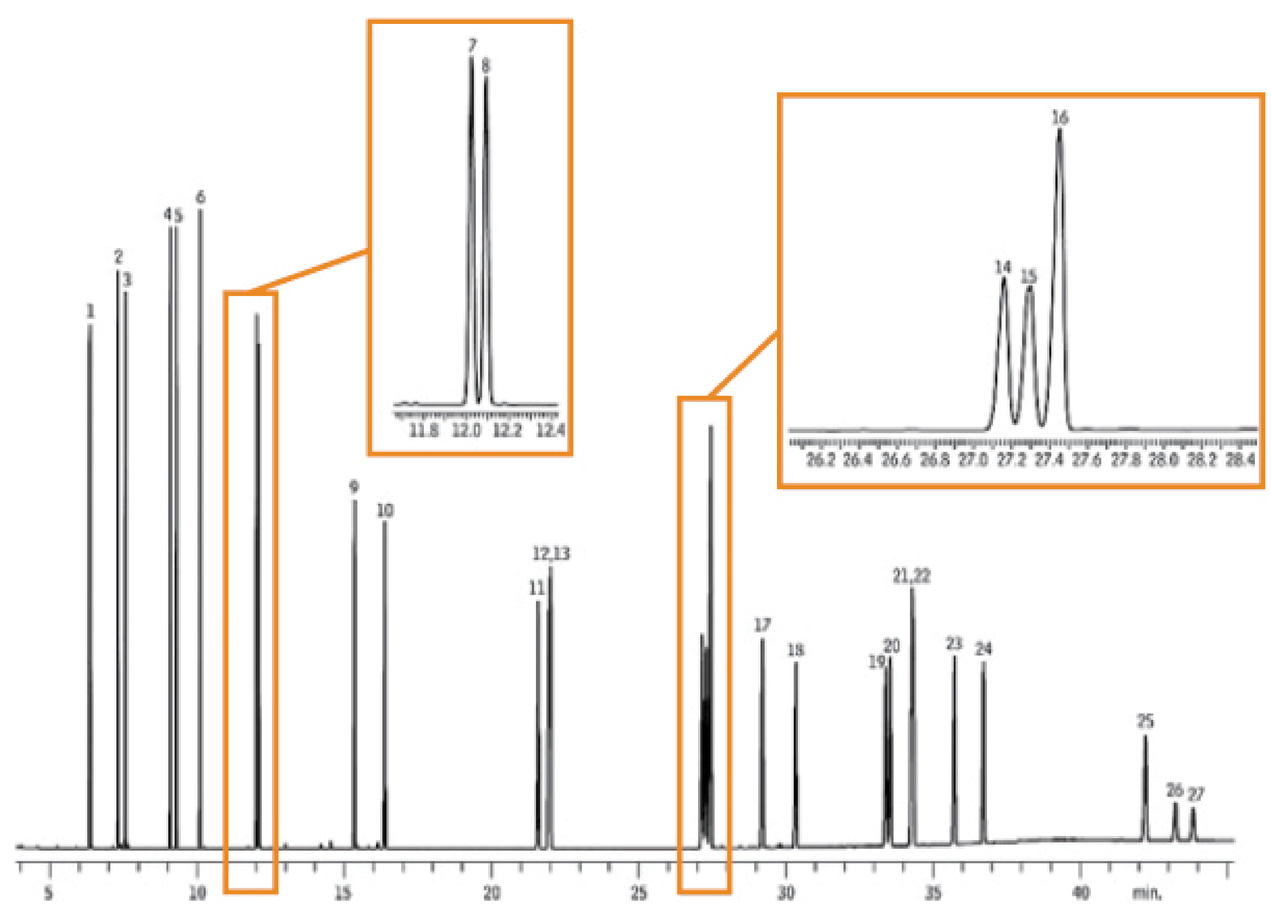
- Mid-polarity proprietary phase
- Ideal for EFSA PAH4 analysis—separates all priority compounds: benz[a]anthracene, chrysene, benzo[b]fluoranthene and benzo[a] pyrene.
- Best resolution of chrysene from interfering PAHs, triphenylene, and cyclopenta[cd]pyrene.
- Complete separation of benzo [b], [k], [j], and [a] fluoranthenes.

| ID | df | Temp. Range | 30 m | 40 m | 60 m |
|---|---|---|---|---|---|
| 0.18 mm | 0.07 µm | to 360 °C | – | 227-36073-01 | – |
| 0.25 mm | 0.10 µm | to 360 °C | 227-36074-01 | – | 227-36074-02 |

# Polycyclic Aromatic Hydrocarbons (US EPA Method 8100)

**Peaks**

1. Naphthalene
2. 2-Methylnaphthalene
3. 1-Methylnaphthalene
4. Acenaphthylene
5. Acenaphthene
6. Fluorene
7. Phenanthrene
8. Anthracene
9. Fluoranthene
10. Pyrene
11. Benz[a]anthracene
12. Chrysene
13. Triphenylene
14. Benzo[b]fl uoranthene
15. Benzo[k]fl uoranthene
16. Benzo(j)fl uoranthene
17. Benzo[a]pyrene
18. 3-Methylcholanthrene
19. Dibenz(a,h)acridine
20. Dibenz[a,j]acridine
21. Indeno[1,2,3-cd]pyrene
22. Dibenz[a,h]anthracene
23. Benzo[ghi]perylene
24. 7H-Dibenzo[c,g]carbazole
25. Dibenzo[a,e]pyrene
26. Dibenzo(a,i)pyrene
27. Dibenzo(a,h)pyrene



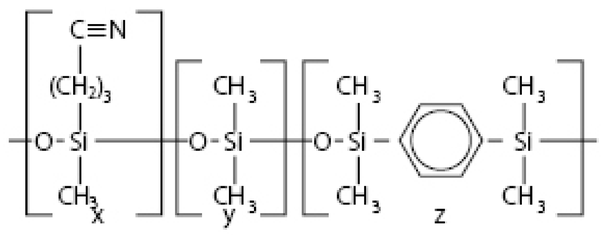

**Conditions**

**Column** : SH-I-17Sil MS, 30 m, 0.25 mm ID, 0.25 um (P/N: 221-75916-30)
**Inj. Vol.** : 0.5 µL splitless (hold 1.75 min)
**Inj. Temp** : 320 °C
**Purge Flow** : 75 mL/min
**Oven Temp** : 65 °C (hold 0.5 min) to 220 °C at 15 °C/min to 330 °C at 4 °C/min (hold 15 min)
**Carrier Gas** : He, constant flow rate 2.0 mL/min
**Detector** : FID, 320 °C

## SH-I-624Sil MS

- Mid-polarity Crossbond™ silarylene phase (similar to 6% cyanopropylphenyl / 94%dimethyl polysiloxane)
- Low-bleed, high-thermal stability column—maximum temperatures up to 300–320 °C.
- Inert—excellent peak shape for a wide range of compounds.
- Selective—G43 phase highly selective for volatile organics and residual solvents, great choice for USP<467>.
- Manufactured for column-to-column reproducibility—well-suited for validated methods.
- Similar phases: HP-624, DB-624, VF-624ms, CP-Select 624 CB

SH-I-624Sil MS Structure

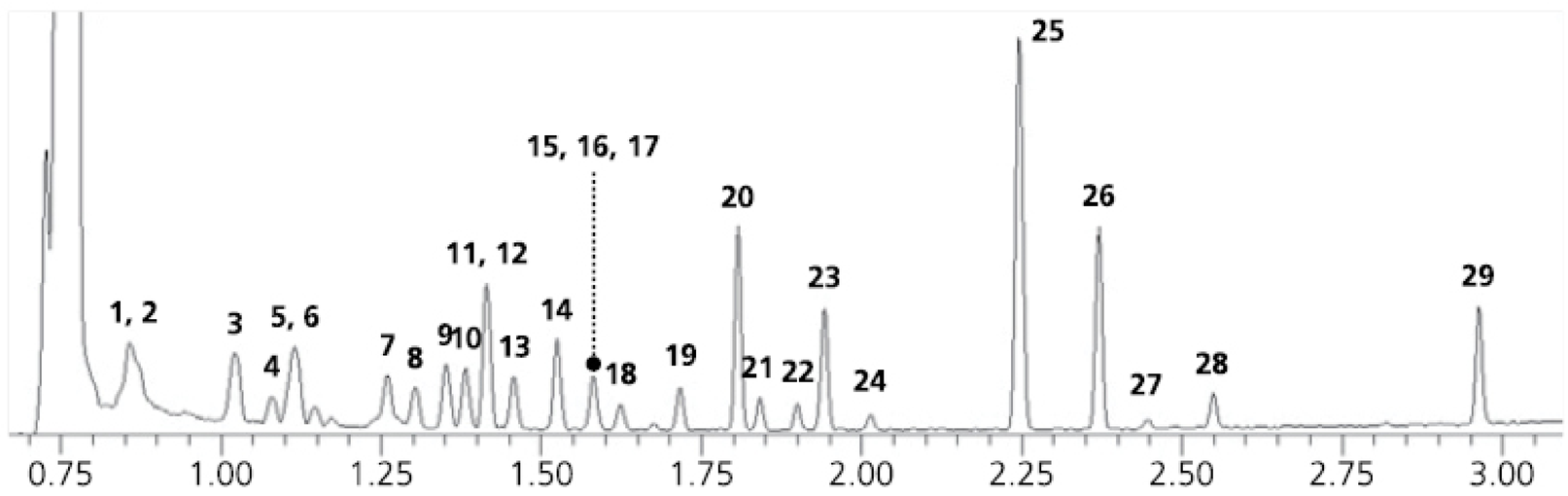


| ID | df | Temp. Range | 20 m | 30 m | 60 m | 75 m | 105 m |
|---|---|---|---|---|---|---|---|
| 0.18 mm | 1.00 µm | -20 to 300/320 °C | 227-36075-01 | – | – | – | – |
| 0.25 mm | 1.40 µm | -20 to 300/320 °C | – | 221-75962-30 | 227-36076-01 | – | – |
| 0.32 mm | 1.80 µm | -20 to 300/320 °C | – | 227-36077-01 | 221-75963-60 | – | – |
| 0.53 mm | 3.00 µm | -20 to 280/300 °C | – | 227-36078-01 | 227-36078-02 | 227-36078-03 | 227-36078-04 |

# Ultra-Fast Analysis of Volatile Organic Compounds in Water

**Peaks**

1. Vinyl chloride-d3 (ISTD)
2. Vinyl chloride
3. 1,1-dichloroethylene
4. Dichloromethane
5. Methyl-t-butyl ether (MTBE)
6. Trans-1,2-dichloroethylene
7. Cis-1,2-dichloroethylene
8. Trichloromethane
9. 1,1,1-trichloroethane
10. Carbon tetrachloride
11. 1,2-dichloroethane
12. Benzene
13. Fluorobenzene (ISTD)
14. Trichloroethylene
15. 1,4-dioxane-d8 (ISTD)
16. 1,2-dichloropropane
17. 1,4-dioxane
18. Bromodichloromethane
19. Cis-1,3-dichloropropene
20. Toluene
21. Trans-1,3-dichloropropene
22. 1,1,2-trichloroethane
23. Tetrachloroethylene
24. Dibromochloromethane
25. m-,p-xylene
26. o-xylene
27. Bromoform
28. 4-bromofl uorobenzene
29. 1,4-dichlorobenzene



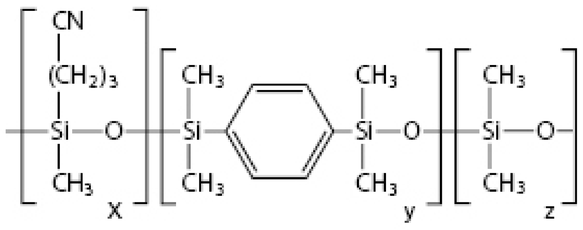

**Conditions**

| | |
|---|---|
| **Instrument** | : GCMS-TQ8030 + HS-20 Loop |
| **Column** | : SH-I-624Sil MS, 20 m, 0.18 mm ID, 1.00 µm (P/N: 227-36075-01) |
| **Headspace-Loop** | : Loop volume: 1 mL |
| **Sample Equilibration** | : 70 °C for 30 min |
| **Vial pressurization** | : 0.5 min, 50 kPa, equilibration 0.05 min |
| **Needle Flush** | : 2 min |
| **Sample Pathway Temp** | : 200 °C |
| **Transfer Line Temp** | : 200 °C |
| **Inj.** | : Split (split ratio 30:1) |
| **Oven Temp** | : 70 °C, 40 °C/min to 220 °C (hold 0.5 min) |
| **Carrier Gas** | : He, constant linear velocity mode, 50 cm/sec |
| **Detector** | : MS: SIM<br>MS/MS: MRM<br>Event (loop) time: 0.15 sec<br>Source Temp: 200 °C<br>Interface Temp: 230 °C |

## SH-I-1301Sil MS

- Mid-polarity Crossbond™ silarylene phase (similar to 6% cyanopropylphenyl / 94%dimethyl polysiloxane)
- Highest thermal stability in the industry ensures dependable, accurate MS results and increased uptime.
- Stabilized cyano phase selectivity improves the performance of existing methods. Ideal for solvents, glycols, and other polar compounds.
- Rigorous QC testing ensures inertness and accurate, reliable data for multiple compound classes.
- Similar phase: VF-1301ms

SH-I-1301Sil MS Structure




| ID | df | Temp. Range | 15 m | 30 m | 60 m |
|---|---|---|---|---|---|
| 0.25 mm | 0.25 µm | -60 to 320 °C | – | 227-36079-01 | 227-36079-02 |
| | 1.00 µm | -60 to 320 °C | – | 227-36080-01 | 227-36080-02 |
| 0.32 mm | 0.25 µm | -60 to 320 °C | – | 227-36081-01 | – |
| | 1.00 µm | -60 to 320 °C | – | 227-36082-01 | 227-36082-02 |
| | 1.50 µm | -60 to 320 °C | – | 227-36083-01 | 227-36083-02 |
| 0.53 mm | 1.00 µm | -60 to 320 °C | 227-36084-01 | 227-36084-02 | – |
| | 1.50 µm | -60 to 320 °C | – | 227-36085-01 | – |
| | 3.00 µm | -60 to 320 °C | – | 227-36086-01 | 227-36086-02 |

Guard columns for SH are also available. Please refer to page C-44.

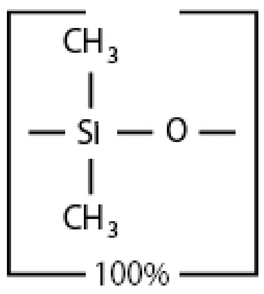
# Capillary Columns

General-Purpose Columns

## SH-1

- Non-polar phase: Crossbond™ 100% dimethyl polysiloxane
- General-purpose columns for solvent impurities, PCB congeners (e.g., Aroclor mixes), simulated distillation, arson accelerants, gases, natural gas odorants, sulfur compounds, essential oils, hydrocarbons, semi-volatiles, pesticides, oxygenates.
- Equivalent to USP G1, G2, G38 phases.
- Similar phases: HP-1, DB-1, CP-Sil 5 CB, SPB-1

SH-1 Structure




For SH-1 columns with Integra-Guard™ column, please refer to page C-44.

| ID | df | Temp. Range | 10 m | 15 m | 25 m | 30 m | 60 m | 105 m |
|---|---|---|---|---|---|---|---|---|
| 0.25 mm | 0.10 µm | -60 to 330/350 °C | – | 221-75718-15 | – | 221-75718-30 | 227-36096-01 | – |
| | 0.25 µm | -60 to 330/350 °C | 221-75719-10 | – | 221-75719-25 | 221-75719-30 | 221-75719-60 | – |
| | 0.50 µm | -60 to 330/350 °C | – | – | – | 227-36097-01 | 227-36097-02 | – |
| | 1.00 µm | -60 to 320/340 °C | – | – | – | 227-36098-01 | 227-36098-02 | 221-75721-05 |
| 0.32 mm | 0.10 µm | -60 to 330/350 °C | – | – | – | 227-36099-01 | 227-36099-02 | – |
| | 0.25 µm | -60 to 330/350 °C | – | – | – | 221-75723-30 | 221-75723-60 | – |
| | 0.50 µm | -60 to 330/350 °C | – | – | – | 221-75724-30 | 227-36100-01 | – |
| | 1.00 µm | -60 to 320/340 °C | – | – | – | 221-75725-30 | 221-75725-60 | – |
| | 1.50 µm | -60 to 310/330 °C | – | – | – | 227-36101-01 | 227-36101-02 | – |
| | 3.00 µm | -60 to 280/300 °C | – | – | – | 227-36102-01 | 227-36102-02 | – |
| | 4.00 µm | -60 to 280/300 °C | – | – | – | 227-36103-01 | – | – |
| | 5.00 µm | -60 to 260/280 °C | – | – | – | 221-75728-30 | 221-75728-60 | – |
| 0.53 mm | 0.10 µm | -60 to 320/340 °C | – | – | – | 227-36104-01 | – | – |
| | 0.25 µm | -60 to 320/340 °C | – | – | – | 221-75729-30 | 227-36105-01 | – |
| | 0.50 µm | -60 to 310/330 °C | – | 221-75730-15 | – | 221-75730-30 | 227-36106-01 | – |
| | 1.00 µm | -60 to 310/330 °C | – | 221-75731-15 | – | 221-75731-30 | 221-75731-60 | – |
| | 1.50 µm | -60 to 310/330 °C | – | 221-75732-15 | – | 221-75732-30 | 227-36107-01 | – |
| | 3.00 µm | -60 to 270/290 °C | – | – | – | 221-75733-30 | 221-75733-60 | – |
| | 5.00 µm | -60 to 270/290 °C | – | – | – | 221-75734-30 | 221-75734-60 | – |
| | 7.00 µm | -60 to 240/260 °C | – | – | – | 227-36108-01 | 227-36108-02 | – |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

## SH-PONA

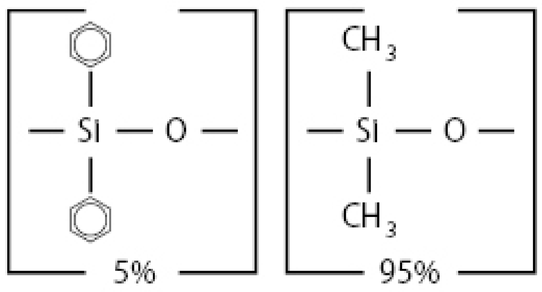
Compatible with ASTM and CGSB for hydrocarbon analysis.

| ID | df | Temp. Range | 100 m |
|---|---|---|---|
| 0.25 mm | 0.50 µm | -60 to 300/340 °C | 221-76196-00 |

## SH-5

- Low-polarity phase: Crossbond™ 5% diphenyl / 95% dimethyl polysiloxane
- General-purpose columns for drugs, solvent impurities, pesticides, hydrocarbons, PCB congeners (e.g., Aroclor mixes), essential oils, semi-volatiles.
- Equivalent to USP G27 and G36 phases.
- Similar phases: HP-5, DB-5, CP-Sil 8 CB, SPB-5

SH-5 Structure




For SH-5 columns with Integra-Guard™ column, please refer to page C-44.

| ID | df | Temp. Range | 15 m | 25 m | 30 m | 60 m |
|---|---|---|---|---|---|---|
| 0.25 mm | 0.10 µm | -60 to 330/350 °C | 221-75700-15 | – | 221-75700-30 | 227-36109-01 |
| | 0.25 µm | -60 to 330/350 °C | 227-36313-01 | – | 221-75701-30 | 227-36110-01 |
| | 0.50 µm | -60 to 330/350 °C | – | 221-76178-25 | 221-76178-30 | 227-36111-01 |
| | 1.00 µm | -60 to 320/340 °C | – | – | 221-75702-30 | 227-36112-01 |
| 0.32 mm | 0.10 µm | -60 to 330/350 °C | 227-36312-01 | – | 227-36113-01 | – |
| | 0.25 µm | -60 to 330/350 °C | 221-75703-15 | – | 221-75703-30 | 221-75703-60 |
| | 0.50 µm | -60 to 330/350 °C | – | – | 221-75704-30 | 227-36114-01 |
| | 1.00 µm | -60 to 320/340 °C | – | – | 221-75705-30 | 221-75705-60 |
| | 1.50 µm | -60 to 310/330 °C | – | – | 221-76181-30 | 227-36115-01 |
| | 3.00 µm | -60 to 280/300 °C | – | – | 227-36116-01 | 227-36116-02 |
| 0.53 mm | 0.10 µm | -60 to 320/340°C | – | – | 227-36117-01 | – |
| | 0.25 µm | -60 to 320/340 °C | 227-36314-01 | – | 221-75708-30 | 227-36118-01 |
| | 0.50 µm | -60 to 320-330 °C | – | – | 221-75709-30 | 227-36119-01 |
| | 1.00 µm | -60 to 320/330 °C | 221-75710-15 | – | 221-75710-30 | 221-75710-60 |
| | 1.50 µm | -60 to 310/330 °C | 221-75711-15 | – | 221-75711-30 | 227-36120-01 |
| | 3.00 µm | -60 to 270/290 °C | – | – | 221-75712-30 | 227-36121-01 |
| | 5.00 µm | -60 to 270/290 °C | – | – | 221-75713-30 | 221-75713-60 |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

Metal columns are also available. Please refer to page C-43.

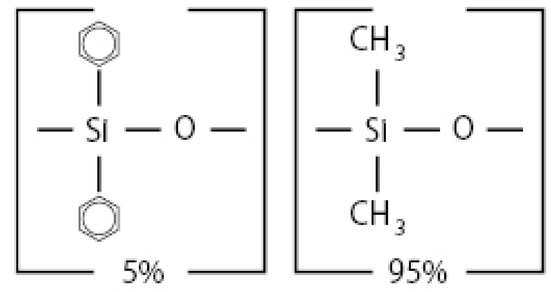
# Capillary Columns

General-Purpose Columns

## SH-5MS

- Low-polarity phase: Crossbond™ 5% diphenyl / 95% dimethyl polysiloxane
- Column specifically tested for low-bleed performance.
- General-purpose columns for drugs, solvent impurities, pesticides, hydrocarbons, PCB congeners (e.g., Aroclor mixes), essential oils, semi-volatiles.
- Equivalent to USP G27 and G36 phases.
- Similar phases: HP-5, DB-5, CP-Sil 8 CB, SPB-5

SH-5MS Structure

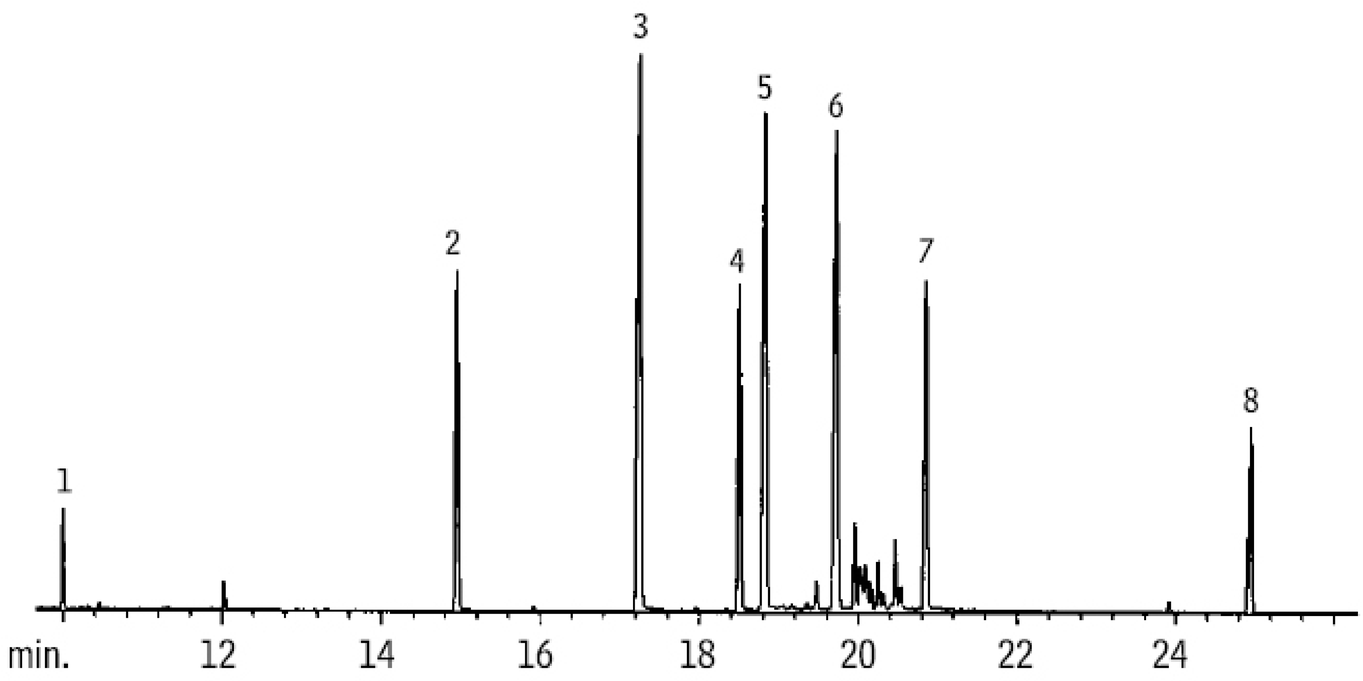



For SH-I-5MS columns with Integra-Guard™ column, please refer to page C-44.

| ID | df | Temp. Range | 15 m | 30 m | 60 m |
|---|---|---|---|---|---|
| 0.25 mm | 0.10 µm | -60 to 330/350 °C | 221-75854-15 | 221-75854-30 | 227-36122-01 |
| | 0.25 µm | -60 to 330/350 °C | 221-75855-15 | 221-75855-30 | 227-36123-01 |
| | 0.50 µm | -60 to 330/350 °C | – | 227-36124-01 | 227-36124-02 |
| | 1.00 µm | -60 to 325/350 °C | – | 221-75857-30 | – |
| 0.32 mm | 0.10 µm | -60 to 330/350 °C | – | 227-36125-01 | 227-36125-02 |
| | 0.25 µm | -60 to 330/350 °C | – | 221-75858-30 | 221-75858-60 |
| | 0.50 µm | -60 to 330/350 °C | – | 227-36126-01 | 227-36126-02 |
| | 1.00 µm | -60 to 325/350 °C | – | 227-36127-01 | – |
| 0.53 mm | 0.50 µm | -60 to 320/340 °C | – | 221-76191-30 | – |
| | 1.00 µm | -60 to 320/340 °C | – | 227-36128-01 | – |
| | 1.50 µm | -60 to 310/330 °C | – | 227-36129-01 | – |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

# Endocrine Disruptors: Alkyl Phenols




**Peaks**

1. *tert*-butyl phenol
2. *n*-pentyl phenol
3. *n*-hexyl phenol
4. *n*-heptyl phenol
5. *tert*-octyl phenol
6. *n*-octyl phenol
7. *n*-nonyl phenol
8. bisphenol A

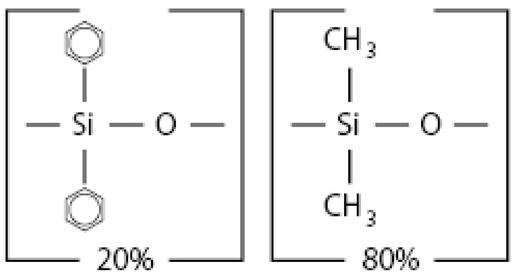
**Conditions**

| | |
|---|---|
| **Column** | : SH-5MS, 30 m, 0.25 mm ID, 0.25 µm (P/N: 221-75855-30). |
| **Conc.** | : 5–10 ng on-column |
| **Inj.** | : Splitless, purge on at 1 min |
| **Inj. Temp** | : 275 °C |
| **Purge Flow** | : 32.2 mL/min (20:1 split) |
| **Oven Temp** | : 35 °C (hold 1 min) to 300 °C at 10 °C/min (hold 15 min) |
| **Carrier Gas** | : He |
| **Det. Temp** | : 310 °C |

## SH-20

- Mid-polarity phase: Crossbond™ 20% diphenyl / 80% dimethyl polysiloxane
- General-purpose columns for volatile compounds, flavor compounds, alcoholic beverages.
- Equivalent to USP G28 and G32 phases.
- Similar phases: SPB-20, 007-20, AT-20, EC-20.

SH-20 Structure

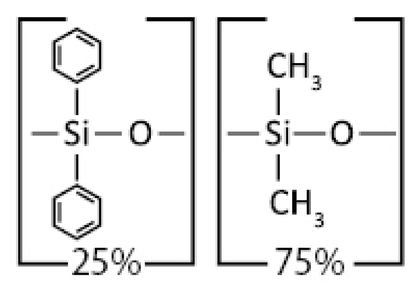



| ID | df | Temp. Range | 30 m | 60 m |
|---|---|---|---|---|
| 0.25 mm | 0.10 µm | -20 to 300/320 °C | 227-36130-01 | 227-36130-02 |
| | 0.25 µm | -20 to 300/320 °C | 227-36131-01 | 227-36131-02 |
| | 0.50 µm | -20 to 290/310 °C | 227-36132-01 | 227-36132-02 |
| | 1.00 µm | -20 to 280/300 °C | 227-36133-01 | 227-36133-02 |
| 0.32 mm | 0.10 µm | -20 to 300/320 °C | 227-36134-01 | 227-36134-02 |
| | 0.25 µm | -20 to 300/320 °C | 227-36135-01 | 227-36135-02 |
| | 0.50 µm | -20 to 290/310 °C | 227-36136-01 | 227-36136-02 |
| | 1.00 µm | -20 to 280/300 °C | 227-36137-01 | 227-36137-02 |
| | 1.50 µm | -20 to 270/290 °C | 227-36138-01 | 227-36138-02 |
| | 3.00 µm | -20 to 250/270 °C | 227-36139-01 | 227-36139-02 |
| 0.53 mm | 0.10 µm | -20 to 260/280 °C | 227-36140-01 | 227-36140-02 |
| | 0.25 µm | -20 to 260/280 °C | – | 227-36141-01 |
| | 0.50 µm | -20 to 260/280 °C | 227-36142-01 | – |
| | 1.00 µm | -20 to 260/280 °C | 227-36143-01 | 227-36143-02 |
| | 1.50 µm | -20 to 250/270 °C | 227-36144-01 | – |
| | 3.00 µm | -20 to 240/260 °C | 227-36145-01 | 227-36145-02 |

## SH-25

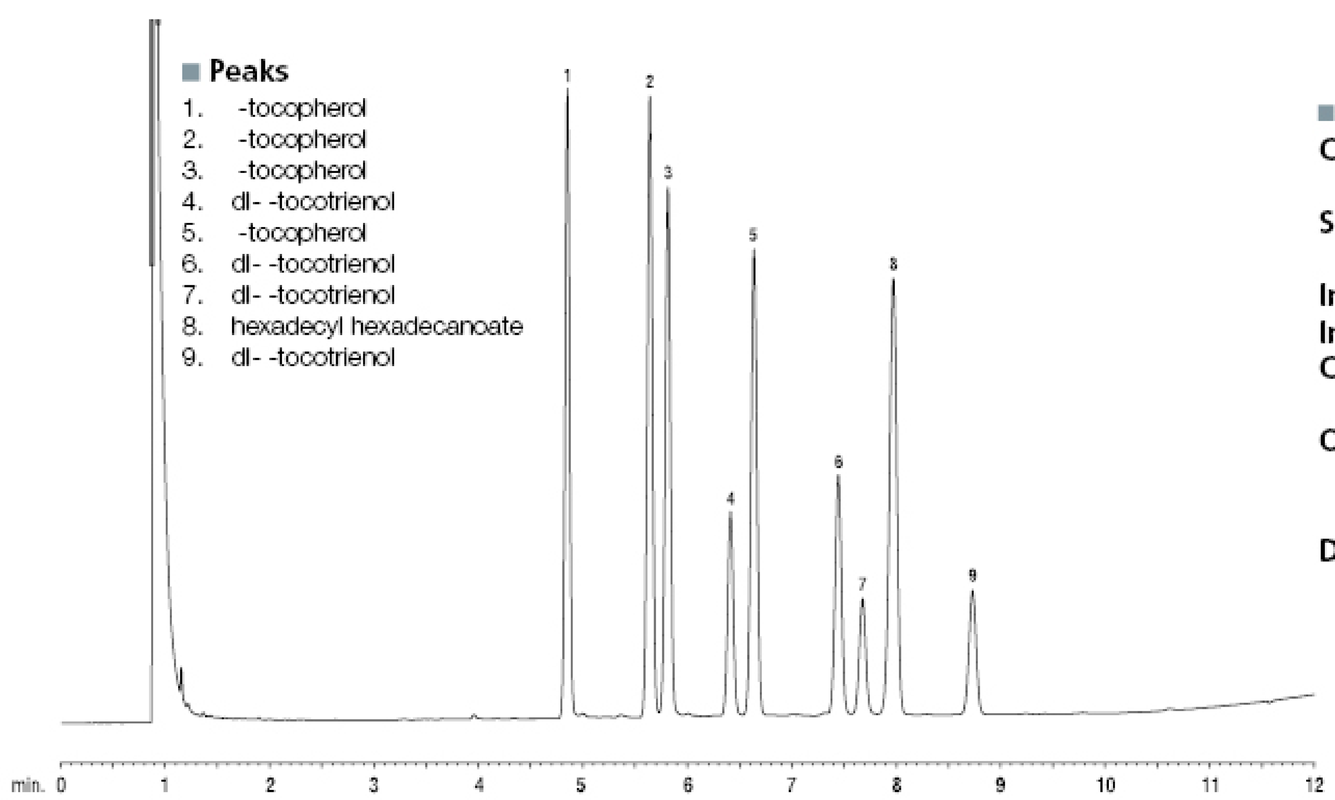
- Mid-polarity phase: Crossbond™ 25% diphenyl / 75% dimethyl polysiloxane
- General-purpose columns for volatile compounds, flavor compounds, alcoholic beverages.

SH-25 Structure




| ID | df | Temp. Range | 60 m |
|---|---|---|---|
| 0.32 mm | 1.49 µm | -20 to 250/270 °C | 227-36329-01 |

## Tocopherols and Tocotrienols



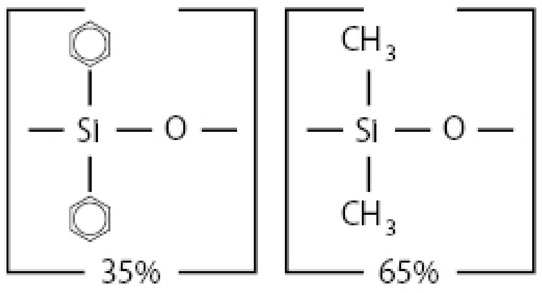

**Conditions**

| | |
|---|---|
| **Column** | : SH-20, 30 m, 0.53 mm ID, 0.50 µm (P/N: 227-36142-01) |
| **Sample** | : 1 mg/mL each component in isooctane |
| **Inj. Vol.** | : 1 µL split (split ratio 20:1) |
| **Inj. Temp** | : 320 °C |
| **Carrier Gas** | : Hydrogen, constant flow rate 5.2 mL/min |
| **Oven Temp** | : 270 °C to 290 °C at 2 °C/min<br>290 °C to 320 °C at 10 °C/min<br>(hold 1 min) |
| **Detector** | : FID, 320 °C |

## SH-35/SH-35MS

- Mid-polarity phase: Crossbond™ 35% diphenyl / 65% dimethyl polysiloxane
- General-purpose columns for organochlorine pesticides, PCB congeners (e.g., Aroclor mixes), herbicides, pharmaceuticals, sterols, rosin acids, phthalate esters.
- Equivalent to USP G42 phase.
- Similar phases: HP-35, DB-35, SPB-35, SPB-608

SH-35




SH-35

| ID | df | Temp. Range | 30 m | 60 m |
|---|---|---|---|---|
| 0.25 mm | 0.10 µm | 40 to 320 °C | 227-36146-01 | 227-36146-02 |
| | 0.25 µm | 40 to 320 °C | 227-36147-01 | 227-36147-02 |
| | 0.50 µm | 40 to 310 °C | 227-36148-01 | 227-36148-02 |
| | 1.00 µm | 40 to 290 °C | 227-36149-01 | 227-36149-02 |
| 0.32 mm | 0.10 µm | 40 to 320 °C | 227-36150-01 | 227-36150-02 |
| | 0.25 µm | 40 to 320 °C | 227-36151-01 | 227-36151-02 |
| | 0.50 µm | 40 to 310 °C | 227-36152-01 | 227-36152-02 |
| | 1.00 µm | 40 to 290 °C | 227-36153-01 | 227-36153-02 |
| | 1.50 µm | 40 to 270/290 °C | 227-36154-01 | – |
| | 3.00 µm | 40 to 250/270 °C | 227-36155-01 | 227-36155-02 |
| 0.53 mm | 0.10 µm | 40 to 260/280 °C | – | 227-36156-01 |
| | 0.25 µm | 40 to 260/280 °C | – | 227-36157-01 |
| | 0.50 µm | 40 to 300 °C | 227-36158-01 | 227-36158-02 |
| | 1.00 µm | 40 to 290 °C | 227-36159-01 | 227-36159-02 |
| | 1.50 µm | 40 to 280 °C | 227-36160-01 | 227-36160-02 |
| | 3.00 µm | 40 to 240/260 °C | 227-36161-01 | 227-36161-02 |

SH-35MS (Low-bleed for GCMS analysis)

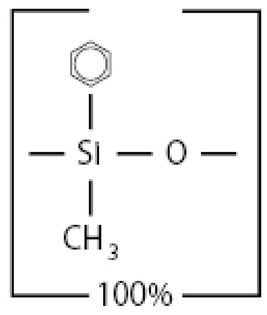
| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.25 mm | 0.25 µm | 40 to 320 °C | 221-75835-30 |

Download the brochure of GC/GCMS consumables from
http://www.shimadzu.com/an/gc/column_consumable/index.html

## SH-50

- Mid-polarity phase: Crossbond™ 100% methyl phenyl polysiloxane
- General-purpose columns for pesticides, herbicides, rosin acids, phthalate esters, sterols.
- Equivalent to USP G3 phase.
- Similar phases: HP-50+, CP-Sil 24 CB, SPB-50

SH-50 Structure

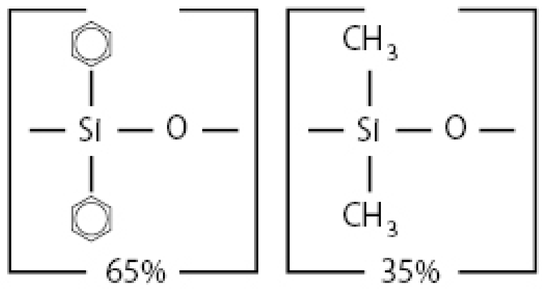



| ID | df | Temp. Range | 30 m | 60 m |
|---|---|---|---|---|
| 0.25 mm | 0.25 µm | 40 to 300/320 °C | 227-36162-01 | 227-36162-02 |
| | 0.50 µm | 40 to 290/310 °C | 227-36163-01 | 227-36163-02 |
| | 1.00 µm | 40 to 280/300 °C | 227-36164-01 | 227-36164-02 |
| 0.32 mm | 0.25 µm | 40 to 300/320 °C | 221-76182-30 | 227-36165-01 |
| | 0.50 µm | 40 to 290/310 °C | 227-36166-01 | 227-36166-02 |
| | 1.00 µm | 40 to 280/300 °C | 227-36167-01 | 227-36167-02 |
| 0.53 mm | 0.50 µm | 40 to 270/290 °C | 227-36168-01 | 227-36168-02 |
| | 0.83 µm | 40 to 270/290 °C | 227-36169-01 | – |
| | 1.00 µm | 40 to 260/280 °C | 227-36170-01 | 227-36170-02 |
| | 1.50 µm | 40 to 250/270 °C | 227-36171-01 | 227-36171-02 |

## SH-65

- Mid-polarity phase: Crossbond™ 65% diphenyl / 35% dimethyl polysiloxane
- General-purpose columns for phenols, fatty acids, triglycerides.
- Equivalent to USP G17 phase.

SH-65 / SH-65TG Structure




| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.25 mm | 0.25 µm | 50 to 300 °C | 227-36172-01 |
| | 0.50 µm | 50 to 280/300 °C | 227-36173-01 |
| | 1.00 µm | 50 to 260/280 °C | 227-36174-01 |
| 0.32 mm | 0.25 µm | 50 to 300 °C | 227-36175-01 |
| | 0.50 µm | 50 to 280/300 °C | 227-36176-01 |
| | 1.00 µm | 50 to 260/280 °C | 227-36177-01 |
| 0.53 mm | 1.00 µm | 50 to 250/270 °C | 227-36178-01 |

## SH-65TG

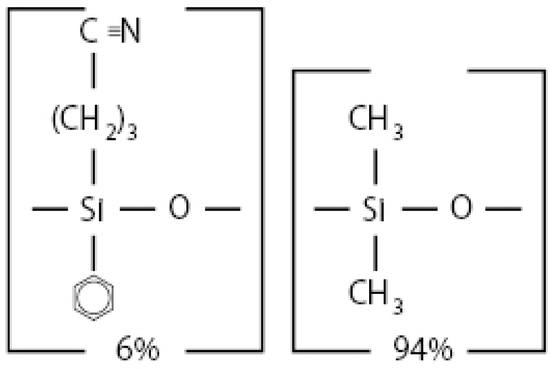
- High-polarity phase; Crossbond diphenyl dimethyl polysiloxane
- Application-specific columns, specially tested for triglycerides.
- Stable to 370 °C.

| ID | df | Temp. Range | 15 m | 30 m |
|---|---|---|---|---|
| 0.25 mm | 0.10 µm | 40 to 370 °C | 227-36325-01 | 227-36325-02 |

## SH-1301

- Mid-polarity phase: Crossbond™ 6% cyanopropylphenyl / 94% dimethyl polysiloxane
- General-purpose columns for residual solvents, alcohols, oxygenates, and volatile organic compounds.
- Equivalent to USP G43 phase.
- Similar phases: DB-1301, CP-1301, SPB-1301

SH-1301 Structure




For SH-1301 columns with Integra-Guard™ column, please refer to page C-44.

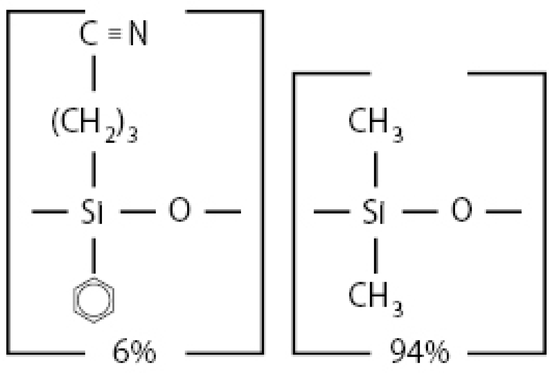
| ID | df | Temp. Range | 30 m | 60 m |
|---|---|---|---|---|
| 0.25 mm | 0.25 µm | -20 to 280 °C | 221-76194-30 | 221-76194-60 |
| | 0.50 µm | -20 to 270 °C | 227-36203-01 | – |
| | 1.00 µm | -20 to 260 °C | 227-36204-01 | 227-36204-02 |
| | 1.40 µm | -20 to 240 °C | – | 227-36205-01 |
| 0.32 mm | 0.25 µm | -20 to 280 °C | 227-36206-01 | 227-36206-02 |
| | 0.50 µm | -20 to 270 °C | 227-36207-01 | 227-36207-02 |
| | 1.00 µm | -20 to 260 °C | 227-36208-01 | 227-36208-02 |
| | 1.50 µm | -20 to 250 °C | 227-36209-01 | 227-36209-02 |
| | 1.80 µm | -20 to 240 °C | 227-36210-01 | 227-36210-02 |
| 0.53 mm | 0.25 µm | -20 to 280 °C | 227-36211-01 | – |
| | 0.50 µm | -20 to 270 °C | 227-36212-01 | 227-36212-02 |
| | 1.00 µm | -20 to 260 °C | 227-36213-01 | 227-36213-02 |
| | 1.50 µm | -20 to 250 °C | 227-36214-01 | – |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

## SH-624

- Mid-polarity phase: Crossbond™ 6% cyanopropylphenyl / 94% dimethyl polysiloxane
- Application-specific columns for volatile organic pollutants. Recommended in U.S. EPA methods for volatile organic pollutants.
- Equivalent to USP G43 phase.
- Similar phases: HP-624, DB-624, DB-624 UI, VF-624ms, SPB-624

SH-624 Structure




For SH-624 columns with Integra-Guard™ column, please refer to page C-44.

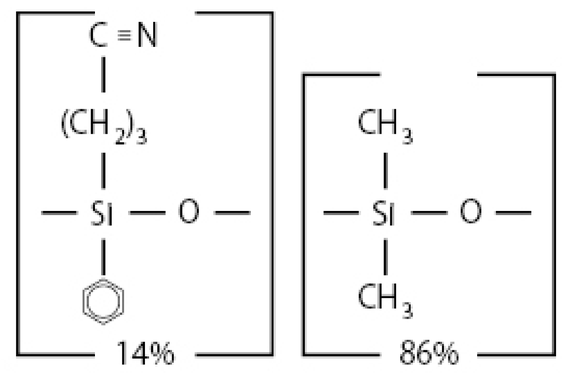
| ID | df | Temp. Range | 20 m | 30 m | 60 m | 75 m |
|---|---|---|---|---|---|---|
| 0.10 mm | 0.50 µm | -20 to 240 °C | 227-36332-01 | – | – | – |
| 0.18 mm | 1.00 µm | -20 to 240 °C | 227-36259-01 | – | – | – |
| 0.25 mm | 1.40 µm | -20 to 240 °C | – | 221-75863-30 | 227-36215-01 | – |
| 0.32 mm | 1.80 µm | -20 to 240 °C | – | 221-75864-30 | 221-75864-60 | – |
| 0.53 mm | 3.00 µm | -20 to 240 °C | – | 221-75865-30 | 221-75865-60 | 221-75865-75 |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

## SH-1701

- Mid-polarity phase: Crossbond™ 14% cyanopropylphenyl / 86% dimethyl polysiloxane
- General-purpose columns for alcohols, oxygenates, PCB congeners (e.g., Aroclor mixes), pesticides, and fragrance compounds.
- Equivalent to USP G46 phase.
- Similar phases: DB-1701P, DB-1701, CP-Sil 19 CB, VF-1701ms, VF-1701 Pesticides, Equity-1701

SH-1701 Structure

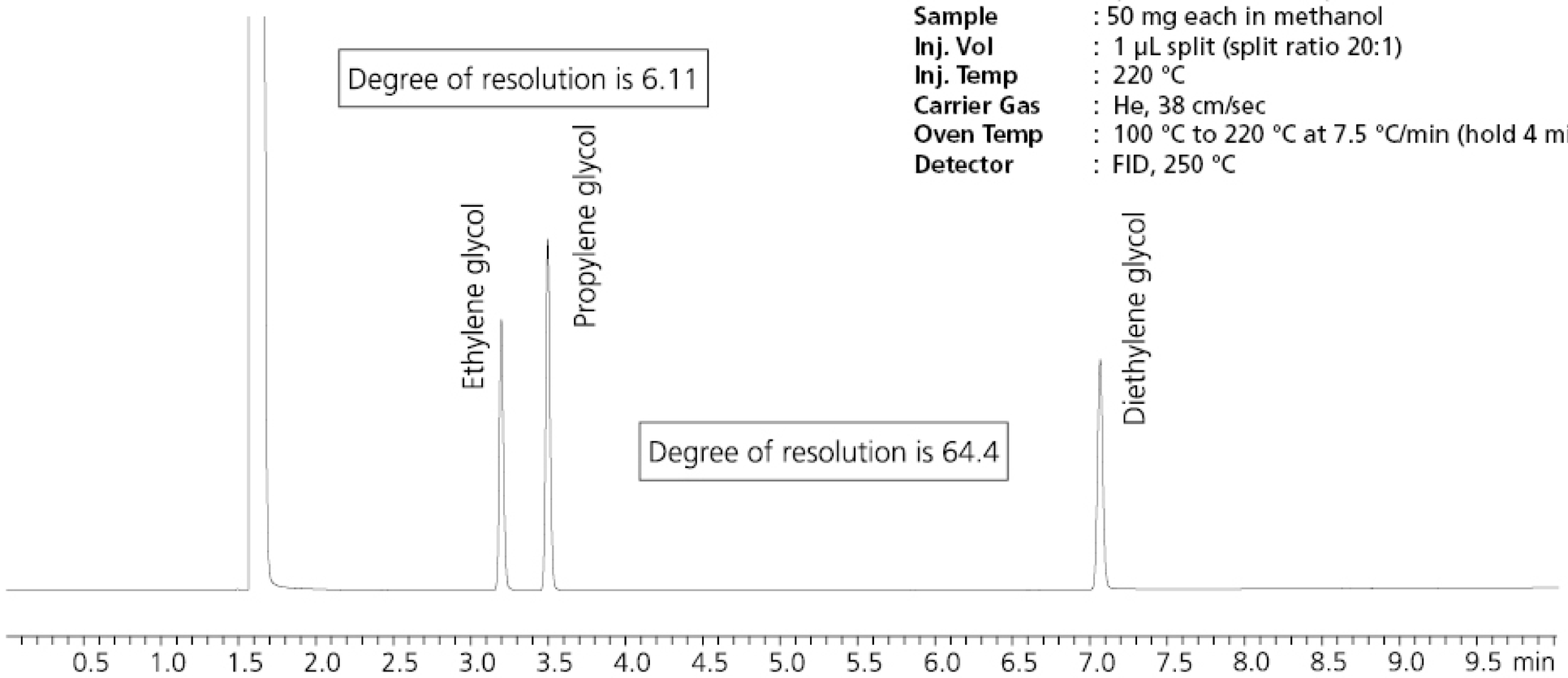



For SH-1701 columns with Intega-Guard™ column, please refer to page C-44.

| ID | df | Temp. Range | 15 m | 30 m | 60 m |
|---|---|---|---|---|---|
| 0.25 mm | 0.10 µm | -20 to 280 °C | – | 227-36216-01 | 227-36216-02 |
| | 0.25 µm | -20 to 280 °C | – | 221-75777-30 | 227-36217-01 |
| | 0.50 µm | -20 to 270/280 °C | – | 221-75778-30 | 227-36218-01 |
| | 1.00 µm | -20 to 260/280 °C | – | 221-75779-30 | 227-36219-01 |
| 0.32 mm | 0.10 µm | -20 to 280 °C | – | 221-76184-30 | 227-36220-01 |
| | 0.25 µm | -20 to 280 °C | 221-75780-15 | 221-75780-30 | 221-75780-60 |
| | 0.50 µm | -20 to 270/280 °C | – | 221-75781-30 | 227-36221-01 |
| | 1.00 µm | -20 to 260/280 °C | – | 221-75782-30 | 221-75782-60 |
| | 1.50 µm | -20 to 240/260 °C | – | 227-36222-01 | 227-36222-02 |
| 0.53 mm | 0.10 µm | -20 to 270/280 °C | – | 227-36223-01 | 227-36223-02 |
| | 0.25 µm | -20 to 270/280 °C | – | 227-36224-01 | – |
| | 0.50 µm | -20 to 260/270 °C | – | 227-36225-01 | – |
| | 1.00 µm | -20 to 250/270 °C | – | 221-75785-30 | 227-36226-01 |
| | 1.50 µm | -20 to 240/260 °C | – | 227-36227-01 | 227-36227-02 |
| | 3.00 µm | -20 to 230/250 °C | – | 227-36228-01 | 227-36228-02 |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

# Analysis of Ethylene Glycol and Diethylene Glycol in Propylene Glycol



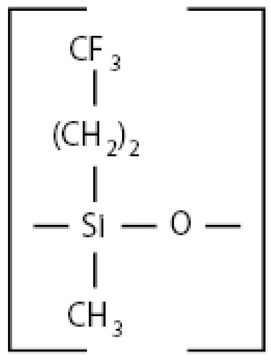

**Conditions**

| | |
|---|---|
| **Instrument** | : GC-2010 Plus AF/AOC-20i |
| **Column** | : SH-1701, 30 m, 0.32 mm ID, 1.00 µm (P/N: 221-75782-30) |
| **Sample** | : 50 mg each in methanol |
| **Inj. Vol** | : 1 µL split (split ratio 20:1) |
| **Inj. Temp** | : 220 °C |
| **Carrier Gas** | : He, 38 cm/sec |
| **Oven Temp** | : 100 °C to 220 °C at 7.5 °C/min (hold 4 min) |
| **Detector** | : FID, 250 °C |

## SH-200/SH-200MS

- Mid-polarity phase: Crossbond™ trifluoropropyl methyl polysiloxane
- General-purpose columns for solvents, Freon® fluorocarbons, alcohols, ketones, silanes, glycols, and drugs of abuse.
- Equivalent to USP G6 phase.
- Similar phases: DB-210, DB-200, VF-200ms

SH-200 / SH-200MS Structure




SH-200

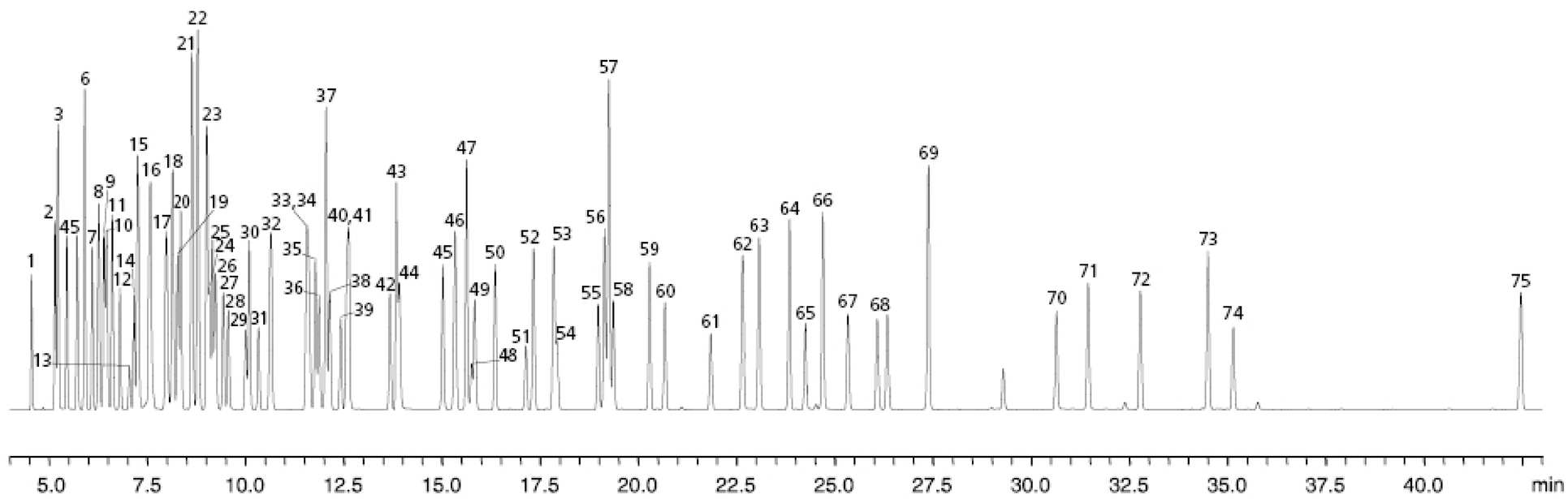
| ID | df | Temp. Range | 30 m | 60 m | 105 m |
|---|---|---|---|---|---|
| 0.25 mm | 0.10 µm | -20 to 320/340 °C | 227-36179-01 | 227-36179-02 | – |
| | 0.25 µm | -20 to 320/340 °C | 227-36180-01 | 227-36180-02 | – |
| | 0.50 µm | -20 to 310/330 °C | 227-36181-01 | 227-36181-02 | – |
| | 1.00 µm | -20 to 290/310 °C | 221-75800-30 | 227-36182-01 | – |
| 0.32 mm | 0.10 µm | -20 to 320/340 °C | 227-36183-01 | 227-36183-02 | – |
| | 0.25 µm | -20 to 320/340 °C | 227-36184-01 | 227-36184-02 | – |
| | 0.50 µm | -20 to 310/330 °C | 227-36185-01 | 227-36185-02 | – |
| | 1.00 µm | -20 to 290/310 °C | 227-36186-01 | 227-36186-02 | – |
| | 1.50 µm | -20 to 280/300 °C | 227-36187-01 | 227-36187-02 | 221-75804-15 |
| 0.53 mm | 0.10 µm | -20 to 310/330 °C | 227-36188-01 | 227-36188-02 | – |
| | 0.25 µm | -20 to 310/330 °C | 227-36189-01 | 227-36189-02 | – |
| | 0.50 µm | -20 to 300/320 °C | 227-36190-01 | 227-36190-02 | – |
| | 1.00 µm | -20 to 290/310 °C | 227-36191-01 | 227-36191-02 | – |
| | 1.50 µm | -20 to 280/300 °C | 227-36192-01 | 227-36192-02 | – |
| | 3.00 µm | -20 to 260/380 °C | 227-36193-01 | 227-36193-02 | – |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

SH-200MS (Low-bleed phase for GCMS analysis)

| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.25 mm | 0.10 µm | -20 to 320/340 °C | 227-36194-01 |
| | 0.25 µm | -20 to 320/340 °C | 221-75811-30 |
| | 0.50 µm | -20 to 310/330 °C | 227-36195-01 |
| | 1.00 µm | -20 to 290/310 °C | 227-36196-01 |
| 0.32 mm | 0.10 µm | -20 to 320/340 °C | 227-36197-01 |
| | 0.25 µm | -20 to 320/340 °C | 221-75814-30 |
| | 0.50 µm | -20 to 310/330 °C | 227-36198-01 |
| | 1.00 µm | -20 to 290/310 °C | 227-36199-01 |
| 0.53 mm | 0.50 µm | -20 to 300/320 °C | 227-36200-01 |
| | 1.00 µm | -20 to 290/310 °C | 227-36201-01 |
| | 1.50 µm | -20 to 280/300 °C | 227-36202-01 |

# Analysis of Organic Solvents




## Peaks

1. Methanol
2. Ethanol
3. Acetaldehyde + Ethyl Ether
4. 1,1-Dichloroethylene
5. Isopropanol
6. Dichloromethane + Hexane
7. trans-1,2-Dichloroethylene
8. tert.-Butanol
9. tert.-Butyl Methyl Ether
10. Isopropyl Ether
11. n-Propanol
12. Ethyl Formate
13. Chloroform
14. Methyl Acetate
15. Cyclohexane
16. Tetrachloromethane + sec.-Butanol
17. Isooctane
18. Isobutanol + 1,1,1-Trichloroethane
19. Acetonitrile
20. Acrylonitrile
21. Benzene
22. Tetrahydrofuran + methylcyclohexane
23. Methyl Acrylate + 1,2-Dichloroethane
24. Trichloroethylene
25. n-Butanol
26. Ethyl Acetate
27. 1,2-Dimethoxyethane
28. Ethylene Glycol Monomethyl Ether
29. Ethylenechlorohydrin
30. Methyl Ethyl Ketone
31. Nitromethane
32. Propylene Glycol Monomethyl Ether + Isopropyl Acetate
33. Ethyl Acrylate
34. Isoamyl Alcohol
35. Methyl Methacrylate
36. Ethylene Glycol Monoethyl Ether
37. Toluene
38. 1,4-Dioxane
39. tetrachloroethylene
40. n-Propyl Acetate
41. n-Amyl Alcohol
42. Epichlorohydrin
43. Pyridine
44. Ethylene Glycol Monoisopropyl Ether
45. Isobutyl Acetate
46. Methyl Isobutyl Ketone + Ethylbenzene
47. Chlorobenzene
48. p-Xylene
49. m-Xylene
50. n-Butyl Acetate
51. o-Xylene
52. Methyl Butyl Ketone
53. Cyclohexanol
54. 1,1,2,2-Tetrachloroethane
55. Isoamyl Acetate
56. Butyl Acrylate
57. Ethylene Glycol Monobutyl Ether
58. Anisole + Propylene Glycol Monomethyl Ether Acetate
59. n-Amyl Acetate
60. Ethylene Glycol Monoethyl Ether Acetate
61. N,N-Dimethylformamide
62. Isooctanol
63. Cyclohexanone
64. o-Dichlorobenzene
65. Diethylene Glycol Monoethyl Ether
66. Benzyl Alcohol
67. N,N-Dimethylacetamide
68. Dimethyl Sulfoxide
69. Tetralin
70. Diethylene Glycol Monobutyl Ether
71. 2-Ethylhexyl Acrylate
72. N-Methylpyrrolidone
73. Isophorone
74. 1,3-Dimethyl-2-Imidazolidinone
75. Sulfolane

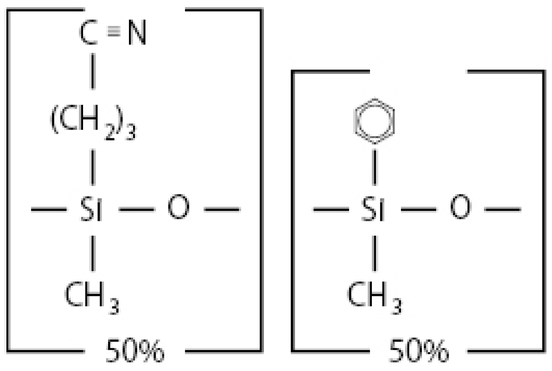
## Conditions

**Instrument** : GC-2010
**Column** : SH-200, 60 m, 0.32 mm ID, 1.00 µm (P/N: 227-36186-02)
**Injection** : Split (split ratio: 50:1)
**Inj. Temp** : 250 °C
**Carrier Gas** : He, constant linear velocity mode, 25 cm/sec
**Oven Temp** : 40 °C (0 min) to 310 °C at 4 °C/min
**Detector** : FID, 330 °C

## SH-225

- Polar phase: Crossbond™ 50% cyanopropylmethyl / 50% phenylmethyl polysiloxane
- General-purpose columns for FAMEs, carbohydrates, sterols, flavor compounds.
- Equivalent to USP G7 and G19 phases.
- Similar phases: DB-225, DB-225MS, CP-Sil 43 CB, SPB-225

SH-225 Structure



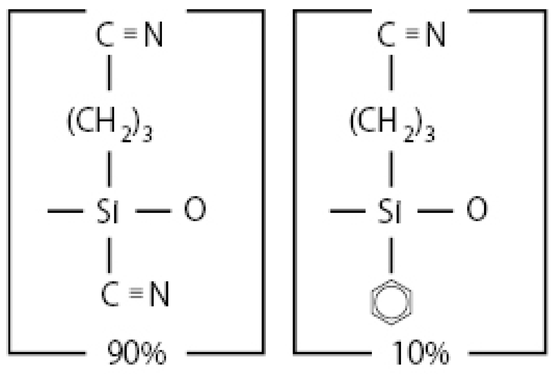

| ID | df | Temp. Range | 30 m | 60 m |
|---|---|---|---|---|
| 0.25 mm | 0.25 µm | 40 to 220/240 °C | 227-36229-01 | 227-36229-02 |
| | 0.50 µm | 40 to 220/240 °C | 227-36230-01 | – |
| 0.32 mm | 0.10 µm | 40 to 220/240 °C | 227-36231-01 | – |
| | 0.25 µm | 40 to 220/240 °C | 227-36232-01 | – |
| | 0.50 µm | 40 to 220/240 °C | 227-36233-01 | – |
| | 1.00 µm | 40 to 200/220 °C | 227-36234-01 | 227-36234-02 |
| 0.53 mm | 0.25 µm | 40 to 200/220 °C | 227-36235-01 | – |
| | 0.50 µm | 40 to 200/220 °C | 227-36236-01 | – |
| | 1.00 µm | 40 to 200/220 °C | 227-36237-01 | – |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

## SH-2330

- Highly polar phase: Crossbond™ 90% biscyanopropyl / 10% cyanopropylphenyl polysiloxane (Non-bonded)
- General-purpose columns for cis/trans FAMEs, dioxin isomers.
- Equivalent to USP G8 and G48 phase.
- Similar phases: DB-23, VF-23ms, SP-2330, SP-2331, SP-2380

SH-2330 Structure




| ID | df | Temp. Range | 30 m | 60 m |
|---|---|---|---|---|
| 0.25 mm | 0.10 µm | 0 to 260/275 °C | 227-36238-01 | 227-36238-02 |
| | 0.20 µm | 0 to 260/275 °C | 227-36239-01 | 227-36239-02 |
| 0.32 mm | 0.10 µm | 0 to 260/275 °C | 227-36240-01 | 227-36240-02 |
| | 0.20 µm | 0 to 260/275 °C | 227-36241-01 | 227-36241-02 |
| 0.53 mm | 0.10 µm | 0 to 260/275 °C | – | 227-36242-01 |
| | 0.20 µm | 0 to 260/275 °C | 227-36243-01 | 227-36243-02 |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

# Capillary Columns

General-Purpose Columns

## SH-2560

- Highly polar phase; biscyanopropyl polysiloxane—not bonded
- Stationary phase selectivity optimized for isomer separation to ensure accurate quantification of critical cis/trans FAMEs.
- Application-specific QC test guarantees consistent, reliable performance for AOAC 996.06 and AOCS Ce 1j-07 methods.
- Excellent sample capacity; no peak distortion means easy, accurate peak integration.
- Similar Phase(s): HP-88, CP-Sil 88, SP-2560, BPX-90, MEGA-10

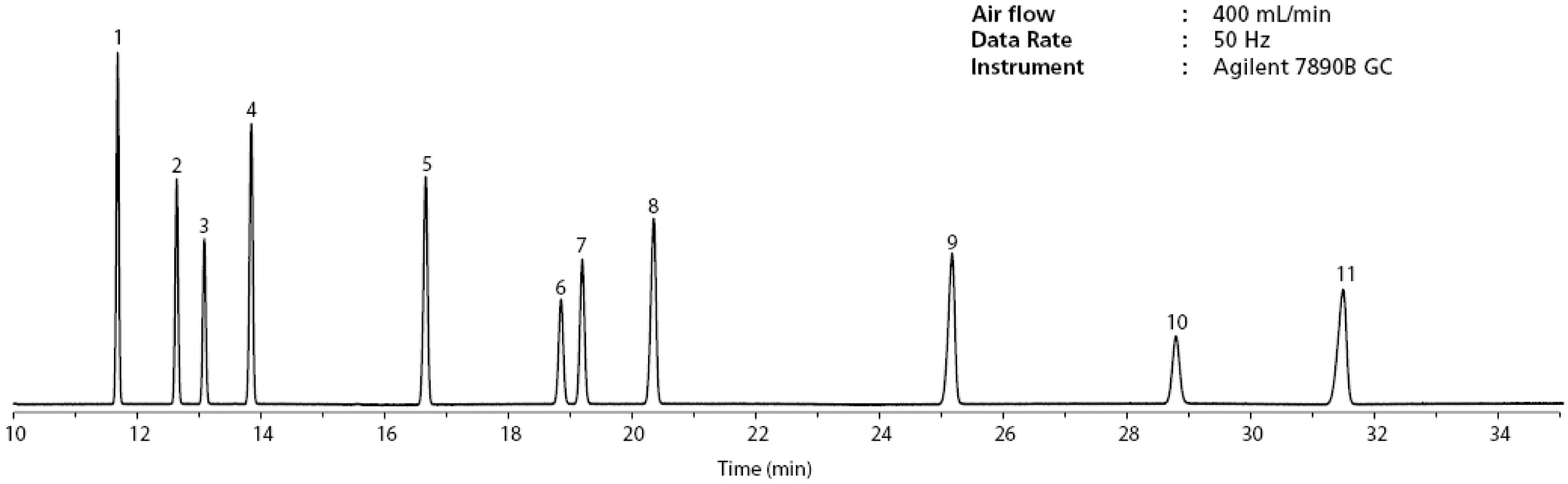
| ID | df | Temp. Range | 100 m |
|---|---|---|---|
| 0.25 mm | 0.20 µm | 20 to 250 °C | 227-36311-01 |

# Unsaturated FAMES QC Test Mix on SH-2560

| Peaks | tR (min) | Conc. (µg/mL) | Structural Nomenclature |
|---|---|---|---|
| 1. Methyl octadecanoate | 11.68 | 1.1 | C18:0 |
| 2. Methyl elaidate | 12.64 | 0.8 | C18:1 (t9) |
| 3. Methyl oleate | 13.09 | 0.6 | C18:1 (c9) |
| 4. Methyl nonadecanoate | 13.84 | 1.1 | C19:0 |
| 5. Methyl eicosanoate | 16.66 | 1.1 | C20:0 |
| 6. Methyl eicosenoate | 18.85 | 0.6 | C20:1 (c11) |
| 7. Methyl linolenate | 19.20 | 0.8 | C18:3 (c9,c12,c15) |
| 8. Methyl heneicosanoate | 20.35 | 1.1 | C21:0 |
| 9. Methyl docosanoate | 25.17 | 1.1 | C22:0 |
| 10. Methyl eicosatrienoate | 28.79 | 0.6 | C20:3 (c11,c14,c17) |
| 11. Methyl tricosanoate | 31.49 | 1.1 | C23:0 |

**Conditions**

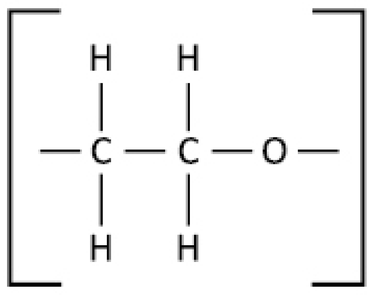
| | | |
|---|---|---|
| **Column** | : | SH-2560, 2560, 100 m, 0.25mm ID, 0.20 µm (227-36311-01) |
| **Sample** | : | Unsaturated FAMES QC test mix |
| **Diluent** | : | Hexane |
| **Injection** | : | 1 µL split (split ratio 200:1) |
| **Liner** | : | Premium 4 mm Precision liner w/wool (cat.# 23305.1) |
| **Inj. Temp** | : | 250 °C |
| **Oven Temp** | : | 180 °C (hold 40 min) |
| **Carrier Gas** | : | $H_2$, constant flow |
| **Flow Rate** | : | 2.5 mL/min |
| **Detector** | : | FID, 275 °C |
| **Make-up Gas Type** | : | $N_2$ |
| **Hydrogen flow** | : | 40 mL/min |
| **Air flow** | : | 400 mL/min |
| **Data Rate** | : | 50 Hz |
| **Instrument** | : | Agilent 7890B GC |



## SH-Wax

- Polar phase: Crossbond™ polyethylene glycol
- Best polyethylene glycol (PEG) phase for alkenols, glycols, and aldehydes.
- Equivalent to USP G14, G15, G16, G20, G39 phases.
- Similar phases: DB-Wax, CP-Wax 52 CB

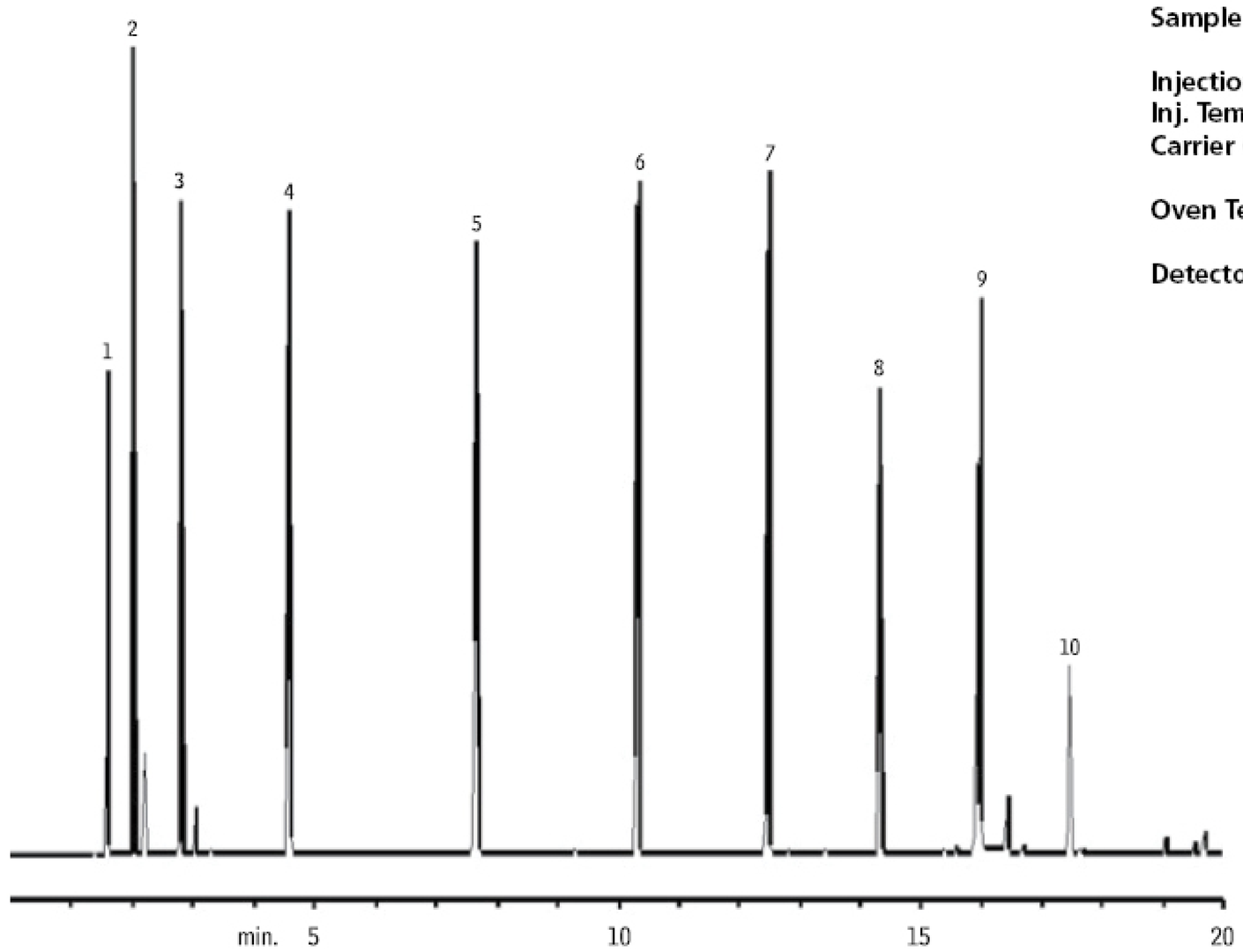
SH-Wax Structure




| ID | df | Temp. Range | 15 m | 20 m | 30 m | 50 m | 60 m |
|---|---|---|---|---|---|---|---|
| 0.25 mm | 0.10 µm | 20 to 250 °C | – | – | 221-76186-30 | – | – |
| | 0.25 µm | 20 to 250 °C | – | – | 221-75893-30 | 221-75893-50 | 221-75893-60 |
| | 0.50 µm | 20 to 250 °C | – | – | 221-75894-30 | – | 221-75894-60 |
| 0.32 mm | 0.25 µm | 20 to 250 °C | – | 221-75895-20 | 221-75895-30 | – | 221-75895-60 |
| | 0.50 µm | 20 to 250 °C | – | – | 221-75896-30 | 221-75896-50 | 221-75896-60 |
| | 1.00 µm | 20 to 240/250 °C | – | – | 221-75897-30 | – | 221-75897-60 |
| 0.53 mm | 0.25 µm | 20 to 250 °C | – | – | 227-36244-01 | – | – |
| | 0.50 µm | 20 to 250 °C | – | – | 221-76188-30 | – | 227-36245-01 |
| | 1.00 µm | 20 to 240/250 °C | 221-75899-15 | – | 221-75899-30 | – | 221-75899-60 |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

# Aldehydes




**Peaks**

1. ethanal
2. propanal
3. butenal
4. pentanal
5. hexanal
6. heptanal
7. octanal
8. nonanal
9. decanal
10. undecanal

**Conditions**

| | |
|---|---|
| **Column** | : SH-Wax, 30 m, 0.25mm ID, 0.50 µm (P/N: 221-75894-30) |
| **Sample** | : C2-C11 aldehydes mixture On-column conc.: 250 ng |
| **Injection** | : Split (split ratio: 100:1) |
| **Inj. Temp** | : 200 °C |
| **Carrier Gas** | : Hydrogen, linear velocity 35 cm/sec. set at 40 °C |
| **Oven Temp** | : 40 °C (hold 5 min) to 200 °C at 10 °C/min |
| **Detector** | : FID, 200 °C |

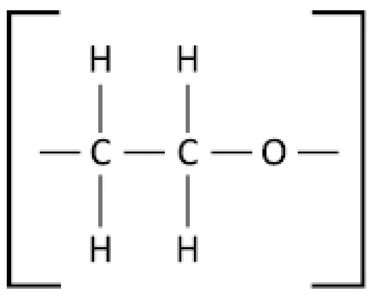
# Capillary Columns

General-Purpose Columns

## SH-PolarWax / SH-PolarWax MS

- Polar phase: Crossbond™ polyethylene glycol
- Low-bleed PEG column ensures long column lifetimes.
- Rugged enough to withstand repeated water injections.
- Equivalent to USP G14, G15, G16, G20, and G39 phases.
- Similar phases: Innowax, CP-Wax 52 CB, VF-WAX MS, Supelcowax-10

SH-PolarWax / SH-PolarWax MS Structure




SH-PolarWax

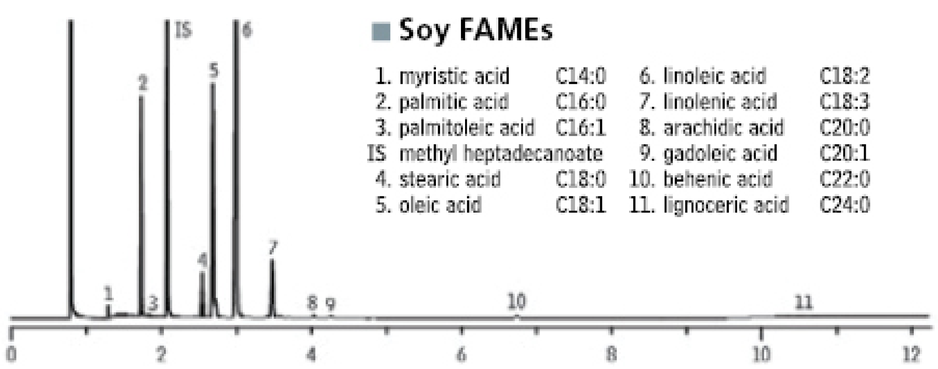
| ID | df | Temp. Range | 30 m | 50 m | 60 m |
|---|---|---|---|---|---|
| 0.25 mm | 0.10 µm | 40 to 250/260 °C | 227-36246-01 | – | 227-36246-02 |
| | 0.25 µm | 40 to 250/260 °C | 227-36305-02 | 227-36247-01 | 227-36247-02 |
| | 0.50 µm | 40 to 250/260 °C | 227-36248-01 | – | 227-36248-02 |
| 0.32 mm | 0.10 µm | 40 to 250/260 °C | 227-36249-01 | – | 227-36249-02 |
| | 0.25 µm | 40 to 250/260 °C | 221-75972-30 | – | 227-36250-01 |
| | 0.50 µm | 40 to 250/260 °C | 227-36251-01 | – | 221-75975-60 |
| | 1.00 µm | 40 to 240/250 °C | 227-36252-01 | – | 227-36252-02 |
| 0.53 mm | 0.10 µm | 40 to 250/260 °C | 227-36253-01 | – | – |
| | 0.25 µm | 40 to 250/260 °C | 227-36254-01 | – | 227-36254-02 |
| | 0.50 µm | 40 to 250/260 °C | 227-36255-01 | – | 227-36255-02 |
| | 1.00 µm | 40 to 240/250 °C | 221-75979-30 | – | 227-36256-01 |
| | 1.50 µm | 40 to 230/240 °C | 227-36257-01 | – | 227-36257-02 |
| | 2.00 µm | 40 to 220/230 °C | 227-36258-01 | – | – |

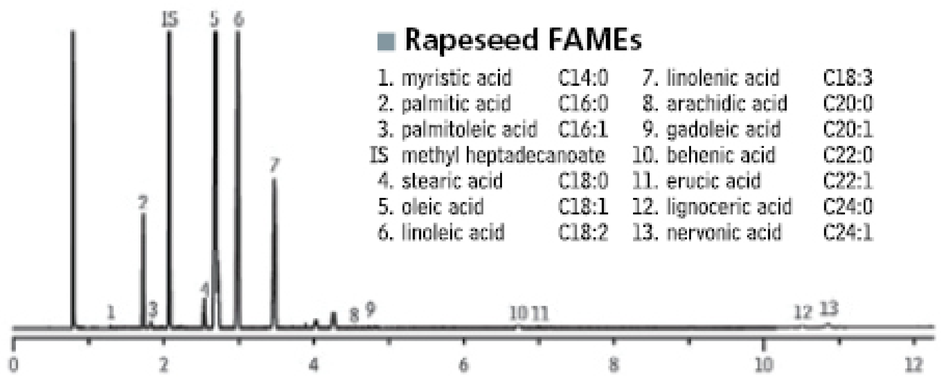
* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

SH-PolarWax MS

| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.25 mm | 0.25 µm | 40 to 250/260 °C | 227-36322-01 |
| 0.32 mm | 0.25 µm | 40 to 250/260 °C | 227-36322-03 |

# FAMEs in Biodiesel Oils




**Conditions**

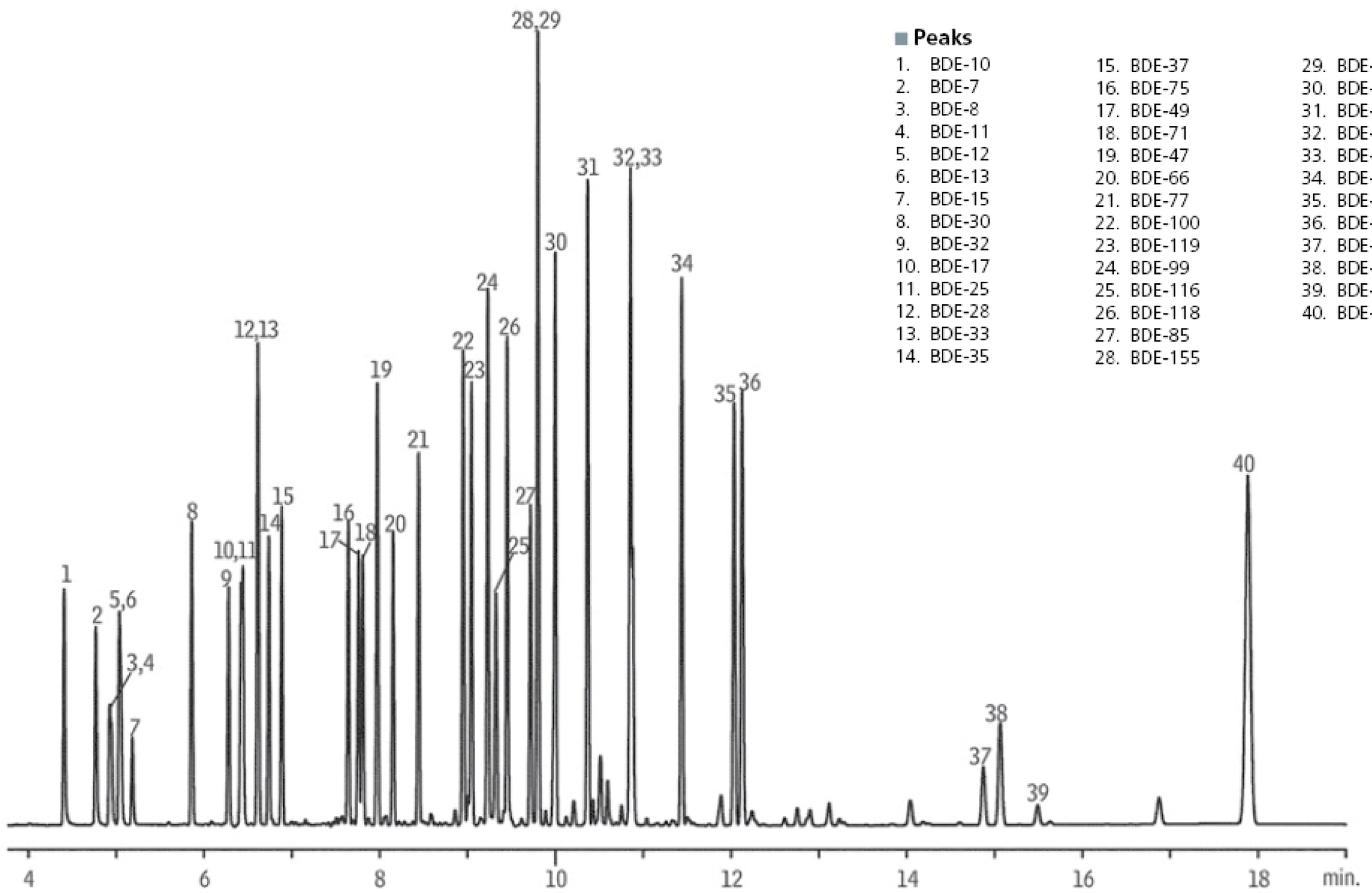
**Column** : SH-PolarWax, 30 m, 0.32 mm ID, 0.25 µm (P/N: 221-75972-30)
**Inj. Vol.** : 1 µL split (split ratio 100:1)
**Inj. Temp** : 250 °C
**Carrier Gas** : Hydrogen, constant flow rate 3mL/min, linear velocity 60 cm/sec.
**Oven Temp** : 210 °C (hold 5 min) to 230 °C at 20 °C/min (hold 5 min)
**Detector** : FID, 250 °C

## SH-1614

- 5% diphenyl / 95% dimethyl polysiloxane
- Optimized for PBDE analysis by EPA Method 1614.
- Short column option resolves BDE-209 three times faster, with less thermal breakdown.
- Unique deactivation gives higher BDE-209 response than competitor columns, for greater analytical sensitivity.
- Exceeds EPA Method 1614 resolution criteria for BDE-49 and BDE-71.

| ID | df | Temp. Range | 15 m | 30 m |
|---|---|---|---|---|
| 0.25 mm | 0.10 µm | -60 to 330/360 °C | 227-36265-01 | 227-36265-02 |

# Brominated Flame Retardants




**Peaks**

1. BDE-10
2. BDE-7
3. BDE-8
4. BDE-11
5. BDE-12
6. BDE-13
7. BDE-15
8. BDE-30
9. BDE-32
10. BDE-17
11. BDE-25
12. BDE-28
13. BDE-33
14. BDE-35
15. BDE-37
16. BDE-75
17. BDE-49
18. BDE-71
19. BDE-47
20. BDE-66
21. BDE-77
22. BDE-100
23. BDE-119
24. BDE-99
25. BDE-116
26. BDE-118
27. BDE-85
28. BDE-155
29. BDE-126
30. BDE-154
31. BDE-153
32. BDE-138
33. BDE-166
34. BDE-183
35. BDE-181
36. BDE-190
37. BDE-208
38. BDE-207
39. BDE-206
40. BDE-209

**Conditions**

| | |
|---|---|
| **Column** | : SH-1614, 15 m, 0.25 mm ID, 0.10 µm (P/N: 227-36265-01) |
| **Sample** | : 100-300 ppb PBDE PAR Solution<br>500 ppb decabromodiphenyl ether |
| **Inj. Vol.** | : 1 µL splitless (hold 1 min) |
| **Inj. Temp** | : 340 °C |
| **Carrier Gas** | : He, constant flow, linear velocity 60 cm/sec., 120 °C |
| **Oven Temp** | : 120 °C (hold 1 min) to 275 °C at 15 °C/min to 300 °C at 5 °C/min (hold 5 min) |
| **Detector** | : µ-ECD, 345 °C |

## Capillary Columns

Dedicated Columns

### SH-OPP2

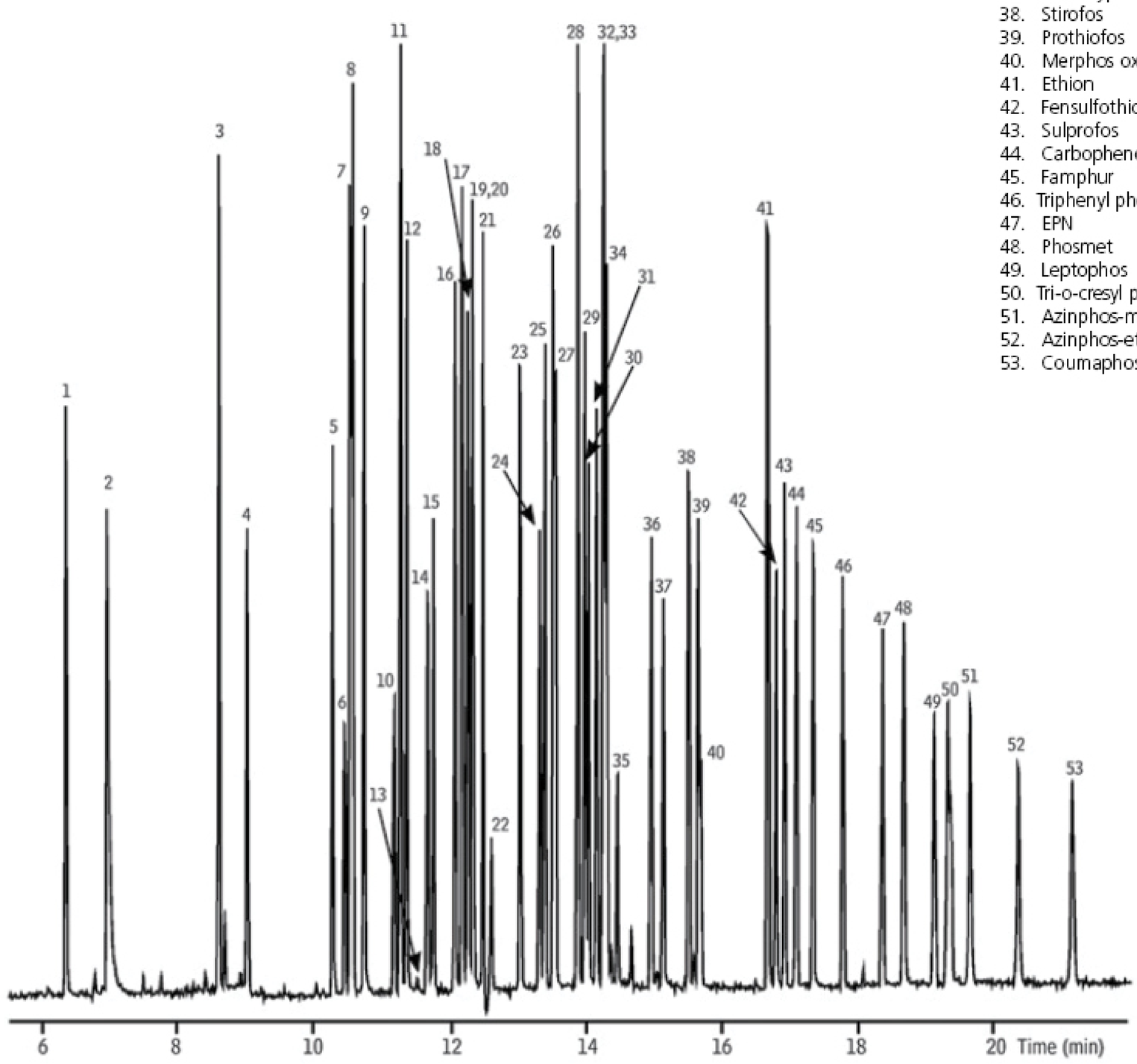
- Dedicated column for organophosphorus pesticides; best column combination for US EPA Method 8141.
- Low bleed - ideal for GC-FPD, GC-NPD, or GCMS analyses.

| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.32 mm | 0.32 µm | -20 to 310/330 °C | 221-75887-30 |

## Organophosphorus Pesticides (U.S. EPA Method 8141A)

**Peaks**

1. Dichlorvos
2. Hexamethylphosphoramide
3. Mevinphos
4. Trichlorfon
5. TEPP
6. Demeton-O
7. Tributyl phosphate (SS)
8. Thionazin
9. Ethoprop
10. Naled
11. Sulfotepp
12. Phorate
13. Dicrotophos
14. Monocrotophos
15. Demeton-S
16. Terbufos
17. Dimethoate
18. Diazinon
19. Dioxathion
20. Fonophos
21. Disulfoton
22. Phosphamidon isomer (breakdown product)
23. Dichlorofenthion
24. Phosphamidon
25. Chlorpyrifos methyl
26. Methyl parathion
27. Ronnel
28. Aspon
29. Fenitrothion
30. Malathion
31. Chlorpyrifos
32. Trichloronate
33. Parathion-ethyl
34. Fenthion
35. Merphos
36. Chlorfenvinphos
37. Crotoxyphos
38. Stirofos
39. Prothiofos
40. Merphos oxone (breakdown product)
41. Ethion
42. Fensulfothion
43. Sulprofos
44. Carbophenothion
45. Famphur
46. Triphenyl phosphate (SS)
47. EPN
48. Phosmet
49. Leptophos
50. Tri-o-cresyl phosphate
51. Azinphos-methyl
52. Azinphos-ethyl
53. Coumaphos




**Conditions**

| | | | |
|---|---|---|---|
| **Column** | : SH-OPP2, 30 m, 0.32 mm ID, 0.32 µm (P/N: 221-75887-30) | **Carrier Gas** | : He |
| **Inj. Vol.** | : 1 µL splitless (hold 1 min) | **Dead Time** | : 1.03 min at 80 °C |
| **Inj. Temp** | : 200 °C | **Detector** | : FPD, 250 °C |
| **Oven Temp** | : 80 °C (hold 0.5 min) to 280 °C at 12 °C/min (hold 10 min) | **Notes** | : Constant pressure |

## SH-CLP / SH-CLP II

- Dedicated columns for organochlorine pesticides and herbicides.
- Low bleed - ideal for high-sensitivity GC-ECD or GCMS analyses.
- Baseline separations in less than 10 minutes.
- Analyze EPA Method 8081B, 8082A, 8151A, 504.1, 515, 508.1, and 552.2 compounds without time-consuming column changes.
- Similar phases: DB-CLP1 / DB-CLP2

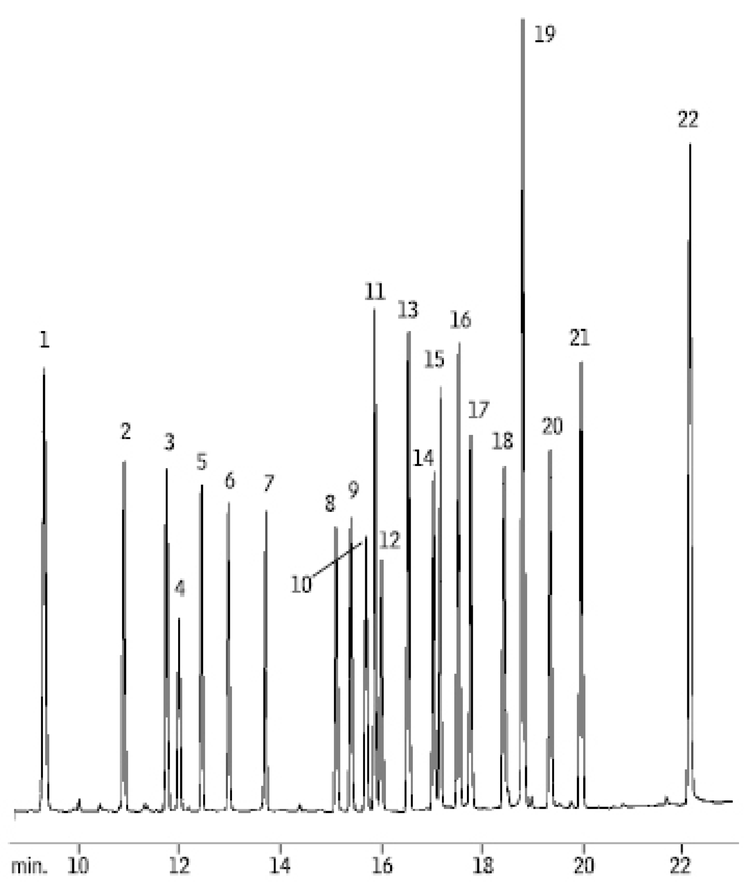
SH-CLP

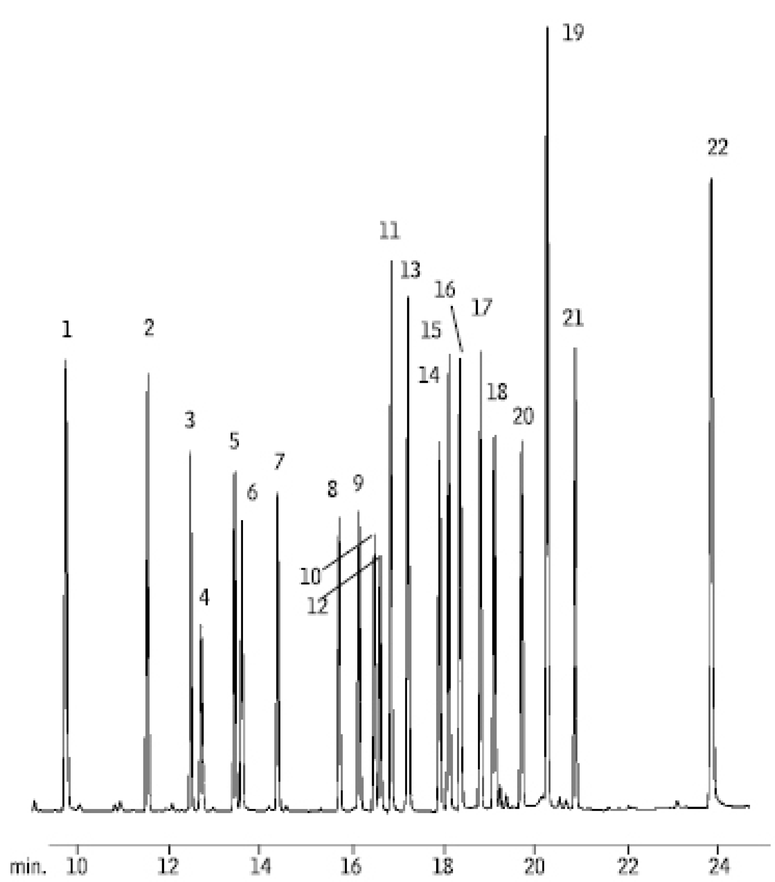
| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.32 mm | 0.32 µm | -20 to 320/340 °C | 227-36266-01 |
| | 0.50 µm | -20 to 320/340 °C | 221-75879-30 |

SH-CLP II

| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.32 mm | 0.25 µm | -20 to 320/340 °C | 227-36267-01 |

# Organochlorine Pesticides (US EPA Method 8081)




**Peaks**

1. 2,4,5,6-tetrachloro-m-xylene
2. α-BHC (α-HCH)
3. γ-BHC (lindane)
4. β-BHC (β-HCH)
5. δ-BHC (δ-HCH)
6. heptachlor
7. aldrin
8. heptachlor epoxide
9. γ-chlordane
10. α-chlordane
11. 4,4'-DDE
12. endosulfan I
13. dieldrin
14. endrin
15. 4,4'-DDD
16. endosulfan II
17. 4,4'-DDT
18. endrin aldehyde
19. methoxychlor
20. endosulfan sulfate
21. endrin ketone
22. decachlorobiphenyl

**Conditions**

| | | |
|---|---|---|
| **Column** | : SH-CLP, 30 m, 0.32 mm ID, 0.50 µm (P/N: 221-75879-30) | SH-CLP2, 30 m, 0.32 mm ID, 0.25 µm (P/N: 227-36267-01) |
| **Oven Temp** | : 120 °C (hold 1 min) to 300 °C (hold 10 min) at 9 °C/min | |
| **Inj.** | : Direct | |
| **Inj. Temp** | : 200 °C | |
| **Detector** | : ECD, 300 °C with anode purge | |
| **Dead time** | : 1.9 min | |
| **Head pressure** | : 8.7 psi (constant) | |
| **Flow rate** | : 1.3 mL/min at 120 °C, He | |

# Capillary Columns

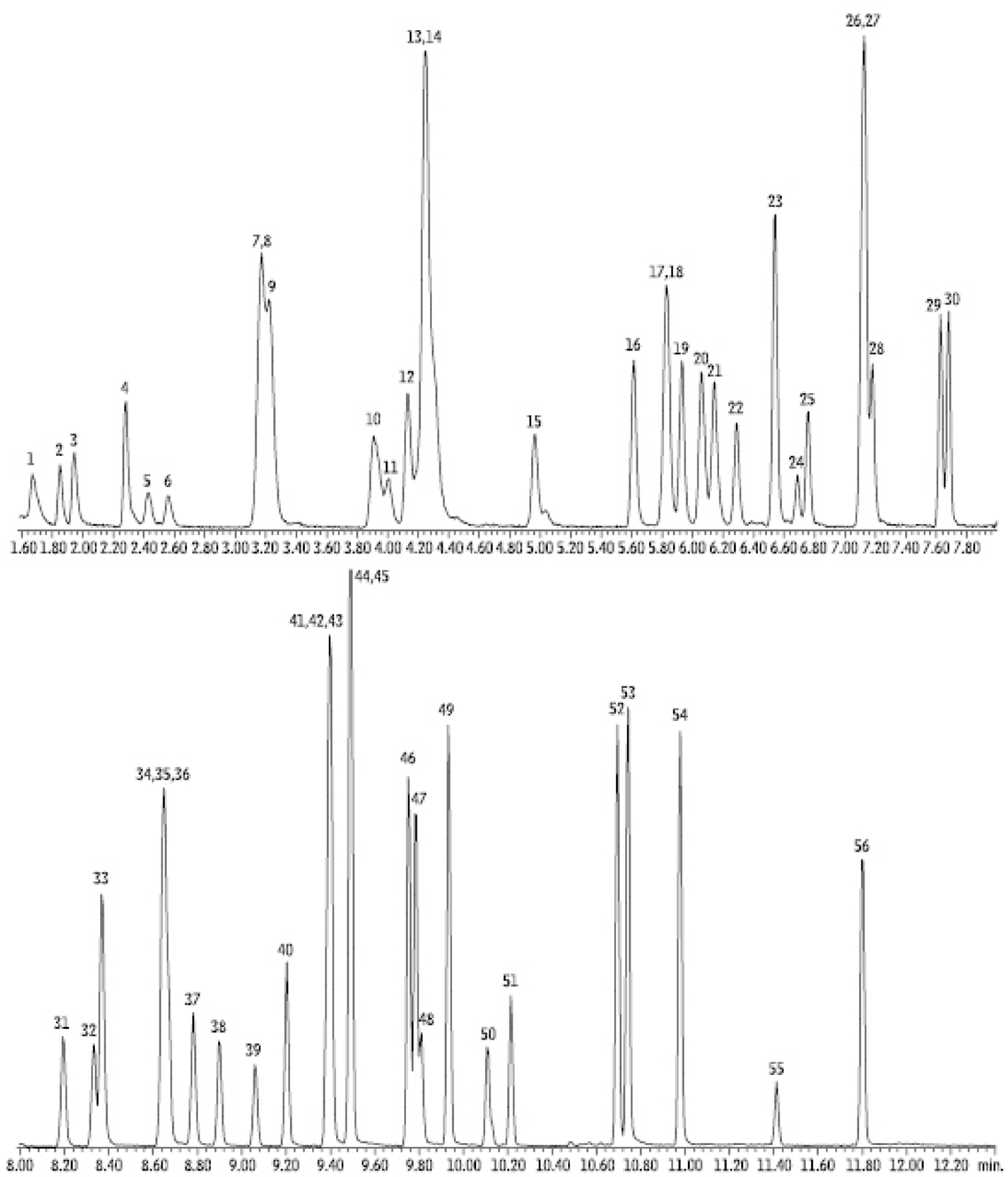
Dedicated Columns

## SH-VMS

- Dedicated columns for analyzing volatile organic pollutants by GCMS including methods TO-15, TMS, and EPA 8260.
- Complete separation of U.S. EPA Method 8260 compounds in less than 10 minutes.

| ID | df | Temp. Range | 20 m | 30 m | 60 m |
|---|---|---|---|---|---|
| 0.18 mm | 1.00 µm | -40 to 240/260 °C | 227-36412-01 | – | – |
| 0.25 mm | 1.40 µm | -40 to 240/260 °C | – | 227-36268-01 | 227-36268-02 |
| 0.32 mm | 1.80 µm | -40 to 240/260 °C | – | 227-36269-01 | 227-36269-02 |

## Volatile Organics (US EPA CLP 04.1)




**Peaks**

1. dichlorodifluoromethane
2. chloromethane
3. vinyl chloride
4. bromomethane
5. chloroethane
6. trichlorofl uoromethane
7. 1,1-dichloroethene
8. carbon disulfi de
9. 1,1,2-trichloro-1,2,2-trifl uoroethane
10. methylene chloride
11. acetone
12. trans -1,2-dichloroethene
13. methyl acetate
14. methyl tert-butyl ether
15. 1,1-dichloroethane
16. cis-1,2-dichoroethane
17. cyclohexane
18. bromochloromethane (IS)
19. chloroform
20. carbon tetrachloride
21. 1,1,1-trichloroethane
22. 2-butanone
23. benzene
24. 1,2-dichloroethane-d4 (SS)
25. 1,2-dichloroethane
26. methylcyclohexane
27. trichloroethene
28. 1,4-difl uorobenzene (IS)
29. 1,2-dichloropropane
30. bromodichloromethane
31. cis -1,3-dichloropropene
32. toluene d8 (SS)
33. toluene
34. tetrachloroethane
35. 4-methyl-2-pentanone
36. trans -1,3-dichloropropane
37. 1,1,2-trichloroethane
38. dibromochloromethane
39. 1,2-dibromoethane
40. 2-hexanone
41. chlorobenzene d5 (IS)
42. chlorobenzene
43. ethylbenzene
44. m -xylene
45. p -xylene
46. o -xylene
47. styrene
48. bromoform
49. isopropylbenzene
50. 4-bromofl uorobenzene (SS)
51. 1,1,2,2-tetrachloroethane
52. 1,3-dichlorobenzene
53. 1,4-dichlorobenzene
54. 1,2-dichlorobenzene
55. 1,2-dibromo-3-chloropropane
56. 1,2,4-trichlorobenzene

**Conditions**

**Column** : SH-VMS, 30 m, 0.25 mmID, 1.40 µm (P/N: 227-36268-01)

**Purge and Trap** : Trap: #10 (Tenax$_R$/silica gel/carbon molecular sieve)
Sample Temp: ambient
Purge: 11 min at 40 mL/min
Desorb preheat: 185 °C
Desorb: 0.5 min at 190 °C
Desorb flow rate: 35.0 mL/min
Bake: 8 min at 210 °C
Interface: split injector
Transfer Line Temp: 150 °C

**Inj.** : Split (split ratio: 35:1)

**Inj. Temp** : 200 °C

**Carrier Gas** : He, linear velocity 34 cm/sec., 40 °C, constant flow

**Oven Temp** : 40 °C (hold 4 min) to 90 °C at 16 °C/min to 220 °C at 32 °C/min (hold 5 min)

**Detector** : MS
Transfer Line Temp: 150 °C
Scan Range: 35-300 amu.
Ionization: EI

# Capillary Columns

Dedicated Columns

## SH-VRX

- Proprietary Crossbond phase
- Application-specific columns for volatile organic pollutants.
- Excellent for U.S. EPA Method 8021 compounds.
- Stable to 260 °C.
- Similar Phase(s): DB-VRX

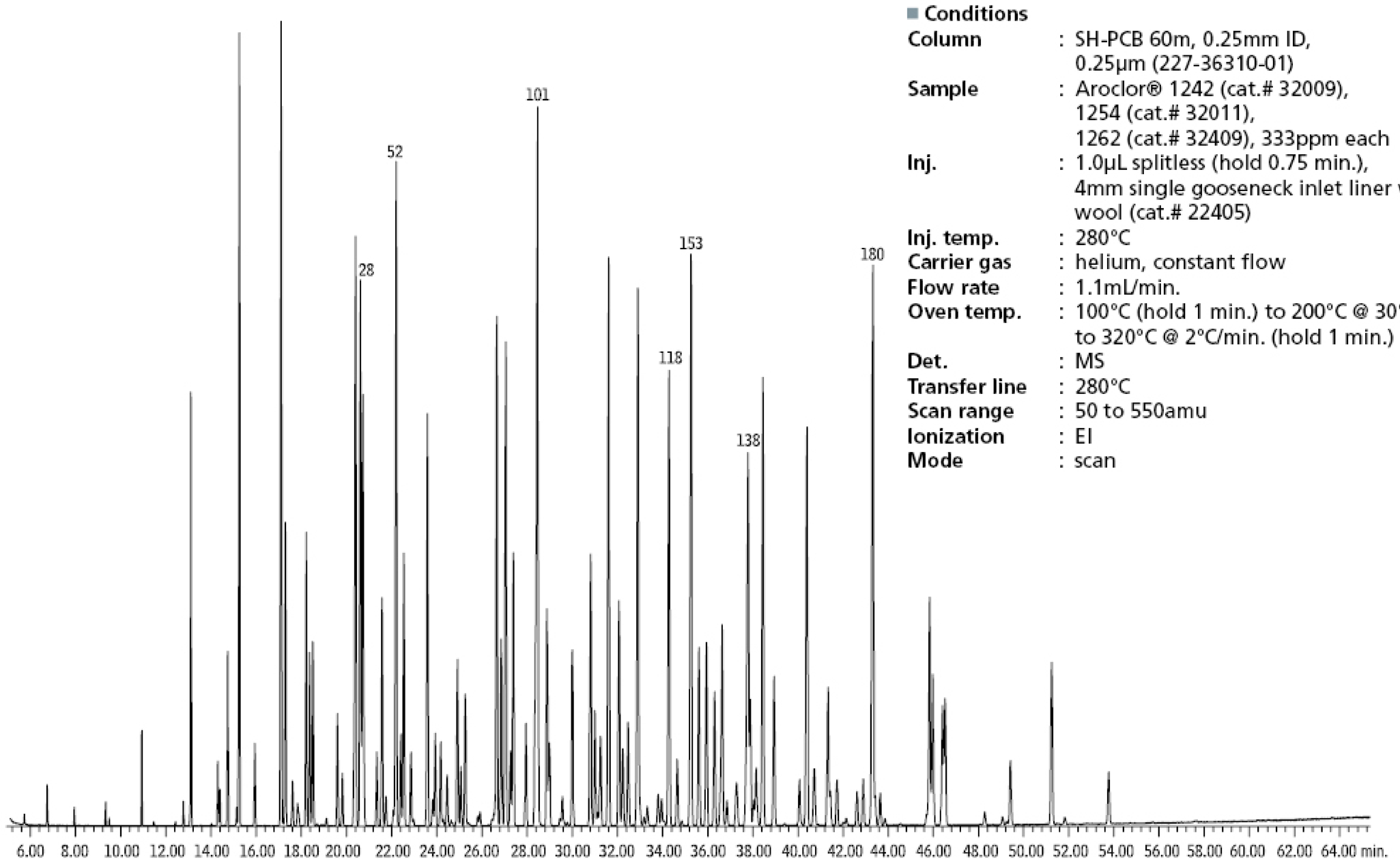
| ID | df | Temp. Range | 25 m |
|---|---|---|---|
| 0.10 mm | 0.50 µm | -40 to 240/260 °C | 227-36331-01 |

## SH-PCB

- Proprietary Crossbond phase
- Unique polymer for PCBs analysis by GC-ECD or GC-MS.
- Good results for other semi-volatiles.
- Low polarity; inert to active compounds.
- Stable to 340 °C.

| ID | df | Temp. Range | 60 m |
|---|---|---|---|
| 0.25 mm | 0.25 µm | 30 to 320/340 °C | 227-36310-01 |

# Aroclor PCBs




**Conditions**

| | |
|---|---|
| **Column** | : SH-PCB 60m, 0.25mm ID, 0.25µm (227-36310-01) |
| **Sample** | : Aroclor® 1242 (cat.# 32009), 1254 (cat.# 32011), 1262 (cat.# 32409), 333ppm each |
| **Inj.** | : 1.0µL splitless (hold 0.75 min.), 4mm single gooseneck inlet liner w/ wool (cat.# 22405) |
| **Inj. temp.** | : 280°C |
| **Carrier gas** | : helium, constant flow |
| **Flow rate** | : 1.1mL/min. |
| **Oven temp.** | : 100°C (hold 1 min.) to 200°C @ 30°C/min., to 320°C @ 2°C/min. (hold 1 min.) |
| **Det.** | : MS |
| **Transfer line** | : 280°C |
| **Scan range** | : 50 to 550amu |
| **Ionization** | : EI |
| **Mode** | : scan |

# Capillary Columns

Dedicated Columns

## SH-BAC Plus 1 / SH-BAC Plus 2

- Optimized column selectivities guarantee resolution of ethanol, internal standards, and frequently encountered interferences.
- Robust and reproducible column chemistry ensures longer column lifetime and consistent results.

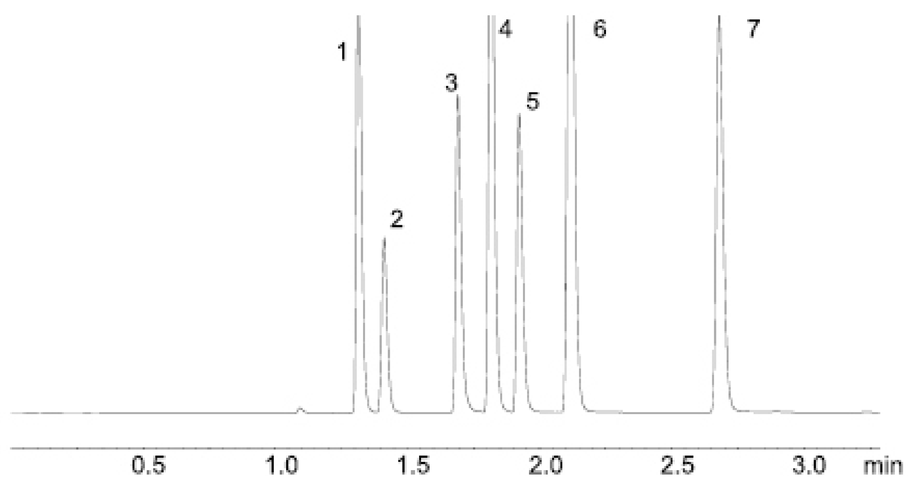
SH-BAC Plus 1

| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.32 mm | 1.80 µm | -20 to 240/260 °C | 227-36260-01 |
| 0.53 mm | 3.00 µm | -20 to 240/260 °C | 227-36261-01 |

SH-BAC Plus 2

| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.32 mm | 0.60 µm | -20 to 240/260 °C | 227-36263-01 |
| 0.53 mm | 1.00 µm | -20 to 240/260 °C | 227-36264-01 |

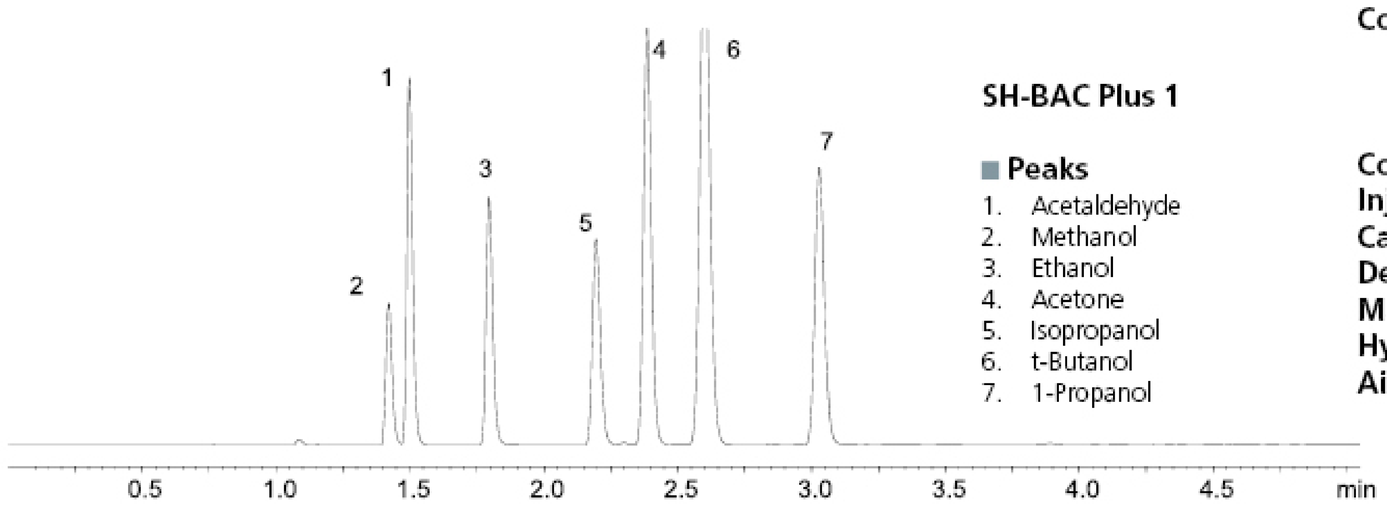
## Analysis of Alcohol Compounds in Blood




**SH-BAC Plus 2**

**Peaks**

1. Acetaldehyde
2. Methanol
3. Ethanol
4. Acetone
5. Isopropanol
6. t-Butanol
7. 1-Propanol




**SH-BAC Plus 1**

**Peaks**

1. Acetaldehyde
2. Methanol
3. Ethanol
4. Acetone
5. Isopropanol
6. t-Butanol
7. 1-Propanol

**Conditions**

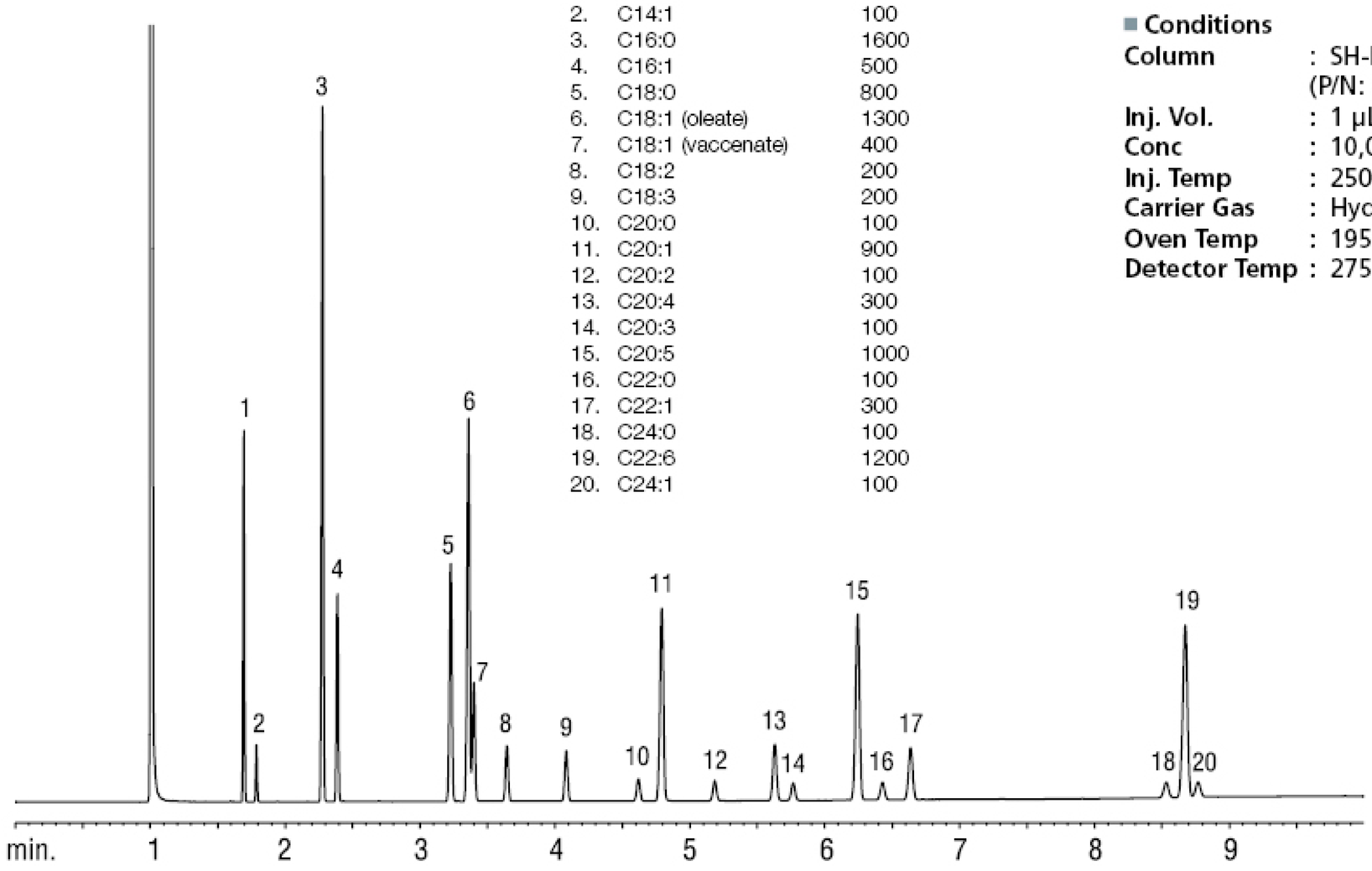
| | |
|---|---|
| **Instrument** | : GC-2010 Plus AF + HS-20 |
| **Headspace** | : Oven Temp.: 85 °C<br>Vial Warming Time: 15 min<br>Vial Pressurization Time: 1 min<br>Injection Time: 0.5 min<br>Sample Line Temp: 150 °C<br>Vial Volume: 20 mL<br>Vial Agitation: Off<br>Vial Pressurization: 100 kPa<br>Load Time: 0.5 min<br>Needle Flash Time: 0.5 min<br>Transfer Line Temp: 150 °C |
| **Column** | : SH-BAC Plus 2, 30 m, 0.32 mm ID, 0.60 µm (P/N: 227-36263-01)<br>SH-BAC Plus 1, 30 m, 0.32 mm ID, 1.80 µm (P/N: 227-36260-01) |
| **Column Temp** | : 40 °C |
| **Inj.** | : Split (split ratio: 20:1) |
| **Carrier Gas** | : He, 100 kPa |
| **Detector** | : FID, 250 °C |
| **Makeup Gas** | : He, 30 mL/min |
| **Hydrogen** | : 40 mL/min |
| **Air** | : 400 mL/min |

## SH-FAME

- Dedicated column for FAMEs, specially tested with a FAME mixture.
- Equivalent to USP G16 phase.
- Similar phases: Select FAME, Omegawax

| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.25 mm | 0.25 µm | 20 to 320/340 °C | 227-36324-01 |
| 0.32 mm | 0.25 µm | 20 to 320/340 °C | 227-36270-01 |

# FAMEs (Marine Oil Standard)




| Peaks | Conc. (µg/mL) |
|---|---|
| 1. C14:0 | 600 |
| 2. C14:1 | 100 |
| 3. C16:0 | 1600 |
| 4. C16:1 | 500 |
| 5. C18:0 | 800 |
| 6. C18:1 (oleate) | 1300 |
| 7. C18:1 (vaccenate) | 400 |
| 8. C18:2 | 200 |
| 9. C18:3 | 200 |
| 10. C20:0 | 100 |
| 11. C20:1 | 900 |
| 12. C20:2 | 100 |
| 13. C20:4 | 300 |
| 14. C20:3 | 100 |
| 15. C20:5 | 1000 |
| 16. C22:0 | 100 |
| 17. C22:1 | 300 |
| 18. C24:0 | 100 |
| 19. C22:6 | 1200 |
| 20. C24:1 | 100 |

**Conditions**

**Column** : SH-FAME, 30 m, 0.32 mm ID, 0.25 µm (P/N: 227-36270-01)
**Inj. Vol.** : 1 µL split (split ratio: 100:1)
**Conc** : 10,000 µg/mL in isooctane (total FAMEOs)
**Inj. Temp** : 250 °C
**Carrier Gas** : Hydrogen, constant flow rate 3 mL/min
**Oven Temp** : 195 - 240 °C at 5 °C/min (hold 1 min)
**Detector Temp** : 275 °C

## SH-Volatil Amin

- Unique selectivity for baseline resolution of all volatile amines.
- Excellent inertness assures accuracy and sensitivity for volatile amines, including free ammonia.
- Highly robust phase withstands repeated water injections, resulting in longer column lifetime.
- High temperature stability (290 °C) ensures elution of amines up to C16 and allows contaminants to be removed by "baking out" the column.
- Similar Phase(s): CP-Volamine

| ID | Temp. Range | 30 m | 60 m |
|---|---|---|---|
| 0.32 mm | 40 to 370 °C | 227-36326-01 | 227-36326-02 |

## SH-5 Amine / SH-35 Amine

- Dedicated columns for amines and other basic compounds, including alkylamines, diamines, triamines, ethanolamines, and nitrogen-containing heterocyclics.

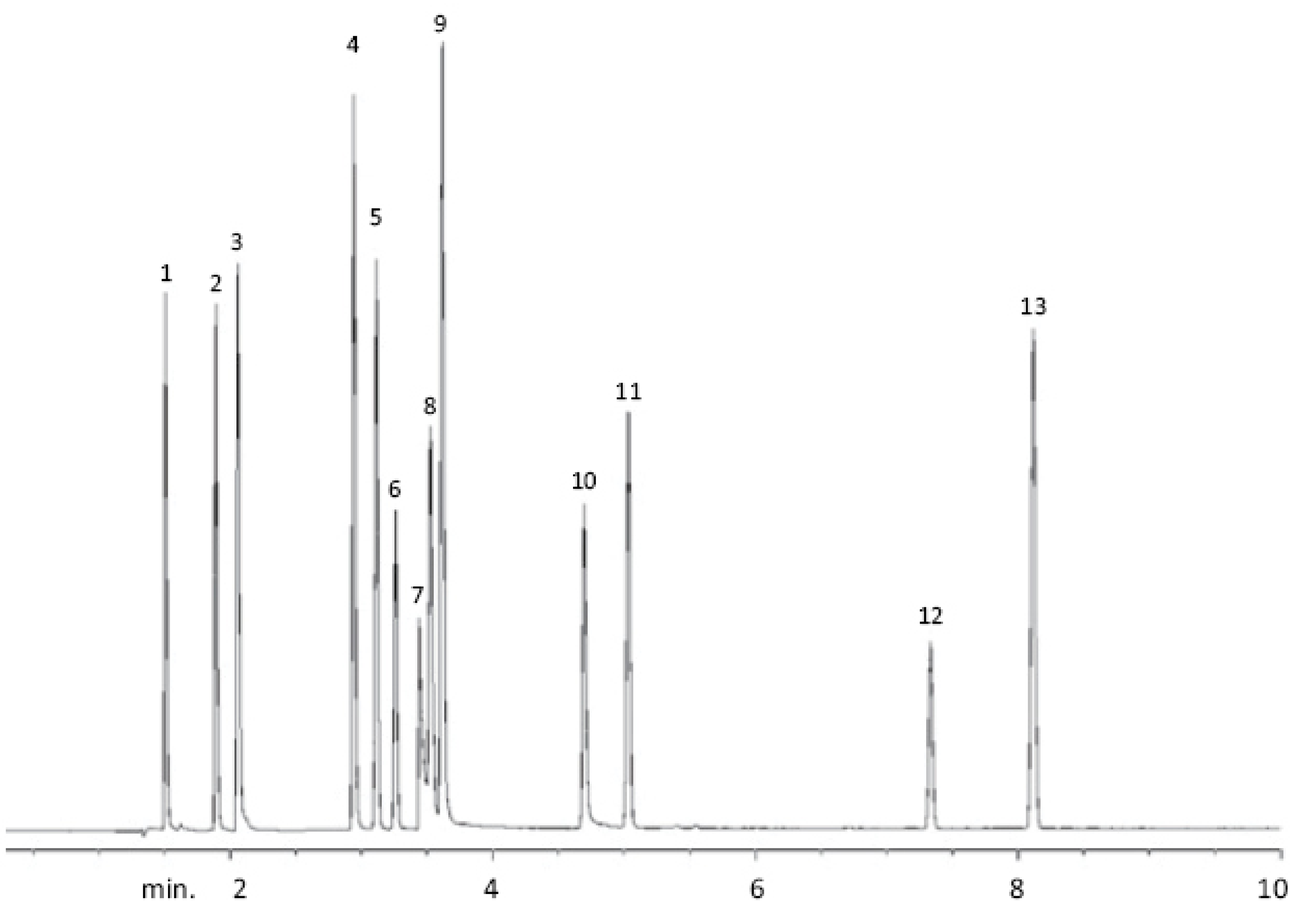
SH-5 Amine (Low-polarity phase: Crossbond™ 5% diphenyl / 95% dimethyl polysiloxane)

| ID | df | Temp. Range | 15 m | 30 m |
|---|---|---|---|---|
| 0.25 mm | 0.25 µm | -60 to 300/315 °C | - | 227-36282-01 |
| | 0.50 µm | -60 to 300/315 °C | 227-36323-01 | 227-36283-01 |
| | 1.00 µm | -60 to 300/315 °C | 227-36323-02 | 227-36284-01 |
| 0.32 mm | 1.00 µm | -60 to 300/315 °C | - | 227-36332-02 |
| | 1.50 µm | -60 to 290/305 °C | - | 227-36285-01 |
| 0.53 mm | 1.00 µm | -60 to 290/305 °C | - | 227-36286-01 |
| | 3.00 µm | -60 to 280/295 °C | - | 227-36287-01 |

SH-35 Amine (Mid-polarity phase: Crossbond™ 35% diphenyl / 65% dimethyl polysiloxane)

| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.25 mm | 0.50 µm | 0 to 220 °C | 227-36288-01 |
| | 1.00 µm | 0 to 220 °C | 227-36289-01 |
| 0.32 mm | 1.00 µm | 0 to 220 °C | 227-36290-01 |
| | 1.50 µm | 0 to 220 °C | 227-36291-01 |
| 0.53 mm | 1.00 µm | 0 to 220 °C | 227-36292-01 |
| | 3.00 µm | 0 to 220 °C | 227-36293-01 |

# Amines & Phenols




**Peaks**

1. diethylamine
2. pyridine
3. morpholine
4. phenol
5. aniline
6. 2-chlorophenol
7. diethylenetriamine
8. octylamine
9. 1-methyl-2-pyrrolidinone
10. 2-nitrophenol
11. 2,6-dimethylaniline
12. nicotine
13. 2-nitroaniline

**Conditions**

| | | |
|---|---|---|
| **Column** | : | SH-5 Amine, 30 m, 0.32 mm ID, 1.00 µm (P/N: 227-36290-01) |
| **Inj. Vol.** | : | 1 µL split injection of miscellaneous amines and phenols in water (split ratio: 25:1) |
| **On-column conc.** | : | 22 ng |
| **Inj. Temp** | : | 305 °C |
| **Oven Temp** | : | 120 °C to 220 °C at 10 °C/min |
| **Carrier Gas** | : | Hydrogen, linear velocity 38cm/sec. set at 120 °C |
| **Detector Temp** | : | 305 °C |
| **FID sensitivity** | : | $6.4 \times 10^{-11}$ AFS |

# Capillary Columns

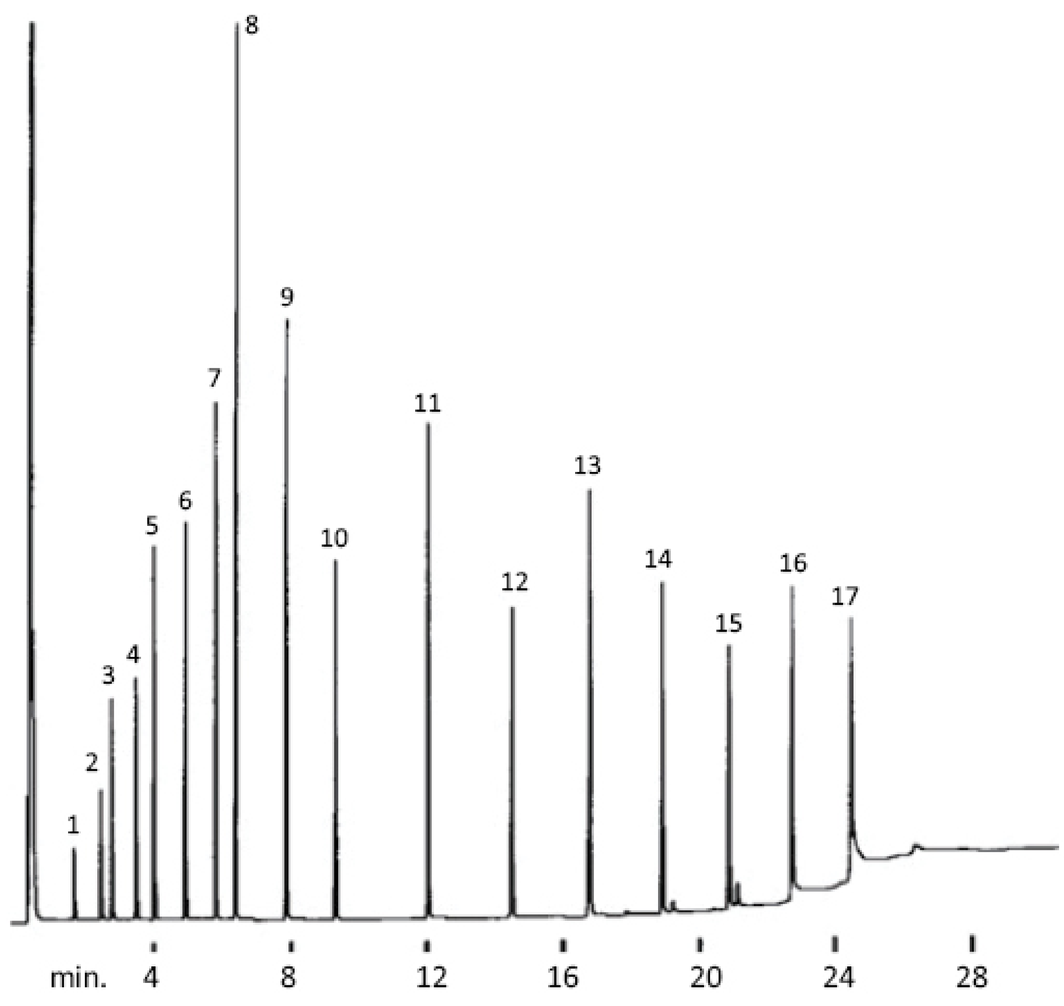
Dedicated Columns

## SH-PolarD

- Polar phase: Crossbond™ acid-deactivated Carbowax™ polyethylene glycol
- Dedicated columns for free (underivatized) acids, some inorganic acids.
- Resistant to oxidative damage.
- Equivalent to USP G25 and G35 phases.
- Similar phases: HP-FFAP, DB-FFAP, VF-DA, CP-Wax 58 CB, CP-FFAP CB, Nukol

| ID | df | Temp. Range | 30 m | 60 m |
|---|---|---|---|---|
| 0.25 mm | 0.10 µm | 40 to 250/260 °C | 227-36271-01 | – |
| | 0.25 µm | 40 to 250/260 °C | 221-75981-30 | 227-36272-01 |
| | 0.50 µm | 40 to 250/260 °C | 227-36273-01 | 227-36273-02 |
| 0.32 mm | 0.10 µm | 40 to 250/260 °C | 227-36274-01 | – |
| | 0.25 µm | 40 to 250/260 °C | 227-36321-02 | 227-36275-01 |
| | 0.50 µm | 40 to 250/260 °C | 227-36322-02 | 227-36276-01 |
| | 1.00 µm | 40 to 240/250 °C | 227-36277-01 | 227-36277-02 |
| 0.53 mm | 0.25 µm | 40 to 250/260 °C | 227-36278-01 | 227-36278-02 |
| | 0.50 µm | 40 to 250/260 °C | 227-36279-01 | 227-36279-02 |
| | 1.00 µm | 40 to 240/250 °C | 227-36280-01 | 227-36280-02 |
| | 1.50 µm | 40 to 230/240 °C | 227-36281-01 | 227-36281-02 |

# Organic Acids (Free Fatty Acids)




**Peaks**

1. acetic acid
2. propionic acid
3. isobutyric acid
4. n-butyric acid
5. isovaleric acid
6. n-valeric acid
7. isocaproic acid
8. caproic acid
9. heptanoic acid
10. caprylic acid
11. capric acid
12. lauric acid
13. myristic acid
14. palmitic acid
15. stearic acid
16. arachidic acid
17. behenic acid

**Conditions**

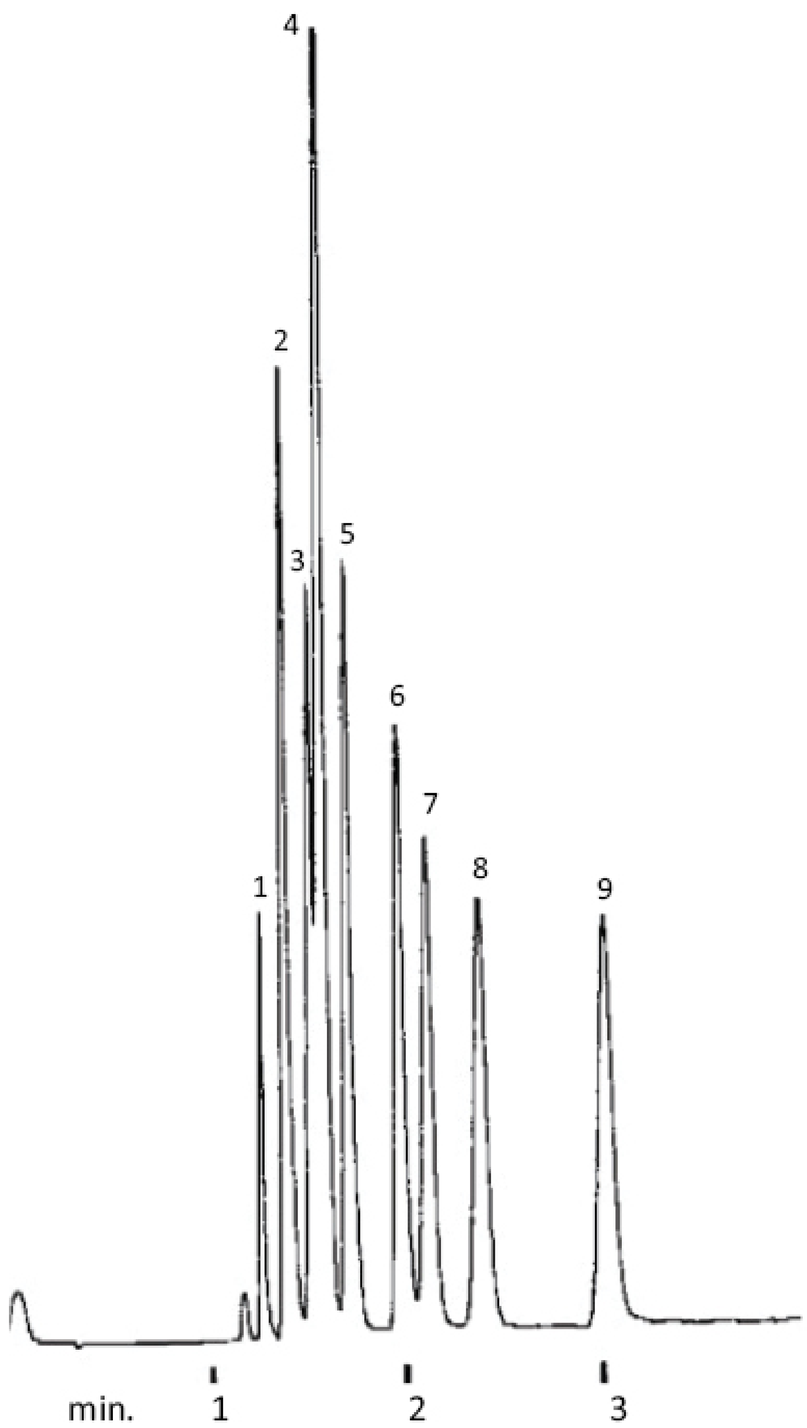
| | |
|---|---|
| **Column** | : SH-PolarD, 30 m, 0.53 mm ID, 0.25 µm (P/N: 227-36278-01) |
| **Sample** | : free acid standard Conc.: 25 ng/µL. |
| **Inj. Vol.** | : 0.3 µL direct |
| **Inj. Temp** | : 280 °C |
| **Oven Temp** | : 100 °C (hold 2 min) to 280 °C at 8 °C/min, (hold 10 min) |
| **Carrier Gas** | : Hydrogen, flow rate 10 cc/min, linear velocity 80 cm/sec. |
| **Detector** | : FID, 280 °C |

## SH-PolarX

- Polar phase: Crossbond™ base-deactivated Carbowax™ polyethylene glycol
- Dedicated columns for underivatized amines and other basic compounds, including alkylamines, diamines, triamines, nitrogen-containing heterocyclics. No need for column priming.
- Similar phases: CAM, CP-Wax 51 for Amines, Carbowax Amine

| ID | df | Temp. Range | 30 m | 60 m |
|---|---|---|---|---|
| 0.25 mm | 0.25 µm | 40 to 210/220 °C | 227-36294-01 | – |
| | 0.50 µm | 40 to 210/220 °C | 227-36295-01 | – |
| 0.32 mm | 0.25 µm | 40 to 210/220 °C | 227-36296-01 | 227-36296-02 |
| | 0.50 µm | 40 to 210/220 °C | 227-36297-01 | – |
| | 1.00 µm | 40 to 210/220 °C | 227-36298-01 | – |
| 0.53 mm | 0.50 µm | 40 to 210/220 °C | 227-36299-01 | – |
| | 1.00 µm | 40 to 210/220 °C | 227-36300-01 | 227-36300-02 |

# Amines (low MW)




**Peaks**

1. trimethylamine
2. dimethylamine
3. ethylamine
4. methylamine
5. isopropylamine
6. n-propylamine
7. tert-butylamine
8. diethylamine
9. sec-butylamine

**Conditions**

**Column** : SH-PolarX, 30 m, 0.53 mm ID, 1.00 µm (P/N: 227-36300-01)
**Inj. Vol.** : 1 µL direct injection of amines in water
**Inj. Temp** : 250 °C
**Carrier Gas** : Hydrogen, flow rate 5 cc/min, linear velocity 40 cm/sec.
**Oven Temp** : 45 °C
**Detector** : FID, 250 °C

## SH-Silica BOND

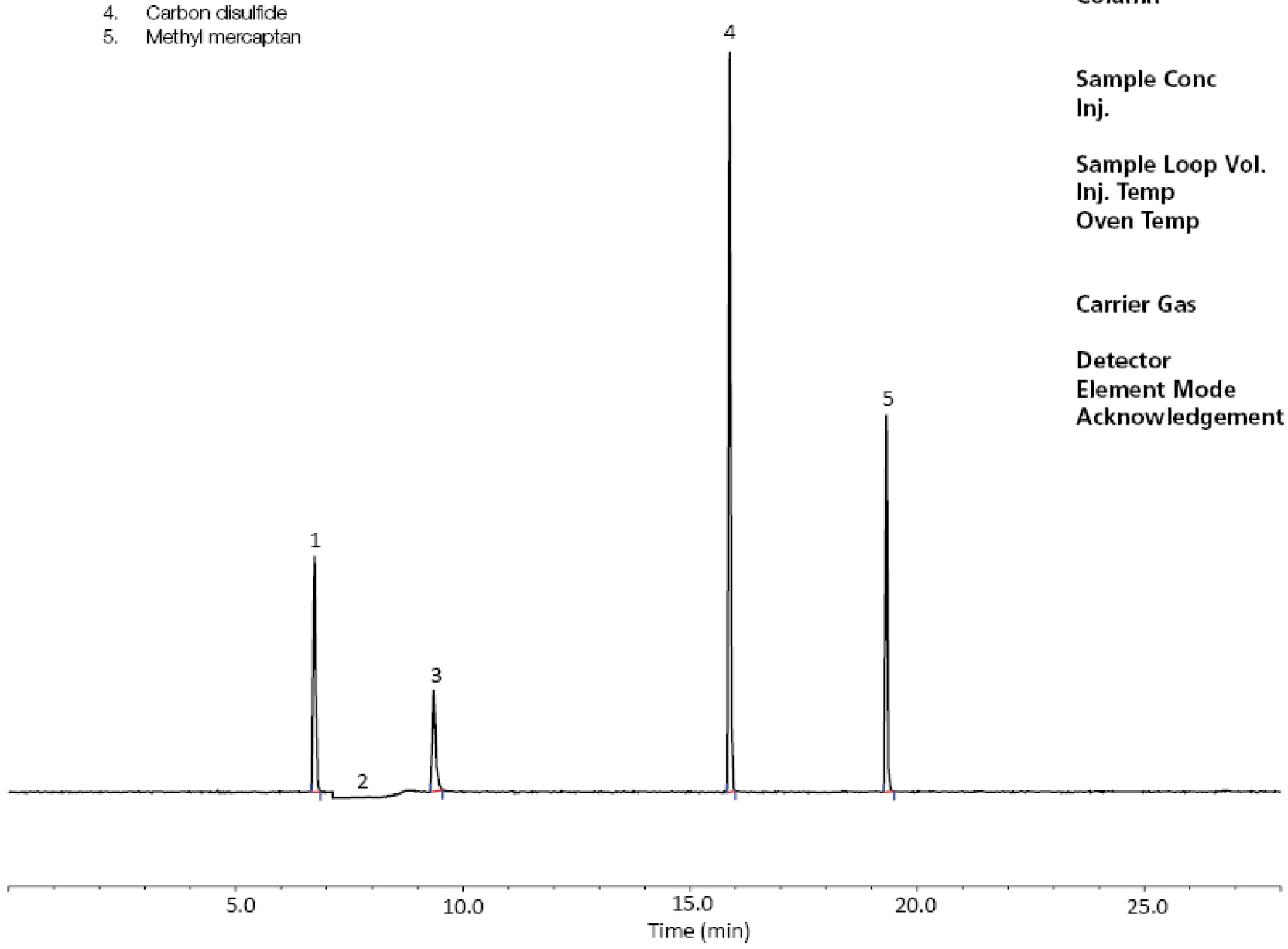
- Bonded silica stationary phase minimizes impact of water, resulting in reproducible retention times for water-containing samples.
- Versatile column ideal for analysis of light hydrocarbons, sulfur gases, halocarbons, and carbon dioxide.
- Individually QC tested with sensitive C4 probes to ensure consistent selectivity.
- Proprietary manufacturing process practically eliminates particle release, reducing downtime due to obstructed FID jets.
- Similar phases: GS-GASPRO, CP-SilicaPLOT

| ID | Temp. Range | 30 m |
|---|---|---|
| 0.32 mm | -80 to 260 °C | 227-36620-02 |

# Sulfur Compounds in Propane

**Peaks**

1. Carbonyl sulfide
2. Propane
3. Hydrogen sulfide
4. Carbon disulfide
5. Methyl mercaptan




**Conditions**

| | | |
|---|---|---|
| **Column** | : | SH-Silica BOND, 30 m, 0.32 mm ID (P/N: 227-36620-02) |
| **Sample Conc** | : | 6 ppm in 100% propane |
| **Inj.** | : | Sample valve, split (split flow: 40 mL/min) |
| **Sample Loop Vol.** | : | 250 µL |
| **Inj. Temp** | : | 250 °C |
| **Oven Temp** | : | 35 °C (hold 8 min) to 200 °C at 10 °C/min (hold 5 min) |
| **Carrier Gas** | : | He, constant flow rate 2 mL/min |
| **Detector** | : | PFPD, 250 °C |
| **Element Mode** | : | sulfur |
| **Acknowledgement** | : | Chromatogram courtesy of Brix and Joeri Vercammen (Global Analyser Solutions, Belgium) |

Trap columns for adhering dislodged particles from PLOT columns are also available.
Please refer to page C-45.

## SH-Alumina BOND

- The reactivity of the aluminum oxide stationary phase is minimized to improve column response for polar unsaturates, such as dienes, and the column's sensitivity (or response) ensures linear and quantitative chromatographic analysis for these compounds.
- Highly selective for C1–C5 hydrocarbons
- Separate all saturated and unsaturated hydrocarbon isomers above ambient temperatures.

### SH-Alumina BOND/$Na_2SO_4$

- $Na_2SO_4$ deactivation
- Acetylene and propadiene elute after butanes.
- Best separation for butene isomers (impurities in butene streams).
- Methyl acetylene elutes after 1,3-butadiene.
- Cyclopropane (impurity in propylene) elutes well before propylene.
- Similar phases: GS-ALUMINA, CP-Al2O3/Na2SO4, Alumina sulfate PLOT

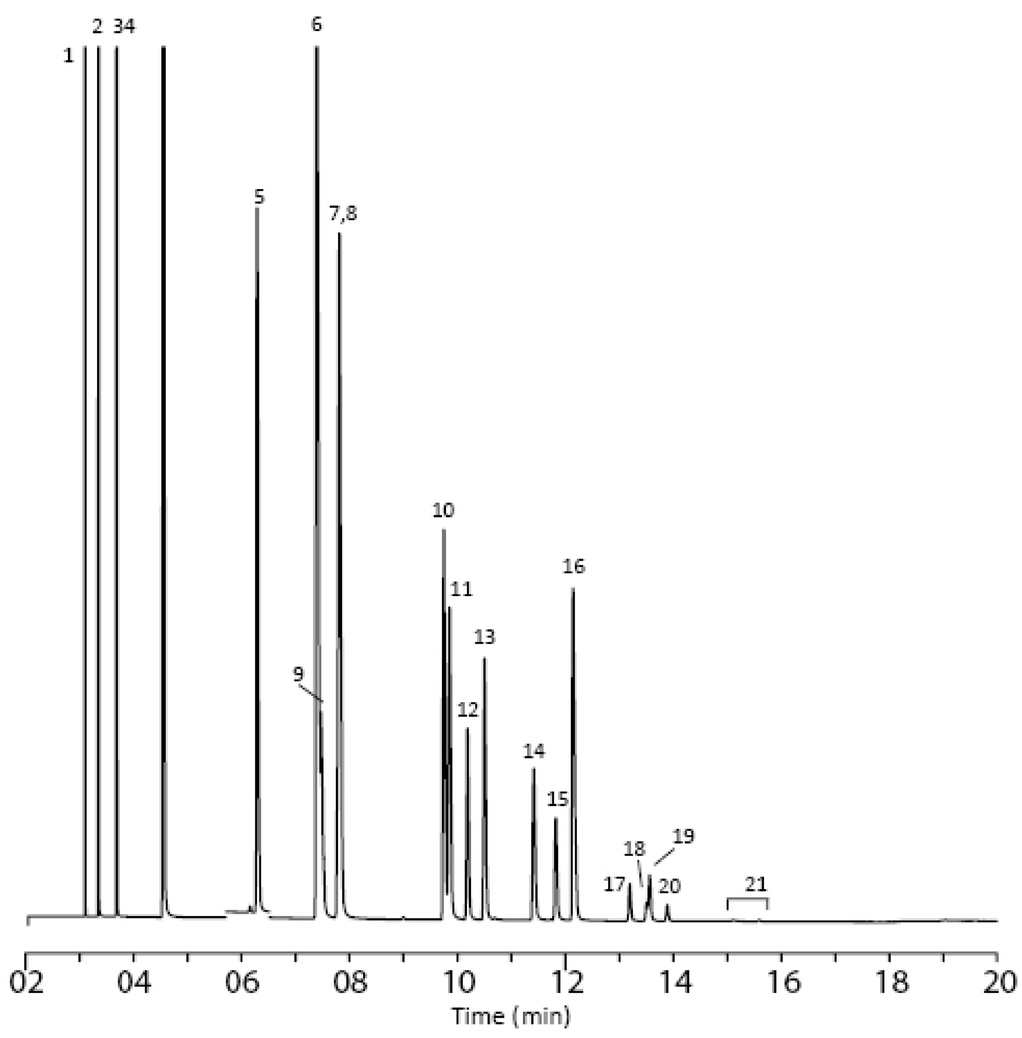
| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.32 mm | 5 µm | to 200 °C | 227-36328-01 |
| 0.53 mm | 10 µm | to 200 °C | 227-36316-01 |
| **ID** | **df** | **Temp. Range** | **50 m** |
| 0.53 mm | 10 µm | to 200 °C | 227-36301-01 |

### SH-Alumina BOND/KCL

- KCl deactivation
- Lowest polarity alumina column in Shimadzu PLOT columns.
- Low moisture sensitivity reduces the need for frequent regeneration.
- Acetylene elutes before n-butane.
- Methyl acetylene (impurity in 1,3-butadiene) elutes before 1,3-butadiene.
- Similar phases: GS-Alumina KCl, HP-PLOT Al2O3 KCl, CP-Al2O3/KCl, Alumina chloride PLOT

| ID | df | Temp. Range | 50 m |
|---|---|---|---|
| 0.53 mm | 10 µm | to 200 °C | 221-76139-50 |

## Refinery Gas




**Peaks**

1. methane
2. ethane
3. ethylene
4. propane
5. propylene
6. isobutane
7. n-butane
8. propadiene
9. acetylene
10. trans-2-butene
11. 1-butene
12. isobutylene
13. cis-2-butene
14. isopentane
15. n-pentane
16. 1,3-butadiene
17. trans-2-pentene
18. 2-methyl-2-butene
19. 1-pentene
20. cis-2-pentene
21. hexanes

**Conditions**

| | |
|---|---|
| **Column** | : SH-Alumina BOND/KCL, 50 m, 0.53 mm ID, 10 µm (P/N: 221-76139-50) |
| **Sample** | : Refinery gas |
| **Inj. Vol** | : 10 µL split (split vent flow 80mL/min) |
| **Inj. Temp** | : 200 °C |
| **Oven Temp** | : 45 °C (hold 1 min) to 200 °C at 10 °C/min (hold 3.5 min) |
| **Carrier Gas** | : Hydrogen, constant pressure, 8.0 psi, linear velocity 74 cm/sec. at 45 °C |
| **Detector** | : FID, 200 °C |

# Capillary Columns

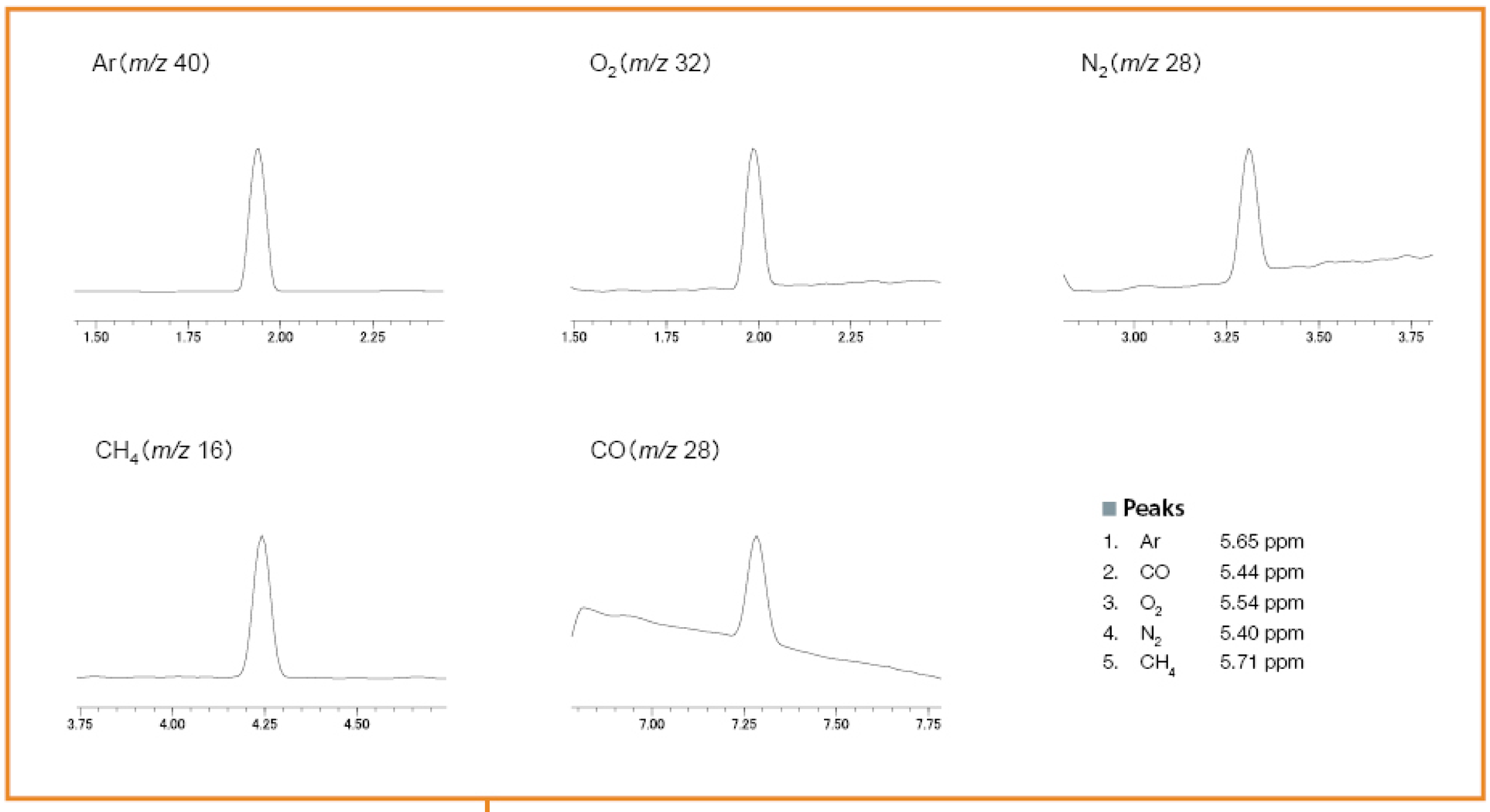
PLOT Columns

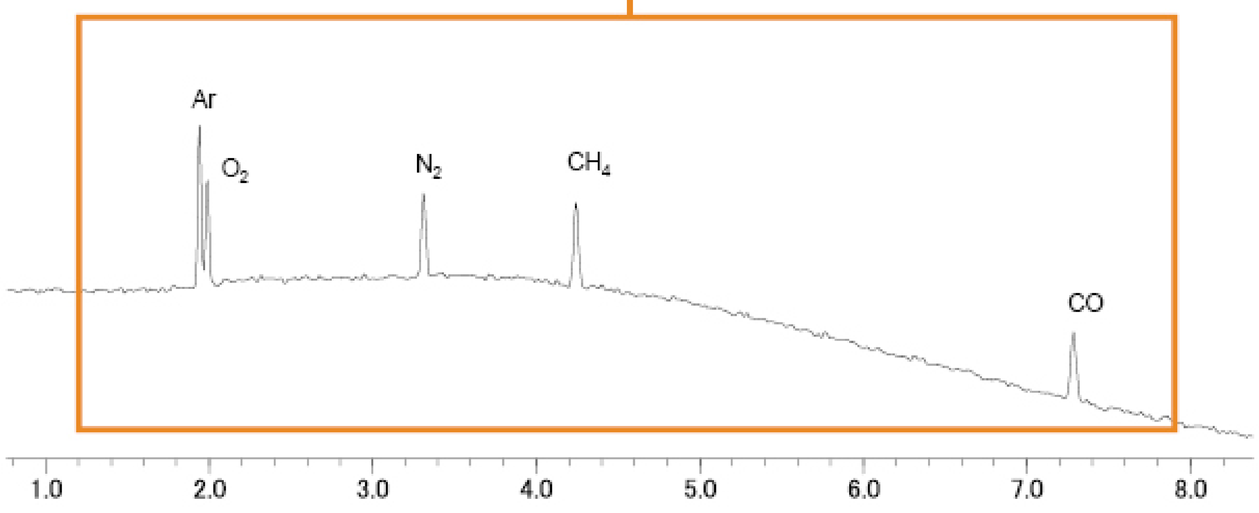
## SH-Msieve 5A

- Stationary phase: Molecular sieve 5A
- Easily separate permanent gases at temperatures above ambient.
- Improve accuracy with sharp, symmetrical peaks for argon, oxygen, and carbon monoxide.
- Similar phases: HP-PLOT Molesieve, CP-Molsieve 5A, Molsieve 5A PLOT

| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.32 mm | 30 µm | to 300 °C | 227-36611-02 |
| 0.53 mm | 50 µm | to 300 °C | 221-75763-30 |

# Analysis of Inorganic Gas




**Conditions**

| | | |
|---|---|---|
| **Instrument** | : | GCMS-QP2010 Ultra |
| **Column** | : | SH-Msieve 5A, 30 m, 0.32 mm ID, 30 µm (P/N: 227-36611-02) |
| **Sample injection** | : | Gas sampler (1 mL loop volume) (P/N: 223-57653-91) |
| **Inj. Mode** | : | Split (split ratio: 50:1) |
| **Inj. Temp** | : | 200 °C |
| **Control Mode** | : | Pressure (100 kPa) |
| **Carrier Gas** | : | Helium |
| **Oven Temp** | : | 35 °C (hold 2 min) to 150°C at 10°C/min (hold 5 min) |
| **Detector** | : | MS<br>Interface Temp: 200 °C<br>Ion Source Temp: 200 °C<br>Measurement Mode: Scan (m/z 10 to100)<br>Event Time: 0.5 sec<br>Ionization Method: EI<br>Emission Current:150 µA |

## SH-Q-BOND PLOT

- Non-polar PLOT column incorporating 100% divinylbenzene
- Excellent for analysis of C1 to C3 hydrocarbons as well as isomers and alkanes up to C12
- High retention for CO2 simplifies gas analysis; CO2 and methane separated from O2/N2/CO. (Note: O2/N2/CO not separated at ambient temperature.)
- Use for analysis of oxygenated compounds and solvents.
- Similar phases: HP-PLOT Q, CP-PoraPLOT Q, CP-PoraBOND Q, Supel-Q PLOT

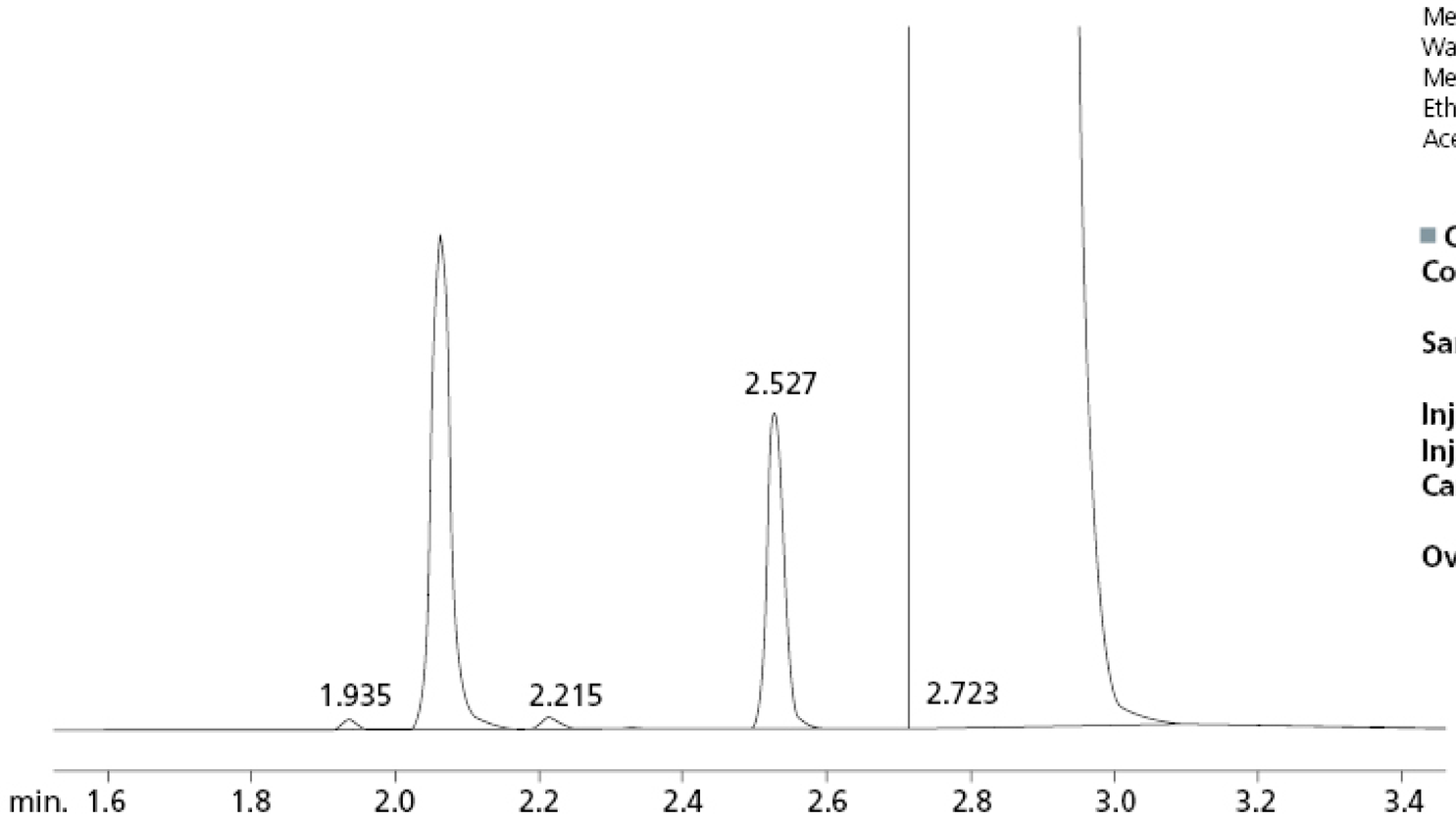
| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.32 mm | 10 µm | to 280/300 °C | 221-75764-30 |
| 0.53 mm | 20 µm | to 280/300 °C | 221-75765-30 |

## SH-U-BOND PLOT

- Polar PLOT column, incorporating divinylbenzene ethylene glycol / dimethylacrylate.
- Highest polarity porous polymer column in Shimadzu PLOT columns.
- Highly inert for the analysis of polar and nonpolar compounds.
- Ideal for trace H2S, COS, and mercaptans in hydrocarbon streams.
- Similar phases: HP-PLOT U, CP-PoraPLOT U, CP-PoraBOND U

| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.32 mm | 10 µm | to 190 °C | 227-36327-01 |
| 0.53 mm | 20 µm | to 190 °C | 227-36302-01 |

## Water and Ethanol in Acetone




| Peaks | Ret. Time |
|---|---|
| Methane | 1.935 |
| Water | 2.063 |
| Methanol | 2.215 |
| Ethanol | 2.527 |
| Acetone | 2.723 |

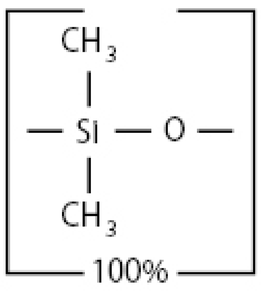
**Conditions**

**Column** : SH-Q-BOND PLOT, 30 m, 0.53 mm ID, 20 µm (P/N: 221-75765-30)
**Sample** : 0.5% water and ethanol in acetone
**Inj. Vol** : 3 µL split (split ratio 11:1)
**Inj. Temp** : 250 °C
**Carrier Gas** : He, constant flow, linear velocity 28.7 cm/sec. @ 200 °C
**Oven Temp** : 200 °C, isothermal

## SH-MetalX-1

- Non-polar phase: Crossbond™ 100% dimethyl polysiloxane
- General-purpose columns for solvent impurities, PCB congeners (e.g., Aroclor mixes), gases, natural gas odorants, sulfur compounds, essential oils, hydrocarbons, semivolatiles, pesticides, and oxygenates.
- Equivalent to USP G1, G2, G38 phases.
- 4.5" standard coil diameter.
- Similar phases: DB-PS1, UAC-1

SH-MetalX-1 Structure

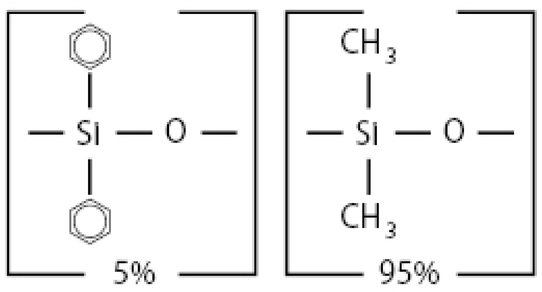



| ID | df | Temp. Range | 15 m |
|---|---|---|---|
| 0.10 mm | 0.25 µm | -60 to 430 °C | 227-36318-01 |
| 0.28 mm | 0.10 µm | -60 to 430 °C | 221-75734-15 |

## SH-MetalX-5

- Low-polarity phase: Crossbond™ 5% diphenyl / 95% dimethyl polysiloxane
- General-purpose columns for drugs, solvent impurities, pesticides, hydrocarbons, PCB congeners (e.g., Aroclor mixes), essential oils, and semivolatiles.
- Equivalent to USP G27 and G36 phase
- 4.5" standard coil diameter.
- Similar phases: DB-PS5, VF-5ht UltiMeta

SH-MetalX-5 Structure




| ID | df | Temp. Range | 30 m |
|---|---|---|---|
| 0.25 mm | 0.25 µm | -60 to 430 °C | 221-75743-30 |

## SH-MetalX-1701 (Siltek-treated stainless steel)

- Midpolarity Crossbond phase
- General-purpose columns for alcohols, oxygenates, PCB congeners (e.g., Aroclor mixes), and pesticides.
- Equivalent to USP G46 phase.
- 4.5" standard coil diameter.
- Similar Phase(s): DB-PS1701

| ID | df | Temp. Range | 15 m |
|---|---|---|---|
| 0.53 mm | 1.00 µm | -20 to 260 °C | 227-36334-01 |

## SH-MetalX-WAX (Siltek-treated stainless steel)

- Polar phase; Crossbond Carbowax polyethylene glycol—provides oxidation resistance
- General-purpose columns for FAMEs, flavor compounds, essential oils, amines, solvents, xylene isomers, and U.S. EPA Method 603 (acrolein/acrylonitrile).
- Equivalent to USP G14, G15, G16, G20, and G39 phases.
- 4.5" standard coil diameter.
- Similar Phase(s): DB-PSWAX, UAC-CW

| ID | df | Temp. Range | 15 m |
|---|---|---|---|
| 0.53 mm | 1.00 µm | 40 to 240/250 °C | 227-36335-01 |

## SH-MetalX Biodiesel TG Column (Siltek-treated stainless steel)

- Fast analysis times and sharp mono-, di-, and triglyceride peaks
- Stable at 430 °C for reliable, consistent performance

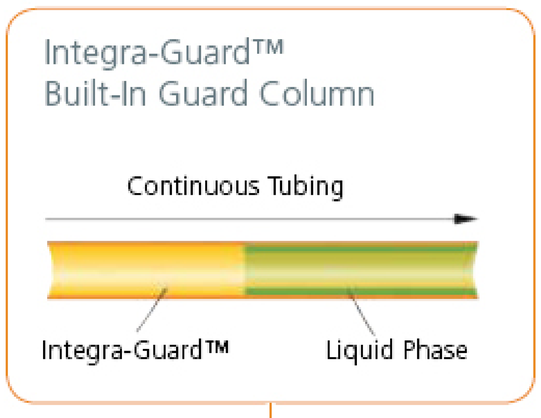
| ID | df | Temp. Range | 14 m |
|---|---|---|---|
| 0.53 mm | 0.16 µm | -60 to 430 °C | 227-36315-01 |

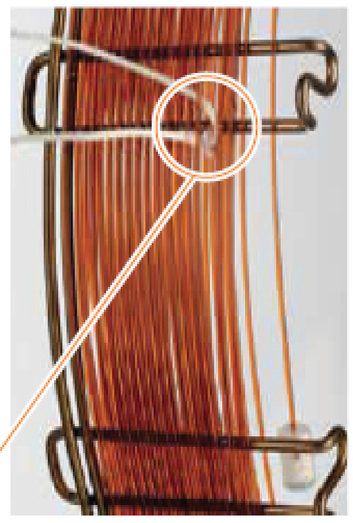
# Capillary Columns

Guard Columns

## Integra-Guard Columns

- No leaks for a more robust method.
- No column connections for easier, faster maintenance.
- No peak distortions due to connector dead volume and thermal capacity.



String indicates where the analytical column begins

| Column | ID | df | Length | With 5 m Integra-Guard™ | With 10 m Integra-Guard™ |
|---|---|---|---|---|---|
| SH-I-5Sil MS | 0.25 mm | 0.25 µm | 30 m | 221-76161-30 | 221-76162-30 |
| SH-1 | 0.25 mm | 0.25 µm | 30 m | 221-75719-31 | – |
| | 0.53 mm | 1.00 µm | 30 m | 221-75731-31 | – |
| | 0.53 mm | 1.50 µm | 30 m | 227-36333-01 | – |
| | 0.53 mm | 5.00 µm | 30 m | 221-75734-31 | – |
| SH-5 | 0.25 mm | 0.25 µm | 30 m | 221-76153-05 | 221-76153-30 |
| | 0.25 mm | 1.00 µm | 30 m | 221-76179-30 | – |
| | 0.32 mm | 0.25 µm | 30 m | 221-76177-30 | – |
| | 0.32 mm | 0.25 µm | 60 m | 221-76177-60 | – |
| | 0.32 mm | 1.00 µm | 30 m | 221-76180-30 | – |
| | 0.53 mm | 5.00 µm | 30 m | 221-76154-35 | – |
| SH-5MS | 0.25 mm | 0.10 µm | 30 m | 221-76189-30 | – |
| | 0.25 mm | 0.25 µm | 15 m | 221-75861-15 | – |
| | 0.25 mm | 0.25 µm | 30 m | 221-75861-05 | 221-75861-10 |
| | 0.32 mm | 0.25 µm | 30 m | 221-76190-30 | – |
| SH-1301 | 0.53 mm | 3.00 µm | 30 m | 221-76164-35 | – |
| SH-624 | 0.25 mm | 1.40 µm | 30 m | 221-76183-30 | – |
| | 0.32 mm | 1.80 µm | 30 m | 221-76157-35 | – |
| | 0.53 mm | 3.00 µm | 30 m | 221-76158-30 | – |
| SH-1701 | 0.25 mm | 0.25 µm | 30 m | 221-76185-30 | – |

## SH-I Guard / Retention Gap Columns

- Extend column lifetime.
- Excellent inertness—obtain lower detection limits for active compounds.
- Sharper chromatographic peaks by utilizing retention gap technology.
- Maximum temperature: 360 °C.

| ID | 5 m | 10 m |
|---|---|---|
| 0.25 mm | 227-36303-01 | 227-36304-01 |
| 0.32 mm | 227-36305-01 | 227-36306-01 |
| 0.53 mm | 227-36307-01 | 227-36308-01 |

## SH IP Guard Column

- Tested with a comprehensive test mix to ensure high inertness.
- Useful for a wide range of applications.
- Use with most common solvents.
- Maximum temperature: 325 °C.

| ID | OD | 5 m | 10 m |
|---|---|---|---|
| 0.25 mm | 0.37 mm | 227-36320-01 | 227-36321-03 |
| 0.32 mm | 0.45 mm | 227-36320-02 | 227-36321-04 |
| 0.53 mm | 0.69 mm | 227-36320-03 | 227-36321-01 |

## SH-MetalX-Siltek Guard Column

- Useful for a wide range of applications.
- Compatible with most common solvents.
- Specially tested with a Florida TRPH test mix.
- Guard column for most non-polar to intermediate polarity MetalX GC capillary columns.
- Maximum temperature: 325 °C.

| ID | 10 m |
|---|---|
| 0.53 mm | 227-36319-01 |

## SH-Particle Trap (for PLOT columns)

- Includes two Press-Tight® connectors and a 2.5 m column.
- Protects detector and valves; connects between column and detector or valve.
- Eliminates detector spikes and scratches in valve rotors.

| Description | P/N |
|---|---|
| SH-Particle Trap for 0.32 mmID PLOT Columns | 227-36800-01 |
| SH-Particle Trap for 0.53 mmID PLOT Columns | 227-36800-02 |

## Capillary Columns

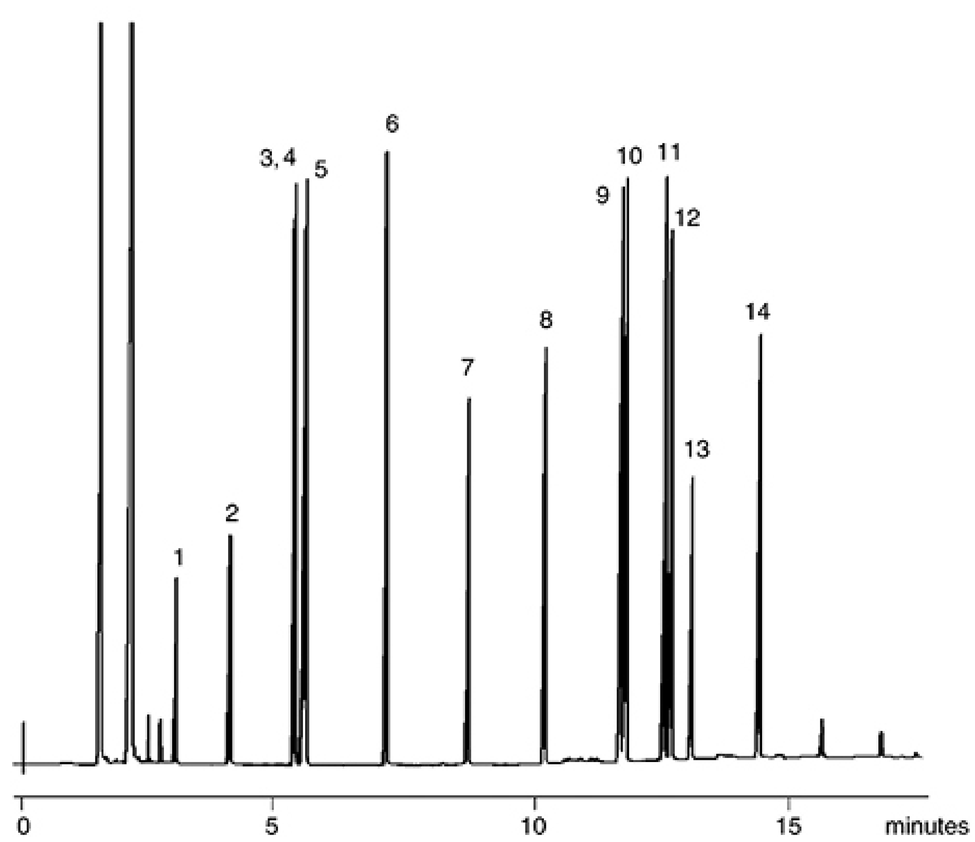
General purpose

- **CBP-1: 100% Dimethyl Polysiloxane;**
  **Classic Crosslinked Dimethyl Polysiloxane Technology**

- Excellent general purpose non-polar GC column
- Suitable for all routine analyses
- 320 – 340 °C upper temperature limit – dependent on film thickness

| ID (mm) | Film Thickness (µm) | Length (m) | Temperature Limits (°C) | P/N |
|---|---|---|---|---|
| 0.22 | 0.25 | 25 | -60 to 320/340 | 221-28635-25 |
| 0.22 | 0.25 | 50 | -60 to 320/340 | 221-28635-50 |
| 0.10 | 0.1 | 12 | -60 to 320/340 | 221-28651-12 |
| 0.32 | 0.5 | 25 | -60 to 320/340 | 221-28639-25 |
| 0.32 | 0.5 | 50 | -60 to 320/340 | 221-28639-50 |
| 0.53 | 1.0 | 12 | -60 to 320/340 | 221-28647-12 |
| 0.53 | 1.0 | 25 | -60 to 320/340 | 221-28647-25 |
| 0.53 | 5.0 | 12 | -60 to 320/340 | 221-28648-12 |
| 0.53 | 5.0 | 25 | -60 to 320/340 | 221-28648-25 |
| 0.53 | 5.0 | 50 | -60 to 320/340 | 221-28648-50 |

## Analysis of Dimethyl Esters of Dicarboxylic Acids on CBP-1




**Column** : CBP1-M25-025 (M = 0.22 mm ID)
**Shimadzu P/N** : 221-28635-25

**Components**

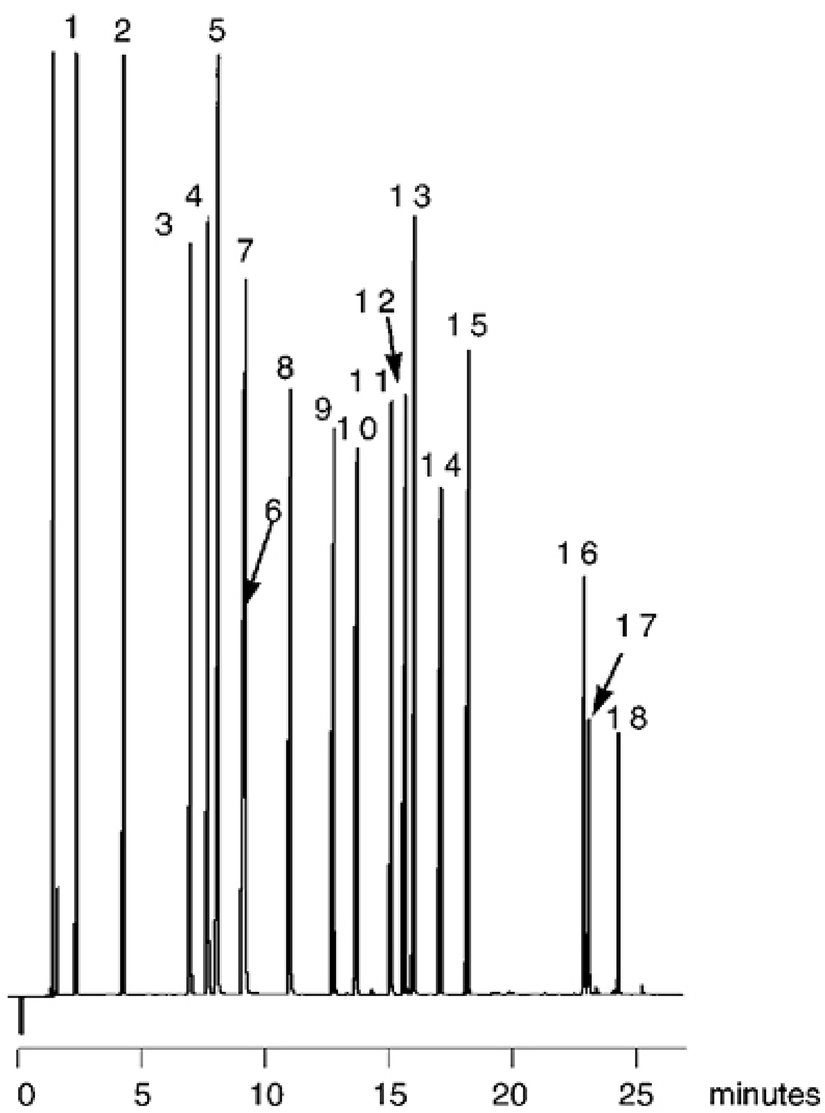
1. Dimethyl Oxalate
2. Dimethyl Malonate
3. Dimethyl Fumarate
4. Dimethyl Succinate
5. Dimethyl Maleate
6. Dimethyl Glutarate
7. Dimethyl Adipate
8. Dimethyl Pimelate
9. Dimethyl Suberate
10. Dimethyl Phthalate
11. Dimethyl Terephthalate
12. Dimethyl iso-Phthalate
13. Dimethyl Azelate
14. Dimethyl Sebacate

## CBP-5: 5% phenyl / 95% Dimethyl Polysiloxane

- Ideal general purpose non-polar column
- Excellent inertness
- Good thermal stability

| ID (mm) | Film Thickness (µm) | Length (m) | Temperature Limits (°C) | P/N |
|---|---|---|---|---|
| 0.22 | 0.25 | 25 | -60 to 320/340 | 221-28636-25 |
| 0.22 | 0.25 | 50 | -60 to 320/340 | 221-28636-50 |
| 0.32 | 0.5 | 25 | -60 to 320/340 | 221-28641-25 |
| 0.32 | 0.5 | 50 | -60 to 280/340 | 221-28641-50 |

# Analysis of Substituted Aromatics on CBP-5




**Column** : CBP5-M25-025
**Shimadzu P/N** : 221-28636-25

**Components**

1. Benzene
2. Toluene
3. Chlorobenzene
4. Ethylbenzene
5. m, p-Xylene
6. o-Xylene
7. Styrene
8. iso Propylbenzene
9. n-Propylbenzene
10. 1,3,5-Trimethylbenzene
11. 1,2,4-Trimethylbenzene
12. m-Dichlorobenzene
13. ec-Butylbenzene, p-Dichlorobenzene
14. o-Dichlorobenzene
15. Butyl-benzene
16. 1,2,4 - Trichlorobenzene
17. Napthalene
18. Hexachlorobutadine

# Capillary Columns

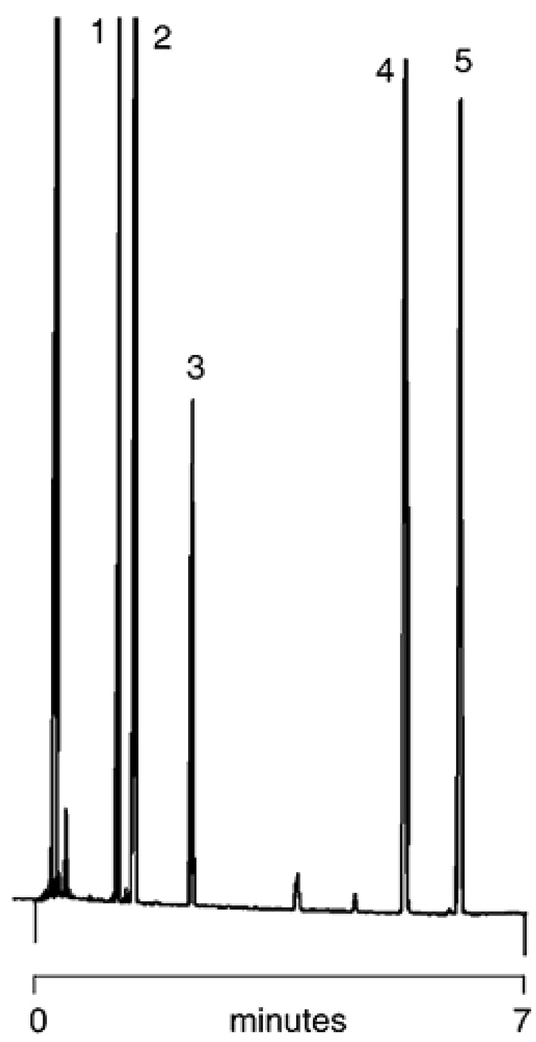
General purpose

## CBP-10: 14% Cyanopropylphenyl Polysiloxane

- Used for organochlorine pesticides analysis
- Bonded and crossed-linked
- Able to be solvent rinsed

| ID (mm) | Film Thickness (µm) | Length (m) | Temperature Limits (°C) | P/N |
|---|---|---|---|---|
| 0.1 | 0.1 | 12 | -20 to 280/300 | 221-28652-12 |
| 0.22 | 0.25 | 25 | -20 to 280/300 | 221-28637-25 |
| 0.22 | 0.25 | 50 | -20 to 280/300 | 221-28637-50 |
| 0.32 | 0.50 | 25 | -20 to 280/300 | 221-28643-25 |
| 0.32 | 0.50 | 50 | -20 to 280/300 | 221-28643-50 |
| 0.53 | 1.0 | 12 | -20 to 260/280 | 221-28649-12 |
| 0.53 | 1.0 | 25 | -20 to 260/280 | 221-28649-25 |

## Analysis of Haloethers on CBP-10




**Column** : CBP10-W12-100
**Shimadzu P/N** : 221-28649-12

**Components**

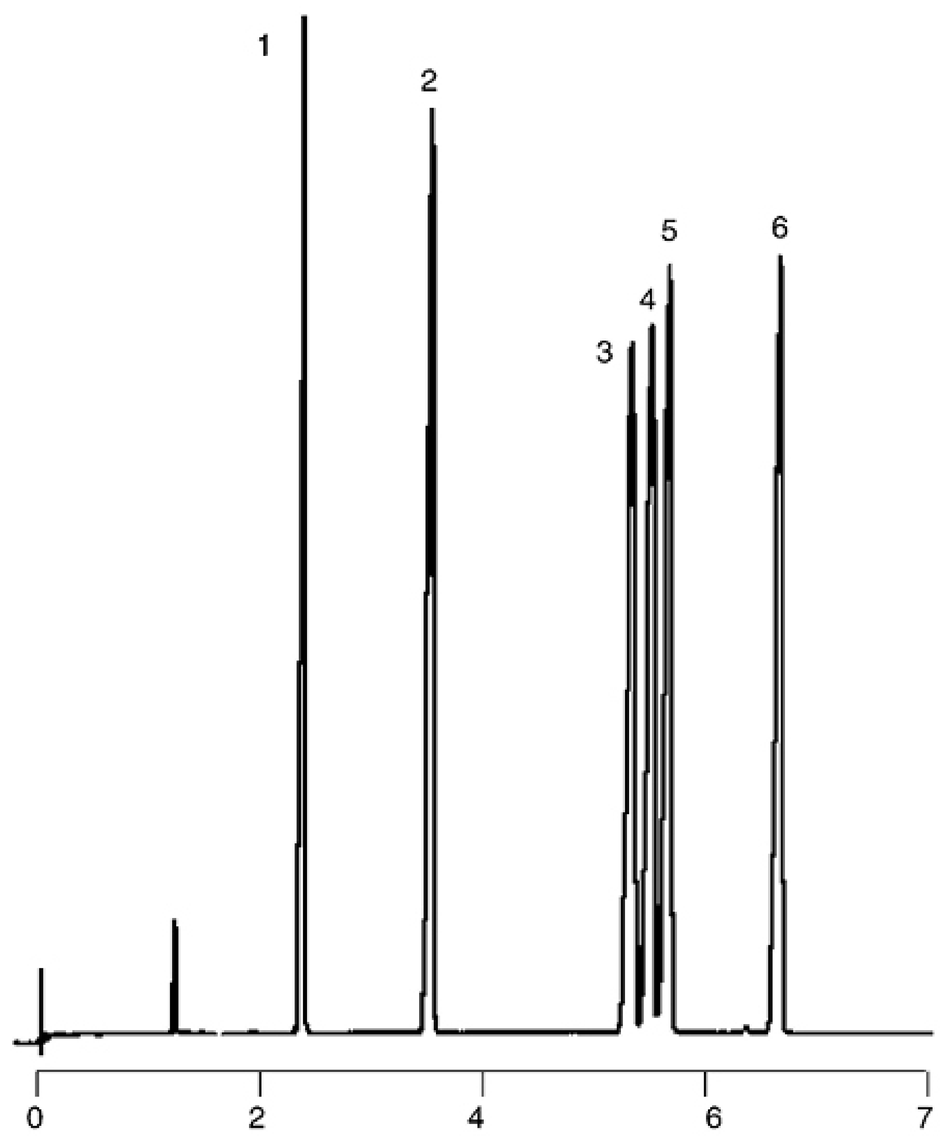
1. Bis (2-chloroethyl) ether
2. Bis (2-chloroisopropyl) ether
3. Bis (2-chloroethoxy) methane
4. 4-Chlorophenyl ether
5. 4-Bromophenyl ether

## CBP-20: Bonded Polyethylene Glycol (Wax)

- Industry standard wax column
- Low bleed
- Polar phase suitable for hydrogen bonding analytes

| ID (mm) | Film Thickness (µm) | Length (m) | Temperature Limits (°C) | P/N |
|---|---|---|---|---|
| 0.22 | 0.25 | 25 | 20 to 260/280 | 221-28638-25 |
| 0.22 | 0.25 | 50 | 20 to 260/280 | 221-28638-50 |
| 0.32 | 0.5 | 25 | 20 to 260/280 | 221-28645-25 |
| 0.32 | 0.5 | 50 | 20 to 260/280 | 221-28645-50 |
| 0.53 | 1.0 | 12 | 20 to 260/280 | 221-28650-12 |
| 0.53 | 1.0 | 25 | 20 to 260/280 | 221-28650-25 |

## Analysis of Aromatic Pollutants in Water on CBP-20




**Column** : CBP20-W25-100
**Shimadzu P/N** : 221-28650-25

**Components**

1. Benzene
2. Toluene
3. Ethylbenzene
4. p-Xylene
5. m-Xylene
6. o-Xylene

# Capillary Columns

General purpose

## CBP1-PONA

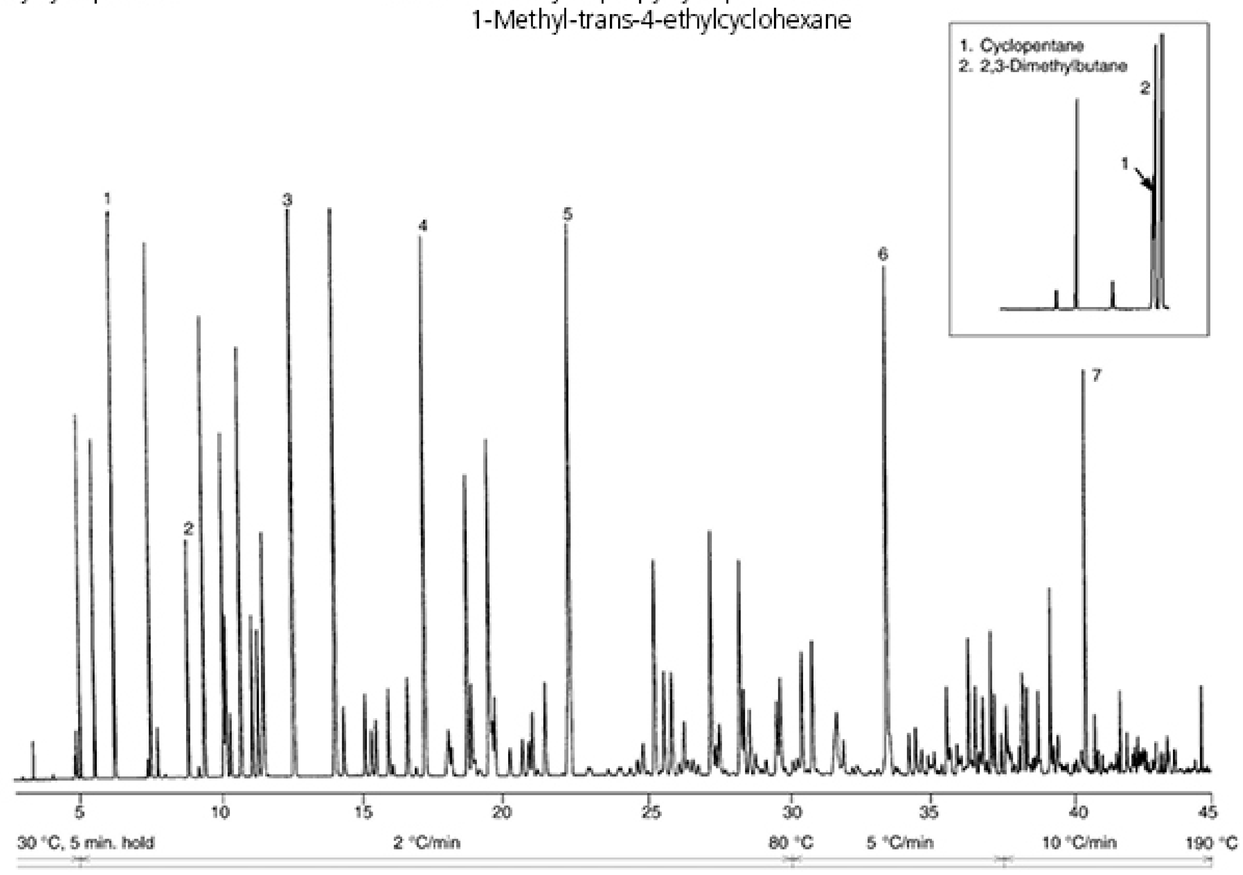
- Designed for the analysis of petroleum products
- Non-polar phase for PONA analysis
- Detailed hydrocarbon analysis according to ASTM (DHA-method)

| ID (mm) | Film Thickness (µm) | Length (m) | Temperature Limits (°C) | P/N |
|---|---|---|---|---|
| 0.15 | 0.50 | 50 | -60 to 320/340 | 221-44082-50 |

# Analysis of Gasline Range Hydrocarbons on CBP1-PONA

**Components**

| | TIME | COMPOUND |
|---|---|---|
| | 4.85 | Toluene |
| | 5.00 | Ethylbenzene |
| | 5.25 | p-Xylene |
| | 5.74 | m-Xylene |
| 1 | 6.45 | o-Xylene |
| | 7.46 | 2,2-Dimethylpentane |
| | 7.60 | Methylcyclopentane |
| | 7.91 | 2,4-Dimethylpentane |
| | 8.18 | 2,2,3-Trimethylbutane |
| 2 | 8.99 | Benzene |
| | 9.35 | 3,3-Dimethylpentane |
| | 9.55 | Cyclohexane |
| | 10.23 | 2-Methylhexane |
| | 10.32 | 2,3-Dimethylpentane |
| | 10.47 | 1,1-Dimethylcyclohexane |
| | 10.83 | 3-Methylhexane |
| | 11.23 | 1-trans-3-Dimethylcyclopentane |
| | 11.43 | 1-cis-3-Dimethylcyclopentane |
| | 11.55 | 3-Ethylpentane |
| | 11.63 | 1-trans-2-Dimethylcyclopentane |
| | 11.78 | 2,2,4-Trimethylpentane |
| 3 | 12.73 | n-Heptane |
| | 14.23 | Methylcyclohexane |
| | 14.53 | 2,2-Dimethylhexane |
| | 15.27 | Ethylcyclopentane |
| | 15.49 | 2,5-Dimethylhexane |
| | 15.65 | 2,4-Dimethylhexane |
| | 16.09 | 1-trans-2-cis-4-Trimethylcyclopentane |
| | 16.24 | 2,3,4-Trimethylpentane |
| | 16.78 | 1-trans-2-cis-3-Trimethylcyclopentane |
| | 17.05 | 2,3,3-Trimethylpentane |
| 4 | 17.39 | Toluene |
| | 18.27 | 2,3-Dimethylhexane |
| | 18.43 | 2-Methyl-3-ethylpentane |
| | 18.84 | 2-Methylheptane |
| | 19.69 | 1-Methyl-2-ethylcyclopentane |
| | 18.98 | 4-Methylheptane |
| | 19.23 | 1-cis-2-cis-4-trans-Trimethylcyclopentane |
| | 19.50 | 3-Methylheptane |
| | 19.77 | 1-trans-4-Dimethylcyclohexane |
| | 20.73 | 1-Methyl-cis-2-ethylcyclopentane |
| | 20.86 | 1-Methyl-trans-3-ethylcyclopentane |
| | 21.08 | 1-Methyl-cis-3-ethylcyclohexane |
| | 21.27 | 1-Ethy-1-methycyclopentane |
| | 21.53 | 1-trans-2-Dimethylcyclohexane |
| 5 | 22.43 | n-Octane |
| | 23.05 | iso-Propylcyclopentane |
| | 24.14 | 2.2.5-Trimethylhexane |
| | 24.19 | 2,2,4-Trimethylhexane |
| | 24,53 | 2,4,4-Trimethylhexane |
| | 24.79 | 2,3,5-Trimethylhexane |
| | 25.16 | 2,4-Dimethylheptane |
| | 25.41 | n-Propylcyclopentane |
| | 25.73 | 1-cis-2-Dimethylcyclohexane |
| | 26.00 | 1,1,3-Trimethylcyclohexane |
| | 26.25 | 2,5-Dimethylheptane |
| | 26.44 | 3,3-Dimethylheptane |
| | 26.58 | 3,5-Dimethylheptane |
| | 26.77 | 4,4-Dimethylheptane |
| | 26.94 | 2,3,3-Trimethylhexane |
| | 27.43 | Ethylbenzene |
| | 27.57 | 1-cis-3-cis-5-Trimethylpentane |
| | 27.69 | 1,1,4-Trimethylcyclohexane |
| | 27.88 | 2,3,4-Trimethylhexane |
| | 28.15 | 3,3,4-Trimethylhexane |
| | 28.42 | m-Xylene |
| | 28.54 | p-Xylene |
| | 28.74 | 2,3-Dimethylheptane |
| | 28.84 | 1-cis-2-trans-4-trans-Trimethylcyclohexane |
| | 28.95 | 1-cis-2-trans-4-cis-Trimethylcyclohexane |
| | 29.16 | 3,4-Dimethylheptane |
| | 29.31 | 3-Methylethylhexane |
| | 29.68 | 4-Methyloctane |
| | 29.81 | 2-Methyloctane |
| | 30.56 | 3-Methyloctane |
| | 30.93 | o-Xylene |
| | 31.75 | 1-Methyl-2-propylcyclopentane and 1-Methyl-trans-4-ethylcyclohexane |
| | 31.98 | 1-Methyl-cis-4-ethylcyclohexane |
| | 32.46 | 3,3-Diethylpentane |
| | 32.89 | 2,2,6-Trimethylheptane |
| | 33.17 | 1,1,2-Trimethycyclohexane |
| 6 | 33.52 | n-Nonane |
| | 34.26 | iso-Propylbenzene |
| | 34.48 | tert-Butylcyclopentane |
| | 34.68 | tert-Butylbenzene |
| | 35.57 | sec-Butylcyclopentane |
| | 36.33 | 3-Methylnonane |
| | 36.56 | n-Propylbenzene |
| | 36.83 | n-Propylcyclohexane |
| | 37.12 | m-Ethyltoluene |
| | 37.24 | p-Ethyltoluene |
| | 37.64 | 1,3,5-Trimethylbenzene |
| | 38.20 | 2-Methylnonane |
| | 38.36 | o-Ethyltoluene |
| | 38.75 | 3,6-Dimethyloctane |
| | 38.75 | 1,2,4-Trimethylbenzene |
| 7 | 40.32 | n-Decane |
| | 40.63 | 1,2,3-Trimethylbenzene |
| | 41.57 | 4-Methyldecane |
| | 41.94 | sec-Butylbenzene |
| | 42.45 | n-Butylbenzene |
| | 44.54 | n-Undecane |




**Column** : CBP1-PONA
**Shimadzu P/N** : 221-44082-50
**Detector** : FID

# GC Packed Columns

The Shimadzu a wide selection of packed columns that fits in most GC instruments in the market.

Some of the more commonly used columns below:

## ShinCarbon ST Columns (packed & micropacked)

- Rapid separations of permanent gas/light hydrocarbon mixtures.
- Separate permanent gases, including carbon monoxide and carbon dioxide, without cryogenic cooling.
- Excellent compatibility with most GC detectors—minimal bleed, minimal baseline rise.
- Preconditioned, less than 30 minutes to stabilize.
- Maximum temperature of 280 °C/300 °C.

## Molecular Sieve Columns

- Molecular sieve packed columns easily separate permanent gases at above-ambient temperatures. In addition, our molecular sieves are pre-activated and ready to use.

## Micropacked GC Columns

- Higher capacity than PLOT columns.
- Increased efficiency over traditional packed columns.
- Made from inert, flexible SilcoSmooth tubing.
- Wide range of packings available.

## Rt-XLSulfur Columns (packed & micropacked)

- Optimized columns for low ppbv sulfur analyses.
- Eliminate the need for PTFE tubing.
- Column and end fittings are Sulfinert treated for maximum inertness.
- Maximum temperature of 290 °C.

## Porous Polymer Columns (packed)

- Available in both glass and stainless steel tubing.

For availability and ordering information on custom columns, please contact your representative direct sales/distributors.

# ShinCarbon ST Columns

Analyzing the permanent gases oxygen, nitrogen, methane, carbon monoxide, and carbon dioxide has been virtually impossible for a single gas chromatography (GC) or gas-solid chromatography (GSC) column, without sub-ambient temperatures.

ShinCarbon ST material, a high surface area carbon molecular sieve (~1500 m2/g), is the ideal medium for separating gases and highly volatile compounds by GSC. A 2 m x 1 mm ID micropacked column containing ShinCarbon ST separates the permanent gases in 10 minutes, without cryogenic cooling (Figure 1).

ShinCarbon ST columns can also separate light hydrocarbon / permanent gas mixtures. Figure 2 shows an analysis of permanent gases plus acetylene, ethylene, and ethane, completed in less than 20 minutes. Natural gas components (70% methane) also are cleanly separated (Figure 3). Other potential applications for ShinCarbon ST include analyses of sulfur dioxide and Freon® fluorocarbons (Figure 4).*

** For analysis of other low molecular height sulfur compound, we recommand Rt-X2 Sulfur micropacked and packed columns or SH-Rtx-1 Capillary columns.*

**Figure 1** Separate permanent gases in 10 minutes, without cryogenic cooling.

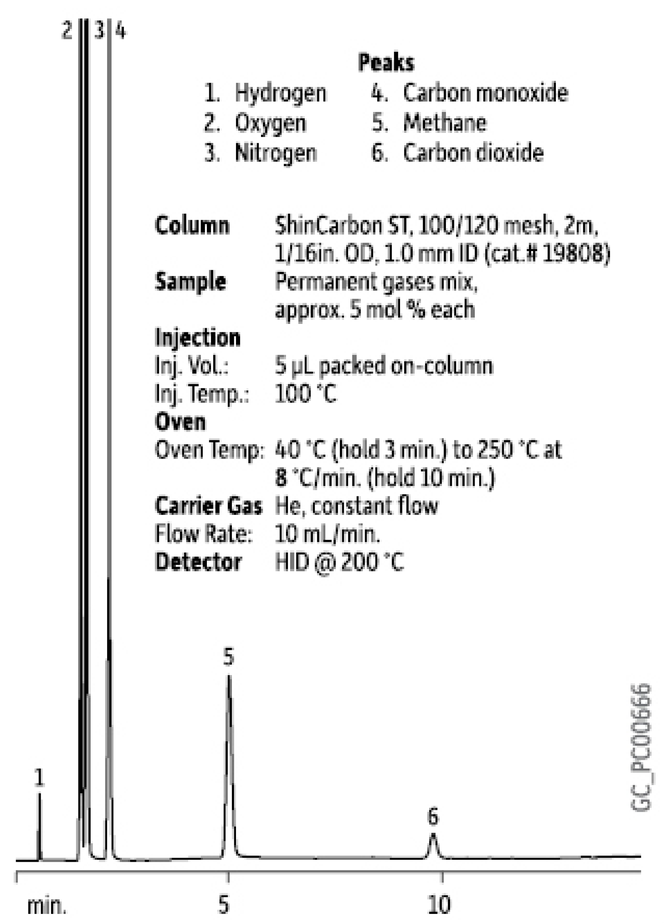



**Figure 2** Rapidly analyze light hydrocarbon/permanent gas mixtures.

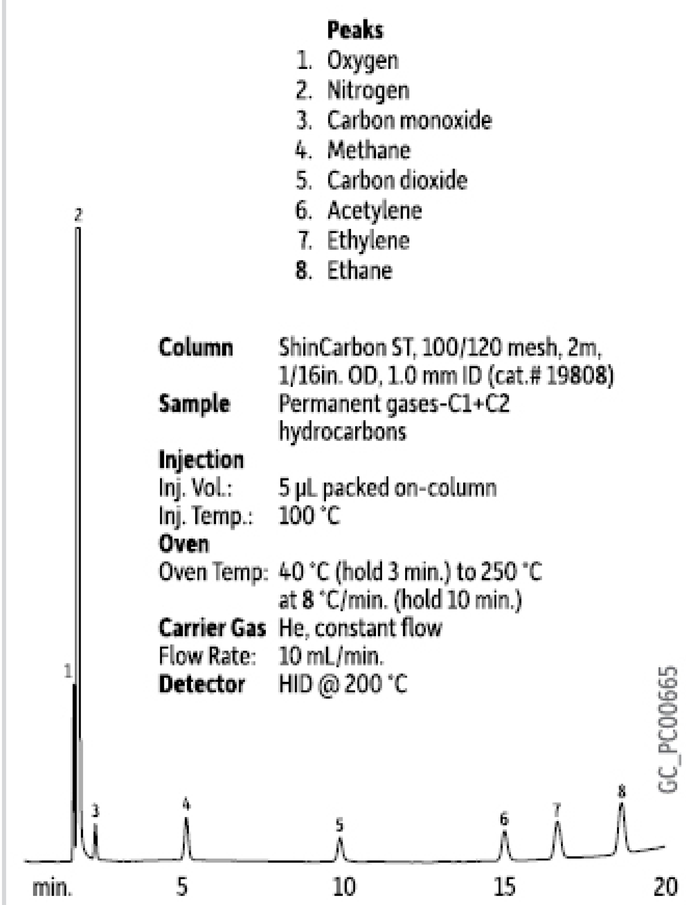
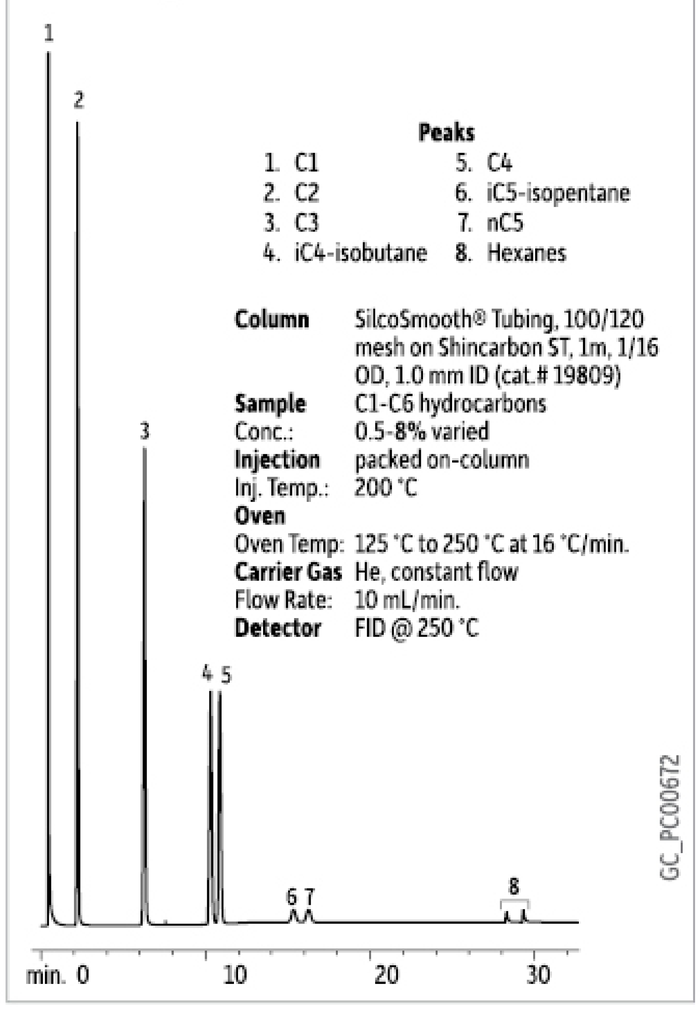



**Figure 3** Separate components in natural gas.




# ShinCarbon ST Columns (micropacked)

(SilcoSmooth® Stainless Steel)**

| OD | ID / mm | Mesh | Length / m |
|---|---|---|---|
| 1/16" | 1.0 | 80/100<br>100/120 | 1.0 |
| | | | 2.0 |
| | | | 3.0 |

*** Does not include column nuts and ferrules. Optimal installation kits can be ordered separately.*

# ShinCarbon ST Columns (packed)

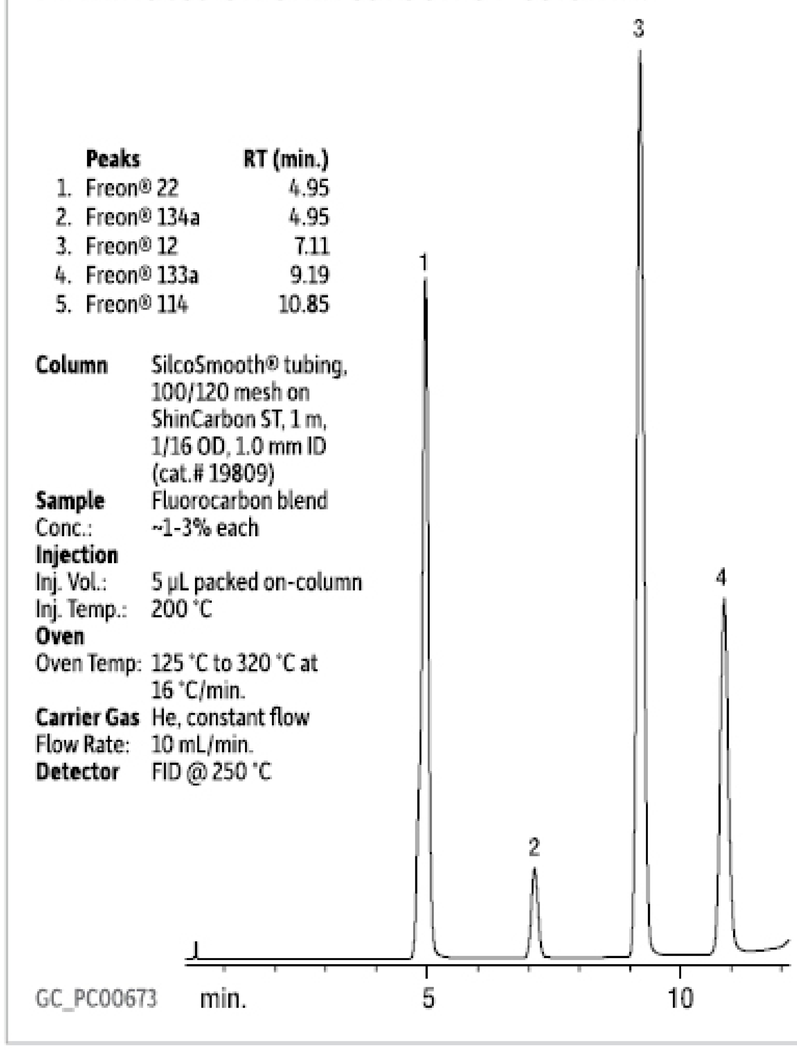
(SilcoSmooth® Stainless Steel)*

| OD | ID / mm | Mesh | Length / m |
|---|---|---|---|
| 1/8" | 2.1 | 80/100 or 100/120 | 2.0 |

** Please indicate instrument configuration when ordering.*

For availability and ordering information on custom columns, please contact your representative direct sales/distributors.

**Figure 4** Fluorocarbon analysis completed in 11 minutes on ShinCarbon ST column.

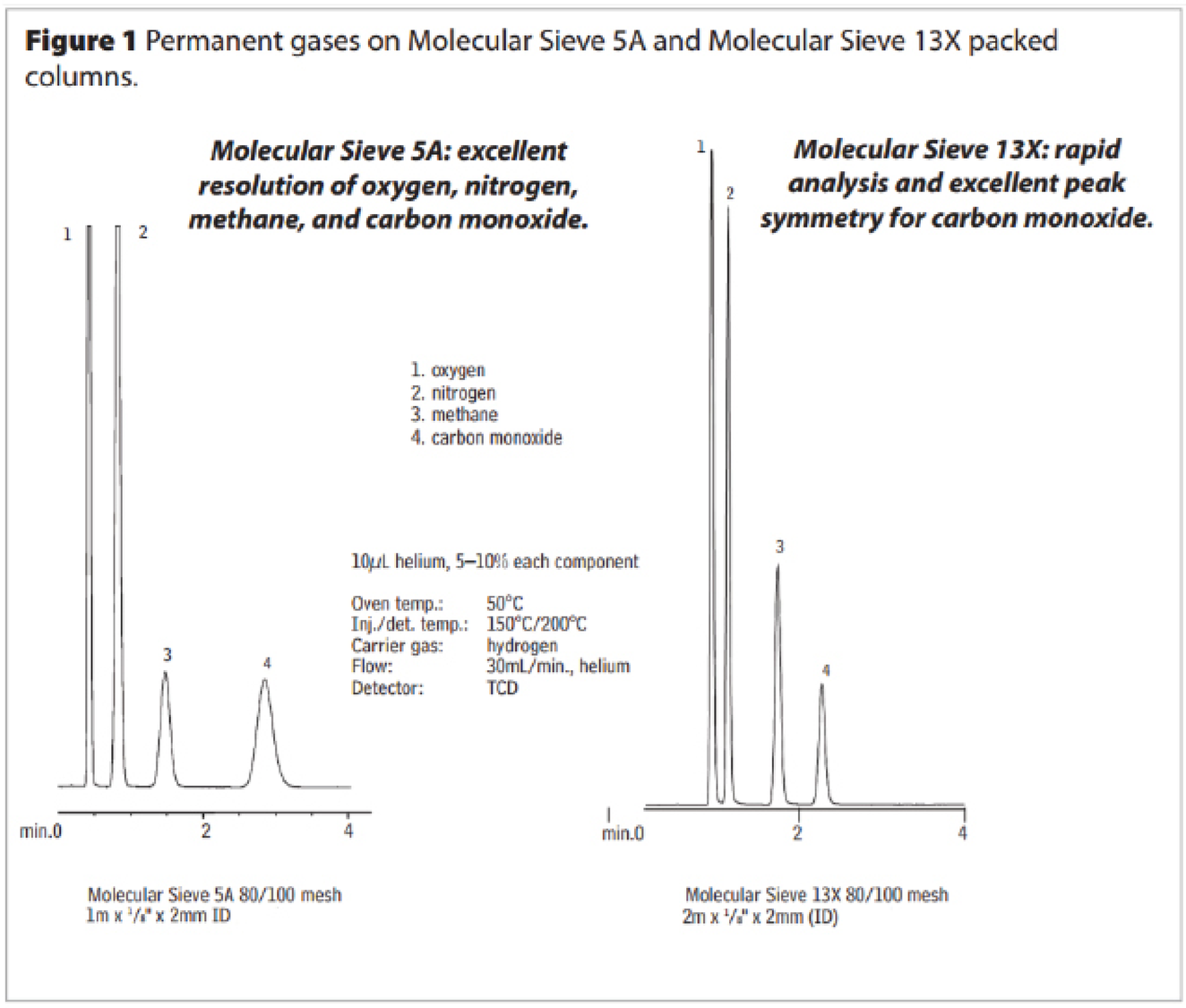


# Molecular Sieve 5A / 13X

Molecular sieve packed columns easily separate permanent gases at above-ambient temperatures. The two most common molecular sieves used are 5A and 13X.

Molecular sieve 5A and 13X packings differ in pore size and composition, causing differences in retention and selectivity for many gases. The 5A packing provides greater retention, which improves the separation of argon, oxygen, and nitrogen, and is a better choice for analyzing the trace impurities in inert gases typically used in the semiconductor industry. The 13X packing often is preferred for analysis of carbon monoxide, particularly at trace concentrations, because lower retention results in sharper chromatographic peaks and improved detection limits.

**Figure 1** Permanent gases on Molecular Sieve 5A and Molecular Sieve 13X packed columns.




# Molecular Sieve Packed Columns

| Molesieve | OD | ID / mm | Mesh | Length / m |
|---|---|---|---|---|
| Molesieve 5A<br>Molesieve 13X | 1/8″ | 2.1 | 60/80<br>80/100 | 1.0 |
| | | | | 2.0 |
| | | | | 3.0 |

# Molecular Sieve Micropacked Columns

| Molesieve | OD | ID / mm | Mesh | Length / m |
|---|---|---|---|---|
| Molesieve 5A<br>Molesieve 13X | 1/16″ | 1.0 | 80/100 | 1.0 |
| | | | | 2.0 |

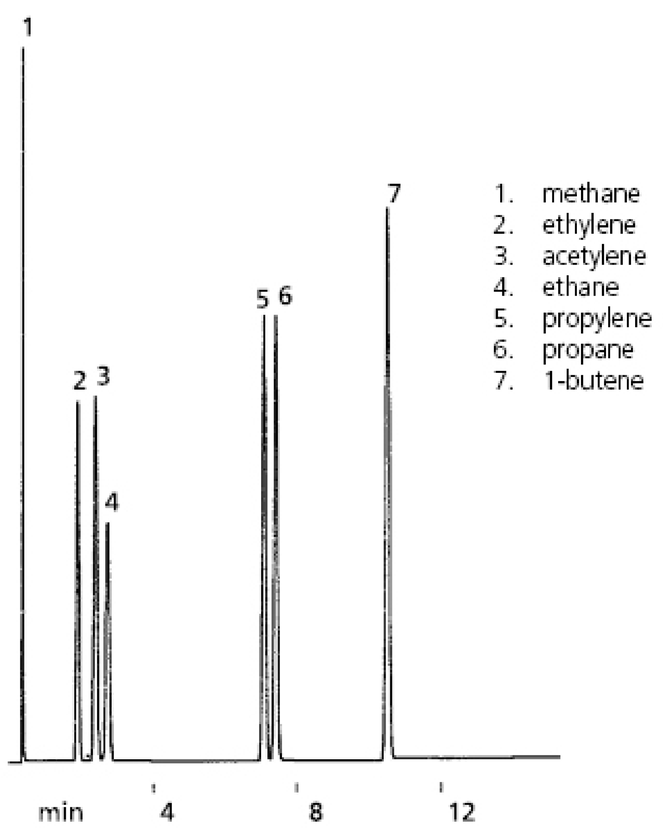
Molecular Sieve 5A and 13X are available in both stainless steel and glass column.

For availability and ordering information on custom columns, please contact your representative direct sales/distributors.

# Micropacked GC Columns

Micropacked columns are highly efficient and provide good sample capacity, resulting in a powerful tool for solving many difficult application problems. The unsurpassed inertness of SilcoSmooth tubing is based on Siltek deactivation, which allows the column to be flexed and coiled without any fear of chipping or cracking the inert surface.

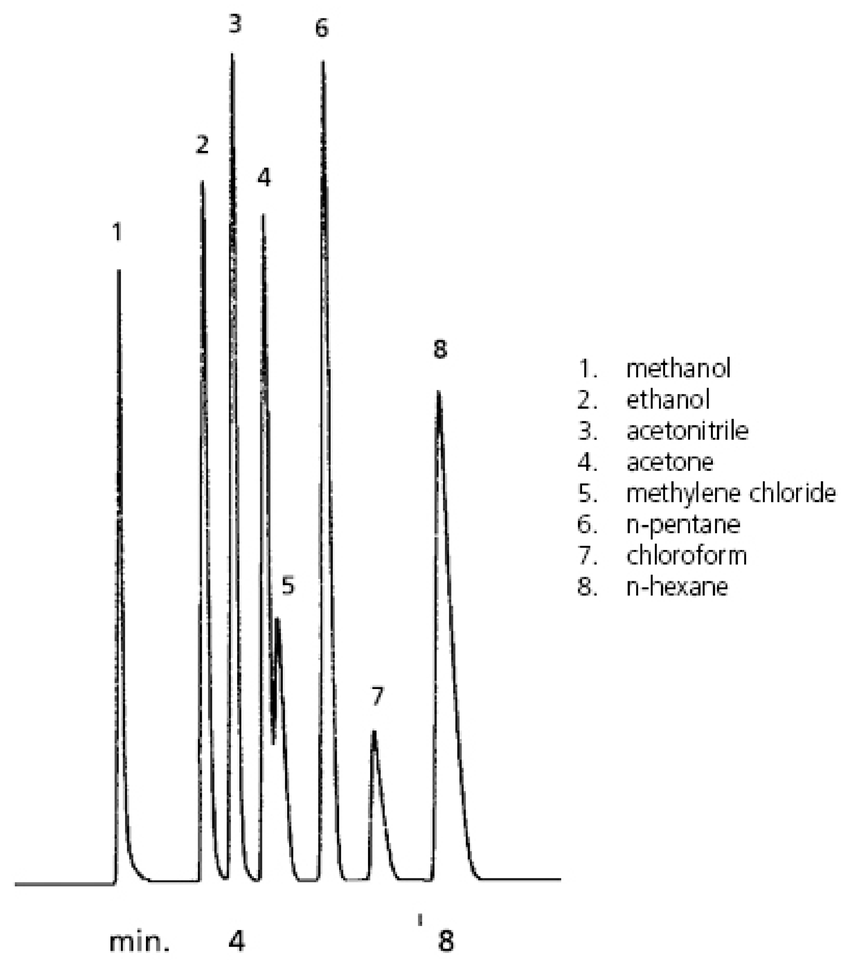
**Hydrocarbon Gases**
**HayeSep® S**
**(micropacked)**




2m, 0.75mm ID HayeSep S micropacked column
500µL split injection of a light hydrocarbon gas mixture

| | | |
|---|---|---|
| **Oven temp.** | : | 40°C (hold 3 min.) to 150°C @ 15°C/min. (hold 5 min.) |
| **Inj. & det. temp.** | : | 220 °C |
| **Carrier gas** | : | helium |
| **Flow** | : | 20mL/min. set @ 40 °C |
| **FID sensitivity** | : | 32 x 10-11 AFS |
| **Split ratio:** | : | 10:1 |

**Solvents**
**HayeSep® Q**




2m, 1mm ID HayeSep® Q
1µL direct injection of a neat solvent mixture

| | | |
|---|---|---|
| **Oven temp.** | : | 80°C to 180°C @ 16°C/min. (hold 5 min.) |
| **Inj. & det. temp.** | : | 200 °C |
| **Carrier gas** | : | helium |
| **Flow** | : | 20mL/min. set @ 40 °C |
| **FID sensitivity** | : | 512 x 10-11 AFS |

Types of micropacked columns available:

| Mesh | Packing material |
|---|---|
| 80/100 | HayeSep Q |
| | Molesieve 5A |
| | Molesieve 13X |
| | ShinCarbon ST |
| 100/120 | HayeSep Q |
| | HayeSep R |
| | HayeSep N |
| | Rt-XLSulfur Micropacked Column |
| 20% TCEP on 80/100 Chromosorb PAW | |

For availability and ordering information on custom columns, please contact your representative direct sales/distributors.

# Rt-XLSulfur Columns (Packed and Micropacked)

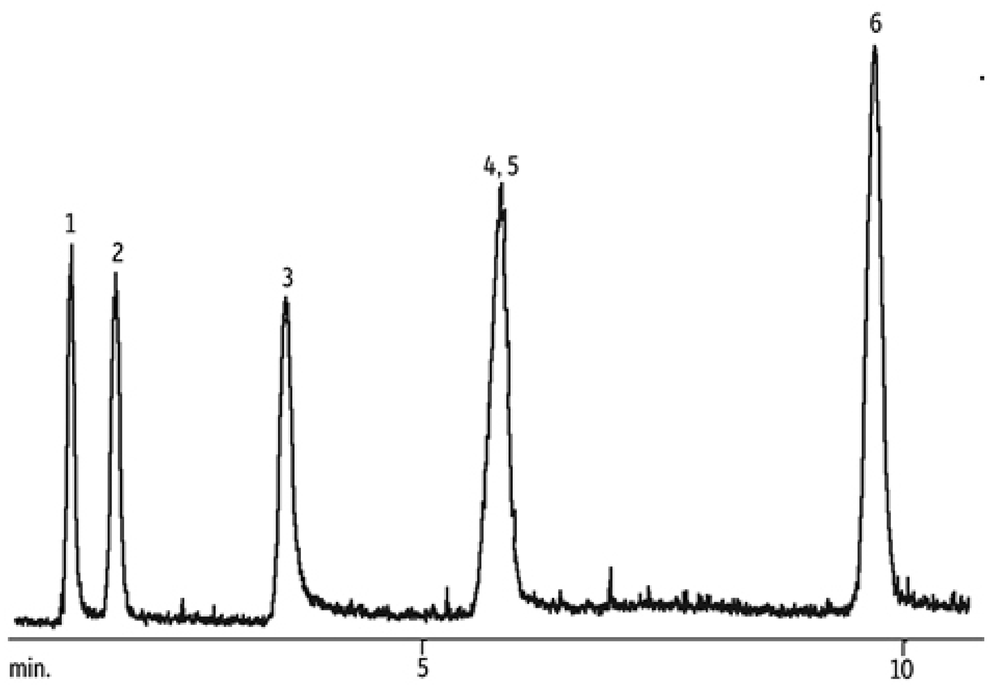
Rt-XLSulfur packed and micropacked columns are designed for ppb-level sulfur analysis. Every component of the sample pathway is treated to provide the highest degree of inertness for reactive, low-level sulfur compounds. The porous polymer phase features a unique surface modification, which results in excellent peak symmetry and thermal stability to 300 °C.

The high performance and reproducibility of the Rt-XLSulfur column enables resolution and quantitation of COS, $H_2S$, $SO^2$, $CH_3SH$, $(CH_3)_2S_2$ at low ppb concentrations. These sulfur compounds typically are found in pulp mill byproducts, natural gas, and petroleum products.

## Features:

- Optimized columns for low pbbv sulfur analyses.
- Eliminate the need for PTFE tubing.
- Column and end-fittings are Sulfinert® treated for maximum inertness.

**Figure 1** The Rt-XLSulfur column analyzes 50 ppb levels of sulfur compounds, providing low bleed and good symmetry.




**Peaks**

1. Hydrogen sulfide
2. Carbonyl sulfide
3. Methyl mercaptan
4. Ethyl mercaptan
5. Dimethyl sulfide
6. Dimethyl disulfide

**Conditions**

| | |
|---|---|
| **Column** | : Rt-XLSulfur, 1 m, 0.75 mm ID |
| **Sample conc.** | : 1 mL of 50ppbv each sulfur compound |
| **Injection** | : sample valve |
| **Oven Temp.** | : 60 °C to 230 °C at 15 °C/min. |
| **Carrier Gas** | : He, constant flow |
| **Flow Rate:** | : 9 mL/min. |
| **Detector** | : SCD |

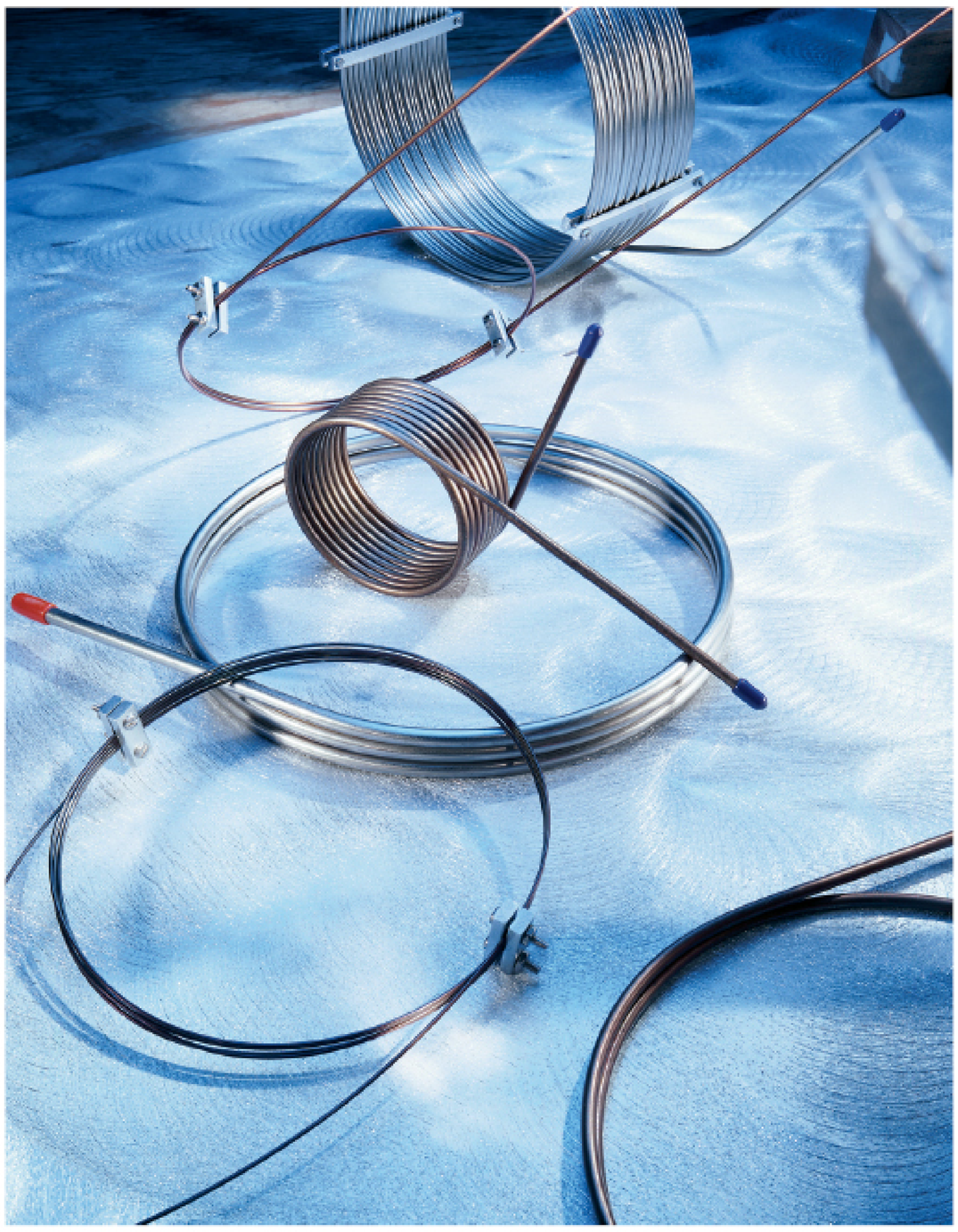
| Column | OD | ID / mm | Length / m |
|---|---|---|---|
| Rt-XLSulfur Columns (packed) | 1/8″ | 2.0 | 1.0 |
| | | | 2.0 |
| | 1/16″ | 3.2 | 1.0 |
| | | | 2.0 |
| Rt-XLSulfur Columns (micropacked) | 1/16″ | 1.0 | 1.0 |
| | | | 2.0 |
| | 0.95mm | 0.75mm | 1.0 |
| | | | 2.0 |

For availability and ordering information on custom columns, please contact your representative direct sales/distributors.

## Porous Polymer Columns (Packed)

- **Types of packing material available:**

- Activated Charcoal
- HayeSep A
- HayeSep C
- HayeSep D
- HayeSep N
- HayeSep Q
- HayeSep T
- Porapak Q
- Porapak QS
- Porapak R
- Porapak N
- Porapak T
- Shimalite Q
- Silica Gel



Available in both glass and stainless steel tubing.

For availability and ordering information on custom columns, please contact your representative direct sales/distributors.

# SAMPLE INTRODUCTION – Syringes

Shimadzu Diamond syringes are the result of technological advancements in materials, design, and engineering. Designed to meet the ever increasing levels of sensitivity required by today's analyses, Shimadzu Diamond syringes give you a new level of accuracy and precision.

## LONGER LIFE

Shimadzu Diamond syringes have a longer life. The improved solvent resistance and maximized operational temperature range along with the smoothest available internal glass surface ensure you receive the longest lifetime from your Shimadzu syringe.

## SUPERIOR PERFORMANCE AND ROBUSTNESS

Shimadzu Diamond syringes have superior performance and robustness with unsurpassed levels of operational strength and durability. Potential for contamination is significantly reduced by the near-zero syringe dead volume and minimized adhesive in the flow path.

## REDUCED CARRYOVER

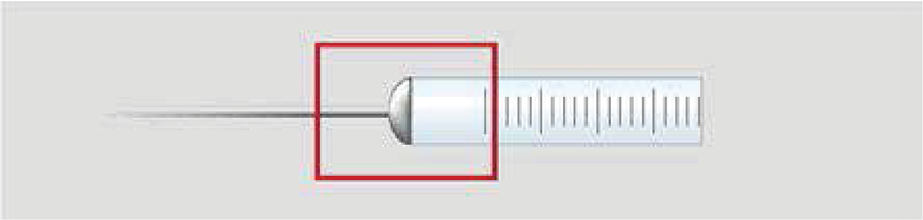
Engineering enhancements have eliminated areas where fluid can become trapped and potentially cause carryover, improving accuracy, precision and analysis results.

# Syringe

**Syringe Selection Guide**
If a syringe is being used by hand, a manual syringe should be selected. If a syringe is installed in an AOC autosampler, then choose the appropriate syringe and volume to suit your instrument and application.

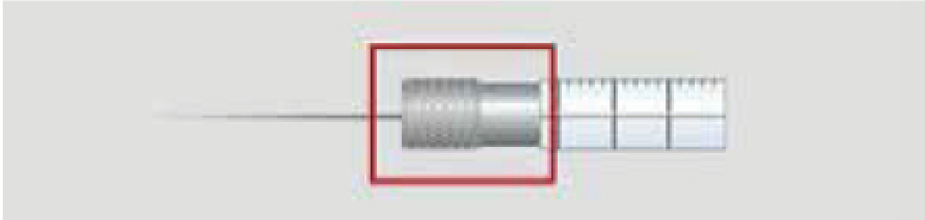
## Syringe Style

Fixed Needle



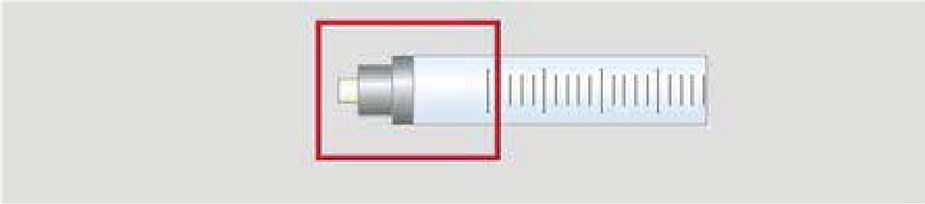
- Better option for experienced users or for applications requiring trace sample levels
- Recommended for use with an autosampler because the probability of needle bending is minimal
- Minimal sample carryover

Removable Needle



- Better option for inexperienced users
- Reduce cost if used in precipitation of salts or in situations in which it may bend easily (such as thick septum ) Available for many methods by changing needles

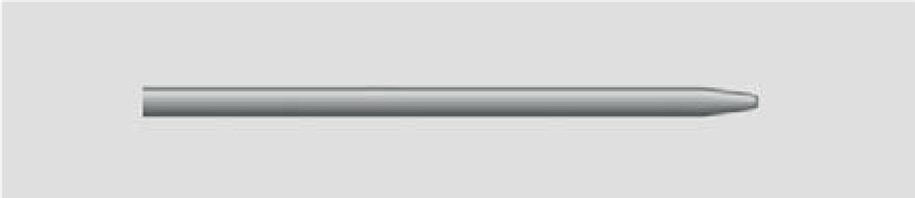
Gas Tight



- For Luer Lock needles and fittings
- Specifically designed to install and secure Luer Lock needles easily

## Needle Tip Style

Cone: Autosampler

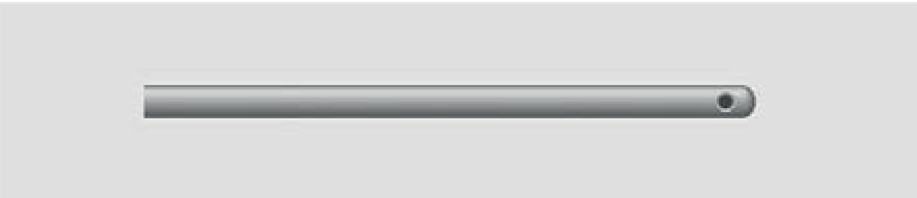


The cone-shaped needle tip is specially developed to withstand multi- injection demands and improve septum lifetime when used with an autosampler. The cone design effectively "parts" the septum during piercing instead of cutting it, as would a bevel needle.

Bevel: Manual Injection

The standard general-purpose needle tip style supplied with many syringes is a 20 ° bevel tip. It is the preferred option for manual injection when piercing the septum in exactly the same place is difficult. The bevel tip is designe d for optimum septum penetration and prevention of septum coring.

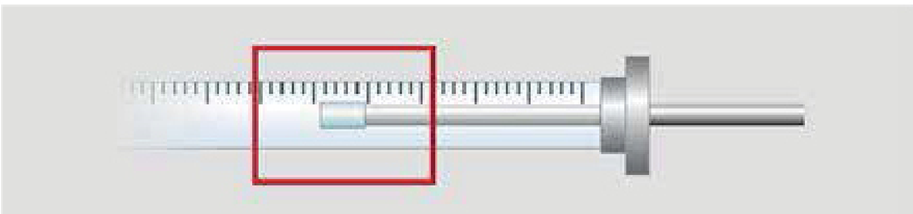
Side Hole Dome



Samples are filled and dispensed through the side hole , eliminating septum plugging of the needle. Ideal for large-volume gas injections. The solid domed tip minimizes septum damage.

## Plunger Style

PTFE Tipped Plunger



- PTFE Tip enables gastight analysis
- Suitable for both liquid and gas samples
- Ideal for analysis of highly viscous liquid because it reduces the possibility of the plunger sticking due to micro particles (samples should have no effects with PTFE)
- Plunger is replaceable

# Manual Autosampler or Instrument Syringes

If a syringe is being used by hand, a manual syringe should be selected. If a syringe is installed in an AOC autosampler then choose the appropriate syringe and volume to suit your instrument and application.

Shimadzu autosampler syringes are specifically designed to meet instrument dimensional specifications, have an accuracy of better than ± 1 % and are designed for precise, worry-free overnight sampling.

# Needle Tip Styles

Cone: GC Autosampler

The cone shaped needle tip is specially developed to withstand multi injection demands and improve septum lifetime when used with the AOC autosampler. The cone design effectively "parts" the septum during piercing instead of cutting it, as would a bevel needle.

LC: HPLC

These needles are used for LC and HPLC valve injection and have a 90 ° square tip with rounded and polished edges. This eliminates damage to the valve's rotor seal and stator face. This needle tip style is a good choice for general liquid dispensing.

Bevel: Manual GC

The standard general purpose needle tip style supplied with many Shimadzu syringes is a 20 ° bevel tip. It is the preferred option for manual injection where piercing the septum in exactly the same place is difficult. The bevel tip is designed for optimum septum penetration and prevention of septum coring.

Side Hole Dome:

Samples are filled and dispensed through the side hole eliminating septum plugging of the needle. Ideal for large volume gas injection. The solid domed tip minimizes septum damage.

Dome:

This style needle is recommended for use with predrilled septa. The tip is rounded and polished to help septum penetration.

# Valves

OPEN ⟷ CLOSED

The push-button valve attaches directly to any luer lock 1 mL – 100 mL Shimadzu syringe.

OPEN ⟷ CLOSED

The push-button valve attaches to any luer lock 5 mL – 100 mL Shimadzu syringe.

## Syringe for AOC-20i/20s and AOC-20i Plus / 20s Plus

| Syringe Volume | PTFE Tipped Plunger | Needle Length (mm) | Needle Gauge | Needle OD (mm) | Needle Tip | Needle ID (mm) | P/N | Replacement Plunger P/N | Replacement Needle P/N |
|---|---|---|---|---|---|---|---|---|---|
| 5 µL | – | 42 | 23 | 0.63 | Cone | 0.11 | 221-75173 | – | – |
| 10 µL | √ | 42 | 23 | 0.63 | Cone | 0.11 | 221-74469 | – | – |
| 10 µL | – | 42 | 23 | 0.63 | Cone | 0.11 | 221-34618 | – | – |
| 10 µL | √ | 42 | 23 | 0.63 | Cone | 0.11 | 221-75174 | 221-75174-02 | 221-75174-01 |
| 50 µL | – | 42 | 23 | 0.63 | Cone | 0.11 | 221-45243 | – | – |
| 250 µL | √ | 42 | 23 | 0.63 | Cone | 0.11 | 221-45244 | 221-45244-01 | – |

| Description | P/N | Syringe Volume |
|---|---|---|
| Syringe for OCI | 221-37282-02 | 10 µL |

## Syringe for AOC-5000 Plus

| Syringe Volume | PTFE Tipped Plunger | Needle Length (mm) | Needle Gauge | Needle OD (mm) | Needle ID (mm) | Needle Tip | P/N |
|---|---|---|---|---|---|---|---|
| 10 µL | – | 50 | 26 | 0.47 | 0.11 | Cone | 221-75175 |
| 10 µL | – | 50 | 23 | 0.63 | 0.11 | Cone | 221-75175-01 |
| 10 µL | – | 80 | 26 | 0.47 | 0.11 | Cone | 221-75176 |
| 10 µL | – | 80 | 23 | 0.63 | 0.11 | Cone | 221-75176-01 |
| 10 µL | √ | 50 | 26 | 0.47 | 0.11 | Cone | 221-75175-02 |
| 10 µL | √ | 50 | 23 | 0.63 | 0.11 | Cone | 221-75175-03 |
| 25 µL | √ | 50 | 23 | 0.63 | 0.24 | Cone | 221-75177 |
| 1 mL | √ | 50 | 26 | 0.47 | 0.15 | Side Hole Dome | 221-75178 |
| 1 mL | √ | 50 | 23 | 0.63 | 0.15 | Side Hole Dome | 221-75178-01 |
| 2.5 mL | √ | 50 | 26 | 0.47 | 0.15 | Side Hole Dome | 221-75179 |
| 2.5 mL | √ | 50 | 23 | 0.63 | 0.15 | Side Hole Dome | 221-75179-01 |

## Xtra Life Micro Syringe for AOC-30i / AOC-20s

Fixed needle syringe with super flexible titanium alloy plunger. They are resistant to bending and sliding friction for extended lifetime, even with water soluble samples. Plunger and barrel are machined for an exact fit, so they are not interchangeable with another syringe if either part is damaged.

| Syringe Volume | PTFE Tipped Plunger | Needle Length (mm) | Needle Gauge | Needle OD (mm) | Needle ID (mm) | Needle Tip | P/N |
|---|---|---|---|---|---|---|---|
| 5 µL | 0.1 µL | 43 | 23 | 0.64 | 0.15 | Cone | 227-35401-01 |
| 10 µL | 0.2 µL | 43 | 23 | 0.64 | 0.15 | Cone | 227-35400-01 |

## Syringe for AOC-6000

| Syringe Volume | PTFE Tipped Plunger | Needle Length (mm) | Needle Gauge | Needle OD (mm) | Needle Tip | P/N |
|---|---|---|---|---|---|---|
| 1 µL | - | 57 | 23 | 0.63 | Cone | 225-19744-01 |
| 5 µL | - | 57 | 26 | 0.47 | Cone | 225-19744-02 |
| 5 µL | - | 57 | 23 | 0.63 | Cone | 227-37166-01 |
| 5 µL | - | 85 | 23 | 0.63 | Cone | 227-37160-01 |
| 10 µL | - | 57 | 26 | 0.47 | Cone | 225-19744-03 |
| 10 µL | √ | 57 | 26 | 0.47 | Cone | 225-19744-04 |
| 10 µL | - | 57 | 23 | 0.63 | Cone | 227-37167-01 |
| 10 µL | - | 85 | 23 | 0.63 | Cone | 227-37161-01 |
| 25 µL | √ | 57 | 26 | 0.47 | Cone | 225-19744-05 |
| 50 µL | √ | 57 | 26 | 0.47 | Cone | 225-19744-06 |
| 100 µL | √ | 57 | 26 | 0.47 | Cone | 225-19744-07 |
| 250 µL | √ | 57 | 26 | 0.47 | Cone | 225-19744-08 |
| 500 µL | √ | 57 | 26 | 0.47 | Cone | 225-19744-09 |
| 1 mL | √ | 57 | 23 | 0.63 | Side Hole Dome | 225-19744-10 |
| 2.5 mL | √ | 65 | 23 | 0.63 | Side Hole Dome | 225-19744-11 |

## Gastight Syringe for AOC-6000

| Syringe Volume | Needle Length (mm) | Needle Gauge | Needle OD (mm) | Needle Tip | P/N |
|---|---|---|---|---|---|
| 10 µL | 85 | 23 | 0.63 | Cone | 227-37162-01 |
| 10 µL | 57 | 23 | 0.63 | Cone | 227-37168-01 |
| 25 µL | 85 | 23 | 0.63 | Cone | 227-37163-01 |
| 50 µL | 85 | 23 | 0.63 | Cone | 227-37164-01 |
| 100 µL | 57 | 23 | 0.63 (ID 0.11) | Cone | 227-37169-01 |
| 100 µL | 85 | 23 | 0.63 | Cone | 227-37165-01 |
| 250 µL | 57 | 23 | 0.63 | Cone | 227-37170-01 |

# Manual Syringe

Shimadzu manual syringes are available from 5µL to 500µL, and can be widely used in your laboratory work.

## Fixed Needle Style

| Syringe Volume | PTFE Tipped Plunger | Needle Length (mm) | Needle Gauge | Needle OD (mm) | Needle ID (mm) | Needle Tip | P/N | Replacement Plunger | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | P/N | Qty |
| 5 µL | – | 50 | 26 | 0.47 | 0.11 | Bevel | 221-75170 | – | – |
| 10 µL | – | 50 | 26 | 0.47 | 0.11 | Bevel | 670-12552-01 | – | – |
| 10 µL | √ | 80 | 26 | 0.47 | 0.11 | Bevel | 221-75170-01 | 221-75170-02 | 2 |
| 25 µL | – | 80 | 25 | 0.5 | 0.2 | Bevel | 670-12510-31 | – | – |
| 25 µL | √ | 50 | 25 | 0.5 | 0.2 | Bevel | 221-75171 | 221-75171-01 | 1 |
| 50 µL | – | 50 | 25 | 0.5 | 0.2 | Bevel | 670-12510-36 | – | – |
| 50 µL | √ | 50 | 25 | 0.5 | 0.2 | Bevel | 221-75172 | 221-75172-03 | 1 |
| 100 µL | – | 50 | 25 | 0.5 | 0.2 | Bevel | 670-12510-18 | – | – |
| 100 µL | √ | 50 | 25 | 0.5 | 0.2 | Bevel | 221-75172-01 | 221-75172-04 | 1 |
| 250 µL | – | 50 | 25 | 0.5 | 0.2 | Bevel | 670-12510-19 | – | – |
| 250 µL | √ | 50 | 25 | 0.5 | 0.2 | Bevel | 221-75172-02 | 221-75172-05 | 1 |
| 500 µL | – | 50 | 25 | 0.5 | 0.2 | Bevel | 670-12510-20 | – | – |
| 10 µL | – | 51 | 22 | 0.028" | 0.17 | LC | 670-12554-01 | – | – |
| 25 µL | – | 51 | 22 | 0.028" | 0.37 | LC | 670-12554-02 | – | – |
| 50 µL | – | 51 | 22 | 0.028" | 0.37 | LC | 670-12554-03 | – | – |
| 100 µL | – | 51 | 22 | 0.028" | 0.37 | LC | 670-12554-04 | – | – |
| 250 µL | – | 51 | 22 | 0.028" | 0.37 | LC | 670-12554-05 | – | – |
| 500 µL | – | 51 | 22 | 0.028" | 0.37 | LC | 670-12554-06 | – | – |

## Removable Needle Style

| Syringe Volume | PTFE Tipped Plunger | Needle Length (mm) | Needle Gauge | Needle OD (mm) | Needle Tip | P/N | Replacement Plunger P/N | Replacement Needle P/N |
|---|---|---|---|---|---|---|---|---|
| 10 µL | √ | 50 | 26 | 0.47 | Bevel | 670-12553-21 | 670-12553-33 | 670-12510-95 |
| 25 µL | – | 50 | 25 | 0.5 | Bevel | 670-12510-74 | – | 670-12510-96 |
| 50 µL | – | 50 | 25 | 0.5 | Bevel | 670-12510-75 | – | |
| 100 µL | – | 50 | 25 | 0.5 | Bevel | 670-12510-76 | – | |
| 250 µL | – | 50 | 25 | 0.5 | Bevel | 670-12510-77 | – | |
| 500 µL | – | 50 | 25 | 0.5 | Bevel | 670-12510-78 | – | |

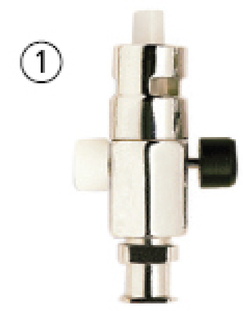
# Syringe for Gas Analysis

## Luer Lock Needle Style

| Syringe Volume | PTFE Tipped Plunger | P/N | Replacement Plunger P/N |
|---|---|---|---|
| 1 mL | √ | 221-54778-01 | 221-54778-11 |
| 5 mL | √ | 221-54778-02 | 221-54778-12 |
| 10 mL | √ | 221-54778-03 | 221-54778-13 |
| 25 mL | √ | 221-54778-04 | 221-54778-14 |
| 50 mL | √ | 221-54778-05 | 221-54778-15 |
| 100 mL | √ | 221-54778-06 | 221-54778-16 |

## Luer Lock Needle

| Needle Length (mm) | Needle Gauge | Needle OD (mm) | Needle Tip | Qty | P/N |
|---|---|---|---|---|---|
| 50 | 23 | 0.63 | Bevel | 5 | 221-54778-51 |
| 50 | 19 | 1.07 | Bevel | 5 | 221-54778-52 |
| 50 | 14 | 2.1 | Bevel | 5 | 221-54778-54 |




OPEN ⟷ CLOSED

## Syringe Valve

| Diag. # | Syringe Volume | Description | Qty | P/N |
|---|---|---|---|---|
| ① | 5 mL to 2 L | Push Button Valve for Luer Lock Needle | 1 | 221-54778-49 |
| ② | 50 µL to 2 L | Push Button Valve for Luer Lock Needle and Tip Syringe | 1 | 221-54778-50 |

OPEN ⟷ CLOSED

## Removable Needle Style

Gastight syringes with a capacity of milliliter quantity level. The needle is 30mm long and is of a screw-in type, which ensures an easy exchange.

| Description | Syringe Volume | P/N | Replacement Needle P/N |
|---|---|---|---|
| MS-GAN025 | 0.25 mL | 670-12504-28 | 670-12504-85 (5 pcs) |
| MS-GAN050 | 0.5 mL | 670-12504-29 | |
| MS-GAN100 | 1 mL | 670-12504-30 | |
| MS-GAN250 | 2.5 mL | 670-12504-31 | |
| MS-GAN500 | 5 mL | 670-12504-32 | |
| MS-GANX00 | 10 mL | 670-12504-33 | |

## PIN Style Microsyringe

Plunger-in-needle style. The plunger goes into the needle tip to eliminate dead volume. Ideal for highly precise analysis of micro-volume samples.

| Description | P/N | Syringe Volume |
|---|---|---|
| 0.5BR-7 | 670-12510-71 | 0.5 µL |
| 1BR-7 | 670-12510-72 | 1 µL |
| 5BR-7 | 670-12510-73 | 5 µL |

## Microsyringe with Plunger Guide

This type of microsyringe has an extended barrel (120 mm long) to prevent the plunger from bending.

| Description | P/N | Syringe Volume | Replacement Needle P/N | Qty |
|---|---|---|---|---|
| 10R-GP | 670-12510-80 | 10 µL | 670-12510-95 | 5 |
| 5R-GPS | 670-12510-86 | 5 µL | 670-12510-94 | 5 |

## Elastic Plunger Style Microsyringe

These syringes use a titanium alloy plunger, which is highly flexible and corrosion resistant. The high flexibility of the plunger ensures stable injection of samples as small as 5 µL. The needle is 0.41 mm in tip diameter, which is suitable for on-column injection into a capillary column.

| Description | P/N | Syringe Volume | Replacement Needle P/N |
|---|---|---|---|
| MS-E05-CS | 670-12580-21 | 5 µL | Fixed Needle |
| MS-E10-CS | 670-12580-22 | 10 µL | |
| MS-NE05-CS | 670-12580-25 | 5 µL | 670-12580-31 (5 pcs) |
| MS-NE10-CS | 670-12580-26 | 10 µL | |

## Microsyringe with Guide Bar

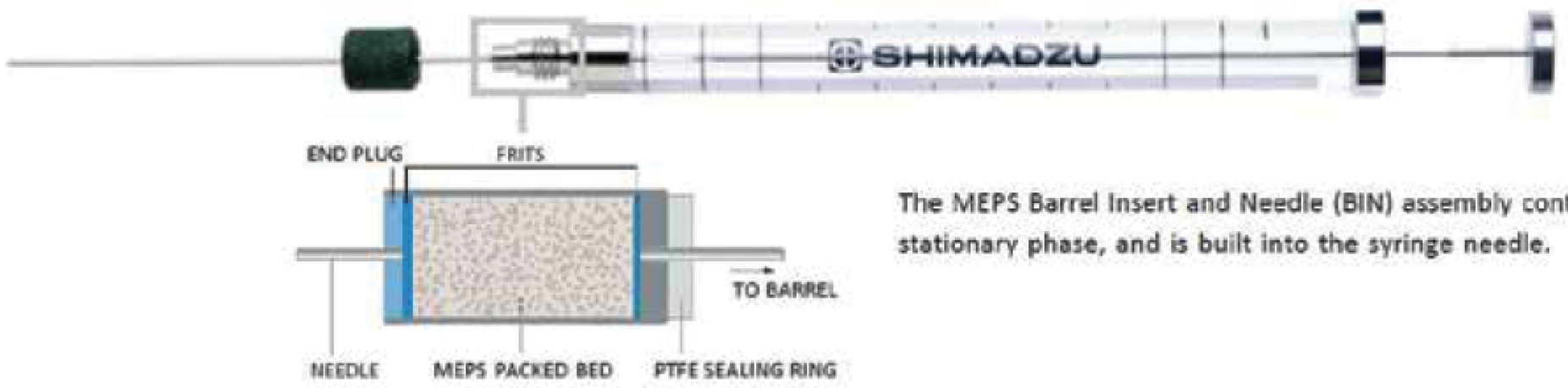
A guide bar is installed parallel to the plunger, which prevents the plunger from bending. A stopper is also provided to allow a preset amount of sample to be injected accurately without reading the scale in each run.

| Description | P/N | Syringe Volume | Replacement Needle P/N |
|---|---|---|---|
| MS-G10 | 670-12504-25 | 10 µL | Fixed Needle |
| MS-NG10 | 670-12504-22 | 10 µL | 670-12504-86 (5 pcs) |

# Micro Solid Phase Extraction Syringe MEPS™

MEPS™ is Micro Extraction by Packed Sorbent and is used for sample preparation and handling. MEPS is the miniaturization of conventional SPE packed bed devices from milliliter bed volumes to microliter volumes. The MEPS approach to sample preparation is suitable for reversed phases, normal phases, mixed mode or ion exchange chemistries. MEPS is available in a variety of common SPE phases.

# Meps Barrel Insert And Needle



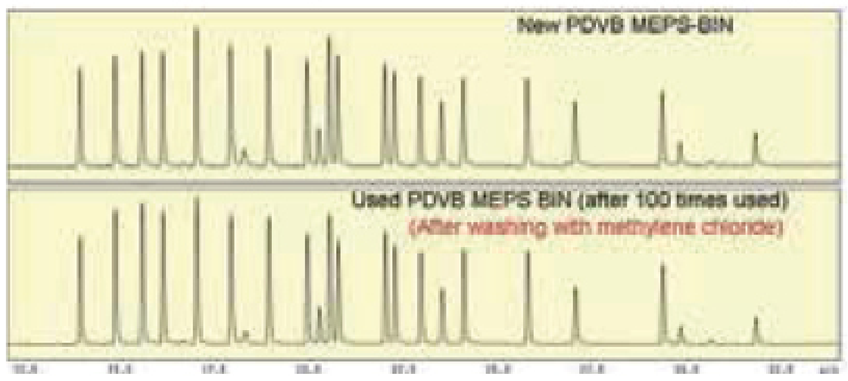

The MEPS Barrel Insert and Needle (BIN) assembly contains the stationary phase, and is built into the syringe needle.

SAMPLE SIZE AND SENSITIVITY
Sample volumes may be as little as 10 µL, or by taking multiple aliquots of 100 µL or 250 µL, samples of 1 mL or larger may be concentrated.

AUTOMATION
Extract samples and make injections on-line using a single device, reducing sample processing times and the need for operator intervention.

SORBENT LIFE
BIN life is dependent on the specific matrix being analyzed. For example, C18 analysis of whole plasma samples is conservatively 25-100 samples before the BIN needs to be changed. BIN life of cleaner samples is significantly longer.

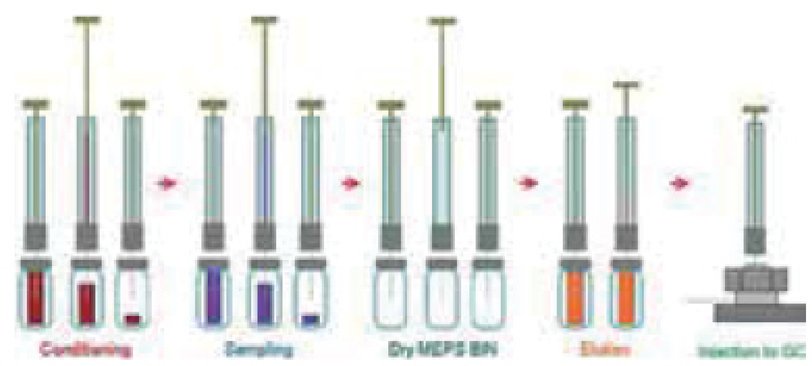
Chromatogram of 22 pesticides standard solution (40 ng/mL)




CARRYOVER
The small quantity of phase in the MEPS BIN is easily and effectively washed between samples to reduce the possibility of carryover. This washing process is not practical with off-line SPE devices. With automated MEPS, washing occurs while the previous sample is running.

FLEXIBLE AND EASY TO USE
The dimensions of the sorbent bed ensure performance remains identical to conventional SPE devices when used for extraction of similar samples. The AOC-MEPS system was developed to incorporate MEPS into a process automation workflow, combining sample preparation and analysis in a single platform.

AOC-MEPS System




When automated by an AOC-MEPS system, the injection volume is much larger compared to the commonly used GC injection volumes of 1 - 2 µL. With AOC-MEPS, the typical injections are 50 to 200 µL of elution solvent.
A large volume injection technique that removes the solvent volume from inside the injector unit while condensing the target compounds should be employed.

## MEPS™ Syringe for AOC-20i/20s and AOC-20i Plus/ AOC-20s Plus

| Syringe Volume | PTFE Tipped Plunger | P/N | Replacement Plunger | |
|---|---|---|---|---|
| | | | P/N | Qty |
| 100 µL | √ | 221-74830-01 | 221-74830-10 | 1 |

| Base | P/N | Qty |
|---|---|---|
| C18 | 221-74830-03 | 5 |
| Silica | 221-74830-04 | 5 |
| C8 + SCX | 221-74830-05 | 5 |
| C2 | 221-74830-06 | 5 |
| C8 | 221-74830-07 | 5 |
| PDVB | 221-74830-02 | 5 |
| SDVB | 221-74830-11 | 5 |
| HDVB | 221-74830-12 | 5 |
| Development Kit | 221-74830-08 | 1 each of C18, C8, Silica, C8+SCX, C2 |

## MEPS™ Syringes for AOC-5000 Plus

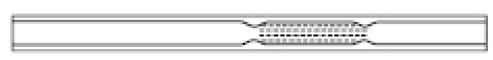
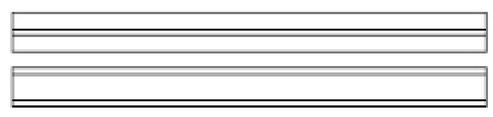
| Syringe Volume | PTFE Tipped Plunger | P/N | Replacement Plunger | |
|---|---|---|---|---|
| | | | P/N | Qty |
| 100 µL | √ | 221-75202-01 | 221-75202-03 | 1 |
| 250 µL | √ | 221-75202-02 | 221-75202-04 | 1 |

| Phase | Qty | P/N for 100 µL syringe | P/N for 250 µL syringe |
|---|---|---|---|
| C18 | 5 | 221-75198-01 | 221-75199-01 |
| Silica | 5 | 221-75198-02 | 221-75199-02 |
| C8 + SCX | 5 | 221-75198-03 | 221-75199-03 |
| C2 | 5 | 221-75198-04 | 221-75199-04 |
| C8 | 5 | 221-75198-05 | 221-75199-05 |
| Development Kit | 1 each of C18, C8, Silica, C8+SCX, C2 | 221-75198-06 | 221-75199-06 |

# GC Glass Insert

The GC inlet functions as the interface between the syringe and the GC capillary column, where the sample is introduced, vaporized, mixed with carrier gas and transferred to the column. Shimadzu instruments offer several types of inlets - split, splitless, programmable temperature vaporization (PTV) and on-column.

The glass insert prevents the sample contacting the metal walls of the injector block. Glass insert geometry and packing materials enable the glass insert to achieve greater heated surface area; this additional surface area can often improve sample vaporization. Conversely, choosing the wrong glass insert geometry can significantly decrease the reproducibility and quality of analysis.

| Injection Technique | Sample Types | Glass insert Geometry | Function |
|---|---|---|---|
| Splitless | Trace Level Analyses/ Active Compounds | Taper | A bottom taper focuses sample onto the head of the column and minimizes sample contact with metal parts of the inlet. The addition of quartz wool to your glass insert promotes mixing of analytes, aids the vaporization of liquid samples, and works as a trap to collect non-volatile residue in the sample (i.e. protects capillary column from 'dirty' samples). |
| Split | General Purpose/ Concentrated Samples/ Dirty Samples | FocusLiner™  | Ensures quartz wool remains in the correct position in the liner. Excellent reproducibility results from the wiping of the sample from the syringe needle and the prevention of droplet formation. Minimizes high molecular weight discrimination. |
| Splitless | Trace Level Analyses/ Dirty Samples/ Wide Boiling Point Range | Taper FocusLiner™ | Bottom taper focuses sample onto the head of the column and minimizes contact with metal parts of the inlet. Excellent reproducibility results from the wiping of the sample from the syringe needle and the prevention of droplet formation. Minimizes high molecular weight discrimination. |
| Direct | Trace Level Analyses/ Active Compounds | Direct Taper | Direct glass inserts facilitate maximum transfer of sample by connecting directly to the GC column and inhibiting sample degradation due to hot metal components inside inlet. |
| Split/Splitless | General Purpose/ Concentrated Samples/ Dirty Samples (only if quartz wool is present)/ Gaseous Samples (also purge & trap, headspace) | Straight  | Straight glass inserts facilitate higher split flows. Narrow bore straight glass inserts facilitate fast GC work. Small injection volumes of less than 0.5 µL are best used with a narrow bore. Narrow bore straight glass inserts improve focussing of gaseous samples (purge, trap & headspace). |

# Glass Insert Deactivation

Every batch of glass inserts are tested for inertness using the EPA 8081B method. This standard method ensures that each batch of glass inserts has less than 3 % Endrin breakdown from a 1 ppm injection.

# Glass Insert for Capillary Column Analysis

Glass insert is very important to prevent the column from being contaminated by sample components. Please choose an appropriate insert according to your system model, injection port and injection method, and exchange it regularly to avoid poor reproducibility and peak shape caused by the crossover of residual samples, etc.

S: Standard; O: Option

| | | P/N | Specification | Nexis GC-2030 | GC-2010 Plus GC-2010 GC-2025 | GC-2014 | GC-17A ver. 1-3 GC-1700 GC-18A | GC-14A GC-14B | GC-8A |
|---|---|---|---|---|---|---|---|---|---|
| | | | Injection Unit → | SPL-2030 | SPL-2010 Plus SPL-2010 SPL-2025 | SPL-2014 | SPL-17 | SPL-14 | SPL-G9 |
| Injection Port Side | Split/Splitless Injection Method: For Split | 221-41444 | (ID 3.5mm; OD 5mm; Length 95mm) | O | O | S | S | | |
| | | 221-41444-01 | (ID 3.5mm; OD 5mm; Length 95mm) | O | S | | O | | |
| | | 221-37574-01 | (99mm) | | | | | S | |
| | | 221-25822-03 | (87mm) | | | | | | S |
| | | 227-35007-01 | (ID 3.4mm; OD 5mm; Length 95mm, Deactivated, with wool, 5pcs) | S | O | O | O | | |
| | For Splitless | 221-48335-01 | (ID 3.5mm; OD 5mm; Length 95mm) | | S | S | O | | |
| | | 221-41544 | (95mm) | | O | O | S | | |
| | | 221-75192 | (ID 3.4mm; OD 5mm; Length 95mm, Deactivated, 5pcs) | | O | O | | | |
| | | 221-32544 | (99mm) | | | | | S | |
| | | 221-25944-03 | (87mm) | | | | | | S |
| | | 227-35008-01 | (ID 3.4mm; OD 5mm; Length 95mm, Deactivated, with wool*2, 5pcs) | S | O | O | O | | |
| | For Split and Splitless | 221-75187 | (ID 3.4mm; OD 5mm; Length 95mm, Deactivated, with wool, 5pcs) | O | O | O | | | |
| | | 221-75188 | (ID 3.4mm; OD 5mm; Length 95mm, Deactivated, needle onto wool, 5pcs) | O | O | O | | | |
| | | 221-75189 | (ID 3.4mm; OD 5mm; Length 95mm, Deactivated, needle into wool, 5pcs) | O | O | O | | | |
| | | 221-75190 | (ID 3.4mm; OD 5mm; Length 95mm, Deactivated, Straight Through, 5pcs) | O | O | O | | | |
| | | 221-75191 | (ID 3.4mm; OD 5mm; Length 95mm, Deactivated, needle into wool, 5pcs) | O | O | O | | | |
| | | 221-75193 | (ID 3.4mm; OD 5mm; Length 95mm, Deactivated, with wool, 5pcs) | O | O | | | | |
| | | 221-75194 | (ID 3.4mm; OD 5mm; Length 95mm, Deactivated, 5pcs) | O | O | | | | |
| | | 221-41444-05 | (ID 3.4mm; OD 5mm; Length 95mm, Deactivated, 5pcs) | | | O | | | |
| | | 221-41544-05 | (ID 2.6mm; OD 5mm; Length 95mm, Deactivated, 5pcs) | | | O | | | |
| | | 221-75195 | (ID 3.4mm; OD 5mm; Length 95mm, Deactivated, with wool, 5pcs) | | | O | | | |
| | | | Injection Unit → | WBI-2030 | WBI-2010 Plus WBI-2010 | WBI-2014 | WBI-17 | | |
| | Direct Injection Method (WBI) | 221-41599 | (95mm) | O | O | O | S | | |
| | | 221-48335-01 | (ID 3.5mm; OD 5mm; Length 95mm) | S | S (WBI-2010) | S | O | | |
| | | 221-75197 | (ID 3.4mm; OD 5mm; Length 95mm, Deactivated, with wool*2, 5pcs) | | O | O | | | |
| | | 221-41599-05 | (ID 2.6mm; OD 5mm; Length 95mm, Deactivated, for 0.53mmID column, 5pcs) | | | O | | | |
| | | P/N | Specification | Nexis GC-2030 | GC-2010 Plus GC-2010 GC-2025 | GC-2014 | GC-17A ver. 1-3 GC-1700 GC-18A | GC-14A GC-14B | GC-8A |
| | | | Injection Unit → | SPL-2030 | SPL-2010 Plus | SPL-2014 | SPL-17 | SPL-14 | SPL-G9 |
| | For SPME | 221-75196* | (ID 0.75mm; OD 5mm; Length 95mm, Deactivated, 5pcs ) | O | O | O | | | |
| | For HS 10 | 221-76863-73 | (ID 1.2mm; OD 5mm, Length 95mm, Deactivated, 5pcs) | S | S | S | | | |
| | WBC Attachment | 221-38107 *1 | (139mm) | | | S | | S | |
| | | 221-39148 | (86 mm) | | | | | | S |

*1 Required if the WBC Attachment is used for a packed column injection in GC-2014, Insert for GC-14 septum purge unit is P/N: 221-38151-04
*2 Wool is 25mm from the top of insert.
* Can be used for AOC-6000 SPME

# Glass Insert for Capillary Column Analysis

S: Standard; O: Option

| | | | Injection Unit –› | WBI-2030 | WBI-2010 Plus WBI-2010 | WBI-2014 | WBI-17 | SPL-14 | SPL-G9 |
|---|---|---|---|---|---|---|---|---|---|
| For CLH-14 | Injection Port Side | 221-32998-01 | (123mm) | | | | | S | |
| For CLH-14 | Detector Side | 221-33000 | (71mm) | | | | | S | |
| For CLH-800 | Injection Port Side | 221-18384-04 | (78mm, for split injection method) | | | | | | S |
| For CLH-800 | Detector Side | 221-18756-02 | (78mm) | | | | | | S |

# Glass Insert for OCI / PTV

S: Standard; O: Option

| | P/N | Injection Unit –› | Nexis GC-2030 | GC-2010 / GC-2010 Plus | GC-17 |
|---|---|---|---|---|---|
| | | | OCI-2030 | OCI/PTV-2010 *1 | OCI/PTV-17 *2 |
| Simple On-column Injection Method | 221-49381-01 | | O | O | |
| Simple On-column Injection Method | 221-49381-02 | (deactivated) | O | O | |
| | P/N | Specification / Injection Unit –› | PTV-2030 | OCI/PTV-2010*1 | OCI/PTV-17*2 |
| PTV Injection Method | 221-42223 | | | | S |
| PTV Injection Method | 221-49300 | (ID 1.5mm; OD 3.5mm; Length 95mm, quartz) | S | S | |
| PTV Injection Method | 221-74830-09 | (for AOC-MEPS™ system, deactivated, with wool, 5 pcs) | O | O | |

*1 GC-2010 OCI requires an additional adapter (P/N: 221-49298-91).
*2 GC-17 OCI requires an additional adapter (P/N: 221-42222-91).

# Glass Insert for Packed Column Analysis

When using a glass column, one may add a glass insert to prevent the column from accumulating non-volatile components. Please choose a proper insert according to the inter diameter of the glass column.

When using a stainless column, it is necessary to connect a glass insert to a 3.0 mmID column at the side of the injection unit. Please exchange it regularly to avoid poor reproducibility and peak shape caused by the crossover of residual sample, etc.

Note: Glass insert cannot be used in a GC-8A Series instrument when using glass columns.

S: Standard; O: Option

| | P/N | Specification | GC-2014 | GC-17A ver. 1-3 | GC-14A/B |
|---|---|---|---|---|---|
| Injection Port Side | 221-41484 | | | O | |
| Injection Port Side | 221-14093 | (for 3.0 mmID column) | S | | S |
| Injection Port Side | 221-14093-84 | (for 3.0 mmID column, 5 pcs) | O | | O |
| Injection Port Side | 221-14094 | (for 2.6 mmID column) | S | | S |
| Injection Port Side | 221-14094-84 | (for 2.6 mmID column, 5 pcs) | O | | O |

* GC for packed column analysis includes one insert for a 3.0 mmID column and one insert for a 2.6 mmID column as standard accessories.

# Ferrules

Ferrules are available in a variety of different materials, shapes and sizes depending on their use, the instrument and the size of the capillary column being used. Probably the most important but difficult aspect of choosing a ferrule is the selection of the material type. The table below will help you choose the appropriate ferrule material for your application.

**When choosing ferrules ensure you consider the following:**

1) The material that best suits your application.
2) The connection type you want.

The following selection table will assist with your decision.

| Ferrule Material Type | Graphite | Graphite Vespel® | SilTite™ Metal | ClickTek Ferrule |
|---|---|---|---|---|
| | | | | |
| Features | • Easy to use.<br>• Forms a stable seal.<br>• Soft material.<br>• Porous to oxygen.<br>• Can be reused.<br>• Forms a soft grip with capillary column.<br>• Low emissions. | • A composite of graphite and Vespel®.<br>• Mechanically robust.<br>• Hard material, long lifetime.<br>• Forms a strong grip with capillary column.<br>• Cannot be reused with another capillary column.<br>• Requires re-tightening. | • Specifically developed to overcome the problems associated with the use of 100% graphite and composite ferrules.<br>• Strong seal on capillary columns.<br>• Leak free - The ferrule and nut expand and contract at the same rate eliminating any chance of leaks with temperature cycling.<br>• Nut does not need re-tightening after initial temperature cycles. | • Easy to use<br>• Leak free<br>• Specially designed to use with ClickTek Connector on Nexis GC-2030<br>• Cannot be reused with another capillary column<br>• Not suitable for stainless steel column |
| Suitable Uses | • Column to injector connection.<br>• Non-mass spectrometer detectors (FID, TCD, FTD, FPD, ECD, BID). | MS interfaces, although even with a good seal will leak air compared to SilTite™ ferrules. | Ideal for MS interfaces and advanced flow technology due to leak-free | • Column to injector connection<br>• Non-mass spectrometer detectors (FID, TCD, FTD, FPD, ECD, BID). |
| Not Suitable For | Connecting columns to mass spectrometers, as porous to oxygen. | High temperature applications. | – | – |
| Risks | • Can leave residue inside your column.<br>• Can extrude into the injector or detector if it is over-tightened. | If not re-tightened after installation and temperature cycles of the GC, air may enter the column or detector decreasing sensitivity of the analysis and possibly degrading the column as well as components of the system. | Over-tightening of the seal can introduce leaks into the system. Follow the recommended installation instructions to avoid this problem. | – |
| Operating Temperature | Upper limit of 450 °C | Upper limit of 325 °C | No temperature limit in GC use. | – |

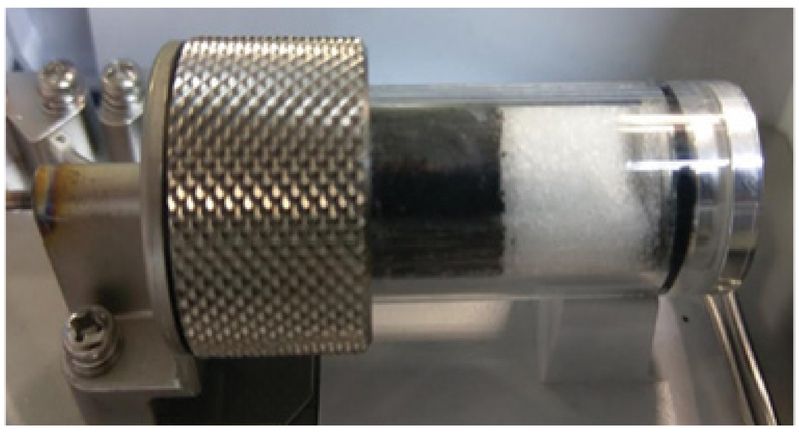
| Description | Specification | P/N |
|---|---|---|
| Graphite Ferrule (10 pcs) | For 5 mmOD packed columns | 221-75182 |
| Graphite Ferrule (10 pcs) | For 0.25 - 0.32 mmID columns | 227-35006-01 |
| Graphite Ferrule (10 pcs) | For 0.53 mmID columns | 227-35009-01 |
| Graphite Vespel® Ferrule (10 pcs) | No hole | 670-15003-01 |
| Graphite Vespel® Ferrule (10 pcs) | For 0.32 mmID columns | 670-15003-04 |
| Graphite Vespel® Ferrule (10 pcs) | For 0.53 mmID columns | 670-15003-07 |
| Graphite Vespel® Ferrule (10 pcs) | For 0.05 - 0.25 mmID columns | 670-15003-03 |
| SilTite™ Metal Ferrule (10 pcs) | For 0.05 - 0.25 mmID columns | 221-72563-04 |
| SilTite™ Metal Ferrule (10 pcs) | For 0.32 mmID columns | 221-72563-05 |
| SilTite™ Metal Ferrule (10 pcs) | For 0.53 mmID columns | 221-72563-08 |
| SilTite™ Metal Ferrule (10 pcs) | For 1/32" ID columns | 221-75200-04 |
| SilTite™ Kit (10 pcs ferrules, 2 pcs nuts) | For 0.05 - 0.25 mmID columns | 221-75200 |
| SilTite™ Kit (10 pcs ferrules, 2 pcs nuts) | For 0.32 mmID columns | 221-75200-01 |
| SilTite™ Kit (10 pcs ferrules, 2 pcs nuts) | For 0.53 mmID columns | 221-75200-02 |
| SilTite™ Kit (10 pcs ferrules, 2 pcs nuts) | For 1/32" ID columns | 221-75200-03 |
| SilTite™ Nut 10/32" 0.8 mm ID Column (5 pc) | – | 221-75186 |
| ClickTek Ferrule Kit | Narrow bore 0.43, includes 6 ferrules and prefixing tool (for 0.05 - 0.25 mmID columns) | 221-81162-01 |
| ClickTek Ferrule Kit | Middle bore 0.50, includes 6 ferrules and prefixing tool (for 0.32 mmID columns) | 221-81162-02 |
| ClickTek Ferrule Kit | Wide bore 0.73, includes 6 ferrules and prefixing tool (for 0.53 mmID columns) | 221-81162-03 |
| ClickTek Ferrule | No Hole (for blinding) | 221-81162-00 |

| Other Accessories | |
|---|---|
| Description | P/N |
| Capillary Ceramic Tube Cutter (3 pc) | 221-75181 |
| Stainless Steel Nut/ SSNE-16-012S (Pk 5) | 670-11009 |
| O-ring for insert, Max. Temp. 350 °C (10pcs) | 227-35005-01 |
| Filter for split, for Nexis GC-2030 | 221-77580-42 |

*O-ring for insert*

*Capillary Ceramic tube cutter*

*Stainless Steel Nut*



*Filter for split, for Nexis GC-2030*

# Septums

## Injection Port Septum

| Description | P/N | Color | Description |
|---|---|---|---|
| Standard type (20 pcs) | 201-35584 | White | • General-purpose septum<br>• Maximum temperature (INJ setting temperature): 250 °C |
| LL Septum (long life type, 20 pcs) | 221-48972-91 | Blue | Provides significant durability improvements compared to a conventional low-bleed septum, offering both low bleed and long life.<br><br>The problem of sticking to the vaporizing chamber during continuous use at high temperatures experienced with a conventional septum has also been eliminated.<br><br>• Suitable for high-sensitivity analysis<br>• Maximum temperature (INJ setting temperature): 450°C |
| HT Septum (high temp type, 20 pcs) | 221-48398-91 | Brown | Using this septum alleviates the problem of reduced durability when the vaporizing chamber is used continuously at 450°C. Compared to the LL septum, the increase in bleed when used at high temperatures is kept at a lower level.<br><br>The problem of sticking to the vaporizing chamber during continuous use at high temperatures experienced with a conventional septum has also been eliminated.<br><br>• Suitable for high-sensitivity analysis at high temperatures<br>• Maximum temperature (INJ setting temperature): 450°C |
| Low-bleed Septum (25 pcs) | 221-76650-01 | Green | This septum is least influenced by a plasticizer. Better prevents septum coring &<br><br>• Low-bleed, suitable for high-sensitivity analysis<br>• Maximum temperature (INJ setting temperature): 340°C |
| Enduro Blue Septum (50 pcs) | 221-75180 | Light Blue | • Low-bleed, suitable for high-sensitivity analysis at high temperatures<br>• Maximum temperature (INJ setting temperature): 350°C |
| Premium Green Septa (50 pcs) | 227-35004-01 | Light green | • Low bleed, highly robust (max. usable temp. 350°C)<br>• High durability, proper sealing and good resistance to most chemical solvents.<br>• Useful for trace analysis and other applications where high sensitivity is critical |
| Perforated septum for HS-10 | 221-76863-96 | White | • For HS-10 only<br>• To ensure cleanliness and inertness<br>• Maximum temperature (INJ setting temperature): 250 °C |

Low-bleed septum is not completely free of bleeding. The type of bleeding that occurs varies with the septum, and results in different patterns on chromatograms. In the case of high-sensitivity analysis, it is necessary to select a septum whose bleeding will not occur at a point that interferes with the peak of the target compound. Conditioning for several hours between 200°C and 250°C after extraction with hexane may help to reduce bleeding.

In the case of using a syringe for AOC, it is recommended to exchange the septum after about 100 injections. If the outside diameter of a needle of a gastight syringe is thick, it is recommended to exchange after about 50 injections.

# Shimadzu SPME Arrow

Ferrules are available in a variety of different materials, shapes and sizes depending on their use, the instrument and the size of the capillary column being used. Probably the most important but difficult aspect of choosing a ferrule is the selection of the material type. The table below will help you choose  the appropriate ferrule material for your application.

## Features:

- Each SPME Arrow is equipped with its unique Smart chip containing parameters, ranges and usage history.
- Automatic application of the correct parameters for the individual Smart Arrow.
- Color Code for easy optical identification of coating type and thickness
- Rugged stainless-steel construction ensures longer lifetimes.
- Faster extraction means higher sample throughput.
- Better sensitivity allows lower LODs.

The table below shows the dimension of a Shimadzu SPME Arrow 1.5 mm (a), 1.1 mm (b) and a SPME Fiber (c) in comparison:

| | | Sorption Phase Surface | Sorption Phase Volume |
|---|---|---|---|
| a | | 62.8 m² | 11.8 µL |
| b | | 44.0 m² | 3.8 µL |
| c | | 9.4 m² | 0.6 µL |

| Stationary Phase | Color Code | Thickness (µm) | O.D. (mm) | Analytes | Set of 1 Part Number | Set of 3 Part Number | Set of 5 Part Number |
|---|---|---|---|---|---|---|---|
| Acrylate (Polyacrylate) | Grey | 100 | 1.1 | Polar, semivolatile, 80–300 g/mol | 227-35301-01*^ | 227-35301-03 | 227-35301-05 |
| Carbon WR/PDMS (Carbon Wide Range) | Light Blue | 120 | 1.1 | Highly volatile, 30–225 g/mol | 227-35302-01*^ | 227-35302-03 | 227-35302-05 |
| | | | 1.5 | | 227-35306-01 | 227-35306-03 | 227-35306-05 |
| PDMS (Polydimethylsiloxane) | Red | 100 | 1.1 | Volatile, 60–275 g/mol | 227-35305-01*^ | 227-35305-03 | 227-35305-05 |
| | | | 1.5 | | 227-35309-01 | 227-35309-03 | 227-35309-05 |
| | Black | 250 | 1.5 | Volatile, 60–275 g/mol (high capacity) | 227-35310-01* | 227-35310-03 | 227-35310-05 |
| DVB/PDMS (Divinylbenzene) | Violet | 120 | 1.1 | Amines and polar compounds, 60–300 g/mol | 227-35303-01*^ | 227-35303-03 | 227-35303-05 |
| | | | 1.5 | Aromatic semi-volatile, 60–300 g/mol | 227-35308-01 | 227-35308-03 | 227-35308-05 |
| DVB/Carbon WR/PDMS (Divinylbenzene) | Dark Grey | 120 | 1.1 | Volatile and semi-volatile, 40–275 g/mol | 227-35304-01^ | 227-35304-03 | 227-35304-05 |
| | | | 1.5 | | 227-35307-01 | 227-35307-03 | 227-35307-05 |
| Shimadzu SPME Arrow Selection5-Set1 Set of 5; includes 1pc of each type listed above with a * | | | | | | | 227-35311-01 |
| Shimadzu SPME Arrow Selection5-Set2 Set of 5; includes 1pc of each type listed above with a ^ | | | | | | | 227-35312-01 |

All Shimadzu SPME Arrows have a phase length of 20mm bonded onto stainless steel.
Recommended maximum GC inlet pressure is 50 psi or less.

# Shimadzu SPME Arrow glass insert

| Part number | Inner diameter (mm) | Injection method | GC Model | Pack size |
|---|---|---|---|---|
| 227-35327-03 | 1.3 | Split/Splitless | 2010 | 3 |
| 227-35328-03 | 1.7 | Split/Splitless | 2010 | 3 |

# Shimadzu SPME Fiber

SPME is a very effective way of automated sample preparation. It is used for extracting organics from a matrix (solid, liquid or gaseous) into a stationary phase immobilized on a fiber. The analytes are thermally desorbed directly in the injector of a gas chromatograph.

Shimadzu SPME fibers are suitable for a wide range of analyte chemistries and sample matrices. Choose the best SPME fiber for your application based on the properties of your target compounds.

## Typical Applications:

- Trace analysis in food
- Drugs and pharmaceuticals
- Herbicides/pesticides
- Medical diagnostics
- Organics in water
- Trace impurities in polymers and solid samples
- Solvent residues in raw materials

| Stationary Phase | Color Code | Thickness (µm) | Analytes | Set of 1 Part Number | Set of 3 Part Number | Set of 5 Part Number |
|---|---|---|---|---|---|---|
| PDMS (Polydimethylsiloxane) | Green | 7 | Non-polar, 125 - 600 g/mol | 227-35313-01* | 227-35313-03 | 227-35313-05 |
| | Gold | 30 | Non-polar semi-volatiles, 80 – 500 g/mol | 227-35314-01* | 227-35314-03 | 227-35314-05 |
| | Red | 100 | Volatiles, 60 – 275 g/mol | 227-35315-01*^ | 227-35315-03 | 227-35315-05 |
| DVB/Carbon WR/PDMS (Divinylbenzene) | Dark grey | 80 | Volatile and semi-volatile, 40-275 g/mol | 227-35316-01^ | 227-35316-03 | 227-35316-05 |
| DVB/PDMS (Divinylbenzene) | Violet | 65 | Aromatic, semi-volatile, 50-300 g/mol | 227-35317-01^ | 227-35317-03 | 227-35317-05 |
| Carbon WR/PDMS (Carbon Wide Range) | Dark Blue | 95 | Gases and low molecular weight compounds, 30 – 225 g/mol | 227-35318-01*^ | 227-35318-03 | 227-35318-05 |
| Acrylate (Polyacrylate) | Grey | 85 | Polar semi-volatiles, 80 -300 g/mol | 227-35319-01*^ | 227-35319-03 | 227-35319-05 |
| Shimadzu SPME Fiber Selection5-Set1<br>Set of 5; includes 1pc of each type listed above with a * | | | | | | 227-35320-01 |
| Shimadzu SPME Fiber Selection5-Set1<br>Set of 5; includes 1pc of each type listed above with a ^ | | | | | | 227-35321-01 |

All Shimadzu SPME fibers have a phase length length of 10 mm, gauge 23 and the core material is fused silica.
They can be used for a wide range of GC injector models. Recommended maximum GC inlet pressure is 50 psi or less.

# Shimadzu SPME Fiber Glass Insert

| Part number | Inner diameter (mm) | Injection method | GC Model | Pack size |
|---|---|---|---|---|
| 227-35322-01 | 0.8 | Split/Splitless | 2010 | 1 |
| 227-35322-03 | | Split/Splitless | 2010 | 3 |

CoreFocus
SHIMADZU

# Gas Filtration

# Gas Filtration

## Ensuring a Super-Clean Analytical Journey

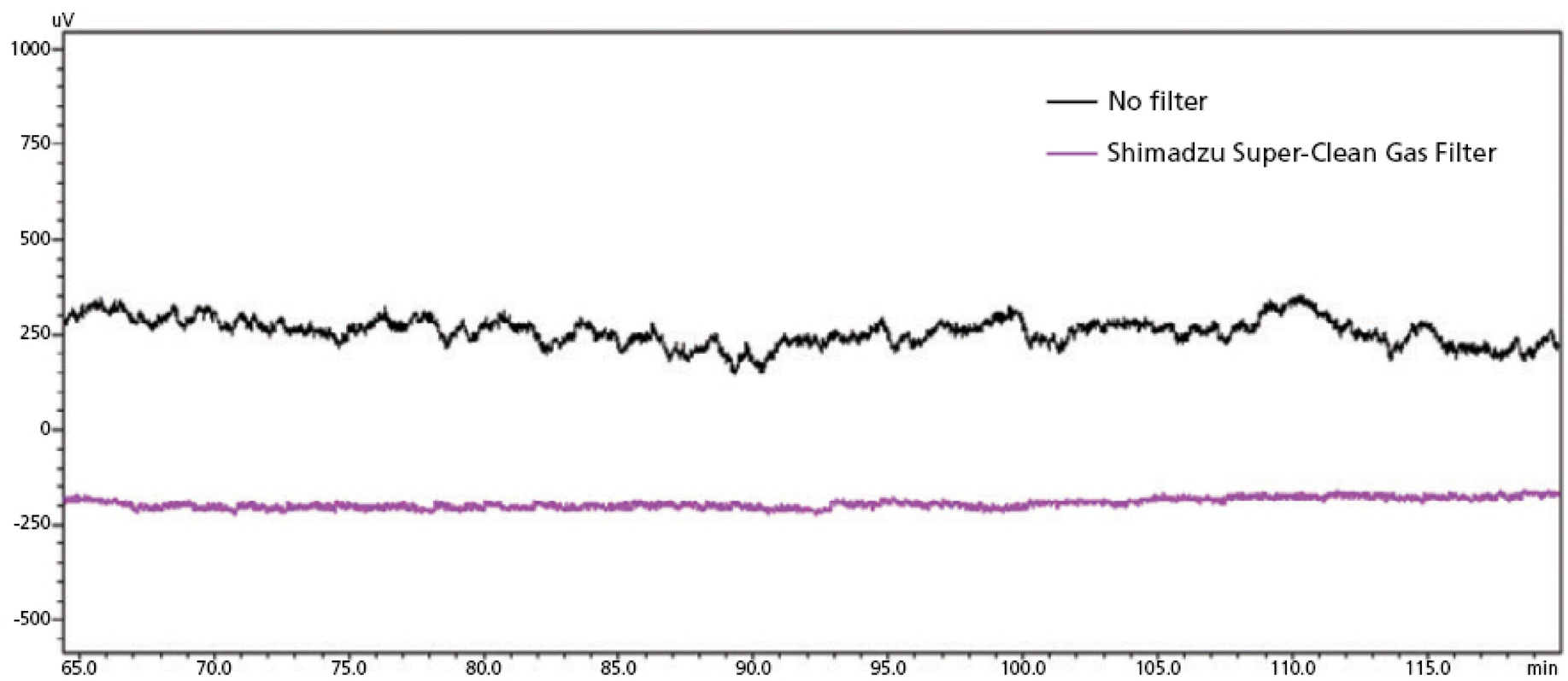
Impurities in gases, such as hydrocarbons, moisture and oxygen, can contaminate the gas line and instrument, cause column degradation and affect the accuracy of your analysis results, which may lead to instrument downtime. Even though high-purity gases are used, contaminants may result from pressure regulators or other parts of the gas line. Therefore, an additional gas filter is essential.

Introducing the *Shimadzu Super-Clean Gas Filter!*

Example of Shimadzu Gas Filter Kit for GC-FID

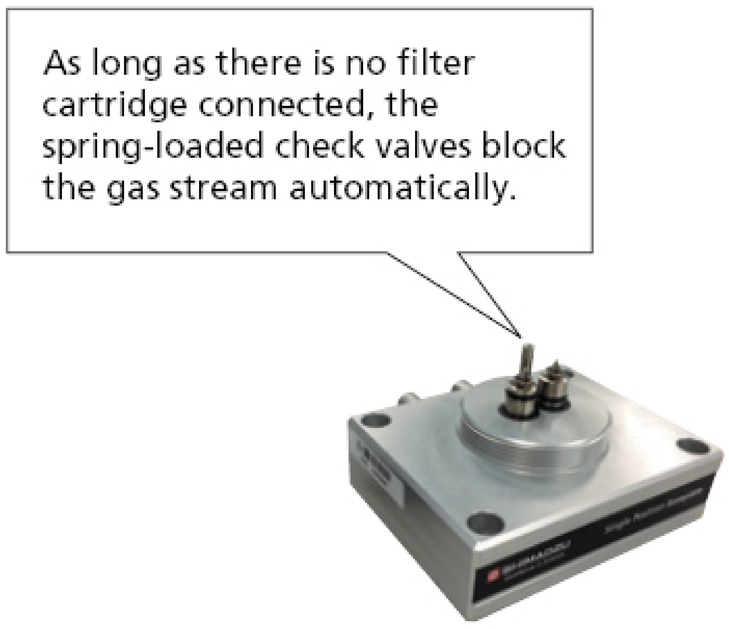
## Ensure High-purity Gas

The Shimadzu Super-Clean Gas Filter can remove the impurities (hydrocarbons, moisture and oxygen) and outlet 99.9999% pure gas. The use of high-purity and contaminant-free gases reduces column degradation, prevents ghost peaks and baseline fluctuations, eliminates excessive detector noise, and keeps your instrument in good working performance.




Using the Shimadzu Super-Clean Gas Filter results in significantly lower detector noise.

## Easy and Leak-tight Replacement



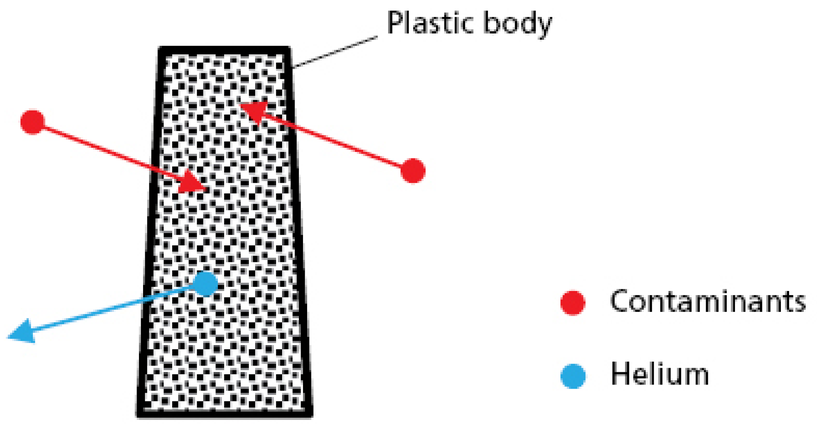
Installing the filter

The design of the Shimadzu Super-Clean Gas Filter makes it possible to replace filter cartridges quickly and easily without any tools. Spring-loaded check valves seal when a cartridge is removed and open only when a new cartridge has been locked in place, which prevents contamination of the system during the replacement process.

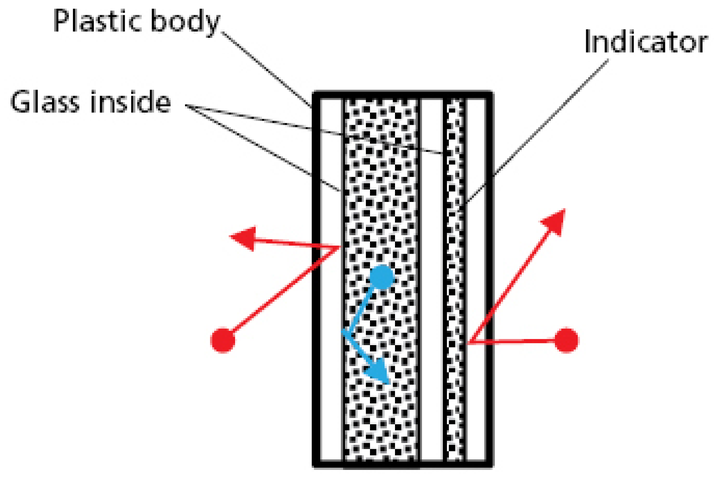
Swagelok connector can be connected directly to the Shimadzu gas supply pipe, ensuring a leak free and completely clean gas line

## Unique Body Design

A plastic body helps with checking the indicators and replacing the filter cartridges. However, it also allows contaminants to diffuse into the instrument and cause helium to leak. To address this issue, the Shimadzu Super-Clean Gas Filter has been designed to pack the absorbents in glass inside the plastic body, thereby preventing diffusion.




Other filter with plastic body




Shimadzu Super-Clean Gas Filter

## Easy-to-read Indicator

The Shimadzu Super-Clean Gas Filter is designed with an easy-to-read indicator. It changes color when the absorbent is saturated, indicating when filter cartridges should be replaced.

Before using

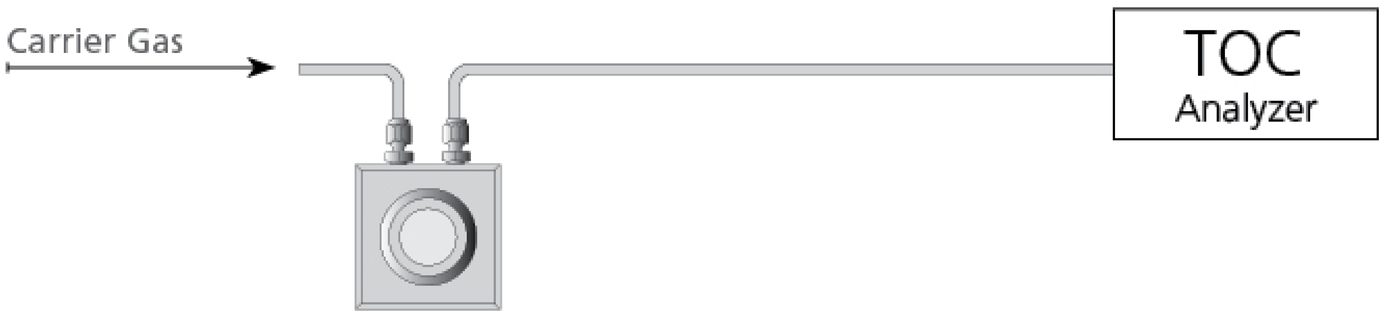
If absorbent is saturated, the indicator changes color

# Connection Diagrams

## GC / MS (ITD/MSD)

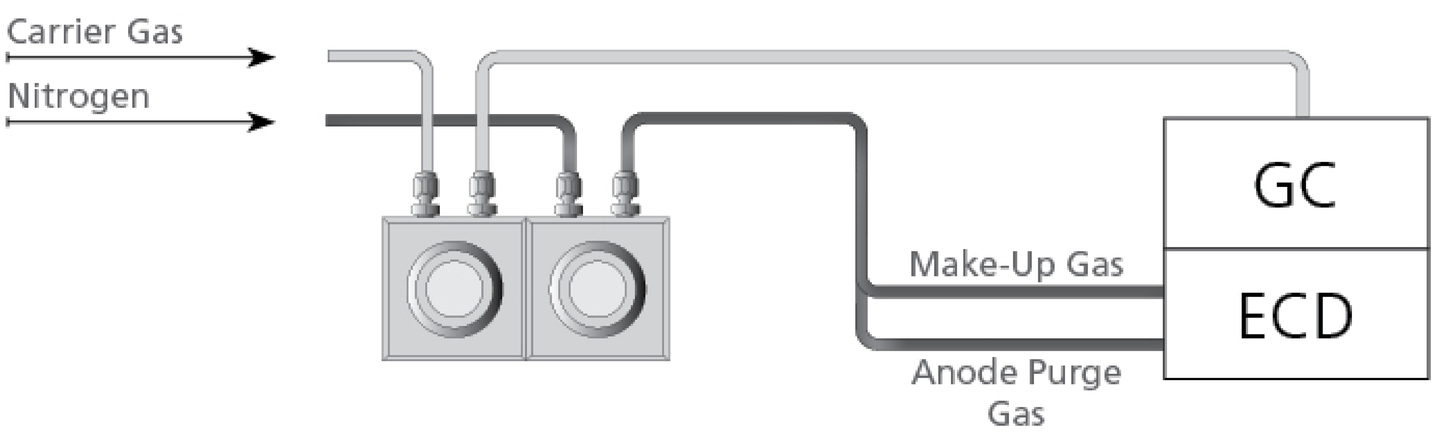
| Product | Part No. | Qty |
|---|---|---|
| Triple Filter | 226-50751-00 | 1 |
| 1 Position Base plate | 226-50771-00 | 1 |
| Kit Part Number | 226-50710-00 | |

## TOC Analyzer




| Product | Part No. | Qty |
|---|---|---|
| $CO_2$ / Moisture Filter | 226-50759-00 | 1 |
| 1 Position Base plate | 226-50771-00 | 1 |
| Kit Part Number | 226-50779-00 | |

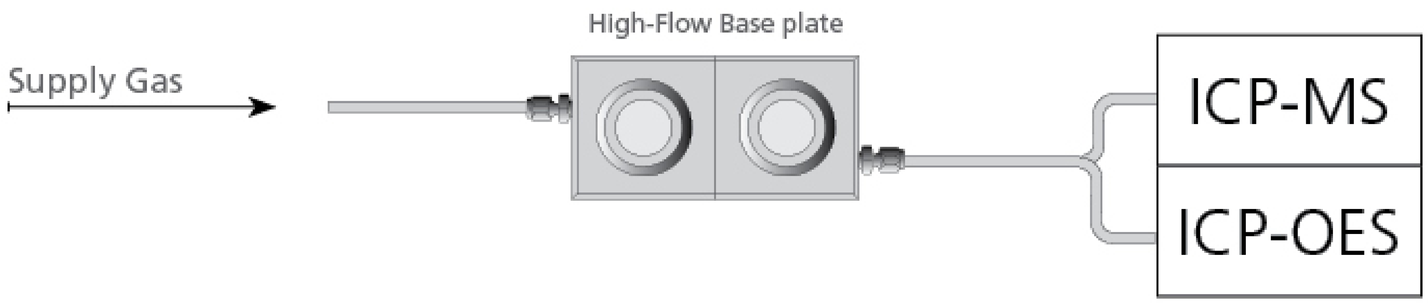
## GC / ECD




| Product | Part No. | Qty |
|---|---|---|
| Triple Helium Filter | 226-50752-00 | 1 |
| Oxygen/Moisture Filter | 226-50758-00 | 1 |
| 2 Position Base plate | 226-50772-00 | 1 |
| Kit Part Number | 226-50780-00 | |

## ICP-OES / ICP-MS

Plasma Gas = Nebulizer Gas

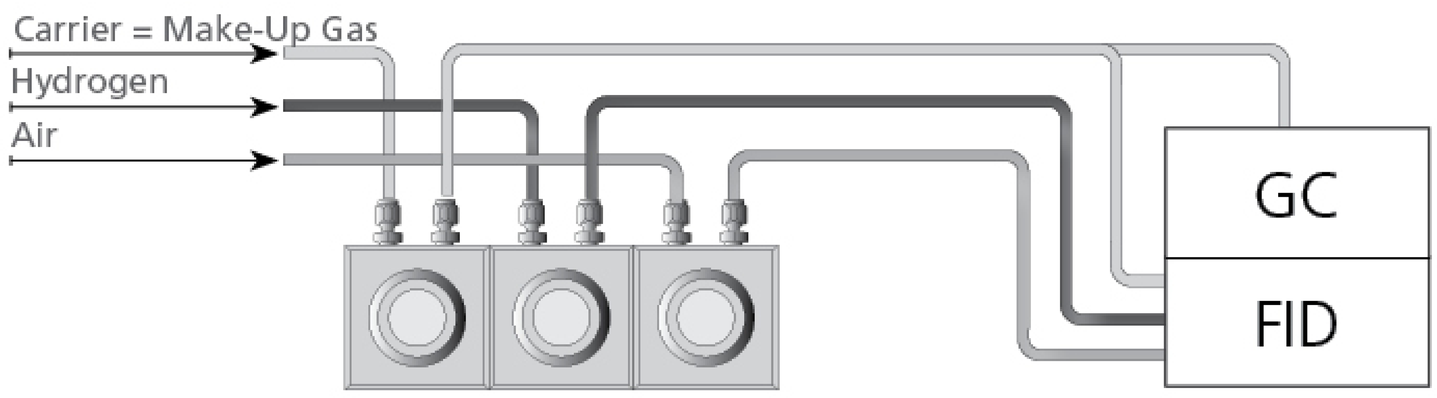



| Product | Part No. | Qty |
|---|---|---|
| High Flow Oxygen/Moisture Filter Bundle | 226-50766-00 | 1 |
| ICP-MS Base plate | 226-50776-00 | 1 |
| Kit Part Number | 226-50767-00 | |

# Connection Diagrams

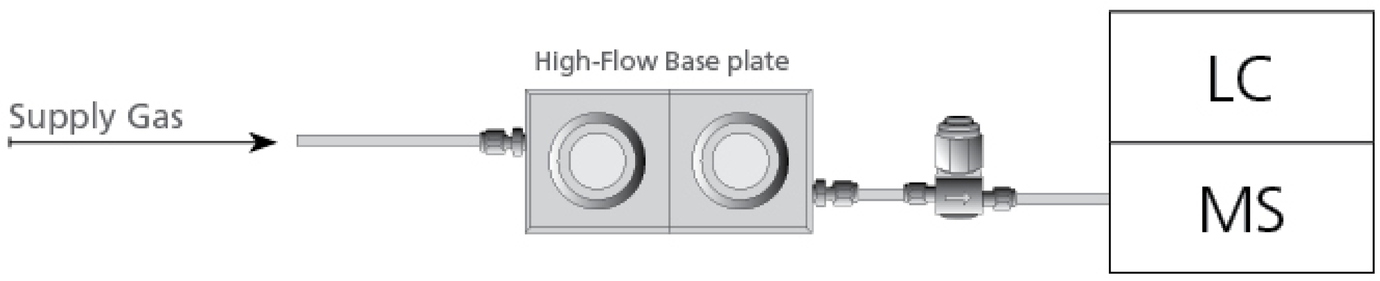
## GC / FID

GC/FID Solution 2 (Carrier Gas = Make-Up Gas)

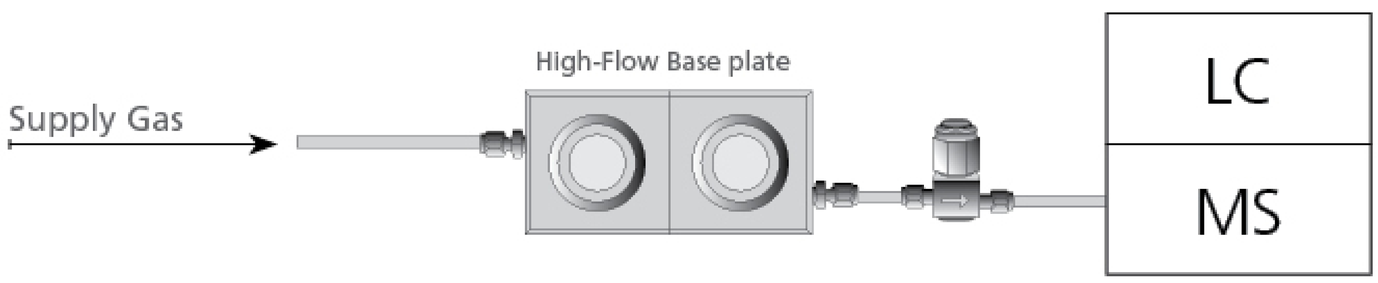



| Product | Part No. | Qty |
|---|---|---|
| Triple Filter | 226-50751-00 | 1 |
| Hydrocarbon/ Moisture Filter | 226-50750-00 | 2 |
| 3 Position Base plate | 226-50773-00 | 1 |
| Kit Part Number | 226-50730-00 | |

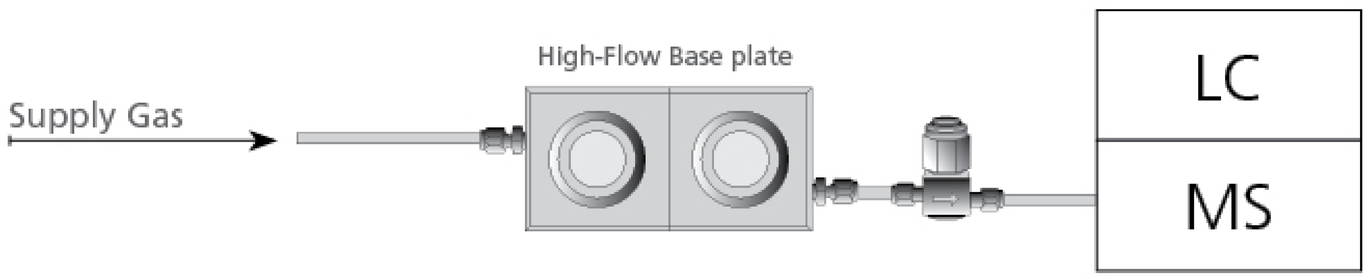
## LC/MS




| Product | Part No. | Qty |
|---|---|---|
| High Flow Hydrocarbon Filter Bundle | 226-50760-00 | 1 |
| Particle Filter | 226-50794-01 | 1 |
| High Flow Base plate | 226-50775-01 | 1 |
| Kit Part Number | 226-50720-00 | |



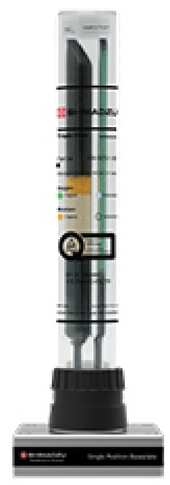

| Product | Part No. | Qty |
|---|---|---|
| High Flow Moisture Filter Bundle | 226-50762-00 | 1 |
| Particle Filter | 226-50794-01 | 1 |
| High Flow Base plate | 226-50775-01 | 1 |
| Kit Part Number | 226-50722-00 | |




| Product | Part No. | Qty |
|---|---|---|
| High Flow Hydrocarbon/ Moisture Filter Bundle | 226-50764-00 | 1 |
| Particle Filter | 226-50794-01 | 1 |
| High Flow Base plate | 226-50775-01 | 1 |
| Kit Part Number | 226-50724-00 | |

# Installation Kits

| Catalog No. | 226-50710-00<br>226-50712-00 (Helium) |
|---|---|
| **Usable for** | **Benefit** |
| GC/MS | Higher data accuracy and less maintenance |
| GC/TCD | Greater sensitivity and less maintenance |



## GC/MS TRIPLE FILTER KIT

The triple combination filter kit is ideal for purifying GC/MS carrier gases. It contains oxygen, moisture and hydrocarbon scrubbers in one easy to change economical cartridge

| Catalog No. | 226-50779-00 |
|---|---|
| **Usable for** | **Benefit** |
| TOC Analyzer | Greater sensitivity |
| Zero-Air generator | Cleaner gas |

## TOC CO2/MOISTURE FILTER KIT

The carbon dioxide/moisture combination filter kit is ideal for TOC analysers and Zero-Air generators. It removes both carbon dioxide and moisture from gas streams.

| Catalog No. | 226-50780-00 |
|---|---|
| **Usable for** | **Benefit** |
| GC/ECD | Greater sensitivity |

## GC/ECD FILTER KIT

Removes oxygen, moisture and hydrocarbons from the carrier gas and removes moisture and oxygen from the make-up and purge gas.

| Catalog No. | 226-50767-00 |
|---|---|
| **Usable for** | **Benefit** |
| ICP-MS | Greater sensitivity |
| ICP-OES | Greater sensitivity |

## ICP-MS MOISTURE/OXYGEN FILTER KIT

Removes Oxygen and Moisture from gas streams.

# Installation Kits

| Catalog No. | 226-50730-00 |
|---|---|
| **Usable for** | **Benefit** |
| GC/FID | Greater sensitivity |

## FID 3 POSITION KIT

The FID Filter kit is the perfect all-in-one solution for purifying flame ionization detector (FID) fuel gases together with the carrier gas.
This kit removes hydrocarbons, moisture and oxygen from the carrier gas and removes both moisture and hydrocarbons from the Hydrogen and Air fuel gases.

| Catalog No. | 226-50720-00 |
|---|---|
| **Usable for** | **Benefit** |
| LC/MS | Greater sensitivity |

## LC/MS HYDROCARBON KIT

Up to 20 L/min. of hydrocarbon-free nitrogen per minute with this LC/MS High Flow Kit

| Catalog No. | 226-50722-00 |
|---|---|
| **Usable for** | **Benefit** |
| LC/MS | Greater sensitivity |

## LC/MS MOISTURE KIT

Up to 20 L/min. of moisture-free nitrogen per minute with this LC/MS High Flow Kit

| Catalog No. | 226-50724-00 |
|---|---|
| **Usable for** | **Benefit** |
| LC/MS | Greater sensitivity |

## LC/MS COMBI (HYDROCARBON/MOISTURE) KIT

Removes Moisture and Hydrocarbons from high flow gas streams.

## Replacement Filters

| Replacement Filter for | GC/MS Triple Filter Kit (226-50710-00) |
|---|---|
| Catalog No. | 226-50751-00<br>226-50752-00 (Helium)<br>226-50752-10 (Hydrogen) |

### GC/MS TRIPLE (OXYGEN/MOISTURE/ HYDROCARBON) FILTER

The Triple trap is ideal for purifying carrier gas. It contains oxygen, moisture and hydrocarbon scrubbers in one easy to change economical cartridge

| Capacity | |
|---|---|
| $H_2O$ | 1.8 g |
| $O_2$ | 75 mL |
| HC | 4 g (as n-butane) |

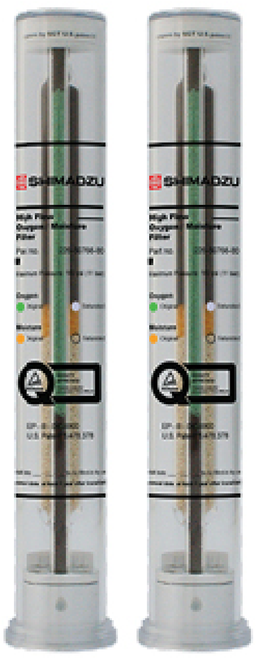
| Replacement Filter for | TOC $CO_2$/Moisture Filter Kit (226-50779-00) |
|---|---|
| Catalog No. | 226-50759-00 |

### TOC COMBI (CARBON DIOXIDE/ MOISTURE) FILTER

Removes carbon dioxide and moisture from gas streams.

| Capacity | |
|---|---|
| $H_2O$ | 3.5 g |
| $CO_2$ | 6 g |

| Replacement Filters for | ICP-MS Moisture/Oxygen Filter Kit (226-50767-00) |
|---|---|
| Catalog No. | 226-50766-00 |

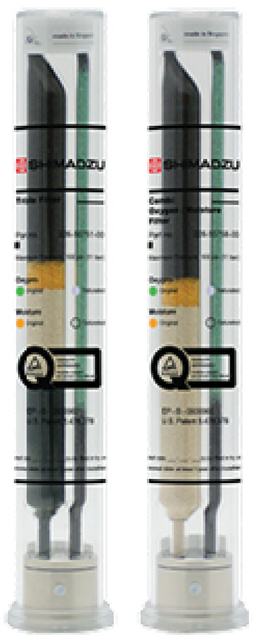


### ICP-MS COMBI (OXYGEN/MOISTURE) FILTER BUNDLE

Removes Oxygen and Moisture from the ICP-MS supply gas stream. To be used in combination with a high flow ICP-MS base plate.

| Capacity | |
|---|---|
| $H_2O$ | 7.2 g |
| $O_2$ | 150 mL |

| Replacement Filters for | GC/ECD Filter Kit (226-50780-00) |
|---|---|
| Catalog No. | 226-50781-00<br>includes:<br>(1) 226-50752-00 and<br>(1) 226-50758-00 |



### GC/ECD FILTER BUNDLE

Removes oxygen, moisture and hydrocarbons from the carrier gas and removes moisture and oxygen from the make-up and purge gas.

| Capacity | |
|---|---|
| $H_2O$ | 1.8 g / 3.5 |
| $O_2$ | 75 mL / 75 mL |
| HC | 4 g (as n-butane) |

# Replacement Filters

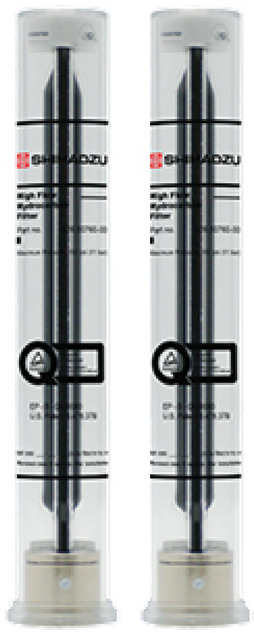
| | |
|---|---|
| **Replacement Filter for** | FID 3 Position Filter Kit (226-50730-00) |
| **Catalog No.** | 226-50761-00 includes: (1) 226-50751-00 and (2) 226-50750-00 |

## FID FILTER BUNDLE OF 3

Removes Oxygen and Moisture from high flow gas streams. To be used in combination with a high flow base plate.

| Capacity | |
|---|---|
| $H_2O$ | 7.2 g |
| $O_2$ | 150 mL |

| | |
|---|---|
| **Replacement Filter for** | LC/MS Hydrocarbon Filter Kit (226-50720-00) |
| **Catalog No.** | 226-50760-00 |



## LC/MS HIGH FLOW HYDROCARBON FILTER BUNDLE

Up to 20 L/min. of hydrocarbon-free nitrogen per minute. To be used in combination with a high flow base plate.

| Capacity | |
|---|---|
| HC | 24 g (as n-butane) |

| | |
|---|---|
| **Replacement Filters for** | LC/MS Moisture Filter Kit (226-50722-00) |
| **Catalog No.** | 226-50762-00 |

## LC/MS HIGH FLOW MOISTURE FILTER BUNDLE

Removes moisture from high flow gas streams. To be used in combination with a high flow base plate.

| Capacity | |
|---|---|
| $H_2O$ | 14.4 g |

| | |
|---|---|
| **Replacement Filters for** | LC/MS Combi (hydrocarbon/moisture) Filter Kit (226-50724-00) |
| **Catalog No.** | 226-50764-00 |

## LC/MS HIGH FLOW COMBI (HYDROCARBON/ MOISTURE) FILTER BUNDLE

Removes Moisture and Hydrocarbons from high flow gas streams. To be used in combination with a high flow base plate.

| Capacity | |
|---|---|
| HC | 12 g (as n-butane) |
| $H_2O$ | 7.2 g |

# Gas Filtration

## Single Filters

| Catalog No. | 226-50754-00 |
|---|---|
| **Specifications** | |
| Outlet Gas Quality (%) | > 99.9999 |
| Maximum Pressure | 11 bar (160 psi) |
| Maximum Flow | 7 L/min. |
| Usable For | Inert carrier gas, He, H2, N2, AR, Air |
| Dimensions | 24 cm x Ø 4.4 cm |
| Weight | 0.26 Kg |
| Estimated Lifetime | > 2 years |

### MOISTURE FILTER

Moisture in carrier gas lines will prematurely degrade oxygen and hydrocarbon traps and increase detector noise. As a precaution, we higly recommend installing a moisture trap before the hydrocarbon and oxygen traps on all carrier gas lines.

| Capacity | |
|---|---|
| $H_2O$ | 7.2 g |

| Catalog No. | 226-50755-00 |
|---|---|
| **Specifications** | |
| Outlet Gas Quality (%) | > 99.9999 |
| Maximum Pressure | 11 bar (160 psi) |
| Maximum Flow | 7 L/min. |
| Usable For | Inert carrier gas, He, H2, N2, AR |
| Dimensions | 24 cm x Ø 4.4 cm |
| Weight | 0.26 Kg |
| Estimated Lifetime | > 2 years |

### OXYGEN FILTER

Oxygen is a column killer. It is present even in UHP gases, as minutes leaks at fittings allow oxygen to influx against the concentration gradient. Because oxygen can enter a gas line at any fitting or during gas bottle exchange, the oxygen trap should be the last connection before the gas line enters the chromatograph.

| Capacity | |
|---|---|
| O2 | 150 mL |

| Catalog No. | 226-50756-00 |
|---|---|
| **Specifications** | |
| Outlet Gas Quality (%) | > 99.9999 |
| Maximum Pressure | 11 bar (160 psi) |
| Maximum Flow | 7 L/min. |
| Usable For | Inert carrier gas, He, H2, N2, AR, Air |
| Dimensions | 24 cm x Ø 4.4 cm |
| Weight | 0.26 Kg |
| Estimated Lifetime | > 2 years |

### HYDROCARBON FILTER

Use a hydrocarbon trap if your gas has a potential source of hydrocarbon contaminants or if you suspect you are observing carrier gas ghost peaks. Install the hydrocarbon trap after the moisture trap, to prevent moisture from degrading the hydrocarbon-trapping ability of the activated carbon in the hydrocarbon trap.

| Capacity | |
|---|---|
| HC | 12 g (as n-butane) |

| Catalog No. | 226-50757-00 |
|---|---|
| **Specifications** | |
| Outlet Gas Quality (%) | > 99.9999 |
| Maximum Pressure | 11 bar (160 psi) |
| Maximum Flow | 7 L/min. |
| Usable For | Inert carrier gas, He, H2, N2, AR, Air |
| Dimensions | 24 cm x Ø 4.4 cm |
| Weight | 0.26 Kg |
| Estimated Lifetime | > 2 years |

### CARBON DIOXIDE FILTER

Removes carbon dioxide from gas streams. To be used in combination with a Moisture Filter

| Capacity | |
|---|---|
| CO2 | 12 g |

# COMBI Filters

| Catalog No. | 226-50750-00 |
|---|---|
| **Specifications** | |
| Outlet Gas Quality (%) | > 99.9999 |
| Maximum Pressure | 11 bar (160 psi) |
| Maximum Flow | 7 L/min. |
| Usable For | Inert carrier gas, He, H2, N2, AR, Air |
| Dimensions | 24 cm x Ø 4.4 cm |
| Weight | 0.26 Kg |
| Estimated Lifetime | > 2 years |

## COMBI (HYDROCARBON/MOISTURE) FILTER

The Fuel Gas Filter is perfect for purifying flame ionization detector (FID) fuel gases, removing both moisture and hydrocarbons. Using the Fuel Gas Filter for FID Hydrogen and air will produce a stable baseline, improving overall reproducability and sensitivity.

| Capacity | |
|---|---|
| $H_2O$ | 3.5 g |
| HC | 6 g (as n-butane) |

| Catalog No. | 226-50758-00 |
|---|---|
| **Specifications** | |
| Outlet Gas Quality (%) | > 99.9999 |
| Maximum Pressure | 11 bar (160 psi) |
| Maximum Flow | 7 L/min. |
| Usable For | Inert carrier gas, He, H2, N2, AR |
| Dimensions | 24 cm x Ø 4.4 cm |
| Weight | 0.26 Kg |
| Estimated Lifetime | > 2 years |

## COMBI (OXYGEN/MOISTURE) FILTER

This Combi trap is ideal for purifying carrier gas. It contains oxygen and moisture scrubbers in one easy to change economical cartridge

| Capacity | |
|---|---|
| $H_2O$ | 3.5 g |
| HC | 75 mL |

| Catalog No. | 226-50759-00 |
|---|---|
| **Specifications** | |
| Outlet Gas Quality (%) | > 99.9999 |
| Maximum Pressure | 11 bar (160 psi) |
| Maximum Flow | 7 L/min. |
| Usable For | Inert carrier gas, He, H2, N2, AR, Air |
| Dimensions | 24 cm x Ø 4.4 cm |
| Weight | 0.26 Kg |
| Estimated Lifetime | > 2 years |

## COMBI (CARBON DIOXIDE/ MOISTURE) FILTER

Removes carbon dioxide and moisture from gas streams.

| Capacity | |
|---|---|
| $H_2O$ | 3.5 g |
| HC | 6 g |

| Catalog No. | 226-50751-00<br>226-50752-00 (Helium Specfic)<br>226-50752-10 (Hydrogen Specific) |
|---|---|
| **Specifications** | |
| Outlet Gas Quality (%) | > 99.9999 |
| Maximum Pressure | 11 bar (160 psi) |
| Maximum Flow | 7 L/min. |
| Usable For | Inert carrier gas, He, H2, N2, AR |
| Dimensions | 24 cm x Ø 4.4 cm |
| Weight | 0.26kg |
| Estimated Lifetime | > 2 years |

## TRIPLE (OXYGEN/MOISTURE/ HYDROCARBON) FILTER

The Triple trap is ideal for purifying carrier gas. It contains oxygen, moisture and hydrocarbon scrubbers in one easy to change economical cartridge

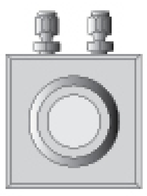
| Capacity | |
|---|---|
| $H_2O$ | 1.8 g |
| O2 | 75 mL |
| HC | 4 g (as n-butane) |

# Base Plates

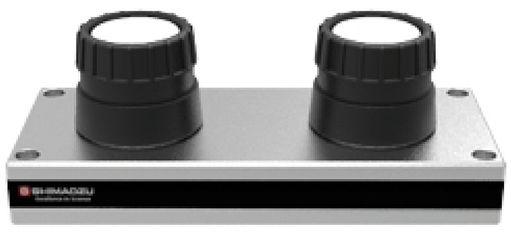
| Catalog No. | Fitting Type |
|---|---|
| 226-50771-00 | 1/8″ SS |

## 1 POSITION BASE PLATE

Single position base plate

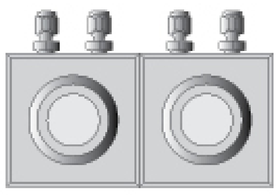


| Catalog No. | Fitting Type |
|---|---|
| 226-50772-00 | 1/8″ SS |



## 2 POSITION BASE PLATE

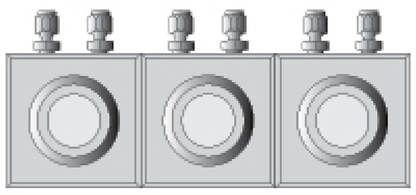
Double position base plate



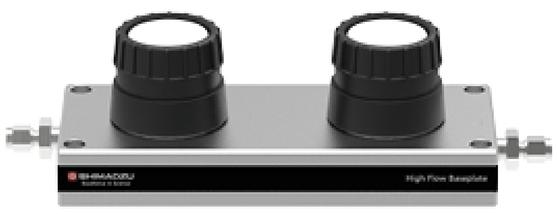
| Catalog No. | Fitting Type |
|---|---|
| 226-50773-00 | 1/8″ SS |

## 3 POSITION BASE PLATE

Three position base plate

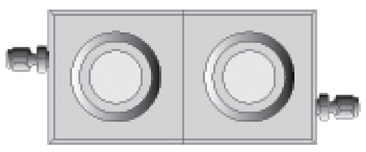


| Catalog No. | Fitting Type |
|---|---|
| 226-50776-00 | 1/8″ SS |

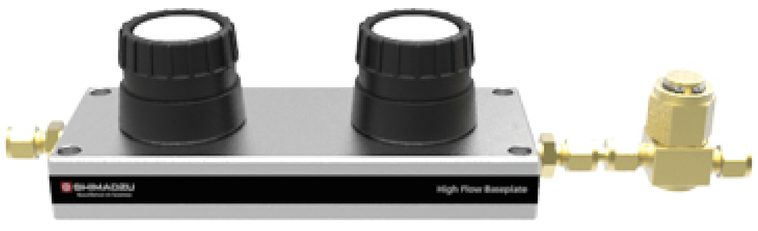


## ICP-MS
## HIGH FLOW BASE PLATE

High Flow Base plate for ICP-MS (in parallel)

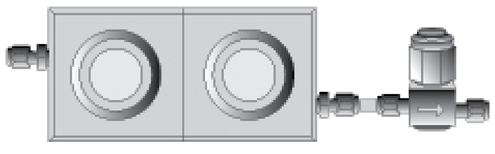


| Catalog No. | Fitting Type |
|---|---|
| 226-50775-01 | 1/4″ Brass |
| 226-50775-00 | 1/4″ SS |



## LC/MS
## HIGH FLOW BASE PLATE

High Flow double position base plate (in parallel)

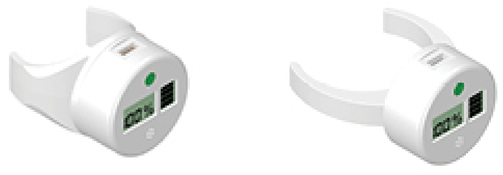


# Base Plate Accesories

| Catalog No. | Clip Type |
|---|---|
| 226-50798-00 | Filter Cartridge |
| 226-50797-00 | Universal Ring Nut |

**Usable for**

All base plates with Universal Ring Nut



## ELECTRONIC INDICATOR

Electronic Maintenance Indicator device warns when scheduled filter replacement or base plate maintenance is due.

**Catalog No.** 226-50799-00

**Usable for**

All base plates

## UNIVERSAL RING NUT

Universal Ring Nut to mount a filter or flush-cap on a base plate.

**Catalog No.** 226-50770-00

**Usable for**

All base plates

## O-RING REPLACEMENT SET

O-ring replacement set for replacing the O-rings on the in- and outlet valves on a base plate.

**Catalog No.** 226-50790-00

**Usable for**

All base plates

## WALL-MOUNT BRACKET SET

Wall mounting brackets to mount a Base plate on a wall.

**Catalog No.** 226-50796-00

**Usable for**

All base plates

## UNIVERSAL FLUSH-CAP SET

Flush-cap that mounts on a base plate , and allows the gas to pass through the base plate without a filter attached.

| Catalog No. | Connection Type |
|---|---|
| 226-50792-01 | 1/4" Brass |
| 226-50791-01 | 1/8" Brass |
| 226-50792-00 | 1/4" SS |
| 226-50791-00 | 1/8" SS |

**Usable for**

1, 2, 3 and 4 position base plates

## STANDARD BASE PLATE CONNECTOR SET

Replacement connectors for standard base plates.

| Catalog No. | Connection Type |
|---|---|
| 226-50793-01 | 1/4" Brass |
| 226-50793-00 | 1/4" SS |

**Usable for**

High flow base plates

## HIGH FLOW BASE PLATE CONNECTOR SET

Replacement connector for high flow base plates.

| Catalog No. | Description |
|---|---|
| 226-50794-01 | 0.5 Micron Particle Filter (1/4" Brass) |
| 226-50795-00 | 0.5 Micron Particle Filter Cup Replacement Pack |

## PARTICULATE FILTER

Particulate filter for high flow base plates.

# Capillary Column Cutters

| | |
|---|---|
| **Catalog No.** | 226-50700-00 |
| **Specifications** | |
| **Usable For** | Fused Silica Capillary Column Ø 0.5 Use with 0.25mm ID to 0.53mm ID tubing (0.78mm OD maximum). |
| **Dimensions** | 9.2 cm x 1.7 cm x 1.7 cm |
| **Weight** | 94 g |

## SHORTIX™ GC

In Gas chromatography, the Glass Quick-Fit connection is often used (e.g. for Retention Gaps, Guard Columns). This connection will only be leak-tight when the column is cut extremely straight and without any damage to the fused-silica column wall.

| | |
|---|---|
| **Catalog No.** | 226-50700-01 |
| **Specifications** | |
| **Usable For** | Fused Silica Capillary Column Ø 0.25micron |
| **Dimensions** | 9.7 cm x 1.7 cm x 1.7 cm |
| **Weight** | 94 g |

## SHORTIX™ CE-CEC

For CE/CEC analyses, a clean and straight cut of the capillary column is needed to assure symetrical Field-Strength over the inlet of the column. When there is no symetrical Field-Strength, the analytical results will be non-reproducible.

| | |
|---|---|
| **Catalog No.** | 226-50700-10 |
| **Specifications** | |
| **Usable For** | Shortix™ GC |

## MAINTENANCE KIT FOR SHORTIX TM GC

Includes diamond cutting wheel, O-rings and a tool to open the column cutter.

| | |
|---|---|
| **Catalog No.** | 226-50700-11 |
| **Specifications** | |
| **Usable For** | Shortix™ CE-CEC |

## MAINTENANCE KIT FOR SHORTIX™ CE-CEC

Includes diamond cutting wheel, O-rings and a tool to open the column cutter.

# Gas Filter System Components

## Base Plate

Connecting unit with in- and outlet connectors for the gas line and two spring-loaded check valves that automatically start the flow of gas once a filter is installed.

## Filter Cartridge

The filter cartridges are made of glass to prevent diffusion, and protected by a plastic housing for safety. The PTFE seals at the base of the Filter will only be punctured during installation on the base plate.

## Universal Ring Nut

The Universal Ring Nut is used for mounting a filter cartridge or flush-cap to a base plate. It can also serve as a mounting point for the Electronic Maintenance Indicator device.

## Electronic Indicator

Optional Electronic Maintenance Indicator device warns when scheduled replacement or maintenance is due.

## Wall Mount Bracket Set

Optional wall mounting brackets to mount a base plate to a wall.

CoreFocus
SHIMADZU

# Spectrum Consumables

# UV Cells

The following table shows the wavelength range and tolerance for different window materials:

| Window Material | Path lengths | Wavelength Range | Tolerance |
|---|---|---|---|
| Quartz | 0.5 to 30mm | 200 nm – 2500 nm | ± 0.01mm |
| | 40 to 100mm | | ± 0.02mm |
| Glass | up to 20mm | 320 nm – 2500 nm | ± 0.01mm |
| | 30 to 100mm | | ± 0.02mm |

## Standard cell with PTFE Lid

- Open top, comes with either non-sealing PTFE cover or a stopper providing a liquid-tight seal.
- Two polished windows.
- Walls polished internally, fine ground externally.
- Suitable for use with all standard cell holders.

### Cell with PTFE Lid

| Light path /mm | Maximum Vol/µL | External Dimension (L x W x H) / mm | Quartz cell | | Glass cell |
|---|---|---|---|---|---|
| | | | Single Cell | Matched Pair | Single cell |
| 1 | 400 | 3.5 x 12.5 x 45 | 226-85101-01 | 226-85102-01 | 226-85111-01 |
| 2 | 700 | 4.5 x 12.5 x 45 | 226-85101-02 | 226-85102-02 | 226-85111-02 |
| 5 | 1700 | 7.5 x 12.5 x 45 | 226-85101-05 | 226-85102-05 | 226-85111-05 |
| 10 | 3500 | 12.5 x 12.5 x 45 | 226-85101-10 | 226-85102-10 | 226-85111-10 |
| 20 | 7000 | 22.5 x 12.5 x 45 | 226-85101-20 | 226-85102-20 | 226-85111-20 |
| 40 | 14000 | 42.5 x 12.5 x 45 | 226-85101-40 | 226-85102-40 | 226-85111-40 |
| 50 | 17500 | 52.5 x 12.5 x 45 | 226-85101-50 | 226-85102-50 | 226-85111-50 |
| 100 | 35000 | 102.5 x 12.5 x 45 | 226-85101-00 | 226-85102-00 | 226-85111-00 |

*10mm Quartz Cell, 226-85101-10*

### Cell with stopper

| Light path /mm | Maximum Vol/µL | External Dimension (L x W x H) / mm | Quartz cell | Glass cell |
|---|---|---|---|---|
| 1 | 400 | 3.5 x 12.5 x 55 | 226-85201-01 | 226-85211-01 |
| 2 | 700 | 4.5 x 12.5 x 55 | 226-85201-02 | 226-85211-02 |
| 5 | 1700 | 7.5 x 12.5 x 48 | 226-85201-05 | 226-85211-05 |
| 10 | 3500 | 12.5 x 12.5 x 48 | 226-85201-10 | 226-85211-10 |
| 20 | 7000 | 22.5 x 12.5 x 48 | 226-85201-20 | 226-85211-20 |
| 40 | 14000 | 42.5 x 12.5 x 48 | 226-85201-40 | 226-85211-40 |
| 50 | 17500 | 52.5 x 12.5 x 48 | 226-85201-50 | 226-85211-50 |
| 100 | 35000 | 102.5 x 12.5 x 48 | 226-85201-00 | 226-85211-00 |

*10mm Quartz Cell with stopper, 226-85201-10*

## Semi-Micro cell with PTFE Lid, Single cell

- Reduced nominal volume to <50% of Standard rectangular.
- Open top, comes with non-sealing PTFE cover.
- Two polished windows.
- Walls polished internally, fine ground externally.
- Suitable for use with all standard cell holders.
- Self-masking solid black walls enhance sensitivity and improve linearity at higher absorbances.

| Light path /mm | Maximum Vol/µL | External Dimension (L x W x H) / mm | Quartz cell | Glass cell | Black Quartz cell |
|---|---|---|---|---|---|
| 5 | 700 | 7.5 x 12.5 x 45 | 226-85301-05 | 226-85311-05 | 226-85401-05 |
| 10 | 1400 | 12.5 x 12.5 x 45 | 226-85301-10 | 226-85311-10 | 226-85401-10 |
| 20 | 2800 | 22.5 x 12.5 x 45 | 226-85301-20 | 226-85311-25 | 226-85401-20 |
| 40 | 5600 | 42.5 x 12.5 x 45 | 226-85301-40 | 226-85311-40 | 226-85401-40 |
| 50 | 7000 | 52.5 x 12.5 x 45 | 226-85301-50 | 226-85311-50 | 226-85401-50 |

*10mm Semi-Micro Quartz cell, 226-85301-10*

*10mm Semi-Micro Quartz Black cell, 226-85401-10*

## Semi-Micro cell with PTFE Lid Black, Single cell – Lower sample volume

*9mm thick base, not suitable for an instrument with an 8.5mm 'Z' dimension

| Light path /mm | Maximum Vol/µL | External Dimension (L x W x H) / mm | Quartz cell |
|---|---|---|---|
| 10 | 1160 | 12.5 x 12.5 x 45 | 226-85401-99 |

*10mm Semi-micro Quartz Black cell, 226-85401-99*

## Semi-Micro cell with PTFE Lid, Single cell – Lower sample volume

*9mm thick base, not suitable for an instrument with an 8.5mm 'Z' dimension

| Light path /mm | Maximum Vol/µL | External Dimension (L x W x H) / mm | Quartz cell |
|---|---|---|---|
| 10 | 1160 | 12.5 x 12.5 x 45 | 226-85501-10 |

*10mm Semi-micro Quartz cell, 226-85501-10*

## Micro cells

- Reduced nominal volume to <20% of Standard rectangular.
- Open top, comes with non-sealing PTFE cover or a stopper providing a liquid-tight seal.
- Two polished windows.
- Walls polished internally, fine ground externally.
- Suitable for use with all standard cell holders.

**Cell with PTFE Lid**

| Light path /mm | Maximum Vol/µL | External Dimension (L x W x H) / mm | Quartz cell | Glass cell |
|---|---|---|---|---|
| 5 | 350 | 7.5 x 12.5 x 45 | 226-85601-05 | 226-85611-05 |
| 10 | 700 | 12.5 x 12.5 x 45 | 226-85601-10 | 226-85611-10 |
| 20 | 1400 | 22.5 x 12.5 x 45 | 226-85601-20 | 226-85611-20 |
| 40 | 2800 | 42.5 x 12.5 x 45 | 226-85601-40 | 226-85611-40 |
| 50 | 3500 | 52.5 x 12.5 x 45 | 226-85601-50 | 226-85611-50 |

*10mm Micro Quartz cell, 226-85601-10*

## Micro cells

Cell with stopper

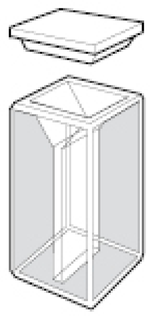
| Light path /mm | Maximum Vol/µL | External Dimension (L x W x H) / mm | Quartz cell | Glass cell | Black Quartz cell |
|---|---|---|---|---|---|
| 5 | 350 | 7.5 x 15.5 x 48 | 226-86301-05 | 226-86311-05 | 226-85001-05 |
| 10 | 700 | 12.5 x 12.5 x 48 | 226-86301-10 | 226-86311-10 | 226-85001-10 |
| 20 | 1400 | 22.5 x 12.5 x 48 | 226-86301-20 | 226-86311-20 | 226-85001-20 |
| 40 | 2800 | 42.5 x 12.5 x 48 | 226-86301-40 | 226-86311-40 | 226-85001-40 |
| 50 | 3500 | 52.5 x 12.5 x 48 | 226-86301-50 | 226-86311-50 | 226-85001-50 |

*10mm Micro Quartz Cell with stopper, 226-85001-10*

## Micro short cell

- Two polished windows.
- Open top, comes with non-sealing PTFE cover.
- Walls polished internally, fine ground externally.

| Light path /mm | Maximum Vol/µL | External Dimension (L x W x H) / mm | Type | Quartz cell |
|---|---|---|---|---|
| 5 | 200 | 7.5 x 12.5 x 25 | Clear | 226-86101-05 |
| 10 | 400 | 12.5 x 12.5 x 25 | Clear | 226-86101-10 |
| 5 | 200 | 7.5 x 12.5 x 25 | Black | 226-89029-05 |
| 10 | 400 | 12.5 x 12.5 x 25 | Black | 226-89002-10 |



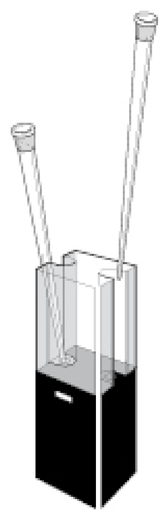
*10mm Micro short Quartz Cell 226-86101-10*

## Ultra-micro lens cell

- Ultra-micro volume ranges from 0.5µl to 10µl.
- Two polished windows.
- Sample inserted and retrieved with micro pipette tip.
- Two micro pipette tips provided with each cell.

| Light path /mm | Maximum Vol/µL | External Dimension (L x W x H) / cm | *Z* Height | Quartz cell |
|---|---|---|---|---|
| 0.1 | 0.5 | 12.5 x 12.5 x 45 | 15 | 226-89031-01 |
| 1 | 5 | 12.5 x 12.5 x 45 | 15 | 226-86201-01 |
| 5 | 2.5 | 12.5 x 12.5 x 45 | 15 | 226-86201-05 |
| 5 | 5 | 12.5 x 12.5 x 45 | 15 | 226-89001-05* |
| 10 | 5 | 12.5 x 12.5 x 45 | 15 | 226-86201-10 |

*Has integral focusing lens which increases the energy entering the sample



*0.1mm Ultra-micro Lens Quartz Cell, 226-89031-01*

## Cylindrical Cell, single cell

- Two polished windows.
- Closed by PTFE stopper, providing a liquid-tight seal.
- 10 & 20 mm cell closed by a single PTFE stopper
- 50 & 100 mm cell closed by two PTFE stoppers
- Internal diameter = 19mm

| Light path /mm | Maximum Vol/µL | External Dimension (Dia. x L) / mm | Quartz cell | Glass cell |
|---|---|---|---|---|
| 10 | 2800 | 22 x 12.5 | 226-85701-10 | 226-85711-10 |
| 20 | 5600 | 22 x 22.5 | 226-85701-20 | 226-85711-20 |
| 50 | 14100 | 22 x 52.5 | 226-85701-50 | 226-85711-50 |
| 100 | 28200 | 22 x 102.5 | 226-85701-00 | 226-85711-00 |

*10mm Cylindrical Quartz Cell, 226-85701-10*

## Standard Fluorescence Cell with PTFE Lid, Single cell

- Open top, with non-sealing PTFE cover.
- Four windows and base polished.

| Light path /mm | Maximum Vol/µL | External Dimension (L x W x H) / mm | Quartz cell | Glass cell |
|---|---|---|---|---|
| 5 | 1700 | 7.5 x 12.5 x 45 | 226-85801-05 | 226-85811-05 |
| 10 | 3500 | 12.5 x 12.5 x 45 | 226-85801-10 | 226-85811-10 |
| 20 | 7000 | 22.5 x 12.5 x 45 | 226-85801-20 | 226-85811-20 |
| 40 | 14000 | 42.5 x 12.5 x 45 | 226-85801-40 | 226-85811-40 |

*10mm Fluorescence Cell, 226-85801-10*

## Micro Fluorescence Cell with PTFE Lid, Single cell

- Four windows and base polished.
- Comes with non-sealing PTFE cover.
- Base thickness - 3mm
- Suitable for use with all standard cell holders.

| Light path /mm | Maximum Vol/µL | External Dimension (L x W x H) / mm | Quartz cell |
|---|---|---|---|
| 10 | 700 | 12.5 x 12.5 x 45 | 226-85901-10 |

*Micro Fluorescence Cell, 226-85901-10*

## Flow cells

- Two polished windows, long aperture.
- Path lengths of 0.5mm or less incorporate by-pass tubes to avoid back pressure and assist laminar flow through the sample compartment.
- M6 Screw-in connections.
- Profiled sample compartment to optimize flow characteristics, reduces carry over and bubble retention.

| Light path /mm | Maximum Vol/µL | External Dimension (L x W x H) / mm | *Z* Height | Quartz cell |
|---|---|---|---|---|
| 0.1 | 41 | 12.5 x 12.5 x 45 | 15 | 226-89021-01 |
| 0.2 | 47 | 12.5 x 12.5 x 45 | 15 | 226-89022-02 |
| 0.5 | 95 | 12.5 x 12.5 x 45 | 15 | 226-89023-05 |
| 1 | 120 | 12.5 x 12.5 x 45 | 15 | 226-89024-10 |

*0.5mm Flow Cell, 226-89023-05*

# Certified Glass Filter

## Shimadzu Glass Filters are accepted by the following bodies:

- United States Pharmacopeia
- American Society for Testing and Materials
- Therapeutic Goods Administration (Australia)
- British Pharmacopoeia

## Characteristics:

- Each glass filter is individually certified.
- Certificate of Calibration and Traceability are provided

| Material | Part number | Wavelength range | Usage |
|---|---|---|---|
| Didymium | 226-85009-01 | 430 nm to 890 nm | For wavelength analysis |
| Holmium Oxide | 226-85009-02 | 240 nm to 640 nm | |
| Didymium Oxide/Neutral Density | 226-85009-21 | 430 nm to 890 nm | For wavelength and absorbance analysis |
| Holmium Oxide/Neutral Density | 226-85009-22 | 360 nm to 640 nm | |

# Accessories

| Part Number | Description |
|---|---|
| 226-80001-00 | KBr Agate Mortar and Pestle, 5cm |
| 226-89001-00 | UV 10mm matched pair cell GSKit |

# Nano Stick - S

The optimized nano cuvette for concentration and purity measurements of DNA, RNA, oligonucleotides and proteins

## Features:

- Dedicated cell for micro volume of sample
- Compatible with any kind of UV-Vis. Spectrophotometer
- No need for any special cell holder.
- Easy to use and clean

## Specifications:

| | |
|---|---|
| Pathlength | 0.5 mm |
| Physical Dimensions | 12.5 x 12.5 x 60 mm (WDH) |
| Beam Height (Z-Dimension) | 15 or 8.5mm types |
| Minimum Sample Volume | 2 uL |
| Recommended Sample Volume | 2.5 – 3 uL |
| DNA Detection Limit | 1.1 ng/uL |
| DNA Maximum Concentration | 3000 ng/uL |
| DNA Reproducibility at 100 ng/uL | ±1.0 ng/uL |
| DNA Reproducibility at 1000 ng/uL | ±3.0 ng/uL |
| Protein Detection Limit | 0.06 mg/ml |
| Protein Maximum Concentration | 100 mg/ml |
| Protein Reproducibility at 2 mg/ml | ±0.02 mg/ml |
| Protein Reproducibility at 10 mg/uL | ±0.05 mg/ml |

## Application:

- Nucleic Acid concentration measurement
- Nucleic Acid purity measurement
- Protein concentration measurement (Direct UV method)
- Bio / Life Science
- Medical
- Environmental / Agriculture
- Food / Beverage

- **Nano Stick – S Components (Red) :**

- **How to use:**

1. Pipette the blank
2. Close the cover
3. Look for bubbles
4. Measure the blank
5. Clean the sampling port
6. Pipette the sample
7. Look for bubbles
8. Measure the sample

- For next sample measurement, repeat the procedures 5~8.

| Part number | Path Length | Description |
|---|---|---|
| 226-80002-03 | 0.5 mm | NanoStick-S, Single Port, Z-height 15 mm, Black, one cell |
| 226-80002-02 | 0.5 mm | NanoStick-S, Single Port, Z-height 15 mm, Red, one cell |

# Autosampler vials for AAS, ICPE, ICPMS

## Features:

- Easy to use, pre-calibrated for make-up volume
- Made of polypropylene to avoid contamination
- Cost-effective
- Suitable for sample storage (comes with lid)

## Autosamplers:

- ASC-6880/7000 for Flame AAS
- AS-10/ ASX-280/560 for ICP/ICPMS
- Available in economy pack of 500 vials

15mL vial 50mL vial

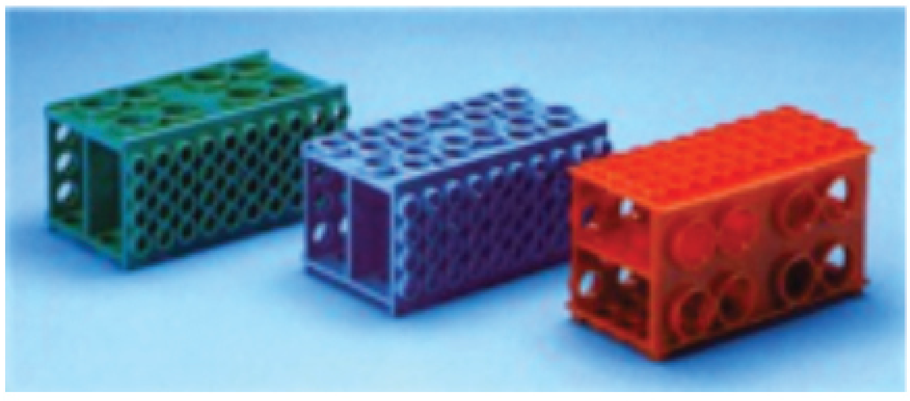
| Part number | Description | Pack Size |
|---|---|---|
| 226-89902-01 | 15ml Autosampler vials for AAS, ICPE, ICPMS | 500 pcs |
| 226-89902-02 | 50ml Autosampler vials for AAS, ICPE, ICPMS | 500 pcs |

# PP Test Tube Rack for Autosampler vials

## Features:

- PP Stand for 15 ml and 50 ml autosampler vials
- 4-way rack for to suit different size vials
- Suitable for sample make-up and storage
- Facilitates manual mode analysis

| Part number | Description | Pack Size |
|---|---|---|
| 226-89903-01 | 4 way PP Test Tube Rack, Natural | 4 pcs |



# Appendix I

## Septa

### Septa Selection Guide

| Septum Material | Description | Temperature (°C) |
|---|---|---|
| PTFE/Red Rubber | Most popular and economical choice for general GC and HPLC applications. Used for routine analysis in GC with FID, TCD and FPD detectors or HPLC with UV/Vis and RI detectors. They offer moderate resealability and excellent chemical inertness prior puncture. Low durometer of rubber allows ease of needle penetration. PTFE/Red Rubber septa are not recommended for multiple injections or storage of samples. | -40 to 110 |
| PTFE/Silicone | Ideal for use in GC and HPLC applications for its high resealability even after repeated punctures. Good for sensitive analysis (lower background) and storage of samples. PTFE/Silicone septa are soft and more easily punctured, and protects the needle in autosampler. | -60 to 200 |
| PTFE/Silicone, pre-slit | Share the same chromatographic characteristics, physical and chemical property as non-slit PTFE/Silicone septa. The cross-slit aid in needle penetration for low coring, and prevent formation of vacuum when multiple injection or large volume of sample is withdrawal from vial. However, the pre-slit septa are not recommended for storage of samples due to evaporation of volatile organic solvents through the slit. | -60 to 200 |
| PTFE/Silicone/PTFE | Recommended for ultra trace analysis, or where there is a longer time between injections. PTFE liners on both sides of Silicone resist coring during penetration, and protects Silicone from chemical attacks. | -60 to 200 |
| Butyl/PTFE | The PTFE barrier provides excellent chemical resistance to most solvents. Butyl/PTFE septa has good resealability and suitable for gas sampling due to low permeability. | -40 to 120 |

### Physical Characteristic and Solvent Compatibility of Materials used for Caps and Septa.

The chart below displayed the physical characteristic and solvent compatibility of materials used for caps and septa. You might want to test your product under actual conditions of use as there are many factors that can affect chemical resistance.

### Physical Characteristic of Caps and Septa

| Code | Description | Appearance | Temp. MAX °C | Temp. MIN °C | Autoclavable | Dry Heat | Gamma | Microwavable | Ethylene Oxide | Analytical Purity | Fragmentation* | Hardness† | Resealability‡ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PP | Polypropylene | Translucent | 135 | -20 | Yes | No | No | Yes | Yes | Method Dependent | Low | Medium hard | No resealability |
| PTFE | Polytetra-fluorethylene | White | 260 | -200 | Yes | Yes | Yes | Yes | Yes | Very high | Low | Very hard (Very thin) | No resealability |
| RR | Synthetic Red Rubber/PTFE | Red/beige | 110 | -30 | No | No | No | No | No | Medium | Medium | Medium hard | Medium |
| Butyl | Grey Butyl | Opaque grey | 125 | -20 | Yes | No | Yes | Yes | Yes | Method Dependent | Low to Medium | Soft to medium | Highly resealable |
| T/S | Silicone/PTFE | White/Red | 200 | -60 | Yes | Yes | Yes | Yes | Yes | High | Low to Medium | Soft | Highly resealable |
| T/S/T | PTFE/Silicone/PTFE | Red/White/Red | 200 | -60 | Yes | Yes | Yes | Yes | Yes | High | Very low | Soft | Good |

* Due to hardness and molecular structure (coring)
† Needle penetration
‡ In case of multiple injection

### Chemical Resistance of Vials and Caps

| Chemical | Glass | PP | Chemical | Glass | PP | Chemical | Glass | PP |
|---|---|---|---|---|---|---|---|---|
| 1,2-Dichloroethane | EE | NN | Diacetone | EE | GF | n-Amyl Acetate | EE | GF |
| 1,2,4-Trichlorobenzene | EE | NN | Diacetone Alcohol | EE | EF | n-Butanol | EE | EE |
| 1,4-Dioxane | EE | GF | Dibutylphthalate | EE | NN | n-Butyl Acetate | EE | GF |
| 2,2,4-Trimethylpentane | EE | FN | Diethyl Benzene | EE | NN | n-Decane | EE | FN |
| 2,4 Dichlorophenol | EE | NN | Diethyl Ether | EE | NN | n-Heptane | EE | FF |
| 2-Butanol | EE | EE | Diethyl Ketone | EE | GG | Nitric Acid, 10% | EE | EE |
| 2-Methoxyethanol | EE | EE | Diethyl Malonate | EE | EE | Nitric Acid, 20% | EE | FF |
| 2-Propanol | EE | EE | Diethylamine | EE | GN | Nitric Acid, 50% | EE | FN |
| Acetaldehyde | EE | GN | Diethylene Dioxide | EE | GF | Nitric Acid, 70% | EE | NN |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Acetamide, Sat. | EE | EE | Diethylene Glycol | EE | EE | Nitrobenzene | EE | NN |
| Acetic Acid, 5% | EE | EE | Dimethyl Acetamide | EE | EE | Nitromethane | EE | FN |
| Acetic Acid, 50% | EE | EE | Dimethyl Formamide | EE | EE | n-Octane | EE | EE |
| Acetic Acid, Glacial | EE | EG | Dimethylsulphoxide (DMSO) | EE | EE | o-Dichlorobenzene | EE | FN |
| Acetic Anhydride | EE | GF | Dioxane | EE | GF | Oil, Mineral | EE | EE |
| Acetone | EE | EG | Dipropylene Glycol | EE | EE | Oxalic Acid, 10% | EE | EE |
| Acetonitrile | EE | FN | Ether | EE | NN | Ozone | EE | EG |
| Acetophenone | EE | FN | Ethyl acetate | EE | EG | p-Chloroacetophenone | EE | EE |
| Acrylonitrile | EE | EE | Ethyl Alcohol (Absolute) | EE | EG | p-Dichlorobenzene | EE | GF |
| Adipic Acid | EE | EE | Ethyl Alcohol, 40% | EE | EG | Perchloric Acid | EE | GN |
| Allyl Alcohol | EE | EE | Ethyl Alcohol, 96% | EE | EE | Perchloric Acid, 70% | EE | GN |
| Aluminum Hydroxide | SS | EG | Ethyl Benzene | EE | NN | Perchloroethylene | EE | NN |
| Amino Acids | EE | EE | Ethyl Benzoate | EE | GF | Phenol, 100% | EE | NN |
| Ammonia | SS | EE | Ethyl Butyrate | EE | GN | Phenol, 50% | EE | NN |
| Ammonia, 25% | SS | EE | Ethyl Chloride | EE | FN | Phenol, Crystals | EE | GN |
| Ammonium Glycolate | EE | EG | Ethyl Chloride, Liquid | EE | FN | Phenol, Liquid | EE | NN |
| Ammonium Hydroxide, 30% | SS | EG | Ethyl Cyanoacetate | EE | EE | Phosphoric Acid, 5% | EE | EE |
| Ammonium Hydroxide, 5% | SS | EE | Ethyl Lactate | EE | EE | Phosphoric Acid, 85% | EE | EG |
| Ammonium Oxalate | EE | EG | Ethylene Chloride | EE | FN | Picric Acid | EE | NN |
| Ammonium Salts | EE | EE | Ethylene Glycol | EE | EE | Potassium Hydroxide, 1% | SS | EE |
| Amyl Alcohol | EE | EE | Ethylene Oxide Gas | EE | FF | Potassium Hydroxide, 30% | SS | EE |
| Amyl Chloride | EE | NN | Ethylene Oxide, 100% | EE | FF | Potassium Permanganate | EE | EE |
| Aniline | EE | GF | Fatty Acids | EE | EG | Propane Gas | EE | NN |
| Aqua Regia | SS | NN | Fluorine | EE | FN | Proprionic Acid | EE | EG |
| Arsenic Acid | EE | EE | Formaldehyde, 10% | EE | EE | Propylene Glycol | EE | EE |
| Benzaldehyde | EE | EG | Formaldehyde, 40% | EE | EG | Propylene Oxide | EE | EG |
| Benzenamine | EE | GF | Formalin, 10% | EE | EE | Pyridine | EE | NN |
| Benzene | EE | NN | Formalin, 40% | EE | EG | Resorcinol, 5% | EE | EE |
| Benzoic Acid, Sat. | EE | EG | Formic Acid | EE | EG | Resorcinol, Sat. | EE | EE |
| Benzyl Acetate | EE | EG | Formic Acid, 100% | EE | EG | Salicylaldehyde | EE | EG |
| Benzyl Alcohol | EE | NN | Formic Acid, 3% | EE | EG | Salicylic Acid, Sat. | EE | EE |
| Boric Acid | EE | EE | Formic Acid, 50% | EE | EG | Salt Solutions, Metallic | SS | EE |
| Bromine | EE | NN | Formic Acid, 85% | EE | EG | Silicone Oil | EE | EE |
| Bromobenzene | EE | NN | Freon TF | EE | EG | Silver Nitrate | EE | EG |
| Bromoform | EE | NN | Glutaraldehyde | EE | EE | Sodium Dichromate | EE | EE |
| Butadiene | EE | NN | Glycerine (Glycerol) | EE | EE | Sodium Hydroxide, 50% | SS | EE |
| Butyl Acetate | EE | FF | Hexane | EE | GF | Sodium Hydroxide, 1% | SS | EE |
| Butyl Chloride | EE | NN | Hydrazine | EE | NN | Sodium Hydroxide, 10% | SS | EE |
| Butyric Acid | EE | NN | Hydrobromic Acid, 4% | EE | EG | Sodium Hypochlorite, 15% | EE | GF |
| Calcium Hydroxide | SS | EE | Hydrobromic Acid, 48% | EE | EE | Stearic Acid | EE | EE |
| Calcium Hypochlorite | EE | EE | Hydrobromic Acid, 69% | EE | EG | Sulfur dioxide | EE | NN |
| Carbazole | EE | EE | Hydrochloric Acid, 20% | EE | EE | Sulfur Dioxide, wet or dry | EE | EE |
| Carbon Disulphide | EE | NN | Hydrochloric Acid, 35% | EE | EG | Sulfur Salts | FE | FN |
| Carbon Tetrachloride | EE | GF | Hydrochloric Acid, 5% | EE | EE | Sulfuric Acid, (96%) | EE | FN |
| Cellosolve Acetate | EE | EG | Hydrogen Peroxide, 3% | EE | EE | Sulfuric Acid, 20% | EE | EG |
| Chlorine Water | EE | FN | Hydrogen Peroxide, 30% | EE | EG | Sulfuric Acid, 30% | EE | EG |
| Chlorine, 10% (Moist) | EE | FN | Hydrogen Peroxide, 90% | EE | EG | Sulfuric Acid, 6% | EE | EE |
| Chlorine, 10% in air | EE | FN | Isobutanol | EE | EE | Sulfuric Acid, 60% | EE | EG |
| Chlorine, wet gas | EE | FN | Isopropanol, 100% | EE | EE | Sulfuric Acid, 98% | EE | FN |
| Chloroacetic Acid | EE | EG | Isopropyl Acetate | EE | GF | Tartaric Acid | EE | EE |
| Chlorobenzene | EE | NN | Isopropyl Benzene | EE | FN | Tetrahydrofuran | EE | GF |
| Chloroform | EE | NN | Isopropyl Ether | EE | NN | Thionyl Chloride | EE | NN |
| Chromic Acid, 10% | EE | EE | Lactic Acid, 3% | EE | EG | Tincture of Iodine | EE | GG |
| Chromic Acid, 20% | EE | GG | Lactic Acid, 85% | EE | EG | Toluene | EE | FN |
| Chromic Acid, 50% | EE | GF | Mercury | EE | EE | Tributyl Citrate | EE | GF |
| Chromic:Surfuric Acid Mixture,96% | EE | NN | Methanol, 100% | EE | EE | Trichloroacetic Acid (TCA) | EE | FN |
| | | | Methoxyethyl Oleate | EE | EG | Trichloroethane | EE | NN |
| Citric Acid, 10% | EE | EE | Methyl Acetate | EE | GF | Trichloroethylene | EE | NN |
| Cresol | EE | GF | Methyl Ethyl Ketone | EE | EG | Triethylene Glycol | EE | EE |
| Cyclohexane | EE | FN | Methyl Isobutyl Ketone | EE | GF | Tripropylene Glycol | EE | EE |
| Cyclohexanone | EE | FN | Methyl Propyl Ketone | EE | GF | Tris Buffer, Solution | EE | EG |
| Cyclopentane | EE | FN | Methylene Chloride | EE | FN | Urea | EE | EE |
| Decahydronaphtalene | EE | GF | Methyl-t-Butyl Ether | EE | FN | Xylene | EE | FN |

The first character indicates the characteristics of vials and cap at low temperature; the second character indicates the characteristics at high temperature conditions.

# Appendix I

E = No damage after 30 days of constant exposure; G = Little of no damage after 30 days of constant exposure; F = Some effect after 7 days of constant exposure; N = Immediate damage may occur. Not recommended for continuous use; S = Surface.

**Solvent Compatibility of Materials Used for Septa**

| Solvent | PTFE/Red Rubber | PTFE/Silicone | PTFE/Silicone/PTFE | PTFE/Butyl |
|---|---|---|---|---|
| Acetic Acid Aqueous | A(A) | A(A) | A(A) | A(A) |
| Acetone | A(A) | A(A) | A(B) | A(A) |
| Acetonitrile | A(A) | A(A) | A(–) | A(A) |
| Alcohols (Aromatic) | A(B) | A(A) | A(–) | A(B) |
| Alcohols (Aliphatic) | A(A) | A(A) | A(–) | A(A) |
| Amyl Acetate | A(A) | A(C) | A(D) | A(A) |
| Aqueous Solution Dilute | A(A) | A(A) | A(–) | A(A) |
| Benzene | A(D) | A(C) | A(D) | A(D) |
| Butyl Alcohol | A(B) | A(B) | A(B) | A(B) |
| Carbon Disulphide | A(D) | A(A) | A(–) | A(D) |
| Carbon Tetrachloride | A(D) | A(C) | A(D) | A(D) |
| Chloroform | A(D) | A(C) | A(D) | A(D) |
| Cyclohexane | A(D) | A(C) | A(D) | A(D) |
| Cyclohexanol | A(D) | A(B) | A(–) | A(D) |
| Diethyl Ether | A(D) | A(B) | A(–) | A(D) |
| Dimethyl Sulphoxide | A(C) | A(A) | A(–) | A(C) |
| Dioxane | A(B) | A(C) | A(D) | A(B) |
| Esters | A(B) | A(B) | A(–) | A(B) |
| Ethyl Acetate | A(B) | A(B) | A(B) | A(B) |
| Ethyl Alcohol | A(A) | A(A) | A(B) | A(A) |
| Ethylene Chloride | A(D) | A(C) | A(D) | A(D) |
| Ethylene Glycol | A(A) | A(A) | A(A) | A(A) |
| Formaldehyde | A(B) | A(A) | A(B) | A(B) |
| Glycol | A(A) | A(A) | A(A) | A(A) |
| Halogenated Hydrocarbons | A(D) | A(A) | A(–) | A(D) |
| Hexane | A(D) | A(C) | A(D) | A(D) |
| Hydrochloric Acid Dilute | A(A) | A(A) | A(–) | A(A) |
| Iso-Octane | A(D) | A(C) | A(D) | A(D) |
| Ketones | A(A) | A(B) | A(–) | A(A) |
| MeOH/$H_2O$/Acetonitrile | A(A) | A(B) | A(–) | A(A) |
| Methanol | A(A) | A(A) | A(A) | A(A) |
| Methyl Chloride | A(C) | A(A) | A(D) | A(C) |
| Methyl Acetate | A(B) | A(B) | A(D) | A(B) |
| Methyl Ethyl Ketone | A(A) | A(A) | A(D) | A(A) |
| Methyl Chloride | A(D) | A(B) | A(–) | A(D) |
| Nitric Acid Dilute | A(A) | A(B) | A(B) | A(A) |
| Pentane | A(D) | A(C) | A(–) | A(D) |
| Petroleum Ether | A(D) | A(C) | A(–) | A(D) |
| Sodium Hydroxide | A(A) | A(A) | A(B) | A(A) |
| Sulphuric Acid Dilute | A(D) | A(B) | A(D) | A(D) |
| Surfactants | A(A) | A(A) | A(–) | A(A) |
| Toluene | A(D) | A(C) | A(D) | A(D) |
| Trichloroethylene | A(D) | A(C) | A(D) | A(D) |
| Water | A(A) | A(A) | A(A) | A(A) |

The first character indicates the characteristics of septa prior puncture. The second character indicates the characteristics of septa after puncture.

A = Recommended; B = Suitable for most purposes; C = Use with care; D = Not advisable; - = Not tested.

# Appendix I

**Product Description**

1) **Seal**
   A seal is an already assembled closure consisting of a cap and septum.

2) **Rubber**
   Red Rubber/PTFE is a synthetic rubber which is softer and show less fragmentation than Natural Rubber/PTFE. It has better cleanliness and purity then Natural Rubber/PTFE but inferior than Silicone. Nevertheless, it does not have the outstanding resealability property like Natural Rubber for multiple injections.

3) **Pre-slit septa**
   The septa are cross-slit to aid in the needle penetration. The Septa are only cut through the Silicone layer, but not the PTFE layer to avoid the risk of concentration changes due to solvent loss or contamination from the environment.

4) **Ultrabond**
   The Ultrabond seal is that the septa and screw cap form an inseparable unit. The molecular structure of the contact areas of the PP screw cap and the septa are modified such that it requires no glue or adhesive between the two to form a firm unit. The Ultrabond products is recommended over a general cap/septa assembly:
   - To avoid pushing the septa into the vial when use with very thick and dull needles
   - For screw caps with a wide diameter, where a septum cannot achieve any press-fit in the cap

5) **Micro-insert**
   A Micro-insert is different from a Micro-vial where it cannot be sealed on its own. The diameter of the Micro-insert is depending on the size of vial opening. A Micro-insert reduces the volume of sample needed and allow the needle to pick up even the smallest sample quantities.

## Appendix I

# Syringe filter order guideline

Choosing the right membrane is important. The wrong membrane could cause loss of valuable samples, time and money. Please use below guideline and chemical compatibility table as reference.

| | | |
|---|---|---|
| Hydrophilic Nylon | pH 6-13 | • Naturally hydrophilic, high protein binding, high dirt-loading, surfactant-free and offer the lowest extractables.<br>• Filtering of general samples and organic solvents.<br>• Not recommended for use with acids. |
| Hydrophilic PVDF (polyvinylidene fluoride) | pH 3-12 | • Extremely low protein binding.<br>• Good chemical compatibility.<br>• For filtration of non-aggressive aqueous and mild organic solutions, or when maximizing protein recovery is important. |
| Hydrophilic RC (regenerated cellulose) | pH 3-12 | • Hydrophilic membrane with good solvent resistance.<br>• Low protein binding and extractables.<br>• Good chemical compatibility with nearly all common HPLC solvents and stable against DMSO.<br>• Good for general filtration, tissue culture media filtration or life science applications. |
| Hydrophilic PES (polyethersulfone) | pH 3-12 | • Low protein binding and extractables.<br>• Good for life science applications. |
| PTFE | pH 1-14 | • High chemical compatibility.<br>• High temperature resistance.<br>• Good for filtration of gases, aggressive chemicals, and strong acid. |
| Cellulose Acetate (CA) | pH 4-8 | • Low protein binding<br>• For filtration of aqueous solutions<br>• Good for applications involving culture media |
| Mixed Cellulose Ester (MCE) | pH 4-8 | • High protein binding<br>• Good for general filtration of aqueous solutions. |

## Solvent Compatibility:

| Solvent | MCE | CA | PES | Nylon | PVDF | PTFE | RC |
|---|---|---|---|---|---|---|---|
| Acetic Acid (glacial) | X | X | O | X | O | O | LR |
| Acetone | X | X | X | O | X | O | O |
| Acetonitrile (ACN) | X | X | X | O | LR | O | O |
| Benzene | O | O | X | O | O | O | O |
| Butyl Alcohol | O | O | O | O | O | O | O |
| Chloroform | O | X | X | X | O | O | O |
| Cyclohexanone | X | X | X | O | X | O | O |
| Dimethyl Sulfoxide (DMSO) | X | X | X | O | X | O | O |
| Ethyl Acetate | X | X | X | O | O | O | O |
| Ethyl Alcohol | X | O | O | O | LR | O | O |
| Formaldehyde | X | X | NI | O | O | O | LR |
| Hexane | O | O | O | O | O | O | O |
| Hydochloric Acid, 1N (HCl) | LR | LR | O | LR | O | O | X |
| Hydochloric Acid, 6N (HCl) | LR | X | LR | X | LR | O | X |
| Hydochloric Acid, 12N (HCl) | X | X | LR | X | X | O | X |
| Hydrogen Peroxide, 3% | X | O | NI | O | O | O | X |
| Isopropyl Alcohol | X | O | O | LR | O | O | O |
| Methanol | X | O | O | LR | O | O | O |
| Nitric Acid, 6N (HNO3) | X | O | O | X | O | O | X |
| Nitric Acid, 12N (HNO3) | X | X | NI | X | X | LR | X |
| Sodium Carbonate (aqueous) | O | NI | NI | LR | O | O | NI |
| Sodium Hydroxide, 3N (NaOH) | X | X | O | O | O | O | X |
| Sulfuric Acid, 6N (H2SO4) | LR | X | LR | X | LR | O | LR |
| Sulfuric Acid, 32N (H2SO4) | X | X | X | X | LR | LR | X |
| Tetrahydrofuran (THF) | X | X | NI | O | X | O | O |
| Toluene | O | O | O | O | O | O | O |

| O: Recommended | LR: Limited recommendation | X: Not recommended | NI: No info |
|---|---|---|---|

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