

Consumables Catalogue



CoreFocus

The Smart Choice In Consumables **SHIMADZU**

For 150 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”.

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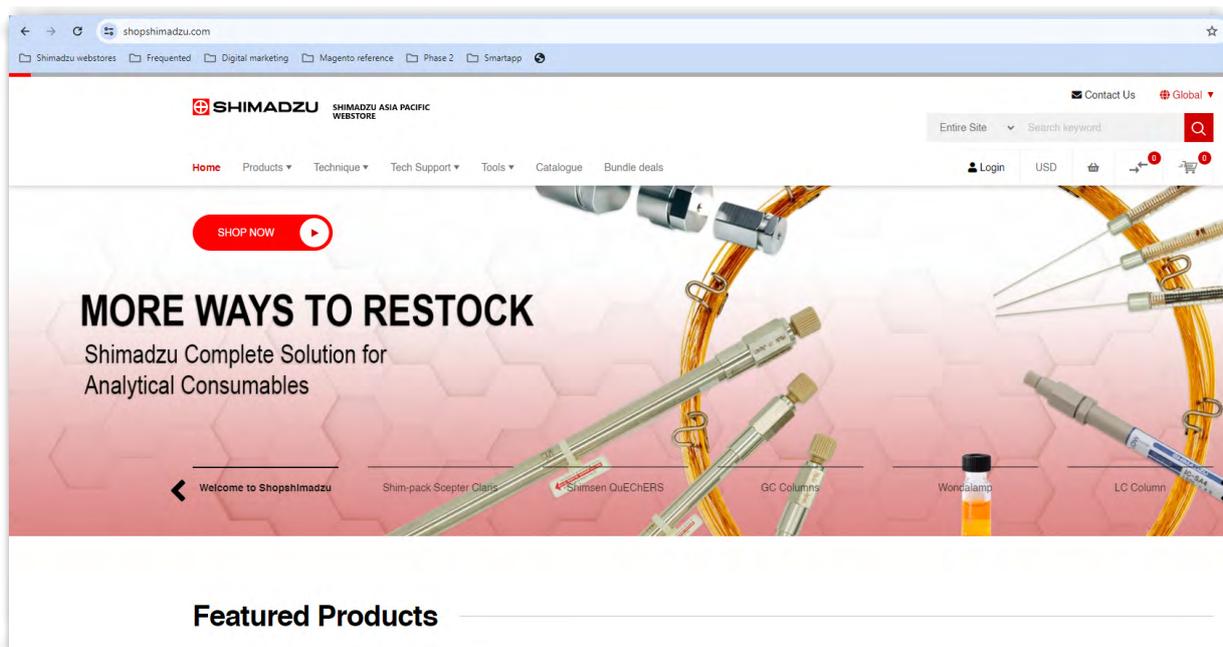
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UHPLC/HPLC Columns and LC Accessories



Shimadzu Liquid Chromatographs



Nexera X3 model

Nexera X3 is Shimadzu's new flagship UHPLC model. Nexera X3 excels in high throughput environments requiring fast separations. The system easily handles small ID UHPLC columns with sub-2 micron particles for high efficiency chromatography. Five minute run times are the norm.

Utilizing Analytical Intelligence (AI) technologies, and featuring the most advanced performance features available, the Nexera X3 will transform your workflows for maximum reliability, uptime, and efficiency.

Nexera XS model

Nexera XS excels at fast separations, easily handling small ID UHPLC columns with sub-2 micron particles or the popular SPP phases for high efficiency and lower back pressure. A common XS configuration may have a 4-channel solvent selection valve on each pump providing versatility for method development. Five to ten minute run times are the norm.

Nexera XR model

Nexera XR is perfect for fast separations using the popular SPP column phases for high efficiency and lower back pressure. This system offers a rugged and forgiving UHPLC workflow. Five to ten minute separations are the norm.

Common Features:

- Automated support functions utilizing digital technology, such as M2M, IoT, and Artificial Intelligence (AI), that enable higher productivity and maximum reliability.
- Allows a system to monitor and diagnose itself, handle any issues during data acquisition without user input, and automatically behave as if it were operated by an expert.
- Supports the acquisition of high quality, reproducible data regardless of an operator's skill level for both routine and demanding applications.



Liquid Chromatograph Mass Spectrometer
LCMS-2050

LCMS-2050

The LCMS-2050 provides both high speed and high sensitivity analysis even in a small design. We have achieved the utmost in both miniaturization and high performance with Shimadzu's technology cultivated over many years of MS development. A single platform, a single solution for LC detection, the LCMS-2050 has the power to deliver better results with incredible simplicity and unparalleled robustness. It may be small but the design and capability of the new single quadrupole LC/MS will change the productivity of any analytical laboratory.

| | | |
|--|---|--|
| <ul style="list-style-type: none"> 3-10 μm > 3-4.6 mm i.d. 2.7-5 μm 3-4.6 mm i.d. | <ul style="list-style-type: none"> 1.9-3 μm 2.1-3 mm i.d. 2.7 μm 2.1-3 mm i.d. | <ul style="list-style-type: none"> < 2 μm 2.1 mm i.d. 2 < 2 μm 2.1 mm i.d. |
| <p>Nexera XS Ultra High Performance Liquid Chromatograph</p> | <p>Nexera X3 Ultra High Performance Liquid Chromatograph</p> <p>It is compatible with a wide range of analysis conditions from conventional HPLC analysis to ultra-high separation analysis.</p> | |
| <p>Nexera XR Ultra High Performance Liquid Chromatograph</p> | <p>This UHPLC-like model is the new standard for the Shimadzu LC series.</p> | <p>Fully porous particles (FPP)</p> |
| <p>Nexera lite High Performance Liquid Chromatograph</p> | <p>A conventional HPLC model</p> | <p>Superficially porous particles (SPP)</p> |

Column Features

| Column Type | Column Series | Feature |
|------------------------|---------------------|--|
| UHPLC/HPLC Columns | Shim-pack Arata | Unprecedented resolution and peak shape of basic compounds & peptides |
| | Shim-pack Scepter | Excellent stability & performance could be achieved under a wide range of LC conditions |
| | Shim-pack Velox | Maximize LC separation performance with core shell technology |
| | Shim-pack G | Wide range of chemistries |
| | Shim-pack XR | Offer versatility and fast analysis |
| | Shim-pack VP | Strict manufacturing uniformity |
| | Shim-pack MAqC-ODS | Strong retention of basic compounds |
| | Shim-pack FC-ODS | Shortens the analysis time using a conventional system |
| | Shim-pack Mix-HILIC | HILIC column suitable for polar metabolite analysis |
| | Mastro2 | Metal free column for stable and reliable data |
| | STR-ODS | Durable, high-performance, low-pressure column |
| Preparative Columns | Shim-pack Scepter | Seamless scaleup from UHPLC/analytical HPLC to preparative separation |
| | Shim-pack G | Wide range of chemistries |
| | Shim-pack PREP | Prep columns packed with 15 μ m particles |
| Microscale Columns | Shim-pack MC | Excellent durability & versatility |
| | Shim-pack MCT | Trap column with suppressed metal coordinative adsorption |
| | Shim-pack MCT L | Low volume trap column to minimize gradient delay |
| SFC Columns | Shim-pack UC | Wide range of stationary phases meets diverse needs |
| Size Exclusion Columns | Shim-pack GPC | Organic SEC (GPC) columns for the measurement of molecular weight distribution of high polymers and oligomers |
| | Shim-pack Bio Diol | Aqueous SEC (GFC) columns for aggregates and fragments analysis of peptides, oligonucleotides and biopharmaceuticals |
| | Shim-pack Diol | Aqueous SEC (GFC) columns |

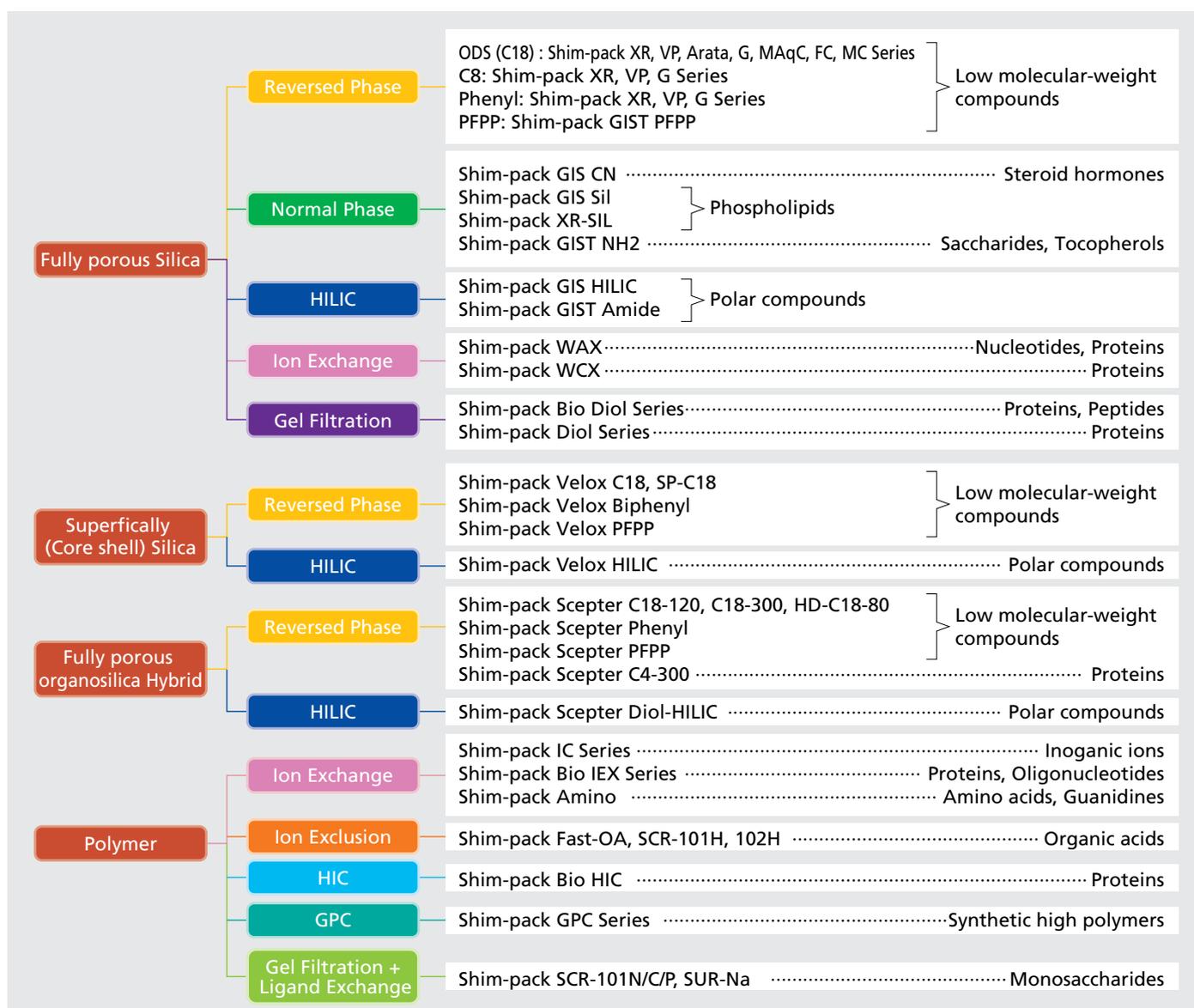
Column Features

| Column Type | Column Series | Feature |
|--|---------------------|--|
| Ion Exchange Columns | Shim-pack Bio IEX | Polymer based IEX columns for analysis of peptides, oligonucleotides and biopharmaceuticals |
| | Shim-pack WAX/WCX | Chemically-bonded hydrophilic silica gel-based ion exchange columns |
| Ion Chromatography Columns | Shim-pack IC | IC columns for the analysis of inorganic and organic ions |
| Hydrophobic Interaction Chromatography Columns | Shim-pack Bio HIC | HIC Column suitable for the analysis of DAR of ADC |
| Dedicated Columns | Nexleaf | Cannabis Analysis |
| | Shim-pack Amino | Ion exchange columns for post-column derivatization amino acid analysis |
| | Shim-pack Fast-OA | High-speed organic acid analysis column, quick and easy monitoring of culture or fermentation processes. |
| | Shim-pack SCR | For the analysis of monosaccharides and organic acids by ligand exchange + size exclusion and ion exclusion mode |
| | Shim-pack SUR | For the analysis of monosaccharides by ligand exchange + size exclusion and ion exclusion mode |
| | Intrada Amino Acid | Underivatized amino acid analysis |
| | Ultron PS | Organic acid, sugar and sugar alcohol analysis |
| Chiral Columns | Ultron ES | β -cyclodextrin bonded for separation of chiral compounds |
| Pretreatment Columns | Shim-pack MAYI | Biological sample pretreatment column |
| Mobile Phase Cleaner for UHPLC/HPLC | Ghost Trap DS/DS-HP | Consistently traps impurities, even in organic solvents |

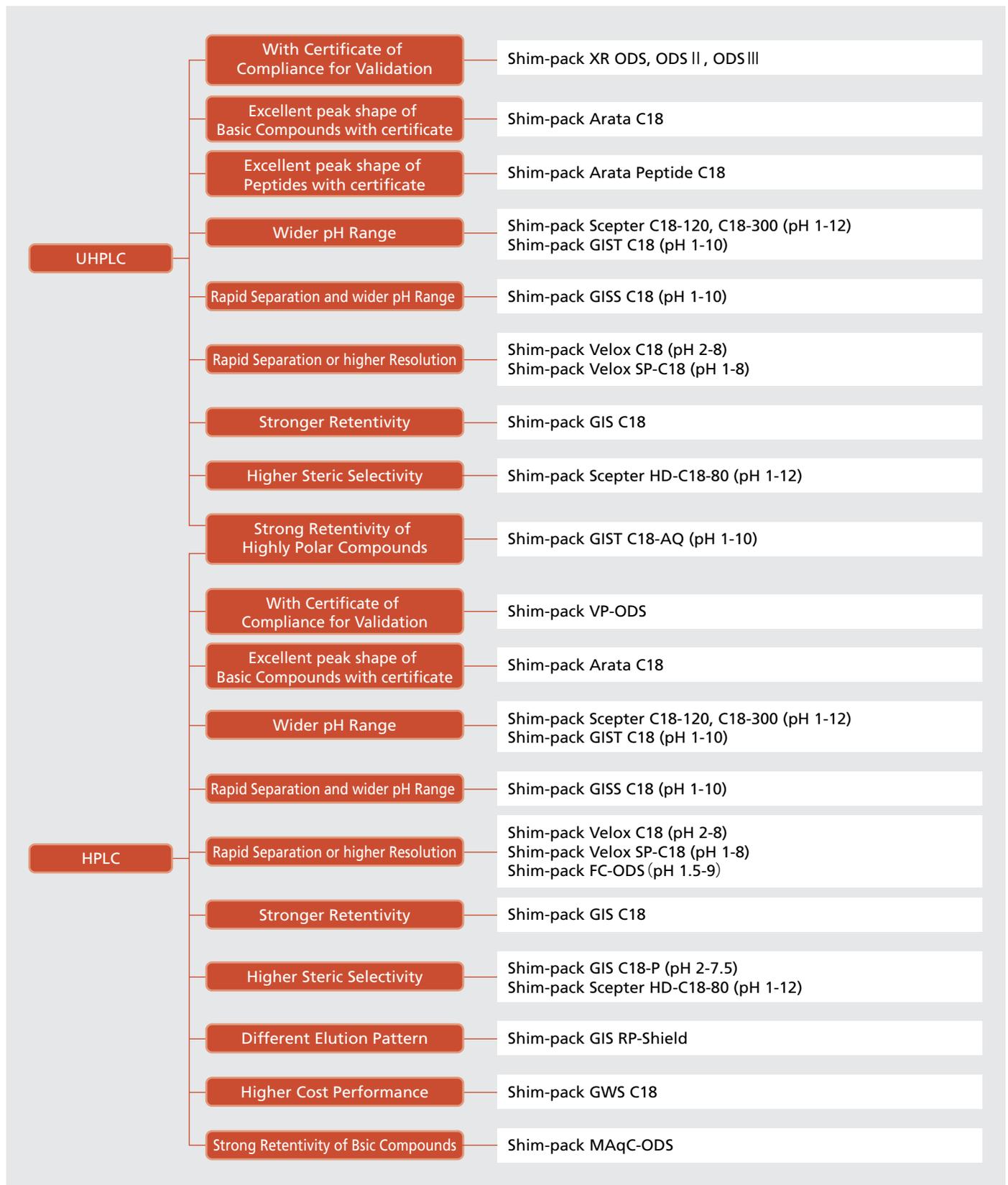
Selection by Base Particle Substrates



Selection by Separation Modes



Selection of ODS columns



Physical characteristics of HPLC/UHPLC/SFC Packing Materials

| Brand | Chemistry | Particle Size | Pore Size [nm] | Surface Area [m ² /g] | % Carbon Load | Endcapped | USP Code | Page |
|-------------------------|----------------------|----------------|----------------|----------------------------------|---------------|-----------|----------|------|
| Shim-pack Arata | C18 | 2.2, 5 | 12 | 340 | 17 | Yes | L1 | 18 |
| | Peptide C18 | 2.2 | 12 | 340 | 17 | Yes | L1 | 20 |
| Shim-pack GIST | C18 | 2, 3, 5 | 10 | 350 | 14 | Yes | L1 | 32 |
| | C18-AQ | 1.9, 3, 5 | 10 | 350 | 13 | Yes | L1 | 34 |
| | C8 | 2, 3, 5 | 10 | 350 | 8 | Yes | L7 | 43 |
| | Phenyl | 2, 3, 5 | 10 | 350 | 10 | No | L11 | 45 |
| | Phenyl-Hexyl | 3, 5 | 10 | 350 | 9 | Yes | L11 | 47 |
| | PFPP | 3, 5 | 10 | 350 | 10 | Yes | L43 | 49 |
| | Amide | 1.9, 3, 5 | 10 | 350 | 8.5 | No | L68 | 51 |
| Shim-pack GISS | NH2 | 3, 5 | 10 | 350 | 7 | No | L8 | 55 |
| | C18 | 1.9, 3, 5 | 20 | 200 | 9 | Yes | L1 | 36 |
| Shim-pack GISS | C8 | 1.9, 3, 5 | 20 | 200 | 6 | Yes | L7 | - |
| | C18 | 2, 3, 4, 5, 10 | 10 | 450 | 15 | Yes | L1 | 38 |
| Shim-pack GIS | C18-P | 3, 5 | 10 | 450 | 29 | Yes | L1 | 40 |
| | RP-Shield | 5 | 10 | 450 | 9 | No | L1 | 42 |
| | CN | 3, 5 | 10 | 450 | 14 | No | L10 | 57 |
| | Sil | 3, 5 | 10 | 450 | - | No | L3 | 59 |
| | HILIC (Diol) | 3, 5 | 10 | 450 | 20 | No | L20 | 54 |
| Shim-pack GWS | C18 | 5 | 10 | 450 | 9.5 | Yes | L1 | 61 |
| Shim-pack Velox | C18 | 1.8 | 9 | 125 | 9 | Yes | L1 | 27 |
| | | 2.7 | | 130 | 7 | | | |
| | | 5 | | 100 | 5 | | | |
| | SP-C18 | 1.8 | 9 | 125 | 7 | No | L1 | 27 |
| | | 2.7 | | 130 | 7 | | | |
| | | 5 | | 100 | 5 | | | |
| | Biphenyl | 1.8 | 9 | 125 | 7 | Yes | L11 | 27 |
| 2.7 | | 130 | | 7 | | | | |
| 5 | | 100 | | 5 | | | | |
| PFPP | 1.8 | 9 | 125 | 4 | No | L43 | 27 | |
| | 2.7 | | 130 | 4 | | | | |
| | 5 | | 100 | 3 | | | | |
| HILIC (Unbonded Silica) | 2.7 | 9 | 130 | - | - | L3 | 27 | |
| Shim-pack Scepter | C18-120 | 1.9, 3, 5 | 12 | 360 | 20 | Yes | L1 | 22 |
| | C18-300 | 1.9, 3, 5 | 12 | ND | ND | Yes | L1 | 22 |
| | HD-C18-80 | 1.9, 3, 5 | 8 | 430 | 25 | Yes | L1 | 22 |
| | C8-120 | 1.9, 3, 5 | 12 | 360 | 17 | Yes | L7 | 22 |
| | Phenyl-120 | 1.9, 3, 5 | 12 | 360 | 17 | Yes | L11 | 22 |
| | PFPP-120 | 1.9, 3, 5 | 12 | 360 | 15 | No | L43 | 22 |
| | C4-300 | 1.9, 3, 5 | 30 | ND | ND | Yes | L26 | 22 |
| | Diol-HILIC-120 | 1.9, 3, 5 | 12 | 360 | 12 | No | L20 | 22 |
| Shim-pack VP | ODS | 5 | 12 | 410 | 20 | Yes | L1 | 62 |
| | C8 | 5 | 12 | 410 | 12.5 | Yes | L7 | 62 |
| | Phenyl | 5 | 12 | 410 | 12.3 | Yes | L11 | 62 |
| Shim-pack XR | ODS | 2.2 | 12 | 340 | 18 | Yes | L1 | 62 |
| | ODS II | 2.2 | 8 | 470 | 20 | Yes | L1 | 62 |
| | ODS III (50/75 mm) | 1.6 | 7.5 | 500 | 22 | Yes | L1 | 62 |
| | ODS III (150/200 mm) | 2.2 | 8 | 470 | 20 | Yes | L1 | 62 |
| | C8 | 2.2 | 12 | 340 | 11 | Yes | L7 | 62 |
| | Phenyl | 2.2 | 12 | 340 | 11 | Yes | L11 | 62 |
| | Sil | 2.2 | 12 | 340 | - | - | L3 | 62 |

| Brand | Chemistry | Particle Size | Pore Size [nm] | Surface Area [m ² /g] | % Carbon Load | Endcapped | USP Code | Page |
|----------------|-----------------|---------------|----------------|----------------------------------|---------------|-------------|----------|------|
| Shim-pack MAqC | ODS I | 5 | 12 | ND | 13 | Yes | L1 | 66 |
| Shim-pack FC | ODS | 3 | 12 | 315 | 18 | Yes | L1 | 68 |
| Shim-pack UC | RP | 3, 5 | 10 | 450 | 9 | No | L1 | 84 |
| | ODS | 3, 5 | 12 | 3 μm: 340, 5 μm: 300 | 16 | Yes | L1 | 85 |
| | GIS II | 3, 5 | 10 | 450 | 11 | Yes | L1 | 84 |
| | Phenyl | 3, 5 | 10 | 450 | 9.5 | No | L11 | 84 |
| | CN | 3, 5 | 10 | 450 | 14 | No | L10 | 84 |
| | Diol | 3, 5 | 10 | 450 | 20 | No | L20 | 84 |
| | Diol II | 3, 5 | 12 | 3 μm: 340, 5 μm: 300 | ND | No | L20 | 85 |
| | Sil | 3, 5 | 10 | 450 | - | - | L3 | 84 |
| | Sil II | 3, 5 | 12 | 3 μm: 340, 5 μm: 300 | - | - | L3 | 85 |
| | Amide | 3, 5 | 10 | 450 | 18 | No | L68 | 84 |
| | NH ₂ | 3, 5 | 10 | 450 | 8 | No | L8 | 84 |
| | Choles | 3, 5 | 12 | 3 μm: 340, 5 μm: 300 | 20 | Yes | L101 | 85 |
| | PBr | 3, 5 | 12 | 3 μm: 340, 5 μm: 300 | 8 | Yes | - | 85 |
| | PyE | 3, 5 | 12 | 3 μm: 340, 5 μm: 300 | 18 | Yes | - | 85 |
| | HyP | 3, 5 | 12 | 3 μm: 340, 5 μm: 300 | ND | Yes | - | 85 |
| | Py | 3, 5 | 12 | 3 μm: 340, 5 μm: 300 | ND | Yes | - | 85 |
| | Triazole | 3, 5 | 12 | 3 μm: 340, 5 μm: 300 | ND | No | L104 | 85 |
| | NaE | 3, 5 | 12 | 3 μm: 340, 5 μm: 300 | 16 | Yes | - | 85 |
| | PolyVP | 3, 5 | ND | ND | ND | Proprietary | - | 85 |
| | PolyBT | 3, 5 | ND | ND | ND | Proprietary | - | 85 |

ND: Not Disclosed

Selection by USP

| USP Code | Description | Shimadzu Column |
|---------------------|---|-----------------------------|
| 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 |
| | | Shim-pack Velox SP-C18 |
| | | Shim-pack Scepter C18-120 |
| | | Shim-pack Scepter C18-300 |
| | | Shim-pack Scepter HD-C18-80 |
| | | Shim-pack Arata C18 |
| | | Shim-pack Arata Peptide C18 |
| | | Shim-pack XR-ODS |
| | | Shim-pack XR-ODS II |
| | | Shim-pack XR-ODS III |
| | | Shim-pack VP-ODS |
| | | Shim-pack GIST C18 |
| | | Shim-pack GIST C18-AQ |
| | | Shim-pack GISS C18 |
| | | Shim-pack GIS C18 |
| | | Shim-pack GIS C18-P |
| | | Shim-pack GIS RP-Shield |
| | | Shim-pack GWS C18 |
| | | Shim-pack Solar C18 |
| | | Shim-pack FC-ODS |
| | | Shim-pack UC GIS II |
| | | Shim-pack UC ODS |
| | | Shim-pack UC-RP |
| Shim-pack MC C18 | | |
| Mastro2™ C18 | | |
| ULTRON VX-ODS | | |
| STR ODS-II | | |
| STR ODS-M | | |
| L3 | Porous silica particles, 1.5 to 10 µm in diameter, or a monolithic silica rod. | Shim-pack Velox HILIC |
| | | Shim-pack XR-SIL |
| | | Shim-pack GIS SIL |
| | | Shim-pack UC Sil |
| | | Shim-pack UC Sil II |
| ULTRON VX-SIL | | |
| 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 |
| | | Shim-pack XR-C8 |
| | | Shim-pack VP-C8 |
| | | Shim-pack GIST C8 |
| | | Shim-pack Solar C8 |
| ULTRON VX-Octyl | | |
| 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 |
| | | Shim-pack UC NH2 |
| 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 |
| | | Shim-pack UC CN |
| 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 |
| | | Shim-pack Scepter Phenyl |
| | | Shim-pack XR-Phenyl |
| | | Shim-pack VP-Phenyl |
| | | Shim-pack GIST Phenyl |
| | | Shim-pack GIST Phenyl-Hexyl |
| Shim-pack UC Phenyl | | |

| USP Code | Description | Shimadzu Column |
|----------|--|------------------------------|
| 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 |
| | | Shim-pack SCR-102H |
| | | Shim-pack FAST-OA |
| | | ULTRON PS-80H |
| 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 |
| | | ULTRON PS-80C |
| 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 |
| | | Shim-pack GIS HILIC |
| | | Shim-pack UC Diol |
| | | Shim-pack UC Diol II |
| | | Shim-pack Diol-150, 300 |
| | | Shim-pack Bio Diol Series |
| L21 | A rigid, spherical styrene-divinylbenzene copolymer, 3 to 30 µm in diameter | Shim-pack GPC-800 Series |
| L22 | A cation-exchange resin made of porous polystyrene gel with sulfonic acid groups, 5 – 15 µm in diameter. | Shim-pack IC-C1 |
| | | Shim-pack AMINO-LI |
| | | Shim-pack AMINO-NA |
| L26 | Butyl silane chemically bonded to totally porous or superficially porous silica particles, 1.5 to 10 µm in diameter | Shim-pack Scepter C4 |
| 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 Series |
| L34 | Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the lead form, 7 to 9 µm in diameter | ULTRON PS-80P |
| L43 | Pentafluorophenyl groups chemically bonded to silica particles by a propyl spacer, 1.5 to 10 µm in diameter | Shim-pack Velox PFPP |
| | | Shim-pack Scepter PFPP |
| | | Shim-pack GIST PFPP |
| | | Mastro2™ PFP |
| L45 | Beta cyclodextrin, R,S-hydroxypropyl ether derivative, bonded to porous silica particles, 3 to 10 µm in diameter | ULTRON ES-CD |
| | | ULTRON ES-PhCD |
| 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 |
| 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 |
| | | Shim-pack SUR-Na |
| | | ULTRON PS-80N |
| 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, 300 |
| | | Shim-pack Bio Diol Series |
| 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 |
| | | Shim-pack UC Amide |
| L96 | Alkyl chain, reversed-phase bonded totally or superficially porous silica designed to retain hydrophilic and other oplar compounds when using highly aqueous mobile phases, including 100% aqueous, 1.5 µm to 10 µm in diameter. | Shim-pack GIST C18-AQ |
| L101 | Cholesteryl groups 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 UC-Choles |
| L104 | Triazole groups chemically bonded to porous silica particles, 1.5 to 10 µm in diameter | Shim-pack UC-Triazole |

Shim-pack Arata™ Series

■ Unprecedented Resolution and Peak Shape of Basic Compounds & Peptides

Shim-pack Arata C18

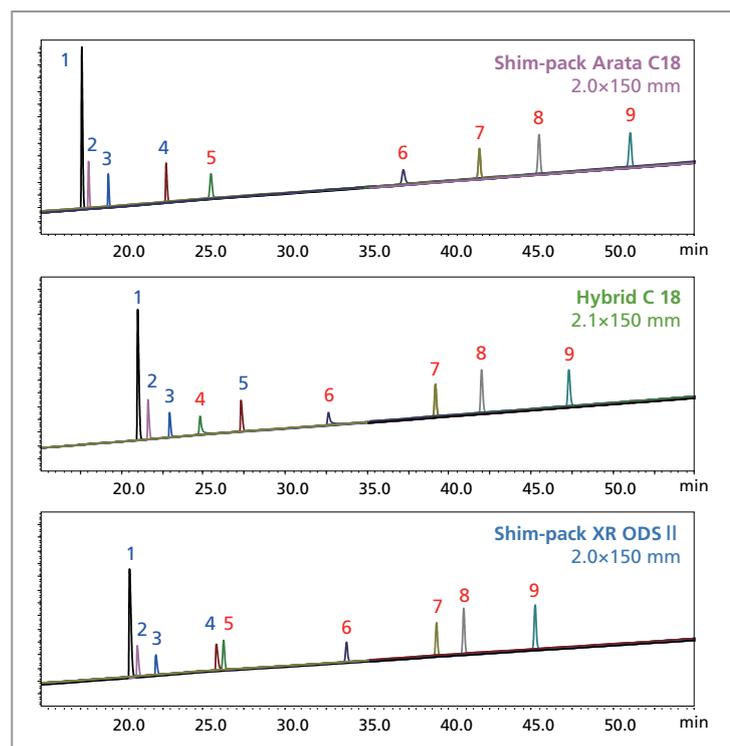
Even for LC columns that claim to be designed for basic compounds, adequate resolution often can not be obtained due to problems such as leading of highly polar basic compounds, peak shape deterioration of acidic compounds, or long equilibration time required for low ionic strength acidic mobile phase.

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

Unmatched peak shape of basic compounds can be achieved while maintaining good peak shape for acidic compounds using Shim-pack Arata LC columns.

■ Analysis of Mixtures of Basic and Acidic Drugs (Particle size: 2.2 -2.5 µm)



1. Cyproheptidine 2. Hydroxyzine 3. Mequitazine 4. Clemastine (basic drug)
5. Proxicam 6. Meloxicam 7. Flurbiprofen 8. Diclofenac 9. Mefenamic acid (acidic drug)

A mixture of 4 basic drugs and 5 acidic drugs was analyzed using a Shim-pack Arata C18 column (2.2 µm), a Hybrid C18 column (designed for improving peak shape of basic compounds: 2.5 µm), and a typical ODS column (Shim-pack XR-ODSII column: 2.2 µm). This mixture was analyzed under the low ionic strength acidic mobile phase (0.1 % formic acid mobile phase) condition, in which the peak shape of basic compounds tends to deteriorate so that the peak shapes (symmetry factors) of each drug were compared.

The peak symmetry of basic drugs (1-4) was improved using the hybrid C18 column, which is specifically claimed to be good for the peak shape of basic compounds under low ionic acidic mobile phase conditions, compared to the typical ODS column. While, the peak symmetry of acidic drugs (5-9) on the hybrid C18 column was deteriorated showing tailing. On the other hand, the Shim-pack Arata C18 column not only showed the best peak symmetry for the basic drugs, but also showed similar or better peak symmetry for acidic drugs compared to the general ODS.

| Shim-pack Arata | C18 |
|----------------------------------|--------------|
| Particle size | 2.2 µm, 5 µm |
| Pore size | 12 nm |
| Surface Area (m ² /g) | 340 |
| Carbon content (%) | 17 |
| End-cap | proprietary |
| pH range of use | 2 -7.5 |
| 100 % aqueous condition | Yes |
| USP classification | L1 |

■ Conditions

LC system : Nexera X2_SPD20A (semi-micro cell)

LC column :

Shim-pack Arata C18 (2.0 × 150 mm I.D., 2.2 µm)

Hybrid C18 (2.1 × 150 mm, 2.5 µm)

Shim-pack XR ODS II (2.0 × 150 mm I.D., 2.2 µm)

Mobile phase : A) 0.1 % HCOOH in H₂O

B) 0.1 % HCOOH in Acetonitrile

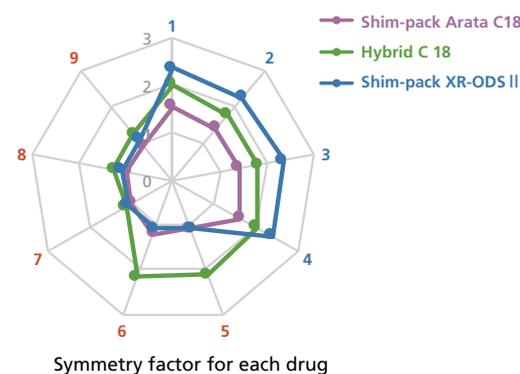
Gradient : 10 %B (0 min) →70 %B (50-60 min)→10 %B (60.01-70 min.)

Flow rate : 0.2 mL/min

Detection : 226 nm

Column temp. : 40 °C

Injection volume : 1 µL



Rapid Equilibration and Stable Retention Times

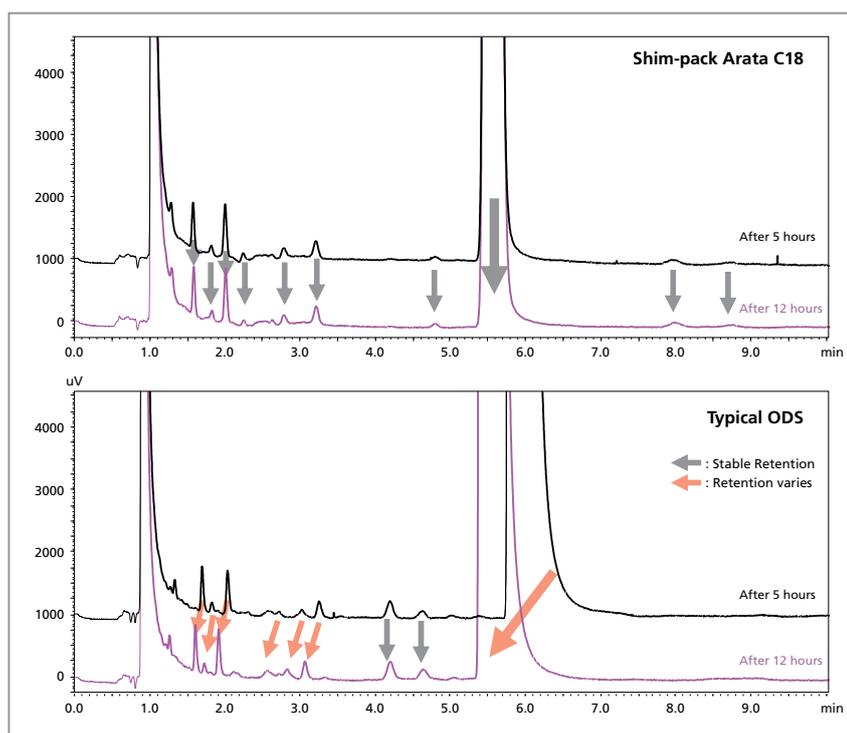
When analyzing basic compounds on a typical ODS column with low ionic acidic mobile phase (0.1 % formic acid, phosphoric acid, and others), not only poor peak shape but also long equilibration time required to obtain stable data is a common problem faced by customers. Shim-pack Arata C18 column can be rapidly equilibrated in low ionic strength acidic mobile phase conditions yielding excellent peak shape and stable retention times, which allows reliable qualitative and quantitative analysis.

■ Drug Purity Test

~ Retention Behavior of Basic Drug and its Impurities under 0.1 % Phosphoric Acid Mobile Phase Condition ~

Impurity control in drug substances and drug products is strictly regulated in the quality control process of pharmaceutical manufacturing. Impurities in the drug substances and drug products, which are final products, are controlled through impurity control in the raw materials and in each manufacturing process. As the concept of "Quality by design in manufacturing processes" is basically required, it is particularly important to improve the qualitative efficiency of impurity management in the CMC departments of pharmaceutical companies. In particular, ensuring the reliability (ruggedness) of the methods used for impurity control is a key factor affecting the quality control of pharmaceutical products.

Shim-Pack Arata C18 columns provides a method that yields stable separation performance through rapid equilibration under 0.1 % phosphoric acid mobile phase condition and secures high reliability (ruggedness) not only for basic drugs but also for trace amounts of related impurities.



■ Conditions

LC system : Nexera X2_M30A (STD Cell)
 LC Column : Shim-pack Arata C18 (3.0 × 75 mm I.D., 2.2 μm)
 Typical ODS column (3.0 × 75 mm I.D., sub 2 μm)
 Mobile phase : 0.1 % H₃PO₄ in H₂O / Acetonitrile
 = 76 / 24 (Shim-pack Arata C18)
 = 70 / 30 (Typical ODS)
 Flow rate : 0.4 mL/min
 Detection : 210 nm
 Column temp. : 40 °C
 Injection volume : 1 μL
 Sample : Amitriptyline

Both columns were equilibrated with mobile phase containing 0.1 % phosphoric acid and the retention behavior of Amitriptyline and its impurities were compared after 5 hours and 12 hours of equilibration.

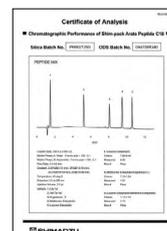
Retention time change of Amitriptyline and many related impurities depend on the equilibration time with the typical ODS column. This results in a concern about what effect the change in the retention time has on the resolution and selectivity. On the other hand, no change was observed in the retention time of Amitriptyline and its impurities regardless of the equilibration time with the Shim-Pack Arata C18 column. This difference in retention time change is suggested to be due to the difference in column equilibration time required under 0.1 % phosphate mobile phase condition.

Shim-pack Arata C18

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 pairing acid) containing mobile phase conditions, which are suitable for LC/MS(/MS) without the use of typical ion pairing agents.

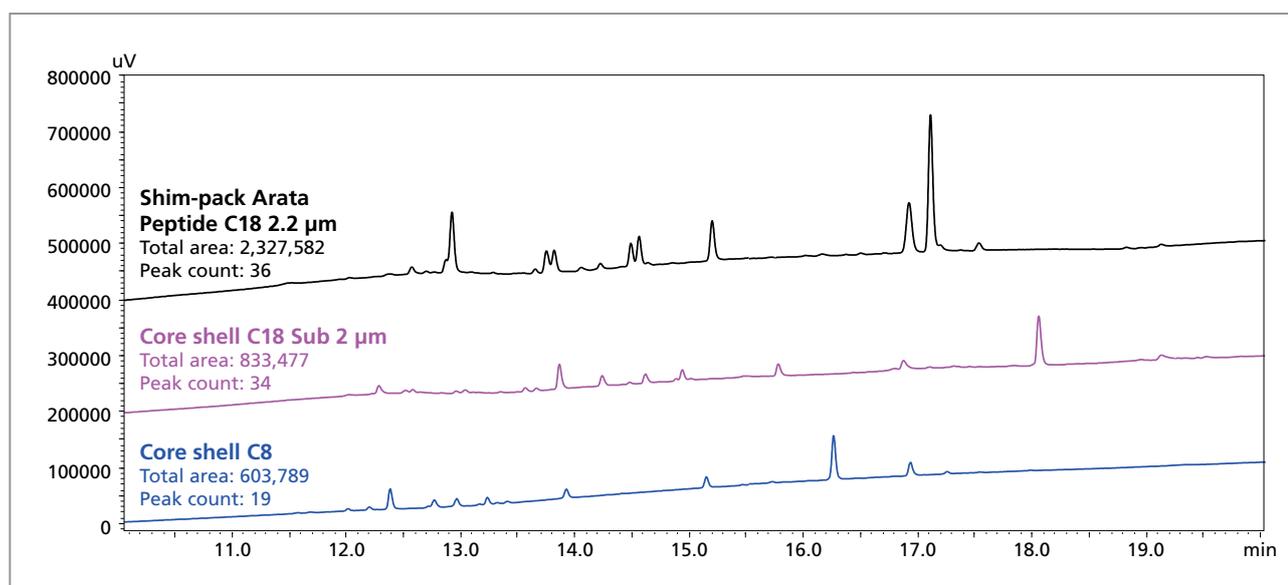
■ Increased Assurance of Peptide Analysis ~ Shim-pack Arata Peptide C 18 column ~

In order to ensure lot-to-lot reproducibility in peptide analysis, each lot of Shim-pack Arata Peptide C18 material is tested using a mixture of peptide standards in addition to the standard Shim-pack Arata C18 lot QC test. 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.



High Peptide Recovery enabled by Shim-pack Arata technology

Peptides are known to show non-specific adsorption to particles of LC columns. Since the adsorption of peptides to particles is minimized, high recovery of peptides is ensured and excellent peptides analysis can be provided by Shim-pack Arata Peptide C18 column.



■ Conditions

LC System : Nexera X2 M30A (STD Cell)
 LC Column : Shim-pack Arata Peptide C18 (2.0 × 150 mm I.D., 2.2 μm)
 Core shell Peptide C18 (2.1 × 150 mm I.D., sub 2 μm)
 Core shell C8 (2.1 × 150 mm I.D., sub 4 μm)
 Mobile phase : A) 0.1 % HCOOH in H₂O
 B) 0.1 % HCOOH in Acetonitrile
 Gradient : 2 % B (0-5 min) → 45 % B (20 min) → 100 % B (20.01 - 25 min)
 → 2 % B (25.01 - 30 min)

Flow rate : 0.2 mL/min
 Detection : 214 nm
 Column temp. : 40 °C
 Injection volume : 5 μL
 Sample : Myoglobin tryptic digest
 Vial : TORAST-H Bio Vial

Order Information

Shim-pack Arata C18 2.2 μm

| Length (mm) | I.D. (mm) | 2.0 | 3.0 |
|-------------|-----------|--------------|--------------|
| | | | |
| 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 |

Shim-pack Arata C18 5 μm

| Length (mm) | I.D. (mm) | 2.0 | 3.0 | 4.6 |
|-------------|-----------|--------------|--------------|--------------|
| | | | | |
| 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 C18 2.2 μm

| Length (mm) | I.D. (mm) | 2.0 |
|-------------|-----------|--------------|
| | | |
| 50 | | 227-32806-01 |
| 100 | | 227-32806-02 |
| 150 | | 227-32806-03 |

Shim-pack Arata Validation Kit*

| P/N | Description |
|--------------|---|
| 227-32807-01 | Validation Kit Shim-pack Arata C18, 2.2 μm , 2.0 \times 50 mm, 3/pk |
| 227-32807-02 | Validation Kit Shim-pack Arata C18, 2.2 μm , 2.0 \times 100 mm, 3/pk |
| 227-32807-03 | Validation Kit Shim-pack Arata C18, 2.2 μm , 3.0 \times 50 mm, 3/pk |
| 227-32807-04 | Validation Kit Shim-pack Arata C18, 2.2 μm , 3.0 \times 100 mm, 3/pk |
| 227-32808-01 | Validation Kit Shim-pack Arata C18, 5 μm , 2.0 \times 150 mm, 3/pk |
| 227-32808-02 | Validation Kit Shim-pack Arata C18, 5 μm , 3.0 \times 150 mm, 3/pk |
| 227-32808-03 | Validation Kit Shim-pack Arata C18, 5 μm , 4.6 \times 100 mm, 3/pk |
| 227-32808-04 | Validation Kit Shim-pack Arata C18, 5 μm , 4.6 \times 150 mm, 3/pk |
| 227-32808-05 | Validation Kit Shim-pack Arata C18, 5 μm , 4.6 \times 250 mm, 3/pk |
| 227-32809-01 | Validation Kit Shim-pack Arata Peptide C18, 2.2 μm , 2.0 \times 100 mm, 3/pk |
| 227-32809-02 | Validation Kit Shim-pack Arata Peptide C18, 2.2 μm , 2.0 \times 150 mm, 3/pk |

* Validation Kit consists of three columns packed with three different batches of sorbent.

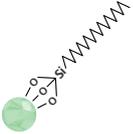
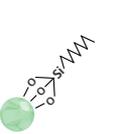
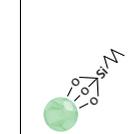
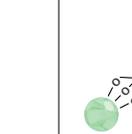
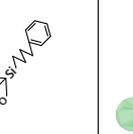
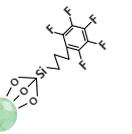
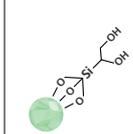
Shim-pack Scepter™ Series

■ Fully Porous Hybrid Particle Based Column Series

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.

Chemistries

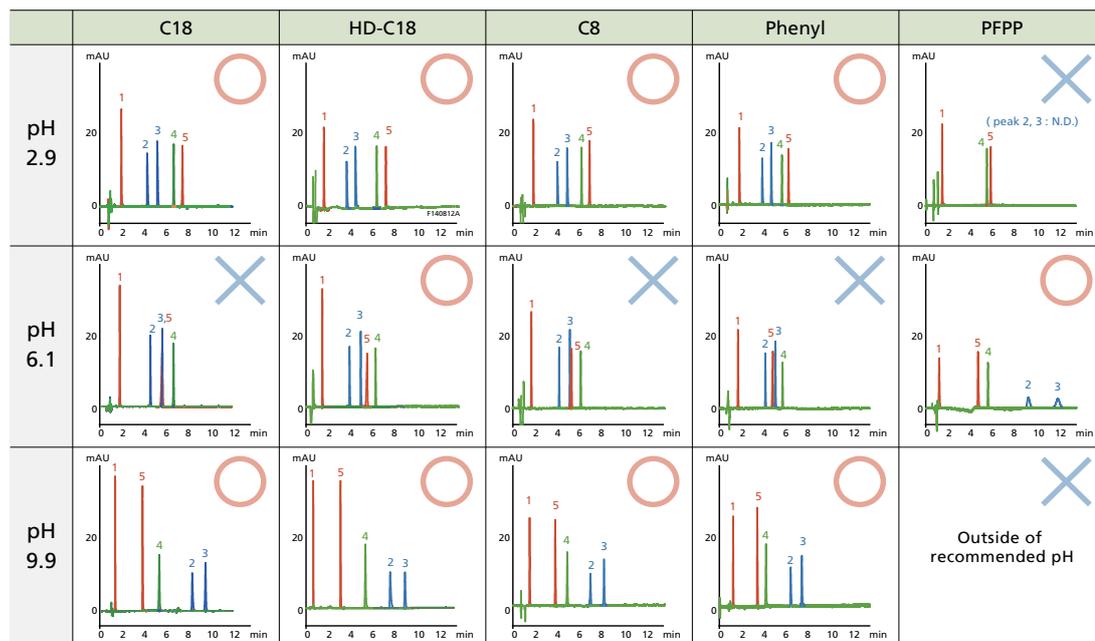
| | Reversed Phase | | | | | | | HILIC |
|-------------------------|---|--------------------------------------|---|---|--|---|---|---|
| | C18-120 | C18-300 | HD-C18 | C8-120 | C4-300 | Phenyl | PFPP | Diol-HILIC |
| Chemistry |  | |  |  |  |  |  |  |
| Bonded Phase | Octadecyl groups | Octadecyl groups (High Density type) | Octyl groups | Butyl groups | Phenylbutyl groups | Pentafluorophenyl propyl groups | Dihydroxypropyl groups | |
| Particle | Organic Silica Hybrid | | | | | | | |
| Particle Size (μm) | 1.9, 3, 5 | | | | | | | |
| Pore Size (nm) | 12 | 30 | 8 | 12 | 30 | 12 | | |
| End Capping | Proprietary | | | | | | None | |
| pH Range | 1 - 12 | | | | 1 - 10 | | 1 - 8 | 2 - 10 |
| 100 % aqueous condition | Yes | Yes | No | No | Yes | Yes | Yes | N/A |
| USP Code | L1 | | L1 | L7 | L26 | L11 | L43 | 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



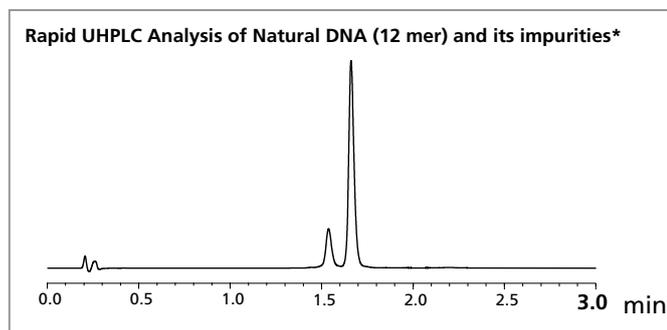
■ Analytes

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

Analysis Examples

Oligonucleotides Analysis using Shim-pack Scepter C18 Column

With excellent stability of organic silica hybrid particles, Shim-pack Scepter C18 columns are suitable for oligonucleotide analysis (under basic condition and high temperature).

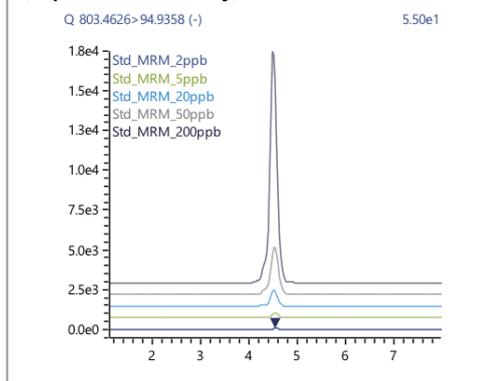


■ Conditions

- Column : Shim-pack Scepter C18 (50 mm × 2.1 mm I.D., 1.9 μm)
P/N: 227-31012-03
- Mobile phase : A) 0.1M TEAA (pH = 7.0)
B) CH₃CN
A/B = 75/25 (v/v)
- Flow rate : 0.8 mL/min
- Column temp. : 50 °C
- Detection : UV 260 nm
- Injection volume : 5 μL

* The sample was provided by Professor Obika's laboratory, Graduate School of Pharmaceutical Sciences, Osaka University.

Analysis of Phosphorothioate Oligonucleotides (Mipomersen-2'-deoxy)



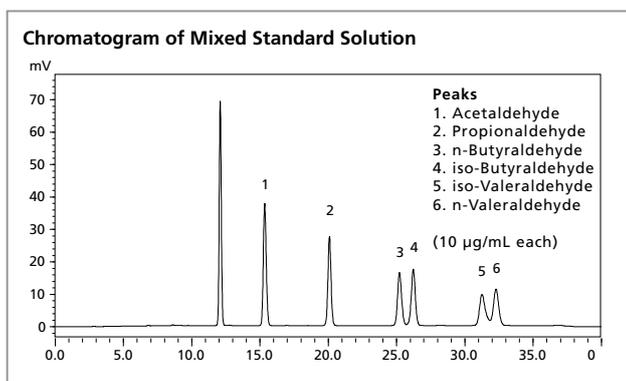
Conditions

| | |
|------------------|---|
| System | : Nexera/ LCMS-9030 |
| Column | : Shim-pack Scepter C18 (75 mmL × 2.0 mm I.D., 1.9 μm) P/N: 227-31011-04 |
| Mobile phase | : A) 50 mM HFIP in water B) Acetonitrile |
| Gradient program | : 5 %B (0-0.5 min) → 15 %B (0.5-6 min) |
| Flow rate | : 0.2 mL/min |
| Column temp. | : 50 °C |
| Injection volume | : 5 μL |

Mipomersen-2'-deoxy:
5'-mG-mC*-mC*-mU*-mC*-dA-dG-dT-dC*-dT-dG-dC*-dT-dT-dC*-mG-mC*-mA-mC*-mC*-3

Simultaneous Analysis of Six DNPH-Derivatized Aldehydes using a Shim-pack Scepter PFPP Column

The structural isomers, normal butyraldehyde and isobutyraldehyde, as well as isovaleraldehyde and normal valeraldehyde, were well separated with Shim-pack Scepter PFPP column.

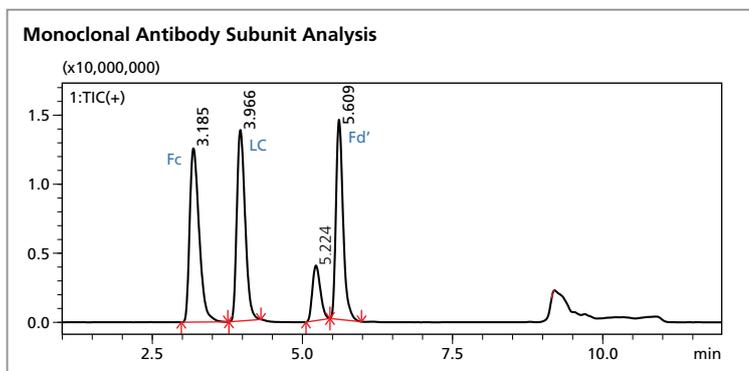


Conditions

| | |
|------------------|---|
| Column | : Shim-pack Scepter PFPP (150 mm × 4.6 mm I.D., 3 μm) |
| Mobile phase | : A) Water B) Methanol/Acetonitrile = 8/2 (v/v) |
| Gradient | : 20 %B (0 min) → 55 %B (5 min) → 60 %B (25 min) → 60 % (25-35 min) → 20 % (35-40 min) |
| Flow rate | : 1.0 mL/min |
| Column temp. | : 35 °C |
| Injection volume | : 20 μL |
| Detection | : UV 360 nm |

Monoclonal Antibody Subunit Analysis by LC/MS using Shim-pack Scepter C4-300 Column

Shim-pack Scepter C4-300 columns support protein analysis of molecular weight up to about 150,000, and the hybrid organic silica substrate material makes them well-suited for analyzing antibodies even under acidic and high-temperature conditions. Because they provide excellent peak shape even when using formic acid with poor ion pair effect as a mobile phase, they are also useful for high sensitivity analysis in an LC-MS system.



Conditions

| | |
|------------------|--|
| System | : Nexera X2/ LCMS-8060 |
| Column | : Shim-pack Scepter C4-300, 50 mm × 2.1 mm I.D., 3 μm |
| Mobile phase | : A) 0.1% formic acid in Water B) 0.1% formic acid in Acetonitrile |
| Gradient | : 1 %B (1 min) → 25 %B (1.1 min) → 40 %B (8 min) → 95 %B (8.1 min-10min) → 1 % (10.1 min) |
| Flow rate | : 0.3 mL/min |
| Column temp. | : 50 °C |
| Injection volume | : 1 μL |
| Sample | : IdeZ digested + DTT treated Adalimumab 0.2 mg/mL |

Order Information

Shim-pack Scepter

| Chemistry | | C18-120 | | | HD-C18-80 | | | C18-300 | | |
|--------------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Particle Size (µm) | ID (mm) | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 |
| | Length (mm) | | | | | | | | | |
| 1.9 | 50 | 227-31012-03 | 227-31013-01 | | 227-31026-03 | 227-31027-01 | | 227-31203-03 | 227-31203-07 | |
| | 75 | 227-31012-04 | 227-31013-02 | | 227-31026-04 | 227-31027-02 | | 227-31203-04 | 227-31203-08 | |
| | 100 | 227-31012-05 | 227-31013-03 | | 227-31026-05 | 227-31027-03 | | 227-31203-05 | 227-31203-09 | |
| | 150 | 227-31012-06 | 227-31013-04 | | 227-31026-06 | 227-31027-04 | | 227-31203-06 | 227-31203-10 | |
| 3 | 50 | 227-31014-03 | 227-31015-01 | 227-31016-02 | 227-31028-03 | 227-31029-01 | 227-31030-02 | 227-31203-13 | 227-31203-17 | 227-31203-22 |
| | 75 | 227-31014-04 | 227-31015-02 | 227-31016-03 | 227-31028-04 | 227-31029-02 | 227-31030-03 | 227-31203-14 | 227-31203-18 | 227-31203-23 |
| | 100 | 227-31014-05 | 227-31015-03 | 227-31016-04 | 227-31028-05 | 227-31029-03 | 227-31030-04 | 227-31203-15 | 227-31203-19 | 227-31203-24 |
| | 150 | 227-31014-06 | 227-31015-04 | 227-31016-05 | 227-31028-06 | 227-31029-04 | 227-31030-05 | 227-31203-16 | 227-31203-20 | 227-31203-25 |
| | 250 | | | 227-31016-06 | | | 227-31030-06 | | | 227-31203-26 |
| 5 | 50 | 227-31017-03 | 227-31018-01 | 227-31020-02 | 227-31021-02 | 227-31022-01 | 227-31024-02 | 227-31203-29 | 227-31203-33 | 227-31203-40 |
| | 75 | 227-31017-04 | 227-31018-02 | 227-31020-03 | 227-31021-03 | 227-31022-02 | 227-31024-03 | 227-31203-30 | 227-31203-34 | 227-31203-41 |
| | 100 | 227-31017-05 | 227-31018-03 | 227-31020-04 | 227-31021-04 | 227-31022-03 | 227-31024-04 | 227-31203-31 | 227-31203-35 | 227-31203-42 |
| | 150 | 227-31017-06 | 227-31018-04 | 227-31020-05 | 227-31021-05 | 227-31022-04 | 227-31024-05 | 227-31203-32 | 227-31203-36 | 227-31203-43 |
| | 250 | | | 227-31020-06 | | | 227-31024-06 | | | 227-31203-44 |

| Chemistry | | C8-120 | | | C4-300 | | | Phenyl | | |
|--------------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Particle Size (µm) | ID (mm) | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 |
| | Length (mm) | | | | | | | | | |
| 1.9 | 50 | 227-31033-03 | 227-31034-01 | | 227-31175-03 | 227-31176-01 | | 227-31063-03 | 227-31064-01 | |
| | 75 | 227-31033-04 | 227-31034-02 | | 227-31175-04 | 227-31176-02 | | 227-31063-04 | 227-31064-02 | |
| | 100 | 227-31033-05 | 227-31034-03 | | 227-31175-05 | 227-31176-03 | | 227-31063-05 | 227-31064-03 | |
| | 150 | 227-31033-06 | 227-31034-04 | | 227-31175-06 | 227-31176-04 | | 227-31063-06 | 227-31064-04 | |
| 3 | 50 | 227-31035-03 | 227-31036-01 | 227-31037-02 | 227-31177-03 | 227-31178-01 | 227-31179-02 | 227-31065-03 | 227-31066-01 | 227-31067-02 |
| | 75 | 227-31035-04 | 227-31036-02 | 227-31037-03 | 227-31177-04 | 227-31178-02 | 227-31179-03 | 227-31065-04 | 227-31066-02 | 227-31067-03 |
| | 100 | 227-31035-05 | 227-31036-03 | 227-31037-04 | 227-31177-05 | 227-31178-03 | 227-31179-04 | 227-31065-05 | 227-31066-03 | 227-31067-04 |
| | 150 | 227-31035-06 | 227-31036-04 | 227-31037-05 | 227-31177-06 | 227-31178-04 | 227-31179-05 | 227-31065-06 | 227-31066-04 | 227-31067-05 |
| | 250 | | | 227-31037-06 | | | 227-31179-06 | | | 227-31067-06 |
| 5 | 50 | 227-31038-03 | 227-31039-01 | 227-31041-02 | 227-31180-03 | 227-31181-01 | 227-31183-02 | 227-31068-03 | 227-31069-01 | 227-31071-02 |
| | 75 | 227-31038-04 | 227-31039-02 | 227-31041-03 | 227-31180-04 | 227-31181-02 | 227-31183-03 | 227-31068-04 | 227-31069-02 | 227-31071-03 |
| | 100 | 227-31038-05 | 227-31039-03 | 227-31041-04 | 227-31180-05 | 227-31181-03 | 227-31183-04 | 227-31068-05 | 227-31069-03 | 227-31071-04 |
| | 150 | 227-31038-06 | 227-31039-04 | 227-31041-05 | 227-31180-06 | 227-31181-04 | 227-31183-05 | 227-31068-06 | 227-31069-04 | 227-31071-05 |
| | 250 | | | 227-31041-06 | | | 227-31183-06 | | | 227-31071-06 |

| Chemistry | | PFPP | | | Diol-HILIC | | |
|--------------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Particle Size (µm) | ID (mm) | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 |
| | Length (mm) | | | | | | |
| 1.9 | 50 | 227-31053-03 | 227-31054-01 | | 227-31043-03 | 227-31044-03 | |
| | 75 | 227-31053-04 | 227-31054-02 | | 227-31043-01 | 227-31044-01 | |
| | 100 | 227-31053-05 | 227-31054-03 | | 227-31043-02 | 227-31044-02 | |
| | 150 | 227-31053-06 | 227-31054-04 | | | | |
| 3 | 50 | 227-31055-03 | 227-31056-01 | 227-31057-02 | 227-31045-03 | 227-31046-01 | 227-31047-02 |
| | 75 | 227-31055-04 | 227-31056-02 | 227-31057-03 | 227-31045-04 | 227-31046-02 | 227-31047-03 |
| | 100 | 227-31055-05 | 227-31056-03 | 227-31057-04 | 227-31045-05 | 227-31046-03 | 227-31047-04 |
| | 150 | 227-31055-06 | 227-31056-04 | 227-31057-05 | 227-31045-06 | 227-31046-04 | 227-31047-05 |
| | 250 | | | 227-31057-06 | | | 227-31047-06 |
| 5 | 50 | 227-31058-03 | 227-31059-01 | 227-31061-02 | 227-31048-03 | 227-31049-01 | 227-31051-02 |
| | 75 | 227-31058-04 | 227-31059-02 | 227-31061-03 | 227-31048-04 | 227-31049-02 | 227-31051-03 |
| | 100 | 227-31058-05 | 227-31059-03 | 227-31061-04 | 227-31048-05 | 227-31049-03 | 227-31051-04 |
| | 150 | 227-31058-06 | 227-31059-04 | 227-31061-05 | 227-31048-06 | 227-31049-04 | 227-31051-05 |
| | 250 | | | 227-31061-06 | | | 227-31051-06 |

Shim-pack Scepter Preparative Columns

| Chemistry | ID (mm) | 10 | 20 | 30 | |
|-----------|-------------|----|--------------|--------------|--------------|
| | Length (mm) | | | | |
| C18-120 | 50 | | 227-31102-01 | 227-31103-01 | |
| | 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 |
| HD-C18-80 | 50 | | 227-31105-01 | 227-31106-01 | |
| | 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 |
| C18-300 | 50 | | 227-31205-03 | 227-31205-07 | |
| | 75 | | 227-31205-08 | | |
| | 100 | | 227-31205-04 | 227-31205-09 | |
| | 150 | | 227-31205-01 | 227-31205-05 | 227-31205-10 |
| | 250 | | 227-31205-02 | 227-31205-06 | 227-31205-11 |

| Chemistry | ID (mm) | 10 | 20 | 30 | |
|-----------|-------------|----|--------------|--------------|--------------|
| | Length (mm) | | | | |
| C8-120 | 50 | | 227-31108-01 | 227-31109-01 | |
| | 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 |
| C4-300 | 50 | | 227-31185-01 | 227-31186-01 | |
| | 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 |
| Phenyl | 50 | | 227-31114-01 | 227-31115-01 | |
| | 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 |
| PFPP | 50 | | 227-31111-01 | 227-31112-01 | |
| | 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 |

* Main P/Ns are described in the list. Please contact your local representative for columns in dimensions other than listed above.

Shim-pack Scepter EXP Guard Cartridge (Particle size : 1.9 µm, 3 pk)

| Chemistry | C18-120 | HD-C18-80 | C18-300 | C8-120 | C4-300 | Phenyl | PFPP |
|-----------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Dimension | | | | | | | |
| 2.1x5 mm | 227-31120-01 | 227-31128-01 | 227-31206-01 | 227-31136-01 | 227-31187-01 | 227-31158-01 | 227-31150-01 |
| 3.0x5 mm | 227-31120-02 | 227-31128-02 | 227-31206-02 | 227-31136-02 | 227-31187-02 | 227-31158-02 | 227-31150-02 |

* EXP Cartridge holder for Shim-pack Scepter: 227-32041-01

Shim-pack Scepter Analytical Guard Cartridge (5 pk)

| Particle Size (µm) | 3 | | | | | | | |
|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Chemistry | C18-120 | HD-C18-80 | C18-300 | C8-120 | C4-300 | Phenyl | PFPP | Diol-HILIC |
| Dimension | | | | | | | | |
| 2.1x10 mm | 227-31121-01 | 227-31129-01 | 227-31207-01 | 227-31137-01 | 227-31188-01 | 227-31159-01 | 227-31151-01 | 227-31144-01 |
| 3.0x10 mm | 227-31122-01 | 227-31130-01 | 227-31207-03 | 227-31138-01 | 227-31189-01 | 227-31160-01 | 227-31152-01 | 227-31145-01 |
| 4.0x10 mm | 227-31123-01 | 227-31131-01 | 227-31207-05 | 227-31139-01 | 227-31190-01 | 227-31161-01 | 227-31153-01 | 227-31146-01 |
| 2.1x20 mm | 227-31121-02 | 227-31129-02 | 227-31207-02 | 227-31137-02 | 227-31188-02 | 227-31159-02 | 227-31151-02 | 227-31144-02 |
| 3.0x20 mm | 227-31122-02 | 227-31130-02 | 227-31207-04 | 227-31138-02 | 227-31189-02 | 227-31160-02 | 227-31152-02 | 227-31145-02 |
| 4.0x20 mm | 227-31123-02 | 227-31131-02 | 227-31207-06 | 227-31139-02 | 227-31190-02 | 227-31161-02 | 227-31153-02 | 227-31146-02 |

| Particle Size (µm) | 5 | | | | | | | |
|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Chemistry | C18-120 | HD-C18-80 | C18-300 | C8-120 | C4-300 | Phenyl | PFPP | Diol-HILIC |
| Dimension | | | | | | | | |
| 2.1x10 mm | 227-31124-01 | 227-31132-01 | 227-31207-07 | 227-31140-01 | 227-31191-01 | 227-31162-01 | 227-31154-01 | 227-31147-01 |
| 3.0x10 mm | 227-31125-01 | 227-31133-01 | 227-31207-09 | 227-31141-01 | 227-31192-01 | 227-31163-01 | 227-31155-01 | 227-31148-01 |
| 4.0x10 mm | 227-31126-01 | 227-31134-01 | 227-31207-11 | 227-31142-01 | 227-31193-01 | 227-31164-01 | 227-31156-01 | 227-31149-01 |
| 2.1x20 mm | 227-31124-02 | 227-31132-02 | 227-31207-08 | 227-31140-02 | 227-31191-02 | 227-31162-02 | 227-31154-02 | 227-31147-02 |
| 3.0x20 mm | 227-31125-02 | 227-31133-02 | 227-31207-10 | 227-31141-02 | 227-31192-02 | 227-31163-02 | 227-31155-02 | 227-31148-02 |
| 4.0x20 mm | 227-31126-02 | 227-31134-02 | 227-31207-12 | 227-31142-02 | 227-31193-02 | 227-31164-02 | 227-31156-02 | 227-31149-02 |

* Cartridge holder for Analytical Shim-pack Scepter guard cartridges (10 mm length): 227-31172-03

Shim-pack Scepter Preparative Guard Cartridge (Particle size : 5 µm, 2 pk)

| Chemistry | C18-120 | HD-C18-80 | C18-300 | C8-120 | C4-300 | Phenyl | PFPP | Cartridge Holder |
|-----------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------|
| Dimension | | | | | | | | |
| 10x10 mm | 227-31127-01 | 227-31135-01 | 227-31207-13 | 227-31143-01 | 227-31194-01 | 227-31165-01 | 227-31157-01 | 227-31171-01 |
| 20x10 mm | 227-31127-02 | 227-31135-02 | 227-31207-14 | 227-31143-02 | 227-31195-01 | 227-31165-02 | 227-31157-02 | 227-31171-02 |
| 30x10 mm | 227-31127-03 | 227-31135-03 | 227-31207-15 | 227-31143-03 | 227-31196-01 | 227-31165-03 | 227-31157-03 | 227-31171-03 |

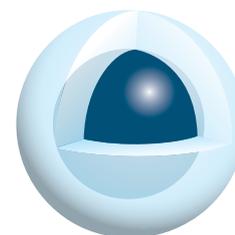
Shim-pack Velox™ Series

■ 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.

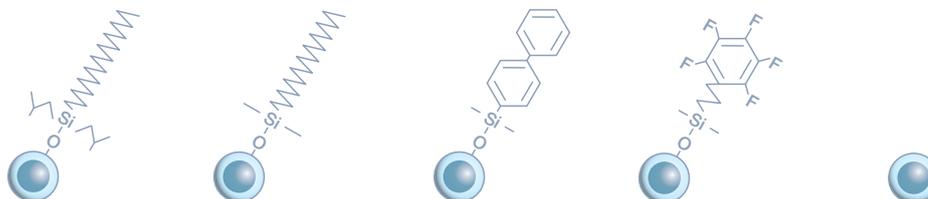


Shim-pack Velox column will deliver

- 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 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 |
| Bonded Phase | | Sterically protected octadecyl groups | Octadecyl groups | Biphenyl groups | Pentafluorophenyl propyl groups | None |
| Features | | Sterically protected to resist strongly acidic mobile phase | General purpose core shell column for RP chromatography | Enhanced separation of aromatic compounds | Alternative selectivity to C18 columns | Increased retention of polar analytes |
| Particle Size | | 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 |
| Surface 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 % | N/A |
| | 5 µm | 5 % | 5 % | 5 % | 3 % | |
| End-Cap | | No | YES | Yes | No | N/A |
| 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 80 MPa.

Analysis Examples

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 %

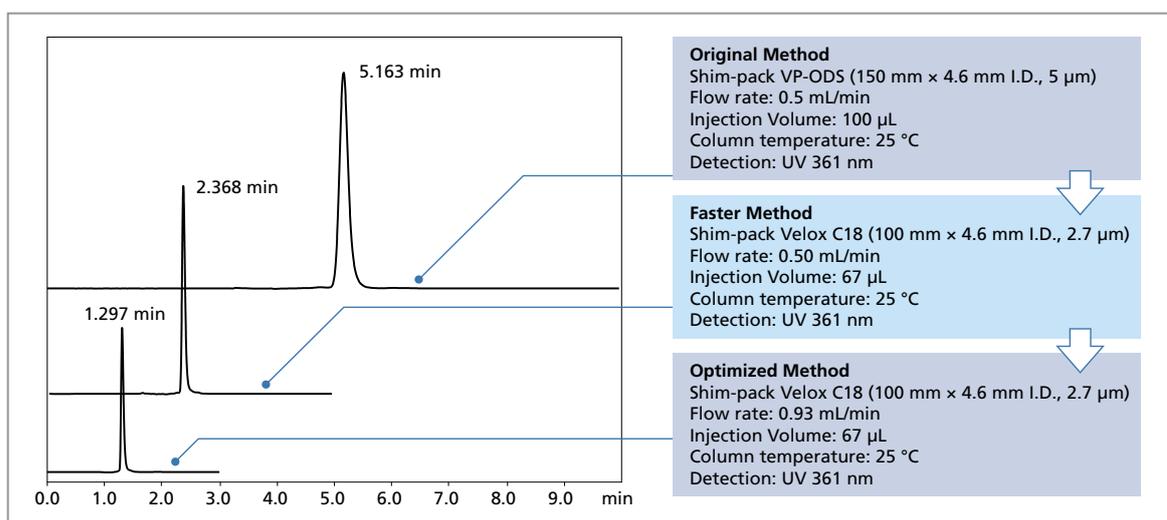
or

Number of theoretical plates (N): within -25 % to +50 % (For SPP)

2) Flow rate: *Based on particle size and internal diameter and ±50 %

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

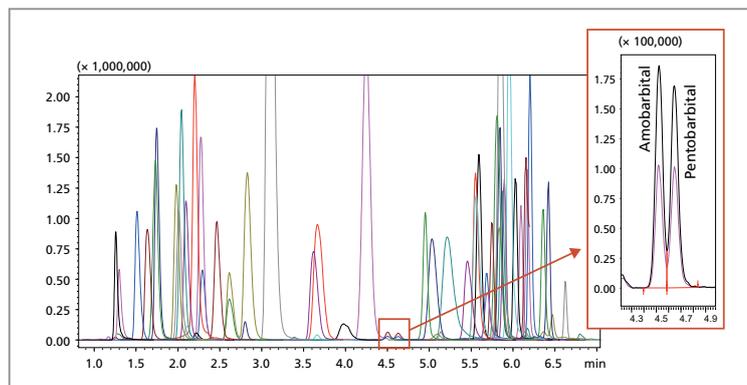
L : Column length
 dp : Particle size
 F : Flow rate
 dc : Internal diameter of the column



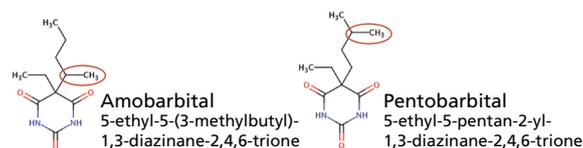
| Column | L/dp | Flow rate (mL/min) | N | System suitability test result (Requirement: %RSD < 2.0 %) |
|---|-------------------|--------------------|------------------|--|
| VP-ODS (150 mm × 4.6 mm I.D., 5 µm) | 30,000 | 0.50 | 5,244 | tR: 0.025 % Area: 0.175 % (n=6) |
| Velox C18 (100 mm × 4.6 mm I.D.,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

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, amobarbital 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



System : Nexera UHPLC System / LCMS-8050

Column : Shim-pack Velox Biphenyl 100 mm × 2.1 mm I.D., 2.7 μm
(PN: 227-32015-03)

Flow rate : 0.5 mL/min

Mobile phase : A) 0.15 mM ammonium fluoride in water

B) Methanol

Gradient : 20 %B (0 min) → 48 %B (1.5 min) → 53 %B (4 min)
→ 100 %B (6 min - 7.5 min) → 20 %B (7.51 min - 9.5 min)

Column temp. : 30 °C

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.

Order Information

Shim-pack Velox 1.8 μm

| Chemistry | SP-C18 | | C18 | | Biphenyl | | PFPP | |
|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| I.D. (mm) | 2.1 | 3.0 | 2.1 | 3.0 | 2.1 | 3.0 | 2.1 | 3.0 |
| Length(mm) | | | | | | | | |
| 30 | 227-32001-01 | 227-32002-03 | 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

| Chemistry | SP-C18 | | | C18 | | | Biphenyl | | |
|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| I.D. (mm) | 2.1 | 3.0 | 4.6 | 2.1 | 3.0 | 4.6 | 2.1 | 3.0 | 4.6 |
| Length(mm) | | | | | | | | | |
| 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) | 2.1 | 3.0 | 4.6 | 2.1 | 3.0 | 4.6 | | | |
| Length(mm) | | | | | | | | | |
| 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 | | | |

Shim-pack Velox 5 µm

| Chemistry | SP-C18 | C18 | Biphenyl | PFPP |
|------------|--------------|--------------|--------------|--------------|
| I.D. (mm) | 4.6 | | | |
| Length(mm) | 4.6 | | | |
| 50 | 227-32005-01 | 227-32012-01 | 227-32018-01 | 227-32024-01 |
| 100 | 227-32005-02 | 227-32012-02 | 227-32018-02 | 227-32024-02 |
| 150 | 227-32005-03 | 227-32012-03 | 227-32018-03 | 227-32024-03 |
| 250 | 227-32005-04 | 227-32012-04 | 227-32018-04 | 227-32024-04 |

Shim-pack Velox Guard Column Cartridge (3/pk)

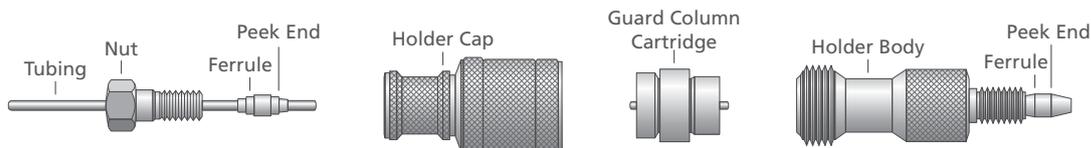
| Type | UPLC | | | | 2.7 µm | | | | |
|-----------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| I.D. (mm) | SP-C18 | C18 | Biphenyl | PFPP | SP-C18 | C18 | Biphenyl | PFPP | HILIC |
| 2.1 | 227-32028-01 | 227-32031-01 | 227-32034-01 | 227-32037-01 | 227-32029-01 | 227-32032-01 | 227-32035-01 | 227-32038-01 | 227-32040-01 |
| 3.0 | 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 | - | - | - | - | 227-32029-03 | 227-32032-03 | 227-32035-03 | 227-32038-03 | 227-32040-03 |
| Type | 5 µm | | | | | | | | |
| I.D. (mm) | SP-C18 | C18 | Biphenyl | PFPP | | | | | |
| 4.6 | 227-32030-01 | 227-32033-01 | 227-32036-01 | 227-32039-01 | | | | | |

Shim-pack Velox UHPLC Precolumn Filter (0.2 µm)

| | |
|------------------|--------------|
| Part No. 1 pack | 227-32042-01 |
| Part No. 5 pack | 227-32042-02 |
| Part No. 10 pack | 227-32042-03 |

Shim-pack 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 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.

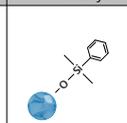
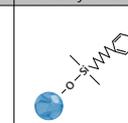
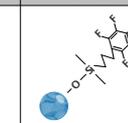
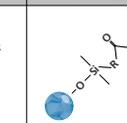
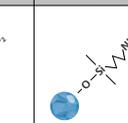


Shim-pack G Series

■ Fully Porous Silica Particle Based Column Series

Shim-pack GIST Series ~ High Inert & Highly Stable Fully Porous Silica Column Series ~

- Excellent peak shape and stability achieved by using uniquely modified high purity fully porous silica particles
- Excellent lot to lot reproducibility

| | Shim-pack GIST | | | | | | | |
|----------------------------------|---|---|---|---|---|---|---|---|
| | Reversed Phase | | | | | | HILIC | |
| | C18 | C18-AQ | C8 | Phenyl | Phenyl-Hexyl | PFPP | Amide | NH ₂ |
| Chemistry |  |  |  |  |  |  |  |  |
| Bonded Phase | Octadecyl groups | Octadecyl groups | Octyl groups | Phenyl groups | Phenyl-Hexyl groups | Pentafluorophenylpropyl groups | Carbamoyl groups | Aminopropyl groups |
| Features | Ultra-high inertness and high stability | Excellent retentivity of highly polar compounds | Ultra-high inertness and high stability | Extremely strong π - π interactions | Alternative selectivity to C18 columns | Excellent retentivity of highly polar base | First choice HILIC column | Sugar analysis |
| Particle Size (μ m) | 2, 3, 5 | 1.9, 3, 5 | 2, 3, 5 | 2, 3, 5 | 3, 5 | 3, 5 | 1.9, 3, 5 | 3, 5 |
| Pore Size (nm) | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Surface Area (m ² /g) | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 |
| Carbon Loading (%) | 14 | 13 | 8 | 10 | 9 | 10 | 15 | 7 |
| End Cap | Yes | Yes | Yes | No | Yes | Yes | No | No |
| pH Range | 1-10 | 1-10 | 1-10 | 2-7.5 | 1-10 | 2-7.5 | 2-8.5 | 2-7.5 |
| USP Code | L1 | L1 | L7 | L11 | L11 | L43 | L68 | L8 |

Shim-pack GISS Series

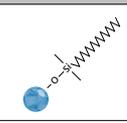
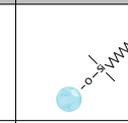
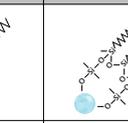
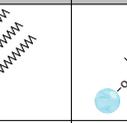
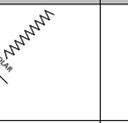
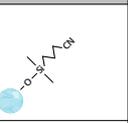
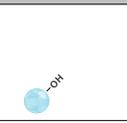
~ High Speed Analysis with High Inertness and High Stability ~

- Optimization of surface area of the inert fully porous silica using wider pore sizes provides rapid separation with excellent peak shapes

Shim-pack GIS Series

~ High Surface Area Fully Porous Silica ~

- Shim-pack GIS C18 is a fully porous high surface area column offering high retention and suitable for preparative purification application.

| | Shim-pack GISS | Shim-pack GIS | | | | | |
|----------------------------------|---|---|---|---|---|---|---|
| | Reversed Phase | Reversed Phase | | | Normal Phase/RP | | HILIC |
| | C18 | C18 | C18-P | RP-Shield | CN | SIL | HILIC |
| Chemistry |  |  |  |  |  |  |  |
| Bonded Phase | Octadecyl groups | Octadecyl groups | Octadecyl groups | Octadecyl groups | Cyanopropyl groups | - | Diol groups |
| Features | High speed analysis with ultra-high inertness and high stability | High retentivity, lower column back pressure, high inertness | High steric selectivity | Embedded with a polar functional group | Suitable in either reversed phase or normal phase mode | Suitable in either reversed phase or normal phase mode | Ideal for the separation of highly polar basic compounds |
| Particle Size (μ m) | 1.9, 3, 5 | 2, 3, 4, 5, 10 | 3, 5 | 5 | 3, 5 | 3, 5 | 3, 5 |
| Pore Size (nm) | 20 | 10 | 10 | 10 | 10 | 10 | 10 |
| Surface Area (m ² /g) | 200 | 450 | 450 | 450 | 450 | 450 | 450 |
| Carbon Loading (%) | 9 | 15 | 29 | 9 | 14 | - | 20 |
| End Cap | Yes | Yes | No | No | No | No | No |
| pH Range | 1-10 | 2-7.5 | 2-7.5 | 2-7.5 | 2-7.5 | 2-7.5 | 2-7.5 |
| USP Code | L1 | L1 | L1 | L1 | L10 | L3 | L20 |

Shim-pack GIST C18

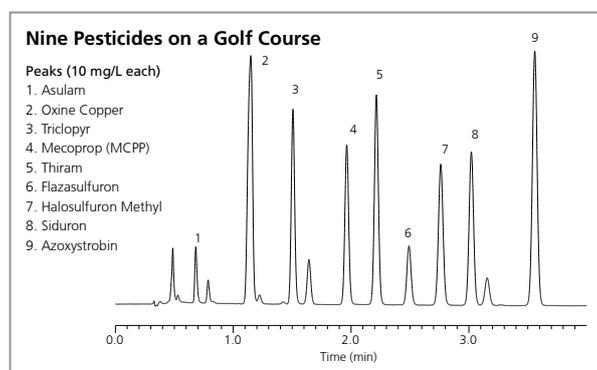
■ Ultra-High Inertness, High Stability

Shim-pack GIST C18 has superior inertness, which improves analysis precision and increases column stability. 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.

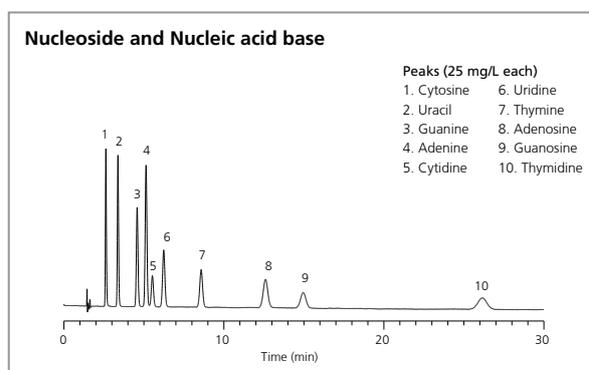
Furthermore, because of the new silica gel, Shim-pack GIST C18 is suitable for wider pH (1-10) analysis at a consistent performance. This enables use of a silica-based column under alkaline conditions.

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

Analysis Examples



■ **Conditions**
Column : Shim-pack GIST-HP C18 (150 mm × 3.0 mm I.D., 3 µm) (P/N: 227-30040-05)
Mobile phase : A) 50 mmol/L Monopotassium phosphate buffer solution (pH 3.5)
 B) Acetonitrile
 40%B (0 min) → 60%B (4 min)
Flow rate : 1.5 mL/min
Column temp. : 40 °C
Detection : UV 235 nm
Injection volume : 5.0 µL



■ **Conditions**
Column : Shim-pack GIST C18 (150 mm × 4.6 mm I.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
Column temp. : 40 °C
Detection : UV 260 nm
Injection volume : 1 µL

Analytical Columns

| Particle Size (µm) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|--------------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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 |
| 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) | Length (mm) | I.D. (mm) | Cartridge Guard Column (2 pcs) | | | | 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) | Length (mm) | I.D. (mm) | Cartridge Guard Column (2 pcs) and Holder | | | | 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 | |

Analytical Columns (High-Pressure Series)

| Particle Size (µm) | Length (mm) | I.D. (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|--------------------|-------------|--------------|--------------|--------------|--------------|--------------------------|
| | | | 2 | 30 | 227-30001-01 | |
| | 50 | 227-30001-02 | 227-30002-02 | - | | |
| | 75 | 227-30001-03 | 227-30002-03 | - | | |
| | 100 | 227-30001-04 | 227-30002-04 | - | | |
| | 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) | Length (mm) | I.D. (mm) | Cartridge Guard Column (2 pcs) | | | 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) | Length (mm) | I.D. (mm) | Cartridge Guard Column (2 pcs) and Holder | | | Pressure Tolerance (MPa) | Holder |
| | | | 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) | Length (mm) | I.D. (mm) | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|--------------------|-------------|-----------|--------------|--------------|--------------|--------------------------|
| | | | 2 | 30 | 227-30771-01 | |
| 3 | 30 | | 227-30774-01 | 227-30775-01 | 227-30776-01 | 50 |

Shim-pack GIST C18-AQ

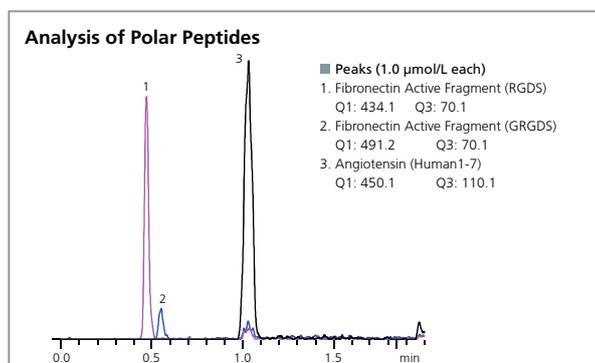
■ Excellent Retentivity of Highly Polar Compounds

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.

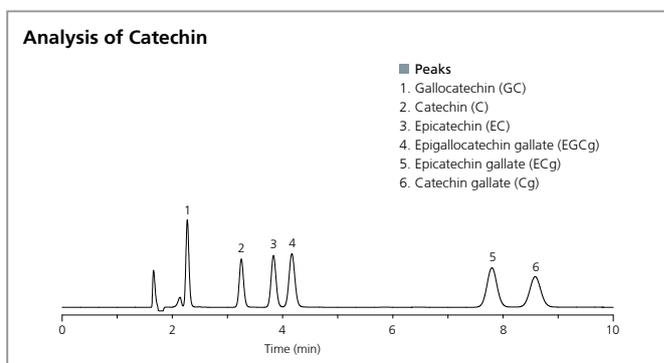
Shim-pack GIST C18-AQ is also able to reduce the absorption of basic and acidic compounds and achieve superior peak shapes in the analysis of metal complexes.

| | |
|----------------|---|
| Bonded Phase | Octadecyl groups |
| Particle Size | 1.9 μm , 3 μm , 5 μm |
| Pore Size | 10 nm |
| Surface Area | 350 m ² /g |
| Carbon Loading | 13 % |
| End-capping | Yes |
| pH Range | 1 - 10 |
| USP Code | L1 |

Analysis Example



■ **Conditions**
Column : Shim-pack GIST C18-AQ (100 mm \times 2.1 mm I.D., 1.9 μm) (P/N: 227-30807-02)
Mobile phase : A) 0.1 % Formic acid in Water
 B) Acetonitrile
 0%B (0-0.5 min) \rightarrow 85%B (1.5 min) \rightarrow 0%B (1.52-2.5 min)
Flow rate : 0.8 mL/min
Column temp. : 40 $^{\circ}\text{C}$
Detection : LC/MS/MS (LCMS-8030, ESI, Positive, SRM)
Injection volume : 2 μL



■ **Conditions**
Column : Shim-pack GIST C18-AQ (150 mm \times 4.6 mm I.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
Column temp. : 40 $^{\circ}\text{C}$
Detection : UV 280 nm

Analytical Columns

| Particle Size (μm) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|---------------------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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) | | Cartridge Guard Column (2 pcs) | | | | Holder |
|------------------------------------|-------------|--|---|--------------|--------------|--------------|--------------|
| | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | | |
| | Length (mm) | | 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) | | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|------------------------------------|-------------|--|--------------|--------------|--------------|-----------------------------|
| | Length (mm) | | | | | |
| 1.9 | 50 | | 227-30807-01 | 227-30808-01 | - | 80 |
| | 100 | | 227-30807-02 | 227-30808-02 | - | |
| | 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) | | Cartridge Guard Column (2 pcs) | | | Pressure Tolerance (MPa) | Holder |
|------------------------------------|-------------|--|---|--------------|--------------|-----------------------------|--------------|
| | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | | |
| | Length (mm) | | 1.5 | 2.1 | 3.0 | Pressure Tolerance (MPa) | |
| 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) | | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|------------------------------------|-------------|--|--------------|--------------|--------------|-----------------------------|
| | Length (mm) | | | | | |
| 3 | 30 | | 227-30801-01 | 227-30802-01 | 227-30803-01 | 50 |

Shim-pack GISS C18

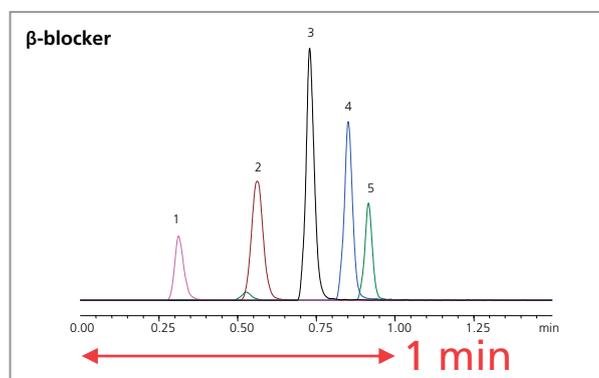
■ Ideal for Rapid Analysis

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 m ² /g |
| Carbon Loading | 9 % |
| End-capping | Yes |
| pH Range | 1 - 10 |
| USP Code | L1 |

Analysis Example



■ 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 mm × 2.1 mm I.D., 1.9 µm) (P/N: 227-30048-01) |
| Mobile phase | : A) 10 mmol/L Ammonium formate in Water B) 10 mmol/L Ammonium formate in Methanol 30%B (0-0.3 min)→60%B (0.8 min)→100%B (0.9 min)→30%B (0.91-1.4 min) |
| Flow rate | : 0.6 mL/min |
| Column temp. | : 40 °C |
| Detection | : LC/MS/MS (ESI, Positive, Negative MRM) |

Analytical Columns

| Particle Size (µm) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|--------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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) | | Cartridge Guard Column (2 pcs) | | | | Holder |
|--------------------|-------------|--|---|--------------|--------------|--------------|--------------|
| | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | | |
| | Length (mm) | | 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) | | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|--------------------|-------------|--|--------------|--------------|--------------|--------------------------|
| | Length (mm) | | | | | |
| 1.9 | 50 | | 227-30048-01 | 227-30049-01 | - | 80 |
| | 100 | | 227-30048-02 | 227-30049-02 | - | |
| | 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) | | Cartridge Guard Column (2 pcs) | | | Pressure Tolerance (MPa) | Holder |
|--------------------|-------------|--|---|--------------|--------------|--------------------------|--------------|
| | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | Pressure Tolerance (MPa) | |
| | Length (mm) | | 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) | | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|--------------------|-------------|--|--------------|--------------|--------------|--------------------------|
| | Length (mm) | | | | | |
| 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

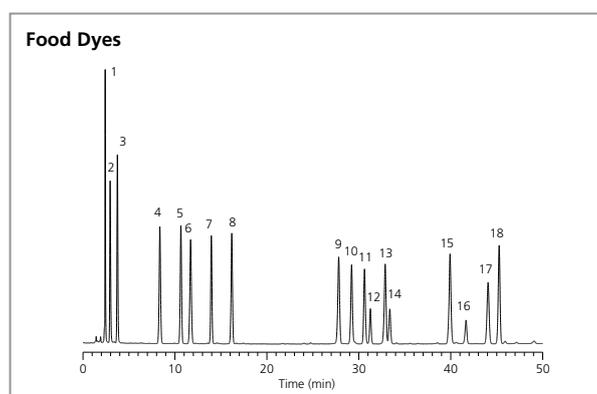
■ High Retentivity, Lower Column Back Pressure

Widely used octadecyl bonded silica gel enables the Shim-pack GIS C18 to have strong hydrophobic interaction and low adsorption 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 | 2 µm, 3 µm, 4 µm, 5 µm, 10 µm |
| Pore Size | 10 nm |
| Surface Area | 450 m ² /g |
| Carbon Loading | 15 % |
| End-capping | Yes |
| pH Range | 2 - 7.5 |
| USP Code | L1 |

Analysis Example



■ 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 cocine | 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 mm × 4.6 mm I.D., 4 µm) (PN: 227-30100-07) |
| Mobile phase | : A) 10 mmol/L Disodium phosphate buffer solution (pH 6.9) B) Acetonitrile 10%B (0 min)→35%B (50 min) |
| Flow rate | : 1.0 mL/min |
| Detection | : UV 270 nm |
| Column temp. | : 40 °C |
| Injection volume | : 10 µL |

Analytical Columns

| Particle Size (µm) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|--------------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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 |
| 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) | | 4.0 | 4.6 |
|------------------------------------|-------------|--|--------------|--------------|
| | Length (mm) | | | |
| 10 | 150 | | 227-30111-01 | 227-30112-01 |
| | 250 | | 227-30111-02 | 227-30112-02 |

Cartridge Guard Columns

| Particle Size (μm) | I.D. (mm) | | Cartridge Guard Column (2 pcs) | | | | Holder |
|------------------------------------|-------------|--|---|--------------|--------------|--------------|--------------|
| | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | | |
| | Length (mm) | | 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) | | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|------------------------------------|-------------|--|--------------|--------------|--------------|-----------------------------|
| | Length (mm) | | | | | |
| 2 | 30 | | 227-30093-01 | 227-30094-01 | - | 80 |
| | 50 | | 227-30093-02 | 227-30094-02 | - | |
| | 75 | | 227-30093-03 | 227-30094-03 | - | |
| | 100 | | 227-30093-04 | 227-30094-04 | - | |
| | 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) | | Cartridge Guard Column (2 pcs) | | | Pressure Tolerance (MPa) | Holder |
|------------------------------------|-------------|--|---|--------------|--------------|-----------------------------|--------------|
| | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | Pressure Tolerance (MPa) | |
| | Length (mm) | | 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) | | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|------------------------------------|-------------|--|--------------|--------------|--------------|-----------------------------|
| | Length (mm) | | | | | |
| 2 | 30 | | 227-30783-01 | 227-30784-01 | 227-30785-01 | 80 |
| 3 | 30 | | 227-30786-01 | 227-30787-01 | 227-30788-01 | 50 |

Shim-pack GIS C18-P

■ High Steric Selectivity

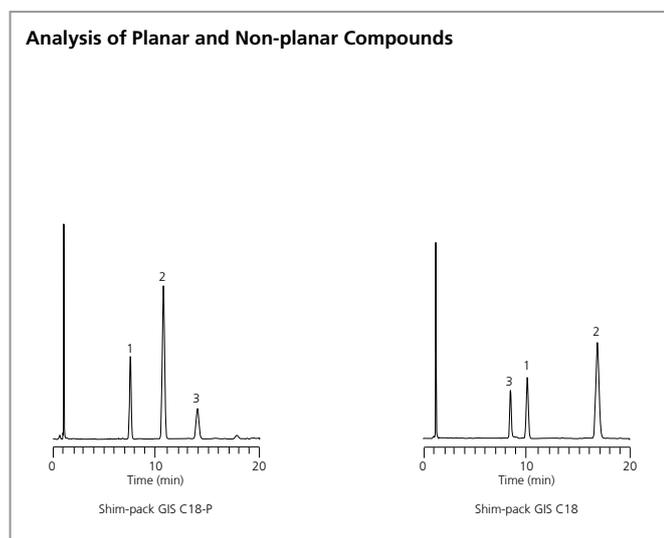
Shim-pack GIS C18-P is designed with a polymerically bonded octadecyl group, which provides high steric selectivity for separation of planar and non-planar compounds. It achieves complete baseline separation of structurally similar compounds such as vitamin D2 and D3 because of the planarity recognition 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 m ² /g |
| Carbon Loading | 29 % |
| End-capping | - |
| pH range | 2 - 7.5 |
| USP Code | L1 |

Analysis Example

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



■ Peaks

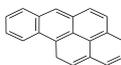
1. Phenanthro[3,4-c]phenanthrene (PhPh)



2. Tetrabenzonaphthalene (TBN)

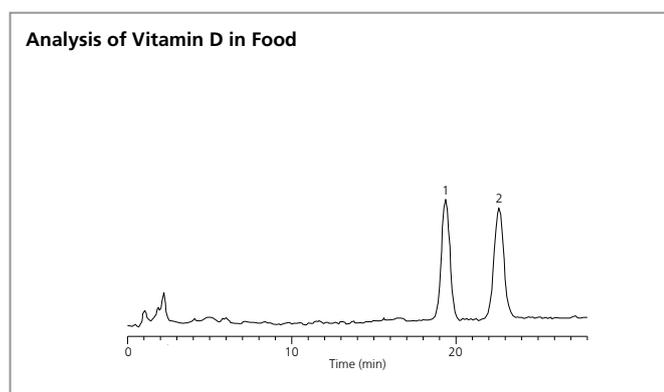


3. Benzo[a]pyrene (BaP)



■ Conditions

| | |
|--------------|--|
| Column | : 250 mm \times 4.6 mm I.D., 5 μm |
| Mobile phase | : A) Water B) Acetonitrile A/B = 15/85 (v/v) |
| Flow rate | : 2.0 mL/min |
| Column temp. | : 30 $^{\circ}\text{C}$ |
| Detection | : UV 254 nm |
| Samples | : Standard Reference Material 869 |



■ Peaks (0.1 mg/L each)

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

■ Conditions

| | |
|------------------|--|
| Column | : Shim-pack GIS C18-P (250 mm \times 4.6 mm I.D., 5 μm , P/N: 227-30557-07) |
| Mobile phase | : Acetonitrile |
| Flow rate | : 1.5 mL/min |
| Column temp. | : 40 $^{\circ}\text{C}$ |
| Detection | : UV 265 nm |
| Injection volume | : 200 μL |

Analytical Columns

| Particle Size (μm) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|------------------------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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) | | Cartridge Guard Column (2 pcs) | | | | Holder |
|------------------------------------|-------------|--|---|--------------|--------------|--------------|--------------|
| | Length (mm) | | 1.0 | 1.5 | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | | |
| | Length (mm) | | 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 78.

Shim-pack GIS RP-Shield

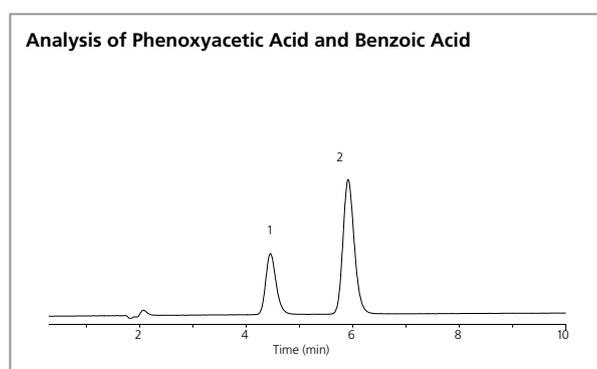
■ Embedded with a Polar Functional Group

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 μ m |
| Pore Size | 10 nm |
| Surface Area | 450 m ² /g |
| Carbon Loading | 9 % |
| End-capping | - |
| pH Range | 2 - 7.5 |
| USP Code | L1 |

Analysis Example



■ Peaks

1. Phenoxyacetic acid
2. Benzoic acid

■ Conditions

Column : Shim-pack GIS RP-Shield (150 mm x 3.0 mm I.D., 5 μ m, 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
 Column temp. : 40 °C
 Detection : UV 254 nm

Analytical Columns

| Particle Size (μ m) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|--------------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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 (μ m) | I.D. (mm) | | Cartridge Guard Column (2 pcs) | | | | Holder |
|--------------------------|-------------|--|---|--------------|--------------|--------------|--------------|
| | Length (mm) | | 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 (μ m) | I.D. (mm) | | Cartridge Guard Column (2 pcs) and Holder | | | | |
| | Length (mm) | | 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 GIST C8

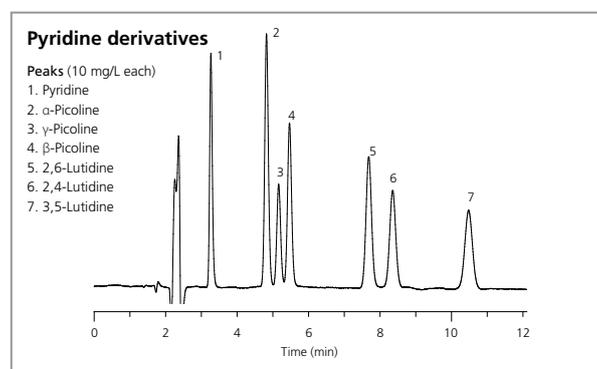
■ Ultra-High Inertness, High Durability

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.

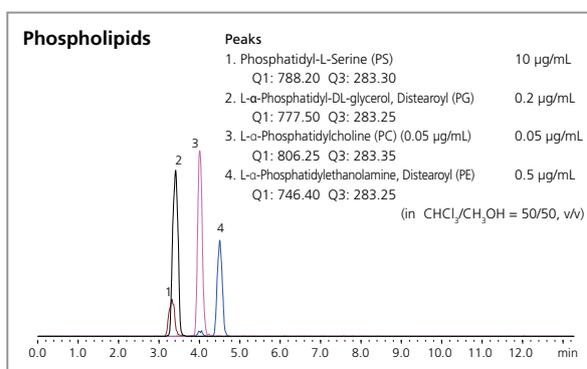
Shim-pack GIST C8 is the ideal choice for the rapid analysis of hydrophobic compounds.

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

Analysis Examples



■ **Conditions**
Column : Shim-pack GIST C8 (150 mm x 4.6 mm I.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
Column temp. : 40 °C
Detection : UV 260 nm
Injection volume : 5 µL



■ **Conditions**
Column : Shim-pack GIST C8 (150 mm x 2.1 mm I.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
Column temp. : 40 °C
Detection : LC/MS/MS (ESI, Negative, MRM)
Injection volume : 2 µL

Analytical Columns

| Particle Size (µm) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|--------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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 |

Shim-pack GIST C8

Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) Length (mm) | Cartridge Guard Column (2 pcs) | | | | 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 (2 pcs) 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 | |
| 50 | 227-30160-02 | | 227-30161-02 | - | |
| 75 | 227-30160-03 | | 227-30161-03 | - | |
| 100 | 227-30160-04 | | 227-30161-04 | - | |
| 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 (2 pcs) | | | 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 (2 pcs) 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 | |
| 3 | 227-30792-01 | | | 227-30793-01 | 227-30794-01 |

Shim-pack GIST Phenyl

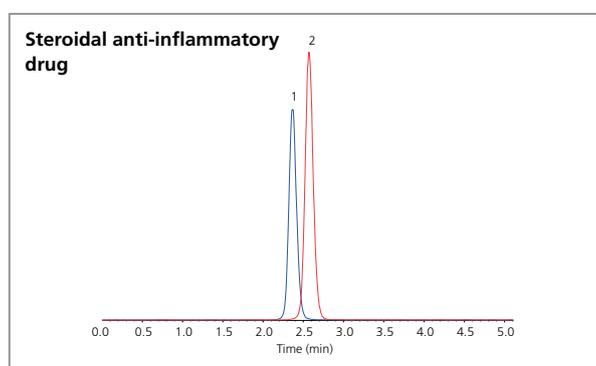
Extremely Strong π - π Interactions

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 groups |
| Particle Size | 2 μ m, 3 μ m, 5 μ m |
| Pore Size | 10 nm |
| Surface Area | 350 m ² /g |
| Carbon Loading | 10 % |
| End-capping | - |
| pH Range | 2 - 7.5 |
| USP Code | L11 |

Analysis Example



■ Peaks (0.1 mg/L each)

- Hydrocortisone
- Prednisolone

■ Conditions

Column : Shim-pack GIST Phenyl (50 mm x 2.1 mm I.D., 2 μ m, 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
 Column temp. : 40 °C
 Detection : LC/MS/MS (ESI, Positive, MRM)
 Injection volume : 5 μ L

Analytical Columns

| Particle Size (μ m) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|--------------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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 |

Shim-pack GIST Phenyl

Cartridge Guard Columns

| Particle Size (µm) | I.D. (mm) Length (mm) | Cartridge Guard Column (2 pcs) | | | | 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 (2 pcs) 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 | |
| 50 | 227-30207-02 | | 227-30208-02 | - | |
| 75 | 227-30207-03 | | 227-30208-03 | - | |
| 100 | 227-30207-04 | | 227-30208-04 | - | |
| 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 (2 pcs) | | | 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 (2 pcs) 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 | |
| 3 | 227-30798-01 | 227-30799-01 | | 227-30800-01 | 50 |

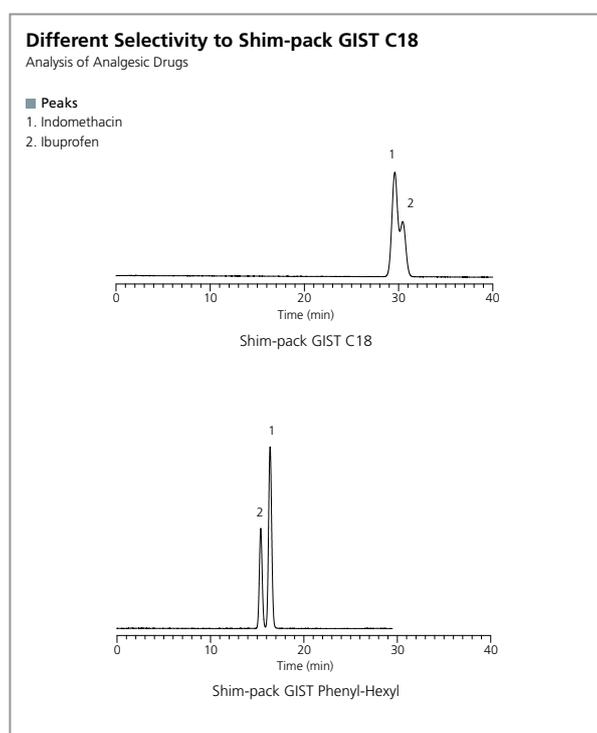
Shim-pack GIST Phenyl-Hexyl

■ 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.

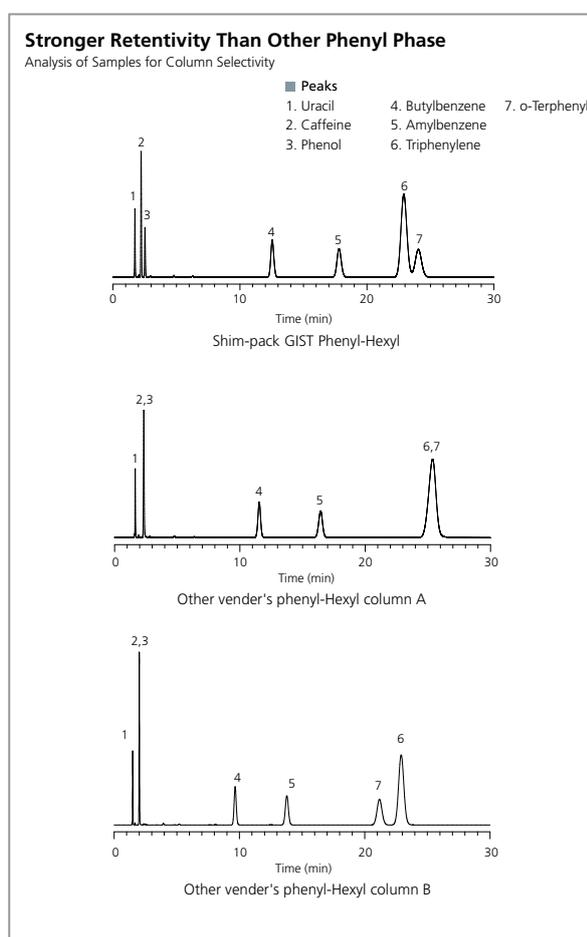
| | |
|----------------|-----------------------|
| Bonded Phase | Phenylhexyl groups |
| Particle Size | 3 μ m, 5 μ m |
| Pore Size | 10 nm |
| Surface Area | 350 m ² /g |
| Carbon Loading | 9 % |
| End-capping | Yes |
| pH Range | 1 - 10 |
| USP Code | L11 |

Analysis Example



■ Conditions

Column : 150 mm \times 4.6 mm I.D., 5 μ m
 Mobile phase : A) Acetonitrile
 B) 25 mmol/L Monopotassium phosphate buffer solution (pH 3.0)
 A/B = 45/55 (v/v)
 Flow rate : 1.0 mL/min
 Column temp. : 40 °C
 Detection : UV 230 nm



■ Conditions

Column : 150 mm \times 4.6 mm I.D., 5 μ m
 Mobile phase : A) Water
 B) Methanol
 A/B = 30/70 (v/v)
 Flow rate : 1.0 mL/min
 Column temp. : 40 °C
 Detection : UV 254 nm

Shim-pack GIST Phenyl-Hexyl

Analytical Columns

| Particle Size (µm) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|--------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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) | | Cartridge Guard Column (2 pcs) | | | | Holder |
|--------------------|-------------|--|---|--------------|--------------|--------------|--------------|
| | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | | |
| | Length (mm) | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 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) | | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|--------------------|-------------|--|--------------|--------------|--------------|--------------------------|
| | Length (mm) | | | | | |
| 3 | 30 | | - | 227-30714-01 | 227-30715-01 | 50 |
| | 50 | | 227-30713-01 | 227-30714-02 | 227-30715-02 | |
| | 75 | | 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) | | Cartridge Guard Column (2 pcs) | | | Pressure Tolerance (MPa) | Holder |
|--------------------|-------------|--|---|--------------|--------------|--------------------------|--------------|
| | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | Pressure Tolerance (MPa) | |
| | Length (mm) | | 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) | | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|--------------------|-------------|--|--------------|--------------|--------------|--------------------------|
| | Length (mm) | | | | | |
| 3 | 30 | | 227-30804-01 | 227-30805-01 | 227-30806-01 | 50 |

Shim-pack GIST PFPP

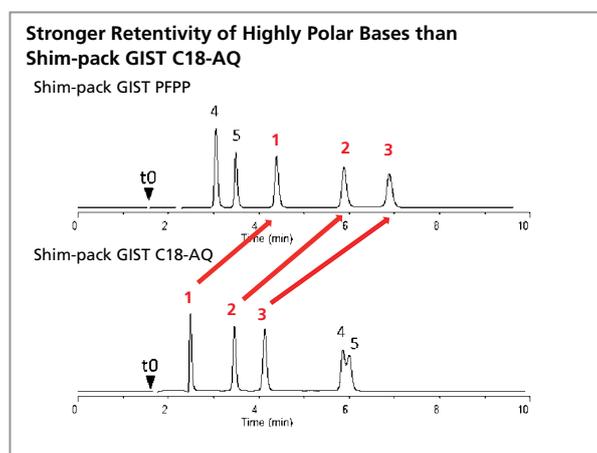
■ Excellent Retention of Highly Polar Bases

Shim-pack GIST PFPP delivers unique separation patterns by multiple interactions such as π - π , dipole, hydrogen bonding and ionic interactions with ultra high inertness and stability which are characteristics of Shim-pack GIST Series.

One of the characteristics of Shim-pack GIST PFPP column is its extremely strong retention capability highly polar basic compounds. In addition, the inertness of Shim-pack GIST PFPP columns offer excellent peak symmetry for compounds that commonly adsorb to conventional column packing.

| | |
|----------------|---------------------------------|
| Bonded Phase | Pentafluorophenyl propyl groups |
| Particle Size | 3 μ m, 5 μ m |
| Pore Size | 10 nm |
| Surface Area | 350 m ² /g |
| Carbon Loading | 10 % |
| End-capping | Yes |
| pH Range | 2 - 7.5 |
| USP Code | L43 |

Analysis Example



■ Peaks

1. Norepinephrine
2. L-Adrenaline
3. Dopamine
4. L-DOPA
5. L-(-)-Tyrosine

■ Conditions

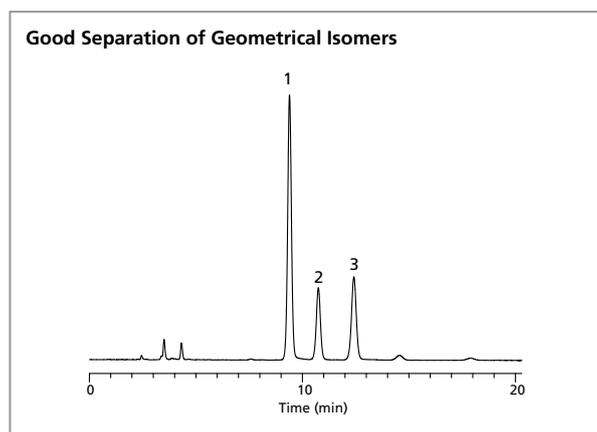
Column : 150 mm \times 2.1 mm I.D., 3 μ m

Mobile phase : 10 mM HCOONH₄ + 0.1 % HCOOH in H₂O

Flow rate : 0.2 mL/min

Column temp. : 40 °C

Detection : UV 210 nm



■ Conditions

Column : Shim-pack GIST-HP PFPP (150 mm \times 2.1 mm I.D., 3 μ m, P/N: 227-30890-05)

Mobile phase : A) Methanol

B) H₂O

A/B = 40/60, v/v

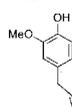
Flow rate : 0.2 mL/min

Column temp. : 40 °C

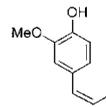
Detection : UV 210 nm

Injection volume : 2.5 μ L

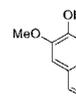
1. Eugenol



2. *cis*-Isoeugenol



3. *trans*-Isoeugenol



Shim-pack GIST PFPP

■ Order Information

| Analytical Columns

| Particle Size (µm) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|--------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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 | | - | 227-30863-01 | 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) | | Cartridge Guard Column (2 pcs) | | | | Holder |
|--------------------|-------------|--|---|--------------|--------------|--------------|--------------|
| | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | | |
| | Length (mm) | | 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 Column (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) | | 2.1 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|--------------------|-------------|--|--------------|--------------|--------------|--------------------------|
| | Length (mm) | | | | | |
| 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) | | Cartridge Guard Column (2 pcs) | | | Pressure Tolerance (MPa) | Holder |
|--------------------|-------------|--|---|--------------|--------------|--------------------------|--------------|
| | Length (mm) | | 1.5 | 2.1 | 3.0 | | |
| 3 | 10 | | 227-30893-01 | 227-30894-01 | 227-30895-01 | 80 | 227-30533-01 |
| Particle Size (µm) | I.D. (mm) | | Cartridge Guard Column (2 pcs) and Holder | | | Pressure Tolerance (MPa) | |
| | Length (mm) | | 1.5 | 2.1 | 3.0 | | |
| 3 | 10 | | 227-30893-02 | 227-30894-02 | 227-30895-02 | 80 | |

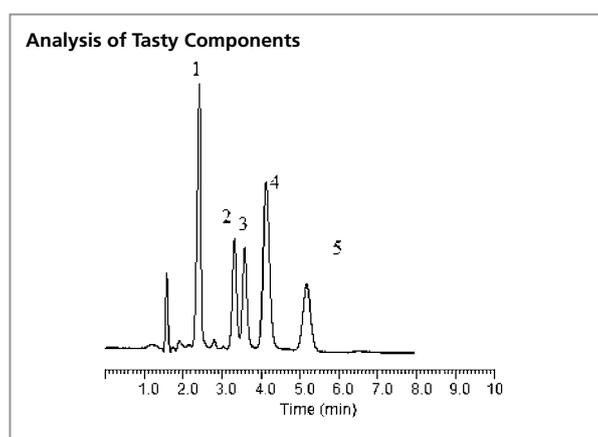
Shim-pack GIST Amide

■ Enhanced Retention of Polar Analytes with Higher Chemical Stability

Shim-pack GIST Amide provides relatively strong retention of highly polar compounds in HILIC mode due to its amide (carbamoyl group) ligand. It is also highly stable, which is a characteristic of Shim-pack GIST series. The column also exhibits great stability under 100% aqueous mobile phase conditions.

| | |
|----------------|---|
| Bonded Phase | Carbamoyl groups |
| Particle Size | 1.9 μm , 3 μm , 5 μm |
| Pore Size | 10 nm |
| Surface Area | 350 m ² /g |
| Carbon Loading | 15 % |
| End-capping | Yes |
| pH Range | 2 - 8.5 |
| USP Code | L68 |

Analysis Example

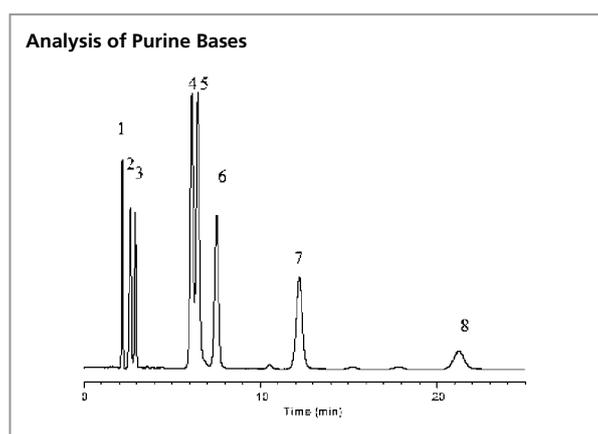


■ **Peaks**

| | |
|------------------------|-----------|
| 1. Succinic acid | 5 mg/mL |
| 2. Glutamic acid | 5 mg/mL |
| 3. Aspartic acid | 5 mg/mL |
| 4. Inosinic acid (IMP) | 0.1 mg/mL |
| 5. Guanylic acid (GMP) | 0.1 mg/mL |

■ **Conditions**

| | |
|------------------|--|
| Column | : Shim-pack GIST Amide (150 mm \times 2.1 mm I.D., 5 μm , P/N: 227-30824-06) |
| Mobile phase | : A) Acetonitrile B) 25 mM Phosphate Buffer (K ₂ HPO ₄ and KH ₂ PO ₄) A/B = 75/25 (v/v) |
| Flow rate | : 0.2 mL/min |
| Column temp. | : 40 °C |
| Detection | : UV 210 nm |
| Injection volume | : 1 μL |



■ **Peaks**

| |
|---------------------------------|
| 1. Caffeine |
| 2. Theophylline |
| 3. Theobromine |
| 4. Hypoxanthine |
| 5. Adenine |
| 6. Xanthine |
| 7. Guanine |
| 8. Uric acid (100 mg/L each) |

■ **Conditions**

| | |
|------------------|--|
| Column | : Shim-pack GIST Amide (150 mm \times 2.1 mm I.D., 5 μm , P/N: 227-30824-06) |
| Mobile phase | : A) Acetonitrile B) 50 mM HCOONH ₄ in H ₂ O C) HCOOH A/B/C = 90/10/0.1 (v/v/v) |
| Flow rate | : 0.2 mL/min |
| Column temp. | : 40 °C |
| Detection | : UV 254 nm |
| Injection volume | : 0.5 μL |

Shim-pack GIST Amide

■ Order Information

| Analytical Columns

| Particle Size (µm) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|--------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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) | | Cartridge Guard Column (2 pcs) | | | | Holder |
|--------------------|-------------|--|---|--------------|--------------|--------------|--------------|
| | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | | |
| | Length (mm) | | 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 | |

| Analytical Column (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) | | 2.1 | 3 | Pressure Tolerance (MPa) |
|--------------------|-------------|--|--------------|--------------|--------------------------|
| | Length (mm) | | | | |
| 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 Columns (High-Pressure Series)

| Particle Size (µm) | I.D. (mm) | | Cartridge Guard Column (2 pcs) | | Pressure Tolerance (MPa) | Holder |
|--------------------|-------------|--|--------------------------------|--------------|--------------------------|--------------|
| | Length (mm) | | 2.1 | 3 | | |
| 1.9 | 10 | | 227-30949-01 | 227-30950-01 | 80 | 227-30533-01 |
| Particle Size (µm) | I.D. (mm) | | Cartridge Guard Column (2pcs) | | Pressure Tolerance (MPa) | |
| | Length (mm) | | 2.1 | 3 | | |
| 1.9 | 10 | | 227-30949-02 | 227-30950-02 | 80 | |

Shim-pack GIS HILIC

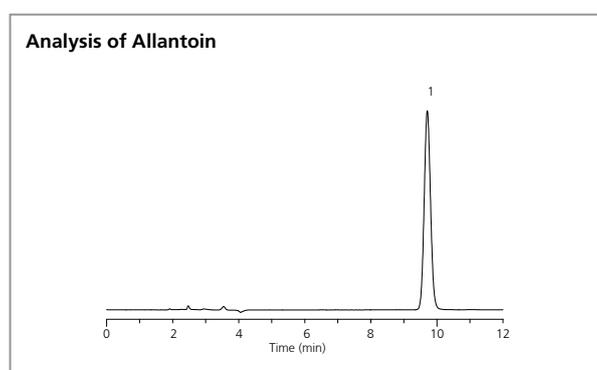
■ Ideal for the Separation of Highly Polar Basic Compounds

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 m ² /g |
| Carbon Loading | 20 % |
| End-capping | - |
| pH Range | 2 - 7.5 |
| USP Code | L20 |

Analysis Example



■ Peaks

1. Allantoin

■ Conditions

Column : Shim-pack GIS HILIC (250 mm \times 3.0 mm I.D., 5 μm)
(P/N: 227-30639-07)

Mobile phase : A) 10 mmol/L Ammonium acetate

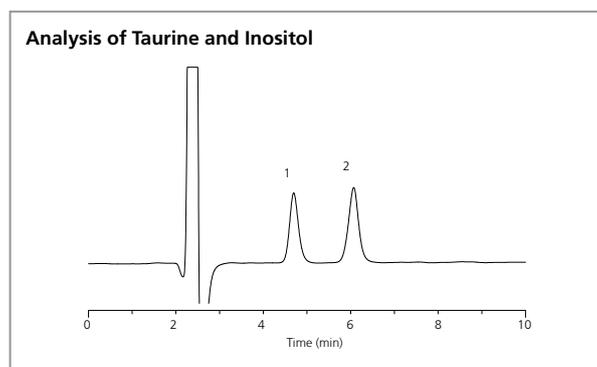
B) Acetonitrile

A/B = 5/95 (v/v)

Flow rate : 0.4 mL/min

Column temp. : 40 $^{\circ}\text{C}$

Detection : UV 210 nm



■ Peaks (500 mg/L each)

1. Taurine

2. Inositol

■ Conditions

Column : Shim-pack GIS HILIC (150 mmL. \times 3.0 mm I.D., 5 μm)
(P/N: 227-30639-06)

Mobile phase : A) Water

B) Acetonitrile

A/B = 20/80 (v/v)

Flow rate : 0.4 mL/min

Column temp. : 40 $^{\circ}\text{C}$

Detection : RID (35 $^{\circ}\text{C}$, positive)

Injection volume : 20 μL

Shim-pack GIS HILIC

Analytical Columns

| Particle Size (µm) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|--------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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 |
| 5 | 250 | | 227-30618-06 | 227-30619-06 | 227-30620-07 | 227-30621-07 | 227-30622-07 | 227-30623-07 |
| | 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 |
| 5 | 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) | | Cartridge Guard Column (2 pcs) | | | | Holder |
|--------------------|-------------|--|---|--------------|--------------|--------------|--------------|
| | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | | |
| | Length (mm) | | 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 78.

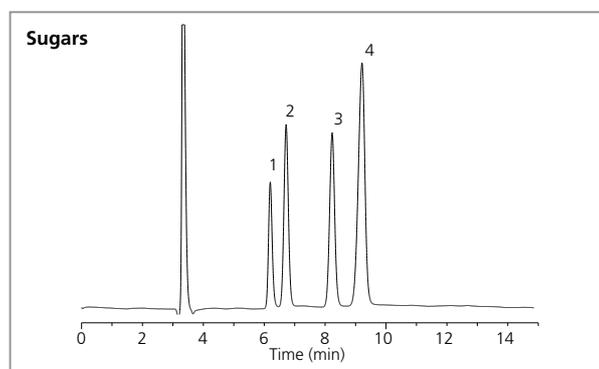
Shim-pack GIST NH2

■ 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 groups |
| Particle Size | 3 µm, 5 µm |
| Pore Size | 10 nm |
| Surface Area | 350 m ² /g |
| Carbon Loading | 7 % |
| End-capping | - |
| pH Range | 2 -7.5 |
| USP Code | L8 |

Analysis Examples

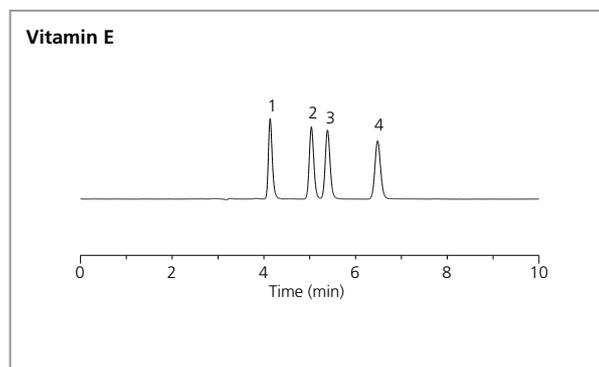


■ Peaks

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

■ Conditions

Column : Shim-pack GIST NH2 (250 mm × 4.6 mm I.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
 Column temp. : 40 °C
 Detection : RID
 Injection volume : 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 mm × 4.6 mm I.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
 Column temp. : 30 °C
 Detection : UV 290 nm
 Injection volume : 10 µL

Shim-pack GIST NH2

Analytical Columns

| Particle Size (µm) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|--------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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) | | Cartridge Guard Column (2 pcs) | | | | Holder |
|--------------------|-------------|----|---|--------------|--------------|--------------|--------------|
| | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | | |
| | Length (mm) | | 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 GIS CN

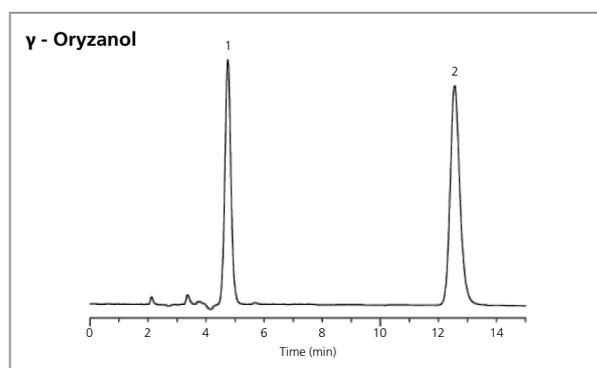
■ Suitable in Either Reversed Phase or Normal Phase Mode

Shim-pack GIS CN is capable of either normal phase or reversed phase analysis. Cyanopropyl 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 | Cyanopropyl groups |
| Particle Size | 3 µm, 5 µm |
| Pore Size | 10 nm |
| Surface Area | 450 m ² /g |
| Carbon Loading | 14 % |
| End-capping | - |
| pH Range | 2 - 7.5 |
| USP Code | L10 |

Analysis Examples

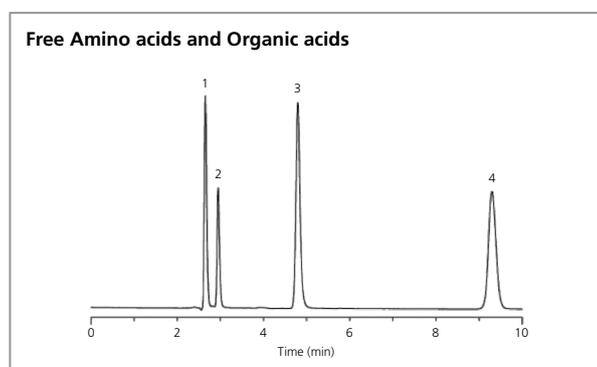


■ Peaks

1. gamma-oryzanol
2. vanillin

■ Conditions

Column : Shim-pack GIS CN (150 mm × 4.6 mm I.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
 Column temp. : 30 °C
 Detection : UV 320 nm
 Injection volume : 1 µL



■ Peaks

1. Asparagine · H₂O (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 mm × 4.6 mm I.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
 Column temp. : 40 °C
 Detection : UV 210 nm
 Injection volume : 5 µL

Shim-pack GIS CN

Analytical Columns

| Particle Size (µm) | I.D. (mm) | | 1.0 | 1.5 | 2.1 | 3.0 | 4.0 | 4.6 |
|--------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | | | |
| 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) | | Cartridge Guard Column (2 pcs) | | | | Holder |
|--------------------|-------------|--|---|--------------|--------------|--------------|--------------|
| | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | | | |
| | Length (mm) | | 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 | |



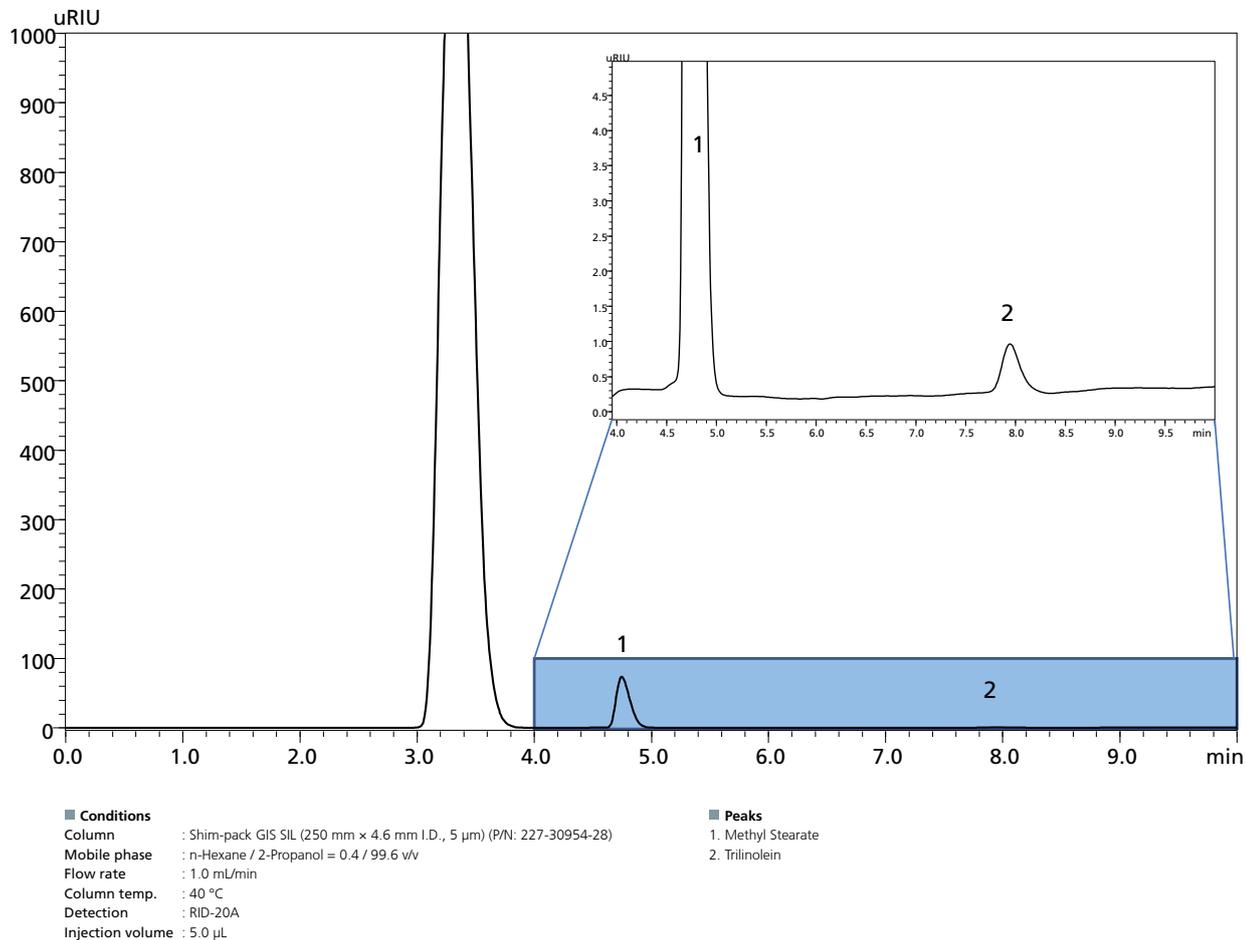
Shim-pack GIS SIL

■ Suitable in Either Reversed Phase or Normal Phase Mode

Shim-pack GIS SIL is a high quality of pure silica gel column that achieves separation with sharp peaks and provides high column-to-column reproducibility. Shim-pack GIS SIL tends to strongly retain basic compounds due to the silanol groups of the silica gel.

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

Analysis Examples



Shim-pack GIS SIL

Analytical Columns

| Particle Size (μm) | I.D. (mm) | | 2.1 | 3.0 | 4.0 | 4.6 |
|------------------------------------|-------------|--|--------------|--------------|--------------|--------------|
| | Length (mm) | | | | | |
| 3 | 30 | | 227-30953-01 | 227-30953-08 | 227-30953-15 | 227-30953-22 |
| | 33 | | 227-30953-02 | 227-30953-09 | 227-30953-16 | 227-30953-23 |
| | 50 | | 227-30953-03 | 227-30953-10 | 227-30953-17 | 227-30953-24 |
| | 75 | | 227-30953-04 | 227-30953-11 | 227-30953-18 | 227-30953-25 |
| | 100 | | 227-30953-05 | 227-30953-12 | 227-30953-19 | 227-30953-26 |
| | 150 | | 227-30953-06 | 227-30953-13 | 227-30953-20 | 227-30953-27 |
| | 250 | | 227-30953-07 | 227-30953-14 | 227-30953-21 | 227-30953-28 |
| 5 | 30 | | 227-30954-01 | 227-30954-08 | 227-30954-15 | 227-30954-22 |
| | 33 | | 227-30954-02 | 227-30954-09 | 227-30954-16 | 227-30954-23 |
| | 50 | | 227-30954-03 | 227-30954-10 | 227-30954-17 | 227-30954-24 |
| | 75 | | 227-30954-04 | 227-30954-11 | 227-30954-18 | 227-30954-25 |
| | 100 | | 227-30954-05 | 227-30954-12 | 227-30954-19 | 227-30954-26 |
| | 150 | | 227-30954-06 | 227-30954-13 | 227-30954-20 | 227-30954-27 |
| | 250 | | 227-30954-07 | 227-30954-14 | 227-30954-21 | 227-30954-28 |

Cartridge Guard Columns

| Particle Size (μm) | I.D. (mm) | | Cartridge Guard Column (2 pcs) | | | | Holder |
|------------------------------------|-------------|--|---|--------------|--------------|--------------|--------------|
| | Length (mm) | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | | - | 227-30955-01 | 227-30955-03 | 227-30955-07 | 227-30532-01 |
| | 20 | | - | - | 227-30955-05 | 227-30955-09 | 227-30532-02 |
| 5 | 10 | | - | 227-30955-11 | 227-30955-13 | 227-30955-17 | 227-30532-01 |
| | 20 | | - | - | 227-30955-15 | 227-30955-19 | 227-30532-02 |
| Particle Size (μm) | I.D. (mm) | | Cartridge Guard Column (2 pcs) and Holder | | | | |
| | Length (mm) | | 1.0 | 1.5 | 3.0 | 4.0 | |
| 3 | 10 | | - | 227-30955-02 | 227-30955-04 | 227-30955-08 | |
| | 20 | | - | - | 227-30955-06 | 227-30955-10 | |
| 5 | 10 | | - | 227-30955-12 | 227-30955-14 | 227-30955-18 | |
| | 20 | | - | - | 227-30955-16 | 227-30281-20 | |

Shim-pack GWS C18

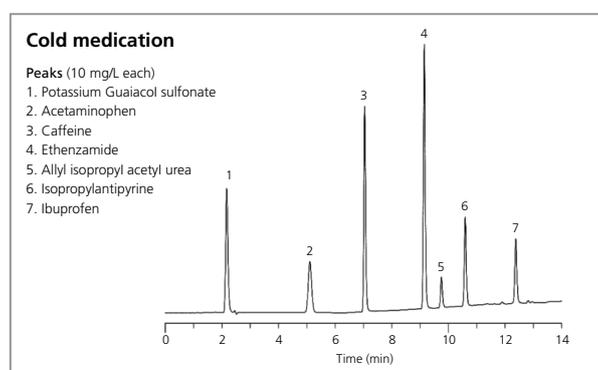
■ Economical Choice

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 m ² /g |
| Carbon Loading | 9.5 % |
| End-capping | Yes |
| pH Range | 2 - 7.5 |
| USP Code | L1 |

Analysis Examples



■ **Conditions**

Column : Shim-pack GWS C18 (150 mm × 4.6 mm I.D., 5 µm, P/N: 227-30158-01)

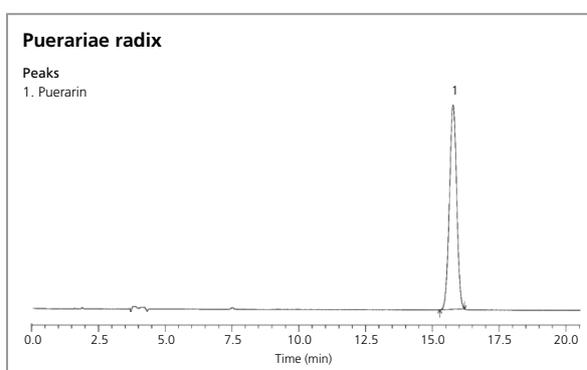
Mobile phase : A) 0.1 % Phosphoric acid in Water
B) Acetonitrile
A/B = 90/10 - 2 min - 90/10 - 10 min - 0/100

Flow rate : 1.0 mL/min

Column temp. : 40 °C

Detection : UV 210 nm

Injection volume : 10 µL



■ **Conditions**

Column : Shim-pack GWS C18 (250 mm × 4.6 mm I.D., 5 µm, P/N: 227-30158-03)

Mobile phase : A) Water
B) Acetonitrile
A/B = 89/11

Flow rate : 1.0 mL/min

Column temp. : 20 °C

Detection : UV 250 nm

Injection volume : 10 µL

Analytical Columns

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

Cartridge Guard Columns

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

Shim-pack VP/XR Series

■ Shim-pack XR-ODS II / III

While the Shim-pack XR-ODSII 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.

| | 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 (m^2/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 |

■ Shim-pack XR Series

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 (m^2/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 VP Series

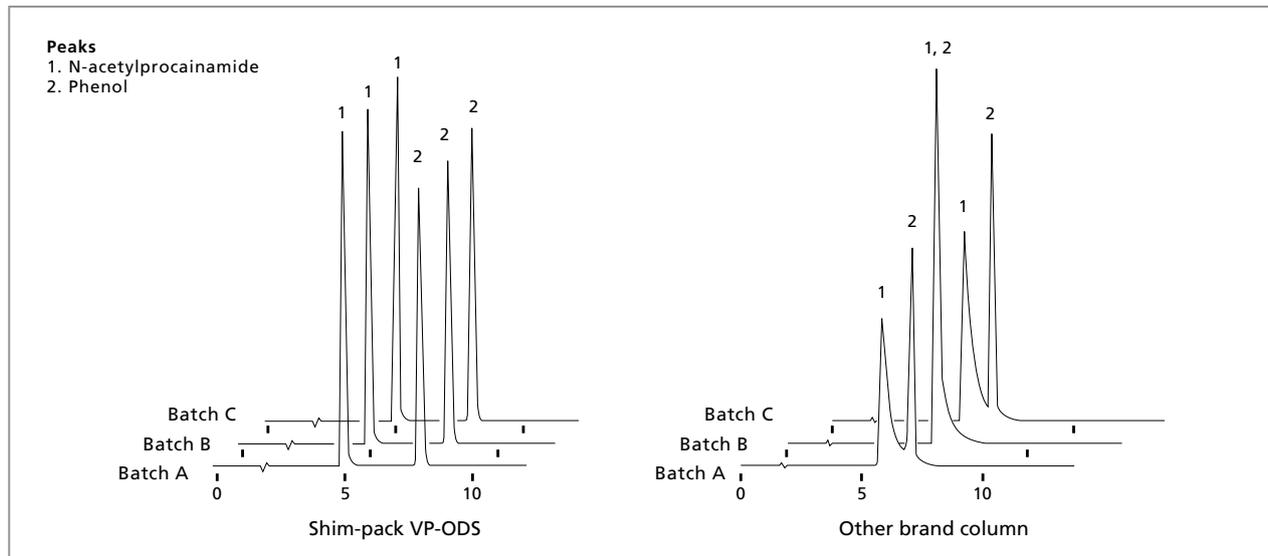
Shim-pack VP-ODS columns are standard columns that use a homogeneous high-purity silica gel as the substrate. They achieve analysis with a high number of theoretical plates without raising the pressure.

They optimize the surface modification ratio and provide favorable peak shapes and separation for compounds with a wide range of physical properties.

| | 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 (m^2/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

■ Quality Certificate Ensuring Traceability

Multiple inspection items have been established for the Shim-pack VP/XR series including silica substrate particle size, metallic content, surface modification ratio, and packing. A quality certificate certifying that rigorous controls are enforced with respect to these inspection results is delivered with the columns, so they can be used with confidence.

Certificate of Compliance
Physical Properties of Shim-pack XR-ODS

Silica Batch No. S021214BT ODS Batch No. 01GTS18A0

| Particle Characteristics of Bare Silica | | | |
|---|-------------|----------|--------|
| | Criteria | Measured | Result |
| Particle Size (µm) | 2.20 ± 0.1 | 2.25 | Pass |
| Pore Size (nm) | 12.5 ± 1.5 | 11.7 | Pass |
| Pore Volume (mL/g) | 1.05 ± 0.10 | 0.99 | Pass |
| Specific Surface Area (m ² /g) | 340 ± 20 | 338 | Pass |

| Trace Metal Contents of Bare Silica | | | |
|-------------------------------------|----------|----------|--------|
| | Criteria | Measured | Result |
| Na (ppm) | < 20.0 | 1.3 | Pass |
| Ca (ppm) | < 15.0 | 0.1 | Pass |
| Mg (ppm) | < 5.0 | 0.1 | Pass |
| Al (ppm) | < 5.0 | 0.9 | Pass |
| Fe (ppm) | < 20.0 | 7.3 | Pass |
| Ti (ppm) | < 0.5 | 0.1 | Pass |
| Total (ppm) | < 50.0 | 9.8 | Pass |

| ODS Properties | | | |
|-------------------------------------|--------------|----------|--------|
| | Criteria | Measured | Result |
| Carbon Loading (%) | 18.40 ± 1.00 | 18.49 | Pass |
| ODS Coverage (µmol/m ²) | 2.65 ± 0.20 | 2.74 | Pass |

Verified by SHIMADZU

Certificate of Compliance
Performance of Shim-pack XR-ODS

ODS Batch No. 01GTS18A0

Basic Compound

(Phenol/Acetylnaphthol)

Criteria 1.772/2.07
Measured 2.02
Result Pass

(N-Acetylprocainamide)

Criteria 2.2/2.0
Measured 1.31
Result Pass

†† Testing factor based on USP

Chelating Compound

(Methylbenzoate)

Criteria 3.38/3.78
Measured 3.02
Result Pass

(Naphthalene)

Criteria ≥ 1500
Measured 3940
Result Pass

SHIMADZU

PERFORMANCE REPORT

ODS

mm

34 mm

µL INJECTOR)

g) 2: Methyl Benzoate (0.22 µg)
µ g) 4: Naphthalene (0.20 µg)

| Measured | Result |
|----------|--------|
| 2.11 | PASS |
| 18100 | PASS |
| 1.10 | PASS |
| 22.30 | PASS |

± 54k₂ / %₂²

± H₂ / (2₂)²

% peak height

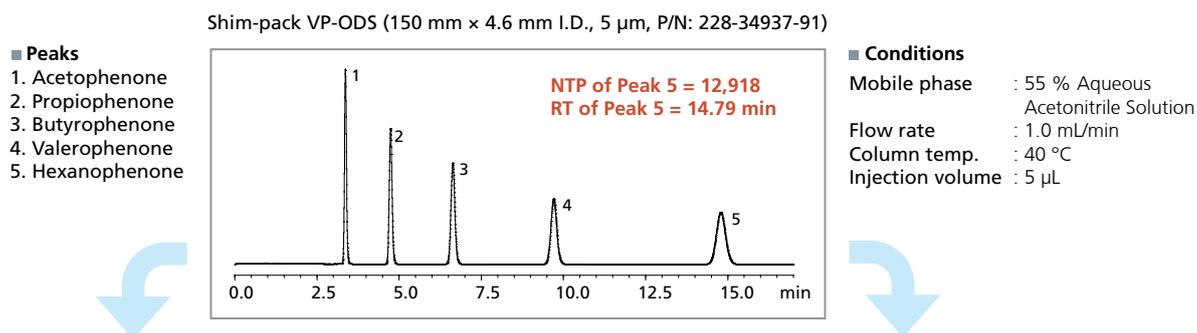
CORPORATION

Extensive product range, including 1.5 mm I.D. column to reduce mobile phase consumption

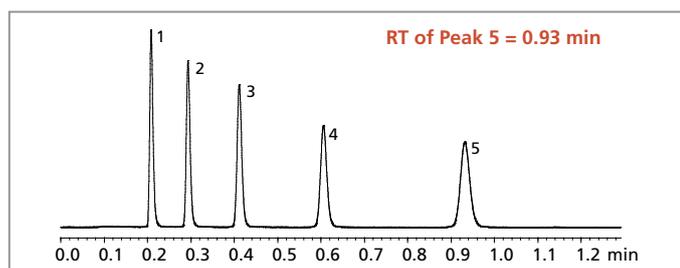
The Shim-pack XR-ODS II range includes a 1.5 mm I.D. model in addition to normal 2 mm and 3 mm I.D. columns. With an optimal flow rate of 0.2 to 0.3 mL/min, the 1.5 mm I.D. column offers the optimal flow rate for LC/MS and reduces mobile phase consumption.

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.

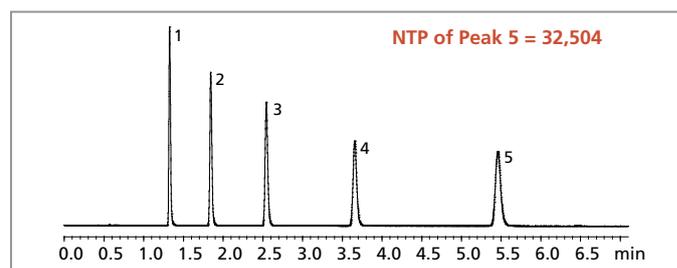


Shim-pack XR-ODS III (50 mm \times 2 mm I.D., 1.6 μm , P/N: 228-59922-91)



■ **Conditions**
Mobile phase : 55 % Aqueous Acetonitrile Solution
Flow rate : 1.1 mL/min
Column temp. : 40 °C
Injection volume : 0.5 μL

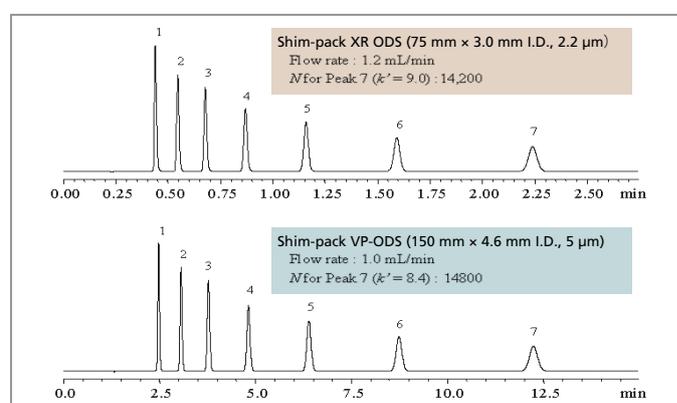
Shim-pack XR-ODS III (200 mm \times 2 mm I.D., 2.2 μm , P/N: 228-59910-92)



■ **Conditions**
Mobile phase : 55 % Aqueous Acetonitrile Solution
Flow rate : 0.6 mL/min
Column temp. : 50 °C
Injection volume : 0.5 μL

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.



Order Information

| Column | Particle Size (µm) | I.D. (mm) | | 1.5 | 2.0 | 3.0 | 4.6 | Pressure Tolerance (MPa) |
|----------------------|--------------------|-------------|--|--------------|--------------|--------------|--------------|--------------------------|
| | | Length (mm) | | | | | | |
| 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 | - | - | |
| 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 | 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 | - | |

| Column | Particle Size (µm) | I.D. (mm) | | 2.0 | 4.6 | 6.0 |
|---------------------|--------------------|-------------|--|--------------|--------------|--------------|
| | | Length (mm) | | | | |
| 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

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

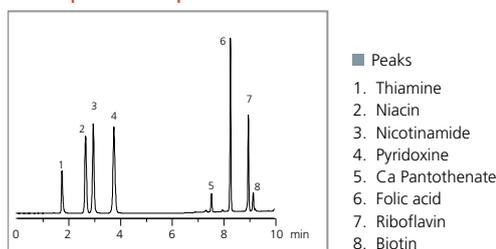
Shim-pack MAqC-ODS

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.

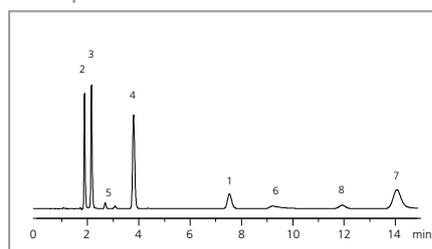
Shim-pack MAqC-ODS I



■ Conditions

Column : Shim-pack MAqC-ODS I (150 mm × 4.6 mm I.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 - 2.5 min - 99/1 - 7.5 min - 50/50 - 0.01 min -
99/1 - 5 min
Flow rate : 1.2 mL/min
Column temp. : 40 °C
Detection : UV 210 nm
Injection volume : 10 μL

Shim-pack VP-ODS



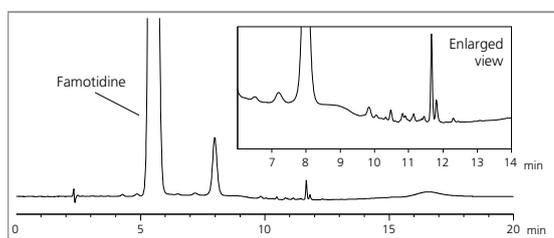
■ Conditions

Column : Shim-pack VP-ODS (150 mm × 4.6 mm I.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
Column temp. : 40 °C
Detection : UV 210 nm
Injection volume : 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 case of the mobile phase used for famotidine analysis with Shim-pack MAqC-ODS I, LC/MS analysis is also possible by desalting the mobile phase using an automatic pretreatment system such as Co-Sense for 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.

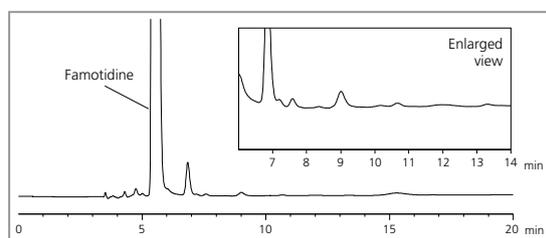
Shim-pack MAqC-ODS I



■ Conditions

Column : Shim-pack MAqC-ODS I (150 mm × 4.6 mm I.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 - 5 min - 92/8 - 7 min - 50/50 - 0.01 min -
92/8 - 8 min
Flow rate : 1.0 mL/min
Column temp. : 25 °C
Detection : UV 254 nm
Injection volume : 5 μL

Shim-pack VP-ODS

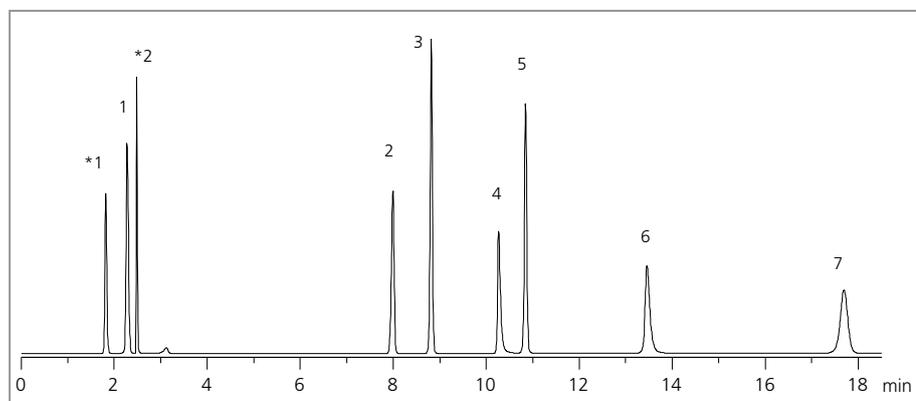


■ Conditions

Column : Shim-pack VP-ODS (150 mm × 4.6 mm I.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
Column temp. : 25 °C
Detection : UV 254 nm
Injection volume : 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 | *1 Nitric acid |
| 2. Acetaminophen | *2 Maleic acid |
| 3. Caffeine | |
| 4. Chlorpheniramine | |
| 5. Ethenzamide | |
| 6. Isopropylantipyrine | |
| 7. Ibuprofen | |

■ Conditions

Column : Shim-pack MAqC-ODS I (150 mm × 4.6 mm I.D., 5 μm)
(P/N: 228-59936-91)
Mobile phase : A) 20 mmol/L phosphate (Na) buffer solution (pH 2.5)
B) Acetonitrile
A/B = 99/1 - 2 min - 99/1 - 6 min - 50/50 - 10 min - 50/50 - 0.01 min - 99/1 - 5 min
Flow rate : 1.0 mL/min
Column temp. : 40 °C
Detection : UV 220 nm
Injection volume : 10 μL

■ Order Information

| Particle Size (μm) | I.D. (mm) | |
|-----------------------|-------------|--------------|
| | Length (mm) | |
| 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 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 | Polymeric |
| 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.

■ 30 mm

Recommended for use in high-throughput analysis of samples that do not have a complex matrix.

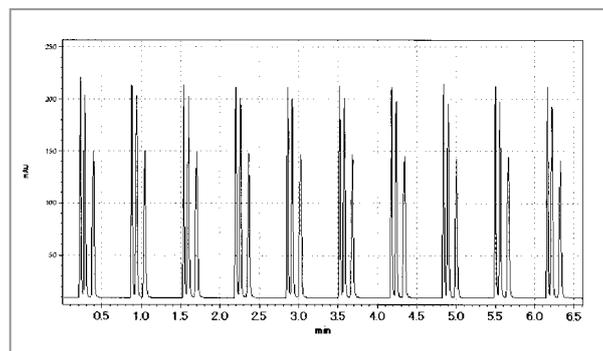
■ 75 mm

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.)

■ 150 mm

Recommended for analyzing samples that are difficult to be retained in other 150 mm ODS columns.

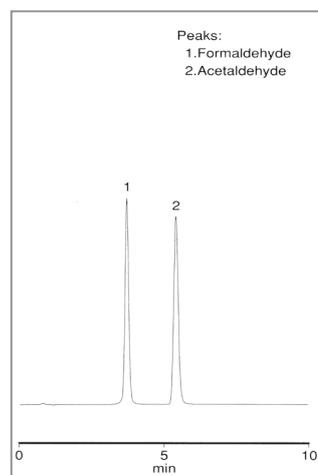
High-Throughput Analysis



10 times repeated analysis in 6.5 minutes is possible.

■ **Conditions**
 Column : Shim-pack FC-ODS (30 mm × 4.6 mm I.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.8 MPa)
 Column temp. : 50 °C
 Detection : 254 nm Response 1, AuxRNG×2
 Instrument : LC-2010+C-R8A

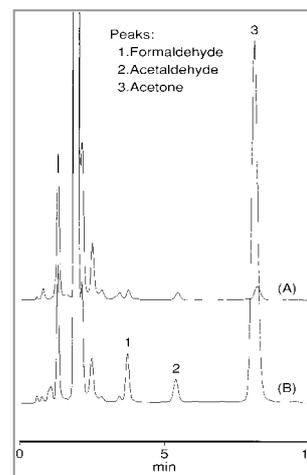
High-speed analysis of 2,4-DNPB derivatized aldehydes / ketones



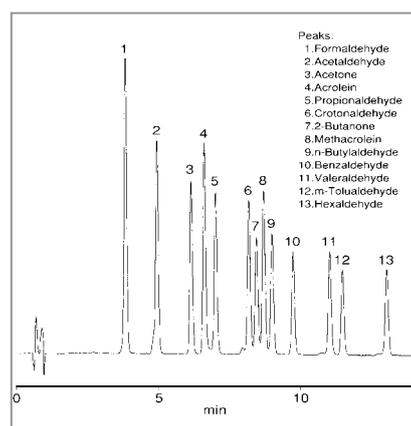
■ Conditions

Column : Shim-pack FC-ODS (75 mm × 4.6 mm I.D., 3 μm)
(P/N: 228-40511-92)
Mobile phase : Water/Acetonitrile = 55/45 (v/v)
Flow rate : 1.0 mL/min
Column temp. : 40 °C
Detection : UV 360 nm

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



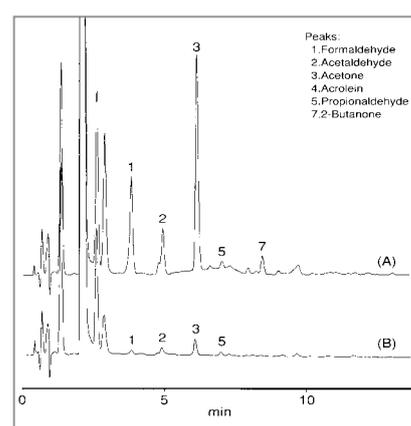
Chromatograms of Environmental Air (A)
and Indoor Air at Laboratory (B)



■ Conditions

Column : Shim-pack FC-ODS
(75 mm × 4.6 mm I.D., 3 μm)
(P/N: 228-40511-92)
Mobile phase : A) Water/Tetrahydrofuran = 8/2 (v/v)
B) Acetonitrile
A/B = 80/20 - 14 min - 40/60 - 0.01 min -
80/20 - 6 min
Flow rate : 1.2 mL/min
Column temp. : 40 °C
Detection : UV 365 nm

Chromatogram of Standard Sample
(each 0.3 μg/mL as carbonyl compounds, 10 μL
injected)



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

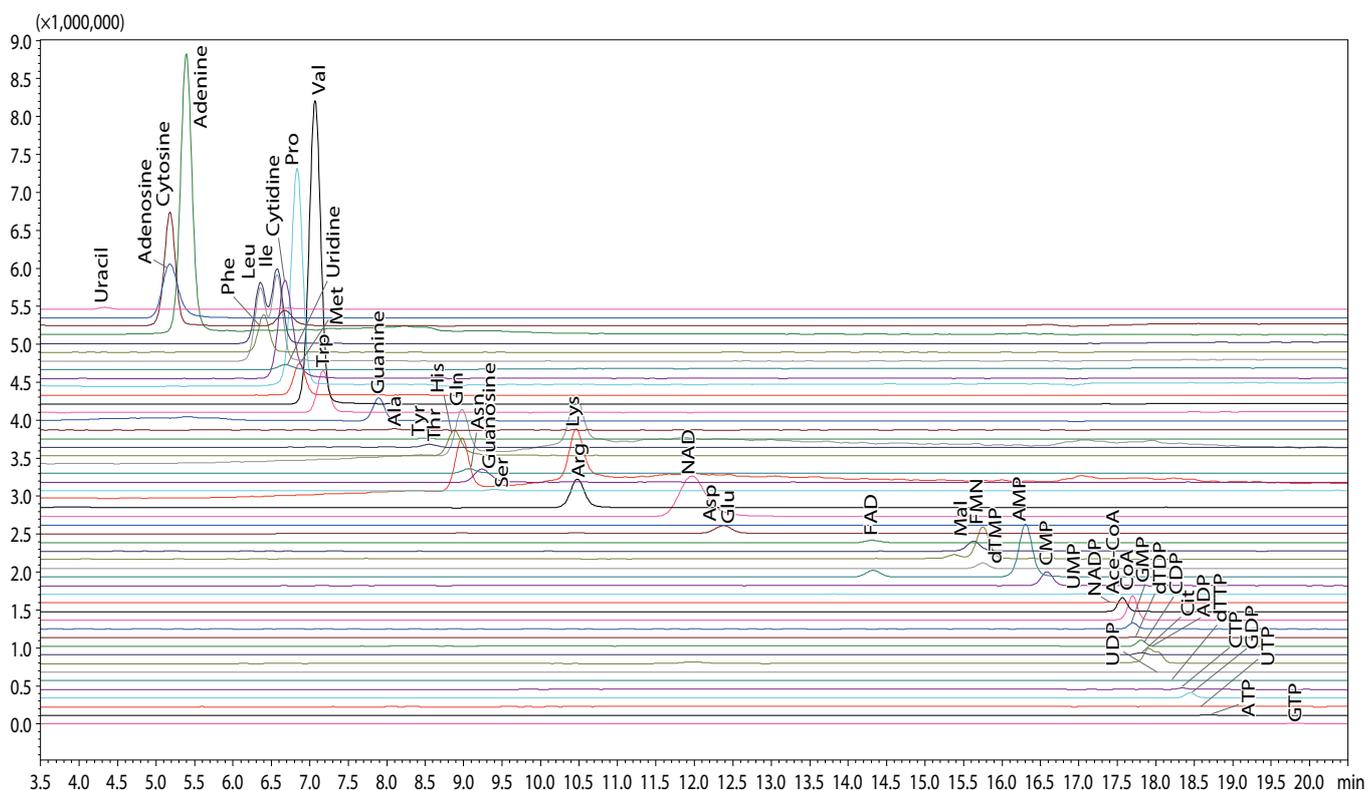
■ Order Information

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

Shim-pack Mix-HILIC

Shim-pack Mix-HILIC chromatography column for hydrophilic interactions enables separation of important amino acids in organisms as well as nucleobases, nucleosides, nucleotides, coenzymes, and organic acids via characteristic hydrophilic interactions and ionic interactions. Accordingly, it is suitable for the simultaneous monitoring of hydrophilic metabolites with a variety of physicochemical properties.

Analysis Example



It is generally known that metal chelating compounds such as compounds containing phosphate groups cause peak tailing and/or adsorption during LC analysis. These chelating compounds are widely found in metabolites, drugs and so on. The adsorption can be reduced by adding salt or chelating agents to the mobile phase. However, such eluents cannot be used for mass spectrometry analysis. In addition, there is a concern that such salts and chelating agents might remain in flow path of an HPLC system and they may be the cause of ghost peaks.

This type of adsorption is caused by the metal parts of flow path including column. PEEK column body is highly inert against chelating compounds. However it is difficult to produce high efficiency columns due to its limited pressure resistance. Mastro2 Series, Shim-pack Scepter Series and Shim-pack G Series ($\leq 3 \mu\text{m}$) Metal Free Columns satisfy both inertness and high pressure resistance by adopting a stainless steel column with the inner surface coated with polymer and frits made of high pressure resistant polymer, providing a completely metal free flow path.

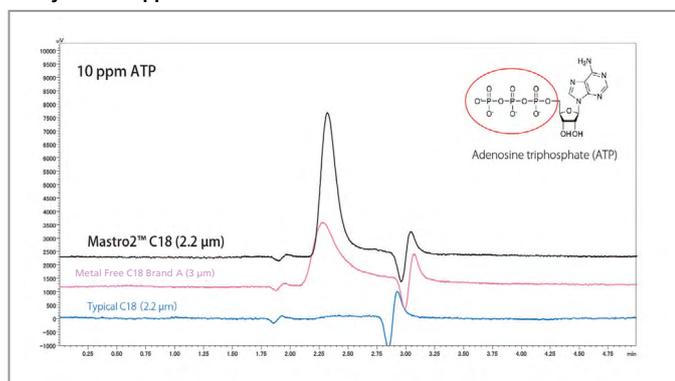
Mastro2 Series

Because of its innovative column hardware design, Mastro2 series column is less prone to metal chelate formation than a typical metal free column, as well as less likely to deform the polymer part inside the column, which is a problem with typical metal free columns. It is therefore less prone to problems compared to other typical metal free columns.

Stable and Reliable Data

A typical C18 column, a typical metal free C18 column and Mastro2 C18 column were compared for ATP analysis. Along with increase peak response, the resulting CV shows very little variation in peak area with Mastro2 C18. In addition, since the peak shape was also improved, the S/N ratio was large and the detection sensitivity was also improved.

Analysis of 10 ppm ATP



Conditions

LC System : Nexera Bio
 Column Dimension : 150 mm × 2.0 (or 2.1) mm I.D.
 Mobile phase : A) 10 mM HCOONH₄ in H₂O
 B) Acetonitrile
 A/B = 95/5, v/v
 Flow rate : 0.2 mL/min
 Column temp. : 40 °C
 Detection : UV 254 nm
 Injection volume : 1 μL
 Sample : ATP (10 ppm)

| | Area average (n=3) | CV | Asymetry | S/N |
|------------------------|--------------------|-----|----------|-----|
| Mastro2 C18 | 50482 | 0.4 | 1.47 | 109 |
| Metal Free C18 Brand A | 38481 | 4.5 | 1.83 | 46 |
| Typical C18 | No data | - | - | - |

Order Information

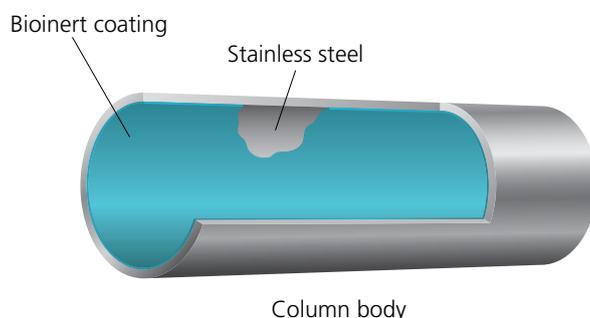
Analytical Columns

| P/N | Description |
|--------------|--|
| 370-01003-44 | Mastro2 C18, 50 mm × 2.0 mm I.D. 2.2 μm |
| 370-01003-64 | Mastro2 C18, 100 mm × 2.0 mm I.D. 2.2 μm |
| 370-01003-84 | Mastro2 C18, 150 mm × 2.0 mm I.D. 2.2 μm |
| 370-01007-44 | Mastro2 C18, 50 mm × 2.0 mm I.D. 5.0 μm |
| 370-01007-64 | Mastro2 C18, 100 mm × 2.0 mm I.D. 5.0 μm |
| 370-01007-84 | Mastro2 C18, 150 mm × 2.0 mm I.D. 5.0 μm |
| 370-01015-64 | Mastro2 PFP, 100 mm × 2.0 mm I.D. 3 μm |
| 370-01015-84 | Mastro2 PFP, 150 mm × 2.0 mm I.D. 3 μm |

Shim-pack Scepter Claris

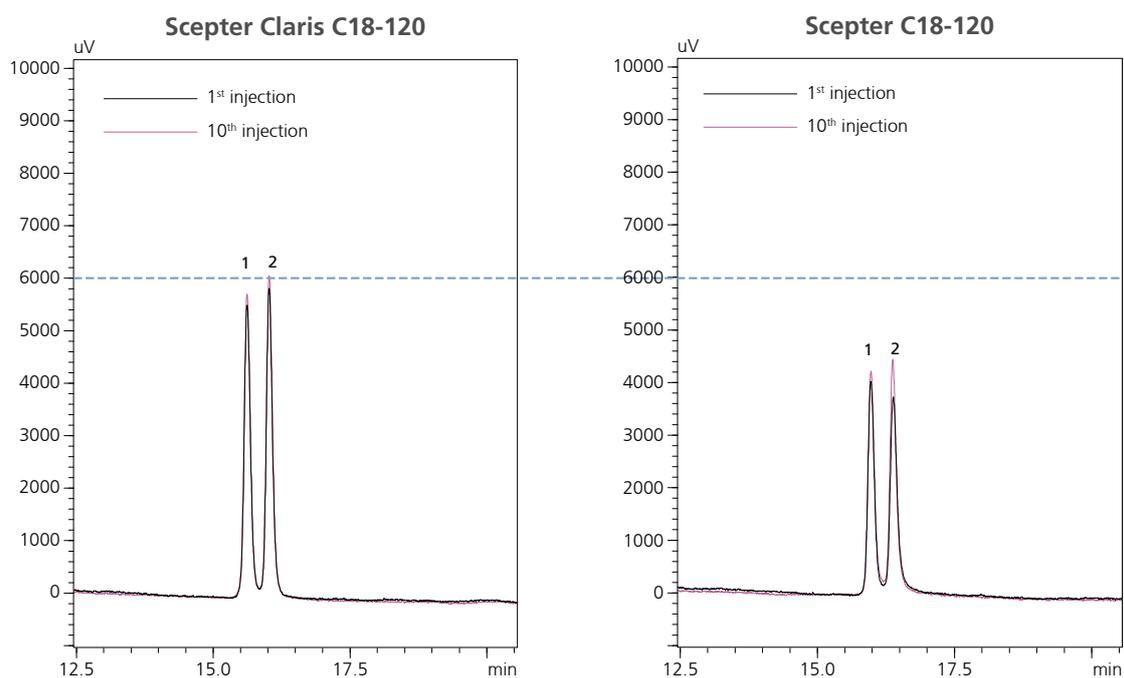
Shim-pack Scepter Claris features a column body with a newly-developed bioinert coating packed with Scepter series stationary phases.

- Bioinert coating is applied to the column body and stainless steel frit
- Ideal for analysis of metal-coordinating and hydrophobically adsorbing compounds such as nucleic acids, proteins, and lipids
- Outstanding pH and lifetime stability due to Scepter organic silica hybrid packing



■ Superior Sensitivity and Separation Performance in Nucleic Acid Analysis

Shim-pack Scepter Claris C18-120 with the bioinert coating and Scepter C18-120 with traditional stainless steel hardware were compared in this example of an analysis of a synthetic oligonucleotide. Results from Claris were highly sensitive and reproducible from the 1st injection, with no loss of sample signal. Scepter C18-120 in a stainless steel column body produced low-sensitivity results and showed adsorption from the 1st sample injection



System : Nexera XS inert
 Mobile phase : A) 100 mmol/L HFIP + 10 mmol/L TEA in water
 B) Methanol
 Flow rate : 0.3 mL/min
 Column temp. : 60 °C
 Injection volume : 1 µL
 Sample : 1. Synthetic oligonucleotide 20 mer (10 mg/L)
 2. Synthetic oligonucleotide 21 mer (10 mg/L)
 Detection : UV 260 nm

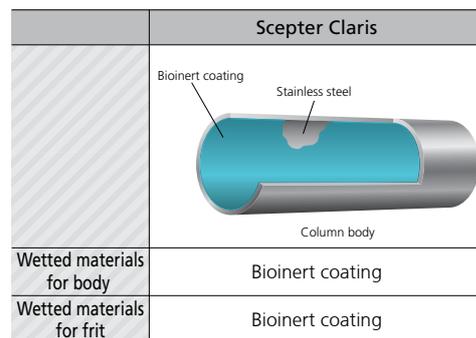
Shim-pack Scepter Claris Series

Shim-pack Scepter Claris

| Chemistry | | C18-120 | | | HD-C18-80 | | | C18-300 | | |
|--------------------|---------|--------------|---|--------------|--------------|---|--------------|--------------|---|--------------|
| Particle Size (µm) | ID (mm) | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 |
| 1.9 | 50 | 227-31210-01 | | | 227-31211-01 | | | 227-31209-01 | | |
| | 75 | | | | | | | | | |
| | 100 | 227-31210-02 | | | 227-31211-02 | | | 227-31209-02 | | |
| | 150 | 227-31210-03 | | | 227-31211-03 | | | 227-31209-03 | | |
| 3 | 50 | 227-31210-04 | | 227-31210-07 | 227-31211-04 | | 227-31211-07 | 227-31209-04 | | 227-31209-07 |
| | 75 | | | | | | | | | |
| | 100 | 227-31210-05 | | 227-31210-08 | 227-31211-05 | | 227-31211-08 | 227-31209-05 | | 227-31209-08 |
| | 150 | 227-31210-06 | | 227-31210-09 | 227-31211-06 | | 227-31211-09 | 227-31209-06 | | 227-31209-09 |
| | 250 | | | | | | | | | |
| 5 | 50 | 227-31210-10 | | 227-31210-13 | 227-31211-10 | | 227-31211-13 | 227-31209-10 | | 227-31209-13 |
| | 75 | | | | | | | | | |
| | 100 | 227-31210-11 | | 227-31210-14 | 227-31211-11 | | 227-31211-14 | 227-31209-11 | | 227-31209-14 |
| | 150 | 227-31210-12 | | 227-31210-15 | 227-31211-12 | | 227-31211-15 | 227-31209-12 | | 227-31209-15 |
| | 250 | | | | | | | | | |

| Chemistry | | C8-120 | | | C4-300 | | | Phenyl | | |
|--------------------|---------|--------------|---|--------------|--------------|---|--------------|--------------|---|--------------|
| Particle Size (µm) | ID (mm) | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 |
| 1.9 | 50 | 227-31212-01 | | | 227-31208-01 | | | 227-31215-01 | | |
| | 75 | | | | | | | | | |
| | 100 | 227-31212-02 | | | 227-31208-02 | | | 227-31215-02 | | |
| | 150 | 227-31212-03 | | | 227-31208-03 | | | 227-31215-03 | | |
| 3 | 50 | 227-31212-04 | | 227-31212-07 | 227-31208-04 | | 227-31208-07 | 227-31215-04 | | 227-31215-07 |
| | 75 | | | | | | | | | |
| | 100 | 227-31212-05 | | 227-31212-08 | 227-31208-05 | | 227-31208-08 | 227-31215-05 | | 227-31215-08 |
| | 150 | 227-31212-06 | | 227-31212-09 | 227-31208-06 | | 227-31208-09 | 227-31215-06 | | 227-31215-09 |
| | 250 | | | | | | | | | |
| 5 | 50 | 227-31212-10 | | 227-31212-13 | 227-31208-10 | | 227-31208-13 | 227-31215-10 | | 227-31215-13 |
| | 75 | | | | | | | | | |
| | 100 | 227-31212-11 | | 227-31212-14 | 227-31208-11 | | 227-31208-14 | 227-31215-11 | | 227-31215-14 |
| | 150 | 227-31212-12 | | 227-31212-15 | 227-31208-12 | | 227-31208-15 | 227-31215-12 | | 227-31215-15 |
| | 250 | | | | | | | | | |

| Chemistry | | PFPP | | | Diol-HILIC | | |
|--------------------|---------|--------------|---|--------------|--------------|---|--------------|
| Particle Size (µm) | ID (mm) | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 |
| 1.9 | 50 | 227-31214-01 | | | 227-31213-01 | | |
| | 75 | | | | | | |
| | 100 | 227-31214-02 | | | 227-31213-02 | | |
| | 150 | 227-31214-03 | | | 227-31213-03 | | |
| 3 | 50 | 227-31214-04 | | 227-31214-07 | 227-31213-04 | | 227-31213-07 |
| | 75 | | | | | | |
| | 100 | 227-31214-05 | | 227-31214-08 | 227-31213-05 | | 227-31213-08 |
| | 150 | 227-31214-06 | | 227-31214-09 | 227-31213-06 | | 227-31213-09 |
| | 250 | | | | | | |
| 5 | 50 | 227-31214-10 | | 227-31214-13 | 227-31213-10 | | 227-31213-13 |
| | 75 | | | | | | |
| | 100 | 227-31214-11 | | 227-31214-14 | 227-31213-11 | | 227-31213-14 |
| | 150 | 227-31214-12 | | 227-31214-15 | 227-31213-12 | | 227-31213-15 |
| | 250 | | | | | | |



Shim-pack Scepter Series (Metal Free Columns)

Shim-pack Scepter [metal-free]

| Chemistry | | C18-120 | | | HD-C18-80 | | | C18-300 | | |
|--------------------|-------------|--------------|---|--------------|--------------|---|--------------|--------------|---|--------------|
| Particle Size (µm) | ID (mm) | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 |
| | Length (mm) | | | | | | | | | |
| 1.9 | 50 | 227-31072-01 | | | 227-31173-01 | | | 227-31204-01 | | |
| | 75 | | | | | | | | | |
| | 100 | 227-31072-02 | | | 227-31173-02 | | | 227-31204-02 | | |
| | 150 | | | | | | | 227-31204-03 | | |
| 3 | 50 | 227-31073-01 | | 227-31074-01 | 227-31077-01 | | 227-31078-01 | 227-31204-04 | | 227-31204-07 |
| | 75 | | | | | | | | | |
| | 100 | 227-31073-02 | | 227-31074-02 | 227-31077-02 | | 227-31078-02 | 227-31204-05 | | 227-31204-08 |
| | 150 | 227-31073-03 | | 227-31074-03 | | | 227-31078-03 | 227-31204-06 | | 227-31204-09 |
| | 250 | | | | | | | | | |
| 5 | 50 | 227-31075-01 | | 227-31076-01 | 227-31079-01 | | 227-31080-01 | 227-31204-10 | | 227-31204-13 |
| | 75 | | | | | | | | | |
| | 100 | 227-31075-02 | | 227-31076-02 | 227-31079-02 | | 227-31080-02 | 227-31204-11 | | 227-31204-14 |
| | 150 | | | 227-31076-03 | | | 227-31080-03 | 227-31204-12 | | 227-31204-15 |
| | 250 | | | | | | | | | |

| Chemistry | | C8-120 | | | C4-300 | | | Phenyl | | |
|--------------------|-------------|--------------|---|--------------|--------------|---|--------------|--------------|---|--------------|
| Particle Size (µm) | ID (mm) | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 |
| | Length (mm) | | | | | | | | | |
| 1.9 | 50 | 227-31166-01 | | | 227-31197-01 | | | 227-31169-01 | | |
| | 75 | | | | | | | | | |
| | 100 | 227-31166-02 | | | 227-31197-02 | | | 227-31169-02 | | |
| | 150 | 227-31166-03 | | | 227-31197-03 | | | | | |
| 3 | 50 | 227-31081-01 | | 227-31082-01 | 227-31198-01 | | 227-31199-01 | 227-31093-01 | | 227-31094-03 |
| | 75 | | | | | | | | | |
| | 100 | 227-31081-02 | | 227-31082-02 | 227-31198-02 | | 227-31199-02 | 227-31093-02 | | 227-31094-01 |
| | 150 | 227-31081-03 | | 227-31082-03 | 227-31198-03 | | 227-31199-03 | | | 227-31094-02 |
| | 250 | | | | | | | | | |
| 5 | 50 | 227-31083-01 | | 227-31084-01 | 227-31200-01 | | 227-31201-01 | 227-31095-01 | | 227-31096-01 |
| | 75 | | | | | | | | | |
| | 100 | 227-31083-02 | | 227-31084-02 | 227-31200-02 | | 227-31201-02 | 227-31095-02 | | 227-31096-02 |
| | 150 | 227-31083-03 | | 227-31084-03 | 227-31200-03 | | 227-31201-03 | | | 227-31096-03 |
| | 250 | | | | | | | | | |

| Chemistry | | PFPP | | | Diol-HILIC | | |
|--------------------|-------------|--------------|---|--------------|--------------|---|--------------|
| Particle Size (µm) | ID (mm) | 2.1 | 3 | 4.6 | 2.1 | 3 | 4.6 |
| | Length (mm) | | | | | | |
| 1.9 | 50 | 227-31168-01 | | | 227-31167-01 | | |
| | 75 | | | | | | |
| | 100 | 227-31168-02 | | | 227-31167-02 | | |
| | 150 | | | | | | |
| 3 | 50 | 227-31089-01 | | 227-31090-03 | 227-31085-01 | | 227-31086-01 |
| | 75 | | | | | | |
| | 100 | 227-31089-02 | | 227-31090-01 | 227-31085-02 | | 227-31086-02 |
| | 150 | | | 227-31090-02 | | | 227-31086-03 |
| | 250 | | | | | | |
| 5 | 50 | 227-31091-01 | | 227-31092-01 | 227-31087-01 | | 227-31088-03 |
| | 75 | | | | | | |
| | 100 | 227-31091-02 | | 227-31092-02 | 227-31087-02 | | 227-31088-01 |
| | 150 | | | 227-31092-03 | | | 227-31088-02 |
| | 250 | | | | | | |

| Scepter [metal-free] | |
|---------------------------|---|
| | <p>PEEK Stainless steel Column body</p> |
| Wetted materials for body | PEEK |
| Wetted materials for frit | PEEK |

Shim-pack G Series (Metal Free Columns)

Analytical Columns

| Chemistry | | GIST C18 | | GIST C18-AQ | GISS C18 | | Pressure Tolerance (MPa) | |
|--------------------|-------------|----------|--------------|--------------|--------------|--------------|--------------------------|----|
| Particle Size (µm) | I.D. (mm) | | 2.1 | 4.6 | 2.1 | 4.6 | | |
| | Length (mm) | | | | | | | |
| 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 | |
| 5 | 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) | | 2.1 | 4.6 | 2.1 | 4.6 | 2.1 | | 4.6 |
| | Length (mm) | | | | | | | | |
| 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 | |
| 5 | 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) | | Cartridge Guard Column (2 pcs) | | Pressure Tolerance (MPa) | Holder |
|-------------|--------------------|-------------|--|---|--------------|--------------------------|--------------|
| | | Length (mm) | | 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) | | Cartridge Guard Column (2 pcs) and Holder | | Pressure Tolerance (MPa) | |
| | | Length (mm) | | 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 | | |

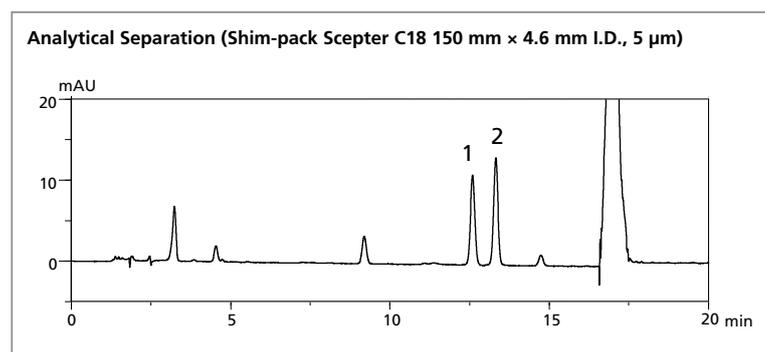
Shim-pack Scepter Series

Shim-pack Scepter Series preparative columns are ideal for preparative purification with their excellent stability and efficiency. 1.9 μm UHPLC columns and 3 and 5 μm HPLC columns are also available, enabling seamless transfer of analytical methods from UHPLC and analytical HPLC to preparative HPLC.

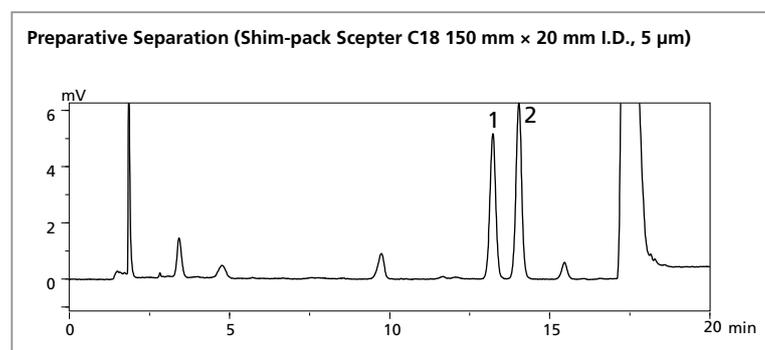
Seamless Scale up to Preparative Separation

– Separation of Sennosides A and B in Senna Powder –

Analytical separation developed with Shim-pack Scepter C18 analytical column could be seamlessly scaled up to preparative separation with Shim-pack Scepter C18 preparative column because of their full scalability.



Scale Up



■ Conditions

Column : Shim-pack Scepter C18
Analytical 150 mm \times 4.6 mm I.D., 5 μm , P/N: 227-31020-05
Preparative 150 mm \times 20 mm I.D., 5 μm , P/N: 227-31103-04

Mobile phase : A) 0.1M Ammonium acetate (pH 6.9)
B) Acetonitrile

Gradient : 5 %B (0 min) \rightarrow 15 % (15 min)
 \rightarrow 100 % (15.01-20 min) \rightarrow 5 % (20.01-30 min)

Flow rate : Analytical 1.0 mL/min
Preparative 19 mL/min

Column temp. : Ambient

Detection : UV 340 nm

Injection volume : Analytical 2 μL
Preparative 500 μL

Sample : 100 mg of Powdered Senna leaf was dissolved in 10 mL of 70 % MeOH. After 30 minutes of sonication, the solution was filtered for analysis.

■ Peaks

1. Sennoside B
2. Sennoside A

Order Information

For information of analytical columns and each chemistry, please refer to page 25.

Preparative Columns (5 µm)

| Chemistry | I.D. (mm) | | 10 | 20 | 30 |
|-------------|-------------|--|--------------|--------------|--------------|
| | Length (mm) | | | | |
| C18 | 50 | | - | 227-31102-01 | 227-31103-01 |
| | 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 |
| HD-C18 | 50 | | - | 227-31105-01 | 227-31106-01 |
| | 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 |
| C8 | 50 | | - | 227-31108-01 | 227-31109-01 |
| | 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 |
| Chemistry | I.D. (mm) | | 10 | 20 | 30 |
| Length (mm) | | | | | |
| C4-300 | 50 | | - | 227-31185-01 | 227-31186-01 |
| | 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 |
| Phenyl | 50 | | - | 227-31114-01 | 227-31115-01 |
| | 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 |
| PFPP | 50 | | - | 227-31111-01 | 227-31112-01 |
| | 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 |

Shim-pack Scepter Preparative Guard Cartridge (5 µm, 2/pk)

| Chemistry | C18 | HD-C18 | C8 | C4-300 | Phenyl | PFPP | Cartridge Holder |
|------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------|
| 10 × 10 mm | 227-31127-01 | 227-31135-01 | 227-31143-01 | 227-31194-01 | 227-31165-01 | 227-31157-01 | 227-31171-01 |
| 20 × 10 mm | 227-31127-02 | 227-31135-02 | 227-31143-02 | 227-31195-01 | 227-31165-02 | 227-31157-02 | 227-31171-02 |
| 30 × 10 mm | 227-31127-03 | 227-31135-03 | 227-31143-03 | 227-31196-01 | 227-31165-03 | 227-31157-03 | 227-31171-03 |

Shim-pack G Series

■ Order Information

For information of analytical columns and each chemistry, please refer to page 31.

| Chemistry | Particle Size (μm) | I.D. (mm) | | 6.0 | 7.6 | 10 | 14 | 20 |
|-----------------------------|--------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|
| | | Length (mm) | | | | | | |
| 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 GIST PFPP | 5 | 50 | | 227-30868-01 | 227-30869-01 | 227-30870-01 | 227-30871-01 | 227-30872-01 |
| | | 100 | | 227-30868-02 | 227-30869-02 | 227-30870-02 | 227-30871-02 | 227-30872-02 |
| | | 150 | | 227-30868-03 | 227-30869-03 | 227-30870-03 | 227-30871-03 | 227-30872-03 |
| | | 250 | | 227-30868-04 | 227-30869-04 | 227-30870-04 | 227-30871-04 | 227-30872-04 |
| └ Guard Column | 5 | 50 | | 227-30885-01 | 227-30886-01 | 227-30887-01 | 227-30888-01 | 227-30889-01 |
| Shim-pack GIST Amide | 5 | 50 | | 227-30828-01 | 227-30829-01 | 227-30830-01 | 227-30831-01 | 227-30832-01 |
| | | 100 | | 227-30828-02 | 227-30829-02 | 227-30830-02 | 227-30831-02 | 227-30832-02 |
| | | 150 | | 227-30828-03 | 227-30829-03 | 227-30830-03 | 227-30831-03 | 227-30832-03 |
| | | 250 | | 227-30828-04 | 227-30829-04 | 227-30830-04 | 227-30831-04 | 227-30832-04 |
| └ Guard Column | 5 | 50 | | 227-30845-01 | 227-30846-01 | 227-30847-01 | 227-30848-01 | 227-30849-01 |

| Column | Particle Size (µm) | I.D. (mm) | | 6.0 | 7.6 | 10 | 14 | 20 |
|-------------------------|--------------------|-------------|--|--------------|--------------|--------------|--------------|--------------|
| | | Length (mm) | | | | | | |
| 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 |
| Shim-pack GIS SIL | 5 | 50 | | 227-30954-29 | 227-30954-33 | 227-30954-37 | 227-30954-41 | 227-30954-45 |
| | | 100 | | 227-30954-30 | 227-30954-34 | 227-30954-38 | 227-30954-42 | 227-30954-46 |
| | | 150 | | 227-30954-31 | 227-30954-35 | 227-30954-39 | 227-30954-43 | 227-30954-47 |
| | | 250 | | 227-30954-32 | 227-30954-36 | 227-30954-40 | 227-30954-44 | 227-30954-48 |
| └ Guard Column | 5 | 50 | | 227-30955-21 | 227-30955-22 | 227-30955-23 | 227-30955-24 | 227-30955-25 |
| Column | Particle Size (µm) | I.D. (mm) | | 30 | 50 | | | |
| | | Length (mm) | | | | | | |
| 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 PREP Series

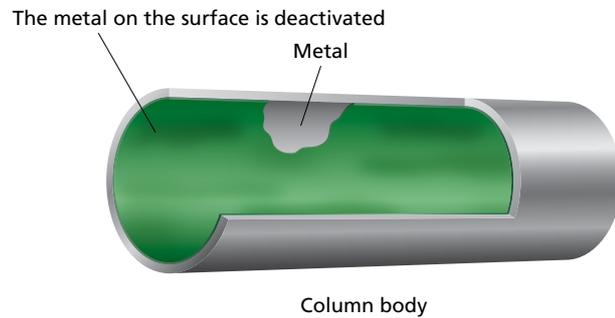
Shim-pack PREP series is packed with fully porous spherical silica particles on which respective stationary phases are chemically bonded. (Except the PREP-SIL which is packed with silica particles without any surface treatment.)

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

Order Information

| Column | Particle Size (µm) | I.D. (mm) | | 20 | 30 | Guard Column | |
|--------------------|--------------------|-------------|--|--------------|--------------|--------------|--------------|
| | | Length (mm) | | | | | |
| 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 MC C18



■ Versatility

- Shim-pack MC C18 column with 1.9 μm UHPLC particle achieves excellent separation and peak shape.
- The high pressure rating of 70 MPa allows 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.

■ Order information

Analytical Columns

■ 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 | |

Shim-pack MCT Series

■ Trap Columns Wide Portfolio

- Shim-pack MCT C18/C8

70 MPa pressure limitation 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 (particle size 3 μm)

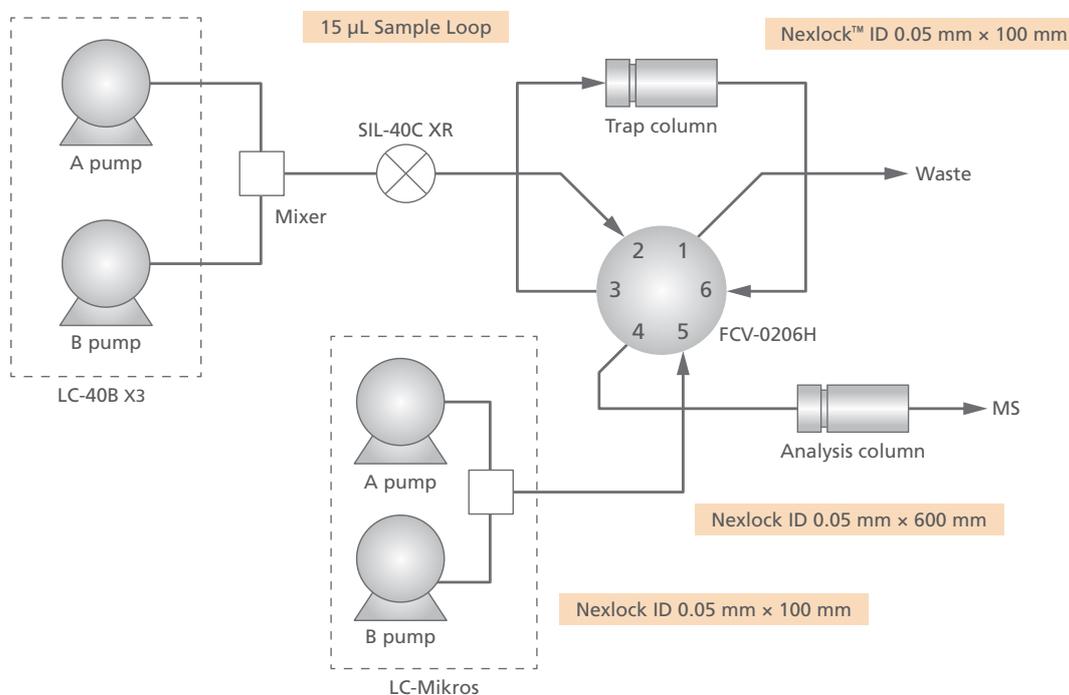
| Part Number | Bonded Phase | Diameter (mm) | Length (mm) |
|--------------|--------------|---------------|-------------|
| 228-59938-91 | C18 | 0.3 | 35 |
| 228-59938-92 | | 0.5 | |
| 228-59939-91 | C8 | 0.3 | 35 |
| 228-59939-92 | | 0.5 | |

■ 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 | |

■ Nexera Mikros: Trap and Elute Configuration

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



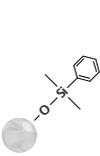
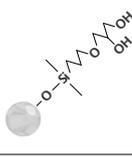
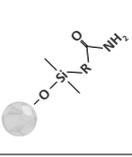
Shim-pack UC Series

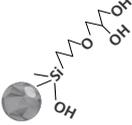
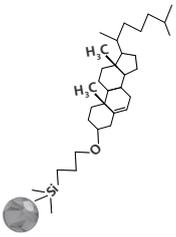
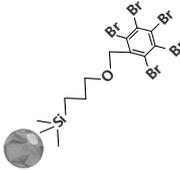
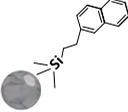
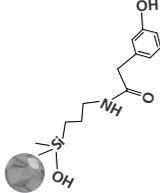
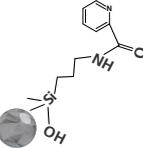
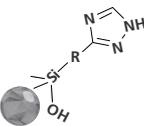
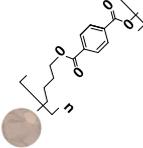
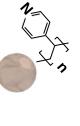
■ Fully Porous Silica Particle Based Columns for Supercritical Fluid Chromatography

Chemistries

The Shim-pack UC series columns offer a wide variety of stationary phases for separating all sorts of compounds using the unique characteristics of supercritical fluid chromatography (SFC).

The series includes twenty kinds of packing materials and a wide range of particle and column sizes that can be selected based on the purpose of analysis.

| | RP | GIS II | Phenyl | CN |
|----------------------------------|---|---|---|---|
| Chemistry |  |  |  |  |
| Bonded Phase | Polar-Embedded Octadecyl Group | Octadecyl Group | Phenyl group | Cyanopropyl group |
| Particle Size (µm) | 3, 5 | | | |
| Pore Size (nm) | 10 | | | |
| Surface Area (m ² /g) | 450 | | | |
| Carbon Loading | 9 % | 11 % | 9.5 % | 14 % |
| Pressure Tolerance (MPa) | 50 (3 µm), 30 (5 µm, I.D. 2.1-10 mm), 23 (5 µm, I.D. 20-28 mm) | | | |
| Pore Volume (mL/g) | 1.05 | | | |
| End Capping | No | Yes | No | No |
| USP Code | L1 | L1 | L11 | L10 |
| | Diol | Sil | Amide | NH ₂ |
| Chemistry |  |  |  |  |
| Bonded Phase | Diol Group | - | Carbamoyl Group | Aminopropyl Group |
| Particle Size (µm) | 3, 5 | | | |
| Pore Size (nm) | 10 | | | |
| Surface Area (m ² /g) | 450 | | | |
| Carbon Loading | 20 % | - | 18 % | 8 % |
| Pressure Tolerance (MPa) | 50 (3 µm), 30 (5 µm, I.D. 2.1-10 mm), 23 (5 µm, I.D. 20-28 mm) | | | |
| Pore Volume (mL/g) | 1.05 | | | |
| End Capping | No | No | No | No |
| USP Code | L20 | L3 | L68 | L8 |

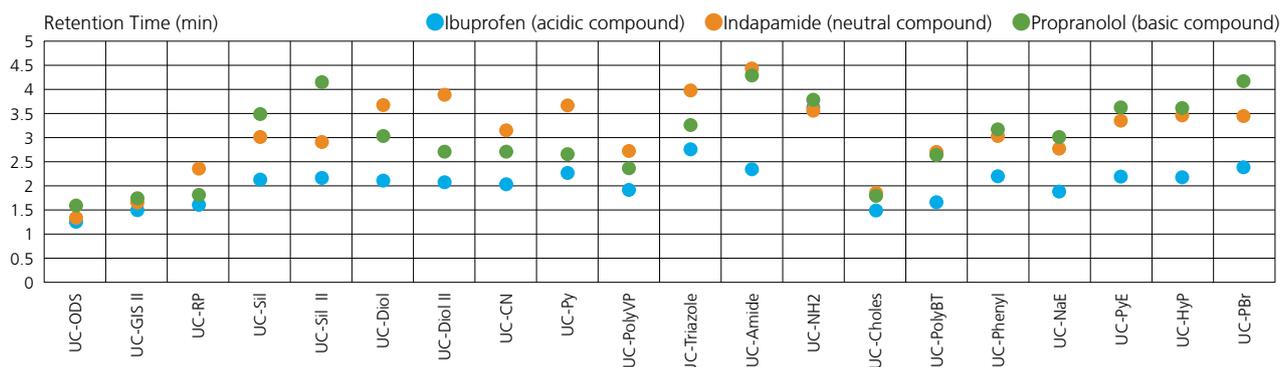
| | Diol II | Sil II | Choles | PBr | ODS | NaE |
|----------------------------------|---|---|---|--|---|---|
| Chemistry |  |  |  |  |  |  |
| Bonded Phase | Diol Group | - | Cholesteryl Group | Pentabromobenzyl Group | Octadecyl Group | Naphtylethyl group |
| Particle Size (µm) | 3, 5 | | | | | |
| Pore Size (nm) | 12 | | | | | |
| Surface Area (m ² /g) | 340 (3 µm), 300 (5 µm) | | | | | |
| Carbon Loading | - | - | 20 % | 8 % | 16 % | 11 % |
| Pressure Tolerance (MPa) | 50 (3 µm), 30 (5 µm, I.D. 2.1-10 mm), 23 (5 µm, I.D. 20-28 mm) | | | | | |
| Pore Volume (mL/g) | 1.00 (3 µm), 0.90 (5 µm) | | | | | |
| End Capping | No | No | Yes | Yes | Yes | Yes |
| USP Code | L20 | L3 | L101 | - | L1 | - |
| | PyE | HyP | Py | Triazole | Poly BT | Poly VP |
| Chemistry |  |  |  |  |  |  |
| Bonded Phase | Pyrenylethyl Group | 3-Hydroxyphenyl Group | Pyridinyl Group | Triazolyl group | Polybutylene terephthalate | Poly (4-vinylpyridine) group |
| Particle Size (µm) | 3, 5 | | | | | |
| Pore Size (nm) | 12 | | | | | N.D. |
| Surface Area (m ² /g) | 340 (3 µm), 300 (5 µm) | | | | | N.D. |
| Carbon Loading | 18 % | - | - | - | N.D. | N.D. |
| Pressure Tolerance (MPa) | 50 (3 µm), 30 (5 µm, I.D. 2.1-10 mm), 23 (5 µm, I.D. 20-28 mm) | | | | | N.D. |
| Pore Volume (mL/g) | 1.00 (3 µm), 0.90 (5 µm) | | | | | N.D. |
| End Capping | Yes | Yes | Yes | No | N.D. | N.D. |
| USP Code | - | - | - | L104 | - | - |

Shim-pack UC

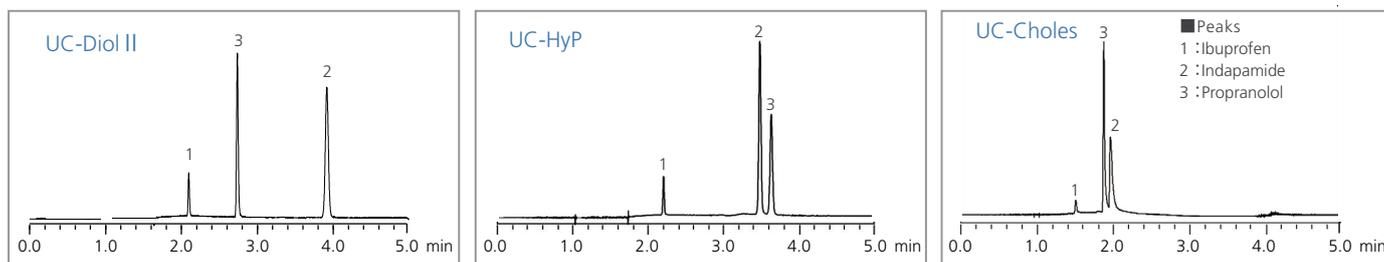
Retention Behavior of Respective Columns

Since the hydrophobicity of supercritical carbon dioxide is similar to hexane, the primary separation behavior of SFC is considered generally similar to the normal phase mode. Depending on the stationary phase selected, other interactions can also occur, such as pi-pi interactions or electrostatic reactions similar to HPLC.

All 20 column types can be used for compounds with approximately neutral polarity. The figure below shows how retention behavior can vary significantly depending on the type of stationary phase used when analyzing typical acidic, neutral, or basic compounds. Stronger retention can be achieved by selecting a stationary phase expected to interact with the target compound.



Retention Time and Elution Order of Acidic, Neutral, and Basic Compounds



Differences in Retention Behavior for Each Stationary Phase

(Main separation modes: Normal phase for Diol II, normal phase + electrostatic reaction for HyP, and hydrophobic interaction for Choles columns)

Selecting an SFC Column

First Choice

Given that normal phase separation is the main separation mode used for SFC, normal phase UC-Diol and UC-Diol II columns are commonly used. They are followed by UC-Py columns that exhibit similar behavior to ethylpyridine-based columns.

UC-Diol and UC-Diol II normal phase columns can even be used for lipids and other compounds with low polarity. However, given that normal phase columns separate by class, UC-HyP columns may be better suited for separation by molecular type.

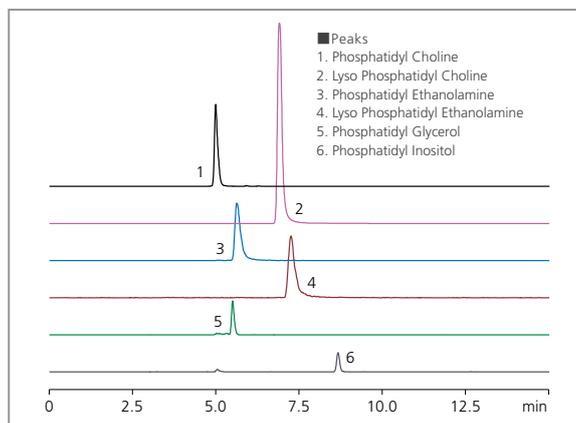
That means it may be possible to separate isomers and other compounds by SFC that are difficult to separate by HPLC. Columns with specific or multiple interaction modes may help improve separation. UC-Choles columns, which contain a rigid cholesteryl group, UC-PyE columns, which can be expected to have strong pi-pi interactions, and UC-PBr columns, which apply a dispersive force with respect to Br, can be especially effective.

Useful for Column Scouting

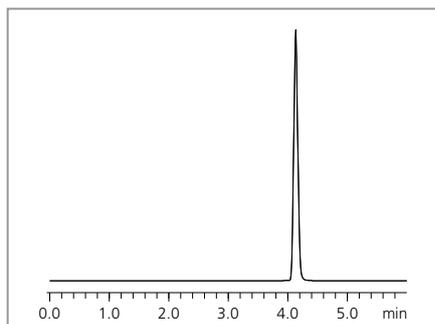
HPLC involves using mobile phases with very different compositions for reverse phase and normal phase analysis, such as water-based versus non-water based mobile phases. In contrast, SFC uses a mixture of supercritical carbon dioxide and a modifier (an organic solvent such as methanol) regardless of the stationary phase used. Therefore, the same mobile phase composition can be used for serial analysis through all columns.

■ Supports Analyzing a Wide Range of Polarities, from Lipids to Peptides (UC-Diol and UC-Diol II)

UC-Diol and UC-Diol II columns, which are mainly for normal phase separation, offer excellent general applicability for analyzing a wide variety of compounds, from phospholipids and other lipids to highly polar peptide compounds. However, a column with an ODS group stationary phase, such as the Shim-pack UC-GIS II, must be used to separate phospholipids by molecular species with similar modifier parameters.

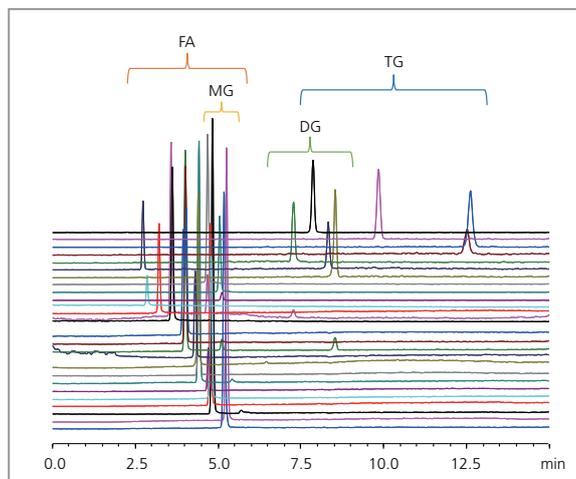


Analysis of Phospholipids



Analysis of Peptides (Cyclosporin A)

■ Simultaneously Analyzing Fatty Acids to Triglycerides in a Single Analysis (UC-HyP)



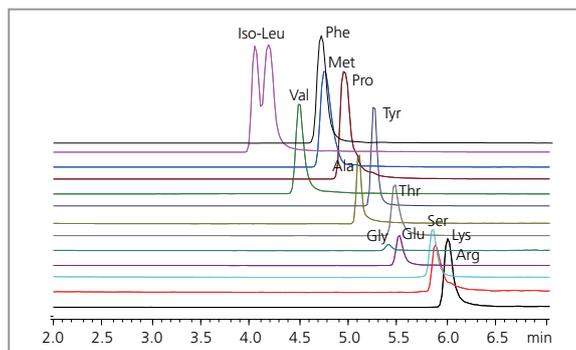
Simultaneous Analysis of Lipids

Different separation methods are generally used for fatty acids, which are typically analyzed by GC, and glycerides, which are typically analyzed by HPLC.

However, because supercritical carbon dioxide has properties similar to hexane, SFC is well-suited to analyzing compounds with low polarity.

UC-HyP columns can be used to simultaneously analyze everything from fatty acids to glycerides.

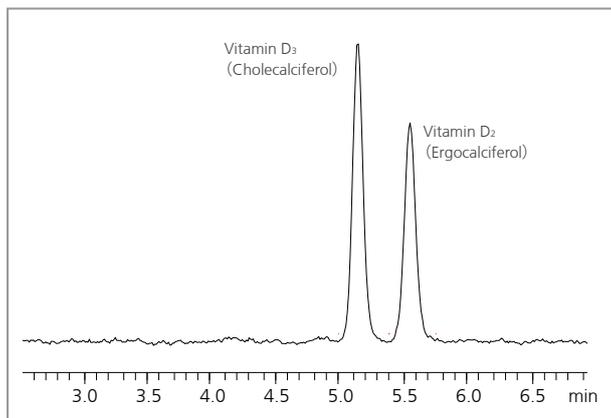
■ Analyzing Amino Acids and Other Highly Polar Compounds (UC-Amide)



Simultaneous Analysis of Amino Acids

Highly polar compounds, such as amino acids, can be analyzed by selecting an appropriate stationary phase and modifier. By using a UC-Amide column, amino acids can be analyzed without the time and trouble of derivatization.

■ Separation of Vitamins D₂ and D₃ (UC-PyE)



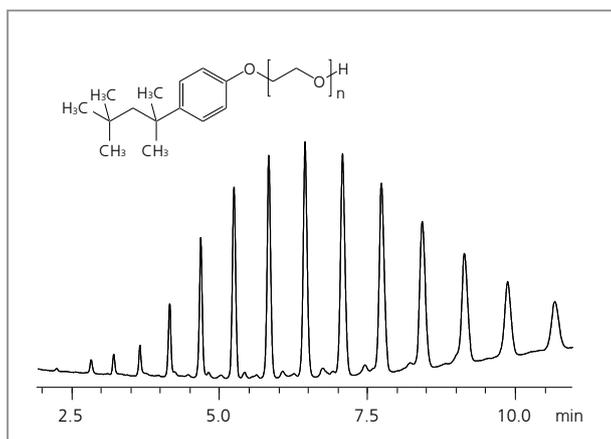
Analysis of Vitamin D

Vitamins D₂ and D₃ are difficult to separate by normal phase HPLC. To use the reverse phase mode, samples must be pretreated to remove especially fat-soluble contaminant components prior to analysis.

Due to the compatibility of SFC with fat-soluble compounds, the time and trouble involved in pretreatment can be eliminated.

If a UC-PyE column is used, the slight differences between vitamins D₂ and D₃ can be quickly separated based on differences in their mutual interaction with the pyrenylethyl group.

■ Separation of Surfactants (UC-PBr)

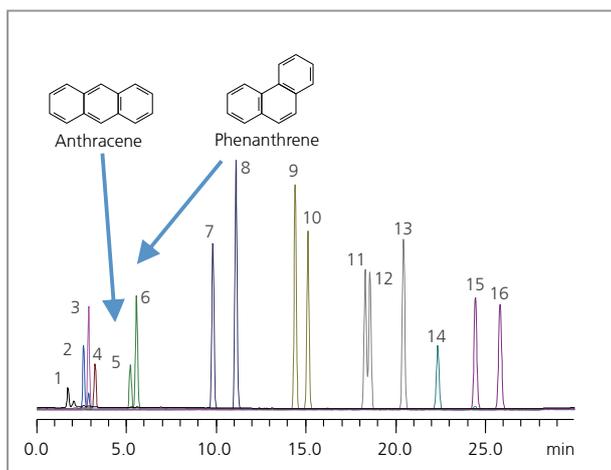


Analysis of Tritonx-100

Surfactants contain polymers with a range of polymerization levels. That distribution of polymerization is known to affect surfactant performance.

If a UC-PBr column is used, compounds can be separated based on differences in the degree of Tritonx-100 polymerization in about 10 minutes. That enables the polymerization distribution to be compared.

■ Separation of Isomers of Polycyclic Aromatic Hydrocarbons (PAH) (UC-Choles)



Analysis of 16 Polycyclic Aromatic Hydrocarbon Components

PAHs contain multiple isomers, such as anthracene and phenanthrene, which cannot be separated with a mass spectrometer. Therefore, they must be separated by chromatography.

All five isomer combinations can be separated using a UC-Choles column.

The rigid stationary phase structure of the cholesteryl group presumably contributes to recognition of the molecular form.

■ Peaks

- | | |
|-------------------|----------------------------|
| 1. Naphthalene | 9. Benzo(a)anthracene |
| 2. Acenaphthylene | 10. Chrysene |
| 3. Acenaphthene | 11. Benzo(k)fluoranthene |
| 4. Fluorene | 12. Benzo(b)fluoranthene |
| 5. Anthracene | 13. Benzo(a)pyrene |
| 6. Phenanthrene | 14. Dibenzo(a,h)anthracene |
| 7. Fluoranthene | 15. Indeno(1,2,3-cd)pyrene |
| 8. Pyrene | 16. Benzo(g,h,i)perylene |

Order Information

| | I.D. × L (mm) | 3 µm | 5 µm |
|----------------------|---------------|--------------|--------------|
| Shim-pack UC-ODS | 2.1×150 | 227-32608-01 | – |
| | 3.0×50 | 227-32608-02 | – |
| | 3.0×100 | 227-32608-03 | – |
| | 3.0×150 | 227-32608-04 | – |
| | 4.6×250 | – | 227-32608-05 |
| | 10×50 | – | 227-32608-10 |
| | 10×250 | – | 227-32608-06 |
| | 20×50 | – | 227-32608-11 |
| | 20×250 | – | 227-32608-07 |
| 28×250 | – | 227-32608-08 | |
| Shim-pack UC-GIS II | 2.1×150 | 227-30404-03 | 227-30406-03 |
| | 2.1×250 | 227-30404-04 | 227-30406-04 |
| | 4.6×150 | 227-30405-03 | 227-30407-03 |
| | 4.6×250 | 227-30405-04 | 227-30407-04 |
| Shim-pack UC-RP | 2.1×150 | 227-30400-03 | 227-30402-03 |
| | 2.1×250 | 227-30400-04 | 227-30402-04 |
| | 4.6×150 | 227-30401-03 | 227-30403-03 |
| | 4.6×250 | 227-30401-04 | 227-30403-04 |
| Shim-pack UC-Sil | 2.1×150 | 227-30412-03 | 227-30414-03 |
| | 2.1×250 | 227-30412-04 | 227-30414-04 |
| | 4.6×150 | 227-30413-03 | 227-30415-03 |
| | 4.6×250 | 227-30413-04 | 227-30415-04 |
| Shim-pack UC-Sil II | 2.1×150 | 227-32607-01 | – |
| | 3.0×50 | 227-32607-07 | – |
| | 3.0×100 | 227-32607-08 | – |
| | 3.0×150 | 227-32607-09 | – |
| | 4.6×250 | – | 227-32607-02 |
| | 10×50 | – | 227-32607-10 |
| | 10×250 | – | 227-32607-03 |
| | 20×50 | – | 227-32607-11 |
| | 20×250 | – | 227-32607-04 |
| 28×250 | – | 227-32607-05 | |
| Shim-pack UC-Diol | 2.1×150 | 227-30408-03 | 227-30410-03 |
| | 2.1×250 | 227-30408-04 | 227-30410-04 |
| | 4.6×150 | 227-30409-03 | 227-30411-03 |
| | 4.6×250 | 227-30409-04 | 227-30411-04 |
| Shim-pack UC-Diol II | 2.1×150 | 227-32606-01 | – |
| | 3.0×50 | 227-32606-07 | – |
| | 3.0×100 | 227-32606-08 | – |
| | 3.0×150 | 227-32606-09 | – |
| | 4.6×250 | – | 227-32606-02 |
| | 10×50 | – | 227-32606-10 |
| | 10×250 | – | 227-32606-03 |
| | 20×50 | – | 227-32606-11 |
| | 20×250 | – | 227-32606-04 |
| | 28×250 | – | 227-32606-05 |
| Shim-pack UC-CN | 2.1×150 | 227-30428-03 | 227-30430-03 |
| | 2.1×250 | 227-30428-04 | 227-30430-04 |
| | 4.6×150 | 227-30429-03 | 227-30431-03 |
| | 4.6×250 | 227-30429-04 | 227-30431-04 |
| Shim-pack UC-Py | 2.1×150 | 227-32601-01 | – |
| | 3.0×50 | 227-32601-07 | – |
| | 3.0×100 | 227-32601-08 | – |
| | 3.0×150 | 227-32601-09 | – |
| | 4.6×250 | – | 227-32601-02 |
| | 10×50 | – | 227-32601-10 |
| | 10×250 | – | 227-32601-03 |
| | 20×50 | – | 227-32601-11 |
| 20×250 | – | 227-32601-04 | |
| 28×250 | – | 227-32601-05 | |

| | I.D. × L (mm) | 3 µm | 5 µm |
|-----------------------|---------------|--------------|--------------|
| Shim-pack UC-PolyVP | 2.1×50 | 227-32506-11 | – |
| | 2.1×100 | 227-32506-12 | – |
| | 2.1×150 | 227-32506-13 | – |
| | 3.0×50 | 227-32507-11 | – |
| | 3.0×100 | 227-32507-12 | – |
| | 3.0×150 | 227-32507-13 | – |
| | 4.6×50 | 227-32508-11 | – |
| | 4.6×100 | 227-32508-12 | – |
| | 4.6×150 | 227-32508-13 | – |
| | 4.6×250 | 227-32508-14 | – |
| | 4.6×150 | – | 227-32509-11 |
| | 4.6×250 | – | 227-32509-12 |
| | 10×250 | – | 227-32510-11 |
| 20×250 | – | 227-32511-11 | |
| Shim-pack UC-Triazole | 2.1×150 | 227-32605-01 | – |
| | 3.0×50 | 227-32605-07 | – |
| | 3.0×100 | 227-32605-08 | – |
| | 3.0×150 | 227-32605-09 | – |
| | 4.6×250 | – | 227-32605-02 |
| | 10×50 | – | 227-32605-10 |
| | 10×250 | – | 227-32605-03 |
| | 20×50 | – | 227-32605-11 |
| | 20×250 | – | 227-32605-04 |
| 28×250 | – | 227-32605-05 | |
| Shim-pack UC-Amide | 2.1×150 | 227-30416-03 | 227-30418-03 |
| | 2.1×250 | 227-30416-04 | 227-30418-04 |
| | 4.6×150 | 227-30417-03 | 227-30419-03 |
| | 4.6×250 | 227-30417-04 | 227-30419-04 |
| Shim-pack UC-NH2 | 2.1×150 | 227-30420-03 | 227-30422-03 |
| | 2.1×250 | 227-30420-04 | 227-30422-04 |
| | 4.6×150 | 227-30421-03 | 227-30423-03 |
| | 4.6×250 | 227-30421-04 | 227-30423-04 |
| Shim-pack UC-Choles | 2.1×150 | 227-32603-01 | – |
| | 3.0×50 | 227-32603-07 | – |
| | 3.0×100 | 227-32603-08 | – |
| | 3.0×150 | 227-32603-09 | – |
| | 4.6×250 | – | 227-32603-02 |
| | 10×50 | – | 227-32603-10 |
| | 10×250 | – | 227-32603-03 |
| | 20×50 | – | 227-32603-11 |
| | 20×250 | – | 227-32603-04 |
| 28×250 | – | 227-32603-05 | |
| Shim-pack UC-PolyBT | 2.1×50 | 227-32500-11 | – |
| | 2.1×100 | 227-32500-12 | – |
| | 2.1×150 | 227-32500-13 | – |
| | 3.0×50 | 227-32501-11 | – |
| | 3.0×100 | 227-32501-12 | – |
| | 3.0×150 | 227-32501-13 | – |
| | 4.6×50 | 227-32502-11 | – |
| | 4.6×100 | 227-32502-12 | – |
| | 4.6×150 | 227-32502-13 | – |
| | 4.6×250 | 227-32502-14 | – |
| | 4.6×150 | – | 227-32503-11 |
| | 4.6×250 | – | 227-32503-12 |
| | 10×250 | – | 227-32504-11 |
| 20×250 | – | 227-32505-11 | |
| Shim-pack UC-Phenyl | 2.1×150 | 227-30424-03 | 227-30426-03 |
| | 2.1×250 | 227-30424-04 | 227-30426-04 |
| | 4.6×150 | 227-30425-03 | 227-30427-03 |
| | 4.6×250 | 227-30425-04 | 227-30427-04 |

| | I.D. × L (mm) | 3 μm | 5 μm |
|------------------|---------------|--------------|--------------|
| Shim-pack UC-NaE | 2.1×150 | 227-32609-01 | – |
| | 3.0×50 | 227-32609-02 | – |
| | 3.0×100 | 227-32609-03 | – |
| | 3.0×150 | 227-32609-04 | – |
| | 4.6×250 | – | 227-32609-05 |
| | 10×50 | – | 227-32609-10 |
| | 10×250 | – | 227-32609-06 |
| | 20×50 | – | 227-32609-11 |
| | 20×250 | – | 227-32609-07 |
| 28×250 | – | 227-32609-08 | |
| Shim-pack UC-PyE | 2.1×150 | 227-32604-01 | – |
| | 3.0×50 | 227-32604-07 | – |
| | 3.0×100 | 227-32604-08 | – |
| | 3.0×150 | 227-32604-09 | – |
| | 4.6×250 | – | 227-32604-02 |
| | 10×50 | – | 227-32604-10 |
| | 10×250 | – | 227-32604-03 |
| | 20×50 | – | 227-32604-11 |
| | 20×250 | – | 227-32604-04 |
| 28×250 | – | 227-32604-05 | |
| Shim-pack UC-HyP | 2.1×150 | 227-32600-01 | – |
| | 3.0×50 | 227-32600-07 | – |
| | 3.0×100 | 227-32600-08 | – |
| | 3.0×150 | 227-32600-09 | – |
| | 4.6×250 | – | 227-32600-02 |
| | 10×50 | – | 227-32600-10 |
| | 10×250 | – | 227-32600-03 |
| | 20×50 | – | 227-32600-11 |
| | 20×250 | – | 227-32600-04 |
| 28×250 | – | 227-32600-05 | |

| | I.D. × L (mm) | 3 μm | 5 μm |
|---------------------------|---------------|--------------|--------------|
| Shim-pack UC-PBr | 2.1×150 | 227-32602-01 | – |
| | 3.0×50 | 227-32602-07 | – |
| | 3.0×100 | 227-32602-08 | – |
| | 3.0×150 | 227-32602-09 | – |
| | 4.6×250 | – | 227-32602-02 |
| | 10×50 | – | 227-32602-10 |
| | 10×250 | – | 227-32602-03 |
| | 20×50 | – | 227-32602-11 |
| | 20×250 | – | 227-32602-04 |
| 28×250 | – | 227-32602-05 | |
| Shim-pack UC-ODS (G) | 10×20 | – | 227-32608-09 |
| Shim-pack UC-Sil II (G) | 10×20 | – | 227-32607-06 |
| Shim-pack UC-Diol II (G) | 10×20 | – | 227-32606-06 |
| Shim-pack UC-Py (G) | 10×20 | – | 227-32601-06 |
| Shim-pack UC-Triazole (G) | 10×20 | – | 227-32605-06 |
| Shim-pack UC-Choles (G) | 10×20 | – | 227-32603-06 |
| Shim-pack UC-NaE (G) | 10×20 | – | 227-32609-09 |
| Shim-pack UC-PyE (G) | 10×20 | – | 227-32604-06 |
| Shim-pack UC-HyP (G) | 10×20 | – | 227-32600-06 |
| Shim-pack UC-PBr (G) | 10×20 | – | 227-32602-06 |

Column Pressure Tolerance

- 3 μm particle diameter: 50 MPa
- 5 μm particle diameter (with 2.1 to 10 mm I.D.): 30 MPa
- 5 μm particle diameter (with 20 to 28 mm I.D.): 23 MPa

Shim-pack GPC Series

Shim-pack GPC series columns are used for the determination of tetrahydrofuran (800 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/80MD are mixed gel columns.

■ Determination of Tetrahydrofuran

■ Analytical Columns

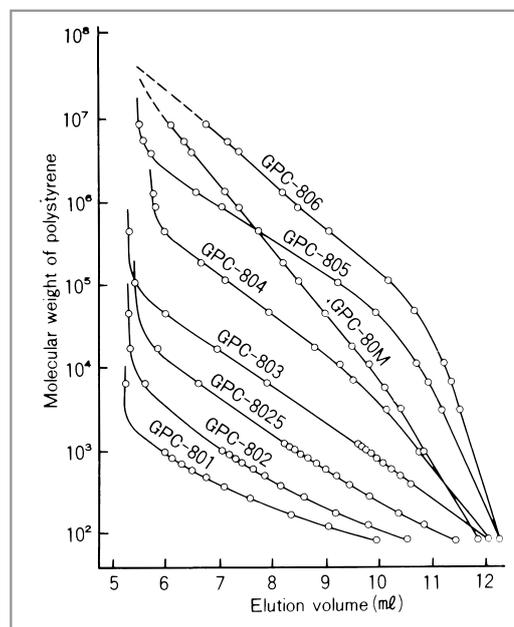
| Column | Exclusion Limit (polystyrene) | Target molecular weight range | Dimensions (Length × I.D., mm) | P/N |
|--------------------|-----------------------------------|-------------------------------|--------------------------------|--------------|
| Shim-pack GPC-801 | 1.5 × 10 ³ | 100-700 | 300 × 8.0 | 228-20803-91 |
| Shim-pack GPC 802 | 5.0 × 10 ³ | 300-3,000 | 300 × 8.0 | 228-20804-91 |
| Shim-pack GPC 8025 | 2.0 × 10 ⁴ | 300-8,000 | 300 × 8.0 | 228-20805-91 |
| Shim-pack GPC 803 | 7.0 × 10 ⁴ | 1,000-50,000 | 300 × 8.0 | 228-20806-91 |
| Shim-pack GPC 804 | 4.0 × 10 ⁵ | 7,000-300,000 | 300 × 8.0 | 228-20807-91 |
| Shim-pack GPC 805 | 4.0 × 10 ⁶ | 50,000-2,000,000 | 300 × 8.0 | 228-20808-91 |
| Shim-pack GPC 806 | 4.0 × 10 ⁷ | 150,000-20,000,000* | 300 × 8.0 | 228-20809-91 |
| Shim-pack GPC 80M | 4.0 × 10 ⁷ , Mixed gel | 1,000-20,000,000* | 300 × 8.0 | 228-20810-91 |
| Shim-pack GPC-800P | Guard Column | | 10 × 4.6 | 228-20812-91 |

* Estimated Value

Shim-pack GPC Series

■ Analysis Examples

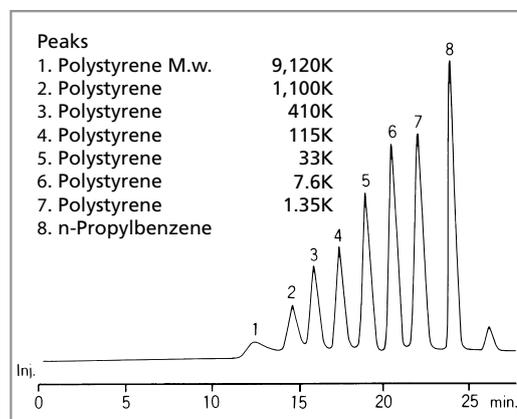
Calibration Curves



■ Conditions

Mobile phase : Tetrahydrofuran
 Flow rate : 1.0 mL/min
 Column temp. : Ambient
 Detection : UV 254 nm

Analysis of Polystyrene Standard



■ Conditions

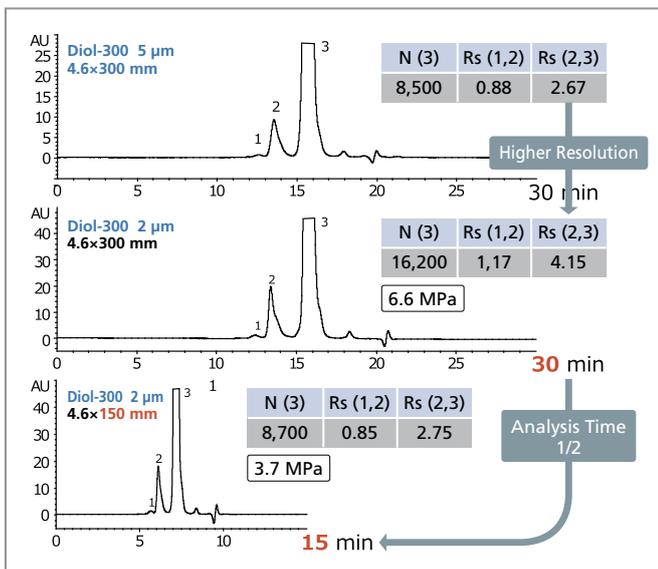
Column : Shim-pack GPC-80M (2 columns in series) (P/N: 228-20810-91)
 Mobile phase : Tetrahydrofuran
 Flow rate : 1.0 mL/min
 Column temp. : Ambient
 Detection : UV 254 nm

Shim-pack Bio Diol 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 2 µm Shim-pack Bio Diol-300 column

| Shim-pack Bio Diol | Diol-60 | Diol-120 | Diol-200 | Diol-250 | Diol-300 |
|------------------------|-----------------------|-----------------|------------------|------------------|--------------------|
| Particle | Silica | | | | |
| Ligand | Dihydroxypropyl(Diol) | | | | |
| Particle Size | 3 µm, 5 µm | | 2 µm, 3 µm, 5 µm | 3 µm | 2 µm, 3 µm, 5 µm |
| Pore Size | 6 nm | 12 nm | 20 nm | 25 nm | 30 nm |
| pH Range | 5.0 - 7.5 | | | | |
| Molecular Weight Range | below 10,000 | 1,000 - 100,000 | 5,000 - 300,000 | 10,000 - 700,000 | 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.

| | |
|--------------|---|
| Column | : Shim-pack Bio Diol-300 |
| Eluent | : 0.1 M KH ₂ PO ₄ -K ₂ HPO ₄ (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 |

Order Information

| Particle Size | 2 µm | | 3 µm | | | | |
|----------------------------|--------------|--------------|--------------|--------------|--------------|--------------------------------------|--------------|
| | Diol-200 | Diol-300 | Diol-60 | Diol-120 | Diol-200 | Diol-250 | Diol-300 |
| Chemistry | | | | | | | |
| Column Dimension | | | | | | | |
| 150 × 4.6 mm | 227-31009-01 | 227-31010-01 | | | | | |
| 300 × 4.6 mm | 227-31009-02 | 227-31010-02 | 227-31007-01 | 227-31008-01 | 227-31009-03 | 227-31216-01 | 227-31010-03 |
| 300 × 8.0 mm | - | - | - | - | - | 227-31216-02 | - |
| 10 × 4.0 mm (Guard Column) | 227-31202-02 | 227-31202-01 | - | - | 227-31202-04 | - | 227-31202-03 |
| Pressure Tolerance (MPa) | 45 | | 20 | | | 4.6 mm I.D. : 14 8.0 mm I.D. : 12 | 20 |
| Particle Size | 5 µm | | | | | | |
| | Diol-60 | Diol-120 | Diol-200 | Diol-300 | | | |
| Chemistry | | | | | | | |
| Column Dimension | | | | | | | |
| 300 × 4.6 mm | 227-31007-02 | 227-31008-02 | 227-31009-04 | 227-31010-04 | | | |
| 300 × 8.0 mm | 227-31007-03 | 227-31008-03 | 227-31009-05 | 227-31010-05 | | | |
| 30 × 8.0 mm (Guard Column) | 227-31007-04 | 227-31008-04 | 227-31009-06 | 227-31010-06 | | | |
| Pressure Tolerance (MPa) | 20 | | | | | | |
| 300 × 20 mm | 227-31097-01 | 227-31098-01 | 227-31099-01 | 227-31100-01 | | | |
| 500 × 20 mm | 227-31097-02 | 227-31098-02 | 227-31099-02 | 227-31100-02 | | | |
| 50 × 20 mm (Guard Column) | 227-31116-01 | 227-31118-01 | 227-31118-01 | 227-31119-01 | | | |
| Pressure Tolerance (MPa) | 10 | | | | | | |

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).

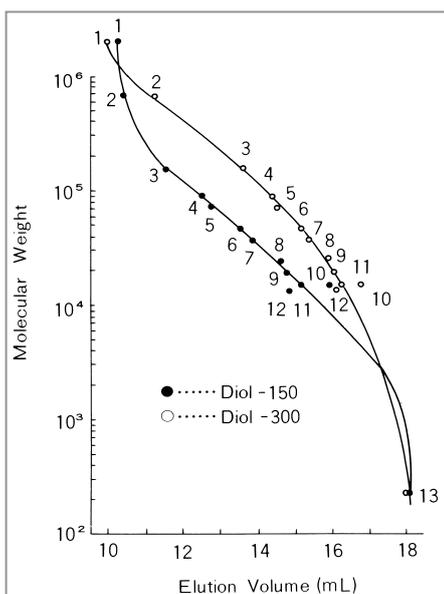
Order Information

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



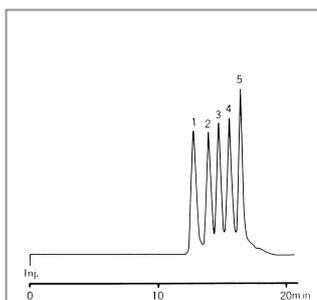
Peaks

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 mm × 7.9 mm I.D., 5 μm)
Mobile phase : A) 10 mmol/L phosphate buffer solution (pH 7)
 B) 0.2 mol/L sodium sulfate
Flow rate : 1.0 mL/min
Column 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 mm × 7.9 mm I.D., 5 μm)
 (P/N: 228-14776-92)
Mobile phase : A) 10 mmol/L phosphate buffer solution (pH 7)
 B) 0.1 mol/L sodium chloride
Flow rate : 1.0 mL/min
Column temp. : Ambient
Detection : UV 280 nm

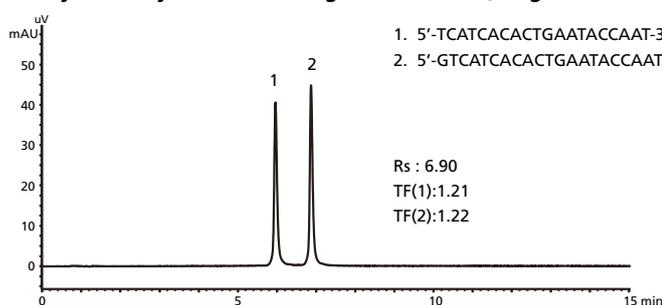
Shim-pack Bio IEX Columns

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.

| 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 | - $\text{CH}_2\text{N}^+(\text{CH}_3)_3$ | - $(\text{CH}_2)_3\text{SO}_3^-$ | - $\text{CH}_2\text{N}^+(\text{CH}_3)_3$ | - $(\text{CH}_2)_3\text{SO}_3^-$ |
| pH Range | 2 - 12 | | | |

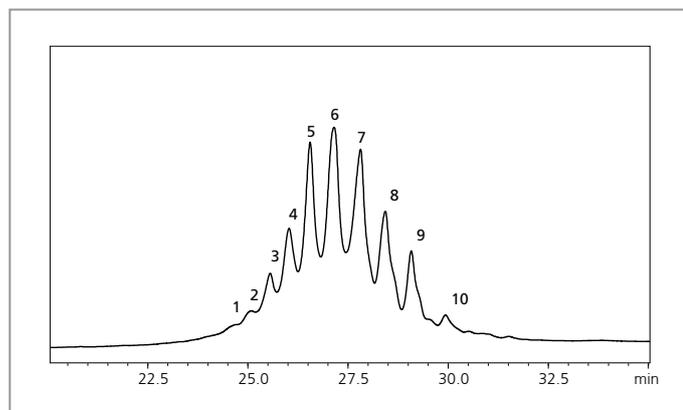
■ Analysis Examples

Analysis of Synthesized Oligonucleotide (Single Strand DNA) using Shim-pack BIO IEX Q-NP



Column : Shim-pack Bio IEX Q-NP 100 \times 4.6 mm I.D., 5 μm
(P/N : 227-31003-03)
Mobile phase : A) 10 mM NaOH
B) 10 mM NaOH with 1.0 M NaClO_4
Gradient : 25 \rightarrow 55 %B (0-15 min), 100 %B (15-20 min)
Flow rate : 1.0 mL/min
Column temp. : 25 $^\circ\text{C}$
Detection : UV 260 nm
Injection volume : 4 μL (5 nmol/mL)

Charge Variant Analysis of mAb Biosimilar by pH Gradient using Shim-pack Bio IEX Column



■ Conditions

Column : Shim-pack Bio SP-NP (100 mm \times 4.6 mm I.D., 3 μm)
P/N: 227-31005-03
Mobile phase : A) 10 mM sodium phosphate buffer, pH 6.0
B) 10 mM sodium bicarbonate buffer, pH 10.0
Gradient : 35 %B (0 min) \rightarrow 55 %B (2 min) \rightarrow 100 %B (12-16 min)
 \rightarrow 35 %B (16.1 – 20 min)
Flow rate : 0.6 mL/min
Column temp. : Ambient
Detection : UV 280 nm
Injection volume. : 5 μL

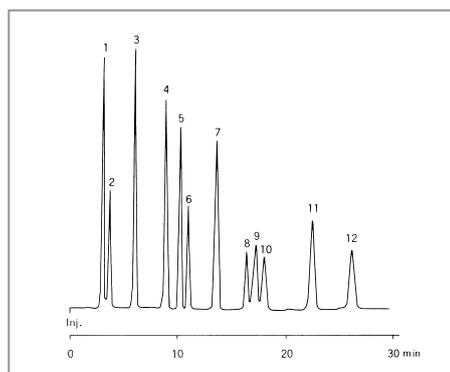
■ Order Information

| Shim-pack Bio IEX | Q-NP | | SP-NP | | Q | SP |
|-------------------|--------------------|-----------------|--------------------|-----------------|---------------------|--------------|
| Polarity | Non-Porous | | | | Porous | |
| Particle Size | 3 μm | 5 μm | 3 μm | 5 μm | 5 μm | |
| Dimension | 30 \times 4.6 mm | | 50 \times 4.6 mm | | 100 \times 4.6 mm | |
| | 227-31002-01 | 227-31003-01 | 227-31005-01 | 227-31006-01 | 227-31001-01 | 227-31004-01 |
| | 227-31002-02 | 227-31003-02 | 227-31005-02 | 227-31006-02 | 227-31001-02 | 227-31004-02 |
| | 227-31002-03 | 227-31003-03 | 227-31005-03 | 227-31006-03 | 227-31001-03 | 227-31004-03 |

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.



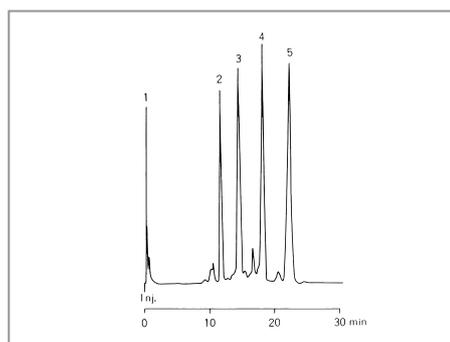
Analysis of Mononucleotides

■ **Peaks**

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

■ **Conditions**

- Column** : Shim-pack WAX-1 (50 mm × 4.0 mm I.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
- Column 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 mm × 4.0 mm I.D., 5 μm)
(P/N: 228-16366-91)
- Mobile phase** : A) 20 mM phosphate buffer solution (pH 6.0)
B) Sodium sulfate
gradient elution
- Flow rate** : 1.0 mL/min
- Column temp.** : Ambient
- Detection** : UV 415 nm

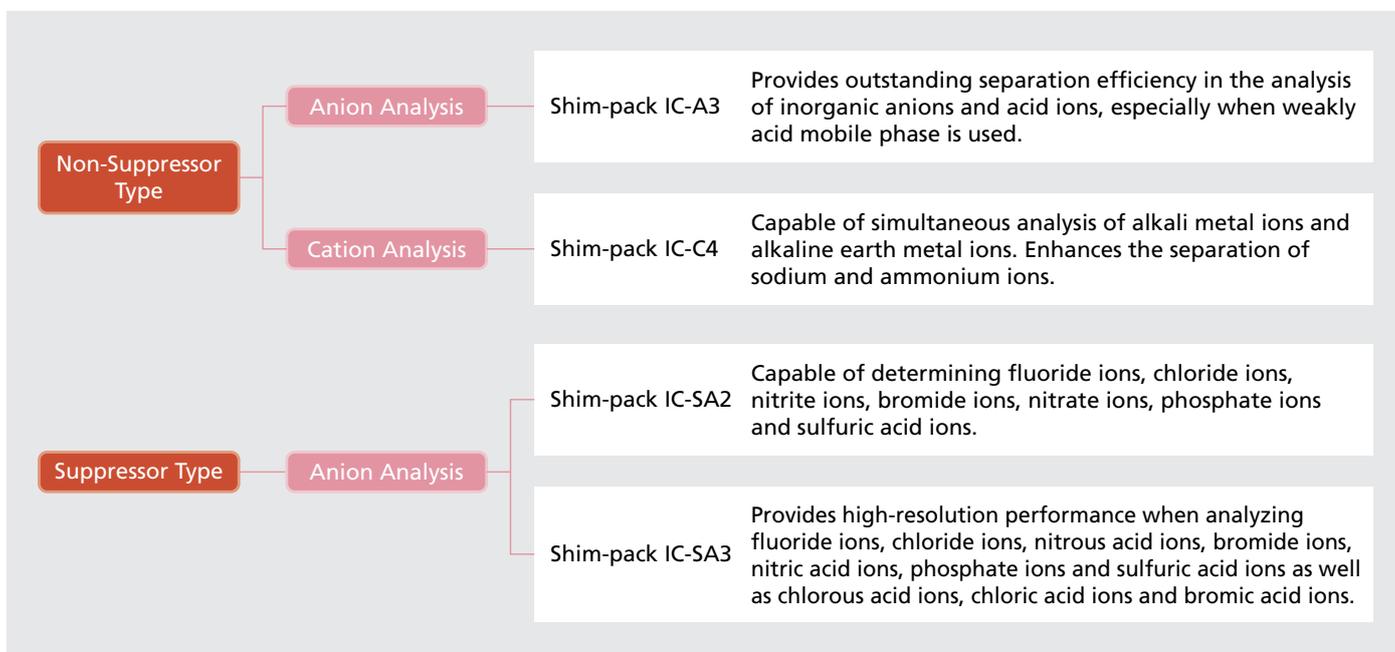
Order Information

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

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

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.



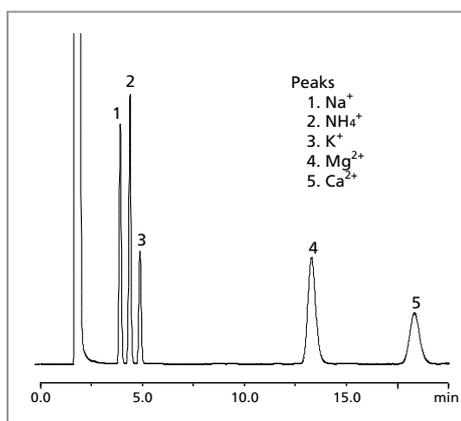
■ Analysis Examples

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⁺

Greater 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.



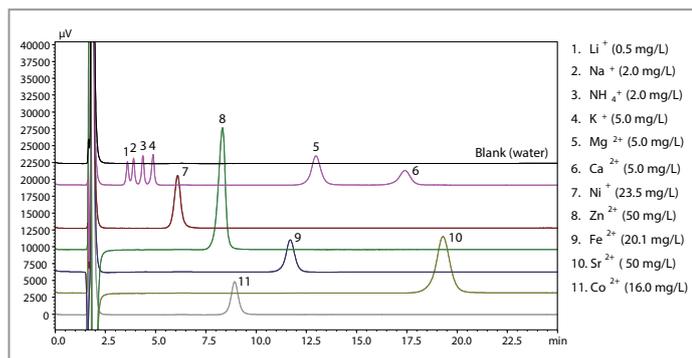
■ Conditions

Column : Shim-pack IC-C4 (150 mm × 4.6 mm I.D., 7 μm)
 (P/N: 228-41616-91)
 Mobile phase : 2.5 mmol/L oxalic acid
 Flow rate : 1.0 mL/min
 Column temp. : 40 °C
 Detection : CDD
 Injection volume : 50 μL

Analysis of a Standard Mixture of 5 Cations

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

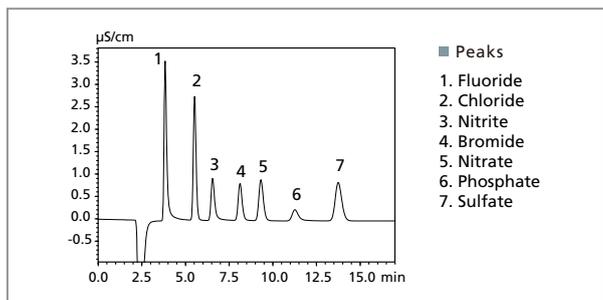
System : Prominence™ HIC-NSP
 Column : Shim-pack IC-C4 (150 mm × 4.6 mm I.D., 7 μm),
 P/N: 228-41616-91
 Shim-pack IC-C4 (G) (10 mm × 4.6 mm I.D., 7 μm),
 P/N: 228-41616-92
 Mobile phase : 2.5 mmol/L Oxalic acid /
 2.5 mmol/L Methanesulfonic acid = 50 / 50 (v/v)
 Flow rate : 1.0 mL/min
 Column temp. : 40 °C
 Detection : Conductivity (CDD-10Asp)
 Injection volume : 20 μL

Analysis of inorganic cations and transition metals

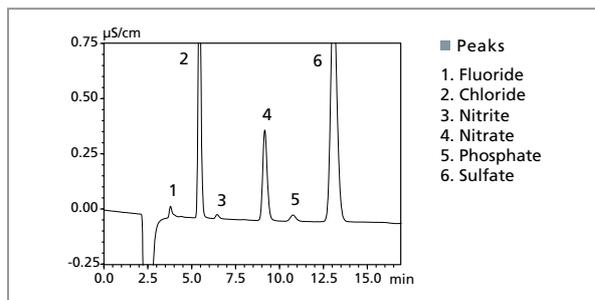
Shim-pack IC Series

Analysis of Anions in Water

Shim-pack IC-SA2 and IC-SA3 columns were developed for anion analysis with a Shimadzu Ion Chromatograph HIC-SP (suppressor type). Both columns are capable of analyzing fluoride ions, chloride ions, nitrite ions, bromide ions, nitrate ions, phosphate ions, sulfate ions, etc. allowing both the IC-SA2 and IC-SA3 columns to be used for analysis of tap water and environmental water samples. The Shim-pack IC-SA3 is a high-separation column that can analyze more components than Shim-pack IC-SA2.



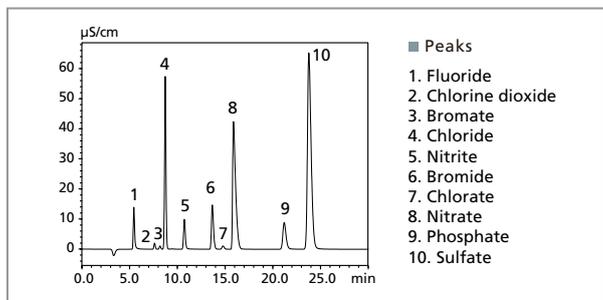
Analysis of Standard Inorganic Anion Samples



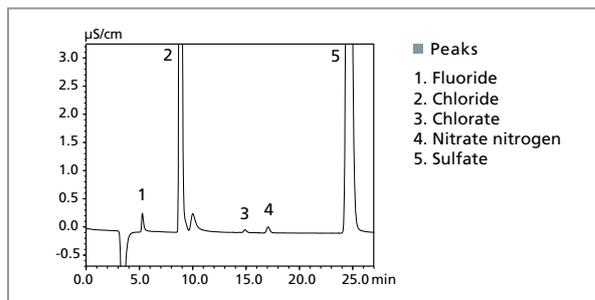
Analysis of Waste Water

Conditions

Column : Shim-pack IC-SA2
 Mobile phase : A) 12 mmol/L sodium hydrogen carbonate
 B) 0.6 mmol/L sodium carbonate
 Flow rate : 1.0 mL/min
 Column temp. : 30 °C
 Detection : CDD (a suppressor is used)
 Injection volume : 50 µL



Analysis of Standard Inorganic Anion Samples



Analysis of Tap Water

Conditions

Column : Shim-pack IC-SA3
 Mobile phase : 3.6 mmol/L sodium carbonate
 Flow rate : 0.8 mL/min
 Column temp. : 45 °C
 Detection : CDD (a suppressor is used)
 Injection volume : 50 µL

■ Order Information

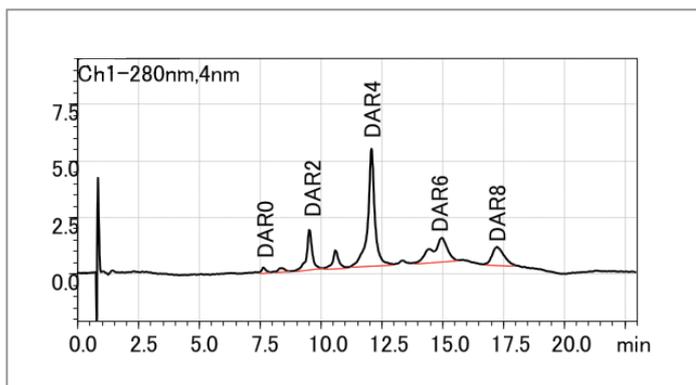
| Column | Stationary Phase | Particle Size (µm) | Dimensions (Length × I.D., mm) | P/N | Guard Column |
|----------------------|----------------------------|--------------------|--------------------------------|--------------|--|
| Shim-pack IC-A3 | Quaternary ammonium groups | 5 | 150 × 4.6 | 228-31076-91 | 228-31076-92 |
| Shim-pack IC-A3 (S)* | Quaternary ammonium groups | 5 | 150 × 2.0 | 228-33366-91 | |
| Shim-pack IC-C4 | Carboxyl groups | 7 | 150 × 4.6 | 228-41616-91 | 228-59900-91 (Cartridge+ Holder) 228-59900-92 (Cartridge) |
| Shim-pack IC-SA2 | Quaternary ammonium groups | 9 | 250 × 4.0 | 228-38983-91 | 228-38983-92 |
| Shim-pack IC-SA3 | Quaternary ammonium groups | 5 | 250 × 4.0 | 228-41600-91 | 228-41600-92 |

* Shim-pack IC(S) series are for semi-micro LC. PIA-1000 is required.

Shim-pack Bio HIC Column

Shim-pack Bio HIC Column is a hydrophobic interaction chromatography (HIC) column packed with butyl bonded hydrophilic nonporous polymer particles (4 µm). HIC is suitable for the separation of analytes with slightly different hydrophobicity, such as antibody-drug conjugate (ADC) with different drug-antibody ratios (DAR). Shim-pack Bio HIC can be used for the analysis of DAR of ADC with relatively low pressure and high resolution.

ADC DAR Analysis using Shim-pack BIO HIC Column



■ Conditions

LC System : Inert LC (1.6 mL mixer)
Workstation : LabSolutions™ LC/GC
Column : Shim-pack Bio HIC (100 mm. x 4.6 mm I.D., 4 µm)
Mobile phase : A) 50 mM NaH₂PO₄-Na₂HPO₄ (pH 7.0)
 containing 1.5 M (NH₄)₂SO₄/2-propanol (95/5)
 B) 50 mM NaH₂PO₄-Na₂HPO₄ (pH 7.0)/2-propanol (80/20)
Gradient : 0 %B (0-1 min), 0-100 %B (1-18 min), 100 %B (18-23 min)
Flow rate : 1.0 mL/min
Injection volume : 5 µL
Column temp. : 25 °C
Detection : 280 nm (PDA)
Sample : Cysteine-liked ADC Mimic (5 mg/mL)

Peak area reproducibility (n = 6)

| | %RSD |
|------|------|
| DAR0 | 5.98 |
| DAR2 | 2.57 |
| DAR4 | 1.62 |
| DAR6 | 2.23 |
| DAR8 | 2.87 |

* Peaks were automatically integrated using i-peak finder (peak integration algorithm for LabSolutions)

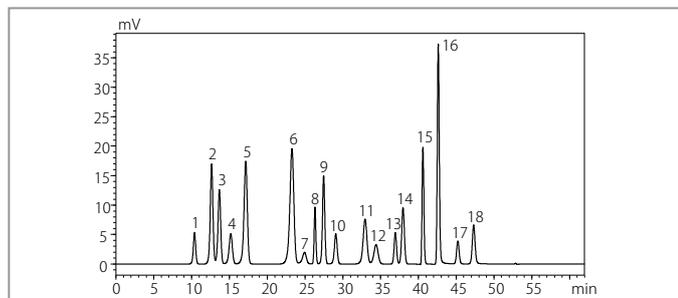
■ Order Information

| P/N | Description |
|--------------|--|
| 227-31174-01 | Shim-pack Bio HIC Butyl, 100 x 4.6 mm I.D., 4 µm |

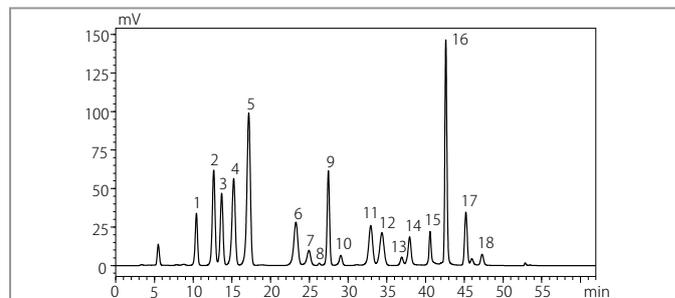
Analysis of Amino Acids

■ Shim-pack Amino Series

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



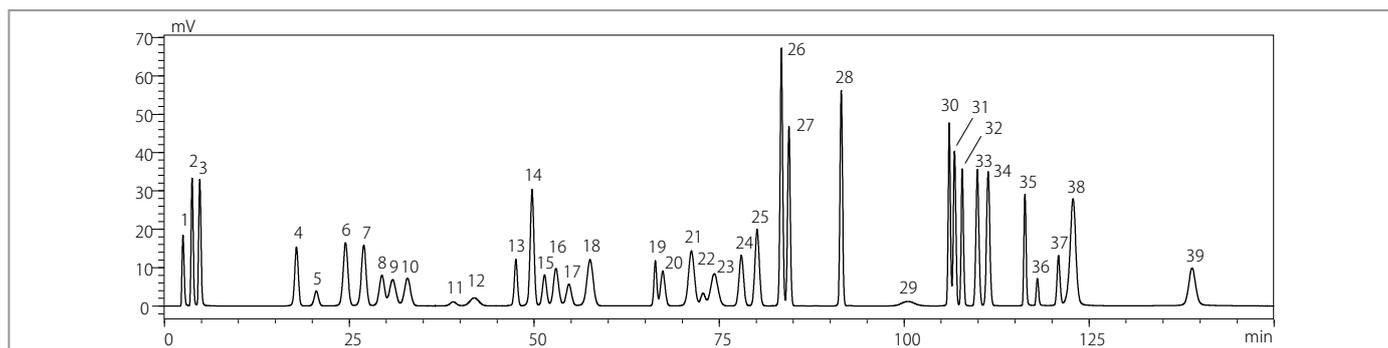
Analysis of Infant Formula

■ Conditions

Column : Shim-pack Amino-Na (100 mm × 6.0 mm I.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
Column 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

■ Conditions

Column : Shim-pack Amino-Li (100 mm × 6.0 mm I.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
Column temp. : 39 °C
Detection : RF-10AXL Ex. 350 nm, Em. 450 nm

■ Peaks

| | | | |
|--------------------------|----------------------------|--------------------------------|-----------------------|
| 1. o-Phosphoserine | 11. Sarcosine | 21. Isoleucine | 31. 3-Methylhistidine |
| 2. Taurine | 12. α-Aminoadipic acid | 22. Cystathionine | 32. 1-Methylhistidine |
| 3. o-Phosphoethanolamine | 13. Proline | 23. Leucine | 33. Carnosine |
| 4. Aspartic acid | 14. Glycine | 24. Tyrosine | 34. Anserine |
| 5. Hydroxyproline | 15. Alanine | 25. Phenylalanine | 35. Hydroxylysine |
| 6. Threonine | 16. Citrulline | 26. β-Alanine | 36. Ornithine |
| 7. Serine | 17. α-Amino-n-butyric acid | 27. β-Aminoisobutyric acid | 37. Lysine |
| 8. Asparagine | 18. Valine | 28. γ-Aminobutyric acid (GABA) | 38. Ammonia |
| 9. Glutamic acid | 19. Cystine | 29. Tryptophan | 39. Arginine |
| 10. Glutamine | 20. Methionine | 30. Histidine | |

■ Order 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.

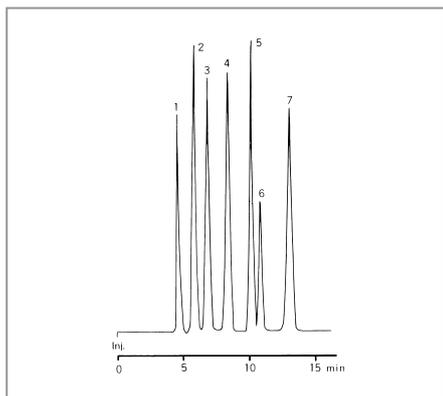
| Description | Dimensions (Length × I.D., mm) | P/N |
|---|--------------------------------|--------------|
| ISC-30/S 0504 NA (For trapping Na type ammonia) | 50 × 4.0 | 228-14206-91 |
| ISC-30/S 0504 LI (For trapping Li type ammonia) | 50 × 4.0 | 228-00821-91 |

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.



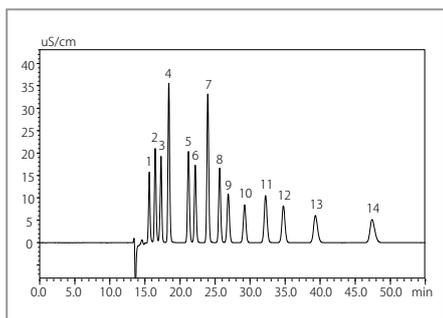
Analysis of Saccharide Standard

■ Peaks

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

■ Conditions

Column : Shim-pack SCR-101C (300 mm × 7.9 mm I.D., 10 μm, P/N: 228-17889-91)
 Mobile phase : Water
 Flow rate : 1.0 mL/min
 Column temp. : 80 °C
 Detection : RID



Analysis of Organic Acids

■ Peaks

- 1. Phosphoric acid
- 2. Citric acid
- 3. Pyruvic acid
- 4. Malic acid
- 5. Succinic acid
- 6. Lactic acid
- 7. Formic acid
- 8. Acetic acid
- 9. Levulinic acid
- 10. Pyroglutamic acid
- 11. Isobutyric acid
- 12. Butyric acid
- 13. Isovaleric acid
- 14. Valeric 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
 Column temp. : 40 °C
 Detection : CDD (pH buffer organic acids analysis system)

■ Order Information

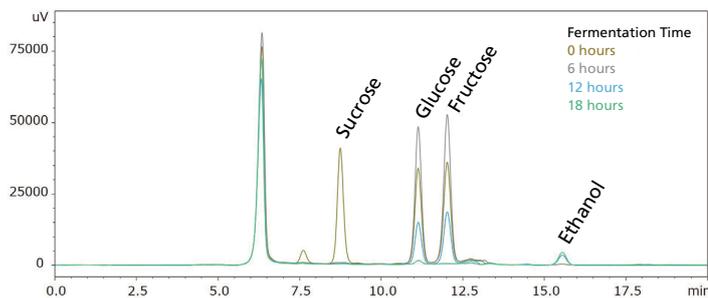
| Column | Stationary Phase | Particle Size (μm) | Dimensions (Length × I.D., mm) | P/N | Guard Column |
|--------------------|-----------------------|--------------------|--------------------------------|--------------|--------------|
| Shim-pack SCR-101N | Na type sulfone group | 10 | 300 × 7.9 | 228-07730-92 | 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 |

Analysis of Sugar and Alcohol

■ Shim-pack SUR-Na

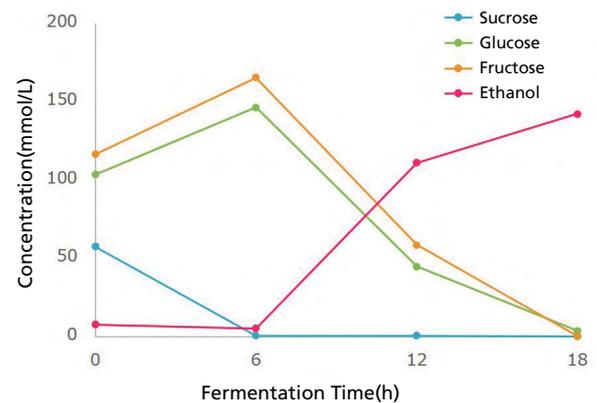
Sugar analysis is commonly conducted in a variety of markets. The ethanol production process in the food and biofuels fields, which utilizes the sugar digestion system of yeast microorganisms, requires measuring and monitoring sugar components and amounts accurately for process design and quality control.

Shim-pack SUR-Na, a ligand exchange chromatography column, offers excellent performance by combining size exclusion mode and sodium-based ligand exchange mode to provide superior separation of sugar components. Pure water can be used for the mobile phase, resulting in less effort to prepare for the analysis.



- **Conditions**
- Column : Shim-pack SUR-Na
- Guard column : Shim-pack SUR-Na (G)
- Mobile phase : Ultrapure water
- Column temp. : 80 °C
- Detector : RI detector (RID-20A)

■ Fermentation Monitoring Results



■ Order Information

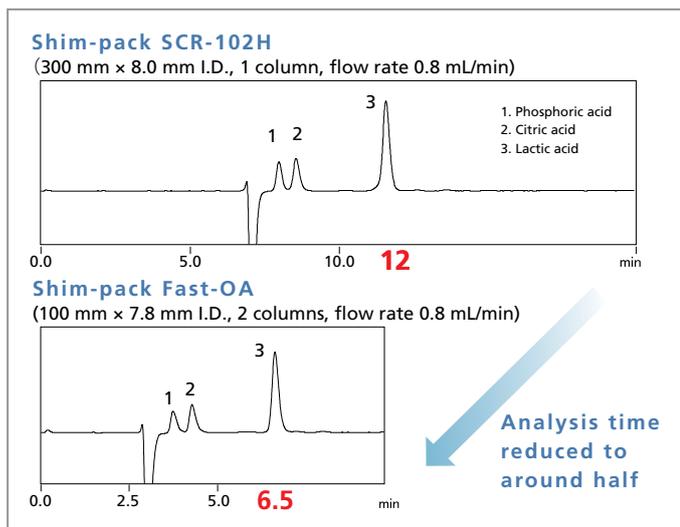
| P/N | Description | Size | Remarks |
|--------------|----------------------|----------------------|-------------------|
| 228-95929-01 | Shim-pack SUR-Na | 250 mm x 7.8 mm I.D. | Analytical column |
| 228-95929-02 | Shim-pack SUR-Na (G) | 50 mm x 7.8 mm I.D. | Guard column |

Shim-pack Fast-OA

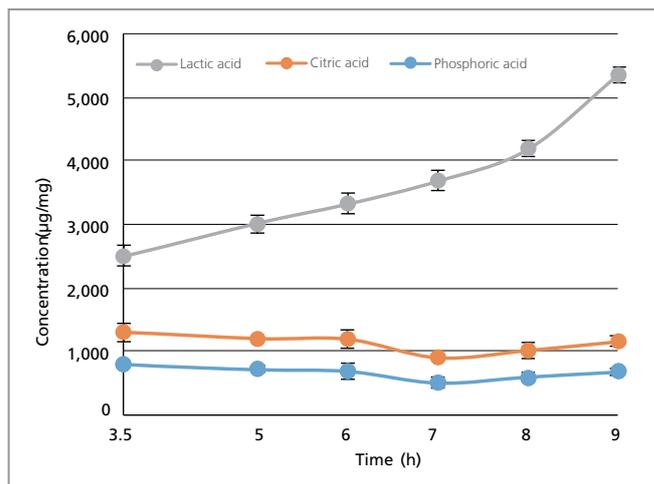
■ High-speed Organic Acid Analysis Column

In the fields of fermented food production and bio-industry, organic acid metabolites are monitored to control the activity of yeast or bacteria. The quantity of organic acids needs to be checked and the production environment adjusted accordingly in order to improve production and quality control, and these checks must be carried out in a timely manner.

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.



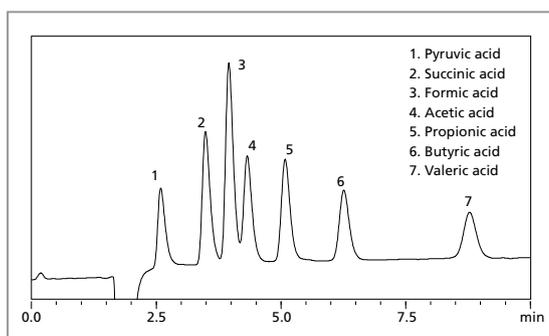
Chromatograms of home-fermented yogurt



Monitoring of organic acid content in home-fermented yogurt

■ Analysis of short-chain fatty acids with strong retention in under 10 minutes

The Shim-pack Fast-OA column can also be used to analyze short-chain fatty acids with strong retention, of interest in the study of intestinal flora, in less than 10 minutes.



Chromatogram of a standard mixture containing seven organic acids

■ Conditions

| | |
|--------------------|---|
| Column | : Shim-pack Fast-OA |
| Mobile phase | : 5 mmol/L p-toluenesulfonic acid |
| pH buffer solution | : 5 mmol/L p-toluenesulfonic acid 20 mmol/L Bis- Tris |
| | : 0.1 mmol/L EDTA |
| Flow rate | : 0.8 mL/min |
| Detection method | : Conductivity detector (CDD-10 AVP) |

■ Order Information

Shim-pack Fast-OA is an ion-exclusion chromatography column. Up to three columns can be connected according to the target compounds*. A guard column, the Shim-pack Fast-OA (G), can be used in combination to protect the analysis column. The guard column is a cartridge-type, and the cartridge can be replaced.

| P/N | Product name | Dimensions (Length × I.D., mm) | Remarks |
|--------------|---|--------------------------------|--|
| 228-59942-41 | Shim-pack Fast-OA | 100 × 7.8 | Analytical column |
| 228-59942-42 | Shim-pack Fast-OA (G) | 10 × 4.0 | Guard column, includes a column holder and a cartridge |
| 228-59942-43 | Shim-pack Fast-OA (G) Cartridge (4 pcs) | - | Replacement cartridge for guard column |

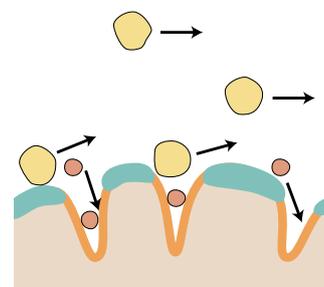
*For details about the piping, please refer to the technical report *High-Speed Analysis of Organic Acids Using Shim-pack Fast-OA and pH-Buffered Electrical Conductivity Detection (C190-E237)*

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.

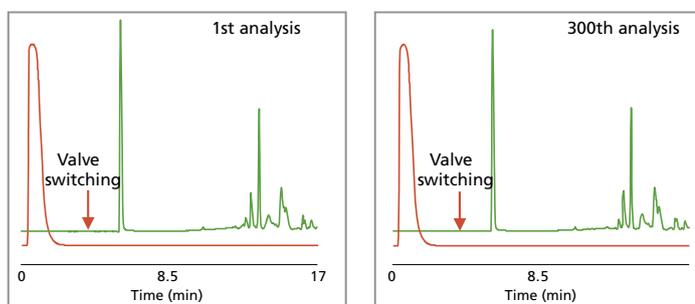


■ Quick and Reliable Protein Removal

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
 Sample solution: 0.1 % phosphoric acid and acetonitrile mixture (95:5)
 Dilution: 8 times

Detection : Analysis: 275 nm, Blood plasma matrix: 280 nm

Injection volume : 100 μL

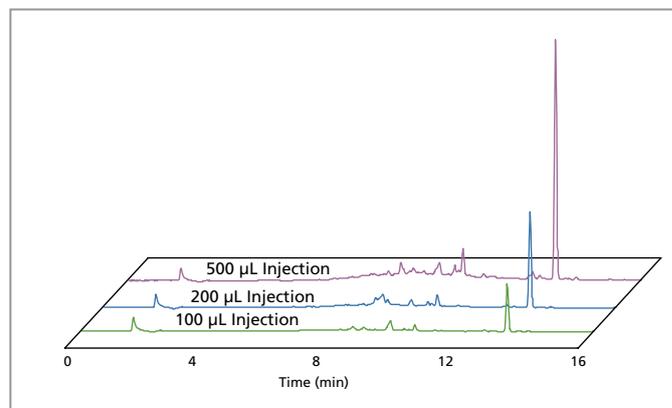
Shim-pack MAYI Series

■ 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

■ Order Information

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

■ Cartridge

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

■ Column Holder

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

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

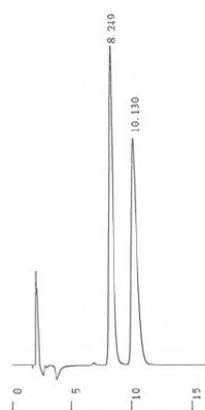
- A chiral separation column immobilized with ovomucoid which is a strong protein for denaturation
- Display a wide range of chiral recognition.
- No sample pretreatment required for chiral separations.
- Can be used for reversed-phase analyses.
- Trace analyses possible (several nanograms).
- [ULTRON 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

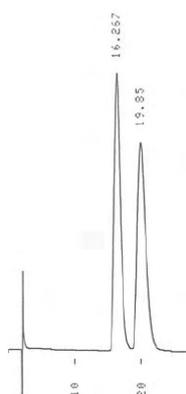
■ ULTRON ES-OVM-3

- Maximum operating pressure of 30 MPa.
- Can be used in LC/MS systems as well.
- Employs a 3 μ m 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
 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
 150 mm x 4.6 mm I.D.
 Mobile Phase : 20 mM KH₂PO₄ (pH 4.6) /
 C₂H₅OH = 100 / 20
 Flow Rate : 1.0 mL/min
 Col. Temp. : 25 °C
 Detection : UV-220 nm

■ ULTRON ES-PEPSIN

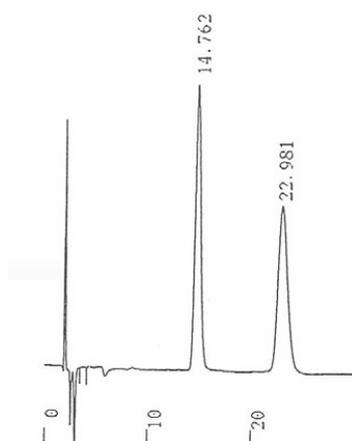
- An enantiomer separation column immobilized with pepsin which is the polypeptide dialytic enzyme of the pig stomach mucous membrane origin.
- Displays superior performance with respect to chiral separations of amino alcohol pharmaceuticals such as beta blockers.
- No sample pretreatment required for 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

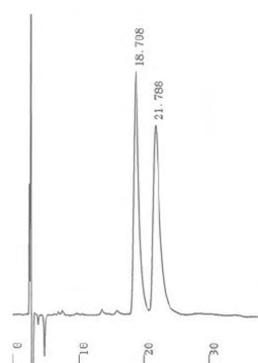
Column : ULTRON ES-BSA, 150 mm x 4.6 mm I.D
 Mobile Phase : 20 mM KH₂PO₄ (pH 7.0) / 1-Propanol / Caprylic Acid = 98 / 2 / 0.08
 Flow Rate : 1.0 mL/min
 Col. Temp. : 25 °C
 Detection : UV-220 nm

■ ULTRON ES-CD, ULTRON ES-PhCD

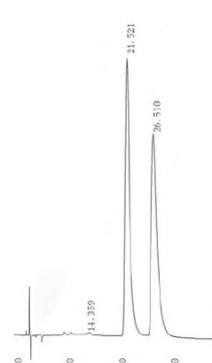
ULTRON ES-CD and ULTRON ES-PhCD are enantiomeric separation columns chemically bonded with β -cyclodextrin (CD) and phenylcarbamated β -cyclodextrin (PhCD), respectively.

- 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 | - | - |
| ES-OVM-C | 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 | - | |
| ES-OVM-C (prep) | 10 | 4.6 | - | - | APASHI-0006 | - | APASHI-0007 |
| | 10 | 20.0 | - | - | - | - | |
| 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 10x4.0) |
| ES-PhCD | 5 | 2.0 | - | - | APASHI-0033 | - | APASHI-0035 (5um 10x4.0) |
| 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

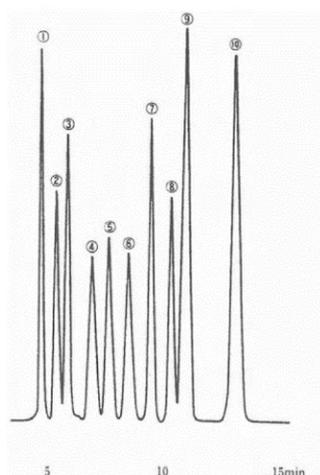
■ Shim-pack ULTRON PS-80N, ULTRON PS-80C, ULTRON PS-80P

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

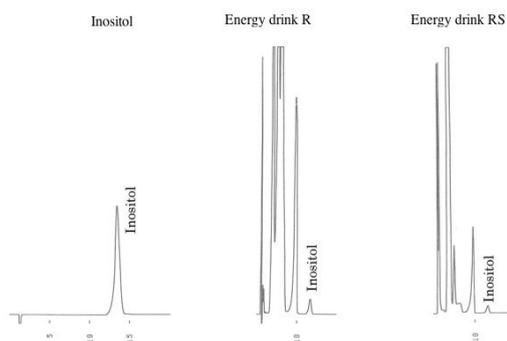
- | | |
|-----------------|-----------------------|
| 1. Dextran T-10 | 6. Fructose |
| 2. Raffinose | 7. Adonitol |
| 3. Sucrose | 8. Glycerol |
| 4. Glucose | 9. Ethanol + Mannitol |
| 5. Galactose | 10. Xylitol +Sorbitol |

Column : ULTRON PS-80C, 300 mm x 8.0 mm I.D.
 Mobile Phase : H₂O
 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.



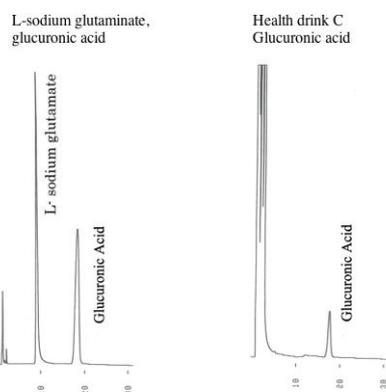
■ Inositol in Health Drink

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 m ² /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) |
| | | 20.0 | - | 226-80052-01 | 226-80062-01 (15 x 8.0 mm) |
| | 10 | 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 | 226-80064-01 (15 x 8.0 mm) |
| | | 30.0 | - | 226-80057-01 | |
| | | 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.

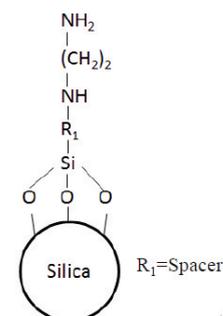
| Column | Particle Size (µm) | I.D (mm) | Length (mm) | | Guard column |
|----------------------------|--------------------|----------|--------------|--------------|----------------------------|
| | | | 150 | 250 | |
| VX-Octyl (for Analytical) | 5 | 4.6 | 226-80069-01 | 226-80070-01 | 226-80072-91 (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.

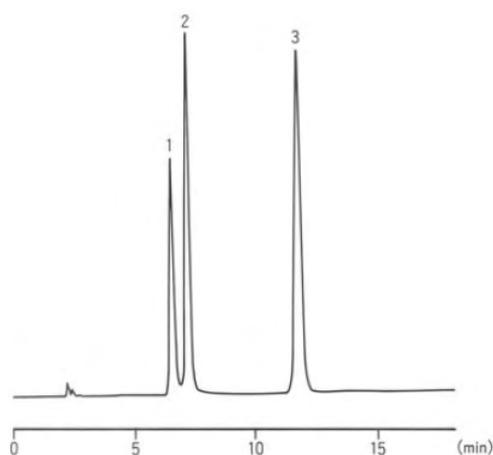
| | |
|------------------|-----------------------------|
| Bonded Phase | Octadecyl Group |
| Particle Size | 5 µm |
| Particle Shape | Spherical Porous Silica Gel |
| Pore Size | 12 nm |
| Specific Surface | 320 m ² /g |
| End-Cap | Yes |
| Carbon content | 17 % |
| USP Code | L1 |

| 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 m ² /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

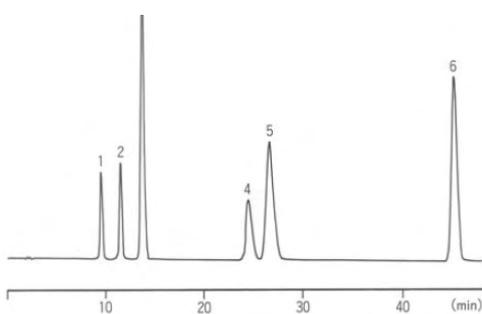
Column : STR ODS-M, 150 mm x 4.6 mm, I.D. (226-80100-01)

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 | - |

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.

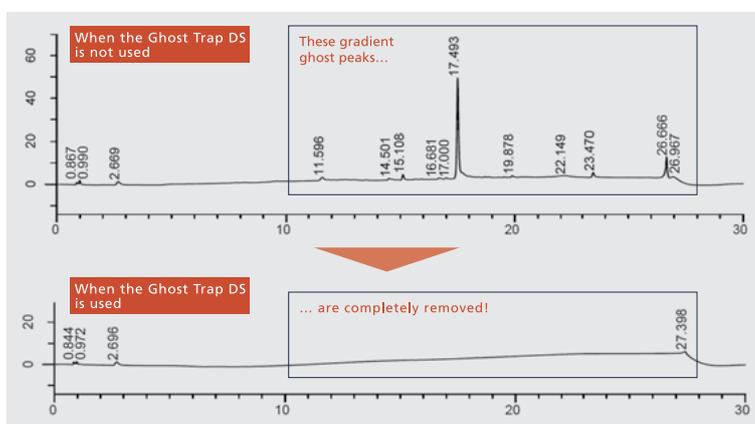
The 100 MPa pressure tolerance of the Ghost Trap DS-HP allows it to be used with UHPLC systems. This permits the effective use of the Ghost Trap DS for method development by UHPLC and subsequent transfer to conventional analysis.

* 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) | 7.6 mmI.D × 30 mmL. | Approx. 700 µL | 35 MPa |
| | 228-59921-92 | Cartridge (2pcs) + Holder | | | |
| | 228-59921-93 | Cartridge (2pcs) | 4.0 mmI.D. × 20 mmL. | | |
| | 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

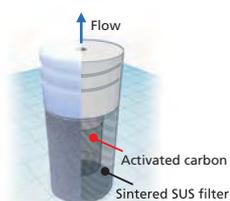
- Removes contaminants from the mobile phase.
- Does not affect gradient delay* to install this product in front of the pump (see Fig. 2).
- Available for LCMS due to low bleed.

(*The delay from 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 chemical 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 of the GLC Suction Filter 2

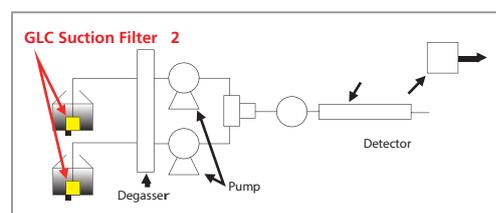


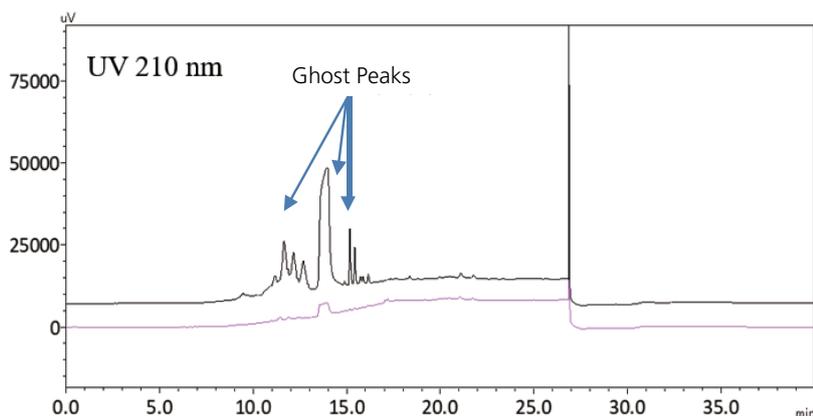
Fig. 2. Attachment position

Mobile Phase Cleaner for UHPLC/HPLC

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 B ; Acetonitrile |
| Time prog. | : B Conc. 20% (0-5 min.) → 95% (5-25 min.) → 20% (25.01-40 min.) |
| Flow rate | : 1 mL /min |

Product Information

| Description | P/N | Porosity | Qty |
|----------------------|--------------|--|-----|
| GLC Suction Filter 2 | 370-02010-01 | Connecting tube: 3.0mm outer diameter suction tube Internal volume: 0.7 mL 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 absorbed 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**

Stainless steel filter with a 0.5µm frit that protects UFLC columns while maintaining excellent column performance. Easily installs on 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 | 0.2µm | 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.

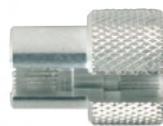
| Part number | Description | Pack size |
|--------------|------------------------------------|-----------|
| 226-50000-01 | Ultrashield HPLC Pre-Column Filter | 1 |
| 226-50106-02 | Peek fitting | 2 |
| 226-50000-99 | Tightening Tool | 1 |



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. 226-50100-02 (2pcs) 226-50100-10 (10pcs) |  | Yes | 25,000 psi / 1,720 bar | Yes 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 Long bodied version of one above for injection valves. 226-50101-02 (2pcs) 226-50101-10 (10pcs) |  | Yes | 25,000 psi / 1,720 bar | Yes 8mm hex spanner | S/S | Particularly suitable for LC injection ports. | Separate nut and "captured" ferrule. |
| Ultra-High Pressure Fitting With fingertight head and integrated ferrule, 10-32 thread. 226-50104-02 (2pcs) 226-50104-10 (10pcs) |  | Yes | 25,000 psi / 1,720 bar | Finger tightened. | S/S and PEEK | All fittings up to 25,000 psi. Good fitting especially for changing columns- fast and reusable with no spanners. | Two piece- S/S nut and "captured" PEEK polymer blend ferrule. |
| Finger 1 – Peek One piece, cone tip, 10-32 thread. 226-50106-02 (2pcs) 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. Good fitting for when you are in a hurry. | Single piece PEEK |

Vials & Accessories



Want to start shopping for vials and accessories?

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Overview

Compatibility with Sample Capacity and Autosampler

Choosing an appropriate vial requires consideration of factors such as the sample capacity, analysis method, and which autosampler is being used. When determining which vial to select, consider using the following table as a reference.

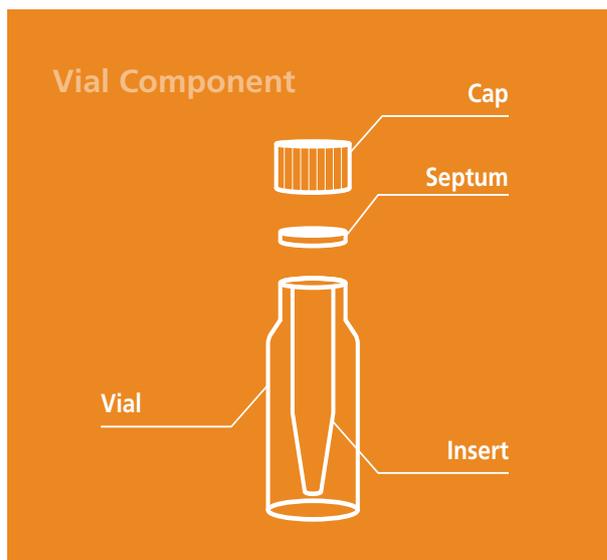
| Use vol. | Vial | Usage | Compatible autosampler |
|------------------|--|---|-------------------------------------|
| Less than 1.5 mL | Vial insert (0.1 to 0.2 mL) Integrated vial (0.2 to 0.3 mL) | Use as a sample bottle or for liquid sample injection Most appropriate when the sample volume is limited | AOC-30/20 Series AOC-6000 Series |
| 1.5 mL | 1.5 mL glass vial | Use as a sample bottle or for liquid sample injection | AOC-30/20 Series AOC-6000 Series |
| 4 mL | 4 mL glass vial | Use as a sample bottle or for liquid sample injection Also used for cleaning solvents and waste liquid | AOC-30/20 Series |
| 10 mL or more | 10 mL glass vial 20 mL glass vial | For headspace | HS-10/20 Series AOC-6000 Series |

Vials and Accessories

Vial Components

Mainly composed of a vial, cap, and septum, and sometimes used with a vial insert placed inside the vial.

To obtain the best analysis results, the most appropriate vial, cap, and septum need to be selected. Select the most appropriate items using this guide as a reference.



Vial Selection Guide

Vial Form

Vial neck

There are three types of vials: screw, crimp, and snap, according to the cap attachment method. Since highly volatile solvents are often used with GC and GC-MS, airtight screw neck or crimp neck vials are recommended.

| Type | Sealing property | Remarks |
|-------|------------------|--|
| Screw | High | Screw type caps can be attached and detached easily. Highly versatile. |
| Crimp | Very High | Requires a dedicated crimping tool (crimper/decapper). |
| Snap | Medium | No tools required, but the airtightness is rather inferior. |



Screw neck



Crimp neck

Select the appropriate cap according to the vial type as vial caps vary depending on the form of the vial neck.

Vial bottom

Flat-bottom vials are used in most cases, but vials for headspace have rounded bottoms for compatibility with headspace samplers.

Rounded bottom vials should be used with the HS-20 series and HS-10 since flat-bottom vials may cause a malfunction.



Flat bottom



Rounded bottom

Vial Glass

Vial glass is manufactured from chemically very low active glass. Type I borosilicate glass (33 or 51 Expansion), which is the highest grade in the United States Pharmacopeia (USP) and European Pharmacopoeia (EP) standards, has been adopted.

Deactivated Glass

Suitable for chemical compounds that are easily adsorbed onto glass. The polarity of the glass surface is reduced by silanization to make the glass surface hydrophobic. It is also suitable for storing samples.

Vials for Microscale Samples

When the sample volume is less than 1 mL, using vial inserts or integrated vials in which an insert is adhered inside the vial ensures liquid levels that are high enough to be aspirated by an autosampler.

Vial Insert



Flat bottom



Resin leg bottom

Integrated Insert



Septum/Cap Selection Guide

Septum

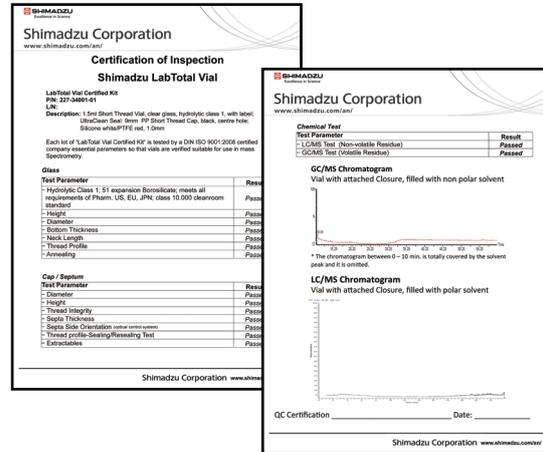
Obtaining accurate analysis results requires selecting the appropriate septum. A septum is influenced by penetration of the autosampler needle, interaction between the solvent used in analysis, the heat by headspace analysis, etc., so features such as its seal-ability, deactivation to the sample and heat resistance need to be considered.

| Material | Appearance | Description |
|--------------------|------------|--|
| PTFE | | The chemical resistance is stable, and the septum is inexpensive. Since it cannot be tightly sealed once a hole is made, it is not suitable for multiple injections and long-term sample storage. |
| Silicone/PTFE | | Chemically-resistant septum is most commonly used. Its hardness is suitable for usage with an autosampler needle, it has high seal-ability and is suitable for multiple injections. It can be used for many GC and GC-MS analyses. |
| PTFE/Silicone/PTFE | | A septum with PTFE coating on both sides will have the highest chemical resistance. As breakage of the septum is unlikely to occur when a needle passes through, it is suitable for multiple injections. It is relatively expensive among septa. It is suitable for analyses requiring high accuracy, such as microanalysis. |



CQ (Certificated Quality) Vial Septum

The bleed of the septum from siloxane bonds is very low due to the use of high-quality silicon polymer and a specific cleaning technique. This confirms that there was an absence of elution components from the vial in random inspections using GC/MS and LC/MS. A mass spec quality certificate is included with each CQ vial kit.



Mass spec quality certificate

Septum for Headspace

In headspace analysis, heat resistance is an important factor to consider when selecting a septum. The heat resistance of various septa is listed below.

| Material | Heat resistance temperature | Description |
|---------------|-----------------------------|--|
| Silicone/PTFE | 200 °C | Septum suitable for analysis of volatile organic compounds. Has low bleeding and high solvent resistance. |
| Silicone/PI | 300 °C | Septum with excellent heat resistance that can keep bleeding to a minimum even when the temperature is raised. Adopted for Xtra Low Bleed HS Septum. |

Xtra Low Bleed HS Septum

Elution of the bleeding components is low even if the temperature is kept at 300 °C, enabling analysis at high temperatures, which had been difficult with a headspace sampler.



Xtra Low Bleed HS septum

Caps

Screw Cap and Crimp Cap

Select the appropriate cap according to the vial. Since highly volatile solvents are often handled with GC/GC-MS, screw top or crimp top vials are generally used.

A crimp top vial requires a dedicated tool for attachment and detachment and takes time to open and close. At the same time, the risk of contamination is low, making it suitable for applications in the areas of food and forensic medicine where emphasis is placed on security.



Screw cap



Crimp cap

Septum-free Cap

Contaminants from the septum can often hinder high-precision analysis and the effects are especially significant when performing injection operations multiple times.

- **Septum-less cap**

A cap that does not use a septum and can be used as a vial cap for 1.5 mL screw vials; however, the airtightness of these caps is inferior to caps that use a septum.

- **Xtra Clean Conical Cap**

Xtra Clean Conical Caps are used with 4 mL vials into which cleaning solvents are put for the AOC series. Conical caps have a pre-hole opening so that septum-originated contaminants will not be generated.

For cleaning solvents, injection operations are performed repeatedly and the effects of contaminants from the septum are likely to occur. It is therefore recommended to use this cap.



Septum-less cap



Xtra Clean Conical cap

Magnetic Cap

Cap made of steel that is used for multifunctional autosamplers. Compatible with vial conveyance using a magnet.



Magnetic caps

Vials

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 |

Vials and Accessories

■ 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 | |
| 227-34119-01 | Translucent | - | - | - | ND9 | |
| 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 |
|-----------------|--------------------------|------------------|----------------------------|-----------------------|
| 226-54110-33 | 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 |
| 226-54111-51 | 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 | |
| 227-34310-01 Silanized treated | 25 uL | 150 uL | ND9 wide opening vial | √ | 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 | |
| 227-34131-01 Silanized treated | 40 uL | 350 uL | ND9 wide opening vial | X | Flat bottom | |

Vials and Accessories



1.5 mL amber screw vial kit



1.5 mL clear screw vial kit

Eco Vials series

■ Screw vial, 100/pack

| Part number | Min. sample vol | Max. sample vol | Usage | Write on spot | Dimension |
|--------------|-----------------|-----------------|------------------|---------------|-------------|
| 226-55912-00 | 200 uL | 1.5ml | ND9 wide opening | √ | 32 x 11.6mm |



■ Cap/Septa for Eco screw vials, 100/pack

| Part number | Cap | Septa Material | Septa Thickness | Septa Durometer | Size | Picture |
|--------------|----------------------|----------------------|-----------------|-----------------|------|---------|
| 226-55911-13 | Red PP, centre hole | PTFE/Silicone | 1.0mm | 50° shore A | ND 9 | |
| 226-55911-21 | Red PP, centre hole | PTFE/Silicone, Slit* | 1.0mm | 50° shore A | ND 9 | |
| 226-55911-12 | Blue PP, centre hole | PTFE/Silicone, Slit | 1.0mm | 50° shore A | ND 9 | |

*Bonded Septa

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.

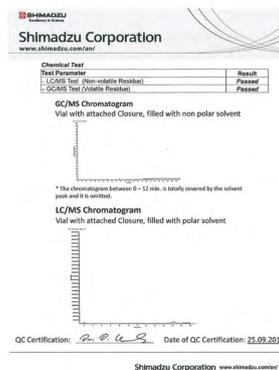


| Part number | Description |
|--------------|--|
| 227-34001-01 | LabTotal Vial Certified Kit for LCMS, 100/pk |
| 227-34001-02 | Blue PP cap, Silicone white/PTFE red for LabTotal vial LCMS, 50/pk |
| 226-84340-01 | Black PP cap, Silicone white/PTFE red for LabTotal vial LCMS, 100/pk |
| 227-34002-01 | LabTotal Vial Certified Kit for GCMS, 100/pk |
| 227-34001-11 | LabTotal Amber Vial Certified Kit |



■ 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.



■ Each Vial Inspected Visually



Our small-volume vials with their unique shape are made of the same materials and receive the same cleaning treatment as the 1.5 mL vials. They suppress adsorption more than other small-volume inserts by limiting the contact surface between the sample and the container. In addition, the bottom surface of the vial is hollowed out in order to increase thermal conductivity.

Residual volume: Approx. 10 μ L

When using it, adjust the needle stroke parameter to be 15 mm higher than for the 1.5 mL vials.

For example; Shimadzu SIL-40 series: 32 mm or less

■ Vial Selection by Application

Our lineup includes Shim-vial H, which enables trace-quantity analysis of basic compounds prone to adsorption by glass, thanks to advanced low adsorption treatment, and the cost-effective Shim-vial S.

Shim-vial H (For high-sensitivity analysis)

- ppt order high-sensitivity analysis (LC-MS)
- Analysis of compounds prone to adsorption (LC-MS and LC)
- Analysis with a focus on repeatability (QA/QC)
- Analysis requiring a low background

Shim-vial S (For routine analysis)

- Analysis of general compounds (LC-MS and LC)
- ppm to ppb order high-sensitivity analysis
- Analysis with a focus on repeatability (QA/QC)
- Analysis requiring a low background

■ Item List

| P/N | Product Name | Remarks |
|--------------|--|---------|
| 227-34500-01 | Shim-vial H 1.5 mL clear glass, Cap with PTFE/silicon septum (slitless) | 100 pcs |
| 227-34500-02 | Shim-vial H 1.5 mL clear glass, Cap with PTFE/silicon septum (slit) | 100 pcs |
| 227-34500-03 | Shim-vial H 1.5 mL amber glass, Cap with PTFE/silicon septum (slitless) | 100 pcs |
| 227-34500-04 | Shim-vial H 1.5 mL amber glass, Cap with PTFE/silicon septum (slit) | 100 pcs |
| 227-34500-51 | Shim-vial S 1.5 mL clear glass, Cap with PTFE/silicon septum (slitless) | 100 pcs |
| 227-34500-52 | Shim-vial S 1.5 mL clear glass, Cap with PTFE/silicon septum (slit) | 100 pcs |
| 227-34500-53 | Shim-vial S 1.5 mL amber glass, Cap with PTFE/silicon septum (slitless) | 100 pcs |
| 227-34500-54 | Shim-vial S 1.5 mL amber glass, Cap with PTFE/silicon septum (slit) | 100 pcs |
| 227-34500-11 | Shim-vial H 0.15 mL clear glass, Cap with PTFE/silicon septum (slitless) | 100 pcs |
| 227-34500-12 | Shim-vial H 0.15 mL clear glass, Cap with PTFE/silicon septum (slit) | 100 pcs |
| 227-34500-13 | Shim-vial H 0.15 mL amber glass, Cap with PTFE/silicon septum (slitless) | 100 pcs |
| 227-34500-14 | Shim-vial H 0.15 mL amber glass, Cap with PTFE/silicon septum (slit) | 100 pcs |
| 227-34500-21 | Cap with PTFE/silicon septum (slitless) | 100 pcs |
| 227-34500-22 | Cap with PTFE/silicon septum (slit) | 100 pcs |

Shim-vial and CoreFocus are trademarks of Shimadzu Corporation or its affiliated companies in Japan and/or other countries.

TORAST-H Bio Vial

■ Features

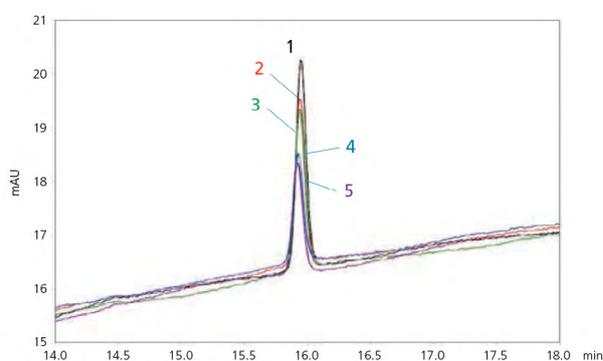
- Prevents the adsorption of organic compounds
- Reduces the adsorptive loss of the precious sample
- Ideal for peptide and basic compounds analysis



■ 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



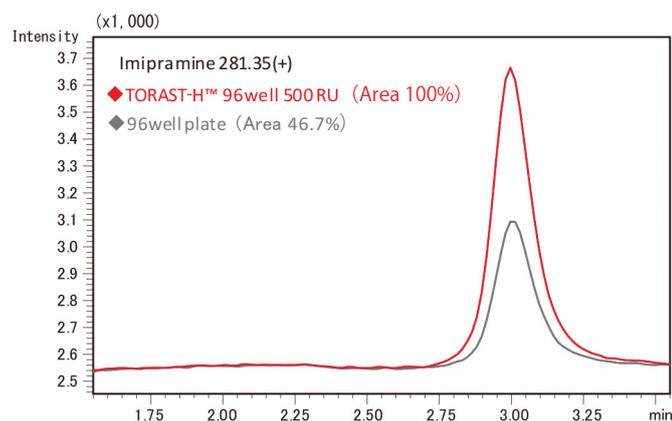
Adsorption Test of Imipramine

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

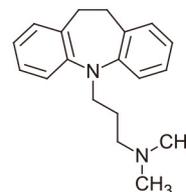
The chromatogram below shows a comparison of the Imipramine peak area with non-coated polypropylene 96-well plate compared to TORAST-H™ 96-well plates.

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.



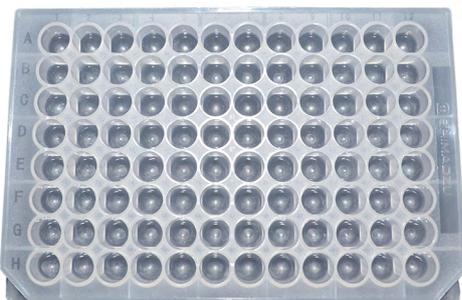
Sample : Imipramine (1 ng/mL)
 Instruments : Nexera-i, LCMS-2020
 Mobile Phase : 10 mM Ammonium Acetate in Water : MeCN
 =40:60_Isocratic flow
 Flow Rate : 0.2 mL/min



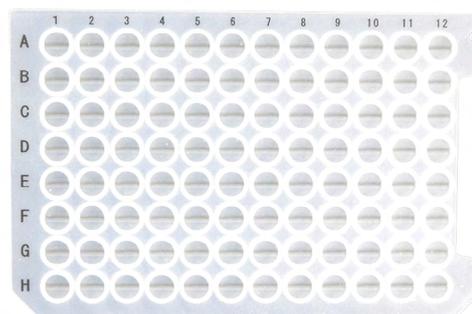
Imipramine Molecular Weight : 280.4

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

Viials

■ 1.5mL crimp viials, 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 viials, 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 | |
| 226-54128-02 | - | 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 |
|-----------------|-------|------------------|----------------------------|-----------------------|
| 226-54120-61 | Clear | 226-54120-01 | PTFE/rubber | 226-54124-01 |
| 226-54121-31 | Amber | 226-54121-01 | PTFE/Silicone, ultra-Clean | 226-54123-01 |

■ **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 |
| 227-35500-01 | 11mm Electronic Crimper |
| 227-35501-01 | 11mm Electronic 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 |
| 226-84903-12 | Red PP | 200 x 105 x 17mm | 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

Vials



| 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 |
|-----------------|-------|------------------|---------------------------|-----------------------|
| 226-84410-41 | 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 |

■ Xtra Clean Conical Cap

Appropriate as a vial cap for cleaning solvents. Due to its septum-less structure, cleaning solvents are not contaminated by the septum. As a result, this cap offers reliable, long-term use for multi-specimen analysis.

| Part number | Colour | Pack size |
|--------------|-------------|-----------|
| 227-35600-01 | Translucent | 12 pcs |



■ Vial Rack for 4mL vials

| Part Number | Type | Dimension | Cavities |
|--------------|--------|--------------|----------|
| 226-84905-10 | Red PP | 130x130x52mm | 49 |

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



| Part number | 226-84521-01 | 226-84521-21 | 226-84510-01 | 226-84510-21 |
|--|--------------|--------------|---------------|---------------|
| | 10 | 10 | 20 | 20 |
| | Round bottom | Round bottom | Round bottom | Round bottom |
| | 46 x 22.5mm | 46 x 22.5mm | 75.5 x 22.5mm | 75.5 x 22.5mm |
| 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 | |

Vials

■ 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 | |

■ 20mL crimp vial kit, including vial, cap and septa, 100/pack

| Kit part number | Vial | Vial part number | Cap / Septa | Cap/Septa part number |
|-----------------|-------|------------------|---|-----------------------|
| 226-84521-31 | 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 |
| 227-35500-02 | 20mm Crimper (Rechargeable) |
| 227-35501-02 | 20mm Decapper (Rechargeable) |

Electronic high-power auto crimper/decapper (non-integration of main body with a power cord and jaw part)

| Outline | Compatible cap diameter | P/N | Remarks |
|------------------------|-------------------------|--|---|
| Main body | - | 227-35503-01 (For JPN) 227-35503-02 (For USA) 227-35503-03 (For UK) 227-35503-04 (For AU) 227-35503-05 (For EU) 227-35503-06 (For CN) | <ul style="list-style-type: none"> •With power cord •Jaw part corresponding to each cap diameter is required separately |
| Auto crimper jaw part | 11 mm | 227-35504-01 | For 1.5 mL crimp vial |
| Auto crimper jaw part | 20 mm | 227-35504-02 | For 10 mL /20 mL crimp vial |
| Auto decapper jaw part | 11 mm | 227-35505-01 | For 1.5 mL crimp vial |
| Auto decapper jaw part | 20 mm | 227-35505-02 | For 10 mL /20 mL crimp vial |

Stand for crimper/decapper

| Outline | P/N | Remarks |
|---------------------------------|--------------|--|
| Base for auto crimper/decapper | 227-35510-01 | The base is easy to assemble and hardware is included. |
| Stand for auto crimper/decapper | 227-35508-01 | The stand is available for use with both the electronic and manual crimping tools. |



Manual crimper/decapper



Electronic battery



Electronic high-power

Auto crimper/decapper



Base for auto crimper/decapper



Stand for auto crimper/decapper



Acrylic vial rack



Headspace wash kit

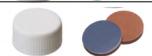
EPA vials

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 |
|-----------------|-------------|------------------|--|-----------------------|
| 226-84532-31 | 20 mL clear | 226-84531-01 | Closed top, Silicone/PTFE (EPA-Quality) | 226-84534-11 |
| 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

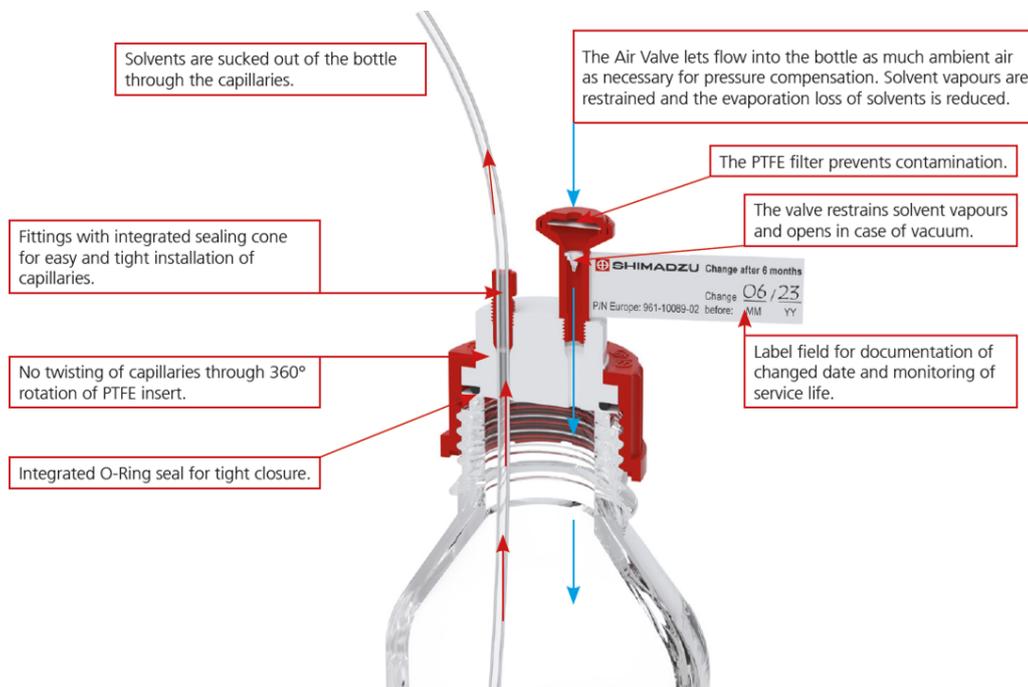
| Part number | Description | Remarks |
|--------------|--|--|
| 226-50580-00 | 40mL TOC Vial Certified Kit, incl. cap and 0.068" Silicon/PTFE septa | Comes with certificate certified <10ppb Carbon, meets USP Method 643 |
| 226-50581-00 | 40mL TOC Vial Certified Kit, incl. cap and 0.125" Silicon/PTFE 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 | - |

SH-Solvent Safety Caps

Shimadzu Solvent Caps, together with the connectors and the air valve, are the optimum solution for the removal of solvents. They create a closed system to prevent hazardous vapors from entering the laboratory. Shimadzu Solvent Caps hermetically seal all laboratory bottles with GL45 thread and ensure safe inflow and outflow of HPLC solvents via capillaries with OD- \varnothing 3.2 mm. Preventing tangling of tubes when caps are removed or fitted by allowing the inner body of the cap to rotate independently. Their chemical resistance allows sterilization and autoclaving up to 140 °C for soap-free operation. All Solvent Caps are supplied with air valve and capillary fitting.



Ordering Information

| | 1 Line Cap | 2 Lines Cap | 4 Lines Cap |
|-------------|--|--|---|
| Part Number | 226-50412-00 | 226-50413-00 | 226-50415-00 |
| Consists of | 1 cap 1 Air Valve + Flag 1 Fitting | 1 cap 1 Air Valve + Flag 2 Fittings 1 Blind stopper | 1 cap 1 Air Valve + Flag Fittings 3 Blind stoppers |
| Image | | | |

Ordering Information

| | Air Valve +Flag | | Blind Stopper |
|--------------|--------------------|--------------|-----------------------|
| Part Number | 226-50416-02 | 226-50416-10 | 226-50418-10 |
| Pack size | 2 pcs | 10 pcs | 10 pcs |
| Service life | 6 months per piece | | Change when necessary |
| Image | | | |

Sample Preparation

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 |



Sample preparation

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

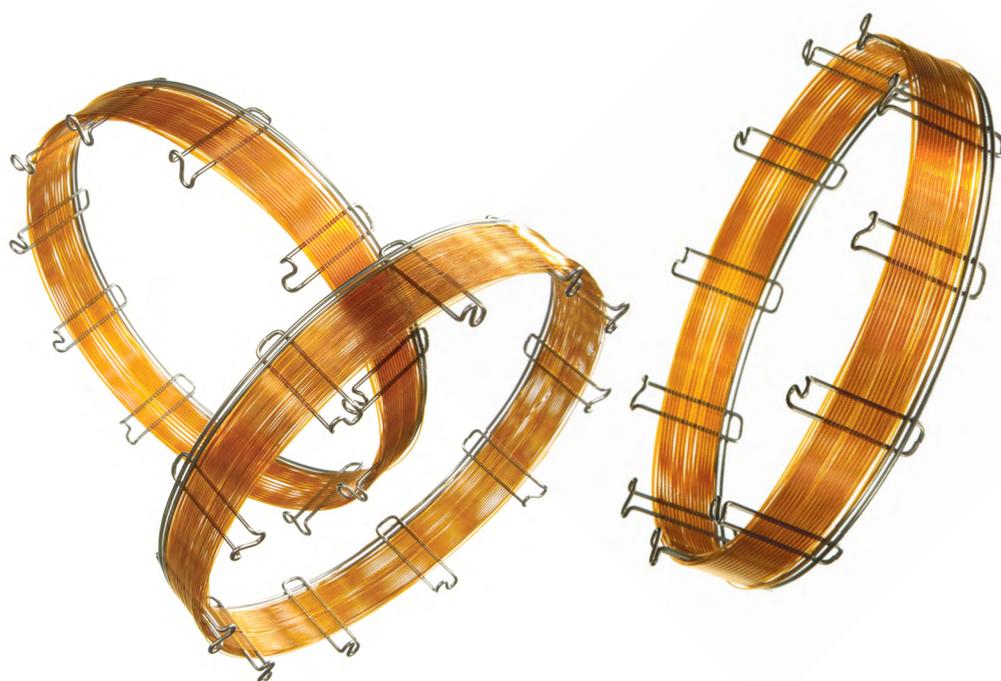
| Type | Material | Pore Size / μm | Diameter | | | | |
|-----------------|------------------|---------------------------|--------------|--------------|--------------|--------------|--------------|
| | | | 4mm* | 13mm | 25mm | 33mm** | 47mm* |
| Syringe filter | Nylon | 0.22 | 226-82104-22 | 226-82113-22 | 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

**sterile

Gas Chromatograph Series Columns

GC Columns



Capillary Columns Column Selection Guide

Check the structure of the target components

Investigate the structure (functional group), boiling point, nature, stability, and other properties of the target component.



Select the stationary phase

Selecting a stationary phase of chemical properties close to those of the target component helps increase retention force and prevent drops in separation caused by defective peak shape.

| Stationary Phase | 100% dimethyl polysiloxane | ** % diphenyl / ** % dimethyl polysiloxane | ** % cyanopropylphenyl / ** % dimethyl polysiloxane | Trifluoropropyl methyl polysiloxane | Polyethylene glycol |
|-----------------------|---|--|---|--|--|
| Polarity | Non-polar | Low to Medium | Medium | Medium to High | High |
| Separation Properties | Elution in boiling point order | Aromatic compounds are retained by phenyl group content | Effective for separation of oxygenated compounds, isomers, etc. | Uniquely retains compounds containing halogens | Strong retention of polar compounds |
| Applications | Gasoline and solvent related | Flavors, environmental related, aromatic compounds, semivolatiles | Pesticides, PCBs, oxygenated compounds | Halogenated compounds, polar compounds, solvents | Polar compounds, solvents, Flavors, FAME |
| Columns | SH-I-1MS SH-I-1HT SH-1 SH-MetalX-1 | SH-I-5MS SH-I-5HT SH-I-17 SH-I-SVOC MS SH-5 SH-5MS SH-20 SH-35 SH-35MS SH-65 SH-MetalX-5 | SH-1301 SH-624 SH-1701 | SH-200 SH-200MS | SH-Wax SH-PolarWax |



Determine the column size

Determine the column size according to the sample amount to inject while referring to the following table.

| | | |
|----------------|--------------------|--|
| Inner Diameter | 0.18 mm | Has extremely high resolution but its sample load is small. • Samples having a complex mixed system • Suited to split injection |
| | 0.25 mm 0.32 mm | Has high resolution and a moderate sample load • Supports samples having a complex mixed system • Suited to split/splitless injection |
| | 0.53 mm | Has satisfactory resolution and a large sample load • Suited to purity measurement and analysis of trace components • Used in direct injection, on-column injection, and large-volume injection • Can be easily replaced from packed column |
| Film Thickness | Thick Film | • Good separation of high-concentration components • Suited to purity analysis |
| | Thin Film | • Fast elution of high boiling point compounds • Suited to the analysis of medium to high boiling point compounds |
| Length | | When twice as long (for fixed-temperature analysis) • The analysis time will be twice • The degree of separation will be 1.4 times |



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 | 156 |
| SH-I-5MS | 5% diphenyl / 95% dimethyl polysiloxane | G27, G36 | HP-5ms UI, HP-5ms, HP-5ms5V, DB-5, Ultra-2, CP Sil 8 CB | SPB-5, Equity-5 | BP-5ms | ZB-5, ZB-5msi | 007-5 | AT-5ms | 157 |
| SH-I-1HT | 100% dimethyl polysiloxane | - | DB-1HT | - | - | ZB-1HTinferno | - | AT-1ht | 158 |
| SH-I-5HT | 5% diphenyl / 95% dimethyl polysiloxane | - | DB-5HT, VF-5HT | - | HT-5 | ZB-5HTinferno | - | - | 158 |
| SH-I-5Sil MS | 1,4-bis(dimethylsiloxy) phenylene dimethyl polysiloxane | G27, G36 | DB-5ms UI, DB-5ms, VF-5ms | SLB-5ms | BPX-5 | ZB-5MS, ZB-Semi-Volatiles, ZM-5MS plus | 007-5MS | - | 159 |
| SH-I-XLB | proprietary phase | - | DB-XLB, VF-Xms | - | - | ZB-MR1, ZB-XLB | - | - | 160 |
| SH-I-17 | 50% diphenyl / 50% dimethyl polysiloxane | G3 | HP-17, DB-17, DB-17HT, DB-608 | SPB-17 | - | ZB-50 | - | - | 161 |
| SH-I-35Sil MS | proprietary phase | G42 | DB-35ms, DB-35ms UI, VF-35ms | - | BPX35, BPX608 | ZB-MR2 | - | - | 161 |
| SH-I-17Sil MS | proprietary phase | G17 | DB-17ms, VF-17ms | - | BPX-50 | - | - | - | 162 |
| SH-I-PAH | proprietary phase | G51 | - | - | - | - | - | - | 162 |
| SH-I-624Sil MS | proprietary phase | G43 | DB-624, VF-624ms, CP-Select 624 CB | - | BP-624 | - | - | - | 163 |
| SH-I-1301Sil MS | silarylene-based cyano | G43 | VF-1301ms | - | - | - | - | - | 164 |
| SH-I-SVOC MS | proprietary phase | G27, G36 | DB-UI 8270D | - | - | ZB-SemiVolatiles | - | - | 164 |
| SH-I-LAO | proprietary phase | - | - | - | - | - | - | - | 165 |
| 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 | 166 |
| SH-1 PONA | 100% dimethyl polysiloxane | - | CP-Sil PONA C8, DB-Petro, HP-PONA | Petrocol DH | BP1PONA | - | - | - | 166 |
| 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 | 167 |
| 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 | 168 |

| Shimadzu | Stationary Phase | USP | Similar Phases | | | | | | Page |
|----------------------|--|---------------------|---|---------------------------------|--------------------|----------------------|----------|---------------------|------|
| | | | Agilent | Supelco | SGE | Phenomenex | Quadrex | Alltech | |
| SH-20 | 20% diphenyl / 80% dimethyl polysiloxane | G32 | – | SPB-20 | – | – | 007-20 | AT-20, EC-20 | 169 |
| 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 | 170 |
| SH-50 | 100% methyl phenyl polysiloxane | G3 | HP-50+, CP-Sil 24 CB | SPB-50 | – | – | 007-17 | AT-50 | 171 |
| SH-65 | 65% diphenyl / 35% dimethyl polysiloxane | – | – | – | – | – | 007-65HT | – | 171 |
| SH-65TG | 65% diphenyl / 35% dimethyl polysiloxane | – | CP-TAP-CB | – | – | – | 007-65HT | – | 172 |
| SH-1301 | 6% cyanopropylphenyl / 94% dimethyl polysiloxane | G43 | DB-1301, CP-1301, VF-1301ms | – | – | – | 007-1301 | AT-1301 | 172 |
| 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 | 173 |
| SH-1701 | 14% cyanopropylphenyl / 86% dimethyl polysiloxane | G46 | DB-1701P, DB-1701, CP Sil 19 CB, VF-1701ms, VF-1701 Pesticides | SPB-1701 | BP-10 | ZB-1701, ZB-1701P | 007-1701 | AT-1701 | 174 |
| SH-200/ SH-200MS | Trifluoropropylmethyl polysiloxane | G6 | DB-210, DB-200, VF-200ms | – | – | – | – | AT-210 | 175 |
| SH-225 | 50% cyanopropylmethyl / 50% phenylmethyl polysiloxane | G7, G19 | DB-225, CP-Sil 43 CB | SPB-225 | BP-225 | – | 007-225 | AT-225 | 177 |
| SH-440 | modified polysiloxane (unique phase) | – | – | – | – | – | – | – | 177 |
| SH-502.2 | diphenyl / dimethyl polysiloxane | – | DB-502.2 | – | – | – | – | – | 177 |
| SH-2330 | 90% biscyanopropyl / 10% cyanopropylphenyl polysiloxane (Non-bonded) | G5, G8, G48 | VF-23ms | SP-2330, SP-2331, SP-2380 | BPX-70 | – | 007-23 | AT-Silar90 | 178 |
| SH-2560 | biscyanopropyl / polysiloxane | G5 | HP-88, CP-Sil88 | SP-2560 | – | – | – | – | 178 |
| SH-2887 | dimethyl polysiloxane | – | DB-2887 | Petrocol 2887 | – | – | – | – | 178 |
| SH-Wax | Polyethylene glycol | G16, G20, G39 | DB-Wax | – | BP-20 | ZB-Wax | 007-CW | AT-WAXms, EC-WAX | 179 |
| SH-PolarWax | Polyethylene glycol | G16, G20, G39 | HP-INNOWax, CP-Wax 52 CB, VF-WAX MS | Supelcowax-10 | – | ZB-Wax Plus | – | AT-WAX, EC-WAX | 180 |
| Dedicated Columns | | | | | | | | | |
| SH-1614 | Ideal for analysis of PBDE | – | – | – | – | – | – | – | 181 |
| SH-OPP1/ SH-OPP2 | Ideal for analysis of organophosphorus pesticides | – | – | – | – | – | – | – | 182 |
| SH-CLP/ SH-CLP II | Ideal for analysis of organochlorine pesticides | – | DB-CLP1 / DB-CLP2 | – | – | – | – | – | 183 |

Capillary Columns Cross-Reference

| Shimadzu | Stationary Phase | USP | Similar Phases | | | | | | Page |
|---|--|----------|--|-----------------------|-------|---------------------|---------|---------------------------------|------|
| | | | Agilent | Supelco | SGE | Phenomenex | Quadrex | Alltech | |
| SH-VMS | Ideal for analysis of volatile organic pollutants | - | - | - | - | - | - | - | 184 |
| SH-Volatil Amin | Ideal for analysis of volatile amines | - | CP-Volamine | - | - | - | - | - | 185 |
| SH-PCB | Dedicated to PCBs analysis | - | - | - | - | - | - | - | 185 |
| SH-VRX | Ideal for analysis of volatile organic pollutants | - | - | - | - | - | - | - | 185 |
| SH-FAME | Ideal for analysis of FAMES | G16 | Select FAME | Omegawax | - | - | - | AT-AquaWax, AT-FAME | 186 |
| 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 | - | - | 187 |
| SH-5 Amine/ SH-35 Amine | Ideal for analysis of amines | - | - | - | - | - | - | - | 188 |
| SH-PolarD | Ideal for analysis of free acid | G25, G35 | HP-FFAP, DB-FFAP, VF-DA, CP-Wax 58 CB, CP-FFAP CB | Nukol | BP-21 | ZB-FFAP | - | AT-AquaWax-DA, AT-1000, EC-1000 | 189 |
| SH-PolarX | Ideal for analysis of amines | - | CAM, CP-Wax 51 for Amines | Carbowax Amine | - | - | - | AT-CAM | 190 |
| SH-PolarWAX MS | Ideal for analyses of food, flavor, fragrance, industrial chemical and solvent | - | - | - | - | - | - | AT-WAXms | 191 |
| SH- β DEXse | Ideal for the separation of chiral compounds | - | - | - | - | - | - | - | 191 |
| SH- β DEXsm | Ideal for the separation of most chiral compounds in essential oils | - | - | - | - | - | - | - | 191 |
| SH- β DEXsa | Unique selectivity for esters, lactones, and other fruit flavor components | - | - | - | - | - | - | - | 192 |
| SH-Dioxin | Unique selectivity for toxic dioxin and furan congeners allows | - | - | - | - | - | - | - | 192 |
| SH-Mineral Oil | Optimized column dimensions for fast mineral oil screening | - | Select Mineral Oil | - | - | - | - | - | 192 |
| SH-TCEP | Ideal for aromatics and oxygenates in gasoline | - | CP-TCEP | SPB-TCEP | - | - | - | - | 192 |
| SH-Volatiles | Application-specific column for volatile organic compounds | - | - | - | - | - | - | - | 193 |
| PLOT Columns | | | | | | | | | |
| SH-Alumina BOND/Na ₂ SO ₄ | Aluminum oxide with Na ₂ SO ₄ deactivation | - | GS-ALUMINA, CP-Al ₂ O ₃ /Na ₂ SO ₄ | Alumina sulfate PLOT | - | - | - | AT-Alumina | 194 |
| SH-Alumina BOND/KCl | Aluminum oxide with KCl deactivation | - | GS-Alumina KCl, HP-PLOT Al ₂ O ₃ KCl, CP-Al ₂ O ₃ /KCl | Alumina chloride PLOT | - | - | - | - | 194 |
| SH-Alumina BOND/CFC | proprietary phase | - | - | - | - | - | - | - | 195 |

| Shimadzu | Stationary Phase | USP | Similar Phases | | | | | | Page |
|---|--|---------------|--|-------------------|-------|-------------------|----------|---------------|------|
| | | | Agilent | Supelco | SGE | Phenomenex | Quadrex | Alltech | |
| SH-Alumina BOND/MAPD | proprietary phase | - | Select Al ₂ O ₃ MAPD | - | - | - | - | - | 195 |
| SH-Msieve 5A | Molecular Sieve 5A | - | HP-PLOT Molesieve, CP-Molsieve 5A | Mol Sieve 5A PLOT | - | - | PLT-5A | AT-Mole Sieve | 196 |
| SH-Q-BOND | 100% divinylbenzene porous polymer | - | HP-PLOT Q, CP-PoraPLOT Q, CP-PoraBOND Q | Supel-Q PLOT | - | - | - | AT-Q | 197 |
| SH-U-BOND | Divinylbenzene ethylene glycol / dimethylacrylate porous polymer | - | HP-PLOT U, CP-PoraPLOT U, CP-PoraBOND U | - | - | - | - | - | 197 |
| SH-QS-BOND | Porous divinylbenzene homopolymer | - | GS-Q | - | - | - | - | - | 198 |
| Metal Columns | | | | | | | | | |
| SH-MetalX-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 | 199 |
| SH-MetalX-1HT SimDist | 100% dimethyl polysiloxane | - | CP-SimDist UltiMetal, DB-HT SimDis ProSteel | - | - | ZB-1X SimDist | - | - | 199 |
| SH-MetalX-5 | 5% diphenyl / 95% dimethyl polysiloxane | G27, G36 | HP-5, DB-5, CP-Sil 8 CB | SPB-5 | BP-5 | ZB-5 | 007-5 | EC-5, AT-5 | 199 |
| SH-MetalX-1701 | proprietary phase | 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 | 200 |
| SH-MetalX-WAX | polyethylene glycol | G16, G20, G39 | HP-INNOWax, CP-Wax 52 CB, VF-WAX MS | Supelcowax-10 | - | ZB-WAXplus | - | AT-WAX | 200 |
| SH-MetalX Biodiesel TG | proprietary phase | - | - | MET-Biodiesel | - | - | - | - | 200 |
| SH-MetalX-Alumina BOND /Na ₂ SO ₄ | proprietary phase | - | CP-Al ₂ O ₃ /Na ₂ SO ₄ | - | - | - | - | - | 201 |
| SH-MetalX-Q-BOND | Nonpolar porous polymer | - | PoraPLOT Q UltiMetal Quadrex PLT-Q | - | - | - | - | - | 201 |
| SH-MetalX-Msieve 5A PLOT | proprietary phase | - | - | - | - | - | - | - | 201 |

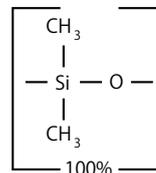
Capillary Columns

High-Performance Columns

SH-I-1MS

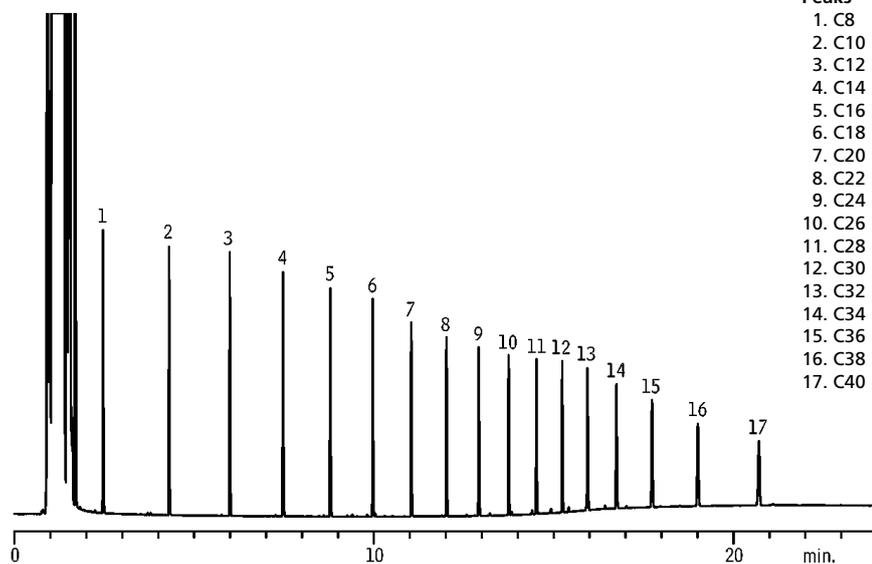
- Non-polar phase: Crossbond™ 100% dimethyl polysiloxane
- Tested and guaranteed for ultra-low bleed; improved signal-to-noise ratio for better sensitivity and mass spectral integrity.
- General-purpose columns for arson accelerants, essential oils, hydrocarbons, pesticides, PCB congeners (e.g., Aroclor 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 | 12 m | 20 m | 25 m | 50 m |
|---------|---------|-------------------|--------------|--------------|--------------|--------------|
| 0.15 mm | 0.15 µm | -60 to 330/350 °C | – | 227-36001-01 | – | – |
| | 2.0 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 | 227-36004-03 | – | 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 | |
| | 1.0 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 | |
| | 1.0 µm | -60 to 330/350 °C | – | 227-36010-01 | 221-75928-60 | |
| | 4.0 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 | – | |
| | 1.0 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)



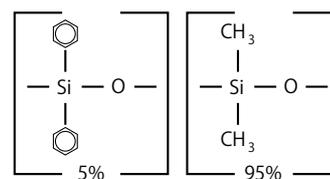
Peaks

- | | |
|---------|---|
| 1. C8 | Conditions |
| 2. C10 | Instrument: GC-2010 |
| 3. C12 | Column: SH-I-1MS, 20 m, |
| 4. C14 | 0.18 mm ID, 0.18 µm |
| 5. C16 | (P/N: 221-75921-20) |
| 6. C18 | Sample: Florida TRPH |
| 7. C20 | Standard, 500 µg/mL |
| 8. C22 | each component in hexane |
| 9. C24 | Inj. Vol.: 0.5 µL, split (split ratio 20:1) |
| 10. C26 | Inj. Temp: 275 °C |
| 11. C28 | Carrier Gas: Hydrogen, constant |
| 12. C30 | linear velocity mode, |
| 13. C32 | 55 cm/sec. |
| 14. C34 | Oven Temp: 40 °C (hold 1 min) to |
| 15. C36 | 330 °C at 20 °C/min |
| 16. C38 | (hold 10 min) |
| 17. C40 | Detector: FID, 350 °C |

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

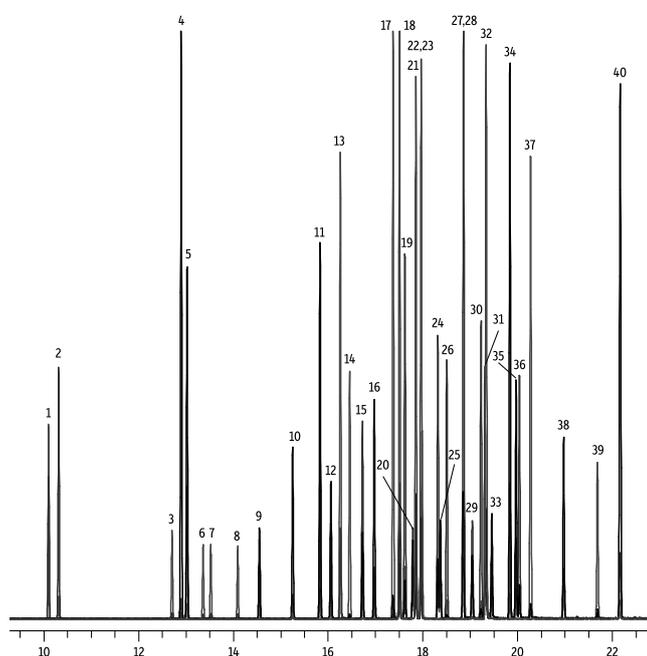
SH-I-5MS Structure



| ID | df | Temp. Range | 10 m | 15 m | 20 m | 25 m | 30 m | 50 m | 60 m |
|---------|---------|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 0.10 mm | 0.10 μm | -60 to 330/350 °C | 227-36342-01 | - | - | - | - | - | - |
| 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 | - |
| 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 |
| | 1.0 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 |
| | 1.0 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 | - | - |
| | 1.0 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 Columns
High Performance
Columns

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. Pentachloroethoxyanisole
12. Aldrin
13. 4,4'-Dichlorobenzophenone
14. Fenoxon
15. Isodrin
16. Heptachlor epoxide (Isomer B)
17. Chlorbendazole
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

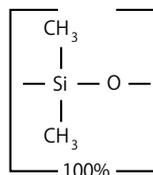
Column: SH-I-5MS, 30 m, 0.25 mm ID, 0.25 μm
(P/N: 221-75940-30)
Inj. Vol.: 1 μL split (split ratio 50:1)
Inj. Temp: 250 °C
Oven Temp: 90 °C (hold 1 min) to 330 °C at 8.5 °C/min (hold 5 min)
Carrier Gas: He, constant flow rate 1.4 mL/min
Detector: MS-QP
Transfer Line Temp: 290 °C
Source Temp: 325 °C
Solvent Delay Time: 5 min
Ionization: EI

Capillary Columns High-Performance Columns

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

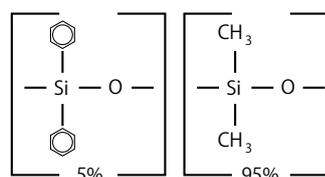


| ID | df | Temp. Range | 15 m | 30 m |
|---------|---------|---------------|--------------|--------------|
| 0.25 mm | 0.10 μm | -60 to 400 °C | 227-36087-01 | 227-36087-02 |
| | 0.25 μm | -60 to 400 °C | - | 227-36088-01 |
| 0.32 mm | 0.10 μm | -60 to 400 °C | 227-36089-01 | 227-36089-02 |
| | 0.25 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



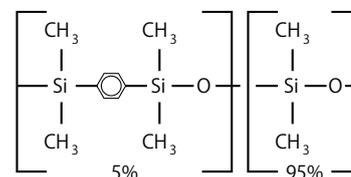
| ID | df | Temp. Range | 15 m | 30 m |
|---------|---------|-------------------|--------------|--------------|
| 0.25 mm | 0.10 μm | -60 to 400 °C | 221-75933-15 | 227-36091-01 |
| | 0.25 μm | -60 to 400 °C | 227-36092-01 | 221-75934-30 |
| 0.32 mm | 0.10 μm | -60 to 400 °C | 227-36093-01 | 227-36093-02 |
| | 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-5Siil 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

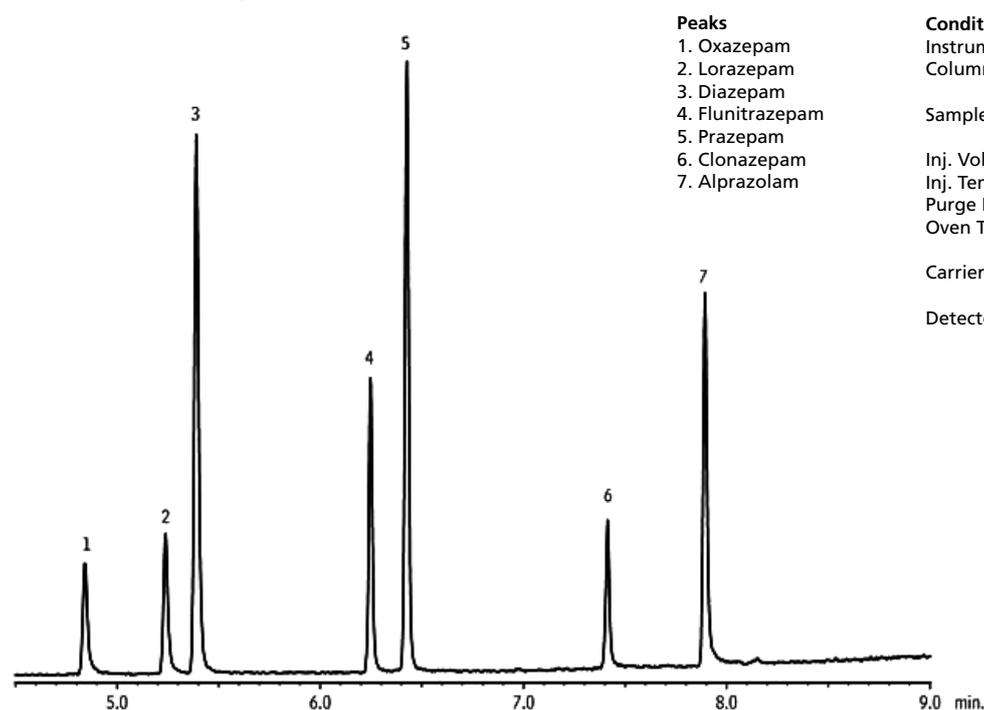
SH-I-5Siil MS Structure



For SH-I-5Siil MS columns with Integrated Guard column, please refer to page 205.

| ID | df | Temp. Range | 10 m | 15 m | 20 m | 30 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 | - | - | - |
| | 2.0 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 | - | - | - |
| 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 | - | - |
| | 1.0 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 | - | - |
| | 1.0 μm | -60 to 320/350 °C | - | - | - | 227-36041-01 | - | - |
| 0.53 mm | 1.50 μm | -60 to 320/350 °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-5Siil 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

Capillary Columns
High-Performance Columns

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

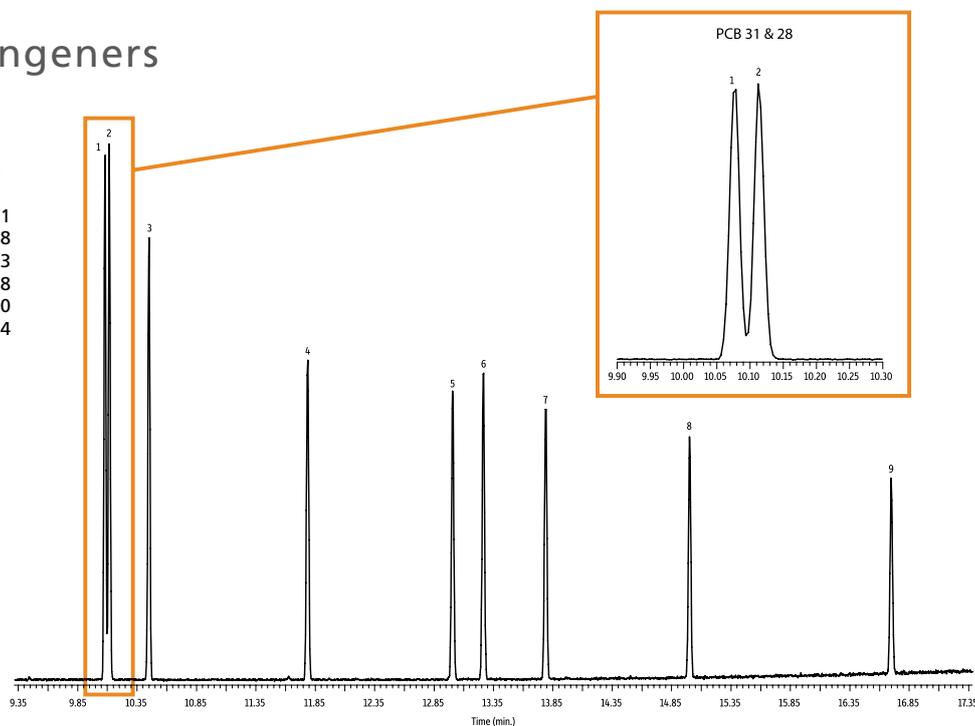
| ID | df | Temp. Range | 20 m | 30 m | 60 m |
|---------|---------|------------------|--------------|--------------|--------------|
| 0.18 mm | 0.18 µm | 30 to 340/360 °C | 227-36309-01 | - | - |
| 0.25 mm | 0.10 µm | 30 to 340/360 °C | - | 227-36042-01 | - |
| | 0.25 µm | 30 to 340/360 °C | - | 227-36043-01 | 227-36043-02 |
| | 0.50 µm | 30 to 340/360 °C | - | 227-36044-01 | - |
| | 1.0 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 | - |
| | 1.0 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 | - | - | - |

* 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

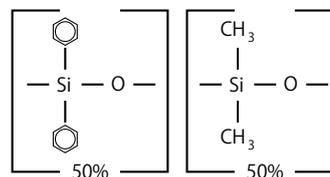
Column: SH-I-XLB, 30 m, 0.25 mm ID, 0.25 µm
(P/N: 227-36043-01)
Sample: PCB congener standard
Diluent: Dichloromethane
Conc.: 3.5 ppm
Inj. Vol.: 0.5 µL splitless (hold 1.75 min)
Inj. Temp: 300 °C
Purge Flow: 50 mL/min

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

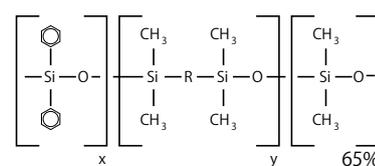


| ID | df | Temp. Range | 20 m | 30 m |
|---------|---------|------------------|--------------|--------------|
| 0.18 mm | 0.18 μm | 40 to 280/320 °C | 227-36061-01 | – |
| 0.25 mm | 0.25 μm | 40 to 280/320 °C | – | 221-75907-30 |
| | 0.50 μm | 40 to 280/320 °C | – | 227-36062-01 |
| | 1.0 μm | 40 to 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 |
| | 1.0 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 | – | – |
| | 1.0 μm | 40 to 280/320 °C | – | 221-76193-30 |
| | 1.50 μm | 40 to 280/320 °C | – | 227-36070-01 |

SH-I-35Si 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-35Si 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 |
| | 1.0 μm | 50 to 340/360 °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 |
| | 1.0 μm | 50 to 340/360 °C | – | 227-36056-02 |
| 0.53 mm | 0.50 μm | 50 to 340/360 °C | 227-36057-01 | 227-36057-02 |
| | 1.0 μm | 50 to 320/340 °C | 227-36058-01 | 227-36058-02 |
| | 1.50 μm | 50 to 310/330 °C | – | – |
| | 3.0 μm | 50 to 280/300 °C | – | 227-36060-02 |

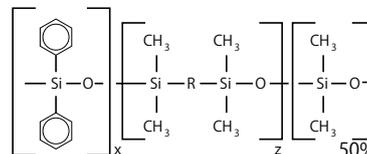
Capillary Columns

High-Performance Columns

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



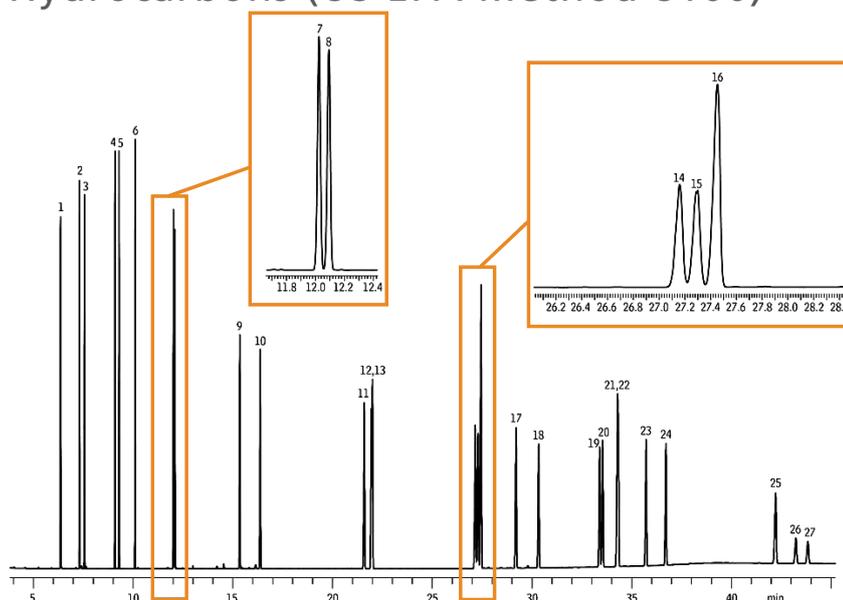
| ID | df | Temp. Range | 15 m | 20 m | 30 m | 60 m |
|---------|---------|------------------|--------------|--------------|--------------|--------------|
| 0.18 mm | 0.18 µm | 40 to 340/360 °C | – | 227-36071-03 | – | – |
| 0.25 mm | 0.25 µm | 40 to 340/360 °C | 227-36071-02 | – | 221-75916-30 | 227-36071-01 |
| 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.

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. Benzo[a]anthracene
12. Chrysene
13. Triphenylene
14. Benzo[b]fluoranthene
15. Benzo[k]fluoranthene
16. Benzo[j]fluoranthene
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 µm (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-PAH

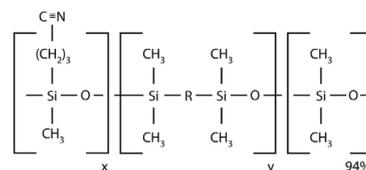
- Mid-polarity proprietary phase
- Ideal for EFSA PAH4 analysis—separates all priority compounds: benzo[a]anthracene, chrysene, benzo[b]fluoranthene and benzo[a]pyrene.
- Best resolution of chrysene from interfering PAHs, triphenylene, and cyclopenta[cd]pyrene.
- Complete separation of benzo [b], [k], [j], and [a] fluoranthenes.

| ID | df | Temp. Range | 30 m | 40 m | 60 m |
|---------|---------|---------------|--------------|--------------|--------------|
| 0.18 mm | 0.07 µm | to 350/360 °C | – | 227-36073-01 | – |
| 0.25 mm | 0.10 µm | to 350/360 °C | 227-36074-01 | – | 227-36074-02 |

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

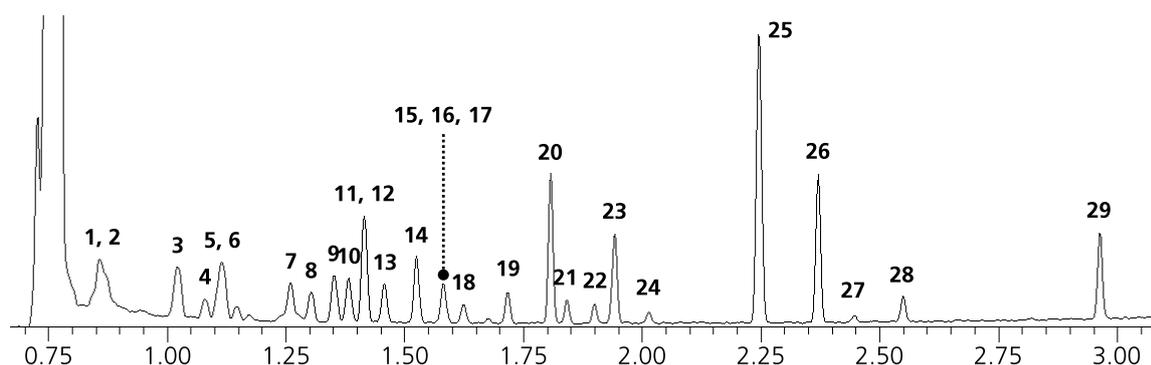


| ID | df | Temp. Range | 20 m | 30 m | 60 m | 75 m | 105 m |
|---------|---------|-------------------|--------------|--------------|--------------|--------------|--------------|
| 0.18 mm | 1.0 μm | -20 to 300/320 °C | 227-36075-01 | – | – | – | – |
| 0.25 mm | 1.40 μm | -20 to 300/320 °C | – | 221-75962-30 | 227-36076-01 | – | – |
| 0.32 mm | 1.80 μm | -20 to 300/320 °C | – | 227-36077-01 | 221-75963-60 | – | – |
| 0.53 mm | 3.0 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) | 9. 1,1,1-trichloroethane | 17. 1,4-dioxane | 25. <i>m</i> -, <i>p</i> -xylene |
| 2. Vinyl chloride | 10. Carbon tetrachloride | 18. Bromodichloromethane | 26. <i>o</i> -xylene |
| 3. 1,1-dichloroethylene | 11. 1,2-dichloroethane | 19. Cis-1,3-dichloropropene | 27. Bromoform |
| 4. Dichloromethane | 12. Benzene | 20. Toluene | 28. 4-bromofluorobenzene |
| 5. Methyl- <i>t</i> -butyl ether (MTBE) | 13. Fluorobenzene (ISTD) | 21. Trans-1,3-dichloropropene | 29. 1,4-dichlorobenzene |
| 6. Trans-1,2-dichloroethylene | 14. Trichloroethylene | 22. 1,1,2-trichloroethane | |
| 7. Cis-1,2-dichloroethylene | 15. 1,4-dioxane-d8 (ISTD) | 23. Tetrachloroethylene | |
| 8. Trichloromethane | 16. 1,2-dichloropropane | 24. Dibromochloromethane | |



Conditions

| | | | |
|-----------------|--|--------------------|--|
| Instrument: | GCMS-TQ8030 + HS-20 Loop | Inj.: | Split (split ratio 30:1) |
| Column: | SH-I-624Sil MS, 20 m, 0.18 mm ID, 1.00 μm (P/N: 227-36075-01) | Oven Temp: | 70 °C, 40 °C/min to 220 °C (hold 0.5 min) |
| Headspace-Loop: | Loop volume: 1 mL | Carrier Gas: | He, constant linear velocity mode, 50 cm/sec |
| | Sample Equilibration: 70 °C for 30 min | MS: | SIM |
| | Vial pressurization: 0.5 min, 50 kPa, equilibration 0.05 min | MS/MS: | MRM |
| | Needle Flush: 2 min | Event (loop) time: | 0.15 sec |
| | Sample Pathway Temp: 200 °C | Source Temp: | 200 °C |
| | Transfer Line Temp: 200 °C | Interface Temp: | 230 °C |

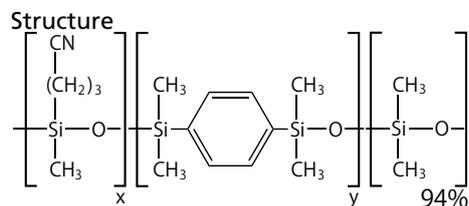
Capillary Columns

High-Performance Columns

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

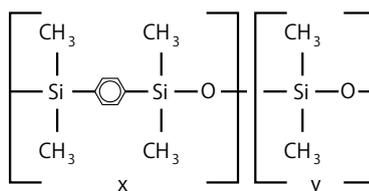


| ID | df | Temp. Range | 15 m | 30 m | 60 m |
|---------|---------|-------------------|--------------|--------------|--------------|
| 0.25 mm | 0.25 µm | -60 to 320 °C | - | 227-36079-01 | 227-36079-02 |
| | 1.0 µm | -60 to 320 °C | - | 227-36080-01 | 227-36080-02 |
| 0.32 mm | 0.25 µm | -60 to 320 °C | - | 227-36081-01 | - |
| | 1.0 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 | 1.0 µm | -60 to 320 °C | 227-36084-01 | 227-36084-02 | - |
| | 1.50 µm | -60 to 320 °C | - | - | - |
| | 3.0 µm | -60 to 280/320 °C | - | 227-36086-01 | 227-36086-02 |

SH-I-SVOC MS

- Proprietary 5% phenyl-type phase
- Engineered to be a low-bleed GC-MS column.
- SH-I-SVOC MS columns keep your instrument online and analyzing semivolatiles (SVOC) samples instead of offline for time-consuming recalibration or column replacement.
- The best choice for analyzing semivolatiles in environmental samples.
- Similar phase: DB-UI 8270D, ZB-SemiVolatiles

SH-I-SVOC MS Structure

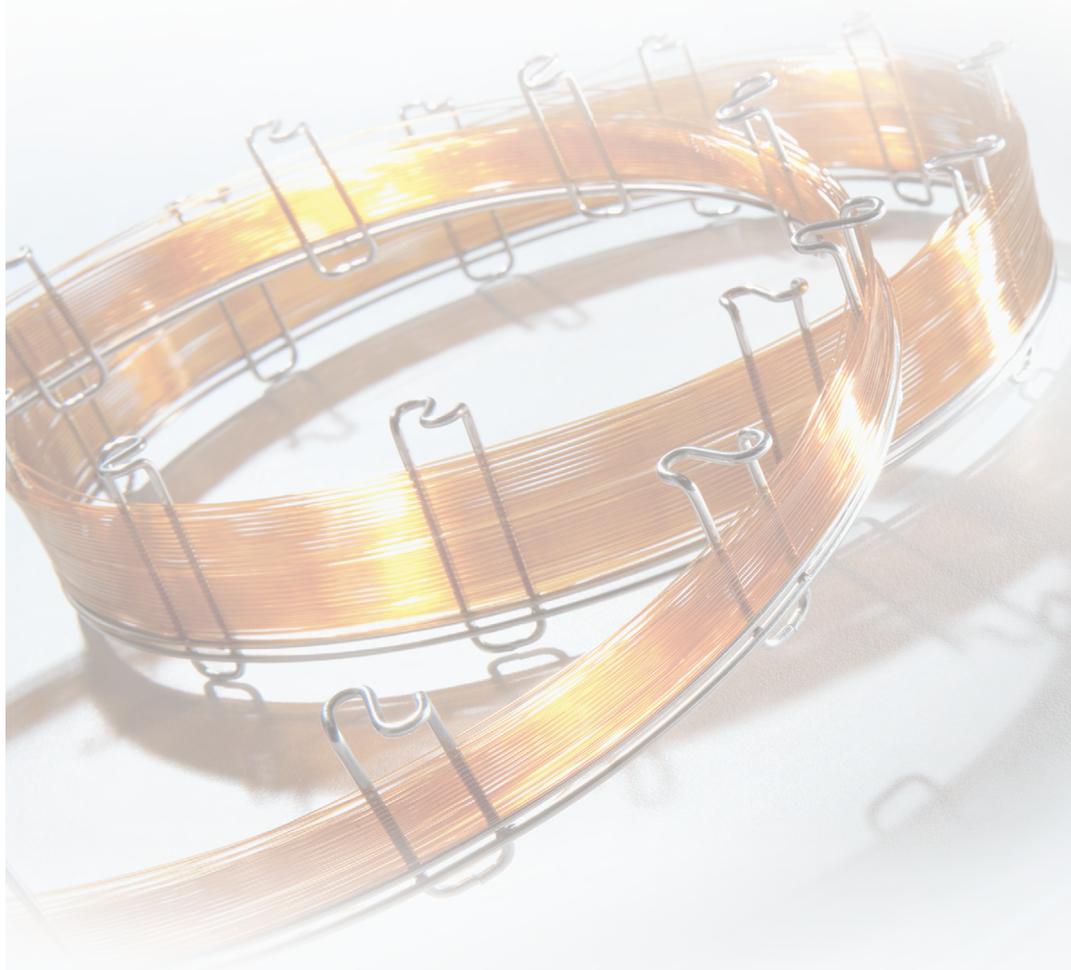


| ID | df | Temp. Range | 15 m | 20 m | 30 m |
|---------|---------|---------------|--------------|--------------|--------------|
| 0.15 mm | 0.15 µm | to 340/340 °C | - | 227-36362-01 | - |
| 0.18 mm | 0.18 µm | to 340/340 °C | - | 227-36362-02 | - |
| | 0.36 µm | to 330/340 °C | - | 227-36362-03 | - |
| 0.25 mm | 0.25 µm | to 340/340 °C | 227-36362-04 | - | 227-36362-06 |
| | 0.50 µm | to 330/340 °C | - | - | 227-36362-08 |
| 0.32 mm | 0.25 µm | to 340/340 °C | - | - | 227-36362-10 |
| | 0.50 µm | to 330/340 °C | - | - | 227-36362-11 |

SH-I-LAO

- Specifically applicated for linear alpha olefin (LAO) impurity analysis.
- Unique selectivity enables high resolution of impurities from peaks of interest.
- Engineered to be a low-bleed column.

| ID | df | Temp. Range | 60 m |
|---------|-------------------|-------------------|--------------|
| 0.25 mm | 1.4 μm | -20 to 300/320 °C | 227-36364-01 |



Guard columns for SH-I are also available. Please refer to page 202

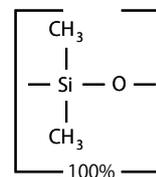
Capillary Columns

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 Integrated Guard column, please refer to page 205.

| ID | df | Temp. Range | 10 m | 15 m | 20 m | 25 m | 30 m | 60 m | 105 m |
|---------|-------------------|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 0.10 mm | 0.40 µm | -60 to 330/350 °C | - | - | 227-36330-01 | - | - | - | - |
| 0.18 mm | 0.40 µm | -60 to 330/350 °C | 227-36378-01 | - | - | - | - | - | - |
| 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 | 227-36354-01 | - | 221-75719-25 | 221-75719-30 | 221-75719-60 | - |
| | 0.50 µm | -60 to 330/350 °C | - | - | - | - | 227-36097-01 | 227-36097-02 | - |
| | 1.0 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 | 227-36108-03 |
| | 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 | - |
| | 1.0 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 | - |
| | 3.0 µm | -60 to 280/300 °C | - | - | - | - | 227-36102-01 | 227-36102-02 | 227-36102-03 |
| | 4.0 µm | -60 to 280/300 °C | - | - | - | - | 227-36103-01 | - | - |
| 0.53 mm | 5.0 µm | -60 to 260/280 °C | - | 227-36108-04 | - | - | 221-75728-30 | 221-75728-60 | - |
| | 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 | 227-36108-05 |
| | 1.0 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 | - |
| | 3.0 µm | -60 to 270/290 °C | - | - | - | - | 221-75733-30 | 221-75733-60 | 227-36108-06 |
| | 5.0 µm | -60 to 270/290 °C | - | 227-36108-07 | - | - | 221-75734-30 | 221-75734-60 | 227-36108-05 |
| 7.0 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-1 PONA

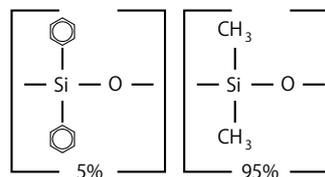
Compatible with ASTM and CGSB for hydrocarbon analysis.

| ID | df | Temp. Range | 50 m | 100 m | 150 m |
|---------|---------|-------------------|--------------|--------------|--------------|
| 0.20 mm | 0.50 µm | -60 to 300/340 °C | 227-36368-01 | - | - |
| 0.25 mm | 0.50 µm | -60 to 300/340 °C | - | 221-76196-00 | - |
| 1.0 mm | 0.25 µm | -60 to 300/340 °C | - | - | 227-36361-01 |

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 Integrated Guard column, please refer to page 205.

| 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 | 227-36111-02 | 221-76178-25 | 221-76178-30 | 227-36111-01 |
| | 1.0 µm | -60 to 320/340 °C | 227-36112-02 | – | 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 |
| | 1.0 µm | -60 to 320/350 °C | – | – | – | 221-75705-60 |
| | | -60 to 325/350 °C | – | – | 221-75705-30 | – |
| | | -60 to 330/350 °C | – | 227-36352-01 | – | – |
| | 1.50 µm | -60 to 310/330 °C | – | – | 221-76181-30 | 227-36115-01 |
| 3.0 µm | -60 to 280/300 °C | – | – | 227-36116-01 | 227-36116-02 | |
| 0.53 mm | 0.10 µm | -60 to 320/340 °C | 227-36117-02 | – | 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 | 227-36119-02 | – | 221-75709-30 | 227-36119-01 |
| | 1.0 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 |
| | 3.0 µm | -60 to 270/290 °C | – | – | 221-75712-30 | 227-36121-01 |
| | 5.0 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 199.

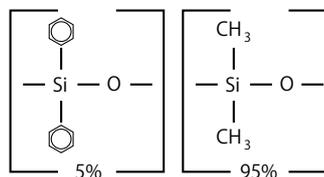
Capillary Columns

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

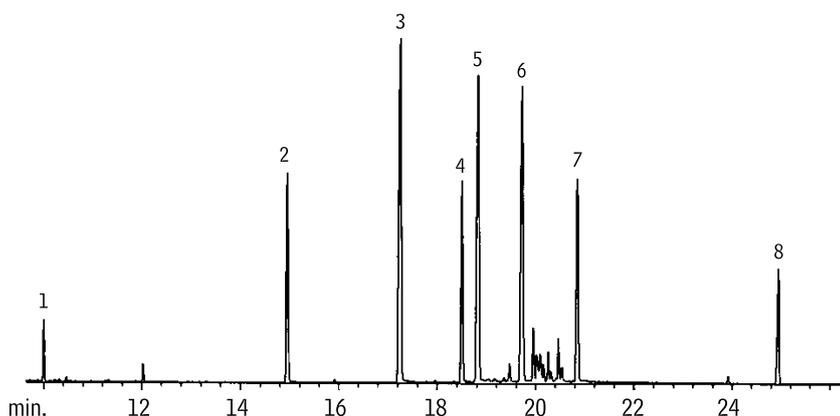


For SH-5MS columns with Integrated Guard column, please refer to page 205.

| 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 |
| | 1.0 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 |
| | 1.0 µm | -60 to 325/350 °C | – | 227-36127-01 | – |
| 0.53 mm | 0.50 µm | -60 to 320/340 °C | – | 221-76191-30 | – |
| | 1.0 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

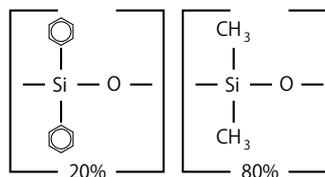
Conditions

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
 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

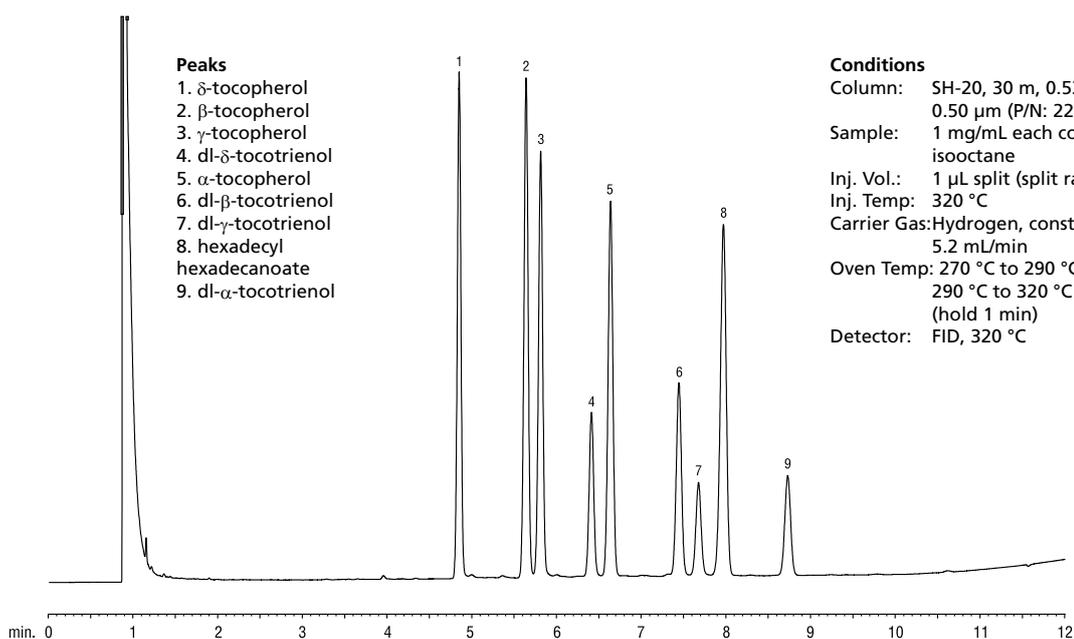
- Mid-polarity phase: Crossbond™ 20% diphenyl / 80% dimethyl polysiloxane
- General-purpose columns for volatile compounds, flavor compounds, alcoholic beverages.
- Equivalent to USP G28 and G32 phases.
- Similar phases: SPB-20, 007-20, AT-20, EC-20

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 | - |
| | 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 | - |
| | 1.0 µm | -20 to 280/300 °C | 227-36133-01 | 227-36133-02 |
| 0.32 mm | 0.25 µm | -20 to 300/320 °C | 227-36135-01 | - |
| | 0.50 µm | -20 to 290/310 °C | 227-36136-01 | - |
| | 1.0 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 |
| | 3.0 µm | -20 to 250/270 °C | 227-36139-01 | 227-36139-02 |
| 0.53 mm | 0.10 µm | -20 to 260/280 °C | - | - |
| | 0.25 µm | -20 to 260/280 °C | - | - |
| | 0.50 µm | -20 to 260/280 °C | 227-36142-01 | - |
| | 1.0 µm | -20 to 260/280 °C | 227-36143-01 | - |
| | 1.50 µm | -20 to 250/270 °C | 227-36144-01 | - |
| | 3.0 µm | -20 to 240/260 °C | 227-36145-01 | - |

Tocopherols and Tocotrienols



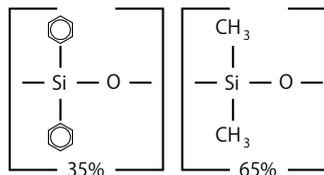
Capillary Columns

General-Purpose Columns

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-35MS Structure



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 |
| | 1.0 µm | 40 to 290 °C | 227-36149-01 | 227-36149-02 |
| 0.32 mm | 0.25 µm | 40 to 320 °C | 227-36151-01 | 227-36151-02 |
| | 0.50 µm | 40 to 310 °C | 227-36152-01 | – |
| | 1.0 µm | 40 to 290 °C | 227-36153-01 | – |
| | 1.50 µm | 40 to 270/290 °C | 227-36154-01 | – |
| | 3.0 µm | 40 to 250/270 °C | 227-36155-01 | 227-36155-02 |
| 0.53 mm | 0.50 µm | 40 to 300 °C | 227-36158-01 | – |
| | 1.0 µm | 40 to 290 °C | 227-36159-01 | 227-36159-02 |
| | 1.50 µm | 40 to 280 °C | 227-36160-01 | – |
| | 3.0 µm | 40 to 240/260 °C | 227-36161-01 | – |

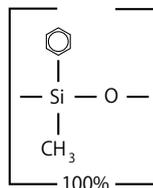
SH-35MS (Low-bleed phase for GCMS analysis)

| ID | df | Temp. Range | 30 m |
|---------|---------|--------------|--------------|
| 0.25 mm | 0.25 µm | 40 to 320 °C | 221-75835-30 |

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

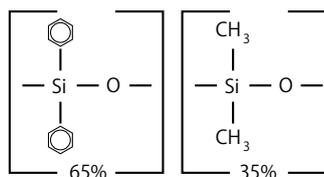


| ID | df | Temp. Range | 10 m | 30 m | 60 m |
|---------|---------|------------------|--------------|--------------|--------------|
| 0.25 mm | 0.25 µm | 40 to 300/320 °C | – | 227-36162-01 | 227-36162-02 |
| | 0.50 µm | 40 to 290/310 °C | – | 227-36163-01 | – |
| | 1.0 µm | 40 to 280/300 °C | – | 227-36164-01 | 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 |
| | 1.0 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 | – |
| | 1.0 µm | 40 to 260/280 °C | – | 227-36170-01 | 227-36170-02 |
| | 1.50 µm | 40 to 250/270 °C | – | 227-36171-01 | – |
| | 2.0 µm | – | 227-36171-03 | – | – |

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 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 |
| | 1.0 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 |
| | 1.0 µm | 50 to 260/280 °C | 227-36177-01 |
| 0.53 mm | 1.0 µm | 50 to 250/270 °C | 227-36178-01 |

Capillary Columns

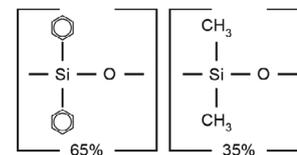
General-Purpose Columns

SH-65TG

- Application-specific columns, specially tested for triglycerides.

The SH-65TG phase resolves triglycerides by degree of unsaturation as well as by carbon number.

■ SH-65TG Structure

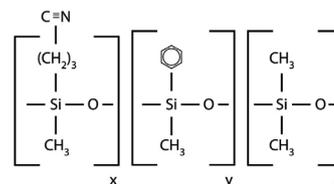


| ID | df | Temp. Range | 15 m | 30 m |
|---------|---------|--------------|--------------|--------------|
| 0.25 mm | 0.10 μm | 40 to 370 °C | 227-36325-01 | 227-36325-02 |

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 Integrated Guard column, please refer to page 205.

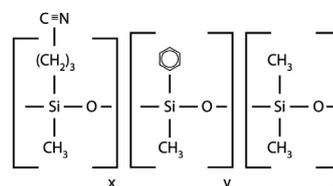
| ID | df | Temp. Range | 30 m | 60 m |
|---------|---------|---------------|--------------|--------------|
| 0.25 mm | 0.25 μm | -20 to 280 °C | 221-76194-30 | 221-76194-60 |
| | 0.50 μm | -20 to 270 °C | 227-36203-01 | - |
| | 1.0 μm | -20 to 260 °C | 227-36204-01 | 227-36204-02 |
| | 1.40 μm | -20 to 240 °C | - | 227-36205-01 |
| 0.32 mm | 0.25 μm | -20 to 280 °C | 227-36206-01 | - |
| | 0.50 μm | -20 to 270 °C | 227-36207-01 | - |
| | 1.0 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 |
| | 1.0 μm | -20 to 260 °C | 227-36213-01 | 227-36213-02 |
| | 1.50 μm | -20 to 250 °C | 227-36214-01 | - |
| | 3.0 μm | -20 to 240 °C | 221-75776-30 | 221-75776-60 |

* 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-1301

■ SH-624 Structure



For SH-624 columns with Integrated Guard column, please refer to page 205.

| ID | df | Temp. Range | 20 m | 30 m | 40 m | 50 m | 60 m | 75 m | 105 m |
|---------|---------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 0.10 mm | 0.50 μm | -20 to 240 °C | 227-36332-01 | - | - | - | - | - | - |
| 0.18 mm | 1.0 μm | -20 to 240 °C | 227-36259-01 | - | 227-36259-02 | - | - | - | - |
| 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 | - | 227-36347-01 | 221-75864-60 | - | - |
| 0.53 mm | 3.0 μm | -20 to 240 °C | - | 221-75865-30 | - | - | 221-75865-60 | 221-75865-75 | 227-36215-02 |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

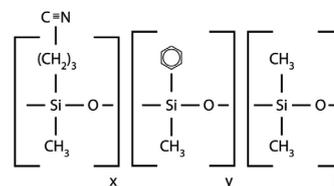
Capillary Columns

General-Purpose Columns

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, SPB-1701

SH-1701 Structure

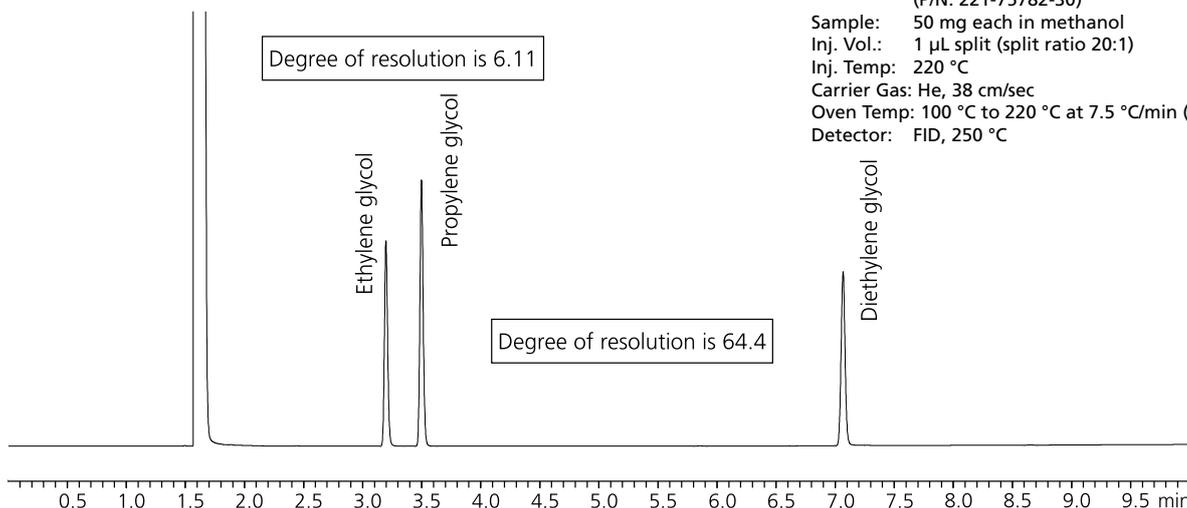


For SH-1701 columns with Integrated Guard column, please refer to page 205.

| ID | df | Temp. Range | 15 m | 30 m | 40 m | 60 m |
|---------|---------|-------------------|--------------|--------------|--------------|--------------|
| 0.18 mm | 0.20 μm | -20 to 280 °C | - | - | 227-36216-03 | - |
| 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 |
| | 1.0 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 | - | - |
| | 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 |
| | 1.0 μm | -20 to 260/280 °C | - | 221-75782-30 | - | 221-75782-60 |
| 0.53 mm | 1.50 μm | -20 to 240/260 °C | - | 227-36222-01 | - | 227-36222-02 |
| | 0.10 μm | -20 to 270/280 °C | - | 227-36223-01 | - | - |
| | 0.25 μm | -20 to 270/280 °C | - | 227-36224-01 | - | - |
| | 0.50 μm | -20 to 260/270 °C | - | 227-36225-01 | - | - |
| | 1.0 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 |
| | 3.0 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



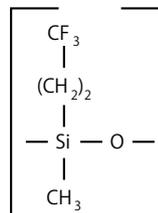
Conditions

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 | 100 m | 105 m |
|---------|---------|-------------------|--------------|--------------|--------------|--------------|
| 0.25 mm | 0.10 μm | -20 to 320/340 °C | – | – | – | – |
| | 0.25 μm | -20 to 320/340 °C | 227-36180-01 | 227-36180-02 | – | 227-36180-03 |
| | 0.50 μm | -20 to 310/330 °C | 227-36181-01 | 227-36181-02 | – | – |
| | 1.0 μm | -20 to 290/310 °C | 221-75800-30 | 227-36182-01 | 227-36182-02 | – |
| 0.32 mm | 0.10 μm | -20 to 320/340 °C | 227-36183-01 | – | – | – |
| | 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 | – | – |
| | 1.0 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 | – | – | – | – |
| | 0.25 μm | -20 to 310/330 °C | 227-36189-01 | – | – | – |
| | 0.50 μm | -20 to 300/320 °C | 227-36190-01 | 227-36190-02 | – | – |
| | 1.0 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 | – | – |
| | 3.0 μm | -20 to 260/280 °C | 227-36193-01 | 227-36193-02 | 227-36193-03 | – |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

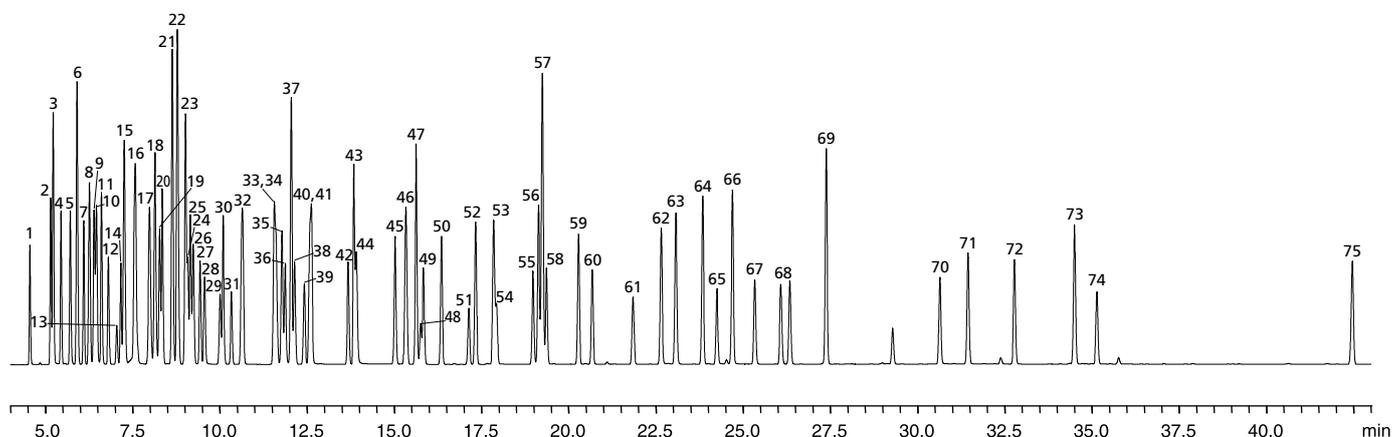
SH-200MS (Low-bleed phase for GCMS analysis)

| 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 |
| | 1.0 μm | -20 to 290/310 °C | 227-36196-01 |
| 0.32 mm | 0.25 μm | -20 to 320/340 °C | 221-75814-30 |
| | 0.50 μm | -20 to 310/330 °C | 227-36198-01 |
| | 1.0 μm | -20 to 290/310 °C | 227-36199-01 |
| 0.53 mm | 0.50 μm | -20 to 300/320 °C | 227-36200-01 |
| | 1.0 μm | -20 to 290/310 °C | 227-36201-01 |
| | 1.50 μm | -20 to 280/300 °C | 227-36202-01 |

Capillary Columns

General-Purpose Columns

Analysis of Organic Solvents



Peaks

- | | | |
|--|---|---|
| 1. Methanol | 27. 1,2-Dimethoxyethane | 63. Cyclohexanol |
| 2. Ethanol | 28. Ethylene Glycol Monomethyl Ether | 64. 1,1,2,2-Tetrachloroethane |
| 3. Acetaldehyde + Ethyl Ether | 29. Ethylenechlorohydrin | 65. Isoamyl Acetate |
| 4. 1,1-Dichloroethylene | 30. Methyl Ethyl Ketone | 66. Butyl Acrylate |
| 5. Isopropanol | 31. Nitromethane | 67. Ethylene Glycol Monobutyl Ether |
| 6. Dichloromethane + Hexane | 32. Propylene Glycol Monomethyl Ether + Isopropyl Acetate | 68. Anisole + Propylene Glycol Monomethyl Ether Acetate |
| 7. trans-1,2-Dichloroethylene | 33. Ethyl Acrylate | 69. n-Amyl Acetate |
| 8. tert.-Butanol | 34. Isoamyl Alcohol | 70. Ethylene Glycol Monoethyl Ether Acetate |
| 9. tert.-Butyl Methyl Ether | 35. Methyl Methacrylate | 71. N,N-Dimethylformamide |
| 10. Isopropyl Ether | 36. Ethylene Glycol Monoethyl Ether | 72. Isooctanol |
| 11. n-Propanol | 37. Toluene | 73. Cyclohexanone |
| 12. Ethyl Formate | 38. 1,4-Dioxane | 74. o-Dichlorobenzene |
| 13. Chloroform | 39. tetrachloroethylene | 75. Diethylene Glycol Monoethyl Ether |
| 14. Methyl Acetate | 40. n-Propyl Acetate | 76. Benzyl Alcohol |
| 15. Cyclohexane | 41. n-Amyl Alcohol | 77. N,N-Dimethylacetamide |
| 16. Tetrachloromethane + sec.-Butanol | 42. Epichlorohydrin | 78. Dimethyl Sulfoxide |
| 17. Isooctane | 43. Pyridine | 79. Tetralin |
| 18. Isobutanol + 1,1,1-Trichloroethane | 44. Ethylene Glycol Monoisopropyl Ether | 80. Diethylene Glycol Monobutyl Ether |
| 19. Acetonitrile | 45. Isobutyl Acetate | 81. 2-Ethylhexyl Acrylate |
| 20. Acrylonitrile | 46. Methyl Isobutyl Ketone + Ethylbenzene | 82. N-Methylpyrrolidone |
| 21. Benzene | 47. Chlorobenzene | 83. Isophorone |
| 22. Tetrahydrofuran + methylcyclohexane | 48. p-Xylene | 84. 1,3-Dimethyl-2-Imidazolidinone |
| 23. Methyl Acrylate + 1,2-Dichloroethane | 49. m-Xylene | 85. Sulfolane |
| 24. Trichloroethylene | 50. n-Butyl Acetate | |
| 25. n-Butanol | 51. o-Xylene | |
| 26. Ethyl Acetate | 52. Methyl Butyl Ketone | |

Conditions

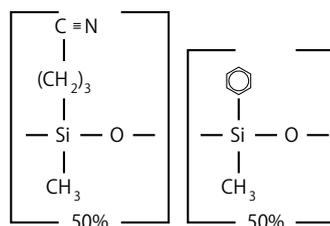
Instrument: GC-2010
 Column: SH-200, 60 m, 0.32 mm ID, 1.00 μ m (P/N: 227-36186-02)
 Injection: Split (split ratio: 50:1)
 Inj. Temp: 250 $^{\circ}$ C
 Carrier Gas: He, constant linear velocity mode, 25 cm/sec
 Oven Temp: 40 $^{\circ}$ C (0 min) to 310 $^{\circ}$ C at 4 $^{\circ}$ C/min
 Detector: FID, 330 $^{\circ}$ C

For information on connection parts for capillary columns, please refer to page 218.

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 | 0.25 µm | 40 to 220/240 °C | 227-36232-01 | - |
| | 0.50 µm | 40 to 220/240 °C | 227-36233-01 | - |
| | 1.0 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 | - |
| | 1.0 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-440

- General-purpose columns with unique selectivity for pesticides, PAHs, or other semivolatiles. Ideal for low/trace-level analyses.
- Low-bleed, high-resolution columns with unique selectivity.

| ID | df | Temp. Range | 20 m | 30 m |
|---------|---------|------------------|--------------|--------------|
| 0.18 mm | 0.18 µm | 20 to 320 °C | 227-36340-02 | - |
| 0.25 mm | 0.25 µm | 20 to 320/340 °C | - | 227-36340-01 |
| 0.32 mm | 0.25 µm | 20 to 320/340 °C | - | 227-36340-03 |

SH-502.2

- Application-specific columns with unique selectivity for volatile organic pollutants. The SH-502.2 column is cited in U.S. EPA Method 502.2 and in many gasoline range organics (GRO) methods for monitoring underground storage tanks.
- Excellent separation of trihalomethanes; ideal polarity for light hydrocarbons and aromatics.
- Similar phase: DB-502.2

The SH-502.2 column will enable you to quantify all compounds listed in U.S. EPA methods 502.2 or 524.2, whether you use a mass spectrometer or a PID in tandem with an ELCD. The diphenyl/dimethyl polysiloxane based SH-502.2 stationary phase provides low bleed and thermal stability to 270 °C. A 105-meter column can separate the light gases specified in EPA methods without subambient cooling. Narrow bore columns can interface directly in GC/MS systems.

| ID | df | Temp. Range | 30 m | 40 m | 60 m | 75 m | 105 m |
|---------|---------|-------------------|--------------|------|--------------|--------------|--------------|
| 0.25 mm | 1.40 µm | -20 to 250/270 °C | 227-36341-04 | - | 227-36341-03 | - | - |
| 0.32 mm | 1.80 µm | -20 to 250/270 °C | 227-36341-01 | - | - | - | 227-36341-02 |
| 0.45 mm | 2.55 µm | -20 to 250/270 °C | - | - | - | 227-36341-05 | - |
| 0.53 mm | 3.0 µm | -20 to 250/270 °C | - | - | 227-36341-06 | - | 227-36341-07 |

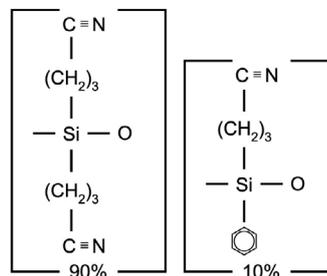
Capillary Columns

General-Purpose Columns

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 | 105 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 | 227-36239-03 |
| 0.32 mm | 0.20 μm | 0 to 260/275 °C | 227-36241-01 | 227-36241-02 | - |
| 0.53 mm | 0.20 μm | 0 to 260/275 °C | 227-36243-01 | - | - |

* Maximum temperatures listed are for shorter length columns. Longer columns may have a different maximum temperature.

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 phases: HP-88, CP Sil 88, SBP-2560

| ID | df | Temp. Range | 50 m | 100 m |
|---------|---------|--------------|--------------|--------------|
| 0.25 mm | 0.20 μm | 20 to 250 °C | 227-36311-04 | 227-36311-01 |

SH-2887

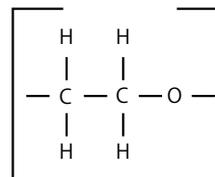
- Nonpolar phase: Crossbond™ 100% dimethyl polysiloxane
- Application-specific column for simulated distillation.
- Guarantee a stable baseline with low bleed and reproducible retention times.
- Similar phase: DB-2887, Petrocol 2887, Petrocol EX2887

| ID | df | Temp. Range | 10 m |
|---------|---------|---------------|--------------|
| 0.53 mm | 2.65 μm | -60 to 360 °C | 227-36373-01 |

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

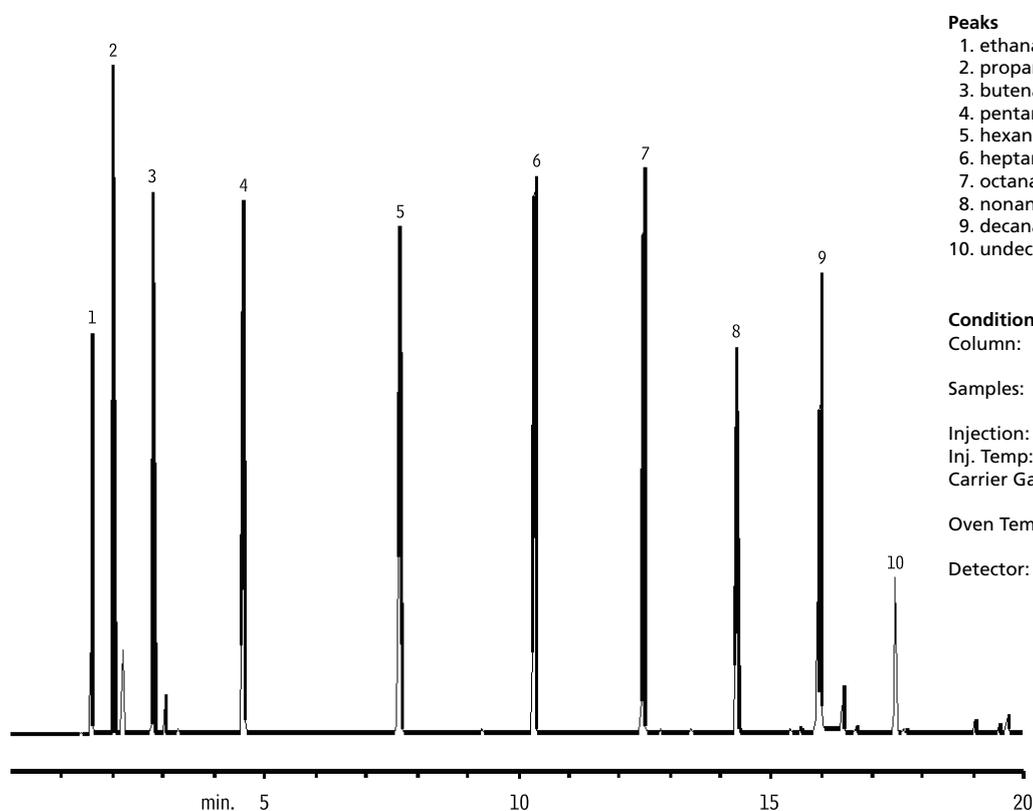
■ SH-Wax Structure



| ID | df | Temp. Range | 15 m | 20 m | 30 m | 50 m | 60 m |
|---------|---------|------------------|--------------|--------------|--------------|--------------|--------------|
| 0.10 mm | 0.10 µm | 20 to 250 °C | – | 227-36356-01 | – | – | – |
| 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 |
| | 1.0 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 |
| | 1.0 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, 0.25 mm ID, 0.50 µm (P/N: 221-75894-30)
 Samples: 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

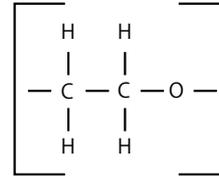
Capillary Columns

General-Purpose Columns

SH-PolarWax

- 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

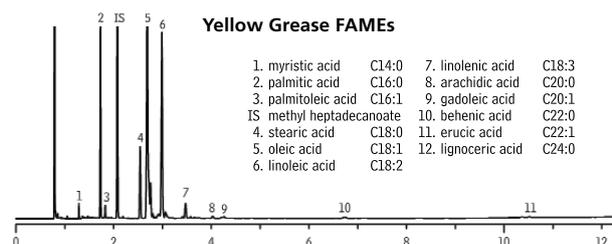
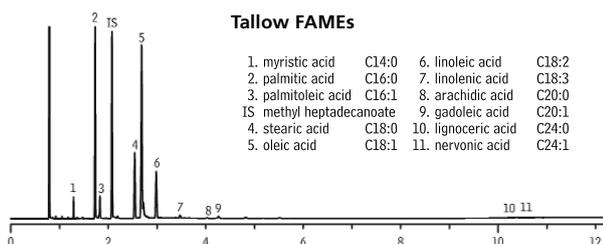
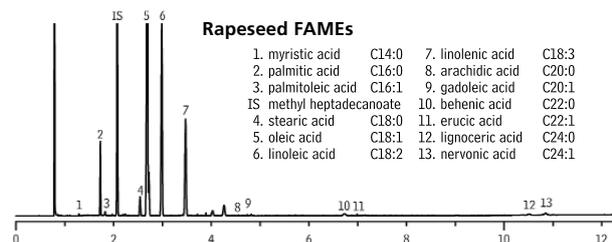
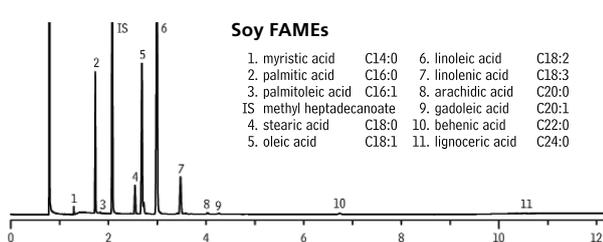
SH-PolarWax Structure



| ID | df | Temp. Range | 10 m | 15 m | 20 m | 30 m | 50 m | 60 m |
|---------|---------|------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 0.10 mm | 0.10 µm | 40 to 250/260 °C | 227-36343-01 | - | - | - | - | - |
| 0.18 mm | 0.18 µm | 40 to 250 °C | - | - | 227-36357-01 | - | - | - |
| 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 °C | - | - | - | 227-36249-01 | - | - |
| | 0.25 µm | 40 to 250/260 °C | - | - | - | 221-75972-30 | - | 227-36250-01 |
| | 0.50 µm | 40 to 250/260 °C | - | 227-36251-02 | - | 227-36251-01 | - | 221-75975-60 |
| | 1.0 µm | 40 to 240/260 °C | - | - | - | 227-36252-01 | - | 227-36252-02 |
| 0.53 mm | 0.10 µm | 40 to 250 °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 |
| | 1.0 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 |
| | 2.0 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.

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)
 Det.: FID, 250 °C

Capillary Columns

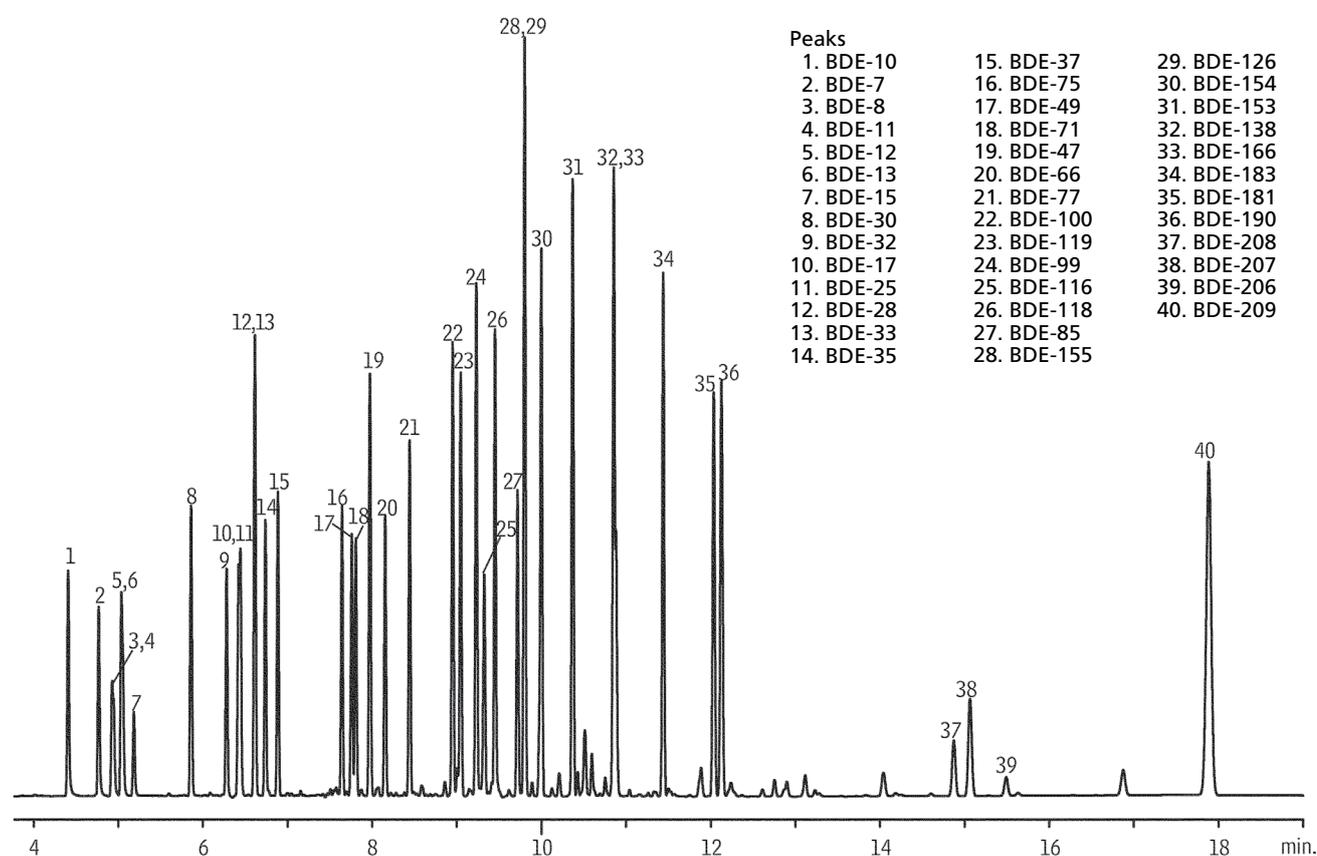
Dedicated Columns

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 μ m | -60 to 330/360 $^{\circ}$ C | 227-36265-01 | 227-36265-02 |

Brominated Flame Retardants



Conditions

Column: SH-1614, 15 m, 0.25 mm ID, 0.10 μ m (P/N: 227-36265-01)
 Sample: 100-300 ppb PBDE PAR Solution
 500 ppb decabromodiphenyl ether
 Inj. Vol.: 1 μ L splitless (hold 1 min),
 Inj. Temp: 340 $^{\circ}$ C
 Carrier Gas: He, constant flow, linear velocity 60 cm/sec., 120 $^{\circ}$ C
 Oven Temp: 120 $^{\circ}$ C (hold 1 min) to 275 $^{\circ}$ C at 15 $^{\circ}$ C/min to 300 $^{\circ}$ C at 5 $^{\circ}$ C/min (hold 5 min)
 Detector: μ -ECD, 345 $^{\circ}$ C

Capillary Columns

Dedicated Columns

SH-OPP

- Application-specific columns for 53 organophosphorus pesticides (OPP) listed in EPA Method 1841.
- Low bleed—ideal for GC-FPD, GC-NPD, or GC-MS analyses.

| ID | df | Temp. Range | 30 m |
|---------|---------|-------------------|--------------|
| 0.32 mm | 0.50 μm | -20 to 310/330 °C | 227-36377-01 |

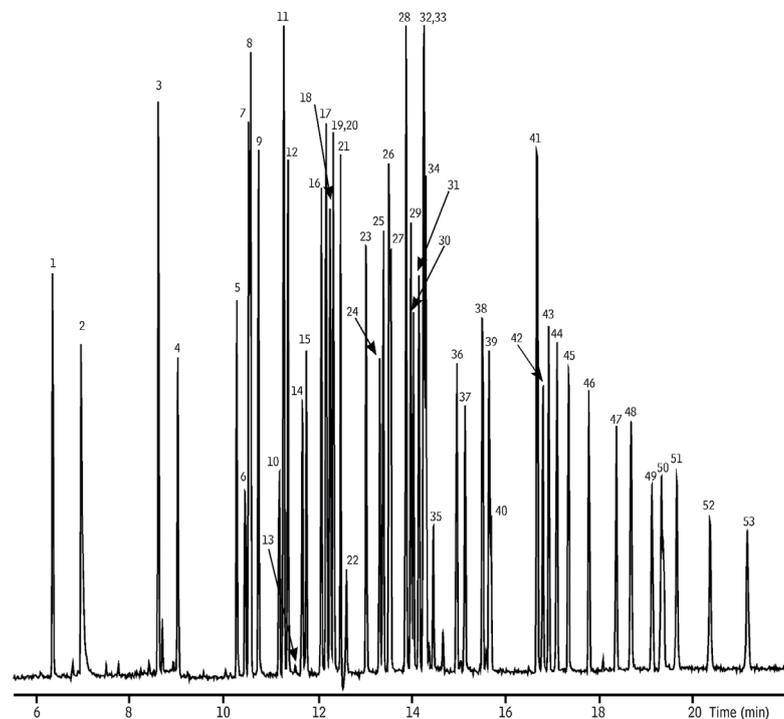
SH-OPP2

- 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 | 8. Thionazin | 15. Demeton-S | 22. Phosphamidon isomer (breakdown product) |
| 2. Hexamethylphosphoramide | 9. Ethoprop | 16. Terbufos | 23. Dichlorofenthion |
| 3. Mevinphos | 10. Naled | 17. Dimethoate | 24. Phosphamidon |
| 4. Trichlorfon | 11. Sulfotepp | 18. Diazinon | 25. Chlorpyrifos methyl |
| 5. TEPP | 12. Phorate | 19. Dioxathion | 26. Methyl parathion |
| 6. Demeton-O | 13. Dicrotophos | 20. Fonophos | 27. Ronnel |
| 7. Tributyl phosphate (SS) | 14. Monocrotophos | 21. Disulfoton | 28. Aspon |



Conditions

| | |
|--|------------------------------|
| Columns: 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

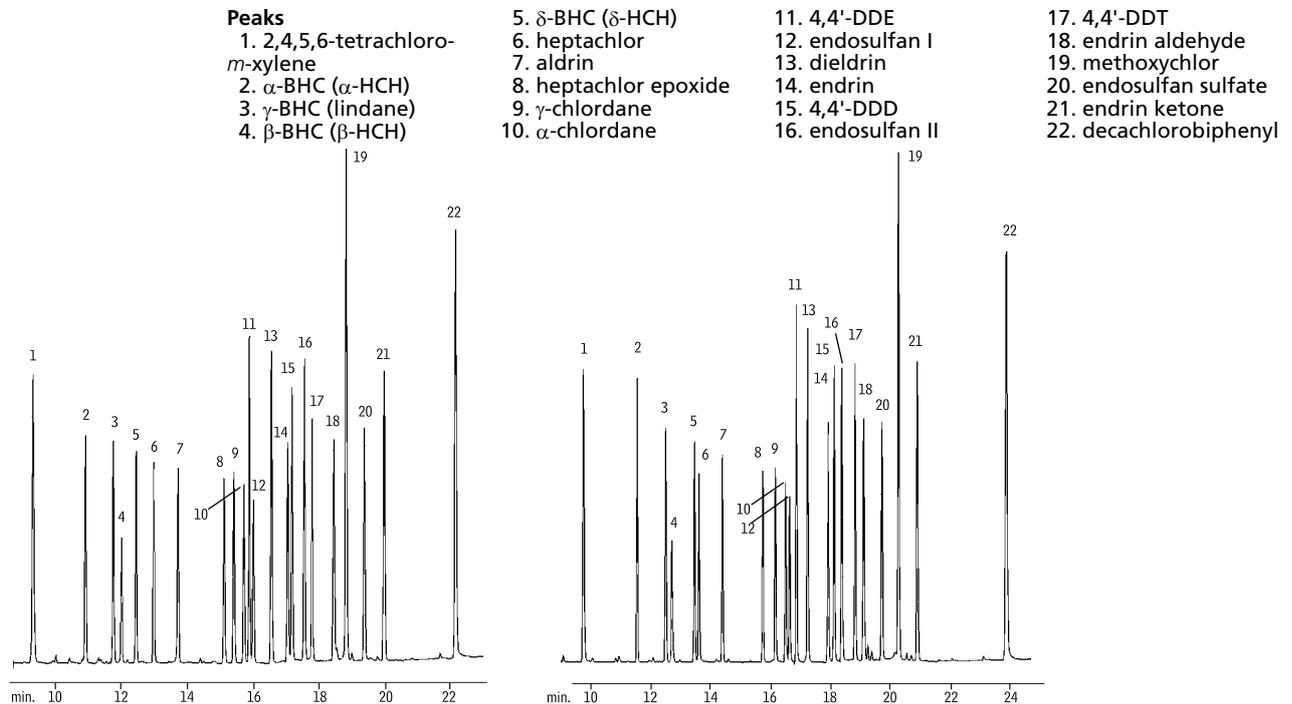
SH-CLP

| ID | df | Temp. Range | 20 m | 30 m |
|---------|---------|-------------------|--------------|--------------|
| 0.18 mm | 0.18 µm | -60 to 320/340 °C | 227-36266-02 | - |
| 0.32 mm | 0.32 µm | -60 to 320/340 °C | - | 227-36266-01 |
| | 0.50 µm | -60 to 320/340 °C | - | 221-75879-30 |

SH-CLP II

| ID | df | Temp. Range | 30 m |
|---------|---------|-------------------|--------------|
| 0.25 mm | 0.25 µm | -60 to 320/340 °C | 227-36267-02 |
| 0.32 mm | 0.25 µm | -60 to 320/340 °C | 227-36267-01 |
| | 0.50 µm | -60 to 320/340 °C | 227-36267-03 |

Organochlorine Pesticides (US EPA Method 8081)



Conditions

Column: SH-CLP, 30 m, 0.32 mm ID, 0.50 µm
(P/N: 221-75879-30)
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

SH-CLP II, 30 m, 0.32 mm ID, 0.25 µm
(P/N: 227-36267-01)

Capillary Columns Dedicated Columns

SH-VMS

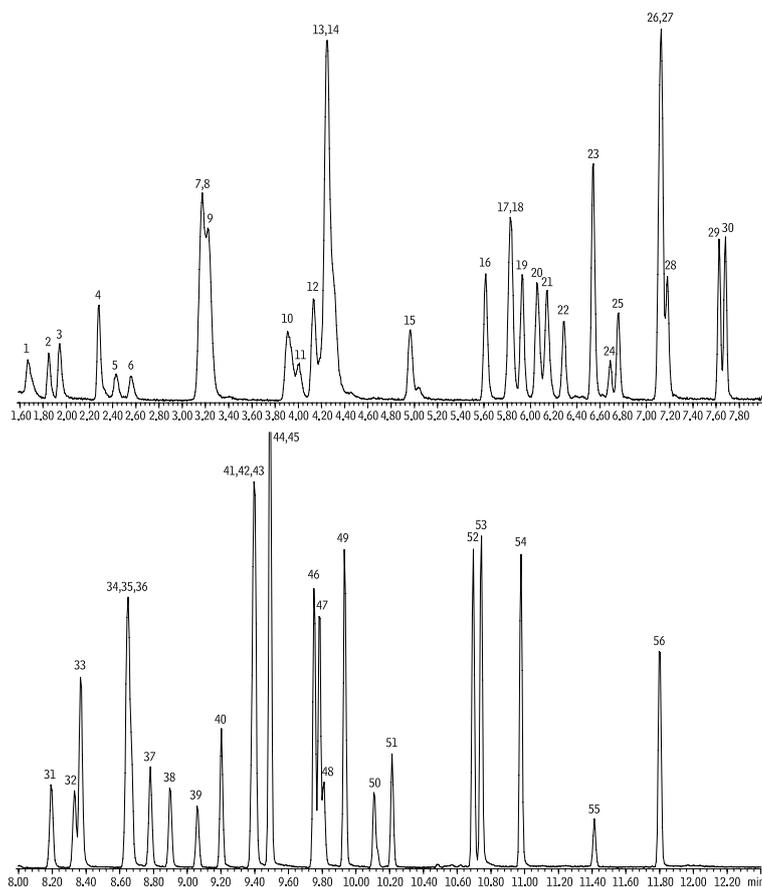
- Dedicated columns for analyzing volatile organic pollutants by GCMS including methods TO-15, TMS, and EPA 8260.
- Complete separation of U.S. EPA Method 8260 compounds in less than 10 minutes.

| ID | df | Temp. Range | 20 m | 30 m | 40 m | 60 m |
|---------|---------|-------------------|--------------|--------------|--------------|--------------|
| 0.18 mm | 1.0 µm | -40 to 240/260 °C | 227-36412-01 | - | 227-36412-02 | - |
| 0.25 mm | 1.40 µm | | - | 227-36268-01 | - | 227-36268-02 |
| 0.32 mm | 1.80 µm | | - | 227-36269-01 | - | 227-36269-02 |
| 0.45 mm | 2.55 µm | | - | - | - | 227-36348-01 |
| 0.53 mm | 3.0 µm | | - | 227-36353-01 | - | - |

Volatile Organics (US EPA CLP 04.1)

Peaks

- dichlorodifluoromethane
- chloromethane
- vinyl chloride
- bromomethane
- chloroethane
- trichlorofluoromethane
- 1,1-dichloroethene
- carbon disulfide
- 1,1,2-trichloro-1,2,2-trifluoroethane
- methylene chloride
- acetone
- trans*-1,2-dichloroethene
- methyl acetate
- methyl *tert-butyl* ether
- 1,1-dichloroethane
- cis*-1,2-dichloroethane
- cyclohexane
- bromochloromethane (IS)
- chloroform
- carbon tetrachloride
- 1,1,1-trichloroethane
- 2-butanone
- benzene
- 1,2-dichloroethane-d4 (SS)
- 1,2-dichloroethane
- methylcyclohexane
- trichloroethene
- 1,4-difluorobenzene (IS)
- 1,2-dichloropropane
- bromodichloromethane
- cis*-1,3-dichloropropene
- toluene d8 (SS)
- toluene
- tetrachloroethane
- 4-methyl-2-pentanone
- trans*-1,3-dichloropropane
- 1,1,2-trichloroethane
- dibromochloromethane
- 1,2-dibromoethane
- 2-hexanone
- chlorobenzene d5 (IS)
- chlorobenzene
- ethylbenzene
- m*-xylene
- p*-xylene
- o*-xylene
- styrene
- bromoform
- isopropylbenzene
- 4-bromofluorobenzene (SS)
- 1,1,2,2-tetrachloroethane
- 1,3-dichlorobenzene
- 1,4-dichlorobenzene
- 1,2-dichlorobenzene
- 1,2-dibromo-3-chloropropane
- 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_g/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

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: CP-Volamine

The SH-Volatile Amine column was designed specifically for analyzing volatile amines in difficult matrices, such as water. The unique base deactivation creates an exceptionally inert surface for these sensitive compounds, resulting in highly symmetrical peaks, which allow low detection limits. The stable bonded phase yields a column that is not only retentive and highly selective for these compounds but is also very robust and able to withstand repeated water injections.

| ID | df | Temp. Range | 30 m | 60 m |
|---------|--------|-------------------|--------------|--------------|
| 0.32 mm | 5.0 µm | -60 to 270/290 °C | 227-36326-01 | 227-36326-02 |

SH-PCB

- Unique polymer for PCBs analysis by GC-ECD or GC-MS.
- Good results for other semivolatiles.
- Low polarity; inert to active compounds.

| ID | df | Temp. Range | 30 m | 60 m |
|---------|---------|------------------|--------------|--------------|
| 0.18 mm | 0.18 µm | 30 to 320/340 °C | – | 227-36310-03 |
| 0.25 mm | 0.25 µm | | 227-36310-04 | 227-36310-01 |

SH-VRX

- Application-specific columns for volatile organic pollutants.
- Excellent for U.S. EPA Method 8021 compounds.

The SH-VRX stationary phase and optimized column dimensions provide low bleed, excellent resolution, and fast analysis times for volatile compounds.

| ID | df | Temp. Range | 20 m | 25 m | 30 m | 60 m |
|---------|---------|-------------------|--------------|--------------|--------------|--------------|
| 0.10 mm | 0.50 µm | -40 to 240/260 °C | – | 227-36331-01 | – | – |
| 0.18 mm | 1.0 µm | | 227-36331-02 | – | – | – |
| 0.25 mm | 1.40 µm | | – | – | 227-36355-01 | 227-36355-02 |
| 0.32 mm | 1.80 µm | | – | – | 227-36355-03 | – |
| 0.53 mm | 3.0 µm | | – | – | 227-36355-04 | – |

Capillary Columns

Dedicated Columns

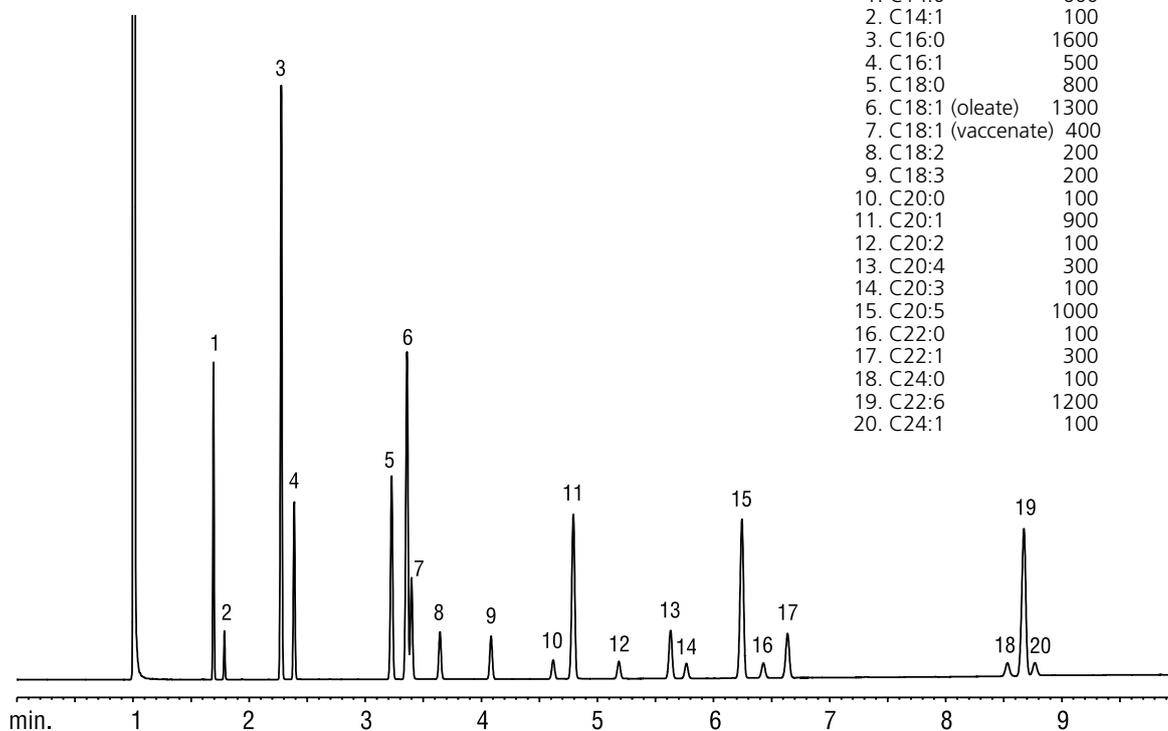
SH-FAME

- 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 240/250 °C | 227-36324-01 |
| 0.32 mm | 0.25 µm | 20 to 240/250 °C | 227-36270-01 |

FAMES (Marine Oil Standard)

| Peak List | 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-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.

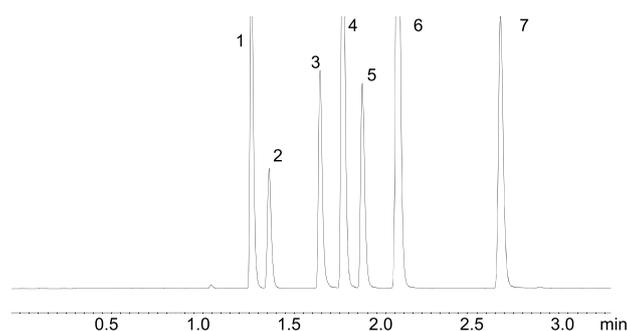
SH-BAC Plus 1

| ID | df | Temp. Range | 30 m |
|---------|--------------------|-----------------------------------|--------------|
| 0.32 mm | 1.80 μm | -20 to 240/260 $^{\circ}\text{C}$ | 227-36260-01 |
| 0.53 mm | 3.0 μm | -20 to 240/260 $^{\circ}\text{C}$ | 227-36261-01 |

SH-BAC Plus 2

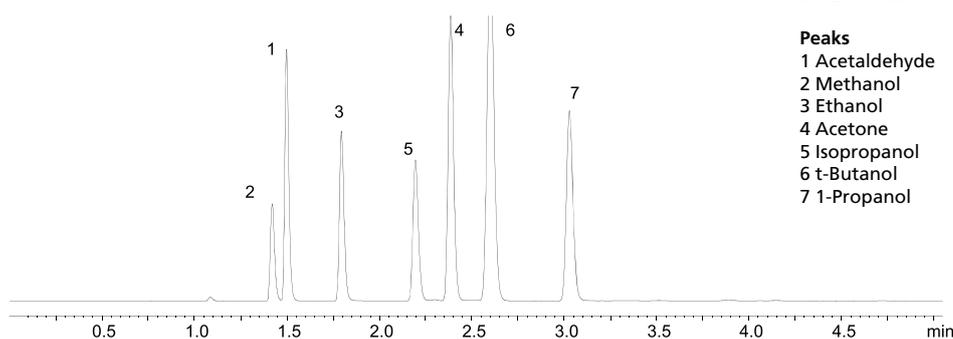
| ID | df | Temp. Range | 30 m |
|---------|--------------------|-----------------------------------|--------------|
| 0.32 mm | 0.60 μm | -20 to 240/260 $^{\circ}\text{C}$ | 227-36263-01 |
| 0.53 mm | 1.0 μm | -20 to 240/260 $^{\circ}\text{C}$ | 227-36264-01 |

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
 Oven Temp.: 85 $^{\circ}\text{C}$
 Vial Warming Time: 15 min
 Vial Pressurization Time: 1 min
 Injection Time: 0.5 min
 Sample Line Temp: 150 $^{\circ}\text{C}$
 Vial Volume: 20 mL
 Vial Agitation: Off
 Vial Pressurization: 100 kPa
 Load Time: 0.5 min
 Needle Flash Time: 0.5 min
 Transfer Line Temp: 150 $^{\circ}\text{C}$

Column: SH-BAC Plus 2, 30 m, 0.32 mm ID, 0.60 μm (P/N: 227-36263-01)
 SH-BAC Plus 1, 30 m, 0.32 mm ID, 1.80 μm (P/N: 227-36260-01)
 Column Temp: 40 $^{\circ}\text{C}$
 Inj.: Split (split ratio: 20:1)
 Carrier Gas: He, 100 kPa
 Detector: FID, 250 $^{\circ}\text{C}$
 Makeup Gas: He, 30 mL/min
 Hydrogen: 40 mL/min
 Air: 400 mL/min

Capillary Columns

Dedicated Columns

SH-5 Amine / SH-35 Amine

- Dedicated columns for amines and other basic compounds, including alkylamines, diamines, triamines, ethanolamines, and nitrogen-containing heterocyclics.

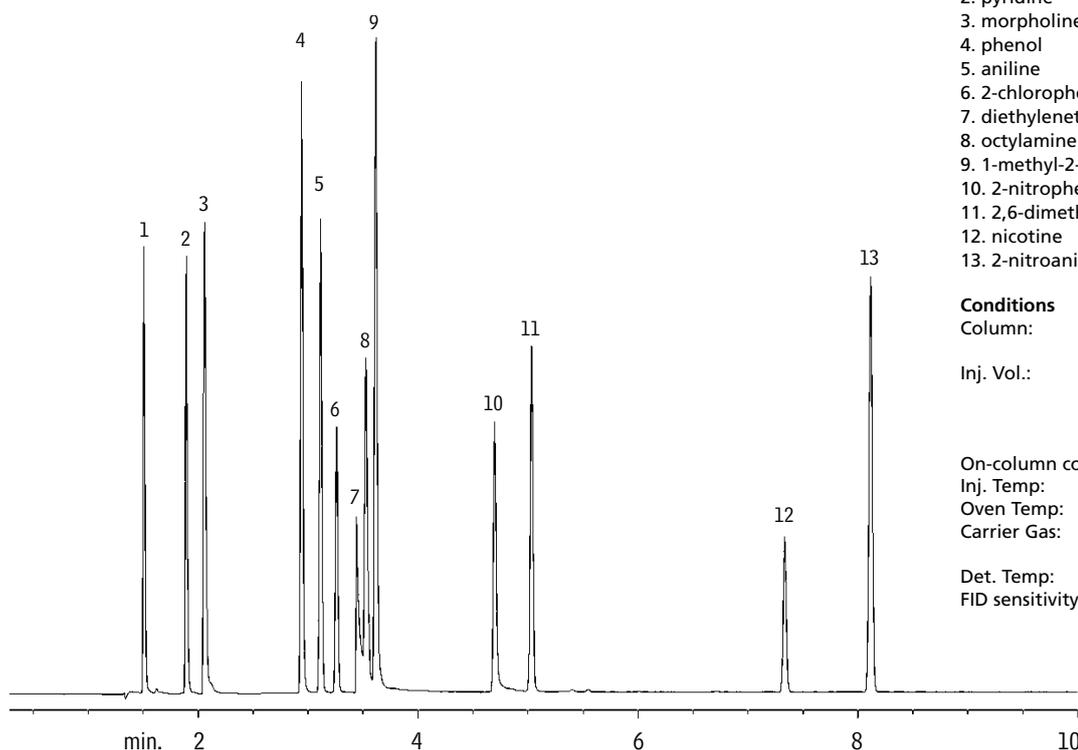
SH-5 Amine (Low-polarity phase: Crossbond™ 5% diphenyl / 95% dimethyl polysiloxane)

| ID | df | Temp. Range | 15 m | 30 m |
|---------|---------|-------------------|--------------|--------------|
| 0.25 mm | 0.25 µm | -60 to 315 °C | - | 227-36282-01 |
| | 0.50 µm | -60 to 300/315 °C | 227-36323-01 | 227-36283-01 |
| | 1.0 µm | -60 to 300/315 °C | 227-36323-02 | 227-36284-01 |
| 0.32 mm | 1.0 µm | -60 to 300/315 °C | 227-36332-03 | 227-36332-02 |
| | 1.50 µm | -60 to 290/305 °C | - | 227-36285-01 |
| 0.53 mm | 1.0 µm | -60 to 290/305 °C | - | 227-36286-01 |
| | 3.0 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 | 15 m | 30 m |
|---------|---------|-------------|--------------|--------------|
| 0.25 mm | 0.50 µm | 0 to 220 °C | - | 227-36288-01 |
| | 1.0 µm | 0 to 220 °C | - | 227-36289-01 |
| 0.32 mm | 1.0 µm | 0 to 220 °C | - | 227-36290-01 |
| | 1.50 µm | 0 to 220 °C | - | 227-36291-01 |
| 0.53 mm | 1.0 µm | 0 to 220 °C | 227-36280-03 | 227-36292-01 |
| | 3.0 µm | 0 to 220 °C | - | 227-36293-01 |

Amines & Phenols



Peaks

- diethylamine
- pyridine
- morpholine
- phenol
- aniline
- 2-chlorophenol
- diethylenetriamine
- octylamine
- 1-methyl-2-pyrrolidinone
- 2-nitrophenol
- 2,6-dimethylaniline
- nicotine
- 2-nitroaniline

Conditions

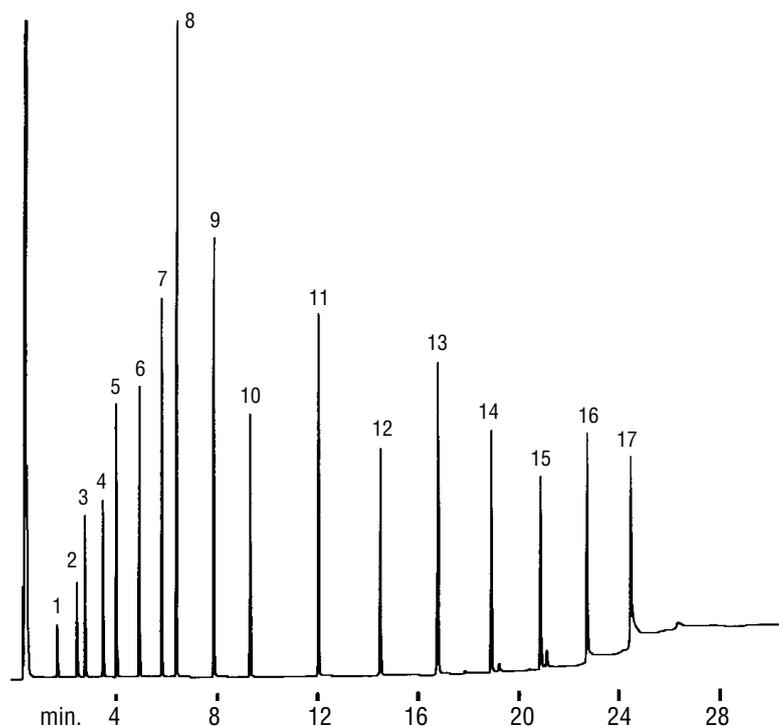
Column: SH-5 Amine, 30 m, 0.32 mm ID, 1.00 µm (P/N: 227-36290-01)
 Inj. Vol.: 1 µL split injection of miscellaneous amines and phenols in water (split ratio: 25:1)
 On-column conc.: 22 ng
 Inj. Temp: 305 °C
 Oven Temp: 120 °C to 220 °C at 10 °C/min
 Carrier Gas: Hydrogen, linear velocity 38cm/sec. set at 120 °C
 Det. Temp: 305 °C
 FID sensitivity: 6.4 × 10⁻¹¹ AFS

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 | 15 m | 30 m | 50 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 |
| | 1.0 µm | 40 to 240/250 °C | – | 227-36277-01 | 227-36277-03 | 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 |
| | 1.0 µm | 40 to 240/250 °C | 227-36280-03 | 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

Capillary Columns

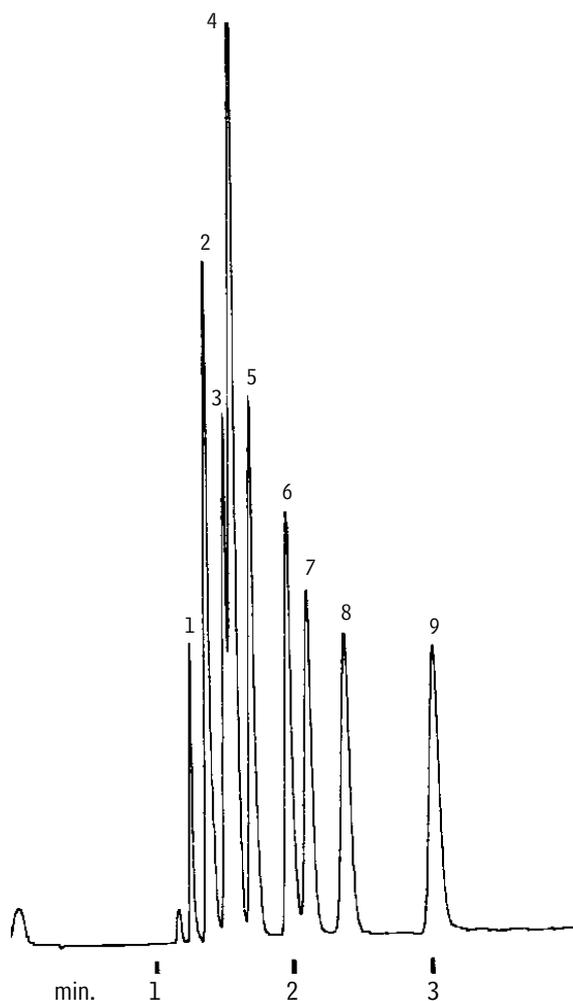
Dedicated Columns

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 | 15 m | 30 m | 60 m |
|---------|---------|------------------|--------------|--------------|--------------|
| 0.25 mm | 0.25 µm | 40 to 210/220 °C | 227-36359-01 | 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 | – |
| | 1.0 µm | 40 to 210/220 °C | – | 227-36298-01 | 227-36298-02 |
| 0.53 mm | 0.50 µm | 40 to 210/220 °C | – | 227-36299-01 | – |
| | 1.0 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

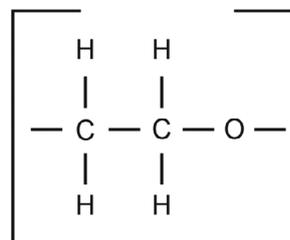
Column: SH-PolarX, 30 m, 0.53 mm ID, 1.00 µm
(P/N: 227-36300-01)
Inj. Vol.: 1 µL direct injection of amines in water
Inj. Temp: 250 °C
Carrier Gas: Hydrogen, flow rate 5 cc/min, linear velocity
40 cm/sec.
Oven temp.: 45 °C
Detector: FID, 250 °C

SH-PolarWAX MS

- High-polarity, stable polyethylene glycol (PEG) stationary phase.
- Low bleed and rugged enough to withstand repeated temperature cycles without retention time shifting.
- Ideal for food, flavor, fragrance, and industrial chemical and solvent analysis.
- Temperature range: 40 °C to 250/260 °C.
- Equivalent to USP G14, G15, G16, G20, and G39 phases.
- Similar phases: VF-WAXms, TR-WaxMS

The SH-PolarWax MS column ensures reproducible retention times from run to run, even with temperature cycling. When methods require trace analysis, this highly polar, low-bleed stationary phase produces excellent signal-to-noise levels! Ideal for food and flavor analysis (e.g., essential oils), fragrance and allergen analysis, as well as industrial solvent and chemical analysis.

SH-PolarWAX MS Structure



| 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 |

SH-βDEXse

- Phase: 2,3-di-O-ethyl-6-O-tert-butyl dimethylsilyl beta cyclodextrin added into 14% cyanopropylphenyl/86% dimethyl polysiloxane
- Excellent the column lifetime by adding β or γ cyclodextrin in stationary phase.
- Ideal for the separation of chiral compounds.
- Provides better resolution for limonene, linalool, linalyl acetate, ethyl-2-methylbutyrate, 2,3-butane diol, and styrene oxides.

| ID | df | Temp. Range | 30 m |
|---------|---------|--------------|--------------|
| 0.25 mm | 0.25 μm | 40 to 230 °C | 227-36365-01 |

SH-βDEXsm

- Phase: 2,3-Di-O-methyl-6-O-tert-butyl-dimethylsilyl-beta-cyclodextrin, added to 14% cyanopropylphenyl/86% dimethylpolysiloxane
- Excellent the column lifetime by adding β or γ cyclodextrin in stationary phase.
- Ideal for the separation of most chiral compounds in essential oils.

| ID | df | Temp. Range | 30 m |
|---------|---------|--------------|--------------|
| 0.25 mm | 0.25 μm | 40 to 230 °C | 227-36365-02 |
| 0.32 mm | 0.25 μm | 40 to 230 °C | 227-36365-03 |

Capillary Columns Dedicated Columns

SH-βDEXsa

- Phase: 2,3-Di-acetoxy-6-O-tert-butyl-dimethylsilyl-beta-cyclodextrin, added to 14% cyanopropylphenyl/86% dimethylpolysiloxane
- Excellent the column lifetime by adding β or γ cyclodextrin in stationary phase.
- Unique selectivity for esters, lactones, and other fruit flavor components.

| ID | df | Temp. Range | 30 m |
|---------|---------|--------------|--------------|
| 0.25 mm | 0.25 μm | 40 to 230 °C | 227-36365-04 |

SH-Dioxin

- Isomer separation for for 2,3,7,8-TCDD and 2,3,7,8-TCDF achieved with one GC column.
- Thermally stable to 340 °C for longer lifetime.
- Unique selectivity for toxic dioxin and furan congeners allows.

| ID | df | Temp. Range | 10 m | 40 m | 60 m |
|---------|---------|------------------|------|--------------|--------------|
| 0.18 mm | 0.18 μm | 20 to 320/340 °C | – | 227-36374-01 | – |
| 0.25 mm | 0.25 μm | 20 to 320/340 °C | – | – | 227-36374-02 |

SH-Mineral Oil

- Application specific columns meet DIN EN ISO 9377-2:2000 requirements.
- Optimized column dimensions for fast mineral oil screening.
- Surface linked phase guarantees long lifetime, robustness, and stability to 400 °C

| ID | df | Temp. Range | 15 m |
|---------|---------|-------------------|--------------|
| 0.32 mm | 0.10 μm | -60 to 380/400 °C | 227-36379-02 |
| | 0.15 μm | -60 to 380/400 °C | 227-36379-01 |

SH-TCEP

- Highly polar phase; 1,2,3-tris [2-cyanoethoxy] propane—not bonded
- General-purpose columns, ideal for aromatics and oxygenates in gasoline.
- Similar phases: CP-TCEP, SPB-TCEP

| ID | df | Temp. Range | 30 m |
|---------|---------|-----------------|--------------|
| 0.25 mm | 0.40 μm | 0 to 135/150 °C | 227-36376-01 |

SH-Volatiles

- Application-specific columns for volatile organic compounds.
- Can be used for alcohols and solvents.
- Low bleed - ideal for GCMS analyses.

| ID | df | Temp. Range | 30 m | 60 m |
|---------|--------------------|-------------------|--------------|--------------|
| 0.25 mm | 1.0 μm | -20 to 270/280 °C | 227-36375-01 | 227-36375-02 |
| 0.32 mm | 1.50 μm | -20 to 270/280 °C | - | 227-36375-03 |

Capillary Columns

PLOT Columns

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/Na₂SO₄

- Na₂SO₄ 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

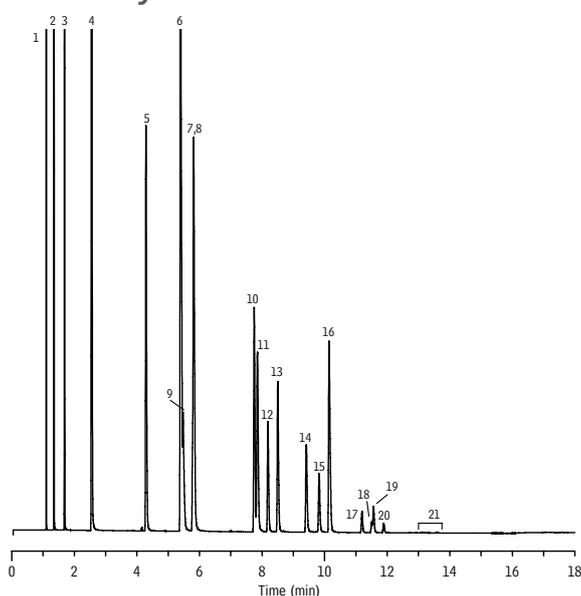
| ID | df | Temp. Range | 30 m | 50 m |
|---------|--------|---------------|--------------|--------------|
| 0.25 mm | 4.0 μm | -60 to 200 °C | 227-36328-03 | – |
| 0.32 mm | 5.0 μm | -60 to 200 °C | 227-36328-01 | 227-36328-02 |
| 0.53 mm | 10 μm | -60 to 200 °C | 227-36316-01 | 227-36301-01 |

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 | 30 m | 50 m |
|---------|--------|---------------|--------------|--------------|
| 0.25 mm | 4.0 μm | -60 to 200 °C | 227-36367-01 | – |
| 0.32 mm | 5.0 μm | -60 to 200 °C | – | 227-36380-01 |
| 0.53 mm | 10 μm | -60 to 200 °C | – | 221-76139-50 |

Refinery Gas



Peaks

- | | |
|----------------------------|-----------------------------|
| 1. methane | 12. isobutylene |
| 2. ethane | 13. <i>cis</i> -2-butene |
| 3. ethylene | 14. isopentane |
| 4. propane | 15. <i>n</i> -pentane |
| 5. propylene | 16. 1,3-butadiene |
| 6. isobutane | 17. <i>trans</i> -2-pentene |
| 7. <i>n</i> -butane | 18. 2-methyl-2-butene |
| 8. propadiene | 19. 1-pentene |
| 9. acetylene | 20. <i>cis</i> -2-pentene |
| 10. <i>trans</i> -2-butene | 21. hexanes |
| 11. 1-butene | |

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

SH-Alumina BOND/CFC

- Highly selective for C1–C5 hydrocarbons and separate all saturated and unsaturated hydrocarbon isomers above ambient temperatures.
- Improved inertness for chlorofluorocarbon (CFC) compounds.
- Highly selective alumina-based column, separates most CFCs.

| ID | df | Temp. Range | 30 m |
|---------|------------|---------------|--------------|
| 0.53 mm | 10 μ m | -60 to 200 °C | 227-36369-01 |

SH-Alumina BOND/MAPD

- Optimized deactivation produces maximum response when analyzing trace levels of acetylene, methyl acetylene, and propadiene.
- Extended temperature range up to 250 °C for fast elution of high molecular weight (HMW) hydrocarbons and accelerated column regeneration following exposure to water.

| ID | df | Temp. Range | 50 m |
|---------|------------|---------------|--------------|
| 0.53 mm | 10 μ m | -60 to 250 °C | 227-36358-01 |

Capillary Columns

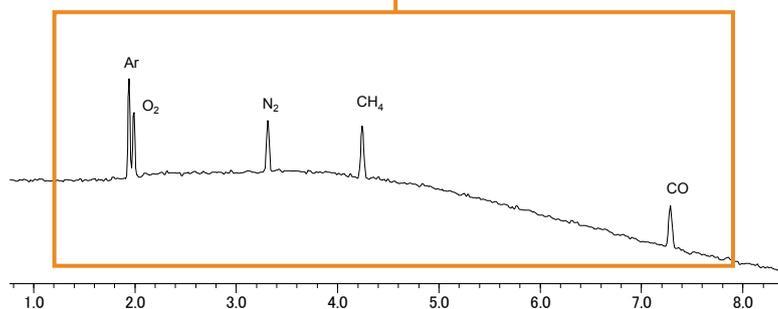
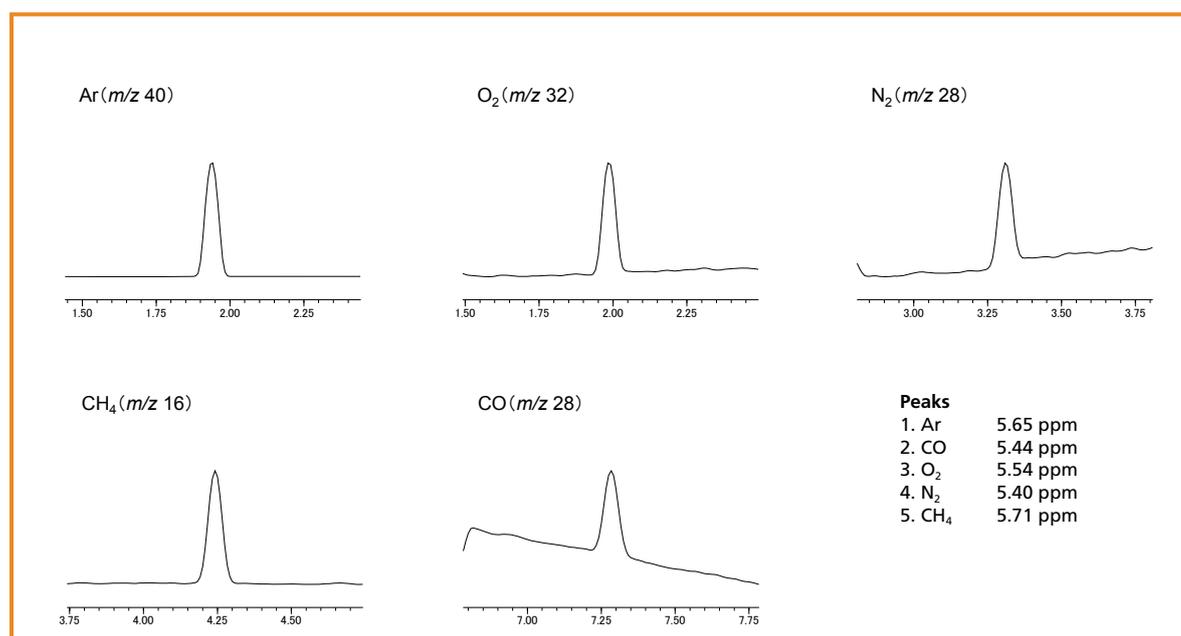
PLOT Columns

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, Mol Sieve 5A PLOT

| ID | df | Temp. Range | 15 m | 30 m |
|---------|-------|----------------|--------------|--------------|
| 0.25 mm | 20 µm | -100 to 300 °C | 227-36611-01 | - |
| 0.32 mm | 30 µm | -100 to 300 °C | - | 227-36611-02 |
| 0.53 mm | 50 µm | -100 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
 Interface Temp: 200 °C
 Ion Source Temp: 200 °C
 Measurement Mode: Scan (m/z 10 to 100)
 Event Time: 0.5 sec
 Ionization Method: EI
 Emission Current: 150 µA

SH-Q-BOND

- 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

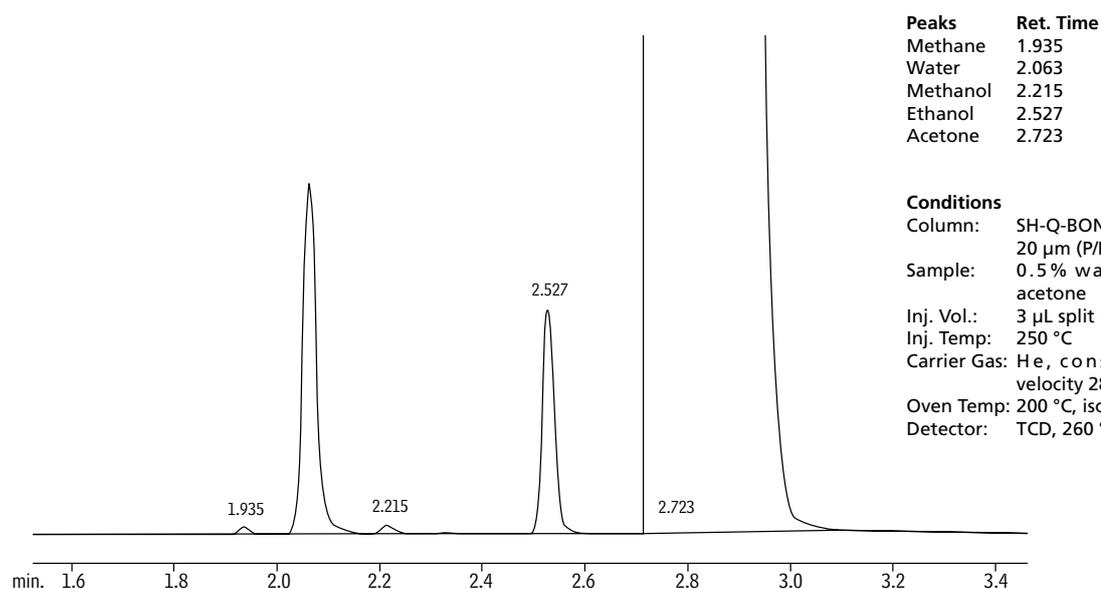
| ID | df | Temp. Range | 30 m |
|---------|--------|-------------------|--------------|
| 0.25 mm | 8.0 µm | -60 to 280/300 °C | 227-36381-01 |
| 0.32 mm | 10 µm | -60 to 280/300 °C | 221-75764-30 |
| 0.53 mm | 20 µm | -60 to 280/300 °C | 221-75765-30 |

SH-U-BOND

- 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 | 15 m | 30 m |
|---------|--------|---------------|--------------|--------------|
| 0.25 mm | 8.0 µm | -60 to 190 °C | – | 227-36302-03 |
| 0.32 mm | 10 µm | -60 to 190 °C | – | 227-36327-01 |
| 0.53 mm | 20 µm | -60 to 190 °C | 227-36302-02 | 227-36302-01 |

Water and Ethanol in Acetone



Capillary Columns

PLOT Columns

SH-QS-BOND

- Phase: Porous divinylbenzene homopolymer
- Intermediate polarity porous polymer PLOT column incorporating low 4-vinylpyridine.
- Separates ethane, ethylene, and acetylene to baseline.
- Similar Phases: GS-Q

| ID | df | Temp. Range | 30 m |
|---------|------------|---------------|--------------|
| 0.53 mm | 20 μ m | -60 to 250 °C | 227-36366-01 |

Trap columns for adhering dislodged particles from PLOT columns are also available.

Please refer to page 202.

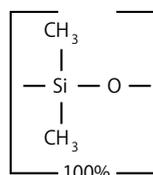
Capillary Columns

Metal Columns

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 | 7.5 m | 15 m | 30 m |
|---------|---------|-------------------|--------------|--------------|--------------|
| 0.25 mm | 0.10 µm | -60 to 360/430 °C | - | 227-36318-01 | - |
| 0.28 mm | 0.10 µm | -60 to 360/430 °C | - | 221-75734-15 | - |
| | 0.25 µm | -60 to 360/430 °C | - | - | 227-36318-02 |
| 0.53 mm | 1.50 µm | -60 to 360/430 °C | 227-36363-01 | - | - |

SH-MetalX-1HT SimDist

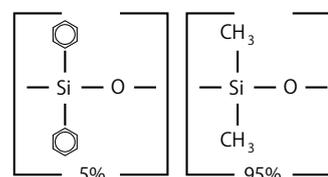
- Nonpolar phase
- Lowest bleed for longest column lifetime.
- Reliably meets all ASTM D2887, D6352, D7169, D7213, and D7500 specifications.
- 100% dimethyl polysiloxane phase allows easy comparisons to historical data.
- Individually tested for guaranteed performance.
- 7" coil diameter.
- Similar phases: DB-HT SimDis ProSteel, CP-SimDist, UltiMetal, ZB-1X SimDist

| ID | df | Temp. Range | 5 m |
|---------|---------|-------------------|--------------|
| 0.53 mm | 0.10 µm | -60 to 430/450 °C | 227-36344-01 |

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 phases.
- 4.5" standard coil diameter.
- Similar phases: DB-PS5, VF-5ht UltiMetal

SH-MetalX-5 Structure



| ID | df | Temp. Range | 30 m |
|---------|---------|---------------|--------------|
| 0.25 mm | 0.25 µm | -60 to 430 °C | 221-75743-30 |

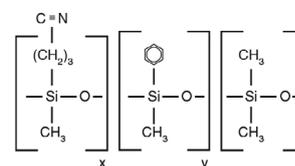
Capillary Columns

Metal Columns

SH-MetalX-1701

- 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: DB-PS1701

SH-MetalX-1701 Structure

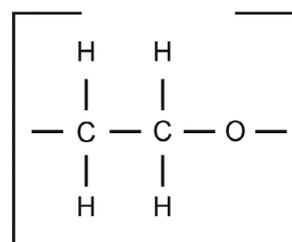


| ID | df | Temp. Range | 15 m |
|---------|---------|---------------|--------------|
| 0.53 mm | 1.00 μm | -20 to 260 °C | 227-36336-01 |

SH-MetalX-WAX

- 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.

SH-MetalX-WAX Structure



| ID | df | Temp. Range | 15 m |
|---------|---------|------------------|--------------|
| 0.53 mm | 1.00 μm | 40 to 240/250 °C | 227-36337-01 |

SH-MetalX Biodiesel TG

- Fast analysis times and sharp mono-, di-, and triglyceride peaks.
- Stable at 430 °C for reliable, consistent performance.
- Similar phase: MET-Biodiesel

| ID | df | Temp. Range | 14 m | 15 m |
|---------|---------|-------------------|--------------|--------------|
| 0.32 mm | 0.10 μm | -60 to 380/430 °C | - | 227-36315-02 |
| 0.53 mm | 0.16 μm | -60 to 380/430 °C | 227-36315-01 | - |

SH-MetalX-Alumina BOND / Na₂SO₄

- Can be made in small coil diameters—perfect for tight spaces.
- Similar Phases: CP-Al₂O₃/Na₂SO₄

| ID | df | Temp. Range | 30 m |
|---------|-------|---------------|--------------|
| 0.53 mm | 10 μm | -60 to 200 °C | 227-36382-01 |

SH-MetalX-Q-BOND

- Phase: Nonpolar porous polymer
- Can be made in small coil diameters—perfect for tight spaces.
- Similar Phases: PoraPLOT Q Ultimetel , Quadrex PLT-Q

| ID | df | Temp. Range | 30 m |
|---------|-------|-------------------|--------------|
| 0.53 mm | 20 μm | -60 to 280/300 °C | 227-36383-01 |

SH-MetalX-Msieve 5A PLOT

- Efficient separation of argon/oxygen and other permanent gases, including carbon monoxide.
- Molecular sieves have very high retention, allowing separations of permanent gases at temperatures above ambient.

| ID | df | Temp. Range | 30 m |
|---------|-------|---------------|--------------|
| 0.53 mm | 50 μm | -100 to 300°C | 227-36384-01 |

Capillary Columns

Guard Columns

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-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.



* For information about Press-Tight® connectors, please refer to page 52.

| 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 |

SH-IP Guard Columns

- Tested with a comprehensive test mix to ensure high inertness.
- Useful for a wide range of applications.
- Use with most common solvents.
- Maximum temperature: 360 °C.

| Description | ID | 5 m | 10 m | 30 m |
|--------------------|---------|--------------|--------------|--------------|
| SH-IP Guard Column | 0.10 mm | 227-36321-06 | – | – |
| | 0.15 mm | 227-36321-07 | – | – |
| | 0.25 mm | 227-36320-01 | 227-36321-03 | – |
| | 0.32 mm | 227-36320-02 | 227-36321-04 | – |
| | 0.53 mm | 227-36320-03 | 227-36321-01 | 227-36321-05 |

SH Guard Columns Polar Deactivation

- Polar polyethylene glycol deactivation
- Tested with a comprehensive test mix to ensure high inertness.
- Polyethylene glycol deactivation layer provides optimum wettability for polar compounds.
- Minimize peak splitting when using polar solvents such as methanol or water.
- Compatible with SH-PolarWax, SH-225 and SH-2330 capillary columns.
- Maximum temperature: 280 °C.

| Description | ID | 5 m | 30 m |
|------------------------------------|---------|--------------|--------------|
| SH Guard Column Polar Deactivation | 0.25 mm | 227-36335-01 | 227-36335-04 |
| | 0.32 mm | 227-36335-02 | – |
| | 0.53 mm | 227-36335-03 | – |

SH Guard Columns Base Deactivated

- Tested with a basic amine test mix.
- Excellent inertness for basic compounds.
- Recommended for use with SH-5 Amine, SH-35 Amine, SH-Volatile Amine, and SH-PolarX capillary columns.
- Batch test chromatogram included.
- Maximum temperature: 315 °C.

Chemists using guard columns in the analyses of basic compounds frequently observe peak tailing and low recovery. This happens because conventionally deactivated tubing surfaces can be adsorptive to basic compounds. Shimadzu offers base-deactivated guard columns, as well as base-deactivated inlet liners, for completely inert sample pathways.

| Description | ID | 5 m |
|----------------------------------|---------|--------------|
| SH Guard Column Base Deactivated | 0.25 mm | 227-36334-01 |
| | 0.32 mm | 227-36334-02 |
| | 0.53 mm | 227-36334-03 |

Capillary Columns Guard Columns

SH-MetalX-Siltek Guard Column

- Tested with a comprehensive test mix, to ensure high inertness.
- Revolutionary deactivation process for superior inertness.
- Analyze active samples accurately; ideal for chlorinated pesticide analysis (reduces endrin breakdown to less than 1%).
- Maximum temperature: 380 °C.

| Description | ID | 10 m |
|------------------------|---------|--------------|
| SH-MetalX-Siltek Guard | 0.53 mm | 227-36319-01 |

SH Guard Column Siltek Deactivation

- Revolutionary deactivation process for superior inertness.
- Maximum temperature: 380 °C

| Description | ID | 5 m |
|-------------------------------------|---------|--------------|
| SH Guard Column Siltek Deactivation | 0.32 mm | 227-36385-01 |

SH Guard Column NP Deactivation

- Useful as guard columns, transfer lines, or long retention gaps
- Maximum temperature: 325 °C

| Description | ID | 30 m |
|---------------------------------|---------|--------------|
| SH Guard Column NP Deactivation | 0.32 mm | 227-36370-01 |

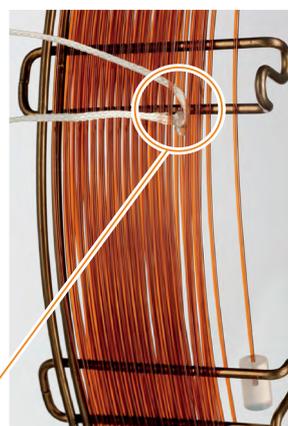
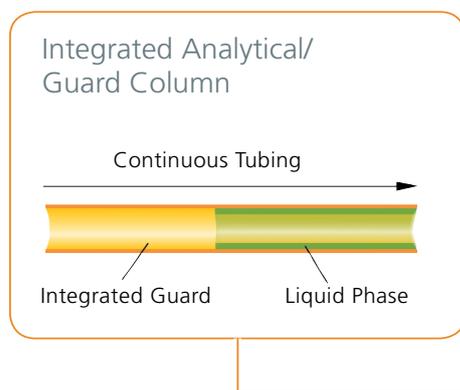
SH Guard Column Hydroguard Deactivation

- Extend analytical column lifetime by preventing degradation from harsh "steam-cleaning" water injections.
- Maximum temperature: 325 °C

| Description | ID | 5 m | 10 m |
|---|---------|--------------|--------------|
| SH Guard Column Hydroguard Deactivation | 0.25 mm | 227-36372-01 | 227-36372-02 |

Integrated 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 2m Integrated Guard | With 5m Integrated Guard | With 10m Integrated Guard |
|--------------|---------|---------|--------|--------------------------|--------------------------|---------------------------|
| SH-I-5Sil MS | 0.25 mm | 0.25 µm | 15 m | – | – | 227-36386-01 |
| | | | 30 m | – | 221-76161-30 | 221-76162-30 |
| SH-I-1 | 0.25 mm | 0.25 µm | 30 m | – | 221-75719-31 | – |
| | | | 60 m | – | 227-36333-02 | – |
| | 0.53 mm | 1.0 µm | 30 m | – | 221-75731-31 | – |
| | | 1.50 µm | 30 m | – | 227-36333-01 | – |
| SH-5 | 0.25 mm | 0.25 µm | 30 m | – | 221-76153-05 | 221-76153-30 |
| | | 1.0 µm | 30 m | – | 221-76179-30 | – |
| | 0.32 mm | 0.25 µm | 30 m | – | 221-76177-30 | – |
| | | 60 m | – | 221-76177-60 | – | |
| | 0.53 mm | 1.0 µm | 30 m | – | 221-76180-30 | – |
| | | 5.0 µm | 30 m | – | 221-76154-35 | – |
| SH-5MS | 0.25 mm | 0.10 µm | 30 m | – | 221-76189-30 | – |
| | | 0.25 µm | 15 m | – | 221-75861-15 | – |
| | 30 m | | – | 221-75861-05 | 221-75861-10 | |
| | 0.32 mm | 0.25 µm | 30 m | – | 221-76190-30 | – |
| SH-1301 | 0.53 mm | 3.0 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 | 3.0 µm | 30 m | – | 221-76158-30 | – |
| SH-1701 | 0.25 mm | 0.25 µm | 30 m | – | 221-76185-30 | – |
| SH-1MS | 0.25 mm | 0.10 µm | 15 m | 227-36346-01 | – | – |
| SH-PolarWax | 0.25 mm | 0.25 µm | 30 m | – | 227-36360-01 | – |
| | 0.53 mm | 1.0 µm | 30 m | – | 227-36360-02 | – |

Capillary Columns Guard Columns

Columns with pre-connected guard

- Zero-dead-volume design and deactivated metal construction connector ensures optimal peak shapes.
- Since the separation column and guard column are integrated, it is possible to avoid the leakage trouble and save labor caused by manually connecting analytical column and guard column.

| Column | ID | df | Length | With 5m Integrated Guard | With 10m Integrated Guard |
|--------------|---------|--------------|--------|--------------------------|---------------------------|
| SH-I-5HT | 0.25 mm | 0.25 μ m | 30 m | 227-36345-01 | – |
| SH-I-SVOC MS | 0.25 mm | 0.25 μ m | 15 m | – | 227-36362-05 |
| | | | 30 m | 227-36362-07 | – |
| | | 0.50 μ m | 30 m | 227-36362-09 | – |

Others

Low-Pressure GC (LPGC) Column Kit

- Pre-connected column by Restrictor column (5 m length of 0.18 mm ID Hydroguard tubing) and SH-5MS with integrated transfer line (15 m, 0.53 mm ID, 1 μ m) plus 1 m integrated transfer lines on the outlet end (16 m total length of 0.53 mm ID tubing).
- Easily install LPGC into GC-MS or GC-MS/MS system as simple as a normal column.
- 3 times faster multiresidue pesticides analysis in foods.

| Column | ID | df | Length | Low-Pressure GC (LPGC) Column Kit |
|-------------------|---------|--------------|--------|-----------------------------------|
| Restrictor column | 0.18 mm | – | 5 m | 227-36349-01 |
| SH-5MS* | 0.53 mm | 1.00 μ m | 16 m | |

* Column with integrated transfer line

SH Untreated Fused Silica Tubing

- Flexible polyimide coated fused silica tubing.
- Making the own column or using some kind of gas line.
- Maximum temperature: 350 °C

| Description | ID | Length |
|----------------------------------|---------|----------------------|
| SH Untreated Fused Silica Tubing | 0.53 mm | 15 m 227-36371-01 |

GC Columns

Capillary Columns

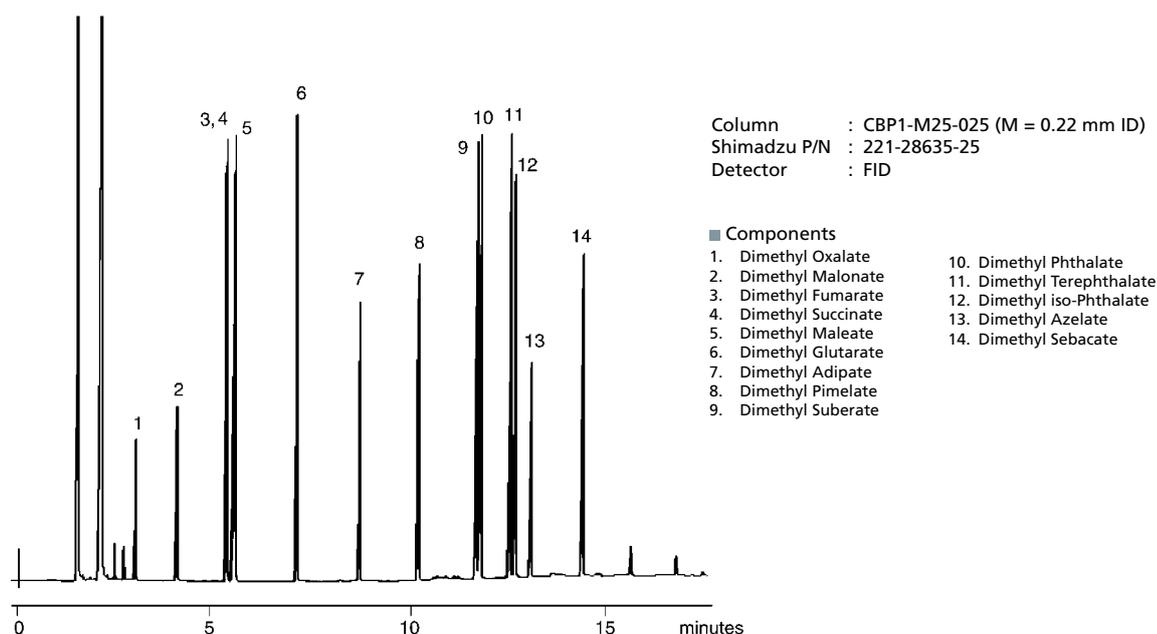
General purpose

■ **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



GC Columns Capillary Columns

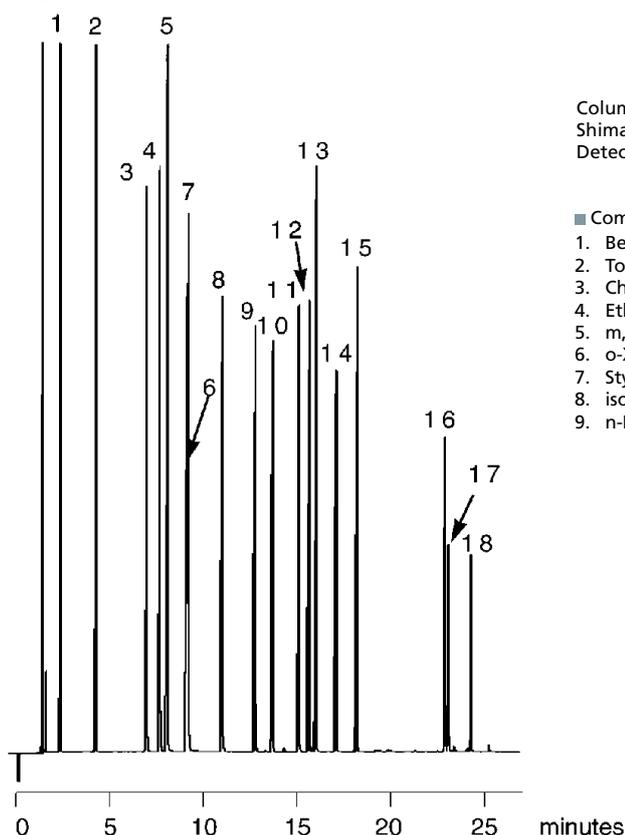
General purpose

■ 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
Detector : FID

■ Components

- | | |
|----------------------|--|
| 1. Benzene | 10. 1,3,5-Trimethylbenzene |
| 2. Toluene | 11. 1,2,4-Trimethylbenzene |
| 3. Chlorobenzene | 12. m-Dichlorobenzene |
| 4. Ethylbenzene | 13. ec-Butylbenzene, p-Dichlorobenzene |
| 5. m, p-Xylene | 14. o-Dichlorobenzene |
| 6. o-Xylene | 15. Butyl-benzene |
| 7. Styrene | 16. 1,2,4 - Trichlorobenzene |
| 8. iso Propylbenzene | 17. Napthalene |
| 9. n-Propylbenzene | 18. Hexachlorobutadine |

GC Columns

Capillary Columns

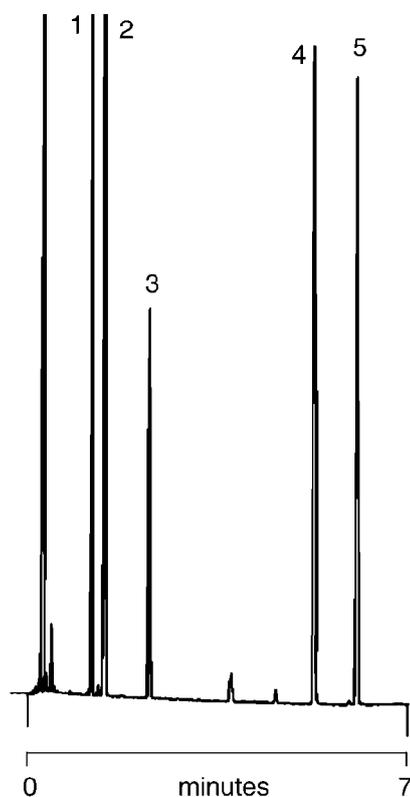
General purpose

■ **CBP-10: 14% Cyanopropylphenyl Polysiloxane**

- Used for organochlorine pesticides analysis
- Bonded and cross-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
 Detector : FID

■ Components

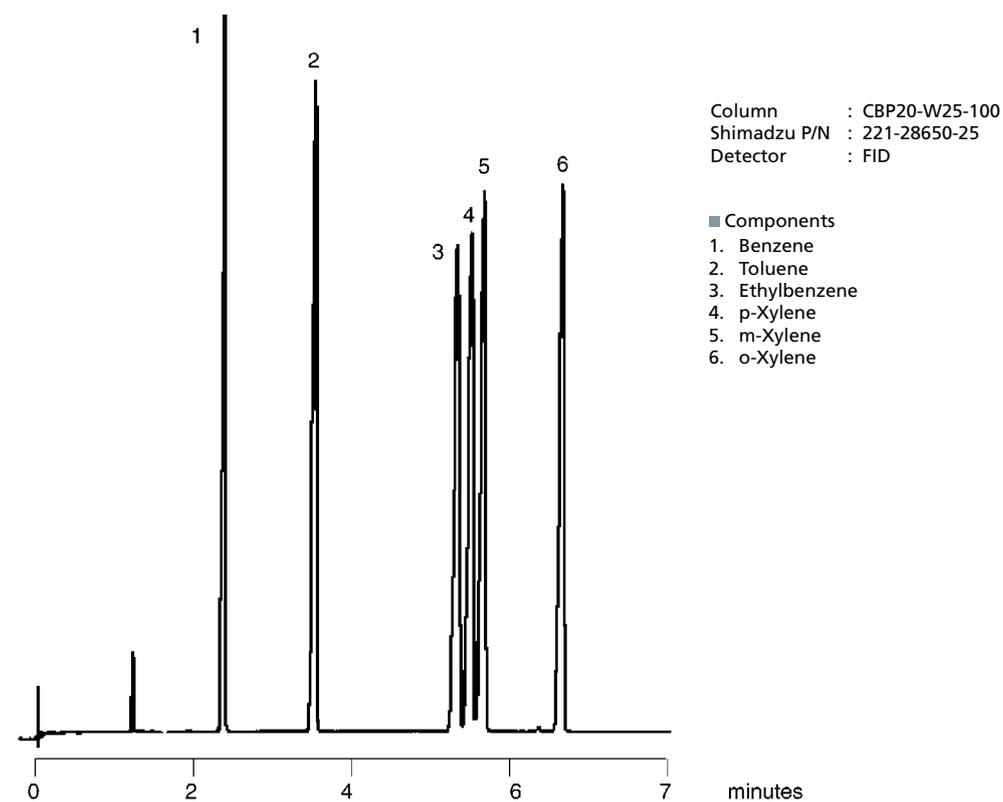
1. Bis (2-chloroethyl) ether
2. Bis (2-chloroisopropyl) ether
3. Bis (2-chloroethoxy) methane
4. 4-Chlorophenyl ether
5. 4-Bromophenyl ether

■ **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



GC Columns

Capillary Columns

General purpose

■ CBP1-PONA

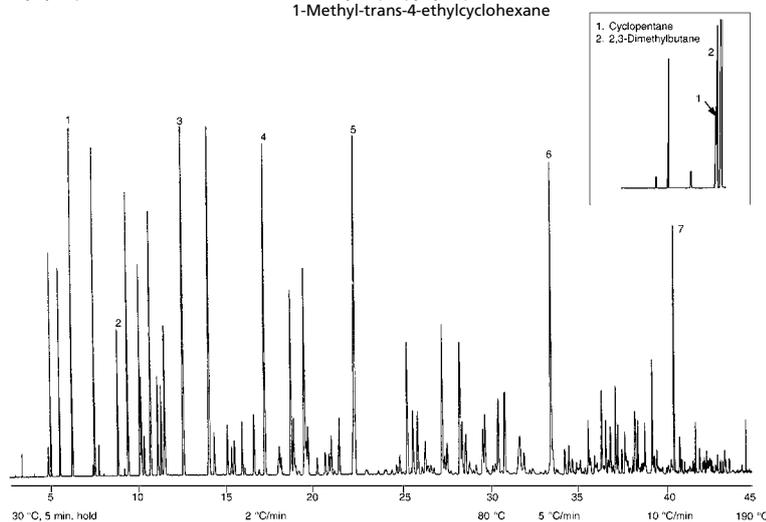
- Designed for the analysis of petroleum products
- Non-polar phase for PONA analysis
- Detailed hydrocarbon analysis according to ASTM (DHA-method)

| 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 |
| 6.45 | o-Xylene |
| 7.46 | 2,2-Dimethylpentane |
| 7.60 | Methylcyclopentane |
| 7.91 | 2,4-Dimethylpentane |
| 8.18 | 2,2,3-Trimethylbutane |
| 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 |
| 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 |
| 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-Ethyl-1-methylcyclopentane |
| 21.53 | 1-trans-2-Dimethylcyclohexane |
| 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-Trimethylcyclohexane |
| 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 |
| 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.



GC Packed Columns

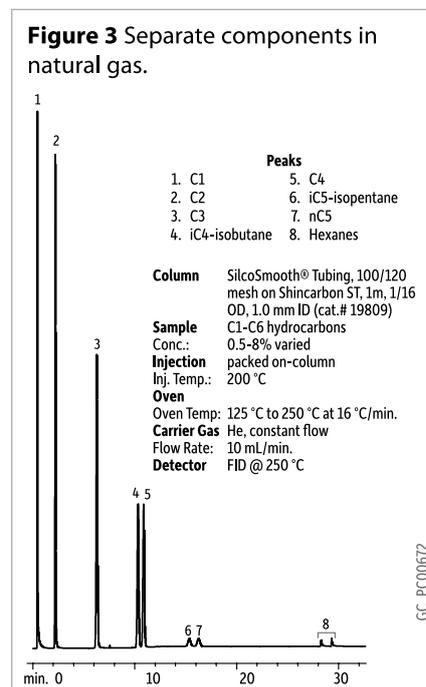
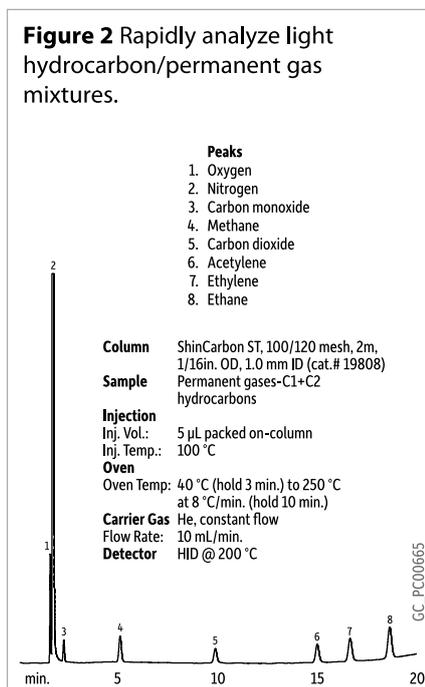
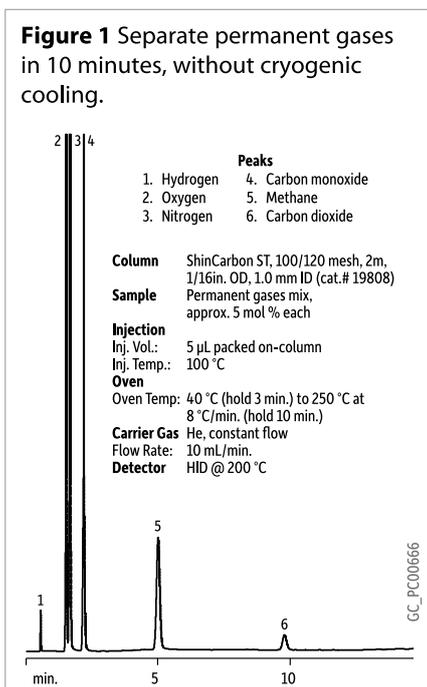
ShinCarbon ST Columns

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 recommend Rt-X2 Sulfur micropacked and packed columns or SH-Rtx-1 Capillary columns.



ShinCarbon ST Columns (micropacked)

(SilcoSmooth® Stainless Steel)**

| OD | ID / mm | Mesh | Length / m |
|-------|---------|-------------------|------------|
| 1/16" | 1.0 | 80/100 100/120 | 1.0 |
| | | | 2.0 |
| | | | 3.0 |

** Does not include column nuts and ferrules. Optimal installation kits can be ordered separately.

ShinCarbon ST Columns (packed)

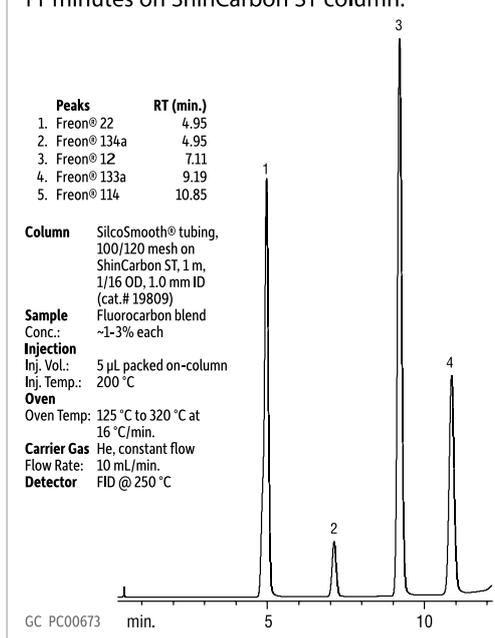
(SilcoSmooth® Stainless Steel)*

| 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.



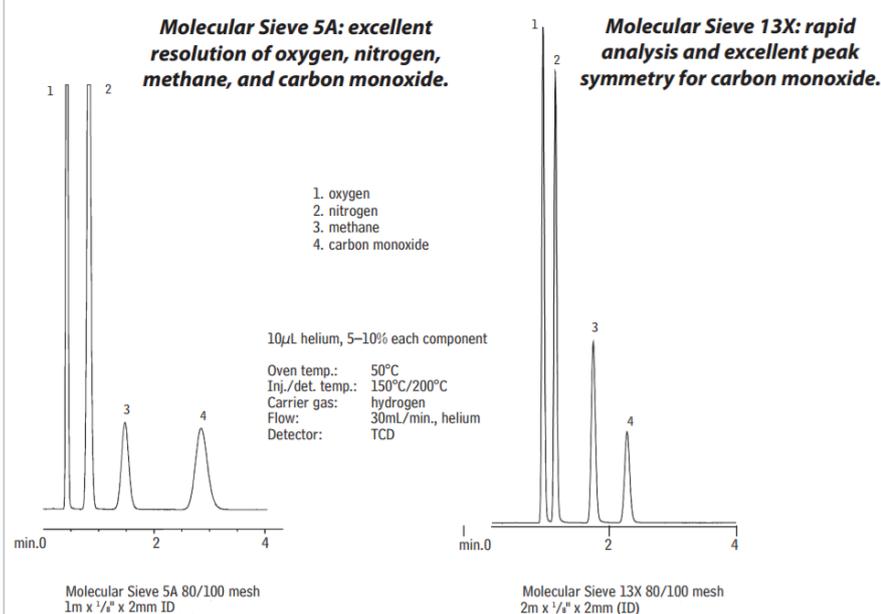
GC Columns
Packed
Columns

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 Molesieve 13X | 1/8" | 2.1 | 60/80 80/100 | 1.0 |
| | | | | 2.0 |
| | | | | 3.0 |

Molecular Sieve Micropacked Columns

| Molesieve | OD | ID / mm | Mesh | Length / m |
|-------------------------------|-------|---------|--------|------------|
| Molesieve 5A 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.

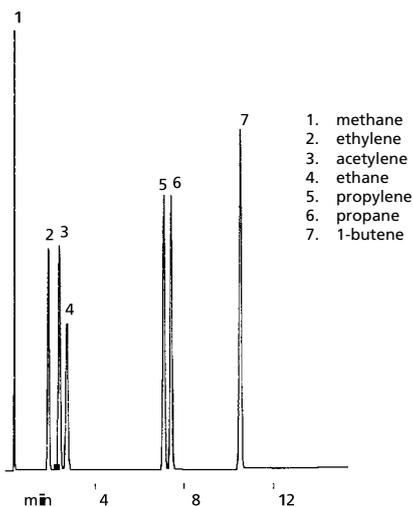
For availability and ordering information on custom columns, please contact your representative direct sales/distributors.

GC Packed Columns

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.

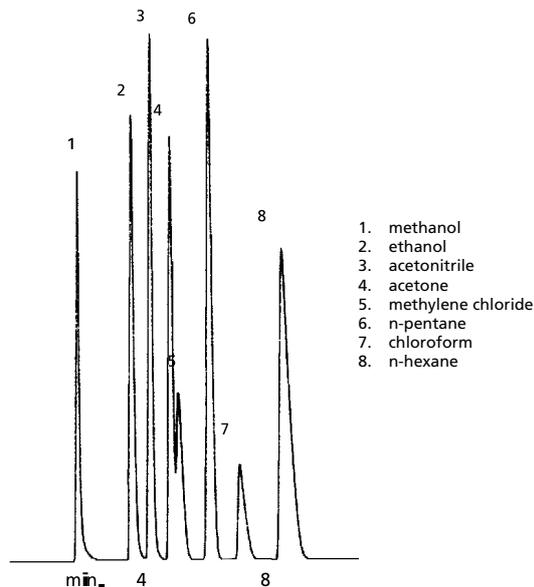
■ Hydrocarbon Gases
HayeSep® S
(micropacked)



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)

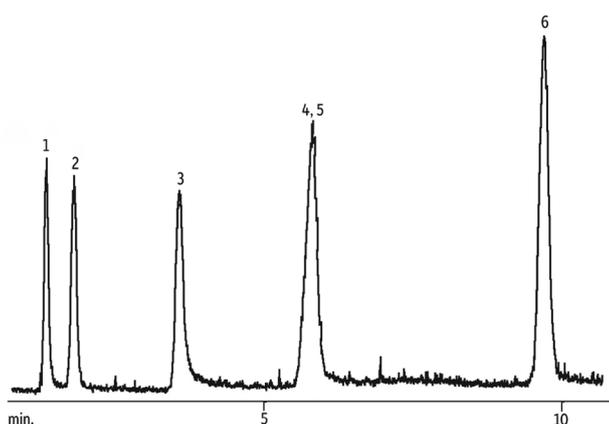
Rt-XLSulfur packed and micropacked columns are designed for ppb-level sulfur analysis. Every component of the sample pathway is treated to provide the highest degree of inertness for reactive, low-level sulfur compounds. The porous polymer phase features a unique surface modification, which results in 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, H₂S, SO₂, CH₃SH, (CH₃)₂S₂ at low ppb concentrations. These sulfur compounds typically are found in pulp mill byproducts, natural gas, and petroleum products.

■ Features:

- Optimized columns for low ppbv 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 | 4. Ethyl mercaptan |
| 2. Carbonyl sulfide | 5. Dimethyl sulfide |
| 3. Methyl mercaptan | 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 |

GC Columns
Packed
Columns

| 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 |

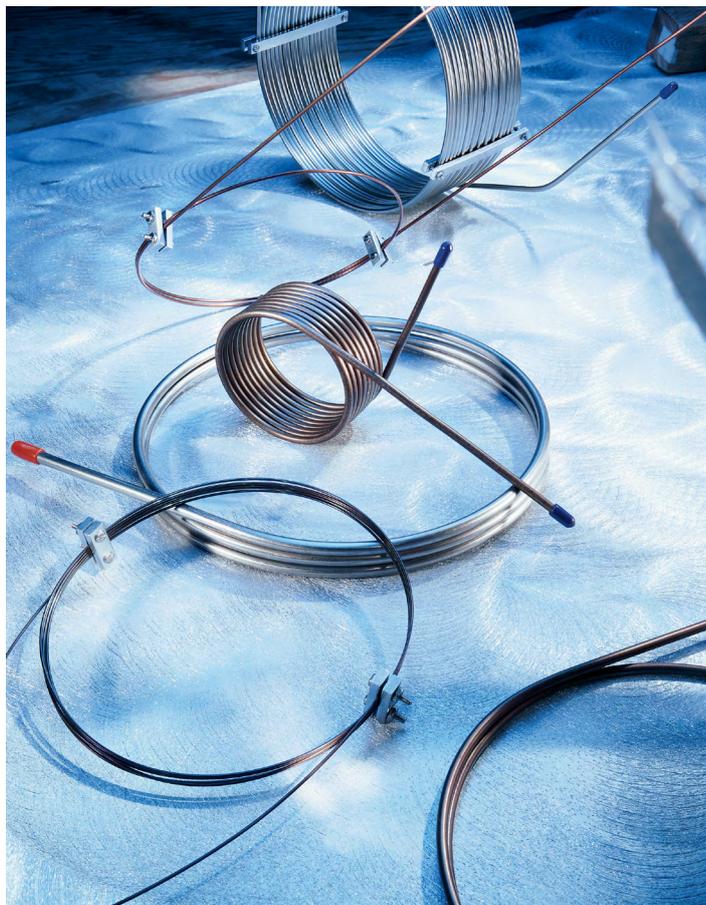
For availability and ordering information on custom columns, please contact your representative direct sales/distributors.

GC Packed Columns

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.

Capillary Columns

Accessories and Supplies

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 | <ul style="list-style-type: none"> • Easy to use. • Forms a stable seal. • Soft material. • Porous to oxygen. • Can be reused. • Forms a soft grip with capillary column. • Low emissions. | <ul style="list-style-type: none"> • A composite of graphite and Vespel®. • Mechanically robust. • Hard material, long lifetime. • Forms a strong grip with capillary column. • Cannot be reused with another capillary column. • Requires re-tightening. | <ul style="list-style-type: none"> • Specifically developed to overcome the problems associated with the use of 100% graphite and composite ferrules. • Strong seal on capillary columns. • Leak free - The ferrule and nut expand and contract at the same rate eliminating any chance of leaks with temperature cycling. • Nut does not need re-tightening after initial temperature cycles. | <ul style="list-style-type: none"> • Easy to use • Leak free • Specially designed to use with ClickTek Connector on Nexis GC-2030 • Cannot be reused with another capillary column • Not suitable for stainless steel column |
| Suitable Uses | <ul style="list-style-type: none"> • Column to injector connection. • 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 | <ul style="list-style-type: none"> • Column to injector connection • 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 | <ul style="list-style-type: none"> • Can leave residue inside your column. • 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. | – |

Capillary Columns

Accessories and Supplies

Connection Parts for Capillary Columns

Nuts and Ferrules



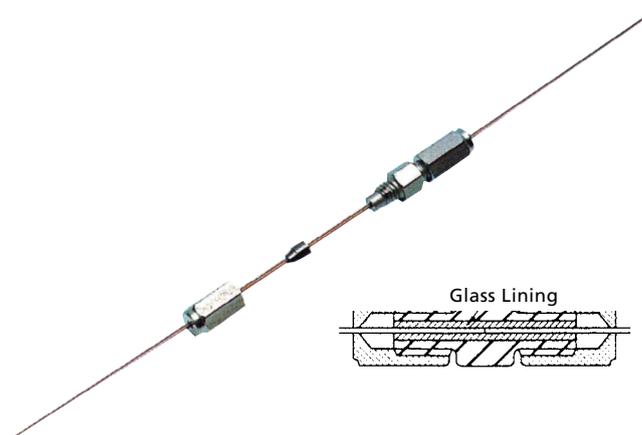
| Diag. # | Description | Specification | P/N |
|----------------------|--|---|--------------|
| 1 | Nut with slit (5 pcs) | Detector side of GC-2010/2010 Plus/2014/2025 | 221-32705-84 |
| 2 | Nut without slit (10 pcs) | Injection unit side of GC-2010/2010 Plus/2014/2025 | 221-16325-81 |
| 3 | Nut without slit (5 pcs) | For GCMS | 670-11009 |
| | Graphite Ferrule 0.5 (10 pcs) | For 0.1 - 0.32 mmID columns | 221-32126-05 |
| 3 | Graphite Ferrule 0.8 (10 pcs) | For 0.53 mmID columns | 221-32126-08 |
| | Graphite Vespel® Ferrule (10 pcs) | For 0.1 - 0.25 mmID columns | 670-15003-03 |
| | 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 |
| | SilTite™ Metal Ferrule (10 pcs) | For 0.1 - 0.25 mmID columns | 221-72563-04 |
| 4 | 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 0.1 - 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 (5 pcs) | - | 221-75186 | |
| 5 | 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 |

GC Columns
Accessories
and Supplies

Glass-Lined Stainless Steel Joint

This is a compact joint to connect capillary columns. The glass lining minimizes the adsorption of sample components. To ensure a positive connection, it is necessary to cut the ends of capillary columns properly to match each other.

| Description | Applicable Capillary OD (mm) | P/N |
|---|------------------------------|--------------|
| Mini-union (with 5 pcs graphite ferrules) | 0.4 | 670-11424-11 |
| | 0.5 | 670-11424-12 |
| | 0.8 | 670-11424-13 |
| Graphite Ferrule (10 pcs) | 0.4 - 0.5 | 670-11424-21 |
| | 0.8 | 670-11424-22 |



Capillary Columns Accessories and Supplies

Connection Parts for Capillary Columns Press-Tight™ Connectors

This connector is used to connect capillary columns easily by inserting the columns into the connector from both ends. When the columns are coated with polyimide resin, the connection will remain tight almost permanently and will be completely free of leakage. Applicable to 0.35 mm to 0.8 mmOD capillary columns.

| Description | P/N |
|---|--------------|
| Press-Tight™ Connector (5 pcs) | 221-38102-91 |
| Press-Tight™ Connector (5 pcs with 5 g polyimide resin) | 221-38102-92 |



Main use of Press-Tight™ connectors

- Connection of broken capillary columns
The connectors are unobtrusive.
- On-column sample injection
Any capillary columns can be used in on-column injection mode by connecting a short wide-bore capillary columns to the inlet of the column.
- Retention gap method
An about 2 meters long capillary tube with no stationary phase, which is connected to the head of analytical capillary column, prevents peaks from being split.
- Column conditioning
A short capillary tube, which is connected to the outlet of the column, prevents air (oxygen) from diffusing into the column, thus preventing the deterioration of liquid phase which is kept at a high temperature.
- Stable storing of capillary columns
Deterioration by air and contamination can be prevented by connecting the both ends with a capillary tube.

Capillary Column Accessory Set

This set contains tools and supplies which are used to ensure high analytical productivity in capillary gas chromatography.

| | |
|-----|--------------|
| P/N | 221-38652-91 |
|-----|--------------|

The set includes:

- Graphite ferrules
- Nuts
- Soap film flow meter
- Capillary tube cutter
- Spanner
- Tweezers
- Magnifying lens
- Ruler (stainless steel, 150mm)
- Accessory Box
- Pin vise
- Drill
- Press-Tight® connectors
- Polyimide resin
- Compact vise
- Adapter Socket (MM-C)
- Magnet grips

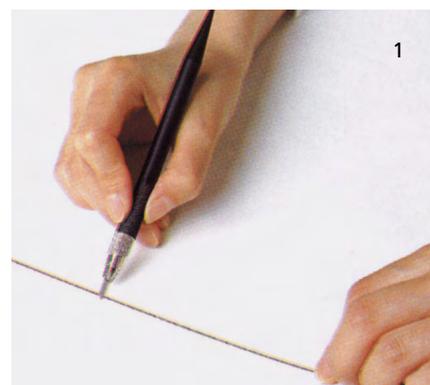


Capillary Tube Cutters

To cut a fused silica capillary tube, score the desired part with the above cutters, which have a ceramic blade, and snap at the position.

The figure on the right shows an easy-to-use pen type. A spare blade is included.

| Diag. # | Description | P/N |
|---------|--|--------------|
| 1 | Capillary Tube Cutter (pen type with 1 pc spare blade) | 221-50595-91 |
| 2 | Capillary Tube Ceramic Cutter (3 pcs) | 221-75181 |



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 symmetrical Field-Strength over the inlet of the column. When there is no symmetrical Field-Strength, the analytical results will be non-reproducible.

Catalog No. 226-50700-10

Specifications

Usable For Shortix™ GC



MAINTENANCE KIT FOR SHORTIX™ 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.



**Want to start shopping for
GC Columns Accessories and Supplies?
[CLICK HERE](#)**

GC/GC-MS Syringe Selection Guide

CoreFocus



Selection Guide

Overview

Optimal Syringe Selection

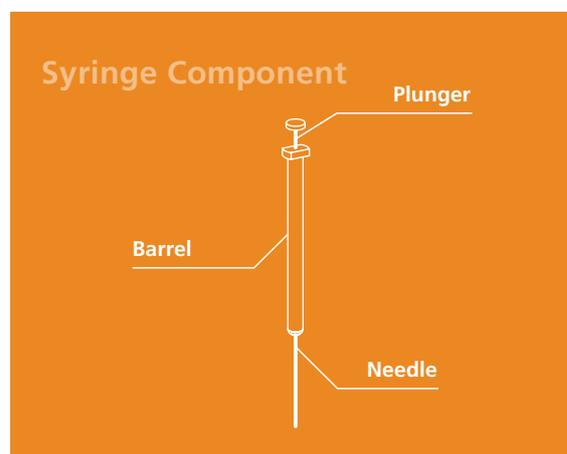
When selecting the optimal syringe, it is recommended that you start by using the following table as a reference.

| Considerations/Parameters | Explanation |
|---|---|
| (1) Autosampler | Special syringes are available for the AOC-30i/20i, AOC-6000 Plus, and other autosampler models. → Autosampler Syringes (page 229) For manual injection, check here → Manual Injection Syringes (page 231) |
| (2) Sample Type and Syringe Capacity | Select the syringe capacity to suit the sample type (liquid/gas). → Syringe Selection Guide (page 226) |
| (3) Analysis Objectives, Applications, and Priorities | Select the optimal plunger and needle in accordance with the application and priority, such as trace volume analysis, analysis of water-soluble samples, or gas analysis. → Syringe Selection Guide (page 226) |

Syringe Components

The main components of a syringe are the plunger, barrel, and needle.

To obtain the best analysis results, the optimal plunger, syringe capacity, and needle must be selected. Select the optimal items using this guide as a reference.



Syringe Selection Guide

Sample Type and Syringe Capacity

Samples are broadly classified into liquid samples and gas samples.

Liquid samples: Select a syringe to suit the sample type, such as an organic solvent, aqueous solvent, or high-viscosity sample.

Gas samples: Select a large-capacity gas-tight syringe or a PTFE tipped syringe. If the target components are at a sufficiently high concentration, a microsyringe can also be used.

The following table shows guidelines for sample type (liquid/gas) and sample injection volume for each injection port. Select a syringe based on the injection volume being about 10 to 20 % of the syringe capacity.

| Injection Method | Hot Injection | | | Cold Injection | |
|-------------------------|---|-----------------|---|-------------------|---------------------------------|
| | Split | Splitless | Full Volume Injection | Cold On-Column | Programmed Heating Vaporization |
| Name of Injection Port | SPL | SPL | WBI, INJ | OCI* ² | PTV |
| Liquid Samples | ● | ● | ● | ● | ● |
| Gas Samples | ● | — ^{*1} | ● | — | — |
| Sample Injection Volume | Liquid Samples: 2 µL max. Gas Samples: 1 µL max. | 2 µL max. | Liquid Samples: 2 µL max. Gas Samples: 0.5 µL max. | 0.5 to 2 µL | 1 to 8 µL |

Note 1: If a cryogenic valve unit (CRG) can be added, and the initial column temperature can be reduced to 0 °C or below, then some components may be compatible with a splitless analysis.

Note 2: With on-column analysis, the needle is inserted directly into the column, so a dual-tapered OCI syringe with a narrow needle tip is used.

Analysis Types and Applications

Gas analysis

With gas analysis, select a gas-tight syringe with a large capacity.

Selection

- PTFE tipped plunger
- Gas-tight syringe

Breakage prevention

This syringe prevents the plunger from bending back and forth during manual injection. It can also be used with confidence by analysts unfamiliar with using a syringe.

Selection

- Plunger guide equipped syringe

Microinjection

If microinjection is required, a plunger-in-needle syringe, which has minimal dead volume, is used.

Selection

- Plunger-in-needle

Needle replacement

It is possible to replace just the needle. This type is economical, as the needle can be replaced if it becomes dirty or bent.

Selection

- Replaceable needle
- Luer tip/Luer lock type

Water soluble samples

Selecting a flexible plunger limits malfunctions caused by bending and sliding friction. It is also suitable for extended analyses.

Selection

- Titanium alloy plunger

Needle Type

Needle connection style



Fixed needle

This is an inexpensive, general-purpose needle. There is no connection part, so there is limited carryover.

Needle tip shape

Cone



This is for autosamplers and autoinjectors. This is designed to reduce damage to the septum and clogging of the needle during consecutive injections.

Side Hole Dome



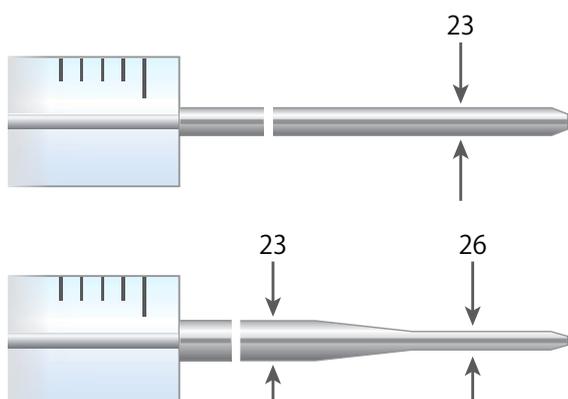
With this type, the sample is injected and delivered through a side hole. This can prevent clogging of the needle tip during penetration of the septum, for instance, when a gas-tight syringe with a needle tip with a large outer diameter is used for gas samples.

Needle gauge

The needle gauge is a measure of the thickness of the needle. The larger the number, the finer the needle. The thicker the needle, the more durable it is and the longer its operating life. In general, select a smallest gauge (i. e. thickest) needle that is compatible.

The suffix "s" means that the needle wall is thicker (the inner diameter is smaller) in comparison to needles without the suffix "s," so this type is more durable.

With on-column injection, the needle tip must fit inside the capillary column. Typically, a tapered dual syringe with a fine needle tip is used.



Single gauge Examples: 23, 23s, 26, 26s

Split/Splitless injection, Packed column injection

Tapered dual gauge Examples: 23s/26s

On-column injection, Split/Splitless injection

Replaceable needle



The needle can be replaced. This is suitable for sampling with salt deposition and when the needle is prone to bending. The outer diameter, length, and shape of the needle can be changed to suit the application.

Bevel



Cut on an angle, this type is used for manual injection. It is designed for high septum penetrability, with minimal damage.

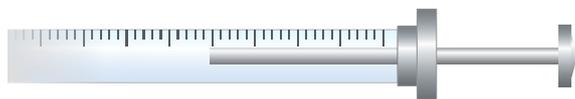
LC



The needle tip is cut at a 90-degree angle and is suitable for HPLC injection. It is also suitable for pipetting liquids.

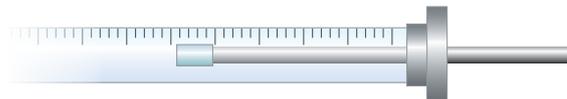
Plunger Types

Stainless Steel plunger (standard)



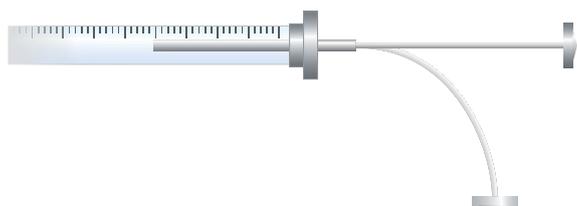
- This is a standard plunger made of stainless steel.
- The plunger cannot be replaced.
- The plunger can be removed for cleaning.

PTFE tipped plunger



- This is a highly gas-tight type with a PTFE plunger tip.
- It can be used for liquid or gas samples.
- Even with samples that tend to adhere to the syringe plunger, such as trace residual particles and components that react easily to metals, there are fewer injection problems with PTFE-tipped plungers.
- PTFE-tipped plungers are replaceable.
- The plunger can be removed for cleaning.
- They effectively reduce plunger adhesion when analyzing highly viscous liquid samples that are difficult to draw in with a stainless steel plunger. (This is limited to samples that are unaffected by contact with PTFE.)

Titanium alloy plunger



- Special titanium alloy plungers are highly flexible.
- This limits plunger malfunctions due to bending and sliding friction.
- The plunger cannot be replaced.
- Syringes with titanium alloy plungers are also recommended for analysis of water-soluble samples that are prone to adhesion.

Plunger-in-needle



- This type is suited to high-accuracy analyses of micro injections.
- The sample is collected into the needle, not the barrel.
- The plunger in the needle reaches all the way to the tip, so there is zero dead volume.
- Sample carryover is minimized.

Syringe Selection



Autoinjector Syringes

AOC-30i/AOC-20i Syringes (1 pc each)

Stainless Steel plunger

| Capacity | Needle Length (mm) | Needle Gauge | Needle Outer Diameter (mm) | Needle Tip | P/N |
|----------|--------------------|--------------|----------------------------|------------|--------------|
| 5 µL | 42 | 23 | 0.63 | Cone | 221-75173 |
| 5 µL | 42 | 23/26 | 0.63/0.47 | Cone | 227-35011-01 |
| 10 µL | 42 | 23 | 0.63 | Cone | 221-34618 |
| 10 µL | 42 | 23/26 | 0.63/0.47 | Cone | 227-35010-01 |
| 50 µL | 42 | 23 | 0.63 | Cone | 221-45243 |



Standard accessories (221-34618)

This includes a replacement plunger for the PTFE plunger and two replacement needles.

| Capacity | Needle Length (mm) | Needle Gauge | Needle Outer Diameter (mm) | Needle Tip | P/N | Replacement Plunger P/N | Replacement Needle P/N |
|----------|--------------------|--------------|----------------------------|------------|-----------|-------------------------|------------------------|
| 10 µL | 42 | 23 | 0.63 | Cone | 221-74469 | 221-75173-01 | - |
| 10 µL | 42 | 23 | 0.63 | Cone | 221-75174 | 221-75174-02 | 221-75174-01 |
| 250 µL | 42 | 23 | 0.63 | Cone | 221-45244 | 221-45244-01 | - |

Xtra Life microsyringe

Special titanium alloy plungers are highly flexible, so they can be used with confidence for extended analyses, with no concerns about plunger malfunctions due to bending or sliding friction. These syringes are recommended for analysis of water-soluble samples that are prone to adhesion with stainless steel plungers.

| Capacity | Needle Length (mm) | Needle Gauge | Needle Outer Diameter (mm) | Needle Tip | P/N | Remarks |
|----------|--------------------|--------------|----------------------------|------------|--------------|-------------------------------------|
| 5 µL | 42.5 | 23 | 0.64 | Cone | 227-35401-01 | Premium Item Titanium Alloy Plunger |
| 10 µL | 42.5 | 23 | 0.64 | Cone | 227-35400-01 | Premium Item Titanium Alloy Plunger |

CoreFocus



Plunger-in-needle microsyringe

With this microsyringe, the plunger is inside the needle. Measurement errors are minimized by retaining the sample liquid within the needle, making it suitable for trace sample analyses.

| Capacity | Needle Length (mm) | Needle Gauge | Needle Outer Diameter (mm) | Needle Tip | P/N |
|----------|--------------------|--------------|----------------------------|------------|--------------|
| 0.5 µL | 42 | 23/26 | 0.63/0.47 | Cone | 227-35002-01 |



Microsyringe for OCI analysis

The needle tip has been narrowed to ensure injection into the column tip.

| Capacity | Needle Length (mm) | Needle Gauge | Needle Outer Diameter (mm) | Needle Tip | P/N |
|----------|--------------------|--------------|----------------------------|----------------|--------------|
| 5 µL | 42 | 23/26 | 0.63/0.47 | Side Hole Dome | 227-35031-01 |
| 10 µL | 42 | 23/26 | 0.63/0.47 | Side Hole Dome | 221-37282-02 |



AOC-6000 Plus Syringes (1 pc each)

The Smart Syringe, which can be used with the AOC-6000 Plus, is equipped with a proprietary R/W chip that can store information on syringe type parameters, operational range, and usage logs. Smart Syringes are automatically recognized by the AOC-6000 Plus, so their lifetime can be tracked.

AOC-6000 Plus syringe can also be used for AOC-6000.

When using derivatization reagents, select a syringe with a PTFE plunger.

| Capacity | Plunger Type | Needle Length (mm) | Needle Gauge | Needle Outer Diameter (mm) | Needle Tip | P/N | Application |
|----------|-----------------|--------------------|--------------|----------------------------|----------------|--------------|---------------------|
| 10 µL | Stainless Steel | 57 | 23S | 0.64 | Cone | 227-35352-02 | Liquid Injection |
| 10 µL | PTFE | 57 | 26S | 0.47 | Cone | 227-35353-01 | Liquid Injection |
| 10 µL | PTFE | 57 | 23S | 0.64 | Cone | 227-35353-02 | Liquid Injection |
| 25 µL | PTFE | 57 | 26S | 0.47 | Cone | 227-35354-01 | Liquid Injection |
| 100 µL | PTFE | 57 | 26S | 0.47 | Cone | 227-35355-01 | Liquid Injection |
| 250 µL | PTFE | 57 | 26 | 0.46 | Cone | 227-35356-01 | Liquid Injection |
| 1000 µL | PTFE | 57 | 23 | 0.64 | Cone | 227-35358-01 | Liquid Injection |
| 1300 µL | PTFE | – | 23S | 0.64 | Side Hole Dome | 227-35385-01 | ITEX Injection |
| 2250 µL | PTFE | 65 | 23 | – | Side Hole Dome | 227-35387-01 | Headspace Injection |
| 2500 µL | PTFE | 65 | 23S | 0.64 | Side Hole Dome | 227-35359-01 | Headspace Injection |

Select from the following syringes when using LINEX.

| Capacity | Plunger Type | Needle Length (mm) | Needle Gauge | Needle Outer Diameter (mm) | Needle Tip | P/N | Application |
|----------|-----------------|--------------------|--------------|----------------------------|------------|--------------|-------------------------|
| 10 µL | Stainless Steel | 85 | 26S | 0.47 | Cone | 227-35361-01 | Liquid Injection, LINEX |
| 10 µL | PTFE | 85 | 26S | 0.47 | Cone | 227-35361-02 | Liquid Injection, LINEX |
| 100 µL | PTFE | 85 | 26S | 0.47 | Cone | 227-35362-01 | Liquid Injection, LINEX |

AOC-6000 Syringes (1 pc each)

Please note that AOC-6000 Plus syringe can be used for AOC-6000, but AOC-6000 syringe cannot be used for AOC-6000 Plus.

When using derivatization reagents, select a syringe with a PTFE plunger.

| Capacity | Plunger Type | Needle Length (mm) | Needle Gauge | Needle Outer Diameter (mm) | Needle Tip | P/N | Application |
|----------|-----------------|--------------------|--------------|----------------------------|----------------|--------------|---------------------|
| 1 µL | Stainless Steel | 57 | 23 | 0.63 | Cone | 225-19744-01 | Liquid Injection |
| 5 µL | Stainless Steel | 57 | 26S | 0.47 | Cone | 225-19744-02 | Liquid Injection |
| 10 µL | Stainless Steel | 57 | 26S | 0.47 | Cone | 225-19744-03 | Liquid Injection |
| 10 µL | PTFE | 57 | 26S | 0.47 | Cone | 225-19744-04 | Liquid Injection |
| 25 µL | PTFE | 57 | 26S | 0.47 | Cone | 225-19744-05 | Liquid Injection |
| 50 µL | PTFE | 57 | 26S | 0.47 | Cone | 225-19744-06 | Liquid Injection |
| 100 µL | PTFE | 57 | 26S | 0.47 | Cone | 225-19744-07 | Liquid Injection |
| 250 µL | PTFE | 57 | 26S | 0.47 | Cone | 225-19744-08 | Liquid Injection |
| 500 µL | PTFE | 57 | 26S | 0.47 | Cone | 225-19744-09 | Liquid Injection |
| 1000 µL | PTFE | 57 | 22 | 0.72 | Cone | 225-19744-10 | Liquid Injection |
| 1300 µL | PTFE | – | 23S | 0.64 | Side Hole Dome | 227-35385-01 | ITEX Injection |
| 2500 µL | PTFE | 65 | 23 | 0.63 | Side Hole Dome | 225-19744-11 | Headspace Injection |

Select from the following syringes when using LINEX.

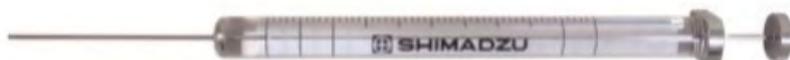
| Capacity | Plunger Type | Needle Length (mm) | Needle Gauge | Needle Outer Diameter (mm) | Needle Tip | P/N | Application |
|----------|-----------------|--------------------|--------------|----------------------------|------------|--------------|-------------------------|
| 5 µL | Stainless Steel | 85 | 23 | 0.63 | Cone | 227-37160-01 | Liquid Injection, LINEX |
| 10 µL | Stainless Steel | 85 | 23 | 0.63 | Cone | 227-37161-01 | Liquid Injection, LINEX |
| 10 µL | PTFE | 85 | 23 | 0.63 | Cone | 227-37162-01 | Liquid Injection, LINEX |
| 25 µL | PTFE | 85 | 23 | 0.63 | Cone | 227-37163-01 | Liquid Injection, LINEX |
| 50 µL | PTFE | 85 | 23 | 0.63 | Cone | 227-37164-01 | Liquid Injection, LINEX |
| 100 µL | PTFE | 85 | 23 | 0.63 | Cone | 227-37165-01 | Liquid Injection, LINEX |

Manual Syringes

Standard Syringes

General-purpose manual syringes are available with capacities ranging from 5 to 500 μL . They can be used in a wide range of laboratory work.

Fixed needles



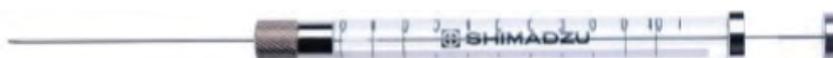
Stainless Steel plungers

| Capacity | Needle Length (mm) | Needle Gauge | Needle Outer Diameter (mm) | Needle Tip | P/N |
|-------------------|--------------------|--------------|----------------------------|------------|--------------|
| 5 μL | 50 | 26 | 0.47 | Bevel | 221-75170 |
| 10 μL | 50 | 26 | 0.47 | Bevel | 670-12552-01 |
| 10 μL | 51 | 22 | 0.71 | LC | 670-12554-01 |
| 25 μL | 50 | 25 | 0.5 | Bevel | 670-12510-31 |
| 25 μL | 51 | 22 | 0.71 | LC | 670-12554-02 |
| 50 μL | 50 | 25 | 0.5 | Bevel | 670-12510-36 |
| 50 μL | 51 | 22 | 0.71 | LC | 670-12554-03 |
| 100 μL | 50 | 25 | 0.5 | Bevel | 670-12510-18 |
| 100 μL | 51 | 22 | 0.71 | LC | 670-12554-04 |
| 250 μL | 50 | 25 | 0.5 | Bevel | 670-12510-19 |
| 250 μL | 51 | 22 | 0.71 | LC | 670-12554-05 |
| 500 μL | 50 | 25 | 0.5 | Bevel | 670-12510-20 |
| 500 μL | 51 | 22 | 0.71 | LC | 670-12554-06 |

PTFE plungers

| Capacity | Needle Length (mm) | Needle Gauge | Needle Outer Diameter (mm) | Needle Tip | P/N | Replacement Plunger P/N |
|-------------------|--------------------|--------------|----------------------------|------------|--------------|-------------------------|
| 10 μL | 50 | 26 | 0.47 | Bevel | 221-75170-01 | 221-75170-02 |
| 25 μL | 50 | 25 | 0.5 | Bevel | 221-75171 | 221-75171-01 |
| 50 μL | 50 | 25 | 0.5 | Bevel | 221-75172 | 221-75172-03 |
| 100 μL | 50 | 25 | 0.5 | Bevel | 221-75172-01 | 221-75172-04 |
| 250 μL | 50 | 25 | 0.5 | Bevel | 221-75172-02 | 221-75172-05 |

Replaceable needles



| Capacity | PTFE Tipped Plunger | Needle Length (mm) | Needle Gauge | Needle Outer Diameter (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 | 670-12553-34 | – |
| 50 μL | – | 50 | 25 | 0.5 | Bevel | 670-12510-75 | – | – |
| 100 μL | – | 50 | 25 | 0.5 | Bevel | 670-12510-76 | 670-12553-36 | – |
| 250 μL | – | 50 | 25 | 0.5 | Bevel | 670-12510-77 | – | – |
| 500 μL | – | 50 | 25 | 0.5 | Bevel | 670-12510-78 | – | – |

Syringes by Application

Plunger-in-needle microsyringes (trace analysis)

With this microsyringe, the plunger is inside the needle. Measurement errors due to the sample liquid retained within the needle are minimized, making it suitable for high-accuracy trace sample analyses.

| Capacity | Needle Length (mm) | Needle Outer Diameter (mm) | Needle Tip | P/N |
|----------|--------------------|----------------------------|------------|--------------|
| 0.5 µL | 70 | 0.64 | Cone | 670-12510-71 |
| 1 µL | 70 | 0.64 | Cone | 670-12510-72 |
| 5 µL | 70 | 0.64 | Cone | 670-12510-73 |

Elastic plunger microsyringes (extended analyses and aqueous analyses)

This microsyringe uses a titanium alloy plunger that is highly elastic and chemical resistant. The plunger does not break easily because it recovers flexibly when bent, so even the small capacity 5 µL size can be used with confidence. With an outer tip diameter of 0.43 mm, it can also be used for capillary on-column injection (OCI).



| Capacity | Needle Length (mm) | Needle Outer Diameter (mm) | P/N | Replacement Needle P/N | Remarks |
|----------|--------------------|----------------------------|--------------|------------------------|--------------------|
| 5 µL | 50 | 0.43/0.52 | 670-12580-21 | - | Fixed Needle |
| 10 µL | 50 | 0.43/0.52 | 670-12580-22 | - | Fixed Needle |
| 5 µL | 50 | 0.43/0.52 | 670-12580-25 | 670-12580-31 (5 pc) | Replaceable Needle |
| 10 µL | 50 | 0.43/0.52 | 670-12580-26 | 670-12580-31 (5 pc) | Replaceable Needle |

Plunger guide-equipped microsyringes (breakage prevention)

With small-capacity syringes with narrow plungers, there are concerns about breaking the plunger if the analyst is inexperienced. This type uses the latter half of the barrel as a guide, and is especially designed to make the plunger grip thicker, which solves the issue of plunger bending. It can be used with confidence, even by novices.



| Capacity | Needle Length (mm) | Needle Outer Diameter (mm) | P/N | Replacement Needle P/N | Remarks |
|----------|--------------------|----------------------------|--------------|------------------------|--------------------|
| 5 µL | 50 | 0.5 | 670-12510-86 | 670-12510-94 (5 pc) | Replaceable Needle |
| 10 µL | 50 | 0.5 | 670-12510-80 | 670-12510-95 (5 pc) | Replaceable Needle |

Microsyringes with guide bar (breakage prevention)

Bending of the plunger is prevented by a guide bar set parallel to the plunger. By adjusting the stopper position, a set volume of sample can be collected each time without checking the markings.



| Capacity | P/N | Replacement Needle P/N | Remarks |
|----------|--------------|------------------------|--------------------|
| 10 µL | 670-12504-25 | - | Fixed Needle |
| 10 µL | 670-12504-22 | 670-12504-86 (5 pc) | Replaceable Needle |

Gas Tight Syringes

Luer lock syringes

The needle is easy to detach, so sampling and delivery can be performed with a different needle. The needle is screwed in, so it is highly pressure resistant.

| Capacity | PTFE Tipped Plunger | Needle Tip | P/N | Replacement Plunger P/N |
|----------|---------------------|------------|--------------|-------------------------|
| 1 mL | ○ | Bevel | 221-54778-01 | 221-54778-11 |
| 5 mL | ○ | Bevel | 221-54778-02 | 221-54778-12 |
| 10 mL | ○ | Bevel | 221-54778-03 | 221-54778-13 |
| 25 mL | ○ | Bevel | 221-54778-04 | 221-54778-14 |
| 50 mL | ○ | Bevel | 221-54778-05 | 221-54778-15 |
| 100 mL | ○ | Bevel | 221-54778-06 | 221-54778-16 |



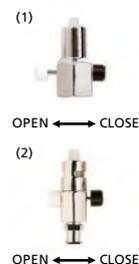
Luer lock needles

| Needle Length (mm) | Needle Gauge | Needle Outer Diameter (mm) | Needle Tip | Quantity | 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 |

Luer tip syringes

The needle can be detached. Sampling and discharge can easily be performed with a different needle. The needle is only press fitted into the tapered cone, so this type is not pressure resistant.

| # | Capacity | Application | Quantity | P/N |
|---|-------------|------------------------------|----------|--------------|
| 1 | 5 mL to 2L | Luer lock needle | 1 | 221-54778-49 |
| 2 | 50 µL to 2L | Luer lock and tipped syringe | 1 | 221-54778-50 |



Gas-tight syringes with replaceable needles

This is a milliliter-sized gas-tight syringe. The needle is 30 mm long and screws in, so it is easily replaced.

| Capacity | P/N | Replacement Needle P/N |
|----------|--------------|------------------------|
| 0.25 mL | 670-12504-28 | 670-12504-85 (5 pc) |
| 0.5 mL | 670-12504-29 | 670-12504-85 (5 pc) |
| 1 mL | 670-12504-30 | 670-12504-85 (5 pc) |
| 2.5 mL | 670-12504-31 | 670-12504-85 (5 pc) |
| 5 mL | 670-12504-32 | 670-12504-85 (5 pc) |
| 10 mL | 670-12504-33 | 670-12504-85 (5 pc) |



Multifunctional Autosampler System AOC-6000 Plus

Smart SPME Fibers and Arrow Selection Guide





Solid Phase Micro Extraction (SPME) Method

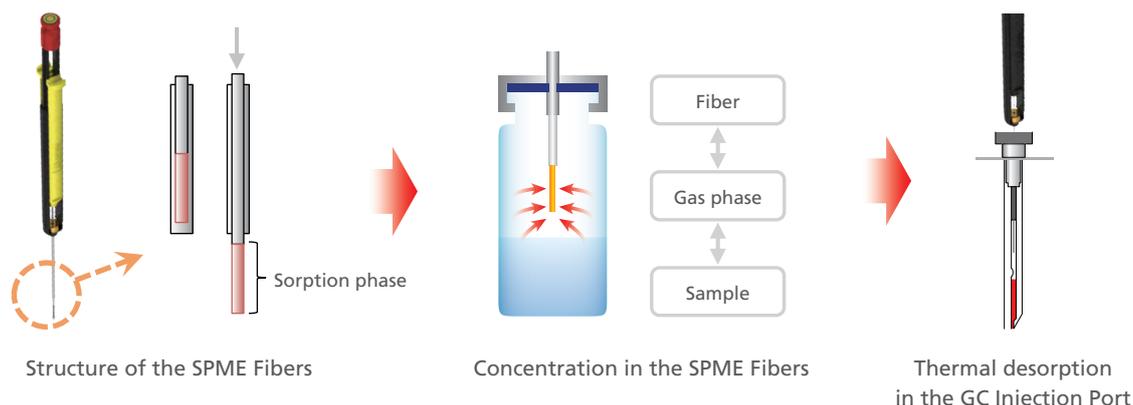
The solid phase micro extraction (SPME) method concentrates volatile compounds in SPME fibers for sample introduction into GC and GCMS. It is used in a wide variety of fields, including food, environmental, chemistry, and life science. It is faster and more convenient than other sample introduction methods and, furthermore, can concentrate volatile compounds without using solvents. Using the AOC-6000 Plus multifunctional autosampler enables automation of all the processes from sampling to analysis and conditioning, and even management of usage logs for Smart SPME fibers and Smart SPME Arrow.

SPME

In the SPME method, SPME fibers are used for sampling. A fiber coated with a sorption phase is stored inside the needle. When the plunger is lowered, the fiber is exposed, and the volatile compounds from the sample are concentrated in the sorption phase.

Afterward, the concentrated compounds are loaded into the GC column under thermal desorption at the GC injection port.

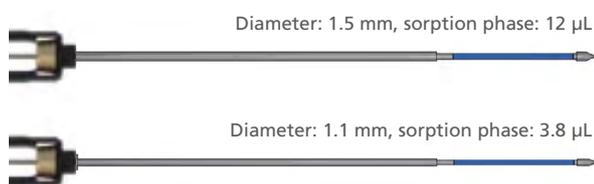
The principle behind the SPME method is movement of the compounds in the sample to the sorption phase in the fibers via the partition coefficient. Accordingly, in order to increase the amount concentrated in the fibers, the sorption phase must be selected to suit the targeted compounds and the sample must be salted out, increasing the sorption phase partition coefficient. The extraction time, the temperature, and the agitation are also important parameters.



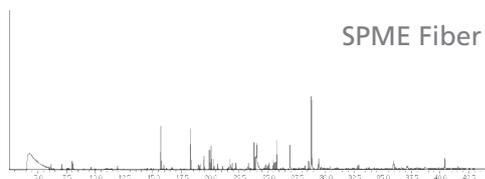
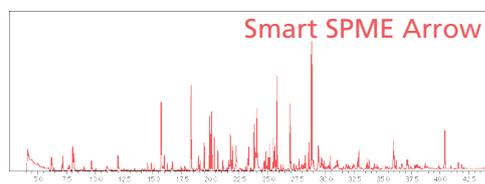
Smart SPME Arrow Provides High Sensitivity and High Durability

Smart SPME Arrow, cutting-edge SPME technology, is coated with more adsorbent than conventional SPME fibers, enabling high-sensitivity analysis. Further, the thick and sturdy construction provides high durability.

Smart SPME Arrow



SPME Fiber



Analysis of Aroma Compounds in Coffee
(The PDMS 100 μ m type Smart SPME Arrow and SPME fibers are used.)

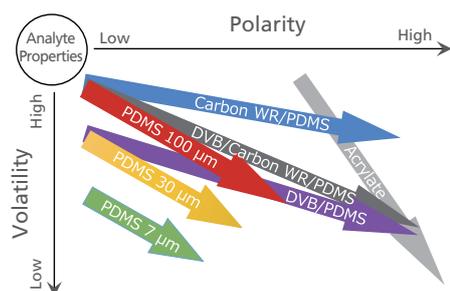
Selection of Smart SPME

Selection of the Sorption Phase

When using SPME fibers and SPME Arrow, the optimal sorption phase for the compounds to be analyzed must be selected.

The Smart SPME fibers and Smart SPME Arrow include various sorption phases, so they can be used in a wide range of analyses.

The following figure and table show the features of each sorption phase corresponding to the targeted compounds. The color of the Smart SPME fibers and Smart SPME Arrow plunger indicates the type of sorption phase, enabling the sorption phase to be ascertained at a glance.



Selection Guide

- PDMS is used for low polarity volatile compounds.
- Carbon WR/PDMS effectively concentrates low molecular weight compounds.
- DVB/PDMS is used for volatile compounds including polar compounds.
- Acrylate is used for high polarity compounds.
- DVB/Carbon WR/PDMS is optimal for a wide range of

Smart SPME Fibers

| | Sorption phase | Target compound | Molecular weight | Polarity | Concentration method |
|--|----------------------------|--|------------------|-----------|----------------------|
| | PDMS, 7 µm | Non-polar, high boiling point compounds | 125-600 | Non Polar | Absorption |
| | PDMS, 30 µm | Non-polar, medium boiling point compounds | 80-500 | Non Polar | Absorption |
| | PDMS, 100 µm | Non-polar to medium polarity volatile compounds | 60-275 | Non Polar | Absorption |
| | Acrylate, 100 µm | Polar, medium boiling point compounds, and phenols | 80-300 | Polar | Absorption |
| | Carbon WR/PDMS, 120 µm | Low molecular weight, low boiling point compounds | 30-225 | Non Polar | Adsorption |
| | DVB/PDMS, 120 µm | Polar, volatile compounds, amines, and alcohols | 60-300 | Bipolar | Adsorption |
| | DVB/Carbon WR/PDMS, 120 µm | A wide range of volatile compounds | 30-300 | Bipolar | Adsorption |

Smart SPME Arrow

| | Sorption phase | Diameter | Target compound | Molecular weight | Polarity | Concentration method |
|--|----------------------------|---------------|--|------------------|-----------|----------------------|
| | PDMS, 100 µm | 1.1 mm/1.5 mm | Non-polar to medium polarity volatile compounds | 60-275 | Non Polar | Absorption |
| | Acrylate, 100 µm | 1.1 mm | Polar, medium boiling point compounds, and phenols | 80-300 | Polar | Absorption |
| | Carbon WR/PDMS, 120 µm | 1.1 mm/1.5 mm | Low molecular weight, low boiling point compounds | 30-225 | Non Polar | Adsorption |
| | DVB/PDMS, 120 µm | 1.1 mm/1.5 mm | Polar, volatile compounds, amines, and alcohols | 60-300 | Bipolar | Adsorption |
| | DVB/Carbon WR/PDMS, 120 µm | 1.1 mm/1.5 mm | A wide range of volatile compounds | 30-300 | Bipolar | Adsorption |
| | PDMS, 250 µm | 1.5 mm | Non-polar to medium polarity volatile compounds | 60-275 | Non Polar | Absorption |

Selection of the Extraction Method

With the SPME method, the sensitivity and compounds that can be measured vary with the extraction method. Accordingly, the extraction method must be selected to suit the analysis objective.

Headspace sampling is the most often used SPME extraction method. It can accommodate a wide range of volatile sample compounds including liquids, solids, and highly viscous samples. In contrast, with direct immersion sampling, the SPME fibers are dipped directly into the liquid sample. This method can accommodate high polarity, high boiling point compounds, which are difficult to collect using headspace sampling. Smart SPME Arrow is particularly durable and optimal for direct immersion sampling. In direct immersion sampling, when the sample contains a solvent that causes PDMS swelling, use of the wide sleeve type is recommended to prevent peeling off of the sorption phase. Additionally, inclusion of the washing step with the recommended solvent is recommended when salting out and for samples containing large matrix quantities.



SPME Method

Headspace Sampling

- Accommodates samples with a wide range of forms and matrices
- Compatible with volatile compounds
- Smart SPME fibers and Smart SPME Arrow can be used.

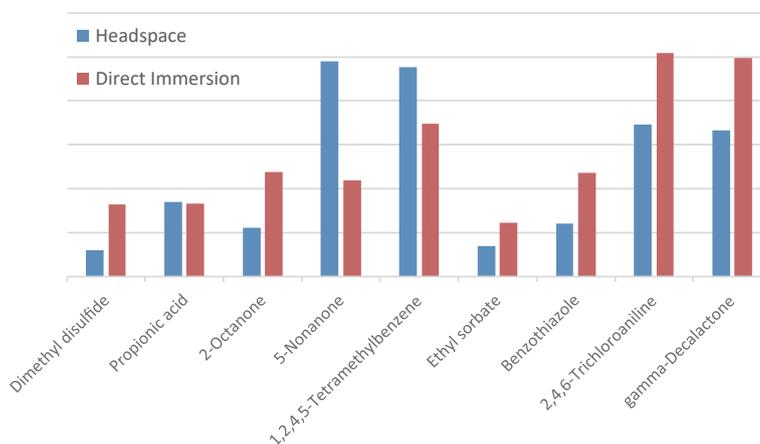


SPME Method

Direct Immersion Sampling

- Suitable for liquid samples
- Can concentrate high polarity, high boiling point compounds, which are hard to vaporize
- If there is PDMS swelling, use the wide sleeve Smart SPME Arrow.

The figure at right shows a comparison of the response of headspace sampling and direct immersion sampling using Smart SPME Arrow (PDMS, 250 μ m). Low vapor pressure compounds are collected very efficiently with headspace sampling. Highly polar, high boiling point components tend to be collected very efficiently with direct immersion sampling.



Selection of Glass Inserts

Favorably shaped peaks can be obtained by selecting the optimal GC glass insert for the Smart SPME fibers or Smart SPME Arrow. When using Smart SPME fibers, if glass inserts for liquid injection are used, the bandwidth for low boiling point compounds will widen, resulting in broadly shaped peaks. For this reason, with the SPME method, sharp peaks can be obtained by using glass inserts with as narrow an inner diameter as possible.

- When using Smart SPME fibers, select a glass insert with a narrow 0.8 mm inner diameter for SPME.
- When using Smart SPME Arrow with an outer diameter of 1.1 mm, use glass inserts for SPME Arrow with an inner diameter of 1.3 or 1.7 mm.
- When using Smart SPME Arrow with an outer diameter of 1.5 mm, use glass inserts for SPME Arrow with an inner diameter of 1.7 mm.

Ordering Guide

Smart SPME Fiber

| No. | Sorption phase | Phase thickness | Color code | P/N (1 pc) | P/N (3 pcs) | P/N (5 pcs) |
|---|-----------------------------|-----------------|------------|--------------|--------------|--------------|
| 1 | Polydimethylsiloxane (PDMS) | 7 µm | Green | 227-35342-01 | 227-35342-03 | 227-35342-05 |
| 2 | Polydimethylsiloxane (PDMS) | 30 µm | Golden | 227-35343-01 | 227-35343-03 | 227-35343-05 |
| 3 | Polydimethylsiloxane (PDMS) | 100 µm | Red | 227-35344-01 | 227-35344-03 | 227-35344-05 |
| 4 | Acrylate | 85 µm | Grey | 227-35348-01 | 227-35348-03 | 227-35348-05 |
| 5 | Carbon Wide Range (WR)/PDMS | 95 µm | Dark Blue | 227-35347-01 | 227-35347-03 | 227-35347-05 |
| 6 | Divinylbenzene (DVB)/PDMS | 65 µm | Violet | 227-35346-01 | 227-35346-03 | 227-35346-05 |
| 7 | DVB/Carbon WR/PDMS | 80 µm | Dark Grey | 227-35345-01 | 227-35345-03 | 227-35345-05 |
| Smart SPME fiber for method developing 1 (No. 1, 2, 3, 4 and 5) | | | | | | 227-35349-01 |
| Smart SPME fiber for method developing 2 (No. 3, 4, 5, 6 and 7) | | | | | | 227-35350-01 |

Smart SPME Arrow

| No. | Diameter | Sorption phase | Phase thickness | Color code | P/N (1 pc) | P/N (3 pcs) | P/N (5 pcs) |
|--|----------|-----------------------------|-----------------|------------|--------------|--------------|--------------|
| 1 | 1.1 mm | Polydimethylsiloxane (PDMS) | 100 µm | Red | 227-35334-01 | 227-35334-03 | 227-35334-05 |
| 2* | 1.5 mm | Polydimethylsiloxane (PDMS) | 100 µm | Red | 227-35338-01 | 227-35338-03 | 227-35338-05 |
| 3 | 1.1 mm | Acrylate | 100 µm | Grey | 227-35330-01 | 227-35330-03 | 227-35330-05 |
| 4 | 1.1 mm | Carbon Wide Range (WR)/PDMS | 120 µm | Light Blue | 227-35331-01 | 227-35331-03 | 227-35331-05 |
| 5* | 1.5 mm | Carbon Wide Range (WR)/PDMS | 120 µm | Light Blue | 227-35335-01 | 227-35335-03 | 227-35335-05 |
| 6 | 1.1 mm | Divinylbenzene (DVB)/PDMS | 120 µm | Violet | 227-35332-01 | 227-35332-03 | 227-35332-05 |
| 7* | 1.5 mm | Divinylbenzene (DVB)/PDMS | 120 µm | Violet | 227-35337-01 | 227-35337-03 | 227-35337-05 |
| 8 | 1.1 mm | DVB/Carbon WR/PDMS | 120 µm | Dark Grey | 227-35333-01 | 227-35333-03 | 227-35333-05 |
| 9* | 1.5 mm | DVB/Carbon WR/PDMS | 120 µm | Dark Grey | 227-35336-01 | 227-35336-03 | 227-35336-05 |
| 10 | 1.5 mm | Polydimethylsiloxane (PDMS) | 250 µm | Black | 227-35339-01 | 227-35339-03 | 227-35339-05 |
| Smart SPME Arrow for method development 2 (No. 1, 3, 4, 6 and 8) | | | | | | | 227-35341-01 |

*Use the SPME Arrow wide sleeve type for applications in which the PDMS layer might swell due to the solvent.

Glass Inserts

| Part Name | P/N | Remarks |
|--|--------------|---|
| Smart SPME Inserts, 5 pc. | 221-75196 | |
| Smart SPME Arrow Inserts, Inner Diameter 1.3 mm, 3 pc. | 227-35327-03 | For Smart SPME Arrow with an outer diameter of 1.1 mm |
| Smart SPME Arrow Inserts, Inner Diameter 1.7 mm, 3 pc. | 227-35328-03 | For Smart SPME Arrow with an outer diameter of 1.1 mm or 1.5 mm |

Vials

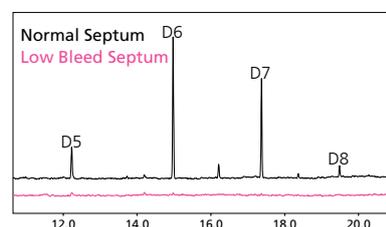
| Part Name | P/N | Quantity |
|---|--------------|----------|
| 20 mL Screw Vial, Transparent | 227-34141-01 | 100 |
| Magnetic Screw Cap and Septum for 10-20 mL, Silicone (white)/PTFE (blue) | 227-34152-01 | 100 |
| Low Bleed Septum for SPME, Magnetic Screw Cap and Septum for 10-20 mL, Silicone (reddish brown)/PTFE (dark reddish-brown) | 225-47192-91 | 100 |

Low Bleed Septum for SPME

SPME analyses often detect peaks of cyclic siloxanes from septums, which can interfere with the analytes. The newly developed low bleed septum for SPME minimizes the bleed of siloxanes derived from the septum.



Low Bleed Septum for SPME



Evaluation by blank analysis, vial heating condition 80 °C
(Normal Septum vs Low Bleed Septum)

Glass Insert Selection Guide for GC and GC-MS

GC/GC-MS Glass Insert/Liner Selection Guide



Introduction



Glass Inserts/Liners

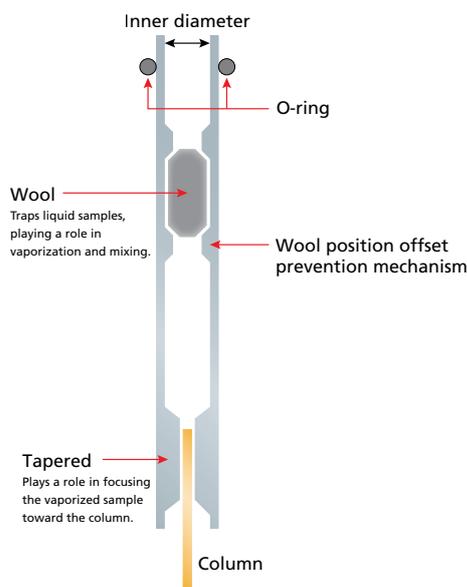
In a gas chromatograph, the sample is injected into the column via the injection unit. A glass insert / liner is used to vaporize the sample more efficiently, and to inject the vaporized sample into the column with no unnecessary dispersion. Additionally, using a glass insert reduces the extent to which contaminants such as high boiling point compounds from the sample contaminate the injection unit. Accordingly, selecting a glass insert appropriate for the objective heightens the accuracy of analysis and leads to more reliable results.

When selecting a glass insert, various selection standards are used depending on the application. For example, the following cases can be cited as selection standards for glass inserts.

- What type of injection unit is used? What sample injection method is used during analysis?
- Is the glass insert filled with wool (glass wool)? What shape is the glass insert?
- What are the dimensions of the glass insert?
- Is surface treatment of the glass insert necessary?

Glass inserts with a variety of specifications are commercially available to suit these varied selection criteria, so selecting a glass insert can be daunting.

This selection guide describes how to select an appropriate glass insert for the objective/application as well as points to consider in accordance with elements of the glass insert configuration. Additionally, this guide introduces glass inserts appropriate for your Shimadzu GC system.



Schematic Diagram of the Glass Insert and O-Ring



| Element | Parameter | Explanation | Role |
|-------------------|---|--|---|
| Wool | Position | Wool position within the glass insert | Controls the vaporization point |
| | Amount of filler | Weight of the wool | Controls the vaporization efficiency |
| Inner Diameter | Inner diameter | Inner diameter of the glass insert | Impact on the delivery rate of the vaporized components |
| | Capacity | Internal volume of the glass insert | Impact on the upper limit of the injection volume |
| Shape | Wool position offset prevention mechanism | Protrusion within the glass insert on the order of 1 mm | Prevents offset of the wool position |
| | Tapered | A narrowing of the inner diameter at the bottom of the glass insert on the order of 1 mm | Focuses the vaporized sample toward the column tip |
| Surface Treatment | | Chemical treatment of the surface of the glass insert | Impact on adsorption and degradation of compounds |

Sample Injection Unit/Injection Method

The glass insert is designed in accordance with the sample injection method. This section introduces typical sample injection unit and injection methods.

Select a glass insert suited to the sample injection unit and injection method being used.

| Sample Injection Unit | Injection Method | Glass Insert | Target Sample | Sample Injection | Compatible Columns |
|-----------------------|--------------------------------|--|--|--|---|
| SPL | Split | Split glass insert, Split/Splitless glass insert | Medium to high-concentration samples | The sample is instantaneously vaporized, and some of it is injected into the column. | 0.1 mm to 0.53 mm capillary columns |
| | Splitless | Splitless glass insert, Split/Splitless glass insert | Low-concentration samples | The sample is vaporized, and a large portion of it is injected into the column. | 0.1 mm to 0.53 mm capillary columns (Wide diameter columns are more suitable) |
| WBI | Full volume injection (Direct) | Splitless glass insert/WBI glass insert | No concentration restriction | The sample is instantaneously vaporized, and the full amount is injected into the column. | 0.53 mm capillary columns |
| OCI | Full volume injection (Direct) | OCI glass insert | Samples with a wide range of boiling points, and samples with ultra-high boiling points | The entire sample solution is injected into the column before vaporization. | 0.25 mm to 0.53 mm capillary columns |
| PTV | Heated split | PTV glass insert | Medium to high-concentration samples prone to thermal decomposition, and samples with a wide range of boiling points | A heating program is used to vaporize the compounds in the sample in order of boiling point. A portion is then injected into the column. | 0.1 mm to 0.53 mm capillary columns |
| | Heated splitless | PTV glass insert | Low-concentration samples prone to thermal decomposition, and samples with a wide range of boiling points | A heating program is used to vaporize the compounds in the sample in order of boiling point. A large portion is then injected into the column. | 0.1 mm to 0.53 mm capillary columns (Wide diameter columns are more suitable) |
| SINJ/DINJ | Full volume injection (Direct) | Packed glass insert | No concentration restriction | The sample is instantaneously vaporized, and the full amount is injected into the column. | Packed Columns |

Glass Insert Selection



Glass Inserts by GC Model/Sample Injection Unit

This section introduces frequently used, general-purpose glass inserts for each GC model, sample injection unit, and injection method. If you are having difficulty making a selection, it is recommended that you start by selecting from the following lineup. The full glass insert list is provided in Chapter 4, so use that in combination with this section.

Nexis GC-2030

GCMS-QP2020 NX
GCMS-TQ8040 NX
GCMS-TQ8050 NX

Brevis GC-2050



GC-2030

GC-2050

SPL (Split)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|------------------------|----------------------------|
| 1 | | 227-35007-01 | 5 | ✓ | 95 | 4.9 | 3.4 | 863 | Inactivation treatment | 350°C |

General purpose item

Standard accessory

SPL (Splitless)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|------------------------|----------------------------|
| 19 | | 227-35008-01 | 5 | ✓ | 95 | 5 | 3.4 | 654 | Inactivation treatment | 350°C |

General purpose item

Standard accessory

WBI (Full Volume Injection)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|------------------------|----------------------------|
| 19 | | 227-35008-01 | 5 | ✓ | 95 | 5 | 3.4 | 654 | Inactivation treatment | 350°C |

General purpose item

Standard accessory

Nexis GC-2030

GCMS-QP2020 NX
GCMS-TQ8040 NX
GCMS-TQ8050 NX

Brevis GC-2050



GC-2030

GC-2050

SINJ+WBC Attachment (WBC Full Volume Injection)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (µL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|-------------------|----------------------------|
| 34 | | 221-38107-02 | 1 | --- | 126 | 4.8 | 3.4 | 870 | None | 450°C |

OCI-2030 Insert (Metal)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (µL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|-------------------|----------------------------|
| 25 | | 221-49298-91 | 1 | --- | 103 | 2 | 1 | 81 | None | 450°C |

Note: Cannot be used with the OCI-2030 NX.

Simple OCI Insert

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (µL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|---|----------------------------|
| 27 | | 221-49381-02 | 1 | --- | 95 | 3.5 | 0.8 | 48 | Inactivation treatment (Silanizing treatment) | 350°C |

Note: Cannot be used with the OCI-2030 NX

OCI-2030 NX Insert (Metal)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (µL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|-----------|----------|--------------|-------------|---------------------|---------------------|---------------|-------------------|----------------------------|
| 28 | | 221-85694 | 1 | --- | 11.5 | - | - | - | None | 450°C |

Note: Note: This can only be used with the OCI-2030 NX. This cannot be used with OCI-2030.

PTV (Heated Split/Heated Splitless)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (µL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|-----------|----------|--------------|-------------|---------------------|---------------------|---------------|-------------------|----------------------------|
| 30 | | 221-49300 | 1 | --- | 95 | 3.5 | 1.5 | 168 | None | 450°C |

General purpose item

Standard accessory

GC/GC-MS Glass/Liner Insert Selection Guide

SINJ (Packed Column Full Volume Injection)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (µL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|-----------|----------|--------------|-------------|---------------------|---------------------|---------------|-------------------|----------------------------|
| 32 | | 221-80902 | 1 | --- | 93 | 5 | 3.4 | 726 | None | 450°C |

Standard accessory

GC-2010 series

GCMS-QP2010 SE
GCMS-QP2020
GCMS-TQ8050/8040/8030



GC-2010

SPL (Split)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|------------------------|----------------------------|
| 1 | | 227-35007-01 | 5 | ✓ | 95 | 4.9 | 3.4 | 863 | Inactivation treatment | 400°C |
| 2 | | 221-41444-01 | 1 | --- | 95 | 4.9 | 3.4 | 863 | None | 450°C |
| 21 | | 225-20803-01 | 5 | ✓ | 95 | 5 | 3.5 | 914 | Inactivation treatment | 350°C |

General purpose item

Standard accessory

227-35007-01 can be used with the GC-2010 series. The wool filling position differs from the recommended position for the 2010 series. If it is used in the default position, the form is such that as with the GC-2030, the tip of the syringe needle will enter the wool.

· 221-41444-01 is a standard accessory for the GC-2010 unit.

· 225-20803-01 has a history of being recommended for GCMS with the GC-2010 series.

SPL (Splitless)/WBI (Full Volume Injection)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|------------------------|----------------------------|
| 19 | | 227-35008-01 | 5 | ✓ | 95 | 5 | 3.4 | 654 | Inactivation treatment | 400°C |
| 20 | | 221-48335-01 | 1 | --- | 95 | 5 | 3.4 | 654 | None | 450°C |
| 6 | | 221-48876-03 | 5 | ✓ | 95 | 5 | 3.4 | 654 | Inactivation treatment | 350°C |

General purpose item

Standard accessory

· 227-35008-01 can be used with the GC-2010 series.

· 221-48335-01 is a standard accessory for the GC-2010 unit.

· 221-48876-03 has a history of being recommended for GCMS with the GC-2010 series.

OCI Insert (Metal)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|-------------------|----------------------------|
| 25 | | 221-49298-91 | 1 | --- | 103 | 2 | 1 | 81 | None | 450°C |

Simple OCI Insert

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|---|----------------------------|
| 27 | | 221-49381-02 | 1 | --- | 95 | 3.5 | 0.8 | 48 | Inactivation treatment (Silanizing treatment) | 350°C |

PTV (Heated Split/Heated Splitless)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|-----------|----------|--------------|-------------|---------------------|---------------------|---------------|-------------------|----------------------------|
| 30 | | 221-49300 | 1 | --- | 95 | 3.5 | 1.5 | 168 | None | 450°C |

General purpose item

Standard accessory

GC-2014 series



GC-2014/GC-2014s/GC-2014c

SPL (Split)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|---------------------------|----------|--------------|-------------|---------------------|---------------------|---------------|------------------------|----------------------------|
| 1 | | 227-35007-01 | 5 | 8.5 | 95 | 4.9 | 3.4 | 863 | Inactivation treatment | 350°C |
| 3 | | 221-41444 221-41444-84 | 1 5 | --- | 95 | 5 | 3.4 | 863 | None | 450°C |

General purpose item

Standard accessory

- 227-35007-01 can be used with the GC-2014 series. The wool filling position differs from the recommended position for the 2014 series.
- 221-41444 is a standard accessory for the GC-2014 unit. It is not wool filled.

SPL (Splitless)/WBI (Full Volume Injection)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|------------------------|----------------------------|
| 19 | | 227-35008-01 | 5 | ✓ | 95 | 5 | 3.4 | 654 | Inactivation treatment | 400°C |
| 20 | | 221-48335-01 | 1 | --- | 95 | 5 | 3.4 | 654 | None | 450°C |

General purpose item

Standard accessory

- 227-35008-01 can be used with the GC-2014 series.
- 221-48335-01 is a standard accessory for the GC-2014 unit. It is not wool filled.

SINJ/DINJ+WBC Attachment (WBC Full Volume Injection)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|-----------|----------|--------------|-------------|---------------------|---------------------|---------------|-------------------|----------------------------|
| 33 | | 221-38107 | 1 | --- | 139 | 4.8 | 3.4 | 988 | None | 450°C |

SINJ/DINJ (Dia. 3.2 mm Packed Column Full Volume Injection Method)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|---------------------------|----------|--------------|-------------|---------------------|---------------------|---------------|-------------------|----------------------------|
| 37 | | 221-14093 221-14093-84 | 1 5 | --- | 139 | 4.4 (Tip 2.9) | 3.5 | 1104 | None | 450°C |

Standard accessory

- 221-14093 and 14093-84 are used for glass-packed or SUS-packed columns with a diameter of 3.0 to 3.4mm.

SINJ/DINJ (Dia. 2.6 mm Packed Column Full Volume Injection Method)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|---------------------------|----------|--------------|-------------|---------------------|---------------------|---------------|-------------------|----------------------------|
| 38 | | 221-14094 221-14094-84 | 1 5 | --- | 139 | 4.4 (Tip 2.3) | 3.4 | 825 | None | 450°C |

Standard accessory

- 221-14094 and 14094-84 are used for glass-packed columns with a diameter of 2.4 to 2.8mm.

GC-2025



GC-2025

SPL (Split)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|---------------------------|----------|--------------|-------------|---------------------|---------------------|---------------|------------------------|----------------------------|
| 1 | | 227-35007-01 | 5 | 8.5 | 95 | 5 | 3.4 | 863 | Inactivation treatment | 350°C |
| 3 | | 221-41444 221-41444-84 | 1 5 | --- | 95 | 5 | 3.4 | 863 | None | 450°C |

General purpose item

Standard accessory

- 227-35007-01 can be used with the GC-2025. The wool filling position differs from the recommended position for the 2025. If it is used in the default position, the form is such that as with the GC-2030, the tip of the syringe needle will enter the wool.
- 221-41444 is a standard accessory for the GC-2025 unit. It is not wool filled.

SPL (Splitless)/WBI (Full Volume Injection)

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|------------------------|----------------------------|
| 19 | | 227-35008-01 | 5 | ✓ | 95 | 5 | 3.4 | 654 | Inactivation treatment | 400°C |
| 20 | | 221-48335-01 | 1 | --- | 95 | 5 | 3.4 | 654 | None | 450°C |

General purpose item

Standard accessory

- 227-35008-01 is a wool filled glass insert that can be used with the GC-2025 series.
- 221-48335-01 is a standard accessory for the GC-2025 unit. It is not wool filled.

HS-10



HS-10

With the HS-10 headspace sampler, the transfer line is connected to the GC SPL injection port. The sample is injected from the HS to the GC. The HS-10 glass insert is used for the SPL.

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|------------------------|----------------------------|
| 40 | | 227-35014-01 | 1 | --- | 95 | 5 | 1.2 | 107 | Inactivation treatment | 350°C |

Shimadzu HS-20 series Headspace sampler has a short transfer line design that reduces carryover and enables highly sensitive analysis.

A glass insert is not required for HS-20 series because a column can be connected to them without going through a injection units such as SPL.

Glass Insert Selection by Application

SPME/SPME Arrow Analysis

The solid phase micro extraction (SPME) method concentrates volatile components in SPME fibers, for sample loading into GC and GCMS systems. Analysis can be performed by the AOC-6000 Plus multi-functional autosampler system.

Refer also to C146-E424 "Smart SPME Fibers and Arrow Selection Guide".



AOC-6000 Plus

Favorably shaped peaks can be obtained by selecting the optimal GC injection port glass insert for the Smart SPME fibers or Smart SPME Arrow. If an ordinary glass insert for liquid injection is used when using Smart SPME fibers, the bandwidth for low boiling point compounds widens, leading to wider peak shapes. For this reason, with the SPME method, use glass inserts with as narrow an inner diameter as possible to obtain sharp peaks.

SPME

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|-----------|----------|--------------|-------------|---------------------|---------------------|---------------|-------------------|----------------------------|
| 18 | | 221-75196 | 5 | --- | 95 | 5 | 0.8 | 48 | None | 350°C |

When using Smart SPME fibers, select a glass insert with a narrow 0.8 mm inner diameter for SPME.

SPME Arrow

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|-------------------|----------------------------|
| 41 | | 227-35327-03 | 3 | --- | 95 | 5 | 1.3 | 126 | None | 350°C |
| 42 | | 227-35328-03 | 3 | --- | 95 | 5 | 1.7 | 216 | None | 350°C |

- When using Smart SPME Arrow with an outer diameter of 1.1 mm, use glass inserts for SPME Arrow with an inner diameter of 1.3 or 1.7 mm.
- When using Smart SPME Arrow with an outer diameter of 1.5 mm, use glass inserts for SPME Arrow with an inner diameter of 1.7 mm.

Aqueous Solvent Analysis

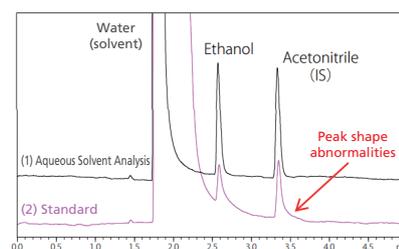


GC-2030/GC-2050/GC-2010 series/GC-2014 series/GC-2025

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|------------------------|----------------------------|
| 39 | | 227-35015-01 | 5 | ✓ | 95 | 5 | 3.4 | 863 | Inactivation treatment | 400°C |

227-35015-01 is a glass insert for aqueous solvent analysis. The shape, wool amount, and wool filling position are optimized, enabling stable sample vaporization and good repeatability.

Application News (01-00328) introduces examples of the use of glass inserts for aqueous solvent analysis.



Measurement Results for a Standard Solution for Alcohol Concentration Measurements (TCD)

SPL (Split/Splitless)



GC-2030/GC-2050/GC-2010 series/GC-2014 series/GC-2025

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|---|--------------|----------|--------------|-------------|---------------------|---------------------|---------------|------------------------|----------------------------|
| 8 |  | 227-35016-01 | 5 | ✓ | 95 | 5 | 3.5 | 847 | Inactivation treatment | 350°C |

The 227-35016-01 split/splitless glass insert can accommodate two injection methods with one. This insert, with its high wool content, is suitable for the analysis of relatively stable compounds. Delicate compounds like pesticides may be prone to accelerated degradation. If you cannot get good analysis results with this split/splitless glass insert, the 227-35007-01 split insert and the 227-35008-01 splitless insert, which are better optimized for each injection method, are recommended.

- The lower taper of this insert may pose resistance issues, especially when high split flow rates are configured, particularly when using large-diameter columns.
- This insert, with its high wool content, is well-suited for relatively stable compounds. Delicate compounds like pesticides may be prone to accelerated degradation.
- This insert has wool located in the upper part, which results in poor transition for relatively high-boiling compounds.

Selection Guide



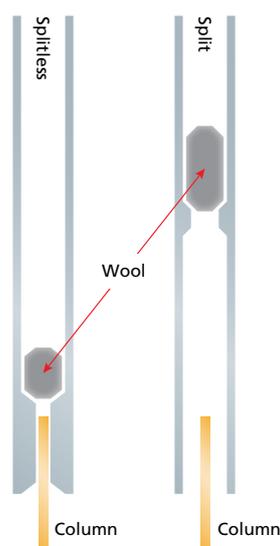
This section describes glass insert selection methods.

Selecting the Glass Insert Wool

Wool is used inside the glass insert when performing SPL, WBI, and PTV analysis. The wool traps the liquid sample injected into the glass insert, promoting efficient vaporization. The two main wool substances are hard glass and quartz glass. This section describes the role of the wool, and cautions when filling the glass insert with wool.

Wool Filling Position

In many cases, the liquid sample is vaporized at the wool surface or within the wool plug. In other words, the wool position is the site at which the sample vaporizes, so controlling the position of the wool controls the timing of the sample vaporization.



In splitless analysis with a smaller flowrate of the carrier gas and direct analysis, the glass insert is generally filled with wool all the way to the bottom.

If the vaporization site is too far away from the column inlet, it will take time for the vaporized sample to reach the column inlet, which can cause reduced sensitivity and peak shape problems. Additionally, there is a risk that the vaporized sample will spill over the top of the glass insert, leading to reversed flow or deviation from the septum purge flowrate. Caution is necessary when injecting 3 μL or more of the sample.

In split analysis with a larger total flowrate of the carrier gas, the top of the glass insert is generally filled with wool.

If the top is filled with wool, the syringe needle tip and the top edge of the wool tend to be in close proximity or contact. As a result, when the liquid sample is injected, the direction of scatter of the liquid from the syringe needle tip is uniform, leading to improved repeatability of area values.

Wool Filling Position

The amount of wool filling differs depending on the vaporization chamber and the injection method, but is generally between 2 mg and 20 mg.

The liquid sample is vaporized by the heat provided not only by the carrier gas but also by the filled wool. In particular, if the inside of the glass insert is not filled with wool, the liquid sample will not vaporize sufficiently, and repeatability will drop. The amount of heat provided by the wool changes depending on the amount of wool filler, so adjust the amount of wool filler if you are concerned about repeatability during liquid sample analysis.

In split analysis, the amount of wool filler must be increased to improve the sample vaporization efficiency.

The greater the amount of wool filler, the more efficient the sample vaporization, but this can also cause adsorption and degradation depending on the compound.

In splitless analysis, in which the sample retention time within the glass insert is long, if the amount of wool filler is large, excessive heat might be applied to the sample, which can cause sample adsorption or degradation. When increasing the amount of wool filler, be careful of adsorption and degradation of compounds in the sample. **With splitless analysis and direct analysis in pursuit of sensitivity, when analyzing target compounds that are comparatively prone to adsorption and degradation, it is recommended that you reduce the amount of wool filling for the analysis.**

Recommended Filling Position and Amount of Filler for Each Model

If purchasing a glass insert with no wool, and then filling the wool yourself, pay attention while filling to the amount and position of the wool. For details on the recommended wool amount and position, refer to the instruction manual and maintenance help for the applicable instrument.

| GC Model | Sample Injection Unit | Injection Method | Recommended Amount of Wool | Recommended Wool Position |
|---------------------------------------|-----------------------|---------------------------------|----------------------------|--|
| GC-2030 GC-2050 (SPL) | SPL | Split | 10 mg | 22 mm from the top surface |
| | | Splitless/Full volume injection | 4 mg | 67 mm from the top surface (Filled to the tapered bottom) |
| | PTV | Heated split/Heated splitless | 1 to 2 mg | 22 mm from the top surface |
| GC-2014 | SPL | Split | 10 mg | 20 mm from the top surface |
| | | Splitless/Full volume injection | 2 mg | 67 mm from the top surface (Filled to the tapered bottom) |
| GC-2025 (SPL) GC-2010 series (SPL) | SPL | Split | 10 mg | 25 mm from the top surface |
| | | Splitless/Full volume injection | 2 mg | 67 mm from the top surface (Filled to the tapered bottom) |
| GC-2010 series | PTV | Heated split/Heated splitless | 1 to 2 mg | 25 mm from the top surface |

Note: The optimal wool position and amount of wool may differ depending on the sample, the measured components, and the injection volume. The above-mentioned are generally recommended values.

In split analysis, it is advisable to pack the upper surface of the wool as flat as possible, as this improves reproducibility. When injecting samples, having the upper surface of the wool as flat as possible is beneficial because it ensures stable sample vaporization, especially when the wool is in close proximity to the syringe tip.

Other Roles of the Wool

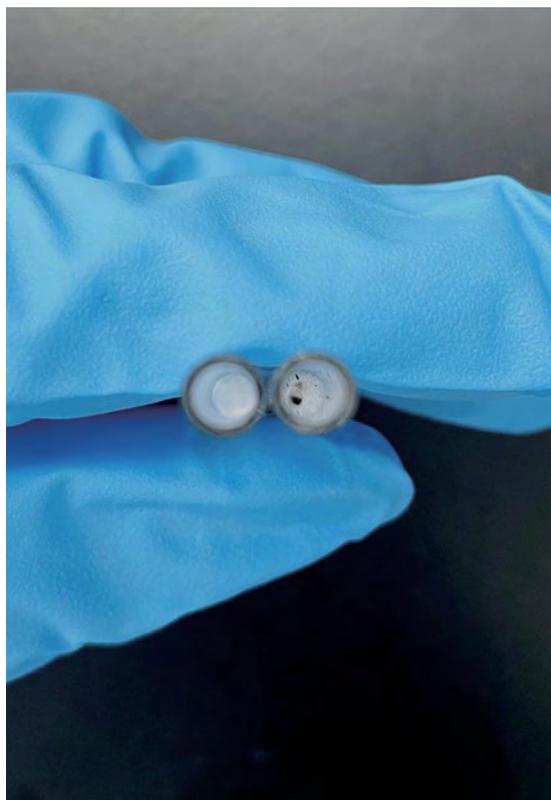
Trapping Nonvolatile Components

During analysis, as the number of injections increases, so too does the possibility that various nonvolatile components will be injected and accumulate within the sample injection unit.

- Nonvolatile components from the sample
- Contaminants and specks of silicon from the septum
- Metal powder from the syringe

When a large amount of nonvolatile components accumulate, this may have an impact on the analysis results.

Trapping as many of these nonvolatile components as possible with the wool, and reducing column contamination from nonvolatile components, leads to more reliable analysis results. Additionally, trapping nonvolatile components with the wool helps reduce the frequency of replacing columns and the frequency of maintenance for the GC system as a whole.



Mixing

Filling the glass insert with wool promotes mixing of the sample after vaporization with the carrier gas, reducing discrimination* during sample vaporization.

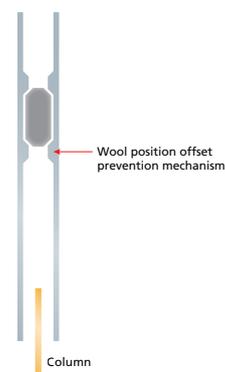
* Note: Discrimination refers to a structural change that occurs when using a chromatograph to analyze mixed samples containing components with a range of boiling points from low to high.

Selecting the Shape of the Glass Insert

This section describes the role of the various shapes of glass inserts, as well as points to consider when selecting the shape.

Wool Position Offset Prevention Mechanism

When there is a sudden pressure change in sample injection unit, such as during septum replacement, the wool position is sometimes offset, worsening the repeatability of the analysis results. To prevent wool position offset, some glass inserts are shaped with a protrusion. Using a glass insert with a wool position offset prevention mechanism should provide analysis results with more stable repeatability.



Tapered Structure

A tapered part is one in which the inner diameter of the glass insert quickly narrows from the top down, from a position at the bottom of the glass inserter (in proximity to the column inlet).

A tapered structure plays a role in focusing the injection of the vaporized sample toward the column. This structure is often used in glass inserts for splitless and direct analysis. In these analyses, in which the total flowrate of the carrier gas is small, the delivery rate of the vaporized sample within the glass insert is slowed. For this reason, using a tapered structure helps the vaporized sample to collect at the column inlet more efficiently.



Selecting the Inner Diameter of the Glass Insert

This section describes how to select the inner diameter of the glass insert in accordance with the analysis conditions.

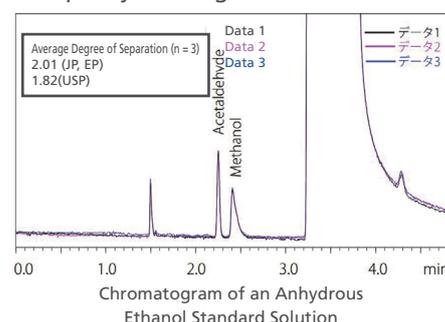
Inner Diameter

The inner diameter of the glass insert has an impact on the sample delivery rate and the capacity of the glass insert.

This section focuses on describing the impact on the sample delivery rate. (Capacity is described in the next section.)

In almost all liquid sample analysis, a thicker inner diameter of glass insert is appropriate. When the carrier gas passes through the glass insert, if the glass insert has a narrow inner diameter, the linear velocity will increase. Liquid samples take some time to vaporize, and the volume expands considerably, so the use of glass inserts with extremely narrow inner diameters should be avoided.

However, when analyzing some samples containing low boiling point components, the peak bandwidth tends to spread, so a fast delivery rate is required. For this sort of analysis, a glass insert with a comparatively narrow inner diameter is suitable.



Capacity

The internal capacity of a glass insert is calculated as $(\text{Inner diameter of the glass insert}/2)^2 \times \pi \times \text{Length of the glass insert}$. The capacity of a GC glass insert is generally about 100 to 900 μL . Select a suitable glass insert in accordance with the vaporization volume of the sample for analysis. The following table shows the vaporization volume (at 250 °C and 140 kPa) of typical sample solvents utilized in analysis.

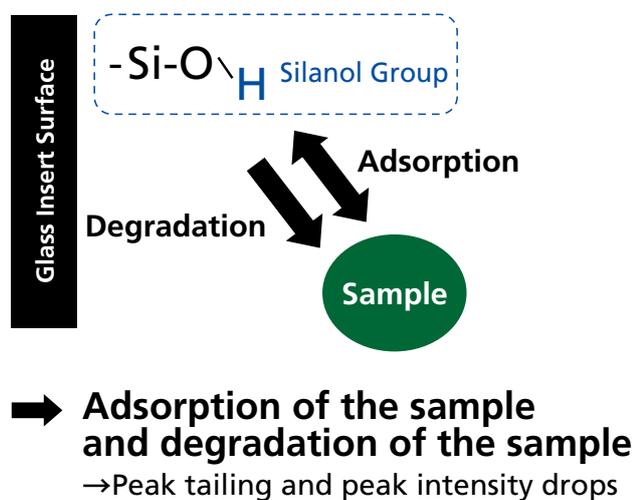
| Solvent Type | 1 μL Injection Volume | 2 μL Injection Volume |
|------------------|----------------------------------|----------------------------------|
| Isooctane | 110 | 220 |
| n-Hexane | 140 | 280 |
| Toluene | 170 | 340 |
| Ethyl Acetate | 185 | 370 |
| Acetone | 245 | 490 |
| Dichloromethane | 285 | 570 |
| Carbon Disulfide | 300 | 600 |
| Acetonitrile | 350 | 700 |
| Methanol | 450 | 900 |
| Water | 1010 | 2020 |

Surface Treatment of Glass Inserts

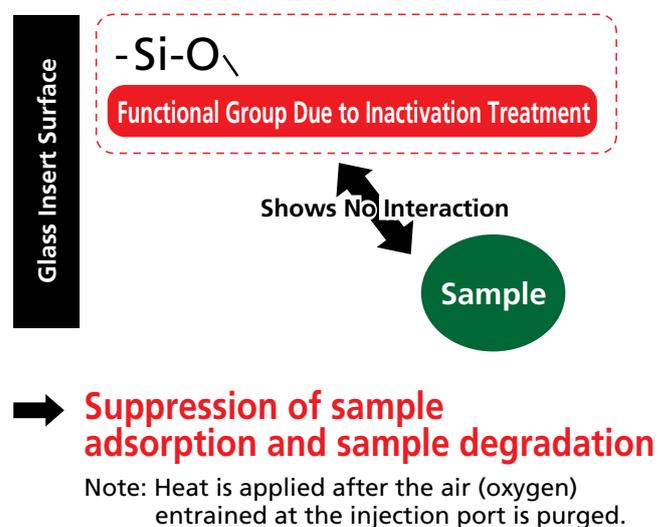
Samples make direct contact with the inner walls of glass inserts, so if a sample contains compounds prone to degradation, problems such as peak tailing and drops in peak intensity sometimes occur. In this case, the use of a glass insert and wool treated to inactivate the surface is recommended. Note that the heat resistance of inactivated glass inserts is at maximum approximately 350 °C. The heat resistance of glass inserts without inactivation treatment is at maximum approximately 450 °C.

Example

Without Inactivation Treatment



With Inactivation Treatment



All Glass Insert List



This is a list of the glass inserts provided by Shimadzu. Information on compatible GC instruments is also noted. The same ID numbers used in the section list in Chapter 2 are used in this table.

List of Glass Inserts and Compatible Instruments

- ★...Standard accessory ●...Described as a recommended item in Chapter 2 ✓...Can be used
- *1 Special order for glass column + pTCD
 - *2 Special order for glass column + packed detector other than a TCD
 - *3 It can be used by remodeling the GC unit SPL to WBI with WBI Modification Kit 221-74660-41.
 - *4 Connections to systems other than the GC-2010, GC-2014, or GC-2030 series are handled by special order.

| ID | Figure | P/N | Quantity | Wool Filling | Category | GC-2030 | GC-2050 | GC-2010 series | GC-2025 | GC-2014 series |
|----|--------|---------------------------|----------|--------------|-------------------------|---------|---------|----------------|---------|----------------|
| 1 | | 227-35007-01 | 5 | ✓ | SPL (Split) | ★● | ★● | ● | ● | ● |
| 2 | | 221-41444-01 | 1 | | SPL (Split) | ✓ | ✓ | ★● | ✓ | ✓ |
| 3 | | 221-41444 221-41444-84 | 1 5 | | SPL (Split) | ✓ | ✓ | ✓ | ★● | ★ |
| 4 | | 221-75193 | 5 | ✓ | SPL (Split) | ✓ | ✓ | ✓ | ✓ | ✓ |
| 5 | | 221-48876-02 | 5 | | SPL (Splitless) | ✓ | ✓ | ✓ | ✓ | ✓ |
| 6 | | 221-48876-03 | 5 | ✓ | SPL (Splitless) | ✓ | ✓ | ★● | ✓ | ✓ |
| 7 | | 221-48876-05 | 5 | | SPL (Splitless) | ✓ | ✓ | ✓ | ✓ | ✓ |
| 8 | | 227-35016-01 | 5 | ✓ | SPL (Split / Splitless) | ★● | ★● | ● | ● | ● |
| 9 | | 221-41544 221-41544-84 | 1 5 | | SPL (Split / Splitless) | ✓ | ✓ | ✓ | ✓ | ✓ |
| 10 | | 221-41544-05 | 5 | | SPL (Split / Splitless) | ✓ | ✓ | ✓ | ✓ | ✓ |
| 11 | | 221-75187 | 5 | ✓ | SPL (Split / Splitless) | ✓ | ✓ | ✓ | ✓ | ✓ |
| 12 | | 221-75188 | 5 | ✓ | SPL (Split / Splitless) | ✓ | ✓ | ✓ | ✓ | ✓ |
| 13 | | 221-75189 | 5 | ✓ | SPL (Split / Splitless) | ✓ | ✓ | ✓ | ✓ | ✓ |
| 14 | | 221-75190 | 5 | | SPL (Split / Splitless) | ✓ | ✓ | ✓ | ✓ | ✓ |
| 15 | | 221-75192 | 5 | | SPL (Split / Splitless) | ✓ | ✓ | ✓ | ✓ | ✓ |
| 16 | | 221-75194 | 5 | | SPL (Split / Splitless) | ✓ | ✓ | ✓ | ✓ | ✓ |

★...Standard accessory ●...Described as a recommended item in Chapter 2 ✓...Can be used

*1 Special order for glass column + pTCD

*2 Special order for glass column + packed detector other than a TCD

*3 It can be used by remodeling the GC unit SPL to WBI with 221-74660-41 WBI Modification Kit.

*4 Connections to systems other than the GC-2010, GC-2014, or GC-2030 series are handled by special order.

| ID | Figure | P/N | Quantity | Wool Filling | Category | GC-2030 | GC-2050 | GC-2010 series | GC-2025 | GC-2014 series |
|----|--------|---------------------------|----------|--------------|--|---------|---------|----------------|---------|----------------|
| 17 | | 221-75195 | 5 | ✓ | SPL (Split / Splitless) | ✓ | ✓ | ✓ | ✓ | ✓ |
| 18 | | 221-75196 | 5 | | SPME | ✓ | ✓ | ✓ | ✓ | ✓ |
| 19 | | 227-35008-01 | 5 | ✓ | SPL/WBI (Splitless, Full Volume Injection) | ★● | ★● | ✓ | ✓ | ✓ |
| 20 | | 221-48335-01 | 1 | | SPL/WBI (Splitless, Full Volume Injection) | ✓ | ✓ | ★● | ★● | ★● |
| 21 | | 225-20803-01 | 5 | ✓ | SPL/WBI (Splitless, Full Volume Injection) | ✓ | ✓ | ★● | ✓ | ✓ |
| 22 | | 221-75197 | 5 | ✓ | SPL/WBI (Splitless, Full Volume Injection) | ✓ | ✓ | ✓ | ✓ | ✓ |
| 23 | | 221-41599 221-41599-84 | 1 5 | | WBI (Full Volume Injection) | ✓ | | ✓ | ✓ | ✓ |
| 24 | | 221-41599-05 | 5 | | WBI (Full Volume Injection) | ✓ | | ✓ | * 3 | ✓ |
| 25 | | 221-49298-91 | 1 | | OCI | ★● | | ★● | | |
| 26 | | 221-49381-01 | 1 | | Simple OCI | ✓ | | ✓ | | |
| 27 | | 221-49381-02 | 1 | | Simple OCI | ● | | ● | | |
| 28 | | 221-85694 | 1 | | OCI | ★● | | | | |
| 29 | | 225-08184 | 1 | | PTV/OCI | ✓ | | ★ | | |
| 30 | | 221-49300 | 1 | | PTV | ★● | | ★● | | |
| 31 | | 221-74830-09 | 5 | ✓ | PTV | ✓ | | ✓ | | |
| 32 | | 221-80902 | 1 | | SINJ (Packed Column Full Volume Injection) | ★● | | | | |
| 33 | | 221-38107 | 1 | | SINJ/DINJ (WBC Full Volume Injection) | | | | | ★● |
| 34 | | 221-38107-02 | 1 | | SINJ/DINJ (WBC Full Volume Injection) | ★● | | | | |
| 35 | | 221-48993 | 1 | | SPL/WBI (Packed Column Full Volume Injection Method) | | | ✓ * 1 | | |
| 36 | | 221-48886 | 1 | | SPL/WBI (Packed Column Full Volume Injection Method) | | | ✓ * 2 | | |
| 37 | | 221-14093 221-14093-84 | 1 5 | | SINJ/DINJ (Packed Column Full Volume Injection Method) | | | | | ★● |
| 38 | | 221-14094 221-14094-84 | 1 5 | | SINJ/DINJ (Packed Column Full Volume Injection Method) | | | | | ★● |
| 39 | | 227-35015-01 | 5 | ✓ | Aqueous Solvent Analysis | ✓ | ✓ | ✓ | ✓ | ✓ |
| 40 | | 227-35014-01 | 1 | | HS-10 | ★ | | ★ | * 4 | ★ |
| 41 | | 227-35327-03 | 3 | | AOC-6000 Plus SPME arrow | ★ | ★ | ★ | | |
| 42 | | 227-35328-03 | 3 | | AOC-6000 Plus SPME arrow | ★ | ★ | ★ | | |

Standard Accessories for the GC-17A ver.1-3, the GC-1700, and the GC-18A

| ID | P/N | Category |
|-----|----------------------------------|--|
| 3 | 221-41444 221-41444-84 (5 pc) | SPL (Split) |
| 9 | 221-41544 221-41544-84 (5 pc) | SPL (Splitless) |
| 23 | 221-41599 221-41599-84 (5 pc) | WBI (Full Volume Injection) |
| 100 | 221-41484 | Packed Column Full Volume Injection |

Standard Accessories for the GC-14A/B

| ID | P/N | Category |
|-----|----------------------------------|--|
| 101 | 221-32574-01 | SPL (Split) without taper |
| 102 | 221-32544-01 | SPL (Split) with taper |
| 103 | 221-32544 | SPL (Splitless) |
| 104 | 221-38151-04 | Septum purge unit (Full Volume Injection) |
| 33 | 221-38107 | WBC attachment (Full Volume Injection) |
| 105 | 221-32998-01 | CLH (Injection unit) |
| 106 | 221-33000 | CLH (Detector) |
| 37 | 221-14093 221-14093-84 (5 pc) | Dia. 3.2 mm packed Full Volume Injection |
| 38 | 221-14094 221-14094-84 (5 pc) | Dia. 2.6 mm packed Full Volume Injection |

Standard Accessories for the GC-8A

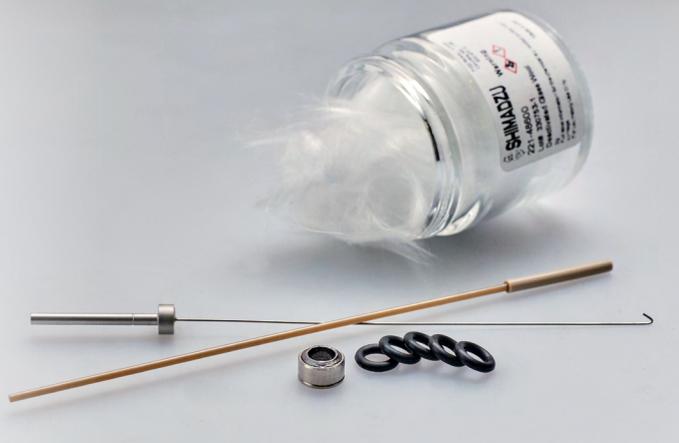
| ID | P/N | Category |
|-----|--------------|---|
| 107 | 221-25822-03 | SPL (Split) |
| 108 | 221-25944-03 | SPL (Splitless) |
| 109 | 221-39148 | WBC attachment (Full Volume Injection) |
| 110 | 221-18384-04 | CLH (Injection unit) |
| 111 | 221-18756-02 | CLH (Detector) |

Glass Insert Information

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (μL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|---------------------------|----------|--------------|-------------|---------------------|---------------------|---------------|------------------------|----------------------------|
| 1 | | 227-35007-01 | 5 | ✓ | 95 | 4.9 | 3.4 | 863 | Inactivation treatment | 350°C |
| 2 | | 221-41444-01 | 1 | | 95 | 4.9 | 3.4 | 863 | None | 450°C |
| 3 | | 221-41444 221-41444-84 | 1 5 | | 95 | 5 | 3.4 | 863 | None | 450°C |
| 4 | | 221-75193 | 5 | ✓ | 95 | 5 | 3.4 | 863 | Inactivation treatment | 350°C |
| 5 | | 221-48876-02 | 5 | ✓ | 95 | 5 | 3.4 | 654 | Inactivation treatment | 350°C |
| 6 | | 221-48876-03 | 5 | ✓ | 95 | 5 | 3.4 | 654 | Inactivation treatment | 350°C |
| 7 | | 221-48876-05 | 5 | | 95 | 5 | 3.4 | 654 | Inactivation treatment | 350°C |
| 8 | | 227-35016-01 | 5 | ✓ | 95 | 5 | 3.5 | 847 | Inactivation treatment | 350°C |
| 9 | | 221-41544 221-41544-84 | 1 5 | | 95 | 5 | 2.6 | 504 | None | 450°C |
| 10 | | 221-41544-05 | 5 | | 95 | 5 | 2.6 | 504 | Inactivation treatment | 350°C |
| 11 | | 221-75187 | 5 | ✓ | 95 | 5 | 3.4 | 799 | Inactivation treatment | 350°C |
| 12 | | 221-75188 | 5 | ✓ | 94.5 | 5 | 3.4 | 858 | Inactivation treatment | 350°C |
| 13 | | 221-75189 | 5 | ✓ | 95 | 5 | 3.4 | 863 | Inactivation treatment | 350°C |
| 14 | | 221-75190 | 5 | | 95 | 5 | 3.3 | 813 | Inactivation treatment | 350°C |
| 15 | | 221-75192 | 5 | | 95 | 5 | 3.5 | 847 | Inactivation treatment | 350°C |
| 16 | | 221-75194 | 5 | | 95 | 5 | 3.4 | 863 | Inactivation treatment | 350°C |
| 17 | | 221-75195 | 5 | ✓ | 95 | 5 | 3.4 | 863 | Inactivation treatment | 350°C |

| ID | Figure | P/N | Quantity | Wool Filling | Length (mm) | Outer Diameter (mm) | Inner Diameter (mm) | Capacity (µL) | Surface Treatment | Heat Resistant Temperature |
|----|--------|---------------------------|----------|--------------|-------------|---------------------|---------------------|---------------|---|----------------------------|
| 18 | | 221-75196 | 5 | | 95 | 5 | 0.8 | 48 | Inactivation treatment | 350°C |
| 19 | | 227-35008-01 | 5 | ✓ | 95 | 5 | 3.4 | 654 | Inactivation treatment | 350°C |
| 20 | | 221-48335-01 | 1 | | 95 | 5 | 3.4 | 654 | None | 450°C |
| 21 | | 225-20803-01 | 5 | ✓ | 95 | 5 | 3.5 | 914 | Inactivation treatment | 350°C |
| 22 | | 221-75197 | 5 | ✓ | 95 | 5 | 3.3 | 599 | Inactivation treatment | 350°C |
| 23 | | 221-41599 221-41599-84 | 1 5 | | 95 | 5 | 2.6 | 504 | None | 450°C |
| 24 | | 221-41599-05 | 5 | | 95 | 5 | 2.6 | 504 | Inactivation treatment | 350°C |
| 25 | | 221-49298-91 | 1 | | 103 | 2 | 1 | 81 | None | 450°C |
| 26 | | 221-49381-01 | 1 | | 95 | 3.5 | 0.8 | 48 | None | 450°C |
| 27 | | 221-49381-02 | 1 | | 95 | 3.5 | 0.8 | 48 | Inactivation treatment (Silanizing treatment) | 350°C |
| 28 | | 221-85694 | 1 | | 11.5 | - | - | - | None | 450°C |
| 29 | | 225-08184 | 1 | | 95 | 3.5 | 1.5 | 131 | None | 450°C |
| 30 | | 221-49300 | 1 | | 95 | 3.5 | 1.5 | 168 | None | 450°C |
| 31 | | 221-74830-09 | 5 | ✓ | 95 | 3.5 | 2.5 | 466 | Inactivation treatment | 350°C |
| 32 | | 221-80902 | 1 | | 93 | 5 | 3.4 | 726 | None | 450°C |
| 33 | | 221-38107 | 1 | | 139 | 4.8 | 3.4 | 988 | None | 450°C |
| 34 | | 221-38107-02 | 1 | | 126 | 4.8 | 3.4 | 870 | None | 450°C |
| 35 | | 221-48993 | 1 | | 87 | 5 | 3.4 | 590 | None | 450°C |
| 36 | | 221-48886 | 1 | | 87 | 5 | 3.4 | 672 | None | 450°C |
| 37 | | 221-14093 221-14093-84 | 1 5 | | 139 | 4.4 (Tip 2.9) | 3.5 | 1104 | None | 450°C |
| 38 | | 221-14094 221-14094-84 | 1 5 | | 139 | 4.4 (Tip 2.3) | 3.4 | 825 | None | 450°C |
| 39 | | 227-35015-01 | 5 | ✓ | 95 | 4.8 | 3.4 | 863 | Inactivation treatment | 400°C |
| 40 | | 227-35014-01 | 1 | | 95 | 5 | 1.2 | 107 | Inactivation treatment | 350°C |
| 41 | | 227-35327-03 | 3 | | 95 | 5 | 1.3 | 126 | None | 350°C |
| 42 | | 227-35328-03 | 3 | | 95 | 5 | 1.7 | 216 | None | 350°C |

Accessories



This section introduces the glass insert accessories provided by Shimadzu.

O-Ring

| ID | Part Name | P/N | Quantity | Sample Injection Unit | Remarks |
|-----|---|--------------|----------|-----------------------|--|
| 201 | O-Ring, 4D, P5 | 227-35005-01 | 10 | SPL/WBI | Maximum usage temperature: 450 °C |
| 202 | O-Ring, K8900 High Temperature Applications | 036-11544-01 | 1 | | High temperature, low bleed type, maximum usage temperature: 450 °C This is suitable O-ring for FPD and other high-sensitivity analyses, because it limits the appearance of ghost peaks resulting from O-rings when the injection port temperature is increased. |
| 203 | O-Ring, 4D, P3 | 036-11201 | 1 | OCI/PTV | Maximum usage temperature: 450 °C |
| 204 | O-Ring, K8900, P3 High Temperature Applications | 036-11544-02 | 1 | | High temperature, low bleed type, maximum usage temperature: 450 °C This is suitable O-ring for FPD and other high-sensitivity analyses, because it limits the appearance of ghost peaks resulting from O-rings when the injection port temperature is increased. |

Standard accessory



Image of O-Ring (ID201)

Graphite O-ring

| ID | Part Name | P/N | Quantity | Remarks |
|-----|------------------------|--------------|----------|--|
| 205 | Split Graphite | 221-48393-91 | 4 | It cannot be applied to GC-2030 and GC-2050. For high temperatures, SPL (Split), temperatures of 300 to 450 °C |
| 206 | Splitless/WBI Graphite | 221-47222-91 | 4 | It cannot be applied to GC-2030 and GC-2050. For high temperatures, SPL (Splitless)/WBI, temperatures of 300 to 450 °C |



Image of graphite O-Ring (ID205)

Ferrule

| ID | Part Name | P/N | Quantity | Applicable Instruments |
|-----|-----------|--------------|----------|------------------------|
| 207 | Graphite | 221-46403-92 | 4 | GC-17A/1700/18A |
| 208 | Graphite | 221-75182 | 10 | GC-14A/B |

Standard accessory



Image of Ferrule (ID207)

Wool

| ID | Part Name | P/N | Quantity | Applicable Instruments |
|-----|---|--------------|----------|---|
| 209 | Inactivated Glass Wool (2 g) | 221-48600 | 1 | GC-2010 series GC-2014 series GC-2025 |
| 210 | Silica (quartz) wool, not inactivated (2 g) | 201-47616-01 | 1 | GC-17A/1700/ 18A/14A/B |



P/N : 221-48600



P/N : 201-47616-01

Silica Beads Shimalite Q

| ID | Part Name | P/N | Quantity |
|-----|----------------------------------|--------------|----------|
| 211 | Silica Beads Shimalite Q (25 mL) | 670-10458-73 | 1 |



Wool Filling Kit

| ID | Part Name | P/N | Quantity |
|-----|------------------------------------|--------------|----------|
| 212 | Wool Filling Kit for Glass Inserts | 227-35030-01 | 1 |

This is a kit for filling wool into glass inserts that are not filled with wool. This kit allows you to increase the flatness of the top end of the wool, improving reproducibility.



Inlet Liner Removal Tool

| ID | Part Name | P/N | Quantity |
|-----|--------------------------|--------------|----------|
| 213 | Inlet Liner Removal Tool | 227-35032-01 | 1 |

The Inlet Liner Removal Tool is designed to simplify the removal of gas chromatography (GC) inlet liners.



Septums

Injection Port Septum

| Description | P/N | Color | Description |
|--|--------------|-------------|---|
|  Standard type (20 pcs) | 201-35584 | White | <ul style="list-style-type: none"> • General-purpose septum • Maximum temperature (INJ setting temperature): 250 °C |
|  LL Septa (long life type, 20 pcs) | 221-48972-91 | Blue | <p>Provides significant durability improvements compared to a conventional low-bleed septum, offering both low bleed and long life.</p> <p>The problem of sticking to the vaporizing chamber during continuous use at high temperatures experienced with a conventional septum has also been eliminated.</p> <ul style="list-style-type: none"> • Suitable for high-sensitivity analysis • Maximum temperature (INJ setting temperature): 450°C |
|  HT Septa (high temp type, 20 pcs) | 221-48398-91 | Brown | <p>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.</p> <p>The problem of sticking to the vaporizing chamber during continuous use at high temperatures experienced with a conventional septum has also been eliminated.</p> <ul style="list-style-type: none"> • Suitable for high-sensitivity analysis at high temperatures • Maximum temperature (INJ setting temperature): 450°C |
|  Xtra Life Septa (25 pcs) | 227-35511-01 | Red | <ul style="list-style-type: none"> • Extra long-life septum, lasts up to 10x longer than a standard septum • Maximum temperature (INJ setting temperature): 400°C |
|  Low-bleed Septa (25 pcs) | 221-76650-01 | Green | <p>This septum is least influenced by a plasticizer. Better prevents septum coring &</p> <ul style="list-style-type: none"> • Low-bleed, suitable for high-sensitivity analysis • Maximum temperature (INJ setting temperature): 340°C |
|  Enduro Blue Septa (50 pcs) | 221-75180 | Light Blue | <ul style="list-style-type: none"> • Low-bleed, suitable for high-sensitivity analysis at high temperatures • Maximum temperature (INJ setting temperature): 350°C |
|  Premium Green Septa (50 pcs) | 227-35004-01 | Light green | <ul style="list-style-type: none"> • Low bleed, highly robust (max. usable temp. 350°C) • High durability, proper sealing and good resistance to most chemical solvents. • Useful for trace analysis and other applications where high sensitivity is critical |
|  Perforated septa for HS-10 | 221-76863-96 | White | <ul style="list-style-type: none"> • For HS-10 only • To ensure cleanliness and inertness • 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.

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.

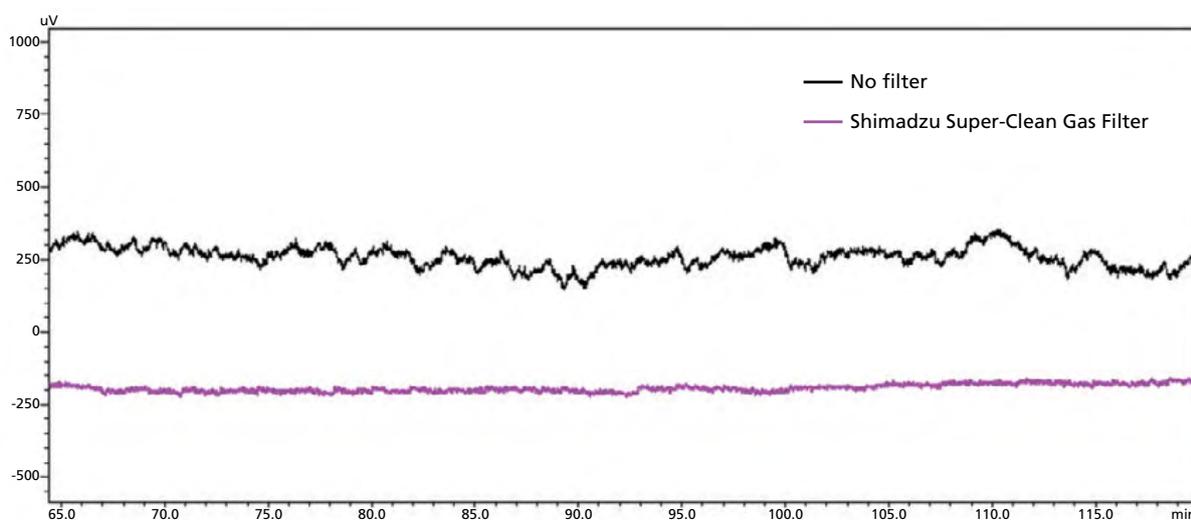
Introducing the *Shimadzu Super-Clean Gas Filter!*



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

As long as there is no filter cartridge connected, the spring-loaded check valves block the gas stream automatically.



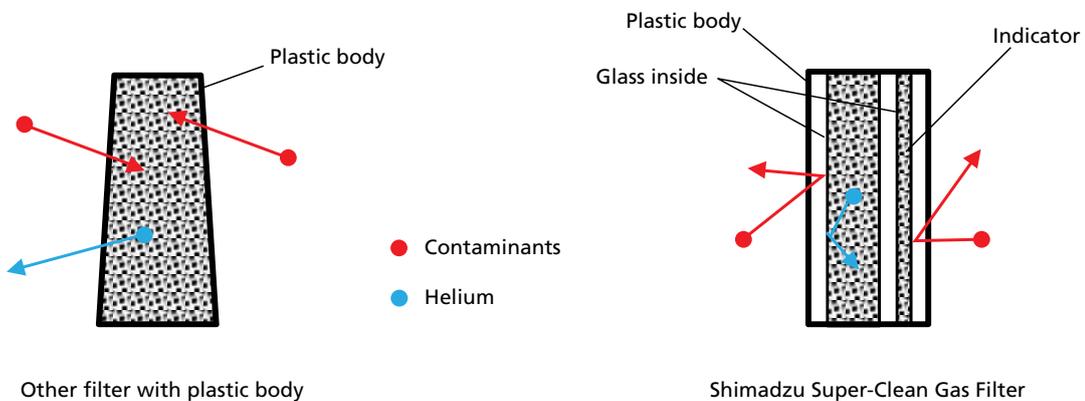
Installing the filter

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 complete 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

Gas Filtration

Connection Diagrams

GC / MS (ITD/MSD)



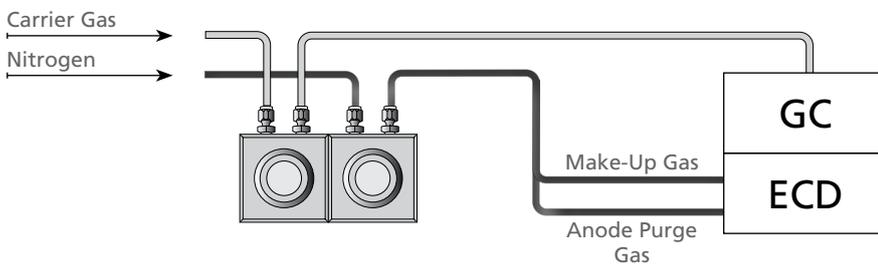
| Product | Part No. | Qty |
|------------------------|---------------------|-----|
| Triple Filter | 226-50751-00 | 1 |
| 1 Position Base plate | 226-50771-00 | 1 |
| Kit Part Number | 226-50710-00 | |

TOC Analyzer



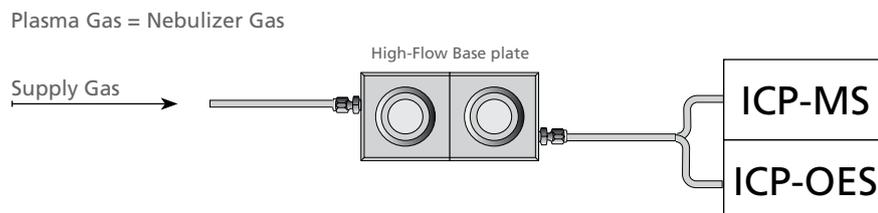
| Product | Part No. | Qty |
|-----------------------------------|---------------------|-----|
| CO ₂ / Moisture Filter | 226-50759-00 | 1 |
| 1 Position Base plate | 226-50771-00 | 1 |
| Kit Part Number | 226-50779-00 | |

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

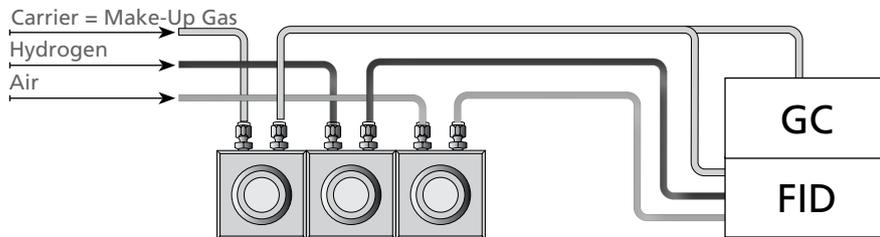


| Product | Part No. | Qty |
|---|---------------------|-----|
| High Flow Oxygen/Moisture Filter Bundle | 226-50766-00 | 2 |
| ICP-MS Base plate | 226-50776-00 | 1 |
| Kit Part Number | 226-50767-00 | |

Connection Diagrams

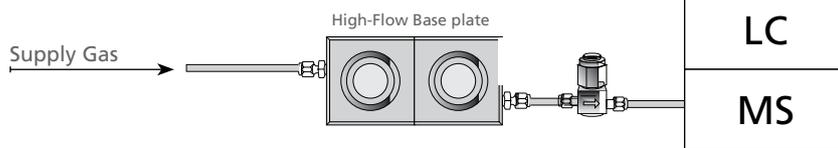
GC / FID

GC/FID Solution 2 (Carrier Gas = Make-Up Gas)

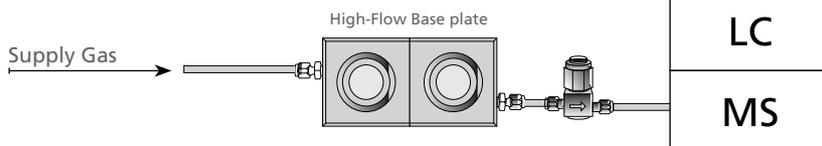


| Product | Part No. | Qty |
|---------------------------------|---------------------|-----|
| Triple Filter | 226-50751-00 | 1 |
| Hydrocarbon/ Moisture Filter | 226-50750-00 | 2 |
| 3 Position Base plate | 226-50773-00 | 1 |
| Kit Part Number | 226-50730-00 | |

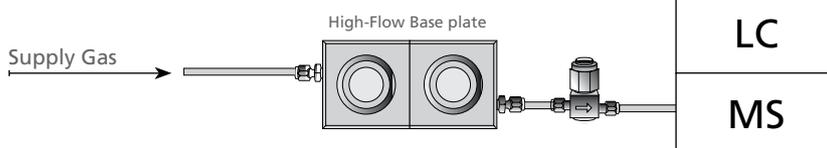
LC/MS



| Product | Part No. | Qty |
|---|---------------------|-----|
| High Flow Hydrocarbon Filter Bundle | 226-50760-00 | 2 |
| 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 | 2 |
| 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 | 2 |
| Particle Filter | 226-50794-01 | 1 |
| High Flow Base plate | 226-50775-01 | 1 |
| Kit Part Number | 226-50724-00 | |

Gas Filtration

Installation Kits

Catalog No. 226-50710-00
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.

Gas Filtration

Replacement Filters

| | |
|-------------------------------|--|
| Replacement Filter for | GC/MS Triple Filter Kit (226-50710-00) |
| Catalog No. | 226-50751-00 226-50752-00 (Helium) 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 ₂ O | 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 ₂ O | 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 ₂ O | 7.2 g |
| O ₂ | 150 mL |

| | |
|--------------------------------|---|
| Replacement Filters for | GC/ECD Filter Kit (226-50780-00) |
| Catalog No. | 226-50781-00 includes: (1) 226-50752-00 and (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 ₂ O | 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 ₂ O | 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 ₂ O | 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 ₂ O | 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, H ₂ , N ₂ , AR, Air |
| Dimensions | 24 cm x Ø 4.4 cm |
| Weight | 0.26 Kg |
| Estimated Lifetime | > 2 years |

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, H ₂ , N ₂ , AR |
| Dimensions | 24 cm x Ø 4.4 cm |
| Weight | 0.26 Kg |
| Estimated Lifetime | > 2 years |

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, H ₂ , N ₂ , AR, Air |
| Dimensions | 24 cm x Ø 4.4 cm |
| Weight | 0.26 Kg |
| Estimated Lifetime | > 2 years |

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, H ₂ , N ₂ , 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 highly recommend installing a moisture trap before the hydrocarbon and oxygen traps on all carrier gas lines.

Capacity

| | |
|------------------|-------|
| H ₂ O | 7.2 g |
|------------------|-------|



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

| | |
|----------------|--------|
| O ₂ | 150 mL |
|----------------|--------|



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) |
|----|--------------------|



CARBON DIOXIDE FILTER

Removes carbon dioxide from gas streams. To be used in combination with a Moisture Filter

Capacity

| | |
|-----------------|------|
| CO ₂ | 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, H ₂ , N ₂ , 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 reproducibility and sensitivity.

Capacity

| | |
|------------------|-------------------|
| H ₂ O | 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, H ₂ , N ₂ , 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 ₂ O | 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, H ₂ , N ₂ , 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 ₂ O | 3.5 g |
| HC | 6 g |

Catalog No. 226-50751-00
226-50752-00 (Helium Specific)
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, H ₂ , N ₂ , 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 ₂ O | 1.8 g |
| O ₂ | 75 mL |
| HC | 4 g (as n-butane) |

Gas Filtration

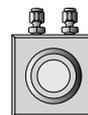
Base Plates

| Catalog No. | Fitting Type |
|--------------|--------------|
| 226-50771-00 | 1/8" SS |



1 POSITION BASE PLATE

Single position base plate

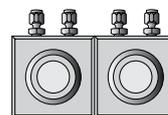


| Catalog No. | Fitting Type |
|--------------|--------------|
| 226-50772-00 | 1/8" SS |



2 POSITION BASE PLATE

Double position base plate

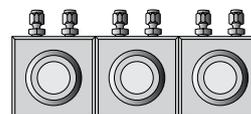


| Catalog No. | Fitting Type |
|--------------|--------------|
| 226-50773-00 | 1/8" SS |



3 POSITION BASE PLATE

Three position base plate

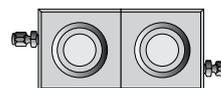


| Catalog No. | Fitting Type |
|--------------|--------------|
| 226-50776-00 | 1/8" SS |



ICP-MS HIGH FLOW BASE PLATE

High Flow Base plate for ICP-MS
(in parallel)

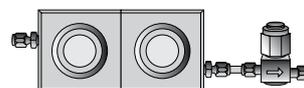


| Catalog No. | Fitting Type |
|--------------|--------------|
| 226-50775-01 | 1/4" Brass |
| 226-50775-00 | 1/4" SS |



LC/MS HIGH FLOW BASE PLATE

High Flow double position base plate
(in parallel)



Base Plate Accesories

| | |
|--------------------|-----------------|
| Catalog No. | 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 Partice Filter (1/4" Brass) |
| 226-50795-00 | 0.5 Micron Particle Filter Cup Replacement Pack |



PARTICULATE FILTER
Particulate filter for high flow base plates.

Gas Filtration

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.

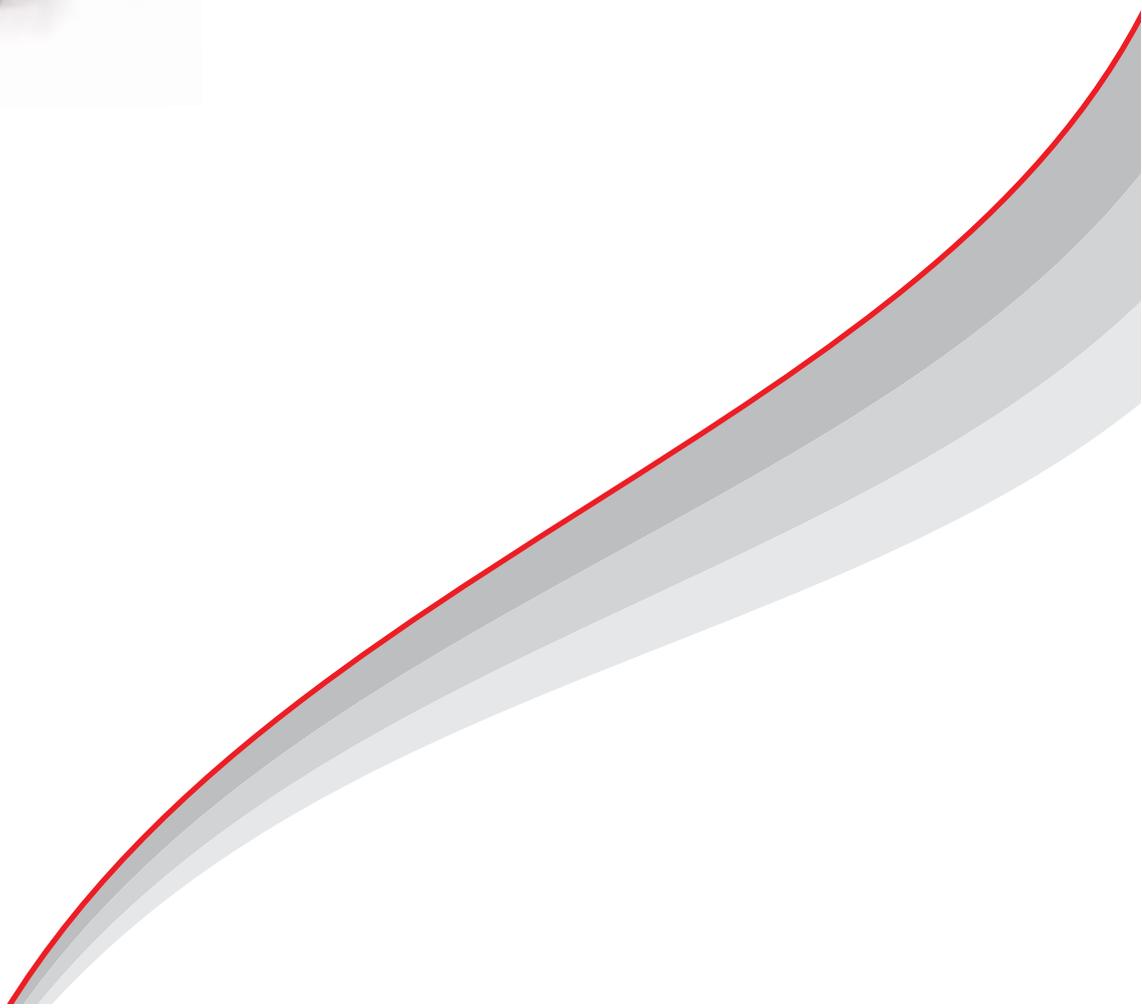


Wall Mount Bracket Set

Optional wall mounting brackets to mount a base plate to a wall.



Spectrum Consumables



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

■ Shimadzu EcoCells

- Light path ranging from 10mm to 100mm
- Quartz cuvettes with SAN lid.
- 80% transmission on empty cell for EcoCells at 200nm

| Light path /mm | Maximum Vol/μL | External Dimension (L x W x H) / mm | Quartz cell | |
|----------------|----------------|-------------------------------------|--------------|--------------|
| | | | Single Cell | Matched Pair |
| 10 | 3500 | 45 x 12.5 x 12.5 | 226-87010-91 | 226-87010-92 |
| 20 | 14000 | 45 x 12.5 x 42.5 | 226-87040-91 | |
| 50 | 17500 | 45 x 12.5 x 52.5 | 226-87050-91 | 226-87050-92 |
| 100 | 35000 | 45 x 12.5 x 102.5 | | 226-87100-92 |



■ 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/ μ L | 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/ μ L | 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/ μ L | 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/ μ L | External Dimension (L x W x H) / mm | Quartz cell |
|----------------|----------------------|-------------------------------------|--------------|
| 5 | 350 | 7.5 x 12.5 x 45 | 226-85601-05 |
| 10 | 700 | 12.5 x 12.5 x 45 | 226-85601-10 |
| 20 | 1400 | 22.5 x 12.5 x 45 | 226-85601-20 |
| 40 | 2800 | 42.5 x 12.5 x 45 | 226-85601-40 |
| 50 | 3500 | 52.5 x 12.5 x 45 | 226-85601-50 |



10mm Micro Quartz cell, 226-85601-10

UV Cells

■ Micro cells

Cell with stopper

| Light path /mm | Maximum Vol/ μ L | 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 |

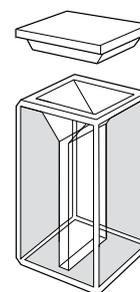


10mm Micro Quartz Cell with stopper, 226-85001-10

■ 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/ μ L | 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 |



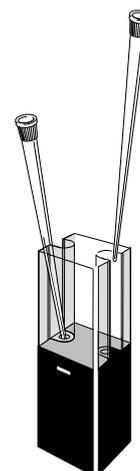
10mm Micro short Quartz Cell 226-86101-10

■ Ultra-micro lens cell

- Ultra-micro volume ranges from 0.5 μ L to 10 μ L.
- Two polished windows.
- Sample inserted and retrieved with micro pipette tip.
- Two micro pipette tips provided with each cell.

| Light path /mm | Maximum Vol/ μ L | 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/ μ L | 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/ μ L | 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/ μ L | 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/ μ L | 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

Spectrum Consumables

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 μ L |
| Recommended Sample Volume | 2.5 – 3 μ L |
| DNA Detection Limit | 1.1 ng/ μ L |
| DNA Maximum Concentration | 3000 ng/ μ L |
| DNA Reproducibility at 100 ng/ μ L | \pm 1.0 ng/ μ L |
| DNA Reproducibility at 1000 ng/ μ L | \pm 3.0 ng/ μ L |
| Protein Detection Limit | 0.06 mg/ml |
| Protein Maximum Concentration | 100 mg/ml |
| Protein Reproducibility at 2 mg/ml | \pm 0.02 mg/ml |
| Protein Reproducibility at 10 mg/ μ L | \pm 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



Spectrum Consumables

■ Nano Stick – 5 Components (Red) :



■ How to use:



■ 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 |



15mL vial



50mL vial

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

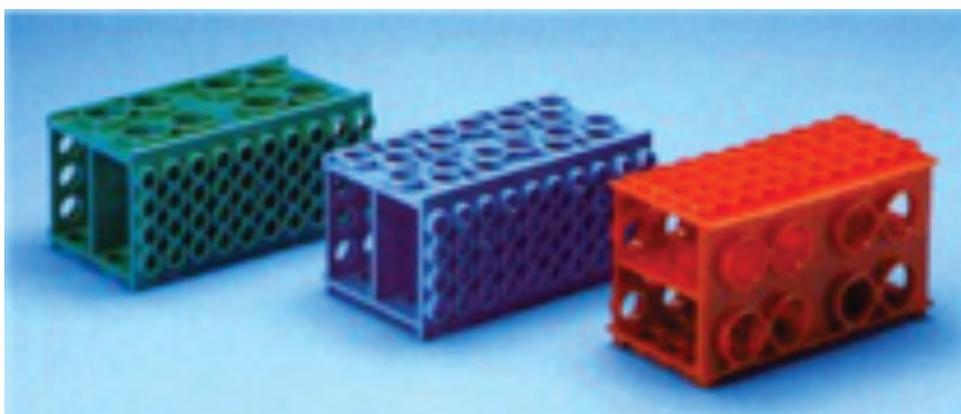
| Part number | Description | Pack Size |
|--------------|---|-----------|
| 226-89902-01 | 15ml Autosampler vials for AAS, ICPE, ICPMS | 500 pcs |
| 226-89902-02 | 50ml Autosampler vials for AAS, ICPE, ICPMS | 500 pcs |

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 |



Sample Preparation Series Product

SHIMSEN QuEChERS

CoreFocus





Overview and Procedure

A brief overview of the method of QuEChERS-method

- QuEChERS (Quick, Easy, Cheap, Effective, Rugged and Safe) was originally proposed by the US Department of Agriculture as a sample preparation method in 2003.
- It has been applied to a variety of sample preparations, especially for pesticide residue pretreatment.
- It's simpler, more economical, and faster than traditional methods.

Principle of EN 15662

The homogeneous sample is extracted with the help of acetonitrile. Samples with low water content (< 80 %) require the addition of water before the initial extraction to get a total of approximately 10 g of water. After addition of magnesium sulfate, sodium chloride and buffering citrate salts, the mixture is shaken intensively and centrifuged for phase separation. An aliquot of the organic phase is cleaned-up by dispersive solid phase extraction (d-SPE) employing bulk sorbents as well as magnesium sulfate for the removal of residual water.

Following clean-up with amino-sorbents (e.g. primary secondary amine sorbent, PSA) extracts are acidified by adding a small amount of formic acid, to improve the storage stability of certain base-sensitive pesticides. The final extract can be directly employed for GC- and LC-based determinative analysis. Quantification is performed using an internal standard, which is added to the extract after the initial addition of acetonitrile.

Principle of EN 15662

The QuEChERS (quick, easy, cheap, effective, rugged, and safe) method uses a single-step buffered acetonitrile (MeCN) extraction and salting out liquid-liquid partitioning from the water in the sample with $MgSO_4$.

Dispersive-solid-phase extraction (dispersive-SPE) cleanup is done to remove organic acids, excess water, and other components with a combination of primary secondary amine (PSA) sorbent and $MgSO_4$; then the extracts are analyzed by mass spectrometry (MS) techniques after a chromatographic analytical separation.

The Procedure of QuEChERS-method

AOAC 2007.01 Method

Weigh 15g Homogenized sample, then add 15mL acetonitrile with 1% Acetic acid (V/V), 6g MgSO₄+1.5g NaOAc+ Internal standards solution.

Shake or Vortex vigorously for 1min, centrifuge > 1500x g, 1min.

Transfer 1mL or 8mL Supernatant to the dSPE Tube depending on the dSPE specification. Shake or Vortex vigorously for 1min, and then centrifuge > 1500x g, 1min.

EN 15662 Method

Weigh 10g Homogenized sample ^①, then add 10mL acetonitrile and internal standards. Shake or Vortex vigorously for 1min. (If the sample's water content is < 80%, water must be added after Homogenization, please see the following EN15662:2018

Add extraction salts (4g MgSO₄, 1g NaCl, 1g TSCD, 0.5g DHS) into the above sample extraction solution. Shake or vortex vigorously for 1min, and then centrifuge > 3000x g, 5min.

Transfer 1mL or 6mL Supernatant to the dSPE Tube depending on the dSPE specification. Shake or Vortex vigorously for 1min, and then centrifuge > 3000x g, 5min.

Dilute, solvent exchange or evaporate as necessary for GC/MS-MS or LC/MS-MS Analysis

1. The sample size depends on the sample matrix: Fruit and vegetable samples, sampled at 10g ± 0.1g; Grain and honey samples, sampled at 5g ± 0.05g; Tea and spices, sampled at 2g ± 0.03g.
2. If the water content of the sample is <80%, a sufficient amount of cold water (<4 °C) needs to be added before the sample is homogenized. The water content of common samples and the amount of water that needs to be added, Please refer to EN15662:2018
3. TSCD - Trisodium citrate dihydrate, DHS - Disodium hydrogen citrate sesquihydrate

About SHIMSEN QuEChERS

QuEChERS, which stands for Quick, Easy, Cheap, Effective, Rugged, and Safe, is a popular sample preparation technique used in analytical chemistry, particularly in the analysis of pesticides, herbicides, and other contaminants in food and environmental samples.

This method was developed to streamline the sample preparation process, making it quicker, more cost-effective, and safer while maintaining high analytical accuracy and sensitivity.

Step 1: Homogenization

Cut sample into smaller portion and freeze before homogenization



Step 2: Extraction

Process of removing the target analytes from the sample using the solvent mixture.

Add extraction solvent and internal standard solution to the sample.



Selection guide of d-SPE

AOAC 2007

PN: 380-00990-05
15 mL PSA dSPE, 400 mg PSA,
1200 mg MgSO₄

PN:380-00990-17
2mL PSA dSPE, 50 mg PSA,
150 mg MgSO₄

EN 15662

PN: 380-00990-02
15 mL PSA dSPE, 150 mg PSA,
900 mg MgSO₄

PN:380-00990-21
2mL PSA dSPE, 25 mg PSA,
150 mg MgSO₄

AOAC 2007

PN: 380-00990-07
15mL PSA/C18 dSPE,
400 mg PSA, 400 mg C18
1200 mg MgSO₄

PN:380-00990-18
2mL PSA/C18 dSPE,
50 mg PSA, 50 mg C18,
150 mg MgSO₄

EN 15662

PN: 380-00990-06
15 mL PSA/C18 dSPE,
150 mg PSA, 150 mg C18
900 mg MgSO₄

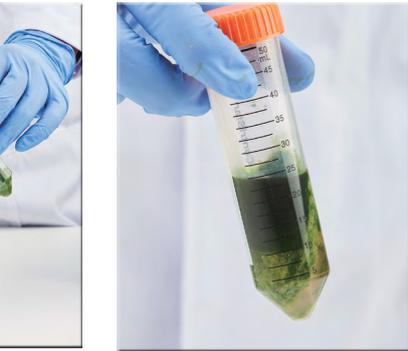
PN:380-00990-22
2mL PSA/C18 dSPE,
25 mg PSA, 25 mg C18,
150 mg MgSO₄



General Fruits and Vegetables



e complex sample matrix using a
lution, shake vigorously



Step 3: Clean-up

To remove unwanted matrix components, interfering substances, and co-extracted impurities that could potentially affect the accuracy and sensitivity of the analytical method



Pigmented Fruits and Vegetables



AOAC 2007

PN: 380-00990-25
15 mL PSA/GCB dSPE,
400 mg PSA, 400 mg GCB,
1200 mg MgSO₄

PN: 380-00990-19
2 mL PSA/GCB dSPE,
50 mg PSA, 50 mg GCB,
150 mg MgSO₄

AOAC 2007

PN: 380-00990-08
15 mL PSA/C18/GCB dSPE,
400 mg PSA, 400 mg C18
400 mg GCB, 1200 MgSO₄

PN:380-00990-20
2 mL PSA/C18/GCB dSPE,
50 mg PSA, 50 mg C18
50 mg GCB, 150 MgSO₄

EN 15662

PN: 380-00990-04
15 mL PSA/GCB dSPE,
150 mg PSA, 45 mg GCB,
900 mg MgSO₄

PN: 380-00990-24
2 mL PSA/GCB dSPE,
25 mg PSA, 7.5 mg GCB,
150 mg MgSO₄

SHIMSEN QuEChERS **Product List****Products by Method****Products for AOAC 2007.01-Method**

| Part Number | Product Name | Pack Size | Type |
|--------------|---|-----------|------------------|
| 380-00151 | Extraction Salts with 50mL Centrifuge Tube, 6g MgSO ₄ , 1.5g NaOAc | 50 pcs | Extraction Salts |
| 380-00152 | Extraction Salts Packets only, 6g MgSO ₄ , 1.5g NaOAc | 50 pcs | Extraction Salts |
| 380-00990-05 | 15 mL, 400 mg PSA, 1200 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-07 | 15 mL, 400 mg PSA, 400 mg C18, 1200 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-08 | 15 mL, 400 mg PSA, 400 mg C18, 400 mg GCB, 1200 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-25 | 15 mL, 400 mg PSA, 400 mg GCB, 1200 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-17 | 2 mL, 50 mg PSA, 150 mg MgSO ₄ | 100 pcs | 2 ml dSPE |
| 380-00990-18 | 2 mL, 50 mg PSA, 50 mg C18, 150 mg MgSO ₄ | 100 pcs | 2 ml dSPE |
| 380-00990-19 | 2 mL, 50 mg PSA, 50 mg GCB, 150 mg MgSO ₄ | 100 pcs | 2 ml dSPE |
| 380-00990-20 | 2 mL, 50 mg PSA, 50 mg C18, 50 mg GCB, 150 mg MgSO ₄ | 100 pcs | 2 ml dSPE |

Products for EN 15662-Method

| Part Number | Product Name | Pack Size | Type |
|--------------|---|-----------|------------------|
| 380-00148 | Extraction Salts with 50mL Centrifuge Tube, 4g MgSO ₄ , 1g NaCl, 0.5g DHS, 1g TSCD | 50 pcs | Extraction Salts |
| 380-00149 | Extraction Salts Packets only, 4g MgSO ₄ , 1g NaCl, 0.5g DHS, 1g TSCD | 50 pcs | Extraction Salts |
| 380-00990-01 | 15 mL, 150 mg PSA, 15 mg GCB, 900 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-02 | 15 mL, 150 mg PSA, 900 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-03 | 15 mL, 150 mg PSA, 15 mg GCB, 885 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-04 | 15 mL, 150 mg PSA, 45 mg GCB, 900 MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-06 | 15 mL, 150 mg PSA, 150 mg C18, 900 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-21 | 2 mL, 25 mg PSA, 150 mg MgSO ₄ | 100 pcs | 2 ml dSPE |
| 380-00990-22 | 2 mL, 25 mg PSA, 25 mg C18, 150 mg MgSO ₄ | 100 pcs | 2 ml dSPE |
| 380-00990-23 | 2 mL, 25 mg PSA, 2.5 mg GCB, 150 mg MgSO ₄ | 100 pcs | 2 ml dSPE |
| 380-00990-24 | 2 mL, 25 mg PSA, 7.5 mg GCB, 150 mg MgSO ₄ | 100 pcs | 2 ml dSPE |

Products for Original Unbuffered Method

| Part Number | Product Name | Package | Type |
|-------------|--|---------|------------------|
| 380-00160 | Extraction Salts with 50mL Centrifuge Tube, 4g MgSO ₄ , 1g NaCl | 50 pcs | Extraction Salts |
| 380-00156 | Extraction Salts Packets only, 4g MgSO ₄ , 1g NaCl | 50 pcs | Extraction Salts |

SHIMSEN QuEChERS Product List

Products by Sample Type

| Dispersive-solid-phase extraction (dSPE) | | | | | | | | | |
|--|--|--------------|-------------------|--|--------------------------------|--|---------------------|-----------|--------------|
| Sample Type | Example | Method | Contents (mg) | | | | Product Information | | |
| | | | MgSO ₄ | PSA | C18 | GCB | Vial Volume (ml) | Pack Size | Part Number |
| | | | Removes | | | | | | |
| | | | Excess water | Sugars, fatty acids, organic acids, anthocyanins | Lipids, nonpolar interferences | Pigments, sterols, nonpolar substances | | | |
| General fruits and vegetables | Celery, head lettuce, cucumber, melon | AOAC 2007.01 | 150 | 50 | - | - | 2 | 100 pcs | 380-00990-17 |
| | | | 1200 | 400 | - | - | 15 | 50 pcs | 380-00990-05 |
| | | EN 15662 | 150 | 25 | - | - | 2 | 100 pcs | 380-00990-21 |
| | | | 900 | 150 | - | - | 15 | 50 pcs | 380-00990-02 |
| Food with fats and waxes | Citrus fruits, cereals, avocado, nuts, seeds, dairy products | AOAC 2007.01 | 150 | 50 | 50 | - | 2 | 100 pcs | 380-00990-18 |
| | | | 1200 | 400 | 400 | - | 15 | 50 pcs | 380-00990-07 |
| | | EN 15662 | 150 | 25 | 25 | - | 2 | 100 pcs | 380-00990-22 |
| | | | 900 | 150 | 150 | - | 15 | 50 pcs | 380-00990-06 |
| Pigmented fruits and vegetables | Carrot, mango, sweet potatoes, tomatoes | AOAC 2007.01 | 150 | 50 | - | 50 | 2 | 100 pcs | 380-00990-19 |
| | | | 150 | 50 | 50 | 50 | 2 | 100 pcs | 380-00990-20 |
| | | | 1200 | 400 | 400 | 400 | 15 | 50 pcs | 380-00990-08 |
| | | | 1200 | 400 | - | 400 | 15 | 50 pcs | 380-00990-25 |
| | | EN 15662 | 150 | 25 | - | 2.5 | 2 | 100 pcs | 380-00990-23 |
| | | | 885 | 150 | - | 15 | 15 | 50 pcs | 380-00990-03 |
| | | | 900 | 150 | - | 15 | 15 | 50 pcs | 380-00990-01 |
| Highly pigmented fruits and vegetables | Red peppers, spinach, chive, lamb's lettuce, blueberries | EN 15662 | 150 | 25 | - | 7.5 | 2 | 100 pcs | 380-00990-24 |
| | | | 900 | 150 | - | 45 | 15 | 50 pcs | 380-00990-04 |
| General Purpose | Wide range of commodities, including fatty and pigmented fruits and vegetables | - | 150 | 50 | 50 | 7.5 | 2 | 100 pcs | 380-00990-26 |
| | | | 900 | 300 | 300 | 45 | 15 | 50 pcs | 380-00990-27 |

MgSO₄: Magnesium sulfate, NaOAc: Sodium acetate, NaCl: Sodium chloride, TSCD: Trisodium citrate dihydrate, PSA: Primary secondary amine sorbent, GCB: Graphitized carbon black
 DHS: Disodium hydrogen citrate sesquihydrate

Supplementary explanation 1:

PSA is mainly used to remove impurities such as sugars, fatty acids, organic acids and anthocyanins in the sample matrix;
 C18 is mainly used to remove lipids and non-polar interference substances in the sample matrix;
 GCB (graphitized carbon) is mainly used to remove pigments, sterols, non-polar substances;

Supplementary explanation 2:

2mL purification tube is suitable for transferring 1mL extraction solution;
 15mL purification tube is suitable for transferring 6-8mL extraction solution;

| Others | | | |
|--------------|---|-----------|------------------|
| Part Number | Product Name | Pack Size | Type |
| 380-00990-09 | 15 mL, 300 mg PSA, 300 mg C18, 90 mg GCB, 300 mg Silica, 900 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-10 | 15 mL, 400 mg PSA, 400 mg C18, 200 mg GCB, 1200 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-11 | 15 mL, 300 mg PSA, 100 mg C18, 1200 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-12 | 15 mL, 30 mg PSA, 900 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-13 | 15 mL, 30 mg PSA, 15 mg GCB, 900 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-14 | 15 mL, 80 mg PSA, 400 mg C18, 1200 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-15 | 15 mL, 40 mg PSA, 400 mg C18, 1200 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-16 | 15 mL, 30 mg PSA, 300 mg C18, 900 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-27 | 15 mL, 300 mg PSA, 300 mg C18, 45 mg GCB, 900 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00128-02 | 15 mL, 50 mg PSA, 150 mg C18, 900 mg Na ₂ SO ₄ | 50 pcs | 15 ml dSPE |
| 380-05300-07 | 15 mL, 200 mg ± 10 mg C18, 900 mg ± 20 mg Na ₂ SO ₄ | 50 pcs | 15 ml dSPE |
| 380-05300-08 | 15 mL, 200 mg ± 10 mg PSA, 200 mg ± 10 mg C18, 1200 mg ± 10 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-05300-09 | 15 mL, 200 mg ± 10 mg PSA, 1400 mg ± 10 mg C18, 1200 mg ± 10 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-32 | 15 mL, 150 mg PSA, 150 mg C18, 15 mg GCB, 900 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00164 | 15 mL, 400 mg PSA, 400 mg C18, 45 mg GCB, 1200 mg MgSO ₄ | 50 pcs | 15 ml dSPE |
| 380-00990-26 | 2 mL, 50 mg PSA, 50 mg C18, 7.5 mg GCB, 150 mg MgSO ₄ | 100 pcs | 2 ml dSPE |
| 380-00180 | Extraction Salts Packets Only, 6 g MgSO ₄ , 1.5 g NaCl | 50 pcs | Extraction Salts |
| 380-00180-01 | Extraction Salts Packets with 50 mL Centrifuge Tube, 6 g MgSO ₄ , 1.5 g NaCl | 50 pcs | Extraction Salts |
| 380-00154 | Extraction Salts Packets with 50 mL Centrifuge Tube, 4 g Na ₂ SO ₄ , 1 g NaCl | 50 pcs | Extraction Salts |
| 380-05300-10 | Extraction Salts Packets Only, 4 g Na ₂ SO ₄ , 1 g NaCl, 0.5 g DHS, 1 g TSCD | 50 pcs | Extraction Salts |

| Bulk Sorbents | | | |
|---------------|----------------------|----------|----------|
| Part Number | Product Name | Material | Quantity |
| 380-00172-04 | Packing Material PSA | PSA | 100g |
| 380-00172-02 | Packing Material C18 | C18 | 100g |
| 380-00172-03 | Packing Material GCB | GCB | 100g |

SHIMSEN Styra SPE

Sample Preparation

CoreFocus



CoreFocus
The Smart Choice In Consumables SHIMADZU



Shimsen Styra SPE

Cleanse, Capture, and Concentrate:
Elevate Your Analysis with
Shimsen Styra Solid Phase Extraction!

What is SPE?

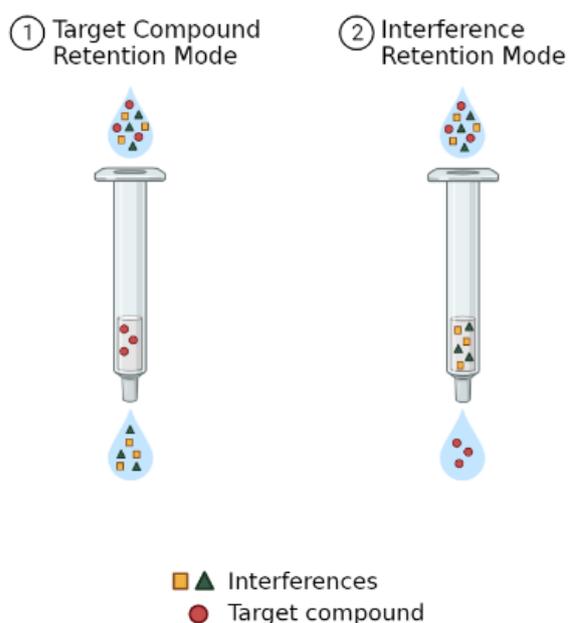
Solid-phase extraction (SPE) is a fundamental and versatile sample preparation technique widely employed in the field of analytical chemistry. Its primary purpose is to isolate and concentrate specific target compound(s) from complex mixtures, enabling enhanced sensitivity and accuracy in subsequent analytical methods. SPE plays a crucial role in sample cleanup, pre-concentration, and purification, making it an indispensable tool for a broad range of applications, including environmental monitoring, pharmaceutical analysis, clinical research, forensic investigations, and food safety testing.

Purification mechanism of SPE

The purification mechanism of SPE method can be divided into two modes including target compound retention mode and interference retention mode.

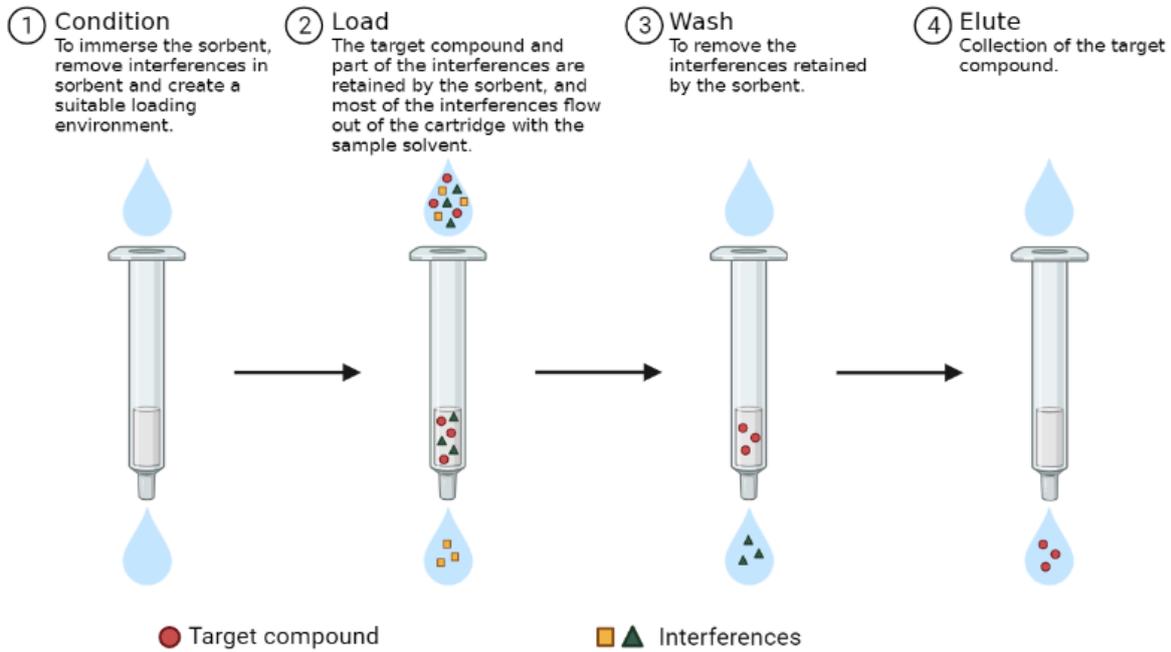
In target compound retention mode, the target compound is retained by the solid sorbent while the interference compounds are being washed off. Subsequently, the target compounds is eluted using an appropriate solvent to give a purified target compound, free from interference compound. This retention mode is also commonly used for concentrating target compound from a diluted sample.

In interference retention mode, interference compounds are retained by the solid sorbent while the target compound passes through the solid sorbent unretained and collected in its pure form.



Steps of SPE method

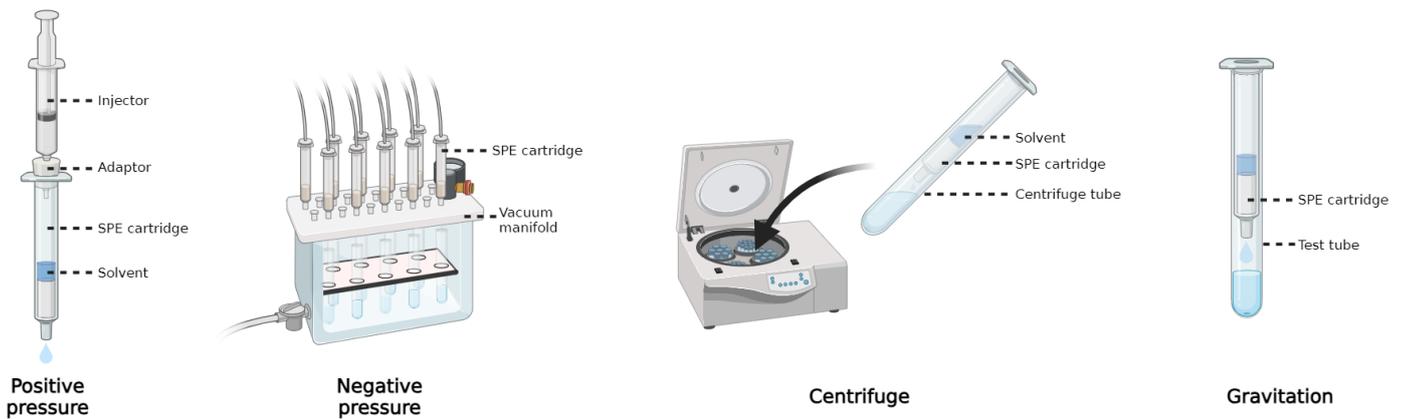
The universal steps of SPE method are showed as followed:



Sample Preparation

Flow rate control

The following four methods are commonly used for flow rate control. The choice of method depends on the application and the availability of apparatus.



Choose Proper Sorbent

Sorbent Selection by Matrix and Analyte

| | | | | |
|-----------------|----------------------------|--|-------------------------|---------------------------|
| Target Compound | Soluble in organic solvent | Soluble in hexane | Normal phase adsorption | Silica, FL-PR |
| | | | Normal phase | PSA, NH ₂ , CN |
| | | Soluble in methanol or methanol /water mixture | Normal phase | PSA, NH ₂ , CN |
| | | | Reversed phase | HLB, C18, C8, Ph, C2 |
| | Soluble in aqueous solvent | Non-ionizable | Reversed phase | HLB, C18, C8, Ph, C2 |
| | | Ionizable | Cationic | MCX, WCX, SCX |
| Anionic | | | MAX, WAX, SAX | |

It is a standard of SPE phase selection that the SPE phase should be consistent with the property of the analytes. Besides, it is necessary to consider the characteristics of sample matrix, analytes and the solubility of the solvent used. Solid phase extraction sorbent can be divided into reverse phase, normal phase and ion exchange according to chemical properties.

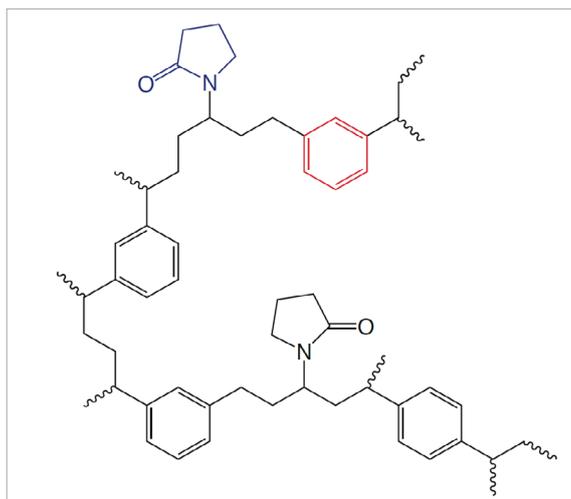
Retention Mechanisms

| SPE Phase Type | Analyte | Sample Matrix Type | Mechanisms |
|----------------|-----------------------------|-------------------------|---|
| Reverse Phase | Non-polar Compound | Polar | Reverse phase sorbent is used to extract analytes from aqueous samples using a non-polar (hydrophobic) retention mechanism. |
| Normal Phase | Polar Compound | Non-polar | Normal phase sorbent is used to extract analytes from non-polar (typically solvent) matrices using polar retention mechanisms. |
| Ion Exchange | Ionizable Compound | Aqueous, Non-polar, etc | Ion exchange sorbent is used to extract ionizable analytes from aqueous samples using an ion exchange retention mechanism. |
| Mixed Mode | Ionizable Nonpolar Compound | Aqueous, Non-polar, etc | Mixed mode sorbent is used to extract ionizable analytes from aqueous or nonpolar samples using an ion exchange retention mechanism combined with non-polar retention mechanism |

Polymeric Cartridge

SHIMSEN Styra HLB / Hydrophilic-Lipophilic Balanced Cartridge

SHIMSEN Styra HLB is a hydrophilic-lipophilic balanced cartridge, which is based on styrene-divinylbenzene as the matrix and introduced into the polar functional group containing -N. It has good retention effect on non-polar compounds, and also has a certain retention effect on polar compounds.

**Application:**

Environmental monitoring: PAHs, PAEs, phenolic compounds, bisphenol A, triazine herbicides in water and soil;

Food safety testing: analysis of drug residues in animal samples, such as tetracycline drugs, chloramphenicol, sulfonamides, avermectin, macrolides antibiotics, furan drugs and their metabolites, and pesticide residues in plant samples;

Biological samples: analysis of drugs in blood and urine, such as tetracycline drugs, cocaine and its metabolites, morphine and its metabolites, barbiturates, tricyclic drugs, ranitidine, etc.

- Polystyrene / Divinylbenzene copolymer spherical particles
- Particle size 50 μm , pore size 80 \AA , specific surface area 800 m^2/g
- Function groups: phenyl, vinyl, pyrrolidone

SHIMSEN Styra HLB Product Information:

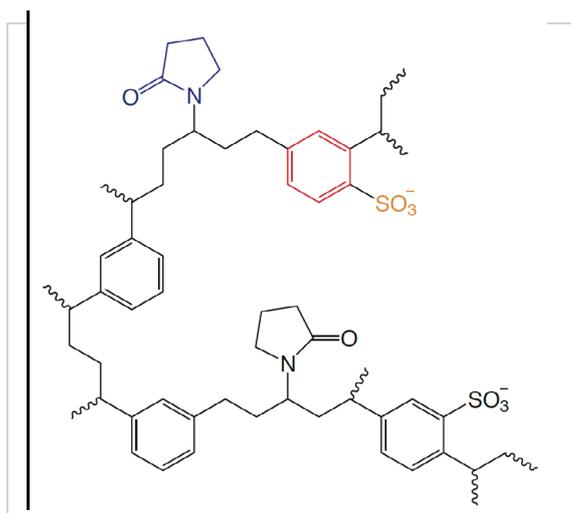
| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00855-03 | 60 mg / 3 mL | 50pcs |
| 380-00855-04 | 60 mg / 1 mL | 100pcs |
| 380-00855-05 | 6 g / 60 mL | 10pcs |
| 380-00855-06 | 500 mg / 3 mL | 50pcs |
| 380-00855-07 | 500 mg / 6 mL | 30pcs |
| 380-00855-08 | 500 mg / 12 mL | 20pcs |
| 380-00855-09 | 30 mg / 1 mL | 100pcs |
| 380-00855-10 | 200 mg / 6 mL | 30pcs |
| 380-00855-11 | 150 mg / 6 mL | 30pcs |
| 380-00855-12 | 100 mg / 6 mL | 30pcs |
| 380-00855-13 | 1000 mg / 6 mL | 30pcs |
| 380-00855-14 | 1 g / 20 mL | 20pcs |

Polymeric Cartridge

SHIMSEN Styra MCX / Mixed-Mode Strong Cation Exchange Reversed Phase Cartridge

SHIMSEN Styra MCX uses a polymeric cation-exchange resin that combines the outstanding properties of SHIMSEN Styra HLB with strong cation exchange functionalities.

MCX is suitable for the enrichment and purification of basic compounds with pKa 2-10.



Retention mechanism: strong cation exchange interaction (primary), non-polar interaction (primary), polar interaction (secondary)

Application:

Food safety testing: melamine analysis; analysis of alkaline drug residues in animal samples, such as sulfonamides, clenbuterol hydrochloride and other drugs; alkaline pesticides in vegetables, fruits and fruit juices, such as carbendazim, thiamethoxam and other fungicides.

Biological samples: analysis of alkaline drugs in blood and urine

- Polystyrene-divinylbenzene copolymer bonded with sulfonic acid groups
- Particle size 50 μm , pore size 80 \AA , specific surface area 800 m^2/g
- Function groups: sulfonic acid group, phenyl, vinyl, pyrrolidone
- pKa: <1.0

SHIMSEN Styra MCX Product Information:

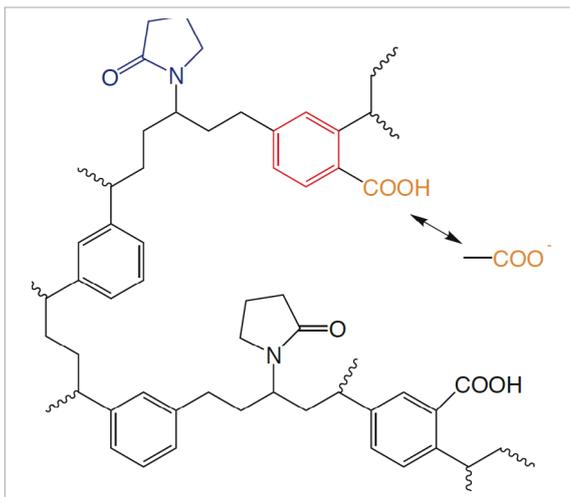
| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00853-01 | 60 mg / 3 mL | 50pcs |
| 380-00853-02 | 6 g / 60 mL | 10pcs |
| 380-00853-03 | 500 mg / 12 mL | 20pcs |
| 380-00853-04 | 30 mg / 1 mL | 100pcs |
| 380-00853-05 | 20 mg / 3 mL | 50pcs |
| 380-00853-06 | 200 mg / 6 mL | 30pcs |
| 380-00853-07 | 150 mg / 6 mL | 30pcs |
| 380-00853-08 | 1 g / 20 mL | 20pcs |

Polymeric Cartridge

SHIMSEN Styra WCX / Mixed-Mode Weak Cation Exchange Reversed Phase Cartridge

SHIMSEN Styra WCX uses a polymeric cation-exchange resin that combines the outstanding properties of SHIMSEN Styra HLB with weak cation exchange functionalities.

WCX is suitable for the enrichment and purification of strong basic compounds with pKa 10 or more.



Retention mechanism: weak cation exchange interaction (primary), non-polar interaction (primary), polar interaction (secondary)

Application:

Separation and purification of strong basic compounds, such as compounds with quaternary ammonium groups

- Polystyrene-divinylbenzene copolymer bonded with carboxyl groups
- Particle size 50 μm , pore size 80 \AA , specific surface area 800 m^2/g
- Function groups: carboxyl, phenyl, vinyl, pyrrolidone
- pKa: 4.2

SHIMSEN Styra WCX Product Information:

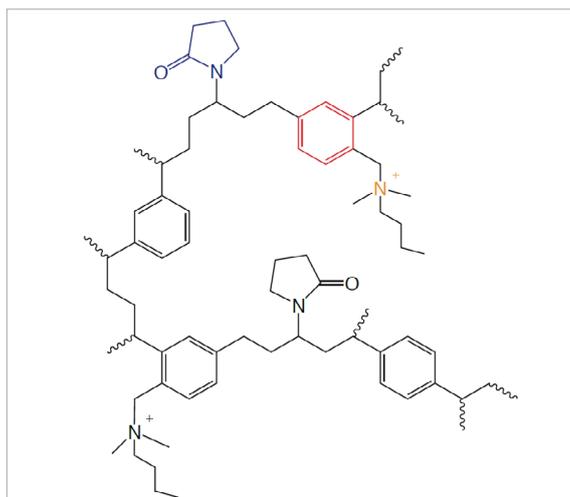
| Product Number | Specification | Package |
|----------------|---------------|---------|
| 380-00850-01 | 60 mg / 3 mL | 50pcs |
| 380-00850-02 | 500 mg / 6 mL | 30pcs |
| 380-00850-03 | 500 mg / 3 mL | 50pcs |
| 380-00850-04 | 30 mg / 1 mL | 100pcs |
| 380-00850-05 | 150 mg / 6 mL | 30pcs |

Polymeric Cartridge

SHIMSEN Styra MAX / Mixed-Mode Strong Anion Exchange Reversed Phase Cartridge

SHIMSEN Styra MAX uses a polymeric anion-exchange resin that combines the outstanding properties of SHIMSEN Styra HLB with strong anion exchange functionalities.

MAX is suitable for the enrichment and purification of acidic compounds with pKa 2-8.



Retention mechanism: anion exchange interaction (primary), non-polar interaction (primary), polar interaction (secondary)

Application:

Separation and purification of acidic compounds, such as compounds containing carboxyl and phenolic hydroxyl groups

- Polystyrene-divinylbenzene copolymer bonded with quaternary ammonium groups
- Particle size 50 μm , pore size 80 \AA , specific surface area 800 m^2/g
- Function groups: quaternary ammonium group, phenyl, vinyl, pyrrolidone group
- pKa: completely dissociated

SHIMSEN Styra MAX Product Information:

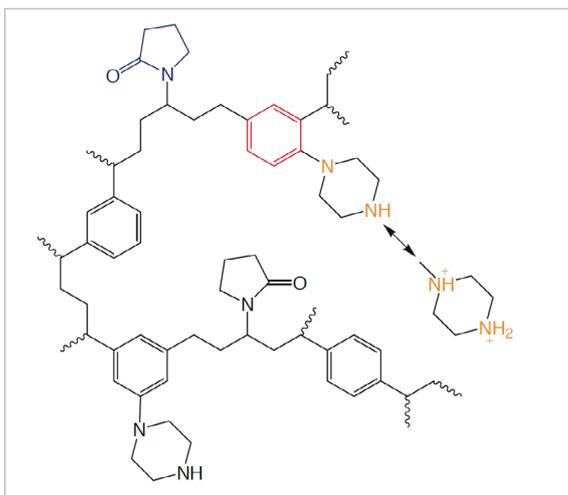
| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00854-01 | 60 mg / 3 mL | 50pcs |
| 380-00854-02 | 6 g / 60 mL | 10pcs |
| 380-00854-03 | 500 mg / 6 mL | 30pcs |
| 380-00854-04 | 500 mg / 12 mL | 20pcs |
| 380-00854-05 | 30 mg / 1 mL | 100pcs |
| 380-00854-06 | 150 mg / 6 mL | 30pcs |
| 380-00854-07 | 1000 mg / 6 mL | 30pcs |
| 380-00854-08 | 1 g / 20 mL | 20pcs |

Polymeric Cartridge

SHIMSEN Styra WAX / Mixed-Mode Weak Anion Exchange Reversed Phase Cartridge

SHIMSEN Styra WAX uses a polymeric anion-exchange resin that combines the outstanding properties of SHIMSEN Styra HLB with weak anion exchange functionalities.

WAX is suitable for the enrichment and purification of strong acidic compounds with pKa 1 or less.



Retention mechanism: anion exchange interaction (primary), non-polar interaction (primary), polar interaction (secondary)

Application:

Separation and purification of strong acidic compounds, such as compounds containing sulfonic acid groups

- Polystyrene-divinylbenzene copolymer bonded with piperazine group
- Particle size 50 μm , pore size 80 \AA , specific surface area 800 m^2/g
- Function groups: piperazine group, phenyl, vinyl, pyrrolidone
- pKa: 9.5, 5.7 (the pKa value of the conjugated acid of the piperazine group)

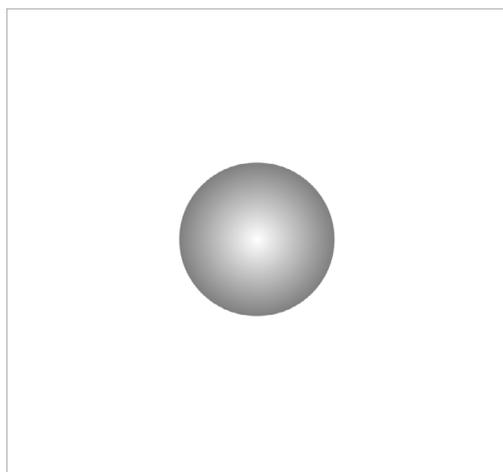
SHIMSEN Styra WAX Product Information:

| Product Number | Specification | Package |
|----------------|---------------|---------|
| 380-00852-03 | 60 mg / 3 mL | 50pcs |
| 380-00852-04 | 500 mg / 6 mL | 30pcs |
| 380-00852-05 | 30 mg / 1 mL | 100pcs |
| 380-00852-06 | 150 mg / 6 mL | 30pcs |

Normal Phase Cartridge

SHIMSEN Styra SI / Normal Phase Silica Cartridge

SHIMSEN Styra SI is based on unbonded silica gel particles. The primary interaction available is strong polar interaction due to the silanol groups. It can be used for enrichment of polar compounds from low-polar solvents or removal of polar impurities from non-polar solvents. It is necessary to prevent moisture absorption before use.



Retention mechanism: Strong polar interaction

Application:

Extraction of compounds with polar groups from lipid samples; Adsorption of interfering substances in pesticide residue analysis.

- Matrix: Spherical silica particles, particle size 50 μm , pore size 60 \AA , specific surface area 500 m^2/g
- Function groups: Silicon Hydroxy
- Endcapped: No

SHIMSEN Styra SI Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00856-01 | 5 g / 20 mL | 20pcs |
| 380-00856-02 | 500 mg / 6 mL | 30pcs |
| 380-00856-03 | 500 mg / 3 mL | 50pcs |
| 380-00856-04 | 2 g / 12 mL | 20pcs |
| 380-00856-05 | 200 mg / 3 mL | 50pcs |
| 380-00856-06 | 2000 mg / 6 mL | 30pcs |
| 380-00856-07 | 10 g / 60 mL | 10pcs |
| 380-00856-08 | 1000 mg / 6 mL | 30pcs |
| 380-00856-09 | 100 mg / 1 mL | 100pcs |

Normal Phase Cartridge

SHIMSEN Styra FL-PR / Florisil Cartridge

SHIMSEN Styra FL-PR is based on natural Florisil silica ($\text{MgO} \cdot \text{SiO}_2$) and is used for the recovery or cleanup of polar substances from non-polar solvents. This sorbent is high in polarity and can be used to extract polar compounds from non-polar solutions. The larger particle size (200 μm) of the sorbent enables fast flow for large sample volumes and is therefore an attractive alternative to silica if the sample matrix is particularly viscous. FL-PR can not only separate chlorinated insecticides, but also be used in AOAC, EPA and other methods. In addition, FL-PR is an excellent replacement for alumina cartridge when the acidic nature of alumina affects the extraction effect.



Florisil

Retention mechanism:

Application:

Environmental samples and pesticide residue analysis

Food: SHIMSEN Styra FL-PR is suitable for the purification of pesticide residues in crops

- Adsorbent: Magnesium silicate particles with size of 150-200 μm
- Function groups: Silicon Hydroxy

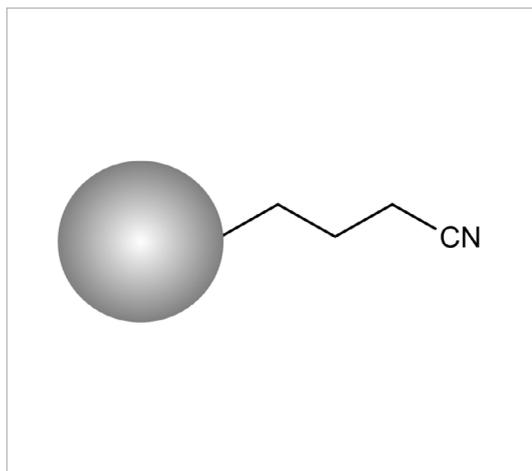
SHIMSEN Styra FL-PR Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00862-01 | 500 mg / 6 mL | 30pcs |
| 380-00862-02 | 500 mg / 3 mL | 50pcs |
| 380-00862-03 | 5 g / 20 mL | 20pcs |
| 380-00862-04 | 2 g / 6 mL | 30pcs |
| 380-00862-05 | 2 g / 12 mL | 20pcs |
| 380-00862-06 | 200 mg / 3 mL | 50pcs |
| 380-00862-07 | 1000 mg / 6 mL | 30pcs |
| 380-00862-08 | 100 mg / 1 mL | 100pcs |
| 380-00862-09 | 10 g / 60 mL | 10pcs |

Normal Phase Cartridge

SHIMSEN Styra CN / Cyano-bonded Silica Cartridge

SHIMSEN Styra CN exhibits both non-polar and polar interactions with target compound. It is a good choice when sorbents such as C18, C8 or Si do not provide the desired selectivity.



Retention mechanism: Polar interaction and non-polar interaction

Application:

Pesticides, drugs and their metabolites in aqueous samples.

- Matrix: Particle size 50 μm , pore size 60 \AA
- Spherical silica particles with a specific surface area of 500 m^2/g
- Function groups: Cyanopropyl
- Endcapped: Yes
- Carbon load (C%): 6.5%

SHIMSEN Styra CN Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00864-01 | 500 mg / 3 mL | 50pcs |
| 380-00864-02 | 5 g / 20 mL | 20pcs |
| 380-00864-03 | 200 mg / 3 mL | 50pcs |
| 380-00864-04 | 2 g / 12 mL | 20pcs |
| 380-00864-05 | 1000 mg / 6 mL | 30pcs |
| 380-00864-06 | 100 mg / 1 mL | 100pcs |
| 380-00864-07 | 10 g / 60 mL | 10pcs |

Normal Phase Cartridge

SHIMSEN Styra AL-N / Neutral Alumina Cartridge

SHIMSEN Styra AL-N is packed with neutral alumina (Al_2O_3) to retain or remove polar compounds. Similar to silica gel, neutral Al_2O_3 is a strongly polar sorbent. However, the neutral alumina tends to be slightly more stable under high pH conditions than silica gel. The neutralized surface allows interaction with compounds whose heteroatoms are electronegative (e.g., O, P, S) or with an electron-rich, highly aromatic structure.



Retention mechanism: Lewis acid-base interaction, polar interaction and ion exchange interaction

Application:

SHIMSEN Styra AL-N is used to extract polar or non-polar compounds from both aqueous and non-aqueous solutions, such as sample preparation of malachite green and crystal violet in aquatic products.

- Adsorbent: Neutral Al_2O_3 particles with size of 125 μm
- pH : 7.5

SHIMSEN Styra AL-N Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00865-01 | 500 mg / 6 mL | 30pcs |
| 380-00865-02 | 500 mg / 3 mL | 50pcs |
| 380-00865-03 | 5 g / 20 mL | 20pcs |
| 380-00865-04 | 250 mg / 3 mL | 50pcs |
| 380-00865-05 | 200 mg / 3 mL | 50pcs |
| 380-00865-06 | 2 g / 12 mL | 20pcs |
| 380-00865-07 | 1000 mg / 6 mL | 30pcs |
| 380-00865-08 | 100 mg / 1 mL | 100pcs |
| 380-00865-09 | 10 g / 60 mL | 10pcs |

Normal Phase Cartridge

SHIMSEN Styra AL-A / Acidic Alumina Cartridge

SHIMSEN Styra AL-A is packed with acidic alumina (Al_2O_3) to retain or remove polar compounds and acidic compounds. Acidic alumina is a typical Lewis acid with two electrons missing from the aluminum atom. Acid treatment enhances the Lewis acid property of alumina, and results in a weak cationic property, allowing strong interaction with electron-rich compounds and retention of polar compounds and anionic compounds.



Alumina

Retention mechanism: Lewis acid-base interaction, polar interaction and ion exchange interaction

Application:

Retention of polar compounds and anionic compounds.

- Adsorbent: Acidic Al_2O_3 particles with size of 125 μm
- pH : 4.5

SHIMSEN Styra AL-A Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00867-01 | 500 mg / 6mL | 30pcs |
| 380-00867-02 | 500 mg / 3 mL | 50pcs |
| 380-00867-03 | 5 g / 20 mL | 20pcs |
| 380-00867-04 | 2 g / 12 mL | 20pcs |
| 380-00867-05 | 1000 mg / 6 mL | 30pcs |
| 380-00867-06 | 100 mg / 1 mL | 100pcs |
| 380-00867-07 | 10 g / 60 mL | 10pcs |

Normal Phase Cartridge

SHIMSEN Styra AL-B / Basic Alumina Cartridge

SHIMSEN Styra AL-B is packed with basic alumina (Al_2O_3) to retain or remove polar compounds and basic compounds. Basic alumina has anionic properties and cation exchange function, and tends to retain compounds with positive charges or hydrogen bonds. In addition, it can be used to retain electronic samples, such as neutral amines.



Alumina

Retention mechanism: Lewis acid-base interaction, polar interaction and ion exchange interaction

Application:

Retention of polar compounds and anionic compounds. It is suitable for the detection of Sudan red in hot pepper.

- Adsorbent: Basic Al_2O_3 particles with size of 125 μm
- pH : 10

SHIMSEN Styra AL-B Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00866-01 | 500 mg / 3 mL | 50pcs |
| 380-00866-02 | 5 g / 20 mL | 20pcs |
| 380-00866-03 | 2 g / 12 mL | 20pcs |
| 380-00866-04 | 1000 mg / 3 mL | 50pcs |
| 380-00866-05 | 1000 mg / 6 mL | 30pcs |
| 380-00866-06 | 100 mg / 1 mL | 100pcs |
| 380-00866-07 | 10 g / 60 mL | 10pcs |

Normal Phase Cartridge

SHIMSEN Styra NH₂ / Amino Bonded Silica Cartridge

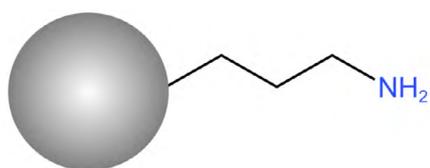
SHIMSEN Styra NH₂ is an amino bonded silica cartridge and can act either as a weak anion exchanger (aqueous solutions) or polar phase sorbent (non-polar organic solutions). When conditioned with a non-polar solvent, e.g., hexane, it tends to form hydrogen bond with any molecule containing -OH, -NH, or -SH functional groups. In an aqueous environment with pH 7.8 or less, it can function as a weak anion exchanger.

Retention mechanism: Polar interaction and weak anion exchange

Application:

It can be used to separate structural isomers; extract compounds with polar groups from lipid samples; remove polar compounds (such as carbohydrates, pigments), organic acids, and phenols, etc. in pesticide residue analysis.

- Matrix: Particle size 50 μm, pore size 60 Å
- Spherical silica particles with a specific surface area of 500 m²/g
- Function groups: Cyanopropyl
- Endcapped: No
- Carbon load (C%): 3.5%
- pKa: 9.8 (the pKa of its conjugated acid)

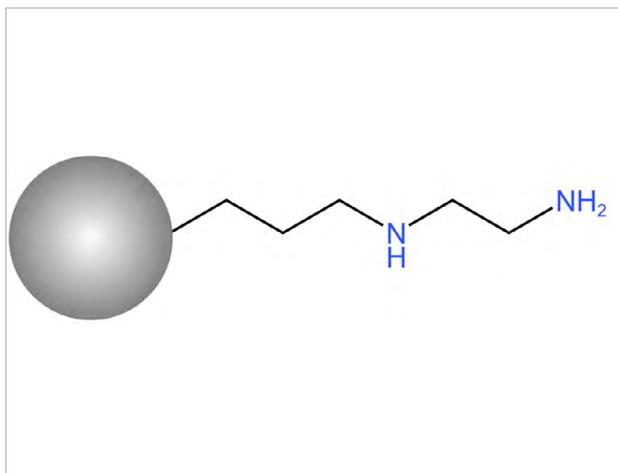
SHIMSEN Styra NH₂ Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00861-01 | 6 g / 60 mL | 10pcs |
| 380-00861-02 | 500 mg / 6 mL | 30pcs |
| 380-00861-03 | 500 mg / 3 mL | 50pcs |
| 380-00861-04 | 5 g / 20 mL | 20pcs |
| 380-00861-05 | 200 mg / 3 mL | 50pcs |
| 380-00861-06 | 2 g / 12 mL | 20pcs |
| 380-00861-07 | 1000 mg / 6 mL | 30pcs |
| 380-00861-08 | 100 mg / 1 mL | 100pcs |
| 380-00861-09 | 10 g / 60 mL | 10pcs |

Normal Phase Cartridge

SHIMSEN Styra PSA/ Ethylenediamino Bonded Silica Cartridge

SHIMSEN Styra PSA is based on silica gel particles bonded with ethylenediamino-N-propyl which contain two different amino—the pKa of one is 10.1, and other is 10.9. It is similar to NH₂ cartridge but has stronger ion exchange functionalities. At the same time, PSA can be used to extract metal ion due to the chelation with metal ion.



Retention mechanism: Weak anion exchange, polar interaction, chelation

Application:

It can be used to separate structural isomers; extract compounds with polar groups from lipid samples, and remove polar compounds (such as carbohydrates, pigments), organic acids, phenols, etc. in pesticide residue analysis.

- Matrix: Particle size 50 μm , pore size 60 \AA
- Spherical silica particles with a specific surface area of 500 m^2/g
- Function groups: Ethylenediamine-N-propyl
- Endcapped: No
- Carbon load (C%): 7%
- pKa: 10.1 and 10.9 (the pKa of its conjugated acid)

SHIMSEN Styra PSA Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00859-01 | 500 mg / 6 mL | 30pcs |
| 380-00859-02 | 500 mg / 3 mL | 50pcs |
| 380-00859-03 | 5 g / 20 mL | 20pcs |
| 380-00859-04 | 200 mg / 3 mL | 50pcs |
| 380-00859-05 | 2 g / 12 mL | 20pcs |
| 380-00859-06 | 1000 mg / 6 mL | 30pcs |
| 380-00859-07 | 100 mg / 1 mL | 100pcs |
| 380-00859-08 | 10 g / 60 mL | 10pcs |

FEATURES OF SILICA-BASED REVERSED-PHASE CARTRIDGES

1. The functional groups bonded on the surface of silica gel play a major role in the retention of the target compounds. Based on the types of bonded functional groups, there are three mechanisms by which sorbents retain the target compounds: reversed phase retention, normal phase retention and ion exchange retention.
2. Bonded silica sorbents are stable from pH 2 to 7.5.
3. The bonded silica sorbent are rigid, neither shrink nor expand during solvent conversion, and can reach equilibrium rapidly in new solvents.
4. The matrix of bonded silica sorbents is spherical silica gel with a particle size of 50 μm . The particle size is uniform and its surface is smooth, which reduces the resisting force of the passing solvent. The characteristic pore size of bonded silica sorbents is 60 \AA , which are suitable for compounds with molecular weight less than 15,000.
5. Reverse phase sorbents are endcapped, while normal phase sorbents and ion exchange sorbents are not endcapped.

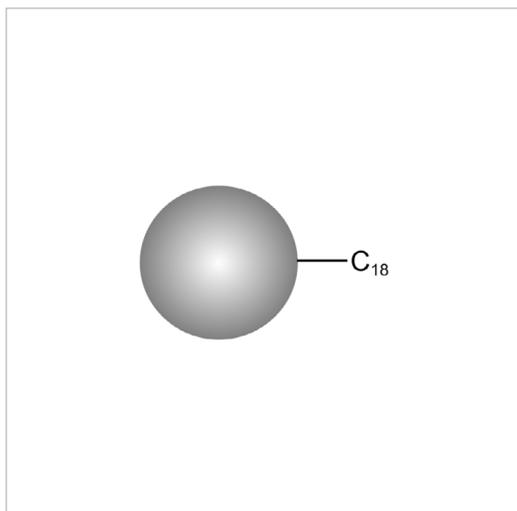


Silica-based Reversed -phase Cartridge

SHIMSEN Styra C18 / Octadecyl Bonded Silica Cartridge

SHIMSEN Styra C18 is an octadecyl bonded silica cartridge and can retain target compounds by non-polar interaction. Highly endcapping of this sorbent inhibits cation exchange interaction caused by silanol groups, resulting in less adsorption of basic compounds.

It is a good choice when non-polar interaction is needed.



Retention mechanism: Strong non-polar interaction

Application:

Extraction of organic pollutants from water: PAHs, PAEs, PCBs, pesticides, herbicides, phenols, etc.;

Life sciences: extraction of drugs and their metabolites from plasma, serum, and urine;

Extraction of pesticide and veterinary drug residues from food;

Animal and plant extracts: aromatic oils, fat-soluble vitamins, water-soluble vitamins, carbohydrates, organic acids, steroids, etc.;

Desalination of biological macromolecules.

- Matrix: Particle size 50 μm , pore size 60 \AA
- Spherical silica particles with a specific surface area of 500 m^2/g
- Function groups: Octadecyl
- Endcapped: Yes
- Carbon load (C%): 17%

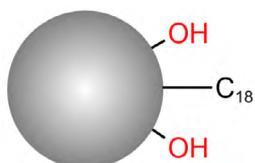
SHIMSEN Styra C18 Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00872-01 | 60 mg / 3 mL | 50pcs |
| 380-00872-02 | 500 mg / 6 mL | 30pcs |
| 380-00872-03 | 500 mg / 3 mL | 50pcs |
| 380-00872-04 | 50 mg / 1 mL | 100pcs |
| 380-00872-05 | 5 g / 20 mL | 20pcs |
| 380-00872-06 | 250 mg / 3 mL | 50pcs |
| 380-00872-07 | 200 mg / 6 mL | 30pcs |
| 380-00872-08 | 200 mg / 3 mL | 50pcs |
| 380-00872-09 | 2 g / 12 mL | 20pcs |
| 380-00872-10 | 100 mg / 6 mL | 30pcs |
| 380-00872-11 | 100 mg / 3 mL | 50pcs |
| 380-00872-12 | 1000 mg / 6 mL | 30pcs |
| 380-00872-13 | 100 mg / 1 mL | 100pcs |
| 380-00872-14 | 10 g / 60 mL | 10pcs |

Silica-based Reversed-phase Cartridge

SHIMSEN Styra C18-U / Octadecyl Bonded Silica Cartridge

SHIMSEN Styra C18-U is an octadecyl bonded silica cartridge and can retain target compounds by non-polar interaction. The phase is non-encapped which enhances retention of polar compounds.



Retention mechanism: Non-polar interaction (primary) , polar interaction (secondary)

Application:

C18-U is a non-encapped version of the octadecyl bonded phases. The residual silanols on the surface of the silica gel matrix have polar interaction with polar compounds, which can enhance retention of polar compounds, especially amine compounds (such as tetracycline drugs), and is suitable for the extraction of polar and non-polar compounds.

- Matrix: Particle size 50 μm , pore size 60 \AA
- Spherical silica particles with a specific surface area of 500 m^2/g
- Function groups: Octadecyl
- Encapped: No
- Carbon load (C%): 17%

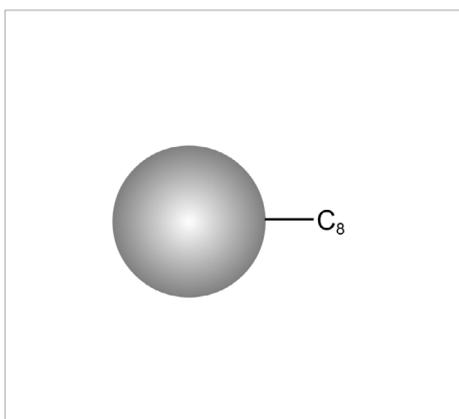
SHIMSEN Styra C18-U Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00876-01 | 60 mg / 3 mL | 50pcs |
| 380-00876-02 | 500 mg / 20 mL | 20pcs |
| 380-00876-03 | 500 mg / 6 mL | 30pcs |
| 380-00876-04 | 500 mg / 3 mL | 50pcs |
| 380-00876-05 | 50 mg / 1 mL | 100pcs |
| 380-00876-06 | 5 g / 20 mL | 20pcs |
| 380-00876-07 | 200 mg / 3 mL | 50pcs |
| 380-00876-08 | 2 g / 12 mL | 20pcs |
| 380-00876-09 | 1000 mg / 6 mL | 30pcs |
| 380-00876-10 | 100 mg / 1 mL | 100pcs |
| 380-00876-11 | 10 g / 60 mL | 10pcs |

Silica-based Reversed-phase Cartridge

SHIMSEN Styra C8 / Octyl Bonded Silica Cartridge

SHIMSEN Styra C8 is an octyl bonded silica cartridge and has weaker non-polar interaction compared to C18. C8 is an excellent replacement for C18 when highly hydrophobic compounds are too strongly retained for effective elution. Highly endcapping of this sorbent inhibits secondary interaction caused by silanol groups, resulting in less adsorption of basic compounds.



Retention mechanism: Moderate non-polar interaction

Application:

It is suitable for retention of moderate polar compounds, drugs and their metabolites from biological samples, and extraction of peptides from biological samples, etc.

- Matrix: Particle size 50 μm , pore size 60 \AA
- Spherical silica particles with a specific surface area of 500 m^2/g
- Function groups: Octyl
- Endcapped: Yes
- Carbon load (C%): 11%

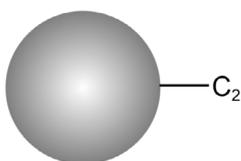
SHIMSEN Styra C8 Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00870-01 | 500 mg / 6 mL | 30pcs |
| 380-00870-02 | 500 mg / 3 mL | 50pcs |
| 380-00870-03 | 5 G / 20 mL | 20pcs |
| 380-00870-04 | 200 mg / 3 mL | 50pcs |
| 380-00870-05 | 2 g / 12 mL | 20pcs |
| 380-00870-06 | 1000 mg / 6 mL | 30pcs |
| 380-00870-07 | 100 mg / 1 mL | 100pcs |
| 380-00870-08 | 10 g / 60 mL | 10pcs |

Silica-based Reversed-phase Cartridge

SHIMSEN Styra C2 / Ethyl Bonded Silica Cartridge

SHIMSEN Styra C2 is an ethyl bonded silica cartridge and has weaker non-polar interaction compared to C8. It is an excellent replacement for C8 when highly hydrophobic compounds are too strongly retained for effective elution. Highly endcapping of this sorbent inhibits secondary interactions caused by silanol groups, resulting in less adsorption of basic compounds. It is an excellent replacement for C8 and C18 when analytes are too strongly retained for effective elution.



Retention mechanism: Non-polar interaction (primary) and polar interaction (secondary)

Application:

The polarity of C2 group is slightly lower than CN group. SHIMSEN Styra C2 is usually used to extract drugs from plasma and serum samples.

Extraction of drugs and metabolites from blood samples.

- Matrix: Particle size 50 μm , pore size 60 \AA
- Spherical silica particles with a specific surface area of 500 m^2/g
- Function groups: Ethyl
- Endcapped: Yes
- Carbon load (C%): 2.7%

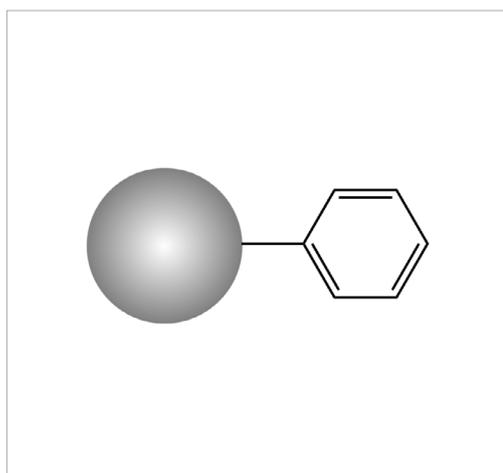
SHIMSEN Styra C2 Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00871-01 | 500 mg / 3 mL | 50pcs |
| 380-00871-02 | 5 g / 20 mL | 20pcs |
| 380-00871-03 | 2 g / 12 mL | 20pcs |
| 380-00871-04 | 1000 mg / 6 mL | 30pcs |
| 380-00871-05 | 100 mg / 1 mL | 100pcs |
| 380-00871-06 | 10 g / 60 mL | 10pcs |

Silica-based Reversed-phase Cartridge

SHIMSEN Styra Ph / Phenyl Bonded Silica Cartridge

SHIMSEN Styra Ph is a phenyl-bonded silica cartridge. It has the same non-polar interaction as C8, and also has the unique π -electron pair interaction due to phenyl. It is a good choice for sample preparation when C8 could not provide the desired selectivity. And it has good selectivity for aromatic compounds with benzene ring.



Retention mechanism: Moderate non-polar interaction

Application:

Extraction of organic pollutants from water: PAHs, PAEs, PCBs, pesticides, herbicides, phenols, etc.; Life sciences: such as the extraction of drugs and their metabolites from plasma, serum, and urine; the extraction of pesticides and veterinary drug residues from food animal and plant extracts: aromatic oils, fat-soluble vitamins, water-soluble vitamins, carbohydrates, organic acids, steroids, etc.

- Matrix: Particle size 50 μm , pore size 60 \AA
- Spherical silica particles with a specific surface area of 500 m^2/g
- Function groups: Phenyl
- Endcapped: Yes
- Carbon load (C%): 8%

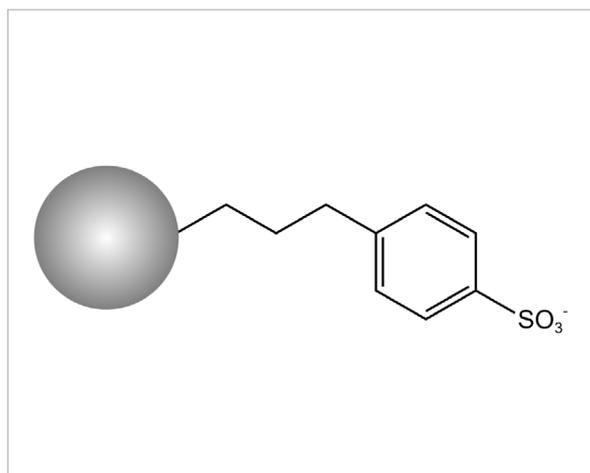
SHIMSEN Styra Ph Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00860-01 | 500 mg / 3 mL | 50pcs |
| 380-00860-02 | 5 g / 20 mL | 20pcs |
| 380-00860-03 | 2 g / 12 mL | 20pcs |
| 380-00860-04 | 1000 mg / 6 mL | 30pcs |
| 380-00860-05 | 100 mg / 1 mL | 100pcs |
| 380-00860-06 | 10 g / 60 mL | 10pcs |

Silica-based Ion Exchange Cartridge

SHIMSEN Styra SCX / Strong Cation Exchange Cartridge

SHIMSEN Styra SCX is a propyl benzenesulfonate bonded silica cartridge and has strong cation exchange functionalities. The presence of the benzene ring in the functional group increases its nonpolar characteristics. Besides, SHIMSEN Styra SCX is suitable for the separation of basic compounds.



Retention mechanism: Strong cation exchange interaction and reverse phase interaction (primary); - electron pair interaction (secondary)

Application:

Enrichment and purification of alkaline compounds from aqueous samples, biological fluids and organic phases.

- Matrix: Particle size 50 μm , pore size 60 \AA
- Spherical silica particles with a specific surface area of 500 m^2/g
- Function groups: P-propylbenzene sulfonic acid
- Endcapped: No
- Carbon load (C%): 10.9%
- pKa : <1.0

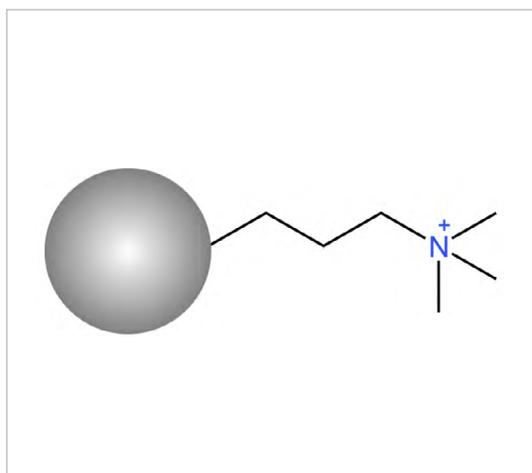
SHIMSEN Styra SCX Product Information:

| Product Number | Specification | Package |
|----------------|----------------|---------|
| 380-00857-01 | 60 mg / 3 mL | 50pcs |
| 380-00857-02 | 500 mg / 6 mL | 30pcs |
| 380-00857-03 | 500 mg / 3 mL | 50pcs |
| 380-00857-04 | 5 g / 20 mL | 20pcs |
| 380-00857-05 | 2 g / 12 mL | 20pcs |
| 380-00857-06 | 100 mg / 12 mL | 20pcs |
| 380-00857-07 | 1000 mg / 6 mL | 30pcs |
| 380-00857-08 | 100 mg / 1 mL | 100pcs |
| 380-00857-09 | 10 g / 60 mL | 10pcs |

Silica-based Ion Exchange Cartridge

SHIMSEN Styra SAX / Strong Anion Exchange Cartridge

SHIMSEN Styra SAX is a trimethylaminopropyl-bonded silica cartridge and has strong anion exchange functionalities. It can provide selective retention for anionic organic compounds (such as compounds containing carboxyl groups and phenolic hydroxyl groups). The non-polar interactions are weak due to its short carbon chain on the quaternary ammonium group.



Retention mechanism: Strong anion exchange interaction (primary), non-polar interaction (secondary)

Application:

SHIMSEN Styra SAX is generally used for the retention of weak anionic compounds containing carboxylic acid groups.

Enrichment and purification of anionic organic compounds from aqueous samples, biological fluids and organic phases.

- Matrix: Particle size 50 μm , pore size 60 \AA
- Spherical silica particles with a specific surface area of 500 m^2/g
- Function groups: Trimethylaminopropyl
- Endcapped: No
- Carbon load (C%): 7.5%
- pKa : Completely dissociated

SHIMSEN Styra SAX Product Information:

| Product Number | Specification | Package |
|----------------|---------------|---------|
| 380-00858-01 | 500 mg / 6 mL | 30pcs |
| 380-00858-02 | 500 mg / 3 mL | 50pcs |
| 380-00858-03 | 5 g / 20 mL | 20pcs |
| 380-00858-04 | 2 g / 12 mL | 20pcs |
| 380-00858-05 | 100 mg / 1 mL | 100pcs |
| 380-00858-06 | 10 g / 60 mL | 10pcs |

Carbon-based and Composite Cartridge

SHIMSEN Styra GCB / Graphitized Carbon Cartridge

SHIMSEN Styra GCB is packed with planarized graphitized carbon, mainly used to remove pigment components from crops. The polarity and ion exchange property of this cartridge are used to purify all kinds of sample substrates. The typical application of this cartridge is the analysis of pesticide residues in agricultural products. Plant samples often contain various pigments, such as chlorophyll, lutein, carotenoids, etc, which need to be removed in order to eliminate its interference with the analysis results and experimental instruments.

Retention mechanism: Surface adsorption

Application:

Sample cleanup in pesticide residue analysis of vegetables, fruits, tea and plant products.

- Adsorbent: graphitized carbon with lamellar structure.
- Particle size: 120 - 400 mesh

SHIMSEN Styra GCB Product Information:

| Product Number | Specification | Package |
|----------------|---------------|---------|
| 380-00869-01 | 500 mg / 3 mL | 50pcs |
| 380-00869-02 | 500 mg / 6 mL | 30pcs |
| 380-00869-03 | 2 g / 12 mL | 20pcs |
| 380-00869-04 | 250 mg / 3 mL | 50pcs |
| 380-00869-05 | 200 mg / 6 mL | 30pcs |
| 380-00869-06 | 1 g / 6 mL | 30pcs |
| 380-00869-07 | 125 mg / 3 mL | 50pcs |
| 380-00869-08 | 100 mg / 3 mL | 50pcs |
| 380-00869-09 | 100 mg / 1 mL | 100pcs |

Carbon-based and Composite Cartridge

SHIMSEN Styra GCB / PSA Graphitized Carbon Composite PSA Cartridge

SHIMSEN Styra GCB / NH₂ Graphitized Carbon Composite Amino Cartridge

SHIMSEN Styra GCB/PSA and SHIMSEN Styra GCB/NH₂ are mixed sorbent SPE cartridges consisting of graphitized carbon particles (GCB) and silica gel particles bonded with PSA or NH₂ group. The GCB can remove pigments, while PSA and NH₂ can remove anionic compounds. They are mainly used for the analysis of multi-pesticide residues in food samples.

Retention mechanism: Surface adsorption and anion exchange function

Application:

They are widely used in the analysis of multiple pesticide residues in food.

SHIMSEN Styra GCB/PSA Product Information:

| Product Number | Specification | Package |
|----------------|-------------------------|---------|
| 380-00868-01 | 500 mg / 500 mg / 6 mL | 30pcs |
| 380-00868-02 | 500 mg / 500 mg / 20 mL | 20pcs |
| 380-00868-03 | 250 mg / 250 mg / 6 mL | 30pcs |

SHIMSEN Styra GCB/NH₂ Product Information:

| Product Number | Specification | Package |
|----------------|-------------------------|---------|
| 380-00868-04 | 500 mg / 500 mg / 6 mL | 30pcs |
| 380-00868-05 | 500 mg / 500 mg / 20 mL | 20pcs |
| 380-00868-06 | 250 mg / 250 mg / 6 mL | 30pcs |

Carbon-based and Composite Cartridge

SHIMSEN Styra GAC / Activated Carbon Cartridge

SHIMSEN Styra GAC is packed with activated carbon particles and used to analyse pesticides, herbicides and acrylamide in aqueous samples.

Retention mechanism: Surface adsorption

SHIMSEN Styra GAC Product Information:

| Product Number | Specification | Package |
|----------------|---------------|---------|
| 380-00874-01 | 500 mg / 6 mL | 30pcs |
| 380-00874-02 | 2 g / 12 mL | 20pcs |
| 380-00874-03 | 250 mg / 3 mL | 50pcs |

Carbon-based and Composite Cartridge

SHIMSEN Styra SAX/PSA / Mixed-Mode Strong Anion Exchange Normal Phase Cartridge

SHIMSEN Styra SAX/PSA is packed with 2 layers of anion exchange packing to enhance the removal of anionic impurities in samples. It is widely used in the analysis of multiple pesticide residues in food.

SHIMSEN Styra SAX/PSA Product Information:

| Product Number | Specification | Package |
|----------------|------------------------|---------|
| 380-00877-05 | 250 mg / 250 mg / 6 mL | 30pcs |

Special Cartridge / Glass Cartridge

SHIMSEN Styra Glass / Glass Cartridge

SHIMSEN Styra Glass is developed specifically for high-purity extraction and suitable for detection on ppt level. The inert glass tube completely eliminates contamination from plasticizers, such as phthalates. The sorbent and the specially cleaned sieve plate used in SHIMSEN Styra glass cartridge are all high-grade to ensure stability and repeatability.

Sample
Preparation

SHIMSEN Styra Glass Product Information:

| Product Number | Packing | Specification | Package |
|----------------|---------------------|------------------------|---------|
| 380-00855-01 | HLB | 500 mg / 6 mL | 30pcs |
| 380-00873-01 | | 200 mg / 6 mL | 30pcs |
| 380-00873-02 | SI | 500 mg / 6 mL | 30pcs |
| 380-00873-03 | | 2000 mg / 6 mL | 30pcs |
| 380-00873-04 | GCB/NH ₂ | 500 mg / 500 mg / 6 mL | 30pcs |
| 380-00873-05 | C18 | 500 mg / 6 mL | 30pcs |
| 380-00873-06 | FL-PR | 1 g / 6 mL | 30pcs |
| 380-00873-07 | | 500 mg / 6 mL | 30pcs |
| 380-00873-08 | PSA/SI | 500 mg / 500 mg / 6 mL | 30pcs |
| 380-00873-11 | PSA | 1 g / 6 mL | 30pcs |
| 380-00873-12 | | 500 mg / 6 mL | 30pcs |

Special Cartridge / Glass Cartridge

SHIMSEN Styra Na₂SO₄ / Dehydration / Drying Cartridge

SHIMSEN Styra Na₂SO₄ is a special dehydrating column filled with anhydrous sodium sulfate.

Na₂SO₄

Ultra-pure anhydrous sodium sulfate

SHIMSEN Styra Na₂SO₄ Product Information:

| Product Number | Specification | Package |
|----------------|---------------|---------|
| 380-00875-01 | 5 g / 6 mL | 30pcs |
| 380-00875-02 | 500 mg / 3 mL | 50pcs |
| 380-00875-03 | 4 g / 6 mL | 30pcs |
| 380-00875-04 | 3 g / 6 mL | 30pcs |
| 380-00875-05 | 2 g / 6 mL | 30pcs |
| 380-00875-06 | 1 g / 6 mL | 30pcs |
| 380-00875-07 | 1 g / 3 mL | 50pcs |

Special Cartridge / Glass Cartridge

Project-specific cartridge, tailored for special applications, can be directly used without method development



| Product Number | Packing | Remark | Application | Type | Package |
|----------------|-------------------------------|--|--|-----------------------------|---------|
| 380-00873-01 | SHIMSEN Styra Glass HLB | Bisphenol A test | Used for the detection of bisphenol A migration in plastic milk bottles | 200 mg / 6 mL | 30pcs |
| 380-00873-08 | SHIMSEN Styra Glass PSA/SI | Plasticizer test | Used for the detection of textile flame retardants and plasticizers | 500 mg / 500 mg / 6mL | 30pcs |
| 380-00877-01 | SHIMSEN Styra VD | Vitamin D ₂ , D ₃ test | Used to purify milk powder sample | 2 g / 12 mL | 20pcs |
| 380-00877-02 | SHIMSEN Styra TEA | Detection of pesticide residues in tea | GB/T 23204-2008 GB/T 23205-2008 | 6 mL | 30pcs |
| 380-00877-03 | | | | 12 mL | 20pcs |
| 380-00877-04 | SHIMSEN Styra SLE | Special for azo dyes (diatomite liquid-liquid extraction column) | Used for the detection of aromatic amine released by azo dyes | / | 50pcs |
| 380-00877-05 | SHIMSEN Styra SAX / PSA | SAX/PSA mixed extraction column | Equivalent amount of SAX and PSA, widely used in the analysis of multi-pesticide residues in food | 250 mg / 250 mg / 6 mL | 30pcs |
| 380-00877-17 | | | | 500 mg / 500 mg / 6 mL | 30pcs |
| 380-00877-06 | SHIMSEN Styra RES | Resveratrol in wine | Used for the detection of resveratrol in wine | 6 mL | 30pcs |
| 380-00877-07 | SHIMSEN Styra RED | Sudan Red Test | Sudan Red I, Sudan Red, Sudan Red II, Sudan Red M, Sudan Red G, and Sudan Red 7B in Chili Oil | 6 mL | 30pcs |
| 380-00877-09 | SHIMSEN Styra p-NIT | P-nitrophenol detection | Special cartridge for the detection of p-nitrophenol in urine | 3 mL | 50pcs |
| 380-00877-10 | SHIMSEN Styra PGR | Plant growth regulator | Used for the determination of 4-chlorophenoxyacetic acid, naphthaleneacetic acid, 2,4-D, indoleacetic acid, indolebutyric acid and other plant growth regulator residues in bean sprouts | 500 mg / 6 mL | 30pcs |
| 380-00877-12 | SHIMSEN Styra Glass PAEs | Plasticizer | Special cartridge for plasticizer in grease | 6 mL | 30pcs |
| 380-00877-13 | SHIMSEN Styra Oligose | Detection of oligosaccharides in honey | Used for determination of oligosaccharides in honey according to Chinese pharmacopoeia | 12 mL | 20pcs |
| 380-00877-14 | SHIMSEN Styra MPV | Detection of agricultural and veterinary drugs in dairy products | Used for the detection of chloramphenicol in milk powder | 3 g / 12 mL | 20pcs |
| 380-00877-15 | SHIMSEN Styra MER | Thiomersal test | Detection of thimerosal in cosmetics | 350 mg / 6 mL | 30pcs |
| 380-00877-16 | SHIMSEN Styra MEL | Melamine | Melamine in milk | 60 mg / 3 mL | 50pcs |
| 380-00877-18 | SHIMSEN Styra DMY | Dimethyl yellow, diethyl yellow | Used for the detection of dimethyl yellow and diethyl yellow in fermented bean curd | 3 mL | 50pcs |
| 380-00877-19 | SHIMSEN Styra DICY | Dicyandiamide | Detection of dicyandiamide in dairy products | 1g / 12 mL | 20pcs |
| 380-00877-20 | SHIMSEN Styra CPS | Detection of pesticide residues in grain | Used for the detection of pesticide residues in grains | 1.5 g / 12 mL | 20pcs |
| 380-00877-21 | SHIMSEN Styra BaP | Benzopyrene detection | Determination of benzo(a) pyrene in food according to GB 5009.27-2016 | 22 g / 60 mL | 10pcs |
| 380-00877-26 | SHIMSEN Styra SS Rack 6-Ports | Drop holder for benzopyrene cartridge | Matching with SHIMSEN Styra BaP | Suitable for 60mL cartridge | 1pcs |
| 380-00877-27 | SHIMSEN Styra SS needle | Needle for benzopyrene cartridge | | / | 50pcs |
| 380-00877-25 | SHIMSEN Styra CMP | Detection of pesticide residues in traditional Chinese Medicine | Detection of pesticide residues in herb | 1.5 g / 12 mL | 20pcs |
| 380-00852-02 | SHIMSEN Styra PGM | Synthetic colorants | Used for the detection of synthetic colorants | 150 mg / 6 mL | 30pcs |
| 380-00877-28 | SHIMSEN Styra GLYPHOSATE | Glyphosate | Used for the detection of glyphosate in food and tea | 6 mL | 30pcs |
| 380-00877-22 | SHIMSEN Styra AFTQ | Aflatoxin | Used for the detection of aflatoxin in food | 12 mL | 20pcs |

96-Well SPE Product

96-Well Sample Plate

When biological samples are stored or incubated in standard vessels, most of the analytes may be lost within 24 hours as a result of adsorption of biomolecules to the plastic surface.

SHIMSEN Low-Adsorption (LA) 96-Well Sample plates maximize analytes recovery by reducing sample adsorption to the surface.



Features

- High quality pure PP material to reduce adsorption of analytes
- Optimized well geometry for maximum sample recovery
- Conformed to international SBS Standards

Application:

- Storage of Polypeptide compounds;
- Oligonucleotides; Alkaline compound;
- Low concentration sample;
- Metal sensitive compounds, etc.

SHIMSEN LA Sample Plate Product Information:

| Product No. | Product Description | Package |
|--------------|---|---------|
| 380-00813-01 | SHIMSEN 96-Well Plate LA-Sample plate, 2.0mL, U, Round | 10 |
| 380-00817-01 | SHIMSEN 96-Well Plate LA-Sample plate Mat, 2.0mL, Round | 10 |
| 380-00887-50 | SHIMSEN 96-Well Plate LA-Sample plate Mat, 2.0mL, Round | 50 |
| 380-00888-50 | SHIMSEN 96-Well Plate LA-Sample plate, 2.0mL, U, Round | 50 |

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 | Polytetrafluorethylene | 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 |

Appendix I

| | | | | | | | | |
|-----------------------------------|----|----|---------------------------|----|----|----------------------------|----|----|
| 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 | Propionic 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 Hypochlorite | 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 |
| Citric Acid, 10% | EE | EE | Methoxyethyl Oleate | EE | EG | Trichloroethane | EE | NN |
| Cresol | EE | GF | Methyl Acetate | EE | GF | Trichloroethylene | EE | NN |
| Cyclohexane | EE | FN | Methyl Ethyl Ketone | EE | EG | Triethylene Glycol | EE | EE |
| Cyclohexanone | EE | FN | Methyl Isobutyl Ketone | EE | GF | Tripropylene Glycol | EE | EE |
| Cyclopentane | EE | FN | Methyl Propyl Ketone | EE | GF | Tris Buffer, Solution | EE | EG |
| Decahydronaphtalene | EE | FN | Methylene Chloride | EE | FN | Urea | EE | EE |
| | 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 ₂ O/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 than 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 | <ul style="list-style-type: none">• Naturally hydrophilic, high protein binding, high dirt-loading, surfactant-free and offer the lowest extractables.• Filtering of general samples and organic solvents.• Not recommended for use with acids. |
| Hydrophilic PVDF (polyvinylidene fluoride) | pH 3-12 | <ul style="list-style-type: none">• Extremely low protein binding.• Good chemical compatibility.• For filtration of non-aggressive aqueous and mild organic solutions, or when maximizing protein recovery is important. |
| Hydrophilic RC (regenerated cellulose) | pH 3-12 | <ul style="list-style-type: none">• Hydrophilic membrane with good solvent resistance.• Low protein binding and extractables.• Good chemical compatibility with nearly all common HPLC solvents and stable against DMSO.• Good for general filtration, tissue culture media filtration or life science applications. |
| Hydrophilic PES (polyethersulfone) | pH 3-12 | <ul style="list-style-type: none">• Low protein binding and extractables.• Good for life science applications. |
| PTFE | pH 1-14 | <ul style="list-style-type: none">• High chemical compatibility.• High temperature resistance.• Good for filtration of gases, aggressive chemicals, and strong acid. |
| Cellulose Acetate (CA) | pH 4-8 | <ul style="list-style-type: none">• Low protein binding• For filtration of aqueous solutions• Good for applications involving culture media |
| Mixed Cellulose Ester (MCE) | pH 4-8 | <ul style="list-style-type: none">• High protein binding• Good for general filtration of aqueous solutions. |

Appendix I

■ 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 |
| Hydrochloric Acid, 1N (HCl) | LR | LR | O | LR | O | O | X |
| Hydrochloric Acid, 6N (HCl) | LR | X | LR | X | LR | O | X |
| Hydrochloric 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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