

EXCITING INNOVATIONS



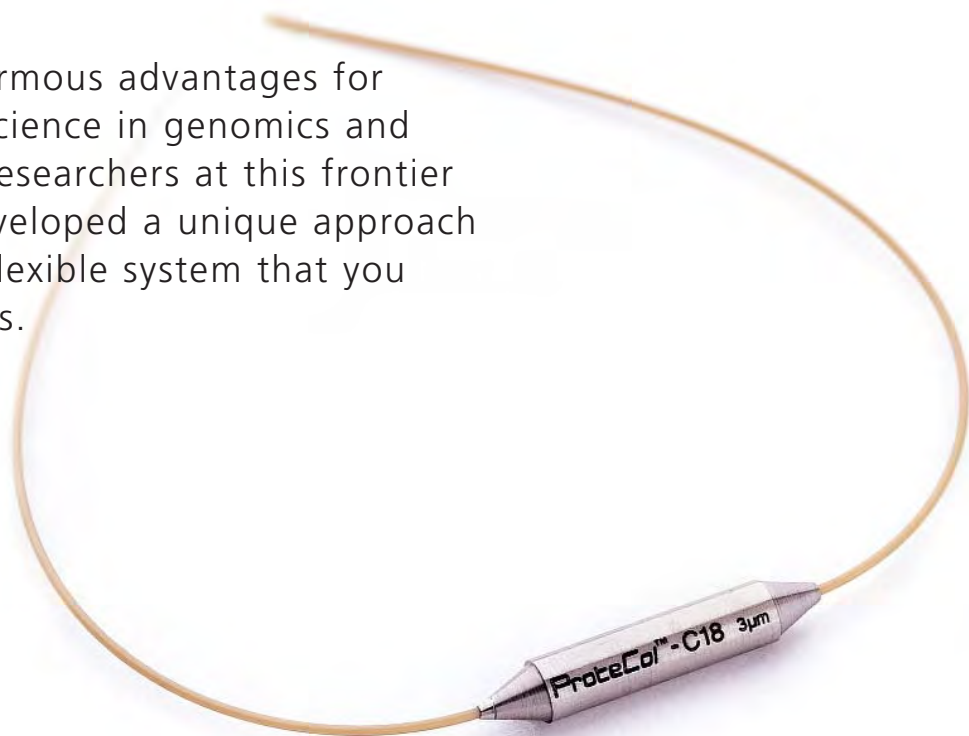
ProteCol™

**Power to create your own
capillary LC system**



A FLEXIBLE CAPILLARY LC SYSTEM

Capillary LC offers enormous advantages for LC-MS and emerging science in genomics and proteomics. To assist researchers at this frontier of science, SGE has developed a unique approach to capillary LC with a flexible system that you tailor to suit your needs.



HOW FLEXIBLE? – YOU DECIDE

ProteCol™ is a revolutionary, integrated approach to capillary LC incorporating columns, unions, tubing, splitters and filters. The ProteCol system provides flexibility and versatility with a range of user friendly demountable union and tubing options. You decide the column, union and tubing length you need. So regardless of the analysis you want to achieve, we provide you with the flexibility to custom-make your own capillary LC system.

The SGE ProteCol™ System includes:

- Capillary LC columns 150µm and 300µm inner diameters and various length options
- PEEKsil™ tubing — precise smooth bore fused silica lined PEEK™ connecting tubing
- Filtering connectors
- Unions for a range of tubing options
- Guard columns and trap columns

Perfect for LC-MS

- New optimized approach to capillary LC
- Connecting tubing integrated into the column design
- Perfect flow path geometry gives perfect peak shape
- Smooth, inert fused silica column and connecting tubing flow path
- Robust
- No special capillary LC skills required
- Low volume frit system maintains highest efficiency while trapping particles

For the latest complete listing, visit:

www.sge.com/protocol

EXAMPLE APPLICATION

Polyaromatic Hydrocarbons (PAHs)

Column: ProteCol™ 300µm x 150mm C18 (120Å)

Mobile Phase: 80% Acetonitrile water

Split Flow Rate: 4.0µL/min

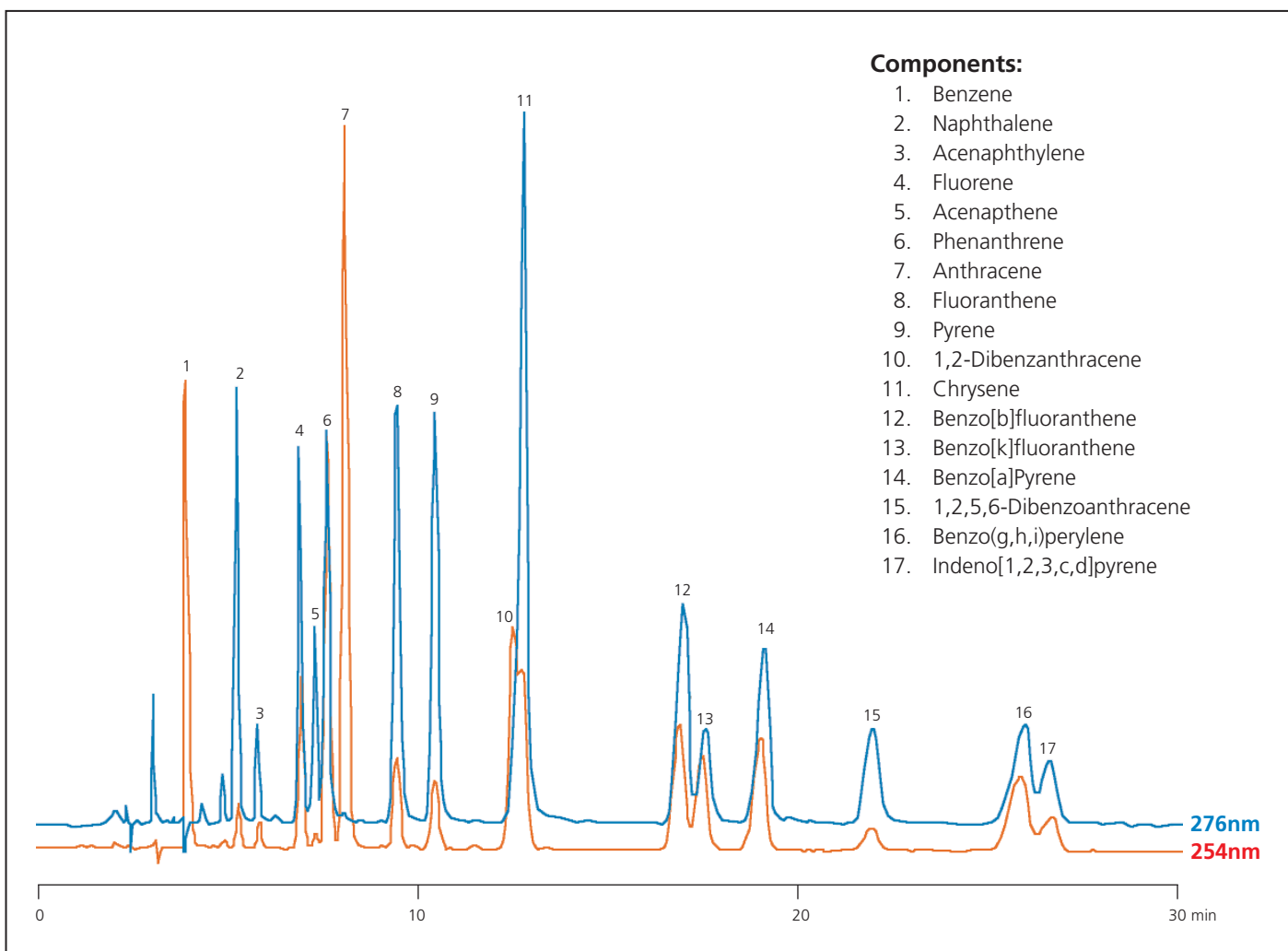
Detection: 254 and 276nm

Pump Used: Agilent Technologies 1100

Pump Flow Rate: 200µL/min

Flow split to SGE splitter to 4.0µL/min

UV detector optimized for on-line capillary detection system



ORDERING INFORMATION

ProteCol™ Capillary LC

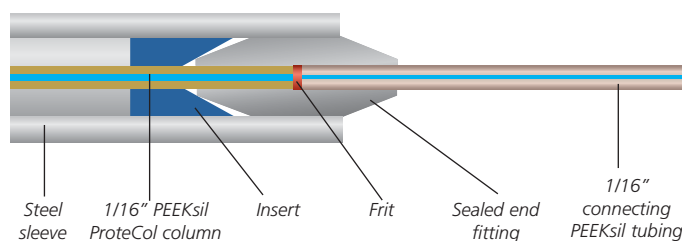
| Description | ID (µm) | Column Length (mm) | Tubing OD (inch) | Outlet Tail Length (mm) | Inlet Tail Length (mm) | Packing Material | Part No. |
|---|---------|--------------------|------------------|-------------------------|------------------------|---------------------------|----------------|
| ProteCol C18 3µm Capillary Columns | | | | | | | |
| | 150 | 50 | 1/16 | 100 | 200 | ProteCol C18-120-3 (120Å) | 2104152 |
| | 150 | 100 | 1/16 | 100 | 200 | ProteCol C18-120-3 (120Å) | 2104252 |
| | 150 | 150 | 1/16 | 100 | 200 | ProteCol C18-120-3 (120Å) | 2104352 |
| | 300 | 50 | 1/16 | 100 | 200 | ProteCol C18-120-3 (120Å) | 2102152 |
| | 300 | 100 | 1/16 | 100 | 200 | ProteCol C18-120-3 (120Å) | 2102252 |
| | 300 | 150 | 1/16 | 100 | 200 | ProteCol C18-120-3 (120Å) | 2102352 |
| | 150 | 50 | 1/16 | 100 | 200 | ProteCol C18-300-3 (300Å) | 2104154 |
| | 150 | 100 | 1/16 | 100 | 200 | ProteCol C18-300-3 (300Å) | 2104254 |
| | 150 | 150 | 1/16 | 100 | 200 | ProteCol C18-300-3 (300Å) | 2104354 |
| | 300 | 50 | 1/16 | 100 | 200 | ProteCol C18-300-3 (300Å) | 2102154 |
| | 300 | 100 | 1/16 | 100 | 200 | ProteCol C18-300-3 (300Å) | 2102254 |
| | 300 | 150 | 1/16 | 100 | 200 | ProteCol C18-300-3 (300Å) | 2102354 |
| | 150 | 50 | 1/32 | 100 | 200 | ProteCol C18-120-3 (120Å) | 2204152 |
| | 150 | 100 | 1/32 | 100 | 200 | ProteCol C18-120-3 (120Å) | 2204252 |
| | 150 | 150 | 1/32 | 100 | 200 | ProteCol C18-120-3 (120Å) | 2204352 |
| | 300 | 50 | 1/32 | 100 | 200 | ProteCol C18-120-3 (120Å) | 2202152 |
| | 300 | 100 | 1/32 | 100 | 200 | ProteCol C18-120-3 (120Å) | 2202252 |
| | 300 | 150 | 1/32 | 100 | 200 | ProteCol C18-120-3 (120Å) | 2202352 |
| | 150 | 50 | 1/32 | 100 | 200 | ProteCol C18-300-3 (300Å) | 2204154 |
| | 150 | 100 | 1/32 | 100 | 200 | ProteCol C18-300-3 (300Å) | 2204254 |
| | 150 | 150 | 1/32 | 100 | 200 | ProteCol C18-300-3 (300Å) | 2204354 |
| | 300 | 50 | 1/32 | 100 | 200 | ProteCol C18-300-3 (300Å) | 2202154 |
| | 300 | 100 | 1/32 | 100 | 200 | ProteCol C18-300-3 (300Å) | 2202254 |
| | 300 | 150 | 1/32 | 100 | 200 | ProteCol C18-300-3 (300Å) | 2202354 |
| ProteCol Guard Columns – Pkt 3 | | | | | | | |
| | 150 | 10 | 1/16 | 12 | 50 | ProteCol C18-120-3 (120Å) | 212403 |
| | 300 | 10 | 1/16 | 12 | 50 | ProteCol C18-120-3 (120Å) | 212203 |
| | 150 | 10 | 1/32 | 12 | 50 | ProteCol C18-120-3 (120Å) | 222403 |
| | 300 | 10 | 1/32 | 12 | 50 | ProteCol C18-120-3 (120Å) | 222203 |
| ProteCol Guard Column Adaptor 1/16" | - | - | - | - | - | - | 212004 |

ProteCol™ Capillary LC Column

The central part of a separation system is the column. ProteCol™ columns are designed with special regards to the needs of capillary LC. The column body is integrated with the connection tubing, both of which are made from inert fused silica lined PEEK™ tubing[†]. The ends of the connection tubing, which are supplied with 1/16" and 1/32" OD (outside diameter), are precisely square cut and polished to allow easy, dead-volume-free connections.

Enquiries for custom-made columns are welcomed.

[†]Patent pending.



- Diagram showing the integrated fused silica lined PEEK™ (PEEKsil™) tubing column design.

Column Specifications:

| | | | |
|-----------|--|----------------|--------------|
| OD: | 1/16" or 1/32" | Packing Type: | C18 silica |
| ID: | 150 and 300µm | Pore Size: | 120Å or 300Å |
| Length: | 50, 100 and 150mm | Particle Size: | 3µm or 5µm |
| Material: | PEEKsil™ Tubing (fused silica lined PEEK) | Tail Length: | 100mm-200mm |

ORDERING INFORMATION

ProteCol™ Capillary LC

| Description | ID (µm) | Column Length (mm) | Tubing OD | Outlet Tail Length (mm) | Inlet Tail Length (mm) | Packing Material | Part No. |
|---|------------|-----------------------|------------------|----------------------------|---------------------------|----------------------------|----------------|
| ProteCol Trap Column | | | | | | | |
| | 2.1 | 15 | 1/32" | 70 | 70 | ProteCol C18-3120-3 (120Å) | 222003 |
| | 2.1 | 15 | 1/32" | 70 | 70 | ProteCol C18-300-3 (300Å) | 222004 |
| ProteCol Flow Splitters | | | | | | | |
| | – | – | 1/16" | – | – | – | 212001 |
| | – | – | 1/32" | – | – | – | 222001 |
| ProteCol Accessory Kit | | | | | | | |
| Kit contains: | | | | | | | 212000 |
| 1/16" - 1/16" connector x 2 | | | | | | | |
| 1/16" - 1/16" double-end PEEK ferrules x 3 | | | | | | | |
| Filtering Connector with 1/16" 50µm x 50mm PEEKsil™ tubing x 1 | | | | | | | |
| 1/16" 50µm x 100 mm PEEKsil tubing x 1 | | | | | | | |
| 1/16" 50µm x 150 mm PEEKsil tubing x 1 | | | | | | | |
| Accessory Tool x 1 | | | | | | | |
| ProteCol Filters | | | | | | | |
| | – | 50 | 1/32" | 30 | 50 | – | 222005 |
| | – | 50 | 1/16" | 30 | 50 | – | 212005 |
| ProteCol Unions Wrench Tightened – 2 unions & 4 ferrules | | | | | | | |
| | – | – | 1/16" to 1/16" | – | – | – | 212006 |
| | – | – | 1/16" to 1/32" | – | – | – | 212007 |
| | – | – | 1/16" to 0.36mm | – | – | – | 212008 |
| | – | – | 1/32" to 1/32" | – | – | – | 222005 |
| | – | – | 1/32" to 0.36mm | – | – | – | 222006 |
| | – | – | 0.36mm to 0.36mm | – | – | – | 222007 |
| ProteCol Unions Finger Tightened – 2 unions & 4 ferrules | | | | | | | |
| | – | – | 1/16" to 1/16" | – | – | – | 212009 |
| | – | – | 1/16" to 1/32" | – | – | – | 212010 |
| | – | – | 1/16" to 0.36mm | – | – | – | 212011 |
| ProteCol Ferrules – Pkt 5 | | | | | | | |
| | – | – | 1/16" to 1/16" | – | – | – | 213006 |
| | – | – | 1/16" to 1/32" | – | – | – | 213007 |
| | – | – | 1/16" to 0.36mm | – | – | – | 213008 |
| | – | – | 1/32" to 1/32" | – | – | – | 223005 |
| | – | – | 1/32" to 0.36mm | – | – | – | 223006 |
| | – | – | 0.36mm to 0.36mm | – | – | – | 223007 |
| PEEKsil™ Tubing Kits – contains 50µm ID tubing of 100, 200 and 300mm lengths | | | | | | | |
| ProteCol 1/16" PEEKsil Tubing Kit | | | | | | | |
| | 50 | 100, 200 & 300 | 1/16" | – | – | – | 212012 |
| ProteCol 1/32" PEEKsil Tubing Kit | | | | | | | |
| | 50 | 100, 200 & 300 | 1/32" | – | – | – | 2220008 |

PERFECT CONNECTION

HOW LONG WOULD YOU LIKE YOUR TUBING?

Unions are available to allow you to connect the desired tubing size (1/16", 1/32" and 0.36mm OD) and length to your capillary column.

Making the Perfect Connection with Unions

The ProteCol™ system is designed to minimize void volume by reducing the number of necessary connections and by avoiding dead volumes within a connection. This is achieved by creating perfect butt connections with perfectly cut square and polished tubing ends.

NOTE: Conventional LC fittings are not designed and made to sufficient dimensional conformance and are therefore not ideal for capillary LC applications.



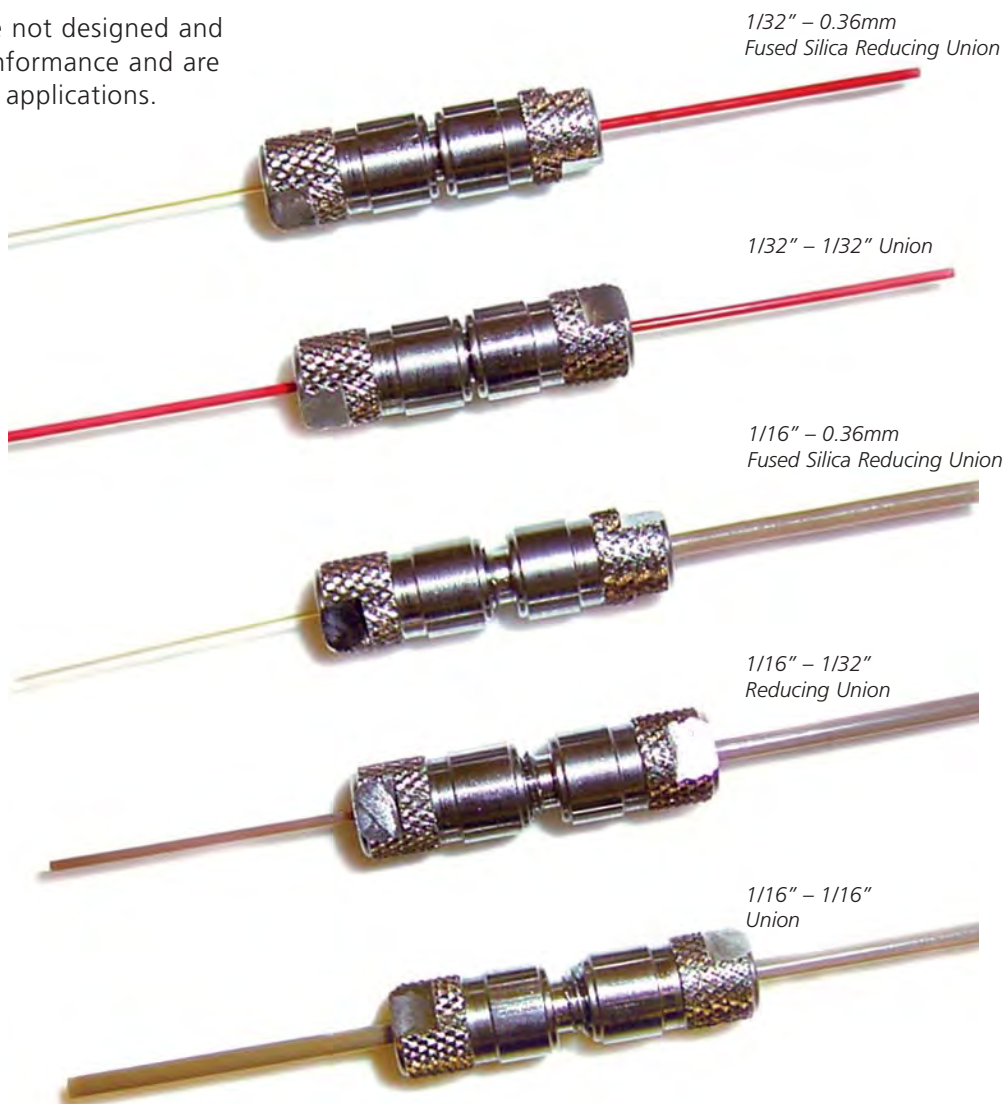
1/16" fitting



1/32" fitting



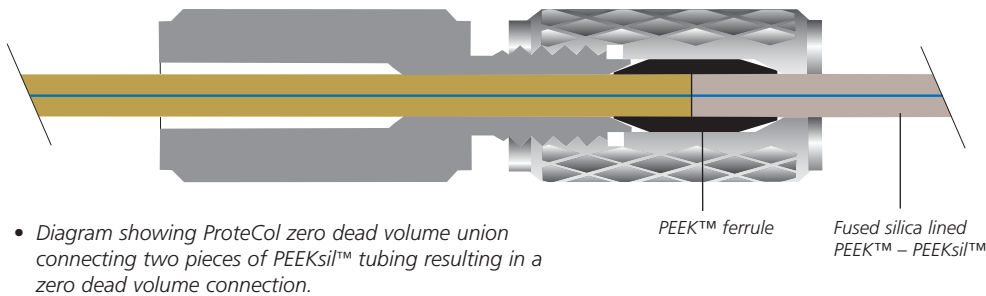
0.36mm
Fused Silica fitting



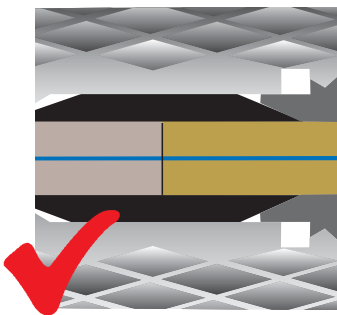
PERFECT CONNECTION

Other features of the SGE Unions:

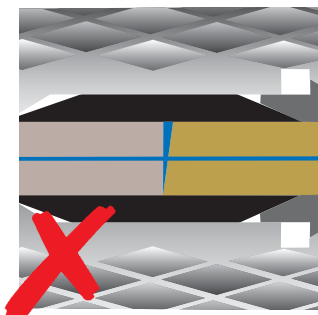
- Dimension tolerances of the unions perfectly match the SGE PEEKsil™ tubing and ProteCol columns
- Purposely designed for capillary LC
- No internal channels with large volumes: zero dead volume
- Even for isocratic separation, there is no loss of peak shape due to the connection
- PEEK™ reusable ferrules with dimensions for any combination of tubing
- Unions are specially designed with flats for wrench tightening with a 3/16" wrench. Larger finger-tightened union versions available
- Tightening of ferrule is designed to compress tubing together to help ensure zero volume butt connections



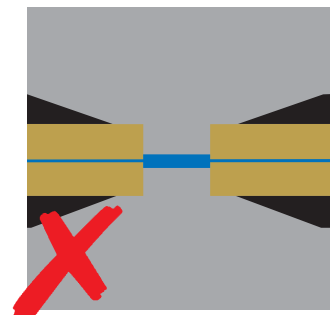
- Diagram showing ProteCol zero dead volume union connecting two pieces of PEEKsil™ tubing resulting in a zero dead volume connection.



- SGE factory cut and ground tubing resulting in a perfect square cut and dead-volume-free connection. The outside diameter of the PEEKsil and inside diameter of the connector are sized to fit perfectly so the bores of the tubes match perfectly.



- Diagram showing a poorly cut end introducing dead volume resulting in poor chromatography peak shape.



- Conventional micro union resulting in a large dead volume which leads to poor chromatography peak shape.

PEEKsil™ TUBING

PEEKsil™ TUBING

SGE offers PEEKsil capillary LC connecting tubing cut to any length you desire.

For capillary LC, **NEVER** use conventional LC connecting tubing. Even conventional PEEK™ tubing compromises performance.

Inside Diameters:

Variety of ID sizes from 25µm to 300µm

Outside Diameters:

1/32" or 1/16"

Tubing Length:

50, 100, 150, 250 or 500mm

- Fused silica lined PEEK
- Perfect for capillary LC
- Inert smooth flow path
- Reduced band broadening
- Precise inside diameter
- Lower sample carryover than other types of tubing
- Flexible
- As supplied, ends are cut perfectly square and polished for critical capillary LC connections

To ensure perfect low volume connections, special cutting techniques and equipment are required. For this reason PEEKsil tubing is available in a variety of lengths. Select the appropriate length for your application.

For full PEEKsil tolerances and information, visit:

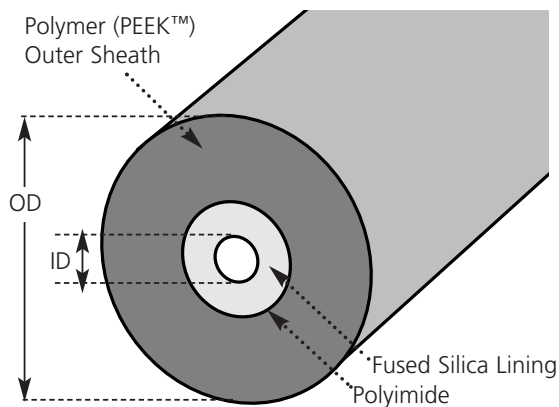
www.sge.com

PEEKsil tubing is constructed from a core of smooth precision bore fused silica tubing bonded to a 1/16" or 1/32" OD PEEK™ outer sheath. It is ideal for LC systems where conventional 1/16" OD fittings are used and small bore tubing, capable of withstanding high pressures, is required.



• PEEKsil tubing showing the ground and square cut end enabling a zero dead volume connection.

• Conventional PEEK™ tubing as supplied showing a rough cut end resulting in dead volume and a loss in chromatographic performance.



• PEEKsil tubing cross-section

ORDERING INFORMATION

Fused Silica Lined PEEK™ Tubing

| Tubing Type | ID (mm) | Length (mm) | Pack Size | Part No. |
|-------------|---------|-------------|-----------|----------|
| 1/32" OD | 0.025 | 50 | 2 | 0624241 |
| | | 100 | 2 | 0624242 |
| | | 150 | 2 | 0624243 |
| | | 250 | 2 | 0624245 |
| | | 500 | 2 | 0624249 |
| | 0.050 | 50 | 2 | 0624261 |
| | | 100 | 2 | 0624262 |
| | | 150 | 2 | 0624263 |
| | | 250 | 2 | 0624265 |
| | | 500 | 2 | 0624269 |
| | 0.075 | 50 | 2 | 0624271 |
| | | 100 | 2 | 0624272 |
| | | 150 | 2 | 0624273 |
| | | 250 | 2 | 0624275 |
| | | 500 | 2 | 0624279 |
| | 0.100 | 50 | 2 | 0624311 |
| | | 100 | 2 | 0624312 |
| | | 150 | 2 | 0624313 |
| | | 250 | 2 | 0624315 |
| | | 500 | 2 | 0624319 |
| 0.150 | 50 | 2 | 0624341 | |
| | 100 | 2 | 0624342 | |
| | 150 | 2 | 0624343 | |
| | 250 | 2 | 0624345 | |
| | 500 | 2 | 0624349 | |
| 1/16" OD | 0.025 | 50 | 5 | 0624225 |
| | | 100 | 5 | 0624226 |
| | | 150 | 5 | 0624227 |
| | | 200 | 5 | 0624228 |
| | | 500 | 2 | 0624229 |
| | 0.050 | 50 | 5 | 0624251 |
| | | 100 | 5 | 0624252 |
| | | 150 | 5 | 0624254 |
| | | 200 | 5 | 0624253 |
| | | 500 | 2 | 0624250 |
| | 0.075 | 50 | 5 | 0624290 |
| | | 100 | 5 | 0624291 |
| | | 150 | 5 | 0624292 |
| | | 200 | 5 | 0624293 |
| | | 500 | 2 | 0624294 |
| | 0.100 | 50 | 5 | 0624301 |
| | | 100 | 5 | 0624302 |
| | | 150 | 5 | 0624304 |
| | | 200 | 5 | 0624303 |
| | | 500 | 2 | 0624300 |
| | 0.150 | 50 | 5 | 0624230 |
| | | 100 | 5 | 0624231 |
| | | 150 | 5 | 0624232 |
| | | 200 | 5 | 0624233 |
| | | 500 | 2 | 0624234 |
| | 0.175 | 50 | 5 | 0624351 |
| | | 100 | 5 | 0624352 |
| | | 150 | 5 | 0624354 |
| | | 200 | 5 | 0624353 |
| | | 500 | 2 | 0624350 |
| | 0.200 | 50 | 5 | 0624202 |
| | | 100 | 5 | 0624203 |
| | | 150 | 5 | 0624205 |
| | | 200 | 5 | 0624204 |
| | | 500 | 2 | 0624201 |
| | 0.300 | 50 | 5 | 0624214 |
| | | 100 | 5 | 0624215 |
| | | 150 | 5 | 0624216 |
| | | 200 | 5 | 0624217 |
| | | 500 | 2 | 0624218 |

Color Coded PEEKsil Tubing:

- Orange – 25µm
- Beige (Natural) – 50µm
- Black – 75µm
- Red – 100µm
- Purple – 150µm
- Yellow – 175µm
- Blue – 200µm
- Grey – 300µm



ProteCol™ ACCESSORIES

EVEN MORE FLEXIBILITY

A range of versatile accessories allows you the capability to fine tune your ProteCol capillary LC system.



ProteCol™ Filtering Connector

The ProteCol Filtering Connector prevents particles from passing to the column. It protects the system without introducing peak tailing and loss of resolution.

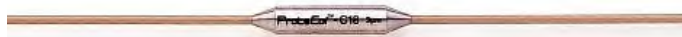
- Filter Type: 2µm mesh
- Tubing OD: 1/16" or 1/32"
- Tubing ID: 50µm
- Tail Length: 30mm-50mm



ProteCol™ Guard Column

ProteCol Guard Columns act as chemical filters to help maintain the integrity of the analytical column.

- Tubing OD: 1/16" or 1/32" x 50µm ID
- Column ID: 150µm or 300µm
- Tail Length: 12mm-50mm
- Column Length: 10mm
- Packing: C18-120Å-3µm
C18-300Å-3µm
C18-300Å-5µm

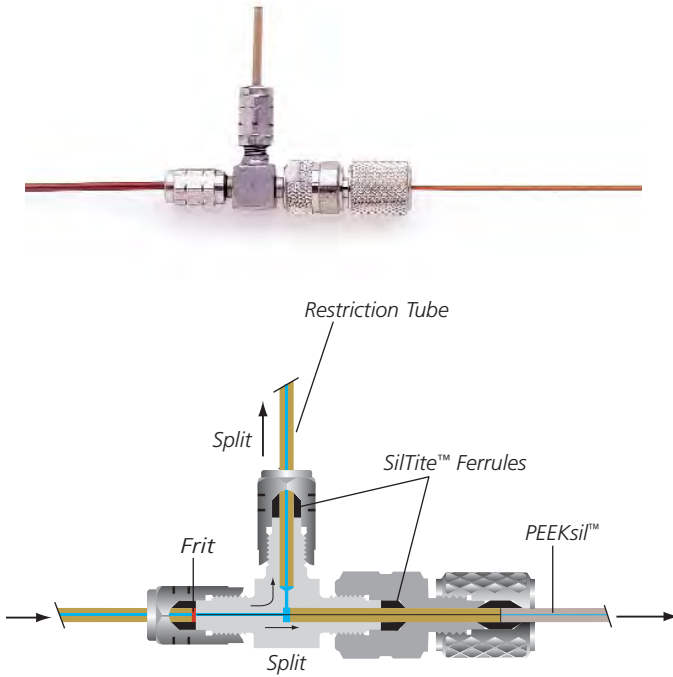


ProteCol™ Trap Column

The ProteCol Trap Column allows preconcentration of a sample before injection onto the analytical column.

- Tubing OD: 1/32" x 100µm ID
- Column ID: 2.1mm
- Tail Length: 70mm-70mm
- Column Length: 15mm
- Packing: C18-120Å-3µm
C18-300Å-3µm

ProteCol™ ACCESSORIES



• ProteCol™ Splitter

ProteCol™ Inlet Splitter System

The ProteCol Inlet Splitter System lets you control the sample flow you require to the column by changing the length of the restriction tube.

When analysts use capillary LC columns on conventional LC systems, the flow rates and volumes of the pump and the design of the injection valves may be too large for optimum results. The versatile Inlet Splitter System can be used before the injector, between the injector and the column, and between the column and detector to maximize performance. Various split ratios can be achieved by changing the length of the restriction tubing. Detailed instructions are provided with the splitter system.



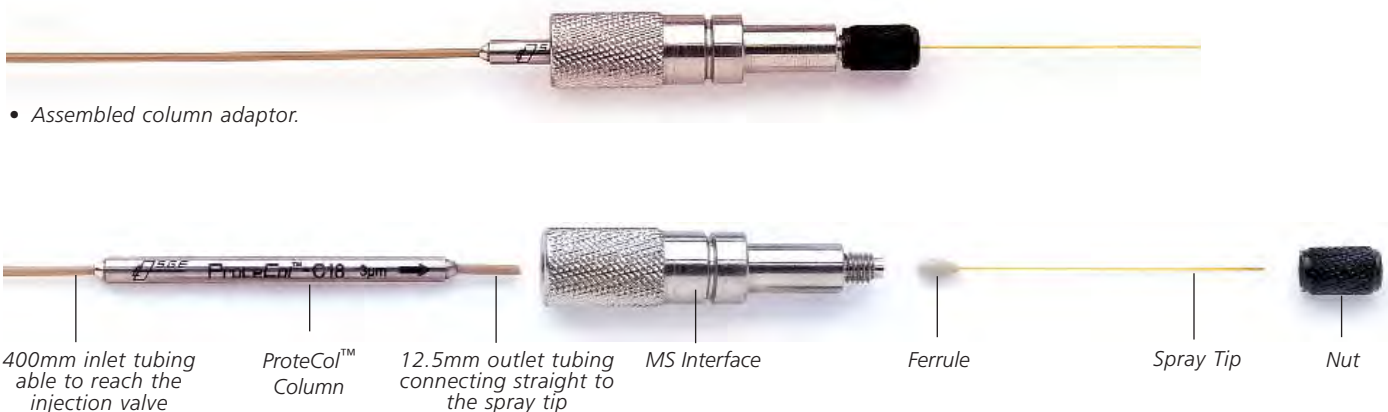
• ProteCol™ Accessories: wrench, ferrules and spacer.

For the latest complete listing, visit: www.sge.com/protecol

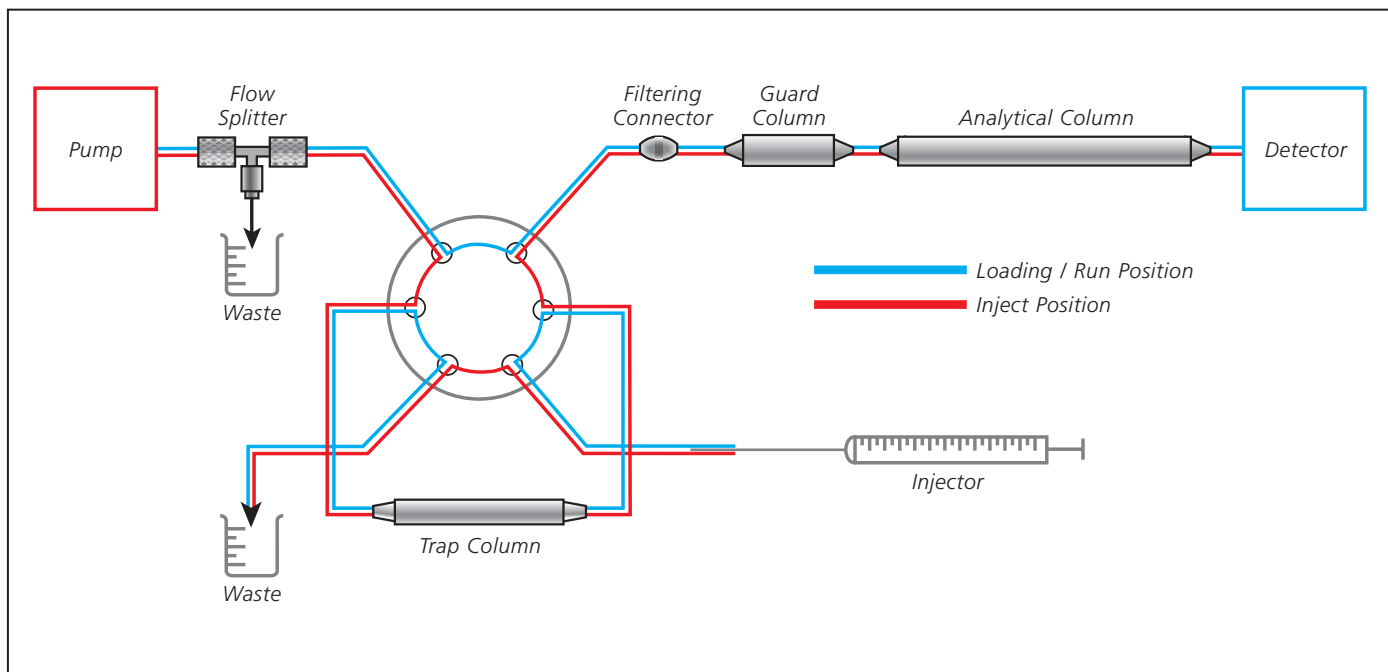
A FLEXIBLE CAPILLARY LC SYSTEM

CUSTOM MADE DESIGN CAPABILITY

Diagrams show column adaptor custom-made for Thermo Finnigan LCQ.



- Assembled column adaptor.



- Schematic diagram showing possible flow paths using the ProteCol™ Trap Column.

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