

Chromatography Consumables and Accessories



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Handpicked, Consumable and Accessory Brands with Proven Quality and Reliability

With its deep chromatography expertise, AFP has ultra-reliable valves, manifolds, and handpicked, consumables and accessories that ensure you get the highest possible quality and performance. AFP's user-friendly online store www.afplifesciences.com makes it quick and easy to purchase replacement consumables and accessories. AFP is a preferred source for instrument manufacturers and end users that need the highest quality and reliability with minimized system downtime.

AFP offers a premium line of curated chromatography consumables and accessories. These products include vials, caps, septa, vial inserts, gas filters, crimpers, columns, ferrules, fittings, connectors, injection port septa, syringes, syringe filters, inlet liners, tubing, sample loops and more.

AFP specializes in the manufacturing of high-precision fluid control components and sub-assemblies for chromatography and laboratory analytic and diagnostic systems. It is part of the Schivo Group, a leader in high-precision manufacturing for the medical device, analytical instrument, clinical diagnostic, and genomics markets. Based in Waterford, Ireland, Schivo has more than 600 employees at seven global facilities in Europe, North America, and Asia.



AFP's products are easy to purchase online at www.afplifesciences.com. Contact sales@afplifesciences.com or for inquiries call +1.418.266.1247



SHOP NOW



Caps and Septa



High-quality autosampler caps and septa made from platinum-cured silicone and premium PTFE films are designed to withstand demanding conditions in liquid and gas chromatography. Easy Pierce™ technology ensures easy needle penetration, resealability, and resistance to evaporation, enhancing the efficiency and precision of automated sampling processes.

As a leading supplier of septa, lined caps, and bonded caps for chromatography professionals, we provide products made from the highest quality silicone and elastomer materials. We offer a wide range of liner materials, including PTFE/silicone, butyl, PTFE/butyl, aluminum-faced/silicone, and natural rubber/PTFE, designed to meet stringent application requirements. Our comprehensive selection includes varying material thicknesses and durometers for compatibility with all analytical instruments.

Our autosampler septa withstand demanding conditions and won't contaminate the sample via leaching. Compared to peroxide-cured compounds, our platinum-cured silicones have more tailorable physical properties. Plus, our ultra-low bleed platinum-catalyzed materials won't release byproducts into the sample.



Description	Pkg. 100	Pkg. 1000
9 mm Open Top Screw Caps		
2 mL, 9 mm Blue Screw Cap, Red PTFE/ White Silicone 0.040" Thickness, Hardness 45 Shore A	CS-100000	CS-100001
2 mL, 9 mm Black Screw Cap, Red PTFE/ White Silicone 0.040" Thickness, Hardness 45 Shore A	CS-100002	CS-100003
2 mL, 9 mm Blue Screw Cap, SLIT, Red PTFE/ White Silicone 0.040" Thickness, Hardness 60 Shore A, VALUE	CS-100004	CS-100005
2 mL, 9 mm Black Screw Cap, SLIT, Red PTFE/ White Silicone 0.040" Thickness, Hardness 60 Shore A, VALUE	CS-100006	CS-100007
2 mL, 9 mm Blue Screw Cap, Red PTFE/ White Silicone 0.040" Thickness	CS-100060	CS-100061
2 mL, 9 mm Black Screw Cap, SLIT, Red PTFE/ White Silicone 0.040" Thickness	CS-100062	CS-100063
2 mL, 9 mm Blue Screw Cap, White PTFE/ Red Silicone 0.040" Thickness	CS-100008	CS-100009
2 mL, 9 mm Blue Screw Cap, Red PTFE/ White Silicone/ Red PTFE 0.040" Thickness	CS-100010	CS-100011
2 mL, 9 mm Blue Screw Cap, Red PTFE/ White Silicone/ 0.040" Thickness, Ultra Low Bleed	CS-100012	CS-100013
2 mL, 9 mm Blue Short Screw Cap, White PTFE/Red Silicone Septa, 9x1 mm, 6 mm Center Hole	CS-100066	
2 mL, 9 mm Blue Short Screw Cap, White PTFE/Red Silicone Septa, 9x1 mm, Closed-top	CS-100067	
2 mL, 9 mm Blue Short Screw Cap, Red PTFE/White Silicone/Red PTFE Septa, 9x1 mm, 6 mm Center Hole	CS-100068	
2 mL, 9 mm Blue Short Screw Cap Pre-slit White PTFE/Red Silicone Septa, 9x1 mm, 6 mm Center Hole	CS-100069	
9 mm Open Top Screw Caps with Bonded Septa		
2 mL, 9 mm Blue Screw Cap, Tan PTFE/ White Silicone 0.040" Thickness, Bonded	CS-100014	CS-100015
2 mL, 9 mm Blue Screw Cap, Tan PTFE/ White Silicone 0.040" Thickness, SLIT Bonded	CS-100016	CS-100017
2 mL, 9 mm Blue Screw Cap, Red PTFE/ White Silicone 0.040" Thickness, Bonded	CS-100018	CS-100019
2 mL, 9 mm Blue Screw Cap, Red PTFE/ White Silicone 0.040" Thickness, SLIT Bonded	CS-100020	CS-100021
2 mL, 9 mm Blue Screw Cap, Red PTFE/ White Silicone 0.040" Thickness, Bonded Ultra Low Bleed	CS-100022	CS-100023
2 mL, 9 mm Blue Screw Cap, Clear PTFE/White Silicone Septa, 9x1 mm, 6 mm Center Hole, Bonded	CS-100070	
2 mL, 9 mm Blue Screw Cap, Pre-slit Clear PTFE/White Silicone Septa, 9x1 mm, 6 mm Center Hole Bonded	CS-100071	
2 mL, 9 mm Blue Screw Cap, Clear PTFE/Red Silicone Rubber 0.040" Thickness, Bonded	CS-100087	
2 mL, 9 mm Blue Screw Cap, LC Clean Clear PTFE/Clear Silicone 0.050" Thickness, Bonded	CS-100093	
2 mL, 9 mm Black Screw Cap, Red PTFE/White Silicone 0.040" Thickness, Bonded	CS-100089	
2 mL, 9 mm Black Screw Cap, Transparent Blue Silicone/Clear 0.050" Thickness, Bonded	CS-100095	
2 mL, 9 mm Green Screw Cap, Red PTFE/White Silicone 0.040" Thickness, Bonded	CS-100090	
2 mL, 9 mm Red Screw Cap, Red PTFE/White Silicone 0.040" Thickness, Bonded	CS-100091	
2 mL, 9 mm Gray Screw Cap, LC Clean Clear PTFE/Clear Silicone 0.050" Thickness, SLIT Bonded	CS-100094	
10-425 Open Top Screw Caps		
2 mL, 10-425 Black Screw Cap, Red PTFE/ White Silicone 0.060" Thickness	CS-100024	CS-100025
11 mm Open Top Crimp Caps		
2 mL, 11 mm Silver Aluminum Crimp Cap, Clear PTFE/ Orange Silicone 0.040" Thickness	CS-100026	CS-100027
2 mL, 11 mm Silver Aluminum Crimp Cap, Red PTFE/ White Silicone 0.040" Thickness	CS-100028	CS-100029
2 mL, 11 mm Silver Aluminum Crimp Cap, Red PTFE/ White Silicone 0.040" Thickness, Ultra Low Bleed	CS-100030	CS-100031
2 mL, 11 mm Silver Aluminum Crimp Cap, White PTFE/Red Silicone Septa, 11x1 mm, 5.5 mm Center Hole	CS-100075	
2 mL, 11 mm Silver Aluminum Crimp Cap, Red PTFE/White Silicone/Red PTFE Septa, 11x1 mm, 5.5 mm Center Hole	CS-100076	
2 mL, 11 mm Silver Aluminum Crimp Cap, Pre-slit White PTFE/Red Silicone Septa, 11x1 mm, 5.5 mm Center Hole	CS-100077	



Description	Pkg. 100	Pkg. 1000
11 mm Open Top Crimp Caps		
2 mL, 11 mm Silver Aluminum Crimp Cap, Clear PTFE/Red Silicone Rubber 0.040" Thickness	CS-100096	
2 mL, 11 mm Silver Aluminum Crimp Cap, Red PTFE/White Silicone/ Red PTFE 0.040" Thickness	CS-100100	
2 mL, 11 mm Red Aluminum Crimp Cap, Clear PTFE/Red Silicone Rubber 0.040" Thickness	CS-100097	
2 mL, 11 mm Blue Aluminum Crimp Cap, Clear PTFE/Red Silicone Rubber 0.040" Thickness	CS-100098	
11 mm Plastic Snap Caps		
2 mL, 11 mm Clear Snap Cap, Red PTFE/White Silicone 0.040" Thickness	CS-100032	CS-100033
2 mL, 11 mm Blue Snap Cap, Red PTFE/White Silicone 0.040" Thickness	CS-100034	CS-100035
2 mL, 11 mm Clear Snap Cap, PRE-SLIT, Red PTFE/White Silicone 0.040" Thickness	CS-100036	CS-100037
2 mL, 11 mm Blue Snap Cap, PRE-SLIT, Red PTFE/White Silicone 0.040" Thickness	CS-100038	CS-100039
2 mL, 11 mm Natural Snap Cap, White PTFE/Red Silicone Septa, 11x1 mm, 6 mm Center Hole	CS-100072	
2 mL, 11 mm Natural Snap Cap, Red PTFE/White Silicone/Red PTFE Septa 11x1 mm, 6 mm Center Hole	CS-100073	
2 mL, 11 mm Natural Snap Cap, Pre-slit White PTFE/Red Silicone Septa, 11x1 mm, 6 mm Center Hole	CS-100074	
2 mL, 11 mm Natural PerkinElmer Snap Cap, Red PTFE/White Silicone 0.040" Thickness	CS-100101	
2 mL, 11 mm Natural PerkinElmer Snap Cap, Red PTFE/White Silicone 0.040" Thickness, SLIT	CS-100102	
2 mL, 11 mm Natural PerkinElmer Snap Cap, Red PTFE/White Silicone 0.040" Thickness, CROSS	CS-100103	
18 mm Magnetic Screw Caps		
20 mL, 18 mm Magnetic Screw Cap, Blue PTFE/ White Silicone .060" Thickness, Ultra Low Bleed, D55	CS-100040	CS-100041
20 mL, 18 mm Magnetic Screw Cap, Red PTFE/White Silicone 0.050" Thickness Ultra Low Bleed, D45	CS-100042	CS-100043
20 mL, 18 mm Magnetic Screw Cap, White PTFE/Transparent Blue Silicone 0.050" Thickness, Ultra Low Bleed, D38	CS-100044	CS-100045
20 mm Magnetic Crimp Caps		
20 mL, 20 mm Blue Magnetic Aluminum Crimp Cap White PTFE/White Silicone Septa, 20x3 mm, 8 mm Center Hole	CS-100079	
20 mL, 20 mm Headspace Blue Bi-Metal Magnetic Crimp Cap, Tan PTFE/White Sil 0.120" Thickness, Ultra Low Bleed	CS-100048	CS-100049
20 mL, 20 mm Gold Steel Magnetic Crimp Cap, Natural PTFE/White Silicone 0.125" Thickness	CS-100107	
20 mL, 20 mm Red Aluminum Steel Bi-Metal Magnetic Crimp Cap, Natural PTFE/White Silicone 0.125" Thickness	CS-100108	
20 mm Headspace Crimp Caps		
20 mL, 20 mm Headspace Aluminum Crimp Cap, Tan PTFE/White Silicone 0.120" Thickness, Ultra Low Bleed	CS-100046	CS-100047
20 mL, 20 mm Silver Aluminum Crimp Cap, Natural PTFE/White Silicone 0.125" Thickness	CS-100105	
20 mL, 20 mm Silver Aluminum Press Release Crimp Cap, Natural PTFE/White Silicone 0.125" Thickness	CS-100106	
20 mL, 20 mm Silver Aluminum Crimp Cap, PTFE/Light Gray Butyl, 0.118" Thickness	CS-100109	
20 mL, 20 mm Silver Aluminum Crimp Cap, Pharmafix PTFE/Dark Gray Butyl, 0.118" Thickness	CS-100110	
20 mL, 20 mm Silver Aluminum Crimp Cap, White PTFE/White Silicone Septa, 20x3 mm, 9.5 mm Center Hole	CS-100078	

Autosampler Vials and Convenience Kits



9 mm Screw Top Vials

9 mm Screw Thread Vials are manufactured from Type 1 borosilicate glass, available in clear or amber, or from Polypropylene. Excellent for long term storage.

11 mm Large Opening Crimp Top Vials

Crimp Vials are manufactured from Type 1 borosilicate glass, available in clear or amber, or from Polypropylene. Requires a crimper and decapper. Excellent for long term storage.

11 mm Large Opening Snap Ring Top Vials

Snap Vials are manufactured from Type 1 borosilicate glass, available in clear or amber, or from Polypropylene. Snap Vials accept both an Aluminum Snap Seal as well as a Polyethylene Snap Cap. Excellent for short term storage.

13-425 Screw Top Vials

13-425 Screw Thread Vials are manufactured from Type 1 borosilicate glass, available in clear or amber, or from Polypropylene. Excellent for long term storage.



11 mm and 20 mm Headspace Vials

We offer a variety of GC headspace vials, caps and septa to fulfil your application needs. Our vial and cap design incorporates pressure-relief features which guarantee safe operation with the high pressure typically developed during thermostating. Ordinary vials and caps without these safety features may burst. All of our headspace vials have a greater wall thickness and round base which enables them to withstand pressure up to 60 psig. Low-volume sampling can be achieved by using a 6 mL vial and vial adapter. AFP headspace vials are manufactured to specific tolerances that are guaranteed for fit and performance.



Autosampler Vials, Cap and Septa

Convenience Kits

Available with either glass or polypropylene vials and a range of cap choices, these autosampler vial, cap and septa kits make it surprisingly simple to re-stock your laboratory. Crimp vials are commonly used for GC and screw vials commonly used for LC, but either crimp or screw configurations can be used.



For your convenience and a perfect fit, we've compiled common vial and cap combinations to help you restock your laboratory quickly and effortlessly.

9 mm Vials

9 mm Screw Top Vials

Description	Marking	Line	Part No.
2 mL Clear Glass 9 mm Screw Top Vial Large Opening, Pkg. 100		Standard	CV-100039
2 mL Clear Glass 9 mm Screw Top Vial with Write-on Spot Large Opening, Pkg. 100	Write-on	Standard	CV-100040
2 mL Amber Glass 9 mm Screw Top Vial Large Opening, Pkg. 100		Standard	CV-100041
2 mL Amber Glass 9 mm Screw Top Vial with Write-on Spot Large Opening, Pkg. 100	Write-on	Standard	CV-100042
2 mL Clear Glass 9 mm Screw Top Vial, 7.0 Type Glass, Pkg. 100		Value	CV-100000
2 mL Clear Glass 9 mm Screw Top Vial with Write-on Spot, 7.0 Type Glass, Pkg. 100	Write-on	Value	CV-100001
2 mL Amber Glass 9 mm Screw Top Vial, 7.0 Type Glass, Pkg. 100		Value	CV-100002
2 mL Amber Glass 9 mm Screw Top Vial, with Write-on Spot, 7.0 Type Glass, Pkg. 100	Write-on	Value	CV-100003
2 mL Clear Glass 9 mm Screw Top Vial, 5.0 Type Glass, Pkg. 100		Value	CV-100004
2 mL Clear Glass 9 mm Screw Top Vial with Write-on Spot, 5.0 Type Glass, Pkg. 100	Write-on	Value	CV-100005
2 mL Amber Glass 9 mm Screw Top Vial, 5.0 Type Glass, Pkg. 100		Value	CV-100006
2 mL Amber Glass 9 mm Screw Top Vial with Write-on Spot, 5.0 Type Glass, Pkg. 100	Write-on	Value	CV-100007
0.3 mL Clear Glass 9 mm Screw Top Vial Sealed in Insert, Pkg. 100		Standard	CV-100043

11 mm Vials

11 mm Crimp Top Vials			
Description	Marking	Line	Part No.
2 mL Clear Glass 11 mm Crimp Top Vial with Write-on Spot Large Opening, Pkg. 100	Write-on	Standard	CV-100035
2 mL Clear Glass 11 mm Crimp Top Vial, 7.0, Type Glass, Pkg. 100		Value	CV-100014
2 mL Clear Glass 11 mm Crimp Top Vial with Write-on Spot, 7.0 Type Glass, Pkg. 100	Write-on	Value	CV-100015
2 mL Amber Glass 11 mm Crimp Top Vial, 7.0 Type Glass, Pkg. 100		Value	CV-100016
2 mL Amber Glass 11 mm Crimp Top Vial with Write-on Spot, 7.0 Type Glass, Pkg. 100	Write-on	Value	CV-100017
2 mL Clear Glass 11 mm Crimp Top Vial, 5.0 Type Glass, Pkg. 100		Value	CV-100018
2 mL Clear Glass 11 mm Crimp Top Vial with Write-on Spot, 5.0 Type Glass, Pkg. 100	Write-on	Value	CV-100019
2 mL Amber Glass 11 mm Crimp Top Vial, 5.0 Type Glass, Pkg. 100		Value	CV-100020
2 mL Amber Glass 11 mm Crimp Top Vial with Write-on Spot, 5.0 Type Glass, Pkg. 100	Write-on	Value	CV-100021
0.3 mL Clear Glass 11 mm Crimp Top Vial Sealed in Insert, Pkg. 100		Standard	CV-100036
11 mm Screw Ring Top Vials			
2 mL Clear Glass 11 mm Screw Ring Top Vial, 7.0 Type Glass, Pkg. 100		Value	CV-100008
2 mL Clear Glass, 11 mm Screw Ring Top Vial with Write-on Spot, 7.0 Type Glass, Pkg. 100	Write-on	Value	CV-100009
2 mL Clear Glass 11 mm Screw Ring Top Vial, 5.0 Type Glass, Pkg. 100		Value	CV-100010
2 mL Clear Glass 11 mm Screw Ring Top Vial with Write-on Spot, 5.0 Type Glass, Pkg. 100	Write-on	Value	CV-100011
2 mL Amber Glass 11 mm Screw Ring Top Vial, 5.0, Type Glass, Pkg. 100		Value	CV-100012
2 mL Amber Glass 11 mm Screw Ring Top Vial with Write-on Spot, 5.0 Type Glass, Pkg. 100	Write-on	Value	CV-100013
11 mm Snap Ring Top Vials			
2 mL Clear Glass 11 mm Snap Ring Top Vial with Write-on Spot Large Opening, Pkg. 100	Write-on	Standard	CV-100037
0.3 mL Clear Glass 11 mm Snap Ring Top Vial Sealed in Insert, Pkg. 100		Standard	CV-100038

13-425 Vials

13-425 Screw Top Vials			
4 mL Clear Glass 13-425 Screw Top Vial Large Opening, Pkg. 100		Standard	CV-100044

Headspace Vials

18 mm Headspace Vials			
10 mL Clear Glass 18 mm Screw-Top Headspace Vial, Radius Bottom, Pkg. 1000		Standard	CV-100067
10 mL Clear Glass 18 mm Screw Top Headspace Vial, Radius Bottom, Pkg. 100		Standard	CV-100051
20 mL Clear Glass 18 mm Screw Top Headspace Vial, Radius Bottom, Pkg. 100		Standard	CV-100052
20 mL Clear Glass 18 mm Screw-Top Headspace Vial, Radius Bottom, Pkg. 1000		Standard	CV-100068

Headspace Vials

20 mm Headspace Vials

Description	Marking	Line	Part No.
20 mL Clear Glass 20 mm Crimp Top Headspace Vial Tapered Top, Radius Bottom, Pkg. 100		Standard	CV-100047
20 mL Clear Glass 20 mm Crimp-Top Headspace Vial Tapered Top, Radius Bottom, Pkg. 1000		Standard	CV-100063
20 mL Clear Glass 20 mm Crimp-Top Headspace Vial Tapered Top, Flat Bottom, Pkg. 1000		Standard	CV-100066
20 mL Clear Glass 20 mm Crimp Top Headspace Vial Tapered Top, Flat Bottom, Pkg. 100		Standard	CV-100050
20 mL Clear Glass 20 mm Crimp Top Headspace Vial, Flat Bottom, 7.0 Type Glass, Pkg. 100		Value	CV-100026
20 mL Clear Glass 20 mm Crimp Top Headspace Vial, Round Bottom, 7.0 Type Glass, Pkg. 100		Value	CV-100028
20 mL Clear Glass Crimp Top Headspace Vial, Flat Bottom, 5.0 Type Glass, Pkg. 100		Value	CV-100029
20 mL Clear Glass 20 mm Crimp Top Headspace Vial, Round Bottom, 5.0 Type Glass, Pkg. 100		Value	CV-100030
20 mL Amber Glass 20 mm Crimp Top Headspace Vial, Flat Bottom, 5.0 Type Glass, Pkg. 100		Value	CV-100031
20 mL Amber Glass 20 mm Crimp Top Headspace Vial, Round Bottom, 5.0 Type Glass, Pkg. 100		Value	CV-100032
20 mL Clear Glass 20 mm Crimp Top Headspace Vial with Write-on Spot, Flat Bottom, 5.0 Type Glass, Pkg. 100	Write-on	Value	CV-100033
20 mL Clear Glass 20 mm Crimp Top Headspace Vial with Write-on, Round Bottom, 5.0 Type Glass, Pkg. 100	Write-on	Value	CV-100034
10 mL Clear Glass 20 mm Crimp Top Headspace Vial Tapered Top, Flat Bottom, Pkg. 100		Standard	CV-100049
10 mL Clear Glass 20 mm Crimp Top Headspace Vial, Flat Bottom, 7.0 Type Glass, Pkg. 100		Value	CV-100023
10 mL Clear Glass 20 mm Crimp Top Headspace Vial, Round Bottom, 7.0 Type Glass, Pkg. 100		Value	CV-100024
10 mL Clear Glass 20 mm Crimp Top Headspace Vial, Flat Bottom, 5.0 Type Glass, Pkg. 100		Value	CV-100025
10 mL Clear Glass 20 mm Crimp Top Headspace Vial Tapered Top, Radius Bottom, Pkg. 100		Standard	CV-100046
10 mL Clear Glass 20 mm Crimp-Top Headspace Vial Tapered Top, Radius Bottom, Pkg. 1000		Standard	CV-100062
10 mL Clear Glass 20 mm Crimp-Top Headspace Vial Tapered Top, Flat Bottom, Pkg. 1000		Standard	CV-100065
6 mL Clear Glass 20 mm Crimp-Top Headspace Vial Tapered Top, Radius Bottom, Pkg. 1000		Standard	CV-100061
6 mL Clear Glass 20 mm Crimp-Top Headspace Vial Tapered Top, Flat Bottom, Pkg. 1000		Standard	CV-100064
6 mL Clear 20 mm Crimp Top Headspace Vial, Flat Bottom, 22*38 mm (6 mL Karl Fisher), 5.0 Type Glass, Pkg. 100		Value	CV-100022
6 mL Clear Glass 20 mm Crimp Top Headspace Vial Tapered Top, Radius Bottom, Pkg. 100		Standard	CV-100045
6 mL Clear Glass 20 mm Crimp Top Headspace Vial Tapered Top, Flat Bottom, Pkg. 100		Standard	CV-100048

Autosampler Vial, Cap and Septa - Convenience Kits

Autosampler Vial, Cap and Septa Convenience Kits	
Description	Part No.
2 mL Clear Glass 9 mm Screw-Top Vial Write-on Patch, Polypropylene Blue Cap, White Silicone /Red PTFE, Pkg. 100	CV-100053
2 mL Clear Glass 9 mm Screw-Top Vial Write-on Patch, Polypropylene Blue Cap White Silicone/Red PTFE SLIT, Pkg. 100	CV-100054
2 mL Clear Glass 9 mm Screw-Top Vial Write-on Patch Polypropylene Blue Cap Clear Silicone/Clear PTFE, MS Cert, Pkg. 100	CV-100055
2 mL Clear Glass 9 mm Screw-Top Vial Write-on Patch Polypropylene Grey Cap Clear Silicone/Clear PTFE PRE-SLIT MS Cert Pkg. 100	CV-100056
2 mL Clear Glass 11 mm Crimp-Top Vial Write-on Patch Wide Open, Silver Red Rubber/Clear PTFE, Pkg. 100	CV-100057
2 mL Clear Glass 11 mm Crimp-Top Vial Write-on Patch Wide Open, Silver White Silicone/Red PTFE, Pkg. 100	CV-100058
2 mL Clear Glass 11 mm Snap-Top Cap Vial Write-on Patch Wide Open, Natural White Silicone/Red PTFE, Pkg. 100	CV-100059
2 mL Clear Glass 11 mm Snap-Top Cap Vial Write-on Patch Wide Open, Natural White Silicone/Red PTFE PRE-SLIT, Pkg. 100	CV-100060



Vial Inserts



Our vial inserts are made from the same Type 1 borosilicate glass as our vials and can be used for maximum sample extraction when handling micro volumes.

Bottom Design	Description
Flat Bottom	Flat Bottom inserts lay flat on the bottom of the vial.
Conical Bottom <i>(Pulled Point and Mandrel Point)</i>	Conical Bottom taper to a point. The bottom point rests on the bottom of the vial. The manufacturing process of Pulled Point inserts creates the taper, while creating a flat surface inside the point. The manufacturing process of Mandrel inserts creates the taper, while creating a conical surface inside the point.
Conical Bottom with Bottom Spring	A PP Bottom Spring can be attached to both Pulled Point Conical Bottom inserts and Mandrel Conical Bottom inserts, in glass or in plastic. This spring helps center the insert inside the vial and protects the autosamplers' needle from impact with the insert.

Limited-volume inserts are an economical way to reduce the use and waste of solvents in small samples. AFP's conical bottom inserts provide the smallest dead volume, and are a good choice for minimizing sample loss. Polypropylene bottom springs are attached to conical bottom inserts to help center the insert inside the vial and to protect the autosampler needle. AFP also offers flat bottom inserts that are very economical and are often a viable option for limited sampling.

Description	Part No.
250 μ L Clear Insert with Bottom Spring for Large Opening 1.8 mL Vials Pkg. 100	CI-100000
250 μ L Clear Insert with Flat Bottom for Large Opening 1.8 mL Vials Pkg. 100	CI-100001
250 μ L Clear Insert with Bottom Spring for Large Opening 1.8 mL Vials, Deactivated, Pkg. 100	CI-100004
250 μ L Clear Insert with Flat Bottom for Large Opening 1.8 mL Vials, Deactivated, Pkg. 100	CI-100005
300 μ L Clear Insert with Bottom Spring for Large Opening 4.0 mL Vials, Pkg. 100	CI-100002
500 μ L Clear Insert with Flat Bottom for Large Opening 4.0 mL Vials, Pkg. 200	CI-100003

Sealing Mats



96 Well Plate Sealing Mats

Our premium grade, 100% pure silicone well pads are specially formulated and available with options such as low bleed and pre-slit, designed to fit most 96-well plates.

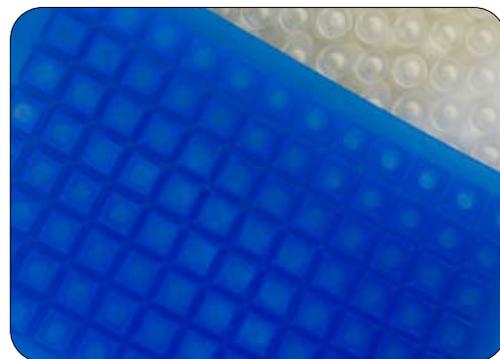
Features

- Conditioned for ultra low bleed
- Soft, strong premium silicone

Benefits

- Reduced handling/contamination
- No interfering peaks
- Easy needle penetration/resealability
- Easily control/identify inventory
- Can be slit for easy piercing and increased ventilation

When it comes to chromatography and other laboratory testing, the integrity of your samples is important. Our 96-well cap mats provide superior protection and performance. These cap mats are engineered to fit precisely over the wells of microplates, ensuring each sample is securely sealed and protected.



High-Quality Materials

The cap mats are crafted from a proprietary platinum-catalyzed, premium-grade, FDA-compliant silicone elastomer. This material is known for its durability and resistance to contamination. For applications requiring analytically pure conditions, Ultra Low Bleed mats are specifically formulated to minimize siloxane peaks, ensuring that your results are free from interference.

Cap Mats with Precision Fit and Versatility

Cap mats are available with either round or square plugs to suit different microplate designs. The 96-round cap mats come with two plug diameter options: 7 mm and 8 mm. The 7 mm plugs are ideal for plates holding samples over 1 mL, while the 8 mm plugs are suited for shallower plates with samples under 1 mL. This flexibility ensures a perfect fit and optimal performance for various laboratory needs.

Easy Access and Sample Integrity

Cap mats with cross slits allow pipettes or syringes to penetrate the mat effortlessly, ensuring convenient sample retrieval without compromising the seal. This feature is crucial for maintaining the integrity of your samples by preventing evaporation and contamination.



Sealing Mats

Square Well Plate Sealing Mats

Description	Part No.
96 Square Well Plate Sealing Mat, Premium Clear Silicone, Pkg. 5	CS-100050
96 Square Well Plate Sealing Mat, PRE-SLIT, Premium Clear Silicone, Pkg. 5	CS-100051
96 Square Well Plate Sealing Mat, Premium Clear Silicone, Ultra Low Bleed, Pkg. 5	CS-100052
96 Square Well Plate Sealing Mat, PRE-SLIT, Premium Clear Silicone, Ultra Low Bleed, Pkg. 5	CS-100053
Round Well Plate Sealing Mats	
96 Round Well Plate Sealing Mat, 7 mm Diameter Plug, Premium Clear Silicone, Pkg. 5	CS-100054
96 Round Well Plate Sealing Mat, 7 mm Diameter Plug, PRE-SLIT Premium Clear Silicone, Pkg. 5	CS-100055
96 Round Well Plate Sealing Mat, 7 mm Diameter Plug, Premium Clear Silicone, Ultra Low Bleed, Pkg. 5	CS-100056
96 Round Well Plate Sealing Mat, PRE-SLIT 7 mm Plug, Premium Clear Silicone, Ultra Low Bleed, Pkg. 5	CS-100057
96 Round Well Plate Sealing Mat, 8 mm Diameter Short Plug, Premium Clear Silicone, Pkg. 5	CS-100058
96 Round Well Plate Sealing Mat, PRE-SLIT 8 mm Diameter Short Plug, Premium Clear Silicone, Pkg. 5	CS-100059

Crimpers and Decappers



Manual Crimpers

Our ergonomically designed crimping tools have advanced the standards of manual crimpers and decappers by addressing all of the deficiencies associated with traditional blocky, metal tools.

- Reliability seal crimp caps manually with less physical strain.

Features and Benefits

- Constructed of tough, light-weight plastic that is incredibly durable, but weighs much less than metal crimping tools.
- The curved handles create a natural grip, greatly improving comfort over metal grips.
- Unique bottom-pull technology allows for steadier operation in comparison to top-push handle designs.
- The adjustment knob is easily viewed and clearly displays + and - symbols along with directional arrows, simplifying the process of adjusting the crimp setting - no tools needed!
- No more extra squeeze required! When the adjustment knob touches the body of the crimper, the desired crimp setting has been reached - significantly reducing arm strain and fatigue associated with traditional manual crimping.



Recommended Applications

Low volume crimping/decapping applications for aluminum crimp caps.

Product Specifications

Tools in 8, 11, 13, and 20 mm crimping and decapping.

Electronic Battery Crimpers

Electronic battery crimping tools effortlessly crimp/decap aluminum and 2-part aluminum/steel caps with just the push of a button.

- Consistently crimp caps to a reproducible seal setting with less physical strain.

Features and Benefits

- Powerful brushless motor with a fast cycle.
- Long lasting lithium ion battery provides up to 800 crimps/decaps per charge with an average recharge time of 1-2 hours.
- Innovative charging system, which includes a warning light when recharging is necessary.
- Can be operated while charging.
- The controls to increase or decrease crimp settlings are conveniently located on top of the unit, preventing accidental adjustment of the settings.
- OLED screen for simple operation displays tool size, battery status, crimp setting and cycle result.
- Performance tracking through an internal cycle log.



Recommended Applications

High volume or strenuous crimping/decapping applications.

Product Specifications

Tools in 8, 11, 13, and 20 mm crimping and decapping.

Description	Part No.
Manual Crimpers and Decappers	
11 mm Manual Crimper	CR-100002
11 mm Manual Decapper	CR-100003
13 mm Manual Decapper	CR-100004
20 mm Manual Crimper	CR-100005
20 mm Manual Decapper	CR-100006
Electronic Battery Powered Crimpers and Decappers	
11 mm Model 6 Battery Powered Crimper Tool	CR-100007
11 mm Model 6 Battery Powered Decapper Tool	CR-100008
13 mm Model 6 Battery Powered Flip Off Crimper Tool	CR-100009
20 mm Model 6 Battery Powered Crimper Tool	CR-100010



Manual Hand Crimpers

The AFP hand crimper provides a consistent and dependable seal that allows secure vial closure each and every time. The high-quality construction is engineered for durability and long life to provide a smooth and simple operation. The adjustable hand crimper is ideal if you use varying thickness of septa in your analysis. This product has the ability to be adjusted for changes in septa thickness. This product is very useful in SPME applications requiring the use of a thinner septa.

Features

- The hand-operated device features an adjustable stop, a jaw pressure regulator on the operating handle, and a cushion grip for user comfort.
- Simple to operate, allowing for quick and easy seal removal.
- Durable jaws made from a specialized metal alloy, designed for long-lasting performance.
- The height of the cover is adjustable using the hexagonal bolt on the jaw head.
- Specially designed for use in the laboratory with good chemical resistance of the surface coating.

- Our Hand Crimper is commonly used for crimping caps on laboratory Headspace vials.
- The vial crimper is perfect for low-volume crimping and sample preparation tasks.
- The capping is secure, reliable, tight, smooth, and provides excellent sealing.





Manual Crimpers

Description	Part Number
Hand Crimper for 11 mm Crimp Cap Seals, Latest Style	CR-100001
Hand Crimper for 20 mm Crimp Cap Seals, Latest Style	CR-100000

Injection Port Septa



Our GC septa is founded on unique technologies that optimize the performance of the injection port.

Features

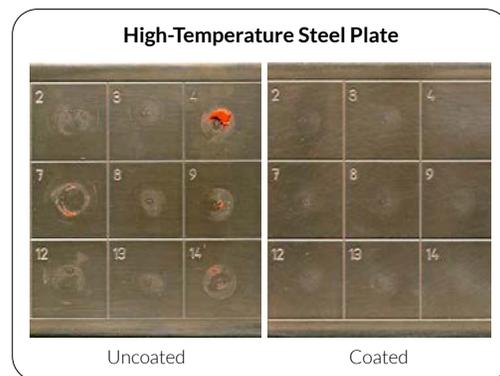
- Very high temperatures of operation.
- Exceedingly tight requirements for low emission of volatile and liquid components.
- Resistance to sticking.

GC Septa

GC septa are preconditioned for low bleed, plasma-coated to reduce sticking, and packed in blister packs and glass jars for high purity. We have developed unique technologies while developing injection port septa for gas chromatographs. This particular application is characterized by very high temperatures of operation – to the limit of the material specification; Exceedingly tight requirements for low emission of volatile and liquid components, and a surface that needs to be resistant to sticking.

High-Temperature Performance

Accelerated high-temperature tests show the adhesion of silicone rubber formulations to a steel plate, with and without the non-stick coating. The difference in adhesion is readily apparent. This performance means easier septum removal and less injection port cleanup.



Plasma Coating

- Non-stick surface treatment.
- Easy to change even with high temperatures.
- Stays clean, and does not attract dust.

Center Guide and Pre-Pierced Advantage

- The center point guides the needle for easy penetration.
- Reduces needle bending.
- Reduces coring and tearing.

GC septa in BTO, AG3, and Marathon formulations are precision molded with a recess on the injection side, to guide the syringe needle to the same point with every injection. The center guide design requires less force on initial penetration for a smoother feel. Pre-pierced septa give a long injection life for autosampling, reduce coring, and enhance reliable performance.

BTO Premium High-Temperature GC Septa

GC septa BTO is bleed and temperature optimized for the most demanding GC and GC-MS applications: it is the finest GC septum we have tested. GC septa BTO is formulated to extend low bleed and outstanding mechanical properties of premium GC septa to the highest temperature applications. It retains remarkable softness and permeability at high temperatures, with extremely low bleed, and has been optimized to reduce injection port adhesion.

AG3 Low-Bleed GC Septa

Advanced Green 3 (AG3) GC septum was created to combine significantly longer injection life, low bleed, and low injection port adhesion. The result is a green septum you can use for all your critical analyses.

Marathon Long-Life GC Septa

This is an advanced GC septum for autosampler use, with a significantly longer life. The Marathon GC septum typically achieves 400 injections without failure when used with a rounded-tip (HP-style) needle and autosampler or needle guide. Now you can make extended autosampler runs without fear of sample loss caused by blow-back of leaking carrier gas. The Marathon GC septum is also ideal for standard manual injection GC and GC-MS.

General Purpose Blue GC Septa

We offer general-purpose blue GC septa that are economical and suitable for use in many applications. While they do not have the low-bleed quality or plasma coating of the premium GC septa they do hold up well at up to 275°C and provide lower bleed levels than many low-end or generic GC septa.

Plasma Example

Exposed to Dust



Uncoated

Coated

Cleaned with Air



Uncoated

Coated

Center Guide and Pre-Pierced



Center guide and pre-pierced

Non-center guide and non-pierced

Center Guide Recess



BTO

AG3

Marathon

Blue GC Septa



Puresep T GC Septa

The Puresep T GC septa are faced with polyimide film and have a double layer of polyimide and PTFE on one side. Puresep T GC septa are not low bleed septa, and their recommended maximum temperature is 225°C. Puresep T GC septa are stamped from sheets of material to the size specified. All general-purpose septa are produced to tight tolerances in dedicated molds.



General Purpose GC Septa

Description	Part Number
5 mm OD General Purpose Blue GC Septa, Pkg. 50	CP-100003
6.4 mm (1/4") OD General purpose Blue GC Septa, Pkg. 50	CP-100004
9.5 mm OD General Purpose Blue GC Septa, Pkg. 100	CP-100005
9.5 mm (3/8") OD General purpose Blue GC Septa, Pkg. 50	CP-100006

Puresep T GC Septa

Description	Part Number
6.4 mm (1/4") OD Puresep T Coated GC Septa, Pkg. 50	CP-100000
9.5 mm (3/8") OD Puresep T Coated GC Septa, Pkg. 50	CP-100001
11 mm OD Puresep T coated GC Septa, Pkg. 50	CP-100002

Advanced Green 3 (AG3) GC Septa

Description	Part Number
6 mm OD Advanced Green 3 Center Guide GC Septa, Pkg. 50	CP-100011
9.5 mm OD Advanced Green 3 Low-bleed GC Septa, Pkg. 50	CP-100008
11 mm OD Advanced Green 3 Low-bleed Center Guide GC Septa, Pkg. 25	CP-100018
11 mm OD Advanced Green 3 Low-bleed Center Guide GC Septa, Pkg. 50	CP-100009
11 mm OD Advanced Green 3 Low-bleed Center Guide GC Septa, Pkg. 100	CP-100010
11.5 mm OD Advanced Green 3 Low-bleed Center Guide GC Septa, Pkg. 50	CP-100013
17 mm OD Advanced Green 3 Low-bleed Center Guide GC Septa, Pkg. 50	CP-100012

Marathon GC Septa

Description	Part Number
11 mm OD Marathon Long-life Center Guide GC Septa, Pkg. 100	CP-100007

Bleed Temperature Optimized (BTO) GC Septa

Description	Part Number
9 mm OD BTO Premium High-temp Center Guide GC Septa, Pkg. 50	CP-100014
11 mm OD BTO Premium High-temp Center Guide GC Septa, Pkg. 25	CP-100017
11 mm OD BTO Premium High-temp Center Guide GC Septa, Pkg. 50	CP-100015
11 mm OD BTO Premium High-temp Center Guide GC Septa, Pkg. 100	CP-100016

Other GC Septa

Description	Part Number
GC Inlet Plug Septa for Shimadzu GCs, Φ 5.5x7 mm Height: 7.5mm, Brown, Pkg. 25	CS-100064
GC Septa, Green Color, Φ 11*3mm, Temperature Resistant 250 °C, Pkg. 25	CS-100065



MicroSeal™ Kits

Complexity Made Simple

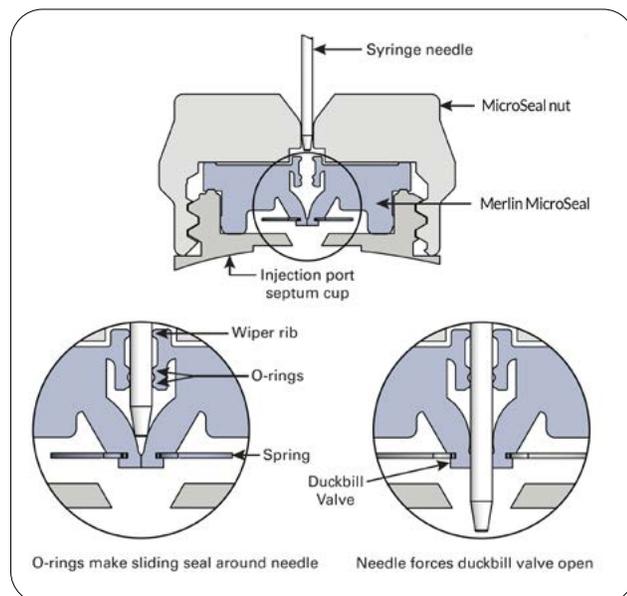
The Merlin MicroSeal is a long-life replacement for traditional rubber disc septa. Two sealing mechanisms work to seal the injection port during sample injection and analysis.

Extend Lifetime and Reduce Bleed.

The Merlin MicroSeal is the preferred choice of chromatographers seeking improved performance for both manual and automated injections, including SPME.

Benefits:

- Reduces downtime for septum and liner changes.
- Improves reliability and performance during extended automated runs.
- Eliminates septum coring and crumbling.
- Reduces septum bleed peaks.
- Lowers needle insertion force.



Features:

- O-rings seal around needle during injection.
- Duckbill valve allows needle to penetrate easily.
- Spring ensures rapid duckbill closure.
- Duckbill valve seals more tightly at higher pressures.
- Wiper rib at entry point reduces particulate contamination.

Agilent Instruments

Description	Part No.
Low Pressure MicroSeal Kit (Nut & 2 #310 MicroSeals)	CP-100025
Low Pressure MicroSeal Kit (Nut & 1 #310 MicroSeals)	CP-100026
General Purpose MicroSeal Kit (Nut & 2 #401 MicroSeals)	CP-100027
General Purpose MicroSeal Kit (Nut & 1 #401 MicroSeals)	CP-100028
MicroSeal Nut	CP-100029

Shimadzu Instruments

MicroSeal Kit for Shimadzu (Nut, Adapter assembly, & 2 #410 MicroSeals)	CP-100033
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Thermo Scientific Instruments

MicroSeal Kit for Thermo Trace 1300 Series (Nut & 2 #410 MicroSeals)	CP-100030
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Bruker/Varian Instruments

MicroSeal Kit for Varian 1079 (Nut, Adapter, O-ring, & 1 #410 MicroSeals)	CP-100034
MicroSeal Kit for Varian 1177 (Nut, Adapter, O-ring, Spacer & 1 #410 MicroSeals)	CP-100035

PerkinElmer Instruments

MicroSeal Kit for PerkinElmer (Nut, Adapter, O-ring, & 2 #410 MicroSeal)	CP-100036
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Replacement MicroSeal

Low Pressure MicroSeal (1 to 45 psi and Parts)	CP-100019
General Purpose MicroSeal (Most Applications, 3 to 100 psi)	CP-100020
MicroSeal for SPME Applications (3 to 100 psi)	CP-100021

Additional Parts

19 Ga. MicroSeal for Torion T-9 GC-MS or Rheosense VROC Initium	CP-100022
26 Ga. MicroSeal for 26 ga. or 23/26 ga. tapered needles	CP-100023
26 Ga. MicroSeal for Thermo Trace 1300 cold on-column GC/MS	CP-100024
MicroSeal Nut for Thermo Trace 1300 Series ports, nut only	CP-100031
MicroSeal Adapter for Thermo Trace Ultra GC (adapter parts only)	CP-100032
Arrow MicroSeal Nut for Agilent Inlets	CP-100037
Arrow MicroSeal adapter kit for Shimadzu 2010 & 2025 GCs	CP-100038
Arrow MicroSeal Nut for Thermo Trace 1300 Series GCs	CP-100039
Arrow MicroSeal Adapter kit for Thermo Trace Ultra GCs	CP-100040
MicroSeal for 1.1 mm Arrow SPME probes	CP-100041
MicroSeal for 1.5 mm Arrow SPME probes	CP-100042
Tube Stem Adapter	CP-100043
MicroSeal for ambient conditions	CP-100044

MicroShot™ Injector



The Merlin MicroShot injector enables convenient and repeatable manual injections for Gas Chromatography (GC). The unique trigger mechanism makes each injection automatic when the needle is inserted into the injection port. The plunger displacement is fixed for precise volume delivery confirming reproducibility. The Merlin MicroShot uses syringes with removable or fixed 23 or 26 gauge needles with a ball-end plunger detail.

How It Works

A GC syringe is mounted in the MicroShot injector and a spring-driven plunger slide holds and supports the syringe plunger, making it easy to rinse and fill the syringe without damaging the plunger. The sample volume is controlled by calibrated volume rod. When the injector is filled and armed, pushing the syringe needle into the injection port triggers the sample injection, reducing the injection process to a simple motion.

The MicroShot injector is available in 5 fixed sizes which deliver precise, repeatable sample volumes from 0.1 to 2.0 microliters when used with the appropriate 10- μ L syringe.

Advantages

- Improves injection precision by eliminating the task of carefully adjusting each sample volume by eye
- Provides a convenient holder for the syringe and allows easy manipulation of the syringe plunger, which protects these delicate parts
- Fast injection minimizes needle residence time in the injection port, which minimizes potential sample discrimination
- Provides convenient sampling from a wide variety of sample containers, eliminating the necessity of processing samples into vials specifically for autosamplers

The **Merlin MicroShot Injector** delivers quick and reproducible manual syringe injections for gas chromatography.

In order to understand why afp tubing is superior of what's available on the market we need to explain all the steps of its production by starting with the raw material.

Key Components

Figure 1 shows the components of the **Merlin MicroShot Injector** and will be referred to throughout this instruction manual.

Caution: Pumping a dry syringe can reduce the syringe life and compromise injector performance. Always supply solvent to the needle tip when moving the syringe plunger.

Selecting a Syringe

The **MicroShot Injector** does not come with a syringe installed. These can be purchased from your distribution partner.

Figure 2 shows the syringe compatibility requirements including plunger end detail, which is important for proper function. A 10 μL syringe will give the nominal injected volume indicated for that **MicroShot Injector** and a 5 μL syringe will give half that volume. Removable or fixed needles, 23 or 26 gauge needles can all be used with the **MicroShot Injector**.

Installing the Syringe

1. To lubricate the Syringe Plunger, load approximately 1 μL of solvent into the syringe.
2. Move the Plunger Stop to the released position.
3. Open Plunger Bolt.
4. Open Syringe Latch.
5. Raise the Plunger Slide about half way.
6. Slide the Syringe Flange under the Syringe Flange Clamp.
7. Close the Syringe Latch to secure the syringe.
8. Lower Plunger Slide until it stops.
9. Close the Plunger Bolt to secure the Syringe Plunger.
10. Rinse with solvent to check for free plunger motion.

Removing the Syringe

1. Open the Plunger Bolt.
2. Raise the Plunger Slide half way.
3. Open the Syringe Latch.
4. Remove the syringe.

Figure 1

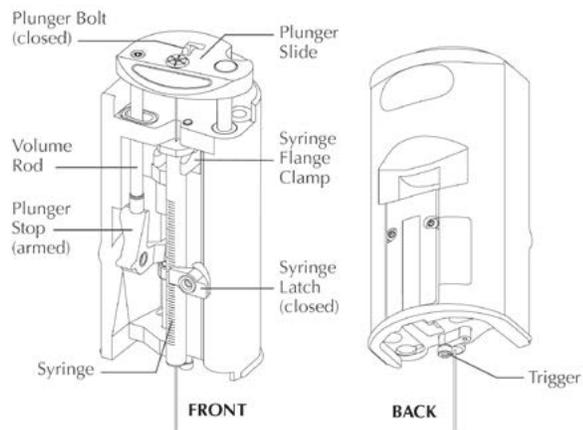


Figure 2

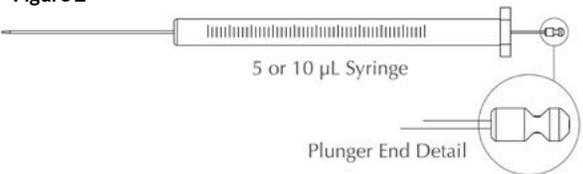
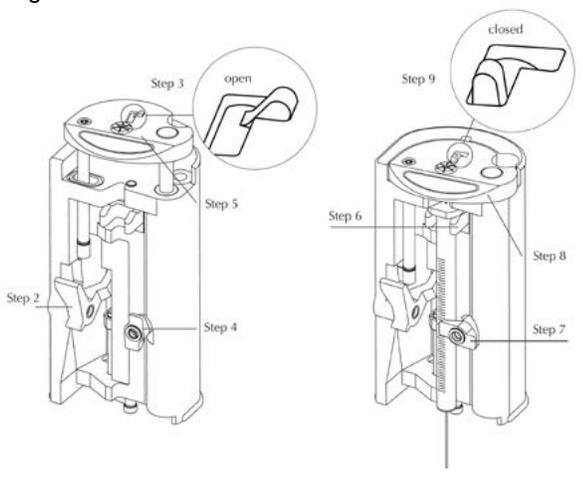


Figure 3



Preparing for an Injection

1. With the Plunger Stop in the released position, rinse and fill the syringe with sample using the Plunger Slide.
2. Keeping the Plunger Slide raised, arm the Plunger Stop.
3. Lower the Plunger Slide slowly until the Volume Rod comes to rest on the Plunger Stop.
4. Wipe the needle.
5. The MicroShot Injector is now filled and armed for injection.

Making an Injection

1. Align the syringe needle with the injection port.
2. Push the needle all the way into the injection port and then withdraw the MicroShot Injector. The injection occurs when the Trigger is displaced by the top of the injection port.
3. Start the instrument.

Safety and Cleaning

Please use all applicable laboratory safety procedures when using sharp objects or chemical solvents. Laboratory goggles should be worn at all times when working with the MicroShot Injector.

The injector can be cleaned with warm solution of laboratory-grade detergent and rinsed with deionized water. **Dry the injector completely before use.**

Warranty and Calibration

The MicroShot Injector is warranted against defects in materials and workmanship for one year from date of purchase. Please contact your distribution partner for service or return policies.

Each MicroShot Injector is calibrated to deliver a stroke of the plunger slide within +/- .025 mm of nominal. Most syringes are calibrated by the manufacturer therefore, please refer to your syringe manufacturer for calibration requirements for your particular syringe.

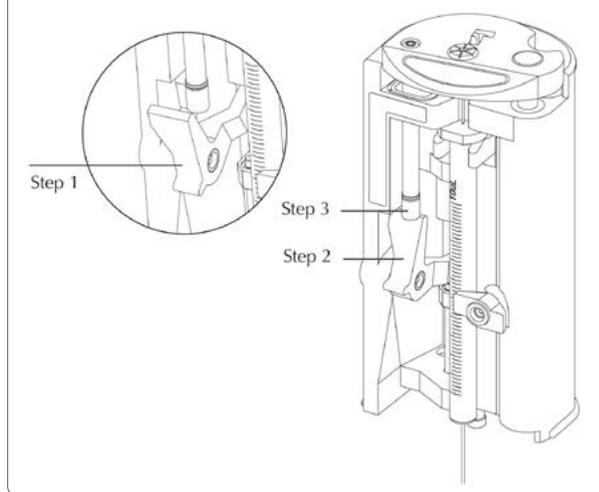
Tips for Best Performance

For split injections use a small amount of glass wool in the inlet liner to prevent the sample from reaching the bottom of the liner, which would cause vaporization past the split point. Other appropriate inlet liner designs will also serve this same function. Glass wool also helps wick low volatility compounds from the tip of the syringe needle.

An easy way to verify the MicroShot Injector is functioning properly is as follows:

- Load and arm the syringe.
- Hold the needle tip approximately 2 cm above a piece of paper.
- Manually push the trigger and listen for an audible click.
- Look for a small spot of liquid on the paper.

Figure 4



Troubleshooting

Problem	Probable Cause	Solution
Syringe Plunger end doesn't go into Plunger Slide.	Plunger Bolt is in the closed position.	Move Plunger Bolt to the open position (Figure 3).
Sample doesn't fill syringe.	Syringe plunger not connected to Plunger Slide.	Close Plunger Bolt (Figure 3).
	Syringe needle is plugged.	Remove and clean or replace syringe.
Microshot Injector fails to make injection.	Plunger Stop not armed before injection.	Arm Plunger Stop prior to injection (Figure 4).
	Trigger is not getting pressed in all the way.	Make sure Trigger contacts septum nut.
	Plunger Slide or syringe plunger sticking.	Remove and clean syringe. Verify free plunger movement.

Description	Part No.
MicroShot Injector with 0.1 µL Volume delivery	CY-100089
MicroShot Injector with 0.2 µL Volume delivery	CY-100090
MicroShot Injector with 0.5 µL Volume delivery	CY-100091
MicroShot Injector with 1.0 µL Volume delivery	CY-100092
MicroShot Injector with 2.0 µL Volume delivery	CY-100093

Inlet Liners



Spot the Difference in the SGE Lineup

Choosing the right inlet liner and injection parameter can increase peak areas and reduce detection limits by up to 300%.¹

Customer research shows that a significant number of GC users don't understand the importance of inlet liner selection, or how it contributes to their analysis. The SGE inlet liner range aims to make it simple for all gas chromatographers to select the right liner.

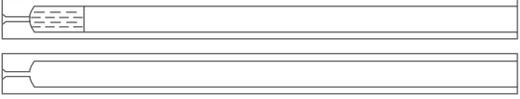
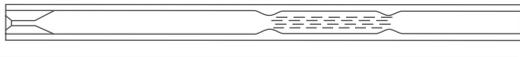
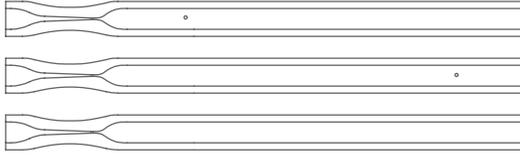
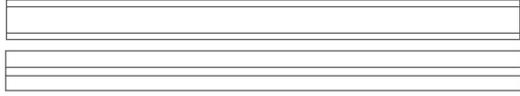
To optimize your results for different sample types, inlet liners are color coded by geometry for ease of selection.

Confidence in Quality Assurance

- SGE inlet liners have the lowest level of Endrin degradation and DDT degradation when compared to competitor results.
- Every batch is tested for activity using the EPA 8081B method. A 5 ppm standard is used to validate that every batch has less than 3% Endrin degradation and less than 1% DDT degradation.
- Each pack includes a batch certificate with quality assurance test results.

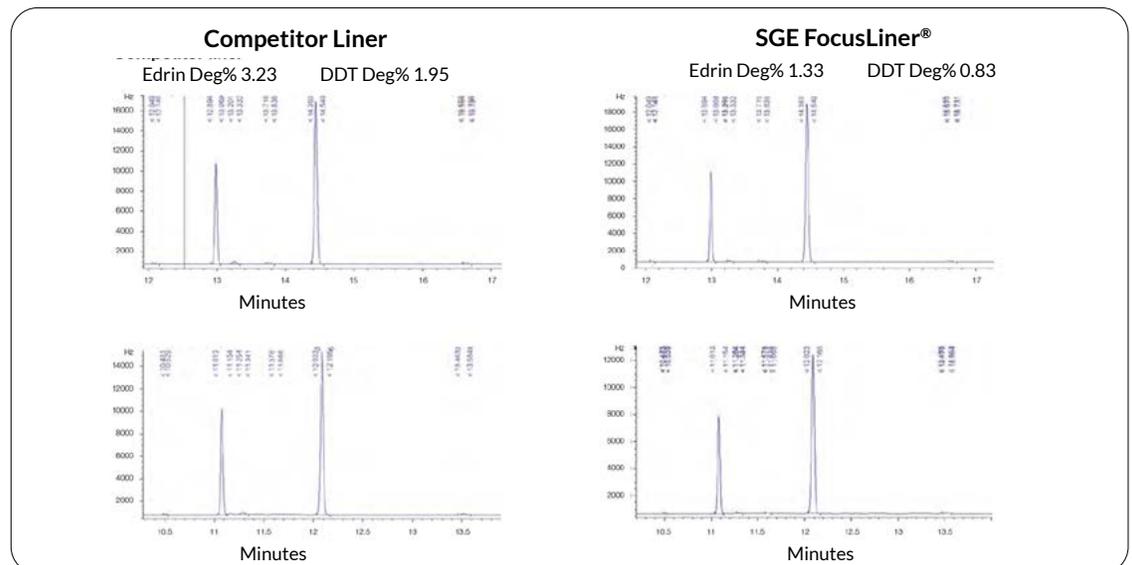


Easy to Choose

Color	Injection Technique	Sample Types	Liner Geometry
Dark Green	Splitless	<ul style="list-style-type: none"> Trace level analyses. Active compounds. 	Taper / Gooseneck 
Blue	Split	<ul style="list-style-type: none"> General purpose. Concentrated samples. Dirty samples. 	FocusLiner® 
Aqua	Splitless	<ul style="list-style-type: none"> Trace level analyses. Dirty samples. Wide boiling point range. 	Tapered FocusLiner® 
Orange	Direct	<ul style="list-style-type: none"> Trace level analyses. Active compounds. 	Connectite 
Purple	Split Splitless	<ul style="list-style-type: none"> General purpose. Concentrated samples. Dirty samples (only if quartz wool is present) Gaseous samples (also Purge and Trap, Headspace). 	Straight 
Yellow	Splitless LVI	<ul style="list-style-type: none"> Trace level analyses. Low boiling point compounds. Active compounds. 	Double Taper 
Gray	PTV LVI	<ul style="list-style-type: none"> Trace level analyses. Large volume injections. 	PTV/LVI 

1. Kende, A et al. Chromatographia, 2006; 63 (3/4): 181-7

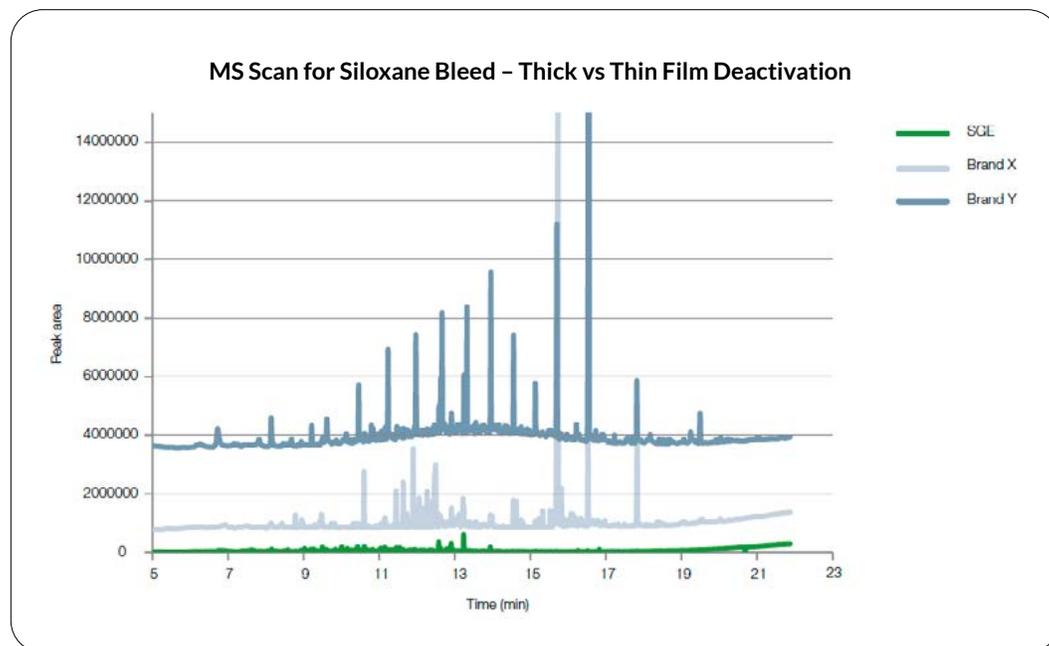
Liner Comparison Endrin and DDT % Breakdown



If the Endrin or DDT breakdown is 3% or higher it is a fail.

Confidence in Your Trace Analysis

SGE inlet liners have the lowest siloxane bleed due to unique thin film deactivation - making them the liner of choice for sensitive MS analysis.



Column Part Number	054101		
Phase	BPX5	Purge On (Split) Vent Flow	20 mL/min
Column	30 m x 0.25 mm x 0.25 µm	Carrier Gas	He
Initial Temperature	50 °C	Carrier Gas Flow	1.2 mL/min
Rate	20 °C/min	Injection Mode	No Injection – Gas Flow for 5 mins
Final Temperature	350 °C, 2.2 min	Injection Temperature	350 °C
Detector	MS		

Confidence in Your Analysis

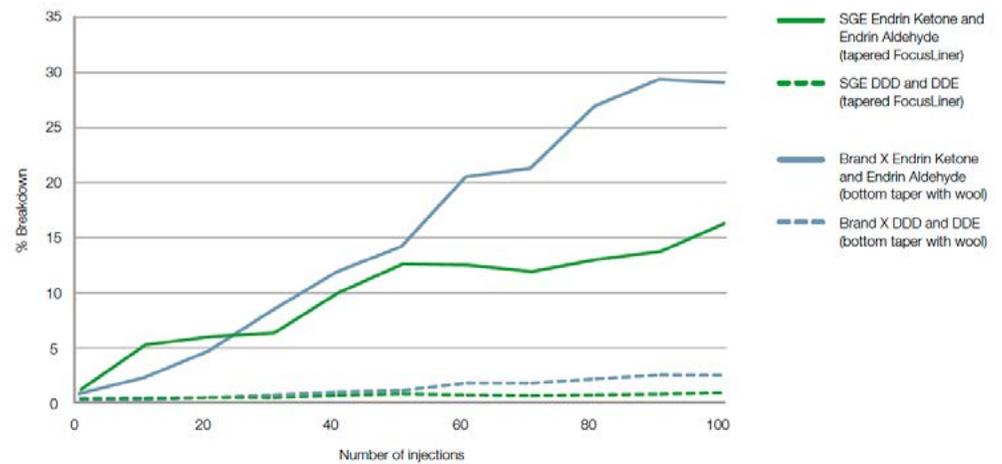
Whether for routine analysis, difficult probes, or trace analysis, have confidence in your analysis with SGE inlet liners. While bottom taper with wool is considered the best geometry for trace analysis, the SGE FocusLiner® delivers optimal performance in all applications.

A unique proprietary “thin film” process guarantees every surface of every SGE inlet liner, including the wool is fully deactivated. Tests show this deactivation provides an excellent analysis whether you are testing trace pesticides, difficult probes such as 2,4-dinitrophenol, or amphetamines.

Confidence for Routine Analysis - Injection After Injection

- SGE tapered FocusLiner shows improved performance compared with a competitor’s premium deactivated liner.
- Choose the tapered FocusLiner to ensure your analysis is uncompromised injection after injection.

50 ppb 100 repeat injections comparison Endrin and DDT % breakdown

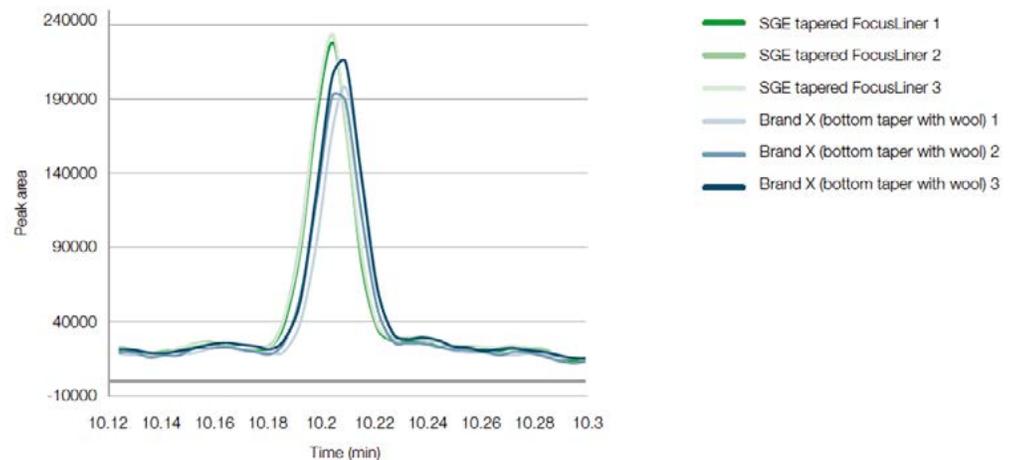


50 ppm Endrin and DDT test mix, 1 μ L splitless injection at 250 $^{\circ}$ C, HT grade septa (PN: 041898)

Confidence with Difficult Probes Such as 2,4-dinitrophenol

Reproducible performance with the right choice in liner geometry.

Liner comparison 0.5 ng 2,4-dinitrophenol



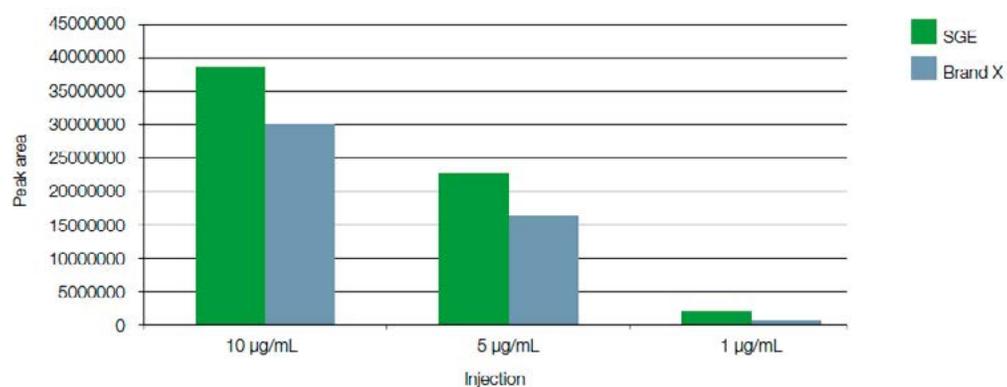
Column Part Number	054101		
Phase	BPX5	Rate 3	30 $^{\circ}$ C/min
Column	30 m x 0.25 mm x 0.25 μ m	Final temperature	350 $^{\circ}$ C, 1 min
Sample	50 $^{\circ}$ C	Detector	MS
		Carrier gas	He, 4.9 psi
		Carrier gas flow	1.2 mL/min
Initial temperature	40 $^{\circ}$ C	Injection volume	1 μ L
Rate 1	10 $^{\circ}$ C/min to 80 $^{\circ}$ C	Injection temperature	200 $^{\circ}$ C
Rate 2	20 $^{\circ}$ C/min to 190 $^{\circ}$ C, 2 min	Full scan / SIM	Full scan 50-550

Easy to Use

- Packs of 1, 5 and 25 liners.
- Complete with instrument appropriate o-rings or sealing rings.
- Each pack supplied with quality assurance test results.
- 5 and 25 blister packs are perforated enabling easy division, while maintaining liner integrity.



Liner comparison 2,4-dinitrophenol



Column Part Number	054101		
Phase	BPX5	Detector	FID 300 °C
Column	30 m x 0.25 mm x 0.25 µm	Carrier Gas	He
Sample	2,4-dinitrophenol (in DCM) 10 µg/mL	Carrier Gas Flow	1.5 mL/min
Initial Temperature	20 °C/min	Injection Volume	1 µL
Rate	10 °C/min to 80 °C	Injection Temperature	250 °C
Final Temperature	150 °C, 2.2 min		

Inlet Liner Taper FocusLiner®

Spot the Difference in the SGE Lineup!

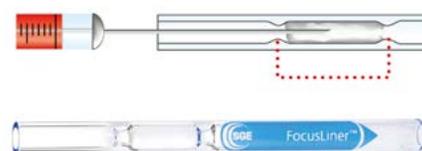
The SGE inlet liner range aims to make it simple for all gas chromatographers to select the correct liner.

Choosing the right inlet liner and injection parameters can increase peak areas and reduce detection limits by up to 300%.

- Easy to choose - color coded by geometry to simplify your selection.
- Easy to use - contains o-rings so you're ready to go.
- Confidence in your analysis - certified deactivation.

Inlet Liner Taper FocusLiner®:

Color Coded Aqua



Features and Benefits

The SGE FocusLiner® uses a unique design to hold the quartz wool in the correct position.

- Bottom taper focuses sample onto the head of the column and minimizes contact with metal parts of the inlet.
- A taper at the top aids in minimizing sample flashback.
- Ensures quartz wool remains in the correct position in the liner.
- Excellent reproducibility results from the wiping of the sample from the syringe needle and the prevention of droplet formation. The wiping of the needle by the quartz wool prevents droplet formation ensuring excellent reproducibility.
- Two focus points in the liner ensures quartz wool remains in the optimum location.
- The presence of the quartz wool improves vaporization minimizing high molecular weight discrimination.

Recommended Applications

The Taper FocusLiner® is recommended for the following sample or injection modes:

- Trace level analysis.
- Splitless.
- Dirty sample.
- Wide boiling point range.

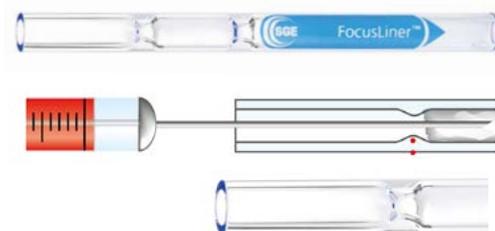
Inlet Liner Straight

- The SGE inlet liner range aims to make it simple for all gas chromatographers to select the correct liner.
- Choosing the right inlet liner and injection parameters can increase peak areas and reduce detection limits by up to 300 %.
- Easy to choose - color coded by geometry to simplify your selection.
- Easy to use - contains o-rings so you're ready to go.
- Confidence in your analysis - certified deactivation.

Features and Benefits

- Straight liners facilitate higher split flows.
- Narrow bore straight liners facilitate fast GC work.
- Small injection volumes of less than 0.5 µL are best used.
- Narrow bore straight liners improve focusing of gaseous samples (purge, trap and headspace).

Inlet Liner Taper FocusLiner®: Color Coded Aqua



Product Specifications

Taper FocusLiner available for Agilent, PerkinElmer, Shimadzu, Thermo Scientific, and Varian/Bruker injectors.

Injector	Length (mm)	OD (mm)	ID (mm)
Agilent	78.5	6.3	4
Agilent	78.5	6.3	2.3
PerkinElmer	92	6.2	4
Shimadzu	99	5	3.4
Shimadzu	95	5	3.4
Thermo	105	8	5
Thermo	78.5	6.3	4
Thermo	78.5	6.3	2.3
Bruker/Varian	78.5	6.3	2.3
Bruker/Varian	54	5	3.4
Bruker/Varian	72	6.3	4

Inlet Liner Straight: Color Coded Purple



Recommended Applications

Straight liners are recommended for the following sample or injection modes:

- General purpose.
- Concentrated samples.
- Dirty samples (only if quartz wool is present).
- Gaseous samples.
- Purge and trap.
- Headspace.
- Split/splitless.

Product Specifications

Straight liners available for Agilent, PerkinElmer, Shimadzu 2010, 17A, 2014 and 2025 injectors, Thermo Scientific, and Varian/Bruker 1177 & 1078/1079 injectors.

OptChem™ inlet liner

Confidence In Your Analysis

SGE OptChem™ inlet liners provide optimal performance with advanced coating technologies in an easy to use format for GC and GCMS.

OptChem deactivation extends the existing SGE inlet liner range with familiar designs, with CRS ONE o-rings and touchless packaging.

- Easy to choose - color coded by geometry to simplify your selection.
- Easy to use - ready to install touchless packaging with pre-fitted CRS ONE o-rings.
- Confidence in your analysis - certified deactivation.

Features and Benefits

- OptChem deactivation is a unique thick film which limits breakdown, ensuring minimal loss of sample and increased system sensitivity.
- Quality tested to USEPA 8081: organochlorine pesticides, and USEPA 8270: semivolatile organic compounds to ensure a high level of inertness.
- Pre-fitted with CRS ONE o-rings to reduce contamination from handling.
- Touchless packaging format reduces the risk of contamination during installation.
- Recyclable packaging - less waste to landfill.



Recommended Application

Suitable for trace level analysis, volatile and organochlorine pesticides (OCPs), pesticides, persistent organic pollutants (POPs), brominated flame retardants (BFRs), dirty samples, and general purpose GC and GCMS.

Product Specifications

Available for industry standard injectors.

Length	OD	ID	Example instrument compatibility
78.5 mm	6.3 mm	<ul style="list-style-type: none"> • 4 mm • 2.3 mm • 1.2 mm • ConnectTite 	<ul style="list-style-type: none"> • Agilent Intuvo 9000, 8890, 8860, 7890, 7890B, 7820A, 6890, 6850, 5890 and 4890 • Bruker/Varian 1177 • Lucidity GC-FID • PerkinElmer GC 2400, Clarus 690 and 590 • Scion Instruments 8500 and 8300 • Thermo Scientific TRACE 1610, 1600, 1300 series and GC Ultra

Inlet Liners

Inlet Liners FocusLiner

Description	Part No.
Inlet Liners 4 mm ID FocusLiner, Length 78.5 mm, Pkg. 5	CL-100001
Inlet Liners 4 mm ID FocusLiner, Length 78.5 mm, Pkg. 25	CL-100013
Shimadzu 2010/17A Inlet Liners 3.4 mm ID FocusLiner, Length 95 mm, Pkg. 5	CL-100010
PerkinElmer Inlet Liners 2 mm ID FocusLiner, Length 86.2 mm, Pkg. 5	CL-100011
Optic FocusLiner, Length 81 mm, Pkg. 5	CL-100018

Inlet Liners

Inlet Liners Taper FocusLiner

Inlet Liners 4 mm ID Tapered FocusLiner, Length 78.5 mm, Pkg. 1	CL-100003
Inlet Liners 4 mm ID Tapered FocusLiner, Length 78.5 mm, Pkg. 5	CL-100002
Inlet Liners 4 mm ID Tapered FocusLiner, Length 78.5 mm, Pkg. 25	CL-100005
Shimadzu 2010/17A Inlet Liners 3.4 mm ID Tapered FocusLiner, on Wool, Length 95 mm, Pkg. 5	CL-100009
Bruker/Varian Taper FocusLiner 3.4 mm ID, Length 54 mm, Pkg. 5	CL-100008

Straight Inlet Liners

Description	Part No.
Inlet Liners 1.2 mm ID Straight, Length 78.5 mm, Pkg. 5	CL-100006
Inlet Liners with Quartz Wool 4 mm ID, Length 78.5 mm, Pkg. 5	CL-100000
Inlet Liners, Quartz, 2 mm ID Straight, Length 78.5 mm, Pkg. 5	CL-100004
Inlet Liners with Quartz Wool 4 mm ID, Length 78.5 mm, Pkg. 25	CL-100014
Inlet Liners 4 mm ID Straight, Length 78.5 mm, Pkg. 25	CL-100015

Taper Inlet Liners

Inlet Liners Tapered with Quartz Wool 4 mm ID, Length 78.5 mm, Pkg. 5	CL-100007
Inlet Liners Tapered with Quartz Wool 4 mm ID, Length 78.5 mm, Pkg. 25	CL-100012
Inlet Liners Tapered 4 mm ID, Length 78.5 mm, Pkg. 25	CL-100016

Double Tapered Inlet Liners

Inlet Liners 4 mm ID Double Taper, Length 78.5 mm, Pkg. 25	CL-100017
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OptChem Taper Inlet liners

OptChem Taper Inlet Liner w/Quartz Wool, pre-fitted CRS ONE O-Ring, 4 mm ID, Length 78.5 mm, Pkg. 5	CL-100019
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Inlet Liner Replacement Parts

Viton O-Ring Seal for Agilent Liners 6.3 mm OD, Pkg. 10	CL-100021
Viton O-Ring Seal for Shimadzu 2010/2014 Liners 5 mm OD, Pkg. 10	CL-100022
O-Ring for Inlet Liners, FKM, B010, 6.1 mm ID, 9.3 mm OD, Pkg. 10	CL-100023
Graphite Sealing O-Ring 6.35 mm, Pkg. 10	CL-100020



Syringe Filters



Discover the ultimate solution for your analytical procedures with our premium Nylon syringe filters. Designed for universal application, these filters are perfect for a variety of sample preparations, including aqueous (non-acidic) and organic samples. Whether you're conducting HPLC, GC, or dissolution sample analysis, our Nylon filters provide exceptional performance tailored to meet your needs.

Engineered to deliver very low extractable levels, they ensure the integrity of your samples is maintained throughout the analysis process. This remarkable combination of physical parameters makes our filters an ideal choice for even the most stringent analytical requirements, empowering you to achieve precise and reliable results every time.

Hydrophobic PTFE syringe filters have broad chemical compatibility, high pH resistance.. They are versatile filters for use with aggressive organic solvent-based solutions and are especially ideal for HPLC sample preparation. The Pure polypropylene housings are color-coded and available in smooth rim or gear rim formats.



Description	Sterility	Hydrophobicity	Pore Size	Diameter	Part No.
Glass Fiber Syringe Filters					
Glass Fiber Syringe Filters, 1.0 μm , 25 mm, Nonsterile, Pkg. 100	Nonsterile	Hydrophobic	1.0 μm	25 mm	CF-100000
Nylon Syringe Filters					
Nylon Syringe Filters, 0.22 μm , 25 mm, Nonsterile, Pkg. 100	Nonsterile	Hydrophobic	0.22 μm	25 mm	CF-100001
Nylon Syringe Filters, 0.45 μm , 25 mm, Nonsterile, Pkg. 100	Nonsterile	Hydrophobic	0.45 μm	25 mm	CF-100002
Nylon Syringe Filters, 0.22 μm , 30 mm, Nonsterile, Pkg. 100	Nonsterile	Hydrophobic	0.22 μm	30 mm	CF-100003
Nylon Syringe Filters, 0.22 μm , 25 mm, Nonsterile, Pkg. 100	Nonsterile	Hydrophobic	0.22 μm	25 mm	CF-100007
Nylon Syringe Filters, 0.22 μm , 25 mm, Sterile, Pkg. 100	Sterile	Hydrophobic	0.22 μm	25 mm	CF-100008
Nylon Syringe Filters, 0.45 μm , 25 mm, Nonsterile, Pkg. 100	Nonsterile	Hydrophobic	0.45 μm	25 mm	CF-100009
Nylon Syringe Filters, 0.45 μm , 25 mm, Sterile, Pkg. 100	Sterile	Hydrophobic	0.45 μm	25 mm	CF-100010
Nylon Syringe Filters, 0.22 μm , 30 mm, Nonsterile, Pkg. 100	Nonsterile	Hydrophobic	0.22 μm	30 mm	CF-100011
Nylon Syringe Filters, 0.22 μm , 30 mm, Sterile, Pkg. 100	Sterile	Hydrophobic	0.22 μm	30 mm	CF-100012
PTFE Syringe Filters					
PTFE Syringe Filters, 0.22 μm , 25 mm, Pkg. 100	Nonsterile	Hydrophobic	0.22 μm	25 mm	CF-100005
PTFE Syringe Filters, 0.45 μm , 25 mm, Pkg. 100	Nonsterile	Hydrophobic	0.45 μm	25 mm	CF-100006
PTFE Syringe Filters, 0.22 μm , 25 mm, Nonsterile, Pkg. 100	Nonsterile	Hydrophilic	0.22 μm	25 mm	CF-100015
PTFE Syringe Filters, 0.22 μm , 25 mm, Sterile, Pkg. 100	Sterile	Hydrophilic	0.22 μm	25 mm	CF-100016
PTFE Syringe Filters, 0.45 μm , 25 mm, Nonsterile, Pkg. 100	Nonsterile	Hydrophobic	0.45 μm	25 mm	CF-100017
PTFE Syringe Filters, 0.45 μm , 25 mm, Sterile, Pkg. 100	Sterile	Hydrophobic	0.45 μm	25 mm	CF-100018
PES Syringe Filters					
PES Syringe Filters, 0.45 μm , 25 mm, Nonsterile, Pkg. 100	Nonsterile	Hydrophobic	0.45 μm	25 mm	CF-100004
PES Syringe Filters, 0.45 μm , 25 mm, Nonsterile, Pkg. 100	Nonsterile	Hydrophobic	0.45 μm	25 mm	CF-100013
PES Syringe Filters, 0.45 μm , 25 mm, Sterile, Pkg. 100	Sterile	Hydrophobic	0.45 μm	25 mm	CF-100014



Syringes



Trajan offers a complete range of syringes with a range of capacities, termination types and needle styles to suit almost any application.

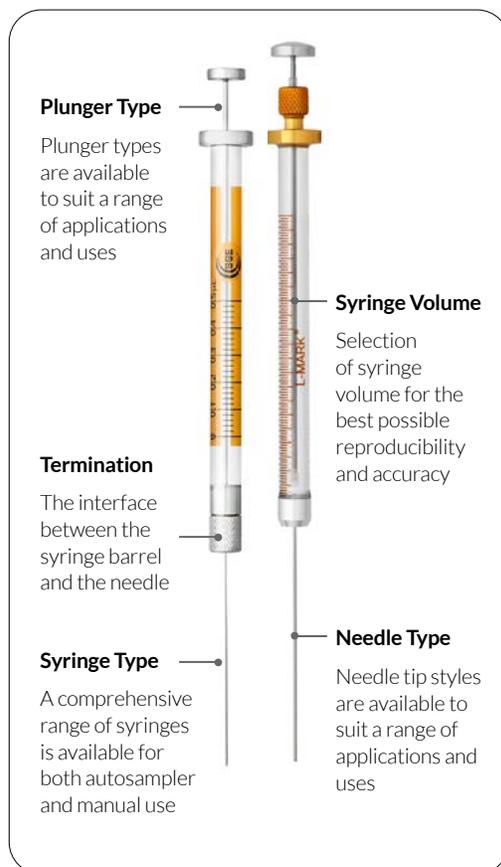
What type of syringe?

If the syringe is being used by hand, a manual syringe is selected. If the syringe is being installed in an instrument then select an autosampler syringe to suit that particular instrument. Trajan's extensive range of autosampler syringes are designed to meet all fit, form and function criteria of a specific autosampler model. They meet dimensional specifications and have accuracy $\geq \pm 1\%$.

Syringe volume

For the best possible injection reproducibility and accuracy, the smallest injectable volume from any syringe should be no less than 10% of its total capacity. For example, the smallest recommended injection volume from a 10 μL syringe would be 1 μL .

To accurately dispense less than 1 μL a NanoVolume syringe is recommended. SGE® NanoVolume syringes are available with capacities ranging from 0.5 μL to 5 μL . These syringes can inject volumes as low as 0.05 μL because the entire sample is contained within the needle. Designed with submicron tolerances, they provide precision and accuracy of $\pm 2\%$.



Trajan's extensive range of autosampler syringes meet all fit, form and function criteria of a specific autosampler model. SGE GC autosampler syringes are color coded according to syringe volume, enabling easy identification of syringes installed in instruments.

Syringe termination

Termination refers to the interface between the syringe barrel and the needle. Many syringes are supplied and used with needles attached, such as fixed needle (FN) and removable needle (RN). Other terminations are available where the needle is not supplied - Luer Lock (LL), Luer Tip (LT), and threaded terminations.

Color	Syringe volumes	
Light Orange	0.5 µL	500 µL
Yellow	1 µL	
Lime	5 µL	
Dark Orange		10 µL
Green		25 µL
Purple		50 µL
Aqua		100 µL
Gray		250 µL

Termination Type	Details	Code
Fixed Needle 	<ul style="list-style-type: none"> Recommended for autosampler use where the probability of needle bending is minimal. 	F
Removable Needle 	<ul style="list-style-type: none"> Allows for the needle to be changed if damaged or for different applications. 	R
Luer Lock 	<ul style="list-style-type: none"> Fixed Luer Lock syringes have a Luer fitting that is permanently attached to the barrel. 	LL
Luer Tip 	<ul style="list-style-type: none"> Removable needle versions have a Luer fitting that screws onto the barrel with the Luer Tip inserted. 	LT
Thread 	<ul style="list-style-type: none"> Screw into a valve or other device, required for some LC autosamplers. Various threaded terminations are available. 	N/A

Needle Selection

Needle Tip Style	Application	Features/Applications	Code
Bevel 	Manual GC	<ul style="list-style-type: none"> A 20° tip which is typically used for manual injections. Designed for optimum septa penetration and prevention of septa coring. 	BV
Cone 	GC Autosampler	<ul style="list-style-type: none"> Designed to withstand multi-injection requirements and improve septa lifetime when used with a GC autosampler. The needle passes through the septa during use and does not cause a slit. 	C
Dual gauge 	On-Column Injection - Autosampler	<ul style="list-style-type: none"> Narrow gauge at the tip is suitable for large bore on-column injection. The wider gauge part of the needle gives increased strength to the needle for autosampler use 	N/A
Square 	LC	<ul style="list-style-type: none"> Used for LC valve injection and have a 90° square tip with rounded and polished edges. This eliminates damage to the valve's rotor seal and stator face. 	LC
Dome 	With Pre-Drilled Septa	<ul style="list-style-type: none"> The rounded and polished tip make this needle ideal for use with pre-drilled septa. 	D
Side hole 	Large Volume Injection (LVI)	<ul style="list-style-type: none"> Samples are filled and dispensed through the side hole eliminating septa plugging of the needle. Ideal for large volume gas injections and headspace. 	H

Plunger Selection

Termination Type		
 Metal Plunger	<ul style="list-style-type: none"> Stainless steel plunger individually fitted to its own syringe barrel. Plunger is not replaceable nor interchangeable. 	<ul style="list-style-type: none"> Industry-standard syringe for chromatography applications. For use when injection volume is greater than 1 μL.
 PTFE and PE Tipped Plunger	<ul style="list-style-type: none"> Plunger is replaceable. Easy to remove and clean to extend plunger lifetime. Capacities: 10 μL to 100 μL. 	<ul style="list-style-type: none"> Liquid and gas samples. Headspace applications. Ideal for samples with high levels of contaminants.
 Metal Plunger for Nanovolume Syringes (Plunger-In-Needle)	<ul style="list-style-type: none"> Plunger extends into the needle tip. Sample is contained only in the needle i.e. no glass contact. Capacities: 0.5 μL, 1 μL and 5 μL. 	<ul style="list-style-type: none"> Dispensing very small liquid volumes (less than 1 μL).
 Superflex™ Flexible Plunger	<ul style="list-style-type: none"> Made from titanium/nickel alloy. Virtually indestructible plunger. Capacities: 5 μL and 10 μL. 	<ul style="list-style-type: none"> Chromatography applications requiring greater plunger durability.
 Plunger Protection	<ul style="list-style-type: none"> Extended protection from the top of the syringe back flange to help prevent plunger bending during injection and improve plunger stroke. Capacities: 5 μL and 10 μL. 	<ul style="list-style-type: none"> General use for both experienced and inexperienced users.
 Guided Plunger	<ul style="list-style-type: none"> Extended barrel guides plunger during injection. Robust and rugged. Capacities: 5 μL and 10 μL. 	Industrial applications.

Syringe Care and Maintenance

Regular maintenance of a syringe is important for ensuring long life and robust performance.

Syringes should be routinely checked for damage to the barrel and needle. Look for fine cracks in the barrel. Needles should also be checked for burrs and rough surfaces which may cause tearing and excessive wear on the septa.

Needle Care: Unblocking Needles

1. Remove the plunger and fill the syringe with solvent using another syringe.
2. Insert plunger and gently push solvent through the needle. Never force the plunger as too much pressure may crack the syringe barrel.

The syringe needle cleaning kits contain a range of stylet wires for needle cleaning, tweezers, and a surfactant material for barrel cleaning.

Syringe Cleaning

1. Flush the syringe thoroughly with suitable solvents (such as methanol, methylene chloride, acetonitrile and acetone). Depending on the type of contaminant, this may have to be done up to 20 times.
2. Rinse with distilled water.
3. Flush with acetone.
4. Remove plunger and wipe with tissue.
5. Refit plunger and flush with acetone.
6. Allow syringe to dry.

Cleaning steps for NanoVolume syringes can be found in the manual supplied with the syringe.

Syringe temperature specifications

Heating will remove semi-volatile material from the syringe. Before heating or autoclaving, remove the plunger.

Syringe Type	Maximum Temperature
Fixed Needle And Fixed Luer	70 °C
Removable Needle and Removable Luer	100 °C
Nanovolume	70 °C
Headspace	150 °C

Rapid changes in temperature can lead to damage of the glass barrel. Ensure heating and cooling of a syringe is a gradual process.



Syringe Use

- Always inspect the syringe before use. Check the barrel for cracks and the needle tip for burrs.
- To eliminate carryover between samples, flush the syringe with solvent 5-20 times, remembering to discard at least the first 2-3 washes.
- To eliminate air bubbles from the barrel, repeatedly draw and expel the sample while keeping the needle tip immersed in the solution. Bubbles can also be removed by turning the barrel upright while expelling some of the sample. If bubbles persist, slow the aspiration speed.
- To make an injection, overfill the syringe then press the plunger until the correct volume is reached. Draw the plunger back slightly, wipe the needle tip with a lint-free tissue, then make the injection. For improved precision, a repeating adaptor may be used to pre-set the volume.
- Before storage always flush the syringe with solvent and air dry.

Plunger Care

Termination Type	Details
Metal	<ul style="list-style-type: none"> • Never force the plunger. • Do not pump the plunger when the needle is blocked as the high pressure generated could crack the barrel. • Replacement plungers are not available. Plungers are individually fitted to the barrels to achieve a perfect seal. • Avoid unnecessary movement of plungers when the syringe is dry.
Metal for NanoVolume Syringes	<ul style="list-style-type: none"> • Always loosen needle cover nut before removing or inserting plunger. • Wipe plunger with a lint-free tissue before replacing into the syringe.
PTFE and Polyethylene (PE) Tipped	<ul style="list-style-type: none"> • Avoid unnecessary movement of plungers when the syringe is dry. • Replacement PTFE and PE tipped plungers are available for many syringes.

Syringe Troubleshooting

Termination Type	Cause	Solution
Blocked Needles	Improper cleaning.	Refer to syringe cleaning tips (page 3).
	Inappropriate needle selection.	Refer to the needle selection guide (page 2).
Seized Plungers	Poor dispensing technique	Ensure correct injection technique is being followed.
	Build up of contaminants in samples	Refer to syringe cleaning tips (page 3).
	Syringe installed in autosampler incorrectly.	Ensure the syringe is installed correctly.
Poor Reproducibility	Incorrect syringe selection.	Refer to the selection guide (page 2), the dispensed volume should be greater than 10% of the entire syringe capacity.
	Operator technique.	Check that each sample is being injected in the same way.
	Incorrect instrument set up.	Check if any changes have been, or need to be made to your instrument or set up (septa, injection port liner etc.).
Air Bubbles	Incorrect instrument set up.	Check if any changes have been, or need to be made to your instrument or set up (septa, injection port liner etc.).
Leakages	Incorrectly fitted needle.	Remove and refit the needle. Check the seal is in place and undamaged.
	No seal at plunger tip – plunger tip damaged or worn due to use or using syringe dry.	Replace plunger assembly if using a PTFE or PE tipped plunger.
Ghost Peaks	Contaminated needle.	Between samples flush the syringe with solvent 5-20 times (discard at least the first 2-3 washes).

Luer Lock and Luer Tip



Luer Lock and Luer Tip terminations offer universal connections for a number of different applications. This allows different needles or accessories to be connected quickly for workflows in analytical settings. This termination type can be used with a valve to enable samples to be easily stored and transported prior to analyses, from the field to the laboratory.

Specifications			
Accuracy And Reproducibility	Operator Dependent	Scale Length	50 µL to 25 mL = 60 mm 50 mL = 84.2 mm 100 mL = 104 mm
Borosilicate Glass Barrel Outer Diameter (OD)	50 µL to 500 µL = 8 mm 1 mL = 9 mm 2.5 mL = 11 mm 5 mL = 14 mm 10 mL = 18 mm 25 mL = 27 mm 50 mL = 32.8 mm 100 mL = 40.8 mm	Thread in Plunger Stem	6-32 UNC
		International Standards Traceability	✓

eVol syringes

eVol syringes are designed for use with the eVol xr digital analytical syringe.

Accuracy of eVol syringes					
Syringe volume	1 mL	500 µL	100 µL	50 µL	5 µL
At 100% (uncalibrated)*	±0.7%	±0.7%	±0.7%	±1.0%	±1.0%
At 100% (calibrated)**	±0.2%	±0.2%	±0.2%	±0.2%	±0.2%
At 10% (calibrated)***	±0.5%	±0.5%	±0.5%	±0.5%	±1.0%

*Calibration factor of 1.0000 applied to handle.

**Syringe and handle calibrated at full volume.

***Syringe and handle calibrated at 10% of capacity. Accuracy based on the 10% dispensed volume closest to zero position.

Note: For best results when performing repeat dispense (one aspiration followed by multiple dispense steps) use a calibration factor of 1.0000.

Precision of eVol syringes

Accuracy of eVol syringes					
Syringe volume	1 mL	500 µL	100 µL	50 µL	5 µL
At 100%	±0.3%	±0.3%	±0.4%	±0.4%	±0.5%
At 10%	±0.6%	±0.6%	±0.7%	±0.8%	±1.0%

MEPS®

MEPS® is microextraction by packed sorbent, the miniaturization of conventional SPE (solid phase extraction) packed bed devices from milliliter bed volumes to microliter volumes.

The MEPS approach to sample preparation is suitable for reversed phase, normal phase, mixed mode or ion exchange chemistries.

MEPS advantages over conventional SPE:

Less sample required giving you greater flexibility when you have small sample quantities.

- Less solvent used means less solvent waste and ultimately reduced expense.
- Faster preparation time, reducing from hours to minutes for improved laboratory workflow.

MEPS incorporates packed phase in a micro-cartridge or BIN (barrel insert and needle) which is then integrated into an SGE analytical syringe to make miniaturized SPE possible. With MEPS, the sample processing, extraction and injection steps are performed using the same syringe.

Configuration for MEPS

MEPS BINs are available for use with eVol MEPS syringes, with a range of packing material phases.

- MEPS BINs can be used with 50 µL, 100 µL and 500 µL eVol MEPS syringes.
- LC needles are 55.5 mm in length, 22 gauge and LC tipped.
- GC needles are 55.5 mm in length, 23 gauge and cone tipped.

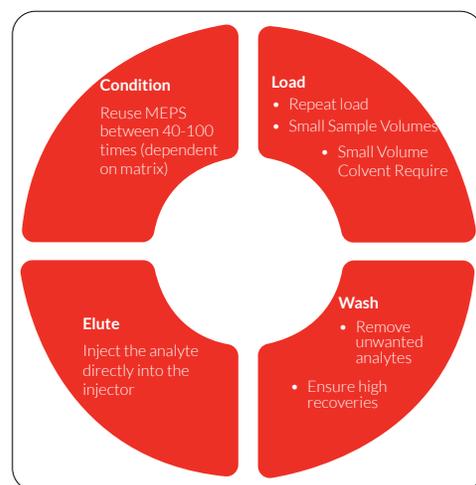
NanoVolume

With the ability to inject down to 50 nL with high precision and accuracy, SGE® NanoVolume syringes are perfect for NanoVolume capillary chromatography injection as well as making accurate standards that require small volumes.

The sample is only drawn into the needle, not the syringe barrel. When the plunger is depressed, the sample is completely dispensed by the NanoVolume plunger that extends to the tip of the needle.

Features and Benefits

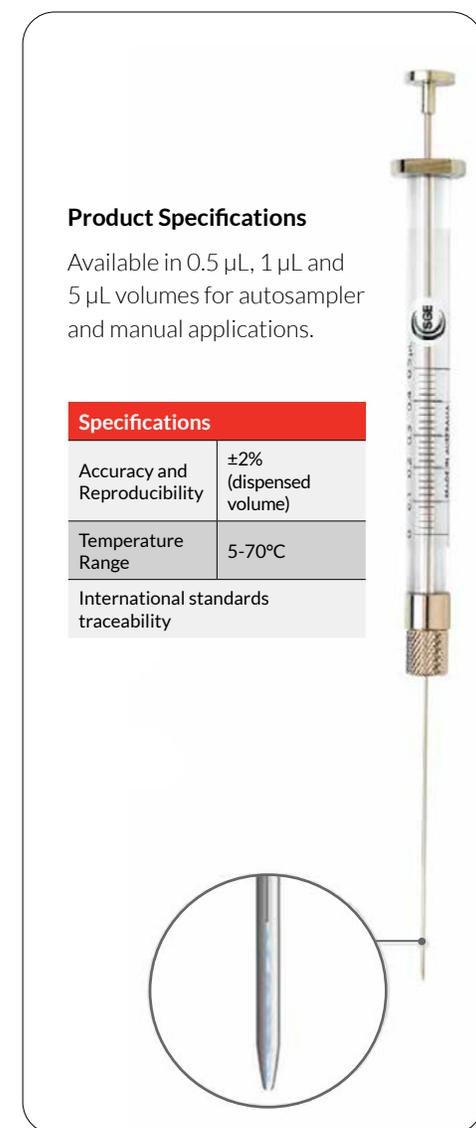
- Plunger extends into the needle tip.
- Sample is contained only in the needle, i.e. no glass contact.
- Ideal for dispensing very small liquid volumes. Virtually zero dead volume and carry over between injections. prevent plunger bending during injection.



Product Specifications

Available in 0.5 µL, 1 µL and 5 µL volumes for autosampler and manual applications.

Specifications	
Accuracy and Reproducibility	±2% (dispensed volume)
Temperature Range	5-70°C
International standards traceability	



Recommended Applications

Recommended for use when sample volume is less than 1 µL.

Guided Plunger

Guided plunger syringes are the most rugged syringe available, making them perfect for industrial environments.

Features and Benefits

- Extended barrel guides plunger during injection.
- Robust and rugged.

Recommended Applications

Ideal for student and industrial use.

Product Specifications

Available in 5 μL to 10 μL capacities.

Manual

The comprehensive range of SGE® syringes are designed and tested to meet critical specifications. We combine precision manufacturing of components and meticulous assembly, to produce syringes of the highest quality.

Features and Benefits

- Minimal carryover, adhesive contamination and sample interaction.
- Gas tight syringes with PTFE plunger tip for optimum sealing.
- Resistant to wide range of solvents.
- Plunger protection on 5 μL and 10 μL syringes helps prevent plunger bending during injection.
- Syringe valves allow fluid to be stored in the syringe without contamination.

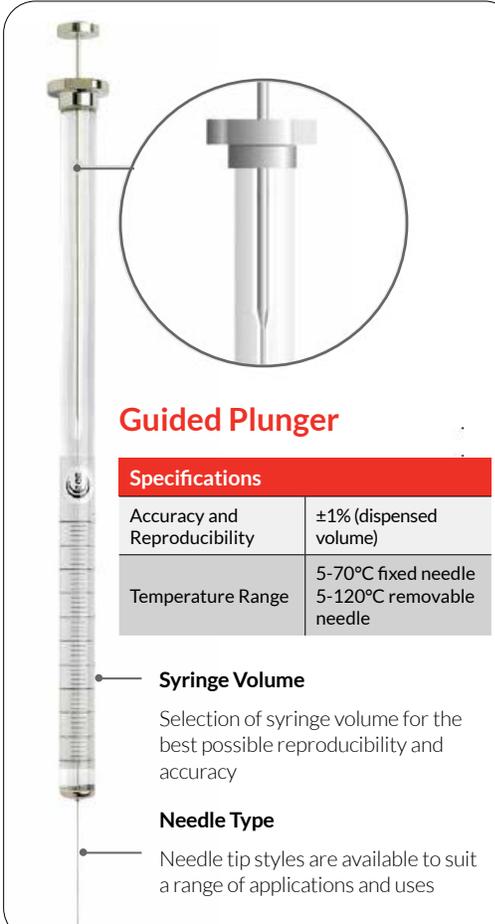
Recommended Applications

- Manual GC and LC sample injection
- Liquid dispensing

Product Specifications

- Fixed and removable needle
- Luer Lock and Luer Tip
- Syringes with valves

Specifications	
Borosilicate glass barrel outer diameter	5 μL to 10 μL = 6.5 mm 25 μL to 500 μL = 8 mm 1 mL = 9 mm 2.5 mL = 11 mm 5 mL = 14 mm 10 mL = 18 mm 25 mL = 27 mm 50 mL = 32.8 mm 100 mL = 40.8 mm
Scale length	5 μL to 10 μL = 54.1 mm 25 μL to 25 mL = 60 mm 50 mL = 84.2 mm 100 mL = 104 mm



Guided Plunger

Specifications	
Accuracy and Reproducibility	$\pm 1\%$ (dispensed volume)
Temperature Range	5-70°C fixed needle 5-120°C removable needle

Syringe Volume
Selection of syringe volume for the best possible reproducibility and accuracy

Needle Type
Needle tip styles are available to suit a range of applications and uses



Manual syringe **Syringe with valves** **Gas tight syringe**

GC autosampler

The comprehensive range of SGE® GC autosampler syringes are designed and tested to meet critical autosampler specifications.

Features and Benefits

Unique plunger design minimizes bending and seizing, and the cone tip needle point style has been developed specifically to withstand multiple fast septum injections.

Recommended Applications

Metal plungers are individually fitted to the syringe glass barrel for a perfect 'feel', optimized life with minimal carryover, liquid tight seal between the barrel and plunger and excellent performance.

PTFE tipped replaceable plunger syringes reduce the risk of plunger seizing when working with samples that are contaminated with particulate matter, reducing instrument downtime, and minimizing the risk of instrument shutdown during the processing of large batches of samples.

Product specifications Wide range of fixed needle and removable needle options available for Agilent, CTC Analytics, PerkinElmer, Scion Instruments, Shimadzu, and Thermo Scientific autosamplers. PTFE tipped replaceable plunger versions are available for use with gas and headspace samples.

GC autosampler

In addition, multi-packs are available for most popular autosamplers.



Specifications	
For Nano Volume Syringes	
Accuracy and Reproducibility	±2% (Dispensed Volume)
Temperature Range	5-70 °C
For Fixed Needle Syringes	
Accuracy and Reproducibility	±1% (Dispensed Volume)
Temperature Range	5-70 °C
For Removable Needle Syringes	
Accuracy and Reproducibility ±1% (Dispensed Volume)	±1% (Dispensed Volume)
Temperature Range	5-100 °C

Syringe Volume

Selection of syringe volume for the best possible reproducibility and accuracy

Needle Type

Needle tip styles are available to suit a range of applications and uses

Manual Application without Repeating Injector

NanoVolume Syringes

Description	Part No.
0.5 µL NanoVolume Syringe with 5 cm 0.63 mm OD Cone Tipped Needle	CY-100000
0.5 µL NanoVolume Syringe with 5 cm 0.63 mm OD Bevel Tipped Needle	CY-100001
0.5 µL NanoVolume Syringe with 7 cm 0.63 mm OD Cone Tipped Needle	CY-100002
0.5 µL NanoVolume Syringe with 7 cm 0.63 mm OD Bevel Tipped Needle	CY-100003
1.0 µL NanoVolume Syringe with 5 cm 0.63 mm OD Cone Tipped Needle	CY-100010
1.0 µL NanoVolume Syringe with 5 cm 0.63 mm OD Bevel Tipped Needle	CY-100011
1.0 µL NanoVolume Syringe with 7 cm 0.63 mm OD Cone Tipped Needle	CY-100012
1.0 µL NanoVolume Syringe with 7 cm 0.63 mm OD Bevel Tipped Needle	CY-100013
1.0 µL NanoVolume Syringe with 7 cm 0.47 mm OD Cone Tipped Needle	CY-100014
5.0 µL NanoVolume Syringe with 5 cm 0.63 mm OD Cone Tipped Needle	CY-100015
5.0 µL NanoVolume Syringe with 7 cm 0.63 mm OD Cone Tipped Needle	CY-100016
5.0 µL NanoVolume Syringe with 7 cm 0.63 mm OD Bevel Tipped Needle	CY-100017
Replacement Kit for Plunger-in-needle Syringe, NP1B-5C, 1 µL, L: 50 mm, Cone	CY-100018
Replacement Kit for Plunger-in-needle Syringe, NP1B-7C, 1 µL, L: 70 mm, Cone	CY-100019
Replacement Kit for Plunger-in-needle Syringe, NP0.5B-7C, 0,5 µL, 23 G, L: 70 mm, Cone	CY-100026
Replacement Kit for Plunger-in-needle Syringe, NP0.5B-S-0.63, 0,5 µL, 23 G, L: 42 mm	CY-100027
Replacement Kel-F Luer Cone, Pkg. 2	CY-100024

Manual Application without Repeating Injector

Agilent 7693A, 7683, 7673, 7650A and 6850 ALS

Description	Part No.
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0.5 µL NanoVolume Agilent Syringe with 4.2 cm 0.47 mm OD Cone Tipped Needle	CY-100004
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0.5 µL NanoVolume Agilent Syringe with 4.2 cm 0.63 mm OD Cone Tipped Needle	CY-100005
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Shimadzu AOC-20i, AOC-20, AOC-17 and AOC-14

0.5 µL NanoVolume Shimadzu Syringe with 4.2 cm 0.63 mm OD Cone Tipped Needle	CY-100006
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PerkinElmer Clarus 690, 590, 600, 500 and AutoSystem

0.5 µL NanoVolume PerkinElmer Syringe with 7 cm 0.47 mm OD Cone Tipped Needle	CY-100007
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0.5 µL NanoVolume PerkinElmer Syringe with 7 cm 0.63 mm OD Cone Tipped Needle	CY-100008
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Thermo Scientific AI/AS 1610, AI/AS 1310 and TriPlus

0.5 µL NanoVolume CTC Analytics and Thermo Syringe with 5 cm 0.63 mm OD Cone Tipped Needle	CY-100009
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Syringe Valve Accessories

Push-pull Valve with Replacement 5 cm 0.63 mm OD Cone Tip Needle for 25 µL to 2.5 mL Rem. Needle Syringes	CY-100020
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Push-button Valve with Luer Lock Termination for 5 mL to 2 L Rem. Luer Lock or Rem. Needle Syringes	CY-100021
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Push-button Valve with Luer Lock Termination for any Luer Lock and Luer Tip Syringes	CY-100022
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Syringe Racks

6 Syringe Rack for 8 mm Barrel OD Syringes, Holds 6 Standard SGE Syringes with Barrel OD up to 8 mm	CY-100023
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Syringe Repeating Adaptor (RAX)

Syringe Repeating Adaptor (RAX) with Assembly Tool	CY-100025
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Guided Plunger Syringes

5 µL Fixed Needle Guided Plunger Syringe with 5 cm 0.47 mm OD Bevel Tipped Needle	CY-100028
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GC Autosampler Syringes

Agilent 7693A, 7683, 7673, 7650A and 6850ALS

5 µL Fixed Needle Agilent Syringe with 4.2 cm 0.63/0.47 mm OD Cone Tipped Dual Gauge Needle	CY-100029
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5 µL Fixed Needle Agilent Syringe with 4.2 cm 0.63/0.47 mm OD Cone Tipped Dual Gauge Needle, Pkg. 6	CY-100030
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10 µL Fixed Needle Agilent Syringe with 4.2 cm 0.63 mm OD Cone Tipped Needle	CY-100034
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10 µL Fixed Needle Agilent Syringe with 4.2 cm 0.63 mm OD Cone Tipped Needle, Pkg. 6	CY-100035
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10 µL Fixed Needle Agilent Syringe with 4.2 cm 0.63/0.47 mm OD Cone Tipped Dual Gauge Needle	CY-100036
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10 µL Fixed Needle Agilent Syringe with 4.2 cm 0.63/0.47 mm OD Cone Tipped Dual Gauge Needle, Pkg. 6	CY-100037
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CTC Analytics PAL3 RTC, Shimadzu AOC-6000, Thermo Scientific TriPlus RSH and Agilent PAL3

10 µL Fixed Needle Syringe with 5.7 cm 0.47 mm OD Cone Tipped Needle	CY-100038
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PerkinElmer Clarus 690, 590, 600, 500 and AutoSystem

5 µL Fixed Needle PerkinElmer Syringe with 7 cm 0.63 mm OD Cone Tipped Needle	CY-100031
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Shimadzu AOC-20i, AOC-20, AOC-17 and AOC-14

5 µL Fixed Needle Shimadzu Syringe with 4.2 cm 0.63 mm OD Cone Tipped Needle	CY-100033
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10 µL Removable Needle Shimadzu Syringe with 4.2 cm 0.63 mm OD Cone Tipped Needle	CY-100039
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Manual Application without Repeating Injector

Thermo Scientific AI/AS 1610, AI/AS 1310 and TriPlus

Description	Part No.
5 µL Fixed Needle CTC Analytics and Thermo Syringe with 5 cm 0.47 mm OD Cone Tipped Needle	CY-100032
Other Autosampler Syringes	
Autosampler-Syringe, 10F-VA8400/BT-5/0.63C, 10 µL, Needle: Fixed, 23 G, L: 50 mm, Tip: Coned	CY-100040
Autosampler-Syringe, 10uL, Needle: Exchangeable, L: 50 mm, 26 G, Tip: Coned	CY-100041
Autosampler-Syringe, 5 µL, Needle: Fixed, 23 G, L: 70 mm, Tip: Coned, Gas Tight, GT-plunger	CY-100066
Autosampler-Syringe, Needle: Fixed, 23-26 G, L: 42 mm, tip: Coned, Gas Tight, GT-plunger, Pkg. 6	CY-100068
Autosampler-Syringe, 10 µL Needle: Exchangeable, 23 G, L: 42 mm, tip: Coned, Gas Tight, GT-plunger	CY-100069
Autosampler-Syringe, 25 µL DIAMOND MS, Needle: Exchangeable, Gas Tight, GT-plunger	CY-100070
Autosampler-Syringe, 25 µL, Needle: Fixed, 23 G, L: 50 mm, Tip: Coned, Gas Tight, GT-plunger	CY-100071
Autosampler-Syringe, 25 µL, Needle: Exchangeable, 23 G, L: 50 mm, Tip: Coned, Gas Tight, GT-plunger	CY-100072
Autosampler-Syringe, 100 µL, Needle: Fixed, 23 G, L: 50 mm, Tip: Coned, Gas Tight, GT-plunger	CY-100076
10 µL Fixed Needle Syringe with 5 cm 0.5 mm OD Cone Tipped Needle	CY-100042
10 µL Fixed Needle CTC Analytics and Thermo Syringe with 5 cm 0.47 mm OD Cone Tipped Needle	CY-100043
10 µL Fixed Needle CTC Analytics and Thermo Syringe with 5 cm 0.63 mm OD Cone Tipped Needle	CY-100044
10 µL Removable Needle CTC Analytics and Thermo Syringe with 5 cm 0.47 mm OD Cone Tipped Needle	CY-100045
10 µL Fixed Needle Syringe with 5 cm 0.47 mm OD Cone Tipped Needle, Pkg. 6	CY-100046
100 µL Fixed Needle Syringe with 5.1 cm 0.72 mm OD LC Tipped Needle	CY-100047
Plunger Syringes	
Plunger P5F-PE-GT, 5 µL, Gas Tight, GT-plunger, Pkg. 2	CY-100048
Plunger P10R-HP-GT, 10 µL, Gas Tight, GT-plunger, Pkg. 2	CY-100049
Plunger P25-GT, 25 µL, Gas Tight, GT-plunger	CY-100050
Plunger P25F-C/T-GT, 25 µL, Gas Tight, GT-plunger	CY-100051
Plunger P100-GT, 100 µL, Gas Tight, GT-plunger	CY-100052
Plunger P5MD-GT, 5 mL, Gas Tight, GT-plunger	CY-100053
Plunger P5MDF-GT, 5 mL, Gas Tight, GT-plunger	CY-100054
Plunger P10MD-GT, 10 mL, Gas Tight, GT-plunger	CY-100055
Plunger P10MDF-LL, 10 mL, Gas Tight, GT-plunger	CY-100056
Plunger P25-RSH-MS1, 25 µL	CY-100057
Replacement Needles	
Luer Lock 5 cm 0.63 mm OD Bevel Tipped Needle, Pkg. 5	CY-100058
Luer Lock 5 cm 0.63 mm OD Side Hole Dome Tipped Needle, Pkg. 2	CY-100059
Luer Lock 7 cm 0.63 mm OD Bevel Tipped Needle, Pkg. 5	CY-100060
Luer Lock 11.5 cm 0.63 mm OD Bevel Tipped Needle, Pkg. 5	CY-100061
Luer Lock 5 cm 1.07 mm OD Bevel Tipped Needle, Pkg. 5	CY-100062
Luer Lock 5 cm 1.07 mm OD Side Hole Dome Tipped Needle, Pkg. 2	CY-100063
Luer Lock 5 cm 1.27 mm OD Bevel Tipped Needle, Pkg. 5	CY-100064
Luer Lock 5.1 cm 0.72 mm OD LC Tipped Needle, Pkg. 2	CY-100065

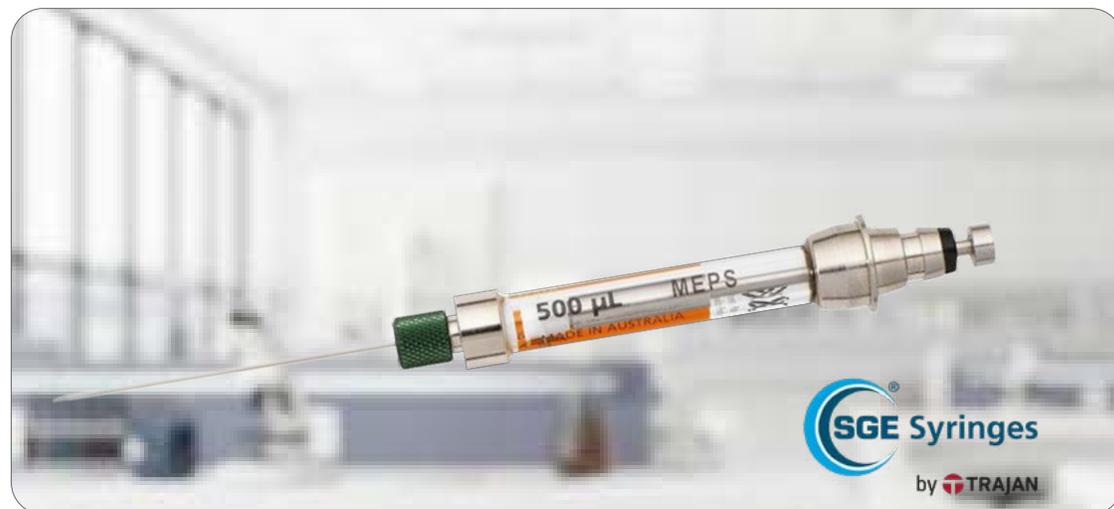
Manual Application without Repeating Injector

Manual Syringes

Fixed needle, gas tight syringes

Description	Part No.
Syringe, 10F-GT, 10 μ L, Needle: Fixed, 26 G, L: 50 mm, Tip: Bevel, Gas Tight, GT-plunger	CY-100067
Syringe, 50F-GT, 50 μ L, Needle: Fixed, 25 G, L: 50 mm, Tip: Bevel, Gas Tight, GT-plunger	CY-100073
Syringe, 100F-GT, 100 μ L, Needle: Fixed, 25 G, L: 50 mm, Tip: Bevel, Gas Tight, GT-plunger	CY-100074
Syringe, 100R-GT, 100 μ L, Needle: Exchangeable, 25 G, L: 50 mm, Tip: Bevel, Gas Tight, GT-plunger	CY-100075
Syringe, 250F-GT, 250 μ L, Needle: Fixed, 25 G, L: 50 mm, tip: bevel, Gas Tight, GT-plunger	CY-100077
Syringe, 1MDF-LL-GT, 1 mL, Fixed Luer Lock, Gas Tight, GT-plunger	CY-100078
Syringe, 1MR-GT, 1 mL, Needle: Exchangeable, 23 G, L: 50 mm, Tip: Bevel, Gas Tight, GT-plunger	CY-100079
Syringe, 5MDR-LL-GT, 5 mL, Exchangeable Luer Lock, Gas Tight, GT-plunger	CY-100080
Syringe, 5MDF-LL-GT, 5 mL, Fixed Luer Lock, Gas Tight, GT-plunger	CY-100081
Syringe with Valve, 5MDR-VLLMA-GT, 5 mL, Needle: Exchangeable, Gas Tight, GT-plunger	CY-100082
Syringe, 10MDR-LL-GT, 10 mL, Exchangeable Luer Lock, Gas Tight, GT-plunger	CY-100083
Syringe with Valve, 10MDR-VLLMA-GT, 10 mL, Needle: Exchangeable, Gas Tight, GT-plunger	CY-100084
Syringe, 50MR-LL-GT, 50 mL, Exchangeable Luer Lock, Gas Tight, GT-plunger	CY-100085





MEPS® Syringes

MEPS® is Micro Extraction by Packed Sorbent, the miniaturization of conventional SPE packed bed devices from milliliter bed volumes to microliter volumes. The MEPS approach to sample preparation is suitable for reversed phases, normal phases, mixed mode or ion exchange chemistries.

The MEPS Barrel Insert and Needle (BIN) assembly contains the stationary phase, and is built into the syringe needle. Using MEPS requires both a suitable syringe and a MEPS BIN.

With MEPS, the sample processing, extraction and injection steps are performed using the same syringe.

Features and Benefits

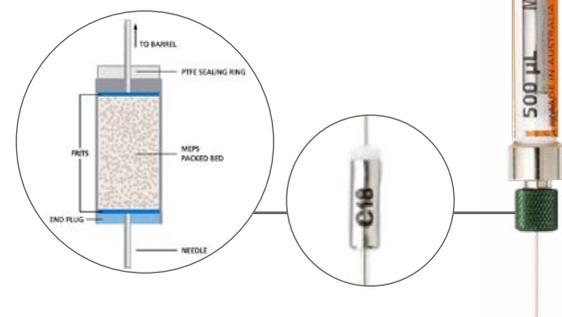
- MEPS syringes are compatible for use with MEPS BINs.
- Save hours in sample preparation.
- Reduce solvent usage and sample volume.

Recommended Applications

SPE method development, and/or proofing before transition to fully automated platforms. Processing small sample batches, or urgent samples.

Product Specifications

- 100 µL and 250 µL removable needle MEPS syringes available to suit a range of autosamplers or can be used manually.
- MEPS syringes are easily identifiable with MEPS printed on the barrel, and a green removable nut.
- MEPS BINs are available separately.



MEPS Syringes and Needles

Description	Part No.
500 µL eVol MEPS Syringe with GT Plunger	CY-100094
250 µL Thermo MEPS Syringe	CY-100095
50 µL eVol MEPS Syringe with GT Plunger	CY-100096
MEPS-SDVB-XCHANGE, BIN-needle for LC, Phase: SDVB, 22 Gauge, 0,72 OD for eVol MEPS syringes, Pkg. 5	CY-100088
MEPS-APS-XCHANGE, BIN-needle for LC, Phase: APS, 22 Gauge, 0,72 OD for eVol MEPS syringes, Pkg. 5	CY-100087
MEPS-C18-XCHANGE, BIN-needle for LC, Phase: C18, 22 Gauge, 0,72 OD for eVol MEPS syringes, Pkg. 5	CY-100086

Gas Filters and Traps



Super Clean™ Gas Filters

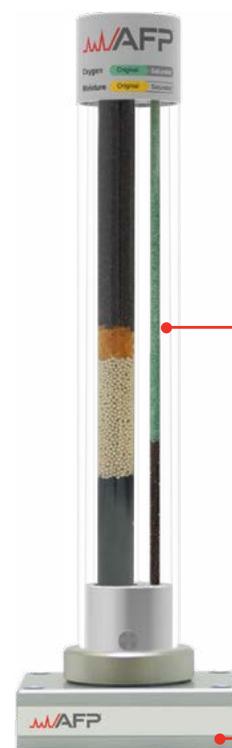
Cartridge systems make changing gas filters quick and easy. A base plate allows cartridges to be exchanged without introducing oxygen. Spring-loaded check valves seal when a filter is removed and open only when a new filter has been locked in place. There is no longer a need for loosening and tightening fittings every time a trap is changed and your system will not become contaminated during the process.

- High Capacity
- High-purity output ensures 99.9999% Pure gas
- "Quick connect" fittings for easy, leak-tight cartridge changes
- Glass inside to prevent diffusion, plastic outside for safety
- Easy to read indicators

Why Gas Purity is Important

Carrier gas should contain less than 1 ppm of oxygen, moisture, or other trace contaminants, to prevent column degradation, increase column lifetime, and decrease stationary phase bleed. The expense of using high-purity gases in combination with carrier gas line purifiers will be offset by longer column lifetime and less GC maintenance.

Gas Filter System Components



Wall Mount Bracket Set

Optional wall mounting brackets to mount a Base plate on a wall.

Filter Cartridge

The filter cartridges are made of glass to prevent diffusion, and protected by a plastic housing for safety.

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 is filter is installed.

Contaminants cause ghost peaks to appear during temperature programming and degrade the validity of analytical data. Make-up gas also should be contaminant-free, or baseline fluctuations and excessive detector noise can occur; detector gases should be free of water and hydrocarbons, or excessive baseline noise can result. Gas purifiers remove these contaminants from gas sources, thereby improving system performance.

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.

Usable for	Benefit
GC/MS	Higher data accuracy and less maintenance
GC/ECD	Greater sensitivity
GC/TCD	Greater sensitivity and less maintenance

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	3.5 g
O ₂	75 mL
HC	4 g (as <i>n</i> -butane)
Usable For	Inert carrier gas, He, H ₂ , N ₂ , AR

Specifications	
Outlet Gas Quality (%)	> 99.9999
Maximum Pressure	15 bar (217 psi)
Maximum Flow	7 L/min.
Dimensions	24 cm x Ø 4.4 cm
Weight	0.26 Kg
Estimated Lifetime	> 2 years

Accessories



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.

Usable for

All base plates



O-Ring Replacement Set

A set of 10 + 10 replacement O-rings for replacing the O-rings on the in- and outlet valves on a base plate.

Usable for

All base plates



Universal Ring Nut

Universal ring nut to mount a filter or flush-cap on a base plate.

Usable for

All base plates



Wall-Mount Bracket Set

Wall mounting brackets to mount a base plate on a wall.

Usable for

All base plates

Base Plate

Fitting Type

1/8" Brass

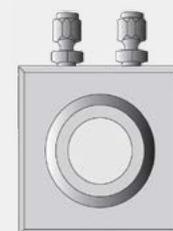
1/4" Brass

1/8" SS

1/4" SS



1 Position Base Plate: Single position base plate





Description	Part No.
Triple Filters (Oxygen/Moisture/Hydrocarbon)	
AFP Triple (Oxygen/Moisture/Hydrocarbon) Replacement Filter	CG-100001
AFP Triple (Oxygen/Moisture/Hydrocarbon) Filter Kit - 1/8" Brass <i>Includes (1) 1 position base plate with 1/8" Brass inlet/outlet fittings and (1) Oxygen/Moisture/Hydrocarbon Trap</i>	CG-100002
AFP Triple (Oxygen/Moisture/Hydrocarbon) Filter Kit - 1/4" Brass <i>Includes (1) 1 position base plate with 1/4" Brass inlet/outlet fittings and (1) Oxygen/Moisture/Hydrocarbon Trap</i>	CG-100003
AFP Triple (Oxygen/Moisture/Hydrocarbon) Filter Kit - 1/8" Stainless Steel <i>Includes (1) 1 position base plate with 1/8" Stainless Steel inlet/outlet fittings and (1) Oxygen/Moisture/Hydrocarbon Trap</i>	CG-100004
AFP Triple (Oxygen/Moisture/Hydrocarbon) Filter Kit - 1/4" Stainless Steel <i>Includes (1) 1 position base plate with 1/4" Stainless Steel inlet/outlet fittings and (1) Oxygen/Moisture/Hydrocarbon Trap</i>	CG-100005
Filter Base Plates and Replacement Parts	
AFP Base Plate 1 Position - 1/8" Brass	CG-100008
AFP Base Plate 1 Position - 1/4" Brass	CG-100009
AFP Base Plate 1 Position - 1/8" Stainless Steel	CG-100010
AFP Base Plate 1 Position - 1/4" Stainless Steel	CG-100011
Flush Cap Replacement Set, Pkg. 2 <i>Includes (2) flush caps and (2) universal ring nuts</i>	CG-100017
Universal Ring Nut	CG-100018
Base Plate O-ring Replacement Set, Pkg. 20 <i>A set of 10 + 10 replacement O-rings for replacing the O-rings</i>	CG-100019
Wall-mounting Bracket Set	CG-100020
Click-On Inline Filter Kits (Stainless Steel)	
AFP Click-On Hydrocarbon Replacement Trap	CG-100044
AFP Click-On Triple (Oxygen/Moisture/Hydrocarbon) Replacement Trap	CG-100045
AFP Click On Triple (Oxygen/Moisture/Hydrocarbon) Trap Kit - 1/8" Brass <i>Includes 1 trap and 2 connectors</i>	CG-100041
AFP Click On Triple (Oxygen/Moisture/Hydrocarbon) Trap Kit - 1/4" Brass <i>Includes 1 trap and 2 connectors</i>	CG-100042
AFP Click On Hydrocarbon Trap Kit - 1/8" Brass <i>Includes 1 trap and 2 connectors</i>	CG-100039
AFP Click On Hydrocarbon Trap Kit - 1/4" Brass <i>Includes 1 trap and 2 connectors</i>	CG-100040

Click-On Medium Big Traps

Click-On Inline Super-Clean™ Medium Big Traps are inline traps designed with Click-On adaptor connectors which allows inline cartridges to be exchanged without introducing oxygen. Spring loaded check valves seal when a filter is removed and open only when a new filter has been locked in place. There is no need for loosening and tightening fittings every time a trap is changed and your system will not become contaminated during the process.

- Ideal for Central Purifying Solutions and LC-MS
- High Pressure Stainless Steel
- High-purity output ensures 99.9999% Pure gas
- Click-On fittings for easy, leaktight cartridge changes

Hydrocarbon Medium Big Traps

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.

Specifications	
Outlet Gas Quality (%)	> 99.9999
Maximum Pressure	11 bar (160 psi)
Maximum Flow	25 L/min.
Usable For	Inert carrier gas, He, H ₂ , N ₂ , AR, Air
Dimensions	11 inch x Ø 2.5 inch
Weight	1.5 Kg
Estimated Lifetime	2-3 years
HC Capacity	180 g

Triple (Oxygen/Moisture/Hydrocarbon) Medium Big Traps

The Triple trap is ideal for purifying carrier gas. It contains oxygen, moisture and hydrocarbon scrubbers in one easy to change economical cartridge.

Specifications	
Outlet Gas Quality (%)	> 99.9999
Maximum Pressure	11 bar (160 psi)
Maximum Flow	25 L/min.
Usable For	Inert carrier gas, He, H ₂ , N ₂ , AR
Dimensions	11 inch x Ø 2.5 inch
Weight	1.5 Kg
Estimated Lifetime	2-3 years
H ₂ O Capacity	35 g
O ₂ Capacity	1 L
HC Capacity (as n-butane)	60 g

Click-On Inline Medium Big Trap System Components



Click-On Inline Medium Big Trap

The Click-On Medium Big Trap is completely made out of stainless steel and can withstand high pressures.

The seals at each side of the trap will only be punctured when the Click-On connector is locked in place.



Medium Big Trap Mounting Brackets

Included in every installation kit are the wall mounting clamps to mount a Medium Big trap to a wall or surface.

Accessories



1/4" Brass Click-On Connector Set

Click-On Connector Set - 1/4" Brass



Wall Mount Bracket Set

Two wall mount brackets suitable for mounting a Click-On Medium Big Trap.

Usable for

1/4" Brass tubing

Usable for

Medium Big Traps



Description	Part No.
Click-On Medium Big Traps and Replacement Parts	
AFP Click-On Medium Big Replacement Trap Triple (Oxygen/Moisture/Hydrocarbon) Helium-specific 750CC (GCMS)	CG-100037
AFP Click-On Medium Big Trap Triple (Oxygen/Moisture/Hydrocarbon) Helium-specific 750CC Kit - 1/8" Brass (GCMS) <i>Includes 1 trap, 2 connectors and 2 wall-mount brackets</i>	CG-100038
AFP Click-On Medium Big Replacement Trap Hydrocarbon 750CC (LCMS)	CG-100006
AFP Click-On Medium Big Trap Hydrocarbon 750CC Installation Kit - 1/4" Brass (LCMS) <i>Includes 1 trap, 2 connectors and 2 wall-mount brackets</i>	CG-100007
Click-On Big Trap Connector Set - 1/4" Brass, Pkg. 2 <i>Includes (2) 1/4" Brass Click-On Connectors</i>	CG-100012
AFP Click-On Connector Set - 1/8" Brass <i>Includes (2) 1/8" Brass Click-On Connectors</i>	CG-100046
Click-On Big Trap Replacement O-ring Set, Pkg. 20 <i>A set of 10 + 10 Replacement O-rings for Click-On Inline Trap Connectors</i>	CG-100013
Click-On Big Trap Wall-mounting Bracket Set, Pkg. 2	CG-100014
Click-On Wall-mounting Clamp Set	CG-100043
Description	Part No.
Replacement Parts and Accessories	
AFP Split Vent Trap Cartridge	CG-100015
AFP Split Vent Trap Kit	CG-100016
Swagelok 1/16" x 1/8" Brass Reducer	CG-100021
Swagelok 1/16"OD x 1/4"T Brass Reducer, SPL	CG-100022
Swagelok SS316, 1/16"OD x 1/8" Tube Stub Reducer	CG-100023
Swagelok SS316, 1/16"OD x 1/4" Tube Stub Reducer	CG-100024



Gas Purifiers and Filters

Pure gas is a critical requirement in gas chromatography, spectroscopy, optics, lithography, and numerous other applications in manufacturing and analytical laboratories. The ZPure™ line of filters remove a wide range of contaminants to trace levels.

Features and Benefits

- High-efficiency in-line traps with outstanding capacity.
- High quality activated adsorbents for long purifier life and efficient contaminant removal.
- Various size and fitting configurations to fit existing installations.
- Filter lifetime is dependent on quality of incoming gas, and the flow rate.
- Individually leak-tested.

Recommended Applications

ZPure™ H₂O: It can be used to remove water from inert gases, He, Ar, N₂, H₂, methane and clean dry air (CDA) to low ppb levels. It is recommended for any application requiring ultra-dry gas.

ZPure™ HC: It can be used to remove hydrocarbons heavier than butane from inert gases, He, Ar, N₂, H₂, and clean dry air (CDA) to low ppb levels. It is recommended for most applications requiring hydrocarbon-free gas.

SPure™ H₂O: It can be used to remove moisture, oil and dust from air and inert gases. It is suitable for general purpose, non-critical laboratory use.



Compression fittings seal well and can be broken and retightened many times if used properly. They are compatible with industry standard ferrules and tubing.

ZPure™ H₂O

ZPure™ gas filters are the core of our broad program of inline purifiers. The ZPure products represent the highest quality and most reasonably priced gas filters both in stainless steel bodies and in shielded glass bodies for applications requiring visual indicators. They offer long life, efficient contaminant removal and come in various size and fitting configurations for most laboratory analytical applications.

Standard filters

- Stainless steel bodies.
- Integrated stainless steel frits for particle removal.
- High capacity absorbents with well-characterized performance data.
- All-metal sealing system.
- Individually helium leak-checked in vacuum.

Glass filters

- Double seal glass body with polycarbonate shell isolates the gas stream in the event of glass failure.
- Highly sensitive visual indicators for oxygen and water.
- Integrated stainless steel frits for particle removal.
- High capacity absorbents with well characterized performance data.
- Fluoroelastomer seals for inertness.
- Individually helium leak-checked in vacuum.

SPure™ H₂O

The SPure™ line is a general-purpose filter for removing moisture, oil, and dust from air and inert gases. SPures are made from strong acrylic and polycarbonate with aluminum end caps and use a cobalt free indicator. Not for carrier, compressed air, hydrogen, or any other hazardous, flammable, or reactive gas.

Pure gas is a critical requirement in gas chromatography, spectroscopy, optics, lithography, and numerous other applications in manufacturing and analytical laboratories. The SPure™ H₂O filters remove moisture, oil and dust from air and inert gases.

Features and Benefits

- High-strength polycarbonate body with aluminum end caps.
- Available with standard brass and stainless steel compression fittings.
- Not recommended for house compressed air lines or for GC carrier gases.
- Not for use with hazardous, flammable, or reactive gases.



ZPure™ H ₂ O							
Volume	Function	Capacity (nominal-max)	Outlet Concentration at Nominal Flow Rate	Flow rate (nominal-max)	Max Pressure	Dimensions	Fittings
130 cc	Removes water	12 - 22 g water	Moisture < 20 ppb	1 - 10 SLPM	68.9 bar/1000 psi	3.2 cm x 28 cm	1/8" and 1/4" brass and stainless steel compression
475 cc		45 - 79 g water		3.7 - 36 SLPM		3.8 cm x 57 cm	
500 cc		48 - 83 g water		3.8 - 38 SLPM		5 cm x 35 cm	
750 cc		72 - 124 g water		5.8 - 57 SLPM		5 cm x 50 cm	

1) The nominal water capacity is determined for an inlet impurity level of 200 ppm H₂O. The maximum water capacity is determined for an inlet impurity level of 10000 ppm H₂O.

2) Nominal flow rate is the recommended flow rate for an estimated gas purifier life of 1 year. This assumes the following inlet impurities: 1 ppm H₂O. The maximum recommended flow rate is recommended for intermittent use only.

Product Specifications

ZPure™ HC

Volume	Function	Capacity (nominal-max)	Outlet Concentration at Nominal Flow Rate	Flow rate (nominal-max)	Max Pressure	Dimensions	Fittings
130 cc	Removes hydrocarbons (C5 and heavier)	11 - 36 g	< 5 ppb	1 - 10 SLPM	68.9 bar/1000 psi	3.2 cm x 28 cm	1/8" and 1/4" brass and stainless steel compression
475 cc		40 - 131 g		3.7 - 36 SLPM		3.8 cm x 57 cm	
500 cc		42 - 137 g		3.8 - 38 SLPM		5 cm x 35 cm	
750 cc		63 - 206 g		5.8 - 57 SLPM		5 cm x 50 cm	

- 1) The nominal hydrocarbon capacity is determined for an inlet impurity level of 500 ppm pentane.
- 2) The maximum hydrocarbon capacity is determined for an inlet impurity level of 2300 ppm pentane.
- 3) The nominal flow rate is the recommended flow rate for an estimated gas purifier life of 1 year. This assumes the following inlet impurities: 1 ppm hydrocarbons (C5 and heavier)
- 4) The maximum recommended flow rate is recommended for intermittent use only.

SPure™ H₂O

Volume	Function	Capacity (nominal-max)	Flow rate (nominal-max)	Max Pressure	Dimensions	Fittings	Body Material
88 cc	Removes water, oil and dust	6.3 - 11.0 g water	0.680 - 6.8 SLPM	6.89 bar/100 psi	3.8 cm x 26.3 cm	1/8" and 1/4" brass and stainless steel compression	Polycarbonate
116 cc		8.3 - 14.4 g water	0.900 - 9.0 SLPM		3.8 cm x 31.8 cm		Polycarbonate
240 cc		17.2 - 29.9 g water	1.85 - 18.5 SLPM		5.6 cm x 28.5 cm		Polycarbonate
400 cc		28.6 - 49.8 g water	3.0 - 30.0 SLPM		5.6 cm x 41.9 cm		Polycarbonate

- 1) The nominal water capacity is determined for an inlet impurity level of 200 ppm H₂O. The maximum water capacity is determined for an inlet impurity level of 10000 ppm H₂O.
- 2) Nominal flow rate is the recommended flow rate for an estimated gas purifier life of 1 year. This assumes the following inlet impurities: 1 ppm H₂O. The maximum recommended flow rate is recommended for intermittent use only.

Description	Part No.
ZPure H₂O Gas Filters	
ZPure DS H ₂ O Filter, 1/8" Stainless Steel Fittings	CG-100025
ZPure Glass H ₂ O/HC Filter, 1/4" Stainless Steel Fittings	CG-100034
ZPure Glass H ₂ O Filter, 1/8" Brass Fittings	CG-100028
ZPure Glass H ₂ O Filter, 1/4" Brass Fittings	CG-100029
ZPure HC (Hydrocarbon) Gas Filters	
ZPure LS Hydrocarbon Filter, 1/4" Stainless Steel Fittings	CG-100026
ZPure XLS Hydrocarbon Filter, 1/4" Stainless Steel Fittings	CG-100027
SPure H₂O Gas Filters	
SPure H ₂ O Filter, 1/8" Brass Fittings	CG-100030
SPure XLS H ₂ O Filter, 1/8" Brass Fittings	CG-100031
SPure XLS H ₂ O Filter, 1/4" Brass Fittings	CG-100032
SPure XLS H ₂ O Filter, 1/4" Stainless Steel Fittings	CG-100033



Fused Silica Capillary Columns

Quadrex fused silica columns are produced with the industry standard polyimide outer coating (390°C maximum temperature) for most general GC applications.

Each stationary phase used in our coating processes is synthesized and cleaned in-house to insure column to column reproducibility. All Quadrex phases are bonded to the silica substrate and cross-linked. Our stringent QA / QC program governs the production of all in-house phases which results in accurate selectivity, reproducibility, and outstanding thermal stability.

Ultra-alloy™ Stainless Steel Capillary Columns

The inertness of Ultra ALLOY™ stainless steel columns match that of fused silica and is derived from a patented, multi-step manufacturing process which utilizes a five-layered pretreatment of the inner surface of the stainless steel.

- High temperature stability
- Highly inert deactivated inner surface
- Exceptional mechanical durability-cannot break
- Perfect for field use or high vibration situations
- Can be tightly coiled (3 inches) for portable GCs
- Ideal for use in small, field portable GCs



Each layer is chemically stable at elevated temperatures and has equal to, if not superior, mechanical properties to that of steel tubing. The layers are less than 0.01 microns thick and are chemically bonded together. Stationary phases are then easily bonded to this stable inert surface resulting in superbly deactivated columns which compare directly to fused silica columns. Ultra-ALLOY™ capillary columns offer unsurpassed inertness and mechanical durability and are suitable replacements for fused silica capillary columns. Unlike other stainless-steel columns on the market, Ultra-ALLOY™ columns are not lined with fused silica (see photo above) which can crack or flake-off when flexed or bent thus exposing active sites. As a result, the Ultra-ALLOY™ columns can be tightly coiled to accommodate even the smallest of GC oven designs.

Fused Silica Capillary Columns

Description	Part No.
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 10 m x 0.53 mm ID, 1 µm Film	CH-100018
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 10 m x 0.32 mm ID, 5 µm Film	CH-100019
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 15 m x 0.53 mm ID, 1 µm Film	CH-100020
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 15 m x 0.32 mm ID, 5 µm Film	CH-100021
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 25 m x 0.53 mm ID, 3 µm Film	CH-100022
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 25 m x 0.53 mm ID, 5 µm Film	CH-100023
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 30 m x 0.25 mm ID, 0.5 µm Film	CH-100024
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 60 m x 0.25 mm ID, 1 µm Film	CH-100025
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 60 m x 0.32 mm ID, 5 µm Film	CH-100026
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 15 m x 0.25 mm ID, 0.25 µm Film	CH-100027
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 30 m x 0.25 mm ID, 0.25 µm Film	CH-100028
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 50 m x 0.53 mm ID, 5 µm Film	CH-100029
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 50 m x 0.32 mm ID, 5 µm Film	CH-100030
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 75 m x 0.53 mm ID, 3 µm Film	CH-100031
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 30 m x 0.53 mm ID, 3 µm Film	CH-100032
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 30 m x 0.32 mm ID, 1.8 µm Film	CH-100033
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 25 m x 0.25 mm ID, 0.1 µm Film	CH-100034
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 30 m x 0.25 mm ID, 0.1 µm Film	CH-100035
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 30 m x 0.53 mm ID, 1 µm Film	CH-100036
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 30 m x 0.32 mm ID, 0.25 µm Film	CH-100037
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 30 m x 0.32 mm ID, 0.5 µm Film	CH-100038
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 25 m x 0.53 mm ID, 3 µm Film	CH-100039
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 30 m x 0.32 mm ID, 1 µm Film	CH-100040
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 50 m x 0.25 mm ID, 0.25 µm Film	CH-100041
GC Column, non-polar 007-1 dimethylpolysiloxane phase, 60 m x 0.32 mm ID, 0.5 µm Film	CH-100042

PLOT Columns

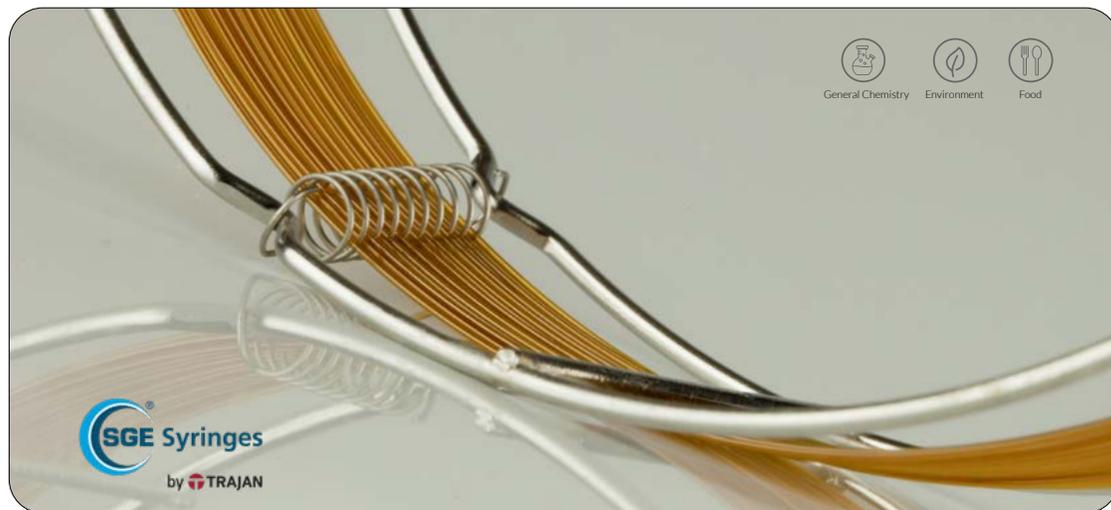
GC Column PLOT MoleSieve 5A, 30 m x 0.53 mm ID, 25 µm Film	CH-100043
GC Column PLOT-Q, 30 m x 0.53 mm ID, 0.30 µm Film	CH-100044

Ultra-alloy Stainless Steel Capillary Columns

GC Column, 100% Dimethylpolysiloxane, 30 m x 0.53 mm ID, 0.30 µm Film	CH-100045
GC Column, 5% Phenyl-Methylpolysiloxane, 30 m x 0.25 mm ID, 0.25 µm Film	CH-100046
GC Column, Carborane siloxane, 30 m x 0.53 mm ID, 0.15 µm Film	CH-100047

Ferrules

Graphite Ferrules for 1/16" Fittings, 0.25 mm ID/0.35 mm OD Columns, Pkg. 10	CC-100071
Graphite Ferrules for 1/16" Fittings, 0.53 mm ID/0.65 mm OD Columns, Pkg. 10	CC-100073
Graphite Ferrules for 1/16" Fittings, 0.32 mm ID/0.45 mm OD Columns, Pkg. 10	CC-100072
Graphite Reducing Ferrules for 1/8" Fittings, 0.53 mm ID/0.8 mm OD Columns, Pkg. 10	CC-100074
Graphite Vespel Ferrules for 0.32 mm ID/0.45 mm OD Columns, Pkg. 10	CC-100075
Graphite Vespel Ferrules for 0.53 mm ID/0.65 mm OD Columns, Pkg. 10	CC-100076
HP Graphite Ferrules for 0.25 mm ID/0.35 mm OD Columns, Pkg. 10	CC-100077
HP Graphite Short-Style Ferrules for Agilent, 0.32 mm ID/0.45 mm OD Columns, Pkg. 10	CC-100078
HP Graphite Short-Style Ferrules for Agilent, 0.53 mm ID/0.65 mm OD Columns, Pkg. 10	CC-100079



GC Column BP1

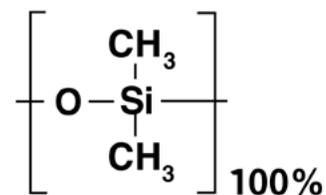
More than five decades of innovative phase technologies and unique fused silica production capabilities, together provide end-to-end separation solutions for all applications.

Features and Benefits:

- Classic crosslinked dimethyl polysiloxane technology.
- Excellent general purpose GC column.
- Low bleed.
- Non-polar.
- Suitable for all routine analyses.

Recommended Applications:

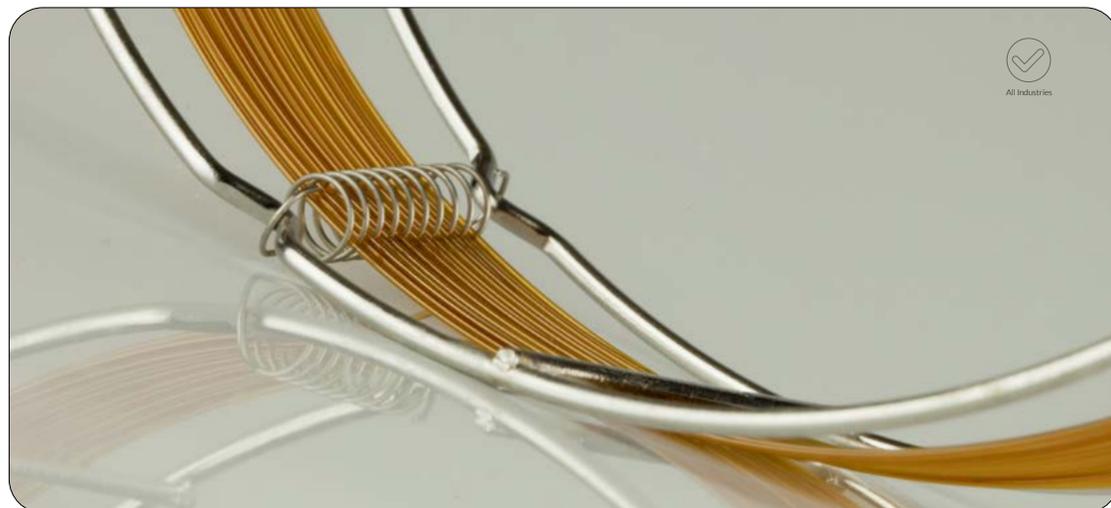
- Hydrocarbons.
- Aromatics.
- Pesticides.
- Phenol.
- Herbicides.
- Amines.



Film Thickness	Operating Temperature
0.1-1.0 μm	-60 °C to 340/360 °C
1.5-3.0 μm	-60 °C to 300/320 °C
4.0-5.0 μm	-60 °C to 280/300 °C

Product Specifications

100 % Dimethyl Polysiloxane. Suitable replacement for: DB-1, DB-Petro, HP-1, HP-1MS, Rtx-1, Ultra-1, SPB-1, SPB-1 Sulfur, Petrocol DH, CP-Sil 5CB, VB-1, ZB-1, VF-1ms.



GC Column BPX5

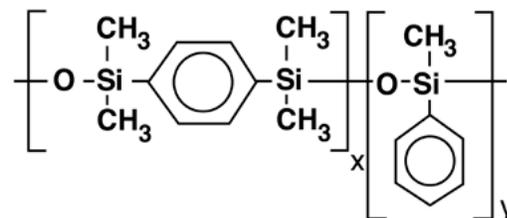
More than five decades of innovative phase technologies and unique fused silica production capabilities, together provide end-to-end separation solutions for all applications.

Features and Benefits:

- High temperature.
- General purpose GC column (suitable for over 80% routine GC analyses).
- Very low bleed – ideal for trace analysis.
- Non-polar.
- Extremely inert.
- Ideal for GC-MS.

Recommended Applications:

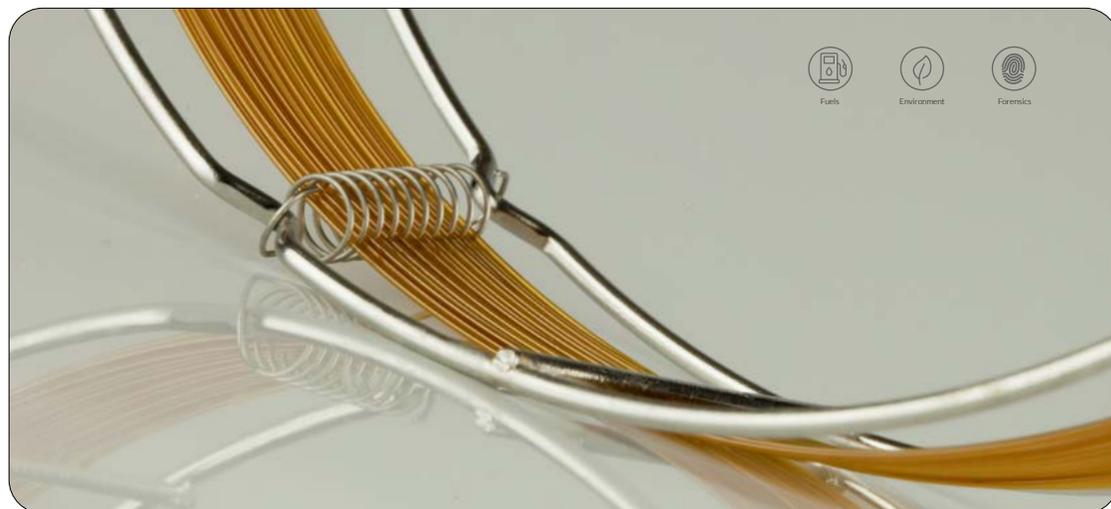
- Ultra trace analyses.
- Pesticides.
- Herbicides.
- Hydrocarbons.
- Solvents.
- Phenols.
- Amines.



GC Column Dimensions (mm)	Film Thickness	Operating Temperature
0.1, 0.15, 0.18, 0.22, 0.25, 0.32, 0.53	0.1, 0.25, 0.5, 1 µm	10 °C to 330/360 °C

Product Specifications

5% Phenyl / 95% Dimethyl Polysiloxane (equivalent). Suitable replacement for: DB-5, DB-5ms, DB-5.625, XTI-5, Rtx-5ms, Ultra-2, HP-5, HP-5MS, HP5-TA, SPB-5, MDN-5S, CP-Sil8CB, Rxt-Sil 5MS, AT-5ms, VB-5, ZB-5, VF-5ms.



GC Column BP5

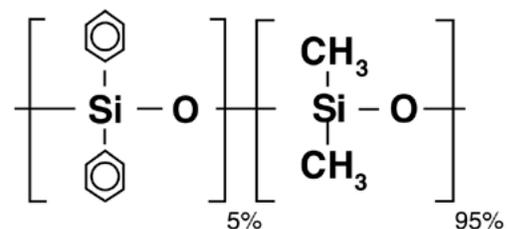
More than five decades of innovative phase technologies and unique fused silica production capabilities, together provide end-to-end separation solutions for all applications.

Features and Benefits:

- Excellent general purpose GC column.
- Low bleed.

Recommended Applications:

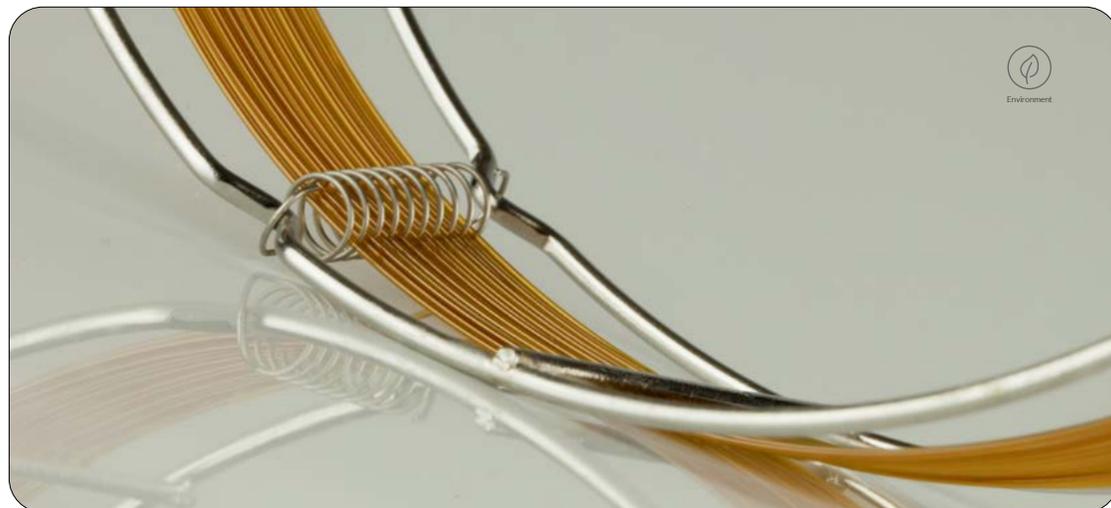
- General purpose.
- Aromatics.
- Pesticides.
- Herbicides.
- Drugs of abuse.
- Hydrocarbons.
- Solvent impurities.
- PCB congeners.
- Aroclor mixes.
- Essential oils.
- Semivolatiles.



Film Thickness	Operating Temperature
0.25-1.5 μm	-60 °C to 320/340 °C
> 1.5 μm	-60°C to 280/300°C

Product Specifications

5% Phenyl / 95% Dimethyl Polysiloxane. Suitable replacement for: DB-5, Rtx-5, HP-5, Ultra-2, PTE-5, SPB-5, MDN-5, CP-Sil 8CB, VB-5, ZB-5, VF-5ms.



GC Column HT8-PCB

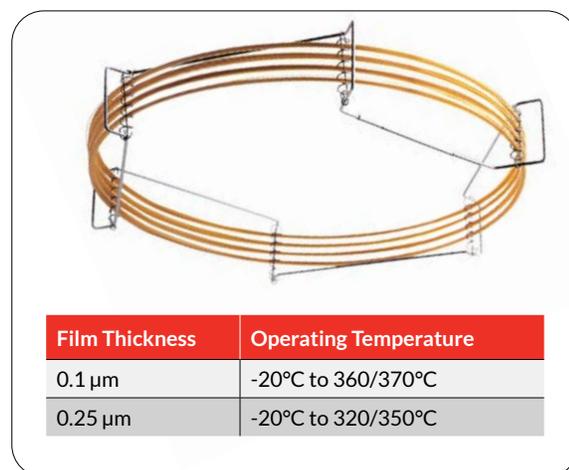
More than five decades of innovative phase technologies and unique fused silica production capabilities, together provide end-to-end separation solutions for all applications.

Features and Benefits:

- Preferred column for polychlorinated biphenyl (PCB) compounds.
- Separates PCBs on ortho ring substitution as well as boiling point.
- Ideal for environmental analysis.
- Unique high temperature phase suited for the analysis of persistent organic pollutants (POPs).

Recommended Applications:

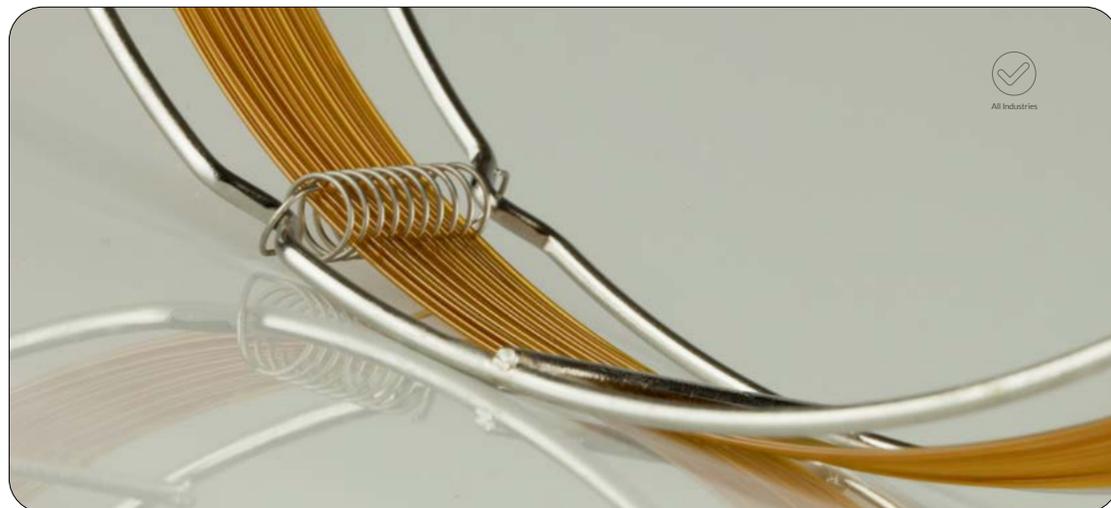
- PCB Aroclor and congener analyses.
- Nitro-substituted aromatics.
- Polynuclear aromatic hydrocarbons (PAHs).
- Pesticides/herbicides.



Film Thickness	Operating Temperature
0.1 μm	-20°C to 360/370°C
0.25 μm	-20°C to 320/350°C

Product Specifications

5% Phenyl / 95% Dimethyl Polysiloxane. 8% Phenyl Polycarborane-siloxane. Suitable replacement for: no equivalents, unique ultra high temperature column with single copolymer phase.



GC Column BP5MS

More than five decades of innovative phase technologies and unique fused silica production capabilities, together provide end-to-end separation solutions for all applications.

Features and Benefits:

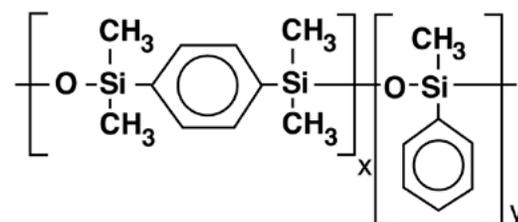
- Perfect for your 5% GC-MS analysis.
- Optimized Silphenylene content for general purpose MS analyses.

Recommended Applications:

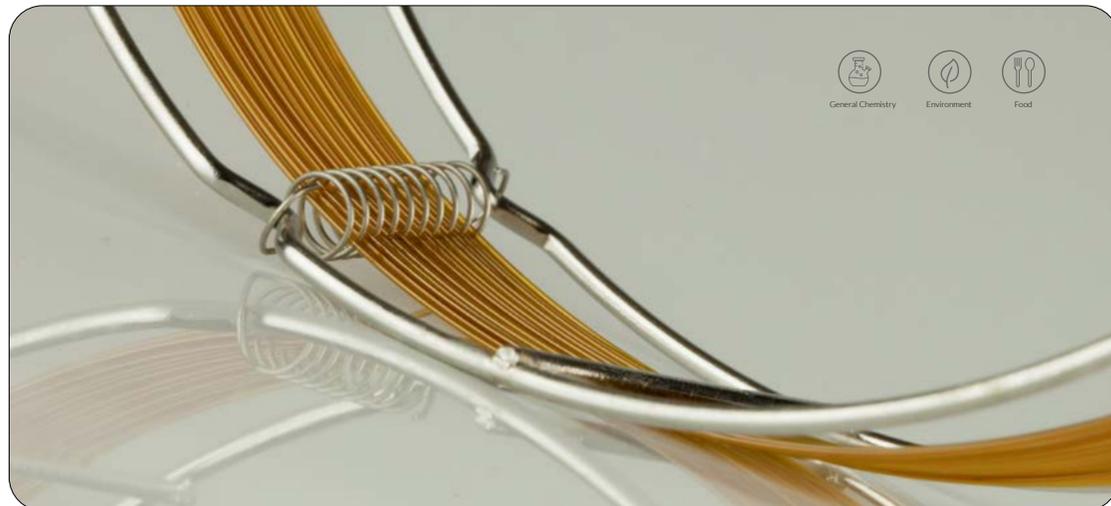
- 5% GC-MS analyses.

Product Specifications

5% Phenyl Polysilphenylene-siloxane.
Suitable replacement for: DB-5ms, ZB-5ms, Rxi-5Sil MS, VF-5ms, CP-Sil 8 CB.



Film Thickness	Operating Temperature
0.1, 0.18, 0.25 μm	-40 $^{\circ}\text{C}$ to 330/350 $^{\circ}\text{C}$



GC Column BP20 (WAX)

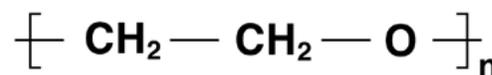
More than five decades of innovative phase technologies and unique fused silica production capabilities, together provide end-to-end separation solutions for all applications.

Features and Benefits:

- Industry standard wax column
- Polar phase
- Cross-linked for stability and washing

Recommended Applications:

- Alcohol
- Free acids
- Fatty acid methyl esters (FAMES)
- Aromatics
- Solvents
- Essential oils

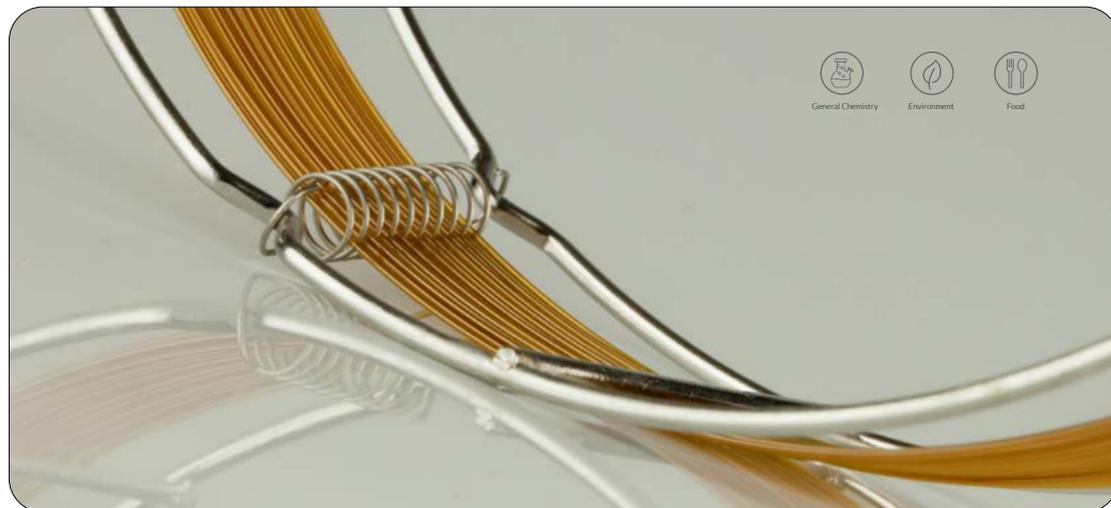


Film Thickness	Operating Temperature
0.1-1.0 μm	20 °C to 260/280 °C
1.0 μm	20 °C to 240/260 °C

Product Specifications

Polyethylene Glycol phase.

Suitable replacement for: Carbowax 20M, CP-Wax 52 CB, DB-WAX, Elite-WAX, HP-20M, HP-INNOWax RH-WAX, Rtx-Wax, Stabilwax, SUPELCOWAX 10, TG-WaxMS, VF-WAXms, ZB-WAX.



GC Column BP21 (FFAP)

More than five decades of innovative phase technologies and unique fused silica production capabilities, together provide end-to-end separation solutions for all applications.

Features and Benefits:

- Polar phase.
- Ideal for low molecular weight acids.
- Able to be solvent rinsed.
- Bonded and cross-linked.

Recommended Applications:

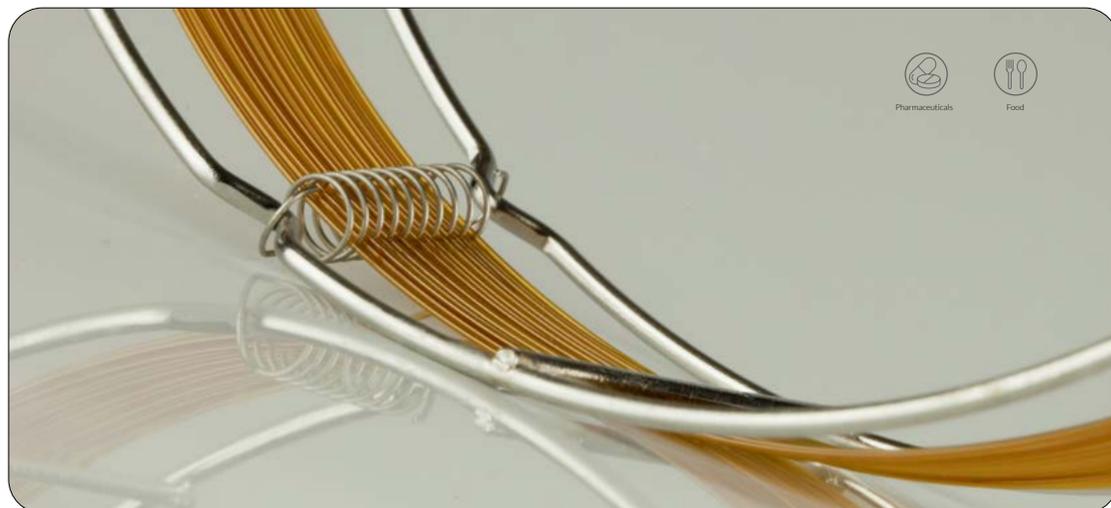
- Volatile free acids.
- FAMES.
- Alcohols.
- Aldehydes.
- Acrylates.
- Ketones.



Film Thickness	Operating Temperature
0.25, 0.5, 1 μm	35 $^{\circ}\text{C}$ to 240/250 $^{\circ}\text{C}$

Product Specifications

Nitroterephthalic acid modified PEG. Suitable Replacement for: DB-FFAP, HP-FFAP, Stabilwax-DA, CPWax-58CB.



GC Column BPX70

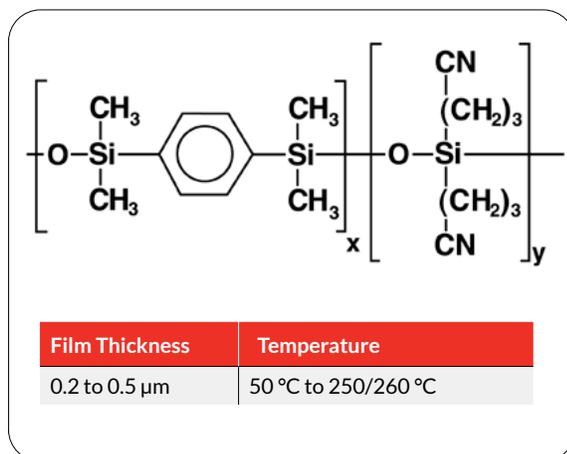
More than five decades of innovative phase technologies and unique fused silica production capabilities, together provide end-to-end separation solutions for all applications.

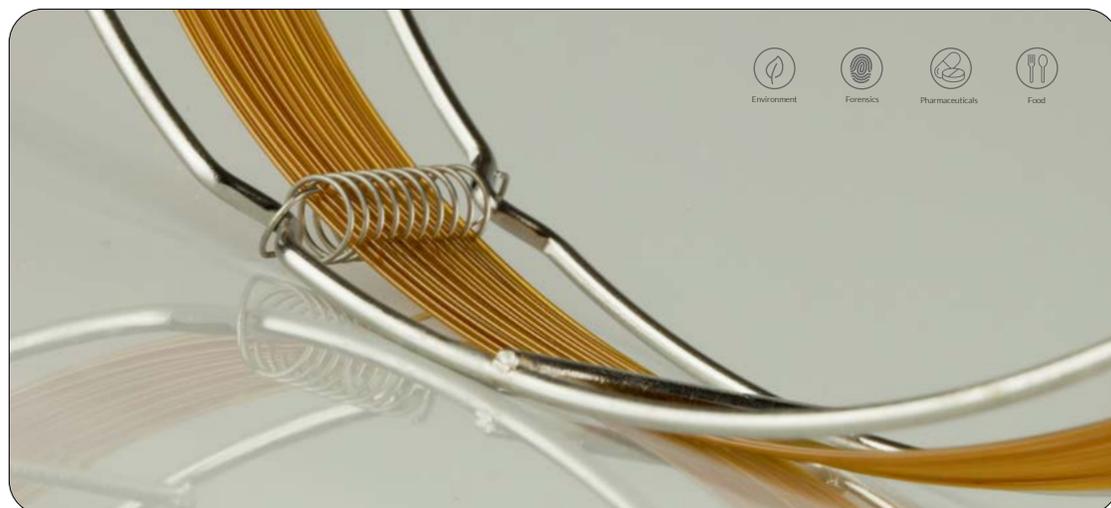
Features and Benefits:

- Industry standard column for FAME analysis.
- Bonded and cross-linked. Able to be solvent rinsed.
- Long operating life.

Recommended Applications:

- Fatty acid methyl esters (FAMEs).
- Carbohydrates.
- Pharmaceuticals.
- GC/MS applications.





GC Column BPX35

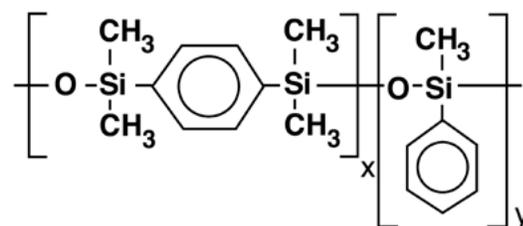
More than five decades of innovative phase technologies and unique fused silica production capabilities, together provide end-to-end separation solutions for all applications.

Features and Benefits:

- Mid polarity column. Ideal for confirmational analysis.
- Inert.
- Equivalent to USP phase G42.
- High temperature.
- Very low bleed.
- Pharmaceutical specialist.
- Bonded and cross-linked. Able to be solvent rinsed.

Recommended Applications:

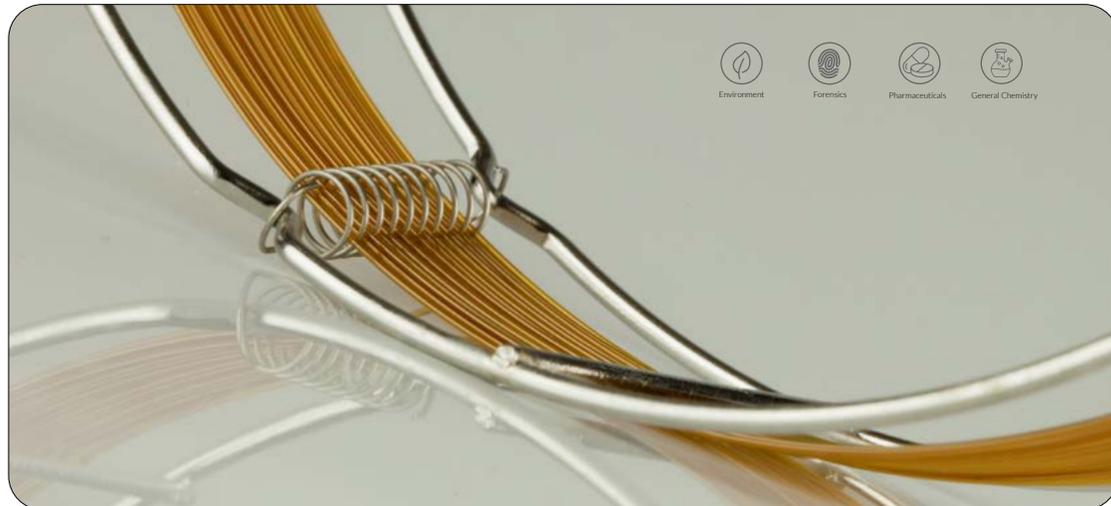
- Environmental analyses.
- Pesticides/herbicides.
- Drugs of abuse.
- Pharmaceuticals.
- Polynuclear aromatic hydrocarbons.
- GC/MS applications.



Film Thickness	Operating Temperature
0.1, 0.25, 0.5, 1 μm	10 $^{\circ}\text{C}$ to 330/360 $^{\circ}\text{C}$

Product Specifications

35% Phenyl Polysilphenylene-siloxane. Suitable Replacement for: DB-35, DB-35ms, Rtx-35, HP-35, HP-35MS, SPB-35, MDN-35.



GC Column BPX50

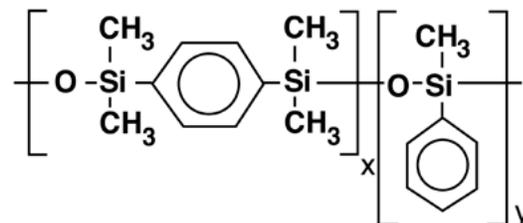
More than five decades of innovative phase technologies and unique fused silica production capabilities, together provide end-to-end separation solutions for all applications.

Features and Benefits:

- Ideal for a range of EPA methods and pharmaceutical applications.
- Bonded and cross-linked. Able to be solvent rinsed..

Recommended Applications:

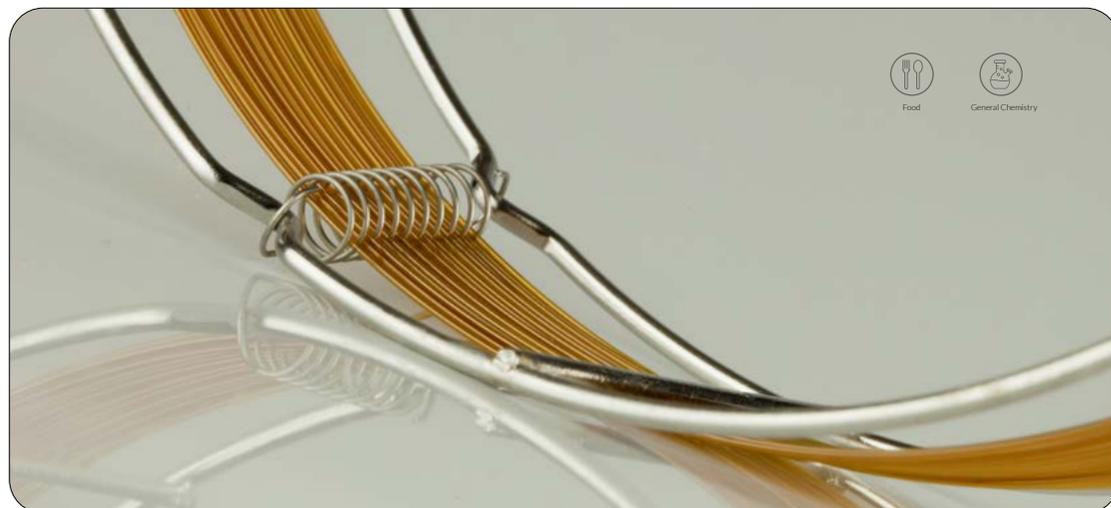
- EPA methods 604, 608, 8060, 8081.
- Triazines/herbicides.
- Drug screening.
- Steroids.
- A variety of pharmaceutical applications GC2D.



Film Thickness	Operating Temperature
0.1 to 1.0 μm	80 °C to 330/350 °C

Product Specifications

50% Phenyl Polysilphenylene-siloxane. Suitable replacement for: OV-17, SP-2250, DB-17, DB-17ms, DB-17ht, Rtx-50, SPB-50, HP-50+, HP-17.



GC Column SolGel-WAX™

More than five decades of innovative phase technologies and unique fused silica production capabilities, together provide end-to-end separation solutions for all applications.

Features and Benefits:

- Bonded polyethylene glycol.
- Very robust high-temperature column.
- Less susceptible to damage by oxygen than conventional wax phases.
- Polar phase.
- Low bleed and inert.
- Bonded and cross-linked. Able to be solvent rinsed.

Recommended Applications:

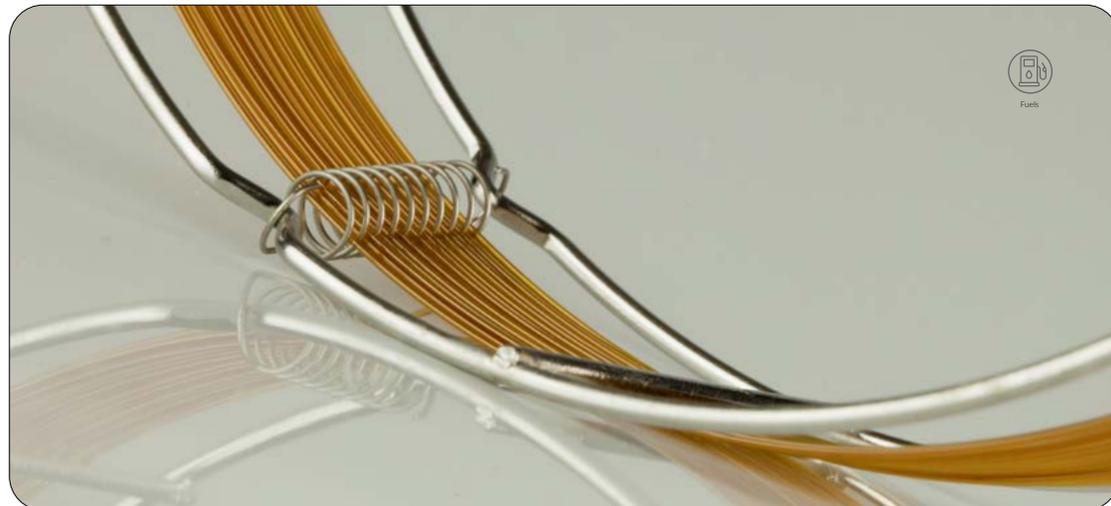
- Highly active compounds.



Film Thickness	Operating Temperature
0.1, 0.25, 0.5, 1 μm	30 °C to 260/280 °C

Product Specifications

Polyethylene Glycol (PEG) in a Sol-Gel matrix.
 Suitable replacement for: DB-Wax, Rtx-Wax, Stabilwax, HP20M, HP-Wax, HP-INNOWax, Supelcowax-10, AT-Wax, Nukol, CP, Wax 52CB, VB-WAX, ZB-WAX.



GC Column BPX1

More than five decades of innovative phase technologies and unique fused silica production capabilities, together provide end-to-end separation solutions for all applications.

Features and Benefits:

- Non-polar column.
- Dimensionally stabilized phase.
- Low bleed.
- Specifically designed for high temperature hydrocarbon analysis.

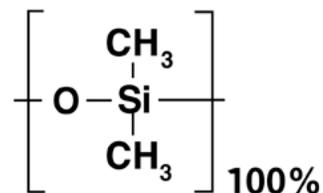
Recommended Applications:

- ASTM methods D2887 and D6532.

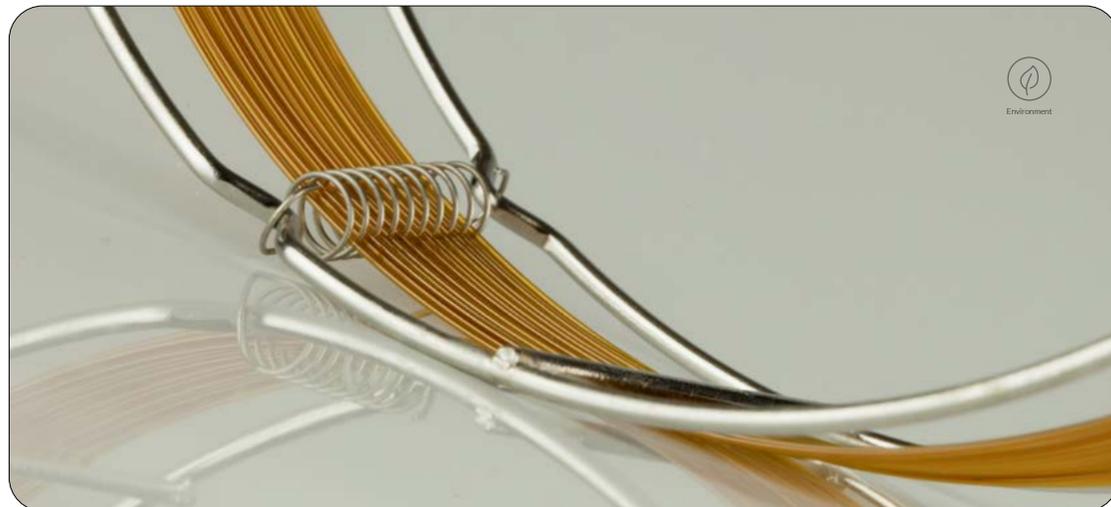
Product Specifications

100% Dimethyl Polysiloxane.

Suitable replacement for: DB-2887, DB-HT Sim Dis, HP-1, Petrocol 2887, Petrocol EX2887, Rtx-2887.



Film Thickness	Operating Temperature
Polyimide clad 0.1-0.9 μm	30 °C to 260/280 °C
2.65 μm	30°C to 370°C



GC Column BP624

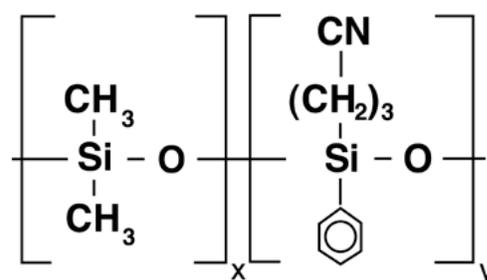
More than five decades of innovative phase technologies and unique fused silica production capabilities, together provide end-to-end separation solutions for all applications.

Features and Benefits:

- US EPA 624 optimized column.
- Designed for volatiles analysis.
- Able to be solvent rinsed.
- Bonded and cross-linked.

Recommended Applications:

- EPA method 624, USP G43 methods, SW-846 and 8240/8260 methods.
- Drinking water volatiles.
- Chlorinated hydrocarbons.
- Solvents.



Film Thickness	Operating Temperature
1.2, 1.4, 1.8, 3 μm	0 $^{\circ}\text{C}$ to 230/240 $^{\circ}\text{C}$

Product Specifications

Cyanopropylphenyl Polysiloxane. Suitable replacement for: DB-624, OV-624, AT-624, HP-VOC, CP-Select624CB, 007-624, Rtx-Volatiles, VOCOL, ZB-624.

Product List

Description	Part No.
GC Columns - BP1	
0.25 mm ID x 0.25 µm Film Thickness x 30 m Length BP1 GC Capillary Column	CH-100000
0.25 mm ID x 1 µm Film Thickness x 30 m Length BP1 GC Capillary Column	CH-100001
0.32 mm ID x 1 µm Film Thickness x 25 m Length BP1 GC Capillary Column	CH-100002
GC Columns - BPX5	
0.25 mm ID x 0.25 µm Film Thickness x 30 m Length BPX5 GC Capillary Column	CH-100003
GC Columns - BP5	
0.25 mm ID x 0.25 µm Film Thickness x 30 m Length BP5 GC Capillary Column	CH-100004
GC Columns - HT8-PCB	
0.25 mm ID x 60 m Length HT8-PCB GC Capillary Column	CH-100005
GC Columns - BP5MS	
0.25 mm ID x 0.25 µm Film Thickness x 30 m Length BP5MS GC Capillary Column	CH-100006
GC Columns - BP20	
0.25 mm ID x 0.25 µm Film Thickness x 30 m Length BP20 GC Capillary Column	CH-100007
GC Columns - BP21	
0.32 mm ID x 0.25 µm Film Thickness x 60 m Length BP21 GC Capillary Column	CH-100008
GC Columns - BP70	
0.32 mm ID x 0.25 µm Film Thickness x 50 m Length BPX70 GC Capillary Column	CH-100009
GC Columns - BPX35	
0.25 mm ID x 0.25 µm Film Thickness x 30 m Length BPX35 GC Capillary Column	CH-100010
GC Columns - BPX50	
0.25 mm ID x 0.25 µm Film Thickness x 15 m Length BPX50 GC Capillary Column	CH-100011
0.25 mm ID x 0.25 µm Film Thickness x 30 m Length BPX50 GC Capillary Column	CH-100012
GC Columns - SolGel-WAX	
0.53 mm ID x 1.0 µm Film Thickness x 30 m Length SolGel-WAX GC Capillary Column	CH-100013
GC Columns - BPX1	
0.53 mm ID x 0.9 µm Film Thickness x 10 m Length BPX1 simulated distillation GC Capillary Column	CH-100014
GC Columns - BP624	
0.53 mm ID x 3.0 µm Film Thickness x 30 m Length BP624 GC Capillary Column	CH-100015
0.53 mm ID x 3.0 µm Film Thickness x 60 m Length BP624 GC Capillary Column	CH-100016
0.25 mm ID x 1.4 µm Film Thickness x 30 m Length BP624 GC Capillary Column	CH-100017



Stainless Steel Capillary Columns and Tubing

Ultra Alloy® Capillary Columns, Stainless Steel or Fused Silica?

Ultra ALLOY® metal capillary columns are characterized by their inertness, high temperature stability and mechanical durability.

A high heat and contamination resistant column with a proprietary deactivation treatment on the inner surface of the stainless steel tube. It is more heat resistant than fused silica columns and can be used at 450 °C. In addition to low bleed and long life, there are many other benefits such as (1) prevention of column deterioration due to oil in the sample, (2) solvent-free cleaning, (3) low ghost peaks, (4) saving analysis time, and (5) high performance sustainability.

Employing a slanted-multi-layer structure on a Stainless Steel (SS) column surface, Ultra ALLOY® capillary columns have been paid much attention, and are replacing conventional columns based on fused silica (FS), which has been considered as the ultimate material. The following ten Q&A's feature the high performance.

Q1: Capillary columns have evolved from Golay (SS) column, then to glass, and to FS. Why SS column now? What is the difference between FS and SS besides the materials? Please describe it using a methylsilicone column as an example among many others.

Your concern is very natural. Although we have developed the columns, there are some areas that we cannot explain. Iron atoms in SS are known to adsorb hydrocarbons and polar components. However, if the surface can be completely covered by an inert layer, SS will be an ideal material for capillary columns. Because SS is a metal, it has high flexural, abrasion, impact, and thermal resistances. Use of SS and our advanced proprietary column pretreatment technology have made it possible to develop the Ultra ALLOY columns and we are the center of world attention.

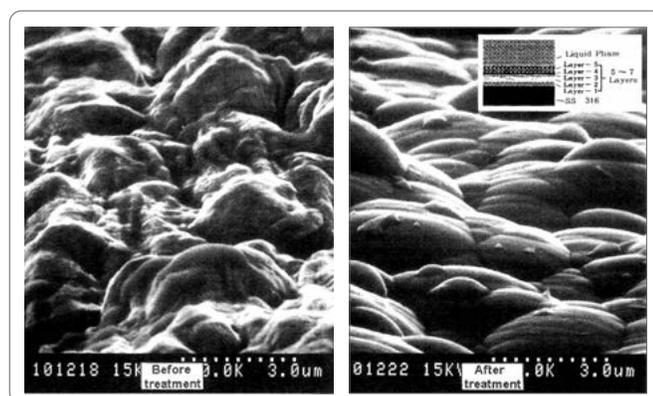


Figure 1. SEM images of stainless steel column surface before and after multi-layer pretreatment.

Q2: How was the metal surface pretreated?

We have succeeded in forming a multi-layer structure (5-7 layers each less than 0.001 micron) on the surface of SS column as shown in the SEM pictures in the front cover page (patent applied for). These layers are chemically bonded to each other, and the chemical structure of the top layer can be modified depending on the kind of liquid phase. We wanted to limit the number of layers to 3, but we found at least 5 layers were required in order to outperform the FS column performance. Our top grade columns have 7 layers to provide highest inertness.

Q3: What about the absorption of primary amines which are known to be the problems with ODS columns used in HPLC? Is the analysis difficult with FS columns due to tailing problems?

That's a hard question. Only Hewlett Packard, known to supply high performance products, has done the tests on this. We have challenged them with Ultra ALLOY® 1. Figure 1 shows the performance comparison with Brand (J). When 5mg of a sample was used in heating program mode, ours clearly outperforms. The pyrolysis of Nylon-12.6 is known to give peaks due to various amines, shown in Figure 5. These peaks are extremely difficult to separate with FS columns.

Q4: The internal surface of a SS capillary column has less than 10µm (peak to valley) roughness. The thickness of liquid phase at the peak is small, while that at the valley is large. Does this affect peak separation?

Yes, it does. As the liquid phase becomes very thin, the top layer of the slanted 5 layer structure emerges, causing problems. We found 3 layer surface pretreatment of the SS column to be inadequate due to the effects from the metal surface; therefore, 5 layer pretreatment was necessary to solve the problem. The coating efficiency is about 90% and is comparable to FS columns. The SEM picture shown in the front cover page clearly shows the improved surface structure.

Q5: I hear that Ultra ALLOY® columns have high thermal stability: however, I rarely heat up to 250°C. I do not think such high temperature stability is necessary, because I thoroughly pretreat samples before analysis. Does it still have any advantages?

Yes, it does. Advantages of high thermal stability of a column are: (1) low bleeding and high durability; (2) protection against column degradation by nonvolatiles from samples; (3) cleaning of columns without use of solvents and guarding against ghost peaks - allowing great time saving; and (4) high data reproducibility over extended period of time.

Samples normally contain a minute amount of nonvolatile species as impurities. Such species deposit over the column inlet or the entire column, they can act as the liquid phase and cause peak broadening and adsorption. Triglycerides and mineral oil are the common high boiling impurities, and they can be eluted off the column by baking at high temperatures (380-400°C). Cumbersome solvent cleaning steps (removing column, cleaning, drying, mounting column, and baking) are not required, if columns are baked at the end of a day. Another advantage is that it is effective in reducing ghost peaks due to high boiling species remained in the column, leading to great saving of analysis time. The high degree of durability means that the analysis is reliable and the data are reproducible over an extended period of time. Figure 2 shows a comparison of column degradation by blending 5% rapeseed oil in a sample. The internal surface area of our SS columns is 10-20 times greater than that of FS columns; thus, oil components are difficult to diffuse. As a result, SS columns have high resistance against contamination.

Q6: Is the lot-to-lot reproducibility good?

Yes, it is. Ultra ALLOY columns are quality checked by retention indices, partition ratios, coating efficiency, and the use of polar species for inertness. Table 1. shows the reproducibility of the columns.

Q7: How small can a column be coiled? We would like to condense a sample using a liquid nitrogen trap. FS Megabore columns cannot be coiled so small in diameter.

You have come up with a good application. If SS columns are coiled slowly, the diameter can be as small as 1 cm. Columns with 0.25 mm inner diameter can be clogged by moisture and solvent condensation, when concentrating sample at liquid nitrogen temperature, but ones with 0.5 mm inner diameter should work without problems. (See Figure 7 for an example)

Q8: What polar columns do you have?

There are a variety of polar columns available as tabulated in the last page. See application examples. Liquid phases used in packed columns are available in Ultra ALLOY® columns. Please ask for details. PyGC, triglyceride and PEG20M (with KOH) columns are also available for specific applications.

Table 1. Lot-to-lot Reproducibility (n=30 for each year) Column: UA-1(HT), 100% dimethylpolysiloxane, 30 m (0.25Ø), 0.15 µm at 130 °C.

	1993		1994		1995	
	RI	CV (%)	RI	CV (%)	RI	CV (%)
Methylcaprate	1305.4	0.018	1305.5	0.017	1305.6	0.015
Acenaphthalene	1418.7	0.021	1419.1	0.022	1419.7	0.022
1-dodecanol	1456.1	0.009	1456.1	0.008	1456.0	0.006
Column Efficiency (%)	82.3	2.010	83.4	1.970	87.2	1.720

RI: Retention Index

Q9: What precautions do you recommend for GC/MS applications? With a quadruple type MS, the column outlet can be inserted to the ion source, but with a magnetic type, a jet separator should be used, or alternatively, a length (50 cm) of a FS column (P/N:PY1-2210) should be connected at the column outlet.

Q10: I have seen SS columns internally coated with fused silica in the U.S. If bent, do you think the FS breaks and metal surface is exposed?

FS coating was considered in our lab at the early stage of development, but we found FS on the internal surface would break easily when columns were bent as you speculated Figure 6 shows that a commercial FS coated columns becomes very active when the internal FS coating breaks and comes off from the metal surface, exposing the metal surface. Because of the reasons above, Frontier Lab does not employ the FS coating method, although the manufacturing cost is less. Currently our inert tubing is extensively used as an interface in various purge & trap TG/MS and GC/MS.

Basic Performance

Applications featuring high inertness, high contamination resistance, high thermal resistance, low bleeding, and high durability

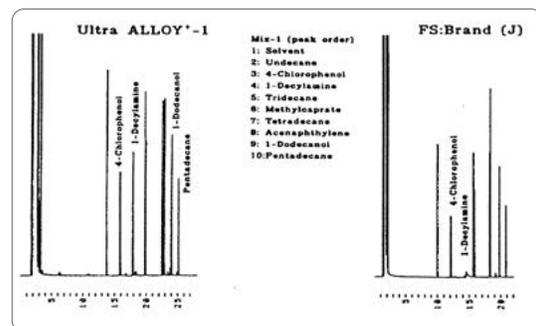


Figure 1. Activity Comparison of Ultra ALLOY®-1 and Fused Silica (FS) Columns. 30m (0.25Ø) 0.25 µm, programmed from 40°C to 220°C at 5°C/min

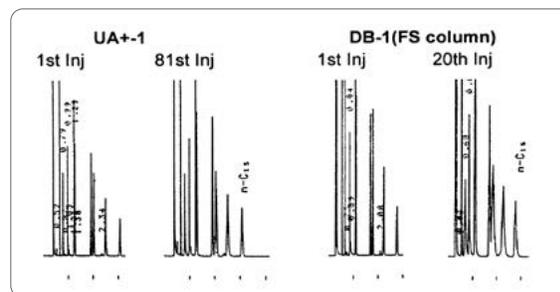


Figure 2. High Contamination Resistance (consecutive injection of a sample containing 5% rapeseed oil). UA-1 (10m (0.25Ø) 0.25 µm at 120°C, Split at 250°C)

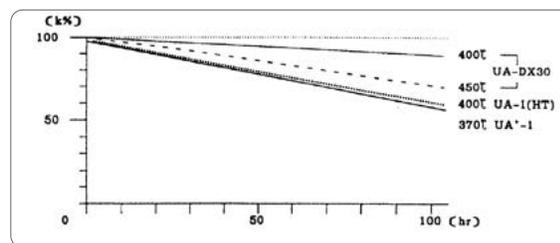


Figure 3. Thermal Stability change in capacity ratio (k) upon continuous exposure to high temperatures. Column: UA-DX30, UA-1(H/T), 15m (0.25Ø) 0.15 µm (Because the stationary phases are physically bonded to the rough column internal surface as shown in the SEM picture in the front cover page, our products offer high maximum temperatures and durability.)

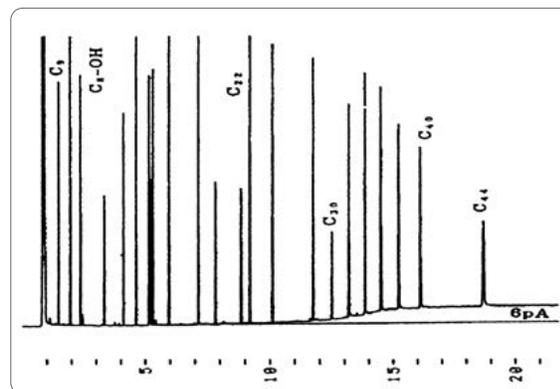


Figure 4. Low Bleeding (UA-5: 6pA at 350°C). 15m (0.25 mmØ) 0.25 µm at 70 to 350°C at 20°C/min, Split at 300°C

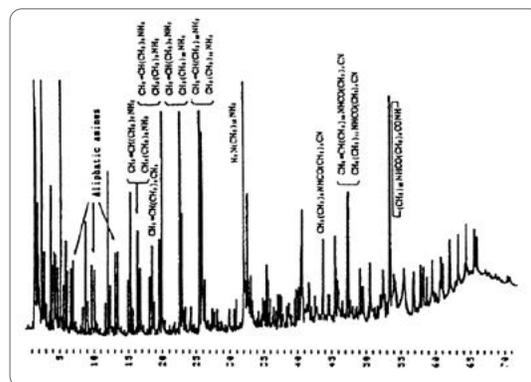


Figure 5. Inertness (PyGC of Nylon 12-6): UA-PY2.
 (Various primary amines from pyrolysis are eluted off).
 Pyrolysis at 550°C, 30m (0.25Ø) 0.5µm, 40–360°C at
 5°C/min, Split at 300°C.

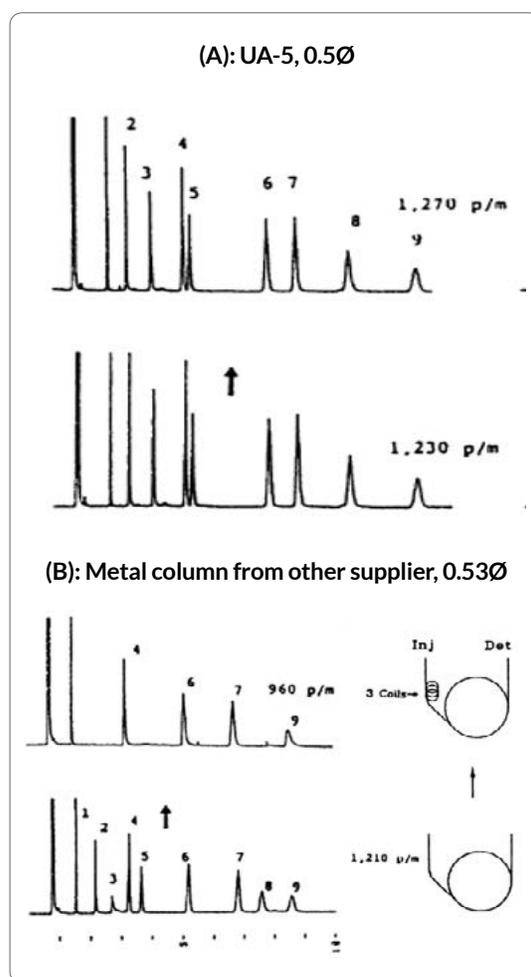


Figure 6. Comparison with USA Products: UA-5.
 Column activity with a coiled column at the inlet
 (3 turns / 3cm in diameter) with Column (B), polar
 species are adsorbed when the internal silica coating
 came off. 15m, 0.5 µm at 120°C. Sample is the same as
 in Figure 1.

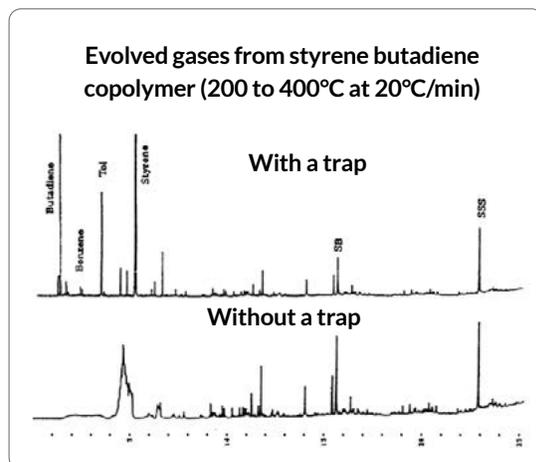


Figure 7. Use of Gas Trap: UA-1. A length of a column
 at the edge was coiled (2 cm in diameter) and was
 immersed in liquid N₂. Evolved gases from pyrolysis
 were trapped for 10 min. 30m (0.25Ø) 0.5 µm, 30 to
 250°C at 10°C/min

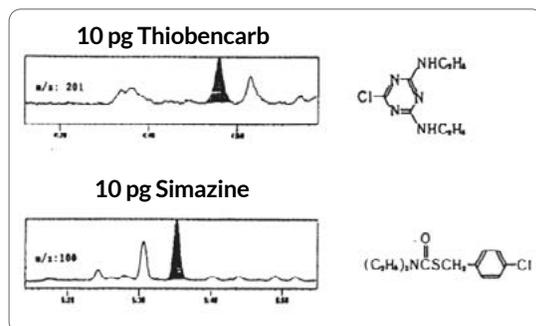


Figure 8. A trace amount of agricultural chemicals:
UA-1(S) 15m (0.25Ø) 0.25 µm, 60 to 320°C at
 15°C/min

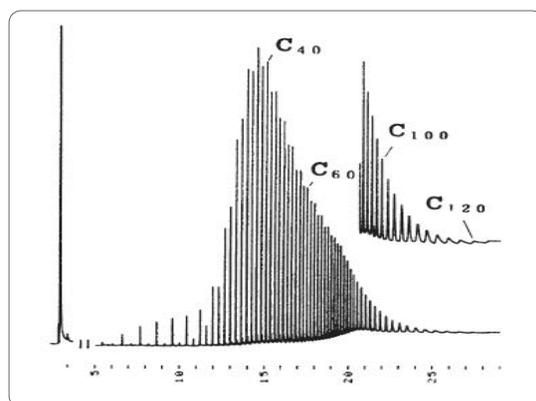


Figure 9. Wax: UA-DX-30. 15m (0.5Ø) 0.15µm, 50°C
 to 440°C at 20°C/min, On-column

Ultra ALLOY Metal Capillary Columns

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column, UA1(MS/HT)-15 m x 0.25 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.1µm	450°C	CH-100049
Ultra ALLOY Metal Capillary Column, UA1(MS/HT)-15 m x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.25µm	450°C	CH-100050
Ultra ALLOY Metal Capillary Column, UA1(MS/HT)-15 m x 0.25 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.5µm	420°C	CH-100051
Ultra ALLOY Metal Capillary Column, UA5(MS/HT)-15 m x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	0.1µm	430°C	CH-100052
Ultra ALLOY Metal Capillary Column UA5(MS/HT)-15 m x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	0.25µm	430°C	CH-100053
Ultra ALLOY Metal Capillary Column UA5(MS/HT)-15 m x 0.25 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	0.5µm	420°C	CH-100054
Ultra ALLOY Metal Capillary Column UADX30-15 m x 0.25 mm ID, 0.15µm Film	Carborane-siloxane	Micropolarity	0.25 mm	15 m	0.15µm	450°C	CH-100055
Ultra ALLOY Metal Capillary Column UA1(MS/HT)-30M x 0.25 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.1µm	450°C	CH-100056
Ultra ALLOY Metal Capillary Column UA1(MS/HT)-30M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.25µm	450°C	CH-100057
Ultra ALLOY Metal Capillary Column UA1(MS/HT)-30M x 0.25 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.5µm	420°C	CH-100058
Ultra ALLOY Metal Capillary Column UA5(MS/HT)-30M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	0.1µm	430°C	CH-100059
Ultra ALLOY Metal Capillary Column UA5(MS/HT)-30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	0.25µm	430°C	CH-100060
Ultra ALLOY Metal Capillary Column UA5(MS/HT)-30M x 0.25 mm ID, 0.50µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	0.5µm	420°C	CH-100061

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UADX30-30M- x 0.25 mm ID, 0.15µm Film	Carborane-siloxane	Micropolarity	0.25 mm	30 m	0.15µm	450°C	CH-100062
Ultra ALLOY Metal Capillary Column UA1(MS/HT)-60M x 0.25 mm ID, 0.25µm Film	Carborane-siloxane	Micropolarity	0.25 mm	60 m	0.25µm	450°C	CH-100063
Ultra ALLOY Metal Capillary Column UADX30-60M x 0.25 mm ID, 0.15µm Film	Carborane-siloxane	Micropolarity	0.25 mm	60 m	0.15µm	450°C	CH-100064
Ultra ALLOY Metal Capillary Column UA1-15 m x 0.25 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.1µm	380°C	CH-100065
Ultra ALLOY Metal Capillary Column UA1-15 m x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.25µm	380°C	CH-100066
Ultra ALLOY Metal Capillary Column UA1-15 m x 0.25 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.5µm	380°C	CH-100067
Ultra ALLOY Metal Capillary Column UA1-15 m x 0.25 mm ID, 1.0µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	1.0µm	330/360°C	CH-100068
Ultra ALLOY Metal Capillary Column UA5-15 m x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	0.1µm	380°C	CH-100069
Ultra ALLOY Metal Capillary Column UA5-15 m x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	0.25µm	380°C	CH-100070
Ultra ALLOY Metal Capillary Column UA5-15 m x 0.25 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	0.5µm	380°C	CH-100071
Ultra ALLOY Metal Capillary Column UA5-15 m x 0.25 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	15 m	1.0µm	330/360°C	CH-100072
Ultra ALLOY Metal Capillary Column UA65-15 m x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.1µm	380°C	CH-100073
Ultra ALLOY Metal Capillary Column UAWAX-15 m x 0.25 mm ID, 0.25 µm Film	Polyethyleneglycol	Strong polarity	0.25 mm	15 m	0.25µm	260°C	CH-100074
Ultra ALLOY Metal Capillary Column UAPY3-10M x 0.25 mm ID, 0.1 µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	10 m	0.1µm	420°C	CH-100075

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UA1-30M x 0.25 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.1µm	380°C	CH-100076
Ultra ALLOY Metal Capillary Column UA1-30M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.25µm	380°C	CH-100077
Ultra ALLOY Metal Capillary Column UA1-30M x 0.25 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.5µm	380°C	CH-100078
Ultra ALLOY Metal Capillary Column UA1-30M x 0.25 mm ID, 1.0µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	1.0µm	330/360°C	CH-100079
Ultra ALLOY Metal Capillary Column UA5-30M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	0.1µm	380°C	CH-100080
Ultra ALLOY Metal Capillary Column UA5-30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	0.25µm	380°C	CH-100081
Ultra ALLOY Metal Capillary Column UA5-30M x 0.25 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	0.5µm	380°C	CH-100082
Ultra ALLOY Metal Capillary Column UA5-30M x 0.25 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.25 mm	30 m	1.0µm	330/360°C	CH-100083
Ultra ALLOY Metal Capillary Column UA35-30M x 0.25mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100084
Ultra ALLOY Metal Capillary Column UA65-30M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.1µm	380°C	CH-100085
Ultra ALLOY Metal Capillary Column UAWAX-30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100086
Ultra ALLOY Metal Capillary Column UA1-60M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	60 m	0.25µm	380°C	CH-100087
Ultra ALLOY Metal Capillary Column UA1-60M x 0.25 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	60 m	0.5µm	380°C	CH-100088
Ultra ALLOY Metal Capillary Column UA1-60M x 0.25 mm ID, 1.0µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	60 m	1.0µm	330/360°C	CH-100089
Ultra ALLOY Metal Capillary Column UA5-60M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Micropolarity	0.25 mm	60 m	0.25µm	380°C	CH-100090

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UA5-60M x 0.25 mm ID, 0.5µm Film	Dimethyl polysiloxane	Micropolarity	0.25 mm	60 m	0.5µm	380°C	CH-100091
Ultra ALLOY Metal Capillary Column UA5-60M x 0.25 mm ID, 1.0µm Film	Dimethyl polysiloxane	Micropolarity	0.25 mm	60 m	1.0µm	330/360°C	CH-100092
Ultra ALLOY Metal Capillary Column UA65-60M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	60 m	0.1µm	380°C	CH-100093
Ultra ALLOY Metal Capillary Column UAWAX-60M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Strong polarity	0.25 mm	60 m	0.25µm	260°C	CH-100094
Ultra ALLOY Metal Capillary Column UAPBDE-15M x 0.25 mm ID, 0.05µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.05µm	380°C	CH-100095
Ultra ALLOY Metal Capillary Column UAPHTHA-15M x 0.25 mm ID, 0.05µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.05µm	380°C	CH-100096
Ultra ALLOY Metal Capillary Column UA1(S)-15M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.25µm	450°C	CH-100097
Ultra ALLOY Metal Capillary Column UA1(S)-15M x 0.25 mm ID, 0.4µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	15 m	0.4µm	420°C	CH-100098
Ultra ALLOY Metal Capillary Column UA1701-15M x 0.25 mm ID, 0.25µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	15 m	0.25µm	380°C	CH-100099
Ultra ALLOY Metal Capillary Column UA1701-15M x 0.25 mm ID, 0.5µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	15 m	0.5µm	380°C	CH-100100
Ultra ALLOY Metal Capillary Column UA1701-15M x 0.25 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	15 m	1.0µm	330/360°C	CH-100101
Ultra ALLOY Metal Capillary Column UA50-15M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.1µm	350°C	CH-100102
Ultra ALLOY Metal Capillary Column UA50-15M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.25µm	350°C	CH-100103
Ultra ALLOY Metal Capillary Column UA50-15M x 0.25 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.5µm	350°C	CH-100104

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UA50-15M x 0.25 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	1.0µm	350°C	CH-100105
Ultra ALLOY Metal Capillary Column UAFFAP-15M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.25µm	350°C	CH-100106
Ultra ALLOY Metal Capillary Column UATRG-15M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.1µm	350°C	CH-100107
Ultra ALLOY Metal Capillary Column UASIL-15M x 0.25 mm ID, 0.2µm Film	Cyanopropyl	Strong polarity	0.25 mm	15 m	0.2µm	350°C	CH-100108
Ultra ALLOY Metal Capillary Column UAWAXK-15M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	15 m	0.25µm	350°C	CH-100109
Ultra ALLOY Metal Capillary Column UAPBDE-30M x 0.25 mm ID, 0.05µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.05µm	380°C	CH-100110
Ultra ALLOY Metal Capillary Column UAPHTHA-30M x 0.25 mm ID, 0.05µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.05µm	380°C	CH-100111
Ultra ALLOY Metal Capillary Column UA1(S)-30M x 0.25 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.25µm	380°C	CH-100112
Ultra ALLOY Metal Capillary Column UA1(S)-30M x 0.25 mm ID, 0.4µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	30 m	0.4µm	380°C	CH-100113
Ultra ALLOY Metal Capillary Column UA1701-30M x 0.25 mm ID, 0.25µm Film	Cyanopropylphenyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100114
Ultra ALLOY Metal Capillary Column UA1701-30M x 0.25 mm ID, 0.5µm Film	Cyanopropylphenyl polysiloxane	Strong polarity	0.25 mm	30 m	0.5µm	380°C	CH-100115
Ultra ALLOY Metal Capillary Column UA1701-30M x 0.25 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Strong polarity	0.25 mm	30 m	1.0µm	330/360°C	CH-100116
Ultra ALLOY Metal Capillary Column UA50-30M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.1µm	380°C	CH-100117
Ultra ALLOY Metal Capillary Column UA50-30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100118
Ultra ALLOY Metal Capillary Column UA50-30M x 0.25 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.5µm	380°C	CH-100119

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UA50-30M x 0.25 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	1.0µm	330/360°C	CH-100120
Ultra ALLOY Metal Capillary Column UAFFAP-30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100121
Ultra ALLOY Metal Capillary Column UA5(P)-D30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100122
Ultra ALLOY Metal Capillary Column UAPY1-30M x 0.25 mm ID, 0.25µm Film	Polydimethylsiloxane	Nonpolar	0.25 mm	30 m	0.25µm	380°C	CH-100123
Ultra ALLOY Metal Capillary Column UAPY2-30M x 0.25 mm ID, 0.5µm Film	Polydimethylsiloxane	Nonpolar	0.25 mm	30 m	0.5µm	380°C	CH-100124
Ultra ALLOY Metal Capillary Column UA624-30M x 0.25 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	30 m	1.0µm	330/360°C	CH-100125
Ultra ALLOY Metal Capillary Column UADIDP-30M x 0.25 mm ID, 0.4µm Film	Di-isodecylphthalate	Strong polarity	0.25 mm	30 m	0.4µm	380°C	CH-100126
Ultra ALLOY Metal Capillary Column UATRG-30M x 0.25 mm ID, 10µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	10µm	380°C	CH-100127
Ultra ALLOY Metal Capillary Column UASIL-30M x 0.25 mm ID, 0.2µm Film	Cyanopropyl	Strong polarity	0.25 mm	30 m	0.2µm	380°C	CH-100128
Ultra ALLOY Metal Capillary Column UAWAXK-30M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	30 m	0.25µm	380°C	CH-100129
Ultra ALLOY Metal Capillary Column UA1(S)-60M x 0.25 mm ID, 0.4µm Film	Dimethyl polysiloxane	Nonpolar	0.25 mm	60 m	0.4µm	380°C	CH-100130
Ultra ALLOY Metal Capillary Column UA1701-60M x 0.25 mm ID, 0.25µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	60 m	0.25µm	380°C	CH-100131
Ultra ALLOY Metal Capillary Column UA1701-60M x 0.25 mm ID, 0.5µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	60 m	0.5µm	380°C	CH-100132
Ultra ALLOY Metal Capillary Column UA1701-60M x 0.25 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	60 m	1.0µm	330/360°C	CH-100133

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UA50-60M x 0.25 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	60 m	0.1µm	380°C	CH-100134
Ultra ALLOY Metal Capillary Column UA50-60M x 0.25 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	60 m	0.25µm	380°C	CH-100135
Ultra ALLOY Metal Capillary Column UA50-60M x 0.25 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	60 m	0.5µm	380°C	CH-100136
Ultra ALLOY Metal Capillary Column UA50-60M x 0.25 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Strong polarity	0.25 mm	60 m	1.0µm	330/360°C	CH-100137
Ultra ALLOY Metal Capillary Column UAFFAP-60M x 0.25 mm ID, 0.25µm Film	PEG20M (Nitro-TPA ester)	Midpolarity	0.25 mm	60 m	0.25µm	380°C	CH-100138
Ultra ALLOY Metal Capillary Column UA624-60M x 0.25 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.25 mm	60 m	1.0µm	330/360°C	CH-100139
Ultra ALLOY Metal Capillary Column UADIDP-60M x 0.25 mm ID, 0.4µm Film	Di-isodecylphthalate	Strong polarity	0.25 mm	60 m	0.4µm	150°C	CH-100140
Ultra ALLOY Metal Capillary Column UASIL-60M x 0.25 mm ID, 0.2µm Film	Cyanopropyl	Midpolarity	0.25 mm	60 m	0.2µm	280°C	CH-100141
Ultra ALLOY Metal Capillary Column UAWAXK-60M x 0.25 mm ID, 0.25µm Film	PEG20M (KOH treatment)	Strong polarity	0.25 mm	60 m	0.25µm	260°C	CH-100142
Ultra ALLOY Metal Capillary Column UA1-30MW x 0.32 mm ID, 0.10µm Film	Polydimethylsiloxane	Nonpolar	0.32 mm	30 m	10µm	380°C	CH-100143
Ultra ALLOY Metal Capillary Column UA1(HT)-15W x 0.53 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	0.1µm	420°C	CH-100144
Ultra ALLOY Metal Capillary Column UA1(HT)-15W x 0.53 mm ID, 0.15µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	0.15µm	420°C	CH-100145
Ultra ALLOY Metal Capillary Column UA1(HT)-15W x 0.53 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	0.25µm	420°C	CH-100146
Ultra ALLOY Metal Capillary Column UADX30-15W x 0.53 mm ID, 0.15µm Film	Carborane-siloxane	Micropolarity	0.53 mm	15 m	0.15µm	450°C	CH-100147

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UA1(HT)-30W x 0.53 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	0.1µm	380°C	CH-100148
Ultra ALLOY Metal Capillary Column UA1(HT)-30W x 0.53 mm ID, 0.15µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	0.15µm	380°C	CH-100149
Ultra ALLOY Metal Capillary Column UA1(HT)-30W x 0.53 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	0.25µm	380°C	CH-100150
Ultra ALLOY Metal Capillary Column UADX30-30W x 0.53 mm ID, 0.15µm Film	Carborane-siloxane	Micropolarity	0.53 mm	30 m	0.15µm	450°C	CH-100151
Ultra ALLOY Metal Capillary Column UA1-15W x 0.53 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	0.25µm	380°C	CH-100152
Ultra ALLOY Metal Capillary Column UA1-15W x 0.53 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	0.5µm	380°C	CH-100153
Ultra ALLOY Metal Capillary Column UA1-15W x 0.53 mm ID, 1.5µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	1.5µm	380°C	CH-100154
Ultra ALLOY Metal Capillary Column UA1-15W x 0.53 mm ID, 5.0µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	5.0µm	380°C	CH-100155
Ultra ALLOY Metal Capillary Column UA1-30W x 0.53 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	0.25µm	380°C	CH-100156
Ultra ALLOY Metal Capillary Column UA1-30W x 0.53 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	0.5µm	380°C	CH-100157
Ultra ALLOY Metal Capillary Column UA1-30W x 0.53 mm ID, 1.5µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	1.5µm	380°C	CH-100158
Ultra ALLOY Metal Capillary Column UA1-30W x 0.53 mm ID, 5.0µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	5.0µm	380°C	CH-100159
Ultra ALLOY Metal Capillary Column UA1-60W x 0.53 mm ID, 0.25µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	60 m	0.25µm	380°C	CH-100160
Ultra ALLOY Metal Capillary Column UA1-60W x 0.53 mm ID, 0.5µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	60 m	0.5µm	380°C	CH-100161

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UA1-60W x 0.53 mm ID, 1.5µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	60 m	1.5µm	380°C	CH-100162
Ultra ALLOY Metal Capillary Column UA1-60W x 0.53 mm ID, 5.0µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	60 m	5.0µm	380°C	CH-100163
Ultra ALLOY Metal Capillary Column UA5-15W x 0.53 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	15 m	0.25µm	380°C	CH-100164
Ultra ALLOY Metal Capillary Column UA5-15W x 0.53 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	15 m	0.5µm	380°C	CH-100165
Ultra ALLOY Metal Capillary Column UA5-15W x 0.53 mm ID, 1.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	15 m	1.5µm	380°C	CH-100166
Ultra ALLOY Metal Capillary Column UA5-15W x 0.53 mm ID, 5.0µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	15 m	5.0µm	380°C	CH-100167
Ultra ALLOY Metal Capillary Column UA5-30W x 0.53 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	30 m	0.25µm	380°C	CH-100168
Ultra ALLOY Metal Capillary Column UA5-30W x 0.53 mm ID, 0.50µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	30 m	0.50µm	380°C	CH-100169
Ultra ALLOY Metal Capillary Column UA5-30W x 0.53 mm ID, 1.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	30 m	1.5µm	380°C	CH-100170
Ultra ALLOY Metal Capillary Column UA5-30W x 0.53 mm ID, 5.0µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	30 m	5.0µm	380°C	CH-100171
Ultra ALLOY Metal Capillary Column UA5-60W x 0.53 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	60 m	0.25µm	380°C	CH-100172
Ultra ALLOY Metal Capillary Column UA5-60W x 0.53 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	60 m	0.5µm	380°C	CH-100173
Ultra ALLOY Metal Capillary Column UA5-60W x 0.53 mm ID, 1.5µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	60 m	1.5µm	380°C	CH-100174
Ultra ALLOY Metal Capillary Column UA5-60W x 0.53 mm ID, 5.0µm Film	Diphenyldimethyl polysiloxane	Micropolarity	0.53 mm	60 m	5.0µm	380°C	CH-100175
Ultra ALLOY Metal Capillary Column UAWAX-15W x 0.53 mm ID, 1.0µm Film	Dimethyl polysiloxane	Strong polarity	0.53 mm	15 m	1.0µm	260°C	CH-100176

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UAWAX-30W x 0.53 mm ID, 1.0µm Film	Dimethyl polysiloxane	Strong polarity	0.53 mm	30 m	1.0µm	260°C	CH-100177
Ultra ALLOY Metal Capillary Column UAWAX-60W x 0.53 mm ID, 1.0µm Film	Dimethyl polysiloxane Dimethyl polysiloxane	Strong polarity	0.53 mm	60 m	1.0µm	260°C	CH-100178
Ultra ALLOY Metal Capillary Column UASIM(HT)-5W x 0.53 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	5m	0.1µm	380°C	CH-100179
Ultra ALLOY Metal Capillary Column UASIM(HT)-10W x 0.53 mm ID, 0.1µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	10 m	0.1µm	380°C	CH-100180
Ultra ALLOY Metal Capillary Column UAPHTHA-15 m x 0.53 mm ID, 0.05µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	15 m	0.05µm	380°C	CH-100181
Ultra ALLOY Metal Capillary Column UAPHTHA-30M x 0.53 mm ID, 0.05µm Film	Dimethyl polysiloxane	Nonpolar	0.53 mm	30 m	0.05µm	380°C	CH-100182
Ultra ALLOY Metal Capillary Column UA624-30W x 0.53 mm ID, 3.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	30 m	3.0µm	320°C	CH-100183
Ultra ALLOY Metal Capillary Column UA624-60W x 0.53 mm ID, 3.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	60 m	3.0µm	320°C	CH-100184
Ultra ALLOY Metal Capillary Column UA624Dx-45W x 0.53 mm ID, 3.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	45m	3.0µm	320°C	CH-100185
Ultra ALLOY Metal Capillary Column UA1(S)-15W x 0.53 mm ID, 0.25µm Film	Polydimethylsiloxane	Nonpolar	0.53 mm	15 m	0.25µm	370°C	CH-100186
Ultra ALLOY Metal Capillary Column UA1(S)-30W x 0.53 mm ID, 0.25µm Film	Polydimethylsiloxane	Nonpolar	0.53 mm	30 m	0.25µm	370°C	CH-100187
Ultra ALLOY Metal Capillary Column UA1701-15W x 0.53 mm ID, 0.25µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	15 m	0.25µm	320°C	CH-100188
Ultra ALLOY Metal Capillary Column UA1701-30W x 0.53 mm ID, 0.25µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	30 m	0.25µm	320°C	CH-100189

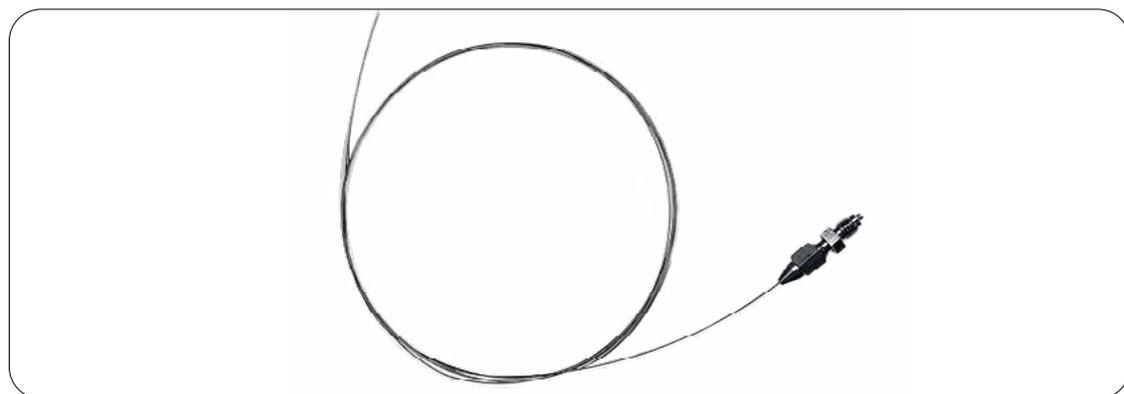
Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UA1701-60W x 0.53 mm ID, 0.25µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	60 m	0.25µm	320°C	CH-100190
Ultra ALLOY Metal Capillary Column UA1701-15W x 0.53 mm ID, 0.5µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	15 m	0.5µm	320°C	CH-100191
Ultra ALLOY Metal Capillary Column UA1701-30W x 0.53 mm ID, 0.5µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	30 m	0.5µm	320°C	CH-100192
Ultra ALLOY Metal Capillary Column UA1701-60W x 0.53 mm ID, 0.5µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	60 m	0.5µm	320°C	CH-100193
Ultra ALLOY Metal Capillary Column UA1701-15W x 0.53 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	15 m	1.0µm	320°C	CH-100194
Ultra ALLOY Metal Capillary Column UA1701-30W x 0.53 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	30 m	1.0µm	320°C	CH-100195
Ultra ALLOY Metal Capillary Column UA1701-60W x 0.53 mm ID, 1.0µm Film	Cyanopropylphenyl polysiloxane	Midpolarity	0.53 mm	60 m	1.0µm	320°C	CH-100196
Ultra ALLOY Metal Capillary Column UA50-60W x 0.53 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	60 m	0.1µm	390°C	CH-100197
Ultra ALLOY Metal Capillary Column UA50-15W x 0.53 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	15 m	0.25µm	390°C	CH-100198
Ultra ALLOY Metal Capillary Column UA50-30W x 0.53 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	30 m	0.25µm	390°C	CH-100199
Ultra ALLOY Metal Capillary Column UA50-60W x 0.53 mm ID, 0.25µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	60 m	0.25µm	390°C	CH-100200
Ultra ALLOY Metal Capillary Column UA50-15W x 0.53 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	15 m	0.5µm	390°C	CH-100201
Ultra ALLOY Metal Capillary Column UA50-30W x 0.53 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	30 m	0.5µm	390°C	CH-100202
Ultra ALLOY Metal Capillary Column UA50-60W x 0.53 mm ID, 0.5µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	60 m	0.5µm	390°C	CH-100203

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UA50-15W x 0.53 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	15 m	1.0µm	390°C	CH-100204
Ultra ALLOY Metal Capillary Column UA50-30W x 0.53 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	30 m	1.0µm	390°C	CH-100205
Ultra ALLOY Metal Capillary Column UA50-60W x 0.53 mm ID, 1.0µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	60 m	1.0µm	390°C	CH-100206
Ultra ALLOY Metal Capillary Column UA65-15W x 0.53 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	15 m	0.1µm	390°C	CH-100207
Ultra ALLOY Metal Capillary Column UA65-30W x 0.53 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	30 m	0.1µm	390°C	CH-100208
Ultra ALLOY Metal Capillary Column UA65-60W x 0.53 mm ID, 0.1µm Film	Diphenyldimethyl polysiloxane	Midpolarity	0.53 mm	60 m	0.1µm	390°C	CH-100209
Ultra ALLOY Metal Capillary Column UAWAX-15W x 0.53 mm ID, 0.5µm Film	Polyethyleneglycol	Strong polarity	0.53 mm	15 m	0.5µm	260°C	CH-100210
Ultra ALLOY Metal Capillary Column UAWAX-30W x 0.53 mm ID, 0.5µm Film	Polyethyleneglycol	Strong polarity	0.53 mm	30 m	0.5µm	260°C	CH-100211
Ultra ALLOY Metal Capillary Column UAWAX-60W x 0.53 mm ID, 0.5µm Film	Polyethyleneglycol	Strong polarity	0.53 mm	60 m	0.5µm	260°C	CH-100212
Ultra ALLOY Metal Capillary Column UAFFAP-15W x 0.53 mm ID, 0.5µm Film	PEG 20M Nitro-TPA ester	Strong polarity	0.53 mm	15 m	0.5µm	260°C	CH-100213
Ultra ALLOY Metal Capillary Column UAFFAP-30W x 0.53 mm ID, 0.5µm Film	PEG 20M Nitro-TPA ester	Strong polarity	0.53 mm	30 m	0.5µm	260°C	CH-100214
Ultra ALLOY Metal Capillary Column UAFFAP-60W x 0.53 mm ID, 0.5µm Film	PEG 20M Nitro-TPA ester	Strong polarity	0.53 mm	60 m	0.5µm	260°C	CH-100215
Ultra ALLOY Metal Capillary Column UAFFAP-15W x 0.53 mm ID, 1.0µm Film	PEG 20M Nitro-TPA ester	Strong polarity	0.53 mm	15 m	1.0µm	260°C	CH-100216
Ultra ALLOY Metal Capillary Column UAFFAP-30W x 0.53 mm ID, 1.0µm Film	PEG 20M Nitro-TPA ester	Strong polarity	0.53 mm	30 m	1.0µm	260°C	CH-100217

Description	Specification	Polarity	ID	Length	Film Thickness	Max Temp	Part No.
Ultra ALLOY Metal Capillary Column UAFFAP-60W x 0.53 mm ID, 1.0µm Film	PEG 20M Nitro-TPA ester	Strong polarity	0.53 mm	60 m	1.0µm	260°C	CH-100218
Ultra ALLOY Metal Capillary Column UAWAXK-15W x 0.53 mm ID, 0.5µm Film	PEG 20M (KOH treatment)	Strong polarity	0.53 mm	15 m	0.5µm	260°C	CH-100219
Ultra ALLOY Metal Capillary Column UAWAXK-30W x 0.53 mm ID, 0.5µm Film	PEG 20M (KOH treatment)	Strong polarity	0.53 mm	30 m	0.5µm	260°C	CH-100220
Ultra ALLOY Metal Capillary Column UAWAXK-60W x 0.53 mm ID, 0.5µm Film	PEG 20M (KOH treatment)	Strong polarity	0.53 mm	60 m	0.5µm	260°C	CH-100221
Ultra ALLOY Metal Capillary Column UAWAXK-15W x 0.53 mm ID, 1.0µm Film	PEG 20M (KOH treatment)	Strong polarity	0.53 mm	15 m	1.0µm	260°C	CH-100222
Ultra ALLOY Metal Capillary Column UAWAXK-30W x 0.53 mm ID, 1.0µm Film	PEG 20M (KOH treatment)	Strong polarity	0.53 mm	30 m	1.0µm	260°C	CH-100223
Ultra ALLOY Metal Capillary Column UAWAXK-60W x 0.53 mm ID, 1.0µm Film	PEG 20M (KOH treatment)	Strong polarity	0.53 mm	60 m	1.0µm	260°C	CH-100224

Ultra ALLOY Guard Columns

Description	Part No.
Ultra ALLOY Guard Column Set Phthalates	CH-100225
Ultra ALLOY Guard Column Phthalates, Qty. 2	CH-100226
Ultra ALLOY Guard Column Connector, Qty. 1	CC-100336
Vent Free Metal Ferrule D, Qty. 20	CC-100337



Ultra ALLOY 316 Stainless Steel Capillary Deactivated Tubes

Description	ID	Length	Part No.
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.15 x 0.47, 5M	0.15 mm	5 m	CT-100110
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.25 x 0.47, 5M	0.25 mm	5 m	CT-100111
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.25 x 1.58 (1/16"), 5M	0.25 mm	5 m	CT-100112
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.32 x 0.75, 5M	0.32 mm	5 m	CT-100113
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.53 x 0.75, 5M	0.53 mm	5 m	CT-100114
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.53 x 1.58 (1/16"), 5M	0.53 mm	5 m	CT-100115
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.80 x 1.15, 5M	0.80 mm	5 m	CT-100116
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.80 x 1.58 (1/16"), 5M	0.80 mm	5 m	CT-100117
Ultra ALLOY 316 SS Capillary Deactivated Tube 1.20 x 1.58 (1/16"), 5M	1.20 mm	5 m	CT-100118
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.15 x 0.47, 10M	0.15 mm	10 m	CT-100119
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.25 x 0.47, 10M	0.25 mm	10 m	CT-100120
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.25 x 1.58 (1/16"), 10M	0.25 mm	10 m	CT-100121
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.32 x 0.75, 10M	0.32 mm	10 m	CT-100122
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.53 x 0.75, 10M	0.53 mm	10 m	CT-100123
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.53 x 1.58 (1/16"), 10M	0.53 mm	10 m	CT-100124
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.80 x 1.15, 10M	0.80 mm	10 m	CT-100125
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.80 x 1.58 (1/16"), 10M	0.80 mm	10 m	CT-100126
Ultra ALLOY 316 SS Capillary Deactivated Tube 1.20 x 1.58 (1/16"), 10M	1.20 mm	10 m	CT-100127
Ultra ALLOY 316 SS EGA Capillary Tube 0.15 x 0.47, 2.5 M	0.15 mm	2.5 m	CT-100109

Ultra ALLOY 316 Stainless Steel Untreated Capillary Tubes

Description	ID	Length	Part No.
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.15 x 0.47, 5M	0.15 mm	5 m	CT-100128
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 0.47, 5M	0.25 mm	5 m	CT-100129
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 1.58 (1/16"), 5M	0.25 mm	5 m	CT-100130
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.32 x 0.75, 5M	0.32 mm	5 m	CT-100131
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.53 x 0.75, 5M	0.53 mm	5 m	CT-100132
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.53 x 1.58 (1/16"), 5M	0.53 mm	5 m	CT-100133
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.80 x 1.15, 5M	0.80 mm	5 m	CT-100134
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.80 x 1.58 (1/16"), 5M	0.80 mm	5 m	CT-100135
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 1.20 x 1.58 (1/16"), 5M	1.20 mm	5 m	CT-100136
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.05 x 0.315, 10M	0.05 mm	10 m	CT-100137
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.15 x 0.47, 10M	0.15 mm	10 m	CT-100138
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 0.47, 10M	0.25 mm	10 m	CT-100139
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 0.47, 30M	0.25 mm	30 m	CT-100140
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 1.58 (1/16"), 10M	0.25 mm	10 m	CT-100141
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.32 x 0.75, 10M	0.32 mm	10 m	CT-100142
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.53 x 0.75, 10M	0.53 mm	10 m	CT-100143
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.53 x 1.58 (1/16"), 10M	0.53 mm	10 m	CT-100144



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Orders for custom-made columns will be given immediate attention and most will be shipped within 24 hours from receipt of order. We can supply packed columns made with any combination of support and liquid phase listed in this catalog. We will also make every effort to supply your requirements for other supports or liquid phases.

- Over 42 years experience in packing preparation and column techniques.
- 24 hour delivery.
- Complete with brass Swagelok fittings.
- All stainless steel tubing is our premium grade, manufactured for GC use only.
- Each column packed in individual container. (No lost ferrules or end caps)
- OV's guide to packings and columns included

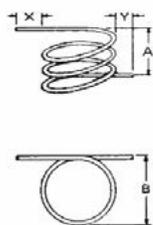


Diagram 1

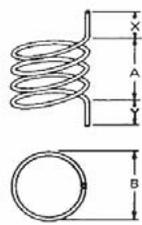


Diagram 2

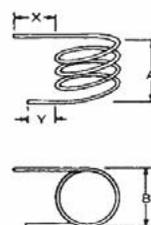


Diagram 3

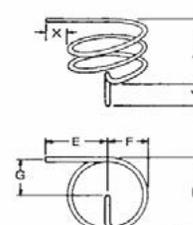


Diagram 4

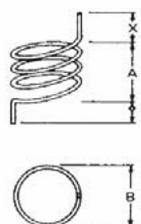


Diagram 5

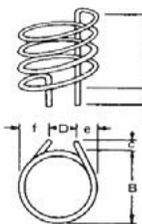


Diagram 6

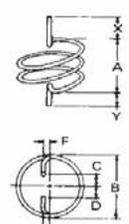


Diagram 7

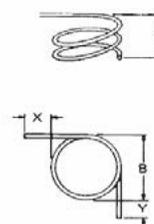
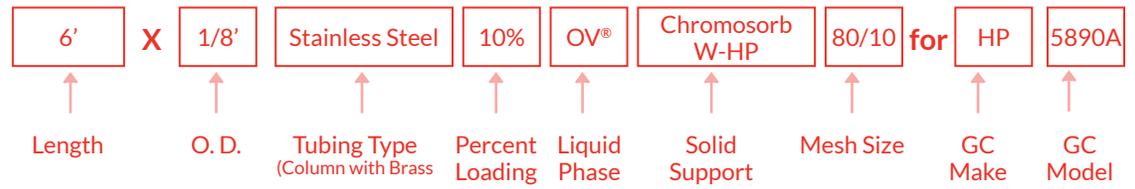


Diagram 8

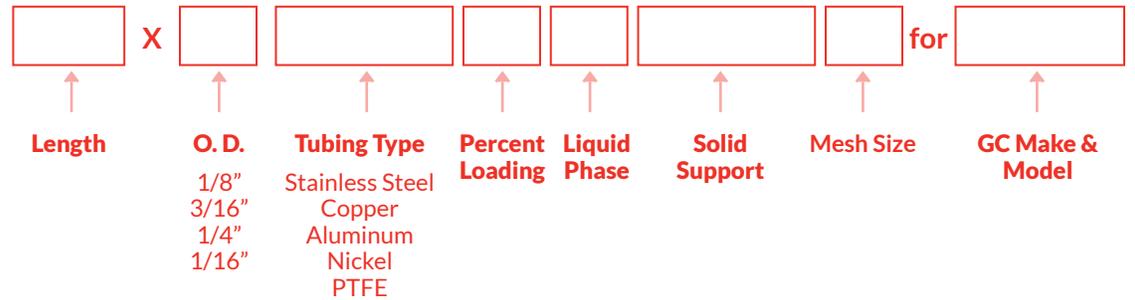
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HPLC Columns



Basics

High performance liquid chromatography (HPLC) is part of liquid chromatographic separating processes of substance mixtures and their analysis. In the beginning the technique was also called high pressure liquid chromatography due to the high back pressure of the column. HPLC offers qualitative (identification of substances) and quantitative (concentration determination) analysis by comparison with standard substances. The term HPLC was introduced in the 1970s to describe the high performance method developed from the column liquid chromatography that came about in the 1930s. At the beginning of the 21st century HPLC was complemented by even more efficient UHPLC (ultra high performance liquid chromatography). Hereby even higher pressures (> 400 bar) result in shorter analysis time and enhanced efficiency enabling a higher sample throughput with smaller sample volumes.

Application

HPLC/UHPLC is used additionally to gas chromatography (GC) for separation and determination of complex substance mixtures composed of low-volatile, polar and ionic, high-molecular or thermal instable substances. Therefore, a sufficient solubility of the sample in a solvent or a solvent mixture is required. HPLC/UHPLC is used for purity control of chemicals and industrial products, determination of active agents for drug development, production and testing, environmental analytics, quality and purity control of foods, analysis of ingredients in cosmetics as well as isolation of biopolymers.



Basic Principle

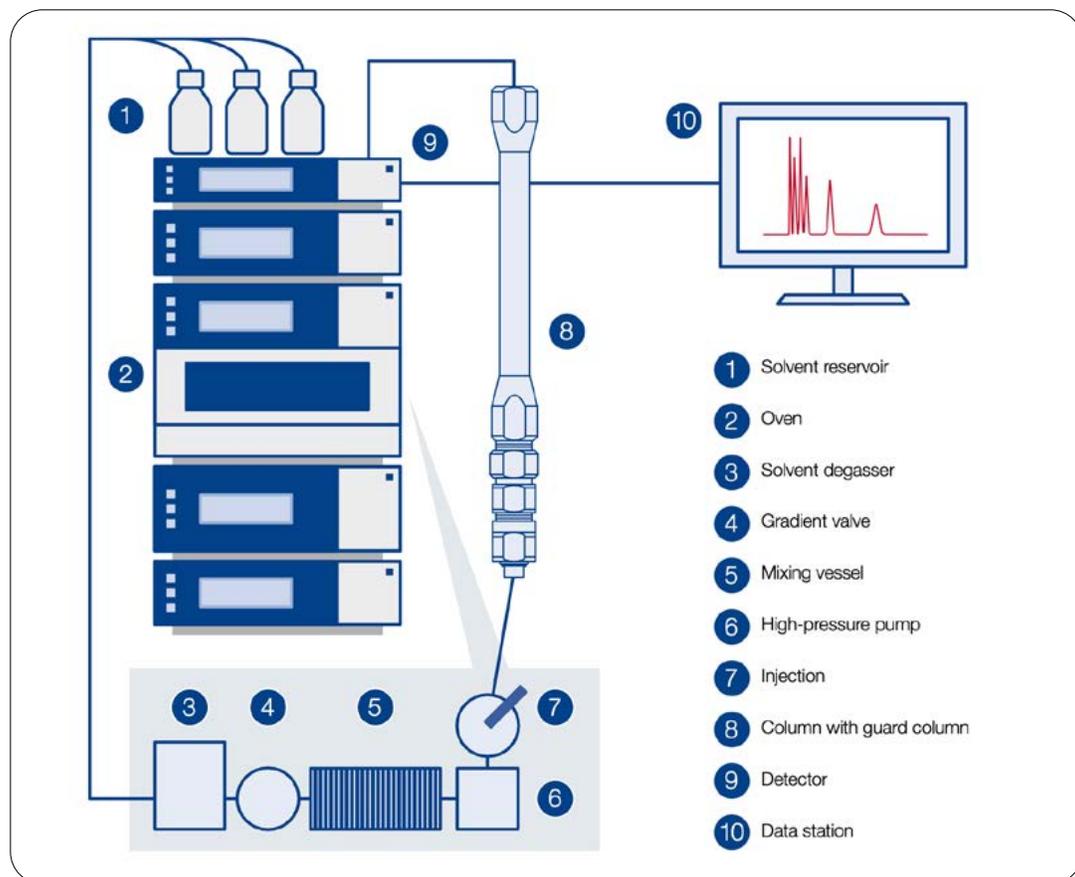
In liquid column chromatography a mobile phase (eluent) flows through a particle filled tube (separation column, stationary phase). In classic column chromatography this tube is a glass column with an inner diameter of several centimeters and a length up to 450 mm or even bigger. The filling material typically consists of coarse-grained particles like silica gel 60. The eluent is transported through the separation column either by hydrostatic pressure or a low-pressure pump with 1.5–2 bar.

In contrast HPLC columns consist of stainless steel with an inner diameter of 2–4.6 mm and a length of 20–300 mm. The column packing, mostly modified porous silica, has generally a particle size of 3, 5, 7 or 10 μm and a pore size of 50, 100, 120 (for low-molecular analytes) or 300–4000 \AA (for high-molecular analytes). In UHPLC shorter columns in the range of 20–150 mm length with highly efficient particles of 1.8 μm size (sub-2 μm) are utilized. A guard column of a few millimeters length can be utilized and installed with a specific Column Protection System to increase the column lifetime. HPLC/UHPLC uses a high-pressure pump

to transport the eluent from a storage vessel into the system with a column back pressure of up to 600/1200 bar.

Instrument

HPLC as well as UHPLC instruments have different building blocks. The storage vessel (eluent reservoir, 1) usually contains a deaerator unit (3) for the solvents. Followed by a gradient valve (4) with mixing chamber (5) in flow direction, which allows the usage of isocratic as well as gradient methods. A high-pressure pump (6) transports the sample into the system. The sample is injected via an injection valve (7). Usually this is operated automatically with a syringe by an autosampler. With the eluent flow the sample is transported to guard and separating column (8). For better reproducibility of the separation tempering with a column oven (2) should be performed. The separated substances are determined with a detector (9). In the resulting chromatogram each detector signal of a substance (peak), is related to the retention time of the column. With the data evaluation (10) these peaks can be identified and their concentration can be determined.



Separation Mechanism

While flowing through the column each component of the solved mixture interacts differently with the stationary phase. According to the characteristics of the substance (hydrophobic, polar, ionic, aromatic, sterically hindered etc.) the strength of the interactions vary and thus the compounds are retained by the stationary phase in different ways. Essentially a distinction is drawn between normal phase (NP), reversed phase (RP) and ion exchange chromatography. Depending on the structure of the stationary phase diverse interactions e.g., van der Waals forces or π - π -stacking can occur and different polar mobile phases are required. For polar stationary normal phases (e.g., SiOH, CN, OH, NH₂) non-polar eluents like *n*-heptane, hexane, dichloromethane or 2-propanol are applicable. While for reversed phases (e.g., C₁₈, C₈, C₄, C₂, C₆H₅) typically polar RP eluents (e.g., acetonitrile or methanol with ultrapure water or buffer) and for ion exchange (e.g., SA, SB) aqueous buffers (e.g., phosphate, acetate, citric buffer) come to use.

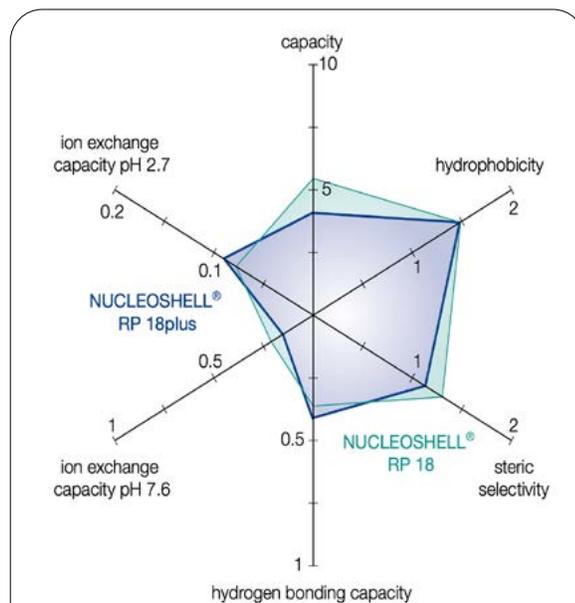
Selectivity

The characteristic separation behavior of phases under certain conditions is also called selectivity. This is dependent on different parameters like structure and modifications of the base silica gel, nature of the chemical binding or the type of endcapping.

In recent decades several methods have been developed to compare and distinguish the selectivity of various silica gels and their modifications. In this connection defined substances or substance classes are analyzed and the chromatographic parameters are graphically presented. A frequently applied model in specialist literature is e.g., the TANAKA plot, which allows a quick comparison of different HPLC phases¹.

Characteristic Parameters

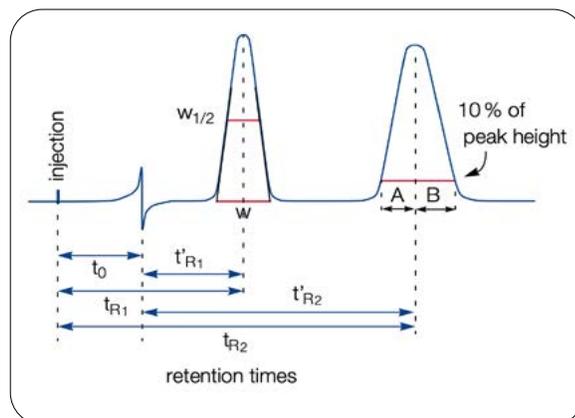
The success of a chromatographic separation depends apart from the stationary and mobile phase also on other characteristics like the quality of the separating column or the linear flow rate. The following schematic chromatogram illustrates the most important parameters which characterize a separation.



Parameter of the Tanaka diagram:

- Capacity = k' (pentylbenzene)
- Hydrophobicity = α (pentylbenzene, butylbenzene)
Steric selectivity = α (triphenyl, *o*-terphenyl)
- Hydrogen bonding capacity (capacity of silanol) = α (caffeine, phenol) Ion exchange capacity at pH 2.7 = α (benzylamine, phenol) Ion exchange capacity at pH 7.6 = α (benzylamine, phenol)

The comparison of NUCLEOSHELL® RP18 and NUCLEOSHELL® RP 18plus for example shows a lower ion exchange capacity at pH 7.6 for the monomeric NUCLEOSHELL® RP 18plus. The radar chart also reflects a more pronounced steric selectivity of NUCLEOSHELL® RP 18 due to a higher density of modifications with C₁₈ chains.



Schematic Chromatogram Legend

Peak Width:	
$W_{1/2}$	Peak width at half height
W	Peak width of the peak (intersection point of the inflectional tangents with the zero line)
Peak Symmetry:	
A	Peak front to peak maximum at 10 % of peak height
B	Peak maximum to peak end at 10 % of peak height
Retention Time:	
t_0	Dead time of a column = retention time of a non-retarded substance
t_{R1}, t_{R2}	Retention times of components 1 and 2
t'_{R1}, t'_{R2}	Net retention times of components 1 and 2

In a chromatographic system the substances differ from each other in their retention time in or on the stationary phase. The time, which is needed by a sample component to migrate from column inlet (sample injection) to the column end (detector) is the retention time t_{R1} or t_{R2} . The dead time t_0 is the time required by an inert compound to migrate from column inlet to column end without any retardation by the stationary phase. Consequently, the dead time is identical with the retention time of the sample component remaining in the stationary phase. The difference of total retention time and dead time yields the net retention time t'_{R1} or t'_{R2} , which is the time a sample component remains in the stationary phase.

$$t'_{R1} = t_{R1} - t_0 \text{ bzw. } t'_{R2} = t_{R2} - t_0$$

To compare chromatograms that are recorded with columns of different lengths and internal diameters, as well as different flow rates, the retention time is converted into a dimensionless capacity factor k' .

$$k'_1 = \frac{t_{R1} - t_0}{t_0} \quad \text{bzw.} \quad k'_2 = \frac{t_{R2} - t_0}{t_0}$$

The relative retention α , also known as the separation factor, describes the ability of a chromatographic system (stationary and mobile phase) to distinguish between two compounds. This is calculated from the rate of the capacity factors of the substances, where the figure in the denominator is the reference compound.

$$\alpha = \frac{k'_2}{k'_1}$$

The resolution R is a measure for the efficiency of the column to separate two substances. Besides the retention time t_R the peak width at half height $w_{1/2}$ is also included.

$$R = 1.18 \cdot \frac{t_{R2} - t_{R1}}{(w_{1/2})_2 + (w_{1/2})_1}$$

For practical reasons the peak symmetry is calculated at 10 % of peak height. Ideally symmetry should be 1, i.e. $A = B$. Values > 1 indicate peak tailing, while values < 1 indicate peak fronting.

$$\text{Peak symmetry} = \frac{B}{A}$$

Instead of the mobile phase volumetric flow rate [mL/min], which is controlled at the HPLC instrument, it is advantageous to use the linear velocity u [cm/sec]. The linear velocity is independent of the column cross section and proportional to the pressure drop in the column. The linear velocity can be calculated by means of the dead time, where L is the column length in cm and t_0 the dead time in sec.

$$u = \frac{L}{t_0}$$

The quality of a column packing is determined through the number of theoretical plates N . High N values indicate a high capability to separate complex sample mixtures.

$$N = 5.54 \cdot \left(\frac{t_{R1}}{W_{1/2}} \right)^2$$

The value of the height equivalent to a theoretical plate HEPT is a criterion for the quality of a column. HEPT, is the length, in which the chromatographic equilibrium between mobile and stationary phase has been adjusted once. Its value depends on the particle size, the flow velocity, the mobile phase viscosity and especially on the packing quality. Small HEPT values, meaning a large number of theoretical plates N , facilitate the column to separate complex sample mixtures.

$$H = \frac{L}{N}$$

The Van Deemter equation shows the dependence of the HEPT on the velocity u .

$$H = A + \frac{B}{u} + C \cdot u$$

The A term, also called eddy-diffusion, is a function of the particle size, the B term a function of the diffusion coefficient of the substance in the mobile phase and the C term the retardation of a substance by the interface between stationary and mobile phase. At the point of intersection of h_{min} and u_{opt} the optimal separation efficiency for a column with high peak symmetry for the separated substances is obtained.

Column Quality

Each HPLC/UHPLC column of MACHEREY-NAGEL is individually tested according to the most important characteristic parameters in quality control and the results are documented in a certificate of analysis.

Detailed information of the particular properties of the modern high-purity silica phases NUCLEODUR® and Core-Shell material NUCLEOSHELL® as well as the respective HPLC- and UHPLC-columns can be found on the following pages.

Strict Quality Specifications: Outstanding Reliability

Highest Production Standard

- Our facilities are ISO 9001 certified
- Perfect reproducibility from batch-to-batch and within each lot
- Individually tested columns, supplied with test chromatogram and conditions

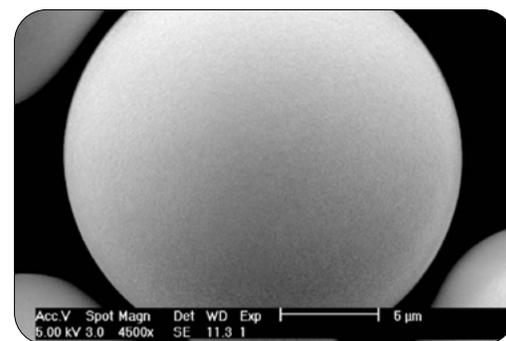
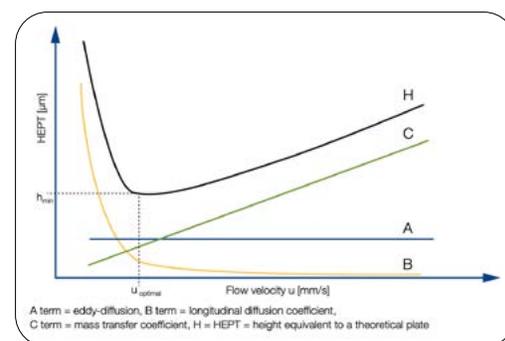
NUCLEODUR® High Purity Silica for HPLC

NUCLEODUR® is a fully synthetic type B silica (silica of 3rd generation) offering highly advanced physical properties like totally spherical particle shape, outstanding surface microstructure, high pressure stability and low metal content.

NUCLEODUR® as a state-of-the-art silica is the ideal base material for modern HPLC phases. It is the result of MACHEREY-NAGEL's pioneering research in chromatography for more than 40 years.

In RP liquid chromatography the efficiency of the packing is strongly affected by the quality of the base silica itself. Shortcomings in the surface geometry of the particles or metal contaminants are the main reasons for inadequate coverage with the covalently bonded alkylsilanes in the subsequent derivatization steps. It is well known, that poor surface coverage and, in consequence, high activity of residual free silanols often results in peak tailing or adsorption, particularly with basic compounds.

NUCLEODUR® silicas are synthesized in a unique and carefully controlled manufacturing process which provides silica particles, which are totally spherical. The picture shows the outstanding smoothness of the NUCLEODUR® surface.



Purity

As already mentioned above, a highly pure silica is required for achieving symmetric peak shapes and maximum resolution. Inclusions of, e.g., iron or alkaline earth metal ions on the silica surface are largely responsible for the unwanted interactions with ionizable analytes, e.g., amines or phenolic compounds.

NUCLEODUR® is virtually free of metal impurities and low acidic surface silanols. Elemental analysis data of NUCLEODUR® 5 µm measured by AAS are listed on the following page.

Pressure Stability

The totally spherical and 100% synthetic silica gel exhibits an outstanding mechanical stability, even at high pressures and elevated eluent flow rates. In addition, after several cycles of repeated packing, no significant drop in pressure can be observed. The latter is of prime importance for preparative and process-scale applications.

NUCLEODUR® silica is available with two pore sizes – 110 Å pore size as standard material and as 300 Å widepore material for the separation of biomolecules, like peptides and proteins.

NUCLEODUR® Modifications

Several different surface modifications based on NUCLEODUR® silica have been developed over the last two decades providing a full range of specified HPLC phases and an ideal tool for every separation.

NUCLEODUR® High Purity Silica for UHPLC

1.8 µm particles for increased separation efficiency

Advantages of 1.8 µm Particle Size

Miniaturization started in the early stage of HPLC with the reduction of particle size from 10 µm via 7 µm to standard 5 µm – still the most used particle diameter in analytical HPLC – to 3 µm spherical particles. With the introduction of 1.8 µm NUCLEODUR® particles researchers have turned over a new leaf in HPLC column technology, featuring extraordinary improvements in terms of plate numbers, column efficiency and resolution compared with 3 µm particles.

Increased separation efficiency by higher number of theoretical plates (N):

- 50 × 4.6 mm NUCLEODUR® C18 Gravity
- 3 µm: N ≥ 100 000 plates/m (h-value ≤ 10)
- 1.8 µm: N ≥ 166 667 plates/m (h-value ≤ 6)

Increasing the plate number by ~ 67% offers the possibility of using shorter columns with equal plate number, therefore resulting in a decrease of analysis time.

Elementary Analysis (Metal Ions) of NUCLEODUR® 100-5

Aluminum	<5	ppm
Iron	<5	ppm
Sodium	<5	ppm
Calcium	<10	ppm
Titanium	<1	ppm
Zirconium	<1	ppm
Arsenic	< 0.5	ppm
Mercury	< 0.05	ppm

Physical Data of NUCLEODUR®

	Standard	Widepore
Pore size	110 Å	300 Å
Surface area (BET)	340 m ² /g	100 m ² /g
Pore volume	0.9 mL/g	0.9 mL/g
Density	0.47 g/mL	0.47 g/mL

Key Features

- Decrease of analysis time (ultra-fast HPLC)
- Shorter columns with high separation efficiency and significant improvement of resolution and detection sensitivity
- Suitable for LC/MS due to low bleeding characteristics

Fractionation

- NUCLEODUR® 1.8 µm particles are specially fractionated to limit the increase in back pressure.

Availability

- The following NUCLEODUR® phases are available in 1.8 µm: C18 Gravity, C8 Gravity, C18 Gravity-SB, C18 Isis, C18 Pyramid, PolarTec, Phenyl-Hexyl, PFP, Sphinx RP, C18 HTec and HILIC

Significant Improvement in Resolution

$$R_s = \frac{\sqrt{N}}{4} \left(\frac{\alpha - 1}{\alpha} \right) \left(\frac{k'_i}{k'_i + 1} \right)$$

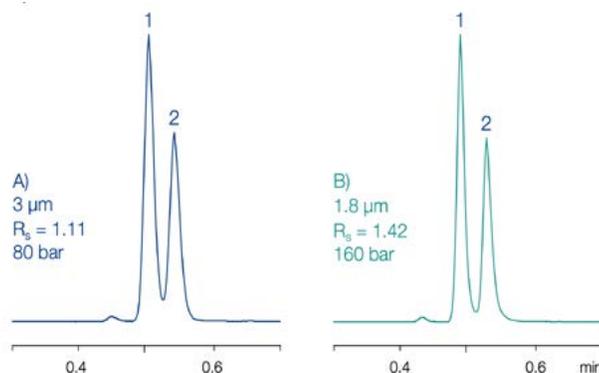
R_s = resolution, α = selectivity (separation factor), k'_i = retention N = plate number with $N \propto 1/d_p$, d_p = particle diameter

Resolution as Function of Particle Size

Column:	50 x 4 mm NUCLEODUR® C ₁₈ Gravity A) 3 µm, B) 1.8 µm
Solvent	Acetonitrile – water (80:20, v/v)
Flow Rate	2 mL/min
Detection:	UV, 254 nm

Peaks:

1. Naphthalene
2. Ethylbenzene



Use of 1.8 µm instead of 3 µm particles leads to an increase of resolution by a factor of 1.29 (29 %) since the resolution is inversely proportional to the square root of the particle size.

NUCLEODUR® High Purity Silica for UHPLC

Column Back Pressure

Due to the smaller particles the back pressure will increase according to

$$\Delta_p = \frac{\Phi \cdot L_c \cdot \eta \cdot \mu}{d_p^2}$$

Δ_p = pressure drop, Φ = flow resistance (non-dimensional), L_c = column length, η = viscosity, μ = linear velocity, d_p = particle diameter

The high sphericity of the NUCLEODUR® particles and a very narrow particle size distribution allow to keep the back pressure on a moderate level.

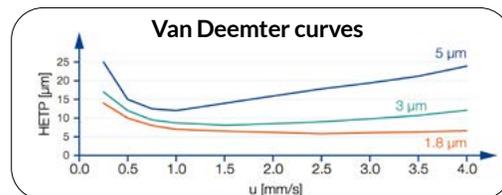
Comparison of back pressures

Eluent 100 % methanol, flow rate 1.5 mL/min
temperature 22 °C, column dimensions 50 × 4.6 mm

	NUCLEODUR® C18 Gravity	Competitor
3 µm	70 bar	–
1.8 µm	130 bar	170 bar

Higher Flow Rates and Shorter Run Times

The optimal flow rate for 1.8 µm particles is higher than for 3 and 5 µm particles (see figure – the flow rate should be at the van Deemter minimum).



Column 50 x 4.6 mm, acetonitrile – water (50:50, v/v), analyte toluene

Technical Requirements

To gain best results with 1.8 µm particles certain technical demands must be met including pumps for flow rates of 2–3 mL with pressures of 250–1000 bar, minimized dead volume, and fast data recording.



NUCLEODUR® C₁₈ Gravity • C₈ Gravity

Base deactivation

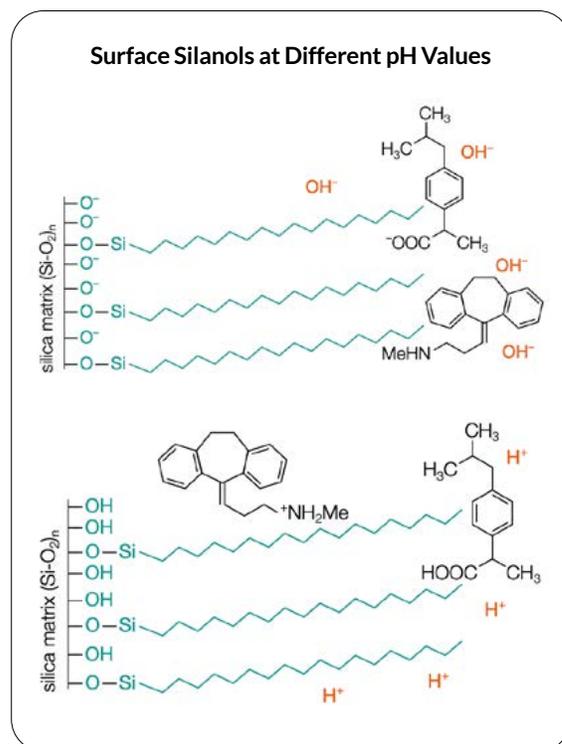
NUCLEODUR® C₁₈ Gravity and NUCLEODUR® C₈ Gravity are based on the ultrapure NUCLEODUR® silica. Derivatization generates a homogeneous surface with a high density of bonded silanes (~ 18 % C for C₁₈, ~ 11 % C for C₈). Thorough endcapping suppresses any unwanted polar interactions between the silica surface and the sample, which makes “Gravity” particularly suitable for the separation of basic and other ionizable analytes. Even strongly basic pharmaceuticals like amitriptyline are eluted without tailing under isocratic conditions. For a discussion of the different retention behavior of C₁₈ phases compared to C₈ phases.

Enhanced pH Stability

One major disadvantage of silica stationary phases is limited stability at strongly acidic or basic pH. Cleavage of the siloxane bonding by hydrolysis, or dissolution of the silica will rapidly lead to a considerable loss in column performance. Conventional RP phases are usually not recommended to be run with mobile phases at $\text{pH} > 8$ or $\text{pH} < 2$ for extended periods of time. The special surface bonding technology and the low concentration of trace elements of NUCLEODUR® C_{18} and C_8 Gravity allow for use at an expanded pH range from pH 1 to 11.

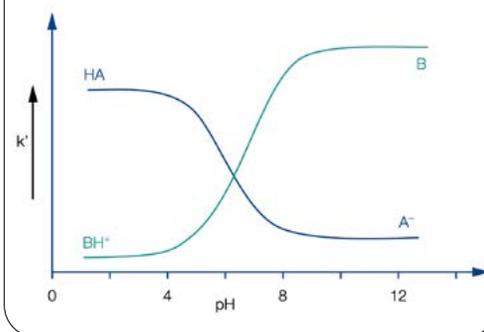
Benefits of Enhanced pH Stability

An expanded pH range is often required in method development. Many nitrogen containing compounds like basic drugs are protonated at acidic or neutral pH and exhibit poor retention on a standard C_{18} phase. The retention behavior can be improved by working at a higher pH, where the analyte is no longer protonated, but formally neutrally charged, as a rule between pH 9–10. For acidic analytes it is exactly in inverse proportion, maximum retention can be attained at low pH.



The figure above shows the extent of protonation of surface silanols and of two exemplary analytes at acidic and alkaline pH. The following graph explains the general correlation between retention and pH.

Correlation between retention and pH for basic and acidic compounds



An example how selectivity can be controlled by pH is the separation of the acid ketoprofen, the base lidocaine and benzamide. Under acidic conditions the protonated lidocaine is eluted very fast due to lack of sufficiently strong hydrophobic interactions.

Key Features

- Suitable for LC/MS and HPLC at pH extremes (pH 1–11)
- Superior base deactivation
- Ideal for method development

Technical Data

- Octadecyl (C_{18}) and octyl (C_8) phase; multi-endcapped
- Pore size 110 Å; particle sizes
- 1.8 μm , 3 μm and 5 μm for C_{18} ,
- 1.8 μm , 3 μm and 5 μm for C_8 ; 7 μm , 10 μm , 12 μm and 16 μm particles for preparative purposes on request
- Carbon content 18% for C_{18} , 11% for C_8

Recommended Applications

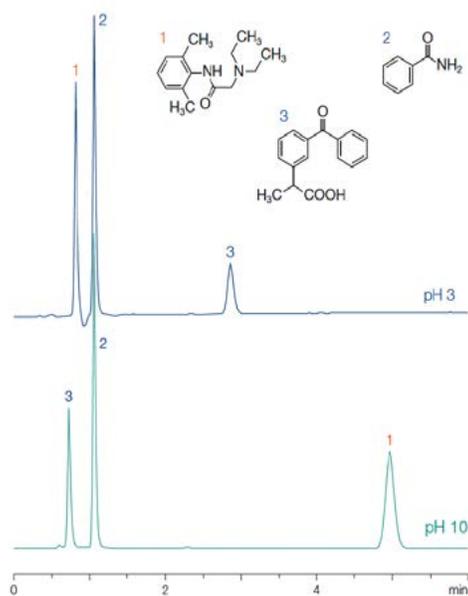
- USP listing L1
- Overall sophisticated analytical separations
- Compound classes separated include pharmaceuticals, e.g., analgesics, anti-inflammatory drugs, antidepressants; herbicides; phytopharmaceuticals; immunosuppressants

NUCLEODUR® C₁₈ Gravity • C₈ Gravity

between analyte and C₁₈ chains, while the formally neutral ketoprofen is eluted after about 3 min. However, at pH 10 a reversal of the elution order, with a visibly longer retention time for the basic lidocaine, is observed.

Influence of the pH value on selectivity

MN Appl. No. 120860



Column:	125 x 4 mm NUCLEODUR® C ₁₈ Gravity, 5 µm
Solvent	A) acetonitrile – 10 mmol/L ammonium formate, pH 3.0 (50:50, v/v); B) acetonitrile – 10 mmol/L ammonium bicarbonate, pH 10.0 (50:50, v/v)
Flow rate	1.0 mL/min
Temperature	30 °C
Detection	UV, 230 nm
Injection	2 µL

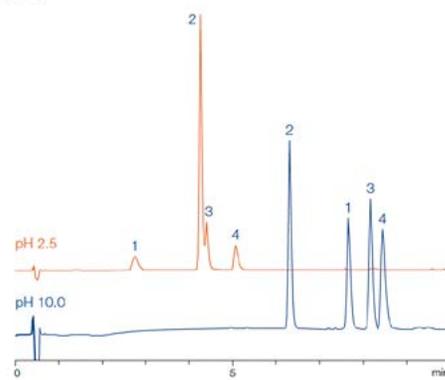
Peaks:

1. Lidocaine
2. Benzamide
3. Ketoprofen

As mentioned above, pH stability of the stationary phase can be helpful for improving selectivity in method development. The following figure shows the separation of 4 basic drugs under acidic and basic conditions. At pH 2.5 the protonated analytes exhibit poor retention (early elution) and in addition an inadequate resolution for papaverine and noscapine, whilst the formally non ionized molecules can be baseline separated due to the better retention pattern at alkaline pH.

Separation of basic alkaloids

MN Appl. No. 118010



Column:	125 x 4 mm NUCLEODUR® C ₁₈ Gravity, 5 µm
Solvent	A) acetonitrile B) 20 mmol/L (NH ₄) ₂ HPO ₄ , pH 2.5 / 10.0 10 % A (1 min) → 75 % A in 10 min
Flow rate	1.0 mL/min; Temperature 25 °C
Detection	UV, 254 nm; Injection 2 µL

Peaks:

1. Lidocaine
2. Papaverine
3. Noscapine
4. Diphenhydramine

NUCLEODUR® C₁₈ Gravity • C₈ Gravity

The following chromatogram demonstrates the stability of NUCLEODUR® C₁₈ Gravity under alkaline conditions. The ultra-pure Gravity with its unique high density surface bonding technology withstands strong alkaline mobile phase conditions.

Even after 300 injections no loss of column efficiency - identified, e.g., by peak broadening or decrease in retention times - could be observed.

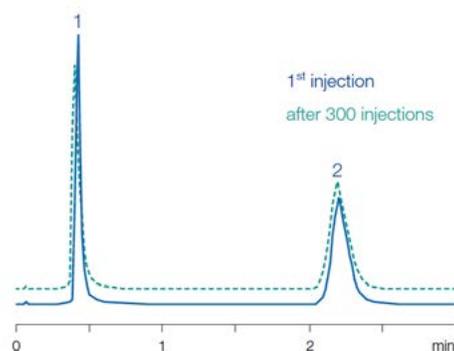
Under alkaline conditions dissolution of the silica support is possible, resulting in dead volume and thus peak broadening. It is worth mentioning, that this phenomenon also depends on type and concentration of buffers, as well as on the temperature. It is well known that the use of

phosphate buffers, particularly at elevated temperatures, can reduce column lifetime even at moderate pH. If possible, phosphate buffers should be replaced by less harmful alternatives.

The following chromatograms show the excellent column stability of NUCLEODUR® C₁₈ Gravity in acidic conditions. Retention times of all three compounds in the column performance test remain consistent and virtually unchanged, even after the column is run with 5000 mL eluent. Due to the extremely stable surface modification, no cleavage of the Si-O-Si bonding occurs, column deterioration is therefore successfully prevented.

Separation of Basic Alkaloids

MN Appl. No. 118010



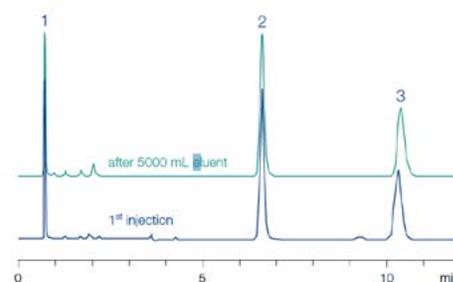
Column:	50 x 4.6 mm NUCLEODUR® C ₁₈ Gravity, 5 µm
Solvent	Methanol - water - ammonia (20:80:0.5, v/v/v), pH 11
Flow rate	1.3 mL/min
Temperature	30 °C
Detection	UV, 254 nm
Injection	2.0 µL

Peaks:

1. Theophylline
2. Caffeine

Stability of NUCLEODUR® C₁₈ Gravity at pH 1.5

MN Appl. No. 120840



Column:	125 x 4 mm NUCLEODUR® C ₁₈ Gravity, 5 µm
Solvent	acetonitrile - 1 % TFA in water (50:50, v/v), pH 1.5
Flow rate	1.0 mL/min
Temperature	30 °C
Detection	UV, 230 nm
Injection	5 µL

Peaks:

1. Pyridine
2. Toluene
3. Ethylbenzene

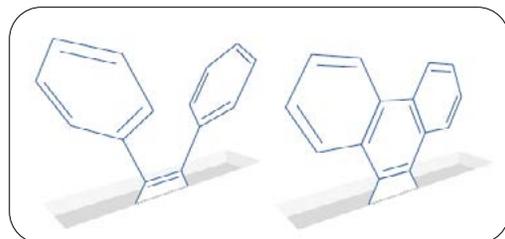
NUCLEODUR® C₁₈ Isis

Surface Modification

By use of specific C₁₈ silanes and polymeric bonding technologies a dense shield of alkyl chains protects the subjacent silica matrix. Elemental analysis of NUCLEODUR® C₁₈ Isis shows a carbon load of 20%. The target crosslinking of the C₁₈ chains on the surface enables the separation of compounds with similar molecular structure but different stereochemical properties. The technical term for this feature is steric selectivity.

Slot Model

Sander and Wise² proposed a model for the retention of aromatic compounds based on molecular shape, which is referred to as "Slot Model". This model pictures the bonded C₁₈ phase on the silica surface with slots which analytes have to penetrate during retention. Planar molecules are able to penetrate these slots deeper than non-planar molecules of similar molecular weight and length-to-width ratio. Thus triphenylene (left structure) is retained longer than *o*-terphenyl (right structure).



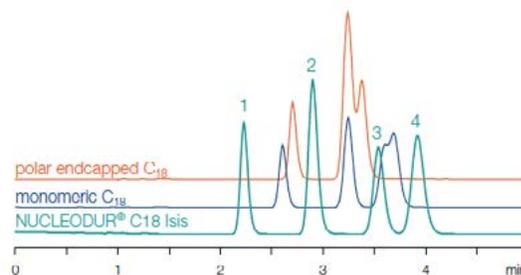
Steric Selectivity

The following chromatograms reveal the improved resolution for positional isomers in a test mixture of aromatic compounds on NUCLEODUR® C₁₈ Isis (green) in direct comparison with monomerically coated (blue) and polar endcapped (orange) C₁₈ columns.

The separation of *o*-terphenyl and triphenylene is a good example to evaluate selectivity of a RP column in terms of the shape of two molecules. The phenyl rings of *o*-terphenyl are twisted out of plane while triphenylene has a planar geometry. The separation factor α is a measure for the steric selectivity. As shown on the next page the α value is considerable larger on NUCLEODUR® C₁₈ Isis compared to a conventional C₁₈ column.

The surface bonding technology also provides improved stability features for the NUCLEODUR® C₁₈ Isis phase.

Steric Selectivity of NUCLEODUR® C₁₈ Isis



Column:	125 x 4 mm NUCLEODUR® C ₁₈ Isis monomerically coated C ₁₈ phase polar endcapped phase C ₁₈ phase
Solvent	methanol – water (90:10, v/v)
Flow rate	1 mL/min, temperature: 35 °C
Detection	UV, 254 nm
Injection	5 µL

Peaks:

1. *o*-Terphenyl
2. *m*-Terphenyl
3. *p*-Terphenyl
4. Triphenylene

Key Features

- Phase with exceptional steric selectivity
- Outstanding surface deactivation
- Suitable for LC/MS

Technical Data

- C₁₈ phase with special polymeric, crosslinked surface modification; endcapped
- Pore size 110 Å; particle sizes 1.8 µm, 3 µm and 5 µm; carbon content 20 %; pH stability 1–10

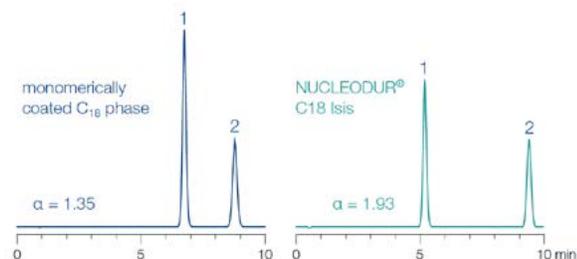
Recommended Applications

- USP listing L1
- Steroids, (*o,p,m*-)substituted aromatics, fat-soluble vitaminists

NUCLEODUR® C₁₈ Isis

Steric Selectivity of NUCLEODUR® C₁₈ Isis

Column:	125 x 4 mm
Solvent	methanol – water (80:20, v/v)
Flow rate	1 mL/min
Temperature	40 °C
Detection	UV, 254 nm
Injection	1 µL



Peaks:

1. o-Terphenyl
2. Triphenylene

Surface Deactivation

The chromatography of basic analytes requires a high density of surface-bonded C₁₈ silanes combined with a thorough endcapping procedure to keep silanol activity at a minimum. This ensures tailing-free elution of even strongly basic amino-containing compounds (see application No. 121210 at ChromaAppDB.mn-net.com).

Ordering information

NUCLEODUR® C ₁₈ Isis				
Analytical EC columns NUCLEODUR® C ₁₈ Isis (pack of 1)				
Length (mm)	ID (mm)	Particle size (µm)	REF	Guard columns*
250	4.6	5	760414.46	761912.30
250	3	5	760414.30	761912.30
125	4	5	760412.40	761912.30
50	3	5	760410.30	761912.30
250	4.6	3	760404.46	761911.30
150	4	3	760403.40	761911.30
100	3.6	3	760401.46	761911.30
100	4	3	760401.40	761911.30
100	3	1.8	760407.30	761910.30
50	4.6	1.8	760405.46	761910.30

* Pack of 3, EC guard columns require column protection system REF 718966.

NUCLEODUR® C₁₈ Pyramid

RP-HPLC with highly aqueous mobile phases

The efforts to neutralize unwanted silanol activity often results in well base-deactivated RP phases with high carbon load, but a limited scope of selectivity beyond non-polar interactions. Polar compounds like carboxylic acids or drug metabolites show only weak retention on densely bonded RP columns due to distinct hydrophobic properties but low polar interactions. Very polar analytes require highly aqueous mobile phases for solubility and retention. Conventional reversed phase columns often display stability problems in eluent systems with high percentage of water (> 95 %) as evidenced by a sudden decrease of retention time and overall poor reproducibility. This phenomenon is described as phase collapse caused by the mobile phase expelled from the pores due to the fact, that hydrophobic RP phases are incompletely wetted with the mobile phase³.

Different approaches can be used to increase column stability with highly aqueous mobile phase systems. The most promising concepts are incorporating a polar group in the hydrophobic alkyl chain, or using hydrophilic endcapping procedures to improve the wettability of the reversed phase modification. NUCLEODUR® PolarTec may be taken as an example for the embedded polar group strategy, in which a C₁₈ silane with a polar function is successfully linked to the silica surface.

Stability Features

NUCLEODUR® C₁₈ Pyramid is a silica phase with hydrophilic endcapping, designed especially for use in eluent systems of up to 100 % water. The lower figure shows the retention behavior of tartaric, acetic and maleic acid under purely aqueous conditions on NUCLEODUR® C₁₈ Pyramid in comparison with a conventionally bonded C₁₈ phase.

It can be shown that the retention times for NUCLEODUR® C₁₈ Pyramid remain nearly unchanged between initial injection and restart after the flow has been stopped for 12 h, whilst the performance of the conventional RP column already totally collapsed after 5 min.

Key Features

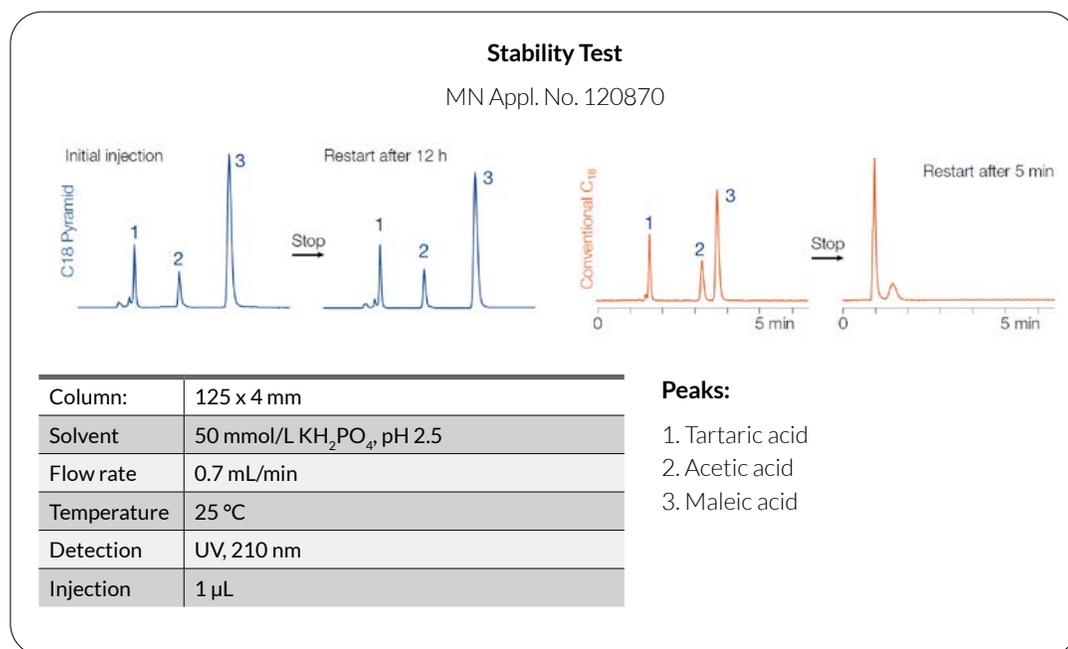
- Stable in 100 % aqueous mobile phase systems
- Interesting polar selectivity features
- Excellent base deactivation
- Suitable for LC/MS due to low bleeding characteristics

Technical Data

- Special C₁₈ phase; polar endcapped
- Pore size 110 Å; particle sizes 1.8 µm, 3 µm and 5 µm (7 and 10 µm particles for preparative purposes on request); carbon content 14 %; pH stability 1–9

Recommended Applications

- USP listing L1
- Analgesics, penicillin antibiotics, nucleic acid bases, water-soluble vitamins, complexing agents, organic acids

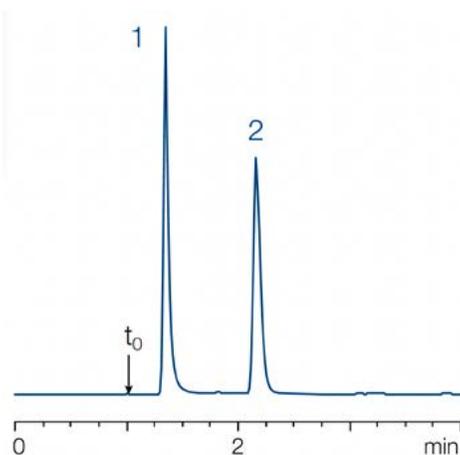


NUCLEODUR® C₁₈ Pyramid

The polar surface exhibits retention characteristics different from conventional C₁₈ phases. Application 119170 shows improved retention behavior of very polar short chain organic acids, which are insufficiently retained on RP columns with predominantly hydrophobic surface properties. In addition to the exceptional polar selectivity NUCLEODUR® C₁₈ Pyramid also provides adequate hydrophobic retention (application No. 119190 at ChromaAppDB.mn-net.com). The perceptible increase in polarity has no impact on the retention behavior of ionizable analytes. Even with the strongly basic compounds of the tricyclic antidepressant drug test mixture, no unwanted interactions or a so-called lack in base deactivation are observed in application 119200.

Separation of Very Polar Compounds

MN Appl. No. 119170



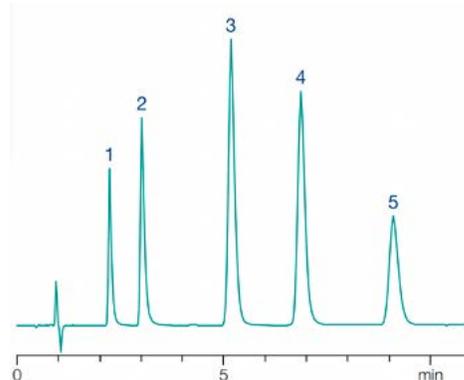
Column:	125 x 4 mm NUCLEODUR® C ₁₈ Pyramid, 5 µm
Solvent	0.2 % H ₃ PO ₄
Flow rate	1.0 mL/min
Temperature	22 °C
Detection	UV, 202 nm
Injection	1 µL

Peaks:

1. Formic acid
2. Acetic acid

Separation of Basic Alkaloids

MN Appl. No. 118010



Column:	125 x 4 mm NUCLEODUR® C ₁₈ Pyramid, 5 µm
Solvent	methanol - 20 mM NH ₄ H ₂ PO ₄ , pH 6.95 (70:30, v/v)
Flow rate	40 °C
Temperature	5 µL
Detection	UV, 254 nm
Injection	2 µL

Peaks:

- | | |
|------------------|------------------|
| 1. Protriptyline | 4. Imipramine |
| 2. Nortriptyline | 5. Amitriptyline |
| 3. Doxepin | 6. Trimipramine |

NUCLEODUR® PolarTec

RP-HPLC under 100 % aqueous conditions

The dominant form of interactions of conventional C₁₈ phases are nonpolar London dispersion forces. Besides nonpolar interactions phases with embedded polar groups possess the ability to show polar interactions (dipole-dipole, hydrogen bonds, π-π, etc.). These interactions enhance retention and selectivity for polar compounds like carboxylic acids, phenols and nitrogen containing compounds.

In order to increase retention for polar compounds it is often necessary to decrease the organic ratio of the mobile phase to zero. Under these conditions many conventional C₁₈ phases display the so-called dewetting effect which means that the mobile phase is expelled from the pores. This phenomenon leads to a dramatic loss in retention. NUCLEODUR® PolarTec is stable in 100 % aqueous mobile phases and therefore especially suited for the separation of polar compounds like organic acids.

Due to the shielding effect of the embedded group NUCLEODUR® PolarTec shows an excellent base deactivation, which is top-notch of embedded polar group phases on the market. The pronounced steric selectivity is an additional tool for the separation of complex mixtures.

Due to low bleeding characteristics NUCLEODUR® PolarTec is also suitable for LC/MS. Even after days or weeks of operation in purely aqueous eluents the C₁₈ chains of NUCLEODUR® PolarTec are neither folded nor show any collapsing. A significant reduction of retention time cannot be observed.

Key Features

- RP phase with embedded polar group
- Excellent base deactivation
- Pronounced steric selectivity
- Suitable for LC/MS and 100 % aqueous eluents

Technical Data

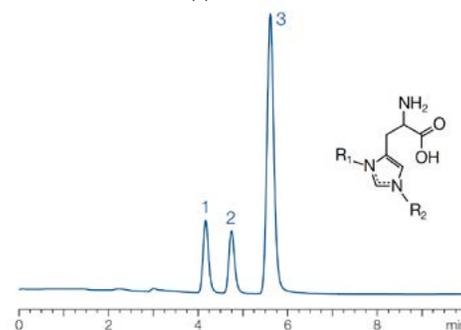
- Phase with embedded polar group; endcapped
- Pore size 110 Å; particle sizes 1.8 μm, 3 μm and 5 μm; carbon content 17%; pH stability 1–9

Recommended Applications

- USP listing L1 and L60
- Exceptional selectivity for phenols and nitrogen containing compounds, polar compounds like basic pharmaceuticals, organic acids, pesticides, amino acids, water-soluble vitamins, etc.

Separation of Histidines

MN Appl. No. 125140



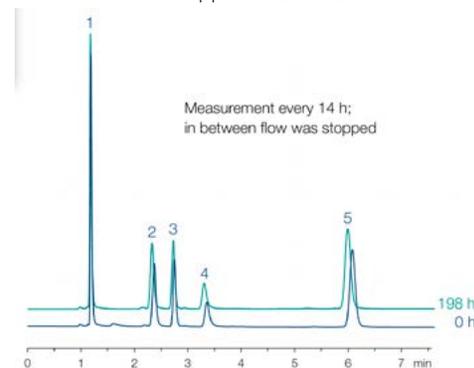
Column:	150 x 3 mm NUCLEODUR® PolarTec, 3 μm
Solvent	1.0 mmol/L perfl uoropentanoic acid in water – 0.5 mmol/L perfl uoropentanoic acid in acetonitrile (99.5:0.5, v/v)
Flow rate	0.4 mL/min
Temperature	20 °C
Detection	UV, 230 nm

Peaks:

1. 3-Methylhistidine R₁ = H, R₂ = CH₃
2. Histidine R₁ = R₂ = H
3. 1-Methylhistidine R₁ = CH₃, R₂ = H

Stability of NUCLEODUR® PolarTec

MN Appl. No. 124610



Column:	1150 x 3 mm NUCLEODUR® PolarTec, 3 μm
Solvent	30 mmol/L KH ₂ PO ₄ , pH 3.0
Flow rate	0.5 mL/min
Detection	30 °C
Injection	UV, 220 nm

Peaks:

1. Cytosine
2. Uracil
3. Adenine
4. Guanine
5. Thymine

NUCLEODUR® Phenyl-Hexyl

Alternative selectivity to C₁₈ phases Phenylhexyl modified phases are an interesting alternative to classical C₁₈ phases due to an excellent separation of aromatic and unsaturated compounds especially with electron withdrawing groups.

The combination of hydrophobic and polar π - π interactions result in an interesting and alternate selectivity in comparison to C₁₈ and C₈ modified phases.

Through short phenylhexyl chains the NUCLEODUR® Phenyl-Hexyl is more polar than the bifunctional modified NUCLEODUR® Sphinx RP. Therefore shorter analysis times can be achieved with mixtures of structural similar aromatic and aliphatic unsaturated compounds.

With NUCLEODUR® Phenyl-Hexyl e.g., tricyclic antidepressants or water soluble vitamins can be separated with good resolution.

Key Features

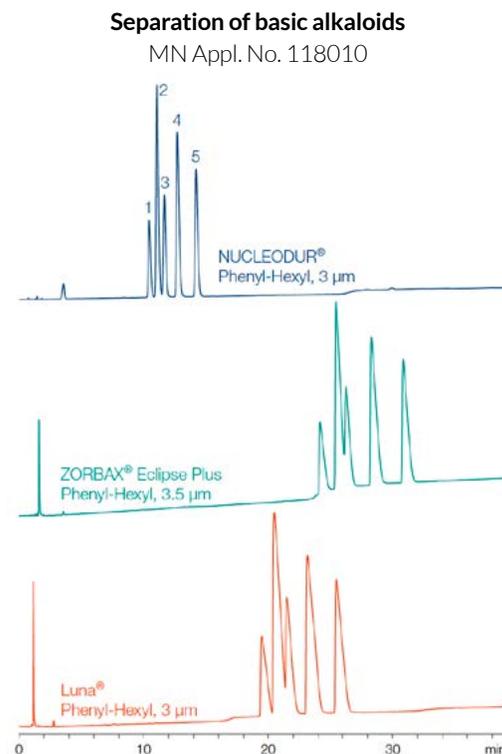
- Suitable for polar / aromatic compounds
- Hydrophobic phase with alternative selectivity compared to classical C₁₈ modifications
- Separation principle based on 2 retention mechanisms: π - π interactions and hydrophobic interactions
- Suitable for LC/MS due to low bleeding characteristics

Technical Data

- Phase with phenylhexyl modification; multi-endcapped
- Pore size 110 Å; particle sizes 1.8 μ m, 3 μ m and 5 μ m; carbon content 10%; pH stability 1–10

Recommended Applications

- USP listing L11
- Aromatic and unsaturated compounds, polar compounds like pharmaceuticals, antibiotics



Column:	150 x 3 mm NUCLEODUR® Phenyl-Hexyl, 3 μ m Agilent ZORBAX® Eclipse Phenyl-Hexyl, 3.5 μ m Phenomenex Luna® Phenyl-Hexyl, 3 μ m
Solvent	A) 0.1 % formic acid in acetonitrile B) 0.1 % formic acid in water 20–32.5 % A in 40 min
Flow rate	0.56 mL/min
Temperature	40 °C
Detection	UV, 254 nm
Injection	0.2 μ L, each compound 1 mg/mL in solvent

Peaks:

1. Protriptyline
2. Nortriptyline
3. Imipramine
4. Amitriptyline
5. Trimipramine

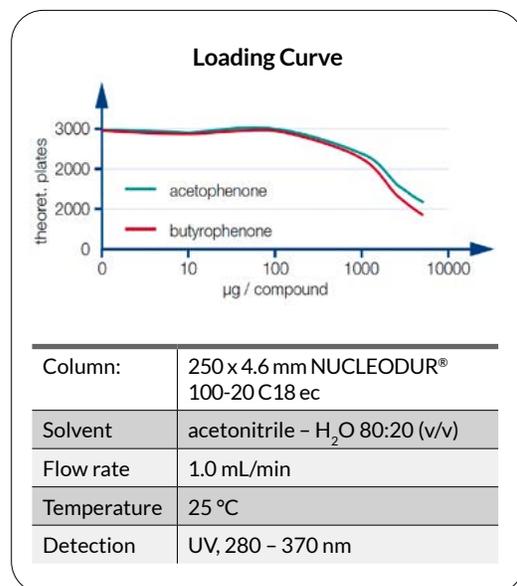
NUCLEODUR® C₁₈ ec · C₈ ec · C₄ ec

NUCLEODUR® C₁₈ ec for daily routine analysis

The efficiency of a separation is controlled by particle size and selectivity of the stationary phase. The exceptional surface coverage of monomeric bonded alkylsilanes, combined with an exhaustive endcapping, results in a surface with lowest silanol activity. This allows the tailing-free elution of polar compounds such as basic drugs. NUCLEODUR® C₁₈ ec is available in 9 different particle sizes (3, 5, 7, 10, 12, 16, 20, 30 and 50 µm) which cover the whole range from high speed analytical HPLC up to medium and low pressure prep LC. NUCLEODUR® C₁₈ ec is also an ideal tool for scale-up purposes.

Loading Capacity

Loading capacity, probably the most important feature for preparative LC applications, is determined by pore size, pore volume and surface area of the packing. However, it can also be influenced by the molecular weight of the analytes. In the figure below the mass loading curve for acetophenone and butyrophenone on a NUCLEODUR® 100-20 C₁₈ ec column describes the correlation between the increase of column loading and the decrease of separation efficiency.



Key Features

- Nonpolar phases for routine analysis n Ideal and reliable standard RP phase for daily routine analysis and up-scaling for preparative HPLC
- Medium density octadecyl (C₁₈) and octyl (C₈) modification with pore size of 110 Å for a wide range of applications
- Octadecyl (C₁₈) and butyl (C₄) modification with pore size of 300 Å for the separation of biomolecules
- High batch-to-batch reproducibility

Technical Data

- Medium density octadecyl, octyl and butyl phase; endcapped
- Pore size 110 Å: particle sizes 3 µm and 5 µm, 7 µm, 10 µm, 12 µm, 16 µm, 20 µm, 30 µm and 50 µm for preparative separations; carbon content 17.5 % for C₁₈, 10.5 % for C₈; pH stability 1-9
- Pore size 300 Å; particle size 5 µm, carbon content 4 % for C₁₈, 2.5 % for C₄; pH stability 1- 9

Recommended Applications

- USP listing L1 (C₁₈) · L7 (C₈) · L26 (C₄)
- 110 Å: basic, neutral or acidic drugs; derivatized
- amino acids; pesticides; fat-soluble vitamins; aldehydes and ketones; phenolic compounds
- 300 Å: biomolecular macromolecules, like proteins and peptides

NUCLEODUR® C₁₈ ec · C₈ ec · C₄ ec

Chemical Stability

The utmost purity of the base silica and the exceptional silane bonding chemistry minimize the risk of dissolution, or hydrolysis at pH extremes.

The chromatograms show the retention behavior at pH values of 1.5 and 10.0 for NUCLEODUR® 100-5 C18 ec.

NUCLEODUR® Octyl Phases

In addition to NUCLEODUR® C₁₈ phases MACHEREY-NAGEL offers octyl modified NUCLEODUR® C₈ Gravity and NUCLEODUR® C₈ ec columns to expand the RP tool box. Based on the same spherical high purity silica the C₈ phases exhibit the same chemical and mechanical stability as the C₁₈ counterparts. Indeed, NUCLEODUR® C₈ Gravity can also be run at pH extremes (pH 1–11) by choosing appropriate elution parameters. Due to the shorter chain and less hydrophobic properties of the stationary phase the retention of nonpolar compounds is decreased, and in consequence a reduction in time of analysis can be achieved. Moreover, a stronger polar selectivity, particularly with the separation of ionizable analytes is frequently observed (as distinct from the C₁₈ phases). NUCLEODUR® C₈ ec and NUCLEODUR® C₈ Gravity are most suitable for the development of new methods but also for robust routine analyses.

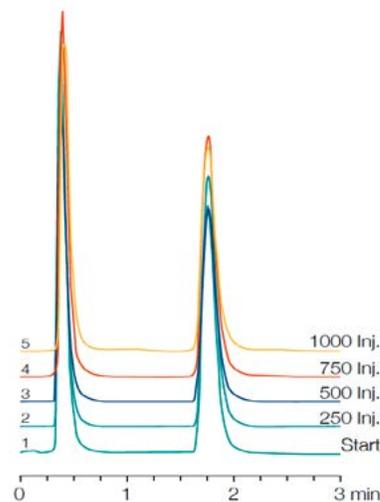
There are no general guidelines which could make the choice between C₈ and C₁₈ phases easier but it will always be beneficial to add both phases to the existing pool of RP columns in the laboratory. Comparative studies reveal some different selectivity patterns of NUCLEODUR® C₈ ec and C₁₈ ec. The separation of phenols below shows baseline separation for 2-ethoxyphenol and dimethoxybenzene (veratrol) and in addition a reversal of the elution order of phenol and 4-methoxyphenol can be shown on the octyl phase.

Good to Know

- Octyl phases (C₈) show superior polar selectivity.
- Octadecyl phases (C₁₈) show superior hydrophobic selectivity.
- Hydrophobic compounds show shorter retention times on C₈ phases.

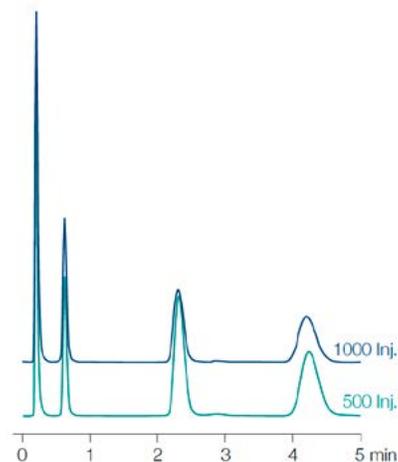
pH Stability of NUCLEODUR® C₁₈ ec

Separation of theophylline and caffeine at pH 10



Column:	30 x 3 mm NUCLEODUR® 100-5 C18 ec
Solvent	methanol - aq. NH ₃ (20:80, v/v), pH 10
Flow rate	0.5 mL/min
Temperature	25 °C
Detection	UV, 254 nm

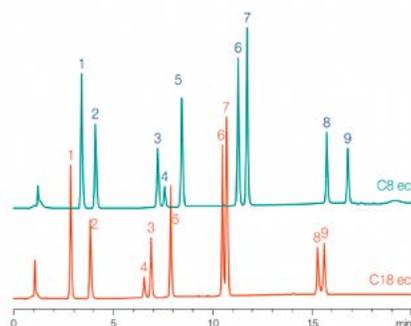
Separation of uracil, veratrol, toluene and ethylbenzene at pH 1.5



Column:	30 x 3 mm NUCLEODUR® 100-5 C18 ec
Solvent	acetonitrile - H ₂ O (65:35, v/v), TFA, pH 1.5
Flow rate	1.0 mL/min
Temperature	25 °C
Detection	UV, 254 nm

Separation of Phenols

MN Appl. Nos. 12089 / 120891



Column:	250 x 4 mm NUCLEODUR® 100-5 C8 ec/C18 ec
Solvent	A) water, B) methanol C ₈ : 20% B (2 min) → 60% B in 12 min C ₁₈ : 25% B (2 min) → 65% B in 12 min
Flow rate	1.0 mL/min, temperature 25 °C
Detection	UV, 275 nm, injection 10 µL

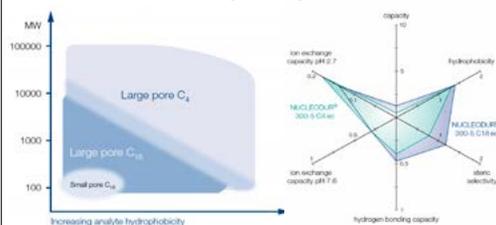
Peaks:

- | | |
|--------------------|-------------------|
| 1. Resorcinol | 6. 2-Ethoxyphenol |
| 2. Pyrocatechol | 7. Veratrol |
| 3. 4-Methoxyphenol | 8. Biphenyl-2-ol |
| 4. Phenol | 9. Phenetole |
| 5. 2-Methoxyphenol | |

NUCLEODUR® Phases For Biochromatography

A description and applications for C₁₈ and C₄ modified 300 Å NUCLEODUR® widepore materials for the separation of biopolymers, like peptides and proteins can be seen on the following pages.

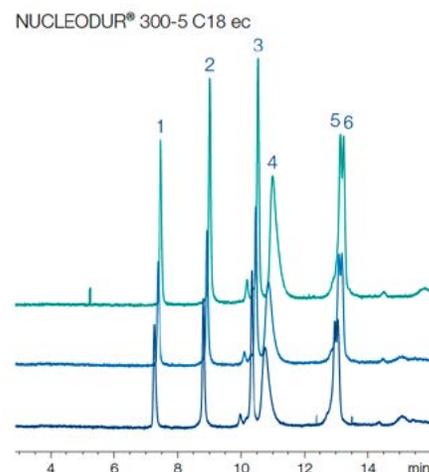
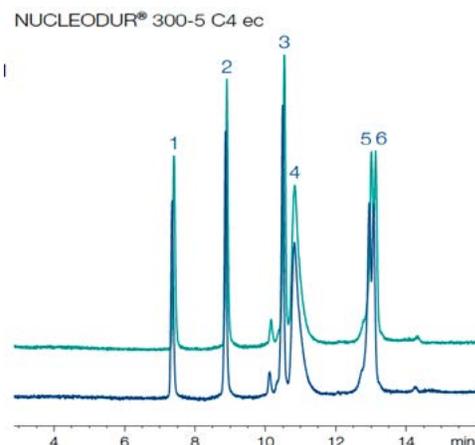
Column Selection by Analyte Characteristics



Tanaka plots of NUCLEODUR® wide pore phases

Batch-to-batch reproducibility of NUCLEODUR® 300-5 C4 ec and NUCLEODUR® 300-5 C18 ec

MN Appl. Nos. 126551 / 126552



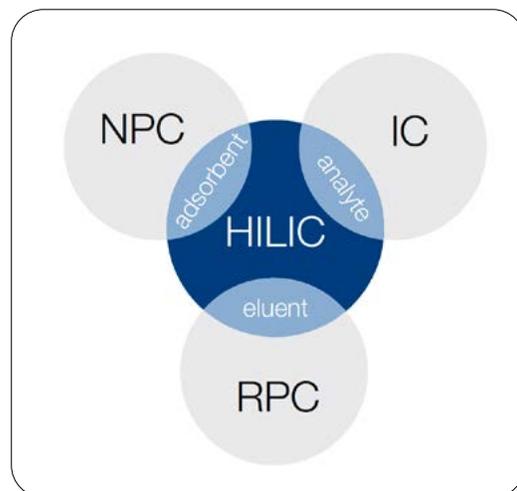
Column:	250 x 4 mm
Solvent	A) 0.1% TFA in water B) 0.08% TFA in acetonitrile 20–60% B in 15 min
Flow rate	1 mL/min
Temperature	25 °C
Detection	UV, 280 nm

Peaks:

- | | |
|-------------------|----------------------|
| 1. Ribonuclease A | 4. BSA |
| 2. Cytochrome C | 5. β-Lactoglobulin |
| 3. Lysozyme | 6. β-Lactoglobulin 2 |

NUCLEODUR® HILIC

Hydrophilic Interaction Chromatography



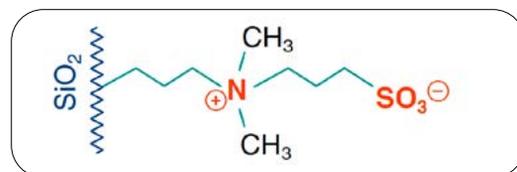
Especially for polar compounds reversed phase HPLC – the most common analytical method – is often limited. Here, hydrophilic stationary phases provide an additional tool for the separation of polar analytes in HPLC.

The expression HILIC (Hydrophilic Interaction Chromatography) was firstly published by Andrew Alpert in 1990 – since then it took quite some efforts to develop robust and reproducible hydrophilic HPLC phases for HILIC chromatography⁴.

HILIC combines the characteristics of the 3 major methods in liquid chromatography reversed phase (RPC), normal phase (NPC) and ion chromatography (IC):

- Stationary phases (adsorbents) are mostly polar modifications of silica or polymers (SiOH, NH₂, Diol, (zwitter) ions, ...) – like in NPC.
- Mobile phases (eluents) are mixtures of aqueous buffer systems and organic modifiers like acetonitrile or methanol – like in RPC.
- Fields of application include quite polar compounds as well as organic and inorganic ions – like in IC.

Summarized: "HILIC is NP chromatography of polar and ionic compounds under RP conditions."



NUCLEODUR® HILIC is a special zwitterionic modified stationary phase based on ultra-spherical NUCLEODUR® particles. The betaine character of the ammoniumsulfonic acid ligands results in total charge equalization and in an overall neutrally but highly polar surface.

Retention Characteristic

Commonly HILIC is described as partition chromatography or liquid-liquid extraction system between mobile and stationary phases. Versus a water-poor mobile phase a water-rich layer on the surface of the polar stationary phase is formed. Thus, a distribution of the analytes between these two layers will occur. Furthermore, HILIC includes weak electrostatic mechanisms as well as hydrogen donor interactions between neutral polar molecules under high organic elution conditions. This distinguishes HILIC from ion exchange chromatography - main principle for HILIC separation is based on compound's polarity and degree of solvation.

Stability Features

Due to an advanced and unique surface modification procedure NUCLEODUR® HILIC columns provide short equilibration times. After just 20 min equilibration the 2nd injection already shows stable and reproducible results.

Key Features

- Ideal for reproducible and stable chromatography of highly polar analytes
- Suitable for analytical and preparative applications
- Very short column conditioning period High batch-to-batch reproducibility

Technical Data

- Zwitterionic ammonium-sulfonic acid phase; not endcapped
- Pore size 110 Å; particle sizes 1.8 µm, 3 µm and 5 µm; carbon content 7 %; pH stability 2–8.5

Recommended Applications

- Hydrophilic compounds such as organic polar acids and bases, polar natural compounds, nucleosides, oligonucleotides, amino acids, peptides, water soluble vitamins

NUCLEODUR® HILIC

Beyond this, NUCLEODUR® HILIC columns are characterized by an outstanding column life time - even after nearly 800 runs the columns show no loss of its pristine performance - peak shape and retention are still immaculate. Due to its high loading capacity NUCLEODUR® HILIC is suitable for (semi-) preparative applications.

Good to Know

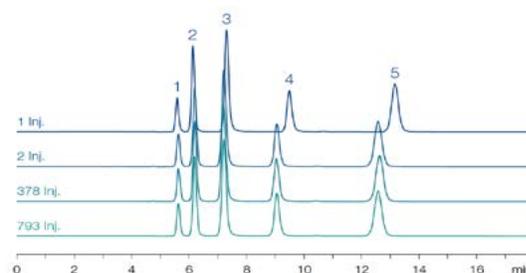
- NUCLEODUR® HILIC is a patented phase modification (pat. number DE102009006007 (B4))

Overall NUCLEODUR® HILIC provides excellent chromatographic features and is hereby the perfect choice for separation of polar or charged compounds which can be shown in application 122920.

Stability and Equilibration

MN Appl. No. 123100

Column:	250 x 4 mm NUCLEODUR® HILIC, 5 µm
Solvent	CH ₃ CN - 5 mmol/L ammonium acetate (80:20, v/v)
Flow rate	0.6 mL/min
Temperature	25 °C
Detection	UV, 254 nm



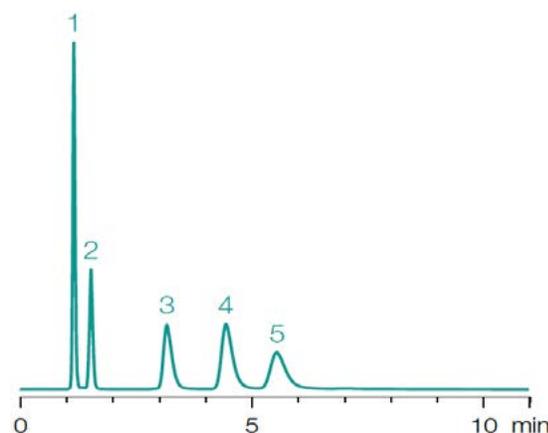
Peaks:

- | | |
|------------|--------------|
| 1. Thymine | 4. Cytosine |
| 2. Uracil | 5. Guanosine |
| 3. Adenine | |

Separation of Adenosine and Phosphates

MN Appl. No. 123100

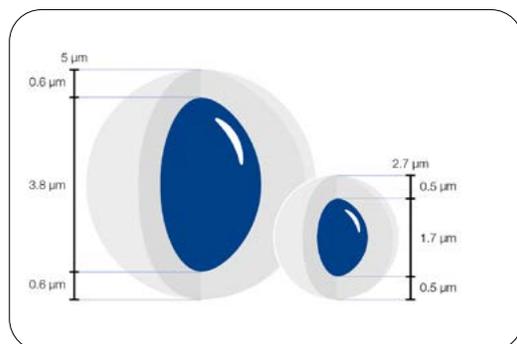
Column:	125 x 4 mm NUCLEODUR® HILIC, 5 µm
Solvent	acetonitrile - 100 mM ammonium acetate, pH 5.3 (70:30, v/v)
Flow rate	1.3 mL/min
Temperature	25 °C
Detection	UV, 254 nm



Peaks:

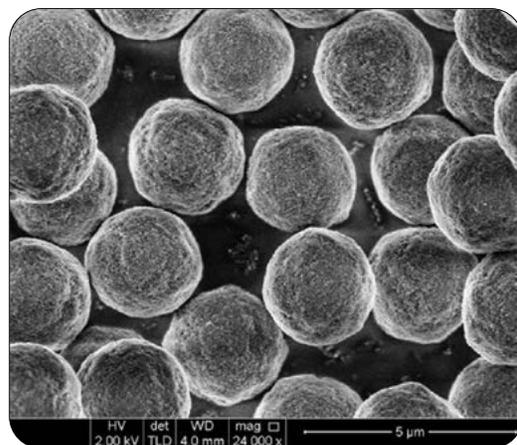
- | | |
|--------------|--------|
| 1. Adenosine | 4. ADP |
| 2. cAMP | 5. ATP |
| 3. AMP | |

NUCLEODUR® Core-Shell Silica for Hplc



Core-Shell Technology

Demands on HPLC separations are constantly increasing with respect to separation efficiency, detection limits, and the time requirements for each analysis. Several approaches have been made to achieve fast separations without losing chromatographic performance. HPLC columns packed with particles < 2 µm show very high efficiencies (plates/meter) and allow the use of smaller column sizes with the positive side effect of significant solvent savings. However they generate a high back pressure of the mobile phase during column runs which requires specifically designed equipment.



Electron microscopic image of NUCLEOSHELL®

NUCLEOSHELL® silica particles consist of a non-porous solid core of 1.7 µm diameter and a porous outer shell of 0.5 µm thickness. Accordingly, the total diameter of the particle is 2.7 µm.

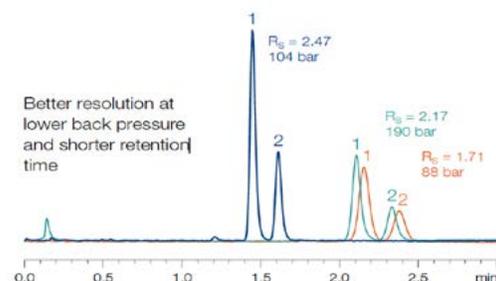
Utilizing a proprietary process of synthesis, NUCLEOSHELL® particles exhibit a distinct narrow particle size distribution ($d_{90} / d_{10} \sim 1.1$). Columns packed with NUCLEOSHELL core shell particles feature exceptional separation efficiencies with theoretical plate numbers easily comparable to totally porous sub 2 micron particles.

$$R_s = \frac{\sqrt{N}}{4} \left(\frac{\alpha - 1}{\alpha} \right) \left(\frac{k'_i}{k'_i + 1} \right)$$

R_s = resolution, α = selectivity (separation factor),
 k'_i = retention N = plate number with $N \propto 1/d_p$,
 d_p = particle diameter

Resolution R_s as Function of Particle Size

MN Appl. No. 125270



Column:	50 x 4 mm NUCLEOSHELL® RP 18, 2.7 µm NUCLEODUR® C ₁₈ Gravity, 3 µm NUCLEODUR® C ₁₈ Gravity, 1.8 µm
Solvent	acetonitrile – water (60:40, v/v)
Flow rate	1 mL/min
Temperature	25 °C
Detection	UV, 254 nm

Peaks:

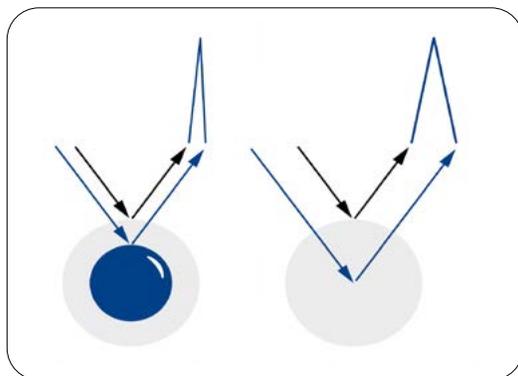
1. Naphthalene
2. Ethylbenzene

Theoretical column efficiency (optimal conditions)

Silica	d_p [μm]	L [m]	HETP [μm]	Efficiency [plates/m]	L [mm]	N	Rs	Analysis time
NUCLEOSHELL®	2.7	1	4	250 000	100	25 000	112%	40%
	5	1	6.5	154 000	150	23 000	115%	60%
NUCLEODUR®	1.8	1	4.5	222 222	100	22 000	105%	40%
	3	1	7.5	133 333	150	20 000	100%	60%
	5	1	12.5	80 000	250	20 000	100%	100%

Benefits of Core-Shell Technology

Core-shell particles vs. totally porous silica



With conventional fully porous particles the mass transfer between stationary and mobile phase usually results in peak broadening at higher flow rates (C-term in van Deemter equation). The short diffusion paths in the core-shell particles reduce the dwell time of the analyte molecules in the stationary phase. So that even at high flow velocities of the mobile phase, optimal separation results can be obtained.

The van Deemter plots demonstrate how efficiency is affected by flow rate. In comparison with fully porous silicas, core-shell particles from various manufacturers maintain the efficiency optimum (max. plates/m) over a long range of increasing linear mobile phase velocity.

Benefits

Short diffusion paths

- Fast mass transfer (term C of Van Deemter equation)
- High flow velocity without peak broadening for fast LC

Narrow particle size distribution ($d_{90}/d_{10} \sim 1.1$)

- Stable packing

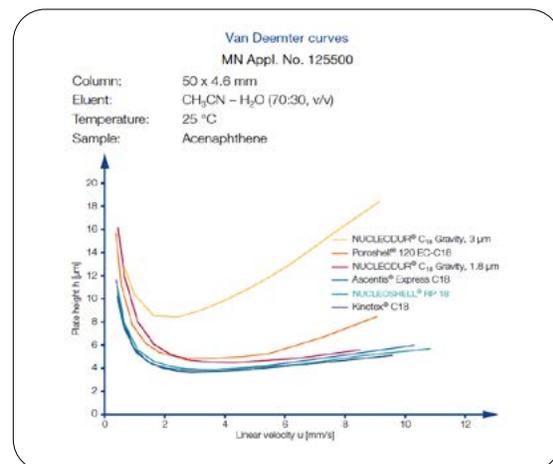
High heat transfer

- Minimized influence of frictional heat
- Efficiency of NUCLEOSHELL® $\sim 250\,000\text{ m}^{-1}$ (HETP $\sim 4\ \mu\text{m}$)

NUCLEOSHELL® Core-Shell Silica for HPLC

$$H = A + \frac{B}{u} + C \cdot u$$

A term = eddy-diffusion, B term = longitudinal diffusion coefficient, C term = mass transfer coefficient



In direct comparison with conventional sub 2 micron phases, NUCLEOSHELL® columns only generate about 60% of the back pressure and can be operated with the majority of conventional HPLC systems. In order to develop the maximum performance of NUCLEOSHELL® columns, we recommend reducing extra column voids by using suitable capillaries (< 0.15 mm inner diameter) and specially adapted detector cells.

Moreover, detector settings should be optimized by increasing the measuring rate or by decrease of the time constant.

$$\Delta_p = \frac{\Phi \cdot L_c \cdot \eta \cdot \mu}{d_p^2}$$

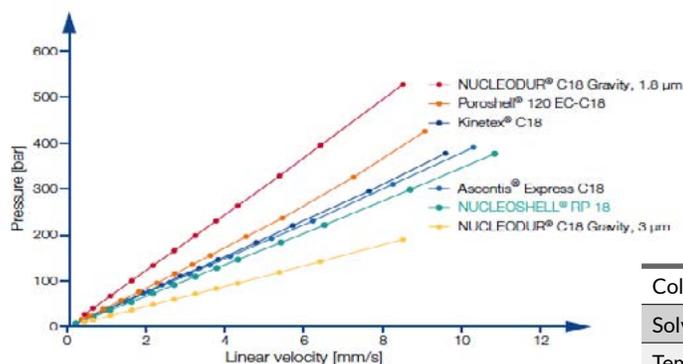
Δ_p = pressure drop, Φ = flow resistance (non-dimensional), L_c = column length, η = viscosity, μ = linear velocity, d_p = particle diameter

Good to Know

Core-shell particle technology from MACHERY-NAGEL is an alternate route to gain highest column efficiency and resolution in HPLC at short run time, but with moderate back pressure.

Pressure drop

MN Appl. No. 125510



Column:	50 x 4.6 mm
Solvent	CH ₃ CN - H ₂ O (70:30, v/v)
Temperature	25 °C

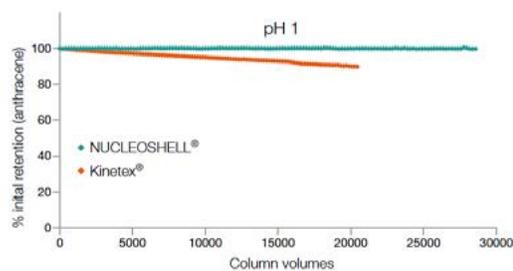
Features of NUCLEOSHELL® Particles

A criterion for the long-term stability of the column at pH extremes is the percentage decrease of initial retention and initial plates, respectively.

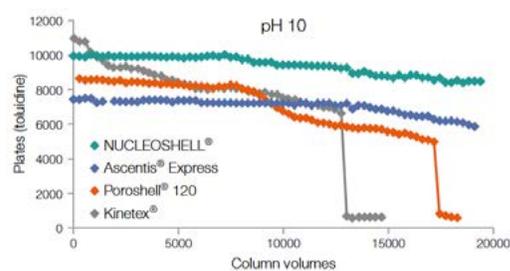
The following figure shows a column stability test of NUCLEOSHELL® RP 18 at mobile phase levels pH 1 and pH 10 compared with three competing phases.

Stability Under Acidic and Basic Conditions

MN Appl. No. 125510



Column:	50 x 4.6 mm NUCLEOSHELL® RP 18, 2.7 µm, 50 x 4.6 mm Kinetex® 2.6 µm C ₁₈
Solvent	acetonitrile - 1% TFA in water, pH 1 (50:50, v/v)
Flow rate	1.3 mL/min
Temperature	80 °C
Detection	UV, 254 nm
Analyt	anthracene



Column:	50 x 4.6 mm NUCLEOSHELL® RP 18, 2.7 µm, 50 x 4.6 mm Ascantis® Express C ₁₈ , 2.7 µm, 50 x 4.6 mm Poroshell® 120 EC-C ₁₈ , 50 x 4.6 mm Kinetex® 2,6 µm C ₁₈
Solvent	20 mmol/L Na borate - 10 mmol/L NaOH - methanol, pH 10 (21:49:30, v/v/v)
Flow rate	1.5 mL/min
Temperature	40 °C
Detection	UV, 220 nm
Analyt	toluidine

Columns can be operated at elevated temperatures without loss in retention, efficiency or peak symmetry.

Temperature Stability

MN Appl. No. 125400

Stability Test

Column:	50 x 2 mm NUCLEOSHELL® RP 18, 2.7 µm
Solvent	A) 10 mmol/L ammonium formate – methanol (9:1, v/v) + 120 µL formic acid, ~ pH 4 B) 10 mmol/L ammonium formate – methanol (1:9, v/v) + 120 µL formic acid, ~ pH 4 0–100 % B in 7 min
Flow rate	0.5 mL/min
Temperature	100 °C
Detection	UV, 220 nm

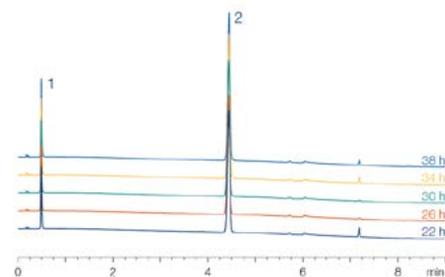
Peaks:

1. Phenol
2. Naphthalene

Efficiency Test:

Solvent	Acetonitrile – water (60:40, v/v)
Flow rate	0.33 mL/min
Temperature	25 °C
Detection	UV, 254 nm
Analyt	Anthracene

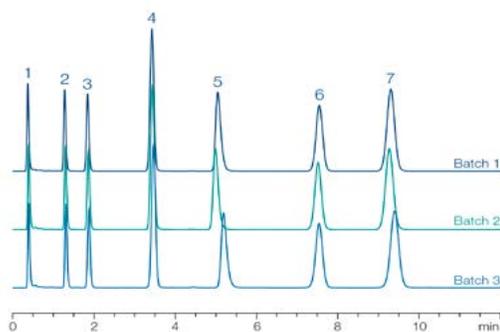
	HETP [µm]	Asymmetry
Start (t = 0)	5.2	0.98
End (t = 40 h)	5.2	1.01



Uniformly shaped NUCLEOSHELL® particles combined with optimized bonding technology safeguard tightly packed columns for 100 % reproducible results.

Batch-To-Batch Reproducibility

MN Appl. No. 125410



Column:	50 x 4 mm NUCLEOSHELL® RP 18, 2.7 µm
Solvent	methanol – 25 mmol/L KH ₂ PO ₄ , pH 7 (70:30, v/v)
Flow rate	1 mL/min
Temperature	40 °C
Detection	UV, 254 nm

Peaks:

- | | |
|-----------------|------------------|
| 1. Uracil | 5. Amitriptyline |
| 2. Toluene | 6. o-Terphenyl |
| 3. Ethylbenzene | 7. Triphenylene |
| 4. Acenaphthene | |

NUCLEOSHELL® RP 18

High density, base-deactivated core-shell silica

NUCLEOSHELL® RP 18 is based on core-shell silica. A unique derivatization process generates a homogeneous surface with a high density of bonded silanes. The following thorough endcapping suppresses any unwanted polar interactions between the silica surface and the sample, which makes NUCLEOSHELL® RP 18 particularly suitable for the separation of basic and other ionizable analytes. The extremely reduced silanol activity of the phase can be demonstrated by applying basic analytes such as tricyclic antidepressants. The chromatogram below shows a sharp elution profile (superior resolution!) of these highly polar compounds with an excellent asymmetry value for amitriptyline of 1.12.

NUCLEOSHELL® RP 18 combines innovative silica technology and excellent surface deactivation that outperforms conventional C₁₈ silicas in terms of efficiency, resolution, and speed.

Key Features

- Nonpolar high density phase
- Suitable for LC/MS and HPLC at pH extremes (pH 1–11)
- Superior base deactivation, ideal for method development

Technical Data

- Octadecyl phase; multi-endcapped
- Pore size 90 Å, particle sizes 2.7 and 5 µm, carbon content 7.8 % for 2.7 µm, 6.1 % for 5 µm; pH stability 1–11

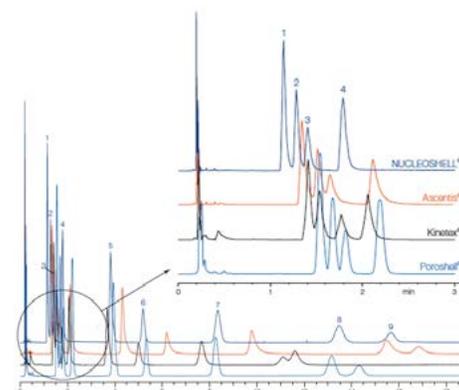
Recommended Applications

- USP listing L1
- Overall sophisticated analytical separations, e.g., analgesics, anti-inflammatory drugs, antidepressants; herbicides; phytopharmaceuticals; immunosuppressants

Due to the applied core-shell particle design the back pressure at elevated flow rates remains at a moderate level and in many cases permits the use of existing HPLC equipment. NUCLEOSHELL® RP 18 with extended pH stability, low bleed characteristics in LC/MS applications, and overall robustness is an ideal tool for method development and routine analyses in modern HPLC.

Tricyclic Antidepressants • Comparison of Selectivity and Resolution

MN Appl. No. 124960



Column	50 x 4.6 mm each NUCLEOSHELL® RP 18, 2.7 µm Ascentis® Express C ₁₈ Kinetex® 2.6 µm C ₁₈ Poroshell® 120 EC-C ₁₈
Solvent	methanol – acetonitrile – 25 mmol/L KH ₂ PO ₄ , pH 7 (22.5:22.5:55, v/v/v)
Flow rate	2 mL/min
Pressure	224 bar, 239 bar, 248 bar, 212 bar
Temperature	40 °C
Detection	UV, 220 nm

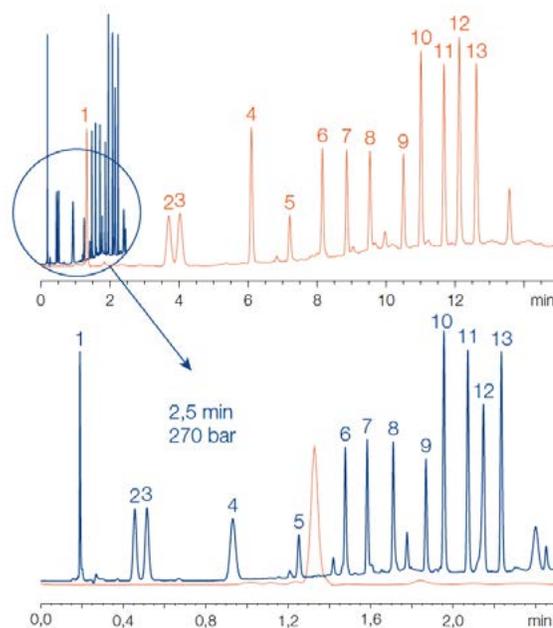
Peaks:

- | | |
|------------------|------------------|
| 1. Protriptyline | 6. Imipramine |
| 2. Desipramine | 7. Amitriptyline |
| 3. Maprotiline | 8. Clomipramine |
| 4. Nortriptyline | 9. Trimipramine |
| 5. Doxepin | |

	Asymmetry (amitriptyline)	Resolution (8, 9)
NUCLEOSHELL®	1.12	3.35
Ascentis® Express	2.07	1.91
Kinetex®	1.33	n/a
Poroshell®	1.05	1.95

13 β -Lactam Antibiotics in Less Than 3 min

MN Appl. No. 124940



Column	50 x 4 mm NUCLEOSHELL® RP 18, 2.7 μ m, 150 x 4 mm NUCLEODUR® C ₁₈ Gravity, 5 μ m
Solvent	A) acetonitrile B) 20 mmol/L KH ₂ PO ₄ , pH 3.5 10 % A (0,5 min) → 50 % A in 1.5 min (0.5 min 50 % A) 10 % A (3 min) → 50 % A in 9 min (3 min 50 % A)
Flow rate	2 mL/min, 1 mL/min
Pressure	270 bar, 110 bar
Temperature	25 °C
Detection	UV, 220 nm

Peaks:

- | | |
|----------------|-------------------|
| 1. Amoxicillin | 8. Piperacillin |
| 2. Ampicillin | 9. Penicillin V |
| 3. Cephalexin | 10. Oxacillin |
| 4. Cefotaxime | 11. Cloxacillin |
| 5. Cefoxitin | 12. Nafcillin |
| 6. Cefamandole | 13. Dicloxacillin |
| 7. Cephalothin | |

Ordering information

NUCLEODUR® RP 18

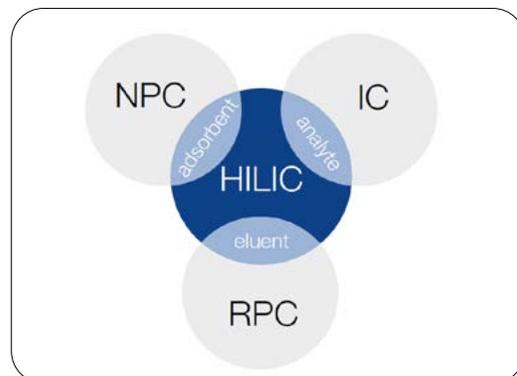
Analytical EC columns NUCLEOSHELL® RP 18 (pack of 1)

Length (mm)	ID (mm)	Particle size (μ m)	REF	Guard columns*
150	4.6	2.7	763136.46	763138.30
150	4	2.7	763136.40	763138.30
150	3	2.7	763136.30	763138.30
150	2	2.7	763136.20	763138.20
100	4.6	2.7	763134.46	763138.30
100	4	2.7	763134.40	763138.30
100	3	2.7	763134.30	763138.30
100	2	2.7	763134.20	763138.20
50	3	2.7	763132.30	763138.30
50	2	2.7	763132.20	763138.20
250	4.6	5	763157.46	763158.30
250	4	5	763157.40	763158.30
250	3	5	763157.30	763158.30
150	4.6	5	763156.46	763158.30
150	4	5	763156.40	763158.30
150	3	5	763156.30	763158.30
100	4.6	5	763154.46	763158.30
100	3	5	763154.30	763158.30
100	2	5	763154.20	763158.20
50	4.6	5	763152.46	763158.30

* Pack of 3, EC guard columns require column protection system REF 718966.

NUCLEOSHELL® HILIC

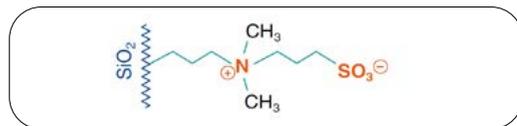
Hydrophilic Interaction Chromatography



Hydrophilic interaction chromatography (HILIC) is a separation technique using polar stationary phases and organic-aqueous mobile phases. A minimum water content of at least 2% is indispensable to provide a permanent water layer between the adsorbent surface and the organic fraction of the mobile phase. The sample molecules become separated in a partition chromatography, in which polar analytes are more strongly retained than neutral, less hydrophilic compounds. Consequently, increasing the aqueous part in the mobile phase will diminish retention of the polar sample constituents. In this way HILIC behaves inverse to classical RP chromatography. The particular retention profile of HILIC enables the chromatography of very polar and often small molecules, which will not show any retention on C₈ or C₁₈ reversed phases

Ultra-fast separations at moderate back pressure

- NUCLEOSHELL® HILIC is a core-shell technology based stationary phase with a covalently bonded 3-N,N-dimethylaminopropane sulfonic acid ligand. The betaine character of the strong ion-exchanger results in full charge balancing and facilitates fast equilibration times.



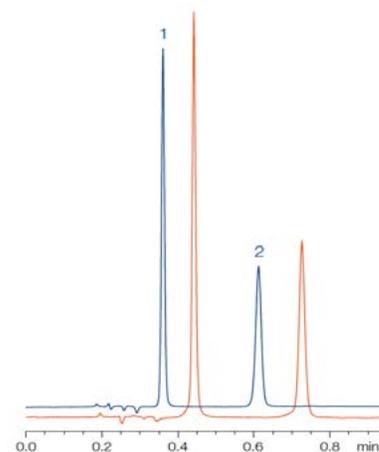
Good separation of polar compounds like the physiologically important substances creatine and creatinine can be achieved on NUCLEOSHELL® HILIC as well as on NUCLEODUR® HILIC, 1.8 µm at similar retention but much lower back pressure.

Good to know

NUCLEODUR® HILIC is a patented phase modification (pat. number DE102009006007 (B4))

Separation of Creatine and Creatinine

MN Appl. No. 124990



Column	50 x 4 mm NUCLEOSHELL® HILIC, 2.7 µm, 50 x 4 mm NUCLEODUR® HILIC, 1.8 µm
Solvent	acetonitrile – 10 mmol/L ammonium acetate, pH 4.0 (90:10, v/v)
Flow rate	1.7 mL/min
Pressure	129 bar 180 bar
Temperature	25 °C
Detection	UV, 210 nm

Peaks:

1. Creatinine
2. Creatine

Key Features

- Ideal for reproducible and stable chromatography of highly polar analytes
- Very short column equilibration times
- Suitable for LC/MS

Technical Data

- Zwitterionic ammonium-sulfonic acid phase; not endcapped
- Pore size 90 Å, particle size 2.7 µm; carbon content 1.3%; pH stability 2–8.5

Recommended Applications

- Hydrophilic compounds such as polar organic acids and bases, polar natural compounds, nucleosides, oligonucleotides, amino acids, peptides, water-soluble vitamins

NUCLEOSHELL® HILIC

The following chromatograms show the method transfer from a fully porous 3 µm HILIC phase to 2.7 µm core-shell silica with equal selectivity features.

Run time has been cut down to 1 min. Column back pressure remains modest < 400 bar, while solvent demand is reduced to less than 35 %.

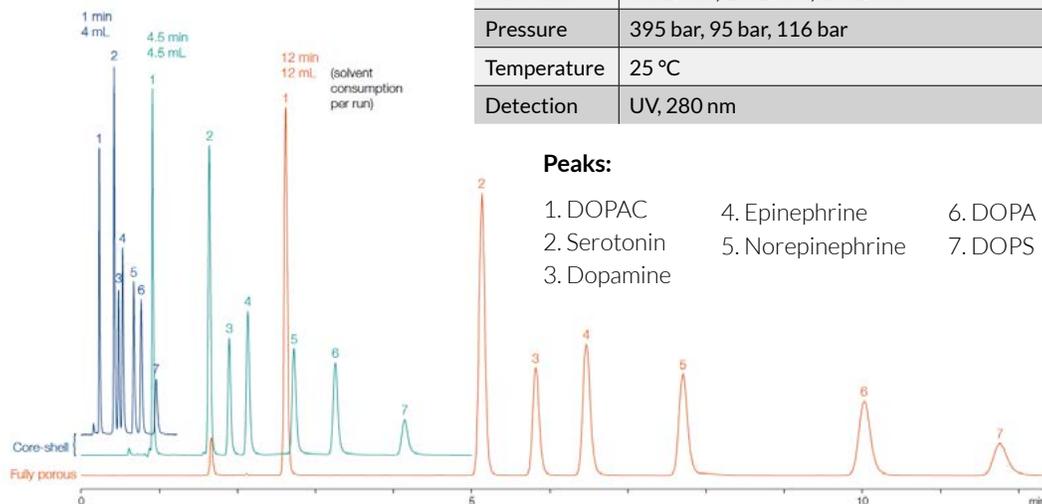
Good to know

NUCLEOSHELL® HILIC provides stable and reproducible chromatography, comprising all the benefits of a state-of-the-art core-shell silica.

Separation of Catecholamines

MN Appl. No. 125440

Column	100 x 4 mm NUCLEOSHELL® HILIC, 2.7 µm 100 x 4 mm NUCLEOSHELL® HILIC, 2.7 µm 250 x 4 mm NUCLEODUR® HILIC, 3 µm
Solvent	acetonitrile – 100 mmol/L ammonium formate, pH 3.2 (80:20, v/v)
Flow rate	4 mL/min, 1 mL/min, 1 mL/min
Pressure	395 bar, 95 bar, 116 bar
Temperature	25 °C
Detection	UV, 280 nm



Peaks:

- | | | |
|--------------|-------------------|---------|
| 1. DOPAC | 4. Epinephrine | 6. DOPA |
| 2. Serotonin | 5. Norepinephrine | 7. DOPS |
| 3. Dopamine | | |

Accessories

Accessories for stainless steel HPLC columns

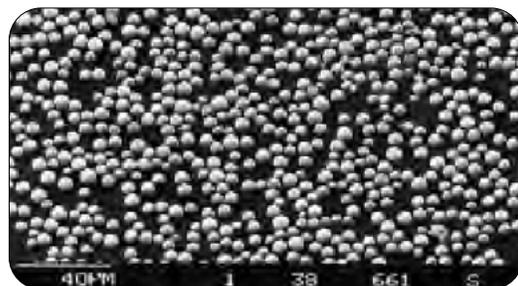
- Stainless steel accessories are corrosion resistant, pressure stable and easy to work mechanically
- Suitable for HPLC columns with 1/16" connections

Ordering Information

Capillary Accessories		
Description	Pack of	REF
1/16" column end caps (plastic)	4	718582
1/16" nut for connecting 1/16" capillaries	5	718583
1/16" ferrule	5	718584
Capillary Accessories		
Typ 1: 100 mm × 1/16" × 0.25 mm	1	718637
Typ 2: 100 mm × 1/16" × 0.12 mm	1	719489
Cutter for 1/16" capillary tubing	1	706290



NUCLEOSIL® Standard Silica for HPLC



Benefits of NUCLEOSIL® Silica

- High efficiency due to narrow particle size distribution
- High separation performance due to optimized binding techniques
- High chemical and mechanical stability
- High load capacity and recovery rates
- High reproducibility from lot to lot

Physical Properties

- NUCLEOSIL® is manufactured with different pore diameters (50, 100, 120, 300, 500, 1000 and 4000 Å) and particle sizes from
- 3 μm (only NUCLEOSIL® 50, 100 and 120) to 10 μm with very narrow fractionation. All narrow-pore NUCLEOSIL® packings are stable up to 500 bar (7,250 psi), the wide-pore NUCLEOSIL® silicas are stable up to 300 or 400 bar (4,200 or 5,600 psi).

NUCLEOSIL® Modifications

- NUCLEOSIL® packings are available as unmodified silica or with numerous chemically bonded phases: RP phases like
- C₁₈ AB, C₁₈ HD, C₁₈ Nautilus, C₁₈, C₁₈ ec, Protect I, C₈ HD, C₈ ec, C₈, C₄, C₂ and C₆H₅ separate mainly by hydrophobic interactions (van der Waals forces). The less polar the sample molecules, the more they are retained – the more polar the sample, the weaker are the hydrophobic interactions and consequently the retention times are shorter.

- Phases with chemically bonded polar groups such as CN, NH₂, N(CH₃)₂, OH show selective separation properties. Due to the availability of different functional groups it is possible to vary the chemical characteristics of the surface and consequently the adsorption characteristics of the stationary phase.
- Silica-based ion exchangers (NUCLEOSIL® SA and SB) are stable from pH 2 to 8 and do not swell. Compared to resin-based ion exchangers they offer the advantage of constant permeability, even when the ionic strength and/or pH of the eluent are changed. The separation can be influenced by
 - the type of buffer
 - the ionic strength and
 - the pH value

Key Features

- NUCLEOSIL® is a family of totally porous spherical silicas. They feature a very pure and uniform SiO₂ structure and have gained wide acceptance as routine chromatographic packings for very different fields of modern chromatography.
- One of the first spherical silicas used in HPLC
- Developed in the early seventies, it became a world- renowned HPLC packing
- Absolutely reliable choice for routine analyses
- Largest variety of modified HPLC silicas available
- pH stability 2 – 8 (for NUCLEOSIL® 100-5 C₁₈ AB 1-9)
- Due to its particle sizes NUCLEOSIL® finds application in analytical as well as in preparative columns.

Phase	Pore Size	Pore Volumn	Surface (BET)	Density	Pressure Stablility*
NUCLEOSIL® 50	50 Å	0.8 mL/g	420 m ² /g	0.45 g/mL	500 bar
NUCLEOSIL® 100	100 Å	1 mL/g	350 m ² /g	0.36 g/mL	500 bar
NUCLEOSIL® 120	120 Å	0.65 mL/g	200 m ² /g	0.55 g/mL	500 bar
NUCLEOSIL® 300	300 Å	0.8 mL/g	100 m ² /g	0.45 g/mL	400 bar
NUCLEOSIL® 500	500 Å	0.8 mL/g	35 m ² /g	0.45 g/mL	400 bar
NUCLEOSIL® 1000	1000 Å	0.8 mL/g	25 m ² /g	0.45 g/mL	300 bar
NUCLEOSIL® 4000	4000 Å	0.7 mL/g	10 m ² /g	0.48 g/mL	300 bar

* Maximum packing pressure of NUCLEOSIL® bulk packings

NUCLEODUR® HPLC C₁₈ Columns

Description	Part No.
HPLC Column NUCLEODUR® 100-5 C ₁₈ ec 125x3 mm	CM-100000
HPLC Column NUCLEODUR® 100-5 C ₁₈ ec 125x4 mm	CM-100001
HPLC Column NUCLEODUR® 100-5 C ₁₈ ec 250x4,6 mm	CM-100002
HPLC Column NUCLEODUR® 100-5 C ₁₈ ec 150x4,6 mm	CM-100003
HPLC Column EC 50/4.6 NUCLEODUR® 100-5	CM-100004
HPLC Column EC 250/4.6 NUCLEODUR® 100-3 C18 HPLC Column, EC	CM-100005
HPLC Column EC 150/4.6 NUCLEODUR® C ₁₈ Gravity, 3 µm	CM-100006
HPLC Column EC 250/4.6 NUCLEODUR® C ₁₈ Gravity, 5 µm	CM-100007
HPLC Column EC 150/4.6 NUCLEODUR® C ₁₈ Gravity, 5 µm	CM-100008
HPLC Column EC 125/4 NUCLEODUR® 300-5 C4 125 mm, ID: 4 mm	CM-100009
HPLC Column EC 250/4 NUCLEODUR® C ₁₈ Pyramid, 5 µm	CM-100010
HPLC Column EC 150/4.6 NUCLEODUR® C ₁₈ Pyramid, 5 µm	CM-100011
HPLC Column EC 50/2 NUCLEODUR® C ₁₈ Pyramid, 1.8 µm	CM-100012
HPLC Column EC 100/2 NUCLEODUR® C ₁₈ HTHPLC Column, EC, 1.8 µm	CM-100013
HPLC Column EC 250/4.6 NUCLEODUR® C ₁₈ Isis, 3 µm	CM-100014
HPLC Column EC 100/3 NUCLEODUR® PolarTHPLC Column, EC, 3 µm	CM-100015
HPLC Column EC 150/3 NUCLEODUR® PolarTHPLC Column, EC, 3 µm	CM-100016
HPLC Column EC 150/2 NUCLEODUR® HILIC, 1.8 µm	CM-100017
HPLC Column EC 100/3 NUCLEODUR® HILIC, 3 µm	CM-100018
HPLC Column EC 150/2 NUCLEODUR® HILIC, 5 µm	CM-100019
HPLC Column EC 125/4.6 NUCLEODUR® 100-5 NH2	CM-100020
HPLC Guard Column EC 4/3 NUCLEODUR® C ₁₈ Pyramid, 5 µm, Pkg. 3	CM-100021
HPLC Guard Column EC 4/2 NUCLEODUR® 100-5 C ₁₈ EC, Pkg. 3	CM-100022
HPLC Guard Column EC 4/3 NUCLEODUR® 100-5 C ₁₈ EC, Pkg. 3	CM-100023
HPLC Cartridge Column CC 30/4 NUCLEODUR® Sugar 810-H	CM-100029

NUCLEOSHELL® HPLC Columns

HPLC Column EC 50/2 NUCLEOSHELL® RP 18, 2.7 µm	CM-100024
HPLC Column EC 150/4.6 NUCLEOSHELL® RP 18 5 µm, 150 mm, ID: 4.6 mm	CM-100025
HPLC Column EC 100/2 NUCLEOSHELL® HILIC, 2.7 µm	CM-100026

NUCLEOGEL® HPLC Columns

HPLC Column VA 300/7.8 NUCLEOGEL® Sugar 810 H	CM-100028
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NUCLEOSIL® HPLC C₈ Columns

HPLC Column EC NUCLEOSIL 100-5 C ₈ HD, 5 µm, 150 x 4.6 mm	CM-100037
HPLC Column EC NUCLEOSIL 100-5 C ₈ , 5 µm, 250 x 4.6 mm	CM-100038
HPLC Column EC NUCLEOSIL 120-5 C ₈ , 5 µm, 150 x 4 mm	CM-100039
HPLC Column EC NUCLEOSIL 100-5 C ₈ , 5 µm, 150 x 4.6 mm	CM-100040
HPLC Column EC NUCLEOSIL 100-5 C ₈ HD, 5 µm, 125 x 2 mm	CM-100041
HPLC Column EC NUCLEOSIL 120-3 C ₈ , 3 µm, 125 x 4 mm	CM-100042
HPLC Column EC NUCLEOSIL 100-5 C ₈ , 5 µm, 250 x 4 mm	CM-100043

Guard Columns and Holders

HPLC Guard Column EC 4/3 UNIVERSAL RP, Pkg. 3	CM-100031
ChromCart Guard Column Holder 30 mm for Stand-alone	CM-100030
Column Protection System Guard Column Holder for EC 4x2 + 4x3 mm Guard Columns	CM-100027



HPLC Column ProteCol® C₁₈ and Connections

Turn Imagination into Results

High quality phases and a variety of hardware options provide a perfect match for all your separation needs.

Features and Benefits

- A range of C₁₈ phases including options for pore size and pH stability.
- Reduced sample and column preparation time.
- Improved peak shape, reproducibility and sensitivity.
- Reduced carry over.

Recommended Applications

General purpose reverse phase separations.

Product Specifications

0.15, 0.3, 1, 2.1, 3, and 4.6 mm ID columns available in 50, 100, 150, 250 mm lengths.

PEEK coated, and PEEKsil®, column hardware available to reduce non-specific interactions when analyzing compounds with metal chelating activity.



Phase	Specifications	Pore Size (Å)	Particle Size (µm)	Pore Volume (ml)	Surface Area	Carbon Load %	USP Code
C18 Q	<ul style="list-style-type: none"> Ultra pure silica Fully end capped optimized C₁₈ phases 	100	3, 5	1.0 ± 0.1	400 ± 40	16.8	L1
C18 G	<ul style="list-style-type: none"> Stable in aqueous conditions 	120	2.5, 3, 5, 10	1.0 ± 0.1	1.0 ± 0.1	17.1	L1
	<ul style="list-style-type: none"> Reduced non-specific analyte interactions 	200	3, 5		200 ± 30	12.6	L1
	<ul style="list-style-type: none"> Separates polar compounds pH stability 1-9 	300	3, 5		100 ± 20	6.9	L1
C18 H	<ul style="list-style-type: none"> Modified bonded phase making it easier to work from low to high pH using the same column Novel chemical bonding ensuring stability under extreme alkaline and acidic conditions pH stability 1 -11 	120	5	1.0 ± 0.1	300 ± 40	20.9	L1
C18 P	<ul style="list-style-type: none"> Polar embedded C₁₈ 100 % compatible with water pH stability 1 - 9 	120	3, 5	1.0 ± 0.1	300 ± 40	14.5	L1

HPLC Capillary Column ProteCol®

Turn Imagination into Results

The ProteCol® capillary HPLC design includes integrated connection tubing with PEEKsil® for the column body and connection capillaries delivering robust design, zero volume connections and uninterrupted flow.

Features and Benefits

Integrated PEEKsil connection tubing, PEEKsil column body, and zero volume connections allows for use with:

- Small samples.
- Exotic solvents.
- Low concentrations.
- Direct coupling into MS.

Recommended Applications

- Biotechnology.
- Medical research.
- Proteomics.
- Pharmaceuticals.

HPLC Guard Column ProteCol

ProteCol® guard columns are recommended to protect the analytical column, and ensure it performs consistently.

Features and Benefits

The unique design of the guard column couples directly to the analytical column. The guard column is designed to fit into the back of a PEEK fingertight fitting (provided with the guard column). No further unions are required.

Recommended Applications

We recommend the use of ProteCol Guard columns to protect the analytical column, and ensure it performs consistently.



Product Specifications

150 µm and 300 µm.
Available in C₁₈, C₈ and C₄ phases.



Product Specifications

Available in C₁₈ and C₈ phases.

ProteCol® HPLC unions

Perfect connections, every time

ProteCol® HPLC unions are specifically designed and precision engineered for use in capillary LC. The ideal way to avoid any void or dead volume in a connection is to achieve a faultless butt connection. .

Features and Benefits

- Easy to use ProteCol HPLC unions are available in stainless steel or PEEK, with reusable PEEK ferrules.
- Zero dead volume design for no peak dispersion.
- Complete versatility - allows connection to the same or different sized tubing.
- Stainless steel unions can be finger tightened, or tightened with a 3/16" wrench for high-pressure applications. PEEK unions can be finger tightened. They are slightly larger than stainless steel unions but also lighter - less stress on your tubing.
- Replacement PEEK ferrules available.

Recommended Applications

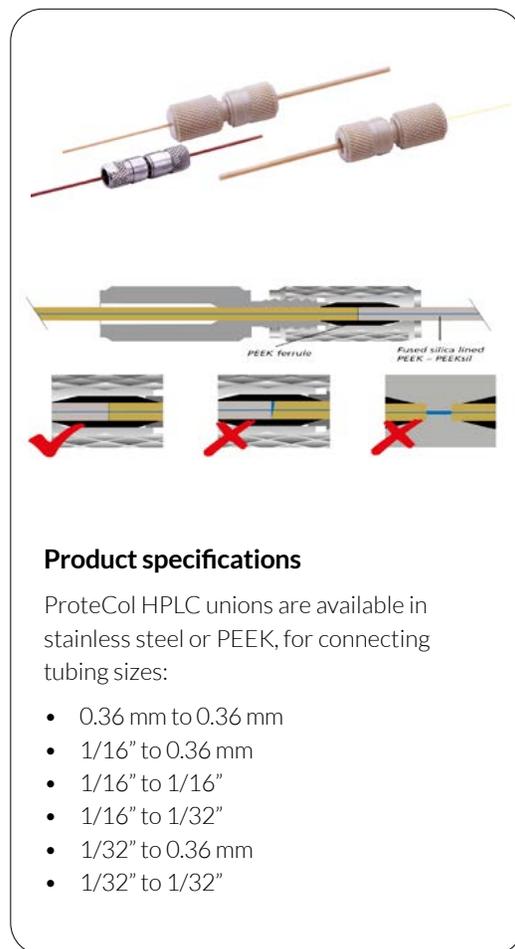
ProteCol HPLC unions and reusable PEEK ferrules allow you to connect any combination of:

- 1/32" PEEKsil® tubing.
- 1/16" PEEKsil tubing.
- 0.36 mm fused silica tubing.
- Use for connecting guard or trap columns to analytical columns, or for bypassing the analytical column.

All unions use the same range of reusable PEEK ferrules.

Pressure rating: 5,000 psi (stainless steel unions),

2,175 psi (PEEK unions).



Product specifications

ProteCol HPLC unions are available in stainless steel or PEEK, for connecting tubing sizes:

- 0.36 mm to 0.36 mm
- 1/16" to 0.36 mm
- 1/16" to 1/16"
- 1/16" to 1/32"
- 1/32" to 0.36 mm
- 1/32" to 1/32"

ProteCol HPLC Columns and Connections

Description	Part No.
C ₁₈ H x 3 µm Particle Size x 120 Å Pore Size, 100 mm Length x 4.6 mm ID, Stainless Steel ProteCol HPLC Column	CM-100032
C ₁₈ H x 5 µm Particle Size x 120 Å Pore Size, 150 mm Length x 4.6 mm ID, PEEK Coated ProteCol HPLC Column	CM-100034
C ₁₈ H x 5 µm Particle Size x 120 Å Pore Size, 250 mm Length x 4.6 mm ID, PEEK Coated ProteCol HPLC Column	CM-100035
C ₁₈ H x 5 µm Particle Size x 120 Å Pore Size, 10 mm Length x 4.0 mm ID, Stainless Steel ProteCol HPLC Guard Column, Pkg. 3	CM-100033
C ₁₈ Q x 5 µm Particle Size x 100 Å Pore Size, 250 mm Length x 4.6 mm ID, PEEK Coated ProteCol HPLC Column	CM-100036
PEEK Fingertight Fittings, 1/16" to 10-32UNF Thread, Pkg. 10	CC-100096
PEEK Fingertight Fittings, 1/32" to 6-40UNF Thread, Pkg. 5	CC-100098
PEEK Ferrule, for 1/16" to 1/32" ID Columns, Pkg. 5	CC-100097

Ferrules



Designed to Simplify Your GC Connections

AFP offers a wide variety of standard and special ferrules used in gas chromatographs and other instruments. Our wide range of ferrules are made from Vespel®, Vespel/graphite, graphite and PTFE. The standard ferrule product line is used to seal tubing and capillaries to standard compression fittings in a variety of sizes.

Graphite GC Ferrules

Graphite GC ferrules are made from high purity exfoliated graphite. They seal with minimal torque and are reusable if they are not over tightened. Graphite GC ferrules do not shrink in use but are very soft and must be packed and handled with care.

Graphite ferrules are commonly used in GC systems on the inlet and detector ends because they don't stick to the column, and can be removed and reinserted easily. They should not be used with GC/MS instruments because of permeability to air.

You should always trim a short piece of the column after replacing the ferrule to be sure that not graphite particles have plugged the column. **Upper temperature limit of 450 °C.**



PTFE GC Ferrules

PTFE GC ferrules are made from 100% PTFE. They are soft, completely inert, and have very low friction. PTFE GC ferrules are hydrophobic and commonly used in liquid applications.

Upper temperature limit of 250 °C.

Vespel GC Ferrules

Vespel GC ferrules are made from 100% high-temperature polyimide, a hard polymeric material that tends to seal permanently to capillary columns when in use. A firm torque is required to compress and seal. They are not reusable and tend to shrink through repeated heating and cooling cycles.

Vespel GC ferrules are excellent for creating seals on metal or glass and have long lifetimes. 100% Vespel is essentially non-porous to oxygen so it is ideal for GC/MS interface use, where air permeation can raise the background signal and contribute to phase degradation. They also work best in connections that are isothermal or insulated from oven temperature changes.

Upper temperature limit of 350°C.



Vespel/graphite GC Ferrules

Vespel/graphite GC ferrules are made from quality polyimide/graphite blend. They seal with minimal torque and can be reused and repositioned along capillary columns if not over compressed in the fitting. Due to slight shrinking at high temperatures, they must be retightened after initial temperature cycles to avoid leaks.

Two types of Vespel/graphite are commonly used, one with 40% graphite and one with 15% graphite. They are ideal for GC/MS interface applications because they are non-porous to oxygen. The inclusion of graphite increases high-temperature tolerance and reduces sticking and shrinkage.

We offer both Vespel/graphite blends, a 60/40 mix and an 85/15 mix. The 85/15 maintains a high level of hardness and long lifetime. The 60/40 blend is softer, with improved wear resistance and lower friction. These ferrules will require less force to compress and form a seal.

Both blends have an upper temperature limit of 400 C.

GC Ferrules

Connections | Graphite Ferrules

Description	Part No.
1/16" GC Ferrule 0.5 mm ID Agilent Style Graphite, Pkg. 10	CC-100000
1/16" GC Ferrule 0.8 mm ID Agilent Style Graphite, Pkg. 10	CC-100001
1/16" GC Ferrule 0.4 mm ID (Long) Graphite, Pkg. 10	CC-100017
1/16" GC Ferrule 0.5 mm ID (Long) Graphite, Pkg. 10	CC-100018
1/16" GC Ferrule 0.25 mm ID/0.35 mm OD Columns, Pkg. 10	CC-100071
1/16" GC Ferrule 0.32 mm ID/0.45 mm OD Columns, Pkg. 10	CC-100072
1/16" GC Ferrule 0.53 mm ID/0.65 mm OD Columns, Pkg. 10	CC-100073
1/8" GC Ferrule 1/8" ID Graphite, Pkg. 10	CC-100002
1/8" GC Ferrule 0.8 mm ID Graphite, Pkg. 10	CC-100003
1/4" GC Ferrule 1/4" ID Graphite, Pkg. 10	CC-100004
1/4" GC Ferrule 6.0 mm ID Graphite, Pkg. 10	CC-100005
Graphite Short-Style Ferrules for Agilent, 0.25 mm ID/0.35 mm OD Columns, Pkg. 10	CC-100077
Graphite Short-Style Ferrules for Agilent, 0.32 mm ID/0.45 mm OD Columns, Pkg. 10	CC-100078
Graphite Short-Style Ferrules for Agilent, 0.53 mm ID/0.65 mm OD Columns, Pkg. 10	CC-100079
Graphite Reducing Ferrules for 1/8" Fittings, 0.53 mm ID/0.8 mm OD Columns, Pkg. 10	CC-100074

GC Ferrules

Connections | Graphite Ferrules

Description	Part No.
Graphite Short Reducing Ferrule with 1 mm Hole for 1/16" Fittings, Pkg. 10	CC-100006
Graphite Short Reducing Ferrule with 0.5 mm Hole for 1/16" Fittings, Pkg. 10	CC-100007
Graphite Reducing Ferrule with 6 mm Hole for 1/4" Fittings, Pkg. 10	CC-100008
Graphite Ferrule with 1/16" Hole for 1/16" Fittings, Pkg. 10	CC-100009
Graphite Ferrules with 0.5 mm Hole for use with 1/8" nuts on PE Detector/Injectors, Pkg. 10	CC-100010
Graphite Ferrule with 0.8 mm Hole for 1/16" Fittings, Pkg. 10	CC-100011
Graphite Ferrule with 0.5 mm Hole for 1/16" Fittings, Pkg. 10	CC-100012
Graphite Ferrules with 1.0 mm Hole for use with 1/8" Nuts on PE Detector/Injectors, Pkg. 10	CC-100013
Graphite Short Reducing Ferrule with 0.5 mm Hole for Detector/Injectors, Pkg. 10	CC-100014
Graphite Short Reducing Ferrule with 0.8 mm Hole for Detector/Injectors, Pkg. 10	CC-100015

Connections | Vespel/Graphite Ferrules

Description	Part No.
1/16" GC Ferrule 0.4 mm ID (Long) 60% Vespel / 40% Graphite, Pkg. 10	CC-100019
1/16" GC Ferrule 0.5 mm ID (Long) 60% Vespel / 40% Graphite, Pkg. 10	CC-100020
1/16" GC Ferrule 0.8 mm ID (Long) 60% Vespel / 40% Graphite, Pkg. 10	CC-100021
1/16" GC Ferrule 0.4 mm ID Agilent Style 60% Vespel / 40% Graphite, Pkg. 10	CC-100022
1/16" GC Ferrule 0.5 mm ID Agilent Style 60% Vespel / 40% Graphite, Pkg. 10	CC-100023
1/16" GC Ferrule 0.8 mm ID Agilent Style 60% Vespel / 40% Graphite, Pkg. 10	CC-100024
1/4" GC Ferrule 1/4" ID 60% Vespel / 40% Graphite, Pkg. 10	CC-100025
1/16" GC Ferrule 0.4 mm ID (Long) 85% Vespel / 15% Graphite, Pkg. 10	CC-100026
1/16" GC Ferrule 0.5 mm ID (Long) 85% Vespel / 15% Graphite, Pkg. 10	CC-100027
1/16" GC Ferrule 0.8 mm ID (Long) 85% Vespel / 15% Graphite, Pkg. 10	CC-100028
1/16" GC Ferrule 0.9 mm ID (Long) 85% Vespel / 15% Graphite, Pkg. 10	CC-100029
1/16" GC Ferrule 0.5 mm ID (Long) Two-hole 85% Vespel / 15% Graphite, Pkg. 10	CC-100030
1/16" GC Ferrule 0.3 mm ID (Long) Two-hole 85% Vespel / 15% Graphite, Pkg. 10	CC-100031
1/16" GC Ferrule 0.4 mm ID Agilent Style 85% Vespel / 15% Graphite, Pkg. 10	CC-100032
1/16" GC Ferrule 0.5 mm ID Agilent Style 85% Vespel / 15% Graphite, Pkg. 10	CC-100033
1/16" GC Ferrule 0.8 mm ID Agilent Style 85% Vespel / 15% Graphite, Pkg. 10	CC-100034
1/4" GC Ferrule 1/4" ID 85% Vespel / 15% Graphite, Pkg. 10	CC-100035

Connections | Vespel/Graphite Ferrules

Description	Part No.
15% Graphite/85% Vespel Mini Union Ferrule with 0.5 mm Hole, Pkg. 10	CC-100037
15% Graphite/85% Vespel Mini Union Ferrule with 0.8 mm Hole, Pkg. 10	CC-100038
1/16" GC Ferrule 0.4 mm ID (Long) Vespel, Pkg. 10	CC-100069
1/16" GC Ferrule 0.8 mm ID (Long) Vespel, Pkg. 10	CC-100070
Graphite Vespel Ferrules for 0.32 mm ID/0.45 mm OD Columns, Pkg. 10	CC-100075
Graphite Vespel Ferrules for 0.53 mm ID/0.65 mm OD Columns, Pkg. 10	CC-100076

GC Ferrules

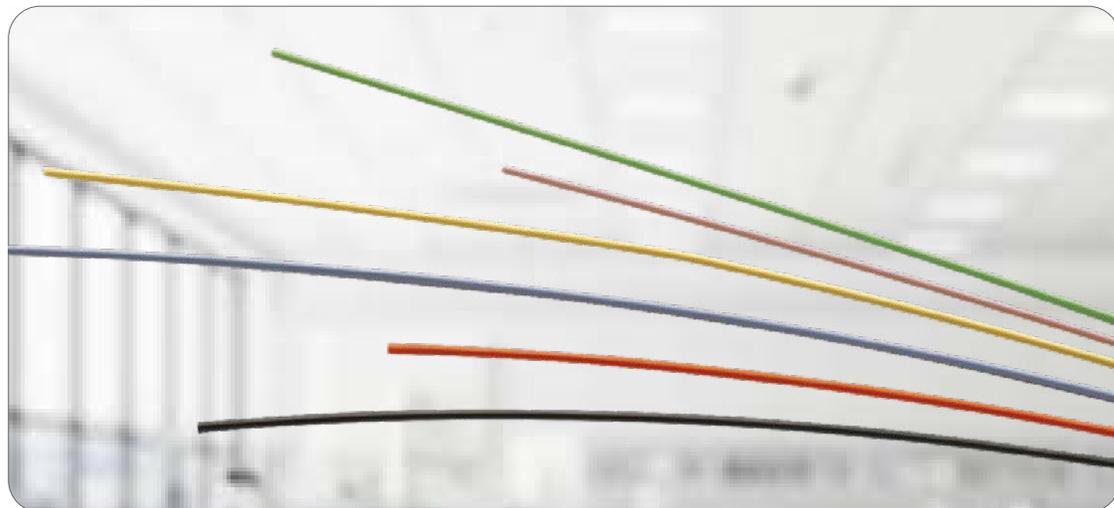
Connections PTFE Ferrules	
Description	Part No.
1/16" GC Ferrule 1/16" ID PTFE, Pkg. 10	CC-100039
1/16" GC Ferrule 0.4 mm ID (Long) PTFE, Pkg. 10	CC-100040
1/16" GC Ferrule 0.5 mm ID (Long) PTFE, Pkg. 10	CC-100041
1/16" GC Ferrule 0.8 mm ID (Long) PTFE, Pkg. 10	CC-100042
1/16" GC Ferrule 1.0 mm ID (Long) PTFE, Pkg. 10	CC-100043
1/8" GC Ferrule 1/8" ID PTFE, Pkg. 10	CC-100044
1/8" GC Ferrule 0.5 mm ID PTFE, Pkg. 10	CC-100045
1/4" GC Ferrule 1/4" ID PTFE, Pkg. 10	CC-100046
1/4" GC Ferrule 1/8" ID PTFE, Pkg. 10	CC-100047
1/4" GC Ferrule 3/16" ID PTFE, Pkg. 10	CC-100048
Connections SilTite Ferrules and Unions	
SilTite Kit 10/32" 0.25 Column, Pkg. 1	CC-100049
SilTite Ferrule 1/32 Column, Pkg. 10	CC-100050
SilTite Ferrule 0.25 Column, Pkg. 10	CC-100051
SilTite Ferrule 0.32 Column, Pkg. 10	CC-100052
SilTite Ferrule 0.53 Column, Pkg. 10	CC-100053
SilTite Ferrule Shimadzu 0.10-0.25 mm ID Columns 0.25, Pkg. 10	CC-100055
SilTite Mini Union Ferrule 0.25 Columns, Pkg. 10	CC-100057
SilTite Mini Union Ferrule 0.32 Columns, Pkg. 10	CC-100058
SilTite Mini Union Ferrule 0.53 Columns, Pkg. 10	CC-100059
SilTite Micro Union 0.35 to 0.35, Pkg. 1	CC-100060
SilTite Micro Union 0.4 to 0.4, Pkg. 1	CC-100061
SilTite Micro Union 0.4 to 0.8, Pkg. 1	CC-100062
SilTite Micro Union Ferrule 0.4-0.4, Pkg. 10	CC-100063
SilTite Micro Union Ferrule 0.4-0.8, Pkg. 10	CC-100064
SilTite Micro Union Ferrule 0.5-0.8, Pkg. 10	CC-100065
SilTite Micro Union Re-order 0.4-0.5 / 0.4-0.5, Pkg. 5	CC-100066
SilTite Micro Union Re-order 0.4-0.5 / 0.8, Pkg. 5	CC-100067
SilTite Fingertite Ferrule 0.4 mm, Pkg. 10	CC-100068



Ferrules for AFP Gas Chromatography Valves

Description	1/16"	1/8"
	Part No.	Part No.
Brass Ferrules	FFH-0202-VL0	FFH-0404-VL0
Gold Plated Ferrules	FFH-0202-VB1	FFH-0404-WB1
Hastelloy C-22 Ferrules	FFH-0202-VD0	FFH-0404-WD0
Stainless Steel Ferrules	FFH-0202-VB0	FFH-0404-WB0

Tubing



Durable, Bio-Compatible Tubing for Precision Needs

Precision bore PEEK tubing is designed specifically for modern LC, LCMS and automation usage. PEEK tubing is a flexible alternative to stainless steel tubing in high pressure applications.

Precision bore PEEK tubing ensures reproducibility in your chromatographic flow rates through smooth internal surface along with consistent and tight tolerated IDs.

Specifications

- Operating temperature up to 100°C max continuous use.
- Operating pressure range up to 10,000 psi (690 bar), size dependent.
- Can be used across a broad pH range of 2 to 14.
- Pre-cut lengths of 5', 10', 50' and 100'.

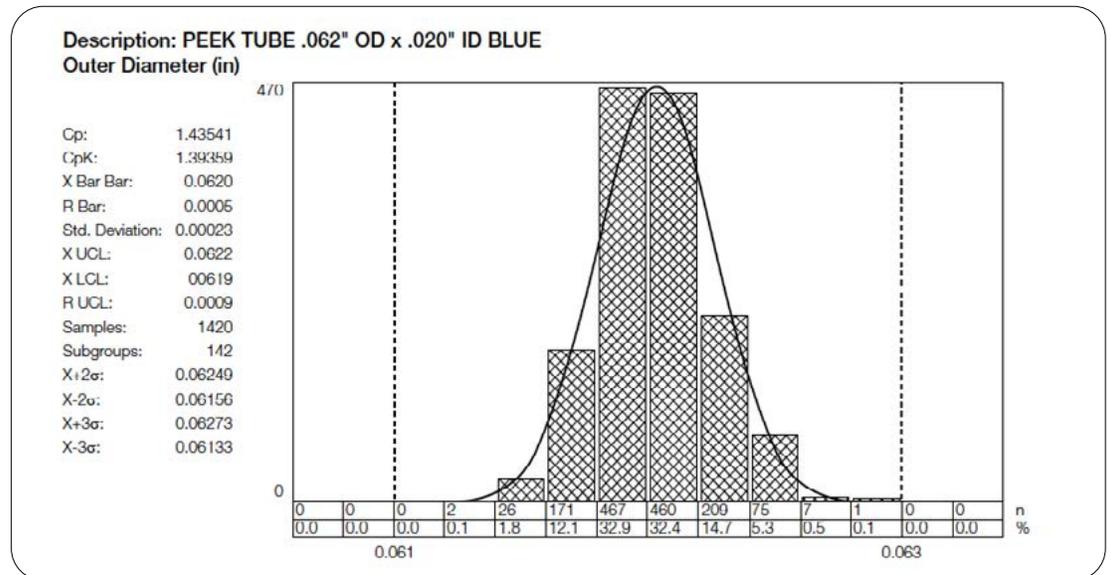
Features and Benefits

- Excellent chemical resistance and inert to most commonly used solvents. Exceptions are very caustic reagents, strong acids and bases.
- Bio-inert and bio-compatible.
- Color coded to industry standards for easy identification of internal diameter.
- Leach free colorants.
- Smooth inner walls and precise IDs.
- Works well with both polymer or stainless steel fittings.
- Can be formed to specific customer needs.



OD	ID	Tolerances		Operating Temperature	Max Operating Pressure (psi/bar)	Color
		OD	ID			
1/16"	0.0025"	±0.001"	±0.0005"	100 °C	7,000 psi (483 bar)	Natural
1/16"	0.004"	±0.001"	±0.0005"	100 °C	7,000 psi (483 bar)	Black
1/16"	0.005"	±0.001"	±0.001"	100 °C	7,000 psi (483 bar)	Red
1/16"	0.007"	±0.001"	±0.001"	100 °C	7,000 psi (483 bar)	Yellow
1/16"	0.010"	±0.001"	±0.001"	100 °C	7,000 psi (483 bar)	Blue
1/16"	0.013"	±0.001"	±0.001"	100 °C	7,000 psi (483 bar)	Orange
1/16"	0.015"	±0.001"	±0.001"	100 °C	7,000 psi (483 bar)	Natural
1/16"	0.015"	±0.001"	±0.001"	100 °C	7,000 psi (483 bar)	Gray
1/16"	0.020"	±0.001"	±0.001"	100 °C	6,000 psi (414 bar)	Orange
1/16"	0.030"	±0.001"	±0.001"	100 °C	4,000 psi (276 bar)	Green
1/16"	0.030"	±0.001"	±0.001"	100 °C	4,000 psi (276 bar)	Red
1/16"	0.040"	±0.001"	±0.001"	100 °C	3,000 psi (207 bar)	Natural
1/32"	0.0025"	±0.0005"	±0.0005"	100 °C	5,000 psi (345 bar)	Natural
1/32"	0.004"	±0.0005"	±0.0005"	100 °C	5,000 psi (345 bar)	Black
1/32"	0.005"	±0.0005"	±0.0005"	100 °C	5,000 psi (345 bar)	Red
1/32"	0.007"	±0.0005"	±0.0005"	100 °C	5,000 psi (345 bar)	Yellow
1/32"	0.010"	±0.0005"	±0.0005"	100 °C	5,000 psi (345 bar)	Blue
1/32"	0.015"	±0.0005"	±0.0005"	100 °C	4,000 psi (276 bar)	Natural
1/32"	0.015"	±0.0005"	±0.0005"	100 °C	4,000 psi (276 bar)	Gray
1/32"	0.020"	±0.0005"	±0.0005"	100 °C	3,000 psi (207 bar)	Orange
360 µm	50 µm (0.002")	±0.0005"	±0.0005"	100 °C	5,000 psi (345 bar)	Natural
360 µm	75 µm (0.003")	±0.0005"	±0.0005"	100 °C	5,000 psi (345 bar)	Black
360 µm	100 µm (0.004")	±0.0005"	±0.0005"	100 °C	2,000 psi (138 bar)	Red
360 µm	125 µm (0.005")	±0.0005"	±0.0005"	100 °C	2,000 psi (138 bar)	Green
360 µm	150 µm (0.006")	±0.0005"	±0.0005"	100 °C	2,000 psi (138 bar)	Yellow
1/8"	0.062"	±0.003"	±0.003"	100 °C	4,000 psi (276 bar)	Natural
1/8"	0.080"	±0.003"	±0.003"	100 °C	3,000 psi (207 bar)	Natural

Real-time Online SPC Data



Connecting PEEK Tubing

Precision engineered to make stronger, more reliable connections within the instrument workflow

Accurately cut your PEEK tubing to precise lengths to eliminate seating issues, dead volume and leaks in the critical interfaces of your instrument such as sample introduction, columns, valves and detectors.

Our range of connection solutions for PEEK tubing extends to:

- Traditional PEEK Fingertight options.
- ProteCol® stainless connectors to join tubing of different ODs and IDs together.
- PEEKLok™ fittings:
 - Designed to minimize dead volume
 - Improve performance at higher pressures
 - Simplify port configurations with less crowding

Fused Silica Tubing

Precision Tubing for Performance

Coated fused silica tubing exhibits excellent flexibility, chemical stability, tensile strength and exacting tolerances making it the tubing of choice for GC capillary applications, LC tubing and other micro tubing requirements.

Features and Benefits

- High homogeneity.
- 100% proof tested for strength.
- Excellent resistance to thermal shock.
- Chemical inertness.
- Standard polyimide temperature resistance to +380 °C
 - equivalent to other high temperature polyimides.
- Polyimide coating is chemically resistant.
- Low dielectric constant, low dielectric loss.
- Impermeable to all gases (except H₂, He).
- Free of thermal hysteresis.
- Low weight loss (below devitrification temperature).
- Optical properties of uncoated - transparent above 180 nm.
- High intrinsic tensile strength.
- Uncoated, temperature resistant to 1000 °C.
- Pressure resistant to 1000 bar.
- Very low thermal expansion.
- Internal surface modification is available.



Recommended Applications

- Capillary GC.
- HPLC.
- Bioanalytical.
- High temperature GC.

Avoid use with hydrofluoric or phosphoric acids, alkalis and alkali-metalized compounds as dissolution of silica glass and surface devitrification may occur.

Product Specifications

ID	OD	Iron	Lithium	Sodium	Potassium	Magnesium	Manganese	Titanium	Chlorine	Zirconium
25 $\mu\text{m} \pm 1 \mu\text{m}$	360 $\mu\text{m} \pm 15 \mu\text{m}$	< 8 ppb	< 10 ppb	< 8 ppb	< 10 ppb	< 10 ppb	< 5 ppb	< 10 ppb	0 ppb	< 10 ppb
50 $\mu\text{m} \pm 3 \mu\text{m}$	430 $\mu\text{m} \pm 20 \mu\text{m}$									
75 $\mu\text{m} \pm 3 \mu\text{m}$	680 $\mu\text{m} \pm 25 \mu\text{m}$									
100 $\mu\text{m} \pm 3 \mu\text{m}$										
150 $\mu\text{m} \pm 3 \mu\text{m}$										
220 $\mu\text{m} \pm 5 \mu\text{m}$										
250 $\mu\text{m} \pm 5 \mu\text{m}$										
320 $\mu\text{m} \pm 5 \mu\text{m}$										
530 $\mu\text{m} \pm 10 \mu\text{m}$										

Glass lined Tubing (GLT™)

Combining strength and inertness

Features and Benefits

- GLT is inert and has excellent resistance to strong acids and bases, unlike inferior silica coated brands.
- Biocompatible making it ideal for many HPLC applications.
- Mirror surface finish allows high HPLC column efficiencies.
- GLT is stable and withstands high temperatures to 500°C.

Recommended Applications

GLT can be used for:

- Reactor tubing.
- Transfer lines or flow lines.
- Stack probes for environmental monitoring.
- HPLC columns for protein and biosensitive analyses.
- Mass spectrometer interfaces.
- Thermal desorption tubes.
- Inert tee pieces and unions.



Product Specifications

- GLT comes in a wide range of sizes:
- OD range of 1/16", 1/8", 1/4" and 1/2".
- ID range between 0.3 - 9.5 mm.
- Standard lengths available are 30 cm, 60 cm, 90 cm and 180 cm.
- Other lengths are available on request (minimum order quantity may apply).
- Standard OD surface finish is not polished. Polished OD surface finish is available on request.

GLT can be machined to form unions, fittings, and a range of other chromatography accessories.

OD	ID (mm)												
	0.3	0.4	0.5	0.7	0.75	0.8	0.9	1.0	1.5	1.8	2.0	4.0	9.5
1/16"	●	●	●	●		●	●						
1/8"	●		●		●			●	●	●			
1/4"								●			●	●	
1/2"													●

PEEK Tubing

Precision bore PEEK tubing is designed specifically for modern LC, LCMS and automation usage. PEEK tubing is a flexible alternative to stainless steel tubing in high pressure applications.

Precision bore PEEK tubing ensures reproducibility in your chromatographic flow rates and results through smooth internal surface along with consistent and tight toleranced IDs.

Features and Benefits

- Excellent chemical resistance and inert to most commonly used solvents. Exceptions are very caustic reagents, strong acids and bases.
- Bio-inert and bio-compatible.
- Color coded to industry standards for easy identification of inner diameter.
- Leach free colorants.
- Smooth inner walls and precise IDs.
- Works well with either polymer fittings as well as stainless steel fittings.
- Can be formed to specific customer needs.

Recommended Applications

LC, LCMS and automation solutions.

PEEKsil® Tubing

Fused silica lined PEEK

PEEKsil® is constructed from a core of smooth precision bore fused silica tubing bonded to a PEEK outer sheath. It is manufactured to exacting tolerances of bore size and concentricity, for reproducible flow rates and reliable connections.

PEEKsil reduces separation dispersion and therefore loss of efficiency, sensitivity and resolution.

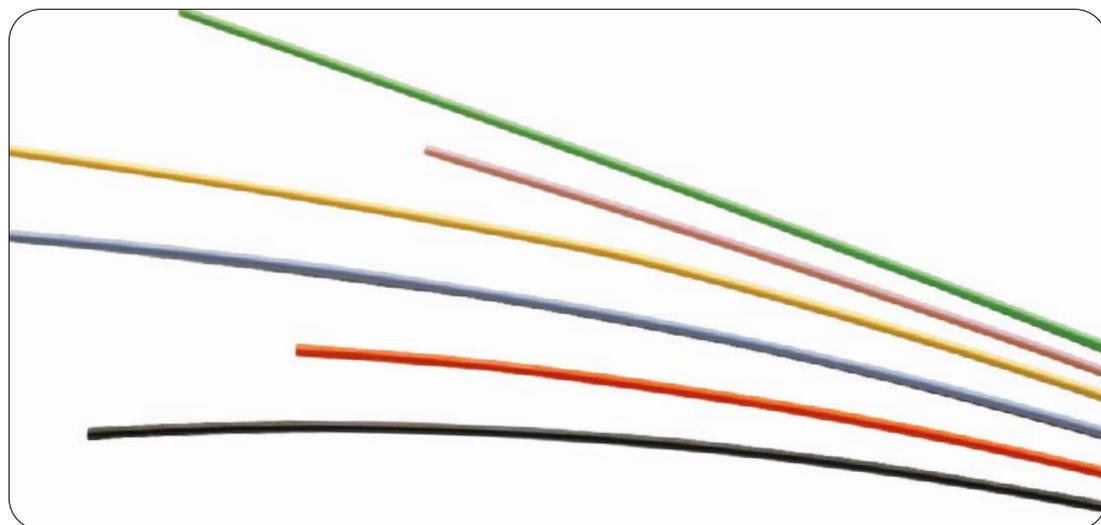
Features and Benefits

- Inert smooth flow path, to minimize band broadening.
- Precise inside bore diameter.
- Flexible and robust.
- Lower sample carryover.
- Color coded for easy identification of internal diameter.
- Perfectly square cut and polished ends.
- Capable of withstanding high pressures.
- Effective pH range of 0-10 (not compatible with hydrofluoric acid).
- Compatible with most organic solvents (unlike PEEK).

Recommended Applications

UHPLC, HPLC and LCMS.





Tubing Parts

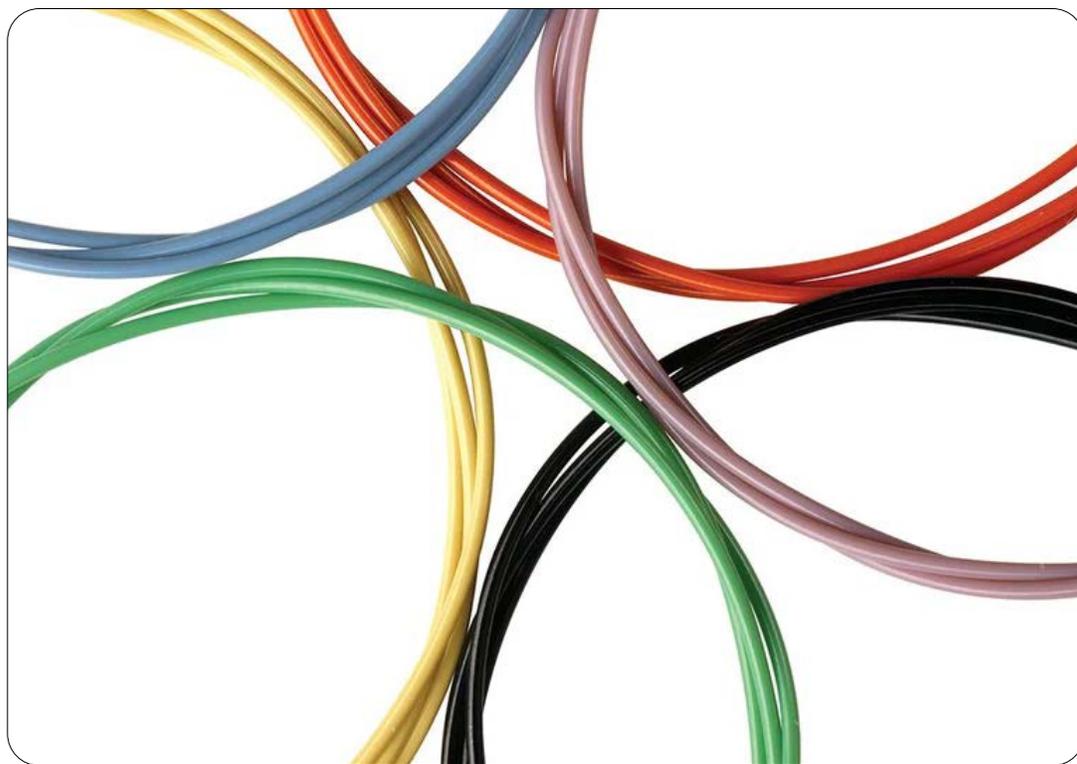
Tubing	
Fused Silica Tubing	
Description	Part No.
GC Tubing, Fused Silica, 180 μm ID, 363 μm OD, L: 5 m, VSD	CT-100010
GC Tubing, Fused Silica (not deactivated), 110 μm ID, 170 μm OD, L: 10 m	CT-100011
GC Tubing, Fused Silica (not deactivated), 25 μm ID, 285 μm OD, L: 10 m	CT-100012
GC Tubing, Fused Silica (not deactivated), 50 μm ID, 150 μm OD, L: 10 m	CT-100013
GC Tubing, Fused Silica (not deactivated), 100 μm ID, 200 μm OD, L: 10 m	CT-100014
GC Tubing, Fused Silica (not deactivated), 320 μm ID, 430 μm OD, L: 10 m	CT-100015
GC Tubing, Fused Silica (not deactivated), 250 μm ID, 363 μm OD, L: 10 m	CT-100016
GC Tubing, Fused Silica (not deactivated), 50 μm ID, 363 μm OD, Sold per meter.	CT-100017
GC Tubing, Fused Silica (not deactivated), 75 μm ID, 363 μm OD, Sold per meter.	CT-100018
GC-Tubing, SilFlow, Deactivated Fused Silica, 200 μm ID, 363 μm OD, L: 2 m	CT-100059
GC Tubing, Methyl Deactivated Fused Silica, 25 μm ID, 285 μm OD, L: 2 m	CT-100000
GC Tubing, Methyl Deactivated Fused Silica, 125 μm ID, 363 μm OD, L: 2 m	CT-100001
GC Tubing, Methyl Deactivated Fused Silica, 75 μm ID, 363 μm OD, L: 2 m	CT-100002
GC Tubing, Methyl Deactivated Fused Silica, 50 μm ID, 363 μm OD, L: 2 m	CT-100003
GC Tubing, Methyl Deactivated Fused Silica, 110 μm ID, 170 μm OD, L: 2 m	CT-100004

Fused Silica Tubing	
Description	Part No.
GC Tubing, Methyl Deactivated Fused Silica, 150 µm ID, 220 µm OD, L: 2 m	CT-100005
GC Tubing, Methyl Deactivated Fused Silica, 150 µm ID, 363 µm OD, L: 2 m	CT-100006
GC Tubing, Methyl Deactivated Fused Silica, 220 µm ID, 363 µm OD, L: 5 m	CT-100007
GC Tubing, Methyl Deactivated Fused Silica, 320 µm ID, 430 µm OD, L: 25 m	CT-100008
GC Tubing, Methyl Deactivated Fused Silica, 150 µm ID, 363 µm OD, L: 5 m	CT-100009
Fused Silica Tubing	
1/16" OD x 0.3 mm ID x 180 cm Length Glass Lined Tubing	CT-100019
1/4" OD x 4.0 mm ID x 30 cm Length Glass Lined Tubing	CT-100020
1/4" OD x 4.0 mm ID x 60 cm Length Glass Lined Tubing	CT-100021
1/2" OD x 9.50 mm ID x 60 cm Length Glass Lined Tubing	CT-100022
1/8" OD x 1,0 mm ID x 50 mm Length Glass Lined Tubing	CT-100023
Stainless Steel Tubing	
GC Tubing, Stainless Steel, 0.25 mm ID, 1/48" OD, L: 25 m	CT-100024
GC Tubing, Stainless Steel, 0.50 mm ID, 1/32" OD, L: 25 m	CT-100025
GC Tubing, Stainless Steel, 16SSB/UM	CT-100026
GC Tubing, Stainless Steel, 0.80 mm ID, 1/16" OD, L: 10 m	CT-100027
GC Tubing, Stainless Steel, 0.80 mm ID, 1/16" OD, L: 5 m	CT-100028
HPLC Tubing 5 Feet, PEEK, 1/16" OD, 0.004" ID, Black, 5 F - PC/Pack	CT-100034
HPLC Tubing 10 Feet, PEEK, 1/16" OD, 0.005" ID, Red, 10 F - PC/Pack	CT-100035
HPLC Tubing 5 Feet, PEEK, 1/16" OD, 0.005" ID, Red, 5 F - PC/Pack	CT-100036
HPLC Tubing 10 Feet, PEEK, 1/16" OD, 0.007" ID, Yellow, 10 F - PC/Pack	CT-100037
HPLC Tubing 5 Feet, PEEK, 1/16" OD, 0.007" ID, Yellow, 5 F - PC/Pack	CT-100038
HPLC Tubing 10 Feet, PEEK, 1/16" OD, 0.01" ID, Blue, 10 F - PC/Pack	CT-100039
HPLC Tubing 5 Feet, PEEK, 1/16" OD, 0.01" ID, Blue, 5 F - PC/Pack	CT-100040
HPLC Tubing 5 Feet, PEEK, 1/16" OD, 0.03" ID, Red, 5 F - PC/Pack	CT-100041
HPLC Tubing 10 Feet, PEEK, 1/16" OD, 0.03" ID, Green, 10 F - PC/Pack	CT-100042
HPLC Tubing 5 Feet, PEEK, 1/16" OD, 0.03" ID, Green, 5 F - PC/Pack	CT-100043
HPLC Tubing 100 Feet, PEEK, 1/8" OD, 0.062" ID, Natural, 100 F - PC/Pack	CT-100044
HPLC Tubing 10 Feet, PEEK, 1/8" OD, 0.062" ID, Natural, 10 F - PC/Pack	CT-100045
HPLC Tubing 10 Feet, PEEK, 1/8" OD, 0.08" ID, Natural, 10 F - PC/Pack	CT-100046
HPLC Tubing 5 Feet, PEEK, 1/8" OD, 0.08" ID, Natural, 5 F - PC/Pack	CT-100047
HPLC Tubing 10 Feet, PEEK, 360 µm OD, 0.002" ID, Natural, 10 F - PC/Pack	CT-100048

Tubing

PEEKsil Tubing

Description	Part No.
HPLC Tubing, PEEKsil, 0.025 mm ID, 1/16" OD, L: 50 mm, Pkg. 5	CT-100049
HPLC Tubing, PEEKsil, 0.15 mm ID, 1/16" OD, L: 100 mm, Pkg. 5	CT-100050
HPLC Tubing, PEEKsil, 0.15 mm ID, 1/16" OD, L: 150 mm, Pkg. 5	CT-100051
HPLC Tubing, PEEKsil, 0.15 mm ID, 1/16" OD, L: 200 mm, Pkg. 5	CT-100052
HPLC Tubing, PEEKsil, 0.10 mm ID, 1/16" OD, L: 50 mm, Pkg. 5	CT-100053
HPLC Tubing, PEEKsil, 0.025 mm ID, 0.36 mm OD, L: 50 mm, Pkg. 2	CT-100054
HPLC Tubing, PEEKsil, 0.025 mm ID, 0.36 mm OD, L: 100 mm, Pkg. 2	CT-100055
HPLC Tubing, PEEKsil, 0.05 mm ID, 0.36 mm OD, L: 50 mm, Pkg. 2	CT-100056
HPLC Tubing, PEEKsil, 0.05 mm ID, 0.36 mm OD, L: 150 mm, Pkg. 2	CT-100057
HPLC Tubing, PEEKsil, 0.2mm ID, 1/16" OD, L: 300 mm, Blue, Pkg. 2	CT-100058





316 L Stainless Steel Chromatography Tubing

Stainless Steel Pre-cut and Coiled Tubing for Chromatography Applications

AFP offers a complete range of off-the-shelf pre-cut tubing, or custom-cut lengths, and bulk tubing options in both 304 and 316 stainless steel for gas chromatography applications. Available in coated or uncoated, seamless or seamed configurations, our tubing is engineered for superior performance, corrosion resistance, and reliability in demanding environments. Manufactured to exacting standards, AFP tubing ensures smooth internal surfaces, precise ID tolerances, and exceptional cleanliness—supporting accurate, consistent, and contamination-free results. Backed by ISO 9001-certified quality control and full traceability, AFP delivers tubing solutions that optimize system integrity, longevity, and purity.

AFP provides a comprehensive range of long-length seamless coil tubing with outer diameters under 1" (25.4 mm). Available in corrosion-resistant stainless steels and high nickel alloys, this tubing is engineered to perform in demanding environments. With continuous lengths up to and exceeding 5,000 feet, the seamless design eliminates welds, reducing installation time, lowering the need for additional fittings, and minimizing the risk of leaks.

Our ultra-small diameter (USD™) capillary tubing is precisely manufactured for chromatography, flow measurement, and sensing applications. Designed to withstand pressures exceeding 36,000 psi (2500 bar), this tubing is produced to exacting specifications, resulting in smoother internal surfaces and consistently uniform ID tolerances. The result is greater accuracy, reliability, and extended service life in high-performance systems.

From raw material selection through every stage of production, AFP ensures strict quality control and tight tolerances. This end-to-end commitment delivers tubing that not only meets but exceeds industry standards, giving customers dependable solutions that enhance efficiency, safety, and overall system performance.



Stainless Steel Tubing

Stainless steel tubing is available in a number of different size combinations, suitable for your tubing needs.

Features and Benefits

- Smooth and clean bore
- 5, 10 and 25 meter lengths supplied in coils. Where tubing OD is smaller than 1/16", ends are bushed to 1/16" and GC ferrules are supplied.
- 5, 10 and 25 meter lengths supplied clean and passivated.

Recommended Applications

GC gas lines.



Stainless Steel Tubing	
Description	Part No.
GC Tubing, Stainless Steel, 0.25 mm ID, 1/48" OD, L: 25 m	CT-100024
GC Tubing, Stainless Steel, 0.50 mm ID, 1/32" OD, L: 25 m	CT-100025
GC Tubing, Stainless Steel, 16SSB/UM	CT-100026
GC Tubing, Stainless Steel, 0.80 mm ID, 1/16" OD, L: 10 m	CT-100027
GC Tubing, Stainless Steel, 0.80 mm ID, 1/16" OD, L: 5 m	CT-100028

Pre-cut Seamless Tubing

1/16" OD Tubing	.005" ID	.010" ID	.020" ID	.030" ID	.040" ID
Length	Part No.				
10 pieces per package					
5 cm	TU-SS-16-005-0017-10	TU-SS-16-010-0017-10	TU-SS-16-020-0017-10	TU-SS-16-030-0017-10	TU-SS-16-040-0017-10
10 cm	TU-SS-16-005-0037-10	TU-SS-16-010-0037-10	TU-SS-16-020-0037-10	TU-SS-16-030-0037-10	TU-SS-16-040-0037-10
20 cm	TU-SS-16-005-0077-10	TU-SS-16-010-0077-10	TU-SS-16-020-0077-10	TU-SS-16-030-0077-10	TU-SS-16-040-0077-10
30 cm	TU-SS-16-005-0116-10	TU-SS-16-010-0116-10	TU-SS-16-020-0116-10	TU-SS-16-030-0116-10	TU-SS-16-040-0116-10
50 cm	TU-SS-16-005-0195-10	TU-SS-16-010-0195-10	TU-SS-16-020-0195-10	TU-SS-16-030-0195-10	TU-SS-16-040-0195-10
100 cm	TU-SS-16-005-0393-10	TU-SS-16-010-0393-10	TU-SS-16-020-0393-10	TU-SS-16-030-0393-10	TU-SS-16-040-0393-10
50 pieces per package					
5 cm	TU-SS-16-005-0017-50	TU-SS-16-010-0017-50	TU-SS-16-020-0017-50	TU-SS-16-030-0017-50	TU-SS-16-040-0017-50
10 cm	TU-SS-16-005-0037-50	TU-SS-16-010-0037-50	TU-SS-16-020-0037-50	TU-SS-16-030-0037-50	TU-SS-16-040-0037-50
20 cm	TU-SS-16-005-0077-50	TU-SS-16-010-0077-50	TU-SS-16-020-0077-50	TU-SS-16-030-0077-50	TU-SS-16-040-0077-50
30 cm	TU-SS-16-005-0116-50	TU-SS-16-010-0116-50	TU-SS-16-020-0116-50	TU-SS-16-030-0116-50	TU-SS-16-040-0116-50
50 cm	TU-SS-16-005-0195-50	TU-SS-16-010-0195-50	TU-SS-16-020-0195-50	TU-SS-16-030-0195-50	TU-SS-16-040-0195-50
100 cm	TU-SS-16-005-0393-50	TU-SS-16-010-0393-50	TU-SS-16-020-0393-50	TU-SS-16-030-0393-50	TU-SS-16-040-0393-50
100 pieces per package					
5 cm	TU-SS-16-005-0017-100	TU-SS-16-010-0017-100	TU-SS-16-020-0017-100	TU-SS-16-030-0017-100	TU-SS-16-040-0017-100
10 cm	TU-SS-16-005-0037-100	TU-SS-16-010-0037-100	TU-SS-16-020-0037-100	TU-SS-16-030-0037-100	TU-SS-16-040-0037-100
20 cm	TU-SS-16-005-0077-100	TU-SS-16-010-0077-100	TU-SS-16-020-0077-100	TU-SS-16-030-0077-100	TU-SS-16-040-0077-100
30 cm	TU-SS-16-005-0116-100	TU-SS-16-010-0116-100	TU-SS-16-020-0116-100	TU-SS-16-030-0116-100	TU-SS-16-040-0116-100
50 cm	TU-SS-16-005-0195-100	TU-SS-16-010-0195-100	TU-SS-16-020-0195-100	TU-SS-16-030-0195-100	TU-SS-16-040-0195-100
100 cm	TU-SS-16-005-0393-100	TU-SS-16-010-0393-100	TU-SS-16-020-0393-100	TU-SS-16-030-0393-100	TU-SS-16-040-0393-100

Ultra ALLOY 316 Stainless Steel Capillary Deactivated Tubes

Description	ID	Length	Part No.
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.15 x 0.47, 5M	0.15 mm	5 m	CT-100110
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.25 x 0.47, 5M	0.25 mm	5 m	CT-100111
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.25 x 1.58 (1/16"), 5M	0.25 mm	5 m	CT-100112
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.32 x 0.75, 5M	0.32 mm	5 m	CT-100113
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.53 x 0.75, 5M	0.53 mm	5 m	CT-100114
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.53 x 1.58 (1/16"), 5M	0.53 mm	5 m	CT-100115
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.80 x 1.15, 5M	0.80 mm	5 m	CT-100116
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.80 x 1.58 (1/16"), 5M	0.80 mm	5 m	CT-100117
Ultra ALLOY 316 SS Capillary Deactivated Tube 1.20 x 1.58 (1/16"), 5M	1.20 mm	5 m	CT-100118
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.15 x 0.47, 10M	0.15 mm	10 m	CT-100119
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.25 x 0.47, 10M	0.25 mm	10 m	CT-100120
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.25 x 1.58 (1/16"), 10M	0.25 mm	10 m	CT-100121
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.32 x 0.75, 10M	0.32 mm	10 m	CT-100122
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.53 x 0.75, 10M	0.53 mm	10 m	CT-100123
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.53 x 1.58 (1/16"), 10M	0.53 mm	10 m	CT-100124
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.80 x 1.15, 10M	0.80 mm	10 m	CT-100125
Ultra ALLOY 316 SS Capillary Deactivated Tube 0.80 x 1.58 (1/16"), 10M	0.80 mm	10 m	CT-100126
Ultra ALLOY 316 SS Capillary Deactivated Tube 1.20 x 1.58 (1/16"), 10M	1.20 mm	10 m	CT-100127
Ultra ALLOY 316 SS EGA Capillary Tube 0.15 x 0.47, 2.5 M	0.15 mm	2.5 m	CT-100109

Ultra ALLOY 316 Stainless Steel Untreated Capillary Tubes

Description	ID	Length	Part No.
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.15 x 0.47, 5M	0.15 mm	5 m	CT-100128
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 0.47, 5M	0.25 mm	5 m	CT-100129
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 1.58 (1/16"), 5M	0.25 mm	5 m	CT-100130
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.32 x 0.75, 5M	0.32 mm	5 m	CT-100131
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.53 x 0.75, 5M	0.53 mm	5 m	CT-100132
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.53 x 1.58 (1/16"), 5M	0.53 mm	5 m	CT-100133
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.80 x 1.15, 5M	0.80 mm	5 m	CT-100134
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.80 x 1.58 (1/16"), 5M	0.80 mm	5 m	CT-100135
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 1.20 x 1.58 (1/16"), 5M	1.20 mm	5 m	CT-100136
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.05 x 0.315, 10M	0.05 mm	10 m	CT-100137
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.15 x 0.47, 10M	0.15 mm	10 m	CT-100138
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 0.47, 10M	0.25 mm	10 m	CT-100139
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 0.47, 30M	0.25 mm	30 m	CT-100140
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.25 x 1.58 (1/16"), 10M	0.25 mm	10 m	CT-100141
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.32 x 0.75, 10M	0.32 mm	10 m	CT-100142
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.53 x 0.75, 10M	0.53 mm	10 m	CT-100143
Ultra ALLOY 316 SS Untreated Metal Capillary Tube 0.53 x 1.58 (1/16"), 10M	0.53 mm	10 m	CT-100144

Valves



High Performance valves are offered in micro control or pneumatic format delivering gas control in the best format for your analytical science needs.

Features and Benefits

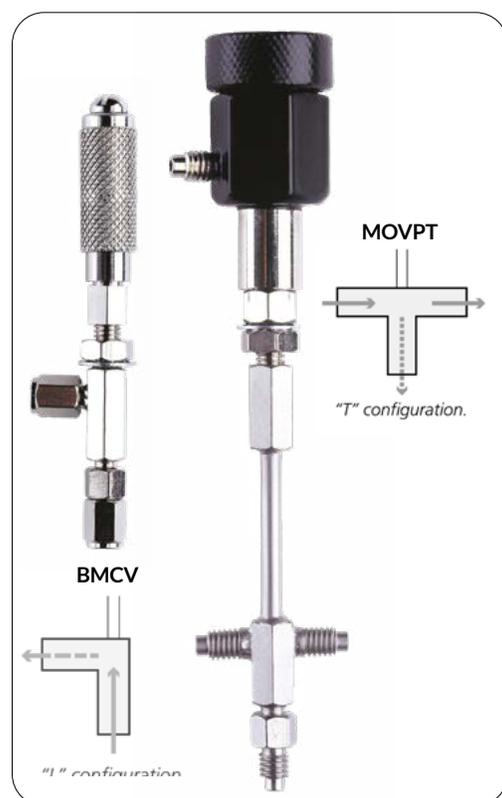
Designed specifically for chromatography applications. Can be used at elevated temperatures from high vacuum to medium pressure.

Vacuum rated to a leak rate of 1×10^{-5} cc/sec of Helium except for BMCV and SMOV, which are not vacuum tested.

- Minimal exposure to stainless steel.
- Fully swept flow path.
- Replaceable graphitized Vespe^l® seat.
- Range of stem lengths where appropriate.
- Easy installation.
- Maintenance instructions, spare seals and seats are provided with each unit.
- Minimal dead volume.

Recommended applications

Fine control of gas for all analytical science needs.



Product Specifications

Configuration/Material	Length/Connection	Temp Rating	Vacuum Rating	Pressure Rating	Flow Rating	Valve Code
Brass Micro Control Valve (BMCV) - Manual Operation						
L Single Outlet, Brass	1/16"	100 °C	No	700 psi	0-2000 mL/min	BMCV-1
Stainless Steel Manual On/Off Valve (SMOV) - Manual Operation						
L Single Outlet, Stainless Steel	1/16"	100 °C	No	700 psi	n/a	SMOV
On/Off valve (MOV) - Pneumatic Operation						
L Single Outlet, Stainless Steel	50 mm, 1/16"	300 °C	Yes	700 psi	n/a	MOV
T Dual Outlet, Stainless Steel	50 mm, 1/16"	300 °C	Yes	700 psi	n/a	MOVPT
Dual Outlet, Stainless Steel	100 mm, 1/16"	300 °C	Yes	700 psi	n/a	MOVPT (L)

Valves Stem

Description	Part No.
On/Off Valve with Pneumatic Operation (MOV), L Flow Path with Single Outlet, and 50 mm Long Stem	CA-100000
On/Off Valve with Pneumatic Operation (MOVPT), T Flow Path with Dual Outlet, and 50 mm Long Stem	CA-100001
On/Off Valve with Pneumatic Operation (MOVPT), T Flow Path with Dual Outlet, and 100 mm Long Stem	CA-100002



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