

# Maximize Performance!

Gas Chromatography  
Accessories and  
Gas Purification/  
Management Products





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# Choosing the Correct Products

Choosing the proper items for routine system maintenance and new column installation can save costly downtime and rework, plus help prevent inaccurate chromatographic results. For the gas chromatographer, choosing the correct items when upgrading and replacing parts and accessories for their system can bring on many challenges due to the vast array of commercially available products. We offer our own unique Supelco® products, as well as products from some of the most trusted names in the industry, to assist in making the selection process easier.

## Preventive Maintenance

Often overlooked is the importance of preventive maintenance of the gas chromatographic system. Many times, maintenance is only performed after a serious problem occurs, and serves solely to remedy the situation. A better choice is to take a proactive, instead of a reactive, approach to maintenance in an effort to prevent problems from manifesting. This can best be performed by strictly adhering to a schedule of routine preventive maintenance. Non-volatile material accumulates on injection port items, creating active spots, leading to poor chromatography and loss of sensitivity. Periodical replacement of injection port items will minimize this adsorption of analytes. Over time, purifiers become saturated and must be replaced to maintain the continuous supply of chromatographic quality carrier gas. To maximize the performance of the chromatographic system, Supelco® preventive maintenance items are of the highest quality and

includes septa, inlet liners, O-rings, inlet seals, ferrules and purifiers.

## Installation and Troubleshooting

In addition to being required for a scheduled preventive maintenance routine, quality products are also needed for installation and troubleshooting tasks. Some of the same items and tools are used whether performing an initial setup of a new instrument, the replacement of system components (such as a column), or troubleshooting activities. To aid in accomplishing these tasks, we offer the highest quality products; products such as column nuts, flow meters, tubing, fittings, valves, particle and oil filters, gas generators, leak detectors and pressure regulators. Additionally, numerous hand tools have been specifically designed to assist the chromatographer in the installation and maintenance associated with gas chromatography.

## Supelco® Products

Throughout this brochure you will find GC Accessories and Gas Purification/Management products that are designed to maximize instrument performance while helping to reduce the risk of chromatographic problems. Please note that this represents a brief listing of the GC Accessories and Gas Purification/Management products that we offer.

## Quick Look-Up Tables

These quick look-up tables can be used as a reference to find frequently replaced accessories for commonly used GC instruments. In-depth details (photos,

descriptions and specifications) can be found elsewhere in this brochure.

Description	Pkg.	Cat. No.
<b>Agilent® 5890, 6890, 7890 GCs</b>		
Molded Thermogreen® LB-2 Septa, 9.5 mm, with injection hole	50 ea.	<b>28331-U</b>
Molded Thermogreen® LB-2 Septa, 11 mm, with injection hole	50 ea.	<b>28336-U</b>
Inlet Liner, Cup Design, Wool Packed, 4 mm I.D.	5 ea.	<b>2048205</b>
Inlet Liner, Straight Through, Wool Packed, 4 mm I.D.	5 ea.	<b>2048605</b>
Inlet Liner, Single Taper. 4 mm I.D.	5 ea.	<b>2046605</b>
Inlet Liner, FocusLiner™, Single Taper, Wool Packed, 4 mm I.D.	5 ea.	<b>2879905-U</b>
Therm-O-Ring™, 1/4 in.	10 ea.	<b>21003-U</b>
Gold Plated Inlet Seal	10 ea.	<b>23319-U</b>
Supeltex® M-2A Short Capillary Ferrules, 0.25 mm Column	10 ea.	<b>24803-U</b>
Supeltex® M-4 Short Capillary Ferrules, 0.25 mm Column	10 ea.	<b>24811-U</b>
Supeltex® M-2A Long Capillary Ferrules, 0.25 mm Column	10 ea.	<b>24826-U</b>
Column Nut for Agilent	2 ea.	<b>24833-U</b>

Description	Pkg.	Cat. No.
Source Column Nut for Agilent MSD	5 ea.	<b>28034-U</b>
<b>PerkinElmer® AutoSystem™ and Clarus® GCs</b>		
Molded Thermogreen® LB-2 Septa, 11 mm, with injection hole	50 ea.	<b>28336-U</b>
Inlet Liner, FocusLiner, Single Taper, Wool Packed, 4 mm I.D.	5 ea.	<b>2879105-U</b>
Inlet Liner, Straight Through, 2 mm I. D.	5 ea.	<b>2631105</b>
Therm-O-Ring, 1/4 in.	10 ea.	<b>21003-U</b>
M-2A Long Capillary Ferrules, 0.25 mm Column	10 ea.	<b>24826-U</b>
Column Nut for PerkinElmer	5 ea.	<b>28034-U</b>
<b>Varian® GCs</b>		
Thermogreen® LB-2 Septa, 9.0 mm	50 ea.	<b>28021-U</b>
Molded Thermogreen® LB-2 Septa, 11 mm, with injection hole	50 ea.	<b>28336-U</b>
Inlet Liner, FocusLiner, Single Taper, Wool Packed, 3.4 mm I.D. for 1078/1079 injectors	5 ea.	<b>2875705-U</b>
Inlet Liner, SPME, 0.75 mm I.D., for CP-1177 Injector	5 ea.	<b>2637505</b>
M-2A Long Capillary Ferrules, 0.25 mm Column	10 ea.	<b>24826-U</b>
Column Nut for Varian	1 ea.	<b>28033-U</b>

# Septa

## Molded Thermogreen® LB-2 Septa

Molded Thermogreen® LB-2 septa are manufactured from high quality, low bleed material using the same exclusive LB-2 rubber formulation that chromatographers are accustomed to using. The difference is that molded septa, unlike traditional die-cut septa, offer easier installation and better sealing. This is because our liquid injection molding process yields septa that all conform to the same shape with crisp, clean sides.



The usable inlet temperature range of 100–350 °C is adequate for the majority of GC applications. Don't be fooled by other septa that advertise a maximum temperature of 400 °C (to make a septa with high thermal limits, one must also make it stiffer, resulting in septa that are harder to pierce and easier to core)! Our molded Thermogreen® LB-2 septa offer the perfect combination of temperature range, low bleed and easy puncturability.

The version with injection hole is for autosampler injections, manual injections and/or SPME applications. The solid disc version is for manual injections.

- Rubber formulation available exclusively as part of the Supelco® portfolio
- Strict tolerances (diameter, thickness and injection hole) due to the constant dimensions of the mold itself
- Ultra low bleed over a wide range of inlet temperatures (100–350 °C)
- No foreign substances or powders (which could contaminate the inlet) are used during manufacturing
- Fully tested for bleed and contamination
- Already conditioned, ready-to-use
- Ideal for use with low bleed GC-MS columns

Description	Pkg.	Cat. No.
9.5 mm, with injection hole	50 ea.	<b>28331-U</b>
	250 ea.	<b>28332-U</b>
9.5 mm, solid discs	50 ea.	<b>28670-U</b>
	250 ea.	<b>28671-U</b>
10 mm, with injection hole	50 ea.	<b>28333-U</b>
	250 ea.	<b>28334-U</b>
10 mm, solid discs	50 ea.	<b>28673-U</b>
	250 ea.	<b>28675-U</b>
11 mm, with injection hole	50 ea.	<b>28336-U</b>
	250 ea.	<b>28338-U</b>
11 mm, solid discs	50 ea.	<b>28676-U</b>
	250 ea.	<b>28678-U</b>
11.5 mm, with injection hole	50 ea.	<b>29446-U</b>
	250 ea.	<b>29448-U</b>
11.5 mm, solid discs	50 ea.	<b>29449-U</b>
	250 ea.	<b>29451-U</b>
17 mm, with injection hole	50 ea.	<b>29452-U</b>
	250 ea.	<b>29453-U</b>
17 mm, solid discs	50 ea.	<b>29456-U</b>
	250 ea.	<b>29457-U</b>

## Thermogreen® LB-2 Septa

We test every lot of Thermogreen® LB-2 septa, to ensure low bleed and high puncture tolerance. We also condition these septa—they are ready-to-use, right from the container. Popular dimensions are listed below. Other dimensions can be found in our catalog and on our website.



- Exclusive Supelco® formulation
- Extremely low bleed over a wide range of inlet temperatures (100–350 °C)
- Already conditioned, ready-to-use

Description	Pkg.	Cat. No.
9.0 mm	50 ea.	<b>28021-U</b>
9.5 mm	50 ea.	<b>20652</b>
	250 ea.	<b>20666</b>
10 mm	50 ea.	<b>20653-U</b>
	250 ea.	<b>23156</b>
11 mm	50 ea.	<b>20654</b>
	250 ea.	<b>23163</b>
	1000 ea.	<b>23164</b>
11.5 mm	50 ea.	<b>23154</b>
17 mm	50 ea.	<b>23159</b>
Plug (for Shimadzu®)	10 ea.	<b>20608</b>
	50 ea.	<b>20633</b>

## Merlin Microseal™ System Kits

The Merlin Microseal system incorporates a unique design with two sequential seals that provide long septum life. The patented design is a replacement for the standard septum and septum nut in a capillary inlet system. Popular kits are listed below. Kit components can be found in our catalog and on our website.



- Sustain many injections without leaks or septum fragments
- For use with 23 gauge blunt tipped needles
- Ideal for use with an SPME device with a 23 gauge needle
- These kits include all necessary items for initial installation

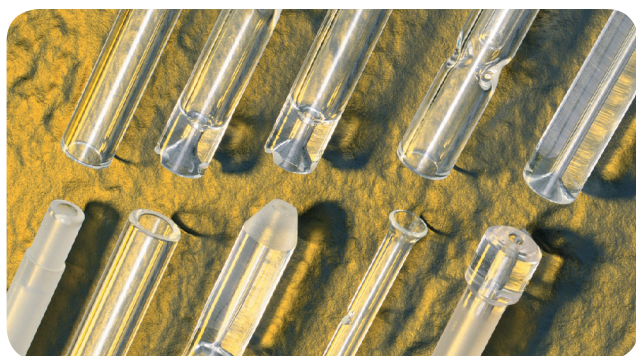
Description	Max Pressure	Cat. No.
For Agilent 5890/6890/7890 GCs	30 psi	<b>22584</b>
For Agilent 5890/6890/7890 GCs	100 psi	<b>24815-U</b>
For Varian 3400/3800 GCs with 1077/1078/1079 Injectors	100 psi	<b>24817-U</b>
For Varian 3800 GCs with CP-1177 Injector	100 psi	<b>22609-U</b>



# Liners and Seals

## Inlet Liners

A regular schedule of inlet liner replacement as part of a preventive maintenance routine will help prevent adsorption problems that can drastically affect chromatography if left unchecked. Inlet liners should be highly inert and manufactured to the strictest of tolerances. We are recognized as a leader in the manufacturing of high quality inlet liners. Popular inlet liner dimensions are listed below. Other inlet liners can be found in our catalog and on our website.



- Proprietary high temperature silanization (a Supelco® portfolio exclusive) ensures inertness
- Our in-house glass shop ensures consistent dimensions that meet, or exceed, GC manufacturers' strict tolerances
- Inlet liners that are packed use a high-quality glass wool, deactivated using our exclusive Supelco® proprietary silanization process

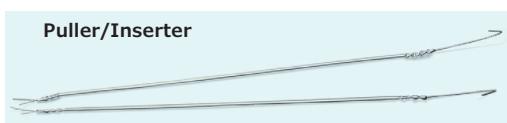
Description	Pkg	Cat. No.
<b>For Agilent 5890/6890/7890 (78.5 mm length x 6.3 mm O.D.)</b>		
Split with cup, 4 mm I.D., unpacked	5 ea	2051005
Split with cup, 4 mm I.D., wool packed	5 ea	2048205
Split straight through, 4 mm I.D., unpacked	5 ea	2879405-U
Split straight through, 4 mm I.D., wool packed	5 ea	2048605
Splitless with single taper, 4 mm I.D., unpacked	5 ea	2046605
Splitless with single taper, 4 mm I.D., wool packed	5 ea	2047805
Splitless with dual taper, 4 mm I.D., unpacked	5 ea	2048505
Splitless straight through, 2 mm I.D., unpacked	5 ea	2051305
Splitless straight through, 1.5 mm I.D., unpacked	5 ea	2051705
SPME, 0.75 mm I.D., unpacked	5 ea	2637505
<b>For Finnigan</b>		
Same catalog numbers as Agilent		
<b>For PerkinElmer AutoSystem and Clarus (92 mm length x 6.3 mm O.D.)</b>		
Split, 4 mm I.D., unpacked	5 ea	2630905
Split, 4 mm I.D., wool packed	5 ea	2631005
Splitless straight through, 2 mm I.D., unpacked	5 ea	2631105
SPME, 0.75 mm I.D., unpacked	5 ea	2631205
<b>For Shimadzu® 17A with SPL-17 Injector (95 mm length x 5 mm O.D.)</b>		
Split, 3.4 mm I.D., unpacked	5 ea	2633605
Split, 3.4 mm I.D., wool packed	5 ea	2632705

Description	Pkg	Cat. No.
Splitless with middle gooseneck, 3.4 mm I.D., unpacked	5 ea	2878305-U
Splitless with recessed gooseneck, 3.4 mm I.D., wool packed	5 ea	2877905-U
Splitless straight through, 2.6 mm I.D., unpacked	5 ea	2633705
SPME, 0.75 mm I.D., unpacked	5 ea	2633905
<b>For Thermo® ThermoQuest 8000/TRACE® (105 mm length x 8 mm O.D.)</b>		
Split, 5 mm I.D., unpacked	5 ea	2877105-U
Split, 3 mm I.D., unpacked	5 ea	2876705-U
Splitless with single taper, 5 mm I.D., unpacked	5 ea	2877305-U
Splitless with single taper, 3 mm I.D., unpacked	5 ea	2877405-U
SPME, 0.8 mm I.D., unpacked	5 ea	2876605-U
<b>For Varian 1075/1077 Injectors (72 mm length x 6.3 mm O.D.)</b>		
Split with baffle, 4 mm I.D., unpacked	5 ea	2050105
Split, 4 mm I.D., unpacked	5 ea	2636105
Split, 4 mm I.D., wool packed	5 ea	2636005
Splitless, 2 mm I.D., unpacked	5 ea	2050205
SPME, 0.75 mm I.D., unpacked	5 ea	2635805
<b>For Varian 1078/1079 Injectors (54 mm length x 5 mm O.D.)</b>		
Split, 3.4 mm I.D., unpacked	5 ea	2637105
Split, 3.4 mm I.D., wool packed	5 ea	2637305
Splitless, 2 mm I.D., unpacked	5 ea	2637405
Splitless, 2 mm I.D., wool packed	5 ea	2637705
SPME, 0.8 mm I.D., unpacked	5 ea	2637805
<b>For Varian CP-1177 Injectors</b>		
Same catalog numbers as Agilent		

## Glass Wool



Puller/Inserter

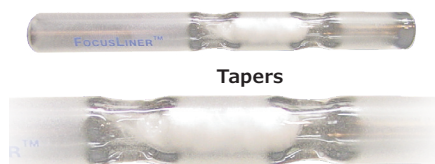


Glass wool is a fine pliable untreated glass fiber. Silanized glass wool and Pesticide Grade glass wool undergo a proprietary deactivation process to remove active sites that may interfere with an analysis.

- Maximum temperature 400 °C
- Silanized – use where minimal activity is required
- Pesticide Grade – use in the analysis of pesticides
- Phosphoric Acid Treated – use in the analysis of free acids, phenols and glycols
- Puller/Inserter – easily inserts or removes glass wool plugs

Description	Pkg	Cat. No.
Silanized	50 g	20411
Pesticide Grade	10 g	20409
Phosphoric Acid Treated	50 g	20383
Puller/Inserter Tool	2 g	22406

## FocusLiner™ Inlet Liners



The use of a wool plug in inlet liners has been used for many years to promote the rapid vaporization of the entire sample, minimize mass discrimination and prevent non-volatile material from entering the column. FocusLiner inlet liners incorporate a unique design that prevents shifting of the wool plug during repeated injections or sudden inlet pressure changes. Popular FocusLiner inlet liners are listed below. Other inlet liners can be found in our catalog and on our website.

- Tapers inside the liner stabilize the position of the wool plug, the wool plug is always correctly located
- Unique design prevents shifting of the wool plug during repeated injections or sudden inlet pressure changes
- Large surface area for maximum sample vaporization
- Wiping action removes residual liquid sample from the needle tip, thus preventing droplet formation
- Reduced solvent tailing
- Lower mass discrimination during split injections
- Typically reduces injection variability by at least 96%
- Provide maximum sensitivity and improved detection levels
- High temperature deactivated glass
- Guaranteed to fit

Description	Pkg	Cat. No.
<b>For Agilent 5890/6890/7890 (78.5 mm length x 6.3 mm O.D.)</b>		
Split/splitless, 4 mm I.D., wool packed	5 ea	<b>2879805-U</b>
Split/splitless, 2.3 mm I.D., wool packed	5 ea	<b>2879605-U</b>
Split/splitless with single taper, 4 mm I.D., wool packed	5 ea	<b>2879905-U</b>
Split/splitless with single taper, 2.3 mm I.D., wool packed	5 ea	<b>2879505-U</b>
<b>For Finnigan</b>		
Same catalog numbers as Agilent		
<b>For PerkinElmer AutoSystem and Clarus (92 mm length x 6.3 mm O.D.)</b>		
Split/splitless, 4 mm I.D., wool packed	5 ea	<b>2879205-U</b>
Split/splitless with single taper, 4 mm I.D., wool packed	5 ea	<b>2879105-U</b>
<b>For Shimadzu 17A with SPL-17 Injector (95 mm length x 5 mm O.D.)</b>		
Split/splitless, 3.4 mm I.D., wool packed	5 ea	<b>2878605-U</b>
Split/splitless with single taper, 3.4 mm I.D., wool packed	5 ea	<b>2878405-U</b>
<b>For Thermo ThermoQuest 8000/TRACE (105 mm length x 8 mm O.D.)</b>		
Split, 5 mm I.D., wool packed (for use with 50 mm needles)	5 ea	<b>2877005-U</b>
Splitless, 5 mm I.D., wool packed (for use with 70 mm needles)	5 ea	<b>2877205-U</b>

Description	Pkg	Cat. No.
Splitless with single taper, 5 mm I.D., wool packed	5 ea	<b>2877505-U</b>
<b>For Varian 1075/1077 Injectors (72 mm length x 6.3 mm O.D.)</b>		
Split, 4 mm I.D., wool packed	5 ea	<b>2875405-U</b>
Split with single taper, 4 mm I.D., wool packed	5 ea	<b>2874805-U</b>
Split, 2.3 mm I.D., wool packed	5 ea	<b>2874705-U</b>
<b>For Varian 1078/1079 Injectors (54 mm length x 5 mm O.D.)</b>		
Split/splitless with single taper, 3.4 mm I.D., wool packed	5 ea	<b>2875705-U</b>
Split/splitless with dual taper, 3.4 mm I.D., wool packed	5 ea	<b>2875505-U</b>
<b>For Varian CP-1177 Injectors</b>		
Same catalog numbers as Agilent		

## Therm-O-Ring™ Seals

Inlet liners used in an Agilent GC require an O-ring placed near the top for proper operation. This O-ring ensures that the only path for carrier gas to get to the outside of the inlet liner is through the grooves in the inlet seal at the bottom of the injection port.

- Available exclusively from our Supelco® portfolio
- Fit 6.3 mm, 6.5 mm, or 1/4" O.D. capillary liners that use an O-ring seal
- Can be used with inlet temperatures up to 375 °C without sticking or fragmenting
- Superior replacements for O-rings made from Viton™

Description	Pkg.	Cat. No.
Therm-O-Ring Seal	10 ea.	<b>21003-U</b>
Therm-O-Ring Seal	25 ea.	<b>21004-U</b>

## Inlet Seals

The inlet seals in an Agilent GC must be regularly changed to prevent sample adsorption due to accumulation of sample residue and/ or septum fragments. We offer replacement inlet seals of the highest quality.

- Stainless steel for analyses of non-reactive compounds
- Pure gold plating for applications requiring more inertness
- No brighteners used in the plating process
- Cross design intended for high split flows (>200 mL/min.)
- Packs of two or ten include one washer for each seal
- Packs of 100 include 50 washers

Description	Pkg.	Cat. No.
Non-plated	2 ea.	<b>23316-U</b>
	10 ea.	<b>23317-U</b>
	100 ea.	<b>23363-U</b>
Gold-plated	2 ea.	<b>23318-U</b>
	10 ea.	<b>23319-U</b>
Gold-plated, cross design	2 ea.	<b>23413-U</b>
	10 ea.	<b>23415-U</b>

# Ferrules and Nuts

## Ferrules

GC ferrules should provide a leak-tight seal, accommodate column O.D. variations, seal with minimum torque and not stick to the column or fittings. Additionally, they should be resilient enough to maintain their seal when column temperature and corresponding back pressure increases. Three popular ferrule compositions that meet these requirements are listed below. Ferrules of other compositions and/or with other internal diameters can be found in our catalog and on our website.

### Supeltex® M-2A Ferrules

- Max. Temp.: 400 °C
- Composition: Vespel™ SP-21 (85% polyimide/15% graphite)
- Characteristics: Seal at 1/4-turn past fingertight.
- Benefits: High reusability. Won't stick to metal or glass. Form leaktight seals without sticking to the column. Do not require back ferrules.

### Supeltex® M-4 Ferrules

- Max. Temp.: 450 °C
- Composition: Flexible graphite
- Characteristics: Seal at 1/4-turn past fingertight.
- Benefits: An improved design that offers a clean, sharp profile with minimal flash. Maximum sealing surface contact. Reduced risk of column contamination at installation.

### CapSeal Bullet® Ferrules

- Exclusively available from the Supelco® product portfolio
- Max. Temp.: 450 °C
- Composition: Graphite material captured in aluminum base
- Characteristics: Seal at 1/8-turn past fingertight
- Benefits: Reusable. A special end taper reduces graphite extrusion into fitting. Aluminum base keeps the ferrule from adhering to the fitting, making it easy to remove.

#### Ferrule Designs

##### Short design ferrules fit:

- The original nuts that ship with Agilent® GCs

##### Long design ferrules fit:

- MSD source nuts for Agilent GCs
- The original nuts that ship with PerkinElmer® GCs
- The original nuts that ship with Varian® GCs

##### General purpose ferrules fit:

- Supelco® Ferrule Nut Adapters for Agilent® GCs
- 1/16 inch compression nuts for PerkinElmer GCs

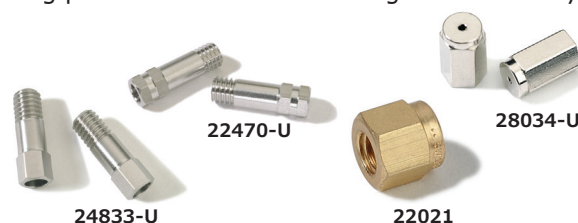


## 0.10–0.25 mm Column I.D., 0.4 mm Ferrule I.D.

Column I.D.	Pkg	Cat. No.
Supeltex® M-2A, Short Design	10 ea	24803-U
	50 ea	24807-U
Supeltex® M-4, Short Design	10 ea	24811-U
CapSeal Bullet, Short Design	10 ea	23864
	50 ea	23867
Supeltex® M-2A, Long Design	10 ea	24826-U
	50 ea	28022-U
Supeltex® M-4, Long Design	10 ea	28025-U
	50 ea	28028-U
CapSeal Bullet, Long Design	12 ea	23488
	48 ea	23493
Supeltex® M-2A, General Purpose	10 ea	503258
	50 ea	22474
Supeltex® M-4, General Purpose	10 ea	22498
	50 ea	22480-U
CapSeal Bullet, General Purpose	12 ea	23480-U
	48 ea	23485

## Column Nuts

Improper nut/ferrule combinations create dead volume (empty space between the ferrule and the injection port that is not swept by carrier gas). This may result in poor chromatography, as evidenced by fronting peaks and band broadening. Ensure that your



chromatography is the best by always using the proper nut/ ferrule combination. For assistance in determining the correct nut/ ferrule combination, contact Technical Service at 800-325-5832 or email techserv@sial.com.

Description	Ferrules Used	Pkg	Cat. No.
Agilent nut	Short design	2 ea	24833-U
Supelco ferrule nut adapter	General purpose	2 ea	22470-U
Agilent MSD source nut	Long design	5 ea	28034-U
PerkinElmer nut	Long design	5 ea	28034-U
1/16 inch compression nut	General purpose	10 ea	22021
Varian nut	Long design	1 ea	28033-U



# Guard Columns and Connectors

## Fused Silica Guard Columns



For use as guard columns to protect analytical columns from damaging sample components. Match the deactivation of the tubing with the polarity of the injection solvent.

Deactivation	Injection Solvents	Max. Temp.
Non-Polar	Alkanes Carbon disulfide Ethers	360 °C
Intermediate Polarity	Acetone Methylene chloride Toluene	360 °C
Polar	Acetonitrile Methanol Water	260 °C

Length (m)	I.D. (mm)	Cat. No.
<b>Non-Polar Deactivation</b>		
3	0.25	<b>25722</b>
5	0.25	<b>25742</b>
3	0.32	<b>25723</b>
5	0.32	<b>25743</b>
<b>Intermediate Polarity Deactivation</b>		
3	0.25	<b>25727</b>
5	0.25	<b>25747</b>
3	0.32	<b>25728</b>
5	0.32	<b>25748-U</b>
<b>Polar Deactivation</b>		
5	0.32	<b>25752-U</b>

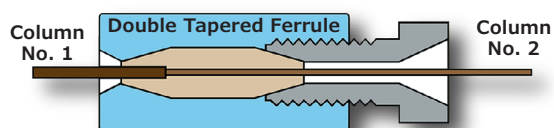
## Fused Silica Tubing Inner/Outer Diameters

Tubing I.D.	Tubing I.D. Range	Tubing O.D. Range
0.10 mm (1)	0.094 – 0.106 mm	0.348 – 0.370 mm
0.10 mm (2)	0.094 – 0.106 mm	0.285 – 0.315 mm
0.20 mm	0.194 – 0.206 mm	0.345 – 0.375 mm
0.25 mm	0.244 – 0.256 mm	0.345 – 0.375 mm
0.32 mm	0.312 – 0.328 mm	0.425 – 0.455 mm
0.53 mm	0.523 – 0.551 mm	0.650 – 0.690 mm
0.75 mm	0.742 – 0.758 mm	0.875 – 0.925 mm

(1) Columns with non-polar or intermediate polarity stationary phases.

(2) Columns with polar stationary phases.

## Capillary Column Butt Connector



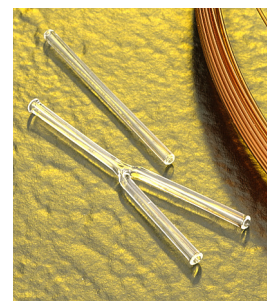
Butt Connection

This device consists of a double-tapered ferrule and a stainless steel compression housing with a threaded cap. Small and light (2.3 cm x 0.6 cm, 4.4 g with ferrule), it provides a gas tight seal with zero dead volume. This unit maintains inertness with no change in column efficiency.

Description	Cat. No.
Capillary Column Butt Connector, body only	<b>23804</b>
Supeltex® M-2B Ferrules, pack of 2, Max. Temp. 350 °C	
To connect 0.20/0.25 mm I.D. to 0.20/0.25 mm I.D.	<b>22453</b>
To connect 0.32 mm I.D. to 0.32 mm I.D.	<b>22454</b>
To connect 0.53 mm I.D. to 0.53 mm I.D.	<b>22591</b>
To connect 0.20/0.25 mm I.D. to 0.53 mm I.D.	<b>22455-U</b>
To connect 0.32 mm I.D. to 0.53 mm I.D.	<b>22586</b>

## GlasSeal™ Capillary Column Connectors

Use a GlasSeal™ connector to attach a guard column to an analytical column or to repair a column which has broken. Use a GlasSeal™ “Y” connector to split a sample to two columns for confirmatory analysis or to split the output of one column to two detectors. Silanized for an inert inside surface, these can be used with our 0.10–0.53 mm I.D. tubing. To make this an extremely durable connection, use a small drop of polyimide sealing resin (cure at 200 °C, maximum temperature 350 °C).



Description	Pkg	Cat. No.
Borosilicate Glass Connector	12 ea	<b>20479</b>
Fused Silica Connector	5 ea	<b>23627</b>
Fused Silica Connector	25 ea	<b>23628</b>
Borosilicate Glass “Y” Connector	1 ea	<b>20480</b>
Fused Silica “Y” Connector	1 ea	<b>23631</b>
Fused Silica “Y” Connector	3 ea	<b>23632</b>
Polyimide Sealing Resin	5 ea	<b>23817</b>

Gas chromatographers must routinely measure gas flows (when setting up an instrument, developing a method, or trouble-shooting). Even though many GCs have electronic pressure control (EPC) for setting flow rates, a flowmeter is still an essential tool to verify EPC readings when troubleshooting. Additionally, older GCs do not have EPC, requiring that flows be set manually. There are a variety of flow measuring devices available for this, falling into one of two categories, volumetric (bubble) flowmeters and mass flowmeters.



## Guard Chips/Jumper Chips for Agilent® Intuvo GC system

Guard chips eliminate the need for column trimming, saving time and improving sample throughput with the

Agilent® Intuvo GC System. With regular replacement, sample contamination never reaches the head of the Agilent® Intuvo GC column - eliminating the need for column trimming.

### Item List

Description	Cat.No.
Guard chip, Intuvo, split/splitless inlet, 2/pk	<b>28344INT</b>
Jumper Chip, Intuvo, split/splitless inlet	<b>28346INT</b>
Guard chip, Intuvo, multimode inlet, 2/pk	<b>28347INT</b>
Jumper Chip, Intuvo, multimode inlet	<b>28349INT</b>

Intuvo Jumper chips provide a short, direct flow path for ultra-clean applications where a guard may not be needed. However, most applications will utilize Guard Chips to ensure column longevity. For more information visit: [SigmaAldrich.com/intuvo](http://SigmaAldrich.com/intuvo)

## Flowmeters

### Optiflow Bubble Flowmeters

These volumetric (bubble) flowmeters are reliable, accurate and easy to use.

- Automates the 'positive displacement' technique, which works independently of the type, mass, or mixture of gas being measured
- Combines the simplicity and versatility of a bubble meter with the speed and accuracy of a microprocessor
- Optical sensors respond accurately to the passage of a bubble
- Features an easy to read, accurate digital display, eliminating the need for tedious bubble watching, timing and flow rate/time conversions
- Requires a 9 volt battery for operation



Description	Flow Range	Cat. No.
Model 520	0.5-500 mL/min.	<b>28679-U</b>

### Ellutia 7000 Digital Volumetric/Mass Flowmeter

This pocket-sized flowmeter has a large OLED display, which makes reading flows clear and easy. Unlike other flowmeters, the Ellutia 7000 can operate in either a volumetric or a mass mode. The built-in rechargeable battery means the user no longer has to worry about changing dead batteries.

- Mode: volumetric or mass measurements

- Split ratio mode: yes
- Gases: air, argon, argon/methane, carbon dioxide, helium, hydrogen, nitrogen, and oxygen
- Inlet pressure: 25 psi (175 kpa) maximum
- Inlet: 1/16" I.D. flexible tubing (included)
- Flow range: 0.1 to 500 mL/min (0.1 to 275 mL/min for carbon dioxide)
- Resolution: 0.1 mL/min
- Accuracy:  $\pm 2.5\%$  of reading or  $\pm 0.4$  mL/min (whichever is greater), able to dial in column I.D., temperature, and pressure values for added accuracy
- Display: OLED
- Calibration: 25-point, ISO 17025 traceability, recalibration service available
- Declaration of Conformity according to ISO/IEC Guide 22 and EN 45014
- Temperature: 15-35 °C
- Size: 68 x 130 x 30 mm
- Weight: 150 g
- Power: internal battery (automatic shutoff feature conserves battery), charge battery using a 110 VAC charger or a micro-USB cable
- CE mark: yes
- Data output: USB cable

Description	Pkg.	Cat. No.
Ellutia 7000 Digital Volumetric/Mass Flowmeter	1 ea.	<b>29597-U</b>

# Agilent ADM 2000 Digital Volumetric Flowmeter

This field-portable flowmeter measures flow volumetrically, so you don't have to make any adjustments when changing from one gas to another.

Mode: volumetric (the flowmeter can calculate mass flow values from the volumetric measurements by correcting for temperature and pressure)

- Split ratio mode: yes
- Gases: air, carbon dioxide, helium, hydrogen, methane, nitrogen, and oxygen
- Inlet: 1/8" I.D. flexible tubing (included)
- Flow range: 0.5 to 1000 mL/min (autoranging)
- Resolution: 0.01 mL/min (for flows 0.50-9.99 mL/min), 0.1 mL/min (for flows 10.0-99.9 mL/min), and 1.0 mL/min (for flows 100-1000 mL/min)
- Accuracy:  $\pm 3\%$  of reading or  $\pm 0.2$  mL/min (whichever is greater)
- Display: 16 character alphanumeric
- Calibration: 5-point, NIST traceability, recalibration service available
- Temperature: flowmeter (0 to 45 °C), tubing (-62 to 110 °C)
- Power: 9 V alkaline battery (automatic shutoff feature conserves battery) or 110 VAC power cord
- CE mark: yes
- Data output: RS-232 cable

Description	Pkg.	Cat. No.
Agilent ADM 2000 Digital Volumetric Flowmeter	1 ea.	29596-U

## Aalborg Digital Mass Flowmeters



These easy-to-use instruments can be used to measure gas flow rates for common GC gases. The 1/4" NPT fittings on both the inlet and outlet allows installation in-line to provide continuous measurements. These units can also be used as hand-held units by attaching a short length of flexible tubing to the inlet.

- Mode: mass measurements
- Gases: air, argon/methane, carbon dioxide, helium, hydrogen, and nitrogen
- Inlet pressure: 500 psi (34.5 bar) maximum; optimal operation at 20 psi (1.4 bar)
- Inlet/outlet: 1/4" NPT fittings
- Flow range: depends on model (7 models, from as low as 0 to 50 mL/min to as high as 0 to 10 L/min)
- Accuracy:  $\pm 1.5\%$  of reading
- Display: digital LCD, tiltable (more than 90°)
- Power: external battery, charge battery using 110 or 230 VAC charger

## Aalborg Digital Mass Flow Meter

Description	Cat. No.
Flow Range, 0-50 mL/min	503894
Flow Range, 0-100 mL/min	503908
Flow Range, 0-200 mL/min	503916
Flow Range, 0-500 mL/min	503924
Flow Range, 0-1 L/min	503932
Flow Range, 0-5 L/min	503940
Flow Range, 0-10 L/min	503959
Aalborg Mass Flowmeter Battery Kit AC input 110 V (AC)	503266
Aalborg Mass Flowmeter Battery Kit AC input 230 V (AC)	503274
Aalborg Mass Flowmeter Power Supply AC input 110 V (12 VDC)	503282
Aalborg Mass Flowmeter Power Supply AC input 230 V (12 VDC)	503290

# GC Autosampler Syringes

The syringe is the interface between the sample and the chromatograph. Rapid and precise injection requires a tight fit of the syringe in the autosampler. We carry two brands of top-quality autosampler syringes, Hamilton® and SGE.



- 23s gauge needles – for standard injections
- 26s gauge needles – for on-column and split/splitless injection
- 23s–26s dual gauge needles perform all applications without the need to change syringes
- Available with fixed needle or removable needle

## Agilent (7673, 7683 and 6850)

Manufacturer Model Number	Volume	Needle Length in./mm	Gauge	O.D. mm	Point Style	Manufacturer Part No.	Pkg. Size	Cat. No.
<b>Hamilton</b>								
<b>Modified Microliter Syringes - Removable Needle</b>								
7000.5ASRN	0.5 µL	1.71/43	23s	0.64	Cone	86276	1	26214
7000.5ASRN	0.5 µL	1.71/43	26s	0.47	Cone	86274	1	26215
7001ASRN	1 µL	1.71/43	23s	0.64	Cone	80176	1	26216
7001ASRN	1 µL	1.71/43	26s	0.47	Cone	80175	1	26217
<b>Microliter Syringes - Fixed Needle</b>								
75ASN	5 µL	1.71/43	23s	0.64	Cone	87987	1	21311
75ASN	5 µL	1.71/43	23s-26s	0.64-0.47	Cone	87993	1	24570-U
75ASN	5 µL 6/pk	1.71/43	23s	0.64	Cone	87990	6	21315
75ASN	5 µL 6/pk	1.71/43	26s	0.47	Cone	87989	6	21314
75ASN	5 µL 6/pk	1.71/43	23s-26s	0.64-0.47	Cone	87994	6	24571
75ASN	5 µL	1.71/43	23s	0.64	Bevel	87991	1	26714
75ASN	5 µL	1.71/43	26s	0.47	Bevel	87992	1	26721
701ASN	10 µL	1.71/43	23s	0.64	Cone	80387	1	21313
701ASN	10 µL	1.71/43	26s	0.47	Cone	80388	1	21312
701ASN	10 µL	1.71/43	23s-26s	0.64-0.47	Cone	80393	1	24573
701ASN	10 µL 6/pk	1.71/43	23s	0.64	Cone	80390	6	21317
701ASN	10 µL 6/pk	1.71/43	26s	0.47	Cone	80389	6	21316
701ASN	10 µL 6/pk	1.71/43	23s-26s	0.64-0.47	Cone	80391	6	24574
701ASN	10 µL	1.71/43	23s	0.64	Bevel	80398	1	26715
701ASN	10 µL	1.71/43	26s	0.47	Bevel	80399	1	26722
<b>Microliter Syringes - Removable Needle</b>								
75ASRN	5 µL	1.71/43	23s	0.64	Cone	87957	1	21321
701ASRN	10 µL	1.71/43	23s	0.64	Cone	80357	1	21323-U
701ASRN	10 µL	1.71/43	26s	0.47	Cone	80358	1	21322-U
701ASRN	10 µL	1.71/43	23s-26s	0.64-0.47	Cone	80359	1	24575
<b>Gastight Syringes - Fixed Needle</b>								
175	5 µL	1.71/43	23s	0.64	Cone	80074	1	26716
175	5 µL 6/pk	1.71/43	23s	0.64	Cone	80090	6	26700-U
175	5 µL 6/pk	1.71/43	23s-26s	0.64-0.47	Cone	80092	6	24577
1701	10 µL	1.71/43	23s	0.64	Cone	80080	1	26719
1701	10 µL	1.71/43	23s-26s	0.64-0.47	Cone	80079	1	24579
1701	10 µL 6/pk	1.71/43	23s	0.64	Cone	80094	6	26701
1701	10 µL 6/pk	1.71/43	23s-26s	0.64-0.47	Cone	80096	6	24580

Manufacturer Model Number	Volume	Needle Length in./mm	Gauge	O.D. mm	Point Style	Manufacturer Part No.	Pkg. Size	Cat. No.
<b>Gastight Syringes - Removable Needle</b>								
1701	10 µL	1.71/43	23s	0.64	Cone	80087	1	<b>21325-U</b>
1701	10 µL	1.71/43	26s	0.47	Cone	80088	1	<b>21324</b>
1701	10 µL	1.71/43	23s-26s	0.64-0.47	Cone	80089	1	<b>24581</b>
<b>SGE</b>								
<b>Fixed Needle</b>								
SK-5F-HP-0.47	5 µL	1.65/42	26	0.47	Cone	001804	6	<b>21910</b>
5F-HP-0.63	5 µL	1.65/42	23	0.63	Cone	001810	1	<b>21542</b>
SK-5F-HP-0.63	5 µL	1.65/42	23	0.63	Cone	001814	6	<b>21911</b>
10F-HP-0.47	10 µL	1.65/42	26	0.47	Cone	002800	1	<b>21541</b>
SK-10F-HP-0.47	10 µL	1.65/42	26	0.47	Cone	002804	6	<b>21912</b>
10F-HP-0.63	10 µL	1.65/42	23	0.63	Cone	002810	1	<b>21543</b>
SK-10F-HP-0.63	10 µL	1.65/42	23	0.63	Cone	002814	6	<b>21544</b>
<b>Fixed Needle - Dual Gauge</b>								
5F-HP-0.63/0.47	5 µL	1.65/42	23-26	0.63/0.47	Cone	001822	6	<b>26887-U</b>
10F-HP-0.63/0.47	10 µL	1.65/42	23-26	0.63/0.47	Cone	002821	1	<b>29616-U</b>
10F-HP-0.63/0.47	10 µL	1.65/42	23-26	0.63/0.47	Cone	002822	6	<b>26889-U</b>
<b>Removable Needle</b>								
0.5BR-HP-0.63	0.5 µL	1.65/42	23	0.63	Cone	000410	1	<b>24403</b>
5R-HP-0.47	5 µL	1.65/42	26	0.47	Cone	001805	1	<b>23963</b>
5R-HP-0.63	5 µL	1.65/42	23	0.63	Cone	001815	1	<b>23962</b>
10R-HP-0.47	10 µL	1.65/42	26	0.47	Cone	002805	1	<b>24417</b>
10R-HP-0.63	10 µL	1.65/42	23	0.63	Cone	002815	1	<b>24416</b>
25R-HP-0.63	25 µL	1.65/42	23	0.63	Cone	003865	1	<b>509701</b>
<b>Gas Tight - Fixed Needle, Dual Gauge</b>								
10F-HP-GT-0.63/0.47	10 µL	1.65/42	23-26	0.63/0.47	Cone	002826	1	<b>26890-U</b>
SK-10F-HP-GT-0.63/0.47	10 µL	1.65/42	23-26	0.63/0.47	Cone	002827	6	<b>26891-U</b>
25F-HP-GT-0.63/0.47	25 µL	1.65/42	23-26	0.63/0.47	Cone	003668	1	<b>26892-U</b>
50F-HP-GT-0.63/0.47	50 µL	1.65/42	23-26	0.63/0.47	Cone	004668	1	<b>26893-U</b>
100F-HP-GT-0.63/0.47	100 µL	1.65/42	23-26	0.63/0.47	Cone	005668	1	<b>26894-U</b>

## CTC (A200S)

Manufacturer Model Number	Volume	Needle Length in./mm	Gauge	O.D. mm	Point Style	Manufacturer Part No.	Pkg. Size	Cat. No.
<b>Hamilton</b>								
<b>Gastight Syringes – Fixed Needle</b>								
1701N	10 µL	2/51	22s	0.72	Blunt	203560	1	<b>29612-U</b>
1702N	25 µL	2/51	22s	0.72	Blunt	203563	1	<b>29613-U</b>
1710N	100 µL	2/51	22s	0.72	Blunt	203566	1	<b>29614-U</b>

## CTC (GC PAL Autosamplers)

Manufacturer Model Number	Volume	Needle Length in./mm	Gauge	O.D. mm	Point Style	Manufacturer Part No.	Pkg. Size	Cat. No.
<b>Microliter Syringes - Fixed Needle</b>								
7701.2N	1.2 µL	2/51	26P	---	Cone	203185	1	<b>28617-U</b>
75N	5 µL	2/51	26s	0.47	Cone	203189	1	<b>28613-U</b>
701N	10 µL	2/51	26s	0.47	Bevel	203072	1	<b>28614-U</b>



Manufacturer Model Number	Volume	Needle Length in./mm	Gauge	O.D. mm	Point Style	Manufacturer Part No.	Pkg. Size	Cat. No.
701N	10 µL	2/51	26s	0.47	Bevel	203269	6	29607-U
701N	10 µL	2/51	26s	0.47	Cone	203205	1	28615-U
701N	10 µL	2/51	23s	0.64	Bevel	203363	1	29606-U
701N	10 µL	2/51	23s	0.64	Cone	203361	1	29603-U
<b>Gastight Syringes - Fixed Needle</b>								
1702N	25 µL	2/51	26s	0.47	Cone	203043	1	28649-U
1702N Slim	25 µL	2/51	26s	0.47	Cone	203074	1	29608-U
1710N	100 µL	2/51	26s	0.47	Cone	203076	1	28651-U
1725N	250 µL	2/51	26s	0.47	Cone	203078	1	28652-U
1750N	500 µL	2/51	26s	0.47	Cone	203080	1	28653-U

## PerkinElmer (GC Autosystem and Clarus® 500)

Manufacturer Model Number	Volume	Needle Length in./mm	Gauge	O.D. mm	Point Style	Manufacturer Part No.	Pkg. Size	Cat. No.
<b>Hamilton</b>								
<b>Microliter Syringes - Fixed Needle</b>								
75ASN/PE	5 µL	2.75/70	26s	0.47	Blunt	88040	1	24522
75ASN/PE	5 µL	2.75/70	23s	0.64	Blunt	88035	1	24523
<b>SGE</b>								
<b>Fixed Needle</b>								
5F-PE-0.47	5 µL	2.75/70	26	0.47	Cone	001953	1	509736
5F-PE-0.63	5 µL	2.75/70	23	0.63	Cone	001954	1	509744
<b>Removable Needle (Plunger-in-needle)</b>								
0.5BR-PE-0.47	0.5 µL	2.75/70	26	0.47	Cone	000475	1	24406
0.5BR-PE-0.63	0.5 µL	2.75/70	23	0.63	Cone	000478	1	24407
<b>Gas Tight Syringes - Fixed Needle</b>								
5F-PE-GT-0.47	5 µL	2.75/70	26	0.47	Cone	001955	1	21930-U
5F-PE-GT-0.63	5 µL	2.75/70	23	0.63	Cone	001957	1	21929-U

## Shimadzu (AOC9 Autosampler)

Manufacturer Model Number	Volume	Needle Length in./mm	Gauge	O.D. mm	Point Style	Manufacturer Part No.	Pkg. Size	Cat. No.
<b>Hamilton</b>								
<b>Microliter Syringe - Removable Needle</b>								
701	10 µL	2/51	26s	0.47	Bevel	80330	1	20697
<b>SGE</b>								
<b>Fixed Needle - Flexible Plunger</b>								
10FX	10 µL	1.97/50	26	0.47	Bevel	002130	6	23966

## Shimadzu (AOC9 Autosampler and AOC 14, AOC 17, and AOC 20 GC Autosamplers)

Manufacturer Model Number	Volume	Needle Length in./mm	Gauge	O.D. mm	Point Style	Manufacturer Part No.	Pkg. Size	Cat. No.
<b>SGE</b>								
<b>Removable Needle - Flexible Plunger</b>								
10RX	10 µL	1.97/50	26	0.47	Bevel	002180	6	23967
<b>Removable Needle</b>								
0.5BR-S(9)-0.63	10 µL	1.97/50	26	0.47	Cone	002885	1	509760
<b>Fixed Needle</b>								
10F-S-0.47	5 µL	1.65/42	26	0.47	Cone	001987	1	29619-U
10F-S-0.63	5 µL	1.65/42	23	0.63	Cone	001988	1	29618-U
<b>Removable Needle</b>								
10R-S-0.47	10 µL	1.65/42	26	0.47	Cone	002897	1	24418
10R-S-0.63	10 µL	1.65/42	23	0.63	Cone	002898	1	24419
<b>Gas Tight - Removable Needle</b>								
10R-S-GT-0.63	10 µL	1.65/42	23	0.63	Cone	002902	1	29621-U

## Thermo Finnigan Autosamplers

Manufacturer Model Number	Volume	Needle Length in./mm	Gauge	O.D. mm	Point Style	Manufacturer Part No.	Pkg. Size	Cat. No.
<b>Hamilton</b>								
<b>Microliter Syringes - Fixed Needle</b>								
701	10 µL	2/51	26s	0.47	Bevel	80300	1	20734
701	10 µL	2/51	26s	0.47	Bevel	80366	6	20779
701	10 µL	2/51	26s	0.47	Cone tip, Side-port	80339	1	24532
<b>Microliter Syringes - Removable Needle</b>								
701	10 µL	2/51	26s	0.47	Bevel	80338	1	21357

## Varian Autosamplers

Manufacturer Model Number	Volume	Needle Length in./mm	Gauge	O.D. mm	Point Style	Manufacturer Part No.	Pkg. Size	Cat. No.
<b>SGE</b>								
<b>Varian 8035, 8100, and 8200 GC Autosamplers - Fixed Needle</b>								
10F-VA8X-11	10 µL	1.97/50	26	0.47	Bevel	002950	1	29617-U
<b>Varian 8035, 8100, and 8200 GC Autosamplers - Removable Needle</b>								
10R-VA8X-11	10 µL	2.09/53	25	0.5	Cone tip, Side-port	002924	1	24421
<b>SGE Replacement Needles and Plungers for Varian Syringes</b>								
for Varian 8035	---	.09/53	25	0.5	Bevel	037776	2	24444
for Varian 8100	---	2.09/53	25	0.5	Cone tip, Side-port	037777	1	24445
Replacement plunger for Varian 10 µL syringes	---	---	---	---	---	031218	1	21924

# Low Adsorption (LA) Vials

## Features and Benefits

- Maintains sample integrity during storage
- Minimizes pH shifts in the sample
- Reduces metal contamination in the sample
- Compatible with most autosamplers

Supelco® Certified Low Adsorption (LA) vials are manufactured using a process that decreases the number of hydroxyl groups on the vial's glass surface, significantly reducing surface activity while improving analytical quantization and minimizing pH shifts in the sample. This same process also removes unwanted surface metals such as sodium and boron that can

contaminate samples and interfere with trace analysis. Unlike other methods used to decrease vial surface activity, the elimination of surface activity in the LA vials is integral to the manufacturing process and is not a chemical surface treatment.

Supelco® Certified LA vials are manufactured from Type 1 borosilicate glass and are offered in four styles: Center Drain (CD™), MRQ30 CD™, QSertVial™ and a standard 12 x 32 mm autosampler vial. These new low adsorption CD, MRQ30 and QSertVial products now offer the benefit of maximum sample extraction without the worry of trace analytes being adsorbed by the vial surface.

## Low Adsorption (LA) Vials

Description	Pkg. Size	Cat. No.
2 mL, Clear, PTFE/Silicone Septum with Marking Spot	100	29651-U
2 mL, Clear, PTFE/Silicone Septum with Slit, with Marking Spot	100	29652-U
2 mL, Amber, PTFE/Silicone Septum with Marking Spot	100	29653-U
2 mL, Amber, PTFE/Silicone Septum with Slit, with Marking Spot	100	29654-U

## Low Adsorption (LA) CD

Description	Pkg. Size	Cat. No.
1.5 mL, Clear, PTFE/Silicone Septum	100	29655-U
1.5 mL, Clear, PTFE/Silicone Septum with Slit	100	29656-U

## Low Adsorption (LA) MRQ30 CD

Description	Pkg. Size	Cat. No.
1.2 mL, MRQ30, PTFE/Silicone Septum	100	29658-U
1.2 mL, MRQ30, PTFE/Silicone Septum with Slit	100	29659-U

## Low Adsorption (LA) QSertVial

Description	Pkg. Size	Cat. No.
0.3 mL, Clear Glass, Natural PTFE/Silicone Septum	100	29661-U
0.3 mL, Clear Glass, Natural PTFE/Silicone Septum with Slit	100	29662-U
0.3 mL, Amber Glass, Natural PTFE/Silicone Septum	100	29663-U
0.3 mL, Amber Glass, Natural PTFE/Silicone Septum with Slit	100	29664-U

## MSQ™ Caps with Septa, Mass Spec Quality

Description	Pkg. Size	Cat. No.
Blue 9 mm Cap, PTFE/Silicone Septum	100	29665-U
Blue 9 mm Cap, PTFE/Silicone Septum with Slit	100	29666-U

## MSQ™ Caps with Septa, Mass Spec Quality

Description	Pkg. Size	Cat. No.
Blue 9 mm Cap, PTFE/Silicone Septum	100	29665-U
Blue 9 mm Cap, PTFE/Silicone Septum with Slit	100	29666-U

## Certified QSertVial with Cap & Septa, Snap Top Vial, 12 x 32 mm

Description	Pkg. Size	Cat. No.
300 µL Clear Glass (with fused insert) PTFE/Silicone Septum	100	29428-U
300 µL Clear Glass (with fused insert), PTFE/Silicone Septum with Slit	100	29429-U

# GC Autosampler Vials

A critical component to a successful chromatography analysis is the autosampler vial. Autosampler vials in several configurations to assist in maintaining sample integrity are available from our Supelco® portfolio.

- Available with crimp seals or screw caps
- Available in clear or amber glass (amber glass protects sensitive samples from exposure to UV light)
- Silanized glass available in some configurations (silanization prevents adsorption on glass surfaces)



## Crimp Top Vials

Description	Pack Size	Cat. No.	Pack Size	Cat. No.
<b>12 x 32 mm, 6.0 mm Opening</b>				
<b>Vials</b>				
2.0 mL, Clear glass, 6.0 mm opening, crimp top	100	SU860055	1000	854964
2.0 mL, Amber glass, 6.0 mm opening, crimp top	100	SU860063	1000	854981
2.0 mL, Clear glass, 6.0 mm opening, crimp top, with marking spot	100	—	1000	854500
2.0 mL, Clear glass, 6.0 mm opening, crimp top, silanized	100	27060-U	1000	27061
2.0 mL, Amber glass, 6.0 mm opening, crimp top, silanized	100	27225-U	1000	27216
2.0 mL, Amber glass, 6.0 mm opening, crimp top, with marking spot	100	854998	—	—
1.5 mL, Maximum recovery vials, clear glass	100	29298-U	—	—
1.1 mL, Clear glass, conical bottom (requires support 27335)	100	27310	1000	27311
0.1 mL, Limited volume vials, clear glass	100	24714	—	—
<b>Inserts for 6.0mm vials</b>				
0.1 mL Glass insert with bottom spring, 6 x 28 mm	100	SU860066	1000	854110
0.1 mL Glass insert, conical, 6 x 31 mm	100	SU860067	1000	854988
0.25 mL Glass insert, conical, 6 x 31 mm	100	24717	1000	24718
0.35 mL Glass insert, shell style, 6 x 31 mm	100	24715	1000	24716
<b>11mm Crimp caps</b>				
Aluminum, clear, 5.5 mm opening, TEF/natural rubber, 1.0 mm thick	100	854140	1000	854980-U
Aluminum, green, 5.5 mm opening, TEF/natural rubber, 1.0 mm thick	—	—	1000	854142
Aluminum, red, 5.5 mm opening, TEF/natural rubber, 1.0 mm thick	—	—	1000	854144
Aluminum, blue, 5.5 mm opening, TEF/natural rubber, 1.0 mm thick	100	854187	—	—
Aluminum, gold, 5.5 mm opening, TEF/natural rubber, 1.0 mm thick	100	854188	—	—
Aluminum, clear, 5.5 mm opening, PTFE/white silicone, 1.3 mm thick	100	SU860094	1000	SU860016
Aluminum, clear, 5.5 mm opening, red PTFE/white silicone/red PTFE, 1.0 mm thick	100	SU860080	—	—
<b>Convenience kits</b>				
2.0 mL Clear vials, with PTFE/red rubber cap, unassembled	100	27239	1000	27240-U
2.0 mL Amber vials, with PTFE/red rubber cap, unassembled	100	27241	1000	27242-U

## Snap Top Vials

Description	Pack Size	Cat. No.	Pack Size	Cat. No.
<b>12 x 32 mm, 6.0 mm Opening</b>				
<b>Vials</b>				
2.0 mL Clear glass, 6.0 mm opening	100	SU860068	1000	854974
2.0 mL Amber glass, 6.0 mm opening	100	SU860089	1000	854993
2.0 mL Clear glass, 6.0 mm opening, with marking spot	100	SU860081	–	–
2.0 mL Amber glass, 6.0 mm opening, with marking spot	100	SU860082	–	–

## Snap Top Vials

Description	Pack Size	Cat. No.	Pack Size	Cat. No.
<b>12 x 32 mm, 6.0 mm Opening (contd.)</b>				
<b>Inserts for 6.0mm vials</b>				
0.1 mL Glass insert with bottom spring, 6 x 28 mm	100	SU860066	1000	854110
0.1 mL Glass insert, conical, 6 x 31 mm	100	SU860067	1000	854988
0.25 mL Glass insert, conical, 6 x 31 mm	100	24717	1000	24718
0.35 mL Glass insert, shell style, 6 x 31 mm	100	24715	1000	24716
<b>Snap ring caps</b>				
Polyethylene snap caps, 6 mm opening, TEF/natural rubber liner, 1.0 mm thick	100	SU860090	1000	854975
Polyethylene snap caps, 6 mm opening, PTFE/silicone liner, 1.3 mm thick	100	SU860093	–	–
Polypropylene snap caps with PTFE liner, 0.3 mm thick	100	24754	–	–
Polypropylene snap caps with PTFE/silicone with slit, 1.0 mm thick	100	27426	–	–
Polypropylene snap caps with PTFE/silicone with starburst, 1.0 mm thick	100	27427	–	–
Polypropylene snap caps with PTFE/silicone/PTFE with starburst, 1.0 mm thick	100	27428	–	–
Polypropylene snap caps with PTFE/silicone/PTFE, 1.0 mm thick	100	24760-U	–	–

## Screw Cap Vials

Description	Pack Size	Cat. No.	Pack Size	Cat. No.
<b>12 x 32 mm, 4.6 mm Opening, 8/425 Thread</b>				
<b>Vials</b>				
2.0 mL, Amber glass, 4.6 mm opening	100	SU860083	1000	854983
2.0 mL, Clear glass, 4.6 mm opening, with marking spot	100	854171	–	–
2.0 mL, Amber glass, 4.6 mm opening, with marking spot	100	854172	–	–
1.1 mL, Clear glass, tapered bottom, Chromacol (requires sleeve 27335)	100	27317	1000	27318
<b>Inserts for 4.6mm vials</b>				
0.1 mL Glass insert with bottom spring, 5 x 29 mm	100	24707	–	–
0.35 mL Glass insert, shell style, 5 x 31 mm	100	24701	1000	24702
<b>Caps with septa</b>				
Polypropylene cap, black, 5.5 mm centre hole, TEF/natural rubber, 1.3 mm thick	100	SU860091	1000	854984
Polypropylene cap, black, 5.5 mm centre hole, red PTFE/white silicone, 1.3 mm thick	100	SU860076	–	–
Polypropylene cap, black, 5.5 mm centre hole, red PTFE/cream silicone, 1.3 mm thick	–	–	1000	854985
<b>Caps without septa</b>				
Phenolic cap, black, open top	100	27094-U	–	–
Polypropylene cap, black, open top	100	27052	1000	24764
Phenolic cap, solid caps with PTFE liner	100	27091-U	–	–
Phenolic cap, solid cap with aluminum liner	100	27092-U	–	–
<b>Septa</b>				
Septa, red PTFE/silicone/red PTFE, 1.0 mm thick	100	27096-U	1000	23182-U
Septa, beige PTFE/silicone, 1.5 mm thick	100	27095-U	1000	33213
Septa, red PTFE/white silicone, 1.5 mm thick	100	27097-U	1000	23243
Septa, PTFE/silicone with slit, 1.0 mm thick	100	27098-U	1000	24881



Description	Pack Size	Cat. No.	Pack Size	Cat. No.
Septa, black viton, 0.75 mm thick	100	27350-U	–	–
Septa, PTFE/red rubber, 1.3 mm thick	100	27132	–	–
Liner, white PTFE, 0.25 mm thick (for use with solid top cap)	100	27133	–	–

## Screw Cap Vials

Description	Pack Size	Cat. No.	Pack Size	Cat. No.
<b>12 x 32 mm, 6.0 mm Opening, 9 mm Thread</b>				
<b>Vials</b>				
2.0 mL, Clear glass, 6.0 mm opening, with marking spot	100	854165	–	–
2.0 mL, Amber glass, 6.0 mm opening, with marking spot	100	SU860033	–	–
<b>Inserts for 6.0mm vials</b>				
0.1 mL, Glass insert with bottom spring, 6 x 28 mm	100	SU860066	1000	854110
0.1 mL, Glass insert, conical, 6 x 31 mm	100	SU860067	1000	854988
0.25 mL, Glass insert, conical, 6 x 31 mm	100	24717	1000	24718
0.35 mL, Glass insert, shell style, 6 x 31 mm	100	24715	1000	24716
<b>Caps</b>				
Blue polypropylene cap, 6.0 mm centre hole with TEF/natural rubber septa, 1.0 mm thick	100	854161	1000	–
Blue polypropylene cap, 6.0 mm centre hole with red PTFE/white silicone septa, 1.0 mm thick	100	SU860092	1000	SU860019
Blue polypropylene cap, 6.0 mm centre hole with red PTFE/white silicone/red PTFE septa, 1.0 mm thick	100	SU860079	1000	SU860020
<b>12 x 32 mm, 6.0 mm Opening, 10/425 Thread</b>				
<b>Vials</b>				
2.0 mL, Clear glass, 6.0 mm opening	100	27265	2000	27266
2.0 mL, Clear glass, 6.0 mm opening, with 0.25 mL glass insert	100	27418	–	–
2.0 mL, Amber glass, 6.0 mm opening	100	27267-U	1000	–
2.0 mL, Amber glass with step, 6.0 mm opening	100	27406	–	–
2.0 mL, Amber glass, 6.0 mm opening, with 0.25 mL glass insert	100	27419	–	–
1.0 mL, Polypropylene, 6.0 mm opening	100	27269	1000	27270-U
0.75 mL, Polypropylene, 6.0 mm opening	100	27411	–	–
0.5 mL, Polypropylene, 6.0 mm opening	100	27410	–	–
<b>Inserts for 6.0mm vials</b>				
0.1 mL, Glass insert with bottom spring, 6 x 29 mm	100	24721	–	–
0.25 mL, Glass insert, conical, 6 x 31 mm	100	24717	1000	24718
0.35 mL, Glass insert, shell style, 6 x 31 mm	100	24715	1000	24716
<b>Caps for 6.0 mm opening vials</b>				
Polypropylene, black, open top	100	27271	1000	27272-U
Polypropylene, yellow, open top	100	27413	–	–
Polypropylene, white, open top	100	27414	–	–
Polypropylene, black, open top with PTFE/silicone septa, 1.5 mm thick	100	27273	–	–
<b>Septa for 6.0 mm opening vials</b>				
Septa, PTFE/silicone/PTFE, 1.0 mm thick	100	27275	1000	27276
Septa, red PTFE/silicone, 1.5 mm thick	100	27277	1000	27278
Septa, PTFE/silicone with slit, 1.0 mm thick	100	27279	1000	27280-U

# PID Lamps

## Preassembled Sampling Vials

Description	Pkg. Size	Cat. No.
<b>Screw Top with Solid Green Melamine Caps, PTFE Liner</b>		
2 mL, clear glass, standard opening 4.6 mm	100	<b>27134</b>
4 mL, clear glass, 15 mm O.D. × 45 mm H	100	<b>27138</b>
7 mL, clear glass, 17 mm O.D. × 60 mm H	100	<b>27150-U</b>
15 mL, clear glass, 21 mm O.D. × 70 mm H	100	<b>27161</b>
22 mL, clear glass, 23 mm O.D. × 85 mm H	100	<b>27172-U</b>
40 mL, clear glass, 29 mm O.D. × 82 mm H	100	<b>27181</b>
2 mL, amber glass, standard opening, 4.6 mm	100	<b>27000</b>
4 mL, amber glass, 15 mm O.D. × 45 mm H	100	<b>27001-U</b>
7 mL, amber glass, 17 mm O.D. × 60 mm H	100	<b>27002-U</b>
15 mL, amber glass, 21 mm O.D. × 70 mm H	100	<b>27003</b>
22 mL, amber glass, 23 mm O.D. × 85 mm H	100	<b>27004</b>
40 mL, amber glass, 29 mm O.D. × 82 mm H	100	<b>27182</b>

The photoionization detector (PID) lamp is a valuable tool for chromatographers and others investigating the presence of volatile organic compounds (VOCs). In fact, the PID continues to be the preferred choice for detecting VOCs due to its fast response time and sensitivity.

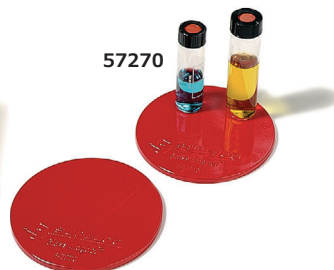


- Can detect volatiles as low as 1 ppb
- Emits very stable, precise photon energy
- More selective alternative than the flame ionization detector (FID)

Description	Chamber Gas	Cat. No.
Model 108, 10.0/10.6 eV	Krypton	<b>22626</b>
Model 108-BTEX, 10.0/10.6 eV	Krypton	<b>23129-U</b>
Model 103C, 10.0/10.6 eV	Krypton	<b>22631</b>
PID Window Cleaning Kit	—	<b>22627</b>

## Vial Accessories

- Hand Crimper – secures vial closure with a consistent and dependable seal
- Decapper – for quick and easy removal of an aluminum seal
- Vial Rack – convenient storage of screw and crimp cap vials
- Glass Magnet – keeps individual vials in place to prevent them from being accidentally knocked over



Description	Pkg.	Cat. No.
Hand Crimper, for use with 11 mm crimp seals	1 ea.	<b>33195</b>
Pliers-Type Decapper, for use with 11 mm crimp seals	1 ea.	<b>33281</b>
Vial Rack, for 12 × 32 mm vials (holds 50 vials)	5 ea.	<b>23207</b>
Glass Magnet, 4 inch diameter	2 ea.	<b>57270</b>

## Wire Brush Detector Cleaning Kit

A collection of wire brushes specially tailored to clean FIDs and injection ports that accept 1/4 inch columns. The brass brushes prevent scratching and marring of expensive FID components.



### Kit includes:

- Two detector brushes
- One injector port tube brush
- Brass toothbrush (for cleaning jets)
- A piece of emery (for electrical contacts)

Description	Pkg.	Cat. No.
For use with HP 5700, 5830	1 ea.	<b>22403</b>
For use with Varian® 3700, 1400 and 2700	1 ea.	<b>22404</b>

# Purifiers

Gas purification begins by determining the contaminants that need to be removed from the particular gas stream, levels to which the contaminants must be reduced, flow and pressure needs of the system and the desired frequency of purifier change-out. Multiple purifiers may be necessary to remove the desired levels of contaminants to adequately protect the column and detector. Purifiers for most applications are listed below. Other purifiers are available, and can be found in our catalog and on our website.

## OMI® (Oxygen Moisture Indicating) Polishing Purifier



- Polishing purifier that removes many contaminants that other upstream purifiers miss
- Simultaneously removes moisture, oxygen, carbon monoxide, carbon dioxide, most sulfur compounds, most halogen compounds, alcohols and phenols to less than 10 ppb
- Detects moisture and oxygen in hydrogen, helium, nitrogen, argon and argon/methane
- As little as 1 ppm of moisture or oxygen will change the indicating resin from black to brown
- The indicating resin is licensed exclusively to Supelco® for use in chromatographic applications
- Inert glass body prevents diffusion of ambient room contaminants into the carrier gas stream
- See-through polycarbonate holder provides safety

## Supelcarb® HC Hydrocarbon Trap



- Removes organics from carrier gases, air and hydrogen
- Twice the trapping ability of activated charcoal

## Supelpure® HC Hydrocarbon Trap



- Activated charcoal purifier that adsorbs hydrocarbons and other contaminants from carrier gas, compressed air and hydrogen
- When the total hydrocarbons in the incoming gas average 100 ppm, operates efficiently for approximately six months

## High Capacity Gas Purifier

- Removes moisture, oxygen, carbon monoxide and carbon dioxide
- No other purifier removes both moisture and oxygen in such large quantities
- Removes up to 35 liters of moisture or 14 liters of oxygen



- Clamshell heating unit has been specifically designed to ensure maximum gas purity
- Purifier tube is heated inside an oven where moisture and oxygen react with the reactant material in the tube
- Irreversible chemical reaction prevents contaminants from returning to the gas stream even when the purifier tube reaches saturation
- 230V now CE approved

## Molecular Sieve 5Å Water Vapor Trap



- Can reduce moisture in the gas stream to final concentrations less than 0.1 ppm
- Also preferred for use on in-house gas lines where moisture content could be high
- Offers greater working capacity than similar molecular sieves

## Supelpure®-O Oxygen Trap



- Reduces oxygen to less than 0.5 ppm when the level in the incoming gas does not exceed 10 ppm
- Oxygen-removing catalyst coated on a molecular sieve, will also trap significant amounts of moisture
- 120 cc purifier removes up to 1.5 g of moisture
- 750 cc purifier removes up to 10.2 g of moisture

## Supelco® Helium Purifier



- Incorporates a highly effective, high capacity adsorbent material to remove hydrocarbons, moisture, oxygen, carbon monoxide and carbon dioxide from helium streams
- Ideal for any GC or GC-MS application where high purity helium is essential
- Output gas is 99.99999% pure
- Output purity: <100 ppb total of all contaminants, <30 ppb hydrocarbons (as methane), <20 ppb moisture, <2 ppb oxygen, <20 ppb carbon monoxide, <20 ppb carbon dioxide

## Carbon Dioxin Trap



- Selectively removes carbon dioxide from gas streams
- Contains sodium hydroxide nonfibrous silicate media
- Media changes color from greenish-brown to white as carbon dioxide is absorbed
- Media can absorb 20–30% of its weight in carbon dioxide before reaching saturation
- Media evolves water as carbon dioxide is absorbed (recommend to install a water vapor trap downstream)

## Economy Water Vapor Trap



- Economical choice for moisture removal for compressed air service to pneumatically-controlled devices
- Contains a mixture of Molecular Sieves 4Å and 13X
- Purifier body is clear polycarbonate
- Not for use with carrier gases due to permeability of purifier body

## Recommended Purifier Options per Application

**Carrier gas:** need to remove hydrocarbons, moisture and oxygen

**Option 1:** Supelpure® HC, High Capacity Gas Purifier, OMI-2

**2:** Supelpure® HC, Molecular Sieve 5A, Supelpure-O, OMI-2

**3:** Supelco® Helium Purifier, OMI-2

**4:** Super Clean™ hydrocarbon, Super Clean moisture, Super Clean oxygen, OMI-2

**5:** Super Clean dual, Super Clean oxygen, OMI-2

**6:** Super Clean triple, OMI-2

**Compressed air (for FIDs):** need to remove hydrocarbons and moisture

**Option 1:** Supelpure® HC, Molecular Sieve 5A

**2:** Super Clean hydrocarbon, Super Clean moisture

**3:** Super Clean dual

**Hydrogen fuel gas (for FIDs):** need to remove hydrocarbons

**Option 1:** Supelpure® HC

**2:** Super Clean hydrocarbon

**Compress air (for pneumatic control):** need to remove moisture

**Option 1:** Economy water vapor trap

## Purifiers

Description	Design	Indicating?	Fittings	Cat. No.
<b>Polishing Purifiers (remove many contaminants that upstream purifiers miss)</b>				
OMI-2 purifier tube	In-line (1)	Yes (2)	n/a	23906
OMI-4 purifier tube	In-line (1)	Yes (2)	n/a	23909
<b>Hydrocarbon-only Removing Purifiers</b>				
Supelpure® HC hydrocarbon trap, 120 cc	In-line	No	1/8 inch	22445-U
Supelpure® HC hydrocarbon trap, 120 cc	In-line	No	1/4 inch	22446
Supelpure® HC hydrocarbon trap, 750 cc	In-line	No	1/4 inch	24518
Supelpure® HC hydrocarbon trap, 750 cc	In-line	No	1/2 inch	24519
Super Clean hydrocarbon trap	Base-plate (3)	No	n/a	SU861023
<b>High Capacity Moisture and Oxygen Removing Purifiers</b>				
High Capacity Gas Purifier, 110 V	In-line	No	1/8 inch	23800-U
High Capacity Gas Purifier, 230 V	In-line	No	1/8 inch	23801
High Capacity replacement purifier tube	In-line	No	1/8 inch	22396
High Capacity Gas Purifier, 110 V	In-line	No	1/4 inch	23802
High Capacity Gas Purifier, 230 V	In-line	No	1/4 inch	23803
High Capacity replacement purifier tube	In-line	No	1/4 inch	22398
<b>Moisture-only Removing Purifiers</b>				
Molecular Sieve 5A water vapor trap, 200 cc	In-line	No	1/8 inch	20619
Molecular Sieve 5A water vapor trap, 200 cc	In-line	No	1/4 inch	20618
Molecular Sieve 5A water vapor trap, 750 cc	In-line	No	1/4 inch	23991
Molecular Sieve 5A water vapor trap, 750 cc	In-line	No	1/2 inch	23992
Super Clean moisture trap	Base-plate (3)	Yes	n/a	SU861021
Economy water vapor trap, 400 cc	In-line	Yes	1/8 inch	23987
Economy water vapor trap, 400 cc	In-line	Yes	1/4 inch	23988
<b>Oxygen-only Removing Purifiers</b>				
Supelpure-O oxygen trap, 120 cc	In-line	No	1/8 inch	22449
Supelpure-O oxygen trap, 120 cc	In-line	No	1/4 inch	22450-U
Supelpure-O oxygen trap, 750 cc	In-line	No	1/4 inch	503088
Supelpure-O oxygen trap, 750 cc	In-line	No	1/2 inch	503096
Super Clean oxygen trap	Base-plate	Yes	n/a	SU861022
<b>Triple Purifiers (remove hydrocarbons, moisture, and oxygen)</b>				
Supelco® Helium purifier	In-line	No	1/8 inch	27600-U
Supelco® Helium purifier	In-line	No	1/4 inch	27601-U
Super Clean triple purifier	Base-plate (3)	Yes (4)	n/a	SU861026
Super Clean triple purifier, helium specific	Base-plate (3)	Yes (4)	n/a	SU861027
<b>Dual Purifiers (remove hydrocarbons and moisture)</b>				
Super Clean dual purifier	Base-plate (3)	Yes (4)	n/a	SU861025
<b>Carbon Dioxide-only Removing Purifiers</b>				
Carbon dioxide trap, 100 cc	In-line	Yes	1/8 inch	503185
Carbon dioxide trap, 100 cc	In-line	Yes	1/4 inch	503193
Carbon dioxide trap, 250 cc	In-line	Yes	1/8 inch	503207
Carbon dioxide trap, 250 cc	In-line	Yes	1/4 inch	503215

1. Must be installed into a reusable holder prior to use.
2. Indicating for moisture and oxygen.
3. Must be installed into a reusable base-plate prior to use.
4. Not indicating for hydrocarbons.



## Purifier Accessories

Description	Cat. No.
<b>Mounting Clips</b>	
For 100 cc traps, 1 ea.	502936
For 120 cc traps, 1 ea.	23993
For 200 cc traps, 1 ea.	503231
For 400 cc traps, 1 ea.	23990
For 750 cc traps, 1 ea.	24983

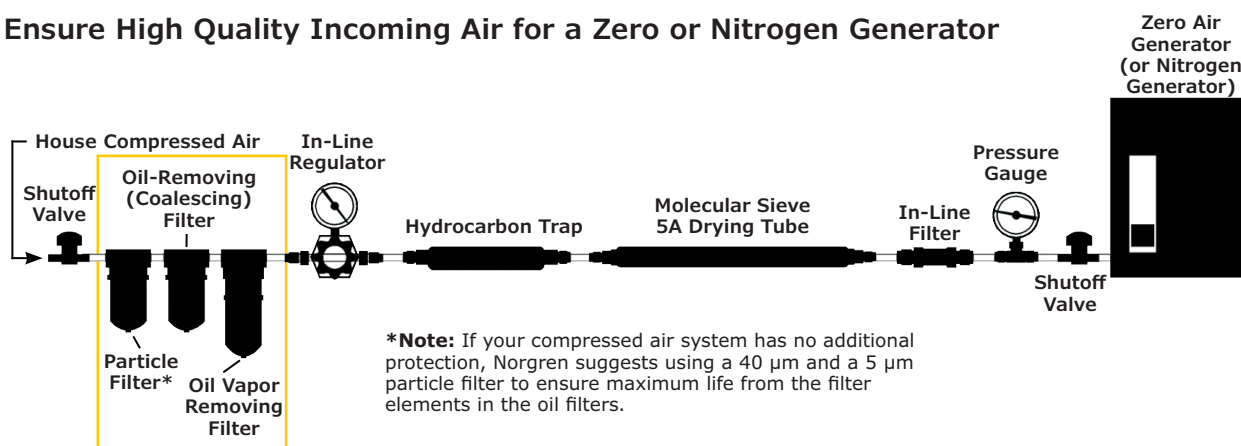
Description	Cat. No.
<b>OMI Holders</b>	
OMI-2 holder, 1/8 inch stainless steel fittings	22823-U
OMI-4 holder, 1/8 inch stainless steel fittings	23926
<b>Purifier Refills</b>	
Supelpure® HC Hydrocarbon Trap Refill volume 474 cc	22823-U
Molecular Sieve 5Å water vapor trap refill, non-indicating, 220 g	20298
Carbon dioxide trap refill, indicating, 500 cc	503223
Economy water vapor trap refill, indicating, 475 cc	23989

## Norgren® Particle and Oil Filters

Airborne dust can be drawn into the intake of an air compressor. These dust particles as well as any oils released from an air compressor can damage any downstream gas generator. Norgren filters are designed to remove solid and liquid particles in addition to oil aerosols. The oil-removing and oil vapor-removing filters must be protected with a particle filter upstream.

- Install between air compressors and gas generators
- Designed to be used together as a three- or four-filter system
- Elements are easily replaced

### Ensure High Quality Incoming Air for a Zero or Nitrogen Generator



## Norgren® Filter

Description	Cat. No.
Norgren® Filter particle filter, pore size 40 µm, 1/4 in. female NPT	24990-U
Norgren® Filter particle filter, pore size 5 µm, 1/4 in. female NPT	24992
Norgren® Filter Oil-Removing Filter, 1/4 in. female NPT	24994
Norgren® Filter Oil Vapor-Removing Filter, 3/8 in. female NPT	24996

## Norgren® Replacement Element

Description	Cat. No.
Norgren® Replacement Element for use with Particle Filter 24990-U	24991
Norgren® Replacement Element for use with Oil-Removing Filter 24994	24995
Norgren® Replacement Element for use with Oil Vapor-Removing Filter 24996	24997

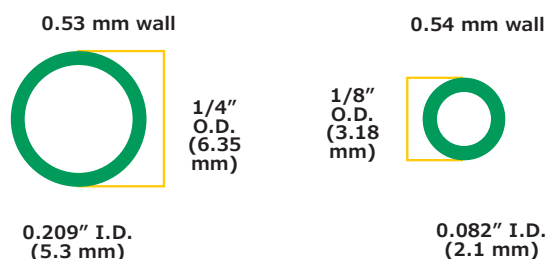
# Tubing, Cutters and Fittings

Many types of tubing are available to supply a variety of gases for gas chromatography systems. We recommend using stainless steel for the most sensitive applications, such as high resolution MS detection (MS-MS, ion trap, or TOF). More economical copper tubing is recommended for all other GC and GC-MS plumbing needs. All of our tubing is specially cleaned to remove any residue. Other tubing choices are available and can be found in our catalog and on [SigmaAldrich.com](http://SigmaAldrich.com).



## Premium Grade 304 Stainless Steel Tubing

### Stainless Steel Tubing Dimensions



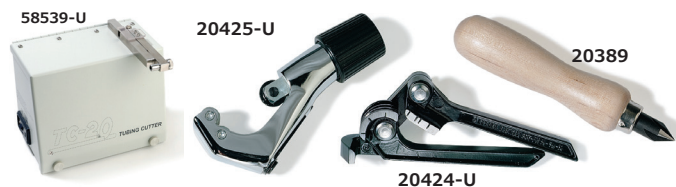
- Virtually impermeable to the diffusion of room air through the tubing walls
- Undergoes a proprietary cleaning procedure to remove all active sites and to ensure inertness
- Best choice for the most sensitive applications, such as high resolution MS detection (MS-MS, ion trap, or TOF)

## Cleaned Copper Tubing

- Most commonly used tubing for gas chromatography
- Cleaned according to ASTM B-280 plus a proprietary Supelco® cleaning procedure, resulting in tubing that exceeds instrument manufacturers' requirements
- Best choice for most GC and GC-MS plumbing needs

Description	Cat. No.
<b>Premium Grade 304 Stainless Steel Tubing</b>	
50 ft. x 1/4 inch (6.35 mm) O.D. x 0.209 inch (5.3 mm) I.D.	20527
50 ft. x 1/8 inch (3.18 mm) O.D. x 0.085 inch (2.1 mm) I.D.	20526-U
100 ft. x 1/16 inch (1.59 mm) O.D. x 0.030 inch (0.762 mm) I.D.	20553
<b>Cleaned Copper Tubing</b>	
50 ft. x 1/4 inch (6.35 mm) O.D. x 0.190 inch (4.83 mm) I.D.	20489
50 ft. x 1/8 inch (3.18 mm) O.D. x 0.065 inch (1.65 mm) I.D.	20488

## Tubing Cutters



Proper gas line connections are important for maximum chromatographic performance. Leaks, caused by a poor fit between tubing and the mating seat, can cause serious damage to GC columns. Therefore, it is critical for tubing to have crisp, clean ends.

- TC-20 is voltage selectable (110/220 V) and CE compliant
- TC-20 cuts 1/16, 1/8 or 1/4 inch copper or stainless steel
- Heavy duty cuts 1/8 or 1/4 inch copper or stainless steel
- Tubing bender – easily bends copper and stainless tubing up to 180° without kinking
- Tubing reamer – opens and rounds tubing after cutting

Description	Cat. No.
TC-20 Tubing Cutter (110/220 V)	58539-U
Heavy Duty Tubing Cutter	20425-U
1/8 inch O.D. Tubing Bender	20422-U
1/4 inch O.D. Tubing Bender	20424-U
Tubing Reamer	20389

## Swagelok® Tubing Fittings

A leak free system is the first requirement in a systematic approach to supplying quality gas to a chromatography system. Swagelok fittings combine superior design principles with close manufacturing tolerance and rigid quality to provide such a leak free connection. Some of the most popular items are listed. For a complete listing, refer to our catalog and/or our website.



Description	Cat. No.
Swagelok Fittings Kit	22668-U
Nuts plus front and back ferrules, brass, 1/8 inch, 10 ea.	22014
Nuts plus front and back ferrules, stainless steel, 1/8 inch, 5 ea.	22040-U
Tee, brass, 1/8 inch	22020-U
Tee, stainless steel, 1/8 inch	22046
On/off throttling valve, brass, 1/8 inch	22138-U
On/off throttling valve, stainless steel, 1/8 inch	22139-U
Toggle valve, brass, 1/8 inch	22699
Toggle valve, stainless steel, 1/8 inch	22698

# Leak Detectors

Using liquids to detect gas leaks in a gas chromatography system can lead to unforeseen problems. Small amounts of liquid can seep into fittings, or through the septum, and damage the column. Electronic leak detectors are a much better alternative than liquid detectors, and can easily and quickly pinpoint gas leaks that are too small to detect with a soap solution. Liquid leak detectors are still available, and can be found in our catalog and on our website.

## GOW-MAC® Gas Leak Detectors



- Easy to operate
- Allow leaks to be found quickly without risk of contaminating the system
- Provides maximum usable sensitivity with high signal to noise ratio amplification
- Operates on the same principle as a thermal conductivity detector
- Will respond to any gas mixture that has a thermal conductivity value different from that of air
- Include internal, rechargeable batteries and charger

Description	Cat. No.
Model 21-070, miniature, 115 V	22807
Model 21-072, miniature, 230 V	22808
Carrying case for 22807 or 22808	22809

# Hand Tools

We offer a variety of hand tools that are specifically designed to assist the chromatographer in the installation and maintenance associated with gas chromatography.



Description	Cat. No.
Capillary Starter Kit	23639
Hook Septum Puller	20352
Screw Septum Puller	20353
Stainless Steel Forceps	22435-U
Pin Vise Drill Kit	23820-U
Capillary Cleaving Tool, retractable blade	23814
Coddington Magnifier, 20X	23139
Lenscope Illuminated Magnifier, 10X	23135
Mirror with Rotating Head	22434
Split Vent Trap Kit	22536

# Pressure Regulators

For all chromatographic applications, it is recommended to use a regulator that does not allow contaminants to enter the gas stream. Our HP, HP+ and UHP regulators meet this stringent demand. We only offer regulators with bar stock bodies. Compared to forged body regulators, ours have:

- Smoother internal surfaces resulting in more efficient gas flows (no eddy swirling), and that contaminants will not cling to
- Much smaller internal volumes (about 20X less) that take less time to purge
- Each of our cylinder regulators also has two additional features, which help keep contaminants from entering the regulator body
- A check valve in the inlet fitting, activated during cylinder change-out
- A shut-off valve on the outlet side that can be closed when replacing downstream components

## Two-Stage Cylinder Regulators

- Reduces cylinder pressure to a factory-set intermediate pressure, then to a user-set final pressure
- Use when the gas cylinder is located within 25 feet of the instrumentation



## Single-Stage Cylinder Regulators

- Reduces cylinder pressure to a user-set intermediate pressure
- Use when the gas cylinder is located more than 25 feet from the instrumentation
- Requires an in-line regulator to be installed within 25 feet of the instrumentation



## In-line Regulators

- Reduces an intermediate pressure to a user-set final pressure
- Install within 25 feet of the instrumentation



## Cylinder Pressure Regulator Features

Feature	HP	HP+	UHP
Check valve in inlet	•	•	•
Bar stock nickel-plated brass body	•	•	•
Stainless steel diaphragm with captive Teflon seal	•	•	
Stainless steel diaphragm with metal-to-metal seal			•
Nickel-plated zinc bonnets	•	•	
Machined brass bonnets (panel-mount capable)			•
2 1/2 inch diameter gauges	•	•	•
Needle shut-off valve	•		
Diaphragm shut-off valve		•	•
1/8 inch male stainless steel Swagelok outlet fitting	•	•	•

## Pressure Regulators

Description	Grade	Maximum Inlet Pressure (psi / bar)	Maximum Delivery Pressure (psi / bar)	Cat. No.
<b>CGA 580 Cylinders (for helium, nitrogen, and argon)</b>				
Two-stage	HP	3000 / 204	0-100 / 0-6.9	29557-U
Single-stage	HP	3000 / 204	0-100 / 0-6.9	29556-U
Two-stage	HP+	3000 / 204	0-100 / 0-6.9	29574-U
Two-stage	HP+	3000 / 204	0-150 / 0-10.3	29575-U
Single-stage	HP+	3000 / 204	0-100 / 0-6.9	29573-U
Two-stage	UHP	3000 / 204	0-100 / 0-6.9	29585-U
Single-stage	UHP	3000 / 204	0-100 / 0-6.9	29584-U
<b>DIN 6 Cylinders (for helium, nitrogen, and argon)</b>				
Two-stage	HP	3000 / 204	0-100 / 0-6.9	29559-U
Single-stage	HP	3000 / 204	0-100 / 0-6.9	29558-U
Two-stage	HP+	3000 / 204	0-100 / 0-6.9	29577-U

Description	Grade	Maximum Inlet Pressure (psi / bar)	Maximum Delivery Pressure (psi / bar)	Cat. No.
Two-stage	HP+	3000 / 204	0-150 / 0-10.3	29578-U
Single-stage	HP+	3000 / 204	0-100 / 0-6.9	29576-U
Two-stage	UHP	3000 / 204	0-100 / 0-6.9	29588-U
Single-stage	UHP	3000 / 204	0-100 / 0-6.9	29587-U
<b>CGA 350 Cylinders (for hydrogen, methane, and argon/methane)</b>				
Two-stage	HP	3000 / 204	0-100 / 0-6.9	29561-U
Single-stage	HP	3000 / 204	0-100 / 0-6.9	29560-U
Two-stage	HP+	3000 / 204	0-100 / 0-6.9	29581-U
Single-stage	HP+	3000 / 204	0-100 / 0-6.9	29579-U
Two-stage	UHP	3000 / 204	0-100 / 0-6.9	29591-U
Single-stage	UHP	3000 / 204	0-100 / 0-6.9	29589-U
<b>DIN 1 Cylinders (for hydrogen, methane, and argon/methane)</b>				
Two-stage	HP	3000 / 204	0-100 / 0-6.9	29563-U
Single-stage	HP	3000 / 204	0-100 / 0-6.9	29562-U
Two-stage	HP+	3000 / 204	0-100 / 0-6.9	29583-U
Single-stage	HP+	3000 / 204	0-100 / 0-6.9	29582-U
Two-stage	UHP	3000 / 204	0-100 / 0-6.9	29593-U
Single-stage	UHP	3000 / 204	0-100 / 0-6.9	29592-U
<b>CGA 320 Cylinders (for carbon dioxide)</b>				
Two-stage	HP	3000 / 204	0-100 / 0-6.9	29567-U
Single-stage	HP	3000 / 204	0-100 / 0-6.9	29564-U
<b>CGA 590 Cylinders (for compressed air)</b>				
Two-stage	HP	3000 / 204	0-100 / 0-6.9	29569-U
Single-stage	HP	3000 / 204	0-100 / 0-6.9	29568-U
<b>DIN 13 Cylinders (for compressed air)</b>				
Two-stage	HP	3000 / 204	0-100 / 0-6.9	29572-U
Single-stage	HP	3000 / 204	0-100 / 0-6.9	29571-U
<b>In-line</b>				
Single-stage	HP	400 / 27	0-100 / 0-6.9	23882
Single-stage	UHP	400 / 27	0-100 / 0-6.9	23884

## Related Information

Interested in learning more? Here is a short list of technical and application pieces designed to assist you in meeting your analyses needs, available for download at no charge. Simply visit [SigmaAldrich.com/gc](http://SigmaAldrich.com/gc), or contact Supelco® Technical Service at 800-325-5832 (US and Canada only), visit [SigmaAldrich.com/customer-support.html](http://SigmaAldrich.com/customer-support.html)

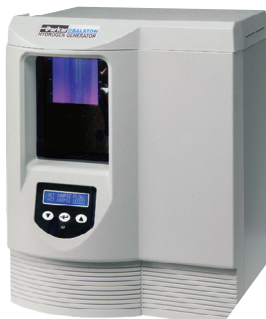
Lit. Code	Type	Description
T401027 DWM	Product Information Sheet	Capillary Injector Products for Agilent Technologies GCs
T407082 JQV	Product Information Sheet	Molded Thermogreen® LB-2 Septa
T196899 BBB	Bulletin	Capillary GC Inlet Liner Selection Guide
T408101 KOX	Product Information Sheet	FocusLiner Inlet Liners
T404081 HCH	Poster	Selecting The Appropriate Inlet Liner
T100741 AXR	Bulletin	Ferrules and Fittings for Packed and Capillary GC
T308184 KPP	Application Note	Hydrogen: Superior Carrier Gas to Helium
T197918 BIT	Bulletin	Selecting Purifiers for Gas Chromatography
T196898 AYW	Bulletin	Gas Management Systems for GC
T407110 JXP	Brochure	Gas Generators
T112853 AIP	Bulletin	Capillary GC Troubleshooting Guide



# Gas Generators

Laboratory gas generators are a great alternative to gas cylinders. In addition to being a much more sensible source of gas from a cost standpoint, generators are safer, cosmetically better, take up less space and do not require the labor needed to transport bulky cylinders into the lab.

## Parker® PEM and ChromGas® Hydrogen Generators



- Easy to use, an electrical outlet and deionized water are all that are required to generate hydrogen for weeks of continuous operation
- Minimal maintenance required
- Uses a solid polymer electrolyte, rather than a liquid electrolyte, eliminating the need for toxic liquids
- Built-in sensing circuit shuts the generator down if a leak is detected
- Can be used with any instrumentation requiring fuel grade hydrogen
- Connections: 1/8" compression fitting
- Delivery purity: 99.9995% (99.99997% for Model 9800)

## Parker ChromGas Zero Air Generators



- Easy to use, an electrical outlet and a compressed air source are all that are required to produce ultra-high purity zero air
- Minimal maintenance required
- Recommended for use with flame ionization detectors to stabilize baselines and improve detection
- Inlet air pressure: 2–125 psi
- Connections: 1/8" compression fitting
- Delivery purity: <0.1 ppm total hydrocarbons (as methane)

Description	Max. Output	Cat. No.
<b>Parker PEM and ChromGas Hydrogen Generators</b>		
H2PEM-100, 110–230 V	100 mL/min.; 90 psi	<b>27773-U</b>
H2PEM-165, 110–230 V	165 mL/min.; 90 psi	<b>27620-U</b>
H2PEM-260, 110–230 V	260 mL/min.; 90 psi	<b>22751</b>
H2PEM-510, 110–230 V	510 mL/min.; 90 psi	<b>22801</b>
<b>Parker ChromGas Zero Air Generators</b>		
Model 1000, 110 V	1000 mL/min.; 125 psi	<b>22824</b>
Model 3500, 110 V	3500 mL/min.; 125 psi	<b>27625-U</b>
Model 1001, 230 V	1000 mL/min.; 125 psi	<b>22830-U</b>
Model 3501, 230 V	3500 mL/min.; 125 psi	<b>27626-U</b>

# High-Purity GC Solvents

The comprehensive Supelco® portfolio includes our range of high-purity GC solvents which have been developed with your application in mind to ensure the best signal-to-noise ratio for accurate GC analysis.

## SupraSolv® solvents for ECD and FID

Our SupraSolv® ECD and FID range of solvents includes high purity products designed specifically for gas chromatography coupled with a Flame Ionization Detector (FID) or an Electron Capture Detector (EID). Their detector specific characteristics result in stable baselines, broader retention time range and improved signal-to-noise ratio to achieve consistently accurate, reliable, and reproducible results. Typical applications include the determination of polychlorinated biphenyls (PCB) in environmental and food samples.

## SupraSolv® solvents for GC-MS

SupraSolv® MS solvents are specialized for Gas Chromatography with mass spectrometric detection. Their suitability and high purity offer analytical reliability in highly sensitive detection processes like analysis of dioxins (PCDD), furans (PCDF) or polycyclic aromatic hydrocarbons (PAH) in food and environmental samples. They offer minimal interference signals in the relevant retention time window with the best possible batch consistency. As a result, the work becomes more reliable, accurate, and economical.

## SupraSolv® Headspace GC solvents

SupraSolv® Headspace GC solvents are specifically devised for the analysis of residual solvents in drug substances and products following European and United States Pharmacopoeia. These solvents offer accurate analysis as they specify the concentrations of all the residual solvents of the three defined classes in the ICH guideline.

## UniSolv™ solvents for organic trace analysis

UniSolv™ solvents offer unique solutions for all the applications regardless of the method (GC-FID, GC-ECD & GC-MS) and the sample used. These solvents have larger retention time and lower permissible concentration of interference signals within the retention time range. Their specifications are broader and higher than that of SupraSolv® solvents and can be used in areas that demand the highest level of reliability in analytical results.

## SupraSolv® solvents for gas chromatography ECD and FID

	Product	Purity (GC) min. [%]	Evap. residue max. [mg/L]	Water max. [%]	Color max. [Hazen]	Content / Packaging	Cat. No.
A	Acetone	99.8	3.0	0.05	10	1   GL	1.00012.1000
						2.5   GL	1.00012.2500
						4   GL	1.00012.4000
						30   ST	1.00012.9030
	Acetonitrile	99.8	3.0	0.05	10	1   GL	1.00017.1000
B	tert-Butyl methyl ether	99.8	3.0	0.02	10	2.5   GL	1.00017.2500
						4   GL	1.00017.4000
						1   GL	1.01995.1000
C	Chloroform, stabilized	99.8	5.0	0.01	10	2.5   GL	1.01995.2500
						1   GL	1.02432.1000
	Cyclohexane	99.8	3.0	0.01	10	2.5   GL	1.02432.2500
						1   GL	1.02817.1000
						2.5   GL	1.02817.2500
						4   GL	1.02817.4000
						10   ST	1.02817.9010

	Product	Purity (GC) min. [%]	Evap. residue max. [mg/L]	Water max. [%]	Color max. [Hazen]	Content / Packaging	Cat. No.
D	Dichloromethane, stabilized	99.8	5.0	0.01	10	1   GL	1.06054.1000
						2.5   GL	1.06054.2500
						4   GL	1.06054.4000
						10   ST	1.06054.9010
	Diethyl ether, stabilized	98.0	3.0	0.05	10	1   GL	1.00931.1000
						2.5   GL	1.00931.2500
						4   GL	1.00931.4000
	N,N- Dimethylformamide	99.8	3.0	0.05	10	1   GL	1.10983.1000
						2.5   GL	1.10983.2500
E	Ethanol	99.8	3.0	0.01	10	1   GL	1.02371.1000
						2.5   GL	1.02371.2500
	Ethyl acetate	99.8	3.0	0.02	10	1   GL	1.10972.1000
						2.5   GL	1.10972.2500
						4   GL	1.10972.4000
						10   ST	1.10972.9010
						30   ST	1.10972.9030
H	n-Hexane	98.0 *	3.0	0.01	10	1   GL	1.04371.1000
						2.5   GL	1.04371.2500
						4   GL	1.04371.4000
						10   ST	1.04371.9010
						30   ST	1.04371.9030
I	Isohexane	99.8	3.0	0.01	10	2.5   GL	1.04340.2500
	Isooctane	99.8	3.0	0.01	10	1   GL	1.15440.1000
						2.5   GL	1.15440.2500
M	Methanol	99.8	3.0	0.1	10	1   GL	1.06011.1000
						2.5   GL	1.06011.2500
						4   GL	1.06011.4000
P	n-Pentane	99.8	3.0	0.02	10	1   GL	1.00882.1000
						2.5   GL	1.00882.2500
	Petroleum benzine (40 - 60°C)	-	3.0	0.01	10	1   GL	1.01772.1000
						2.5   GL	1.01772.2500
						4   GL	1.01772.4000
						10   ST	1.01772.9010
						30   ST	1.01772.9030
	2-Propanol	99.8	3.0	0.1	10	1   GL	1.00998.1000
						2.5   GL	1.00998.2500
T	Toluene	99.8	3.0	0.03	10	1   GL	1.08389.1000
						2.5   GL	1.08389.2500
						4   GL	1.08389.4000
						10   ST	1.08389.9010

GL = glass bottle I ST = stainless steel barrel I \* = sum of hexane isomers + methyl cyclopentane (GC) 99.8 0/o I GC-ECD (retention range 1,2,4-Trichlorobenzene to Decachlorobiphenyle individual signals (Lindane standard)) ≤ 3 pg/ml I GC-F D (retention range n-Undecane to n-Tetracontane individual signals (n-Tetradecane standard)) ≤ 3 ng/ml

## SupraSolv® solvents for gas chromatography MS

	Product	Purity (GC) min. [%]	Evap. residue max. [mg/L]	Water max. [%]	Color max. [Hazen]	Content / Packaging	Cat. No.
A	Acetone	99.8	3.0	0.05	10	1   GL	1.00658.1000
						2.5   GL	1.00658.2500
	Acetonitrile	99.8	3.0	0.05	10	1   GL	1.00665.1000
						2.5   GL	1.00665.2500
C	Cyclohexane	99.8	3.0	0.01	10	1   GL	1.00667.1000
						2.5   GL	1.00667.2500
D	Dichloromethane, stabilized	99.8	5.0	0.01	10	1   GL	1.00668.1000
						2.5   GL	1.00668.2500
E	Ethyl acetate	99.8	3.0	0.02	10	1   GL	1.00789.1000
						2.5   GL	1.00789.2500
H	n-Hexane	98.0 *	3.0	0.01	10	1   GL	1.00795.1000
						2.5   GL	1.00795.2500
M	Methanol	99.8	3.0	0.1	10	1   GL	1.00837.1000
						2.5   GL	1.00837.2500
T	Toluene	99.8	3.0	0.03	10	1   GL	1.00849.1000
						2.5   GL	1.00849.2500
W	Water		5.0		10	1   GL	1.03702.1000
						2.5   GL	1.03702.2500

GL = glass bottle I \* = sum of hexane isomers + methyl cyclopentane (GC) 99.8% I GC-MS (retention range n-Undecane to n-Tetracontane; scanning area 30 - 600 amu individual signals (n-Tetradecane standard)) ≤ 3 ng/ml

## SupraSolv® headspace For the analysis of residual solvents according to ICH, Ph Eur and USP

	Product	Purity (GC) min. [%]	Evap. residue max. [mg/L]	Water max. [%]	Color max. [Hazen]	Content / Packaging	Cat. No.
B	Benzyl alcohol	≥ 99.5 %		0.1 %	≤ 10 Hazen	1   GL	1.02695.1000
						2.5   GL	1.02695.2500
D	N,N-Dimethylacetamide	99.8	3.0	0.05	10	1   GL	1.00399.1000
	N,N-Dimethylformamide	99.8	3.0	0.05	10	1   GL	1.00202.1000
						2.5   GL	1.00202.2500
	Dimethyl sulfoxide	99.8	3.0	0.05	10	1   GL	1.01900.1000
						2.5   GL	1.01900.2500
	W	Water	-	5.0	-		1   GL
2.5   GL							1.00577.2500
5.0				10		1   GL	1.02699.1000
						2.5   GL	1.02699.2500

GL = glass bottle I Every residual solvent of class 1 acc. CH ≤ 1 µg/g I Every residual solvent of class 2 acc. CH ≤ 10 µg/g I Every residual solvent of class 3 acc. CH ≤ 50 µg/g

## UniSolv® solvents for organic trace analysis

	Product	Purity (GC) min. [%]	Evap. residue max. [mg/L]	Water max. [%]	Color max. [Hazen]	Content / Packaging	Cat. No.
D	Dichloromethane	99.9	3.0	0.005	10	1   GL	1.06454.1000
H	n-Hexane	99.0*	3.0	0.005	10	1   GL	1.04369.1000
						2.5   GL	1.04369.2500
P	n-Pentane	99.9	3.0	0.01	10	1   GL	1.07288.1000
						2.5   GL	1.07288.2500
	Petroleum benzine (40 - 60°C)	-	3.0	0.005	10	1   GL	1.16740.1000
						2.5   GL	1.16740.2500
T	Toluene	99.9	3.0	0.005	10	1   GL	1.08388.1000
						2.5   GL	1.08388.2500

GL = glass bottle I \* Sum of hexane isomers + methylcyclopentane (GC) :2 99.9% I GC-ECD (retention range Dichloromethane to 1,2,4-Trichlorobenzene individual signals (Tetrachloromethane standard)) ;, 1 ng/ml I GC-ECD (retention range 1,2,4-Trichlorobenzene to Decachlorobiphenyl individual signals (Lindane standard)) ≤ 2 pg/ml I GC-F D (retention range n-Undecane to n-Tetracontane individual signals (n-Tetradecane standard)) ≤ 2 ng/ml I GC-MS (retention range n-Undecane to n-Tetracontane; scanning area 30 - 600 amu individual signals (n-Tetradecane))

# GC Workflow Solutions to streamline your GC analyses

Whether you use ECD, FID, TCD, MS or another detector—our range of GC columns, solvents, standards & accessories offers a dedicated quality for your specific application and detection method.

Ensure accurate and reliable results while supporting laboratory regulatory requirements with our comprehensive portfolio of solutions for the entire GC workflow

## Our complete GC workflow solutions provide:

- Proficiency testing
- Sample collection and preparation products: SPE, purge & traps, water, air sampling etc.
- GC products for analysis: columns, solvents and accessories
- Detection and calibration: certified reference materials and standards, matrix materials etc.

Visit [SigmaAldrich.com/gc](https://SigmaAldrich.com/gc) to discover how we can help you to streamline your analyses, whatever your sample matrix

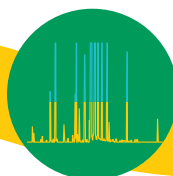
### PROFICIENCY TESTING



### SAMPLE PREPARATION AND COLLECTION



### GC ANALYSIS



### DETECTION AND CALIBRATION





## Notes

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[illegible]

# Supelco®

Analytical Products

Merck KGaA  
Frankfurter Strasse 250  
64293 Darmstadt, Germany



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