GAS CHROMATOGRAPHY

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Capillary GC Columns and Guard Columns/Retention Gaps

Supelco Analytical brand products include capillary GC columns and guard columns, packed GC columns and components, GC accessories, and gas purification/management items. Fluka Analytical brand products include GC solvents and GC derivatization reagents.

Capillary GC Columns and Guard Columns/Retention Gaps

Supelco began in 1966 in a tiny garage in a small central Pennsylvania (USA) town manufacturing packed gas chromatography (GC) columns. By 1977, glass capillary GC columns were being manufactured and in 1982, production began on fused silica capillary GC columns. In 1983, the first special purpose fused silica capillary GC column was introduced. Since then, an impressive list of special purpose fused silica capillary GC columns has followed. We test every capillary column we manufacture according to strict quality assurance processes, and guarantee satisfactory performance.

How to Choose a Column

An optimized chromatographic separation begins with the column. The selection of the proper capillary column for any application should be based on four significant factors: stationary phase, column I.D., film thickness, and column length. The practical effects of these factors on the performance of the column are discussed briefly in this section, in order of importance. Note that this information is general. Specific situations may warrant exceptions to these guidelines.

Step 1 - Stationary Phase

Choosing a stationary phase is the most important step in selecting a column. A stationary phase is the film coated on the inner wall of a capillary column, and should be selected based on the application to be performed. The differences in the chemical and physical properties of injected organic compounds and their interactions with the stationary phase are the basis of the separation process. When the strength of the analyte-phase interactions differs significantly for two compounds, one is retained longer than the other. How long they are retained in the column (retention time) is a measure of these analyte-phase interactions.

Changing the chemical features of the stationary phase alters its physical properties. Two compounds that co-elute (do not separate) on a particular stationary phase might separate on another phase of a different chemistry, if the difference in the analyte-phase interactions is significant. This is the reason for providing a wide variety of capillary column phases. Each phase provides a specific combination of interactions for each chemical class of analytes.

Established Applications: Gas chromatography, first established in the 1950's, is a mature analytical technique with many established applications. Therefore, it is probable that literature, such as written methodology or journals, exists stating which stationary phases have successfully been used for a given application. Additionally, column manufacturers routinely publish phase selection charts which are conveniently arranged by industry to simplify the process of selecting the proper phase. First, find the chart that matches your industry or area of interest. Then, locate the application within that chart to identify a recommended column phase. Our phase selection charts are located in our GC Column Selection Guide, which can be viewed by entering "T407133" as a search term on the Sigma-Aldrich web site, at **sigma-aldrich.com**

New Applications: For new applications, there is often no existing reference to provide guidance. In these 'method development' instances, one must have some knowledge of the chemistry of the compounds to be analyzed. Phase selection is based on the general chemical principle that "likes dissolves like." A non-polar column is the recommended starting point for the analyses of non-polar compounds. Likewise, polar columns are usually recommended as the starting point for the separation of polar compounds.

Phase Polarity Based on Compound Polarity

Compound Polarity	Compound Examples	Recommended Phases
Non-Polar Compounds		
C and H atoms only, C-C bonds	alkanes	Petrocol, SPB-Octyl, Equity-1, SPB-1, SLB-5ms, Equity-5, SPB-5
Polar Compounds		
Primarily C and H atoms, also contain Br, Cl, F, N, O, P, and/or S	alcohols, amines, carboxylic acids, diols, esters, ethers, ketones, thiols	SPB-624, OVI-G43, VOCOL, SPB-20, SPB-35, Equity-1701, SPB-50, SPB-225, PAG, Omegawax, SPB-1000, Nukol, SUPELCOWAX 10
Polarizable Compounds		
C and H atoms only, C=C and/or C≡C bonds	alkenes, alkynes, aromatic hydrocarbons	SP-2330, SP-2331, SP-2380, SP-2560, SP-2340, TCEP

Step 2 - Column I.D.

Fused Silica Tubing Inner/Outer Diameters

Tubing I.D.	Tubing I.D. Range	Tubing O.D. Range
0.10 mm[A]	0.094–0.106 mm	0.349–0.369 mm
0.10 mm[B]	0.094–0.106 mm	0.290–0.310 mm
0.18 mm[A]	0.174–0.186 mm	0.349–0.369 mm
0.18 mm[B]	0.174–0.186 mm	0.330–0.350 mm
0.20 mm[C]	0.194–0.206 mm	0.349–0.370 mm
0.25 mm[C]	0.244–0.256 mm	0.349–0.370 mm
0.32 mm[C]	0.314–0.326 mm	0.425–0.450 mm
0.53 mm[C]	0.526–0.546 mm	0.640–0.680 mm
0.75 mm[C]	0.737–0.758 mm	0.875–0.925 mm

[A]Analytical columns with non-polar or intermediate polarity stationary phases
[B]Analytical columns with polar stationary phases; guard columns regardless of deactivation
[C]Analytical columns regardless of polarity; guard columns regardless of deactivation

Capillary GC Columns and Guard Columns/Retention Gaps

How to Choose a Column: *Step 2 - Column I.D.*

The current range of commercially available capillary column internal diameters enables the balancing of two factors: efficiency (number of theoretical plates) and sample capacity (amount of any one sample component that can be applied to the column without causing the desired sharp peak to overload). Optimizing one of these factors requires a sacrifice from the other. The ideal I.D. for a given application is dependent on the analytical needs. Columns with a 0.25 mm I.D. are the most popular, providing adequate plates/meter for most applications while allowing acceptable sample capacity.

High Efficiency: Observed chromatographically as narrow and well-resolved peaks. The efficiency of a capillary column, measured in plates (N) or plates per meter (N/m), increases as the I.D. of the column decreases. This is one of the basic principles behind Fast GC. If the sample to be analyzed contains many analytes, or has analytes that elute closely together, the most narrow I. D. capillary column that is practical should be selected. Note that very narrow bore columns, such as 0.10 or 0.18 mm I.D., may require specialized equipment, such as a GC with a pressure regulator that allows a higher column head pressure.

Sample Capacity: Increases as column I.D. increases. Wide bore columns can accommodate a larger mass of each analyte in a sample than narrow bore capillary columns. Exceeding the sample capacity of a column will result in skewed peaks and decreased resolution. Therefore, if the samples to be analyzed contain compounds at high concentrations, or represent a wide range of concentrations, then a wide bore column should be considered. If the proper I.D. is chosen, the column should allow the system to provide sufficient sensitivity for the minor components without being overloaded with the major components. The analyst must decide if the loss in efficiency resulting from using a wide bore column is problematic for their application. Note that the nature of the sample components and the polarity of the phase will affect sample capacity. Non-polar phases have higher capacities for non-polar analytes, and polar phases have higher capacities for polar analytes.

Effects of Column I.D.

Internal Diam. (mm)	Efficiency: Plates/Meter (N/m)	Efficiency: Total Plates (N)	Capacity: Each Analyte (ng)
0.53	1,300	39,000	1,000–2,000
0.32	2,300	69,000	400–500
0.25	2,925	87,750	50–100
0.20	3,650	109,500	<50
0.18	4,050	121,500	<50
0.10	7,300	219,000	<10

*Theoretical values for 30 m long columns, calculated @ a k = 6.00 and 85% coating efficiency

Step 3 - Film Thickness

Most 0.25 mm I.D. columns have a 0.25 or 0.50 µm film thickness. Depending on the application, the optimal film thickness may be different.

Decreasing Film Thickness: The benefits are sharper peaks (which may increase resolution) and reduced column bleed; both resulting in increased signal-to-noise. Additionally, the column's maximum operating temperature will be increased. The drawbacks are increased analyte interaction with the tubing wall, and decreased analyte capacity. Decreasing film thickness also allows analytes to elute with shorter retention times and at lower temperatures, which may be desirable or undesirable, depending on the application. Thinner film columns should be used for analytes with high (>300 °C) boiling points (such as pesticides, PCBs, FAMEs, phthalate esters, and other semivolatile compounds), or for trace analyses.

Increasing Film Thickness: The benefits are reduced analyte-tubing interaction and increased sample capacity. The drawbacks are increased peak widths (which may reduce resolution), increased column bleed, and a reduced maximum operating temperature for the column. Increasing film thickness also leads to increased analyte retention (may also increase resolution, specifically for compounds with low k') and increased elution temperature. Depending on the application, these last effects may be either desirable or undesirable. Thicker film columns are best suited for analytes with low boiling points (such as volatile organic compounds and gases). These types of analytes are retained longer on the thicker film, which may eliminate the need for subambient oven conditions. A thicker film will also increase capacity, thus making the column more compatible for higher concentration samples than a thinner film column.

Phase Ratio (β)

Effects of phase film thickness are interdependent with column I.D. The phase ratio, beta (β), expresses the ratio of the gas volume and the stationary phase volume in a column:

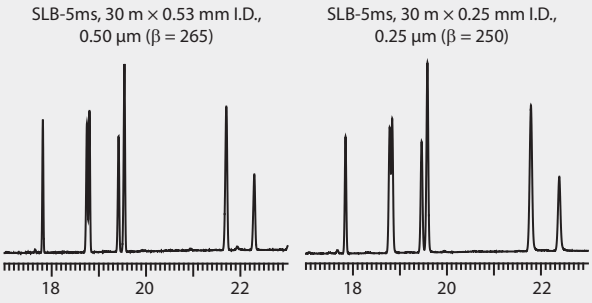
$$\beta = \frac{\text{column radius (µm)}}{2 \times \text{film thickness (µm)}}$$

In contrast to relative terms ("thick film" and "thin film"), β values establish a distinct ranking for columns. As a general rule, select columns by β values as follows:

β Value	Uses
<100	Highly volatile, low molecular weight compounds
100–400	General purpose analyses Wide range of compounds
>400	High molecular weight compounds Trace analyses

β values are also useful when changing column I.D. and film thickness combinations for a particular analysis, because columns with the same phase ratio will provide very similar retention times and elution order under the same analytical conditions.

Columns With Similar β Values



Capillary GC Columns and Guard Columns/Retention Gaps

How to Choose a Column: *Step 4 - Column Length*

Step 4 - Column Length

Generally a 30 m column provides the best balance of resolution, analysis time, and required column head pressure. Specific applications may warrant a different column length.

Longer Columns: Provides greater resolution, but increases back pressure. It should be stressed that doubling column length will NOT double resolution (resolution only increases according to the square root of the column length). If resolution between a critical pair is less than 1, doubling column length will not bring it to baseline (resolution value of at least 1.5). Increasing column length to increase resolution should be considered as a last resort. A more effective approach to increasing resolution is to reduce column I.D.

Shorter Columns: When great resolution is not required, such as for screening purposes or for simple samples whose components are dissimilar in chemical nature. However, if column I.D. is decreased along with length, resolution can be maintained, or in some cases, actually increased.

Effects of Column Length

Column Length (m)	Inlet Pressure (psi)	Peak 1 Retention (min.)	Peak 1/2 Resolution (R)	Efficiency: Total Plates (N)
15	5.9	8.33	0.8	43,875
30	12	16.68	1.2	87,750
60	24.9	33.37	1.7	175,500

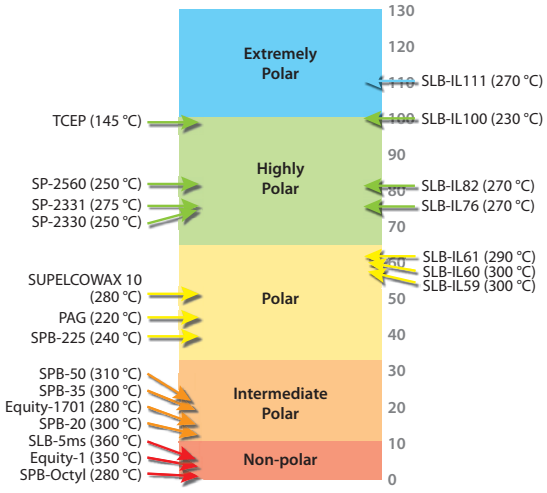
*Theoretical values for 0.25 mm I.D. columns with 85% coating efficiency, 145 °C isothermal analyses, helium at 21 cm/sec, k (peak 1) = 6.00

Columns by Phase Polarity

Choosing a stationary phase is the most important step in choosing a column, and should be selected based on the application to be performed. It is recommended to first consult our "GC Column Selection Guide" brochure (T407133 KCX) to determine if we have already identified appropriate columns. For new applications, there is often no existing reference to provide guidance. In these method development instances, one must have some knowledge of the chemistry of the compounds to be analyzed. Phase selection is based on the general chemical principle that "likes dissolves like" and relates to the specific analyte-stationary phase interactions that each group of columns can perform. Choose:

- **Non-Polar GC columns** for non-polar compounds (such as alkanes) that contain 1) only carbon and hydrogen atoms, and 2) only single bonds between carbon atoms.
- **Intermediate polar GC columns** for an alternate selectivity of non-polar and/or polar compounds.
- **Polar GC columns** for polar compounds (such as alcohols, amines, carboxylic acids, diols, esters, ethers, ketones, and thiols) that contain 1) primarily carbon and hydrogen atoms, and 2) also some bromine, chlorine, fluorine, nitrogen, oxygen, phosphorus, and/or sulfur atoms.
- **Highly polar GC columns** for polarizable compounds (such as alkenes, alkynes, and aromatic hydrocarbons) that contain 1) only carbon and hydrogen atoms, and 2) some double and/or triple bonds between carbon atoms.
- **Extremely polar GC columns** for additional selectivity of polarizable compounds.

GC Column Polarity Scale



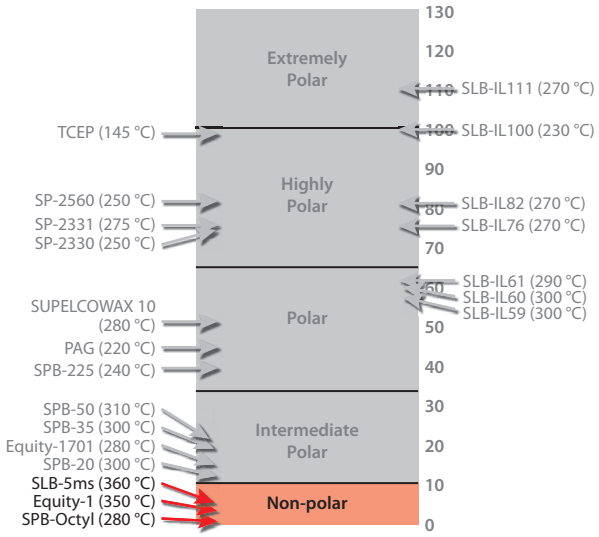
Our GC column polarity scale is a convenient tool to classify columns. The procedure we follow was proposed to us by Prof. Luigi Mondello (University of Messina, Italy). Each column is characterized with a series of five probes plus several n-alkane markers to determine the retention index for each probe. McReynolds Constants are then calculated using the retention index data of the column relative to the retention index data for the same five probes on squalane, the most non-polar GC stationary phase. The five McReynolds Constants are summed to obtain Polarity (P) values, which are then normalized to SLB-IL100 (set at P=100) to obtain Polarity Number (P.N.) values.

Once Polarity Number (P.N.) values are calculated, the relationships to each other can be shown in a visual representation. The scale is broken into five regions. The first four regions (non-polar, intermediate polar, polar, and highly polar) are generally accepted and used by several GC column manufacturers. The fifth region (extremely polar) was required with the introduction of the SLB-IL111 in 2010 (no column existed in this region prior to this). The positions and maximum temperatures of several of our capillary GC columns are shown (non-ionic liquid columns on the left and ionic liquid columns on the right). Our GC column polarity scale can be used for column selection because it allows multiple columns to be compared easily, because all P.N. values are relative to both squalane (0 on the scale) and SLB-IL100 (100 on the scale).

Capillary GC Columns and Guard Columns/Retention Gaps

Columns by Phase Polarity: *Non-Polar*

Non-Polar



Non-polar GC columns are made with the least selective of the GC stationary phases. They are commonly used to separate non-polar compounds (such as alkanes) that contain 1) only carbon and hydrogen atoms, and 2) only single bonds between carbon atoms. Elution order generally follows the boiling points of the analytes.

- Interactions are primarily dispersive (van der Waals forces).
- Phases with phenyl functional groups can also undergo a moderate amount of π-π interactions.
- PTA-5 columns are specially-engineered to also allow strong basic interactions.
- Phases with octyl functional groups also possess shape selectivity.

Petrocol® DH Octyl Capillary GC Column

Application: This column, for detailed analyses of petroleum products, is known within the petroleum and chemical industries for its unique selectivity. Baseline separations of benzene/1-methylcyclopentene and toluene/2,3,3-trimethylpentane that are possible with this column are not obtainable with classical poly(dimethyl siloxane) columns.
USP Code: None
Phase:

- Bonded
- Poly(50% n-octyl/50% methyl siloxane)

Temp. Limits:

- -60 °C to 220 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.50	100	125	24282	1 ea

SPB®-Octyl Capillary GC Column

Application: The low polarity of this column approaches squalane, making it substantially less polar than that of the widely used non-polar poly(dimethyl siloxane) columns. This column offers unique selectivity compared to non-polar and intermediate polarity columns, and can be used for confirmational analyses of PCB-containing samples.
USP Code: None
Phase:

- Bonded
- Poly(50% n-octyl/50% methyl siloxane)

Temp. Limits:

- ≤0.32 mm I.D.: -60 °C to 280 °C (isothermal or programmed)
- ≥0.53 mm I.D.: -60 °C to 260 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24218-U	1 ea
	0.25	60	250	24219-U	1 ea
	1.00	30	63	24232	1 ea
	1.00	60	63	24233-U	1 ea
0.53	3.00	60	44	25398	1 ea

SPB®-HAP Capillary GC Column

Application: This column was developed to provide the best resolution of very volatile hazardous air pollutants. The thick film helps to focus analytes on the column, possibly eliminating the need to employ cryogenic focusing techniques.
USP Code: This column meets USP G1, G2, and G9 requirements.
Phase:

- Bonded
- Poly(dimethyl siloxane)

Temp. Limits

- -60 °C to 300 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.32	4.00	60	20	25020-U	1 ea

Petrocol® DH 50.2 Capillary GC Column

Application: This column is designed for detailed hydrocarbon analyses of naphthas, gasolines, and similar samples, according to ASTM D5134.
USP Code: This column meets USP G1, G2, and G9 requirements.
Phase:

- Bonded
- Poly(dimethyl siloxane)

Temp. Limits:

- -60 °C to 320 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.20	0.50	50	100	24133-U	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Columns by Phase Polarity: *Non-Polar*

Petrocol® DH Capillary GC Column

Application: This highly reproducible column has considerable theoretical plate numbers and is designed for detailed analyses of petroleum products for PIANO, PONA, and PNA-type analytes. Includes an extensive retention index data sheet of 400+ analytes.
USP Code: This column meets USP G1, G2, and G9 requirements.
Phase:

- Bonded
- Poly(dimethyl siloxane)

Temp. Limits:

- -60 °C to 320 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.50	100	125	24160-U	1 ea

Petrocol® DH 150 Capillary GC Column

Application: The longest capillary column commercially available as a stock item. For detailed purity analyses of light hydrocarbon gases and petroleum products (oxygenates, solvents, naphthas, gasolines, etc.).
USP Code: This column meets USP G1, G2, and G9 requirements.
Phase:

- Bonded
- Poly(dimethyl siloxane)

Temp. Limits:

- -60 °C to 320 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	1.00	150	63	24155	1 ea

Petrocol® 2887 Capillary GC Column

Application: This column is designed for ASTM D2887 (simulated distillation [Sim Dis] of petroleum fractions) for samples having boiling points up to 1000 °F.
USP Code: This column meets G1, G2, and G9 requirements.
Phase:

- Bonded
- Poly(dimethyl siloxane)

Temp. Limits:

- Subambient to 350 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.53	0.50	5	265	25323	1 ea

Petrocol® EX2887 Capillary GC Column

Application: This column is designed for ASTM D2887 (simulated distillation [Sim Dis] of petroleum fractions) for samples having boiling points greater than 1000 °F.
USP Code: This column meets G1, G2, and G9 requirements.
Phase:

- Bonded
- Poly(dimethyl siloxane)

Temp. Limits:

- Subambient to 380 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.53	0.10	5	1325	25337	1 ea

SPB®-1 SULFUR Capillary GC Column

Application: A specialized version of the SPB-1, this column was developed for analyses of sulfur gases and other volatile sulfur compounds. The column displays relatively low column bleed, which makes it compatible for use with sulfur-specific detectors.
USP Code: This column meets USP G1, G2, and G9 requirements.
Phase

- Bonded
- Poly(dimethyl siloxane)

Temp. Limits:

- -60 °C to 300 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.32	4.00	30	20	24158	1 ea

Equity®-1 Capillary GC Column

Application: This column is designed for general purpose applications where a non-polar column is required. Analytes will be separated primarily according to boiling point.
USP Code: This column meets USP G1, G2, and G9 requirements.
Phase:

- Bonded
- Poly(dimethyl siloxane)

Temp. Limits:

- ≤0.32 mm I.D., <2 µm: -60 °C to 325 °C (isothermal) or 350 °C (programmed)
- ≤0.32 mm I.D., ≥2 µm: -60 °C to 300 °C (isothermal or programmed)
- ≥0.53 mm I.D., <2 µm: -60 °C to 300 °C (isothermal) or 320 °C (programmed)
- ≥0.53 mm I.D., ≥2 µm: -60 °C to 260 °C (isothermal) or 280 °C (programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.10	15	250	28039-U	1 ea
0.20	0.33	12	152	28041-U	1 ea
	1.20	10	42	28043-U	1 ea
0.25	0.10	30	625	28044-U	1 ea
	0.25	15	250	28045-U	1 ea
	0.25	30	250	28046-U	1 ea
	0.25	60	250	28047-U	1 ea
	1.00	15	63	28048-U	1 ea
	1.00	30	63	28049-U	1 ea
	1.00	60	63	28050-U	1 ea
	1.00	100	63	28052-U	1 ea
0.32	0.10	30	800	28053-U	1 ea
	0.25	15	320	28054-U	1 ea
	0.25	30	320	28055-U	1 ea
	0.25	60	320	28056-U	1 ea
	1.00	30	80	28057-U	1 ea
	1.00	60	80	28058-U	1 ea
	1.00	100	80	28060-U	1 ea
	2.00	30	40	28061-U	1 ea
	5.00	30	16	28062-U	1 ea
	5.00	60	16	28063-U	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Columns by Phase Polarity: *Non-Polar*

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.53	0.10	15	1325	28064-U	1 ea
	0.50	15	265	28067-U	1 ea
	0.50	30	265	28068-U	1 ea
	1.00	15	133	28069-U	1 ea
	1.00	30	133	28071-U	1 ea
	1.50	15	88	28072-U	1 ea
	1.50	30	88	28073-U	1 ea
	1.50	60	88	28074-U	1 ea
	3.00	15	44	28075-U	1 ea
	3.00	30	44	28076-U	1 ea
	3.00	60	44	28077-U	1 ea
	5.00	15	27	28079-U	1 ea
	5.00	30	27	28081-U	1 ea
	5.00	60	27	28082-U	1 ea

SPB®-1 Capillary GC Column

Application: This column is often used for traditional general purpose applications, where a non-polar column is required. Analytes will be separated primarily according to boiling point.
USP Code: This column meets USP G1, G2, and G9 requirements.
Phase:

- Bonded
- Poly(dimethyl siloxane)

Temp. Limits:

- ≤0.32 mm I.D., <2 µm: -60 °C to 320 °C (isothermal or programmed)
- ≤0.32 mm I.D., ≥2 µm: -60 °C to 300 °C (isothermal or programmed)
- ≥0.53 mm I.D., <2 µm: -60 °C to 300 °C (isothermal) or 320 °C (programmed)
- ≥0.53 mm I.D., ≥2 µm: -60 °C to 260 °C (isothermal) or 280 °C (programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.20	0.20	15	250	24162	1 ea
	0.20	30	250	24163	1 ea
	0.33	12	152	24229-U	1 ea
	0.33	25	152	24230-U	1 ea
	1.20	10	42	24134-U	1 ea
0.25	0.10	30	625	24261	1 ea
	0.25	15	250	24026	1 ea
	0.25	30	250	24028	1 ea
	0.25	60	250	24030-U	1 ea
	0.25	100	250	24198	1 ea
	1.00	15	63	24027	1 ea
	1.00	30	63	24029	1 ea
	1.00	60	63	24031	1 ea
	1.00	100	63	24220-U	1 ea
	3.00	60	21	23304-U	1 ea
0.32	0.25	15	320	24099	1 ea
	0.25	30	320	24044	1 ea
	0.25	60	320	24046	1 ea
	1.00	15	80	24098-U	1 ea
	1.00	30	80	24045-U	1 ea
	1.00	60	80	24047	1 ea
	1.00	100	80	24213-U	1 ea
	2.00	30	40	24215-U	1 ea
	2.00	60	40	24216-U	1 ea
	5.00	30	16	24296	1 ea
	5.00	60	16	24297	1 ea

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.53	0.10	15	1325	25360	1 ea
	0.10	30	1325	25361	1 ea
	0.50	15	265	25314	1 ea
	0.50	30	265	25315	1 ea
	0.50	60	265	25382	1 ea
	1.00	30	133	25417	1 ea
	1.50	15	88	25302-U	1 ea
	1.50	30	88	25303	1 ea
	1.50	60	88	25388	1 ea
	3.00	15	44	25340	1 ea
	3.00	30	44	25341-U	1 ea
	3.00	60	44	25348	1 ea
	5.00	15	27	25344	1 ea
	5.00	30	27	25345-U	1 ea
	5.00	60	27	25349	1 ea
0.75	1.00	60	188	23302-U	1 ea

SLB®-5ms Capillary GC Column

Application: The 5% phenyl equivalent phase provides a boiling point elution order with a slight increase in selectivity, especially for aromatic compounds. The low bleed characteristics, inertness, and durable nature make it the column of choice for environmental analytes (such as semivolatiles, pesticides, PCBs, and herbicides) or anywhere a low bleed non-polar column is required.
USP Code: This column meets USP G27 and G36 requirements.
Phase:

- Bonded and highly crosslinked
- Silphenylene polymer virtually equivalent in polarity to poly(5% diphenyl/ 95% dimethyl siloxane)

Temp. Limits:

- ≤0.32 mm I.D.: -60 °C to 340 °C (isothermal) or 360 °C (programmed)
- ≥0.53 mm I.D.: -60 °C to 330 °C (isothermal) or 340 °C (programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.10	10	250	28465-U	1 ea
	0.10	15	250	28466-U	1 ea
0.18	0.18	20	250	28564-U	1 ea
	0.30	12	150	28566-U	1 ea
	0.30	30	150	28575-U	1 ea
	0.36	20	125	28576-U	1 ea
0.20	0.20	30	250	28513-U	1 ea
0.25	0.10	30	625	28467-U	1 ea
	0.25	15	250	28469-U	1 ea
	0.25	30	250	28471-U	1 ea
	0.25	60	250	28472-U	1 ea
	0.50	15	125	28577-U	1 ea
	0.50	30	125	28473-U	1 ea
	0.50	60	125	28474-U	1 ea
	1.00	30	63	28476-U	1 ea
0.32	0.25	15	320	28557-U	1 ea
	0.25	30	320	28482-U	1 ea
	0.32	30	250	28532-U	1 ea
	0.50	15	160	28597-U	1 ea
	0.50	30	160	28484-U	1 ea
	1.00	30	80	28487-U	1 ea
0.53	0.50	30	265	28541-U	1 ea
	1.00	30	132	28559-U	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Columns by Phase Polarity: *Non-Polar*

MET-Biodiesel Capillary GC Column

Application: This rugged metal column was designed specifically for the determination of free and total glycerin in B100 biodiesel samples. A guard is integrated, thereby providing protection with a leak-free connection (the guard and analytical column are one continuous piece of tubing; there is no union between the guard and analytical column).
USP Code: None
Phase:

- Bonded
- Proprietary

Temp. Limits:

- -60 °C to 380 °C (isothermal) or 430 °C (programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.53	0.16	14	828	28668-U	1 ea

HT-5 (aluminum clad) Capillary GC Column

Application: This column offers the highest maximum temperature of any commercially available column. It is well suited for simulated distillation (Sim Dis) analyses of petroleum samples.
USP Code: None
Phase:

- Bonded
- Siloxane-carborane equivalent in polarity to poly(5% diphenyl/95% dimethyl siloxane)

Temp. Limits:

- 10 °C to 460 °C (isothermal) or 480 °C (programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.32	0.10	12	800	25002	1 ea
	0.10	25	800	25003	1 ea
0.53	0.10	6	1325	25004	1 ea
	0.15	12	883	25005-U	1 ea

PTA-5 Capillary GC Column

Application: This column is designed for analyses of amines and other basic analytes.
USP Code: None
Phase:

- Bonded
- Base-modified poly(5% diphenyl/95% dimethyl siloxane)

Temp. Limits:

- ≤0.32 mm I.D.: -60 °C to 320 °C (isothermal or programmed)
- ≥0.53 mm I.D., <2 µm: -60 °C to 320 °C (isothermal or programmed)
- ≥0.53 mm I.D., ≥2 µm: -60 °C to 260 °C (isothermal) or 280 °C (programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.50	30	125	24277	1 ea
	1.00	30	63	24330	1 ea
0.32	0.50	30	160	24331	1 ea
	1.00	30	80	24332	1 ea
	1.50	30	53	24333	1 ea
0.53	1.50	30	88	25438	1 ea
	3.00	30	44	25439	1 ea

SAC™-5 Capillary GC Column

Application: This column is an application specific non-polar column, designed for reproducible analyses of plant sterols, cholesterol, and other animal sterols.
USP Code: None
Phase:

- Bonded
- Poly(5% diphenyl/95% dimethyl siloxane)

Temp. Limits:

- -60 °C to 320 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24156	1 ea

Equity®-5 Capillary GC Column

Application: This popular column is designed for general purpose applications where a non-polar column is required. The low phenyl content provides thermal stability compared to 100% poly(dimethyl siloxane) columns.
USP Code: This column meets USP G27 and G36 requirements.
Phase:

- Bonded
- Poly(5% diphenyl/95% dimethyl siloxane)

Temp. Limits:

- ≤0.32 mm I.D., <2 µm: -60 °C to 325 °C (isothermal) or 350 °C (programmed)
- ≤0.32 mm I.D., ≥2 µm: -60 °C to 300 °C (isothermal or programmed)
- ≥0.53 mm I.D., <2 µm: -60 °C to 300 °C (isothermal) or 320 °C (programmed)
- ≥0.53 mm I.D., ≥2 µm: -60 °C to 260 °C (isothermal) or 280 °C (programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.10	15	250	28083-U	1 ea
0.20	0.20	30	250	28085-U	1 ea
	0.20	60	250	28086-U	1 ea
	0.33	12	152	28087-U	1 ea
0.25	0.25	15	250	28088-U	1 ea
	0.25	30	250	28089-U	1 ea
	0.25	60	250	28090-U	1 ea
	0.50	30	125	28092-U	1 ea
	1.00	15	63	28093-U	1 ea
	1.00	30	63	28094-U	1 ea
	1.00	60	63	28095-U	1 ea
0.32	0.25	15	320	28096-U	1 ea
	0.25	30	320	28097-U	1 ea
	0.25	60	320	28098-U	1 ea
	0.32	30	250	28099-U	1 ea
	0.50	30	160	28195-U	1 ea
	1.00	30	80	28199-U	1 ea
	1.00	60	80	28251-U	1 ea
0.53	0.50	15	265	28252-U	1 ea
	0.50	30	265	28259-U	1 ea
	0.50	60	265	28263-U	1 ea
	1.50	30	88	28267-U	1 ea
	3.00	30	44	28268-U	1 ea
	5.00	15	27	28278-U	1 ea
	5.00	30	27	28279-U	1 ea
	5.00	60	27	28293-U	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Columns by Phase Polarity: *Non-Polar*

SPB®-5 Capillary GC Column

Application: This non-polar general purpose column provides primarily a boiling point elution order with a slight increase in selectivity, especially for aromatic compounds.
USP Code: This column meets USP G27 and G36 requirements.
Phase:

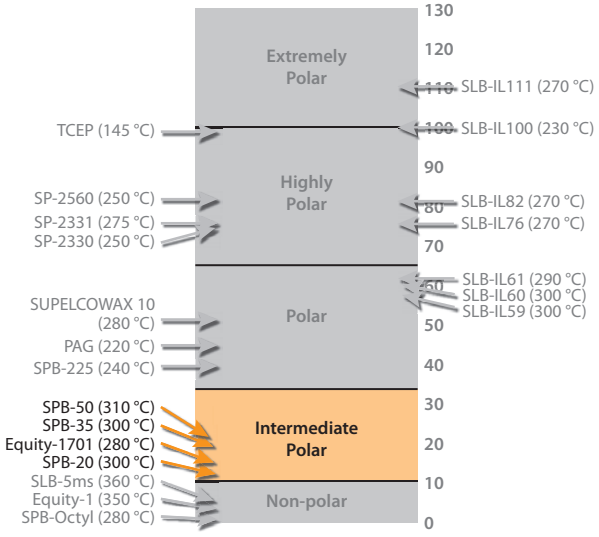
- Bonded
- Poly(5% diphenyl/95% dimethyl siloxane)

Temp. Limits:

- ≤0.32 mm I.D., <2 µm: -60 °C to 320 °C (isothermal or programmed)
- ≤0.32 mm I.D., ≥2 µm: -60 °C to 300 °C (isothermal or programmed)
- ≥0.53 mm I.D., <2 µm: -60 °C to 300 °C (isothermal) or 320 °C (programmed)
- ≥0.53 mm I.D., ≥2 µm: -60 °C to 260 °C (isothermal) or 280 °C (programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.20	0.20	15	250	24165-U	1 ea
	0.20	30	250	24166	1 ea
0.25	0.25	15	250	24032	1 ea
	0.25	30	250	24034	1 ea
	0.25	60	250	24036	1 ea
	1.00	15	63	24033	1 ea
	1.00	30	63	24035	1 ea
	1.00	60	63	24037	1 ea
0.32	0.25	15	320	24101-U	1 ea
	0.25	30	320	24048	1 ea
	0.25	60	320	24050	1 ea
	0.52	25	154	24359	1 ea
	1.00	15	80	24100-U	1 ea
	1.00	30	80	24049	1 ea
	1.00	60	80	24051	1 ea
	5.00	50	16	23307-U	1 ea
0.53	0.50	15	265	25316	1 ea
	0.50	30	265	25317	1 ea
	0.50	60	265	25383	1 ea
	1.00	30	133	25420-U	1 ea
	1.50	15	88	25304	1 ea
	1.50	30	88	25305-U	1 ea
	1.50	60	88	25389	1 ea
	3.00	15	44	25342	1 ea
	3.00	30	44	25343	1 ea
	3.00	60	44	25350	1 ea
	5.00	15	27	25346	1 ea
	5.00	30	27	25347	1 ea
	5.00	60	27	25351	1 ea

Intermediate Polarity



Intermediate polar GC columns are made with phases that incorporate both non-polar and polar elements. Thus, they are commonly used to provide alternate selectivity to non-polar and polar columns. Elution order is determined by differences in the overall effects of possible interactions.

- Interactions are strongly dispersive (van der Waals forces). The greater the phenyl content of the phase, the stronger the interactions.
- Phases with phenyl functional groups can also undergo π-π, dipole-dipole, and dipole-induced dipole interactions. The greater the phenyl content, the stronger these interactions.
- Phases with cyanopropyl functional groups can also undergo strong dipole-dipole and moderate basic interactions. The greater the cyanopropyl content, the greater these interactions.

SPB®-624 Capillary GC Column

Application: This column is specially tested for separation, efficiency, and low bleed. It is designed for purge-and-trap analyses of volatile halogenated, non-halogenated, and aromatic contaminants from environmental samples.
USP Code: This column meets USP G43 requirements.
Phase:

- Bonded
- Proprietary

Temp. Limits:

- ≤0.32 mm I.D.: Subambient to 250 °C (isothermal or programmed)
- ≥0.53 mm I.D.: Subambient to 230 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.18	1.00	20	45	28662-U	1 ea
0.25	1.40	30	45	24255	1 ea
	1.40	60	45	24256	1 ea
0.32	1.80	30	44	23323-U	1 ea
	1.80	60	44	24251	1 ea
0.53	3.00	30	44	25430	1 ea
	3.00	60	44	28663-U	1 ea
	3.00	75	44	25432	1 ea
	3.00	105	44	28664-U	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Columns by Phase Polarity*Intermediate Polarity*

OVI-G43 Capillary GC Column

Application: This column is specially prepared and tested to meet the requirements of United States Pharmacopoeia and European Pharmacopoeia methods for determining residual solvents in pharmaceutical preparations.
USP Code: This column meets USP G43 requirements.
Phase:

- Bonded
- Poly(6% cyanopropylphenyl/94% dimethyl siloxane)

Temp. Limits:

- -20 °C to 260 °C (isothermal or programmed)

Note: To make a 5 m x 0.53 mm I.D. guard column, use P/N **25339** (fused silica tubing), P/N **23804** (butt connector body), and P/N **22591** (double-tapered ferrule).

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.53	3.00	30	44	25396	1 ea

VOCOL® Capillary GC Column

Application: This intermediate polarity column, designed for analyses of volatile organic compounds (VOCs), offers great retention and resolution of highly volatile compounds. Use this column in direct injection ports or coupled to purge and trap systems.
USP Code: None
Phase:

- Bonded
- Proprietary

Temp. Limits:

- ≤0.32 mm I.D., <2 µm: Subambient to 250 °C (isothermal or programmed)
- ≤0.32 mm I.D., ≥2 µm: Subambient to 230 °C (isothermal or programmed)
- ≥0.53 mm I.D., <2 µm: Subambient to 250 °C (isothermal or programmed)
- ≥0.53 mm I.D., ≥2 µm: Subambient to 230 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.18	1.00	20	45	28463-U	1 ea
0.20	1.20	10	42	24129-U	1 ea
0.25	1.50	30	42	24205-U	1 ea
	1.50	60	42	24154	1 ea
0.32	1.80	30	44	28464-U	1 ea
	1.80	60	44	24217-U	1 ea
	3.00	60	27	24157	1 ea
0.53	3.00	30	44	25320-U	1 ea
	3.00	60	44	25381	1 ea
	3.00	105	44	25358	1 ea
0.75	1.50	60	125	23313-U	1 ea

SPB®-20 Capillary GC Column

Application: This column has intermediate polarity due to the higher (20%) phenyl content, producing a different elution order of polar compounds for confirmational information. It is often used for analyses of aromatic analytes.
USP Code: This column meets USP G32 requirements.
Phase:

- Bonded
- Poly(20% diphenyl/80% dimethyl siloxane)

Temp. Limits:

- -25 °C to 300 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24086	1 ea
	0.25	60	250	24087-U	1 ea
	1.00	30	63	24196-U	1 ea
0.32	0.25	30	320	24088	1 ea
	1.00	60	80	24194-U	1 ea
0.53	0.50	30	265	25329-U	1 ea
	1.00	15	133	28569-U	1 ea
	1.00	30	133	25333	1 ea

Equity®-1701 Capillary GC Column

Application: Increased phase polarity, due to cyanopropylphenyl functional group substitution, offers unique selectivity compared to other phases. This column works well with systems employing ECD, NPD, and MSD detectors, and is often used for alcohols, oxygenates, pharmaceuticals, pesticides, and PCB applications.
USP Code: This column meets G46 requirements
Phase:

- Bonded
- Poly(14% cyanopropylphenyl/86% dimethyl siloxane)

Temp. Limits:

- ≤0.32 mm I.D.: Subambient to 280 °C (isothermal or programmed)
- ≥0.53 mm I.D.: Subambient to 260 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.10	15	250	28343-U	1 ea
0.25	0.25	15	250	28371-U	1 ea
	0.25	30	250	28372-U	1 ea
	0.25	60	250	28373-U	1 ea
	1.00	15	63	28374-U	1 ea
	1.00	30	63	28378-U	1 ea
	1.00	60	63	28379-U	1 ea
0.32	0.25	30	320	28382-U	1 ea
	0.25	60	320	28384-U	1 ea
	1.00	30	80	28387-U	1 ea
	1.00	60	80	28388-U	1 ea
0.53	0.50	30	265	28391-U	1 ea
	1.00	15	133	28393-U	1 ea
	1.00	30	133	28394-U	1 ea
	1.50	30	88	28396-U	1 ea

SPB®-608 Capillary GC Column

Application: This column is specially tested with low concentrations of 18 chlorinated pesticides, using an ECD detector. In addition to selectivity and efficiency, it is also tested to ensure minimum breakdown of 4,4'-DDT and endrin. This column is also suitable for use in herbicide analyses.
USP Code: None
Phase:

- Bonded
- Proprietary

Temp. Limits:

- Subambient to 300 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24103-U	1 ea
	0.25	60	250	23314-U	1 ea
0.53	0.50	15	265	25310-U	1 ea
	0.50	30	265	25312	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Columns by Phase Polarity*Intermediate Polarity*

Sup-Herb™ Capillary GC Column

Application: This is a specially tested intermediate polarity column for analyses of herbicides, specifically for US EPA Method 507.
USP Code: None
Phase:

- Bonded
- Proprietary

Temp. Limits:

- Subambient to 300 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.53	0.50	15	265	25322	1 ea

SPB®-35 Capillary GC Column

Application: With a phenyl content of 35%, this column offers a higher polarity option compared to columns containing a lower phenyl content. This column is useful for analyses of polar compounds because they are retained longer relative to non-polar compounds.
USP Code: This column meets USP G42 requirements.
Phase:

- Bonded
- Poly(35% diphenyl/65% dimethyl siloxane)

Temp. Limits:

- 0 °C to 300 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24092	1 ea
	0.25	60	250	28568-U	1 ea
0.32	0.25	30	320	24094	1 ea
0.53	0.50	30	265	25331	1 ea
	1.00	30	133	25335	1 ea

SPB®-50 Capillary GC Column

Application: This column has the highest phenyl content of the common phenyl-containing series of phases. The column is useful for analyses of polar analytes and provides useful confirmational information. It also offers additional selectivity for polynuclear aromatic hydrocarbon isomers over columns with lower phenyl content.
USP Code: This column meets USP G3 requirements.
Phase:

- Bonded
- Poly(50% diphenyl/50% dimethyl siloxane)

Temp. Limits:

- 30 °C to 310 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24181	1 ea
0.32	0.25	30	320	24187	1 ea
0.53	0.50	30	265	25363	1 ea

SP™-2250 Capillary GC Column

Application: The SP-2250 column is a non-bonded 50% phenyl polymer. It is highly effective for the analysis of polar compounds.
USP Code: This column meets USP G3 requirements.
Phase:

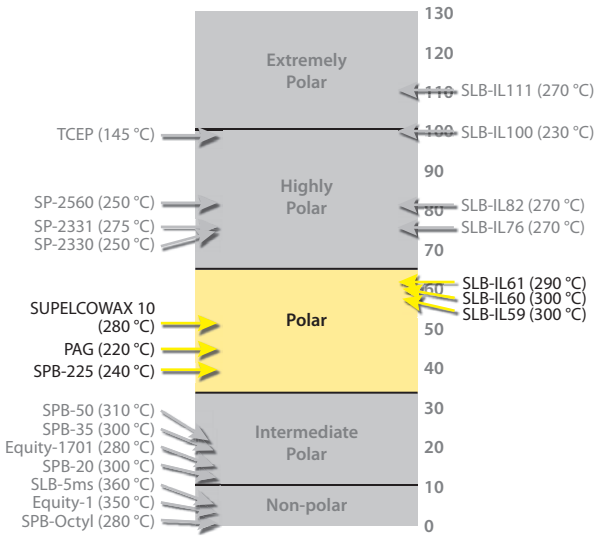
- Non-bonded
- Poly(50% phenyl/50% methyl siloxane)

Temp. Limits:

- 0 °C to 250 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.20	15	313	24009	1 ea
	0.20	30	313	24010	1 ea

Polar



Polar GC columns are made using polar stationary phases, the most common being polyethylene glycol and modified versions. These columns are commonly used to separate polar analytes (such as alcohols, amines, carboxylic acids, diols, esters, ethers, ketones, and thiols) that contain 1) primarily carbon and hydrogen atoms, and 2) also some bromine, chlorine, fluorine, nitrogen, oxygen, phosphorus, and/or sulfur atoms. Elution order is determined by differences in the overall effects of possible interactions.

- Dispersive (van der Waals forces), π-π, dipole-dipole, and dipole-induced dipole interactions are all strong with these columns.
- Moderate amounts of hydrogen bonding and basic interactions are also possible.
- SPB-1000 and Nukol columns are specially-engineered to also allow strong acidic interactions.
- Carbowax amine columns are specially-engineered to also allow strong basic interactions.

SPB®-225 Capillary GC Column

Application: Supelco offers the broadest range of cyanopropyl columns in the industry, such as this intermediate polarity column.
USP Code: This column meets USP G7 and G19 requirements.
Phase:

- Bonded
- Poly(50% cyanopropylphenyl/50% dimethyl siloxane)

Temp. Limits:

- 45 °C to 220 °C (isothermal) or 240 °C (programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.15	30	417	24334	1 ea
	0.25	15	250	23329-U	1 ea
	0.25	30	250	24335	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Columns by Phase Polarity*Polar*

SPB®-PUFA Capillary GC Column

Application: This column provides the necessary polarity for analyses of polyunsaturated fatty acids (PUFAs) as fatty acid methyl esters (FAME). This column is specifically tuned to provide highly reproducible analyses.
USP Code: This column meets USP G18 requirements.
Phase:

- Bonded
- Poly(alkylene glycol)

Temp. Limits:

- 50 °C to 220 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.20	30	313	24314	1 ea
0.32	0.20	30	400	24323	1 ea

PAG Capillary GC Column

Application: This column fills the polarity space between a 50% phenyl substituted column and a classical wax-type column, due to its polarity being slightly lower than a wax-type column. It is well suited for analyses of alcohols.
USP Code: This column meets USP G18 requirements.
Phase:

- Bonded
- Poly(alkylene glycol)

Temp. Limits:

- 30 °C to 220 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24223	1 ea
0.32	0.25	30	320	24226	1 ea
0.53	0.50	30	265	25423-U	1 ea

SPB®-1000 Capillary GC Column

Application: The incorporation of acid functional groups into the phase lends an acidic character to this column, useful for analyses of volatile acidic compounds. It offers great performance for analyses of glycols. It is the recommended column for ethylene glycol analysis.
USP Code: This column meets USP G25 and G35 requirements.
Phase:

- Bonded
- Acid-modified poly(ethylene glycol)

Temp. Limits:

- 60 °C to 200 °C (isothermal) or 220 °C (programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24313	1 ea
0.32	0.25	30	320	24315	1 ea
0.53	0.50	30	265	25445	1 ea

Nukol™ Capillary GC Column

Application: The incorporation of acid functional groups into the phase lends an acidic character to this column, useful for analyses of volatile acidic compounds. Difficult to analyze carboxylic acids (free fatty acids) can be analyzed with excellent peak shape and minimal adsorption.
USP Code: This column meets USP G25 and G35 requirements.
Phase:

- Bonded
- Acid-modified poly(ethylene glycol)

Temp. Limits:

- 60 °C to 200 °C (isothermal) or 220 °C (programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	15	250	24106-U	1 ea
	0.25	30	250	24107	1 ea
	0.25	60	250	24108	1 ea
0.32	0.25	15	320	24130	1 ea
	0.25	30	320	24131	1 ea
	0.25	60	320	24132	1 ea
	1.00	15	80	24206-U	1 ea
	1.00	30	80	24207	1 ea
	1.00	60	80	24208	1 ea
0.53	0.50	15	265	25326	1 ea
	0.50	30	265	25327	1 ea
	0.50	60	265	25386	1 ea

Carbowax® Amine Capillary GC Column

Application: This specially prepared base-deactivated column is designed for analyses of primary, secondary, and tertiary amines, as well as other volatile basic compounds.
USP Code: None.
Phase:

- Non-bonded
- Base-modified poly(ethylene glycol)

Temp. Limits:

- 60 °C to 200 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.53	1.00	15	133	25352	1 ea
	1.00	30	133	25353	1 ea
	1.00	60	133	25354	1 ea

Omegawax® Capillary GC Column

Application: This column allows highly reproducible analyses of fatty acid methyl esters (FAMEs), specifically the omega 3 and omega 6 fatty acids. It is tested to ensure reproducible FAME equivalent chain length (ECL) values and resolution of key components.
USP Code: This column meets USP G16 requirements.
Phase:

- Bonded
- Poly(ethylene glycol)

Temp. Limits:

- 50 °C to 280 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.10	15	250	23399-U	1 ea
0.25	0.25	30	250	24136	1 ea
0.32	0.25	30	320	24152	1 ea
0.53	0.50	30	265	25374	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Columns by Phase Polarity*Polar*

SUPELCOWAX® 10 Capillary GC Column

Application: This column is based on one of the most widely used polar phases, Carbowax 20M, and is a polar column suitable for analyses of solvents, fatty acid methyl esters (FAMEs), food, flavor and fragrance compounds, alcohols, and aromatics. Additionally, this column is a great choice when a polar general purpose column is required.
USP Code: This column meets USP G16 requirements.
Phase:

- Bonded
- Poly(ethylene glycol)

Temp. Limits:

- ≤0.32 mm I.D.: 35 °C to 280 °C (isothermal or programmed)
- ≥0.53 mm I.D., <2 µm: 35 °C to 280 °C (isothermal or programmed)
- ≥0.53 mm I.D., ≥2 µm: 35 °C to 250 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.10	5	250	25025-U	1 ea
	0.10	10	250	25026-U	1 ea
	0.10	15	250	24343	1 ea
0.20	0.20	30	250	24169	1 ea
	0.20	60	250	24170	1 ea
0.25	0.25	15	250	24077	1 ea
	0.25	30	250	24079	1 ea
	0.25	60	250	24081	1 ea
	0.25	100	250	23308-U	1 ea
	0.50	30	125	24284	1 ea
	0.50	60	125	24285-U	1 ea
0.32	0.25	15	320	24078	1 ea
	0.25	30	320	24080-U	1 ea
	0.25	60	320	24082	1 ea
	0.50	15	160	24083	1 ea
	0.50	30	160	24084	1 ea
	0.50	60	160	24085-U	1 ea
	1.00	30	80	24211	1 ea
	1.00	60	80	24212	1 ea
0.53	0.50	15	265	25324	1 ea
	0.50	30	265	25325	1 ea
	0.50	60	265	25385	1 ea
	1.00	15	133	25300-U	1 ea
	1.00	30	133	25301-U	1 ea
	1.00	60	133	25391	1 ea
	2.00	30	66	25375-U	1 ea
	2.00	60	66	25376	1 ea
0.75	1.00	30	188	23327-U	1 ea

NEW PRODUCTS

SLB®-IL59 Capillary GC Column

Application: This polar ionic liquid column has a polarity/selectivity similar to that of polyethylene glycol (PEG) columns (usually have 'wax' in the product name), but with a higher maximum temperature (300 °C compared to 270-280 °C). This increased temperature allows faster analyses to be achieved and/or additional analytes with higher boiling points to be analyzed. This combination of a high thermal limit and an orthogonal selectivity to non-polar columns also makes it a good GCxGC column choice. Launched in 2009.
USP Code: None
Phase:

- Non-bonded
- 1,12-Di(tripropylphosphonium)dodecane bis(trifluoromethylsulfonyl)imide

Temp. Limits:

- Subambient to 300 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.08	15	313	28880-U	1 ea
0.25	0.20	30	313	28891-U	1 ea

NEW PRODUCTS

SLB®-IL60 Capillary GC Column

Application: The SLB-IL60 polar ionic liquid column has a polarity/selectivity similar to that of polyethylene glycol (PEG) columns (usually have 'wax' in the product name), but different enough to provide a unique elution pattern. It also has a higher maximum temperature of 300 °C, compared to 250-280 °C for most PEG columns. These features make it an excellent alternative to existing 'wax' columns. The combination of a high thermal limit and an orthogonal selectivity to non-polar columns also makes it a good GCxGC column choice. Launched in 2012.
USP Code: None
Phase:

- Non-bonded
- 1,12-Di(tripropylphosphonium)dodecane bis(trifluoromethylsulfonyl)imide

Temp. Limits:

- 35 °C to 300 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.20	30	313	29505-U	1 ea

NEW PRODUCTS

SLB®-IL61 Capillary GC Column

Application: This polar column, the first of our third generation ionic liquid columns, has a polarity/selectivity close to that of the SLB-IL59 due to structural similarities. This column has a polarity/selectivity similar to that of polyethylene glycol (PEG) columns (usually have 'wax' in the product name), but with a higher maximum temperature (290 °C compared to 270-280 °C). Launched in 2010.
USP Code: None
Phase:

- Non-bonded
- 1,12-Di(tripropylphosphonium)dodecane bis(trifluoromethylsulfonyl)imide trifluoromethylsulfonate

Temp. Limits:

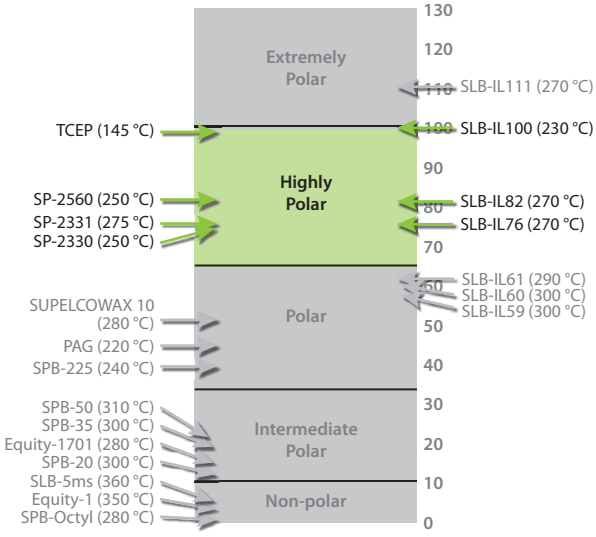
- 40 °C to 290 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.08	15	313	29484-U	1 ea
0.25	0.20	30	313	29486-U	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Columns by Phase Polarity: *Highly Polar*

Highly Polar



Highly polar GC columns are made with very selective GC stationary phases, typically containing high percentages of cyanopropyl functional groups. They are commonly used to analyze polarizable compounds (such as alkenes, alkynes, and aromatic hydrocarbons) that contain 1) only carbon and hydrogen atoms, and 2) some double and/or triple bonds between carbon atoms. Elution order is determined by differences in the overall effects of possible interactions.

- Strong dispersive (van der Waals forces), very strong dipole-dipole, very strong dipole-induced dipole, and moderate basic interactions are possible. The greater the cyanopropyl content of the phase, the greater these interactions.

SP™-2330 Capillary GC Column

Application: Supelco offers the broadest range of biscyanopropyl phases in the industry. This column is a highly specialized column that offers both polar and polarizable features due to the substitution of biscyanopropyl and phenyl groups onto the polymer backbone. It can be used for both high and low temperature separations for analytes such as geometric isomers of fatty acid methyl esters (FAMEs), dioxins, and aromatic compounds.
USP Code: This column meets USP G8 requirements.
Phase:

- Non-bonded
- Poly(80% biscyanopropyl/20% cyanopropylphenyl siloxane)

Temp. Limits:

- Subambient to 250 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.20	15	313	24018	1 ea
	0.20	30	313	24019	1 ea
	0.20	60	313	24020-U	1 ea
0.32	0.20	30	400	24073	1 ea
	0.20	60	400	24074	1 ea
0.75	0.20	30	938	23328-U	1 ea

NEW PRODUCTS

SLB®-IL76 Capillary GC Column

Application: This highly polar column was the first of our second generation ionic liquid columns. It is engineered with a phase structure that allows numerous analyte solvation interactions that are not possible with other columns (non-ionic liquid columns as well as ionic liquid columns), resulting in selectivity differences even when compared to columns with similar GC column polarity scale values. Launched in 2009.
USP Code: None
Phase:

- Non-bonded
- Tri(tripropylphosphoniumhexanamido)triethylamine bis(trifluoromethyl-sulfonyl)imide

Temp. Limits:

- Subambient to 270 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.08	15	313	28909-U	1 ea
0.25	0.20	30	313	28913-U	1 ea

SP™-2331 Capillary GC Column

Application: A highly polar cyanosiloxane column specially tested for analyses of dioxins, specifically tetrachlorodibenzodioxin (TCDD) isomers. Because the phase is stabilized, it has a maximum temperature slightly higher than non-bonded cyanosiloxane columns.
USP Code: None
Phase:

- Stabilized
- Proprietary

Temp. Limits:

- Subambient to 275 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.20	30	313	24257	1 ea
	0.20	60	313	24104-U	1 ea
0.32	0.20	60	400	24105-U	1 ea

SP™-2380 Capillary GC Column

Application: A highly polar cyanosiloxane column commonly used for separation of geometric (cis/trans) fatty acid methyl ester (FAME) isomers as a group. Also useful when a highly polar general purpose column with good thermal stability is required.
USP Code: This column meets USP G48 requirements.
Phase:

- Stabilized
- Poly(90% biscyanopropyl/10% cyanopropylphenyl siloxane)

Temp. Limits:

- Subambient to 275 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.20	15	313	24109	1 ea
	0.20	30	313	24110-U	1 ea
	0.20	60	313	24111	1 ea
	0.20	100	313	24317	1 ea
0.32	0.20	30	400	24116-U	1 ea
	0.20	60	400	24117	1 ea
0.53	0.20	30	663	25319	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Columns by Phase Polarity: *Highly Polar*

SP™-2560 Capillary GC Column

Application: This highly polar biscyanopropyl column was specifically designed for detailed separation of geometricpositional (cis/trans) isomers of fatty acid methyl esters (FAMEs). It is extremely effective for FAME isomer applications.
USP Code: This column meets USP G5 requirements.
Phase:

- Non-bonded
- Poly(biscyanopropyl siloxane)

Temp. Limits:

- Subambient to 250 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.18	0.14	75	321	23348-U	1 ea
0.25	0.20	100	313	24056	1 ea
	0.20	100	313	23362-U	1 ea

Note: P/N **23362-U** is wound on a 5" cage designed to fit an Agilent 6850 GC.

SP™-2340 Capillary GC Column

Application: This non-bonded column offers the highest polarity in its class. As with all general purpose biscyanopropyl columns, it is highly effective for both high and low temperature separations of geometric isomers of fatty acid methyl esters (FAMEs), dioxins, carbohydrates, and aromatic compounds.
USP Code: This column meets USP G5 requirements.
Phase:

- Non-bonded
- Poly(biscyanopropyl siloxane)

Temp. Limits:

- Subambient to 250 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.20	15	313	24021	1 ea
	0.20	30	313	24022	1 ea
	0.20	60	313	24023	1 ea
0.32	0.20	30	400	24075	1 ea
	0.20	60	400	24076	1 ea

NEW PRODUCTS

SLB®-IL82 Capillary GC Column

Application: This highly polar ionic liquid column is most similar in polarity to non-ionic liquid columns that contain a polysiloxane phase with a high percentage of cyanopropyl pendent groups. It provides an alternate selectivity to these cyanopropyl siloxane columns, and is less susceptible to damage from oxygen/moisture. Launched in 2010.
USP Code: None
Phase:

- Non-bonded
- 1,12-Di(2,3-dimethylimidazolium)dodecane bis(trifluoromethylsulfonyl) imide

Temp. Limits:

- 50 °C to 270 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.08	15	313	29477-U	1 ea
0.25	0.25	30	313	29479-U	1 ea

TCEP Capillary GC Column

Application: The unique chemistry of the phase allows for specialized separations. It is often used for analyses of alcohols and aromatics in mineral spirits, aliphatic constituents in gasoline, impurities in individual aromatics, and oxygenates.
USP Code: None
Phase:

- Non-bonded
- 1,2,3-tris(2-cyanoethoxy)propane

Temp. Limits:

- Subambient to 145 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.44	60	142	24153	1 ea
0.32	0.51	60	157	24161	1 ea

SLB®-IL100 Capillary GC Column

Application: This highly polar column was the world's first commercially available ionic liquid GC column. It serves as the benchmark of 100 on our GC column polarity scale. Compared to a TCEP column (almost identical polarity/selectivity), the SLB-IL100 is more thermally stable, plus more resistant to damage from moisture/oxygen. Launched in 2008.
USP Code: None
Phase:

- Non-bonded
- 1,9-Di(3-vinylimidazolium)nonane bis(trifluoromethylsulfonyl)imide

Temp. Limits:

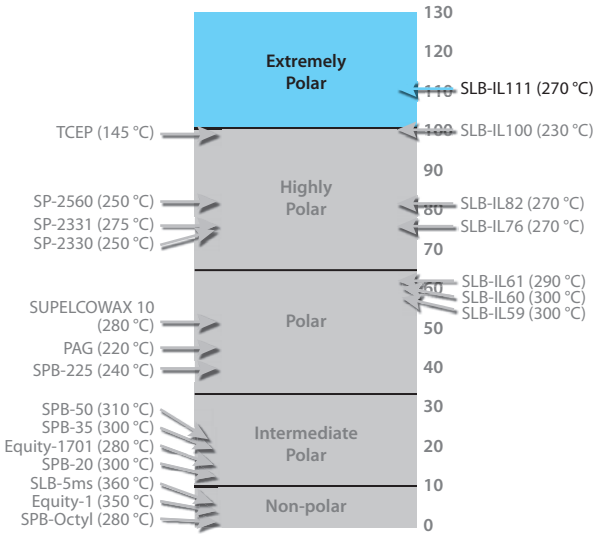
- Subambient to 230 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.08	15	313	28882-U	1 ea
0.18	0.14	20	313	28883-U	1 ea
0.25	0.20	30	313	28884-U	1 ea
	0.20	60	313	28886-U	1 ea
0.32	0.26	30	313	28887-U	1 ea
	0.26	60	313	28888-U	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Columns by Phase Polarity: *Extremely Polar*

Extremely Polar



Extremely polar GC columns are made with the most selective of the GC stationary phases. They are commonly used to provide alternative selectivity of polarizable compounds. Another use is in GCxGC applications due to their orthogonal selectivity to non-polar columns. Elution order is determined by differences in the overall effects of possible interactions.

- Strong dispersive (van der Waals forces), very strong dipole-dipole, very strong dipole-induced dipole, and moderate basic interactions are possible.

NEW PRODUCTS

SLB®-IL111 Capillary GC Column

Application: This extremely polar ionic liquid column was the world's first commercial column to rate over 100 on our GC column polarity scale. It has very orthogonal selectivity compared to commonly used non-polar and intermediate polar columns, providing increased selectivity for polar and polarizable analytes. Its temperature limit of 270 °C is very impressive for such an extremely polar column. The 60 m version is excellent at resolving benzene and other aromatics in gasoline. The 100 m version is suitable for detailed cis/trans FAME isomer analysis, and is a great complementary column to the SP-2560. Launched in 2010.
USP Code: None
Phase:

- Non-bonded
- 1,5-Di(2,3-dimethylimidazolium)pentane bis(trifluoromethylsulfonyl)imide

Temp. Limits:

- 50 °C to 270 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.08	15	313	28925-U	1 ea
0.25	0.20	30	313	28927-U	1 ea
	0.20	60	313	28928-U	1 ea
	0.20	100	313	29647-U	1 ea

Ionic Liquid Columns

In 2005, Prof. Daniel W. Armstrong (University of Texas at Arlington) showed that dicationic and polycationic ionic liquids could successfully be used as viable GC stationary phases. These consist of two or more organic cations joined by a linkage, and associated with anions, which can be either inorganic or organic. Ionic liquid phases differ physically and chemically from non-ionic liquid stationary phases.

- They are much smaller compared to big, bulky polysiloxane polymer and polyethylene glycol phases, plus there are no active hydroxyl groups. These features lead to greater stability, even in the presence of moisture and/or oxygen.
- Many modifications are possible to alter selectivity. The base structure can be dicationic or polycationic. There are numerous cation, linkage, and anion choices. Pendant groups can be added to cations and/or linkages.

Ionic liquids have the opportunity to impact current practices along several paths:

- Columns can be engineered with **identical selectivity** to non-ionic liquid columns, but with higher operating temperatures and less susceptibility to damage from moisture and/or oxygen.
- Columns can be engineered with **completely unique selectivity** to non-ionic liquid columns, producing good peak shape and resolution for compounds of varying functionality.
- Columns can be used in **multidimensional separations**, due to their engineered orthogonality and high thermal stability.

NEW PRODUCTS

SLB®-IL59 Capillary GC Column

Application: This polar ionic liquid column has a polarity/selectivity similar to that of polyethylene glycol (PEG) columns (usually have 'wax' in the product name), but with a higher maximum temperature (300 °C compared to 270-280 °C). This increased temperature allows faster analyses to be achieved and/or additional analytes with higher boiling points to be analyzed. This combination of a high thermal limit and an orthogonal selectivity to non-polar columns also makes it a good GCxGC column choice. Launched in 2009.
USP Code: None
Phase:

- Non-bonded
- 1,12-Di(tripropylphosphonium)dodecane bis(trifluoromethylsulfonyl)imide

Temp. Limits:

- Subambient to 300 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.08	15	313	28880-U	1 ea
0.25	0.20	30	313	28891-U	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Ionic Liquid Columns

NEW PRODUCTS

SLB®-IL60 Capillary GC Column

Application: The SLB-IL60 polar ionic liquid column has a polarity/selectivity similar to that of polyethylene glycol (PEG) columns (usually have 'wax' in the product name), but different enough to provide a unique elution pattern. It also has a higher maximum temperature of 300 °C, compared to 250-280 °C for most PEG columns. These features make it an excellent alternative to existing 'wax' columns. The combination of a high thermal limit and an orthogonal selectivity to non-polar columns also makes it a good GCxGC column choice. Launched in 2012.
USP Code: None
Phase:

- Non-bonded
- 1,12-Di(tripropylphosphonium)dodecane bis(trifluoromethylsulfonyl)imide

Temp. Limits:

- 35 °C to 300 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.20	30	313	29505-U	1 ea

NEW PRODUCTS

SLB®-IL61 Capillary GC Column

Application: This polar column, the first of our third generation ionic liquid columns, has a polarity/selectivity close to that of the SLB-IL59 due to structural similarities. This column has a polarity/selectivity similar to that of polyethylene glycol (PEG) columns (usually have 'wax' in the product name), but with a higher maximum temperature (290 °C compared to 270-280 °C). Launched in 2010.
USP Code: None
Phase:

- Non-bonded
- 1,12-Di(tripropylphosphonium)dodecane bis(trifluoromethylsulfonyl)imide trifluoromethylsulfonate

Temp. Limits:

- 40 °C to 290 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.08	15	313	29484-U	1 ea
0.25	0.20	30	313	29486-U	1 ea

NEW PRODUCTS

SLB®-IL76 Capillary GC Column

Application: This highly polar column was the first of our second generation ionic liquid columns. It is engineered with a phase structure that allows numerous analyte solvation interactions that are not possible with other columns (non-ionic liquid columns as well as ionic liquid columns), resulting in selectivity differences even when compared to columns with similar GC column polarity scale values. Launched in 2009.
USP Code: None
Phase:

- Non-bonded
- Tri(tripropylphosphoniumhexanamido)triethylamine bis(trifluoromethylsulfonyl)imide

Temp. Limits:

- Subambient to 270 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.08	15	313	28909-U	1 ea
0.25	0.20	30	313	28913-U	1 ea

NEW PRODUCTS

SLB®-IL82 Capillary GC Column

Application: This highly polar ionic liquid column is most similar in polarity to non-ionic liquid columns that contain a polysiloxane phase with a high percentage of cyanopropyl pendent groups. It provides an alternate selectivity to these cyanopropyl siloxane columns, and is less susceptible to damage from oxygen/moisture. Launched in 2010.
USP Code: None
Phase:

- Non-bonded
- 1,12-Di(2,3-dimethylimidazolium)dodecane bis(trifluoromethylsulfonyl) imide

Temp. Limits:

- 50 °C to 270 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.08	15	313	29477-U	1 ea
0.25	0.25	30	313	29479-U	1 ea

SLB®-IL100 Capillary GC Column

Application: This highly polar column was the world's first commercially available ionic liquid GC column. It serves as the benchmark of 100 on our GC column polarity scale. Compared to a TCEP column (almost identical polarity/selectivity), the SLB-IL100 is more thermally stable, plus more resistant to damage from moisture/oxygen. Launched in 2008.
USP Code: None
Phase:

- Non-bonded
- 1,9-Di(3-vinylimidazolium)nonane bis(trifluoromethylsulfonyl)imide

Temp. Limits:

- Subambient to 230 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.08	15	313	28882-U	1 ea
0.18	0.14	20	313	28883-U	1 ea
0.25	0.20	30	313	28884-U	1 ea
	0.20	60	313	28886-U	1 ea
0.32	0.26	30	313	28887-U	1 ea
	0.26	60	313	28888-U	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Ionic Liquid Columns

NEW PRODUCTS

SLB®-IL111 Capillary GC Column

Application: This extremely polar ionic liquid column was the world's first commercial column to rate over 100 on our GC column polarity scale. It has very orthogonal selectivity compared to commonly used non-polar and intermediate polar columns, providing increased selectivity for polar and polarizable analytes. Its temperature limit of 270 °C is very impressive for such an extremely polar column. The 60 m version is excellent at resolving benzene and other aromatics in gasoline. The 100 m version is suitable for detailed cis/trans FAME isomer analysis, and is a great complementary column to the SP-2560. Launched in 2010.
USP Code: None
Phase:

- Non-bonded
- 1,5-Di(2,3-dimethylimidazolium)pentane bis(trifluoromethylsulfonyl)imide

Temp. Limits:

- 50 °C to 270 °C (isothermal or programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.08	15	313	28925-U	1 ea
0.25	0.20	30	313	28927-U	1 ea
	0.20	60	313	28928-U	1 ea
	0.20	100	313	29647-U	1 ea

MS-Grade Columns

SLBms columns are designed for GC and GC-MS analysts who require low bleed, inert, durable, and consistent capillary GC columns. SLBms columns will help your laboratory achieve low detection limits, easy mass spectral identification, less instrument downtime, great resolution, short analysis times, and long column life.

SLB®-5ms Capillary GC Column

Application: The 5% phenyl equivalent phase provides a boiling point elution order with a slight increase in selectivity, especially for aromatic compounds. The low bleed characteristics, inertness, and durable nature make it the column of choice for environmental analytes (such as semivolatiles, pesticides, PCBs, and herbicides) or anywhere a low bleed non-polar column is required.
USP Code: This column meets USP G27 and G36 requirements.
Phase:

- Bonded and highly crosslinked
- Silphenylene polymer virtually equivalent in polarity to poly(5% diphenyl/95% dimethyl siloxane)

Temp. Limits:

- ≤0.32 mm I.D.: -60 °C to 340 °C (isothermal) or 360 °C (programmed)
- ≥0.53 mm I.D.: -60 °C to 330 °C (isothermal) or 340 °C (programmed)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.10	0.10	10	250	28465-U	1 ea
	0.10	15	250	28466-U	1 ea
0.18	0.18	20	250	28564-U	1 ea
	0.30	12	150	28566-U	1 ea
	0.30	30	150	28575-U	1 ea
	0.36	20	125	28576-U	1 ea
0.20	0.20	30	250	28513-U	1 ea
0.25	0.10	30	625	28467-U	1 ea
	0.25	15	250	28469-U	1 ea
	0.25	30	250	28471-U	1 ea
	0.25	60	250	28472-U	1 ea
	0.50	15	125	28577-U	1 ea
	0.50	30	125	28473-U	1 ea
	0.50	60	125	28474-U	1 ea
	1.00	30	63	28476-U	1 ea
0.32	0.25	15	320	28557-U	1 ea
	0.25	30	320	28482-U	1 ea
	0.32	30	250	28532-U	1 ea
	0.50	15	160	28597-U	1 ea
	0.50	30	160	28484-U	1 ea
	1.00	30	80	28487-U	1 ea
0.53	0.50	30	265	28541-U	1 ea
	1.00	30	132	28559-U	1 ea

Fast GC Columns

Increase Sample Throughput without Sacrificing Quality

Analytical GC chemists are continually striving to reduce analysis times, because shorter analysis times increase sample throughput, which translates to the completion of more billable samples per shift. However, any decrease in analysis time must not diminish the resolution necessary to adequately resolve peaks of interest, and identify specific elution patterns. Applying the Principles of Fast GC to any application can achieve both objectives. A wide variety of columns are offered in Fast GC dimensions.

Special Purpose Columns

- **SPB-624**: For environmental volatiles. Maximum termperature of 250 °C (isothermal or programmed).
- **VOCOL**: For environmental volatiles. Maximum termperature of 250 °C (isothermal or programmed).
- **SLB-5ms**: For environmental semivolatiles, pesticides, and PCBs. Maximum termperature of 340 °C (isothermal) or 360 °C (programmed).
- **Equity-1701**: For environmental pesticides and PCBs. Maximum termperature of 280 °C (isothermal or programmed).
- **Omegawax**: For food and beverage omega 3 and omega 6 FAMEs. Maximum termperature of 280 °C (isothermal or programmed).
- **SP-2560**: For food and beverage cis/trans FAME isomers. Maximum termperature of 250 °C (isothermal or programmed).

I.D. (mm)	d_f (µm)	L (m)	Beta Value	Cat. No.	Qty
SPB®-624 Capillary GC Column					
0.18	1.00	20	45	28662-U	1 ea
VOCOL® Capillary GC Column					
0.18	1.00	20	45	28463-U	1 ea
SLB®-5ms Capillary GC Column					
0.10	0.10	10	250	28465-U	1 ea
	0.10	15	250	28466-U	1 ea
0.18	0.18	20	250	28564-U	1 ea
	0.30	12	150	28566-U	1 ea
	0.30	30	150	28575-U	1 ea
	0.36	20	125	28576-U	1 ea
Equity®-1701 Capillary GC Column					
0.10	0.10	15	250	28343-U	1 ea
Omegawax® Capillary GC Column					
0.10	0.10	15	250	23399-U	1 ea
SP™-2560 Capillary GC Column					
0.18	0.14	75	321	23348-U	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Fast GC Columns: *Ionic Liquid Columns*

Ionic Liquid Columns

- **SLB-IL59**: a polar column. Maximum termperature of 300 °C (isothermal or programmed).
- **SLB-IL61**: a polar column. Maximum termperature of 290 °C (isothermal or programmed).
- **SLB-IL76**: a highly polar column. Maximum termperature of 270 °C (isothermal or programmed).
- **SLB-IL82**: a highly polar column. Maximum termperature of 270 °C (isothermal or programmed).
- **SLB-IL100**: a highly polar column. Maximum termperature of 230 °C (isothermal or programmed).
- **SLB-IL111**: an extremely polar column. Maximum termperature of 270 °C (isothermal or programmed).

I.D. (mm)	d_f (µm)	L (m)	Beta Value	Cat. No.	Qty
SLB®-IL59 Capillary GC Column					
0.10	0.08	15	313	28880-U	1 ea
SLB®-IL61 Capillary GC Column					
0.10	0.08	15	313	29484-U	1 ea
SLB®-IL76 Capillary GC Column					
0.10	0.08	15	313	28909-U	1 ea
SLB®-IL82 Capillary GC Column					
0.10	0.08	15	313	29477-U	1 ea
SLB®-IL100 Capillary GC Column					
0.18	0.14	20	313	28883-U	1 ea
SLB®-IL111 Capillary GC Column					
0.10	0.08	15	313	28925-U	1 ea

General Purpose Columns

- **Equity-1**: For general purpose non-polar Fast GC applications. Maximum termperature of 325 °C (isothermal) or 350 °C (programmed).
- **Equity-5**: For general purpose non-polar Fast GC applications. Maximum termperature of 325 °C (isothermal) or 350 °C (programmed).
- **SUPELCOWAX 10**: For general purpose polar Fast GC applications. Maximum termperature of 280 °C (isothermal or programmed).

I.D. (mm)	d_f (µm)	L (m)	Beta Value	Cat. No.	Qty
Equity®-1 Capillary GC Column					
0.10	0.10	15	250	28039-U	1 ea
Equity®-5 Capillary GC Column					
0.10	0.10	15	250	28083-U	1 ea
SUPELCOWAX® 10 Capillary GC Column					
0.10	0.10	5	250	25025-U	1 ea
	0.10	10	250	25026-U	1 ea
	0.10	15	250	24343	1 ea

GCxGC Columns

GCxGC is one of the fastest growing areas in analytical chemistry. The level of detail it can provide cannot be equaled by any other chromatographic technique. It employs two columns in series, separated by a modulator. The role of the modulator is to collect fractions from the first column (often called the primary column, first dimension column, or 1° column) and focus them onto the second column (often called the secondary column, second dimension column, or 2° column). Primary columns tend to be 30 m x 0.25 mm I.D., whereas 1-2 m x 0.10 mm I.D. is common for secondary columns. Common detectors, including MS, can be used.

Column Selection Strategy

One key to the successful operation of GCxGC is that the two columns must have orthogonal selectivity, that is, they must utilize different retention mechanisms. The more different (more orthogonal), the better the overall performance will be. Two strategies can be used for GCxGC column selection to achieve orthogonal selectivity.

Non-Polar to Polar Strategy

Analytes are separated on a non-polar column in the first dimension, and on a polar column in the second dimension. This strategy is useful for complex samples, such as gasoline.

Polar to Non-Polar Strategy

Analytes are separated on a polar column in the first dimension, and on a non-polar column in the second dimension. This strategy is useful for complex samples, such as FAMEs.

Non-Polar Primary (1°) Columns

Non-polar GC columns are made with the least selective GC stationary phases. Interactions are primarily dispersive (van der Waals forces). Phases with phenyl functional groups can also undergo a moderate amount of π-π interactions. Elution order generally follows the boiling points of the analytes. Choices are:

- **SLB-5ms**: 5% phenyl, the best choice due to high temperature limits. Maximum temperature of 340 °C (isothermal) or 360 °C (programmed).
- **Equity-5**: alternative 5% phenyl choice. Maximum temperature of 325 °C (isothermal) or 350 °C (programmed).
- **SPB-5**: alternative 5% phenyl choice. Maximum temperature of 320 °C (isothermal or programmed).
- **PTA-5**: specially-engineered 5% phenyl for basic compounds. Maximum temperature of 320 °C (isothermal or programmed).
- **SAC-5**: specially-engineered 5% phenyl for sterols. Maximum temperature of 320 °C (isothermal or programmed).
- **Equity-1**: 100% methyl, provides less selectivity than obtained with a 5% phenyl. Maximum temperature of 325 °C (isothermal) or 350 °C (programmed).
- **SPB-1**: alternative 100% methyl choice. Maximum temperature of 320 °C (isothermal or programmed).

I.D. (mm)	d_f (µm)	L (m)	Beta Value	Cat. No.	Qty
SLB®-5ms Capillary GC Column					
0.25	0.10	30	625	28467-U	1 ea
	0.25	30	250	28471-U	1 ea
	0.50	30	125	28473-U	1 ea
Equity®-5 Capillary GC Column					
0.25	0.25	30	250	28089-U	1 ea
	0.50	30	125	28092-U	1 ea
SPB®-5 Capillary GC Column					
0.25	0.25	30	250	24034	1 ea
PTA-5 Capillary GC Column					
0.25	0.50	30	125	24277	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

GCxGC Columns*Non-Polar Primary (1°) Columns*

I.D. (mm)	d_f (µm)	L (m)	Beta Value	Cat. No.	Qty
SAC™-5 Capillary GC Column					
0.25	0.25	30	250	24156	1 ea
Equity®-1 Capillary GC Column					
0.25	0.10	30	625	28044-U	1 ea
	0.25	30	250	28046-U	1 ea
SPB®-1 Capillary GC Column					
0.25	0.10	30	625	24261	1 ea
	0.25	30	250	24028	1 ea

Polar Secondary (2°) Columns

Polar, highly polar, and extremely polar GC columns are made with very selective GC stationary phases. These include polyethylene glycol and ionic liquids. They are commonly used to analyze polarizable compounds (such as alkenes, alkynes, and aromatic hydrocarbons) that contain some double and/or triple bonds between carbon atoms. Dispersive (van der Waals forces), π-π, dipole-dipole, and dipole-induced dipole interactions are all strong with these columns. Moderate amounts of hydrogen bonding and basic interactions are also possible. Elution order is determined by differences in the overall effects of possible interactions. Choices are:

- **SUPELCOWAX 10**: polyethylene glycol phase, similar to the original polar phase used for GCxGC applications. Maximum temperature of 280 °C (isothermal or programmed).
- **SLB-IL59**: polar ionic liquid phase with a high temperature limit. Maximum temperature of 300 °C (isothermal or programmed).
- **SLB-IL61**: polar ionic liquid phase with improved inertness compared to the SLB-IL59. Maximum temperature of 290 °C (isothermal or programmed).
- **SLB-IL111**: extremely polar ionic liquid phase, most orthogonal phase to non-polar phases. Maximum temperature of 270 °C (isothermal or programmed).
- **SLB-IL76**: alternative ionic liquid phase. Maximum temperature of 270 °C (isothermal or programmed).
- **SLB-IL82**: alternative ionic liquid phase. Maximum temperature of 270 °C (isothermal or programmed).

I.D. (mm)	d_f (µm)	L (m)	Beta Value	Cat. No.	Qty
SUPELCOWAX® 10 Capillary GC Column					
0.10	0.10	5	250	25025-U	1 ea
	0.10	10	250	25026-U	1 ea
	0.10	15	250	24343	1 ea
SLB®-IL59 Capillary GC Column					
0.10	0.08	15	313	28880-U	1 ea
SLB®-IL61 Capillary GC Column					
0.10	0.08	15	313	29484-U	1 ea
SLB®-IL111 Capillary GC Column					
0.10	0.08	15	313	28925-U	1 ea
SLB®-IL76 Capillary GC Column					
0.10	0.08	15	313	28909-U	1 ea
SLB®-IL82 Capillary GC Column					
0.10	0.08	15	313	29477-U	1 ea

Polar Primary (1°) Columns

Polar, highly polar, and extremely polar GC columns are made with very selective GC stationary phases. These include polyethylene glycol, ionic liquids, and polysiloxane polymers with cyanopropyl functional groups. They are commonly used to analyze polarizable compounds (such as alkenes, alkynes, and aromatic hydrocarbons) that contain some double and/or triple bonds between carbon atoms. Dispersive (van der Waals forces), π-π, dipole-dipole, and dipole-induced dipole interactions are all strong with these columns. Moderate amounts of hydrogen bonding and basic interactions are also possible. Elution order is determined by differences in the overall effects of possible interactions. Choices are:

- **SUPELCOWAX 10**: polyethylene glycol phase, similar to the original polar phase used for GCxGC applications. Maximum temperature of 280 °C (isothermal or programmed).
- **SLB-IL60**: most inert polar ionic liquid phase with a high temperature limit. Maximum temperature of 300 °C (isothermal or programmed).
- **SLB-IL59**: polar ionic liquid phase with a high temperature limit. Maximum temperature of 300 °C (isothermal or programmed).
- **SLB-IL61**: polar ionic liquid phase with improved inertness compared to the SLB-IL59. Maximum temperature of 290 °C (isothermal or programmed).
- **SLB-IL111**: extremely polar ionic liquid phase, most orthogonal phase to non-polar phases. Maximum temperature of 270 °C (isothermal or programmed).
- **SP-2380**: highly polar cyanopropyl siloxane phase commonly used for FAME separations. Maximum temperature is 275 °C (isothermal or programmed).
- **SLB-IL76**: alternative ionic liquid phase. Maximum temperature of 270 °C (isothermal or programmed).
- **SLB-IL82**: alternative ionic liquid phase. Maximum temperature of 270 °C (isothermal or programmed).
- **SP-2331**: alternative highly polar cyanopropyl siloxane phase. Maximum temperature is 275 °C (isothermal or programmed).

I.D. (mm)	d_f (µm)	L (m)	Beta Value	Cat. No.	Qty
SUPELCOWAX® 10 Capillary GC Column					
0.25	0.25	30	250	24079	1 ea
	0.50	30	125	24284	1 ea
SLB®-IL60 Capillary GC Column					
0.25	0.20	30	313	29505-U	1 ea
SLB®-IL59 Capillary GC Column					
0.25	0.20	30	313	28891-U	1 ea
SLB®-IL61 Capillary GC Column					
0.25	0.20	30	313	29486-U	1 ea
SLB®-IL111 Capillary GC Column					
0.25	0.20	30	313	28927-U	1 ea
SP™-2380 Capillary GC Column					
0.25	0.20	30	313	24110-U	1 ea
SLB®-IL76 Capillary GC Column					
0.25	0.20	30	313	28913-U	1 ea
SLB®-IL82 Capillary GC Column					
0.25	0.25	30	313	29479-U	1 ea
SP™-2331 Capillary GC Column					
0.25	0.20	30	313	24257	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

GCxGC Columns: *Non-Polar Secondary (2°) Columns*

Non-Polar Secondary (2°) Columns

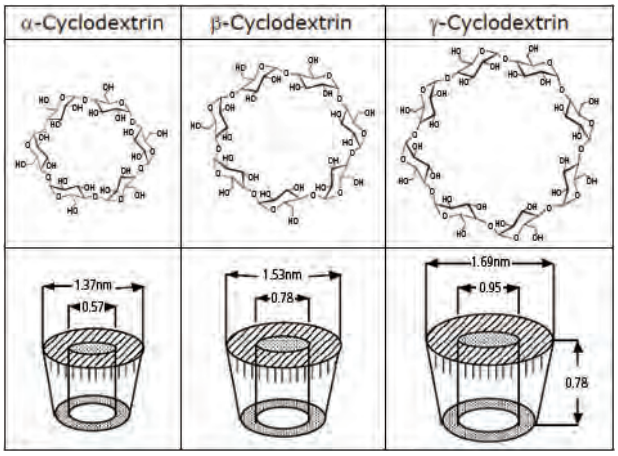
Non-polar GC columns are made with the least selective GC stationary phases. Interactions are primarily dispersive (van der Waals forces). Phases with phenyl functional groups can also undergo a moderate amount of π-π interactions. Elution order generally follows the boiling points of the analytes. Choices are:

- **SLB-5ms**: 5% phenyl, the best choice due to high temperature limits. Maximum temperature of 340 °C (isothermal) or 360 °C (programmed).
- **Equity-5**: alternative 5% phenyl choice. Maximum temperature of 325 °C (isothermal) or 350 °C (programmed).
- **Equity-1**: 100% methyl, provides less selectivity than obtained with a 5% phenyl. Maximum temperature of 325 °C (isothermal) or 350 °C (programmed).

I.D. (mm)	d_f (µm)	L (m)	Beta Value	Cat. No.	Qty
SLB®-5ms Capillary GC Column					
0.10	0.10	10	250	28465-U	1 ea
	0.10	15	250	28466-U	1 ea
Equity®-5 Capillary GC Column					
0.10	0.10	15	250	28083-U	1 ea
Equity®-1 Capillary GC Column					
0.10	0.10	15	250	28039-U	1 ea

Chiral Columns

GC columns that employ a chiral stationary phase (CSP) are suitable for enantiomer separations. We offer two cyclodextrin-based column lines, **Astec CHIRALDEX®** and **Supelco DEX**. Cyclodextrins are macromolecules composed of 6 or more D(+)-glucose residues bonded through α-glycosidic linkages. They are classified according to the number of glucose residues they contain: α-cyclodextrins contain six residues, β-cyclodextrins contain seven residues, and γ-cyclodextrins contain eight residues. All hydroxyl groups, whether at the 2, 3 or 6 position of each residue, can be selectively modified with a derivative to impart unique selectivities. Without derivatization, no enantiomeric selectivity is exhibited in GC.



Cyclodextrin molecules showing dimensions

Selectivity of cyclodextrin-based phases is a function of the derivative, the degree of derivatization, the position of the derivative on the cyclodextrin, whether the derivatized cyclodextrin is used neat or doped into a polysiloxane polymer, and if doped, at what percentage. Certain CSPs are more selective for given molecular structures. Often, more than one CSP will achieve a separation. CSPs may be chosen to optimize resolution, but also elution order or analysis time. Cyclodextrin-based CSPs are grouped into three general categories:

- Surface Interactions, Complex Derivatives
- Surface/Inclusion Interactions, Simple Derivatives
- Inclusion Interactions

Chiral GC Column Screening Kits

Predicting the best column for a new chiral method is difficult, if not impossible. Unless a published method exists for your precise analytes, multi-column screening is still the only way. Our Column Screening Kits contain the most popular Astec CHIRALDEX® or Supelco DEX phases, along with a comprehensive method development guide. The kits are priced at a substantial savings over the cost of the columns sold separately.

- **Astec CHIRALDEX® Kit** contains G-TA, B-DM, and B-DA
- **Supelco DEX Kit I** contains α-DEX 120, β-DEX 120, and γ-DEX 120
- **Supelco DEX Kit II** contains β-DEX 325, β-DEX 225, γ-DEX 225, and β-DEX 120

Astec CHIRALDEX® GC Column Screening Kit

Description	Cat. No.	Qty
30 m kit	71030AST	1 kit

Supelco DEX™ GC Column Screening Kit

Description	Cat. No.	Qty
kit I	24340	1 kit
kit II	24328-U	1 kit

Group 1: Surface Interactions, Complex Derivatives

Sigma-Aldrich is the only supplier of complex derivatives for chiral GC. There are four members in this important group:

- Astec CHIRALDEX® TA (Trifluoroacetyl derivatives)
- Astec CHIRALDEX® PN (Propionyl derivatives)
- Astec CHIRALDEX® DP (Dipropionyl derivatives)
- Astec CHIRALDEX® BP (Butyryl derivatives)

Because the predominant mechanism of retention for phases in this group is based on surface interaction, the γ-cyclodextrin, with 8 glucose residues, has been shown to be the most useful. Compared to α- and β-cyclodextrins, the greater number of glucose residues in a γ-cyclodextrin results in the greater number of hydroxyl functional groups available for derivatization. High derivative concentration is beneficial for maximizing surface interactions.

Astec CHIRALDEX® G-TA is the first choice in this group. This phase has been shown to be the most broadly selective phase for the pharmaceutical industry, especially in the analysis of chiral intermediates and drug studies in various stages of clinical trials. Separations occur without the inclusion mechanism and are typically faster and more efficient than most other CSPs. This phase does not contain a polysiloxane polymer carrier and, therefore, there are no deleterious effects at low temperatures. The ability of this phase to separate parent drug enantiomers and their metabolites has proven quite beneficial.

A modified version of the Astec CHIRALDEX® G-TA is the **Astec CHIRALDEX® G-PN**. It functions like the Astec CHIRALDEX® G-TA but shows higher selectivity toward certain amines (amphetamine, methamphetamine). This phase is more stable to moisture than the Astec CHIRALDEX® G-TA.

The **Astec CHIRALDEX® G-DP** phase was introduced to enhance selectivity for both aliphatic and aromatic amines in additional to aliphatic and some aromatic esters. This phase is especially useful for polar racemates. This phase demonstrates better hydrolytic and thermal stability than the Astec CHIRALDEX® G-TA.

The **Astec CHIRALDEX® G-BP** phase can be used as a general purpose column but it is especially useful for amino acids.

Capillary GC Columns and Guard Columns/Retention Gaps

Chiral Columns: *Group 1: Surface Interactions, Complex Derivatives*

Note: The subtle differences in functional groups between the Astec CHIRALDEX® *G-TA, Astec* CHIRALDEX® *G-PN, Astec* CHIRALDEX® *G-DP, and Astec* CHIRALDEX® *G-BP often allow for major enhancements in chiral and achiral selectivity when changing from one phase to another.*

Astec CHIRALDEX® A-TA Capillary GC Column

Incorporates a phase consisting of a 2,6-di-O-pentyl-3-trifluoroacetyl derivative of α-cyclodextrin. This phase exhibits high selectivity for oxygen-containing analytes in the form of alcohols, ketones, acids, aldehydes and lactones. It is also highly selective for halogenated compounds.

Temp. Limits:

- -10 °C to 180 °C, isothermal and programmed

phase ..... non-bonded; 2,6-di-O-pentyl-3-trifluoroacetyl derivative of α-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	20	500	73002AST	1 ea
	0.12	30	500	73003AST	1 ea
	0.12	40	500	73004AST	1 ea
	0.12	50	500	73005AST	1 ea

Astec CHIRALDEX® B-TA Capillary GC Column

Incorporates a phase consisting of a 2,6-di-O-pentyl-3-trifluoroacetyl derivative of β-cyclodextrin. This phase exhibits high selectivity for oxygen-containing analytes in the form of alcohols, ketones, acids, aldehydes and lactones. It is also highly selective for halogenated compounds.

Temp. Limits:

- -10 °C to 180 °C isothermal and programmed

phase ..... non-bonded; 2,6-di-O-pentyl-3-trifluoroacetyl derivative of β-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	20	500	73022AST	1 ea
	0.12	30	500	73023AST	1 ea
	0.12	40	500	73024AST	1 ea

Astec CHIRALDEX® G-TA Capillary GC Column

Astec CHIRALDEX G-TA is the first choice in the Group 1 CSPs (Surface Interactions, Complex Derivatives). This phase has been shown to be the most broadly-selective phase for the pharmaceutical industry, especially for the analysis of chiral intermediates and drug studies in various stages of clinical trials. Separations occur without the inclusion mechanism and are typically faster and more efficient than most chiral stationary phases. G-TA has also been used to separate parent drug enantiomers and their metabolites. G-TA has its highest selectivity for oxygen-containing analytes like alcohols, diols and polyols as the free alcohol and as an acyl derivative; amines as acyl derivatives; amino alcohols, halogens (Cl>Br>F), amino acids, hydroxy acids, lactones, furans and pyrans. It is also highly selective for halogenated compounds.

Temp. Limits:

- -10 °C to 180 °C isothermal and programmed

phase ..... non-bonded; 2,6-di-O-pentyl-3-trifluoroacetyl derivative of γ-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	10	500	73031AST	1 ea
	0.12	20	500	73032AST	1 ea
	0.12	30	500	73033AST	1 ea
	0.12	40	500	73034AST	1 ea
	0.12	50	500	73035AST	1 ea

Astec CHIRALDEX® G-PN Capillary GC Column

Incorporates a phase consisting of a 2,6-di-O-pentyl-3-propionyl derivative of γ-cyclodextrin. This phase exhibits high selectivity for lactones and aromatic amines. It is also suitable for epoxide separations. Additionally, the analysis of styrene oxide can be accomplished on this phase (this analyte degrades on the TA phases).

GC capillary column

fused silica

Temp. Limits:

- -10 °C to 200 °C isothermal, 220 °C programmed

phase ..... non-bonded; 2,6-di-O-pentyl-3-propionyl derivative of γ-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	30	500	74033AST	1 ea

Astec CHIRALDEX® B-DP Capillary GC Column

Incorporates a phase consisting of a 2,3-di-O-propionyl-6-t-butyl silyl derivative of β-cyclodextrin. This phase exhibits good hydrolytic stability, broad chiral selectivity, and is excellent for aliphatic and aromatic amines. It is also good for many aliphatic and some aromatic esters as well as exhibiting high efficiency and resolution at low retention times for polar racemates.

Temp. Limits:

- -10 °C to 200 °C isothermal, 220 °C programmed

phase ..... non-bonded; 2,3-di-O-propionyl-6-t-butyl silyl derivative of β-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	30	500	78023AST	1 ea

Astec CHIRALDEX® G-DP Capillary GC Column

Incorporates a phase consisting of a 2,3-di-O-propionyl-6-t-butyl silyl derivative of γ-cyclodextrin. The CHIRALDEX G-DP phase was designed to enhance selectivity for both aliphatic and aromatic amines, in additional to aliphatic and some aromatic esters. This phase is especially useful for polar racemates, as it exhibits high efficiency and resolution at low retention times. G-DP demonstrates better hydrolytic and thermal stability than the CHIRALDEX G-TA.

Temp. Limits:

- -10 °C to 200 °C isothermal, 220 °C programmed

phase ..... non-bonded; 2,3-di-O-propionyl-6-t-butyl silyl derivative of γ-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	30	500	78033AST	1 ea

Astec CHIRALDEX® G-BP Capillary GC Column

Incorporates a phase consisting of a 2,6-di-O-pentyl-3-butyryl derivative of γ-cyclodextrin. This phase exhibits high selectivity for amino acids, amines, and furans.

GC capillary column

fused silica

Temp. Limits:

- -10 °C to 200 °C isothermal, 220 °C programmed

phase ..... non-bonded; 2,6-di-O-pentyl-3-butyryl derivative of γ-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	30	500	75033AST	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Chiral Columns: *Group 2: Surface/Inclusion Interactions, Simple Derivatives*

Group 2: Surface/Inclusion Interactions, Simple Derivatives

There are three different derivatives in this group:

- Astec CHIRALDEX® DM and Supelco DEX 325 (Dimethyl derivatives)
- Supelco DEX 225 (Diacetyl derivatives)
- Astec CHIRALDEX® PM, Supelco DEX 110, and Supelco DEX 120 (Permethyl derivatives)

The β-cyclodextrin has shown the greatest applicability for phases with these derivatives. **Astec CHIRALDEX® B-DM** is the recommended column in this category. The **Supelco β-DEX 325** is similar in both chemistry and use to the Astec CHIRALDEX® B-DM phase, the main difference being the concentration of the dimethyl-derivatized cyclodextrin that is doped into the polysiloxane polymer carrier.

The **Supelco β-DEX 225** is a modified form of the Supelco β-DEX 325 phase, employing acetyl derivatives at the 2,3-positions instead of more traditional methyl derivatives.

This group also includes the popular permethyl derivatives, and includes **Astec CHIRALDEX® B-PM**, **Supelco β-DEX 110**, and **Supelco β-DEX 120** phases. They are recommended as general purpose columns for the separation of a wide variety of compounds and are especially useful for the analysis of alcohols and diols in their underivatized form, as well as analytes with polar groups (such as tertiary amines). The main difference between these three phases is the concentration of the permethyl-derivatized cyclodextrin that is doped into the polysiloxane polymer carrier.

Astec CHIRALDEX® B-DM Capillary GC Column

Through special derivatization techniques, the concentration of the cyclodextrin in the CHIRALDEX B-DM has been substantially increased in the polysiloxane carrier. This phase is very useful for a number of free acids and bases. The B-DM is able to perform most of the separations done on a beta-permethylated phase, but with higher resolution. The selectivity of the B-DM covers applications of both the B-PM and B-PH phases, although with superior performance.

Temp. Limits:

- -10 °C to 200 °C isothermal, 220 °C programmed

phase ..... non-bonded; 2,3-di-O-methyl-6-t-butyl silyl derivative of β-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	20	500	77022AST	1 ea
	0.12	30	500	77023AST	1 ea
	0.12	40	500	77024AST	1 ea
	0.12	50	500	77025AST	1 ea

Astec CHIRALDEX® G-DM Capillary GC Column

Incorporates a phase consisting of a 2,3-di-O-methyl-6-t-butyl silyl derivative of γ-cyclodextrin. This phase exhibits broad chiral selectivity, resolving aliphatic, olefenic, and aromatic enantiomers. It combines the selectivities of the PM and PH phases.

Temp. Limits:

- -10 °C to 200 °C isothermal, 220 °C programmed

phase ..... non-bonded; 2,3-di-O-methyl-6-t-butyl silyl derivative of γ-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	30	500	77033AST	1 ea

α-DEX™ 325

The chiral stationary phase in α-DEX 325 columns contains 2,3-di-O-methyl-6-0-TBDMS-α-cyclodextrin embedded in an intermediate polarity phase.

Temp. Limits:

- 30 °C to 230 °C

phase ..... non-bonded; 25% 2,3-di-O-methyl-6-O-TBDMS-α-cyclodextrin in SPB-20 poly(20% phenyl/80% dimethylsiloxane)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24303	1 ea

β-DEX™ 325

The chiral stationary phase in β-DEX 325 columns contains 2,3-di-O-methyl-6-0-TBDMS-β-cyclodextrin embedded in an intermediate polarity phase. The Supelco β-DEX 325 is similar in both chemistry and use to the CHIRALDEX B-DM phase, the main difference being the concentration of the dimethyl-derivatized cyclodextrin that is doped into the polysiloxane carrier.

Temp. Limits:

- 30 °C to 230 °C

phase ..... non-bonded; 25% 2,3-di-O-methyl-6-O-TBDMS-β-cyclodextrin in SPB-20 poly(20% phenyl/80% dimethylsiloxane)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24308	1 ea

γ-DEX™ 325

The chiral stationary phase in Supelco γ-DEX 325 columns contains 2,3-di-O-methyl-6-0-TBDMS-γ-cyclodextrin embedded in an intermediate polarity phase.

Temp. Limits:

- 30 °C to 230 °C

phase ..... non-bonded; 25% 2,3-di-O-methyl-6-O-TBDMS-γ-cyclodextrin in SPB-20 poly(20% phenyl/80% dimethylsiloxane)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24306	1 ea

α-DEX™ 225

The chiral stationary phase in α-DEX 225 columns contains 2,3-di-O-acetyl-6-0-TBDMS-α-cyclodextrin embedded in an intermediate polarity phase.

Temp. Limits:

- 30 °C to 230 °C

phase ..... non-bonded; 25% 2,3-di-O-acetyl-6-O-TBDMS-α-cyclodextrin in SPB-20 poly(20% phenyl/80% dimethylsiloxane)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24311	1 ea

β-DEX™ 225

The Supelco β-DEX 225 is a modified form of the β-DEX 325 phase, and employs acetyl derivatives at the 2,3-positions instead of more traditional methyl derivatives. The chiral stationary phase in β-DEX 225 columns contains 2,3-di-O-acetyl-6-0-TBDMS-β-cyclodextrin embedded in an intermediate polarity phase. These columns provide unique selectivity for enantiomeric separations of small molecules: alcohols, aldehydes (e.g., 2-phenylpropionaldehyde), esters (e.g. methyl malate, methyl lactate), flavor compounds and ketones.

Temp. Limits:

- 30 °C to 230 °C

phase ..... non-bonded; 25% 2,3-di-O-acetyl-6-O-TBDMS-β-cyclodextrin in SPB-20 poly(20% phenyl/80% dimethylsiloxane)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24348	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Chiral Columns: *Group 2: Surface/Inclusion Interactions, Simple Derivatives*

γ-DEX™ 225

The chiral stationary phase in γ-DEX 225 columns contains 2,3-di-O-acetyl-6-0-TBDMS-γ-cyclodextrin embedded in an intermediate polarity phase.

Temp. Limits:

- 30 °C to 230 °C

phase ..... non-bonded; 25% 2,3-di-O-acetyl-6-O-TBDMS-γ-cyclodextrin in SPB-20 poly(20% phenyl/80% dimethylsiloxane)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24312	1 ea

Astec CHIRALDEX® B-PM Capillary GC Column

The main difference between CHIRALDEX B-PM and the Supelco β-DEX 110 and Supelco β-DEX 120 phases is the concentration of the permethyl-derivatized cyclodextrin that is doped into the polysiloxane carrier. CHIRALDEX B-PM is a general-purpose column used for the separation of acids, alcohols, barbitals, diols, epoxides, esters, hydrocarbons, ketones, lactones and terpenes. Also, some underivatized alcohols and diols as well as some analytes with polar groups, i.e. tertiary amines, show excellent separation.

Temp. Limits:

- -10 °C to 200 °C isothermal, 220 °C programmed

phase ..... non-bonded; 2,3,6-tri-O-methyl derivative of β-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	30	500	76023AST	1 ea
	0.12	50	500	76025AST	1 ea

β-DEX™ 110

The chiral stationary phase in β-DEX 110 columns contains permethylated β-cyclodextrin embedded in an intermediate polarity stationary phase. They are recommended for the enantiomeric separation of a wide range of chiral compounds (ketones, esters, alkanes, alkenes, alcohols, acids, ethers, etc.). The 10% (β-DEX 110) and 20% (β-DEX 120) β-cyclodextrin content alters the elution order while maintaining similar enantioselectivity.

Temp. Limits:

- 30 °C to 230 °C

phase ..... non-bonded; 10% permethylated β-cyclodextrin in SPB-35 poly(35% diphenyl/65% dimethylsiloxane)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24301	1 ea
	0.25	60	250	24302	1 ea

α-DEX™ 120

Containing permethylated α-cyclodextrin embedded in an intermediate polarity stationary phase, Supelco α-DEX 120 columns provide unique selectivity for enantiomeric separations of small molecules. They are also recommended for separating positional isomers (phenols, xylenes, etc.).

Temp. Limits:

- 30 °C to 230 °C

phase ..... non-bonded; 20% permethylated α-cyclodextrin in SPB-35 poly(35% diphenyl/65% dimethylsiloxane)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24310	1 ea

β-DEX™ 120

The chiral stationary phase in β-DEX 120 columns contains permethylated β-cyclodextrin embedded in an intermediate polarity stationary phase. They are recommended for the enantiomeric separation of a wide range of chiral compounds (ketones, esters, alkanes, alkenes, alcohols, acids, ethers, etc.). The 10% (β-DEX 110) and 20% (β-DEX 120) β-cyclodextrin content alters the elution order while maintaining similar enantioselectivity.

Temp. Limits:

- 30 °C to 230 °C

phase ..... non-bonded; 20% permethylated β-cyclodextrin in SPB-35 poly(35% phenyl/65% dimethylsiloxane)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24304	1 ea
	0.25	60	250	24305-U	1 ea

γ-DEX™ 120

Because the elution order of the members of a chiral pair frequently reverses (enantioreversal) on a γ-DEX column compared to the elution order on an α-DEX or β-DEX column, we recommend γ-DEX 120 columns as complements to α-DEX 120 and β-DEX 120 columns. γ-DEX is useful for enantiomeric differentiation of large analytes, i.e. α-BHC, carvone, carboxylic acids and methamphetamine.

Temp. Limits:

- 30 °C to 230 °C

phase ..... non-bonded; 20% permethylated γ-cyclodextrin in SPB-35 poly(35% phenyl/65% dimethylsiloxane)

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.25	30	250	24307	1 ea

Group 3: Inclusion Interactions

The third group relies on inclusion interactions for retention mechanism. There are two derivatives in this group:

- Astec CHIRALDEX® DA (Dialkyl derivatives)
- Astec CHIRALDEX® PH (S-Hydroxypropyl derivatives)

The fact that there are three different size cyclodextrins (α, β, and γ) allows for separation of a wide variety of different size analytes. **Astec CHIRALDEX® B-DA** demonstrates the strongest size selectivity. This phase requires analytes to minimally contain two ring structures, one of which is unsaturated (aromatic). The mechanism of this phase is strongly dependent on the inclusion mechanism and is able to differentiate changes in the base structure. Because the Astec CHIRALDEX® B-DA most effectively separates multi-ring analytes, analysis temperatures are often higher than 150 °C. A key application area for this phase is fingerprinting raw materials and identifying structural differences.

Astec CHIRALDEX® B-PH shows at least some selectivity to a great variety of analytes, but is especially effective for saturated analytes with minimal functionality, saturated cyclics, and saturated bicyclics. This phase often shows a reversal of elution order (enantioreversal) compared to the Astec CHIRALDEX B-DA phase.

Capillary GC Columns and Guard Columns/Retention Gaps

Chiral Columns: *Group 3: Inclusion Interactions*

Astec CHIRALDEX® A-DA Capillary GC Column

Incorporates a phase consisting of a 2,6-di-O-pentyl-3-methoxy derivative of α-cyclodextrin. This phase is good for separations of heterocyclic amines. It has different selectivity from other phases and often shows reversal in elution from the PH phases. MAOT = 200 °C isothermal, 220 °C programmed.

GC capillary column

fused silica

Temp. Limits:

- -10 °C to 200 °C isothermal, 220 °C programmed

phase ..... non-bonded; 2,6-di-O-pentyl-3-methoxy derivative of α-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	30	500	72003AST	1 ea

Astec CHIRALDEX® B-DA Capillary GC Column

CHIRALDEX B-DA requires that analytes possess a minimum of two ring structures, one of which is unsaturated (aromatic) α, β to the stereogenic center. Examples include fluoxetine, methylphenidate and chlorophenir-amine. Inclusion complexation or proper fit between the analyte and cyclodextrin cavity is the dominant enantioselectivity mechanism for the DA series. There must be an includable group α or β to the stereogenic center for chiral recognition. Since CHIRALDEX DA columns most effectively separate multi-ring analytes, analysis temperatures are often higher than 150°C. Enantioselectivity has been observed at temperatures >200°C (fluoxetine acetyl derivative).

Temp. Limits:

- -10 °C to 200 °C isothermal, 220 °C programmed

phase ..... non-bonded; 2,6-di-O-pentyl-3-methoxy derivative of β-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	30	500	72023AST	1 ea

Astec CHIRALDEX® G-DA Capillary GC Column

Incorporates a phase consisting of a 2,6-di-O-pentyl-3-methoxy derivative of γ-cyclodextrin. This phase is good for separations of heterocyclic amines. It has different selectivity from other phases and often shows reversal in elution from the PH phases. MAOT = 200 °C isothermal, 220 °C programmed.

GC capillary column

fused silica

Temp. Limits:

- -10 °C to 200 °C isothermal, 220 °C programmed

phase ..... non-bonded; 2,6-di-O-pentyl-3-methoxy derivative of γ-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	30	500	72033AST	1 ea

Astec CHIRALDEX® B-PH Capillary GC Column

CHIRALDEX B-PH shows at least some selectivity to a great variety of analytes, but is especially effective for saturated analytes with minimal functionality, saturated cyclics and bicyclics. The CHIRALDEX PH series of columns shows less of a necessity for inclusion complexation for chiral recognition than the DA columns. This phase often shows a reversal of elution order (enantioreversal) compared to the B-DA phase.

Temp. Limits:

- -10 °C to 200 °C isothermal, 220 °C programmed

phase ..... non-bonded; (S)-2-hydroxy propyl methyl ether derivative of β-cyclodextrin

I.D. (mm)	d_f (µm)	Length (m)	Beta Value	Cat. No.	Qty
0.25	0.12	30	500	71023AST	1 ea

PLOT Columns

We offer a wide variety of Porous Layer Open Tubular (PLOT) GC columns, including those made with our specialty carbon adsorbents. A proprietary procedure is used to fix adsorbent particles to the inside of fused silica tubing, and ensures they will not be dislodged in normal use. PLOT GC columns are commonly used for separations of small molecules, such as permanent gases, light hydrocarbons, and volatile sulfur compounds.

Choose:

- **Carboxen®-1010 PLOT** for separations of hydrogen, oxygen, nitrogen, carbon monoxide, methane, carbon dioxide, and C2/C3 hydrocarbons. This is the only column that can separate all these permanent gases.
- **Carboxen®-1006 PLOT** for most permanent gases and C1-C3, using above ambient initial temperatures. Also for resolving formaldehyde/water/methanol (formalin) mixtures and monitoring impurities in ethylene.
- **Supel-Q PLOT** for analyses of sulfur gases, alcohols, ketones, aldehydes, and many polar compounds. Also for carbon dioxide and C1-C4 hydrocarbons at above ambient temperatures, and for gasoline and other petroleum fractions.
- **Alumina sulfate PLOT** for C1-C4 hydrocarbons, specifically methane from the C2 hydrocarbons, with reduced peak tailing. Also for elution of acetylene after n-butane, and the elution of methyl acetylene after n-pentane and 1,3-butadiene.
- **Alumina chloride PLOT** for C1-C4 hydrocarbons. Also for excellent separation of many common fluorocarbon compounds
- **Mol Sieve 5A PLOT** for oxygen, nitrogen, carbon monoxide, and methane in less than 5 minutes. For more difficult separations, such as argon from oxygen, by using subambient temperatures (15 °C or below).

Carboxen®-1010 PLOT Capillary GC Column

Application: This column is ideal for the separation of all major components in permanent gas (helium, hydrogen, oxygen, nitrogen, carbon monoxide, methane, and carbon dioxide) and light hydrocarbons (C2-C3) in the same analysis. It is the only column commercially available that is able to separate all major components in permanent gas. This column can also separate oxygen from nitrogen at subambient temperatures.

USP Code: None

Phase:

- Carbon molecular sieve

Temp. Limits:

- Subambient to 250 °C (isothermal or programmed)

I.D. (mm)	L (m)	Cat. No.	Qty
0.32	30	24246	1 ea
0.53	30	25467	1 ea

Carboxen®-1006 PLOT Capillary GC Column

Application: This column is ideal for the separation of many permanent gas components (such as helium, hydrogen, nitrogen, carbon monoxide, methane, and carbon dioxide), and light hydrocarbons (C2-C3) in the same analysis. It is ideal for resolving formaldehyde/water/methanol (formalin) mixtures and monitoring impurities in ethylene. This column can be used with high flow rates and rapid temperature programs to ensure excellent, fast separations.

USP Code: None

Phase:

- Carbon molecular sieve

Temp. Limits:

- Subambient to 250 °C (isothermal or programmed)

I.D. (mm)	L (m)	Cat. No.	Qty
0.32	30	24241-U	1 ea
0.53	30	25461	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

PLOT Columns

Supel-Q™ PLOT Capillary GC Column

Application: This column exhibits very little bleed, even at its maximum temperature, and effectively resolves carbon dioxide and C1-C4 hydrocarbons at above ambient temperatures. It is also suitable for analyses of sulfur gases, alcohols, ketones, aldehydes, and many polar compounds. Gasoline and other petroleum fractions can be analyzed as well.
USP Code: None
Phase:

- Divinylbenzene

Temp. Limits:

- Subambient to 250 °C (isothermal or programmed)

I.D. (mm)	L (m)	Cat. No.	Qty
0.32	30	24242	1 ea
0.53	30	25462	1 ea
0.53	30	23937-U	1 ea
0.53	50	23939-U	1 ea

Note: P/N **23937-U** includes an attached guard column.

Alumina Sulfate PLOT Capillary GC Column

Application: This highly dependable column has the necessary selectivity for the separation of alkanes, alkenes, and alkynes in mixtures of C1-C4 hydrocarbons. It provides elution of acetylene after n-butane and the elution of methyl acetylene after n-pentane and 1,3-butadiene. The polymer surface is deactivated to reduce peak tailing.
USP Code: None
Phase:

- Sulfate-deactivated alumina

Temp. Limits:

- Subambient to 180 °C (isothermal or programmed)

I.D. (mm)	L (m)	Cat. No.	Qty
0.32	30	28321-U	1 ea
0.32	50	28322-U	1 ea
0.53	30	28323-U	1 ea
0.53	50	28324-U	1 ea

Alumina Chloride PLOT Capillary GC Column

Application: This column allows for the separation of C1-C4 hydrocarbons. Because this column is slightly less polar than the Alumina sulfate PLOT, it provides a different elution order pattern when alkane, alkene, and alkyne mixtures of light hydrocarbons are analyzed. It also provides excellent separation of many common fluorinated compounds, such as freons.
USP Code: None
Phase:

- Chloride-deactivated alumina

Temp. Limits:

- Subambient to 180 °C (isothermal or programmed)

I.D. (mm)	L (m)	Cat. No.	Qty
0.32	30	28326-U	1 ea
0.32	50	28327-U	1 ea
0.53	30	28328-U	1 ea
0.53	50	28329-U	1 ea

Mol Sieve 5A PLOT Capillary GC Column

Application: This column can be used for the separation of many permanent gas components, such as oxygen, nitrogen, carbon monoxide, and methane, in less than five minutes. More difficult separations, such as argon from oxygen, can be achieved by using subambient temperatures. These columns possess the strongest adsorption strength of any PLOT column.
USP Code: None
Phase:

- Aluminosilicate

Temp. Limits:

- Subambient to 300 °C (isothermal or programmed)

I.D. (mm)	L (m)	Cat. No.	Qty
0.32	30	24243	1 ea
0.53	30	25463	1 ea

SCOT Columns

Supelco is the leader in Support Coated Open Tubular (SCOT) GC column technology. Our unsurpassed manufacturing technique allows us to deposit a uniform layer of liquid phase-coated support particles on the inner wall of stainless steel tubing. This technology gives us access to many phases that are inaccessible to conventional fused silica capillary column manufacturing technology. SCOT columns combine the sensitivity and excellent sample resolution of capillary GC with the extensive stationary phase library of packed GC.

All our SCOT columns have dimensions of 50 feet x 1/32 inch O.D. x 0.02 inch I.D. and include 1/16 inch O.D. connections at each end. They are banded in 3.5 inch coils, with 12 inch loose column at each end. Four columns are available as stock items. Columns with other phases may be available through our custom program.

Bentone 34/DNDP SCOT

- **Application**: Use for analyses of xylene isomers.
- **USP Code**: None
- **Phase**: Bentone 34/di-n-decyl phthalate
- **Temp. Limits**: 10 °C to 150 °C (isothermal or programmed)

TCEP SCOT

- **Application**: Use for analyses of aromatic analytes.
- **USP Code**: None
- **Phase**: 1,2,3-Tris(2-cyanoethoxy)propane
- **Temp. Limits**: 0 °C to 150 °C (isothermal or programmed)

BMEA SCOT

- **Application**: Use for analyses of olefins.
- **USP Code**: None
- **Phase**: Bis-methoxyethyladipate
- **Temp. Limits**: 25 °C to 100 °C (isothermal or programmed)

Squalane SCOT

- **Application**: Use for boiling point separations.
- **USP Code**: None
- **Phase**: Squalane
- **Temp. Limits**: 20 °C to 120 °C (isothermal or programmed)

SCOT Capillary GC Column

Phase	Cat. No.	Qty
Bentone 34/DNDP	23813-U	1 ea
TCEP	23829-U	1 ea
BMEA	23818-U	1 ea
Squalane	23819-U	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Guard Columns/Retention Gaps

Over time, the inlet end of a capillary GC column can become contaminated from the accumulation of non-volatile material. The phase in the front section of the column can also be damaged from the continuous condensation and vaporization of solvent and analytes. Inevitably, active analytes will adsorb to this contaminated/damaged section (the analytes "drag" when passing through the inlet end of the column). Poor peak shape (peak tailing), loss in resolution, and reduced response may be observed. When the chromatographic system degrades to an unacceptable level, performance is restored by clipping the contaminated/damaged section off the inlet end of the column. A decrease in retention times and resolution occurs each time the column is clipped, as theoretical plates are lost. Eventually, the column will be rendered useless.

The use of a guard column/retention gap is an inexpensive technique to extend the lifetime of capillary columns. A guard column/retention gap is a short (1-5 m) piece of uncoated deactivated fused silica tubing which is placed in-line between the GC injection port and the capillary column. The guard column/retention gap is used to take the brunt of the contamination/damage from the solvent and sample. By clipping the guard column/retention gap periodically to restore performance instead of the capillary column, the capillary column remains unaltered. Therefore, chromatography (retention times and resolution) is not affected. A guard column/retentipon gap consists of two parts: a short length of fused silica tubing, and a connector.

Match the deactivation of the fused silica tubing with the polarity of the injection solvent. In most cases, it is also recommended to match the I.D. of the capillary column. Choose:

- **Non-polar deactivation** for injection solvents such as alkanes, carbon disulfide, and ethers.
- **Intermediate polar deactivation** for injection solvents such as acetone, methylene chloride (dichloromethane), and toluene.
- **Polar deactivation** for injection solvents such as acetonitrile, methanol, and water.

We offer two options for connecting two pieces of fused silica tubing. The **butt connector** is a small stainless steel fitting that makes a zero dead volume seal. The **GlasSeal™ connectors** offer convenience.

Fused Silica Tubing, Non-Polar Deactivated

This tubing is deactivated non-polar, for use with injection solvents such as alkanes, carbon disulfide, and ethers. It has a maximum temperature of 360 °C.

Non-Polar Fused Silica Tubing

I.D. (mm)	L (m)	Cat. No.	Qty
0.10	1	25704	3 ea
0.10	3	25720-U	1 ea
0.10	5	25740-U	1 ea
0.20	5	25741	1 ea
0.20	15	25755	1 ea
0.20	30	25768-U	1 ea
0.25	1	24025	3 ea
0.25	3	25722	1 ea
0.25	5	25742	1 ea
0.25	15	25756	1 ea
0.25	30	25769-U	1 ea
0.25	60	25783	1 ea
0.32	1	24058	3 ea
0.32	3	25723	1 ea
0.32	5	25743	1 ea
0.32	15	25757	1 ea
0.32	30	25770-U	1 ea
0.53	1	25307	3 ea
0.53	3	25724	1 ea
0.53	5	25744	1 ea
0.53	15	25758	1 ea
0.53	30	25771	1 ea

Fused Silica Tubing, Intermediate Polar Deactivated

This tubing is deactivated intermediate polar, for use with injection solvents such as acetone, methylene chloride (dichloromethane), and toluene. It has a maximum temperature of 360 °C.

Intermediate Polar Fused Silica Tubing

I.D. (mm)	L (m)	Cat. No.	Qty
0.10	5	25745-U	1 ea
0.20	1	25706	3 ea
0.20	5	25746	1 ea
0.25	1	25707	3 ea
0.25	3	25727	1 ea
0.25	5	25747	1 ea
0.25	15	25760-U	1 ea
0.25	60	25787	1 ea
0.32	1	25708	3 ea
0.32	3	25728	1 ea
0.32	5	25748-U	1 ea
0.32	15	25761	1 ea
0.32	30	25774	1 ea
0.53	1	25709	3 ea
0.53	3	25729	1 ea
0.53	5	25339	1 ea
0.53	15	25762	1 ea
0.53	30	25775-U	1 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Guard Columns/Retention Gaps: *Fused Silica Tubing, Polar Deactivated*

Fused Silica Tubing, Polar Deactivated

This tubing is deactivated polar, for use with injection solvents such as acetonitrile, methanol, and water. It has a maximum temperature of 260 °C.

Polar Fused Silica Tubing

I.D. (mm)	L (m)	Cat. No.	Qty
0.10	1	25710	3 ea
0.25	1	25712	3 ea
0.25	30	25777	1 ea
0.32	5	25752-U	1 ea
0.32	15	25765	1 ea
0.32	60	25792	1 ea
0.53	1	25714	3 ea
0.53	3	25734	1 ea
0.53	5	25753	1 ea
0.53	15	25766	1 ea
0.53	30	25779	1 ea

Fused Silica Tubing, Untreated

This tubing is untreated, for general purpose use where high inertness is not necessary. It has a maximum temperature of 360 °C.

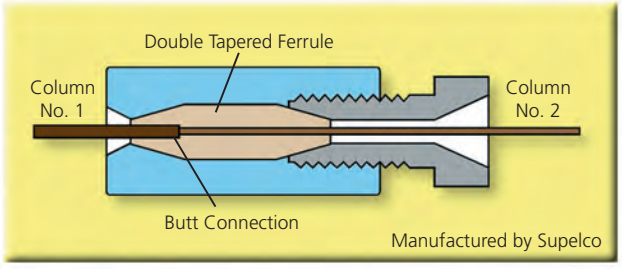
Untreated Fused Silica Tubing

I.D. (mm)	L (m)	Cat. No.	Qty
0.10	1	25700-U	3 ea
0.10	3	25715	1 ea
0.10	5	25735	1 ea
0.25	1	24024	3 ea
0.25	3	25717	1 ea
0.25	5	25737	1 ea
0.25	15	24059	1 ea
0.25	60	24061	1 ea
0.32	1	25702	3 ea
0.32	3	25718	1 ea
0.32	5	25738	1 ea
0.32	15	24062	1 ea
0.32	30	24063	1 ea
0.32	60	24064	1 ea
0.53	1	25703	3 ea
0.53	3	25719	1 ea
0.53	5	25739	1 ea
0.53	15	25306	1 ea
0.53	60	25781	1 ea

Capillary Column Butt Connectors

This device consists of a double-tapered ferrule and a stainless steel compression body with a threaded nut. Small (2.3 cm x 0.6 cm) and light (4.4 g with ferrule), it provides a gas tight seal without a change in column efficiency or inertness. The columns to be connected can have the same or different internal and external diameters. The butt connection is made inside the special double-tapered ferrule. The ferrule is then compressed within the housing. When the column ends are butted squarely and tightly together, the butt connector will not alter the chromatographic performance of your capillary columns. There is little or no dead volume and little chance of gas flow disruption by following these steps:

- Make sure the bore of the ferrule is clean. Blow out any ferrule fragments with nitrogen. Using a magnifier, examine the column ends to be connected. Make sure each cut is clean and square. The two ends must butt squarely, without any gaps.
- With white typewriter correction fluid, place a reference mark 1/4 inch from the end of the column with the larger bore. This mark will help you to confirm visually that the end of the column is centered within the 1/2 inch ferrule.
- Place the ferrule inside the housing and loosely tighten the nut. Feed the unmarked column completely through the ferrule and out the opposite end. Cut off ~1 inch (25 mm) of the column to ensure no ferrule fragments are in the column. Draw the column back far enough to insert the marked column into the ferrule to the indicating mark. Tighten the nut about 1/8 turn past fingertight.
- Press the ends of the columns together, observing the reference mark to make certain they butt together at the center of the ferrule. Tighten the ferrule to about 1/4-1/2 turn past fingertight. Gently pull on both columns to ensure they are secure. If they are loose, additional tightening is necessary.
- Any undetected leaking connection, including this butt connection, can allow oxygen and water vapor to enter the system. Leak check the butt connector in the same manner as any capillary column connection. DO NOT USE LIQUID LEAK INDICATORS. Liquids can contaminate the capillary system. We recommend using a GOW-MAC® electronic leak detector. These thermal conductivity detectors are highly sensitive to trace amounts of hydrogen or helium, and will not contaminate the system.



Capillary Column Butt Connector

	Cat. No.	Qty
Capillary Column Butt Connector		
I.D. 0.4 mm, Supeltex M-2 ferrule included	23796	1 ea
body only (ferrules not included)	23804	1 ea

Supeltex® M-2 Double-Tapered Ferrule

- **Max. Temp.**: 350 °C
- **Composition**: DuPont VESPEL SP-1 (100% polyimide)
- **Characteristics**: High reusability.

Compatible	I.D. (mm)	Cat. No.	Qty
Supeltex® M-2 Double-Tapered Ferrule			
0.10 mm to like I. D. column	0.25	22585	2 ea
0.10-0.25 mm to like I.D. column	0.4	23797	2 ea
0.32 mm to like I. D. column	0.5	22464	2 ea

Capillary GC Columns and Guard Columns/Retention Gaps

Guard Columns/Retention Gaps: *Capillary Column Butt Connectors*

Compatible	I.D. (mm)	Cat. No.	Qty
0.53 mm to like I. D. column	0.8	22590-U	2 ea
0.10-0.25 mm I.D. to 0.53 mm I.D. column (reducing)	0.4-0.8	22465	2 ea
0.32 mm I.D. to 0.53 mm I.D. column	0.5-0.8	22596	2 ea
0.32 mm I.D. to 0.75 mm I.D. Column	0.5-1.2	22466	2 ea

Supeltex® M-2B Double-Tapered Ferrule

- **Max. Temp.**: 350 °C
- **Composition**: DuPont VESPEL SP-211 (75% polyimide, 15% graphite, 10% PTFE)
- **Characteristics**: Conforms easily to capillary column, ensuring an effective seal and less chance of breakage.

Compatible	I.D. (mm)	Cat. No.	Qty
Supeltex® M-2B Double-Tapered Ferrule			
0.10-0.25 mm to like I.D. Column	0.4	22453	2 ea
0.32 mm to like I. D. Column	0.5	22454	2 ea
0.53 mm to like I. D. Column	0.8	22591	2 ea
0.10-0.25 mm I.D. to 0.53 mm I.D. Column	0.4-0.8	22455-U	2 ea
0.32 mm I.D. to 0.53 mm I.D. Column	0.5-0.8	22586	2 ea
0.32 mm I.D. to 0.75 mm I.D. Column	0.5-1.2	22456	2 ea

Capillary Column Butt Connector Nut

Replacement nut for the Capillary Column Butt Connector.

	Cat. No.	Qty
Capillary Column Butt Connector Nut		
1/16 in. male hexagonal wrenchtight	23805	4 ea
1/16 in. male knurled fingertight	23812	2 ea

GlasSeal™ Capillary Column Connectors

GlasSeal™ connectors are inexpensive, easy-to-use, and silanized for an inert inside surface.

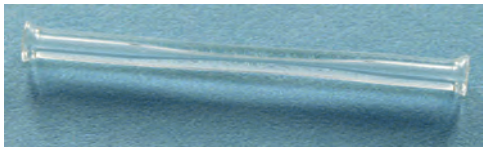
- Straight connectors connect two pieces of fused silica tubing of the same or different diameters without the need for tools. The leak-free connection is useful to connect a guard column or transfer line, repair a broken column, or connect two columns (same or different phases).
- "Y" connectors connect three pieces of fused silica tubing of the same or different diameters without the need for tools. The leak-free connection is useful to split a sample to two columns, or to split a column effluent to two detectors.

For use with 0.10 - 0.53 mm I.D. fused silica tubing.

GlasSeal™ Capillary Column Connector, Fused Silica

Cat. No.	Qty
23627	5 ea
23628	25 ea

GlasSeal™ Capillary Column Connector, Borosilicate Glass

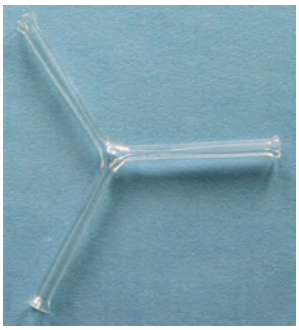


Cat. No.	Qty
20479	12 ea

"Y" GlasSeal™ Connector, Fused Silica

Cat. No.	Qty
23631	1 ea
23632	3 ea

"Y" GlasSeal™ Connector, Borosilicate Glass



Cat. No.	Qty
20480	1 ea

Polyimide Sealing Resin

A GlasSeal™ connector will form a perfect seal between two fused silica columns. To make this connection extremely durable, use a small drop of this resin. Also for use as an excellent high temperature glue. Cures at 200 °C. For use at 350 °C or lower operating temperatures. The bottle contains 5 g of resin, and includes a handy applicator cap.

Cat. No.	Qty
23817	5 g

Capillary GC Columns and Guard Columns/Retention Gaps

Cross-Reference Chart

Cross-Reference Chart

Cross capillary GC columns from other manufacturers to comparable Supelco columns.

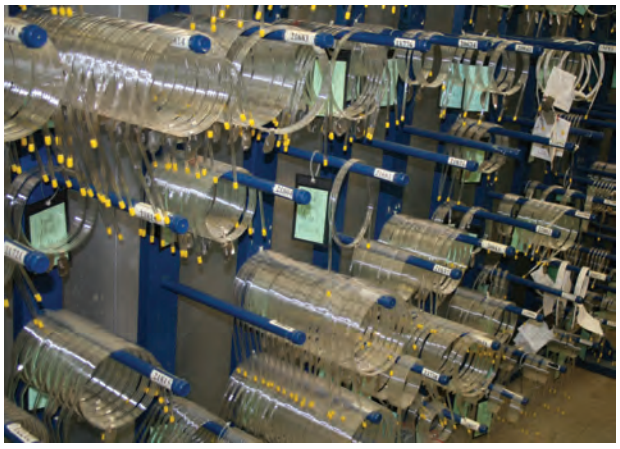
Supelco	Agilent	Grace	Macherey-Nagel	Phenomenex	Restek	SGE	Varian
TRADITIONAL (Phases by increasing phase polarity)							
Petrocol DH Octyl	-	-	-	-	-	-	-
SPB-Octyl	-	-	-	-	-	-	CP-Sil 2 CB
SPB-HAP	-	-	-	-	-	-	-
Petrocol DH 50.2	DB-Petro, HP-PONA	-	-	-	-	BP1 PONA	-
Petrocol DH	DB-Petro	AT-Petro	-	-	Rtx-1PONA	BP1 PONA	CP-Sil PONA CB
Petrocol DH 150	-	-	-	-	-	-	-
Petrocol 2887, Petrocol EX2887	DB-2887	AT-2887	-	-	Rtx-2887	-	CP-SimDist
SPB-1 SULFUR	-	AT-Sulfur	-	-	-	-	CP-Sil 5 CB for Sulfur
Equity-1, SPB-1	DB-1, HP-1	AT-1	Optima-1	ZB-1	Rtx-1	BP1	CP-Sil 5 CB
SLB-5ms	DB-5ms, HP-5ms	AT-5ms	Optima-5 MS	ZB-5ms	Rtx-5Sil MS	BPX5	VF-5ms
MET-Biodiesel	-	-	-	-	MXT-BiodieselTG	-	Select Biodiesel for Triglycerides
HT-5 (aluminum clad)	DB-5ht	-	-	ZB-5ht	-	HT-5	VF-5ht
PTA-5	-	AT-Amine	-	-	Rtx-5 Amine	-	CP-Sil 8 CB for Amines
SAC-5	-	-	-	-	-	-	-
Equity-5, SPB-5	DB-5, HP-5	AT-5	Optima-5	ZB-5	Rtx-5	BP5	CP-Sil 8 CB
SPB-624	DB-624, DB-VRX	AT-624	Optima-624	ZB-624	Rtx-624	BP624	CP-Select 624 CB
OVI-G43	HP-Fast Residual Solvent	-	-	-	Rtx-G43	-	-
VOCOL	DB-502.2, HP-VOC	AT-502.2	-	-	Rtx-502.2, Rtx-Volatiles	-	-
SPB-20	-	AT-20	-	-	Rtx-20	-	-
Equity-1701	DB-1701	AT-1701	Optima-1701	ZB-1701	Rtx-1701	BP10	CP-Sil 19 CB
SPB-608	DB-608	AT-Pesticide	-	-	-	-	-
Sup-Herb	-	-	-	-	-	-	-
SPB-35	DB-35, HP-35	AT-35	-	ZB-35	Rtx-35	-	-
SPB-50	DB-17, HP-50	AT-50	Optima-17	ZB-50	-	-	CP-Sil 24 CB
SPB-225	DB-225	AT-225	Optima-225	-	Rtx-225	BP225	CP-Sil 43 CB
SPB-PUFA	-	-	-	-	-	-	-
PAG	-	-	-	-	-	-	-
SPB-1000, Nukol	DB-FFAP, HP-FFAP	AT-1000, AT-AquaWax-DA	Optima-FFAP	ZB-FFAP	Stabilwax-DA	BP21	CP-FFAP CB
Carbowax Amine	CAM	AT-CAM	-	-	Stabilwax-DB	-	CP-Wax 51 for Amines
Omegawax	-	AT-FAME	-	-	FAMEWAX	-	-
SUPELCOWAX 10	DB-WAX	AT-WAX, AT-AquaWax	Optima-WAX	ZB-WAX	Rtx-WAX, Stabilwax	BP20	CP-Wax 52 CB
SLB-IL59	-	-	-	-	-	-	-
SLB-IL61	-	-	-	-	-	-	-
SP-2330	HP-88	-	-	-	Rtx-2330	-	-
SLB-IL76	-	-	-	-	-	-	-
SP-2331	DB-Dioxin	-	-	-	Rtx-Dioxin2	-	CP-Sil 88 for Dioxins
SP-2380	-	AT-Silar 90	-	-	-	-	-
SP-2560	-	-	-	-	Rt-2560	-	CP-Sil 88 for FAME
SP-2340	-	AT-Silar 100	-	-	-	-	CP-Sil 88
SLB-IL82	-	-	-	-	-	-	-
TCEP	-	-	-	-	Rt-TCEP	-	CP-TCEP
SLB-IL100	-	-	-	-	-	-	-
SLB-IL111	-	-	-	-	-	-	-
CHIRAL Phases							
Astec CHIRALDEX	-	-	-	-	-	-	-
α-DEX	-	-	FS-LIPODEX	-	-	-	-
β-DEX	CycloSil-B	-	FS-LIPODEX, FS-HYDRODEX	-	Rt-bDEX	CYDEX-B	-
γ-DEX	-	-	FS-LIPODEX	-	Rt-gDEX	-	-
PLOT Columns							
Carboxen-1010 PLOT	-	-	-	-	-	-	CP-CarboPLOT P7
Carboxen-1006 PLOT	GS-Carbon PLOT	Carbograph VOC	-	-	-	-	CP-CarboBOND
Supel-Q PLOT	HP-PLOT Q	AT-Q	-	-	Rt-QPLOT	-	CP-PoraPLOT Q

Capillary GC Columns and Guard Columns/Retention Gaps

Cross-Reference Chart

Supelco	Agilent	Grace	Macherey-Nagel	Phenomenex	Restek	SGE	Varian
Alumina sulfate PLOT	HP-PLOT Al2O3 "S"	-	-	-	-	-	CP-Al_2O_3 PLOT Na_2SO_4
Alumina chloride PLOT	HP-PLOT Al2O3 "KCl"	-	-	-	-	-	CP-Al_2O_3 PLOT KCl
Mol Sieve 5A PLOT	HP-PLOT Molesieve	AT-Mole Sieve	-	-	Rt-Msieve 5A	-	CP-Molsieve 5A
SCOT Columns							
SCOT Columns	-	-	-	-	-	-	-

Packed GC Columns and Components



Supelco has manufactured packed GC columns and components (empty columns, ready-to-use packings, high-purity stationary phases, and stable supports) since 1966. Our unsurpassed knowledge of packed GC, and our unrivaled product offering, is why Supelco Analytical is the world's leading supplier of packed GC columns and components.

Packed Columns

We offer a wide selection of packed GC columns with popular packings. These columns are configured to fit many commonly used instruments and are ready-to-install.

- Use **glass** columns for applications where high inertness is required, such as for the analysis of active analytes. All glass columns undergo a proprietary high temperature silanization to ensure inertness.
- More economical **metal** columns should be used for less demanding applications where the inertness of glass is not required.
- For low temperature applications, **PTFE** columns offer the flexibility of metal with inertness approaching that of glass.

TightSpec columns conform to within +/-6 mm of their stated lengths. Other columns conform to within 1.5% of instrument manufacturers' length specifications.

Custom Capabilities: The products listed here are only those that are stock items. We have the ability to manufacture many, many more products. If you do not see the item you need, please contact Technical Service at 800-359-3041 (US and Canada), 814-359-3041, or techservice@sial.com

For Agilent® GCs

These columns fit Agilent 5890 and 6890.

Glass Packed GC Column (fits Agilent, Configuration "A")

Use a glass column for applications where high inertness is required, such as for the analysis of active analytes. All glass columns undergo a proprietary high temperature silanization to ensure inertness. This column fits Agilent 5890 and 6890 (configuration A, on-column injection, all detectors except TCD).

glass column

Phase	Support	L × O.D. × I.D.	Cat. No.	Pkg
4% Carbowax 20M + 0.8% KOH	60/80 Carbopack B	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	26030-U	1 ea
4% Carbowax 20M + 0.8% KOH	60/80 Carbopack C	6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (TightSpec)	26021	1 ea
4% Carbowax 20M	80/120 Carbopack B DA	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	25936	1 ea
4% Carbowax 20M	80/120 Carbopack B DA	6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (TightSpec)	23110-U	1 ea
5% Carbowax 20M	60/80 Carbopack B	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	26048	1 ea
5% Carbowax 20M	60/80 Carbopack B	6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (TightSpec)	26039	1 ea
5% Carbowax 20M	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13090-U	1 ea
5% Carbowax 20M	80/120 Carbopack B AW	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	25953	1 ea

Packed GC Columns and Components

Packed Columns: *For Agilent® GCs*

Glass Packed GC Column (fits Agilent, Configuration "A") *(continued)*

Phase	Support	L × O.D. × I.D.	Cat. No.	Pkg
5% Carbowax 20M	80/120 Carbopack B AW	6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (TightSpec)	25945	1 ea
5% Carbowax 20M	100/120 Chromosorb W HP	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13091-U	1 ea
10% Carbowax 20M	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13088-U	1 ea
10% Carbowax 20M	100/120 Chromosorb W HP	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13089-U	1 ea
20% Carbowax 20M	100/120 Chromosorb W AW	6.6 ft (2.0 m) × 1/4 in. × 4.0 mm (Preconditioned)	12474-U	1 ea
10% FFAP + 1% H_3PO_4	100/120 Chromosorb W AW	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13081-U	1 ea
3% OV-1	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13083-U	1 ea
10% OV-1	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13086-U	1 ea
3% OV-17	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13085-U	1 ea
10% OV-17	100/120 Chromosorb W HP	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13084-U	1 ea
3% OV-101	100/120 Chromosorb W HP	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13087-U	1 ea
1.95% OV-210 + 1.5% OV-17	100/120 Chromosorb W HP	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13079-U	1 ea
0.1% SP-1000	80/100 Carbopack C	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	26012	1 ea
0.1% SP-1000	80/100 Carbopack C	6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (TightSpec)	26003	1 ea
1% SP-1000	60/80 Carbopack B	6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (TightSpec)	23093	1 ea
1% SP-1000	60/80 Carbopack B	7.9 ft (2.4 m) × 1/4 in. × 2.0 mm (TightSpec)	23084	1 ea
1.5% SP-2250 + 1.95% SP-2401	100/120 SUPELCOPORT	6.0 ft (1.8 m) × 1/4 in. × 4.0 mm	25965	1 ea
1.5% SP-2250 + 1.95% SP-2401	100/120 SUPELCOPORT	6.6 ft (2.0 m) × 1/4 in. × 4.0 mm (TightSpec)	23077	1 ea
0.8% THEED	80/100 Carbopack C	3.3 ft (1.0 m) × 1/4 in. × 2.0 mm (TightSpec)	26057	1 ea
none	80/100 Chromosorb 102	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13082-U	1 ea
none	80/100 Porapak P	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13092-U	1 ea
none	80/100 Porapak Q	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13093-U	1 ea
none	80/100 Porapak QS	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	13094-U	1 ea
none	100/120 Porapak S	6.6 ft (2.0 m) × 1/4 in. × 4.0 mm (Preconditioned)	12481-U	1 ea

Metal Packed GC Column (fits Agilent, Configuration "A")

An economical metal column should be used for less demanding applications where the inertness of glass is not required. This column fits Agilent 5890 and 6890 (configuration A, on-column injection, all detectors except TCD).

Phase	Support	L × O.D. × I.D.	Column	Cat. No.	Pkg
0.2% Carbowax 1500	80/100 Carbopack C	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12506-U	1 ea
5% Carbowax 20M	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13128-U	1 ea
10% Carbowax 20M	80/100 SUPELCOPORT	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12787-U	1 ea
10% Carbowax 20M	80/100 Chromosorb W AW	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12785-U	1 ea
10% Carbowax 20M	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13126-U	1 ea
10% Carbowax 20M	100/120 Chromosorb W HP	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13127-U	1 ea
25% DC-200 (350 cstks)	80/100 Chromosorb P AW	15.0 ft (4.6 m) × 1/8 in. × 2.1 mm	stainless steel	13039-U	1 ea
35% DC-200 (350 cstks)	80/100 Chromosorb P AW	5.0 ft (1.5 m) × 1/8 in. × 2.1 mm	stainless steel	13044-U	1 ea
35% DC-200 (350 cstks)	80/100 Chromosorb P AW	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	13064-U	1 ea
35% DC-200 (350 ctsks)	80/100 Chromosorb P AW	30.0 ft (9.1 m) × 1/8 in. × 2.1 mm	stainless steel	13072-U	1 ea
35% DC-200 (500 cstks)	80/100 Chromosorb P AW	3.0 ft (0.91 m) × 1/8 in. × 2.1 mm	stainless steel	13019-U	1 ea
5% OV-1	100/120 Chromosorb W HP	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13107-U	1 ea
10% OV-1	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13106-U	1 ea
5% OV-17	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13114-U	1 ea
10% OV-17	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13109-U	1 ea
3% OV-101	100/120 Chromosorb W HP	1.8 ft (0.55 m) × 1/4 in. × 5.3 mm	stainless steel	13095-U	1 ea
10% OV-101	60/80 Chromosorb W HP	2.6 ft (0.79 m) × 1/8 in. × 2.1 mm	stainless steel	13031-U	1 ea
10% OV-101	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13115-U	1 ea
10% OV-101	100/120 Chromosorb W HP	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13116-U	1 ea
20% OV-101	80/100 Chromosorb W HP	4.0 ft (1.2 m) × 1/8 in. × 2.1 mm	stainless steel	13035-U	1 ea
5% SE-30	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13124-U	1 ea
10% SE-30	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13122-U	1 ea
20% Sebaconitrile	80/100 Chromosorb P AW	2.0 ft (0.61 m) × 1/8 in. × 2.1 mm	stainless steel	13014-U	1 ea
20% Sebaconitrile	80/100 Chromosorb P AW	2.0 ft (0.61 m) × 1/8 in. × 2.1 mm	stainless steel	13059-U	1 ea
20% Sebaconitrile	80/100 Chromosorb P AW	30.0 ft (9.1 m) × 1/8 in. × 2.1 mm	stainless steel	13043-U	1 ea

Packed GC Columns and Components

Packed Columns: *For Agilent® GCs*

Phase	Support	L × O.D. × I.D.	Column	Cat. No.	Pkg
20% Sebaconitrile + 2% H_3PO_4	80/100 Chromosorb P AW	30.0 ft (9.1 m) × 1/8 in. × 2.1 mm	stainless steel	13066-U	1 ea
10% Silar 5 CP	80/100 Chromosorb W HP	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13121-U	1 ea
0.1% SP-1000	80/100 Carbopack C	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12500-U	1 ea
1% SP-1000	60/80 Carbopack B	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12487	1 ea
1% SP-1000	60/80 Carbopack B	8.0 ft (2.4 m) × 1/8 in. × 2.1 mm	stainless steel	12548-U	1 ea
10% SP-1000	80/100 SUPELCOPORT	20.0 ft (6.1 m) × 1/8 in. × 2.1 mm	stainless steel	12794-U	1 ea
3% SP-1500	80/120 Carbopack B	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	12594	1 ea
10% SP-2100	80/100 SUPELCOPORT	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12801-U	1 ea
10% SP-2100	100/120 SUPELCOPORT	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	12803-U	1 ea
20% SP-2100 + 0.1% Carbowax 1500	100/120 SUPELCOPORT	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	12804-U	1 ea
25% SP-2100	80/100 Chromosorb P AW	5.7 ft (1.7 m) × 1/16 in. × 0.75 mm	stainless steel	12995-U	1 ea
10% SP-2330	100/120 Chromosorb W AW	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13776	1 ea
20% TCEP	80/100 Chromosorb P AW	1.8 ft (0.55 m) × 1/16 in. × 0.75 mm	stainless steel	12873	1 ea
20% TCEP	80/100 Chromosorb P AW	15.0 ft (4.6 m) × 1/8 in. × 2.1 mm	stainless steel	13034-U	1 ea
10% UCW-98	80/100 Chromosorb P AW	1.7 ft (0.52 m) × 1/8 in. × 2.1 mm	stainless steel	13041-U	1 ea
12% UCW-98	80/100 Chromosorb P AW	2.0 ft (0.61 m) × 1/8 in. × 2.1 mm	stainless steel	13049-U	1 ea
none	40/60 Carboxen-1000	5.0 ft (1.5 m) × 1/8 in. × 2.1 mm	stainless steel	12382	1 ea
none	60/80 Carboxen-1000	15.0 ft (4.6 m) × 1/8 in. × 2.1 mm	stainless steel	12392-U	1 ea
none	80/100 Carboxen-1004	6.6 ft (2.0 m) × 1/16 in. × 0.75 mm	stainless steel	12846	1 ea
none	60/80 Chromosorb P AW	3.0 ft (0.91 m) × 1/8 in. × 2.1 mm	stainless steel	13068-U	1 ea
none	80/100 HayesSep A	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13105-U	1 ea
none	80/100 HayeSep D	6.6 ft (2.0 m) × 1/16 in. × 0.75 mm	stainless steel	12921-U	1 ea
none	80/100 HayeSep N	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13144-U	1 ea
none	80/100 HayeSep N	8.0 ft (2.4 m) × 1/8 in. × 2.1 mm	stainless steel	13067-U	1 ea
none	80/100 HayeSep N	20.0 ft (6.1 m) × 1/8 in. × 2.1 mm	stainless steel	13021-U	1 ea
none	80/100 HayeSep Q	1.7 ft (0.52 m) × 1/8 × 2.1 mm (Both ends packed full)	stainless steel	14066-U	1 ea
none	80/100 HayeSep Q	3.0 ft (0.91 m) × 1/8 in. × 2.1 mm	nickel	13018-U	1 ea
none	80/100 HayeSep Q	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13803-U	1 ea
none	80/100 HayeSep Q	6.6 ft (2.0 m) × 1/16 in. × 0.75 mm	stainless steel	12879	1 ea
none	80/100 HayeSep Q	9.0 ft (2.7 m) × 1/8 in. × 2.1 mm	stainless steel	13073-U	1 ea
none	80/100 HayeSep Q	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	13038-U	1 ea
none	45/60 Molecular Sieve 5A	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13130-U	1 ea
none	45/60 Molecular Sieve 5A	9.0 ft (2.7 m) × 1/8 in. × 2.1 mm	stainless steel	13074-U	1 ea
none	60/80 Molecular Sieve 5A	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13133-U	1 ea
none	60/80 Molecular Sieve 5A	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	13832	1 ea
none	80/100 Molecular Sieve 5A	6.6 ft (2.0 m) × 1/16 in. × 0.75 mm	stainless steel	12963-U	1 ea
none	100/120 Molecular Sieve 5A	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12484-U	1 ea
none	45/60 Molecular Sieve 13X	2.0 ft (0.61 m) × 1/8 in. × 2.1 mm	stainless steel	13069-U	1 ea
none	45/60 Molecular Sieve 13X	3.0 ft (0.91 m) × 1/8 in. × 2.1 mm	stainless steel	13047-U	1 ea
none	45/60 Molecular Sieve 13X	4.0 ft (1.2 m) × 1/8 in. × 2.1 mm	stainless steel	13061-U	1 ea
none	45/60 Molecular Sieve 13X	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13134-U	1 ea
none	45/60 Molecular Sieve 13X	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	13036-U	1 ea
none	60/80 Molecular Sieve 13X	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13136-U	1 ea
none	80/100 Porapak N	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13063-U	1 ea
none	80/100 Porapak N	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13141-U	1 ea
none	80/100 Porapak N	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	13052-U	1 ea
none	80/100 Porapak P	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13146-U	1 ea
none	50/80 Porapak Q	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13232-U	1 ea
none	50/80 Porapak Q	8.0 ft (2.4 m) × 1/8 in. × 2.1 mm	stainless steel	13247-U	1 ea
none	80/100 Porapak Q	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12792-U	1 ea
none	80/100 Porapak Q	9.0 ft (2.7 m) × 1/8 in. × 2.1 mm	stainless steel	13016-U	1 ea
none	80/100 Porapak QS	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13789	1 ea
none	80/100 Porapak R	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13156-U	1 ea
none	80/100 Porapak S	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13161-U	1 ea
none	80/100 Porapak T	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13163-U	1 ea
none	60/80 Tenax TA	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12554	1 ea

Packed GC Columns and Components

Packed Columns: *For Agilent® GCs*

Glass Packed GC Column (fits Agilent, Configuration "C")

Use a glass column for applications where high inertness is required, such as for the analysis of active analytes. All glass columns undergo a proprietary high temperature silanization to ensure inertness. This column fits Agilent 5890 and 6890 (configuration C, not-on-column injection, all detectors except TCD).

Phase	Support	L × O.D. × I.D.	Cat. No.	Pkg
10% Carbowax 20M	100/120 SUPELCOPORT	6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (Preconditioned)	12478-U	1 ea
none	50/80 Porapak Q	6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (Preconditioned)	12483-U	1 ea

Metal Packed GC Column (fits Agilent, Configuration "C")

An economical metal column should be used for less demanding applications where the inertness of glass is not required. This column fits Agilent 5890 and 6890 (configuration C, not-on-column injection, all detectors except TCD).

Phase	Support	L × O.D. × I.D.	Column	Cat. No.	Pkg
none	80/100 HayeSep Q	3.0 ft (0.91 m) × 1/8 in. × 2.1 mm	stainless steel	14068-U	1 ea
none	80/100 HayeSep Q	3.0 ft (0.91 m) × 1/8 in. × 2.1 mm	nickel	14069-U	1 ea
none	60/80 Molecular Sieve 5A	8.0 ft (2.4 m) × 1/8 in. × 2.1 mm	stainless steel	14067-U	1 ea
none	80/100 Porapak Q	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm (Preconditioned)	stainless steel	14065-U	1 ea

For PerkinElmer® GCs

These columns fit PerkinElmer 8000, 9000, AutoSystem, XL, and Clarus 500 (Not On-Column Injection).

Glass Packed GC Column (fits PerkinElmer®)

Use a glass column for applications where high inertness is required, such as for the analysis of active analytes. All glass columns undergo a proprietary high temperature silanization to ensure inertness. This column fits PerkinElmer 8000, 9000, AutoSystem, XL, and Clarus 500 (Not On-Column Injection).

Phase	Support	L × O.D. × I.D.	Cat. No.	Pkg
4% Carbowax 20M + 0.8% KOH	60/80 Carbopack B	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	26033-U	1 ea
4% Carbowax 20M + 0.8% KOH	60/80 Carbopack B	6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (TightSpec)	26024	1 ea
4% Carbowax 20M	80/120 Carbopack B DA	6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (TightSpec)	25931-U	1 ea
5% Carbowax 20M	60/80 Carbopack B	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	26051	1 ea
5% Carbowax 20M	80/120 Carbopack B AW	6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (TightSpec)	25947	1 ea

Metal Packed GC Column (fits PerkinElmer®)

An economical metal column should be used for less demanding applications where the inertness of glass is not required. This column fits PerkinElmer 8000, 9000, AutoSystem, XL, and Clarus 500 (Not On-Column Injection).

Phase	Support	L × O.D. × I.D.	Column	Cat. No.	Pkg
0.2% Carbowax 1500	80/100 Carbopack C	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13738-U	1 ea
10% Carbowax 20M	80/100 SUPELCOPORT	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13748-U	1 ea
10% Carbowax 20M	80/100 Chromosorb W AW	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13746-U	1 ea
0.1% SP-1000	80/120 Carbopack C	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13736-U	1 ea
1% SP-1000	60/80 Carbopack B	8.0 ft (2.4 m) × 1/8 in. × 2.1 mm	stainless steel	13730-U	1 ea
3% SP-1500	80/120 Carbopack B	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	13734-U	1 ea
10% SP-2100	100/120 SUPELCOPORT	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13769	1 ea
10% SP-2330	100/120 Chromosorb W AW	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13778	1 ea
none	60/80 Carboxen-1000	15.0 ft (4.6 m) × 1/8 in. × 2.1 mm	stainless steel	13744-U	1 ea
none	80/100 Porapak Q	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13785	1 ea

Packed GC Columns and Components

Packed Columns: *For Varian® GCs*

For Varian® GCs

These columns fit Varian 3000, 4000, 6000, and Vista (FID, inj A to det A).

Glass Packed GC Column (fits Varian®)

Use a glass column for applications where high inertness is required, such as for the analysis of active analytes. All glass columns undergo a proprietary high temperature silanization to ensure inertness. This column fits Varian 3000, 4000, 6000, and Vista (FID, inj A to det A).

Phase	Support	L × O.D. × I.D.	Cat. No.	Pkg
4% Carbowax 20M	80/120 Carbopack B DA	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	25942	1 ea
3% SP-2100	100/120 SUPELCOPORT	6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	23858	1 ea

Metal Packed GC Column (fits Varian®)

An economical metal column should be used for less demanding applications where the inertness of glass is not required. This column fits Varian 3000, 4000, 6000, and Vista (FID, inj A to det A).

Phase	Support	L × O.D. × I.D.	Column	Cat. No.	Pkg
10% Carbowax 20M	80/100 SUPELCOPORT	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12768	1 ea
10% Carbowax 20M	80/100 Chromosorb W AW	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12456	1 ea
1% SP-1000	60/80 Carbopack B	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12489	1 ea
1% SP-1000	60/80 Carbopack B	8.0 ft (2.4 m) × 1/8 in. × 2.1 mm	stainless steel	12545-U	1 ea
3% SP-1500	80/120 Carbopack B	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	12596	1 ea
10% SP-2100	100/120 SUPELCOPORT	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12771	1 ea
none	40/60 Carboxen-1000	5.0 ft (1.5 m) × 1/8 in. × 2.1 mm	stainless steel	12384	1 ea
none	60/80 Carboxen-1000	15.0 ft (4.6 m) × 1/8 in. × 2.1 mm	stainless steel	12394	1 ea
none	80/100 Porapak Q	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12469	1 ea

General Configuration

These columns are general configuration, and can be carefully bent to fit most instruments.

Metal Packed GC Column (General Configuration)

An economical metal column should be used for less demanding applications where the inertness of glass is not required. This column is of a general configuration, and can be carefully bent to fit most instruments.

Phase	Support	L × O.D. × I.D.	Column	Cat. No.	Pkg
0.2% Carbowax 1500	60/80 Carbopack C	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13860-U	1 ea
0.2% Carbowax 1500	80/100 Carbopack C	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12501-U	1 ea
5% Carbowax 20M	60/80 Carbopack B	3.0 ft (0.91 m) × 1/16 in. × 1.25 mm (Preconditioned)	stainless steel	12087-U	1 ea
10% Carbowax 20M	80/100 SUPELCOPORT	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12713	1 ea
10% Carbowax 20M	80/100 Chromosorb W AW	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12212	1 ea
1.2% DC-200 (500 cstks)	80/100 Chromosorb P NAW	1.7 ft (0.52 m) × 1/8 in. × 2.1 mm	stainless steel	13978-U	1 ea
1.2% DC-200 (500 cstks)	80/100 Chromosorb P NAW	2.5 ft (0.76 m) × 1/8 in. × 2.1 mm	stainless steel	13986-U	1 ea
30% DC-200 (500 cstks)	80/100 Chromosorb P NAW	1.3 ft (0.40 m) × 1/8 in. × 2.1 mm	stainless steel	13984-U	1 ea
30% DC-200 (500 cstks)	80/100 Chromosorb P NAW	1.5 ft (0.46 m) × 1/8 in. × 2.1 mm	stainless steel	13976-U	1 ea
30% DC-200 (500 cstks)	80/100 Chromosorb P NAW	24.0 ft (7.3 m) × 1/8 in. × 2.1 mm	stainless steel	13977-U	1 ea
5% Fluorcol	60/80 Graphitized Carbon Black	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	SP alloy	12425	1 ea
5% Krytox 143AC	60/80 Carbopack B	20.0 ft (6.1 m) × 1/8 in. × 1.7 mm	copper	13271-U	1 ea
5% Krytox 143AC	60/80 Carbopack B	40.0 ft (12.2 m) × 1/8 in. × 1.7 mm	copper	13273-U	1 ea
30% Krytox 143AC	60/80 Chromosorb P NAW	20.0 ft (6.1 m) × 1/8 in. × 1.7 mm	copper	13274-U	1 ea
30% Krytox 143AC	60/80 Chromosorb P NAW	40.0 ft (12.2 m) × 1/8 in. × 1.7 mm	copper	13277-U	1 ea
3% OV-17	80/100 SUPELCOPORT	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12210	1 ea
3% Petrocol B	80/100 SUPELCOPORT	1.7 ft (0.52 m) × 1/8 in. × 2.1 mm	stainless steel	12449	1 ea
10% Petrocol C	80/100 SUPELCOPORT	1.7 ft (0.52 m) × 1/8 in. × 2.1 mm	stainless steel	12455	1 ea
0.1% SP-1000	80/100 Carbopack C	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12495-U	1 ea
1% SP-1000	60/80 Carbopack B	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12485-U	1 ea
1% SP-1000	60/80 Carbopack B	8.0 ft (2.4 m) × 1/8 in. × 2.1 mm	stainless steel	12543-U	1 ea
10% SP-1000	80/100 SUPELCOPORT	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	12537-U	1 ea
10% SP-1000	80/100 SUPELCOPORT	20.0 ft (6.1 m) × 1/8 in. × 2.1 mm	stainless steel	12719	1 ea
3% SP-1500	80/120 Carbopack B	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	12592	1 ea
23% SP-1700	80/100 Chromosorb P AW	30.0 ft (9.1 m) × 1/8 in. × 2.1 mm	stainless steel	12809-U	1 ea
10% SP-2100	80/100 SUPELCOPORT	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12429	1 ea
10% SP-2100	80/100 SUPELCOPORT	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	13766-U	1 ea

Packed GC Columns and Components

Packed Columns: *General Configuration*

Metal Packed GC Column (General Configuration) *(continued)*

Phase	Support	L × O.D. × I.D.	Column	Cat. No.	Pkg
10% SP-2100	100/120 SUPELCOPORT	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	12717	1 ea
20% SP-2100 + 1% Carbowax 1500	100/120 SUPELCOPORT	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	12718-U	10 ft
none	40/60 Carboxen-1000	2.0 ft (0.61 m) × 1/8 in. × 2.1 mm	stainless steel	12370-U	1 ea
none	40/60 Carboxen-1000	5.0 ft (1.5 m) × 1/8 in. × 2.1 mm	stainless steel	12380	1 ea
none	60/80 Carboxen-1000	15.0 ft (4.6 m) × 1/8 in. × 2.1 mm	stainless steel	12390-U	1 ea
none	80/100 Carboxen-1004	6.6 ft (2.0 m) × 1/16 in. × 0.75 mm	stainless steel	12854	1 ea
none	80/100 Chromosorb 102	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13794	1 ea
none	80/100 HaySep D	6.6 ft (2.0 m) × 1/16 in. × 0.75 mm	stainless steel	12917	1 ea
none	80/100 HayeSep Q	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13801	1 ea
none	80/100 HayeSep Q	6.6 ft (2.0 m) × 1/16 in. × 0.75 mm	stainless steel	12875	1 ea
none	80/100 HayeSep R	3.0 ft (0.91 m) × 1/16 in. × 1.25 mm (Preconditioned)	stainless steel	12085-U	1 ea
none	80/100 HayeSep R	6.0 ft (1.8 m) × 1/16 in. × 1.25 mm (Preconditioned)	stainless steel	12086-U	1 ea
none	60/80 Molecular Sieve 5A	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13823	1 ea
none	60/80 Molecular Sieve 5A	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	13830-U	1 ea
none	80/100 Molecular Sieve 5A	4.9 ft (1.5 m) × 1/16 in. × 1.25 mm	stainless steel	13166-U	1 ea
none	80/100 Molecular Sieve 5A	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13837	1 ea
none	80/100 Molecular Sieve 5A	6.6 ft (2.0 m) × 1/16 in. × 0.75 mm	stainless steel	12959-U	1 ea
none	45/60 Molecular Sieve 13X	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	13981-U	1 ea
none	80/100 Porapak Q	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13037-U	1 ea
none	80/100 Porapak Q	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	12437	1 ea
none	80/100 Porapak Q	10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	stainless steel	13979-U	1 ea
none	80/100 Porapak QS	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	stainless steel	13787	1 ea

PTFE Packed GC Column (General Configuration)

For low temperature applications, a PTFE column offers the flexibility of metal with inertness approaching that of glass. This column is of a general configuration, and can be carefully bent to fit most instruments.

Phase	Support	L × O.D. × I.D.	Cat. No.	Pkg
12% Polyphenyl ether + 0.5% H_3PO_4	40/60 Chromosorb T	36.0 ft (11.0 m) × 1/8 in. × 2.1 mm	11500	1 ea
none	Chromosil 310	8.0 ft (2.4 m) × 1/8 in. × 2.1 mm (Ends empty; middle 6 ft packed)	11501-U	1 ea
none	Chromosil 330	8.0 ft (2.4 m) × 1/8 in. × 2.1 mm (Ends empty, middle 6 ft packed)	11496	1 ea
none	80/100 Porapak QS	6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	13071-U	1 ea
none	Supelpak S	2.5 ft (0.76 m) × 1/8 in. × 2.1 mm (Ends empty; middle 1.5 ft packed)	12255-U	1 ea

Column Sets

These column sets are specifically designed for specific column switching applications. Column manufacturing procedures have been optimized resulting in column sets that provide highly reproducible analyses.

Packed GC Column Set

Description	Suitability		Cat. No.	Qty
Packed GC Column Set	GPA 2177 (3-column set) *Supelco 13984-U* *Supelco 13977-U*	*Supelco 13986-U*	13987-U	1 set
Packed GC Column Set	GPA 2261 (3-column set) *Supelco 13976-U* *Supelco 13977-U*	*Supelco 13978-U*	13993-U	1 set
Packed GC Column Set	GPA 2261 (3-column set, pretested) *Supelco 13976-U* *Supelco 13977-U*	*Supelco 13978-U*	13994-U	1 set
Packed GC Column Set	GPA 2261 (5-column set) *Supelco 13976-U* *Supelco 13977-U* *Supelco 13978-U*	*Supelco 13981-U* *Supelco 13979-U*	13982-U	1 set

Packed GC Columns and Components

PureCol Sleeves for Packed GC Columns

PureCol Sleeves for Packed GC Columns

When nonvolatiles accumulate in the column inlet, you must replace several inches of packing - or the entire column. A silanized glass PureCol sleeve, inserted in the column inlet, solves this problem simply and inexpensively. When column performance begins to deteriorate, you can quickly and conveniently replace the sleeve - often without removing the column from the instrument. Replacement time is comparable to replacing a septum. Replace the PureCol sleeve when you change the septum, or when you analyze a new type of sample. PureCol sleeves are available in two sizes. The larger size fits any 4 mm I.D. glass column that has 7 cm of straight, unpacked inlet. The smaller size fits any 2 mm I.D. glass columns with 7 cm of straight, unpacked inlet (end must be chamfered). Use PureCol sleeves with a 2 in. (5 cm) 21-gauge or finer needle.

PureCol Sleeve

Description	Cat. No.	Qty
PureCol Sleeve, for 4 mm I.D. columns	20540-U	10 ea
	20543	50 ea
PureCol Sleeve, for 2 mm I.D. columns (chamfered inlet only)	20534	10 ea
	20536	50 ea

Inlet Liners for Packed GC (Not On-Column)

These deactivated (silanized) glass liners prevent reaction between active sample components and the metal surfaces inside the injection port.

Inlet Liner, for Packed GC (unpacked)

Deactivated (silanized) glass inlet liner for packed injection ports.

- Fits Agilent (5890, 6890, and 7890)

L × O.D. × I.D. ..... 91.5 mm × 3.0 mm × 1.8 mm

Cat. No.	Qty
20508	5 ea
20511	25 ea

Inlet Liner, for Packed GC (wool packed)

Deactivated (silanized) glass inlet liner for packed injection ports.

- Fits PerkinElmer (AutoSystem)

L × O.D. × I.D. ..... 112 mm × 6.0 mm × 3.0 mm

Cat. No.	Qty
2631705	5 ea
2631725	25 ea

Inlet Liner, for Packed GC (unpacked)

Deactivated (silanized) glass inlet liner for packed injection ports.

- Fits PerkinElmer (AutoSystem)

L × O.D. × I.D. ..... 112 mm × 6.0 mm × 3.0 mm

Cat. No.	Qty
2631605	5 ea
2631625	25 ea

Empty Columns

To make your own column, first choose an empty column that fits your system. Both glass and stainless steel columns are offered.

Custom Capabilities: The products listed here are only those that are stock items. We have the ability to manufacture many, many more products. If you do not see the item you need, please contact Technical Service at 800-359-3041 (US and Canada), 814-359-3041, or techservice@sial.com

Empty Glass Columns

All empty glass columns are made in our in-house glass shop, thereby controlling quality at a high level. Over 500 column configurations are currently on hand. All glass columns also undergo a proprietary high temperature silanization to ensure inertness. Fittings are not included.

TightSpec columns conform to within +/-6 mm of their stated lengths. Other columns conform to within 1.5% of instrument manufacturers' length specifications.

Empty Glass GC Column, for Agilent® 5700 (Configuration "5")

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 8.72 in. (221 mm)
- Y (length of detector arm) = 5.18 in. (132 mm)
- S (span, injector to detector) = 6.0 in. (152 mm)

This column fits Agilent 5700 (configuration 5, on-column injection).

L × O.D. × I.D.	Cat. No.	Qty
6.0 ft (1.8 m) × ¼ in. × 4.0 mm	21637	1 ea

Packed GC Columns and Components

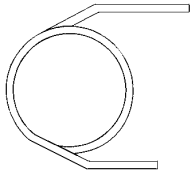
Empty Columns: *Empty Glass Columns*

Empty Glass GC Column, for Agilent® 5890 and 6890 (Configuration "A")

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 11.02 in. (280 mm)
- Y (length of detector arm) = 9.05 in. (230 mm)
- S (span, injector to detector) = 9.0 in. (229 mm)

This column fits Agilent 5890 and 6890 (configuration A, on-column injection, all detectors except TCD).



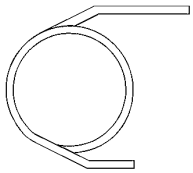
L × O.D. × I.D.	Cat. No.	Qty
2.0 ft (0.61 m) × 1/4 in. × 2.0 mm	21638	1 ea
3.0 ft (0.91 m) × 1/4 in. × 2.0 mm	21838	1 ea
3.3 ft (1.0 m) × 1/4 in. × 2.0 mm (TightSpec)	21203-U	1 ea
4.0 ft (1.2 m) × 1/4 in. × 4.0 mm	21839	1 ea
4.0 ft (1.2 m) × 1/4 in. × 2.0 mm	21776	1 ea
6.0 ft (1.8 m) × 1/4 in. × 4.0 mm	21681	1 ea
6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	21641	1 ea
6.6 ft (2.0 m) × 1/4 in. × 4.0 mm (TightSpec)	21815	1 ea
6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (TightSpec)	21814	1 ea
7.9 ft (2.4 m) × 1/4 in. × 2.0 mm (TightSpec)	21816	1 ea
10.0 ft (3.0 m) × 1/4 in. × 2.0 mm	21683	1 ea
12.0 ft (3.6 m) × 1/4 in. × 2.0 mm	13077-U	1 ea

Empty Glass GC Column, for Agilent® 5890 and 6890 (Configuration "B")

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 11.02 in. (280 mm)
- Y (length of detector arm) = 7.09 in. (180 mm)
- S (span, injector to detector) = 9.0 in. (229 mm)

This column fits Agilent 5890 and 6890 (configuration B, on-column injection, TCD only).



L × O.D. × I.D.	Cat. No.	Qty
6.0 ft (1.8 m) × 1/4 in. × 4.0 mm	20500-U	1 ea
6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	20613	1 ea
10.0 ft (3.0 m) × 1/4 in. × 2.0 mm	21642	1 ea

Empty Glass GC Column, for Carlo Erba 2100

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 11.85 in. (301 mm)
- Y (length of detector arm) = 10.67 in. (271 mm)
- S (span, injector to detector) = 2.82 in. (72 mm)

This column fits Carlo Erba 2100.

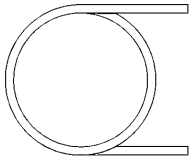
L × O.D. × I.D.	Cat. No.	Qty
6.0 ft (1.8 m) × 6.0 mm × 2.0 mm	20583-U	1 ea

Empty Glass GC Column, for PerkinElmer® 115, 300, 900, 2000, and Sigma (Not On-Column)

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 8.62 in. (219 mm)
- Y (length of detector arm) = 8.62 in. (219 mm)
- S (span, injector to detector) = 8.75 in. (222 mm)

This column fits PerkinElmer 115, 300, 900, 2000, and Sigma (not on-column injection).



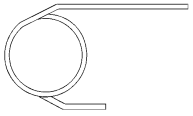
L × O.D. × I.D.	Cat. No.	Qty
4.0 ft (1.2 m) × 1/4 in. × 2.0 mm	21842	1 ea
6.0 ft (1.8 m) × 1/4 in. × 4.0 mm	21654	1 ea
6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	20487	1 ea

Empty Glass GC Column, for PerkinElmer® 8000 and 9000 (On-Column)

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 12.0 in. (305 mm)
- Y (length of detector arm) = 6.81 in. (173 mm)
- S (span, injector to detector) = 6.5 in. (165 mm)

This column fits PerkinElmer 8000 and 9000 (on-column injection).



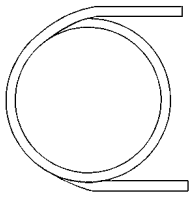
L × O.D. × I.D.	Cat. No.	Qty
3.0 ft (0.91 m) × 1/4 in. × 2.0 mm	21739	1 ea

Empty Glass GC Column, for PerkinElmer® 8000, 9000, AutoSystem, XL, and Clarus 500 (Not On-Column)

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 6.81 in. (173 mm)
- Y (length of detector arm) = 6.81 in. (173 mm)
- S (span, injector to detector) = 6.5 in. (165 mm)

This column fits PerkinElmer 8000, 9000, AutoSystem, XL, and Clarus 500 (not on-column injection).



L × O.D. × I.D.	Cat. No.	Qty
6.0 ft (1.8 m) × 1/4 in. × 4.0 mm (TightSpec)	21806	1 ea
6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	21804	1 ea
6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (TightSpec)	21179-U	1 ea

Packed GC Columns and Components

Empty Columns: *Empty Glass Columns*

Empty Glass GC Column, for Pye 104, 106, and 204 (On-Column)

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 11.0 in. (279 mm)
- Y (length of detector arm) = 5.38 in. (137 mm)
- S (span, injector to detector) = 7.0 in. (178 mm)

This column fits Pye 104, 106, and 204 (on-column injection).

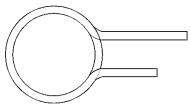
L × O.D. × I.D.	Cat. No.	Qty
6.0 ft (1.8 m) × 1/4 in. × 4.0 mm	21792	1 ea

Empty Glass GC Column, for Shimadzu™ 7A, 9A, 12A, 14A, 14B, 15A, 16A, and 2014 (On-Column)

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 13.0 in. (330 mm)
- Y (length of detector arm) = 11.0 in. (279 mm)
- S (span, injector to detector) = 1.57 in. (40 mm)

This column fits Shimadzu 7A, 9A, 12A, 14A, 14B, 15A, 16A, and 2014 (on-column injection).



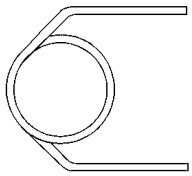
L × O.D. × I.D.	Cat. No.	Qty
3.3 ft (1.0 m) × 5.0 mm × 2.6 mm (TightSpec)	21190-U	1 ea
6.0 ft (1.8 m) × 5.0 mm × 3.0 mm (TightSpec)	21192-U	1 ea
6.0 ft (1.8 m) × 5.0 mm × 3.0 mm	21538	1 ea
6.0 ft (1.8 m) × 5.0 mm × 2.6 mm (TightSpec)	21191-U	1 ea
6.0 ft (1.8 m) × 5.0 mm × 2.6 mm	21879-U	1 ea
8.2 ft (2.5 m) × 5.0 mm × 2.6 mm	21880-U	1 ea

Empty Glass GC Column, for Shimadzu™ 8A and 8A1F

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 9.0 in. (229 mm)
- Y (length of detector arm) = 9.0 in. (229 mm)
- S (span, injector to detector) = 6.0 in. (152 mm)

This column fits Shimadzu 8A and 8A1F.



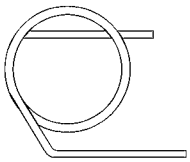
L × O.D. × I.D.	Cat. No.	Qty
4.9 ft (1.5 m) × 5.0 mm × 3.0 mm	21632	1 ea
6.6 ft (2.0 m) × 5.0 mm × 3.0 mm	21633	1 ea

Empty Glass GC Column, for Shimadzu™ Mini-GC (On-Column)

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 7.48 in. (190 mm)
- Y (length of detector arm) = 5.59 in. (142 mm)
- S (span, injector to detector) = 4.72 in. (120 mm)

This column fits Shimadzu mini-GC (on-column injection).



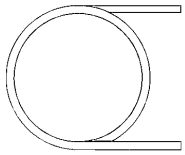
L × O.D. × I.D.	Cat. No.	Qty
6.0 ft (1.8 m) × 5.0 mm × 3.0 mm	20609	1 ea

Empty Glass GC Column, for Tracor 540, 560, 565, 570, and 585 (Not On-Column)

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 8.0 in. (203 mm)
- Y (length of detector arm) = 8.0 in. (203 mm)
- S (span, injector to detector) = 6.0 in. (152 mm)

This column fits Tracor 540, 560, 565, 570, and 585 (not on-column injection).



L × O.D. × I.D.	Cat. No.	Qty
6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	21588	1 ea

Empty Glass GC Column, for Varian® 3000, 4000, 6000, and Vista™ (FID, Inj. A to Det. A, On-Column)

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 9.31 in. (236 mm)
- Y (length of detector arm) = 8.0 in. (203 mm)
- S (span, injector to detector) = 5.5 in. (140 mm)

This column fits Varian 3000, 4000, 6000, and Vista (FID, injector A to detector A, on-column injection).

L × O.D. × I.D.	Cat. No.	Qty
3.3 ft (1.0 m) × 1/4 in. × 2.0 mm (TightSpec)	21207	1 ea
6.0 ft (1.8 m) × 1/4 in. × 4.0 mm	21722	1 ea
6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	21721	1 ea
6.6 ft (2.0 m) × 1/4 in. × 4.0 mm (TightSpec)	21194-U	1 ea
6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (TightSpec)	21181-U	1 ea
6.6 ft (2.0 m) × 1/4 in. × 2.0 mm (TightSpec)	21829	1 ea
6.6 ft (2.0 m) × 1/4 in. × 2.0 mm	21853-U	1 ea
8.6 ft (2.6 m) × 1/4 in. × 2.0 mm	21765	1 ea

Packed GC Columns and Components

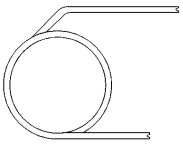
Empty Columns: *Empty Glass Columns*

Empty Glass GC Column, for Varian® 3300 and 3400 (FID, Inj. B to Det. B, On-Column)

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 9.31 in. (236 mm)
- Y (length of detector arm) = 8.0 in. (203 mm)
- S (span, injector to detector) = 6.82 in. (173 mm)

This column fits Varian 3300 and 3400 (FID, injector B to detector B, on-column injection).



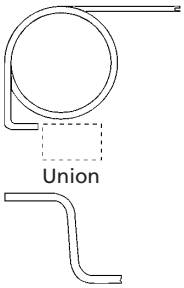
L × O.D. × I.D.	Cat. No.	Qty
6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	20841	1 ea

Empty Glass GC Column, for Varian®, Universal for 3000, 4000, 6000, and Vista™ (On-Column)

Silane treated empty glass column. Fittings are not included.

- X (length of injector arm) = 9.25 in. (235 mm)
- Y (length of detector arm) = 2.0 in. (51 mm)
- S (span, injector to detector) = n/a

This column fits Varian 3000, 4000, 6000, and Vista (on-column injection). The three piece construction (injector arm + coil, union, and detector arm) allows its use in any injector to detector position (A to A, B to B, A to B, and B to A).



L × O.D. × I.D.	Cat. No.	Qty
6.0 ft (1.8 m) × 1/4 in. × 4.0 mm	20847	1 ea
6.0 ft (1.8 m) × 1/4 in. × 2.0 mm	20845	1 ea
6.6 ft (2.0 m) × 1/4 in. × 2.0 mm	21882-U	1 ea

Empty Stainless Steel Columns

For less demanding applications where the inertness of glass is not required, choose more economical stainless steel. Columns can be carefully bent to fit most instruments.

Empty Stainless Steel GC Column

L × O.D. × I.D.	Cat. No.	Qty
6.0 ft (1.8 m) × 1/8 in. × 2.1 mm	13096-U	1 ea
8.0 ft (2.4 m) × 1/8 in. × 2.1 mm	13097-U	1 ea
10.0 ft (3.0 m) × 1/8 in. × 2.1 mm	13098-U	1 ea
12.0 ft (3.6 m) × 1/8 in. × 2.1 mm	13099-U	1 ea
20.0 ft (6.1 m) × 1/8 in. × 2.1 mm	13100-U	1 ea

Packings

We offer small quantities of many ready-to-use packings for those wanting to pack their own columns. Both coated and uncoated packings are available.

Custom Capabilities: The products listed here are only those that are stock items. We have the ability to manufacture many, many more products. If you do not see the item you need, please contact Technical Service at 800-359-3041 (US and Canada), 814-359-3041, or techservice@sial.com

Coated Packings

Coated packings consist of a liquid (gum) stationary phase pre-coated on a solid support. All coated packings are prepared in our in-house manufacturing facility.

Coated GC Packing

Phase	Support	Cat. No.	Qty
0.2% Carbowax 1500	60/80 Carbopack C	11826	15 g
0.2% Carbowax 1500	80/100 Carbopack C	11827	15 g
0.3% Carbowax 20M + 0.1% H_3PO_4	60/80 Carbopack C	11825-U	15 g
4% Carbowax 20M + 0.8% KOH	60/80 Carbopack B	11887	15 g
4% Carbowax 20M	80/120 Carbopack B DA	11889	15 g
5% Carbowax 20M	40/60 Chromosorb T	11993	50 g
5% Carbowax 20M	60/80 Carbopack B	11766	15 g
5% Carbowax 20M	80/120 Carbopack B AW	11812-U	15 g
6.6% Carbowax 20M	80/120 Carbopack B AW	11814	15 g
2.5% Oronite NIW	60/80 Carbopack B	11800-U	15 g
1.5% OV-225 + 1% H_3PO_4	60/80 Carbopack B	1505-U	10 g
0.1% SP-1000	80/100 Carbopack C	11820	15 g
1% SP-1000	60/80 Carbopack B	11815	15 g
3% SP-1500	80/120 Carbopack B	11813-U	15 g
1% SP-1510	60/80 Carbopack B	11809	15 g
0.8% THEED	80/100 Carbopack C	11880-U	15 g

Uncoated Packings

Uncoated packings consist of an adsorbent-type support that does not require a liquid (gum) stationary phase to be coated on it to perform chromatography. We use some of the most commonly used carbon, molecular sieve, and porous polymer adsorbents:

- **Carboxen® Adsorbents**: Carbon molecular sieve materials with through-pore structures, which provides excellent thermodynamic and kinetic properties.
- **Carbosieve® Adsorbents**: Carbon molecular sieve materials with closed-pore structure, which provides very strong retention of small molecules.
- **Molecular Sieve Adsorbents**: Synthetically produced zeolites (naturally occurring aluminosilicate minerals), characterized by pores and internal cavities of extremely uniform dimensions.
- **Tenax Adsorbents**: Widely used porous polymers with unique structures, that provide alternate and desirable adsorption/desorption characteristics compared to other porous polymers.
- **HayeSep Adsorbents**: Second generation porous polymer materials that exhibit minimal shrinkage and monomer bleed.
- **Porapak Adsorbents**: These are first generation porous polymer materials.
- **Chromosorb Adsorbents**: These polyaromatic cross-linked porous polymers have uniform rigid structures. We do not offer Chromosorb adsorbents for sale in bulk. These materials are only available in columns.

Packed GC Columns and Components

Packings: *Uncoated Packings*

Many of these materials are also used as adsorbents in air collection media.

	Cat. No.	Qty
Carboxen® Adsorbent		
matrix Carboxen® 563, 20-45 mesh	10263	10 g
matrix Carboxen® 564, 20-45 mesh	10264	10 g
matrix Carboxen® 564, 20-45 mesh	11324-U	144 × 290 mg
matrix Carboxen® 569, 20-45 mesh	10269	10 g
matrix Carboxen® 569, 20-45 mesh	11048-U	500 g
matrix Carboxen® 572, 20-45 mesh	11072-U	10 g
matrix Carboxen® 1000, 40-60 mesh	10477-U	50 g
matrix Carboxen® 1000, 60-80 mesh	10478-U	10 g
matrix Carboxen® 1003, 40-60 mesh	10471	10 g
matrix Carboxen® 1016, 60-80 mesh	11021-U	10 g
Carbosieve® Adsorbent		
matrix Carbosieve® G, 45-60 mesh	10197	5 g
matrix Carbosieve® G, 60-80 mesh	10198	5 g
matrix Carbosieve® G, 80-100 mesh	10199	5 g
matrix Carbosieve® S-II, 60-80 mesh	10189	10 g
matrix Carbosieve® S-II, 80-100 mesh	10190-U	10 g
matrix Carbosieve® S-III, 60-80 mesh	10184	10 g
Molecular Sieve Adsorbent		
matrix Molecular Sieve 5A, 30-40 mesh	20300	50 g
matrix Molecular Sieve 5A, 45-60 mesh	20301	50 g
matrix Molecular Sieve 5A, 60-80 mesh	20302	50 g
matrix Molecular Sieve 13X, 45-60 mesh	20304	50 g
matrix Molecular Sieve 13X, 60-80 mesh	20305	50 g
matrix Molecular Sieve 13X, 100-120 mesh	20307	50 g
Tenax® Porous Polymer Adsorbent		
matrix Tenax TA, 60-80 mesh	11982	10 g
matrix Tenax TA (refined), 60-80 mesh	12168-U	100 g
matrix Tenax TA, 80-100 mesh	21009-U	10 g
matrix Tenax GR, 20-35 mesh	11049-U	500 g
HayeSep® Porous Polymer Adsorbent		
matrix HayeSep A, 60-80 mesh	10282	75 cc
matrix HayeSep A, 80-100 mesh	10283	75 cc
matrix HayeSep A, 100-120 mesh	10284	75 cc
matrix HayeSep B, 80-100 mesh	10286	75 cc
matrix HayeSep C, 60-80 mesh	10288	75 cc
matrix HayeSep C, 80-100 mesh	10289	75 cc
matrix HayeSep C, 100-120 mesh	10290	75 cc
matrix HayeSep D, 60-80 mesh	10291	75 cc
matrix HayeSep D, 80-100 mesh	10292	75 cc
matrix HayeSep D, 100-120 mesh	10293	75 cc
matrix HayeSep DB, 80-100 mesh	10280-U	75 cc
matrix HayeSep DB, 100-120 mesh	10281-U	75 cc
matrix HayeSep N, 60-80 mesh	10294	75 cc
matrix HayeSep N, 80-100 mesh	10295	75 cc
matrix HayeSep N, 100-120 mesh	10296	75 cc
matrix HayeSep P, 60-80 mesh	10297	75 cc
matrix HayeSep P, 80-100 mesh	10298	75 cc
matrix HayeSep Q, 60-80 mesh	10300-U	75 cc
matrix HayeSep Q, 80-100 mesh	10301-U	75 cc
matrix HayeSep Q, 100-120 mesh	10302-U	75 cc
matrix HayeSep R, 60-80 mesh	10303	75 cc
matrix HayeSep R, 80-100 mesh	10304	75 cc
matrix HayeSep R, 100-120 mesh	10305-U	75 cc
matrix HayeSep S, 60-80 mesh	10306	75 cc
matrix HayeSep S, 80-100 mesh	10307	75 cc
matrix HayeSep T, 60-80 mesh	10309	75 cc
matrix HayeSep T, 80-100 mesh	10310	75 cc
matrix HayeSep T, 100-120 mesh	10311	75 cc
Porapak™ Porous Polymer Adsorbent		
matrix Porapak N, 50-80 mesh	20324	75 cc
matrix Porapak N, 80-100 mesh	20325	75 cc
matrix Porapak N, 100-120 mesh	20326	75 cc
matrix Porapak P, 50-80 mesh	20327	75 cc
matrix Porapak P, 80-100 mesh	20328	75 cc
matrix Porapak P, 100-120 mesh	20329	75 cc
matrix Porapak PS, 50-80 mesh	20345	75 cc
matrix Porapak PS, 80-100 mesh	20346	75 cc
matrix Porapak Q, 50-80 mesh	20330-U	75 cc
matrix Porapak Q, 80-100 mesh	20331	75 cc
matrix Porapak Q, 100-120 mesh	20332	75 cc
matrix Porapak QS, 50-80 mesh	20342	75 cc
matrix Porapak QS, 80-100 mesh	20343	75 cc
matrix Porapak QS, 100-120 mesh	20344	75 cc
matrix Porapak R, 50-80 mesh	20333	75 cc
matrix Porapak R, 80-100 mesh	20334	75 cc
matrix Porapak R, 100-120 mesh	20335	75 cc
matrix Porapak S, 80-100 mesh	20337	75 cc
matrix Porapak S, 100-120 mesh	20338	75 cc
matrix Porapak T, 50-80 mesh	20339	75 cc
matrix Porapak T, 80-100 mesh	20340	75 cc

Stationary Phases

A GC stationary phase is the chemical entity that provides chromatography to occur. Prior to use, a stationary phase must first be coated then dried onto a support, before being used to fill a column. All of the stationary phases we offer are synthesized specifically for GC use, resulting in those that are typically purer, of narrow molecular weight range, and without trace catalysts or impurities.

Custom Capabilities: The products listed here are only those that are stock items. We have the ability to manufacture many, many more products. If you do not see the item you need, please contact Technical Service at 800-359-3041 (US and Canada), 814-359-3041, or techservice@sial.com

GC Stationary Phase

Phase	Cat. No.	Qty
Apiezon L	21006	25 g
Bentone 34	21013-U	50 g
bis(2-Ethoxyethyl)adipate	21146	50 g
Carbowax 1540	21028	50 g
Carbowax 20M	21032	50 g
Carbowax 20M/terephthalic acid	11033-U	50 g
DC-200 (12,500 cstks)	21095	50 g
DC-200	85377-250ML	250 mL
DC-550	21096	50 g
DC-550	85378-50ML	50 mL
DC-710	85427-100ML	100 mL
DC QF-1 (FS 1265)	21098-U	50 g
Di-n-decyl phthalate	21042-U	25 g
Diethylene glycol succinate (DEGS)	11045	25 g
Dinonyl phthalate	80151-25ML	25 mL
Dinonyl phthalate	21052-U	50 g
Ethylene glycol adipate (EGA)	11060	25 g
Free fatty acid phase (FFAP)	21063-U	10 g
OV-1	85380-5G	5 g
OV-1	21104	10 g
OV-17	21105	25 g

Packed GC Columns and Components

Stationary Phases

GC Stationary Phase *(continued)*

Phase	Cat. No.	Qty
OV-25	21234	10 g
OV-25	85382-10G	10 g
OV-101	21228	20 g
OV-210	21240-U	25 g
OV-225	21241	5 g
OV-275	21278-U	5 g
β,β-Oxydipropionitrile	21086	50 g
Polyethyleneimine	21195-U	50 g
PS 347.5	85392-50ML	50 mL
SE-30	21099-U	10 g
SE-54	21106	50 g
SF-96	21101-U	50 g
SP-1200	21263	10 g
SP-2100	21284-U	10 g
SP-2330	21287-U	5 g
SP-2340	21288	5 g
Squalane	21109	50 g
Synperonic PE/F68	81112-50G	50 g
Synperonic PE/L64	81114-10ML	10 mL
1,2,3-tris(2-Cyanoethoxy)propane (TCEP)	21217	50 g
Triton X-100	21123	50 g
UCW 98	21272-U	50 g

Supports

A GC support is the solid or porous particle that a liquid (gum) stationary phase is coated onto then dried, making a GC packing which can then be use to fill a GC column. We use three types of supports:

- **Carbon**: Our Carbopack™ specialty carbon materials make excellent GC supports. Because these materials are synthesized in-house, their physical and chemical characteristics can be controlled more tightly than with natural materials. Carbopack™ materials are also widely used as adsorbents in air sampling media.
- **Diatomite**: Sedimentary rock composed of the siliceous skeletal remains of pre-historic single-celled aquatic plants. These naturally-occurring materials must first be mined from deposits then processed for use a GC supports. Versions include NAW (non-acid washed), AW (acid washed), and AW-DMCS (acid washed then silanized). Our SUPELCOPORT supports are similar to Chromosorb W AW-DMCS materials, although more inert. We do not offer diatomite supports for sale in bulk. These materials are only available in columns.
- **Fluorocarbon**: A high molecular weight fluorocarbon resin particle is both inert and has a fairly high surface area. It is useful for lower temperature applications when a highly inert surface is required. We do not offer fluorocarbon supports for sale in bulk. These materials are only available in columns.

Custom Capabilities: The products listed here are only those that are stock items. We have the ability to manufacture many, many more products. If you do not see the item you need, please contact Technical Service at 800-359-3041 (US and Canada), 814-359-3041, or techservice@sial.com

	Cat. No.	Qty
Carbotrap®/Carbopack™ Adsorbent		
matrix Carbopack B, 60-80 mesh	20273	10 g
matrix Carbopack™ C, 60-80 mesh	10257	10 g
matrix Carbopack™ C, 80-100 mesh	10258	10 g

GC Column Test Mixes

Test mixes are an inexpensive aid to obtaining high quality chromatograms. They are useful when analyzed:

- After you install a column in your system, to make sure you haven't also installed some surprises (such as ferrule or column fragments in the column, or small leaks). Poor peak shape may be an indication of dead volume from an improper nut/ferrule combination, or an incorrect insertion distance of the column inlet into the injection port.
- During method development, to assist in setting proper linear velocity, split ratio, injection volume, etc.
- Routinely as part of a preventative maintenance regiment. This allows trends in the chromatography to be observed, providing an early warning to keep little problems from growing into big problems.
- For troubleshooting purposes, to help identify root causes, and to verify when the system is back in working order.

GC Column Test Mixes

Methane Standard and Accessories

Methane Standard and Accessories

Methane is the ideal compound to measure linear velocity and dead time for many GC columns because it is unretained. Use 50 µL injections of this dilute methane standard for more accurate flow measurements than will smaller quantities of more concnetrated methane.

Description	Cat. No.	Qty
Methane in helium, 100 ppm, analytical standard	307200	14 L
Miniature Regulator with Gauge	513010	1 ea
Syringe Adaptor	609010	1 ea
Hamilton® GASTIGHT® Syringe, 1700 series, volume 250 µL, needle size 22s ga (side-port)	20705	1 ea

General Test Mixes

These test mixes can be used following installation or on a routine schedule to indicate column efficiency, leaks, dead volume, and column inertness.

The **Programmed Test Mix** is based on the comprehensive mix developed by Grob (Grob, et al., *J. Chromatogr.* 156, 1978, p. 1). It can be used to measure a column's affinity for many analyte types:

- The normal alkanes (decane and undecane) measure column efficiency.
- The fatty acid methyl esters (methyl decanoate, methyl laurate, and methyl undecanoate) measure column efficiency.
- The alcohol (1-octanol) and diol (2,3-butanediol) measure the presence of hydrogen-bonding sites (exposed silanols).
- The aldehyde (nonanal) measures saturated aldehyde adsorption by means other than hydrogen-bonding.
- The amine (dicyclohexylamine) measures irreversible adsorption.
- The acid/base pair (2,6-dimethylphenol/2,6-dimethylaniline) measure acid/base surface characteristic.
- The acid/base pair (2-ethylhexanoic acid/dicyclohexylamine) measure acid/base surface characteristic.

Three **Isothermal Test Mixes** are offered. Match the polarity of the test mix with the polarity of the column. A convenient kit containing one of each mix is available.

Use a **Hydrocarbon Test Mix** to check for proper capillary GC column installation. Calculating theoretical plates is also possible.

The **Acidity Test Mix** is used to measure the acid/base affinity of your column. Simply inject this mix and compare peak heights.

Description	Concentration			Cat. No.	Qty
Programmed Test Mix	in methylene chloride (varied conc.) *2,3-Butanediol, 530 µg/mL* *Decane, 280 µg/mL* *Dicyclohexylamine, 310 µg/mL* *2,6-Dimethylaniline, 320 µg/mL* *2,6-Dimethylphenol, 320 µg/mL* *2-Ethylhexanoic acid, 380 µg/mL*	 *Methyl decanoate, 420 µg/mL* *Methyl laurate, 410 µg/mL* *Methyl undecanoate, 420 µg/mL* *Nonanal, 400 µg/mL* *1-Octanol, 360 µg/mL* *Undecane, 290 µg/mL*	-	47304	2 mL
Isothermal Test Mix Kit	- *Nonpolar Column Test Mix (Supelco 47300-U)* *Intermediate Polar Column Test Mix (Supelco 47301)*	 *Polar Column Test Mix (Supelco 47302)*	-	47303	3 × 2 mL
Nonpolar Column Test Mix	500 µg/mL in methylene chloride *Decane* *2,6-Dimethylaniline* *2,6-Dimethylphenol* *Dodecane*	 *1-Octanol* *2-Octanone* *Tridecane* *Undecane*	-	47300-U	2 mL
Intermediate Polar Column Test Mix	500 µg/mL in methylene chloride *Decane* *2,6-Dimethylaniline* *2,6-Dimethylphenol* *Dodecane* *1-Octanol*	 *2-Octanone* *Tetradecane* *Tridecane* *Undecane*	-	47301	2 mL
Polar Column Test Mix	500 µg/mL each component in methylene chloride *2,6-Dimethylaniline* *2,6-Dimethylphenol* *Eicosane* *Heptadecane* *Hexadecane*	 *Octadecane* *1-Octanol* *2-Octanone* *Pentadecane*	-	47302	2 mL
Hydrocarbon Test Mix	in chloroform (varied conc.) *Dodecane* *Tridecane* *Tetradecane*	 *Pentadecane* *Hexadecane* *Heptadecane*	-	48244	2 mL

GC Column Test Mixes

General Test Mixes

Description	Concentration			Cat. No.	Qty
C7 - C30 Saturated Alkanes	1000 µg/mL each component in hexane		-	49451-U	1 mL
	Decane *Docosane* *Dodecane* *Eicosane* *Heneicosane* *Heptacosane* *Heptadecane* *Hexacosane* *Hexadecane* *Heptane* *Nonacosane* *Nonadecane*	*Nonane* *Octacosane* *Octadecane* *Octane* *Pentacosane* *Pentadecane* *Tetracosane* *Tetradecane* *Triacontane* *Tricosane* *Tridecane* *Undecane*			
C7 - C40 Saturated Alkane Mixture	1000 µg/mL each component in hexane		-	49452-U	1 mL
	Decane *Docosane* *Dodecane* *Dotriacontane* *Eicosane* *Heneicosane* *Hentriacontane* *Heptacosane* *Heptadecane* *Heptane* *Heptatriacontane* *Hexacosane* *Hexadecane* *Hexatriacontane* *Nonacosane* *Nonadecane* *Nonane*	*Nonatriacontane* *Octacosane* *Octadecane* *Octane* *Octatriacontane* *Pentacosane* *Pentadecane* *Pentatriacontane* *Tetracontane* *Tetracosane* *Tetradecane* *Tetratriacontane* *Triacontane* *Tricosane* *Tridecane* *Tritriacontane* *Undecane*			
Acidity Test Mix	0.05% each component in methylene chloride		-	48255-U	2 mL
	2,6-Dimethylaniline	*2,6-Dimethylphenol*			

Test Mixes for Specific Applications

These test mixes are designed to measure the ability of a column to perform a specific application. Selectivity, resolution, peak shape, and signal-to-noise ratio can be measured.

Description	Concentration			Cat. No.	Qty
Herbicides Mix 1	100 µg/mL each component in ethyl acetate		-	49136	1 mL
	Atrazine *Bromacil* *Butylate* *Cycloate* *S-Ethyl-N,N-dipropylthiocarbamate* *Hexazinone* *Isopropalin*	*Metribuzin* *Molinate* *Oxyfluorfen* *Pebulat* *Terbacil* *Trifluralin*			
Herbicides Mix 2	100 µg/mL in ethyl acetate		-	49138-U	1 mL
	Benfluralin *Metolachlor* *Oxadiazon* *Profluralin* *Propachlor*	*Propazine* *Prowl (Pendimethaline)* *Simazine* *Vernolat*			
ASTM® D2887/D5307 Column Resolution Test Mix	1 % (w/v) each component in octane		-	48889	6 × 1 mL
	Hexadecane	*Octadecane*			
C4 - C24 Even Carbon Saturated FAMEs	1000 µg/mL each component in hexane		-	49453-U	1 mL
	Methyl arachidate *Methyl behenate* *Methyl butyrate* *Methyl decanoate* *Methyl hexanoate* *Methyl dodecanoate*	*Methyl lignocerate* *Methyl myristate* *Mehtyl octanoate* *Methyl palmitate* *Methyl stearate*			
C4 - C24 Even Carbon Saturated Fatty Acid Ethyl Esters (FAEES)	1000 µg/mL each component in hexane		-	49454-U	1 mL
	Ethyl arachidate *Ethyl behenate* *Ethyl butyrate* *Ethyl caprylate* *Ethyl decanoate* *Ethyl dodecanoate*	*Ethyl hexanoate* *Ethyl myristate* *Ethyl palmitate* *Ethyl stearate* *Ethyl tetracosanoate*			
Partially hydrogenated menhaden oil	100 µg/mL in hexane		-	48473	1 mL
	FAMEs				

GC Column Test Mixes

Test Mixes for Specific Non-Chiral Columns

Test Mixes for Specific Non-Chiral Columns

These test mixes are designed to measure the performance of specific non-chiral GC columns. Included are some of the same mixes we use in our QA/QC laboratory.

Description	Concentration		Cat. No.	Qty
Equity® / SPB® Thin Film Test Mix I	500 µg/mL each component in cyclohexane *Cetyl alcohol* *Eicosane* *Nonadecane* *Octadecane*	-	48273	1 mL
Equity® / SPB® Thick Film Test Mix II	500 µg/mL each component in methylene chloride *Decane* *2,6-Dimethylaniline* *2,6-Dimethylphenol* *Dodecane* *Nonane* *1-Octanol* *2-Octanone* *Tridecane*	-	48275-U	1 mL
SPB®-50 Column Test Mix	500 µg/mL each component in methylene chloride *Decane* *2,6-Dimethylaniline* *2,6-Dimethylphenol* *Dodecane* *1-Octanol* *2-Octanone* *Pentadecane* *Tridecane* *Undecane*	-	48280-U	1 mL
Carbowax® Amine Test Mix	500 µg/mL each component in methyl *tert*-butyl ether *Benzylamine* *Decylamine* *2,4-Dimethylaniline* *2,6-Dimethylaniline* *Eicosane* *Heptadecane* *Hexadecane* *Nonylamine* *Octadecane* *Octylamine* *Pentadecane* *Trihexylamine*	-	48278	1 mL
Omegawax® Column Test Mix	50 µg/mL in hexane *FAMEs*	-	48476	1 mL
FAME Column Evaluation Mix	1000 µg/mL each component in methylene chloride *Methyl cis-11-eicosenoate* *Methyl heneicosanoate* *Methyl laurate* *Methyl linolenate* *Methyl oleate* *cis-11-Octadecenoic methyl ester*	-	47088-U	1 mL
cis/trans FAME Column Performance Mix	2.5 mg/mL in methylene chloride *FAMEs*	-	40495-U 4M0495-U	1 mL 10 × 1 mL

Test Mixes for Specific Chiral Columns

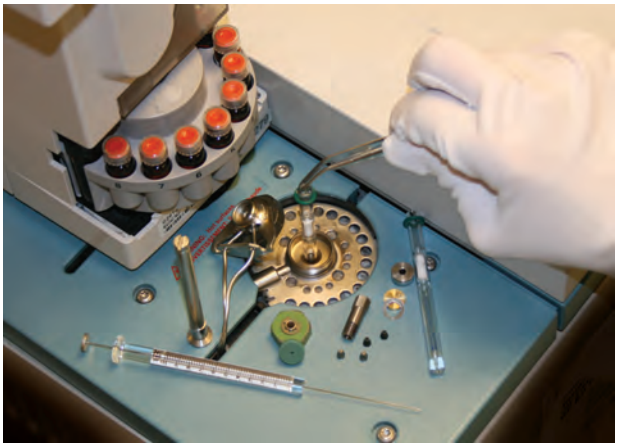
These test mixes are designed to measure the performance of specific chiral GC columns. Choose:

- P/N 90001AST for Astec CHIRALDEX® A-DA columns.
- P/N 90002AST for Astec CHIRALDEX® G-TA and G-BP columns.
- P/N 90003AST for Astec CHIRALDEX® A-TA, G-DP, G-PN, G-DM, and B-PH columns.
- P/N 90004AST for Astec CHIRALDEX® B-DA and G-DA columns.
- P/N 90005AST for Astec CHIRALDEX® B-TA and B-DP columns.
- P/N 90006AST for Astec CHIRALDEX® A-PH columns.
- P/N 90007AST for Astec CHIRALDEX® B-PM and B-DM columns.
- P/N 48013 for a-DEX 120 columns.
- P/N 48028 for ß-DEX 120 columns.

Description	Concentration		Cat. No.	Qty
1-(N-TFA)-2-Methylpiperidine	5000 µg/mL in ethanol: isopropanol (95:5)	-	90002AST	1 mL
2-(N-TFA)aminoheptane	5000 µg/mL in ethanol: isopropanol (95:5)	-	90003AST	1 mL
1-(N-TFA)aminoindan	5000 µg/mL in ethanol: isopropanol (95:5)	-	90004AST	1 mL
2-(Bromomethyl)tetra-2*H*-pyran	5000 µg/mL in ethanol: isopropanol (95:5)	-	90005AST	1 mL
3,4-Dihydro-2-ethoxy-2*H*-pyran	5000 µg/mL in ethanol: isopropanol (95:5)	-	90006AST	1 mL
1-Phenyl-1-ethanol	5000 µg/mL in ethanol: isopropanol (95:5)	-	90007AST	1 mL
α-DEX™ 120 Column Test Mix	500 µg/mL each component in methylene chloride *Decane* *Nonane* *1,2-Propanediol* *Undecane* *m-Xylene* *p-Xylene*	-	48013	1 mL
β-DEX™ 120 Column Test Mix	500 µg/mL each component in methylene chloride *Decane* *3,3-Dimethyl-2-butanol* *1-Hexanol* *(+)-3-Methyl-2-heptanone* *Nonane* *Undecane*	-	48028	1 mL

GC Accessories

GC Accessories



The proper supplies are required to maintain your GC and keep it operating at peak performance. Supelco offers premium products, such as septa, liners, and ferrules, designed to maximize performance!

Septa and Specialized Hand Tools

A GC septum is located at the top of the injection port and serves two functions: 1) providing a leak-free seal to maintain carrier gas pressure inside the system, and 2) handling repeated puncturing by a syringe needle for sample introduction purposes without severe coring or leaking.

Routine Maintenance: To reduce the risk of leaks and contamination, injection port septa should routinely be replaced. Change the septum daily, especially if the instrument is in heavy use. Repeated use of the same septum may result in increased coring, resulting in a leak. Septum fragments in the inlet liner can also lead to ghost peaks and/or loss of response due to adsorption of analytes as they pass through.

Storage and Handling: Septa can become contaminated by volatile compounds in the room air, or by finger oils. To ensure cleanliness, it is recommended that septa be stored in their shipping container with the lid securely closed, and that clean forceps be used for handling the septa during installation.

We offer a variety of septa to serve many functions. Choose:

- **Molded Thermogreem LB-2 septa** for most applications. These ***bleed-temperature-puncturability-optimized*** septa (up to 350 °C injection port temperatures) are widely considered the best septa choice.
- **Thermogreen LB-2 septa** when the diameter required is not offered in the Molded Thermogreen LB-2 septa line.
- **Thermogreen LB-1 septa** for lower temperature applications.
- **SS-174 PTFE-Faced septa** when the inertness of PTFE is required.
- **GR-2 septa** as an economical option for lower temperature applications (up to 200 °C injection port temperatures).
- **Merlin Miscroseal systems** for a septum-less system. While more expensive, these long-lasting systems will pay for themselves many times over.

In addition to septa, we offer several specialized hand-tools for removing septum from injection ports.

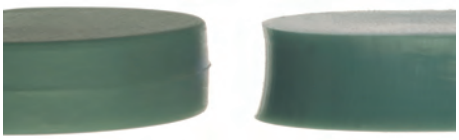
Septum Sizes for Various Chromatographs

Manufacturer	GC Model	Disc Diam. (mm)	Disc Diam. (in.)
Agilent/HP	5880A, 5890 5700 series, 5880 5880/90, 6890, OCI ports, capillary	11 9.5 5	7/16 3/8 3/16
Antek	all	9.5	3/8
Finnigan	9600	9.5	3/8
Finnigan/Tremetics	9000, 9500	12.5	1/2
GOW-MAC	all	9.5	3/8
HNU	portable GC	9.5	3/8
PerkinElmer	Sigma series, 900 & 990, 8000, Auto System, Clarus 500	11	7/16
Shimadzu	14, 15A, 16, 17A	plug	
Thermoquest	8000 series	17	21/32
Tracor	220, 222, 540 550, 560	12.5 9.5	1/2 3/8
Varian	packed col. injectors SPI 3700/Vista, capillary injectors Saturn GC/MS 1177	9.5 11 11/11.5 11.5 9.0	3/8 7/16 7/16/11/24 11/24 11/32

Molded Thermogreen® LB-2 GC Septa

The Perfect Combination of Low Bleed, Thermal Stability, and Easy Puncturability!

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 inside the injection port. This is because our liquid injection molding process ensures that every septum conforms to the same shape with crisp, clean sides. This is an improvement over a die-cutting process where septa can become cupped and/or distorted when the cutting surface becomes dull.



Left: Molded septum; Right: Die-cut septum

The useable inlet temperature range of 100-350 °C is adequate for most GC applications. **Don't be fooled by other septa that advertise a maximum temperature of 400 °C!** To make septa with high thermal limits, they must be made stiffer, resulting in septa that are harder to pierce and easier to core. Our molded Thermogreen LB-2 septa offer the perfect combination of low bleed, thermal stability, and easy puncturability.

- Rubber formulation exclusive to Supelco
- Strict tolerances (diameter, thickness, injection hole) due to constant dimension of the mold itself
- Ultra low bleed over a wide range of inlet temperatures (100 °C to 350 °C)
- No foreign substances/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

Molded Thermogreen LB-2 septa are offered in two styles:

- **With injection hole** - reduces coring and extends life
- **Solid discs** - traditional design

GC Accessories

Septa and Specialized Hand Tools: *Molded Thermogreen® LB-2 GC Septa*

Molded Thermogreen® LB-2 Septa, with injection hole

The injection hole helps guide the syringe needle to puncture the same location every injection, resulting in two benefits:

- Minimal coring leading to long life
- Less septum fragments that contaminate the inlet liner

Their high puncture tolerance makes these septa ideal for use with autosampler injections, manual injections, and/or SPME applications.

Diam. (mm)	Cat. No.	Qty
9.5	28331-U	50 ea
9.5	28332-U	250 ea
10	28333-U	50 ea
10	28334-U	250 ea
11	28336-U	50 ea
11	28338-U	250 ea
11.5	29446-U	50 ea
11.5	29448-U	250 ea
17	29452-U	50 ea
17	29453-U	250 ea

Molded Thermogreen® LB-2 Septa, solid discs

Traditional solid discs are suitable for use with manual injections.

Diam. (mm)	Cat. No.	Qty
9.5	28670-U	50 ea
9.5	28671-U	250 ea
10	28673-U	50 ea
10	28675-U	250 ea
11	28676-U	50 ea
11	28678-U	250 ea
11.5	29449-U	50 ea
11.5	29451-U	250 ea
17	29456-U	50 ea
17	29457-U	250 ea

Thermogreen® LB-2 GC Septa

We recommend using Thermogreen LB-2 septa when the diameter required is not offered in the Molded Thermogreen LB-2 septa line.

Thermogreen® LB-2 Septa, pre-drilled

Use pre-drilled septa for SPME applications to reduce septum coring.

Diam. (mm)	Cat. No.	Qty
9.5 (3/8 in.)	23161	25 ea
	23162-U	50 ea
11.0 (7/16 in.)	23167	25 ea
	23168	50 ea

Thermogreen® LB-2 Septa, solid discs

An improved version over the original Thermogreen LB-1 septa.

- Extremely low bleed over a wide range of inlet temperatures (100 °C to 350 °C)
- Already conditioned, ready to use
- Easier needle penetration and high puncture tolerance (ideal for autosamplers)
- Rubber formulation exclusive to Supelco

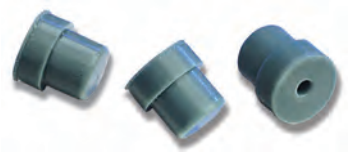
Diam. (mm)	Cat. No.	Qty
5.0 (3/16 in.)	20638	50 ea
6.0 (1/4 in.)	20651	50 ea
6.7 (9/32 in.)	20606	10 ea
9.0 (11/32 in.)	28006-U	5 ea
	28021-U	50 ea
9.5 (3/8 in.)	20652	50 ea
	20666	250 ea
	20677	1000 ea
10.0 (13/32 in.)	20653-U	50 ea
	23156	250 ea
	23157	1000 ea
11.0 (7/16 in.)	20654	50 ea
	23163	250 ea
	23164	1000 ea
11.5 (11/24 in.)	23154	50 ea
12.5 (1/2 in.)	20660-U	50 ea
	20678	250 ea
14.0 (9/16 in.)	20662-U	50 ea
16.0 (5/8 in.)	20663	50 ea
17.0 (21/32 in.)	23159	50 ea

GC Accessories

Septa and Specialized Hand Tools: *Thermogreen® LB-2 GC Septa*

Thermogreen® LB-2 Septa, cylindrical

For use in Shimadzu GCs that require plug septa.



Diam. × L (mm)	Cat. No.	Qty
~6 × 9	20608	10 ea
	20633	50 ea

Thermogreen® LB-1 GC Septa

The original low bleed GC septa.

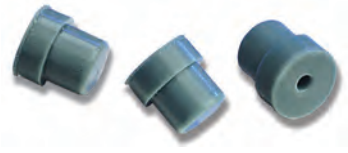
Thermogreen® LB-1 Septa, solid discs

For use with 50 °C to 300 °C inlet temperatures.

Diam. (mm)	Cat. No.	Qty
9.5 (3/8 in.)	20659-U	50 ea
10.0 (13/32 in.)	20657-U	50 ea
11.0 (7/16 in.)	20658	50 ea
12.5 (1/2 in.)	20661	50 ea

Thermogreen® LB-1 Septa, cylindrical

For use in Shimadzu GCs that require plug septa, glass gas sampling bulbs, and purge & trap glassware.



Diam. × L (mm)	Cat. No.	Qty
~6 × 9	20668	100 ea

Non-Thermogreen GC Septa

In addition to our Thermogreen LB-2 septa, we also offer other popular septa.

SS-174 PTFE-Faced Septa

PTFE-faced septa are designed for applications where greater inertness is required. The off-white silicone rubber body (123 mil thick) provides plenty of support for the yellow PTFE face (2 mil thick). After the PTFE is ruptured during injection, some bleeding may occur. Because this bleed increases as more of the rubber is exposed, we recommend using a needle guide to reduce the size of the punctured area. For use with 200 °C to 300 °C inlet temperatures.

Diam. (mm)	Cat. No.	Qty
6.0 (1/4 in.)	22654	100 ea
9.5 (3/8 in.)	22656	100 ea
	22618	250 ea
10.0 (13/32 in.)	22647	100 ea
11.0 (7/16 in.)	22731	100 ea
12.5 (1/2 in.)	22657	100 ea
14.0 (9/16 in.)	22732	50 ea

GR-2 Septa

These low cost gray silicone rubber septa are designed for routine, isothermal use. For use with 50 °C to 200 °C inlet temperature.

Diam. (mm)	Cat. No.	Qty
5.0 (3/16 in.)	20712	100 ea
6.0 (1/4 in.)	20442-U	100 ea
9.5 (3/8 in.)	20405	100 ea
	20625	250 ea
	20627	1000 ea
10.0 (13/32 in.)	20441	100 ea
11.0 (7/16 in.)	20421	100 ea
12.5 (1/2 in.)	20413	100 ea

GR-2 Rubber Sheet Stock

This 290 mm x 290 mm x 3 mm thick sheet stock is useful for making septa of various diameters. Simply cut-out the desired size.

Cat. No.	Qty
20420-U	1 ea

Three Layer Disc Septa

These septa feature a soft inner layer of silicone rubber sandwiched between hard outside layers. For use with GC inlet temperatures up to 200 °C.

Diam. (mm)	Cat. No.	Qty
9.0 (11/32 in.)	20416	12 ea
10.0 (13/32 in.)	20417	12 ea
12.5 (1/2 in.)	20418	12 ea

GC Accessories

Septa and Specialized Hand Tools: *Merlin Microseal™ Systems*

Merlin Microseal™ Systems

The Merlin Microseal System is a septum-less system that provides very long life. Because there is not a septum to pierce, septum fragments will not be formed and deposited in the inlet liner. The septum contains a series of seals (wiper rib, o-rings, and a duckbill valve) that allow a needle to enter while maintaining a leak-free seal. The septum can be used only with a syringe that has a 23 gauge "blunt tipped" needle, or with an SPME fiber assembly with a 23 gauge needle. The thicker shaft is required to make the necessary contact with the septum seals.

Merlin Microseal™ System (fits Agilent)

Simply place the septum directly onto the septum cup and then add the nut (an additional adapter for the septum cup is not required for Agilent GCs). The septum incorporates a unique design with two sequential seals to provide a much longer life. Order replacement septa, or alternate versions, separately. Compatile with all Agilent autosamplers and stainless steel injection ports.

Note: Do not use with beveled tips.

Left: Septum; Right: Nut

Description	Cat. No.	Qty
1 nut and 1 Low Pressure (1-45 psi) septum	22584	1 ea
1 nut and 2 Low Pressure (1-45 psi) septa	22581-U	1 ea
1 nut and 1 General Purpose (3-100 psi) septum	24815-U	1 ea
1 nut and 2 General Purpose (3-100 psi) septa	24814-U	1 ea
1 nut	22582	1 ea

Merlin Microseal™ System (fits Varian®)

Varian GCs require an inlet adapter and an o-ring in addition to the septum and nut. The septum incorporates a unique design with two sequential seals to provide a much longer life. Order replacement septa, or alternate versions, separately. Not compatible with the Varian 8200 autosampler.

Note: Do not use with beveled tips.

Description	Cat. No.	Qty
For 1079 injector; 1 nut, 1 inlet adapter, 1 o-ring, and 1 General Purpose (3-100 psi) septum	24817-U	1 ea
For CP-1177 injector; 1 nut, 1 inlet adapter, 1 o-ring, and 1 General Purpose (3-100 psi) septum	22609-U	1 kit

Merlin Microseal™ System Replacement Septum

Three septa versions are available:

- **Low Pressure** for use with 23 gauge syringe needles, and injection port pressures between 1 and 45 psi. Do not use with syringe needles that have beveled tips.
- **General Purpose** for use with 23 gauge syringe needles, and injection port pressures between 3 and 100 psi. Do not use with syringe needles that have beveled tips.
- **SPME** for use with 23 gauge SPME fiber assemblies. Do not use with SPME fiber assemblies that have beveled tips.

Note: Do not use with beveled tips.

Description	Cat. No.	Qty
1 Low Pressure (1-45 psi) septum	22583	1 ea
1 General Purpose (3-100 psi) septum	24816-U	1 ea
1 SPME septum	24818-U	1 ea

Specialized Hand Tools

These handy tools are designed specifically for use with GC septa.

Septum Puller

hook design

The hook septum puller is great for removing soft silicone septa from injection ports, and graphite ferrules from columns nuts. It has dozens of other uses around the lab.

20352	1 ea

screw design

The screw septum puller is perfect for removing harder, high temperature septa from injection ports.

20353	1 ea

Septum Pick

The septum pick is useful for removing small pieces of septa from injection ports, and graphite ferrules from column nuts.

Z236136-1EA	1 ea

GC Accessories

Inlet Liners, Glass Wool, and Specialized Hand Tools

Inlet Liners, Glass Wool, and Specialized Hand Tools

An injection port liner is used to make the connection between sample introduction and the GC column. Four primary injection techniques are used in GC; split, splitless, direct, and on-column. Inlet liners should be selected based on the injection technique being used to ensure optimal sample transfer to the column.

Split Injection: The most common injection method used. Split liners use a design that establishes turbulent flow rather than laminar flow, ensuring sample vaporization and enhancing proper mixing prior to the point where the sample is split, thereby minimizing inlet discrimination. Cups, baffles, twists, or frits are used to facilitate sample mixing. Wool may be used to improve vaporization, and/or to keep non-volatile material from entering the column. Wide bore 2 - 4 mm I.D. inlet liners are necessary for solvent expansion.

Splitless Injection: Because the sample dwell time in the liner is significantly longer in the splitless injection mode, the liner design does not need to create high turbulence. Splitless liners usually are straight 2 - 4 mm I.D. tubes with internal volume between 0.25 and 1 mL (choose a liner with an internal volume equal to or larger than the expansion volume of the solvent). Tapers (either at the bottom, or at both the top and bottom) may be incorporated to help focus analytes onto the column. Wool may be used to improve vaporization, and/or to keep non-volatile material from entering the column. NOTE: Deactivation of splitless liners is very important due to the long residence time of the sample.

Direct Injection: Often used for gas phase samples, such as with headspace, purge-and-trap, and solid phase microextraction (SPME) techniques, where the entire gas sample is transferred to the column. Because there is no solvent, large internal volumes are not necessary for solvent expansion. Narrow bore 0.5 - 1.5 mm I.D. inlet liners are used to maintain a high linear velocity through the injection port, minimizing band broadening. Also known as flash vaporization.

On-Column Injection: Liquid samples are deposited directly into the inlet of a capillary column. A specialized syringe is usually required. These liners are designed with a tapered region where the column end is seated to create a seal between the column and the liner. This taper also guides the needle into the column. The oven temperature program is then used to vaporize the sample component.

We also offer highly pure glass wool and several specialized hand tools for repacking inlet liners.

Inlet Liners for Agilent (5890, 6890, and 7890)

Deactivated (silanized) glass inlet liners.

Inlet Liner, Split Type, Cup Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2048201	1 ea
2048205	5 ea
2048225	25 ea

Inlet Liner, Split Type, Cup Design (packed with 10% OV-1 on Chromosorb W HP)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2055101	1 ea
2055105	5 ea
2055125	25 ea

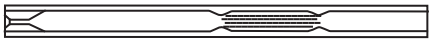
Inlet Liner, Split Type, Cup Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2051001	1 ea
2051005	5 ea
2051025	25 ea

Inlet Liner, Split/Splitless Type, Single Taper FocusLiner™ Design (wool packed)

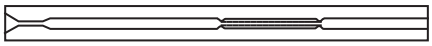
L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm



Cat. No.	Qty
2879901-U	1 ea
2879905-U	5 ea
2879925-U	25 ea

Inlet Liner, Split/Splitless Type, Single Taper Fast FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 2.3 mm



Cat. No.	Qty
2879501-U	1 ea
2879505-U	5 ea
2879525-U	25 ea

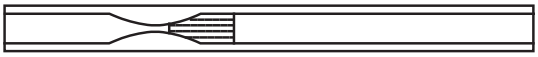
Inlet Liner, Split/Splitless Type, Single Taper Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 4.0 mm

Cat. No.	Qty
2047801	1 ea
2047805	5 ea
2047825	25 ea

Inlet Liner, Split/Splitless Type, Recessed Gooseneck Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm



Cat. No.	Qty
2879701-U	1 ea
2879705-U	5 ea
2879725-U	25 ea

GC Accessories

Inlet Liners, Glass Wool, and Specialized Hand Tools: *Inlet Liners for Agilent (5890, 6890, and 7890)*

Inlet Liner, Split/Splitless Type, Straight FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2879801-U	1 ea
2879805-U	5 ea
2879825-U	25 ea

Inlet Liner, Split/Splitless Type, Straight Fast FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 2.3 mm

Cat. No.	Qty
2879601-U	1 ea
2879605-U	5 ea
2879625-U	25 ea

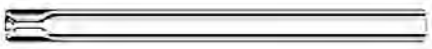
Inlet Liner, Split/Splitless Type, Straight Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2048601	1 ea
2048605	5 ea
2048625	25 ea

Inlet Liner, Splitless Type, Single Taper Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 4.0 mm



Cat. No.	Qty
2046601	1 ea
2046605	5 ea
2046625	25 ea

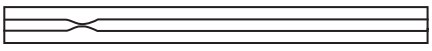
Inlet Liner, Splitless Type, Dual-Taper Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 4.0 mm

Cat. No.	Qty
2048501	1 ea
2048505	5 ea
2048525	25 ea

Inlet Liner, Splitless Type, Recessed Gooseneck Design (unpacked)

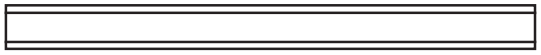
L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 2.0 mm



Cat. No.	Qty
2879301-U	1 ea
2879305-U	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm



Cat. No.	Qty
2879401-U	1 ea
2879405-U	5 ea
2879425-U	25 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 2.0 mm

Cat. No.	Qty
2051301	1 ea
2051305	5 ea
2051325	25 ea

Inlet Liner, Direct Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 1.5 mm

Cat. No.	Qty
2051701	1 ea
2051705	5 ea
2051725	25 ea

Inlet Liner, Direct (SPME) Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 0.75 mm

Cat. No.	Qty
2637501	1 ea
2637505	5 ea
2637525	25 ea

Inlet Liner, for Packed GC (unpacked)

Deactivated (silanized) glass inlet liner for packed injection ports.

- Fits Agilent (5890, 6890, and 7890)

L × O.D. × I.D. ..... 91.5 mm × 3.0 mm × 1.8 mm

Cat. No.	Qty
20508	5 ea
20511	25 ea

GC Accessories

Inlet Liners, Glass Wool, and Specialized Hand Tools: *Inlet Liners for ATAS (Optic 2)*

Inlet Liners for ATAS (Optic 2)

Deactivated (silanized) glass inlet liners.

Inlet Liner, Split Type, Frit Design (unpacked)

L × O.D. × I.D. ..... 80 mm × 5.0 mm × 3.0 mm

Cat. No.	Qty
2632605	5 ea
2632625	25 ea

Inlet Liners for Carlo Erba/Fisons (6000)

Deactivated (silanized) glass inlet liners.

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 79.5 mm × 5.5 mm × 4.0 mm

Cat. No.	Qty
2632105	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 79.5 mm × 5.0 mm × 2.0 mm

Cat. No.	Qty
2632005	5 ea

Inlet Liners for Finnigan (9001GCQ)

Deactivated (silanized) glass inlet liners.

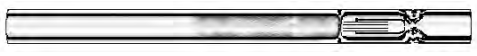
Inlet Liner, Split Type, Cup Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2048201	1 ea
2048205	5 ea
2048225	25 ea

Inlet Liner, Split Type, Cup Design (packed with 10% OV-1 on Chromosorb W HP)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm



Cat. No.	Qty
2055101	1 ea
2055105	5 ea
2055125	25 ea

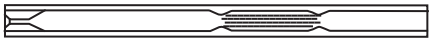
Inlet Liner, Split Type, Cup Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2051001	1 ea
2051005	5 ea
2051025	25 ea

Inlet Liner, Split/Splitless Type, Single Taper FocusLiner™ Design (wool packed)

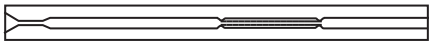
L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm



Cat. No.	Qty
2879901-U	1 ea
2879905-U	5 ea
2879925-U	25 ea

Inlet Liner, Split/Splitless Type, Single Taper Fast FocusLiner™ Design (wool packed)

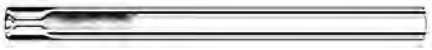
L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 2.3 mm



Cat. No.	Qty
2879501-U	1 ea
2879505-U	5 ea
2879525-U	25 ea

Inlet Liner, Split/Splitless Type, Single Taper Design (wool packed)

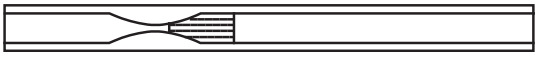
L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 4.0 mm



Cat. No.	Qty
2047801	1 ea
2047805	5 ea
2047825	25 ea

Inlet Liner, Split/Splitless Type, Recessed Gooseneck Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm



Cat. No.	Qty
2879701-U	1 ea
2879705-U	5 ea
2879725-U	25 ea

Inlet Liner, Split/Splitless Type, Straight FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2879801-U	1 ea
2879805-U	5 ea
2879825-U	25 ea

GC Accessories

Inlet Liners, Glass Wool, and Specialized Hand Tools: *Inlet Liners for Finnigan (9001GCQ)*

Inlet Liner, Split/Splitless Type, Straight Fast FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 2.3 mm

Cat. No.	Qty
2879601-U	1 ea
2879605-U	5 ea
2879625-U	25 ea

Inlet Liner, Split/Splitless Type, Straight Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2048601	1 ea
2048605	5 ea
2048625	25 ea

Inlet Liner, Splitless Type, Single Taper Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 4.0 mm

Cat. No.	Qty
2046601	1 ea
2046605	5 ea
2046625	25 ea

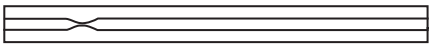
Inlet Liner, Splitless Type, Dual-Taper Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 4.0 mm

Cat. No.	Qty
2048501	1 ea
2048505	5 ea
2048525	25 ea

Inlet Liner, Splitless Type, Recessed Gooseneck Design (unpacked)

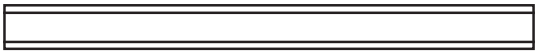
L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 2.0 mm



Cat. No.	Qty
2879301-U	1 ea
2879305-U	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm



Cat. No.	Qty
2879401-U	1 ea
2879405-U	5 ea
2879425-U	25 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 2.0 mm

Cat. No.	Qty
2051301	1 ea
2051305	5 ea
2051325	25 ea

Inlet Liner, Direct Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 1.5 mm

Cat. No.	Qty
2051701	1 ea
2051705	5 ea
2051725	25 ea

Inlet Liner, Direct (SPME) Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 0.75 mm

Cat. No.	Qty
2637501	1 ea
2637505	5 ea
2637525	25 ea

Inlet Liners for PerkinElmer® (2000 and 8000)

Deactivated (silanized) glass inlet liners.

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 100 mm × 5.0 mm × 4.0 mm

Cat. No.	Qty
2630301	1 ea
2630305	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 100 mm × 5.0 mm × 2.0 mm

Cat. No.	Qty
2630401	1 ea
2630405	5 ea

GC Accessories

Inlet Liners, Glass Wool, and Specialized Hand Tools: *Inlet Liners for PerkinElmer® (Clarus and AutoSystem)*

Inlet Liners for PerkinElmer® (Clarus and AutoSystem)

Deactivated (silanized) glass inlet liners.

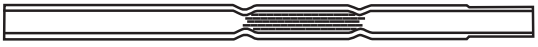
Inlet Liner, Split/Splitless Type, Single Taper FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 92 mm × 6.2 mm × 4.0 mm

Cat. No.	Qty
2879101-U	1 ea
2879105-U	5 ea

Inlet Liner, Split/Splitless Type, Straight FocusLiner™ Design (wool packed)

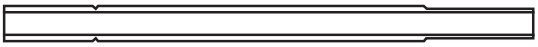
L × O.D. × I.D. ..... 92 mm × 6.2 mm × 4.0 mm



Cat. No.	Qty
2879201-U	1 ea
2879205-U	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 92 mm × 6.2 mm × 4.0 mm



Cat. No.	Qty
2878701-U	1 ea
2878705-U	5 ea

Inlet Liners for PerkinElmer® (AutoSystem)

Deactivated (silanized) glass inlet liners.

Inlet Liner, Split/Splitless Type, Straight Design (wool packed)

L × O.D. × I.D. ..... 92 mm × 6.35 mm × 4.0 mm

Cat. No.	Qty
2631001	1 ea
2631005	5 ea
2631025	25 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 92 mm × 6.35 mm × 4.0 mm

Cat. No.	Qty
2630901	1 ea
2630905	5 ea
2630925	25 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 92 mm × 6.35 mm × 2.0 mm

Cat. No.	Qty
2631105	5 ea

Inlet Liner, Direct (SPME) Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 92 mm × 6.35 mm × 0.75 mm

Cat. No.	Qty
2631205	5 ea

Inlet Liner, for Packed GC (wool packed)

Deactivated (silanized) glass inlet liner for packed injection ports.

- Fits PerkinElmer (AutoSystem)

L × O.D. × I.D. ..... 112 mm × 6.0 mm × 3.0 mm

Cat. No.	Qty
2631705	5 ea
2631725	25 ea

Inlet Liner, for Packed GC (unpacked)

Deactivated (silanized) glass inlet liner for packed injection ports.

- Fits PerkinElmer (AutoSystem)

L × O.D. × I.D. ..... 112 mm × 6.0 mm × 3.0 mm

Cat. No.	Qty
2631605	5 ea
2631625	25 ea

Inlet Liners for PerkinElmer® (PSS Injector)

Deactivated (silanized) glass inlet liners.

Inlet Liner, Split/Splitless Type, Straight FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 86.2 mm × 4.0 mm × 2.0 mm

Cat. No.	Qty
2878901-U	1 ea
2878905-U	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 86 mm × 4.0 mm × 2.0 mm

Cat. No.	Qty
2631301	1 ea
2631305	5 ea
2631325	25 ea

GC Accessories

Inlet Liners, Glass Wool, and Specialized Hand Tools: *Inlet Liners for PerkinElmer® (PSS Injector)*

Inlet Liner, Direct Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 86 mm × 4.0 mm × 1.0 mm

Cat. No.	Qty
2631405	5 ea

Inlet Liner, On-Column Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 86 mm × 4.0 mm × 2.0 mm

Cat. No.	Qty
2631505	5 ea

Inlet Liners for Shimadzu™ (9A and 16A)

Deactivated (silanized) glass inlet liners.

Inlet Liner, Splitless Type, Single Taper Design (unpacked)

L × O.D. × I.D. ..... 139 mm × 5.0 mm × 3.4 mm

Cat. No.	Qty
2878201-U	1 ea
2878205-U	5 ea

Inlet Liners for Shimadzu™ (9A, 15A, and 16) [with SPL-G9/15 Injector]

Deactivated (silanized) glass inlet liners.

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 127 mm × 5.0 mm × 3.4 mm

Cat. No.	Qty
2633001	1 ea
2633005	5 ea

Inlet Liner, Direct (SPME) Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 127 mm × 5.0 mm × 0.75 mm

Cat. No.	Qty
2632901	1 ea
2632905	5 ea

Inlet Liners for Shimadzu™ (14, 15A, and 16) [with SPL-14 Injector]

Deactivated (silanized) glass inlet liners.

Inlet Liner, Split/Splitless Type, Single Taper FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 99 mm × 5.0 mm × 3.4 mm

Cat. No.	Qty
2877801-U	1 ea
2877805-U	5 ea

Inlet Liner, Split/Splitless Type, Straight FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 99 mm × 5.0 mm × 3.4 mm

Cat. No.	Qty
2878101-U	1 ea
2878105-U	5 ea

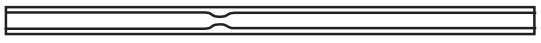
Inlet Liner, Splitless Type, Single Taper Design (unpacked)

L × O.D. × I.D. ..... 99 mm × 5.0 mm × 3.0 mm

Cat. No.	Qty
2633305	5 ea

Inlet Liner, Splitless Type, Middle Gooseneck Design (unpacked)

L × O.D. × I.D. ..... 99 mm × 5.0 mm × 3.4 mm



Cat. No.	Qty
2877701-U	1 ea
2877705-U	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 99 mm × 5.0 mm × 3.0 mm

Cat. No.	Qty
2633405	5 ea
2633425	25 ea

Inlet Liner, Direct (SPME) Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 99 mm × 5.0 mm × 0.75 mm

Cat. No.	Qty
2633501	1 ea
2633505	5 ea

GC Accessories

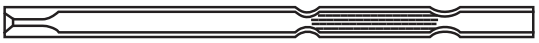
Inlet Liners, Glass Wool, and Specialized Hand Tools: *Inlet Liners for Shimadzu™ (17A) [with SPL-17 Injector]*

Inlet Liners for Shimadzu™ (17A) [with SPL-17 Injector]

Deactivated (silanized) glass inlet liners.

Inlet Liner, Split/Splitless Type, Single Taper FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 95 mm × 5.0 mm × 3.4 mm



Cat. No.	Qty
2878401-U	1 ea
2878405-U	5 ea

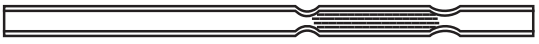
Inlet Liner, Split/Splitless Type, Recessed Gooseneck Design (wool packed)

L × O.D. × I.D. ..... 95 mm × 5.0 mm × 3.4 mm

Cat. No.	Qty
2877901-U	1 ea
2877905-U	5 ea

Inlet Liner, Split/Splitless Type, Straight FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 95 mm × 5.0 mm × 3.4 mm



Cat. No.	Qty
2878601-U	1 ea
2878605-U	5 ea

Inlet Liner, Split/Splitless Type, Straight Design (wool packed)

L × O.D. × I.D. ..... 95 mm × 5.0 mm × 3.0 mm

Cat. No.	Qty
2632705	5 ea
2632725	25 ea

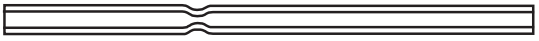
Inlet Liner, Splitless Type, Single Taper Design (unpacked)

L × O.D. × I.D. ..... 95 mm × 5.0 mm × 2.6 mm

Cat. No.	Qty
2633801	1 ea
2633805	5 ea

Inlet Liner, Splitless Type, Middle Gooseneck Design (unpacked)

L × O.D. × I.D. ..... 95 mm × 5.0 mm × 3.4 mm



Cat. No.	Qty
2878301-U	1 ea
2878305-U	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 95 mm × 5.0 mm × 3.4 mm

Cat. No.	Qty
2633601	1 ea
2633605	5 ea
2633625	25 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 95 mm × 5.0 mm × 2.6 mm

Cat. No.	Qty
2633705	5 ea
2633725	25 ea

Inlet Liner, Direct (SPME) Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 95 mm × 5.0 mm × 0.75 mm

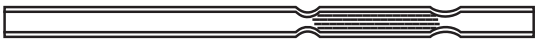
Cat. No.	Qty
2633901	1 ea
2633905	5 ea
2633925	25 ea

Inlet Liners for Shimadzu™ (GC-2010)

Deactivated (silanized) glass inlet liners.

Inlet Liner, Split/Splitless Type, Straight FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 95 mm × 5.0 mm × 3.4 mm



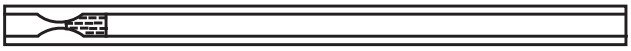
Cat. No.	Qty
2877601-U	1 ea
2877605-U	5 ea

Inlet Liners for Thermo (ThermoQuest 4000, 5000, and 6000)

Deactivated (silanized) glass inlet liners.

Inlet Liner, Split/Splitless Type, Recessed Gooseneck Design (wool packed)

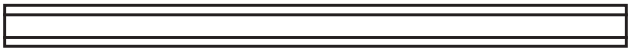
L × O.D. × I.D. ..... 79.5 mm × 5.0 mm × 3.0 mm



Cat. No.	Qty
2876905-U	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 79.5 mm × 5.0 mm × 3.0 mm



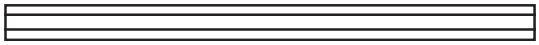
Cat. No.	Qty
2876101-U	1 ea

GC Accessories

Inlet Liners, Glass Wool, and Specialized Hand Tools: *Inlet Liners for Thermo (ThermoQuest 4000, 5000, and 6000)*

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 79.5 mm × 5.0 mm × 2.0 mm



Cat. No.	Qty
2875801-U	1 ea
2875805-U	5 ea

Inlet Liners for Thermo (ThermoQuest 8000 and TRACE)

Deactivated (silanized) glass inlet liners.

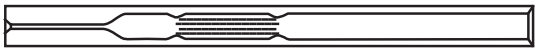
Inlet Liner, Split/Splitless Type, Single Taper FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 105 mm × 8.0 mm × 5.0 mm

Cat. No.	Qty
2877201-U	1 ea
2877205-U	5 ea

Inlet Liner, Split/Splitless Type, Single Taper FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 105 mm × 8.0 mm × 5.0 mm



Cat. No.	Qty
2877505-U	5 ea

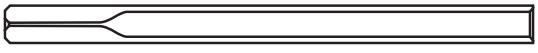
Inlet Liner, Split/Splitless Type, Straight FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 105 mm × 8.0 mm × 5.0 mm

Cat. No.	Qty
2877001-U	1 ea
2877005-U	5 ea

Inlet Liner, Splitless Type, Single Taper Design (unpacked)

L × O.D. × I.D. ..... 105 mm × 8.0 mm × 5.0 mm



Cat. No.	Qty
2877301-U	1 ea
2877305-U	5 ea

Inlet Liner, Splitless Type, Single Taper Design (unpacked)

L × O.D. × I.D. ..... 105 mm × 8.0 mm × 3.0 mm

Cat. No.	Qty
2877401-U	1 ea
2877405-U	5 ea

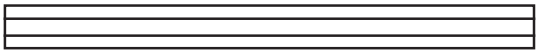
Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 105 mm × 8.0 mm × 5.0 mm

Cat. No.	Qty
2877101-U	1 ea
2877105-U	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

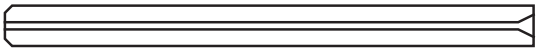
L × O.D. × I.D. ..... 105 mm × 8.0 mm × 3.0 mm



Cat. No.	Qty
2876701-U	1 ea
2876705-U	5 ea

Inlet Liner, Direct (SPME) Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 105 mm × 8.0 mm × 0.8 mm



Cat. No.	Qty
2876601-U	1 ea
2876605-U	5 ea

Inlet Liners for Thermo (PTV Injector)

Deactivated (silanized) glass inlet liners.

Inlet Liner, On-Column Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 120 mm × 2.75 mm × 2.0 mm

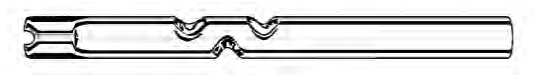
Cat. No.	Qty
2875901-U	1 ea
2875905-U	5 ea

Inlet Liners for Varian® (1075 and 1077 Injector)

Deactivated (silanized) glass inlet liners.

Inlet Liner, Split Type, Baffle Design (unpacked)

L × O.D. × I.D. ..... 72 mm × 6.3 mm × 4.0 mm



Cat. No.	Qty
2050105	5 ea

Inlet Liner, Split Type, Frit Design (unpacked)

L × O.D. × I.D. ..... 72 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2050501	1 ea
2050505	5 ea
2050525	25 ea

GC Accessories

Inlet Liners, Glass Wool, and Specialized Hand Tools: *Inlet Liners for Varian® (1075 and 1077 Injector)*

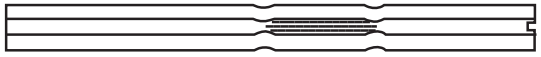
Inlet Liner, Split/Splitless Type, Straight FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 72 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2875405-U	5 ea

Inlet Liner, Split/Splitless Type, Straight Fast FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 72 mm × 6.3 mm × 2.3 mm



Cat. No.	Qty
2874705-U	5 ea

Inlet Liner, Split/Splitless Type, Straight Design (wool packed)

L × O.D. × I.D. ..... 72 mm × 6.3 mm × 3.4 mm

Cat. No.	Qty
2636005	5 ea

Inlet Liner, Split/Splitless Type, Straight Design (packed with 10% OV-101 on 80/100 Chromosorb W HP)

L × O.D. × I.D. ..... 72 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2055501	1 ea
2055505	5 ea

Inlet Liner, Splitless Type, Single Taper Design (unpacked)

L × O.D. × I.D. ..... 73 mm × 6.35 mm × 4.0 mm

Cat. No.	Qty
2636801	1 ea
2636805	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 72 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2636101	1 ea
2636105	5 ea
2636125	25 ea

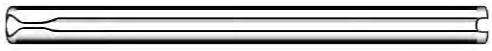
Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 72 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2636201	1 ea
2636205	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 74 mm × 6.3 mm × 2.0 mm



Cat. No.	Qty
2050201	1 ea
2050205	5 ea
2050225	25 ea

Inlet Liner, Direct (SPME) Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 74 mm × 6.35 mm × 0.75 mm

Cat. No.	Qty
2635801	1 ea
2635805	5 ea
2635825	25 ea

Inlet Liners for Varian® (1078 and 1079 Injector)

Deactivated (silanized) glass inlet liners.

Inlet Liner, Split Type, Frit Design (unpacked)

L × O.D. × I.D. ..... 54 mm × 5.0 mm × 3.4 mm

Cat. No.	Qty
2637201	1 ea
2637205	5 ea
2637225	25 ea

Inlet Liner, Split/Splitless Type, Single Taper FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 54 mm × 5.0 mm × 3.4 mm

Cat. No.	Qty
2875501-U	1 ea
2875505-U	5 ea

Inlet Liner, Split/Splitless Type, Straight FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 54 mm × 5.0 mm × 3.4 mm

Cat. No.	Qty
2875701-U	1 ea
2875705-U	5 ea

GC Accessories

Inlet Liners, Glass Wool, and Specialized Hand Tools: *Inlet Liners for Varian® (1078 and 1079 Injector)*

Inlet Liner, Split/Splitless Type, Straight Design (wool packed)

L × O.D. × I.D. ..... 54 mm × 5.0 mm × 2.0 mm

Cat. No.	Qty
2637701	1 ea
2637705	5 ea
2637725	25 ea

Inlet Liner, Split/Splitless Type, Straight Design (packed with 10% OV-101 on 80/100 Chromosorb W HP)

L × O.D. × I.D. ..... 54 mm × 5.0 mm × 3.4 mm

Cat. No.	Qty
2637301	1 ea
2637305	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 54 mm × 5.0 mm × 3.4 mm

Cat. No.	Qty
2637101	1 ea
2637105	5 ea
2637125	25 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 54 mm × 5.0 mm × 2.0 mm

Cat. No.	Qty
2637401	1 ea
2637405	5 ea

Inlet Liner, Direct Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 54 mm × 5.0 mm × 0.5 mm

Cat. No.	Qty
2637601	1 ea
2637605	5 ea

Inlet Liner, Direct (SPME) Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 54 mm × 5.0 mm × 0.8 mm

Cat. No.	Qty
2637801	1 ea
2637805	5 ea

Inlet Liners for Varian® (1093-94 SPI Injector)

Deactivated (silanized) glass inlet liners.

Inlet Liner, Direct Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 54 mm × 4.6 mm × 0.5 mm

Cat. No.	Qty
2636301	1 ea
2636305	5 ea
2636325	25 ea

Inlet Liner, Direct (SPME) Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 54 mm × 4.6 mm × 0.8 mm

Cat. No.	Qty
2636401	1 ea
2636405	5 ea
2636425	25 ea

Inlet Liners for Varian® (CP-1177 Injector)

Deactivated (silanized) glass inlet liners.

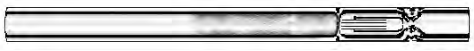
Inlet Liner, Split Type, Cup Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2048201	1 ea
2048205	5 ea
2048225	25 ea

Inlet Liner, Split Type, Cup Design (packed with 10% OV-1 on Chromosorb W HP)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm



Cat. No.	Qty
2055101	1 ea
2055105	5 ea
2055125	25 ea

Inlet Liner, Split Type, Cup Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm

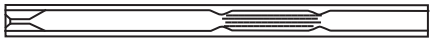
Cat. No.	Qty
2051001	1 ea
2051005	5 ea
2051025	25 ea

GC Accessories

Inlet Liners, Glass Wool, and Specialized Hand Tools: *Inlet Liners for Varian® (CP-1177 Injector)*

Inlet Liner, Split/Splitless Type, Single Taper FocusLiner™ Design (wool packed)

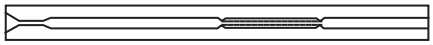
L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm



Cat. No.	Qty
2879901-U	1 ea
2879905-U	5 ea
2879925-U	25 ea

Inlet Liner, Split/Splitless Type, Single Taper Fast FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 2.3 mm



Cat. No.	Qty
2879501-U	1 ea
2879505-U	5 ea
2879525-U	25 ea

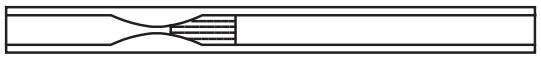
Inlet Liner, Split/Splitless Type, Single Taper Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 4.0 mm

Cat. No.	Qty
2047801	1 ea
2047805	5 ea
2047825	25 ea

Inlet Liner, Split/Splitless Type, Recessed Gooseneck Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm



Cat. No.	Qty
2879701-U	1 ea
2879705-U	5 ea
2879725-U	25 ea

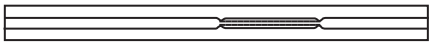
Inlet Liner, Split/Splitless Type, Straight FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2879801-U	1 ea
2879805-U	5 ea
2879825-U	25 ea

Inlet Liner, Split/Splitless Type, Straight Fast FocusLiner™ Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 2.3 mm



Cat. No.	Qty
2879601-U	1 ea
2879605-U	5 ea
2879625-U	25 ea

Inlet Liner, Split/Splitless Type, Straight Design (wool packed)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm

Cat. No.	Qty
2048601	1 ea
2048605	5 ea
2048625	25 ea

Inlet Liner, Splitless Type, Single Taper Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 4.0 mm

Cat. No.	Qty
2046601	1 ea
2046605	5 ea
2046625	25 ea

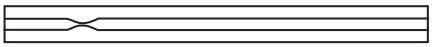
Inlet Liner, Splitless Type, Dual-Taper Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 4.0 mm

Cat. No.	Qty
2048501	1 ea
2048505	5 ea
2048525	25 ea

Inlet Liner, Splitless Type, Recessed Gooseneck Design (unpacked)

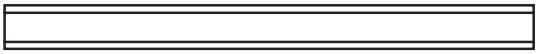
L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 2.0 mm



Cat. No.	Qty
2879301-U	1 ea
2879305-U	5 ea

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 4.0 mm



Cat. No.	Qty
2879401-U	1 ea
2879405-U	5 ea
2879425-U	25 ea

GC Accessories

Inlet Liners, Glass Wool, and Specialized Hand Tools: *Inlet Liners for Varian® (CP-1177 Injector)*

Inlet Liner, Splitless Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 2.0 mm

Cat. No.	Qty
2051301	1 ea
2051305	5 ea
2051325	25 ea

Inlet Liner, Direct Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.3 mm × 1.5 mm

Cat. No.	Qty
2051701	1 ea
2051705	5 ea
2051725	25 ea

Inlet Liner, Direct (SPME) Type, Straight Design (unpacked)

L × O.D. × I.D. ..... 78.5 mm × 6.5 mm × 0.75 mm

Cat. No.	Qty
2637501	1 ea
2637505	5 ea
2637525	25 ea

PureCol Sleeves for Packed GC Columns

When nonvolatiles accumulate in the column inlet, you must replace several inches of packing - or the entire column. A silanized glass PureCol sleeve, inserted in the column inlet, solves this problem simply and inexpensively. When column performance begins to deteriorate, you can quickly and conveniently replace the sleeve - often without removing the column from the instrument. Replacement time is comparable to replacing a septum. Replace the PureCol sleeve when you change the septum, or when you analyze a new type of sample. PureCol sleeves are available in two sizes. The larger size fits any 4 mm I.D. glass column that has 7 cm of straight, unpacked inlet. The smaller size fits any 2 mm I.D. glass columns with 7 cm of straight, unpacked inlet (end must be chamfered). Use PureCol sleeves with a 2 in. (5 cm) 21-gauge or finer needle.

PureCol Sleeve

Description	Cat. No.	Qty
PureCol Sleeve, for 4 mm I.D. columns	20540-U	10 ea
	20543	50 ea
PureCol Sleeve, for 2 mm I.D. columns (chamfered inlet only)	20534	10 ea
	20536	50 ea

On-Column Injection

Splitter discrimination among sample components that have different boiling points causes inaccurate quantification among components. Using on-column injection with a 0.53 mm I.D. thin film capillary column yields negligible discrimination for paraffins up to C44. A syringe with a 6 in. (15.24 cm) needle is required to deposit samples properly within the sleeve.

Left to Right: Ferrule for 1/4 in. sleeve, Nut for 1/4 in. sleeve, Reducing union, Sleeve

	Cat. No.	Qty
Cool On-Column Injection Sleeve Kit		
1 injection sleeve plus 1/4 in. connecting hardware	23630	1 ea
Cool On-Column Injection Sleeve		
1 injection sleeve	20476	1 ea
Swagelok® Nut		
Swagelok®, 402-1, brass, 1/4 in. Swagelok	22000-U	20 ea
Supeltex® M-2A Packed Column Ferrule, 1/4 in. Column O.D.		
I.D. 1/4 in., configured for 1/4 in. O.D. Column	22481	10 ea
Reducing Union (1/4 in. to 1/16 in.)		
1 stainless steel reducing union 1/4 in. to 1/16 in.	23633	1 ea
Capillary Column Butt Connector Nut		
1/16 in. male hexagonal wrenchtight	23805	4 ea
1/16 in. male knurled fingertight	23812	2 ea

GC Accessories

Inlet Liners, Glass Wool, and Specialized Hand Tools: *Injection Tee Kit*

Injection Tee Kit

Our injection tee allows simultaneous analyses on two wide bore columns of different polarity, a great time-saver when performing confirmatory analysis. The tee is deactivated, and the inlet is chamfered for use with autosamplers. Use in ¼ in. injection ports.

Kit includes deactivated 6 in. glass tee, two ¼ in. × 1/16 in. stainless steel reducing unions, ferrules for 0.53 mm I.D. and 0.75 mm I.D. columns, and instructions.

Left: Injection tee; Center: Ferrules for 0.53 mm I.D. columns; Right: Reducing unions

	Cat. No.	Qty
Injection Tee Kit		
6 in. (15 cm)	23664	1 ea
Injection Tee		
6 in. (15 cm)	23666	1 ea
8 in. (20 cm)	23667	1 ea
Swagelok® Nut		
Swagelok®, 402-1, brass, ¼ in. Swagelok	22000-U	20 ea
Supeltex® M-2A Packed Column Ferrule, ¼ in. Column O.D.		
I.D. ¼ in., configured for ¼ in. O.D. Column	22481	10 ea
Reducing Union (¼ in. to 1/16 in.)		
1 stainless steel reducing union ¼ in. to 1/16 in.	23633	1 ea
Capillary Column Butt Connector Nut		
1/16 in. male hexagonal wrenchtight	23805	4 ea
1/16 in. male knurled fingertight	23812	2 ea

Glass Wool and Specialized Hand Tools

Wool plugs are often used in GC inlet liners to improve sample vaporization, and/or to keep non-volatile material from entering the column. They can also be used in packed GC columns, solvent desorption tubes, thermal desorption tubes, and purge traps to retain packed beds. Choose:

- **Pesticide Grade (Silanized)** for applications that involve active analytes, such as organochlorine and/or organophosphorous pesticides
- **Silanized** for general purpose use
- **Phosphoric Acid Treated** for acidic compounds such as barbiturates, free fatty acids, etc.
- **Non-Treated** for special application where the user deactivates based on their intended analytes

Our puller/inserter tool was specifically designed to assist in inserting/removing plugs to/from narrow bore tubing.

Glass Wool

Description	Cat. No.	Qty
Pesticide Grade (Silanized)	20409 21688-U	10 g 100 g
Silanized	20411 20410	50 g 250 g
Phosphoric Acid Treated	20383	50 g
Non-Treated	20384	50 g

Puller/Inserter Tool

Simplifies the task of inserting or removing wool or foam plugs when working with GC inlet liners, packed GC columns, solvent desorption tubes, thermal desorption tubes, and purge traps. The forked end is used to feed the plug into tubing, leaving it cleanly when the tool is removed. The hooked end will not disrupt the packing material when the plug is removed. Made of stainless steel, this tool can be used with 1 - 4 mm I.D. tubing (glass, metal, and PTFE).

22406	2 ea

Inlet Liner O-Rings and Inlet Seals for Agilent (5890, 6890, and 7890)

Two commonly replaced consumables in an Agilent capillary injection port are the inlet liner o-ring, and the inlet seal. Inlet liner o-rings develop stress cracks over time, potentially allowing split gases to enter the carrier gas stream. Inlet seals must be regularly changed to prevent sample adsorption due to accumulation of sample residue and/or septum fragments.

Inlet Liner O-Rings

These high temperature o-rings can be used with inlet temperatures up to 375 °C without sticking or fragmenting. Fit 6.3 mm O.D. (split) and 6.5 mm O.D. (splitless) capillary liners, and any ¼in. O.D. capillary liner that uses an o-ring. Superior replacement for Viton o-rings.

Cat. No.	Qty
21003-U	10 ea
21004-U	25 ea

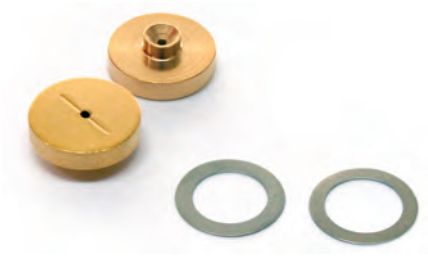
GC Accessories

Inlet Liner O-Rings and Inlet Seals for Agilent (5890, 6890, and 7890): *Inlet Seals*

Inlet Seals

Supelco manufactures replacement inlet seals using a high quality stainless steel. Three versions are offered:

- **Gold-plated (straight design)**. A straight design seal is suitable for applications with low split flows (<200 mL/min.). Plated with *pure gold* to insure inertness. No brighteners are used in the plating process. Each pack includes one washer for each seal.
- **Gold-Plated (cross design)**. A cross design seal is suitable for applications with high split flows (>200 mL/min.). Plated with *pure gold* to insure inertness. No brighteners are used in the plating process. Each pack includes one washer for each seal.
- **Non-Plated (straight design)**. A straight design seal is suitable for applications with low split flows (<200 mL/min.). More economical choice for applications that do not require high inertness. Packs of 2 and 10 include one washer for each seal. Pack of 100 includes 50 washers.



Left: Gold-plated (straight design) inlet seals; Right: Washers

Gold-Plated Inlet Seal (Straight Design)

Cat. No.	Qty
23318-U	2 ea
23319-U	10 ea

Gold-Plated Inlet Seal (Cross Design)

Cat. No.	Qty
23413-U	2 ea
23415-U	10 ea

Non-Plated Inlet Seal (Straight Design)

Cat. No.	Qty
23316-U	2 ea
23317-U	10 ea
23363-U	100 ea

Column Ferrules, Nuts, and Specialized Hand Tools

Supelco offers ferrules, nuts, and specialized hand tools for both capillary and packed column use. Supeltex® ferrules form leaktight seals without sticking to columns, and they do not require back ferrules. We recommend:

- Supeltex® M-2A, CapSeal Bullet®, or Supeltex® M-4 ferrules for fused silica capillary columns
- Supeltex® M-2A or Supeltex® M-4 ferrules for glass columns
- Supeltex® M-2A or Supeltex® M-2 ferrules for metal columns

Supeltex® M-1

- **Max. Temp.**: 250 °C
- **Composition**: Ceramic-filled PTFE
- **Characteristics**: Ideal for connections to mass spectrometers. High reusability. Isothermal use only.

Supeltex® M-2

- **Max. Temp.**: 350 °C
- **Composition**: DuPont VESPEL SP-1 (100% polyimide)
- **Characteristics**: High reusability.

Supeltex® M-2A

- **Max. Temp.**: 400 °C
- **Composition**: DuPont VESPEL SP-21 (85% polyimide/15% graphite)
- **Characteristics**: Seals at 1/4-turn past fingertight. High reusability. Won't stick to metal or glass.

Supeltex® M-2B

- **Max. Temp.**: 350 °C
- **Composition**: DuPont VESPEL SP-211 (75% polyimide/15% graphite, 10% PTFE)
- **Characteristics**: Conforms easily to capillary column, ensuring an effective seal and less chance of breakage.

Supeltex® M-4

- **Max. Temp.**: 450 °C
- **Composition**: Flexible graphite
- **Characteristics**: Seals at 1/4-turn past fingertight. Maximum sealing surface contact, reduced risk of column contamination at installation. An improved design. Supelco has refined the design of graphite ferrules so that we can offer you the finest quality ferrule available. Compare these ferrules to the graphite ferrules you are now using. Supeltex M-4 ferrules offer a clean, sharp profile with minimal flash.

CapSeal Bullet®

- **Max. Temp.**: 450 °C
- **Composition**: Graphite in an aluminum base
- **Characteristics**: Seals at 1/8-turn past fingertight. Reusable. A special end taper reduces graphite extrusion into fitting. Will not adhere to fittings. Reusable CapSeal Bullet ferrules consist of a graphite material captured in an aluminum base. This unique design keeps the ferrule from adhering to the fitting, making it easy to remove. Eliminate the headache of digging out a stuck ferrule and risking damage to your fitting.

O-Ring

- **Max. Temp.**: 200 °C
- **Composition**: Silicone
- **Characteristics**: Seals column having O.D. over or under specifications.

PTFE

- **Max. Temp.**: 250 °C
- **Composition**: PTFE
- **Characteristics**: Seals at 1/8-turn past fingertight.

Capillary GC Ferrules, Short Design

Short design ferrules are designed to fit:

- the original nuts that ship with Agilent Technologies GCs

Supeltex® M-2A Capillary Ferrule, Short Design

Column I.D.	Ferrule I.D.	Cat. No.	Qty
0.10-0.25 mm Column I.D.	I.D. 0.4 mm	24803-U 24807-U	10 ea 50 ea
0.32 mm Column I.D.	I.D. 0.5 mm	24806-U	50 ea
0.53 mm Column I.D.	I.D. 0.8 mm	24801-U 24804-U	10 ea 50 ea

GC Accessories

Column Ferrules, Nuts, and Specialized Hand Tools: *Capillary GC Ferrules, Short Design*

Supeltex® M-4 Capillary Ferrule, Short Design

Column I.D.	Ferrule I.D.	Cat. No.	Qty
0.10-0.25 mm Column I.D.	I.D. 0.4 mm	24811-U	10 ea
0.32 mm Column I.D.	I.D. 0.5 mm	24809-U 24813-U	10 ea 50 ea
0.53 mm Column I.D.	I.D. 0.8 mm	24808-U 24812-U	10 ea 50 ea

CapSeal Bullet® Capillary Ferrule, Short Design

Column I.D.	Ferrule I.D.	Cat. No.	Qty
0.10-0.25 mm Column I.D.	I.D. 0.4 mm	23864 23867	10 ea 50 ea
0.32 mm Column I.D.	I.D. 0.5 mm	23865 23868	10 ea 50 ea
0.53 mm Column I.D.	I.D. 0.8 mm	23866 23869	10 ea 50 ea

Capillary GC Ferrules, Long Design

Long design ferrules are designed to fit:

- MSD source nuts for Agilent Technologies GCs
- Original nuts that ship with PerkinElmer GCs
- Original nuts that ship with Varian GCs

Supeltex® M-2A Capillary Ferrule, Long Design

Column I.D.	Ferrule I.D.	Cat. No.	Qty
0.10-0.25 mm Column I.D.	I.D. 0.4 mm	24826-U 28022-U	10 ea 50 ea
0.32 mm Column I.D.	I.D. 0.5 mm	24824-U 28023-U	10 ea 50 ea
0.53 mm Column I.D.	I.D. 0.8 mm	24823-U 28024-U	10 ea 50 ea

Supeltex® M-2B Capillary Ferrule, Long Design

Column I.D.	Ferrule I.D.	Cat. No.	Qty
0.10-0.25 mm Column I.D.	I.D. 0.4 mm	22510-U	10 ea
0.32 mm Column I.D.	I.D. 0.5 mm	22511	10 ea
0.53 mm Column I.D.	I.D. 0.8 mm	22512	10 ea

Supeltex® M-4 Capillary Ferrule, Long Design

Column I.D.	Ferrule I.D.	Cat. No.	Qty
0.10-0.25 mm Column I.D.	I.D. 0.4 mm	28025-U 28028-U	10 ea 50 ea
0.32 mm Column I.D.	I.D. 0.5 mm	28026-U 28031-U	10 ea 50 ea
0.53 mm Column I.D.	I.D. 0.8 mm	28027-U 28032-U	10 ea 50 ea

CapSeal Bullet® Capillary Ferrule, Long Design

Column I.D.	Ferrule I.D.	Cat. No.	Qty
0.10-0.25 mm I.D. Column	I.D. 0.4 mm	23488 23493	12 ea 48 ea
0.32 mm I.D. Column	I.D. 0.5 mm	23489 23494-U	12 ea 48 ea
0.53 mm Column I.D.	I.D. 0.8 mm	23490 23495	2 ea 48 ea
0.50-0.75 mm I.D. Column	I.D. 1.0 mm	23491-U	12 ea

GC Accessories

Column Ferrules, Nuts, and Specialized Hand Tools: *Capillary GC Ferrules, General Purpose*

Capillary GC Ferrules, General Purpose

General purpose ferrules are designed to fit:

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

Supeltex® M-1 Capillary Ferrule, General Purpose

Column I.D.	Ferrule I.D.	Cat. No.	Qty
0.53 mm Column I.D.	I.D. 0.8 mm	22499	10 ea

Supeltex® M-2A Capillary Ferrule, General Purpose

Column I.D.	Ferrule I.D.	Cat. No.	Qty
0.10-0.25 mm Column I.D.	I.D. 0.4 mm	503258 22474	10 ea 50 ea
0.10-0.25 mm Column I.D. (2-hole)	I.D. 0.4 mm	22467	5 ea
0.32 mm Column I.D.	I.D. 0.5 mm	22461	10 ea
0.32 mm Column I.D. (2-hole)	I.D. 0.5 mm	22463	5 ea
0.53 mm Column I.D.	I.D. 0.8 mm	22489 22473	10 ea 50 ea
0.50-0.75 mm Column I.D.	I.D. 1.2 mm	22459	10 ea
Indented blank (drill to fit your column)	-	22488	10 ea

22467, 22463: 2-hole ferrules for splitting sample in the injection port onto two columns.
22488: indented blank ferrule that can be drilled to fit any capillary column O.D.

Supeltex® M-4 Capillary Ferrule, General Purpose

Column I.D.	Ferrule I.D.	Cat. No.	Qty
0.10-0.25 mm Column I.D.	I.D. 0.4 mm	22498 22480-U	10 ea 50 ea
0.32 mm Column I.D.	I.D. 0.5 mm	22462 22412	10 ea 50 ea
0.53 mm Column I.D.	I.D. 0.8 mm	20628 22479	10 ea 50 ea
0.75 mm Column I.D.	I.D. 1.0 mm	22494	10 ea
0.50-0.75 mm Column I.D.	I.D. 1.2 mm	22460	10 ea

CapSeal Bullet® Capillary Ferrule, General Purpose

Column I.D.	Ferrule I.D.	Cat. No.	Qty
0.10-0.25 mm Column I.D.	I.D. 0.4 mm	23480-U 23485	12 ea 48 ea
0.32 mm Column I.D.	I.D. 0.5 mm	23481 23486	12 ea 48 ea
0.53 mm Column I.D.	I.D. 0.8 mm	23482 23487	12 ea 48 ea

Packed GC Ferrules, 1/4 in. O.D. Columns

Supeltex® M-1 Packed Column Ferrule, 1/4 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 1/4 in.	22086-U 22087-U	10 ea 100 ea

Supeltex® M-2 Packed Column Ferrule, 1/4 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 1/4 in.	22320-U 22475	10 ea 50 ea

Supeltex® M-2A Packed Column Ferrule, 1/4 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 1/4 in.	22481 22471	10 ea 50 ea

Supeltex® M-4 Packed Column Ferrule, 1/4 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 1/4 in.	22492 22478	10 ea 50 ea

GC Accessories

Column Ferrules, Nuts, and Specialized Hand Tools: *Packed GC Ferrules, 1/4 in. O.D. Columns*

O-ring for Packed Column, 1/4 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 1/4 in.	20407	100 ea

PTFE Packed Column Ferrule, 1/4 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 1/4 in.	29024-U	10 ea

Packed GC Ferrules, 6 mm O.D. Columns

Supeltex® M-1 Packed Column Ferrule, 6 mm Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 6 mm	22089-U	10 ea

Supeltex® M-2A Packed Column Ferrule, 6 mm Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 6 mm	22393	10 ea
I.D. 6 mm	22196-U	100 ea

Supeltex® M-4 Packed Column Ferrule, 6 mm Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 6 mm	22493	10 ea

Packed GC Ferrules, 5 mm O.D. Columns

Stainless Steel Graphite Ferrules

Graphite ferrules and stainless steel spacers for use with 5 mm columns and liners in Shimadzu GCs.

23311	4 ea

Packed GC Ferrules, 1/8 in. O.D. Columns

Supeltex® M-1 Packed Column Ferrule, 1/8 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 1/8 in.	22496	10 ea
	22309	100 ea

Supeltex® M-2 Packed Column Ferrule, 1/8 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
ferrule I.D. 1/8 in.	22321	10 ea
	22476	50 ea

Supeltex® M-2A Packed Column Ferrule, 1/8 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
-	22483-U	10 ea
	22472	50 ea

Supeltex® M-4 Packed Column Ferrule, 1/8 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 1/8 in.	22491	10 ea

GC Accessories

Column Ferrules, Nuts, and Specialized Hand Tools: *Packed GC Ferrules, 1/16 in. O.D. Columns*

Packed GC Ferrules, 1/16 in. O.D. Columns

Supelteх® M-1 Packed Column Ferrule, 1/16 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 1/16 in.	22386	10 ea
I.D. 1/16 in.	23862-U	200 ea

Supelteх® M-2 Packed Column Ferrule, 1/16 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 1/16 in.	20644-U	10 ea

Supelteх® M-2A Packed Column Ferrule, 1/16 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 1/16 in.	22487-U	10 ea

Supelteх® M-4 Packed Column Ferrule, 1/16 in. Column O.D.

Ferrule I.D.	Cat. No.	Qty
I.D. 1/16 in.	22495-U	10 ea

Packed GC Ferrules, Reducing Design

Supelteх® M-1 Reducing Ferrule

For Use With	I.D. × O.D. (in.)	Cat. No.	Qty
1/16 in. O.D. Column in 1/8 in. fitting	1/16 × 1/8	22387	10 ea

Supelteх® M-2 Reducing Ferrule

For Use With	I.D. × O.D. (in.)	Cat. No.	Qty
1/16 in. O.D. Column in 1/4 in. fitting	1/1 × 1/4	22384	10 ea
1/8 in. O.D. Column in 1/4 in. fitting	1/8 × 1/4	22314	10 ea

Supelteх® M-2A Reducing Ferrule

For Use With	I.D. × O.D. (in.)	Cat. No.	Qty
1/16 in. O.D. Column in 1/8 in. fitting	1/16 × 1/8	22484-U	10 ea
1/16 in. O.D. Column in 1/4 in. fitting	1/16 × 1/4	22486	10 ea
1/8 in. O.D. Column in 1/4 in. fitting	1/8 × 1/4	22485-U	10 ea

Supelteх® M-4 Reducing Ferrule

For Use With	I.D. × O.D.	Cat. No.	Qty
0.32 mm I.D. Column in 1/8 in. fitting	0.5 mm × 1/8 in.	22458	2 ea
0.32mm I.D. Column in 1/4 in. fitting	0.5 mm × 1/4 in.	22457	2 ea

GC Ferrule Kits

Finding the right ferrule can be difficult. Simplify this chore with one of our ferrule starter kits. Each kit contains several types of Supeltex ferrules - you can determine which type is best for your applications. Kits include instructions for installing each ferrule.

Cat. No. 22469 is our kit for fused silica capillary columns (0.25 to 0.32 mm I. D.). It includes 4 drilled Supeltex M-2A, 4 indented blank Supeltex M-2A, 4 Supeltex M-4 ferrules, a pin vise drill kit (Cat. No. 23820-U), and instructions.

Cat. No. 22468 is our kit for wide bore fused silica capillary columns (0.53 to 0.75 mm I.D.). It includes 4 Supeltex M-1, 4 Supeltex M-2A, 4 Supeltex M-4 ferrules, a pin vise drill kit (Cat. No. 23820-U), and instructions.

Cat. No. 20648 is our kit for 1/4 in. O.D. glass packed columns. It includes 4 Supeltex M-1, 4 Supeltex M-2A, 4 Supeltex M-4 ferrules, a 6 in./15 cm × 1/4 in. practice piece of glass tubing, and instructions.

Description	Cat. No.	Qty
Fused Silica Ferrule Kit	22469	1 ea
Wide Bore Fused Silica Capillary Ferrule Kit	22468	1 ea
Packed Column Ferrule Kit	20648	1 ea

GC Accessories

Column Ferrules, Nuts, and Specialized Hand Tools: *Capillary GC Column Nuts*

Capillary GC Column Nuts

When performing capillary GC, it is critical to use the correct nut/ferrule combination. Improper nut/ferrule combinations can create dead volume (empty space that is not swept by carrier gas), resulting in poor chromatography (fronting peaks and/or band broadening).

Capillary Column Nut (fits Agilent injectors and non-MS detectors), hexagonal wrenchtight version

These stainless steel column nuts are replacements for damaged or misplaced original Agilent nuts. Use with *short* ferrules. Hexagonal shape allows tightening with a wrench to keep fingers from getting burned.

24833-U	2 ea

Supelco Ferrule Nut Adapter (fits Agilent injectors and non-MS detectors), hexagonal wrenchtight version

These stainless steel adapters enable you to use *general purpose* and other 1/16 in. compression ferrules in Agilent GCs. Hexagonal shape allows tightening with a wrench to keep fingers from getting burned.

Supelco (Hexagonal) Ferrule Nut Adapter (22470-U)

22470-U	2 ea

Supelco Ferrule Nut Adapter (fits Agilent injectors and non-MS detectors), knurled fingertight version

These stainless steel adapters enable you to use *general purpose* and other 1/16 in. compression ferrules in Agilent GCs. Knurled head allows tightening with fingers, eliminating the need to locate the proper wrench.

22509	2 ea

Capillary Column Nut (fits Agilent [MS detector] and PerkinElmer®), hexagonal wrenchtight version

These nickel-plated brass column nuts are replacements for damaged or misplaced original Agilent MSD or PerkinElmer nuts. Use with *long* ferrules.

28034-U	5 ea

Supelco Ferrule Nut Adapter (fits Agilent MS detectors), knurled fingertight version

These brass adapters enable you to use *long* or *general purpose* ferrules in Agilent MSDs. Made of brass to prevent damage to MSD source threads. Knurled head allows tightening with fingers, eliminating the need to locate the proper wrench.

22517	2 ea

Capillary Column Nut Kit (fits Shimadzu™)

Kit includes stainless steel nut, spring, stainless steel front ferrule, and metal back spacer. Note that 2 kits are needed per column.

23312	1 ea

Capillary Column Nut (fits Varian®)

These brass column nuts are replacements for damaged or misplaced original Varian nuts.

28033-U	1 ea

Specialized Hand Tools

These handy tools are designed specifically for use with GC ferrules.

Ferrule Remover

Spiral tapered tip for removal of capillary ferrules from nuts. Two sizes are included, for removing 0.4 mm and 0.8 mm I.D. ferrules.
not available in EU

Z236128-1PAK	1 pkg

Pin Vise Drill Kit

Drill the exact bore you need in hard or soft ferrules. Includes pin vise and 14 drill bits:

0.33 mm (0.0135 in.)
0.40 mm (0.016 in.)
0.56 mm (0.022 in.)
0.63 mm (0.025 in.)
0.72 mm (0.028 in.)
0.77 mm (0.031 in.)
0.83 mm (0.033 in.)
0.91 mm (0.036 in.)
0.97 mm (0.038 in.)
1.02 mm (0.040 in.)
1.06 mm (0.042 in.)
1.17 mm (0.046 in.)
1.40 mm (0.055 in.)
1.61 mm (0.061 in.)

The vise handle holds all bits to keep them at your fingertips. The vise also is handy for gripping fine wire when cleaning FID jets, syringe needles, or any other small orifice.

23820-U	1 ea

Drill Bits

for use with Pin Vise Drill Kit

Description	Cat. No.	Qty
Drill Bits, diam. 0.35 mm	23811-U	6 ea
Drill Bits, diam. 0.40 mm	23810	6 ea
Drill Bits, diam. 0.51 mm	23809	6 ea

Capillary Column Installation, Maintenance, and Storage

This collection of specialized items is designed to assist the capillary GC user in several tasks.

Capillary Starter Kit

This convenient kit includes all the tools needed for installing capillary GC columns and related accessories. It contains:

6 in. (15 cm) pipe cleaners
Tweezers
Pocket mirror with rotating head
$\frac{1}{4}$in. × $\frac{5}{16}$in. open end wrench
Capillary Cleaving Tool
6 in. (15 cm) stainless steel ruler
Small flashlight
Pin vise drill kit
Screw-type septum puller

23639	1 ea

Capillary Cleaving™ Tool

This handy tool makes scalpel-like cuts to polyimide-coated fused silica, leaving no jagged edges to create problems. The industrial sapphire cutting edges remains sharp indefinitely.

Description	Cat. No.	Qty
Retractable Blade Version	23814	1 ea
Replacement Blade (for P/N 23814)	23815	1 ea
Fixed Blade Version	23740-U	1 ea

Shortix™ Tubing Cutter

A rotating diamond cutting blade ensures precision cuts to polyimide-coated fused silica tubing. Even an inexperienced user can make the clean, 90° cuts required for capillary columns. Cuts 0.30 - 0.78 mm O.D. fused silica tubing. Includes a protective wood box for storage.

21386-U	1 ea

GC Accessories

Capillary Column Installation, Maintenance, and Storage

Column scribe

Inexpensive ceramic scribes for cutting fused silica tubing.

Z290254-1PAK	10 ea

Solvent Rinse Kit

Ideal for coating or washing capillary columns. Insert one end of the capillary column into the reservoir fitting and seal with a graphite ferrule. Gas pressure applied through a side arm forces the solution from the reservoir through the column.

23626	1 ea

Cage for Fused Silica Column

This unique design with minimal metal-to-column contact reduces the possibility of damaging the protective coating on columns. Additionally, the design makes it easy to hang columns in most GC ovens.

Left: 23742; Right: 23743

For Use With	Cat. No.	Qty
0.25 mm I.D. column	23742	3 ea
0.32 mm or 0.53 mm I.D. column	23743	3 ea

Capillary Column Tags

Permanently label capillary columns.

- Soft enough to imprint with a ball-point pen
- Big enough for all necessary information
- Lightweight and will not damage column

writing surface L × W ..... 1⅛ in. × ¾ in.
tongue L ..... 5¼ in.

23779	100 ea

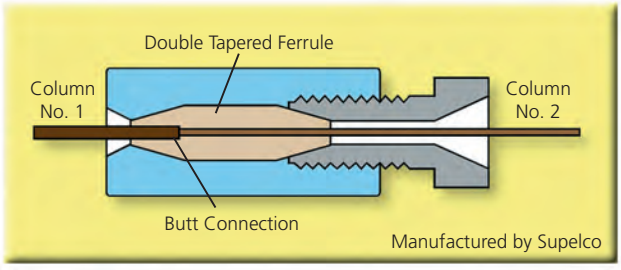
Capillary Column Connectors

Column connectors are useful for attaching a guard column/retention gap to an analytical column, or for repairing a broken column. We offer two options for connecting two pieces of fused silica tubing. The **butt connector** is a small stainless steel fitting that makes a zero dead volume seal. The **GlasSeal™ connectors** offer convenience.

Capillary Column Butt Connectors

This device consists of a double-tapered ferrule and a stainless steel compression body with a threaded nut. Small (2.3 cm x 0.6 cm) and light (4.4 g with ferrule), it provides a gas tight seal without a change in column efficiency or inertness. The columns to be connected can have the same or different internal and external diameters. The butt connection is made inside the special double-tapered ferrule. The ferrule is then compressed within the housing. When the column ends are butted squarely and tightly together, the butt connector will not alter the chromatographic performance of your capillary columns. There is little or no dead volume and little chance of gas flow disruption by following these steps:

- Make sure the bore of the ferrule is clean. Blow out any ferrule fragments with nitrogen. Using a magnifier, examine the column ends to be connected. Make sure each cut is clean and square. The two ends must butt squarely, without any gaps.
- With white typewriter correction fluid, place a reference mark 1/4 inch from the end of the column with the larger bore. This mark will help you to confirm visually that the end of the column is centered within the 1/2 inch ferrule.
- Place the ferrule inside the housing and loosely tighten the nut. Feed the unmarked column completely through the ferrule and out the opposite end. Cut off ~1 inch (25 mm) of the column to ensure no ferrule fragments are in the column. Draw the column back far enough to insert the marked column into the ferrule to the indicating mark. Tighten the nut about 1/8 turn past fingertight.
- Press the ends of the columns together, observing the reference mark to make certain they butt together at the center of the ferrule. Tighten the ferrule to about 1/4-1/2 turn past fingertight. Gently pull on both columns to ensure they are secure. If they are loose, additional tightening is necessary.
- Any undetected leaking connection, including this butt connection, can allow oxygen and water vapor to enter the system. Leak check the butt connector in the same manner as any capillary column connection. DO NOT USE LIQUID LEAK INDICATORS. Liquids can contaminate the capillary system. We recommend using a GOW-MAC® electronic leak detector. These thermal conductivity detectors are highly sensitive to trace amounts of hydrogen or helium, and will not contaminate the system.



GC Accessories

Capillary Column Connectors: *Capillary Column Butt Connectors*

Capillary Column Butt Connector

	Cat. No.	Qty
Capillary Column Butt Connector		
I.D. 0.4 mm, Supeltex M-2 ferrule included	23796	1 ea
body only (ferrules not included)	23804	1 ea

Supeltex® M-2 Double-Tapered Ferrule

- **Max. Temp.**: 350 °C
- **Composition**: DuPont VESPEL SP-1 (100% polyimide)
- **Characteristics**: High reusability.

Compatible	I.D. (mm)	Cat. No.	Qty
Supeltex® M-2 Double-Tapered Ferrule			
0.10 mm to like I. D. column	0.25	22585	2 ea
0.10-0.25 mm to like I.D. column	0.4	23797	2 ea
0.32 mm to like I. D. column	0.5	22464	2 ea
0.53 mm to like I. D. column	0.8	22590-U	2 ea
0.10-0.25 mm I.D. to 0.53 mm I.D. column (reducing)	0.4-0.8	22465	2 ea
0.32 mm I.D. to 0.53 mm I.D. column	0.5-0.8	22596	2 ea
0.32 mm I.D. to 0.75 mm I.D. Column	0.5-1.2	22466	2 ea

Supeltex® M-2B Double-Tapered Ferrule

- **Max. Temp.**: 350 °C
- **Composition**: DuPont VESPEL SP-211 (75% polyimide, 15% graphite, 10% PTFE)
- **Characteristics**: Conforms easily to capillary column, ensuring an effective seal and less chance of breakage.

Compatible	I.D. (mm)	Cat. No.	Qty
Supeltex® M-2B Double-Tapered Ferrule			
0.10-0.25 mm to like I.D. Column	0.4	22453	2 ea
0.32 mm to like I. D. Column	0.5	22454	2 ea
0.53 mm to like I. D. Column	0.8	22591	2 ea
0.10-0.25 mm I.D. to 0.53 mm I.D. Column	0.4-0.8	22455-U	2 ea
0.32 mm I.D. to 0.53 mm I.D. Column	0.5-0.8	22586	2 ea
0.32 mm I.D. to 0.75 mm I.D. Column	0.5-1.2	22456	2 ea

Capillary Column Butt Connector Nut

Replacement nut for the Capillary Column Butt Connector.

	Cat. No.	Qty
Capillary Column Butt Connector Nut		
1/16 in. male hexagonal wrenchtight	23805	4 ea
1/16 in. male knurled fingertight	23812	2 ea

GlasSeal™ Capillary Column Connectors

GlasSeal™ connectors are inexpensive, easy-to-use, and silanized for an inert inside surface.

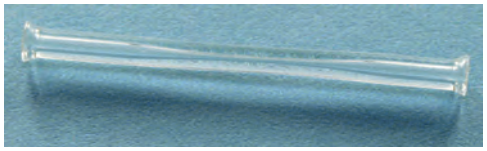
- Straight connectors connect two pieces of fused silica tubing of the same or different diameters without the need for tools. The leak-free connection is useful to connect a guard column or transfer line, repair a broken column, or connect two columns (same or different phases).
- "Y" connectors connect three pieces of fused silica tubing of the same or different diameters without the need for tools. The leak-free connection is useful to split a sample to two columns, or to split a column effluent to two detectors.

For use with 0.10 - 0.53 mm I.D. fused silica tubing.

GlasSeal™ Capillary Column Connector, Fused Silica

Cat. No.	Qty
23627	5 ea
23628	25 ea

GlasSeal™ Capillary Column Connector, Borosilicate Glass



Cat. No.	Qty
20479	12 ea

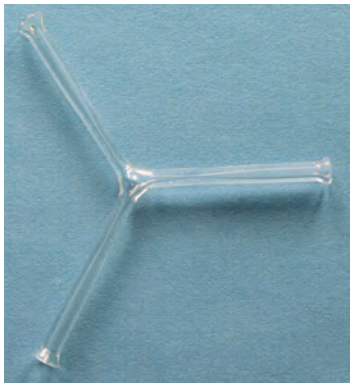
GC Accessories

Capillary Column Connectors: *GlasSeal™ Capillary Column Connectors*

"Y" GlasSeal™ Connector, Fused Silica

Cat. No.	Qty
23631	1 ea
23632	3 ea

"Y" GlasSeal™ Connector, Borosilicate Glass



Cat. No.	Qty
20480	1 ea

Polyimide Sealing Resin

A GlasSeal™ connector will form a perfect seal between two fused silica columns. To make this connection extremely durable, use a small drop of this resin. Also for use as an excellent high temperature glue. Cures at 200 °C. For use at 350 °C or lower operating temperatures. The bottle contains 5 g of resin, and includes a handy applicator cap.

Cat. No.	Qty
23817	5 g

Packed Column Preparation, Installation, Maintenance, and Storage

This collection of specialized items is designed to assist the packed GC user in several tasks.

Sylon CT™

$C_2H_6Cl_2Si$ FW 129.06

5% dimethyldichlorosilane in toluene

For deactivating glassware.
Treat the glass tubing that you use for columns with Sylon-CT solution (5% dimethyldichlorosilane in toluene). It deactivates the tubing for use up to 350 °C to 400 °C, far exceeding the capabilities of other deactivating agents used at room temperature. Sylon CT™ also deactivates transfer lines and glass or glass-lined injection port liners. Instructions included.

33065-U	400 mL

Packed Column Filling Kit

This convenient kit contains many of the items need to quickly and efficiently pack columns. Includes two puller/inserter tools (Cat. No. 22406), plastic funnel, rubber column connector, and 50 g of silanized glass wool for plugs.

22447	1 ea

Funnel and Tubing

A small funnel and short piece of tubing simplify the process packing columns.

20390-U	1 ea

Glass Wool

Description	Cat. No.	Qty
Pesticide Grade (Silanized)	20409	10 g
	21688-U	100 g
Silanized	20411	50 g
	20410	250 g
Phosphoric Acid Treated	20383	50 g
Non-Treated	20384	50 g

GC Accessories

Packed Column Preparation, Installation, Maintenance, and Storage

Puller/Inserter Tool

Simplifies the task of inserting or removing wool or foam plugs when working with GC inlet liners, packed GC columns, solvent desorption tubes, thermal desorption tubes, and purge traps. The forked end is used to feed the plug into tubing, leaving it cleanly when the tool is removed. The hooked end will not disrupt the packing material when the plug is removed. Made of stainless steel, this tool can be used with 1 - 4 mm I.D. tubing (glass, metal, and PTFE).

22406	2 ea

Dremel Engraver

Eliminate gaps when packing your columns. The Burgess Vibrograver is ideal for vibrating columns or marking tags.

- 110 VAC models: 9 watts, 0.08 amp, 60Hz.
- 220 VAC model: 12 watts, 0.05 amp, 50Hz; not CE compliant.

Description	Cat. No.	Qty
110 V	20402	1 ea

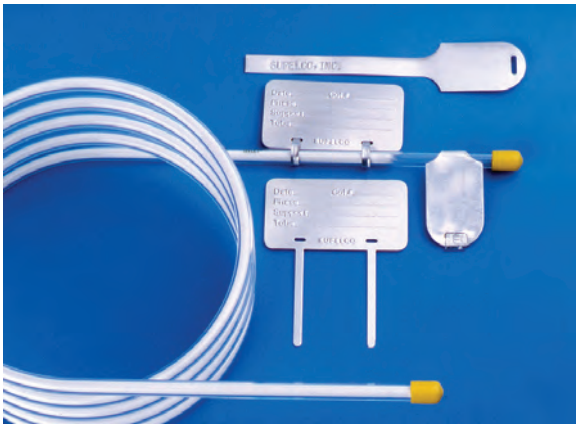
Stainless Steel Screening

An alternative to the use of wool plugs to hold packing material inside columns. Includes a single 2 in. x 2 in. (5 cm x 5 cm) sheet of 10 µm pore size material.

22327	1 ea

Column Tag

These aluminum tags are easily marked with a Burgess Vibrograver or other scribing tool, for a permanent record of important chromatographic data.



Description	Cat. No.	Qty
engraved, two straps	20396	50 ea
plain, one strap	20401	100 ea

Rejuv-8™

Silylating reagent

For packed columns only.

How can you improve deteriorating chromatographic results, salvage a tired column, or minimize peak tailing and sample loss when working with submicrogram samples? Simply inject 10- 50 µL of Rejuv-8 silylating agent directly onto your column.

Contains no chlorosilanes.

33059-U	25 mL

Plastic Column Cap

These plastic caps will easily slip over the ends of packed GC columns to protect them during storage.

Description	Cat. No.	Qty
for use with $\frac{1}{16}$ in. O.D. column	20436	100 ea
for use with $\frac{1}{8}$ in. O.D. columns	20437-U	100 ea
for use with $\frac{3}{16}$ in. O.D. column	20438-U	100 ea
for use with $\frac{1}{4}$ in. O.D. column	20439	100 ea

GC Accessories

Flow Measurement

Flow Measurement

Those doing gas chromatography must routinely measure gas flows when setting up an instrument, developing a method, or troubleshooting. With today's modern GCs, chromatographers may rely on electronic pressure control (EPC) for setting flow rates. However, a flowmeter is still an essential tool to have when troubleshooting is necessary. Also, many older GCs still in use do not have EPC, requiring that flows be set manually using a flowmeter. Gas flowmeters generally fall into two types, volumetric (bubble) and mass, each with its advantages and limitations. Both types measure the amount of gas exiting a column or split vent in a specific time period.

Volumetric (Bubble) Measurement

If the amount of gas exiting a column or split vent is measured in units of volume, the flow rate is volumetric based. For example, measuring the volume of gas in milliliters (mL) per unit time in minutes will result in a volumetric flow rate in mL/min. The most common device for measuring a volumetric flow rate is a bubble flowmeter. These devices are used to determine flow by measuring the time required for a gas stream to move a soap bubble through a specific volume.

There are several important considerations when using a bubble flowmeter:

- The flow measurement is based on volume, and can be affected by atmospheric pressure and temperature conditions.
- If water vapor is present, it can result in an elevated flow rate measurement.
- The gas being measured can diffuse rapidly through the soap bubble resulting in an erroneously low flow rate measurement. This is especially a consideration for helium and hydrogen.

Usually, flow rates are measured at ambient temperature and pressure. If it is necessary to compare flow rates taken under different temperature and/or pressure conditions, a correction factor relative to a set standard temperature and pressure should be applied:

- $F_{ref} = F_{amb} (P_{amb}/P_{ref}) (T_{ref}/T_{amb})$

Where:

- F_{ref} = flow corrected to reference conditions
- F_{amb} = flow measured at ambient conditions
- P_{amb} = atmospheric pressure at ambient conditions
- P_{ref} = pressure at reference conditions (1 atm commonly used)
- T_{ref} = temperature at reference conditions in Kelvin (K) (298 K commonly used)
- T_{amb} = temperature at ambient conditions in K

In the case of water vapor, a correction factor can be applied to the flow measurement to compensate:

- Corrected flow = measured flow x $(1-p_w/p_{amb})$

Where:

- p_w = vapor pressure of water at ambient temperature
- p_{amb} = ambient pressure

To minimize the error introduced by diffusion of air, one can purge the flowmeter tube with several volumes of the gas being measured prior to taking the flow reading.

Mass Measurement

If the amount of gas exiting a column or split vent is measured in units of mass, the flow rate is mass based. Unlike volumetric flow rate, this measurement is not affected by atmospheric temperature or pressure changes. Also, no compensation for water vapor effect is required. The devices used for mass flow measurements in GC are usually thermal flowmeters, which are commonly referred to as mass flowmeters. The operating principle is that the gas flow transfers heat between two sensors in proportion to its mass and velocity. The resulting heat imbalance produces an electrical signal in the flow sensor, which is used to calculate mass flow in mass/unit time. This measurement is then converted to a volumetric value using constant temperature and pressure values, as well as the density of the gas. Fluctuations due to ambient temperature are minimized by the heat. Because gases have differing thermal conductivities and densities, each mass flowmeter must be periodically calibrated for the specific gas to be measured. In contrast, a volumetric (bubble) flowmeter is non-specific (it can be used for any gas).

Digital Volumetric (Bubble) Flowmeters

A digital bubble flowmeter is one of the most useful tools in a GC lab. They are very reliable, and easy to use. The principle is that an optical sensor detects when the bubble enters and exits the calibrated tube. A microprocessor then calculates the resulting volumetric flow rate and displays it on a small screen.

NEW PRODUCTS

Optiflow Digital Bubble Flowmeters

Optiflow digital bubble flowmeters automate the bubble flowmeter "positive displacement" technique, which works independent of the type, mass, or mixture of the gas being measured. These high-precision instruments combine the simplicity and versatility of a bubble flowmeter with the speed and accuracy of a microprocessor. This provides you with a reliable means of measuring gas flow.

These versatile units can be used with all gases. Plus, they feature an easy-to-read, accurate digital display, eliminating the need for tedious bubble watching, timing, and flow rate/time conversions. The bubble is visible for your observation.

- Accurate to within ±3% of any reading
- Portable - includes standard 9-volt battery
- Automatic power-off for extended battery life
- Field replaceable tubes

Model 520, flow range: 0.5-500 mL/min

Included with this product are: flowmeter, glassware (flow tube), squeeze bulb, bulb clamp, and flexible tubing.

28679-U	1 ea

GC Accessories

Flow Measurement: *Digital Volumetric (Bubble) Flowmeters*

NEW PRODUCTS

Optiflow Flowmeter Glassware Kits

This kit includes: glassware (flow tube), squeeze bulb, and flexible tubing.

28683-U	1 ea

Manual Volumetric (Bubble) Flowmeters

The most basic configuration of a bubble flowmeter is a calibrated tube, a stopwatch, and a good eye. The bubble is timed as it moves up the calibrated tube between two markings.

Manual Bubble Flowmeter (Capillary Version)

This 0.5 mL bubble flowmeter allows the true split ratio to be determined by measuring actual flow rate. The flow tube is graduated in 0.01 mL increments to allow for the low flows typical of capillary GC applications. The flow tube is held by two magnetic clamps so the unit can be attached to any metal surface for easy storage. A version that includes a sampling stand is offered for added portability.

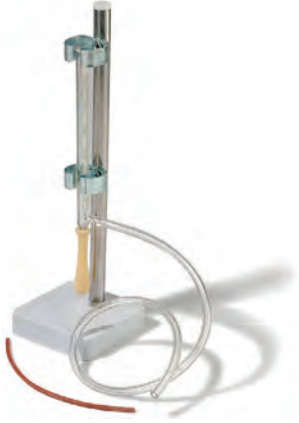
Description	Cat. No.	Qty
magnetic clamps	23762-U	1 ea
stand included	23771	1 ea

Manual Bubble Flowmeter (Standard Version)

The most basic configuration of a bubble flowmeter is a calibrated tube, a stopwatch, and a good eye. The bubble is timed as it moves up the calibrated tube between two markings. Flow tubes are graduated as follows:

- 10 mL tube in 1 mL increments
- 25 mL tube in 5 mL increments
- 50 mL tube in 10 mL increments
- 100 mL tube in 20 mL increments

Includes glass flow tube with two magnetic clamps, a short piece of Tygon tubing and a squeeze bulb. **Stand not included.**



Description	Cat. No.	Qty
flow meter volume 10 mL	20562	1 ea
flow meter volume 25 mL	20431	1 ea
flow meter volume 50 mL	20432	1 ea
flow meter volume 100 mL	20433-U	1 ea

Manual Bubble Flowmeter (Large Version)

The most basic configuration of a bubble flowmeter is a calibrated tube, a stopwatch, and a good eye. The bubble is timed as it moves up the calibrated tube between two markings. A alternative tubing attachment port at the top of the flow tube allows the measurement of negative displacement. Flow tubes are graduated as follows:

- 500 mL tube in 50 mL increments
- 1000 mL tube in 100 mL increments

Includes the glass flow tube, 30 in. ($^{3}/_{4}$ m) of $^{5}/_{16}$ in. Tygon tubing, a squeeze bulb, a collapsible stand, and a bottle of liquid soap solution.

20414

Description	Cat. No.	Qty
500 mL	20414	1 ea
1000 mL	20415	1 ea

Replacement 500 mL Glass Flow Tube

20427-U	1 ea

Replacement 1000 mL Glass Flow Tube

20428-U	1 ea

GC Accessories

Flow Measurement: *Volumetric (Bubble) Flowmeter Accessories*

Volumetric (Bubble) Flowmeter Accessories

A bubble is required for proper operation of a volumetric flowmeter. This is accomplished with a soap solution and a squeeze bulb. Both items can be replenished or replaced periodically.

SNOOP® Liquid Leak Detector

For use with volumetric (bubble) flowmeters. Also useful for checking gas delivery system plumbing for leaks. Not recommend for use upstream of capillary GC systems (an electronic leak detector is preferred).

20640-U	3.8 L
20434	8 oz

Squeeze Bulb 2mL

23166	10 ea

Digital Mass Flowmeters

Benefits of a mass flowmeter over a volumetric (bubble) flowmeter include:

- Not affected by atmospheric temperature or pressure changes
- No need to compensate for water vapor effect
- Can be used for measurements outside the laboratory

The main drawback is the need for periodic calibration for the gas to be measured.

Aalborg Mass Flowmeter

This easy to use instrument can be used to measure gas flow rates for common GC gases (H_2, He, N_2, CO_2, air, and argon/methane mixtures). It features:

- ±1.5% accuracy
- Maximum inlet pressure: 500 psi (34.5 bar)
- Optimal operation at 20 psi (1.4 bar)
- Aluminum body for noncorrosive gases
- 1/4 in. NPT fittings
- Tiltable (more than 90°) LCD digital display
- **Power options shown above must be purchased separately. Please see related tab for your required voltage.**

EN 55011 Class I, Class B; and EN 50082-1

Principal of Operation

The stream of metered gas is split proportionally. A small part of the flow is shunted through a straight capillary sensor tube, the balance of the gas flows through a laminar flow conduit. Heat flux is introduced at two sections of the capillary sensor tube by means of precision wound coils. As it flows, the gas carries heat between the two coils. The resultant temperature differential is proportional to the change in resistance of the coils. Wheatstone bridges are used to monitor the instantaneous temperature of each of the coils. The closed loop control circuit detects and amplifies the temperature gradient and restores the temperature balance of the coils. The current required at any given time to maintain dynamic equilibrium is a function of the amount of heat carried by the gases. An output signal of 0-5 VDC or 4-20 mA is generated, which indicates the mass molecular-based flow rate of the metered gas. Flow rates are unaffected by temperature or pressure variations within stated limits.

Left: Flowmeter; Right: Battery kit with battery pack (back right), battery to flowmeter cable (front center), and battery AC power cord (front right)

Flow Range	Cat. No.	Qty
0-50 mL/min	503894	1 ea
0-100 mL/min	503908	1 ea
0-200 mL/min	503916	1 ea
0-500 mL/min	503924	1 ea
0-1 L/min	503932	1 ea
0-5 L/min	503940	1 ea
0-10 L/min	503959	1 ea

Aalborg Mass Flowmeter Power Supply

Description	Cat. No.	Qty
Aalborg Mass Flowmeter Power Supply, 110 V (12 VDC)	503282	1 ea
Aalborg Mass Flowmeter Power Supply, 230 V (12 VDC)	503290	1 ea

Aalborg Mass Flowmeter Battery Kit

Description	Cat. No.	Qty
Aalborg Mass Flowmeter Battery Kit, 110 V (AC)	503266	1 ea
Aalborg Mass Flowmeter Battery Kit, 230 V (AC)	503274	1 ea

Instrument Upgrades and Maintenance

These products allow the user to upgrade their instrument with new components, replace worn items, and perform the necessary maintenance to keep the system in optimal condition.

Instrument Regulators/Controllers

Upgrading instrument pressure regulators and flow controllers can lead to improved system performance, and is a much less expensive option than the purchase of a new instrument. For example, an older system that employs column outlet pressure regulation can be upgraded to operate with backpressure regulation, allowing the user to:

- Conserve carrier gas
- Set linear velocity more accurately
- Use hydrogen carrier gas more safely

We offer instrument regulators/controllers made by Porter Instrument Company that are specifically designed for GC instrumentation. They are suitable for panel mounting, can be used to 160 °F, provide bubble-tight shutoff to 250 psi (helium), and have $\frac{1}{8}$ in. brass Swagelok connections.

Porter Model 9000 Backpressure Regulator

Specifications

- Flow Capacity: 0-1000 cc/min
- Regulation Range: 0-100 psig (0-7.0 kg/cm^2)
- Construction: aluminum body & bonnet, Fairprene 5029A diaphragm, Viton valve seat

Requires a low flow controller (Cat. No. 22834) with a 0-535 cc/min flow element (Cat. No. 22839).

22811-U	1 ea

Porter Low Flow Pressure Regulator

Provides precise pressure regulation at very low flows. Outlet pressure will not decrease more than 0.3 psi over the entire flow range.

Specifications

- Regulation Range: 0-100 psig (0-7.0 kg/cm^2).
- Max. Operating Pressure: 250 psig (17.6 kg/cm^2)
- Pressure Drop Required: >10 psi (0.7 kg/cm^2)
- Control Accuracy: less than 0.3 psi decrease
- Construction: aluminum body & bonnet, stainless steel diaphragm & filter, Buna-N O-rings, Viton valve seat

22816	1 ea

Porter Model 4000 Miniature Pressure Regulator

Provides the same control and stability at lower pressures as the larger low flow pressure regulator (Cat. No. 22816), but requires much less space. The $\frac{1}{8}$ in. (2.9 cm) O.D. body fits into the smallest of instruments. Recommended for flows of 0-500 cc/min. A 10 psi pressure change will not change the outlet pressure by more than 0.05 psi. From 2 cc/min to 250 cc/min, the outlet pressure will not change by more than 0.2 psi.

Specifications

- Flow Capacity: 0-15 liters/min (60 psig helium supply, 15 psig outlet)
- Regulation Range: 0-60 psig (0-4.2 kg/cm^2)
- Max. Operating Pressure: 250 psig (17.6 kg/cm^2)
- Pressure Drop Required: >10 psi (0.7 kg/cm^2)
- Construction: aluminum body & bonnet, stainless steel diaphragm

22813-U	1 ea

Porter Low Flow Controller

Accurate to within 0.3%. Includes 0-110 cc/min flow element (green). Element can be changed depending on application. Order other elements [0-10 cc/min (blue) and 0-535 cc min (black)] separately.

Specifications

- Max. Operating Pressure: 250 psig
- Pressure Drop Required: >15 psi
- Construction: aluminum body & bonnet, Fairprene 5029A diaphragm, Viton valve seat, Buna-N O-ring

22834	1 ea

Optional Flow Elements

Fits Porter low flow controller (Cat. No. 22834).

Description	Cat. No.	Qty
flow rate: 0-10 cc/min (blue)	22836	1 ea
flow rate: 0-535 cc/min (black)	22839	1 ea

GC Accessories

Instrument Upgrades and Maintenance: *Injection Port Items*

Injection Port Items

Upgrading the sample introduction area (by installing a Merlin Microseal system, or a needle guide) will decrease the time and expense of changing rubber septa. Rethreading damaged threads will save money compared to the cost of replacing the entire injection port. Keep the injection port clean with specialized brushes.

Merlin Microseal™ System (fits Agilent)

Simply place the septum directly onto the septum cup and then add the nut (an additional adapter for the septum cup is not required for Agilent GCs). The septum incorporates a unique design with two sequential seals to provide a much longer life. Order replacement septa, or alternate versions, separately. Compatile with all Agilent autosamplers and stainless steel injection ports.

Note: Do not use with beveled tips.

Left: Septum; Right: Nut

Description	Cat. No.	Qty
1 nut and 1 Low Pressure (1-45 psi) septum	22584	1 ea
1 nut and 2 Low Pressure (1-45 psi) septa	22581-U	1 ea
1 nut and 1 General Purpose (3-100 psi) septum	24815-U	1 ea
1 nut and 2 General Purpose (3-100 psi) septa	24814-U	1 ea
1 nut	22582	1 ea

Merlin Microseal™ System (fits Varian®)

Varian GCs require an inlet adapter and an o-ring in addition to the septum and nut. The septum incorporates a unique design with two sequential seals to provide a much longer life. Order replacement septa, or alternate versions, separately. Not compatible with the Varian 8200 autosampler.

Note: Do not use with beveled tips.

Description	Cat. No.	Qty
For 1079 injector; 1 nut, 1 inlet adapter, 1 o-ring, and 1 General Purpose (3-100 psi) septum	24817-U	1 ea
For CP-1177 injector; 1 nut, 1 inlet adapter, 1 o-ring, and 1 General Purpose (3-100 psi) septum	22609-U	1 kit

Merlin Microseal™ System Replacement Septum

Three septa versions are available:

- **Low Pressure** for use with 23 gauge syringe needles, and injection port pressures between 1 and 45 psi. Do not use with syringe needles that have beveled tips.
- **General Purpose** for use with 23 gauge syringe needles, and injection port pressures between 3 and 100 psi. Do not use with syringe needles that have beveled tips.
- **SPME** for use with 23 gauge SPME fiber assemblies. Do not use with SPME fiber assemblies that have beveled tips.

Note: Do not use with beveled tips.

Description	Cat. No.	Qty
1 Low Pressure (1-45 psi) septum	22583	1 ea
1 General Purpose (3-100 psi) septum	24816-U	1 ea
1 SPME septum	24818-U	1 ea

Supelco Packed GC Septum Nut

The Supelco packed GC septum nut provides consistent septum tightness, resulting in better sealing and fewer bent needles. The nut contains a needle guide, ensuring that the needle consistently penetrates the septum in the same place, prolonging septum life. The guide also prevents the needle from striking the edge of the column. Each nut is supplied with easily interchanged 1/2 in. and 1 in. aluminum needle guides. The 9/16 in. stainless steel hexagonal nut head uses septa with a 9.5 mm diameter. For use with PerkinElmer (3920, 900, Sigma series), Agilent (5700), and other injection ports that accept a 1/4 in. Swagelok nut with 7/16 in. threads at 20/in.

22399	1 ea

Needle Guide

Prolongs septum and needle life. Use with septum nuts that have a 3/16 in. diameter hole in the center. For septum nuts with smaller holes, simply drill to 3/16 in. to insert guide.

20839-U	1 ea

Injection Port Rethreading Die

This die, enclosed in a knurled brass jacket, restores worn injection port threads, ensuring a good seal with the septum nut.

For Use With	Cat. No.	Qty
1/4 in. Varian nuts (7/16 in. threads at 24 threads/in.)	20854	1 ea
1/4 in. Swagelok nuts (7/16 in. threads at 20 threads/in.)	20855	1 ea
1/8 in. Swagelok nuts (5/16 in. threads at 20 threads/in.)	20856	1 ea

Injection Port Cleaning Kit (with Large Diameter Brushes)

Includes three stainless steel brushes (5 mm, 1/4 in., and 3/8 in. diameters) and one scraper for removing septa residue.

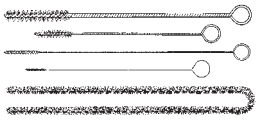
not available in EU

Z236144-1EA	1 ea

Injection Port Cleaning Kit (with Small Diameter Brushes)

Includes four nylon brushes (0.5, 1, 2, and 4 mm diameters) and 12″ of pipe cleaner.

not available in EU



Z236160-1EA	1 ea

GC Accessories

Instrument Upgrades and Maintenance: *PID Lamps and FID Cleaning*

PID Lamps and FID Cleaning

Replacing PID lamps and cleaning FID jets on a routine schedule will help keep the GC system in peak operating condition.

PID Lamp

We offer high quality PID lamps manufactured by Andrews Glass Co.

Model 108 is the most commonly used PID lamp. The 0.781 in. (1.98 cm) base diameter is compatible with OI Model 4430, Tracor, and Baseline photoionization detectors.

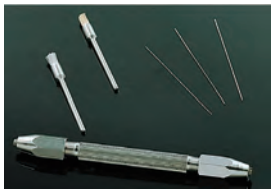
Model 103C is the original PID lamp (developed by Scientific Services Co). The 1.375 in. (3.49 cm) base diameter is compatible with HNU and SRI detectors.

22626

Description	Cat. No.	Qty
Model 108, diam. 0.781 in., potential 10.0/10.6 eV, krypton bulb gas	22626	1 ea
Model 108-BTEX, diam. 0.781 in., potential 10.0/10.6 eV, krypton bulb gas	23129-U	1 ea
Model 103C, diam. 1.375 in., potential 10.0/10.2/10.6 eV, krypton bulb gas	22631	1 ea

FID Cleaning Kit

Includes three spiral jet reamers, a brass and a stainless steel minibrush, and a dual-ended handle the reamers and brushes.
not available in EU



Z236179-1EA	1 ea

Packed GC FID Cleaning Kit

This collection of wire brushes is specially tailored to clean FIDs (and injection ports) that accept 1/4 in. columns. Brass brushes prevent scratching and marring of expensive FID components and save downtime by allowing the detector to be cleaned while hot. Each kit includes two detector brushes, one injection port tube brush, a brass toothbrush (for cleaning jets and other odd surfaces), and a piece of fine emery cloth to clean electrical contacts.

Description	Cat. No.	Qty
for use with Agilent/HP instruments	22403	1 ea
for use with Varian instruments	22404	1 ea

Split Vent Traps

Most capillary GC methods split some of the sample in the injection port away from the column.

- When operating in the split injection mode, the split is always open
- When operating in the splitless injection mode, the split valve is typically opened after 0.5 - 2 minutes to drive any residual solvent vapors away from the column to minimize the solvent tail

These vapors are released through a split vent port, commonly located on the front of the instrument. Some type of engineering control needs to be used to protected users from breathing in these potentially harmful vapors. One method is to attach flexible tubing to the split vent port, and run it to a fume hood. A less cumbersome (and more aesthetic) approach is to attach a carbon scrubber directly to the split vent port.

Supelcarb® Split-Vent Trap

This is a very simple strategy to prevent sample vapors from entering the workplace environment! Our Supelcarb Split Vent Trap traps a broad range of organic compounds, and works with typical split vent flow rates of 10-100 mL/min. The Supelcarb specialty carbon adsorbent is engineered to provide twice the trapping capacity of activated charcoal. Additionally, a narrow particle size distribution and spherical shape allows tight packing and less gas channeling than the irregular shape of activated charcoal particles. We recommend replacing the trap every two weeks. This is based on data that shows that breakthrough of the Supelcarb Split Vent Trap occurs after approximately 2 weeks at 65 mL/min, a much longer time than with other traps that use activated charcoal adsorbent.

22536

	Cat. No.	Qty
Supelcarb® Split-Vent Trap		
Starter kit (1 trap and attachment fittings)	22536	1 ea
Replacement trap	2253502 2253505	2 ea 5 ea

GC Accessories

Instrument Upgrades and Maintenance: *Manual Sampling/Switching Valves*

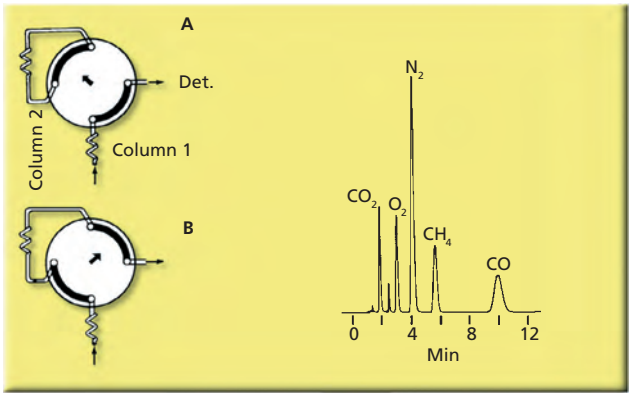
Manual Sampling/Switching Valves

Sampling valves and/or column switching valves can make a GC system much more versatile. Adding multi-port valves will enable an instrument to perform analyses that call for switching columns, reversing the elution sequence of sample components, selecting between two columns to a single detector, and the analyses of gas samples through a sample loop. These valves also eliminate pressure surges and improve sample-to-sample reproducibility of peak separations. We offer manual sampling and switching valves manufactured by Valco.

These precision valves utilize zero volume fittings that allow connections to be made directly to the valve, minimizing dead volume for on-column injections, and adapt easily to any type of tubing. Valve bodies are made of 303 grade stainless steel, and use PTFE-filled rotors. Each valve includes the complete valve, zero volume nuts, a mounting bracket, and a 3 in. handle.

4-Port Sampling and Switching Valve

Isolate a column to prevent a compound, emerging from an upstream column, from being irreversibly adsorbed. In the figure, CO_2 is separated from air in Column 1, and bypasses Column 2 when the valve is switched to position B. After the CO_2 is detected, the valve is switched back to position A and O_2, N_2, CH_4, and CO elute from Column 2 to the detector.

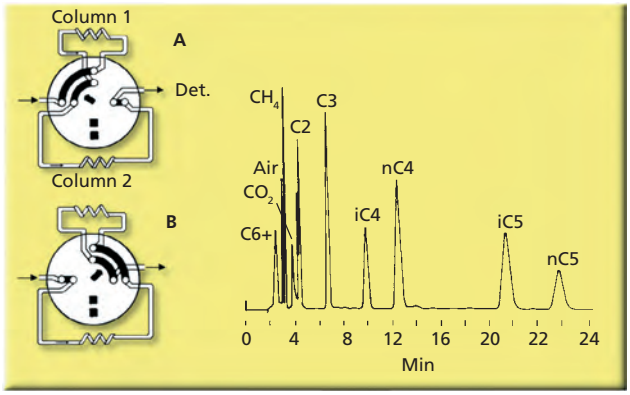


column 1: 60/80 Chromosorb 102, 6 ft × 1/8 in. SS
column 2: 60/80 Molecular Sieve 5A, 3 ft × 1/8 in. SS
oven: 50 °C, Sample: 1% mixture in H_2

Description	Cat. No.	Qty
fitting 1/8 in., maximum temperature 300 °C	22914	1 ea
fitting 1/8 in., maximum temperature 175 °C	22975	1 ea
fitting 1/16 in., maximum temperature 300 °C	22941	1 ea

6-Port Sampling and Switching Valve

Foreflushing allows you to separate low molecular weight compounds. In the example shown, C1-C5 hydrocarbons are rapidly eluted from Column 1 onto Column 2 (position A). When the valve is switched to position B, C6 and heavier compounds (which have moved slowly through Column 1) are eluted from Column 1 to the detector. C1-C5 hydrocarbons are eluted from Column 2 back onto Column 1, then to the detector.

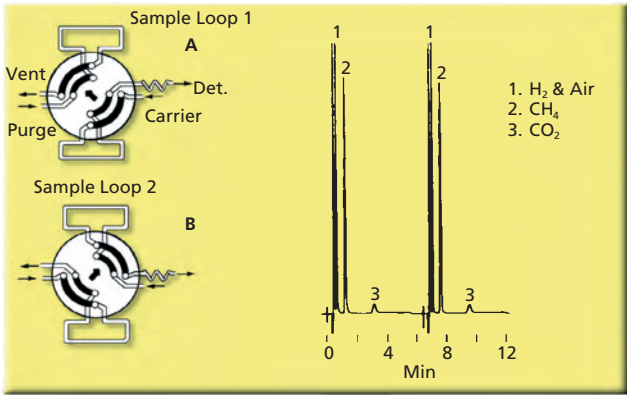


column 1: DC-200 on 60/80 Chromosorb P AW, 2.5 ft × 1/8 in. SS
column 2: DC-200 on 60/80 Chromosorb P AW, 30 ft × 1/8 in. SS
oven: 88 °C

Description	Cat. No.	Qty
fitting 1/8 in., maximum temperature 300 °C	22915	1 ea
fitting 1/8 in., maximum temperature 175 °C	22977	1 ea
fitting 1/16 in., maximum temperature 300 °C	22950	1 ea
fitting 1/16 in., maximum temperature 175 °C	22976	1 ea

8-Port Sampling and Switching Valve

Select between two columns connected to a single detector requiring auxiliary gas for the second column. The figure shows the 8-port sampling valve with two sample loops used for repetitive sample injections on one column.



column: 60/80 Chromosorb 102, 5 ft × 1/8 in. SS
oven: 40 °C, Sample: 5% mixture in H_2

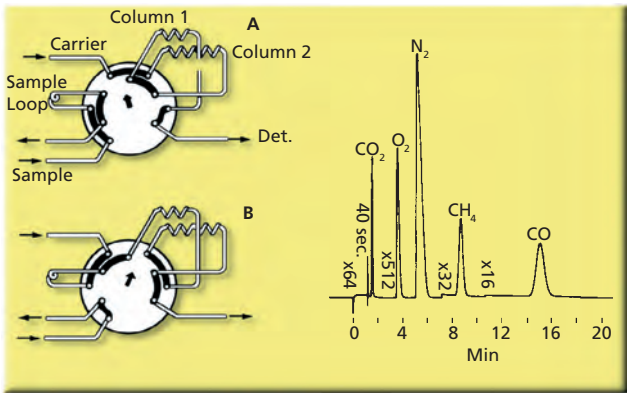
Description	Cat. No.	Qty
fitting 1/8 in., maximum temperature 300 °C	22916	1 ea

GC Accessories

Instrument Upgrades and Maintenance: *Manual Sampling/Switching Valves*

10-Port Sampling and Switching Valve

The figure illustrates the use of sequence reversal to monitor CO_2, CH_4, and CO in air. The sample is injected onto Column 1 and held 40 seconds to allow the composite peak of air, CO, and CH_4 to pass onto Column 2. The valve is switched back to position A and the column sequence is reversed to allow CO_2 to pass to the detector, followed by O_2, N_2, CH_4, and CO.



column 1: 60/80 Chromosorb 102, 5 ft × 1/8 in. SS
column 2: 60/80 Molecular Sieve 5A, 5ft × 1/8 in. SS
oven: 70 °C, Sample: 1% mixture in air

Description	Cat. No.	Qty
fitting 1/8 in., maximum temperature 175 °C	22981	1 ea

Sample Loop for Gas Sampling

This 303 stainless steel sample loop does not include zero volume nuts (must purchase separately).

Description	Cat. No.	Qty
loop volume 5.0 mL, fitting 1/8 in., number of ports: 10	22651	1 ea
loop volume 5.0 mL, fitting 1/8 in., number of ports: 6	22635	1 ea
loop volume 0.5 mL, fitting 1/8 in., number of ports: 6	22633	1 ea
loop volume 0.25 mL, fitting 1/16 in., number of ports: 6	22628	1 ea

Ink Cartridges

Older Agilent/HP instruments may still employ an integrator for performing the data processing tasks. In addition to replacing the chart paper, the ink cartridge needs replaced periodically.

Agilent/HP JetPaper Print Cartridge

Fits the Agilent/HP 3396A integrator, plus QuietJet, ThinkJet, and QuietJet Plus printers. One cartridge prints ~600,000 characters in black ink.

22775	1 ea

Recorder Pens

Chart recorders were used by chromatographers long before computers were widespread in analytical labs. We offer recorder pens for some of the most common chart recorders still being used.

Recorder Pens for Houston Instruments Recorders

For use with recorder models 5110 and 5210 (1- and 2-pen versions).

Nib L (in.)	Ink	Cat. No.	Pkg
3/8 (10 mm)	red	22938	4 ea
3/8 (10 mm)	blue	22939	4 ea

Recorder Pen for Kipp & Zonen Recorders

For use with recorder models BD7, BD8, BD9, BD10, BD11, BD12, BD14, BD14D, BD30, BD31, BD40, and BD41.

Nib L (in.)	Ink	Cat. No.	Pkg
1/4 (7 mm)	black	22752-U	6 ea

Recorder Pen for Linear Instruments Recorders

Cat. No. 22774
For models: 140, 141, 143, 232, 255, 282, 285, 285-14, 291, 294, 355, 361, 385, 395, 412, 422, 432, 455, 456, 485, 486

Cat. No. 22770-U
For models: 112, 152, 160, 161, 212, 222, 252, 252A, 254, 255-14, 260, 264

Nib L (in.)	Ink	Cat. No.	Pkg
1/4 (7 mm)	black	22774	5 ea
1/4 (7 mm)	black	22770-U	5 ea

GC Accessories

Instrument Upgrades and Maintenance: *Chart Paper*

Chart Paper

To record data on paper, a chart recorder/integrator can use either ink (cartridge or pen) or thermal means. We *still* offer replacement chart paper (rolls and pads) for many makes and models of chart recorders/integrators.

Chart Paper for Many Recorders

			Single Roll/Pad		Box		
Recorder Model	**Chart Type**	**Mfr.'s Chart No.**	**Cat. No.**	**Price**	**Cat. No.**	**Qty. per Box**	**Price**
Agilent/HP Recorders							
1080, 3380, 3388A, 5380, 5880	Z-fold blank, blue Z-fold blank, black	5080-8735 9270-0658	**22870** **22887**		**22885-U** **22888**	10 10	
85B, 3390, 3390A, 3392A	blank, blue, 107 mm × 400' roll (82931A) blank, black, 107 mm × 400' roll (82954A)	5080-8800 9270-1134	**22337**[1] **22355-U**[1]		**22346** **22356**	10 10	
3394, 3395, 3396	blank roll Z-fold JetPaper, 500 sheets	5181-1219 5062-3561	**22350-U** –	– –	**22357** **22896**	4 5	
Houston Instruments Recorders							
B-5000 Series	0–10 English	EC-100	**22934**[2]		–	–	–
Kipp & Zonen Recorders							
BD 40/41	0–100 (230 mm × 66 ft)	XR-9	–	–	**22802**	25	
BD 111/112	100-0 English (230 mm × 66 ft)	XR-18	**23609**		–	–	–
Linear Instruments Recorders							
1200, 1201, 1202, 1210, 2020, 2030	0100-0026	–	–	–	**22349**	25	
Perkin Elmer Recorders							
056	0– 100 double scale metric	056-7300	**22854**		–	–	–
Sigma Series (except Sigma 15)	Z-fold blank, blue Z-fold blank, black	332-1910/30/31 –	**22870** **22887**		**22885-U** **22888**	10 10	
LCI-100, GP100	blank	N625-1026/27	–	–	**22856**	25	
R100	0– 100 English (274 mm × 85 ft)	C005-0610	**23613**		–	–	–
EX-800, FX-85 PR-100/110/	Z-fold JetPaper, 500 sheets	0944-1006	–	–	**22896**	5	
Shimadzu Recorders							
C-R3A	black thermal (8 3/16 in. × 167 ft)	221-25412-00	–	–	**22851**	10	
C-R5A	black thermal (208 mm × 148 ft)	223-02037-81	–	–	**22838**	10	
C-R4A	black thermal (255 mm × 148 ft)	223-02000-12	**23615**		**23616**	25	
C-R1A, C-R1B	black thermal (8 3/16 in. × 170 ft)	S221-13391-01	**23617**		–	–	–
CR501	blank (208 mm × 168 ft)	223-02037-02	–	–	**23604**	10	
Spectra Physics Recorders							
4270, 4290	blank (9.3 in. × 165 ft)	A-2157-010	**22374**		**22375**	25	
4400	Z-fold JetPaper, 500 sheets	4000-010	–	–	**22896**	5	
Varian Recorders							
3000	black thermal, blank (4.33 in. × 150 ft)	03-917650-01	–	–	**22891**	12	
4270, 4290	blank (9.3 in. × 165 ft)	00-997140-01	**22374**		**22375**	25	
4400	Z-fold JetPaper, 500 sheets	00-997325-00	–	–	**22896**	5	
Waters Recorders							
–	Z-fold, blue	74701	**22870**		**22885-U**	10	
–	Z-fold blank, black	74703	**22887**		**22888**	10	
746	Z-fold JetPaper, 500 sheets	87137	–	–	**22896**	5	

[1] 2 rolls
[2] 4 rolls

Gas Purification/Management

Gas Purification/Management

It is critical that a gas delivery system provides gas at the proper purity level, and at the correct pressure, based on its intended use. Supelco offers many products that enable the GC user to purify and manage their gas streams (such as helium, hydrogen, nitrogen, argon, 5% methane in argon, and air). Some of these items are Supelco brand products, such as many of the purifiers we offer (OMI, High Capacity, and Supelcarb). Others items are sourced from well-known suppliers, such as Swagelok (tubing fittings), Airgas (gas cylinder regulators), and Parker (gas generators).

We have organized products into three groups to simplify locating the required item:

- **Purifiers**: Used to achieve the required purity level by removing specific contaminants from a gas stream based on its intended use.
- **Plumbing/Regulation**: Used to transport gases from the source (gas cylinder or gas generator) to the point of use. This group includes tubing, fittings, and valves, plus products for pressure regulation and measurement, flow regulation and measurement, and leak detection.
- **Gas Generators and Air Compressors**: When possible, generating gas on-site is often a less expensive option to gas cylinders.

Purifiers

Gas is used to perform several functions associated with the GC technique. Each function has specific contaminants that must be controlled. Listed here are several of those functions, the contaminants that must be controlled, the appropriate gas choices, and recommendations for purifier selection.

Column Carrier Gas

- **Description**: The 'mobile phase' in GC, it transports analytes through the column, between the injector and detector, when the analytes are not partitioned into the stationary phase.
- **Remove**: Hydrocarbons, moisture, and oxygen. An overall gas purity of 99.9995% is desirable to optimize chromatography and column life.
- **Gas Choices**: Helium, hydrogen, nitrogen, argon, or 5% methane in argon.
- **Purifiers (Option 1)**: [In series] Supelcarb HC hydrocarbon trap, molecular sieve 5A moisture trap, Supelpure-O oxygen trap, OMI (oxygen moisture indicating) polishing purifier.
- **Purifiers (Option 2, not for use with hydrogen)**: [In series] Supelcarb HC hydrocarbon trap, high capacity gas purifier, OMI (oxygen moisture indicating) polishing purifier.
- **Purifiers (Option 3, for helium delivery to GC-MS)**: Supelco helium purifier.

Purge Gas for Purge and Trap Operation

- **Description**: Water, and soil mixed with water, can be gas purged to drive analytes onto a trap containing adsorbent beds. This adsorbent bed trap is subsequently desorbed to transport analytes to the head of the GC column.
- **Remove**: Hydrocarbons.
- **Gas Choices**: Helium or nitrogen. Helium can be used for both the purge and desorption modes. Nitrogen can only be used for the purge mode (to reduce costs).
- **Purifier**: Supelcarb HC hydrocarbon trap.

Make-up Gas for ECD Operation

- **Description**: An ECD requires a non-inert gas for proper operation. When helium, hydrogen, or argon is used as the carrier gas, a stream of non-inert gas is plumbed into the carrier gas line between the column outlet and the detector inlet.
- **Remove**: Hydrocarbons, moisture, and oxygen. An overall gas purity of 99.9995% is desirable to optimize sensitivity and prolong detector life.
- **Gas Choices**: Nitrogen or 5% methane in argon.
- **Purifiers**: [In series] Supelcarb HC hydrocarbon trap, molecular sieve 5A moisture trap, Supelpure-O oxygen trap, OMI (oxygen moisture indicating) polishing purifier.

Fuel Gas to Support FID Combustion

- **Description**: A fuel source, along with oxygen and heat, is required to generate/maintain a flame.
- **Remove**: Hydrocarbons.
- **Gas Choices**: Hydrogen.
- **Purifier**: Supelcarb HC hydrocarbon trap.

Oxygen Source to Support FID Combustion

- **Description**: An oxygen source, along with fuel and heat, is required to generate/maintain a flame.
- **Remove**: Hydrocarbons and moisture.
- **Gas Choices**: Air.
- **Purifiers**: [In series] Supelcarb HC hydrocarbon trap, molecular sieve 5A moisture trap.

Fourier Transform Infrared Spectroscopy (FTIR) and Total Organic Carbon (TOC) Operation

- **Description**: These detection techniques operate in a nitrogen or air environment, and are sensitive to the presence of carbon dioxide.
- **Remove**: Carbon dioxide and moisture.
- **Gas Choices**: Nitrogen or air.
- **Purifiers**: [In series] Carbon dioxide trap (evolves moisture as carbon dioxide is absorbed), molecular sieve 5A moisture trap.

Pneumatic Control

- **Description**: Pressure is used to drive equipment, such as autosamplers and valves.
- **Remove**: Moisture.
- **Gas Choices**: Air.
- **Purifier**: Economy moisture trap.

Gas Purification/Management

Purifiers: *OMI® (Oxygen Moisture Indicating) Polishing Purifiers*

OMI® (Oxygen Moisture Indicating) Polishing Purifiers

The OMI is a polishing purifier that removes many contaminants that other upstream purifiers miss. It will simultaneously and irreversibly remove moisture, oxygen, carbon monoxide, carbon dioxide, most sulfur compounds, most halogen compounds, alcohols, and phenols to less than 10 ppb. It is recommended that an OMI be installed in carrier gas streams just upstream of every GC. It consists of two components:

- A re-useable **tube holder** that is installed into the gas delivery system. The use of polycarbonate provides see-through capability along with safety.
- A **purifier tube** containing an indicating resin (changes color from black to brown when exposed to as little as 1 ppm of moisture or oxygen). The use of glass provides see-through capability and prevents diffusion of room contaminants into the gas stream.

Spent purifier tubes are easily replaced. Simply unscrew the end assembly from the tube holder and replace it with a new purifier tube. The design prevents room air from entering the new tube during installation (protective foil covers on each end are only pierced as the end assembly is screwed back onto the tube holder to complete installation).

OMI® Tube Holder

Specifications:

- The OMI-2 tube holder is 10 in. (25.4 cm) long with a diameter of 1.5 in. (3.8 cm) and 1/8 in. fittings.
- The OMI-4 tube holder is 16 in. (40.6 cm) long with a diameter of 1.5 in. (3.8 cm) and 1/8 in. fittings.

OMI-2 tube holder

Description	Cat. No.	Qty
for use with OMI-2 purifier tubes	23921	1 ea
for use with OMI-4 purifier tubes	23926	1 ea

OMI® Purifier Tube

OMI-2 purifier tube

Description	Cat. No.	Qty
OMI-1 Purifier Tube	23900-U	1 ea
OMI-2 Purifier Tube	23906	1 ea
OMI-4 Purifier Tube	23909	1 ea

OMI® Seal Kit

Replace worn seals on OMI-2 and OMI-4 tube holders periodically to reduce the risk of leaks. Kits includes two PTFE seals and handy tool.

23917	1 ea

Supeltex® M-1 Ferrule

Replace ferrules on OMI-1 tube holders periodically to reduce the risk of leaks.

- **Max. Temp.**: 250 °C
- **Composition**: Ceramic-filled PTFE
- **Characteristics**: Ideal for connection to mass spectrometers. High reusability. Isothermal use only.

Cat. No.	Qty
22311	10 ea

High Capacity Gas Purifiers (Remove Moisture and Oxygen)

The best purifier choice for removing moisture and oxygen from carrier gas streams is our High Capacity Gas Purifier. It consists of three parts:

- Clam-shell oven
- Replaceable heating elements
- Replaceable converter tube

A convenient starter kit contains all three items for new installations.

High Capacity Gas Purifier, Starter Kit

No other purifier removes both moisture and oxygen in such large quantities (35 liters of moisture, 14 liters of oxygen).

Protects GC columns and detectors from damage caused by moisture and oxygen in the carrier gas stream, even when present up to 100 ppm levels. The clam-shell oven heats a converter tube to 580 °C, causing moisture and oxygen to irreversibly react with the reactant material. This chemical reaction prevents contaminants from returning to the gas stream, even when the material approaches saturation, or when the oven is cooled. Carbon monoxide and carbon dioxide are also removed.

It is recommended to install 4 ft. (1.2 m) of tubing downstream of the oven to allow heat to dissipate from the gas stream. This tubing can be coiled to reduce space.

The starter kit includes a clam-shell oven, two elements (installed), and a converter tube.

Note: Not for use with hydrogen gas.

Clam-Shell Oven

- **Length**: 14 1/2 in. (36.8 cm)
- **Height**: 5 1/4 in. (13.3 cm)
- **Depth**: 6 in. (15.2 cm)
- **Operating Temp.**: 580 °C
- **Power Consumption**: 90 watt
- **Mounting**: Horizontally only (bench or wall) using integral bracket
- **Warranty:** 1 year

Converter Tube

- **Length**: 10 in. (25.4 cm)
- **Diameter**: 1/2 in. (12.7 mm)
- **Max. Inlet Pressure**: 150 psi
- **Max. Flow Rate**: 1100 mL/min.

Gas Purification/Management

Purifiers: *High Capacity Gas Purifiers (Remove Moisture and Oxygen)*

High Capacity Gas Purifier starter kit (clam-shell oven with elements installed, and a converter tube)

Description	Cat. No.	Qty
110 V, 1/8 in.	29541-U	1 ea
110 V, 1/4 in.	29542-U	1 ea
230 V, 1/8 in.	29546-U	1 ea
230 V, 1/4 in.	29547-U	1 ea

High Capacity Gas Purifier, Replacement Converter Tube

This replacement converter tube fits 110 V or 230 V clam-shell ovens. The converter tube must be at operating temperature (580 °C) inside a clam-shell oven for proper operation. Because the material inside is not active at room temperature, converter tube ends are not capped/plugged during shipment.

- **Length**: 10 in. (25.4 cm)
- **Diameter**: 1/2 in. (12.7 mm)
- **Max. Inlet Pressure**: 150 psi
- **Max. Flow Rate**: 1100 mL/min.

Description	Cat. No.	Qty
fitting 1/8 in.	22396	1 ea
fitting 1/4 in.	22398	1 ea

High Capacity Gas Purifier, Replacement Heating Element

This replacement element can be used to replace either the top or bottom half of a clam-shell oven.

Description	Cat. No.	Qty
110 V	29553-U	1 ea
230 V	29554-U	1 ea

In-Line Purifiers (Remove a Single Contaminant)

These purifiers will remove a specific contaminant (hydrocarbons, moisture, oxygen, or carbon dioxide) from a gas stream. They are filled with a single adsorbent material, providing greater capacity for individual contaminants than many multi-bed purifiers. When spent, just that purifier needs replaced (and not an entire multi-bed purifier). They can be used in series with other purifiers, for various applications.

NEW PRODUCTS

Supelcarb® HC Hydrocarbon Trap

Supelcarb adsorbent has the greatest trapping ability of hydrocarbons per gram of adsorbent (twice that of activated charcoal). Simply stated, Supelcarb HC hydrocarbon traps are the best trap available for removing hydrocarbons and other organics from carrier, fuel, air, and other gas streams.

Dimensions:

- 120 cc Trap: 11 1/8 in. (28.2 cm) long x 1 3/8 in. (35 mm) diameter
- 750 cc Trap: 16 1/2 in. (41.9 cm) long x 2 5/16 in. (59 mm) diameter

Top 24565, Bottom 24449

Description	Cat. No.	Qty
volume 120 cc, fitting 1/8 in.	24448	1 ea
volume 120 cc, fitting 1/4 in.	24449	1 ea
volume 750 cc, fitting 1/4 in.	24564	1 ea
volume 750 cc, fitting 1/2 in.	24565	1 ea

Supelpure® HC Hydrocarbon Trap

Activated charcoal adsorbs hydrocarbons and other contaminants from carrier gases, air, and hydrogen. Operates efficiently for approximately six months when total hydrocarbons in the incoming gas average 10 ppm.

Dimensions:

- 120 cc Trap: 11 1/8 in. (28.2 cm) long x 1 3/8 in. (35 mm) diameter
- 750 cc Trap: 16 1/2 in. (41.9 cm) long x 2 5/16 in. (59 mm) diameter
- S-Trap: 7 1/2 in. (19 cm) long x 5 9/16 in. (14.1 cm) wide x 1/2 in. (13 mm) diameter [total bed length = 19 3/4 in. (50.2 cm); the extended bed length ensures prolonged contact between the gas and the adsorbent and provides greater working capacity]

Description	Cat. No.	Qty
volume 120 cc, fitting 1/8 in.	22445-U	1 ea
volume 120 cc, fitting 1/4 in.	22446	1 ea
volume 750 cc, fitting 1/4 in.	24518	1 ea
volume 750 cc, fitting 1/2 in.	24519	1 ea
S-trap, fitting 1/8 in.	503142	1 ea

Supelpure® HC Hydrocarbon Trap Refill

Activated charcoal.

volume 474 cc

22823-U	474 cc

volume 948 cc

22828-U	948 cc

Gas Purification/Management

Purifiers: *In-Line Purifiers (Remove a Single Contaminant)*

Molecular Sieve 5A Moisture Trap

Molecular Sieve 5A efficiently removes moisture and heavy hydrocarbons from compressed air, electrolytically produced hydrogen, house nitrogen, or other gases with high moisture or hydrocarbon content.

Dimensions:

- 200 cc Trap: 26 1/4 in. (67 cm) long × 1 in. (2.5 cm) diameter
- 750 cc Trap: 18 in. (45.7 cm) long × 2 3/8 in. (6 cm) diameter
- S-Trap: 7 1/2 in. (19 cm) long x 5 9/16 in. (14.1 cm) wide x 1/2 in. (13 mm) diameter [total bed length: 19 3/4 in. (50.2 cm); the extended bed length ensures prolonged contact between the gas and the adsorbent and provides greater working capacity]

Top: 23991; Middle: 20619; Bottom: 503118

Description	Cat. No.	Qty
volume 200 cc, fitting 1/8 in.	20619	1 ea
volume 200 cc, fitting 1/4 in.	20618	1 ea
volume 750 cc, fitting 1/4 in.	23991	1 ea
volume 750 cc, fitting 1/2 in.	23992	1 ea
S-trap, fitting 1/8 in.	503118	1 ea

Molecular Sieve 5A Water Vapor Trap Refill

Molecular Sieve 5A.

volume 460 cc

20298	0.22 kg

Economy Moisture Trap

The clear polycarbonate tubes contains a mixture of Molecular Sieve 13X and Molecular Sieve 4A with indicating capability. Because room air may permeate through the polycarbonate tube, this trap should not be used with carrier gas streams. It is designed for pneumatic control to drive equipment, such as autosamplers and valves.

The indicating 4A changes from blue to tan at 20% relative humidity.

Note: Not for use with carrier gas streams.

Dimensions:

- 400 cc Traps: 17 1/2 in. (44.4 cm) long x 2 in. (51 mm) diameter

Top: Economy water vapor trap (23987); Bottom: Mounting clip (23990)

Description	Cat. No.	Qty
volume 400 cc, fitting 1/8 in.	23987	1 ea
volume 400 cc, fitting 1/4 in.	23988	1 ea

Economy Water Vapor Trap Refill

Blend of Molecular Sieve 13X and Molecular Sieve 4A with indicating capability.

23989	475 cc

Supelpure®-O Oxygen/Moisture Trap

The oxygen-removing catalysts can reduce oxygen to less than 2 ppb when the level in the incoming gas does not exceed 10 ppm. Because the catalyst is coated on a Molecular Sieve, this trap also can remove water vapor.

Dimensions:

- 120 cc Trap: 11 1/8 in. (28.2 cm) long x 1 3/8 in. (35 mm) diameter
- 750 cc Trap: 16 1/2 in. (41.9 cm) long x 2 5/16 in. (59 mm) diameter
- S-Trap: 7 1/2 in. (19 cm) long x 5 9/16 in. (14.1 cm) wide x 1/2 in. (13 mm) diameter [total bed length = 19 3/4 in. (50.2 cm); the extended bed length ensures prolonged contact between the gas and the adsorbent and provides greater working capacity]

Top: 503088; Middle: 22450-U; Bottom: 503126

Description	Cat. No.	Qty
volume 120 cc, fitting 1/8 in.	22449	1 ea
volume 120 cc, fitting 1/4 in.	22450-U	1 ea
volume 750 cc, fitting 1/4 in.	503088	1 ea
volume 750 cc, fitting 1/2 in.	503096	1 ea
S-trap, fitting 1/8 in.	503126	1 ea

Oxisorb® Oxygen Scrubber

This trap will reduce oxygen and moisture to less than 1 ppm when the incoming level of oxygen is below 15 ppm and the incoming level of moisture is below 10 ppm. Use alternative traps when the levels in the incoming gas exceed these values. The kit includes a cartridge, and fittings for installation. Replacing the cartridge is simple, and can be performed quickly.

Dimensions:

- Cartridge and Fittings: 9 1/4 in. (23.5 cm) long x 2 in. (51 mm) diameter
- Cartridge Only: 4 7/8 in. (12.4 cm) long x 1 1/8 in. (29 mm) diameter

Description	Cat. No.	Qty
Kit, fitting 1/4 in.	20639-U	1 ea
Replacement cartridge	20631	1 ea

Gas Purification/Management

Purifiers: *In-Line Purifiers (Remove a Single Contaminant)*

Oxiclear™ Disposable Oxygen/Moisture Trap

Reduces oxygen to less than 1 ppm when the incoming level is below 10 ppm. Also removes some moisture, and organic contaminants.

Dimensions:

- Oxiclear: 7 ½ in. (19.0 cm) long x 1 ⅞ in. (48 mm) diameter

Description	Cat. No.	Qty
fitting ⅛ in.	22992	1 ea
fitting ¼ in.	22993	1 ea

Carbon Dioxide Trap

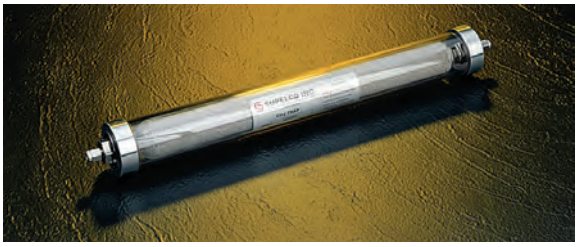
Sodium hydroxide nonfibrous silicate material is universally accepted for its high absorptive capacity and indicating properties for carbon dioxide. Typically, this material will absorb 20-30% of its weight in carbon dioxide before replacement of the saturated material is required. As carbon dioxide is absorbed, the greenish-brown material turns white because of the formation of sodium carbonate. The trap body is constructed of borosilicate glass, and the fittings are nickel-plated and have sintered stainless steel frits.

A moisture trap should be installed downstream from this unit to absorb the moisture that is produced.

Note: Exercise extreme caution when refilling the trap due to the caustic nature of the absorbent.

Dimensions:

- 100 cc Traps: 12¾ in. (32.4 cm) long x 1¾ in. (44 mm) diameter
- 250 cc Traps: 17½ in. (44.4 cm) long x 2 in. (51 mm) diameter



Description	Cat. No.	Qty
volume 100 cc, fitting ⅛ in.	503185	1 ea
volume 100 cc, fitting ¼ in.	503193	1 ea
volume 250 cc, fitting ⅛ in.	503207	1 ea
volume 250 cc, fitting ¼ in.	503215	1 ea

Carbon Dioxide Trap Refill

Sodium hydroxide nonfibrous silicate material.

503223	500 cc

Mounting Clip

This clip is designed to fit one of our in-line traps based on the volume of the trap. Simply mount two or more clips to a bench or wall using screws (not supplied), then snap the trap into the clips. One plastic clip per package.

Description	Cat. No.	Qty
for use with 100 cc traps	502936	1 ea
for use with 120 cc traps	23993	1 ea
for use with 200 cc traps	503231	1 ea
for use with 400 cc traps	23990	1 ea
for use with 750 cc traps	24983	1 ea

Specialty In-Line Purifiers for GC-MS Helium

The most sensitive GC-MS instruments require a steady stream of ultra-high purity (99.99999%) helium for optimal performance. To achieve this level, a specialty purifier is required. These purifiers contain multiple adsorbent beds for the removal of all critical contaminants. Additionally, the adsobent materials are packed into the cartridge under helium to ensure no other gas off-gases into the system during use.

Supelco® Helium Purifier

This multiple bed trap removes hydrocarbons, moisture, oxygen, carbon monoxide, and carbon dioxide from helium gas streams. The amount of highly effective, high capacity adsorbent material in each bed is optimized so that breakthrough of each contaminant is as close to simultaneous as possible. This avoids the costly replacement observed with other broad-spectrum traps that have exhausted their capacity for one contaminant, but still have capacity for other contaminants. This trap will easily purify 99.997% purity helium to a cumulative level of 100 ppb (hydrocarbons + moisture + oxygen + carbon monoxide + carbon dioxide).

Specifications:

- Output Purity: 99.99999%
- Output Efficiency (total): <100 ppb
- Output Efficiency (hydrocarbons): <20 ppb (as methane)
- Output Efficiency (moisture): <10 ppb
- Output Efficiency (oxygen): <2 ppb
- Output Efficiency (carbon monoxide): <20 ppb
- Output Efficiency (carbon dioxide): <1ppm
- Capacity (hydrocarbons): 30 g (as methane)
- Capacity (moisture): 46 g
- Capacity (oxygen): 1200mg
- Max. Flow Rate: 8 L/min.
- Max. Pressure: 500 psi
- Max. Temp.: 100 °C

Dimensions for both purifiers
/ in. (41..91 cm) long × 2 5/16 in. (6.3 cm) diameter

Description	Cat. No.	Qty
stainless steel fittings, ⅛ in. O.D. Swagelok (nuts and ferrules included)	27600-U	1 ea
stainless steel fittings, ¼ in. Swagelok (nuts and ferrules included)	27601-U	1 ea

Gas Purification/Management

Purifiers: *Base Plate Purifier Systems*

Base Plate Purifier Systems

With this design, the purifiers connect into a base plate in such a manner that gas supply is not interupted during purifier change-out. Therefore, the purifier can be replaced without shutting down the entire system. Additionally, the risk of forcing a 'slug' of air into the instrument after purifier change-out is eliminated.

Super Clean (Base-Plate Design) Kit

Super Clean™ base-plate purifiers are a unique point-of use glass/metal, diffusion proof purification system to purifiy carrier, fuel, and other gases for the GC or GC-MS system. These purifiers remove hydrocarbons, oxygen (color indicated), and moisture (color indicated) to better than 6.0 gas (99.9999%) quality at 2 L/min., independent of the original gas quality.

Description	Cat. No.	Qty
carrier gas kit (includes SU861026 + SU861011)	28878-U	1 kit
helium carrier gas kit (includes SU861027 + SU861011)	SU861040	1 kit
GC-FID fuel gas kit (includes SU861026, 2 X SU861025, and SU861013)	SU861043	1 kit

Super Clean (Base-Plate Design) Gas Purifier

Description	Cat. No.	Qty
hydrocarbon, without indicator	SU861023	1 ea
moisture, with indicator	SU861021	1 ea
oxygen, with indicator	SU861022	1 ea
triple trap (hydrocarbon, moisture, oxygen), for carrier gas	SU861026	1 ea
triple trap (hydrocarbon, moisture, oxygen), for helium carrier gas	SU861027	1 ea
dual trap (hydrocarbon, moisture), for fuel gas	SU861025	1 ea

Super Clean (Base-Plate Design) Base Plate

Base Plates
Top: Three position; Middle: Two position; Bottom: Single position

Description	Cat. No.	Qty
single position, $\frac{1}{8}$ in.	SU861011	1 ea
two position, $\frac{1}{8}$ in.	SU861012	1 ea
three position, $\frac{1}{8}$ in.	SU861013	1 ea

Super Clean (Base-Plate Design) O-ring Set

includes 10 small and 10 large

SU861050	1 ea

Super Clean (Base-Plate Design) Wall Mounting Bracket

SU861016	1 ea

Gas Purification/Management

Purifiers: *Click-On In-Line Purifer Systems*

Click-On In-Line Purifer Systems

This design purifier incorporates special connectors that prevent room air from entering the gas line during purifier change-out. Therefore, the risk of forcing a slug of air into the instrument after purifier change-out is eliminated.

Super Clean (In-Line Design) Gas Purifier

Installation and replacement of the Click-On purifier is simple and eliminates the risk of damage to the gas line connections caused by overtightening. Simply attach the connectors to the gas line, install the purifier, and hand tighten the connectors.

Note: Does not include Click-on Connectors, these must be purchased before initial use.

Dimensions:

- Cartridge and Connectors: 11 1/2 in. long x 1 1/4 in. diameter
- Cartridge Only: 7 5/8 in. long x 1 1/4 in. diameter

Top: 28863-U; Bottom: 28867-U

Description	Cat. No.	Qty
hydrocarbon trap, stainless steel	28863-U	1 ea
moisture trap, stainless steel	28861-U	1 ea
oxygen trap, stainless steel	28862-U	1 ea
triple trap (hydrocarbon, moisture, oxygen), stainless steel	28864-U	1 ea
triple trap (hydrocarbon, moisture, oxygen), gas specific for helium, stainless steel	28865-U	1 ea
triple trap (hydrocarbon, moisture, oxygen), gas specific for helium, indicating	28867-U	1 ea
dual trap (hydrocarbon, moisture), for fuel gas, stainless steel	28866-U	1 ea

Super Clean (In-Line Design) Brass Click-On Connector

Description	Cat. No.	Qty
1/8 in.	28869-U	2 ea
1/4 in.	28868-U	2 ea

Super Clean (In-Line Design) Stainless Steel Click-On Connector

Description	Cat. No.	Qty
1/8 in.	28873-U	2 ea
1/4 in.	28872-U	2 ea

Super Clean (In-Line Design) Double Version Click-On Connector

Description	Cat. No.	Qty
1/8 in.	28874-U	1 ea

Super Clean (In-Line Design) O-ring Set

includes 10 small and 10 large

28875-U	10 ea

Super Clean (In-Line Design) Wall Mounting Clamp

28876-U	4 ea

Panel Purifer Systems

Panel purifier systems offer convenience, as well as have limited space requirements. They consist of two components:

- A **panel unit** mounted to a wall near the point of use. Both 3-head and 4-head versions exist.
- Removable adsorbent **cartidges** for each head. The adsorbent material contained inside a cartridge determines what contaminant it will remove.

We no longer offer panel units. Replacement cartidges are *still* offered for those with panel units installed at their facility.

Point-of-Operation Cartridges

Cartridge Dimension: 6 1/4in. (15.9 cm) long x 1 1/4in. (32 cm) diameter

Description	Cat. No.	Qty
Hydrocarbon-Removing (GC-3)	23997	1 ea
Moisture-Removing (GC-2)	23996	1 ea
Oxygen-Removing (GC-1)	23995	1 ea
Oxygen-Removing with indicator (GC-4)	24987	1 ea

Gas Purification/Management

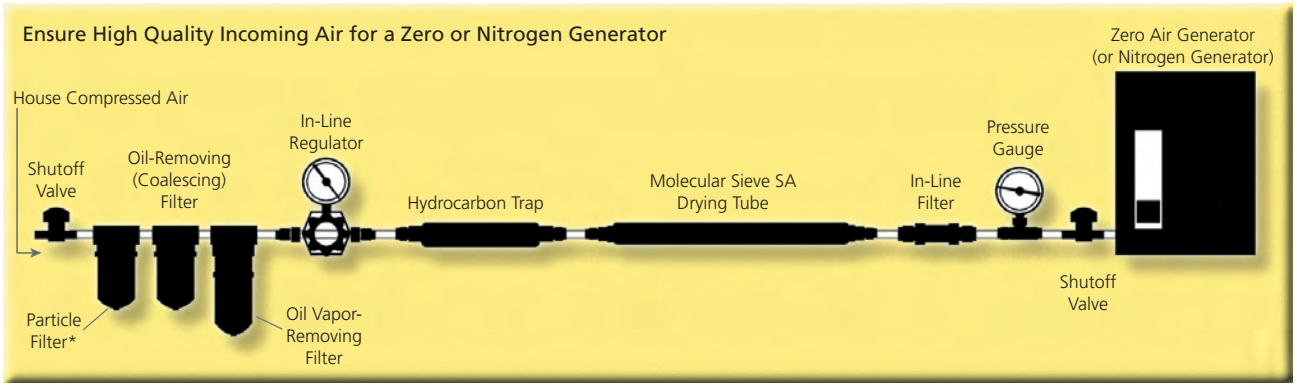
Purifiers: *Norgren® Particle and Oil Filters*

Norgren® Particle and Oil Filters

Airborne contaminants (dust, moisture, and organic pollutants) can be drawn into the air intake of an air compressor. The air compressor can add contaminants (oil vapors and aerosol droplets, plus sludge, rust, and other matter). These contaminants can significantly shorten the lifetimes of downstream zero air generators, nitrogen generators, and other downstream instruments, and can affect the performance of the instruments themselves. The particle-, oil-, and oil vapor-removing filters described here will eliminate these contaminants from compressed air.

Three types of filters are offered:

- **Norgren Particle Filters** remove liquids and solid particles as small as 5 microns in diameter. One of these filters should be the initial filtering device downstream from the air compressor (see figure).
- **Norgren Oil-Removing (Coalescing) Filters** remove submicron solid particles and oil aerosols, down to 0.01 micron. At 21 °C, from an inlet concentration of 8 ppm, a maximum of 0.01 ppm oil will leave the filter.
- **Norgren Oil Vapor-Removing Filters** remove oil vapors. At 21 °C, only 0.003 ppm oil will remain in air leaving the filter, when it is used properly (the oil vapor-removing filter must be protected by an oil-removing filter). We recommend incorporating this three filter system in any compressed line serving sensitive, high-performance gas chromatography or other laboratory instruments.



*Note: If your compressed air system has no additional protection, Norgren suggests using a 40 µm *and* a 5 µm particle filter to ensure maximum life from the filter elements in the oil filters.

Norgren® Filter

Description	Cat. No.	Qty
particle filter, 40 µm, ¼ in. female NPT	24990-U	1 ea
particle filter, 5 µm, ¼ in. female NPT	24992	1 ea
Oil-Removing Filter, ¼ in. female NPT	24994	1 ea
Oil Vapor-Removing Filter, ⅜ in. female NPT	24996	1 ea

Norgren® Replacement Element

Description	Cat. No.	Qty
for use with Particle Filter 24990-U	24991	1 ea
for use with Oil-Removing Filter 24994	24995	1 ea
for use with Oil Vapor-Removing Filter 24996	24997	1 ea

Plumbing/Regulation

As critical as it is to use the proper purifiers to remove contaminants, it is also important to use the plumbing and regulation items to insure a leak-free delivery system. Any leak, no matter how small, can compromise the quality of the gas. Additionally, the gas must be delivered to the point of use within the pressure requirements of the instrumentation. Some of the highest quality and best known companies (such as SSI, Swagelok, and Airgas) are represented by the following products.

Tubing

We offer several tubing choices. Our recommendations are:

- **Cleaned Copper** - Solvent-washed to ASTM B-280 specifications, plus in-house proprietary cleaning performed, to remove residual hydrocarbons. Use for most GC plumbing applications.
- **Premium Grade Stainless Steel** - Grade 304 tubing, specially cleaned to ensure inertness. Use for sensitive GC-MS applications.
- **Fused Silica-Lined Stainless Steel** - The strength of stainless steel with the inertness of deactivated fused silica. Use for gas transfer lines.

Cleaned Copper Tubing

Solvent-washed to ASTM B-280 specifications, plus in-house proprietary cleaning performed, to remove residual hydrocarbons. Use for most GC plumbing applications.

Length (ft)	O.D. (in.)	I.D. (in.)	Cat. No.	Pkg
50	1/8 (3.18 mm)	0.065 (1.65 mm)	20488	1 ea
50	1/4 (6.35 mm)	0.190 (4.83 mm)	20489	1 ea

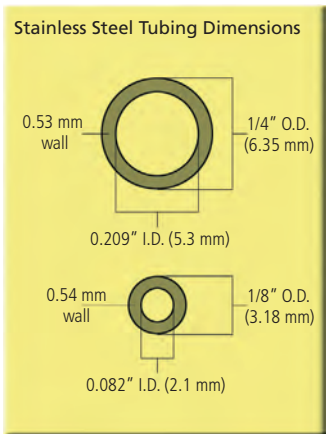
General Purpose Copper Tubing

Cleaned to ASTM B-280 specifications.

Length (ft)	O.D. (in.)	I.D. (in.)	Cat. No.	Pkg
50	1/8 (3.18 mm)	0.065 (1.65 mm)	20520-U	1 ea
50	1/4 (6.35 mm)	0.190 (4.83 mm)	20522	1 ea

Premium Grade 304 Stainless Steel Tubing

Grade 304 tubing, specially cleaned to ensure inertness. Use for sensitive GC-MS applications.



Length (ft)	Tubing I.D. (in.)	Cat. No.	Pkg
tubing O.D. 1/8 in. (3.18 mm)			
50	0.085 (2.1 mm)	20526-U	1 ea
tubing O.D. 1/4 in. (6.35 mm)			
50	0.209 (5.3 mm)	20527	1 ea
tubing O.D. 1/16 in. (1.59 mm)			
100	0.010 (0.254 mm)	20552	1 ea
100	0.030 (0.762 mm)	20553	1 ea

Fused Silica-Lined Stainless Steel Tubing

The strength of stainless steel with the inertness of deactivated fused silica. Use for gas transfer lines.

Length (ft)	Tubing I.D. (in.)	Cat. No.	Pkg
tubing O.D. 1/8 in. (3.18 mm)			
6	0.085 (2.1 mm)	24965	1 ea
25	0.85 (2.1 mm)	24966	1 ea
50	0.085 (2.1 mm)	24967	1 ea
tubing O.D. 1/16 in. (1.59 mm)			
25	0.01 (0.254 mm)	24951	1 ea
50	0.01 (0.254 mm)	24952	1 ea
100	0.01 (0.254 mm)	24953	1 ea
6	0.02 (0.508 mm)	24954	1 ea
25	0.02 (0.508 mm)	24955	1 ea
50	0.02 (0.508 mm)	24956	1 ea
100	0.02 (0.508 mm)	24957	1 ea
6	0.03 (0.762 mm)	24958	1 ea
25	0.03 (0.762 mm)	24959	1 ea
100	0.03 (0.762 mm)	24961	1 ea
6	0.04 (1.016 mm)	24962	1 ea
25	0.04 (1.016 mm)	24963	1 ea
50	0.04 (1.016 mm)	24964	1 ea

SP-Alloy Tubing

Nickel Alloy, for maximum inertness.

Length (ft)	O.D. (in.)	I.D. (in.)	Cat. No.	Pkg
50	1/8 (3.18 mm)	0.085 (2.1 mm)	22709-U	1 ea

Gas Purification/Management

Plumbing/Regulation: *Tubing*

PTFE Tubing

Maximum temperature of 240 °C.

Length (ft)	O.D. (in.)	I.D. (in.)	Cat. No.	Pkg
25	0.085 (2.1 mm)	0.062 (1.58 mm)	20531	1 ea
25	1/4 (6.35 mm)	0.228 (5.8 mm)	20533	1 ea

PTFE (FEP) Tubing

Maximum temperature of 200 °C.

Length (ft)	O.D. (in.)	I.D. (in.)	Cat. No.	Pkg
50	1/8 (3.18 mm)	0.085 (2.1 mm)	20532	1 ea

Tubing Cutters, Reamers, and Benders

Clean cuts, crisp internal openings, and smooth bends of tubing are required to ensure optimal laminar flow and to reduce the risk of leaks. These specialized tools are offered to simplify the tasks of cutting, reaming, and bending tubing.

SSI™ TC-20 Tubing Cutter

The SSI Model TC-20 electric stainless steel tube cutter assures a zero dead volume connection. Because the tubing is held securely in a clamp vise on the vertical swing arm, a square cut is produced when the swing arm is lowered against the abrasive cutting wheel, which produces a finished end. No lubricant or cutting fluid is required. The unit, which is CE marked, will cut most common tubing used in chromatography. Tubing with 1/16 in., 1/8 in., and 1/4 in. outside diameter, can be smooth-cut and dressed without distortion.

The precision ground dressing tool for the 1/16 in. O.D. tubing is included and is attached directly to the swing arm: it cannot be misplaced or lost. A dressing tool (deburring tool - Cat. No. 58804) for 1/8 in. diameter can be ordered separately.

58539-U

110 V / 220 V, 50-60 Hz (voltage selectable), CE compliant

58539-U	1 ea

TC-20 Replacement Parts

Description	Cat. No.	Qty
Cutting Wheel for TC-20	58540-U	3 ea
Deburring Tool, configured for 1/16 in. tubing	58804	1 ea
Deburring Tool, configured for 1/8 in. tubing	58806	1 ea
Needle Insert for Dressing Tool, configured for 1/16 in.	58805	1 ea
Needle Insert for Dressing Tool, configured for 1/8 in.	58807	1 ea

Cutting Wheel for TC-10

Replacement cutting wheel for SSI Model TC-10 tubing cutter. Will not fit Model TC-20.

58803	3 ea

Tubing Cutters

Top: 22410-U; Bottom: 20425-U

Description	Cat. No.	Qty
Heavy Duty Tubing Cutter	20425-U	1 ea
Cutting Wheel for 20425-U	20626	3 ea
Imp® tubing cutter	22410-U	1 ea
Cutting Wheel for 22410-U and 58692-U	22411	2 ea

The wheel that is included with catalog number 20425-U is for cutting soft metal (such as copper). To cut hard meter (such as stainless steel), replace the wheel with catalog number 20626.

Tubing Cutter for 1/16″ Stainless Steel Tubing

Easily cut 1/16 in. stainless steel tubing, then deburr the cut end ensure a uniform flow of gas or liquid. Deburring kit includes deburring tool, tubing holder, file. Order tubing cutter and deburring kit separately.
A replacement cutting blade is available as product number 22411.

58692-U

Description	Cat. No.	Qty
Manual Cutting Tool	58692-U	1 ea
Cutting Wheel for 22410-U and 58692-U	22411	2 ea
Deburring Kit	58691-U	1 ea

Gas Purification/Management

Plumbing/Regulation: *Tubing Cutters, Reamers, and Benders*

Tubing Reamer

This 5 in. hand tool does a fine job of opening and rounding tubing ends thet are cut. The tip is stainless steel for durability and inertness; and the handle is wood for comfort.

20389	1 ea

Tubing Bender

The heavy duty benders easily bend aluminum, copper, or stainless steel tubing up to 180°, without kinking or splitting the tubing.

The three-in-one tool (20857) bends $^{1}/_{8}$ in., $^{3}/_{16}$ in., or $^{1}/_{4}$ in. (3, 4, or 6 mm) tubing of standard wall thickness.

20422-U has a bend radius of $^{3}/_{8}$ inch from center.
20424-U has a bend radius of $^{9}/_{16}$ inch from center.
20857 (three-in-one tool) has a bend radius of 14.2 mm from center (pictured above).

20857 (three-in-one tool)

Description	Cat. No.	Qty
Tubing Bender, for $^{1}/_{8}$ in. O.D. tubing	20422-U	1 ea
Tubing Bender, for $^{1}/_{4}$ in. O.D. tubing	20424-U	1 ea
Tubing Bender, Three-Size for $^{1}/_{4}$in. (6 mm, $^{3}/_{16}$in. (4 mm) & $^{1}/_{8}$in. tube	20857	1 ea

Swagelok Tubing Fittings

Swagelok tubing fittings combine superior design principles with close manufacturing tolerances and rigid quality assurance programs. They have stood the test of time, providing unparalleled performance since 1947.

Swagelok® Fittings Kit

A useful assortment of $^{1}/_{8}$ in. and $^{1}/_{4}$ in. brass fittings, packaged in a compartmented clear plastic storage box. Have the required parts on hand when needed, and save money (more than 30%, compared to purchasing items individually).

The Swagelok Fittings Kit

Swagelok No.	Description	Qty.
202-1	1/8 in. nut	20
402-1	1/4 in. nut	20
203-1	1/8 in. front ferrule	20
403-1	1/4 in. front ferrule	20
204-1	1/8 in. back ferrule	20
404-1	1/4 in. back ferrule	20
200-C	1/8 in. cap	6
400-C	1/4 in. cap	6
200-P	1/8 in. plug	6
400-P	1/4 in. plug	6

The Swagelok Fittings Kit

Swagelok No.	Description	Qty.
200-6	1/8 in. union	2
400-6	1/4 in. union	2
400-60-2	1/4 in. × 1/8 in. reducing union	2
200-3	1/8 in. tee	2
400-3	1/4 in. tee	2
200-R-4	Reducer 1/8 in. Swagelok × 1/4 in. tube	2
400-R-2	Reducer 1/4 in. Swagelok × 1/8 in. tube	2
MS-IG-200	1/8 in. inspection gauge	1
MS-IG-400	1/4 in. inspection gauge	1

22668-U	1 ea

Swagelok® Nut, Front and Back Ferrule Set

Description	Swagelok No.	Cat. No.	Qty
brass			
Swagelok $^{1}/_{16}$ in.	100-S	22024	10 ea
Swagelok $^{1}/_{8}$ in.	200-S	22014	10 ea
Swagelok $^{1}/_{4}$ in.	400-S	22003	10 ea
stainless steel			
Swagelok $^{1}/_{16}$ in.	100-S	22050	1 ea
Swagelok $^{1}/_{8}$ in.	200-S	22040-U	5 ea
Swagelok $^{1}/_{4}$ in.	400-S	22029	5 ea

Gas Purification/Management

Plumbing/Regulation: *Swagelok Tubing Fittings*

Swagelok® Nut

Description	Swagelok No.	Cat. No.	Qty
brass			
Swagelok 1/16 in.	102-1	22021	10 ea
Swagelok 1/8 in.	202-1	22011-U	20 ea
Swagelok 1/4 in.	402-1	22000-U	20 ea
stainless steel			
Swagelok 1/16 in.	102-1	22047	2 ea
Swagelok 1/8 in.	202-1	22037	5 ea
Swagelok 1/4 in.	402-1	22026	5 ea

Swagelok® Front Ferrule

Description	Swagelok No.	Cat. No.	Qty
brass			
Swagelok 1/16 in.	103-1	22022-U	10 ea
Swagelok 1/8 in.	203-1	22012	20 ea
Swagelok 1/4 in.	403-1	22001	20 ea
stainless steel			
Swagelok 1/16 in.	103-1	22048-U	2 ea
Swagelok 1/8 in.	203-1	22038	5 ea
Swagelok 1/4 in.	403-1	22027	5 ea

Swagelok® Back Ferrule

Description	Swagelok No.	Cat. No.	Qty
brass			
Swagelok 1/16 in.	104-1	22023	10 ea
Swagelok 1/8 in.	204-1	22013	20 ea
Swagelok 1/4 in.	404-1	22002	20 ea
stainless steel			
Swagelok 1/16 in.	104-1	22049-U	2 ea
Swagelok 1/8 in.	204-1	22039	5 ea
Swagelok 1/4 in.	404-1	22028	5 ea
Swagelok 1/2 in.	814-1	25825	5 ea

Swagelok® Union

Nut and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
1/16 in.	100-6	22025	1 ea
1/8 in.	200-6	22015	2 ea
1/4 in.	400-6	22004	2 ea
1/2 in.	810-6	25816	2 ea
stainless steel			
1/16 in.	100-6	22051-U	1 ea
1/8 in.	200-6	22041	1 ea
1/4 in.	400-6	22030-U	1 ea
1/2 in.	810-6	25828	1 ea

Swagelok® Bulkhead Union

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
1/16 in.	100-61	21980-U	1 ea
1/8 in.	200-61	21981-U	1 ea
1/4 in.	400-61	21982-U	1 ea
stainless steel			
1/16 in.	100-61	22665-U	1 ea
1/8 in.	200-61	22666	1 ea
1/4 in.	400-61	22667-U	1 ea

Swagelok® Reducing Union

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
Swagelok 1/16 in. (B) Swagelok 1/8 in. (A)	200-6-1	22016	2 ea
Swagelok 3/16 in. (A) Swagelok 1/8 in. (B)	300-6-2	22072	2 ea
Swagelok 1/16 in. (B) Swagelok 1/4 in. (A)	400-6-1	22074	2 ea
Swagelok 1/8 in. (B) Swagelok 1/4 in. (A)	400-6-2	22005	2 ea
Swagelok 1/8 in. (B) Swagelok 1/2 in. (A)	810-6-2	22714	2 ea
Swagelok 1/2 in. (B) Swagelok 1/4 in. (A)	810-6-4	22716	2 ea
stainless steel			
Swagelok 1/16 in. (A) Swagelok 1/8 in. (B)	200-6-1	22042-U	1 ea
Swagelok 1/4 in. (A) Swagelok 1/16 in. (B)	400-6-1	22075-U	1 ea
Swagelok 1/8 in. (B) Swagelok 1/4 in. (A)	400-6-2	22031	1 ea

Gas Purification/Management

Plumbing/Regulation: *Swagelok Tubing Fittings*

Description	Swagelok No.	Cat. No.	Qty
Swagelok 1/4 in. (B) Swagelok 3/16 in. (A)	400-6-3	22077-U	1 ea

Swagelok® Bored-Through Union

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
1/4 in.	400-6BT	21664	1 ea
stainless steel			
1/8 in.	200-6BT	22088	1 ea
1/4 in.	400-6BT	21518	1 ea

Swagelok® Zero-Dead Volume Union

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
1/16 in.	l Of-6-GC	22053-U	1 ea
stainless steel			
1/16 in.	l Of-6-GC	22052	1 ea

Swagelok® Tee

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
Swagelok 1/16 in.	100-3	22132-U	1 ea
Swagelok 1/8 in.	200-3	22020-U	1 ea
Swagelok 1/4 in.	400-3	22010-U	1 ea
Swagelok 1/2 in.	810-3	25817	1 ea
stainless steel			
Swagelok 1/16 in.	100-3	22133-U	1 ea
Swagelok 1/8 in.	200-3	22046	1 ea
Swagelok 1/4 in.	400-3	22036	1 ea
Swagelok 1/2 in.	810-3	25829	1 ea

Swagelok® Branch Tee

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
NPT 1/8 in. (B) Swagelok 1/8 in. (A)	200-3TTF	22143-U	1 ea

Swagelok® Union Cross

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
Swagelok 1/8 in.	200-4	22684	1 ea
Swagelok 1/4 in.	400-4	22686	1 ea

Swagelok® Caps

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
male 1/8 in.	-	22018-U	6 ea
male 1/4 in.	400-C	22008	6 ea
stainless steel			
male 1/4 in.	400-C	22034	2 ea

Swagelok® Plug

Description	Swagelok No.	Cat. No.	Qty
brass			
Swagelok 1/16 in.	100-P	22136-U	3 ea
Swagelok 1/8 in.	200-P	22019-U	6 ea
Swagelok 1/4 in.	400-P	22009	6 ea
Swagelok 1/2 in.	810-P	25814	3 ea
stainless steel			
Swagelok 1/16 in.	100-P	22137-U	1 ea
Swagelok 1/8 in.	200-P	22045-U	1 ea
Swagelok 1/4 in.	400-P	22035-U	2 ea

Swagelok® Reducer

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
tube 1/8 in. (B) Swagelok 1/16 in. (A)	100-R-2	22017-U	2 ea
Swagelok 1/16 in. (A) tube 1/4 in. (B)	100-R-4	22701	2 ea
tube 1/4 in. (B) Swagelok 1/8 in. (A)	200-R-4	22006	2 ea

Gas Purification/Management

Plumbing/Regulation: *Swagelok Tubing Fittings*

Swagelok® Reducer *(continued)*

Description	Swagelok No.	Cat. No.	Qty
tube 1/8 in. (B) Swagelok 1/4 in. (A)	400-R-2	21516	2 ea
Swagelok 1/4 in. (A) tube 1/2 in. (B)	400-R-8	25815	2 ea
stainless steel			
Swagelok 1/16 in. (A) tube 1/8 in. (B)	100-R-2	22043	1 ea
tube 1/4 in. (B) Swagelok 1/16 in. (A)	100-R-4	22702	1 ea
Swagelok 1/8 in. (A) tube 1/4 in. (B)	200-R-4	22032	1 ea
tube 1/8 in. (B) Swagelok 1/4 in. (A)	400-R-2	21517	1 ea
tube 1/2 in. (B) Swagelok 1/4 in. (A)	400-R-8	25827	1 ea

Swagelok® Port Connector

Description	Swagelok No.	Cat. No.	Qty
brass			
Swagelok 1/8 in.	201-PC	22688	2 ea
Swagelok 1/4 in.	401-PC	22690-U	2 ea
Swagelok 1/4 in. (B) tube 1/8 in. (A)	401-PC-2	22094-U	2 ea
stainless steel			
Swagelok 1/8 in.	201-PC	22689	2 ea
tube 1/8 in. (A) Swagelok 1/4 in. (B)	401-PC-2	22095-U	2 ea

Swagelok® Pipe Adapter

Description	Swagelok No.	Cat. No.	Qty
brass			
tube 1/4 in. (A) NPT male 1/8 in. (B)	4-TA-1-2	22100-U	2 ea

Swagelok® Connector to Male NPT

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
Swagelok 1/8 in. (A) NPT male 1/8 in. (B)	200-1-2	22082	2 ea
Swagelok 1/4 in. (A) NPT male 1/8 in. (B)	400-1-2	22083	2 ea
NPT male 1/4 in. (B) Swagelok 1/8 in. (A)	200-1-4	22066	2 ea
Swagelok 1/4 in. (A) NPT male 1/4 in. (B)	400-1-4	21519	2 ea
NPT male 1/4 in. (B) Swagelok 1/2 in. (A)	810-1-4	25818	2 ea
stainless steel			
Swagelok 1/8 in. (A) NPT male 1/8 in. (B)	200-1-2	22084-U	1 ea
Swagelok 1/4 in. (A) NPT male 1/8 in. (B)	400-1-2	22085-U	1 ea
Swagelok 1/8 in. (A) NPT male 1/4 in. (B)	200-1-4	22067	1 ea
NPT male 1/4 in. (B) Swagelok 1/4 in. (A)	400-1-4	22700-U	1 ea
Swagelok 1/2 in. (A) NPT male 1/4 in. (B)	810-1-4	25830	1 ea

Swagelok® Connector to Female NPT

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
NPT female 1/8 in. (B) Swagelok 1/8 in. (A)	200-7-2	22703	2 ea
NPT female 1/8 in. (B) Swagelok 1/4 in. (A)	400-7-2	22705-U	2 ea
Swagelok 1/8 in. (A) NPT female 1/4 in. (B)	200-7-4	21978-U	2 ea

Gas Purification/Management

Plumbing/Regulation: *Swagelok Tubing Fittings*

Description	Swagelok No.	Cat. No.	Qty
NPT female 1/4 in. (B) Swagelok 1/4 in. (A)	400-7-4	22707	2 ea
Swagelok 1/2 in. (A) NPT female 1/4 in. (B)	810-7-4	25819	2 ea
stainless steel			
NPT female 1/8 in. (B) Swagelok 1/4 in. (A)	400-7-2	22706	1 ea
NPT female 1/4 in. (B) Swagelok 1/8 in. (A)	200-7-4	21979-U	1 ea
Swagelok 1/4 in. (A) NPT female 1/4 in. (B)	400-7-4	22708	1 ea

Swagelok® 90 Degree Male Elbow

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
Swagelok 1/8 in. (A) NPT male 1/8 in. (B)	200-2-2	21970-U	2 ea
NPT male 1/4 in. (B) Swagelok 1/8 in. (A)	200-2-4	21971	2 ea
NPT male 1/8 in. (B) Swagelok 1/4 in. (A)	400-2-2 Pittsburgh Valve & Fitting 400-2-2	21972	2 ea
NPT male 1/4 in. (B) Swagelok 1/4 in. (A)	400-2-4	21973	2 ea
stainless steel			
NPT male 1/8 in. (B) Swagelok 1/8 in. (A)	200-2-2 Pittsburgh Valve & Fitting 200-2-2	21974	1 ea
NPT male 1/8 in. (B) Swagelok 1/4 in. (A)	400-2-2	21976-U	1 ea
NPT male 1/4 in. (B) Swagelok 1/4 in. (A)	400-2-4	21977-U	1 ea

Swagelok® Miniature Quick Connect Body Assembly

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
fitting Swagelok 1/8 in.	QM2-B-200	22712-U	1 ea
stainless steel			
fitting Swagelok 1/8 in.	QM2-B-200	22713	1 ea

Swagelok® Miniature Quick Connect Stem Assembly

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
fitting Swagelok 1/8 in.	QM2-S-200	22710-U	1 ea
stainless steel			
fitting Swagelok 1/8 in.	QM2-S-200	22711-U	1 ea

Swagelok® PTFE Ferrules

Use PTFE ferrules instead of brass or stainless steel ferrules when attaching fittings to glass tubing, or to flexible tubing (such as PTFE or Tygon).

Description	Cat. No.	Qty
PTFE front ferrule, Swagelok for 1/4 in. tubing	22054	10 ea
PTFE back ferrule, Swagelok for 1/4 in. tubing	22055-U	10 ea
PTFE front ferrule, Swagelok for 1/8 in. tubing	22058	10 ea
PTFE back ferrule, Swagelok for 1/8 in. tubing	22059	10 ea
PTFE front ferrule, Swagelok for 1/16 in. tubing	22068	5 ea
PTFE back ferrule, Swagelok for 1/16 in. tubing	22069	5 ea

Swagelok® Tee Wrench 1/4 in.

Made specifically for 1/4in. Swagelok union tees and crosses. This wrench allows sure, easy gripping (even in cramped areas) to hold the fitting body while an open-ended wrench is applied to tighten or loosen a nut. Made from rugged alloy steel for strength. Includes a no-slip vinyl sleeve on the handle.

21983-U	1 ea

Swagelok® Gap Inspection Gauge

Use this tool to ensure the correct tightening of 1/8 in. Swagelok tubing fittings. Simply place in the gap between the fitting nut and body. The gauge will not fit if the nut is overtightened.

21984-U	1 ea

Gas Purification/Management

Plumbing/Regulation: *Gas Line Filters (remove dust and small particles)*

Gas Line Filters (remove dust and small particles)

Needle valves may become fouled by the presence of dust or particulate matter in a gas stream. To protect any component that has a needle valve incorporated, simply install a small, inexpensive gas line filter directly upstream.

Gas Line Filter

This brass gas line filter contains a replaceable 7 µm stainless steel filter, and will remove dust and small particles that could otherwise foul downstream needle valves. Nuts and ferrules included.

stainless steel (filter)

Description	Cat. No.	Qty
for use with 1/8 in. tubing	20620	1 ea
for use with 1/4 in. tubing	20621	1 ea

Replacement 7 µm Stainless Steel Filter

Use this filter to replace worn or damages filters in our gas line filter. Note that this filter will not fit into our "T"-type gas line filter.

Description	Cat. No.	Qty
for use with 1/8 in. gas line filter (Cat. No. 20620)	25810-U	1 ea
for use with 1/4 in. gas line filter (Cat. No. 20621)	25809	1 ea

"T"-Type Gas Line Filter

This gas line filter contains a replaceable 7 µm sintered stainless steel frit, and will remove dust and small particles that could otherwise foul downstream needle valves. Nuts and ferrules included.

Description	Cat. No.	Qty
brass, 1/4 in. male	25806	1 ea
stainless steel, 1/8 in. male	25807	1 ea
stainless steel, 1/4 in. male	25808	1 ea

Shutoff Valves

The flow of gas through a delivery system must occassionally be stopped for various reasons, such as during the changeout of spent purifiers, or during routine instrument maintenance. To prevent the infusion of room air into the delivery system, it is recommended to install a shuttoff valve:

- Directly downstream of gas cylinders and/or gas generators
- Direct upstream and directly downstream of purifiers
- Directly upstream of the instrumentation

Three types of shuttoff valves are offered: on/off toggle type, on/off ball type, and knob diaphragm type.

On/Off Toggle Valve

Nuts and ferrules included.

Description	Cat. No.	Qty
brass, straight arms: 1/8 in.	22699	1 ea
brass, angle arms: 1/8 in.	22123-U	1 ea
brass, straight arms: 1/4 in.	22697	1 ea
brass, angle arms: 1/4 in.	22125-U	1 ea
stainless steel, straight arms: 1/8 in.	22698	1 ea
stainless steel, angle arms: 1/8 in.	22124-U	1 ea
stainless steel, angle arms: 1/4 in.	22126-U	1 ea

On/Off Throttling Valve

Nuts and ferrules included.

Description	Cat. No.	Qty
brass, 1/8 in.	22138-U	1 ea
brass, 1/4 in.	22140-U	1 ea
stainless steel, 1/8 in.	22139-U	1 ea
stainless steel, 1/4 in.	22141-U	1 ea
stainless steel, 1/2 in.	25832	1 ea

Diaphragm Shutoff Valve

This grease-free, high integrity valve uses multiple metal diaphragms to provide a permanent seal. It will prevent diffusion of air and water vapor into the gas flow.

Specifications:

- Body: brass
- Seat: KEL-F
- Max. Pressure: 2000 psig (350 kg/cm^2)
- Leak tested to 10^{-10} cc/sec (helium)
- Min. Temp.: -40 °C
- Max. Temp.: 93 °C

Left: 23897; Right: 23896

Description	Cat. No.	Qty
1/4 in. male NPT, 1/4 in. female NPT	23896	1 ea
1/4 in. male NPT	23897	1 ea

Gas Purification/Management

Plumbing/Regulation: *Shutoff Valves*

Universal Mounting Bracket

This bracket can be easily be used to mount any valve or restrictor firmly in place. Allows convenient placement of these items out of the way.

22131-U	2 ea

Gas Cylinder Pressure Regulators

Most GC systems require that the pressure is regulated between the source (gas cylinder or gas generator) and the instrument. Select a pressure regulator based on the application:

- **2-Stage Gas Cylinder Regulators**: Reduce pressure in two steps, enabling the regulator to uniformly control the output pressure despite the decreasing input pressure from the gas cylinder. An in-line regulator is typically not required downstream. Choose a 2-stage regulator when the gas cylinder is within 10 feet of the instrument. 3000 psig maximum inlet pressure.
- **1-Stage Gas Cylinder Regulators**: Reduce pressure in a single step. Some pressure change can occur downstream as the gas cylinder pressure drops. Choose a 1-stage regulator when the gas cylinder is greater than 10 feet from the instrument. Then install an in-line regulator within 10 feet of the instrument. 3000 psig maximum inlet pressure.

We offer several versions of **gas cylinder pressure regulators** to serve a wide variety of needs.

2-stage gas cylinder pressure regulator

1-stage gas cylinder pressure regulator

High Purity

- Check valve in inlet; keeps air from entering during cylinder change-out
- Bar stock nickel-plated brass body with small internal volume; purges quickly
- Smooth internal cavity; efficient gas flow
- Stainless steel diaphragm with captive PTFE seal; appropriate for most applications
- Nickel-plated zinc bonnets
- 2 ½ in. diameter nickel-plated brass gauges; easy to read
- Needle shut-off valve at body outlet; keeps air from entering during change-out of downstream components
- ⅛ in. stainless steel male Swagelok fitting at valve outlet; ready for use with copper or stainless steel tubing

High Purity Plus

- Check valve in inlet; keeps air from entering during cylinder change-out
- Bar stock nickel-plated brass body with small internal volume; purges quickly
- Smooth internal cavity; efficient gas flow
- Stainless steel diaphragm with captive PTFE seal; appropriate for most applications
- Nickel-plated zinc bonnets
- 2 ½ in. diameter nickel-plated brass gauges; easy to read
- Diaphragm shut-off valve at body outlet; keeps air from entering during change-out of downstream components; higher leak integrity than needle valve
- ⅛ in. stainless steel male Swagelok fitting at valve outlet; ready for use with copper or stainless steel tubing

Ultra High Purity

- Check valve in inlet; keeps air from entering during cylinder change-out
- Bar stock nickel-plated brass body with small internal volume; purges quickly
- Smooth internal cavity; efficient gas flow
- Stainless steel diaphragm with metal-to-metal seal; impervious for the most sensitive applications
- Machined brass bonnets; used for panel-mount applications
- 2 ½ in. diameter nickel-plated brass gauges; easy to read
- Diaphragm shut-off valve at body outlet; keeps air from entering during change-out of downstream components; higher leak integrity than needle valve
- ⅛ in. stainless steel male Swagelok fitting at valve outlet; ready for use with copper or stainless steel tubing

NEW PRODUCTS

CGA-580 Gas Cylinder Pressure Regulator

For use with helium, nitrogen, or argon gas cylinders.

	Cat. No.	Qty
CGA-580 Gas Cylinder Pressure Regulator		
2-stage high purity, 0-100 psi	29557-U	1 ea
1-stage high purity, 0-100 psi	29556-U	1 ea
2-stage high purity plus, 0-100 psi	29574-U	1 ea
2-stage high purity plus, 0-150 psi	29575-U	1 ea
1-stage high purity plus, 0-100 psi	29573-U	1 ea
2-stage ultra high purity, 0-100 psi	29585-U	1 ea
1-stage ultra high purity, 0-100 psi	29584-U	1 ea

Gas Purification/Management

Plumbing/Regulation: *Gas Cylinder Pressure Regulators*

NEW PRODUCTS

DIN6 Gas Cylinder Pressure Regulator

For use with helium, nitrogen, or argon gas cylinders.

	Cat. No.	Qty
DIN6 Gas Cylinder Pressure Regulator		
2-stage high purity, 0-100 psi	29559-U	1 ea
1-stage high purity, 0-100 psi	29558-U	1 ea
2-stage high purity plus, 0-100 psi	29577-U	1 ea
2-stage high purity plus, 0-150 psi	29578-U	1 ea
1-stage high purity plus, 0-100 psi	29576-U	1 ea
2-stage ultra high purity, 0-100 psi	29588-U	1 ea
1-stage ultra high purity, 0-100 psi	29587-U	1 ea

NEW PRODUCTS

CGA-350 Gas Cylinder Pressure Regulator

For use with hydrogen, methane, or 5% methane in argon gas cylinders.

	Cat. No.	Qty
CGA-350 Gas Cylinder Pressure Regulator		
2-stage high purity, 0-100 psi	29561-U	1 ea
1-stage high purity, 0-100 psi	29560-U	1 ea
2-stage high purity plus, 0-100 psi	29581-U	1 ea
1-stage high purity plus, 0-100 psi	29579-U	1 ea
2-stage ultra high purity, 0-100 psi	29591-U	1 ea
1-stage ultra high purity, 0-100 psi	29589-U	1 ea

NEW PRODUCTS

DIN1 Gas Cylinder Pressure Regulator

For use with hydrogen, methane, or 5% methane in argon gas cylinders.

	Cat. No.	Qty
DIN1 Gas Cylinder Pressure Regulator		
2-stage high purity, 0-100 psi	29563-U	1 ea
1-stage high purity, 0-100 psi	29562-U	1 ea
2-stage high purity plus, 0-100 psi	29583-U	1 ea
1-stage high purity plus, 0-100 psi	29582-U	1 ea
2-stage ultra high purity, 0-100 psi	29593-U	1 ea
1-stage ultra high purity, 0-100 psi	29592-U	1 ea

NEW PRODUCTS

CGA-320 Gas Cylinder Pressure Regulator

For use with carbon dioxide gas cylinders.

	Cat. No.	Qty
CGA-320 Gas Cylinder Pressure Regulator		
2-stage high purity, 0-100 psi	29567-U	1 ea
1- stage high purity, 0-100 psi	29564-U	1 ea

NEW PRODUCTS

CGA-590 Gas Cylinder Pressure Regulator

For use with compressed air gas cylinders.

	Cat. No.	Qty
CGA-590 Gas Cylinder Pressure Regulator		
2-stage high purity, 0-100 psi	29569-U	1 ea
1-stage high purity, 0-100 psi	29568-U	1 ea

NEW PRODUCTS

DIN13 Gas Cylinder Pressure Regulator

For use with compressed air gas cylinders.

	Cat. No.	Qty
DIN13 Gas Cylinder Pressure Regulator		
2-stage high purity, 0-100 psi	29572-U	1 ea
1-stage high purity, 0-100 psi	29571-U	1 ea

In-Line Pressure Regulators and Gauges

Most GC systems require that the pressure is regulated between the source (gas cylinder or gas generator) and the instrument. Select a pressure regulator based on the application:

- **In-Line Regulators**: Reduce pressure in a single step. Choose an in-line regulator if a 1-stage gas cylinder regulator is used. Install the in-line regulator within 10 feet of the instrument. 400 psig maximum inlet pressure.

We offer several versions of **in-line pressure regulators** to serve a wide variety of needs.

General Purpose

- Bar stock nickel-plated brass body with small internal volume; purges quickly
- Smooth internal cavity; efficient gas flow
- Neoprene diaphragm; inexpensive
- 2 ½ in. diameter nickel-plated brass gauges; easy to read
- ⅛ in. brass male Swagelok fitting at valve outlet; ready for use with copper tubing

High Purity

- Bar stock nickel-plated brass body with small internal volume; purges quickly
- Smooth internal cavity; efficient gas flow
- Stainless steel diaphragm with captive PTFE seal; appropriate for most applications
- 2 ½ in. diameter nickel-plated brass gauges; easy to read
- ⅛ in. stainless steel male Swagelok fitting at valve outlet; ready for use with copper or stainless steel tubing

Ultra High Purity

- Bar stock nickel-plated brass body with small internal volume; purges quickly
- Smooth internal cavity; efficient gas flow
- Stainless steel diaphragm with metal-to-metal seal; impervious for the most sensitive applications
- 2 ½ in. diameter nickel-plated brass gauges; easy to read
- ⅛ in. stainless steel male Swagelok fitting at valve outlet; ready for use with copper or stainless steel tubing

Economy

- Aluminum body; lightweight and inexpensive
- Non-releaving diaphragm; inexpensive
- Plastic gauge; lightweight and inexpensive
- ⅛ in. brass male Swagelok fitting at valve outlet; ready for use with copper tubing

Gas Purification/Management

Plumbing/Regulation: *In-Line Pressure Regulators and Gauges*

In-Line Pressure Regulator

Install an in-line pressure regulator downstream of a gas cylinder regulator to adjust pressure closer to the point of use. 400 psig maximum input pressure. 1/8 in. Swagelok nuts and ferrules included.

Description	Cat. No.	Qty
General Purpose version (outlet pressure 0-50 psi, 1/8 in. brass fittings)	23883	1 ea
High Purity version (outlet pressure 0-100 psi, 1/8 in. stainless steel fittings)	23882	1 ea
Ultra-High Purity version (outlet pressure 0-100 psi, 1/8 in. stainless steel fittings)	23884	1 ea

In-Line Pressure Regulator (economy model)

The economy in-line pressure regulator is an inexpensive version for general lab applications. Use it with gas streams for pneumatic control, and other non-chromaotgraphic purposes. 400 psig maximum input pressure. 1/8 in. brass Swagelok nuts and ferrules included.

Description	Cat. No.	Qty
Regulator body (outlet pressure 0-60 psi), gauge, and panel mount bracket	23831-U	1 ea
Regulator body only (outlet pressure 0-60 psi)	23832-U	1 ea
Gauge only	23833-U	1 ea
Panel mount bracket with nut	23834-U	1 ea

In-Line Pressure Gauge Kit

Install a pressure gauge in the gas delivery system to measure pressure at any given point. For example, install one upstream and downstream of the High Capacity Gas Purifier. When the pressure drop across the purifier exceeds 10 psi, the converter tube should be replaced. Kit contains:

- 2 in. (5 cm) diameter steel and copper alloy gauge (0-100 psi)
- NPT to Swagelok adapter
- 1/8 in. tee
- 18 in. (1/2 m) of 1/8 in. copper line
- assembly and installation instructions

Nuts and ferrules included.

20392	1 ea

In-Line Pressure Gauge

Install a pressure gauge in the gas delivery system to measure pressure at any given point. For example, install one upstream and downstream of the High Capacity Gas Purifier. When the pressure drop across the purifier exceeds 10 psi, the converter tube should be replaced. Contains:

- 2 in. (5 cm) diameter steel and copper alloy gauge
- NPT to Swagelok adapter
- 1/8 in. tee

Nuts and ferrules included.

Description	Cat. No.	Qty
0-30 psi	20469	1 ea
0-60 psi	20470	1 ea
0-100 psi	22423	1 ea
0-30 psi, gauge only (tee not included)	20393	1 ea
0-60 psi, gauge only (tee not included)	20394	1 ea

Flow Regulation and Measurement

In addition to pressure, flow is another parameter that can be regulated and measured. Several products allow the precise control of flow to achieve the desired specifications. As important as metering is, the flow must also be accurately measured. A rotameter is commonly employed for this function. The added benefit of a rotameter is its ability to both regulate and measure flow.

Fine Metering Valve

Use for very accurate flow regulation. Install a flow measuring device downstream. Nuts and ferrules included. An optional vernier handle (Cat. No. 22122, order separately) is available for added convenience.

Description	Cat. No.	Qty
brass, straight arms: 1/8 in.	22116	1 ea
brass, angle arms: 1/8 in.	22114	1 ea
stainless steel, straight arms: 1/8 in.	22117	1 ea
stainless steel, angle arms: 1/8 in.	22115	1 ea
brass, angle arms: 1/16 in.	22118	1 ea
stainless steel, straight arms: 1/16 in.	22121	1 ea

Gas Purification/Management

Plumbing/Regulation: *Flow Regulation and Measurement*

Vernier Handle for Fine Metering Valve

This optional vernier handle attaches to the stem of a fine metering valve, and is more comfortable to turn than the stem itself. The thicker body also allows for more precise control than possible by turning the stem. Additionally, a scale on the handle can be used for visual detection of movement. Order choice of fine metering valve separately.

22122	1 ea

Supelco Rotameter

This rotameter is designed for the accurate regulation of gas flow, providing measurement at the same time. This versatile unit includes four interchangeable floats, each with a different working range. Simply install the float required for the application. Standard flow tables in mL/min at STP are included.

The rotameter is easy to mount. Alternatively, it can be installed on a tripod assembly (order tripod assembly separately). Available with or without needle valve.

Specifications:

- **Max. Pressure**: 200 psig (13.8 bar)
- **Max. Temp.**: 250 °F (121 °C)
- **Connections**: 1/8 in. female NPT (use connector to male NPT fittings to connect into gas delivery system)

Float Upper Flow Rates:

0-33 mL/min. Rotameter

- Glass Float: 6 mL/min.
- Sapphire Float: 8 mL/min.
- Stainless Steel Float: 17 mL/min.
- Carboloy Float: 33 mL/min.

0-110 mL/min. Rotameter

- Glass Float: 19 mL/min.
- Sapphire Float: 30 mL/min.
- Stainless Steel Float: 61 mL/min.
- Carboloy Float: 110 mL/min.

0-246 mL/min. Rotameter

- Glass Float: 49 mL/min.
- Sapphire Float: 73 mL/min.
- Stainless Steel Float: 137 mL/min.
- Carboloy Float: 246 mL/min.

0-454 mL/min. Rotameter

- Glass Float: 92 mL/min.
- Sapphire Float: 140 mL/min.
- Stainless Steel Float: 264 mL/min.
- Carboloy Float: 454 mL/min.

Description	Cat. No.	Qty
flow range: 0-33 mL/min, with needle valve	23324	1 ea
flow range: 0-110 mL/min, with needle valve	23325	1 ea
flow range: 0-244 mL/min, with needle valve	23320-U	1 ea
flow range: 0-454 mL/min, with needle valve	23326	1 ea
flow range: 0-33 mL/min, without needle valve	503843	1 ea
flow range: 0-110 mL/min, without needle valve	503851	1 ea
flow range: 0-454 mL/min, without needle valve	503886	1 ea

Modular Rotameter

The modular design of this rotameter allows the unit to be quickly converted to monitor different flow ranges. Each unit includes a rotameter body and two modules, each with two floats installed inside the flow tube (each float has a different working range). The floats are never touched. Instead, the module is simply interchanged.

Connections are 1/8 in. female NPT. Use connector to male NPT fittings to connect into gas delivery system. The rotameter can be installed on a tripod assembly (order tripod assembly separately).

Low Flow Kit (Cat. No. 22549)

Module 1

- Glass Float: 6-60 mL/min.
- Stainless Steel Float: 15-150 mL/min.

Module 2

- Sapphire Float: 11-110 mL/min.
- Carboloy Float: 30-300 mL/min.

High Flow Kit (Cat. No. 22550-U)

Module 1

- Glass Float: 38-380 mL/min.
- Stainless Steel Float: 84-840 mL/min.

Module 2

- Sapphire Float: 54-540 mL/min.
- Carboloy Float: 125-1250 mL/min.

Gas Purification/Management

Plumbing/Regulation: *Flow Regulation and Measurement*

Modular rotameter (both modules shown)

Description	Cat. No.	Qty
flow range: 6-300 mL/min	22549	1 ea
flow range: 38-1250 mL/min	22550-U	1 ea

Rotameter Tripod Assembly

Use a rotameter tripod assembly to mount a rotameter anywhere.

Description	Cat. No.	Qty
for use with Supelco rotameters (legs have leveling screws, unit has a built-in level)	23322	1 ea
for use with Modular rotameters	22548	1 ea

Swagelok® Connector to Male NPT

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
NPT male 1/8 in. (B) Swagelok 1/8 in. (A)	200-1-2	22082	2 ea
NPT male 1/8 in. (B) Swagelok 1/4 in. (A)	400-1-2	22083	2 ea
stainless steel			
NPT male 1/8 in. (B) Swagelok 1/8 in. (A)	200-1-2	22084-U	1 ea
NPT male 1/8 in. (B) Swagelok 1/4 in. (A)	400-1-2	22085-U	1 ea

Leak Detection

Leaks in a gas delivery system can lead to loss of gas (potentially a large cost over enough time), and/or the introduction of room air containants into the gas stream (lowering gas purity levels). A leak check of the gas delivery system should be peformed after any modification or component change-out. If these occur infrequently, then a leak check should be performed at least annually. Electronic sniffers are recommended over liquids, as these liquids may be drawn into the gas stream, potentially contaminating downstream components.

GOW-MAC® Miniature Leak Detector

This highly sensitive leak detector is excellent at finding leaks quickly, without the risk of contaminating the instrument associated with liquid leak detectors. Lightweight and compact, it includes a hand-held sniffer wand that allows the location of leaks to be pinpointed. This unit operates on the same principle as a thermal conductivity detector, it responds to any gas that has a thermal conductivity value different from that of air. It is easy to use, and can be operated with little or no training:

- Turn the unit on
- Zero out background air
- Probe for leaks

This unit can be powered through an electrical cord, or by charging an on-board battery. The power cord, battery, and charger are all included.

Note: Do not use with combustible gases.

Specifications:

- **Detector**: thermal conductivity cell with thermistors
- **Pump**: diaphragm type
- **Visual Readout**: LED bar graph
- **Zero**: automatic with drift elimination
- **Audio Signal**: audible alarm with adjustable setpoint and volume
- **Battery**: rechargeable Ni-Cd
- **Battery Life**: 8 hours, can be recharged to 95% of capacity in 1 hour
- **Dimensions**: 3 1/4 in. (8 cm) wide × 1 13/16 in. (4.5 cm) high × 5 1/4 in. (13 cm) deep

Sensitivity (minimum leak rate required to produce 10% deflection of full scale):

- **Helium**: 1.0×10^{-5} cc/sec (0.012 ft^3/yr)
- **Argon**: 1.0×10^{-4} cc/sec (0.110 ft^3/yr)
- **CO_2**: 1.0×10^{-4} cc/sec (0.123 ft^3/yr)
- **Refrigerent**: 1.0×10^{-4} cc/sec (0.123 ft^3/yr)
- **H_2:He (40:60)**: 1.0×10^{-5} cc/sec (0.012 ft^3/yr)

Description	Cat. No.	Qty
110 V (60 Hz)	22807	1 ea
230 V (50 Hz)	22808	1 ea

Gas Purification/Management

Plumbing/Regulation: *Leak Detection*

Carrying Case for GOW-MAC® Miniature Leak Detector

Convenient case for GOW-MAC miniature leak detectors (110 V or 230 V models).

22809	1 ea

SNOOP® Liquid Leak Detector

For use with volumetric (bubble) flowmeters. Also useful for checking gas delivery system plumbing for leaks. Not recommend for use upstream of capillary GC systems (an electronic leak detector is preferred).

20640-U	3.8 L
20434	8 oz

Leak Tester Kit

This kit allows septum leaks to be detected without the risk of contaminating the system. Simply dip one end of a leak tester tube into SNOOP®, then place the other end over the septum nut or needle guide. Bubbles indicate a leak. Kit includes 10 leak tester tubes and 8 ounces of SNOOP.

22660-U	1 ea

Leak-Tec® Leak Detector

PubChem 24852215

For use on heated parts, at temperatures up to 210 °C. Simply spray onto heated fittings, joints, or other parts. The material will not bubble unless there is a leak. The pressurized delivery and short straw allow the material to be sprayed onto hard to reach parts.

20566	283 g

Gas Cylinder Accessories

This group of products are designed to make working with gas cylinders a little more user friendly and/or safe.

- Mounting the regulator on the wall instead of on the cylinder will take stress off the tubing, reducing the chance of kinking it (resulting in leaks).
- A changeover panel allows for a continuous flow of gas, even during cylinder change-out.
- Flexible pigtails (part of a wall mount, a changeover panel, or as a stand-alone item) elimiate the tendence of tubing to kink near the fitting.
- When working with hydrogen, an engineering control must be installed to prevent the realease of gas if a leak develops downstream.

Cylinder valve and cap wrench

Enables easy opening of gas cylinder valves that have been fitted with a hand wheel. It is also the correct and safe tool for removing cylinder caps. product of Matheson TW-5

Z261866-1EA	1 ea

Regulator Wall Bracket

Wall-mounting a gas cylinder regulator eliminates the need to handle it during cylinder change-out, thereby reducing the chance of kinking the tubing (kinked tubing next to a fitting may result in a leak). The bracket is fabricated from grade 304 stainless steel for long life, and can be used for 2-stage or 1-stage gas cylinder regulators (order separately). An integral 30 in. flexible stainless steel pigtail allows connection to a cylinder without the risk of a leak caused from kinked tubing. The CGA connector is a hand-tight design, eliminating the need for a wrench during cylinder change-out. Choose:

- CGA 580 for helium, nitrogen, and argon
- CGA 350 for hydrogen, ethane, and 5% methane in argon
- CGA 590 for compressed air

The two station bracket has 2 pigtails that join before the regulator fitting, and allows 2 gas cylinders to feed the system, extending the time between cylinder change-out.

Description	Cat. No.	Qty
Single station, CGA 580	503665	1 ea
Single station, CGA 350	503657	1 ea
Single station, CGA 590	503673	1 ea
Two station, CGA 590	503738	1 ea

Gas Purification/Management

Plumbing/Regulation: *Gas Cylinder Accessories*

Automatic Changeover Panel

A wall-mounted automatic changeover panel allows for uninterupted gas flow. One cylinder is always feeding the system. When it becomes empty, the unit switches to the full cylinder. The empty cylinder can be replaced so it is ready when the unit switches back. When cylinders are replaced, the tubing from the cylinder to the unit can be purged, so a slug of room air does not enter the internal regulator when the unit switches back. The pressure gauges indicate which cylinder is in use and which cylinder is empty. Flexible stainless steel pigtails allow connection to cylinders without the risk of a leak caused from kinked tubing.

Note: This unit contains a 1-stage regulator, and requires that an in-line pressure regulator is installed downstream for final pressure control.

Specifications:

- Check valve in inlets; keeps air from entering during cylinder change-out
- Stainless steel diaphragm; appropriate for most applications
- Diaphragm packless purge valves; higher leak integrity than needle valve
- Shut-off valve at unit outlet; keeps air from entering during change-out of downstream components

Description	Cat. No.	Qty
CGA 350, for use with H_2, Ar/CH_4	503576	1 ea

Check valve

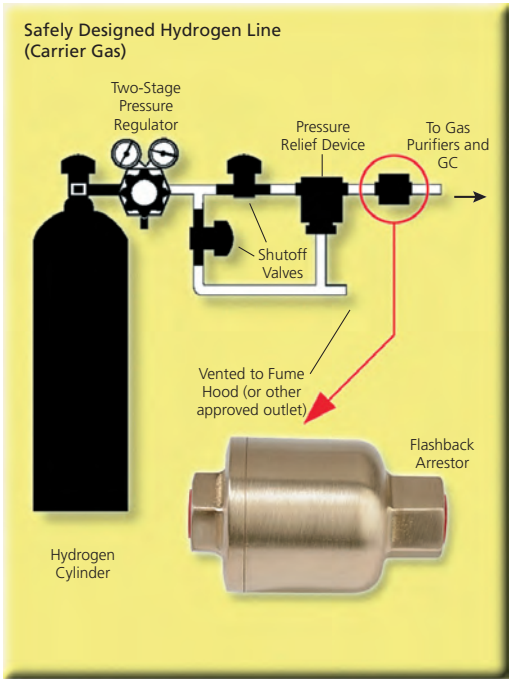
Max. pressure: 3,000 psig. ¼ × ¼ in. NPTF inlets. Attaches to the outlet side of a regulator to prevent backstreaming of liquids and gases into the regulator or cylinder.

Operating Temperature Range:
Viton: -20 °F to 400 °F
EPR: -65 °F to 300 °F
Neoprene: 80 °F to 300 °F

Description	Cat. No.	Qty
Viton® O-ring, brass valve	Z146846-1EA	1 ea
stainless steel valve, EPR O-ring	Z146854-1EA	1 ea
neoprene O-ring, stainless steel valve	Z146862-1EA	1 ea
Viton® O-ring, stainless steel valve	Z146870-1EA	1 ea

Hydrogen Flash Arrestor

Install a flash arrestor downstream of a hydrogen gas cylinder (see figure), or a hydrogen generator. In event of a flashback, the flash arrestor diverts the flame into three feet (1 m) of tubing, where the flame is extinguished and the heat is absorbed. The shock wave preceding the flashback closes and locks the arrestor's shutoff valve, eliminating the flow of gas. Inlet/outlet fittings are ¼ in. female NPT. For use to 50 psig (3.5 kg/cm^2). Meets Occupational Safety and Health Administration (OSHA) and National Fire Protection Agency (NFPA) codes. Factory Mutual approved.



23315	1 ea

Gas Purification/Management

Plumbing/Regulation: *Gas Cylinder Accessories*

Swagelok® Connector to Male NPT

Nuts and ferrules included.

Description	Swagelok No.	Cat. No.	Qty
brass			
Swagelok 1/8 in. (A) NPT male 1/4 in. (B)	200-1-4	22066	2 ea
NPT male 1/4 in. (B) Swagelok 1/4 in. (A)	400-1-4	21519	2 ea
NPT male 1/4 in. (B) Swagelok 1/2 in. (A)	810-1-4	25818	2 ea
stainless steel			
NPT male 1/4 in. (B) Swagelok 1/8 in. (A)	200-1-4	22067	1 ea
NPT male 1/4 in. (B) Swagelok 1/4 in. (A)	400-1-4	22700-U	1 ea
NPT male 1/4 in. (B) Swagelok 1/2 in. (A)	810-1-4	25830	1 ea

Flexible Stainless Steel Hose

This infinitely flexible, 30 in. (76 cm) × 1/4 in. 316 grade stainless steel hose solves many routing problems. It enables the direction of a gas line to change as needed without the risk of a leak caused from kinked tubing. Tested to 3000 psig (211 kg/cm^2) with helium. End are both 1/8 in. male Swagelok fittings. Nuts and ferrules included.

22060-U	1 ea

Gas Generators and Air Compressors

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 move bulky cylinders around the lab. Gas generators do not require switching systems or long runs of tubing to, or through, exterior walls. They just do their job - quietly, safely, and year after year. Several models of Parker gas generators, and high quality air compressors from Jun-Air, are offered.

Need a Parker generator we do not offer? We have access to the full line of Parker generators. Simply contact Technical Service at 800-359-3041 (US and Canada), 814-359-3041, or techservice@sial.com for a quotation.

Hydrogen Generators

Hydrogen has two primary uses in a GC lab; as a column carrier gas choice, and as the fuel source for FIDs. Hydrogen generators are not only more cost-effective than hydrogen cylinders, they are much safer (only a small volume of hydrogen is present at any given time, and internal controls shut the system off if a downstream leak is detected).

Parker® H2PEM Hydrogen Generator

This H2PEM hydrogen generator employs a Proton Exchange Membrane (PEM) cell to produce hydrogen on demand. An economical alternative to high pressure gas cylinders, this unit should pay for itself in a year or two.

Features/Benefits

- Eliminates need for dangerous and expensive hydrogen gas cylinders
- Compact; only requires one square foot of bench space
- Can be used anywhere that an electrical supply is available
- Just add deionized water for weeks of continuous operation
- Easy-to-read display changes color to indicate when to add water
- Only 100 mL of hydrogen is stored in the system at any time, and at low pressure
- A built-in sensing circuit shuts the generator down if a hydrogen leak is detected
- PEM technology eliminates the need for caustic liquids

Maintenance

- Add deionized water as needed
- Change the filters every six months
- Change the hydration pump every six months
- Change the desiccant cartridge when it changes color from beige to clear

Specifications

- Outlet Purity: 99.9995%
- Outlet Pressure: 10-100 psig
- Outlet Fitting: 1/8 in. compression
- Power Needs: 110-230 V (50-60 Hz)
- Shipping Weight: 40 lb (18 Kg) dry
- Dimensions (H x W x D): 17.12 in. x 13.46 in. x 17.95 in. (43.48 cm x 34.19 cm x 45.6 cm)

Marks

- CE approved
- UL listed
- CSA listed
- IEC 1010 certified
- Satisfies OSHA and NFPA requirements

Gas Purification/Management

Gas Generators and Air Compressors: *Hydrogen Generators*

Description	Cat. No.	Qty
Model H2PEM-100, 110/230 volt, output flow: 0-100 cc/min	27773-U	1 ea
Model H2PEM-165, 110/230 volt, output flow: 0-165 cc/min	27620-U	1 ea
Model H2PEM-260, 110/230 volt, output flow: 0-260 cc/min	22751	1 ea
Model H2PEM-510, 110/230 volt, output flow: 0-510 cc/min	22801	1 ea

Parker® ChromGas® Hydrogen Generator

This ChromGas hydrogen generator employs a SPE Electrolyzer cell which uses a solid polymer electrolyte to produce hydrogen on demand. An economical alternative to high pressure gas cylinders, this unit should pay for itself in a year or two.

Features/Benefits

- Eliminates need for dangerous and expensive hydrogen gas cylinders
- Compact; only requires one square foot of bench space
- Can be used anywhere that an electrical supply is available
- Just add deionized water for weeks of continuous operation
- Only 100 mL of hydrogen is stored in the system at any time, and at low pressure
- A built-in sensing circuit shuts the generator down if a hydrogen leak is detected
- If contaminated water or low level water is detected, the system activates a warning light and shuts off the generator which avoids damage to the electrolytic cell
- SPE Electrolyzer technology eliminates the need for caustic liquids

Maintenance

- Add deionized water as needed
- Change the deionizer bag every six months (or if "Change Water" indicator comes on)
- Change the desiccant cartridge when it changes color to pink

Specifications

- Water Reservoir Capacity: 4 L
- Outlet Purity: 99.99997%
- Outlet Pressure: 0-100 psig
- Outlet Fitting: 1/8 in. compression
- Power Needs: 110-230 V (50-60 Hz)
- Shipping Weight: 40 lb (18.1 Kg) dry
- Dimensions (H x W x D): 14.75 in. x 13 in. x 14 in. (37 cm x 33 cm x 36 cm)

Marks

- CE approved
- UL listed
- CSA listed
- IEC 1010 certified
- Satisfies OSHA and NFPA requirements

Description	Cat. No.	Qty
Model 9800, 110/230 volt, output flow: 0-1200 cc/min	22835	1 ea

Parker® ChromGas® Hydrogen Generator Replacement Parts

Use for routine maintenance of Parker ChromGas hydrogen generators.

- Change the deionizer bag every six months (or if "Change Water" indicator comes on)
- Change the desiccant cartridge when it changes color to pink

Description	Cat. No.	Qty
Deionizer Bags	22963	2 ea
Desiccant Cartridge	22837	1 ea

Zero Air Generators

The oxygen source for FIDs is commonly obtained by using pressurized air. In particular, zero air is recommended for FID use. This grade of air is free of methane, a compound that may cause interference with an FID (a clean flame is required for an accurate response to the analytes eluting from the column).

Parker® ChromGas® Zero Air Generator

This ChromGas zero air generator incorporates three stages:

- A 0.5 mm coalescing inlet filter removes particles, oil, and water
- A heated catalyst removes hydrocarbons
- A 0.01 mm cellulose fiber outlet filter removes residual particulate material from the product air stream

A hazard-free and economical alternative to high pressure gas cylinders, this unit should pay for itself in a year or two.

Features/Benefits

- Eliminates need for expensive gas cylinders
- Compact; requires less than one square foot of bench space
- Can be used anywhere that an electrical supply is available
- Only requires an upstream compressed air source

Maintenance

- Clean the inlet and outlet filters every six months
- Change the inlet and outlet filters every two years

Specifications

- Inlet Pressure: 2-125 psig
- Outlet Purity: <0.1 ppm hydrocarbons (as methane)
- Outlet Pressure: 125 psig
- Outlet Fitting: 1/8 in. compression
- Power Needs: 110 V (60 Hz), or 230 V (50 Hz)
- Shipping Weight (Model 1000 and 1001): 11 lb (5 Kg)
- Shipping Weight (Model 3500 and 3501): 20 lb (9.1 Kg)
- Dimensions (Model 1000 and 1001; H x W x D): 9.75 in. x 5.75 in. x 12 in. (25 cm x 14.7 cm x 30.8 cm)
- Dimensions (Model 3500 and 3501; H x W x D): 12 in. x 6.75 in. x 15 in. (29.2 cm x 17.8 cm x 39.4 cm)

Gas Purification/Management

Gas Generators and Air Compressors: *Zero Air Generators*

Parker® ChromGas® Zero Air Generator *(continued)*

Marks

- CE approved
- UL listed
- CSA listed
- IEC 1010 certified

Description	Cat. No.	Qty
Model 1000, 110 volt, output flow: 1000 cc/min	22824	1 ea
Model 1001, 230 volt, output flow: 1000 cc/min	22830-U	1 ea
Model 3500, 110 volt, output flow: 3500 cc/min	27625-U	1 ea
Model 3501, 230 volt, output flow: 3500 cc/min	27626-U	1 ea

Nitrogen Generators

When the application allows, switching to nitrogen may lead to cost savings. Example applications include purging samples, dry-purging air monitoring collection devices to remove moisture, or purging adsorbents during regeneration steps. Nitrogen is the most plentiful component of air, and its generation is not as complex as other gases.

domnick hunter® Nitrox Hydrocarbon-Free Nitrogen Generator

This Nitrox nitrogen generator employs pressure swing adsorption technology to produce a continuous supply of hydrocarbon-free nitrogen.

- Compressed air at 101 psig (7 bar) is delivered to a bed of carbon molecular sieve, which selectively removes hydrocarbons, moisture, oxygen, and carbon dioxide
- A heated catalyst then reduces the hydrocarbons in the nitrogen stream to less than 0.1 ppm (as methane)
- Two adsorbent beds alternate between purification and regeneration modes, ensuring a continuous supply of nitrogen

An economical alternative to high pressure gas cylinders, this unit should pay for itself in a year or two.

Features/Benefits

- Eliminates need for expensive gas cylinders
- Can be used anywhere that an electrical supply is available
- Integral oil-free air compressor eliminates need for an upstream air compressor
- Two adsorbent beds alternate between purification and regeneration modes, ensuring a continuous supply of nitrogen

Specifications

- Outlet Purity: <0.1 ppm hydrocarbons (as methane)
- Outlet Purity: <10 ppm oxygen
- Outlet Pressure: 73 psig (5 bar)
- Outlet Fitting: 1/4 in. NPT
- Power Needs: 110 V (60 Hz) or 230 V (50 Hz)
- Shipping Weight: 101 lb (46 Kg)
- Dimensions (H x W x D): 33 in. x 14 in. x 18 in. (84 cm x 36 cm x 46 cm)

Marks

- CE approved

Description	Cat. No.	Qty
Model 1001, 110 volt, output flow: 1000 cc/min	27765-U	1 ea
Model 1001, 230 volt, output flow: 1000 cc/min	28366-U	1 ea

Gas Purification/Management

Gas Generators and Air Compressors: *Air Compressors*

Air Compressors

Use a stand-alone air compressor to supply downstream zero air or nitrogen generators that do not have integral air compressors. These units can also be used to supply compressed air for pneumatic control applications. More than 30 years of experience and product development keep Jun-Air the leader in air compressor technology.

Jun-Air™ Model 2000-40MD Oilless Air Compressor

Features/Benefits

- Generate oilless, dry, clean air
- Quiet and vibrationless
- Highly efficient cooling enables compressors to run continuously
- Compressor is housed in a sound-reducing cabinet
- Incorporates an effluent filter/dryer to reduce moisture

Specifications

- Max. Pressure: 120 psig (8 bar)
- Flow Rate at 0 bar: 175 L/min.
- Flow Rate at 1 bar: 132 L/min.
- Flow Rate at 2 bar: 120 L/min.
- Flow Rate at 3 bar: 112 L/min.
- Flow Rate at 4 bar: 105 L/min.
- Flow Rate at 5 bar: 99 L/min.
- Flow Rate at 6 bar: 94 L/min.
- Flow Rate at 7 bar: 90 L/min.
- Flow Rate at 8 bar: 86 L/min.
- Noise: 53 dB at 120 psig (8 bar)
- Power Needs: 110 V (60 Hz) or 230 V (60 Hz)
- Shipping Weight: 254 lb (115 Kg)
- Dimensions (H x W x D): 31 in. x 25 in. x 22.5 in. (79 cm x 63 cm x 57 cm)

Marks

- CE approved
- UL listed
- CSA listed
- IEC 1010 certified

Description	Cat. No.	Qty
110 V, flow rate: 100 L/min (at 4 bar)	27675-U	1 ea
230 V, flow rate: 100 L/min (at 4 bar)	22825	1 ea

Jun-Air™ Model OF302-25MD2 Oilless Air Compressor

Features/Benefits

- Generate oilless, dry, clean air
- Quiet and vibrationless
- Highly efficient cooling enables compressors to run continuously
- Compressor is housed in a sound-reducing cabinet
- Incorporates an effluent filter/dryer to reduce moisture

Specifications

- Max. Pressure: 120 psig (8 bar)
- Flow Rate at 0 bar: 113 L/min.
- Flow Rate at 1 bar: 69 L/min.
- Flow Rate at 2 bar: 62 L/min.
- Flow Rate at 3 bar: 53 L/min.
- Flow Rate at 4 bar: 50 L/min.
- Flow Rate at 5 bar: 47 L/min.
- Flow Rate at 6 bar: 45 L/min.
- Flow Rate at 7 bar: 41 L/min.
- Flow Rate at 8 bar: 38 L/min.
- Noise: 48 dB at 120 psig (8 bar)
- Power Needs: 110 V (60 Hz)
- Shipping Weight: 183 lb (83 Kg)
- Dimensions (H x W x D): 33.9 in. x 17.4 in. x 26.1 in. (86.1 cm x 44 cm x 66.5 cm)

Marks

- CE approved
- UL listed
- CSA listed
- IEC 1010 certified

Description	Cat. No.	Qty
110 V, flow rate: 50 L/min (at 4 bar)	503762	1 ea

Intake Filter for Jun-Air™ Compressor

Two filters are required to perform complete maintenance on a single compressor.

Description	Cat. No.	Qty
for use with OF302-25MD2	503797	1 ea

Gas Purification/Management

Gas Generators and Air Compressors: *Air Compressors*

Jun-Air™ Model OF301-4B Oilless Air Compressor

Features/Benefits

- Generate oilless, dry, clean air
- Quiet and vibrationless
- Highly efficient cooling enables compressors to run continuously

Specifications

- Max. Pressure: 120 psig (8 bar)
- Flow Rate at 0 bar: 68 L/min.
- Flow Rate at 1 bar: 43 L/min.
- Flow Rate at 2 bar: 36 L/min.
- Flow Rate at 3 bar: 34 L/min.
- Flow Rate at 4 bar: 32 L/min.
- Flow Rate at 5 bar: 30 L/min.
- Flow Rate at 6 bar: 28 L/min.
- Flow Rate at 7 bar: 27 L/min.
- Flow Rate at 8 bar: 25 L/min.
- Noise: 61 dB at 120 psig (8 bar)
- Power Needs: 110 V (60 Hz) or 230 V (60 Hz)
- Shipping Weight: 42 lb (19 Kg)
- Dimensions (H x W x D): 13.1 in. x 11.8 in. x 15 in. (33.4 cm x 30 cm x 38.2 cm)

Marks

- UL listed
- CSA listed
- IEC 1010 certified

Description	Cat. No.	Qty
110 V, flow rate: 32 L/min (at 4 bar)	503746	1 ea
230 V, flow rate: 32 L/min (at 4 bar)	503754	1 ea

GC Solvents

These solvents have been developed for residue analysis in application fields such as environmental analysis, and food & beverage control. All solvents are manufactured and bottled under oxygen-free conditions and sealed with a PTFE-lined cap to prevent product contamination and degradation.

Fluka's GC solvents are free of impurities which would show greater signals than 5 ng/l lindane, in the GC/ECD retention time range of lindane to DDT.

Fluka's GC solvents for trace analysis are controlled for high volatile halogenated hydrocarbons: with GC/ECD in the corresponding retention volume ranges (methylene chloride-pentachloroethane) no impurities are present with a signal greater than 10 µg/l in each range.

Fluka's GC solvents, Purge & Trap Grade are suitable for GC/MS analysis of volatile organics in water and oil sediment samples according to the EPA purge & trap methods 601, 624 and 8240.

General Solvents

CAS No.	Compound	Cat. No.	Qty
67-64-1	Acetone, capillary GC grade, ≥99.9%	414689-4X4L	4 × 4 L
67-64-1	Acetone, for pesticide residue analysis	34480-1L	1 L
		34480-2.5L	2.5 L
		34480-4X2.5L	4 × 2.5 L
		34480-72X2.5L	72 × 2.5 L
		34480-7L	7 L
		34480-45L	45 L
75-05-8	Acetonitrile, for pesticide residue analysis	34481-50ML	50 mL
		34481-1L	1 L
		34481-6X1L	6 × 1 L
		34481-2.5L	2.5 L
		34481-4X2.5L	4 × 2.5 L
		34481-7L	7 L
1634-04-4	*tert*-Butyl methyl ether, for residue analysis, ≥99.0%	20257-1L-F	1 L
67-66-3	Chloroform, contains ~1% ethanol as stabilizer, for residue analysis, ≥99.8%	25669-1L	1 L
		25669-2.5L	2.5 L
60-29-7	Diethyl ether, for residue analysis	31671-1L	1 L
		31671-2.5L	2.5 L
64-17-5	Ethanol, for residue analysis	02851-1L	1 L
		02851-2.5L	2.5 L
141-78-6	Ethyl acetate, for pesticide residue analysis	31063-1L	1 L
		31063-2.5L	2.5 L
		31063-4X2.5L	4 × 2.5 L
		31063-72X2.5L	72 × 2.5 L
		31063-7L	7 L
		31063-45L	45 L
142-82-5	Heptane, for pesticide residue analysis	34495-1L	1 L
		34495-2.5L	2.5 L
		34495-4X2.5L	4 × 2.5 L
		34495-7L	7 L
110-54-3	Hexane, for residue analysis, ≥99.0%	52767-1L	1 L
		52767-2.5L	2.5 L
110-54-3	Hexane, for pesticide residue analysis	34484-1L	1 L
		34484-2.5L	2.5 L
		34484-4X2.5L	4 × 2.5 L
		34484-7L	7 L
		34484-18L	18 L
		34484-45L	45 L
-	Hexane, mixture of isomers, for pesticide residue analysis	34493-2.5L	2.5 L
		34493-4X4L	4 × 4 L
67-56-1	Methanol, for pesticide residue analysis	34485-1L	1 L
		34485-2.5L	2.5 L
		34485-4X2.5L	4 × 2.5 L
		34485-72X2.5L	72 × 2.5 L
		34485-7L	7 L
67-56-1	Methanol, capillary GC grade, ≥99.9%	414719-4X4L	4 × 4 L
67-56-1	Methanol, for GC/MS analysis of volatile organics, ≥99.9%	414816-1L	1 L
109-66-0	Pentane, for residue analysis, ≥99.0%	76869-1L	1 L
		76869-2.5L	2.5 L
109-66-0	Pentane, for residue analysis (of high-volatile halogenated hydrocarbons), ≥99.0%	76866-1L	1 L
		76866-2.5L	2.5 L

GC Solvents

General Solvents

CAS No.	Compound	Cat. No.	Qty
109-66-0	Pentane, for pesticide residue analysis	34497-1L	1 L
		34497-2.5L	2.5 L
101316-46-5	Petroleum ether, for pesticide residue analysis, low boiling point hydrogen treated naphtha, 40-60 °C	34491-1L	1 L
		34491-6X1L	6 × 1 L
		34491-2.5L	2.5 L
		34491-4X2.5L	4 × 2.5 L
		34491-7L	7 L
		34491-45L	45 L
67-63-0	2-Propanol, for pesticide residue analysis	34486-2.5L	2.5 L
		34486-4X2.5L	4 × 2.5 L
108-88-3	Toluene, for pesticide residue analysis acc. to FDA	34494-1L	1 L
		34494-2.5L	2.5 L
		34494-4X2.5L	4 × 2.5 L
		34494-7L	7 L
		34494-45L	45 L
540-84-1	2,2,4-Trimethylpentane, for pesticide residue analysis	34499-1L	1 L
		34499-6X1L	6 × 1 L
		34499-2.5L	2.5 L

High Purity GC Solvents for Pesticide Residue Analysis

These solvents are suitable for application in residue analysis of pesticides and other low-volatile, environmentally relevant substances by means of GC/ECD or GC/PND. As polychlorinated biphenyles (PCBs) are also detected in the GC/ECD test, theses solvents are suitable for analysis of this class of substances as well. Besides a general high grade of purity, the specifications are tailor-made to the special requirements in residue analysis of pesticides, metabolites, preservatives and other low-volatile, environmentally relevant substances.

CAS No.	Compound	Cat. No.	Qty
67-64-1	Acetone, for analysis of dioxins, furans and PCB, ≥99.8%	31062-2.5L	2.5 L
		31062-7L	7 L
67-64-1	Acetone, for pesticide residue analysis	34480-1L	1 L
		34480-2.5L	2.5 L
		34480-4X2.5L	4 × 2.5 L
		34480-72X2.5L	72 × 2.5 L
		34480-7L	7 L
		34480-45L	45 L
75-05-8	Acetonitrile, for pesticide residue analysis	34481-50ML	50 mL
		34481-1L	1 L
		34481-6X1L	6 × 1 L
		34481-2.5L	2.5 L
		34481-4X2.5L	4 × 2.5 L
		34481-7L	7 L
1634-04-4	*tert*-Butyl methyl ether, for pesticide residue analysis	34498-1L	1 L
		34498-2.5L	2.5 L
		34498-4X2.5L	4 × 2.5 L
67-66-3	Chloroform, contains ~1% ethanol as stabilizer, for residue analysis, ≥99.8%	25669-1L	1 L
		25669-2.5L	2.5 L
110-82-7	Cyclohexane, for pesticide residue analysis	34496-1L	1 L
		34496-2.5L	2.5 L
		34496-4X2.5L	4 × 2.5 L
		34496-72X2.5L	72 × 2.5 L
		34496-7L	7 L
		34496-18L	18 L
75-09-2	Dichloromethane, for pesticide residue analysis	34488-1L	1 L
		34488-2.5L	2.5 L
		34488-4X2.5L	4 × 2.5 L
		34488-7L	7 L
		34488-45L	45 L
60-29-7	Diethyl ether, for residue analysis	31671-1L	1 L
		31671-2.5L	2.5 L
68-12-2	*N,N*-Dimethylformamide, for pesticide residue analysis	34489-2.5L	2.5 L
141-78-6	Ethyl acetate, for pesticide residue analysis	31063-1L	1 L
		31063-2.5L	2.5 L
		31063-4X2.5L	4 × 2.5 L
		31063-72X2.5L	72 × 2.5 L
		31063-7L	7 L
		31063-45L	45 L
142-82-5	Heptane, for pesticide residue analysis	34495-1L	1 L
		34495-2.5L	2.5 L
		34495-4X2.5L	4 × 2.5 L
		34495-7L	7 L

GC Solvents

High Purity GC Solvents for Pesticide Residue Analysis

CAS No.	Compound	Cat. No.	Qty
110-54-3	Hexane, for pesticide residue analysis	34484-1L	1 L
		34484-2.5L	2.5 L
		34484-4X2.5L	4 × 2.5 L
		34484-7L	7 L
		34484-18L	18 L
		34484-45L	45 L
-	Hexane, mixture of isomers, for pesticide residue analysis	34493-2.5L	2.5 L
		34493-4X4L	4 × 4 L
67-56-1	Methanol, for pesticide residue analysis	34485-1L	1 L
		34485-2.5L	2.5 L
		34485-4X2.5L	4 × 2.5 L
		34485-72X2.5L	72 × 2.5 L
		34485-7L	7 L
109-66-0	Pentane, for pesticide residue analysis	34497-1L	1 L
		34497-2.5L	2.5 L
101316-46-5	Petroleum ether, for pesticide residue analysis, low boiling point hydrogen treated naphtha, 40-60 °C	34491-1L	1 L
		34491-6X1L	6 × 1 L
		34491-2.5L	2.5 L
		34491-4X2.5L	4 × 2.5 L
		34491-7L	7 L
		34491-45L	45 L
67-63-0	2-Propanol, for pesticide residue analysis	34486-2.5L	2.5 L
		34486-4X2.5L	4 × 2.5 L
108-88-3	Toluene, for pesticide residue analysis acc. to FDA	34494-1L	1 L
		34494-2.5L	2.5 L
		34494-4X2.5L	4 × 2.5 L
		34494-7L	7 L
		34494-45L	45 L
540-84-1	2,2,4-Trimethylpentane, for pesticide residue analysis	34499-1L	1 L
		34499-6X1L	6 × 1 L
		34499-2.5L	2.5 L
7732-18-5	Water, for pesticide residue analysis	34478-1L	1 L

GC Solvents for Residue Analysis of Dioxins, Furans, and PCBs

These solvents are GC-MS tested and contain less than 5 pg/l (5 ppg) of the 17 relevant dibenzodioxins and dibenzofuranes.

CAS No.	Compound	Cat. No.	Qty
75-09-2	Dichloromethane, for analysis of dioxins, furans and PCB	34411-2.5L	2.5 L
		34411-7L	7 L
110-54-3	Hexane, for analysis of dioxins, furans and PCB, ≥95%	34412-2.5L	2.5 L
		34412-7L	7 L
108-88-3	Toluene, for analysis of dioxins, furans and PCB, ≥99.7%	34413-2.5L	2.5 L
		34413-7L	7 L

GC Solvents

GC Headspace Solvents

GC Headspace Solvents

Analysis of residual solvents using GC-Headspace technique is a major control procedure in pharmaceutical and food related industries. These solvents are specifically developed and optimized for sensitive GC-Headspace analysis of Organic Volatile Impurities. The purity of these solvents and handling specifications meet the requirements of the latest Ph.Eur., USP and ICH guidelines.

CAS No.	Compound	Cat. No.	Qty
100-51-6	Benzyl alcohol, GC-Headspace tested, ≥99.9% (GC)	80708-1L	1 L
108-94-1	Cyclohexanone, GC-Headspace tested, ≥99.9%	68809-1L	1 L
127-19-5	*N,N*-Dimethylacetamide, GC-Headspace tested, ≥99.9%	44901-1L	1 L
68-12-2	*N,N*-Dimethylformamide, GC-Headspace tested, ≥99.9%	51781-1L	1 L
80-73-9	1,3-Dimethyl-2-imidazolidinone, GC-Headspace tested, ≥99.5%	67484-100ML 67484-1L	100 mL 1 L
67-68-5	Dimethyl sulfoxide, GC-Headspace tested, ≥99.9%	51779-1L 51779-2.5L	1 L 2.5 L
872-50-4	1-Methyl-2-pyrrolidinone, GC-Headspace tested, ≥99.9%	69337-1L	1 L
7732-18-5	Water, GC-Headspace tested	53463-1L	1 L

GC Purge & Trap Solvents

Suitable for GC/MS analysis of volatile organics in water and oil sediment samples according to the EPA purge & trap methods 601, 624 and 8240.

CAS No.	Compound	Cat. No.	Qty
1634-04-4	*tert*-Butyl methyl ether, for residue analysis, ≥99.0%	20257-1L-F	1 L
110-54-3	Hexane, for residue analysis, ≥99.0%	52767-1L 52767-2.5L	1 L 2.5 L
67-56-1	Methanol, for GC/MS analysis of volatile organics, ≥99.9%	414816-1L	1 L
109-66-0	Pentane, for residue analysis, ≥99.0%	76869-1L 76869-2.5L	1 L 2.5 L

GC-MS Solvents

CAS No.	Compound	Cat. No.	Qty
75-05-8	Acetonitrile, *Trace*SELECT®, for trace analysis, ≥99.9%	01324-1L	1 L
67-56-1	Methanol, *Trace*SELECT®, for metal speciation analysis, ≥99.9%	42105-1L	1 L
872-50-4	1-Methyl-2-pyrrolidinone, *Trace*SELECT®, ≥99.0% (GC), for inorganic trace analysis	43729-1L	1 L
7732-18-5	Water, *Trace*SELECT® Ultra, ACS reagent, for ultratrace analysis	14211-1L-F	1 L

GC Derivatization Reagents

There are several reasons that derivatization may be performed prior to GC analysis; 1) to increase analyte volatility, 2) to increase response, and 3) to suppress the activity of an active functional group. Regardless of the reason, it is important that the proper derivatization-grade reagent is used. Sigma-Aldrich/Supelco offers reagents for the derivatization of a wide-range of functional groups and analyte classes.

Silylation Reagents

Silyl refers to Trimethylsilyl $Si(CH_3)_3$, or TMS. Silylation is the introduction of a silyl group into a molecule, usually in substitution for active hydrogen. Replacement of active hydrogen by a silyl group reduces polarity of the compound and decreases hydrogen bonding. The silylated derivative is thus more volatile. Also, stability is enhanced because the number of reactive sites containing active hydrogen has been reduced. Silylated compounds are less polar, detection is enhanced, and the derivatives are thermally more stable.

The greatest use of silylation has been in GC. Many hydroxy and amino compounds regarded as nonvolatile or unstable at 200-300 °C have been successfully chromatographed after silylation.

Silyl reagents are influenced by both the solvent system and the addition of a catalyst. The use of a catalyst (e.g. trimethylchlorosilane, pyridine) increases the reactivity of the silyl reagent. It is important to determine the reaction times and reaction temperatures when developing derivatization procedures. The conversion rate for the derivative must be known in order to achieve quantitative analysis of the unknown sample. The reagents generally are moisture sensitive and are sealed to prevent deactivation from moisture during storage. These silyl reagents are suitable for general use but, if used in excess, can cause difficulties with flame ionization detectors.

The trimethylsilyl group is the most popular and versatile silyl group for GC analysis. Introduction of this group enables better GC separation and the application of special detection techniques.

Related Information

Bulletin 909 contains detailed information on selecting a suitable derivatization reagent for most applications. Request a free copy of Bulletin 909 by phone, fax, or visit **sigma-aldrich.com/literature**.

No.	Title
T196909	*Derivatization Reagents*

Acronyms for Silylation Reagents

Acronym	Chemical Name	CAS No.
BSA	N,O-Bis(trimethylsilyl) acetamide	10416-59-8
BSTFA	Bis(trimethylsilyl) trifluoroacetamide	25561-30-2
DMDCS	Dimethyldichlorosilane	75-78-5
HMDS	1,1,1,3,3,3-Hexamethyldisilazane	999-97-3
MTBSTFA	N-(*tert*-Butyldimethylsilyl)-N-methyltrifluoroacetamide	77377-52-7
TBDMCS	*t*-Butyldimethylchlorosilane	18162-48-6
TFA	Trifluoroacetic acid	76-05-1
TMCS	Trimethylchlorosilane	75-77-4
TMSDEA	Trimethylsilyldiethylamine (N,N-Diethyl-1,1,1-trimethylsilylamine)	996-50-9
TMSI	Trimethylsilylimidazole	18156-74-6

GC Derivatization Reagents

Silylation Reagents

CAS No.	Compound	Cat. No.	Qty
3768-58-9	Bis(dimethylamino)dimethylsilane, for GC derivatization	14755-100ML	100 mL
10416-59-9	*N,O*-Bis(trimethylsilyl)acetamide, for GC derivatization	15269-10X1ML 15269-5ML 15269-25ML	10 × 1 mL 5 mL 25 mL
35342-88-2	*N,O*-Bis(trimethylsilyl)carbamate, ≥98.0% (T)	15236-10G	10 g
920-68-3	*N,N*-Bis(trimethylsilyl)methylamine, for GC derivatization	15235-50ML	50 mL
25561-30-2	*N,O*-Bis(trimethylsilyl)trifluoroacetamide, for GC derivatization, ≥99.0%	15222-144X0.1ML-F 15222-1ML-F 15222-10X1ML-F 15222-5ML-F 15222-25ML-F	144 × 0.1 mL 1 mL 10 × 1 mL 5 mL 25 mL
25561-30-2	*N,O*-Bis(trimethylsilyl)trifluoroacetamide, ≥99%	155195-5G 155195-25G 155195-100G	5 g 25 g 100 g
25561-30-2	*N,O*-Bis(trimethylsilyl)trifluoroacetamide with trimethylchlorosilane, contains 1% TMCS, 99% (excluding TMCS)	15238-10X0.1ML 15238-10X1ML 15238-5ML 15238-25ML 15238-100ML	10 × 0.1 mL 10 × 1 mL 5 mL 25 mL 100 mL
25561-30-2	*N,O*-Bis(trimethylsilyl)trifluoroacetamide with trimethylchlorosilane, contains 10% TMCS, 98% (excluding TMCS)	15209-10X1ML 15209-5ML 15209-25ML	10 × 1 mL 5 mL 25 mL
18297-63-7	*N,N'*-Bis(trimethylsilyl)urea, purum, ≥98.0% (N)	15248-250G	250 g
2857-97-8	Bromotrimethylsilane, 97%	194409-5G 194409-25G 194409-100G	5 g 25 g 100 g
-	BSA+TMCS, for GC, with 5% trimethylchlorosilane	15256-10ML 15256-50ML	10 mL 50 mL
-	BSA+TMCS, 5:1	33018 33019-U	20 × 1 mL 25 mL
-	BSA+TMCS+TMSI, 3:2:3	33151 33030 33031-U	144 × 0.1 mL 20 × 1 mL 25 mL
25561-30-2	BSTFA, Derivatization Grade, for GC derivatization	33084	144 × 0.1 mL
25561-30-2	BSTFA, Derivatization Grade, for GC derivatization	33024	20 × 1 mL
25561-30-2	BSTFA, Derivatization Grade, for GC derivatization	33027	25 mL
-	BSTFA + TMCS, 99:1	33154-U 33148 33155-U 33149-U	144 × 0.1 mL 20 × 1 mL 25 mL 50 mL
-	BSTFA + TMCS, 99:1	33148	20 × 1 mL
54925-64-3	*tert*-Butyldimethylsilylimidazole solution, TBDMSIM in DMF	33092-U	10 × 1 mL
850418-20-1	*tert*-Butyldimethylsilyl methallylsulfinate, for GC derivatization	79262-5ML	5 mL
77377-52-7	*N-tert*-Butyldimethylsilyl-*N*-methyltrifluoroacetamide, >97%	394882-10X1ML 394882-5ML 394882-25ML 394882-100ML	10 × 1 mL 5 mL 25 mL 100 mL
77377-52-7	*N-tert*-Butyldimethylsilyl-*N*-methyltrifluoroacetamide with 1% *tert*-Butyldimethylchlorosilane, ≥95%	375934-10X1ML 375934-5ML 375934-10ML 375934-25ML	10 × 1 mL 5 mL 10 mL 25 mL
20082-71-7	Chlorodimethyl(pentafluorophenyl)silane, for GC derivatization, ≥95.0%	76750-5ML	5 mL
994-30-9	Chlorotriethylsilane, for GC derivatization	90383-50ML	50 mL
994-30-9	Chlorotriethylsilane solution, 1.0 M in THF	372943-100ML	100 mL
75-77-4	Chlorotrimethylsilane, purified by redistillation, ≥99%	386529-100ML 386529-1L	100 mL 1 L
-	Chlorotrimethylsilane	33014	100 mL
7453-26-1	1,3-Dimethyl-1,1,3,3-tetraphenyldisilazane, ≥98.0% (NT)	41663-10G	10 g
2083-91-2	*N,N*-Dimethyltrimethylsilylamine, 97%	226289-10G 226289-50G	10 g 50 g
999-97-3	Hexamethyldisilazane, for GC derivatization	52619-10ML 52619-50ML 52619-250ML 52619-1L	10 mL 50 mL 250 mL 1 L
107-46-0	Hexamethyldisiloxane, for GC derivatization	01565-1ML 01565-10X1ML	1 mL 10 × 1 mL

GC Derivatization Reagents

Silylation Reagents

CAS No.	Compound	Cat. No.	Qty
999-97-3	HMDS, Derivatization Grade, for GC derivatization	33011	
-	HMDS+TMCS, 3:1	33046	20 × 1 mL
-	HMDS+TMCS+Pyridine, 3:1:9 (Sylon™ HTP)	33038	20 × 1 mL
-	HMDS+TMCS+Pyridine, 3:1:9 (Sylon™ HTP)	33039	25 mL
7449-74-3	*N*-Methyl-*N*-trimethylsilylacetamide, for GC derivatization	69480-10ML	10 mL
53296-64-3	*N*-Methyl-*N*-trimethylsilylheptafluorobutyramide, for GC derivatization	69484-1ML 69484-5ML	1 mL 5 mL
24589-78-4	*N*-Methyl-*N*-(trimethylsilyl)trifluoroacetamide, for GC derivatization, ≥98.5%	69479-10X1ML 69479-5ML 69479-25ML	10 × 1 mL 5 mL 25 mL
24589-78-4	*N*-Methyl-*N*-(trimethylsilyl)trifluoroacetamide, synthesis grade	394866-10X1ML 394866-5ML 394866-25ML	10 × 1 mL 5 mL 25 mL
-	*N*-Methyl-*N*-trimethylsilyltrifluoroacetamide activated I, for GC, activated with ethanethiol and ammonium iodide	12245-10X1ML-F	10 × 1 mL
-	*N*-Methyl-*N*-trimethylsilyltrifluoroacetamide activated I, for GC, activated with ethanethiol and ammonium iodide	50992-5ML-F 50992-25ML-F	5 mL 25 mL
-	*N*-Methyl-*N*-trimethylsilyltrifluoroacetamide activated II, for GC, activated with trimethylsily-ethanethiol	44156-5ML-F 44156-100ML-F	5 mL 100 mL
-	*N*-Methyl-*N*-trimethylsilyltrifluoroacetamide activated III, for GC, activated with imidazole	12124-10X1ML-F 12124-5ML-F	10 × 1 mL 5 mL
24589-78-4	*N*-Methyl-*N*-(trimethylsilyl)trifluoroacetamide with 1% trimethylchlorosilane, for derivatization	69478-10X0.1ML-F 69478-1ML-F 69478-5ML-F	10 × 0.1 mL 1 mL 5 mL
-	Rejuv-8™, Silylating reagent	33059-U	25 mL
318974-69-5	Silylating mixture Fluka I according to Sweeley, for GC derivatization, ampule	85434-10X1ML	10 × 1 mL
318974-69-5	Silylating mixture Fluka I according to Sweeley, for GC derivatization	85431-10ML	10 mL
101660-05-3	Silylating mixture Fluka II according to Horning, for GC derivatization	85435-10X1ML	10 × 1 mL
101660-05-3	Silylating mixture Fluka II according to Horning, for GC derivatization	85432-10ML	10 mL
-	Silylation Sampler Kit	505846	1 ea
75-78-5	Sylon CT™, 5% dimethyldichlorosilane in toluene	33065-U	400 mL
3449-26-1	1,1,3,3-Tetramethyl-1,3-diphenyldisilazane, for GC derivatization	43340-10ML 43340-50ML	10 mL 50 mL
-	TMSI, Derivatization Grade	33068-U	1 kit
8077-35-8	TMSI+PYRIDINE, 1:4 (Sylon™ TP)	33159-U 33156-U	20 × 1 mL 25 mL
850418-19-8	Triethylsilyl methallylsulfinate, for GC derivatization	79264-5ML	5 mL
79271-56-0	Triethylsilyl trifluoromethanesulfonate, 99%	279471-10G 279471-50G	10 g 50 g
13154-24-0	Triisopropylsilyl chloride, 97%	241725-10G 241725-50G	10 g 50 g
80522-42-5	Triisopropylsilyl trifluoromethanesulfonate, 97%	248460-10G 248460-50G	10 g 50 g
13257-81-3	4-(Trimethylsiloxy)-3-penten-2-one, for GC derivatization, ≥97.0% (GC)	69649-1ML 69649-10X1ML	1 mL 10 × 1 mL
13435-12-6	*N*-(Trimethylsilyl)acetamide, for GC derivatization	91566-1G 91566-5G	1 g 5 g
18156-74-6	1-(Trimethylsilyl)imidazole, for GC derivatization	394874-10X1ML 394874-5ML 394874-25ML	10 × 1 mL 5 mL 25 mL
8077-35-8	1-(Trimethylsilyl)imidazole - Pyridine mixture, for GC derivatization	92718-10ML	10 mL
723336-86-5	Trimethylsilyl methallylsulfinate, for GC derivatization	79271-10X1ML 79271-5ML	10 × 1 mL 5 mL

Silyl Reagents for Deactivating Glassware and Chromatographic Supports

CAS No.	Compound	Cat. No.	Qty
-	Rejuv-8™, Silylating reagent	33059-U	25 mL
75-78-5	Sylon CT™, 5% dimethyldichlorosilane in toluene	33065-U	400 mL

GC Derivatization Reagents

Acylation Reagents

Acylation Reagents

Acylation, an alternative to silylation, is the conversion of compounds that contain active hydrogens (-OH, -SH and -NH) into esters, thioesters, and amides through the action of a carboxylic acid or derivative. The presence of a carbonyl group adjacent to the halogenated carbons enhances electron capture detector (ECD) response.

Acylation has many benefits:

- It improves stability of compounds by protecting unstable groups.
- It may confer volatility on substances such as carbohydrates or amino acids, which have so many polar groups that they are nonvolatile and normally decompose on heating.
- It assists in separations not possible with underivatized compounds.
- Compounds are detectable at very low levels with an ECD.

Perfluoro Acid Anhydrides – Acylation reduces the polarity of amino, hydroxyl, and thiol groups to form perfluoroacyl derivatives, which are both stable and highly volatile. Fluorinated anhydride derivatives are used primarily for ECD, but also can be used for flame ionization detection (FID). They react with alcohols, phenols, and amines to produce stable derivatives. Fluorinated anhydrides are used in derivatizing samples for drug of abuse confirmation. The anhydrides and acyl halide reagents form acid byproducts which must be removed in GC analysis to prevent destructive effects on the column. Acylations with anhydride reagents are normally performed in pyridine, tetrahydrofuran, or some other solvent capable of accepting the acid byproduct. Amine bases also may be used as catalysts/acid acceptors.

Perfluoroacylimidazoles – Perfluoroacylimidazoles offer advantages over anhydrides in preparing perfluoroacyl derivatives. The reactions are smooth and quantitative, and produce no acid byproducts that must be removed from the system before injection. The activated amide reagents yield no acid byproducts, giving only imidazole and N-methyltrifluoroacetamide, respectively. The perfluoroacylimidiazoles react with hydroxyl groups, both primary and secondary amines, and quantitatively acylate into alkylamines.

General Acylation Reagents – N-methylbis(trifluoroacetamide) reacts with amines at room temperature. Hydroxyl derivatizations are slower. Heat is recommended.

Related Information

Bulletin 909 contains detailed information on selecting a suitable derivatization reagent for most applications. Request a free copy of Bulletin 909 by phone, fax, or visit **sigma-aldrich.com/literature**.

No.	Title
T196909	*Derivatization Reagents*

Acronyms for Acylation Reagents

Acronym	Chemical Name	CAS No.
HFBA	Heptafluorobutyric anhydride	336-59-4
MBTFA	N-Methylbis (trifluoroacetamide)	685-27-8
PFPA	Pentafluoropropionic anhydride	356-42-3
TFAA	Trifluoroacetic anhydride	407-25-0
TFAI	1-(Trifluoroacetyl) imidazole	1546-79-8

CAS No.	Compound	Cat. No.	Qty
108-24-7	Acetic anhydride, for GC derivatization, ≥99.0%	91204-10X1ML-F	10 × 1 mL
108-24-7	Acetic anhydride	33085	10 × 2 mL
2466-76-4	1-Acetylimidazole, 98%	157864-25G 157864-100G	25 g 100 g
-	Acylation Sampler Kit	505862	1 ea
65-85-0	Benzoic acid, for calorimetrical determination (approx. 26460 J/g)	33045-100G-R	100 g
373-57-9	Boron trifluoride-methanol solution, ~10% (~1.3 M), for synthesis	15715-50ML 15715-250ML 15715-1L	50 mL 250 mL 1 L
70-11-1	2-Bromoacetophenone, for GC derivatization, ≥99.0%	77450-10G 77450-50G	10 g 50 g
93128-04-2	4-Bromophenacyl trifluoromethanesulfonate, ≥95% (H-NMR/C-NMR)	41392-50MG-F 41392-250MG-F	50 mg 250 mg
4426-47-5	Butylboronic acid, for GC derivatization	19667-1G 19667-5G	1 g 5 g
1634-04-4	*tert*-Butyl methyl ether, puriss. p.a., ≥99.5% (GC)	20256-1L-F 20256-2.5L-F 20256-2.5L-CB-F	1 L 2.5 L 2.5 L
56-06-4	2,4-Diamino-6-hydroxypyrimidine, 96%	D19206-25G D19206-100G	25 g 100 g
2687-25-4	2,3-Diaminotoluene, 97%	272361-5G	5 g
4755-50-4	4-(Dimethylamino)benzoyl chloride, for HPLC derivatization, ≥99.0% (HPLC)	67954-1G	1 g
4637-24-5	Esterate M, for GC derivatization	33140	25 mL
141-97-9	Ethyl acetoacetate, puriss. p.a., ≥99.0% (GC)	00410-100ML 00410-1L	100 mL 1 L

GC Derivatization Reagents

Acylation Reagents

CAS No.	Compound	Cat. No.	Qty
425-75-2	Ethyl trifluoromethanesulfonate, for GC derivatization, ≥99.0%	91734-5ML	5 mL
336-59-4	Heptafluorobutyric anhydride, for GC derivatization, ≥99.0%	394912-10X1ML 394912-5ML 394912-25ML	10 × 1 mL 5 mL 25 mL
336-59-4	Heptafluorobutyric anhydride, for GC derivatization, ≥99.0%	77253-10X1ML 77253-10ML 77253-50ML	10 × 1 mL 10 mL 50 mL
32477-35-3	*N*-Heptafluorobutyrylimidazole, 97%	556645-1G 556645-5G	1 g 5 g
17587-22-3	6,6,7,7,8,8,8-Heptafluoro-2,2-dimethyl-3,5-octanedione, 98%	175161-5G	5 g
1522-22-1	Hexafluoroacetylacetone, 98%	238309-5G 238309-25G	5 g 25 g
-	Lab Kit , for the evaluation of FA status in blood (n-3 + n-6 PUFA)	05904-1KT	1 kit
14602-86-9	(1*R*)-(−)-Menthyl chloroformate, ee (GLC): 99%	245305-25G 245305-100G	25 g 100 g
7635-54-3	(1*S*)-(+)-Menthyl chloroformate, ee (GLC): 97%	378712-5ML 378712-25ML	5 mL 25 mL
81655-41-6	(±)-α-Methoxy-α-trifluoromethylphenylacetic acid, for GC derivatization	65371-5G	5 g
73980-71-9	*N*-Methyl-bis-heptafluorobutyramide, for GC/MS derivatization	78268-1ML-F	1 mL
685-27-8	*N*-Methyl-bis(trifluoroacetamide), for GC derivatization	M0789-10X1ML M0789-5ML	10 × 1 mL 5 mL
685-27-8	*N*-Methyl-bis(trifluoroacetamide), for GC derivatization	65943-5ML 65943-25ML	5 mL 25 mL
13061-96-6	Methylboronic acid, 97%	165336-1G 165336-5G	1 g 5 g
54648-79-2	*o*-Methyl-*N*,*N*′-diisopropylisourea, 97%	226408-5G 226408-25G	5 g 25 g
333-27-7	Methyl trifluoromethanesulfonate, for GC derivatization, 98.0%	18503-1G 18503-5G	1 g 5 g
653-37-2	2,3,4,5,6-Pentafluorobenzaldehyde, 98%	103748-2.5G 103748-10G 103748-100G	2.5 g 10 g 100 g
832-53-1	Pentafluorobenzenesulfonyl chloride, 99%	103764-1G 103764-5G 103764-25G	1 g 5 g 25 g
15989-99-8	2,3,4,5,6-Pentafluorobenzoic anhydride, for GC-MS derivatization, ≥98.0%	02379-5G	5 g
2251-50-5	2,3,4,5,6-Pentafluorobenzoyl chloride, 99%	103772-1G 103772-5G 103772-25G	1 g 5 g 25 g
356-42-3	Pentafluoropropionic anhydride, purum, ≥97.0% (GC)	77292-5ML 77292-25ML	5 mL 25 mL
71735-32-5	1-(Pentafluoropropionyl)imidazole, for GC derivatization, ≥98.5%	17281-1ML	1 mL
98-80-6	Phenylboronic acid, 95%	P20009-10G P20009-50G P20009-250G	10 g 50 g 250 g
18704-37-5	8-Quinolinesulfonyl chloride, ≥96.0% (AT)	22695-5G 22695-25G	5 g 25 g
1118-71-4	2,2,6,6-Tetramethyl-3,5-heptanedione, for GC derivatization, ≥98.0%	87851-5ML 87851-25ML	5 mL 25 mL
326-91-0	2-Thenoyltrifluoroacetone, for spectrophotometric det. of metal ions, ≥99.0%	88300-5G	5 g
76-02-8	Trichloroacetyl chloride, for GC derivatization	80521-1G 80521-5G	1 g 5 g
407-25-0	Trifluoroacetic anhydride, for GC derivatization	91719-10X1ML 91719-10ML 91719-50ML	10 × 1 mL 10 mL 50 mL
421-50-1	1,1,1-Trifluoroacetone, 97%	T62804-5G T62804-25G T62804-100G	5 g 25 g 100 g
1546-79-8	1-(Trifluoroacetyl)imidazole, for GC derivatization	394920-10X1ML 394920-5ML	10 × 1 mL 5 mL
329-15-7	4-(Trifluoromethyl)benzoyl chloride, 97%	249475-1G 249475-5G 249475-25G	1 g 5 g 25 g
367-57-7	1,1,1-Trifluoro-2,4-pentanedione, 98%	235970-10G 235970-25G	10 g 25 g

GC Derivatization Reagents

Alkylation/Esterification Reagents

Alkylation/Esterification Reagents

Alkylation involves the addition of an alkyl group (aliphatic or aliphatic-aromatic) to an active functional group. Replacement of hydrogen with an alkyl group is important because of the decreased polarity of the derivative as compared with the parent compound. This reagent is used to modify compounds containing acidic hydrogens such as carboxylic acids and phenols.

The resulting products are ethers, esters, thioethers, thioesters, n-alkyl amines, and n-alkyl amides. Alkylation of weakly acidic groups (alcohols) requires strongly basic catalysts (sodium methoxide, potassium methoxide). More acidic OH groups, as in phenols and carboxylic acids, require less basic catalysts (hydrogen chloride, boron trifluoride).

DMF-Dialkyl acetals – Dimethylformamide dialkyl acetals are used to esterify acids to their methyl esters. Hydroxyl groups are not alkylated with this reagent. Carboxylic acids, phenols, and thiols quickly react to give the corresponding alkyl derivatives. N,N-Dimethylformamide dimethyl acetals are moisture sensitive.

Diazoalkales – Diazomethane reacts rapidly with unesterified fatty acids in the presence of a small amount of methanol, which catalyzes the reaction to form methyl esters. The yield is high and the side reactions are minimal. Diazomethane is a yellow gas which is used as an ethereal solution with some methanol present. The elimination of gaseous nitrogen drives the reaction. Diazomethane is carcinogenic, highly toxic, potentially explosive, and unstable. Diazomethane is not ideal for esterification of phenolic acids because the phenolic hydroxyl groups are also methylated at a slower rate which may lead to mixtures of partially methylated products.

Esterification and Transesterification Reagents – Esterification is the reaction of an acid with an alcohol in the presence of a catalyst to form an ester. The process involves the condensation of the carboxyl group of the acid and the hydroxyl group of the alcohol with the elimination of water. Esterification is best done in the presence of a catalyst (e.g., hydrogen chloride), which is removed with the water.

Esterification is the most popular alkylation method. Alkyl esters offer excellent stability and provide quick and quantitative samples for GC analysis.

Transesterification is the displacement of the alcohol from an ester by another alcohol. This has been widely used for making esters of higher alcohols from those of lower alcohols. Transesterification can be performed with an acidic or basic catalyst using methanol to react with fats and oils.

General Alkylation Reagents – Pentafluorobenzyl bromide is convenient for making esters and ethers and has been used in trace analysis. This reagent is a strong lachrymator and should be handled only in a hood. Hexacyclooctadecane and pentafluorobenzylbromide are reagents for preparing pentafluorobenzyl phenol derivatives for US EPA Method 604. Esterate-M is used in the preparation of methyl and other esters of long chain fatty acids by reaction with dimethylformamide dialkylacetals. Aldehydes and ketones are conveniently derivatized by forming oximes with o-alkylhydroxylamine HCl reagents. O-methylhydroxylamine HCl has been used with ketosteroids, prostaglandins, saccharides, aldoacids, and ketoacids. N-butylboronic acid reacts with 1,2- or 1,3-diols or with α- or β-hydroxy acids to form 5- or 6-member ring nonpolar boronate derivatives. They are prepared simply by adding n-butylboronic acid to a solution of the hydroxy compound in dimethylformamide.

Related Information

Bulletin 909 contains detailed information on selecting a suitable derivatization reagent for most applications. Request a free copy of Bulletin 909 by phone, fax, or visit **sigma-aldrich.com/literature**.

No.	Title
T196909	*Derivatization Reagents*

Acronyms for Alkylation Reagents

Acronym	Chemical Name	CAS No.
Diazald	N-Methyl-N-nitroso-p-toluenesulfonamide	–
Diazald-N-methyl-^{13}C	N-Methyl-^{13}C-N-nitroso-p-toluenesulfonamide	60858-95-9
Diazald-N-methyl-^{13}C-N-methyl-d_3	N-Methyl-^{13}C-d_3-N-nitroso-p-toluene-sulfonamide	102832-11-1
DMF-DBA	N,N-Dimethylformamide di-tert-butyl acetal	36805-97-7
DMF-DEA	N,N-Dimethylformamide diethyl acetal	1188-33-6
DMF-DMA	N,N-Dimethylformamide dimethyl acetal	4637-24-5
DMF-DPA	N ,N-Dimethylformamide dipropyl acetal	6006-65-1
DMP	2,2-Dimethoxypropane	77-76-9
Esterate M	2 meq DMF-DMA in 1 mL pyridine	–
MNNG	1-Methyl-3-nitro-1-nitrosoguanidine	70-25-7
NBB	n-Butylboronic acid	4426-47-5
PFBBr	Pentafluorobenzyl bromide	1765-40-8
TMAH	Trimethylphenylammonium hydroxide	–

GC Derivatization Reagents

Alkylation/Esterification Reagents

CAS No.	Compound	Cat. No.	Qty
-	BCl_3-2-Chloroethanol, 10 % (w/w)	33056-U	10 × 1 mL
7637-07-2	BF_3 - Butanol solution, 10 % (w/w)	33126-U 33125-U	10 × 5 mL 100 mL
-	BF_3 - Methanol, 10 % (w/w)	33021	400 mL
-	Boron trichloride - Methanol, 12 % (w/w)	33353	20 × 1 mL
-	Boron trichloride - Methanol, 12 % (w/w)	33089-U	20 × 2 mL
-	Boron trichloride - Methanol, 12 % (w/w)	33033	400 mL
-	Boron trifluoride-ethanol, ~10% in ethanol (~1.3 M), for GC derivatization	05576-10ML-F 05576-100ML-F	10 mL 100 mL
373-57-9	Boron trifluoride-methanol solution, 50% w/w in methanol	134821-4X25ML 134821-50ML 134821-250ML 134821-1L	4 × 25 mL 50 mL 250 mL 1 L
373-57-9	Boron trifluoride-methanol solution, ~10% (~1.3 M), for GC derivatization	15716-10ML 15716-100ML 15716-250ML 15716-1L	10 mL 100 mL 250 mL 1 L
762-48-1	Boron trifluoride propanol complex, in excess propanol, BF_3: 14 wt. %	156825-100G	100 g
7637-07-2	Bortrifluoride - 1-butanol solution, ~10% in 1-butanol (~1.3 M), for GC derivatization, for esterification of fatty acids for GC purposes	83253-100ML-F	100 mL
589-15-1	4-Bromobenzyl bromide, 98%	112186-25G 112186-100G	25 g 100 g
17455-13-9	18-Crown-6	33003-U	25 g
-	Derivatizing agents, Set for GC: Alcohols with hydrogen chloride, for GC derivatization	72558-1SET-F	1 set
80-11-5	Diazald®, 99%	D28000-25G D28000-100G D28000-250G D28000-4X250G D28000-500G D28000-1KG	25 g 100 g 250 g 4 × 250 g 500 g 1 kg
1133-63-7	2,3-Dihydroxy-biphenyl, for GC derivatization, ≥98.0%	17403-100MG	100 mg
77-76-9	2,2-Dimethoxypropane, for GC derivatization	33053	25 g
18503-90-7	*N,N*-Dimethylformamide dibutyl acetal, for esterification of fatty acids, ≥98.0%	40262-10ML	10 mL
36805-97-7	*N,N*-Dimethylformamide di-*tert*-butyl acetal, for GC derivatization	395005-10X1ML 395005-5ML 395005-25ML	10 × 1 mL 5 mL 25 mL
1188-33-6	*N,N*-Dimethylformamide diethyl acetal, for GC derivatization	394971-5ML 394971-25ML	5 mL 25 mL
1188-33-6	*N,N*-Dimethylformamide diethyl acetal, for esterification of fatty acids, ≥95.0% (GC)	40252-25ML-F 40252-100ML-F	25 mL 100 mL
18503-89-4	*N,N*-Dimethylformamide diisopropyl acetal, 95%	178535-25G	25 g
4637-24-5	*N,N*-Dimethylformamide dimethyl acetal, for GC derivatization	394963-10X1ML 394963-5ML 394963-25ML	10 × 1 mL 5 mL 25 mL
4909-78-8	*N,N*-Dimethylformamide dineopentyl acetal, 99%	140244-10G 140244-50G	10 g 50 g
6006-65-1	*N,N*-Dimethylformamide dipropyl acetal, 97%	178527-25G	25 g
6006-65-1	*N,N*-Dimethylformamide dipropyl acetal, for GC derivatization	394998-10X1ML 394998-5ML 394998-25ML	10 × 1 mL 5 mL 25 mL
4637-24-5	Esterate M, for GC derivatization	33140	25 mL
3332-29-4	O-Ethylhydroxylamine hydrochloride, 97%	274992-1G 274992-5G	1 g 5 g
-	FID Alkyation Sampler Kit	505854	1 ea
920-66-1	1,1,1,3,3,3-Hexafluoro-2-propanol, for GC derivatization, ≥99.8%	52517-10ML 52517-50ML	10 mL 50 mL
7647-01-0	Hydrogen chloride - 1-butanol solution, ~3 M in 1-butanol, for GC derivatization	87472-50ML-F 87472-250ML-F	50 mL 250 mL
7647-01-0	Hydrogen chloride – ethanol solution, ~1.25 M HCl, for GC derivatization	17934-50ML 17934-250ML	50 mL 250 mL
132228-87-6	Hydrogen chloride – methanol solution, ~1.25 M HCl, for GC derivatization	17935-100X1ML 17935-50ML 17935-250ML	100 × 1 mL 50 mL 250 mL
-	Hydrogen chloride – 2-propanol solution, puriss. p.a., for GC, ~1.25 M (T)	17933-250ML	250 mL

GC Derivatization Reagents

Alkylation/Esterification Reagents

CAS No.	Compound	Cat. No.	Qty
7664-93-9	Methanolic H_2SO_4, 10 % (v/v) in methanol, for GC derivatization	506516	6 × 5 mL
7647-01-0	Methanolic HCl, 0.5 M HCl in methanol (0.5N), for GC derivatization	33095	10 × 5 mL
7647-01-0	Methanolic HCl, 3 M HCl in methanol (3N), for GC derivatization	33051	10 × 3 mL
7647-01-0	Methanolic HCl, 3 N	33355 33051 33050-U	20 × 1 mL 10 × 3 mL 400 mL
7647-01-0	Methanolic HCl, 0.5 M HCl in methanol (0.5N), for GC derivatization	33354	20 × 1 mL
593-56-6	Methoxyamine hydrochloride	33045-U	5000 mg
593-56-6	Methoxyamine hydrochloride, 98%	226904-1G 226904-5G 226904-25G 226904-100G	1 g 5 g 25 g 100 g
100-11-8	4-Nitrobenzyl bromide, 99%	N13054-25G N13054-100G	25 g 100 g
423-39-2	Nonafluoro-1-iodobutane, 98%	317845-25G 317845-100G	25 g 100 g
1765-40-8	Pentafluorobenzyl bromide, analytical standard	33001	5000 mg
1765-40-8	2,3,4,5,6-Pentafluorobenzyl bromide, 99%	101052-1G 101052-5G 101052-25G	1 g 5 g 25 g
57981-02-9	*O*-(2,3,4,5,6-Pentafluorobenzyl)hydroxylamine hydrochloride, for GC derivatization	76735-250MG 76735-1G	250 mg 1 g
354-64-3	Pentafluoroiodoethane, 97%	331015-25G 331015-300G	25 g 300 g
828-73-9	Pentafluorophenylhydrazine, 97%	156388-10G	10 g
422-05-9	2,2,3,3,3-Pentafluoro-1-propanol, 97%	257478-5G 257478-25G	5 g 25 g
23231-91-6	Tetrabutylammonium tetrabutylborate, 97%	477230-5G	5 g
76437-40-6	2,3,5,6-Tetrafluoro-4-(trifluoromethyl)benzyl bromide, 98%	406406-1G	1 g
1899-02-1	TMAH, 0.2 M in methanol	33358-U 33097-U	10 × 1 mL 10 mL
115-20-8	2,2,2-Trichloroethanol, *ReagentPlus®*, ≥99%	T54801-100G T54801-500G	100 g 500 g
17950-40-2	Triethyloxonium hexafluorophosphate, contains ~10% diethyl ether as stabilizer	164682-5G 164682-25G	5 g 25 g
368-39-8	Triethyloxonium tetrafluoroborate, ≥97.0% (T)	90520-25G 90520-100G	25 g 100 g
75-89-8	2,2,2-Trifluoroethanol, *ReagentPlus®*, ≥99%	T63002-25G T63002-100G T63002-500G	25 g 100 g 500 g
823-96-1	Trimethylboroxine, 99%	323136-1G 323136-5G 323136-25G	1 g 5 g 25 g
420-37-1	Trimethyloxonium tetrafluoroborate, 95%	281077-1G 281077-10G	1 g 10 g
1899-02-1	Trimethylphenylammonium hydroxide solution, ~0.5 M $(CH_3)_3N(OH)C_6H_5$ in methanol, for GC derivatization	79266-10ML 79266-50ML	10 mL 50 mL
17287-03-5	Trimethylsulfonium hydroxide solution, ~0.25 M in methanol, for GC derivatization	92732-10X1ML 92732-10ML	10 × 1 mL 10 mL

Product specification sheets are available for most of these reagents. Information includes properties, features and benefits, typical derivatization procedure, mechanism, toxicity, hazards, and stability. For free literature, request a copy by phone or see our Web site.
Note: All Supelco glass GC columns have been silane treated.

Derivatization Reagent Sampler Kits

Our derivatization reagent sampler kits enable you to determine the best reagent for a specific application, without the cost of purchasing, storing, and ultimately disposing of large volumes of individual reagents. Because of our purity specifications and reaction efficiency checks, we can guarantee consistently high reactivity from every lot of each reagent. Documentation detailing the chemistry, a tested derivatization procedure, and handling and storing recommendations is available for most reagents. Each of our four kits incorporates a group of related reagents.

Description	Concentration		Cat. No.	Qty
Acylation Sampler Kit	-	-	505862	1 ea
	Acetic anhydride, 3 × 2 mL *Heptafluorobutyric anhydride, 3 x 1mL*	*Pentafluoropropionic anhydride, 3 x 1mL* *Trifluoroacetic anhydride, 3 x 1mL*		
FID Alkyation Sampler Kit	-	-	505854	1 ea
	BF_3-Methanol, 3 x 1mL *Methanolic Base, 3 x 1mL* *Methanolic HCl (0.5N), 3 x 1mL*	*Methanolic HCl (3N), 3 x 1mL* *TMAH, 0.2M in Methanol, 3 x 1mL*		
Silylation Sampler Kit	-	-	505846	1 ea
	BSA, 3 x 1mL *BSTFA, 3 x 1mL* *BSTFA + TMCS, 99:1 (Sylon BFT), 3 x 1mL*	*HMDS + TMCS, 3:1 (Sylon HT), 3 x 1mL* *TMSI, 3 x 1mL*		

GC Derivatization Reagents

Derivatization Reagent Sampler Kits

Related Information

Free Technical Literature

Reagent	Product Specification Sheet
Acetic Acid	T497121
• BCl_3 Methanol	T496123
• BCl_3-20-Chloroethanol	T496122
• BF_3 Butanol	T496124
• BF_3 Methanol	T496125
BSA	T496017
BSA + TMCS, 5:1 (Sylon BT)	T496018
BSA + TMCS + TMSI, 3:2:3 (Sylon BTZ)	T496019
BSTFA	T496020
BSTFA + TMCS, 99:1 (Sylon BFT)	T496021
DMDCS	T496022
• 5% DMDCS in Toluene (Sylon CT)	T496023
HMDS	T496024
HMDS + TMCS, 3:1 (Sylon HT)	T496025
HMDS + TMCS + Pyridine, 3:1:9 (Sylon HTP)	T496026
• Methanolic Base	T497007
• Methanolic HCl	T497099
• Methanolic Sulfuric Acid	T497018
N-t-Butyldimethylsilylimidazole	T496065
Perfluoro Acid Anhydrides	T497104
PFBBr & 18 Crown 6	T497103
• Rejuv 8	T496066
TFA	T496027
TMCS	T496028
TMSI	T496029
TMSI + Pyridine, 1:4 (Sylon TP)	T496030

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Certificates of Analysis, containing lot-specific data, are available for many Supelco reagents free of charge. These certificates, as well as product specification sheets (see table above), contain information about the reagent: use, physical properties, benefits, typical procedures for derivatizing a compound, toxicity, hazards, storage and stability, and reaction mechanism. To obtain free copies, contact our Customer Service Department.

- Certificates of Analysis are not available for these reagents, only product specification sheets are available.