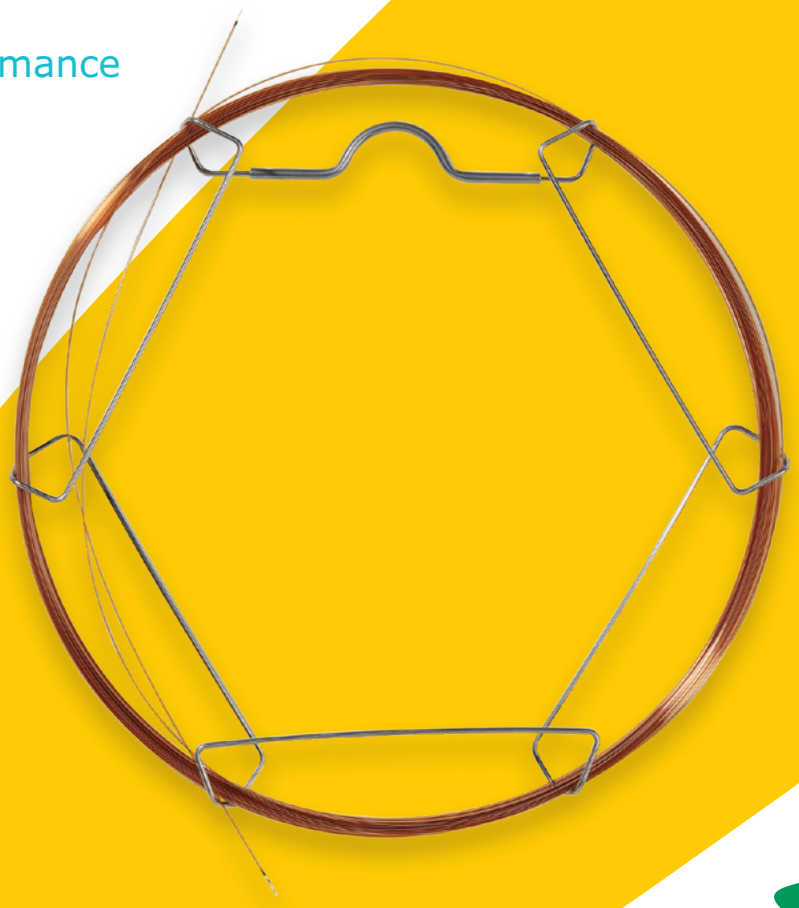
GC Column Selection Guide

Ensuring Optimal Method Performance



Supelco®
Analytical Products

Supelco® GC Columns

Tracing its origins to 1966, Supelco® Analytical Products has been recognized for manufacturing reliable and reproducible GC columns for over 50 year.

How to Choose a Capillary 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.

Phase Polarity

Phase polarity is the most critical characteristic in selecting a capillary column, as it dictates "selectivity"— the column's ability to separate sample components. The selection of the phase is based on the general chemical principle that "like dissolves like." Non-polar columns are most effective for analyzing non-polar compounds, while polar columns are best suited for separating polar compounds.

Non-polar compounds typically consist solely of carbon and hydrogen atoms, featuring carbon-carbon single bonds. Non-polar capillary columns excel at separating these compounds, as the interactions between non-polar compounds and a non-polar phase are dispersive, governed by Van der Waals forces. These intermolecular attractions increase with the size of the compound, resulting in larger compounds with higher boiling points exhibiting longer retention times. Consequently, the elution order generally aligns with the boiling points of the compounds.

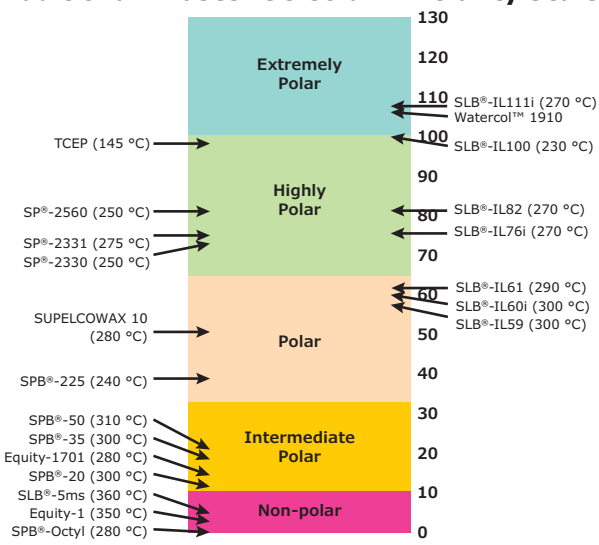
Polar compounds, on the other hand, primarily contain carbon and hydrogen atoms but also include one or more atoms of bromine, chlorine, fluorine, nitrogen, oxygen, phosphorus, or sulfur. Typical polar compounds analyzed by capillary gas chromatography include alcohols, amines, carboxylic acids, diols, esters, ethers, ketones, and thiols. Intermediate polar or polar capillary columns effectively separate these compounds. In addition to dispersive interactions, the interactions between polar compounds and the phase may involve dipole, π-π, and/or acid-base interactions, with separations determined by the overall effects of these interactions.

Polarizable compounds, which consist of carbon and hydrogen but contain one or more double or triple carbon-carbon bonds, include alkenes, alkynes, and aromatic hydrocarbons. Highly polar capillary columns are typically employed to separate these types of compounds.

Phase Polarity Based on Compound Polarity

Compound Polarity	Compound Examples	Recommended Phases
Non-Polar		
C and H atoms only, C-C bonds	alkanes	Equity, Omegawax, Petrocol®, SPB®, SLB®, Supelcowax and VOCOL®
Polar		
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, Equity-1701, SPB®-35 SPB®-50, SPB®-225, Omegawax, SPB®-1000, SLB®-IL60i, Nukol, Supelcowax 10
Polarizable		
C and H atoms only, C=C or C≡C bonds	alkenes, alkynes, aromatic hydrocarbons	SP®-2330, SP®-2331, SP®-2380, SP®-2560, SP®-2340, TCEP, SLB®-IL111i

Traditional Phases: GC Column Polarity Scale



Step 1 – Stationary Phase

Choosing a stationary phase is the most critical step in selecting a column. The stationary phase refers to the film coated on the inner wall of a capillary column and should be chosen based on the specific application. The separation process relies on the differences in the chemical and physical properties of the injected organic compounds and their interactions with the stationary phase. When the strength of the interactions between the analyte and the phase varies significantly for two compounds, one compound is retained longer than the other, a phenomenon known as selectivity. The retention time, or how long compounds are held in the column, serves as a measure of these analyte-phase interactions.

Changing the chemical features of the stationary phase alters its selectivity. Two compounds that co-elute (fail to 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/selectivities. Each phase provides a specific combination of interactions for each chemical class of analytes.

Established Applications: Gas chromatography, developed in the 1950s, is a well-established analytical technique with numerous applications. Extensive literature, including methodologies and journals, likely exists detailing which stationary phases have been successfully employed for various applications. Additionally, column manufacturers frequently publish phase selection charts, such as those found on pages 8–18. These charts are organized by industry to facilitate the selection of the appropriate phase. To use them, first identify the chart relevant to your industry or area of interest, then locate the specific application within that chart to find a recommended column phase.

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.

Bonded/Non-Bonded Phases

Bonded phases are immobilized/chemically bonded (crosslinked) within the tubing, while non-bonded phases are simply coated on the wall. Generally a bonded phase is preferred, because it exhibits less bleed during use, can be used at higher temperatures, and, when necessary, can be rinsed with solvents to remove accumulated non-volatile materials. When a bonded phase is not available, such as for the highly polar phases, look for a stabilized phase. These phases are not as permanent as bonded phases (cannot be rinsed), but have greater thermal stability than non-bonded phases. For some applications, the only choice is a non-bonded phase.

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 effects of column I.D. on efficiency and sample capacity are represented in **Table 1.** As shown, 0.25 mm I.D. columns provide adequate plates/meter for most applications while allowing acceptable sample capacity. Because of this compromise between efficiency and sample capacity, 0.25 mm is the most popular I.D. for capillary GC columns. Columns with a smaller or larger I.D. allow the user to optimize either efficiency or sample capacity, based on the requirements of their application.

Table 1. Effects of Column I.D.

Internal Diameter (mm)	Efficiency: Plates/Meter (N/m)	Efficiency: Total Plates (N)	Capacity Each Analyte (ng)
0.53	1,300	39,000	1000-2000
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 with k = 6.00 and 85% coating efficiency. The equilibrium constant, K, is termed the partition coefficient; defined as the molar concentration of analyte in the stationary phase divided by the molar concentration of the analyte in the mobile phase.

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.

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. 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.

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 ratios. 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:

$$\beta = \frac{\textbf{column radius (µm)}}{\textbf{2 x film thickness (µm)}}$$

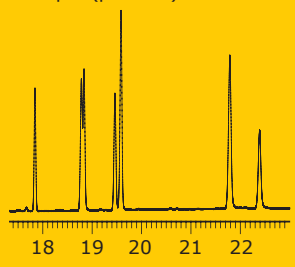
In contrast to relative terms ("thick film" and "thin film"), β values establish a distinct ranking for columns. As a general rule, select columns by β values as follows:

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

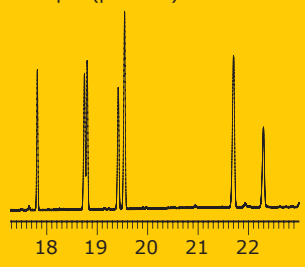
β values are also useful when changing column I.D. and film thickness combinations for a particular analysis, because columns with the same phase ratio will provide very similar retention times and elution order under the same analytical conditions.

Columns With Similar β Values

SLB®-5ms, 30 m x 0.25 mm I.D., 0.25 µm (β = 250)



SLB®-5ms, 30 m x 0.53 mm I.D., 0.50 µm (β = 265)



Step 4 – Column Length

Generally a 30 m column provides the best balance of resolution, analysis time, and required column head pressure. Data is shown in **Table 2.** Specific applications may warrant a different column length.

Longer Columns: provide greater resolution, but increase 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: best used 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.

Table 2. 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	12.0	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

Fused Silica Tubing Inner/Outer Diameters

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

▲ Analytical columns with non-polar or intermediate polarity stationary phases.

▼ Analytical columns with polar stationary phases. Guard columns regardless of deactivation.

◆ Analytical columns regardless of polarity. Guard columns regardless of deactivation.

Gas Chromatography Workflow Tools

We provide a comprehensive range of high quality tools for each step of the GC workflow ensuring accuracy, precision and consistency of your analysis.

SAMPLE PREPARATION AND COLLECTION

GC ANALYSIS

Sample Preparation and Collection

- **SPME** - Solid Phase Microextraction (Fibers, Holders, Accessories)
- **SPE** (Tubes, Manifolds, Accessories, QuEChERS, Bulk Adsorbents)
- **Purge & Traps** (Traps & Purge Vessels)
- **Solvents** (Suprasolv® FID/ECD, MS, HS, Unisolv™)
- **Milli-Q® water purification systems** and VOC-Pak® Polisher
- **Derivatization Reagents**

SPE Products

Solvents

SPME Products

Derivitization Reagents

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Air Sampling

- Thermal Desorption (Adsorbent Tubes & Accessories)
- Solvent Desorption (Adsorbent Tubes & Accessories)
- Whole Air (Sampling Bags & Bulbs, Sampler)

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GC Analysis

- **GC Columns** for GC, GC/MS, Fast GC, GCxGC
- **General Purpose Columns** (e.g. SLB®-1ms, SLB®-5ms, SLB®-35ms, Equity-1701, Supelcowax, Nukol/FFAP)
- **Special Application Columns** (e.g. FAME, PAH, PCB, Dioxins, VOC, PLOT, Chiral)
- **Ionic Liquid Columns** (SLB®-IL i-Series, Watercol™)
- **Packed Columns** (SS & Glass)

GC Columns (Packed)

GC Columns (Capillary)

Accessories

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- Fittings, Ferrules & Column Connectors
- Flow Measurement
- Vials & Syringes
- Gas Management & Purification
  - Gas Generators
  - Gas Purifiers
  - Plumbing (Valves, Fittings & Tubing)

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Vials

Gas Generators

Liner

Septa

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- Neats & Solutions (for almost every application area)
- Matrix Standards
- Pharmacopoeia & Metrological Institute Standards

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Reference Standards & Certified Reference Materials

Column Selection by Industry

We have developed the most extensive line of special purpose columns designed for industry specific applications. These columns are manufactured to deliver high resolution, great analyte response, low bleed, and long column life; allowing you to achieve the analytical performance you require.

The stationary phase dictates the minimum and maximum temperatures at which a column can be used. It is therefore critical to ensure the selected stationary phase can withstand the temperature requirements of the GC method.

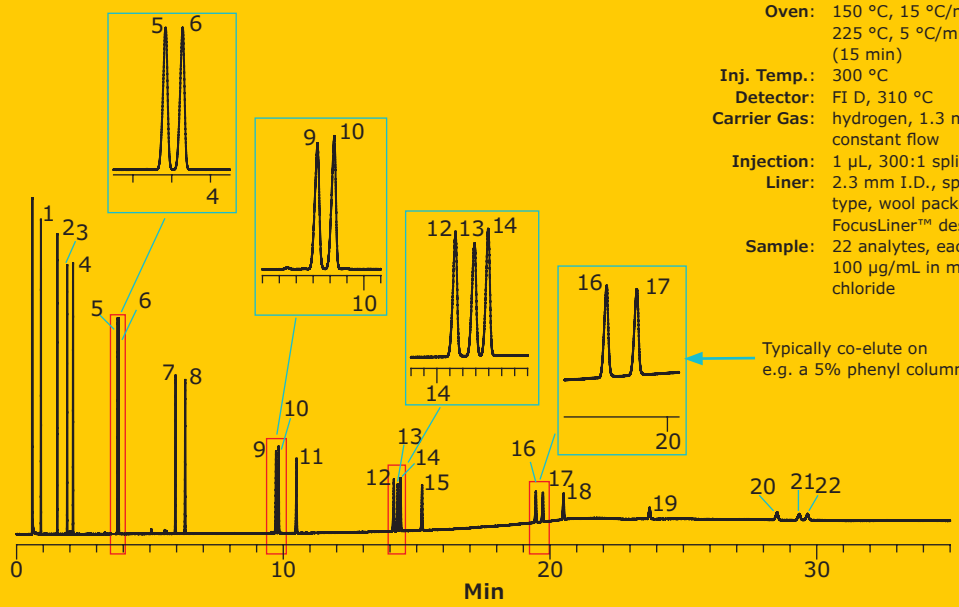
Environmental Industry

	SPB®-Octyl	SLB®-5ms	Equity-5	SPB®-624	VOCOL®	Equity-1701	SPB®-608	SPB®-35	SPB®-50	SPB®-225	SPB®-1000	SLB®-IL59	SLB®-IL60i	SLB®-IL82	SP®-2331	SLB®-IL111i	Chiral *	SLB®-ILPAH	SLB®-PAHms
Volatiles by GC-MS				●	●														
Volatiles by GC				●	●														
Semivolatiles by GC-MS		●																	
Semivolatiles by GC**		●	●			●	●	●	●								●		
Fuels (GRO, DRO, TPH)		●	●	●	●														
Dioxins by GC-HRMS		●								●					●				
PCBs by GC-HRMS	●	●										●		●		●			
PBDEs by GC-MS		●																	
PAHs by GC or GC-MS		●																●	●
Oil Spill Dispersants											●								
Odor Compounds (Geosmin, 2-MIB)		●																	

* See “by Application” section

** Includes: organochlorine pesticides, PCBs as Aroclors, herbicides, organophosphorous pesticides, nitrosamines, phenols, phthalate esters, haloacetic acids, disinfection by-products and solvents, and PAHs.

High Resolution Analysis of 22-Component PAH Mix



Column: SLB®-ILPAH, 20 m × 0.18 mm I.D., 0.05 µm **(29799-U)**
Oven: 150 °C, 15 °C/min to 225 °C, 5 °C/min to 300 °C (15 min)
Inj. Temp.: 300 °C
Detector: FI D, 310 °C
Carrier Gas: hydrogen, 1.3 mL/min, constant flow
Injection: 1 µL, 300:1 split
Liner: 2.3 mm I.D., split/splitless type, wool packed straight FocusLiner™ design
Sample: 22 analytes, each at 100 µg/mL in methylene chloride

1. Naphthalene
2. Acenaphthene
3. Acenaphthalene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Fluoranthene
8. Pyrene
9. Benzo[a]anthracene
10. Chrysene
11. 5-Methylchrysene
12. Benzo[b]fluoranthene
13. Benzo[k]fluoranthene
14. Benzo[j]fluoranthene
15. Benzo[a]pyrene
16. Dibenz[a,h]anthracene
17. Indeno[1,2,3-cd]pyrene
18. Benzo[g,h,i]perylene
19. Dibenzo[a,l]pyrene
20. Dibenzo[a,e]pyrene
21. Dibenzo[a,i]pyrene
22. Dibenzo[a,h]pyrene

Petroleum Industry

	MET-SimDis	Alumina KCl PLOT	Silica PLOT	Petrocol® DH 50.2	Petrocol® DH	Petrocol® DH 150	Petrocol® EX2887	SPB®-1 SULFUR	Equity-1	SLB®-1ms	SLB®-5ms	Supelcowax 10	SLB®-IL59	SLB®-IL60i	SLB®-IL111i	Supel-Q PLOT	SLB®-ILD3606	Watercol™ 1910
Detailed Hydrocarbon Analysis (DHA)				●	●	●												
Simulated Distillation (Sim Dis)	●						●											
Fuels by Pattern Recognition									●		●							
Aromatics in Fuel															●		●	
Oxygenates in Fuel				●	●	●											●	
Sulfur Compounds in Fuel								●					●	●		●		
Impurities in Fuel						●						●				●		
Natural Gas, Natural Gas Liquids									●									
Hopanes (Triterpenes)											●							
ASTM D3606/Benzenes and Aromatics in Fuel																	●	
ASTM D2887	●																	
Extended ASTM D2877 Methods	●																	
ppm levels of C1-C5 hydrocarbons and fluorinated compounds		●																
Moisture Analysis in Fuel																		●
C1-C4 isomers in presence of water			●															

Biofuel Industry

	SPB®-Biodiesel	Petrocol® DH 150	Equity-1	SLB®-1ms	MET-Biodiesel	Omegawax	SLB®-IL60i	SLB®-IL111i
Bioethanol: Ethanol Content		●						
Biodiesel: FAME Profile						●	●	●
Biodiesel: Glycerin Impurity					●			
Biodiesel: Methanol Impurity			●	●				
Free and total glycerin	●				●			

Chemical Industry

	Petrocol® DH Octyl	Petrocol® DH 50.2	Petrocol® DH	Petrocol® DH 150	SPB®-1 SULFUR	Equity-1	SLB®-1ms	SLB®-5ms	PTA-5	SPB®-1000	Nukol	Carbowax Amine	Supelcowax 10	SLB®-IL59	SLB®-IL60i	SP®-2380	TCEP	SLB®-IL100	SLB®-IL111i	Chiral*	Carboxen®-1010 PLOT	Carboxen®-1006 PLOT	Supel-Q PLOT	Alumina KCl PLOT	Mol Sieve 5A PLOT	Bentone 34/DNDP SCOT	TCEP SCOT	BMEA SCOT	Fluorcol and Krytox	Micropacked Columns	Watercol™
Solvents								●					●		●																
C1-C5 Alkanes, Alkenes, Alkynes																								●							
Impurities in Ethylene																															
Impurities in Propylene																															
Aromatics													●	●	●				●							●					
Impurities in Toluene																	●	●									●				
Xylene Isomers													●	●	●											●					
Mineral Spirits																	●										●				
Chlorinated Solvents								●					●		●																
Pesticides								●												●											
Fluorocarbons																							●	●					●		
Alcohols						●	●	●					●		●					●											
Glycol Ethers (Cellosolves), Diols, Glycols										●	●				●					●											
Formalin																						●									
Ketones						●	●	●					●		●					●											
Carboxylic Acids as Methyl Esters																●			●	●											
Dicarboxylic Acids as Dimethyl Esters																●			●												
Tall Oil Fatty Acid as Methyl Esters																●			●												
Esters and Ethers										●	●				●					●											
Impurities in MTBE	●	●	●	●																											
Terpenes						●	●	●						●	●				●	●											
Amines									●			●		●	●																
Aromatic Amines (Anilines)									●			●		●	●																
Sulfur Compounds					●									●	●								●								
Dissolved Gas Analysis (DGA)																					●										
Gases, Light Hydrocarbons																					●	●	●	●	●						
Process Analyzers																										●	●	●		●	
Moisture Analysis																															●

* See “by Application” section

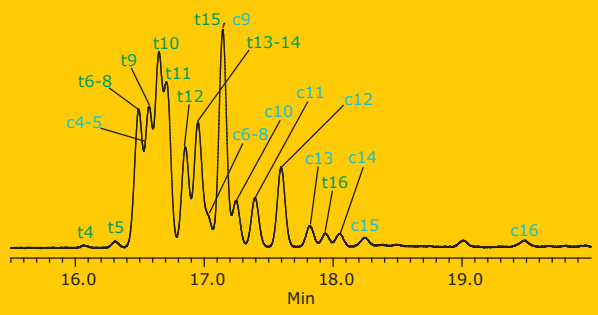
Agriculture Industry

	Equity-1	SLB®-5ms	SAC-5	Equity-1701	SPB®-608	SPB®-225	SPB®-PUFA	Nukol	SPB®-1000	Omegawax	Supelcowax 10	SLB®-IL59	SLB®-ILPAH	SLB®-PAHms	SLB®-IL60i	SP™-2331	SP™-2380	SP™-2560	SLB®-IL111i	Chiral*	Watercol™ 1910
Edible Oils		●	●							●		●			●		●	●	●		
Free Fatty Acids								●	●												
FAMEs by Boiling Point Elution	●	●	●																		
FAMEs by Degree of Unsaturation							●			●		●			●						
Omega 3 and Omega 6 FAMEs							●			●		●			●		●	●	●		
cis/trans FAME Isomers															●		●	●	●		
Pesticides		●		●	●															●	
Dioxins		●				●										●					
Flavors and Fragrances, Aroma	●	●									●				●				●	●	
Moisture Analysis																					●
PAHs													●	●							

* See “by Application” section

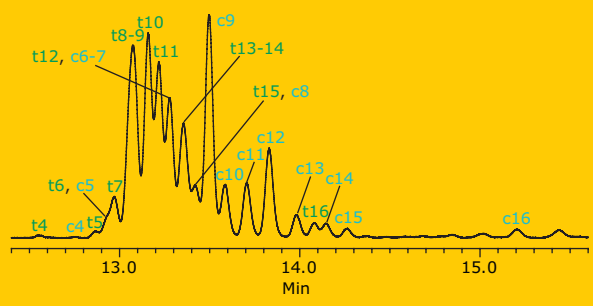
GC Analysis of C18:1 cis/trans FAME Isomers in Partially Hydrogenated Vegetable Oil (PHVO) on the SP™-2560

Column: SP®-2560, 100 m x 0.25 mm I.D., 0.20 µm (**24056**)
Oven: 180 °C isothermal
Inj. Temp.: 250 °C
Detector: FID, 250 °C
Carrier Gas: hydrogen, 1 mL/min
Injection: 1 µL, 100:1 split
Liner: 4 mm I.D., split liner with cup (**2051005**)
Sample: partially hydrogenated vegetable oil FAMEs



GC Analysis of C18:1 cis/trans FAME Isomers in Partially Hydrogenated Vegetable Oil (PHVO) on the SLB®-IL111

Column: SLB®-IL111, 100 m x 0.25 mm I.D., 0.20 µm (**29647-U**)
Oven: 168 °C isothermal
Inj. Temp.: 250 °C
Detector: FID, 250 °C
Carrier Gas: hydrogen, 1 mL/min
Injection: 1 µL, 100:1 split
Liner: 4 mm I.D., split liner with cup (**2051005**)
Sample: partially hydrogenated vegetable oil FAMEs



Food and Beverage Industry

	SPB®-Octyl	SPB®-1 SULFUR	Equity-1	SLB®-1ms	SLB®-5ms	MET-Biodiesel	SAC-5	SPB®-624	VOCOL®	SPB®-20	Equity-1701	SLB®-ILPAH	SLB®-PAHms	SPB®-608	SPB®-35	SPB®-50	SPB®-225	SPB®-PUFA	SLB®-35ms	Nukol/SPB®-1000	Omegawax	Supelcowax 10	SLB®-IL59	SLB®-IL60i	SP®-2331	SP®-2380	SP®-2560	SLB®-IL111i	Chiral*	Carboxen®-1010 PLOT	Carboxen®-1006 PLOT	Supel-Q PLOT	Alumina KCl PLOT	Mol Sieve 5A PLOT	Watercol™ 1910
Sugars as Alditol Acetates								●			●																								
Free Fatty Acids																				●															
FAMEs by Boiling Point Elution			●	●																															
FAMEs by Degree of Unsaturation																		●			●		●	●											
Omega 3 and Omega 6 FAMEs																		●			●		●	●											
cis/trans FAME Isomers																										●	●	●							
Fatty Acid Ethyl Esters (FAEEs)					●																●		●	●		●	●	●							
Mono-, Di-, Triglycerides						●																													
Sterols, Aliphatic Alcohols, Waxes						●	●																												
Amino Acids					●																								●						
Nutraceuticals, Antioxidants					●																														
Organic Acids					●															●		●		●											
Flavors & Fragrances, Aroma			●	●	●																	●		●					●						
Preservatives					●																														
Pesticide Residues					●						●			●					●										●						
Veterinary Drug Residues					●						●			●																					
Allergens					●																														
Dioxins, Furans, PCBs	●				●												●								●										
Phthalate Esters					●																														
Bisphenol A, BADGE, BFDGE, NOGE					●																														
Benzene								●	●														●	●				●							
Nitrosamines					●																		●	●											
PAHs					●							●	●	●	●								●	●											
Acrylamide																						●													
3-MCPD					●																														
Disinfection By-Products and Solvents					●						●																								
Adulterants					●																	●													
Beverage Analysis					●					●	●				●	●				●		●		●							●				
Sulfur Compounds in Beverages		●																					●	●							●				
Moisture Analysis																																			●

* See “by Application” section

Flavor and Fragrance Industry

	Equity-1	SLB®-1ms	SLB®-5ms	Supelcowax 10	SLB®-IL60i	Chiral*	Watercol™ 1910
Volatiles	●	●	●	●	●	●	
Essential Oils	●	●	●	●	●	●	
Moisture Analysis							●

* See “by Application” section

Cosmetic and Personal Care/Cleaning Product Industry

	Equity-1	SLB®-1ms	SLB®-5ms	PTA-5	SPB®-1000	Nukol	Carbowax Amine	Supelcowax 10	SLB®-IL60i	Chiral*	Watercol™ 1910	SLB®-IL111i
Alkalis				●			●					
Allergens			●						●			●
Coloring Compounds			●		●	●		●				
Fragrance Compounds	●	●	●					●	●	●		●
Glycols					●	●			●			
Preservatives			●									
Solvents in Cleaning Products			●		●	●		●	●			
Surfactants: Anionic					●	●						
Surfactants: Nonionic	●	●	●									
Moisture Analysis											●	

* See “by Application” section

Pharmaceutical Industry

	SLB®-5ms	PTA-5	Equity-5	OVI-G43/SPB®-624	Carbowax Amine	Supelcowax 10	Chiral*	Alumina KCl PLOT	Various Packed Columns	Watercol™ 1910
Residual Solvents			●	●		●				
Active Pharmaceutical Ingredient (API)	●	●			●		●			
Preservatives	●									
Heptafluoropropanes								●		
Pharmacopeia (USP/NF/BP/EP/JP) Methods									●	
Moisture Analysis										●

* See “by Application” section

Clinical Industry

	Equity-1	SLB®-5ms	PTA-5	SAC-5	SPB®-20	Equity-1701	SPB®-35	SPB®-PUFA	Nukol	SPB®-1000	Carbowax Amine	Omegawax	SLB®-IL59	SLB®-IL60i	SP®-2380	SP®-2560	SLB®-IL111i	Chiral*
Antidepressants						●												
Antiepileptics					●	●												
Antihistamines			●								●		●	●				
Bacterial Acid Methyl Esters (BAMEs)		●										●	●	●	●	●	●	
Basic Drug Screen		●	●				●				●		●	●				
Benzodiazepines as Acetic Anhydride Derivatives	●																	
Benzodiazepines as TBDMS Derivatives							●						●	●				
Carboxylic Acids as Methyl Esters															●	●	●	●
Cold and Sinus Medications			●								●		●	●				
Deprenyl (Selegiline)																		●
Estrogens		●																
Free Fatty Acids									●	●								
FAMEs by Boiling Point Elution	●																	
FAMEs by Degree of Unsaturation								●				●	●	●				
Omega 3 and Omega 6 FAMEs								●				●	●	●				
cis/trans FAME Isomers															●	●	●	
NSAIDs																		●
Phenothiazines		●																
Psychostimulants																		●
Steroids	●	●		●														
Sympathomimetic Amines			●								●		●					
Sympathomimetic Amines as HFBA Derivatives		●																
Sympathomimetic Amines as TFAA Derivatives		●																

* See “by Application” section

Forensic Industry

	Equity-1	SLB®-5ms	Supelcowax 10	PTA-5	SAC-5	Equity-5	VOCOL®	Equity-1701	SPB®-35	SPB®-1000	Nukol	Carbowax Amine	SLB®-IL59	SLB®-IL60i	Chiral*
Accelerants	●	●													
Blood Alcohols	●						●								
Explosives		●	●										●		
Glycols										●	●				
Drugs of Abuse															
Drug Screen as TBDMS Derivatives		●							●						
Drug Screen as TMS Derivatives		●							●						
Basic Drug Screen		●		●					●			●	●		
Amphetamines		●							●						●
Antidepressants								●							
Barbiturates		●						●	●						
Cannabinoids as TMS Derivatives		●							●						
Cocaine as TMS Derivatives		●							●						
GHB as MTBSTFA Derivatives		●													
Inhalants						●	●								
Ketamines as MBTFA Derivatives		●													
LSD as TMS Derivatives		●							●						
MDMA (Ecstasy) as HFBPC Derivatives		●													
Opiates as TMS Derivatives		●							●						
Phencyclidine (PCP)		●													
Psychostimulants															●
Steroids					●	●									
Tryptamines		●													

* See “by Application” section

Life Science Industry

	SLB®-5ms	Chiral*
Amino Acids	●	●

* See “by Application” section

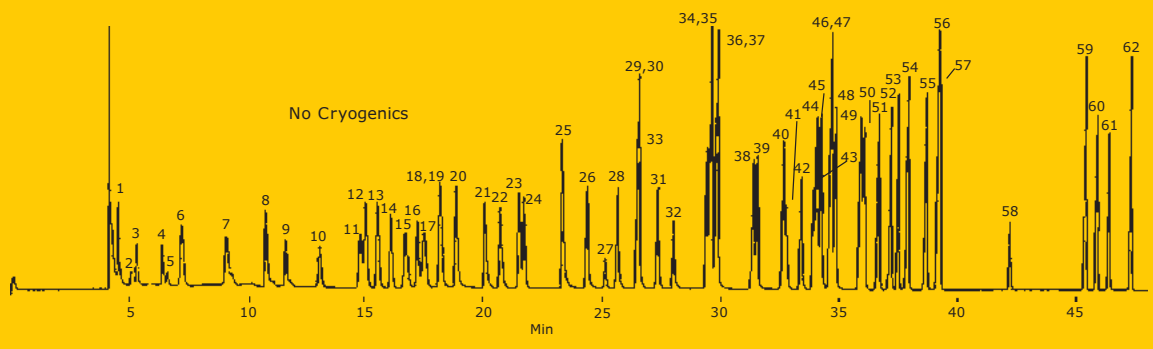
Industrial Hygiene Industry

	Equity-1	SLB®-5ms	VOCOL®	Supelcowax 10
US EPA Method IP-8		●		
NIOSH Method 1003			●	
NIOSH Method 1403	●			
NIOSH Method 1500/1501	●			
NIOSH Method 2530		●		
NIOSH Method 2542	●			
NIOSH Method 5503		●		
OSHA Method 52				●
OSHA Method 53	●			
OSHA Method 56	●			
OSHA Method 62		●		
OSHA Method 80				●

Volatile Compounds by US EPA Method 524.2 (PT/GC)

Sample/Matrix: 10 ppb each component in 5 mL water
Purge Trap: Vocarb 3000 (**21066-U**)
Purge: 40 mL/min for 11 min
Dry Purge: 3 min
Desorption Process: 250 °C for 4 min
Bake: 280 °C for 10 min
Column: VOCOL®, 105 m x 0.53 mm I.D., 3.0 µm film (**25358**)
Oven: 35 °C (10 min), 4 °C/min to 200 °C (10 min)
Scan Range: m/z = 35-260 at 0.6 scan/sec
Carrier Gas: helium, 10 mL/min

1. Dichlorodifluoromethane
2. Chloromethane
3. Vinyl chloride
4. Bromomethane
5. Chloroethane
6. Trichlorofluoromethane
7. 1,1-Dichloroethylene
8. Methylene chloride
9. trans-1,2-Dichloroethylene
10. 1,1-Dichloroethane
11. 2,2-Dichloropropane
12. cis-1,2-Dichloroethylene
13. Chloroform
14. Bromochloromethane
15. 1,1,1-Trichloroethane
16. 1,1-Dichloropropene
17. Carbon tetrachloride
18. 1,2-Dichloroethane
19. Benzene
20. Fluorobenzene (int std)
21. Trichloroethylene
22. 1,2-Dichloropropane
23. Bromodichloromethane
24. Dibromomethane
25. cis-1,3-Dichloropropene
26. Toluene
27. trans-1,3-Dichloropropene
28. 1,1,2-Trichloroethane
29. 1,3-Dichloropropane
30. Tetrachloroethylene
31. Chlorodibromomethane
32. 1,2-Dibromoethane
33. Chlorobenzene
34. 1,1,1,2-Tetrachloroethane
35. Ethylbenzene
36. m-Xylene
37. p-Xylene
38. o-Xylene
39. Styrene
40. Isopropylbenzene
41. Bromoform
42. 1,1,2,2-Tetrachloroethane
43. 1,2,3-Trichloropropane
44. n-Propylbenzene
45. Bromobenzene
46. 1,3,5-Trimethylbenzene
47. 2-Chlorotoluene
48. 4-Chlorotoluene
49. tert-Butylbenzene
50. 1,2,4-Trimethylbenzene
51. sec-Butylbenzene
52. p-Isopropyltoluene
53. 1,3-Dichlorobenzene
54. 1,4-Dichlorobenzene
55. n-Butylbenzene
56. 1,2-Dichlorobenzene-d_4 (int std)
57. 1,2-Dichlorobenzene
58. 1,2-Dibromo-3-chloropropane
59. 1,2,4-Trichlorobenzene
60. Hexachlorobutadiene
61. Naphthalene
62. 1,2,3-Trichlorobenzene



Column Selection by GC Technique & Application

In addition to the industry specific selection charts on the preceding pages, these easy-to-read phase selection charts highlight choices for applications that are independent of any industry. Simply locate the application to identify a recommended column phase.

The stationary phase also dictates the minimum and maximum temperatures at which a column can be used. Therefore, it is critical to ensure the selected stationary phase can withstand the temperature requirements of the GC method.

Fast GC Applications

	SLB®-1ms	Equity-1	SLB®-5ms	Equity-5	SPB®-624	VOCOL®	Equity-1701	Omegawax	Supelcowax 10	SLB®-IL59	SP®-2560	SLB®-IL82	SLB®-IL100	SLB®-IL111i
Volatiles					●	●								
Semivolatiles			●											
Pesticides			●	●			●							
PCBs			●	●			●			●		●		●
Fuels by Pattern Recognition	●	●	●											
Aromatics									●	●			●	●
Sulfur Compounds										●				
Biodiesel: FAME Profile								●						●
Solvents			●						●					
Aromatic Amines (Anilines)										●				
Omega 3 and Omega 6 FAMEs								●		●				
cis/trans FAME Isomers											●			●
Nitrosamines			●							●				
Essential Oils	●	●	●						●					
Drugs of Abuse			●											
General Purpose Non-Polar	●	●		●										
General Purpose Intermediate Polar							●							
General Purpose Polar									●					

GCxGC Applications

	SLB®-5ms	Equity-5	SPB®-5	PTA-5	SAC-5	SLB®-1ms	SPB®-1	Supelcowax 10	SLB®-IL60i	SLB®-IL59	SLB®-IL61	SLB®-IL111i	SP®-2380	SLB®-IL76i	SLB®-IL82	SP®-2331
Non-Polar Primary (1°) Column	●	●	●	●	●	●	●									
Polar Secondary (2°) Column								●		●	●	●		●	●	
Polar Primary (1°) Column								●	●	●	●	●	●	●	●	●
Non-Polar Secondary (2°) Column	●	●				●										

Chiral Applications

	Astec® Chiraldex TA	Astec® Chiraldex PN	Astec® Chiraldex DP	Astec® Chiraldex BP	Astec® Chiraldex DM	Supelco® DEX™ 325	Supelco® DEX™ 225	Astec® Chiraldex PM	Supelco® DEX™ 110	Supelco® DEX™ 120	Astec® Chiraldex DA	Astec® Chiraldex PH	α-Cyclodextrins	β-Cyclodextrins	γ-Cyclodextrins
Oxygen containing analytes in the form of alcohols, ketones, acids, aldehydes, and lactones; halogenated compounds	●														
Lactones and aromatic amines; epoxides; styrene oxide		●													
Aliphatic and aromatic amines; aliphatic and some aromatic esters; polar racemates			●												
Amino acids; amines; furans				●											
Aliphatic, olefinic, and aromatic enantiomers					●	●	●					●			
Terpenes and tertiary amines								●	●	●					
Heterocyclic amines											●				
Xylenes; menthols; cresols; substituted phenols; substituted benzenes; epoxide enantiomers													●		
Acids; alcohols; amines; diols; esters; ethers; halohydrocarbons; hydrocarbons; ketones; positional isomers; silanes; terpenes; terpineols														●	
α-BHC; carvone; carboxylic acids; methamphetamine															●

General Purpose (non-MS) Applications

	Equity-1	SPB®-1	Equity-5	SPB®-5	SPB®-20	Equity-1701	SPB®-35	SPB®-50	SPB®-225	Supelcowax 10	SP®-2330	SP®-2380	SP®-2340
Non-Polar Column	●	●	●	●									
Intermediate Polar Column					●	●	●	●					
Polar Column									●	●			
Highly Polar Column											●	●	●

Cross-Reference Chart

Supelco® Capillary GC Columns with Comparable Columns from Other Manufacturers

Supelco®	Agilent, Varian	Grace®	Macherey-Nagel	Phenomenex™	Restek	SGE®
Traditional (phases by increasing phase polarity)						
SPB®-Octyl	CP-Sil 2 CB	—	—	—	—	—
Petrocol® DH 50.2	DB-Petro, HP-PONA	—	—	—	—	BP1 PONA
Petrocol® DH	DB-Petro, CP-Sil PONA CB	AT-Petro	—	—	Rtx-1PONA	BP1 PONA
Petrocol® DH 150	—	—	—	—	—	—
Petrocol® EX2887	DB-2887, CP-SimDist	AT-2887	—	—	Rtx-2887	—
SPB®-1 SULFUR	CP-Sil 5 CB for Sulfur	AT-Sulfur	—	—	—	—
Equity-1, SPB®-1	DB-1, HP-1, CP-Sil 5 CB	AT-1	Optima-1	ZB-1	Rtx-1	BP1
SLB®-5ms	DB-5ms, HP-5ms, VF-5ms	AT-5ms	Optima-5 MS	ZB-5ms	Rtx-5Sil MS	BPX5
MET-Biodiesel	Select Biodiesel for Triglycerides	—	—	—	MXT-BiodieselTG	—
PTA-5	CP-Sil 8 CB for Amines	AT-Amine	—	—	Rtx-5 Amine	—
SAC-5	—	—	—	—	—	—
Equity-5, SPB®-5	DB-5, HP-5, CP-Sil 8 CB	AT-5	Optima-5	ZB-5	Rtx-5	BP5
SPB®-624	DB-624, DB-VRX, CP-Select 624 CB	AT-624	Optima-624	ZB-624	Rtx-624	BP624
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, CP-Sil 19 CB	AT-1701	Optima-1701	ZB-1701	Rtx-1701	BP10
SPB®-608	DB-608	AT-Pesticide	—	—	—	—
SPB®-35	DB-35, HP-35	AT-35	—	ZB-35	Rtx-35	—
SPB®-50	DB-17, HP-50, CP-Sil 24 CB	AT-50	Optima-17	ZB-50	—	—
SPB®-225	DB-225, CP-Sil 43 CB	AT-225	Optima-225	—	Rtx-225	BP225
SPB®-PUFA	—	—	—	—	—	—
SPB®-1000, Nukol	DB-FFAP, HP-FFAP, CP-FFAP CB	AT-1000, AT-AquaWax-DA	Optima-FFAP	ZB-FFAP	Stabilwax®-DA	BP21
Carbowax Amine	CAM, CP-Wax 51 for Amines	AT-CAM	—	—	Stabilwax-DB	—
Omegawax	—	AT-FAME	—	—	FAMEWAX	—
Supelcowax 10	DB-WAX, CP-Wax 52 CB	AT-WAX, AT-AquaWax	Optima-WAX	ZB-WAX	Rtx-WAX, Stabilwax	BP20
SLB®-IL59	—	—	—	—	—	—
SLB®-IL60i	—	—	—	—	—	—
SP®-2330	HP-88	—	—	—	Rtx-2330	—
SLB®-IL76i	—	—	—	—	—	—
SP®-2331	DB-Dioxin, CP-Sil 88 for Dioxins	—	—	—	Rtx-Dioxin2	—
SP®-2380	—	AT-Silar 90	—	—	—	—
SP®-2560	CP-Sil 88 for FAME	—	—	—	Rt-2560	—
SP®-2340	CP-Sil 88	AT-Silar 100	—	—	—	—
TCEP	CP-TCEP	—	—	—	Rt-TCEP	—
SLB®-IL100	—	—	—	—	—	—
SLB®-IL111i	—	—	—	—	—	—

Supelco®	Agilent, Varian	Grace®	Macherey-Nagel	Phenomenex™	Restek	SGE®
Chiral Phases						
Chiraldex	—	—	—	—	—	—
α-DEX™	—	—	FS-LIPODEX	—	—	—
β-DEX™	CycloSil-B	—	FS-LIPODEX, FS-HYDRODEX	—	Rt-βDEX	CYDEX-B
γ-DEX™	—	—	FS-LIPODEX	—	Rt-γDEX	—
PLOT Columns						
Carboxen®-1010 PLOT	CP-CarboPLOT P7	—	—	—	—	—
Carboxen®-1006 PLOT	GS-Carbon PLOT, CP-CarboBOND	Carbograph VOC	—	—	—	—
Supel-Q PLOT	HP-PLOT Q, CP-PoraPLOT Q	AT-Q	—	—	Rt-QPLOT	—
Alumina KCl PLOT	HP-PLOT Al_2O_3 "KCl", CP-Al_2O_3 PLOT KCl	—	—	—	—	—
Mol Sieve 5A PLOT	HP-PLOT Molesieve, CP-Molsieve 5A	AT-Mole Sieve	—	—	Rt-Msieve 5A	—
Silica PLOT	—	—	—	—	—	—
SCOT Columns						
BMEA	—	—	—	—	—	—
Bentone 43/DNDP	—	—	—	—	—	—
TCEP	—	—	—	—	—	—

Capillary Columns by Phase

Traditional Phases: 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

- **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-trimethyl-pentane 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)

SPB®-Octyl

- **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)

Petrocol® DH 50.2, DH, DH 150

- **Application:** These highly reproducible columns have considerable theoretical plate numbers and are designed for detailed analyses of petroleum products for PIANO, PONA and PNA-type analytes. The 100 m version includes an extensive retention index data sheet of 400+ analytes.
- **USP Code:** These columns meet USP G1, G2 and G9 requirements.
- **Phase:** Bonded; poly(dimethyl siloxane)
- **Temp. Limits:** -60 °C to 320 °C (isothermal or programmed)

Petrocol® EX2887

- **Application:** These columns are designed for ASTM Method D2887 (simulated distillation [Sim Dis] of petroleum fractions). Use Petrocol® EX2887 columns for samples having boiling points greater than 1,000 °F.
- **USP Code:** These columns meet G1, G2 and G9 requirements.
- **Phase:** Bonded; poly(dimethyl siloxane)
- **Temp. Limits:**
  - Petrocol® 2887: Subambient to 350 °C (isothermal or programmed)
  - Petrocol® EX2887: Subambient to 380 °C (isothermal or programmed)

SPB®-1 SULFUR

- **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)

Equity-1

- **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)

SPB®-1

- **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)

SLB®-5ms

- **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)

MET-Biodiesel

- **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)

PTA-5

- **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)

SAC-5

- **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)

Equity-5

- **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)

SPB®-5

- **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)

Traditional Phases: Intermediate Polar

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

- **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)

OVI-G43

- **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)

VOCOL® 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)

SPB®-20

- **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)

Equity-1701

- **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)

SPB®-608

- **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)

SPB®-35

- **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)

SPB®-50

- **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)

Traditional Phases: 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

- **Application:** We offer 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)

SPB®-PUFA

- **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)

SPB®-1000

- **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)

Nukol

- **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)

Carbowax Amine

- **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)

Omegawax 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)

Supelcowax 10

- **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)

SLB®-IL59

- **Application:** Selectivity more polar than PEG/wax phases, resulting in unique elution patterns. Higher maximum temperature than PEG/wax columns (300 °C compared to 270–280 °C). Great choice for analysis of neutral and moderately basic analytes.
- **USP Code:** None
- **Phase:** Non-bonded; 1,12-di(tripropylphosphonium)dodecane bis(trifluoromethylsulfonyl)imide
- **Temp. Limits:** Subambient to 300 °C (isothermal or programmed)

SLB®-IL60i

- **Application:** Modified (deactivated) version of SLB®-IL59 provides better inertness. Selectivity more polar than PEG/wax phases, resulting in unique elution patterns. Higher maximum temperature than PEG/wax columns (300 °C compared to 270–280 °C). Excellent alternative to existing PEG/wax columns. Also a good GCxGC column choice.
- **USP Code:** None
- **Phase:** Non-bonded; 1,12-di(tripropylphosphonium)dodecane bis(trifluoromethylsulfonyl)imide
- **Temp. Limits:** 35 °C to 300 °C (isothermal or programmed)

SLB®-IL61

- **Application:** The first of our third generation ionic liquid columns. Modified (triflate anion) version of SLB®-IL59 increases inertness. Selectivity more polar than PEG/wax phases, resulting in unique elution patterns. Higher maximum temperature than PEG/wax columns (290 °C compared to 270–280 °C). Great choice for analysis of neutral and moderately basic analytes.
- **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)

Traditional Phases: 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

- **Application:** We offer 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)

SLB®-IL76i

- **Application:** The first of our second generation ionic liquid columns. Phase structure engineered with numerous interaction mechanisms, resulting in selectivity differences even when compared to columns with similar GC column polarity scale values.
- **USP Code:** None
- **Phase:** Non-bonded; tri(tripropylphosphoniumhexanamido) triethylamine bis(trifluoromethylsulfonyl)imide
- **Temp. Limits:** Subambient to 270 °C (isothermal or programmed)

SP®-2331

- **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)

SP®-2380

- **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)

SP®-2560

- **Application:** This highly polar biscyanopropyl column was specifically designed for detailed separation of geometric-positional (*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)

SP®-2340

- **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)

SLB®-IL82

- **Application:** Selectivity slightly more polar than polysiloxane phases with a high percentage of cyanopropyl pendent groups, resulting in unique elution patterns. Great choice for analysis of neutral and moderately basic analytes.
- **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)

TCEP

- **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)

SLB®-IL100

- **Application:** World's first commercially available ionic liquid GC column. Serves as the benchmark of 100 on our GC column polarity scale. Selectivity almost identical to TCEP phase. Higher maximum temperature than TCEP columns (230 °C compared to 140 °C). Great choice for analysis of neutral and polarizable (contain double and/or triple C-C bonds) analytes.
- **USP Code:** None
- **Phase:** Non-bonded; 1,9-di(3-vinylimidazolium)nonane bis(trifluoromethylsulfonyl)imide
- **Temp. Limits:** Subambient to 230 °C (isothermal or programmed)

Traditional Phases: 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.

SLB®-IL111i

- **Application:** World's first commercial column to rate over 100 on our GC column polarity scale. Selectivity most orthogonal to non-polar and intermediate polar phases, resulting in very unique elution patterns. Maximum temperature of 270 °C is very impressive for such an extremely polar column. Great choice for separation of polarizable analytes (contain double and/or triple C-C bonds) from neutral analytes. Also a good GCxGC column choice.
- **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)

Chiral Phases

Chiral GC phases consist of derivatives of α-, β-, or γ-cyclodextrin for the separation of enantiomers. These phases can routinely separate a variety of underivatized non-aromatic enantiomers and several aromatic enantiomers that remain difficult to resolve by HPLC. These phases specifically and effectively separate many of these types of molecules, including thousands of compounds that are starting materials or intermediates for chiral synthesis, biochemical and pharmaceutical intermediates and metabolites, environmental contaminants, flavors, etc.

Chiraldex Columns

- **Application:** These columns are used for analyses of enantiomers to determine biological activity (pharmaceutical industry), aroma (flavor and fragrance and food and beverage industries), whether hazardous (environmental industry), and purity (chemical industry).
- **USP Code:** None
- **Phase:** Fourteen specialized phase chemistries comprised of complex derivatives of cyclodextrins that impart a broad range of selectivities
- **Temp. Limits:**
  - TA Phases: -10 °C to 180 °C (isothermal or programmed)
  - All Other Phases: -10 °C to 200 °C (isothermal) or 220 °C (programmed)

DEX™ Columns

- **Application:** These columns are used for analyses of enantiomers to determine biological activity (pharmaceutical industry), aroma (flavor and fragrance and food and beverage industries), whether hazardous (environmental industry), and purity (chemical industry).
- **USP Code:** None
- **Phase:** Ten unique phases comprised of derivatives of cyclodextrins that are able to perform many enantiomeric separations
- **Temp. Limits:** 30 °C to 230 °C (isothermal or programmed)

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 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

- **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)

Carboxen®-1006 PLOT

- **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)

Supel-Q PLOT

- **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)

Alumina chloride PLOT

- **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)

Mol Sieve 5A PLOT

- **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)

SCOT Columns

We are 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 Supelco® 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)

Catalog Numbers

Common Dimensions of Popular Phases

Traditional Phases (by increasing phase polarity)

Phase	I.D. (mm)	Length (m)	d_f (µm)	Beta Value	Cat. No.
SPB®-Octyl	0.25	30	0.25	250	**24218-U**
Petrocol® DH 50.2	0.20	50	0.50	100	**24133-U**
Petrocol® DH	0.25	100	0.50	125	**24160-U**
Petrocol® DH 150	0.25	150	1.00	63	**24155**
SPB®-1 SULFUR	0.32	30	4.00	20	**24158**
Equity-1	0.25	30	0.25	250	**28046-U**
Equity-1	0.25	60	0.25	250	**28047-U**
SPB®-1	0.25	30	0.25	250	**24028**
SPB®-1	0.25	30	1.00	63	**24029**
SPB®-1	0.32	30	0.25	320	**24044**
SPB®-1	0.32	30	1.00	80	**24045-U**
SPB®-1	0.32	60	1.00	80	**24047**
SPB®-1	0.53	30	1.50	88	**25303**
SPB®-1	0.53	30	3.00	44	**25341-U**
SPB®-1	0.53	30	5.00	27	**25345-U**
SLB®-5ms	0.10	10	0.10	250	**28465-U**
SLB®-5ms	0.10	15	0.10	250	**28466-U**
SLB®-5ms	0.18	20	0.18	250	**28564-U**
SLB®-5ms	0.25	30	0.25	250	**28471-U**
SLB®-5ms	0.25	60	0.25	250	**28472-U**
SLB®-5ms	0.32	30	0.25	320	**28482-U**
MET-Biodiesel	0.53	14	0.16	828	**28668-U***
PTA-5	0.25	30	0.50	125	**24277**
PTA-5	0.53	30	3.00	44	**25439**
SAC-5	0.25	30	0.25	250	**24156**
Equity-5	0.25	30	0.25	250	**28089-U**
Equity-5	0.25	30	1.00	63	**28094-U**
Equity-5	0.32	30	0.25	320	**28097-U**
Equity-5	0.53	30	5.00	27	**28279-U**
SPB®-5	0.20	30	0.20	250	**24166**
SPB®-5	0.25	30	0.25	250	**24034**
SPB®-5	0.25	30	1.00	63	**24035**
SPB®-5	0.25	60	0.25	250	**24036**
SPB®-5	0.32	15	0.25	320	**24101-U**
SPB®-5	0.32	30	0.25	320	**24048**
SPB®-5	0.32	30	1.00	80	**24049**
SPB®-5	0.32	30	0.25	320	**24050**
SPB®-5	0.53	15	1.50	88	**25304**
SPB®-5	0.53	30	0.50	265	**25317**
SPB®-5	0.53	30	3.00	44	**25343**
SPB®-5	0.53	60	3.00	44	**25350**
SPB®-5	0.32	50	5.00	16	**23307-U**
SPB®-5	0.53	30	1.00	133	**25420-U**
SPB®-5	0.32	25	0.52	154	**24359**
SPB®-5	0.32	60	1.00	80	**24051**
SPB®-5	0.25	60	1.00	63	**24037**
SPB®-5	0.53	30	1.50	88	**25305-U**
SPB®-5	0.53	30	5.00	27	**25347**
SPB®-5	0.53	60	5.00	27	**25351**
SPB®-624	0.18	20	1.00	45	**28662-U**
SPB®-624	0.25	30	1.40	45	**24255**
SPB®-624	0.25	60	1.40	45	**24256**
SPB®-624	0.32	30	1.80	44	**23323-U**

*A 2 m x 0.53 mm I.D. guard column is pre-attached.

Phase	I.D. (mm)	Length (m)	d_f (µm)	Beta Value	Cat. No.
SPB®-624	0.32	60	1.80	44	**24251**
SPB®-624	0.53	30	3.00	44	**25430**
SPB®-624	0.53	75	3.00	44	**25432**
OVI-G43	0.53	30	3.00	44	**25396**
VOCOL®	0.18	20	1.00	45	**28463-U**
VOCOL®	0.25	30	1.50	42	**24205-U**
VOCOL®	0.25	60	1.50	42	**24154**
VOCOL®	0.32	60	1.80	44	**24217-U**
VOCOL®	0.32	60	3.00	27	**24157**
VOCOL®	0.53	30	3.00	44	**25320-U**
VOCOL®	0.53	60	3.00	44	**25381**
VOCOL®	0.53	105	3.00	44	**25358**
SPB®-20	0.25	30	1.00	63	**24196-U**
Equity-1701	0.25	30	0.25	250	**28372-U**
Equity-1701	0.32	30	0.25	320	**28382-U**
Equity-1701	0.32	30	1.00	80	**28387-U**
Equity-1701	0.53	30	0.50	265	**28391-U**
SPB®-608	0.25	30	0.25	250	**24103-U**
SPB®-608	0.53	30	0.50	265	**25312**
SPB®-50	0.25	30	0.25	250	**24181**
SPB®-1000	0.25	30	0.25	250	**24313**
SPB®-1000	0.53	30	0.50	265	**25445**
Nukol	0.25	30	0.25	250	**24107**
Nukol	0.32	30	0.25	320	**24131**
Nukol	0.32	60	0.25	320	**24132**
Nukol	0.32	30	1.00	80	**24207**
Nukol	0.53	15	0.50	265	**25326**
Nukol	0.53	30	0.50	265	**25327**
Nukol	0.53	60	0.50	265	**25386**
Carbowax Amine	0.53	30	1.00	133	**25353**
Omegawax 100	0.10	15	0.10	250	**23399-U**
Omegawax 250	0.25	30	0.25	250	**24136**
Omegawax 320	0.32	30	0.25	320	**24152**
Supelcowax 10	0.10	15	0.10	250	**24343**
Supelcowax 10	0.25	30	0.25	250	**24079**
Supelcowax 10	0.25	60	0.25	250	**24081**
Supelcowax 10	0.25	30	0.50	125	**24284**
Supelcowax 10	0.32	30	0.25	320	**24080-U**
Supelcowax 10	0.32	60	0.25	320	**24082**
Supelcowax 10	0.25	100	0.25	250	**23308-U**
Supelcowax 10	0.32	15	0.25	320	**24078**
Supelcowax 10	0.25	15	0.25	250	**24077**
Supelcowax 10	0.53	15	1.00	133	**25300-U**
Supelcowax 10	0.20	30	0.20	250	**24169**
Supelcowax 10	0.32	30	0.50	160	**24084**
Supelcowax 10	0.32	60	0.50	160	**24085-U**
Supelcowax 10	0.32	30	1.00	80	**24211**
Supelcowax 10	0.32	60	1.00	80	**24212**
Supelcowax 10	0.53	30	0.50	265	**25325**
Supelcowax 10	0.53	30	1.00	133	**25301-U**
Supelcowax 10	0.53	60	1.00	133	**25391**
Supelcowax 10	0.53	30	2.00	66	**25375-U**
Supelcowax 10	0.53	60	2.00	66	**25376**
SLB®-IL59	0.25	30	0.20	313	**28891-U**
SLB®-IL60i	0.25	30	0.20	313	**29505-U**
SLB®-IL60i	0.25	60	0.20	313	**29833-U**
SLB®-IL60i	0.25	30	0.20	313	**29832-U**
SLB®-IL60i	0.18	20	0.14	321	**29829-U**
SLB®-IL60i	0.32	30	0.26	308	**29836-U**

Phase	I.D. (mm)	Length (m)	d_f (µm)	Beta Value	Cat. No.
SP®-2330	0.25	30	0.20	313	**24019**
SLB®-IL76	0.25	30	0.20	313	**28913-U**
SP®-2331	0.25	60	0.20	313	**24104-U**
SP®-2331	0.25	30	0.20	313	**24257**
SP®-2331	0.32	60	0.20	400	**24105-U**
SP®-2380	0.25	60	0.20	313	**24111**
SP®-2380	0.25	100	0.20	313	**24317**
SP®-2380	0.25	30	0.20	313	**24110-U**
SP®-2380	0.53	30	0.20	663	**25319**
SP®-2380	0.32	30	0.20	400	**24116-U**
SP®-2560	0.18	75	0.14	321	**23348-U**
SP®-2560	0.25	200	0.20	313	**29688-U**
SP®-2560	0.25	100	0.20	313	**24056**
SP®-2560	0.25	100	0.20	313	**23362-U****
SP®-2340	0.25	60	0.20	313	**24023**
SLB®-IL82	0.25	30	0.20	313	**29479-U**
TCEP	0.25	60	0.44	142	**24153**
SLB®-IL100	0.10	15	0.08	313	**28882-U**
SLB®-IL100	0.25	30	0.20	313	**28884-U**
SLB®-IL100	0.25	60	0.20	313	**28886-U**
SLB®-IL100	0.32	30	0.26	313	**28887-U**
SLB®-IL100	0.32	60	0.26	313	**28888-U**
SLB®-IL111i	0.10	15	0.08	313	**28925-U**
SLB®-IL111i	0.25	30	0.20	313	**28927-U**
SLB®-IL111i	0.25	100	0.20	313	**29647-U**
SLB®-IL111i	0.25	60	0.20	313	**28928-U**
SLB®-IL111i	0.25	200	0.20	313	**29689-U**

** 5" cage designed to fit an Agilent 6850 GC.

Chiral Phases

Phase	I.D. (mm)	Length (m)	d_f (µm)	Beta Value	Cat. No.
Chiraldex G-TA	0.25	30	0.12	500	**73033AST**
Chiraldex G-DP	0.25	30	0.12	500	**78033AST**
Chiraldex B-DM	0.25	30	0.12	500	**77023AST**
Chiraldex B-PM	0.25	30	0.12	500	**76023AST**
Chiraldex B-DA	0.25	30	0.12	500	**72023AST**
Chiraldex B-PH	0.25	30	0.12	500	**71023AST**
β-DEX™ 120	0.25	30	0.25	250	**24304**
β-DEX™ 120	0.25	60	0.25	250	**24305-U**
β-DEX™ 225	0.25	30	0.25	250	**24348**
β-DEX™ 325	0.25	30	0.25	250	**24308**
β-DEX™ 120	0.25	30	0.25	250	**24304**

Supelco®
Analytical Products

Merck KGaA
Frankfurter Strasse 250
64293 Darmstadt, Germany

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PLOT Columns

Phase	I.D. (mm)	Length (m)	Cat. No.
Carboxen®-1010 PLOT	0.32	30	**24246**
Carboxen®-1010 PLOT	0.53	30	**25467**
Carboxen®-1006	0.32	30	**24241-U**
Carboxen®-1006 PLOT	0.53	30	**25461**
Supel-Q PLOT	0.32	30	**24242**
Supel-Q PLOT	0.53	30	**25462**

SCOT Columns

Phase	Cat. No.
Bentone 34/DNP	**23813-U**
TCEP	**23829-U**
BMEA	**23818-U**

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