SUPELCO®
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GC Column Selection Guide

Achieve Optimal Method Performance

Performance

Reliability

Service

SIGMA-ALDRICH®

The History of Supelco and the Capillary Column

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.

Technical Service chemists are a valuable resource for providing guidance with the selection and use of capillary columns. Technical Service can be reached at 800-359-3041 (USA and Canada only), 814-359-3041, or at **techserv@sial.com**.

Year Introduced	Special Purpose Fused Silica Capillary GC Column
1983	SP™-2560
1984	SPB®-608, SUPELCOWAX® 10
1985	SP-2331
1986	VOCOL®
1987	Sup-Herb™, SP-2380
1988	Petrocol® DH, Nukol™
1989	Petrocol DH 150, Petrocol 2887
1990	Omegawax® 320, Petrocol DH 50.2
1991	Omegawax 250, SPB-1 SULFUR, Petrocol EX2887, Carbowax® Amine
1993	α-DEX™ 120, β-DEX 110, γ-DEX 120, SAC™-5, TCEP
1994	β-DEX 120, OVI-G43, Carboxen®-1006 PLOT, Mol Sieve 5A PLOT, Supel-Q™ PLOT, SCOT Columns
1995	SPB-624, SPB-PUFA, Petrocol DH Octyl, SPB-Octyl, PTA-5
1996	α-DEX 225, β-DEX 225, γ-DEX 225, α-DEX 325, β-DEX 325, γ-DEX 325, Omegawax 530, SPB-1000
1997	SPB-HAP, Carboxen-1010 PLOT
2003	Equity®-1701, Alumina chloride PLOT, Alumina sulfate PLOT
2005	SLB®-5ms
2007	CHIRALDEX® column line, Omegawax 100
2008	SLB-IL100, MET-Biodiesel
2009	SLB-IL59, SLB-IL76
2010	SLB-IL61, SLB-IL82, SLB-IL111
2012	SLB-IL60

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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.

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, such as those on pages 7–15. Charts like these 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.

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 for the separation of polar compounds. The "Phase Polarity" insert (see below) describes several recommended phases for each group of compound polarities.

Phase Polarity

This is the single most important characteristic in selecting a capillary column because it dictates selectivity, or the ability of the column to separate sample components. Phase selection is based on the general chemical principle that "likes dissolves like." A non-polar column is best for the analyses of non-polar compounds. Polar columns most effectively separate polar compounds.

Non-polar compounds are generally composed only of carbon and hydrogen atoms and contain carbon-carbon single bonds. Non-polar capillary columns separate these compounds very well. Interaction between non-polar compounds and a non-polar phase are dispersive, meaning that they are governed by Van der Waals forces. These are intermolecular attractions that increase with the size of the compound. Thus, larger compounds with higher boiling points have longer retention. Elution order generally follows the boiling points of the compounds.

Polar compounds are composed primarily of carbon and hydrogen atoms, but also contain one or more atoms of bromine, chlorine, fluorine, nitrogen, oxygen, phosphorus, or sulfur. Alcohols, amines, carboxylic acids, diols, esters, ethers, ketones, and thiols are typical polar compounds analyzed by capillary GC. Intermediate polar or polar capillary columns separate these compounds well. In addition to dispersive interactions, interactions between polar compounds and the phase include dipole, π-π, and/or acid-base interactions. Separations are determined by differences in the overall effects of these interactions.

Polarizable compounds are compounds composed of carbon and hydrogen, but contain one or more double or triple carbon-carbon bonds. These compounds include alkenes, alkynes, and aromatic (benzene-ring containing) hydrocarbons. Highly polar capillary columns are generally used to separate these compounds.

Phase Polarity Based on Compound Polarity

Compound Polarity	Compound Examples	Recommended Phases
Non-Polar		
C and H atoms only, C-C bonds	alkanes	Petrocol, SPB-Octyl, Equity-1, SPB-1, SLB-5ms, Equity-5, SPB-5
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, PAG, Omegawax, SPB-1000, 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

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 to 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 ideal I.D. for a given application is dependent on the analytical needs.

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.

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 (see "Fast GC Brochure" insert for further details). 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.

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

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.

Fast GC Brochure

The brochure "Fast GC: A Practical Guide for Increasing Sample Throughput without Sacrificing Quality" contains valuable information concerning Fast GC principles that is not covered in this space. Included are practical considerations, theoretical discussions, a listing of columns in Fast GC dimensions, chromatograms, a listing of related products designed to maximize performance, plus a list of literature for additional reading.

To request your copy, visit
sigma-aldrich.com/lit-request

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:

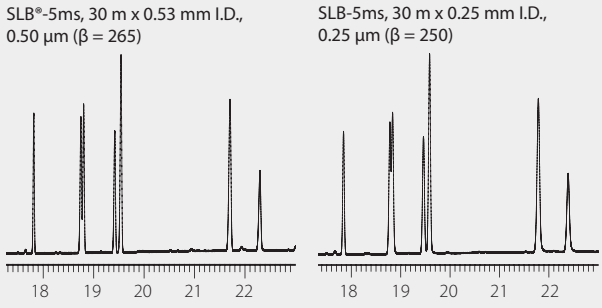
$$\beta = \frac{\text{column radius (µm)}}{\text{2 x film thickness (µm)}}$$

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



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: 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.

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.

Additional Reading

The following is a list of GC literature written by gas chromatography experts and researchers. Consult these references to learn more about the many facets of gas chromatography.

1. Harold McNair and James Miller, "Basic Gas Chromatography" (1997), Wiley, ISBN 0-471-17261-8.
2. David Grant, "Capillary Gas Chromatography" (1996), Wiley, ISBN 0-471-95377-6.
3. Dean Rood, "A Practical Guide to the Care, Maintenance, and Troubleshooting of Capillary Gas Chromatographic Systems" (1991), Hüthig, ISBN 3-7785-1898-4.
4. Konrad Grob, "Split and Splitless Injection in Capillary GC" (1993), Hüthig, ISBN 3-7785-2151-9.
5. Konrad Grob, "On-Column Injection in Capillary Gas Chromatography" (1991), Hüthig, ISBN 3-7785-2055-5.
6. William McFadden, "Techniques of Combined Gas Chromatography/Mass Spectrometry: Applications in Organic Analysis" (1988), Robert E. Krieger Publishing Company, ISBN 0-89464-280-4.
7. Marvin McMaster and Christopher McMaster, "GC/MS: A Practical User's Guide" (1998), Wiley-VCH, ISBN 0-471-24826-6.
8. Janusz Pawliszyn, "Solid Phase Microextraction: Theory and Practice" (1997), Wiley-VCH, ISBN 0-471-19034-9.

Product Literature

The following list of Supelco-published literature provides additional GC column information. To obtain any of these literature pieces no-charge, either visit our website at **sigma-aldrich.com/gc**, or contact Technical Service at 800-359-3041 (US and Canada only), 814-359-3041, or at techserv@sial.com

Title	Identification
GC Column Literature	
Fast GC Brochure	T407096 (JTW)
Dioxin and PCB Analysis	(JXB)
Petroleum/Chemical Application Guide	T109858 (AYD)
Free and Total Glycerin in B100 Biodiesel	T107943 (JLH)
Carboxen® PLOT Capillary GC Columns	T403146 (GFF)
Supel-Q™ PLOT Capillary GC Columns	T403148 (GFH)
Alumina PLOT Capillary GC Columns	T403145 (GFE)
Mol Sieve 5A PLOT Capillary GC Columns	T403147 (GFG)
Fatty Acid/FAME Application Guide	T408126 (KUK)
Capillary Column Choices for Residual Solvents	T103933 (FLX)
Chiral GC Columns	T411101 (OEM)
Supelco Columns for USP Methods (Poster)	T403109 (FWK)
SLB®-5ms Capillary GC Columns	T405130 (IKA)
Equity® Capillary GC Columns	T402049 (FAQ)
General Purpose Non-Polar Capillary GC Columns	T405132 (IKC)
General Purpose Polar Capillary GC Columns	T405131 (IKB)
General Purpose Intermediate Polarity Capillary GC Columns	T405133 (IKD)
Capillary GC Troubleshooting Guide	T112853 (AIP)
Installation/Maintenance of 0.25 and 0.32 mm I.D. Columns	T195895 (DLV)
Installation/Maintenance of 0.53 mm I.D. Columns	T195897 (DLU)
Packed GC Column Application Guide	T195890 (AYT)
Sulfur Gases by Packed GC	T100722 (AXP)
Permanent Gases and Light Hydrocarbons by Packed GC	T396112 (BYL)
Packed GC Troubleshooting Guide	T109792 (AIS)
Related Products Literature	
GC Accessories and Gas Purification/Management	T407103 (JWE)
Molded Thermogreen® LB-2 Septa	T407082 (JQV)
Capillary GC Inlet Liner Selection Guide	T196899 (BBB)
FocusLiner™ Inler Liners	T408101 (KOX)
Selecting The Appropriate Inlet Liner (Poster)	T404081 (HCH)
The Supelco Guide to Leak-Free Connections	T100741 (AXR)
Hydrogen: A Superior Carrier Gas Alternative to Helium	T308184 (KPP)
Selecting Purifiers for Gas Chromatography	T197918 (BIT)
Gas Management Systems for GC	T196898 (AYW)
Gas Generators	T407110 (JXP)
Purge-and-Trap Troubleshooting Guide	T197916 (BIN)
Air Monitoring	T408103 (KQV)
A Tool for Selecting an Adsorbent for Thermal Desorption	T402025 (EQF)
Carbon Adsorbent Kits	T406044 (IPS)
Syringes for Chromatographic & Analytical Applications	T406108 (JCS)
Vial Selection Guide (Poster)	T405074 (IBV)
Supelco Solid Phase Extraction Products	T402150 (FEB)
Solid Phase Microextraction Application Guide (CD-ROM)	T199925 (CJQ)
SPME: Theory and Optimization of Conditions	T198923 (BQT)
Solid Phase Microextraction Troubleshooting Guide	T101928 (EDV)
A Practical Guide to Quantitation with SPME	T101929 (EDW)
Derivatization Reagents	T407138 (KDI)

Column Selection by Industry

Supelco has 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 analysts to achieve the analytical performance they require. The easy-to-read phase selection charts on the next several pages are conveniently arranged by industry to simplify the process of selecting the proper phase.

First, find the chart that matches your industry. Then, locate the application within that industry to identify a recommended phase.

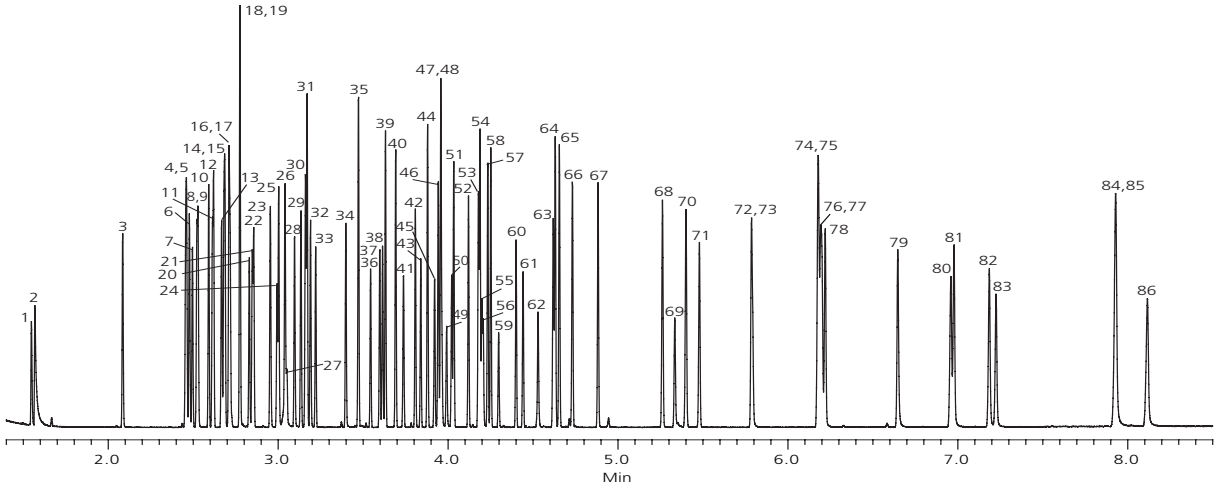
The stationary phase also dictates the minimum and maximum temperatures at which a column can be used. Therefore, it is critical to ensure the selected stationary phase can withstand the temperature requirements of the GC method. Temperature limitations can be located in the capillary column phase section on pages 17–24.

Environmental Industry

	SPB®-Octyl	SLB®-5ms	Equity®-5	SPB-624	VOCOL®	Equity-1701	SPB-608	Sup-Herb™	SPB-35	SPB-50	SPB-225	SPB-1000	SLB-IL59	SLB-IL60	SLB-IL82	SP™-2331	SLB-IL111	Chiral *
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.



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				●

Petroleum Industry

	Petrocol® DH Octyl	Petrocol DH 50.2	Petrocol DH	Petrocol DH 150	Petrocol 2887	Petrocol EX2887	SPB®-1 SULFUR	Equity-1	SLB-5ms	HT-5 (aluminum clad)	SUPELCOWAX 10	SLB-IL59	SLB-IL60	SLB-IL111	Supel-Q™ PLOT	GPA Packed Columns
Detailed Hydrocabon 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 (Triperpenes)									●							

Biofuel Industry

	Petrocol DH 150	Equity-1	MET-Biodiesel	Omegawax	SLB-IL60	SLB-IL111
Bioethanol: Ethanol Content	●					
Biodiesel: FAME Profile				●	●	●
Biodiesel: Glycerin Impurity			●			
Biodiesel: Methanol Impurity		●				

Chemical Industry

	Petrocol DH Octyl	Petrocol DH 50.2	Petrocol DH	Petrocol DH 150	SPB-1 SULFUR	Equity-1	SLB-5ms	PTA-5	SPB-1000	Nukol™	Carbowax® Amine	SUPELCOWAX 10	SLB-IL59	SLB-IL60	SP-2380	TCEP	SLB-IL100	SLB-IL111	Chiral*	Carboxen®-1010 PLOT	Carboxen-1006 PLOT	Supel-Q PLOT	Alumina sulfate PLOT	Alumina chloride PLOT	Mol Sieve 5A PLOT	Bentone® 34/DNDP SCOT	TCEP SCOT	BMEA SCOT	Squalane SCOT	Fluorocol™ and Krytox® Packed Columns	Micropacked Columns
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																										●	●	●	●		●

* 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-IL60	SP-2331	SP-2380	SP-2560	SLB-IL111	Chiral *
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	●	●									●		●					●

* See "by Application" section

Food and Beverage Industry

	SPB®-Octyl	SPB-1 SULFUR	Equity®-1	SLB®-5ms	MET-Biodiesel	SAC™-5	SPB-624	VOCOL®	SPB-20	Equity-1701	SPB-608	SPB-35	SPB-50	SPB-225	SPB-PUFA	Nukol™	SPB-1000	Omegawax®	SUPELCOWAX® 10	SLB-IL59	SLB-IL60	SP™-2331	SP-2380	SP-2560	SLB-IL111	Chiral*	Carboxen®-1010 PLOT	Carboxen-1006 PLOT	Supel-Q™ PLOT	Alumina sulfate PLOT	Alumina chloride PLOT	Mol Sieve 5A PLOT
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				●																●	●											
Furans																											●	●	●	●	●	●
PAHs				●							●	●								●	●											
Acrylamide																			●													
3-MCPD				●																												
Disinfection By-Products and Solvents				●						●																						
Adulterants				●															●													
Beverage Analysis				●					●	●		●	●			●	●		●		●								●			
Sulfur Compounds in Beverages		●																		●	●								●			

* See "by Application" section

Flavor and Fragrance Industry

	Equity-1	SLB-5ms	SUPELCOWAX 10	SLB-IL60	Chiral*
Volatiles	●	●	●	●	●
Essential Oils	●	●	●	●	●

* See "by Application" section

Cosmetic and Personal Care/Cleaning Product Industry

	Equity-1	SLB-5ms	PTA-5	SPB-1000	Nukol	Carbowax Amine	SUPELCOWAX 10	SLB-IL60	Chiral*
Alkalis			●			●			
Allergens		●							
Coloring Compounds		●		●	●		●		
Fragrance Compounds	●	●					●	●	●
Glycols				●	●			●	
Preservatives		●							
Solvents in Cleaning Products		●		●	●		●		
Surfactants: Anionic				●	●				
Surfactants: Nonionic	●	●							

* See "by Application" section

Pharmaceutical Industry

	SLB-5ms	PTA-5	Equity-5	OVI-G43	Carbowax Amine	SUPELCOWAX 10	Chiral*	Alumina chloride PLOT	Various Packed Columns
Residual Solvents			●	●		●			
Active Pharmaceutical Ingredient (API)	●	●			●		●		
Preservatives	●								
Heptafluoropropanes								●	
Pharmacopeia (USP/NF/BP/EP/JP) Methods									●

* 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-IL60	SP™-2380	SP-2560	SLB-IL111	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	PTA-5	SAC-5	Equity-5	VOCOL®	Equity-1701	SPB-35	SPB-1000	Nukol™	Carbowax Amine	SLB-IL59	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

Column Selection by 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. Temperature limitations can be located in the capillary column phase section on pages 17–24.

Fast GC Applications

	Equity®-1	SLB®-5ms	Equity-5	SPB®-624	VOCOL®	Equity-1701	Omegawax®	SUPELCOWAX® 10	SLB-IL59	SP™-2560	SLB-IL82	SLB-IL100	SLB-IL111
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	Equity-1	SPB-1	SUPELCOWAX 10	SLB-IL60	SLB-IL59	SLB-IL61	SLB-IL111	SP-2380	SLB-IL76	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, olefenic, 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 Applications

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

Cross-Reference Chart

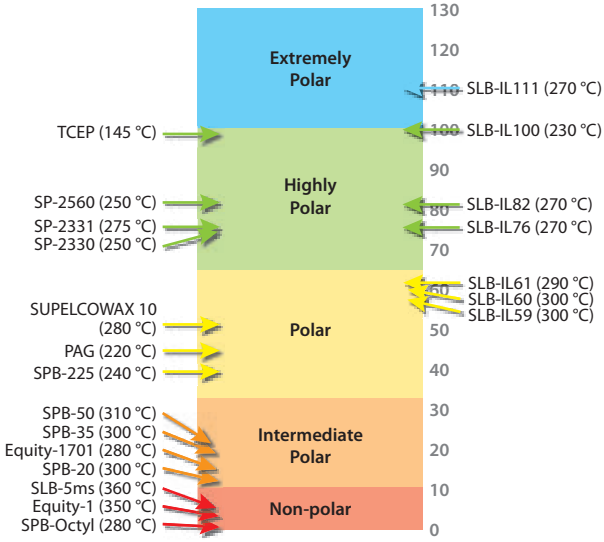
Table 3. Supelco Capillary GC Columns with Comparable Columns from Other Manufacturers

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-IL60	—	—	—	—	—	—	—
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							
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	Carbograph VOC	—	—	—	—	CP-CarboBOND
Supel-Q™ PLOT	HP-PLOT Q	AT-Q	—	—	Rt-QPLOT	—	CP-PoraPLOT Q
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	—	—	—	—	—	—	—

Capillary Columns by Phase

Looking for information or specifications for a particular phase? This section includes the most popular phases and provides application, USP code, polymer and temperature limit information. Where two maximum temperatures are listed (i.e. 200/220 °C), the first is for isothermal oven analyses, whereas the second is for oven temperature programmed analyses. To learn more about any phases listed, or to inquire about a phase not listed, contact Technical Service at 800-359-3041 (US and Canada only), 814-359-3041, or at **techserv@sial.com**.

Traditional Phases: 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).

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.

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-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)

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)

SPB®-HAP

- **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)

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 2887, EX2887

- **Application:** These columns are designed for ASTM Method D2887 (simulated distillation [Sim Dis] of petroleum fractions). Choose Petrocol 2887 for samples having boiling points up to 1,000 °F. Use Petrocol EX2887 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)

HT-5 (aluminum clad)

- **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)

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®

- **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)

Sup-Herb™

- **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)

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:** 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)

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)

PAG

- **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)

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®

- **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-IL60

- **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:** 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)

SLB®-IL76

- **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-IL111

- **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. The brochure "Astec® CHIRALDEX® and Supelco® DEX™ Chiral GC Columns: The Widest Variety of Derivatized Cyclodextrins" (T411101, OEM) contains valuable information concerning chiral GC columns, and includes selection guidelines. A copy of this brochure can be obtained at no-charge by contacting Technical Service at 800-359-3041 (US and Canada only), 814-359-3041, or at **techserv@sial.com**

CHIRALDEX

- **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)

Supelco® DEX™

- **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 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

- **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 sulfate PLOT

- **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)

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

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

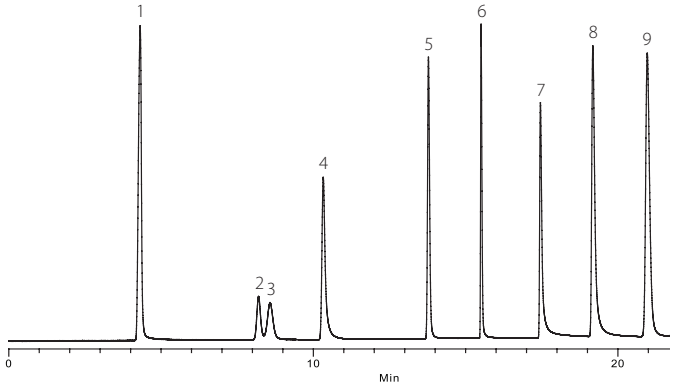
- **Application:** Use for analyses of aromatic analytes.
- **USP Code:** None
- **Phase:** 1,2,3-Tris(2-cyanoethoxy)propane
- **Temp. Limits:** 0 °C to 150 °C (isothermal or programmed)

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)



Catalog Numbers

Common Dimensions of Popular Phases

Table 4. 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	0.10	15	0.10	250	28039-U
Equity-1	0.25	30	0.25	250	28046-U
Equity-1	0.25	60	0.25	250	28047-U
Equity-1	0.32	30	0.25	320	28055-U
SPB-1	0.25	30	0.25	250	24028
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	0.18	20	0.36	125	28576-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*
HT-5 (aluminum clad)	0.32	25	0.10	800	25003
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	60	0.25	250	28090-U
Equity-5	0.25	30	0.50	125	28092-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	0.32	15	0.25	320	24101-U
SPB-5	0.32	30	0.25	320	24048
SPB-5	0.53	30	0.50	265	25317
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

*Plus an integrated 2 m x 0.53 mm I.D. guard.

Table 4. Traditional Phases (by increasing phase polarity) – *continued*

Phase	I.D. (mm)	Length (m)	d_f (µm)	Beta Value	Cat. No.
SPB®-624	0.25	30	1.40	45	24255
SPB-624	0.25	60	1.40	45	24256
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	0.10	15	0.10	250	28343-U
Equity-1701	0.25	30	0.25	250	28372-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	0.53	30	0.50	265	25445
Nukol™	0.25	30	0.25	250	24107
Nukol	0.53	15	0.50	265	25326
Nukol	0.53	30	0.50	265	25327
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	0.32	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	63	25375-U
SUPELCOWAX 10	0.53	60	2.00	53	25376
SLB®-IL59	0.10	15	0.08	313	28880-U
SLB-IL59	0.25	30	0.20	313	28891-U
SLB-IL60	0.25	30	0.20	313	29505-U
SLB-IL61	0.10	15	0.08	313	29484-U
SLB-IL61	0.25	30	0.20	313	29486-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	0.10	15	0.08	313	28909-U
SLB-IL76	0.25	30	0.20	313	28913-U
SP-2331	0.25	60	0.20	313	24104-U
SP-2331	0.32	60	0.20	400	24105-U
SP-2380	0.25	30	0.20	313	24110-U
SP-2380	0.25	60	0.20	313	24111
SP-2380	0.25	100	0.20	313	24317
SP-2380	0.32	30	0.20	400	24116-U
SP-2560	0.18	75	0.14	321	23348-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	0.10	15	0.08	313	29477-U
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	0.18	20	0.14	313	28883-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-IL111	0.10	15	0.08	313	28925-U
SLB-IL111	0.25	30	0.20	313	28927-U

**Wound onto a 5 inch cage to fit an Agilent 6850 GC.

Table 5. 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 225	0.25	30	0.25	250	24348
β-DEX 325	0.25	30	0.25	250	24308

Table 6. PLOT Columns

Phase	I.D. (mm)	Length (m)	Cat. No.
Carboxen®-1010 PLOT	0.53	30	25467
Carboxen-1006 PLOT	0.53	30	25461
Supel-Q™ PLOT	0.53	30	25462
Alumina sulfate PLOT	0.53	30	28323-U
Alumina chloride PLOT	0.53	30	28328-U
Mol Sieve 5A PLOT	0.53	30	25463

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