

HP-INNOWax

- Polyethylene glycol (PEG)
- High polarity
- Highest upper temperature limits of the bonded PEG phases
- Column-to-column repeatability
- Bonded and cross-linked
- Solvent rinsable
- Close equivalent to USP Phase G16

Similar Phases: SUPELCOWAX 10, SUPEROX II, CB-WAX, Stabilwax, BP-20, 007-CW, Carbowax, ZB-WAX, ZB-WAX+

HP-INNOWax

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
<i>0.18</i>	<i>20</i>	<i>0.18</i>	<i>40 to 260/270</i>	<i>19091N-577</i>	<i>19091N-577E</i>	<i>19091N-577LTM</i>
<i>0.20</i>	<i>25</i>	<i>0.20</i>	<i>40 to 260/270</i>	<i>19091N-102</i>		<i>19091N-102LTM</i>
		<i>0.40</i>	<i>40 to 260/270</i>	<i>19091N-202</i>		
	<i>50</i>	<i>0.20</i>	<i>40 to 260/270</i>	<i>19091N-105</i>	<i>19091N-105E</i>	
		<i>0.40</i>	<i>40 to 260/270</i>	<i>19091N-205</i>	<i>19091N-205E</i>	
<i>0.25</i>	<i>5</i>	<i>0.15</i>	<i>40 to 260/270</i>	<i>19091N-030</i>		<i>19091N-030LTM</i>
		<i>0.10</i>	<i>40 to 260/270</i>	<i>19091N-331</i>		
		<i>0.25</i>	<i>40 to 260/270</i>	<i>19091N-131</i>	<i>19091N-131E</i>	
		<i>0.50</i>	<i>40 to 260/270</i>	<i>19091N-231</i>		
	<i>30</i>	<i>0.15</i>	<i>40 to 260/270</i>	<i>19091N-033</i>		
		<i>0.25</i>	<i>40 to 260/270</i>	<i>19091N-133</i>	<i>19091N-133E</i>	<i>19091N-133LTM</i>
		<i>0.50</i>	<i>40 to 260/270</i>	<i>19091N-233</i>	<i>19091N-233E</i>	
		<i>0.15</i>	<i>40 to 260/270</i>	<i>19091N-036</i>		
<i>0.32</i>	<i>15</i>	<i>0.25</i>	<i>40 to 260/270</i>	<i>19091N-111</i>		
		<i>0.15</i>	<i>40 to 260/270</i>	<i>19091N-013</i>		<i>19091N-013LTM</i>
		<i>0.25</i>	<i>40 to 260/270</i>	<i>19091N-113</i>	<i>19091N-113E</i>	
	<i>60</i>	<i>0.50</i>	<i>40 to 260/270</i>	<i>19091N-213</i>	<i>19091N-213E</i>	
		<i>0.25</i>	<i>40 to 260/270</i>	<i>19091N-116</i>		
		<i>0.50</i>	<i>40 to 260/270</i>	<i>19091N-216</i>	<i>19091N-216E</i>	
<i>0.53</i>	<i>15</i>	<i>1.00</i>	<i>40 to 240/250</i>	<i>19095N-121</i>		
	<i>30</i>	<i>1.00</i>	<i>40 to 240/250</i>	<i>19095N-123</i>	<i>19095N-123E</i>	<i>19095N-123LTM</i>
	<i>60</i>	<i>1.00</i>	<i>40 to 240/250</i>	<i>19095N-126</i>		

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers



Column shown with EZ-GRIP

CP-Wax 52 CB

- Polyethylene glycol phase
- High polarity
- Wider temperature range than non-bonded polyethylene glycols
- Bonded and cross-linked
- Solvent rinsable
- High resolution of low boiling point analytes
- High polarity provides separations for a broad range of applications
- Excellent reproducibility and temperature stability for a variety of EPA and ASTM methods
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

Note: We recommend the UltiMetal column when working in rugged environments with process or portable instruments.

Similar Phases: SUPELCOWAX 10, SUPEROX II, CB-WAX, Stabilwax, BP-20, 007-CW, Carbowax, HP-INNOWax, Rtx-WAX, ZB-WAX, ZB-WAX+

CP-Wax 52 CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.10	10	0.10	20 to 250/265	CP7334	
		0.20	20 to 250/265	CP7335	
<i>0.15</i>	<i>15</i>	<i>0.12</i>	<i>20 to 250/265</i>	<i>CP7791</i>	
	<i>25</i>	<i>0.25</i>	<i>20 to 250/265</i>	<i>CP7792</i>	
0.20	30	0.20	20 to 250/265	CP7775	
	50	0.20	20 to 250/265	CP7785	
0.25	10	0.20	20 to 250/265	CP7703	
	15	0.25	20 to 250/265	CP8513	
	25	0.20	20 to 250/265	CP7713	CP7713I5
			20 to 250/265	CP7673	CP7673I5
	30	0.15	20 to 250/265	CP8745	
		0.25	20 to 250/265	CP8713	CP8713I5
		0.50	20 to 250/265	CP8746	
	50	0.20	20 to 250/265	CP7723	CP7723I5
60	0.25	20 to 250/265	CP8723		
		20 to 250/265	CP8748		

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers

(Continued)

CP-Wax 52 CB

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage	5 in Cage	
0.32	10	1.00	20 to 250/265	CP7628		
		15	0.15	20 to 250/265	CP8533	
			0.25	20 to 250/265	CP8543	
			0.50	20 to 250/265	CP8553	
	25	0.20	20 to 250/265	CP7743		
		0.40	20 to 250/265	CP7879		
		1.20	20 to 250/265	CP7763		
	30	0.25	20 to 250/265	CP8843		
		0.50	20 to 250/265	CP8763		
	50	0.20	20 to 250/265	CP7753		
			0.40	20 to 250/265	CP7889	
		1.20	20 to 250/265	CP7773	CP7773I5	
	60	0.25	20 to 250/265	CP8853		
			0.50	20 to 250/265	CP8773	
		1.20	20 to 250/265	CP8073	CP8073I5	
0.53	10	2.00	20 to 250/265	CP7648		
	15	1.00	20 to 250/265	CP8718		
	25	1.00	20 to 250/265	CP7638		
		2.00	20 to 250/265	CP7658	CP7658I5	
	30	1.00	20 to 250/265	CP8738	CP8738I5	
	50	1.00	20 to 250/265	CP7698	CP7698I5	
		2.00	20 to 250/265	CP7668		
	60	1.00	20 to 250/265	CP8798		
	100	2.00	20 to 250/265	CP7678		

CP-Wax 52 CB UltiMetal

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	Part No.
0.53	10	0.50	20 to 250/275	CP7128
		1.00	20 to 250/275	CP7148
	25	2.00	20 to 250/275	CP7178
		50	1.00	20 to 250/275
	2.00		20 to 250/275	CP7179

DB-FFAP

- Nitroterephthalic acid modified polyethylene glycol
- High polarity
- Temperature range from 40 °C to 250 °C
- Designed for the analysis of volatile fatty acids and phenols
- Replaces OV-351
- Bonded and cross-linked
- Solvent rinsable
- Close equivalent to USP Phase G35

Note: We do not recommend the use of water or methanol to rinse DB-FFAP GC columns.

Similar Phases: Stabilwax-DA, Nukol, 007-FFAP, BP21, AT-1000, OV-351

DB-FFAP

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.10	10	0.10	40 to 250	127-3212		127-3212LTM
	15	0.10	40 to 250	127-32H2		127-32H2LTM
0.25	15	0.25	40 to 250	122-3212		
	30	0.25	40 to 250	122-3232	122-3232E	122-3232LTM
		0.50	40 to 250	122-3233		
	60	0.25	40 to 250	122-3262	122-3262E	
		0.50	40 to 250	122-3263		
0.32	15	0.25	40 to 250	123-3212		
	25	0.50	40 to 250	123-3223		
	30	0.25	40 to 250	123-3232	123-3232E	123-3232LTM
		0.50	40 to 250	123-3233		123-3233LTM
		1.00	40 to 250	123-3234		123-3234LTM
	50	0.50	40 to 250	123-3253		
	60	0.25	40 to 250	123-3262		
		0.50	40 to 250	123-3263		
	1.00	40 to 250	123-3264			
0.45	30	0.85	40 to 250	124-3232		
0.53	10	1.00	40 to 250	125-32H2		
	15	0.50	40 to 250	125-3217		125-3217LTM
		1.00	40 to 250	125-3212		
	30	0.25	40 to 250	125-3231		
		0.50	40 to 250	125-3237		
		1.00	40 to 250	125-3232	125-3232E	
		1.50	40 to 250	125-3233		
	60	1.00	40 to 250	125-3262		

HP-FFAP

- Nitroterephthalic acid modified polyethylene glycol
- High polarity
- Temperature range from 60 °C to 240/250 °C (230/240 °C for 0.53 mm)
- Designed for the analysis of volatile fatty acids and phenols
- Replaces OV-351
- Bonded and cross-linked
- Solvent rinsable
- Close equivalent to USP Phase G35

Note: We do not recommend the use of water or methanol to rinse HP-FFAP GC columns.

Similar Phases: Stabilwax-DA, Nukol, 007-FFAP, BP21, AT-1000, OV-351

HP-FFAP

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7890/6890		
				7 in Cage	5 in Cage	LTM II Module
0.20	25	0.33	60 to 240/250	19091F-102	19091F-102E	19091F-102LTM
	50	0.33	60 to 240/250	19091F-105	19091F-105E	
0.25	30	0.25	60 to 240/250	19091F-433	19091F-433E	19091F-433LTM
0.32	25	0.50	60 to 240/250	19091F-112	19091F-112E	19091F-112LTM
	30	0.25	60 to 240/250	19091F-413		
	50	0.50	60 to 240/250	19091F-115	19091F-115E	
0.53	10	1.00	60 to 240	19095F-121		19095F-121LTM
	15	1.00	60 to 240	19095F-120	19095F-120E	
	30	1.00	60 to 240	19095F-123	19095F-123E	19095F-123LTM

TIPS & TOOLS

Agilent also offers CAM columns for amine analysis.



CP-Wax 58 FFAP CB

- Nitroterephthalic acid-modified polyethylene glycol phase
- High polarity
- Ideal for analysis of acidic compounds, such as phenols, underivatized and derivatized free fatty acids
- Highest polarity bonded wax column for analyzing polar compounds
- Chemically-bonded
- Solvent rinsable
- High inertness provides excellent peak shape
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

Similar Phases: SUPELCOWAX 10, SUPEROX II, CB-WAX, Stabilwax, BP-20, 007-CW, Carbowax, Rtx-WAX, ZB-WAX

CP-Wax 58 FFAP CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.20	25	0.30	20 to 250/275	CP7787	
	50	0.30	20 to 250/275	CP7797	
0.25	25	0.20	20 to 250/275	CP7717	CP771715
	50	0.20	20 to 250/275	CP7727	
0.32	25	0.20	20 to 250/275	CP7747	
		1.20	20 to 250/275	CP7767	
	50	0.20	20 to 250/275	CP7757	
		0.50	20 to 250/275	CP7778	
		1.20	20 to 250/275	CP7777	
0.53	15	0.50	20 to 250/275	CP7665	
		1.00	20 to 250/275	CP7614	
	50	2.00	20 to 250/275	CP7654	
		1.00	20 to 250/275	CP7624	
		2.00	20 to 250/275	CP7664	



TIPS & TOOLS

View the latest GC column focused applications, products and educational resources at www.agilent.com/chem/myGCColumns

Carbowax 20M and HP-20M

- Polyethylene glycol, MW 20,000
- Equivalent to USP Phase G16

Similar Phases: Rt-CW20M F&F

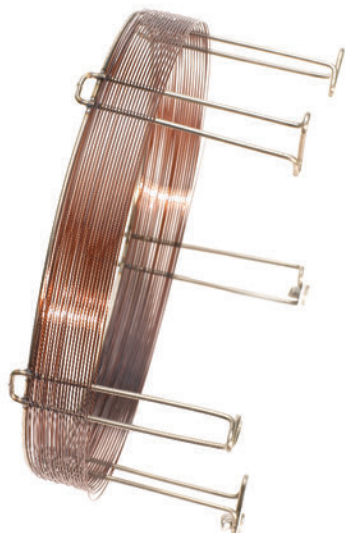
Because the Carbowax 20M and the HP-20M are not bonded or cross-linked, we do not recommend solvent rinsing. DB-WAX is the recommended bonded alternate for the HP-20M.

Carbowax 20M

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7890/6890	
				7 in Cage	LTM II Module
0.25	30	0.25	60 to 220/240	112-2032	112-2032LTM
0.32	30	0.25	60 to 220/240	113-2032	

HP-20M

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7890/6890		
				7 in Cage	5 in Cage	LTM II Module
0.20	25	0.10	60 to 220	19091W-102		
	50	0.10	60 to 220	19091W-105		
0.32	25	0.30	60 to 220	19091W-012	19091W-012E	19091W-012LTM
	50	0.30	60 to 220	19091W-015	19091W-015E	
0.53	10	1.33	60 to 220	19095W-121		
	30	1.33	60 to 220	19095W-123		



Specialty Columns

Agilent chemists have developed many columns with unique characteristics designed to solve the most difficult separation problems of a given method. As a result, we offer a comprehensive line of specialty or "select" columns for a variety of applications to enhance the standard phase portfolio. With columns for volatiles, pesticides, petrochemicals and more – Agilent exceeds standard QA/QC procedures for the manufacturing and testing of all of our specialty columns to ensure they meet the stringent demands for their application. These columns offer reliable, accurate results with the shortest run times possible on complex sample lists and matrices.

High Temperature Columns

DB-1ht

- 100% Dimethylpolysiloxane
- Non-polar
- Specially processed for extended temperature limit of 400 °C
- High temperature, polyimide-coated, fused silica tubing
- Excellent peak shape and faster elution times for high boilers
- Bonded and cross-linked
- Solvent rinsable

Similar Phases: Rxi-1HT, Stx-1ht, ZB-1ht

DB-1ht

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890
						LTM II Module
0.25	15	0.10	-60 to 400	122-1111	122-1111E	
	30	0.10	-60 to 400	122-1131		
0.32	15	0.10	-60 to 400	123-1111		123-1111LTM
	30	0.10	-60 to 400	123-1131	123-1131E	
0.53	30	0.17	-60 to 400	125-1131		

DB-5ht

- (5%-Phenyl)-methylpolysiloxane
- Non-polar
- Specially processed for extended temperature limit of 400 °C
- High temperature, polyimide-coated, fused silica tubing
- Excellent peak shape and faster elution times for high boilers
- Bonded and cross-linked
- Solvent rinsable

Similar Phases: HT5, Stx-5ht, ZB-5ht



DB-5ht

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7890/6890		
				7 in Cage	5 in Cage	LTM II Module
0.25	15	0.10	-60 to 400	122-5711	122-5711E	122-5711LTM
	30	0.10	-60 to 400	122-5731		122-5731LTM
0.32	10	0.10	-60 to 400	123-5701		123-5701LTM
	15	0.10	-60 to 400	123-5711	123-5711E	
	30	0.10	-60 to 400	123-5731	123-5731E	

DB-17ht

- (50%-Phenyl)-methylpolysiloxane
- Mid-polarity
- Extended upper temperature limit of 365 °C
- High temperature, polyimide-coated, fused silica tubing
- Excellent peak shape and faster elution times for high boilers
- Improved resolution for triglycerides
- Ideal for confirmational analyses
- Bonded and cross-linked
- Solvent rinsable

Similar Phases: Rtx-65TG, BPX50

DB-17ht

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	7890/6890
					LTM II Module
0.25	5	0.15	40 to 340/365	122-1801	122-1801LTM
	15	0.15	40 to 340/365	122-1811	
	30	0.15	40 to 340/365	122-1831	122-1831LTM
0.32	15	0.15	40 to 340/365	123-1811	
	30	0.15	40 to 340/365	123-1831	
	60	0.15	40 to 340/365	123-1861	



TIPS & TOOLS

Learn more about the Agilent 7890B GC System at www.agilent.com/chem/7890BGC

VF-5ht and VF-5ht UltiMetal

- Enhanced selectivity improves column longevity and reduces downtime
- Superior detector performance provides improved detection limits
- For analyses of high boiling compounds by exhibiting ultra low bleed at high temperatures
- Optimized sensitivity and accuracy for analysis of high molecular weight compounds
- Identical selectivity as VF-5ms (bleed spec of 30 m x 0.25 mm column is <5 pA at 400 °C)
- UltiMetal technology renders the stainless steel inert and enhances bonding of the stationary phase for improved column lifetime and excellent peak shape

Similar Phases: ZB-5ht, Rxi-5ht

VF-5ht

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	15	0.10	-60 to 400/400	CP9045
	30	0.10	-60 to 400/400	CP9046
0.32	10	0.10	-60 to 400/400	CP9044
	15	0.10	-60 to 400/400	CP9047
	30	0.10	-60 to 400/400	CP9048

Similar Phases: ZB-5ht, Rxi-5ht

VF-5ht UltiMetal

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.25	15	0.10	-60 to 430/450	CP9090	
		0.10	-60 to 430/450	CP9091*	
	30	0.10	-60 to 430/450	CP9092	
		0.10	-60 to 430/450	CP9093*	
0.32	15	0.10	-60 to 430/450	CP9094	CP9094I5
		0.10	-60 to 430/450	CP9095*	
	30	0.10	-60 to 430/450	CP9096	
		0.10	-60 to 430/450	CP9097*	

*These configurations include a 2 m x 0.53 mm id UltiMetal retention gap which are pre-connected to the VF-5ht UltiMetal column with a high temperature column connector.

Petroleum Columns

Petroleum applications vary greatly in character. From noble gases to simulated distillation, Agilent offers a broad range of columns designed to meet the needs of the petroleum/petrochemical chromatographer. Refer to the PLOT column section for columns for the analysis of light gases.

Lowox

- Unique selectivity for a wide range of oxygenates
- Minimal particle loss preserves detector performance
- Industry proven for process and portable GC applications (ASTM D7059)
- Analyze trace level oxygenate impurities in gas and liquid hydrocarbon streams
- High polarity
- Ideal for monitoring catalyst contamination by oxygenates

Lowox

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage	5 in Cage
0.53	10	10.00	0 to 350/350	CP8587	CP8587I5

GS-OxyPLOT

- Accurate analysis of ppm/ppb level oxygenates in C_1 to C_{10} hydrocarbons
- Strong selectivity for a wide range of oxygenates (ethers, alcohols, aldehydes, and ketones) in complex matrixes such as gaseous hydrocarbons, motor fuels, and crude oil
- Suitable for ASTM methods for oxygenates
- Very high column stability (upper temperature limit of 350°C) with no column bleed
- Stable phase coating virtually eliminates particle generation and detector spiking
- Excellent for low concentration, quantitative GC analysis
- Ideal for selective heart-cutting applications

GS-OxyPLOT

ID (mm)	Length (m)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage	5 in Cage
0.53	10	350	115-4912	115-4912E

CP-Sil 5 CB for Formaldehyde

- Optimized for analysis of formaldehyde, water and methanol
- Trace analysis of sulfur compounds possible
- Partial permanent gas analysis possible (especially in switching systems)
- Non-polar phase provides accurate separations based on volatility
- High inertness, elutes sulfur components without absorption for high quality data and low detection limits
- Highest efficiency for this apolar column with the thickest film

CP-Sil 5 CB for Formaldehyde

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.32	60	8.00	-60 to 300/325	CP7475

HP-PONA

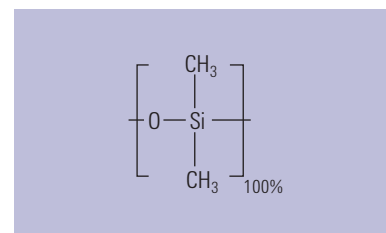
- 100% Dimethylpolysiloxane
- Configured for the analysis of petroleum process products
- Tested to ensure the resolution of m-xylene from p-xylene and of cyclopentane from 2,3-dimethylbutane
- PONA, PIANO
- High resolution
- Bonded and cross-linked
- Solvent rinsable

Note: 100 psi regulator required to reach optimum carrier gas velocity

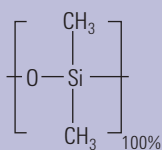
Similar Phases: Petrocol DH, SPB-1, 007-1, Rtx-1, MXT-1, Rtx-1PONA, Rtx-DHA

HP-PONA

Description	ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage	5 in Cage
HP-PONA	0.20	50	0.50	-60 to 325/350	19091S-001	19091S-001E
HP-1	0.20	50	0.50	-60 to 325/350	19091Z-205	19091Z-205E
HP-1	0.25	100	0.50	-60 to 325/350	19091Z-530	19091Z-530E



Structure of HP-PONA



Structure of CP-Sil PONA CB

CP-Sil PONA CB

- High resolution analysis of paraffins, olefins, naphthalenes and aromatics in complex hydrocarbon mixtures
- Engineered for hydrocarbon analysis according to ASTM (DHA method)
- Inert to polar compounds for highly accurate data
- Excellent column-to-column reproducibility

Similar Phases: Petrocol DH, SPB-1, 007-1, Rtx-1, MXT-1

CP-Sil PONA CB

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.21	50	0.50	250/275	CP7531	CP753115
0.25	100	0.50	250/275	CP7530	
0.25	150	1.00	250/275	CP7945	

CP-Sil PONA for ASTM D5134

- Optimized PONA analysis for ASTM D5134
- Exact dimensions as specified in the ASTM method for full compliance
- Inert to polar additives

CP-Sil PONA for ASTM D5134

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage
0.21	50	0.50	250/275	CP7531

DB-Petro

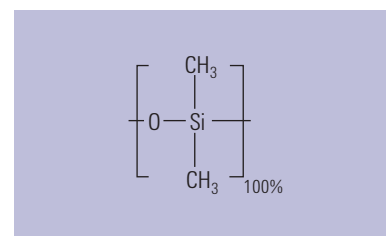
- 100% Dimethylpolysiloxane
- Configured for the analysis of petroleum process products
- PONA, PIANO
- High resolution
- Bonded and cross-linked
- Solvent rinsable

Note: 100 psi regulator required to reach optimum carrier gas velocity

Similar Phases: Petrocol DH, SPB-1, 007-1, Rtx-1, MXT-1

DB-Petro

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.20	50	0.50	-60 to 325/350	128-1056	
0.25	100	0.50	-60 to 325/350	122-10A6	122-10A6E



Structure of DB-Petro



HP-1 Aluminum Clad

- 100% Dimethylpolysiloxane
- Aluminum clad fused silica tubing
- For high temperature simulated distillation
- Bonded and cross-linked
- Solvent rinsable

Similar Phases: MXT-1

HP-1 Aluminum Clad

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage
0.53	5	0.09	0 to 350/450	19095S-205
	10	0.09	0 to 350/450	19095S-200

DB-2887

- 100% Dimethylpolysiloxane
- Specifically designed for simulated distillation using ASTM Method D2887
- Rapid conditioning, fast run time and low bleed when compared to packed columns
- Bonded and cross-linked
- Solvent rinsable

Similar Phases: Petrocol EX2887, MXT-2887, MXT-1, Rtx-2887

DB-2887

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7890/6890		
				7 in Cage	5 in Cage	LTM II Module
0.53	10	3.00	-60 to 350	125-2814	125-2814E	125-2814LTM



DB-HT SimDis

- 100% Dimethylpolysiloxane
- "Boiling point" phase for high temperature simulated distillation
- Durable stainless steel tubing
- 430 °C upper temperature limit
- Distillation range of C₆ to C₁₁₀₊
- Low bleed, even at 430 °C
- Bonded and cross-linked
- Solvent rinsable

Similar Phases: Petrocol EX2887, MXT-2887, Rtx-2887, AC Controls High Temp Sim Dist, AT-2887, ZB-1XT SimDist

DB-HT SimDis

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.53	5	0.10	-60 to 400/430	145-1009
		0.15	-60 to 400/430	145-1001

TIPS & TOOLS



For fast simulated distillation for ASTM method D7798-13, see the LTM columns.

Turn to page 447.

CP-SimDist

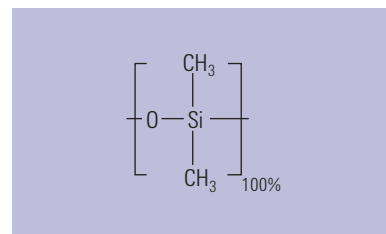
- For simulated distillation analysis up to C₁₀₀
- High temperature non-polar stationary phase
- Low bleed improves quantitation
- High temperature polyimide coating extends lifetime

CP-SimDist fused silica columns are guaranteed for simulated distillation up to C₁₀₀. These columns are low bleed, typically only 4-5 pA at 400 °C. The high temperature stationary phase and polyimide coating extend column lifetime.

Similar Phases: Petrocol EX2887, MXT-2887, Rtx-2887, AC Controls High Temp Sim Dist, AT-2887, ZB-1XT SimDist

CP-SimDist

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.32	10	0.10	375/400	CP7521	
0.53	5	0.17	375/400	CP7522	CP752215
	10	0.10	375/400	CP7541	



Structure of CP-SimDist

TIPS & TOOLS

For optimum performance, ferrules should be replaced every time the column is replaced and during column maintenance.

Turn to page 37.



CP-SimDist UltiMetal

- Designed for ASTM D2887 and the extended D2887 method compliance
- Low bleed
- Extended analysis to C₁₂₀ with maximum temperature of 450 °C
- UltiMetal tubing for excellent durability (same id as 0.53 mm id fused silica)
- Excellent retention time repeatability and column lifetime due to special deactivation of UltiMetal surface

Similar Phases: Petrocol EX2887, MXT-2887, Rtx-2887, AC Controls High Temp Sim Dist, AT-2887, ZB-1XT SimDist

CP-SimDist UltiMetal

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	
0.53	5	0.09	450/450	CP7569	CP7569I5	
		0.17	450/450	CP7532	CP7532I5	
		0.88	450/450	CP7570		
		2.65	400/400	CP7571		
	10	10	0.17	450/450	CP7542	
			0.06	450/450	CP6540	
			0.53	450/450	CP7592	
			0.88	450/450	CP7512	CP7512I5
			1.20	450/450	CP7562	
			2.65	400/400	CP7582	
			5.00	400/400	CP7572	
			20	0.11	450/450	CP7593
	25	0.06	450/450	CP6550		

CP-Sil 2 CB

- Lowest polarity bonded stationary phase available
- Superior replacement to squalane
- Unique selectivity toward cyclic hydrocarbons
- Separation almost entirely based on boiling point
- Stable at temperatures up to 200 °C

CP-Sil 2 CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	25	0.25	25 to 200/200	CP7714
0.32	50	0.25	25 to 200/200	CP7754
	25	1.20	25 to 200/200	CP7764

CP-TCEP for Alcohols in Gasoline

- Engineered for analysis of alcohols in gasoline
- Excellent peak shape for accurate separations of alcohols
- Temperature stability to 135 °C for high productivity
- Unique selectivity separates benzene after n-dodecane

Similar Phases: Rt-TCEP

CP-TCEP

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.25	50	0.40	135/140	CP7525	CP752515

DB-Sulfur SCD

- Engineered for sulfur chemiluminescence detection (SCD) to provide low bleed performance and reduced SCD ceramic tube fouling
- Extends SCD signal stability which greatly reduces instrument downtime and operational cost for detector maintenance
- Excellent peak shape for a wide range of reactive sulfur compounds from H₂S, COS, mercaptans and thiophenes
- 100% Dimethyl polysiloxane stationary phase (PDMS) as specified in ASTM methods such as D5623 and D5504
- Custom configurations are available through the custom column shop, www.agilent.com/chem/CustomColumn

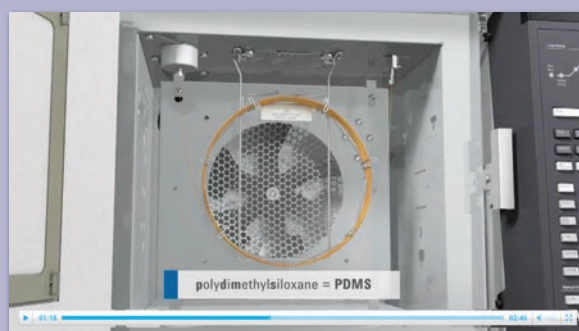
DB-Sulfur SCD

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.32	40	0.75	-60 to 270/290	G3903-63002
	40	3.00	-60 to 25/270	G3903-63004
	60	4.20	-60 to 25/270	G3903-63001
0.53	70	4.30	-60 to 25/270	G3903-63003

TIPS & TOOLS



J&W DB-Sulfur SCD GC Columns are optimized for low bleed and enhanced SCD signal stability. To view a video with more information, visit www.agilent.com/chem/db-sulfur_scd



Select Low Sulfur

- Highest degree of column inertness provides excellent peak shape for active compounds
- Low detection limits for sulfur compounds
- Unique selectivity prevents co-elution and matrix interferences in propylene streams
- Highly permeable PLOT stationary phase provides high retention of volatile compounds
- Unique QC testing results in consistent column inertness performance
- Mechanical stability results in no particle loss

Select Low Sulfur

ID (mm)	Length (m)	Temp Limits (°C)	7 in Cage
0.32	60	185	CP8575

CP-Sil 5 CB for Sulfur

- Optimized for analysis of volatile sulfur compounds
- Trace analysis of sulfur compounds to C₇ mercaptan for high productivity
- Non-polar phase provides accurate separations based on volatility
- High inertness, elutes SO₂ for high quality data and low detection limits

CP-Sil 5 CB for Sulfur

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.32	30	4.00	-60 to 300/325	CP7529



Select for Permanent Gases/CO₂ Column, CP7429

Select for Permanent Gases – Dual Column

- Set of two parallel columns: CP-Molsieve 5Å for permanent gases and PoraBOND Q for CO₂ analysis
- Isothermal separation at temperatures >40 °C eliminates the need for cryogenics
- Temperature stability up to 300 °C allows short regeneration times and improves efficiency
- One injector, one detector simplifies operation
- Engineered for fast separation, low level analysis and quantification of argon/oxygen
- Separates permanent gases and CO₂ in a single run
- Coupled, tested and securely mounted on EZ-GRIP column mount
- For resolution of the difficult-to-separate argon/oxygen and helium/neon pairs, use CP7530 Select Permanent Gases/HR (High Resolution) column

Select for Permanent Gases – Dual Column

Description	Temp Limits (°C)	7 in Cage
Select Permanent Gases/CO ₂	300/325	CP7429
Select Permanent Gases/HR	300/325	CP7430

Select Al₂O₃ MAPD

- Aluminum oxide PLOT column for the analysis of reactive hydrocarbons such as methyl acetylene and propadiene (MAPD)
- Optimized to improve sensitivity and response
- Faster run improves operating efficiency
- Two-fold higher response for MAPD, especially important when running impurity analyses

Similar Phases: Rt-Alumina BOND/MAPD, MXT-Alumina BOND/MAPD

Select Al₂O₃ MAPD

ID (mm)	Length (m)	Temp Limits (°C)	7 in Cage
0.32	25	-100 to 200/200	CP7433
	50	-100 to 200/200	CP7431
0.53	50	-100 to 200/200	CP7432

Agilent J&W Biodiesel Capillary GC Columns

Biofuels are becoming more attractive as a viable supplement or alternative to petroleum-based fuels. Agilent J&W Biodiesel Capillary GC columns are purposely designed and application-optimized for the analysis of biodiesel to meet ASTM and CEN testing standards.

Biodiesel EN14105 Free/Total Glycerin and Biodiesel ASTM D6584 Free/Total Glycerin

- Designed for the analysis of free and total glycerin in B100 according to EN14105 or ASTM D6584
- Specially processed for extended temperature limit of 400 °C
- High temperature, polyimide-coated fused silica tubing
- Excellent peak shape and extended column life
- Bonded and cross-linked
- Solvent rinsable
- Retention gaps please order p/n 160-BD65-5 (5 m x 0.53 mm)

Biodiesel EN14103 FAME Analysis

- Specially designed for the analysis of esters and linoleic acid methyl esters in B100 using EN14103
- Bonded and cross-linked
- Solvent rinsable

Biodiesel EN14110 Residual Methanol

- Specially designed for the determination of trace methanol in B100 using EN14110
- Bonded and cross-linked
- Solvent rinsable



Biodiesel Capillary GC Columns

Description	ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
Biodiesel ASTM D6584 Free/Total Glycerin	0.32	15	0.10	-60 to 400	123-BD11
Biodiesel EN14105 Free/Total Glycerin	0.32	10	0.10	-60 to 400	123-BD01
Biodiesel EN14103 FAME Analysis	0.32	30	0.25	40 to 260/270	1909BD-113
Biodiesel EN14110 Residual Methanol	0.32	30	1.80	20 to 260/280	123-BD34

Biodiesel Test Samples

Description	Part No.
Biodiesel MSTFA kit, 10 x 1 mL ampoules N-Methyl-N-(trimethylsilyl)trifluoro-acetamide for ASTM method D6584	5190-1407
Biodiesel D6584 kit 2 internal standard solutions, 1 mL, 5/pk and 2 internal standard solutions, 5 mL	5190-1408
Biodiesel E14105 kit, 4 x 1 mL ampoules 4 standard solutions	5190-1409
Biodiesel Monoglyceride kit, 3 x 1 mL ampoules	5190-1410



Select Biodiesel

- Complete set of biodiesel columns for full compliance and ease-of-use
- UltiMetal stainless steel technology provides high accuracy and longevity
- Pre-tested for complete confidence in results
- Good column lifetime when operating at temperatures up to 400 °C
- UltiMetal stainless steel column with ultra stable stationary phase
- Convenient pre-coupled retention gap that is leak tested

Technical Specifications

Method	Analytes	Column	Injector Type	Analysis Time (min)
ASTM D6584	Free and total glycerine	Select Biodiesel for Glycerides	On-column	32
EN14103	Ester and linoleic acid methyl esters	Select Biodiesel for FAME	Split/splitless	30
EN14105	Free and total glycerine; mono, di- and tri-glycerides	Select Biodiesel for Glycerides	On-column	35
EN14106	Free glycerol	Select Biodiesel for Glycerides	Split/splitless	10
EN14110	Methanol	Select Biodiesel for Methanol	Headspace with split/splitless	10

Select Biodiesel

Description	ID (mm)	Length (m)	Film (µm)	7 in Cage
For glycerides, UltiMetal, with 2 m retention gap	0.32	15	0.10	CP9078
For glycerides, UltiMetal	0.32	15	0.10	CP9079
For glycerides, UltiMetal, with 2 m retention gap	0.32	10	0.10	CP9076
For glycerides, UltiMetal	0.32	10	0.10	CP9077
For FAME, fused silica	0.32	30	0.25	CP9080
For Methanol, fused silica	0.32	30	3.00	CP9083
UltiMetal retention gap, methyl deactivated	0.53	2		CP6530

Select Silanes

- Stabilized trifluoropropyl-methyl polysiloxane phase for optimized ppm level analysis of silanes
- High capacity and retention
- Low bleed
- Reduced surface activity provides excellent peak shape
- Thick film offers high sample loading capacity and retention
- Typical applications include alkylated chlorosilanes at % levels as well as impurity analysis
- Valved, direct and split/splitless injections are possible

Select Silanes

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.32	30	1.80	0 to 270/300	CP7434
	60	1.80	0 to 270/300	CP7435
0.53	60	3.00	0 to 270/300	CP7437

CP-Volamine

- Non-polar stationary phase
- Excellent stability for samples containing water expands the application range
- Maximum temperature of 265 °C for enhanced productivity
- Highly inert providing sharp amine peaks for accurate results
- Produces symmetrical peaks due to MPD (Multi-Purpose Deactivation) technology
- Excellent performance even when the sample contains high percentages of water
- Ideal for analyzing volatile amines like MMA, DMA and TMA (monomethyl, dimethyl and trimethyl amine)

Similar Phases: Rtx-Volatile Amines

CP-Volamine

ID (mm)	Length (m)	Temp Limits (°C)	7 in Cage	5 in Cage
0.32	15	265/300	CP7446	
	30	265/300	CP7447	CP744715
	60	265/275	CP7448	CP744815

CP-Sil 8 CB for Amines

- Base deactivated 5% phenyl polydimethylpolysiloxane
- Optimized inertness performance for a broad range of amine compounds
- Thermal stability up to 350 °C enables separations of amines up to C₂₀ as well as alkanolamines
- Base deactivated columns also available as CP-Wax for Amines

Similar Phases: Rtx-5 Amine

CP-Sil 8 CB for Amines

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
<i>0.15</i>	<i>25</i>	<i>2.00</i>	<i>325/350</i>	<i>CP7599</i>	
0.25	30	0.25	325/350	CP7598	CP7598I5
	30	0.50	325/350	CP7595	CP7595I5
0.32	30	1.00	325/350	CP7596	CP7596I5
0.53	30	1.00	325/350	CP7597	

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers

CP-Wax for Volatile Amines and Diamines

Similar Phases: Stabilwax DB

CP-Wax for Volatile Amines and Diamines

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.32	25	1.20	220/220	CP7422
0.53	25	2.00	220/220	CP7424

PoraPLOT Amines

- Unique PLOT columns specially designed for high retention of very volatile amines
- High efficiency at temperatures above ambient eliminates the need for cryogenics
- High sensitivity for amines and ammonia

PoraPLOT Amines

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.32	25	10.00	-100 to 220/220	CP7591
0.53	25	20.00	-100 to 220/220	CP7594

Pesticides Columns

Agilent J&W low-bleed columns are ideal for the analysis of pesticides. Not only do they produce less bleed than a standard polymer, which improves the signal-to-noise ratio and minimum detectable quantities, but they also have higher upper temperature limits which allow for faster run times. Agilent also offers several common phases with additional pesticide-specific testing to ensure performance for your application.

Note: For CLP pesticides and other methods using electron capture detectors, see DB-35ms, DB-17ms and DB-XLB.

DB-CLP1 and DB-CLP2

- Universal column pair designed for pesticides analyses
- EPA Methods: CLP (Contract Lab Program) pesticides, 504.1, 505, 508.1, 551, 552.3, 8081B, 8082A, 8154A
- Ideal for dual column, dual ECD GC analyses
- DB-CLP1 and DB-CLP2 columns are regularly used in sets. Connect them together easily with an Agilent Ultra Inert, universal press fit Y-splitter (5190-6980), or an UltiMetal Plus deactivated CFT un-purged splitter (G3184-60065)
- Mid polarity stabilized phases provide fast and low bleed reliable analyses
- Special testing includes pesticides for proof of performance and column to column reproducibility
- DB-CLP1 primary, DB-CLP2 confirmation

DB-CLP1 and DB-CLP2

Description	ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
DB-CLP1	0.32	30	0.25	50 to 340/360	123-8232
DB-CLP2	0.32	30	0.50	50 to 340/360	123-8336



TIPS & TOOLS

Check out Agilent's complete line of sample preparation products for any type of GC and GC/MS analysis at www.agilent.com/chem/sampleprep



VF-5 Pesticides

- Specially designed for the determination of trace levels of pesticide residue
- Highly inert for enhanced ECD and MS detection
- Tested with key pesticides including endrin and aldrin for optimal performance and consistency of results
- Low bleed

VF-5 Pesticides

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.25	30	0.25	-60 to 325/350	CP9074
	50	0.25	-60 to 325/350	CP9073
0.32	30	0.25	-60 to 325/350	CP9075

TIPS & TOOLS

Tips and tricks for making better connections...

- It's important to use ferrules and nuts appropriate for your application, so graphite/polyimide ferrules and Agilent Self Tightening column nuts for oxygen detectors, or UltiMetal Plus Flexible Metal ferrules for ultimate flow path inertness
- Never over tighten fittings to avoid soft ferrules extruding into the fitting, contaminating or creating active sites in the flow path
- Install column at the correct and consistent height, critical for accurate and reproducible results
- Reduce and eliminate leaks at the MS interface with the Agilent Self Tightening column nuts that give you a tight connection without expensive upgrades or adaptors

Watch the animation that shows how to make better column connections in a GC or GC/MS, at www.agilent.com/chem/mbcvideo



DB-1701P

- Low/mid-polarity
- Exact replacement of HP-PAS1701
- Specifically designed and processed for the analysis of organochlorine pesticides
- ECD tested to ensure minimal pesticide breakdown and low ECD bleed
- Bonded and cross-linked
- Solvent rinsable

Similar Phases: SPB-1701, Rtx-1701, BP-10, CB-1701, OV-1701, 007-1701, ZB-1701P

DB-1701P

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	7890/6890
					LTM II Module
0.25	30	0.25	-20 to 280/300	122-7732	122-7732LTM
0.32	25	0.25	-20 to 280/300	123-7722	
	30	0.25	-20 to 280/300	123-7732	
0.53	30	1.00	-20 to 260/280	125-7732	

VF-1701 Pesticides

- Specially designed for the determination of trace levels of pesticide residues
- Columns individually tested with key pesticides, including endrin and aldrin
- Highly inert for improved detection limits for trace pesticide determination
- Proven performance with ECD or MS detection
- Ultra low bleed to improve sensitivity

VF-1701 Pesticides

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	30	0.25	-20 to 280/300	CP9070
	50	0.25	-20 to 280/300	CP9072
0.32	30	0.25	-20 to 280/300	CP9071

CP-Sil 8 CB for Pesticides

- Linear column response down to femtogram level for improved productivity
- Excellent inertness – tested with DDTs to provide very reliable data
- Can be used with on-column injection techniques
- Integrated retention gap helps avoid problems with solvent condensation allowing repeated splitless injections without phase deterioration

CP-Sil 8 CB for Pesticides

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	50	0.12	300/325	CP7481
0.53	50	0.25	300/325	CP7504

CP-Sil 19 CB for Pesticides

- Ideal as a confirmation column for reliable results
- Specified for EPA and CLP analytes for ultimate compliance
- Supplied with a coupled retention gap for on-column injection for best detection limits

CP-Sil 19 CB for Pesticides

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	30	0.25	275/300	CP7406
	50	0.20	275/300	CP7407
0.53	30	1.00	260/275	CP7409

DB-608

- Specifically designed for the analysis of chlorinated pesticides and PCBs
- US EPA Methods: 608, 508, 8080
- Excellent inertness and recoveries without pesticide breakdown
- Bonded and cross-linked
- Solvent rinsable
- Exact replacement of HP-608

Similar Phases: SPB-608, NON-PAKD Pesticide, 007-608

DB-608

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage	7890/6890 LTM II Module
0.25	30	0.25	40 to 280/300	122-6832	
0.32	30	0.50	40 to 280/300	123-1730	123-1730LTM
0.53	30	0.50	40 to 260/280	125-6837	
		0.83	40 to 260/280	125-1730	

HP-PAS5

- Non-polar
- Specifically designed and processed for the analysis of organochlorine pesticides
- ECD tested to ensure minimal pesticide breakdown and low ECD bleed
- Bonded and cross-linked
- Solvent rinsable

Similar Phases: SPB-5, RSL-200, Rtx-5, BP-5, CB-5, OV-5, 007-2 (MPS-5), SE-52, SE-54, XTI-5, PTE-5, CC-5, ZB-5

HP-PAS5

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage
0.32	25	0.52	-60 to 325/350	19091S-010

Rapid-MS

- Equivalent to 5% phenyl, 95% dimethylpolysiloxane
- Fast analysis time improves productivity
- Reduce analysis time by 3-5x for temperature programmed, and up to 10x for isothermal runs
- The film thickness from 0.1 to 1 μm ensures high loadability and higher sensitivity
- Low bleed

Note: Rapid-MS columns utilize the high optimal carrier gas velocity obtained when a separation is performed under reduced pressure for fast analysis times

Rapid-MS

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.53	10	0.12	-60 to 325/325	CP8131
		0.25	-60 to 325/325	CP8132
		0.50	-60 to 325/325	CP8133
		1.00	-60 to 325/325	CP8134

Restriction for Rapid-MS

Description	Part No.
Restriction for Rapid-MS, fused silica, 0.1 mm id, 0.6 m, 5/pk	CP8121

PAH Columns

Select PAH

- Full separation for all PAH isomers avoids false positives and inaccurate results
- Full separation of EPA PAHs in less than 7 minutes and EU PAHs in less than 30 minutes, including separation of chrysene, triphenylene and benzo(a)fluoranthene (type b, j, and k)
- Fast results with no need for further analysis
- Low bleed enhances sensitivity

Select PAH

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
<i>0.15</i>	<i>15</i>	<i>0.10</i>	<i>40 to 325/350</i>	<i>CP7461</i>
0.25	30	0.15	40 to 325/350	CP7462

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers

DB-EUPAH

- Specially designed for analysis of EU regulated PAHs
- Individually tested with application-specific QC test probe mixture
- Great resolution of critical isomers, e.g. benzo(b,j,k)fluoranthenes
- Superb thermal stability for accurate analysis of high boiling PAHs, e.g. dibenzopyrenes
- Excellent signal-to-noise ratio
- Optimized column dimensions for proven performance

DB-EUPAH

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
<i>0.18</i>	<i>20</i>	<i>0.14</i>	<i>40 to 320/340</i>	<i>121-9627</i>
0.25	60	0.25	40 to 320/340	122-96L2

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers

CP-Sil PAH CB UltiMetal

- Separates all 16 PAHs according to EPA Method 610
- High temperature, low bleed phase
- Virtually unbreakable UltiMetal stainless steel capillary column
- Maximum temperature of 400/425 °C

CP-Sil PAH CB UltiMetal

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	25	0.12	400/425	CP7440

Semivolatiles Columns

Semivolatiles are usually extracted from soil samples or other environmental matrixes. GC columns with precise retention time reproducibility and good mass spectrometer performance are key enablers for these often demanding analyses.

DB-UI 8270D for Semivolatiles

- Designed for EPA Method 8270D and other regulated GC/MS semivolatiles analysis
- Special semivolatiles testing ensures poof of column to column performance for trace level analysis
- Excellent 2,4-dinitrophenol response
- Ultra inertness and low bleed
- Available in convenient and economical 6 packs (6 for the price of 5)

DB-UI 8270D for Semivolatiles

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
<i>0.18</i>	<i>20</i>	<i>0.36</i>	<i>-60 to 325/350</i>	<i>121-9723</i>
			<i>-60 to 325/350</i>	<i>621-9723, 6/pk*</i>
<i>0.25</i>	<i>30</i>	<i>0.25</i>	<i>-60 to 325/350</i>	<i>122-9732</i>
			<i>-60 to 325/350</i>	<i>622-9732, 6/pk*</i>
			<i>0.50</i>	<i>-60 to 325/350</i>

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers

*Only available in the US

CP-Sil 8 CB for PCB

- Engineered for the analysis of PCBs according to DIN method 51527
- Ideal for trace level ECD detection of PCBs
- High temperature stability provides low bleed and extended lifetime

CP-Sil 8 CB for PCB

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.25	50	0.25	300/325	CP7482

DB-5.625

- Close equivalent to a (5%-Phenyl)-methylpolysiloxane
- Non-polar
- Specially processed to exhibit excellent inertness for EPA Semivolatiles Methods 625, 1625, 8270 and CLP protocols*
- Surpasses EPA performance criteria for semivolatiles
- Inert for base, neutral and acidic compounds
- High temperature limit with excellent thermal stability and low bleed
- Bonded and cross-linked
- Solvent rinsable

*Pentachlorophenol, 2,4-dinitrophenol, carbazole, and N-nitrosodiphenylamine used to test response factors.

Similar Phases: XTI-5, Rtx-5, PTE-5, BPX-5

DB-5.625

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
<i>0.18</i>	<i>20</i>	<i>0.18</i>	<i>-60 to 325/350</i>	<i>121-5621</i>
		<i>0.36</i>	<i>-60 to 325/350</i>	<i>121-5622</i>
0.25	30	0.25	-60 to 325/350	122-5631
		0.50	-60 to 325/350	122-5632
		1.00	-60 to 325/350	122-5633
		60	0.25	-60 to 325/350
0.32	30	0.25	-60 to 325/350	123-5631
		0.50	-60 to 325/350	123-5632

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers

HP-5ms Semivolatile

- (5%-Phenyl)-methylpolysiloxane, identical selectivity to HP-5
- Non-polar
- Very low bleed characteristics, ideal for GC/MS
- Specifically tested for inertness for active compounds including acidic and basic compounds
- Improved signal-to-noise ratio for better sensitivity and mass spectral integrity
- Bonded and cross-linked
- Solvent rinsable
- Equivalent to USP Phase G27

Similar Phases: Rtx-5ms, Rxi-5ms, Rxi-5Sil MS, PTE-5, BPX-5, AT-5ms, ZB-5ms, SLB-5ms, Equity-6



HP-5ms Semivolatile

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.25	30	0.50	-60 to 325/350	19091S-139

CP-Sil 5/C18 CB for PCB

- Engineered for high resolution PCB analysis
- Lower polarity than 100% polydimethylpolysiloxane due to its C₁₈ substitution
- Provides high signal-to-noise ratios for ECD detectors
- Optimized column length for separation of critical isomer pairs:
28/31, 56/60, 149/118, 105/153/132 and 170/190

CP-Sil 5/C18 CB for PCB

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.25	50	0.10	275/300	CP7477
	100	0.10	275/300	CP7476

DB-Dioxin

- Specifically engineered for the analysis of polychlorinated dibenzodioxins (PCDDs) and dibenzofurans (PCDFs)
- Resolves 2,3,7,8-TCDD and 2,3,7,8-TCDF from all other isomers in one run
- Low bleed
- Bonded and cross-linked
- Solvent rinsable

Note: 100 psi regulator required to reach optimum carrier gas velocity

Similar Phases: SP-2331, 007-23, Rtx-2332, Rtx-Dioxin

DB-Dioxin

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage
0.25	60	0.15	40 to 250/270	122-2461
		0.25	40 to 250/270	122-2462

CP-Sil 88 for Dioxins

- High polarity stationary phase with specific selectivity for dioxins and dibenzofuran separations
- Integrated retention gap eliminates leaks and extends column lifetime with splitless injections
- 2,3,7,8-TCDD can be determined at low concentrations
- For fast runtimes, thin film configurations are available with maximum temperature program limit of 270 °C

Similar Phases: SP-2560, SP-2340, SP-2330, BPX-70, BPX-90

CP-Sil 88 for Dioxins

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage
0.25	50	0.20	50 to 225/240	CP7588
	60	0.10	50 to 250/270	CP7498

Volatiles Columns

Agilent offers a selection of advanced polymer chemistries for increasingly demanding volatiles applications. Whether for a primary analytical column or as a complementary confirmation column, Agilent J&W capillaries are chromatographers' first choice.

DB-624 Ultra Inert

- Environmental volatile organic compounds (VOCs) methods
- Excellent for US EPA Methods: 501.3, 502.2, 503.1, 524.2, 601, 602, 8010, 8015, 8020, 8240, 8260
- Industrial chemical analyses – solvents, petrochemicals, specialty chemicals
- Food and beverage – alcohols, fusel oils
- Pharmaceutical residual solvents per USP <467>
- Ultra inertness processing expands application range with excellent peak shape for low molecular weight acidic compounds
- UI testing ensures premium performance column to column
- Identical selectivity to the industry standard DB-624 – upgrade with no change in method required
- Optimized by the inventors of DB-624

DB-624 Ultra Inert

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
<i>0.18</i>	<i>20</i>	<i>1.00</i>	<i>-20 to 260</i>	<i>121-1324UI</i>
0.25	30	1.40	-20 to 260	122-1334UI
	60	1.40	-20 to 260	122-1364UI
0.32	30	1.80	-20 to 260	123-1334UI
	60	1.80	-20 to 260	123-1364UI
0.53	30	3.00	-20 to 260	125-1334UI
	75	3.00	-20 to 260	125-1374UI

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers

TIPS & TOOLS

Don't forget, we have special offers throughout the year. To learn more, visit www.agilent.com/chem/specialoffers



DB-624

- Specifically designed for the analysis of volatile priority pollutants and residual solvents
- No cryogenics needed for US EPA Method 502.2
- Excellent for US EPA Methods: 501.3, 502.2, 503.1, 524.2, 601, 602, 8010, 8015, 8020, 8240, 8260, and USP 467
- Excellent inertness for active compounds
- Bonded and cross-linked
- Solvent rinsable
- Exact replacement of HP-624
- Equivalent to USP Phase G43

Similar Phases: AT-624, Rxi-624 Sil MS, Rtx-624, PE-624, 007-624, 007-502, ZB-624

DB-624

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
<i>0.18</i>	<i>20</i>	<i>1.00</i>	<i>-20 to 260</i>	<i>121-1324</i>	<i>121-1324E</i>	<i>121-1324LTM</i>
0.20	25	1.12	-20 to 260	128-1324	128-1324E	128-1324LTM
0.25	30	1.40	-20 to 260	122-1334	122-1334E	122-1334LTM
	60	1.40	-20 to 260	122-1364	122-1364E	
0.32	30	1.80	-20 to 260	123-1334	123-1334E	123-1334LTM
	60	1.80	-20 to 260	123-1364	123-1364E	
0.45	30	2.55	-20 to 260	124-1334		124-1334LTM
	75	2.55	-20 to 260	124-1374		
0.53	15	3.00	-20 to 260	125-1314		
	30	3.00	-20 to 260	125-1334	125-1334E	125-1334LTM
	60	3.00	-20 to 260	125-1364	125-1364E	
	75	3.00	-20 to 260	125-1374	125-1374E	

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers

CP-Select 624 CB

- 6% Cyanopropyl, 94% dimethylpolysiloxane
- EPA volatiles methods 524.2, 624 and 8015
- Specified by Pharmacopoeia V.3.3.9 for residual solvents
- Excellent column-to-column reproducibility
- Low bleed

Similar Phases: AT-624, Rtx-624, PE-624, 007-624, 007-502, ZB-624

CP-Select 624 CB

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage	5 in Cage
<i>0.15</i>	<i>25</i>	<i>0.84</i>	<i>265/280</i>	<i>CP7411</i>	
0.25	30	1.40	265/280	CP7412	
	60	1.40	265/280	CP7413	
0.32	30	1.80	265/280	CP7414	
	60	1.80	265/280	CP7415	
0.53	30	3.00	265/280	CP7416	CP741615
	75	3.00	265/280	CP7417	
	105	3.00	265/280	CP7418	

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers

DB-VRX

- Unique selectivity engineered for optimum resolution of volatiles analysis:
US EPA Methods 502.2, 524.2 and 8260
- 0.45 mm id columns provide more plates per meter compared to 0.53 mm id columns for the fewest co-elutions for GC method (an industry first)*
- No subambient cooling required to resolve the six "gases"
- Fast run time:
<30 minutes for optimum sample throughput
<8 minutes with 0.18 mm id
- Low polarity
- Excellent peak shape
- Bonded and cross-linked
- Solvent rinsable

*Two co-elutions: 1) m- and p-xylene, for which US EPA does not require separation, and 2) 1,1,2,2-tetrachloroethane and o-xylene which are separated by detectors PID and ELCD, respectively. **Note to GC/MS analysts:** These co-eluting compounds have different primary characteristic ions of 83 and 106, respectively.

Similar Phases: VOCOL, NON-PAKD, Rtx-Volatiles, PE-Volatiles, 007-624, Rtx-VRX, Rtx-VGC

DB-VRX

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
<i>0.18</i>	<i>20</i>	<i>1.00</i>	<i>-10 to 260</i>	<i>121-1524</i>		<i>121-1524LTM</i>
	<i>40</i>	<i>1.00</i>	<i>-10 to 260</i>	<i>121-1544</i>	<i>121-1544E</i>	
0.25	30	1.40	-10 to 260	122-1534		122-1534LTM
	60	1.40	-10 to 260	122-1564	122-1564E	
0.32	30	1.80	-10 to 260	123-1534		
	60	1.80	-10 to 260	123-1564		
0.45	30	2.55	-10 to 260	124-1534		
	75	2.55	-10 to 260	124-1574		

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers

HP-VOC

- Selectivity engineered for US EPA Methods 502.2, 524.2 and 8260
- Low polarity – slightly more polar than DB-VRX
- Excellent peak shape
- Bonded and cross-linked
- Solvent rinsable

Similar Phases: NON-PAKD, Rtx-Volatiles, PE-Volatiles, 007-624, Rtx-VRX, Rtx-VGC

HP-VOC

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.20	30	1.10	-60 to 280/290	19091R-303
	60	1.10	-60 to 280/290	19091R-306
0.32	60	1.80	-60 to 280/290	19091R-316
	90	1.80	-60 to 280/290	19091R-319
0.53	90	3.00	-60 to 280/290	19095R-429
	105	3.00	-60 to 280/290	19095R-420

TIPS & TOOLS

As part of Agilent's ongoing commitment to be your partner in chromatography, we have created a series of GC Troubleshooting videos, featuring Daron Decker, GC Applications Specialist, and Herb Brooks, Agilent Service Engineer. To view the videos, visit www.agilent.com/chem/gctroubleshooting



DB-502.2

- Available in 105 m for volatiles analyses
- Excellent peak shape
- Bonded and cross-linked
- Solvent rinsable

DB-502.2

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.32	60	1.80	0 to 260/280	123-1464
0.53	105	3.00	0 to 260/280	125-14A4

DB-MTBE

- Low polarity stationary phase
- Resolves MTBE from 2-methylpentane and 3-methylpentane for better quantitation
- Engineered for purge and trap injection without the need for cryofocusing
- Bonded and cross-linked
- Solvent rinsable

DB-MTBE

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.45	30	2.55	35 to 260/280	124-0034

CP-Select CB for MTBE

- Engineered for analysis of MTBE in reformulated gasoline
- Unique selectivity for MTBE
- Broad dynamic range for quantification of MTBE
- Ideal as primary or confirmation column

CP-Select CB for MTBE

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.25	50	0.25	200/200	CP7528

DB-TPH

- Specifically designed for the analysis of total petroleum hydrocarbons (TPHs), soil analysis, and LUFT
- Three analyses in one injection – gas range organics, diesel range organics and motor oil
- Fast run time
- Bonded and cross-linked
- Solvent rinsable

DB-TPH

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.32	30	0.25	-10 to 320	123-1632

TIPS & TOOLS

For a precision cut on your capillary column, use Agilent's GC column cutting tool (p/n 5183-4620).



Select Mineral Oil

- Stabilized non-polar bonded phase engineered for fast mineral oil analysis
- Optimized selectivity for reliable Total Petroleum Hydrocarbon (TPH) results per DIN H53 N-ISO 9377-2 methods
- C₄ to C₄₀ hydrocarbons can be analyzed in less than ten minutes
- Low bleed
- Available in fused silica or UltiMetal
- Fast run time
- High temperature stability up to 375/400 °C
- Available in economical 3 and 6 packs

Note: For optimal injection performance, use the 4 m x 0.53 mm id retention gap

Similar Phases: Rtx-Mineral Oil

Select Mineral Oil

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	Unit	7 in Cage	5 in Cage
0.32	15	0.10	-60 to 390/400	1/pk	CP7491	CP749115
	15	0.10	-60 to 390/400	3/pk	CP749103	
	15	0.10	-60 to 390/400	6/pk	CP749106	
Retention gap						
0.53	4.0		-60 to 325/350	3/pk	CP8015	



TIPS & TOOLS

Ensure highest quality gas while keeping gas lines clean and leak-free with Agilent's high-capacity gas filter. Learn more at www.agilent.com/chem/gasclean



Food, Flavors and Fragrances Columns

Food and flavor analyses place stringent demands on capillary columns. Samples have many components that are difficult to resolve and column-to-column reproducibility becomes critical. Agilent J&W GC columns are ideal for meeting these needs. Our rigorous quality control specifications and extensive QC testing ensure that the column you buy today will perform just like the column you buy tomorrow.

HP-88

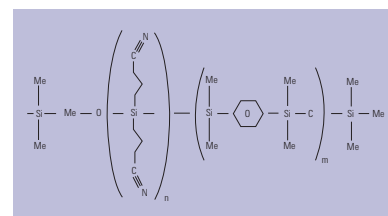
- (88%-Cyanopropyl)aryl-polysiloxane
- 250/320 °C upper temperature limits
- High polarity
- Designed for separation of cis-trans fatty acid methyl esters (FAMES)
- Even better separation than DB-23 of cis-trans isomers

Note: Because HP-88 is not bonded or cross-linked, we do not recommend solvent rinsing.

Similar Phases: SP-2560, SP-2340, SP-2330, BPX-70, BPX-90

HP-88

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7890/6890		
				7 in Cage	5 in Cage	LTM II Module
0.25	100	0.20	0 to 250/260	112-88A7	112-88A7E	
	60	0.20	0 to 250/260	112-8867	112-8867E	
	30	0.20	0 to 250/260	112-8837	112-8837E	112-8837LTM



Structure of HP-88

CP-Sil 88

- High selectivity towards positional and geometric isomers for ease-of-use
- Highly substituted cyanopropyl phase
- Highest polarity, non-chemically bonded and stabilized

Similar Phases: SP-2560, SP-2340, SP-2330, BPX-70, BPX-90

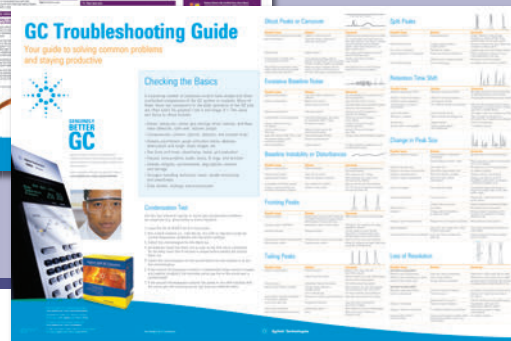
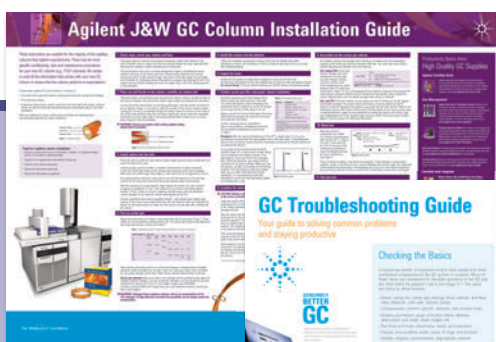
CP-Sil 88

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	25	0.20	50 to 225/240	CP6172
	50	0.20	50 to 225/240	CP6173
0.32	25	0.20	50 to 225/240	CP6174
	50	0.20	50 to 225/240	CP6175



TIPS & TOOLS

Order your free GC troubleshooting and GC column installation posters at www.agilent.com/chem/GCposteroffer



Select FAME

- Tuned for optimal cis-trans separation of FAMES, especially C₁₈ isomers
- Excellent peak shape and separation for FAME isomers – especially if one component is present at a higher concentration
- Bonded and cross-linked
- Low bleed
- High efficiency and column loadability
- Column length up to 200 m available for detailed analysis of the C_{18:1} isomer cluster

Select FAME

ID (mm)	Length (m)	Temp Limits (°C)	7 in Cage	5 in Cage
0.25	50	275/290	CP7419	CP741915
	100	275/290	CP7420	
	200	275/290	CP7421	

CP-Sil 88 for FAME

- Optimized for analysis of FAME cis/trans isomers
- High polarity stationary phase provides improved efficiency and higher productivity
- Use for FAME separations in the C₆ to C₂₆ range

CP-Sil 88 for FAME

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	50	0.20	225/240	CP7488
	60	0.20	225/240	CP7487
	100	0.20	225/240	CP7489

CP-Wax 57 CB

- Unique high polarity bonded wax column
- Industry proven for the analysis of alcohols in the brewing and wine/spirits industry
- Excellent inertness for optimum peak shape of alcohols and glycols
- Offered in 0.15 mm id for significantly high speed throughput

Similar Phases: SUPELCOWAX 10, SUPEROX II, CB-WAX, Stabilwax, BP-20, 007-CW, Carbowax, Rtx-WAX, ZB-WAX

CP-Wax 57 CB

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage	5 in Cage
<i>0.15</i>	<i>30</i>	<i>0.12</i>	<i>20 to 200/225</i>	<i>CP97721</i>	
0.25	25	0.20	20 to 200/225	CP97713	
	50	0.20	20 to 200/225	CP97723	CP9772315
	60	0.40	20 to 200/225	CP8120	
0.32	25	0.20	20 to 200/225	CP97743	
		1.20	20 to 200/225	CP97763	
	50	0.20	20 to 200/225	CP97753	CP9775315
		1.20	20 to 200/225	CP97773	
0.53	25	1.00	20 to 200/225	CP97638	
	25	2.00	20 to 200/225	CP97658	

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers

CP-Carbowax 400 for Volatiles in Alcohol

- Designed for the analysis of volatiles in alcoholic beverages
- High resolution for amyl alcohols for accurate quality control
- High efficiency
- Special testing ensures performance and column-to-column reproducibility

CP-Carbowax 400 for Volatiles in Alcohol

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.32	50	0.20	60/80	CP7527

CP-Wax 57 CB for Glycols and Alcohols

- Optimized for the analysis of glycols, diols and alcohols
- Unique, high polarity wax phase
- Symmetrical peaks providing the most accurate results
- Cross-linked and bonded phase delivers robustness and enhanced column lifetime

CP-Wax 57 CB for Glycols and Alcohols

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.25	25	0.20	200/200	CP7615
0.53	25	0.50	225/250	CP7617

CP-TAP CB for Triglycerides

- Engineered phase for detailed analysis of triglycerides
- Separates complete triglyceride pattern in less than 16 minutes
- Separation based on carbon number and degree of unsaturation
- Stabilized phase for low bleed and enhanced column lifetime
- Available in fused silica and UltiMetal

CP-TAP CB for Triglycerides

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.25	25	0.10	350/360	CP7483

CP-TAP CB UltiMetal

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.25	25	0.10	355/370	CP7463

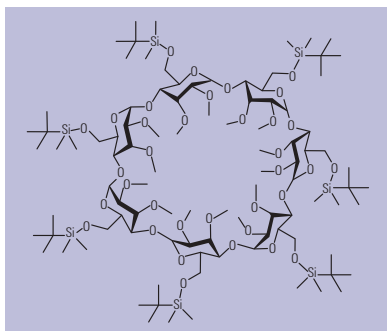
CP-FFAP CB for Free Fatty Acids in Dairy Products

- Ideal for flavors, aromas and free fatty acids C₁-C₂₆
- Separates C₂-C₂₄ acids in one run without derivatization
- Chemically-bonded for excellent longevity
- Water and solvent resistant

CP-FFAP CB

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage	5 in Cage
<i>0.15</i>	25	<i>0.25</i>	250/275	<i>CP7686</i>	
0.32	25	0.30	250/275	CP7485	CP748515
0.53	25	1.00	250/275	CP7486	

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers



Structure of CycloSil-B

CycloSil-B

- 30% Heptakis (2,3-di-O-methyl-6-O-t-butyl dimethylsilyl)-β-cyclodextrin in DB-1701
- Chiral separations without chiral-specific derivatization
- New stationary phase for improved resolution of many chiral separations
- Ideal for many chiral γ-lactones and terpenes

Note: Because CycloSil-B GC columns are not bonded or cross-linked, we do not recommend solvent rinsing.

Similar Phases: LIPODEX C, Rt-β DEXm, β-DEX 110, β-DEX 120

CycloSil-B

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage	7890/6890 LTM II Module
0.25	30	0.25	35 to 260/280	112-6632	112-6632LTM
0.32	30	0.25	35 to 260/280	113-6632	113-6632LTM

Cyclodex-B

- 10.5% β -cyclodextrin in DB-1701
- Chiral separations without chiral-specific derivatization
- Broad range of resolving potential
- Excellent peak shape

Note: Because Cyclodex-B GC columns are not bonded or cross-linked, we do not recommend solvent rinsing.

Similar Phases: LIPODEX C, Rt- β DEXm, β -DEX 110, β -DEX 120

Cyclodex-B

ID (mm)	Length (m)	Film (μ m)	Temp Limits ($^{\circ}$ C)	7890/6890		
				7 in Cage	5 in Cage	LTM II Module
0.25	30	0.25	50 to 230/250	112-2532	112-2532E	112-2532LTM
	60	0.25	50 to 230/250	112-2562		
0.32	30	0.25	50 to 230/250	113-2532	113-2532E	

HP-Chiral β

- β -cyclodextrin in (35%-phenyl)-methylpolysiloxane
- Chiral separations without chiral-specific derivatization
- Phenyl-based polymer provides low bleed and does not interfere with nitrogen-specific detectors
- Available in two concentrations of β -cyclodextrin: 10% and 20%
- 20% β -cyclodextrin best choice for initial screening

Similar Phases: LIPODEX C, Rt- β DEXm, β -DEX 110, β -DEX 120

HP-Chiral β

ID (mm)	Length (m)	Film (μ m)	Temp Limits ($^{\circ}$ C)	7 in Cage	5 in Cage
HP-Chiral 10β					
0.25	30	0.25	30 to 240/250	19091G-B133	
HP-Chiral 20β					
0.25	30	0.25	30 to 240/250	19091G-B233	19091G-B233E
0.32	30	0.25	30 to 240/250	19091G-B213	

CP-Chirasil Val

- Designed for separations of optically active compounds including amino acids
- Both antipode phases are available (D and L) for maximum versatility
- Stabilized chiral phase, over 50% cross-linked for longevity
- Tested for separation of amino acid enantiomers
- Low bleed

Note: On Chirasil-L Val, D-amino acids elute before the L-amino acids, while on Chirasil-D-Val, this elution order is reversed. This is especially valuable when determining the optical purity of these compounds. Selecting the column from which the minor compound elutes before the major enantiomers results in the lowest detection levels.

CP-Chirasil Val

Description	ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage	5 in Cage
Antipode D	0.25	25	0.08	200/200	CP7494	
Antipode L	0.25	25	0.12	200/200	CP7495	CP749515

CP-Chirasil-Dex CB

- Cyclodextrin bonded to dimethylpolysiloxane for homogeneous enantioselectivity throughout the column
- High resolution factor between isomers across a broad application range
- Chemically bonded phase for excellent longevity
- No need for derivatization improved productivity
- Low elution temperature of polar compounds
- Suitable for all injection techniques

Similar Phases: LIPODEX C, Rt- β DEXm, β -DEX 110, β -DEX 120

CP-Chirasil-Dex CB

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage	5 in Cage
0.25	25	0.25	200/200	CP7502	CP750215
0.32	25	0.25	200/200	CP7503	

CP-Cyclodextrin- β -2,3,6-M-19

- Unique selectivity for optical and positional isomer separations
- High efficiency enables wide range of applications
- Separates o-, m-, and p-xylenes
- Excellent peak shape for underivatized polar compounds

CP-Cyclodextrin- β -2,3,6-M-19

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage	5 in Cage
0.25	25	0.25	225/250	CP7500	CP750015
	50	0.25	225/250	CP7501	

TIPS & TOOLS

Agilent CrossLab GC supplies, including CrossLab Ultra Inert liners, perform seamlessly with a variety of instruments regardless of make or model, including Varian (now Bruker), PerkinElmer, Shimadzu, and Thermo Scientific GC systems. Learn more at www.agilent.com/chem/CrossLab



TIPS & TOOLS

Tips and tricks for making better connections...

- It's important to use ferrules and nuts appropriate for your application, so graphite/polyimide ferrules and Agilent Self Tightening column nuts for oxygen detectors, or UltiMetal Plus Flexible Metal ferrules for ultimate flow path inertness
- Never over tighten fittings to avoid soft ferrules extruding into the fitting, contaminating or creating active sites in the flow path
- Install column at the correct and consistent height, critical for accurate and reproducible results
- Reduce and eliminate leaks at the MS interface with the Agilent Self Tightening column nuts that give you a tight connection without expensive upgrades or adaptors



Watch the animation that shows how to make better column connections in a GC or GC/MS, at www.agilent.com/chem/mbcvideo



Life Sciences Columns

The life sciences offer some difficult challenges to capillary GC chromatographers. These include complex sample matrixes, the necessity for low level detection and the chemically active characteristics of many of the samples. In response to this, Agilent offers a line of columns which are designed specifically for drugs of abuse testing.

DB-ALC1 and DB-ALC2

- Reliable blood alcohol analysis
- Optimized primary and confirmation column pair for US blood alcohol analysis
- DB-ALC1 and DB-ALC2 columns are regularly used in sets. Connect them together easily with an Agilent Ultra Inert, universal press fit Y-splitter (5190-6980), or an UltiMetal Plus deactivated CFT un-purged splitter (G3184-60065)
- Faster GC run times
- Improved resolution of key ethanol/acetone peaks
- Available in 0.32 and 0.53 mm id
- Bonded and cross-linked

Similar Phases: Rtx-BAC1, Rtx-BAC2, ZB-BAC-1, ZB-BAC-2

DB-ALC1 and DB-ALC2

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7890/6890		
				7 in Cage	5 in Cage	LTM II Module
DB-ALC1						
0.32	30	1.80	20 to 260/280	123-9134		123-9134LTM
0.53	30	3.00	20 to 260/280	125-9134	125-9134E	
DB-ALC2						
0.32	30	1.20	20 to 260/280	123-9234	123-9234E	
0.53	30	2.00	20 to 260/280	125-9234		

VF-DA

- Engineered for drugs of abuse confirmation testing
- High recovery for trace level analysis and excellent resistance to direct methanol injections
- Ultra low bleed

VF-DA

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.20	12	Optimized	-60 to 325/350	CP8964

DB-5ms EVDX

- Specially configured and tested for drugs of abuse confirmation
- Drug test mix included: caffeine, glutethimide, lidocaine, phenobarbital, EDDP, methaqualone, methadone, cocaine, desipramine, carbamazepine
- DB-5ms EVDX is equivalent to (5%-phenyl)-methylpolysiloxane
- Consistent retention and peak shape
- Low bleed for GC/MS analysis
- Bonded and cross-linked
- Solvent rinsable

DB-5ms EVDX

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.20	25	0.33	-60 to 325/350	128-8522

DB-Select 624 UI for <467>

- Engineered to optimize pharmaceutical residual solvents analysis per USP Method <467>
- Ultra inertness and low bleed
- Resolution of USP regulated critical pairs, also separates benzene and 1,2-dichloroethane
- Identical selectivity to the popular VF-624 ms – upgrade with no changes in method
- UI testing ensures premium performance column to column

DB-Select 624 UI for <467>

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	30	1.40	40 to 260/260	122-0334UI
	60	1.40	40 to 260/260	122-0364UI
0.32	30	1.80	40 to 260/260	123-0334UI
	60	1.80	40 to 260/260	123-0364UI
0.53	30	3.00	40 to 260/260	125-0334UI

HP-Fast Residual Solvent

- Equivalent to USP Phase G43
- Thinner film reduces run time by 2.5 times and increases Minimum Detection Limit (MDL) by 2 times compared to standard film thickness used for this method
- Bonded and cross-linked

Similar Phases: PE-624, 007-624, 007-502, ZB-624

HP-Fast Residual Solvent

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.53	30	1.00	-20 to 260	19095V-420	19095V-420E	19095V-420LTM

Metal Columns

DB-ProSteel and UltiMetal columns are engineered to combine the robustness of stainless steel with advanced surface deactivation for excellent peak shape.

- Configured for high temperature analyses such as simulated distillation
- Wide variety of stationary phases and configurations available
- Ideal for portable and process GC applications
- Superior replacement for MXT/Silcosteel columns

Metal Columns

Phase	ID (mm)	Length (m)	Film (µm)	7 in Cage	5 in Cage
Simulated distillation/high temperature					
DB-HT Sim Dis	0.53	5	0.10	145-1009	
			0.15	145-1001	
DB-PS2887	0.53	10	3.00	145-2814	
CP-SimDist UltiMetal	0.53	5	0.09	CP7569	CP7569I5
			0.17	CP7532	CP7532I5
			0.88	CP7570	
			2.65	CP7571	
		10	0.06	CP6540	
			0.17	CP7542	
			0.53	CP7592	
			0.88	CP7512	
			1.20	CP7562	
			2.65	CP7582	
			5.00	CP7572	
20	0.11	CP7593			
25	0.06	CP6550			
VF-5ht UltiMetal	0.25	15	0.10	CP9090	
			0.32	CP9094	CP9094I5
	0.25	30	0.10	CP9092	
			0.32	CP9096	

(Continued)

Metal Columns

Phase	ID (mm)	Length (m)	Film (µm)	7 in Cage	5 in Cage	
Simulated distillation/high temperature						
VF-5ht UltiMetal with retention gap UltiMetal	0.25	15	0.10	CP9091		
	0.32	15	0.10	CP9095		
	0.25	30	0.10	CP9093		
	0.32	30	0.10	CP9097		
Standard phases and PEG						
DB-PS1	0.53	15	0.15	145-1011		
		30	1.50	145-1032		
CP-Sil 5 CB	0.53	10	2.00	CP7150		
			5.00	CP6666		
			25	0.50	CP7135	
		25	1.00	CP7130		
			2.00	CP7160		
			5.00	CP6670		
			50	1.00	CP7140	
		50	2.00	CP7170		
			5.00	CP6671		
			DB-HT Sim Dis	0.53	5	0.10
0.15	145-1001					
DB-PS2887	0.53	10	3.00	145-2814		
CP-SimDist UltiMetal, 6/pk	0.53	5	0.09	CP67569		
CP-SimDist UltiMetal	0.53	5	0.09	CP7569		
			0.17	CP7532		
			0.88	CP7570		
			2.65	CP7571		
			10	0.06	CP6540	
		10	0.17	CP7542		
			0.53	CP7592		
			0.88	CP7512		
			1.20	CP7562		
			2.65	CP7582		
		20	5.00	CP7572		
			20	0.11	CP7593	
			25	0.06	CP6550	

(Continued)



Metal Columns

Phase	ID (mm)	Length (m)	Film (μm)	7 in Cage	5 in Cage
Standard phases and PEG					
CP-Sil 8 CB UltiMetal	0.53	25	5.00	CP6680	
		50	0.50	CP7196	
					CP6681
CP-Sil 13 CB UltiMetal	0.53	25	1.00	CP7141	
DB-PSWAX	0.53	30	1.00	145-7032	
CP-Wax 52 CB UltiMetal	0.53	10	1.00	CP7148	
		25	2.00	CP7178	
		50	1.00	CP7168	
			2.00	CP7179	
PLOT columns					
PoraPLOT Q UltiMetal	0.53	10	20.00	CP6953	
		25	20.00	CP6954	
CP-Al ₂ O ₃ /KCl UltiMetal	0.53	50	10.00	CP6918	
CP-Al ₂ O ₃ /Na ₂ SO ₄ UltiMetal	0.53	50	10.00	CP6968	
CP-Molsieve 5Å UltiMetal	0.53	10	50.00	CP6937	
		25	50.00	CP6938	CP693815
Select application columns					
DB-PS624	0.53	30	3.00	145-1334	
CP-Sil PAH CB UltiMetal	0.25	25	0.12	CP7440	
CP-TAP CB	0.25	25	0.10	CP7463	
Select Biodiesel	0.32	10	0.10	CP9076	
With retention gap		15	0.10	CP9078	
Select Biodiesel	0.32	10	0.10	CP9077	
		15	0.10	CP9079	



Column shown with EZ-GRIP

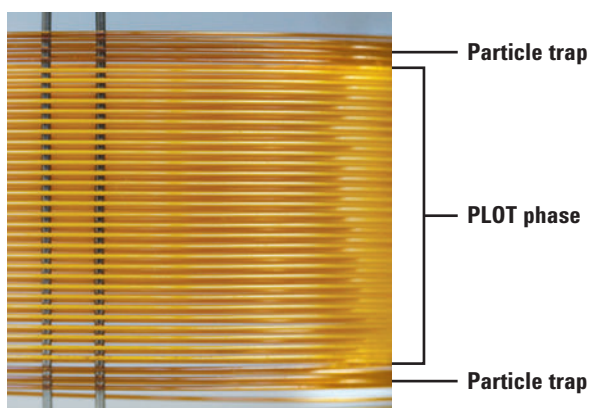
PLOT Columns

PLOT columns are ideal for separating compounds that are gases at room temperatures. Agilent Technologies offers a comprehensive line of PLOT columns for analysis of fixed gases, low molecular weight hydrocarbon isomers, volatile polar compounds and reactive analytes such as sulfur gases, amines and hydrides. Our PLOT phases are offered in dimensions from 0.25 to 0.53 mm id, allowing for easy column selection for various detector and system requirements. For GC/MS systems, we offer several small diameter columns with truly bonded and immobilized stationary phases, eliminating potential detector fouling due to particle generation.

PLOT PT

Agilent J&W PLOT PT columns are engineered to improve lab operations. Unlike current techniques used to prevent PLOT stationary phase particles from shedding downstream, the integral particle traps of the PLOT PT columns remove the aggravation of connecting separate traps. Operation is more convenient and there is no risk from leaks. The integrated particle-trapping technology on both ends of PLOT PT GC columns reduces downtime. What's more, with PLOT PT you can now use GC/MS for detailed, qualitative and quantitative analysis and due to the dual ended particle traps the PLOT PT columns can also be used for backflush applications. No other PLOT column offers this level of worry-free operation for your GC or GC/MS system.

Agilent J&W PLOT PT columns are available in porous polymers Q and U, Aluminum oxide and Molesieve stationary phases.



PLOT PT – with integrated particle traps

Phase	ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	Part No.
PoraBOND Q PT	0.25	10	3.00	-100 to 300/300	CP7348PT
PoraBOND Q PT	0.32	25	5.00	-100 to 300/300	CP7351PT
PoraBOND Q PT	0.32	50	5.00	-100 to 300/300	CP7352PT
PoraBOND Q PT	0.53	10	10.00	-100 to 300/300	CP7353PT
PoraBOND Q PT	0.53	25	10.00	-100 to 300/300	CP7354PT
PoraPLOT Q PT	0.32	10	10.00	-100 to 250/250	CP7550PT
PoraPLOT Q PT	0.32	25	10.00	-100 to 250/250	CP7551PT
PoraPLOT Q PT	0.53	25	20.00	-100 to 250/250	CP7554PT
PoraPLOT Q-HT PT	0.32	5	10.00	-100 to 290/290	CP7557PT
HP-PLOT Q PT	0.32	15	20.00	-60 to 270/290	19091P-Q03PT
HP-PLOT Q PT	0.32	30	20.00	-60 to 270/290	19091P-Q04PT
HP-PLOT Q PT	0.53	15	40.00	-60 to 270/290	19095P-Q03PT
HP-PLOT Q PT	0.53	30	40.00	-60 to 270/290	19095P-Q04PT
GS-Q PT	0.53	30		-60 to 250	115-3432PT
PoraPLOT U PT	0.53	25	20.00	-100 to 190/190	CP7584PT
HP-PLOT U PT	0.53	30	20.00	-60 to 190	19095P-U04PT
HP-PLOT Al ₂ O ₃ KCl PT	0.32	50	8.00	-60 to 200	19091P-K15PT
HP-PLOT Al ₂ O ₃ KCl PT	0.53	30	15.00	-60 to 200	19095P-K23PT
HP-PLOT Al ₂ O ₃ KCl PT	0.53	50	15.00	-60 to 200	19095P-K25PT
PoraPLOT U PT	0.53	25	20.00	-100 to 190/190	CP7584PT
CP-Al ₂ O ₃ /KCl PT	0.32	50	5.00	-100 to 200/200	CP7515PT
CP-Al ₂ O ₃ /KCl PT	0.53	25	10.00	-100 to 200/200	CP7517PT
CP-Al ₂ O ₃ /KCl PT	0.53	50	10.00	-100 to 200/200	CP7518PT
CP-Al ₂ O ₃ /Na ₂ SO ₄ PT	0.32	50	5.00	-100 to 200/200	CP7565PT
CP-Al ₂ O ₃ /Na ₂ SO ₄ PT	0.53	50	10.00	-100 to 200/200	CP7568PT
HP-PLOT Al ₂ O ₃ S PT	0.32	25	8.00	-60 to 200	19091P-S12PT
HP-PLOT Al ₂ O ₃ S PT	0.32	50	8.00	-60 to 200	19091P-S15PT
HP-PLOT Al ₂ O ₃ S PT	0.53	30	15.00	-60 to 200	19095P-S23PT
HP-PLOT Al ₂ O ₃ S PT	0.53	50	15.00	-60 to 200	19095P-S25PT
GS-Alumina PT	0.53	30		-60 to 200	115-3532PT
GS-Alumina PT	0.53	50		-60 to 200	115-3552PT
HP-PLOT Al ₂ O ₃ M PT	0.53	50	15.00	-60 to 200	19095P-M25PT
CP-Molsieve 5A PT	0.32	30	10.00	-200 to 300	CP7534PT
CP-Molsieve 5A PT	0.32	25	30.00	-200 to 300	CP7536PT
CP-Molsieve 5A PT	0.53	25	50.00	-200 to 300	CP7538PT
CP-Molsieve 5A PT	0.53	50	50.00	-200 to 300	CP7539PT

PoraBOND Q

- Bonded PLOT column for more reliable results for analysis of volatile solvents and hydrocarbons
- Extended analysis offers broad application range
- 300/320 °C temperature limits
- Engineered for high stability, withstands repeated water injections
- Proprietary manufacturing technique results in very pure porous polymer with virtually no catalytic activity, allowing operation to 320 °C without decomposition
- Bonding technology results in greatly reduced particle shedding, reduces the needs for particle traps

Similar Phases: Rt-Q BOND, Rt-QPLOT, SupelQ PLOT

PoraBOND Q

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	PLOT PT
0.25	10	3.00	-100 to 300/300	CP7347		CP7348PT
	25	3.00	-100 to 300/320	CP7348		
0.32	10	5.00	-100 to 300/320	CP7350	CP7350I5	
	25	5.00	-100 to 300/320	CP7351	CP7351I5	CP7351PT
	50	5.00	-100 to 300/320	CP7352	CP7352I5	CP7352PT
0.53	10	10.00	-100 to 300/320	CP7353	CP7353I5	CP7353PT
	25	10.00	-100 to 300/320	CP7354	CP7354I5	CP7354PT
	50	10.00	-100 to 300/320	CP7355		

PoraBOND U

- Highly stable polar-bonded porous polymer with maximum operating temperature of 300 °C
- Reduced bleed for low detection limits and fast stabilization time
- Bonded PLOT column for excellent longevity
- Ideal for use with method that pressure programs or valve switching

Similar Phases: Rt-U-BOND

PoraBOND U

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.32	25	7.00	-100 to 300/300	CP7381



PoraPLOT Q and PoraPLOT Q-HT

- Recommended for column switching systems that analyze a broad range of polar and apolar volatile compounds
- Water elutes as a sharp peak enabling quantitation
- Retention of target compounds is not influenced by water in the sample
- Long term stability provides repeatable retention times
- Available in fused silica and UltiMetal

Similar Phases: Rt-Q BOND, Rt-QPLOT, SupelQ PLOT

PoraPLOT Q

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	PLOT PT
0.25	10	8.00	-100 to 250/250	CP7548		
	25	8.00	-100 to 250/250	CP7549		
0.32	10	10.00	-100 to 250/250	CP7550	CP7550I5	CP7550PT
	25	10.00	-100 to 250/250	CP7551	CP7551I5	CP7551PT
	50	10.00	-100 to 250/250	CP7552		
0.53	10	20.00	-100 to 250/250	CP7553		
	25	20.00	-100 to 250/250	CP7554	CP7554I5	CP7554PT
	50	20.00	-100 to 250/250	CP7555		

PoraPLOT Q UltiMetal

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.53	10	20.00	-100 to 250/250	CP6953
	25	20.00	-100 to 250/250	CP6954

PoraPLOT Q-HT

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	PLOT PT
0.32	10	10.00	-100 to 290/290	CP7556	
	25	10.00	-100 to 290/290	CP7557	CP7557PT
0.53	10	20.00	-100 to 290/290	CP7558	
	25	20.00	-100 to 290/290	CP7559	

HP-PLOT Q

- Bonded polystyrene-divinylbenzene based column
- Polarity between Porapak-Q and Porapak-N
- Excellent column for C₁-C₃ isomers and alkanes to C₁₂, CO₂, methane, air/CO, oxygenated compounds, sulfur compounds and solvents
- Replaces packed gas-solid columns
- Separates ethane, ethylene and ethyne (acetylene)
- Improved resolution in less time than conventional packed columns
- Minimal conditioning time required – 1 hour
- Preferred "Q" column due to its robust nature



Similar Phases: Rt-QPLOT, SupelQ PLOT

HP-PLOT Q

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890	
						LTM II Module	PLOT PT
0.32	15	20.00	-60 to 270/290	19091P-Q03		19091P-Q03LTM	19091P-Q03PT
	30	20.00	-60 to 270/290	19091P-Q04	19091P-Q04E	19091P-Q04LTM	19091P-Q04PT
0.53	15	40.00	-60 to 270/290	19095P-Q03	19095P-Q03E	19095P-Q03LTM	19095P-Q03PT
	30	40.00	-60 to 270/290	19095P-Q04	19095P-Q04E	19095P-Q04LTM	19095P-Q04PT

GS-Q

- Porous divinylbenzene homopolymer
- Polarity between Porapak-Q and Porapak-N
- Separates ethane, ethylene and ethyne (acetylene)
- Not recommended for quantification of polar compounds
- Minimal conditioning time required – 1 hour

Similar Phases: Rt-QPLOT, SupelQ PLOT

GS-Q

ID (mm)	Length (m)	Temp Limits (°C)	7 in Cage	5 in Cage	PLOT PT	7890/6890
						LTM II Module
0.32	30	-60 to 250	113-3432	113-3432E		113-3432LTM
0.53	10	-60 to 250	115-34H2			
	15	-60 to 250	115-3412			
	25	-60 to 250	115-3422			
	30	-60 to 250	115-3432	115-3432E	115-3432PT	



TIPS & TOOLS

View the latest GC column focused applications, products and educational resources at www.agilent.com/chem/myGCcolumns

PoraPLOT U and PoraPLOT S

- The most polar porous polymer PLOT column ideal for halogenated compounds, C₁-C₆ hydrocarbons, ketones and solvents
- Excellent peak shape of polar and non-polar volatiles
- Water has no effect on retention times and elutes as a sharp quantifiable peak
- Reliable retention time repeatability

PoraPLOT U

Similar Phases: Rt-U-BOND

PoraPLOT U

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	PLOT PT
0.25	25	8.00	-100 to 190/190	CP7579	
0.32	10	10.00	-100 to 190/190	CP7580	
	25	10.00	-100 to 190/190	CP7581	
0.53	10	20.00	-100 to 190/190	CP7583	
	25	20.00	-100 to 190/190	CP7584	CP7584PT

PoraPLOT S

- Divinylbenzene/vinylpyridine polymer for hydrocarbons and ketones
- Ideal for the analysis of medium polarity volatile including hydrocarbons and ketones
- Higher temperature limit than PoraPLOT U

Similar Phases: Rt-S-BOND, MXT-SBOND

PoraPLOT S

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.53	25	20.00	-100 to 250/250	CP7574

HP-PLOT U

- Bonded divinylbenzene/ethylene glycol dimethacrylate
- More polar than HP-PLOT Q
- Excellent column for C₁-C₇ hydrocarbons, CO₂, methane, air/CO, water, oxygenates, amines, solvents, alcohols, ketones, and aldehydes
- Improved resolution in less time than conventional packed columns

Similar Phases: RTU PLOT

HP-PLOT U

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	PLOT PT	7890/6890
							LTM II Module
0.32	30	10.00	-60 to 190	19091P-U04	19091P-U04E		19091P-U04LTM
0.53	15	20.00	-60 to 190	19095P-U03			
	30	20.00	-60 to 190	19095P-U04	19095P-U04E	19095P-U04PT	19095P-U04LTM

HP-PLOT Al₂O₃ KCl

- Least "polar" alumina phase
- Aluminum oxide deactivated with KCl
- Standard column choice for light hydrocarbon analysis – C₁-C₈ hydrocarbon isomers
- Low retention of olefins relative to comparable paraffin
- Excellent for quantitation of dienes, especially propadiene and butadiene from ethylene and propylene streams
- Recommended phase for many ASTM methods
- Preferred KCl deactivated alumina

Similar Phases: Rt-Alumina PLOT, Alumina PLOT, Al₂O₃/KCl, AB-PLOT Al₂O₃ KCl, AT-Alumina

HP-PLOT Al₂O₃ KCl

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	PLOT PT	7890/6890
							LTM II Module
0.25	30	5.00	-60 to 200	19091P-K33			19091P-K33LTM
0.32	50	8.00	-60 to 200	19091P-K15	19091P-K15E	19091P-K15PT	
0.53	30	15.00	-60 to 200	19095P-K23		19095P-K23PT	19095P-K23LTM
	50	15.00	-60 to 200	19095P-K25	19095P-K25E	19095P-K25PT	

GS-Alumina KCl

- Least "polar" alumina phase
- Aluminum oxide deactivated with KCl
- Good choice for light hydrocarbon analysis
- Good resolution of propadiene and butadiene from ethylene and propylene streams

Similar Phases: $\text{Al}_2\text{O}_3/\text{KCl}$, $\text{Al}_2\text{O}_3/\text{Na}_2\text{SO}_4$, Rt-Alumina PLOT, Alumina PLOT, AB-PLOT Al_2O_3 KCl, AT-Alumina

GS-Alumina KCl

ID (mm)	Length (m)	Temp Limits (°C)	7 in Cage	5 in Cage	PLOT PT
0.53	30	-60 to 200	115-3332		
	50	-60 to 200	115-3352	115-3352E	115-3352PT

CP-Al₂O₃/KCl and CP-Al₂O₃/Na₂SO₄

- Aluminum oxide PLOT columns offer high selectivity for separating ppm levels of C₁-C₅ hydrocarbons in process streams
- High capacity thick films
- No need for sub-ambient cooling
- Choice of two selectivities covers a broad range of applications
- Available in fused silica and UltiMetal

Note: The KCl deactivation salt results in a relatively apolar Al₂O₃ surface while the Na₂SO₄ deactivation provides a polar surface. Unsaturated compounds such as ethylene and acetylene (ethyne) are retained longer.

Selectivity Through KCl or Na₂SO₄ Deactivation

Note: Aluminum oxide PLOT columns are deactivated using KCl or Na₂SO₄ treatments which provide a reproducible and stable deactivation up to 200 °C. The KCl salt deactivation results in a relatively apolar Al₂O₃ surface, while the Na₂SO₄ deactivation provides a polar surface. Unsaturated compounds such as ethylene and acetylene (ethyne) are retained longer.

Similar Phases: Al₂O₃/KCl, Rt-Alumina PLOT, Alumina PLOT, RT-Alumina BOND/KCl, Alumina chloride PLOT, AB-PLOT Al₂O₃ KCl

CP-Al₂O₃/KCl

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	PLOT PT
0.25	25	4.00	-100 to 200/200	CP7576		
	50	4.00	-100 to 200/200	CP7577		
0.32	10	5.00	-100 to 200/200	CP7511		
	25	5.00	-100 to 200/200	CP7519		
	50	5.00	-100 to 200/200	CP7515	CP7515I5	CP7515PT
0.53	25	10.00	-100 to 200/200	CP7517		CP7517PT
	50	10.00	-100 to 200/200	CP7518		CP7518PT

CP-Al₂O₃/KCl UltiMetal

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage
0.53	50	10.00	-100 to 200/200	CP6918

Similar Phases: Al₂O₃/Na₂SO₄, Rt-Alumina PLOT, Alumina PLOT, Rt-Alumina BOND/Na₂SO₄, MXT-AluminaBOND/Na₂SO₄, Alumina sulfate PLOT

CP-Al₂O₃/Na₂SO₄

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage	5 in Cage	PLOT PT
0.25	25	4.00	-100 to 200/200	CP7586		
	50	4.00	-100 to 200/200	CP7587		
0.32	50	5.00	-100 to 200/200	CP7565	CP7565I5	CP7565PT
0.53	25	10.00	-100 to 200/200	CP7567		
	50	10.00	-100 to 200/200	CP7568		CP7568PT

CP-Al₂O₃/Na₂SO₄ UltiMetal

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage
0.53	50	10.00	-100 to 200/200	CP6968

HP-PLOT Al₂O₃ S

- Middle range of "polarity" for alumina phases
- Aluminum oxide deactivated with sodium sulfate
- Excellent general use column for light hydrocarbon analysis – C₁-C₈ hydrocarbon isomers
- Best for resolving acetylene from butane and propylene from isobutane

Similar Phases: Al₂O₃/Na₂SO₄, Rt-Alumina PLOT, Alumina PLOT, Rt-Alumina BOND/Na₂SO₄, MXT-AluminaBOND/Na₂SO₄, Alumina sulfate PLOT, AT-Alumina

HP-PLOT Al₂O₃ S

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	PLOT PT	7890/6890 LTM II Module
0.25	30	5.00	-60 to 200	19091P-S33			
0.32	25	8.00	-60 to 200	19091P-S12		19091P-S12PT	19091P-S12LTM
	50	8.00	-60 to 200	19091P-S15	19091P-S15E	19091P-S15PT	
0.53	15	15.00	-60 to 200	19095P-S21			
	30	15.00	-60 to 200	19095P-S23		19095P-S23PT	
	50	15.00	-60 to 200	19095P-S25	19095P-S25E	19095P-S25PT	



GS-Alumina

- Most "polar" alumina phase
- Aluminum oxide with proprietary deactivation
- Excellent general use column for light hydrocarbon analysis – C₁-C₈ hydrocarbon isomers
- Separates C₁-C₄ saturated and unsaturated hydrocarbons
- Best for resolving cyclopropane from propylene
- Faster, more efficient, and provides more sensitivity than packed equivalents
- Minimal conditioning time required
- Preferred substitution for sodium sulfate deactivated Alumina because of its regenerative nature



Note: Alumina columns have a tendency to adsorb water and CO₂ which, over time, results in changes in retention time. We use an advanced, proprietary deactivation process which allows for rapid regeneration. Fully water saturated GS-Alumina columns regenerate in 7 hours or less at 200 °C.

Similar Phases: Al₂O₃/KCl, Al₂O₃/Na₂SO₄, Rt-Alumina PLOT, Alumina PLOT, AB-PLOT Al₂O₃ KCl, AT-Alumina

GS-Alumina

ID (mm)	Length (m)	Temp Limits (°C)	7 in Cage	PLOT PT
0.53	30	-60 to 200	115-3532	115-3532PT
	50	-60 to 200	115-3552	115-3552PT

HP-PLOT Al₂O₃ M

- Most "polar" alumina phase (similar to GS-Alumina)
- Aluminum oxide deactivated with proprietary deactivation
- Good general use column for light hydrocarbon analysis – C₁-C₈ hydrocarbon isomers
- Good for resolving acetylene from butane and propylene from isobutane

Similar Phases: AB-PLOT Al₂O₃ M, BGB-PLOT Al₂O₃ M, AT-Alumina

HP-PLOT Al₂O₃ M

ID	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	PLOT PT
0.32	50	8.00	-60 to 200	19091P-M15	19091P-M15E	
0.53	30	15.00	-60 to 200	19095P-M23		
	50	15.00	-60 to 200	19095P-M25		19095P-M25PT

GS-GasPro

- Unique bonded silica PLOT column technology
- Excellent choice for light hydrocarbons and sulfur gases
- Retention stability not affected by water
- Separates CO and CO₂ on a single column
- Ideal PLOT column for GC/MS – no particles

Similar Phases: CP-Silica PLOT

GS-GasPro

ID (mm)	Length (m)	Temp Limits (°C)	7 in Cage
0.32	5	-80 to 260/300	113-4302
	15	-80 to 260/300	113-4312
	30	-80 to 260/300	113-4332
	60	-80 to 260/300	113-4362

CP-SilicaPLOT

- No influence of water on retention times
- Elution of CO₂ and sulfur gases at ppm levels
- Separates cyclopropane from propylene
- Ideal for a wide range of applications such as COS in ethylene, freons, hydrocarbons, propylene and sulfur compounds
- High selectivity for C₁-C₄ isomers in the presence of water
- No negative influence on retention or peak shape when water is present in the sample
- Inert surface preparation results in no decomposition pentadienes or freons

Similar Phases: GS-GasPro

CP-SilicaPLOT

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.25	30	3.00	-80 to 225/225	CP8564	
0.32	15	4.00	-80 to 225/225	CP8566	
	30	4.00	-80 to 225/225	CP8567	
	60	4.00	-80 to 225/225	CP8568	
0.53	30	6.00	-80 to 225/225	CP8570	CP8570I5
	60	6.00	-80 to 225/225	CP8571	

TIPS & TOOLS

Ensure a lifetime of peak performance and maximum productivity with Agilent's comprehensive GC supplies portfolio. Learn more at www.agilent.com/chem/GCsupplies



CarboBOND and CarboPLOT P7

- Single column solution for ASTM D2505 for higher productivity
- Stable and robust for high repeatability of results
- Available in bonded and PLOT versions for improved versatility and enhanced productivity

CarboBOND

CarboBOND

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.53	25	5.00	-100 to 200/300	CP7371
		10.00	-100 to 200/300	CP7374
	50	5.00	-100 to 200/300	CP7372
		10.00	-100 to 200/300	CP7375

CarboPLOT P7

CarboPLOT P7

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.53	10	25.00	-200 to 115/115	CP7513
	25	25.00	-200 to 115/115	CP7514

GS-CarbonPLOT

- High stability, bonded carbon layer stationary phase
- Unique selectivity for inorganic and organic gases
- Extended temperature limit of 360 °C
- Ideal for GC/MS – no particle generation
- Retention stability not affected by water

Similar Phases: Carbopack, CLOT, Carboxen-1006 PLOT

GS-CarbonPLOT

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	7890/6890
					LTM II Module
0.32	15	1.50	0 to 360	113-3112	
	30	1.50	0 to 360	113-3132	
		3.00	0 to 360	113-3133	113-3133LTM
	60	1.50	0 to 360	113-3162	
0.53	15	3.00	0 to 360	115-3113	
	30	3.00	0 to 360	115-3133	115-3133LTM

HP-PLOT Molesieve

- A PLOT column for the analysis of permanent gases
- O₂, N₂, CO and CH₄ resolve in less than 5 min
- Durable molecular sieve 5Å coating minimizes baseline spiking and damage to multiport valves
- Select a thick film for Ar/O₂ separation without cryogenic cooling
- Select thin film HP-PLOT Molesieve columns for routine air monitoring applications
- Replaces GS-Molesieve

Note: Molecular sieve columns will absorb water, which, over time results in changes in retention time. We use an advanced, proprietary deactivation process which allows for rapid regeneration. Fully saturated HP-PLOT Molesieve columns regenerate in 7 hours or less at 200 °C.

Similar Phases: Rt-Msieve 5A, MXT-Msieve 5A

HP-PLOT Molesieve

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.32	15	25.00	-60 to 300	19091P-MS7		19091P-MS7LTM
		12.00	-60 to 300	19091P-MS4	19091P-MS4E	
	25.00	-60 to 300	19091P-MS8		19091P-MS8LTM	
0.53	15	25.00	-60 to 300	19095P-MS5		
		50.00	-60 to 300	19095P-MS9		
	30	25.00	-60 to 300	19095P-MS6	19095P-MS6E	
		50.00	-60 to 300	19095P-MS0	19095P-MS0E	19095P-MS0LTM

CP-Molsieve 5Å

- Separate argon and oxygen at ambient temperature to reduce costs
- High efficiency for increased productivity
- Symmetrical peaks for accurate results

Similar Phases: Rt-Msieve 5A, MXT-Msieve 5A, Mol Sieve 5A PLOT

CP-Molsieve 5Å

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	PLOT PT*
0.25	25	30.00	-200 to 350/350	CP7533		
0.32	10	30.00	-200 to 350/350	CP7535	CP7535I5	
	25	30.00	-200 to 350/350	CP7536		CP7536PT
	30	10.00	-200 to 350/350	CP7534	CP7534I5	CP7534PT
	50	30.00	-200 to 350/350	CP7540	CP7540I5	
0.53	10	50.00	-200 to 350/350	CP7537		
	15	15.00	-200 to 350/350	CP7543		
	25	50.00	-200 to 350/350	CP7538	CP7538I5	CP7538PT
	30	15.00	-200 to 350/350	CP7544		
	50	50.00	-200 to 350/350	CP7539		CP7539PT

* CP-Molsieve 5Å PT columns have a lower operating temperature of 300 °C

CP-Molsieve 5Å UltiMetal

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.53	10	50.00	-200 to 350/350	CP6937	
	25	50.00	-200 to 350/350	CP6938	CP6938I5

Particle Traps for use with PLOT Columns

Though highly stabilized, it is impossible to guarantee that no particles will dislodge from the column wall. When used in valve-switching applications, the use of a particle trap can prevent scarring of the column switching valve rotors and changes in flow restriction.

Agilent highly recommends using PLOT PT columns with integrated particle traps but for those analysts who prefer to install individual particle traps, a variety of fused silica and UltiMetal fused silica particle traps are available.

Particle Traps for use with PLOT Columns

ID (mm)	Length (m)	Part No.
0.32	2.5	5181-3351
0.53	2.5	5181-3352

Particle Traps for PoraPLOT Columns

ID (mm)	Length (m)	Material	Part No.
0.32	2.5	Fused Silica	CP4016
0.53	2.5	Fused Silica	CP4017
0.53	2.5	UltiMetal	CP4018*

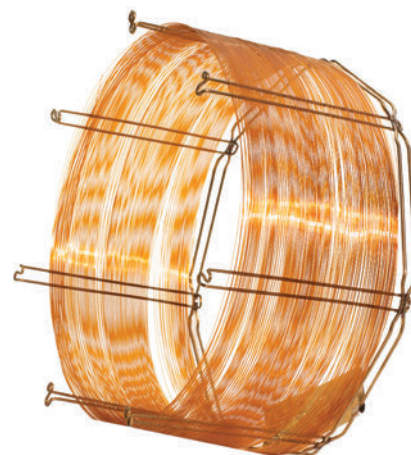
*Includes CP-UltiMetal connector

Particle Trap Connectors for PoraPLOT Columns

ID (mm)	Material	Unit	Part No.
0.25/0.32	Fused Silica	10/pk	CP4788
0.53	Fused Silica	10/pk	CP4789
0.25	UltiMetal	5/pk	CP4795
0.53	UltiMetal	5/pk	CP4796

Columns with Non-Bonded Stationary Phases

Whenever possible, Agilent recommends the use of bonded and cross-linked polymers. Bonded polymers are more rugged, will have longer lifetimes and can be solvent rinsed. However, Agilent recognizes that some methods have been developed on non-bonded phases and therefore maintains these columns to support established methods.



HP-101

- 100% Dimethylpolysiloxane

Because HP-101 columns are not bonded or cross-linked, we do not recommend solvent rinsing.

HP-101

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage	5 in Cage
0.20	25	0.20	-60 to 280	19091Y-102	
0.32	25	0.30	-60 to 280	19091Y-012	19091Y-012E
	50	0.30	-60 to 280	19091Y-015	

HP-17

- 50% Phenyl and 50% methyl siloxane

Because HP-17 columns are not bonded or cross-linked, we do not recommend solvent rinsing.

HP-17

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.53	10	2.00	25 to 260/280	19095L-121

CAM

- Base deactivated polyethylene glycol
- Specifically designed for amine analysis
- Excellent peak shape for primary amines
- Replaces HP-Basicwax

Because CAM columns are not bonded or cross-linked, we do not recommend solvent rinsing.

CAM

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7890/6890	
				7 in Cage	LTM II Module
0.25	15	0.25	60 to 220/240	112-2112	
	30	0.25	60 to 220/240	112-2132	
		0.50	60 to 220/240	112-2133	112-2133LTM
	60	0.25	60 to 220/240	112-2162	
0.32	30	0.25	60 to 220/240	113-2132	113-2132LTM
		0.50	60 to 220/240	113-2133	
0.53	30	1.00	60 to 200/220	115-2132	115-2132LTM

DX-1 and DX-4

- DX-1: 90% Dimethylpolysiloxane 10% polyethylene glycol
- DX-4: 15% Dimethylpolysiloxane 85% polyethylene glycol

Because DX series GC columns are not bonded and cross-linked, we do not recommend solvent rinsing.

DX-1

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.32	30	1.00	50 to 250/270	123-6133

DX-4

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.25	30	0.25	50 to 250/270	122-6432
	60	0.25	50 to 250/270	122-6462
0.32	15	0.25	50 to 250/270	123-6412
	30	0.25	50 to 250/270	123-6432

SE-30 and SE-54

- SE-30: 100% Dimethylpolysiloxane
- SE-54: (5%-Phenyl)(1%-vinyl)-methylpolysiloxane

Because SE series GC columns are not bonded or cross-linked, we do not recommend solvent rinsing.

SE-30

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.32	30	0.25	0 to 325/350	113-3032

SE-54

ID (mm)	Length (m)	Film (μm)	Temp Limits ($^{\circ}\text{C}$)	7 in Cage
0.25	30	0.25	0 to 325/350	112-5432
	60	0.25	0 to 325/350	112-5462
0.32	30	0.25	0 to 325/350	113-5432

Guard Columns

- DuraGuard and EZ-Guard columns with "built-in" guard columns, no press-fit connectors
- Minimize front-end contamination and increase column lifetime
- Aid in focusing sample onto the front of the column for better peak shape
- Minimize MSD contamination originating from the column (when used as transfer line to the MS detector)

Guard columns (or retention gaps) are often added to the front of the analytical column to protect against contamination, or to act as a band-focusing device for liquid samples introduced by on-column and splitless injection techniques.

When resolution or response in a chromatogram diminishes, remove a coil from the guard column so that peak shapes will improve. By removing a coil, the column length is shortened and peaks will elute somewhat faster. For best results, check the integration time windows of your data system.

DuraGuard

DuraGuard

Phase	ID (mm)	Length (m)	Film (μm)	Guard Length (m)	Part No.
DB-1	0.25	30	0.25	10	122-1032G
DB-XLB	0.25	30	0.25	10	122-1232G
DB-5ms	0.25	30	0.25	10	122-5532G
			0.50	10	122-5536G
			1.00	10	122-5533G
		60	0.25	10	122-5562G
	0.53	30	0.50	10	125-5537G
<i>DB-5.625</i>	<i>0.25</i>	<i>30</i>	<i>0.25</i>	<i>5</i>	<i>122-5631G5</i>
DB-1701	0.53	30	1.00	10	125-0732G
DB-624	0.53	30	3.00	5	125-1334G5

Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers



TIPS & TOOLS

Column contamination from sample matrix components is the number one cause of column failure. Use Agilent DuraGuard GC columns with built-in guard if you do not want to use column connectors.





A special tab clearly distinguishes the EZ-Guard guard column section from the analytical column



EZ-Guard

EZ-Guard

Phase	ID (mm)	Length (m)	Film (μm)	Guard Length (m)	Part No.
VF-1ms	0.20	12	0.33	5	CP9023
			0.25	5	CP9010
			0.25	10	CP9011
VF-5ms	0.25	15	0.25	5	CP9021
			0.25	5	CP9012
			0.25	10	CP9013
			0.50	5	CP9014
			0.50	10	CP9015
			0.25	5	CP9016
VF-Xms	0.25	30	0.10	10	CP9022
			0.25	10	CP9019
VF-17ms	0.25	30	0.25	5	CP9024
			0.25	10	CP9025
VF-1701ms	0.25	30	0.25	5	CP9176
			0.25	10	CP9177
VF-35ms	0.25	30	0.25	5	CP9026
			0.25	10	CP9027

LTM Column Modules

Shorten analytical cycle times and boost your high speed gas chromatography capabilities

Agilent J&W LTM column modules combine a high quality fused silica capillary column with heating and temperature sensing components for a low thermal mass column assembly. The LTM column module contains a patented design which heats and cools the column very efficiently for significantly shorter analytical cycle times compared to conventional air-bath GC oven techniques, while simultaneously using less power.

Agilent offers LTM technology for our popular 7890 and 6890 Series GC systems, and the 5975T GC/MS.

For more information, visit www.agilent.com/chem/LTMcol



LTM II standard format with 5 in column toroid

Agilent J&W LTM II Low Thermal Mass Column Modules for 7890A/B Series GC Systems

Available in a wide variety of Wall Coated Open Tubular (WCOT) and select Porous Layer Open Tubular (PLOT) column configurations.

- The capacity to run up to four column modules simultaneously – with four different temperature programs – to maximize your productivity
- Rapid temperature programming rates for higher analysis speeds
- Faster cooling times – as low as one minute or less – to decrease idling and downtime
- Excellent retention time repeatability and performance – comparable to conventional GC

All LTM II column modules are packaged with:

- Two 1 m guard columns (one each for the inlet and detector) fused silica the same id as the analytical column
- Flexible Metal ferrules that fit the dimensions of the analytical and guard columns

TIPS & TOOLS

For information on Agilent UltiMetal Plus Flexible Metal ferrules, **turn to page 43.**



TIPS & TOOLS

When replacing LTM columns, be sure to turn off the instrument power to avoid damage to the column heater and temperature sensing circuitry.





LTM Solution for Ultra Sensitive THCA Application

Specially configured LTM II columns for high sensitivity THCA triple quadrupole GC/MS application, per application note 5990-7535EN.

- Accurate and robust method for detection of THCA metabolite in hair
- Fast analysis run time
- High sensitivity 0.01 pg/mg LOQ

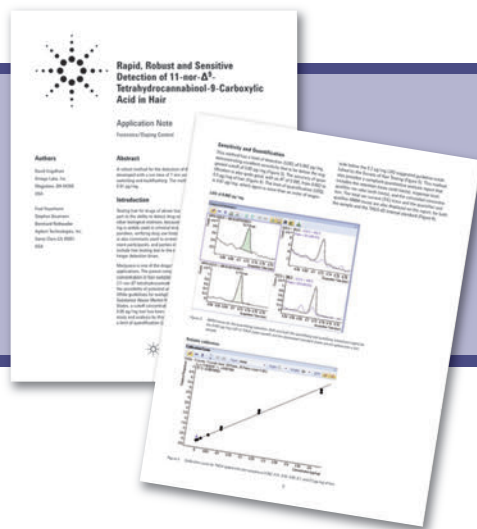
LTM II Columns

Phase	Description	ID (mm)	Length (m)	Film (µm)	Part No.
DB-17ms	5 m DuraGuard and long legs	0.25	15	0.25	G3900-65001
DB-1ms	With long column legs	0.25	15	0.25	G3903-65002
DB-1	Transfer line	0.15	1	1.20	G3903-61004

TIPS & TOOLS



For more information on THCA detection, view this Application Note on-line: *Rapid, Robust and Sensitive Detection of 11-nor-Δ⁹-Tetrahydrocannabinol-9-Carboxylic Acid in Hair* (publication # 5990-7535EN), www.agilent.com/chem/library



LTM Solution for Fast Simulated Distillation, ASTM D7798-13 and ASTM D2887

Simulated distillation is the preferred method for characterizing boiling point distributions of petroleum fractions because it requires less labor than physical distillation. Simulated distillation determines quantitative mass yield (% off) based on the boiling points for the components in feedstocks and finished petroleum-based materials. Using these results, producers can make informed decisions about process optimization and efficiency. A standard simulated distillation run takes about 20 to 30 min. However, with LTM technology, this time can be reduced to 2.5 min, greatly increasing the analyst's productivity.

ASTM recently released a new method, ASTM D7798-13, for fast simulated distillation, and so Agilent developed the Fast Simulated Distillation Analyzer (G3445B#658) to address this new method. Note that this method is similar to ASTM D2887. The new method does not address high temperature simulated distillation or extended simulated distillation. For ASTM D7798-13, Agilent uses the standard 0.25 μm film column configuration (calibration mix C₅-C₄₄). For fast LTM analysis of ASTM D2887, with Agilent analyzer G3445B#653, the 0.5 μm film column is used (calibration mix C₅-C₄₀).

LTM II Columns

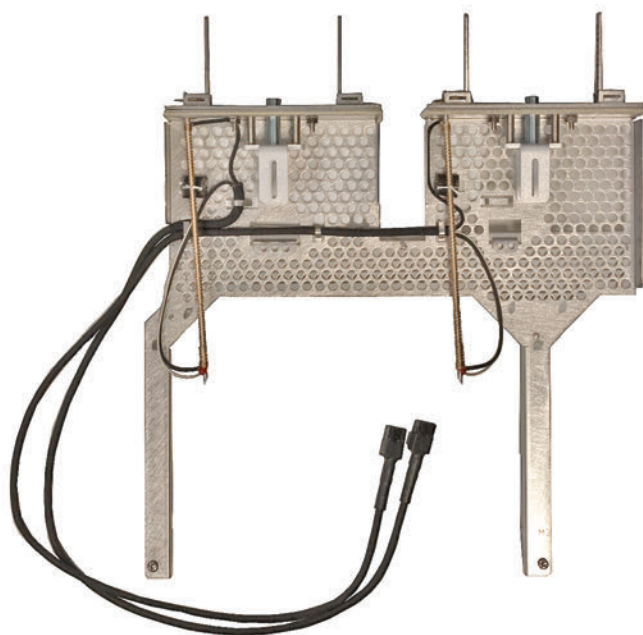
Phase	Description	ID (mm)	Length (m)	Film (μm)	Part No.
DB-Sim-Dist	LTM II	0.25	4	0.25	G3900-65004
DB-Sim-Dist	LTM II	0.25	4	0.50	G3900-65003

LTM II Transfer Line Module

The LTM II transfer line module provides the interface between the standard LTM II 5 in column module and the GC oven. The transfer line module has two heated tubes (transfer lines) through which the column leads pass from the LTM column module into the oven. These transfer lines are temperature programmable to prevent cold spots in the sample path between the GC oven and the LTM column assembly. Each LTM column module attaches to a transfer line module, and the resulting module assembly inserts into slots in the LTM oven door.

LTM II Transfer Line Module

Description	Part No.
LTM II transfer line module, 5 in	G3900-64016



Agilent J&W LTM Column Modules for Transportable 5975T GC/MSD Systems

This LTM column technology is designed specifically for Agilent 5975T GC/MS systems. These modules include an integrated 3 in LTM capillary column toroid assembly with heated transfer lines, cooling fan assembly and sheet metal enclosure. Replacement column toroid assemblies are also available.

Benefits of the LTM column modules include:

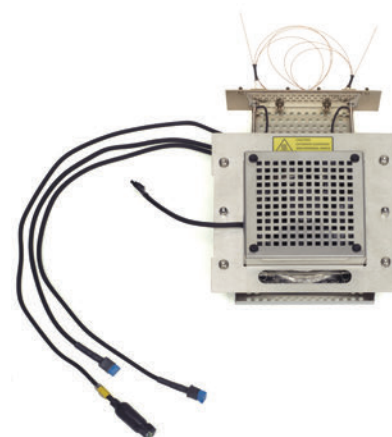
- Faster heating and cooling times – as low as one minute or less – for more rapid analytical cycle times
- Excellent retention time repeatability and performance comparable to conventional GC
- Less power consumption for longer in-field operation
- Integrated module design to facilitate easy column module change in the field



5975T LTM GC/MSD



Replacement column toroid for
LTM 5975T column modules



5975T complete column module

TIPS & TOOLS

Although LTM technology allows very fast temperature programming and fast cycle times, operating under maximum conditions will shorten the lifetime of the LTM column heating circuitry especially for extended 24 hour continuous operation. If you have flexibility in your GC method and/or setup, there are three simple things you can do to improve your LTM Column Module life:

1. Lowering the maximum temperature
2. Lowering the ramp rate during heating
3. Use shorter column lengths. With less thermal mass, heater circuitry generally lasts longer.



Custom LTM Column Ordering

Custom LTM columns are ordered using p/n 100-2000LTM

- Long legs 30 cm column ends (total column length includes the 30 cm column ends)
- **Note:** Long legs are standard for 5975T LTM columns
- Non-standard columns – custom column length, 3 in small format and other special request LTM columns

Note: When requesting quote for custom LTM columns, please specify the following:

- Instrument model, e.g. 7890 or 5975T
- LTM column format: 5 in standard or 3 in small format
- For 5975T, please indicate whether it is for a complete column module or replacement column toroid

Contact your local Agilent office or Authorized Agilent Distributor to receive a quote for your custom column needs. You can find order forms in the back of Agilent's Essential Chromatography Catalog.

Customers in the United States, Canada, and Puerto Rico can request a custom column quote online at www.agilent.com/chem/CustomColumn



Custom LTM II standard format (5 in) with long legs

**Agilent J&W LTM II Low Thermal Mass Column Modules
for 7890A/B Series GC Systems**

Phase	ID (mm)	Length (m)	Film (μm)	Part No.
CAM	0.25	30	0.25	112-2133LTM
	0.32	30	0.25	113-2132LTM
	0.53	30	1.00	115-2132LTM
Carbowax 20M	0.25	30	0.25	112-2032LTM
Cyclodex-B	0.25	30	0.25	112-2532LTM
CycloSil-B	0.25	30	0.25	112-6632LTM
	0.32	30	0.25	113-6632LTM
DB-1	0.10	5	0.12	127-100ALTM
		10	0.40	127-1013LTM
		20	0.40	127-1023LTM
	0.15	10	1.20	12A-1015LTM
	0.18	10	0.18	121-1012LTM
			0.20	121-101ALTM
			0.40	121-1013LTM
	20		0.18	121-1022LTM
			0.40	121-1023LTM
	0.20	12	0.33	128-1012LTM
		25	0.33	128-1022LTM
	0.25	15	0.25	122-1012LTM
		25	0.25	122-1022LTM
		30	0.25	122-1032LTM
			0.50	122-103ELTM
			1.00	122-1033LTM
	0.32	5	0.33	123-100ALTM
		15	0.10	123-1011LTM
	0.25		123-1012LTM	
	5.00		123-1015LTM	
	30		0.25	123-1032LTM
0.50			123-103ELTM	
1.00			123-1033LTM	
1.50			123-103BLTM	
5.00			123-1035LTM	

(Continued)

**Agilent J&W LTM II Low Thermal Mass Column Modules
for 7890A/B Series GC Systems**

Phase	ID (mm)	Length (m)	Film (µm)	Part No.	
DB-1	0.53	5	5.00	125-1005LTM	
		10	2.65	125-10HBLTM	
		15	0.15	125-1011LTM	
			1.50	125-1012LTM	
			5.00	125-1015LTM	
			25	5.00	125-1025LTM
		30	0.25	125-103KLTM	
			1.00	125-103JLTM	
			1.50	125-1032LTM	
			3.00	125-1034LTM	
			5.00	125-1035LTM	
DB-1301	0.53	30	1.50	125-1333LTM	
DB-17	0.10	10	0.10	127-1712LTM	
		0.18	20	0.18	121-1722LTM
		0.25	30	0.25	122-1732LTM
		0.32	30	0.25	123-1732LTM
		0.53	15	1.00	125-1712LTM
			15	1.50	125-1713LTM
30	1.00		125-1732LTM		
DB-1701	0.18	20	0.18	121-0722LTM	
		0.25	15	1.00	122-0713LTM
			30	0.25	122-0732LTM
			30	1.00	122-0733LTM
		0.32	15	0.25	123-0712LTM
		0.53	15	1.00	125-0712LTM
		DB-1701P	0.25	30	0.25
DB-17ht	0.25	5	0.15	122-1801LTM	
		30	0.15	122-1831LTM	
DB-17ms	0.18	20	0.18	121-4722LTM	
		0.25	15	0.15	122-4711LTM
			15	0.25	122-4712LTM
			30	0.25	122-4732LTM
		0.32	30	0.25	123-4732LTM

(Continued)



**Agilent J&W LTM II Low Thermal Mass Column Modules
for 7890A/B Series GC Systems**

Phase	ID (mm)	Length (m)	Film (μm)	Part No.
DB-1ht	0.25	30	0.10	122-1131LTM
	0.32	5	0.25	123-1102LTM
		15	0.10	123-1111LTM
DB-1ms	0.10	10	0.10	127-0112LTM
		20	0.40	127-0123LTM
	0.18	20	0.18	121-0122LTM
	0.20	25	0.33	128-0122LTM
	0.25	15	0.25	122-0112LTM
		30	0.25	122-0132LTM
DB-200	0.25	30	0.25	122-2032LTM
			0.50	122-2033LTM
DB-210	0.53	30	1.00	125-0232LTM
DB-225	0.25	15	0.25	122-2212LTM
		30	0.25	122-2232LTM
DB-225ms	0.25	15	0.25	122-2912LTM
			0.25	122-2932LTM
DB-23	0.25	30	0.25	122-2332LTM
DB-2887	0.53	10	3.00	125-2814LTM
DB-35	0.32	30	0.50	123-1933LTM
			1.00	125-1932LTM
DB-35ms	0.25	30	0.25	122-3832LTM
DB-5	0.10	10	0.10	127-5012LTM
			0.17	127-501ELTM
			0.40	127-5013LTM
	0.15	10	1.20	12A-5015LTM
			0.18	121-5012LTM
	0.18	10	0.18	121-5012LTM
			0.40	121-5013LTM
			0.18	121-5022LTM
	0.20	25	0.40	121-5023LTM
			0.33	128-5022LTM

(Continued)

**Agilent J&W LTM II Low Thermal Mass Column Modules
for 7890A/B Series GC Systems**

Phase	ID (mm)	Length (m)	Film (µm)	Part No.
DB-5	0.25	10	0.25	122-5002LTM
		15	0.25	122-5012LTM
		30	0.25	122-5032LTM
			0.50	122-503ELTM
			1.00	122-5033LTM
	0.32	5	1.00	123-5003LTM
		10	0.50	123-500ELTM
		15	0.10	123-5011LTM
			0.25	123-5012LTM
			1.00	123-5013LTM
		25	0.25	123-5022LTM
		30	0.25	123-5032LTM
			0.50	123-503ELTM
			1.50	123-503BLTM
			5.00	125-5035LTM
0.53	15	1.50	125-5012LTM	
	30	1.50	125-5032LTM	
		5.00	125-5035LTM	
DB-5ht	0.25	15	0.10	122-5711LTM
		30	0.10	122-5731LTM
	0.32	10	0.10	123-5701LTM
DB-5ms	0.18	20	0.18	121-5522LTM
			0.36	121-5523LTM
	0.20	25	0.33	128-5522LTM
	0.25	15	0.10	122-5511LTM
			0.25	122-5512LTM
			1.00	122-5533LTM
		25	0.25	122-5522LTM
		30	0.25	122-5532LTM
	1.00		122-5533LTM	
	0.32	15	0.25	123-5512LTM
			1.00	123-5513LTM
		30	0.50	123-5536LTM
			1.00	123-5533LTM
	0.53	30	1.50	125-5532LTM
			1.00	125-553JLTM

(Continued)



**Agilent J&W LTM II Low Thermal Mass Column Modules
for 7890A/B Series GC Systems**

Phase	ID (mm)	Length (m)	Film (μm)	Part No.
DB-5ms Ultra Inert	0.18	20	0.18	121-5522UULTM
			0.36	121-5523UULTM
	0.25	15	0.25	122-5512UULTM
			0.25	122-5522UULTM
			0.25	122-5532UULTM
			0.50	122-5536UULTM
			1.00	122-5533UULTM
DB-608	0.32	30	0.50	123-1730LTM
DB-624	0.18	20	1.00	121-1324LTM
			1.12	128-1314LTM
	0.20	10	1.12	128-1324LTM
			1.40	122-1334LTM
			1.80	123-1334LTM
	0.32	30	1.80	123-1334LTM
	0.45	30	2.55	124-1334LTM
0.53	30	3.00	125-1334LTM	
DB-ALC1	0.32	30	1.80	123-9134LTM
DB-FFAP	0.10	10	0.10	127-3212LTM
			0.10	127-32H2LTM
	0.25	30	0.25	122-3232LTM
			0.25	123-3232LTM
			0.50	123-3233LTM
	0.32	30	1.00	123-3234LTM
0.50			125-3217LTM	
DB-VRX	0.18	20	1.00	121-1524LTM
			0.25	30

(Continued)

**Agilent J&W LTM II Low Thermal Mass Column Modules
for 7890A/B Series GC Systems**

Phase	ID (mm)	Length (m)	Film (µm)	Part No.
DB-WAX	0.10	10	0.10	127-7012LTM
			0.20	127-7013LTM
		20	0.10	127-7022LTM
			0.20	127-7023LTM
	0.18	10	0.18	121-7012LTM
			0.30	121-7013LTM
		20	0.18	121-7022LTM
			0.30	121-7023LTM
	0.20	30	0.20	128-7032LTM
	0.25	15	0.25	122-7012LTM
			0.50	122-7013LTM
			0.25	122-7032LTM
		30	0.25	122-7032LTM
			0.50	122-7033LTM
			0.50	122-7033LTM
	0.32	15	0.25	123-7012LTM
0.50			123-7013LTM	
	30	0.25	123-7032LTM	
		0.50	123-7033LTM	
		0.50	123-7033LTM	
0.53	30	0.25	125-7031LTM	
		1.00	125-7032LTM	
DB-WAXetr	0.25	30	0.25	122-7332LTM
			1.00	123-7334LTM
			1.50	125-7333LTM
DB-XLB	0.25	15	0.10	122-1211LTM
		30	0.25	122-1232LTM
GS-CarbonPLOT	0.32	30	3.00	113-3133LTM
			3.00	115-3133LTM
GS-Q	0.32	30	0.00	113-3432LTM

(Continued)



**Agilent J&W LTM II Low Thermal Mass Column Modules
for 7890A/B Series GC Systems**

Phase	ID (mm)	Length (m)	Film (μm)	Part No.
HP-1	0.20	25	0.11	19091Z-002LTM
			0.50	19091Z-202LTM
	0.32	25	0.17	19091Z-012LTM
			30	0.10
		30	4.00	19091Z-613LTM
			5.00	19091Z-713LTM
			0.53	10
	30	2.65	19095Z-121LTM	
		0.88	19095Z-023LTM	
		2.65	19095Z-123LTM	
5.00		19095Z-623LTM		
HP-1ms	0.18	20	0.18	19091S-677LTM
		30	0.10	19091S-833LTM
	0.25	30	0.25	19091S-933LTM
			0.50	19091S-633LTM
			1.00	19091S-733LTM
	0.32	30	1.00	19091S-713LTM
HP-20M	0.32	25	0.30	19091W-012LTM
HP-35	0.25	15	0.25	19091G-131LTM
HP-5	0.18	20	0.18	19091J-577LTM
		0.25	5	0.10
	30		0.25	19091J-433LTM
	30		1.00	19091J-233LTM
	0.32	15	0.25	19091J-411LTM
		30	0.25	19091J-413LTM
			0.50	19091J-113LTM
	0.53	10	2.65	19095J-121LTM
	HP-50+	0.25	5	0.15
15			0.25	19091L-431LTM
30			0.25	19091L-433LTM
0.53		15	1.00	19095L-021LTM

(Continued)

TIPS & TOOLSFor more information about LTM II Column Modules, visit www.agilent.com/chem/ltmlcol_ii

**Agilent J&W LTM II Low Thermal Mass Column Modules
for 7890A/B Series GC Systems**

Phase	ID (mm)	Length (m)	Film (µm)	Part No.
HP-5ms	0.18	20	0.18	19091S-577LTM
		12	0.33	19091S-101LTM
		25	0.33	19091S-102LTM
	0.25	15	0.10	19091S-331LTM
			0.25	19091S-431LTM
		30	0.25	19091S-433LTM
	0.32	10	0.50	19091S-111LTM
		30	0.25	19091S-413LTM
HP-5ms Ultra Inert	0.18	20	0.18	19091S-577UILTM
		15	0.25	19091S-431UILTM
			0.25	19091S-433UILTM
			0.50	19091S-133UILTM
	0.32	30	0.25	19091S-413UILTM
			1.00	19091S-213UILTM
HP-88	0.25	30	0.20	112-8837LTM
HP-Fast Residual Solvent	0.53	30	1.00	19095V-420LTM
HP-FFAP	0.20	25	0.33	19091F-102LTM
		30	0.25	19091F-433LTM
	0.32	25	0.50	19091F-112LTM
		10	1.00	19095F-121LTM
			30	1.00
HP-INNOWax	0.18	20	0.18	19091N-577LTM
		25	0.20	19091N-102LTM
	0.25	5	0.15	19091N-030LTM
		30	0.25	19091N-133LTM
	0.32	30	0.15	19091N-013LTM
		30	1.00	19095N-123LTM

(Continued)

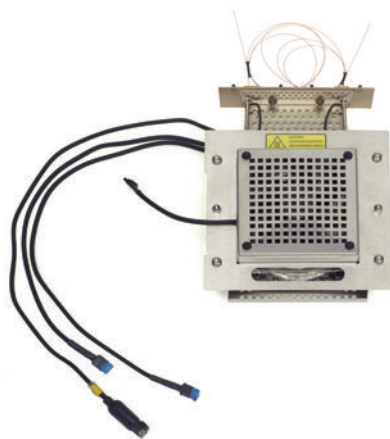


**Agilent J&W LTM II Low Thermal Mass Column Modules
for 7890A/B Series GC Systems**

Phase	ID (mm)	Length (m)	Film (μm)	Part No.
HP-PLOT Al ₂ O ₃ KCl	0.25	30	5.00	19091P-K33LTM
	0.53	30	15.00	19095P-K23LTM
HP-PLOT Al ₂ O ₃ S	0.32	25	8.00	19091P-S12LTM
HP-PLOT Molesieve	0.32	15	25.00	19091P-MS7LTM
		30	25.00	19091P-MS8LTM
	0.53	30	50.00	19095P-MS0LTM
HP-PLOT Q	0.32	15	20.00	19091P-Q03LTM
		30	20.00	19091P-Q04LTM
	0.53	15	40.00	19095P-Q03LTM
		30	40.00	19095P-Q04LTM
HP-PLOT U	0.32	30	10.00	19091P-U04LTM
	0.53	30	20.00	19095P-U04LTM
Ultra 2	0.20	12	0.33	19091B-101LTM
		25	0.33	19091B-102LTM
	0.32	25	0.52	19091B-112LTM



Replacement column toroid for LTM 5975T column modules



LTM 5975T column module

Agilent J&W LTM Column Modules for Transportable 5975T GC/MSD Systems

Phase	ID (mm)	Length (m)	Film (µm)	Toroid Assembly	Column Module	
DB-5ms Ultra Inert	0.18	20	0.18	221-5522UILTM	G3900-63014	
	0.25	15	0.25	222-5512UILTM	G3900-63031	
		30	0.25	222-5532UILTM	G3900-63005	
HP-5ms Ultra Inert	0.18	20	0.18	29091S-577UILTM	G3900-63039	
	0.25	15	0.25	29091S-431UILTM	G3900-63038	
		30	0.25	29091S-433UILTM	G3900-63001	
DB-1	0.25	30	0.25	222-1032LTM	G3900-63002	
DB-1ms	0.18	20	0.18	221-0122LTM	G3900-63009	
		15	0.25	222-0112LTM	G3900-63016	
		30	0.25	222-0132LTM	G3900-63017	
DB-1ht	0.25	15	0.10	222-1111LTM	G3900-63018	
		30	0.10	222-1131LTM	G3900-63019	
HP-1ms	0.18	20	0.18	29091S-677LTM	G3900-63040	
		0.25	30	0.10	29091S-833LTM	G3900-63041
			15	0.25	29091S-931LTM	G3900-63042
DB-5ms	0.18	20	0.18	221-5522LTM	G3900-63013	
		0.25	15	0.25	222-5512LTM	G3900-63030
			30	0.25	222-5532LTM	G3900-63004
DB-5ht	0.25	30	0.10	222-5731LTM	G3900-63033	
		15	0.10	222-5711LTM	G3900-63032	

(Continued)

Agilent J&W LTM Column Modules for Transportable 5975T GC/MSD Systems

Phase	ID (mm)	Length (m)	Film (μm)	Toroid Assembly	Column Module
HP-5ms	0.25	30	0.25	29091S-433LTM	G3900-63007
DB-35ms	0.18	20	0.18	221-3822LTM	G3900-63011
	0.25	15	0.25	222-3812LTM	G3900-63026
		30	0.25	222-3832LTM	G3900-63027
DB-17ms	0.18	20	0.18	221-4722LTM	G3900-63012
	0.25	15	0.25	222-4712LTM	G3900-63028
		30	0.25	222-4732LTM	G3900-63029
DB-225ms	0.25	15	0.25	222-2912LTM	G3900-63022
		30	0.25	222-2932LTM	G3900-63023
DB-1701	0.25	30	0.25	222-0732LTM	G3900-63003
DB-WAX	0.25	15	0.50	222-7013LTM	G3900-63034
		30	0.50	222-7033LTM	G3900-63035
HP-INNOWax	0.18	20	0.18	29091N-577LTM	G3900-63036
	0.25	30	0.25	29091N-133LTM	G3900-63008
DB-FFAP	0.25	15	0.25	222-3212LTM	G3900-63024
		30	0.25	222-3232LTM	G3900-63025
DB-608	0.18	20	0.18	221-6822LTM	G3900-63015
DB-VRX	0.18	20	1.00	221-1524LTM	G3900-63006
	0.25	30	1.40	222-1534LTM	G3900-63021
DB-624	0.18	20	1.00	221-1324LTM	G3900-63010
	0.25	30	1.40	222-1334LTM	G3900-63020
HP-VOC	0.20	30	1.12	29091R-303LTM	G3900-63037

TIPS & TOOLS

For more information about LTM Column Modules for 5975T, visit www.agilent.com/chem/5975t_ltm_col



Fused Silica Tubing

Deactivated Tubing

Deactivated tubing can be used as retention gaps, guard columns, or transfer lines. Our standard deactivation process is a phenyl methyl deactivation – the preferred choice for most applications due to its inertness and robustness.

Deactivated Fused Silica

ID (mm)	OD (mm)	Length (m)	Part No.
0.05	0.36	1	160-2655-1
		5	160-2655-5
		10	160-2655-10
0.10	0.19	1	160-1010-1
		5	160-1010-5
		10	160-1010-10
	0.36	1	160-2635-1
		5	160-2635-5
		5	19091-60620E
	10	160-2635-10	
0.15	0.36	1	160-2625-1
		5	160-2625-5
		10	160-2625-10
0.18	0.34	1	160-2615-1
		5	160-2615-5
		10	160-2615-10
0.20	0.36	1	160-2205-1
		5	160-2205-5
		10	160-2205-10

(Continued)

Deactivated Fused Silica

ID (mm)	OD (mm)	Length (m)	Part No.
0.25	0.36	1	160-2255-1
		5	160-2255-5
		10	160-2255-10
		30	160-2255-30
0.32	0.43	1	160-2325-1
		5	160-2325-5
		10	160-2325-10
		30	160-2325-30
0.45	0.67	1	160-2455-1
		5	160-2455-5
		10	160-2455-10
0.53	0.67	1	160-2535-1
		5	160-2535-5
		10	160-2535-10
		30	160-2535-30
0.53	0.70	5	CP8003*

* 7 in cage

Deactivated Fused Silica High Temperature (400 °C)

ID (mm)	OD (mm)	Length (m)	Part No.
0.05	0.36	5	160-2815-5
0.10	0.36	5	160-2825-5
0.25	0.35	5	160-2845-5
		10	160-2845-10
0.32	0.43	5	160-2855-5
		10	160-2855-10
0.53	0.67	5	160-2865-5
		10	160-2865-10

Retention Gaps

ID (mm)	OD (mm)	Length (m)	Connector	Unit	Part No.
0.25	0.36	2.5	Universal	5/pk	CP8007
0.32	0.45	2.5	Universal	5/pk	CP8008
		2.5	0.32/0.25	5/pk	CP8129
		2.5	0.32/0.32	5/pk	CP8128
0.53	0.70	2.5	Universal	5/pk	CP8009
		2.5	0.53/0.25	5/pk	CP8135
		2.5	0.53/0.32	5/pk	CP8134
		4.0	Universal	3/pk	CP8015

Retention Gaps Apolar Deactivated

ID (mm)	OD (mm)	Length (m)	Unit	Part No.
0.25	0.36	10	6/pk	CP8016

Retention Gaps Medium Polar Deactivated

ID (mm)	OD (mm)	Length (m)	Connector	Unit	Part No.
0.25	0.36	2.5	Universal	5/pk	CP8017
0.32	0.45	2.5	Universal	5/pk	CP8018
0.53	0.70	2.5	Universal	5/pk	CP8019

Retention Gaps Polar Deactivated

ID (mm)	OD (mm)	Length (m)	Connector	Unit	Part No.
0.25	0.36	2.5	Universal	5/pk	CP8087
0.32	0.45	2.5	Universal	5/pk	CP8088
0.53	0.70	2.5	Universal	5/pk	CP8089

Retention Gaps in Three Polarities

A package of 3 apolar, 1 medium polar and 1 polar deactivated

ID (mm)	OD (mm)	Length (m)	Connector	Unit	Part No.
0.25	0.36	2.5	Universal	5/pk	CP8070
0.32	0.45	2.5	Universal	5/pk	CP8080
0.53	0.70	2.5	Universal	5/pk	CP8090

Restriction for Rapid-MS

ID (mm)	OD (mm)	Length (m)	Unit	Part No.
0.1	0.39	0.6	5/pk	CP8121

Guard Column MSD

ID (mm)	OD (mm)	Length (m)	Unit	Part No.
0.53	0.70	5	1/pk	CP8186
			6/pk	CP68186

Large Volume Guard

ID (mm)	OD (mm)	Length (m)	Unit	Part No.
0.53	0.70	10	1/pk	CP8187
			6/pk	CP68187
0.53	0.70	12	1/pk	CP108194

Undeactivated Fused Silica

Undeactivated tubing or bare fused silica is commonly used for capillary electrophoresis. It can also be used for transfer lines and other applications where inertness is not critical.

Undeactivated Fused Silica

ID (mm)	OD (mm)	Length (m)	Part No.
0.02	0.36	5	160-2660-5
0.05	0.36	5	160-2650-5
		10	160-2650-10
0.075	0.36	5	160-2644-5
		10	160-2644-10
0.10	0.36	5	160-2634-5
		10	160-2634-10
0.18	0.34	5	160-2610-5
		10	160-2610-10
0.20	0.36	5	160-2200-5
		10	160-2200-10
0.25	0.36	5	160-2250-5
		10	160-2250-10
0.32	0.43	5	160-2320-5
		10	160-2320-10
		50	19091-21050
0.53	0.67	5	160-2530-5
		10	160-2530-10

Stainless Steel Tubing

UltiMetal Plus Stainless Steel Capillary Tubing

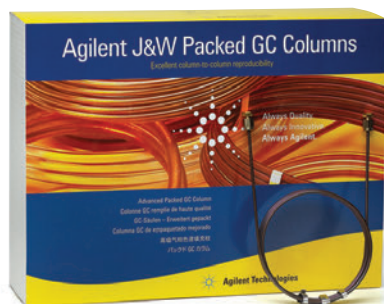
UltiMetal Plus stainless steel capillary tubing can be used as retention gaps, guard columns, or transfer lines.

UltiMetal Plus Stainless Steel Capillary Tubing

Description	ID (mm)	OD (mm)	Length (m)	Part No.
UltiMetal Plus transfer line	0.25	1.59	2	CP6571
UltiMetal Plus transfer line	0.25	1.59	10	CP6572
UltiMetal Plus transfer line	0.75	1.59	2	CP6573
UltiMetal Plus transfer line	0.75	1.59	10	CP6574
UltiMetal Plus guard column	0.25	0.5	2	CP6575
UltiMetal Plus guard column	0.53	0.8	2	CP6576
UltiMetal Plus guard column	0.53	0.8	5	CP6577
UltiMetal Plus guard column	0.53	0.8	10	CP6578
UltiMetal Plus capillary tubing	0.25	0.5	50	CP6579
UltiMetal Plus capillary tubing	0.32	0.5	50	CP6580
UltiMetal Plus capillary tubing	0.53	0.8	50	CP6581

ProSteel Deactivated

ID (mm)	OD (mm)	Length (m)	Part No.
0.53	0.67	5	160-4535-5



Agilent J&W Packed GC Columns

Agilent J&W Packed GC Columns are designed and manufactured to offer excellent and reproducible performance for all sample types associated with packed column separations, most important in the hydrocarbon processing industry.

The highly efficient and rigorous packing technology used in Agilent J&W Packed GC Columns assures column-to-column reproducibility and ultimate efficiency, while the UltiMetal treated stainless steel tubing allows for improved inertness and peak shape performance.

You can choose from a wide range of tubing materials – including stainless steel, UltiMetal, nickel, glass, copper and PTFE – plus hundreds of stationary phases, packings, and supports. All Agilent J&W Packed GC Columns can bend to fit Agilent and non-Agilent instruments with no impact on performance.

And, you can create your custom configurations by visiting www.agilent.com/chem/packedcolumnordering

Carbosieve S-II

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel
20 in (0.51 m)	1/8	2	80/100	G3591-81105	G3591-80105

15% Carbowax 1540

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
15 ft (4.57 m)	1/8	2	Chromosorb WHP	60/80	G3591-81095	G3591-80095	G3591-82095

5% Carbowax 20M (G16, G\$1)

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
7.22 ft (2.2 m)	1/8	2	Chromosorb WHP	100/120	G3591-81084	G3591-80084	G3591-82084

10% Carbowax 20M (G16, G\$1)

Length	OD (in)	ID (mm)	Support	Mesh	Stainless Steel
6.56 ft (2 m)	1/8	2	Chromosorb WHP	80/100	G3591-70016

10% Carbowax 20M (G16, G\$1) + 2% KOH

Length	OD (in)	ID (mm)	Support	Mesh	Stainless Steel
5.91 ft (1.8 m)	1/8	2	Chromosorb WHP	80/100	G3591-70012

20% Carbowax 20M (G16, G\$1)

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
9.84 ft (3 m)	1/8	2	Chromosorb WHP	100/120	G3591-81099	G3591-80099	G3591-82099

7% Carbowax M + 3% Polyphenoether 6 ring + 2% KOH

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Nickel
4 ft (1.22 m)	1/8	2	Chromosorb WAW	80/100	G3591-81050	G3591-82050

Carboxen-1000

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel
10 ft (3.05 m)	1/8	2	60/80	G3591-81055	G3591-80055

Chromosorb 101

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel
6 ft (1.83 m)	1/8	2	80/100	G3591-81021	G3591-80021

Chromosorb 102

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel	Nickel
2 ft (0.61 m)	1/8	2	80/100	G3591-81139	G3591-80139	G3591-82139

25% DC-200 (500 cSt)

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
15 ft (4.57 m)	1/8	2	Chromosorb PAW	80/100	G3591-81001	G3591-80001	G3591-82001

30% DC-200 (500 cSt)

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
20 ft (6.1 m)	1/8	2	Chromosorb PAW	100/120	G3591-81140	G3591-80140	G3591-82140
30 ft (9.14 m)	1/8	2	Chromosorb PAW	80/100	G3591-81082	G3591-80082	G3591-82082
30 ft (9.14 m)	1/8	2	Chromosorb PAW	60/80	CP2058*		

*Preconditioned and pretested

35% DC-200 (500 cSt)

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
3 ft (0.91 m)	1/8	2	Chromosorb PAW	80/100	G3591-81039	G3591-80039	G3591-82039
5 ft (1.52 m)	1/8	2	Chromosorb PAW	80/100	G3591-81027	G3591-80027	
10 ft (3.05 m)	1/8	2	Chromosorb PAW	80/100	G3591-81030	G3591-80030	
30 ft (9.14 m)	1/8	2	Chromosorb PAW	80/100	G3591-81032	G3591-80032	G3591-82032

15% Hallcomid M-18

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
9.84 ft (3 m)	1/8	2	Chromosorb WHP	100/120	G3591-81067	G3591-80067	G3591-82067

30% DC 200/500

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel
2 ft (0.61 m)	1/8	2	Chromosorb PAW	60/80	G3591-81160	G3591-80160
30 ft (9.14 m)	1/8	2	Chromosorb PAW	60/80	G3591-81161	G3591-80161



HayeSep A

Length	OD (in)	ID (mm)	Mesh	UltiMetal
1.31 ft (0.4 m)	1/8	2.1	80/100	G3591-81211**
2 ft (0.61 m)	1/16	1	80/100	G3591-81212*
5 ft (1.52 m)	1/8	2.1	80/100	G3591-81210*
5.58 ft (1.7 m)	1/16	1	80/100	G3591-81213*

*Specially coiled for Large Valve Oven, 41 mm mandrel

**Specially coiled for Large Valve Oven, 25 mm mandrel

HayeSep D

Length	OD (in)	ID (mm)	Mesh	Stainless Steel
6.56 ft (2 m)	1/8	2	80/100	G3591-80158

HayeSep DB

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel	Nickel
30 ft (9.14 m)	1/8	2	100/120	G3591-81088	G3591-80088	G3591-82088

HayeSep N

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel	Nickel
1.64 ft (0.5 m)	1/8	2	80/100	G3591-81156	G3591-80156	
1.64 ft (0.5 m)	1/16	1	80/100	CP1307*		
6 ft (1.83 m)	1/8	2	80/100	G3591-81037	G3591-80037	G3591-82037
6 ft (1.83 m)	1/8	2	80/100	CP2068*		
7 ft (2.13 m)	1/8	2	60/80	G3591-81060	G3591-80060	
8 ft (2.44 m)	1/8	2	80/100	G3591-81011	G3591-80011	G3591-82011
20 ft (6.1 m)	1/8	2	80/100	G3591-81045	G3591-80045	

*Preconditioned and pretested

HayeSep N + HayeSep R 1:1

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel
8 ft (2.44 m)	1/8	2	45/60	G3591-81091	G3591-80091

HayeSep P

Length	OD (in)	ID (mm)	Mesh	UltiMetal
6 ft (1.83 m)	1/8	2	80/100	CP2062

HayeSep Q

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel	Nickel
0.82 ft (0.25 m)	1/16	1	80/100	CP1308*		
1.64 ft (0.5 m)	1/8	2	80/100	G3591-81023	G3591-80023	G3591-82023
1.64 ft (0.5 m)	1/8	2	80/100	CP81073*		
3 ft (0.91 m)	1/8	2	80/100	G3591-81020	G3591-80020	G3591-82020
3.28 ft (1 m)	1/8	2	80/100	G3591-81146	G3591-70007	
3.28 ft (1 m)	1/8	2	80/100	CP81069*		
3.9 ft (1.2 m)	1/8	2	80/100			G3591-82159
4 ft (1.22 m)	1/8	2	80/100	G3591-81019	G3591-80019	
4.92 ft (1.5 m)	1/16	1	80/100	CP1305*		
5.91 ft (1.8 m)	1/8	2	80/100		G3591-70011	
6 ft (1.83 m)	1/8	2	80/100	G3591-81004	G3591-80004	G3591-82004
6.56 ft (2 m)	1/8	2	80/100		G3591-70005	
8 ft (2.44 m)	1/8	2	80/100	G3591-81047	G3591-80047	
9 ft (2.74 m)	1/8	2	80/100	G3591-81033	G3591-80033	G3591-82033
9.84 ft (3 m)	1/8	2	80/100		G3591-70006	
10 ft (3.05 m)	1/8	2	80/100	G3591-81002	G3591-80002	G3591-82002
12 ft (3.66 m)	1/8	2	80/100	G3591-81121	G3591-80121	G3591-82121

*Preconditioned and pretested

HayeSep R

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel	Nickel
3.28 ft (1 m)	1/8	2	80/100	CP86678*		
6 ft (1.83 m)	1/8	2	80/100	G3591-81102	G3591-80124	G3591-82102
8.53 ft (2.6 m)	1/8	2	80/100	CP86677*		
12 ft (3.66 m)	1/8	2	80/100	G3591-81100	G3591-80100	
12 ft (3.66 m)	1/8	2	80/100	CP2055*		

*Preconditioned and pretested

HayeSep T

Length	OD (in)	ID (mm)	Mesh	UltiMetal	PTFE
1.64 ft (0.5 m)	1/8	2	80/100	G3591-81143	
1.64 ft (0.5 m)	1/8	2.4	60/80		G3591-74001

MolSieve 5Å

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel	Nickel
1 ft (0.30 m)	1/8	2	60/80	G3591-81077	G3591-80077	
1.64 ft (0.5 m)	1/8	2	60/80	G3591-81147		
1.97 ft (0.6 m)	1/4	4	80/100		G3591-70004	
3 ft (0.91 m)	1/8	2	60/80	G3591-81103	G3591-80103	
3 ft (0.91 m)	1/8	2	80/100	G3591-81074	G3591-80074	
3 ft (0.91 m)	1/8	2	100/120	G3591-81075	G3591-80075	
3.28 ft (1 m)	1/8	2	80/100		G3591-70008	
3.28 ft (1 m)	1/8	2	60/80	CP81025*		
3.28 ft (1 m)	1/8	2	60/80	G3591-81149		
4 ft (1.22 m)	1/8	2	45/60	G3591-81090	G3591-80090	
4 ft (1.22 m)	1/8	2	60/80	G3591-81104	G3591-80104	G3591-82104
4.92 ft (1.5 m)	1/16	1	80/100	CP1306*		
5 ft (1.52 m)	1/8	2	80/100	CP2046		
6 ft (1.83 m)	1/8	2	45/60	CP2065		
6 ft (1.83 m)	1/8	2	60/80	G3591-81017	G3591-80017	G3591-82017
6.56 ft (2 m)	1/8	2	45/60		G3591-70013	
6.56 ft (2 m)	1/8	2	60/80		G3591-70002	
6.56 ft (2 m)	1/8	2	80/100		G3591-70003	
7 ft (2.13 m)	1/8	2	45/60	G3591-81062	G3591-80062	
7 ft (2.13 m)	1/8	2.1	60/80	G3591-81209**		
8 ft (2.44 m)	1/8	2	60/80	G3591-81022	G3591-80022	G3591-82022
9 ft (2.74 m)	1/8	2	60/80	G3591-81046	G3591-80046	
9 ft (2.74 m)	1/8	2	80/100	G3591-81064	G3591-80064	G3591-82064
10 ft (3.05 m)	1/8	2	80/100	CP2045		
13.1 ft (4 m)	1/8	2	80/100	CP1483*		
15 ft (4.57 m)	1/8	2	45/60	G3591-81061	G3591-80061	
20 ft (6.1 m)	1/8	2	45/60		G3591-80107	
20 ft (6.1 m)	1/8	2	60/80	G3591-81056	G3591-80056	
25 ft (7.62 m)	1/8	2	60/80	G3591-81065	G3591-80065	

*Preconditioned and pretested

**Specially coiled for Large Valve Oven, 41 mm mandrel

MolSieve 13X

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel	Nickel
2 ft (0.61 m)	1/8	2	45/60	G3591-81031	G3591-80031	
3 ft (0.91 m)	1/8	2	45/60	G3591-81028	G3591-80028	
3 ft (0.91 m)	1/8	2	45/60	CP2059*		
3.94 ft (1.2 m)	1/16	1	80/100	CP1309*		
4 ft (1.22 m)	1/8	2	45/60	G3591-81012	G3591-80012	G3591-82012
4.9 ft (1.5 m)	1/8	2	80/100	G3591-81085	G3591-80085	
4.92 ft (1.5 m)	1/8	2	80/100	CP81071*		
6 ft (1.83 m)	1/8	2	60/80	G3591-81035	G3591-80035	G3591-82035
6.56 ft (2 m)	1/16	1	80/100	G3591-81214*		
9 ft (2.74 m)	1/8	2	45/60	G3591-81054	G3591-80054	
9.84 ft (3 m)	1/8	2	45/60		G3591-70017	
9.84 ft (3 m)	1/8	2	80/100		G3591-70015	
10 ft (3.05 m)	1/8	2	45/60	G3591-81003	G3591-80003	G3591-82003
10 ft (3.05 m)	1/16	1	60/80	G3591-81097	G3591-80097	
10 ft (3.05 m)	1/8	2	60/80	G3591-81101	G3591-80101	G3591-82101
10 ft (3.05 m)	1/8	2	80/100	G3591-81043	G3591-80043	G3591-82043
12 ft (3.66 m)	1/8	2	60/80	G3591-81058	G3591-80058	
15 ft (4.57 m)	1/8	2	45/60	G3591-81098	G3591-80098	

*Preconditioned and pretested

**Specially coiled for Large Valve Oven, 41 mm mandrel

1.5% OV-101

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel
2 ft (0.61 m)	1/8	2	Chromosorb GHP	100/120	G3591-81162	G3591-80162

10% OV-101

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
2.6 ft (0.79 m)	1/8	2	Chromosorb WHP	60/80	G3591-81048	G3591-80048	G3591-82048
5 ft (1.52 m)	1/8	2	Chromosorb PAW	80/100	G3591-81093	G3591-80093	G3591-82093

20% OV-101

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
4 ft (1.22 m)	1/8	2	Chromosorb WHP	80/100	G3591-81025	G3591-80025	G3591-82025



10% PEG-20M

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
6.56 ft (2 m)	1/8	2	Chromosorb W	80/100	G3591-81119	G3591-80119	G3591-82119

20% PEG-20M

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
6.56 ft (2 m)	1/8	2	Chromosorb W	80/100	G3591-81122	G3591-80122	G3591-82122
13.1 ft (4 m)	1/8	2	Chromosorb W	80/100	G3591-81123	G3591-80123	G3591-82123

Porapak N

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel	Nickel
3 ft (0.91 m)	1/8	2	80/100	G3591-81072	G3591-80072	G3591-82072
3.9 ft (1.2 m)	1/8	2	60/80	G3591-81087	G3591-80087	G3591-82087
6 ft (1.83 m)	1/8	2	80/100	G3591-81036	G3591-80036	G3591-82036
8.2 ft (2.5 m)	1/8	2	50/80	G3591-81086	G3591-80086	
9 ft (2.74 m)	1/8	2	80/100	G3591-81044	G3591-80044	G3591-82044
12 ft (3.66 m)	1/8	2	60/80	G3591-81059	G3591-80059	

Porapak N + Porapak R 1:1

Length	OD (in)	ID (mm)	Mesh	Stainless Steel
12 ft (3.66 m)	1/8	2	50/80	G3591-80110

Porapak Q

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel	Nickel
3 ft (0.91 m)	1/8	2	80/100	G3591-81135	G3591-80135	G3591-82135
3.28 ft (1 m)	1/8	2	80/100		G3591-70014	
5.91 ft (1.8 m)	1/8	2	80/100		G3591-70010	
6 ft (1.83 m)	1/8	2	60/80	G3591-81136	G3591-80136	G3591-82136
6 ft (1.83 m)	1/8	2	80/100	G3591-81013	G3591-80013	G3591-82013
6.56 ft (2 m)	1/8	2	80/100		G3591-70001	
8 ft (2.44 m)	1/8	2	60/80	G3591-81137	G3591-80137	G3591-82137
8.2 ft (2.5 m)	1/8	2	80/100	G3591-81083	G3591-80083	
9 ft (2.74 m)	1/8	2	80/100	G3591-81016	G3591-80016	G3591-82016
9.84 ft (3 m)	1/8	2	80/100		G3591-70009	
13 ft (3.96 m)	1/8	2	80/100	G3591-81053	G3591-80053	G3591-82053
15 ft (4.57 m)	1/8	2	80/100	G3591-81066	G3591-80066	
25 ft (7.62 m)	1/8	2	100/120	G3591-81052	G3591-80052	
30 ft (9.14 m)	1/16	1	80/100	G3591-81096	G3591-80096	

Porapak QS

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel	Nickel
4.92 ft (1.5 m)	1/8	2	50/80		G3591-70018	
6.56 ft (2 m)	1/8	2	80/100	G3591-81157	G3591-80157	
8 ft (2.44 m)	1/8	2	80/100	G3591-81051	G3591-80051	G3591-82051

Porapak R

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel	Nickel
6 ft (1.83 m)	1/8	2	60/80	G3591-81106	G3591-80106	G3591-82106

Porapak T

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel
1.5 ft (0.46 m)	1/8	2	80/100	G3591-81138	G3591-80138
6.56 ft (2 m)	1/8	2	80/100	G3591-81120	G3591-80120

10% SE-30

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal
2.5 ft (0.76 m)	1/8	2	Chromosorb W	80/100	CP2073

20% Sebaconitrile

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
2 ft (0.61 m)	1/8	2	Chromosorb PAW	80/100	G3591-81029	G3591-80029	G3591-82029
19.7 ft (6 m)	1/8	2	Chromosorb PAW	80/100	G3591-81071	G3591-80071	
30 ft (9.14 m)	1/8	2	Chromosorb PAW	60/80	G3591-81176	G3591-80176	G3591-82176
30 ft (9.14 m)	1/8	2	Chromosorb PAW	80/100	G3591-81026	G3591-80026	G3591-82026

20% Sebaconitrile/2% H₃PO₄

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
2 ft (0.61 m)	1/8	2	Chromosorb PAW	80/100	G3591-81015	G3591-80015	G3591-82015
30 ft (9.14 m)	1/8	2	Chromosorb PAW	80/100	G3591-81014	G3591-80014	G3591-82014

Silica Gel

Length	OD (in)	ID (mm)	Mesh	UltiMetal	Stainless Steel
2 ft (0.61 m)	1/8	2	60/80	G3591-81141	G3591-80141
4 ft (1.22 m)	1/8	2	60/80	G3591-81142	G3591-80142
6 ft (1.83 m)	1/8	2	60/80		G3591-80108
10 ft (3.05 m)	1/8	2	60/80	CP2050	

0.1% SP-1000

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
7 ft (2.13 m)	1/8	2	Carbopak C	80/100	G3591-81063	G3591-80063	G3591-82063

15% SP-2100

Length	OD (in)	ID (mm)	Support	Mesh	Stainless Steel
1.64 ft (0.5 m)	1/16	1	Chromosorb PAW	80/100	G3591-80170
7.22 ft (2.2 m)	1/16	1	Chromosorb PAW	80/100	G3591-80171

25% SP-2100

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel
1.64 ft (0.5 m)	1/16	1	Chromosorb PAW	80/100	G3591-81007	G3591-80007
5.7 ft (1.75 m)	1/16	1	Chromosorb PAW	80/100	G3591-81008	G3591-80008
15 ft (4.57 m)	1/8	2	Chromosorb PAW	80/100	G3591-81068	G3591-80068

20% TCEP

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
1.84 ft (0.56 m)	1/16	0.75	Chromosorb PAW	80/100	G3591-81215*		
1.84 ft (0.56 m)	1/16	1	Chromosorb PAW	80/100	G3591-81006	G3591-80006	
5 ft (1.52 m)	1/8	2	Chromosorb PAW	80/100	G3591-81094	G3591-80094	
15 ft (4.57 m)	1/8	2	Chromosorb PAW	80/100	G3591-81049	G3591-80049	G3591-82049

* Specially coiled for Large Valve Oven, 41 mm mandrel

10% UC W982

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
1.5 ft (0.46 m)	1/8	2	Chromosorb PAW	80/100	G3591-81034	G3591-80034	
2 ft (0.61 m)	1/8	2	Chromosorb PAW	80/100	G3591-81040	G3591-80040	G3591-82040

12% UC W982

Length	OD (in)	ID (mm)	Support	Mesh	UltiMetal	Stainless Steel	Nickel
2 ft (0.61 m)	1/8	2	Chromosorb PAW	80/100	G3591-81000	G3591-80000	G3591-82000



TIPS & TOOLS

To learn more about Agilent J&W Packed GC Columns please visit www.agilent.com/chem/packedcolumns



Custom GC Column Ordering

Even though we offer over a thousand readily available columns, Agilent recognizes that sometimes you need something a little out of the ordinary. That's why we developed our Custom Column Shop. If you can't find what you're looking for in our standard order guides, we will design, build, and test capillary GC columns to meet your needs.

- We can create columns with non-standard lengths or unusual film thickness.
- We can connect columns together in series or as dual columns.
- We recognize that sometimes customers have specific column performance requirements for their applications that might not be met with standard test mixes. As a result, we can also custom-test your columns with your desired test mixture and test conditions to meet specific performance requirements.
- We can create DuraGuard or EZ-Guard columns with an integrated guard column (retention gap). Most phases can be manufactured with a built-in guard column, which means you get the advantages of a guard column without the union. Available in DB, CP and VF phases.

Custom columns are ordered using the p/ns below. Be sure to provide the details of your desired custom service or column including phase, length, id, and film thickness.

- 100-2000 Custom Capillary DB & HP columns
- 100-6000 Custom Capillary CP & VF columns
- 100-9000 UltiMetal treated tubing and parts
- 100-2000 LTM – Custom Low Thermal Mass column configurations
- 100-5000 Custom packed columns or bulk phases/supports

Contact your local Agilent office or Authorized Agilent Distributor to receive a quote for your custom column needs. You can find order forms in the back of Agilent's Essential Chromatography Catalog.

Customers in the United States, Canada, and Puerto Rico can request a custom column quote online at www.agilent.com/chem/CustomColumn



Agilent J&W GC Column Test Standards

Compare your column's performance to the test chromatogram shipped with your Agilent J&W column. The column test standard contains components that test the column for resolution characteristics, efficiency, and inertness. The test mixes are supplied at a concentration of 250 ng/μL in 2 mL vials. Match the phase and column diameter in the chart below to find the test mix for your column.

Agilent J&W GC Column Test Standards

Column Description	Microbore (0.05 & 0.10 mm ID) Part No.	Capillary (0.18 & 0.32 mm ID) Part No.	Megabore (0.45 & 0.53 mm ID) Part No.
OV-351		200-0032	
DB-1ht		200-0010	
DB-1	200-0010	200-0310	200-0110
DB-5	200-0010	200-0310	200-0110
DB-5ht		200-0010	
DB-5ms		200-0185	200-0185
DB-624		200-0113	200-0113
DB-2887			200-0110
DB-WAX	200-0070	200-0370	200-0070
DB-WAXetr		200-0370	200-0070
SE-30		200-0010	
SE-52		200-0010	
SE-54		200-0010	200-0010
HP-1		5080-8858	8500-6812
HP-5		5080-8858	8500-6812
HP-FFAP	8500-6813	8500-6813	8500-6813
GS-OxyPLOT			5188-5379

Test Standards for Agilent J&W CP and VF Columns

Test Mix 31 Hazardous, 1/pk	Part No.
VF-1ms	CP0031
VF-5ms	CP0031
VF-17ms	CP0031
VF-35ms	CP0031
VF-Xms	CP0031
VF-1301ms	CP0031
VF-200ms	CP0031
VF Rapid-MS	CP0031
CP-Sil 5 CB	CP0031
CP-Sil 8 CB	CP0031
CP-Sil 24 CB	CP0031
CP-1301	CP0031

TIPS & TOOLS

Ensure highest quality gas while keeping gas lines clean and leak-free with Agilent's high-capacity gas filter. Learn more at www.agilent.com/chem/gasclean





Column Installation and Troubleshooting

Quick reference guides and tips to ensure peak performance

Agilent J&W GC columns are backed by decades of chromatography experience, so you can count on superior quality and dependability. And you can help ensure maximum performance, efficiency, and column life by implementing the most current installation and troubleshooting procedures.

In this section, you'll discover tips, techniques, and easy reference guides that will help you:

- Confidently install any capillary column
- Condition and test new columns
- Alleviate and avoid column performance degradation due to thermal damage, oxygen damage, and other factors
- Pinpoint and fix the most common column problems

So you'll expand your hours of continuous operation, decrease downtime, and get the reproducible results that your lab demands.

Capillary Column Installation

Quick Reference Guide

For more detailed installation information, refer to the GC Column Installation Guide which is provided with your column, or visit www.agilent.com/chem/columninstall

Precolumn Installation Check List

1. Replace oxygen, moisture, and hydrocarbon traps as needed.
2. Clean the injection port, replace critical injection port seals, replace injection port liners, and change septa as needed.
3. Check detector seals, and replace as necessary. Clean or replace detector jets as necessary.
4. Carefully inspect the column for damage or breakage.
5. Check your GC manufacturer's gas pressure requirements and verify gas cylinder delivery pressures to ensure that an adequate supply of carrier, makeup, and fuel gases are available. Minimum recommended carrier gas purity percentages are: helium 99.995% and hydrogen 99.995%, with H₂O <1 ppm and O₂ <0.5 ppm.
6. Gather the necessary installation tools: You will need a column cutter, column nuts, column nut wrench, ferrules, a magnifying loupe, and typewriter correction fluid.

Installing the Column

1. Uncoil approximately 0.5 m of tubing (1 coil ~ 0.5 m) from the column basket at both ends of the column for injector and detector installation. Avoid using sharp bends in the tubing.
2. Mount the column in the oven. Use a handling bracket if available.
3. Install the column nut and graphite/polyimide or graphite ferrule at each column end; pull the nut and ferrule down the tubing approximately 15 cm (**Table 6**).
4. Score (scratch) the column. Use a light touch to score the column about 4 to 5 cm from each end.

(Continued)

Table 6:

Ferrule Sizes

Column ID (mm)	Ferrule ID (mm)
0.10	0.4
0.18	0.4
0.20	0.4
0.25	0.4
0.32	0.5
0.45	0.8
0.53	0.8



5. Make a clean break. Grasp the column between the thumb and forefinger as close to the score point as possible. Gently pull and bend the column. The column should part easily. If the column does not break easily, do not force it. Score the column again in a different place (farther from the end than before) and try again for a clean break.
6. Use a magnifying loupe to inspect the cut. Make sure the cut is square across the tubing with no polyimide or "glass" fragments at the end of the tube.
7. Install the column in the inlet. Check the GC manufacturer's instrument manual for the correct insertion distance in the injection port type being used. Slide the column nut and ferrule to the proper distance and then mark the correct distance on the column with typewriter correction fluid just behind the column nut. Allow the fluid to dry. Insert the column into the injector. Finger tighten the column nut until it starts to grab the column, and then tighten the nut an additional 1/4 to 1/2 turn, so that the column cannot be pulled from the fitting when gentle pressure is applied. Verify that the correct column insertion distance has been maintained by looking at the typewriter correction fluid mark.
8. Turn on the carrier gas and establish the proper flow rate. Set head pressure, split flow, and septum purge flow to appropriate levels. See **Table 7** for nominal head pressures. If fusing a split/splitless inlet, check that the purge (split) valve is "on" (open).
9. Confirm carrier gas flow through the column. Immerse the end of the column in a vial of solvent and check for bubbles.
10. Install the column into the detector. Check the instrument manufacturer's manual for the proper insertion distance.
11. Check for leaks. **This is very important.** Do not heat the column without thoroughly checking for leaks.
12. Establish proper injector and detector temperatures.
13. Establish proper makeup and detector gas flows. Ignite or turn "on" the detector.
14. Purge the column for a minimum of 10 min at ambient temperature. Add the appropriate additional purge time following inlet or trap maintenance.
15. Inject non-retained substance to check for proper injector installation. Examples: butane or methane (FID), headspace vapors from acetonitrile (NPD), headspace vapors from methylene chloride (ECD), air (TCD), argon (mass spectrometer). Proper installation is indicated by a symmetrical non-retained peak. If tailing is observed, reinstall the column into the inlet.

TIPS & TOOLS



Learn more about Agilent's top-ranked service and support at www.agilent.com/chem/services

Conditioning and Testing the Column

1. Set oven temperature 20 °C above the maximum temperature of the analysis or at the maximum temperature of the column (whichever is lower) for 2 hours. If after 10 min at the upper temperature the background does not begin to fall, immediately cool the column and check for leaks.
2. If you are using polyimide or graphite/polyimide ferrules, recheck column nut tightness after the conditioning process.
3. Confirm final proper average linear velocity by injecting a non-retained substance again.

Table 7:

Approximate Head Pressures (psig)							
Column Length (m)	Column ID (mm)						
	0.1	0.18	0.2	0.25	0.32	0.45	0.53
10	35-45	5-13					
12			10-15				
15				8-12	5-13		1-2
20	75-100	10-20					
25			20-30				
30				15-25	10-20	3-5	2-4
40		35-50					
50			30-60		15-25		
60				30-45	20-30	6-10	4-8
75						8-14	5-13
105				60-80			10-15

Causes of Column Performance Degradation

Column Breakage

Fused silica columns break wherever there is a weak point in the polyimide coating. The polyimide coating protects the fragile but flexible fused silica tubing. The continuous heating and cooling of the oven, vibrations caused by the oven fan, and being wound on a circular cage all place stress on the tubing. Eventually breakage occurs at a weak point. Weak spots are created where the polyimide coating is scratched or abraded. This usually occurs when a sharp point or edge is dragged over the tubing. Column hangers and tags, metal edges in the GC oven, column cutters, and miscellaneous items on the lab bench are just some of the common sources of sharp edges or points.

It is rare for a column to spontaneously break. Column manufacturing practices tend to expose any weak tubing and eliminate it from use in finished columns. Larger diameter columns are more prone to breakage. This means that greater care and prevention against breakage must be taken with 0.45-0.53 mm id tubing than with 0.18-0.32 mm id tubing.

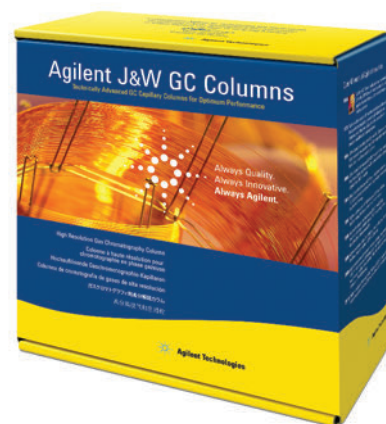
A broken column is not always fatal. If a broken column was maintained at a high temperature either continuously or with multiple temperature program runs, damage to the column is very likely. The back half of the broken column has been exposed to oxygen at elevated temperatures which rapidly damages the stationary phase. The front half is fine since carrier gas flowed through this length of column. If a broken column has not been heated or only exposed to high temperatures or oxygen for a very short time, the back half has probably not suffered any significant damage.

A union can be installed to repair a broken column. Any suitable union will work to rejoin the column. Problems with dead volume (peak tailing) may occur with improperly installed unions.

Thermal Damage

Exceeding a column's upper temperature limit results in accelerated degradation of the stationary phase and tubing surface. This results in the premature onset of excessive column bleed, peak tailing for active compounds and/or loss of efficiency (resolution). Fortunately, thermal damage is a slower process, thus prolonged times above the temperature limit are required before significant damage occurs. Thermal damage is greatly accelerated in the presence of oxygen. Overheating a column with a leak or high oxygen levels in the carrier gas results in rapid and permanent column damage.

Setting the GC's maximum oven temperature at or only a few degrees above the column's temperature limit is the best method to prevent thermal damage. This prevents the accidental overheating of the column. If a column is thermally damaged, it may still be functional. Remove the column from the detector. Heat the column for 8-16 hours at its isothermal temperature limit. Remove 10-15 cm from the detector end of the column. Reinstall the column and condition as usual. The column usually does not return to its original performance; however, it is often still functional. The life of the column will be reduced after thermal damage.



Oxygen Damage

Oxygen is an enemy to most capillary GC columns. While no column damage occurs at or near ambient temperatures, severe damage occurs as the column temperature increases. In general, the temperature and oxygen concentration at which significant damage occurs is lower for polar stationary phases. It is constant exposure to oxygen that is the problem. Momentary exposure such as an injection of air or a very short duration septum nut removal is not a problem.

A leak in the carrier gas flow path (e.g., gas lines, fittings, injector) is the most common source of oxygen exposure. As the column is heated, very rapid degradation of the stationary phase occurs. This results in the premature onset of excessive column bleed, peak tailing for active compounds and/or loss of efficiency (resolution). These are the same symptoms as for thermal damage. Unfortunately, by the time oxygen damage is discovered, significant column damage has already occurred. In less severe cases, the column may still be functional but at a reduced performance level. In more severe cases, the column is irreversibly damaged.

Maintaining an oxygen and leak-free system is the best prevention against oxygen damage. Good GC system maintenance includes periodic leak checks of the gas lines and regulators, regular septa changes, using high quality carrier gases, installing and changing oxygen traps, and changing gas cylinders before they are completely empty.



Chemical Damage

There are relatively few compounds that damage stationary phases. Introducing nonvolatile compounds (e.g., salts) in a column often degrades performance, but damage to the stationary phase does not occur. These residues can often be removed and performance returned by solvent rinsing the column.

Inorganic or mineral bases and acids are the primary compounds to avoid introducing into a column. The acids include hydrochloric (HCl), sulfuric (H₂SO₄), nitric (HNO₃), phosphoric (H₃PO₄), and chromic (CrO₃). The bases include potassium hydroxide (KOH), sodium hydroxide (NaOH), and ammonium hydroxide (NH₄OH). Most of these acids and bases are not very volatile and accumulate at the front of the column. If allowed to remain, the acids or bases damage the stationary phase. This results in the premature onset of excessive column bleed, peak tailing for active compounds and/or loss of efficiency (resolution). The symptoms are very similar to thermal and oxygen damage. Hydrochloric acid and ammonium hydroxide are the least harmful of the group. Both tend to follow any water that is present in the sample. If the water is not or only poorly retained by the column, the residence time of the HCl and NH₄OH in the column is short. This tends to eliminate or minimize any damage by these compounds. Thus, if HCl or NH₄OH are present in a sample, using conditions or a column with no water retention will render these compounds relatively harmless to the column.

The only organic compounds that have been reported to damage stationary phases are perfluoroacids. Examples include trifluoroacetic, pentafluoropropanoic, and heptafluorobutyric acid. They need to be present at high levels (e.g., 1% or higher). Most of the problems are experienced with splitless or megabore direct injections where large volumes of the sample are deposited at the front of the column.

Since chemical damage is usually limited to the front of the column, trimming or cutting 0.5-1 m from the front of the column often eliminates any chromatographic problems. In more severe cases, five or more meters may need to be removed. The use of a guard column or retention gap will minimize the amount of column damage; however, frequent trimming of the guard column may be necessary. The acid or base often damages the surface of the deactivated fused silica tubing which leads to peak shape problems for active compounds.

Column Contamination

Column contamination is one of the most common problems encountered in capillary GC. Unfortunately, it mimics a very wide variety of problems and is often misdiagnosed as another problem. A contaminated column is usually not damaged, but it may be rendered useless.

There are two basic types of contaminants: nonvolatile and semivolatile. Nonvolatile contaminants or residues do not elute and accumulate in the column. The column becomes coated with these residues which interfere with the proper partitioning of solutes in and out of the stationary phase. Also, the residues may interact with active solutes resulting in peak adsorption problems (evident as peak tailing or loss of peak size). Active solutes are those containing a hydroxyl (-OH) or amine (-NH) group, and some thiols (-SH) and aldehydes. Semivolatile contaminants or residues accumulate in the column, but eventually elute. Hours to days may elapse before they completely leave the column. Like nonvolatile residues, they may cause peak shape and size problems, and, in addition, are usually responsible for many baseline problems (instability, wander, drift, ghost peaks, etc.).

Contaminants originate from a number of sources, with injected samples being the most common. Extracted samples are among the worst types. Biological fluids and tissues, soils, waste and ground water, and similar types of matrixes contain high amounts of semivolatile and nonvolatile materials. Even with careful and thorough extraction procedures, small amounts of these materials are present in the injected sample. Several to hundreds of injections may be necessary before the accumulated residues cause problems. Injection techniques such as on-column, splitless, and megabore direct place a large amount of sample into the column, thus column contamination is more common with these injection techniques.

Occasionally, contaminants originate from materials in gas lines and traps, ferrule and septa particles, or anything coming in contact with the sample (vials, solvents, syringes, pipettes, etc.). These types of contaminants are probably responsible when a contamination problem suddenly develops and similar samples in previous months or years did not cause any problems.

Minimizing the amount of semivolatile and nonvolatile sample residues is the best method to reduce contamination problems. Unfortunately, the presence and identity of potential contaminants are often unknown. Rigorous and thorough sample cleanup is the best protection against contamination problems. The use of a guard column or retention gap often reduces the severity or delays the onset of column contamination induced problems. If a column becomes contaminated, it is best to solvent rinse the column to remove the contaminants.

Maintaining a contaminated column at high temperatures for long periods of time (often called baking-out a column) is not recommended. Baking-out a column may convert some of the contaminating residues into insoluble materials that cannot be solvent rinsed from the column. If this occurs, the column cannot be salvaged in most cases. Sometimes the column can be cut in half and the back half may still be useable. Baking-out a column should be limited to 1-2 hours at the isothermal temperature limit of the column.

TIPS & TOOLS

Column contamination from sample matrix components is the number one cause of column failure. Use Agilent DuraGuard GC columns with built-in guard if you do not want to use column connectors.





Column rinse kit, 430-3000

Solvent Rinsing Columns

Solvent rinsing columns involves removing the column from the GC and passing milliliters of solvent through the column. Any residues soluble in the rinse solvents are washed from the column. Injecting large volumes of solvent while the column is still installed is not rinsing and doing so will not remove any contaminants from the column. **A capillary GC column must have a bonded and cross-linked stationary phase before it can be solvent rinsed.** Solvent rinsing a non-bonded stationary phase results in severe damage to the column.

A column rinse kit is used to force solvent through the column (see picture). The rinse kit is attached to a pressurized gas source (N_2 or He), and the column is inserted into the rinse kit. Solvent is added to the vial, and the vial is pressurized using the gas source. The pressure forces solvent to flow through the column. Residues dissolve into the solvent and are backflushed out of the column with the solvent. The solvent is then purged from the column, and the column is properly conditioned.

Before rinsing a column, cut about 0.5 meter from the front (i.e., injector end) of the column. Insert the detector end of the column into the rinse kit. Multiple solvents are normally used to rinse columns. Each successive solvent must be miscible with the previous one. High boiling point solvents should be avoided especially as the last solvent. The sample matrix solvent(s) is often a good choice.

Methanol, methylene chloride and hexane are recommended and work very well for the majority of cases. Acetone can be substituted for methylene chloride to avoid using halogenated solvents; however, methylene chloride is one of the best rinsing solvents. If aqueous based samples (e.g., biological fluids and tissues) were injected, use water before the methanol. Some residues originating from aqueous based samples are only soluble in water and not organic solvents. Water and alcohols (e.g., methanol, ethanol, isopropanol) should be used to rinse bonded polyethylene glycol based stationary phases (e.g., DB-WAX, DB-WAXetr, DB-FFAP, HP-INNOWax) **only as a last resort.**

Table 8 lists the suggested solvent volumes for different diameter columns. Using larger solvent volumes is not harmful, but rarely better and merely wasteful. After adding the first solvent, pressurize the rinse kit, but stay below 20 psi. Use the highest pressure that keeps the solvent flow rate below 1 mL/min. Except for most 0.53 mm id columns, the rinse kit pressure will reach 20 psi before the flow rate reaches 1 mL/min. Longer rinse times are required when using heavy or viscous solvents, and for longer or smaller diameter columns. When all or most of the first solvent has entered the column, add the next solvent. The previous solvent does not have to vacate the column before the next solvent is started through the column.

After the last solvent has left the column, allow the pressurizing gas to flow through the column for 5-10 min. Install the column in the injector and turn on the carrier gas. Allow the carrier gas to flow through the column for 5-10 min. Attach the column to the detector (or leave it unattached if preferred). Using a temperature program starting at 40-50 °C, heat the column at 2-3 °/min until the upper temperature limit is reached. Maintain this temperature for 1-4 hours until the column is fully conditioned.

Column Storage

Capillary columns should be stored in their original box when removed from the GC. Place a GC septa over the ends to prevent debris from entering the tubing. Upon reinstallation of the column, the column ends need to be trimmed by 2-4 cm to ensure that a small piece of septa is not lodged in the column.

If a column is left in a heated GC, there should always be carrier gas flow. The carrier gas flow can be turned off only if the oven, injector, detector and transfer lines are turned off (i.e., not heated). Without carrier gas flow, damage to the heated portion of the column occurs.

Table 8:

Solvent Volumes for Rinsing Columns

Column ID (mm)	Solvent Volume (mL)
0.18-0.2	3-4
0.25	4-5
0.32	6-7
0.45	7-8
0.53	10-12

Using larger volumes will not damage the column





Evaluating the Problem

The first step in any troubleshooting effort is to step back and evaluate the situation. Rushing to solve the problem often results in a critical piece of important information being overlooked or neglected. In addition to the problem, look for any other changes or differences in the chromatogram. Many problems are accompanied by other symptoms. Retention time shifts, altered baseline noise or drift, or peak shape changes are only a few of the other clues that often point to or narrow the list of possible causes. Finally, make note of any changes or differences involving the sample. Solvents, vials, pipettes, storage conditions, sample age, extraction, preparation techniques, or any other factor influencing the sample environment can be responsible.

Checking the Obvious

A surprising number of problems involve fairly simple and often overlooked components of the GC system or analysis. Many of these items are transparent in the daily operation of the GC and are often taken for granted ("set it and forget it"). The areas and items to check include:

- Gases: pressures, carrier gas average linear velocity, and flow rates (detector, split vent, septum purge)
- Temperatures: column, injector, detector, and transfer lines
- System parameters: purge activation times, detector attenuation and range, mass ranges, etc.
- Gas lines and traps: cleanliness, leaks, and expiration
- Injector consumables: septa, liners, O-rings, and ferrules
- Sample integrity: concentration, degradation, solvent, and storage
- Syringes: handling technique, leaks, needle sharpness, and cleanliness
- Data system: settings and connections

The Most Common Problems

Ghost Peaks or Carryover

System contamination is responsible for most ghost peaks or carryover problems. If the extra ghost peaks are similar in width to the sample peaks (with similar retention times), the contaminants were likely introduced into the column at the same time as the sample. The extra compounds may be present in the injector (i.e., contamination) or in the sample itself. Impurities in solvents, vials, caps and syringes are only some of the possible sources. Injecting sample and solvent blanks may help to find possible sources of the contaminants. If the ghost peaks are much broader than the sample peaks, the contaminants were most likely already in the column when the injection was made. These compounds were still in the column when a previous GC run was terminated. They elute during a later run and are often very broad. Sometimes numerous ghost peaks from multiple injections overlap and elute as a hump or blob. This often takes on the appearance of baseline drift or wander.

Increasing the final temperature or time in the temperature program is one method to minimize or eliminate a ghost peak problem. Alternatively, a short bake out after each run or series of runs may remove the highly retained compounds from the column before they cause a problem.

Condensation Test

Use this test whenever injector or carrier gas contamination problems are suspected (e.g., ghost peaks or erratic baseline).

1. Leave the GC at 40-50 °C for 8 or more hours.
2. Run a blank analysis (i.e., start the GC, but with no injection) using the normal temperature conditions and instrument settings.
3. Collect the chromatogram for this blank run.
4. Immediately repeat the blank run as soon as the first one is completed. Do not allow more than 5 min to elapse before starting the second blank run.
5. Collect the chromatogram for the second blank run and compare it to the first chromatogram.
6. If the second chromatogram contains a substantially larger amount of peaks and baseline instability, the incoming carrier gas line or the carrier gas is contaminated.
7. If the second chromatogram contains few peaks or very little baseline drift, the carrier gas and incoming carrier gas lines are relatively clean.

Troubleshooting Guides

Excessive Baseline Noise

Possible Cause	Solution	Comments
Injector contamination	Clean the injector; replace liner, gold seal	Try a condensation test; gas lines may also need cleaning
Column contamination	Bake out the column	Limit the bake out to 1-2 hours
	Solvent rinse the column	Only for bonded and cross-linked phases Check for inlet contamination
Detector contamination	Clean the detector	Usually the noise increases over time and not suddenly
Contaminated or low quality gases	Use better grade gases; also check for expired gas traps or leaks	Usually occurs after changing a gas cylinder
Column inserted too far into the detector	Reinstall the column	Consult GC manual for proper insertion distance
Incorrect detector gas flow rates	Adjust the flow rates to the recommended values	Consult GC manual for proper flow rates
Leak when using an MS, ECD, or TCD	Find and eliminate the leak	Usually at the column fittings or injector
Old detector filament, lamp or electron multiplier	Replace appropriate part	
Septum degradation	Replace septum	For high temperature applications use an appropriate septum

Baseline Instability or Disturbances

Possible Cause	Solution	Comments
Injector contamination	Clean the injector	Try a condensation test; gas lines may also need cleaning
Column contamination	Bake out the column	Limit a bake out to 1-2 hours
Unequilibrated detector	Allow the detector to stabilize	Some detectors may require up to 24 hours to fully stabilize
Incompletely conditioned column	Fully condition the column	More critical for trace level analyses
Change in carrier gas flow rate during the temperature program	Normal in many cases	MS, TCD and ECD respond to changes in carrier gas flow rate

Tailing Peaks

Possible Cause	Solution	Comments
Column contamination	Trim the column	Remove 0.5-1 m from the front of the column
	Solvent rinse the column	Only for bonded and cross-linked phases Check for inlet contamination
Column activity	Irreversible; replace the column	Only affects active compounds
Solvent-phase polarity mismatch	Change sample solvent to a single solvent	More tailing for the early eluting peaks or those closest to the solvent front
	Use a retention gap	3-5 m retention gap is sufficient
Solvent effect violation for splitless or on-column injections	Decrease the initial column temperature	Peak tailing decreases with retention
Too low of a split ratio	Increase the split ratio	Flow from split vent should be 20 mL/min or higher
Poor column installation	Reinstall the column	More tailing for early eluting peaks
Some active compounds always tail	None	Most common for amines and carboxylic acids

Split Peaks

Possible Cause	Solution	Comments
Injection technique	Change technique	Usually related to erratic plunger depression or having sample in the syringe needle; Use an auto injector
Mixed sample solvent	Change sample solvent to a single solvent	Worse for solvents with large differences in polarity or boiling points
Poor column installation	Reinstall the column	Usually a large error in the insertion distance
Sample degradation in the injector	Reduce the injector temperature	Peak broadening or tailing may occur if the temperature is too low
	Change to an on-column injection	Requires an on-column injector
Poor sample focusing	Use a retention gap	For splitless and on-column injection

Retention Time Shift

Possible Cause	Solution	Comments
Change in carrier gas velocity	Check the carrier gas velocity	All peaks will shift in the same direction by approximately the same amount
Change in column temperature	Check the column temperature	Not all peaks will shift by the same amount
Change in column dimension	Verify column identity	
Large change in compound concentration	Try a different sample concentration	May also affect adjacent peaks; Sample overloading is corrected with an increase in split ratio or sample dilution
Leak in the injector	Leak check the injector	A change in peak size usually occurs
Blockage in a gas line	Clean or replace the plugged line	More common for the split line; also check flow controllers and solenoids
Septum leak	Replace septum	Check for needle barb
Sample solvent incompatibility	Change sample solvent to a single solvent Use a retention gap	For splitless injection

Change in Peak Size

Possible Cause	Solution	Comments
Change in detector response	Check gas flows, temperatures and settings	All peaks may not be equally affected
	Check background level or noise	May be caused by system contamination and not the detector
Change in the split ratio	Check split ratio	All peaks may not be equally affected
Change in the purge activation time	Check the purge activation line	For splitless injection
Change in injection volume	Check the injection technique	Injection volumes are not linear
Change in sample concentration	Check and verify sample concentration	Changes may also be caused by degradation, evaporation, or variances in sample temperature or pH
Leak in the syringe	Use a different syringe	Sample leaks past the plunger or around the needle; Leaks are not often readily visible
Column contamination	Trim the column	Remove 0.5-1 m from the front of the column
	Solvent rinse the column	Only for bonded and cross-linked phases
Column activity	Irreversible	Only affects active compounds
Coelution	Change column temperature or stationary phase	Decrease column temperature and check for the appearance of a peak shoulder or tail
Change in injector discrimination	Maintain the same injector parameters	Most severe for split injections
Sample flashback	Inject less, use a larger liner, reduce the inlet temperature	Less solvent and higher flow rates are most helpful
Decomposition from inlet contamination	Clean the injector; replace liner, gold seal	Only use deactivated liners and glass wool in the inlet

Loss of Resolution

Possible Cause	Solution	Comments
Decrease in separation		
Different column temperature	Check the column temperature	Differences in other peaks will be visible
Different column dimensions or phase	Verify column identity	Differences in other peaks will be visible
Coelution with another peak	Change column temperature	Decrease column temperature and check for the appearance of a peak shoulder or tail
Increase in peak width		
Change in carrier gas velocity	Check the carrier gas velocity	A change in the retention time also occurs
Column contamination	Trim the column	Remove 0.5-1 m from the front of the column
	Solvent rinse the column	Only for bonded and cross-linked phases
Change in the injector	Check the injector settings	Typical areas: split ratio, liner, temperature, injection volume
Change in sample concentration	Try a different sample concentration	Peak widths increase at higher concentrations
Improper solvent effect, lack of focusing	Lower oven temperature, better solvent, sample phase polarity match, use a retention gap	For splitless injection



GC and GC/MS Applications

Industry-specific applications from your partner in chromatography

With over 40 years of chromatography expertise, Agilent is a great resource for all types of applications. In fact, we're developing new ones every day.

Simply turn to the pages listed below for the most current applications based on your area of specialization.

Environmental – you'll learn how to perform critical analyses – such as measuring the levels of atmospheric halocarbons and identifying organochlorine pesticides in soil – while meeting your increasing demands for speed and accuracy. **Turn to page 501.**

Food, Flavors, and Fragrances – we'll discuss how to ensure quality, safety, and regulatory compliance for fragrances, perfumes, and essential oils. Applications focus on chiral compounds, menthol, and FAMES. **Turn to page 554.**

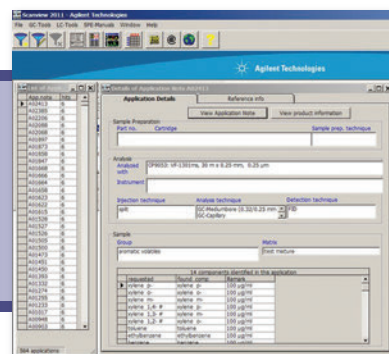
Energy and Fuels – here you'll find applications – such as the analysis of sulfur compounds in propylene – that you can use right away to meet regulatory requirements, improve efficiency, and maintain good environmental stewardship. **Turn to page 576.**

Industrial Chemical – we'll help you maintain product quality – and production efficiency – by sharing the latest applications for alcohols, halogenated hydrocarbons, aromatic solvents, phenols, and inorganic gases. **Turn to page 602.**

Forensic Toxicology and Pharma – we'll bring you fully up-to-date on the newest screening methods for controlled substances such as amphetamines, narcotics, and alcohol. We'll also review the latest techniques for monitoring residual solvents. **Turn to page 635.**

TIPS & TOOLS

Search the ScanView database to find almost 2000 GC applications and standard methods of all types, old and new. Get your free copy of ScanView at www.agilent.com/chem/scanview



Environmental Applications, Hydrocarbons

Unleaded Gasoline

Column: DB-VRX
124-1534
30 m x 0.45 mm, 2.55 µm

Carrier: Helium at 109 cm/s (10.4 mL/min), measured at 40 °C

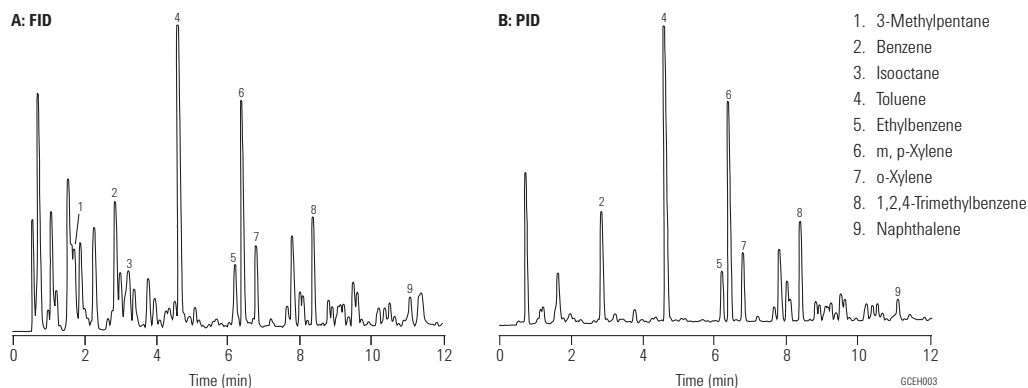
Oven: 40 °C for 2 min,
40-200 °C at 12 °C/min,
200 °C for 5 min

Sampler: Purge and Trap (O.I.A. 4560)
Trap: BTEX (Supelco) at 50 °C during purge
Desorb: 270 °C for 1 min

Injection: LVI (Low Volume Injector)

Detector: A: FID, 250 °C
B: PID (O.I.A. 4430), 200 °C

Sample: 115 ppb gasoline in 5 mL water



Determination of Chlorophenols in Water and Soil

Column: VF-5ms
CP8961
60 m x 0.32 mm, 0.25 µm

Oven: 60 °C, 30 °C/min to 300 °C

Carrier: He 80 kPa, 0.8 bar, 5.7 psi

Injection: Splitless, initial time: 1 min; Splitflow: 50 mL/min
250 °C
2 µL

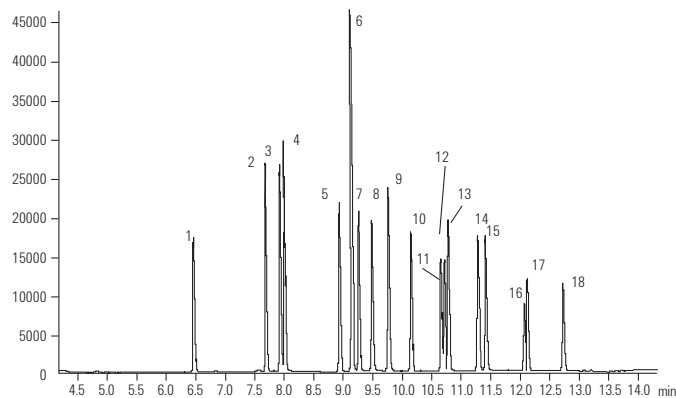
Detector: MS
280 °C

Sample: Isohexane

Sample Conc: Standard, 1 µg/mL, derivatization with acetic acid anhydride

Dr. Weßling, Laboratorien GmbH

- | | |
|---------------------------|-------------------------------|
| 1. Phenol | 10. 2,4,6-Trichlorophenol |
| 2. 2-Chlorophenol | 11. 2,3,6-Trichlorophenol |
| 3. 3-Chlorophenol | 12. 2,3,5-Trichlorophenol |
| 4. 4-Chlorophenol | 13. 2,4,5-Trichlorophenol |
| 5. 2,6-Dichlorophenol | 14. 2,3,4-Trichlorophenol |
| 6. 2,4+2,5-Dichlorophenol | 15. 3,4,5-Trichlorophenol |
| 7. 3,5-Dichlorophenol | 16. 2,3,5,6-Tetrachlorophenol |
| 8. 2,3-Dichlorophenol | 17. 2,3,4,6-Tetrachlorophenol |
| 9. 3,4-Dichlorophenol | 18. 2,3,4,5-Tetrachlorophenol |



PBDEs by ECD

Column: DB-XLB
15 m x 0.18 mm, 0.07 µm
Agilent Technologies custom column

Carrier: Hydrogen at 72 cm/s at 100 °C (4.0 mL/min), constant flow mode

Oven: 100 °C for 0.5 min
100 °C to 300 °C at 30 °C/min
300 °C for 5 min

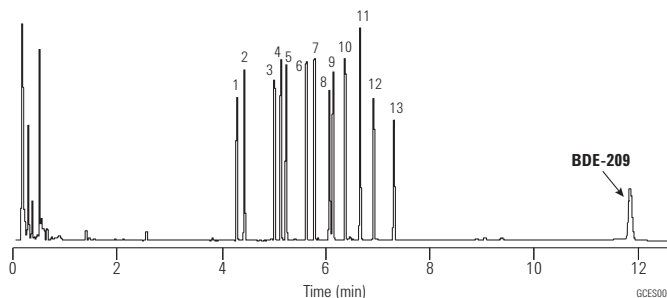
Injection: Split, 250 °C
Split ratio 20:1

Detector: ECD, 300 °C
Peak, Congener (2.5 mg/mL)

Sample: 1 µL

Special thanks to AccuStandard, Inc. of New Haven, CT, for PBDE standards.

- | | |
|-----------------------------------|---|
| 1. 2,2',4-TriBDE (BDE-17) | 8. 2,2',3,4,4'-PentaBDE (BDE-85) |
| 2. 2,4,4'-TriBDE (BDE-28) | 9. 2,2',4,4',5,6'-HexaBDE (BDE-154) |
| 3. 2,3',4',6-Tetra-BDE (BDE-71) | 10. 2,2',4,4',5,5'-HexaBDE (BDE-153) |
| 4. 2,2',4,4'-Tetra-BDE (BDE-47) | 11. 2,2',3,4,4',5'-HexaBDE (BDE-138) |
| 5. 2,3',4,4'-TetraBDE (BDE-66) | 12. 2,2',3,4,4',5',6-HeptaBDE (BDE-183) |
| 6. 2,2',4,4',6-PentaBDE (BDE-100) | 13. 2,3,3',4,4',5,6-HeptaBDE (BDE-190) |
| 7. 2,2',4,4',5-PentaBDE (BDE-99) | 14. DecaBDE (BDE-209) (12.5 mg/mL) |



Diesel Fuel

Column: DB-5ms
125-5532
30 m x 0.53 mm, 1.50 µm

Carrier: Helium at 48.5 cm/s, measured at 60 °C

Oven: 60 °C for 2 min
60-300 °C at 12 °C/min
300 °C for 10 min

Injection: Direct, 280 °C

Detector: FID, 250 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL injection in hexane
A: Standard, 50 ng/component
B: Sample, 0.6 mg/mL

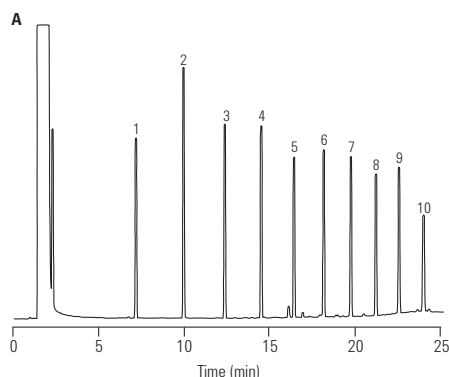
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

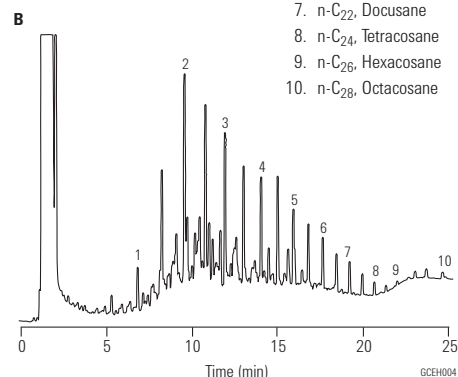
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

**Diesel fuel standard
50 ng/component**



**Diesel fuel
0.6 mg/mL**



1. n-C₁₀, Decane
2. n-C₁₂, Dodecane
3. n-C₁₄, Tetradecane
4. n-C₁₆, Hexadecane
5. n-C₁₈, Octadecane
6. n-C₂₀, Eicosane
7. n-C₂₂, Docosane
8. n-C₂₄, Tetracosane
9. n-C₂₆, Hexacosane
10. n-C₂₈, Octacosane

Analysis of Polycyclic Aromatic Hydrocarbons

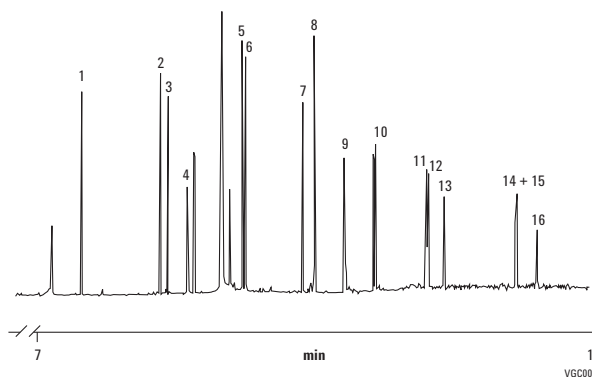
Column: VF-Xms
CP8805
30 m x 0.25 mm, 0.10 µm

Sample: 1 µL ca. 3 ng per component on-column

Carrier: Helium, 60 kPa

Injection: Split, T=275 °C

Detector: Agilent Ion Trap MS



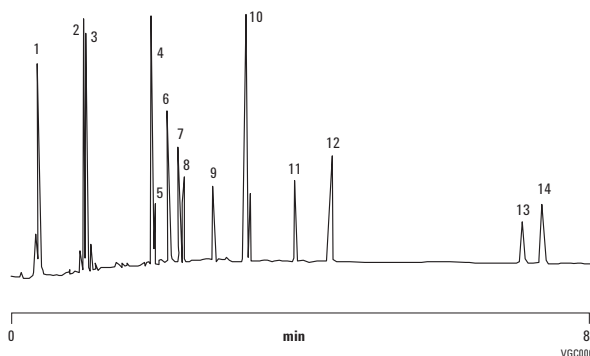
1. Naphthalene
2. Acenaphthylene
3. Acenaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Fluoranthene
8. Pyrene
9. Chrysene
10. Benzo[a]anthracene
11. Benzo[k]fluoranthene
12. Benzo[b]fluoranthene
13. Benzo[a]pyrene
14. Indeno[1,2,3-cd]pyrene
15. Dibenzo[a,h]anthracene
16. Benzo[g,h,i]perylene

Dioxins and Dibenzofurans

Column: CP-Sil 88
CP6173
50 m x 0.25 mm, 0.20 µm

Sample: 1.0 µL Toluene
Sample Conc: 100-400 pg/µL
Carrier: Helium, 170 kPa (1.7 bar, 24 psi)
Oven: 100 °C to 180 °C to 230 °C, 3 °C/min
Injection: Splitless
Detector: MSD

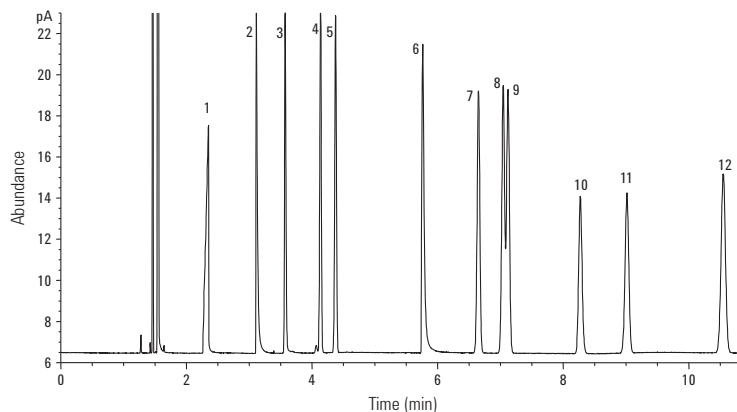
1. 2,3,7,8-TCDD
2. 2,3,7,8-TCDF
3. 1,2,3,7,8-PeCDF
4. 1,2,3,4,7,8-HxCDF
5. 1,2,3,6,7,8-HxCDF
6. 2,3,4,7,8-PeCDF
7. 1,2,3,4,7,8-HxCDD + 1,2,3,7,8-PeCDD
8. 1,2,3,6,7,8-HxCDD
9. 1,2,3,7,8,9-HxCDD
10. 1,2,3,4,6,7,8-HxCDF
11. 2,3,4,6,7,8-HpCDD
12. 1,2,3,4,6,7,8-HpCDD
13. 1,2,3,4,6,7,8,9-OCDF
14. 1,2,3,4,6,7,8,9-OCDD



78 Semi-volatile Components on an Agilent J&W DB-UI 8270D

Column: DB-UI 8270D
122-9732
30 m x 0.25 mm, 0.25 µm

Instrument: Agilent 7890 Series GC
Carrier: Helium, 1.2 mL/min constant flow, septum, purge 3 mL/min, purge time on 0.7 min 50 mL/min, gas saver off
Oven: 30 °C (1.0 min), 15 °C/min to 100 °C, 20 °C/min to 240 °C (0.5 min), 15 °C to 325 °C (6.7 min)
Inlet: MMI in nonpulsed splitless mode, 1 µL at 275 °C
Inlet liner: Dual taper direct connect liner
Sampler: Agilent 7693, 10.0 µL syringe (p/n G4513-80216)
Detector: MSD: 325 °C Transfer line, 280 °C source, 150 °C quad, 35-500 amu range



Example total ion chromatogram of a 78 component semi-volatile standard injection with a 10 ng on-column loading for each component.

Polybrominated Diphenyl Ethers (PBDEs)

Column: DB-5ms Ultra Inert
122-5512UI
15 m x 0.25 mm, 0.25 µm

Instrument: Agilent 6890N/5973B MSD

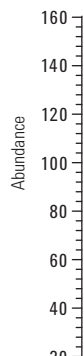
Sampler: Agilent 7683B, 5.0 µL syringe
(p/n 5188-5246),
1.0 µL splitless injection,
5 ng each component on-column

Carrier: Helium 72 cm/s, constant flow

Inlet: Pulsed splitless; 325 °C, 20 psi
until 1.5 min,
purge flow 50 mL/min at 2.0 min

Oven: 150 to 325 °C
(17 °C/min),
hold 5 min

Detector: MSD source at 300 °C,
quadrupole at 150 °C,
transfer line at 300 °C,
scan range 200-1000 amu



1. BDE-47
2. BDE-100
3. BDE-99
4. BDE-154
5. BDE-153
6. BDE-183
7. BDE-205
8. BDE-209

Suggested Supplies

Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700

Syringe: Autosampler syringe, 0.5 µL, 23 g, cone, 5188-5246

15+1 EU Priority PAHs

**Resolution of Critical Pairs
on an Agilent J&W DB-EUPAH Column**

Column: DB-EUPAH
121-9627
20 m x 0.18 mm, 0.14 µm

Instrument: Agilent 6890N/5975B MSD

Sampler: Agilent 7683B, 5.0 µL syringe, 0.5 µL splitless
injection, injection speed 75 µL/min

Carrier: Helium, ramped flow 1.0 mL/min (0.2 min),
5 mL/min² to 1.7 mL/min

Inlet: 325 °C splitless, purge flow 60 mL/min at 0.8 min

Oven: 45 °C (0.8 min) to 200 °C (45 °C/min),
2.5 °C/min to 225 °C, 3 °C/min to 266 °C,
5 °C/min to 300 °C, 10 °C/min to 320 °C (4.5 min)

Detector: MSD source at 300 °C, quadrupole at 180 °C,
transfer line at 330 °C, scan range 50-550 amu

All 15+1 EU regulated priority PAHs are well resolved with the DB-EUPAH column. Challenging benzo[b,k,j]fluoranthene isomers are baseline resolved, allowing for accurate quantitation of each isomer. In addition, baseline resolution is achieved for critical pairs benz[a]anthracene and cyclopenta[c,d]pyrene, cyclopenta[c,d]pyrene and chrysene, and indeno[1,2,3-cd]pyrene and dibenzo[a,h]anthracene. This application demonstrates that the DB-EUPAH column can provide excellent sensitivity and selectivity for the analysis of EU regulated PAHs.

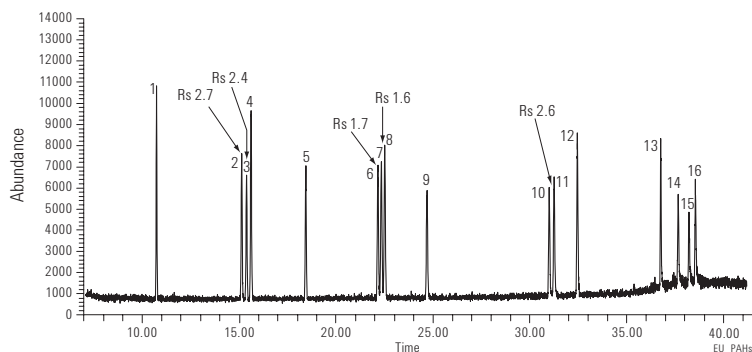
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

1. Benzo[c]fluorene
2. Benz[a]anthracene
3. Cyclopenta[c,d]pyrene
4. Chrysene
5. 5-Methylchrysene
6. Benzo[b]fluoranthene
7. Benzo[k]fluoranthene
8. Benzo[j]fluoranthene
9. Benz[a]pyrene
10. Indeno[1,2,3-cd]pyrene
11. Dibenzo[a,h]anthracene
12. Benzo[g,h,i]perylene
13. Dibenzo[a,i]pyrene
14. Dibenzo[a,e]pyrene
15. Dibenzo[a,j]pyrene
16. Dibenzo[a,h]pyrene



Environmental Applications, Pesticides and Herbicides

Fast CLP Pesticides

Column: DB-CLP1
123-8232
30 m x 0.32 mm, 0.25 µm

Column: DB-CLP2
123-8336
30 m x 0.32 mm, 0.50 µm

Instrument: Agilent 7890 GC with dual µECD

Carrier: Helium, constant flow 3.5 mL/min

Oven: 150 °C (hold 0.2 min), 45 °C/min to 250 °C,
18 °C/min to 300 °C, 30 °C/min to 330 °C, hold 2.5 min

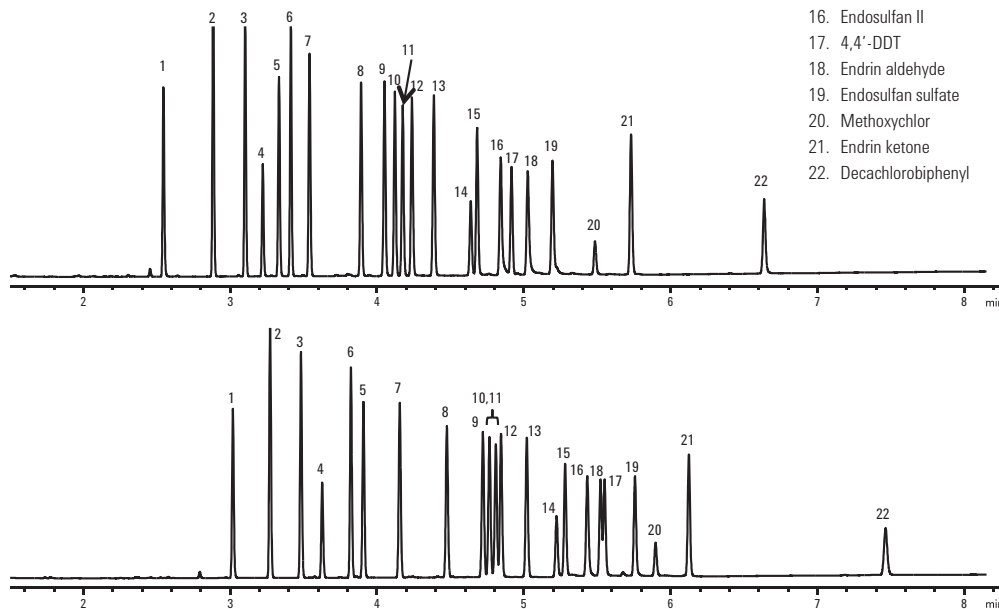
Sampler: Agilent 7693

Injection: 1 µL splitless

Detector: µECD at 340 °C

Sample: 50 ng/mL CLP Pesticides

1. Tetrachloro-m-xylene
2. α-BHC
3. γ-BHC
4. β-BHC
5. Heptachlor
6. δ-BHC
7. Aldrin
8. Heptachlor epoxide
9. γ-Chlordane
10. α-Chlordane
11. Endosulfan I
12. 4,4'-DDE
13. Dieldrin
14. Endrin
15. 4,4'-DDD
16. Endosulfan II
17. 4,4'-DDT
18. Endrin aldehyde
19. Endosulfan sulfate
20. Methoxychlor
21. Endrin ketone
22. Decachlorobiphenyl



**EPA Method 504.1 – 1,2-dibromoethane (EDB),
1,2-dibromo-3-chloropropane (DBCP),
and 1,2,3-trichloropropane (123TCP)**

Column: DB-CLP1
123-8232
30 m x 0.32 mm, 0.25 µm

Column: DB-CLP2
123-8336
30 m x 0.32 mm, 0.50 µm

Carrier: Helium, constant flow, 3.75 mL/min

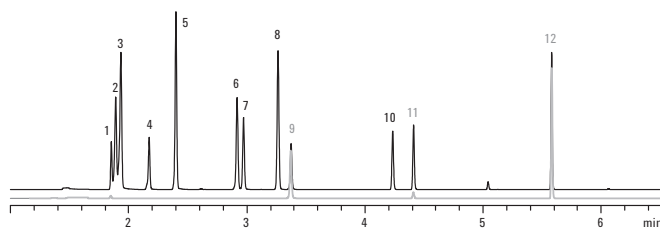
Oven: 50 °C, hold 1.5 min, 20 °C/min to 95 °C,
40 °C/min to 175 °C, hold 1.25 min

Injection: 2 µL, splitless, 200 °C

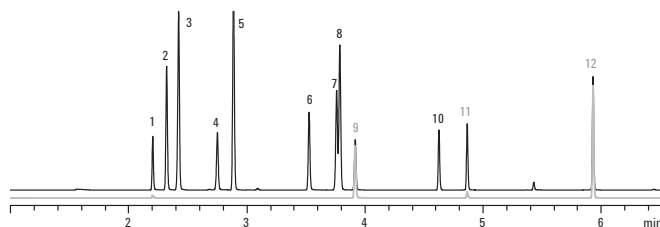
Detector: µECD, 300 °C

Sample: 100 ng/mL EPA 504.1 analytes, 100 ng/mL
chlorinated solvents + trihalomethanes

- | | |
|--------------------------|--|
| 1. Chloroform | 7. 1,1,2-Trichloroethane |
| 2. 1,1,1-Trichloroethane | 8. Dibromochloromethane |
| 3. Carbon tetrachloride | 9. 1,2-Dibromoethane (EDB) |
| 4. Trichloroethane | 10. Bromoform |
| 5. Bromodichloromethane | 11. 1,2,3-Trichloropropane (123TCP) |
| 6. Tetrachloroethane | 12. 1,2-Dibromo-3-chloropropane (DBCP) |



**100 ng/mL chlorinated solvents + THMs
100 ng/mL EPA 504.1 analytes**



**100 ng/mL chlorinated solvents + THMs
100 ng/mL EPA 504.1 analytes**

Agilent J&W DB-CLP1/DB-CLP2 columns analyze 1,2-dibromoethane (EDB), 1,2-dibromo-3-chloropropane (DBCP), and 1,2,3-trichloropropane (123TCP) according to EPA Method 504.1 with cooler analysis temperatures allowing a faster GC cycle time.

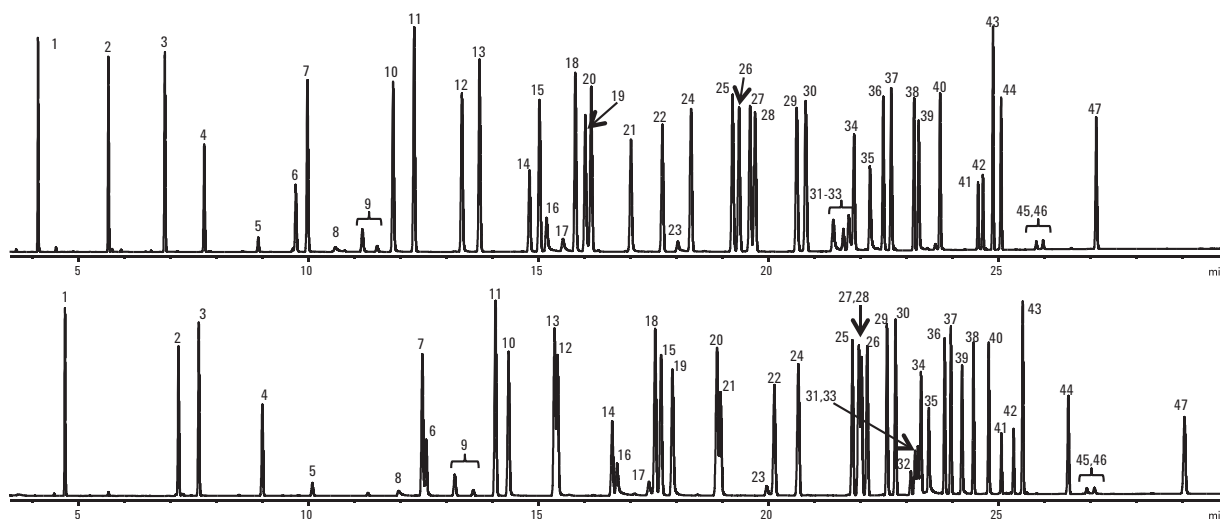
Organochlorine Pesticides, EPA Method 8081B

Column: DB-CLP1
123-8232
30 m x 0.32 mm, 0.25 µm

Column: DB-CLP2
123-8336
30 m x 0.32 mm, 0.25 µm

Instrument: Agilent 7890 GC with dual µECD
Carrier: Helium at 43.5 cm/s (constant flow)
Oven: 80 °C (hold 0.5 min) to 150 °C at 20 °C/min,
5 °C/min to 235 °C, 15 °C/min to 300 °C, hold 5 min
Sampler: Agilent 7693
Injection: 2 µL, splitless
Detector: µECD at 325 °C
Sample: 50 ng/mL 8081B analytes

- | | |
|----------------------------------|---------------------------------|
| 1. 1,2-Dibromo-3-chloropropane | 24. Heptachlor epoxide |
| 2. Hexachlorocyclopentadiene | 25. γ-Chlordane |
| 3. 1-Bromo-2-nitrobenzene | 26. trans-Nonachlor |
| 4. Etridiazole | 27. α-Chlordane |
| 5. Chloroneb | 28. Endosulfan I |
| 6. Trifluralin | 29. 4,4'-DDE |
| 7. TCMX | 30. Dieldrin |
| 8. Propachlor | 31. Chlorobenzilate (250 ng/mL) |
| 9. Di-allate isomers (250 ng/mL) | 32. Perthane (250 ng/mL) |
| 10. Hexachlorobenzene | 33. Chloropropylate (250 ng/mL) |
| 11. α-BHC | 34. Endrin |
| 12. Pentachloronitrobenzene | 35. Nitrofen |
| 13. γ-BHC | 36. 4,4'-DDD |
| 14. β-BHC | 37. Endosulfan II |
| 15. Heptachlor | 38. 4,4'-DDT |
| 16. Dichlone | 39. Endrin aldehyde |
| 17. Alachlor | 40. Endosulfan sulfate |
| 18. δ-BHC | 41. Captafol |
| 19. Chlorothalonil | 42. Methoxychlor |
| 20. Aldrin | 43. Endrin ketone |
| 21. DCPA | 44. Mirex |
| 22. Isodrin | 45. cis-Permethrin |
| 23. Kelthane | 46. trans-Permethrin |
| | 47. Decachlorobiphenyl |



DB-624UI Organic Acid Performance

Column: DB-624 Ultra Inert
123-1334UI
30 m x 0.32 mm, 1.80 µm

Column: Non-Agilent 624, 30 m x 0.32 mm, 1.8 µm

Carrier: Hydrogen, 4 mL/min constant flow

Oven: 70 °C (1 min), then 20 °C/min to 260 °C

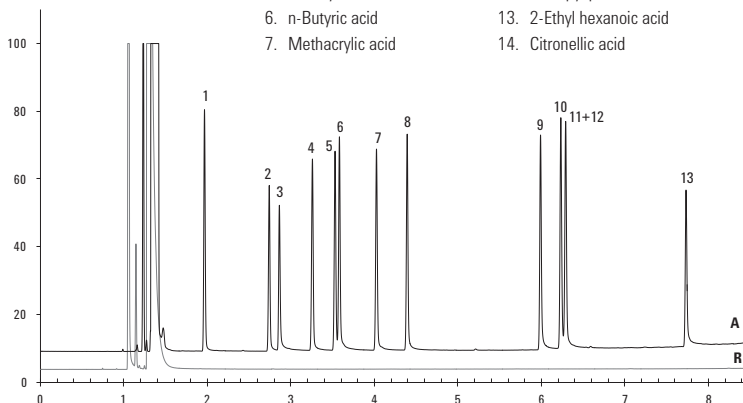
Inlet: 250 °C, 1 µL, split 1:200

Inlet liner: 4 mm, glass wool

Detector: FID at 260 °C

Organic acid mix C₁-C₁₀ (6 to 17 ng) on a DB-624UI column (A) and a traditional non-Agilent 624 column (R) after conditioning at 260 °C for 1 h.

- | | |
|----------------------|-----------------------------|
| 1. Formic acid (<DL) | 8. Isopentanoic acid |
| 2. Acetic acid | 9. n-Pentanoic acid |
| 3. Propionic acid | 10. n-Heptanoic acid |
| 4. Acrylic acid | 11. Levulinic acid |
| 5. Isobutyric acid | 12. 2-Propyl pentanoic acid |
| 6. n-Butyric acid | 13. 2-Ethyl hexanoic acid |
| 7. Methacrylic acid | 14. Citronellic acid |



EPA Method 551 – Chlorinated Solvents, Trihalomethanes (THMs), and Disinfection Byproducts (DBPs)

Column: DB-CLP1
123-8232
30 m x 0.32 mm, 0.25 µm

Carrier: Helium, constant flow, 45 cm/s

Oven: 35 °C, hold 5.75 min, 20 °C/min to 95 °C, 40 °C/min to 200 °C, hold 1.25 min

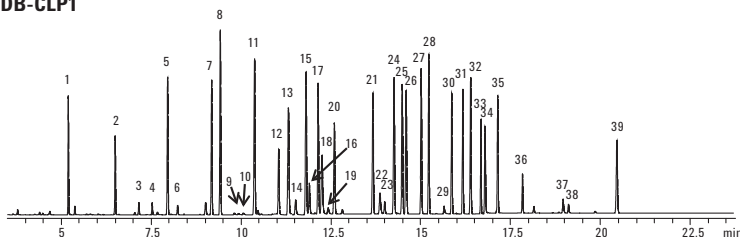
Column: DB-CLP2
123-8336
30 m x 0.32 mm, 0.50 µm

Injection: 2 µL splitless, 200 °C

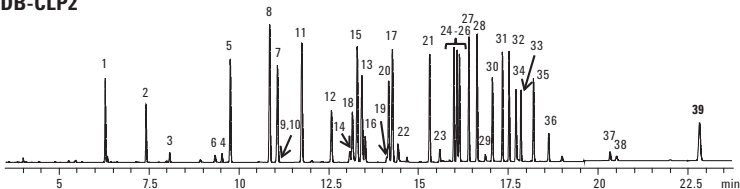
Detector: µECD, 300 °C

1. Chloroform
2. 1,1,1-Trichloroethane
3. Carbon tetrachloride
4. Trichloroacetonitrile
5. Trichloroethane
6. Chloral hydrate
7. Bromodichloromethane
8. 1,1-Dichloro-2-propanone
9. Dichloroacetonitrile
10. Chloropicrin
11. Tetrachloroethane
12. 1,1,2-Trichloroethane
13. Dibromochloromethane
14. 1,2-Dibromoethane
15. 1,1,1-Trichloro-2-propanone
16. Bromochloroacetonitrile
17. Bromoform
18. 1,2,3-Trichloropropane
19. Dibromoacetonitrile
20. 1,2-Dibromo-3-chloropropane

DB-CLP1



DB-CLP2



Analysis of Semivolatiles

Column A: DB-5.625
122-5632
30 m x 0.25 mm, 0.50 µm

Column B: DB-5.625
121-5622
20 m x 0.18 mm, 0.36 µm

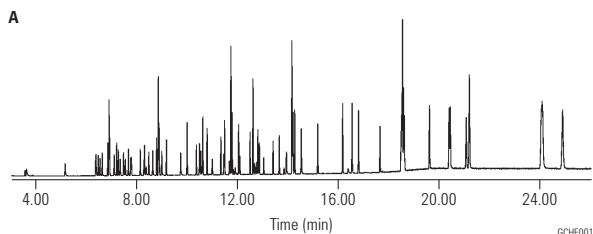
Carrier: He constant flow mode, 1.1 mL/min

Oven: 40 °C (1 min), 25 °C/min to 320 °C
4.80 min hold

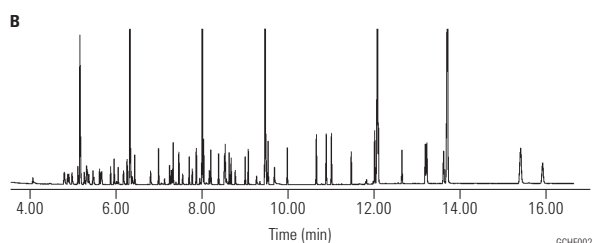
Injection: Splitless 0.5 µL injected at 300 °C,
QuickSwap pressure 5.0 psi during acquisition,
80.0 psi during backflush with inlet set to
1.0 psi during backflush

Detector: Agilent 5975C Performance Turbo MSD
equipped with 6 mm large-aperture drawout lens,
p/n G2589-20045

Translating 0.25 mm id column method to 0.18 mm id format
results in 32% reduction in analysis time. Resolution of 77 peaks
of interest is also maintained for the faster 0.18 mm id separation.



US EPA Method 8270, 5 ng/mL System Performance Check Compounds
Chromatogram using a DB-5.625, 30 m x 0.25 mm, 0.5 µm



US EPA Method 8270, 5 ng/mL System Performance Check Compounds
Chromatogram using a DB-5.625, 20 m x 0.18 mm, 0.36 µm



TIPS & TOOLS

Learn more about the Agilent 7890B GC System at www.agilent.com/chem/7890BGC



Pesticides, EPA 508.1

Column: DB-35ms
123-3832
30 m x 0.32 mm, 0.25 µm

Column: DB-XLB
123-1236
30 m x 0.32 mm, 0.50 µm

Carrier: Helium at 45 cm/s (EPC in constant flow mode)

Oven: 75 °C for 0.5 min
75-300 °C at 10 °C/min
300 °C for 2 min

Injection: Splitless, 250 °C
30 s purge activation time

Detector: µECD, 350 °C
Nitrogen makeup gas
(column + makeup flow = 30 mL/min constant flow)

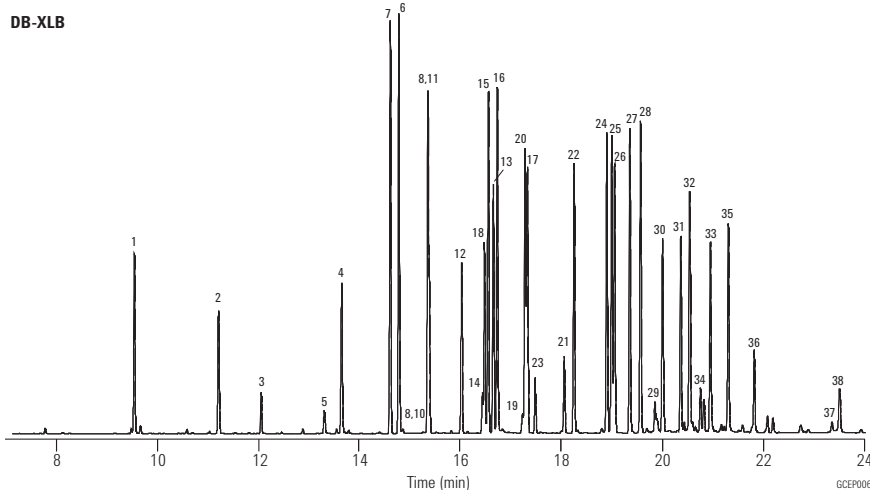
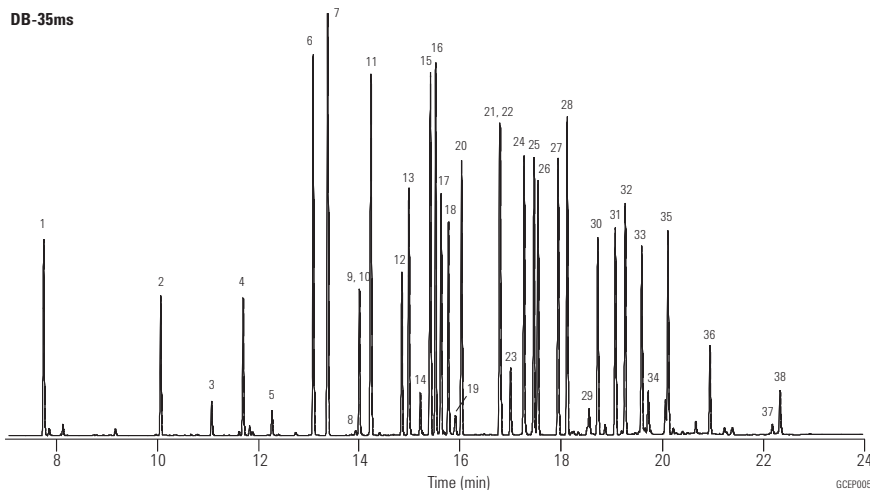
Sample: 50 µg per component

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Hexachlorocyclopentadiene
2. Etridiazole
3. Chloroneb
4. Trifluralin
5. Propachlor
6. Hexachlorobezene
7. α-BHC
8. Atrazine
9. Pentachloronitrobenzene
10. Simazine
11. γ-BHC
12. β-BHC
13. Heptachlor
14. Alachlor
15. δ-BHC
16. Chlorothalonil
17. Aldrin
18. Metribuzin
19. Metolachlor
20. DCPA
21. 4,4'-Dibromobiphenyl
22. Heptachlor epoxide
23. Cyanazine
24. γ-Chlordane
25. α-Chlordane
26. Endosulfan I
27. 4,4'-DDE
28. Dieldrin
29. Chlorobenzilate
30. Endrin
31. 4,4'-DDD
32. Endosulfan II
33. 4,4'-DDT
34. Endrin aldehyde
35. Endosulfan sulfate
36. Methoxychlor
37. cis-Permethrin
38. trans-Permethrin

**Phenoxy Acid Herbicides –
Methyl Derivatives, EPA 8151A**

Column: DB-35ms
123-3832
30 m x 0.32 mm, 0.25 µm

Carrier: Helium at 45 cm/s (EPC in constant flow mode)

Oven: 50 °C for 0.5 min
50-100 °C at 25 °C/min
100-320 °C at 12 °C/min
320 °C for 2 min

Injection: Splitless, 250 °C
30 s purge activation time

Detector: µECD, 350 °C
Nitrogen makeup gas
(column + makeup flow = 30 mL/min constant flow)

Sample: 50 pg per component

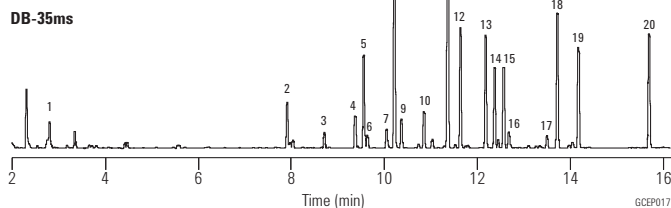
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

1. Dalapon
2. 3,5-Dichlorobenzoic acid
3. 4-Nitrophenol
4. Methyl-2,4-dichlorophenylacetate (SS)
5. Dicamba
6. MCPP
7. MCPA
8. 4,4'-Dibromooctafluorobiphenyl (IS)
9. Dichloroprop
10. 2,4-D
11. Pentachlorophenol
12. 2,4,5-T,P
13. 2,4,5-T
14. Chloramben
15. Dinoseb
16. 2,4-DB
17. Bentazone
18. DCPA
19. Picloram
20. Acifluorfen



**Direct Comparison for Rapid CLP
(Contract Laboratory Program) Pesticide Analysis**

Column: DB-17ms
121-4722
20 m x 0.18 mm, 0.18 µm

Column: DB-XLB
121-1222
20 m x 0.18 mm, 0.18 µm

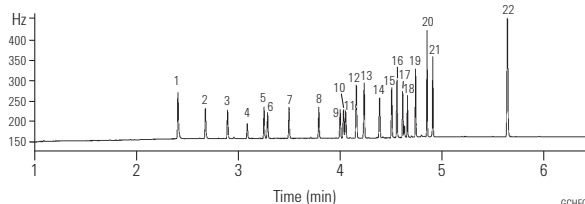
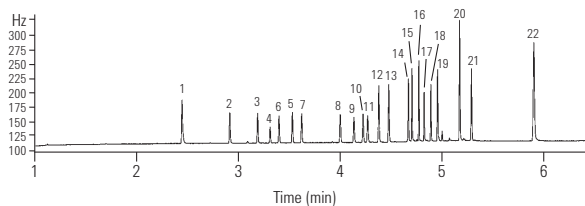
Carrier: Hydrogen (69 cm/s at 120 °C,
ramped at 99 mL/min to
106 cm/s at 4.4 min)

Oven: 120 °C (0.32 min); 120 °C/min to 160 °C;
30 °C/min to 258 °C (0.18 min);
38.81 °C/min to 300 °C (1.5 min)

Injection: Split/splitless, 220 °C, pulsed splitless
(35 psi for 0.5 min, purge flow of 40 mL/min
on at 1 min, gas saver flow
20 mL/min on 3 min)

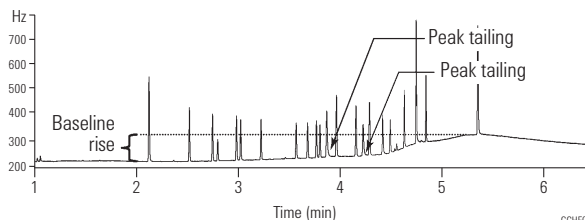
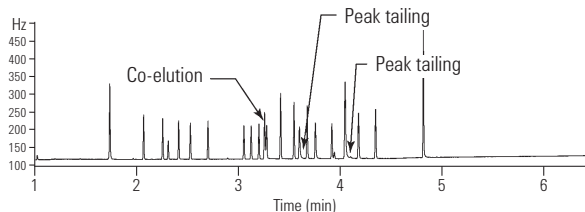
Detector: µECD 320 °C; nitrogen makeup;
constant column + makeup flow 60 mL/min

**DB-17ms primary column
DB-XLB confirmatory column**



1. Tetrachloro-m-xylene
2. α-BHC
3. γ-BHC
4. β-BHC
5. δ-BHC
6. Heptachlor
7. Aldrin
8. Heptachlor epoxide
9. γ-Chlordane
10. α-Chlordane
11. Endosulfan I
12. 4,4' DDE
13. Dieldrin
14. Endrin
15. 4,4' DDD
16. Endosulfan II
17. 4,4' DDT
18. Endrin aldehyde
19. Endosulfan sulfate
20. Methoxychlor
21. Endrin ketone
22. Decachlorobiphenyl

**Vendor R primary column, 20 m x 0.18 mm, 0.18 µm
Vendor R confirmatory column, 20 m x 0.18 mm, 0.14 µm**



The DB-17ms primary column and DB-XLB confirmatory column sufficiently resolved all the peaks of interest in less than six minutes with sharp, symmetrical peaks and minimal baseline drift. In contrast, vendor R's primary analysis column resolved only 20 of 22 peaks with visible peak tailing. Vendor R's confirmatory column resolved all 22 peaks of interest but with peak tailing and an unacceptable level of temperature dependent baseline drift.

Aroclors 1016-1268 (without 1221)

Column: DB-XLB
121-1232
30 m x 0.18 mm, 0.18 µm

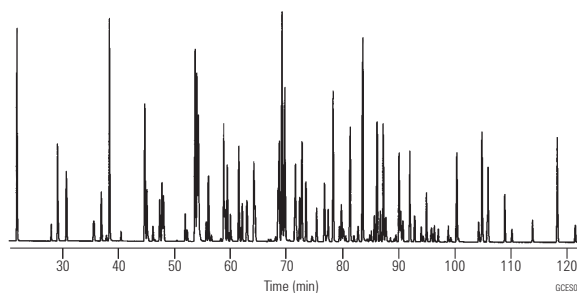
Carrier: Helium at 37 cm/s, measured at 150 °C

Oven: 100 °C for 1 min
100-265 °C at 1.2 °C/min

Injection: Hot on-column, 250 °C

Detector: MSD, 340 °C transfer line, SIM

Sample: 1 µL in isoctane, 12.5 ppm



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

CLP Pesticides

Column: DB-35ms
123-3832
30 m x 0.32 mm, 0.25 µm

Column: DB-XLB
123-1236
30 m x 0.32 mm, 0.50 µm

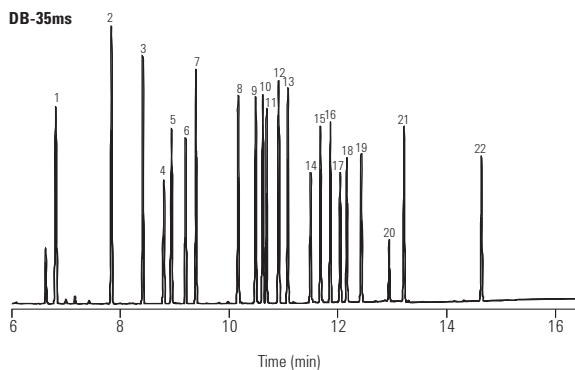
Carrier: Helium at 45 cm/s
(EPC in constant flow mode)

Oven: 110 °C for 0.5 min
110-320 °C at 15 °C/min
320 °C for 2 min

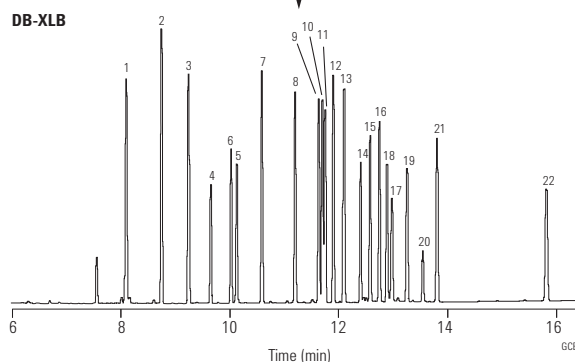
Injection: Splitless, 250 °C
30 s purge activation time

Detector: µECD, 350 °C
Nitrogen makeup gas
(column + makeup flow =
30 mL/min constant flow)

Sample: 50 pg per component



Complete resolution and confirmation of
22 CLP Pesticides in under 16 minutes!



1. Tetrachloro m-xylene (SS)
 2. α-BHC
 3. γ-BHC
 4. β-BHC
 5. Heptachlor
 6. δ-BHC
 7. Aldrin
 8. Heptachlor epoxide
 9. γ-Chlordane
 10. α-Chlordane
 11. Endosulfan I
 12. 4,4'-DDE
 13. Dieldrin
 14. Endrin
 15. 4,4'-DDD
 16. Endosulfan II
 17. 4,4'-DDT
 18. Endrin aldehyde
 19. Endosulfan sulfate
 20. Methoxychlor
 21. Endrin ketone
 22. Decachlorobiphenyl (SS)
- SS - Surrogate Standard

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

High Speed VOC, EPA Method 8260

**Column: DB-VRX
121-1524
20 m x 0.18 mm, 1.00 µm**

Carrier: Helium at 55 cm/s (1.5 mL/min)

Injection: Split, 150 °C
Split ratio 60:1

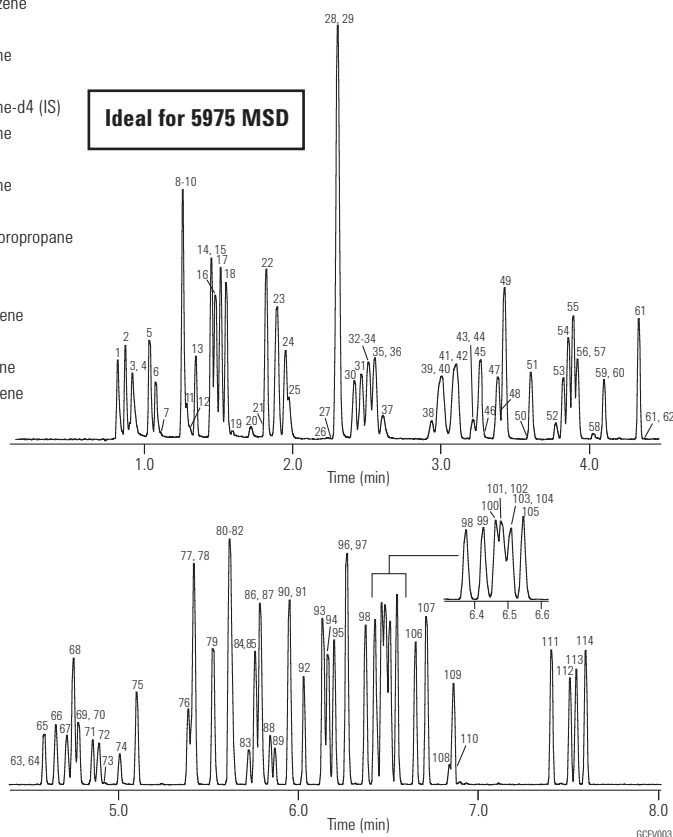
Oven: 45 °C for 3.0 min
45-190 °C at 36 °C/min
190-225 °C at 20 °C/min
225 °C for 0.5 min

Detector: Agilent 5975 MSD
Scan range: 35-260 amu
Scan rate: 3.25 scans/s
Quad temp: 150 °C
Source temp: 200 °C
Transfer line temp: 200 °C

Sampler: Purge and trap (Tekmar 3100)
Purge: 11 min
Trap: VoCarb 3000
Preheat: 245 °C
Desorb: 250 °C for 1 min
Bake: 260 °C for 10 min
Line & valve: 100 °C

Sample: 5 mL
• Halogenated and aromatic analytes at 40 ppb
• Internal standards at 20 ppb
• Polar analytes (i.e., ethers, alcohols and ketones at 100-800 ppb)

- | | | |
|-------------------------------|-------------------------------|----------------------------------|
| 1. Dichlorodifluoromethane | 47. Carbon tetrachloride | 93. Propylbenzene |
| 2. Chloromethane | 48. Chloroacetonitrile | 94. 2-Chlorotoluene |
| 3. Hydroxypropionitrile | 49. Benzene | 95. 4-Chlorotoluene |
| 4. Vinyl chloride | 50. tert-Amylmethyl ether | 96. 1,3,5-Trimethylbenzene |
| 5. Bromomethane | 51. Fluorobenzene (IS) | 97. Pentachloroethane |
| 6. Chloroethane | 52. 2-Pentanone | 98. tert-Butylbenzene |
| 7. Ethanol | 53. Dibromomethane | 99. 1,2,4-Trimethylbenzene |
| 8. Acetonitrile | 54. 1,2-Dichloropropane | 100. sec-Butylbenzene |
| 9. Acrolein | 55. Trichloroethene | 101. 1,3-Dichlorobenzene |
| 10. Trichlorofluoromethane | 56. Bromodichloromethane | 102. Benzyl chloride |
| 11. Isopropyl alcohol | 57. 2-Nitropropane | 103. 1,4-Dichlorobenzene-d4 (IS) |
| 12. Acetone | 58. 1,4-Dioxane | 104. 1,4-Dichlorobenzene |
| 13. Ethyl ether | 59. Epichlorohydrin | 105. Isopropyltoluene |
| 14. 1,1-Dichloroethene | 60. Methyl methacrylate | 106. 1,2-Dichlorobenzene |
| 15. tert-Butyl alcohol | 61. cis-1,3-Dichloropropene | 107. Butylbenzene |
| 16. Acrylonitrile | 62. Propiolactone | 108. 1,2-Dibromo-3-chloropropane |
| 17. Methylene chloride | 63. Bromoacetone | 109. Hexachloroethane |
| 18. Allyl chloride | 64. Pyridine | 110. Nitrobenzene |
| 19. Allyl alcohol | 65. trans-1,3-Dichloropropene | 111. 1,2,4-Trichlorobenzene |
| 20. 1-Propanol | 66. 1,1,2-Trichloroethane | 112. Naphthalene |
| 21. Propargyl alcohol | 67. Toluene-d8 (IS) | 113. Hexachlorobutadiene |
| 22. trans-1,2-Dichloroethene | 68. Toluene | 114. 1,2,3-Trichlorobenzene |
| 23. MTBE | 69. 1,3-Dichloropropane | |
| 24. 1,1-Dichloroethane | 70. Paraldehide | |
| 25. Propionitrile | 71. Ethyl methacrylate | |
| 26. 2-Butanone | 72. Dibromochloromethane | |
| 27. Diisopropyl ether | 73. 3-Chloropropionitrile | |
| 28. cis-1,2-Dichloroethene | 74. 1,2-Dibromoethane | |
| 29. Methacrylonitrile | 75. Tetrachloroethene | |
| 30. Bromochloromethane | 76. 1,1,1,2-Tetrachloroethane | |
| 31. Chloroform | 77. 1-Chlorohexane | |
| 32. 2,2-Dichloropropane | 78. Chlorobenzene | |
| 33. Ethyl acetate | 79. Ethylbenzene | |
| 34. Ethyl-tert-butyl ether | 80. Bromoform | |
| 35. Methyl acrylate | 81. m-Xylene | |
| 36. Dibromofluoromethane (IS) | 82. p-Xylene | |
| 37. Isobutanol | 83. trans-Dichlorobutene | |
| 38. Dichloroethane-d4 (IS) | 84. 1,3-Dichloro-2-propanol | |
| 39. Pentafluorobenzene | 85. Styrene | |
| 40. 1,2-Dichloroethane | 86. 1,1,2,2-Tetrachloroethane | |
| 41. 1,1,1-Trichloroethane | 87. o-Xylene | |
| 42. 1-Chlorobutane | 88. 1,2,3-Trichloropropane | |
| 43. Crotonaldehyde | 89. cis-Dichlorobutene | |
| 44. 2-Chloroethanol | 90. 4-Bromofluorobenzene (IS) | |
| 45. 1,1-Dichloropropene | 91. Isopropylbenzene | |
| 46. 1-Butanol | 92. Bromobenzene | |



Suggested Supplies

- Septum:** 11 mm Advanced Green septa, 5183-4759
Liner: Direct, 1.5 mm id, 18740-80200
Seal: Gold plated seal, 18740-20885

PBDEs

Column: DB-XLB
122-1231
30 m x 0.25 mm, 0.10 µm

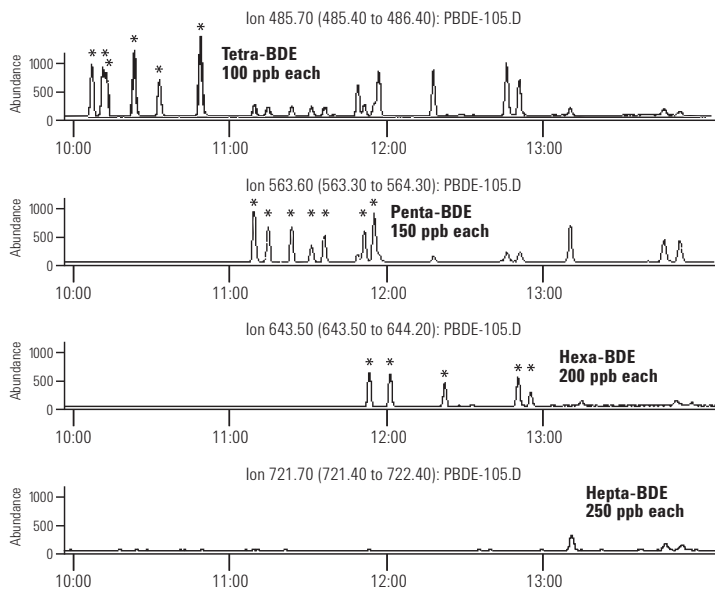
Carrier: Helium at 38 cm/s at 100 °C (1.2 mL/min),
constant flow mode

Oven: 100 °C for 1 min; 100 °C to 340 °C at 20 °C/min,
340 °C for 12 min

Injection: Cool on-column, oven-track mode

Detector: Agilent 5973 MSD, 325 °C transfer line, EI SIM
(ions monitored: 231.8, 248.0, 327.9, 398.6, 400.5,
405.8, 845.7, 563.6, 643.5, 721.4, 799.3)

Sample: 0.5 µL



For a complete Application Note, visit www.agilent.com/chem, select "Literature" from the Library and type 5989-0094EN into the "Keyword" field.

EPA Volatiles by GC/MS (Split Injector)

Column: DB-VRX
122-1564
60 m x 0.25 mm, 1.40 µm

Carrier: Helium at 30 cm/s, measured at 45 °C

Oven: 45 °C for 10 min
45-190 °C at 12 °C/min
190 °C for 2 min
190-225 °C at 6 °C/min
225 °C for 1 min

Sampler: Purge and trap (O.I.A. 4560)
Purge: Helium for 11 min at 40 mL/min
Trap: Tenax/Silica Gel/Carbosieve
Preheat: 175 °C
Desorb: 220 °C for 0.6 min

Injection: Split, 110 °C
Split flow 30 mL/min

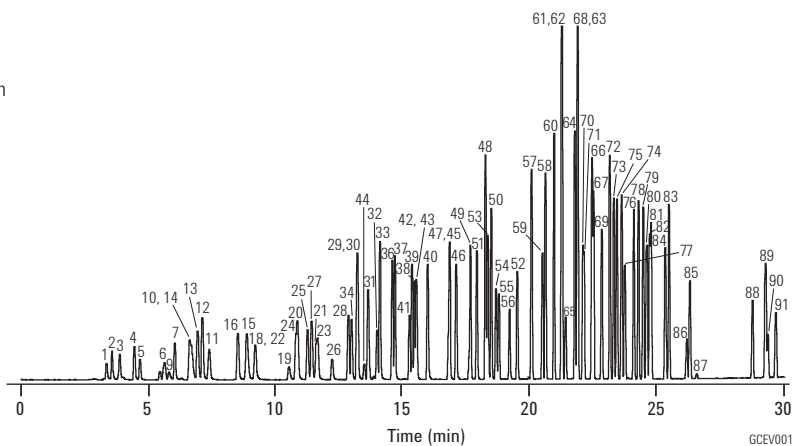
Detector: MSD, 235 °C transfer line
Full scan 35-260 amu (m/z 44 subtracted)

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal kit, 5188-5367



- | | | |
|------------------------------|-----------------------------------|---------------------------------|
| 1. Dichlorodifluoromethane | 32. Carbon tetrachloride | 63. o-Xylene |
| 2. Chloromethane | 33. Benzene | 64. Styrene |
| 3. Vinyl chloride | 34. 1,2-Dichloroethane | 65. Bromoform |
| 4. Bromomethane | 35. 2,2-Dimethylhexane | 66. Isopropylbenzene |
| 5. Chloroethane | 36. Fluorobenzene (IS) | 67. 4-Bromofluorobenzene (SS) |
| 6. Trichlorofluoromethane | 37. 1,4-Difluorobenzene (IS) | 68. 1,1,2,2-Tetrachloroethane |
| 7. Diethyl ether | 38. Trichloroethene | 69. Bromobenzene |
| 8. 1,1-Dichloroethene | 39. 1,2-Dichloropropane | 70. 1,2,3-Trichloropropane |
| 9. Acetone | 40. Methyl methacrylate | 71. trans-1,4-Dichloro-2-butene |
| 10. Iodomethane | 41. Dibromomethane | 72. n-Propylbenzene |
| 11. Carbon disulfide | 42. Bromodichloromethane | 73. 2-Chlorotoluene |
| 12. Allyl chloride | 43. 2-Nitropropane | 74. 1,3,5-Trimethylbenzene |
| 13. Methylene chloride | 44. Chloroacetonitrile | 75. 4-Chlorotoluene |
| 14. Acrylonitrile | 45. cis-1,3-Dichloropropene | 76. tert-Butylbenzene |
| 15. Methyl-tert-butyl ether | 46. 4-Methyl-2-pentanone | 77. Pentachloroethane |
| 16. trans-1,2-Dichloroethene | 47. 1,1-Dichloro-2-propanone | 78. 1,2,4-Trimethylbenzene |
| 17. Hexane | 48. Toluene | 79. sec-Butylbenzene |
| 18. 1,1-Dichloroethane | 49. trans-1,3-Dichloropropene | 80. 1,3-Dichlorobenzene |
| 19. 2-Butanone | 50. Ethyl methacrylate | 81. p-Isopropyltoluene |
| 20. cis-1,2-Dichloroethene | 51. 1,1,2-Trichloroethane | 82. 1,4-Dichlorobenzene |
| 21. 2,2-Dichloropropane | 52. Tetrachloroethene | 83. n-Butylbenzene |
| 22. Propionitrile | 53. 1,3-Dichloropropane | 84. 1,2-Dichlorobenzene |
| 23. Methyl acrylate | 54. 2-Hexanone | 85. Hexachloroethane |
| 24. Methacrylonitrile | 55. Dibromochloromethane | 86. 1,2-Dibromo-3-chloropropane |
| 25. Bromochloromethane | 56. 1,2-Dibromoethane | 87. Nitrobenzene |
| 26. Tetrahydrofuran | 57. 1-Chloro-3-fluorobenzene (IS) | 88. 1,2,4-Trichlorobenzene |
| 27. Chloroform | 58. Chlorobenzene | 89. Hexachlorobutadiene |
| 28. Pentafluorobenzene (IS) | 59. 1,1,1,2-Tetrachloroethane | 90. Naphthalene |
| 29. 1,1,1-Trichloroethane | 60. Ethylbenzene | 91. 1,2,3-Trichlorobenzene |
| 30. 1-Chlorobutane | 61. m-Xylene | |
| 31. 1,1-Dichloropropene | 62. p-Xylene | |

EPA Method 525.2

Column: DB-5ms
122-5532
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 32 cm/s, measured at 45 °C, constant flow mode

Oven: 45 °C for 1 min
45-130 °C at 30 °C/min
130 °C for 3 min
130-180 °C at 12 °C/min
180-240 °C at 7 °C/min
240-325 °C at 12 °C/min
325 °C for 5 min

Injection: Splitless, 300 °C
1.0 min purge activation time
Focus liner

Detector: MSD, 325 °C transfer line
Full scan m/z 45-450

Suggested Supplies

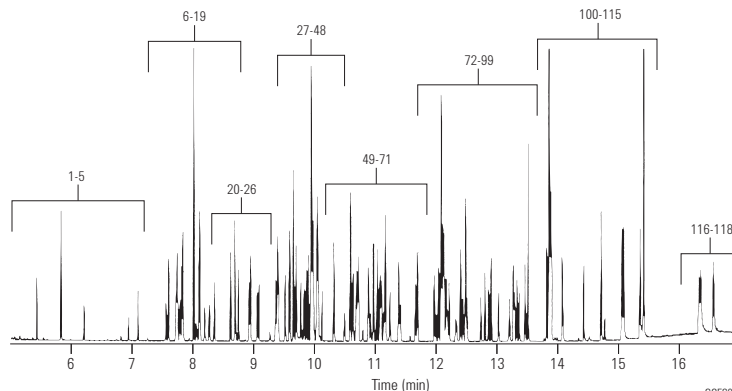
Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Sample: Composite mixture of AccuStandard Method 525.2 standards (M-525.2-SV-ASL, M-525.2-FS-ASL, M-525.2-CP-ASL, M-525.2-NP1-ASL, M-525.2-NP2-ASL): target compounds at 2 ng/µL, IS/SS at 5 ng/µL

Compound	RT	m/z	Compound	RT	m/z	Compound	RT	m/z
1. Isophorone	5.85	82	49. 2,4,5-Trichlorobiphenyl	15.59	256	84. DEF	19.84	57/169
2. 1,3-Dimethyl-2-nitrobenzene (SS)	6.65	134	50. Metribuzin	15.95	198	85. 2,2',4,4',5,6'-Hexachlorobiphenyl	19.90	360
3. Dichlorvos	7.41	109	51. Alachlor	16.14	160	86. Dieldrin	19.92	79
4. Hexachlorocyclopentadiene	8.87	237	52. Simetryn	16.23	213	87. Carboxin	19.97	143
5. EPTC	9.17	128	53. Ametryn	16.33	227/170	88. Endrin	20.43	67/81
6. Mevinphos	10.09	127	54. Heptachlor	16.36	100	89. Chlorobenzilate	20.56	139
7. Butylate	10.18	57/146	55. Prometryn	16.40	241/184	90. Endosulfan II	20.68	195
8. Vernolate	10.42	128	56. Prebane (terbutryn)	16.72	226/185	91. p,p'-DDD	20.77	235/165
9. Dimethyl phthalate	10.45	163	57. Bromacil	16.79	205	92. Endrin aldehyde	21.01	67
10. Terrazole (etridiazole)	10.47	211/183	58. Di-n-butyl phthalate	16.90	149	93. Norflurazon	21.36	145
11. 2,6-Dinitrotoluene	10.56	165	59. 2,2',4,4'-Tetrachlorobiphenyl	17.02	292	94. Benzyl butyl phthalate	21.49	149
12. Tillam (pebulate)	10.61	128	60. Metolachlor	17.11	162	95. Endosulfan sulfate	21.53	272
13. Acenaphthylene	10.65	152	61. Dursban (chlorpyrifos)	17.15	197/97	96. p,p'-DDT	21.61	235/165
14. Acenaphthene-d10 (IS)	11	164	62. Cyanazine	17.23	225/68	97. Hexazinone	21.68	171
15. Chloroneb	11.17	191	63. Dacthal (DCPA methyl ester)	17.27	301	98. Bis(2-ethylhexyl) adipate	21.87	129
16. 2-Chlorobiphenyl	11.19	188	64. Aldrin	17.29	66	99. Triphenylphosphate (SS)	21.98	326/325
17. Tebuthiuron	11.37	156	65. Triadimefon	17.43	57	100. Endrin ketone (breakdown product)	22.52	67/317
18. 2,4-Dinitrotoluene	11.51	165	66. Diphenamid	17.73	72/167	101. 2,2',3,3',4,4',6-Heptachlorobiphenyl	22.59	394/396
19. Molinate	11.68	126	67. MGK-264 (isomer A)	17.78	164/66	102. Benz[a]anthracene	22.66	228
20. Diethyl phthalate	12.21	149	68. MGK-264 (isomer B)	18.11	164	103. Chrysene-d12 (IS)	22.68	240
21. Fluorene	12.35	166	69. Heptachlor epoxide	18.28	81	104. 2,2',3,3',4,5',6,6'-Octachlorobiphenyl	22.70	430/428
22. Propachlor	12.46	120	70. 2,2',3',4,6-Pentachlorobiphenyl	18.34	326	105. Methoxychlor	22.73	227
23. Ethoprop	12.82	158	71. Merphos	18.36	209/153	106. Chrysene	22.74	228
24. Cycloate	12.86	83/154	72. γ-Chlordane	18.88	373	107. Bis(2-ethylhexyl) phthalate	23.10	149
25. Chlorpropham	13.08	127	73. Tetrachlorvinphos (stirifos)	18.95	109	108. Fenarimol	23.80	139
26. Trifluralin	13.14	306	74. Butachlor	19.03	176/160	109. cis-Permethrin	24.38	183
27. α-BHC	13.69	181	75. Pyrene-d10 (SS)	19.13	212	110. trans-Permethrin	24.50	183
28. 2,3-Dichlorobiphenyl	13.74	222/152	76. Pyrene	19.18	202	111. Benzo[b]fluoranthene	25.06	252
29. Hexachlorobenzene	13.77	284	77. α-Chlordane	19.21	375/373	112. Benzo[k]fluoranthene	25.12	252
30. Gesatamine (atraton)	13.99	196/169	78. Endosulfan I	19.22	195	113. Fluridone	25.66	328
31. Prometon	14.14	225/168	79. trans-Nonachlor	19.28	409	114. Benzo[a]pyrene	25.67	252
32. Atrazine	14.26	200/215	80. Fenamiphos	19.33	303/154	115. Perylene-d12 (SS)	25.78	264
33. Simazine	14.27	201/186	81. Napropamide	19.39	72	116. Indeno[1,2,3-c,d]pyrene	27.63	276
34. β-BHC	14.28	181	82. Tricyclazole	19.61	189	117. Dibenzo[a,h]anthracene	27.69	278
35. Pentachlorophenol	14.35	266	83. p,p'-DDE	19.76	246	118. Benzo[g,h,i]perylene	28.11	276
36. Propazine	14.35	214/172						
37. γ-BHC	14.52	181						
38. Terbufos	14.62	57						
39. Pronamide	14.69	173						
40. Diazinon	14.76	137/179						
41. Phenanthrene-d10 (IS)	14.85	188						
42. Chlorothalonil	14.89	266						
43. Phenanthrene	14.92	178						
44. Terbacil	15.02	161						
45. Methyl paraoxon	15.04	109						
46. Disulfoton	15.05	88						
47. Anthracene	15.06	178						
48. δ-BHC	15.20	181						



Pesticides and Fire Retardants (US EPA 527)

Column: DB-5ms Ultra Inert
122-5532UI
30 m x 0.25 mm, 0.25 µm

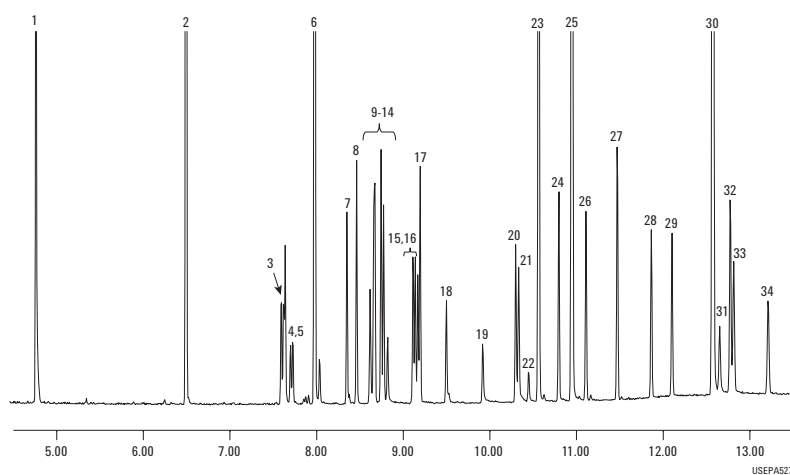
Carrier: Helium, 52 cm/s, constant flow

Oven: 60 °C (1 min) to 210 °C (25 °C/min), 20 °C/min to 310 °C (3 min)

Injection: Splitless, 250 °C, purge flow 50 mL/min at 1 min,
gas saver 80 mL/min on at 3 min

Detector: Transfer line 290 °C, source 300 °C, quad 180 °C

Sample: Pesticide/PBDE standards, 1 ng with 5 ng IS/SS on-column



- | | |
|--------------------------------|-------------------------|
| 1. 1,2-Dimethyl-2-nitrobenzene | 18. Fenamiphos |
| 2. Acenaphthalene-D10 | 19. Nitrophen |
| 3. Dimethoate | 20. Norflurazon |
| 4. Atrazine | 21. Kepone |
| 5. Propazine | 22. Hexazinone |
| 6. Anthracene-D10 | 23. Triphenyl phosphate |
| 7. Vinclozoline | 24. Bifenthrin |
| 8. Prometryn | 25. Chrysene-D12 |
| 9. Bromacil | 26. BDE-47 |
| 10. Malathion | 27. Mirex |
| 11. Thiazopyr | 28. BDE-100 |
| 12. Dursban | 29. BDE-99 |
| 13. Benthiocarb | 30. Perylene-D12 |
| 14. Parathion | 31. Fenvalerate |
| 15. Terbufos sulfone | 32. Esfenvalerate |
| 16. Bioallethrin | 33. Hexabromobiphenyl |
| 17. Oxychlordane | 34. BDE-153 |

**EPA Method 508.1 –
Chlorinated Pesticides and Herbicides**

**Column: DB-CLP1
123-8232
30 m x 0.32 mm, 0.25 µm**

**Column: DB-CLP2
123-8336
30 m x 0.32 mm, 0.50 µm**

Carrier: Helium, constant flow, 35 cm/s

Oven: 80 °C, hold 0.5 min, 26 °C/min to 175 °C, 6.5 °C/min to 235 °C, 15 °C/min to 300 °C, hold 6 min

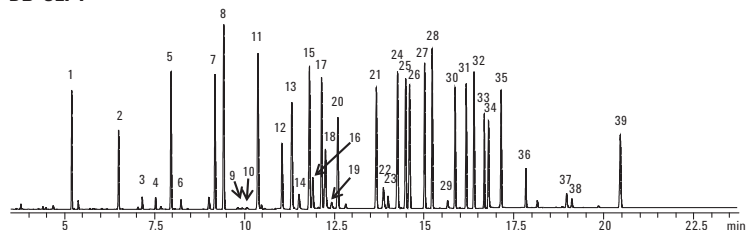
Injection: 2 µL, splitless, 250 °C

Detector: µCED, 340 °C

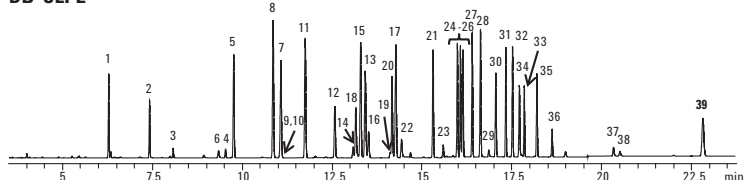
Sample: 100 ng/mL EPA 508.1 analytes,
100 ng/mL pesticide surrogate mix

- | | |
|--|---|
| 1. Hexachlorocyclopentadiene | 20. DCPA |
| 2. Etridiazole | 21. Heptachlor epoxide |
| 3. Chloroneb | 22. Cyanazine |
| 4. Trifluralin | 23. Butachlor |
| 5. Tetrachloro-m-xylene (surrogate standard) | 24. γ-Chlordane |
| 6. Propachlor | 25. α-Chlordane |
| 7. Hexachlorobenzene | 26. Endosulfan I |
| 8. α-BHC | 27. 4,4'-DDE |
| 9. Atrazine | 28. Dieldrin |
| 10. Simazine | 29. Chlorobenzilate |
| 11. γ-BHC | 30. Endrin |
| 12. β-BHC | 31. 4,4'-DDD |
| 13. Heptachlor | 32. Endosulfan II |
| 14. Alachlor | 33. 4,4'-DDT |
| 15. δ-BHC | 34. Endrin aldehyde |
| 16. Chlorothalonil | 35. Endosulfan sulfate |
| 17. Aldrin | 36. Methoxychlor |
| 18. Metribuzin | 37. cis-Permethrin |
| 19. Metolachlor | 38. trans-Permethrin |
| | 39. Decachlorobiphenyl (surrogate standard) |

DB-CLP1



DB-CLP2



The DB-CLP1 column separates all chlorinated pesticide and herbicide analytes according to EPA Method 505.

Chlorinated Pesticides, EPA Method 508

Column: HP-5ms
19091S-433
30 m x 0.25 mm, 0.25 µm

Carrier: Helium, 24 psi, 45 cm/s (80 °C) constant flow

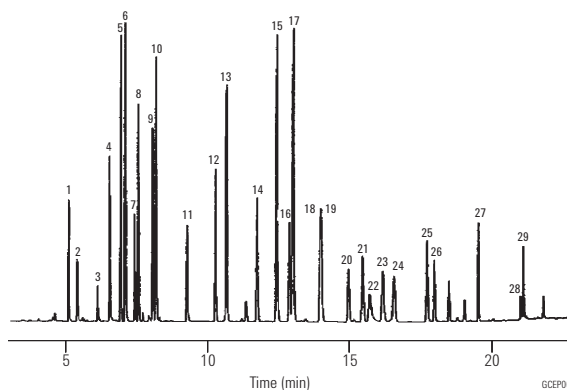
Oven: 80 °C for 1 min
80-180 °C at 30 °C/min
180-205 °C at 3 °C/min
205 °C for 4 min
205-290 °C at 2 °C/min
290 °C for 2 min

Injection: Splitless
1 min purge delay

Detector: ECD, 320 °C
Nitrogen makeup gas at 60 mL/min
Anode purge 3 mL/min

Sample: 1 µL

- | | | |
|---------------------|------------------------|------------------------|
| 1. Etridiazole | 11. Heptachlor | 21. Endosulfan II |
| 2. Chloroneb | 12. Aldrin | 22. Chlorobenzilate |
| 3. Propachlor | 13. DCPA | 23. 4,4'-DDD |
| 4. Trifluralin | 14. Heptachlor epoxide | 24. Endrin aldehyde |
| 5. α-BHC | 15. γ-Chlordane | 25. Endosulfan sulfate |
| 6. Hexachlorobezene | 16. Endosulfan I | 26. 4,4'-DDT |
| 7. β-BHC | 17. α-Chlordane | 27. Methoxychlor |
| 8. δ-BHC | 18. Dieldrin | 28. cis-Permethrin |
| 9. γ-BHC | 19. 4,4'-DDE | 29. trans-Permethrin |
| 10. Chlorothalonil | 20. Endrin | |



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Organochlorine Pesticides

Column: DB-5
125-5037
30 m x 0.53 mm, 0.50 µm

Carrier: Helium at 30 cm/s (4.0 mL/min)

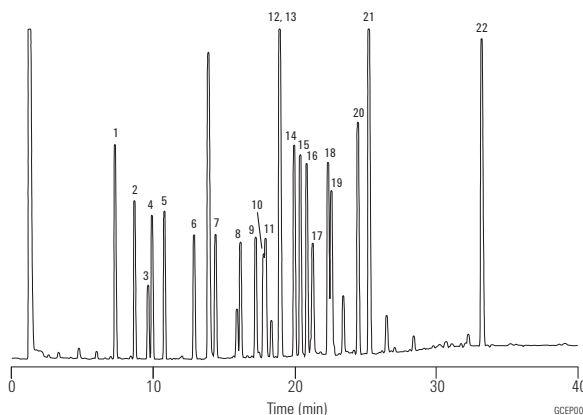
Oven: 150-275 °C at 4 °C/min
275 °C for 30 min

Injection: Splitless, 250 °C

Detector: ECD, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.7 µL of 100 µg/µL standard in isoctane

- | | |
|--------------------------------------|-----------------------------|
| 1. 2,4,5,6-Tetrachloro-m-xylene (IS) | 12. Dieldrin |
| 2. α-BHC | 13. p,p'-DDE |
| 3. β-BHC | 14. Endrin |
| 4. γ-BHC | 15. Endosulfan II |
| 5. δ-BHC | 16. p,p'-DDD |
| 6. Heptachlor | 17. Endrin aldehyde |
| 7. Aldrin | 18. Endosulfan sulfate |
| 8. Heptachlor epoxide | 19. p,p'-DDT |
| 9. γ-Chlordane | 20. Endrin ketone |
| 10. Endosulfan I | 21. Methoxychlor |
| 11. α-Chlordane | 22. Decachlorobiphenyl (IS) |



Suggested Supplies

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Septum: 11 mm Advanced Green septa, 5183-4759

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Organochlorine Pesticides III

Column: DB-1701
125-0737
30 m x 0.53 mm, 0.50 µm

Carrier: Helium at 30 cm/s (4.0 mL/min)

Oven: 150-275 °C at 4 °C/min
275 °C for 30 min

Injection: Splitless, 250 °C

Detector: ECD, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.7 µL of 100 pg/µL standard in isooctane

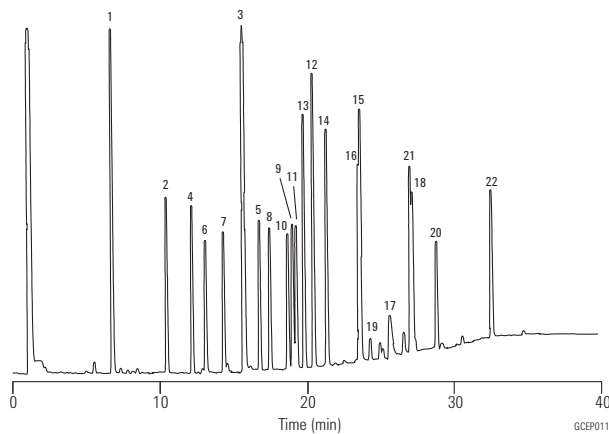
- | | |
|--------------------------------------|-----------------------------|
| 1. 2,4,5,6-Tetrachloro-m-xylene (IS) | 12. Dieldrin |
| 2. α-BHC | 13. p,p'-DDE |
| 3. β-BHC | 14. Endrin |
| 4. γ-BHC | 15. Endosulfan II |
| 5. δ-BHC | 16. p,p'-DDD |
| 6. Heptachlor | 17. Endrin aldehyde |
| 7. Aldrin | 18. Endosulfan sulfate |
| 8. Heptachlor epoxide | 19. p,p'-DDT |
| 9. γ-Chlordane | 20. Endrin ketone |
| 10. Endosulfan I | 21. Methoxychlor |
| 11. α-Chlordane | 22. Decachlorobiphenyl (IS) |

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



Organochlorine Pesticides IV

Column: DB-35
125-1937
30 m x 0.53 mm, 0.50 µm

Carrier: Helium at 30 cm/s (4.0 mL/min)

Oven: 150-275 °C at 4 °C/min
275 °C for 30 min

Injection: Splitless, 250 °C

Detector: ECD, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.7 µL of 100 pg/µL standard in isoctane

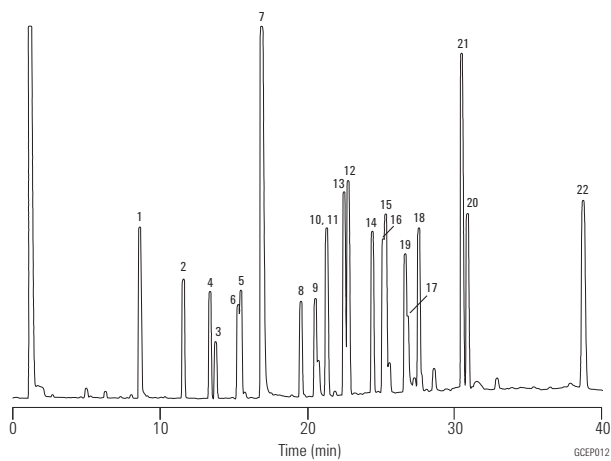
- | | |
|--------------------------------------|-----------------------------|
| 1. 2,4,5,6-Tetrachloro-m-xylene (IS) | 12. Dieldrin |
| 2. α-BHC | 13. p,p'-DDE |
| 3. β-BHC | 14. Endrin |
| 4. γ-BHC | 15. Endosulfan II |
| 5. δ-BHC | 16. p,p'-DDD |
| 6. Heptachlor | 17. Endrin aldehyde |
| 7. Aldrin | 18. Endosulfan sulfate |
| 8. Heptachlor epoxide | 19. p,p'-DDT |
| 9. γ-Chlordane | 20. Endrin ketone |
| 10. Endosulfan I | 21. Methoxychlor |
| 11. α-Chlordane | 22. Decachlorobiphenyl (IS) |

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



Organochlorine Pesticides, DB-5/DB-1701P

Column: DB-5
123-5032
30 m x 0.32 mm, 0.25 µm

Carrier: Helium at 29.2 cm/s, measured at 150 °C

Oven: 60 °C for 0.5 min
60-140 °C at 20 °C/min
140-280 °C at 11 °C/min
280 °C for 23 min

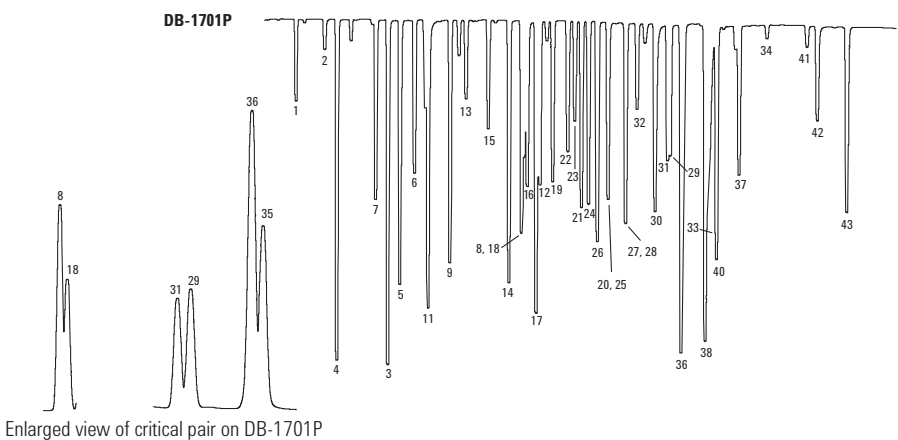
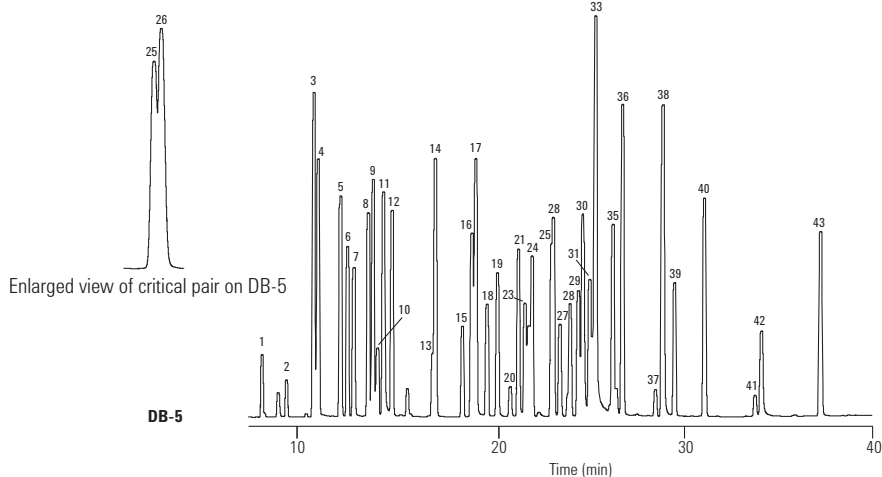
Column: DB-1701P
123-7732
30 m x 0.32 mm, 0.25 µm

Injection: Splitless, 200 °C

Column: Guard Column
160-2535-10
30 m x 0.32 mm, 0.25 µm

Detector: ECD, 325 °C
Nitrogen makeup gas at 30 mL/min

Sample: 2.0 µL, 20-200 pg/µL

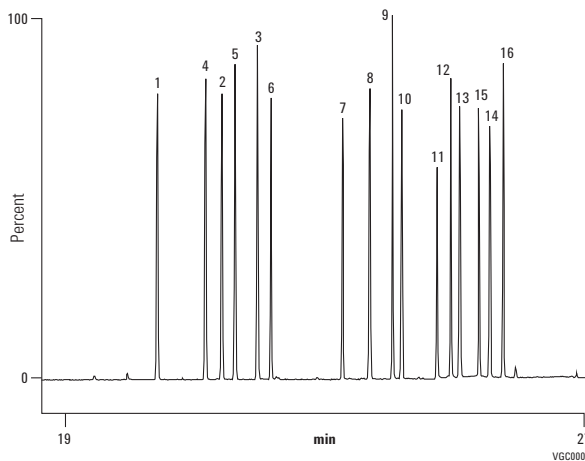


1. Etridiazole
2. Chloroneb
3. Propachlor
4. Tetrachloro-m-xylene (IS)
5. Trifluralin
6. α-BHC
7. Hexachlorobenzene
8. β-BHC
9. γ-BHC
10. Pentachloronitrobenzene
11. p,p'-Dichlorobiphenyl
12. δ-BHC
13. Heptachlor
14. Alachlor
15. Aldrin
16. Chlorpyrifos
17. DCPA
18. Isodrin
19. Heptachlor epoxide
20. Captan
21. γ-Chlordane
22. o,p'-DDE
23. Endosulfan I
24. α-Chlordane
25. Dieldrin
26. p,p'-DDE
27. o,p'-DDD
28. Endrin
29. Endosulfan II
30. Chlorobenzilate
31. p,p'-DDD
32. o,p'-DDT
33. Endrin aldehyde
34. Endrin ketone
35. Carbofenthothion
36. p,p'-DDT
37. Endosulfan sulfate
38. Hexabromobenzene (HBB)
39. Methoxychlor
40. Mirex
41. cis-Permethrin
42. trans-Permethrin
43. Decachlorobiphenyl (IS)

Organochlorine Pesticides

Column: VF-17ms
CP8982
30 m x 0.25 mm, 0.25 µm

Sample: 1.0 µL
Sample Conc: 200 µg/mL
Carrier: Helium, 70 kPa
Injection: Splitter, 1:100
Detector: MS, Ion Trap, TIC



1. α-BHC
2. β-BHC
3. δ-BHC
4. γ-BHC (lindane)
5. Heptachlor
6. Aldrin
7. Heptachlor epoxide
8. Endosulfan I
9. 4,4'-DDE
10. Dieldrin
11. Endrin
12. 4,4'-DDD
13. Endosulfan II
14. Endrin aldehyde
15. 4,4'-DDT
16. Endosulfan sulfate

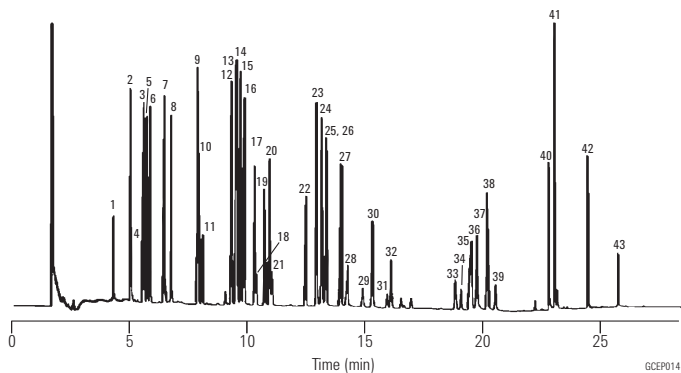
Nitrogen/Phosphorus Containing Pesticides, EPA Method 507

Column: HP-5ms
19091S-433
30 m x 0.25 mm, 0.25 µm

Carrier: Helium, 30 cm/s (13.6 psi) pressure program
Oven: 80-178 °C at 30 °C/min
178 °C for 4 min
178-205 °C at 2 °C/min
205-310 °C at 30 °C/min
310 °C for 4 min
Injection: Splitless, 260 °C
1 min purge delay
Detector: NPD, 290 °C
Helium makeup gas at 30 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|------------------|------------------|
| 1. Dichlorvos | 23. Simetryn |
| 2. EPTC | 24. Alachlor |
| 3. Butylate | 25. Ametryn |
| 4. Mevinphos | 26. Prometryn |
| 5. Vernolate | 27. Terbutryn |
| 6. Pebulate | 28. Bromacil |
| 7. Tebuthiuron | 29. Metolachlor |
| 8. Molinate | 30. Triadimefon |
| 9. Ethoprop | 31. MGK-264 |
| 10. Cycloate | 32. Diphenamid |
| 11. Chlorpropham | 33. Stirifos |
| 12. Atraton | 34. Butachlor |
| 13. Simazine | 35. Fenamiphos |
| 14. Prometon | 36. Napropamide |
| 15. Atrazine | 37. Tricyclazole |
| 16. Propazine | 38. Merphos |
| 17. Terbufos | 39. Carboxin |
| 18. Pronamide | 40. Norflurazon |
| 19. Diazinon | 41. Hexazinone |
| 20. Disulfoton | 42. Fenarimol |
| 21. Terbacil | 43. Fluridone |
| 22. Metribuzin | |

Herbicides I

Column: DB-XLB
122-1232
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 32 cm/s, measured at 50 °C

Oven: 50 °C for 1 min
50-180 °C at 10 °C/min
180-230 °C at 5 °C/min
230-320 °C at 10 °C/min
320 °C for 2 min

Injection: Splitless, 250 °C
30 s purge activation time

Detector: MSD, 300 °C transfer line
Full scan 50-400

Sample: 2 µL x 10-50 ng/µL solution
in acetone

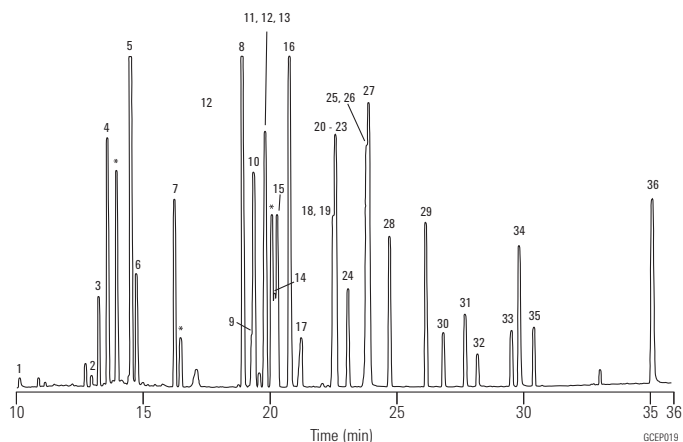
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

- | | |
|-------------------|------------------|
| 1. Monuron | 19. Propanil |
| 2. Diuron | 20. Ametryn |
| 3. EPTC | 21. Prometryn |
| 4. Dichlobenil | 22. Simetryn |
| 5. Vernolate | 23. Metribuzin |
| 6. Pebulate | 24. Terbutryn |
| 7. Molinate | 25. Metolachlor |
| 8. Sulfallate | 26. Bromacil |
| 9. Atraton | 27. Dacthal |
| 10. Prometon | 28. Diphenamid |
| 11. Atrazine | 29. Butachlor |
| 12. Propazine | 30. Napropamide |
| 13. Simazine | 31. Carboxin |
| 14. Terbutylazine | 32. Tricyclazole |
| 15. Pronamide | 33. Norflurazon |
| 16. Secbumeton | 34. Hexazinone |
| 17. Terbacil | 35. Difolatan |
| 18. Alachlor | 36. Fluridone |



* Impurity

Herbicides II

Column: DB-210
122-0232
30 m x 0.25 mm, 0.25 µm

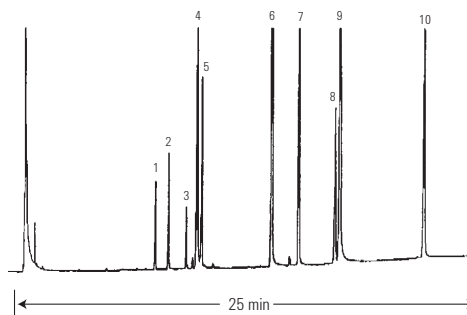
Carrier: Helium at 35 cm/s

Oven: 140-215 °C at 3 °C/min

Injection: Split 1:50, 1 µL

Detector: ECD, 300 °C
Nitrogen makeup gas at 30 mL/min

- | |
|-----------------|
| 1. Phorate |
| 2. Ethoprop |
| 3. Terbufos |
| 4. Atrazine |
| 5. Fonofos |
| 6. Propachlor |
| 7. Chlorpyrifos |
| 8. Alachlor |
| 9. Metolachlor |
| 10. Cyanazine |



C₁ and C₂ Halocarbons (Freons)

Column: GS-GasPro
113-4362
60 m x 0.32 mm

Carrier: Helium at 35 cm/s, constant velocity

Oven: 40 °C for 2 min,
40-120 °C at 10 °C/min
120 °C for 3 min
120-200 °C at 10 °C/min

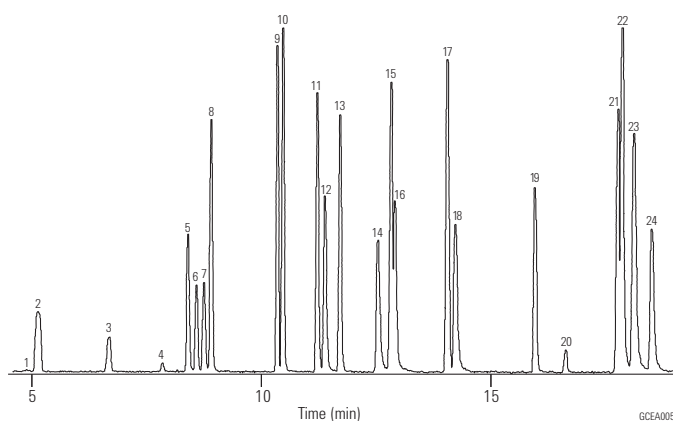
Injection: Splitless, 250 °C
0.20 min purge activation time

Detector: MSD, 280 °C,
Full scan 45-180 amu

Sample: 1.0 µL of 100 ppm mixture
of AccuStandard M-REF &
M-REF-X in methanol

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



	Freon #
1. Chlorotrifluoromethane*	13
2. Trifluoromethane	23
3. Bromotrifluoromethane	13B1
4. Chloropentafluoroethane	115
5. Pentafluoroethane	125
6. 1,1,1-Trifluoroethane	143a
7. Dichlorodifluoromethane	12
8. Chlorodifluoromethane	22
9. 1,1,1,2-Tetrafluoroethane	134a
10. Chloromethane	40
11. 1,1,2,2-Tetrafluoroethane	134
12. Bromochlorodifluoromethane	12B1
13. 1,1-Difluoroethane	152a
14. 1,2-Dichloro-1,1,2,2-tetrafluoroethane	114
15. 2-Chloro-1,1,2-tetrafluoroethane	124
16. 1-Chloro-1,1-difluoroethane	142b
17. Dichlorofluoromethane	21
18. Trichlorofluoromethane	11
19. Chloroethane	160
20. Dichloromethane	30
21. 1,1-Dichloro-1-fluoroethane	141b
22. 2,2-Dichloro-1,1,1-trifluoroethane	123
23. 1,1,2-Trichloro-1,2,2-trifluoroethane	113
24. 1,2-Dibromo-1,1,2,2-tetrafluoroethane	114B2

*Peak not shown

Nitrogen Containing Herbicides (EPA Method 507)

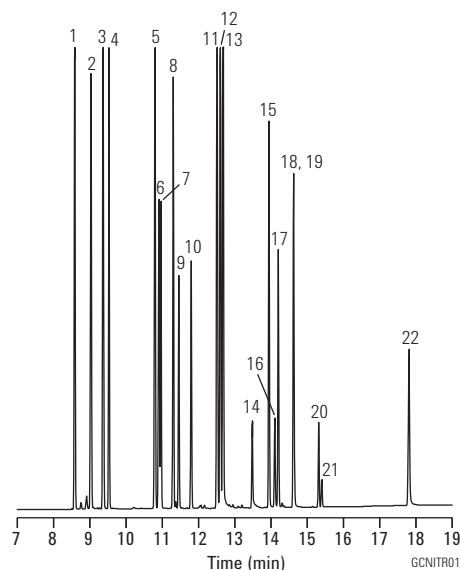
Column: DB-35
125-1937
30 m x 0.53 mm, 0.50 µm

Carrier: Helium at 38 cm/s (5 mL/min),
measured at 150 °C

Oven: 60 °C for 1 min
60-290 °C at 15 °C/min
290 °C for 5 min

Injection: Megabore direct, 290 °C, 1 µL of 3 ng/µL standard

Detector: NPD, 290 °C



1. Eptam
2. Sutan
3. Vernam
4. Tillam
5. Ordram
6. Treflan
7. Balan
8. Ro-Neet
9. Propachlor
10. Tolban
11. Propazine
12. Atrazine
13. Simazine
14. Terbacil
15. Sencor
16. Dual
17. Paarlant
18. Prowl
19. Bromacil
20. Oxadiazon
21. GOAL
22. Hexazinone

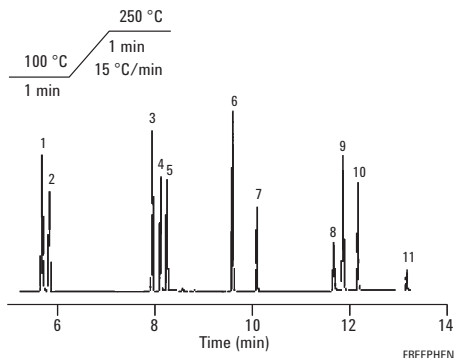
Free Phenols

Column: HP-50+
19091L-433
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen, constant flow 45 cm/s

Injection: Split, 100:1

Detector: FID, 300 °C



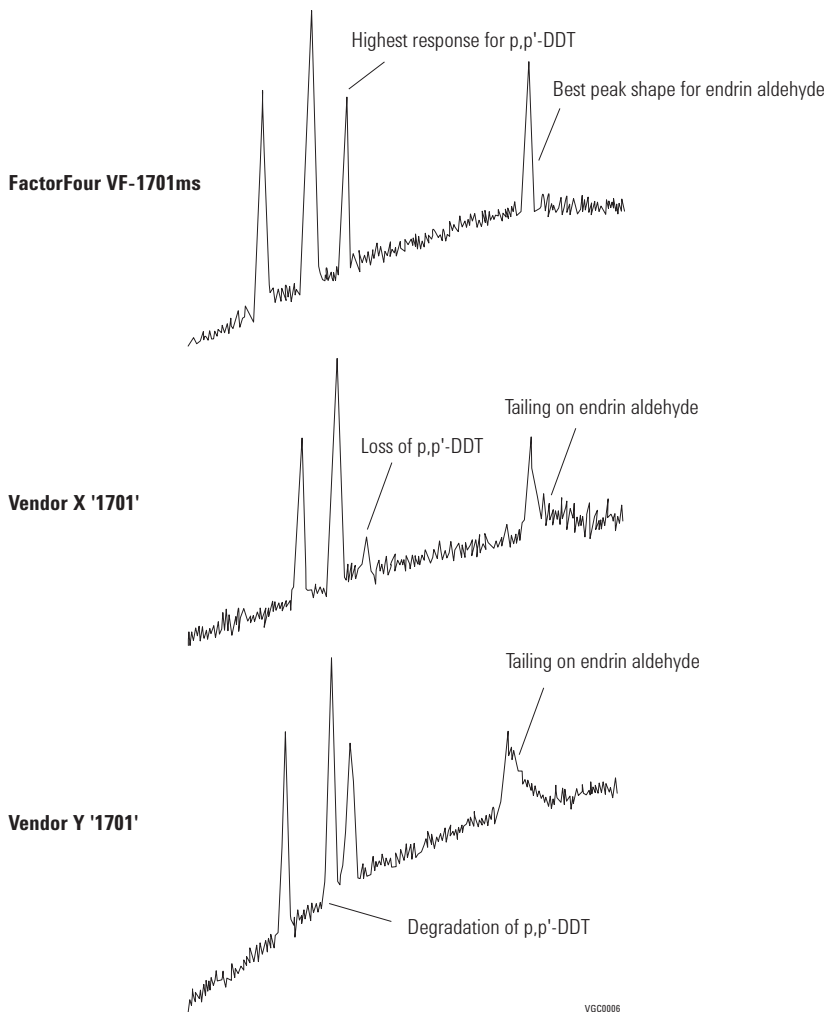
1. Phenol
2. 2-Chlorophenol
3. 2,4-Dimethylphenol
4. 2-Nitrophenol
5. 2,4-Dichlorophenol
6. 4-Chloro-3-methylphenol
7. 2,4,6-Trichlorophenol
8. 2,4-Dinitrophenol
9. 4-Nitrophenol
10. 2-Methyl-4,6-dinitrophenol
11. Pentachlorophenol

EPA 625 Halogenated Pesticides on "1701" Type Phases

Column: VF-1701 Pesticides
CP9070
30 m x 0.25 mm, 0.25 µm

Oven: 150 °C, 5 °C/min to 275 °C

Injection: Split: T=275 °C
ECD: T=275 °C, 2 pg



VGC0006

Organochlorine Pesticides to EPA 625 via GC/MS

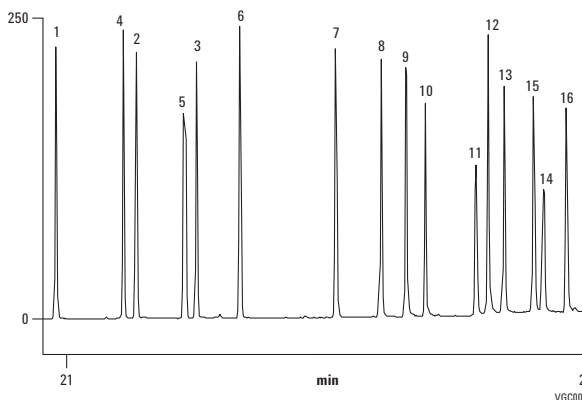
Column: VF-35ms
CP8877
30 m x 0.25 mm, 0.25 µm

Carrier: Helium, approx. 1.0 mL/min, 60 kPa

Oven: 45 °C + 10 °C/min to 325 °C

Injection: Split/splitless, in split mode, 1:100

Detector: Ion Trap MS



1. α-BHC
2. β-BHC
3. δ-BHC
4. γ-BHC (lindane)
5. Heptachlor
6. Aldrin
7. Heptachlor epoxide
8. Endosulfan I
9. 4,4'-DDE
10. Dieldrin
11. Endrin
12. 4,4'-DDD
13. Endosulfan II
14. Endrin aldehyde
15. 4,4'-DDT
16. Endosulfan sulfate

Organochlorine Pesticides I EPA Method 8081A

Column: DB-35ms
122-3832
30 m x 0.25 mm, 0.25 µm

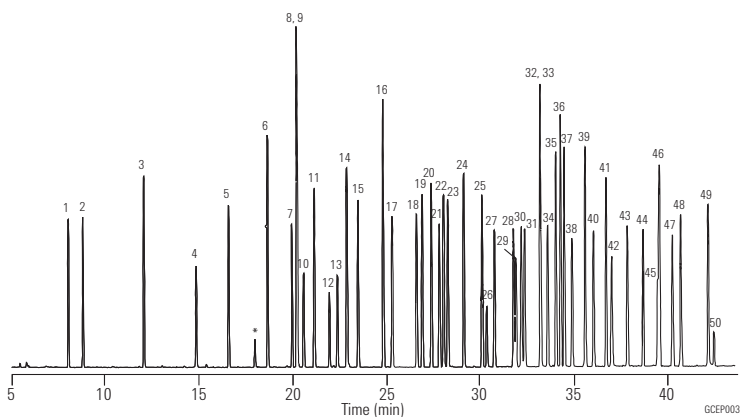
Carrier: Helium at 35 cm/s, measured at 50 °C

Oven: 50 °C for 1 min
50-100 °C at 25 °C/min
100-300 °C at 5 °C/min
300 °C for 5 min

Injection: Splitless, 250 °C
30 s purge activation time

Detector: MSD, 300 °C transfer line
Full scan at m/z 50-500

Sample: 1 µL of 35 µg/mL composite 8081A standards, AccuStandard Inc.



1. 1,2-Dibromo-3-chloropropane
2. 4-Chloro-3-nitrobenzotrifluoride (SS)
3. Hexachloropentadiene
4. 1-Bromo-2-nitrobenzene (IS)
5. Terrazole
6. Chloroneb
7. Trifluralin
8. 2-Bromobiphenyl (SS)
9. Tetrachloro m-xylene (SS)
10. α, α-Dibromo-m-xylene
11. Propachlor
12. Di-allate A
13. Di-allate B
14. Hexachlorobenzene
15. α-BHC
16. Pentachloronitrobenzene (IS)
17. γ-BHC
18. β-BHC
19. Heptachlor
20. Alachlor
21. δ-BHC
22. Chlorothalonil
23. Aldrin
24. Dacthal
25. Isodrin
26. Kelthane
27. Heptachlor epoxide
28. γ-Chlordane
29. trans-Nonachlor
30. α-Chlordane
31. Endosulfan I
32. Captan
33. p,p'-DDE
34. Dieldrin
35. Chlorobenzilate
36. Perthane
37. Chloropropylate
38. Endrin
39. p,p'-DDD
40. Endosulfan II
41. p,p'-DDT
42. Endrin aldehyde
43. Endosulfan sulfate
44. Dibutyl chlorendate (SS)
45. Captafol
46. Methoxychlor
47. Endrin ketone
48. Mirex
49. cis-Permethrin
50. trans-Permethrin

* Breakdown Products
SS - Surrogate Standard
IS - Internal Standard

Suggested Supplies

- Septum:** 11 mm Advanced Green septa, 5183-4759
- Liner:** Splitless, single taper, deactivated, 4 mm id, 5181-3316
- Syringe:** 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Standards used were a composite of individual solutions supplied courtesy of AccuStandard Inc., 25 Science Park, New Haven, CT 06511, 800-442-5290.

Organochlorine Pesticides II EPA Method 8081A

Column: DB-5ms
122-5532
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 35 cm/s, measured at 50 °C

Oven: 50 °C for 1 min
50-100 °C at 25 °C/min
100-300 °C at 5 °C/min
300 °C for 5 min

Injection: Splitless, 250 °C
30 s purge activation time

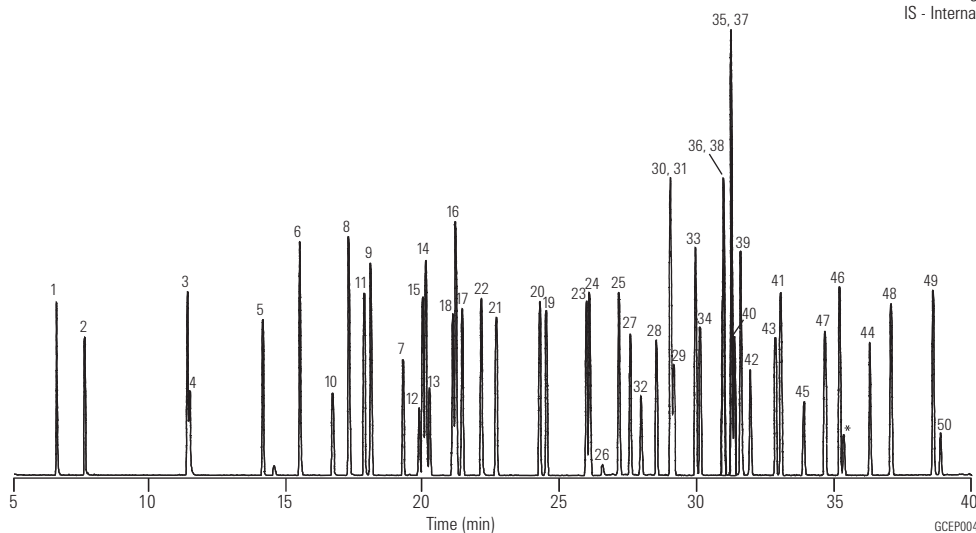
Detector: MSD, 300 °C transfer line
Full scan at m/z 50-500

Sample: 1 µL of 35 µg/mL composite 8081A standards, AccuStandard Inc.

- | | |
|--|------------------------------|
| 1. 1,2-Dibromo-3-chloropropane | 26. Kelthane |
| 2. 4-Chloro-3-nitrobenzotrifluoride (SS) | 27. Heptachlor epoxide |
| 3. Hexachloropentadiene | 28. γ-Chlordane |
| 4. 1-Bromo-2-nitrobenzene (IS) | 29. trans-Nonachlor |
| 5. Terrazole | 30. α-Chlordane |
| 6. Chloroneb | 31. Endosulfan I |
| 7. Trifluralin | 32. Captan |
| 8. 2-Bromobiphenyl (SS) | 33. p,p'-DDE |
| 9. Tetrachloro m-xylene (SS) | 34. Dieldrin |
| 10. α, α-Dibromo-m-xylene | 35. Chlorobenzilate |
| 11. Propachlor | 36. Perthane |
| 12. Di-allate A | 37. Chloropropylate |
| 13. Di-allate B | 38. Endrin |
| 14. Hexachlorobenzene | 39. p,p'-DDD |
| 15. α-BHC | 40. Endosulfan II |
| 16. Pentachloronitrobenzene (IS) | 41. p,p'-DDT |
| 17. γ-BHC | 42. Endrin aldehyde |
| 18. β-BHC | 43. Endosulfan sulfate |
| 19. Heptachlor | 44. Dibutyl chlorendate (SS) |
| 20. Alachlor | 45. Captafol |
| 21. δ-BHC | 46. Methoxychlor |
| 22. Chlorothalonil | 47. Endrin ketone |
| 23. Aldrin | 48. Mirex |
| 24. Dacthal | 49. cis-Permethrin |
| 25. Isodrin | 50. trans-Permethrin |

Standards used were a composite of individual solutions supplied courtesy of AccuStandard Inc., 25 Science Park, New Haven, CT 06511, 800-442-5290.

* Breakdown Products
SS - Surrogate Standard
IS - Internal Standard



Organophosphorus Pesticides in Apple Matrix

Column: DB-35ms Ultra Inert
121-3822UI
20 m x 0.18 mm, 0.18 µm

Instrument: Agilent 7890 GC/Agilent 5975C Series GC/MSD

Sampler: Agilent 7683B automatic liquid sampler,
5.0 µL syringe (p/n 5181-1273)

CFT Device: Purged 2-way splitter (p/n G3180B)
Split Ratio MSD:FPD = 3:1

MSD Restrictor: 1.2 m x 0.15 mm id deactivated fused silica tubing

FPD Restrictor: 1.4 m x 0.15 mm id deactivated fused silica tubing

PCM 1: 3.8 psi constant pressure

Inlet: 1 µL splitless; 250 °C, purge flow 60 mL/min
at 0.25 min, gas saver on at 2 min 20 mL/min

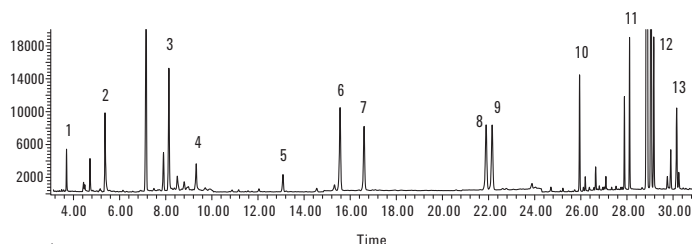
Carrier: Helium, constant pressure 43.5 psi at 95 °C

Oven: 95 °C (1.3 min), 15 °C/min to 125 °C, 5 °C/min to
165 °C, 2.5 °C/min to 195 °C, 20 °C/min to 280 °C
(3.75 min)

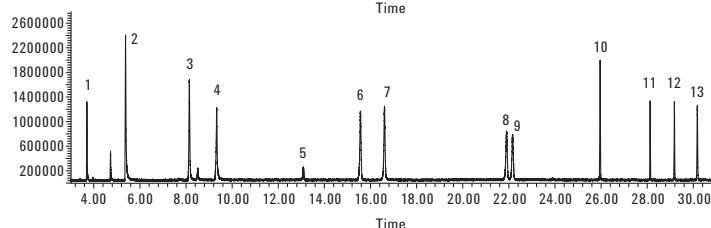
Postrun Backflush: 5 min at 280 °C, PCM 1 pressure 70 psi during
backflush, 2 psi inlet pressure during backflush

Detector: 310 °C transfer line, 310 °C source, 150 °C quad

1. Oxydemeton-methyl
2. Methamidophos
3. Mevinphos
4. Acephate
5. Naled
6. Diazinon
7. Dimethoate
8. Chlorpyrifos
9. Malathion
10. Methidathion
11. TPP (surrogate std)
12. Phosmet



MSD (SIM): 600 ng/mL



FPD (P): 200 ng/mL

GC/MS-SIM and FPD chromatograms of a matrix matched organophosphorus pesticides standard analyzed on an Agilent J&W DB-35ms UI column. The effluent split ratio is MSD:FPD = 3:1.

Environmental Applications, Semivolatiles

Agilent's Ultra Inert Test Probe Mixture

Column: DB-5ms Ultra Inert
122-5532UI
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen, constant pressure, 38 cm/s

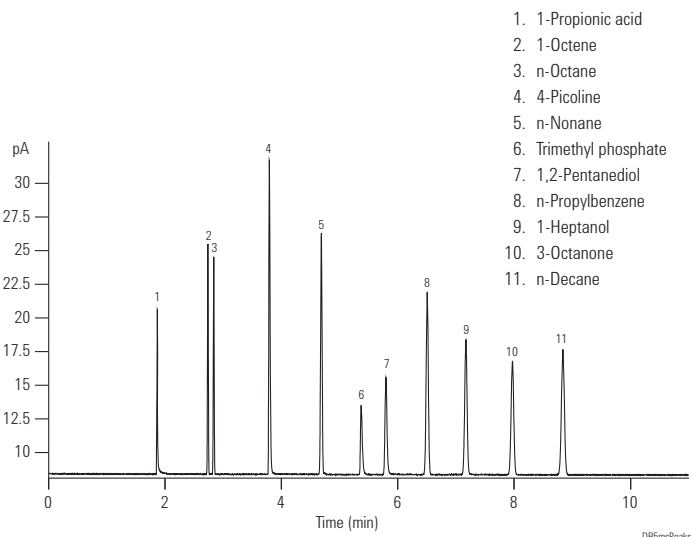
Oven: 65 °C isothermal

Sampler: Agilent 7683B, 0.5 µL syringe
(p/n 5188-5246), 0.02 µL split injection

Injection: Split/splitless, 250 °C, 1.4 mL/min; split column flow
900 mL/min; gas saver flow 75 mL/min at 2.0 min

Detector: FID at 325 °C; 450 mL/min air, 40 mL/min hydrogen,
45 mL/min nitrogen makeup

A properly deactivated DB-5ms Ultra Inert column delivers symmetrical peak shapes, along with increased peak heights, which allow for accurate integration and detection of trace analytes.



Trace Level Polycyclic Aromatic Hydrocarbon (PAH) Analyses

Column: DB-5ms Ultra Inert
122-5532UI
30 m x 0.25 mm, 0.25 µm

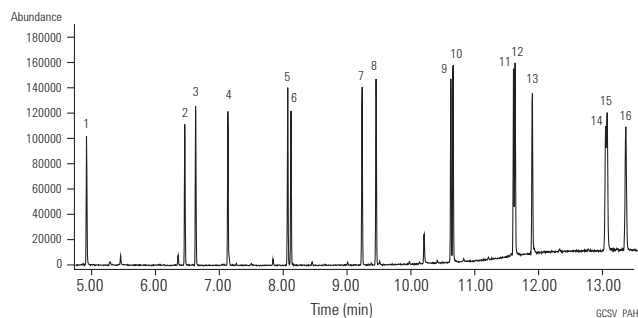
Carrier: Helium constant flow 30 cm/s

Oven: 40 °C (1 min) to 100 °C (15 °C/min)
10 °C to 210 °C (1 min)
5 °C/min to 310 °C (8 min)

Injection: Split/splitless, 260 °C, 53.7 mL/min total flow,
purge flow 50 mL/min on at 0.5 min,
gas saver flow 80 mL/min on at 3.0 min

Detector: MSD source at 300 °C
Quadrupole at 180 °C
Transfer line at 290 °C
Scan range 50-550 amu

- | | |
|-------------------|----------------------------|
| 1. Naphthalene | 9. Benz[a]anthracene |
| 2. Acenaphthylene | 10. Chrysene |
| 3. Acenaphthene | 11. Benzo[b]fluoranthene |
| 4. Fluorene | 12. Benzo[k]fluoranthene |
| 5. Phenanthrene | 13. Benzo[a]pyrene |
| 6. Anthracene | 14. Indeno[1,2,3-cd]pyrene |
| 7. Fluoranthene | 15. Dibenzo[a,h]anthracene |
| 8. Pyrene | 16. Benzo[g,h,i]perylene |



Tetrachlorodibenzo-p-furans

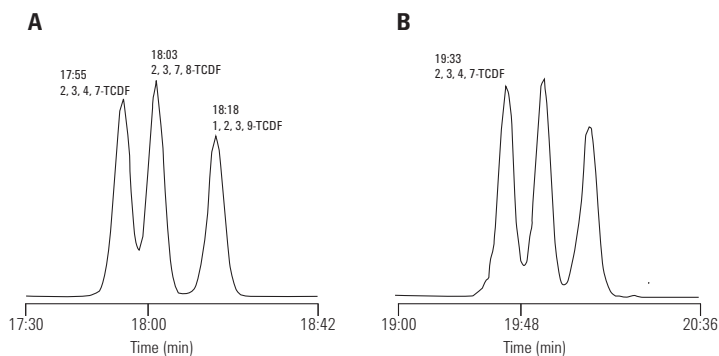
Column A: DB-225
122-2232
30 m x 0.25 mm, 0.25 µm

Column B: DB-225ms
122-2932
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 12 mL/min

Oven: 160-250 °C at 7 °C/min
250 °C until compounds elute

Injection: Splitless, 240 °C



Note the separation between 2,3,7,8-TCDF and 2,3,4,7-TCDF on DB-225 is also easily achievable (and actually a little better) on Agilent J&W DB-225ms.

Congeners in DIN Method PCBs

Column: DB-XLB
122-1236
30 m x 0.25 mm, 0.50 µm

Carrier: Helium at 34.2 cm/s, measured at 150 °C

Oven: 100 °C for 1 min
100-320 °C at 5.6 °C/min

Injection: Hot on-column, 250 °C
Split flow 100 mL/min

Detector: MSD, 300 °C transfer line
SIM of 221.9, 255.9,
291.9, 325.8, 359.8,
395.8, 429.7, 463.7

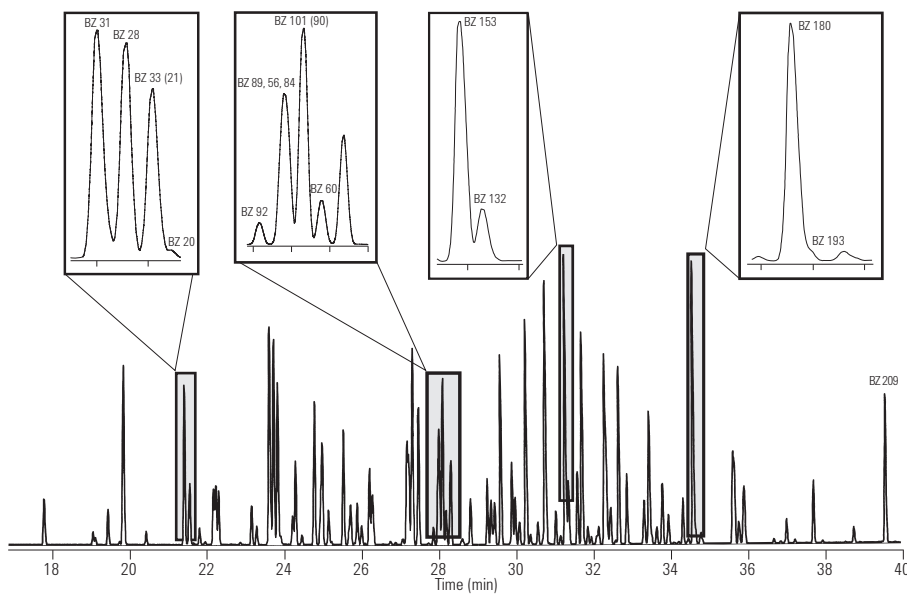
Sample: 2 µL dilute Aroclor mixture

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



**Extended Temperature Program
Resolving Congeners 52 and 138**

Column: DB-XLB
122-1236
30 m x 0.25 mm, 0.50 µm

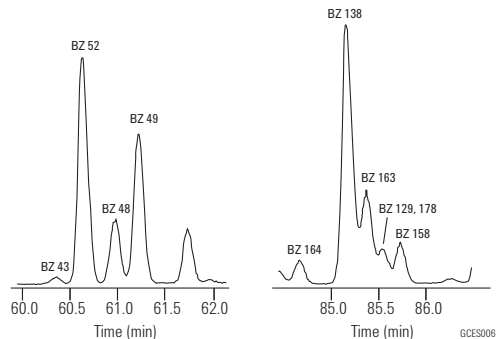
Carrier: Helium at 34.2 cm/s, measured at 150 °C

Oven: 100 °C for 1 min
100-275 °C at 1.6 °C/min

Injection: Hot on-column, 250 °C
Split flow 100 mL/min

Detector: MSD, 300 °C transfer line
SIM of 221.9, 255.9, 291.9, 325.8,
359.8, 395.8, 429.7, 463.7

Sample: 2 µL dilute Aroclor mixture



PCBs by EPA Method 8082

Column: DB-35ms
123-3832
30 m x 0.32 mm, 0.25 µm

Column: DB-XLB
123-1236
30 m x 0.32 mm, 0.50 µm

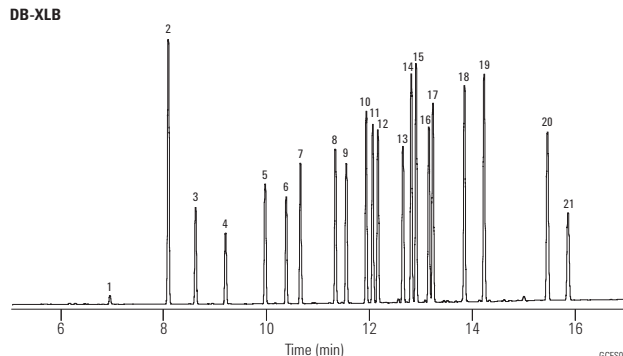
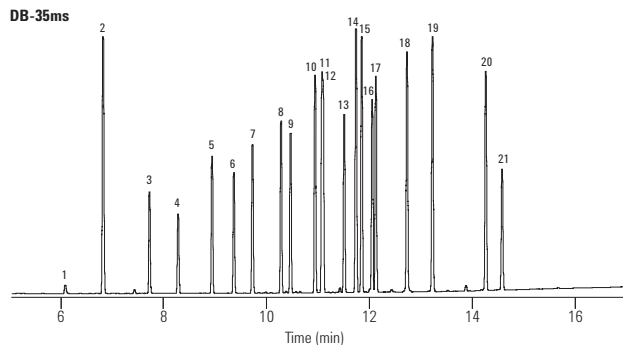
Carrier: Helium at 45 cm/s
(EPC in constant flow mode)

Oven: 110 °C for 0.5 min
110-320 °C at 15 °C/min
320 °C for 5 min

Injection: Splitless, 250 °C
30 s purge activation time

Detector: µECD, 350 °C
Nitrogen makeup gas
(column + makeup flow =
30 mL/min constant flow)

Sample: 50 pg per component



1. IUPAC 1
 2. Tetrachloro-m-xylene (IS/SS)
 3. IUPAC 5
 4. IUPAC 18
 5. IUPAC 31
 6. IUPAC 52
 7. IUPAC 44
 8. IUPAC 66
 9. IUPAC 101
 10. IUPAC 87
 11. IUPAC 110
 12. IUPAC 151
 13. IUPAC 153
 14. IUPAC 141
 15. IUPAC 137
 16. IUPAC 187
 17. IUPAC 183
 18. IUPAC 180
 19. IUPAC 170
 20. IUPAC 206
 21. Decachlorobiphenyl (IS/SS)
- IS/SS - Internal Standard/
Surrogate Standard

Suggested Supplies

Septum: 11 mm Advanced Green septa,
5183-4759

Liner: Splitless, single taper, deactivated,
4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP,
5181-1267

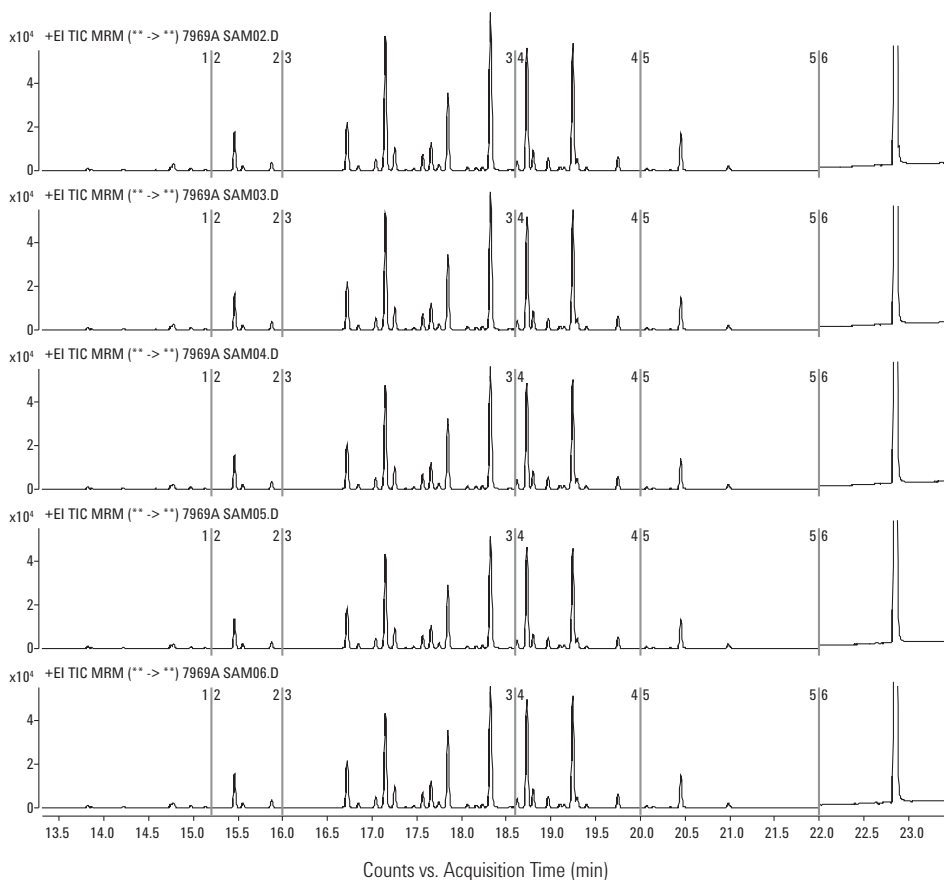
**Automated Cleanup of PCB extracts from Waste Oil
Using 7696A Sample Prep Workbench**

Column: DB-5ms
122-5532
30 m x 0.25 mm, 0.25 µm

Instrument: Agilent 7000 Triple Quadrupole GC/MS system
Carrier: Helium, 1 mL/min constant flow
During backflush: 2 mL/min
Oven: 80 °C (1 min), 10 °C/min to 305 °C, 7.5 min hold
Injection: 1 µL, pulsed splitless
QuickSwap: 28 kPa constant pressure
Backflush: Start at 23.5 min

Detector: MRM mode
CE 25 V, dwell time 100 ms per transition
Trichloro-biphenyls: 256.0 > 186.0; 258.0 > 186.0
Tetrachloro-biphenyls: 293.8 > 222.0; 291.8 > 222.0
Pentachloro-biphenyls: 325.8 > 256.0; 327.8 > 256.0
Hexachloro-biphenyls: 359.9 > 289.9; 361.9 > 289.9
Heptachloro-biphenyls: 393.8 > 323.8; 395.8 > 323.8
Octachloronaphthalene (IS): 404.0 > 404.0 (CE OV)

Sample: Reference sample BCR-449, five aliquots



Pyrethrins

Column: DB-1
123-1032
30 m x 0.32 mm, 0.25 µm

Carrier: Helium at 39 cm/s, measured at 150 °C

Oven: 180 °C for 11 min
 180-200 °C at 10 °C/min
 200 °C for 8 min
 200-210 °C at 10 °C/min
 210 °C for 18 min
 210-245 °C at 30 °C/min
 245 °C for 4 min

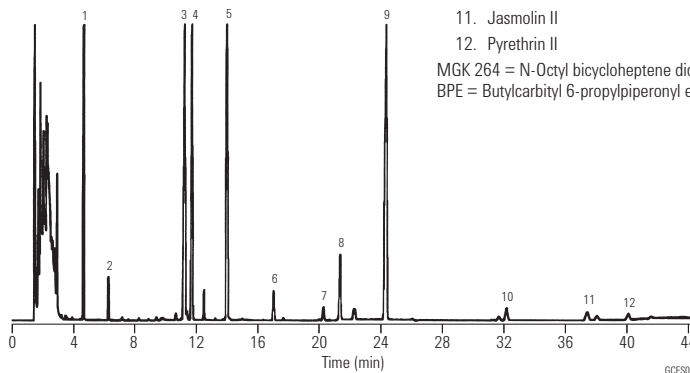
Injection: Split, 250 °C
 Split ratio 1:20

Detector: FID, 300 °C
 Helium makeup gas at 30 mL/min

Sample: 1 µL

1. Heptadecane
2. Octadecane
3. Endo-MGK 264
4. Exo-MGK 264
5. Methoprene
6. Cinerin I
7. Jasmolin I
8. Pyrethrin I
9. BPE (PB)
10. Cinerin II
11. Jasmolin II
12. Pyrethrin II

MGK 264 = N-Octyl bicycloheptene dicarboximide
 BPE = Butylcarbityl 6-propylpiperonyl ether

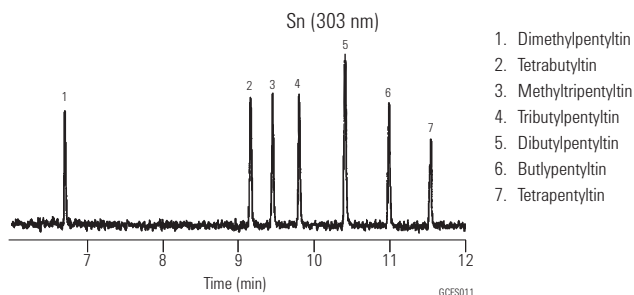


Chromatogram courtesy of Khan Nguyen and Richard Moorman of Sandoz Agro Inc.

Organotin Compounds I

Column: HP-1
19091Z-012
25 m x 0.32 mm, 0.17 µm

Carrier: Helium, 100 kPa
Oven: 50 °C for 1 min
50-260 °C at 15 °C/min
Injection: Splitless
Detector: AED, 330 °C
Sample: 1 µL

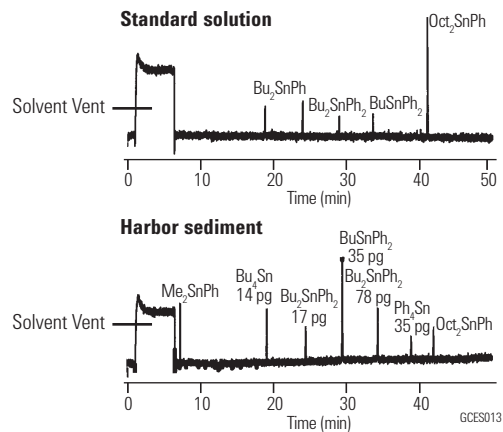
**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Organotin Compounds II

Column: HP-5
19091J-002
25 m x 0.20 mm, 0.11 µm

Carrier: Helium, 0.75 mL/min constant flow
Oven: 60-360 °C at 5 °C/min
Injection: Splitless, 300 °C
Detector: AED, 300 °C
Hg selective at 254 nm
Sample: 1 µL

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Semivolatile Compounds, US EPA Method 8270

Column: HP-5ms
 19091S-133
 30 m x 0.25 mm, 0.50 µm

Carrier: Ramped flow 1.2 mL/min for 0.0 min
 Ramp at 99 mL/min to 2.0 mL/min
 2.0 mL/min for 0.35 min
 Ramp at 10 mL/min to 1.2 mL/min

Oven: 40 °C for 1.0 min
 40-100 °C at 15 °C/min
 100-240 °C at 20 °C/min
 240-310 °C at 10 °C/min

Injection: Splitless, 250 °C
 30 mL/min purge flow
 at 0.35 min

Detector: 5973 MSD, 310 °C transfer line
 Scan range 35-500 amu,
 3.25 scans/s

Sample: 1 µL of 50 ng standard

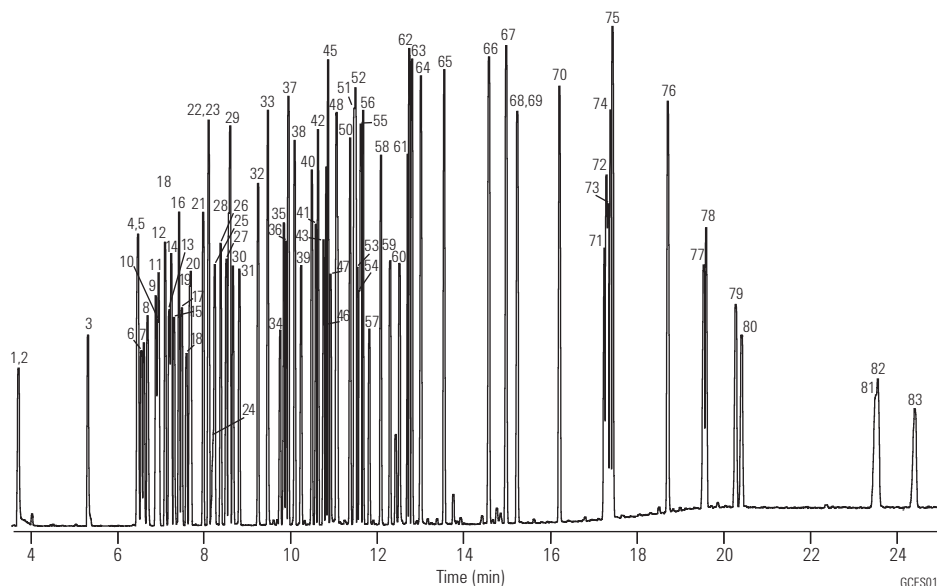
Suggested Supplies

Septum: 11 mm Advanced Green septa,
 5183-4759

Liner: Splitless, single taper, deactivated,
 4 mm id, 5181-3316

Syringe: 10 µL tapered,
 FN 23-26s/42/HP, 5181-1267

- | | | | |
|----------------------------------|---------------------------------|--------------------------------|---------------------------------|
| 1. n-Nitrosodimethylamine | 36. 2,4,5-Trichlorophenol | 52. Fluorene | 68. Terphenyl-d14 |
| 2. Pyridine | 37. 2-Fluorobiphenyl | 53. 4-Nitroaniline | 69. Benzidine |
| 3. 2-Fluorophenol | 38. 2-Chloronaphthalene | 54. 4,6-Dinitro-2-methylphenol | 70. Butylbenzylphthalate |
| 4. Phenol-d5 | 39. 2-Nitroaniline | 55. n-Nitrosodiphenylamine | 71. 3,3'-Dichlorobenzidine |
| 5. Phenol | 40. Dimethyl phthalate | 56. Azobenzene | 72. Benzo[a]anthracene |
| 6. Aniline | 41. 2,6-Dinitrotoluene | 57. 2,4,6-Tribromophenol | 73. Chrysene-d12 |
| 7. Bis(2-chloroethyl) ether | 42. Acenaphthylene | 58. 4-Bromophenyl-phenylether | 74. Chrysene |
| 8. 2-Chlorophenol | 43. 3-Nitroaniline | 59. Hexachlorobenzene | 75. Bis(2-ethylhexyl) phthalate |
| 9. 1,3-Dichlorobenzene | 44. Acenaphthene-d10 | 60. Pentachlorophenol | 76. Di-n-octylphthalate |
| 10. 1,4-Dichlorobenzene-d4 | 45. Acenaphthene | 61. Phenanthrene-d10 | 77. Benzo[b]fluoranthene |
| 11. 1,4-Dichlorobenzene | 46. 2,4-Dinitrophenol | 62. Phenanthrene | 78. Benzo[k]fluoranthene |
| 12. Benzyl alcohol | 47. 4-Nitrophenol | 63. Anthracene | 79. Benzo[a]pyrene |
| 13. 1,2-Dichlorobenzene | 48. Dibenzofuran | 64. Carbazole | 80. Perylene-d12 |
| 14. 2-Methylphenol | 49. 2,4-Dinitrotoluene | 65. Di-n-butyl phthalate | 81. Indeno[1,2,3-cd]pyrene |
| 15. Bis(2-chloroisopropyl) ether | 50. Diethyl phthalate | 66. Fluoranthene | 82. Dibenz[a,h]anthracene |
| 16. 4-Methylphenol | 51. 4-Chlorophenyl-phenyl ether | 67. Pyrene | 83. Benzo[g,h,i]perylene |



A variety of HP-5ms and DB-5ms columns can be used for 8270 and similar semivolatiles applications. The column shown above was chosen to maximize inertness and robustness to residues with a thicker 0.5 µm film, but the price paid is a slightly longer run time.

An HP-5ms, 30 m x 0.25 mm id, 0.25 µm, p/n 19091S-433 would give shorter run times, with slightly less inertness and robustness.

A DB-5ms, 30 m x 0.25 mm id, 0.25 µm, p/n 122-5532, would give slightly less inertness, but offer better resolution of PAHs such as benzo[b]fluoranthene and benzo[k]fluoranthene.

A DB-5ms, 20 m x 0.18 mm x 0.18 µm, p/n 121-5522, can offer significantly reduced run times with a modest loss of inertness.

US EPA Method 8061 (Phthalate Esters)

Column: DB-5ms
121-5522
20 m x 0.18 mm, 0.18 µm

Carrier: Helium at 49 cm/s, measured at 80 °C
constant flow program

Oven: 80 °C for 0.5 min
80-160 °C at 30 °C/min
160-320 °C at 15 °C/min

Injection: Splitless, 300 °C
30 s purge activation time

Detector: MSD, 325 °C transfer line
Full scan m/z 50-400

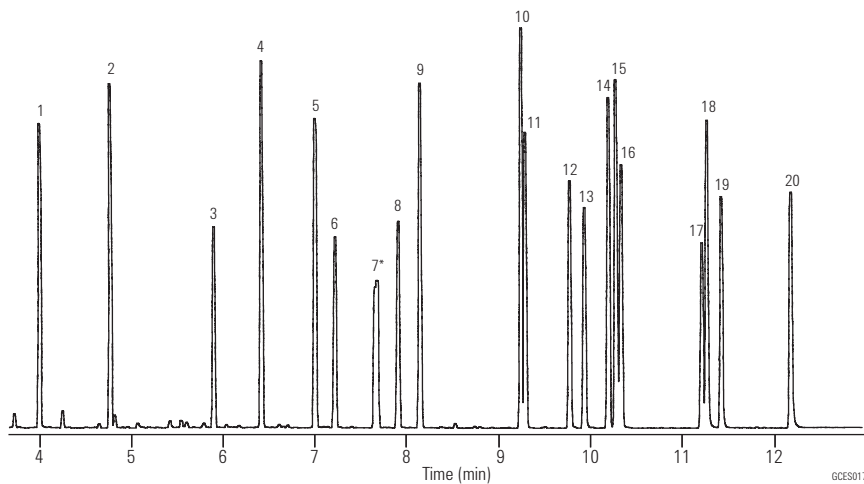
Sample: 1 µL of 20 ng/µL
Method 8061 mixture (AccuStandard) in hexane

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Dimethyl phthalate
 2. Diethyl phthalate
 3. Benzyl benzoate (IS)
 4. Diisobutyl phthalate
 5. Di-n-butyl phthalate
 6. Bis(4-methoxyethyl) phthalate
 7. Bis(4-methyl-2-pentyl) phthalate *
 8. Bis(2-ethoxyethyl) phthalate
 9. Diamyl phthalate
 10. Dihexyl phthalate
 11. Butyl benzyl phthalate
 12. Hexyl 2-ethylhexyl phthalate
 13. Bis(2-n-butoxyethyl) phthalate
 14. Dicyclohexyl phthalate
 15. Bis(2-ethylhexyl) phthalate
 16. Diphenyl phthalate (SS)
 17. Diphenyl isophthalate (SS)
 18. Di-n-octyl phthalate
 19. Dibenzyl phthalate (SS)
 20. Dinonyl phthalate
- * Two isomers
IS - Internal Standard
SS - Surrogate Standard

PAHs

Column: DB-17ms
122-4732
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at: 34.1 cm/s, measured at 150 °C

Oven: 95 °C for 0.5 min
95-340 °C at 5 °C/min
340 °C for 5 min

Injection: Split, 300 °C
Split ratio 1:40

Detector: MSD, 340 °C transfer line
Scan 80-330 amu

Sample: 2 µL, PAH standard

Suggested Supplies

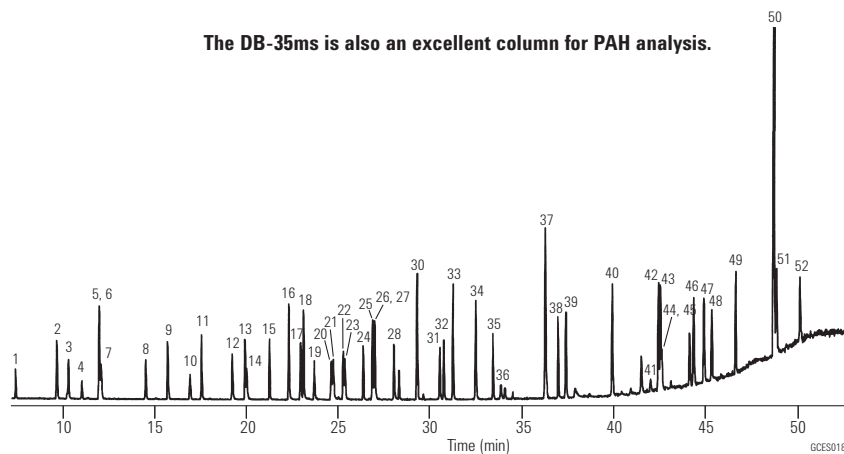
Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

	Ions		Ions
1. Naphthalene	128	27. 3,6-Dimethylphenanthrene	206, 191
2. 2-Methylnaphthalene	142, 141	28. 1,3-Dinitronaphthalene	126, 218
3. 1-Methylnaphthalene	142, 141	29. 1,5-Dinitronaphthalene	218, 114
4. Azulene	128	30. Fluoranthene	202
5. Acenaphthene	154	31. 2,2'-Dinitrophenyl	198, 139
6. Biphenyl	154	32. Pyrene	202
7. 2,6-Dimethylnaphthalene	156, 155	33. 2-Methylfluoranthene	216, 215
8. Acenaphthalene	152	34. 2,3-Benzofluorene	216, 215
9. Dibenzofuran	168, 139	35. Dodecahydrotriphenylene	240, 198
10. Dibenzo-p-dioxin	184	36. 1-Amino-4-nitronaphthalene	188, 115
11. Fluorene	166, 165	37. 9-Phenylanthracene	254, 253
12. 1-Nitronaphthalene	127, 173	38. 1,2-Benzanthracene	228
13. 9,10-Dihydroanthracene	179, 180	39. Chrysene	240
14. 2-Nitronaphthalene	127, 173	40. Benz[a]anthracene-7,12-dione	258, 202
15. 2-Nitrobiphenyl	152, 115	41. 2,7-Dinitrofluorene	256, 163
16. Dibenzothiophene	184	42. Benzo[b]fluoranthene	252
17. Phenanthrene	178	43. Benzo[k]fluoranthene	252
18. Anthracene	178	44. 7,12-Dimethylbenz[a]anthracene	256, 241
19. 3-Nitrobiphenyl	199, 152	45. Benzo[e]pyrene	252
20. 4-Nitrobiphenyl	199, 152	46. Benzo[a]pyrene	252
21. 5,6-Benzoquinoline	179	47. Perylene	252
22. Carbazole	167	48. 3-Methylcholanthrene	268
23. 2-Methylanthracene	192, 191	49. 9,10-Diphenylanthracene	330
24. 1,2,3,4-Tetrahydrofluoranthene	178, 206	50. 1,2,3,4-Dibenzanthracene	278
25. 2-Phenylnaphthalene	204	51. 1,2,5,6-Dibenzanthracene	278
26. 9-Methylanthracene	192, 191	52. Benzo[g,h,i]perylene	276

The DB-35ms is also an excellent column for PAH analysis.



Phenols

Column: DB-5ms
122-5532
30 m x 0.25 mm, 0.25 µm

Column: DB-XLB
122-1232
30 m x 0.25 mm, 0.25 µm

Carrier: He at 1.2 mL/min constant flow

Oven: 40 °C for 2 min
40-100 °C at 40 °C/min
100 °C for 0.50 min
100-140 °C at 2 °C/min
140-340 °C at 30 °C/min

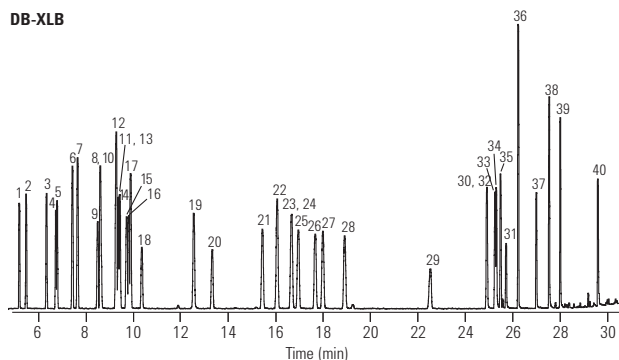
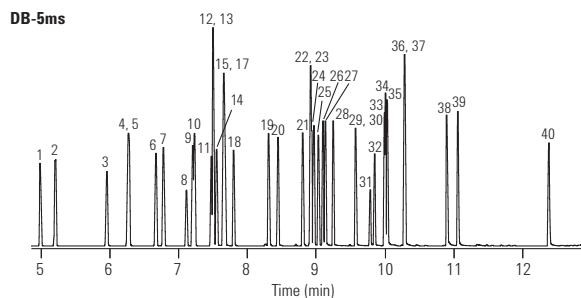
Injection: Pulsed splitless, 200 °C
Pulse pressure & time: 25 psi for 1 min
Purge flow & time: 50 mL/min for 0.25 min
Gas saver flow & time: 20 mL/min for 3 min

Detector: MSD, 320 °C transfer line
Quadrupole at 150 °C
Source at 230 °C

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

1. Phenol
2. 2-Chlorophenol
3. 2-Methylphenol
4. 4-Methylphenol
5. 3-Methylphenol
6. 2-Chloro-5-methylphenol
7. 2,6-Dimethylphenol
8. 2-Nitrophenol
9. 2,4-Dimethylphenol
10. 2,5-Dimethylphenol
11. 2,4-Dichlorophenol
12. 2,3-Dimethylphenol
13. 2,5-Dichlorophenol
14. 2,3-Dichlorophenol
15. 2-Chlorophenol
16. 4-Chlorophenol
17. 3,4-Dimethylphenol
18. 2,6-Dichlorophenol
19. 4-Chloro-2-methylphenol
20. 4-Chloro-3-methylphenol
21. 2,3,5-Trichlorophenol
22. 2,4-Dibromophenol
23. 2,4,6-Trichlorophenol
24. 2,4,5-Trichlorophenol
25. 2,3,4-Trichlorophenol
26. 3,5-Dichlorophenol
27. 2,3,6-Trichlorophenol
28. 3,4,-Dichlorophenol
29. 3-Nitrophenol
30. 2,5-Dinitrophenol
31. 2,4-Dinitrophenol
32. 4-Nitrophenol
33. 2,3,5,6-Tetrachlorophenol
34. 2,3,4,5-Tetrachlorophenol
35. 2,3,4,6-Tetrachlorophenol
36. 3,4,5-Trichlorophenol
37. 2-Methyl-4,6-dinitrophenol
38. Pentachlorophenol
39. Dinoseb
40. 2-Cyclohexyl-4,6-dinitrophenol



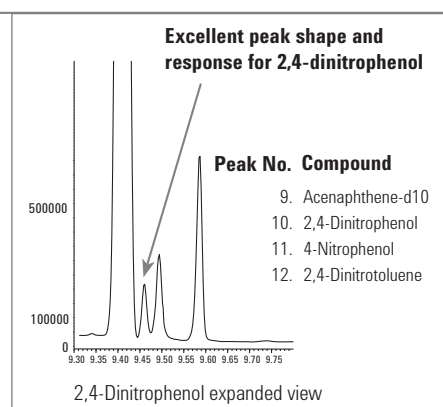
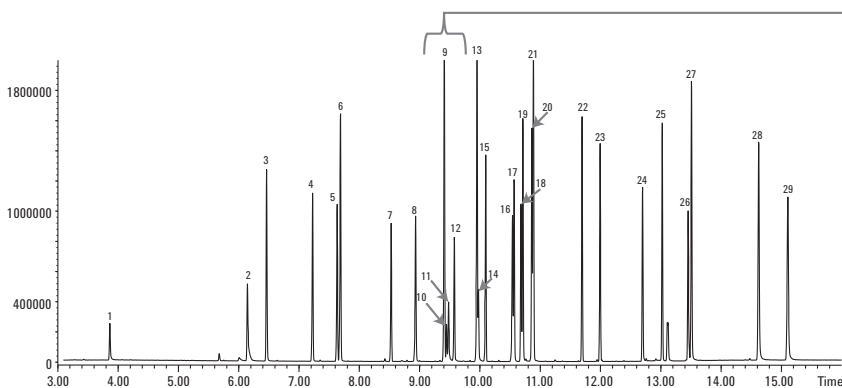
GCES019

10 ng/μL Semivolatile Checkout Standard on a 20 m x 0.18 mm, 0.36 μm Agilent J&W DB-UI 8270D Capillary GC Column using an Ultra Inert Liner with Wool

Column: DB-UI 8270D
121-9723
20 m x 0.18 mm, 0.36 μm

Inlet: S/SL 1 μL pulsed splitless, 300 °C 44 psi pulse to 1.4 min, purge flow 50 mL/min at 1.42 min, gas saver off
Inlet liner: Agilent Ultra Inert single taper with wool (p/n 5190-2293)
Oven: 40 °C (2.5 min), 25 °C/min to 320 °C (4.8 min)
Carrier: Helium, constant flow 1.58 mL/min set at 40 °C
MSD: 325 °C transfer line, 300 °C source, 150 °C quad, 30-550 amu range
GC/MSD: Agilent 7890 Series GC/5975C Series GC/MSD
Aux EPC: 2 psi with 5 mL/min bleed during run
Sampler: Agilent 7683B, 5.0 μL syringe (p/n G4513-80206)
Backflush: Post run 3.5 min at 75 psi Aux EPC, 2 psi inlet pressure

- | | |
|----------------------------------|----------------------------|
| 1. N-Nitrosodimethylamine | 16. Simazine |
| 2. Aniline | 17. Atrazine |
| 3. 1,4-Dichlorobenzene-d4 | 18. Pentachlorophenol |
| 4. Isophorone | 19. Terbufos |
| 5. 1,3-Dimethyl-2-nitrobenzene | 20. Chlorothalonil |
| 6. Naphthalene | 21. Phenanthrene-d10 |
| 7. Hexachlorocyclopentadiene | 22. Aldrin |
| 8. Mevinphos | 23. Heptachlor epoxide |
| 9. Acenaphthene-d10 | 24. Endrin |
| 10. 2,4-Dinitrophenol | 25. 4,4'-DDT |
| 11. 4-Nitrophenol | 26. 3,3'-Dichlorobenzidine |
| 12. 2,4-Dinitrotoluene | 27. Chrysene d-12 |
| 13. Fluorene | 28. Benzo[b]fluoranthene |
| 14. 4,6,-Dinitro-2-methyl phenol | 29. Perylene-d12 |
| 15. Trifluralin | |

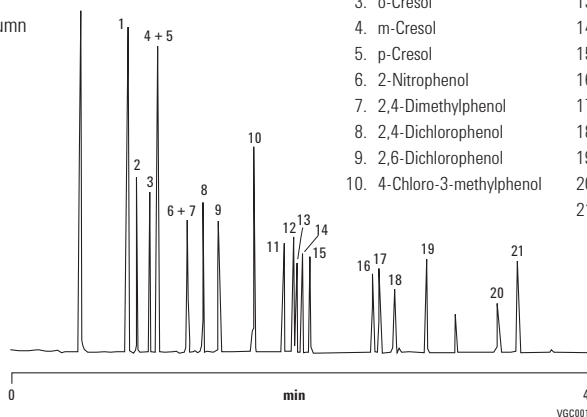


High Resolution Phenol Analysis by GC/MS

Column: VF-5ms
CP8944
30 m x 0.25 mm, 0.25 μm

Sample Conc: Approx. 5-10 ng per component on-column
Carrier: Helium, 70 kPa
Injection: Split, 1:200, T=275 °C
Detector: Agilent Ion Trap MS

- | | |
|-----------------------------|---|
| 1. Phenol | 11. 2,3,5-Trichlorophenol |
| 2. 2-Chlorophenol | 12. 2,4,6-Trichlorophenol |
| 3. o-Cresol | 13. 2,4,5-Trichlorophenol |
| 4. m-Cresol | 14. 2,3,4-Trichlorophenol |
| 5. p-Cresol | 15. 2,3,6-Trichlorophenol |
| 6. 2-Nitrophenol | 16. 4-Nitrophenol |
| 7. 2,4-Dimethylphenol | 17. 2,4-Dinitrophenol |
| 8. 2,4-Dichlorophenol | 18. 2,3,5,6 Tetrachlorophenol |
| 9. 2,6-Dichlorophenol | 19. 2-Methyl-4,6-dinitrophenol |
| 10. 4-Chloro-3-methylphenol | 20. Pentachlorophenol |
| | 21. 2-sec-Butyl-4,6-dinitrophenol (dionseb) |

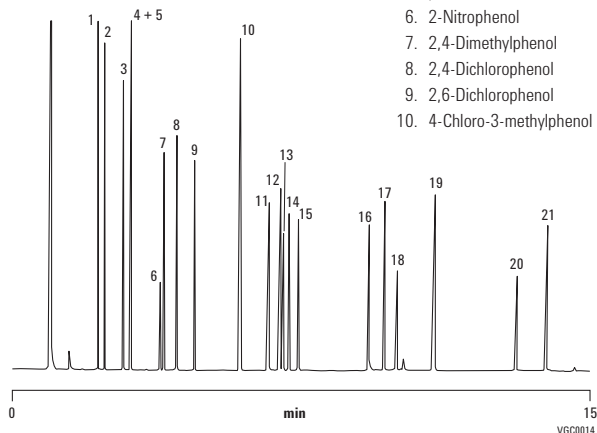


Phenols According to EPA Method 8040

Column: CP-Sil 8 CB
CP7454
50 m x 0.32 mm, 0.25 µm

Sample Conc: 1 ppm
Oven: 80 °C to 200 °C, 8 °C/min
Carrier: H₂, 150 kPa (1.5 bar, 21 psi)
Injection: Split, 100 mL/min
Detector: FID

- | | |
|-----------------------------|---|
| 1. Phenol | 11. 2,3,5-Trichlorophenol |
| 2. 2-Chlorophenol | 12. 2,4,6-Trichlorophenol |
| 3. o-Cresol | 13. 2,4,5-Trichlorophenol |
| 4. m-Cresol | 14. 2,3,4-Trichlorophenol |
| 5. p-Cresol | 15. 2,3,6-Trichlorophenol |
| 6. 2-Nitrophenol | 16. 4-Nitrophenol |
| 7. 2,4-Dimethylphenol | 17. 2,4-Dinitrophenol |
| 8. 2,4-Dichlorophenol | 18. 2,3,5,6-Tetrachlorophenol |
| 9. 2,6-Dichlorophenol | 19. 2-Methyl-4,6-dinitrophenol |
| 10. 4-Chloro-3-methylphenol | 20. Pentachlorophenol |
| | 21. 2-sec-Butyl-4,6-dinitrophenol (dionseb) |

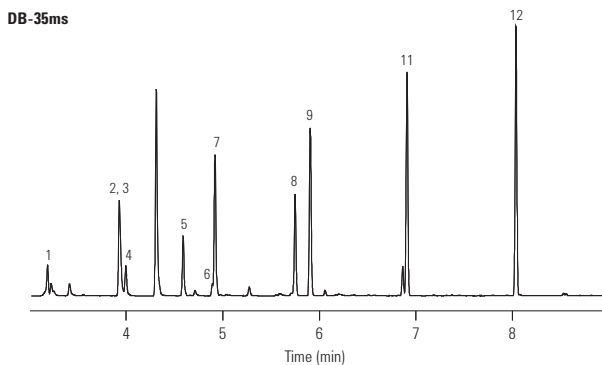


EPA Method 552.2

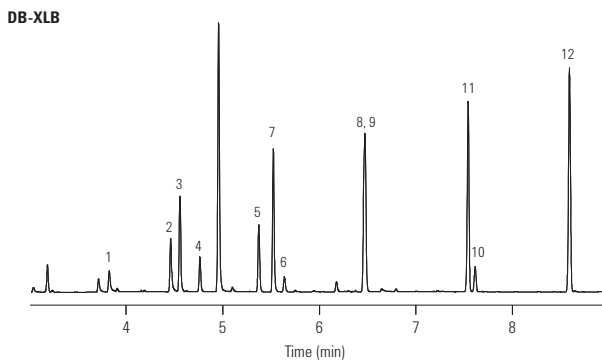
Column: DB-35ms
123-3832
30 m x 0.32 mm, 0.25 µm

Column: DB-XLB
123-1236
30 m x 0.32 mm, 0.50 µm

Carrier: Helium at 45 cm/s
(EPC in constant flow mode)
Oven: 40 °C for 0.5 min
40-200 °C at 15 °C/min
200 °C for 2 min
Injection: Splitless, 250 °C
30 s purge activation time
Detector: µECD, 350 °C
Nitrogen makeup gas
(column + makeup flow =
30 mL/min constant flow)
Sample: 50 pg per component



- | |
|------------------------------------|
| 1. Chloroacetic acid |
| 2. Bromoacetic acid |
| 3. Dichloroacetic acid |
| 4. Dalapon |
| 5. Trichloroacetic acid |
| 6. 1,2,3-Trichloropropane (IS) |
| 7. Bromochloroacetic acid |
| 8. Bromodichloroacetic acid |
| 9. Dibromoacetic acid |
| 10. 2,3-Dibromopropionic acid (SS) |
| 11. Chlorodibromoacetic acid |
| 12. Tribromoacetic acid |
| IS - Internal Standard |
| SS - Surrogate Standard |



Suggested Supplies

Septum: 11 mm Advanced Green septa,
5183-4759
Liner: Direct connect, dual taper,
deactivated, 4 mm id,
G1544-80700
Syringe: 10 µL tapered, FN 23-26s/42/HP,
5181-1267

Environmental Applications, Volatiles

Extended Analyte List for EPA Method 8021 (ELCD)

Column: DB-624
124-1374
75 m x 0.45 mm, 2.55 µm

Column: DB-VRX
124-1574
75 m x 0.45 mm, 2.55 µm

Carrier: Helium at 9 mL/min, measured at 35 °C

Oven: 35 °C for 12 min
35-60 °C at 5 °C/min
60 °C for 1 min
60-200 °C at 17 °C/min
200 °C for 5 min

Sampler: Purge and Trap (O.I.A. 4560)
Trap: VoCarb 3000
Preheat: 175 °C
Desorb: 260 °C for 1 min

Injection: J&W LVI (Low Volume Injector), 150 °C

Detector: A: PID (O.I.A. 4430), 200 °C Helium
makeup gas at 20 mL/min
B: ELCD (O.I.A. 4420), with NiCat reaction tube
in the halogen mode, 950 °C reactor temperature

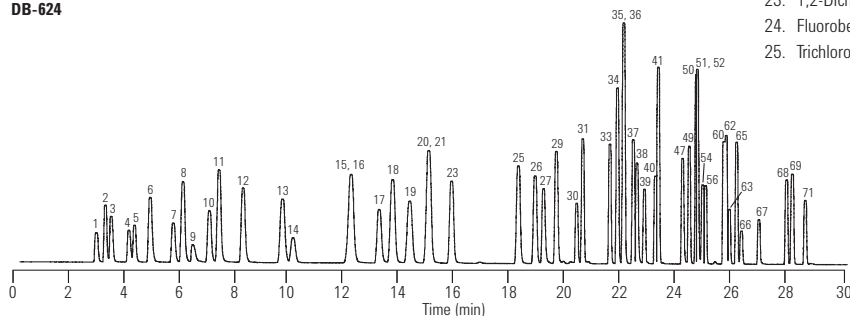
Sample: 20 ppb per component in 5 mL water

Suggested Supplies

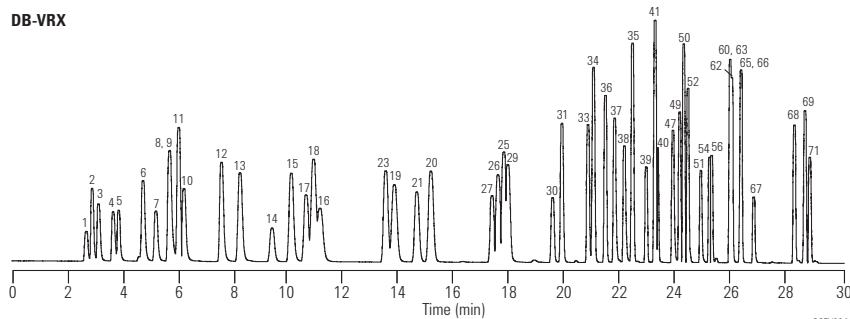
Liner: Direct, 1.5 mm id, 18740-80200
Seal: Gold plated seal, 18740-20885
Septum: 11 mm Advanced Green septa, 5183-4759

1. Dichlorodifluoromethane
2. Chloromethane
3. Vinyl chloride
4. Bromomethane
5. Chloroethane
6. Trichlorofluoromethane
7. 2-Chloropropane (IS)
8. 1,1-Dichloroethene
9. Iodomethane
10. Allyl chloride
11. Methylene chloride
12. trans-1,2-Dichloroethene
13. 1,1-Dichloroethane
14. Chloroprene
15. cis-1,2-Dichloroethene
16. 2,2-Dichloropropane
17. Bromochloromethane
18. Chloroform
19. 1,1,1-Trichloroethane
20. Carbon tetrachloride
21. 1,1-Dichloropropene
22. Benzene
23. 1,2-Dichloroethane
24. Fluorobenzene (IS)
25. Trichloroethene
26. 1,2-Dichloropropane
27. Dibromomethane
28. Trifluorotoluene (IS)
29. Bromodichloromethane
30. 2-Chloroethyl vinyl ether
31. cis-1,3-Dichloropropene
32. Toluene
33. trans-1,3-Dichloropropene
34. 1,1,2-Trichloroethane
35. Tetrachloroethene
36. 1,3-Dichloropropane
37. Dibromochloromethane
38. 1,2-Dibromoethane
39. 1-Chloro-3-fluorobenzene (IS)
40. Chlorobenzene
41. 1,1,1,2-Tetrachloroethane
42. Ethylbenzene
43. m-Xylene
44. p-Xylene
45. Styrene
46. o-Xylene
47. Bromoform
48. Isopropylbenzene
49. cis-1,4-Dichlorobutene
50. 1,1,2,2-Tetrachloroethane
51. Bromobenzene
52. 1,2,3-Trichloropropane
53. n-Propylbenzene
54. 2-Chlorotoluene
55. 1,3,5-Trimethylbenzene
56. 4-Chlorotoluene
57. tert-Butylbenzene
58. 1,2,4-Trimethylbenzene
59. sec-Butylbenzene
60. 1,3-Dichlorobenzene
61. p-Isopropyltoluene
62. 1,4-Dichlorobenzene
63. Benzyl chloride
64. n-Butylbenzene
65. 1,2-Dichlorobenzene
66. Bis(2-chloroisopropyl) ether
67. 1,2-Dibromo-3-chloropropane
68. 1,2,4-Trichlorobenzene
69. Hexachlorobutadiene
70. Naphthalene
71. 1,2,3-Trichlorobenzene

DB-624



DB-VRX



GCEV004

Fast VOC Analysis

Column: DB-624
121-1324
20 m x 0.18 mm, 1.00 µm

Carrier: Helium at 37 cm/s, (constant flow mode)

Oven: 35 °C for 4 min
35-200 °C at 15 °C/min
200 °C for 0.1 min
60-200 °C at 17 °C/min

Sampler: Purge and trap (Tekmar LSC 3000)
Purge: Helium for 11 min at 50 mL/min
Preheat: 250 °C
Desorb: 260 °C for 2 min
Line & valve: 100 °C

Detector: MSD, 250 °C transfer line
Full scan 35-260 amu
3.25 scans per s

Sample: 10 ppb per component in 25 mL water

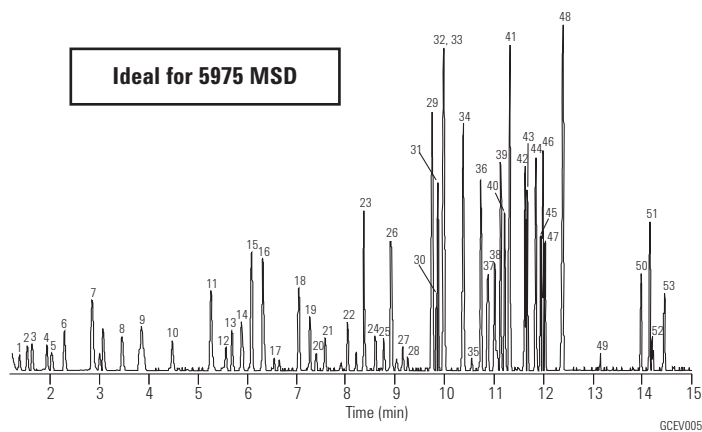
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

- | | |
|-------------------------------|---------------------------------|
| 1. Dichlorofluoromethane | 27. Dibromochloromethane |
| 2. Chloromethane | 28. 1,2-Dibromomethane |
| 3. Vinyl chloride | 29. Chlorobenzene |
| 4. Bromomethane | 30. 1,1,1,2-Tetrachloroethane |
| 5. Chloroethane | 31. Ethylbenzene |
| 6. Trichlorofluoromethane | 32. m-Xylene |
| 7. 1,1-Dichloroethene | 33. p-Xylene |
| 8. Methylene chloride | 34. o-Xylene |
| 9. trans-1,2-Dichloroethene | 35. Bromoform |
| 10. 1,1-Dichloroethane | 36. Isopropylbenzene |
| 11. 2,2-Dichloropropane | 37. Bromofluorobenzene |
| 12. Bromochloromethane | 38. Bromobenzene |
| 13. Chloroform | 39. n-Propylbenzene |
| 14. 1,1,1-Trichloroethane | 40. 2-Chlorotoluene |
| 15. Carbon tetrachloride | 41. 1,3,5-Trimethylbenzene |
| 16. Benzene | 42. tert-Butylbenzene |
| 17. Fluorobenzene | 43. 1,2,4-Trimethylbenzene |
| 18. Trichloroethene | 44. sec-Butylbenzene |
| 19. 1,2-Dichloropropane | 45. 1,3-Dichlorobenzene |
| 20. Dibromomethane | 46. 4-Isopropyltoluene |
| 21. Bromodichloromethane | 47. 1,4-Dichlorobenzene |
| 22. cis-1,3-Dichloropropene | 48. 1,2-Dichlorobenzene |
| 23. Toluene | 49. 1,2-Dibromo-3-chloropropane |
| 24. trans-1,3-Dichloropropene | 50. 1,2,4-Trichlorobenzene |
| 25. 1,1,2-Trichloroethane | 51. Hexachlorobutadiene |
| 26. Tetrachloroethene | 52. Naphthalene |
| | 53. 1,2,3-Trichlorobenzene |



Analysis of Volatile Organic Compounds in Environmental Waters Using the Agilent 7697A Headspace and 7890B/5977A GC/MS

Column: VF-624ms
CP9103
60 m x 0.25 mm, 1.40 µm

Instrument: Agilent 7697A Headspace and 7890B/5977A GC/MS

Carrier: Helium, 11 mL/min, 160 °C

Oven: 32 °C for 2 min, then 10 °C/min to 220 °C for 5 min

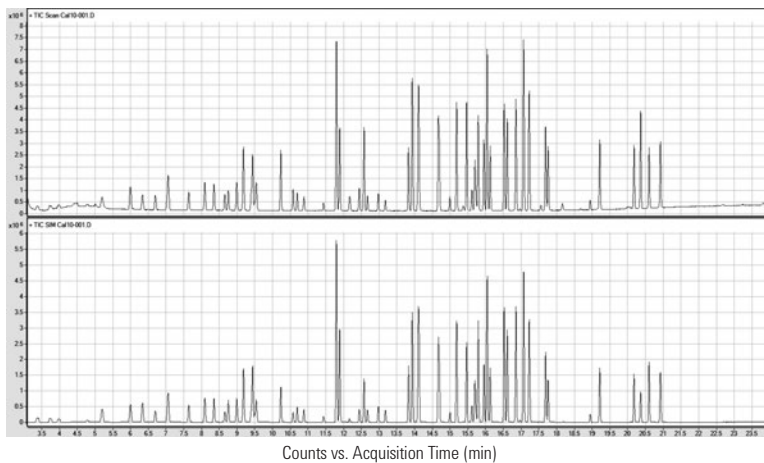
Injection: Split, 4:1, 160 °C for 5 min, purge 100 mL/min for 1 min

Detector: 5977A MSD, simultaneous Scan/SIM mode

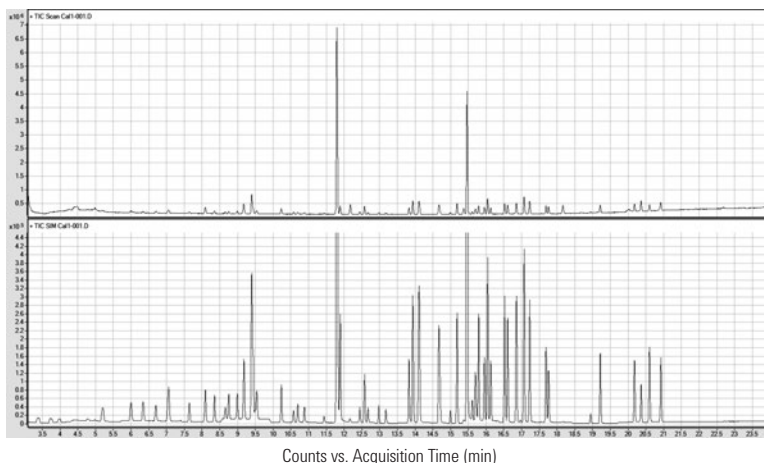
Sample: Standard VOC mix

Sample Conc: 10 µg/L

RT, min	CAS Number	RT, min	CAS Number	RT, min	CAS Number
1. Dichlorodifluoromethane	3.387 75-71-8	11. trans-1,2-Dichloroethene	7.069 156-60-5	21. Benzene	9.440 71-43-2
2. Chloromethane	3.734 74-87-3	12. 1,1-Dichloroethane	7.644 75-34-3	22. 1,2-Dichloroethane	9.497 107-06-2
3. Vinyl chloride	3.980 75-01-4	13. Ethyl tert-butyl ether	8.091 637-92-3	23. tert-Amyl methyl ether	9.540 994-05-8
4. Bromomethane	4.390 74-83-9	14. cis-1,2-Dichloroethene	8.353 156-59-2	24. Trichloroethene	10.232 79-01-6
5. Chloroethane	4.788 75-00-3	15. 2,2-Dichloropropane	8.370 594-20-7	25. 1,2-Dichloropropane	10.576 78-87-5
6. Trichlorofluoromethane	5.202 75-69-4	16. Bromochloromethane	8.656 74-97-5	26. Dibromomethane	10.699 74-95-3
7. 1,1-Dichloroethene	5.998 75-34-4	17. Chloroform	8.756 67-66-3	27. Bromodichloromethane	10.884 75-27-4
8. Carbon disulfide	6.338 75-15-0	18. 1,1,1-Trichloroethane	8.995 71-55-6	28. cis-1,3-Dichloropropene	11.437 10061-01-5
9. Dichloromethane	6.701 75-09-2	19. 1,1-Dichloro-1-propene	9.177 563-58-6	29. Toluene	11.890 108-88-3
10. Methyl tert-butyl ether	7.046 1634-04-4	20. Carbon tetrachloride	9.189 56-23-5	30. trans-1,3-Dichloropropene	12.165 10061-02-6



10 µg/L VOC Standard Scan and SIM Traces



1 µg/L VOC Standard Scan and SIM Traces

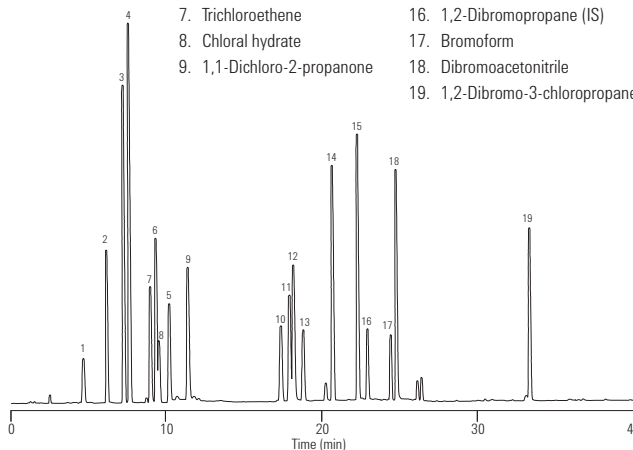
31. 1,1,2-Trichloroethane	12.443 79-00-5
32. Tetrachloroethene	12.580 127-18-4
33. 1,3-Dichloropropane	12.673 142-28-9
34. Dibromochloromethane	12.981 124-48-1
35. 1,2-Dibromoethane	13.175 106-93-4
36. Chlorobenzene	13.830 108-90-7
37. 1,1,1,2-Tetrachloroethane	13.939 630-20-6
38. Ethylbenzene	13.934 100-41-4
39. m and p-Xylene	14.115 108-38-3 & 106-42-3
40. o-Xylene	14.669 95-47-6
41. Styrene	14.699 100-42-5
42. Bromoform	14.994 75-25-2
43. Isopropylbenzene	15.183 98-82-8
44. 1,1,2,2-Tetrachloroethane	15.612 79-34-5
45. Bromobenzene	15.697 108-86-1
46. 1,2,3-Trichloropropane	15.731 96-18-4
47. n-Propylbenzene	15.793 103-65-1
48. 2-Chlorotoluene	15.952 95-49-8
49. 3-Chlorotoluene	16.042 108-41-8
50. 1,3,5-Trimethylbenzene	16.048 108-67-8
51. 4-Chlorotoluene	16.133 106-43-4
52. tert-Butylbenzene	16.526 98-06-6
53. 1,2,4-Trimethylbenzene	16.608 95-63-6
54. sec-Butylbenzene	16.856 135-98-8
55. 1,3-Dichlorobenzene	17.071 541-73-1
56. 4-Isopropyltoluene	17.077 99-87-6
57. 1,4-Dichlorobenzene	17.220 106-46-7
58. 1,2,3-Trimethylbenzene	17.231 526-73-8
59. n-Butylbenzene	17.689 104-51-8
60. 1,2-Dichlorobenzene	17.761 95-50-1
61. 1,2-Dibromo-3-chloropropane	18.949 96-12-8
62. 1,3,5-Trichlorobenzene	19.215 108-70-3
63. 1,2,4-Trichlorobenzene	20.179 120-82-1
64. Hexachlorobutadiene	20.370 87-68-3
65. Naphthalene	20.604 91-20-3
66. 1,2,3-Trichlorobenzene	20.922 87-61-6

EPA Method 551

Column: DB-1
122-1033
30 m x 0.25 mm, 1.00 µm

Carrier: Helium at 24.8 cm/s, measured at 150 °C
Injection: Splitless, 200 °C
15 s purge activation time
Oven: 35 °C for 9 min
35-40 °C at 10 °C/min
40 °C for 3 min
40-150 °C at 6 °C/min
150 °C for 1 min
Detector: ECD, 300 °C
Sample: 1 µL of 50 pg/µL, AccuStandard

- | | |
|-----------------------------|---------------------------------|
| 1. Chloroform | 10. Chloropicrin |
| 2. 1,1,1-Trichloroethane | 11. Dibromochloromethane |
| 3. Carbon tetrachloride | 12. Bromochloroacetonitrile |
| 4. Trichloroacetonitrile | 13. 1,2-Dibromoethane |
| 5. Dichloroacetonitrile | 14. Tetrachloroethene |
| 6. Bromodichloromethane | 15. 1,1,1-Trichloropropanone |
| 7. Trichloroethene | 16. 1,2-Dibromopropane (IS) |
| 8. Chloral hydrate | 17. Bromoform |
| 9. 1,1-Dichloro-2-propanone | 18. Dibromoacetonitrile |
| | 19. 1,2-Dibromo-3-chloropropane |



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

European Red List Volatiles

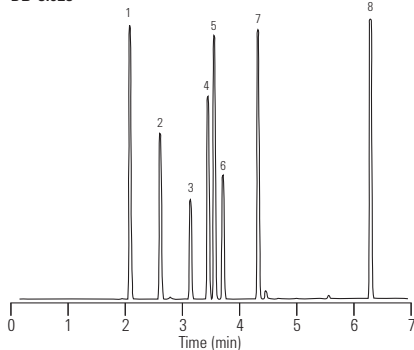
Column: DB-5.625
122-5632
30 m x 0.25 mm, 0.50 µm
Column: DB-624
122-1334
30 m x 0.25 mm, 1.40 µm

Carrier: Helium at 35 cm/s, measured at 40 °C
Injection: Split, 250 °C
Split ratio 1:50
Oven: 40 °C for 2 min
40-140 °C at 12 °C/min
Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min
Sample: 1 µL of headspace of neat mixture

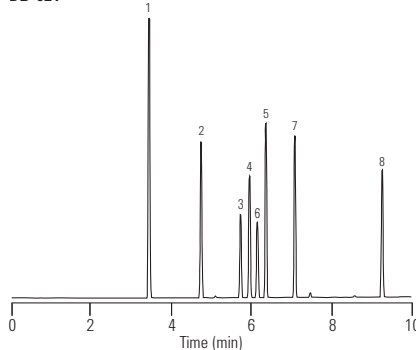
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct, 1.5 mm id, 18740-80200
Seal: Gold plated seal, 18740-20885

DB-5.625



DB-624



1. 1,1-Dichloroethylene
2. 1,1-Dichloroethane
3. Chloroform
4. 1,1,1-Trichloroethane
5. 1,2-Dichloroethane
6. Carbon tetrachloride
7. Trichloroethylene
8. Tetrachloroethylene

EPA Volatiles by GC/MS (Split Injector)

Column: DB-VRX
122-1564
60 m x 0.25 mm, 1.40 µm

Carrier: Helium at 30 cm/s, measured at 45 °C

Oven: 45 °C for 10 min
45-190 °C at 12 °C/min
190 °C for 2 min
190-225 °C at 6 °C/min
225 °C for 1 min

Sampler: Purge and trap (O.I.A. 4560)
Purge: Helium for 11 min at 40 mL/min
Trap: Tenax/Silica Gel/Carbosieve
Preheat: 175 °C
Desorb: 220 °C for 0.6 min

Injection: Split, 110 °C
Split flow 30 mL/min

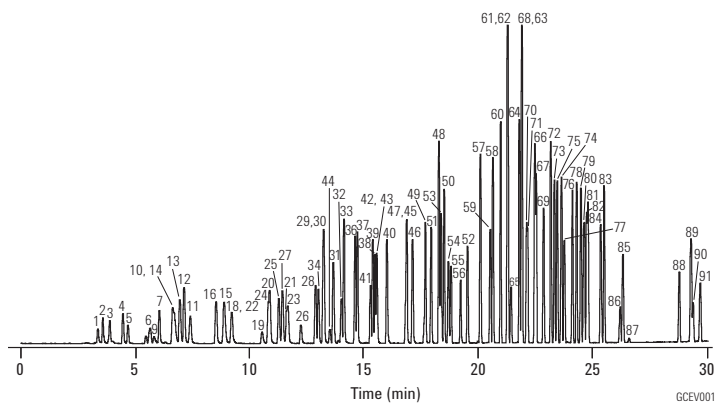
Detector: MSD, 235 °C transfer line
Full scan 35-260 amu (m/z 44 subtracted)

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal kit, 5188-5367



Column: DB-624
122-1364
60 m x 0.25 mm, 1.40 µm

Carrier: Helium at 31 cm/s, measured at 40 °C

Oven: 45 °C for 3 min
45-90 °C at 8 °C/min
90 °C for 4 min
90-200 °C at 6 °C/min
200 °C for 5 min

Sampler: Purge and trap (O.I.A. 4560)
Purge: Helium for 11 min at 40 mL/min
Trap: Tenax/Silica Gel/Carbosieve
Preheat: 175 °C
Desorb: 220 °C for 0.6 min

Injection: Split, 110 °C
Split flow 30 mL/min

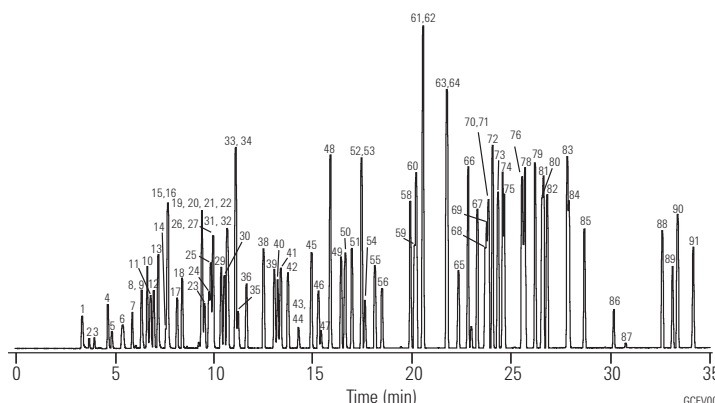
Detector: MSD, 235 °C transfer line
Full scan 35-260 amu (m/z 44 subtracted)

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal kit, 5188-5367



- | | | | | |
|------------------------------|------------------------------|-----------------------------------|---------------------------------|---------------------------------|
| 1. Dichlorodifluoromethane | 20. cis-1,2-Dichloroethene | 39. 1,2-Dichloropropane | 58. Chlorobenzene | 77. Pentachloroethane |
| 2. Chloromethane | 21. 2,2-Dichloropropane | 40. Methyl methacrylate | 59. 1,1,1,2-Tetrachloroethane | 78. 1,2,4-Trimethylbenzene |
| 3. Vinyl chloride | 22. Propionitrile | 41. Dibromomethane | 60. Ethylbenzene | 79. sec-Butylbenzene |
| 4. Bromomethane | 23. Methyl acrylate | 42. Bromodichloromethane | 61. m-Xylene | 80. 1,3-Dichlorobenzene |
| 5. Chloroethane | 24. Methacrylonitrile | 43. 2-Nitropropane | 62. p-Xylene | 81. p-Isopropyltoluene |
| 6. Trichlorofluoromethane | 25. Bromochloromethane | 44. Chloroacetonitrile | 63. o-Xylene | 82. 1,4-Dichlorobenzene |
| 7. Diethyl ether | 26. Tetrahydrofuran | 45. cis-1,3-Dichloropropene | 64. Styrene | 83. n-Butylbenzene |
| 8. 1,1-Dichloroethene | 27. Chloroform | 46. 4-Methyl-2-pentanone | 65. Bromoform | 84. 1,2-Dichlorobenzene |
| 9. Acetone | 28. Pentafluorobenzene (IS) | 47. 1,1-Dichloro-2-propanone | 66. Isopropylbenzene | 85. Hexachloroethane |
| 10. Iodomethane | 29. 1,1,1-Trichloroethane | 48. Toluene | 67. 4-Bromofluorobenzene (SS) | 86. 1,2-Dibromo-3-chloropropane |
| 11. Carbon disulfide | 30. 1-Chlorobutane | 49. trans-1,3-Dichloropropene | 68. 1,1,2,2-Tetrachloroethane | 87. Nitrobenzene |
| 12. Allyl chloride | 31. 1,1-Dichloropropene | 50. Ethyl methacrylate | 69. Bromobenzene | 88. 1,2,4-Trichlorobenzene |
| 13. Methylene chloride | 32. Carbon tetrachloride | 51. 1,1,2-Trichloroethane | 70. 1,2,3-Trichloropropane | 89. Hexachlorobutadiene |
| 14. Acrylonitrile | 33. Benzene | 52. Tetrachloroethene | 71. trans-1,4-Dichloro-2-butene | 90. Naphthalene |
| 15. Methyl-tert-butyl ether | 34. 1,2-Dichloroethane | 53. 1,3-Dichloropropane | 72. n-Propylbenzene | 91. 1,2,3-Trichlorobenzene |
| 16. trans-1,2-Dichloroethene | 35. 2,2-Dimethylhexane | 54. 2-Hexanone | 73. 2-Chlorotoluene | |
| 17. Hexane | 36. Fluorobenzene (IS) | 55. Dibromochloromethane | 74. 1,3,5-Trimethylbenzene | |
| 18. 1,1-Dichloroethane | 37. 1,4-Difluorobenzene (IS) | 56. 1,2-Dibromoethane | 75. 4-Chlorotoluene | |
| 19. 2-Butanone | 38. Trichloroethene | 57. 1-Chloro-3-fluorobenzene (IS) | 76. tert-Butylbenzene | |

Note: Some compounds not present in both chromatograms

Environmental Applications, Air Analysis

EPA Air Analysis Compendium Method TO-14 Standard

Column: DB-1
123-1063
60 m x 0.32 mm, 1.00 μ m

Carrier: Helium at 25 cm/s measured off of CO₂ at 35 °C
constant flow mode

Oven: 35 °C for 5 min
35-120 °C at 5 °C/min
120-220 °C at 30 °C/min
220 °C for 5 min

Injection: Entech 7100 cryogenic sample preconcentrator

Detector: MSD
Full scan of m/z 40-250

Sample: 400 mL of a 10 ppbV TO-14 standard
and 100 mL of a 20 ppbV IS/SS standard

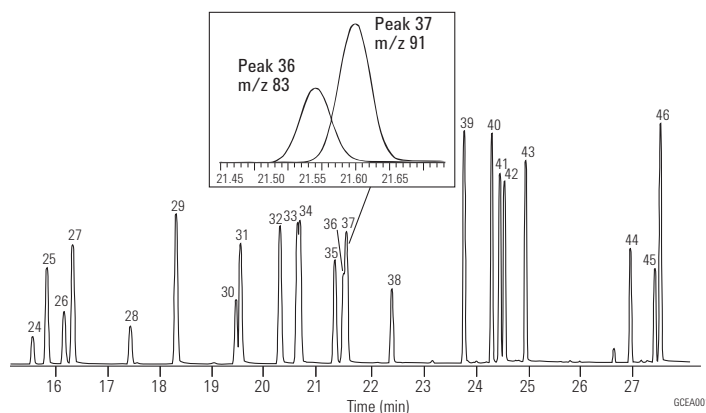
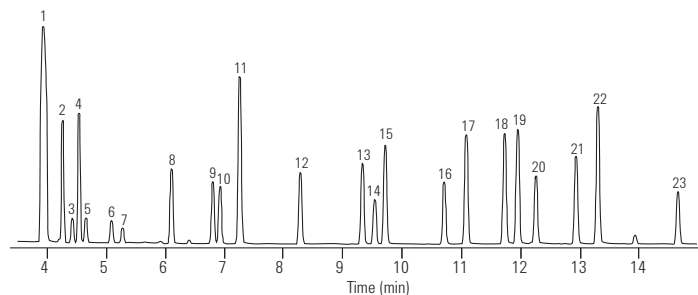
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

- | | |
|---|-------------------------------|
| 1. CO ₂ | 14. Bromochloromethane (IS) |
| 2. Freon 12 (dichlorodifluoromethane) | 15. Chloroform |
| 3. Chloromethane | 16. 1,2-Dichloroethane |
| 4. Freon 114 (1,2-dichloro-1,1,2,2-tetrafluoroethane) | 17. 1,1,1-Trichloroethane |
| 5. Vinyl chloride | 18. Benzene |
| 6. Bromomethane | 19. Carbon tetrachloride |
| 7. Chloroethane | 20. 1,4-Difluorobenzene (IS) |
| 8. Freon 11 (trichlorofluoromethane) | 21. 1,2-Dichloropropane |
| 9. 1,1-Dichloroethane | 22. Trichloroethene |
| 10. Methylene chloride | 23. cis-1,3-Dichloropropene |
| 11. Freon 113 (1,1,2-trichloro-1,1,2-trifluoroethane) | 24. trans-1,3-Dichloropropene |
| 12. 1,1-Dichloroethane | 25. 1,1,2-Trichloroethane |
| 13. cis-1,2-Dichloroethane | 26. Toluene-d8 (SS) |
| | 27. Toluene |
| | 28. 1,2-Dibromoethane |
| | 29. Tetrachloroethene |
| | 30. Chlorobenzene-d5 (SS) |
| | 31. Chlorobenzene |
| | 32. Ethylbenzene |
| | 33. m-Xylene |
| | 34. p-Xylene |
| | 35. Styrene |
| | 36. 1,1,2,2-Tetrachloroethane |
| | 37. o-Xylene |
| | 38. 4-Bromofluorobenzene (SS) |
| | 39. 1,3,5-Trimethylbenzene |
| | 40. 1,2,4-Trimethylbenzene |
| | 41. 1,3-Dichlorobenzene |
| | 42. 1,2-Dichlorobenzene |
| | 43. 1,4-Dichlorobenzene |
| | 44. 1,2,4-Trichlorobenzene |
| | 45. 1,2-Dibromobenzene (IS) |
| | 46. Hexachloro-1,3-butadiene |



Agilent wishes to thank Entech Instruments for providing this chromatogram.

Formaldehyde, 50 ppb

Column: DB-5ms
123-5563
60 m x 0.32 mm, 1.00 µm

Carrier: Helium, 1.5 mL/min

Oven: 35 °C for 5 min
35-85 °C at 10 °C/min

Sampler: Entech 7100 cryogenic sample preconcentrator

Detector: GC/MS 6890/5973N
Scan 29-180 amu 0-6 min
33-280 amu 6-30 min
Electron impact 70 eV

Sample: 100 cc 50 ppb Formaldehyde/20 ppb others

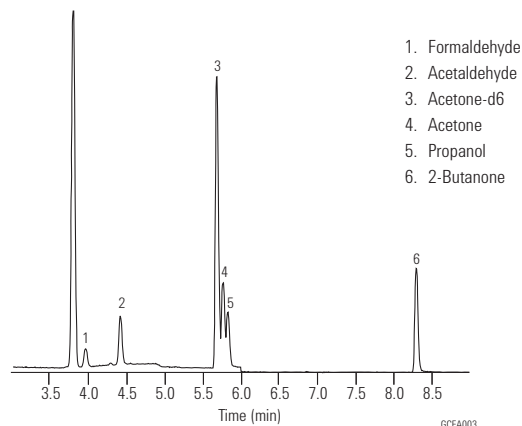
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

Agilent wishes to thank Entech Instruments for providing this chromatogram.



Sulfur in Air

Column: DB-5ms
123-5563
60 m x 0.32 mm, 1.00 µm

Carrier: Helium, 1.5 mL/min

Oven: 35 °C for 5 min
35-140 °C at 6 °C/min
140-220 °C at 15 °C/min
220 °C for 3 min

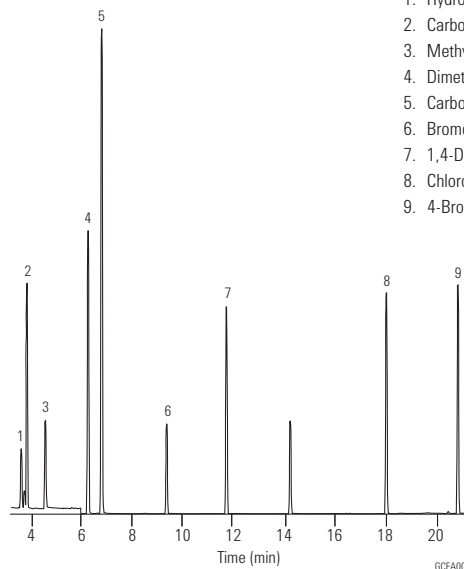
Sampler: Entech 7100 cryogenic sample preconcentrator

Detector: GC/MS 6890/5973N
Scan 29-180 amu 0-6 min
33-280 amu 6-30 min
Electron impact 70 eV

Sample: 400 cc 10 ppb sulfurs

1. Hydrogen sulfide
2. Carbonyl sulfide
3. Methyl mercaptan
4. Dimethyl sulfide
5. Carbon disulfide
6. Bromochloromethane
7. 1,4-Difluorobenzene
8. Chlorobenzene-d5
9. 4-Bromofluorobenzene

Agilent wishes to thank Entech Instruments for providing this chromatogram.



N₂O I

Column: HP-PLOT Q
19095P-Q04
30 m x 0.53 mm, 40.00 μm

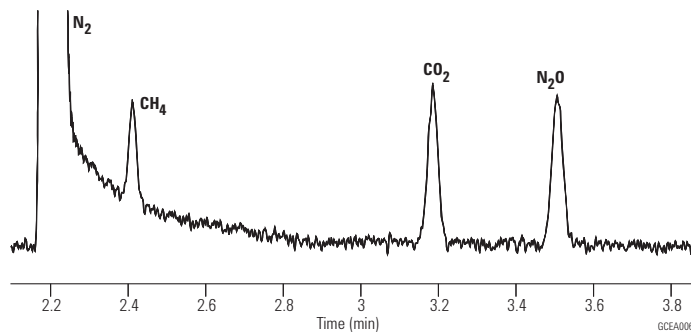
Carrier: Helium, 5 psi (approximately 8 mL/min)

Oven: 35 °C isothermal

Injection: 250 μL, injected
Split ratio 1:3

Detector: TCD, 200 °C

Sample: Approximately 200 ppmv methane
200 ppmv CO₂
250 ppmv N₂O (nitrogen balance gas)

**N₂O II**

Column: HP-PLOT Molesieve
19095P-MS6
30 m x 0.53 mm, 25.00 μm

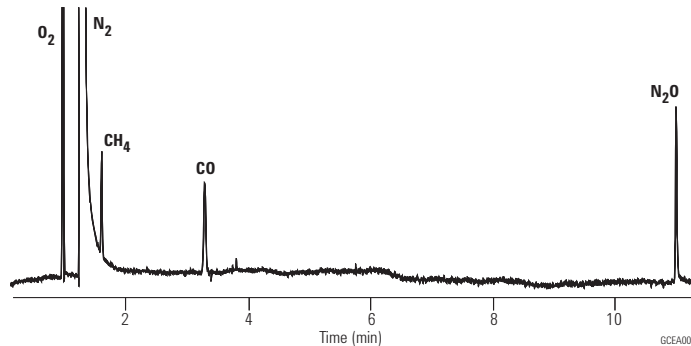
Carrier: Helium, 6 psi (approximately 10 mL/min)

Oven: 50 °C (5 min), 25 °C/min to 200 °C and hold

Injection: 250 μL injected
Split ratio 1:4

Detector: TCD, 250 °C
Column compensation on

Sample: Approximately 200 ppmv methane
200 ppmv CO₂
250 ppmv N₂O (nitrogen balance gas)

**N₂O III**

Column: GS-CarbonPLOT
113-3133
30 m x 0.32 mm, 3.00 μm

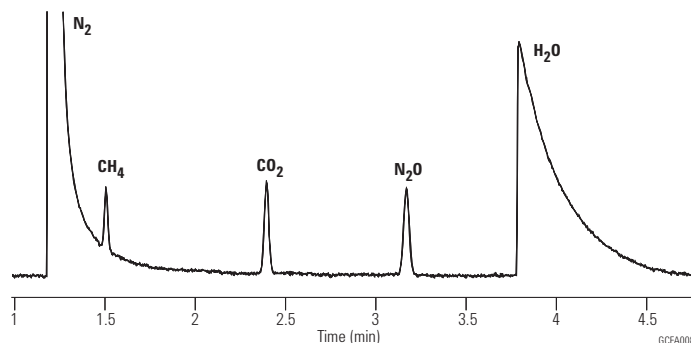
Carrier: Helium, 12 psi (approximately 3 mL/min)

Oven: 35 °C isothermal

Injection: 250 μL injected
Split ratio 1:4

Detector: TCD, 200 °C

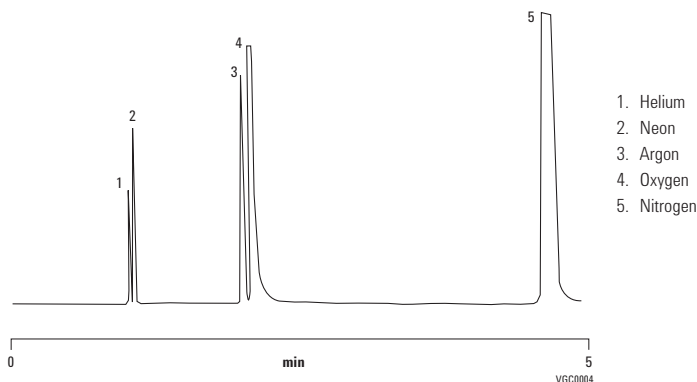
Sample: Approximately 200 ppmv methane
200 ppmv CO₂
250 ppmv N₂O (nitrogen balance gas)



Permanent Gases on a Thick Film Molsieve Column

Column: CP-Molsieve 5Å
CP7538
25 m x 0.53 mm, 50.00 µm

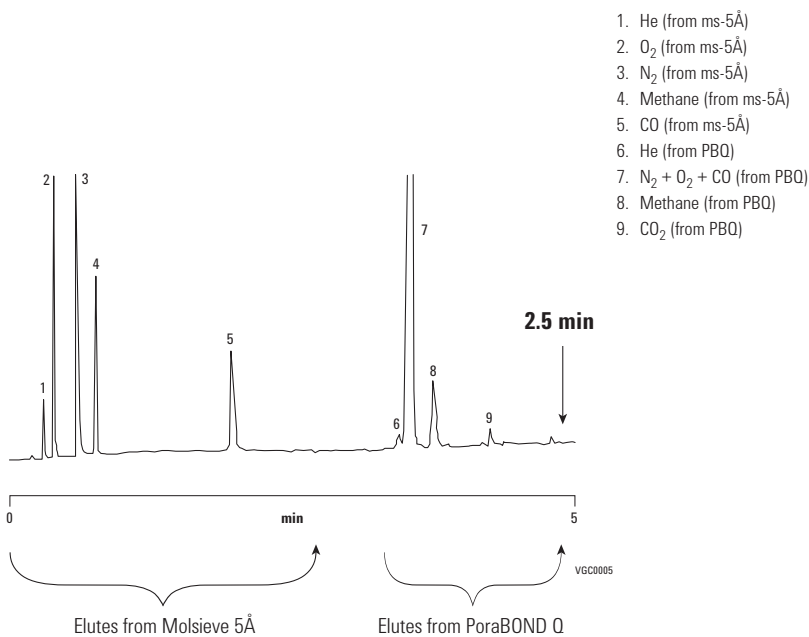
Sample: 10 µL
Sample Conc: % range
Carrier: H₂
Oven: 30 °C
Injection: Split, 100 mL/min
Detector: TCD



Fast Analysis of Permanent Gases and CO₂ using Tandem PLOT Columns

Column: Select for Permanent Gases/CO₂
CP7429

Sample: 10 µL
Sample Conc: % level
Carrier: H₂, 60 kPa
Oven: 45 °C
Injection: Split, 50 mL/min
Detector: µ-TCD



**EPA Air Analysis Method TO-15
(1 ppbv standard)**

Column: DB-5ms
123-5563
60 m x 0.32 mm, 1.00 µm

Carrier: Helium, 1.5 mL/min

Oven: 35 °C for 5 min
35-140 °C at 6 °C/min
140-220 °C at 15 °C/min
220 °C for 3 min

Sampler: Entech 7100 cryogenic sample preconcentrator

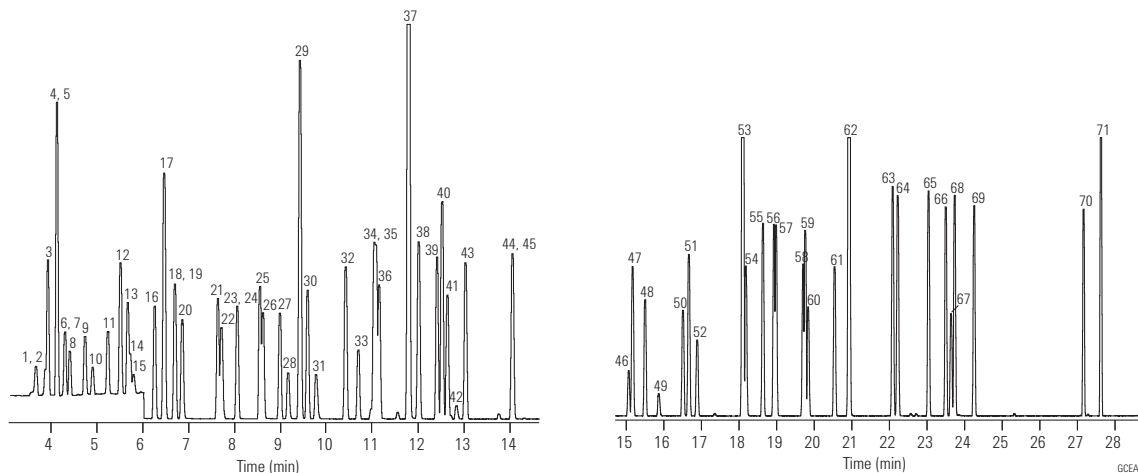
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct, 1.5 mm id, 18740-80200
Seal: Gold plated seal, 18740-20885

Detector: GC/MS 6890/5973N
Scan 29-180 amu 0-6 min
33-280 amu 6-30 min
Electron impact 70 eV

Sample: 400 mL sample load
All compounds at 10 ppbv except formaldehyde (50 ppbv),
acetaldehyde (20 ppbv), propanol (20 ppbv), acetone (30 ppbv),
2-butanone (30 ppbv)

	Quantitation Ion		Quantitation Ion		Quantitation Ion
1. Formaldehyde	30	26. n-Hexane	57	51. Tetrachloroethene	166
2. Propene	41	27. cis-1,2-Dichloroethene	96	52. 1,2-Dibromoethane	107
3. Dichlorodifluoromethane	85	28. Ethyl acetate	43	53. Chlorobenzene-d5 (IS)	117
4. Chloromethane	50	29. Bromochloromethane (IS)	128	54. Chlorobenzene	112
5. Dichlorotetrafluoroethane	85	30. Chloroform	83	55. Ethylbenzene	91
6. Acetaldehyde	29	31. Tetrahydrofuran	42	56. m-Xylene	91
7. Vinyl chloride	62	32. 1,1,1-Trichloroethane	97	57. p-Xylene	91
8. 1,3-Butadiene	39	33. 1,2-Dichloroethane	62	58. Styrene	104
9. Bromomethane	94	34. Benzene	78	59. o-Xylene	91
10. Chloroethane	64	35. Carbon tetrachloride	117	60. Bromoform	173
11. Bromoethene	106	36. Cyclohexane	56	61. 1,1,2,2-Tetrachloroethane	83
12. Trichlorofluoromethane	101	37. 1,4-Difluorobenzene (IS)	114	62. 4-Bromofluorobenzene	95
13. Acetone	58	38. 2,2,4-Trimethylpentane (isooctane)	57	63. 4-Ethyltoluene	105
14. Propanal	29	39. n-Heptane	41	64. 1,3,5-Trimethylbenzene	105
15. Isopropyl alcohol	45	40. Trichloroethene	130	65. 1,2,4-Trimethylbenzene	105
16. 1,1-Dichloroethene	61	41. 1,2-Dichloropropane	63	66. 1,3-Dichlorobenzene	146
17. 1,1,2-Trichloro-1,2,2-trifluoroethane	101	42. 1,4-Dioxane	88	67. Benzyl chloride	91
18. Methylene chloride	49	43. Bromodichloromethane	83	68. 1,4-Dichlorobenzene	146
19. 3-Chloro-1-propene (allyl chloride)	76	44. 4-Methyl-2-pentanone (MIBK)	43	69. 1,2-Dichlorobenzene	146
20. Carbon disulfide	76	45. cis-1,3-Dichloropropene	75	70. 1,2,4-Trichlorobenzene	180
21. trans-1,2-Dichloroethene	96	46. trans-1,3-Dichloropropene	75	71. Hexachlorobutadiene	225
22. tert-Butyl methyl ether (MTBE)	73	47. Toluene	91		
23. 1,1-Dichloroethane	63	48. 1,1,2-Trichloroethane	97		
24. Vinyl acetate	43	49. 2-Hexanone	43		
25. 2-Butanone (MEK)	72	50. Dibromochloromethane	129		



Agilent wishes to thank Entech Instruments for providing this chromatogram.

Food, Flavor, and Fragrance Applications

DB-624UI 1 µL/L Fermented Beverage Standard Mix

Column: DB-624 Ultra Inert

123-1334UI

30 m x 0.32 mm, 1.80 µm

Carrier: Helium, 2.3 mL/min, constant flow set at 35 °C

Oven: 35 °C for 5 min
 10 °C/min to 100 °C for 1.5 min
 15 °C/min to 220 °C for 3.0 min
 25 °C/min to 250 °C for 2.8 min

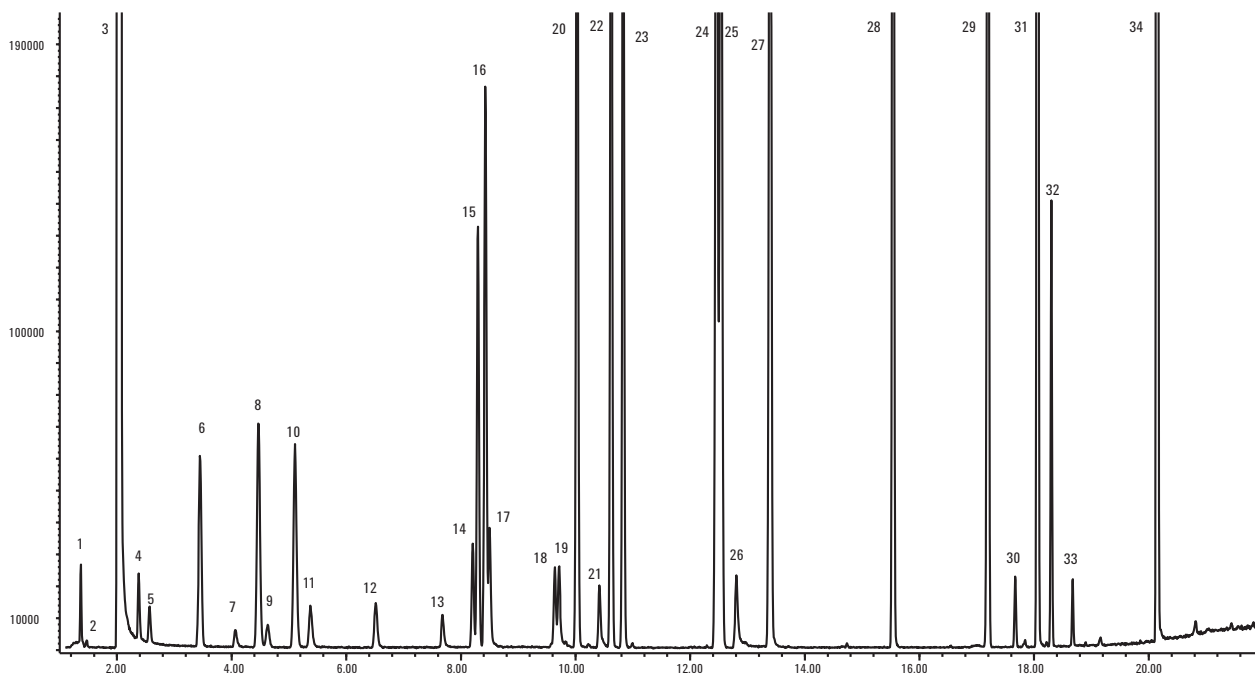
Inlet: Split/splitless, 220 °C, 1 µL, split 20:1

MSD Restrictor: Scan mode 30-400 amu, source temp 230 °C,
 quad temp 150 °C, transfer line temp 260 °C

Instrument: Agilent 7890/5975C equipped with MMI and FID

Sampler: Agilent 7697A headspace with 111 position tray,
 1 mL sample loop

- | | |
|----------------------------|-----------------------------|
| 1. Acetyl aldehyde | 18. Isoamyl alcohol |
| 2. Methanol | 19. Active amyl alcohol |
| 3. Ethanol | 20. Isobutyl acetate |
| 4. Acetone | 21. 1-Pentanol |
| 5. Isopropanol | 22. Ethyl butanoate |
| 6. Isobutyl aldehyde | 23. Hexanal |
| 7. 1-Propanol | 24. Isoamyl acetate |
| 8. Butyl aldehyde | 25. Active amyl acetate |
| 9. 2,3 Butanedione (VDK) | 26. 1-Hexanol |
| 10. Ethyl acetate | 27. Heptanal |
| 11. 2-Butanol | 28. Octanal |
| 12. Isobutyl alcohol | 29. 1,3,5-Trioxane impurity |
| 13. 1-Butanol | 30. 1,3,5-Trioxane impurity |
| 14. 2,3 Pentanedione (VDK) | 31. Ethyl caprylate |
| 15. Ethyl propanoate | 32. 1-Phenyl ethyl acetate |
| 16. Propyl acetate | 33. Benzaldehyde, 3 methoxy |
| 17. 3-Pentanol | 34. Ethyl caprate |



Spearmint Oil

Column A: DB-1
122-1032
30 m x 0.25 mm, 0.25 µm

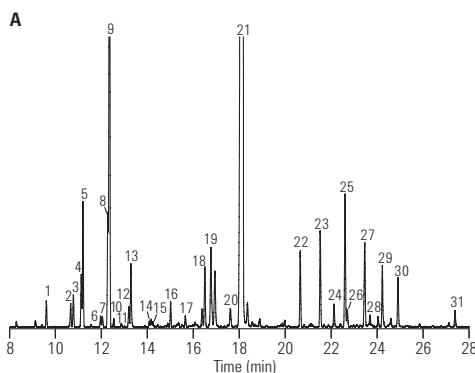
Column B: DB-1
121-1022
20 m x 0.18 mm, 0.18 µm

Carrier: A: Helium 25 cm/s measured at 40 °C
B: Hydrogen 47 cm/s measured at 40 °C

Oven: A: 40 °C hold 1 min, 5 °C/min to 290 °C
B: 40 °C hold 0.38 min, 13 °C/min to 290 °C
hold 13.09 min

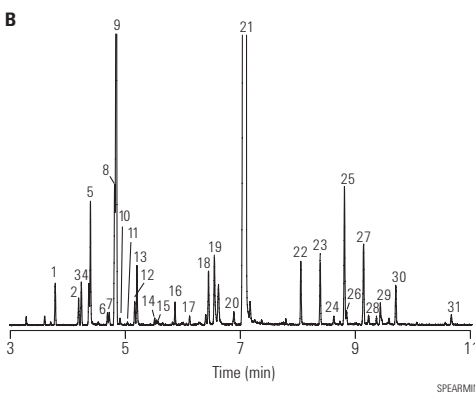
Injection: 250 °C, Split 40:1, 1 µL injection

Original method with a DB-1, 30 m x 0.25 mm, 0.25 µm column and helium carrier



1. α-Pinene
2. Sabinene
3. β-Pinene
4. 3-Octanol
5. Myrcene
6. α-Terpinene
7. p-Cymene
8. 1,8-Cineol
9. Limonene
10. cis-Ocimene
11. trans-Ocimene
12. γ-Terpinene
13. trans-Sabinene hydrate
14. Terpinolene
15. Linalool
16. 3-Octyl acetate
17. Isomenthone
18. Terpinen-4-ol
19. Dihydro carvone
20. trans-Carveol
21. l-Carvone
22. trans-Dihydro carveol acetate
23. cis-Carvyl acetate
24. cis-Jasmone
25. β-Bourbonene
26. α-Bourbonene
27. β-Caryophyllene
28. α-Copaene
29. trans-β-Farnesene
30. Germacrene-d
31. Viridiflorol

Faster method with a high efficiency DB-1, 20 m x 0.18 mm, 0.18 µm column and hydrogen carrier



Using hydrogen as a carrier gas in conjunction with the high efficiency column resulted in an overall speed gain of 61% compared to the original method. In addition, the resolution was well maintained throughout the method translation process.

Lavender Oil Characterization

Column: DB-1ms Ultra Inert
122-0132UI
30 m x 0.25 mm, 0.25 µm

Instrument: Agilent 7890A/5975B MSD
and a 6890N FID equipped

Sampler: Agilent 7683B, 5.0 µL syringe (p/n 5188-5246),
1.0 µL injection

Carrier: Helium 40 cm/s, constant flow MSD system,
35 cm/s FID system

Inlet: 200:1 split

Oven: 62 °C 12.5 min hold, 3 °C/min to 92 °C,
then 5 °C/min to 165 °C,
then 100 °C/min to 310 °C, 2.5 min hold

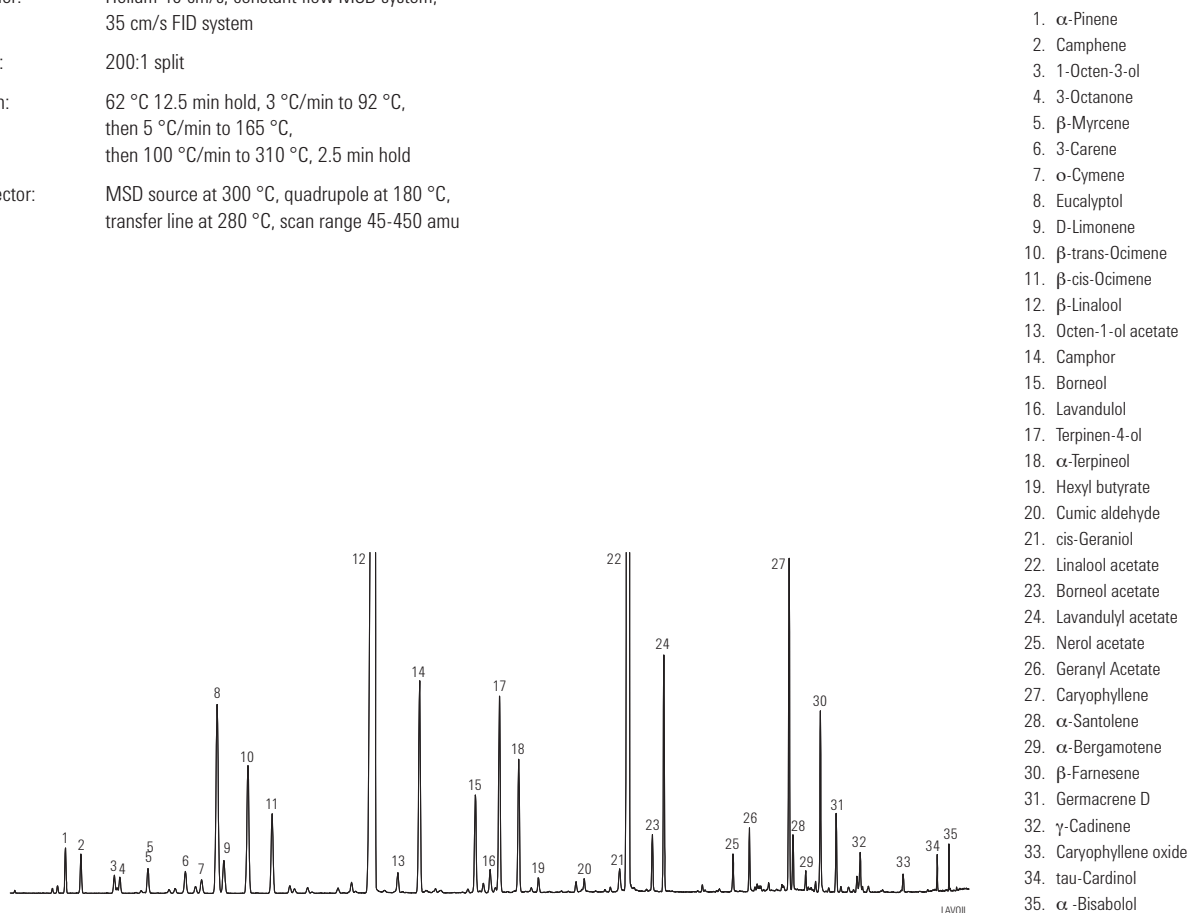
Detector: MSD source at 300 °C, quadrupole at 180 °C,
transfer line at 280 °C, scan range 45-450 amu

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Single taper, MS certified liner with restriction to hold glass wool, 5188-6576

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



GC/MS total ion chromatogram of lavender oil sample on an Agilent J&W DB-1ms Ultra Inert 30 m x 0.25 mm, 0.25 µm capillary GC column (p/n 122-0132UI). The well-resolved, sharp peaks observed on the column ensure reliable analysis and fingerprinting of lavender oils.

Essential Oils

Column: DB-WAX
121-7022
20 m x 0.18 mm, 0.18 µm

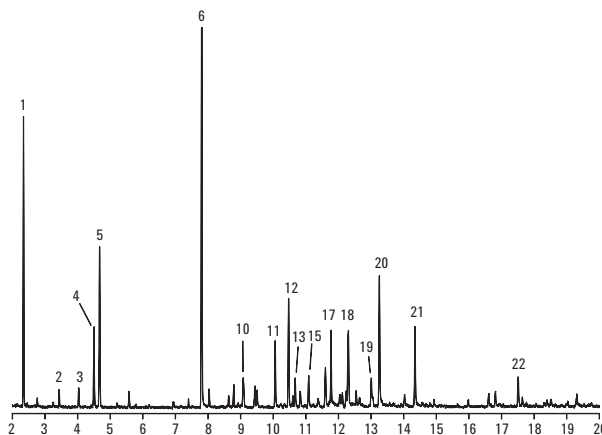
Carrier: Hydrogen at 44.3 cm/s
Measured at 45 °C

Oven: 45 °C hold 0.77 min
7.79 °C/min to 250 °C

Injection: Split 1:30, 250 °C
1 µL of 1:35 oil in acetone

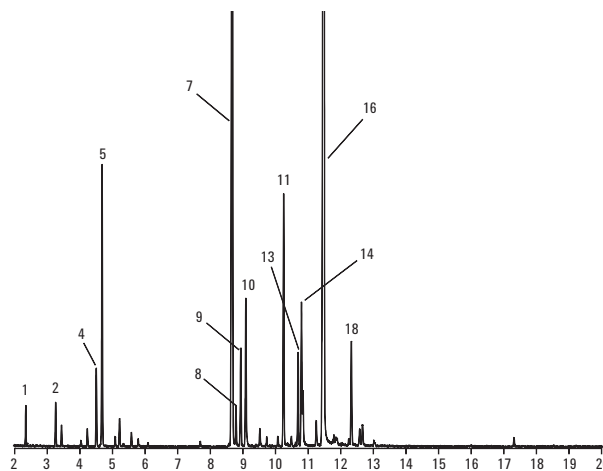
Detector: MSD full scan at m/z 40-500
250 °C transfer line

Wild chamomile



1. α-Pinene
2. β-Pinene
3. β-Myrcene
4. D-Limonene
5. Eucalyptol
6. 2,4-Hexadienal
7. Menthone
8. γ-Terpinene
9. Menthofuran
10. Iso-menthone
11. Δ-Carane
12. Bornyl acetate
13. β-Caryophyllene
14. Isomenthol
15. Citronellyl formate
16. Menthol
17. t-β-Farnesene
18. γ-Cadinene
19. δ-Cadinene
20. Citronellol
21. Nerol
22. β-Maaliene

Peppermint



Fragrance Reference Standard

Column: DB-1
122-1032
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 25 cm/s, measured at 150 °C

Oven: 40 °C for 1 min
40-290 °C at 5 °C/min

Injection: Split, 250 °C
Split ratio 1:50

Detector: MSD, 300 °C transfer line

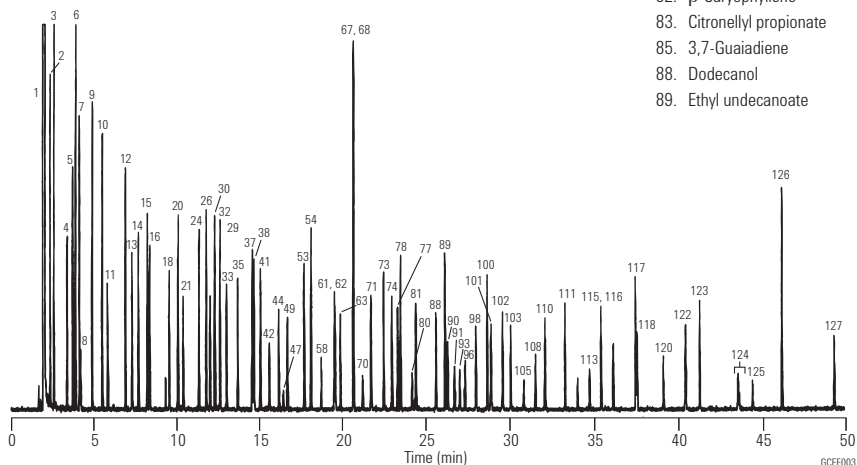
Sample: 1 µL of a 1:20 dilution of neat sample in acetone

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

Many thanks to Carl Frey, Manager of Analytical Services, Dragoco, and Kevin Myung, Director of Flavor and Perfumery Research, Bush Boake Allen, Inc. for contributing to this work.

- | | | | |
|--|-----------------------------|----------------------------|--|
| 1. Acetone | 26. Hexyl acetate | 53. Ethyl octanoate | 90. Eugenyl acetate |
| 2. 2,3-Butanedione (diacetyl) | cis-Linalool oxide | 54. Octyl acetate | 91. Frambinone (raspberry ketone) |
| 3. Ethyl acetate | Methyl benzoate | 56. Fenethyl acetate | 93. Isoamyl salicylate |
| 4. 2,3-Pentanedione (acetyl propionyl) | trans-Linalool oxide | 57. Citronellol | 94. δ-Cadinene |
| 5. Ethyl propionate | 28. Methyl-cresol | 58. Neral | 95. cis-Nerolidol |
| 6. Methyl butyrate | 29. Benzyl alcohol | 59. Carvone | 96. Rosatol (rosetone) |
| 7. 3-Methylbutyl alcohol | 30. para-Cymene | Phenylethyl acetate | Geranyl butyrate |
| 8. 2-Methylbutyl alcohol | 31. 1,8-Cineol | 60. Geraniol | 97. trans-Nerolidol |
| 9. Isobutyl acetate | 32. Limonene | 61. Linalyl acetate | 98. n-Amyl salicylate |
| 10. Ethyl butyrate | 33. 2,6-Dimethylhept-5-enal | 62. Geranial | 99. Phenyl ethyl tiglate |
| 11. Furfural | 34. γ-Terpinene | 63. Hydroxycitronellal | 100. Ethyl dodecanoate |
| 12. Ethyl isovalerate | 35. Octanol | 64. Citronellyl formate | 101. Benzophenone |
| 13. Hexanol | 37. Ethyl heptanoate | 66. Bornyl acetate | 102. Dibenzyl ether |
| 14. Allyl butyrate | 38. Linalool | 67. Vertenex (isomer 1) | 103. γ-Dodecalactone |
| 15. Ethyl pentanoate | 39. Benzene ethanol | 68. Ethyl nonanoate | 104. Citronellyl tiglate |
| 16. Hexylene glycol | 41. Rose oxide, cis-rose | 69. Geranyl formate | 105. Evernyl |
| 17. α-Thujone | 42. Rose oxide, trans-rose | 70. Vertenex (isomer 2) | 106. Geranyl tiglate |
| 18. Benzaldehyde | 43. Camphor | 71. γ-Nonalactone | 107. Geranyl-2-methyl valerate |
| 19. α-Pinene | 44. Citronellal | 72. Citronellyl acetate | 108. Celestolide |
| 20. Camphene | 45. Benzyl acetate | 73. Neryl acetate | 109. Heptadec-1-ene |
| 21. 3,5,5-Trimethylhexanol | 46. Menthone | 74. Geranyl acetate | 110. Benzyl benzoate |
| 22. Sabinene | 47. Isoborneol | 76. Diphenyl oxide | 111. Ethyl tetradecanoate |
| 23. β-Pinene | 48. Isomenthone | 78. Ethyl decanoate | 112. Benzyl salicylate |
| 24. Ethyl hexanoate | 49. Borneol | 79. α-Copaene | 113. Tonalid |
| 25. Myrcene | 51. Terpinen-4-ol | 80. Florazone (isomer 1) | 114. Nonadec-1-ene |
| | 52. α-Terpineol | 81. Florazone (isomer 2) | 115. Isopropylmyristate |
| | | 82. β-Caryophyllene | 116. Ethyl pentadecanoate |
| | | 83. Citronellyl propionate | Nonadecane |
| | | 85. 3,7-Guaiadiene | 117. Ethyl hexadecanoate |
| | | 88. Dodecanol | 118. Musk T (ethylene brassylate) |
| | | 89. Ethyl undecanoate | 119. Eicosane |
| | | | 120. Cinnamyl phenyl acetate |
| | | | 121. Heneicosane |
| | | | 122. Phenyl ethyl cinnamate |
| | | | 123. Ethyl octadecanoate |
| | | | 124. Herculyn D (tetrahydro & dihydro methyl abietate) |
| | | | 125. Cinnamyl cinnamate |
| | | | 126. Cetearyl octanoate |
| | | | 127. Cetearyl decanoate |



Fragrance Reference Standard

Column: DB-WAX
122-7032
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 25 cm/s,
measured at 150 °C

Oven: 45 °C for 2 min
45-250 °C at 3 °C/min
250 °C for 34 min

Injection: Split, 250 °C
Split ratio 1:50

Detector: MSD, 250 °C transfer line

Sample: 1 µL of a 1:20 dilution of neat sample in acetone

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

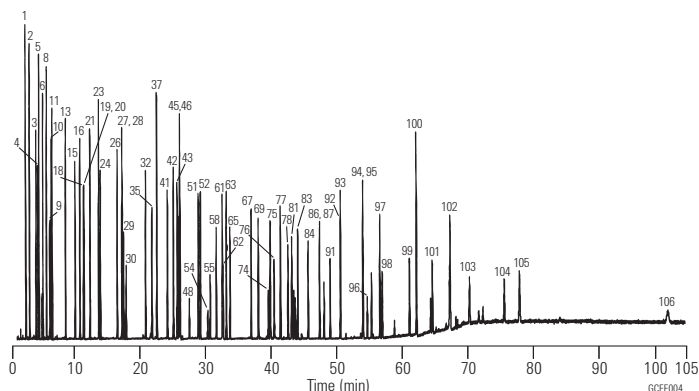
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

Many thanks to Carl Frey, Manager of Analytical Services, Dragoco, and Kevin Myung, Director of Flavor and Perfumery Research, Bush Boake Allen, Inc. for contributing to this work.

- | | | | |
|--|----------------------------|--------------------------|------------------------------------|
| 1. Acetone | 28. Rose oxide, cis-rose | 55. Neral | 83. Ethyl tetradecanoate |
| 2. Ethyl acetate | 29. Hexanol | 56. α-Terpineol | 84. n-Amyl salicylate |
| 3. Ethyl propionate | 30. Rose oxide, trans-rose | 57. Geranyl formate | 85. Geranyl tiglate |
| 4. 2,3-Butanedione (diacetyl) | 31. Methyl-para-cresol | 58. Borneol | 86. Ethyl pentadecanoate |
| 5. Methyl butyrate | 32. Ethyl octanoate | 59. β-Bisabolene | 87. Isopropylmyristate |
| 6. Isobutyl acetate | 33. cis-Linalool oxide | 60. Benzyl acetate | 90. Phenyl ethyl tiglate |
| 7. α-Pinene | 34. Menthone | 61. Neryl acetate | 91. Rosatol (rosetone) |
| 8. Ethyl butyrate | 35. Furfural | 62. Geranial | 92. Eugenyl acetate |
| 9. 2,3-Pentanedione (acetyl propionyl) | 36. trans-Linalool oxide | 63. Ethyl undecanoate | 93. Ethyl hexadecanoate |
| 10. Camphene | 37. Octyl acetate | 64. δ-Cadinene | 94. γ-Dodecalactone |
| 11. Ethyl isovalerate | 38. Isomenthone | 65. Geranyl acetate | 95. Dibenzyl ether |
| 12. β-Pinene | 39. α-Copaene | 66. Citronellol | 96. Tonalid |
| 13. Ethyl pentanoate | 40. Camphor | 67. Ethyl dodecanoate | 97. Ethyl octadecanoate |
| 14. Myrcene | 41. Benzaldehyde | 68. Geraniol | 98. Benzophenone |
| 15. Allyl butyrate | 42. Ethyl nonanoate | 69. Benzyl alcohol | 99. Benzyl benzoate |
| 16. Limonene | 43. Linalool | 70. Geranyl butyrate | 100. Cetearyl octanoate |
| 17. 1,8-Cineol | 44. Linalyl acetate | 71. Nonadecane | 101. Musk T (ethylene brassylate) |
| 18. 3,5,5-Trimethylhexanol | 45. Vertenex (isomer 1) | 72. Benzene ethanol | 102. Cetearyl decanoate |
| 19. 3-Methylbutyl alcohol | 46. Octanol | 73. Nonadec-1-ene | 103. Frambinone (raspberry ketone) |
| 20. 2-Methylbutyl alcohol | 47. β-Caryophyllene | 74. Florazone (isomer 1) | 104. Cinnamyl phenyl acetate |
| 21. Ethyl hexanoate | 48. Vertenex (isomer 2) | 75. Florazone (isomer 2) | 105. Phenyl ethyl cinnamate |
| 22. γ-Terpinene | 49. Terpinen-4-ol | 76. Hydroxycitronellal | 106. Cinnamyl cinnamate |
| 23. p-Cymene | 50. Methyl benzoate | 77. Dodecanol | |
| 24. Hexyl acetate | 51. Hexylene glycol | 78. Diphenyl oxide | |
| 25. Terpinolene | 52. Ethyl decanoate | 79. Citronellyl tiglate | |
| 26. Ethyl heptanoate | 53. Citronellyl acetate | 80. Eugenyl methyl ether | |
| 27. 2,6-Dimethylhept-5-enal (melonal) | 54. Isoborneol | 81. γ-Nonalactone | |



Perfume

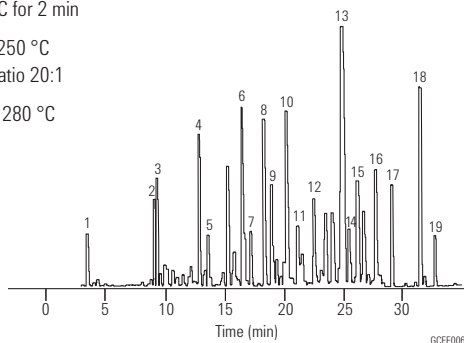
Column: HP-INNOWax
19091N-133
30 m x 0.25 mm, 0.25 µm

Carrier: Helium, 30 cm/s
0.9 mL/min constant flow

Oven: 80 °C for 1 min
80-250 °C at 5 °C/min
250 °C for 2 min

Injection: Split, 250 °C
Split ratio 20:1

Detector: MSD, 280 °C



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

- | | |
|---------------------------|-----------------------|
| 1. Limonene | 11. Commamyl acetate |
| 2. Linalool | 12. Acetyl cedrene |
| 3. Linalyl acetate | 13. Diethyl phthalate |
| 4. Benzyl acetate | 14. Tonalid |
| 5. Citronellol | 15. Coumarin |
| 6. Benzene ethanol | 16. Musk xylene |
| 7. α-Methyl ionone | 17. Benzyl benzoate |
| 8. Carvacrol and geraniol | 18. Benzyl salicylate |
| 9. Isoamyl salicylate | 19. Musk ketone |
| 10. n-Amyl salicylate | |

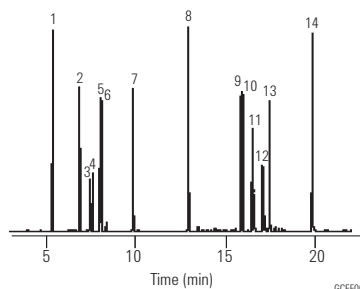
Chiral Compounds in Essential Oils and Fragrances

Column: HP-Chiral 20β
19091G-B233
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen, 39 cm/s, constant pressure
Injection: Split, 250 °C
Split ratio 30:1

Oven: 65 °C for 1 min
65-170 °C at 5 °C/min
Detector: FID, 300 °C

Sample: 1 µL
0.25 ng/µL each
analyte in Hexane



1. 1,2-Dimethylbenzene
2. Myrcene
3. (-)-Camphene
4. (+)-Camphene
5. (+)-β-Pinene
6. 1S(-)-β-Pinene
7. Cineole
8. (R)-(+)-Citronellal
9. 1S,2R,5S-(+)-Menthol
10. 1R,2S,5R-(-)-Menthol
11. α-Terpineol
12. (+/-)-Isoborneol
13. (+)-Borneol
14. trans-Cinnamaldehyde

Menthol

Column: Cyclodex-B
112-2532
30 m x 0.25 mm, 0.25 µm

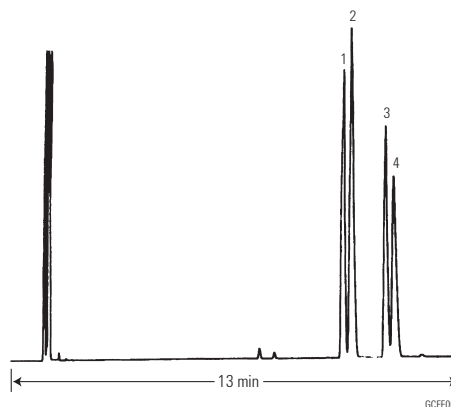
Carrier: Hydrogen, 55 cm/s

Oven: 105 °C isothermal

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 1 µg/µL each chloroform



1. (+)-Neomenthol
2. (-)-Neomenthol
3. (+)-Menthol
4. (-)-Menthol

FAMEs

Column: DB-23
122-2362
60 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 43 cm/s,
constant pressure mode

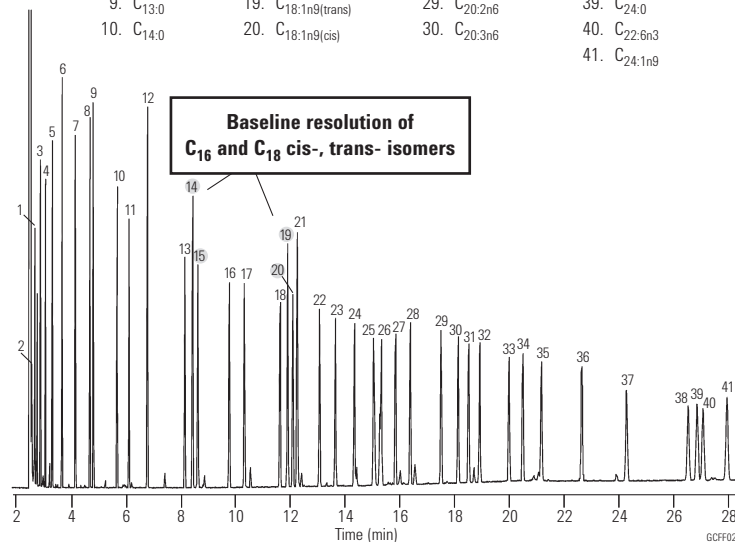
Oven: 130 °C for 1.0 min
130-170 °C at 6.5 °C/min
170-215 °C at 2.75 °C/min
215 °C for 12 min
215-230 °C at 40 °C/min
230 °C for 3 min

Injection: Split, 270 °C
Split ratio 50:1

Detector: FID, 280 °C

Chromatogram provided courtesy of Steve Watkins and Jeremy Ching, FAME Analytics, <http://www.fameanalytics.com>

- | | | | |
|-----------------------|--------------------------------|-------------------------------|-------------------------|
| 1. C _{6:0} | 11. C _{14:1n5} | 21. C _{18:1n7} | 31. C _{20:4n6} |
| 2. C _{7:0} | 12. C _{15:0} | 22. C _{18:2n6} | 32. C _{20:3n3} |
| 3. C _{8:0} | 13. C _{16:0} | 23. C _{18:3n6} | 33. C _{20:5n3} |
| 4. C _{9:0} | 14. C _{16:1n7(trans)} | 24. C _{18:3n3} | 34. C _{22:0} |
| 5. C _{10:0} | 15. C _{16:1n7(cis)} | 25. C _{18:2(d9,11)} | 35. C _{22:1n9} |
| 6. C _{11:0} | 16. C _{17:0} | 26. C _{18:2(d10,12)} | 36. C _{22:2n6} |
| 7. C _{12:0} | 17. C _{17:1} | 27. C _{20:0} | 37. C _{22:4n6} |
| 8. BHT | 18. C _{18:0} | 28. C _{20:1n9} | 38. C _{22:5n3} |
| 9. C _{13:0} | 19. C _{18:1n9(trans)} | 29. C _{20:2n6} | 39. C _{24:0} |
| 10. C _{14:0} | 20. C _{18:1n9(cis)} | 30. C _{20:3n6} | 40. C _{22:6n3} |
| | | | 41. C _{24:1n9} |



Suggested Supplies

- Septum:** 11 mm Advanced Green septa, 5183-4759
- Liner:** Split, single taper, low pressure drop, glass wool, 5183-4647
- Seal:** Gold plated seal, 18740-20885
- Syringe:** 5 µL tapered, FN 23-26s/42/HP, 5181-1273

Analysis of Fragrance and Allergens

Column: VF-WAXms
CP9205
30 m x 0.25 mm, 0.25 µm

Oven: 100 °C to 250 °C with 10 °C/min

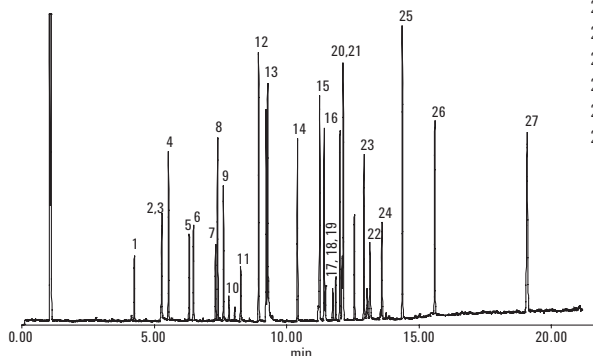
Carrier: Helium, 1.0 mL/min

Injection: Split 1:30, T=250 °C

Detector: GC/MS Ion Trap
Trap: 200 °C
Manifold: 60 °C

Sample: 0.1 µL, Fragrances mixture (500 ppm)

- | | |
|-----------------------------|-----------------------------|
| 1. Linalool | 11. Hydroxy citronellal |
| 2. Methyl heptine carbonate | 12. Methyl eugenol |
| 3. Phenyl acetaldehyde | 13. Lilial |
| 4. Methyl chavicol | 14. Eugenol |
| 5. Methyl octine carbonate | 15. Amyl cinnamyl aldehyde |
| 6. Citronellol | 16. Anisic alcohol |
| 7. Geraniol | 17. Cinnamyl alcohol |
| 8. Methyl gamma ionone | 18. Farnesol isomer I + II |
| 9. Benzyl alcohol | 19. Farnesol isomer III |
| 10. Cinnamaldehyde | 20. iso-Eugenol |
| | 21. Hexyl cinnamic aldehyde |
| | 22. Lyrall (4,4-isomer) |
| | 23. Coumarin |
| | 24. Amyl cinnamic alcohol |
| | 25. Benzyl benzoate |
| | 26. Benzyl salicylate |
| | 27. Benzyl cinnamate |



Organophosphorus Pesticide Residues in Olive Oil Extract

Column: DB-35ms Ultra Inert
122-3832UI
30 m x 0.25 mm, 0.25 µm

Instrument: Agilent 7890/5975C

Sampler: Agilent 7683B, 5.0 µL syringe (p/n 5181-1273)

CFT Device: Purged 2-way splitter (p/n G3180B)
Split ratio MSD:FPD = 1:1

MSD Restrictor: 1.43 m x 0.18 mm id deactivated fused silica tubing

FPD Restrictor: 0.53 m x 0.18 mm id deactivated fused silica tubing

Aux EPC: 3.8 psi constant pressure

Inlet: 2 µL splitless; 250 °C, purge flow 60 mL/min at 0.25 min, gas saver on at 2 min 20 mL/min

Carrier: Helium, constant pressure 28.85 psi at 95 °C

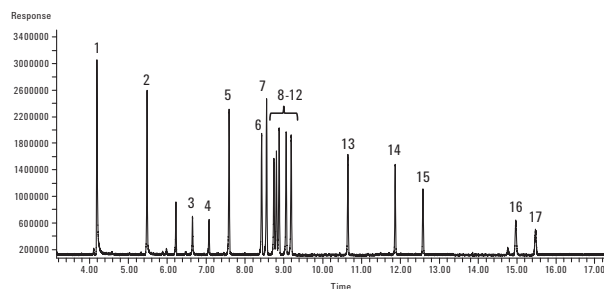
Oven: 95 °C (0.5 min), 25 °C/min to 210 °C, 10 °C/min to 250 °C (0.5 min), 20 °C to 290 °C (4.5 min)

Postrun: 7.5 min at 290 °C, Aux EPC pressure 54 psi during backflush,

Backflush: 2 psi inlet pressure during backflush

Detector: MSD: 300 °C transfer line, 300 °C source, 150 °C quad
FPD: 230 °C, hydrogen 75 mL/min, air 100 mL/min, carrier + makeup (N₂) 60 mL/min

- | | |
|----------------------|---|
| 1. Methamidophos | 10. Fenitrothion |
| 2. Acephate | 11. Parathion |
| 3. Omethoate | 12. Fenthion |
| 4. Diazinon | 13. Methidathion |
| 5. Dimethoate | 14. Carbophenothion |
| 6. Pirimiphos-methyl | 15. Triphenyl-phosphate (surrogate std) |
| 7. Parathion-methyl | 16. Azinphos-methyl |
| 8. Malathion | 17. Azinphos-ethyl |
| 9. Chlorpyrifos | |



GC/FPD chromatogram of a 100 ng/mL matrix-matched organophosphorus pesticide standard with analyte protectant analyzed on an Agilent J&W DB-35ms UI GC column.



TIPS & TOOLS

View the latest GC column focused applications, products and educational resources at www.agilent.com/chem/myGCcolumns

Fragrance Allergens

Column: HP-5ms
19091S-433
30 m x 0.25 mm, 0.25 µm

Carrier: Helium, 1.2 mL/min,
constant pressure of 70 kPa

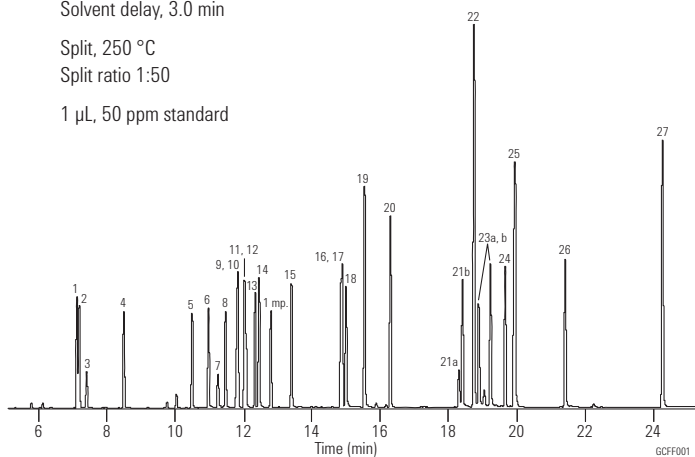
Oven: 50 °C in 1 min, 8 °C/min to 250 °C,
250-300 °C at 35 °C/min
300 °C hold, 5 min
5973N MSD in scan (40-350 amu)
Solvent delay, 3.0 min

Injection: Split, 250 °C
Split ratio 1:50

Sample: 1 µL, 50 ppm standard

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



- | | |
|-----------------------------|----------------------------|
| 1. Limonene | 16. Coumarin |
| 2. Benzyl alcohol | 17. Cinnamyl acetate |
| 3. Phenyl acetaldehyde | 18. Isoeugenol |
| 4. Linalool | 19. Alpha isomethyl ionone |
| 5. Methyl heptene carbonate | 20. Lilial (BMHCA) |
| 6. Citronellol | 21a. Lyril 1 |
| 7. Neral | 21b. Lyril 2 |
| 8. Geraniol | 22. Amyl cinnamyl alcohol |
| 9. Citral (geranial) | 23a. Farnesol 1 |
| 10. Cinnamaldehyde | 23b. Farnesol 1 |
| 11. Anisyl alcohol | 24. Hexyl cinnamaldehyde |
| 12. Hydroxy citronellal | 25. Benzyl benzoate |
| 13. Methyl octine carbonate | 26. Benzyl salicylate |
| 14. Cinnamic alcohol | 27. Benzyl cinnamate |
| 15. Eugenol | |

Flavor Mixture

Column: Ultra 2
19091B-112
25 m x 0.32 mm, 0.52 µm

Carrier: Helium, 90 kPa, 2.2 mL/min constant flow

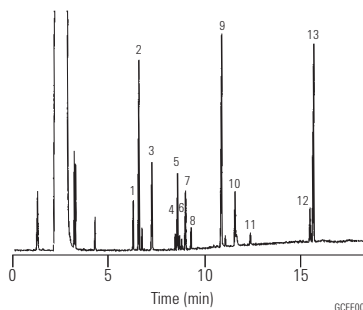
Oven: 80 °C for 1 min
80-210 °C at 8 °C/min
210 °C for 2 min

Injection: Split, 250 °C
Split ratio 20:1

Detector: IRD, 280 °C
Wide Band MCT, 550 to 4000 cm⁻¹

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Fenchone
2. Thujone
3. Benzaldehyde
4. trans-Carveol
5. Farnesol
6. cis-Carveol
7. trans-Geraniol
8. Citral
9. Eugenol
10. Vanillin
11. trans-Isoeugenol
12. trans-Citronellyl tiglate
13. cis-Citronellyl tiglate

Lemon Oil

Column: DB-5
127-5022
20 m x 0.10 mm, 0.10 μm

Carrier: Hydrogen at 60 cm/s, measured at 40 °C

Oven: 40 °C for 3 min
40-185 °C at 30 °C/min
185 °C for 3 min

Injection: Split, 275 °C
Split ratio 1:275

Detector: Nitrogen makeup gas at 30 mL/min

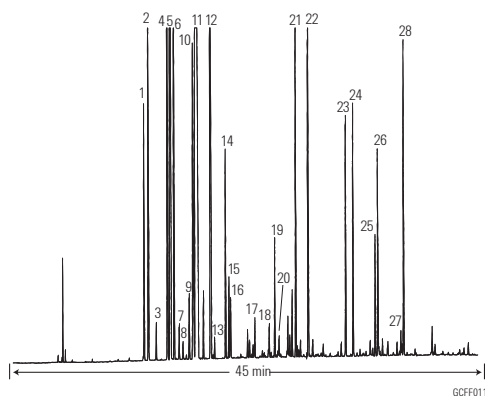
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 μL tapered, FN 23-26s/42/HP, 5181-1273



- | | |
|-------------------|-------------------------|
| 1. α-Thujone | 15. Linalool |
| 2. β-Thujone | 16. Nonanal |
| 3. Camphene | 17. Citronellal |
| 4. Sabinene | 18. Terpinen-4-ol |
| 5. β-Pinene | 19. α-Terpineol |
| 6. Myrcene | 20. Decanal |
| 7. Octanal | 21. Neral |
| 8. α-Phellandrene | 22. Geranial |
| 9. α-Terpinene | 23. Neryl acetate |
| 10. r-Cymene | 24. Geranyl acetate |
| 11. δ-Limonene | 25. β-Caryophyllene |
| 12. γ-Terpinene | 26. trans-α-Bergamotene |
| 13. Octanol | 27. α-Humulene |
| 14. Terpinolene | 28. β-Bisabolene |

Cold-pressed Orange Oil

Column: DB-5
127-5022
20 m x 0.10 mm, 0.10 μm

Carrier: Hydrogen at 60 cm/s, measured at 70 °C

Oven: 70 °C for 1 min
70-250 °C at 30 °C/min
250-310 °C at 20 °C/min
310 °C for 2 min

Injection: Split, 275 °C
Split ratio 1:275

Detector: FID, 350 °C
Nitrogen makeup gas at 30 mL/min

Suggested Supplies

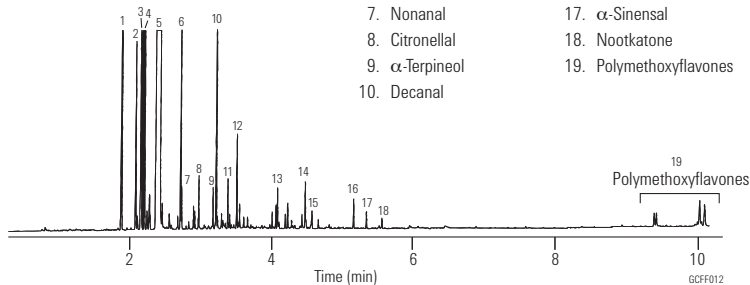
Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 μL tapered, FN 23-26s/42/HP, 5181-1273

Chromatogram courtesy of Tastemaker



- | | |
|----------------|-------------------------|
| 1. α-Pinene | 11. Neral |
| 2. Sabinene | 12. Geranial |
| 3. Myrcene | 13. Dodecenal |
| 4. Octanal | 14. Valencene |
| 5. Limonene | 15. Cadinene |
| 6. Linalool | 16. β-Sinensal |
| 7. Nonanal | 17. α-Sinensal |
| 8. Citronellal | 18. Nootkatone |
| 9. α-Terpineol | 19. Polymethoxyflavones |
| 10. Decanal | |

Peppermint Oil

Column: DB-WAX
122-7062
60 m x 0.25 mm, 0.25 µm

Carrier: Helium at 25 cm/s (0.73 mL/min)

Oven: 75 °C for 8 min
75-200 °C at 4 °C/min
200 °C for 5 min

Injection: Split, 270 °C
Split ratio 1:150

Detector: FID, 270 °C
Nitrogen makeup gas at 30 mL/min

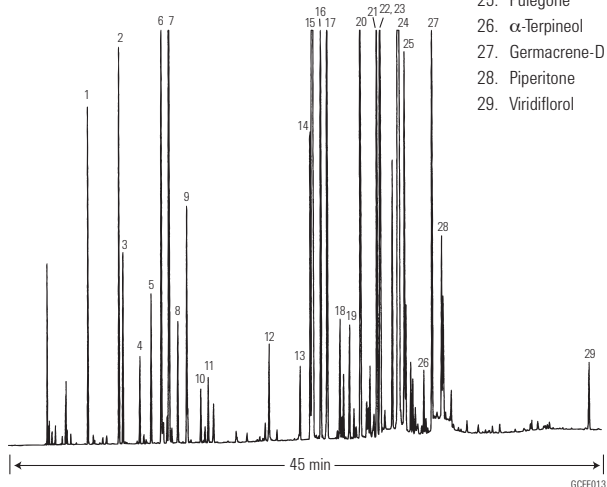
Sample: 1 µL neat

Thanks to William Faas of A.M. Todd Company for providing the sample and assisting with peak identification.

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

- | | | |
|-------------------|----------------------------|---------------------|
| 1. α-Pinene | 9. Terpinene | 17. d-Isomethone |
| 2. β-Pinene | 10. r-Cymene | 18. β-Bourbonene |
| 3. Sabinene | 11. γ-Terpinolene | 19. Linalool |
| 4. Myrcene | 12. 3-Octanol | 20. Menthyl acetate |
| 5. α-Terpinene | 13. 1-Octen-3-ol | 21. Neomenthol |
| 6. (+/-)-Limonene | 14. trans-Sabinene hydrate | 22. Terpinen-4-ol |
| 7. 1,8-Cineol | 15. (+/-)-Methone | 23. β-Caryophyllene |
| 8. cis-Ocimene | 16. Methofuran | 24. (+/-)-Menthol |



Spearmint Oil (Western)

Column: DB-WAX
122-7062
60 m x 0.25 mm, 0.25 µm

Carrier: Helium at 25 cm/s (0.73 mL/min)

Oven: 75 °C for 8 min
75-200 °C at 4 °C/min
200 °C for 5 min

Injection: Split, 270 °C
Split ratio 1:150

Detector: FID, 270 °C
Nitrogen makeup gas at 30 mL/min

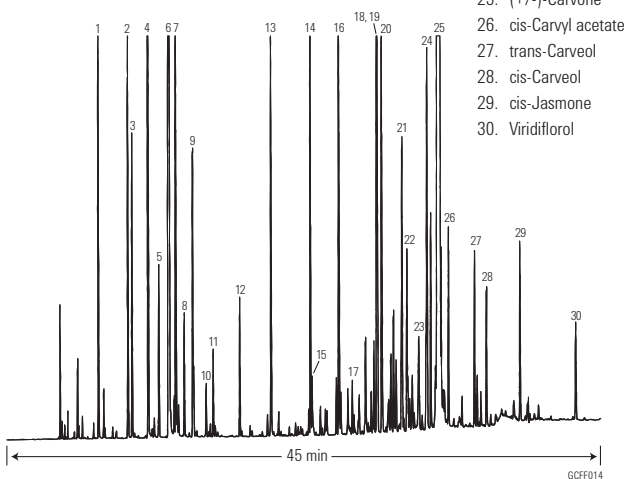
Sample: 1 µL neat

Thanks to William Faas of A.M. Todd Company for providing the sample and assisting with peak identification.

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

- | | | |
|-------------------|----------------------------|--------------------------|
| 1. α-Pinene | 9. γ-Terpinene | 17. Linalool |
| 2. β-Pinene | 10. r-Cymene | 18. Terpinen-4-ol |
| 3. Sabinene | 11. Terpinolene | 19. β-Caryophyllene |
| 4. Myrcene | 12. 3-Octylacetate | 20. Dihydro carvone |
| 5. α-Terpinene | 13. 3-Octanol | 21. trans-Dihydro carvyl |
| 6. (+/-)-Limonene | 14. trans-Sabinene hydrate | 22. trans-β-Farnesene |
| 7. 1,8-Cineol | 15. (+/-)-Methone | 23. α-Terpineol |
| 8. cis-Ocimene | 16. β-Bourbonene | 24. Germacrene-D |



Ylang Ylang Oil

Column: DB-XLB
122-1232
30 m x 0.25 mm, 0.25 μ m

Carrier: Helium at 34 cm/s, measured at 50 $^{\circ}$ C

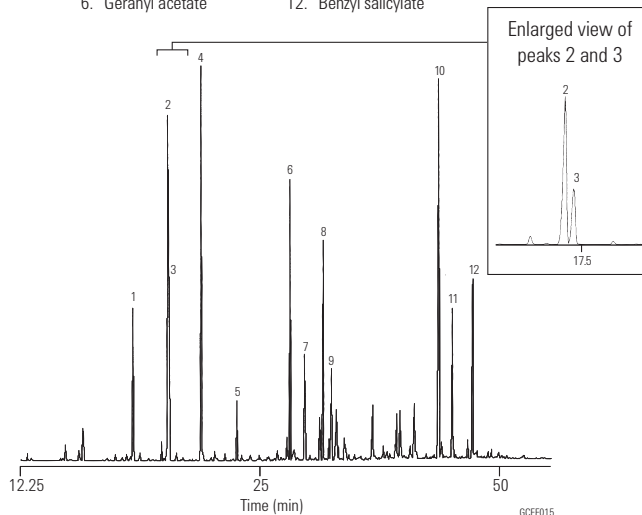
Oven: 50 $^{\circ}$ C for 1 min
50-250 $^{\circ}$ C at 3.5 $^{\circ}$ C/min

Injection: Split, 250 $^{\circ}$ C
Split ratio 1:125

Detector: MSD, 310 $^{\circ}$ C transfer line
full scan at m/z 35-550

Sample: 1 μ L of 10% oil in methylene chloride

- | | |
|--------------------|---------------------------|
| 1. r-Methylansiole | 7. β -Caryophyllene |
| 2. Linalool | 8. Cinnamyl acetate |
| 3. Methylbenzoate | 9. Germacrene-D |
| 4. Benzylacetate | 10. Benzyl benzoate |
| 5. Geraniol | 11. Farnesol acetate |
| 6. Geranyl acetate | 12. Benzyl salicylate |



Suggested Supplies

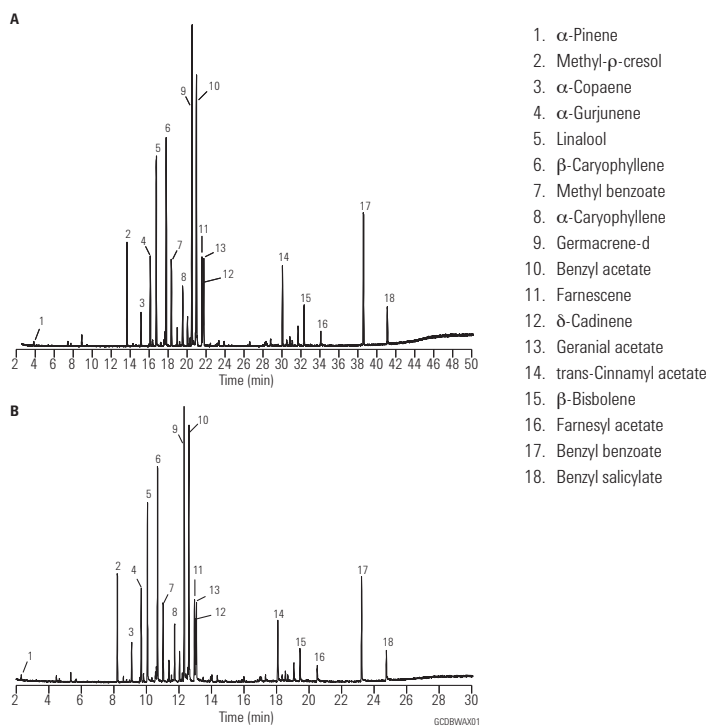
- Septum:** 11 mm Advanced Green septa, 5183-4759
- Liner:** Split, single taper, low pressure drop, glass wool, 5183-4647
- Seal:** Gold plated seal, 18740-20885
- Syringe:** 5 μ L tapered, FN 23-26s/42/HP, 5181-1273

Ylang Ylang Oil

Column: DB-WAX
121-7022
20 m x 0.18 mm, 0.18 μ m

Carrier: A: Helium 26.3 cm/s measured at 45 $^{\circ}$ C
B: Hydrogen 44.3 cm/s measured at 45 $^{\circ}$ C

Oven: A: 45 $^{\circ}$ C hold 1.28 min
4.68 $^{\circ}$ C/min to 250 $^{\circ}$ C hold 21.81 min
B: 45 $^{\circ}$ C hold 0.77 min
7.79 $^{\circ}$ C/min to 250 $^{\circ}$ C hold 13.09 min



Rosemary Oil

Column: CycloSil-B
112-6632
30 m x 0.25 mm, 0.25 µm

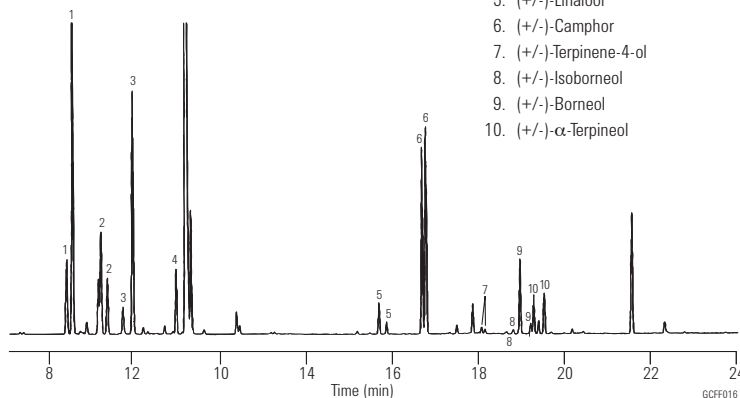
Carrier: Hydrogen at 40 cm/s, measured at 60 °C

Oven: 55 °C for 1 min
50-180 °C at 5 °C/min

Injection: Split, 250 °C
Split ratio 50:1

Detector: FID, 340 °C

1. (+/-)- α -Pinene
2. (+/-)-Camphene
3. (+/-)- β -Pinene
4. (+/-)-Limonene
5. (+/-)-Linalool
6. (+/-)-Camphor
7. (+/-)-Terpinene-4-ol
8. (+/-)-Isoborneol
9. (+/-)-Borneol
10. (+/-)- α -Terpineol



Suggested Supplies

- Septum:** 11 mm Advanced Green septa, 5183-4759
- Liner:** Split, single taper, low pressure drop, glass wool, 5183-4647
- Seal:** Gold plated seal, 18740-20885
- Syringe:** 5 µL tapered, FN 23-26s/42/HP, 5181-1273

Citrus Flavored Carbonated Beverage (Soda)

Column: CycloSil-B
112-6632
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 37 cm/s,
measured at 40 °C

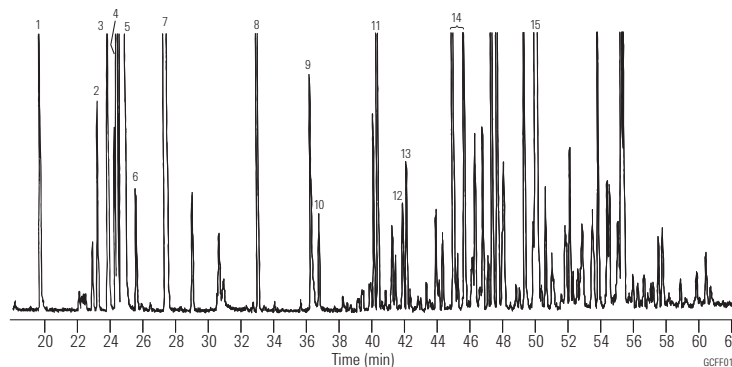
Oven: 40-190 °C at 2 °C/min

Sampler: Headspace
No stir, NaCl 1g/10 mL sample
Adsorption: 27 °C for 68 min
Desorption: 250 °C for 15 min

Injection: Split, 1:5
Polyacrylate fiber, 85 µm

Detector: MSD, 280 °C transfer line

1. S-(-)-Limonene
2. p-Cymene
3. (+)-Limonene
4. Octanol
5. γ -Terpinene
6. Nonanol
7. 2-Ethyl-1-Hexanol
8. Linalool
9. Decanol
10. Terpinen-4-ol
11. Phenethylalcohol
12. α -Terpineol
13. BHT



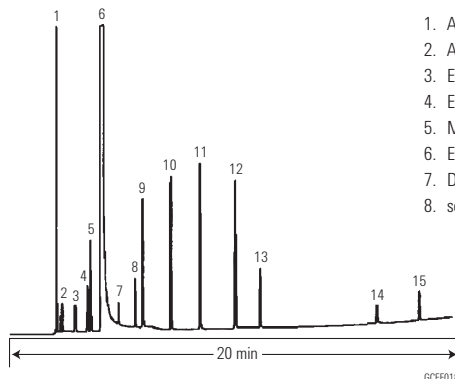
Suggested Supplies

- Septum:** 11 mm Advanced Green septa, 5183-4759
- Liner:** Split, single taper, low pressure drop, glass wool, 5183-4647
- Seal:** Gold plated seal, 18740-20885
- Syringe:** 5 µL tapered, FN 23-26s/42/HP, 5181-1273

Alcohol Beverage Standard

Column: HP-FFAP
19091F-105
50 m x 0.20 mm, 0.33 µm

Carrier: Hydrogen
Oven: 60 °C for 4 min
60-200 °C at 6 °C/min
200 °C for 2 min
Detector: FID

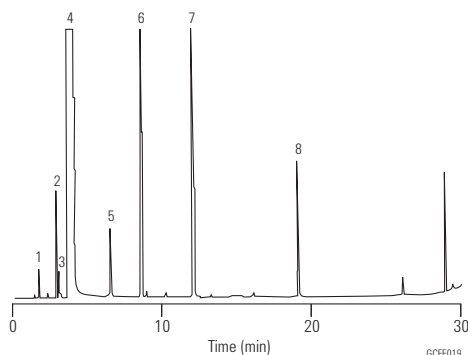


- 1. Acetaldehyde
- 2. Acetone
- 3. Ethyl formate
- 4. Ethyl acetate
- 5. Methanol
- 6. Ethanol
- 7. Diacetyl
- 8. sec-Butanol
- 9. n-Propanol
- 10. Isobutanol
- 11. n-Butanol
- 12. Isoamyl alcohol
- 13. n-Amyl alcohol
- 14. Acetic acid
- 15. Propionic acid

Bourbon

Column: HP-INNOWax
19091N-133
30 m x 0.25 mm, 0.25 µm

Carrier: Helium, 33 cm/s, 15.5 psi (35 °C)
1.5 mL/min constant flow
Oven: 35 °C for 5 min
35-150 °C at 5 °C/min
150-250 °C at 20 °C/min
250 °C for 2 min
Injection: Split, 220 °C
Split ratio 25:1
Detector: FID, 280 °C
Sample: 1 µL

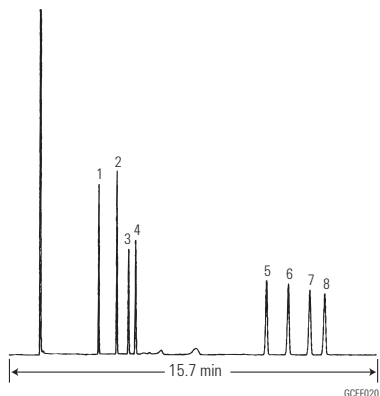


- 1. Acetaldehyde
- 2. Ethyl acetate
- 3. Methanol
- 4. Ethanol
- 5. Acetic acid
- 6. n-Propanol
- 7. Isobutanol
- 8. 2-Methyl-1-butanol or 3-methyl-1-butanol

Alditol Acetates

Column: DB-225
122-2231
30 m x 0.25 mm, 0.15 µm

Carrier: Hydrogen at 36.5 cm/s
Oven: 220 °C isothermal
Injection: Split, 225 °C
Split ratio 1:50
Detector: FID, 250 °C
Nitrogen makeup gas at 30 mL/min
Sample: 1 µL



- 1. Rhamnitol
- 2. Fucitol
- 3. Ribitol
- 4. Arabinitol
- 5. Mannitol
- 6. Galactitol
- 7. Glucitol
- 8. Inositol

Strawberry Syrup

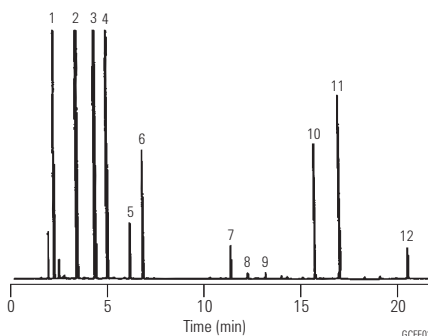
Column: HP-INNOWax
19091N-213
30 m x 0.32 mm, 0.50 µm

Carrier: Helium, 40 cm/s, 11.7 psi (60 °C)
2.5 mL/min constant flow

Oven: 60 °C for 1 min
60-250 °C at 10 °C/min
250 °C for 2 min

Injection: Split, 220 °C
Split ratio 60:1

Detector: FID, 275 °C



1. Ethyl acetate
2. Ethyl butyrate
3. Isoamyl acetate
4. Amyl acetate
5. Isoamyl butyrate
6. Amyl butyrate
7. Ethyl benzoate
8. Citronellol
9. Geraniol
10. Ethyl-3-phenyl oxiran carboxylate
11. Strawberry aldehyde
12. Benzyl benzoate

Separation of TMS-derivatized Sugars using VF-1ms

Column: VF-1ms
CP8912
30 m x 0.25 mm, 0.25 µm

Sample: 5 µL, splitless 1 µL

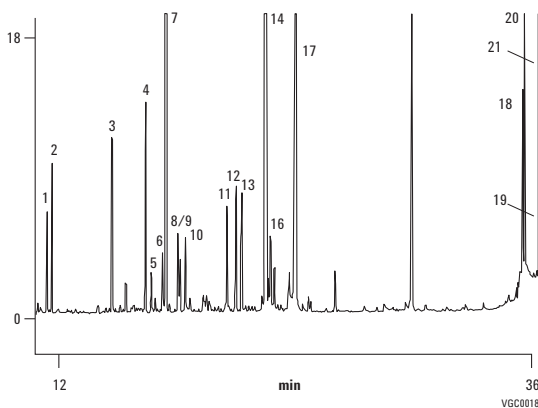
Sample Conc: 40 ppb

Carrier: He, 1.0 mL/min

Oven: 105 °C to 240 °C,
4 °C/min to 300 °C,
20 °C/min

Injection: Split: 1:15

Detector: MS



- | | |
|-------------------------|---------------------------------|
| 1. Threitol | 12. Glucuronic acid-1,5-lactone |
| 2. Erythritol | 13. Ribose 2 |
| 3. Rhamnose 1 | 14. Mannitol |
| 4. Rhamnose 2 | 15. Sorbitol (not identified) |
| 5. Xylose 1 | 16. Galactitol |
| 6. Arabitol | 17. Glucuronic acid |
| 7. Ribitol | 18. Lactulose |
| 8. 3-O-Methylglucose 1 | 19. Lactose |
| 9. Xylose 2 | 20. Sucrose |
| 10. Rhamnitol | 21. Threhalose |
| 11. 3-O-Methylglucose 2 | |

Organic Acids

Column: DB-FFAP
122-3232
30 m x 0.25 mm, 0.25 µm

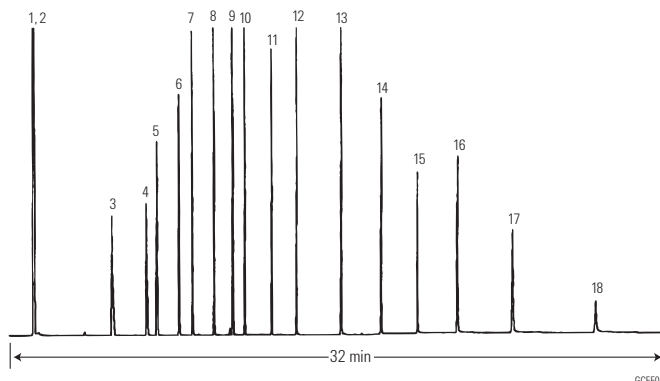
Carrier: Helium at 40 cm/s, measured at 100 °C

Oven: 100 °C for 5 min
100-250 °C at 10 °C/min
250 °C for 12 min

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

- | | |
|----------------------------------|--------------------------------------|
| 1. Acetone | 10. Caproic acid (hexanoic acid) |
| 2. Formic acid | 11. Heptanoic acid |
| 3. Acetic acid | 12. Octanoic acid |
| 4. Propionic acid | 13. Decanoic acid |
| 5. Isobutyric acid | 14. Dodecanoic acid |
| 6. Butyric acid | 15. Tetradecanoic acid |
| 7. Isovaleric acid | 16. Hexadecanoic acid |
| 8. Valeric acid (pentanoic acid) | 17. Octadecanoic acid |
| 9. Isocaproic acid | 18. Arachidic acid (eicosanoic acid) |



Suggested Supplies

- Septum:** 11 mm Advanced Green septa, 5183-4759
- Liner:** Split, single taper, low pressure drop, glass wool, 5183-4647
- Seal:** Gold plated seal, 18740-20885
- Syringe:** 5 µL tapered, FN 23-26s/42/HP, 5181-1273

Acids

Column: VF-WAXms
CP9205
30 m x 0.25 mm, 0.25 µm

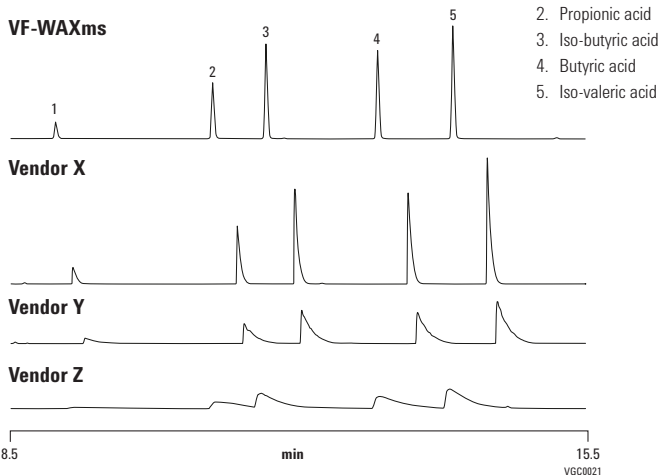
Sample: Acid sample, 0.1% (Cyclohexane), 1.0 µL

Carrier: Hydrogen, 75 kPa

Oven: 60 °C to 200 °C, 5 °C/min

Injection: 250 °C, split 100 mL/min

VF-WAXms



Bacterial Fatty Acid Methyl Esters

Column: DB-5
122-5032
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 42 cm/s

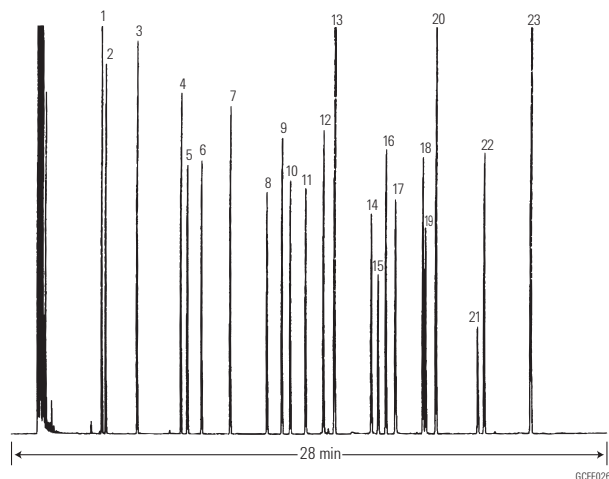
Oven: 150 °C for 4 min
150-250 °C at 4 °C/min

Injection: Split ratio 1:100

Detector: FID
Nitrogen makeup gas at 30 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



- | | |
|---------------------------------|---|
| 1. C _{11:0} | Methyl undecanoate |
| 2. 2-OH C _{10:0} | Methyl 2-hydroxydecanoate |
| 3. C _{12:0} | Methyl laurate |
| 4. C _{13:0} | Methyl tridecanoate |
| 5. 2-OH C _{12:0} | Methyl 2-hydroxydodecanoate |
| 6. 3-OH C _{12:0} | Methyl 3-hydroxydodecanoate |
| 7. C _{14:0} | Methyl myristate |
| 8. 12-Me C _{14:0} | Methyl 12-methyltetradecanoate |
| 9. C _{15:0} | Methyl pentadecanoate |
| 10. 2-OH C _{14:0} | Methyl 2-hydroxytetradecanoate |
| 11. 3-OH C _{14:0} | Methyl 3-hydroxytetradecanoate |
| 12. C _{16:1} | Methyl palmitoleate |
| 13. C _{16:0} | Methyl palmitate |
| 14. 14-Me C _{16:0} | Methyl 14-methylhexadecanoate |
| 15. 9,10-diMe C _{16:0} | Methyl cis-9,10-methyl hexadecanoate |
| 16. C _{17:0} | Methyl heptadecanoate |
| 17. 2-OH C _{16:0} | Methyl 2-hydroxyhexadecanoate |
| 18. C _{18:1} | Methyl oleate |
| 19. C _{18:1} | Methyl elaidate |
| 20. C _{18:0} | Methyl stearate |
| 21. 9,10-diMe C _{18:0} | Methyl cis-9,10-methylene octadecanoate |
| 22. C _{19:0} | Methyl nonadecanoate |
| 23. C _{20:0} | Methyl arachidate |

Separation of cis-trans FAME Isomers

Column: Select FAME
CP7421
200 m x 0.25 mm

Sample: 0.5 µL

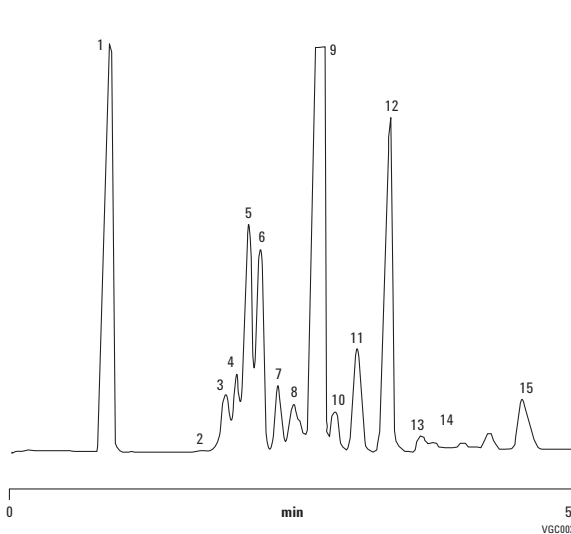
Sample Conc: 5 ng approx. per component on the column

Carrier: Helium, 520 kPa

Oven: 185 °C

Injection: Split, 1:20

Detector: FID



- | |
|-----------------------------------|
| 1. C _{18:0} |
| 2. C _{18:1} 7 trans |
| 3. C _{18:1} 8 trans |
| 4. C _{18:1} 9 trans |
| 5. C _{18:1} 10 trans |
| 6. C _{18:1} 11 trans |
| 7. C _{18:1} 12 trans |
| 8. C _{18:1} 13 trans + ? |
| 9. C _{18:1} 9 cis |
| 10. C _{18:1} 10 cis |
| 11. C _{18:1} 11 cis |
| 12. C _{18:1} 12 cis |
| 13. C _{18:1} 13 cis |
| 14. C _{18:1} 14 cis |
| 15. C _{18:1} 15 cis |

69 Component FAME Mix

Column: HP-88
112-8867
60 m x 0.25 mm, 0.20 μm

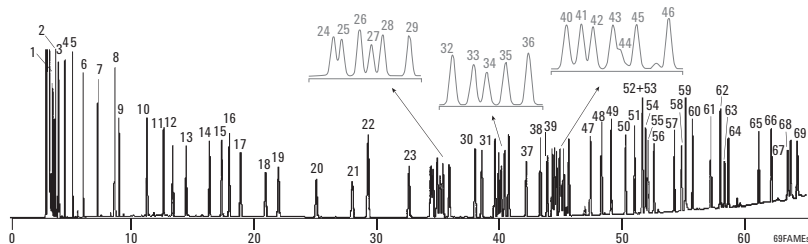
Carrier: He at 1.4 mL/min constant flow

Oven: 125 °C
125 °C to 145 °C at 8 °C/min
145 °C for 26 min
145 °C to 220 °C at 2 °C/min
220 °C for 1 min

Injection: Split, 250 °C
Split ratio 50:1
1 μL of 70 ppm each in CHCl₃

Detector: FID, 260 °C

- | | | | |
|-----------------|---------------------|------------------------|----------------------------|
| 1. nC6:0 | 16. C15:1 (14c) | 31. C19:1 (10t) | 50. C20:3 (8c,11c,14c) |
| 2. nC7:0 | 17. nC16:0 | 32. nC19:0 | 51. nC22:0 |
| 3. nC8:0 | 18. C16:1 (9t) | 33. C19:1 (7t) | 52. C22:1 (13t) |
| 4. nC9:0 | 19. C16:1 (9c) | 34. C18:2 (9c,12c) | 53. C20:4 (5c,8c,11c,14c) |
| 5. nC10:0 | 20. nC17:0 | 35. C19:1 (7c) | 54. C20:3 (11c,14c,17c) |
| 6. nC11:0 | 21. C17:1 (10t) | 36. C19:1 (10c) | 55. C21:2 (12c,15c) |
| 7. nC12:0 | 22. C17:1 (10c) | 37. C18:3 g(6c,9c,12c) | 56. C22:1 (13c) |
| 8. C12:1 (11c) | 23. nC18:0 | 38. nC20:0 | 57. nC23:0 |
| 9. nC13:0 | 24. C18:1 (6t) | 39. C18:3 (9c,12c,15c) | 58. C20:5 (EPA) |
| 10. nC14:0 | 25. C18:1 (9t) | 40. C20:1 (5c) | 59. C22:2 (13c,16c) |
| 11. C14:1 (9t) | 26. C18:1 (11t) | 41. C19:2 (10c,13c) | 60. C23:1 (14c) |
| 12. C14:1 (9c) | 27. nC18:1 (6c) | 42. C20:1 (11t) | 61. nC24:0 |
| 13. nC15:0 | 28. C18:1 (9c) | 43. C18:2 CONJ | 62. C22:3 (13c,16c,19c) |
| 14. C15:1 (10t) | 29. C18:1 (11c) | 44. C20:1 (8c) | 63. C22:4 (7c,10c,13c,16c) |
| 15. C15:1 (10c) | 30. nC18:2 (9t,12t) | 45. C20:1 (11c) | 64. C24:1 (15c) |
| | | 46. C18:2 (10t,12c) | 65. C22:5 (DPA) |
| | | 47. nC21:0 | 66. C22:6 (DHA) |
| | | 48. C20:2 (11c,14c) | 67. C18:1-12 Hydroxy (9t) |
| | | 49. C21:1 (12c) | 68. C18:0 12 Hydroxy |
| | | | 69. C18:1-12 Hydroxy (9c) |



FAME Standard

Column: DB-WAX
127-7012
10 m x 0.10 mm, 0.10 μm

Carrier: Hydrogen at 77 cm/s,
measured at 40 °C

Oven: 40 °C for 0.5 min
40-195 °C at 25 °C/min
195-205 °C at 3 °C/min
205-230 °C at 8 °C/min
230 °C for 1 min

Injection: Split, 250 °C
Split ratio 1:30

Detector: FID, 250 °C

- | | |
|---|--|
| 1. Butyric acid methyl ester (C _{4:0}) | 20. Linolelaic acid methyl ester (C _{18:2n6t}) |
| 2. Caproic acid methyl ester (C _{6:0}) | 21. γ-Linolenic acid methyl ester (C _{18:3n6}) |
| 3. Caprylic acid methyl ester (C _{8:0}) | 22. Linolenic acid methyl ester (C _{18:3n3}) |
| 4. Capric acid methyl ester (C _{10:0}) | 23. Arachidic acid methyl ester (C _{20:0}) |
| 5. Undecanoic acid methyl ester (C _{11:0}) | 24. cis-11,14-Eicosadienoic acid methyl ester (C _{20:2}) |
| 6. Lauric acid methyl ester (C _{12:0}) | 25. cis-11,14-Eicosadienoic acid methyl ester (C _{20:2}) |
| 7. Tridecanoic acid methyl ester (C _{13:0}) | 26. cis-8,11,14-Eicosatrienoic acid methyl ester (C _{20:3n6}) |
| 8. Myristic acid methyl ester (C _{14:0}) | 27. Heneicosanoic acid methyl ester (C _{21:0}) |
| 9. Myristoleic acid methyl ester (C _{14:1}) | 28. cis-11,14,17-Eicosatrienoic acid methyl ester (C _{20:3n3}) |
| 10. Pentadecanoic acid methyl ester (C _{15:0}) | 29. Arachidonic acid methyl ester (C _{20:4n6}) |
| 11. cis-10-Pentadecenoic acid methyl ester (C _{15:1}) | 30. cis-5,8,11,14,17-Eicosapentaenoic acid methyl ester (C _{20:5n3}) |
| 12. Palmitic acid methyl ester (C _{16:0}) | 31. Behenic acid methyl ester (C _{22:0}) |
| 13. Palmitoleic acid methyl ester (C _{16:1}) | 32. Erucic acid methyl ester (C _{22:1n9}) |
| 14. Heptadecanoic acid methyl ester (C _{17:0}) | 33. cis-13,16-Docosadienoic acid methyl ester (C _{22:2}) |
| 15. cis-10-Heptadecenoic acid methyl ester (C _{17:1}) | 34. Tricosanoic acid methyl ester (C _{23:0}) |
| 16. Stearic acid methyl ester (C _{18:0}) | 35. Lignoceric acid methyl ester (C _{24:0}) |
| 17. Oleic acid methyl ester (C _{18:1n9c}) | 36. cis-4,7,10,13,16,19-Docosahexaenoic acid methyl ester (C _{22:6n3}) |
| 18. Elaidic acid methyl ester (C _{18:1n9t}) | 37. Nervonic acid methyl ester (C _{24:1}) |
| 19. Linoleic acid methyl ester (C _{18:2n6c}) | |

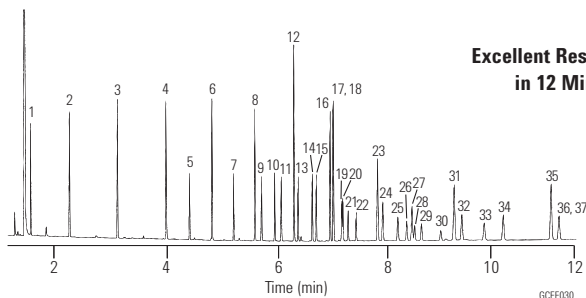
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop,
glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 μL tapered, FN 23-26s/42/HP,
5181-1273



FAME Standard

Column: DB-225
127-2222
20 m x 0.10 mm, 0.10 µm

Carrier: Hydrogen at 59.3 cm/s,
measured at 35 °C

Oven: 35 °C for 0.5 min
35-195 °C at 25 °C/min
195-205 °C at 3 °C/min
205-230 °C at 8 °C/min
230 °C for 1 min

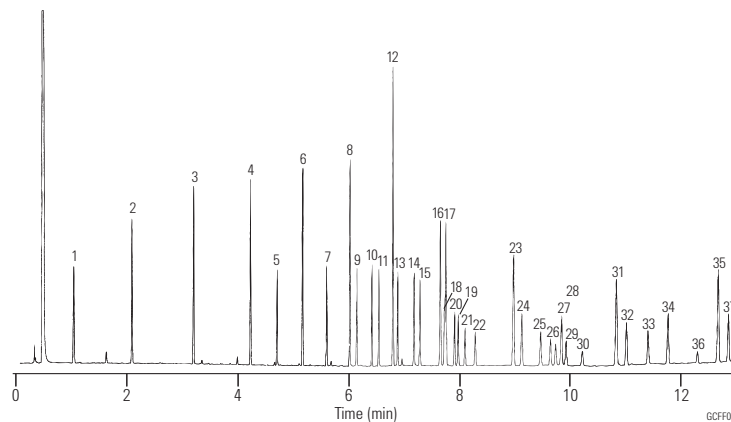
Injection: Split, 250 °C
Split ratio 1:30

Detector: FID, 250 °C

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

- | | |
|--|---|
| 1. Butyric acid methyl ester (C4:0) | 20. Linolelaidic acid methyl ester (C18:2n6t) |
| 2. Caproic acid methyl ester (C6:0) | 21. γ-Linolenic acid methyl ester (C18:3n6) |
| 3. Caprylic acid methyl ester (C8:0) | 22. Linolenic acid methyl ester (C18:3n3) |
| 4. Capric acid methyl ester (C10:0) | 23. Arachidic acid methyl ester (C20:0) |
| 5. Undecanoic acid methyl ester (C11:0) | 24. cis-11-Eicosenoic acid methyl ester (C20:1) |
| 6. Lauric acid methyl ester (C12:0) | 25. cis-11,14-Eicosadienoic acid methyl ester (C20:2) |
| 7. Tridecanoic acid methyl ester (C13:0) | 26. cis-8,11,14-Eicosatrienoic acid methyl ester (C20:3n6) |
| 8. Myristic acid methyl ester (C14:0) | 27. Heneicosanoic acid methyl ester (C21:0) |
| 9. Myristoleic acid methyl ester (C14:1) | 28. cis-11,14,17-Eicosatrienoic acid methyl ester (C20:3n3) |
| 10. Pentadecanoic acid methyl ester (C15:0) | 29. Arachidonic acid methyl ester (C20:4n6) |
| 11. cis-10-Pentadecenoic acid methyl ester (C15:1) | 30. cis-5,8,11,14,17-Eicosapentaenoic acid methyl ester (C20:5n3) |
| 12. Palmitic acid methyl ester (C16:0) | 31. Behenic acid methyl ester (C22:0) |
| 13. Palmitoleic acid methyl ester (C16:1) | 32. Erucic acid methyl ester (C22:1n9) |
| 14. Heptadecanoic acid methyl ester (C17:0) | 33. cis-13,16-Docosadienoic acid methyl ester (C22:2) |
| 15. cis-10-Heptadecenoic acid methyl ester (C17:1) | 34. Tricosanoic acid methyl ester (C23:0) |
| 16. Stearic acid methyl ester (C18:0) | 35. Lignoceric acid methyl ester (C24:0) |
| 17. Oleic acid methyl ester (C18:1n9c) | 36. cis-4,7,10,13,16,19-Docosahexaenoic acid methyl ester (C22:6n3) |
| 18. Elaidic acid methyl ester (C18:1n9t) | 37. Nervonic acid methyl ester (C24:1) |
| 19. Linoleic acid methyl ester (C18:2n6c) | |



**Canola Oil Margarine Partially Hydrogenated
FAMES AOCs Method 1c-89**

Column: DB-23
122-2362
60 m x 0.25 mm, 0.25 µm

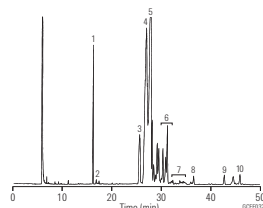
Carrier: Helium at 15 cm/s (0.44 mL/min),
measured at 150 °C

Oven: 150-200 °C at 1.3 °C/min
200 °C for 10 min

Injection: Split, 210 °C
Split 1:100

Detector: FID, 210 °C

Sample: 1 µL



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop,
glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP,
5181-1273

1. C16:0 Methyl palmitate
2. C16:1 Methyl palmitoleate
3. C18:0 Methyl stearate
4. C18:1 trans-Methyl elaidate and multiple isomers
5. C18:1 cis-Methyl oleate and multiple isomers
6. C18:2 trans-Multiple isomers
7. C18:2 cis-Multiple isomers
8. C18:3 Methyl linolenate
9. C20:0 Methyl arachidate
10. C20:1 Methyl 11-eicosanoate

Butter Triglycerides I

Column: DB-5ht
123-5731
30 m x 0.32 mm, 0.10 µm

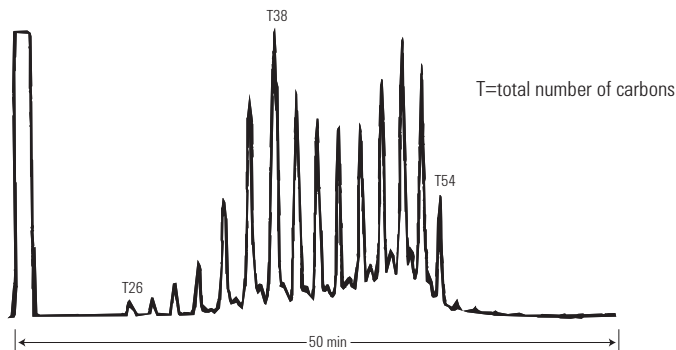
Carrier: Hydrogen at 55 cm/s, measured at 250 °C

Oven: 35-250 °C at 70 °C/min
250-400 °C at 5 °C/min
400 °C for 20 min

Injection: Cool on-column

Detector: FID, 400 °C
Nitrogen makeup gas at 30 mL/min
Baseline corrected

Sample: 1 µL of 9 µg/µL in toluene
(approximately 1% w/w solution)



Butter Triglycerides II

Column: DB-17ht
123-1831
30 m x 0.32 mm, 0.15 µm

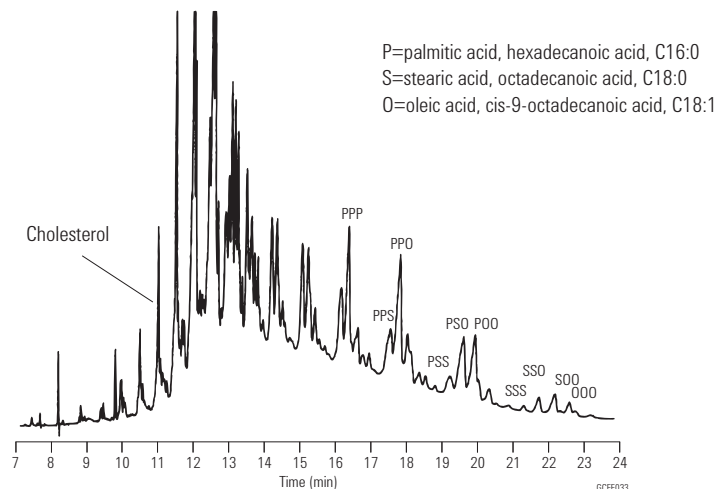
Carrier: Hydrogen at 40 cm/s

Oven: 250-365 °C at 5 °C/min
365 °C for 1 min

Injection: Cool on-column

Detector: FID, 400 °C
Nitrogen makeup gas at 30 mL/min
Baseline corrected

Sample: 1 µL of 9 µg/µL in toluene
(approximately 1% w/w solution)



Fast Screening of FAME Isomers in Butter

Column: VF-23ms
CP8822
30 m x 0.25 mm, 0.25 µm

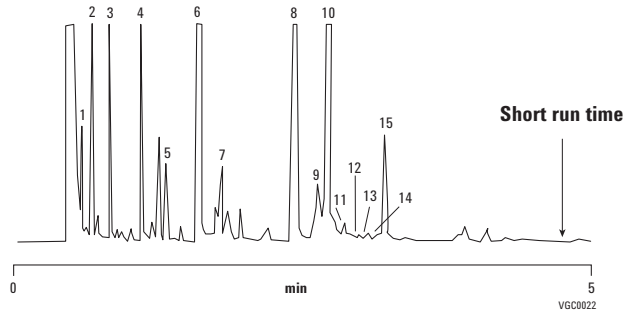
Sample: 0.5 µL ca. 5 ng per component on column

Carrier: Hydrogen, 70 kPa

Oven: 185 °C

Injection: Split, 1:100
T=275 °C

Detector: FID



1. C8:0
2. C10:0
3. C12:0
4. C14:0
5. C14:1
6. C14:1
7. C16:1 9-cis
8. C16:1 9-cis
9. C18:1 trans
10. C18:1 9-cis
11. C18:1 13-cis
12. C18:2 9-trans, 12-trans
13. C18:2 9-cis, 12-trans
14. C18:2 9-trans, 12-cis
15. C18:2 9-cis, 12-cis

Pesticides in Sunflower Oil

Column: VF-5ms
CP8960
60 m x 0.25 mm, 0.25 µm

Sample: 5 µL, splitless

Sample Conc: 40 ppb

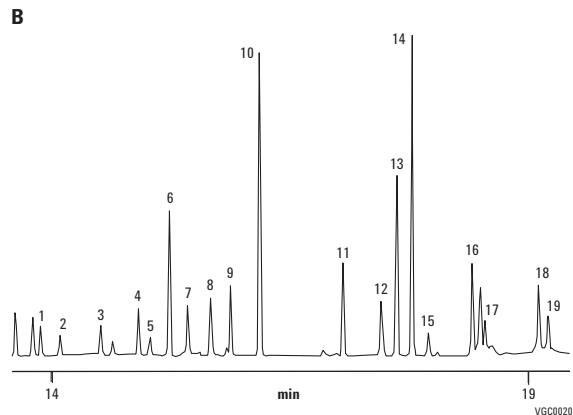
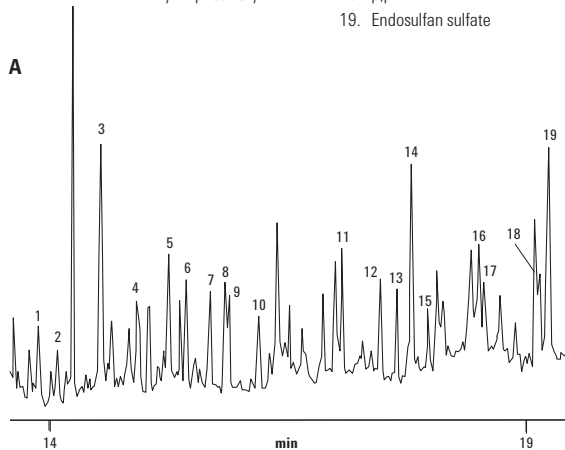
Carrier: He, 1.2 mL/min, constant flow

Oven: 70 °C (3.0 min), 25 °C to 190 °C/min (0.0 min) to
10 °C/min to 320 °C (10 min)

Injection: 1079 with carbofrit liner

Detector: A: Ion Trap in MS/MS, full scan
B: MS/MS

- | | | | |
|----------------------|------------------------|----------------------|------------------------|
| 1. β-HCH | 10. Bromofos | 1. β-HCH | 10. Promofos |
| 2. γ-HCH | 11. o,p'-DDE | 2. γ-HCH | 11. o,p'-DDE |
| 3. δ-HCH | 12. α-Endosulfan | 3. δ-HCH | 12. α-Endosulfan |
| 4. + Vinclozolin | 13. p,p'-DDE | 4. + Vinclozolin | 13. p,p'-DDE |
| 5. Pyrimiphos methyl | 14. o,p'-DDD | 5. Methyl parathion | 14. o,p'-DDD |
| 6. + Malathion | 15. Dieldrin | 6. Pyrimiphos methyl | 15. Dieldrin |
| 7. Chloropyrifos | 16. p,p'-DDD | 7. + Fenitrothion | 16. p,p'-DDD |
| 8. Ethyl parathion | 17. b Endosulfan | 8. Chloropyrifos | 17. b Endosulfan |
| 9. Pyrimiphos ethyl | 18. p,p'-DDT | 9. Pyrimiphos ethyl | 18. p,p'-DDT |
| | 19. Endosulfan sulfate | | 19. Endosulfan sulfate |



Energy and Fuels Applications

Fast Analysis of Aromatic Solvent

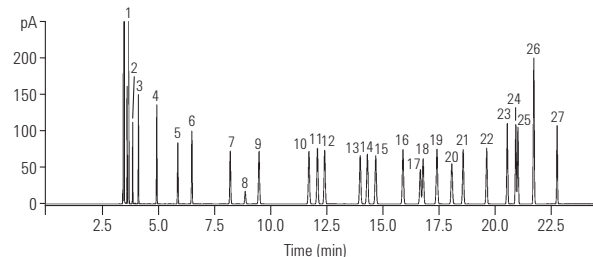
Column: HP-INNOWax
19091N-216
60 m x 0.32 mm, 0.50 μ m

Carrier: Helium at 20 psi constant pressure mode
Oven: 75 °C (10 min); 3 °C/min to 100 °C (0 min)
10 °C/min to 145 °C (0 min)
Injection: Split/splitless at 250 °C
100:1 split ratio
Detector: FID at 250 °C
Sample: 1.0 μ L

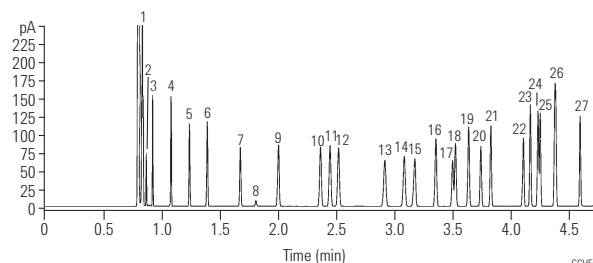
Column: HP-INNOWax
19091N-577
20 m x 0.18 mm, 0.18 μ m

Carrier: Helium at 33 psi constant pressure mode
Oven: 70 °C (3 min); 45 °C/min to 145 °C (1 min)
Injection: Split/splitless at 250 °C
100:1 to 600:1 split ratio
Detector: FID at 250 °C
Sample: 0.2 to 1.0 μ L

Unified aromatic solvent method



Optimized unified aromatic solvent method



1. Heptane
2. Cyclohexane
3. Octane
4. Nonane
5. Benzene
6. Decane
7. Toluene
8. 1,4-Dioxane
9. Undecane
10. Ethylbenzene
11. p-Xylene
12. m-Xylene
13. Cumene
14. Dodecane
15. o-Xylene
16. Propylbenzene
17. p-Ethyltoluene
18. m-Ethyltoluene
19. t-Butylbenzene
20. s-Butylbenzene
21. Styrene
22. Tridecane
23. 1,3-Diethylbenzene
24. 1,2-Diethylbenzene
25. n-Butylbenzene
26. a-Methylstyrene
27. Phenylacetylene

This application showcases the practicality using high efficiency GC columns in daily aromatic solvent analysis. The result: a four-fold reduction in run time (compared to a 0.32 mm id column) with no compromise in resolution.

Refinery Gas I

Column: HP-PLOT Q
19095P-Q04
30 m x 0.53 mm, 40.00 µm

Carrier: Helium p=9.0 psi at 60 °C

Oven: 60 °C for 5 min
60-200 °C at 20 °C/min
200 °C for 1 min

Injection: Split, 250 °C
Split flow 100 mL/min
0.25 cc valve

Detector: TCD, 250 °C

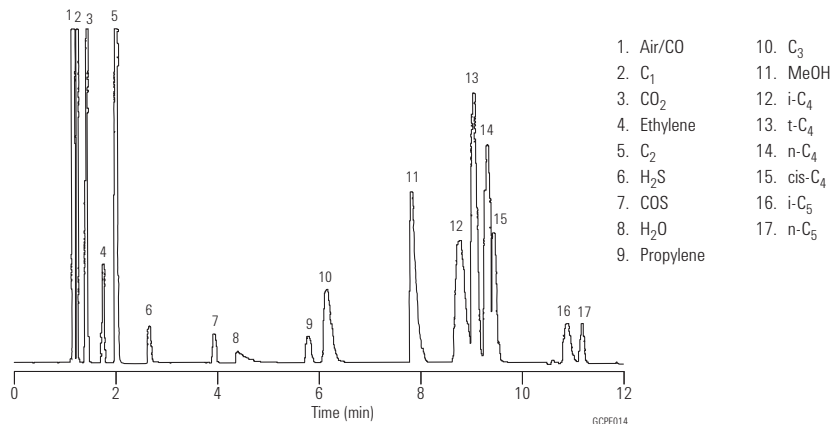
Sample: Refinery gas and others

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



Unleaded Gasoline

Column: DB-Petro
122-10A6
100 m x 0.25 mm, 0.50 µm

Carrier: Helium at 25.6 cm/s

Oven: 0 °C for 15 min
0-50 °C at 1 °C/min
50-130 °C at 2 °C/min
130-180 °C at 4 °C/min
180 °C for 20 min

Injection: Split, 200 °C
Split ratio 1:300

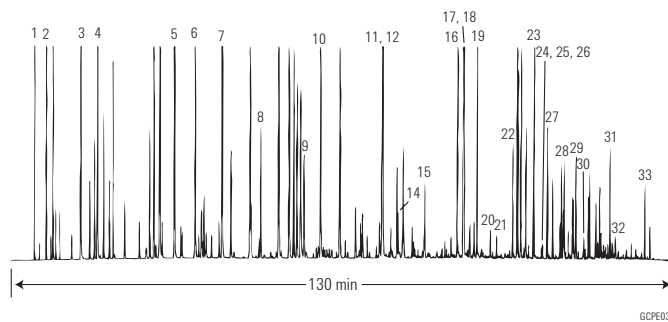
Detector: FID, 250 °C
Nitrogen makeup gas
at 30 mL/min

Sample: 1 µL of neat sample

- | | | |
|-----------------------|----------------------------|--------------------------------|
| 1. Methane | 12. 2,3,3-Trimethylpentane | 23. 1,2,4-Trimethylbenzene |
| 2. n-Butane | 13. 2-Methylheptane | 24. Isobutylbenzene |
| 3. Isopentane | 14. 4-Methylheptane | 25. sec-Butylbenzene |
| 4. n-Pentane | 15. n-Octane | 26. n-Decane |
| 5. n-Hexane | 16. Ethylbenzene | 27. 1,2,3-Trimethylbenzene |
| 6. Methylcyclopentane | 17. m-Xylene ** | 28. Butylbenzene |
| 7. Benzene | 18. p-Xylene | 29. n-Undecane |
| 8. Cyclohexane | 19. o-Xylene | 30. 1,2,4,5-Tetramethylbenzene |
| 9. Isooctane | 20. n-Nonane | 31. Naphthalene |
| 10. n-Heptane | 21. Isopropylbenzene | 32. Dodecane |
| 11. Toluene * | 22. Propylbenzene | 33. Tridecane |

*Valley point with 12 = 78%

**Valley point with 18 = 87%



n-Paraffin Standard

Column: DB-HT Sim Dis
145-1001
5 m x 0.53 mm, 0.15 µm

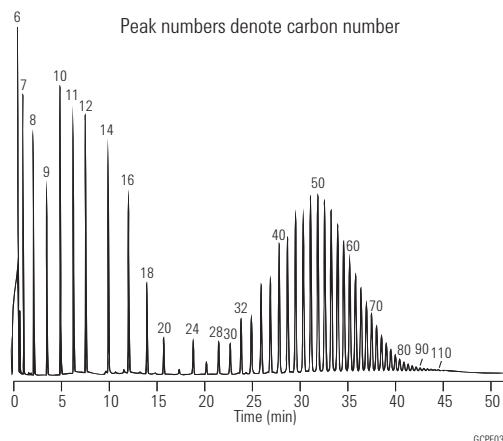
Carrier: Helium at 18 mL/min, measured at 35 °C

Oven: -30-430 °C at 10 °C/min

Injection: OPTIC PTV
55-450 °C at 2 °C/s

Detector: FID, 450 °C
Nitrogen makeup gas at 15 mL/min

Sample: 0.5 µL of about 2% n-paraffins in CS₂

**Sulfur Standards in Toluene**

Column: DB-Sulfur SCD
G3903-63001
60 m x 0.32 mm, 4.20 µm

Inlet: 275 °C, Split ratio 10:1
(Inert Flow Path split/splitless inlet)

Carrier: Helium, constant flow mode, 2.8 mL/min

Oven: 35 °C for 3 min,
35 °C to 250 °C at 10 °C/min,
250 °C for 10 min

Injection: 1 µL

Burner temperature: 800 °C

Vacuum of burner: 364 torr

Vacuum of reaction cell: 5 torr

Hydrogen: 40 mL/min

Air: 60 mL/min

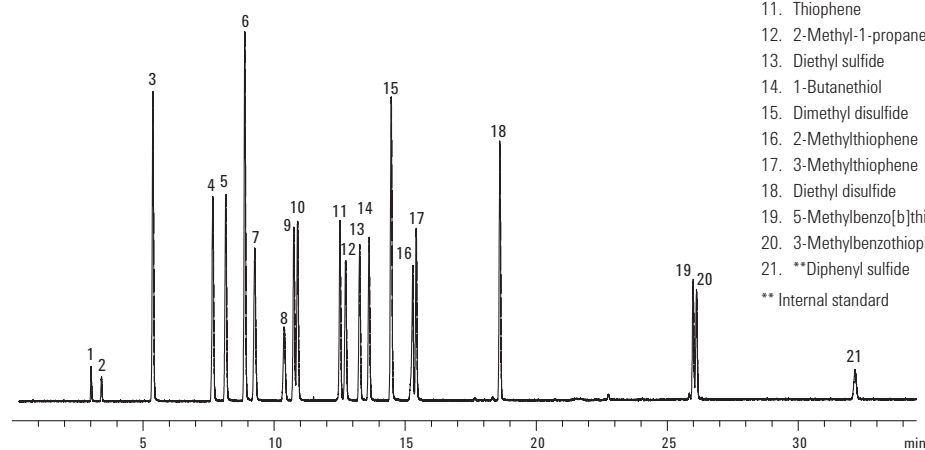
Suggested Supplies

Septum: Non-stick bleed and temperature optimized (BTO) septa, 11 mm, 50/pk, 5183-4757

Liner: Low pressure drop, Ultra Inert Liner with glass wool, 5190-2295

Seal: Ultra Inert gold plated seal and washer, 5190-6144

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



CAS No. **Formula** **Concentration (mg/kg)**

1.	Hydrogen sulfide	7783-06-4	H ₂ S	2000
2.	Carbonyl sulfide	463-58-1	COS	2000
3.	Methanethiol	74-93-1	CH ₃ SH	2000
4.	Ethanethiol	75-08-1	C ₂ H ₅ SH	2000
5.	Dimethyl sulfide	75-18-3	(CH ₃) ₂ S	2000
6.	Carbon disulfide	75-15-0	CS ₂	2000
7.	2-Propanethiol	75-33-2	C ₃ H ₇ S	2000
8.	2-Methyl-2-propanethiol	75-66-1	C ₄ H ₁₀ S	2000
9.	1-Propanethiol	107-03-9	C ₃ H ₇ S	2000
10.	Ethyl methyl sulfide	624-89-5	C ₂ H ₅ SCH ₃	2000
11.	Thiophene	110-02-1	C ₄ H ₄ S	2000
12.	2-Methyl-1-propanethiol	513-44-0	C ₄ H ₁₀ S	2000
13.	Diethyl sulfide	352-93-2	(C ₂ H ₅) ₂ S	2000
14.	1-Butanethiol	109-79-5	C ₄ H ₁₀ S	2000
15.	Dimethyl disulfide	624-92-0	(CH ₃) ₂ S ₂	2000
16.	2-Methylthiophene	554-14-3	C ₅ H ₆ S	2000
17.	3-Methylthiophene	616-44-4	C ₅ H ₆ S	2000
18.	Diethyl disulfide	110-81-6	(C ₂ H ₅ S) ₂	2000
19.	5-Methylbenzo[b]thiophene	14315-14-1	C ₉ H ₈ S	2000
20.	3-Methylbenzothiophene	1455-18-1	C ₉ H ₈ S	2000
21.	**Diphenyl sulfide	139-66-2	C ₁₂ H ₁₀ S	2000

** Internal standard

Sulfur Compounds in Propylene (1 ppm)

Column: GS-GasPro
113-4332
30 m x 0.32 mm

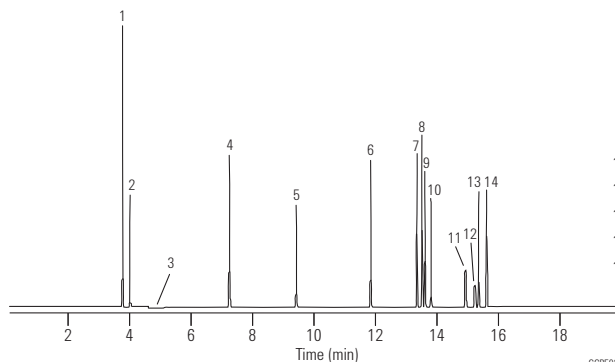
Oven: 60 °C for 2.5 min
60-250 °C at 10 °C/min

Injection: OI Analytical Volatiles Inlet
Split ratio 5:1
200 µL gas sampling valve

Detector: OI Analytical Model 5380 PFPD

Sample: 1 ppm sulfur compounds in propylene

Chromatogram courtesy of OI Analytical



1. COS
2. H₂S
3. Propylene
4. CS₂
5. Methyl mercaptan
6. Ethyl mercaptan
7. Thiophene
8. Dimethyl sulfide
9. 2-Propanethiol
10. 1-Propanethiol
11. 2-Methyl-2-propanethiol
12. 2-Methyl-1-propanethiol
13. 1-Methyl-1-propanethiol
14. 1-Butanethiol

Sulfur Impurities in Propylene

Column: Select Low Sulfur
CP8575
60 m x 0.32 mm

Oven: 65 °C for 4 min, 30 °C/min to 120 °C for 5 min

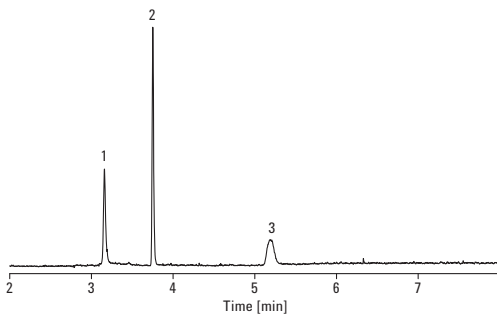
Carrier: Helium, constant flow, 2.0 mL/min

Injection: Gas sampling valve
220 °C, split 1:10

Detector: SCD, 200 °C

Sample: Polypropylene matrix containing
~300 ppb H₂S and CH₃SH, ~500 ppb COS

Injection Volume: 1 mL



1. H₂S
2. COS
3. CH₃SH

C₁ to C₄ Hydrocarbon Mix

Column: PoraPLOT Q PT
CP7550PT
10 m x 0.32 mm, 10.00 μ m

Carrier: Helium, 1 mL/min in constant flow mode

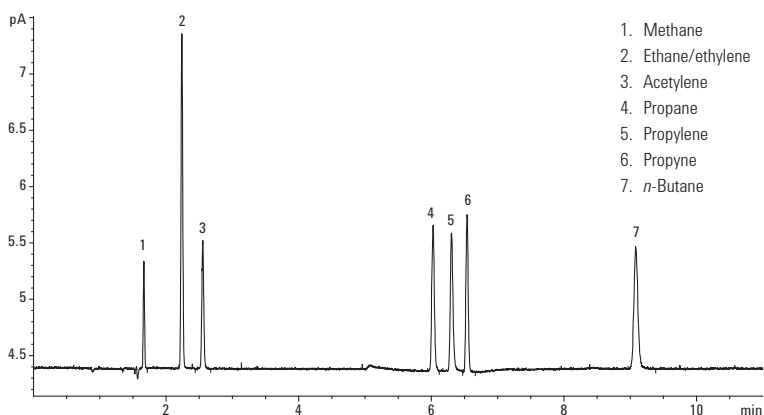
Oven: 50 °C (5 min) then to 120 °C at 50 °C/min,
hold 4.6 min

Sampler: Headspace unit
Oven 40 °C, valve 50 °C, transfer line 60 °C

Detector: FID or TCD at 250 °C

Injection Volume: 0.1 mL loop fitted to inlet valve of headspace unit

Inlet: Split mode at 5:1, typically at 70 °C or higher
depending on column oven initial conditions



PoraPLOT Q PT, 10 m x 0.32 mm, with attached manufacturer-prepared integrated dual-ended particle trap, showing the absence of particles or spikes on FID.

Column: PoraPLOT U PT
CP7584PT
25 m x 0.53 mm, 20.00 μ m

Carrier: Helium, 2 mL/min in constant flow mode

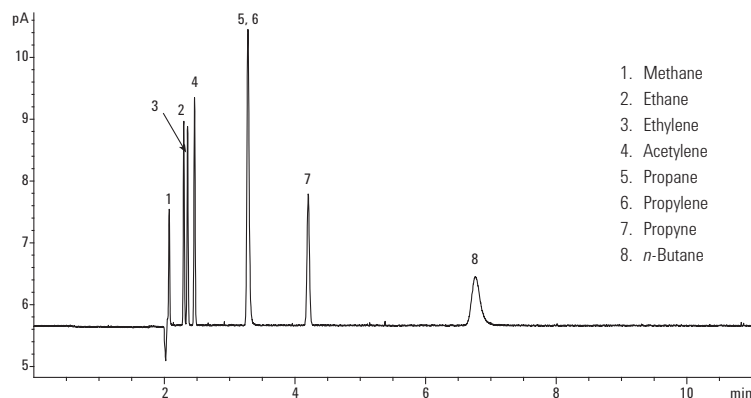
Oven: 85 °C isothermal

Sampler: Headspace unit
Oven 40 °C, valve 50 °C, transfer line 60 °C

Detector: FID or TCD at 250 °C

Injection Volume: 0.1 mL loop fitted to inlet valve of headspace unit

Inlet: Split mode at 5:1, typically at 70 °C or higher
depending on column oven initial conditions



PoraPLOT U PT, 25 m x 0.53 mm, 20 μ m film, with attached manufacturer-prepared integrated dual-ended particle trap, showing the lack of particles or spikes on FID.

Column: HP-PLOT Al₂O₃ KCI PT
19095P-K25PT
50 m x 0.53 mm, 15.00 μ m

Carrier: Helium, 3 mL/min in constant flow mode

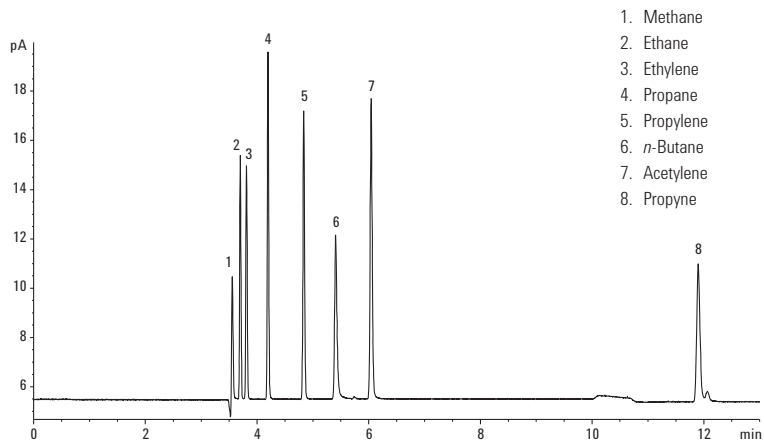
Oven: 100 °C (10 min) then to 120 °C at 30 °C/min,
hold 3 min

Sampler: Headspace unit
Oven 40 °C, valve 50 °C, transfer line 60 °C

Detector: FID or TCD at 250 °C

Injection Volume: 0.1 mL loop fitted to inlet valve of headspace unit

Inlet: Split mode at 5:1, typically at 70 °C or higher
depending on column oven initial conditions



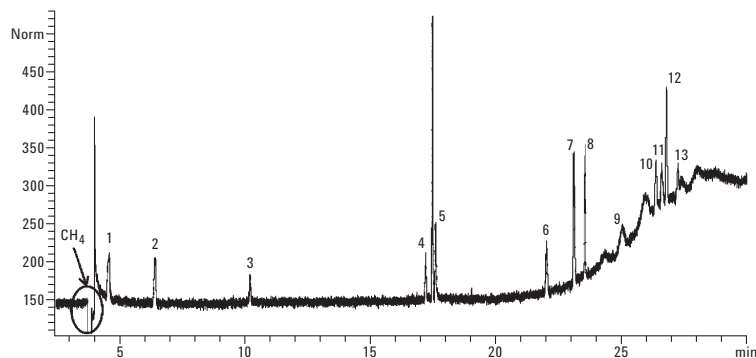
HP-PLOT Al₂O₃ KCI PT, 50 m x 0.53 mm, 15 μ m film, with integrated dual-ended particle trap, showing lack of particles or spikes on FID.

Trace Sulfur Compounds in Methane (50 ppbv)

Column: **Select Low Sulfur
CP8575
60 m x 0.32 mm**

Oven: 40 °C (6 min), to 120 °C at 6 °C/min,
to 180 °C (5 min) at 10 °C/min

Sample: 1 mL, split ratio: 3:1



Compound	Signal/noise
1. Hydrogen sulfide	3.8
2. Carbonyl sulfide	4.0
3. Methylmercaptan	2.2
4. Ethylmercaptan	3.8
5. Dimethyl sulfide	6.3
6. 2-Propanethiol	4.3
7. Methyl ethyl sulfide	11
8. Thiophene	11
9. tert-Butyl mercaptan	2.1
10. 2-Butanethiol	4.5
11. 2-Methyl-1 propanethiol	3.7
12. Diethyl sulfide	9.8
13. 1-Butanethiol	2.4

Trace Oxygenates
in Light Hydrocarbon Matrices

Column: **DB-1
125-102J
25 m x 0.53 mm, 1.00 µm**

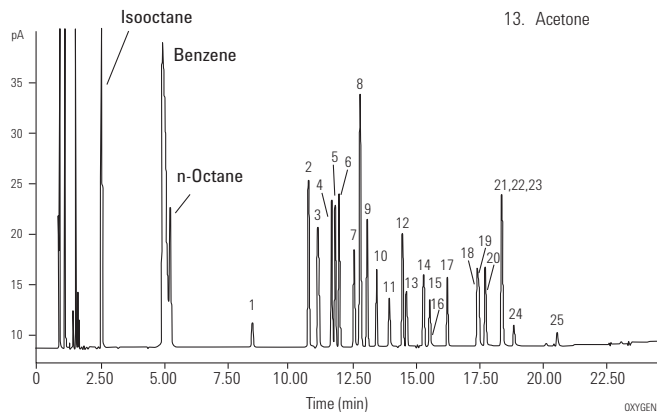
Column: **GS-OxyPLOT
115-4912
10 m x 0.53 mm**

Carrier: Helium (tm = 0.96 min at 50 °C)

Oven: 50 °C for 5 min
50 °C to 240 °C

Injection: Split

Detector: FID



1. Dimethyl ether	14. Isovaleraldehyde
2. Diethyl ether	15. Valeraldehyde
3. Acetaldehyde	16. Methyl ethyl ketone
4. Ethyl t-butyl ether	17. Ethanol
5. Methyl t-butyl ether	18. n-Propanol
6. Diisopropyl ether	19. Isopropanol
7. Propionaldehyde	20. Allyl alcohol
8. Tert-amyl methyl ether	21. Isobutanol
9. Propyl ether	22. t-Butyl alcohol
10. Isobutylaldehyde	23. s-Butyl alcohol
11. Butylaldehyde	24. n-Butyl alcohol
12. Methanol	25. 2-Methyl-2 pentanol
13. Acetone	

Selected Oxygenates

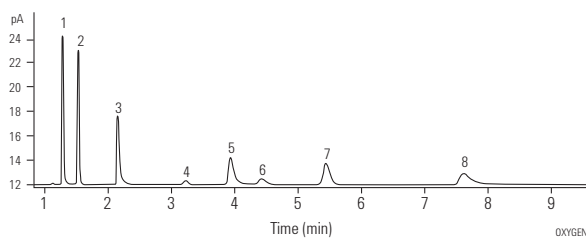
Column: GS-OxyPLOT
115-4912
10 m x 0.53 mm

Carrier: Helium at 41 cm/s

Oven: 150 °C isothermal

Injection: Split, 1:40, 250 °C

Detector: FID, 290 °C



1. n-Dodecane
2. Methyl t-butyl ether
3. n-Tridecane
4. Iso-Butyraldehyde
5. n-Tetradecane
6. Methanol
7. Acetone
8. n-Pentadecane

Noble Gases

Column: HP-PLOT Molesieve
19095P-MS0
30 m x 0.53 mm, 50.00 µm

Carrier: Helium, 4 mL/min

Oven: 35 °C for 3 min
35-120 °C at 25 °C/min
120 °C for 5 min

Injection: Split ratio 50:1

Detector: TCD

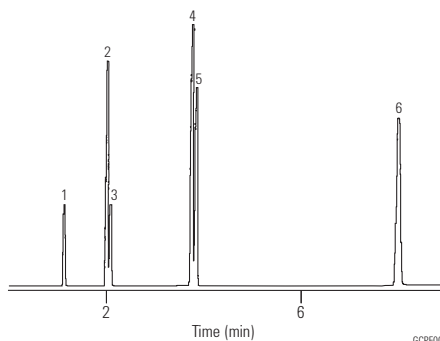
Sample: 250 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Neon
2. Argon
3. Oxygen
4. Nitrogen
5. Krypton
6. Xenon

Permanent Gases

Column: HP-PLOT Molesieve
19091P-MS4
30 m x 0.32 mm, 12.00 µm

Carrier: Helium, 2 mL/min

Oven: 40 °C isothermal

Injection: Split ratio 75:1

Detector: TCD

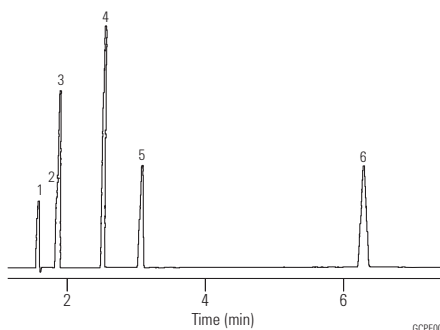
Sample: 250 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Neon
2. Argon
3. Oxygen
4. Nitrogen
5. Methane
6. Carbon monoxide

Baseline Resolution of Air/CO, CO₂, and Methane in a Natural Gas Sample

Column: HP-PLOT Q
19095P-Q04
30 m x 0.53 mm, 40.00 µm

Carrier: Helium (8.6 mL/min at 60 °C)

Oven: 60 °C for 2 min
60-240 °C at 30 °C/min
240 °C for 1 min

Injection: Split ratio 12:1

Detector: TCD, 250 °C

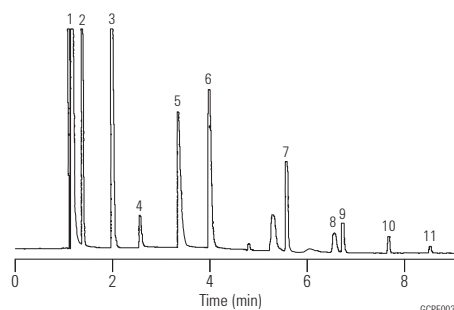
Sample: 0.25 cc natural gas sample, methane, 80%+

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Air/CO
2. CO₂
3. Ethane
4. H₂S
5. Water
6. C₃
7. i-C₄/n-C₄
8. neo-C₅
9. i-C₅/n-C₅
10. C₆
11. C₇

Natural Gas

Column: HP-PLOT Al₂O₃ S
19095P-S21
15 m x 0.53 mm, 15.00 µm

Carrier: Helium, 50 cm/s (100 °C), 6 mL/min

Oven: 100 °C for 1.5 min
100-180 °C at 30 °C/min

Injection: Split, 250 °C
Split ratio 50:1

Detector: FID, 250 °C

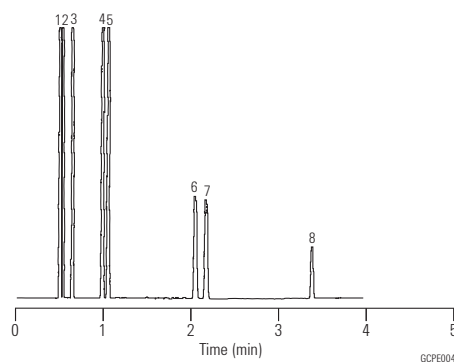
Sample: 5 µL natural gas, p/n 5080-8756

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Methane
2. Ethane
3. Propane
4. iso-Butane
5. n-Butane
6. iso-Pentane
7. n-Pentane
8. n-Hexane

Ethylene

Column: HP-PLOT Al₂O₃ S
19095P-S25
50 m x 0.53 mm, 15.00 μm

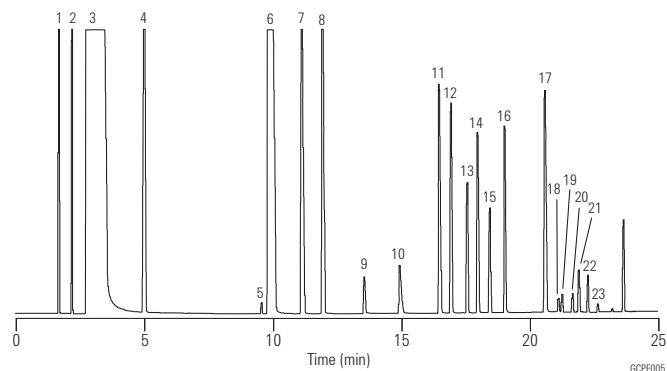
Carrier: Helium, 50 cm/s (35 °C),
7 mL/min constant flow

Oven: 35 °C for 2 min
35-100 °C at 5 °C/min

Injection: Split, 250 °C
Split ratio 65:1

Detector: FID, 250 °C

Sample: 5 μL
ethylene 98.4%



1. Methane
2. Ethane
3. Ethylene
4. Propane
5. Cyclopropane
6. Propylene
7. Isobutane
8. n-Butane
9. Propadiene
10. Acetylene
11. trans-2-Butene
12. Butene-1
13. Isobutylene
14. cis-2-Butene
15. Isopentane
16. n-Pentane
17. 1,3-Butadiene
18. Propyne
19. trans-2-Pentene
20. 2-Methyl-2-butene
21. Pentene-1
22. cis-2-Pentene
23. n-Hexane

Impurities in Ethylene

Column: GS-Alumina KCl
115-3352
50 m x 0.53 mm

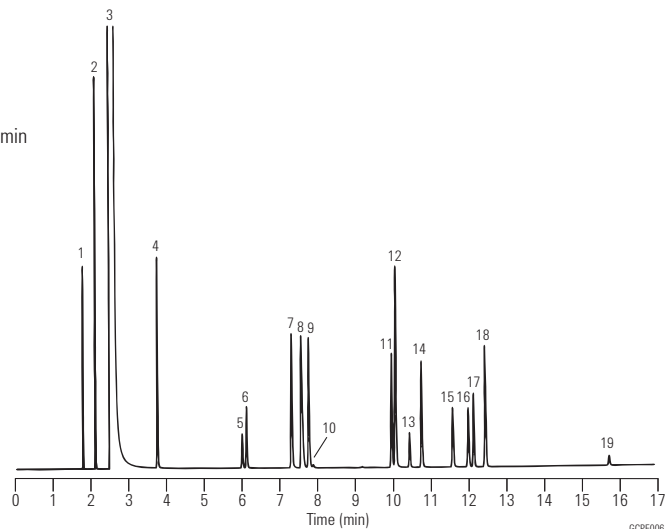
Carrier: Helium at 8 mL/min, measured at 35 °C

Oven: 35 °C for 2 min
35-190 °C at 10 °C/min
190 °C for 3 min

Injection: Split, 200 °C
Split ratio 1:40

Detector: FID, 200 °C
Nitrogen makeup gas at 20 mL/min

Sample: 0.2 mL of trace hydrocarbons
in ethylene



1. Methane
2. Ethane
3. Ethylene
4. Propane
5. Cyclopropane
6. Propylene
7. Isobutane
8. Acetylene
9. n-Butane
10. Propadiene
11. trans-2-Butene
12. 1-Butene
13. Isobutylene
14. cis-2-Butene
15. Isopentane
16. n-Pentane
17. Propyne
18. 1,3-Butadiene
19. 1-Pentene

Impurities in Propylene

Column: GS-Alumina KCl
115-3352
50 m x 0.53 mm

Carrier: Helium at 10 mL/min,
measured at 35 °C

Oven: 35 °C for 2 min
35-190 °C at 10 °C/min
190 °C for 3 min

Injection: Split, 200 °C
Split ratio 1:30

Detector: FID, 200 °C
Nitrogen makeup gas
at 20 mL/min

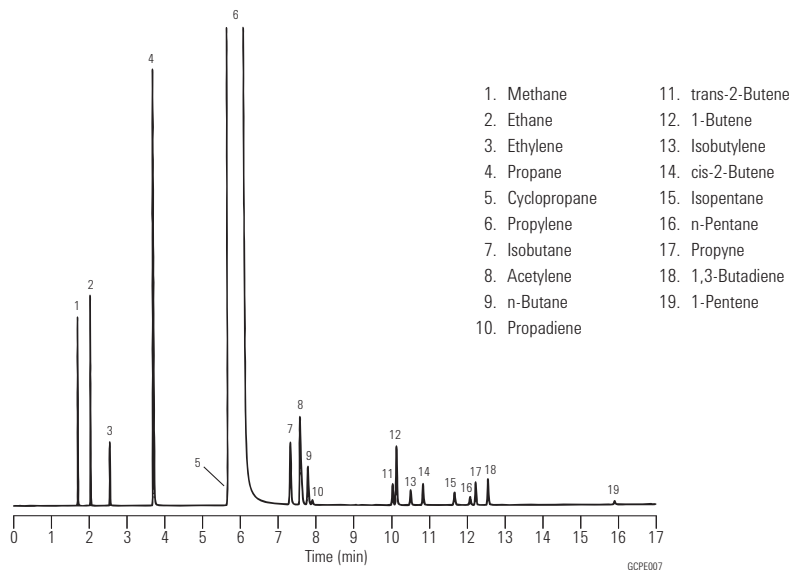
Sample: 0.2 mL of trace
hydrocarbons in propylene

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

**Propylene**

Column: GS-Alumina
115-3552
50 m x 0.53 mm

Carrier: Helium at 10 mL/min,
measured at 35 °C

Oven: 35 °C for 2 min
35-190 °C at 10 °C/min
190 °C for 3 min

Injection: Split, 200 °C
Split ratio 1:30

Detector: FID, 200 °C
Nitrogen makeup gas
at 20 mL/min

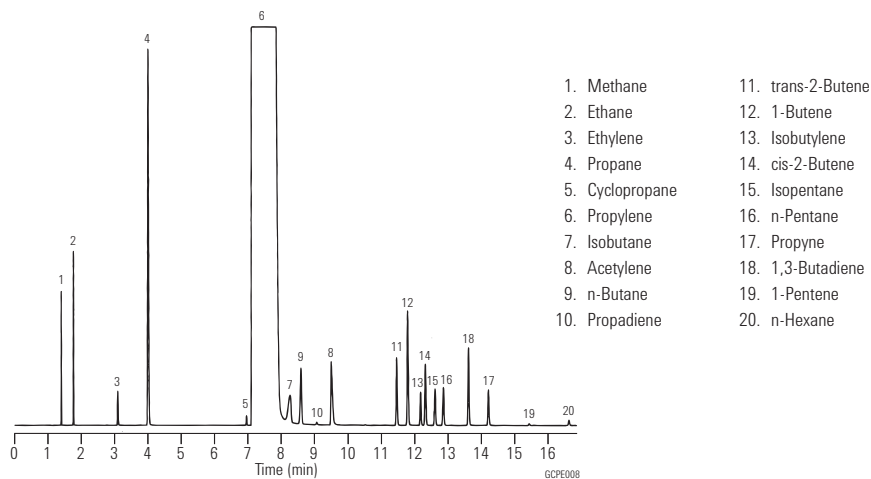
Sample: 0.2 mL of trace
hydrocarbons in propylene

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1,3-Butadiene

Column: DB-624
128-1324
25 m x 0.20 mm, 1.12 μ m

Carrier: Helium at 1.0 mL/min

Oven: -20 °C for 3 min
-20 °C to 20 °C at 4 °C/min
20 °C to 200 °C at 8 °C/min
200 °C for 10 min

Injection: Split, 250 °C
Split ratio 1:150

Detector: FID, 250 °C

Sample: 0.5 μ L

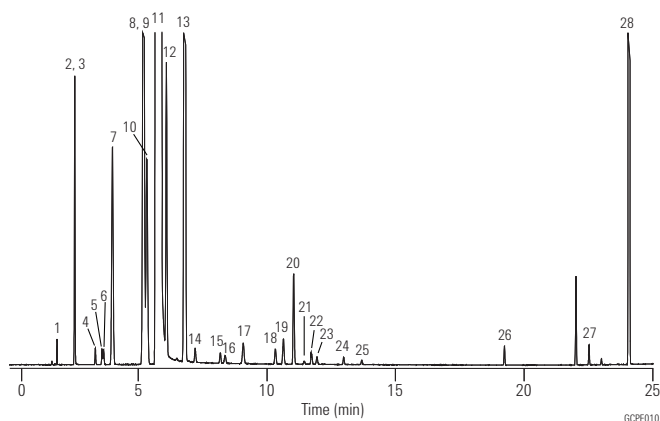
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

Agilent Technologies wishes to thank DCG Industries
(Pearland, TX) for providing this chromatogram.

**Refined Butadiene Standard Component****Gravimetric concentration (PPM)**

1. Acetylene	20.7
2. Propane	19.8
3. Propylene	296
4. Propadiene (allene)	21.1
5. Propyne (methylacetylene)	21
6. Cyclopropane	20
7. Isobutane	506
8. Butene-1	999
9. Isobutylene	495
10. n-Butane	494
11. 1,3-Butadiene	balance
12. trans-2-Butene	442
13. cis-2-Butene	1946
14. 1-Butyne (ethylacetylene)	20.2
15. 1,2-Butadiene	28.9
16. 3-Methyl-1-butene	19.8
17. Isopentane	50.1
18. Pentene-1	29.8
19. n-Pentane	50.1
20. 2-Butyne (dimethylacetylene)	150
21. trans-2-Pentene	5.57
22. Isoprene	20
23. cis-2-Pentene	13.9
24. trans-1,3-Pentadiene	13.8
25. cis-1,3-Pentadiene	7.73
26. Benzene	20.3
27. Toluene	20.2
28. Dimer (4-vinylcyclohexene-1)	

1,3-Butadiene Purity

Column: GS-Alumina
115-3552
50 m x 0.53 mm

Carrier: Helium, 6.0 mL/min
(constant flow mode)

Oven: 45 °C for 3 min
6 °C/min to 195 °C
195 °C for 15 min

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 250 °C

Sample: 0.5 µL

Suggested Supplies

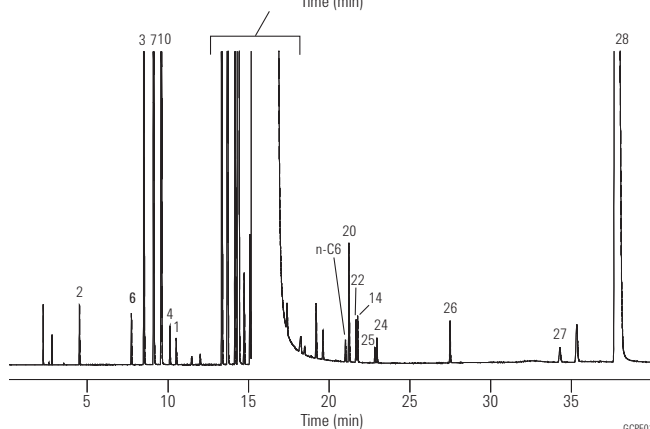
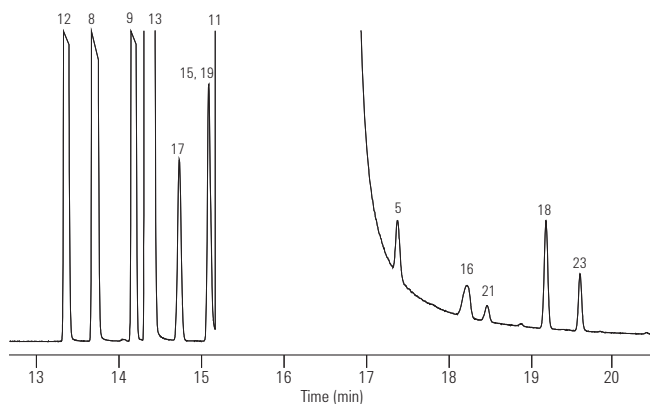
Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

Refined Butadiene Standard

Component	Gravimetric concentration (PPM)
1. Acetylene	20.7
2. Propane	19.8
3. Propylene	296
4. Propadiene (allene)	21.1
5. Propyne (methylacetylene)	21
6. Cyclopropane	20
7. Isobutane	506
8. Butene-1	999
9. Isobutylene	495
10. n-Butane	494
11. 1,3-Butadiene	Balance
12. trans-2-Butene	442
13. cis-2-Butene	1946
14. 1-Butyne (ethylacetylene)	20.2
15. 1,2-Butadiene	28.9
16. 3-Methyl-1-butene	19.8
17. Isopentane	50.1
18. Pentene-1	29.8
19. n-Pentane	50.1
20. 2-Butyne (dimethylacetylene)	150
21. trans-2-Pentene	5.57
22. Isoprene	20
23. cis-2-Pentene	13.9
24. trans-1,3-Pentadiene	13.8
25. cis-1,3-Pentadiene	7.73
26. Benzene	20.3
27. Toluene	20.2
28. Dimer (4-vinylcyclohexene-1)	



GCPE011

Extended Hydrocarbon Analysis I

Column: GS-Alumina
115-3532
30 m x 0.53 mm

Carrier: Helium at 52 cm/s (6.7 mL/min),
measured at 100 °C

Oven: 100 °C for 1 min
100-140 °C at 8 °C/min
140 °C for 0.5 min
140-200 °C at 30 °C/min

Injection: Split, 250 °C
Split ratio 1:8

Detector: FID, 275 °C
Nitrogen makeup gas at 29 mL/min

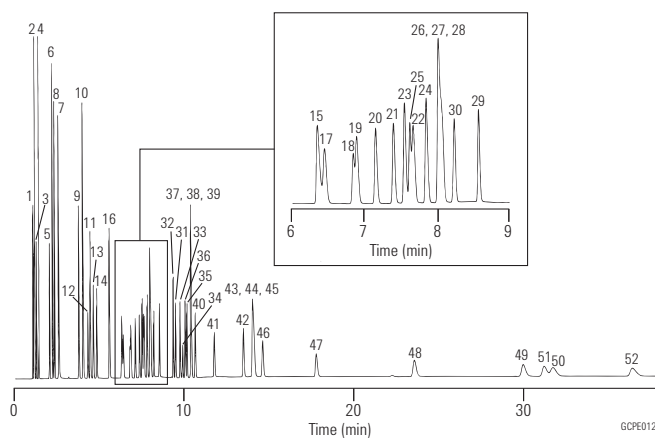
Sample: 300 µL injection of 100 ppmv
SUMMA canister mixture

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



- | | |
|------------------------|--|
| 1. Methane | 27. 2-Methylpentane |
| 2. Ethane | 28. 3-Methylpentane |
| 3. Ethylene | 29. Isoprene |
| 4. Propane | 30. n-Hexane |
| 5. Propylene | 31. 4-Methyl-1-pentene |
| 6. Isobutane | 32. trans-2-Hexene |
| 7. Acetylene | 33. 2-Methyl-1-pentene |
| 8. n-Butane | 34. cis-2-Hexene |
| 9. trans-2-Butene | 35. 2,4-Dimethylpentane |
| 10. 1-Butene | 36. Methylcyclohexane |
| 11. cis-2-Butene | 37. 2,3-Dimethylpentane |
| 12. Cyclopentane | 38. 2-Methylhexane |
| 13. Isopentane | 39. 3-Methylhexane |
| 14. n-Pentane | 40. n-Heptane |
| 15. Propyne | 41. Benzene |
| 16. 1,3-Butadiene | 42. Isooctane (2,2,4-trimethylpentane) |
| 17. Cyclopentene | 43. 2,3,4-Trimethylpentane |
| 18. 3-Methyl-1-butene | 44. 3-Methylheptane |
| 19. trans-2-Pentene | 45. 2-Methylheptane |
| 20. 2-Methyl-2-butene | 46. n-Octane |
| 21. 1-Pentene | 47. Toluene |
| 22. cis-2-Pentene | 48. n-Nonane |
| 23. Methylcyclopentane | 49. Ethylbenzene |
| 24. 2,2-Dimethylbutane | 50. m-Xylene |
| 25. Cyclohexane | 51. p-Xylene |
| 26. 2,3-Dimethylbutane | 52. o-Xylene |

Extended Hydrocarbon Analysis II

Column: GS-GasPro
113-4362
60 m x 0.32 mm

Carrier: Helium at 40 cm/s (3.3 mL/min),
measured at 80 °C

Oven: 80 °C for 0.5 min
80-175 °C at 25 °C/min
175 °C for 2 min
175-250 °C at 25 °C/min

Injection: Split, 250 °C
Split ratio 1:17

Detector: FID, 275 °C
Nitrogen makeup gas at 32 mL/min

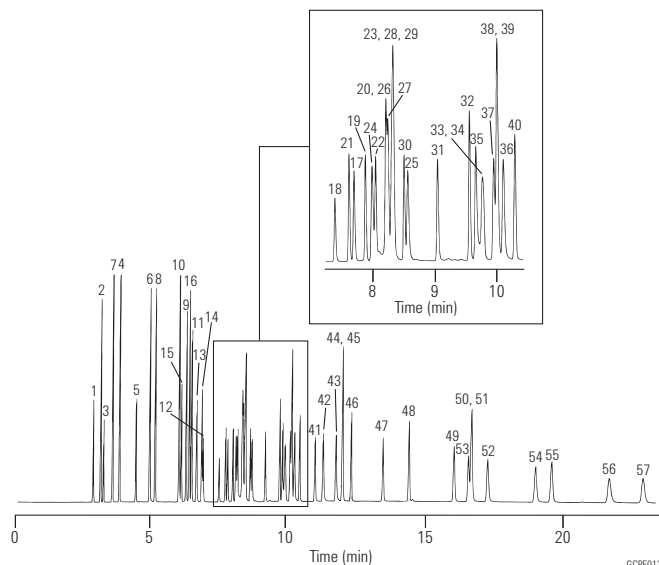
Sample: 500 µL injection of 100 ppmv
SUMMA canister mixture

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



- | | |
|------------------------|--|
| 1. Methane | 30. n-Hexane |
| 2. Ethane | 31. 4-Methyl-1-pentene |
| 3. Ethylene | 32. trans-2-Hexene |
| 4. Propane | 33. 2-Methyl-1-pentene |
| 5. Propylene | 34. cis-2-Hexene |
| 6. Isobutane | 35. 2,4-Dimethylpentane |
| 7. Acetylene | 36. Methylcyclohexane |
| 8. n-Butane | 37. 2,3-Dimethylpentane |
| 9. trans-2-Butene | 38. 2-Methylhexane |
| 10. 1-Butene | 39. 3-Methylhexane |
| 11. cis-2-Butene | 40. n-Heptane |
| 12. Cyclopentane | 41. Benzene |
| 13. Isopentane | 42. Isooctane (2,2,4-trimethylpentane) |
| 14. n-Pentane | 43. 2,3,4-Trimethylpentane |
| 15. Propyne | 44. 3-Methylheptane |
| 16. 1,3-Butadiene | 45. 2-Methylheptane |
| 17. Cyclopentene | 46. n-Octane |
| 18. 3-Methyl-1-butene | 47. Toluene |
| 19. trans-2-Pentene | 48. n-Nonane |
| 20. 2-Methyl-2-butene | 49. Ethylbenzene |
| 21. 1-Pentene | 50. m-Xylene |
| 22. cis-2-Pentene | 51. p-Xylene |
| 23. Methylcyclopentane | 52. o-Xylene |
| 24. 2,2-Dimethylbutane | 53. Styrene |
| 25. Cyclohexane | 54. Isopropylbenzene (cumene) |
| 26. 2,3-Dimethylbutane | 55. n-Propylbenzene |
| 27. 2-Methylpentane | 56. 1,3,5-Trimethylbenzene |
| 28. 3-Methylpentane | 57. 1,2,4-Trimethylbenzene |
| 29. Isoprene | |

Refinery Gas

Column: HP-PLOT Al₂O₃ S
19095P-S25
50 m x 0.53 mm, 15.00 µm

Carrier: Helium 7 mL/min

Oven: 100 °C isothermal

Injection: Split, 250 °C
Split ratio 100:1

Detector: FID, 250 °C

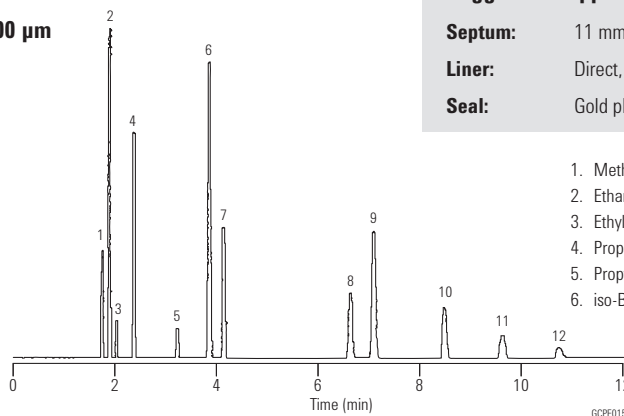
Sample: 5 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



- 1. Methane
- 2. Ethane
- 3. Ethylene
- 4. Propane
- 5. Propylene
- 6. iso-Butane
- 7. n-Butane
- 8. trans-2-Butene
- 9. 1-Butene
- 10. cis-2-Butene
- 11. iso-Pentane
- 12. n-Pentane

**Sulfur Gas Analysis
in Light Hydrocarbon Streams I**

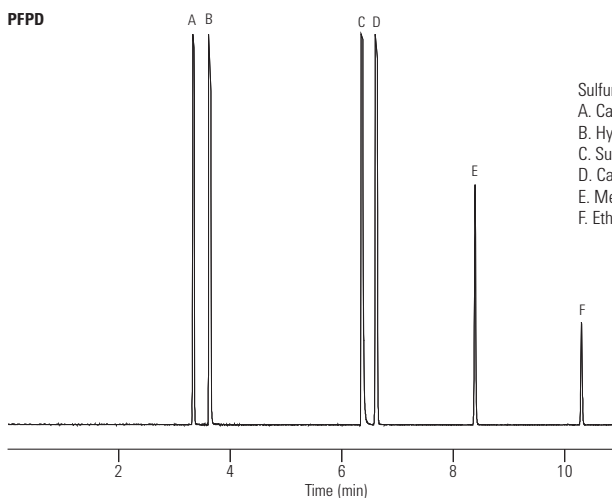
Column: GS-GasPro
113-4332
30 m x 0.32 mm

Carrier: Helium, 10 psig, 2.0 mL/min at 60 °C

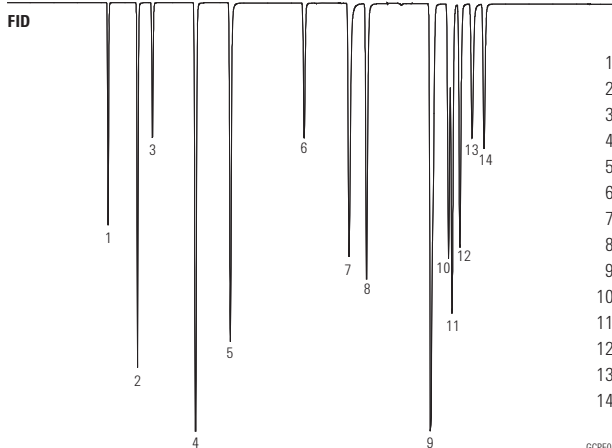
Oven: 60 °C for 2 min, 20 °C/min to 260 °C
and hold

Injection: Split, 200 °C
Split ratio 1:20

Detector: Two separate analyses under identical
conditions on FID and PFPD



- Sulfur compounds (PFPD)
- A. Carbonyl sulfide
 - B. Hydrogen sulfide
 - C. Sulfur dioxide
 - D. Carbon disulfide
 - E. Methyl mercaptan
 - F. Ethyl mercaptan



- 1. Methane
- 2. Ethane
- 3. Ethylene
- 4. Acetylene
- 5. Propane
- 6. Propylene
- 7. iso-Butane
- 8. n-Butane
- 9. 1-Butene/methyl acetylene
- 10. trans-2-Butene
- 11. 1,3-Butadiene
- 12. cis-2-Butene
- 13. iso-Pentane
- 14. n-Pentane

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

Sulfur Gas Analysis in Light Hydrocarbon Streams II

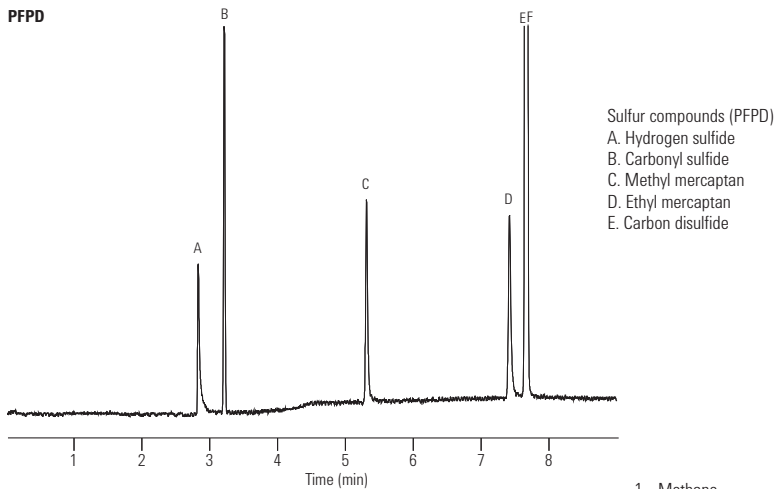
Column: GS-Q
113-3432
30 m x 0.32 mm, 0.20 μ m

Carrier: Helium, 10 psig, 1.7 mL/min at 100 °C

Oven: 100 °C for 2 min, 20 °C/min to 250 °C and hold

Injection: Split, 200 °C
Split ratio 1:20

Detector: Two separate analyses under identical conditions on FID and PFPD

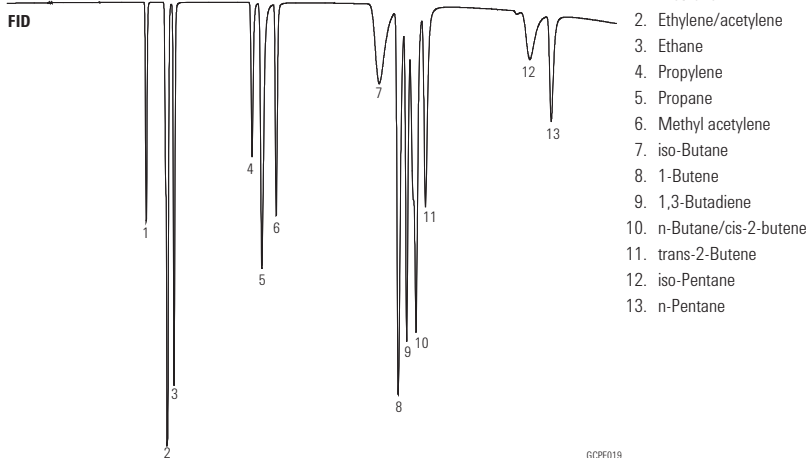


Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



Sulfur Compounds in Propylene (1 ppm)

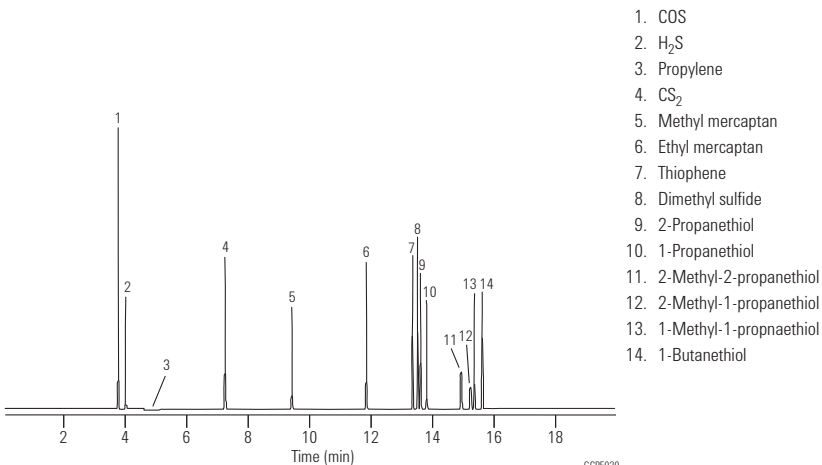
Column: GS-GasPro
113-4332
30 m x 0.32 mm

Oven: 60 °C for 2.5 min
60-250 °C at 10 °C/min

Injection: OI Analytical Volatiles Inlet
Split ratio 5:1
200 μ L gas sampling valve

Detector: OI Analytical Model 5380 PFPD

Sample: 1 ppm sulfur compounds in propylene



Chromatogram courtesy of OI Analytical

Mercaptans

Column: GS-GasPro
113-4332
30 m x 0.32 mm

Carrier: Helium at 25 cm/s

Oven: 175 °C for 2 min
175-260 °C at 10 °C/min

Injection: Split
Split flow 80 mL/min

Detector: FID

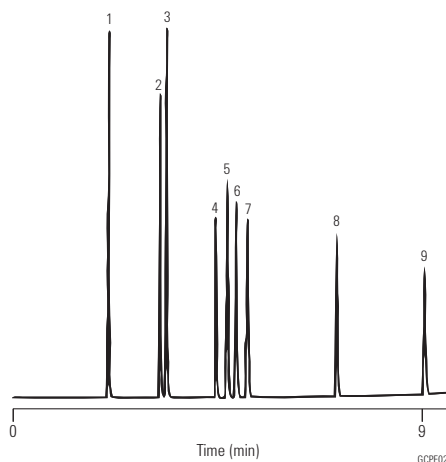
Sample: 0.2 mL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Ethyl mercaptan
2. 2-Propyl mercaptan
3. 1-Propyl mercaptan
4. 2-Methyl-2-propyl mercaptan
5. 2-Methyl-1-propyl mercaptan
6. 1-Methyl-1-propyl mercaptan
7. 1-Butyl mercaptan
8. 1-Pentyl mercaptan
9. 1-Hexyl mercaptan

Sulfur Compounds in Natural Gas – Synthetic Mixture

Column: HP-1
19091Z-205
50 m x 0.20 mm, 0.50 µm

Carrier: Helium

Oven: 35 °C for 10 min
35-300 °C at 7 °C/min

Injection: Split 100:1

Detector: FPD

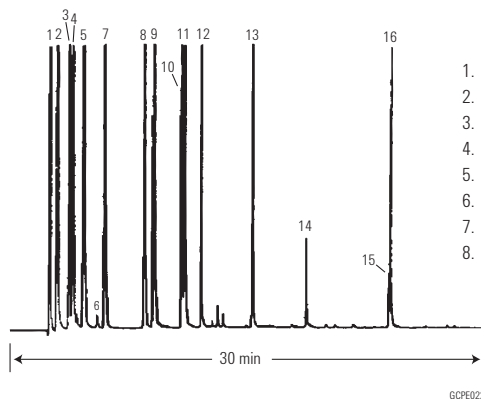
Sample: 0.5 mL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

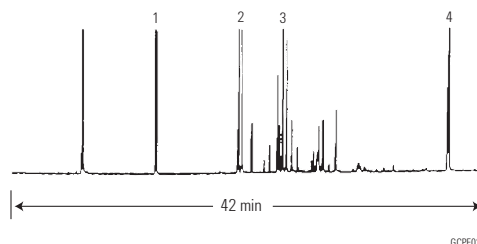


- | | |
|--------------------------------------|----------------------------|
| 1. Hydrogen sulfide | 9. Isobutyl mercaptan |
| 2. Methyl mercaptan | 10. n-Butyl mercaptan |
| 3. Ethyl mercaptan | 11. tert-Amyl mercaptan |
| 4. Dimethyl sulfide | 12. Isoamyl mercaptan |
| 5. Isopropyl mercaptan | 13. n-Amyl mercaptan |
| 6. tert-Butyl mercaptan | 14. n-Hexyl mercaptan |
| 7. n-Propyl mercaptan | 15. tert-Dibutyl disulfide |
| 8. Thiophene and sec-butyl mercaptan | 16. n-Octyl mercaptan |

Sulfur Compounds in Naphtha

Column: HP-PONA
19091S-001
50 m x 0.20 mm, 0.50 µm

Carrier: Helium, 26 cm/s
Oven: 35 °C for 15 min
35-70 °C at 8 °C/min
70-130 °C at 15 °C/min
Injection: Split ratio 400:1
Detector: FPD
Sample: 3 µL

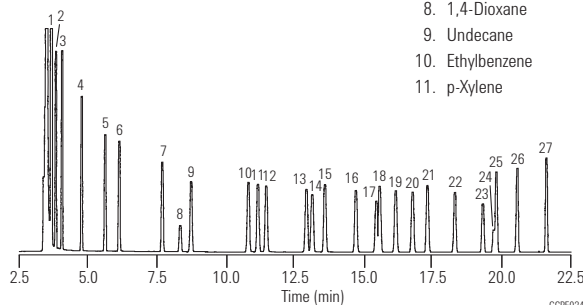


1. Thiophene
2. Methyl thiophenes
3. Ethyl and dimethyl thiophenes
4. Benzothiophene

Aromatics Analysis – ASTM D16 Analytes

Column: HP-INNOWax
19091N-216
60 m x 0.32 mm, 0.50 µm

Carrier: Helium at 20 psi, constant pressure mode
Oven: 75 °C for 10 min
3 °C/min to 100 °C
10 °C/min to 145 °C
Injection: Split, 250 °C
Split ratio 100:1 to 400:1
Detector: FID, 250 °C
Data acquisition rate at 20 Hz

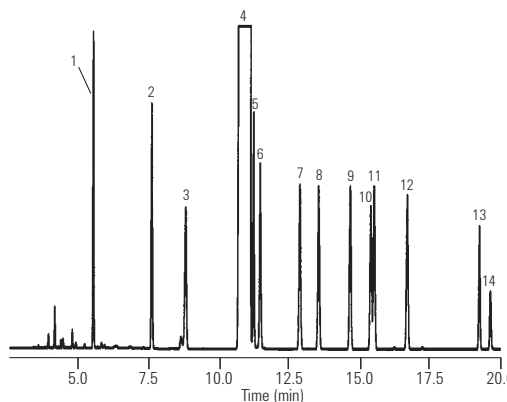


- | | |
|------------------|---------------------------|
| 1. Heptane | 12. m-Xylene |
| 2. Cyclohexane | 13. Cumene |
| 3. Octane | 14. Dodecane |
| 4. Nonane | 15. o-Xylene |
| 5. Benzene | 16. Propylbenzene |
| 6. Decane | 17. p-Ethyltoluene |
| 7. Toluene | 18. m-Ethyltoluene |
| 8. 1,4-Dioxane | 19. tert-Butylbenzene |
| 9. Undecane | 20. sec-Butylbenzene |
| 10. Ethylbenzene | 21. Styrene |
| 11. p-Xylene | 22. Tridecane |
| | 23. Diethylbenzene isomer |
| | 24. Diethylbenzene isomer |
| | 25. n-Butylbenzene |
| | 26. α-Methylstyrene |
| | 27. Phenylacetylene |

Aromatics Analysis – Ethylbenzene Impurities

Column: HP-INNOWax
19091N-216
60 m x 0.32 mm, 0.50 µm

Carrier: Helium at 20 psi, constant pressure mode
Oven: 75 °C for 10 min
3 °C/min to 100 °C
10 °C/min to 145 °C
Injection: Split, 250 °C
Split ratio 100:1 to 400:1
Detector: FID, 250 °C
Data acquisition rate at 20 Hz



1. Benzene
2. Toluene
3. Undecane
4. Ethylbenzene
5. p-Xylene
6. m-Xylene
7. Isopropylbenzene
8. o-Xylene
9. n-Propylbenzene
10. p-Ethyltoluene
11. m-Ethyltoluene
12. s-Butylbenzene
13. Diethylbenzene
14. Diethylbenzene

Impurities in p-Xylene – ASTM D3798

Column: HP-INNOWax
19091N-216
60 m x 0.32 mm, 0.50 µm

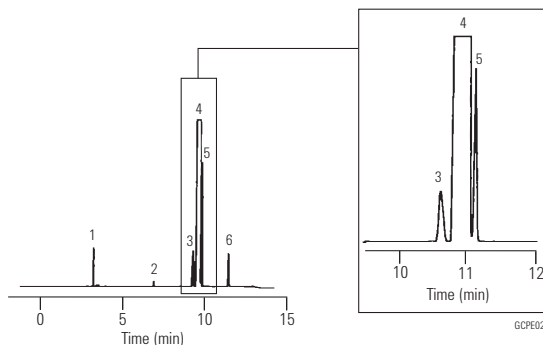
Carrier: Helium, 32 cm/s, 19.9 psi (60 °C),
2.5 mL/min constant flow

Oven: 60 °C for 1 min
60-92 °C at 4 °C/min
92 °C for 4.5 min
92-220 °C at 20 °C/min
220 °C for 5 min

Injection: Split, 220 °C
Split ratio 100:1

Detector: FID, 270 °C

Sample: 0.5 µL
Neat, 99%+



1. Non-aromatic hydrocarbon
2. Toluene
3. Ethylbenzene
4. p-Xylene
5. m-Xylene
6. o-Xylene

Ethylene Oxide Synthetic Standard

Column: HP-PLOT Q
19095P-Q04
30 m x 0.53 mm, 40.00 µm

Carrier: Helium, 25 psi

Oven: 50 °C for 2 min
50-250 °C at 15 °C/min

Injection: Split ratio 40:1

Detector: FID

Sample: 1 µL liquid injection
sample 2000 ppm v/v

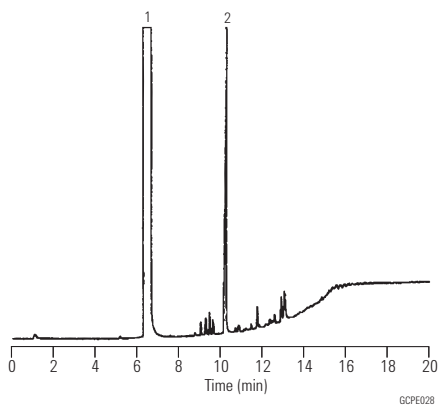
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Ethylene oxide
2. 2-Chloropropene

Analysis of Oxygenates in Mixed C4 Streams

Column: PoraBOND Q PT
CP7351PT
25 m x 0.32 mm, 5.00 µm

Instrument: Agilent 7890A Series

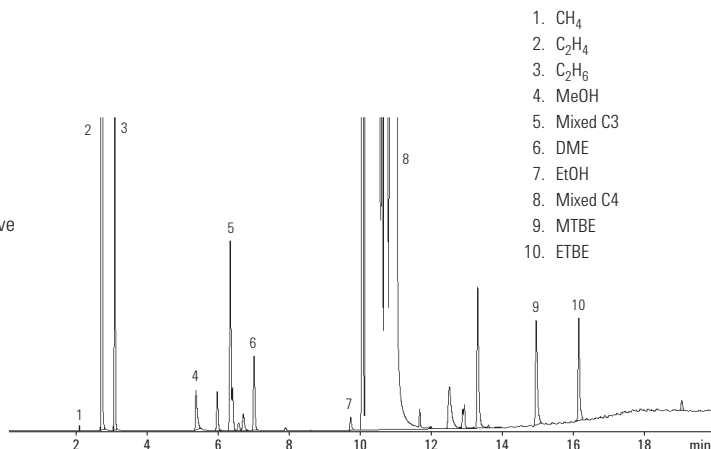
Carrier: Helium, constant flow mode, 35 cm/s, 45 °C

Oven: 45-90 °C at 6 °C/min, 90-240 °C at 15 °C/min,
240 °C for 10 min

Injection: 200 °C, split ratio 30:1, 200 µL gas sampling valve

Detector: FID at 250 °C

Sample: 50-100 mg/L oxygenates in mixed C4



Oxygenates in Gasoline ASTM D5599 (GC-OFID)

Column: HP-1
19091Z-236
60 m x 0.25 mm, 1.00 µm

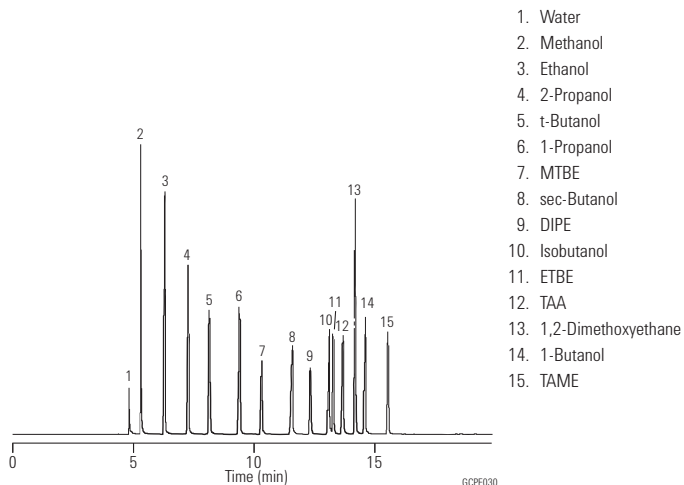
Carrier: Helium, 30 cm/s constant flow

Oven: 40 °C for 6 min
40-50 °C at 5 °C/min
50 °C for 4 min
50-175 °C at 25 °C/min
175 °C for 5 min

Injection: Split ratio 150:1

Detector: Wasson ECE OFID

Sample: 0.5 µL



Denatured Fuel Ethanol – ASTM D5501

Column: HP-1
19091Z-530
100 m x 0.25 mm, 0.50 µm

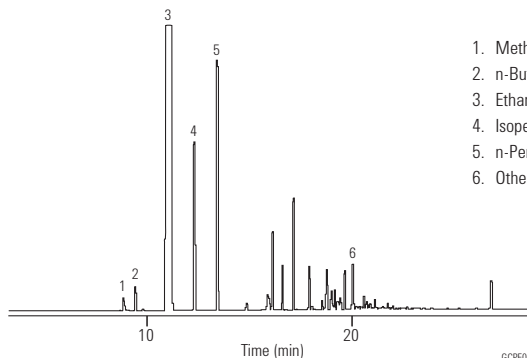
Carrier: Helium 24 cm/s

Oven: 15 °C for 12 min
15-250 °C at 19 °C/min
250 °C for 20 min

Injection: Split ratio 200:1

Detector: FID, 250 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.5 µL



- 1. Methanol
- 2. n-Butane
- 3. Ethanol
- 4. Isopentane
- 5. n-Pentane
- 6. Other hydrocarbons

GCPE031

PONA Mix as Specified by AFNOR Method #2

Column: DB-Petro
128-1056
50 m x 0.20 mm, 0.50 µm

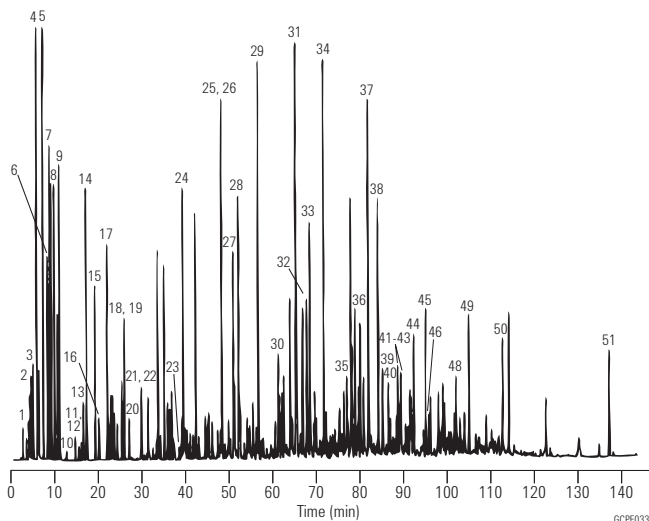
Carrier: Helium at 16.7 cm/s, measured at 35 °C

Oven: 10 °C for 15 min
10-70 °C at 1.3 °C/min
70-250 °C at 1.7 °C/min

Injection: Split, 250 °C
Split ratio 1:200

Detector: FID, 250 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.3 µL petroleum reformat



- 1. Ethane
- 2. Propane
- 3. n-Butane
- 4. Ethanol
- 5. Isopentane
- 6. 1-Pentene
- 7. 2-Methyl-1-butene
- 8. n-Pentane
- 9. 2-Methyl-2-butene
- 10. 2,2-Dimethylbutane
- 11. 1-Cyclopentene
- 12. Cyclopentane
- 13. 2,3-Dimethylbutane
- 14. 2-Methylpentane
- 15. 3-Methylpentane
- 16. 2-Methyl-1-pentene
- 17. n-Hexane
- 18. 2,2-Dimethylpentane
- 19. Methylcyclopentane
- 20. 2,4-Dimethylpentane
- 21. Benzene
- 22. 1-Methyl-1-cyclopentene
- 23. Isooctane
- 24. n-Heptane
- 25. Toluene
- 26. 2,3,3-Trimethylpentane
- 27. 2-Methylheptane
- 28. 3-Methylheptane
- 29. n-Octane
- 30. Ethylbenzene
- 31. m-Xylene
- 32. p-Xylene
- 33. o-Xylene
- 34. n-Nonane
- 35. n-Propylbenzene
- 36. 1,3,5-Trimethylbenzene
- 37. 1,2,4-Trimethylbenzene
- 38. n-Decane
- 39. 1,2,3-Trimethylbenzene
- 40. Indan
- 41. 1,3-Diethylbenzene
- 42. 1-Methyl-3-propylbenzene
- 43. 1,3-Diethyl-5-ethylbenzene
- 44. 1,2-Diethyl-4-ethylbenzene
- 45. n-Undecane
- 46. 1,2,4,5-Tetramethylbenzene
- 47. 1,2,3,5-Tetramethylbenzene
- 48. Naphthalene
- 49. n-Dodecane
- 50. 2-Methylnaphthalene
- 51. Tetradecane

GCPE033

Aromatics in Finished Gasoline – ASTM Method D5769

Column: DB-1
122-1063
60 m x 0.25 mm, 1.00 µm

Carrier: Helium at 35 cm/s,
measured at 50 °C

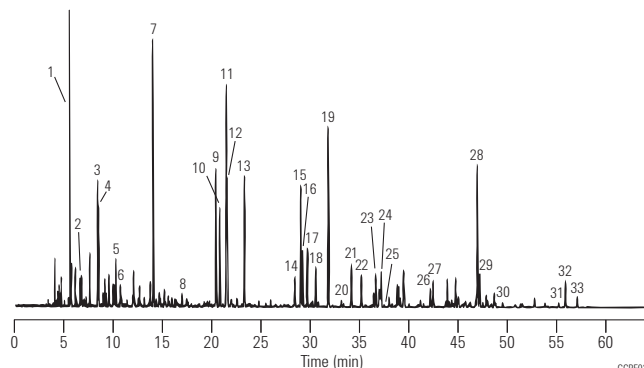
Oven: 50 °C for 1 min
50-190 °C at 2 °C/min
190 °C for 1 min

Injection: Split, 250 °C
Split ratio 1:100

Detector: MSD

Sample: 0.3 µL unleaded gasoline
Calibration standard: ASTM/EPA gasoline
refinery aromatics
(AccuStandard M-GRA-CAL/IS-SET)

- | | | |
|-----------------------------------|-----------------------------|--------------------------------|
| 1. Methyl-tert-butyl-ether (MTBE) | 12. p-Xylene | 23. 1,4-Diethylbenzene |
| 2. n-Hexane | 13. o-Xylene | 24. n-Butylbenzene (valley) |
| 3. Benzene-d6 (IS) | 14. n-Propylbenzene | 25. 1,2-Diethylbenzene |
| 4. Benzene | 15. 1-Methyl-3-ethylbenzene | 26. 1,2,4,5-Tetramethylbenzene |
| 5. Isooctane | 16. 1-Methyl-4-ethylbenzene | 27. 1,2,3,5-Tetramethylbenzene |
| 6. n-Heptane | 17. 1,3,5-Trimethylbenzene | 28. Naphthalene-d8 (IS) |
| 7. Toluene | 18. 1-Methyl-2-ethylbenzene | 29. Naphthalene |
| 8. n-Octane | 19. 1,2,4-Trimethylbenzene | 30. n-Dodecane |
| 9. Ethylbenzene-d10 (IS) | 20. n-Decane | 31. Pentamethylbenzene |
| 10. Ethylbenzene | 21. 1,2,3-Trimethylbenzene | 32. 2-Methylnaphthalene |
| 11. m-Xylene | 22. Indan | 33. 1-Methylnaphthalene |



Simulated Distillation

Column: DB-2887
125-2814
10 m x 0.53 mm, 3.00 µm

Carrier: Helium at 7 mL/min

Oven: 35-350 °C at 15 °C/min

Injection: Direct

Detector: FID
Nitrogen makeup gas
at 30 mL/min

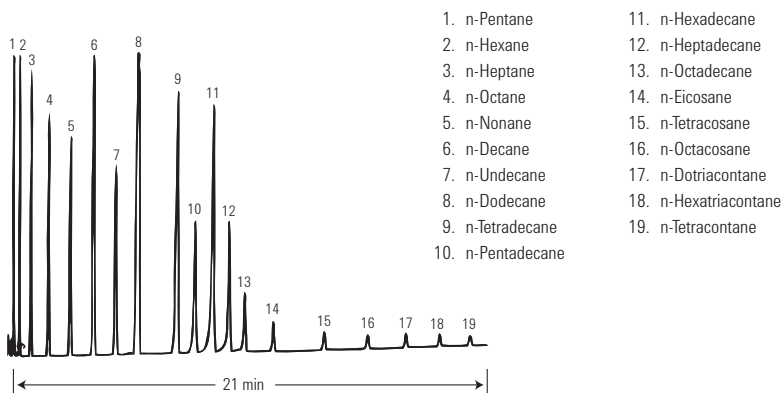
Suggested Supplies

Septum: Non-stick bleed and temperature optimized (BTO) septa, 11 mm, 50/pk, 5183-4757

Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700

Seal: Gold plated seal, 18740-20885

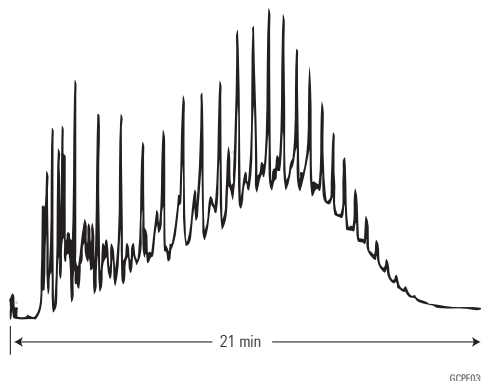
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



Reference Gas Oil

Column: DB-2887
125-2814
10 m x 0.53 mm, 3.00 µm

Carrier: Helium at 7 mL/min
Oven: 35-350 °C at 15 °C/min
Injection: Direct
Detector: FID
Nitrogen makeup gas
at 30 mL/min



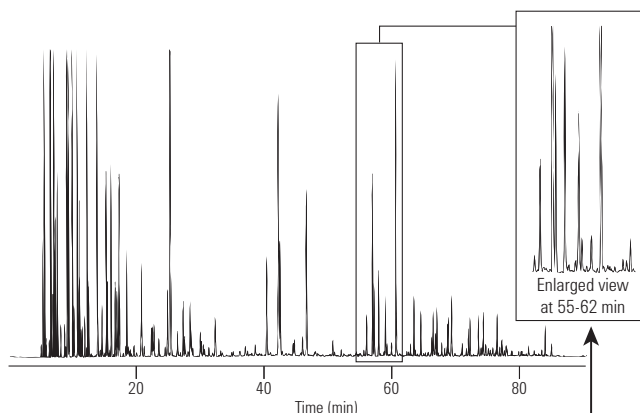
Suggested Supplies

- Septum:** 11 mm Advanced Green septa, 5183-4759
- Liner:** Direct connect, dual taper, deactivated, 4 mm id, G1544-80700
- Seal:** Gold plated seal, 18740-20885
- Syringe:** 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Regular Unleaded Gasoline (California Phase 1) – "Normal" GC Run I

Column: DB-Petro
122-10A6
100 m x 0.25 mm, 0.50 µm

Carrier: Hydrogen at 31 cm/s
Oven: 35 °C for 9.5 min
35-45 °C at 13.3 °C/min
45 °C for 11 min
45-60 °C at 1.4 °C/min
60 °C for 11 min
60-220 °C at 2.7 °C/min
220 °C for 3.6 min
Injection: Split ratio 1:200
Detector: FID, 300 °C
Sample: 0.2 µL

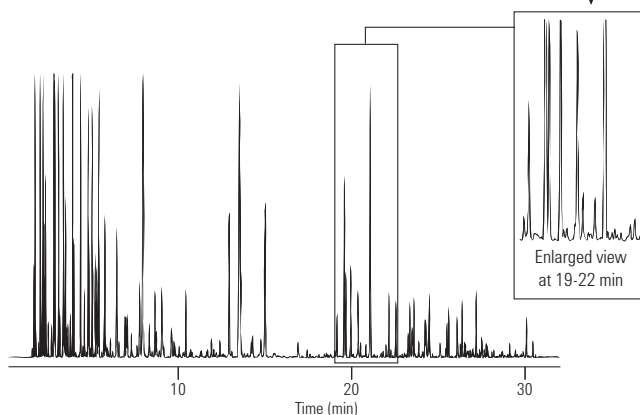


Compare Resolution

Regular Unleaded Gasoline (California Phase 1) – "Normal" GC Run II

Column: DB-1
127-1046
40 m x 0.10 mm, 0.20 µm

Carrier: Hydrogen at 34.8 cm/s
Oven: 35 °C for 3.6 min
35-45 °C at 36.1 °C/min
45 °C for 4.2 min
45-60 °C at 3.9 °C/min
60 °C for 4.2 min
60-220 °C at 6.9 °C/min
220 °C for 1.4 min
Injection: Split ratio 1:400
Detector: FID, 300 °C
Sample: 0.2 µL



Gasoline Unleaded ASTM D5769

Column: CP-Sil PONA CB
CP7530
100 m x 0.25 mm, 0.50 μ m

Sample: 0.1 μ L

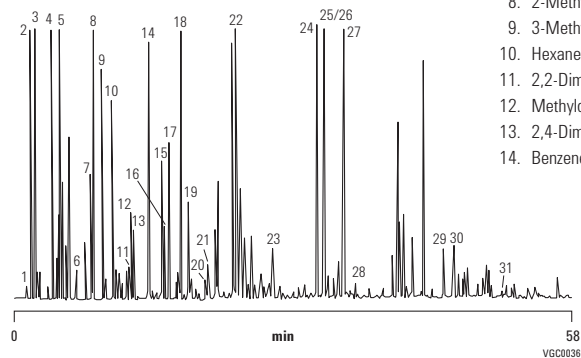
Carrier: Helium, 240 kPa (2.4 bar, 34 psi)

Oven: 35 $^{\circ}$ C (7 min) to 250 $^{\circ}$ C, 3 $^{\circ}$ C/min

Injection: Split, 80 mL/min

Detector: FID

- | | |
|-------------------------|------------------------------------|
| 1. Propane | 15. 2-Methylhexane |
| 2. Isobutane | 16. 2,3-Dimethylpentane |
| 3. Butane | 17. 3-Methylhexane |
| 4. 2-Methylbutane | 18. Tert. amyl methyl ether (TAME) |
| 5. Pentane | 19. Unknown |
| 6. 2,2-Dimethylbutane | 20. 2,2-Dimethylhexane |
| 7. 2,3-Dimethylbutane | 21. Methylcyclohexane |
| 8. 2-Methylpentane | 22. Toluene |
| 9. 3-Methylpentane | 23. Octane |
| 10. Hexane | 24. Ethylbenzene |
| 11. 2,2-Dimethylpentane | 25. p-Xylene |
| 12. Methylcyclopentane | 26. m-Xylene |
| 13. 2,4-Dimethylpentane | 27. o-Xylene |
| 14. Benzene | 28. Nonane |
| | 29. Decane |
| | 30. 1,2,3-Trimethylbenzene |
| | 31. Undecane |

**Polyethylene**

Column: DB-1
125-1011
15 m x 0.53 mm, 0.15 μ m

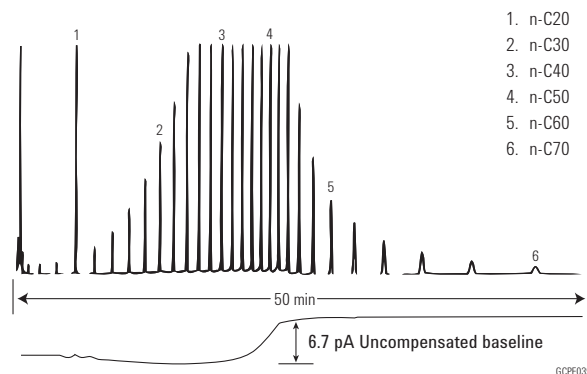
Carrier: Helium at 8 mL/min

Oven: 120-360 $^{\circ}$ C at 10 $^{\circ}$ C/min

Injection: Split ratio 1:500

Detector: FID, 300 $^{\circ}$ C
Nitrogen makeup gas at 30 mL/min

Sample: 0.5 μ L
3% solution in CS₂



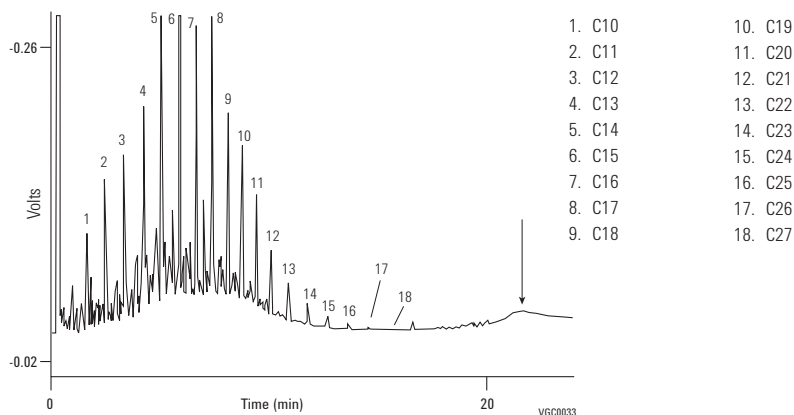
Diesel Analysis

Column: VF-5ht Fused Silica
CP9047
15 m x 0.32 mm, 0.10 µm

Carrier: H₂, 60 kPa, 0.6 bar, 8.6 psi

Oven: 50 °C (1 min), 15 °C to 180 °C,
7 °C to 230 °C, 30 °C to 380 °C

Detector: FID



Analysis of Oxygenates in a C1 to C5 Hydrocarbon Mix

Column: Lowox
CP8587
10 m x 0.53 mm, 10.00 µm

Sample: 1 µL

Sample Conc: 0.01% per compound

Solvent: Cyclohexane

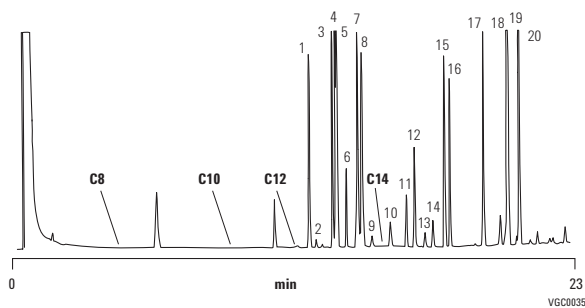
Carrier: He, 28.8 kPa (0.288 bar, 4.1 psi)

Oven: 50 °C (5 min) to 240 °C, 10 °C/min

Injection: Split, T=250 °C

Detector: FID, T=250 °C

- | | |
|-------------------------------|--|
| 1. Acetaldehyde | 11. Methanol |
| 2. Diethyl ether | 12. Acetone |
| 3. Ethyl tert-butyl ether | 13. Isovaleraldehyde |
| 4. Methyl tert-butyl ether | 14. Valeraldehyde |
| 5. Diisopropyl ether | 15. 2-Butanone |
| 6. Propionaldehyde (propanol) | 16. Ethanol |
| 7. Tert-amyl methyl ether | 17. 1-Propanol |
| 8. Dipropyl ether | 18. 2-Methyl-1-propanol (isobutanol) |
| 9. Isobutyraldehyde | 19. 2-Methyl-2-propanol (tert-butanol) |
| 10. Butyraldehyde | 20. 1-Butanol |



Analysis of Process Gas

Column: HP-PLOT Q PT
19095P-Q04PT
30 m x 0.53 mm, 40.00 µm

Instrument: Agilent 7890A

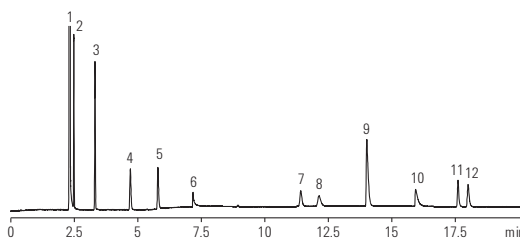
Carrier: Hydrogen, constant flow mode, 40 cm/s, 32 °C

Oven: 32 °C for 5 min, 32 °C to 70 °C at 30 °C/min,
70 °C for 5 min, 70 to 160 °C at 10 °C/min

Injection: 170 °C, split ratio 5:1, 250 µL gas sampling loop

Detector: TCD at 250 °C

1. CO/air
2. Methane
3. Carbon dioxide
4. Ethylene
5. Ethane
6. Hydrogen sulfide
7. Propylene
8. Propane
9. Dimethyl ether
10. Methanol
11. Butylene
12. Butane


**Detailed Hydrocarbon Analysis
of Petroleum Naphthas Through N-nonane
Using ASTM D5134**

Column: CP-Sil PONA for ASTM D5134
CP7531
50 m x 0.21 mm, 0.50 µm

Sample: 0.2 µL

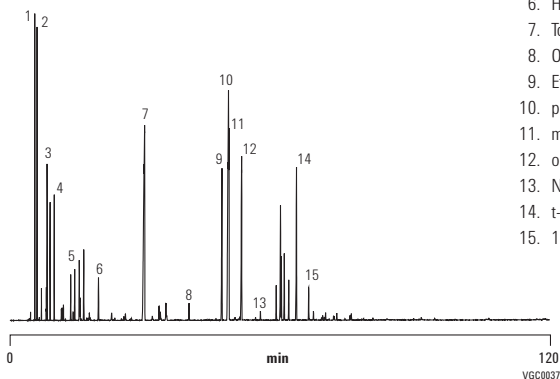
Carrier: Helium

Oven: 35 °C (30 min) at 2 °C/min to 200 °C (10 min)

Injection: Split/splitless 1177, full EFC control,
250 °C, split 200 mL/min

Detector: FID, 250 °C

1. iso-Pentane
2. Pentane
3. Cyclopentane
4. Hexane
5. Benzene
6. Heptane
7. Toluene
8. Octane
9. Ethylbenzene
10. p-Xylene
11. m-Xylene
12. o-Xylene
13. Nonane
14. t-Butylbenzene
15. 1,2,3 Trimethylbenzene



Industrial Chemical Applications

Alcohols I

Column: DB-624
125-1334
30 m x 0.53 mm, 3.00 μ m

Carrier: Helium at 30 cm/s,
measured at 40 °C

Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 μ L of 0.01-0.05% each solvent in CS₂

Suggested Supplies

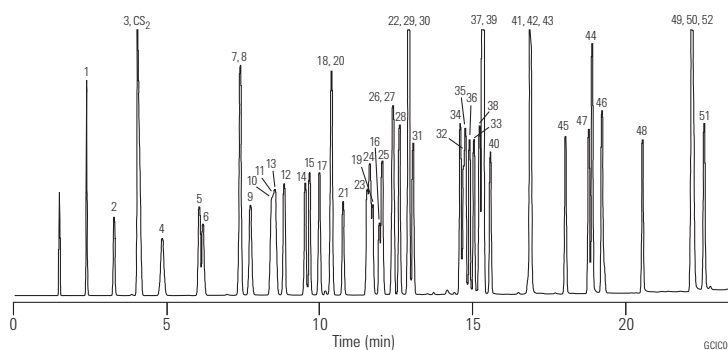
Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal kit, 5188-5367

Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273

- | | |
|--|--|
| 1. Methanol | 27. 2-Penten-1-ol |
| 2. Ethanol | 28. 3-Methyl-2-buten-1-ol |
| 3. Isopropanol | 29. Cyclopentanol |
| 4. tert-Butanol | 30. 3-Hexanol |
| 5. 2-Propen-1-ol (allyl alcohol) | 31. 2-Hexanol |
| 6. 1-Propanol | 32. 4-Hydroxy-4-methyl-2-pentanone |
| 7. 2-Propyn-1-ol (propargyl alcohol) | 33. Furfuryl alcohol |
| 8. sec-Butanol | 34. cis-3-Hexen-1-ol |
| 9. 2-Methyl-3-buten-2-ol | 35. 1-Hexanol |
| 10. Isobutanol | 36. cis-2-Hexen-1-ol |
| 11. 2-Methoxyethanol (methyl cellosolve) | 37. Cyclohexanol |
| 12. 3-Buten-1-ol | 38. 3-Heptanol |
| 13. 2-Methyl-2-butanol (tert-amyl alcohol) | 39. 2-Heptanol |
| 14. 1-Butanol | 40. 2-Butoxyethanol (butyl cellosolve) |
| 15. 2-Buten-1-ol (crotyl alcohol) | 41. cis-4-Hepten-1-ol |
| 16. Ethylene glycol | 42. trans-2-Hepten-1-ol |
| 17. 1-Penten-3-ol | 43. 1-Heptanol |
| 18. 2-Pentanol | 44. Benzyl alcohol |
| 19. Glycidol | 45. 2-Ethyl-1-hexanol |
| 20. 3-Pentanol | 46. α -Methylphenyl alcohol |
| 21. 2-Ethoxyethanol (cellosolve) | 47. 1-Octanol |
| 22. Propylene glycol | 48. 1-Nonanol |
| 23. 3-Methyl-1-butanol (isoamyl alcohol) | 49. 2-Phenoxyethanol |
| 24. 2-Methyl-1-butanol (active amyl alcohol) | 50. α -Ethylphenethyl alcohol |
| 25. 4-Methyl-2-pentanol | 51. β -Ethylphenethyl alcohol |
| 26. 1-Pentanol | 52. 1-Decanol |



Halogenated Hydrocarbons I

Column: DB-624
123-1334
30 m x 0.32 mm, 1.80 µm

Carrier: Helium at 35 cm/s

Oven: 35 °C for 5 min
35-245 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

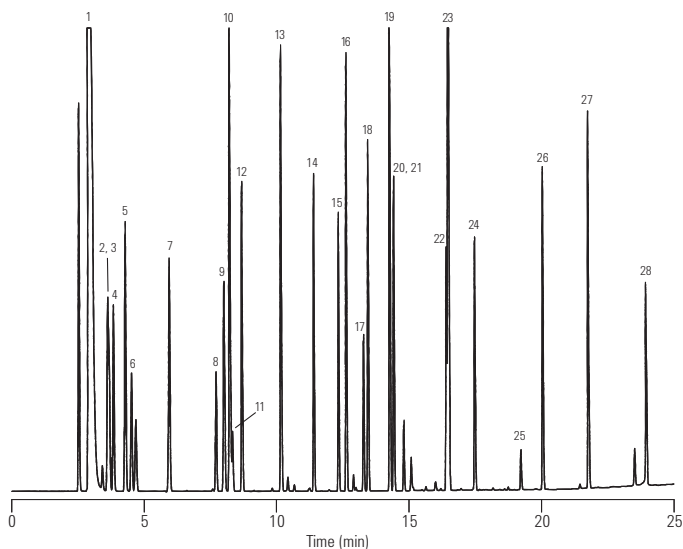
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal kit, 5188-5367

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Pentane
2. Iodomethane
3. 1,1-Dichloroethene
4. 1,1,2-Trichlorotrifluoroethane (freon 113)
5. 3-Chloropropene (allyl chloride)
6. Methylene chloride
7. 1,1-Dichloroethane
8. Chloroform
9. 1,1,1-Trichloroethane
10. 1-Chlorobutane
11. Carbon tetrachloride
12. 1,2-Dichloroethane
13. 1,2-Dichloropropane
14. cis-1,2-Dichloropropene
15. trans-1,2-Dichloropropene
16. 1,1,2-Trichloroethane
17. 1,1,1,2-Tetrachloroethane
18. 1,2-Dibromoethane (EDB)
19. 1-Chlorohexane
20. trans-1,4-Dichloro-2-butene
21. Iodoform
22. Hexachlorobutadiene
23. 1,2,3-Trichloropropane
24. 1,1,2,2-Tetrachloroethane
25. Pentachloroethane
26. 1,2-Dibromo-3-chloropropane (DBCP)
27. Hexachloroethane
28. Hexachlorocyclopentadiene

G010034

Aromatic Solvents

Column: DB-200
122-2032
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 31 cm/s

Oven: 50 °C for 5 min
50-160 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.5 µL of 0.5 µg/µL
standard in hexane

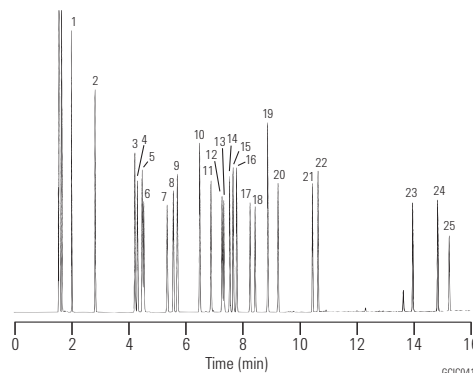
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal kit, 5188-5367

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|---------------------|----------------------------|
| 1. Benzene | 14. tert-Butylbenzene |
| 2. Toluene | 15. sec-Butylbenzene |
| 3. Ethylbenzene | 16. Isobutylbenzene |
| 4. Chlorobenzene | 17. 1,3-Dichlorobenzene |
| 5. p-Xylene | 18. 1,4-Dichlorobenzene |
| 6. m-Xylene | 19. n-Butylbenzene |
| 7. o-Xylene | 20. 1,2-Dichlorobenzene |
| 8. Styrene | 21. 1,3-Diisopropylbenzene |
| 9. Isopropylbenzene | 22. 1,4-Diisopropylbenzene |
| 10. n-Propylbenzene | 23. 2-Nitrotoluene |
| 11. 2-Chlorotoluene | 24. 3-Nitrotoluene |
| 12. 3-Chlorotoluene | 25. 4-Nitrotoluene |
| 13. 4-Chlorotoluene | |

Phenols I

Column: HP-5ms
19091S-433
30 m x 0.25 mm, 0.25 µm

Carrier: Helium, 33 cm/s, constant flow

Oven: 35 °C for 5 min
35-220 °C at 8 °C/min

Injection: Splitless, 250 °C

Detector: FID, 300 °C

Sample: 1 µL
20 µg/mL phenols in methylene chloride

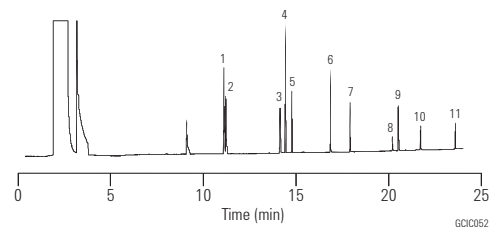
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Seal: Gold plated seal kit, 5188-5367

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Phenol
2. 2-Chlorophenol
3. 2-Nitrophenol
4. 2,4-Dimethylphenol
5. 2,4-Dichlorophenol
6. 4-Chloro-3-methylphenol
7. 2,4,6-Trinitrophenol
8. 2,4-Dinitrophenol
9. 4-Nitrophenol
10. 2-Methyl-4,6-dinitrophenol
11. Pentachlorophenol

Inorganic Gases

Column: GS-GasPro
113-4332
30 m x 0.32 mm

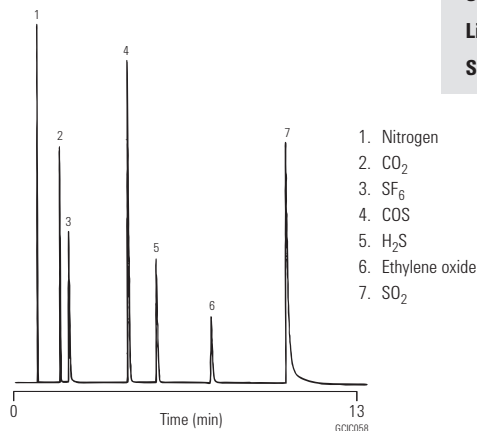
Carrier: Helium at 53 cm/s

Oven: 25 °C for 3 min
25-200 °C at 10 °C/min
200 °C hold

Injection: Split, 200 °C
Split ratio 1:50

Detector: TCD, 250 °C

Sample: 50 µL



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal kit, 5188-5367

Alcohols II

Column: DB-WAXetr
123-7354
50 m x 0.32 mm, 1.00 µm

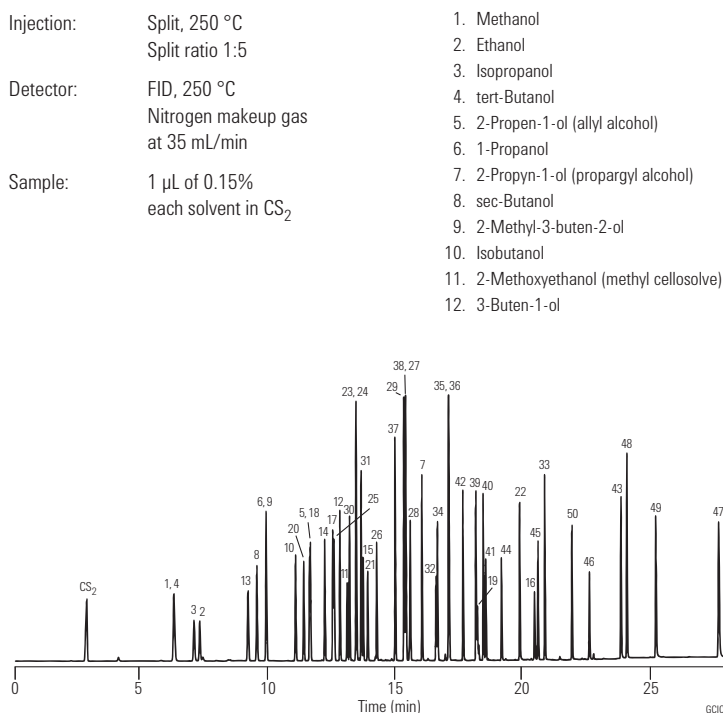
Carrier: Helium at 50 cm/s,
measured at 40 °C

Oven: 40 °C for 5 min
40-230 °C at 10 °C/min
230 °C for 5 min

Injection: Split, 250 °C
Split ratio 1:5

Detector: FID, 250 °C
Nitrogen makeup gas
at 35 mL/min

Sample: 1 µL of 0.15%
each solvent in CS₂



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal kit, 5188-5367

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273

Alcohols III

Column: HP-INNOWax
19095N-123
30 m x 0.53 mm, 1.00 µm

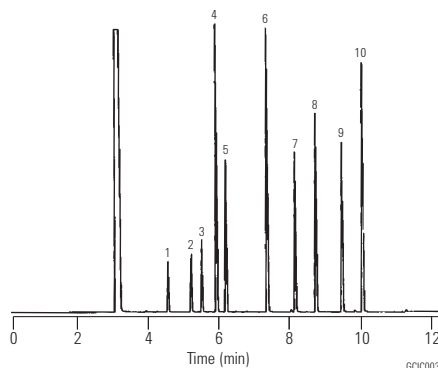
Carrier: Helium, 29 cm/s, 3.0 psi (45 °C)

Oven: 45 °C for 1 min
45-150 °C at 10 °C/min
4 mL/min constant flow

Injection: Split, 250 °C
Split ratio 25:1

Detector: FID, 250 °C

Sample: 1 µL



1. 1-Propanol
2. iso-Butanol
3. 3-Methyl-3-pentanol
4. 1-Butanol
5. 4-Methyl-2-pentanol
6. 1-Pentanol
7. 2-Ethyl-1-butanol
8. 1-Hexanol
9. Cyclohexanol
10. 1-Heptanol

Analysis of Amino Alcohols in Water

Column: CP-Sil 5 CB
CP7640
50 m x 0.53 mm, 2.00 µm

Sample: 0.2 µL

Sample Conc: 1 ppm

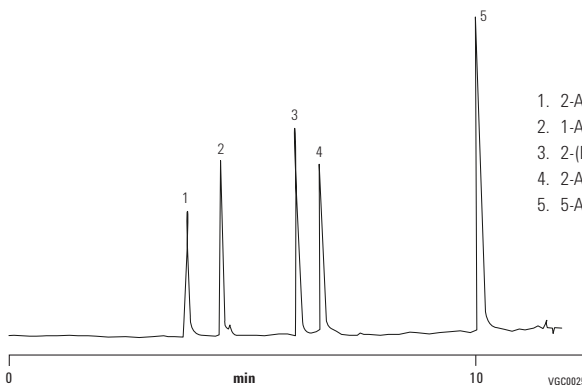
Solvent: Water

Carrier: He, 0.7 mL/min, 70 kPa (0.7 bar, 9 psi)

Oven: 65 °C to 100 °C, 10 °C/min

Injection: Splitless

Detector: MS



1. 2-Amino-ethanol
2. 1-Amino-2-propanol
3. 2-(Ethylamino)-ethanol
4. 2-Amino-1-butanol
5. 5-Amino-1-pentanol

*Courtesy of Victor Berezkin and Aleksey B. Lapin,
Institute of Petrochemical Synthesis, Russian Academy of Science, Moscow, Russia*

Amines and Alcohols

Column: CP-Volamine
CP7446
15 m x 0.32 mm

Sample: 0.5 µL

Sample Conc: 1000 ppm, approx. 5 ng per component
on the column

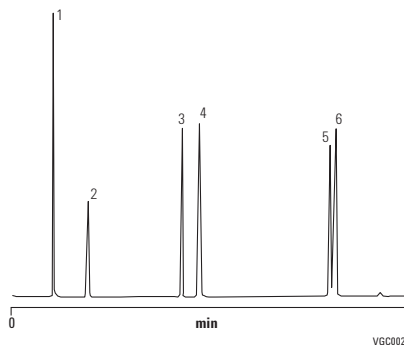
Solvent: Methanol

Carrier: Helium, 50 kPa, 55 cm/s

Oven: 35 °C (0.5 min) to 240 °C, 30 °C/min

Injection: Split

Detector: MS



1. Methanol
2. IPA
3. Mono ethylene glycol
4. MMEA methyl monoethanolamine
5. Diethanolamine
6. MDEA methyl diethanolamine

Courtesy of J. Luong, Dow Chemical Canada

Analysis of Ethanolamines

Column: CP-Sil 8 CB for Amines
CP7596
30 m x 0.32 mm, 1.00 µm

Sample Conc: 5-10 ng per component on the column

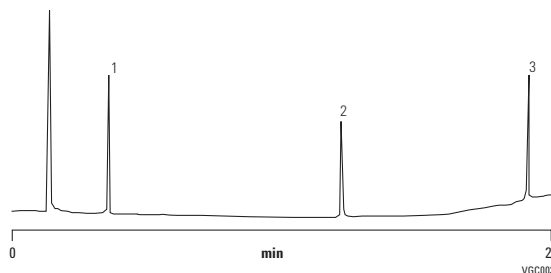
Solvent: Methanol

Carrier: Helium, 50 kPa (0.5 bar, 7 psi)

Oven: 60 °C (5 min) to 220 °C, 6 °C/min

Injection: Split

Detector: FID



1. MEA (mono-ethanolamine)
2. DEA (di-ethanolamine)
3. TEA (tri-ethanolamine)

Ethoxyethanol

Column: HP-FFAP
19095F-123
30 m x 0.53 mm, 1.00 µm

Carrier: Helium, 10 mL/min

Oven: 60 °C for 1 min
60-100 °C at 5 °C/min
100-210 °C at 10 °C/min

Injection: Split ratio 10:1

Detector: TCD

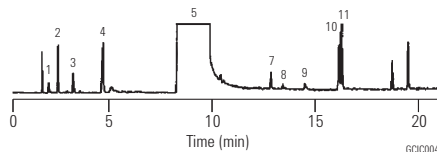
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



- | | |
|--------------------------|---------------------------------|
| 1. Ethylene oxide | 7. Hydroxy acetate |
| 2. Ethyl formate | 8. Acetic acid |
| 3. Ethyl alcohol | 9. Formic acid |
| 4. Water | 10. Ethylene glycol/monoformate |
| 5. 2-Ethoxyethanol | 11. Ethylene glycol/monoacetate |
| 6. 2-Ethoxyethyl acetate | |

Organic Acids

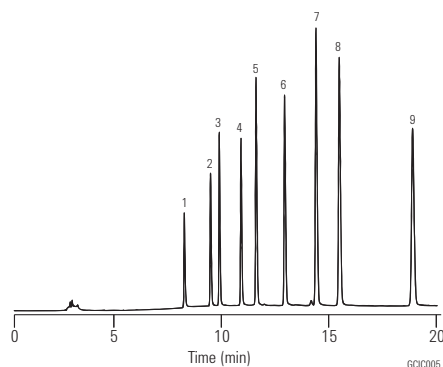
Column: DB-WAXetr
125-7332
30 m x 0.53 mm, 1.00 µm

Carrier: Helium at 37 cm/s,
measured at 40 °C

Oven: 125 °C for 5 min
125-180 °C at 15 °C/min
180 °C for 12 min

Injection: Split, 250 °C

Detector: FID, 250 °C

**Suggested Supplies**

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP,
5181-1273

- | | |
|--------------------|----------------------------------|
| 1. Acetic acid | 6. Valeric acid (pentanoic acid) |
| 2. Propionic acid | 7. Isocaproic acid |
| 3. Isobutyric acid | 8. Caproic acid (hexanoic acid) |
| 4. Butyric acid | 9. Heptanoic acid |
| 5. Isovaleric acid | |

Free Organic Acids/C₄-C₅ Isomers

Column: HP-INNOWax
19091N-133
30 m x 0.25 mm, 0.25 µm

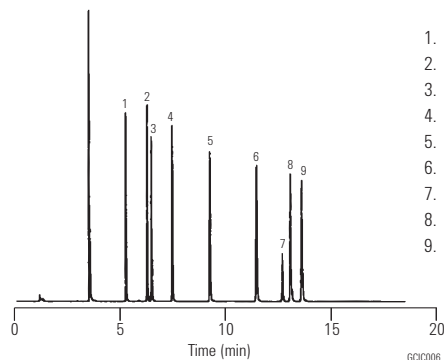
Carrier: Helium 42 cm/s, 24 psi (120 °C)
1.8 mL/min constant flow

Oven: 110 °C for 1 min
110-133 at 2 °C/min
133-160 °C at 3 °C/min

Injection: Split, 250 °C
Split ratio 40:1

Detector: FID, 300 °C

Sample: 1 µL



1. Isobutyric acid
2. Butyric acid
3. Valerolactone
4. 2-Methyl butyric acid
5. Valeric acid
6. 4-Pentenoic acid
7. trans-2-Methyl-2-butenic acid
8. trans-3-Pentenoic acid
9. trans-2-Pentenoic acid

Volatile Amines

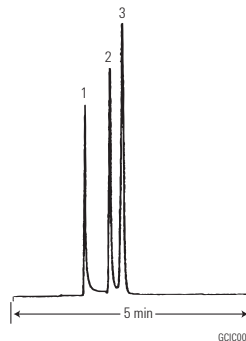
Column: DB-1
125-1035
30 m x 0.53 mm, 5.00 µm

Oven: 30 °C isothermal

Sampler: Headspace

Injection: Split ratio 1:10

Detector: FID
Nitrogen makeup gas at 30 mL/min



1. Methylamine
2. Dimethylamine
3. Trimethylamine

Trace Active Amines, 10 ng on-column

Column: HP-5ms
19091S-213
30 m x 0.32 mm, 1.00 µm

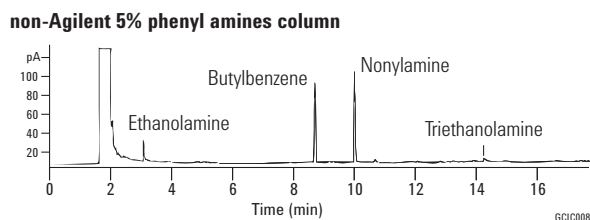
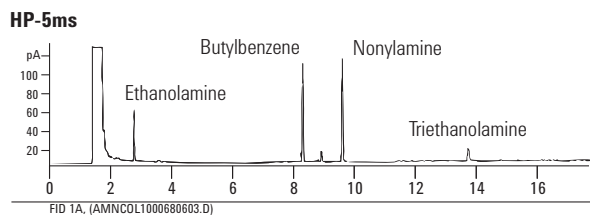
Carrier: Helium, constant pressure 9.79 psi

Oven: 75 °C for 0.5 min
75-250 °C at 10 °C/min
250-320 °C at 25 °C/min
320 °C for 5 min

Injection: On-column
Oven tracking mode

Detector: FID, 300 °C

Sample: 0.5 µL of each standard in methanol



Primary Amines

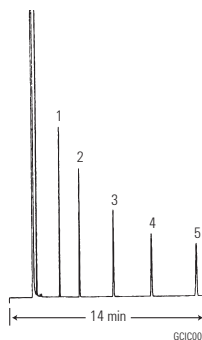
Column: CAM
112-2132
30 m x 0.25 mm, 0.25 μ m

Carrier: Hydrogen at 40 cm/s

Oven: 110 °C isothermal

Injection: Split

Detector: FID
Nitrogen makeup gas at 30 mL/min



1. n-Octylamine
2. n-Nonylamine
3. n-Decylamine
4. Benzylamine
5. Dicyclohexylamine

Polyethyleneamines

Column: DB-5ms
122-5536
30 m x 0.25 mm, 0.50 μ m

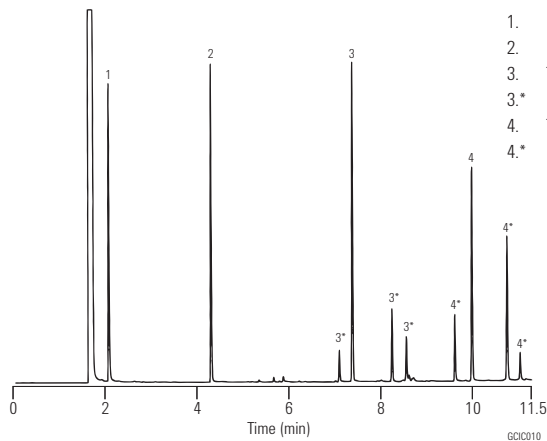
Carrier: Helium at 30 cm/s, measured at 100 °C

Oven: 100 °C for 1 min
100-320 °C at 20 °C/min

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 μ L of 100 ng/ μ L standard in methanol



1. Ethylenediamine
2. Diethylenetriamine
3. Triethylenetetramine
- 3.* Branched and piperazine analogs of peak 3
4. Tetraethylenepentamine
- 4.* Branched and piperazine analogs of peak 4

Amines and Nitriles

Column: DB-5ms
122-5536
30 m x 0.25 mm, 0.50 µm

Carrier: Helium at 22 cm/s, measured at 40 °C

Oven: 40 °C for 1 min
40-260 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 100 ng/µL standard in methanol

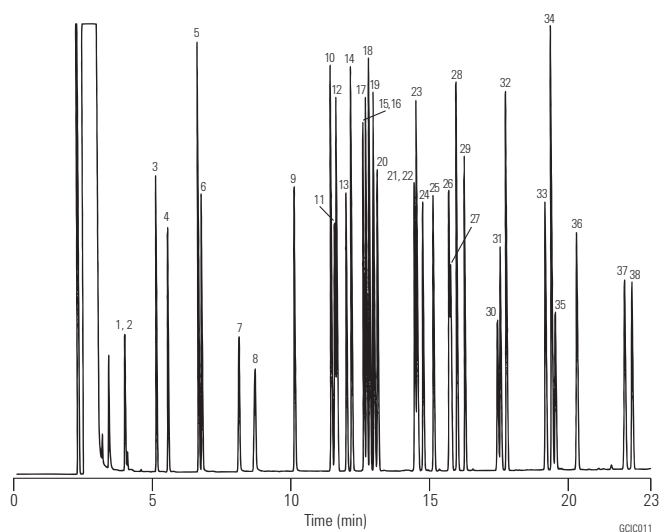
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



- | | |
|-----------------------------|--------------------------|
| 1. Diethylamine | 20. 2-Cyanopyridine |
| 2. Propionitrile | 21. 2-Chloroaniline |
| 3. Diisopropylamine | 22. n-Nonylamine |
| 4. Triethylamine | 23. 2,4-Dimethylaniline |
| 5. Pyridine | 24. 4-Chlorobenzonitrile |
| 6. Pyrimidine | 25. 2,6-Dimethylaniline |
| 7. Pyrazole | 26. 3-Chloroaniline |
| 8. Acrylamide | 27. 4-Chloroaniline |
| 9. Pyridazine | 28. N,N-Diethylaniline |
| 10. Aniline | 29. n-Decylamine |
| 11. 3-Bromopyridine | 30. 4-Bromoaniline |
| 12. Benzonitrile | 31. 3,4-Diaminotoluene |
| 13. 3-Cyanopyridine | 32. 2,6-Diethylaniline |
| 14. Benzylamine | 33. 2-Nitroaniline |
| 15. n-Octylamine | 34. Dicyclohexylamine |
| 16. 1-Methyl-2-pyrrolidine | 35. 3,4-Dichloroaniline |
| 17. N,N-Dimethylbenzylamine | 36. 3-Nitroaniline |
| 18. Phenylethylamine | 37. 4-Nitroaniline |
| 19. N-Benzylmethylamine | 38. Diphenylaniline |

Amines in Water

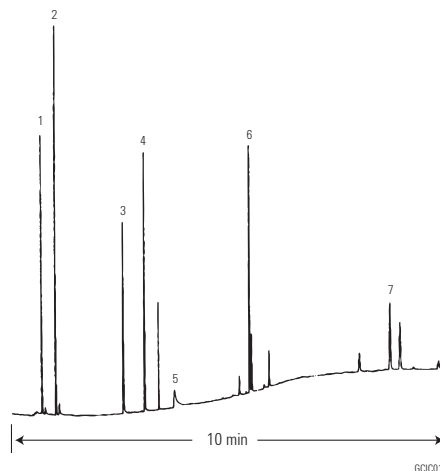
Column: CAM
112-2132
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 38 cm/s

Oven: 120-220 °C at 10 °C/min

Injection: Split

Detector: FID
Nitrogen makeup gas at 30 mL/min



1. Ethylenediamine
2. Piperazine
3. Diethylenetriamine
4. N-(2-Aminoethyl) piperazine
5. Aminoethylethanolamine
6. Triethylenetetramine (4 isomers)
7. Tetraethylenepentamine (4 isomers)

Aldehydes and Acids

Column: HP-INNOWax
19091N-213
30 m x 0.32 mm, 0.50 µm

Carrier: Helium, 40 cm/s, 11.7 psi (60 °C)

Oven: 60 °C for 1 min
60-250 °C at 10 °C/min
2.5 mL/min constant flow

Injection: Split, 250 °C
Split ratio 40:1

Detector: FID, 275 °C

Sample: 0.5 µL

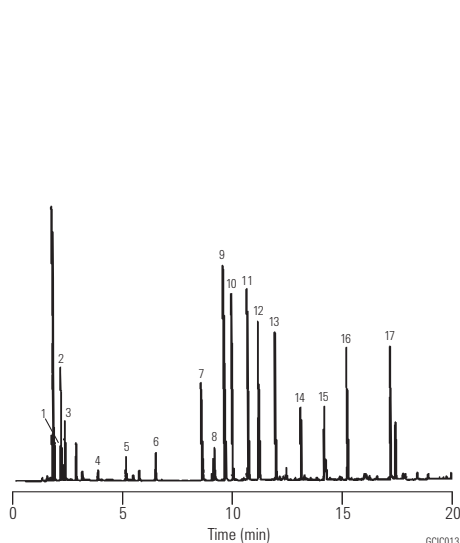
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



1. Butanal
2. 2-Methyl butanal
3. Pentanal
4. Hexanal
5. Heptanal
6. Octanal
7. Acetic acid
8. Decanal
9. Propanoic acid
10. iso-Butyric acid
11. Butyric acid
12. iso-Valeric acid
13. Valeric acid
14. Hexanoic acid
15. Heptanoic acid
16. Octanoic acid
17. Decanoic acid

Aldehydes and Ketones

Column: DB-1
123-1034
30 m x 0.32 mm, 3.00 µm

Column: DB-WAX
123-7033
30 m x 0.32 mm, 0.50 µm

Carrier: Helium at 32 cm/s,
measured at 40 °C

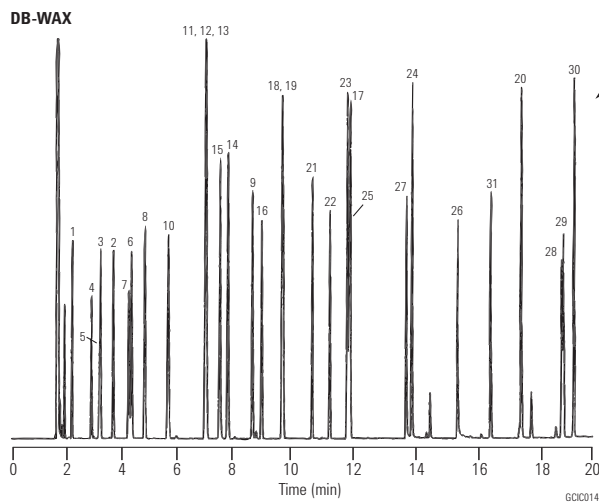
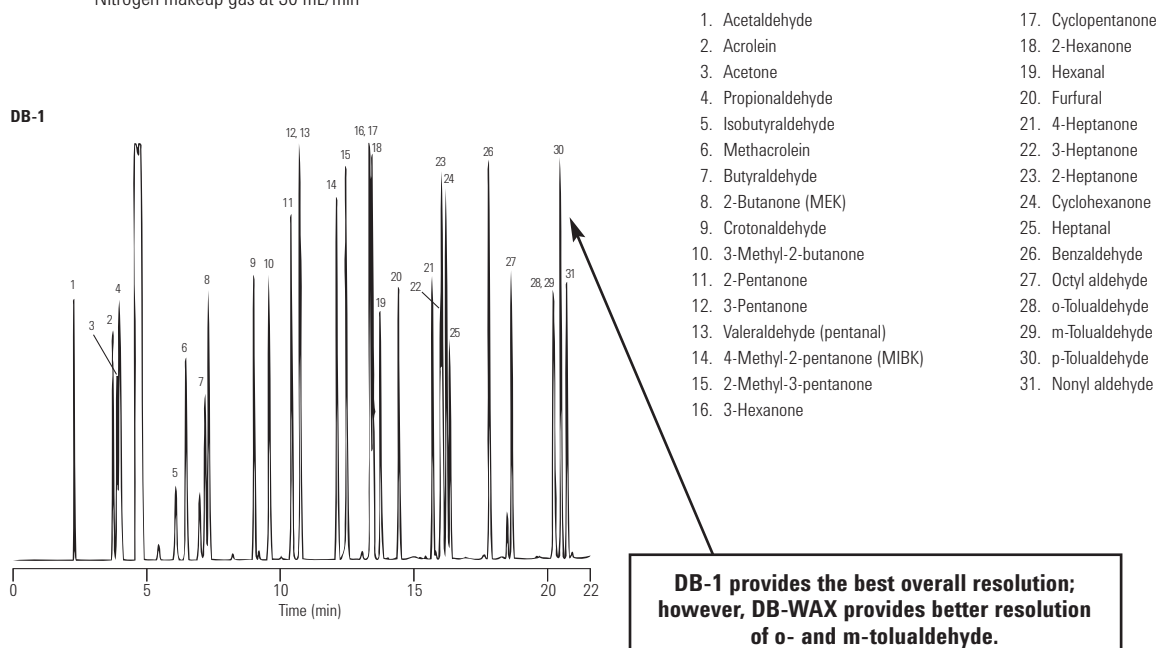
Oven: 40 °C for 5 min
40-210 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



DB-1 provides the best overall resolution; however, DB-WAX provides better resolution of o- and m-tolualdehyde.

Formaldehyde Underivatized

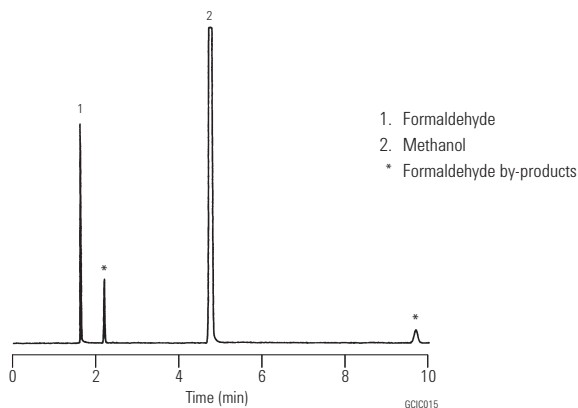
Column: DB-WAX
123-7033
30 m x 0.32 mm, 0.50 μ m

Carrier: Helium at 36 cm/s,
measured at 35 °C

Oven: 35 °C isothermal

Injection: Split, 200 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

**Formaldehyde-DNPH Derivative**

Column: DB-1
123-1012
15 m x 0.32 mm, 0.25 μ m

Carrier: Helium at 35 cm/s,
measured at 150 °C

Oven: 150-250 °C at 20 °C/min

Injection: Split, 300 °C
Split ratio 1:100

Detector: ECD, 375 °C
Nitrogen makeup gas at 35 mL/min

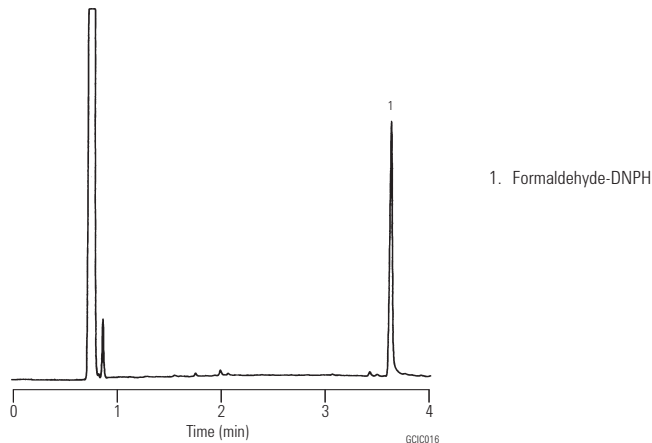
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267



PFBHA Derivative

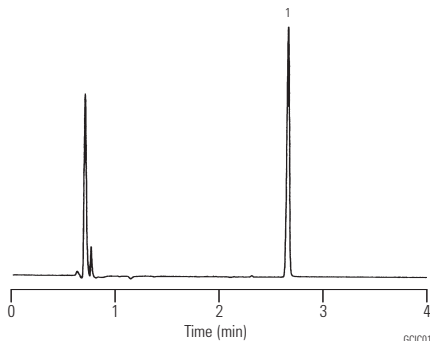
Column: DB-1
123-1012
15 m x 0.32 mm, 0.25 µm

Carrier: Helium at 40 cm/s,
measured at 60 °C

Oven: 60-100 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 375 °C
Nitrogen makeup gas at 35 mL/min



1. Formaldehyde-PFBHA

Aromatics I

Column: DB-1
125-1034
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/s,
measured at 40 °C

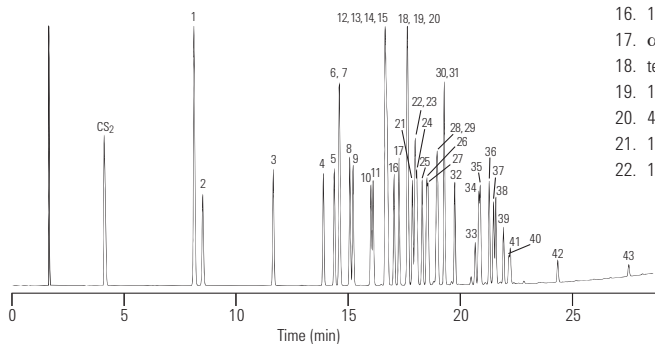
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Suggested Supplies

- Septum:** 11 mm Advanced Green septa, 5183-4759
- Liner:** General purpose split/splitless liner, taper, glass wool, 5183-4711
- Seal:** Gold plated seal, 18740-20885
- Syringe:** 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|---|--|
| 1. Benzene | 23. Isobutylbenzene |
| 2. Fluorobenzene | 24. sec-Butylbenzene |
| 3. Toluene | 25. 1,2,3-Trimethylbenzene (hemimellitene) |
| 4. Chlorobenzene | 26. 1,2-Dichlorobenzene |
| 5. Ethylbenzene | 27. Iodobenzene |
| 6. m-Xylene | 28. Styrene oxide |
| 7. p-Xylene | 29. Butylbenzene |
| 8. Styrene | 30. 4-Chlorostyrene |
| 9. o-Xylene | 31. Nitrobenzene |
| 10. Isopropylbenzene (cumene) | 32. 4-tert-Butyltoluene |
| 11. Bromobenzene | 33. 1,3,5-Trichlorobenzene |
| 12. Propylbenzene | 34. 2-Nitrotoluene |
| 13. 2-Chlorotoluene | 35. 1,3-Diisopropylbenzene |
| 14. 3-Chlorotoluene | 36. 1,4-Diisopropylbenzene |
| 15. 4-Chlorotoluene | 37. 1,2,4-Trichlorobenzene |
| 16. 1,3,5-Trimethylbenzene (mesitylene) | 38. 3-Nitrotoluene |
| 17. α-Methylstyrene | 39. 4-Nitrotoluene |
| 18. tert-Butylbenzene | 40. 1,2,3-Trichlorobenzene |
| 19. 1,2,4-Trimethylbenzene (pseudocumene) | 41. 1-Chloro-4-nitrobenzene |
| 20. 4-Methylstyrene | 42. 1,2,4,5-Tetrachlorobenzene |
| 21. 1,3-Dichlorobenzene | 43. Pentachlorobenzene |
| 22. 1,4-Dichlorobenzene | |

Aromatics II

Column: DB-WAX
125-7032
30 m x 0.53 mm, 1.00 µm

Carrier: Helium at 30 cm/s, measured at 40 °C

Oven: 40 °C for 5 min
40-230 °C at 10 °C/min
230 °C for 7 min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Suggested Supplies

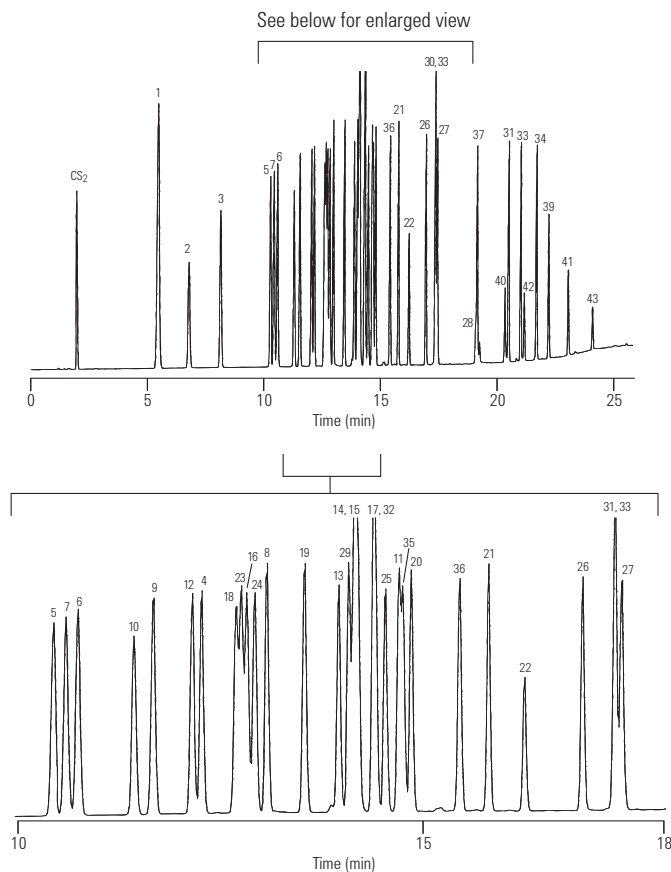
Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

1. Benzene
2. Fluorobenzene
3. Toluene
4. Chlorobenzene
5. Ethylbenzene
6. m-Xylene
7. p-Xylene
8. Styrene
9. o-Xylene
10. Isopropylbenzene (cumene)
11. Bromobenzene
12. Propylbenzene
13. 2-Chlorotoluene
14. 3-Chlorotoluene
15. 4-Chlorotoluene
16. 1,3,5-Trimethylbenzene (mesitylene)
17. α-Methylstyrene
18. tert-Butylbenzene
19. 1,2,4-Trimethylbenzene (pseudocumene)
20. 4-Methylstyrene
21. 1,3-Dichlorobenzene
22. 1,4-Dichlorobenzene
23. Isobutylbenzene
24. sec-Butylbenzene
25. 1,2,3-Trimethylbenzene (hemimellitene)
26. 1,2-Dichlorobenzene
27. Iodobenzene
28. Styrene oxide (peak not shown)
29. Butylbenzene
30. 4-Chlorostyrene
31. Nitrobenzene
32. 4-tert-Butyltoluene
33. 1,3,5-Trichlorobenzene
34. 2-Nitrotoluene
35. 1,3-Diisopropylbenzene
36. 1,4-Diisopropylbenzene
37. 1,2,4-Trichlorobenzene
38. 3-Nitrotoluene
39. 4-Nitrotoluene
40. 1,2,3-Trichlorobenzene
41. 1-Chloro-4-nitrobenzene
42. 1,2,4,5-Tetrachlorobenzene
43. Pentachlorobenzene



Impurities in Styrene

Column: DB-WAXetr
123-7363
60 m x 0.32 mm, 0.50 µm

Carrier: Helium at 29.4 cm/s, measured at 70 °C

Oven: 80 °C isothermal

Injection: Split, 230 °C
Split ratio 1:150

Detector: FID, 240 °C

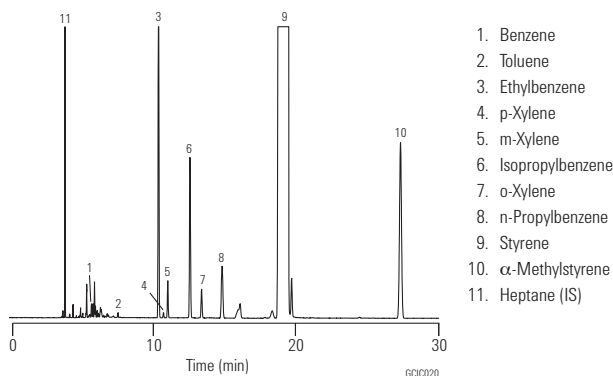
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



Impurities in Ethylbenzene

Column: HP-INNOWax
19091N-216
60 m x 0.32 mm, 0.50 µm

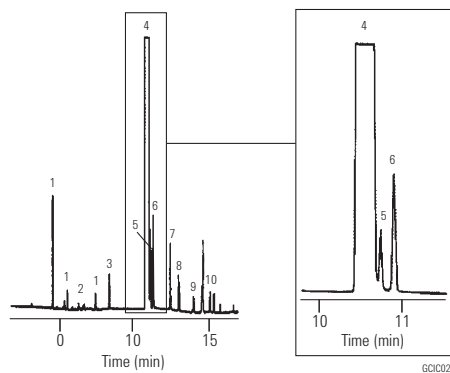
Carrier: Helium, 32 cm/s, 19.9 psi (60 °C)
2.5 mL/min constant flow

Oven: 60 °C for 1 min
60-92 °C at 4 °C/min
92 °C for 4.5 min
92-220 °C at 20 °C/min

Injection: Split, 220 °C
Split ratio 100:1
ASTM Method D5060

Detector: FID, 270 °C

Sample: 0.5 µL
Neat, 99%+



Pyrolysates of Polystyrene

Column: Ultra 1
19091A-105
50 m x 0.20 mm, 0.33 µm

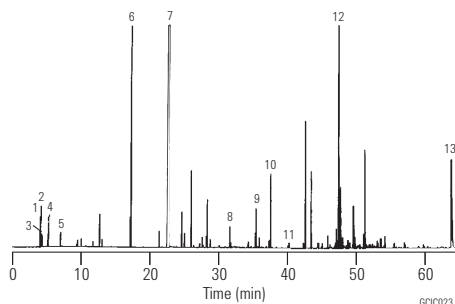
Carrier: Helium, 30 psi, 12 mL/min

Oven: 0-280 at 5 °C/min

Injection: Split, 280 °C
Split ratio 30:1
Pyrolyzer 600 °C

Detector: FID, 300 °C

Sample: 100 mg pyrolyzed



1. Propylene
2. Propane
3. 1-Butene
4. Butene
5. Pentane
6. Toluene
7. Styrene
8. $C_2H_5-C(Ph)=CH_2$
9. $C_4H_9-CH_2-CH_2-Ph$
10. $C_4H_9-C(Ph)=CH_2$
11. $C_4H_9-CH=C(Ph)CH_3$
12. Styrene dimer
13. Styrene trimer

Esters I

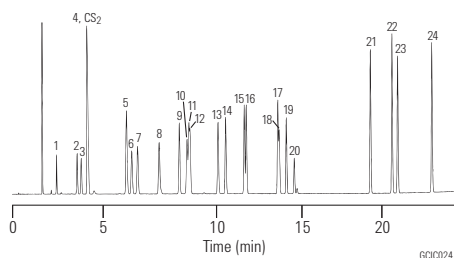
Column: DB-1
125-1034
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/s,
measured at 40 °C

Oven: 40 °C for 5 min
40-260 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

- | | |
|------------------------|---------------------------|
| 1. Methyl formate | 13. sec-Butyl acetate |
| 2. Ethyl formate | 14. Isobutyl acetate |
| 3. Methyl acetate | 15. Propyl propionate |
| 4. Vinyl acetate | 16. Butyl acetate |
| 5. Ethyl acetate | 17. Isoamyl acetate |
| 6. Propyl formate | 18. Amyl acetate |
| 7. Methyl propionate | 19. 2-Ethoxyethyl acetate |
| 8. Isopropyl acetate | 20. 2-Methylbutyl acetate |
| 9. Ethyl acrylate | 21. Methyl benzoate |
| 10. tert-Butyl acetate | 22. Benzyl acetate |
| 11. Ethyl propionate | 23. Ethyl benzoate |
| 12. Propyl acetate | 24. Propyl benzoate |

Esters II

Column: DB-624
125-1334
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/s,
measured at 40 °C

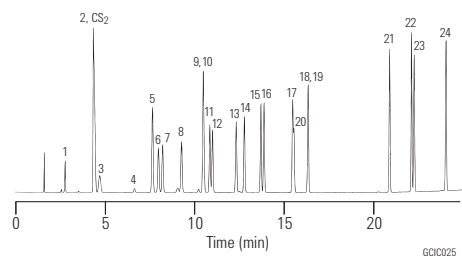
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|------------------------|---------------------------|
| 1. Methyl formate | 13. sec-Butyl acetate |
| 2. Ethyl formate | 14. Isobutyl acetate |
| 3. Methyl acetate | 15. Propyl propionate |
| 4. Vinyl acetate | 16. Butyl acetate |
| 5. Ethyl acetate | 17. Isoamyl acetate |
| 6. Propyl formate | 18. Amyl acetate |
| 7. Methyl propionate | 19. 2-Ethoxyethyl acetate |
| 8. Isopropyl acetate | 20. 2-Methylbutyl acetate |
| 9. Ethyl acrylate | 21. Methyl benzoate |
| 10. tert-Butyl acetate | 22. Benzyl acetate |
| 11. Ethyl propionate | 23. Ethyl benzoate |
| 12. Propyl acetate | 24. Propyl benzoate |

Esters III

Column: HP-INNOWax
19095N-123
30 m x 0.53 mm, 1.00 µm

Carrier: Helium 29 cm/s, 3.0 psi (45 °C)
4 mL/min constant flow

Oven: 45 °C for 1 min
45-200 °C at 5 °C/min

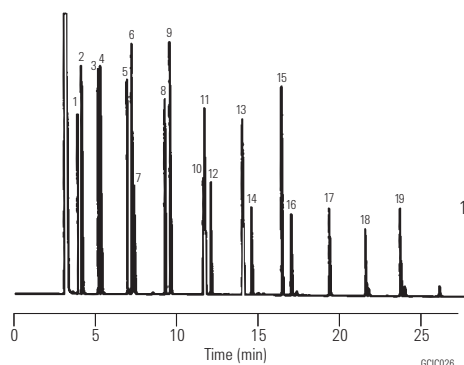
Injection: Split, 250 °C
Split ratio 25:1

Detector: FID, 250 °C

Sample: 1 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|----------------------|---------------------------|
| 1. Ethyl propionate | 11. Propyl caproate |
| 2. Propyl acetate | 12. Methyl decanoate |
| 3. Ethyl butyrate | 13. Butyl caproate |
| 4. Propyl propionate | 14. Methyl dodecanoate |
| 5. Propyl butyrate | 15. Butyl heptanoate |
| 6. Ethyl valerate | 16. Methyl tetradecanoate |
| 7. Butyl propionate | 17. Methyl hexadecanoate |
| 8. Propyl valerate | 18. Methyl octadecanoate |
| 9. Ethyl caproate | 19. Methyl eicosenoate |
| 10. Butyl valerate | |

Ethers

Column: DB-624
125-1334
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/s,
measured at 40 °C

Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

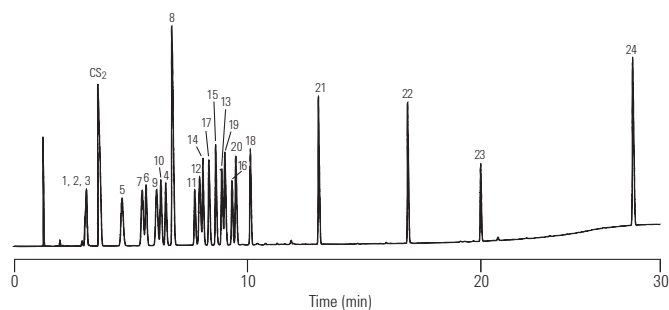
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|---|--|
| 1. Furan | 13. Diglyme (diethylene glycol dimethyl ether) |
| 2. Ethyl vinyl ether | 14. Propyl ether |
| 3. Ethyl ether | 15. Allyl ether |
| 4. 1,3-Dioxalane | 16. 1,4-Dioxane |
| 5. Methyl-tert-butyl ether (MTBE) | 17. Butyl ethyl ether |
| 6. Allyl ethyl ether | 18. Epichlorohydrin |
| 7. Isopropyl ether | 19. Tetrahydropyran |
| 8. Tetrahydrofuran (THF) | 20. Acetal (acetaldehyde diethyl acetal) |
| 9. tert-Amyl methyl ether | 21. Butyl ether |
| 10. Butyl methyl ether | 22. Pentyl ether |
| 11. Glyme (propylene glycol dimethyl ether) | 23. Triglyme (triethylene glycol dimethyl ether) |
| 12. tert-Amyl methyl ether | 24. Benzyl ether |

GCIC027

Glycols I

Column: DB-WAX
124-7032
30 m x 0.45 mm, 0.85 µm

Carrier: Helium at 35 cm/s,
measured at 50 °C

Oven: 50 °C for 2 min
50-220 °C at 10 °C/min

Injection: Megabore direct, 250 °C

Detector: FID, 280 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL

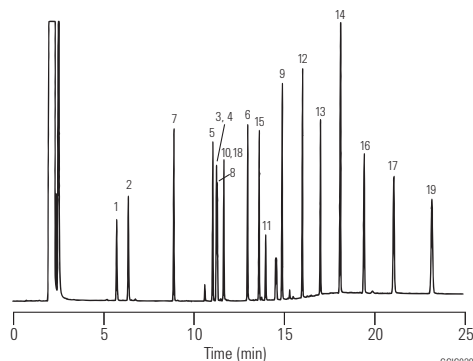
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|---------------------------------------|---------------------------------------|
| 1. Ethylene glycol monomethyl ether | 11. Dipropylene glycol |
| 2. Ethylene glycol monoethyl ether | 12. 1,5-Pentandiol |
| 3. 1,3-Propanediol | 13. 1,6-Hexandiol |
| 4. 1,2-Propanediol (propylene glycol) | 14. 1,7-Heptandiol |
| 5. 2,3-Butandiol | 15. Diethylene glycol monobutyl ether |
| 6. 1,3-Butandiol | 16. 1,8-Octandiol |
| 7. Ethylene glycol monobutyl ether | 17. 1,9-Nonandiol |
| 8. Diethylene glycol monomethyl ether | 18. Ethylene glycol |
| 9. 1,4-Butandiol | 19. 1,10-Decandiol |
| 10. Diethylene glycol monoethyl ether | |

GCIC028

Glycols II

Column: DB-624
125-1334
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/s,
measured at 40 °C

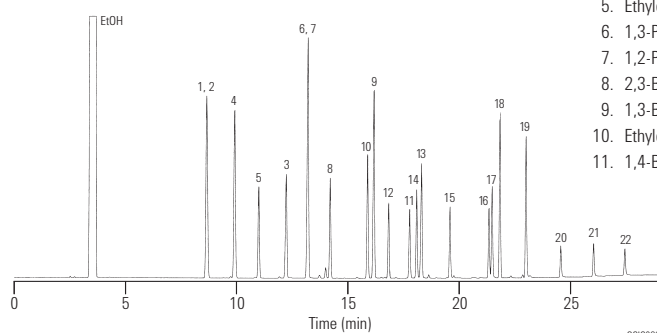
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|---------------------------------------|--|
| 1. Ethylene glycol monomethyl ether | 12. Diethylene glycol monomethyl ether |
| 2. Glyme | 13. Diethylene glycol |
| 3. Ethylene glycol | 14. Diethylene glycol monoethyl ether |
| 4. Diglyme | 15. 1,5-Pentanediol |
| 5. Ethylene glycol monoethyl ether | 16. 1,6-Hexanediol |
| 6. 1,3-Propanediol | 17. Diethylene glycol monobutyl ether |
| 7. 1,2-Propanediol (propylene glycol) | 18. Triglyme |
| 8. 2,3-Butanediol | 19. 1,7-Heptanediol |
| 9. 1,3-Butanediol | 20. 1,8-Octanediol |
| 10. Ethylene glycol monobutyl ether | 21. 1,9-Nonanediol |
| 11. 1,4-Butanediol | 22. 1,10-Decanediol |

Glycols III

Column: DB-1
124-1032
30 m x 0.45 mm, 1.27 µm

Carrier: Helium at 35 cm/s,
measured at 50 °C

Oven: 50 °C for 2 min
50-260 °C at 10 °C/min

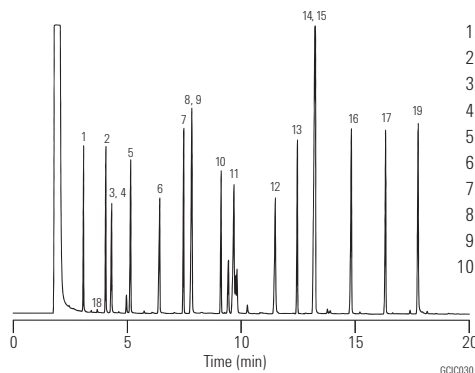
Injection: Split, 250 °C

Detector: FID, 280 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, dual taper, deactivated, 4 mm id, G1544-80700
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|---------------------------------------|---------------------------------------|
| 1. Ethylene glycol monomethyl ether | 11. Dipropylene glycol |
| 2. Ethylene glycol monoethyl ether | 12. 1,5-Pentanediol |
| 3. 1,3-Propanediol | 13. 1,6-Hexanediol |
| 4. 1,2-Propanediol | 14. 1,7-Heptanediol |
| 5. 2,3-Butanediol | 15. Diethylene glycol monobutyl ether |
| 6. 1,3-Butanediol | 16. 1,8-Octanediol |
| 7. Ethylene glycol monobutyl ether | 17. 1,9-Nonanediol |
| 8. Diethylene glycol monomethyl ether | 18. Ethylene glycol |
| 9. 1,4-Butanediol | 19. 1,10-Decanediol |
| 10. Diethylene glycol monoethyl ether | |

Triethylene Glycol and Impurities

Column: DB-1
124-1032
30 m x 0.45 mm, 1.27 μ m

Carrier: Helium at 35 cm/s,
measured at 50 °C

Oven: 170 °C isothermal

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 280 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.5 μ L

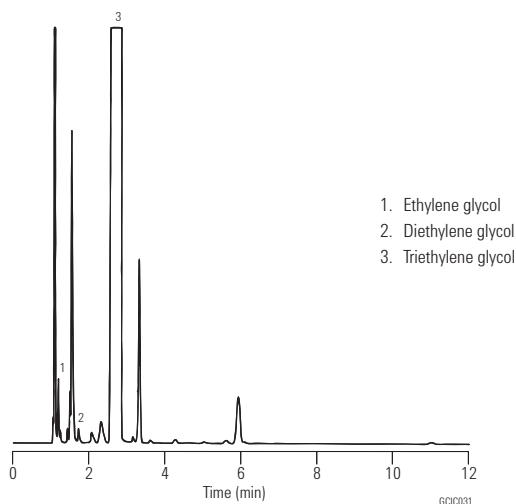
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273

**Ethylene Glycol Mixture**

Column: Ultra 1
19091A-101
12 m x 0.20 mm, 0.33 μ m

Carrier: Helium, 25 cm/s

Oven: 100 °C for 0.5 min
100-200 °C at 20 °C/min

Injection: Split, 250 °C
Split ratio 100:1

Detector: FID

Sample: 1 μ L

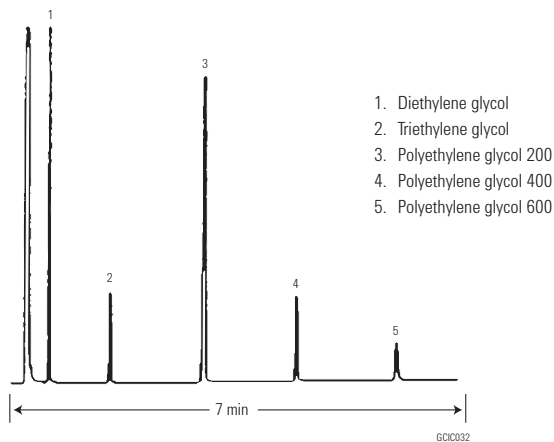
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Liner, splitless, single-taper, glass wool, deactivated, 5062-3587

Seal: Gold plated seal, 18740-20885

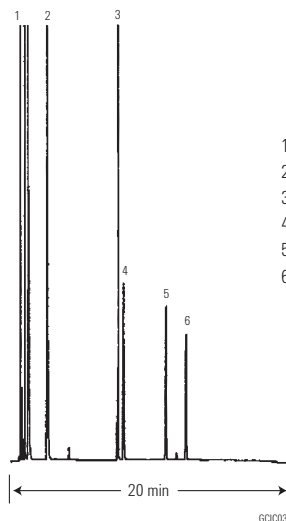
Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267



Glycols/Diols

Column: HP-1
19095Z-023
30 m x 0.53 mm, 0.88 µm

Carrier: Helium
Oven: 50 °C for 3 min
50-180 °C at 8 °C/min
Injection: On-column
Detector: FID, 250 °C
Sample: 1 µL



1. Ethylene glycol
2. 1,3-Butandiol
3. Ethylene glycol phenyl ether
4. 1,7-Hepatanediol
5. 1,9-Nonanediol
6. 1,10-Decanediol

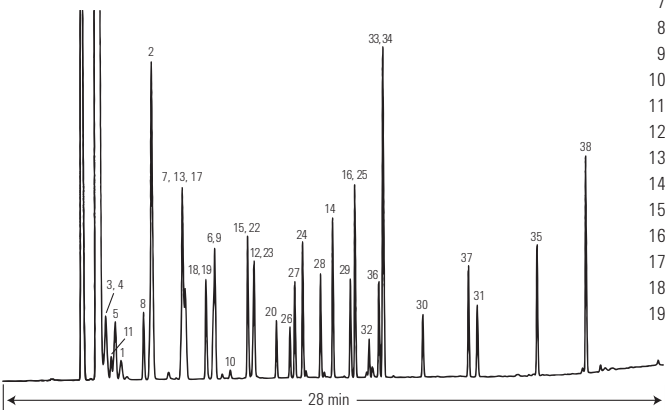
Halogenated Hydrocarbons II

Column: DB-1
123-1034
30 m x 0.32 mm, 3.00 µm

Carrier: Helium at 35 cm/s, measured at 35 °C
Oven: 35 °C for 5 min
35-245 °C at 10 °C/min
245 °C for 2 min
Injection: Split, 250 °C
Split ratio 1:100
Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min
Sample: In pentane

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. 1,1,2-Trichlorotrifluoroethane (freon 113)
2. 1,1-Dichloroethene
3. Bromoethane (ethyl bromide)
4. Iodomethane
5. 3-Chloropropene (allyl chloride)
6. 1-Chlorobutane
7. 2,2-Dichloropropane
8. trans-1,2-Dichloroethene
9. 1,1,1-Trichloroethane
10. Carbon tetrachloride
11. Methylene chloride
12. Trichloroethene
13. Chloroform
14. Tetrachloroethene
15. 1,2-Dichloropropane
16. 1-Chlorohexane
17. Bromochloromethane
18. 1,1-Dichloroethane
19. 1,2-Dichloroethane
20. Iodoform
21. cis-1,3-Dichloropropene
22. Dibromomethane
23. Bromodichloromethane
24. 1,3-Dichloropropane
25. 1,1-Dichloropropane
26. trans-1,3-Dichloropropene
27. 1,1,2-Trichloroethane
28. 1,2-Dibromoethane (EDB)
29. 1,1,1,2-Tetrachloroethane
30. Pentachloroethane
31. Hexachloroethane
32. Bromoform
33. trans-1,4-Dichloro-2-butene
34. 1,2,3-Trichloropropane
35. Hexachlorobutadiene
36. 1,1,2,2-Tetrachloroethane
37. 1,2-Dibromo-3-chloropropane (DBCP)
38. Hexachlorocyclopentadiene

Chlorinated Isooctane

Column: HP-INNOWax
19091N-136
60 m x 0.25 mm, 0.25 µm

Carrier: Helium, 33 cm/s, 35.7 psi (80 °C) 2 mL/min

Oven: 80 °C isothermal

Injection: Split, 250 °C
Split ratio 150:1

Detector: FID, 300 °C

Sample: Monochloro isomers, 0.5 µL

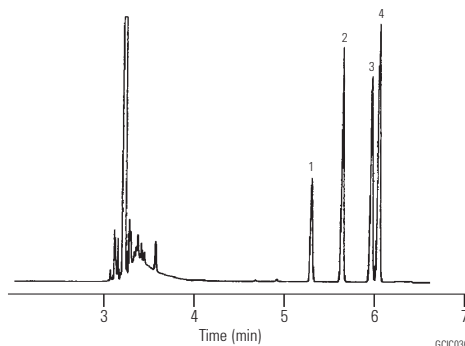
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. 1-Chloro isooctane
2. 4-Chloromethyl 2,2'-dimethyl pentane
3. 3-Chloro isooctane
4. 4-Chloro isooctane

Solvents I

Column: DB-WAXetr
125-7332
30 m x 0.53 mm, 1.00 µm

Carrier: Helium at 30 cm/s,
measured at 40 °C

Oven: 40 °C for 5 min
40-140 °C at 5 °C/min

Injection: Split, 250 °C

Detector: FID, 250 °C

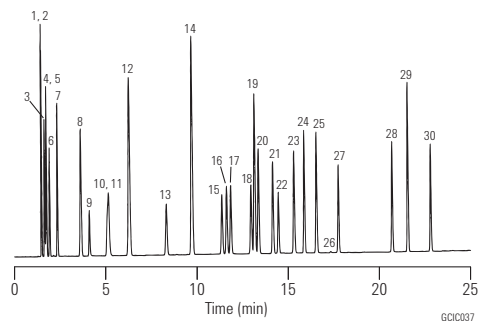
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



- | | |
|-----------------------------------|----------------------------|
| 1. 3-Methylpentane | 16. p-Xylene |
| 2. Hexane | 17. m-Xylene |
| 3. Isooctane | 18. Cumene |
| 4. Methyl-tert-butyl ether (MTBE) | 19. Dodecane |
| 5. Heptane | 20. o-Xylene |
| 6. Cyclohexane | 21. Propylbenzene |
| 7. Octane | 22. Chlorobenzene |
| 8. Nonane | 23. Mesitylene |
| 9. Methanol | 24. Styrene |
| 10. Ethanol | 25. 1,2,4-Trimethylbenzene |
| 11. Benzene | 26. Naphthalene |
| 12. Decane | 27. 4-Chlorotoluene |
| 13. Toluene | 28. 1,3-Dichlorobenzene |
| 14. Undecane | 29. 1,4-Dichlorobenzene |
| 15. Ethylbenzene | 30. 1,2-Dichlorobenzene |

Solvents II

Column: DB-WAXetr
123-7354
50 m x 0.32 mm, 1.00 µm

Carrier: Helium at 41 cm/s, measured at 50 °C

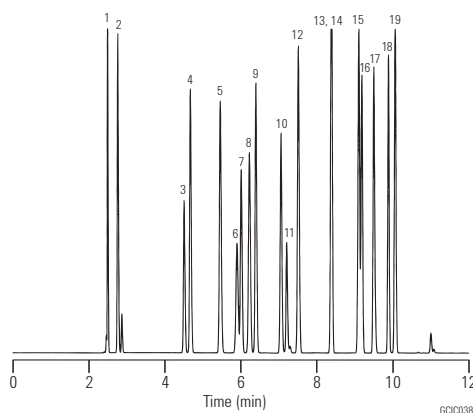
Oven: 50 °C for 5 min
50-170 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 280 °C
Nitrogen makeup gas at 30 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Hexane
2. Isooctane
3. Acetone
4. Ethyl formate
5. Tetrahydrofuran
6. Trichloroethane
7. Ethyl acetate
8. Isopropyl acetate
9. Methyl ethyl ketone
10. Isopropyl alcohol
11. Methylene chloride
12. Benzene
13. 2-Pentanone
14. Methyl isobutyl ketone
15. Isobutyl acetate
16. Chloroform
17. sec-Butyl alcohol
18. Toluene
19. n-Propanol

Solvents III

Column: DB-200
122-2033
30 m x 0.25 mm, 0.50 µm

Carrier: Helium at 31 cm/s

Oven: 45 °C for 7 min
45-145 °C at 20 °C/min

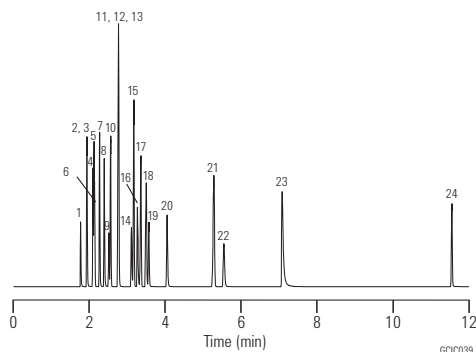
Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.5 µL of 0.5-1.0 µg/µL
standard in water

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



- | | |
|-----------------------|-------------------------------|
| 1. Methanol | 13. Acetone |
| 2. Ethanol | 14. Acetonitrile |
| 3. Ethyl ether | 15. Benzene |
| 4. Isopropanol | 16. Tetrahydrofuran (THF) |
| 5. n-Hexane | 17. Trichloroethylene |
| 6. Methylene chloride | 18. n-Butanol |
| 7. tert-Butanol | 19. Ethyl acetate |
| 8. n-Propanol | 20. Methyl ethyl ketone (MEK) |
| 9. Chloroform | 21. Toluene |
| 10. Cyclohexane | 22. 1,4-Dioxane |
| 11. sec-Butanol | 23. Pyridine |
| 12. n-Heptane | 24. Dimethylformamide (DMF) |

Solvents IV

Column: HP-1
19091Z-205
50 m x 0.20 mm, 0.50 µm

Carrier: Helium, 30 psi

Oven: 70-200 °C at 5 °C/min
200 °C for 2 min

Injection: Split

Detector: TCD

Sample: 1 µL

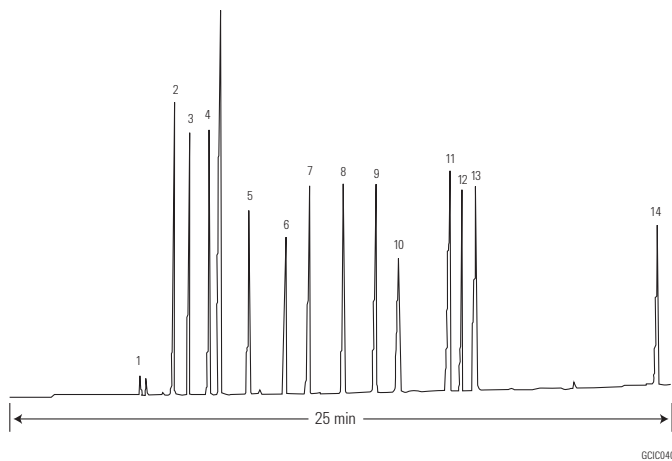
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



1. Isopropanol
2. Methyl ethyl ketone
3. Ethyl acetate
4. n-Butyl alcohol
5. Ethyl cellosolve
6. Methyl isobutyl ketone
7. Toluene
8. n-Butyl acetate
9. Diacetone alcohol
10. p-Xylene
11. Cellosolve acetate
12. o-Xylene
13. Butyl cellosolve
14. Butyl cellosolve acetate

Solvents

Column: PoraBOND Q PT
CP7348PT
25 m x 0.25 mm, 3.00 µm

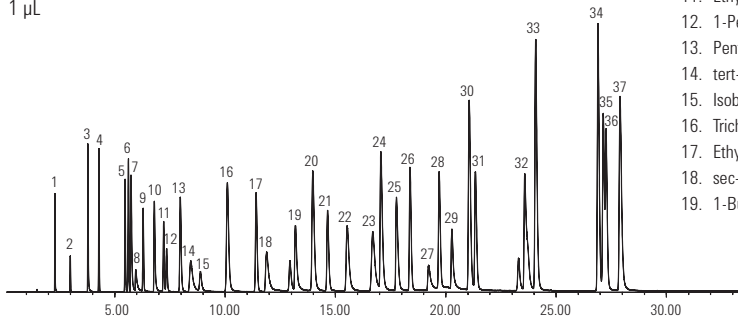
Carrier: Helium, 1.5 mL/min

Oven: 90 °C to 140 °C at 10 °C/min
140 °C for 5 min
140 °C to 210 °C at 4 °C/min
210 °C for 6 min

Injection: Split, 250 °C, split ratio 1:150

Detector: MSD, 280 °C transfer line
Full scan at m/z 30-350

Sample: 1 µL



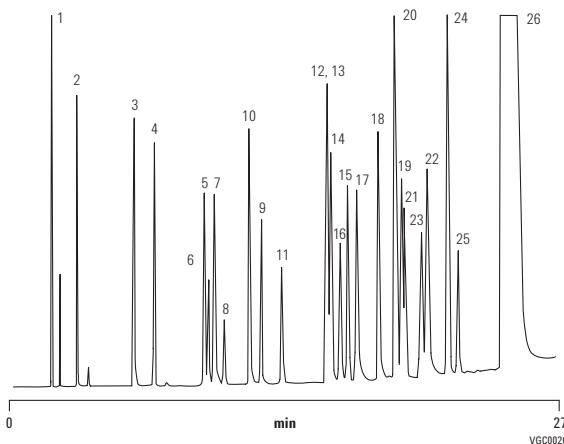
- | | |
|------------------------|----------------------------|
| 1. Methyl alcohol | 20. Benzene |
| 2. Acetaldehyde | 21. Hexane |
| 3. Ethanol | 22. 1,4-Dioxane |
| 4. Acetonitrile | 23. Ethyl tert-butyl ether |
| 5. Acetone | 24. Pyridine |
| 6. Methylene chloride | 25. N,N-dimethylformamide |
| 7. Isopropyl alcohol | 26. N-Propyl acetate |
| 8. 2-Propanamine | 27. 3-Methyl-1-butanol |
| 9. Ethyl formate | 28. n-Propyl ether |
| 10. 1-Propanol | 29. 1-Pentanol |
| 11. Ethyl ether | 30. Toluene |
| 12. 1-Pentene | 31. Heptane |
| 13. Pentane | 32. N,N-dimethylacetamide |
| 14. tert-Butyl alcohol | 33. Chlorobenzene |
| 15. Isobutyraldehyde | 34. Ethylbenzene |
| 16. Trichloromethane | 35. m-Xylene |
| 17. Ethyl acetate | 36. p-Xylene |
| 18. sec-Butyl alcohol | 37. o-Xylene |
| 19. 1-Butanol | |

Analysis of Solvents

Column: PoraBOND Q
CP7354
25 m x 0.53 mm, 10.00 µm

Sample: 5 µL
Sample Conc: 0.1% per compound
Solvent: DMSO
Carrier: He, 25 kPa (0.25 bar, 3.5 psi)
Oven: 100 °C (2 min) to 300 °C, 5 °C/min
Injection: Split, T=250 °C
Detector: FID, T=250 °C

1. Methane
2. Methanol
3. Ethanol
4. Acetonitrile
5. Acetone
6. Dichloromethane
7. 2-Propanol
8. Dimethyl sulfide
9. Diethyl ether
10. 1-Propanol
11. Pentane
12. 2-Butanone
13. Trichloromethane
14. Tetrahydrofuran
15. Ethyl acetate
16. 2-Methoxyethanol
17. Isobutanol
18. Butanol
19. Hexane
20. Benzene
21. Trichloroethylene
22. Cyclohexane
23. 1,4-Dioxane
24. Pyridine
25. N,N-dimethylformamide
26. Dimethyl sulfoxide



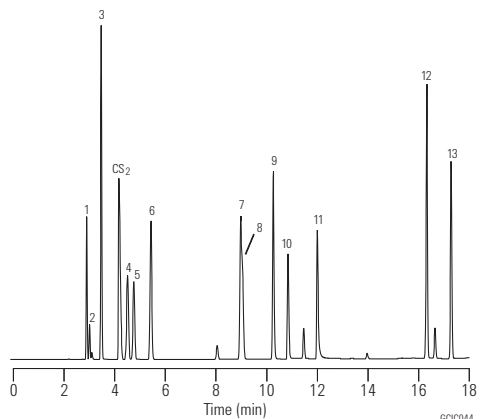
Nitrogen-based Solvents I

Column: DB-1
125-1034
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/s,
measured at 40 °C
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
Injection: Split, 250 °C
Split ratio 1:10
Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



1. Acetonitrile
2. Acrolein
3. Acrylonitrile
4. Propionitrile
5. Methacrolein
6. Methacrylonitrile
7. Triethylamine
8. Ethyl acrylate
9. Pyridine
10. DMF (dimethylformamide)
11. DMSO (dimethyl sulfoxide)
12. Benzonitrile
13. 1-Methyl-2-pyrrolidinone

Nitrogen-based Solvents II

Column: DB-624
125-1334
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/s,
measured at 40 °C

Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

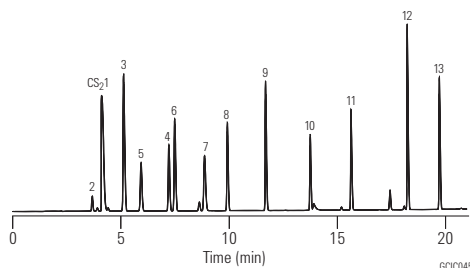
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



1. Acetonitrile
2. Acrolein
3. Acrylonitrile
4. Propionitrile
5. Methacrolein
6. Methacrylonitrile
7. Triethylamine
8. Ethyl acrylate
9. Pyridine
10. DMF (dimethylformamide)
11. DMSO (dimethyl sulfoxide)
12. Benzoinitrile
13. 1-Methyl-2-pyrrolidinone

Acrylate Impurities I

Column: DB-200
125-2032
30 m x 0.53 mm, 1.00 µm

Carrier: Helium at 34.5 cm/s,
measured at 35 °C

Oven: 35 °C for 5 min,
35-200 °C at 10 °C/min

Injection: Split, 230 °C
Split ratio 1:10

Detector: FID, 250 °C

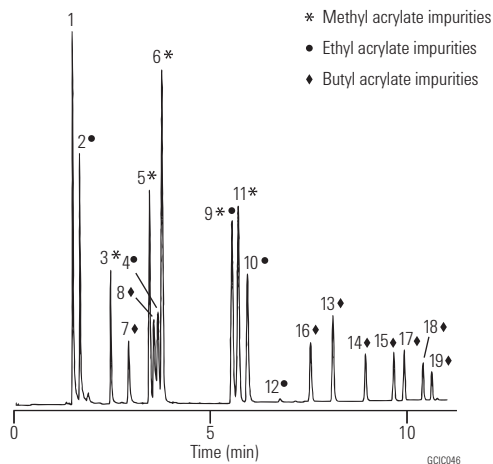
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



1. Methanol
2. Ethanol
3. Methyl acetate
4. Ethyl acetate
5. Methyl acrylate
6. Methyl propionate
7. Isobutanol
8. Butanol
9. Ethyl acrylate
10. Ethyl propionate
11. Methyl methacrylate
12. Isopropyl acrylate
13. Isobutyl acetate
14. Butyl acetate
15. Isobutyl acrylate
16. Dibutyl ether
17. Isobutyl propionate
18. Butyl acrylate
19. Butyl propionate

Acrylate Impurities II

Column: DB-1701
125-0732
30 m x 0.53 mm, 1.00 µm

Carrier: Helium at 36.8 cm/s,
measured at 35 °C

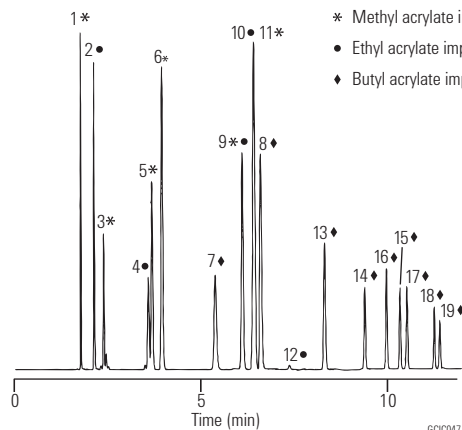
Oven: 35 °C for 5 min,
35-200 °C at 10 °C/min

Injection: Split, 230 °C
Split ratio 1:10

Detector: FID, 250 °C

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



* Methyl acrylate impurities
• Ethyl acrylate impurities
◊ Butyl acrylate impurities

1. Methanol
2. Ethanol
3. Methyl acetate
4. Ethyl acetate
5. Methyl acrylate
6. Methyl propionate
7. Isobutanol
8. Butanol
9. Ethyl acrylate
10. Ethyl propionate
11. Methyl methacrylate
12. Isopropyl acrylate
13. Isobutyl acetate
14. Butyl acetate
15. Isobutyl acrylate
16. Dibutyl ether
17. Isobutyl propionate
18. Butyl acrylate
19. Butyl propionate

Acrylates

Column: HP-FFAP
19095F-121
10 m x 0.53 mm, 1.00 µm

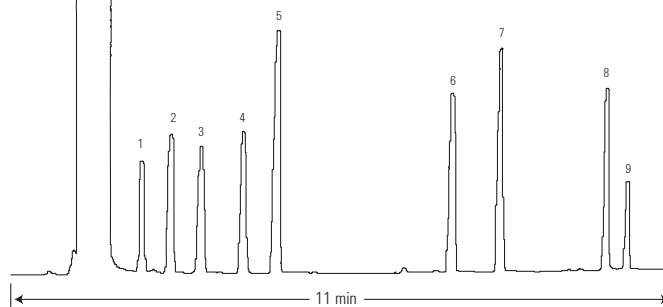
Carrier: Hydrogen

Oven: 35 °C for 1 min
35-60 °C at 10 °C/min
60-160 °C at 15 °C/min

Injection: On-column

Detector: FID

Sample: 1 µL



1. Methyl methacrylate
2. Ethyl methacrylate
3. sec-Butyl methacrylate
4. Allyl acrylate
5. n-Butyl acrylate
6. Hexyl methacrylate
7. Cyclohexyl methacrylate
8. Hydroxypropyl acrylate
9. Unknown

Anilines

Column: DB-35ms
128-3822
25 m x 0.20 mm, 0.33 μ m

Carrier: Helium at 35 cm/s,
measured at 50 °C

Oven: 50 °C for 2 min
50-340 °C at 20 °C/min
340 °C for 10 min

Injection: Splitless, 280 °C
0.50 min purge activation time

Detector: FID, 320 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 μ L of 5 ng
on-column per component

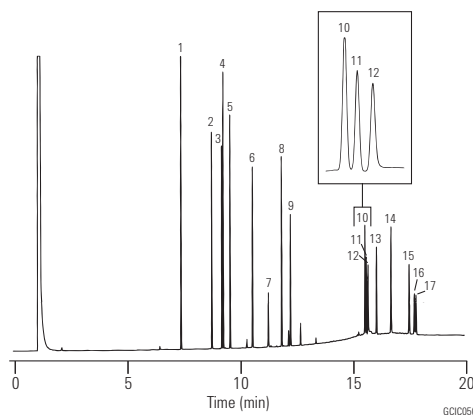
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Seal: Gold plated seal, 18740-20885

Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267



1. o-Toluidine
2. 4-Chloroaniline
3. 2-Methoxy-5-methylaniline
4. 2,4,5-Trimethylaniline
5. 4-Chloro-2-methylaniline
6. 2,4-Diaminotoluene
7. 2,4-Diaminoanisole
8. 2-Aminonaphthalene
9. 2-Methyl-5-nitroaniline
10. 4,4'-Oxydianiline
11. 4,4'-Methylenedianiline
12. Benzidine
13. 2-Aminoazotoluene
14. o-Tolidine
15. 4,4'-Thiodianiline
16. 3,3'-Dimethoxybenzidine
17. 3,3'-Dichlorobenzidine

Substituted Anilines

Column: DB-5ms
122-5536
30 m x 0.25 mm, 0.50 μ m

Carrier: Helium at 33.3 cm/s,
measured at 150 °C

Oven: 40 °C for 5 min
40-290 °C at 12 °C/min
290 °C for 10 min

Injection: Splitless, 250 °C
30 s purge activation time

Detector: MSD, 325 °C transfer line

Sample: 1 μ L of 25 ng/ μ L standard

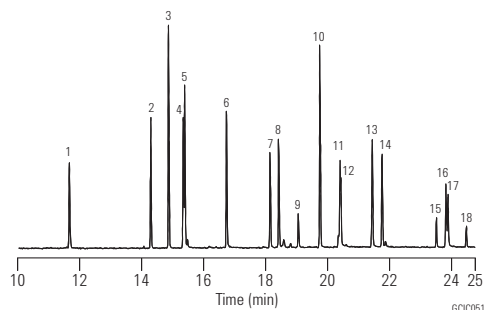
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Seal: Gold plated seal, 18740-20885

Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267



	m/z
1. Aniline	93
2. 2-Chloroaniline	127
3. 2,6-Dimethylaniline	121
4. 3-Chloroaniline	127
5. 4-Chloroaniline	127
6. 4-Bromoaniline	171
7. 2-Nitroaniline	138
8. 3,4-Dichloroaniline	161
9. 3-Nitroaniline	65
10. 2,4,5-Trichloroaniline	195
11. 4-Chloro-2-nitroaniline	172
12. 4-Nitroaniline	138
13. 2-Chloro-4-nitroaniline	172
14. 2,6-Dichloro-4-nitroaniline	176
15. 2-Chloro-4,6-dinitroaniline	217
16. 2,6-Dibromo-4-nitroaniline	266
17. 2,4-Dinitroaniline	183
18. 2-Bromo-4,6-dinitroaniline	261

Phenols II

Column: DB-5ms
122-5536
30 m x 0.25 mm, 0.50 µm

Carrier: Helium at 22 cm/s,
measured at 100 °C

Oven: 100 °C for 1 min
100-270 °C at 10 °C/min

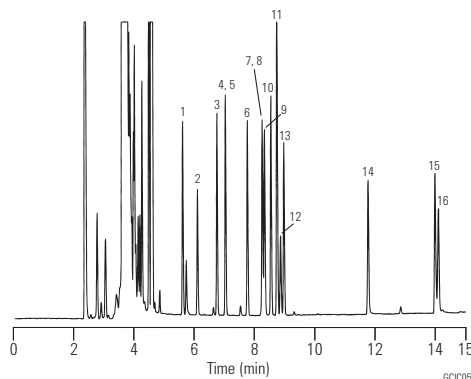
Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 50 ng/µL standard
in toluene/p-xylene

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Phenol
2. 2-Chlorophenol
3. o-Cresol
4. m-Cresol
5. p-Cresol
6. 2,6-Xylenol
7. 2,4-Xylenol
8. 2,5-Xylenol
9. 2-Nitrophenol
10. 3,5-Xylenol
11. 2,3-Xylenol
12. 2,4-Dichlorophenol
13. 3,4-Xylenol
14. 2,4,6-Trichlorophenol
15. 2,4-Dinitrophenol
16. 1-Naphthol

Phenols III

Column: DB-WAX
122-7032
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 43 cm/s

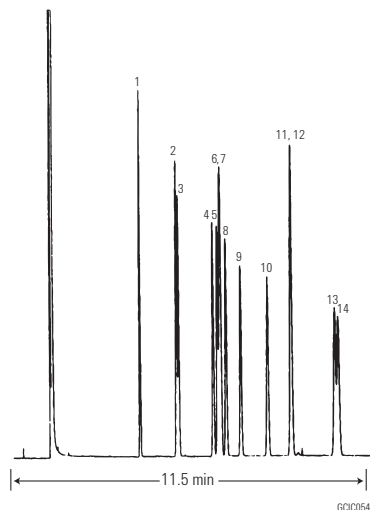
Oven: 165 °C isothermal

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647
Seal: Gold plated seal, 18740-20885
Syringe: 5 µL tapered, FN 23-26s/42/HP, 5181-1273



1. 2,6-Xylenol
2. 2-Cresol
3. Phenol
4. 2-Ethylphenol
5. 2,5-Xylenol
6. 4-Cresol
7. 2,4-Xylenol
8. 3-Cresol
9. 2-Isopropylphenol
10. 2,3-Xylenol
11. 3,5-Xylenol
12. 4-Ethylphenol
13. 3,4-Xylenol
14. 2,3,5-Trimethylphenol

Halocarbons

Column: GS-GasPro
113-4332
30 m x 0.32 mm

Carrier: Helium at 30 cm/s

Oven: 130 °C for 4 min
130-225 °C at 10 °C/min
225 °C hold

Injection: Split, 250 °C
Split ratio 1:67

Detector: FID, 250 °C

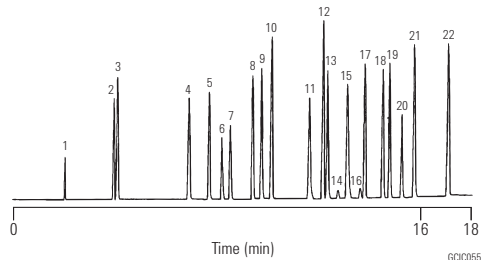
Sample: 1 µL

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



- | | |
|---|---|
| 1. CH ₄ | 12. cis-ClCH=CHCl |
| 2. CHClF ₂ (Freon 22) | 13. CHCl ₃ |
| 3. CCl ₂ F ₂ (Freon 12) | 14. CCl ₄ |
| 4. ClCF ₂ CF ₂ Cl (Freon 114) | 15. CCl ₄ |
| 5. CHCl ₂ F (Freon 21) | 16. CCl ₄ |
| 6. CCl ₃ F (Freon 11) | 17. CH ₃ CH ₂ I |
| 7. CF ₂ Br ₂ (Freon 12B2) | 18. CH ₂ Br ₂ |
| 8. CH ₃ I | 19. CHCl ₂ Br |
| 9. CH ₂ Cl ₂ | 20. C ₄ F ₉ I |
| 10. trans-ClCH=CHCl | 21. CHClBr ₂ |
| 11. CF ₃ CCl ₃ (Freon 113) | 22. CH ₃ CH ₂ CH ₂ I |

Ethylene Oxide

Column: DB-WAX
122-7032
30 m x 0.25 mm, 0.25 µm

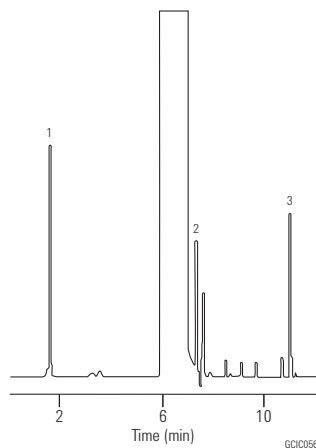
Carrier: Helium at 1 mL/min

Oven: 60 °C for 2 min
60-180 °C at 16 °C/min

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Courtesy of J. Chromatogr. Sci., 28:97 [1990]



1. Ethylene oxide
2. 2-Chloroethanol
3. Ethylene glycol (solvent: dimethylformamide)

Impurities in Mixed Xylenes

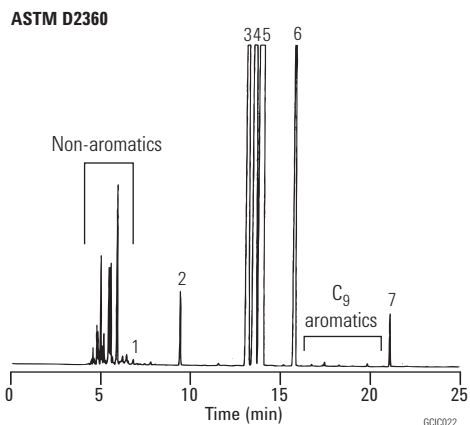
Column: DB-WAXetr
123-7362
60 m x 0.32 mm, 0.25 µm

Carrier: Helium at 20 cm/s,
measured at 145 °C

Oven: 60 °C for 10 min
60-150 °C at 5 °C/min
150 °C for 10 min

Injection: Split, 230 °C
Split ratio 1:150

Detector: FID, 240 °C



1. Benzene
2. Toluene
3. Ethylbenzene
4. p-Xylene
5. m-Xylene
6. o-Xylene
7. n-Butylbenzene (IS)

High Resolution Separation of Xylene Isomers

Column: CP-Chirasil-Dex CB
CP7502
25 m x 0.25 mm, 0.25 µm

Sample: 0.5 µL

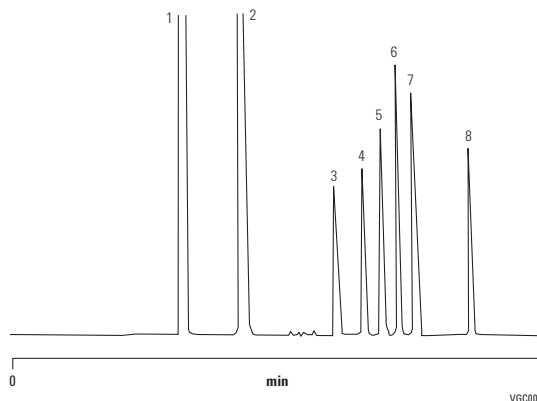
Sample Conc: 10-20%

Carrier: Helium, 40 kPa, 6 psi

Oven: 80 °C, (6 min) to 130 °C, 25 °C/min

Injection: Split, T=210 °C, 1:20

Detector: FID, T=230 °C



1. Benzene
2. Toluene
3. Para xylene
4. Meta xylene
5. Ethyl benzene
6. Ortho xylene
7. Styrene
8. Cumene

Halothane

Column: GS-GasPro
113-4312
15 m x 0.32 mm

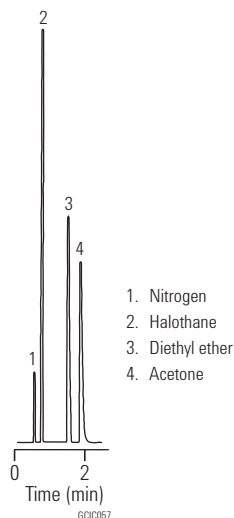
Carrier: Helium at 45 cm/s

Oven: 240 °C isothermal

Injection: Split, 200 °C
Split ratio 1:100

Detector: FID, 200 °C

Sample: 0.2 µL



1. Nitrogen
2. Halothane
3. Diethyl ether
4. Acetone

Suggested Supplies

- Septum:** 11 mm Advanced Green septa, 5183-4759
- Liner:** Direct, 1.5 mm id, 18740-80200
- Seal:** Gold plated seal, 18740-20885

Inorganic Hydride Gases

Column: HP-1
19091Z-205
50 m x 0.20 mm, 0.50 μ m

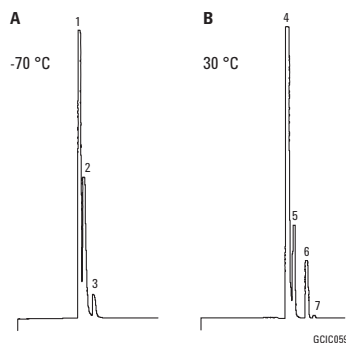
Carrier: Helium, 35 cm/s

Oven: A: -70 °C isothermal
B: 30 °C isothermal

Injection: Split ratio 25:1

Detector: FPD, 535 μ m filter

Sample: 1 μ L



1. Arsine 0.1%
2. Phosphine 0.1%
3. Selenide 0.1%
4. Diborane 0.10 ppm
5. Tetraborane 0.10 ppm
6. Pentaborane 0.10 ppm
7. Dihydropentaborane 0.60 ppm

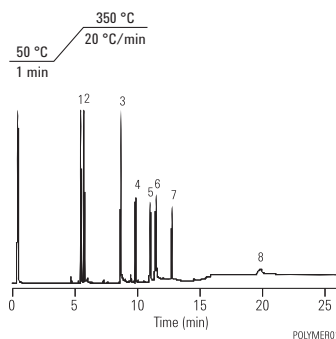
Polymer Additives

Column: HP-35 (use only 10 m)
19091G-013
30 m x 0.32 mm, 0.15 μ m

Carrier: Helium, 6 psi (4 mL/min at 50 °C) hold for 5 min,
ramp to 50 psi (21 mL/min at 350 °C) at 5 psi/min

Injection: EPC on-column, oven track 0.5 μ L injection

Detector: FID



1. BHT
2. BHEB
3. Tinuvin P
4. Isonox 129
5. Irgafos 168
6. Irganox 1076
7. MD 1024
8. Irganox 1010

Fast Separation of Silanes

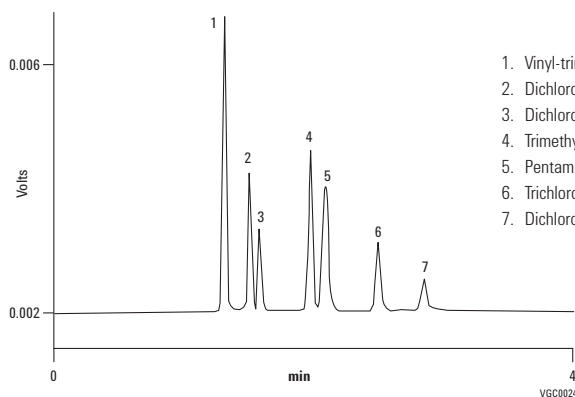
Column: VF-200ms
CP8860
30 m x 0.25 mm, 1.00 μ m

Carrier: Hydrogen, ca 1.0 mL/min, 60 kPa

Oven: 50 °C

Injection: Split/splitless, in split mode, 1:100

Detector: FID



1. Vinyl-trimethyl silane
2. Dichloromethyl silane
3. Dichloromethane
4. Trimethylchloro silane
5. Pentamethyl disiloxane
6. Trichloromethyl silane
7. Dichlorodimethyl silane

Sulfur Gases

Column: PoraPLOT U
CP7584
25 m x 0.53 mm, 20.00 µm

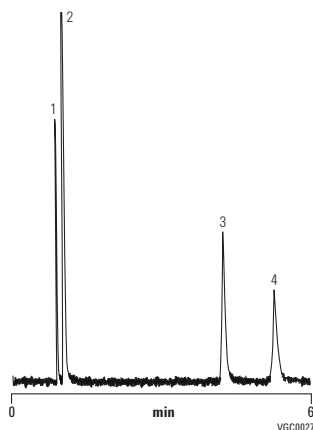
Sample: ±100 ppm

Carrier: H₂

Oven: 50 °C

Injection: 100 mL/min

Detector: FPD



1. Hydrogen sulfide
2. Carbonyl sulfide
3. Sulfur dioxide
4. Methyl sulfide

Analysis of Acetylenes' Mixture

Column: Select Al₂O₃
CP7432
50 m x 0.53 mm

Sample Conc: Approx 100 ppm in nitrogen, synthetic standard

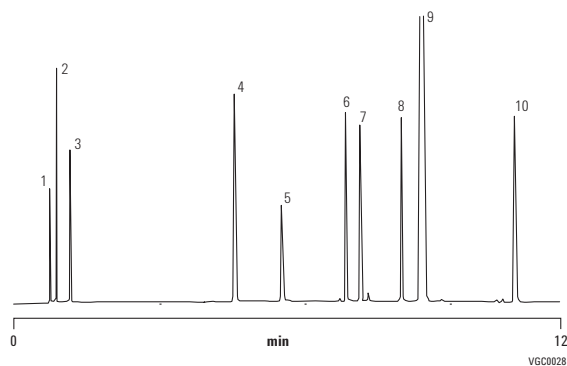
Carrier: Helium, 4 psig, 4 min to 11 psig, 0.5 psig/min, 2 min

Oven: 40 °C, 5 min to 160 °C, 10 °C/min to 200 °C,
20 °C/min, hold 1 min

Injection: Split, 60 mL/min

Detector: FID

Courtesy of J. Luong, Dow Chemical Canada



1. Methane
2. Ethane
3. Ethylene
4. n-Butane
5. Propadiene
6. 1-Butene
7. Iso-butene
8. 1,2-Butadiene
9. 1,3-Butadiene
10. Ethyl acetylene

Forensic Toxicology and Pharma Applications

DB-Select 624 UI for <467>

Megabore

Early Eluting Peaks

Column: DB-Select 624 Ultra Inert
125-0334UI
30 m x 0.53 mm, 3.00 µm

Carrier: Helium 44 cm/s (approx. 6 mL/min) set at 40 °C,
EPC – Constant Flow

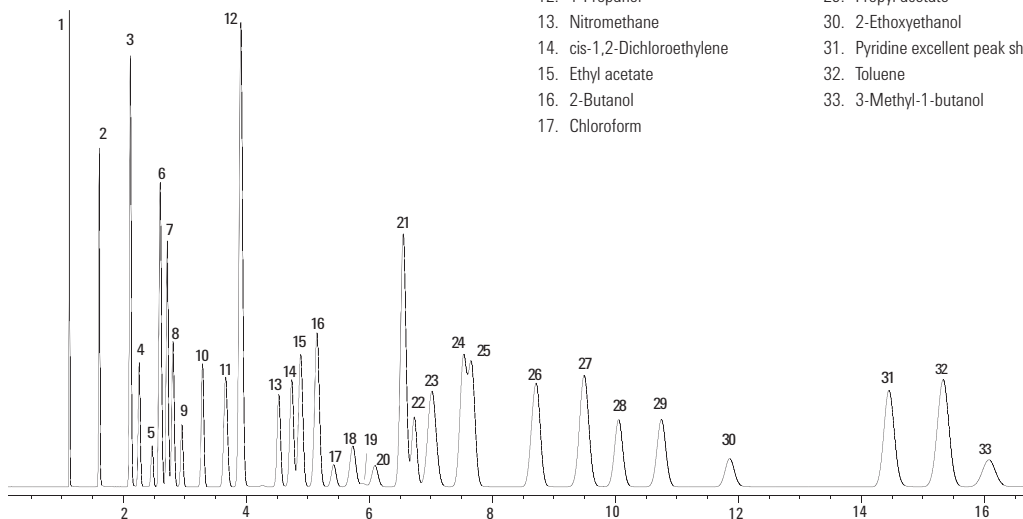
Oven: 40 °C 20 min hold, then 10°/min to 170 °C

Injection: 20 Hz

Detector: FID at 240 °C, H₂ at 30 mL/min
Air at 400 mL/min
N₂ makeup at 35 mL/min
(constant column + makeup)

Sample: FID signal

- | | |
|--------------------------------|--|
| 1. Methane | 18. 1,1,1-Trichloroethane |
| 2. Methanol | 19. Cyclohexane |
| 3. Ethanol | 20. Carbon tetrachloride |
| 4. Diethyl ether | 21. Benzene |
| 5. 1,1-Dichloroethylene | 22. 1,2-Dichloroethane |
| 6. 2-Propanol | 23. Isooctane (2,2,4-trimethylpentane) |
| 7. Acetonitrile | 24. 3-Methyl-2-butanone |
| 8. Methyl acetate | 25. n-Heptane |
| 9. Dichloromethane | 26. Trichloroethylene |
| 10. trans-1,2-Dichloroethylene | 27. Methylcyclohexane |
| 11. n-Hexane | 28. 1,4-Dioxane |
| 12. 1-Propanol | 29. Propyl acetate |
| 13. Nitromethane | 30. 2-Ethoxyethanol |
| 14. cis-1,2-Dichloroethylene | 31. Pyridine excellent peak shape |
| 15. Ethyl acetate | 32. Toluene |
| 16. 2-Butanol | 33. 3-Methyl-1-butanol |
| 17. Chloroform | |



Benzodiazepines I

Column: DB-5ms Ultra Inert
122-5532UI
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen, 53 cm/s, constant flow
1.6 for 11 min
1.6-2.4 at 60 mL/min, hold 2 min
2.4-5.0 at 50 mL/min, hold 9 min

Oven: 170 °C for 3.2 min
170-250 °C at 24.7 °C/min, hold 5.3 min
250-280 °C at 18.6 °C/min, hold 4.0 min
280-325 °C at 50.0 °C/min, hold 4.0 min

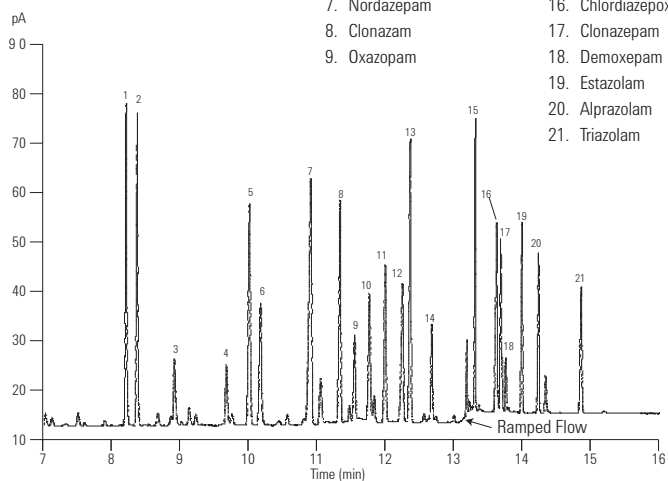
Injection: Pulsed splitless, 280 °C
20 psi pulse pressure for 0.38 min
50 mL/min purge at 0.40 min
Direct connect liner (p/n G1544-80730)

Detector: FID, 350 °C

Sample: 1 µL of 5-10 ppm

Analysis of benzodiazepines and other drugs is particularly challenging because of their high level of activity. For this reason, all aspects of the sample path – particularly the GC Column – must be as inert as possible.

- | | |
|-----------------------|----------------------|
| 1. Medazepam | 10. Temazepam |
| 2. Halazepam | 11. Flunitrazepam |
| 3. Oxazepam | 12. Bromazepam |
| 4. Lorazepam | 13. Prazepam |
| 5. Diazepam | 14. Lormetazepam |
| 6. Desalkyl aurazepam | 15. Nitrazepam |
| 7. Nordazepam | 16. Chlordiazepoxide |
| 8. Clonazam | 17. Clonazepam |
| 9. Oxazepam | 18. Demoxepam |
| | 19. Estazolam |
| | 20. Alprazolam |
| | 21. Triazolam |



BENZODIAZ

Amphetamines and Precursors – TMS Derivatives

Column: DB-5
121-5023
20 m x 0.18 mm, 0.40 µm

Carrier: Helium at 39 cm/s, measured at 100 °C

Oven: 100-240 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:100

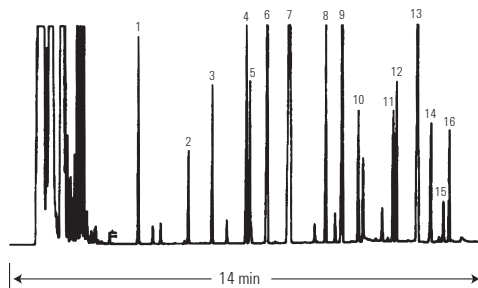
Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 2 µg/µL each in pyridine

Suggested Supplies

- Septum:** 11 mm Advanced Green septa, 5183-4759
Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

1. Phenylacetone
2. Dimethylamphetamine
3. Amphetamine
4. Phentermine
5. Methamphetamine
6. Methyl ephedrine
7. Nicotinamine
8. Ephedrine
9. Phenacetin
10. 3,4-Methylenedioxyamphetamine (MDA)
11. 3,4-Methylenedioxymethylamphetamine
12. 4-Methyl-2,5-dimethoxyamphetamine (STP)
13. Phenyl ephedrine
14. 3,4-Methylenedioxyethylamphetamine (MDE; "Eve")
15. Caffeine
16. Benzphetamine



6CL5004

Barbiturates

Column: DB-35ms
122-3832
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 31 cm/s, measured at 50 °C

Oven: 50 °C for 0.5 min
50-150 °C at 25 °C/min
150-300 °C at 10 °C/min

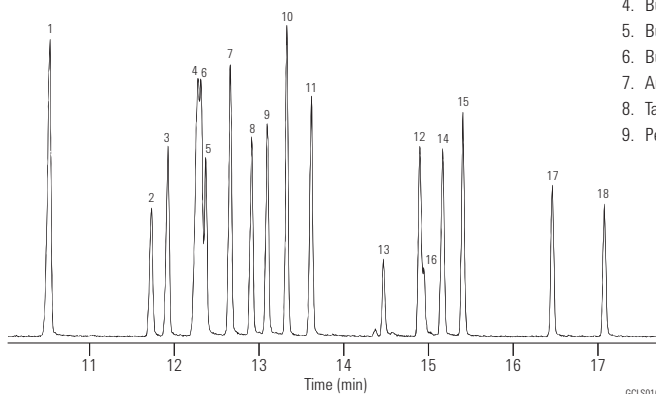
Injection: Splitless, 250 °C
30 s purge activation time

Detector: MSD, 280 °C transfer line
full scan at m/z 40-270

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

- | | |
|------------------|-------------------------|
| 1. Barbital | 10. Methohexital |
| 2. Allobarbital | 11. Secobarbital |
| 3. Aprobarital | 12. Hexobarbital |
| 4. Butabarital | 13. Thiopental |
| 5. Butethal | 14. Cyclopentylbarbital |
| 6. Butalbital | 15. Mephobarbital |
| 7. Amobarbital | 16. Thiamylal |
| 8. Talbutal | 17. Phenobarbital |
| 9. Pentobarbital | 18. Alphenal |



GGLS010

Narcotics

Column: DB-5ms
122-5532
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 31 cm/s, measured at 50 °C

Oven: 50 °C for 0.5 min
50-150 °C at 25 °C/min
150-325 °C at 10 °C/min

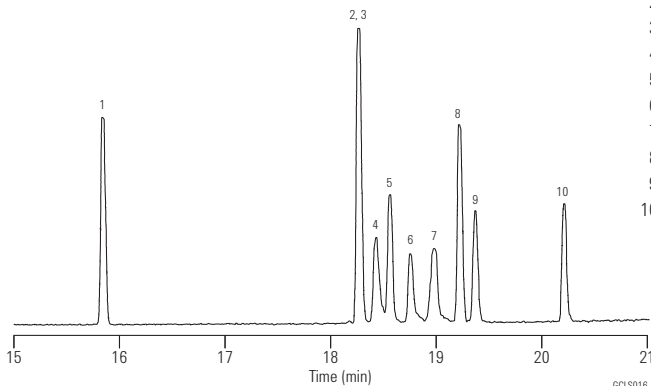
Injection: Splitless, 250 °C
30 s purge activation time

Detector: MSD, 300 °C transfer line
full scan at m/z 40-380

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

- | |
|-------------------------|
| 1. Dextromethorphan |
| 2. Codeine |
| 3. Dihydrocodeine |
| 4. Norcodeine |
| 5. Ethylmorphine |
| 6. Morphine |
| 7. Normorphine |
| 8. 6-Acetylcodeine |
| 9. 6-Monoacetylmorphine |
| 10. Heroin |



GGLS016

Blood Alcohols I (Static Headspace/Split)

Column: DB-ALC1
125-9134
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 80 cm/s,
measured at 40 °C

Oven: 40 °C isothermal

Sampler: Headspace

Injection: Split, 250 °C
Split ratio 1:10

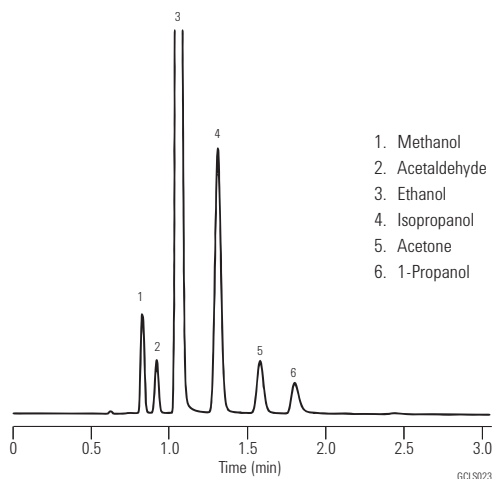
Detector: FID, 300 °C
Nitrogen makeup gas
at 23 mL/min

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Methanol
2. Acetaldehyde
3. Ethanol
4. Isopropanol
5. Acetone
6. 1-Propanol

Blood Alcohols II (Static Headspace/Split)

Column: DB-ALC2
125-9234
30 m x 0.53 mm, 2.00 µm

Carrier: Helium at 80 cm/s,
measured at 40 °C

Oven: 40 °C isothermal

Sampler: Headspace

Oven: 70 °C
Loop: 80 °C
Transfer line: 90 °C
Vial equil. time: 10 min
Pressurization time: 0.20 min
Loop fill time: 0.20 min
Loop equil. time: 0.05 min
Inject time: 0.1-0.2 min
Sample loop size: 1.0 mL

Injection: Split, 250 °C
Split ratio 1:10

Detector: FID, 300 °C
Nitrogen makeup gas
at 23 mL/min

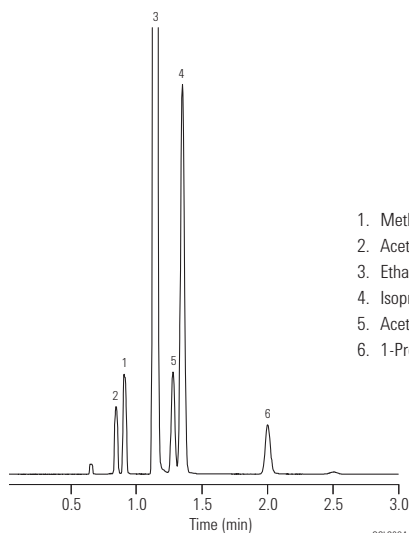
Sample: 0.1% Ethanol,
0.001% Others

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Methanol
2. Acetaldehyde
3. Ethanol
4. Isopropanol
5. Acetone
6. 1-Propanol

Residual Solvents, DMI Diluent

Column: DB-624
123-1364
60 m x 0.32 mm, 1.80 µm

Oven: 50-60 °C, 1 °C/min
60-115 °C, 9.2 °C/min
115-220 °C, 35 °C/min
220 °C – hold 6 min

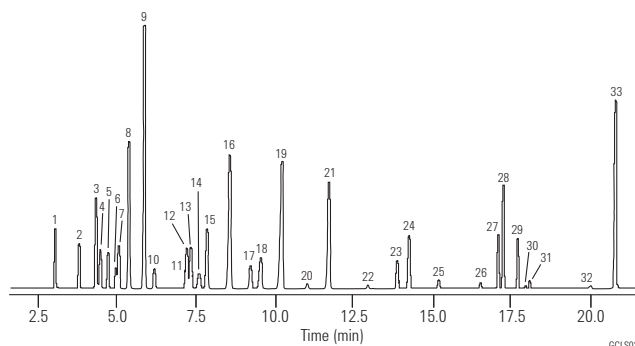
Sampler: Headspace
Plate 140 °C
Transfer line, valve 250 °C
Sample loop 2 mL

Injection: Split, 250 °C
Split ratio 1:18

Detector: FID, 270 °C
Nitrogen makeup

Sample: 5,000 ppm standard

- | | | |
|---------------------------------------|--------------------------|--|
| 1. Methanol | 12. 2-Butanone (MEK) | 23. MIBK (2-Pentanone) |
| 2. Ethanol | 13. Ethyl acetate | 24. Toluene |
| 3. Acetone | 14. 2-Butanol | 25. 1-Pentanol |
| 4. 2-Propanol | 15. Tetrahydrofuran | 26. n,n-Dimethylformamide (DMF) |
| 5. Acetonitrile | 16. Cyclohexane | 27. Ethyl benzene |
| 6. Methylene chloride | 17. Isopropyl acetate | 28. m,p-Xylene |
| 7. 2-Methyl-2-propanol (tert-butanol) | 18. 1,2-Dimethoxyethane | 29. o-Xylene |
| 8. MTBE | 19. Heptane | 30. Dimethyl sulfoxide (DMSO) |
| 9. Hexane | 20. 1-Methoxy-2-propanol | 31. n,n-Dimethylacetamide |
| 10. 1-Propanol | 21. Methylcyclohexane | 32. n-Methylpyrrolidone |
| 11. DMI impurity | 22. 2-Ethoxyethanol | 33. 1,3-Dimethyl-2-imidazolidinone (DMI) |



Special thanks to Julie Kancler, Brian Wallace, Teledyne.

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

Underivatized Drugs of Abuse – Agilent Fast Toxicology Analyzer

Column: DB-35ms Ultra Inert
122-3812UI
15 m x 0.25 mm, 0.25 µm

Carrier: Helium, fixed pressure 35.0 psi

Injection: Splitless 1 µL 280 °C, total flow 56.4 mL/min, 3 mL/min switched septum purge, gas saver off, 50 mL/min after 0.4 min

Liner: Splitless, dual taper, deactivated, 4 mm id, (p/n 5181-3315)

Sample: Agilent GC/MS toxicology checkout mixture (p/n 5190-0471)

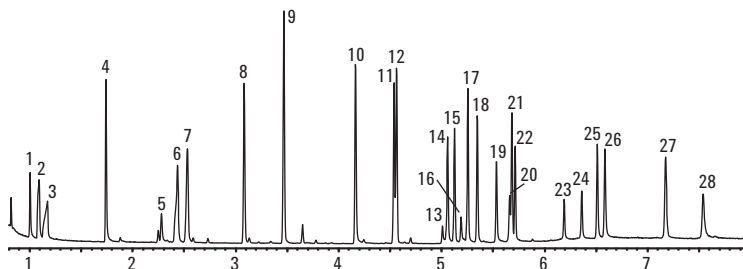
Backflush: Post run: 1 min 1 psi inlet, 75 psi aux EPC

Oven: 100 °C (0.25 min) to 345 °C (40 °C/min, 2.25 min hold)

Detector: MSD: Transfer line 300 °C, source 300 °C
Quadrupole: 180 °C scan mode
NPD: Bloss bead 300 °C H₂ 3 mL/min, 60 mL/min air, 11 mL/min makeup and column flow

CFT Device: 2-Way splitter with solvent venting between MSD and NPD

- | | | |
|---|-----------------------------|----------------------|
| 1. Amphetamine | 9. Phencyclidine | 19. Oxycodone |
| 2. Phentermine | 10. Methadone | 20. Temazepam |
| 3. Methamphetamine | 11. Cocaine | 21. Diacetylmorphine |
| 4. Nicotine | 12. SKF-525a (RTL compound) | 22. Flunitrazepam |
| 5. Methylenedioxyamphetamine (MDA) | 13. Oxazepam | 23. Nitrazepam |
| 6. Methylenedioxymethamphetamine (MDMA) | 14. Tetrahydrocannabinol | 24. Clonazepam |
| 7. Methylenedioxyethylamphetamine | 15. Codeine | 25. Alprazolam |
| 8. Meperidine | 16. Lorazepam | 26. Verapamil |
| | 17. Diazepam | 27. Strychnine |
| | 18. Hydrocodone | 28. Trazodone |



Example NPD chromatogram of underivatized drugs of abuse 5 ng/component on an Agilent J&W DB-35ms UI column. Component number 12 is used for retention time locking in the deconvolution reporting software database.

Benzodiazepines II

Column: DB-35ms
122-3832
30 m x 0.25 mm, 0.25 µm

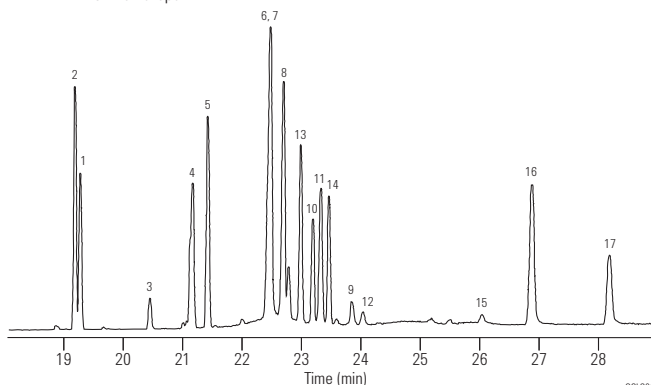
Carrier: Helium at 31 cm/s, measured at 50 °C

Oven: 50 °C for 0.5 min
50-150 °C at 25 °C/min
150-340 °C at 10 °C/min
340 °C for 6 min

Injection: Splitless, 250 °C
30 s purge activation time

Detector: MSD, 280 °C transfer line
full scan at m/z 40-400

- | | |
|----------------------|-------------------|
| 1. Medazepam | 10. Flunitrazepam |
| 2. Halazepam | 11. Delorazepam |
| 3. Oxazepam | 12. Bromazepam |
| 4. Lorazepam | 13. Prazepam |
| 5. Diazepam | 14. Flurazepam |
| 6. Demoxepam | 15. Clonazepam |
| 7. Desmethyldiazepam | 16. Alprazolam |
| 8. Clobazam | 17. Triazolam |
| 9. Temazepam | |



Suggested Supplies

- Septum:** 11 mm Advanced Green septa, 5183-4759
- Liner:** Splitless, single taper, deactivated, 4 mm id, 5181-3316
- Seal:** Gold plated seal, 18740-20885
- Syringe:** 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Drug Screen

Column: DB-1ms
122-0132
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 40 cm/s,
measured at 50 °C

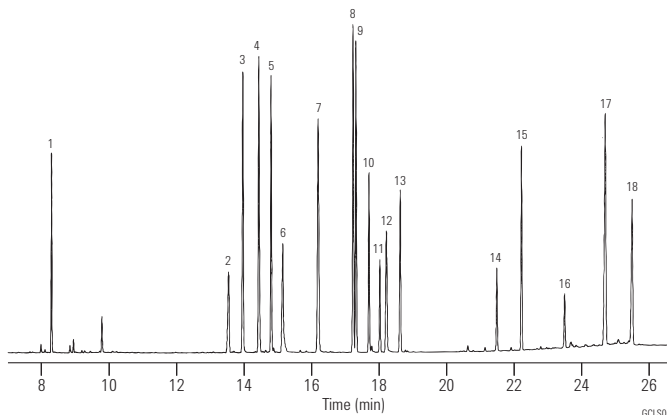
Oven: 50 °C for 1.0 min
50-125 °C at 25 °C/min
125-325 °C at 10 °C/min
325 °C for 5 min

Injection: Cold splitless
Optic II injector, 50-250 °C at 10 °C/s
45 s purge activation time

Detector: FID, 300 °C

Sample: 1 µL injection of 50-150 ppm standard

- | | |
|---------------------------------|-------------------|
| 1. Nicotine | 10. Cocaine |
| 2. Caffeine | 11. Desipramine |
| 3. Glutethimide | 12. Carbamazepine |
| 4. Lidocaine | 13. Trimipramine |
| 5. PCP | 14. Heroin |
| 6. Phenobarbital | 15. Fentanyl |
| 7. Methadone primary metabolite | 16. Ibogaine |
| 8. Methaqualone | 17. Triazolam |
| 9. Methadone | 18. LSD |



Common Drug Screen

Column: DB-5
122-5032
30 m x 0.25 mm, 0.25 µm

Column: DB-17
122-1732
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 41 cm/s,
measured at 80 °C

Oven: 80 °C for 1 min
80-280 °C at 10 °C/min
280 °C for 9 min

Injection: Split, 250 °C
Split ratio 1:40

Detector: FID, 300 °C

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

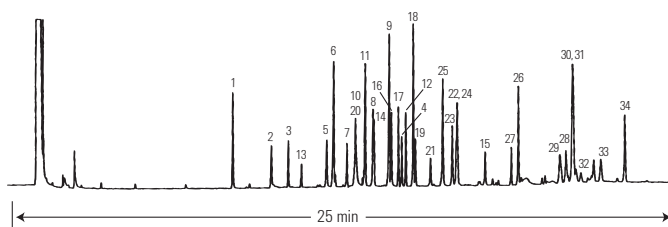
Liner: General purpose split/splitless liner, taper,
glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

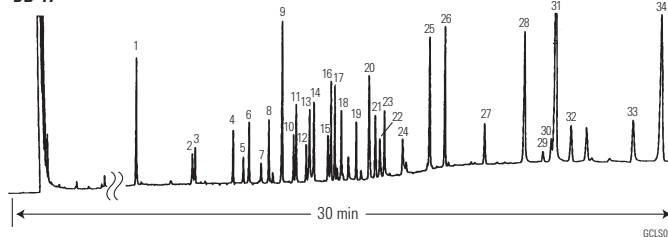
Syringe: 10 µL tapered, FN 23-26s/42/HP,
5181-1267

	DB-17 Time	DB-5 Time		DB-17 Time	DB-5 Time
1. Nicotine	9.87	8.57	18. Hexobarbital	17.52	15.22
2. Phenmetrazine	11.8	9.95	19. Doxylamine	17.69	15.87
3. Ibuprofen	12.06	10.64	20. Caffeine	18.05	13.11
4. Procaine	13.48	14.82	21. Chlorpheniramine	18.47	16.35
5. Allobarbitol	13.91	12.02	22. Methapyrilene	18.72	16.68
6. Aprobarbital	14.14	12.27	23. Thenyldiamine	18.87	16.85
7. Butabarbital	14.56	12.76	24. Phenobarbital	19.11	16.29
8. Secobarbital	14.87	14.31	25. Bromopheniramine	19.71	17.39
9. Pentobarbital	15.41	13.73	26. Chlorcyclizine	20.75	19.13
10. Phenacetin	15.72	12.94	27. Cocaine	21.32	18.88
11. Amobarbital	15.87	13.43	28. Pyrrobutamine	22.79	20.89
12. Benzphetamine	16.14	14.96	29. Codeine	24.27	20.66
13. Acetaminophen	16.34	11.12	30. Diazepam	25.27	21.13
14. Hydroxyphenamate	16.47	15.31	31. Morphine	25.36	21.12
15. Dimenhydrinate	16.93	13.79	32. Hydrocodone	25.98	21.26
16. Meprobamate	17.12	14.44	33. Oxymorphone	28.27	22.21
17. Benactyzine	17.26	14.71	34. Heroin	29.32	23.14

DB-5



DB-17



GCL5001

Urine Drug Screen

Column: Ultra 2
19091B-115
50 m x 0.32 mm, 0.52 µm

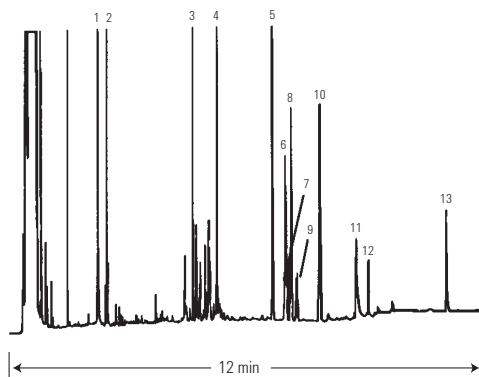
Carrier: Hydrogen, 80 cm/s

Oven: 45 °C for 1.5 min
45-300 °C at 6 °C/min

Injection: Splitless

Detector: FID

1. Amphetamine
2. Methamphetamine
3. Meperidine
4. Phencyclidine (PCP)
5. Methadone
6. Propoxyphene
7. Amitriptyline
8. Cocaine
9. Imipramine
10. Cyheptamide (ISTD)
11. Codeine
12. Diazepam
13. Flurazepam



GCL5003

Analysis of Drugs of Abuse in Urine via GC/MS

Column: VF-DA
CP8964
12 m x 0.20 mm, Optimized µm

Sample: 1 µL

Solvent: Methanol

Carrier: He, ca 1.0 mL/min

Oven: 70 °C, 1.2 min to 200 °C,
20 °C/min to 270 °C,
7 °C/min to 320 °C, 20 °C/min

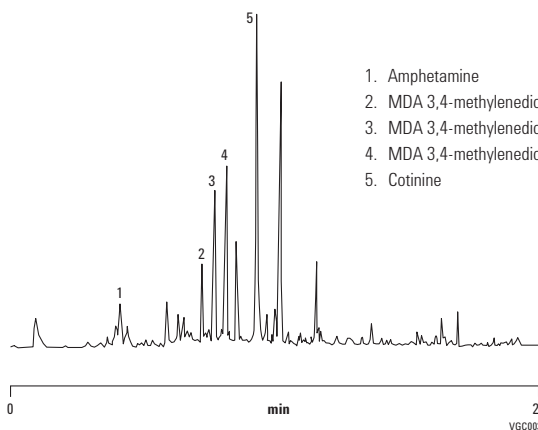
Pressure: 58.7 kPa, 2.2 min to 97 kPa, 58 kPa/min to 132 kPa,
3 kPa/min to 180 kPa, 12 kPa/min

Injection: Splitless

Detector: MS

Derivatization: Acetic acid anhydride to form acetates

1. Amphetamine
2. MDA 3,4-methylenedioxyamphetamine
3. MDA 3,4-methylenedioxymethamphetamine
4. MDA 3,4-methylenedioxy-ethylamphetamine
5. Cotinine



VGC0032

Anesthetics

Column: DB-5ms EVDX
128-8522
25 m x 0.20 mm, 0.33 µm

Carrier: Helium at 35 cm/s, measured at 55 °C

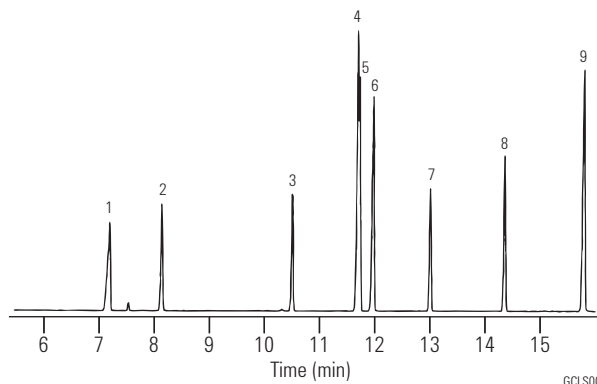
Oven: 55 °C for 1 min
55-130 °C at 25 °C/min
130-325 °C at 15 °C/min

Injection: Splitless, 250 °C
45 s purge activation time

Detector: MSD, 280 °C transfer line
full scan at m/z 35-400

Sample: 1 µL of 50-100 ng/µL standard in methanol

1. Salicylamide
2. Benzocaine
3. Lidocaine
4. Procaine
5. Nefopam
6. Mepivacaine
7. Tetracaine
8. Butacaine
9. Dibucaine



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Anticonvulsants

Column: DB-1
125-1032
30 m x 0.53 mm, 1.50 µm

Carrier: Helium at 8 mL/min

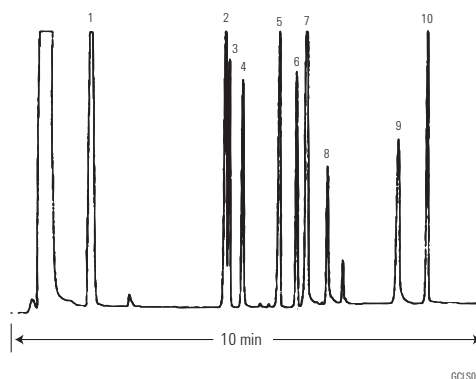
Oven: 160 °C for 2 min
160-275 °C at 15 °C/min

Injection: Megabore direct, 250 °C

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 100 ng/µL in methanol

1. Ethosuximide
2. Methsuximide
3. Phensuximide
4. N-Desmethyl methsuximide
5. Phenylethylmalonamide
6. Phenobarbital
7. Primidone
8. Carbamazepine
9. Phenytoin
10. 5-Methyl-5-phenylhydantoin



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Antihistamines

Column: DB-5
123-5032
30 m x 0.32 mm, 0.25 µm

Carrier: Helium at 40 cm/s, measured at 55 °C

Oven: 55 °C for 1 min
55-175 °C at 30 °C/min
175-320 °C at 10 °C/min
320 °C for 1 min

Injection: Splitless, 250 °C
30 s purge activation time

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 50 ng/µL each in methanol

- | | |
|----------------------|--------------------|
| 1. Pheniramine | 13. Thonzylamine |
| 2. Dimenhydrinate | 14. Chlorcyclizine |
| 3. Diphenhydramine | 15. Pyrilamine |
| 4. Doxylamine | 16. Triprolidine |
| 5. Phenyltoloxamine | 17. Promethazine |
| 6. Tripelemnamine | 18. Antazoline |
| 7. Methapyrilene | 19. Clemizole |
| 8. Chlorpheniramine | 20. Hydroxyzine |
| 9. Cyclizine | 21. Meclizine |
| 10. Carbinoxamine | 22. Cinnanzine |
| 11. Diphenylpyraline | 23. Buclizine |
| 12. Bromopheniramine | |

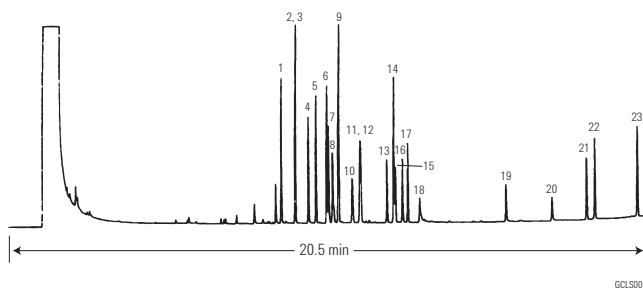
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Splitless, single taper, deactivated, 4 mm id, 5181-3316

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



Antiepileptic Drugs

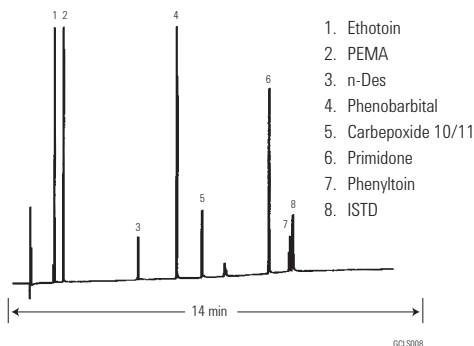
Column: Ultra 2
19091B-012
25 m x 0.32 mm, 0.17 µm

Carrier: Helium, 14 psi

Oven: 100-230 °C at 15 °C/min

Injection: Split ratio 35:1

Detector: NPD



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Tricyclic Antipsychotics

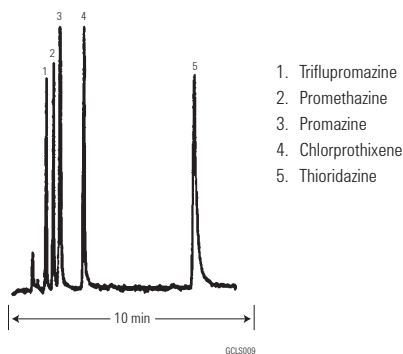
Column: Ultra 2
19091B-011
12 m x 0.20 mm, 0.33 µm

Carrier: Hydrogen, 106 cm/s

Oven: 250 °C for 3 min
250-290 °C at 10 °C/min
290 °C for 10 min

Injection: Split ratio 75:1

Detector: FPD



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

Fentanyls

Column: DB-1701
125-0732
30 m x 0.53 mm, 1.00 μ m

Carrier: Hydrogen at 15 mL/min

Oven: 270 °C isothermal

Injection: Split, 250 °C
Split ratio 1:5

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 0.8 μ L

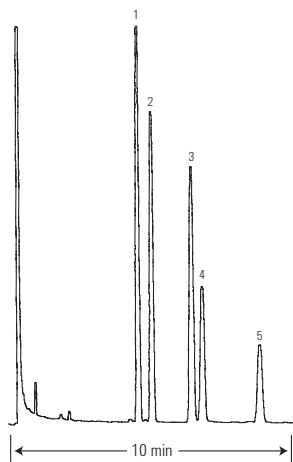
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273



1. Fentanyl
2. Sufentanyl
3. Carfentanyl
4. Lofentanyl
5. Alfentanyl

GCL5012

Tocopherols

Column: DB-17ms
122-4732
30 m x 0.25 mm, 0.25 μ m

Carrier: Helium at 40 cm/s,
measured at 150 °C

Oven: 300 °C for 1 min
300-320 °C at 25 °C/min
320 °C for 4 min

Injection: Split, 310 °C
Split ratio 1:25

Detector: MSD, 310 °C transfer line
full scan at m/z 45-550

Sample: 1 μ L of 1-10 ng/ μ L in isoctane

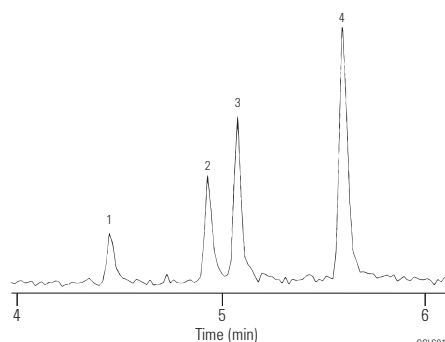
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

Syringe: 5 μ L tapered, FN 23-26s/42/HP, 5181-1273



1. δ -Tocopherol
2. β -Tocopherol
3. γ -Tocopherol
4. α -Tocopherol

GCL5013

Hallucinogens

Column: DB-17ms
122-4732
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 30 cm/s, measured at 50 °C

Oven: 50 °C for 0.5 min
50-125 °C at 25 °C/min
125-255 °C at 10 °C/min
255-320 °C at 25 °C/min
320 °C for 16 min

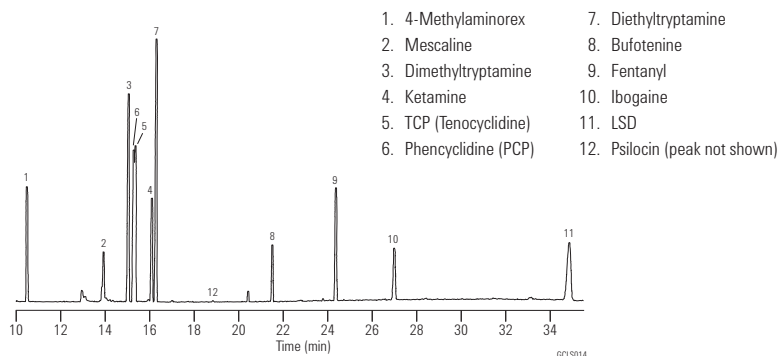
Injection: Splitless, 250 °C
30 s purge activation time

Detector: MSD, 300 °C transfer line
full scan at m/z 40-350

Sample: 1 µL of 10-50 ng/µL standard in methanol

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



Sedative Hypnotics

Column: DB-5ms EVDX
128-8522
25 m x 0.20 mm, 0.33 µm

Carrier: Helium at 35 cm/s, measured at 55 °C

Oven: 55 °C for 1 min
55-130 °C at 25 °C/min
130-325 °C at 15 °C/min
325 °C for 4 min

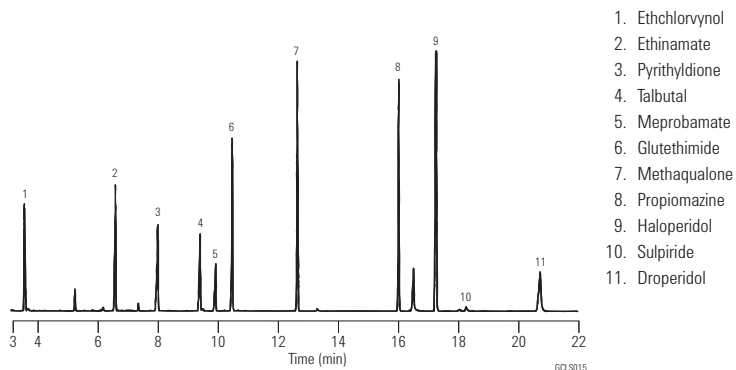
Injection: Splitless, 250 °C
45 s purge activation time

Detector: MSD, 280 °C transfer line
full scan at m/z 35-400

Sample: 1 µL of 50-100 ng/µL standard in methanol

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730
Seal: Gold plated seal, 18740-20885
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267



Narcotics and Adulterants

Column: DB-5
123-5032
30 m x 0.32 mm, 0.25 µm

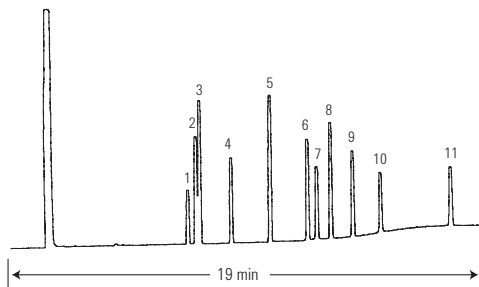
Carrier: Helium at 40 cm/s, measured at 140 °C

Oven: 140-320 °C at 12 °C/min
320 °C for 4 min

Injection: Split, 250 °C
Split ratio 1:75

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 0.5 µg/µL each in methanol



- 1. Caffeine
- 2. Ketamine
- 3. Lidocaine
- 4. Procaine
- 5. Cocaine
- 6. Codeine
- 7. Morphine
- 8. 6-Acetylcodeine
- 9. Diacetylmorphine (heroin)
- 10. Quinine
- 11. Strychnine

GCL5017

Over-the-Counter Pain Killers – TMS Derivatives

Column: DB-5
121-5023
20 m x 0.18 mm, 0.40 µm

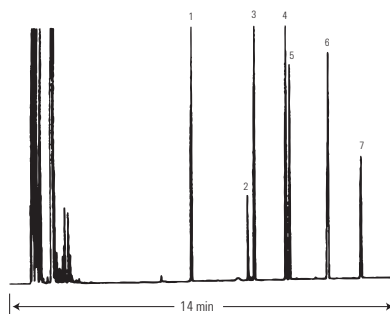
Carrier: Helium at 39 cm/s, measured at 100 °C

Oven: 100-240 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 µL of 2 µg/µL each in pyridine



- 1. Nicotine
- 2. Unknown
- 3. Acetylsalicylic acid (aspirin)
- 4. Ibuprofen
- 5. Acetaminophen
- 6. Unknown
- 7. Caffeine

GCL5018

Aspirin and Ibuprofen in Methanol

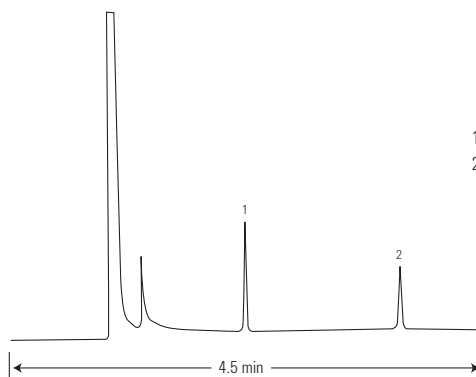
Column: DB-FFAP
122-3232
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 24 cm/s, measured at 180 °C

Oven: 180 °C isothermal

Injection: Split, 250 °C
Split ratio 1:50

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min



- 1. Aspirin
- 2. Ibuprofen

GCL5019

Free Steroids

Column: DB-17
122-1731
30 m x 0.25 mm, 0.15 µm

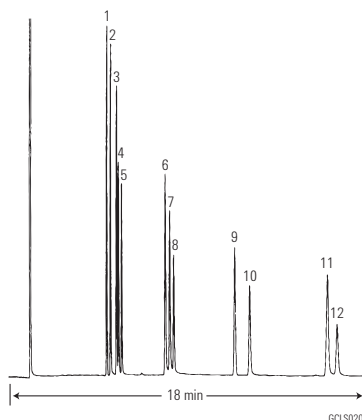
Carrier: Hydrogen at 44 cm/s

Oven: 260 °C isothermal

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 300 °C
Nitrogen makeup gas at
30 mL/min

Sample: 1 µL



1. Coprostan (5-β-cholestane)
2. 5-β-Androsterone
3. 5-α-Cholestane
4. Androsterone
5. Epiandrosterone (trans-androsterone)
6. 17-α-Estradiol
7. β-Estradiol
8. Estrone
9. Progesterone
10. Cholesterol
11. Estriol
12. Stigmasterol

Anabolic Steroids

Column: DB-1
122-1031
30 m x 0.25 mm, 0.10 µm

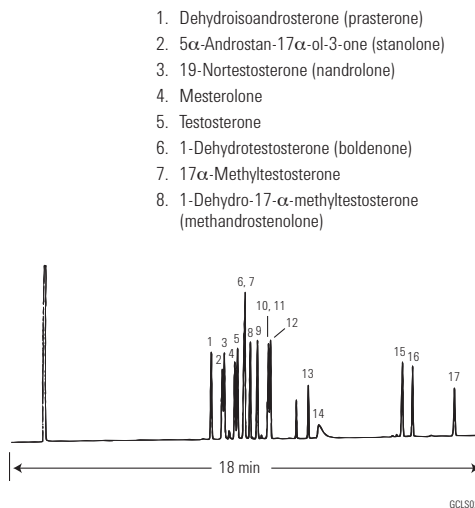
Carrier: Helium at 40 cm/s, measured at 180 °C

Oven: 180-320 °C at 10 °C/min
320 °C for 4 min

Injection: Split ratio 1:40

Detector: FID, Nitrogen makeup gas at 30 mL/min

Sample: 2 µL of 0.125 µg/µL each in methanol



- | | |
|---|--|
| 1. Dehydroisoandrosterone (prasterone) | 9. Norethandrolone |
| 2. 5α-Androstan-17α-ol-3-one (stanolone) | 10. 1-Dehydrotestosterone acetate |
| 3. 19-Nortestosterone (nandrolone) | 11. Oxymetholone |
| 4. Mesterolone | 12. 19-Nortestosterone-17-propionate |
| 5. Testosterone | 13. 4-Chlortestosterone-17-acetate (clostebol) |
| 6. 1-Dehydrotestosterone (boldenone) | 14. Stanozolol |
| 7. 17α-Methyltestosterone | 15. 1-Dehydrotestosterone benzoate |
| 8. 1-Dehydro-17-α-methyltestosterone (methandrostenolone) | 16. 19-Nortestosterone-17-decanoate |
| | 17. 1-Dehydrotestosterone undecylenate |

Marijuana (Δ^9 -THC) and Major Metabolites – TMS Derivatives

Column: DB-5
123-5032
30 m x 0.32 mm, 0.25 μ m

Carrier: Helium at 40 cm/s, measured at 100 °C

Oven: 100 °C for 1 min
100-175 °C at 30 °C/min
175-295 °C at 12 °C/min

Injection: Splitless, 250 °C
30 s purge activation time

Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

Sample: 1 μ L of 0.1 μ g/ μ L each in pyridine

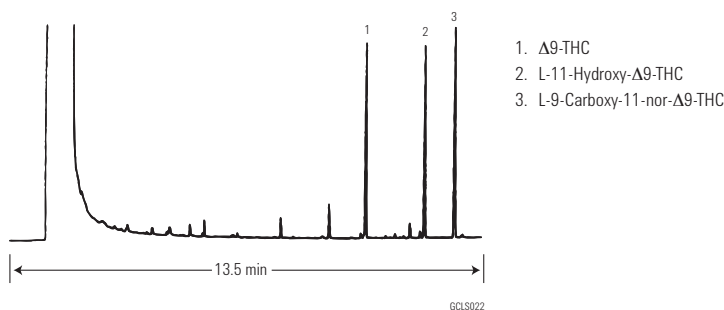
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct connect, single taper, deactivated, 4 mm id, G1544-80730

Seal: Gold plated seal, 18740-20885

Syringe: 10 μ L tapered, FN 23-26s/42/HP, 5181-1267



Blood Pollutants I

Column: DB-ALC1
125-9134
30 m x 0.53 mm, 3.00 μ m

Carrier: Helium, 36 cm/s, measured at 40 °C

Oven: 40 °C for 5 min
40-210 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:10

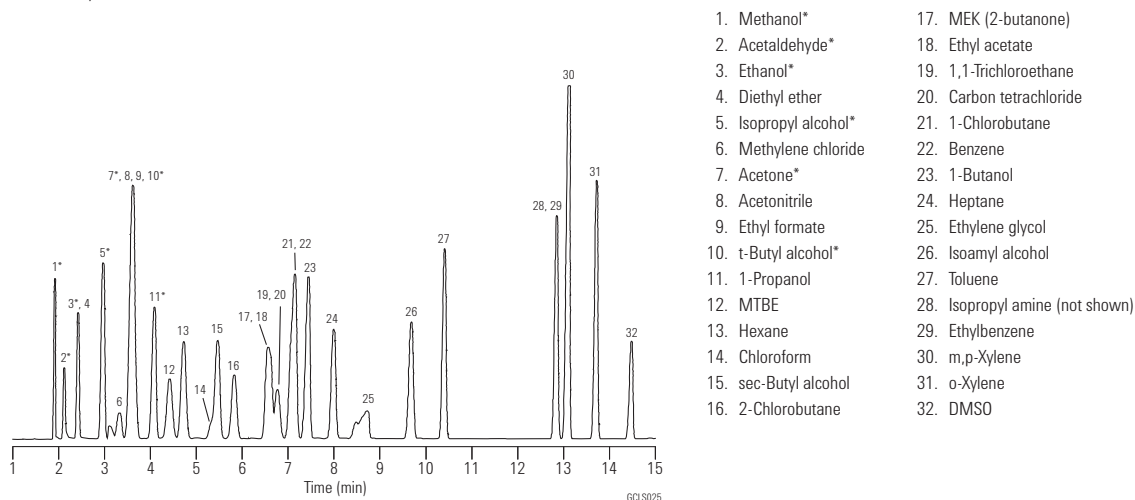
Detector: FID, 300 °C

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



Blood Pollutants II

Column: DB-ALC2
125-9234
30 m x 0.53 mm, 2.00 µm

Carrier: Helium, 36 cm/s, measured at 40 °C

Oven: 40 °C for 5 min
40-210 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:10

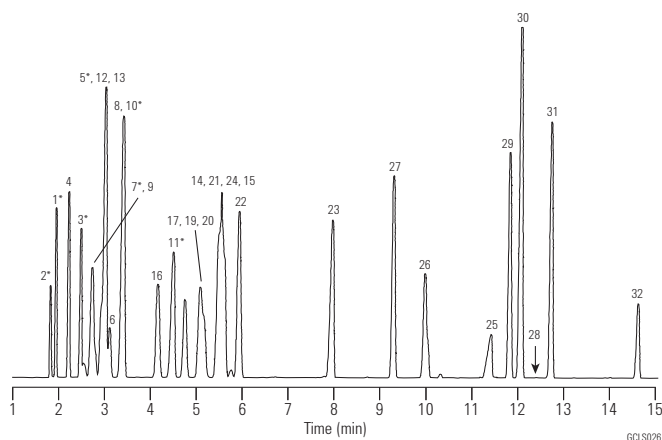
Detector: FID, 300 °C

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



Residual Solvents, USP 467

Column: DB-624
125-1334
30 m x 0.53 mm, 3.00 µm

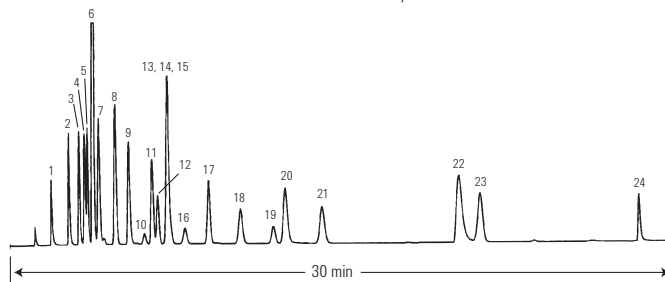
Carrier: Helium at 35 cm/s, measured at 40 °C

Oven: 40 °C for 20 min
40-90 °C at 5 °C/min

Injection: Megabore direct, 250 °C
5 m phenylmethylsilane deactivated
retention gap

Detector: FID, 300 °C
Nitrogen makeup gas at
30 mL/min

- | | |
|-------------------------------|-----------------------------|
| 1. Methanol | 13. Tetrahydrofuran (THF) |
| 2. Ethanol | 14. Chloroform |
| 3. Ethyl ether | 15. sec-Butanol |
| 4. Acetone | 16. Cyclohexane |
| 5. Isopropanol | 17. Benzene |
| 6. Acetonitrile | 18. n-Heptane |
| 7. Methylene chloride | 19. Trichloroethylene |
| 8. tert-Butanol | 20. n-Butanol |
| 9. n-Hexane | 21. 1,4-Dioxane |
| 10. n-Propanol | 22. Pyridine |
| 11. Methyl ethyl ketone (MEK) | 23. Toluene |
| 12. Ethyl acetate | 24. Dimethylformamide (DMF) |



Column Performance for USP <467> Standards

Column: DB-Select 624 Ultra Inert
123-0334UI
30 m x 0.32 mm, 1.80 µm

Carrier: Helium, 2.2 mL/min
constant flow at 40 °C

Oven: 40 °C for 20 min, then
10 °C/min to 240 °C 5 min

Inlet: MMI, 140 °C, 1 µL split 5:1

Inlet liner: 1 mm straight single taper Ultra Inert liner

Sample Conc: 1.0 mL loop

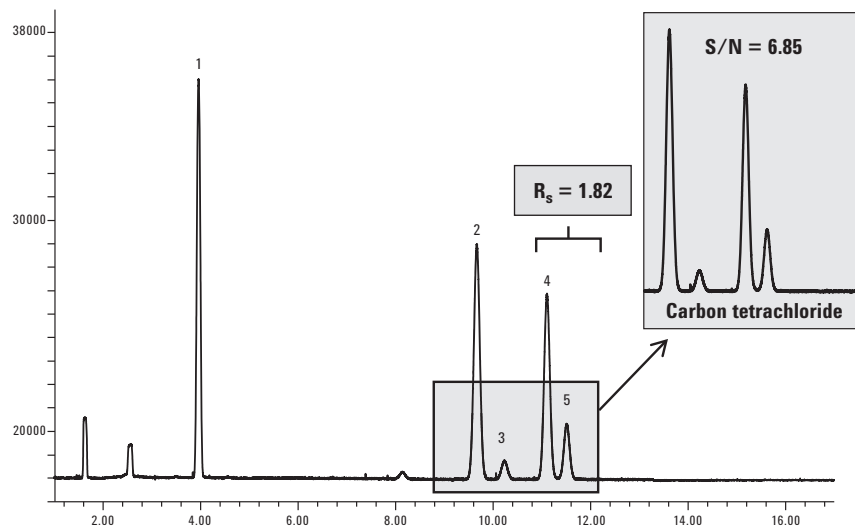
Detector: FID: 250 °C, H₂ 30 mL/min, air 400 mL/min,
N₂ constant col + makeup = 30 mL/min

Suggested Supplies

Septum: Non-stick bleed and temperature optimized (BTO) septa, 11 mm, 50/pk, 5183-4757

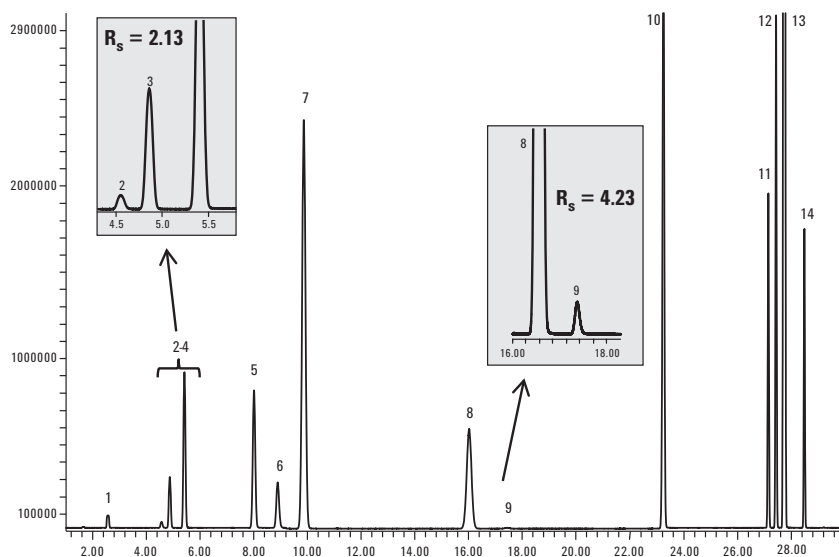
Liner: Liner, GC, Ultra Inert, straight, 1 mm id, 5190-4047

Seal: Certified gold plated seal kit, includes washer, 10/pk, 5190-2209



1. 1,1-Dichloroethene
2. 1,1,1-Trichloroethane
3. Carbon tetrachloride
4. Benzene
5. 1,2-Dichloroethane

FID trace of Class 1 solvent standard at USP <467> specified limits on an Agilent J&W DB-Select 624UI for USP <467>, 30 m x 0.32 mm, 1.80 µm column



1. Methanol
2. Acetonitrile
3. Dichloromethane
4. *trans*-1,2-Dichloroethane
5. *cis*-1,2-Dichloroethane
6. Tetrahydrofuran
7. Cyclohexane
8. Methylcyclohexane
9. 1,4-Dioxane
10. Toluene
11. Chlorobenzene
12. Ethylbenzene
13. *m/p*-Xylene
14. *o*-Xylene

FID trace of Class 2A solvent standard at USP <467> specified limits on an Agilent J&W DB-Select 624UI for USP <467>, 30 m x 0.32 mm, 1.80 µm column

Part Number Index

0100-0057.....	113, 131	05971-20143.....	154-155, 157	115-3352E.....	429	121-5522.....	126, 300
0100-0161.....	127	05971-60571.....	163, 176	115-3352PT.....	429	121-5522E.....	300
0100-0549.....	169	05971-80103.....	165	115-3412.....	426	121-5522LTM.....	300, 456
0100-1324.....	41	05980-20018.....	146, 176-177	115-3422.....	426	121-5522UI.....	266, 290
0100-1325.....	41	05980-60051.....	146, 174	115-3432.....	426	121-5522UILTM.....	290, 457
0100-1326.....	41	05988-20066.....	38, 40, 148, 172	115-3432E.....	426	121-5523.....	300
0100-1331.....	41	07673-20570.....	51	115-3432PT.....	421, 426	121-5523LTM.....	300, 456
0100-1332.....	41, 91, 99, 105, 113, 129, 131, 136-137	07673-40180.....	50	115-34H2.....	426	121-5523UI.....	290
0100-1342.....	41	07673-60840.....	51	115-3532.....	433	121-5523UILTM.....	290, 457
0100-1344.....	41	0960-0897.....	162	115-3532PT.....	278-279, 421, 433	121-5542.....	300
0100-1365.....	41	1000-1437.....	113-115, 131	115-3552.....	433	121-5621.....	394
0100-1375.....	41, 85, 87	1000-1438.....	114	115-3552PT.....	279, 285, 421, 433	121-5622.....	394
0100-1378.....	41	112-2032.....	361	115-4912.....	366	121-7012.....	352
0100-1379.....	41	112-2032LTM.....	361, 453	115-4912E.....	366	121-7012LTM.....	352, 458
0100-1381.....	41	112-2112.....	442	121-0122.....	295	121-7013LTM.....	458
0100-1389.....	80	112-2132.....	442	121-0122LTM.....	295, 455	121-7022.....	352
0100-1597.....	169	112-2133.....	442	121-0122UI.....	289	121-7022LTM.....	352, 458
0100-2138.....	122-123	112-2133LTM.....	442, 453	121-0713.....	349	121-7023.....	352
0100-2430.....	122-123	112-2162.....	442	121-0722.....	266, 349	121-7023LTM.....	352, 458
0100-2594.....	53	112-2532.....	411	121-0722LTM.....	349, 454	121-7042.....	352
0100-2595.....	53	112-2532E.....	411	121-1012.....	319	121-7042E.....	352
0101-0282.....	48	112-2532LTM.....	411, 453	121-1012E.....	319	121-7043.....	352
0101-0299.....	48	112-2562.....	411	121-1012LTM.....	319, 453	121-9627.....	390
0101-0300.....	48	112-5432.....	444	121-1013.....	319	121-9723.....	264, 276, 292, 392
0101-0301.....	48	112-5462.....	444	121-1013LTM.....	319, 453	122-0112.....	295
0101-0302.....	48	112-6632.....	410	121-101A.....	319	122-0112E.....	295
0101-0303.....	48	112-6632LTM.....	410, 453	121-101ALTM.....	319, 453	122-0112LTM.....	295, 455
0101-0304.....	48	112-8837.....	126, 405	121-1022.....	319	122-0112UI.....	289
0101-0355.....	48	112-8837E.....	405	121-1022E.....	319	122-0131.....	295
0101-0403.....	48	112-8837LTM.....	405, 460	121-1022LTM.....	319, 453	122-0132.....	126, 273, 295
0101-0532.....	48	112-8867.....	405	121-1023.....	319	122-0132E.....	295
0101-0584.....	47	112-8867E.....	405	121-1023LTM.....	319, 453	122-0132LTM.....	455
0101-0585.....	47	112-88A7.....	405	121-1043.....	319	122-0132UI.....	289
0101-0633.....	48	112-88A7E.....	405	121-1222.....	304	122-0132UIE.....	289
0101-0636.....	47	113-2032.....	361	121-1232.....	304	122-0162.....	295
0101-0637.....	47	113-2132.....	442	121-1324.....	267, 271, 275, 284, 398	122-0162UI.....	289
0101-0638.....	47	113-2132LTM.....	442, 453	121-1324E.....	398	122-0212.....	344
0101-0639.....	47	113-2133.....	442	121-1324LTM.....	398, 457	122-0232.....	344
0101-0666.....	48	113-2532.....	411	121-1324UI.....	275, 291, 397	122-0232E.....	344
0101-0667.....	48	113-2532E.....	411	121-1524.....	267, 271, 275, 284, 400	122-0233.....	267, 344
0101-0946.....	47	113-3032.....	444	121-1524LTM.....	400, 457	122-0334UI.....	292, 416
0101-0947.....	47	113-3112.....	437	121-1544.....	400	122-0364UI.....	292, 416
0101-0948.....	48	113-3132.....	437	121-1544E.....	400	122-0712.....	349
0101-0954.....	48	113-3133.....	437	121-1722.....	339	122-0713.....	349
0101-0955.....	48	113-3133LTM.....	437, 458	121-1722LTM.....	339, 454	122-0713LTM.....	349, 454
0101-0956.....	48	113-3162.....	437	121-1723.....	339	122-0731.....	349
0101-0957.....	48	113-3432.....	426	121-2223.....	345	122-0732.....	126, 266, 268, 349
0101-1001.....	48	113-3432E.....	426	121-2323.....	342	122-0732E.....	349
0101-1472.....	47	113-3432LTM.....	426, 458	121-3822.....	306	122-0732LTM.....	349, 454
0101-1473.....	47	113-4302.....	434	121-3822UI.....	291	122-0733.....	274, 349
03396-61010.....	127	113-4312.....	434	121-4722.....	308	122-0733E.....	349
0515-0680.....	113, 115, 131	113-4332.....	283, 434	121-4722LTM.....	308, 454	122-0733LTM.....	349, 454
0515-0683.....	114	113-4362.....	278, 434	121-5012.....	329	122-0761.....	349
0515-2495.....	120, 133	113-5432.....	444	121-5012E.....	329	122-0762.....	349
0515-2712.....	128	113-6632.....	410	121-5012LTM.....	329, 455	122-0763.....	349
0515-2726.....	120, 133	113-6632LTM.....	410, 453	121-5013.....	329	122-0763E.....	349
0535-0071.....	157	115-2132.....	282, 442	121-5013LTM.....	329, 455	122-0766.....	349
05890-61525.....	50	115-2132LTM.....	442, 453	121-5022.....	329	122-1011.....	319
05890-80660.....	49	115-3113.....	437	121-5022E.....	329	122-1012.....	319
05921-21170.....	39-40	115-3133.....	437	121-5022LTM.....	329, 455	122-1012LTM.....	319, 453
05970-60045.....	182	115-3133LTM.....	437, 458	121-5023.....	329	122-1013.....	319
05971-20134.....	151, 154	115-3332.....	429	121-5023LTM.....	329, 455	122-1022.....	319
		115-3352.....	429	121-5042.....	329	122-1022LTM.....	319, 453

122-1022LTM	319, 453	122-1811	364	122-5032E	330	122-6832	269-270, 388
122-1031	319	122-1831	364	122-5032LTM	330, 456	122-7012	353
122-1032	319	122-1831LTM	364, 454	122-5033	272, 330	122-7012E	353
122-1032E	319	122-1932	337	122-5033E	330	122-7012LTM	353, 458
122-1032G	445	122-1962	337	122-5033LTM	330, 456	122-7013	272, 353
122-1032LTM	319, 453	122-2032	343	122-503E	330	122-7013LTM	353, 458
122-1033	267, 319	122-2032LTM	343, 455	122-503ELTM	330, 456	122-7031	353
122-1033E	319	122-2033	343	122-5052	330	122-7032	278, 353
122-1033LTM	319, 453	122-2033LTM	343, 455	122-5061	330	122-7032E	353
122-103E	319	122-2212	345	122-5062	330	122-7032LTM	353, 458
122-103ELTM	319, 453	122-2212LTM	345, 455	122-5063	330	122-7033	272, 276, 353
122-1052	319	122-2231	345	122-506E	330	122-7033E	353
122-1061	319	122-2232	345	122-5511	300	122-7033LTM	353, 458
122-1062	319	122-2232LTM	345, 455	122-5511LTM	300, 456	122-7061	353
122-1063	319	122-2312	342	122-5512	300	122-7062	353
122-106E	278, 319	122-2331	342	122-5512LTM	300, 456	122-7062E	353
122-10A6	369	122-2332	342	122-5512UI	267, 290	122-7063	353
122-10A6E	283, 369	122-2332E	342	122-5512UILTM	290, 457	122-7063E	353
122-10AE	319	122-2332LTM	342, 455	122-5513	300	122-7332	354
122-10G3	319	122-2361	342	122-5513UI	290	122-7332E	354
122-1111	362	122-2361E	342	122-5516	300	122-7332LTM	354, 458
122-1111E	362	122-2362	285, 342	122-5522	300	122-7333	354
122-1131	362	122-2362E	342	122-5522LTM	300, 456	122-7362	354
122-1131LTM	455	122-2461	396	122-5522UI	290	122-7363	354
122-1211	304	122-2462	396	122-5522UILTM	290, 457	122-7732	283-284, 386
122-1211LTM	304, 458	122-2912	312	122-5531	300	122-7732LTM	386, 454
122-1212	304	122-2912LTM	312, 455	122-5532	265, 267-268, 272-274, 300	122-96L2	390
122-1231	304	122-2932	283, 312	122-5532E	300	122-9732	276, 292, 392
122-1232	267, 269, 272, 282-285, 304	122-2932E	312	122-5532G	445	122-9736	292, 392
122-1232G	445	122-2932LTM	312, 455	122-5532LTM	300, 456	123-0112	295
122-1232LTM	304, 458	122-2962	312	122-5533	266, 268-271, 290	123-0112UI	289
122-1233	304	122-3212	358	122-5533UI	290	123-0131	295
122-1236	265, 304	122-3232	358	122-5533UIE	290	123-0132	295
122-1262	304	122-3232E	358	122-5533UILTM	290, 457	123-0132UI	289
122-1332	347	122-3232LTM	358, 457	122-5533	267, 273-274, 276, 300	123-0162	295
122-1332E	347	122-3233	358	122-5533E	300	123-0213	344
122-1333	267, 347	122-3262	358	122-5533G	445	123-0232	344
122-1334	265, 269, 272, 398	122-3262E	358	122-5533LTM	300, 456	123-0233	344
122-1334E	398	122-3263	358	122-5533UI	266, 274, 290	123-0334UI	292, 416
122-1334LTM	398, 457	122-3812	306	122-5533UILTM	290, 457	123-0364UI	292, 416
122-1334UI	265, 272, 291, 397	122-3812UI	291	122-5536	270, 300	123-0712	349
122-1362	347	122-3831	306	122-5536E	300	123-0712LTM	349, 454
122-1363	347	122-3832	265, 270, 274, 283-284, 306	122-5536G	445	123-0713	349
122-1363E	347	122-3832E	306	122-5536UI	290	123-0731	349
122-1364	265, 267, 269, 271, 284, 398	122-3832LTM	306, 455	122-5536UILTM	290, 457	123-0732	349
122-1364E	398	122-3832UI	271, 291	122-5552	300	123-0732E	349
122-1364UI	265, 267, 275, 291, 397	122-3862	306	122-5552UI	290	123-0733	349
122-1534	265, 269, 272, 400	122-4711	308	122-5561	300	123-0733E	349
122-1534LTM	400, 457	122-4711LTM	308, 454	122-5562	300	123-0753	349
122-1564	265, 267, 269, 271-272, 275, 284, 400	122-4712	308	122-5562E	300	123-0762	349
122-1564E	400	122-4712LTM	308, 454	122-5562G	445	123-0763	349
122-1712	339	122-4731	308	122-5562UI	270-271, 276, 290	123-0763E	349
122-1713	339	122-4732	270, 273, 308	122-5563	300	123-100ALTM	453
122-1713E	339	122-4732E	308	122-5563UI	290	123-1011	320
122-1731	339	122-4732LTM	308, 454	122-5631	394	123-1011LTM	320, 453
122-1731E	339	122-4762	308	122-5631G5	445	123-1012	320
122-1732	339	122-5002LTM	456	122-5632	394	123-1012LTM	320, 453
122-1732E	339	122-5011	330	122-5633	394	123-1013	320
122-1732LTM	339, 454	122-5012	283, 330	122-5661	394	123-1014	320
122-1733	339	122-5012LTM	330, 456	122-5711	363	123-1015	320
122-1762	339	122-5013	330	122-5711E	363	123-1015LTM	320, 453
122-1801	364	122-501E	330	122-5711LTM	363, 456	123-1022	283, 320
122-1801LTM	364, 454	122-5022	330	122-5731	363	123-1026	320
		122-5031	330	122-5731LTM	363, 456	123-1027	320
		122-5032	284, 330	122-6432	443	123-102F	320
				122-6462	443	123-1031	320

PART NUMBER INDEX

123-1032.....	320	123-1861.....	364	123-5512LTM.....	300, 456	123-BD01.....	378
123-1032LTM.....	320, 453	123-1932.....	337	123-5513.....	300	123-BD11.....	378
123-1033.....	282, 320	123-1933.....	337	123-5513LTM.....	300, 456	123-BD34.....	378
123-1033E.....	320	123-1933E.....	337	123-5526.....	300	124-0034.....	402
123-1033LTM.....	320, 453	123-1933LTM.....	337, 455	123-5531.....	300	124-1032.....	320
123-1034.....	320	123-2032.....	343	123-5532.....	270, 273, 300	124-1034.....	320
123-1035.....	320	123-2033.....	343	123-5532E.....	300	124-1334.....	280, 283, 398
123-1035LTM.....	320, 453	123-2232.....	345	123-5532UI.....	275, 290	124-1334LTM.....	398, 457
123-103B.....	320	123-2232E.....	345	123-5532UIE.....	290	124-1374.....	269, 398
123-103BLTM.....	320, 453	123-2332.....	342	123-5533.....	276, 300	124-1534.....	281, 400
123-103E.....	270, 274, 320	123-2332E.....	342	123-5533LTM.....	300, 456	124-1574.....	281, 400
123-103ELTM.....	320, 453	123-2362.....	342	123-5533UI.....	290	124-3232.....	282, 358
123-1052.....	320	123-2932.....	312	123-5536.....	270, 274, 300	124-5032.....	331
123-1055.....	320	123-3212.....	358	123-5536LTM.....	300, 456	124-5037.....	331
123-1056.....	320	123-3223.....	358	123-5536UI.....	290	124-7032.....	280, 282, 353
123-105C.....	320	123-3232.....	281, 358	123-5561.....	300	125-0212.....	279, 344
123-105F.....	320	123-3232E.....	358	123-5562.....	300	125-0232.....	344
123-1061.....	320	123-3232LTM.....	358, 457	123-5563.....	300	125-0232LTM.....	344, 455
123-1062.....	320	123-3233.....	358	123-5563UI.....	290	125-0334UI.....	292, 416
123-1062E.....	320	123-3233LTM.....	358, 457	123-5566.....	300	125-0712.....	349
123-1063.....	320	123-3234.....	358	123-5631.....	394	125-0712E.....	349
123-1063E.....	320	123-3234LTM.....	358, 457	123-5632.....	394	125-0712LTM.....	349, 454
123-1064.....	320	123-3253.....	358	123-5701.....	363	125-0731.....	349
123-1064E.....	320	123-3262.....	358	123-5701LTM.....	363, 456	125-0732.....	349
123-1065.....	320	123-3263.....	358	123-5711.....	363	125-0732E.....	349
123-1065E.....	320	123-3264.....	358	123-5711E.....	363	125-0732G.....	445
123-106B.....	320	123-3812.....	306	123-5731.....	363	125-0733.....	349
123-106BE.....	320	123-3832.....	273-274, 306	123-5731E.....	363	125-0737.....	349
123-106E.....	279, 320	123-3832E.....	306	123-6133.....	443	125-0762.....	349
123-106G.....	320	123-3832UI.....	266, 268, 270, 275, 291	123-6412.....	443	125-0762E.....	349
123-1102LTM.....	455	123-4712.....	308	123-6432.....	443	125-1002.....	321
123-1111.....	362	123-4732.....	270, 308	123-7012.....	353	125-1005.....	321
123-1111LTM.....	362, 455	123-4732LTM.....	308, 454	123-7012LTM.....	353, 458	125-1005LTM.....	321, 454
123-1131.....	362	123-5003LTM.....	456	123-7013.....	353	125-100B.....	321
123-1131E.....	362	123-500E.....	330	123-7013LTM.....	353, 458	125-1011.....	321
123-1232.....	304	123-500ELTM.....	330, 456	123-7031.....	353	125-1011E.....	321
123-1236.....	266, 268, 270, 273, 304	123-5011.....	330	123-7032.....	353	125-1011LTM.....	321, 454
123-1262.....	304	123-5011LTM.....	330, 456	123-7032E.....	353	125-1012.....	321
123-1332.....	347	123-5012.....	330	123-7032LTM.....	353, 458	125-1012E.....	321
123-1333.....	347	123-5012E.....	330	123-7033.....	353	125-1012LTM.....	321, 454
123-1334.....	398	123-5012LTM.....	330, 456	123-7033E.....	353	125-1014.....	321
123-1334E.....	398	123-5013.....	330	123-7033LTM.....	353, 458	125-1015.....	321
123-1334LTM.....	398, 457	123-5013E.....	330	123-7062.....	281, 353	125-1015LTM.....	321, 454
123-1334UI.....	291, 397	123-5013LTM.....	330, 456	123-7063.....	353	125-1017.....	321
123-1363.....	347	123-5022.....	330	123-7063E.....	353	125-101J.....	321
123-1364.....	398	123-5022LTM.....	330, 456	123-7312.....	354	125-101K.....	321
123-1364E.....	398	123-5026.....	330	123-7314.....	354	125-1025.....	321
123-1364UI.....	275, 291, 397	123-502D.....	330	123-7332.....	354	125-1025LTM.....	321, 454
123-1464.....	402	123-502F.....	330	123-7333.....	354	125-102J.....	321
123-1534.....	283, 400	123-5031.....	330	123-7334.....	354	125-1032.....	321
123-1564.....	400	123-5032.....	330	123-7334LTM.....	354, 458	125-1032LTM.....	321, 454
123-1632.....	284, 403	123-5032E.....	330	123-7354.....	354	125-1034.....	283, 321
123-1711.....	339	123-5032LTM.....	330, 456	123-7354E.....	354	125-1034E.....	321
123-1712.....	339	123-5033.....	282, 330	123-7362.....	354	125-1034LTM.....	321, 454
123-1713.....	339	123-5033E.....	330	123-7363.....	354	125-1035.....	278, 284-285, 321
123-1730.....	266, 282, 388	123-503B.....	330	123-7364.....	285, 354	125-1035E.....	321
123-1730LTM.....	388, 457	123-503BLTM.....	330, 456	123-7722.....	386	125-1035LTM.....	321, 454
123-1731.....	339	123-503E.....	330	123-7732.....	386	125-1037.....	321
123-1732.....	339	123-503ELTM.....	330, 456	123-8232.....	265-266, 268, 273, 275, 384	125-1039.....	321
123-1732E.....	339	123-5052.....	330	123-8336.....	265-266, 268, 273, 275, 384	125-103B.....	321
123-1732LTM.....	339, 454	123-5053.....	330	123-9134.....	414	125-103J.....	321
123-1733.....	339	123-5056.....	330	123-9134LTM.....	414, 457	125-103JLTM.....	321, 454
123-1733E.....	339	123-5062.....	330	123-9234.....	414	125-103K.....	321
123-1762.....	339	123-5063.....	330	123-9234E.....	414	125-103KE.....	321
123-1811.....	364	123-5511.....	300			125-103KLTM.....	321, 454
123-1831.....	364	123-5512.....	300			125-1055.....	321

125-1062.....	321	125-3237.....	358	127-0113.....	295	128-3812.....	306
125-1062E.....	321	125-3262.....	358	127-0122.....	295	128-3822.....	306
125-1064.....	321	125-32H2.....	358	127-0123.....	295	128-5012.....	330
125-1065.....	321	125-3832.....	306	127-0123LTM.....	295, 455	128-5022.....	330
125-1065E.....	321	125-3837.....	306	127-0722.....	349	128-5022LTM.....	330, 455
125-106J.....	321	125-5012.....	273, 331	127-0723.....	349	128-5052.....	330
125-106JE.....	321	125-5012E.....	331	127-100A.....	318	128-50H7.....	330
125-10B5.....	321	125-5012LTM.....	331, 456	127-100ALTM.....	318, 453	128-5512.....	300
125-10H5.....	321	125-5017.....	331	127-1012.....	318	128-5522.....	300
125-10HB.....	321	125-501J.....	331	127-1012E.....	318	128-5522LTM.....	300, 456
125-10HBE.....	321	125-501K.....	331	127-1013.....	318	128-5552.....	300
125-10HBLTM.....	321, 454	125-5025.....	331	127-1013E.....	318	128-7022.....	352
125-1131.....	362	125-5032.....	282, 331	127-1013LTM.....	318, 453	128-7032.....	352
125-1212.....	304	125-5032E.....	331	127-1022.....	318	128-7032LTM.....	352, 458
125-1232.....	304	125-5032LTM.....	331, 456	127-1022E.....	318	128-7052.....	352
125-1312.....	347	125-5034.....	331	127-1023.....	318	128-7323.....	354
125-1314.....	398	125-5035.....	331	127-1023LTM.....	318, 453	128-8522.....	415
125-1332.....	347	125-5035E.....	331	127-1043.....	318	12A-1015.....	319
125-1333.....	347	125-5035LTM.....	331, 456	127-1046.....	318	12A-1015LTM.....	319, 453
125-1333LTM.....	347, 454	125-5037.....	331	127-1046E.....	318	12A-5015.....	329
125-1334.....	279-280, 285, 398	125-503B.....	331	127-1712.....	339	12A-5015LTM.....	329, 455
125-1334E.....	398	125-503D.....	331	127-1712LTM.....	339, 454	1300502506.....	54
125-1334G5.....	445	125-503J.....	331	127-1713.....	339	14-3823-000.....	62
125-1334LTM.....	398, 457	125-503K.....	331	127-1722.....	339	14-6855-000.....	62
125-1334UI.....	291, 397	125-5062.....	331	127-2222.....	345	14-8911-003.....	63
125-1364.....	398	125-5065.....	331	127-3212.....	358	1400-0015.....	120, 133
125-1364E.....	398	125-5065E.....	331	127-3212LTM.....	358, 457	145-1001.....	285, 370, 417-418
125-1374.....	269, 398	125-50HB.....	331	127-32H2.....	358	145-1009.....	370, 417-418
125-1374E.....	398	125-5512.....	300	127-32H2LTM.....	358, 457	145-1011.....	283, 418
125-1374UI.....	291, 397	125-5532.....	300	127-5012.....	329	145-1032.....	418
125-14A4.....	402	125-5532LTM.....	300, 456	127-5012E.....	329	145-1334.....	419
125-1704.....	339	125-5537.....	300	127-5012LTM.....	329, 455	145-2814.....	417-418
125-1711.....	339	125-5537G.....	445	127-5013.....	329	145-7032.....	419
125-1712.....	339	125-553J.....	300	127-5013LTM.....	329, 455	1460-1160.....	113, 115, 131
125-1712LTM.....	339, 454	125-553JLTM.....	300, 456	127-501E.....	329	1460-1914.....	126
125-1713.....	339	125-6837.....	272-273, 275, 388	127-501ELTM.....	329, 455	1500334701.....	218, 220
125-1713LTM.....	339, 454	125-7012.....	353	127-501N.....	329	1535-4952.....	47, 52
125-1717.....	339	125-7012E.....	353	127-5022.....	329	1535-4954.....	47
125-1730.....	282, 388	125-7017.....	353	127-5023.....	329	160-1010-1.....	464
125-1731.....	339	125-7031.....	353	127-7012.....	352	160-1010-10.....	464
125-1732.....	339	125-7031LTM.....	353, 458	127-7012E.....	352	160-1010-5.....	464
125-1732E.....	339	125-7032.....	279-280, 353	127-7012LTM.....	352, 458	160-2200-10.....	468
125-1732LTM.....	339, 454	125-7032E.....	353	127-7013.....	352	160-2200-5.....	468
125-1733.....	339	125-7032LTM.....	353, 458	127-7013LTM.....	352, 458	160-2205-1.....	464
125-1737.....	339	125-7037.....	353	127-7022.....	352	160-2205-10.....	464
125-1762.....	339	125-7062.....	353	127-7022LTM.....	352, 458	160-2205-5.....	464
125-1912.....	337	125-7062E.....	353	127-7023.....	352	160-2250-10.....	468
125-1932.....	337	125-7312.....	354	127-7023E.....	352	160-2250-5.....	468
125-1932LTM.....	337, 455	125-7314.....	354	127-7023FF.....	353	160-2255-1.....	465
125-1937.....	337	125-7332.....	354	127-7023LTM.....	352, 458	160-2255-10.....	465
125-2032.....	343	125-7332E.....	354	128-0112.....	295	160-2255-30.....	465
125-2212.....	273, 345	125-7333.....	354	128-0122.....	295	160-2255-5.....	43, 53, 465
125-2232.....	345	125-7333LTM.....	354, 458	128-0122E.....	295	160-2320-10.....	468
125-2237.....	345	125-7334.....	354	128-0122LTM.....	295, 455	160-2320-5.....	468
125-2312.....	342	125-7334E.....	354	128-1012.....	319	160-2325-1.....	465
125-2332.....	342	125-7362.....	354	128-1012LTM.....	319, 453	160-2325-10.....	465
125-2814.....	279-280, 283, 370	125-7732.....	386	128-1022.....	319	160-2325-30.....	465
125-2814E.....	370	125-9134.....	414	128-1022LTM.....	319, 453	160-2325-5.....	43, 53, 465
125-2814LTM.....	370, 455	125-9134E.....	414	128-1034.....	319	160-2455-1.....	465
125-3212.....	358	125-9234.....	414	128-1052.....	319	160-2455-10.....	465
125-3217.....	358	126-1012.....	318	128-1056.....	284, 369	160-2455-5.....	53, 465
125-3217LTM.....	358, 457	126-1013.....	318	128-1222.....	304	160-2530-10.....	468
125-3231.....	358	126-7012.....	352	128-1314LTM.....	457	160-2530-5.....	468
125-3232.....	358	126-7013.....	352	128-1324.....	398	160-2535-1.....	465
125-3232E.....	358	127-0112.....	295	128-1324E.....	398	160-2535-10.....	465
125-3233.....	358	127-0112LTM.....	295, 455	128-1324LTM.....	398, 457	160-2535-30.....	465

PART NUMBER INDEX

160-2535-5.....	43, 53, 465	19091A-115.....	327	19091J-216E.....	333	19091N-216E.....	355
160-2610-10.....	468	19091B-002.....	328	19091J-231.....	333	19091N-231.....	272, 355
160-2610-5.....	468	19091B-005.....	328	19091J-233.....	272, 333	19091N-233.....	276, 355
160-2615-1.....	464	19091B-012.....	328	19091J-233LTM.....	333, 459	19091N-233E.....	355
160-2615-10.....	464	19091B-012E.....	328	19091J-236.....	333	19091N-236.....	355
160-2615-5.....	464	19091B-015.....	328	19091J-313.....	333	19091N-331.....	355
160-2625-1.....	43, 464	19091B-101.....	328	19091J-330.....	333	19091N-577.....	355
160-2625-10.....	43, 464	19091B-101LTM.....	328, 461	19091J-330LTM.....	333, 459	19091N-577E.....	355
160-2625-5.....	43, 464	19091B-102.....	328	19091J-333.....	333	19091N-577LTM.....	355, 460
160-2634-10.....	468	19091B-102E.....	328	19091J-411.....	333	19091P-K15.....	428
160-2634-5.....	468	19091B-102LTM.....	328, 461	19091J-411LTM.....	333, 459	19091P-K15E.....	428
160-2635-1.....	464	19091B-105.....	328	19091J-413.....	333	19091P-K15PT.....	421, 428
160-2635-10.....	464	19091B-105E.....	328	19091J-413E.....	333	19091P-K33.....	428
160-2635-5.....	464	19091B-112.....	328	19091J-413LTM.....	333, 459	19091P-K33LTM.....	428, 461
160-2644-10.....	468	19091B-112LTM.....	328, 461	19091J-416.....	333	19091P-M15.....	434
160-2644-5.....	468	19091B-115.....	328	19091J-431.....	333	19091P-M15E.....	434
160-2650-10.....	468	19091B-115E.....	328	19091J-431E.....	333	19091P-MS4.....	438
160-2650-5.....	468	19091F-102.....	359	19091J-433.....	333	19091P-MS4E.....	438
160-2655-1.....	464	19091F-102E.....	359	19091J-433E.....	333	19091P-MS7.....	438
160-2655-10.....	464	19091F-102LTM.....	359, 460	19091J-433LTM.....	333, 459	19091P-MS7LTM.....	438, 461
160-2655-5.....	464	19091F-105.....	359	19091J-436.....	333	19091P-MS8.....	438
160-2660-5.....	468	19091F-105E.....	359	19091J-436E.....	333	19091P-MS8LTM.....	438, 461
160-2815-5.....	465	19091F-112.....	359	19091J-577.....	332	19091P-Q03.....	425
160-2825-5.....	465	19091F-112E.....	359	19091J-577E.....	332	19091P-Q03LTM.....	425, 461
160-2845-10.....	465	19091F-112LTM.....	359, 460	19091J-577LTM.....	332, 459	19091P-Q03PT.....	421, 425
160-2845-5.....	465	19091F-115.....	359	19091L-101.....	340	19091P-Q04.....	425
160-2855-10.....	465	19091F-115E.....	359	19091L-113.....	340	19091P-Q04E.....	425
160-2855-5.....	465	19091F-413.....	359	19091L-113E.....	340	19091P-Q04LTM.....	425, 461
160-2865-10.....	465	19091F-433.....	359	19091L-133.....	340	19091P-Q04PT.....	421, 425
160-2865-5.....	465	19091F-433E.....	359	19091L-330.....	340	19091P-S12.....	432
160-4535-5.....	53, 469	19091F-433LTM.....	359, 460	19091L-330LTM.....	340, 459	19091P-S12LTM.....	432, 461
169-0013-HSP.....	55	19091G-113.....	338	19091L-333.....	340	19091P-S12PT.....	421, 432
18596-40015.....	51	19091G-131.....	338	19091L-413.....	340	19091P-S15.....	432
18710-20119.....	96, 119, 130, 135	19091G-131E.....	338	19091L-413E.....	340	19091P-S15E.....	432
18710-60170.....	105, 136	19091G-131LTM.....	338, 459	19091L-416.....	340	19091P-S15PT.....	421, 432
18711-60060.....	105, 136	19091G-133.....	338	19091L-431.....	340	19091P-S33.....	432
18713-60040.....	102, 132	19091G-213.....	338	19091L-431LTM.....	340, 459	19091P-U04.....	428
18713-60050.....	102, 132	19091G-B133.....	411	19091L-433.....	340	19091P-U04E.....	428
18740-20800.....	75, 139	19091G-B213.....	411	19091L-433LTM.....	340, 459	19091P-U04LTM.....	428, 461
18740-20880.....	67, 139	19091G-B233.....	411	19091N-013.....	355	19091R-303.....	401
18740-60830.....	74, 76, 138	19091G-B233E.....	411	19091N-013LTM.....	355, 460	19091R-306.....	267, 271, 275, 401
18740-60835.....	74, 76, 83, 85, 90-91, 137-138	19091J-002.....	332	19091N-030.....	355	19091R-316.....	401
18740-60840.....	31	19091J-005.....	332	19091N-030LTM.....	355, 460	19091R-319.....	401
18740-80190.....	31	19091J-012.....	333	19091N-033.....	355	19091S-001.....	282-283, 367
18740-80200.....	30	19091J-015.....	333	19091N-036.....	355	19091S-001E.....	367
18740-80220.....	30	19091J-101.....	332	19091N-102.....	355	19091S-010.....	388
18789-60060.....	120, 133	19091J-102.....	332	19091N-102LTM.....	355, 460	19091S-101.....	301
18789-80070.....	96, 130	19091J-102E.....	332	19091N-105.....	355	19091S-101LTM.....	301, 460
18900-21000.....	48	19091J-105.....	332	19091N-105E.....	355	19091S-102.....	301
18900-60640.....	124	19091J-105E.....	332	19091N-111.....	355	19091S-102E.....	301
19091-21050.....	468	19091J-108.....	332	19091N-113.....	282, 355	19091S-102LTM.....	301, 460
19091-60312.....	322	19091J-112.....	333	19091N-113E.....	355	19091S-105.....	301
19091-60620E.....	464	19091J-112E.....	333	19091N-116.....	278, 285, 355	19091S-111LTM.....	460
19091-63000.....	80	19091J-113.....	333	19091N-131.....	355	19091S-112.....	301
19091A-002.....	327	19091J-113E.....	333	19091N-131E.....	355	19091S-112E.....	301
19091A-005.....	327	19091J-113LTM.....	333, 459	19091N-133.....	355	19091S-113.....	270, 274, 301
19091A-008.....	327	19091J-115.....	333	19091N-133E.....	355	19091S-133.....	267, 270, 273-274, 276, 301
19091A-012.....	327	19091J-115E.....	333	19091N-136.....	278, 355	19091S-133UI.....	271, 274, 290
19091A-015.....	327	19091J-202.....	332	19091N-136E.....	355	19091S-133UILTM.....	290, 460
19091A-101.....	327	19091J-205.....	332	19091N-202.....	355	19091S-139.....	395
19091A-102.....	327	19091J-212.....	333	19091N-205.....	355	19091S-213.....	276, 282, 301
19091A-102E.....	327	19091J-213.....	333	19091N-205E.....	355	19091S-213UI.....	290
19091A-105.....	327	19091J-213E.....	333	19091N-213.....	355	19091S-213UILTM.....	290, 460
19091A-108.....	327	19091J-215.....	333	19091N-213E.....	355	19091S-231.....	301
19091A-112.....	327	19091J-215E.....	333	19091N-216.....	281-282, 355	19091S-233.....	301
		19091J-216.....	333				

19091S-233E.....	301	19091W-012LTM.....	361, 459	19095F-121LTM.....	359, 460	19095S-100.....	323
19091S-233UI.....	266, 290	19091W-015.....	361	19095F-123.....	359	19095S-100E.....	323
19091S-233UILTM.....	290, 460	19091W-015E.....	361	19095F-123E.....	359	19095S-200.....	369
19091S-313.....	301	19091W-102.....	361	19095F-123LTM.....	359, 460	19095S-205.....	369
19091S-331.....	301	19091W-105.....	361	19095J-023.....	333	19095V-420.....	416
19091S-331LTM.....	301, 460	19091Y-012.....	441	19095J-023E.....	333	19095V-420E.....	416
19091S-333.....	301	19091Y-012E.....	441	19095J-121.....	333	19095V-420LTM.....	416, 460
19091S-336.....	301	19091Y-015.....	441	19095J-121E.....	333	19095W-121.....	361
19091S-413.....	285, 301	19091Y-102.....	441	19095J-121LTM.....	333, 459	19095W-123.....	361
19091S-413E.....	301	19091Z-002.....	322	19095J-123.....	333	19095Z-020.....	279, 323
19091S-413LTM.....	301, 460	19091Z-002LTM.....	322, 459	19095J-123E.....	333	19095Z-021.....	279, 323
19091S-413UI.....	275, 290	19091Z-005.....	322	19095J-321.....	273, 333	19095Z-021E.....	323
19091S-413UILTM.....	290, 460	19091Z-008.....	322	19095J-323.....	333	19095Z-021LTM.....	323, 459
19091S-416.....	301	19091Z-012.....	323	19095J-323E.....	333	19095Z-023.....	323
19091S-431.....	301	19091Z-012LTM.....	323, 459	19095J-621.....	333	19095Z-023E.....	323
19091S-431LTM.....	301, 460	19091Z-015.....	323	19095J-623.....	285, 333	19095Z-023LTM.....	323, 459
19091S-431UI.....	267, 290	19091Z-102.....	322	19095J-623E.....	333	19095Z-121.....	323
19091S-431UILTM.....	290, 460	19091Z-102E.....	322	19095L-021.....	340	19095Z-121E.....	323
19091S-433.....	267, 283-284, 301	19091Z-105.....	322	19095L-021LTM.....	340, 459	19095Z-121LTM.....	323, 459
19091S-433E.....	301	19091Z-112.....	323	19095L-023.....	340	19095Z-123.....	323
19091S-433LTM.....	301, 460	19091Z-112E.....	323	19095L-023E.....	340	19095Z-123E.....	323
19091S-433UI.....	266, 268, 271, 290	19091Z-115.....	281, 285, 323	19095L-121.....	441	19095Z-123LTM.....	323, 459
19091S-433UIE.....	290	19091Z-115E.....	323	19095L-523.....	340	19095Z-220.....	323
19091S-433UILTM.....	290, 460	19091Z-202.....	322	19095N-121.....	355	19095Z-221.....	323
19091S-436.....	301	19091Z-202LTM.....	322, 459	19095N-123.....	355	19095Z-221E.....	323
19091S-436E.....	301	19091Z-205.....	322, 367	19095N-123E.....	355	19095Z-321.....	323
19091S-436UI.....	290	19091Z-205E.....	367	19095N-123LTM.....	355, 460	19095Z-323.....	323
19091S-577.....	301	19091Z-211.....	323	19095N-126.....	355	19095Z-323E.....	323
19091S-577LTM.....	301, 460	19091Z-212.....	323	19095P-K23.....	428	19095Z-421.....	323
19091S-577UI.....	266, 290	19091Z-213.....	323	19095P-K23LTM.....	428, 461	19095Z-423.....	323
19091S-577UILTM.....	290, 460	19091Z-213E.....	323	19095P-K23PT.....	278, 421, 428	19095Z-423E.....	323
19091S-602.....	296	19091Z-215.....	323	19095P-K25.....	428	19095Z-621.....	282, 323
19091S-602E.....	296	19091Z-216.....	323	19095P-K25E.....	428	19095Z-623.....	323
19091S-612.....	296	19091Z-216E.....	323	19095P-K25PT.....	285, 421, 428	19095Z-623E.....	323
19091S-612UI.....	289	19091Z-231.....	322	19095P-M23.....	434	19095Z-623LTM.....	323, 459
19091S-633.....	296	19091Z-233.....	322	19095P-M25.....	434	19095Z-626.....	285, 323
19091S-633LTM.....	296, 459	19091Z-233E.....	322	19095P-M25PT.....	421, 434	19095Z-627.....	283, 323
19091S-633UI.....	289	19091Z-236.....	284-285, 322	19095P-MS0.....	278, 438	1909BD-113.....	378
19091S-677.....	296	19091Z-236E.....	322	19095P-MS0E.....	438	19231-20910.....	98
19091S-677LTM.....	296, 459	19091Z-313.....	323	19095P-MS0LTM.....	438, 461	19231-20940.....	98
19091S-677UI.....	289	19091Z-313LTM.....	323, 459	19095P-MS5.....	438	19231-20980.....	98
19091S-713.....	280, 283, 296	19091Z-331.....	322	19095P-MS6.....	438	19231-21050.....	128
19091S-713LTM.....	296, 459	19091Z-333.....	322	19095P-MS6E.....	438	19231-21060.....	98
19091S-713UI.....	289	19091Z-411.....	323	19095P-MS9.....	278, 438	19231-60680.....	98
19091S-733.....	296	19091Z-413.....	323	19095P-Q03.....	425	19231-80520.....	99, 121, 129, 134
19091S-733E.....	296	19091Z-413E.....	323	19095P-Q03E.....	425	19231-80530.....	99, 121, 129, 134
19091S-733LTM.....	296, 459	19091Z-416.....	323	19095P-Q03LTM.....	425, 461	19233-20755.....	102, 132
19091S-733UI.....	289	19091Z-431.....	322	19095P-Q03PT.....	278, 282, 284, 421, 425	19234-60700.....	90, 99, 102, 129, 132, 137
19091S-833.....	296	19091Z-433.....	322	19095P-Q04.....	425	19234-60715.....	90, 99, 102, 129, 132, 137
19091S-833LTM.....	296, 459	19091Z-433E.....	322	19095P-Q04E.....	425	19234-60720.....	91, 121, 134
19091S-911.....	296	19091Z-436.....	322	19095P-Q04LTM.....	425, 461	19243-00070.....	75, 139
19091S-911UI.....	289	19091Z-513.....	323	19095P-Q04PT.....	283-284, 421, 425	19243-80530.....	90-91, 137
19091S-913.....	296	19091Z-513E.....	323	19095P-S21.....	432	19243-80540.....	90-91, 137
19091S-913E.....	296	19091Z-530.....	283, 322, 367	19095P-S23.....	432	19243-80570.....	90-91, 137
19091S-913UI.....	289	19091Z-530E.....	322, 367	19095P-S23PT.....	278, 421, 432	19244-80540.....	90-91, 137
19091S-916.....	296	19091Z-577.....	322	19095P-S25.....	432	19244-80560.....	96, 119, 130, 135
19091S-931.....	296	19091Z-577E.....	322	19095P-S25E.....	432	19244-80610.....	99, 121, 129, 134
19091S-931UI.....	289	19091Z-613.....	284, 323	19095P-S25PT.....	281, 421, 432	19244-80620.....	96, 119, 130, 135
19091S-933.....	296	19091Z-613LTM.....	323, 459	19095P-U03.....	428	19245-20510.....	80
19091S-933E.....	296	19091Z-713.....	323	19095P-U03E.....	428	19245-20515.....	80
19091S-933LTM.....	296, 459	19091Z-713E.....	323	19095P-U04.....	428	19245-20525.....	80
19091S-933UI.....	289	19091Z-713LTM.....	323, 459	19095P-U04E.....	428	19245-20580.....	80
19091S-936.....	296	19091Z-716.....	323	19095P-U04LTM.....	428, 461	19245-20780.....	80
19091S-936E.....	296	19095F-120.....	359	19095P-U04PT.....	284, 421, 428	19245-40050.....	80
19091W-012.....	361	19095F-120E.....	359	19095R-420.....	401		
19091W-012E.....	361	19095F-121.....	359	19095R-429.....	401		

PART NUMBER INDEX

19245-60760.....	80	222-4712LTM.....	463	390607400.....	220	393050492.....	180
19245-80521.....	80	222-4732LTM.....	463	390607401.....	220	393050493.....	180
19251-60540.....	29	222-5512LTM.....	462	390607900.....	220	393053501.....	180
19251-80680.....	126	222-5512UILTM.....	462	390812700.....	216-217	393053502.....	179-180
19256-00090.....	114	222-5532LTM.....	462	390820601.....	213-217	393060191.....	180
19256-00200.....	114	222-5532UILTM.....	462	390842300.....	213-217	393065201.....	182
19256-00320.....	114	222-5711LTM.....	462	391821100.....	215	393082491.....	179
19256-20690.....	113, 115, 131	222-5731LTM.....	462	391866306.....	215	393101291.....	179
19256-20705.....	113, 131	222-7013LTM.....	463	391866308.....	213	393112601.....	179
19256-20900.....	114	222-7033LTM.....	463	391867600.....	214	393112702.....	179
19256-20910.....	113-115, 131	2302533140.....	54	392017401.....	179	393113001.....	179
19256-21140.....	113, 131	2307230001.....	54	392027300.....	179-180	393161001.....	179
19256-21150.....	113, 131	2307232901.....	54	392030500.....	179-180	393164493.....	179
19256-60510.....	114	232-2790010-EHS.....	55	392035300.....	179-180	393167593.....	179
19256-60700.....	113, 131	232-2790012-EHS.....	55	392043700.....	180	393171201.....	179
19256-60750.....	115	2321700003.....	54-55	392047100.....	180	393175101.....	179
19256-60800.....	113, 131	2321700004.....	54-55	392511901.....	219-220	393706201.....	146, 174
19256-80000.....	114	2322590004.....	54-55	392512800.....	220	393847701.....	179
19256-80010.....	113-115, 131	2322590005.....	54-55	392513800.....	219	394958700.....	218
19256-80640.....	113, 115, 131	2322700011.....	54	392514300.....	219-220	394966601.....	214-215
19258-20830.....	55	2710100200.....	179	392514500.....	219-220	410105017.....	54
19258-20870.....	55	2710100400.....	179	392515101.....	219	4177-0607.....	53
19298-60500.....	124	2710100500.....	179	392515102.....	219	430-1020.....	126
19301-60660.....	128	2722990700.....	180	392515103.....	219	450-1000.....	86, 90, 137
19320-80625.....	80	2735000500.....	179	392515104.....	219	480-0003.....	86, 90, 137
19325-60660.....	48	2740236100.....	220	392515105.....	219	500-2114.....	37
19354-60510.....	124	2740292400.....	219	392515500.....	219-220	500-2118.....	37
200-0010.....	482	2740928202.....	220	392517100.....	219	5020-8292.....	40
200-0032.....	482	29091N-133LTM.....	463	392517600.....	219	5020-8293.....	40
200-0070.....	482	29091N-577LTM.....	463	392517700.....	219	5020-8294.....	40
200-0110.....	482	29091R-303LTM.....	463	392517800.....	219	5021-7107.....	127
200-0113.....	482	29091S-431UILTM.....	462	392517901.....	219	5021-7133.....	45
200-0185.....	482	29091S-433LTM.....	463	392519200.....	219	5021-7134.....	45
200-0310.....	482	29091S-433UILTM.....	462	392543101.....	217	5021-7136.....	45
200-0370.....	482	29091S-577UILTM.....	462	392544001.....	214	5021-7137.....	45
200187500.....	218	29091S-677LTM.....	462	392544011.....	214	5021-7146.....	45
200187600.....	220	29091S-833LTM.....	462	392544391.....	219	5021-7148.....	45
200193800.....	218, 220	29091S-931LTM.....	462	392548201.....	217	5021-7164.....	45
210-3003.....	30	301-011-HSP.....	55	392548301.....	216	5021-7166.....	45
210-3003-5.....	30	301-015-HSP.....	55	392560591.....	218	5021-7168.....	45
210-4004-5.....	29	301-016-HSP.....	55	392561290.....	218	5021-7169.....	45
210-4022-5.....	29	301-017-HSP.....	55	392567111.....	179	5021-7170.....	45
2100003100.....	220	301-152-HSP.....	55	392585291.....	218	5040-4667.....	61
2100003200.....	218, 220	301-169-HSP.....	55	392585292.....	218	5040-4668.....	61
221-0122LTM.....	462	301-170-HSP.....	55	392595501.....	216-217	5040-4669.....	61
221-1324LTM.....	463	301-205-HSP.....	55	392597101.....	213	5040-4671.....	61
221-1524LTM.....	463	301-211-HSP.....	55	392597301.....	213	5060-9086.....	124
221-3822LTM.....	463	301-212-HSP.....	55	392597302.....	213	5061-5869.....	75, 139
221-4722LTM.....	463	3050-0891.....	154-155, 157	392597303.....	213	5061-5886.....	114
221-5522LTM.....	462	3050-1246.....	98	392597501.....	213	5061-5890.....	114
221-5522UILTM.....	462	3050-1301.....	154-155, 157	392599401.....	213	5061-5896.....	146, 174
221-6822LTM.....	463	3050-1374.....	157	392599411.....	213	5062-3506.....	37-38, 148, 172
222-0112LTM.....	462	3050-1375.....	154-155, 159	392599501.....	213	5062-3507.....	37, 172
222-0132LTM.....	462	3150-0602.....	84	392609901.....	23	5062-3508.....	37-38, 148
222-0732LTM.....	463	321-002-HSP.....	55	392609902.....	22	5062-3511.....	37
222-1032LTM.....	462	321-055-HSP.....	55	392609903.....	23	5062-3512.....	37
222-1111LTM.....	462	321-056-HSP.....	55	393001991.....	180	5062-3513.....	37
222-1131LTM.....	462	321-057-HSP.....	55	393010918.....	179	5062-3514.....	37-39, 148
222-1334LTM.....	463	325-062-HSP.....	55	393010920.....	179	5062-3515.....	37
222-1534LTM.....	463	325-132-HSP.....	55	393010924.....	179	5062-3516.....	37
222-2912LTM.....	463	325-185-HSP.....	55	393011391.....	180	5062-3519.....	47
222-2932LTM.....	463	35900-60670.....	127	393031501.....	180	5062-3525.....	45, 84, 86
222-3212LTM.....	463	35900-60800.....	127	393050292.....	180	5062-3538.....	37, 115
222-3232LTM.....	463	35900-60920.....	127	393050293.....	180	5062-3580.....	40
222-3812LTM.....	463	3600500001.....	55	393050392.....	180	5062-3581.....	40
222-3832LTM.....	463	3600500002.....	55	393050393.....	180	5062-3587.....	30

5062-9508.....	47	5181-7460.....	47	5182-9747.....	84-86	5183-4757.....	18, 74, 76,
5062-9509.....	47	5181-8806.....	190	5182-9748.....	84-85, 87	90-91, 137-138	
5062-9510.....	47	5181-8808.....	190	5182-9749.....	84-85	5183-4757-100.....	18, 74, 76, 138
5062-9511.....	47	5181-8809.....	190	5182-9754.....	83, 86	5183-4758.....	18, 80
5067-0226.....	56	5181-8810.....	189	5182-9756.....	83, 86	5183-4759.....	19, 85, 90, 137
5067-0227.....	56	5181-8811.....	190	5182-9757.....	84, 87	5183-4759-100.....	19, 85
5067-0234.....	58	5181-8813.....	190	5182-9758.....	84, 87	5183-4760.....	19, 80
5080-5400.....	86, 90, 137, 146, 174	5181-8815.....	22, 74, 76, 90	5182-9759.....	84, 87	5183-4761.....	19, 74, 76, 85,
5080-8716.....	124	5181-8816.....	22, 74, 76	5182-9760.....	84-85, 87	90, 137-138	
5080-8728-100.....	21	5181-8818.....	30	5182-9761.....	83, 86	5183-4761-100.....	19, 74, 76, 85, 138
5080-8728-50.....	21	5181-8830.....	39-40, 91, 99, 105,	5182-9762.....	83, 86	5183-4762.....	19, 80
5080-8732.....	90-91, 137	121, 129, 132, 134, 137		5182-9763.....	83, 86	5188-1181.....	169
5080-8750.....	91, 99, 127, 129, 137	5181-8833.....	22	5182-9768.....	83, 86	5188-1447.....	63
5080-8751.....	91, 99, 129, 134	5181-8836.....	53, 126	5182-9769.....	83, 86	5188-1448.....	63
5080-8752.....	121, 134	5181-8839.....	22	5182-9770.....	83, 86	5188-2717.....	68, 138
5080-8753.....	121, 134	5181-8863.....	146	5182-9775.....	84, 87	5188-2753.....	59
5080-8755.....	124	5181-8866.....	191	5182-9799.....	191	5188-2759.....	59
5080-8756.....	124	5182-0551.....	50	5183-0314.....	189	5188-5241.....	75, 139
5080-8759.....	124	5182-0773.....	63	5183-0316.....	190	5188-5245.....	113, 115, 131
5080-8761.....	124	5182-0774.....	63	5183-0318.....	87, 190	5188-5246.....	190
5080-8768.....	124	5182-0775.....	63	5183-2007.....	116, 120, 133	5188-5247.....	190
5080-8769.....	124	5182-0781.....	63	5183-2036.....	32, 85, 87	5188-5311.....	33
5080-8773.....	105	5182-0783.....	63	5183-2037.....	32, 87	5188-5312.....	40
5080-8774.....	90-91, 99, 102, 105, 121,	5182-0794.....	62	5183-2038.....	32, 87	5188-5313.....	32, 85, 87
129, 132, 134, 136-137		5182-0795.....	62	5183-2042.....	189	5188-5314.....	40
5080-8853.....	37, 105	5182-0796.....	62	5183-2058.....	87, 190	5188-5315.....	40-41
5080-8858.....	482	5182-0830.....	190	5183-4474.....	56	5188-5316.....	124
5080-8894-100.....	21	5182-0831.....	80, 191	5183-4475.....	56	5188-5317.....	124
5080-8896-50.....	21, 90	5182-0832.....	189, 191	5183-4477.....	58	5188-5347.....	172, 182
5080-8898.....	90-91, 137	5182-0833.....	80, 191	5183-4478.....	58	5188-5348.....	172, 182
5180-4103.....	99, 105-106,	5182-0834.....	190	5183-4479.....	58	5188-5356.....	32, 85, 87
129, 136-137		5182-0835.....	189	5183-4480.....	58	5188-5357.....	172, 182
5180-4105.....	90-91, 99, 102, 105, 121,	5182-0836.....	80, 191	5183-4641.....	127	5188-5365.....	33, 74, 76, 138, 163, 176
129, 132, 134, 136-137		5182-0837.....	56	5183-4642.....	127	5188-5366.....	33, 68, 138
5180-4124.....	136	5182-0838.....	56	5183-4644.....	127	5188-5367.....	67, 75, 139
5180-4150.....	128	5182-0839.....	58	5183-4645.....	127	5188-5370.....	190
5180-4152.....	128	5182-0840.....	58	5183-4647.....	28-30	5188-5371.....	190
5180-4165.....	98, 128	5182-0844.....	62	5183-4691.....	29	5188-5372.....	128
5180-4168.....	33, 74, 76, 138	5182-0845.....	62	5183-4692.....	29	5188-5379.....	482
5180-4173.....	33, 74, 76, 138	5182-0846.....	62	5183-4693.....	30	5188-5392.....	59
5180-4196.....	127	5182-0847.....	62	5183-4694.....	30	5188-5953.....	113, 115, 131
5181-1260.....	21, 80	5182-0848.....	62	5183-4695.....	30	5188-6471.....	31
5181-1261.....	21	5182-0849.....	62	5183-4696.....	30	5188-6493.....	74, 138
5181-1267.....	189	5182-0850.....	62	5183-4697.....	31	5188-6495.....	140
5181-1273.....	189	5182-0851.....	62	5183-4698.....	31	5188-6496.....	74, 138
5181-1291.....	48-49	5182-0852.....	62	5183-4699.....	31	5188-6497.....	74, 138
5181-1292.....	48-49	5182-0853.....	22	5183-4700.....	31	5188-6498.....	90-91, 137
5181-3308.....	37, 40, 172	5182-0875.....	190	5183-4701.....	28-31	5188-6537.....	59
5181-3315.....	30	5182-3442.....	22, 74, 76	5183-4702.....	28-31	5188-6538.....	59
5181-3316.....	30	5182-3444.....	22, 74, 76, 83, 85, 90-91	5183-4703.....	30	5188-8813.....	63
5181-3316i.....	30	5182-3445.....	22, 74, 76, 83, 85, 90-91	5183-4704.....	30	5188-8814.....	63
5181-3319.....	189	5182-3466.....	147	5183-4705.....	30	5188-8815.....	63
5181-3321.....	189	5182-3477.....	106, 136	5183-4706.....	30	5188-8816.....	63
5181-3322.....	37	5182-9622.....	191	5183-4707.....	30	5188-8817.....	63
5181-3323.....	37-39, 148, 172	5182-9626.....	191	5183-4708.....	30	5188-8818.....	63
5181-3351.....	440	5182-9633.....	80	5183-4709.....	30	5188-8819.....	63
5181-3352.....	440	5182-9645.....	80	5183-4710.....	30	5188-8820.....	63
5181-3354.....	189	5182-9651.....	87	5183-4711.....	29	5188-8821.....	63
5181-3356.....	189	5182-9652.....	67, 75, 139	5183-4712.....	29	5188-8822.....	63
5181-3358.....	189-190	5182-9673.....	106, 136	5183-4713.....	29	5190-0468.....	181
5181-3360.....	189	5182-9676.....	106, 136	5183-4728.....	190	5190-0471.....	181
5181-3361.....	189	5182-9677.....	106, 136	5183-4729.....	190	5190-0472.....	181
5181-3365.....	189	5182-9679.....	106, 136	5183-4730.....	190	5190-0473.....	181
5181-3382.....	90-91, 137	5182-9722.....	120, 133	5183-4731.....	190	5190-0490.....	181
5181-3388.....	40	5182-9733.....	52, 54-55	5183-4732.....	40, 105	5190-0491.....	181
5181-7459.....	47	5182-9734.....	191	5183-4741.....	64	5190-0492.....	181

PART NUMBER INDEX

5190-0493.....	181	5190-3193.....	190	8001-0159.....	227-229	8003-0106.....	221
5190-0494.....	181	5190-3976.....	64	8001-0160.....	227-229	8003-0107.....	221
5190-0513.....	181	5190-3978.....	64	8001-0162.....	228	8003-0108.....	222
5190-0531.....	177	5190-3983.....	28	8001-0163.....	228	8003-0109.....	222
5190-0585.....	172	5190-4006.....	28, 31	8001-0201.....	230	8003-0110.....	221
5190-1407.....	378	5190-4007.....	28	8001-0202.....	230	8003-0111.....	221
5190-1408.....	378	5190-4047.....	28, 31	8001-0203.....	230	8003-0151.....	221
5190-1409.....	378	5190-4048.....	28, 31	8001-0211.....	231	8003-0153.....	221
5190-1410.....	378	5190-4054.....	37, 40	8001-0212.....	231	8003-0154.....	222
5190-1426.....	32, 85, 87	5190-4061.....	60	8001-0213.....	231	8003-0155.....	222
5190-1437.....	53	5190-4062.....	60	8001-0214.....	231	8003-0157.....	221
5190-1438.....	53	5190-4063.....	60	8001-0221.....	231	8003-0158.....	221
5190-1441.....	181	5190-4064.....	60	8001-0222.....	231	8003-0159.....	221
5190-1445.....	63	5190-4065.....	60	8001-0223.....	231	8003-0160.....	221
5190-1446.....	63	5190-4066.....	60	8001-0224.....	231	8003-0162.....	221
5190-2209.....	16, 67, 75, 139	5190-4067.....	60	8001-0311.....	232	8003-0163.....	222
5190-2231.....	63	5190-5233.....	38, 40, 148, 172	8001-0312.....	232	8003-0165.....	221
5190-2232.....	63	5190-6144.....	67, 75	8002-0001.....	236	8003-0166.....	221
5190-2233.....	63	5190-6145.....	67, 75	8002-0002.....	236	8003-0202.....	222
5190-2234.....	63	5190-6149.....	16, 67	8002-0003.....	236	8003-0203.....	222
5190-2235.....	63	5190-6168.....	28, 53	8002-0004.....	236, 239	8003-0204.....	222
5190-2238.....	56	5190-6194.....	39-40, 91	8002-0005.....	236, 239	8003-0205.....	222
5190-2239.....	56	5190-6979.....	44	8002-0101.....	234	8003-0211.....	224
5190-2257.....	58	5190-6980.....	44	8002-0102.....	234	8003-0212.....	224
5190-2258.....	58	5190-6981.....	47	8002-0103.....	234	8003-0216.....	223
5190-2265.....	54	5190-6982.....	47	8002-0104.....	234	8003-0219.....	224
5190-2266.....	54	5958-9441.....	51	8002-0105.....	234	8003-0221.....	224
5190-2268.....	16, 33, 68, 138	5958-9442.....	51	8002-0106.....	234	8003-0222.....	224
5190-2269.....	16, 33	5958-9443.....	51	8002-0107.....	234	8003-0223.....	224
5190-2270.....	16, 30	5958-9444.....	51	8002-0151.....	234	8003-0311.....	224
5190-2271.....	16, 30	5958-9445.....	51	8002-0152.....	234	8004-0001.....	210
5190-2272.....	16, 30	5958-9450.....	51	8002-0153.....	234	8004-0002.....	210
5190-2275.....	16, 29	5982-0024.....	181	8002-0154.....	234	8004-0003.....	210
5190-2285.....	56	5982-0025.....	181	8002-0155.....	234	8004-0004.....	210
5190-2286.....	56	6040-0289.....	173-174	8002-0156.....	234	8004-0005.....	210
5190-2287.....	56	6040-0798.....	170	8002-0157.....	234	8004-0006.....	210
5190-2288.....	56	6040-0809.....	170	8002-0159.....	234	8004-0007.....	210
5190-2292.....	28	6040-0834.....	170	8002-0160.....	234	8004-0101.....	206
5190-2293.....	28	6040-1361.....	170	8002-0161.....	234	8004-0102.....	206
5190-2294.....	28	621-9723.....	292, 392	8002-0201.....	235	8004-0103.....	206
5190-2295.....	28	622-9732.....	292, 392	8002-0203.....	235	8004-0104.....	206
5190-2296.....	31	6410090050.....	54	8002-0204.....	235	8004-0105.....	206
5190-2297.....	28, 31	7200008400.....	213-217	8002-0211.....	235	8004-0106.....	206
5190-3151.....	62	8001-0004.....	232	8002-0212.....	235	8004-0107.....	206
5190-3152.....	62	8001-0005.....	232	8002-0213.....	235	8004-0108.....	207
5190-3153.....	62	8001-0006.....	232	8002-0214.....	235	8004-0109.....	207
5190-3154.....	62	8001-0007.....	232	8002-0215.....	235	8004-0110.....	207
5190-3157.....	16, 18	8001-0010.....	232	8002-0216.....	235	8004-0111.....	208
5190-3158.....	16, 19	8001-0011.....	232	8002-0217.....	235	8004-0112.....	207
5190-3162.....	28	8001-0012.....	232	8002-0220.....	235	8004-0113.....	206
5190-3163.....	28	8001-0013.....	232	8002-0221.....	235	8004-0114.....	206
5190-3164.....	28	8001-0014.....	232	8002-0222.....	235	8004-0116.....	206
5190-3165.....	28	8001-0101.....	227-229	8002-0311.....	236	8004-0118.....	207
5190-3166.....	28	8001-0102.....	227, 229	8002-0312.....	236	8004-0119.....	206
5190-3167.....	28	8001-0103.....	227-229	8003-0001.....	225	8004-0151.....	206
5190-3168.....	28	8001-0104.....	228	8003-0002.....	225	8004-0152.....	206
5190-3169.....	28	8001-0105.....	230	8003-0003.....	225	8004-0153.....	206
5190-3170.....	16, 28	8001-0106.....	227-228	8003-0004.....	225	8004-0154.....	206
5190-3171.....	16, 28	8001-0151.....	227-229	8003-0005.....	225	8004-0155.....	206
5190-3172.....	16, 28	8001-0152.....	227, 229	8003-0006.....	225	8004-0156.....	206
5190-3173.....	16, 28	8001-0153.....	227-229	8003-0007.....	225	8004-0157.....	206
5190-3188.....	60	8001-0154.....	228	8003-0008.....	225	8004-0158.....	206
5190-3189.....	60	8001-0155.....	230	8003-0101.....	221	8004-0159.....	207
5190-3190.....	60	8001-0156.....	227-228	8003-0103.....	221	8004-0160.....	207
5190-3191.....	60	8001-0157.....	227-229	8003-0104.....	222	8004-0161.....	207
5190-3192.....	60	8001-0158.....	227-229	8003-0105.....	221	8004-0162.....	207, 215

8004-0163.....	208	8010-0244.....	204, 238	8121-0723.....	127	CP1308.....	474
8004-0164.....	207, 214	8010-0245.....	204, 238	8121-0940.....	127	CP1309.....	476
8004-0165.....	206, 213	8010-0246.....	204, 238	8121-1222.....	127	CP1483.....	475
8004-0167.....	207, 215	8010-0249.....	205, 212, 238	8121-1301.....	127	CP17973.....	147, 164
8004-0168.....	208, 216	8010-0250.....	205, 212, 238	8121-1787.....	127	CP17977.....	147
8004-0170.....	206	8010-0251.....	205, 212, 238	8500-0656.....	146, 177, 182	CP17988.....	147, 164
8004-0171.....	207	8010-0252.....	205, 212, 238	8500-1233.....	146	CP2045.....	475
8004-0173.....	206	8010-0253.....	205, 212, 238	8500-5440.....	172, 182	CP2046.....	475
8004-0176.....	207	8010-0254.....	205, 212, 238	8500-5808.....	182	CP2050.....	479
8004-0178.....	206	8010-0255.....	205, 212, 226, 238	8500-5851.....	182	CP2055.....	474
8004-0201.....	208, 211, 213, 226, 233, 237	8010-0256.....	205, 212, 226, 238	8500-5995.....	182	CP2058.....	472
8004-0202.....	208, 213	8010-0257.....	205, 212, 238	8500-6812.....	482	CP2059.....	476
8004-0203.....	208	8010-0258.....	205, 212, 238	8500-6813.....	482	CP2062.....	473
8004-0204.....	208, 214	8010-0259.....	205, 238	8500-8510.....	163, 176	CP2065.....	475
8004-0211.....	209	8010-0260.....	205, 238	8500-8510.....	182	CP2068.....	473
8004-0212.....	209	8010-0261.....	205, 238	8650-0029.....	146, 174	CP2073.....	478
8004-0213.....	209	8010-0262.....	205, 238	8650-0030.....	146, 172, 174	CP4016.....	440
8004-0214.....	209	8010-0263.....	205, 233	8710-0510.....	40, 147, 172	CP4017.....	440
8004-0215.....	209	8010-0264.....	205, 233	8710-0899.....	147	CP4018.....	440
8004-0216.....	209	8010-0301.....	209, 223	8710-0900.....	147	CP4788.....	440
8004-0217.....	210, 215-217	8010-0302.....	209, 223	8710-1220.....	147	CP4789.....	440
8004-0218.....	209	8010-0303.....	209, 223	8710-1346.....	74, 138	CP4795.....	440
8004-0219.....	209	8010-0304.....	209, 223	8710-1561.....	120, 133	CP4796.....	440
8004-0311.....	210, 213-217	8010-0305.....	210, 215-217, 224	8710-1615.....	147	CP5881.....	297
8004-0312.....	210, 215	8010-0306.....	209, 223	8710-1622.....	147	CP5882.....	309
8010-0201.....	203, 211, 213, 237	8010-0307.....	209, 223	8829951700.....	170, 179	CP5883.....	309
8010-0202.....	203, 211, 237	8010-0308.....	209, 223	8829953800.....	179	CP5884.....	309
8010-0203.....	203, 211, 216-217, 237	8010-0309.....	209, 223	9300003590.....	179	CP5887.....	307
8010-0204.....	203, 211, 237	8010-0310.....	223, 231, 235	9301-0658.....	80	CP5889.....	307
8010-0205.....	203, 211, 237	8010-0311.....	223, 231, 235	9301-0713.....	23, 87, 190	CP5891.....	311
8010-0206.....	203, 211, 237	8010-0312.....	223, 231	9301-0714.....	190	CP5892.....	311
8010-0207.....	203, 211, 226, 237	8010-0313.....	223, 231	9301-0718.....	58	CP6172.....	406
8010-0208.....	203, 211, 226, 237	8010-0314.....	224, 231	9301-0719.....	58	CP6173.....	406
8010-0209.....	203, 211, 214-215, 237	8010-0315.....	224, 231	9301-0721.....	58	CP6174.....	406
8010-0210.....	203, 211, 237	8010-0351.....	239	9301-0723.....	50	CP6175.....	406
8010-0211.....	203, 237-238	8010-0352.....	239	9301-0725.....	190	CP6530.....	379
8010-0212.....	203, 237-238	8010-0353.....	236	9301-0891.....	190	CP6540.....	372, 417-418
8010-0213.....	203, 237	8010-0354.....	236	9301-0892.....	23, 87, 190	CP6550.....	372, 417-418
8010-0214.....	203, 237	8010-0355.....	236, 239	9301-0976.....	58	CP6571.....	469
8010-0215.....	203, 233	8010-0356.....	239	9301-1031.....	50	CP6572.....	469
8010-0216.....	203, 233	8010-0357.....	239	9310-4828.....	146, 174	CP6573.....	469
8010-0217.....	202, 211-213, 237	8010-0358.....	239	998-0000053-EHS.....	55	CP6574.....	469
8010-0218.....	202-205, 211, 226, 233, 237-238	8010-0359.....	239	C-102SSC.....	66	CP6575.....	469
8010-0219.....	202, 211, 216-217, 237	8010-0360.....	239	C-AT010C.....	66	CP6576.....	469
8010-0220.....	202, 211, 237	8010-0361.....	239	C-B010M.....	66	CP6577.....	469
8010-0221.....	202, 211, 237	8010-0362.....	239	C-BIO10.....	66	CP6578.....	469
8010-0222.....	202, 211, 237	8010-0363.....	239	C-BTX1UG.....	66	CP6579.....	469
8010-0223.....	202, 211, 226, 237	8010-0364.....	239	C-CF020.....	66	CP6580.....	469
8010-0224.....	202, 211, 226, 237	8010-0365.....	239	C-CPLOK.....	66	CP6581.....	469
8010-0225.....	202, 211, 214-215, 237	8010-0366.....	239	C-DF010.....	66	CP6666.....	326, 418
8010-0226.....	202, 211, 237	8010-0367.....	236, 239	C-G1CM10.....	66	CP6670.....	326, 418
8010-0227.....	202, 237	8010-0368.....	236	C-GAT010C.....	66	CP6671.....	326, 418
8010-0228.....	202, 237	8010-0371.....	239	C-GT010.....	66	CP6680.....	335, 419
8010-0229.....	202, 237	8010-0401.....	222, 235	C-HY010C.....	66	CP6681.....	419
8010-0230.....	202, 237	8120-5342.....	127	C-PL010.....	66	CP67569.....	418
8010-0231.....	202, 233	8120-6360.....	127	C-TBE10.....	66	CP68186.....	467
8010-0232.....	202, 233	8120-6894.....	127	C-TBP1C1C.....	66	CP68187.....	467
8010-0233.....	204, 212-213, 238	8120-6903.....	127	C-TBP1CXC.....	66	CP6918.....	419, 431
8010-0234.....	204, 212, 238	8120-8619.....	127	C-TBP1TC.....	66	CP6937.....	419, 439
8010-0239.....	204, 212, 226, 238	8120-8620.....	127	C-TNXTA.....	66	CP6938.....	419, 439
8010-0240.....	204, 212, 226, 238	8120-8621.....	127	C-UN010C.....	66	CP6938I5.....	419, 439
8010-0241.....	204, 212, 214-215, 238	8120-8622.....	127	CP0031.....	483	CP6953.....	419, 424
8010-0242.....	204, 212, 238	8121-0070.....	127	CP108194.....	467	CP6954.....	419, 424
8010-0243.....	204, 238	8121-0161.....	127	CP1305.....	474	CP6968.....	419, 431
		8121-0675.....	127	CP1306.....	475	CP7128.....	357
		8121-0710.....	127	CP1307.....	473	CP7130.....	418

PART NUMBER INDEX

CP7135.....	326, 418	CP7440.....	391, 419	CP7529.....	283, 375	CP7584PT.....	421, 427
CP7140.....	326, 418	CP7441.....	324	CP7530.....	368	CP7586.....	431
CP7141.....	357, 419	CP7442.....	325	CP7531.....	282, 368	CP7587.....	431
CP7148.....	357, 419	CP7443.....	324	CP7531I5.....	368	CP7588.....	270-271, 276, 396
CP7150.....	326, 418	CP7443I5.....	324	CP7532.....	279, 372, 417-418	CP7591.....	383
CP7160.....	326, 418	CP7444.....	325	CP7532I5.....	372, 417	CP7592.....	280, 372, 417-418
CP7168.....	357, 419	CP7446.....	381	CP7533.....	278, 439	CP7593.....	372, 417-418
CP7170.....	326, 418	CP7447.....	381	CP7534.....	439	CP7594.....	383
CP7178.....	357, 419	CP7447I5.....	381	CP7534I5.....	439	CP7595.....	382
CP7179.....	357, 419	CP7448.....	381	CP7534PT.....	421, 439	CP7595I5.....	382
CP7196.....	335, 419	CP7448I5.....	381	CP7535.....	439	CP7596.....	269, 382
CP7310.....	324	CP7451.....	334	CP7535I5.....	439	CP7596I5.....	382
CP7311.....	324	CP7452.....	335	CP7536.....	439	CP7597.....	273, 382
CP7334.....	356	CP7453.....	334	CP7536PT.....	421, 439	CP7598.....	274, 382
CP7335.....	356	CP7453I5.....	334	CP7537.....	278, 439	CP7598I5.....	382
CP7340.....	350	CP7454.....	335	CP7538.....	439	CP7599.....	382
CP7347.....	422	CP7461.....	390	CP7538I5.....	439	CP7608.....	326
CP7348.....	422	CP7462.....	390	CP7538PT.....	421, 439	CP7614.....	282, 360
CP7348PT.....	421-422	CP7463.....	409, 419	CP7539.....	439	CP7615.....	285, 409
CP7350.....	280, 422	CP7475.....	367	CP7539PT.....	421, 439	CP7617.....	409
CP7350I5.....	422	CP7476.....	395	CP7540.....	439	CP7619.....	336
CP7351.....	422	CP7477.....	395	CP7540I5.....	439	CP7620.....	326
CP7351I5.....	422	CP7481.....	387	CP7541.....	371	CP7621.....	335
CP7351PT.....	281-282, 421-422	CP7482.....	281, 393	CP7542.....	372, 417-418	CP7622.....	324
CP7352.....	422	CP7483.....	409	CP7543.....	439	CP7624.....	360
CP7352I5.....	422	CP7485.....	410	CP7544.....	439	CP7625.....	326
CP7352PT.....	421-422	CP7485I5.....	410	CP7548.....	424	CP7628.....	357
CP7353.....	422	CP7486.....	279, 410	CP7549.....	424	CP7629.....	336
CP7353I5.....	422	CP7487.....	407	CP7550.....	424	CP7630.....	326
CP7353PT.....	280, 421-422	CP7488.....	278-279, 407	CP7550I5.....	424	CP7631.....	335
CP7354.....	272, 422	CP7489.....	407	CP7550PT.....	421, 424	CP7635.....	326
CP7354I5.....	422	CP7491.....	404	CP7551.....	424	CP7636.....	335
CP7354PT.....	281-282, 421-422	CP749103.....	404	CP7551I5.....	424	CP7637.....	350
CP7355.....	422	CP749106.....	404	CP7551PT.....	421, 424	CP7638.....	357
CP7371.....	436	CP7491I5.....	404	CP7552.....	424	CP7640.....	326
CP7372.....	436	CP7494.....	412	CP7553.....	424	CP7641.....	335
CP7374.....	278, 436	CP7495.....	412	CP7554.....	279, 424	CP7645.....	326
CP7375.....	436	CP7495I5.....	412	CP7554I5.....	424	CP7646.....	335
CP7381.....	423	CP7498.....	396	CP7554PT.....	421, 424	CP7647.....	350
CP7406.....	387	CP7500.....	413	CP7555.....	424	CP7648.....	357
CP7407.....	387	CP7500I5.....	413	CP7556.....	424	CP7649.....	336
CP7409.....	387	CP7501.....	413	CP7557.....	424	CP7654.....	272, 360
CP7411.....	399	CP7502.....	412	CP7557PT.....	421, 424	CP7656.....	335
CP7412.....	399	CP7502I5.....	412	CP7558.....	278, 424	CP7657.....	350
CP7413.....	399	CP7503.....	412	CP7559.....	424	CP7658.....	357
CP7414.....	279, 399	CP7504.....	387	CP7562.....	372, 417-418	CP7658I5.....	357
CP7415.....	399	CP7511.....	430	CP7565.....	431	CP7659.....	336
CP7416.....	399	CP7512.....	372, 417-418	CP7565I5.....	431	CP7664.....	360
CP7416I5.....	399	CP7512I5.....	372	CP7565PT.....	421, 431	CP7665.....	360
CP7417.....	279, 399	CP7513.....	436	CP7567.....	281, 431	CP7666.....	335
CP7418.....	399	CP7514.....	436	CP7568.....	431	CP7667.....	350
CP7419.....	407	CP7515.....	430	CP7568PT.....	421, 431	CP7668.....	357
CP7419I5.....	407	CP7515I5.....	430	CP7569.....	372, 417-418	CP7670.....	324
CP7420.....	407	CP7515PT.....	279, 421, 430	CP7569I5.....	372, 417	CP7670I5.....	324
CP7421.....	407	CP7517.....	430	CP7570.....	279, 372, 417-418	CP7671.....	334
CP7422.....	382	CP7517PT.....	421, 430	CP7571.....	372, 417-418	CP7672.....	350
CP7424.....	382	CP7518.....	430	CP7572.....	372, 417-418	CP7673.....	356
CP7428.....	281	CP7518PT.....	278-279, 421, 430	CP7574.....	427	CP7673I5.....	356
CP7429.....	376	CP7519.....	430	CP7576.....	430	CP7675.....	326
CP7430.....	376	CP7521.....	371	CP7577.....	430	CP7676.....	335
CP7431.....	376	CP7522.....	371	CP7579.....	427	CP7678.....	357
CP7432.....	376	CP7522I5.....	371	CP7580.....	427	CP7680.....	325
CP7433.....	376	CP7525.....	280-282, 284, 373	CP7581.....	427	CP7680I5.....	325
CP7434.....	380	CP7525I5.....	373	CP7582.....	279, 372, 417-418	CP7681.....	335
CP7435.....	380	CP7527.....	408	CP7583.....	427	CP7682.....	324
CP7437.....	380	CP7528.....	403	CP7584.....	427	CP7684.....	324

CP7685	285, 326	CP7770	325	CP81073	474	CP8718	357
CP7685I5	326	CP7770I5	325	CP8120	408	CP8722	350
CP7686	410	CP7771	335	CP8121	389, 467	CP8723	356
CP7688	326	CP7772	350	CP8128	466	CP8730	326
CP7690	325	CP7773	357	CP8129	466	CP8735	278-281, 326
CP7690I5	325	CP7773I5	357	CP8131	389	CP8735I5	326
CP7691	335	CP7775	356	CP8132	389	CP8736	272, 335
CP7691I5	335	CP7777	360	CP8133	389	CP8736I5	335
CP7692	324	CP7778	360	CP8134	389, 466	CP8737	350
CP7693	324	CP7779	335	CP8135	466	CP8738	279-280, 285, 357
CP7694	324	CP7785	356	CP8186	467	CP8738I5	357
CP7695	326	CP7787	360	CP8187	467	CP8741	324
CP7696	335	CP7789	335	CP8430	280, 325	CP8741I5	324
CP7697	350	CP7791	356	CP8431	335	CP8742	325
CP7698	357	CP7792	356	CP8510	324	CP8743	324
CP7698I5	357	CP7797	360	CP8511	334	CP8744	325
CP7700	324	CP7809	350	CP8513	356	CP8745	356
CP7702	350	CP7813	336	CP8521	334	CP8746	356
CP7703	356	CP7820	341	CP8529	325	CP8748	356
CP7709	324	CP7821	341	CP8530	325	CP8750	334
CP7710	324	CP7822	341	CP8531	335	CP8751	276, 334
CP7711	334	CP7822I5	341	CP8533	357	CP8752	335
CP7712	350	CP7824	341	CP8540	325	CP8753	334
CP7713	356	CP7829	350	CP8541	335	CP8754	335
CP7713I5	356	CP7830	341	CP8542	350	CP8756	335
CP7714	373	CP7831	341	CP8543	357	CP8760	279, 281, 325
CP7715	346	CP7832	341	CP8550	325	CP8761	335
CP7717	360	CP7834	341	CP8553	357	CP8762	350
CP7717I5	360	CP7839	350	CP8560	325	CP8763	279-280, 285, 357
CP7719	324	CP7871	341	CP8562	350	CP8770	324
CP7720	324	CP7871I5	341	CP8564	435	CP8771	334
CP7721	334	CP7879	357	CP8566	435	CP8772	350
CP7722	350	CP7884	334	CP8567	435	CP8773	282, 357
CP7723	356	CP7889	357	CP8568	435	CP8774	326
CP7723I5	356	CP7906	336	CP8570	435	CP8775	284, 326
CP7725	346	CP7907	336	CP8570I5	435	CP8780	324
CP7727	360	CP7917	336	CP8571	435	CP8781	334
CP7730	325	CP7926	336	CP8575	375	CP8791	335
CP7731	335	CP7926I5	336	CP8587	366	CP8796	335
CP7732	350	CP7936	336	CP8587I5	366	CP8798	280, 357
CP7739	325	CP7937	336	CP8605	348	CP8799	326
CP7740	325	CP7945	368	CP8607	348	CP8801	305
CP7741	335	CP7946	336	CP8610	348	CP8805	305
CP7741I5	335	CP7947	336	CP8613	348	CP8806	305
CP7742	350	CP7977	336	CP8662	350	CP8807	305
CP7743	357	CP8003	465	CP8667	474	CP8809	305
CP7745	346	CP8007	466	CP86678	474	CP8813	305
CP7747	360	CP8008	466	CP8673	326	CP8816	305
CP7749	325	CP8009	466	CP8674	326	CP8821	310
CP7749I5	325	CP8014	335	CP8675	326	CP8822	310
CP7750	325	CP8015	404, 466	CP8676	326	CP8822I5	310
CP7750I5	325	CP8016	466	CP8677	280-281, 326	CP8824	310
CP7751	335	CP8017	466	CP8678	335	CP8824I5	310
CP7751I5	335	CP8018	466	CP8685	326	CP8827	310
CP7752	350	CP8019	466	CP8687	280-281, 325	CP8828	310
CP7753	357	CP8070	467	CP8687I5	325	CP8829	310
CP7754	373	CP8073	357	CP8688	325	CP8831	310
CP7757	360	CP8073I5	357	CP8688I5	325	CP8842	350
CP7758	325	CP8080	467	CP8689	325	CP8843	357
CP7760	325	CP8087	466	CP8690	325	CP8853	357
CP7761	335	CP8088	466	CP8690I5	325	CP8855	311
CP7762	350	CP8089	466	CP8710	324	CP8857	311
CP7763	357	CP8090	467	CP8712	350	CP8858	271, 311
CP7764	373	CP81025	475	CP8713	356	CP8859	311
CP7767	360	CP81069	474	CP8713I5	356	CP8859I5	311
CP7769	334	CP81071	476	CP8716	335	CP8860	270, 311

PART NUMBER INDEX

CP8861.....	311	CP8951.....	303	CP9053.....	316	CP9205.....	313
CP8864.....	311	CP8953.....	303	CP9054.....	267, 316	CP9205I5.....	313
CP8865.....	311	CP8955.....	265, 276, 303	CP9055.....	316	CP9206.....	269, 313
CP8867.....	311	CP8956.....	303	CP9056.....	316	CP9207.....	313
CP8868.....	274, 311	CP8957.....	267, 275, 303	CP9057.....	316	CP9210.....	314
CP8870.....	325	CP8958.....	303	CP9058.....	316	CP9211.....	314
CP8871.....	335	CP8959.....	303	CP9062.....	316	CP9212.....	314
CP8872.....	307	CP8960.....	271, 303	CP9063.....	316	CP9213.....	314
CP8873.....	307	CP8961.....	303	CP9064.....	316	CP9214.....	314
CP8874.....	307	CP8962.....	303	CP9066.....	316	CP9215.....	272, 274, 276, 314
CP8875.....	307	CP8963.....	303	CP9070.....	265-266, 270-271, 275, 386	CP9216.....	314
CP8877.....	270, 275, 307	CP8964.....	415	CP9071.....	386	CP9217.....	314
CP8878.....	307	CP8965.....	298	CP9072.....	386	CP9218.....	313
CP8879.....	273, 307	CP8967.....	273, 298	CP9073.....	385	CP9219.....	313
CP8880.....	307	CP8968.....	298	CP9074.....	265-267, 270-271, 275, 385	CP9220.....	313
CP8882.....	307	CP8969.....	274, 298	CP9075.....	385	CP9221.....	313
CP8883.....	307	CP8970.....	298	CP9076.....	379, 419	CP9222.....	313
CP8884.....	307	CP8971.....	303	CP9077.....	379, 419	CP9223.....	313
CP8888.....	274, 307	CP8974.....	303	CP9078.....	285, 379, 419	CP9225.....	314
CP8900.....	297	CP8975.....	274, 303	CP9079.....	379, 419	CP9226.....	272, 314
CP8901.....	297	CP8976.....	270, 272-274, 303	CP9080.....	379	CP9228.....	314
CP8902.....	297	CP8977.....	309	CP9083.....	379	CP9229.....	313
CP8903.....	297	CP8979.....	309	CP9090.....	365, 417	CP97638.....	408
CP8904.....	297	CP8980.....	309	CP9091.....	365, 418	CP97658.....	408
CP8905.....	297	CP8981.....	309	CP9092.....	365, 417	CP97713.....	408
CP8906.....	280-281, 284, 298	CP8982.....	270, 309	CP9093.....	365, 418	CP97721.....	408
CP8907.....	298	CP8982I5.....	309	CP9094.....	365, 417	CP97723.....	408
CP8908.....	298	CP8983.....	271, 309	CP9094I5.....	365, 417	CP97723I5.....	408
CP8908I5.....	298	CP8984.....	309	CP9095.....	365, 418	CP97743.....	408
CP8909.....	298	CP8986.....	309	CP9096.....	365, 417	CP97753.....	408
CP8910.....	298	CP8990.....	309	CP9097.....	365, 418	CP97753I5.....	408
CP8911.....	298	CP8991.....	265, 309	CP9100.....	315	CP97763.....	408
CP8912.....	298	CP8996.....	309	CP9101.....	315	CP97773.....	408
CP8912I5.....	298	CP8998.....	309	CP9102.....	265, 267, 269, 315	CR213105.....	209
CP8913.....	267, 298	CP9001.....	272, 309	CP9102I5.....	315	DY50295500.....	64
CP8914.....	298	CP9002.....	273, 309	CP9103.....	265, 267, 272, 275, 315	DY50296800.....	64
CP8915.....	298	CP9010.....	446	CP9103I5.....	315	DY50390600.....	64
CP8916.....	298	CP9011.....	446	CP9104.....	315	DY50402400.....	64
CP8917.....	298	CP9012.....	446	CP9104I5.....	315	DY50540700.....	64
CP8919.....	298	CP9013.....	446	CP9105.....	269, 271, 275, 315	DY50546100.....	64
CP8921.....	298	CP9014.....	446	CP9106.....	315	DY50546390.....	64
CP8922.....	298	CP9015.....	446	CP9106I5.....	315	DY50548400.....	64
CP8923.....	298	CP9016.....	446	CP9107.....	272, 315	DY50549100.....	64
CP8924.....	265, 272, 298	CP9019.....	446	CP9108.....	269, 271, 315	DY50549290.....	64
CP8925.....	298	CP9021.....	446	CP9109.....	315	DY50549500.....	64
CP8926.....	265, 298	CP9022.....	446	CP9110.....	315	DY50551400.....	64
CP8928.....	298	CP9023.....	446	CP9145.....	317	DY50559800.....	64
CP8929.....	298	CP9024.....	446	CP9150.....	317	DY50559900.....	64
CP8930.....	298	CP9025.....	446	CP9151.....	266, 268, 317	DY50572600.....	64
CP8934.....	302	CP9026.....	446	CP9151I5.....	317	DY50573990.....	64
CP8935.....	302	CP9027.....	446	CP9152.....	317	DY50574190.....	64
CP8936.....	302	CP9030.....	297	CP9152I5.....	317	DY50574390.....	64
CP8937.....	302	CP9031.....	297	CP9154.....	317	DY50574500.....	64
CP8938.....	303	CP9032.....	297	CP9156.....	317	DY70001990.....	64
CP8939.....	267, 303	CP9034.....	302	CP9162.....	317	DY70007691.....	64
CP8940.....	303	CP9035.....	302	CP9163.....	265, 317	DY70007701.....	64
CP8941.....	303	CP9036.....	302	CP9165.....	317	DY70007791.....	64
CP8943.....	270, 303	CP9037.....	302	CP9166.....	317	DY70008101.....	64
CP8944.....	266-271, 273-274, 276, 303	CP9038.....	302	CP9170.....	317	DY70008590.....	64
CP8944I5.....	303	CP9039.....	302	CP9171.....	272-274, 317	G1072-20008.....	154-155
CP8945.....	270, 276, 303	CP9041.....	305	CP9176.....	446	G1099-20030.....	38, 126, 147-148, 172
CP8946.....	266, 273, 275-276, 303	CP9044.....	365	CP9177.....	446	G1099-20130.....	154
CP8947.....	303	CP9045.....	365	CP9201.....	313	G1099-20132.....	154
CP8948.....	270, 303	CP9046.....	365	CP9202.....	313	G1099-20133.....	154-155, 157
CP8949.....	303	CP9047.....	365	CP9203.....	313	G1099-20136.....	154-155
CP8950.....	303	CP9048.....	365	CP9204.....	313	G1099-60566.....	146

G1099-80039.....	170	G2589-20044.....	155, 157	G3440-20003.....	48	G3591-70013.....	475
G1530-60560.....	127	G2589-20045.....	151, 155	G3440-20004.....	48	G3591-70014.....	478
G1530-60570.....	127	G2589-20100.....	151, 155	G3440-20005.....	48	G3591-70015.....	476
G1530-60930.....	127	G2591B.....	153	G3440-20007.....	48	G3591-70016.....	471
G1530-61230.....	126	G2591C.....	153	G3440-20008.....	48	G3591-70017.....	476
G1530-61580.....	126	G2591D.....	153	G3440-20033.....	49	G3591-70018.....	478
G1530-61610.....	126	G2617-20510.....	84	G3440-20035.....	49	G3591-74001.....	474
G1530-61640.....	126	G2617-60506.....	83	G3440-20037.....	49	G3591-80000.....	480
G1530-80650.....	123, 127	G2617-60507.....	83, 85, 87	G3440-60033.....	49	G3591-80001.....	472
G1531-20690.....	98	G2617-60508.....	83	G3440-60035.....	49	G3591-80002.....	474
G1531-20700.....	98	G2617-60510.....	84	G3440-60136.....	49	G3591-80003.....	476
G1531-20740.....	98	G2617-80540.....	84	G3440-60233.....	49	G3591-80004.....	474
G1531-21090.....	98	G2617-80550.....	85, 87	G3440-60234.....	49	G3591-80006.....	480
G1531-60690.....	98	G2618-80500.....	83, 85	G3440-60236.....	49	G3591-80007.....	479
G1531-80560.....	96, 119	G2619-60501.....	83	G3440-60300.....	49	G3591-80008.....	479
G1531-80620.....	96, 119	G2630-60710.....	123	G3440-60310.....	49	G3591-80011.....	473
G1532-20710.....	105, 113, 121, 131, 134, 136	G2630-61230.....	107	G3440-60333.....	49	G3591-80012.....	476
G1532-60675.....	107	G2646-60500.....	123	G3440-60334.....	49	G3591-80013.....	478
G1532-60685.....	107	G2647-60501.....	113, 131	G3440-60336.....	49	G3591-80014.....	479
G1532-60690.....	107	G2648-60501.....	113, 131	G3440-60600.....	49	G3591-80015.....	479
G1532-60695.....	107	G2855-20530.....	43, 49	G3440-60610.....	49	G3591-80016.....	478
G1532-60695.....	107	G2855-20532.....	49	G3440-60620.....	49	G3591-80017.....	475
G1532-80540.....	105, 136	G2855-20555.....	38, 40, 43, 49, 148, 172	G3440-80217.....	39-40, 74, 76	G3591-80019.....	474
G1534-20530.....	120, 133	G2855-20590.....	43, 53	G3440-80218.....	39-40, 74, 76	G3591-80020.....	474
G1534-20590.....	120, 133	G2855-40001.....	53	G3440-81664.....	49	G3591-80021.....	471
G1534-60570.....	116, 120, 133	G2855-60200.....	38, 43, 53, 148, 172	G3440-81665.....	49	G3591-80022.....	475
G1534-60640.....	120, 133	G2855-60570.....	53	G3440-85007.....	181	G3591-80023.....	474
G1534-80510.....	120, 133	G2933-85001.....	123	G3440-85009.....	181	G3591-80025.....	476
G1534-80580.....	119	G2933-85003.....	123	G3440-85012.....	181	G3591-80026.....	479
G1534-80590.....	119, 135	G3163-20530.....	154	G3440-85013.....	181	G3591-80027.....	472
G1535-00010.....	114	G3170-20126.....	154-155, 157, 159	G3440-85017.....	181	G3591-80028.....	476
G1535-00030.....	114	G3170-20530.....	154-155	G3440-85018.....	181	G3591-80029.....	479
G1535-60600.....	113, 115, 131	G3170-20540.....	159	G3440-85026.....	181	G3591-80030.....	472
G1535-60610.....	114	G3170-60053.....	157	G3440-85027.....	181	G3591-80031.....	476
G1535-80520.....	114	G3170-60204.....	163	G3440-85028.....	181	G3591-80032.....	472
G1540-30025.....	48	G3170-60416.....	159	G3440-85029.....	181	G3591-80033.....	474
G1540-30026.....	48	G3170-80001.....	162	G3440-85035.....	181	G3591-80034.....	480
G1540-30027.....	48	G3170-80002.....	163, 176-177	G3440-85036.....	181	G3591-80035.....	476
G1540-30028.....	48	G3170-80002.....	146, 174	G3451-80501.....	90, 137	G3591-80036.....	477
G1540-80013.....	90	G3170-80008.....	165	G3452-20512.....	76	G3591-80037.....	473
G1544-20590.....	75, 139	G3170-80100.....	165	G3452-60570.....	74	G3591-80039.....	472
G1544-60585.....	74	G3170-80103.....	165, 173-174	G3452-60586.....	74	G3591-80040.....	480
G1544-80700.....	32	G3182-61580.....	42	G3452-60730.....	74	G3591-80043.....	476
G1544-80730.....	32	G3182-61581.....	42	G3452-60835.....	53	G3591-80044.....	477
G1544-80731.....	32	G3184-60065.....	43	G3452-80570.....	74	G3591-80045.....	473
G1545-80520.....	80	G3188-20509.....	49	G3480-20002.....	48	G3591-80046.....	475
G1888-60701.....	55	G3188-27501.....	37-39, 41, 43, 49, 148, 172	G3480-60663.....	48	G3591-80047.....	474
G1888-60702.....	54	G3188-27502.....	37-39, 41, 43, 49, 148, 172	G3480-67585.....	74	G3591-80048.....	476
G1888-60703.....	54	G3188-27503.....	37, 41, 43, 49, 172	G3500-80000.....	87	G3591-80049.....	480
G1888-60704.....	54	G3188-27504.....	49, 172	G3504-20504.....	40	G3591-80051.....	478
G1890-60000.....	54	G3188-27505.....	49	G3504-60620.....	53	G3591-80052.....	478
G1960-80303.....	174	G3188-27506.....	49	G3507-60660.....	48	G3591-80053.....	478
G1999-20021.....	154-155, 159	G3397A.....	162	G3510-20018.....	76	G3591-80054.....	476
G1999-20022.....	154-155, 159	G3397B.....	162	G3520-20210.....	53	G3591-80055.....	471
G1999-20430.....	159	G3430-60011.....	74	G3591-70001.....	478	G3591-80056.....	475
G1999-20432.....	159	G3431-60680.....	98	G3591-70002.....	475	G3591-80058.....	476
G1999-20433.....	159	G3432-60220.....	107	G3591-70003.....	475	G3591-80059.....	477
G1999-20443.....	159	G3432-60221.....	107	G3591-70004.....	475	G3591-80060.....	473
G1999-20444.....	159	G3433-63000.....	102, 132	G3591-70005.....	474	G3591-80061.....	475
G1999-20446.....	159	G3434-60806.....	116, 120	G3591-70006.....	474	G3591-80062.....	475
G1999-60412.....	159	G3435-60350.....	115	G3591-70007.....	474	G3591-80063.....	479
G1999-60452.....	163, 176	G3435-81330.....	115	G3591-70008.....	475	G3591-80064.....	475
G1999-80410.....	147, 164	G3435-81360.....	115	G3591-70009.....	478	G3591-80065.....	475
G2397-20540.....	102, 132	G3440-05012.....	181	G3591-70010.....	478	G3591-80066.....	478
G2397-80520.....	102			G3591-70011.....	474	G3591-80067.....	472
G2589-20043.....	155			G3591-70012.....	471	G3591-80068.....	479

PART NUMBER INDEX

G3591-80071.....	479	G3591-81016.....	478	G3591-81098.....	476	G3591-82048.....	476
G3591-80072.....	477	G3591-81017.....	475	G3591-81099.....	471	G3591-82049.....	480
G3591-80074.....	475	G3591-81019.....	474	G3591-81100.....	474	G3591-82050.....	471
G3591-80075.....	475	G3591-81020.....	474	G3591-81101.....	476	G3591-82051.....	478
G3591-80077.....	475	G3591-81021.....	471	G3591-81102.....	474	G3591-82053.....	478
G3591-80082.....	472	G3591-81022.....	475	G3591-81103.....	475	G3591-82063.....	479
G3591-80083.....	478	G3591-81023.....	474	G3591-81104.....	475	G3591-82064.....	475
G3591-80084.....	470	G3591-81025.....	476	G3591-81105.....	470	G3591-82067.....	472
G3591-80085.....	476	G3591-81026.....	479	G3591-81106.....	478	G3591-82072.....	477
G3591-80086.....	477	G3591-81027.....	472	G3591-81119.....	477	G3591-82082.....	472
G3591-80087.....	477	G3591-81028.....	476	G3591-81120.....	478	G3591-82084.....	470
G3591-80088.....	473	G3591-81029.....	479	G3591-81121.....	474	G3591-82087.....	477
G3591-80090.....	475	G3591-81030.....	472	G3591-81122.....	477	G3591-82088.....	473
G3591-80091.....	473	G3591-81031.....	476	G3591-81123.....	477	G3591-82093.....	476
G3591-80093.....	476	G3591-81032.....	472	G3591-81135.....	478	G3591-82095.....	470
G3591-80094.....	480	G3591-81033.....	474	G3591-81136.....	478	G3591-82099.....	471
G3591-80095.....	470	G3591-81034.....	480	G3591-81137.....	478	G3591-82101.....	476
G3591-80096.....	478	G3591-81035.....	476	G3591-81138.....	478	G3591-82102.....	474
G3591-80097.....	476	G3591-81036.....	477	G3591-81139.....	471	G3591-82104.....	475
G3591-80098.....	476	G3591-81037.....	473	G3591-81140.....	472	G3591-82106.....	478
G3591-80099.....	471	G3591-81039.....	472	G3591-81141.....	479	G3591-82119.....	477
G3591-80100.....	474	G3591-81040.....	480	G3591-81142.....	479	G3591-82121.....	474
G3591-80101.....	476	G3591-81043.....	476	G3591-81143.....	474	G3591-82122.....	477
G3591-80103.....	475	G3591-81044.....	477	G3591-81146.....	474	G3591-82123.....	477
G3591-80104.....	475	G3591-81045.....	473	G3591-81147.....	475	G3591-82135.....	478
G3591-80105.....	470	G3591-81046.....	475	G3591-81149.....	475	G3591-82136.....	478
G3591-80106.....	478	G3591-81047.....	474	G3591-81156.....	473	G3591-82137.....	478
G3591-80107.....	475	G3591-81048.....	476	G3591-81157.....	478	G3591-82139.....	471
G3591-80108.....	479	G3591-81049.....	480	G3591-81160.....	472	G3591-82140.....	472
G3591-80110.....	477	G3591-81050.....	471	G3591-81161.....	472	G3591-82159.....	474
G3591-80119.....	477	G3591-81051.....	478	G3591-81162.....	476	G3591-82176.....	479
G3591-80120.....	478	G3591-81052.....	478	G3591-81176.....	479	G3850-60014.....	147
G3591-80121.....	474	G3591-81053.....	478	G3591-81209.....	475	G3870-20021.....	157
G3591-80122.....	477	G3591-81054.....	476	G3591-81210.....	473	G3870-20135.....	154, 157
G3591-80123.....	477	G3591-81055.....	471	G3591-81211.....	473	G3870-20440.....	157
G3591-80124.....	474	G3591-81056.....	475	G3591-81212.....	473	G3870-20444.....	151, 157
G3591-80135.....	478	G3591-81058.....	476	G3591-81213.....	473	G3870-20445.....	157
G3591-80136.....	478	G3591-81059.....	477	G3591-81214.....	476	G3870-20446.....	157
G3591-80137.....	478	G3591-81060.....	473	G3591-81215.....	480	G3870-20448.....	151
G3591-80138.....	478	G3591-81061.....	475	G3591-82000.....	480	G3870-20449.....	151
G3591-80139.....	471	G3591-81062.....	475	G3591-82001.....	472	G3870-20530.....	157
G3591-80140.....	472	G3591-81063.....	479	G3591-82002.....	474	G3870-60171.....	157
G3591-80141.....	479	G3591-81064.....	475	G3591-82003.....	476	G3870-60172.....	154
G3591-80142.....	479	G3591-81065.....	475	G3591-82004.....	474	G3870-60179.....	155
G3591-80156.....	473	G3591-81066.....	478	G3591-82011.....	473	G3880-20030.....	38, 147-148
G3591-80157.....	478	G3591-81067.....	472	G3591-82012.....	476	G3880-80010.....	162
G3591-80158.....	473	G3591-81068.....	479	G3591-82013.....	478	G3880-80011.....	162
G3591-80160.....	472	G3591-81071.....	479	G3591-82014.....	479	G3900-63001.....	462
G3591-80161.....	472	G3591-81072.....	477	G3591-82015.....	479	G3900-63002.....	462
G3591-80162.....	476	G3591-81074.....	475	G3591-82016.....	478	G3900-63003.....	463
G3591-80170.....	479	G3591-81075.....	475	G3591-82017.....	475	G3900-63004.....	462
G3591-80171.....	479	G3591-81077.....	475	G3591-82020.....	474	G3900-63005.....	462
G3591-80176.....	479	G3591-81082.....	472	G3591-82022.....	475	G3900-63006.....	463
G3591-81000.....	480	G3591-81083.....	478	G3591-82023.....	474	G3900-63007.....	463
G3591-81001.....	472	G3591-81084.....	470	G3591-82025.....	476	G3900-63008.....	463
G3591-81002.....	474	G3591-81085.....	476	G3591-82026.....	479	G3900-63009.....	462
G3591-81003.....	476	G3591-81086.....	477	G3591-82029.....	479	G3900-63010.....	463
G3591-81004.....	474	G3591-81087.....	477	G3591-82032.....	472	G3900-63011.....	463
G3591-81006.....	480	G3591-81088.....	473	G3591-82033.....	474	G3900-63012.....	463
G3591-81007.....	479	G3591-81090.....	475	G3591-82035.....	476	G3900-63013.....	462
G3591-81008.....	479	G3591-81091.....	473	G3591-82036.....	477	G3900-63014.....	462
G3591-81011.....	473	G3591-81093.....	476	G3591-82037.....	473	G3900-63015.....	463
G3591-81012.....	476	G3591-81094.....	480	G3591-82039.....	472	G3900-63016.....	462
G3591-81013.....	478	G3591-81095.....	470	G3591-82040.....	480	G3900-63017.....	462
G3591-81014.....	479	G3591-81096.....	478	G3591-82043.....	476	G3900-63018.....	462
G3591-81015.....	479	G3591-81097.....	476	G3591-82044.....	477	G3900-63019.....	462

G3900-63020.....	463	G4513-80233.....	188	MKI-UTD-5064.....	66
G3900-63021.....	463	G4513-80234.....	187	MKI-Z-0285.....	65
G3900-63022.....	463	G4513-80235.....	187	MKI-Z-0351.....	65
G3900-63023.....	463	G4513-80236.....	187-188	RDT-1020.....	52, 140
G3900-63024.....	463	G4513-80239.....	187	RDT-1023.....	140
G3900-63025.....	463	G4513-80240.....	187	RMSN-2.....	164
G3900-63026.....	463	G4513-80241.....	188		
G3900-63027.....	463	G4513-80242.....	187		
G3900-63028.....	463	G4513-80243.....	187		
G3900-63029.....	463	G4513-80244.....	187		
G3900-63030.....	462	G4514-60610.....	127		
G3900-63031.....	462	G4514-60710.....	50		
G3900-63032.....	462	G4514-67505.....	50		
G3900-63033.....	462	G4525-60701.....	50		
G3900-63034.....	463	G4525-60702.....	50		
G3900-63035.....	463	G4525-60703.....	50		
G3900-63036.....	463	G4525-60704.....	50		
G3900-63037.....	463	G4556-60019.....	52		
G3900-63038.....	462	G4556-60125.....	52		
G3900-63039.....	462	G4556-67010.....	52		
G3900-63040.....	462	G4556-90500.....	52		
G3900-63041.....	462	G6012A.....	169		
G3900-63042.....	462	G6014A.....	169, 179		
G3900-64016.....	450	G6600-60037.....	123		
G3900-65001.....	448	G6600-60038.....	122		
G3900-65003.....	449	G6600-67007.....	122-123		
G3900-65004.....	449	G6600-67008.....	122-123		
G3903-61004.....	448	G6600-80018.....	41, 122-123		
G3903-63001.....	284, 374	G6600-80042.....	122		
G3903-63002.....	374	G6600-80043.....	122-123		
G3903-63003.....	283, 374	G6600-80044.....	122-123		
G3903-63004.....	374	G6600-80045.....	122		
G3903-65002.....	448	G6600-80050.....	122		
G4333-63000.....	132	G6600-80051.....	122-123		
G4513-20561.....	50	G6600-80063.....	122		
G4513-40525.....	50	G6600-80072.....	122-123		
G4513-40529.....	50	G6600-85000.....	123		
G4513-60560.....	188	G6600-85001.....	122-123		
G4513-60561.....	188	G6600-85002.....	122-123, 170		
G4513-80200.....	187	G7005-60061.....	154-155, 162, 174		
G4513-80201.....	187	G7005-60072.....	159, 162, 174		
G4513-80202.....	187	MKI-C-QSC10.....	65		
G4513-80203.....	188	MKI-MTD-1169.....	65		
G4513-80204.....	187	MKI-MTD-1204.....	65		
G4513-80205.....	187	MKI-SERUTD-5065.....	66		
G4513-80206.....	187	MKI-U-COV06.....	65		
G4513-80208.....	188	MKI-U-COV07.....	65		
G4513-80209.....	23, 187	MKI-U-COV10.....	65		
G4513-80210.....	188	MKI-U-DISK1.....	65		
G4513-80211.....	187	MKI-U-DISK3.....	65		
G4513-80212.....	187	MKI-U-T10CW-2S.....	65		
G4513-80213.....	23, 187	MKI-U-T11GPC.....	65		
G4513-80215.....	187	MKI-U-T11GPC-2S.....	65		
G4513-80216.....	187	MKI-U-T12ME.....	65		
G4513-80218.....	187	MKI-U-T12ME-2S.....	65		
G4513-80219.....	188	MKI-U-T13DHS.....	65		
G4513-80220.....	188	MKI-U-T13DHS-2S.....	65		
G4513-80221.....	188	MKI-U-T15ATA-2S.....	65		
G4513-80222.....	188	MKI-U-T16GHG-2S.....	65		
G4513-80223.....	188	MKI-U-T1703P-2S.....	65		
G4513-80224.....	187	MKI-U-T1HBL-2S.....	65		
G4513-80225.....	187-188	MKI-U-T3ATX.....	65		
G4513-80226.....	187	MKI-U-T3ATX-2S.....	65		
G4513-80227.....	188	MKI-U-T6SUL-2S.....	65		
G4513-80228.....	188	MKI-U-T9TNX.....	65		
G4513-80229.....	187	MKI-U-T9TNX-2S.....	65		

Product Index

Agilent J&W GC Columns

Application and Method Guides

ASTM Methods	278-285
Application Cross Reference Guide	262-264
EPA Methods	
Drinking Water	265-268
Solid Waste	272-276
Waste Water	269-271
United States Pharmacopoeia (USP)	
GC Phases	277

Capillary Columns

By Group

Foods, Flavors and Fragrances	405
High Temperature	362
Life Sciences	414
Low-bleed GC/MS	294
Non-Bonded	441
PAH	390
PLOT	420
Pesticides	384
Petroleum	366
Polyethylene Glycol (PEG)	351-413
Premium Polysiloxane	318
Semivolatiles	392
Ultra Inert	286
Volatiles	397

By Stationary Phase

Biodiesel	377-378
CAM	442
CarboBOND	436
CarboPLOT P7	436
Carbowax 20M and HP-20M	361
CP-1301	348
CP-Al2O3/KCl	430-431
CP-Al2O3/Na2SO4	430-431
CP-Carbowax 400 for Volatiles in Alcohol	408
CP-Chirasil Val	412
CP-Chirasil-Dex CB	412
CP-Cyclodextrin- β -2,3,6-M-19	413
CP-FFAP CB for Free Fatty Acids	
in Dairy Products	410
CP-Molsieve 5A	439
CP-Select 624 CB	399
CP-Select CB for MTBE	403
CP-Sil 13 CB	336
CP-Sil 19 CB	350
CP-Sil 19 CB for Pesticides	387
CP-Sil 2 CB	373
CP-Sil 24 CB	341
CP-Sil 43 CB	346
CP-Sil 5 CB	324-326
CP-Sil 5 CB for Formaldehyde	367
CP-Sil 5 CB for Sulfur	375
CP-Sil 5/C18 CB for PCB	395
CP-Sil 8 CB	334-335
CP-Sil 8 CB for Amines	382
CP-Sil 8 CB for PCB	393
CP-Sil 8 CB for Pesticides	387
CP-Sil 88	406
CP-Sil 88 for Dioxins	396
CP-Sil 88 for FAME	407
CP-Sil PAH CB UltiMetal	391

CP-Sil PONA CB	368
CP-Sil PONA for ASTM D5134	368
CP-SilicaPLOT	435
CP-SimDist	371-372
CP-TAP CB for Triglycerides	409
CP-TCEP for Alcohols in Gasoline	373
CP-Volamine	381
CP-Wax 52 CB	356-357
CP-Wax 57 CB	408
CP-Wax 57 CB for Glycols and Alcohols	409
CP-Wax 58 FFAP CB	360
CP-Wax for Volatile Amines and Diamines	382
CycloSil-B	410
Cyclodex-B	411
DB-1	318-321
DB-1301	347
DB-17	339
DB-1701	349
DB-1701P	386
DB-17ht	364
DB-17ms	308
DB-1ht	362
DB-1ms	295
DB-1ms Ultra Inert	289
DB-200	343
DB-210	344
DB-225	345
DB-225ms	312
DB-23	342
DB-2887	370
DB-35	337
DB-35ms	306
DB-35ms Ultra Inert	291
DB-5	329-331
DB-5.625	394
DB-502.2	402
DB-5ht	363
DB-5ms	299-300
DB-5ms EVDX	415
DB-5ms Ultra Inert	290
DB-608	388
DB-624	398
DB-624 Ultra Inert	291, 397
DB-ALC1	414
DB-ALC2	414
DB-CLP1	384
DB-CLP2	384
DB-Dioxin	396
DB-EUPAH	390
DB-FFAP	358
DB-HT SimDis	370
DB-MTBE	402
DB-Petro	369
DB-Select 624 UI for <467>	292, 416
DB-Sulfur SCD	374
DB-TPH	403
DB-UI 8270D Ultra Inert	292
DB-UI 8270D for Semivolatiles	392
DB-VRX	400
DB-WAX	351-353
DB-WAX FF	351-353
DB-WAXetr	354
DB-XLB	304

DX-1	443
DX-4	443
GS-Alumina	433
GS-Alumina KCl	429
GS-CarbonPLOT	437
GS-GasPro	434
GS-OxyPLOT	366
GS-Q	426
HP-1	322-323
HP-1 Aluminum Clad	369
HP-101	441
HP-17	441
HP-1ms	296
HP-1ms Ultra Inert	289
HP-20M	361
HP-35	338
HP-5	332-333
HP-50+	340
HP-5ms	301
HP-5ms Semivolatile	395
HP-5ms Ultra Inert	290
HP-88	405
HP-Chiral β	411
HP-FFAP	359
HP-Fast Residual Solvent	416
HP-INNOWax	355
HP-PAS5	388
HP-PLOT Al2O3 KCl	428
HP-PLOT Al2O3 M	434
HP-PLOT Al2O3 S	432
HP-PLOT Molesieve	438
HP-PLOT Q	425
HP-PLOT U	428
HP-PONA	367
HP-VOC	401
Lowox	366
PoraBOND Q	422
PoraBOND U	423
PoraPLOT Amines	383
PoraPLOT Q	424
PoraPLOT Q-HT	424
PoraPLOT S	427
PoraPLOT U	427
Rapid-MS	389
SE-30	444
SE-54	444
Select Al2O3 MAPD	376
Select Biodiesel	379
Select FAME	407
Select Low Sulfur	375
Select Mineral Oil	404
Select PAH	390
Select Silanes	380
Select for Permanent Gases	376
Ultra 1	327
Ultra 2	328
VF-1301ms	315-316
VF-1701 Pesticides	386
VF-1701ms	317
VF-17ms	309
VF-1ms	297-298
VF-200ms	311
VF-23ms	310

VF-35ms.....	307	Carboxen-1000	471	MSD Contamination	142-145
VF-5 Pesticides	385	Chromosorb 101	471	MSD Electron Multipliers and Replacement	
VF-5ht.....	365	Chromosorb 102	471	Horn	165
VF-5ms.....	302-303	HayeSep A	473	MSD Filaments	162
VF-624ms	315	HayeSep D	473	Maintenance Schedule	141
VF-DA.....	415	HayeSep DB.....	473	Quadrupole Mass Filter	164
VF-WAXms	313-314	HayeSep N	473	Recommended MS Interface Connections.....	148
VF-Xms.....	305	HayeSep N + HayeSep R 1:1.....	473	Standards	
Metal Columns.....	417	HayeSep P	473	Analyzer Kit Standards	181
Column Selection		HayeSep Q	474	Test and Performance Samples.....	182
Column Diameter	256-257	HayeSep R.....	474	Vacuum Systems and Pumps	166
Column Film Thickness.....	260-261	HayeSep T	474	Diffusion Pump	168
Column Length.....	258-259	MolSieve 13X	476	Foreline Pump.....	170
Gas-Solid or PLOT Columns	254	MolSieve 5Å	475	Pressure Symptoms	166-167
Polarity.....	252-253	Porapak N	477	Quiet Cover	169
Selecting Stationary Phases.....	248-251	Porapak N + Porapak R 1:1	477	Vent Valve Supplies	163
Stationary Phase Selection Summary.....	255	Porapak Q.....	478	Inlet Liners.....	24-25
Custom Ordering.....	481	Porapak OS	478	Specialty Injection	
Fused Silica Tubing		Porapak R.....	478	Direct Connect	32
Deactivated	464-467	Porapak T	478	MultiMode Inlet Heavy Matrix.....	31
Undeactivated	468	Silica Gel.....	479	PTV	32
Guard Columns		Test Standards.....	482-483	Split, Original Deactivation.....	29
DuraGuard	445			Splitless, Original Deactivation	30
EZ-Guard.....	446			Ultra Inert	28
Installation and Troubleshooting				Inlet Septa	17
Causes of Column Performance				Advanced Green	19
Degradation	488-493			Bleed and Temperature Optimized (BTO).....	18
Evaluating the Problem.....	494-495			General Purpose	21
Quick Reference Guide.....	485-487			Long-Life	19
Troubleshooting Guides				Inlet Systems	
Baseline Instability or Disturbances	496			Cool On-Column	78-80
Change in Peak Size.....	498			Flip Top Inlet Sealing System	68
Excessive Baseline Noise.....	496			Multimode	76-77
Loss of Resolution	499			Programmable Temperature Vaporizer (PTV).....	81-87
Retention Time Shift	498			Purged Packed	88-91
Split Peaks.....	497			Split/Splitless Inlet Seals	67, 69-75
Tailing Peaks	497			Large Valve Oven	46
LTM Column Modules	447-463			Liner O-rings.....	33
Packed Columns				Maintenance Schedule.....	14-15
0.1% SP-1000.....	479			Markes Thermal Desorption	65-66
1.5% OV-101	476			Merlin Microseal.....	22-23
10% Carbowax 20M (G16, GS1).....	471			Oven Exhaust Deflector	123
10% Carbowax 20M (G16, GS1) + 2% KOH.....	471			Purge and Trap Systems	
10% OV-101	476			Archon.....	64
10% PEG-20M	477			Teledyne Tekmar	62-63
10% SE-30	478			Sample Introduction Systems	
10% UC W982	480			7693A Automatic Liquid Sampler.....	50
12% UC W982	480			7697A Headspace Sampler	52-53
15% Carbowax 1540	470			Automatic Liquid Sampler.....	51
15% Hallcomid M-18	472			G1883A Network Headspace Sampler.....	55
15% SP-2100.....	479			G1888A Network Headspace Sampler.....	54
20% Carbowax 20M (G16, GS1).....	471			G3520A XLSI Accessory	53
20% OV-101.....	476			Syringes	183
20% PEG-20M	477			7673/7683 On-Column Autosampler Syringes.....	191
20% Sebaconitrile.....	479			Blue Line Autosampler Syringes for 7693A ALS	
20% Sebaconitrile/2% H3PO4	479			Advanced Sample Enhancement.....	188
20% TCEP	480			Fitted Plungers.....	187
25% DC-200 (500 cSt).....	472			PTFE-Tipped Plungers	188
25% SP-2100.....	479			Gold Standard Autosampler Syringes	
30% DC 200/500	472			Straight Needle, 23 and 26s Gauge	190
30% DC-200 (500 cSt).....	472			Tapered Needle, 23-26s Gauge.....	189
35% DC-200 (500 cSt).....	472			HP 7670/71/72 Autosampler Syringes	191
5% Carbowax 20M (G16, GS1).....	470			Needle Gauge	184
7% Carbowax M + 3% Polyphenolether				Needle Termination.....	185
6 ring + 2% KOH.....	471			Needle Tip Design.....	185
Carbosieve S-II.....	470			Valves and Loops.....	47-49

Agilent Supplies

7820A GC System.....	125
Bulk GC Supplies	16
Capillary Column Ferrules and Nuts	
Column Nuts	38-40
Ferrule Selection Recommendations.....	38-39
For LTM Rapid Heating/Cooling System.....	41
For NCD and SCD	41
Reducing	41
Short and Long Ferrules	36
Specialty.....	37-40
Straight.....	41
Capillary Flow Technology	
Column/Retention Gap Installation.....	43
Ferrules	43
Fittings.....	43
Ultimate Union	42
Column Connectors and Splitters	
Graphpak.....	45
Press-fit.....	44
Column Nuts	38-40
Detector Systems	
Electron Capture Detector (ECD).....	100-102
Flame Ionization Detector (FID)	92-99
Flame Photometric Detector (FPD).....	108-115
Nitrogen Chemiluminescence	
Detector (NCD)	122-123
Nitrogen Phosphorus Detector (NPD)	116-121
Sulfur Chemiluminescence Detector (SCD).....	122-123
Thermal Conductivity Detector (TCD)	103-107
GC Standards.....	124
GC/MS	
220-MS.....	180
240-MS Ion Trap	178-179
7000 Triple Quadrupole GC/MS.....	171-174
7200 Q-TOF for GC/MS.....	175-177
Cleaning and Maintenance	146-147
Gas Clean Filters	164
GC/MSD Interface.....	160-161
Ion Source.....	149-159
Chemical Ionization (CI) Ion Source.....	158-159
Electron Impact (EI) Ion Source.....	154-157

Vials and Closures
 Headspace
 20 mm Caps and Septa.....58
 CombiPAL 18 mm Screw Top Caps with Septa...59
 CombiPAL Screw Top Vials.....59
 Convenience Packs.....58
 Crimp Top Vials.....56
 High Performance Septa.....57-58
 Electronic Crimpers and Decappers.....60
 Manual Crimpers and Decappers.....61

Applications

Energy and Fuels576
 Environmental
 Air Analysis.....549
 Hydrocarbons.....501
 Pesticides and Herbicides.....506
 Semivolatiles532
 Volatiles544
 Food, Flavor and Fragrance.....554
 Industrial Chemical602
 Forensic Toxicology and Pharma635

CrossLab Supplies

Bruker, Varian GC Systems
 Autosampler Syringes.....210
 Capillary Column Ferrules209
 Column Nuts210
 Detector Replacement
 Flame Ionization Detector (FID).....218
 Pulsed Flame Photometric Detector (PFPD).....219-220
 Thermal Conductivity Detector (TCD).....218
 Thermionic Specific Detector (TSD).....220
 Injector Replacement
 1041 Packed/Wide Bore
 On-Column (PWOC) injector.....217
 1061 Packed/530 µm
 Capillary Column Injector.....216
 1079 Large Volume Injector (LVI).....214
 1093 Cool On-Column (COC) Injector215
 1177 Split/Splitless Injector.....213
 Inlet Liners
 1060/1061 Injector208
 1075/1077 Injector208
 1078/1079 Injector207-208
 1093/1094 Injector207-208
 1177 Injector206-220
 Inlet Septa.....211-212
 Liner O-rings208
 Packed Column Ferrules.....210
 CTC GC Autosamplers
 Autosampler Syringes.....239
 Column Ferrules.....195-196
 Inlet Liners193-194
 Inlet Septa199-201
 Advanced Green203
 Bleed and Temperature Optimized (BTO)202
 General Purpose205
 Long-Life.....204
 Liner O-rings195

Perkin Elmer GC Systems
 Autosampler Syringes.....225
 Capillary Column Ferrules223
 Column Nuts224
 Inlet Liners
 AutoSystem.....221-222
 AutoSystem XL.....221-222
 Clarus.....221-222
 Inlet Septa.....226
 Liner O-rings222
 Packed Column Ferrules.....224
 Shimadzu GC Systems
 Autosampler Syringes.....232
 Capillary Column Ferrules231
 Column Nuts232
 Inlet Liners
 14 Systems230
 17A Systems229
 2010 and 2010 Plus Systems228
 2014 Systems.....227
 Inlet Septa.....233
 Liner O-rings230
 Packed Column Ferrules.....231
 Syringes197-198
 Thermo Scientific GC Systems
 Autosampler Syringes.....236
 Capillary Column Ferrules235
 Column Nuts236
 Inlet Liners
 Focus Systems.....234
 Trace Systems.....234
 Inlet Septa.....237-238
 Liner O-rings235

Application Title Index

1,3-Butadiene	586
1,3-Butadiene Purity	587
10 ng/μL Semivolatile Checkout Standard on a 20 m x 0.18 mm, 0.36 μm Agilent J&W DB-UI 8270D Capillary GC Column using an Ultra Inert Liner with Wool	542
15+1 EU Priority PAHs	505
69 Component FAME Mix	572
78 Semi-volatile Components on an Agilent J&W DB-UI 8270D	504

A

Acids	570
Acrylate Impurities I	627
Acrylate Impurities II	628
Acrylates	628
Agilent's Ultra Inert Test Probe Mixture	532
Alcohol Beverage Standard	568
Alcohols I	602
Alcohols II	605
Alcohols III	606
Aldehydes and Acids	611
Aldehydes and Ketones	612
Alditol Acetates	568
Amines and Alcohols	606
Amines and Nitriles	610
Amines in Water	611
Amphetamines and Precursors – TMS Derivatives	636
Anabolic Steroids	648
Analysis of Acetylenes' Mixture	634
Analysis of Amino Alcohols in Water	606
Analysis of Drugs of Abuse in Urine via GC/MS	642
Analysis of Ethanolamines	607
Analysis of Fragrance and Allergens	561
Analysis of Oxygenates in Mixed C4 Streams	595
Analysis of Oxygenates in a C1 to C5 Hydrocarbon Mix	600
Analysis of Polycyclic Aromatic Hydrocarbons	503
Analysis of Process Gas	601
Analysis of Semivolatiles	510
Analysis of Solvents	626
Analysis of Volatile Organic Compounds in Environmental Waters Using the Agilent 7697A Headspace and 7890B/5977A GC/MS	546
Anesthetics	643
Anilines	629
Anticonvulsants	643
Antiepileptic Drugs	644
Antihistamines	644
Aroclors 1016-1268 (without 1221)	514
Aromatic Solvents	604
Aromatics Analysis – ASTM D16 Analytes	593
Aromatics Analysis – Ethylbenzene Impurities	593
Aromatics I	614
Aromatics II	615
Aromatics in Finished Gasoline – ASTM Method D5769	597
Aspirin and Ibuprofen in Methanol	647
Automated Cleanup of PCB extracts from Waste Oil Using 7696A Sample Prep Workbench	535

B

Bacterial Fatty Acid Methyl Esters	571
Barbiturates	637
Baseline Resolution of Air/CO, CO ₂ , and Methane in a Natural Gas Sample	583
Benzodiazepines I	636
Benzodiazepines II	640
Blood Alcohols I (Static Headspace/Split)	638
Blood Alcohols II (Static Headspace/Split)	638
Blood Pollutants I	649
Blood Pollutants II	650
Bourbon	568
Butter Triglycerides I	574
Butter Triglycerides II	574

C

C ₁ to C ₄ Hydrocarbon Mix	580
C ₁ and C ₂ Halocarbons (Freons)	527
CLP Pesticides	514
Canola Oil Margarine Partially Hydrogenated FAMES AOCS Method 1c-89	574
Chiral Compounds in Essential Oils and Fragrances	560
Chlorinated Isooctane	623
Chlorinated Pesticides, EPA Method 508	521
Citrus Flavored Carbonated Beverage (Soda)	567
CLP Pesticides	514
Cold-pressed Orange Oil	564
Column Performance for USP <467> Standards	651
Common Drug Screen	641
Congeners in DIN Method PCBs	533

D

DB-624UI 1 μL/L Fermented Beverage Standard Mix	554
DB-624UI Organic Acid Performance	509
DB-Select 624 UI for <467> Megabore Early Eluting Peaks	635
Denatured Fuel Ethanol – ASTM D5501	596
Detailed Hydrocarbon Analysis of Petroleum Naphthas Through N-nonane Using ASTM D5134	601
Determination of Chlorophenols in Water and Soil	502
Diesel Analysis	600
Diesel Fuel	503
Dioxins and Dibenzofurans	504
Direct Comparison for Rapid CLP (Contract Laboratory Program) Pesticide Analysis	513
Drug Screen	640

E

EPA 625 Halogenated Pesticides on "1701" Type Phases	528
EPA Air Analysis Compendium Method TO-14 Standard	549

EPA Air Analysis Method TO-15 (1 ppbv standard)	553
EPA Method 504.1 – 1,2 dibromoethane (EDB), 1,2-dibromo-3-chloropropane (DBCP), and 1,2,3-trichloropropane (123TCP)	507
EPA Method 508.1 – Chlorinated Pesticides and Herbicides	520
EPA Method 525.2	518
EPA Method 551	547
EPA Method 551 – Chlorinated Solvents, Trihalomethanes (THMs), and Disinfection Byproducts (DBPs)	509
EPA Method 552.2	543
EPA Volatiles by GC/MS (Split Injector)	517, 548
Essential Oils	557
Esters I	617
Esters II	618
Esters III	618
Ethers	619
Ethoxyethanol	607
Ethylene	584
Ethylene Glycol Mixture	621
Ethylene Oxide	631
Ethylene Oxide Synthetic Standard	594
European Red List Volatiles	547
Extended Analyte List for EPA Method 8021 (ELCD)	544
Extended Hydrocarbon Analysis I	588
Extended Hydrocarbon Analysis II	589
Extended Temperature Program Resolving Congeners 52 and 138	534

F

FAME Standard	572, 573
FAMES	561
Fast Analysis of Aromatic Solvent	576
Fast Analysis of Permanent Gases and CO ₂ using Tandem PLOT columns	552
Fast CLP Pesticides	506
Fast Screening of FAME Isomers in Butter	575
Fast Separation of Silanes	633
Fast VOC Analysis	545
Fentanyl	645
Flavor Mixture	563
Formaldehyde Underivatized	613
Formaldehyde, 50 ppb	550
Formaldehyde-DNPH Derivative	613
Fragrance Allergens	563
Fragrance Reference Standard	558, 559
Free Organic Acids/C ₄ -C ₅ Isomers	608
Free Phenols	528
Free Steroids	648

G

Gasoline Unleaded ASTM D5769	599
Glycols I	619
Glycols II	620
Glycols III	620
Glycols/Diols	622

H			
Hallucinogens	646	Organochlorine Pesticides, EPA Method 8081B.....	508
Halocarbons	631	Organophosphorous Pesticides in Apple Matrix.....	531
Halogenated Hydrocarbons I	603	Organophosphorus Pesticide Residues	
Halogenated Hydrocarbons II	622	in Olive Oil Extract.....	562
Halothane	632	Organotin Compounds I.....	537
Herbicides I	526	Organotin Compounds II.....	537
Herbicides II	526	Over-the-Counter Pain Killers – TMS Derivatives ..	647
High Resolution Phenol Analysis by GC/MS.....	542	Oxygenates in Gasoline ASTM D5599 (GC-OFID) ..	595
High Resolution Separation of Xylene Isomers	632		
High Speed VOC, EPA Method 8260	515		
		P	
I		PAHs	540
Impurities in Ethylbenzene	616	PBDEs.....	516
Impurities in Ethylene.....	584	PBDEs by ECD.....	502
Impurities in Mixed Xylenes	632	PCBs by EPA Method 8082.....	534
Impurities in Propylene	585	PFBHA Derivative	614
Impurities in Styrene.....	616	PONA Mix as Specified by	
Impurities in p-Xylene – ASTM D3798	594	AFNOR Method #2.....	596
Inorganic Gases	605	Peppermint Oil.....	565
Inorganic Hydride Gases.....	633	Perfume.....	560
		Permanent Gases	582
L		Permanent Gases on a Thick Film	
Lavender Oil Characterization.....	556	Molsieve Column.....	552
Lemon Oil	564	Pesticides and Fire Retardants (US EPA 527)	519
		Pesticides in Sunflower Oil	575
M		Pesticides, EPA 508.1	511
Marijuana ($\Delta 9$ -THC) and Major Metabolites – TMS		Phenols	541
Derivatives.....	649	Phenols According to EPA Method 8040.....	543
Menthol.....	560	Phenols I.....	604
Mercaptans	592	Phenols II.....	630
		Phenols III.....	630
N		Phenoxy Acid Herbicides – Methyl Derivatives,	
N_2O I	551	EPA 8151A.....	512
N_2O II.....	551	Polybrominated Diphenyl Ethers (PBDEs).....	505
N_2O III.....	551	Polyethylene	599
Narcotics	637	Polyethyleneamines.....	609
Narcotics and Adulterants	647	Polymer Additives.....	633
Natural Gas	583	Primary Amines.....	609
Nitrogen Containing Herbicides		Propylene	585
(EPA Method 507)	527	Pyrethrins	536
Nitrogen-based Solvents I.....	626	Pyrolysates of Polystyrene.....	617
Nitrogen-based Solvents II.....	627		
Nitrogen/Phosphorus Containing		R	
Pesticides, EPA Method 507	525	Reference Gas Oil.....	598
Noble Gases	582	Refinery Gas.....	590
n-Paraffin Standard	578	Refinery Gas I.....	577
		Regular Unleaded Gasoline	
O		(California Phase 1) – "Normal" GC Run I.....	598
Organic Acids	570, 607	Regular Unleaded Gasoline	
Organochlorine Pesticides.....	521, 525	(California Phase 1) – "Normal" GC Run II.....	598
Organochlorine Pesticides I		Residual Solvents, DMI Diluent.....	639
EPA Method 8081A.....	529	Residual Solvents, USP 467	650
Organochlorine Pesticides II		Rosemary Oil.....	567
EPA Method 8081A.....	530		
Organochlorine Pesticides III.....	522	S	
Organochlorine Pesticides IV	523	Sedative Hypnotics.....	646
Organochlorine Pesticides		Selected Oxygenates	582
to EPA 625 via GC/MS.....	529	Semivolatile Compounds, US EPA Method 8270.....	538
Organochlorine Pesticides, DB-5/DB-1701P.....	524	Separation of TMS-derivatized Sugars	
		using VF-1ms.....	569
		Separation of cis-trans FAME Isomers	571
		Simulated Distillation.....	597
		Solvents	625
		Solvents I.....	623
		Solvents II.....	624
		Solvents III.....	624
		Solvents IV	625
		Spearmint Oil.....	555
		Spearmint Oil (Western)	565
		Strawberry Syrup	569
		Substituted Anilines.....	629
		Sulfur Compounds in Naphtha.....	593
		Sulfur Compounds in Natural Gas –	
		Synthetic Mixture	592
		Sulfur Compounds in Propylene (1 ppm).....	579, 591
		Sulfur Gas Analysis in Light	
		Hydrocarbon Streams I	590
		Sulfur Gas Analysis in Light	
		Hydrocarbon Streams II	591
		Sulfur Gases.....	634
		Sulfur Impurities in Propylene.....	579
		Sulfur Standards in Toluene.....	578
		Sulfur in Air	550
		T	
		Tetrachlorodibenzo-p-furans	533
		Tocopherols	645
		Trace Active Amines, 10 ng on-column	608
		Trace Level Polycyclic Aromatic	
		Hydrocarbon (PAH) Analyses	532
		Trace Oxygenates in Light	
		Hydrocarbon Matrices.....	581
		Trace Sulfur Compounds in Methane (50 ppbv)	581
		Tricyclic Antipsychotics.....	644
		Triethylene Glycol and Impurities	621
		U	
		US EPA Method 8061 (Phthalate Esters)	539
		Underivatized Drugs of Abuse –	
		Agilent Fast Toxicology Analyzer.....	639
		Unleaded Gasoline	501, 577
		Urine Drug Screen	642
		V	
		Volatile Amines.....	608
		Y	
		Ylang Ylang Oil	566

Compound Index

A			
Acenaphthalene	540	tert-Amyl mercaptan	592
Acenaphthalene-d10	519	tert-Amyl methyl ether (TAME)	515, 546, 581, 595, 599, 600, 619
Acenaphthene	503, 532, 538, 540	n-Amyl salicylate	558-560
Acenaphthene-d10	518, 538, 542	5 α -Androstan-17 α -ol-3-one (stanolone)	648
Acenaphthylene	503, 518, 532, 538	Androsterone	648
Acephate	531, 562	5- β -Androsterone	648
Acetal (acetaldehyde diethyl acetal)	619	Aniline	538, 542, 610, 629
Acetaldehyde	550, 553, 568, 581, 600, 612, 625, 638, 649-650	Anisic alcohol	561
Acetaminophen	641, 647	Anisyl alcohol	563
Acetic acid	509, 568, 570, 607, 611	Antazoline	644
Acetone	515, 517, 548, 550, 553-554, 558-559, 568, 570, 581-582, 600, 612, 624-626, 632, 638-639, 649-650	Anthracene	503, 518, 532, 538, 540
Acetone-d6	550	Anthracene-d10	519
Acetonitrile	515, 624-627, 635, 639, 649-651	Aprobarbital	637, 641
Acetyl aldehyde	554	Arabinitol	568
Acetylcedrene	560	Arabitol	569
6-Acetylcodeine	637, 647	Arachidic acid (eicosanoic acid)	570
Acetylene	580, 584-590	Arachidic acid methyl ester	572, 573
Acetylsalicylic acid (aspirin)	647	Arachidonic acid methyl ester	572, 573
Acifluorfen	512	Argon	552, 582
Acrolein	515, 612, 626-627	Arsine	633
Acrylamide	610	Atraton	525-526
Acrylic acid	509	Atrazine	511, 518-520, 525-527, 542
Acrylonitrile	515, 517, 548, 626-627	Azinphos-ethyl	562
Air/CO	577, 583, 601	Azinphos methyl	531, 562
Alachlor	508, 511, 518, 520, 524-526, 529-530	Azobenzene	538
Aldrin	506, 508, 511, 513-514, 518, 520-525, 529-530, 542	Azulene	540
Alfentanil	645		
Allobarbitol	637, 641	B	
Allyl acrylate	628	Balan	527
Allyl alcohol	515, 581	Barbital	637
Allyl butyrate	558-559	BDE	505, 519
Allyl chloride	515, 517, 544, 548	Behenic acid methyl ester	572, 573
Allyl ether	619	Benactyzine	641
Allyl ethyl ether	619	Bentazone	512
Alpha isomethyl ionone	563	Benthiocarb	519
Alphenal	637	Benz[a]anthracene	505, 518, 532
Alprazolam	194, 636, 639-640	Benz[a]anthracene-7,12-dione	540
Ametryn	518, 525-526	Benzaldehyde	558-559, 563, 612
2-Aminoazotoluene	629	Benzaldehyde, 3 methoxy	554
2-Amino-1-butanol	606	1,2-Benzanthracene	540
2-Amino-ethanol	606	Benzene	501, 515, 517, 544-546, 548-549, 553, 576-577, 586-589, 593, 596-597, 599, 601, 604, 614-616, 623-626, 632, 635, 649-651
Aminoethylethanolamine	611	Benzene-d6	597
n-(2-Aminoethyl) piperazine	611	Benzene ethanol	558-560
2-Aminonaphthalene	629	Benzydine	538, 629
1-Amino-4-nitronaphthalene	540	Benzo[a]anthracene	503, 538
5-Amino-1-pentanol	606	Benzocaine	643
1-Amino-2-propaol	606	Benzo[b]fluoranthene	503, 505, 518, 532, 538, 542
Amitriptyline	642	Benzo[j]fluoranthene	505
Amobarbital	637, 641	Benzo[k]fluoranthene	503, 505, 518, 532, 538, 540
Amphetamine	636, 639, 642	Benzo[l]fluoranthene	540
Amyl acetate	554, 569, 617-618	Benzo[m]fluorene	505
Amyl alcohol	554	Benzo[g,h,i]perylene	503, 505, 518, 532, 538, 540
n-Amyl alcohol	568	Benzo[a]pyrene	503, 518, 532, 538, 540
Amyl butyrate	569	Benzo[e]pyrene	540
Amyl cinnamic alcohol	561	Benzoic acid	538
Amyl cinnamyl alcohol	563	Benzonitrile	610, 626-627
Amyl cinnamyl aldehyde	561	Benzophenone	558-559
n-Amyl mercaptan	592	5,6-Benzoquinoline	540
		Benzothiophene	593
		Benzphetamine	636, 641
		Benz[a]pyrene	505
		Benzyl acetate	558-560, 566, 617-618
		Benzyl alcohol	538, 558-559, 561, 563, 602, 605
		Benzylamine	609-610
		Benzyl benzoate	539, 558-561, 563, 566, 569
		Benzyl butyl phthalate	518
		Benzyl chloride	515, 544, 553
		Benzyl cinnamate	561, 563
		Benzyl ether	619
		n-Benzylmethylamine	610
		Benzyl salicylate	558, 560-561, 563, 566
		α -Bergamotene	556
		trans- α -Bergamotene	564
		α -BHC	506, 508, 511, 513-514, 518, 520-525, 529-530
		β -BHC	506, 508, 511, 513-514, 518, 520-525, 529-530
		δ -BHC	506, 508, 511, 513-514, 518, 520-525, 529-530
		γ -BHC	506, 508, 511, 513-514, 518, 520-525, 529-530
		BHEB	633
		BHT	561, 567, 633
		Bifenthrin	519
		Bioallethrin	519
		Biphenyl	540
		β -Bisabolene	559, 564, 566
		α -Bisabolol	556
		Borneol	556, 558-560, 567
		Borneol acetate	556
		Bornyl acetate	557-558
		α -Bourbonene	555
		β -Bourbonene	555, 565
		BPE (PB)	536
		Bromacil	518-519, 525-527
		Bromazepam	636, 640
		Bromoacetic acid	543
		Bromoacetone	515
		4-Bromoaniline	610, 629
		Bromobenzene	515, 517, 544-546, 548, 614-615
		2-Bromobiphenyl	529-530
		Bromochloroacetic acid	543
		Bromochloroacetonitrile	509, 547
		Bromochlorodifluoromethane	527
		Bromochloromethane	515, 517, 544-546, 548-550, 553, 622
		Bromodichloroacetic acid	543
		Bromodichloromethane	507, 509, 515, 517, 544-548, 553, 622
		2-Bromo-4,6-dinitroaniline	629
		Bromoethane (ethyl bromide)	553, 622
		Bromofluorobenzene	545
		4-Bromofluorobenzene	515, 517, 550, 548-549, 553
		Bromoform	507, 509, 515, 517, 544-548, 553, 622
		Bromofos	575
		Bromomethane	515, 517, 544-546, 548-549, 553
		1-Bromo-2-nitrobenzene	508, 529-530
		Bromopheniramine	641, 644
		4-Bromophenyl-phenylether	538
		3-Bromopyridine	610
		Bromotrifluoromethane	527
		Buclizine	644
		Bufotenine	646
		Butabarbital	637, 641
		Butacaine	643
		Butachlor	518, 520, 525-526

1,2-Butadiene586-587, 634
 1,3-Butadiene553, 584-591, 634
 Butalbitol637
 Butanal611
 1,3-Butandiol619, 622
 1,4-Butandiol619
 2,3-Butandiol619
 Butane599, 601
 iso-Butane583, 590-591
 n-Butane577, 580, 583-590, 596, 634
 n-Butane/cis-2-butene591
 1,3-Butanediol620
 1,4-Butanediol620
 2,3-Butanediol620
 2,3-Butanedione (VDK)554
 2,3-Butanedione (diacetyl)558-559
 1-Butanethiol578-579, 581, 591
 Butanol626-628
 1-Butanol515, 554, 595, 600, 602, 605-606, 625, 649-650
 2-Butanol554, 635, 639
 iso-Butanol606
 n-Butanol568, 624, 650
 sec-Butanol568, 595, 602, 605, 624, 650
 tert-Butanol595, 602, 605, 624, 650
 2-Butanone (MEK)515, 517, 548, 550, 553, 600, 612, 626, 639
 2-Butanthiol581
 Butene617
 Butene-1584, 586-587
 1-Butene584-585, 588-591, 617, 634
 cis-2-Butene584-590
 trans-2-Butene584-591
 1-Butene/methyl acetylene590
 3-Buten-1-ol602, 605
 2-Buten-1-ol (crotyl alcohol)602, 605
 Butethal637
 Butylpentyltin537
 2-Butoxyethanol602, 605
 bis(2-n-Butoxyethyl) phthalate539
 Butyl acetate617-618, 627-628
 n-Butyl acetate625
 sec-Butyl acetate617-618
 n-Butylbenzene517, 544, 546, 548, 576, 593, 597, 604, 632
 tert-Butyl acetate617-618
 Butyl acrylate627-628
 n-Butyl acrylate628
 n-Butyl alcohol581, 625
 s-Butyl alcohol581
 sec-Butyl alcohol624-625, 649-650
 tert-Butyl alcohol515, 581, 625, 649-650
 Butyl aldehyde554, 581
 Butylate518, 525
 Butylbenzene515, 577, 608, 614-615
 s-Butylbenzene576, 593
 sec-Butylbenzene515, 517, 544-546, 548, 577, 593, 604, 614-615
 tert-Butylbenzene515, 517, 544-546, 548, 576, 593, 601, 604, 614-615
 Butyl benzyl phthalate538, 539
 Butyl caproate618
 Butyl cellosolve625
 Butyl cellosolve acetate625
 Butylene601
 Butyl ether619

Butyl ethyl ether619
 Butyl heptanoate618
 1-Butyl mercaptan592
 n-Butyl mercaptan592
 tert-Butyl mercaptan581, 592
 sec-Butyl methacrylate628
 Butyl methyl ether619
 tert-Butyl methyl ether (MTBE)553
 Butyl propionate618, 627-628
 4-tert-Butyltoluene614-615
 Butyl valerate618
 2-Butyne (dimethylacetylene)586-587
 1-Butyne (ethylacetylene)586-587
 2-sec-Butyl-4,6-dinitrophenol (dionseb)542, 543
 Butyraldehyde600, 612
 Butyric acid570, 607-608, 611
 iso-Butyric acid611
 n-Butyric acid509
 Butyric acid methyl ester572, 573

C

Cadinene564
 δ-Cadinene557-559, 566
 γ-Cadinene556-557
 Caffeine636, 640-641, 647
 Camphene556, 558-559, 560, 564, 567
 Camphor556, 558-559, 597
 Capric acid methyl ester561, 572, 573
 Caproic acid methyl ester561, 572, 573, 607
 Caprylic acid methyl ester561, 572, 573
 Captafol508, 529-530
 Captan524, 529-530
 d-Carane557
 Carbamazepine640, 643
 Carbazole538, 540
 Carbepoxide 10/11644
 Carbinoxamine644
 Carbon dioxide549, 552, 577, 583, 601, 605
 CO/air552, 601
 Carbon disulfide517, 546, 548, 550, 553, 578, 579, 591
 Carbon monoxide582
 Carbon tetrachloride507, 509, 515, 517, 544-549, 553, 603, 622, 635, 649-651
 Carbonyl sulfide (COS)550, 577-579, 581, 591, 605, 634
 Carbophenothion524, 562
 Carboxin518, 525-526
 tau-Cardinol556
 3-Carene556
 Carfentanyl645
 Carvacrol560
 cis-Carveol563, 565
 trans-Carveol555, 563, 565
 Carvone565
 l-Carvone555
 Carvone phenylethyl acetate558
 cis-Caryyl acetate555, 565
 Caryophyllene556
 α-Caryophyllene566
 β-Caryophyllene555, 557-559, 564-566
 Caryophyllene oxide556
 Celestolide558
 Cellosolve acetate625
 Cetearyl decanoate558-559

Cetearyl octanoate558-559
 Chloral hydrate509, 547
 Chloramben512
 Chlorcyclizine641, 644
 α-Chlordane506, 508, 511, 513-514, 518, 520-524, 529-530
 γ-Chlordane506, 508, 511, 513-514, 518, 520-524, 529-530
 Chlordiazepoxide636
 Chloroacetic acid543
 Chloroacetonitrile515, 517, 548
 2-Chloroaniline610, 629
 3-Chloroaniline610, 629
 4-Chloroaniline538, 610, 629
 Chlorobenzene515, 517, 544-546, 548-549, 553, 604, 614-615, 623, 625, 651
 Chlorobenzene-d5550, 553, 549
 Chlorobenzilate508, 511, 518, 520-521, 524, 529-530
 4-Chlorobenzonitrile610
 2-Chlorobiphenyl518
 1-Chlorobutane515, 517, 548, 603, 622, 649-650
 2-Chlorobutane649-650
 Chlorodibromoacetic acid543
 1-Chloro-1,1-difluoroethane527
 Chlorodifluoromethane527
 2-Chloro-4,6-dinitroaniline629
 Chloroethane515, 517, 527, 544-546, 548-549, 553
 2-Chloroethanol515, 631
 bis(2-Chloroethoxy) methane538
 bis(2-Chloroethyl) ether538
 2-Chloroethyl vinyl ether544
 1-Chloro-3-fluorobenzene517, 544, 548
 Chloroform507, 509, 515, 517, 544-549, 553, 603, 622, 624, 635, 649-650
 1-Chlorohexane515, 603, 622
 1-Chloro isooctane623
 3-Chloro isooctane623
 4-Chloro isooctane623
 bis(2-Chloroisopropyl) ether538, 544
 Chloromethane515, 517, 527, 544-546, 548-549, 553
 4-Chloro-2-methylaniline629
 4-Chloromethyl 2,2'-dimethyl pentane623
 2-Chloro-5-methylphenol541
 4-Chloro-2-methylphenol541
 4-Chloro-3-methylphenol528, 538, 541-543, 604
 2-Chloronaphthalene538
 Chloroneb508, 511, 518, 520-521, 524, 529-530
 2-Chloro-4-nitroaniline629
 4-Chloro-2-nitroaniline629
 1-Chloro-4-nitrobenzene614-615
 4-Chloro-3-nitrobenzotrifluoride529-530
 Chloropentafluoroethane527
 2-Chlorophenol502, 528, 538, 541-543, 604, 630
 3-Chlorophenol502
 4-Chlorophenol502, 541
 4-Chlorophenyl-phenyl ether538
 Chloropicrin509, 547
 Chloroprene544
 2-Chloropropane544
 2-Chloropropene594
 3-Chloropropene (allyl chloride)553, 603, 622
 3-Chloropropionitrile515
 Chloropropylate508, 529-530

Chloropyrifos.....	575	Cyclizine.....	644	Diacetylmorphone (heroin).....	194, 637, 639-641, 647
4-Chlorostyrene.....	614-615	Cycloate.....	518, 525	Di-allate A.....	529-530
2-Chloro-1,1,1,2-tetrafluoroethane.....	527	Cyclohexane.....	553, 576-577, 588-589, 593, 623-624, 626, 635, 639, 650-651	Di-allate B.....	529-530
Chlorothalonil.....	508, 511, 518, 520-521, 529-530, 542	Cyclohexanol.....	602, 605-606	2,4-Diaminoanisole.....	629
2-Chlorotoluene.....	515, 517, 544-546, 548, 604, 614-615	Cyclohexanone.....	612	2,4-Diaminotoluene.....	629
3-Chlorotoluene.....	546, 604, 614-615	2-Cyclohexyl-4,6-dinitrophenol.....	541	3,4-Diaminotoluene.....	610
4-Chlorotoluene.....	515, 517, 544, 546, 548, 604, 614-615, 623	Cyclohexyl methacrylate.....	628	Diamyl phthalate.....	539
Chlorotrifluoromethane.....	527	Cyclopenta[c,d]pyrene.....	505	Diazepam.....	636, 639-642
Chlorpheniramine.....	641, 644	Cyclopentane.....	588-589, 596, 601	Diazinon.....	518, 525, 531, 562
Chlorpropham.....	518, 525	Cyclopentanol.....	602, 605	Dibenz[a,h]anthracene.....	503, 505, 518, 532, 538
Chlorprothixene.....	644	Cyclopentanone.....	612	1,2,3,4-Dibenzanthracene.....	540
Chlorpyrifos.....	524, 526, 531, 562	Cyclopentene.....	588-589	1,2,5,6-Dibenzanthracene.....	540
4-Chlortestosterone-17-acetate (clostebol).....	648	1-Cyclopentene.....	596	Dibenzo[a,e]pyrene.....	505
5- α -Cholestane.....	648	Cyclopentylbarbital.....	637	Dibenzo[a,h]pyrene.....	505
Cholesterol.....	648	Cyclopropane.....	584-587	Dibenzo[a,l]pyrene.....	505
Chrysene.....	503, 505, 518, 532, 538, 540	Cyheptamide.....	642	Dibenzofuran.....	538, 540
Chrysene-d12.....	518-519, 538, 542	o-Cymene.....	556	Dibenzo-p-dioxin.....	540
1,8-Cineol.....	555, 558-559, 565	p-Cymene.....	558, 559, 567	Dibenzothiophene.....	540
Cineole.....	560	r-Cymene.....	555, 564-565	Dibenzyl ether.....	558-559
Cinerin I.....	536			Dibenzyl phthalate.....	539
Cinerin II.....	536	D		Diborane.....	633
Cinnamaldehyde.....	561, 563	2,4-D.....	512	Dibromoacetic acid.....	543
trans-Cinnamaldehyde.....	560	Dalapon.....	512, 543	Dibromoacetonitrile.....	509, 547
Cinnamic alcohol.....	563	2,4-DB.....	512	1,2-Dibromobenzene.....	549
Cinnamyl acetate.....	563, 566	4,4'-DDD.....	506, 508, 511, 513, 514, 520-521, 525, 529	4,4'-Dibromobiphenyl.....	511
trans-Cinnamyl acetate.....	566	o,p'-DDD.....	524, 575	Dibromochloromethane.....	507, 509, 515, 517, 544-548, 553
Cinnamyl alcohol.....	561	p,p'-DDD.....	518, 521-524, 529-530, 575	1,2-Dibromo-3-chloropropane (DBCP).....	507-509, 515, 517, 529-530, 544-548, 603, 622
Cinnamyl cinnamate.....	558-559	4,4'-DDE.....	506, 508, 511, 513, 514, 520-521, 525, 529	1,2-Dibromoethane (EDB).....	507, 509, 515, 517, 544, 546-549, 553, 603, 622
Cinnamyl phenyl acetate.....	558-559	p,p'-DDE.....	518, 521-524, 529-530, 575	Dibromofluoromethane.....	515
Cinnanzine.....	644	o,p'-DDE.....	524, 575	Dibromomethane.....	515, 517, 544-546, 548, 622
Citral.....	563	4,4'-DDT.....	506, 508, 511, 513, 514, 520-521, 525, 528, 529, 542	1,2-Dibromomethane.....	545
Citronellal.....	558, 564	o,p'-DDT.....	524	α , α -Dibromo-m-xylene.....	529-530
Citronellic acid.....	509	p,p'-DDT.....	518, 521-524, 529-530, 575	2,6-Dibromo-4-nitroaniline.....	629
Citronellol.....	557-561, 563, 569	Decabromobiphenyl ether (decaBDE).....	502	4,4'-Dibromooctafluorobiphenyl.....	512
Citronellyl acetate.....	558-559	Decachlorobiphenyl.....	506, 508, 513-514, 520-524, 534	2,4-Dibromophenol.....	541
Citronellyl formate.....	557-558	Decanal.....	564, 611	1,2-Dibromopropane.....	547
Citronellyl propionate.....	558	1,10-Decandiol.....	619	2,3-Dibromopropionic acid.....	543
Citronellyl tiglate.....	558-559	Decane.....	249, 251-252, 503, 576, 593, 599, 623	1,2-Dibromo-1,1,2,2-tetrafluoroethane.....	527
cis-Citronellyl tiglate.....	563	n-Decane.....	249, 260, 532, 577, 596-597	Dibucaine.....	643
trans-Citronellyl tiglate.....	563	1,10-Decanediol.....	619, 620, 622	Dibutyl chlorendate.....	529-530
Clemizole.....	644	Decanoic acid.....	570, 611	tert-Dibutyl disulfide.....	592
Clobazam.....	640	Decanol.....	567	Dibutyl ether.....	627-628
Clonazam.....	636	1-Decanol.....	602, 605	Dibutylpentyltin.....	537
Clonazepam.....	194, 636, 639-640	n-Decylamine.....	609-610	Dicamba.....	512
Cocaine.....	639-642, 647	DEF.....	518	Dichlobenil.....	526
Codeine.....	637, 639, 641-642, 647	1-Dehydro-17-a-methyltestosterone (methandrostenolone).....	648	Dichlone.....	508
Commamyl acetate.....	560	Dehydroisoandrosterone (prasterone).....	648	Dichloroacetic acid.....	543
α -Copaene.....	555, 558-559, 566	1-Dehydrotestosterone acetate.....	648	Dichloroacetonitrile.....	509, 547
Coprostane (5- β -cholestane).....	648	1-Dehydrotestosterone benzoate.....	648	3,4-Dichloroaniline.....	610, 629
Cotinine.....	642	1-Dehydrotestosterone (boldenone).....	648	1,2-Dichlorobenzene.....	515, 517, 538, 544-546, 548-549, 553, 604, 614-615, 623
Coumarin.....	560-561, 563	1-Dehydrotestosterone undecylenate.....	648	1,3-Dichlorobenzene.....	256, 258, 515, 517, 538, 544-546, 548-549, 553, 604, 614-615, 623
2-Cresol.....	630	Delorazepam.....	640	1,4-Dichlorobenzene.....	256, 258, 515, 517, 538, 544-546, 548-549, 553, 604, 614-615, 623
3-Cresol.....	630	Demoxepam.....	636, 640	1,4-Dichlorobenzene-d4.....	515, 538, 542
4-Cresol.....	630	n-Des.....	644	3,3'-Dichlorobenzidine.....	538, 542, 629
m-Cresol.....	542-543, 630	Desalkyl aurazepam.....	636	3,5-Dichlorobenzoic acid.....	512
o-Cresol.....	542-543, 630	Desipramine.....	640	2,3-Dichlorobiphenyl.....	518
p-Cresol.....	542-543, 630	Desmethyldiazepam.....	640		
Crotonaldehyde.....	515, 612	n-Desmethyl methsuximide.....	643		
Cumene.....	576, 593, 616, 623, 632	Dextromethorphan.....	637		
Cumic aldehyde.....	556	Diacetone alcohol.....	625		
Cyanazine.....	511, 518, 520, 526	Diacetyl.....	568		
2-Cyanopyridine.....	610				
3-Cyanopyridine.....	610				

p,p'-Dichlorobiphenyl.....	524	Diethylbenzene isomer.....	593	Dimethyl phthalate.....	518, 538, 539
cis-Dichlorobutene.....	515	Diethyl disulfide.....	578	Dimethyl sulfide.....	550, 578-579, 581, 591-592, 626
cis-1,4-Dichlorobutene.....	544	Diethylene glycol.....	620-621	Dimethyl sulfoxide (DMSO).....	626-627, 639, 649-650
trans-Dichlorobutene.....	515	Diethylene glycol monobutyl ether.....	619, 620	Dimethyl tetrachloroterephthalate	
trans-1,4-Dichloro-2-butene.....	517, 548, 603, 622	Diethylene glycol monoethyl ether.....	619, 620	(DCPA).....	508, 511-512, 518, 520-521, 524, 526, 529-530
Dichlorodifluoromethane.....	515, 517, 527, 544, 546, 548, 549, 553	Diethylenetriamine.....	611	Dimethyltryptamine.....	646
Dichlorodimethyl silane.....	633	Diethyl ether.....	517, 548, 581, 600, 626, 632, 635, 649-650	Di-n-butyl phthalate.....	518, 538, 539
Dichloroethane-d4.....	515	1,2-Diethyl-4-ethylbenzene.....	596	2,4-Dinitroaniline.....	629
1,1-Dichloroethane.....	515, 517, 544-549, 553, 603, 622	1,3-Diethyl-5-ethylbenzene.....	596	2,2'-Dinitrobiphenyl.....	540
1,2-Dichloroethane.....	515, 517, 544, 546-549, 553, 603, 622, 635, 651	Diethyl formamide (DEF).....	518	2,7-Dinitrofluorene.....	540
cis-1,2-Dichloroethane.....	651	Diethyl phthalate.....	518, 538-539, 560	4,6,-Dinitro-2-methyl phenol.....	538, 542
trans-1,2-Dichloroethane.....	651	Diethyl sulfide.....	578, 581	1,3-Dinitronaphthalene.....	540
1,1-Dichloroethene.....	515, 517, 544-546, 548-549, 553, 603, 622, 651	Diethyltryptamine.....	646	1,5-Dinitronaphthalene.....	540
cis-1,2-Dichloroethene.....	515, 517, 544, 546, 548-549, 553	1,4-Difluorobenzene.....	550, 517, 548-549, 553	2,4-Dinitrophenol.....	528, 538, 541-543, 604, 630
trans-1,2-Dichloroethene.....	515, 517, 544-546, 548, 553, 622	1,1-Difluoroethane.....	527	2,5-Dinitrophenol.....	541
1,1-Dichloroethylene.....	547, 635	Difolatan.....	526	2,4-Dinitrotoluene.....	518, 538, 542
cis-1,2-Dichloroethylene.....	635	Diglyme.....	619, 620	2,6-Dinitrotoluene.....	518, 538
trans-1,2-Dichloroethylene.....	635	Dihexyl phthalate.....	539	Di-n-octyl phthalate.....	538, 539
1,1-Dichloro-1-fluoroethane.....	527	9,10-Dihydroanthracene.....	540	Dinonyl phthalate.....	539
Dichlorofluoromethane.....	527, 545	trans-Dihydro carveol acetate.....	555	Dinoseb.....	512, 541
Dichloromethane.....	527, 546, 626, 633, 635, 651	Dihydro carveone.....	555, 565	1,3-Dioxalane.....	619
Dichloromethyl silane.....	633	trans-Dihydro carvyl.....	565	1,4-Dioxane.....	515, 553, 576, 593, 619, 624-626, 635, 650-651
2,6-Dichloro-4-nitroaniline.....	629	Dihydrocodeine.....	637	Diphenamid.....	518, 525-526
2,3-Dichlorophenol.....	502, 541	Dihydropentaborane.....	633	Diphenhydramine.....	644
2,4-Dichlorophenol.....	502, 528, 538, 541-543, 604, 630	Diisobutyl phthalate.....	539	Diphenylaniline.....	610
2,5-Dichlorophenol.....	502, 541	Diisopropylamine.....	610	9,10-Diphenylanthracene.....	540
2,6-Dichlorophenol.....	502, 541-543	1,3-Diisopropylbenzene.....	604, 614-615	Diphenyl isophthalate.....	539
3,4-Dichlorophenol.....	502, 541	1,4-Diisopropylbenzene.....	604, 614-615	Diphenyl oxide.....	558-559
3,5-Dichlorophenol.....	502, 541	Diisopropyl ether (DIPE).....	515, 581, 595, 600	Diphenyl phthalate.....	539
Dichloroprop.....	512	Dimenhydrinate.....	641, 644	Diphenyl pyraline.....	644
1,1-Dichloropropane.....	622	Dimethoate.....	519, 531, 562	Diphenyl sulfide.....	578
1,2-Dichloropropane.....	515, 517, 544-546, 548-549, 553, 603, 622	3,3'-Dimethoxybenzidine.....	629	Dipropylene glycol.....	619-620
1,3-Dichloropropane.....	515, 517, 544, 546, 548, 622	1,2-Dimethoxyethane.....	595, 639	Dipropyl ether.....	600
2,2-Dichloropropane.....	515, 517, 544-546, 548, 622	Dimethoxyethane (DME).....	595	Disulfoton.....	518, 525
1,3-Dichloro-2-propanol.....	515	n,n-Dimethylacetamide.....	625, 639	Diuron.....	526
1,1-Dichloro-2-propanone.....	509, 517, 547-548	Dimethylamine.....	608	cis-13,16-Docosadienoic acid methyl ester.....	572, 573
1,1-Dichloropropene.....	515, 517, 544, 548	Dimethylamphetamine.....	636	cis-4,7,10,13,16,19-Docosahexaenoic	
1,1-Dichloro-1-propene.....	546	2,4-Dimethylaniline.....	610	acid methyl ester.....	572, 573
cis-1,2-Dichloropropene.....	603	2,6-Dimethylaniline.....	610, 629	Docusane.....	503
cis-1,3-Dichloropropene.....	515, 517, 544-546, 548-549, 553, 622	7,12-Dimethylbenz[a]anthracene.....	540	Dodecahydrotriphenylene.....	540
trans-1,2-Dichloropropene.....	603	1,2-Dimethylbenzene.....	560	γ-Dodecalactone.....	558-559
trans-1,3-Dichloropropene.....	515, 517, 544-546, 548-549, 553, 622	n,n-Dimethylbenzylamine.....	610	Dodecane.....	249, 251-252, 503, 576-577, 593, 623
Dichlorotetrafluoroethane.....	553	2,2-Dimethylbutane.....	588-589, 596, 599	n-Dodecane.....	249, 260, 582, 596-597
1,2-Dichloro-1,1,2,2-tetrafluoroethane.....	527, 549	2,3-Dimethylbutane.....	588-589, 596, 599	Dodecanoic acid.....	570
2,2-Dichloro-1,1,1-trifluoroethane.....	527	Dimethyl disulfide.....	578	Dodecanol.....	558-559
Dichlorvos.....	518, 525	Dimethyl ether (DME).....	581, 601	Dodecenal.....	564
Dicyclohexylamine.....	609-610	Dimethylformamide (DMF).....	624, 626-627, 650	n-Dotriacontane.....	597
Dicyclohexyl phthalate.....	539	n,n-Dimethylformamide.....	625-626, 639	Doxylamine.....	641, 644
Dieldrin.....	506, 508, 511, 513-514, 518, 520-525, 529-530, 575	2,6-Dimethylhept-5-enal (melonal).....	558, 559	Droperidol.....	646
Diethanolamine (DEA).....	606, 607	2,2-Dimethylhexane.....	517, 548, 599	Dursban (chlorpyrifos).....	518, 519
Diethylamine.....	610	1,3-Dimethyl-2-imidazolidinone (DMI).....	639		
n,n-Diethylaniline.....	610	2,6-Dimethylnaphthalene.....	540		
2,6-Diethylaniline.....	610	1,2-Dimethyl-2-nitrobenzene.....	519		
Diethylbenzene.....	593	1,3-Dimethyl-2-nitrobenzene.....	518, 542		
1,2-Diethylbenzene.....	576, 597	2,2-Dimethylpentane.....	596, 599		
1,3-Diethylbenzene.....	576, 596	2,3-Dimethylpentane.....	588-589, 596, 599		
1,4-Diethylbenzene.....	597	2,4-Dimethylpentane.....	588-589, 596, 599		
		Dimethylpentyltin.....	537		
		3,6-Dimethylphenanthrene.....	540		
		2,3-Dimethylphenol.....	541		
		2,4-Dimethylphenol.....	528, 538, 541-543, 604		
		2,5-Dimethylphenol.....	541		
		2,6-Dimethylphenol.....	541		
		3,4-Dimethylphenol.....	541		

E

cis-11,14-Eicosadienoic acid methyl ester.....	572, 573
Eicosane.....	503, 558
n-Eicosane.....	597
cis-5,8,11,14,17-Eicosapentaenoic	
acid methyl ester.....	572, 573
cis-11,14,17-Eicosatrienoic	
acid methyl ester.....	572, 573
cis-8,11,14-Eicosatrienoic acid methyl ester.....	572, 573
cis-11-Eicosenoic acid methyl ester.....	572, 573
Elaidic acid methyl ester.....	572, 573

Endosulfan I.....	506, 508, 511, 513-514, 518, 520-525, 529-530	Ethyl cellosolve.....	625	Farnesyl acetate.....	566
Endosulfan II.....	506, 508, 511, 513-514, 518, 520-525, 529-530	Ethyl decanoate.....	558-559	Fenamiphos.....	518-519, 525
α -Endosulfan.....	575	Ethyl dodecanoate.....	558-559	Fenarimol.....	518, 525
β -Endosulfan.....	575	Ethylene.....	577, 580, 584-585, 588-590, 601, 634	Fenchone.....	563
Endosulfan sulfate.....	506, 508, 511, 513-514, 518, 520-525, 529-530, 575	Ethylene/acetylene.....	591	Fenchyl acetate.....	558
Endrin.....	506, 508, 511, 513-514, 518, 520-525, 529-530, 542	Ethylenediamine.....	611	Fenitrothion.....	562, 575
Endrin aldehyde.....	506, 508, 511, 513-514, 518, 520-525, 528-530	Ethylene.....	595	Fentanyl.....	640, 645-646
Endrin ketone.....	506, 508, 513-514, 518, 521-524, 529-530	Ethylene glycol.....	602, 605, 619-622, 649-650	Fenthion.....	562
Ephedrine.....	636	Ethylene glycol monoacetate.....	607	Fenvalerate.....	519
Epiandrosterone (trans-androsterone).....	648	Ethylene glycol monobutyl ether.....	619-620	Florazone.....	558-559
Epichlorohydrin.....	515, 619	Ethylene glycol monoethyl ether.....	619-620	Flunitrazepam.....	194, 636, 639-640
EPTC.....	518, 525-526	Ethylene glycol monoformate.....	607	Fluoranthene.....	503, 532, 538, 540
Eptam.....	527	Ethylene glycol monomethyl ether.....	619-620	Fluorene.....	503, 518, 532, 538, 540, 542
Erucic acid methyl ester.....	572, 573	Ethylene glycol phenyl ether.....	622	Fluorobenzene.....	515, 517, 544, 545, 548, 614-615
Erythritol.....	569	Ethylene oxide.....	594, 605, 607, 631	2-Fluorobiphenyl.....	538
Esfenvalerate.....	519	Ethyl ether.....	515, 619, 624-625, 650	2-Fluorophenol.....	538
Estazolam.....	636	Ethyl formate.....	568, 607, 617-618, 624-625, 649-650	Flurazepam.....	640, 642
17- α -Estradiol.....	648	Ethyl heptanoate.....	558-559	Fluridone.....	518, 525-526
β -Estradiol.....	648	Ethyl hexadecanoate.....	558-559	Fonofos.....	526
Estriol.....	648	Ethyl hexanoate.....	558-559	Formaldehyde.....	550, 553, 613
Estrone.....	648	2-Ethyl hexanoic acid.....	509	Formaldehyde-DNPH.....	613
Ethane.....	580, 583-585, 588-591, 596, 601, 634	2-Ethyl-1-hexanol.....	602, 605	Formaldehyde-PFBHA.....	614
Ethane/ethylene.....	580	Ethyl isovalerate.....	558-559	Formic acid.....	509, 570, 607
Ethanethiol.....	578	Ethyl mercaptan.....	579, 581, 591-592	Frambinone (raspberry ketone).....	558-559
Ethanol.....	515, 554, 568, 581, 595-596, 600, 602, 605, 623-628, 635, 638-639, 649-650	Ethyl methacrylate.....	515, 517, 548, 628	Fucitol.....	568
Ethanolamine.....	608	Ethyl methyl sulfide.....	578	Furan.....	619
Ethchlorvynol.....	646	Ethyl morphine.....	637	Furfural.....	558-559, 612
Ethinamate.....	646	Ethyl nonanoate.....	558-559	Furfuryl alcohol.....	602, 605
Ethoprop.....	518, 525-526	Ethyl octadecanoate.....	558-559		
Ethosuximide.....	643	Ethyl octanoate.....	558-559	G	
Ethotoin.....	644	Ethyl parathion.....	575	Galactitol.....	568-569
2-Ethoxyethanol.....	602, 605, 607, 635, 639	Ethyl pentadecanoate.....	559	Geranial.....	558-559, 564
bis(2-Ethoxyethyl) phthalate.....	539	Ethyl pentadecanoate nonadecane.....	558	Geranial acetate.....	566
2-Ethoxyethyl acetate.....	607, 617-618	Ethyl pentanoate.....	558-559	Geraniol.....	558-559, 560, 561, 563, 566, 569
2-Ethyl-1-hexanol.....	567	α -Ethylphenethyl alcohol.....	602, 605	cis-Geraniol.....	556
bis(2-Ethylhexyl) adipate.....	518	β -Ethylphenethyl alcohol.....	602, 605	trans-Geraniol.....	563
bis(2-Ethylhexyl) phthalate.....	518, 538-539	2-Ethylphenol.....	630	Geranyl acetate.....	556, 558-559, 564, 566
Ethyl acetate.....	515, 553-554, 558-559, 568-569, 617-618, 624-628, 635, 639, 649-650	4-Ethylphenol.....	630	Geranyl butyrate.....	559
Ethyl acetylene.....	634	Ethyl-3-phenyl oxiran carboxylate.....	569	Geranyl formate.....	558-559
Ethyl acrylate.....	617-618, 626-628	Ethyl propanoate.....	554	Geranyl-2-methyl valerate.....	558
Ethyl alcohol.....	607	Ethyl propionate.....	558-559, 617-618, 627-628	Geranyl tiglate.....	558-559
2-(Ethylamino)-ethanol.....	606	Ethyl tetradecanoate.....	558-559	Germacrene-d.....	555, 556, 565, 566
Ethyl and dimethyl thiophenes.....	593	4-Ethyltoluene.....	553	Gesatamine (atraton).....	518
Ethylbenzene.....	501, 515, 517, 544-546, 548-549, 553, 576-577, 588-589, 593-594, 596-597, 599, 601, 604, 614-616, 623, 625, 632, 639, 649-651	m-Ethyltoluene.....	576, 593	Glucitol.....	568
Ethylbenzene-d10.....	597	p-Ethyltoluene.....	576, 593	Glucuronic acid.....	569
Ethyl benzoate.....	569, 617-618	Ethyl undecanoate.....	558-559	Glucuronic acid-1,5-lactone.....	569
Ethyl butanoate.....	554	Ethyl valerate.....	618	Glutethimide.....	640, 646
2-Ethyl-1-butanol.....	606	Ethyl vinyl ether.....	619	Glycidol.....	602, 605
Ethyl t-butyl ether (ETBE).....	515, 546, 581, 595, 600, 625,	Etridiazole.....	508, 511, 520-521, 524	Glyme.....	620
Ethyl butyrate.....	558-559, 569, 618	Eucalyptol.....	556-557	Glyme (propylene glycol dimethyl ether).....	619, 620
Ethyl caprate.....	554	Eugenol.....	561, 563	GOAL.....	527
Ethyl caproate.....	618	iso-Eugenol.....	561	3,7-Guaiadiene.....	558
Ethyl caprylate.....	554	Evernyl.....	558	α -Gurjunene.....	566
		Eugenyl acetate.....	558-559		
		Eugenyl methyl ether.....	559		
				H	
		F		Halazepam.....	636, 640
		Farnesene.....	566	Haloperidol.....	646
		β -Farnesene.....	556	Halothane.....	632
		t- β -Farnesene.....	557	Helium.....	552
		trans- β -Farnesene.....	555, 565	Heneicosane.....	558
		Farnesol.....	563	Heneicosanoic acid methyl ester.....	572, 573
		Farnesol 1.....	563	1,7-Hepatanediol.....	620
		Farnesol acetate.....	566	Heptachlor.....	506, 508, 511, 513-514, 518, 520-525, 529-530
		Farnesol isomer.....	561		

- Heptachlor epoxide506, 508, 511, 513-514,
518, 520-525, 529-530, 542
2,2',3,3',4,4',6-Heptachlorobiphenyl518
Heptadec-1-ene558
Heptadecane536
n-Heptadecane597
Heptadecanoic acid methyl ester572, 573
cis-10-Heptadecenoic acid methyl ester572, 573
Heptanal554, 611-612
1,7-Heptandiol619, 620
Heptane576, 593, 601, 616, 623,
625, 639, 649-650
n-Heptane553, 577, 588-589,
596-597, 624, 635, 650
Heptanoic acid570, 607, 611
n-Heptanoic acid509
1-Heptanol532, 602, 605-606
2-Heptanol602, 605
3-Heptanol602, 605
2-Heptanone612
3-Heptanone612
4-Heptanone612
cis-4-Hepten-1-ol602, 605
trans-2-Hepten-1-ol602, 605
Hercolyn D
(tetrahydro & dihydro methyl abietate)558
Heroin194, 637, 639-641, 647
Hexabromobenzene (HBB)524
Hexabromobiphenyl519
Hexacosane503
Hexachlorobenzene508, 518, 520, 524, 529-530, 538
Hexachlorobezene511, 521
2,2',4,4',5,6'-Hexachlorobiphenyl518
Hexachlorobutadiene515, 517, 538, 544-546,
548, 553, 603, 622
Hexachloro-1,3-butadiene549
 β -Hexacholorcyclohexane575
 δ -Hexacholorcyclohexane575
 γ -Hexacholorcyclohexane575
Hexachlorocyclopentadiene508, 511, 518, 538,
542, 603, 622
Hexachloroethane515, 517, 538, 548, 603, 622
Hexachloropentadiene529-530
Hexadecane503
n-Hexadecane249, 597
Hexadecanoic acid570
2,4-Hexadienal557
Hexanal554, 611-612
1,6-Hexandiol619
Hexane517, 548, 599, 601, 623-626, 639, 649-650
n-Hexane553, 577, 583-585, 588-589,
596-597, 624, 635, 650
1,6-Hexanediol620
Hexanoic acid611
Hexanol249, 251-252, 558-559
1-Hexanol554, 602, 606
2-Hexanol602, 605
3-Hexanol602, 605
2-Hexanone517, 548, 553, 612
3-Hexanone612
n-Hexatriacontane597
Hexazinone518-519, 525-527
Hexchlorocyclopentadiene520
cis-2-Hexen-1-ol602, 605
cis-3-Hexen-1-ol602, 605
cis-2-Hexene588-589
trans-2-Hexene588-589
Hexobarbital637, 641
Hexyl acetate558-559
Hexyl butyrate556
Hexyl cinnamaldehyde563
Hexyl cinnamic aldehyde561
Hexylene glycol558-559
Hexyl 2-ethylhexyl phthalate539
1-Hexyl mercaptan592
n-Hexyl mercaptan592
Hexyl methacrylate628
 α -Humulene564
Hydrocarbon616
Hydrocodone639, 641
Hydrogen oxide577
Hydrogen sulfide550, 577-579, 581, 583,
591, 592, 601, 605, 634
Hydroxy acetate607
Hydroxy citronellal558-559, 561, 563
4-Hydroxy-4-methyl-2-pentanone602, 605
Hydroxyphenamate641
Hydroxypropionitrile515
Hydroxypropyl acrylate628
Hydroxyzine644
- I**
- Ibogaine640, 646
Ibuprofen641, 647
Imipramine642
Indan596-597
Indeno[1,2,3-c,d]pyrene503, 505, 518, 532, 538
Inositol568
Iodobenzene614-615
Iodoform603, 622
Iodomethane517, 544, 548, 603, 622
Irgafos633
Irganox633
Isoamyl acetate554, 569, 617-618
Isoamyl alcohol554, 568, 649-650
Isoamyl butyrate569
Isoamyl mercaptan592
Isoamyl salicylate558, 560
Isoborneol558-560, 567
Isobutane584-589, 599
Isobutanol515, 568, 581, 595, 602, 605, 626-628
Iso-butene634
Isobutyl acetate554, 558-559, 617-618, 624, 627-628
Isobutyl acrylate627-628
Isobutyl alcohol554
Isobutyl aldehyde554, 581
Isobutylbenzene577, 604, 614-615
Isobutylene584-587
Isobutyl mercaptan592
Isobutyl propionate627-628
Isobutyraldehyde582, 600, 612, 625
Isobutyric acid509, 570, 607-608
Isocaproic acid570, 607
Isodrin508, 524, 529-530
Isoeugenol563
trans-Isoeugenol563
Isomenthol557
Isomenthone555, 557-559
d-Isomethone565
Isonox633
Isooctane577, 588-589, 596-597, 623-624, 635
Isopentane577, 584-589, 596
Isopentanoic acid509
Isophorone518, 538, 542
Isoprene586-589
Isopropanol554, 581, 602, 605,
624-625, 638, 650
Isopropyl acetate617-618, 624, 639
Isopropyl acrylate627-628
Isopropyl alcohol515, 553, 624-625, 649-650
Isopropyl amine649-650
Isopropyl benzene515, 517, 544-546, 548,
577, 588, 589, 593, 604, 614-616
Isopropyl ether619
Isopropyl mercaptan592
Isopropyl myristate558-559
2-Isopropylphenol630
Isopropyltoluene515
4-Isopropyltoluene545-546
p-Isopropyltoluene517, 544, 548
Isovaleraldehyde581, 600
Isovaleric acid570, 607
- J**
- Jasmolin I536
Jasmolin II536
cis-Jasmone555, 565
- K**
- Kelthane508, 529-530
Kepone519
Ketamine646, 647
Krypton582
- L**
- L-9-Carboxy-11-nor- δ 9-THC649
L-11-Hydroxy- δ 9-THC649
Lactose569
Lactulose569
Lauric acid methyl ester572, 573
Lavandulol556
Lavandulyl acetate556
Levulinic acid509
Lidocaine640, 643, 647
Lignoceric acid methyl ester572, 573
Lilial561, 563
Limonene555, 558-560, 563-564, 565, 567
 δ -Limonene556-557, 564
S-(-)-Limonene567
Linalool555, 558-561, 563-567
 β -Linalool556
Linalool acetate556
cis-Linalool oxide558-559
trans-Linalool oxide558-559
Linalyl acetate558-560
Linoleic acid methyl ester572, 573
Linolelaidic acid methyl ester572, 573
Linolenic acid methyl ester572, 573
 γ -Linolenic acid methyl ester572, 573
Lofentanyll645
Lorazepam636, 639-640
Lormetazepam636
Lyrall561
Lyrall 1563
Lyrall 2563
Lysergic acid diethylamide (LSD)640, 646

M

β-Maaliene.....	557	3-Methyl-2-buten-1-ol.....	602, 605	Methyl 3-hydroxydodecanoate.....	571
Malathion.....	519, 531, 562, 575	2-Methyl-1-butene.....	596	Methyl 2-hydroxyhexadecanoate.....	571
Manitol.....	569	2-Methyl-2-butene.....	584, 588-589, 596	Methyl 2-hydroxytetradecanoate.....	571
Mannitol.....	568	3-Methyl-1-butene.....	586-589	Methyl 3-hydroxytetradecanoate.....	571
Meclizine.....	644	trans-2-Methyl-2-butenoic acid.....	608	Methyl isobutyl ketone.....	624-625
Medazepam.....	636, 640	2-Methylbutyl acetate.....	617-618	Methyl laurate.....	571
Menthofuran.....	557	2-Methylbutyl alcohol.....	558-559	Methyl mercaptan.....	550, 579, 581, 591-592
Menthol (MeOH).....	557, 560, 565, 577, 595	3-Methylbutyl alcohol.....	558-559	Methyl methacrylate.....	515, 517, 548, 627-628
Menthone.....	557-559	Methyl t-butyl ether (MTBE).....	515, 595, 639, 649-650	Methyl 14-methylhexadecanoate.....	571
Menthyl acetate.....	565	Methyl butyrate.....	558-559	Methyl 12-methyltetradecanoate.....	571
Meperidine.....	639, 642	2-Methyl butyric acid.....	608	Methyl monoethanolamine (MMEA).....	606
Mephobarbital.....	637	Methyl chavicol.....	561	Methyl myristate.....	571
Mepivacaine.....	643	3-Methylcholanthrene.....	540	1-Methylnaphthalene.....	540, 597
Meprobamate.....	641, 646	2-Methyl-4-chlorophenoxyacetic acid (MCPA).....	512	2-Methylnaphthalene.....	538, 540, 596-597
Merphos.....	518, 525	Methyl chlorophenoxypropionic acid (MCPP).....	512	2-Methyl-5-nitroaniline.....	629
Mescaline.....	646	5-Methylchrysene.....	505	Methyl nonadecanoate.....	571
Mesitylene.....	623	Methyl-cresol.....	558	Methyl octadecanoate.....	618
Mesterolone.....	648	Methyl-p-cresol.....	559	Methyl octine carbonate.....	561, 563
Methacrolein.....	612, 626-627	Methyl-r-cresol.....	566	Methyl oleate.....	571
Methacrylic acid.....	509	Methylcyclohexane.....	588-589, 599, 635, 639, 651	Methyl palmitate.....	571
Methacrylonitrile.....	515, 517, 548, 626-627	Methylcyclopentane.....	577, 588-589, 596, 599	Methyl palmitoleate.....	571
Methadone.....	639-640, 642	1-Methyl-1-cyclopentene.....	596	Methyl paraoxon.....	518
Methamidophos.....	531, 562	Methyl decanoate.....	618	Methyl parathion.....	575
Methamphetamine.....	636, 639, 642	Methyl-2,4-dichlorophenylacetate.....	512	Methyl pentadecanoate.....	571
Methane.....	552, 577, 580, 582-585, 588-591, 601, 626, 634-635	Methyl diethanolamine (MDEA).....	606	2-Methylpentane.....	588-589, 596, 599
Methanethiol.....	578	4-Methyl-2,5-dimethoxyamphetamine (STP).....	636	3-Methylpentane.....	501, 588-589, 596, 599, 623
Methanol.....	554, 568, 581-582, 595-596, 600-602, 605-606, 613, 623-624, 626-628, 635, 638-639, 649-651	2-Methyl-4,6-dinitrophenol.....	528, 541-543, 604	2-Methyl-2 pentanol.....	581
Methapyrilene.....	641, 644	Methyl dodecanoate.....	618	3-Methyl-3-pentanol.....	606
Methaqualone.....	640, 646	Methyl eicosenoate.....	618	4-Methyl-2-pentanol.....	602, 605-606
Methidathion.....	531, 562	Methyl elaidate.....	571	2-Methyl-3-pentanone.....	612
Methofuran.....	565	4,4'-Methylenedianiline.....	629	4-Methyl-2-pentanone (MIBK).....	517, 548, 553, 612
Methohexital.....	637	3,4-Methyl enedioxyamphetamine.....	642	2-Methyl-1-pentene.....	588-589, 596
Methone.....	565	3,4-Methyl enedioxyethylamphetamine.....	642	4-Methyl-1-pentene.....	588-589
Methoprene.....	536	3,4-Methyl enedioxyethamphetamine.....	642	bis(4-Methyl-2-pentyl) phthalate.....	539
Methoxychlor.....	506, 508, 511, 513-514, 518, 520-524, 529-530	Methyl ethyl ketone (2-butanone).....	649, 650	α-Methylphenyl alcohol.....	602
2-Methoxyethanol.....	602, 605, 626	Methyl isobutyl ketone (MIBK).....	639	2-Methylphenol.....	538, 541
bis(4-methoxyethyl) phthalate.....	539	α-Methyl ionone.....	560	3-Methylphenol.....	541
2-Methoxy-5-methylaniline.....	629	Methyl cis-9,10-methylene octadecanoate.....	571	4-Methylphenol.....	538, 541
1-Methoxy-2-propanol.....	639	Methyl cis-9,10-methyl hexadecanoate.....	571	5-Methyl-5-phenylhydantoin.....	643
Methsuximide.....	643	Methylene chloride.....	515, 517, 544-545, 548-549, 553, 603, 622, 624-625, 639, 649-650	2-Methyl-1-propanethiol.....	578-579, 581, 591
Methyl acetate.....	617-618, 627-628, 635	Methylenedioxyamphetamine (MDA).....	636, 639	2-Methyl-2-propanethiol.....	578-579, 591
Methyl acetylene.....	591	Methylenedioxyethylamphetamine (MDE).....	636, 639	2-Methyl-1-propanol (isobutanol).....	600
Methyl acrylate.....	515, 517, 548, 627-628	Methylenedioxyethamphetamine (MDMA).....	636, 639	2-Methyl-2-propanol (tert-butanol).....	600, 639
Methyl alcohol.....	625	Methyl ephedrine.....	636	Methyl propionate.....	617-618, 627-628
Methylamine.....	608	1-Methyl-2-ethylbenzene.....	597	1-Methyl-1-propnaethiol.....	579, 591
4-Methylaminorex.....	646	1-Methyl-3-ethylbenzene.....	597	1-Methyl-3-propylbenzene.....	596
r-Methylansiole.....	566	1-Methyl-4-ethylbenzene.....	597	1-Methyl-1-propyl mercaptan.....	592
2-Methylanthracene.....	540	Methyl ethyl ketone (MEK).....	581, 624-625, 650	2-Methyl-1-propyl mercaptan.....	592
9-Methylanthracene.....	540	Methyl ethyl sulfide.....	581	1-Methyl-2-pyrrolidine.....	610
Methyl arachidate.....	571	Methyl eugenol.....	561	1-Methyl-2-pyrrolidinone.....	626-627
Methyl benzoate.....	558-559, 566, 617-618	2-Methylfluoranthene.....	540	n-Methylpyrrolidone.....	639
5-Methylbenzo[b]thiophene.....	578	Methyl formate.....	617-618	Methyl stearate.....	571
3-Methylbenzothiophene.....	578	Methyl γ ionone.....	561	α-Methylstyrene.....	576, 593, 614-616
2-Methyl butanal.....	611	3-0-Methylglucose 1.....	569	4-Methylstyrene.....	614-615
2-Methylbutane.....	599	3-0-Methylglucose 2.....	569	Methyl sulfide.....	634
2-Methyl-1-butanol.....	568, 602, 605, 611	Methyl heptadecanoate.....	571	Methyl tert-butyl ether (MTBE).....	517, 546, 548, 581-582, 597, 600, 619, 623
2-Methyl-2-butanol.....	602, 605	2-Methylheptane.....	577, 588-589, 596	17α-Methyltestosterone.....	648
3-Methyl-1-butanol.....	568, 602, 605, 625, 635	3-Methylheptane.....	588-589, 596	Methyl tetradecanoate.....	618
3-Methyl-2-butanone.....	612, 635	4-Methylheptane.....	577	2-Methylthiophene.....	578
2-Methyl-3-buten-2-ol.....	602, 605	Methyl heptine carbonate.....	561, 563	3-Methylthiophene.....	578
		Methyl hexadecanoate.....	618	Methyl thiophenes.....	593
		2-Methylhexane.....	588-589, 599	Methyl tridecanoate.....	571
		3-Methylhexane.....	588-589, 599	Methyltripentyltin.....	537
		Methyl 2-hydroxydecanoate.....	571		
		Methyl 2-hydroxydodecanoate.....	571		

Methyl undecanoate.....	571
Metolachlor.....	511, 518, 520, 525-526
Metribuzin.....	511, 518, 520, 525-526
Mevinphos.....	518, 525, 531, 542
MGK-264.....	518, 525
Endo-MGK.....	264, 536
Exo-MGK.....	264, 536
Mirex.....	508, 519, 524, 529-530
Molinate.....	518, 525-526
6-Monoacetylmorphine.....	637
Mono ethylene glycol.....	606
Mono-ethanolamine (MEA).....	607
Monuron.....	526
Morphine.....	637, 641, 647
Musk T (ethylene brassylate).....	558-559
Musk ketone.....	560
Musk xylene.....	560
Myrcene.....	555, 558-560, 564-565
β -Myrcene.....	556-557
Myristic acid methyl ester.....	572, 573
Myristoleic acid methyl ester.....	572, 573
N	
Naled.....	531
Naphthalene.....	249, 251-252, 501, 503, 515, 517, 532, 538, 540, 542, 544-546, 548, 577, 596-597, 623
Naphthalene-d8.....	538, 597
1-Naphthol.....	630
Napropamide.....	518, 525-526
Nefopam.....	643
Neomenthol.....	560, 565
Neon.....	552, 582
Neral.....	558-559, 563-564
Nerol.....	557
Nerol acetate.....	556
cis-Nerolidol.....	558
trans-Nerolidol.....	558
Nervonic acid methyl ester.....	572, 573
Neryl acetate.....	558-559, 564
Nicotinamine.....	636
Nicotine.....	639-641, 647
Nitrazepam.....	194, 636, 639
2-Nitroaniline.....	538, 610, 629
3-Nitroaniline.....	538, 610, 629
4-Nitroaniline.....	538, 610, 629
Nitrobenzene.....	515, 517, 538, 548, 614-615
Nitrobenzene-d5.....	538
2-Nitrobiphenyl.....	540
3-Nitrobiphenyl.....	540
4-Nitrobiphenyl.....	540
Nitrofen.....	508
Nitrogen.....	552, 582, 605, 632
Nitromethane.....	635
1-Nitronaphthalene.....	540
2-Nitronaphthalene.....	540
Nitrophen.....	519
2-Nitrophenol.....	528, 538, 541-543, 604, 630
3-Nitrophenol.....	541
4-Nitrophenol.....	512, 528, 538, 541-543, 604
2-Nitropropane.....	515, 517, 548
n-Nitrosodimethylamine.....	538, 542
n-Nitrosodiphenylamine.....	538
n-Nitroso-di-n-propylamine.....	538
2-Nitrotoluene.....	604, 614-615
3-Nitrotoluene.....	604, 614-615
4-Nitrotoluene.....	604, 614-615
trans-Nonachlor.....	508, 518, 529-530
Nonadecane.....	559
Nonadec-1-ene.....	558-559
Nonanal.....	564
γ -Nonalactone.....	558-559
1,9-Nonanediol.....	619
Nonane.....	576, 593, 599, 601, 623
n-Nonane.....	532, 577, 588-589, 596-597
1,9-Nonanediol.....	620, 622
Nonanol.....	567
1-Nonanol.....	602, 605
Nonyl aldehyde.....	612
Nonylamine.....	608
n-Nonylamine.....	609-610
Nootkatone.....	564
Norcodeine.....	637
Nordazepam.....	636
Norethandrolone.....	648
Norflurazon.....	518-519, 525-526
Normorphine.....	637
19-Nortestosterone (nandrolone).....	648
19-Nortestosterone-17-decanoate.....	648
19-Nortestosterone-17-propionate.....	648
O	
cis-Ocimene.....	555, 565
trans-Ocimene.....	555
β -cis-Ocimene.....	556
β -trans-Ocimene.....	556
Octacosane.....	503
n-Octacosane.....	597
2,2',3,3',4,5',6,6'-Octachlorobiphenyl.....	518
1,2,3,4,6,7,8,9-Octachlorodibenzodioxin.....	504
1,2,3,4,6,7,8,9-Octachlorodibenzofurans.....	504
Octadecane.....	503, 536
n-Octadecane.....	597
Octadecanoic acid.....	570
Octanal.....	554, 564, 611
1,8-Octandiol.....	619
Octane.....	576, 593, 599, 601, 623
isooctane.....	501
n-Octane.....	532, 577, 588-589, 596-597
1,8-Octanediol.....	620
Octanoic acid.....	570, 611
Octanol.....	558-559, 564, 567
1-Octanol.....	602, 605
3-Octanol.....	555, 565
3-Octanone.....	532, 556
1-Octene.....	532
1-Octen-3-ol.....	556, 565
Octen-1-ol acetate.....	556
Octyl acetate.....	558-559
3-Octyl acetate.....	555, 565
Octyl aldehyde.....	612
n-Octylamine.....	609-610
n-Octyl mercaptan.....	592
Oleic acid methyl ester.....	572, 573
Omethoate.....	562
Ordram.....	527
Oxadiazon.....	527
Oxazepam.....	636, 639-640
Oxazopam.....	636
Oxylchordane.....	519
Oxycodone.....	194, 639
Oxydemeton-methyl.....	531
4,4'-Oxydianiline.....	629
Oxygen.....	552, 582
Oxymetholone.....	648
Oxymorphone.....	641
P	
Paarlan.....	527
Palmitic acid methyl ester.....	572, 573
Palmitoleic acid methyl ester.....	572, 573
Paraldehyde.....	515
Parathion.....	519, 562
Parathion-methyl.....	562
Pebulate.....	525-526
Pentaborane.....	633
2,2',3,4,4'-Pentabromodiphenyl ether.....	502
2,2',4,4',5-Pentabromodiphenyl ether.....	502
2,2',4,4',6-Pentabromodiphenyl ether.....	502
Pentachlorobenzene.....	614-615
2,2',3',4,6-Pentachlorobiphenyl.....	518
1,2,3,7,8-Pentachlorodibenzofuran.....	504
2,3,4,7,8-Pentachlorodibenzofuran.....	504
Pentachloroethane.....	515, 517, 548, 603, 622
Pentachloronitrobenzene.....	508, 511, 524, 529-530
Pentachlorophenol.....	512, 518, 528, 538, 541-543, 604
n-Pentadecane.....	249, 582, 597
Pentadecanoic acid methyl ester.....	572, 573
cis-10-Pentadecenoic acid methyl ester.....	572, 573
cis-1,3-Pentadiene.....	586-587
trans-1,3-Pentadiene.....	586-587
Pentafluorobenzene.....	515, 517, 548
Pentafluoroethane.....	527
Pentamethylbenzene.....	597
Pentamethyl disiloxane.....	633
Pentanal.....	611
1,5-Pentandiol.....	619
Pentane.....	599, 601, 603, 617, 625-626
iso-Pentane.....	583, 590-591, 601
n-Pentane.....	577, 583-591, 596-597
1,2-Pentenediol.....	532
1,5-Pentenediol.....	620
2,3-Pentanedione (VDK).....	554
2,3-Pentanedione (acetyl propionyl).....	558-559
n-Pentanoic acid.....	509
1-Pentanol.....	554, 602, 605-606, 625, 639
2-Pentanol.....	602, 605
3-Pentanol.....	554, 602, 605
2-Pentanone.....	515, 612, 624
3-Pentanone.....	612
Pentene-1.....	584, 586-587
1-Pentene.....	584-585, 588-589, 596, 625
cis-2-Pentene.....	584, 586-589
trans-2-Pentene.....	584, 586-589
4-Pentenoic acid.....	608
trans-2-Pentenoic acid.....	608
trans-3-Pentenoic acid.....	608
1-Penten-3-ol.....	602, 605
2-Penten-1-ol.....	602, 605
Pentobarbital.....	637, 641
Pentyl ether.....	619
1-Pentyl mercaptan.....	592
cis-Permethrin.....	508, 511, 518, 520-521, 524, 529-530

o-Xylene	501, 515, 517, 544-546, 548-549, 553, 576-577, 588-589, 593-594, 596-597, 599, 601, 604, 614-616, 623, 625, 632, 639, 649-651
p-Xylene	515, 517, 544-546, 548-549, 553, 576-577, 588-589, 593-594, 596-597, 599, 601, 604, 614-616, 623, 625, 632
2,3-Xylenol	630
2,4-Xylenol	630
2,5-Xylenol	630
2,6-Xylenol	630
3,4-Xylenol	630
3,5-Xylenol	630
Xylose 1	569
Xylose 2	569

Ordering Information

Easy Ordering Terms and Conditions

Discounts and Delivery

Agilent Technologies specializes in fast delivery. In the US, if you call before 2 PM EST, we will ship your order that day. You may also request overnight express delivery before 6 PM EST and you will have your order the next day. Volume discounts on a variety of individual products are offered when the entire quantity is shipped to one address at one time.

A shipping and handling fee will be added to your order unless the purchase is over \$2000 US for orders place online or over \$4000 for orders place via phone. Special shipping (i.e., overnight in the US) is available in most regions at an additional cost.

Agilent is required to collect all state and local sales taxes unless the buyer's tax-exempt certificate is on file with Agilent Technologies. Please be prepared to provide a copy if it is not on file, when placing your order.

Please check with your Agilent Customer Service Representative, local Authorized Distributor, or the Agilent website for current prices, special offers, promotions and discounts when placing your order.

Satisfaction Guaranteed

If you are not satisfied with your Agilent product within the first 60 days, you may return your purchase in its original condition for a full refund or credit. A return policy statement is included in every Agilent shipment and posted under Product Information on the website. In the US and Canada, please call for a Return Authorization form and return instructions at **1-800-227-9770**. If your Agilent product was purchased from a distributor, please contact the distributor.

Shipping Damages

If items are damages in transit, please follow the instructions below:

- If a shipment is visibly damaged upon arrival, do not accept it until the person making the delivery has endorsed the bill of lading with statement for the extent of the damage.
- If any damage is found after unpacking, retain all cartons and inner packaging and immediately request an inspection from the carrier.
- Notify the Agilent Customer Contact Center at **1-800-227-9770** about the damaged shipment so that we can make the appropriate sales adjustment and/or provide you with return instructions (Sales order number, product number and quantity damaged will be needed).

Easy Ways To Order

- Phone: **1-800-227-9770** (option 1, 1) in the US and Canada – Mon-Fri, 8AM to 8PM EST
- Fax: **1-302-633-8901** in the US
- Email: **cag_sales-na@agilent.com** in the US and Canada
- Online: **www.agilent.com/chem** in the US and Canada

Payment Options

- In the US, Visa, MasterCard, Discover and American Express are accepted with a minimum order of \$20 (not applicable in all countries).
- Email ePay@agilent.com to make an electronic payment using the ACH/EFT (Automated Clearing House/Electronic Funds Transfer) method.
- Establish a charge account through your Agilent Customer Service Representative or Your Local Agilent sales office. An account number will be assigned to you for charging your purchases. Payment terms are net 30 days from the invoice date. All orders are subject to credit approval.

We will be happy to supply a price quote via, phone, email or fax if you need it in writing.

Warranties

All Agilent Technologies products in this catalog are designed and manufactured to stringent standards under the Agilent quality system registered to ISO 9001. At Agilent, we back every product with a 90-day warranty and a money-back guarantee. If Agilent receives notice of defects during the warranty period. Agilent shall, at its option, either repair or replace products which prove to be defective. If Agilent is unable, within a reasonable time, to repair or replace any product to a condition as warranted, the buyer shall be entitled to a refund of the purchase price upon return of the product to Agilent. The warranty period for each product begins on the day of shipment.

This warranty shall not apply to any defect, failure, or damage caused by improper use or improper or inadequate maintenance or care. This warranty is exclusive and no other warranty, whether written or oral, is expressed or implied. Agilent specifically disclaims the implied warranties of merchantability and fitness for particular purposes. The remedies provided herein are the buyer's sole and exclusive remedies. In no event shall Agilent be liable for direct, indirect, special, incidental, or consequential damages (including loss of profits) whether based on contract, tort, or any other legal theory.













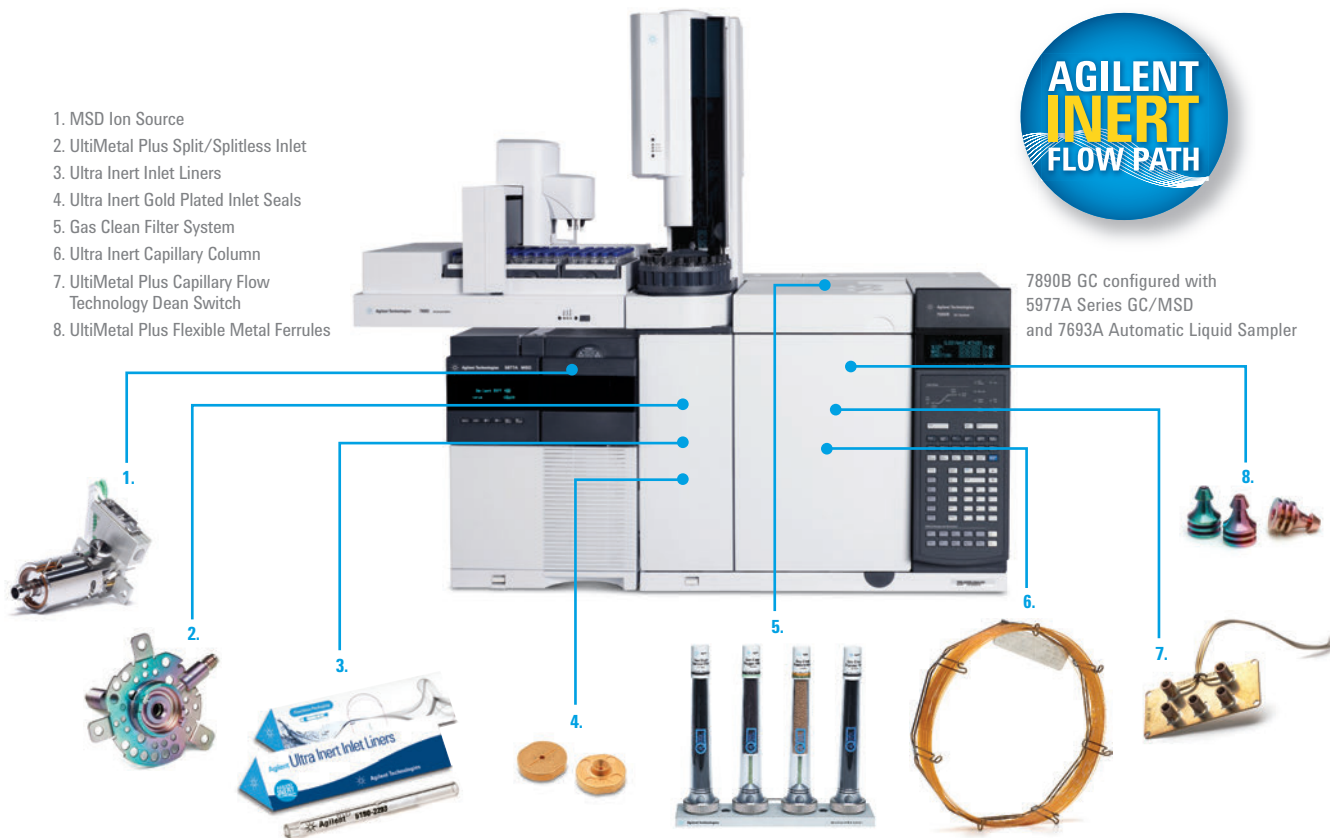
ENSURING AN INERT GC FLOW PATH HAS NEVER BEEN MORE CRITICAL

For labs that need to perform trace level analysis on very active compounds, **Agilent Inert Flow Path solutions** ensure a reliably inert flow path for higher sensitivity, accuracy, and reproducibility. These analyses can now be done with the utmost confidence because each lot of Agilent Inert Flow Path components are qualified using chromatographic QC tests to provide reliable, consistent inertness that spans the entire flow path.

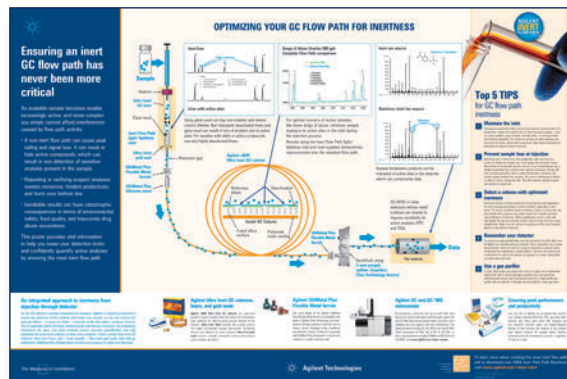
1. MSD Ion Source
2. UltiMetal Plus Split/Splitless Inlet
3. Ultra Inert Inlet Liners
4. Ultra Inert Gold Plated Inlet Seals
5. Gas Clean Filter System
6. Ultra Inert Capillary Column
7. UltiMetal Plus Capillary Flow Technology Dean Switch
8. UltiMetal Plus Flexible Metal Ferrules



7890B GC configured with 5977A Series GC/MSD and 7693A Automatic Liquid Sampler



Learn more about creating an inert flow path, and order the poster at agilent.com/chem/inert



20
15|16

For more information

Buy online:

www.agilent.com/chem/store

Contact us:

www.agilent.com/chem/contactus

This information is subject to change without notice.

© Agilent Technologies, Inc. 2014

Published in December 2014

5991-5213EN



Agilent Technologies

20
15|16

