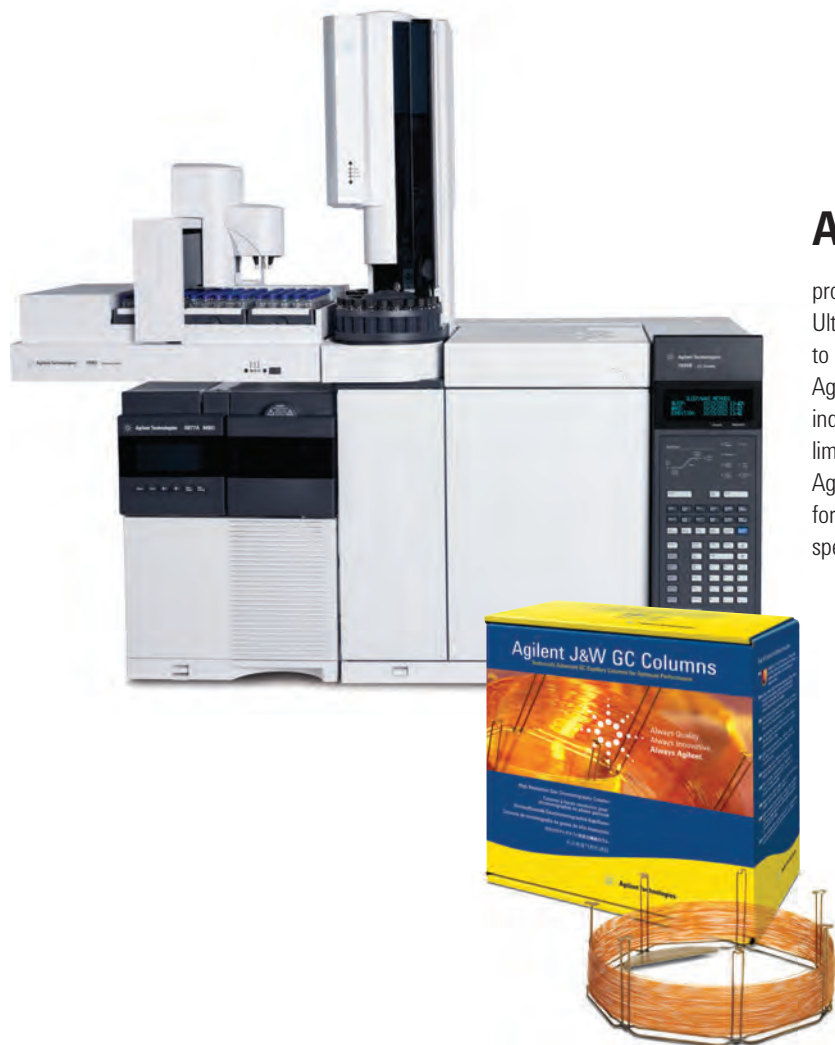




# GC AND GC/MS

## Achieve excellent, reproducible performance for difficult samples

For over 40 years, Agilent has broken new ground with innovations in Gas Chromatography. We continue our leadership tradition by offering the industry's broadest selection of GC and GC/MS columns and supplies. All are manufactured to Agilent's exact specifications to minimize downtime and ensure consistent, high-quality results that you can rely on.



### Agilent Ultra Inert solutions

provide the flow path inertness vital to analytical success. Ultra Inert split and splitless liners are manufactured and tested to our highest level of scrutiny to ensure quality and consistency. Agilent J&W Ultra Inert GC columns are tested with the industry's most demanding test probe to reduce detection limits and produce more accurate data for difficult analytes. Agilent GC and GC/MS instruments bring together all elements for trace-level analysis, dramatically improving MS resolution, spectral integrity, and detection limits.

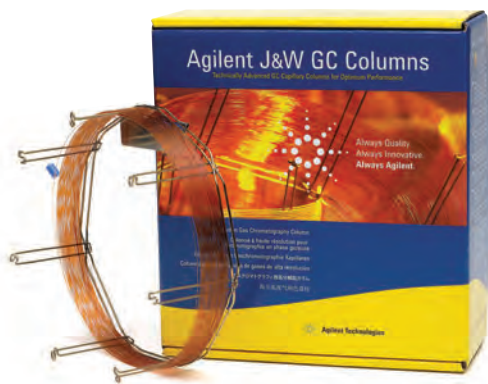


## GC and GC/MS supplies

More samples, lower detection levels, with fewer analysts. These demands challenge laboratories to maximize the productivity and performance of their instrumentation. To help you stay ahead, Agilent is continuously improving our extensive portfolio of innovative, award winning GC columns and supplies, designed to help you resolve many of the day to day setbacks encountered in your lab. You can avoid downtime and your time can be better spent on meeting your analytical and business challenges.

For labs pushing the detection limits of trace level analysis on very active compounds, **Agilent Inert Flow Path solutions** ensure a reliably inert flow path for higher sensitivity, accuracy, and reproducibility. Install industry leading Agilent J&W GC columns with new proprietary design GC column nuts and ferrules to simplify your day yet maximize your GC and GC/MS systems output.

- Inert Flow Path components – Ultra Inert GC columns, Ultra Inert liners, Ultra Inert gold seals, UltiMetal Plus Capillary Flow Technology devices with Flexible Metal ferrules – have Agilent proprietary deactivation chemistries to ensure sample integrity.
- "Better Connectivity" with products such as Self Tightening column nuts, UltiMetal Plus Flexible Metal ferrules, and Ultra Inert liners in Touchless packaging improves productivity with ease of use and convenience.
- Full portfolio of premium GC products to support your lab needs – including Agilent CrossLab brand and Agilent Bulk supplies packaging.



## Agilent J&W GC columns

deliver the best inertness for acids, bases, and mixed functional compounds, the lowest bleed levels, and the tightest column-to-column reproducibility. Mass Spec Grade GC columns (VF-ms, DB-ms and HP-ms) give you robust performance, low column bleed, and a wide range of selectivity. LTM column modules combine a fused silica capillary GC column with heating and temperature-sensing components for efficient column heating and cooling. What's more, integrated guard columns protect your analytical columns from non-volatile compounds in the sample matrix.

# Table of Contents

<b>Agilent Solutions, Services and Support</b> .....	<b>4</b>	Detector Systems .....	<b>92</b>
<b>Featured Products</b> .....	<b>8</b>	Flame Ionization Detector (FID).....	<b>92</b>
<b>Agilent Parts and Supplies</b> .....	<b>14</b>	Electron Capture Detector (ECD) .....	<b>100</b>
GC and GC/MS Maintenance Schedule .....	<b>14</b>	Thermal Conductivity Detector (TCD) .....	<b>103</b>
Bulk GC Supplies .....	<b>16</b>	Flame Photometric Detector (FPD).....	<b>108</b>
Inlet Septa .....	<b>17</b>	Nitrogen Phosphorus Detector (NPD) .....	<b>116</b>
Inlet Liners.....	<b>24</b>	Nitrogen and Sulfur Chemiluminescence Detectors .....	<b>122</b>
Agilent Ultra Inert Liners .....	<b>26</b>	GC Standards .....	<b>124</b>
Capillary Column Ferrules and Nuts .....	<b>34</b>	7820A GC System.....	<b>125</b>
GC Column Connection Supplies .....	<b>40</b>	GC/MS Parts and Supplies .....	<b>141</b>
Capillary Flow Technology Supplies.....	<b>42</b>	MSD Contamination .....	<b>142</b>
Press-fit Capillary Column Connectors .....	<b>44</b>	Ion Source .....	<b>149</b>
Graphpak Capillary Connectors .....	<b>45</b>	MSD Filaments.....	<b>162</b>
Large Valve Oven.....	<b>46</b>	Vent Valve Supplies .....	<b>163</b>
Valves and Loops .....	<b>47</b>	Gas Clean Filters .....	<b>164</b>
Sample Introduction Systems.....	<b>50</b>	Quadrupole Mass Filter.....	<b>164</b>
Agilent Vials and Closures for GC, GC/MS and GC/HS ...	<b>56</b>	MSD Electron Multipliers and Replacement Horn .....	<b>165</b>
Headspace Vials and Closures .....	<b>56</b>	Vacuum Systems and Pumps .....	<b>166</b>
High Performance Septa.....	<b>57</b>	Diffusion Pump.....	<b>168</b>
CombiPAL Headspace Vials and Closures .....	<b>59</b>	Quiet Cover .....	<b>169</b>
Crimping and Decapping Tools .....	<b>60</b>	Foreline Pump.....	<b>170</b>
Teledyne Tekmar Purge and Trap Supplies .....	<b>62</b>	7000 Triple Quadrupole GC/MS .....	<b>171</b>
Markes Thermal Desorption .....	<b>65</b>	7200 Q-TOF for GC/MS.....	<b>175</b>
Inlet Systems .....	<b>67</b>	240-MS Ion Trap Parts and Supplies .....	<b>178</b>
Split/Splitless Inlets.....	<b>69</b>	220-MS Parts and Supplies.....	<b>180</b>
Multimode Inlet.....	<b>76</b>	GC/MS Standards.....	<b>181</b>
Cool On-Column Inlets.....	<b>78</b>	Agilent Syringes .....	<b>183</b>
Programmable Temperature Vaporizer (PTV) Inlets ...	<b>81</b>		
Purged Packed Inlets .....	<b>88</b>		

<b>Agilent CrossLab GC Parts and Supplies</b> .....	<b>192</b>	<b>Applications</b> .....	<b>500</b>
Product Introductions.....	193	Environmental .....	501
Supplies for Bruker, Varian GC Systems.....	206	Hydrocarbons.....	501
Supplies for PerkinElmer GC Systems.....	221	Pesticides and Herbicides.....	506
Supplies for Shimadzu GC Systems.....	227	Semivolatiles.....	532
Supplies for Thermo Scientific GC Systems.....	234	Volatiles .....	544
Supplies for CTC GC Autosamplers .....	239	Air Analysis.....	549
<b>Agilent J&amp;W GC Columns</b> .....	<b>240</b>	Food, Flavor and Fragrance .....	554
Column Selection .....	247	Energy and Fuels.....	576
Column Selection Principles .....	247	Industrial Chemical.....	602
GC Column Application and Method Guides .....	262	Forensic Toxicology and Pharma.....	635
Agilent J&W Ultra Inert GC Columns.....	286	<b>Indices</b> .....	<b>652</b>
Agilent J&W High Efficiency GC Capillary Columns .....	293	<b>Ordering Information</b> .....	<b>684</b>
Low-bleed GC/MS Columns .....	294		
Premium Polysiloxane Columns.....	318		
Polyethylene Glycol (PEG) Columns .....	351		
Specialty Columns .....	362		
PLOT Columns .....	420		
Columns with Non-Bonded Stationary Phases.....	441		
Guard Columns.....	445		
LTM Column Modules .....	447		
Fused Silica Tubing .....	464		
Stainless Steel Tubing.....	469		
Packed GC Columns .....	470		
Custom GC Column Ordering.....	481		
GC Column Test Standards.....	482		
Column Installation and Troubleshooting.....	484		



# PUT MORE THAN 40 YEARS OF RELENTLESS INNOVATION BEHIND YOUR EVERY RESULT

By continually raising the standards for technologies that support your routine analyses, Agilent's R&D efforts have led to breakthroughs such as:

- **New GC columns** that help you achieve higher levels of inertness and column-to-column reproducibility
- **LC column choices** that deliver the sensitivity and reliability you need for demanding applications
- **Cutting-edge sample preparation products** that promote reliable extraction and concentration
- **Fresh atomic and molecular spectroscopy ideas** for identifying and confirming targets and unknowns

Longtime Agilent customers have experienced our commitment firsthand. And now, we look forward to demonstrating how Agilent's approach to relentless innovation can work to your advantage, too.



## CHEMICAL ANALYSIS SOLUTIONS

### Food

From high-volume pesticide screening in food products to rapid identification of pathogens, Agilent understands the analytical needs of food producers, shippers, and regulators. Utilizing our easy-to-use analyzers and updated screening libraries, customers can quickly develop robust and reliable methods. Agilent's leading gas chromatography and mass spectrometry systems are widely regarded as valuable food testing techniques for an array of different analyses.

### Environmental

Agilent offers more than 40 years of environmental testing and regulatory expertise. We help government and private labs with the full range of assays, from routine testing of soils for heavy metals to detection of pharmaceuticals in groundwater, in concentrations down to parts per trillion.

### Energy & Chemicals

Agilent collaborates closely with process industry customers to offer analytical systems that meet their needs for separation, detection, throughput, and support. We'll even preconfigure custom or standard analyzers so they arrive at the lab ready-to-go. From crude oil, natural gas, and refining, to specialty chemicals and alternative fuels, Agilent provides the latest technologies and solutions to increase quality, safety, and profitability for energy and chemical labs, while meeting the industry's stringent quality requirements. Agilent leads the way in ASTM collaborations that have evolved – and will continue to evolve – into industry standards.

### Forensics

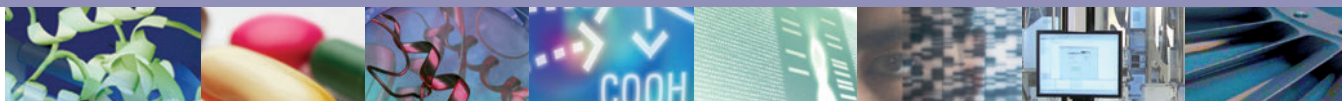
Whether testing for poisons in a forensics investigation, screening athletes for performance enhancing drugs, analyzing samples for recreational drugs, or checking a crime scene for explosive residue – lives and professions may be dependent on the accuracy of your equipment. Agilent Technologies leads the industry with a comprehensive portfolio of workflow solutions that provide the ability to identify, confirm and quantify thousands of substances.

### Lab Informatics

The ways labs capture, analyze and share data profoundly affect their efficiency. Agilent offers a rich, integrated suite of software products built on customer-driven architectural values with the Agilent OpenLAB Software Suite. OpenLAB delivers superior performance and connection across multiple systems, providing open systems integration and investment protection. Our commitment is to deliver more value across each step in the life cycle of scientific data – from data collection and analysis to interpretation and management.

### Materials Science

Agilent offers a newly expanded portfolio of instruments used for the research, manufacturing and testing of advanced materials, from precision optics to pulp and paper. Tools for atomic spectroscopy, molecular spectroscopy, chromatography, and X-ray crystallography all support continuous progress in materials science.



# LIFE SCIENCE SOLUTIONS

## Biopharmaceutical

Biotherapeutics have enormous potential to improve human health, with growing numbers of protein and antibody therapeutics to address unmet medical needs. At every development stage, from disease research to QA/QC and manufacturing, Agilent can help you make the right choices for moving therapeutics to market. We understand the biopharmaceutical workflow so our product families work together seamlessly, as engines of research, discovery, and development. Agilent columns deliver complete characterization of biomolecules using reversed-phase, size exclusion, ion exchange, and affinity chromatography. Our bio-inert supplies ensure that every part of your workflow delivers the performance you need to optimize your bio-separation.

## Pharmaceutical

You need the most efficient processes to evaluate drug candidates, determine efficacy, and ensure safety and compliance during development and manufacture. Agilent has worked with pharma companies for many years to ensure reliability and reproducibility for regulatory compliance, from lab-to-lab and around the world. Our pharma solutions provide high-throughput capability at every stage of the product lifecycle, with automated sample prep, industry-leading U/HPLC systems, the largest family of Fast LC columns, open access LC/MS, spectroscopy, and automated dissolution. A complete family of LC supplies and lamps help optimize every analysis and take day-to-day lab efficiency one step further.

## Proteomics

Research into how large sets of proteins affect the health of an organism requires special sets of analytical tools. Agilent has built a formidable arsenal of liquid chromatograph/mass spectrometers, bioinformatics systems, multiple affinity protein removal columns, and OFFGEL electrophoresis for protein identification and protein biomarker discovery. Accurate-Mass mass spectrometry and the microfluidic HPLC-Chip/MS are two Agilent innovations speeding the work of proteomics researchers around the globe.

## Metabolomics

Collections of small molecules are increasingly being seen as rich sources of biomarkers, but studying metabolites presents many challenges. The need for speed, accuracy, and powerful interpretation capabilities in looking at chemical profile snapshots is underscored because molecules are constantly entering, leaving or changing within the metabolome. Agilent's GC, LC, and MS portfolios, along with our excellent bioinformatics offerings, user-customizable METLIN metabolite database for LC/MS, and the industry's first commercial GC/MS retention time locked metabolite library align well with the needs of metabolomics researchers.

## Genomics

Agilent is a global leader in microarrays, scanners, and NGS reagents used in a wide variety of genomic-based disease research experiments. Our SureSelect and HaloPlex Target Enrichment Systems dominate the category, streamlining next generation sequencing studies. Agilent offers a wide range of catalog CGH and gene expression microarrays and a highly-developed capability to produce custom arrays using our free online design tool, SureDesign. All Agilent microarrays feature highly sensitive, selective 60-mer probes, and, with as many as eight arrays printed on a slide, the cost per sample is cost-efficient.

## Life Science Informatics

Mirroring its extensive instrument portfolio, Agilent offers the industry's most extensive suite of bioinformatics software, helping users derive knowledge from complex genomic, proteomic, metabolomic and other biological data. SureCall and CytoGenomics software analyzes NGS and aCGH data and the GeneSpring suite provides multi-omic analysis and visualization capabilities to help compare complex datasets to explore biological questions from multiple perspectives. The GeneSpring suite includes the GX module for microarray-based gene expression and genotyping data, the PA module for Pathway Analysis and multi-omic analysis and the MPP software, which analyzes mass spec data from proteomics and metabolomics experiments.

## Lab Automation

To meet the skyrocketing demand for more throughput and automation, Agilent has substantially expanded its lab automation offerings. The Agilent line of liquid handlers and microplate processors are designed to streamline high-volume life science workflows. Agilent is also continually upgrading its advanced autosamplers for LC, GC, LC/MS and GC/MS, adding functionality and speed to reflect the performance of its advanced instruments.

## Vacuum Technology

Agilent works with customers to solve vacuum challenges from experiments in high-energy physics to developing systems for nanotechnology. Agilent manufactures vacuum systems used in its own mass spectrometry instruments as well as those of other manufacturers. Agilent's vacuum technology has been proven by the most powerful physics experiment ever built, CERN's Big Bang machine, which was used in the discovery of the Higgs boson.



### Get the Agilent Service Guarantee

Should your instrument require service while covered by an Agilent Advantage service agreement, we guarantee repair or we will replace your instrument for free.

No other company offers this level of commitment to keep your lab up and running at peak efficiency.

## Agilent Service and Support for Instrument Systems

### Focus on what you do best

For over 40 years, Agilent has been building and maintaining the instruments you count on to stay competitive and successful. Trust us to protect your investment with a broad portfolio of services, backed by a global network of experienced service professionals dedicated to the productivity of your lab.

### Agilent Advantage Service Plans

#### The best service available for your Agilent instruments

Agilent offers a flexible range of service plans so that you can choose the level of coverage that is best for your lab.

- **Agilent Advantage Gold** – Priority-one coverage for ultimate uptime and productivity
- **Agilent Advantage Silver** – Comprehensive coverage for dependable laboratory operations
- **Agilent Advantage Bronze** – Total repair coverage at a fixed annual price
- **Agilent Repair Service** – Basic coverage for reliable instrument repair

Agilent Advantage service plans include Agilent Remote Advisor for real-time remote monitoring and diagnostics. Through secure internet connections, you can interact with Agilent service professionals, receive detailed asset reports, and configure text or email alerts to notify you before problems occur – helping you to maximize instrument uptime and optimize laboratory workflows.

And for Agilent-quality service on analytical instruments from other leading manufacturers, Agilent CrossLab services offer the same quality coverage you have come to expect from the expert Agilent engineers you know and trust.



Laboratory decision makers and users ranked Agilent as their first choice for general laboratory compliance services.

### Agilent Compliance Services

#### Equipment qualification that meets the most stringent requirements

Enterprise Edition Compliance was developed to streamline qualification delivery compliance across your entire lab. Used worldwide in regulated labs, including standards organizations and regulatory agencies, Enterprise Edition enables you to:

- Improve qualification efficiency by harmonizing protocols across platforms to ensure greater efficiency and minimize regulatory risk
- Standardize your entire compliance operation with robust test designs that work with all your instruments
- Add, remove or reconfigure tests based upon your unique user requirements
- Reduce staff review time significantly with consistently formatted, computer generated, tamper-proof reports



## Agilent Education and Consulting Services

### Our best minds, working for you

Make the most of your instrument with training and consulting from the same experts who designed the instruments, software and processes you use every day.

- Classroom, online, and on-site training in instrument operation, troubleshooting and maintenance
- Customized consulting services to meet your lab's unique needs

### The Agilent Value Promise – 10 Years of Guaranteed Value

In addition to continually evolving products, we offer something else unique to the industry – our 10-year value promise guarantee. The Agilent Value Promise guarantees you at least 10 years of instrument use from your date of purchase, or we will credit you with the residual value of the system toward an upgraded model. Not only does Agilent ensure a reliable purchase now, but we also ensure that your investment is just as valuable in the future.

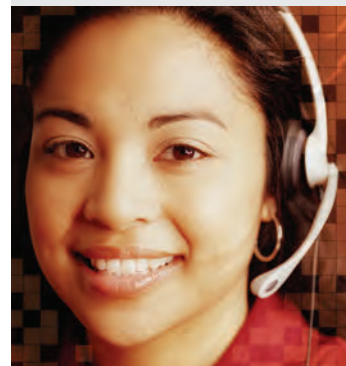
For more detailed information, please go to [www.agilent.com/chem/services](http://www.agilent.com/chem/services) or contact your local Agilent Services and Support representative.



## Technical Support at work for you

Have a hardware, software, application, instrument repair or troubleshooting question? Agilent's technical experts are available to answer your questions. With years of laboratory experience, our technical support specialists can provide in-depth knowledge and experience.

For questions pertaining to supplies found in this catalog, contact your local Agilent office or Authorized Agilent Distributor or visit [www.agilent.com/chem/techsupport](http://www.agilent.com/chem/techsupport)



## Need more information?

Visit [www.agilent.com/chem/contactus](http://www.agilent.com/chem/contactus) to:

- Locate your nearest Agilent office or distributor for expert technical support.
- Get fast sales and product assistance by phone. Simply use the scroll-down menu to select your country.
- Receive email assistance using our convenient online forms.

## Agilent GC and GC/MS Systems

Achieve the highest level of Productivity and Performance

The industry leader in Gas Chromatography

### The Agilent 7890B GC

Gives you everything you need to take your lab to the next level of performance, including advanced separation capabilities and powerful productivity tools.



### The Agilent 7820A GC

An affordable, high-quality solution for small- to medium-sized labs that require routine analyses using standard GC methods.

### The Agilent 6850 Series II GC

An excellent choice for any laboratory where bench space, ease of use, and independent channel flexibility are important.



### The Agilent 7697A Headspace Sampler

The new 7697A Headspace Sampler from Agilent uses advanced designs based on our industry-leading gas chromatography architecture.

**The broadest selection of GC and GC/MS systems, support, and supplies in the industry**

**The Agilent 490 Micro GC and 490-PRO**



The right GC solution if you want the ability to measure anywhere, and get the results you need in seconds.

**The customer-proven worldwide bestseller, Agilent 5977 Series GC/MSD**

**5977A GC/MSD**



Superior performance, reliability, and productivity with industry-leading 7890B GC.

**5975T LTM GC/MSD**



Compact, transportable GC/MS with fast, lab-quality performance.

**5977E GC/MSD**



Affordable GC/MSD with economical 7820 GC.

More GC/MS/MS choices to suit your applications and budgets



### Agilent 7010 Triple Quadrupole GC/MS

For laboratories preparing to measure tomorrow's regulated levels today, the 7010 Triple Quadrupole GC/MS delivers uncompromising results. It is well suited for high-volume labs that cannot afford downtime for routine maintenance.

### Agilent 7000C Triple Quadrupole GC/MS – EASILY UPGRADABLE!

The most precise, reliable choice for laboratories that need a cost-effective, proven solution to meet today's LODs.



## Your choice for exceptional qualitative analysis, Agilent 7200 Q-TOF GC/MS

The world's first Q-TOF GC/MS combines the proven separation power of Agilent's 7890B GC with the high detection selectivity and accurate mass information of a TOF analyzer.



Customized to get you  
on the **FAST TRACK**



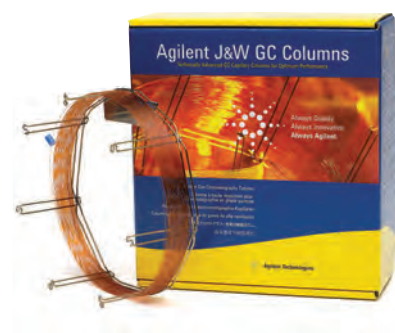
### Agilent Analyzers and Application Kits

Bringing a new application online can stretch your lab to the limit. Agilent GC, Micro GC, GC/MS, and GC/MS/MS analyzers are factory preconfigured and pre-tested to get you up and running in the shortest possible time.

## Agilent Gas Clean Filters

The Agilent Gas Clean Filter System provides enhanced gas quality for maximum productivity. Clean gases reduce the risk of column damage, sensitivity loss, and instrument downtime. Oxygen, hydrocarbons and moisture can cause loss of sensitivity and accuracy of the GC, and damage your column and consumables. Inserting a Gas Clean Filter System in the gas line immediately before the instrument inlet greatly reduces the level of impurities and helps you detect any problems before they occur.

Turn to page 164.



## Ultra Inert GC Columns

The Agilent J&W Ultra Inert GC column family pushes industry standards for consistent column inertness and exceptionally low column bleed, resulting in lower detection limits and more accurate data for difficult analytes. And, each column is tested with the most demanding Ultra Inert test probe mixture in the industry, and an individual performance summary sheet is shipped with each column.

Turn to page 286.

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.

## Ultra Inert Liners

Agilent Ultra Inert Inlet liners provide a robust, reproducible and reliable inert flow path, even when containing wool. These liners are rigorously tested and certified to ensure exceptional batch-to-batch uniformity, low bleed and superior coverage, even with highly active compounds.

Turn to page 26.



## Bulk GC Supplies

Ideal for high-usage laboratories, Agilent bulk gas chromatography supplies provide the high quality and consistency of Agilent chromatography supplies in convenient and economical packaging.

Turn to page 16.

# Agilent CrossLab

## Agilent CrossLab GC Supplies

CrossLab is a growing portfolio of supplies critical to instrument performance and productivity, regardless of the instrument manufacturer. They are backed by our risk-free, compatibility warranty for your confidence, not compromise. In the unlikely event of a problem, we guarantee:

- 90-day refund on supplies
- A technical support consultation
- Free instrument repair or service if required

CrossLab is more than supplies:

- Over 40 years of chromatography expertise
- The right supplies for both routine and challenging applications
- Hassle-free operations and reproducible results
- High-quality products manufactured to Agilent standards
- Technical and application support
- Dependable worldwide availability and delivery
- Convenience of consolidating purchasing
- 90-day risk-free money back guarantee

### Confidence not Compromise

You've come to expect the highest quality from Agilent. Now we offer you that same confidence and quality in our CrossLab supplies, designed for other major brand instruments in your lab.

As further evidence of our confidence in these products, Agilent Services choose CrossLab supplies to service all major instrument brands.

**With CrossLab, Agilent stands behind you, your instruments and your laboratory.**



Agilent CrossLab GC supports instruments from Bruker/Varian, CTC, PerkinElmer, Thermo, Shimadzu, and more. The comprehensive range includes premium non-stick inlet septa, Ultra Inert inlet liners, liner O-rings, column ferrules and nuts, autosampler syringes, and vials and closures.

**Turn to page 192.**

# Agilent Parts and Supplies

## GC and GC/MS Maintenance Schedule

Item	Typical Schedule	Actions/Comments
<b>Gas Management</b>		
Gas purifiers (carrier gas and detector gas)	Every 6 to 12 months	Replacement schedule is based on capacity and grade of gas. In general, replace non-indicating traps every 6 to 12 months or when indicating traps start to change color.
Internal split vent trap	Every 6 months*	Replace to prevent material backing up into EPC control and to avoid costly repair.
External split vent trap	Every 6 months*	Replace to prevent sample analytes from escaping into the laboratory environment.
Flow meter calibration	Every 1 to 2 years	Re-calibrate electronic flow meters – follow recommended schedule for the unit (shown on the calibration certificate).
<b>Sample Introduction and Inlets</b>		
Syringes and/or syringe needles	Every 3 months*	Replace syringe if dirt is noticeable in the syringe, if it cannot be cleaned, if the plunger doesn't slide easily, or if clogged. Replace needle if septa wear is abnormal or the needle becomes clogged.
Inlet liner	Weekly*	Check often. Replace when dirt is visible in the liner or if chromatography is degraded.
Liner O-rings	Monthly*	Replace with every liner change.
Inlet septum	Daily*	Check often. Replace when signs of deterioration are visible (gaping holes, fragments in inlet liner, poor chromatography, low column pressure, etc.)
Inlet hardware	Every 6 months Every year	Check for leaks and clean. Check parts and replace when parts are worn, scratched, or broken.
Inlet gold or stainless steel seal	Monthly*	For highest level of reproducibility, change inlet seal with every liner change, but minimally replace monthly or when scratched, corroded, or if there is build-up of non-volatile sample components.

\*Schedule is an approximation of average usage requirements. Frequency may vary widely based upon application and sample type.

(Continued)





**GC and GC/MS Maintenance Schedule**

<b>Item</b>	<b>Typical Schedule</b>	<b>Actions/Comments</b>
<b>Columns</b>		
Front-end maintenance	Weekly-monthly*	Remove 1/2 to 1 m from the front of the column when experiencing chromatographic problems (peak tailing, decreased sensitivity, retention time changes, etc.). Replace inlet liner and septum, and clean inlet as necessary. Guard column may be useful for increasing column lifetime.
Solvent rinse	As needed	Perform when chromatography degradation is due to column contamination. Only for bonded and cross-linked phases.
Replacement	As needed	Replace when trimming and/or solvent rinsing no longer restore chromatographic performance.
Ferrules	As needed	Replace when changing columns and inlet/detector parts.
<b>Detectors</b>		
FID/NPD jets and collector	As needed	Clean when deposits are present. Replace when they become scratched, bent, or damaged, or when having difficulty lighting FID or keeping flame lit.
NPD bead	As needed	Replace when signal drifts or there is a dramatic change in sensitivity.
FID	Every 6 months	Measure hydrogen, air, and makeup gas flows.
TCD	As needed	Thermally clean by "baking out" when a wandering baseline, increased noise, or a change in response is present. Replace when thermal cleaning does not resolve the problem.
ECD	Every 6 months or as needed	Wipe test. Thermally clean by "baking out" when baseline is noisy, or the output value is abnormally high. Replace when thermal cleaning does not resolve the problem.
FPD	Every 6 months or as needed	Measure hydrogen, air, and makeup gas flows. Clean/replace FPD windows and seals when detector sensitivity is reduced.
NCD and SCD	Every 3 months*	Change pump oil, oil coalescing filter and chemical trap.
<b>Mass Selective Detectors</b>		
Tune MSD	As needed	Keep plenty of PFTBA (p/n 05971-60571) on hand.
Check the calibration vial	Every 6 months	Vial can be refilled without venting the system.
Replace the foreline pump oil	Every 6 months	Check the fluid weekly. Change when the fluid becomes discolored or every 6 months.
Replace the diffusion pump fluid	Every year or as needed	Check the fluid weekly. Too little fluid will cause the pump to run at a higher temperature, resulting in degradation and loss of high vacuum. Change when the fluid is discolored or contains particulates.
Clean the ion source	As needed	Clean when performance deteriorates to remove contamination and to restore the electrostatic properties of the ion lens system. Replace scratched parts to maintain optimal performance.

\*Schedule is an approximation of average usage requirements. Frequency may vary widely based upon application and sample type.

## Bulk GC Supplies

Ideal for high usage laboratories, our bulk supplies provide the quality and consistency of Agilent chromatography supplies in convenient and economical packaging. We currently offer Agilent inlet liners, septa, gold inlet seals, and liner O-rings in bulk packaging.

- Economical and convenient packaging
- Overall cost of ownership reduced
- Same great quality Agilent products



Single taper splitless liner, no wool, 5190-2270



Ultra Inert gold plated seal and washer, 5190-6144



Liner O-rings, 5190-2269



Non-stick BTO septa, 5190-3157

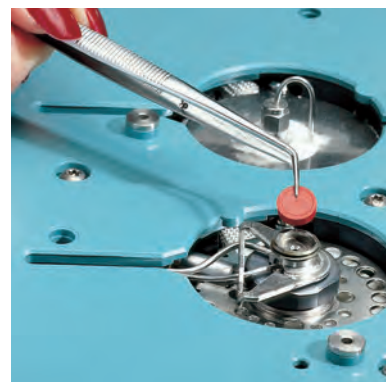
### Bulk GC Supplies

Description	Unit	Part No.
<b>Ultra Inert Liners</b>		
Ultra Inert liner, low pressure drop, glass wool	100/pk	5190-3173
Ultra Inert splitless liner, single taper, no wool	100/pk	5190-3170
Ultra Inert splitless liner, single taper, glass wool	100/pk	5190-3171
Ultra Inert split liner, straight, glass wool	100/pk	5190-3172
<b>Liners</b>		
Single taper split liner, low pressure drop	100/pk	5190-2275
Single taper splitless liner, no wool	100/pk	5190-2270
Single taper splitless liner, glass wool	100/pk	5190-2271
Double taper splitless liner, no wool	100/pk	5190-2272
<b>Seals</b>		
Ultra Inert gold plated seal, includes washer	50/pk	5190-6149
Certified gold plated seal kit, includes washer	10/pk	5190-2209
<b>O-Rings</b>		
Non-stick fluorocarbon O-ring for Flip Top	100/pk	5190-2268
Certified non-stick fluorocarbon O-ring	100/pk	5190-2269
<b>Septa</b>		
Non-stick BTO septa, 11 mm	400/pk	5190-3157
Non-stick Advanced Green septa, 11 mm	400/pk	5190-3158

## Inlet Septa

Septa are available for a variety of different applications and have different upper temperature limits. Lower temperature septa are usually softer, seal better, and can withstand more punctures (injections) than their high-temperature counterparts. If septa are used above their recommended temperatures, they can leak or decompose, causing sample loss, lower column flow, decreased column life, and ghosting. To minimize problems:

- Use within the recommended temperature range
- Change regularly
- Install the retainer nut "finger tight"
- Use septum purge when available
- Use autoinjectors
- Use sharp syringe needles



## Premium Non-Stick Septa

Agilent premium non-stick inlet septa are designed and manufactured to provide a reliable non-contaminating seal. Our tri-fold blister pack ensures that each septum remains clean and ready to use.

- Proprietary plasma treatment prevents sticking and unnecessary inlet cleaning
- Innovative blister packaging keeps each septum clean and ready for use
- Center point guides the needle for easy penetration, less coring and longer life
- Precision molding assures accurate fit in the inlet
- Each batch is tested for bleed on Agilent 7890 GC-FID
- Premium formulations selected for sealing and chromatographic cleanliness
- No need to bake septa before using



Inlet Septa

### Summary of Premium Inlet Septum Characteristics

Septum Type	Bleed	Lifetime	Temperature Limits
Non-Stick BTO (Bleed and Temperature Optimized)	✓✓✓	✓	to 400 °C injection port temp
Non-Stick Advanced Green	✓✓	✓✓	to 350 °C
Non-Stick Long-Life	✓	✓✓✓	to 350 °C

✓✓✓ = best    ✓✓ = very good    ✓ = good

### TIPS & TOOLS

Need inlet septa for your non-Agilent instruments? Check the Agilent CrossLab septa starting on page 199.





Inlet Septa

## Non-Stick Bleed and Temperature Optimized (BTO) Septa

- Extended temperature range, lowest bleed
- Maximum injection port temperature 400 °C
- Plasma treatment eliminates sticking in the injection port
- Pre-conditioned; ready to use
- Blister packaging for cleanliness and convenience
- Ideal for use with low-bleed, "Mass Spec" capillary columns

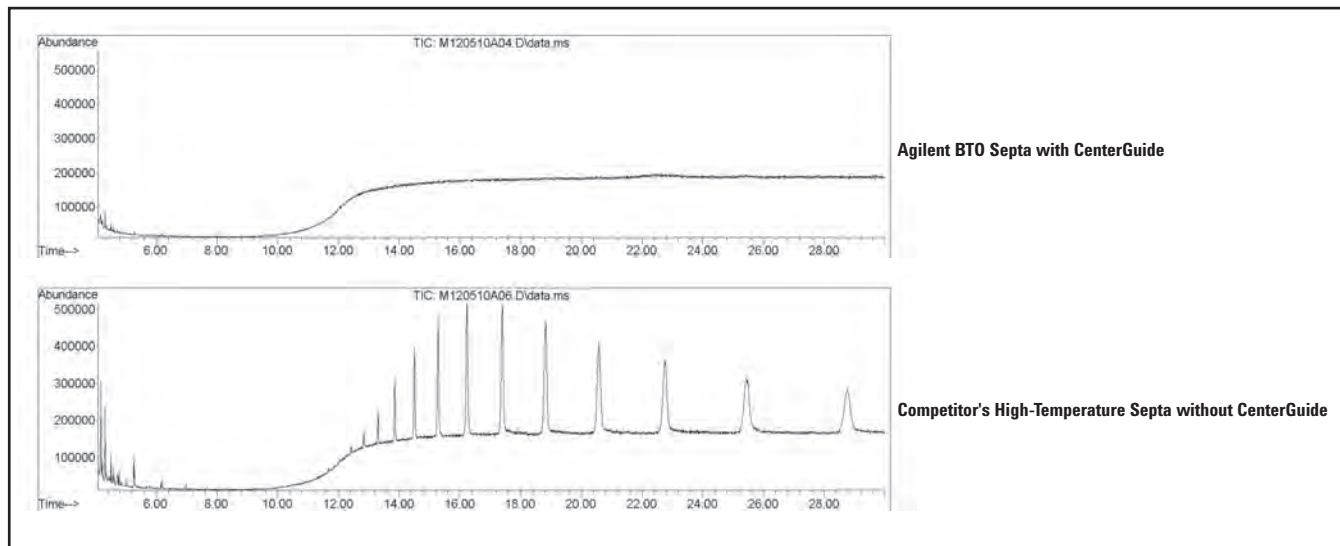


BTO septa, 5183-4757

### Non-Stick Bleed and Temperature Optimized (BTO) Septa

Description	Unit	Part No.
Non-stick bleed and temperature optimized (BTO) septa, 11 mm	50/pk	5183-4757
Non-stick bleed and temperature optimized (BTO) septa, 11 mm	100/pk	5183-4757-100
Non-stick bleed and temperature optimized (BTO) septa, 11 mm	400/pk	5190-3157
5 mm septa through-hole for on-column, in glass jar	50/pk	5183-4758

### Comparison of septum purity: TIC profile of isooctane extractions



## Non-Stick Advanced Green Septa

- True long-life, high temperature green septa
- More injections per septum
- Plasma treatment eliminates sticking in the injection port
- Maximum injection port temperature 350 °C
- High-performance alternative to competitors' "green" septa
- Blister packaging for cleanliness and convenience

### Non-Stick Advanced Green Septa

Description	Unit	Part No.
11 mm septa	50/pk	5183-4759
11 mm septa	100/pk	5183-4759-100
11 mm septa	400/pk	5190-3158
5 mm septa through-hole for on-column, in glass jar	50/pk	5183-4760



Advanced green septa, 5183-4759

## Non-Stick Long-Life Septa

- The preferred septa for autosamplers
- Pre-pierced for extended life and reduced coring
- Ideal for overnight runs
- Up to 400 injections per septum
- Plasma treatment eliminates sticking
- Maximum injection port temperature 350 °C
- Soft, 45 durometer, easy on autosampler needles
- Blister packaging for cleanliness and convenience

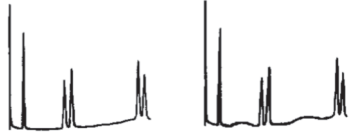

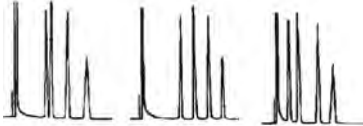
### Non-Stick Long-Life Septa

Description	Unit	Part No.
Non-stick long-life septa, 11 mm	50/pk	5183-4761
Non-stick long-life septa, 11 mm	100/pk	5183-4761-100
5 mm septa through-hole for on-column, in glass jar	50/pk	5183-4762



Long-life septa, 5183-4761

**Septa Troubleshooting**

Symptom	Possible Causes	Remedy
<p>Extra Peaks/Humps</p> 	<p>Septum bleed</p>	<p>Turn off injector heater. If extra peaks disappear, use septum specified for higher temperature or analyze at lower inlet temperature.</p>
<p>Baseline Change After Large Peak</p> 	<p>Large leak at septum during injection and for a short time thereafter (common with large diameter needles)</p>	<p>Replace septum and use smaller diameter needles.</p>
<p>Retention Times Prolonged</p> 	<p>Carrier gas leaks at septum or column connection</p>	<p>Check for leaks. Replace septum or tighten connections if necessary.</p>



## General Purpose Septa

Agilent's general purpose septa are made from an enhanced injection-molded silicone rubber. The septa material, gray in color, is specified to withstand over 200 automatic injections at an injection port temperature of 350 °C.

### General Purpose Septa

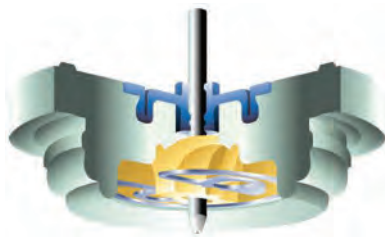
Description	Unit	Part No.
11 mm septa	50/pk	5080-8896-50
11 mm septa	100/pk	5080-8894-100
9.5 mm (3/8 in) septa*	50/pk	5080-8728-50
9.5 mm (3/8 in) septa*	100/pk	5080-8728-100
5 mm through-hole septa for on-column inlets, automatic or manual injections**	25/pk	5181-1260
5 mm septa for high column backpressure, on-column inlets**	25/pk	5181-1261

\*For 5700 series and 5830/40 GCs

\*\*5 mm septa are packaged in glass jars



General purpose gray septa



## Merlin Microseal

- Low bleed, longer life alternative to standard septa for split/splitless injection and SPME
- Requires 23-gauge syringe needle
- Has a lifetime of more than 2000 injections, depending on samples and operating conditions
- Greatly reduced instrument downtime for septa changes and injection port liner changes due to septa particulates
- Two distinct sealing mechanisms: double O-ring type seal around the syringe needle and spring assisted duckbill to seal the injection port
- Temperature range 50-400 °C

### Merlin Microseal

Description	Part No.
Merlin Microseal SPME replacement seal, 23-gauge, 1/pk	392609902
<b>General Purpose Merlin Microseal (3-100 psi)</b>	
Merlin Microseal starter kit, general purpose Includes Microseal septum and nut	5182-3442
Merlin Microseal general purpose replacement septum 3-100 psi	5182-3444
Merlin Microseal high pressure nut	5182-3445
High sample volume septum kit Contains general purpose Merlin Microseal, six 23-gauge syringes, 500 vials and caps	5181-8839
<b>Low Pressure Merlin Microseal (1-45 psi)</b>	
Merlin Microseal kit, low pressure Includes nut and septum	5181-8816
Merlin Microseal kit, low pressure Includes nut and 2 septa	5181-8833
Merlin Microseal low pressure replacement septum	5181-8815
Microseal PTFE nut liners, 2/pk	5182-0853

(Continued)



**Merlin Microseal**

Description	Part No.
<b>For Bruker/Varian GCs*</b>	
Merlin Microseal SPME kit, 1079 23-gauge, 1/pk	392609901
Merlin Microseal adapter kit for 1177 inlets Contains adapter, nut and general purpose Merlin Microseal septum	392609903
<b>Syringes for Merlin Microseal</b>	
Autosampler syringe, Gold Standard, 5 µL, 23-gauge	9301-0892
Autosampler syringe, Gold Standard plunger, 10 µL, 23-gauge	9301-0713
Autosampler syringe, Blue Line, 5 µL, 23-gauge	G4513-80213
Autosampler syringe, Blue Line, 10 µL, 23-gauge	G4513-80209

\*Varian GC systems are now Bruker products

**TIPS & TOOLS**

Agilent Blue Line autosampler syringes are specifically designed to support the higher productivity features of the 7693A ALS, while increasing plunger life and reducing costly downtime. Learn more at [www.agilent.com/chem/BlueLineSyringes](http://www.agilent.com/chem/BlueLineSyringes)





## Inlet Liners

Injection port liners have a variety of features to help vaporize the sample so that a true representation of the sample enters the column. Additionally, Agilent liners are individually packaged to maintain cleanliness until used. The part number and lot are silk screened on the liner for quality control and user convenience, and lot tracking is available for quality assurance.

## Liner Dimensions Driven by Inlet Operation

Well-controlled glass dimensions promote better liner-to-liner consistency, ensuring GC system accuracy and reproducibility. That is why Agilent liners are made to the following precise tolerances:

### Outer Diameter (OD)

- Larger od liners fit tightly to improve analyte recovery and limit sample migration onto the inlet's metal surface. Ideal for splitless injection.
- Smaller od liners are less resistant to carrier and split flow inside the inlet. Best for split injection.

### Internal Diameter (ID)

- Ensures that the sample vapor is small enough to fit within the volume of the liner.
- Prevents backflash, sample loss into the septum purge, and split lines – all of which can lower reproducibility and sensitivity.

## TIPS & TOOLS

### Clearly Better Inertness

Confidently quantify active analytes with industry leading Inert Flow Path solutions



- Agilent industry leading GC/MS instruments
- Ultra Inert columns
- Ultra Inert liners

To learn more and order your free poster, visit [www.agilent.com/chem/inert](http://www.agilent.com/chem/inert)

## Length

- Regulates internal volume and ensures proper sealing between the septum and the inlet seal.
- Precise glass bumps on the bottom of the liner allow you to repeatably position the liner relative to the inlet bottom. This is especially critical if you install liners by measuring the distance from the O-ring to the top of the liner.

## Tapers

None	Bottom Tapers	Dual Tapers
<ul style="list-style-type: none"> <li>• Straight tubes used in split injection with autosamplers</li> </ul>	<ul style="list-style-type: none"> <li>• Directs sample onto head of column and limits analyte exposure to bottom of inlet</li> <li>• Minimizes decomposition and discrimination</li> </ul>	<ul style="list-style-type: none"> <li>• Contain sample within glass liner limiting contact with metal inlet surface</li> <li>• Thought to limit loss through septum purge</li> </ul>

## Glass Wool

- Less molecular weight discrimination
- Provides additional surface area for sample vaporization, increasing reproducibility
- Serves as a trap for non-volatiles

For split liners, Agilent specifies the placement of glass wool in the liner so that the syringe penetrates the glass wool, wiping the syringe, to provide the most repeatable results with Agilent autosampler and split/splitless inlet design thermal profile.

Agilent Ultra Inert deactivated liners are recommended for samples with active analytes – such as phenols, amines, organic acids, pesticides and drugs of abuse – that could be irreversibly adsorbed on active surfaces in the inlet.

## Deactivation

Developed for your high sensitivity analyses, Ultra Inert deactivation provides extreme surface inertness – even for liners containing glass wool. Agilent Original deactivation is recommended for your everyday analyses. With use, even deactivated liners become active. Replace the liner regularly.

### TIPS & TOOLS

Tight control of liner dimensions is critical to reproducibility of GC results.





## Agilent Ultra Inert Liners

### Ensure a reliably inert flow path – with or without glass wool

Whether you are analyzing difficult, active environmental samples or screening for drugs of abuse, our Ultra Inert Inlet liners help ensure an inert GC flow path for higher sensitivity, accuracy, and reproducibility, especially at trace levels.

For samples that contain active or labile compounds, labs typically use liners without wool to prevent degradation or loss of active analytes. However, with Agilent Ultra Inert deactivation, liners with wool are recommended for no loss of sensitivity. The benefits provided by wool, such as homogeneous sample mixing and vaporation, non-volatile residue trapping, and column and detector protection, are gained without compromising detection of active analytes. Plus, Ultra Inert liners are more stable than liners with other deactivations, as shown on the following page. More samples can be analyzed before inlet or column maintenance is required when using Ultra Inert liners with wool.



### Certified performance

Each deactivation lot is certified to ensure efficient, consistent coverage using both acidic and basic probes at trace (2 ng) levels on-column. In addition, every liner is packaged with a Performance Certificate that you can peel and stick into your lab notebook for quick compliance reference.

**Easy traceability:** The deactivation lot number is printed directly on the Performance Certificate; the liner lot number and part number are permanently etched on glass.

## Unequaled manufacturing and quality control deliver best-in-class liner deactivation performance

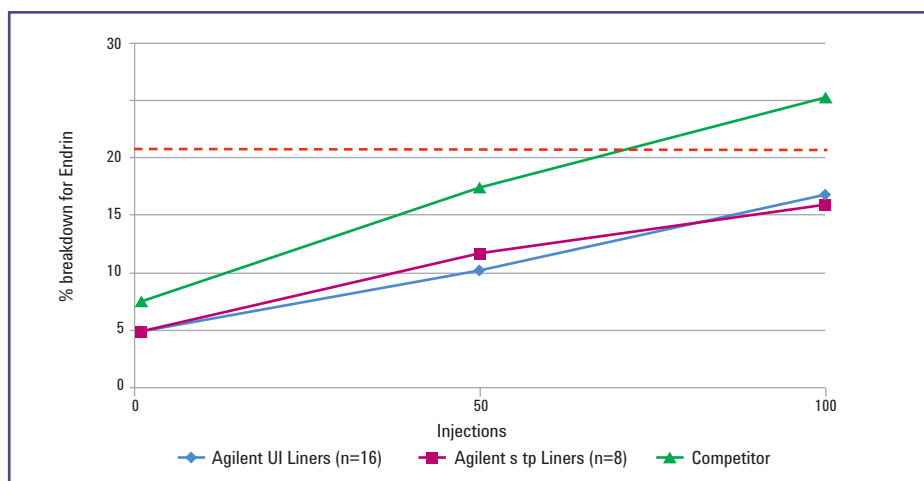
Agilent's proprietary manufacturing process produces Ultra Inert liners that are rigorously tested and certified to ensure exceptional batch-to-batch uniformity, low (to no) bleed or background contamination, and superior coverage – even with highly active compounds. This rigorous process includes:

- Lot testing to ensure reproducible deactivation coverage – and the stability of deactivation over time
- QC testing with probes specifically chosen to reveal activity
- A GC method that tests liner (not column or system) inertness
- The elimination of contamination – a common side effect of manufacturing and packaging



## Touchless packaging – an Agilent exclusive – eliminates O-ring hassles

Ultra Inert Inlet liners are delivered in pharmaceutical-grade PTEG tubing approved by GC/MS extraction testing. But what really sets Agilent's packaging apart is a pre-installed O-ring that has been pre-cleaned, conditioned, and non-stick plasma treated. This unique touchless packaging allows you to quickly and easily install the new liner without searching for and installing the O-ring – saving time and improving productivity, without the risk of contamination from touching.



Agilent Ultra Inert Liners with wool are superior vs. the competition as shown in this endrin breakdown comparison.

To learn more about creating the most inert flow path, visit [www.agilent.com/chem/inert](http://www.agilent.com/chem/inert)



Single taper, Ultra Inert liner with glass wool, 5190-2293



Agilent Ultra Inert Liners

## Agilent Ultra Inert Liners

Agilent Ultra Inert liners are the perfect companion to Agilent J&W Ultra Inert GC columns. They provide reproducible inertness liner after liner, maintained through a sequence of samples, and for a range of analytes. Agilent's Ultra Inert liners were developed – and are manufactured and certified – using a suite of tests specifically designed to ensure batch-to-batch uniformity.

- Exceptional batch-to-batch liner uniformity
- Low to no bleed or background contamination
- Superior coverage, allowing use of glass wool even with highly active compounds

Only Ultra Inert liners are delivered in Agilent's exclusive touchless packaging with a pre-cleaned, conditioned and non-stick plasma treated O-ring pre-installed. Touchless packaging aids in removal of the old liner, and easy installation of the new, clean, preconditioned liner – without risk of contamination from touching.



### Agilent Ultra Inert Liners

Description	Volume (µL)	ID (mm)	1/pk	5/pk	25/pk	100/pk*
<b>Split Inlet Liners</b>						
Low pressure drop, Ultra Inert Liner with glass wool	870	4	5190-2295	5190-3165	5190-3169	5190-3173
Straight, Ultra Inert Liner with glass wool	990	4	5190-2294	5190-3164	5190-3168	5190-3172
<b>Splitless Inlet Liners</b>						
Single taper, Ultra Inert Liner	900	4	5190-2292	5190-3162	5190-3166	5190-3170
Single taper, Ultra Inert Liner with glass wool	900	4	5190-2293	5190-3163	5190-3167	5190-3171
Splitless, double taper Ultra Inert Liner, no wool	800	4	5190-3983	5190-4007		
Dimpled, splitless, Ultra Inert Liner	200	2	5190-2297	5190-4006		
Splitless, straight, Ultra Inert Liner	250	2	5190-6168			
Straight, Ultra Inert Liner	60	1	5190-4047			
Straight Ultra Inert Liner for SPME	35	0.75	5190-4048			

\*The 100/pk is not in the Touchless packaging. O-rings must be purchased separately, p/n 5190-2269.

### TIPS & TOOLS



#### Ultra Inert gold seals prevent active sites from ruining your analysis

Unlike traditional machined seals, Agilent Ultra Inert gold inlet seals are manufactured using metal injection molding, followed by gold plating to ensure a smooth, consistent surface. We then apply our Ultra Inert chemistry on the gold to produce a leak-free seal that reduces active analyte adsorption.

Turn to page 67 for ordering information.

## Agilent Original Deactivation Split Liners

Agilent single taper split liners are made to strict dimension specifications for optimal inlet performance and feature the tightest tolerances for od, id, taper, and glass wool placement. For ease-of-use and reproducibility, some liners have a positioning bead, a restriction to secure the position of the glass wool, and a feature to consistently self-position to the recommended height. The liners also feature Agilent's Original proprietary deactivation.

### Agilent Original Deactivation Split Liners

Description	Volume (µL)	ID (mm)	1/pk	5/pk	25/pk	100/pk
<b>Single Taper Split Liners</b>						
Single taper, glass wool, deactivated, low pressure drop	870	4	5183-4647	5183-4701	5183-4702	5190-2275
Single taper, glass wool, deactivated	870	4	5183-4711	5183-4712	5183-4713	
<b>Straight Split Liners</b>						
Straight, glass wool, non-deactivated	990	4	19251-60540	5183-4691	5183-4692	
<b>Focus Liners</b>						
Deactivated with glass wool	935	4		210-4004-5		
Tapered, deactivated with glass wool	880	4		210-4022-5		

### TIPS & TOOLS

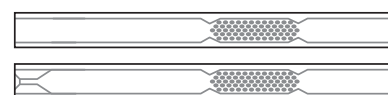
Agilent recommends part number 5190-2295 as the top split liner, and for splitless injection UI part number 5190-2293



Single taper split liner, 5183-4647, 5183-4711



Straight split liner, 19251-60540



Focus liners, 210-4004-5, 210-4022-5



View the Touchless Packaging demonstration video at [www.agilent.com/chem/touchless](http://www.agilent.com/chem/touchless)

### TIPS & TOOLS

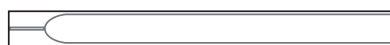
To learn more about our comprehensive portfolio of Agilent CrossLab GC supplies – including our Agilent CrossLab original deactivation liners – go to [www.agilent.com/chem/CrossLab](http://www.agilent.com/chem/CrossLab)



## Agilent Original Deactivation Splitless Liners

### Agilent Original Deactivation Splitless Liners

Description	Volume (μL)	ID (mm)	1/pk	5/pk	25/pk	100/pk
<b>Single Taper Splitless Liners</b>						
Single taper, deactivated	900	4	5181-3316	5183-4695	5183-4696	5190-2270
Single taper, inert	900	4	5181-3316i			
Single taper, glass wool, deactivated	900	4	5062-3587	5183-4693	5183-4694	5190-2271
<b>Double Taper Splitless Liners</b>						
Double taper, deactivated	800	4	5181-3315	5183-4705	5183-4706	5190-2272
<b>Straight Splitless Liners</b>						
Straight, deactivated, quartz	250	2	5181-8818	5183-4703	5183-4704	
Straight, non-deactivated, quartz	250	2	18740-80220	5183-4707	5183-4708	
Straight, non-deactivated	990	4	210-3003	210-3003-5		
<b>Direct Inlet Liners</b>						
Straight, non-deactivated (for gas samples, headspace, or purge & trap)	140	1.5	18740-80200	5183-4709	5183-4710	



Single taper splitless liner, 5181-3316, 5181-3316i



Single taper, glass wool splitless liner, 5062-3587



Double taper splitless liner, 5181-3315



Straight, non-deactivated, quartz splitless liner, 18740-80220, 5181-8818



Straight, non-deactivated splitless liner, 210-3003



Direct inject liner, 18740-80200

### TIPS & TOOLS



Need inlet liners and O-rings for your non-Agilent instruments? Check out the Agilent CrossLab inlet liners.

Turn to page 193.

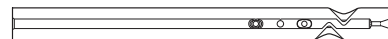
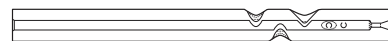




# Agilent Specialty Injection Liners

## Agilent Specialty Injection Liners

Description	Volume (µL)	ID (mm)	1/pk	5/pk	25/pk
<b>MultiMode Inlet Heavy Matrix</b>					
<b>Dimpled</b>					
Dimpled splitless single taper, deactivated	200	2	5190-2296		
<b>Ultra Inert Deactivated Dimpled Liners</b>					
Dimpled, splitless, Ultra Inert Liner	200	2	5190-2297	5190-4006	
<b>Manual Injection</b>					
Straight split liner with cup, glass wool, and packing, 18740-60840	800	4	18740-60840	5183-4697	5183-4698
<b>SPME</b>					
SPME, deactivated	70	0.75	5188-6471		
SPME, Ultra Inert deactivation	70	0.75	5190-4048		
<b>Volatiles</b>					
Volatiles Organic Analysis liner	60	1	5190-4047		



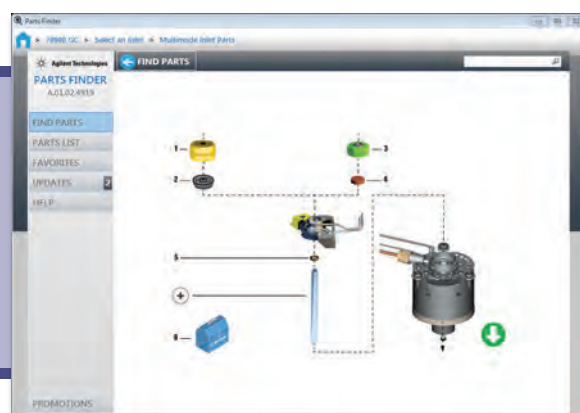
Single taper dimpled splitless liner, 5190-2296, 5190-2297



Straight split liner with cup, glass wool, and packing, 18740-60840

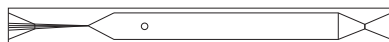
### TIPS & TOOLS

With Agilent Parts Finder quickly locate replacement parts for your Agilent instruments. Finding and ordering a part is as simple as clicking on an instrument model, clicking to locate the part, adding the part to a parts list, and printing the list for easy ordering – go to [www.agilent.com/chem/go2partsfinder](http://www.agilent.com/chem/go2partsfinder)





Single taper direct connect liner, G1544-80730



Dual taper direct connect liner, G1544-80700

**Direct Connect**

Description	ID (mm)	Part No.
<b>Direct Connect</b>		
Direct column connect	4	G1544-80730
Dual taper direct connect liner, splitless, Agilent proprietary deactivation	4	G1544-80700
Single taper direct connect liner, splitless, deactivated, inert	4	G1544-80731

**Programmed Temperature Vaporization (PTV) Liners**

Description	Volume (µL)	ID (mm)	Part No.
<b>PTV Liners</b>			
PTV liner, single baffle, glass wool, deactivated	180	2	5183-2038
PTV liner, single baffle, deactivated	200	2	5183-2036
PTV liner, multi baffled, deactivated	150	1.8	5183-2037
PTV liner, sintered glass, deactivated	112	1.5	5190-1426
<b>Liners for High Temperature PTV Inlet, G3506A</b>			
PTV liner, high temperature, quartz	713	3.4	5188-5313
PTV liner, high temperature, borosilicate	668	3.4	5188-5356

## Liner O-Rings

- Liners are sealed in the inlet with O-rings or graphite seals
- Graphite seals are used when inlet temperatures exceed 350 °C
- Fluorocarbon O-ring seals are easier to replace than graphite that deforms and flakes apart

Only Agilent fluorocarbon liner O-rings are:

- Pre-cleaned, then conditioned to eliminate out-gassing of contaminants, which is especially important for trace, ECD and MSD analyses
- Plasma treated for a non-stick, contaminant-free surface that won't stick to the inlet metal surface
- Packaged for convenience and cleanliness in a novel dial package that delivers 1 clean O-ring at a time



Liner O-rings, 5188-5365

### Liner O-Rings

Description	Unit	Part No.
Certified non-stick fluorocarbon O-ring	10/pk	5188-5365
	100/pk	5190-2269
Graphite O-ring for splitless liner	10/pk	5180-4173
Graphite O-ring for split liner	10/pk	5180-4168
Non-stick fluorocarbon liner O-ring for Flip Top	10/pk	5188-5366
	100/pk	5190-2268
High temperature PTV inlet liner fluorocarbon O-ring	10/pk	5188-5311



Non-stick fluorocarbon liner O-ring for Flip Top, 5188-5366



### TIPS & TOOLS

Agilent's Ultra Inert GC liners are delivered in Touchless packaging with a certified, non-stick O-ring pre-installed.

**Turn to page 28.**



## Capillary Column Ferrules and Nuts

Using the wrong ferrule or a worn-out ferrule to seal your column connection can result in inconsistent and unreliable chromatography. An improper ferrule can cause leaks, which allow air and other contaminants to enter the instrument through the column seal, causing major interference with column and detector performance.

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

To minimize problems, follow these general techniques for ferrule installation:

- Don't overtighten – finger tighten the column nut, then use wrench to tighten
- Maintain cleanliness
- Bake out ferrules prior to use (polyimide and polyimide/graphite only)
- Avoid contamination, such as fingerprint oils
- Inspect used ferrules with magnifier for cracks, chips, or other damage before reusing them
- Change ferrules when new columns or injector/detector parts are installed

### TIPS & TOOLS



Use Self Tightening column nuts with graphite/polyimide ferrules to provide a leak-free column connection, without the risk of overtightening.

Turn to page 40.



Self Tightening column nut

**Ferrule Selection Recommendations**

<b>Ferrule Type</b>	<b>Upper Temp. Limit</b>	<b>Usages</b>	<b>Advantages</b>	<b>Limitations</b>
Graphite (100%)	450 °C	<ul style="list-style-type: none"> <li>• General purpose for capillary columns</li> <li>• Suitable for FID and NPD</li> <li>• Recommended for high temperature and cool on-column applications</li> </ul>	<ul style="list-style-type: none"> <li>• Easy-to-use stable seal</li> <li>• Higher temperature limit</li> <li>• Can be removed easily</li> </ul>	<ul style="list-style-type: none"> <li>• Not for MS or oxygen-sensitive detectors</li> <li>• Soft, easily deformed or destroyed</li> <li>• Possible system contamination</li> </ul>
Polyimide/graphite (85%/15%)	350 °C	<ul style="list-style-type: none"> <li>• General purpose for capillary columns</li> <li>• Recommended for MS and oxygen-sensitive detectors</li> <li>• Most reliable leak-free connection</li> </ul>	<ul style="list-style-type: none"> <li>• Mechanically robust</li> <li>• Long lifetime</li> </ul>	<ul style="list-style-type: none"> <li>• Not reusable</li> <li>• Flows at elevated temperature</li> <li>• Must re-tighten frequently</li> </ul>
Polyimide (100%)	280 °C	<ul style="list-style-type: none"> <li>• Isothermal operation</li> <li>• Can be reused or removed easily</li> <li>• Excellent sealing material when making metal or glass connections</li> </ul>	<ul style="list-style-type: none"> <li>• Mechanically robust</li> <li>• Long lifetime</li> <li>• Can be reused or removed easily</li> </ul>	<ul style="list-style-type: none"> <li>• Leaks after temperature cycle</li> <li>• Flows at elevated temperature</li> <li>• Must re-tighten frequently</li> </ul>
UltiMetal Plus Flexible Metal Ferrules	450 °C	<ul style="list-style-type: none"> <li>• Designed for Capillary Flow Technology fittings</li> <li>• Compatible with Agilent inlet and detector fittings</li> <li>• Suitable with MS interface using the swaging nut G2855-20555</li> </ul>	<ul style="list-style-type: none"> <li>• Inert surface</li> <li>• Robust seal</li> <li>• Pre-swaged for precise height into fitting</li> </ul>	<ul style="list-style-type: none"> <li>• Overtightening of stainless steel nut can damage fitting</li> </ul>

**TIPS & TOOLS**

Look for the following signals that indicate ferrule damage:

- Background noise from oxygen diffusing into the system
- Column bleed catalyzed by oxygen
- Sample degradation
- Sample loss
- Increase in detector signal/noise
- Poor retention time reproducibility



## Short and Long Ferrules

### Short Ferrules (height 3 mm)



Polyimide/graphite ferrules, 5181-3323



Universal column nut, 5181-8830

Standard fitting for Agilent GC inlet and detectors (FID, NPD, ECD) column connections use short ferrules and the Universal nut

### Long Ferrules (height 3.6 mm)



Pre-conditioned long ferrule for MSD connection, 5062-3508



MS interface column nut, 05988-20066

Pre-conditioned graphite/polyimide ferrules are recommended with MSD Interface nut



Column nut for long or long two-hole ferrules, 05921-21170

Alternative nut for Agilent standard inlet or detector fittings used with long graphite/polyimide ferrules

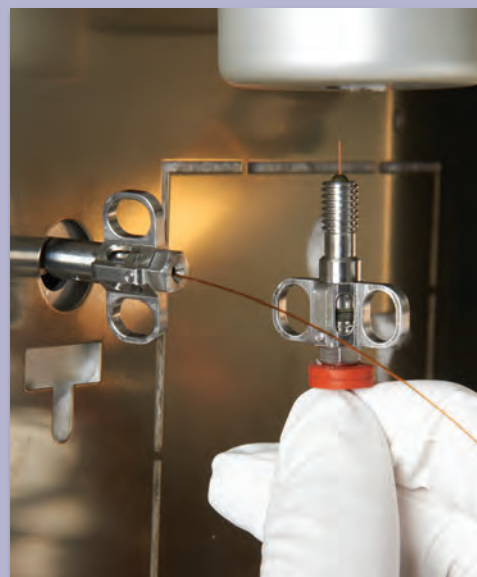
### TIPS & TOOLS

#### Agilent's Self Tightening column nut eliminates the need for retightening once and for all

This unique, self tightening stainless steel GC column nut delivers a tight connection – without expensive upgrades or adapters – and gives you the advantages of:

- Reliable performance
- Less wasted time
- Ease of use
- Faster maintenance

Learn how to install a column using the Self Tightening column nut, visit [www.agilent.com/chem/STnut](http://www.agilent.com/chem/STnut)



**Capillary Column Ferrules – for use with most brands of column, including DB, HP, CP, VF and Select columns**

Column ID (mm)	Ferrule Nom ID	UltiMetal Plus Flexible Metal Ferrule Part No.	Graphite Short Ferrule Part No.	Polyimide Short Ferrule Part No.	85% Polyimide/15% Graphite Short Ferrule Part No.	Pre-Conditioned Long Ferrule 85% Polyimide/15% Graphite for MSD connection Part No.
0.025-0.05	0.4		500-2114	5062-3515	5062-3516	5062-3507
0.075	0.4		500-2114	5062-3515	5062-3516	5062-3507
0.1-0.25	0.4	G3188-27501	500-2114	5181-3322	5181-3323	5062-3508
0.1-0.25*	0.5		5080-8853	5062-3513	5062-3514	5062-3508
0.32	0.5	G3188-27502	5080-8853	5062-3513	5062-3514	5062-3506
0.45	0.8	G3188-27503	500-2118	5062-3511	5062-3512	5062-3538
0.53	0.8	G3188-27503	500-2118	5062-3511	5062-3512	5062-3538

\*FactorFour, CP and VF brand columns made prior to 2013 have a larger od and require a 0.5 mm ferrule. The column test chromatogram confirms the ferrule size needed.

**Specialty Application Capillary Column Ferrules**

Column ID (mm)	Ferrule Nom ID	UltiMetal Plus Flexible Metal Ferrule Part No.	Graphite Short Ferrule Part No.	Polyimide Short Ferrule Part No.	85% Polyimide/15% Graphite Short Ferrule Part No.	Pre-Conditioned Long Ferrule 85% Polyimide/15% Graphite for MSD Part No.
0.32 CP-SilicaPLOT	0.8		500-2118	5062-3511	5062-3512	5062-3538
0.25 and 0.32 UltiMetal Plus column tubing		G3188-27505				
0.53 UltiMetal Plus column tubing		G3188-27506				
No hole					5190-4054	5181-3308

For additional capillary column ferrule selection, please refer to our CrossLab portfolio. **Turn to page 195.**



UltiMetal Plus Flexible Metal ferrules, G3188-27501



Polyimide ferrule, 5181-3322



Polyimide/graphite ferrules, 5181-3323



Graphite ferrules, 5080-8853



Polyimide/graphite ferrule, 5062-3514

**Recommended MS Interface Connections**

Description	Part No.
<b>Recommended</b>	
<b>Nut</b>	
Self Tightening column nut, for MS interface	5190-5233
<b>Ferrule</b>	
250 µm Polyimide/graphite ferrule, 10/pk	5181-3323
320 µm Polyimide/graphite ferrule, 10/pk	5062-3514
<b>Tools</b>	
MS interface column installation tool	G1099-20030
Column installation tool for 5975T	G3880-20030
<b>Traditional</b>	
<b>Nut</b>	
MS interface column nut, female	05988-20066
<b>Ferrule</b>	
0.4 mm Polyimide/graphite ferrule, 10/pk	5062-3508
0.5 mm Polyimide/graphite ferrule, 10/pk	5062-3506
<b>Tools</b>	
MS interface column installation tool	G1099-20030
Column installation tool for 5975T	G3880-20030
<b>Alternative</b>	
<b>Nut</b>	
Swaging nut, for MS interface with Flexible Metal ferrules	G2855-20555
<b>Ferrule</b>	
UltiMetal Plus Flexible Metal ferrule with 0.4 mm id, 10/pk	G3188-27501
UltiMetal Plus Flexible Metal ferrule with 0.5 mm id, 10/pk	G3188-27502
<b>Tools</b>	
Ferrule pre-swaging tool	G2855-60200

**TIPS & TOOLS**

**Tips and tricks for making better connections...**



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





## Recommended Inlet Connections

Description	Part No.
<b>Recommended</b>	
<b>Nut</b>	
Self Tightening column nut, for inlet/detector	5190-6194
<b>Ferrule</b>	
250 µm Polyimide/graphite ferrule, 10/pk	5181-3323
320 µm Polyimide/graphite ferrule, 10/pk	5062-3514
<b>Tools</b>	
Column installation pre-swaging tool, graphite ferrules	G3440-80217
<b>Traditional</b>	
<b>Nut</b>	
Universal column nut, 2/pk	5181-8830
<b>Ferrule</b>	
250 µm Polyimide/graphite ferrule, 10/pk	5181-3323
320 µm Polyimide/graphite ferrule, 10/pk	5062-3514
<b>Tools</b>	
Column installation pre-swaging tool, graphite ferrules	G3440-80217
<b>Inert Flow Path</b>	
<b>Nut</b>	
Column nut for long or long two-hole ferrules	05921-21170
<b>Ferrule</b>	
UltiMetal Plus Flexible Metal ferrule with 0.4 mm id, 10/pk	G3188-27501
UltiMetal Plus Flexible Metal ferrule with 0.5 mm id, 10/pk	G3188-27502
<b>Tools</b>	
Column installation pre-swaging tool, metal ferrules	G3440-80218



### TIPS & TOOLS

Ensuring an inert GC flow path has never been more critical. Access IFP resources here:  
[www.agilent.com/chem/inertflowpath](http://www.agilent.com/chem/inertflowpath)



## GC Column Connection Supplies

The correct tools and supplies make proper GC column installation easier and ensure consistent, robust, leak-free connections and reliable results.

New Self Tightening column nuts have a unique, stainless steel design that delivers a tight connection – without expensive upgrades or adapters. An innovative spring-driven piston continuously presses against the short graphite/polyimide ferrule – maintaining a leak-free seal even after hundreds of injections. It is especially well suited for oxygen sensitive detectors, such as mass spec and ECD.



Self Tightening column nut



Self Tightening column nut, for MS interface, 5190-5233



Universal column nut, 5181-8830



MS interface column nut, 05988-20066



Column installation pre-swaging tool, metal ferrules, G3440-80218



Column installation pre-swaging tool, graphite ferrules, G3440-80217

### Column Nuts

Description	Part No.
<b>Short Nuts</b>	
Self Tightening column nut, for MS interface	5190-5233
Self Tightening column nut, for inlet/detector	5190-6194
Universal column nut, 1/16 in hex, 2/pk	5181-8830
Finger tight column nut for 530 µm columns*	5020-8293
Finger tight column nut for 320 µm columns and smaller*	5020-8292
Blanking plug, finger tight style	5020-8294
6850 column nut, 2/pk	5183-4732
Extended column nut, VI inlet	G3504-20504
High Temperature SimDis PTV inlet, 4 mm hex	5188-5312
<b>Long Nuts</b>	
MS interface column nut, female	05988-20066
Column nut for long or long two-hole ferrules	05921-21170
<b>Accessories</b>	
Swaging nut, for MS interface with Flexible Metal ferrules	G2855-20555
Open end wrench, 1/4 and 5/16 in	8710-0510
Column installation pre-swaging tool, metal ferrules	G3440-80218
Column installation pre-swaging tool, graphite ferrules	G3440-80217

\*For use with graphite ferrules only

### Specialty Ferrules, 85% Polyimide/15% Graphite

Ferrule ID (mm)	Column ID (mm)	Unit	Part No.
<b>Two Hole</b>			
0.5	0.1	10/pk	5181-3388
0.5	0.10, 0.20, 0.25	10/pk	5062-3580
0.5	0.32	10/pk	5062-3581
<b>No Hole</b>			
Capillary column long ferrule		10/pk	5181-3308
Capillary column short ferrule		10/pk	5190-4054
<b>High Temperature PTV Inlet SS/Graphite</b>			
0.4	0.32	10/pk	5188-5315
0.4	0.53	10/pk	5188-5314

**Straight Ferrules**

Description	Unit	Part No.
1/4 in PTFE	10/pk	0100-1378
1/4 in Graphite	10/pk	0100-1324
1/8 in PTFE	10/pk	0100-1365
1/8 in Graphite	10/pk	0100-1325
1/8 in 85% Polyimide/15% graphite	10/pk	0100-1332
1/16 in PTFE	10/pk	0100-1375
1/16 in Graphite	10/pk	0100-1326
1/16 in VG-2 Polyimide/40% graphite	10/pk	0100-1379
1/4 in 85% Polyimide/15% graphite	10/pk	0100-1331



1/8 in 85% Polyimide/15% graphite, 0100-1332

**Reducing Ferrules**

Description	Unit	Part No.
1/8 to 1/16 in Polyimide	10/pk	0100-1342
1/8 to 1/16 in VG-1 Polyimide, 15% graphite	10/pk	0100-1344
1/16 in to 0.4 mm VG-2 Polyimide, 40% graphite	10/pk	0100-1381

**Ferrules for LTM Rapid Heating/Cooling System**

Description	Original Design (5/pk)	2010+ Ultimate Union (10/pk)
For use with 0.25-0.4 mm id LTM columns	5190-1437	G3188-27501
For use with 0.4-0.5 mm id LTM columns	5190-1438	G3188-27502
For use with 0.5-0.8 mm id LTM columns	5190-1439	G3188-27503



UltiMetal Plus Flexible Metal ferrules, G3188-27501

**Ferrules and Nuts for NCD and SCD**

Description	Part No.
Spare column nut and ferrule kit	G6600-80018

## Capillary Flow Technology Supplies

Agilent offers a family of GC accessories based on our proprietary Capillary Flow Technology. These accessories increase system productivity and performance:

- Deans switch device simplifies the analysis of complex samples
- Purged Effluent Splitter for inert, leak-free column effluent splitting



Ultimate Union

### Ultimate Union

The Ultimate Union is part of Agilent's Capillary Flow Technology family, providing extremely low dead volume column connections. Like the QuickSwap, Deans Switch and Purged Effluent Splitter, the Ultimate Union uses special fittings and SilTite ferrules to create an inert, leak-free and robust seal that doesn't need re-tightening after temperature cycles.

Each Agilent Ultimate Union kit contains:

- 1 Union (your choice of UltiMetal Plus deactivated, or non-deactivated)
- 1 Oven wall clip
- 2 Internal nuts, p/n G2855-20530
- 1 Swaging nut, p/n G2855-20555
- 1 5/pk of UltiMetal Plus Flexible Metal ferrules for 0.25 mm column

#### Ultimate Union Kits, Fittings and Ferrules

Description	Part No.
Ultimate union kit, deactivated	G3182-61580
Ultimate union kit, non-deactivated	G3182-61581



#### TIPS & TOOLS

UltiMetal Plus ferrules can be used to install columns in the Split/Splitless inlet using the long column nut, p/n 05921-21170

## Fittings, Ferrules and Supplies

For leak-free, low dead volume and inert column connections with capillary flow accessories, such as the Deans Switch or QuickSwap MS Interface, use SilTite ferrules and specified nuts. For Capillary Flow devices, use deactivated fused silica tubing. Do not use tubing that has been coated with stationary phase.

### Fittings, Ferrules and Supplies

Description	Unit	Part No.
Internal nut		G2855-20530
Swaging nut, for MS interface with Flexible Metal ferrules		G2855-20555
Tee, inert		G3184-60065
Column storage fitting		G2855-20590
UltiMetal Plus Flexible Metal ferrule with 0.4 mm id	10/pk	G3188-27501
UltiMetal Plus Flexible Metal ferrule with 0.5 mm id	10/pk	G3188-27502
UltiMetal Plus Flexible Metal ferrule with 0.8 mm id	10/pk	G3188-27503
Ferrule pre-swaging tool		G2855-60200

### Column/Retention Gap Installation Supplies

Description	Part No.
250 µm retention gap, one 5 m piece	160-2255-5
320 µm retention gap, one 5 m piece	160-2325-5
530 µm retention gap, 5 m length	160-2535-5
Fused silica, deactivated, 0.15 mm x 1 m	160-2625-1
Fused silica, deactivated, 0.15 mm x 5 m	160-2625-5
Fused silica, deactivated, 0.15 mm x 10 m	160-2625-10



Internal nut, G2855-20530



Swaging nut, G2855-20555



Tee, inert, G3184-60065



UltiMetal Plus Flexible Metal ferrules, G3188-27501



Ferrule pre-swaging tool, G2855-60200

## Press-fit Capillary Column Connectors

In the past it was necessary to use press-fit connectors with specific dimensions to connect columns of those dimensions. Modern press-fit connectors are "laser-milled" to provide highly reproducible taper angles throughout the length of the press-fit, ensuring an excellent seal. Agilent's Press-fit capillary column connectors are treated with Agilent Ultra Inert deactivation to provide a robust and inert flow path.



Ultra Inert universal press fit connector, 5190-6979



Ultra Inert universal press fit Y-splitter, 5190-6980

### Ultra Inert Press-fit Column Connectors

Description	Unit	Part No.
Ultra Inert universal press fit connector	10/pk	5190-6979
Ultra Inert universal press fit Y-splitter		5190-6980

# Graphpak Capillary Connectors

## Graphpak Capillary Column Connectors (2.5 mm)\*

Column ID (mm)	Connector ID (mm)	Part No.
<b>Capillary Detector Port Connector</b>		
0.32/0.25	0.4	5021-7166
0.53	0.7	5021-7164
<b>Capillary Divider for Simultaneous Sampling</b>		
0.32/0.25	0.53	5021-7148
0.53	0.7	5021-7146
<b>Capillary Injection Port Connector</b>		
0.2	0.3	5021-7169
0.32/0.25	0.4	5021-7170
0.53	0.7	5021-7168

\*The 2.5 mm Graphpak is not compatible with the Graphpak 2M used for the PTV.

**Note:** Order ferrules in addition to the connector to fit your column. Ferrules must be ordered separately.

## Ferrules for Connectors

Column ID (mm)	ID (mm)	Unit	Part No.
0.2	0.3	10/pk	5021-7136
0.32/0.25	0.4	10/pk	5021-7137
0.53	0.7	10/pk	5021-7134
Graphpak plug ferrule		10/pk	5021-7133
Replacement Graphpak column nut		5/pk	5062-3525



Graphpak connector for Agilent capillary detectors



Graphpak divider for simultaneous sampling



Capillary injection port connector, 5021-7170



## Large Valve Oven

The Agilent Large Valve Oven (LVO) for GC is a versatile, high capacity external oven, which can be configured to support complex, multi-valve GC applications. The LVO supports several standard Agilent multi-valve Analyzers such as RGA and NGA, and is also available as a highly customizable option on the 7890B GC. Precisely engineered for thermal isolation from the GC oven, the LVO provides a homogeneous isothermal environment for up to six columns and/or valves, and convenient open-access for maintenance, adjustment or customization. Accessibility, capacity and thermal uniformity make the Agilent LVO a premium GC valving option, especially suited to support the rising trend of combining multiple complex analysis on a single GC platform.

For more information please visit [agilent.com/chem/largevalveoven](http://agilent.com/chem/largevalveoven)



# Valves and Loops

## Gas Sampling General Purpose Valves

Description	Part No.
6-port replacement valve WE series, 400 psi, 225 °C	5062-9508
6-port replacement valve WE series, Hastelloy C, 400 psi, 225 °C	5062-9509
10-port replacement valve WE series, 400 psi, 225 °C	5062-9510
10-port replacement valve WE series, Hastelloy C, 400 psi, 225 °C	5062-9511
6-port replacement valve WT series, 300 psi, 350 °C	0101-0584
10-port replacement valve WT series, 300 psi, 350 °C	0101-0585
4-port replacement valve WE series, 400 psi, 225 °C	0101-0946
4-port replacement valve WT series, 300 psi, 350 °C	0101-0947
14-port replacement valve UWE series, Hastelloy C, 400 psi, 225 °C	0101-1472
14-port replacement valve UWE series, 400 psi, 225 °C	0101-1473
4-port replacement valve WE series, Hastelloy C, 400 psi, 225 °C	5062-3519



General purpose gas sampling valves

## Liquid Sampling General Purpose Valves

Description	Part No.
0.2 µL replacement valve UWP series, 1,000 psi, 75 °C	0101-0636
0.5 µL replacement valve UWP series, 1,000 psi, 75 °C	0101-0637
1.0 µL replacement valve UWP series, 1,000 psi, 75 °C	0101-0638
0.5 µL replacement valve UWP series, 5,000 psi, 75 °C	0101-0639



General purpose liquid sampling valves

## Replacement Rotors for Gas Sampling Valves

Description	Part No.
6-port replacement rotor WE series, 400 psi, 225 °C	5181-7459
10-port replacement rotor WE series, 400 psi, 225 °C	5181-7460
6-port valve, replacement rotor, WT series, 300 psi, 350 °C	1535-4952
10-port replacement rotor WT series, 300 psi, 350 °C	1535-4954
4-port replacement rotor WE series, 400 psi, 225 °C	5190-6981
14-port replacement rotor UWE series, 400 psi, 225 °C	5190-6982



Front ferrules, stainless steel, 5181-1292

### Valve Supplies

Description	Part No.
1/16 in stainless steel nut, 10/pk	5181-1291
1/16 in front ferrule, stainless steel, 10/pk	5181-1292
Straight metering valve, 1/16 in, stainless steel, for LSVs as a sample-out restrictor or as a flow-balancer for 10-100 mL/min	0101-0355
Micrometering valve, std temperature, Viton O-ring, 225 °C max, for flow balancing gas flows of 2-175 mL/min	0101-0633
Micrometering valve, Hastelloy C body, Viton O-ring, 225 °C max, for flow balancing gas flows of 2-175 mL/min	G3440-20003
Micrometering valve, high temperature, Kalrez O-ring, 350 °C max, for flow balancing gas flows of 2-175 mL/min	0101-0948
Micrometering valve, UltiMetal + treated body, Viton O-ring, 225 °C max, for flow balancing gas flows of 2-175 mL/min	G3480-60663
Air driven valve actuator for Small Valve Oven (box), short shaft	19325-60660
Air driven valve actuator for Large Valve Oven (box), long shaft	G3507-60660
10-port Actuator limiter	18900-21000
14-port Actuator limiter (for LVO only)	G3480-20002
Angle metering valve, 1/16 in, stainless steel	0101-0403
7 µm gas line filter, 7 µm (filtering element) 1/8 in x 1/8 in connectors Swagelok type gas line filter (stainless steel)	0101-0532
2 µm (filtering screen) 1/8 in x 1/16 in connectors Valco type reducing gas line filter (stainless steel)	0101-1001
2 µm (filtering frit) 1/8 in x 1/16 in connectors Valco type reducing gas line filter (Hastelloy C)	G3440-20008
2 µm replacement 1/8 in frits in Hastelloy C for Valco type reducing gas line filter	G3440-20007

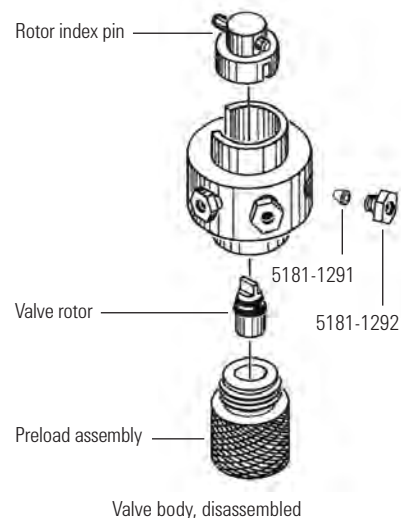
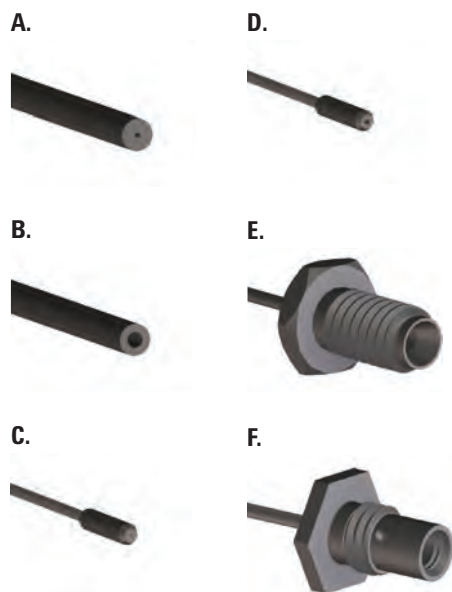
### Valve Loops for GC

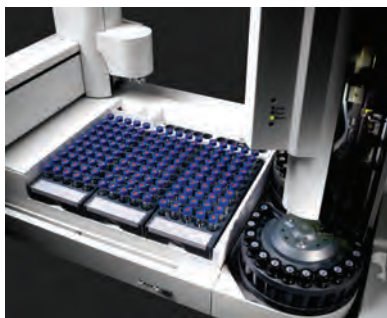
Includes loop, nut and ferrule, 1/16 in

Description	Stainless Steel Part No.	Nickel Part No.	Hastelloy Part No.	UltiMetal Plus Part No.
Sample loop, 0.25 cc	0101-0303	0101-0956		G1540-30024
Sample loop, 0.50 cc	0101-0282	0101-0957	G3440-20005	G1540-30025
Sample loop, 1.00 cc	0101-0299	0101-0954		G1540-30026
Sample loop, 2.00 cc	0101-0300	0101-0955		G1540-30027
Sample loop, 5.00 cc	0101-0301			G1540-30028
Sample loop, 10.00 cc	0101-0302			
Sample loop, 25 µL	0101-0304			
Sample loop, 50 µL	0101-0667			
Sample loop, 100 µL	0101-0666		G3440-20004	

**Valve Tubing Assemblies**

Description	Part No.	Stainless Steel Part No.	UltiMetal Plus Part No.	Nickel Part No.
A. Tube, 1/16 in, 0.010 in x 1000 mm		G3440-20033	G3440-60033	
B. Tube, 1/16 in, 0.031 in x 1000 mm		G3440-20035	G3440-60035	G3440-20037
C. Tube, 1/16 in, 0.010 in x 1000 mm w/adapter (Modified Detector Line)		G3440-60600	G3440-60610	G3440-60620
D. Tube, 1/16 in, 0.031 in x 1000 mm w/adapter (PPI Carrier Line)		G3440-60300	G3440-60310	
E. Tube, 1/16 in, 0.038 in x 975 mm, packed col line w/bulkhead		G3440-60336	G3440-60236	G3440-60136
F. Tube, 1/16 in, 0.010 in x 1000 mm, CPM		G3440-60333	G3440-60233	
Tube, 1/16 in, 0.020 in x 1000 mm, CPM		G3440-60334	G3440-60234	
Swaging nut (for CFT connections)	G2855-20555			
Internal nut (for CFT connections), 0.80 mm id for capillary column connections	G2855-20530			
Internal nut (for CFT connections), 1.65 mm id for 1/16 in tubing connections	G2855-20532			
Nut plate assembly for valve to column connection GC oven mounting (6 Pos.)	05890-80660			
Oven Right Side Nut Plate Assembly (8 Pos.)	G3440-81664			
Oven Left Side Nut Plate Assembly (8 Pos.)	G3440-81665			
UltiMetal Plus Flexible Metal 1/16 in ferrule, for 1/16 in tubing			G3188-20509	
UltiMetal Plus Flexible Metal ferrule with 0.4 mm id, for fused silica tubing 0.1-0.25 mm id, 10/pk			G3188-27501	
UltiMetal Plus Flexible Metal ferrule with 0.5 mm id, for fused silica tubing 0.32 mm id, 10/pk			G3188-27502	
UltiMetal Plus Flexible Metal ferrule with 0.8 mm id, for fused silica tubing 0.53 mm id, 10/pk			G3188-27503	
UltiMetal Plus Flexible Metal ferrule with no hole, 10/pk			G3188-27504	
UltiMetal Plus Flexible Metal ferrule with 0.5 mm id, for 0.25 and 0.32 mm id UltiMetal column tubing, 10/pk			G3188-27505	
UltiMetal Plus Flexible Metal ferrule with 0.8 mm id, for 0.25 mm and 0.32 mm UltiMetal column tubing, 10/pk			G3188-27506	





7693A Automatic Liquid Sampler

## Sample Introduction Systems

### 7693A Automatic Liquid Sampler Replacement Parts and Supplies

To support the higher productivity, performance, and flexibility offered by the 7693A ALS, Agilent has expanded its supplies offering. Agilent Blue Line autosampler syringes are specifically designed to support the 7693A, while increasing plunger life and reducing costly downtime. For cost-conscious laboratories, economical shell vials and caps provide quality at an attractive price. Additional accessories, such as color-coded sample trays and vial caps, add to system ease-of-use.

#### 7693A Replacement Parts and Supplies

Description	Unit	Part No.
Gripper finger caps	16/pk	G4514-60710
Injector mounting post		G4513-20561
Dual parking post for autosampler		05890-61525
Needle support insert, standard		G4513-40525
Needle support insert, on-column		G4513-40529
Vial rack, set of 3. Includes 3 white label tags		G4514-67505
Vial rack label kit		G4525-60701
Vial rack label kit, red	3/pk	G4525-60702
Vial rack label kit, yellow	3/pk	G4525-60703
Vial rack label kit, green	3/pk	G4525-60704

#### Wash Vials (also for standards, diluents)

Description	Unit	Part No.
4 mL wash vials with fill markings and caps	25/pk	5182-0551
Diffusion caps for 4 mL vials	12/pk	07673-40180
Septa for 4 mL vials*	144/pk	9301-1031
4 mL wash vial with screw caps	144/pk	9301-0723

\*Septa for 4 mL vials should only be used for sample storage



Diffusion caps for 4 mL vials, 07673-40180

## Automatic Liquid Sampler Supplies

### Automatic Liquid Sampler Supplies

Description	Part No.
Screw for mounting syringe	07673-20570
Quadrant tray (4 tray sections)	18596-40015
7673 Basic Supply Kit Contains 6 10 $\mu$ L syringes, 23/26 gauge needles, 4 mL vials with diffusion caps (144/pk), 2 mL automatic sampler vials with screw caps (1,000/pk), GC septa (25/pk), vial racks (5/pk)	07673-60840

### Bar Code Reader Labels

Description	Part No.
Labels numbered (1,000/roll)	
1 to 1,000	5958-9450
1,001 to 2,000	5958-9441
2,001 to 3,000	5958-9442
3,001 to 4,000	5958-9443
4,001 to 5,000	5958-9444
5,001 to 6,000	5958-9445





7697A Headspace Sampler

## 7697A Headspace Sampler Supplies

The new 7697A Headspace Sampler from Agilent uses advanced designs based on our industry-leading gas chromatography architecture. The headspace sampling technique allows introduction of volatile compounds to the GC or GC/MS from virtually any sample matrix, while leaving unwanted components in a disposable sample vial. With up to 111 sample vial positions and removable vial racks, the 7697A supports nearly continuous operation to satisfy even the busiest laboratory.

- Built-in legendary Agilent pneumatics for superior control and easier setup
- Proven valve and loop sampling technology
- Fully-automatic sample vial leak checking and available bar code reader help ensure greater confidence in results method compatibility
- Instrument control software that is fully integrated in Agilent data systems
- Resource conserving programmable instrument scheduler

### 7697A Headspace Replacement Parts and Supplies

Description	Part No.
Tray vial racks	G4556-60019
Vial rack label	G4556-90500
Split vent trap with 3 cartridges, 1/8 in Swagelok fitting	RDT-1020
Leak test kit	G4556-67010
Includes instruction sheet, no-hole ferrule, 1/8 in nylon tube fitting plug, headspace leak test vial, 1/16 in stainless steel ZDV plug, 11 mm low bleed septa (5/pk)	
UltiMetal Plus Inert sample probe	G4556-60125
6-port valve, replacement rotor, WT series, 300 psi, 350 °C	1535-4952
<b>Standards</b>	
OO/PV Headspace Sample	5182-9733
Contains 2 g/L t-butyl disulfide, 1,2-dichlorobenzene, and nitrobenzene in ethanol	

(Continued)

### TIPS & TOOLS



The transfer line heater assembly is 1 m in length and accommodates the following tubing types:

- Fused silica capillary of 0.25 mm, 0.32 mm, and 0.53 mm id with maximum od of 0.67 mm
- Metal capillary of 0.53 mm id, such as Agilent UltiMetal or ProSteel, with maximum od of 0.67 mm

For one transfer line, a piece of fused silica or ProSteel approximately 1 m in length is required in addition to one ferrule and one nut and reducing union. Order a ProSteel sleeve to protect the transfer line when operating above 200 °C. ProSteel operated above 200 °C in the transfer line without the sleeve can permanently bind to the heated conduit tube.

**7697A Headspace Replacement Parts and Supplies**

Description	Part No.
<b>Transfer Line Components</b>	
Deactivated fused silica, 5 m length	
0.25 mm	160-2255-5
0.32 mm	160-2325-5
0.45 mm	160-2455-5
0.53 mm	160-2535-5
ProSteel deactivated stainless steel, 5 m length	
0.53 mm	160-4535-5
Polyimide sleeve for ProSteel	4177-0607
Polyimide ferrule, 5/pk, 0.50 mm, 0.80 mm	0100-2595
Polyimide, Valco ferrule, 5/pk	
Ferrule, low thermal mass, column id 320 µm, 0.5 mm id, 5/pk	5190-1438
Ferrule, low thermal mass, column id up to 250 µm, 0.4 mm id, 5/pk	5190-1437
Nut and reducing union for 6 port valve and transfer line connection	0100-2594
Septum nut, transfer line, split/splitless and multimode inlets	G3452-60835

**G3520A XLSI Accessory Supplies**

Description	Part No.
G3520A XLSI Accessory kit	
Ceramic wafer column cutter	5181-8836
Transfer line nut fitting	G3520-20210
Column storage fitting	G2855-20590
Magnifier, 3x, 6x, paddle, plastic	G2855-40001
Plug for microfluidic manifold or unions	G2855-60570
Ferrule pre-swaging tool	G2855-60200
Ultra Inert Straight 2.0 mm liner	5190-6168
Transfer line support bracket	G3504-60620



7697A Headspace Sampler



The 12-vial 7697A Headspace Sampler is compatible with Agilent 7820 Series GC systems, and will also work with Agilent 7890B Series GC systems

**G1888A Network Headspace Sampler Supplies**

<b>Description</b>	<b>Part No.</b>
<b>Stainless Steel Sample Loops</b>	
Certified sample loop, 1 mL, deactivated	5190-2265
Certified sample loop, 3 mL, deactivated	5190-2266
Sample loop, 1 mL, deactivated	2321700003
Sample loop, 3 mL, deactivated	2321700004
<b>Probes and Unions</b>	
Sample probe, deactivated	2322700011
M6 union, brass	2302533140
Union, zero dead volume, deactivated	2307230001
Union	2307232901
<b>Transfer Line Needles and Unions</b>	
Needle only, headspace transfer line, deactivated 0.5 mm od	2322590004
Needle only, headspace transfer line, deactivated 0.7 mm od	2322590005
Strain relief septum nut	6410090050
<b>Tubing</b>	
Tubing, solenoids to 6-port valve, deactivated	410105017
Tubing, probe to 6-port valve, deactivated	1300502506
Transfer line, 1.45 m	G1890-60000
<b>Standards</b>	
OO/PV Headspace Sample	5182-9733
Contains 2 g/L t-butyl disulfide, 1,2-dichlorobenzene, and nitrobenzene in ethanol	
<b>PM Kits</b>	
G1888A PM kit with 1 mL loop	G1888-60702
G1888A PM kit with 3 mL loop	G1888-60703
G1888A enhanced PM kit with valves, transfer line and vent tube	G1888-60704



**G1883A Network Headspace Supplies**

<b>Description</b>	<b>Part No.</b>
<b>Needles</b>	
Needle only, headspace transfer line, deactivated 0.5 mm od	2322590004
Needle for transfer line, 0.25 mm id, 0.5 mm od, nickel	301-016-HSP
Needle only, headspace transfer line, deactivated 0.7 mm od	2322590005
Needle for transfer line, 0.4 mm id, 0.8 mm od, nickel	301-015-HSP
Needle assembly vial probe, deactivated	232-2790012-EHS
Needle assembly vial probe, nickel	232-2790010-EHS
<b>Fittings</b>	
Union elbow M5	998-0000053-EHS
Transfer line nut	19258-20830
Transfer line ferrule	19258-20870
Union FF 6MB, 5-piece set	325-062-HSP
Union T6 MB, 5-piece set, brass	325-132-HSP
Union T5 MA	325-185-HSP
<b>Valves</b>	
Restrictor, stainless steel	321-002-HSP
Valve, solenoid vent Kalrez	3600500001
Valve, solenoid vial pressurization	3600500002
<b>Tubing and Transfer Lines</b>	
Sample loop, 1 mL, deactivated	2321700003
Sample loop, 1 mL, nickel	321-055-HSP
Sample loop, 2 mL, nickel	169-0013-HSP
Sample loop, 3 mL, deactivated	2321700004
Sample loop, 3 mL, nickel	321-056-HSP
Oven adapter for 10 mL vials	301-017-HSP
Tube, needle, 6-port valve, deactivated	301-212-HSP
Tube, needle, 6-port valve, nickel	301-169-HSP
Tube, vent-valve stainless steel	301-170-HSP
Sensor tube, 125 mm PTFE	321-057-HSP
Transfer line, deactivated, 1 m	301-211-HSP
Transfer line, 1 m, nickel	301-152-HSP
Transfer line, 80 cm, nickel	301-011-HSP
<b>Repair, Leak Test, and OQ/PV Supplies</b>	
Strain relief septum nut	301-205-HSP
Headspace leak test kit	G1888-60701
OQ/PV Headspace Sample Contains 2 g/L t-butyl disulfide, 1,2-dichlorobenzene, and nitrobenzene in ethanol	5182-9733



# Agilent Vials and Closures for GC, GC/MS and GC/HS

## Headspace Vials and Closures



Beveled-neck headspace vials are available in both 10 mL and 20 mL capacities, flat or rounded bottom. The 20 mm crimp caps provide a consistently secure seal. Agilent also offers cost-saving convenience packs with vials, caps, and septa packaged together.

- Certified for full warranted compatibility with Agilent autosamplers
- Choice of crimp or screw top vials
- Beveled top for maximum secure seal
- Two neck lengths available
- Choice of a pressure safety release cap at 45 psi
- Available in flat or rounded bottom designs



Clear headspace crimp top vials with graduation marks and write-on spot, 5190-2285



Amber headspace crimp top vials with graduation marks and write-on spot, 5190-2286

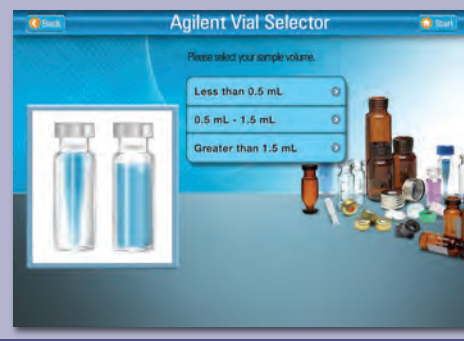
### Certified Headspace Crimp Top Glass Vials

Description	Unit	Flat Bottom	Rounded Bottom
<b>10 mL, 23 x 46 mm</b>			
Clear	100/pk	5182-0838	5183-4475
Amber	100/pk	5067-0227	5190-2238
Clear, graduation marks and write-on spot	100/pk	5190-2285	
Amber, graduation marks and write-on spot	100/pk	5190-2287	
<b>20 mL, 23 x 75 mm</b>			
Clear	100/pk	5182-0837	5183-4474
Amber	100/pk	5067-0226	5190-2239
Amber, graduation marks and write-on spot	100/pk	5190-2286	
Clear, graduation marks and write-on spot	100/pk	5190-2288	

### TIPS & TOOLS



Agilent has made vial, cap and septum selection easy with its new Interactive Vial Selection Tool, available online in both desktop and mobile versions. The tool identifies the right vial and closures for your particular application, and provides the rationale for the choices offered. Visit [www.agilent.com/chem/SelectVials](http://www.agilent.com/chem/SelectVials)

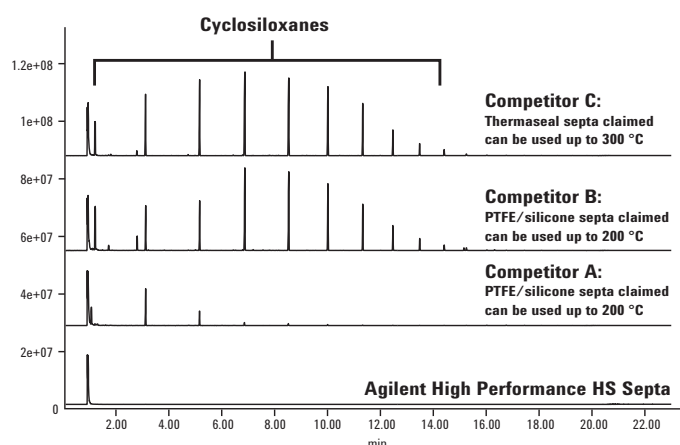


## High Performance Septa

Agilent introduces the first septa that can withstand extreme temperatures and conditions for today's demanding headspace applications.

- Proven to withstand temperatures up to 300 °C with no degradation
- Leakproof
- Available in your choice of crimp or screw

### Headspace screw top vial blank chromatogram comparison at 300 °C with different septa

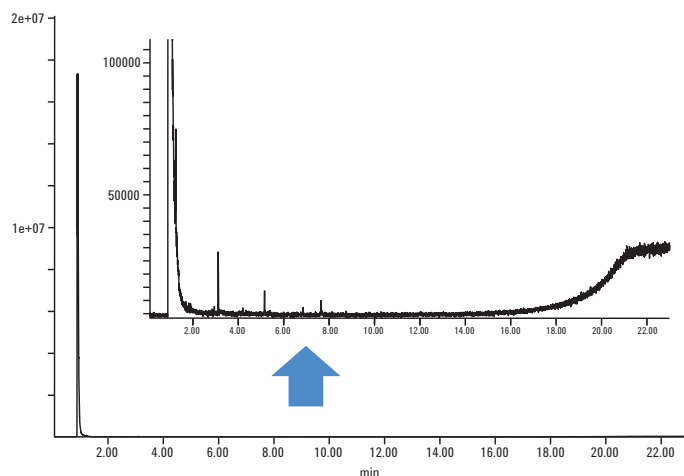


#### GC/MS conditions

Inlet:	Split mode w/ 10:1 ratio, 250 °C
Column:	DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm, Constant flow: 2.5 mL/min
Oven:	40 °C hold 1.5 min, then 15 °C/min to 325 °C and hold for 2.5 min, 23 min total run time
Thermal Aux/MS source/MS guard:	250 °C/230 °C/150 °C
MSD:	Scan mode 25-550 m/z

### Vial blank sample chromatogram at 300 °C with Agilent High Performance HS Septa

Agilent High Performance Septa provide significantly cleaner blank background at high temperature HS testing. Even with small abundance scale, the 300 °C vial blank chromatogram with High Performance Septa only shows few siloxane peaks with very small abundance.



#### Headspace conditions

Septa Type:	Agilent High Performance Septa, 5190-3986
Temperature:	Oven/loop & valve/transfer line: 300 °C/300 °C/300 °C
Times:	GC cycle time: 32 min, Vial equilib time: 30 min
Vial:	Fill pressure: 15 psi, Fill flow: 50 mL/min, Loop fill ramp rate: 20 psi/min, Loop final pressure: 10 psi, Vial Size: 20 mL, Shaking: 1
Carrier:	GC controlled



**TIPS & TOOLS**

For information on CrossLab High Performance Septa, turn to page 199.

**High Performance Septa**

Description	Unit	Agilent Certified Part No.	Compatible With
18 mm steel screw cap with High Performance Septa	100/pk	5190-3986	5188-2753, 5188-6537, 5188-5392, 5188-6538
20 mm steel crimp cap with High Performance Septa	100/pk	5190-3987	5182-0837, 5183-4474, 5067-0226, 5190-2239, 5182-0838, 5183-4475, 5067-0227, 5190-2238

**20 mm Headspace Crimp Caps and Septa**

Cap Color	Septa Type	Specifications	Certified	100/pk	10000/pk
Silver aluminum	PTFE/silicone septa	-60 °C to 180 °C	✓	5183-4477	5190-2257
Silver aluminum with safety feature	PTFE/silicone septa	-60 °C to 180 °C	✓	5183-4478	
Silver aluminum	Molded PTFE/butyl septa	-40 °C to 125 °C	✓	5183-4479	5190-2258
Silver aluminum with safety feature	Molded PTFE/butyl septa	-40 °C to 125 °C		5183-4480	
Silver aluminum	No septa			9301-0721	
Silver aluminum with safety feature	No septa			9301-0718	
Septa only	Gray PTFE/black butyl molded	-40 °C to 125 °C		9301-0976	
Septa only	Tan PTFE/white silicone	-60 °C to 180 °C		9301-0719	5067-0234



Aluminum crimp caps, 5183-4477



Headspace vial convenience kit

**Certified Headspace Vial Convenience Packs**

Septa Type	Vial Type	Cap Color	Specifications	Unit	Part No.
Molded PTFE/black butyl septa	Flat bottom	Silver aluminum with safety feature	<125 °C	100/pk	5182-0839
PTFE/silicone septa	Flat bottom	Silver aluminum with safety feature	<180 °C	100/pk	5182-0840

## CombiPAL Headspace Vials and Closures

Screw top vials and caps are recommended for the tightest seal and the most reproducible headspace results. CombiPAL headspace vials and caps are precision-threaded, making them an excellent choice for dependability and ease-of-use. They are ideal for applications in the environmental, food and beverage, industrial hygiene, drug analysis, and clinical chemistry industries.

### CombiPAL Headspace Screw Top Vials

Description	100/pk
<b>10 mL, 23 x 46 mm</b>	
Clear	5188-5392
Amber	5188-6538
<b>20 mL, 23 x 75 mm</b>	
Clear	5188-2753
Amber	5188-6537

### CombiPAL 18 mm Screw Top Caps with Septa

Cap Color	Septa Type	100/pk
Silver aluminum, magnetic	PTFE/silicone septa (top white, bottom blue)	5188-2759



# Crimping and Decapping Tools

## Electronic Crimpers and Decappers

Designed to replace awkward and bulky manual crimping pliers, the Agilent electronic handheld crimpers give tight, reproducible seals every time. Adjustable, slim steel jaws fit around closely spaced vials, enabling you to crimp vials directly in crowded autosampler trays. Using the same handheld design as the crimpers, Agilent's electronic decappers remove caps instantly and are designed for laboratories that recycle or reuse vials.

- More vials crimped per battery charge – new lithium ion battery lasts three times longer
- Increased crimping speed – new model is 50% more powerful (6.4 volt battery)
- Less hand strain – lighter weight means less effort
- Improved power signal – clearly shows when battery needs recharging
- Easily used in right or left hand – display on top for easier viewing
- More efficient charging – no overheating during recharging
- Extended productivity – significantly longer motor life



11 mm electronic crimper, 5190-3188



20 mm electronic crimper, 5190-3189



11 mm electronic decapper, 5190-3190



20 mm electronic decapper, 5190-3191

### Electronic Crimpers and Decappers

Description	Part No.
11 mm electronic crimper with lithium battery	5190-3188
20 mm electronic crimper with lithium battery	5190-3189
11 mm electronic decapper with lithium battery	5190-3190
20 mm electronic decapper with lithium battery	5190-3191
Replacement lithium battery for crimper and decapper	5190-3192
High power electronic crimping tool with power supply	5190-4061
11 mm Crimper jaw set for HP electronic crimper	5190-4062
11 mm Decapper jaw set for HP electronic crimp tool	5190-4063
20 mm Crimper jaw set	5190-4064
20 mm Decapper jaw set	5190-4065
Base for electronic crimping tool	5190-4066
20 mm HP Crimping tool and jaw sets bundle	5190-4067

## Manual Crimpers and Decappers

Agilent's ergonomic manual crimpers and decappers remove the pain and discomfort of wrist strain with a lightweight, tailored design. Weighing 25-30% less than predecessors and eliminating sore, pinched hands, the new design dramatically improves your experience. Extensively tested with Agilent vials for optimal fit, and color-coded for ease-of-use, this tool is a necessity for every lab. The new crimpers are built for lasting performance: the 11 mm crimper will cap at least 100,000 caps and the 20 mm at least 60,000 before wear starts to impact performance.

- Comfortable, lightweight, ergonomically designed handles fit smoothly in the hand and eliminate pinching
- Top-mounted adjustment knob shows directionality for tightening/loosening
- Adjustment knob doubles as an indicator that the crimp (or decap) is complete
- Crimpers are color-coded with blue knobs and labels, decappers with orange
- Narrow jaws provide better vertical clearance over vials
- Bottom handle motion allows for better control and enhanced stability of crimping jaw
- Sturdy construction of rugged, fiber-reinforced resin with steel reinforcement in the handles



### Manual Crimpers and Decappers

Description	Part No.
Ergonomic manual crimper for 11 mm caps	5040-4667
Ergonomic manual decapper for 11 mm caps	5040-4668
Ergonomic manual crimper for 20 mm caps	5040-4669
Ergonomic manual decapper for 20 mm caps	5040-4671



Ergonomic manual crimper, 5040-4667



Stratum PTC Sample Concentrator

## Teledyne Tekmar Purge and Trap Supplies

### Glassware for Teledyne Tekmar Purge and Trap Concentrators, 1/2 in Mount

Description	Part No.
5 mL frit sparger (glassware only)	5182-0852
5 mL frit sparger kit with fittings	5182-0846
25 mL frit sparger (glassware only)	5182-0851
25 mL frit sparger kit with fittings	5182-0845
5 mL fritless sparger (glassware only)	5182-0850
5 mL fritless sparger kit with fittings	5182-0844
25 mL fritless sparger (glassware only)	5182-0849
25 mL fritless sparger kit with fittings	5182-0796
5 mL needle sparger (glassware only)	5182-0848
5 mL needle sparger kit	5182-0795
25 mL needle sparger (glassware only)	5182-0847
25 mL needle sparger kit	5182-0794

### Tekmar AQUATek 70 and AQUATek 100 Purge and Trap Autosampler Supplies

Description	Part No.
Sample loop, 5 mL PEEK	5190-3151
Sample loop, 25 mL PEEK	5190-3152
Sample loop, 20 mL PEEK	5190-3153
Sample loop, 10 mL PEEK	5190-3154
Septa for 40 mL vials, pre-cleaned, 72/pkg	14-3823-000
Screw caps for 40 mL vials, 24/pkg	14-6855-000



**Traps for Teledyne Tekmar Stratum and Atomx Purge and Trap Concentrator**

Description	Part No.
Trap, BTEX + MTBE	5188-8813
Trap #5, OV-1/Tenax/Silica Gel/Charcoal	5188-8814
Trap #8, Carbopak B/Carbosieve S-III	5188-8815
Trap #9, Proprietary	5188-8816
Trap, Tenax/Silica Gel/Carbosieve S-III, #10	5188-8817
Strat-Trap, Tenax/Silica Gel, #2	5188-8818
Strat-Trap, Tenax/Silica Gel/Charcoal, #3	5188-8819
Strat-Trap, OV-1/Tenax, #7	5190-1445
Strat-Trap, Tenax, #1	5190-1446
Trap, Vocab 3000, Stratum and Atomx P&T	5188-8820
Trap, Vocab 4000	5188-8821
Trap, BTEX	5188-8822
Trap, Tenax, #1A	5188-1447
Trap, VPH, #11	5188-1448

Stratum and Atomx traps are U-shaped

**Atomx VOC Autosampler Supplies**

Description	Part No.
Antifoam agent, Antifoam 1520, 10 mL	5190-2235
Syringe with side port, 27 mL	5190-2234
Vessel, amber IS, 15 mL	5190-2233
Frit sparge glassware kit, 25 mL	5190-2232
Fritless sparge glassware kit, 25 mL	5190-2231

**Traps for Teledyne Tekmar Velocity Purge and Trap Concentrator**

Description	Part No.
Trap, Vocab 3000, 7695 and 3100 P&T	5182-0775
Trap, Vocab 4000 (I Trap)	5182-0774
Trap, Tenax (A Trap)	5182-0783
Trap, Tenax/silica gel/charcoal (C Trap)	5182-0781
Trap, BTEX	5182-0773
DryFlow moisture trap	14-8911-003

Velocity traps are straight



U-trap for Stratum and Atomx, Trap, BTEX + MTBE, 5188-8813



Atomx Purge and Trap Concentrator

**TIPS & TOOLS**

Compared to a frit sparger, the fritless sparger may be the better choice when a water sample has a tendency to foam. This sparger is not appropriate for soil samples, which tend to clog the capillary tube.





Agilent Archon Purge and Trap Autosampler



Agilent Archon Purge and Trap Autosampler with removable tray



Archon removable 51 position sample tray

### Archon Purge and Trap Supplies

Description	Part No.
Vial kit, 40 mL, precleaned vials, caps, and septa, 72/pk	5183-4741
Water reservoir bottle without cap, 80 oz	DY50390600
22 mm septa, PTFE/silicone, 72/pk	5190-3978
22 mm septa, EPA lowbleed, 60/pk	5190-3976
Syringe mount O-ring	DY50549500
Water probe replacement kit, for S/N above 995, screw in mount	DY50573990
Sparge probe replacement kit, for S/N above 13160, square base	DY70007791
Sparge probe replacement kit, for S/N 995-13160, hexagonal base	DY50574190
Sparge probe replacement kit, for S/N below 995, hexagonal base	DY50549290
Standard reservoir	DY50548400
Water transfer line	DY50551400
I.S. pickup/waste lines	DY70001990
Soil transfer line	DY50574500
75 µm screen for water probe	DY50559800
Water probe, cleaned, for S/N 695-995, screw in mount	DY50549100
Sparge probe cleaned, for S/N above 13160	DY70007701
10 µm soil probe frit	DY50559900
Valco rotor loop, 1 µL	DY50572600
Flangeless nuts and ferrules, 8/pk	DY70008101
PTFE stir bar for 40 mL vials	DY50295500
Spin bar for soil vial	DY50402400
Stir magnet	DY50546100
Valco valve and actuator	DY50540700
Glass barrel with decal, 26 mL	DY50296800
Kit, chiller option, field	DY70008590
Soil probe replacement kit, for SV S/N above 13160	DY70007691
Lower soil probe replacement kit, for SV units	DY50546390
Soil probe replacement kit, for SV S/N 995-13160	DY50574390

## Markes Thermal Desorption

Agilent now offers a comprehensive line of supplies for Markes Thermal Desorption (TD) instrumentation. Thermal desorption allows the introduction of volatile and semivolatile compounds from a wide range of sample matrices, directly into a GC or GC/MS.

### Markes Thermal Desorption Instrument Supplies

Description	Unit	Part No.
O-rings, Markes 7 mm cold trap seals	10/pk	MKI-U-COV07
O-rings, Markes 6 mm cold trap seals	10/pk	MKI-U-COV06
PTFE filter disks, 5.1 mm Markes TD	10/pk	MKI-U-DISK1
PTFE filter disks, 6.3 mm Markes TD	10/pk	MKI-U-DISK3
Quick fit connectors, Markes UNITY	10/pk	MKI-C-QSC10
O-ring insertion tool, Markes UNITY TDI		MKI-Z-0285
O-ring extraction tool, Markes UNITY TDI		MKI-Z-0351
O-rings, 010 Markes UNITY	10/pk	MKI-U-COV10

### Cold Traps

Description	Unit	Part No.
Cold trap, universal, UNITY		MKI-U-T11GPC
Cold trap, universal, UNITY 2		MKI-U-T11GPC-2S
Cold trap, air toxics, C <sub>2</sub> -C <sub>14</sub> , UNITY 2		MKI-U-T3ATX-2S
Cold trap, air toxics, C <sub>2</sub> -C <sub>14</sub> , UNITY		MKI-U-T3ATX
Cold trap, materials emissions, UNITY		MKI-U-T12ME
Cold trap, materials emissions, UNITY 2		MKI-U-T12ME-2S
Cold trap for DHS applications, UNITY		MKI-U-T13DHS
Cold trap for DHS applications, UNITY 2		MKI-U-T13DHS-2S
Cold trap, for EPA TO-15/TO-17 air toxics analysis methods, Markes UNITY 2		MKI-U-T15ATA-2S
Stainless steel Difflok cap, Markes UNITY		MKI-MTD-1169
Inert Difflok cap, Markes UNITY		MKI-MTD-1204
Cold trap, Tenax, UNITY		MKI-U-T9TNX
Cold trap, Tenax, UNITY 2		MKI-U-T9TNX-2S
Cold trap, high boilers, C <sub>6</sub> -C <sub>40</sub> , UNITY 2		MKI-U-T1HBL-2S
Cold trap, ozone precursor, UNITY 2		MKI-U-T1703P-2S
Cold trap, sulfur, UNITY 2		MKI-U-T6SUL-2S
Cold trap, chemical weapons, C <sub>6</sub> -C <sub>40</sub> , UNITY 2		MKI-U-T10CW-2S
Cold trap, green house gases, UNITY 2		MKI-U-T16GHG-2S



Markes Thermal Desorption system



Markes Thermal Desorption system

**Standard TD Sorbent tube and related sampling accessories**

Description	Unit	Part No.
Empty stainless steel TD tubes	10/pk	C-TBE10
Tenax stainless steel tubes, preconditioned/capped	10/pk	C-TBP1TC
Empty glass TD tubes	10/pk	C-GT010
PTFE inserts	10/pk	C-PL010
Long term TD tube storage caps	10/pk	C-CF020
Cap-LOK Tool for long term storage caps		C-CPLOK
Diffusive sampling caps	10/pk	C-DF010
Bio-VOC breath samplers	10/pk	C-BIO10
Disposable card mouth piece for Bio-VOC	10/pk	C-B010M
Tenax TA 34-60 Mesh, 10 g		C-TNXTA
General purpose hydrophobic tubes, stainless steel Preconditioned and capped with 1/4 in brass storage caps. For pumped sampling n-C <sub>5</sub> to n-C <sub>20</sub> .	10/pk	C-HY010C
Tenax/S'carb 'Sulphur' tubes Preconditioned and capped with 1/4 in brass storage caps. For odor and landfill gas analysis.	10/pk	C-102SSC
Carbograph 1 stainless steel tubes Preconditioned and capped with 1/4 in brass storage caps. For pumped sampling C <sub>5</sub> to C <sub>14</sub> , plus diffusion of BTX.	10/pk	C-TBP1C1C
Carb X stainless steel tubes Preconditioned and capped with 1/4 in brass storage caps. For pumped/diffusion of 1.3-butadiene & benzene.	10/pk	C-TBP1CXC
Air toxics (TO-17) stainless steel tubes Preconditioned and capped with 1/4 in brass storage caps. For pumped sampling VOCs n-C <sub>3</sub> to n-C <sub>12</sub> .	10/pk	C-AT010C
Universal stainless steel tubes Preconditioned and capped with 1/4 in brass storage caps. For pumped sampling VOCs/SVOCs n-C <sub>3</sub> to n-C <sub>30</sub> .	10/pk	C-UN010C
Glass tubes with 1 cm Tenax For direct liquid injection	10/pk	C-G1CM10
Glass air toxics (TO-17) tubes Pre-packed with 2 carbon-based sorbents; preconditioned and capped with 1/4 in brass storage caps	10/pk	C-GAT010C
CRS BTX Standards, 1 µg	10/pk	C-BTX1UG
Cold trap alignment tool, Markes UNITY		MKI-UTD-5064
Split filter tube, stainless steel, 3 1/2 in, packed with charcoal		MKI-SERUTD-5065

## Inlet Systems

### Split/Splitless Inlet Seals

For samples with active analytes or sensitive compounds, only Agilent combines the best mechanical sealing with an inert surface. Our Ultra Inert chemistry is applied on top of the gold plating to produce a leak-free seal that also reduces active analyte adsorption. This is a critical component of the Agilent Inert Flow Path.

#### Split/Splitless Inlet Seals

Description	Unit	Part No.
Ultra Inert gold plated seal with washer		5190-6144
	10/pk	5190-6145
	50/pk	5190-6149
Gold plated inlet seal kit with washer		5188-5367
	10/pk	5190-2209
Gold plated seal with cross, split only		5182-9652
Inlet seal, stainless steel		18740-20880

**Note:** Due to the deactivation process, the surface of the UI gold plated seal may have spots or darker colored areas. These are normal side effects of the deactivation process, and do not affect the performance or inertness of the seal.



Ultra Inert gold plated seal with washer, 5190-6145



Certified gold plated seal kit, 5190-2209

**AGILENT  
INERT  
FLOW PATH**

#### TIPS & TOOLS

Ensuring an inert GC flow path has never been more critical. Access IFP resources here:

[www.agilent.com/chem/inertflowpath](http://www.agilent.com/chem/inertflowpath)





## Flip Top Inlet Sealing System

Agilent's Flip Top Inlet Sealing System is the faster, smarter way to change inlet liners on Agilent 7820, 6890, 6850 and 5890 GC systems.

- Cuts liner replacement time to as little as 30 seconds
- Eliminates frustrating searches for special wrenches or tools
- Improves inlet ergonomics – no more handling of heated parts, no more burns or scrapes
- Decreases downtime and increases productivity
- Minimizes exposure to ambient air, extending column life
- Easily installed by user in 15 minutes

Available exclusively from Agilent, the Flip Top has a levered arm that attaches to any 6890/6850/5890 insert weldment and locks to the injection port using an adapter ring screwed onto the inlet. Once installed, simply lift the arm of the Flip Top which releases the insert weldment from the injection port, and allows instant access to the liner. The process is simply reversed to reseal the weldment to the port.

### Flip Top Inlet Sealing System

Description	Unit	Part No.
Flip Top Inlet Sealing System For 6890, 6850, 5890 only; not compatible with 7890		5188-2717
Non-stick fluorocarbon liner O-ring for Flip Top	10/pk	5188-5366
	100/pk	5190-2268



Flip Top Inlet Sealing System installation kit,  
5188-2717

## Split/Splitless Inlets

The combined split/splitless inlet is the most popular inlet for capillary column gas chromatography. Because it can be used in either split or splitless mode, it provides a very effective combination that can cover most analysis requirements.

### Split Inlet Troubleshooting

Split inlets are spared from most band-broadening phenomena, since the splitting process generates narrow peaks. Peak broadening or tailing is usually due to:

- Improper column installation
- Low inlet temperature
- Low split flow (<20 mL/min on 6890)
- Inlet and needle discrimination and decomposition

If your results are inaccurate or inconsistent:

- Check the column and reinstall if necessary
- Increase inlet temperature by 50 °C and compare results
- Check inlets and needles for wear and replace as necessary

### Splitless Inlet Troubleshooting

Most problems encountered with a splitless injection are related to:

- Incorrect purge time
- Degradation
- Improper focusing
- Inappropriate column temperature
- Backflash

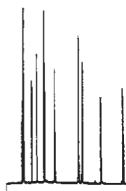
You can also improve the reproducibility and linearity of peak areas and avoid backflash by matching:

- Inlet temperature
- Liner volume
- Injection volume

## Decomposition

Loss of peak area or generation of new peaks can sometimes be dramatically reduced by changing liner type or by deactivating the liner and inlet with silanizing reagents. Removing or reducing the amount of liner packing can also decrease inlet activity.

### Column Troubleshooting



#### Normal Peaks

Correct column positioning in both injection port and FID



#### Tailing Solvent Peaks

Column positioned incorrectly in the injection port or possible ferrule particle in the carrier gas flow path



#### Wrong Peak Ratios

Column positioned in the inlet (either too far or not far enough; verify 4-6 mm installation distance)

For the most reproducible split injection results, try Agilent's low pressure drop split liner (p/n 5183-4647), with built in positioning bead, tight dimension tolerances, glass wool placement, and proprietary deactivation.



**Split Mode Variables, Practices and Rationales**

<b>Parameter</b>	<b>Selection/Setting</b>	<b>Rationale</b>
Inlet temperature	Try 250 °C or BP of last eluting compound	Ensures flash vaporization Minimizes inlet discrimination
Inlet liner	Large volume, deactivated	Minimizes backflash Minimizes degradation
Inlet packing	Silanized glass wool	Retains non-volatiles Minimizes inlet discrimination
	Glass beads or frit	Less active than wool
	None	Least active
Injection volume	0.5-3 µL liquid	Split easily adjusted
	0.10-10 mL gas	Split adjusted accordingly
Injection technique	Fast autoinjection	Less needle discrimination
	Hot-needle fast manual injection	Reproducible discrimination
Split ratio	50:1 to 500:1	Depends on sample and injection volume, and column id
Initial column temperatures	Not critical	Narrow initial peaks
Septum purge	2-3 mL/min	Minimizes ghosting

**Splitless Mode Variables, Practices and Rationales**

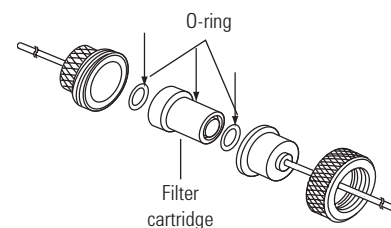
Parameter	Selection/Setting	Rationale
Inlet temperature	Just above highest boiling point of solutes (+20 °C)	Ensures flash vaporization Reduce if degradation occurs Use higher for dirty samples and higher-boiling solutes
Inlet liner	Large volume >0.8 mL	Use with autoinjector
	Small volume <0.2 mL	Use only for slow manual injections and gas injections
Inlet packing	None	Use only with slow injection Decreases degradation
	Silanized glass wool	Use for fast autoinjection and dirty samples
Injection volume	0.5-2 µL liquid	Depends on solvent, liner and conditions
Injection technique	Fast autoinjection	Most reproducible Less needle discrimination
	Hot-needle slow manual	Inject 1-2 µL/s if narrow liner is used and >1 µL injection
	Hot-needle fast manual	Use for <1 µL injections
Split flow	20-50 mL/min	Higher for concentrated samples
Splitless time	20-80 s	Adjust according to column flow rate/liner type and sample conditions
Oven temperature	10-25 °C below solvent BP	Necessary for solvent focusing
Column flow	Typical flow rates between 1 mL/min and 2 mL/min. Use of higher flow rates depends on separation conditions of compounds.	Change of flow rates can provide better chromatographic separation
Septum purge	2-3 mL/min	Reduces ghosting and septum contamination
Quantification	Internal standard	Maximizes reproducibility
	External standard addition	Use only with constant injection volume
Retention gap	1-3 m, deactivated (1-2 m per µL injected)	Promotes solvent and stationary phase focusing Protects analytical column from matrix contamination

## Split/ Splitless Inlet Maintenance

### Changing the Split Vent Trap\*

1. Remove the retaining clip.
2. Remove the old filter cartridge and two O-rings.
3. Verify the new O-rings are seated properly on the new filter cartridge.
4. Install the new filter cartridge then reassemble the trap. Do not fully tighten yet.
5. Place the filter trap assembly in the mounting bracket and install the retaining clip.
6. Fully tighten the split vent front weldment onto the trap.
7. Check for leaks.

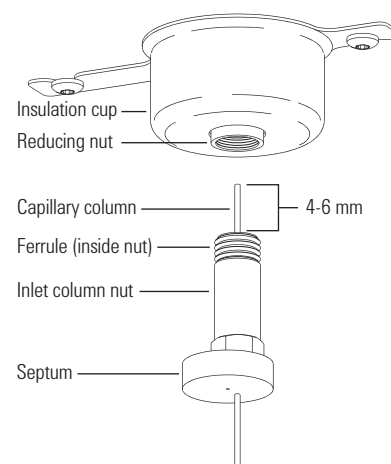
\*Change every 6 months



Split vent trap, 5188-6495

### Installing a Capillary Column in a Split/ Splitless Inlet

1. Prepare the column for installation.
2. Position the column so it extends 4 to 6 mm past the end of the ferrule.
3. Slide the septum to place the nut and ferrule in the correct position.
4. Insert the column in the inlet.
5. Slide the nut up the column to the inlet base and finger tighten the nut.
6. Adjust the column position so the septum is even with the bottom of the column nut.
7. Tighten the column nut an additional 1/4 to 1/2 turn. The column should not slide with a gentle tug.
8. Start carrier gas flow.
9. Verify flow by submerging the free end of the column in isopropanol. Look for bubbles.



### WARNINGS & CAUTION

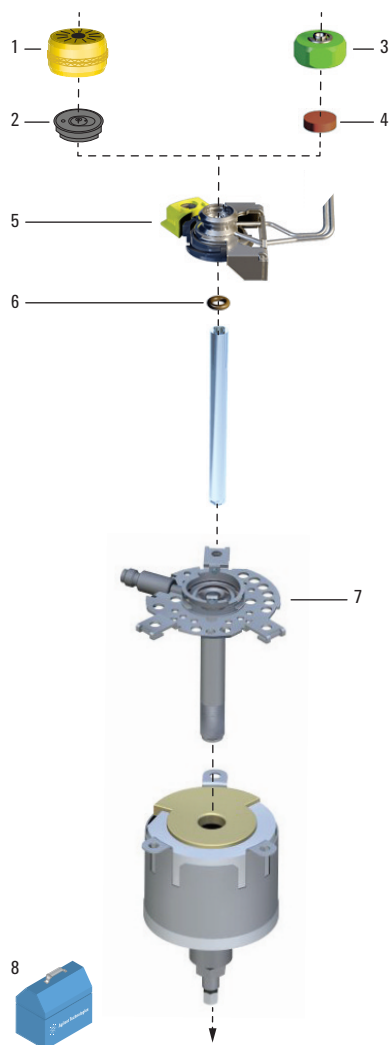
The split vent trap may contain residual amounts of any samples or other chemicals you have injected into the GC. Follow your company's safety procedures for handling these types of substances while replacing the trap filter cartridge.

### TIPS & TOOLS

#### Tools for capillary column installation

Make sure your lab always has the tools you need to install columns correctly. We recommend a column cutting tool such as a diamond-, carbide-, or sapphire-tipped pencil, or a ceramic cutter, a supply of an appropriate nonretained compound, a column test mixture, an electronic flowmeter, and an electronic leak detector. The free Agilent J&W GC Column Installation Guide can help you make good connections for good chromatography, [www.agilent.com/chem/gcinstallationguide](http://www.agilent.com/chem/gcinstallationguide)





Split/Splitless Inlet assembly (top)

### 7890/6890/6850 Split/Splitless Inlet Supplies (Top)

Item	Description	Unit	Part No.
1	Merlin Microseal kit, low pressure		5181-8816
	General purpose Merlin Microseal starter kit		5182-3442
	Merlin Microseal high pressure nut		5182-3445
2	Merlin Microseal low pressure replacement septum		5181-8815
	Merlin Microseal general purpose replacement septum 3-100 psi		5182-3444
3	Septum nut, purged inlets		18740-60835
	Headspace septum retainer nut		18740-60830
4	Non-stick bleed and temperature optimized (BTO) septa, 11 mm	50/pk	5183-4757
		100/pk	5183-4757-100
	Non-stick long-life septa, 11 mm	50/pk	5183-4761
		100/pk	5183-4761-100
5	7890 Top insert assembly, standard		G3452-60730
	7890 Top insert, AC gang fitting weldment		G3430-60011
	7890 Top insert assembly, valve		G3480-67585
	7890 Insert weldment, UltiMetal Plus treated		G3452-60586
	6890 Top insert assembly, standard		G1544-60585
6	Graphite O-ring for splitless liner	10/pk	5180-4173
		10/pk	5180-4168
	Certified non-stick fluorocarbon O-ring	10/pk	5188-5365
7	Cap inlet shell weldment assembly		G3452-80570
	7890 Cap inlet shell weldment assembly, UltiMetal Plus treated		G3452-60570
8	QuickPick split inlet PM kit		5188-6493
	QuickPick splitless vent and inlet PM kit		5188-6497
	FID collector cleaning brush		8710-1346
	QuickPick split vent and inlet PM kit		5188-6496
	Column installation pre-swaging tool, metal ferrules		G3440-80218
	Column installation pre-swaging tool, graphite ferrules		G3440-80217



Column installation pre-swaging tool, metal ferrules, G3440-80218

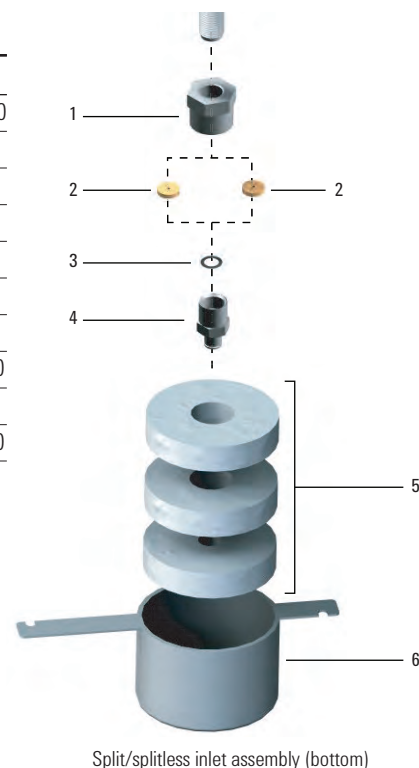
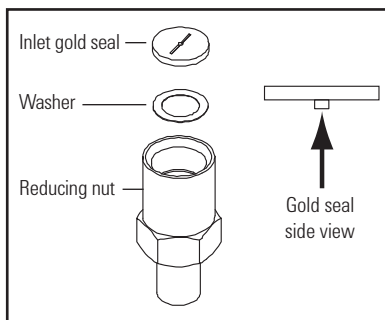


Column installation pre-swaging tool, graphite ferrules, G3440-80217

**7890/6890/6850 Split/ Splitless Inlet Supplies (Bottom)**

Item	Description	Unit	Part No.
1	Inlet heater weldment retaining nut		G1544-20590
2	Gold plated inlet seal kit with washer		5188-5367
	Certified gold plated seal kit, includes washer	10/pk	5190-2209
	Ultra Inert gold plated seal with washer		5190-6144
	Ultra Inert gold plated seal with washer	10/pk	5190-6145
	Gold plated seal with cross, split only		5182-9652
3	Washers, 0.375 od		5061-5869
4	Reducing nut for split/splitless inlet		18740-20800
5	S/SL insulation kit, 3 pieces		5188-5241
6	Cover, lower insulation		19243-00070

**Gold seal on the split/splitless inlet**



Split/splitless inlet assembly (bottom)



Reducing nut, 18740-20800



Gold plated seal kit, 5188-5367

**TIPS & TOOLS**

**Agilent's Self Tightening column nut eliminates the need for retightening once and for all**

This unique, self tightening stainless steel GC column nut delivers a tight connection – without expensive upgrades or adapters – and gives you the advantages of:

- Reliable performance
- Less wasted time
- Ease of use
- Faster maintenance



Learn how to install a column using the Self Tightening column nut, visit [www.agilent.com/chem/STnut](http://www.agilent.com/chem/STnut)

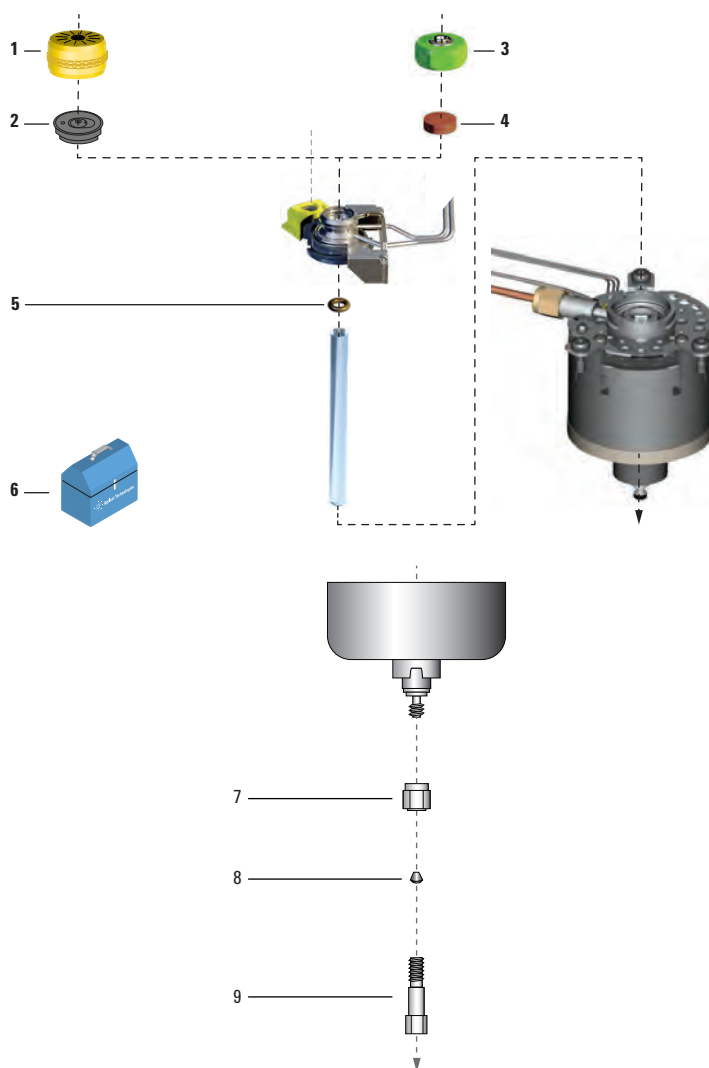
# Multimode Inlet

Agilent's premium inlet – two inlets in one for maximum performance and flexibility for the 7890B GC

The MMI combines the functionality of the split/splitless and PTV inlets. Perform standard injection techniques when SOPs require; use large volume or temperature programs as needed.

## Multimode Inlet Body

Item	Description	Unit	Part No.
1	Merlin cap		5182-3445
	Merlin Microseal kit, low pressure		5181-8816
	General purpose Merlin Microseal starter kit		5182-3442
2	Merlin Microseal low pressure replacement septum		5181-8815
	Merlin Microseal general purpose replacement septum 3-100 psi		5182-3444
3	Septum nut, purged inlets		18740-60835
	Headspace septum retainer nut		18740-60830
4	Non-stick bleed and temperature optimized (BTO) septa, 11 mm	50/pk	5183-4757
		100/pk	5183-4757-100
	Non-stick long-life septa, 11 mm	50/pk	5183-4761
		100/pk	5183-4761-100
5	Certified non-stick fluorocarbon O-ring	10/pk	5188-5365
	Graphite O-ring for split liner	10/pk	5180-4168
	Graphite O-ring for splitless liner	10/pk	5180-4173
6	Wrench for multimode inlet		G3452-20512
	Column installation pre-swaging tool, metal ferrules		G3440-80218
	Column installation pre-swaging tool, graphite ferrules		G3440-80217
7	Column nut adapter		G3510-20018
8	For complete offering of column ferrules, <b>see page 37.</b>		
9	For complete offering of column nuts, <b>see page 40.</b>		



Exploded parts view of the Multimode Inlet

## Installing a Capillary Column in a Multimode Inlet

1. Prepare the column for installation.
2. Thread the column adapter nut onto the base of the inlet and make sure it can spin freely.
3. Place a septum, capillary nut, and graphite ferrule on the column.
4. Score and snap off the end of the column.
5. Position the column so it extends 10-12 mm past the end of the ferrule.
6. Slide the septum to place the nut and ferrule in the correct position.
7. Insert the column in the inlet.
8. While holding the adapter with a wrench, thread the column nut into the inlet (but do not tighten).
9. Adjust the column position so that the septum contacts the bottom of the column nut. Finger tighten the column nut until it begins to grip the column.
10. While holding the inlet base with one wrench, use the second wrench to tighten the column nut an additional 1/4 to 1/2 turn so that the column cannot be pulled from the fitting with gentle pressure.

## Cleaning the Multimode Inlet

Agilent recommends using the G3510-60820 Multimode Cleaning Kit, which ships with detailed cleaning instructions.

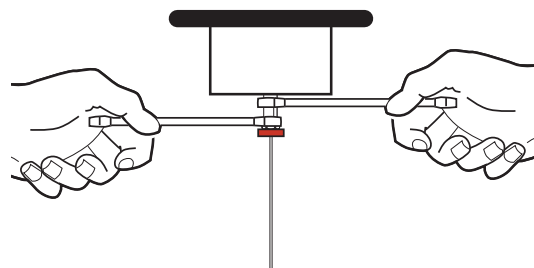
Depending on the inlet mode used, the liner installed, and the cleanliness of the sample, the frequency of cleaning may range from weekly to monthly. When establishing your cleaning frequency, start with a visual inspection of the inlet bottom whenever a liner is changed. A small ring of material will collect at the bottom of the inlet when dirty samples such as food extracts or solid waste extracts are injected. An initial cleaning schedule of every two weeks for dirty samples and every two months for clean samples is appropriate and can be adjusted subsequently.



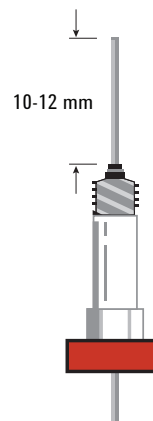
### WARNINGS & CAUTION

The inside of the wall of the inlet is only 0.005 in thick and can be damaged with hard scrubbing.

### Step 2



### Step 5



### TIPS & TOOLS

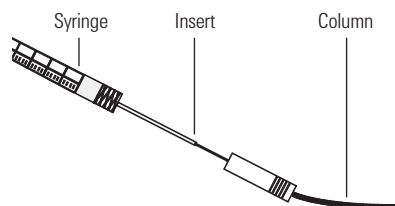
Because of temperature programmability, graphite is the preferred ferrule for the MMI. However, graphite/polyimide ferrules can be used with Self Tightening column nuts to prevent leaks.



Turn to page 36.

## Cool On-Column Inlets

### Cool On-Column Inlet Maintenance



#### Installing a Capillary Column into a Cool On-Column Inlet

1. Gently insert the column into the inlet until it bottoms.
2. Insert the column nut into the inlet fitting and finger tighten.
3. Tighten the column nut an additional 1/4 turn with a wrench or until the column does not move. Use two wrenches to support inlet (5/16 in and 1/4 in).
4. If using an automatic injection system with a 0.25 mm or 0.32 mm column, verify that the column installation by manually pushing the syringe into the inlet.

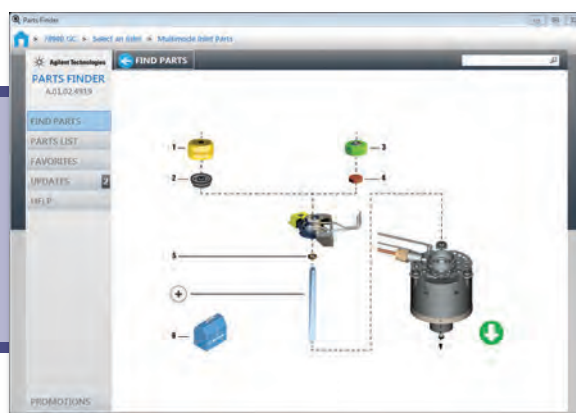
#### Checking the Needle-to-Column Size on the Cool On-Column Inlet

1. Check the needle-to-column size to make certain that the needle fits in the column.
2. Identify the correct insert for the column size. Use the insert that is the same size as the syringe needle to verify that the column you plan to use is the correct size.
3. Insert the column into one end of the insert.
4. Insert the syringe needle through the other end of the insert and into the column. If the needle cannot pass easily into the column, reverse the insert to try the needle and column in the other end.



#### TIPS & TOOLS

Download the Agilent Parts Finder Tool for simplified parts ordering and troubleshooting, [www.agilent.com/chem/go2partsfinder](http://www.agilent.com/chem/go2partsfinder)





## Changing the Septum on the Cool On-Column Inlet

1. Replace the septum.

If you are using a septum nut, grasp the knurling and unscrew. Remove the old septum with tweezers. Use tweezers to install a new septum. Push the septum into the septum nut until properly seated. Firmly tighten the nut.

If you are using a cooling tower, grasp the three rings and unscrew. The spring and duck bill septum may pop out of the inlet when you remove the cooling tower. Be careful not to lose them. If they do not pop out, use a thin wire to remove them from the inlet. Insert the replacement duck bill septum into the spring and place in the inlet. Reattach the cooling tower assembly, then finger tighten.

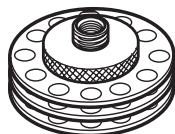
2. Before making an injection, check the alignment of the entire assembly using the proper size syringe.
3. Restore the analytical method.
4. Reset the septum counter.

For 250/320  $\mu\text{m}$   
automated injections

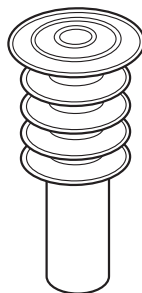


Septum

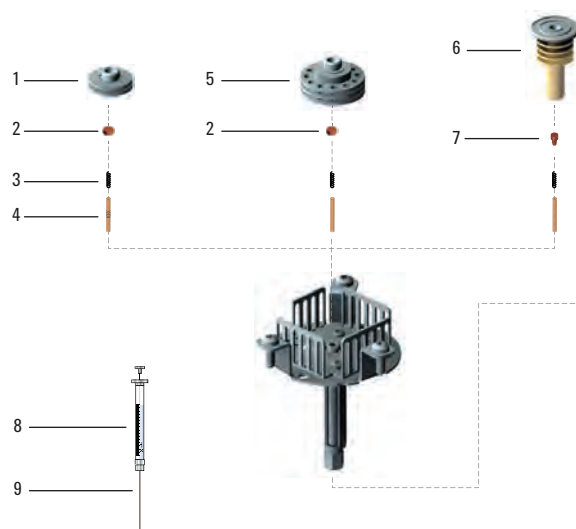
For 530  $\mu\text{m}$   
automated injections



For 200  $\mu\text{m}$  manual injections  
with fused silica needle



Duck bill



Cool On-Column Inlet Parts

**7890/6890 Cool On-Column Inlet Supplies**

Part No.	Description	Unit	Part No.
1	Septum nut for 320 µm columns		19245-80521
2	5 mm septa through-hole for on-column, in glass jar	50/pk	5183-4760
	5 mm through-hole septa	25/pk	5181-1260
	5 mm septa through-hole for on-column, in glass jar	50/pk	5183-4762
	5 mm septa through-hole for on-column, in glass jar	50/pk	5183-4758
3	Spring		19245-60760
4	Insert for 320 µm columns, 5 silver rings		19245-20525
	Insert for 530 µm columns, no rings		19245-20580
	Insert for 250 µm columns, 6 rings		19245-20515
	Insert, 530 µm aluminum clad, 4 rings		19245-20780
	Insert for 200 µm, 1 ring		19245-20510
5	Septum nut base for 530 µm assembly		G1545-80520
6	Cooling tower assembly		19320-80625
7	Duck bill	10/pk	19245-40050
8	On-column syringe, fused silica (barrel only)		9301-0658
	Removable needle, syringe only		5182-0836
	Syringe ferrule, PTFE		0100-1389
	On-column syringe, stainless steel		5182-9633
9	Needle, on-column syringe, 3/pk	3/pk	5182-9645
	Stainless steel needle for 0.25 mm column	3/pk	5182-0833
	Stainless steel needle for 0.32 mm column	3/pk	5182-0831
	Fused silica syringe needles	6/pk	19091-63000

# Programmable Temperature Vaporizer (PTV) Inlets

PTV inlets combine the benefits of split, splitless and on-column inlets. The sample is usually injected into a cool liner, so syringe needle discrimination does not occur. Then the inlet temperature is increased to vaporize the sample. The user programs vent times and temperature to achieve the equivalent of split or splitless transfer of sample vapors to the column. PTV injection is considered the most universal sample introduction system because of its flexibility.

## Advantages

- No syringe-needle discrimination
- Minimal inlet discrimination
- Use of large injection volumes
- Removal of solvent and low boiling components
- Trapping of nonvolatile components in liner
- Split or splitless operation
- Retention time and area reproducibility approaching cool on-column injection

PTV inlets are actively cooled before and during injection by Peltier devices or by forced gases (air, liquid N<sub>2</sub>, or liquid CO<sub>2</sub>). Cryogenic cooling of the inlet can reduce inlet temperature enough to thermally focus gas injections from other sampling devices in the liner. This is a distinct advantage of using PTV inlets in comparison to conventional inlets for coupling auxiliary sampling devices to capillary columns.

Post-injection, PTV inlets are heated using electrical heaters or preheated compressed air. Depending on design, inlet temperature ramps are either ballistic (i.e., ramped to the maximum temperature at an uncontrolled maximum rate) or programmable.



**PTV Inlet Practices and Rationales (Cold Split/Splitless Modes)**

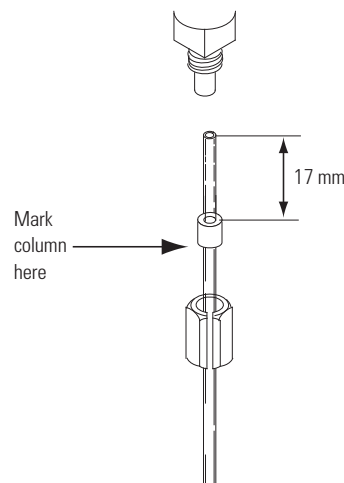
Parameter	Selection/Setting	Rationale
Injection mode	Cold split	For general use and sample screening
	Cold splitless	For trace analysis
	Cold solvent vent	LVI
Inlet temperature ramp rate	Adjustable (i.e., 2 °C/s to 720 °C/s max)	Use slower ramp rates for labile, complex, or large volume samples Use faster ramp rates for most samples Use faster ramp rates to shorten splitless purge delay time
	Ballistic	Simpler, less expensive instrumentation
Inlet liner	Straight with silanized wool	For general use
	Baffled	For labile samples
	Packed with an adsorbent	For focusing gaseous injections from auxiliary sampling devices
Injection volume	0.1-1.5 µL	Use lower volumes for volatile solvents and fast ramp rates
	5-50 µL for LVI	Use volumes larger than 1.5 µL only in solvent-elimination mode
Sample Injection technique	Autosampler or manual, fast or slow	Not critical for cold split and splitless modes
Oven temperature	10-25 °C below solvent BP	For proper solvent effect in splitless mode
	Sample dependent	For split mode
Column flow	30-50 cm/s	Clears inlet faster Less backflash
Septum purge	1-5 mL/min	Minimizes ghosting
Quantification	Any method	Inherently reproducible Low discrimination in cold injection modes
Retention gap	1-3 m, deactivated	Compensates for extended flooded zone and solvent-column incompatibility



# PTV Inlet Maintenance

## Installing a Capillary Column into the PTV Inlet

1. Position the column so it extends 17 mm above the end of the ferrule. Mark the column behind the ferrule with correction fluid or a marker. Slide the nut over the column.
2. Insert the column into the adapter and finger tighten the column nut. Looking through the slot in the nut, adjust the column until the mark is correctly positioned below the Graphpak 2M ferrule.
3. Tighten the column nut an additional 1/8 to 1/4 turn with a wrench. Do not overtighten.



## 7890/6890 Septumless PTV Inlet Supplies

Description	Column ID (mm)	Unit	Part No.
Merlin Microseal high pressure nut			5182-3445
Merlin Microseal			5182-3444
Septumless head			G2617-60507
Septum head			G2618-80500
Septum nut, purged inlets			18740-60835
PTV inlet assembly			G2617-60506
PTV LCO <sub>2</sub> cooling jacket			G2617-60508
PTV LN <sub>2</sub> cooling jacket			G2619-60501
Silver seal		5/pk	5182-9763
Graphpak 2M inlet adapter, 0.2 mm	0.20		5182-9754
	0.25-0.33		5182-9761
	0.53		5182-9762
Ferrules for Graphpak 2M inlet, 0.2 mm	0.20	10/pk	5182-9756
	0.25	10/pk	5182-9768
	0.32	10/pk	5182-9769
	0.53	10/pk	5182-9770

(Continued)

**7890/6890 Septumless PTV Inlet Supplies**

<b>Description</b>	<b>Column ID (mm)</b>	<b>Unit</b>	<b>Part No.</b>
Replacement Graphpak column nut			5062-3525
PTV insulation block			G2617-20510
PTV Cryo insulator			G2617-60510
PTFE ferrule (needle seal)		10/pk	5182-9748
Kalrez seal			5182-9759
Valve body			5182-9757
Pressure spring			5182-9758
Viton seal		5/pk	5182-9775
Sealing element			5182-9760
CO <sub>2</sub> Cryo inline filter			3150-0602
Service kit for septumless head Contains Kalrez seal, valve body, and pressure spring			5182-9747
Graphpak 3D ferrules		5/pk	5182-9749
Assembly tool for Graphpak 3D ferrules			G2617-80540

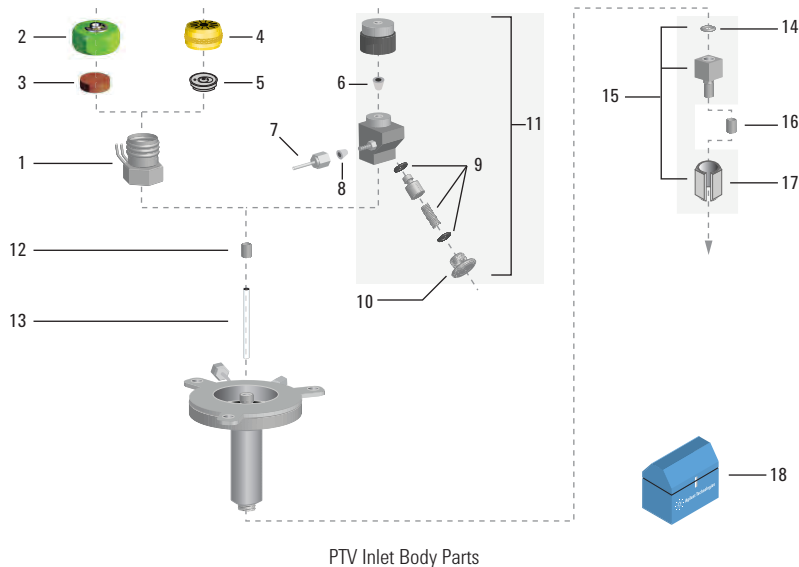
**PTV Inlet Body**

<b>Item</b>	<b>Description</b>	<b>Unit</b>	<b>Part No.</b>
1	Septum head		G2618-80500
2	Septum nut, purged inlets		18740-60835
3	11 mm septa	50/pk	5183-4759
		100/pk	5183-4759-100
	Non-stick long-life septa, 11 mm	50/pk	5183-4761
		100/pk	5183-4761-100
4	Merlin Microseal high pressure nut		5182-3445
5	Merlin Microseal general purpose replacement septum 3-100 psi		5182-3444
6	PTFE ferrule (needle seal)		5182-9748
7	PTV column adapter tube (includes 1/6 in nut and ferrule)		G2617-80550
8	Straight ferrule, 1/16 in	10/pk	0100-1375
9	Service kit for septumless head		5182-9747
10	Sealing element		5182-9760
11	Septumless head		G2617-60507
12	Graphpak 3D ferrules	5/pk	5182-9749
13	PTV liner, high temperature, borosilicate		5188-5356
	PTV liner, single baffle, deactivated		5183-2036
	PTV liner, sintered glass, deactivated		5190-1426
	PTV liner, high temperature, quartz		5188-5313

(Continued)

**PTV Inlet Body**

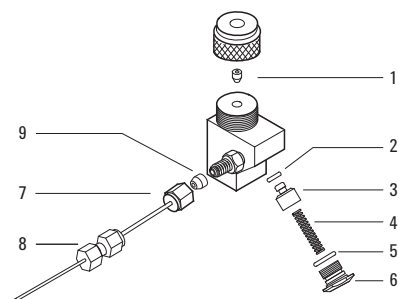
Item	Description	Unit	Part No.
14	Silver seal		5182-9763
15	Graphpak 2M inlet adapter, 0.53 mm		5182-9762
	Graphpak 2M inlet adapter, 0.32/0.25 mm		5182-9761
	Graphpak 2M inlet adapter, 0.2 mm		5182-9754
16	Ferrules for Graphpak 2M inlet, 0.32 mm	10/pk	5182-9769
	Ferrules for Graphpak 2M inlet, 0.2 mm	10/pk	5182-9756
	Ferrules for Graphpak 2M inlet, 0.25 mm	10/pk	5182-9768
	Ferrules for Graphpak 2M inlet, 0.53 mm	10/pk	5182-9770
17	Replacement Graphpak column nut	5/pk	5062-3525
18	Swabs for cleaning GC/MS	100/pk	5080-5400
	Injection port cleaning kit		480-0003
	Septum tool, knurled handle		450-1000
	Service kit for septumless head		5182-9747





**PTV Septumless Head**

Item	Description	Part No.
	Septumless head	G2617-60507
1	PTFE ferrule (needle seal)	5182-9748
2	Kalrez seal	5182-9759
3	Valve body	5182-9757
4	Pressure spring	5182-9758
5	Viton seal	5182-9775
6	Sealing element	5182-9760
7	PTV column adapter tube (includes 1/6 in nut and ferrule)	G2617-80550
8	Septumless head weldment	G3500-80000
9	Straight ferrule, 1/16 in, 10/pk	0100-1375


**Programmable Temperature Vaporizing (PTV) Liners**

Description	ID (mm)	Volume (µL)	Part No.
<b>Liners for Septumless PTV Inlet, G3501A, G3502A, G3503A</b>			
PTV liner, single baffle, glass wool, deactivated	2	180	5183-2038
PTV liner, single baffle, deactivated	2	200	5183-2036
PTV liner, multi baffled, deactivated	1.8	150	5183-2037
PTV liner, sintered glass, deactivated	1.5	112	5190-1426
<b>Liners for High Temperature PTV Inlet, G3506A</b>			
PTV liner, high temperature, quartz	3.4	713	5188-5313
PTV liner, high temperature, borosilicate	3.4	668	5188-5356

**Syringes for Septumless and High Temperature PTV Inlets**

Volume (µL)	Description	Needle	Part No.
0.5	Removable	23/70/HP	5182-9651
5	Straight, fixed	23/42/HP	9301-0892
10	Straight, fixed	23/42/HP	9301-0713
50	Straight, fixed, for large volume injections	23/42/HP	5183-0318
100	Straight, fixed, for large volume injections	23/42/HP	5183-2058

## Purged Packed Inlets

Packed column analysis is frequently done when high efficiency separations are not needed or when gases are analyzed by gas-solid chromatography. Purged packed inlets are simple in both design and use. Few parameters need to be set, and all carrier gas flow flushes through the inlet into the column in the standard configuration.

### Purged Packed Inlet Practices and Rationales

Parameter	Selection/Setting	Rationale
Inlet temperature	BP of solvent +50 °C	Ensures flash vaporization
	BP of major solute(s)	Use for neat samples
Insert type	1/8 in stainless steel	Use for stainless steel column only
	1/4 in stainless steel 530 µm	Inserts permit connection of columns up to 1/4 in od
Liner	Glass	Use to lower activity (replaceable)
Initial column temperature	Temperature programming	Sharpens peaks and reduces run time
Column type	1/8 in packed stainless	Will not break
	1/4 in packed glass 530 µm	Better for polar or labile compounds
Carrier gas flow	10-40 mL/min	Use with N <sub>2</sub> carrier gas
	10-60 mL/min	Use with He or H <sub>2</sub> carrier gas

For more information on our new expanded and refreshed Agilent packed column portfolio, see page 470.

## Purged Packed Inlet Troubleshooting

Purged packed inlets are active, have low volume and are generally flow controlled. This means that most packed column inlet problems involve sample decomposition, flashback, or leaks.

### Decomposition

Diagnose inlet sample decomposition by comparing retention times for decomposition products to their standard retention times. Then try these options to improve results:

- Intracolumn direct injection
- Deactivated glass liners
- Lower inlet temperatures
- Remove column packing in the inlet zone
- Increase flow rates

### Backflash

Large sample injections can exceed liner capacity and backflash into the gas supply lines and onto the septum. This can cause:

- Ghost peaks
- Sample losses
- Irreproducible peak areas
- Decomposition

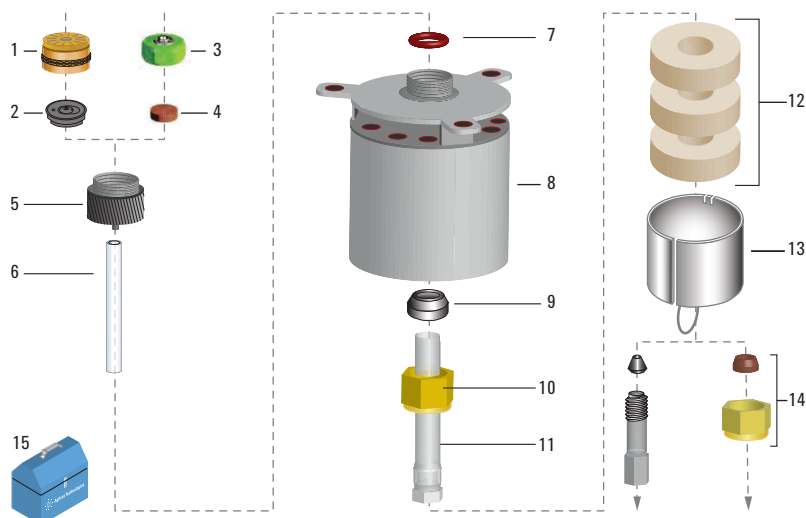
### Leaks

Septum and column leaks can cause column degradation and stationary phase decompositions on flow-controlled column inlets.

- Change the septum on a regular basis and check column connections to help eliminate leak holes.
- Keep the oven and inlet at room temperature when not in use or while changing the septum.

**Purged Packed Inlet**

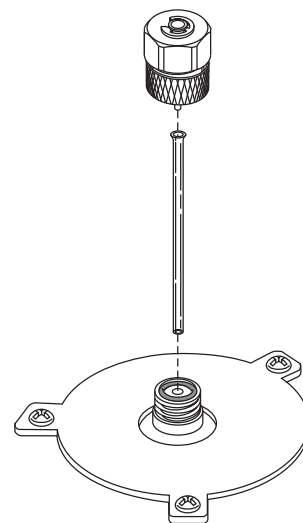
Item	Description	Unit	Part No.
1	Merlin Microseal high pressure nut		5182-3445
2	Merlin Microseal general purpose replacement septum 3 to 100 psi		5182-3444
	Merlin Microseal low pressure replacement septum		5181-8815
3	Septum nut, purged inlets		18740-60835
4	Non-stick advanced green septa, 11 mm	50/pk	5183-4759
	Non-stick long-life septa, 11 mm	50/pk	5183-4761
	General purpose gray septa 11 mm	50/pk	5080-8896-50
	Non-stick bleed and temperature optimized (BTO) septa, 11 mm	50/pk	5183-4757
5	Packed port insert weldment		19243-80570
6	Disposable glass insert, deactivated, 170 µL internal volume		5181-3382
	Disposable glass liner, 170 µL internal volume		5080-8732
7	O-ring, Viton	12/pk	5080-8898
8	Inlet weldment		G3451-80501
9	Polyimide ferrule, 1/4 in	10/pk	5080-8774
10	1/4 in nut, brass	10/pk	5180-4105
11	Packed column adapter		G1540-80013
	1/4 in column adapter		19243-80540
	1/8 in column adapter		19243-80530
	530 µm column adapter for use with glass liners		19244-80540
12	Nut warmer insulation		19234-60715
13	Nut warmer cup assembly		19234-60700
14	For complete offering of column nuts, <b>see page 40.</b>		
15	QuickPick purged packed inlet PM kit		5188-6498
	Swabs for cleaning GC/MS	100/pk	5080-5400
	Injection port cleaning kit		480-0003
	Septum tool, knurled handle		450-1000



Purged packed inlet assembly

**7890/6890/6850 Purged Packed Inlet Supplies**

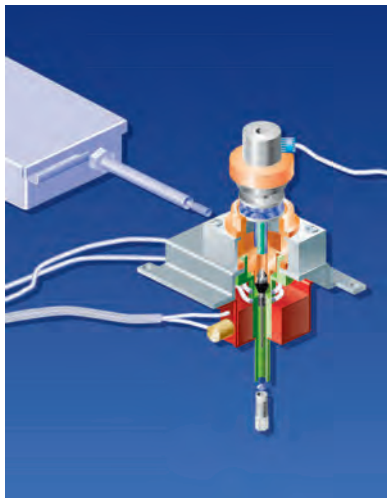
Description	Unit	Part No.
QuickPick purged packed inlet PM kit Includes 5 non-stick BTO septa, 1 O-ring, 1 ferrule, and 1 disposable glass liner		5188-6498
Merlin Microseal		5182-3444
Merlin Microseal high pressure nut		5182-3445
Septum nut, purged inlets		18740-60835
Non-stick bleed and temperature optimized (BTO) septa, 11 mm	50/pk	5183-4757
Packed port insert weldment		19243-80570
O-ring, Viton	12/pk	5080-8898
Disposable glass liner, 170 µL internal volume	25/pk	5080-8732
Disposable glass insert, deactivated, 170 µL internal volume	5/pk	5181-3382
Polyimide ferrule, 1/4 in	10/pk	5080-8774
1/4 in nut, brass	10/pk	5180-4105
530 µm column adapter for use with glass liners		19244-80540
1/8 in column adapter for use with glass liners		19243-80530
1/4 in column adapter for use with glass liners		19243-80540
Nut warmer cup with insulation		19234-60720
Universal column nut	2/pk	5181-8830
Self Tightening column nut, for inlet/detector		5190-6194



How to install glass liner on Purged Packed Inlet

**Nuts and Ferrules for 1/8 in Packed Columns**

Description	Unit	Part No.
1/8 in stainless steel nut and ferrule set	20/pk	5080-8751
1/8 in brass nut and ferrule set	20/pk	5080-8750
Polyimide/graphite ferrule, 1/8 in	10/pk	0100-1332



## Detector Systems

### Flame Ionization Detector (FID)

The FID requires routine maintenance to ensure optimum performance. Maintenance requirements are application dependent, but Agilent recommends periodically cleaning or replacing the following items:

#### FID Routine Maintenance

Item	Comments
FID Jet	A plugged jet results in longer retention times as the column exit/detector pressure increases. Once the jet becomes completely plugged, it is difficult to light or sustain a flame.
Ignitor Glow-Plug	Replace if corroded or burned out.
FID Collector/Insulators	Contamination can contribute to detector noise or loss of sensitivity.
Column Adapter/Seals For Adaptable FID only	Leaks at column fittings can result in difficulty lighting the FID or sustaining a flame after injection.

### Typical FID Problems

#### Condensation

Since the FID combustion process results in water formation, the detector temperature must be kept above 300 °C to prevent condensation. At detector block temperatures below 300 °C, the castle assembly drops below 100 °C, resulting in condensation and possible rusting. Such condensation, especially when combined with chlorinated or fluorinated solvents or samples, causes corrosion, with resulting increase in detector noise and loss of sensitivity.

## Flame Ignition

If the flame goes out or will not light:

- Measure the hydrogen/air and makeup flow rates – Low H<sub>2</sub> or makeup flows indicate a plugged jet, or a leak at the column fitting. Measure each gas flow independently.
- Confirm that the ignitor is glowing during the FID ignition sequence.
- Check for partially or completely plugged jet – Formation of silica or carbon deposits at the tip of the jet can cause plugging. Incorrect capillary column installation can also cause plugging.

It is best to replace a plugged jet, rather than try to clean it.

- Check that the capillary column is not installed all the way to the jet tip (withdraw 1-2 mm).
- Check that the correct type of jet is installed for the column you are using.
- Check for leaking column or adapter fitting at the base of the FID.
- Check the lit offset value to make sure it is not too low or too high.  
Adjust the value (normally set to 2.0 pA).

Injecting large volumes of aromatic solvent or water can cause the flame to go out. Switch to a non-aromatic solvent or reduce injection volume.

## Increased FID Noise or Loss in Sensitivity

FID noise is affected by:

- The cleanliness of the GC gases and gas delivery system – Ensure that the carrier/H<sub>2</sub> and air purity is  $\geq 99.9995\%$ . Check traps and filters in the gas supply lines. The FID background signal should be  $\leq 20$  pA when the flame is lit and stabilized.
- Dirty collector/PTFE insulators – Clean or replace.
- Dirty jet – An incorrect flame pattern can increase noise or affect sensitivity.



FID collector assembly

### TIPS & TOOLS

For optimal sensitivity, use Agilent gas purifiers to ensure cleanliness of your GC gases. **Turn to page 164.**





### WHAT YOU NEED:

- Column
- Ferrule(s)
- Column nut
- Column cutter
- 1/4 in open end wrench
- Septum
- Isopropanol
- Lab tissue
- Lint-free gloves
- Column ferrule installation tool (p/n 19251-80680)



### WARNINGS & CAUTION

- The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.
- Wear safety glasses to protect your eyes from flying particles while handling, cutting or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.
- Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

## Installing a Capillary Column in the FID

1. Gather the required supplies and tools.
2. Load the GC maintenance method and wait for the GC to become ready.
3. If using the adaptable detector, verify that the adapter is installed.
4. Place a septum, capillary column nut, and ferrule on the column.
5. Score the column using a glass scribing tool. The score must be square to ensure a clean break.
6. Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain there are no burrs or jagged edges.
7. Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.
8. Install the capillary column.

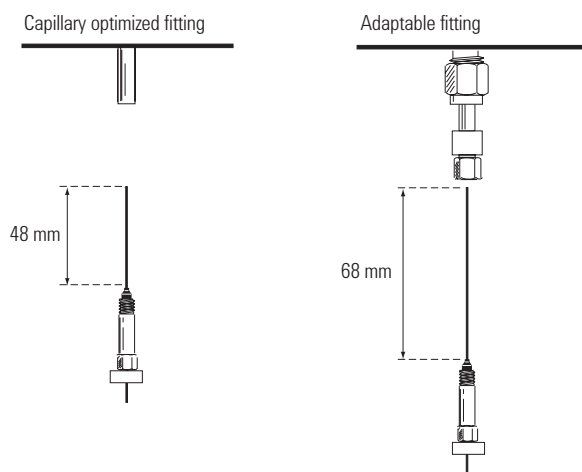
If the column id is greater than 0.1 mm:

- a. Gently insert the column into the detector until it bottoms; do not attempt to force it further.
- b. Finger tighten the column nut, then withdraw the column about 1 mm. Tighten the nut an additional 1/4 turn with a wrench.

If the column id is 0.1 mm or less, position the column so it extends above the ferrule by 48 mm (capillary optimized fitting) or 68 mm (adaptable fitting). Slide the septum up to hold the column nut and ferrule at this fixed position.

- c. Insert the column into the detector. Slide the nut and ferrule up the column to the detector base. Finger tighten the column nut until it grips the column.
- d. Adjust the column (not the septum) position so that the septum is even with the bottom of the column nut. Tighten the nut an additional 1/4 turn with a wrench.

### Positioning the column





## FID Jet Identification and Selection

Before ordering parts for FID maintenance, determine which type of FID is installed on your GC. The FID is available in two versions:

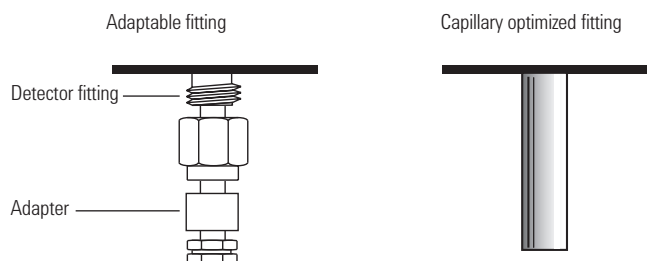
- Dedicated, Capillary Optimized: for capillary columns only
- Adaptable: for packed or capillary columns

To determine the type of FID installed on your GC, open the oven door and examine the fitting at the base of the detector. Compare to the following diagram.



Adaptable FID Jet, 19244-80560

**Hint:** Adaptable jets are longer than dedicated capillary jets.



**FID Jets**

Item	Description	Part No.
1	Jet, 0.011 in/0.29 mm id tip, capillary dedicated	G1531-80560
2	Jet, 0.018 in/0.47 mm id tip, capillary optimized	G1531-80620
3	Jet, capillary adaptable, 0.011 in id tip	19244-80560
4	Jet, packed, high temperature, 0.018 in id tip	19244-80620
5	Jet, packed standard, 0.018 in id tip	18710-20119
6	Jet, packed wide-bore, 0.030 in id tip (for high-bleed applications)	18789-80070



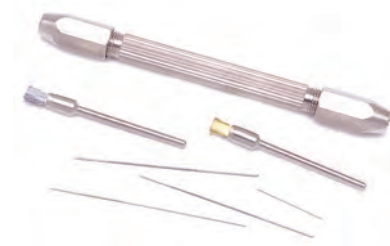
### Jet Cleaning Procedure

Use Agilent FID Cleaning Kit, p/n 9301-0985

1. Run a cleaning wire through the top of the jet. Run it back and forth a few times until it runs smoothly. Be careful not to scratch the jet. (Do not force too large a wire or probe into the jet opening or the opening will become distorted. A loss of sensitivity, poor peak shape, and/or lighting difficulties may result if the opening is deformed.)
2. Fill an ultrasonic cleaning bath with aqueous detergent, and place the jet in the bath. Sonicate for five minutes.
3. Use a jet reamer to clean the inside of the jet.
4. Sonicate again for five min.

**Note:** from this point on, handle the parts only with forceps!

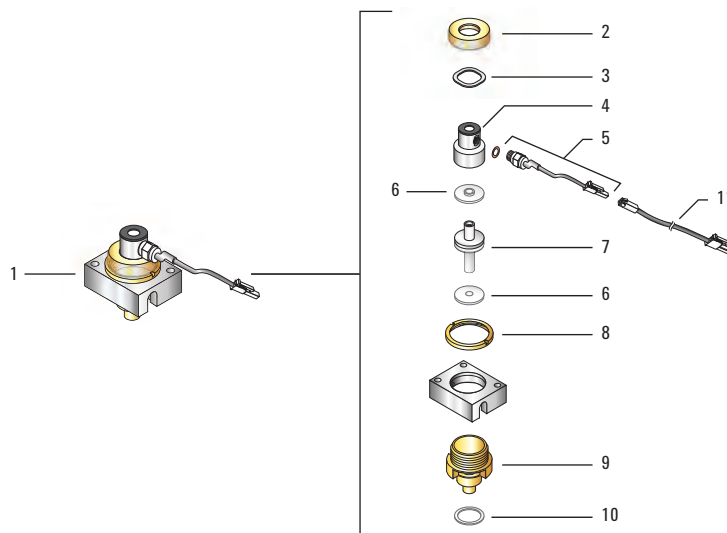
5. Remove the jet from the bath and rinse it thoroughly, first with hot tap water and then with a small amount of GC-grade methanol.
6. Blow the jet dry with a burst of compressed air or nitrogen, and then place the jet on a paper towel and allow to air dry.



FID cleaning kit, 9301-0985

**7890/6890/6850 Flame Ionization Detector (FID) Supplies**

Item	Description	Unit	Part No.
1	FID collector assembly		G1531-60690
2	Collector nut		19231-20940
3	Washer, spring, wavey, 19.0 to 19.81 mm id, 24.5 mm od		3050-1246
4	Hastelloy ignitor castle (optional)		19231-21060
	Ignitor castle		19231-20910
5	Ignitor glow plug assembly		19231-60680
6	Collector insulator		G1531-20700
7	Hastelloy collector body		G1531-21090
	Collector body		G1531-20690
8	Nut, collector spanner		19231-20980
9	Collector housing		G1531-20740
10	Silicone gaskets, 0.890 in od/0.709 in id	12/pk	5180-4165
11	FID ignitor cable, 7890A only		G3431-60680

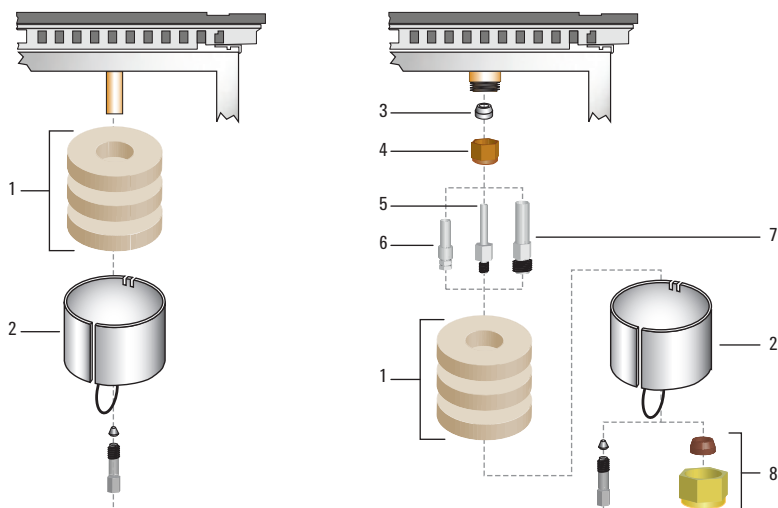


Flame Ionization Detector (FID) assembly

**FID base assembly**

Item	Description	Unit	Part No.
1	Nut warmer insulation		19234-60715
2	Nut warmer cup assembly		19234-60700
3	Polyimide ferrule, 1/4 in	10/pk	5080-8774
4	1/4 in nut, brass	10/pk	5180-4105
5	FID/NPD 1/8 in packed column		19231-80520
6	FID/NPD adapter for capillary column		19244-80610
7	FID/NPD 1/4 in packed column		19231-80530
8	1/8 in stainless steel nut and ferrule set	20/pk	5080-8751
	1/8 in brass nut and ferrule set	20/pk	5080-8750
	Polyimide/graphite ferrule, 1/8 in	10/pk	0100-1332
	1/8 in nut, brass	10/pk	5180-4103
	Universal column nut	2/pk	5181-8830

For complete offering of column ferrules, **see page 37**.



Capillary-optimized FID parts

Adaptable FID parts

FID base assembly



## Electron Capture Detector (ECD)

The Agilent micro ECD is the most sensitive on the market, with a detection zone volume 10 times smaller than any other ECD. The replaceable liner serves as a physical stop for the column, ensuring reproducible column installation and decreasing column contamination of the cell.

### Liner Selection

The only assembly that requires routine maintenance is the glass liner in the makeup gas assembly, especially for the  $\mu$ ECD. All sample passes through the indent in the mixing liner of the  $\mu$ ECD. The mixing liner should be replaced if there is a significant loss of sensitivity or any time the column is removed/reinstalled in the detector.

- Gigabore Liner (p/n 19233-20625): for original ECD design (5890 and 6890), brown, polyimide coating
- Mixing Liner (p/n G2397-20540): for  $\mu$ ECD, clear glass with indent

### Makeup Gas Adapter Maintenance/Installation Procedure

1. Remove the Makeup Gas Adapter from the ECD fitting with a 9/16 in wrench. Be careful not to stress the 1/16 in stainless steel gas supply tube.
2. Unscrew the end cap of the Makeup Gas Adapter and ultrasonically clean in solvent.
3. Remove the old liner.
4. Clean the Makeup Gas Adapter body with solvent in a Nalgene squeeze bottle.
5. Wipe the Makeup Gas Adapter with a clean laboratory wipe.
6. Install the replacement liner.
7. Reinstall the tip of the Makeup Gas Adapter and tighten securely.
8. Reinstall the Makeup Gas Adapter. Make sure it is fully inserted into the detector.
9. Reinstall the column.
10. Reinstall the insulation cup.

### TIPS & TOOLS

#### Agilent's Self Tightening column nut eliminates the need for retightening once and for all

This unique, self tightening stainless steel GC column nut delivers a tight connection – without expensive upgrades or adapters – and gives you the advantages of:

- Reliable performance
- Less wasted time
- Ease of use
- Faster maintenance

Learn how to install a column using the Self Tightening column nut, visit [www.agilent.com/chem/STnut](http://www.agilent.com/chem/STnut)



## Thermal Cleaning

If your baseline is noisy or the output value is abnormally high (>1000 Hz), and you have determined that these problems are not being caused by leaks in the GC system, you may have contamination in the detector from column bleed and sample residues. To remove contamination, you should perform a thermal cleaning (bake out) of the detector. Bake out the detector at 20 to 30 degrees higher than normal operating temperature (375 °C max), with 50 to 100 mL/min of makeup gas flow.



### WARNINGS & CAUTION

Detector disassembly and/or cleaning procedures other than thermal should be performed only by personnel trained and licensed appropriately to handle radioactive materials. Trace amounts of radioactive <sup>63</sup>Ni may be removed during other procedures, causing possible hazardous exposure to β and X-radiation.

## Radioactivity Leak Test

Electron capture detectors must be tested for radioactive leakage at least every six months. Records of tests and results must be maintained for possible inspection by the Nuclear Regulatory Commission and/or responsible local agency. More frequent tests may be conducted when necessary.

The procedure used is a "wipe test". A Wipe Test Kit is supplied with each new detector. Refer to the information card supplied in the kit for instructions on performing the test.

## Gas Purity

For successful EC detection, it's important that the carrier and purge gases are very clean and dry (99.9995% minimum purity). Moisture, oxygen, or other contaminants can result in higher detector response, but usually at the expense of both sensitivity and linear range. Always precondition the column before connection to the detector.

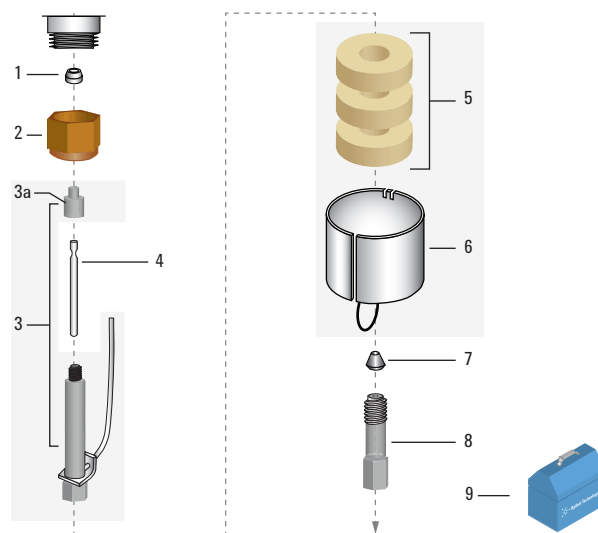
## ECD Wipe Test

The Wipe Test Kit (p/n 18713-60050) included with each new ECD includes an information card with instructions for performing the test. Records of tests and results must be maintained for possible inspection by the Nuclear Regulatory Commission (NRC) and/or responsible state agency.

**Electron Capture Detector (ECD) Supplies**

Item	Description	Unit	Part No.
1	Polyimide ferrule, 1/4 in	10/pk	5080-8774
2	1/4 in nut, brass	10/pk	5180-4105
3	Micro ECD makeup gas adapter, 7890		G3433-63000
	Micro ECD makeup gas adapter, 6890		G2397-80520
3a	ECD adapter end cap		19233-20755*
4	Fused silica liner for micro ECD makeup gas adapter		G2397-20540*
5	Nut warmer insulation		19234-60715
6	Nut warmer cup assembly		19234-60700
7	For complete offering of column ferrules, <b>see page 37.</b>		
8	For complete offering of column nuts, <b>see page 40.</b>		
9	GC electron capture detector standard in isoctane	3 x 0.5 mL ampoules	18713-60040
	Micro ECD wipe test kit		18713-60050

\*Items 3a and 4 are supplied with item 3



Electron Capture Detector (ECD) assembly



**ECD WARNINGS**

Although beta particles at this energy level have little penetrating power – the surface layer of the skin or a few sheets of paper will stop most of them – they may be hazardous if the isotope is ingested or inhaled. For this reason the cell must be handled with care. Radioactive leak tests must be performed at the required intervals, the inlet and outlet fittings must be capped when the detector is not in use, corrosive chemicals must not be introduced into the detector, and the effluent from the detector must be vented outside the laboratory environment.



## Thermal Conductivity Detector (TCD)

The TCD compares the thermal conductivities of two gas flows – pure carrier gas (also called the reference gas) and carrier gas plus sample components (also called column effluent).

### Filament Maintenance

The primary maintenance for a TCD involves the filament. Most procedures involve improving filament life or keeping the filament from becoming damaged or contaminated. To avoid filament damage and contamination:

- Check for leaks
- Use gas purifiers to remove oxygen
- Avoid chemically-active sample components, such as acids and halogenated compounds
- Turn off the filament when not in use

### Increasing Filament Lifetime

Use the following startup process to increase filament lifetime:

Purge the detector with carrier and makeup gas for 10-15 min before turning on the filaments.

This prevents oxidation of the filaments due to the presence of oxygen that has diffused into the cell under no flow conditions.

## Cell Contamination

Cell contamination is a problem when a lower detector temperature is used to improve sensitivity. If the cell becomes contaminated, a solvent flush of the detector may help to remove the condensed material.

## Thermal Cleaning

The TCD can become contaminated with deposits from such things as column bleed or dirty samples. A wandering baseline, increased noise level, or changes in response on a checkout chromatogram all indicate contamination. Thermal cleaning, or bakeout (heating the detector block to evaporate the contaminant), should be performed only after you have confirmed that the carrier gas and the flow system components are leak-free and contaminant-free.

Watch out for decreased sensitivity caused by samples that react with the filament, originating from oxygen-contaminated carrier gas, leaks in plumbing, or column bleeding. Samples with active components, such as acids and halogenated compounds can chemically attack the filament as well. Also, sample condensation will contaminate the detector cell if the temperature is too low.

Some types of contaminants can be removed by temperature bake out.

**7890/6890/6850 Thermal Conductivity Detector (TCD) Supplies**

Description	Unit	Part No.
<b>For 1/8 in SS Packed Column Installation</b>		
Polyimide/graphite ferrule, 1/8 in	10/pk	0100-1332
1/8 in nut, brass	10/pk	5180-4103
<b>For 1/4 in SS Packed Column Installation</b>		
Polyimide/graphite ferrule, 1/8 in	10/pk	0100-1332
1/8 in nut, brass	10/pk	5180-4103
1/4 in packed column adapter		G1532-20710
Polyimide ferrule, 1/4 in	10/pk	5080-8774
1/4 in nut, brass	10/pk	5180-4105
<b>For Capillary Column Installation (Standard)</b>		
TCD capillary column adapter		G1532-80540
Polyimide/graphite ferrule, 1/8 in	10/pk	0100-1332
1/8 in nut, brass	10/pk	5180-4103
Universal column nut	2/pk	5181-8830
6850 column nut	2/pk	5183-4732
530 $\mu\text{m}$ , 1.0 mm id graphite ferrule	10/pk	5080-8773
320 $\mu\text{m}$ , 0.5 mm id graphite ferrule	10/pk	5080-8853
TCD sample	3 x 0.5 mL ampoules	18711-60060
Solution of 0.33% C <sub>14</sub> , C <sub>15</sub> , and C <sub>16</sub> normal alkanes in hexane (w/w).		
FID and TCD sample	3 x 0.5 mL ampoules	18710-60170
This sample is used for the HP 5880, 5890 and 6890 with a FID or TCD. Solution of 0.033% C <sub>14</sub> , C <sub>15</sub> , and C <sub>16</sub> normal alkanes in hexane.		



1/8 in stainless steel packed column



1/4 in packed column adapter, G1532-20710



Standard design



**WHAT YOU NEED:**

- Front ferrule
- Back ferrule
- Column nut
- Column cutter
- 7/16 in wrench
- Lab tissue
- Lint-free gloves

## Installing a Capillary Column in the TCD

1. Gather the required supplies and tools.
2. Assemble the ferrules and 1/8 in brass Swagelok nut on the column.
3. Score the column using a glass scribing tool. The score must be square to ensure a clean break.
4. Break off the column end by supporting it against the column cutter opposite the scribe. Inspect the end with a magnifying loupe to make certain that there are no burrs or jagged edges.
5. Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.
6. Insert the column into the detector until it bottoms.
7. Slide the column nut and ferrules up the column to the detector and finger tighten the nut.
8. Pull out 1 mm of column. Tighten the nut an additional 1/4 turn with a wrench or until the column does not move.

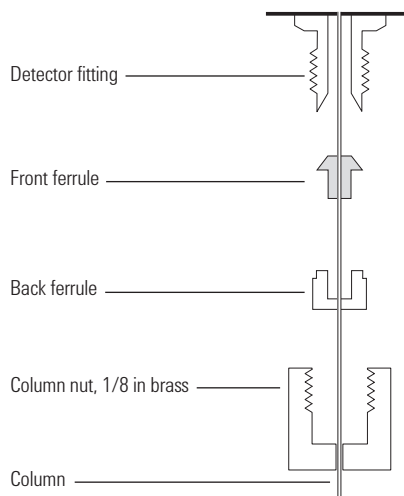


**WARNINGS & CAUTION**

- The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.
- Wear safety glasses to protect your eyes from flying particles while handling, cutting or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.
- Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

### TCD Ferrules

Column ID (mm)	Back Ferrules, 10/pk	Front Ferrules, 10/pk
0.53	5182-3477	5182-9673
0.32	5182-3477	5182-9676
0.25/0.2/0.1	5182-3477	5182-9677
No hole	5182-3477	5182-9679
1/8 in nut, brass	5180-4103	



## Determining the TCD Electronic Pressure Control (EPC)

If you have a 6890A or 6890A Plus GC, you may have an older design EPC flow manifold for the TCD. The older design requires removal of sheet metal panels to attach the TCD reference flow gas supply inside the GC. The new "Minifold" design allows TCD reference gas to be connected directly to the back of the GC. Replacement TCD filament block assemblies have different part numbers depending on the EPC design type.

Once you have determined the type of EPC module, consider ordering a passivated filament block assembly, which is recommended for fatty acid analysis or reactive/acidic samples.

### TCD Filament Block Assemblies

Instrument	Passivated	Applications	Specifications	EPC Design	Part No.
7890A	Yes	Standard TCD Analysis Gases/Hydrocarbons	Complete Detector Assembly Includes detector palette and heater/sensor assembly	Original	G3432-60220
7890A	Yes	Standard TCD Analysis Gases/Hydrocarbons	Complete Detector Assembly Includes detector palette and heater/sensor assembly Third detector, side mounted	Original	G3432-60221
6890	No	Standard TCD Analysis Gases/Hydrocarbons	Filament Block Only Must reuse heater/sensor	Original	G1532-60675
6890	No	Standard TCD Analysis Gases/Hydrocarbons	Filament Block Only Must reuse heater/sensor	Minifold	G1532-60685
6890	Yes	Recommended for Fatty Acid Analysis	Filament Block Only Must reuse heater/sensor	Original	G1532-60690
6890/6850	Yes	Recommended for Fatty Acid Analysis	Filament Block Only Must reuse heater/sensor	Minifold	G1532-60695
6890/6850	No		Complete Detector Assembly Includes detector palette and heater/sensor assembly	Minifold	G2630-61230

## Flame Photometric Detector (FPD)

In 2005, Agilent released an improved FPD with minimum detectable levels (MDL) of 3.6 pg/s for sulfur and 60 fg/s for phosphorus. This is more than a 5 times improvement for sulfur. The updated design is based on a one-piece deactivated transfer line jet assembly and improved optics. Upgrade kits are available.

### Operation

The FPD uses three gases: air and hydrogen to support the flame, and nitrogen makeup for capillary columns. The flow rates are critical for optimizing performance. Using nitrogen as a makeup gas is essential to obtaining low MDLs. Do not use helium for the makeup gas.

#### Recommended Gas Flows

Detector Gas Flows	Phosphorus Mode	Sulfur Mode
Air	100 mL/min	60 mL/min
Hydrogen	75 mL/min	50 mL/min
Nitrogen makeup	60 mL/min	60 mL/min

## Maintenance

Managing gas purity; contamination from column bleed, sample residue, and corrosion; and air leaks can help keep your FPD at peak performance.

### Gas Purity

Sulfur contamination is a common problem and causes noise and/or a higher baseline offset in the FPD. To minimize sulfur contamination and achieve the lowest MDLs, use at least 99.9995% pure gases, clean tubing, and regulators with metal diaphragms. To protect your FPD over its lifetime, Agilent recommends gas generators or supply gas filters designed to remove sulfur.

For more information on Gas Clean Filters, turn to page 164.

### Contamination

The FPD is susceptible to buildup of residue on the surfaces of the ignitor coil, jet, combustion chamber, and chamber window. The residue increases detector offset and reduces the signal-to-noise ratio. The sample or column bleed usually cause the residue. After a period of time, you may need to rebuild the detector and replace the transfer line. Do not clean the transfer line, jet, or other parts with brushes or solvents.

To increase the time between servicing, remove the column, cap off the detector, and run it at 250 °C with the flame to bake off some of the residue. Replacing the ignitor may reduce baseline output. If these tactics are not effective, rebuild the detector.

If your solvent or sample is corrosive, it can erode the aluminum vent tube. Agilent recommends using alternative stainless steel vent tubes for these applications.

### Air Leaks

The original FPD design has three more internal seals than the new design. Temperature cycling of the detector causes the ferrules to shrink and leaks to occur. The most common leaks are around the fused silica transfer line. To eliminate these leaks, remove the detector from the GC and tighten the transfer line fittings.

For both the original and new FPD, leaks can develop at the column nut or capillary column adapter, the gang fitting at the EPC module, around the vent tube, or around the ignitor glow plug. If you are replacing fittings or O-rings, always use conditioned, graphitized-polyimide ferrules and Agilent's low sulfur O-rings. Make sure ferrules are the correct size for your column.



Glow plug, 0854-0141

## Flame Ignition Problems

You can tell if your FPD is lit by checking the detector "Output" and "Flame" on the display. The detector senses that the flame is on by comparing the output with the offset. An optimized FPD normally runs with an output in the range of 30 to 80 with the offset point at 2.0. If the flame is out and the electrometer is on, the output usually displays less than 1.

Most FPD ignition problems are caused by incorrect gas flows, incorrect column installation, or a dirty or defective ignitor. To troubleshoot:

1. Make sure the FPD is at operating temperature before trying to light.
2. Remove the rubber drip tube while lighting the FPD.
3. Increase air supply pressure by 10-20 psi.
4. Check the detector gas flows to see if they match the Recommended Gas Flows table.
5. Check the detector output when you turn the flame on. The photomultiplier will see the glow of the ignitor and jump to about 68000 pA.
6. Remove the column and check the tip for residue or burnt polyimide coating. If it appears damaged, cut off the damaged portion and reinstall to the proper height.
7. Remove the ignitor glow plug. If dirty or damaged, replace it.

Less common problems include leaks, quenching, and condensation:

- Large air leaks at the inlet or detector can reduce the percentage of the hydrogen-air mixture at the detector and cause ignition problems.
- Large injections of certain samples can cause flameouts or quenching that cause the detector to attempt to relight, interrupting your analysis.
- Condensation is a by-product of the burning of your sample. For many analyses, the liquid is collected from the vent tube. If the liquid drips back into the detector, it will extinguish the flame. Agilent recommends that you wait to light the flame until the detector is at temperature and equilibrated.
- Light leaks at the vent tube can cause a higher baseline offset. Make sure the vent tube ferrule seals tightly against the emission block. Keep the lid closed over the detector.

### TIPS & TOOLS

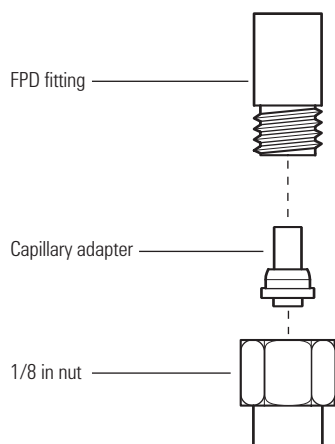


Helium is not a good makeup gas for the FPD. You will not be able to light or keep the detector lit in the sulfur mode with helium.



## Installing a Capillary Column Adapter to the FPD

1. Gather the required supplies and tools.
2. Load the GC maintenance method and wait for the GC to become ready.
3. Insert the capillary adapter into the 1/8 in nut as shown, then thread the nut onto the detector fitting.
4. Finger tighten the nut, then tighten an additional 1/8 turn with a wrench.



### WHAT YOU NEED:

- FPD capillary column adapter
- Column cutter
- 1/4 in and 9/16 in wrenches
- Metric ruler
- 1/8 in nut
- Lint-free gloves



### WARNINGS & CAUTION

- The oven and/or inlet may be hot enough to cause burns. If either is hot, wear heat-resistant gloves to protect your hands.
- Wear safety glasses to protect your eyes from flying particles while handling, cutting or installing glass or fused silica capillary columns. Use care in handling these columns to prevent puncture wounds.
- Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.



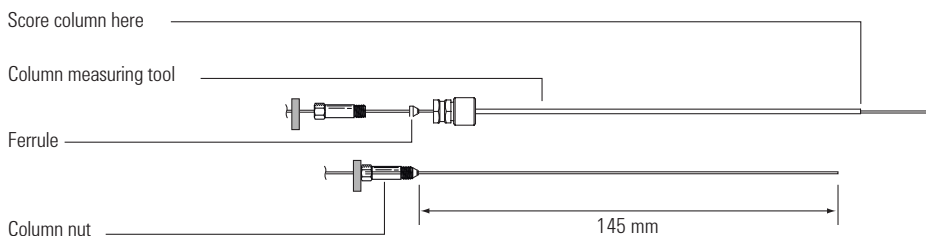
**WHAT YOU NEED:**

- Column measuring tool, p/n 19256-80640
- Column cutter
- 1/4 in and 7/16 in wrenches
- Column nut
- Ferrule
- Capillary column
- Lint-free gloves

## Attaching a Capillary Column to the FPD

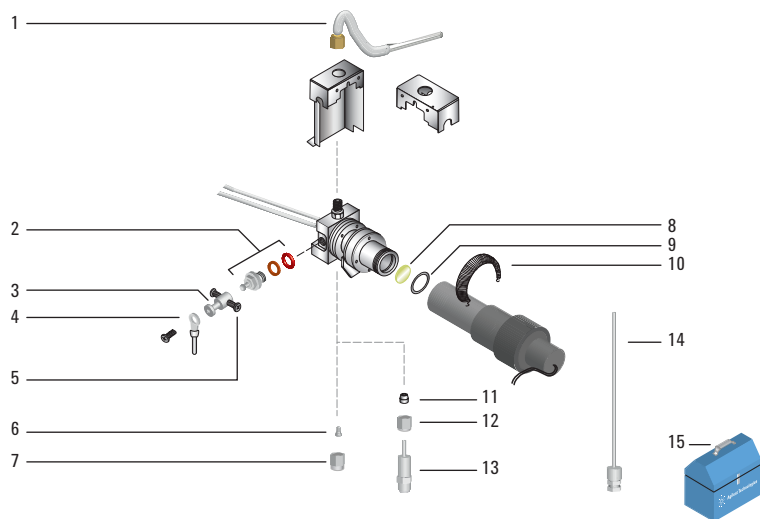
1. Gather the required supplies and tools.
2. Load the GC maintenance method and wait for the GC to become ready.
3. Assemble a septum, column nut, and ferrule on the end of the column.
4. Insert the end of the column through the column measuring tool so that the end protrudes beyond the tool.
5. Tighten the column nut until it grips the column. Tighten the nut an additional 1/8 to 1/4 turn with a pair of wrenches. Snug the septum against the base of the column nut.
6. Use a wafer cutter at 45° to score the column.
7. Snap off the column end. The column may protrude about 1 mm beyond the end of the tool. Inspect the end with a magnifying loupe to make certain that there are no burrs or jagged edges.
8. Remove the column, nut, and swaged ferrule from the tool.
9. Wipe the column walls with a tissue dampened with isopropanol to remove fingerprints and dust.
10. Verify that a capillary adapter is installed in the detector fitting.
11. Carefully thread the swaged column up into the adapter. Finger tighten the column nut, then use a wrench to tighten an additional 1/8 turn.

If you are using a capillary column, the tip of the column must be at least 1 mm below the surface of the jet. When you install the column, measure the distance from the sealing surface of the ferrule to the tip of the column. This measurement is 153 mm for the original FPD and 145 mm for the new FPD. For the new design, Agilent recommends using the column measuring tool, p/n 19256-80640.



**7890/6890/6850 FPD Ignitor and Heat Shield Assembly**

Item	Description	Unit	Part No.
1	FPD exit tube assembly, aluminum		19256-60700
	FPD exit tube assembly, stainless steel		19256-20705
2	FPD ignitor replacement kit		19256-60800
3	Collet for glow plug		19256-20690
4	Ignitor cable assembly		G1535-60600
5	Screw, M3 x 66 mm, T10		0515-0680
6	Capillary adapter seat, FPD		19256-21140
7	Capillary adapter nut		19256-21150
8	Sulfur filter		1000-1437
	Phosphorus filter		19256-80010
9	Filter spacer, use only with sulfur filter for flame photometric detector (p/n 1000-1437)		19256-20910
10	Spring, compression, for flame photometric detector		1460-1160
11	Polyimide/graphite ferrule, 1/8 in	10/pk	0100-1332
12	Nut, 1/8 in, stainless steel		0100-0057
13	1/4 in packed column adapter		G1532-20710
15	FPD check out sample		5188-5953
	FPD sample		5188-5245
	PM kit for single FPD		G2647-60501
	PM kit for dual FPD		G2648-60501



FPD ignitor and heat shield assembly

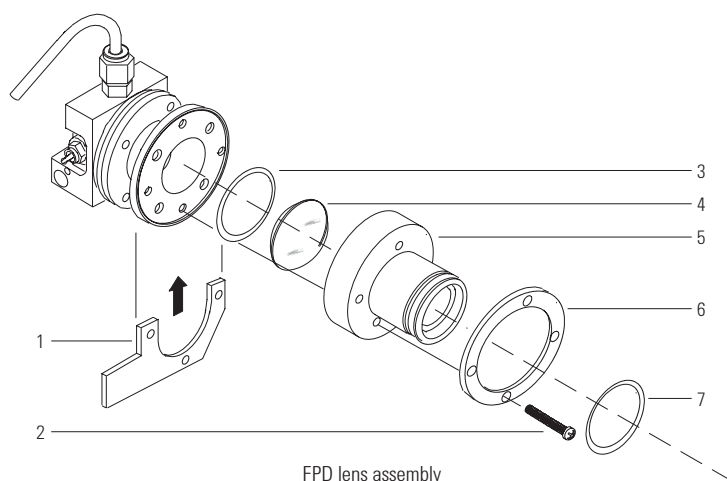
**FPD Lens Assembly**

Item	Description	Part No.
1	Clamp	19256-00090
2	Screw, M3 x 25 mm (4 required)	0515-0683
3	Window O-ring, inner, 0.926 in id, orange	5061-5886
4	Convex lens	1000-1438
5	Lens housing	19256-20900
6	Flange ring	19256-00200
7	Fluorocarbon Elastomer O-ring, brown, 1.239 in id	5061-5890

**TIPS & TOOLS**



Track detector output – when it increases by 50%, remove the column, bake it out, replace the ignitor, or rebuild the detector.



**FPD Photomultiplier Tube (PMT) and Bracket Assemblies**

Description	Part No.
Chimney back cover	G1535-80520
Heator/sensor assembly	G1535-60610
Transfer line support bracket	19256-00320
Bracket/support	G1535-00010
Sulfur filter, 7890 and late model 6890*	1000-1437
Sulfur filter, blue, early model 6890*	19256-80000
Phosphorus filter	19256-80010
Filter spacer, use only with sulfur filter for flame photometric detector (p/n 1000-1437)	19256-20910
PMT housing assembly	19256-60510
Dual FPD chimney front	G1535-00030

\*Please contact Agilent technical support for assistance in selecting the correct sulfur filter for your 6890 FPD detector.

**FPD+ Supplies for 7890B**

Description	Part No.
Single FPD+ heat shield	G3435-81330
Dual FPD+ heat shield	G3435-81360
Ignitor for FPD, cleaned	19256-60750
Collet for glow plug	19256-20690
Screw, M3 x 66 mm, T10	0515-0680
Ignitor cable assembly	G1535-60600
Sulfur filter	1000-1437
Phosphorus filter	19256-80010
Filter spacer, use only with sulfur filter for flame photometric detector (p/n 1000-1437)	19256-20910
Spring, compression, for flame photometric detector	1460-1160
Packed-capillary adapter assembly	G3435-60350
Polyimide ferrule	5062-3538
Column tool brazement	19256-80640
FPD check out sample	5188-5953
FPD sample	5188-5245



FPD+



## Nitrogen Phosphorus Detector (NPD)

### NPD Beads

The NPD for the 7890/6890 GC features a ceramic bead selective for nitrogen and phosphorus compounds. Agilent offers three beads:

- Bloss bead
- White ceramic bead
- Black ceramic bead

Compared to the white ceramic bead, the Bloss bead provides:

- Superior bead lifetime
- Faster attainment of stable operation at initial start-up, as well as more stable operation throughout bead's lifetime
- Superior sensitivity and selectivity for phosphorus-containing compounds
- Similar sensitivity and selectivity for nitrogen-containing compounds
- Superior immunity to moisture

The white ceramic bead exhibits some tailing for phosphorus compounds. The black ceramic bead does not exhibit peak tailing and typically has a longer lifetime than the white bead; however, it is less sensitive.

All Agilent NPD beads are preconditioned, self-aligning for installation and include a proof-of-performance chromatogram.



Bloss NPD bead assembly, G3434-60806

### NPD Beads

Description	Part No.
Bloss NPD bead assembly	G3434-60806
NPD white bead assembly	G1534-60570
NPD black ceramic bead assembly	5183-2007

## NPD Gas Flow

The hydrogen, air and makeup gas flows should be measured frequently. They can drift over time or be changed unintentionally without knowledge of it occurring. Each gas flow should be measured independently to obtain the most accurate values. NPDs are very sensitive to changes in the gas flows and consistent flows are necessary to maintain performance levels.

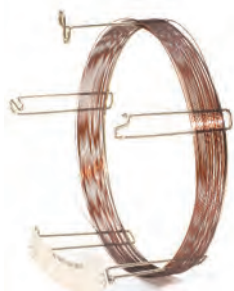
### Measuring NPD Flows

1. Set the bead voltage to 0.0 V.
2. Cool the NPD to 100 °C.
3. Remove the bead and store it carefully until re-installation.
4. Insert the NPD flow meter adapter tool into the NPD collector.
5. Attach the flow-measuring insert to the NPD flow meter adapter tool.
6. Place the flow meter tubing over the flow-measuring insert to begin measuring flows.



## NPD Gas Purity

Because of its high sensitivity, the NPD requires very pure gases (99.999% or better). We strongly recommend that moisture and hydrocarbon traps be used on the carrier gas and all detector gases, including the detector hydrogen, air, and makeup gases. Dirty gases will not only give poor chromatographic performance, but will shorten the bead life as well.



### TIPS & TOOLS

Agilent J&W GC Columns offer the lowest bleed levels, the best inertness for acids/bases/mixed functional compounds, and the tightest column-to-column reproducibility. Learn more at [www.agilent.com/chem/mygccolumns](http://www.agilent.com/chem/mygccolumns)



## Cleaning and Replacement

The NPD requires periodic cleaning. In most cases, this only involves the collector and the jet. Agilent provides brushes and wires that simplify the cleaning of all detector parts. The brushes are used to dislodge particulates clinging to the metal surfaces. A fine wire is used to clean the jet opening of particulates. Do not force too large a wire or probe into the jet opening or the opening will become distorted. A loss of sensitivity or poor peak shape may result if the opening is deformed. The various parts can be ultrasonicated after cleaning with a brush. Eventually the jet needs to be replaced, so it is strongly recommended to have spare jets on hand.

Over time, residue from the bead or sample can build up in the collector and cause baseline problems. You should clean the collector after you have damaged the bead two or three times.

The metal C-rings wear slightly with each assembly and disassembly. After several assemblies and disassemblies (five or more), the rings may not seal effectively, causing an erratic baseline. A ceramic insulator and seal kit is available (p/n 5182-9722). Always cool the detector to near-ambient when changing seals and insulators.

Because there is no flame in the NPD, the jet does not collect silica and soot as does the FID jet. Although you can clean the jet, it is more practical to simply replace dirty jets with new ones. If you do clean the jet, use the cleaning wire, taking care not to damage the inside of the jet. You can also use a sonicator bath to clean the jet.

## Contaminants

Some chemical problems can also arise when using the NPD. Because it is a trace detector, be careful not to contaminate the analytical system.

## Glassware

Glassware must be very clean. Phosphate detergents should be avoided, so acid washing of glassware followed by distilled water and solvent rinsing is recommended.

## Solvents

Solvents should be checked for purity. Chlorinated solvents and silanizing reagents can decrease the useful lifetime of the alkali source; excess reagent should be removed prior to injection, if possible.

## Other Contamination Sources

Phosphate-containing leak detectors, phosphoric acid-treated columns or glass wool, polyimide-coated columns, or nitrogen-containing liquid phases can add noise to the system and should be avoided.



## NPD Jet Identification and Selection

Before ordering parts for NPD maintenance, determine which type of NPD is installed on your GC.

The NPD is available in two versions:

- Dedicated, Capillary Optimized: for capillary columns only
- Adaptable: for packed or capillary columns

**Hint:** Adaptable jets are longer than dedicated capillary jets.

### NPD Jets

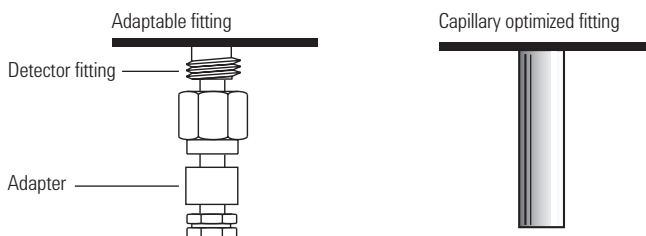
Description	Jet Tip ID	Length (mm)	Part No.
<b>Jets for capillary optimized fittings</b>			
Capillary with extended jet (recommended)	0.29 mm (0.011 in)	51.5	G1534-80580
Capillary	0.29 mm (0.011 in)	42.8	G1531-80560
Capillary	0.47 mm (0.018 in)	42.8	G1531-80620
<b>Jets for adaptable fittings</b>			
Capillary with extended jet (recommended)	0.29 mm (0.011 in)	70.5	G1534-80590
Capillary	0.29 mm (0.011 in)	61.5	19244-80560
Capillary	0.47 mm (0.018 in)	61.5	19244-80620
Packed	0.46 mm (0.018 in)	63.5	18710-20119



Capillary with extended jet, for capillary-optimized fittings, G1534-80580

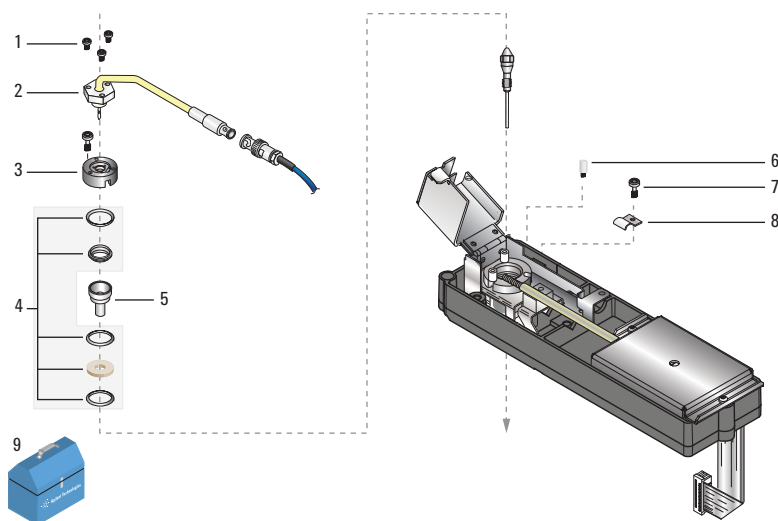


Capillary with extended jet, for adaptable fittings, G1534-80590



**7890/6890 Nitrogen Phosphorus Detector (NPD) Supplies (Top)**

Item	Description	Part No.
1	Screw, T-10, M3 x 8 mm	0515-2726
2	NPD white bead assembly	G1534-60570
	Bios NPD bead assembly	G3434-60806
	NPD black ceramic bead assembly	5183-2007
3	NPD lid weldment	G1534-80510
4	NPD ceramic insulator kit Includes 2 metal C-rings (top and bottom), 2 alumina insulators (upper and lower)	5182-9722
5	NPD collector funnel	G1534-20530
6	NPD lid standoff	G1534-20590
7	Screw, M4 x 0.7, 10 mm	0515-2495
8	J-Clamp	1400-0015
9	Nitrogen phosphorus detector sample 1/4 in nut driver for FID jet, drilled shaft NPD flow adapter	18789-60060 8710-1561 G1534-60640

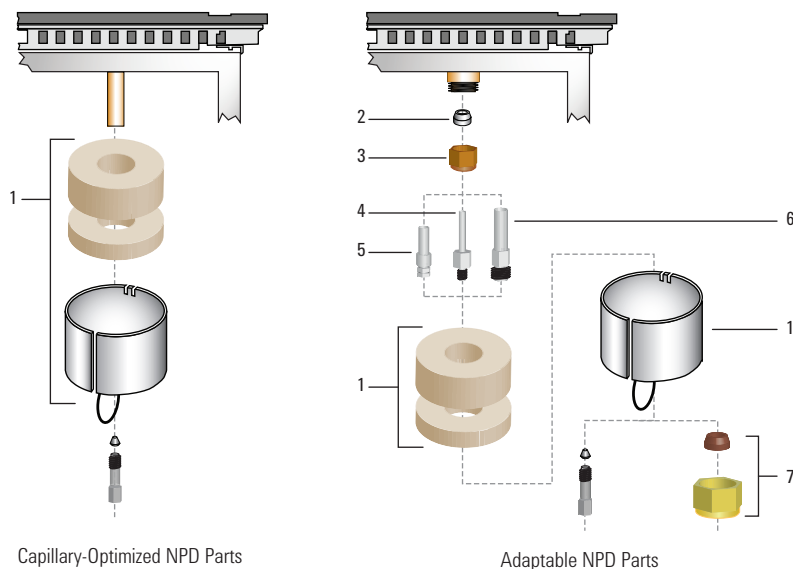


Nitrogen Phosphorus Detector (NPD) assembly (top)

**7890/6890 Nitrogen Phosphorus Detector (NPD) Supplies (Bottom)**

Item	Description	Unit	Part No.
1	Nut warmer cup with insulation		19234-60720
2	Polyimide ferrule, 1/4 in	10/pk	5080-8774
3	1/4 in nut, brass	10/pk	5180-4105
4	FID/NPD 1/8 in packed column		19231-80520
5	FID/NPD adapter for capillary column		19244-80610
6	FID/NPD 1/4 in packed column		19231-80530
	1/4 in packed column adapter		G1532-20710
7	1/4 in stainless steel nut and ferrule set	20/pk	5080-8753
	1/4 in brass nut and ferrule set	20/pk	5080-8752
	1/4 in nut, brass	10/pk	5180-4105
	Polyimide ferrule, 1/4 in	10/pk	5080-8774
	Universal column nut	2/pk	5181-8830

For complete offering of column ferrules, **see page 37**.



Nitrogen Phosphorus Detector (NPD) assembly (bottom)



Nitrogen Chemiluminescence Detector (NCD)

## Nitrogen and Sulfur Chemiluminescence Detectors

The Agilent 355 Sulfur Chemiluminescence Detector (SCD) is the most sensitive and selective chromatographic sulfur detector available for the analysis of sulfur compounds.

The Agilent 255 Nitrogen Chemiluminescence Detector (NCD) is a nitrogen-specific detector that produces a linear and equimolar response to nitrogen compounds based on a chemiluminescent reaction of NO with ozone. Even complex sample matrices can be analyzed with little or no interference.

### Nitrogen Chemiluminescence Detector (NCD) Supplies



Quartz tube kit for NCD DP burner, G6600-60038



Replacement oil coalescing filter, G6600-80042



Replacement oil coalescing filter for oil mist filter, G6600-80044



Replacement odor filtration element, G6600-80045

Description	Part No.
Quartz tube kit for NCD DP burner Includes ferrules, fittings and quartz tube	G6600-60038
PM Kit, DP RV5 oil pump Includes 4 chemical traps for ozone destruction, 4 oil coalescer elements and 4 (1 qt) bottles of synthetic oil	G6600-67007
PM Kit, dry piston pump Includes 4 chemical traps for ozone destruction and 2 repair kits for pump	G6600-67008
Replacement oil coalescing filter	G6600-80042
Oil mist filter for RV5 pump	G6600-80043
Replacement oil coalescing filter for oil mist filter	G6600-80044
Replacement odor filtration element	G6600-80045
O-ring, 1.3614 in id	G6600-80050
O-ring, 1.301 in id	G6600-80051
Dual plasma quartz tube	G6600-80063
Mobil 1 synthetic oil	G6600-85001
Oil, Edwards Ultragrade for RV3 and RV5 pumps	G6600-85002
Spare column nut and ferrule kit	G6600-80018
Column nut, 1/32 in	G6600-80072
Ferrule, column, 1/32 in x 0.5 mm fused silica, Valco	0100-2138
Ferrule, column, 1/32 in x 9 mm, polyimide/graphite	0100-2430

### Sulfur Chemiluminescence Detector (SCD) Supplies

Description	Part No.
PM Kit, DP RV5 oil pump Includes 4 chemical traps for ozone destruction, 4 oil coalescer elements and 4 (1 qt) bottles of synthetic oil	G6600-67007
PM Kit, dry piston pump Includes 4 chemical traps for ozone destruction and 2 repair kits for pump	G6600-67008
Ceramic tube kit for SCD DP burner Includes ferrules, 3 upper ceramic tubes, and 1 lower ceramic tube	G6600-60037
Mobil 1 synthetic oil	G6600-85001
Oil mist filter for RV5 pump	G6600-80043
Oil, Edwards Ultragrade for RV3 and RV5 pumps	G6600-85002
O-ring, 1.301 in id	G6600-80051
Ozone destruction chemical trap	G6600-85000
Replacement oil coalescing filter for oil mist filter	G6600-80044
Sulfur chemiluminescence test sample	G2933-85001
Sulfur trap For carrier H <sub>2</sub> and air gases; one required for each cylinder of gas (3 total)	G2933-85003
Spare column nut and ferrule kit	G6600-80018
Column nut, 1/32 in	G6600-80072
Ferrule, column, 1/32 in x 0.5 mm fused silica, Valco	0100-2138
Ferrule, column, 1/32 in x 9 mm, polyimide/graphite	0100-2430



Sulfur Chemiluminescence Detector (SCD)



PM kit, G6600-67008

### Miscellaneous Instrument Parts and Supplies

Description	Part No.
Oven exhaust deflector for 6890/7890	G1530-80650
Oven exhaust deflector for 6850	G2630-60710
GC oven insert for 6890/7890	G2646-60500



Ceramic tube kit for SCD DP burner, G6600-60037



Oil mist filter, G6600-80043

# GC Standards

## GC Qualitative Standards

Description	Part No.
<b>Qualitative Simulated Distillation Standards</b>	
Boiling Point Calibration Sample No. 1	5080-8716
Low Boiling Point Calibration Sample No. 220	5080-8768
Boiling Point Calibration Sample No. 320	5080-8769
PolyWax 500, 1 g, neat	5188-5316
PolyWax 655, 1 g, neat	5188-5317
<b>Qualitative Petrochemical Standards</b>	
Alcohol in Gasoline Sample	18900-60640
Natural Gas Sample	5080-8756
Transformer Gas Sample	5080-8759
Refinery Gas Sample	5080-8755
Reference Gas Oil No. 1, Batch 2	5060-9086
<b>Miscellaneous Qualitative Standards</b>	
Nickel Catalyst Test Sample	19354-60510
Nickel Catalyst refill	5080-8761
MIDI System Calibration Standard	19298-60500

# 7820A GC System

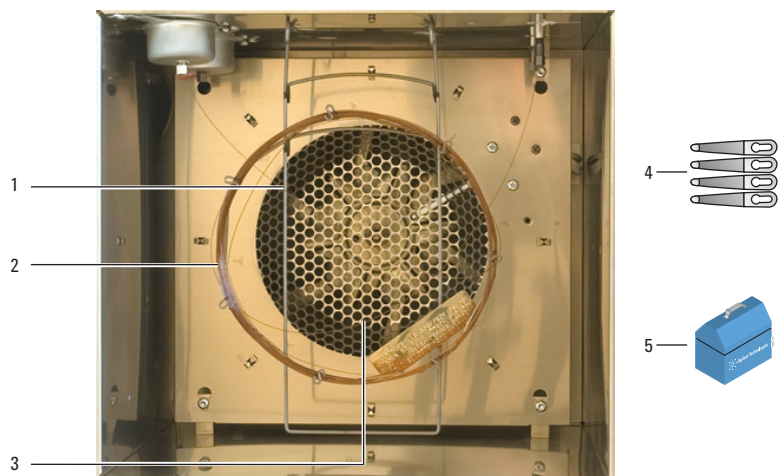
## Reliability and value

The Agilent 7820A GC is an affordable, high-quality solution for small- to medium-sized labs that are mainly concerned with routine analyses using standard GC methods – including those that must comply with regulatory requirements. The 7820A GC was designed to maximize uptime, minimize maintenance and complexity, and provide a high return on your investment. The system uses Agilent's proven electronic pneumatics control and digital electronics so you will get the unsurpassed performance you expect from an industry leader, and results you can count on.

- With an intuitive user interface and 'minimalist' five-button keypad, the 7820A GC is very easy to operate, even for inexperienced or infrequent users. Because there are no gauges or manual gas knobs, errors are minimized. And with convenient, real-world design features and built-in self-diagnostics, the 7820A GC is also easy to maintain.
- The simplified front panel keys and display provide sequence information, instrument conditions, and run status, while minimizing operating errors. The complementary software keyboard and display lets you control the system when it connects with an integrator or third-party software.
- You'll find a wide choice of inlets, including split/splitless for megabore and all capillary columns, packed for wide-bore capillary and packed columns.
- There's a wide choice of detectors, too, from flame ionization to thermal conductivity, micro-electron capture to nitrogen-phosphorus, not forgetting single wavelength flame photometric.
- With an Agilent 7650A or 7693A Injection Tower, you can eliminate the variables of manual injection, and increase your lab's throughput, too. With a capacity of up to sixteen 2 mL samples, this optional accessory offers unprecedented sample handling flexibility, and allows fully unattended operation – from injection all the way through final reporting.



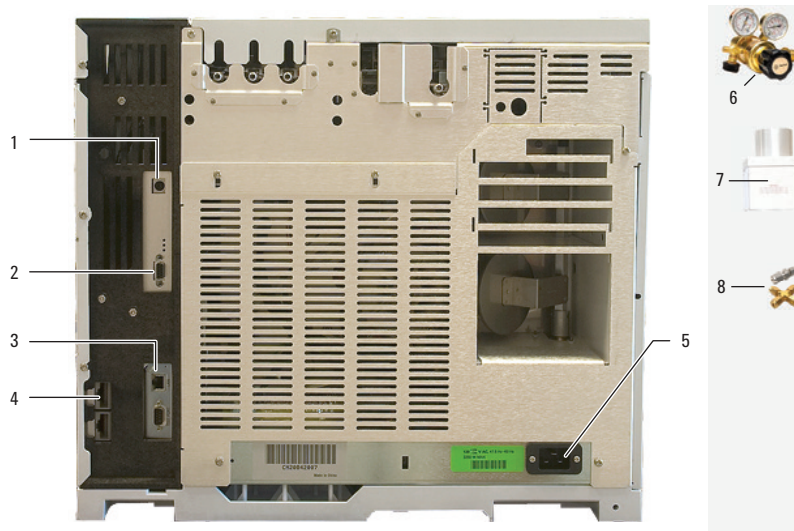
7820A GC System



**7820A Column Oven Parts**

Item	Description	Unit	Part No.
1	Column hanger for 6890, 5890, 5880A		1460-1914
2	HP-88, 30 m, 0.25 mm, 0.20 µm, 7 in cage		112-8837
	DB-5ms, 20 m, 0.18 mm, 0.18 µm, 7 in cage		121-5522
	DB-1ms, 30 m, 0.25 mm, 0.25 µm, 7 in cage		122-0132
	DB-1701, 30 m, 0.25 mm, 0.25 µm, 7 in cage		122-0732
3	Oven shroud, 120 V, US		G1530-61610
	Oven shroud, 220 V/10 A, China		G1530-61230
	Oven shroud, 240 V, Australia		G1530-61640
4	Column hanger clip kit for 7 in basket		G1530-61580
5	Ceramic wafer column cutter	4/pk	5181-8836
	Magnifier, 20x		430-1020
	MS interface column installation tool		G1099-20030
	Column ferrule installation tool		19251-80680



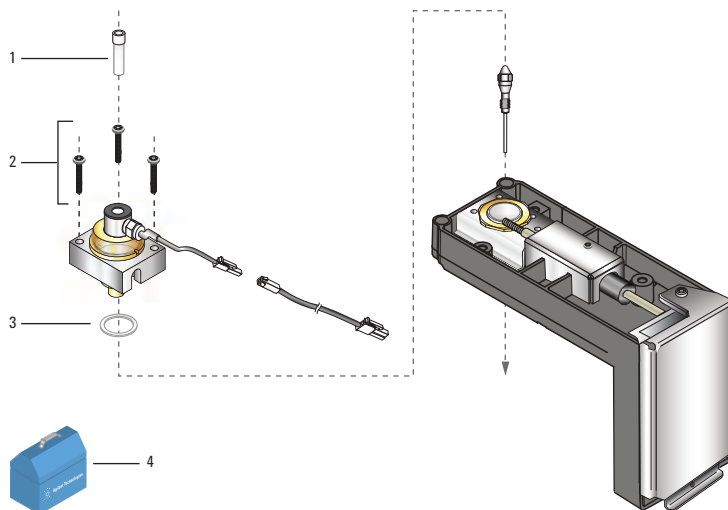


**7820A Back View**

Item	Description	Unit	Part No.
1	Signal cable, general purpose analog output cable assembly, spade lugs/6 pins		G1530-60560
2	Remote start cable for general use with lug		35900-60670
	Cable assembly, 6890A to 3396		G1530-60570
	Remote Start/Stop Cable 3590B/C/D/E		35900-60920
	Remote cable to 6890		03396-61010
	Remote cable APG 9M/9M to 6890		G1530-60930
	Remote control APG h-cable		35900-60800
3	Cable, w/conn, 80-1000V, telecom		8121-0940
4	ALS main cable assembly		G4514-60610
5	Power cord, Korea, C19, 16 amp		8121-1222
	Power cord, India/S.Africa, C19, 15 amp		8121-0710
	Power cord, GB/HK/SG/MY, C19, 13 amp		8120-8620
	Power cord, Europe, 16 amp		8120-8621
	Power cord, Japan, C15, 15 amp		8120-5342
	Power cord, US 120V, C19, 20 amp		8120-6894
	Power cord, Japan, C19, 20 amp		8120-6903
	Power cord, Australia, 16 amp		8120-8619
	Power cord, China, C19, 15 amp, Fast		8121-0070
	Power cord, Israel, C19, 16 amp		8121-0161
	Power cord, Argentina, C19, 20 amp		8121-0675
	Power cord, Thai 220V, 15 amp, 1.8M, C19		8121-1301
	Power cord, Swiss/DK, C19, 16 amp		8120-8622
	Power cord, China, C13, 10 amp		8121-0723
	Power cord, Brazil, C19, 250V max		8121-1787
	Power cord, Taiwan/S America, C19, 20 amp		8120-6360

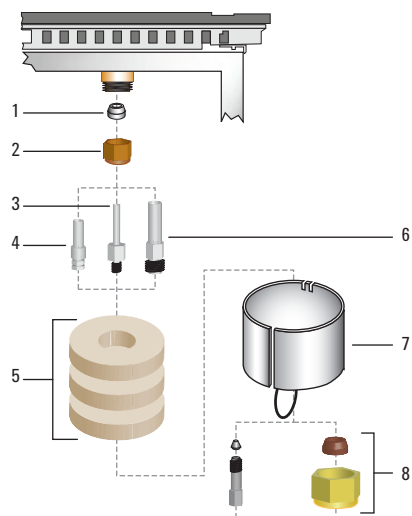
Item	Description	Unit	Part No.
6	Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA590, industrial air, with 1/8 in fitting, for 1/4 in tubing purchase a 1/4 in adapter		5183-4645*
	Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA350, hydrogen, argon/methane, with 1/8 in fitting, for 1/4 in tubing purchase a 1/4 in adapter		5183-4642*
	Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA346, air, with 1/8 in fitting, for 1/4 in tubing purchase a 1/4 in adapter		5183-4641*
	Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA580, helium, argon, nitrogen, 1/8 in fitting, for 1/4 in tubing purchase a 1/4 in adapter		5183-4644*
7	Oven exhaust deflector for 6890/7890		G1530-80650
8	1/8 in brass nut and ferrule set	20/pk	5080-8750
	Copper tubing, 1/8 in	12 ft	5021-7107
	Copper tubing, 1/8 in	50 ft	5180-4196
	1/8 in cross, brass		0100-0161

\*Designed for US thread type CGA.



### 7820A FID Parts Top

Item	Description	Unit	Part No.
1	Chimney insert, PTFE		19231-21050
2	Screw, M4 x 25 mm, Torx T-20		0515-2712
3	Silicone gaskets, 0.890 in od/0.709 in id	12/pk	5180-4165
4	Cleaning wires for 0.016 in id jet	5/pk	5180-4150
	Cleaning wire for 0.018 in id/530 µm jet	5/pk	5180-4152
	GC flame ionization detector MDL standard Agilent 7890 GC		5188-5372
	FID flow measuring insert		19301-60660



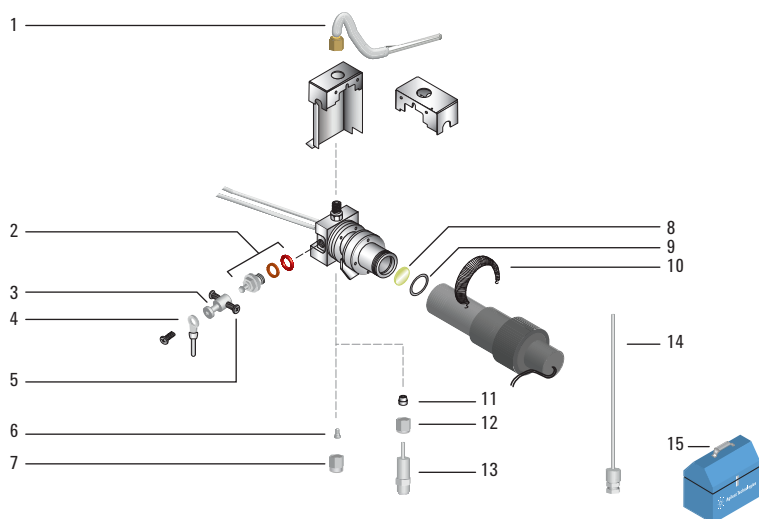
**7820A FID Parts Bottom**

Item	Description	Unit	Part No.
1	1/4 in nut, brass	10/pk	5180-4105
2	Polyimide ferrule, 1/4 in	10/pk	5080-8774
3	FID/NPD 1/8 in packed column		19231-80520
4	FID/NPD adapter for capillary column		19244-80610
5	Nut warmer insulation		19234-60715
6	FID/NPD 1/4 in packed column		19231-80530
7	Nut warmer cup assembly		19234-60700
8	1/8 in stainless steel nut and ferrule set	20/pk	5080-8751
	1/8 in brass nut and ferrule set	20/pk	5080-8750
	Polyimide/graphite ferrule, 1/8 in	10/pk	0100-1332
	1/8 in nut, brass	10/pk	5180-4103
	Universal column nut	2/pk	5181-8830
	For complete offering of column ferrules, <b>see page 37.</b>		



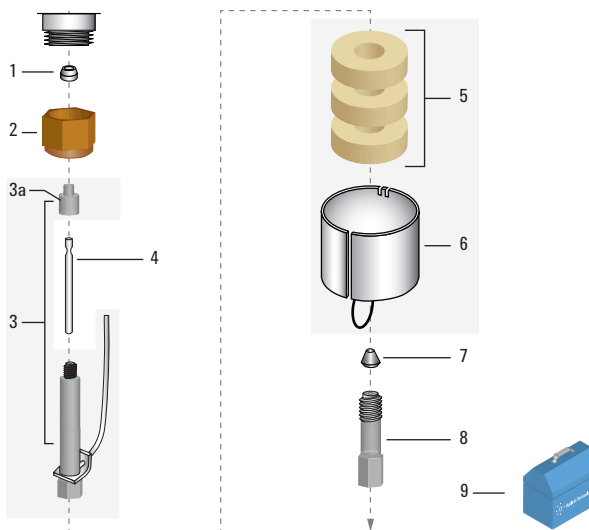
**7820A FID Jets**

Item	Description	Part No.
1	Jet, capillary adaptable, 0.011 in id tip	19244-80560
2	Jet, packed, high temperature, 0.018 in id tip	19244-80620
3	Jet, packed standard, 0.018 in id tip	18710-20119
4	Jet, packed wide-bore, 0.030 in id tip (for high-bleed applications)	18789-80070



**7820A FPD Parts**

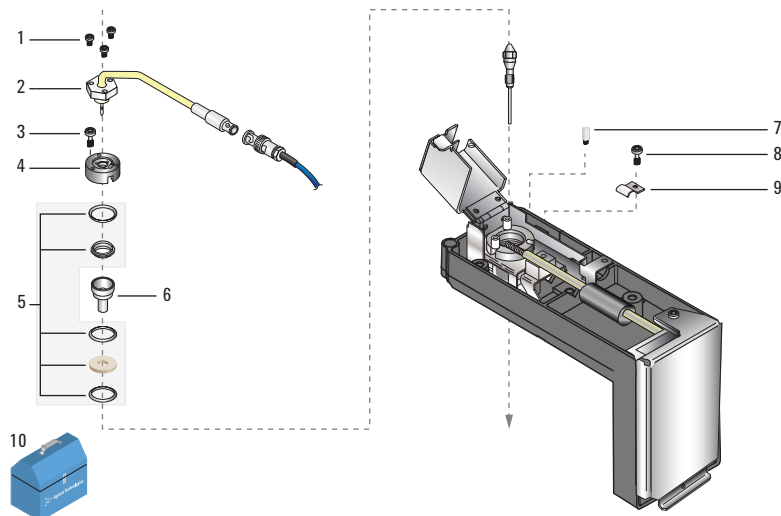
Item	Description	Unit	Part No.
1	FPD exit tube assembly		19256-60700
	FPD vent tube assembly		19256-20705
2	FPD ignitor replacement kit		19256-60800
3	Collet for glow plug		19256-20690
4	Ignitor cable assembly		G1535-60600
5	Screw, M3 x 66 mm, T10		0515-0680
6	Capillary adapter seat, FPD		19256-21140
7	Capillary adapter nut		19256-21150
8	Sulfur filter		1000-1437
	Phosphorus filter		19256-80010
9	Filter spacer, use only with sulfur filter for flame photometric detector (p/n 1000-1437)		19256-20910
10	Spring, compression, for flame photometric detector		1460-1160
11	Polyimide/graphite ferrule, 1/8 in	10/pk	0100-1332
12	Nut, 1/8 in, stainless steel		0100-0057
13	1/4 in packed column adapter		G1532-20710
14	Column tool brazement		19256-80640
	FPD check out sample		5188-5953
	FPD sample		5188-5245
	PM kit for single FPD		G2647-60501
	PM kit for dual FPD		G2648-60501



**7820A Micro ECD Parts**

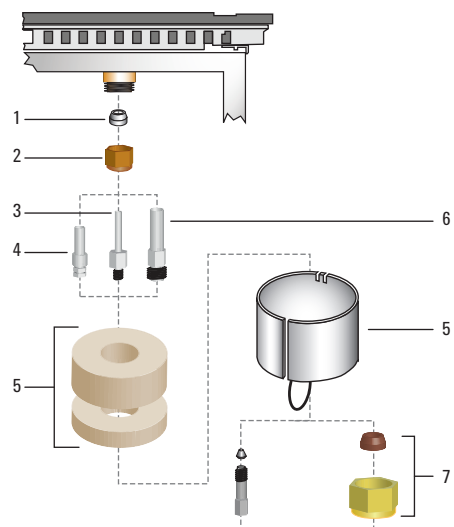
Item	Description	Unit	Part No.
1	Polyimide ferrule, 1/4 in	10/pk	5080-8774
2	1/4 in nut, brass	10/pk	5180-4105
3	Micro ECD makeup gas adapter, 7890 Micro ECD makeup gas adapter weldment assembly for new version detector, connected to EPC with tubing blocks		G3433-63000
	Old Micro ECD mug adapter Micro ECD makeup gas adapter weldment assembly for old version detector, connected to EPC with thumb nuts		G4333-63000
3a	Stainless steel cap for ECD makeup gas adapter, ECD adapter end cap		19233-20755*
4	Fused silica liner for micro ECD makeup gas adapter		G2397-20540*
5	Nut warmer insulation		19234-60715
6	Nut warmer cup assembly		19234-60700
7	For complete offering of column ferrules, <b>see page 37.</b>		
8	Universal column nut	2/pk	5181-8830
9	GC electron capture detector standard in iso-octane	3 x 0.5 mL ampoules	18713-60040
	Micro ECD wipe test kit		18713-60050

\*Items 3a and 4 are supplied with item 3



**7820A NPD Parts – Top**

Item	Description	Unit	Part No.
1	Screw, T-10, M3 x 8 mm		0515-2726
2	NPD white bead assembly		G1534-60570
	NPD black ceramic bead assembly		5183-2007
3	Screw, M4 x 0.7, 10 mm		0515-2495
4	NPD lid weldment		G1534-80510
5	NPD ceramic insulator kit		5182-9722
6	NPD collector funnel		G1534-20530
7	NPD lid standoff		G1534-20590
8	Screw, M4 x 0.7, 10 mm		0515-2495
9	J-Clamp		1400-0015
10	Nitrogen phosphorus detector sample	3 x 0.5 mL ampoules	18789-60060
	1/4 in nut driver for FID jet, drilled shaft		8710-1561
	NPD flow adapter		G1534-60640



**7820A NPD Parts – Bottom**

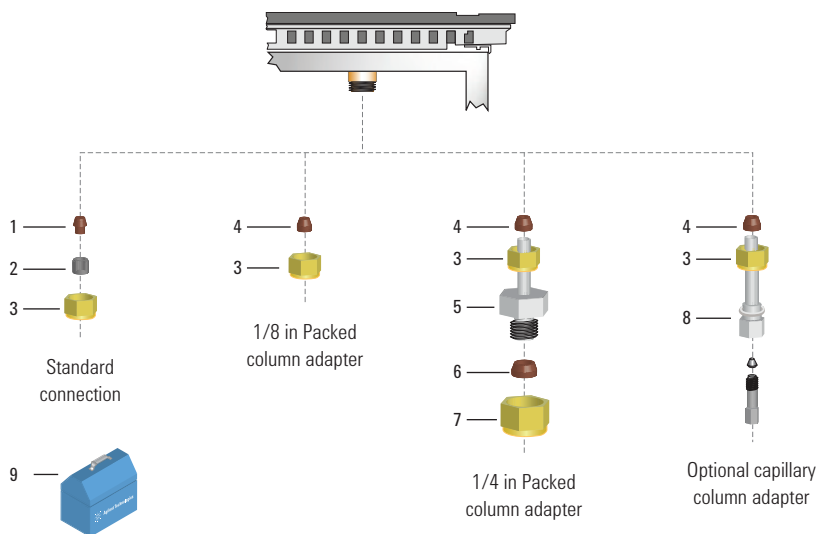
Item	Description	Unit	Part No.
1	Polyimide ferrule, 1/4 in	10/pk	5080-8774
2	1/4 in nut, brass	10/pk	5180-4105
3	FID/NPD 1/8 in packed column		19231-80520
4	FID/NPD adapter for capillary column		19244-80610
5	Nut warmer cup with insulation		19234-60720
6	FID/NPD 1/4 in packed column		19231-80530
	1/4 in packed column adapter		G1532-20710
7	1/4 in nut, brass		5180-4105
	1/8 in stainless steel nut and ferrule set	20/pk	5080-8751
	1/4 in stainless steel nut and ferrule set	20/pk	5080-8753
	1/4 in brass nut and ferrule set	20/pk	5080-8752
	Universal column nut	2/pk	5181-8830
For complete offering of column ferrules, <b>see page 37.</b>			





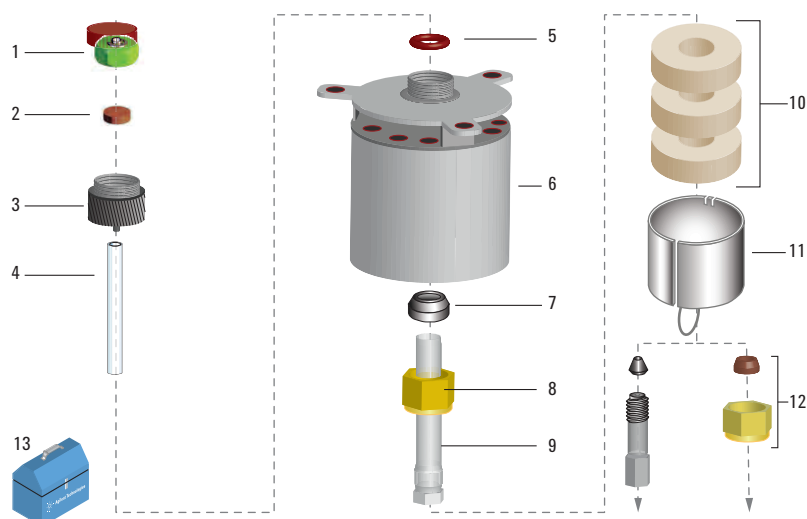
### 7820A NPD Jets

Item	Description	Part No.
1	Capillary with extended jet, 0.011 in/ 0.29 mm id tip, 70.5 mm length for adaptable fittings	G1534-80590
2	Jet, capillary adaptable, 0.011 in id tip	19244-80560
3	Jet, packed, high temperature, 0.018 in id tip	19244-80620
4	Jet, packed standard, 0.018 in id tip	18710-20119



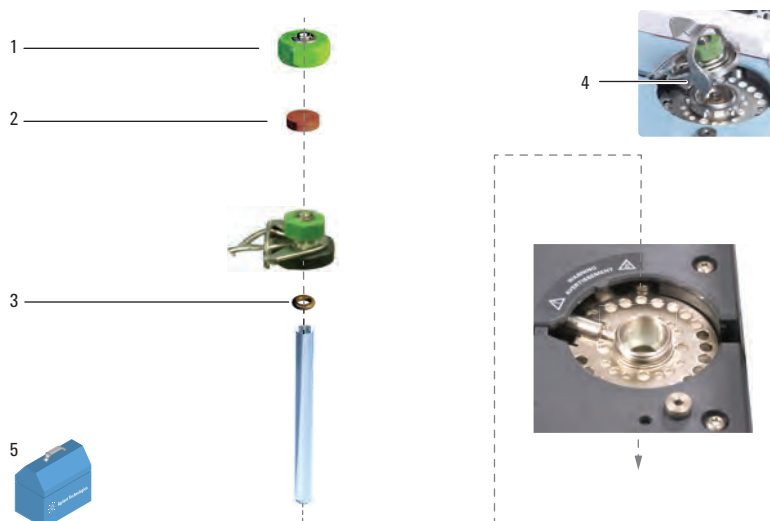
**7820A TCD Parts**

Item	Description	Unit	Part No.
1	TCD Front ferrule for 0.8 mm od columns	10/pk	5182-9673
	TCD Front ferrule for 0.53 mm od columns	10/pk	5182-9676
	TCD Front ferrule for 0.45 mm od columns	10/pk	5182-9677
	TCD Front ferrule, no hole	10/pk	5182-9679
2	TCD Back ferrule for 1/8 in detector fitting	10/pk	5182-3477
3	1/8 in nut, brass	10/pk	5180-4103
	1/8 in plug, brass	6/pk	5180-4124
4	Polyimide/graphite ferrule, 1/8 in	10/pk	0100-1332
5	1/4 in packed column adapter		G1532-20710
6	Polyimide ferrule, 1/4 in	10/pk	5080-8774
7	1/4 in nut, brass	10/pk	5180-4105
8	TCD capillary column adapter		G1532-80540
9	FID and TCD sample	3 x 0.5 mL ampoules	18710-60170
	TCD sample	3 x 0.5 mL ampoules	18711-60060



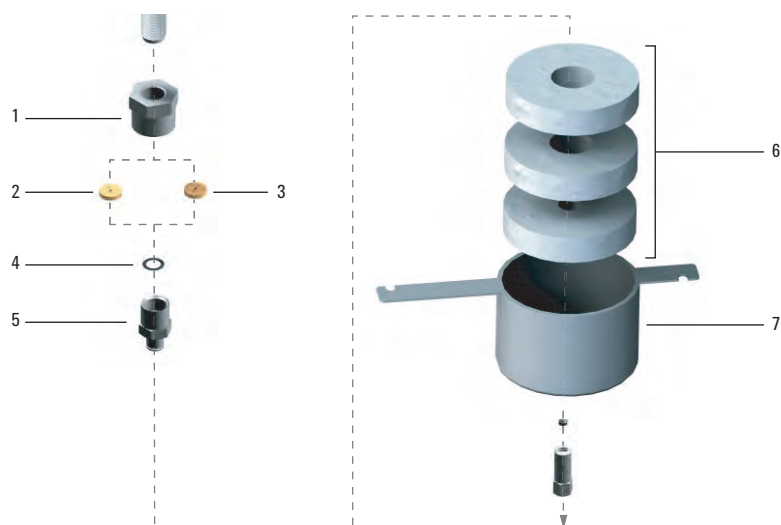
### 7820A Purged Packed Inlet Parts

Item	Description	Unit	Part No.
1	Septum nut, purged inlets		18740-60835
2	11 mm septa	50/pk	5183-4759
	Non-stick long-life septa, 11 mm	50/pk	5183-4761
	Non-stick bleed and temperature optimized (BTO) septa, 11 mm	50/pk	5183-4757
3	Packed port insert weldment		19243-80570
4	Disposable glass insert, deactivated, 170 $\mu$ L internal volume	5/pk	5181-3382
	Disposable glass liner, 170 $\mu$ L internal volume	25/pk	5080-8732
5	O-ring, Viton	12/pk	5080-8898
6	Inlet weldment		G3451-80501
7	Polyimide ferrule, 1/4 in	10/pk	5080-8774
8	1/4 in nut, brass	10/pk	5180-4105
9	1/4 in column adapter		19243-80540
	1/8 in column adapter		19243-80530
	530 $\mu$ m column adapter for use with glass liners		19244-80540
10	Nut warmer insulation		19234-60715
11	Nut warmer cup assembly		19234-60700
12	1/8 in nut, brass	10/pk	5180-4103
	Polyimide/graphite ferrule, 1/8 in	10/pk	0100-1332
	1/8 in brass nut and ferrule set	20/pk	5080-8750
	Polyimide ferrule, 1/4 in	10/pk	5080-8774
	Universal column nut	2/pk	5181-8830
	For complete offering of column ferrules, <b>see page 37.</b>		
13	QuickPick purged packed inlet PM kit		5188-6498
	Swabs for cleaning GC/MS	100/pk	5080-5400
	Injection port cleaning kit		480-0003
	Septum tool, knurled handle		450-1000



**7820A Split/Splitless Inlet Parts (Top)**

Item	Description	Unit	Part No.
1	Headspace septum retainer nut		18740-60830
	Septum nut, purged inlets		18740-60835
2	Non-stick bleed and temperature optimized (BTO) septa, 11 mm	50/pk	5183-4757
	Non-stick bleed and temperature optimized (BTO) septa, 11 mm	100/pk	5183-4757-100
	Non-stick long-life septa, 11 mm	50/pk	5183-4761
	Non-stick long-life septa, 11 mm	100/pk	5183-4761-100
3	Graphite O-ring for splitless liner	10/pk	5180-4173
	Graphite O-ring for split liner	10/pk	5180-4168
	Certified non-stick fluorocarbon O-ring	10/pk	5188-5365
4	Non-stick fluorocarbon O-ring for Flip Top	100/pk	5190-2268
	Non-stick fluorocarbon liner O-ring for Flip Top	10/pk	5188-5366
	Flip Top inlet sealing system		5188-2717
5	QuickPick split inlet PM kit		5188-6493
	QuickPick splitless vent and inlet PM kit		5188-6497
	FID collector cleaning brush	2/pk	8710-1346
	QuickPick split vent and inlet PM kit		5188-6496



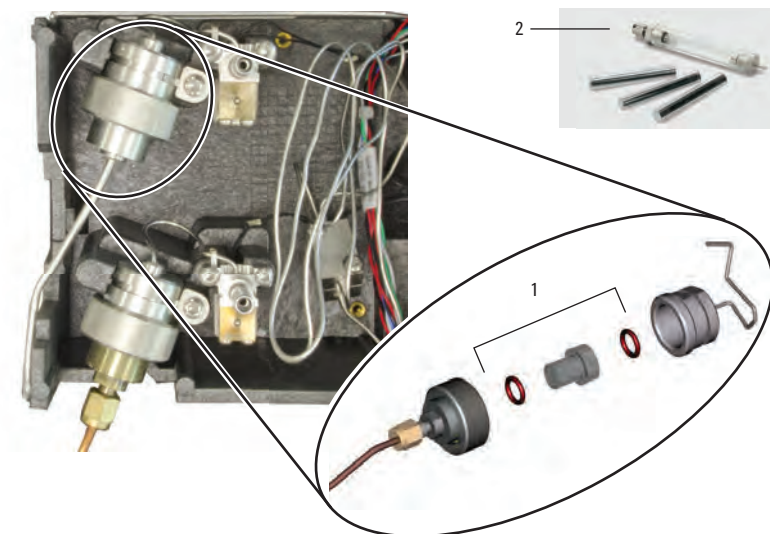
### 7820A Split/Splitless Inlet Parts (Bottom)

Item	Description	Unit	Part No.
1	Inlet heater weldment retaining nut		G1544-20590
2	Gold plated inlet seal kit with washer		5188-5367
	Certified gold plated seal kit, includes washer	10/pk	5190-2209
	Inlet seal, stainless steel		18740-20880
3	Gold plated seal with cross, split only		5182-9652
4	Washers, 0.375 od	12/pk	5061-5869
5	Reducing nut for split/splitless inlet		18740-20800
6	S/SL insulation kit, 3 pieces		5188-5241
7	Cover, lower insulation		19243-00070

### TIPS & TOOLS

Download the Agilent Parts Finder Tool for simplified parts ordering and troubleshooting, [www.agilent.com/chem/go2partsfinder](http://www.agilent.com/chem/go2partsfinder)





**7820A Split Vent Traps**

Item	Description	Unit	Part No.
1	Split vent trap preventive maintenance kit, single cartridge		5188-6495
2	Split vent trap with 3 cartridges		RDT-1020
	Cartridges, split vent trap	3/pk	RDT-1023

## GC/MS Parts and Supplies

Your mass spectrometer is a sensitive, specialized device that delivers a higher level of functionality than other GC detectors. To continue achieving optimal results, it is critical to maintain your system properly by performing the essential tasks within this section. Some of the benefits of maintaining your GC/MSD include:

- Less downtime for repairs
- Longer lifetime for your MSD system
- Reduction in overall operating costs

It is advisable to keep a log book of system performance, Autotune, and maintenance operations performed. This makes it easier to identify variations from normal performance and to take corrective action.



### Maintenance Schedule

Task	Every week	Every 6 months	Every year	As needed
Tune the MSD				✓
Change injection port liners	✓			
Check the foreline pump oil level	✓			
Gas ballast the foreline pump				✓
Check the calibration vial		✓		
Replace the foreline pump oil		✓		
Check the diffusion pump fluid	✓			
Replace the diffusion pump fluid			✓	
Replace the dry pump tip seals (IDP3)			✓	
Replace the traps and filters			✓	
Clean the ion source				✓
Replace worn out parts				✓
Lubricate seals (where appropriate)				✓
Replace column				✓

## MSD Contamination

Contamination is usually identified by excessive background in the mass spectra, which can come from the GC or MSD. The source of contamination can sometimes be determined by identifying the contaminants. Some contaminants are much more likely to originate in the GC, while others are likely to originate in the MSD.

### Contamination Sources in the GC

- Column or septum bleed
- Dirty injection port
- Injection port liner
- Contaminated syringe
- Poor quality carrier gas
- Dirty carrier gas tubing
- Fingerprints
- Air leaks
- Cleaning solvents and materials

### Contamination Sources in the MSD

- Air leaks
- Cleaning solvents and materials
- Fingerprints inside the manifold
- Diffusion pump fluid
- Foreline pump oil

The action required to remove contamination depends on the type and level of contamination. Minor contamination by water or solvents can usually be removed by allowing the system to pump (with a flow of clean carrier gas) overnight. Serious contamination by rough pump oil, diffusion pump fluid or fingerprints is much more difficult to remove and may require extensive cleaning.



## Air Leaks

Air leaks are a problem for any instrument that requires a vacuum to operate. Leaks are generally caused by vacuum seals that are damaged or not fastened correctly.

### Symptoms of leaks

- Higher than normal vacuum manifold pressure or foreline pressure
- Higher than normal background
- Peaks characteristic of air (m/z 18, 28, 32, and 44 or m/z 14 and 16)
- Poor sensitivity
- Low relative abundance of m/z 502 (this varies with the tune program and MSD used)

### Remedy

- Check interface nut for tightness. Replace if necessary.
- Check and leak test the GC injection port.

Leaks can occur in other places in the MSD, including the following:

- GC/MSD interface column nut
- Side/top plate O-ring (all the way around)
- Vent valve O-ring
- Calibration valve
- High vacuum gauge tube/controller fitting
- Cracked ion gauge tube
- Front and rear end plate O-rings
- GC/MSD interface O-ring (where the interface attaches to the vacuum manifold)
- Diffusion pump co-seal
- Baffle adapter O-ring
- Turbomolecular pump O-ring
- Polyimide/graphite ferrules, when heated



## Cleaning Solvents

It is common to see cleaning solvent peaks in the mass spectra shortly after the ion source is cleaned.

### Remedy

- Dry all cleaned metal parts in the GC oven before reassembling and reinstalling them. Refer to specific cleaning procedures in your MSD Hardware Manual or MSD Maintenance and Troubleshooting Manual.
- Use a temperature above the boiling point of the solvent but below the limit of the column.

## Fingerprints

Fingerprints contain hydrocarbons that can appear in mass spectra. Hydrocarbon contamination is characterized by a series of mass peaks 14 m/z apart. The abundance of these peaks decrease as peak mass increases. Fingerprint contamination is usually caused by the failure to wear clean, nylon gloves during ion source handling or cleaning, GC inlet maintenance, or from installing the column. Use special care to avoid recontamination of parts after you clean them. This typically occurs after some maintenance or part replacement.

### Remedy

Reclean using clean, nylon gloves and proper cleaning techniques.

## MSD Contamination Identification

The following table lists some of the more common contaminants, the ion characteristics of those contaminants, and the likely sources of those contaminants.

Common Contaminants		
Ions (m/z)	Compound	Possible Source
13, 14, 15, 16	Methane	Cl gas
18, 28, 32, 44 or 14, 16	H <sub>2</sub> O, N <sub>2</sub> , O <sub>2</sub> , CO <sub>2</sub> , CO <sub>2</sub> or N, O	Residual air and water, air leaks, outgassing from Polyimide ferrules
31, 51, 69, 100, 119, 131, 169, 181, 214, 219, 264, 376, 414, 426, 464, 502, 576, 614	PFTBA and related ions	PFTBA (tuning compound)
31	Methanol	Cleaning solvent
43, 58	Acetone	Cleaning solvent
78	Benzene	Cleaning solvent
91, 92	Toluene or xylene	Cleaning solvent
105, 106	Xylene	Cleaning solvent
151, 153	Trichloroethane	Cleaning solvent
69	Foreline pump fluid or PFTBA	Foreline pump oil vapor or calibration valve leak
73, 147, 207, 221, 281, 295, 355, 429	Dimethylpolysiloxane	Septum bleed or methyl silicone column coating
77, 94, 115, 141, 168, 170, 262, 354, 446	Diffusion pump fluid	Diffusion pump fluid and related ions
149	Plasticizer (phthalates)	Vacuum seals (O-rings) damaged by high temperatures, use of vinyl or plastic gloves
Peaks spaced 14 amu apart	Hydrocarbons	Fingerprints, foreline pump oil

The easiest way to insure that you minimize background contamination and remove damaging oxygen from your carrier gas system is to use a carrier gas purifying trap right before the gas enters your GC system.

Column bleed generally appears as a continuous and increased rise in the baseline at higher column temperatures, especially at or near the upper temperature limit of the GC column. Septum bleed usually appears as discrete peaks, and can occur at any temperature.

A crude sign of a "leak-free" MS system is when the ion ratio of m/z 28 (nitrogen) over m/z 32 (oxygen) is approximately two or greater.

Even preconditioned ferrules can shrink slightly at very high temperatures. If leak problems persist upon a new column installation, check this fitting first.



5977A Series GC/MSD system



Cloths, lint-free, 05980-60051



Cotton swabs, 5080-5400

### Cleaning and Maintenance Supplies

Description	Part No.
Nylon gloves, lint-free, large, 1 pair	8650-0030
Nylon gloves, lint-free, small, 1 pair	8650-0029
Lint-free industrial wipes, 100% cotton, 9 x 9 in, 300/pk	9310-4828
Ion source cleaning kit Includes lint-free cloths (15/pk), abrasive sheets (5/pk), cotton swabs (100/pk), lint-free nylon gloves, abrasive Alumina powder	5181-8863
Cloths, lint-free, 15/pk	05980-60051
Swabs for cleaning GC/MS, 100/pk	5080-5400
Abrasive sheets, aluminum oxide green lapping paper, 600 mesh, 5/pk	5061-5896
Alumina powder, abrasive, 100 g	393706201
PFTBA sample, certified, 10 g	8500-0656
Replacement glass bulb for PFTBA and PFDTD test sample	G3170-80002
Replacement glass vial for PFTBA and PFDTD test sample	05980-20018
Activated alumina, absorbent pellets for Edwards rough pump traps, non-LC/MS, 1 lb can	8500-1233
MSD Tool Kit Includes source hold tool, lint-free cloth, cotton swabs, lint-free nylon gloves, abrasive sheets, wrenches and driving tools	G1099-60566

(Continued)



### TIPS & TOOLS

Self Tightening column nuts at the transfer line and inlet fitting, using short graphite/polyimide-blend ferrules, provide a leak-free seal at both column connections, without the need to retighten the fitting after hundreds of heat cycles.



### Cleaning and Maintenance Supplies

Description	Part No.
<b>MS Interface Supplies</b>	
MS interface column installation tool for the 5973 series, 5975 A/B/C/C TAD/E, 5977 series, and 7000 series Not for the 5975T	G1099-20030
Column installation tool for 5975T	G3880-20030
Column insertion tool for the 7200 series	G3850-60014
<b>Tools</b>	
Screwdriver, 3 in Pozidriv shaft No. 1 pt, fits no. 2-4 screws	8710-0899
Screwdriver, 4 in Pozidriv shaft No. 2 pt, fits no. 5-10 screws	8710-0900
Open end wrench, 1/4 and 5/16 in	8710-0510
Hex nut driver, 5.5 mm	8710-1220
Screwdriver, Torx T20	8710-1615
Screwdriver, Torx T15	8710-1622
Screwdriver, Torx T10	5182-3466
<b>Gas Filters</b>	
Replacement Agilent Gas Clean carrier gas filter	CP17973
Gas Clean carrier gas starter kit for 7890 Includes carrier gas filter, 1/8 in single connecting unit with bracket that installs directly on the 7890	CP17988
GC/MS filter kit Includes 1 connecting unit 1/4 in and 2 carrier gas filters	CP17977
Chemical ionization gas purifier	G1999-80410



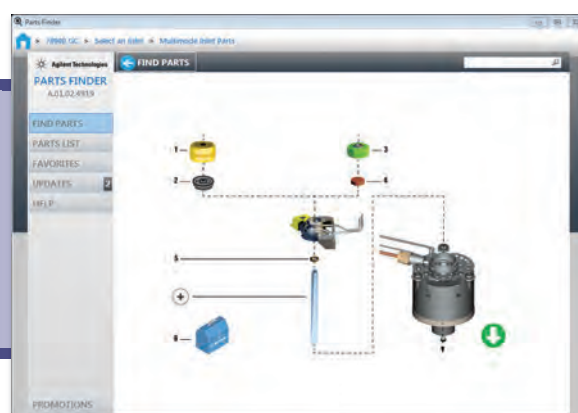
Column installation tool, G1099-20030



Replacement Agilent Gas Clean carrier gas filter, CP17973

### TIPS & TOOLS

Download the Agilent Parts Finder Tool for simplified parts ordering and troubleshooting, [www.agilent.com/chem/go2partsfinder](http://www.agilent.com/chem/go2partsfinder)



By using tools, supplies and best practices that provide a leak-free GC or GC/MS, analysts can improve performance and productivity of their system. The Agilent innovative Self Tightening column nuts using standard short polyimide/graphite ferrules eliminate the need to retighten GC column fitting at the mass spec transfer line, even after repeated heat cycling. Agilent UltiMetal Plus Flexible Metal ferrules provide robust leak-free column connections, along with an inert surface for fittings in the sample flow path.



Self Tightening column nut, for MS interface, 5190-5233



MS interface column nut, 05988-20066



UltiMetal Plus Flexible Metal ferrules, G3188-27501

### Recommended MS Interface Connections

Description	Part No.
<b>Recommended</b>	
<b>Nut</b>	
Self Tightening column nut, for MS interface	5190-5233
<b>Ferrule</b>	
250 µm Polyimide/graphite ferrule, 10/pk	5181-3323
320 µm Polyimide/graphite ferrule, 10/pk	5062-3514
<b>Tools</b>	
MS interface column installation tool	G1099-20030
Column installation tool for 5975T	G3880-20030
<b>Traditional</b>	
<b>Nut</b>	
MS interface column nut, female	05988-20066
<b>Ferrule</b>	
0.4 mm Polyimide/graphite ferrule, 10/pk	5062-3508
0.5 mm Polyimide/graphite ferrule, 10/pk	5062-3506
<b>Tools</b>	
MS interface column installation tool	G1099-20030
Column installation tool for 5975T	G3880-20030
<b>Alternative</b>	
<b>Nut</b>	
Swaging nut, for MS interface with Flexible Metal ferrules	G2855-20555
<b>Ferrule</b>	
UltiMetal Plus Flexible Metal ferrule with 0.4 mm id, 10/pk	G3188-27501
UltiMetal Plus Flexible Metal ferrule with 0.5 mm id, 10/pk	G3188-27502
<b>Tools</b>	
Ferrule pre-swaging tool	G2855-60200

## Ion Source

The ion source operates by electron ionization (EI) or chemical ionization (CI). The sample enters the ion source from the GC/MSD interface. Electrons emitted by a filament enter the ionization chamber, guided by a magnetic field. The high-energy electrons interact with the sample molecules, ionizing and fragmenting them. The positive voltage on the repeller pushes the positive ions into the lens stack, where they pass through several electrostatic lenses. These lenses concentrate the ions into a tight beam, which is directed into the mass filter.



Electron Impact (EI) Ion Source

## Maintaining the Ion Source

Cleaning procedures for MSDs vary. Refer to your Troubleshooting and Maintenance Manual for specific ion source cleaning procedures.

## Common Measures of Instrument Performance

- Abundance of certain ions
- Shape of lens ramps and the chosen voltages
- Sensitivity obtainable for a given analysis
- Ability to tune to a given reference compound (e.g., DFTPP)

## Preparing to Clean

Prior to cleaning, the mass spectrometer must be vented and the ion source must be removed. Before venting the system, the following conditions must be met:

- Heated zones are less than 100 °C
- The diffusion pump is off and cool (if applicable)
- The turbo pump is off and not spinning (if applicable)
- The rough pump is off

Always allow the automatic venting routine to run its full course. Improper venting may cause diffusion pump fluid to be deposited into the analyzer (backstreaming). It can also reduce the life of the multiplier or other sensitive MS parts.

### MSD Flow Rates (mL/min)

	Min	Max Diff Pump	Max Turbo Pump	Tuning Max
5977	0.1	2.0	4.0	2.0
5975	0.1	2.0	4.0	2.0
5973	0.1	2.0	4.0	2.0



### WARNINGS & CAUTION

**Important:** Do not abrasively or ultrasonically clean the insulators.

Abrasively clean the surfaces that contact the sample or ion beam. Use an abrasive slurry of alumina powder and reagent-grade methanol on a cotton swab. Use enough force to remove all discoloration. Polishing the parts is not necessary; small scratches will not harm performance. Abrasively clean discoloration where electrons from filaments enter the source body.

Take care to avoid contaminating cleaned and dried parts. Put on new, clean gloves before handling the parts. Do not put the cleaned parts on a dirty surface. Place them only on clean, lint-free cloths.

### TIPS & TOOLS



It is good practice to replace scratched lenses and other ion source parts regularly. Scratched source parts lead to poor performance.



## El Source Selection Guide

### Inert Ion Source

To ensure accurate quantification and high sensitivity, the entire GC/MSD flow path must be highly inert, including the detector surfaces. The inert ion source is made of the same inert material used in the Extractor EI Source and is programmable to 350 °C, enabling trace level detection and SVOC and VOC analyses (see Source Selection for Various Applications).

#### Aperture Diameters Available for the Agilent 5977A Series Ion Sources

Aperture Diameter	3 mm	6 mm	9 mm
Stainless Steel Source	05971-20134	G3136-20530	--
Inert Source	G2589-20100	G2589-20045	--
Extractor EI Source	G3870-20444	G3870-20448	G3870-20449

Having trouble selecting the appropriate aperture diameters for the Agilent 5977A Series Ion Sources? Download publication number 5991-2106EN at [www.agilent.com/chem/library](http://www.agilent.com/chem/library)

### Source and Tune Selection Guidance

Choosing the most appropriate source configuration and tune can have a significant effect on the success of an application (see, Source Configurations and Supported Tunes). The guidelines outlined here are meant to be general suggestions as starting points. Application-specific method development should be performed to ensure the best operating conditions. EI Tune Options gives a description of the various tune modes and their use.

#### TIPS & TOOLS

Read and understand "A Quick-Start Guide to Optimizing Detector Gain for GC/MSD", publication number 5991-2105EN, before attempting to optimize any method or configuration, [www.agilent.com/chem/library](http://www.agilent.com/chem/library)



## Stainless Steel Ion Source

The most cost-effective source for picogram to high nanogram sensitivity and for obtaining spectra most similar to legacy instruments is the stainless steel ion source, which is programmable up to 350 °C.

### Source Selection for Various Applications

Application	Source(s)	Drawout/ Extractor Lens (mm)	Tune
Ultra-trace level (low fg-low ng)	Extractor EI	3	Etune
Trace level (fg-ng)	Extractor EI, Inert	3	Etune, Atune
Mid to high-level (pg-high ng)	Extractor, Inert, Stainless Steel	6, 9	Atune
Obtain spectra closest to older instruments	Stainless Steel	3	Stune
VOC P&T - (BFB)	Extractor EI, Inert	6	BFB Autotune
SVOC (DFTPP)	Extractor EI, Inert	6	DFTPP

### Source Configurations and Supported Tunes

Source	Etune	Atune	BFB Autotune	Ion Mass	Stune	DFTPP	BFB
Stainless Steel	--*	✓	--	✓	✓	✓	✓***
Inert	--*	✓	✓**	✓	✓	✓	✓***
Extractor EI	✓	✓	✓**	✓	✓	✓	✓***

\*Etune can be executed from the tune menu with a non-extractor source but will produce only an atune

\*\*BFB Autotune requires the use of the 6 mm drawout plate/extraction lens

\*\*\*BFB Autotune is the preferred tune. Download Application Note 5991-0029EN at [www.agilent.com/chem/library](http://www.agilent.com/chem/library)

## El Tune Options

In the Tune menu, and in the Tune and Vacuum Control view there are several options for tune selection. The top two options are mechanisms to run part or the entire active tune. The remaining menu options are tunes for specific purposes and are described below.

### Description of the Tune Options for the Agilent 5977A Series Ion Source

#### Tune menu items

(default tune filenames as \*.U)

#### Description

Tune MSD	Performs the type of tune that is embedded in the active tune.
QuickTune	Provides a fine tuning to ensure acceptable response, resolution and accurate mass assignment.
Autotun (Atune.U)	The standard repeller-based tune of the Agilent 5973 inert MSD and Agilent 5975 Series.
Extraction source tune (Etune.U)	Used with the Extractor EI Source to provide the highest sensitivity. Equivalent to Atune when used with inert or stainless sources.
BFB Autotune (BFB_Atune.U)	Used in conjunction with Atune to meet US EPA BFB tuning criteria. Requires the use of 6 mm drawout/extraction lens and operates in standard repeller-based tuning mode.
Low Mass Autotune (Lomass.U)	Identical to Autotune, except it tunes on masses 69, 131, and 219 instead of 69, 219, and 502. Intended for low molecular weight applications and natural gases under 250 daltons.
Standard Spectra Tune (Stune.U)	Ensures standard response over the full mass range. Specifically, PFTBA mass 69 is the base peak, mass 219 is between 35 and 99%, and mass 502 is >1%. This is a lower sensitivity tune used to better match legacy libraries created using the Agilent 5971 or 5972 MSDs.
DFTPP	A specific target tune used for US EPA semivolatile analysis (8270 methods).
BFB	A specific legacy target tune used for VOC analysis. It does not provide the same sensitivity and stability as BFB Autotune. Provides continuity for established SOPs and for users with a preference for target tuning. See Application Note 5991-0029EN for a description of the recommended procedure for VOC analysis at <a href="http://www.agilent.com/chem/library">www.agilent.com/chem/library</a>

### Available EI Sources for the Agilent 5977A Series GC/MS

Source	Benefit	Part No. (spare parts)
Stainless	Inexpensive	G2591D
Inert	Reduced activity	G2591B
Extractor EI Source	Reduced activity Highest sensitivity	G2591C



Electron Impact (EI) Ion Source

## Electron Impact (EI) Ion Source

The recommended cleaning material for the EI ion source is abrasive, aluminum oxide powder.

Do not immerse filaments or lens insulators in solvent. If insulators are dirty, clean them with a cotton swab dampened with reagent-grade methanol. If that does not clean the insulators, replace them.

### ! WARNINGS & CAUTION

**Important:** Do not abrasively or ultrasonically clean the insulators.

Abrasively clean the surfaces that contact the sample or ion beam. Use an abrasive slurry of alumina powder and reagent-grade methanol on a cotton swab. Use enough force to remove all discoloration. Polishing the parts is not necessary; small scratches will not harm performance. Abrasively clean discoloration where electrons from filaments enter the source body.

Take care to avoid contaminating cleaned and dried parts. Put on new, clean gloves before handling the parts. Do not put the cleaned parts on a dirty surface. Place them only on clean, lint-free cloths.

### 5977/5975/5973 MSD Electron Impact Ion Source Parts (EI)

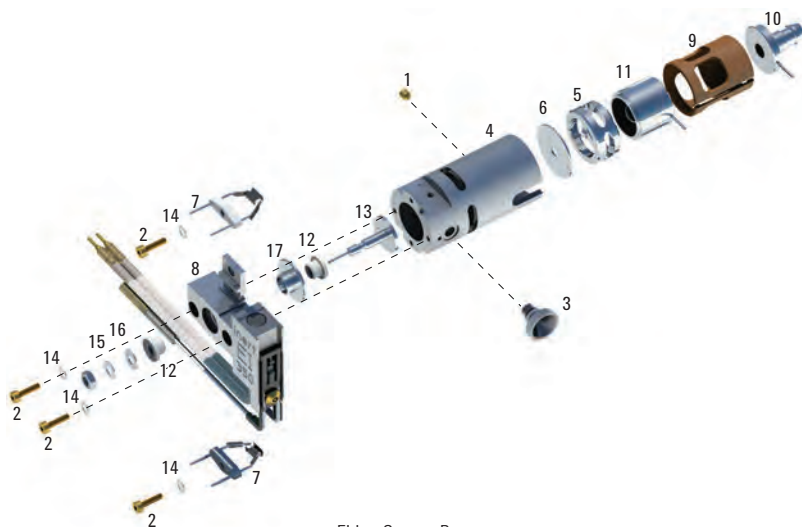
Item	Description	Part No.
1	Set screw for lens stack	G1999-20022
2	Cap screw, gold plated	G1999-20021
3	Transfer line socket	G1099-20136
4	Ion source body	G1099-20130
5	Drawout cylinder	G1072-20008
6	Drawout plate, 3 mm	05971-20134
	Drawout plate, 6 mm	G3163-20530
7	Filament assembly, high temperature (EI)	G7005-60061
8	Repeller assembly, Agilent 5977 MSD, stainless steel EI 350 ion source	G3870-60172
9	Lens insulator	G3170-20530
10	Entrance lens assembly	G3170-20126
11	Ion focus lens	05971-20143
12	Repeller insulator	G1099-20133
13	Repeller	G1099-20132
14	Washer, SPR CRVD, 1.6 to 1.8 mm id, 4 mm od, SS	3050-1375
15	Washer, SPR BLVL 4 .125 in id .25 in od	3050-1301
16	Washer, for Repeller M3	3050-0891
17	Repeller block insert	G3870-20135



Lens insulator, G3170-20530



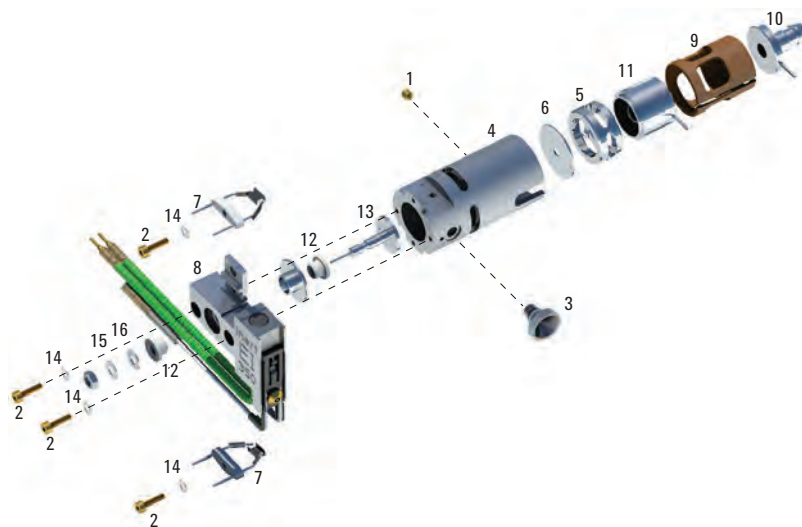
Repeller insulator, G1099-20133



EI Ion Source Parts

**5977/5975/5973 MSD Electron Impact Inert Ion Source Parts (EI)**

Item	Description	Part No.
1	Set screw for lens stack	G1999-20022
2	Cap screw, gold plated	G1999-20021
3	Transfer line socket	G1099-20136
4	Inert ion source body	G2589-20043
5	Drawout cylinder	G1072-20008
6	Drawout plate, 3 mm	G2589-20100
	Drawout plate, 6 mm	G2589-20045
7	Filament assembly, high temperature (EI)	G7005-60061
8	5977 Inert EI 350 repeller block	G3870-60179
9	Lens insulator	G3170-20530
10	Entrance lens assembly	G3170-20126
11	Ion focus lens	05971-20143
12	Repeller insulator	G1099-20133
13	Inert repeller	G2589-20044
14	Washer, SPR CRVD, 1.6 to 1.8 mm id, 4 mm od, SS	3050-1375
15	Washer, SPR BLVL 4 .125 in id .25 in od	3050-1301
16	Washer, for Repeller M3	3050-0891



5977/5975/5973 Inert Ion source parts (EI)



Extractor EI Source

## Extractor EI Source

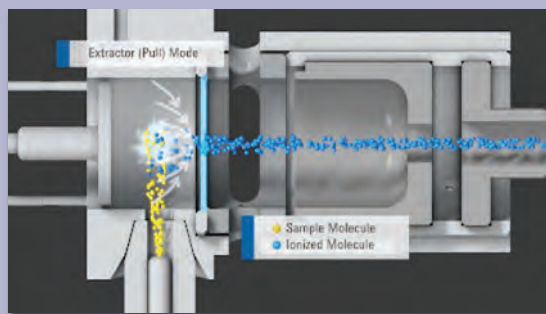
This innovative ion source has an extractor lens in place of the drawout plate used in the other EI sources and it is made of an inert material. It is programmable up to 350 °C to deliver enhanced response for active compounds and late eluters. These unique features provide maximum, ultratrace level sensitivity for a wide variety of compounds. The extractor lens provides additional focus to the ion beam into the mass analyzer. A potential is applied to the extractor lens which pulls the ions out of the ionization chamber, adding to the push provided by the repeller voltage. The result is a significant increase in the number of ions analyzed, improving the true sensitivity of the instrument. There are three available aperture sizes for the Extractor EI Source, as well as the two other sources: 3, 6, and 9 mm. Generally, the 3 mm aperture provides the best sensitivity. Selecting one of the larger aperture sizes enables analysis of higher concentrations of target compounds. Increasing aperture diameters also reduces the residence or interaction time and provides higher effective inertness for fragile compounds.

The Extractor EI Source can be operated in the higher sensitivity mode of extraction tuning or in standard mode in which it behaves in the same way as the standard stainless and inert sources. The ability to change between extractor and repeller-only mode is controlled by the software and does not require any physical changes.



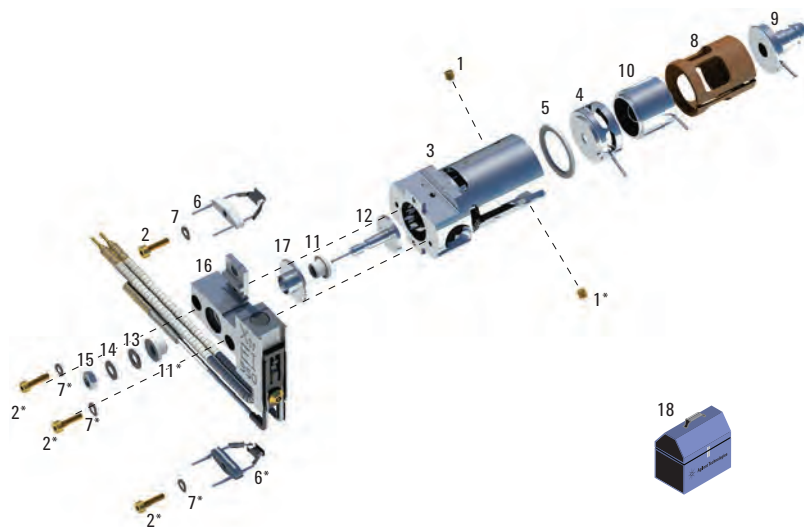
### TIPS & TOOLS

A video description of the Extractor EI Source is available at [www.chem.agilent.com/chem/resolve](http://www.chem.agilent.com/chem/resolve)

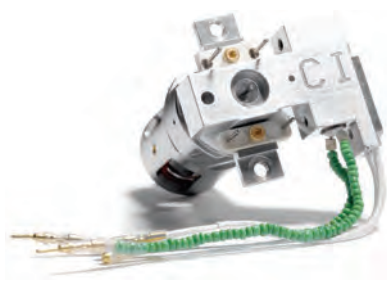


**5977/7000C Extractor Ion Source Parts**

Item	Description	Part No.
1	Set screws	G3870-20446
2	Screws	G3870-20021
3	Extraction source body	G3870-20440
4	Extractor lens	G3870-20444
5	Extractor lens insulator	G3870-20445
6	Filaments, 4-turn	G3170-60053
7	Spring washer	3050-1374
8	Lens insulator	G3870-20530
9	Entrance lens assembly	G3170-20126
10	Ion focus lens	05971-20143
11	Repeller insulator	G1099-20133
12	Inert repeller	G2589-20044
13	Washer, for Repeller M3	3050-0891
14	Washer, SPR BLVL 4 .125 in id .25 in od	3050-1301
15	Nut, 5.5 mm	0535-0071
16	5977 Extraction 350 repeller block assembly	G3870-60171
17	Repeller block insert	G3870-20135



Extractor Ion Source Parts



5977/5975/5973/7000 Ion Source

## Chemical Ionization (CI) Ion Source

Because the CI ion source operates at much higher pressures than the EI ion source, it will probably require more frequent cleaning than the EI ion source.

The source should be cleaned whenever there are performance anomalies that are associated with a dirty ion source. Let analytical performance be your guide.

When cleaning the CI ion source, concentrate on the CI repeller, ion source body, and drawout plate. Be sure to clean the 0.5 mm diameter holes in the ion source body and drawout plate.

Cleaning the ion source is very similar to cleaning the EI ion source. Use the same EI cleaning procedure with the following exceptions:

- The CI ion source may not look dirty, but deposits left by chemical ionization are very difficult to remove. Clean the CI ion source thoroughly.
- Use a round wooden toothpick to gently clean out the electron entrance hole in the source body and the ion exit hole in the drawout plate.
- Do not use halogenated solvents. Use hexane for the final rinse.

### TIPS & TOOLS

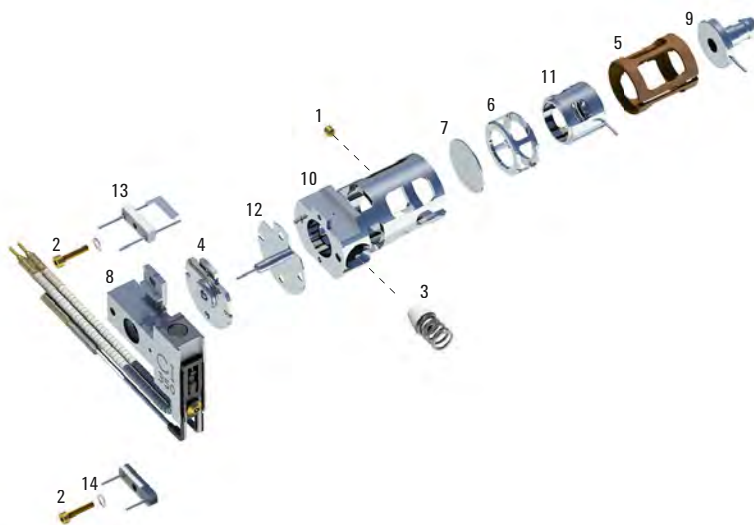


Visual appearance is not an accurate guide to cleanliness of the CI ion source. The CI ion source can show little or no discoloration, yet still need cleaning.



**5977/5975/5973/7000 MSD Chemical Ionization Ion Source Parts (CI)**

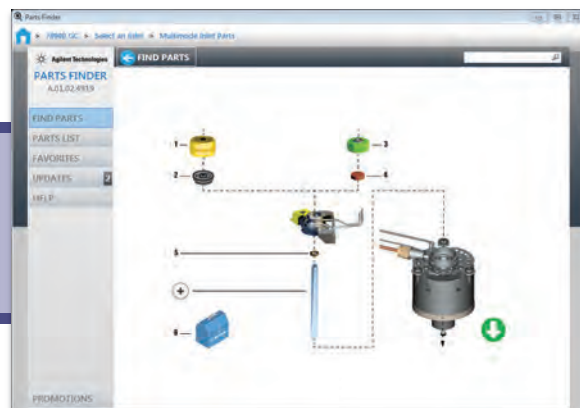
Item	Description	Part No.
1	Set screw for lens stack	G1999-20022
2	Cap screw, gold plated	G1999-20021
3	Interface tip seal/spring	G1999-60412
4	Repeller insulator	G1999-20433
5	Lens insulator	G3170-20540
6	Drawout cylinder	G1999-20444
7	Drawout plate	G1999-20446
8	5977 CI 350 repeller assembly	G3170-60416
9	Entrance lens assembly	G3170-20126
10	Source body	G1999-20430
11	Ion focus lens	G1999-20443
12	Repeller	G1999-20432
13	Filament assembly (CI), 2/pk	G7005-60072
14	Washer, SPR CRVD, 1.6 to 1.8 mm id, 4 mm od, SS	3050-1375



5977/5975/5973/7000 MSD Chemical Ionization (CI) Ion Source Assembly

**TIPS & TOOLS**

Download the Agilent Parts Finder Tool for simplified parts ordering and troubleshooting, [www.agilent.com/chem/go2partsfinder](http://www.agilent.com/chem/go2partsfinder)



## Installing a Capillary Column in the GC/MSD Interface

1. Condition the column.
2. Vent the MSD and open the analyzer chamber. Be sure you can see the end of the GC/MSD interface.
3. If the CI interface is installed, remove the spring-loaded tip seal from the MSD end of the interface.
4. Slide an interface nut and conditioned ferrule onto the free end of the GC column. The tapered end of the ferrule must point towards the nut.
5. Slide the column into the GC/MSD interface until you can pull it out through the analyzer chamber.
6. Score the column using a glass scribing tool. The score must be square to ensure a clean break.
7. Trim 1 cm off the end of the column. Do not let any column fragments fall into the analyzer chamber. They could damage the turbo pump.
8. Clean the outside of the free end of the column with a lint-free cloth moistened with methanol.
9. Adjust the column.
  - 5977/5975 – Push the column through, and then let it pass the end of the transferline by 1-2 mm. With the analyzer door partially open, view through the glass plate to see the column protrude.
  - 5973 – Push the column through, and then let it pass the end of the transferline by 1-2 mm as seen with the analyzer door open from that side.
  - 5972 – Push the column in all the way and then pull it back about 1-2 mm.Use the flashlight and magnifying glass if necessary to see the end of the column inside the analyzer changer. Do not use your finger to feel for the column end.
10. Hand-tighten the nut. Make sure the position of the column does not change as you tighten the nut. Reinstall the spring-loaded tip seal if it was removed earlier.
11. Check the GC oven to be sure that the column does not touch the oven walls.
12. Tighten the nut 1/4 to 1/2 turn. Check the tightness after one or two heat cycles.

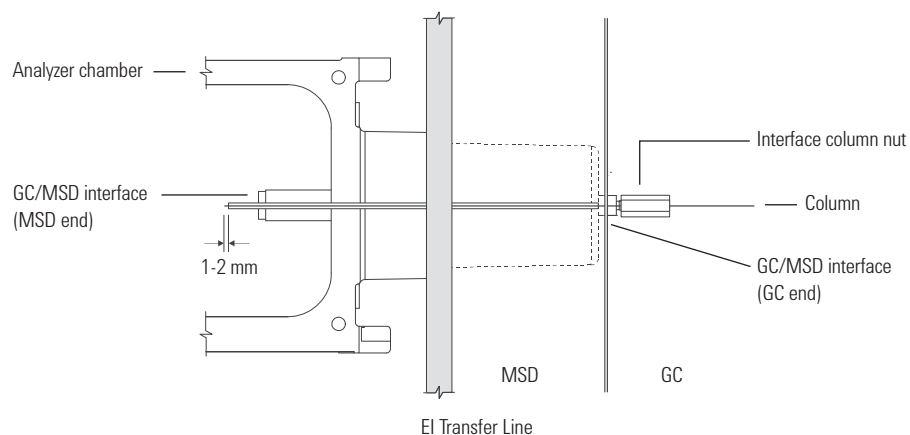
### TIPS & TOOLS



View recommended MS interface connections.

**Turn to page 38.**

## Installing a capillary column in the GC/MSD interface



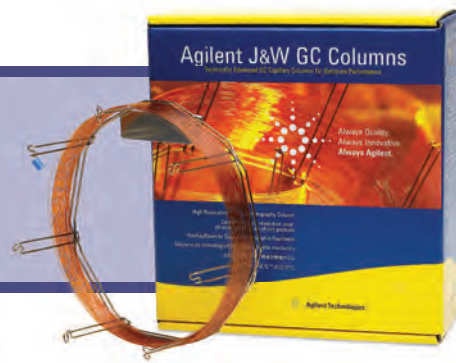
### TIPS & TOOLS

The column installation procedure for 5977 MSDs is different from that for most previous MSDs. Using the procedure from another instrument may result in poor sensitivity and possible damage to the MSD.



### TIPS & TOOLS

Agilent J&W GC Columns offer the lowest bleed levels, the best inertness for acids/bases/mixed functional compounds, and the tightest column-to-column reproducibility. Learn more at [www.agilent.com/chem/mygccolumns](http://www.agilent.com/chem/mygccolumns)



## MSD Filaments

Like the filaments in an incandescent light bulb, the ion source filaments will eventually burn out. Certain practices will reduce the chance of early failure.

- When setting up data acquisition parameters, set the solvent delay so that the analyzer will not turn on while the solvent peak is eluting
- When the software prompts 'Override solvent delay at the beginning of a run' always select 'No'
- Higher emission current will reduce filament life
- If you control your MSD from the Edit Parameters screen, always select 'MS Off' before changing any of the filament parameters

### MSD Filaments

Description	7200 Series	7000 Series	5977 Series	5975 Series	5975T Series	5973 Series
Filament assembly, high temperature (EI)	G7005-60061	G7005-60061	G7005-60061	G7005-60061	G7005-60061	G7005-60061
Filament assembly (CI), 2/pk	G7005-60072	G7005-60072	G7005-60072	G7005-60072		G7005-60072
Micro ion vacuum gauge	G3170-80001	G3170-80001	G3170-80001	G3170-80001		
Triode gauge tube for measuring vacuum						0960-0897
Ion gauge controller			G3397B	G3397A	G3880-80010	
Ion gauge tube					G3880-80011	



Filament assembly, high temperature (EI), G7005-60061



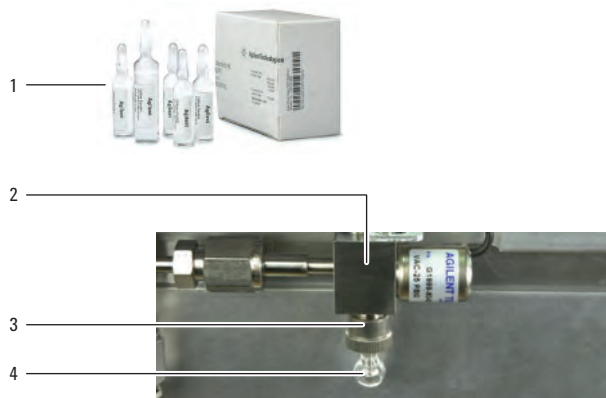
Filament assembly (CI), G7005-60072

### TIPS & TOOLS



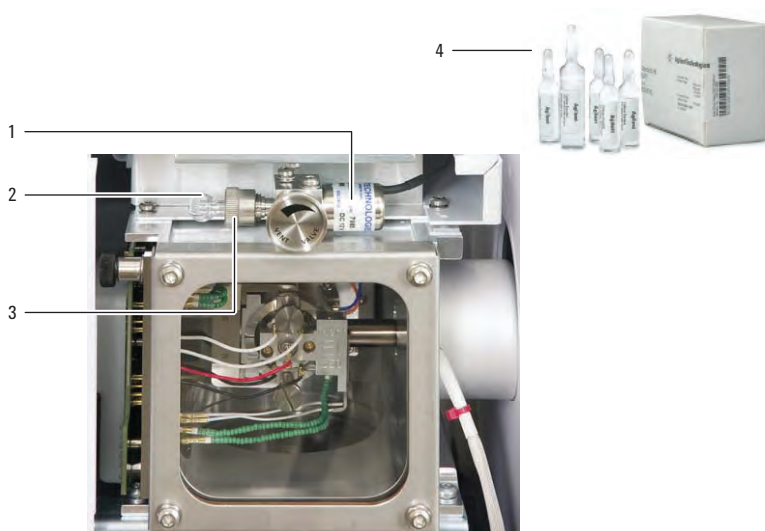
It is very useful to switch from one filament to the other every three months so that when a filament fails, you know the other will fail soon. This will allow you to change both filaments at the same time. Since the GC/MS system is already vented, it's a good idea to replace other supplies in the flowpath at the same time as the filaments.

## Vent Valve Supplies



### CI Valve Supplies

Item	Description	Unit	Part No.
1	PFDTD calibrant, for GC/MS, perfluoro-5,8-dimethyl-3, 6,9-trioxidodecane	1 mL	8500-8510
2	CI Cal valve assembly		G1999-60452
3	Certified non-stick fluorocarbon O-ring	10/pk	5188-5365
4	5975 Calibrant bulb		G3170-80002



### Vent Valve Supplies

Item	Description	Unit	Part No.
1	5975 EI CalVal turbo		G3170-60204
2	5975 Calibrant bulb		G3170-80002
3	Certified non-stick fluorocarbon O-ring	10/pk	5188-5365
4	PFTBA MS sample kit	0.5 mL	05971-60571



Replacement Agilent Gas Clean carrier gas filter, CP17973

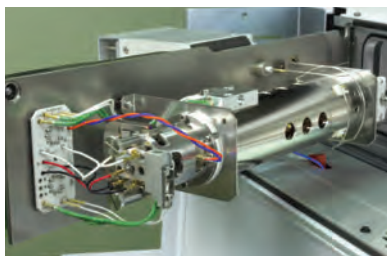
## Gas Clean Filters

The Agilent Gas Clean Filter System delivers clean gases, reducing the risk of column damage, sensitivity loss and instrument downtime. Inserting a Gas Clean Filter System in the gas line immediately before the instrument inlet greatly reduces the level of impurities, thus improving trace analysis. Contaminants entering your GC column will also be reduced, which is critical for high temperature analysis and essential for longer column lifetime.

- Deliver clean gases for accurate analyses
- Fast, leak-free filter replacement reduces downtime
- Economical, with immediate payback
- Highly sensitive filter indicators provide maximum instrument protection

### Gas Filters

Description	Part No.
Chemical ionization gas purifier	G1999-80410
Gas Clean carrier gas starter kit for 7890	CP17988
Replacement Agilent Gas Clean carrier gas filter	CP17973
Big universal trap, 1/8 in fittings, nitrogen, for 7000 and 7200 Series	RMSN-2



## Quadrupole Mass Filter

The mass filter does not require periodic maintenance. It should not be removed from the radiator or disturbed in any way.

- Never put the quadrupole in an ultrasonic cleaner.
- Never change the physical orientation of the quadrupole mass filter.
- The fused-quartz quadrupole is fragile and will break if dropped or handled roughly.
- The material in the cusps of the quadrupole is very hygroscopic. If exposed to water, the quadrupole must be dried very slowly to prevent damage.
- Cleaning techniques that are appropriate for other manufacturers' instruments are not suitable for Agilent MSDs – and may actually harm the mass filter.
- To save time and effort, use only Agilent MSD mass filters, which do not require periodic cleaning or maintenance.
- In case of extreme contamination, contact a trained Agilent service representative to perform the mass filter cleaning.

# MSD Electron Multipliers and Replacement Horn

The lifetime of an electron multiplier is directly related to the current that flows through it and the extent of contamination or condensation that it experiences. Replace the electron multiplier or replacement horn when voltage is over 2500 V. To maximize electron multiplier life:

- Maintain the best possible vacuum, especially in the analyzer manifold
- Use extreme caution and be conservative with venting, pumpdown, and all vacuum system procedures to keep pump fluid background to a minimum
- After venting, allow four hours for pumpdown and thermal equilibration before scanning
- Actively look for background contamination and leaks and repair them immediately
- Don't tune excessively – PFTBA can result in higher background over an extended period of time
- Replace the electron multiplier if vacuum is poor or voltage is over 2600 V



Triple axis electron multiplier, G3170-80103

## MSD Electron Multipliers and Replacement Horn

Description	7000A Series	7000B/C Series	5975 Series	5973 Series	5977 Series
Electron multiplier replacement horn Use with electron multipliers with "straight" horns			05971-80103	05971-80103	
Triple axis detector assembly*	G3170-80100		G3170-80100		G3170-80100
Triple axis electron multiplier	G3170-80103	G3170-80103	G3170-80103		G3170-80103
EM signal wire, low noise detector			G3170-80008		G3170-80008

\*Included on 5975 triple axis detector systems

### TIPS & TOOLS

The Agilent multipliers and horns listed are recommended for your MSD. Other manufacturers' products may be incompatible with Agilent instruments and can result in reduced sensitivity, lifetime, and noise problems.





## Vacuum Systems and Pumps

The vacuum system creates the high vacuum (low pressure) required for the MSD to operate. Without this vacuum, the molecular mean free path is too short.

Ions cannot travel from the ion source through the mass filter to the electron multiplier (detector) without colliding with other molecules.

The main components of the vacuum system are:

- Vacuum manifold
- Foreline gauge
- Calibration valve
- Gauge controller (optional)
- Vacuum seals
- Foreline pump and/or trap
- Diffusion/turbo pump and fan
- High vacuum gauge tube

## Pressure Symptoms

This section describes unusual pressure readings and their possible causes. The symptoms in this section are based on typical pressures. At typical column flow rates (0.5-2.0 mL/min), the foreline pressure will be approximately 20 to 100 mTorr. The vacuum manifold pressure will be approximately  $1 \times 10^{-6}$  to  $1.4 \times 10^{-4}$  Torr.

These pressures can vary widely from instrument to instrument, so it is important that you are familiar with the pressures that are typical for your instrument at a given carrier gas flow and oven temperature.

The foreline pressures listed can only be measured on diffusion pump-equipped systems. Turbomolecular pumps are controlled according to their speed and do not have foreline pressure gauges.

The vacuum manifold pressures can only be measured if your system is equipped with the optional gauge controller.

### TIPS & TOOLS



Keeping a pan under the vacuum pump helps to detect and identify the origin of oil leaks.



## Pressure Symptoms

### Symptoms

### Possible Causes

#### Foreline pressure is too high

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• Pressure is above 100 mTorr.</li> <li>• Pressure for a given column flow has increased over time</li> </ul> | <ul style="list-style-type: none"> <li>• Column (carrier gas) flow is too high</li> <li>• Wrong carrier gas</li> <li>• Air leak (normally at transferline interface)</li> <li>• Foreline pump oil level is low or oil is contaminated</li> <li>• Foreline hose is constricted</li> <li>• Foreline gauge is not working correctly</li> <li>• Foreline pump is not working correctly</li> </ul> |
|--|---|

#### Foreline pressure is too low

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• Pressure is below 20 mTorr.</li> </ul> | <ul style="list-style-type: none"> <li>• Column (carrier gas) flow is too low</li> <li>• Wrong carrier gas</li> <li>• Column plugged or crushed by an overtightened nut</li> <li>• Empty or insufficient carrier gas supply</li> <li>• Bent or pinched carrier gas tubing</li> <li>• Foreline gauge is not working correctly</li> </ul> |
|---|---|

#### Vacuum manifold pressure is too high

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• Pressure is above <math>1.4 \times 10^{-4}</math> Torr.</li> <li>• Pressure for a given column flow has increased over time</li> </ul> | <ul style="list-style-type: none"> <li>• Column (carrier gas) flow is too high</li> <li>• Wrong carrier gas</li> <li>• Air leak</li> <li>• Foreline pump is not working correctly</li> <li>• Diffusion pump fluid level is low or fluid is contaminated</li> <li>• Defective gauge controller</li> <li>• Faulty ion gauge tube</li> </ul> |
|---|---|

#### Vacuum manifold pressure is too low

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• Pressure is below <math>1.4 \times 10^{-4}</math> Torr.</li> </ul> | <ul style="list-style-type: none"> <li>• Column (carrier gas) flow is too low</li> <li>• Wrong carrier gas</li> <li>• Column plugged or crushed by an overtightened nut</li> <li>• Empty or insufficient carrier gas supply</li> <li>• Bent or pinched carrier gas tubing</li> <li>• Defective gauge controller</li> <li>• Faulty ion gauge tube</li> </ul> |
|---|---|

## Diffusion Pump

It is not necessary to change the diffusion pump fluid more than once a year, unless you observe symptoms that suggest a problem with the fluid. The MSD must be vented in order to check the diffusion pump fluid (except for the 5977/5975/5973). Therefore, the best time to check the fluid is when the instrument is already vented for other maintenance.

## How to Check the Fluid Level

### 5977/5975/5973 Series

- Use the sight glass to determine the depth of the fluid. The recommended total fluid charge is approximately 37 mL. Two charges are used for the 5977/5975/5973.



5977A Series GC/MSD system

## Quiet Cover

Agilent has a solution to the annoying, frequent maintenance of GC/MS rough pumps (visual check of oil levels, oil changes, oil additions, cleanup of oil leaks, etc.), as well as the inherent noise produced by the pumps.

The Quiet Cover GC/MS was designed for easy movement, maintenance, and better living with rough pumps used with Agilent and other GC/MS systems.

The Quiet Cover GC/MS is compatible with rough pump models used in many laboratories, including the Agilent DS42, Agilent DS42i, Pfeiffer Duo 2.5, and Edwards E2M1.5. This quiet cover model is compatible with Agilent 5977 GC/MS, 5975 GC/MS and 5973 GC/MS systems.

For more Information Visit: [www.agilent.com/chem/quietcover](http://www.agilent.com/chem/quietcover)

### Quiet Cover

Quiet Cover GC/MS	G6014A
-------------------	--------

The G6012A Quiet Cover DS is used with the 7200 GC-QTOF and requires an extra filter extension and seal.

### Quiet Cover DS

Quiet Cover DS	G6012A
Filter extender tube, NW 25 x 100 mm*	5188-1181
Clamping ring, NW 20/25, stainless steel*	0100-0549
Co-seal, NW 20/25, filter extender tube*	0100-1597

\*Parts required for use with Quiet Cover DS and a 7200 GC-QTOF



Quiet Cover GC/MS



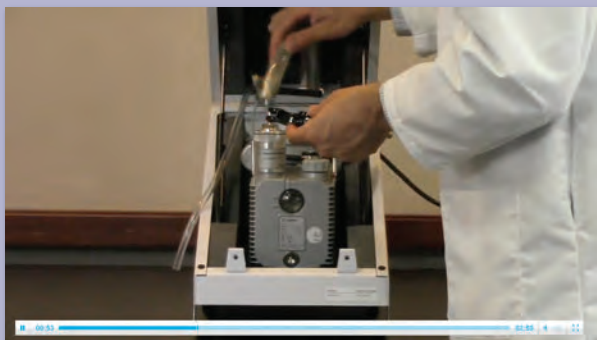
Quiet Cover GC/MS, with open-access cover



Quiet Cover DS, G6012A

### TIPS & TOOLS

Find out how to quiet your rough pump once and for all at [www.agilent.com/chem/quietcovervideo](http://www.agilent.com/chem/quietcovervideo)





Foreline Pump

## Foreline Pump

The oil in the foreline or rough pump should be replaced on average once every six months, but can vary depending upon applications. If a foreline trap is present, the molecular sieves should also be replaced after an oil change.

Avoid contact with the pump oil. The residue from some samples may be toxic. Dispense of used oil properly.

### Pump Oils

Description	Part No.
Foreline pump (rotary pump) oil, Inland 45, 1 L	6040-0834
Diffusion pump fluid, 18.5 mL	6040-0809*
Oil mist exhaust filter	G1099-80039
Inland 45 pump oil, 1 gallon	6040-0798
Foreline (roughing) pump oil, 1 L	8829951700
Oil for vacuum pumps, 1 L, petroleum-based, used on 7000 Series	6040-1361
Oil, Edwards Ultragrade for RV3 and RV5 pumps	G6600-85002

\*2 required for 5977, 5975 and 5973 Series



## General Instructions on How to Replace the Pump Oil

1. Vent and shut down the MSD.
2. Place a container under the drain plug on the foreline pump.
3. Remove the fill cap from the top of the pump to expose the fill hole.
4. Remove the drain plug from the pump.
5. Reinstall the drain plug and pour pump oil into the fill hole.
6. Reinstall the fill cap.
7. Reconnect the MSD power cord.
8. Start up and pump down the MSD according to the Instrument Manual procedure.

# 7000 Triple Quadrupole GC/MS

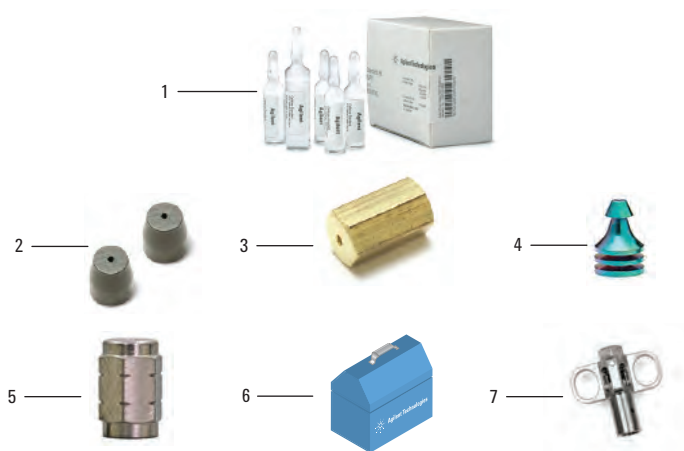
## Precision, reliability and the lowest detection limits

The 7000C Triple Quadrupole GC/MS was designed to deliver the most accurate quantitative results and confident identification even in the most complex matrixes. Coupled with the 7890B GC, the 7000C MS works in perfect harmony to enhance productivity, save resources and alert you when maintenance is pending. Agilent MassHunter software has enhanced MRM optimization tools, giving you complete control from tune to report generation while streamlining your workflow.

- Second-generation extractor ion source: the high sensitivity EI extractor ion source with improved thermal characteristics delivers confident trace analysis even in complex matrixes. We demonstrate the instruments' detection limit of  $\leq 4$  fg octafluoronaphthalene at installation.
- Hyperbolic quadrupoles enhance performance up to 1050 u. The unique stability of the proprietary Gold Quadrupole allows the analyzer to be heated to 200 °C, to eliminate contamination commonly seen with metal quadrupoles operated at lower temperatures.
- The triple-axis HED-EM detector reduces neutral noise by the doubly off-axis position of the HED-EM.
- The MRM optimization tool allows for automated, efficient method development, yet is easily customizable.
- Capillary Flow Technology (CFT) adds functionality to the GC with backflush, Dean switching, or splitters for multiple detectors. CFT also enables reliable, leak-free in-oven connections.
- The programmable helium conservation module reduces helium consumption for GC and GC/MS systems by changing an alternate carrier during system stand-by. You program carrier gas changeover and flows during sleep and wake states. Programmable helium conservation eliminates the revalidation of methods required when converting to other carrier gases.
- The Pesticides and Environmental Pollutants Database provides comprehensive information to help you with simple yet flexible MS/MS method development.
- Retention Time Locking software reproduces retention times from one Agilent GC to another to help transfer methods anywhere, worldwide.
- Early maintenance feedback (EMF) monitors GC and MS resources, with injection counter, operation times, and electronic logs to help you plan maintenance more efficiently.



7000C Triple Quadrupole GC/MS



**7000 Triple Quad GC/MS Interface Parts and Standards**

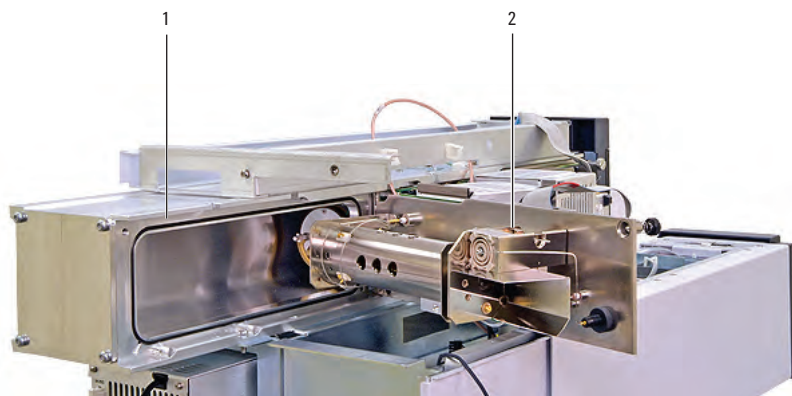
Item	Description	Unit	Part No.
1	OFN, 100 fg/μL	3 x 1 mL ampoules	5188-5347
	OFN, 10 fg/μL	3 x 1 mL ampoules	5190-0585
	OFN, 1 pg/μL	3 x 1 mL ampoules	5188-5348
	Benzophenone, 100 pg/μL	5 ampoules	8500-5440
	PFHT-high mass checkout sample, 10 μg/mL PFHT (Tris(perfluoro- heptyl)-s-triazine) in Hexane	3 x 1 mL ampoules	5188-5357
2	Capillary column long ferrule	10/pk	5181-3308
	250 μm Polyimide/graphite ferrule	10/pk	5181-3323
	0.5 mm Polyimide/graphite ferrule	10/pk	5062-3506
	0.3 mm, 100 μm Polyimide ferrule	10/pk	5062-3507
3	MS interface column nut, female		05988-20066
4	UltiMetal Plus Flexible Metal ferrule with 0.4 mm id	10/pk	G3188-27501
	UltiMetal Plus Flexible Metal ferrule with 0.5 mm id	10/pk	G3188-27502
	UltiMetal Plus Flexible Metal ferrule with 0.8 mm id	10/pk	G3188-27503
	UltiMetal Plus Flexible Metal ferrule with no hole	10/pk	G3188-27504
5	Swaging nut, for MS interface with Flexible Metal ferrules		G2855-20555
6	MS interface column installation tool		G1099-20030
	Ferrule pre-swaging tool		G2855-60200
	Open end wrench, 1/4 and 5/16 in		8710-0510
	Nylon gloves, lint-free, large	1 pair	8650-0030
7	Self Tightening column nut, for MS interface		5190-5233

**TIPS & TOOLS**



View MS interface connection options including the recommended Self Tightening column nut.

**Turn to page 38.**



### 7000 Triple Quad Rear Analyzer Chamber

Item	Description	Unit	Part No.
1	High vacuum grease	25 g	6040-0289
2	Electron multiplier horn		G7000-80103
	Low noise EM horn		G3170-80103

### TIPS & TOOLS

To learn more about the Agilent 7000C Triple Quadrupole GC/MS, visit [www.agilent.com/chem/7000C](http://www.agilent.com/chem/7000C)





7000A Triple Quadrupole GC/MS

## 7000 Triple Quadrupole GC/MS Parts and Supplies

Engineered from the ground up for ease-of-use and routine high performance operation, the 7000 Triple Quadrupole GC/MS delivers advanced high-speed GC/MS/MS quantitation for ultra-trace analysis of even the most complex samples. Combined with the Agilent 7890 GC, the result is an optimally robust GC/MS/MS system.



Low noise EM horn, G3170-80103



Cotton swabs, 5080-5400

### Maintenance Supplies

Description	Part No.
Abrasive sheets	5061-5896
Alumina powder, abrasive, 100 g	393706201
Cloths, lint-free	05980-60051
Lint-free industrial wipes, 100% cotton	9310-4828
Swabs for cleaning GC/MS	5080-5400
Nylon gloves, lint-free, large	8650-0030
Nylon gloves, lint-free, small	8650-0029
High vacuum grease, 25 g	6040-0289
Low noise EM horn	G3170-80103
Filament assembly, high temperature (EI)	G7005-60061
Filament assembly (CI), 2/pk	G7005-60072
Manifold vacuum gauge	G1960-80303
Replacement glass bulb for PFTBA and PFDTD test sample	G3170-80002



## 7200 Q-TOF for GC/MS

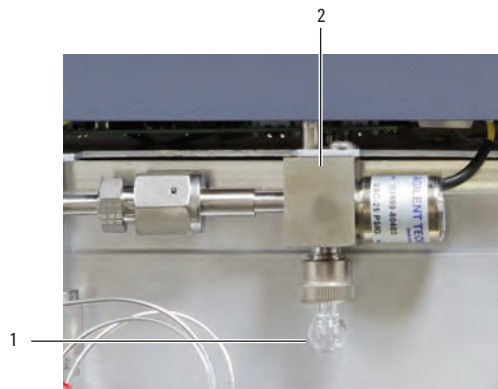
### Detection and selectivity of targets and unknowns with complete confidence

Complex matrix analyses demand your best qualitative GC data. That's why we designed the Agilent 7200 Q-TOF for GC/MS, the world's first Q-TOF purpose built specifically for gas chromatography. The 7200 Q-TOF redraws the boundaries of GC/MS technology by combining the separation power of Agilent's 7890 Series GC with application-tested MS components from our 7000 Triple Quadrupole GC/MS and 6500 LC/Q-TOF systems. You get robust GC/MS operation, outstanding selectivity, full-spectrum acquisition with high sensitivity, fast data rates, and accurate mass information to simplify molecular characterization and structural confirmation.



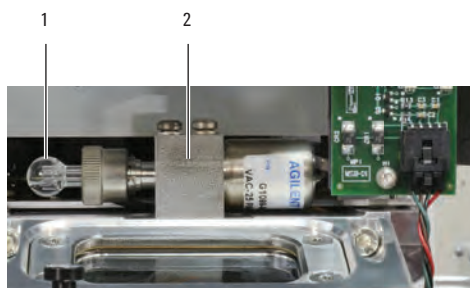
7200 Q-TOF for GC/MS

- Highly accurate mass assignments: low-ppm mass accuracy – combined with 15x to 50x greater resolution than a single quadrupole MS – gives you the power to analyze target, non-target, and unknown compounds with much greater reliability. In addition, the 7200 GC/Q-TOF uses dual gain amplifiers with dual analog-to-digital (ADC) detection to record multiple events over a wide mass range and concentration range.
- High sampling rate (32 Gbit/s): the 4 GHz ADC electronics improve resolution, mass accuracy, and sensitivity for low-abundance samples.
- 24/7 mass accuracy: our proprietary invar flight tube, sealed in a vacuum-insulated shell, stabilizes mass calibration against thermal change.
- Fast, high-quality MS/MS spectra: ions are accelerated in Agilent's unique hexapole collision cell.
- Fast routine maintenance: the removable ion source permits rapid changing of the entire ion source, lens, and filaments, without venting the high vacuum mass analyzer.
- Low detection limits and excellent linearity: a full spectrum with sensitivity better than quadrupole MS lets you capture accurate mass spectra at low pg on-column for most compounds. The dual-gain mode expands this range to 105.
- Unparalleled MS/MS selectivity: the detection selectivity of high-resolution MS/MS dramatically surpasses other MS/MS analyzers. Moreover, accurate mass product-ion spectra help confirm targets and non-targets, as well as elucidate unknown compounds.
- Agilent MassHunter software provides valuable tools for identification, quantitation, and confirmation: you can find compounds in complex samples by applying deconvolution optimized for EI or CI data, simplify compound identification by combining library search results and calculated formulas for molecular and fragment ions, and perform multivariate statistical analysis on several data files using Mass Profiler Professional – a mass spectrometry-centric program.



### 7200A Q-TOF CI Calibration Valves

Item	Description	Unit	Part No.
1	Replacement glass vial for PFTBA and PFDTD test sample		05980-20018
	PFDTD calibrant, for GC/MS, perfluoro-5,8-dimethyl-3, 6,9-trioxidodecane	1 mL	8500-8510
	5975 Calibrant bulb		G3170-80002
2	CI Cal valve assembly		G1999-60452
	Certified non-stick fluorocarbon O-ring	10/pk	5188-5365
3	PFDTD calibrant, for GC/MS, perfluoro-5,8-dimethyl-3, 6,9-trioxidodecane	1 mL	8500-8510



### 7200A Q-TOF EI Calibration Vials

Item	Description	Unit	Part No.
1	5975 Calibrant bulb		G3170-80002
2	Certified non-stick fluorocarbon O-ring	10/pk	5188-5365
3	PFTBA MS Sample Kit	0.5 mL	05971-60571



1

2



### 7200A Q-TOF IRM Vials

Item	Description	Unit	Part No.
1	Replacement glass vial for PFTBA and PFDTD test sample		05980-20018
	5975 Calibrant bulb		G3170-80002
	IRM calibrant for GC/TOF	1 x 0.5 mL	5190-0531
2	PFTBA sample, certified	10 g	8500-0656

### TIPS & TOOLS

To learn more about the capabilities of the Agilent 7200 Q-TOF for GC/MS, visit [www.agilent.com/chem/GCMS\\_QTOF](http://www.agilent.com/chem/GCMS_QTOF)



## 240-MS Ion Trap Parts and Supplies

The Agilent 240-MS Ion Trap delivers unparalleled capabilities for both research and routine applications. Advanced ionization, including positive and negative chemical ionization, improves selectivity and limits of detection. Enhanced scanning techniques ensure compound confirmation. The MS/MS and MS<sup>n</sup> reduce matrix influences and provide more detailed structural information. The software comes with a full complement of productivity, reporting, and regulatory compliance tools.

- Accurate identification and quantification of trace analytes
- Unsurpassed sensitivity (200 femtogram OFN full scan)
- Choice of internal or external ionization configurations
- Powerful MS/MS and CI options
- Low maintenance and high reliability
- Intuitive software for increased productivity



### TIPS & TOOLS



Need GC supplies for your non-Agilent instruments? Check out the Agilent CrossLab supplies for Bruker/Varian GC Systems.

**Turn to page 206.**

**240-MS Ion Trap Parts and Supplies**

<b>Description</b>	<b>Part No.</b>
Manifold O-ring	393010924
Transfer line inner O-ring	393010920
Transfer line outer O-ring	393010918
Internal filaments (2 filaments on one disk)	392017401
Internal transfer line tip	393171201
External filament (single filament)	393161001
Electrode, end cap, SilChrom	393164493
Electrode set kit, SilChrom, DFC (inert) tested Includes 2 end cap electrodes, 1 RF electrode, cleaning instructions	9300003590
Electrode, RF, SilChrom	393167593
Spacer, RF, silco-quartz	393053502
Electron multiplier	393175101
Transfer line assembly upgrade field kit Contains a complete transfer line and side-mounted block for vacuum manifold	393101291
EPA volatile kit for EPA methods 524.2 & 8260B	393082491
ChromatoProbe microvials, 100/pk	392567111
<b>GC/MS Standards</b>	
Evaluation standard (Internal EI & CI) 2 pg/μL OFN, 5 pg/μL benzophenone	393112601
Test standard for external EI (5 pg/μL OFN)	393112702
Benzophenone CI sensitivity standard 50 pg/μL	392030500
Test standard for external NCI (1 pg/μL DFB)	393113001
Tuning calibration compound PFTBA (FC-43)	392035300
GC/MS column test mix	392027300
<b>Vacuum Supplies</b>	
Oil mist exhaust filter, DS42	393847701
Oil mist eliminator	2735000500
Quiet Cover GC/MS	G6014A
Replacement cartridge for oil exhaust filter, 2/pk	2710100200
Foreline (roughing) pump oil, 1 L	8829951700
Premium foreline (roughing) pump oil, 1 L	8829953800
IDP-3 dry scroll pump tip seal maintenance kit	2710100400
IDP-3 dry scroll replacement module	2710100500

## 220-MS Parts and Supplies

The 220-MS is a high sensitivity, flexible gas chromatograph/mass spectrometer that delivers outstanding qualitative and quantitative data in a range of applications. This simple and robust system is easy to operate and maintain.

- Accurately identify and quantify trace analytes
- Take advantage of powerful CI and MS/MS upgrades for advanced applications
- Spend less time on maintenance and more time on analysis

### 220-MS Parts and Supplies

Description	Part No.
Electron multiplier assembly	393031501
Exit end cap electrode, chrome	393050292
Exit end cap electrode, SilChrom	393050293
Filament end cap electrode, chrome	393050392
Filament end cap electrode, SilChrom	393050393
RF ring electrode, chrome	393050492
RF ring electrode, SilChrom	393050493
Complete set of SilChrom electrodes and silco-quartz spacers	393001991
Spacer, RF, quartz	393053501
Spacer, RF, silco-quartz	393053502
Filament disk assembly with wire connectors	393060191
Filament disk assembly User must solder on 3 wire connectors	392043700
Thermocouple vacuum gauge	2722990700
Mass spectrometer expendable supplies kit for 2x0MS Includes PFTBA calibration compound, cal-gas glass chamber, capillary injector nut, O-rings, cotton tipped applicators, end cap insulator, vacuum pump oil	393011391
<b>GC/MS Standards</b>	
Benzophenone CI sensitivity standard 50 pg/μL	392030500
Tuning calibration compound PFTBA (FC-43)	392035300
Hexachlorobenzene EI sensitivity standard 2 pg/mL	392047100
GC/MS column test mix	392027300



## GC/MS Standards

### GC/MS Analyzer Kit Standards

Description	Part No.
GC/MS semivolatiles analyzer checkout mixture	5190-0473
Solvents plus checkout mix for 3 in 1 environmental analyzer	G3440-05012
GC/MS pesticide analyzer internal standard, phenanthrene-d10 at 1000 µg/mL in methylene chloride, 4 x 1 mL	5190-0472
Pesticide analyzer checkout solution, 20 pesticides at 10 µg/mL each in acetone, 5 x 1 mL	5190-0468
Pesticide checkout standard, 100 µg/L, 3 x 1 mL	5190-0494
GC/MS toxicology checkout mixture	5190-0471
Residual solvent revised method 467, class 2A, 1 x 1 mL	5190-0492
Residual solvent revised method 467, class 2B low	5190-0513
Residual solvent revised method 467, class 2B, 1 x 1 mL	5190-0491
Residual solvent revised method 467, class 2C, 1 x 1 mL	5190-0493
Residual solvent revised method 467, class 1	5190-0490
Butanetriol internal standard #1 for biodiesel	5982-0024
Tricaprin internal standard #2 for biodiesel	5982-0025
Pesticide retention locking standard, 3 pesticides at 10 µg/mL each in n-hexane, 3 x 1 mL	5190-1441
Glycerol calibration standards kit, 5 x 1 mL	G3440-85028
Standard glycerides stock solution in THF, 1 x 2 mL	G3440-85018
FAME retention time standard in toluene, 5 x 2 mL	G3440-85027
Methyl nonadecanoate in toluene, 5 x 10 mL	G3440-85026
Solvents-plus checkout mix, 3 x 2 mL	G3440-85012
Transformer Oil Gas Analyzer checkout mix, 17 L SCOTTY cylinder	G3440-85007
PAH Analyzer checkout standard, 5 x 2 mL	G3440-85009
C6 to C12 normal hydrocarbon mix, 3 x 2 mL	G3440-85013
Natural gas analyzer checkout mix, 14 L SCOTTY cylinder	G3440-85017
Methylheptadecanoate-d33 in dodecane, 3 x 2 mL	G3440-85029
Ethanol calibration kit for blood alcohol analyzer	G3440-85035
Multicomponent alcohol kit for blood alcohol analyzer	G3440-85036



MS standards

MS Test and Performance Samples

	Description	Part No.	5977/ 5975 Series	5973 Series	5972 Series	GCD	7000 Series	7200 Series
<b>Tuning Samples</b>								
El Tune	PFTBA sample, certified, 10 g, 5.32 mL	8500-0656	✓	✓	✓	✓	✓	✓
CI Tune	PFDTD calibrant	8500-8510	✓	✓			✓	✓
<b>Performance Verification Samples</b>								
EI	OFN, 1 pg/μL	5188-5348	✓	✓				
	Hexachlorobenzene 10 pg/μL, 1 ng/μL	8500-5808			✓			
	MSD Sampler	05970-60045				✓	✓	
Negative Mode CI	OFN, 100 fg/μL	5188-5347	✓					
Positive Mode CI	Benzophenone, 100 pg/μL	8500-5440	✓	✓	✓			
	1 pg/μL OFN, 5 pg/μL BZ	393065201					✓	
<b>Checkout Samples</b>								
HighMass	PHFT, 100 pg/μL	5188-5357	✓					
Semivolatiles	GC/MS tuning standard, DFTPP	8500-5995	✓	✓	✓	✓		
Volatile	p-Bromofluorobenzene (BFB), 25 μg/mL	8500-5851	✓	✓	✓	✓		
MSD sampler	Solution of dodecane, biphenyl, p-chlorodiphenyl, and methyl palmitate in isooctane. Six 1.0 mL ampoules: 4 at 10 ng/μL, 1 at 100 ng/μL, 1 at 100 pg/μL.	05970-60045	✓	✓	✓	✓	✓	



TIPS & TOOLS

Each GC/MS has a specific test and performance sample. Refer to the chart above for the exact sample. All volumes are approximately 0.5-1 mL unless otherwise specified.



# Agilent Syringes

With a broad selection of syringes for manual and auto injectors, Agilent has what you need for accurate and effective sampling.

Whether you need an autosampler or manual syringe, there are two keys to choosing the right syringe – identifying your sample type and establishing the smallest volume to be dispensed or injected. Agilent offers two varieties of syringes.

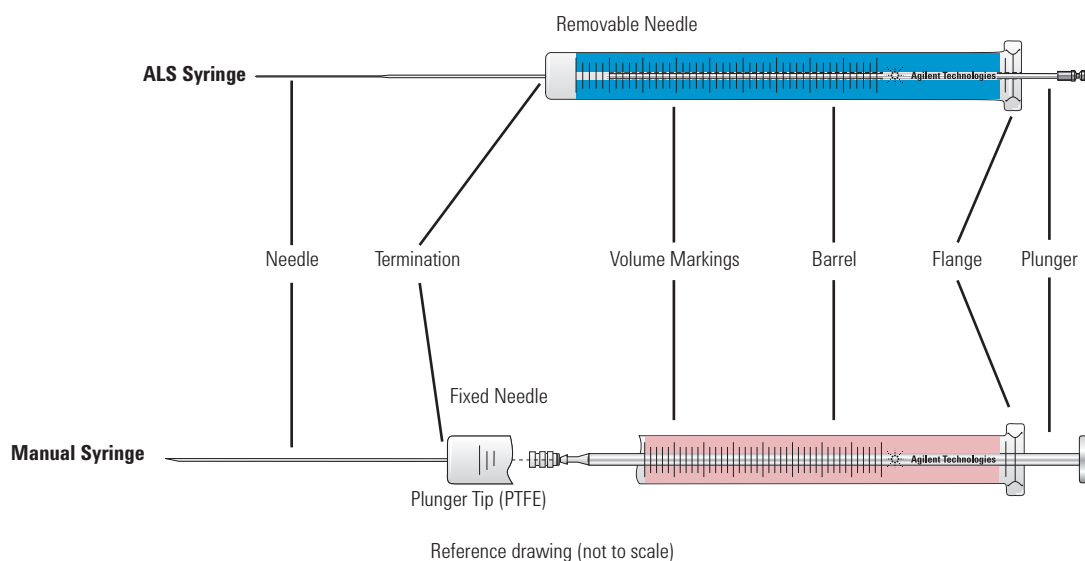
## PTFE-Tipped Syringes for Gases and Liquids

PTFE-tipped syringes have a precision-machined plunger tip that forms a tight seal and enables the tip to wipe the barrel's interior free of sample during operation. This feature is particularly useful for viscous or heterogeneous samples, because it reduces deposits that can cause the plunger to freeze. Replacement plunger assemblies are available for most PTFE-tipped syringes.

## Fitted Plunger Syringes for Liquids

Fitted plunger syringes feature a stainless steel plunger that is meticulously hand-fitted to its matching glass barrel, creating a liquid-tight seal. These syringes are ideal for homogenous samples that are not prone to precipitation or bonding with glass. **Note:** plungers cannot be interchanged or replaced if damaged.

## Syringe Features



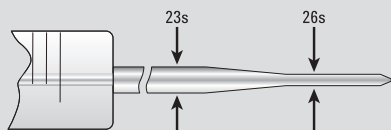


## Needle Gauge

Needle gauge is the thickness of the needle. The gauge depends on the injector. When selecting a needle gauge, it is important to keep in mind the volume of the syringe and the dead volume of the needle. Refer to the chart below to choose a needle gauge with an appropriate dimension before selecting a needle.

### Typical Needle Gauge Dimensions

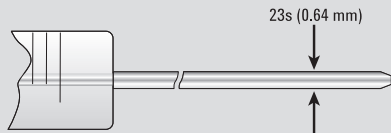
Gauge	OD		ID	
	mm	in	mm	in
22	0.71	0.028	0.41	0.016
23s	0.635	0.025	0.11	0.0045
25	0.50	0.020	0.20	0.008
26s	0.47	0.0184	0.11	0.0045



Tapered Dual Gauge 23-26 or 23s-26s (0.64-0.47 mm)

Durability of a 23-gauge

Versatility of a 26-gauge for split/splitless and on-column injection

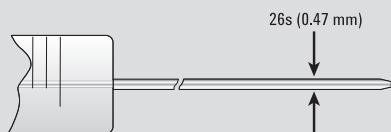


Single Gauge 23 or 23s (0.64 mm)

Merlin Microseal septa

Packed column injector ports

Split/splitless injector ports



Single Gauge 26 or 26s (0.47 mm)

Packed column injector ports

Split/splitless injector ports

**Note:** Needles with an 'S' following the gauge are more durable, with a thicker needle wall and smaller id bore.

## Needle Termination

Needle terminations are available in fixed or removable, with various tip styles:

- **Fixed (cemented)** – Economical, reproducible injections for autosamplers
- **Removable needle** – One syringe fixed – many methods, simplicity of fixed needle, but needle can be replaced if damaged or clogged
- **Luer tip** – Easy, fast needle replacement, syringe filter or pump priming, Luer tip is ground glass suitable for mounting chromatographic or PTFE needles, syringes can be autoclaved (without plunger or needle)
- **Luer Lok** – Security of a locked needle, syringe filter or pump priming, PTFE, male Luer taper with nickel-plated brass locking hub for use with KEL-F or metal hub needles and universal connectors

## Needle Tip Design



**HP Tip**  
(also referred to as  
**Cone or Point Style AS**)

Proprietary design required for Agilent autosamplers for optimal performance and reliability by reducing septum coring.



**Bevel Tip**  
(Point Style 2, BV)

General purpose; excellent choice for transferring liquids from ampoules or vials. For manual GC injections, a beveled tip is preferred for optimum septum penetration and to prevent septum coring.



**Side Hole**  
(Point Style 5)

Recommended for thin gauged septa or large volume injections.



Blue line autosampler syringe shown in 7693A ALS, G4513-80204

## Autosampler Syringes

Premium autosampler syringes optimize system productivity and ensure precise sample handling

### Agilent Blue Line Autosampler Syringes for 7693A ALS

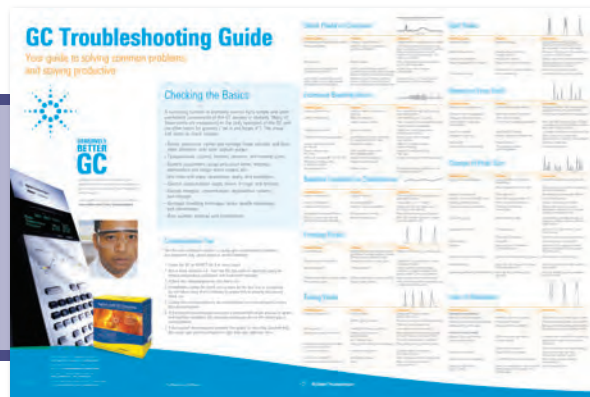
Agilent blue line autosampler syringes are specifically designed to support the higher productivity features of the 7693A ALS, while increasing plunger life and reducing costly downtime. Backed by over 40 years of chromatography experience, these meticulously crafted syringes offer:

- Wider range of volumes including exclusive 250 and 500  $\mu$ L syringes for sample enhancement with the new 7693A
- Precise match with your autosampler's stroking mechanism, resulting in more accurate volume delivered
- Smooth needle that reduces septum coring and keeps your system working at its full potential
- Choice of PTFE-tipped or metal fitted plunger to meet application needs
- Easy-open, environmentally friendly packaging
- Certified compliance with strict Agilent specifications



#### TIPS & TOOLS

Order your free GC troubleshooting and GC column installation posters at [www.agilent.com/chem/GCposteroffer](http://www.agilent.com/chem/GCposteroffer)



## Blue Line Autosampler Syringes with Fitted Plungers

Fitted plunger syringes are recommended for homogeneous liquid samples. Each fitted syringe is individually matched with the plunger for precision injection. Plungers are not interchangeable or replaceable.

### Blue Line Autosampler Syringes with Fitted Plungers

Volume (µL)	Description	Unit	Needle Gauge/ Length (mm)/Tip	Part No.
0.5	Plunger in needle, fixed		23/42/cone tipped	G4513-80229
	Replacement needle/plunger			G4513-80240
1	Plunger in needle, fixed		23/42/cone tipped	G4513-80215
	Replacement needle/plunger			G4513-80239
5	Straight, fixed		23/42/HP	G4513-80213
	Straight, fixed	6/pk	23/42/HP	G4513-80205
	Straight, fixed		26s/42/HP	G4513-80226
	Straight, fixed	6/pk	26s/42/HP	G4513-80212
	Tapered, fixed		23-26s/42/HP	G4513-80206
	Tapered, fixed	6/pk	23-26s/42/HP	G4513-80201
	Straight, removable		23/42/HP	G4513-80234
	Replacement needle	3/pk	23/42/HP	G4513-80236
	Tapered, removable		23-26s/42/HP	G4513-80224
	Replacement needle	3/pk	23-26/42/HP	G4513-80225
10	Straight, fixed		23/42/HP	G4513-80209
	Straight, fixed	6/pk	23/42/HP	G4513-80202
	Straight, fixed		26s/42/HP	G4513-80216
	Straight, fixed	6/pk	26s/42/HP	G4513-80211
	Tapered, fixed	1/ea	23-26s/42/HP	G4513-80204
	Tapered, fixed	6/pk	23-26s/42/HP	G4513-80200
	Straight, removable		23/42/HP	G4513-80235
	Replacement needle	3/pk	23/42/HP	G4513-80236
	Removable		23-26s/42/HP	G4513-80218
	Replacement needle	3/pk	23-26/42/HP	G4513-80225
25	Tapered, fixed		23-26/42/HP	G4513-80242
50	Tapered, fixed	1/ea	23-26/42/HP	G4513-80244
100	Tapered, fixed	1/ea	23-26/42/HP	G4513-80243



Blue line autosampler syringe, G4513-80205



Blue line autosampler syringe, G4513-80204

## Blue Line Autosampler Syringes with PTFE-Tipped Plungers

Suitable for gas and liquid samples, the PTFE tip of the plunger creates a tight seal between the plunger and glass, helping to reduce carry-over and increase syringe lifetime. Replacement plungers are available.

### Blue Line Autosampler Syringes with PTFE-Tipped Plungers

Volume (µL)	Description	Unit	Needle Gauge/ Length (mm)/Tip	Part No.
10	Straight, fixed		23/42/HP	G4513-80220
	Straight, fixed	6/pk	23/42/HP	G4513-80210
	Tapered, fixed		23-26/42/HP	G4513-80203*
	Replacement plunger for fixed needle			G4513-80227
	Tapered, fixed	6/pk	23-26s/42/HP	G4513-80208
	Straight, removable		23/42/HP	G4513-80219
	Replacement needle	3/pk	23/42/HP	G4513-80236
	Tapered, removable		23-26/42/HP	G4513-80233
25	Straight, fixed		23/42/HP	G4513-80228
	Tapered, fixed		23-26/42/HP	G4513-80241
50	Straight, fixed		23/42/HP	G4513-80221
	Tapered, fixed		23-26/42/HP	G4513-80223
100	Tapered, fixed		23-26s/42/HP	G4513-80222

\*Included in 7693A shipments



Needles, replacement, G4513-80236



Blue line autosampler syringe, G4513-60560

## Advanced Sample Enhancement Autosampler Syringes with PTFE-Tipped Plungers

Used with the 7693A optional Enhanced Sample Handling Syringe Carriage, these syringes can eliminate analyst-to-analyst variability and reduce re-work in sample preparation, such as dilution and internal standard addition.

### Advanced Sample Enhancement Autosampler Syringes with PTFE-Tipped Plungers

Volume (µL)	Description	Needle Gauge/ Length (mm)/Tip	Part No.
250	Fixed, advanced sample enhancement	23/42/HP	G4513-60560
500	Fixed, advanced sample enhancement	23/42/HP	G4513-60561

## Gold Standard Autosampler Syringes

Use one needle and get the benefits of two. The upper portion of the tapered needle offers the strength of a 23-gauge needle, while the lower portion at 26s-gauge allows use with split/splitless or on-column injections with 0.53 mm id columns. All standard plungers are stainless steel.

### Tapered Needle, 23-26s Gauge Autosampler Syringes

Volume ( $\mu$ L)	Description	Unit	Needle Gauge/ Length (mm)/ Tip		Part No.
5	Tapered, fixed		23-26s/42/HP		5181-1273
	Tapered, fixed	6/pk	23-26s/42/HP		5181-8810
	Tapered, removable		23-26s/42/HP		5182-0835
	Replacement needle for 5 $\mu$ L syringe	3/pk			5182-0832
10	Tapered, fixed		23-26s/42/HP		5181-1267
	Tapered, fixed	6/pk	23-26s/42/HP		5181-3360
	Tapered, removable		23-26s/42/HP		5181-3321
	Replacement needle for 10 $\mu$ L syringe	3/pk			5181-3319
	Tapered, fixed, PTFE-tipped plunger		23-26s/42/HP		5181-3354
	Tapered, fixed, PTFE-tipped plunger	6/pk	23-26s/42/HP		5181-3361
	Replacement plunger with PTFE tip for fixed needle 10 $\mu$ L syringe				5181-3365
	Tapered, removable		23-26s/42/HP		5181-3356
	Replacement plunger with PTFE tip for removable needle 10 $\mu$ L syringe				5181-3358
50	Tapered, fixed, PTFE-tipped plunger		23-26s/42/HP		5183-0314
100	Tapered, fixed, PTFE-tipped plunger		23-26s/42/HP		5183-2042





Autosampler Syringes

**Straight Needle, 23 and 26s Gauge Autosampler Syringes**

Volume (µL)	Description	Unit	Needle Gauge/Length (mm)/Tip	Part No.
1	Cone-tipped		23/42/HP	5188-5246
1	Replacement needle/plunger for 1.0 µL syringe		23/42/HP	5188-5370
0.5	Replacement needle/plunger for 0.5 µL syringe	1/ea	23-26/42/HP	5190-3193
2	Cone-tipped		23/42/HP	5188-5247
	Replacement needle/plunger for 2.0 µL syringe		23/42/HP	5188-5371
5	Straight, fixed		26s/42/HP	9301-0891
	Straight, fixed	6/pk	26s/42/HP	5183-4728
	Straight, fixed		23/42/HP	9301-0892
	Straight, fixed	6/pk	23/42/HP	5182-0875
	Straight, removable		23/42/HP	5182-0834
	Replacement needle for 5 µL syringe	3/pk		5182-0830
10	Straight, fixed		26s/42/HP	9301-0714
	Straight, fixed	6/pk	26s/42/HP	5183-4729
	Straight, fixed		23/42/HP	9301-0713
	Straight, fixed	6/pk	23/42/HP	9301-0725
	Straight, fixed, PTFE-tipped plunger		23/42/HP	5181-8809
	Straight, fixed, PTFE-tipped plunger	6/pk	23/42/HP	5183-4730
	Replacement plunger for 10 µL fixed needle syringe			5181-8808
	Straight, removable		23/42/HP	5181-8806
	Straight, removable, PTFE-tipped plunger		23/42/HP	5181-8813
	Replacement needle for 10 µL syringe	3/pk		5181-8811
	Replacement plunger with PTFE tip for removable needle 10 µL syringe			5181-3358
	25	Straight, fixed, PTFE-tipped plunger		23/42/HP
50	Straight, fixed, PTFE-tipped plunger		23/42/HP	5183-0318
100	Straight, fixed, PTFE-tipped plunger		23/42/HP	5183-2058



## 7673/7683 On-Column Autosampler Syringes

Agilent 7673/7683 on-column syringes with needle diameter for columns ranging from 0.25 mm to 0.53 mm are specifically designed for the 7673/7683 Autosampler.

### 7673/7683 On-Column Autosampler Syringes

Volume (μL)	Description	Unit	Part No.
5	Removable needle, syringe only		5182-0836
	Stainless steel needle for 0.53 mm column	3/pk	5182-0832
	Stainless steel needle for 0.32 mm column	3/pk	5182-0831
	Stainless steel needle for 0.25 mm column	3/pk	5182-0833
	Plunger button	10/pk	5181-8866



## HP 7670/71/72 Autosampler Syringes

This syringe has a long needle and regular plunger button for compatibility with HP 7670/71/72 autosamplers. Available with a fixed or removable needle.

### HP 7670/71/72 Autosampler Syringes

Volume (μL)	Description	Needle	Part No.
1	Straight, removable	23/56/2	5182-9622
10	Straight, fixed	23/50/HP	5182-9734
	Straight, removable	23/50/HP	5182-9626
	Straight, fixed, PTFE-tipped plunger	23/50/HP	5182-9799



Autosampler syringe, 10 μL, straight, RN, 5182-9626



### TIPS & TOOLS

Agilent color-coded manual syringes allow you to determine syringe volume with one quick glance, so you can more efficiently perform manual dilution, extraction, and sample prep. For your manual syringe selection, see pages 69-76 of the General Chromatography Supplies Catalog, publication number 5991-1056EN.



# Agilent CrossLab

## Supplies for major brand GC Systems

Agilent CrossLab is a growing portfolio of supplies critical to instrument performance and productivity. CrossLab GC supplies are designed and manufactured to perform seamlessly with a variety of other major brands of GCs in your lab.

We currently support:

- Bruker/Varian
- CTC
- PerkinElmer
- Shimadzu
- Thermo Scientific

Our growing GC Supplies portfolio includes the following products, featuring easy-to-use packaging for improved productivity:

- Premium non-stick inlet septa
- Ultra Inert inlet liners
- Liner O-rings
- Column ferrules and nuts
- Autosampler syringes
- Vials and closures  
(See the complete CrossLab Vials and Closures section of our General Chromatography catalog, publication number 5991-1056EN)



## Agilent CrossLab is more than supplies:

- Over 40 years of chromatography expertise and ongoing innovation
- Technical and application support
- Optimal performance for both routine and challenging applications
- Dependable worldwide product availability and delivery
- Convenience of consolidated purchasing
- 90-day risk-free money-back guarantee

Agilent CrossLab works with BRUKER/VARIAN | CTC | PERKINELMER | SHIMADZU | THERMO | AND MORE

## Agilent CrossLab Inlet Liners

Liners are the centerpiece of the inlet system where sample is vaporized and mixed with the carrier gas. CrossLab GC inlet liners have the perfect mix of liner configurations and chemistries to solve your application challenges.

Choose from split, splitless, PTV, and other inlet liner designs in either the new, innovative Ultra Inert deactivation or Agilent's popular proprietary deactivation, now referred to as Agilent Original deactivation. With part number and lot number silk screened on CrossLab liners, identification and re-ordering have never been easier.



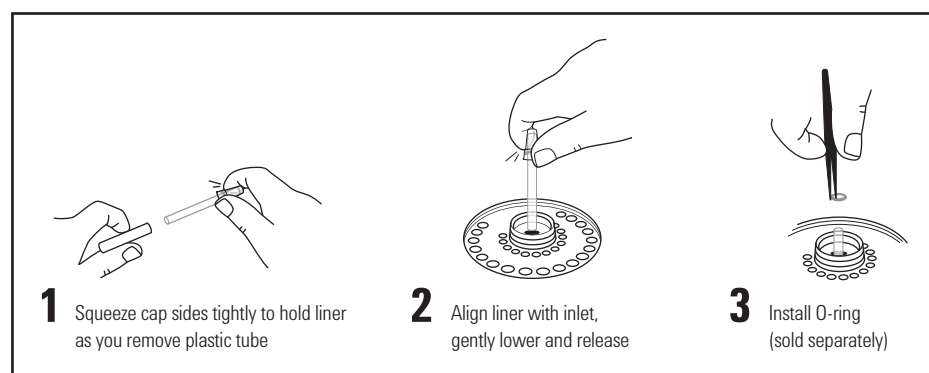
## Agilent CrossLab Liners with Ultra Inert Deactivation

Developed for high sensitivity analysis, Agilent's Ultra Inert deactivation provides extreme surface inertness – even for liners containing glass wool. Ultra Inert chemistry was developed using a suite of tests specifically designed to stress then evaluate liner activity, resulting in liners featuring:

- **Reproducibility** – highest level and consistent inertness for active compounds such as acids and bases
- **Robustness** – tested with a sequence of 100 injections of Endrin/DDT with <20% degradation, allowing use of glass wool even with highly active compounds at trace (0.5 ng on-column) levels
- **Reliability** – lot-tested for inertness to ensure consistent and efficient deactivation using both acidic and basic probes at trace level (2 ng) on-column, with low to no bleed or background contamination

Ultra Inert liners are delivered in Agilent's exclusive Touchless packaging. Touchless packaging aids in easy installation of the new, clean, preconditioned liner – without risk of contamination from touching.

To view a demonstration of the Touchless Packaging for CrossLab Ultra Inert Liners please visit [www.agilent.com/chem/CLTouchless](http://www.agilent.com/chem/CLTouchless)



Agilent CrossLab Ultra Inert Touchless liner packaging includes visual installation guide.

### Consider the following to determine how often to change your liners:

- Previous use pattern
- Sample cleanliness
- Chromatographic abnormalities, such as
  - ✓ Peak shape changes
  - ✓ Peak discrimination
  - ✓ Poor reproducibility
  - ✓ Sample pyrolysis
  - ✓ Active analyte response loss or decomposition

## Get a robust, reproducible, and reliable inert flow path with Agilent CrossLab Ultra Inert Inlet Liners – even when containing glass wool

### Forensic basic drugs test conditions

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

**Sample:** 5 mg/L Checkout mixture for GC/MS forensic/toxicology analyzer (p/n 5190-0471)

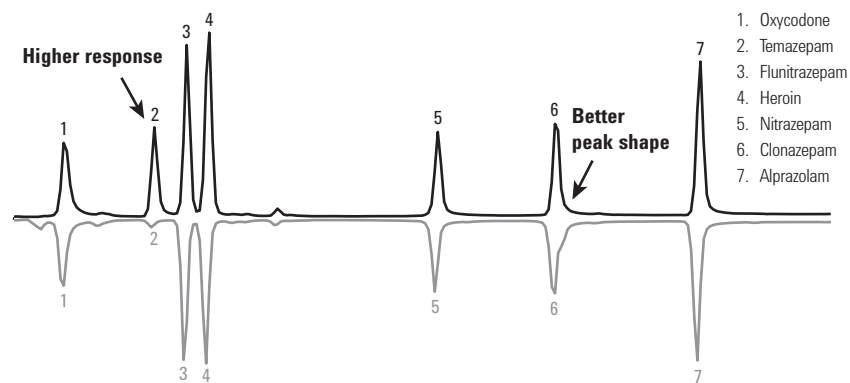
**Injection:** 1 µL splitless at 280 °C (hold 0.75 min)

**Oven:** 100 °C (0.5 min) to 325 °C at 20 °C/min and hold 2.5 min

**Carrier:** He, 18.74 psi (adj to RT lock), constant pressure

**Detector:** MSD; Source temp at 300 °C, Quad temp at 150 °C, Transfer line at 300 °C; Acquisition mode, SIM/scan

#### Agilent CrossLab Ultra Inert single taper liner with wool



#### Restek Siltek deactivated gooseneck liner with deactivated wool (cat. no. 22406.213.5)

Agilent CrossLab Ultra Inert deactivated liners with wool contribute to higher response and better peak shape for very active forensic basic drug compounds than similar Restek Siltek liners.

## Agilent CrossLab Liners with Agilent Original Deactivation

Developed to complement fused silica capillary column technology, Agilent's proprietary deactivation, now referred to as Agilent Original deactivation, has been successfully used for years. Proven to deliver a long-lasting surface deactivation, this proprietary chemistry and manufacturing process was previously available for Agilent gas chromatographs only, but is now available for other GC systems. Agilent Original deactivation is recommended for everyday analysis.

## Agilent CrossLab Liner O-rings

- Liners are sealed in the inlet with fluoroelastomer or graphite O-rings
- Graphite O-rings are used when inlet temperatures exceed 350 °C
- Fluoroelastomer O-rings are easier to replace than graphite O-rings, which deform and flake apart more easily

Ready for chromatographic use, CrossLab fluoroelastomer O-rings feature:

- Proprietary two-step cleaning and conditioning process eliminates out-gassing of contaminants, which is especially important for trace, ECD, and MSD analyses
- Plasma-treatment for a non-stick, contaminant-free surface that won't stick to the inlet metal surface
- Novel translucent dial package that conveniently delivers one clean O-ring at a time and makes it easy to know when to reorder



## Agilent CrossLab Column Ferrules

A variety of column ferrules are available to meet your application requirements, including 100% graphite, 100% polyimide, and polyimide/graphite ferrules.

Using the wrong ferrule or a worn-out ferrule to seal your column connection can result in inconsistent and unreliable chromatography. An improper ferrule can cause leaks, which allow air and other contaminants to enter the instrument through the column seal, causing major interference with column and detector performance.

The ideal ferrule provides a leak-free seal, accommodates various column outer diameters, seals with minimum torque, withstands temperature cycling, and does not stick to the column or fittings.

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

To minimize problems, follow these general techniques for ferrule installation:

- Don't overtighten – finger tighten the column nut, then use wrench to tighten
- Maintain cleanliness
- Bake out ferrules prior to use (polyimide and polyimide/graphite only)
- Avoid contamination, such as fingerprint oils
- Inspect used ferrules with magnifier for cracks, chips, or other damage before reusing them
- Change ferrules when new columns or injector/detector parts are installed

### TIPS & TOOLS

Look for the following signals that indicate ferrule damage:

- Background noise from oxygen diffusing into the system
- Column bleed catalyzed by oxygen
- Sample degradation
- Sample loss
- Increase in detector signal/noise
- Poor retention time reproducibility



Ferrule Selection Recommendations

Ferrule Type	Upper Temp. Limit	Usages	Advantages	Limitations
Graphite (100%)	450 °C	<ul style="list-style-type: none"> <li>• General purpose for capillary columns</li> <li>• Suitable for FID and NPD</li> <li>• Recommended for high temperature and cool on-column applications</li> </ul>	<ul style="list-style-type: none"> <li>• Easy-to-use stable seal</li> <li>• Higher temperature limit</li> <li>• Can be removed easily</li> </ul>	<ul style="list-style-type: none"> <li>• Not for MS or oxygen-sensitive detectors</li> <li>• Soft, easily deformed or destroyed</li> <li>• Possible system contamination</li> </ul>
Polyimide/graphite (85%/15% or 60%/40%)	350 °C	<ul style="list-style-type: none"> <li>• General purpose for capillary columns</li> <li>• Recommended for MS and oxygen-sensitive detectors</li> <li>• Most reliable leak-free connection</li> </ul>	<ul style="list-style-type: none"> <li>• Mechanically robust</li> <li>• Long lifetime</li> </ul>	<ul style="list-style-type: none"> <li>• Not reusable</li> <li>• Flows at elevated temperature</li> <li>• Must re-tighten frequently</li> </ul>
Polyimide (100%)	280 °C	<ul style="list-style-type: none"> <li>• Isothermal operation</li> <li>• Can be reused or removed easily</li> <li>• Excellent sealing material when making metal or glass connections</li> </ul>	<ul style="list-style-type: none"> <li>• Mechanically robust</li> <li>• Long lifetime</li> <li>• Can be reused or removed easily</li> </ul>	<ul style="list-style-type: none"> <li>• Leaks after temperature cycle</li> <li>• Flows at elevated temperature</li> <li>• Must re-tighten frequently</li> </ul>



TIPS & TOOLS

100% Polyimide ferrules should only be used for isothermal applications.



## Agilent CrossLab Autosampler Syringes

With a broad selection of syringes for auto injection, CrossLab autosampler syringes provide what you need for accurate and effective sampling. CrossLab syringes meet all fit, form, and function criteria for specific autosampler models. Agilent delivers more value in every autosampler syringe:

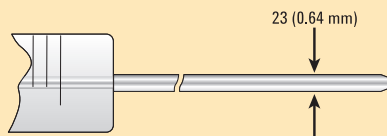
- Lot number printed directly on the barrel with a corresponding Certificate of Conformance
- Illuminating backing strip, for effortless viewing of the volume scale
- Environmentally friendly packaging and improved design that reduces waste
- Individually packaged for contaminant-free use right out of the box

### Typical Needle Gauge Dimensions

Gauge	OD		ID	
	mm	in	mm	in
23	0.64	0.0248	0.11	0.0043
25	0.50	0.0197	0.20	0.0079
26	0.47	0.0184	0.11	0.0043

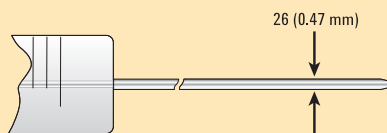


## Needle Gauge



### Single Gauge 23 (0.64 mm)

Packed column injector ports  
Split/splitless injector ports



### Single Gauge 26 (0.47 mm)

Packed column injector ports  
Split/splitless injector ports

## Needle Termination

Needle terminations are available in fixed or removable, with various tip styles.

### Fixed (cemented)

- Economical, reproducible injections for autosamplers
- Preferred for applications requiring trace level samples
- Recommended for use where probability of needle bending is minimal
- Can be heated up to 70 °C

### Removable needle

- Versatile option for injections
- Needle can be replaced if damaged or clogged
- Allows needle to be changed for different applications
- Can be heated up to 120 °C





## Agilent CrossLab Inlet Septa

Inlet septa are a key component of sample introduction. Septa maintain the leak-free seal and exclude air from the inlet. They come in many different sizes and are made from different types of materials specific to inlet type and analysis needs.

Replace septa regularly to avoid:

- Leaks
- Decomposition
- Sample loss
- Reduced column or split vent flow
- Ghost peaks
- Column degradation

Septa are available for a variety of different applications and have different upper temperature limits. Lower temperature septa are usually softer, seal better, and can withstand more punctures (injections) than their high-temperature counterparts. If septa are used above their recommended temperatures, they can leak or decompose, causing sample loss, lower column flow, decreased column life, and ghosting. To minimize problems:

- Use within the recommended temperature range
- Change regularly
- Use septum purge when available
- Use autoinjectors
- Regularly inspect needle tips for wear

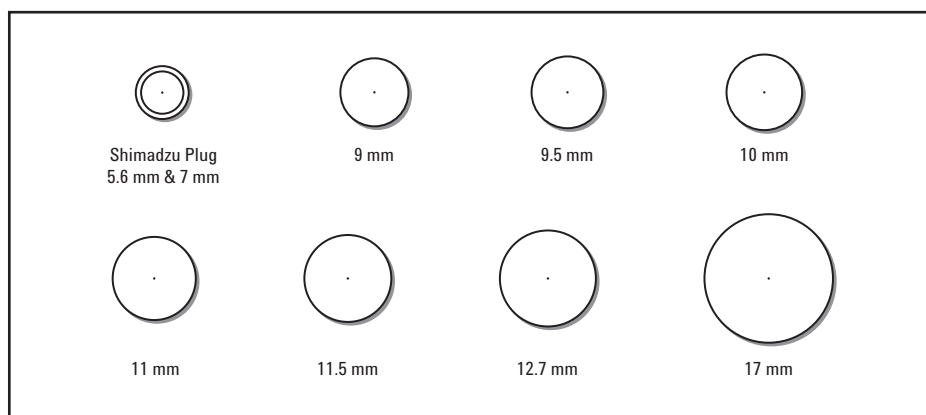


**Agilent CrossLab Inlet Septa Selection Guide**

<b>GC Manufacturer</b>	<b>Instrument Model</b>	<b>Diameter (mm)</b>	<b>Diameter (in)</b>
Bruker, Varian*	1177 Split/Splitless Injector	9	
	1078/1079 Programmable Temperature Vaporizing Injector	11.5	
	1093 Cold On-Column Injector	11	7/16
	1075/1077 Split/Splitless Injector	11	7/16
	1061 Packed/0.53 mm Capillary Column Flash Vaporization Injector	9.5	3/8
	1041 Packed/Wide Bore On-Column Injector	9.5	3/8
PerkinElmer	Clarus System	11	7/16
	AutoSystem	11	7/16
	AutoSystem XL	11	7/16
	8000 Series	11	7/16
	Sigma Series	11	7/16
Thermo Scientific Trace GC Ultra and Focus GC	Split/Splitless Injector	17	
	Large Volume Splitless Injector	9	
	Programmable Temperature Vaporizing Injector	12.7	1/2
	Purged Packed Column Injector	11	
	Packed Column Injector	11	
Thermo Scientific	Trace 2000 Series	9.5	
Finnigan	9001 GC	9.5	
Shimadzu	All Models	Shimadzu Plug	

\*Formerly Varian systems, now Bruker products

**Septa Diameters**



## Premium Non-Stick Septa

Agilent CrossLab premium non-stick inlet septa are designed and manufactured to provide a reliable noncontaminating seal. Our tri-fold blister pack ensures that each septum remains clean and ready to use.

- Proprietary plasma treatment prevents sticking and unnecessary inlet cleaning
- Innovative blister packaging keeps each septum clean and ready for use
- Center point guides the needle for easy penetration, less coring, and longer life
- Precision molding assures accurate fit in the inlet
- Each batch is tested for bleed
- Premium formulations selected for sealing and chromatographic cleanliness
- No need to bake septa before using



### Summary of Premium Inlet Septum Characteristics

Septum Type	Bleed	Lifetime	Temperature Limits
Non-Stick BTO (Bleed and Temperature Optimized)	✓✓✓	✓	to 400 °C injection port temp
Non-Stick Advanced Green	✓✓	✓✓	to 350 °C
Non-Stick Long-Life	✓	✓✓✓	to 350 °C

✓✓✓ = best    ✓✓ = very good    ✓ = good



## Agilent CrossLab Non-Stick Bleed Temperature Optimized (BTO) Inlet Septa

- Extended temperature range, lowest bleed
- Maximum injection port temperature 400 °C
- Plasma treatment eliminates sticking in the injection port
- Pre-conditioned; ready to use
- Blister packaging maintains cleanliness and convenience
- Ideal for use with low-bleed, "Mass Spec" capillary columns



BTO septa, 8010-0223, 8010-0224

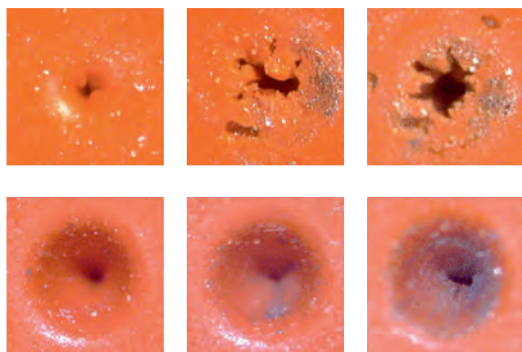
### Non-Stick Bleed and Temperature Optimized (BTO) Septa

Description	Agilent CrossLab Part No. 50/pk	Agilent CrossLab Part No. 100/pk
9 mm, CenterGuide	8010-0217	8010-0218
9.5 mm	8010-0219	8010-0220
10 mm	8010-0221	8010-0222
11 mm, CenterGuide	8010-0223	8010-0224
11.5 mm, CenterGuide	8010-0225	8010-0226
Shimadzu plug	8010-0231	8010-0232

Description	24/pk	48/pk
12.7 mm, CenterGuide	8010-0227	8010-0228
17 mm, CenterGuide	8010-0229	8010-0230

### Comparison of septum purity: TIC profile of isooctane extractions



#### Competitor's High-Temperature Septa without CenterGuide

Major coring before 100 autoinjections

#### Agilent CrossLab BTO Septa with CenterGuide

Very little coring, even after 700 autoinjections

## Agilent CrossLab Non-Stick Advanced Green Inlet Septa

- True long-life, high-temperature green septa
- More injections per septum
- Plasma treatment eliminates sticking in the injection port
- Maximum injection port temperature 350 °C
- High-performance alternative to competitors' "green" septa
- Blister packaging for cleanliness and convenience



Advanced green septa, 8010-0207, 8010-0208

### Non-Stick Advanced Green Septa

Description	Agilent CrossLab Part No. 50/pk	Agilent CrossLab Part No. 100/pk
9 mm, CenterGuide	8010-0201	8010-0202
9.5 mm	8010-0203	8010-0204
10 mm	8010-0205	8010-0206
11 mm, CenterGuide	8010-0207	8010-0208
11.5 mm, CenterGuide	8010-0209	8010-0210
Shimadzu plug	8010-0215	8010-0216
Description	24/pk	48/pk
12.7 mm, CenterGuide	8010-0211	8010-0212
17 mm, CenterGuide	8010-0213	8010-0214

## Agilent CrossLab Non-Stick Long-Life Inlet Septa

- Preferred septa for autosamplers
- Pre-pierced for extended life and reduced coring
- Ideal for overnight runs
- Up to 400 injections per septum
- Plasma treatment eliminates sticking
- Maximum injection port temperature 350 °C
- Soft, 45 durometer, easy on autosampler needles
- Blister packaging for cleanliness and convenience



Long-life septa, 8010-0239, 8010-0240

### Non-Stick Long-Life Septa

Description	Agilent CrossLab Part No. 50/pk	Agilent CrossLab Part No. 100/pk
9 mm, CenterGuide	8010-0233	8010-0234
11 mm, CenterGuide	8010-0239	8010-0240
11.5 mm, CenterGuide	8010-0241	8010-0242
Description	24/pk	48/pk
12.7 mm, CenterGuide	8010-0243	8010-0244
17 mm, CenterGuide	8010-0245	8010-0246



## Agilent CrossLab Gray General Purpose Inlet Septa

Agilent CrossLab general purpose septa are made from an enhanced injection-molded silicone rubber and are good for routine use. The septa material, gray in color, is specified to withstand over 200 automatic injections at an injection port temperature of 350 °C.

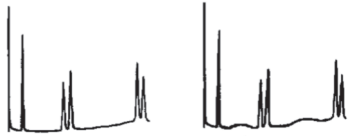


### General Purpose Septa

Description	Agilent CrossLab Part No. 50/pk	Agilent CrossLab Part No. 100/pk
9 mm	8010-0249	8010-0250
9.5 mm	8010-0251	8010-0252
10 mm	8010-0253	8010-0254
11 mm	8010-0255	8010-0256
11.5 mm	8010-0257	8010-0258
12.7 mm	8010-0259	8010-0260
17 mm	8010-0261	8010-0262
Shimadzu plug	8010-0263	8010-0264





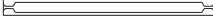









CrossLab general purpose inlet septa, 8010-0257

### Septa Troubleshooting

Symptom	Possible Causes	Remedy
<b>Extra Peaks/Humps</b> 	Septum bleed	Turn off injector heater. If extra peaks disappear, use septum specified for higher temperature or analyze at lower inlet temperature.
<b>Baseline Change After Large Peak</b> 	Large leak at septum during injection and for a short time thereafter (common with large diameter needles)	Replace septum and use smaller diameter needles.
<b>Retention Times Prolonged</b> 	Carrier gas leaks at septum or column connection	Check for leaks. Replace septum or tighten connections if necessary.

# Agilent CrossLab Supplies for Bruker, Varian\* GC Systems

## Liners for 1177 Split/Splitless Injector Ports

Description	ID (mm)	OD (mm)	Length (mm)	Volume (µL)	Unit	Similar to OEM Part No.	Agilent Ultra Inert Deactivation	Similar to OEM Part No.	Agilent Original Deactivation	
<b>Split/Splitless Liners</b>										
 Single taper	4.0	6.3	78.5	1000	5/pk	RT207992145 SG092017	8004-0151	SG092017	8004-0101	
 Single taper, with wool	4.0	6.3	78.5	1000	5/pk	SG092019	8004-0152	SG092019	8004-0102	
 Double taper	4.0	6.3	78.5	1000	5/pk	SG092018	8004-0155	SG092018	8004-0105	
 Gooseneck, with wool	4.0	6.5	78.5	1000	5/pk	392611936	8004-0170	392611936	8004-0114	
 Recessed gooseneck, with wool	4.0	6.3	78.5	1000	5/pk	SG092010	8004-0153	SG092010	8004-0103	
 Gooseneck	2.0	6.5	78.5	250	5/pk	392611926	8004-0178	392611926	8004-0119	
<b>Splitless Liners</b>										
 Straight, with wool	4.0	6.5	78.5	1000	5/pk	392611937	8004-0173	392611937	8004-0116	
 Gooseneck	4.0	6.5	78.5	1000	5/pk	392611927	8004-0165	392611927	8004-0113	
<b>Split Liners</b>										
 Straight-through	4.0	6.3	78.5	1000	5/pk	RT207732145 SG092007	8004-0156	SG092007	8004-0106	
 Straight, with wool	4.0	6.3	78.5	1000	5/pk	SG092001 392611934	8004-0154	SG092001 392611934	8004-0104	
 With frit, gooseneck	4.0	6.3	78.5	1000	5/pk	RT210462145	8004-0158			
<b>Direct Liners</b>										
 Straight-through	1.2	6.3	78.5	90	5/pk	SG092016	8004-0157	SG092016	8004-0107	

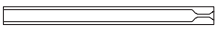






**\*Formerly Varian systems, now Bruker products**

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.





## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems

### Liners for 1078/1079 Injector Ports

Description	ID (mm)	OD (mm)	Length (mm)	Volume (µL)	Unit	Similar to OEM Part No.	Agilent Ultra Inert Deactivation	Similar to OEM Part No.	Agilent Original Deactivation	
<b>Split/Splitless Liners</b>										
 Single taper	3.4	5.0	54	500	5/pk	RT209012145 SG092038	8004-0160	SG092038	8004-0108	
 Gooseneck, with wool	2.0	5.0	54	250	5/pk			392611953	8004-0118	
<b>Splitless Liners</b>										
 Single taper	2.0	5.0	54	170	5/pk	RT207122145 SG092039	8004-0161	SG092039	8004-0109	
<b>Split Liners</b>										
 Gooseneck	3.4	5.0	54	500	5/pk	392611945	8004-0164	392611945	8004-0112	
 With frit, gooseneck	3.4	5.0	54	500	5/pk	RT217092145	8004-0159			
 With frit, gooseneck	3.4	5.0	54	500	5/pk	392611946	8004-0171			
<b>Other Liners</b>										
 SPME, straight	0.8	5.0	54	30	5/pk	392611948	8004-0176			

### Liners for 1093/1094 Injector Ports

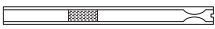
Description	ID (mm)	OD (mm)	Length (mm)	Volume (µL)	Unit	Similar to OEM Part No.	Agilent Ultra Inert Deactivation	Similar to OEM Part No.	Agilent Original Deactivation	
<b>Direct Liners</b>										
 SPL for 0.25/0.32 mm id columns	0.5	4.6	54	10	5/pk	190010906	8004-0167			
 SPL with 0.5 mm restriction for 0.53 mm id on-column	0.8	4.6	54	30	5/pk	SG092034 190010907	8004-0162	SG092034 190010907	8004-0110	

### \*Formerly Varian systems, now Bruker products


The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems

## Liners for 1075/1077 Injector Ports

Description	ID (mm)	OD (mm)	Length (mm)	Volume (µL)	Unit	Similar to OEM Part No.	Agilent Ultra Inert Deactivation	Similar to OEM Part No.	Agilent Original Deactivation
 With wool	4.0	6.3	72	1000	5/pk	SG092021 190010901	8004-0163	SG092021 190010901	8004-0111

## Liners for 1060/1061 Injector Ports

Description	ID (mm)	OD (mm)	Length (mm)	Volume (µL)	Unit	Similar to OEM Part No.	Agilent Ultra Inert Deactivation	Similar to OEM Part No.	Agilent Original Deactivation
 Double gooseneck	0.9	6.3	72	1000	5/pk	392611943	8004-0168		

## Liner O-rings

Description	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
Non-stick fluoroelastomer O-ring, 1177 split/splitless, 6.3/6.5 mm od	10/pk	8850103100	8004-0201
Graphite O-ring, 1177 split/splitless, 6.5 mm od	10/pk	392611930	8004-0202
Graphite O-ring, 1177 split/splitless, 6.3 mm od	10/pk	392611935	8004-0203
Graphite liner seal, 1078/1079 injector, 5 mm id	10/pk	392534201	8004-0204

## \*Formerly Varian systems, now Bruker products

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.



Graphite liner O-ring, 8004-0202

## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems

## Column Ferrules

## Capillary Column Ferrules

Injector	Fitting Size (in)	Ferrule ID (mm)	Column ID (mm)	Hole	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
<b>60% Polyimide/40% Graphite Capillary Column Ferrules</b>							
1177, 1079	1/16	0.3	0.18 or smaller	1	10/pk	CR213103	8004-0211
	1/16	0.425	0.25	2	10/pk	CR213124	8004-0213
	1/16	0.425	0.25	1	10/pk	CR213104	8004-0212
	1/16	0.5	0.32	1	10/pk	CR213105	8004-0214
	1/16	0.5	0.32	2	10/pk	CR213125	8004-0215
1177, 1079, 1061, 1041	1/16	0.8	0.53	1	10/pk	CR213108	8004-0216
<b>Polyimide Capillary Column Ferrules</b>							
1177, 1079	1/16	0.3	0.18	1	10/pk	CR212103	8010-0306
	1/16	0.4	0.25	1	10/pk		8010-0307
	1/16	0.425	0.25	1	10/pk	CR212104	8004-0219
	1/16	0.5	0.32	1	10/pk	CR212105	8010-0308
	1/16	0.5	0.32	2	10/pk	CR212125	8004-0218*
1177, 1079, 1061, 1041	1/16	0.8	0.53	1	10/pk	CR212108	8010-0309
<b>Graphite Capillary Column Ferrules</b>							
1177, 1079	1/16	0.4	0.25	1	10/pk	CR211104	8010-0301
	1/16	0.5	0.32	1	10/pk	CR211105	8010-0302
	1/16	0.5	0.32	2	10/pk	CR211125	8010-0303
1177, 1079, 1061, 1041	1/16	0.8	0.53	1	10/pk	CR211108	8010-0304

\*1177 Injector only

**\*Formerly Varian systems, now Bruker products**

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems

### Packed Column Ferrules

Injector	Fitting Size (in)	Ferrule ID (in)	Column OD (in)	Hole	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
<b>60% Polyimide/40% graphite Packed Column Ferrules</b>							
1093, 1061, 1041	1/4	1/4	1/4	1	10/pk	CR213400	8004-0217*
<b>Graphite Packed Column Ferrules</b>							
1093, 1061, 1041	1/4	1/4	1/4	1	10/pk	CR211400	8010-0305*

\*Straight body

### Column Nuts

Description	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
Column nut, brass, 1177, 1079, 1061, or 1041 injector	2/pk	394955100	8004-0311
Column nut, stainless steel, 1093 injector	2/pk	CP743117	8004-0312

### Autosampler Syringes for Bruker/Varian GC Systems

Model	Volume (µL)	Description	Needle Gauge/Length (mm)/Tip	Similar to OEM Syringe Part No.	Agilent CrossLab Syringe Part No.	Agilent CrossLab Replacement Needle Part No.	Agilent CrossLab Replacement Plunger Part No.
Varian CP8400, CP8410, CP9010, CP9050	10	Fixed needle	26/50/bevel tip		8004-0001		
		Removable needle	26/50/cone tip	SG002982	8004-0003	8004-0004, 2/pk	
Varian 8035, 8100, 8200		Fixed needle, gas tight	26/53/side hole tip		8004-0002		8004-0007
		Removable needle, gas tight	25/53/side hole tip		8004-0005	8004-0006	8004-0007

#### \*Formerly Varian systems, now Bruker products

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems

### Inlet Septa

#### Non-Stick Bleed and Temperature Optimized (BTO) Septa

Description	Agilent CrossLab Part No. 50/pk	Similar to OEM Part No.	Agilent CrossLab Part No. 100/pk
9 mm, CenterGuide	8010-0217	CR298713	8010-0218
9.5 mm	8010-0219	CR298705	8010-0220
10 mm	8010-0221	CR298745	8010-0222
11 mm, CenterGuide	8010-0223	CR298717	8010-0224
11.5 mm, CenterGuide	8010-0225	CR298777	8010-0226



Non-stick bleed and temperature optimized septa, 10 mm, 50/pk, 8010-0221

#### Non-Stick Advanced Green Septa

Description	Agilent CrossLab Part No. 50/pk	Similar to OEM Part No.	Agilent CrossLab Part No. 100/pk
9 mm, CenterGuide	8010-0201	CR246713	8010-0202
9.5 mm	8010-0203	CR246124	8010-0204
10 mm	8010-0205		8010-0206
11 mm, CenterGuide	8010-0207	CR246225	8010-0208
11.5 mm, CenterGuide	8010-0209	CR246725	8010-0210

#### \*Formerly Varian systems, now Bruker products

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems



Long-life septa, 8010-0239, 8010-0240

## Non-Stick Long-Life Septa

Description	Agilent CrossLab Part No. 50/pk	Similar to OEM Part No.	Agilent CrossLab Part No. 100/pk
9 mm, CenterGuide	8010-0233	CR239778	8010-0234
11 mm, CenterGuide	8010-0239	CR239287	8010-0240
11.5 mm, CenterGuide	8010-0241	CR239287	8010-0242

## General Purpose Septa

Description	Agilent CrossLab Part No. 50/pk	Agilent CrossLab Part No. 100/pk
<b>General Purpose Septa</b>		
9 mm	8010-0249	8010-0250
9.5 mm	8010-0251	8010-0252
10 mm	8010-0253	8010-0254
11 mm	8010-0255	8010-0256
11.5 mm	8010-0257	8010-0258

## \*Formerly Varian systems, now Bruker products

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.



## TIPS &amp; TOOLS

For a comprehensive vial compatibility chart, identification guide, septum recommendations, visit [www.agilent.com/chem/vialsposter](http://www.agilent.com/chem/vialsposter)

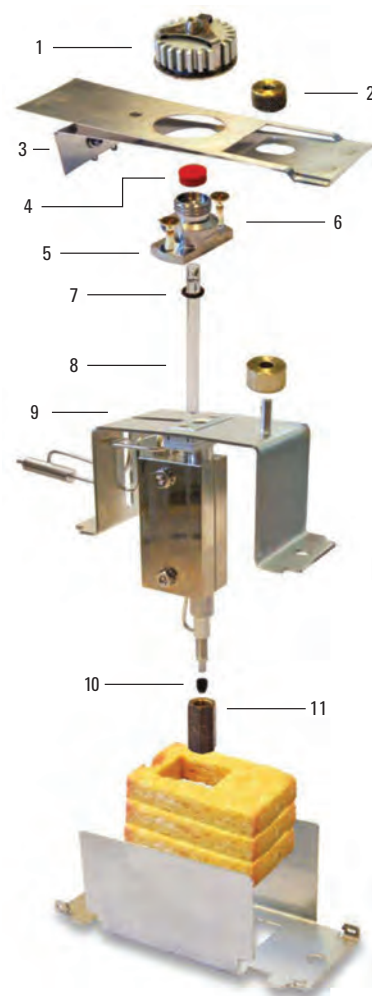
## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems

## Injector Replacement Parts and Supplies

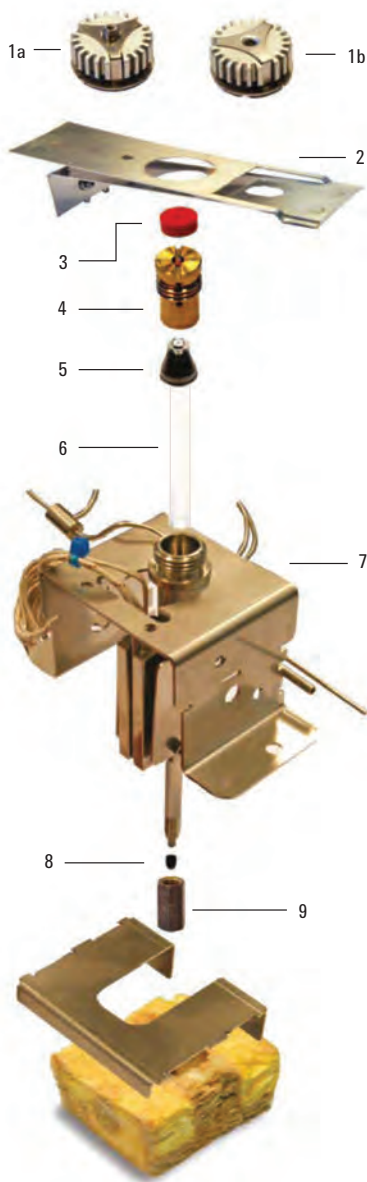
## 1177 Split/Splitless Injector

Item	Description	Agilent CrossLab and Agilent Part No.
1	Injector nut	392597501
	Injector nut wrench	390842300
2	Knob	392597101
3	Automatic start switch	390820601
4	Septum, 9 mm	
	BTO	8010-0217
	Long-Life	8010-0233
	Advanced Green	8010-0201
	Septum pick	7200008400
5	Septum purge head	
	EFC21 (stainless steel)	392597301
	EFC21 (UltiMetal)	392597303
	EFC25 or Manual Pneumatics	392597302
6	Purge head screw	391866308
7	Graphite liner O-ring, splitless, 6.5 mm	8004-0202
	Non-stick fluoroelastomer liner O-ring, 6.3 mm	8004-0201
8	Glass liner	8004-0165
9	Injector body	
	Stainless steel	392599401
	UltiMetal	392599411
	Manual	392599501
10	For replacement ferrules, see complete CrossLab column ferrules ordering information, <b>see page 209.</b>	
11	Bottom nut	8004-0311

\*Formerly Varian systems, now Bruker products



## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems



### 1079 Large Volume Injector (LVI)

Item	Description	Agilent CrossLab and Agilent Part No.
1a	Injector nut	394966601
1b	Injector nut	394966601
	Injector nut wrench	390842300
2	Automatic start switch	390820601
3	Septum, 11.5 mm	
	BTO	8010-0225
	Long-Life	8010-0241
	Advanced Green	8010-0209
	Septum pick	7200008400
4	Septum support	391867600
5	Graphite liner seal	8004-0204
6	Glass liner	8004-0164
7	Injector body, EFC type	
	Stainless steel	392544001
	UltiMetal	392544011
8	For replacement ferrules, see complete CrossLab column ferrules ordering information, <b>see page 209.</b>	
9	Bottom nut	8004-0311

**\*Formerly Varian systems, now Bruker products**

The poster is titled "CHROMATOGRAPHY VIALS THAT PROVIDE MORE OPTIONS, PRODUCTIVITY AND CONFIDENCE". It features a grid of various vial types, including Agilent Vials and Agilent Chromatography Vials. The poster includes detailed compatibility charts for different vial types and sizes, as well as a section for "Specialty Vials" and "Vial Picking by Vial Neck". At the bottom, there is a QR code and a call to action: "Let the experts in chromatography help you select the right vial for your application. Get expert advice to ensure your vial is the best fit for your needs." The Agilent logo is also present.



### TIPS & TOOLS

For a comprehensive vial compatibility chart, identification guide, septum recommendations, visit [www.agilent.com/chem/vialsposter](http://www.agilent.com/chem/vialsposter)

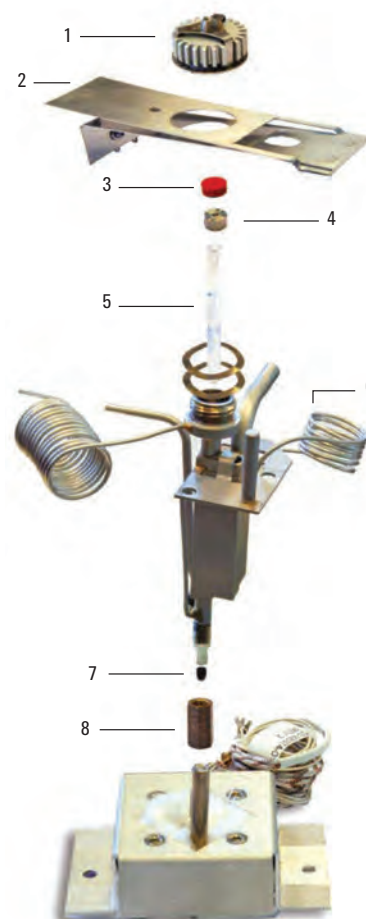


## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems

### 1093 Cool On-Column (COC) Injector

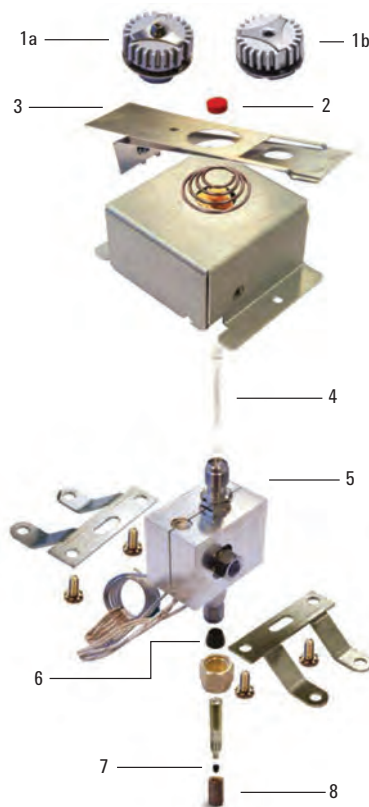
Item	Description	Agilent CrossLab and Agilent Part No.
1	Injector nut	394966601
	Injector nut wrench	390842300
2	Automatic start switch	390820601
3	Septum, 11.5 mm	
	BTO	8010-0225
	Long-Life	8010-0241
	Advanced Green	8010-0209
	Septum pick	7200008400
4	Septum support	391821100
5	Glass liner	
	Default	8004-0162
	High performance	8004-0167
6	Screw	391866306
7	Graphite/polyimide ferrule	8004-0217
	Graphite ferrule	8010-0305
8	Bottom nut	
	Brass	8004-0311
	Stainless steel	8004-0312

**\*Formerly Varian systems, now Bruker products**



## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems

### 1061 Packed/530 µm Capillary Column Injector



Item	Description	Agilent CrossLab and Agilent Part No.
1a	Injector nut	390812700
1b	Injector nut	392595501
	Injector nut wrench	390842300
2	Septum, 9.5 mm	
	BTO	8010-0219
	Advanced Green	8010-0203
	Septum pick	7200008400
3	Automatic start switch	390820601
4	Glass liner	8004-0168
5	Injector body, EFC23	392548301
6	Graphite/polyimide ferrule	8004-0217
	Graphite ferrule	8010-0305
7	For replacement ferrules, see complete CrossLab column ferrules ordering information, <b>see page 209.</b>	
8	Bottom nut	8004-0311

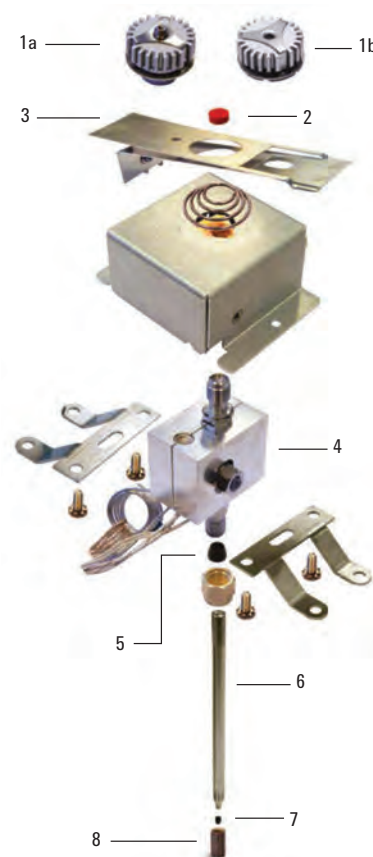
**\*Formerly Varian systems, now Bruker products**

## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems

### 1041 Packed/Wide Bore On-Column (PWOC) Injector

Item	Description	Agilent CrossLab and Agilent Part No.
1a	Injector nut	390812700
1b	Injector nut	392595501
	Injector nut wrench	390842300
2	Septum, 9.5 mm	
	BTO	8010-0219
	Advanced Green	8010-0203
	Septum pick	7200008400
3	Automatic start switch	390820601
4	Injector body, EFC type	392548201
5	Graphite/polyimide ferrule	8004-0217
	Graphite ferrule	8010-0305
6	Injector insert, stainless steel	392543101
7	For replacement ferrules, see complete CrossLab column ferrules ordering information, <b>see page 209.</b>	
8	Bottom nut	8004-0311

**\*Formerly Varian systems, now Bruker products**



## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems

**Detector Replacement Parts and Supplies****Thermal Conductivity Detector (TCD)**

<b>Description</b>	<b>Agilent Part No.</b>
Adapter TCD/DEFC capillary makeup gas	392585291
Adapter TCD/DEFC reference gas kit	392585292
Adapter TCD capillary makeup gas, MPC, 3800	392560591
TCD DEFC 14 (Non-H <sub>2</sub> ), 2 channels	392561290

**Flame Ionization Detector (FID)**

<b>Description</b>	<b>Agilent Part No.</b>
Tube collector	394958700
Lower FID insulator #17311	2100003200
FID flame tip jet, 0.010 in	200187500
FID flame tip jet with nut, 0.020 in	200193800
Crunch washer, 25/pk	1500334701

**\*Formerly Varian systems, now Bruker products**

## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems

### Pulsed Flame Photometric Detector (PFPD)

Description	Agilent Part No.
Photomultiplier tube (PFPD) #R647-08	392517100
O-Ring, silicone, 0.53 in id, PFPD	2740292400
PFPD light pipe	392515500
Sapphire window assembly	392514500
Sapphire window washer	392514300
Wrench, PFPD combustor support	392519200
Seal, combustor support	392513800
Combustor holder, 2 mm	392517800
Combustor Sulfur, 2 mm, cleaned	392517600
Holder, combustor, 3 mm, cleaned	392517901
Combustor Phosphorus, 3 mm, cleaned	392517700

### PFPD Filter Assemblies

Description	Agilent Part No.
Arsenic (As)	392515105
Manganese (Mn)	392544391
Nitrogen (N)	392511901
Sulfur and Phosphorus (S and P)	392515104
Phosphorus (P)	392515102
Sulfur (S)	392515101
Tin (Sn)	392515103

**\*Formerly Varian systems, now Bruker products**

## Agilent CrossLab Supplies for Bruker, Varian\* GC Systems

### PFPD Nitrogen Mode Maintenance

Description	Agilent Part No.
Photomultiplier tube, Nitrogen R-5070A	392512800
O-Ring, 0.987 in id	2740236100
PFPD filter assembly, Nitrogen	392511901
PFPD light pipe	392515500
Sapphire window assembly	392514500
Sapphire window washer	392514300

### Thermionic Specific Detector (TSD)

Description	Agilent Part No.
TSD bead probe, unconditioned and untested	390607400
TSD bead probe, conditioned and tested	390607401
Upper TSD insulator #17310 TSD	2100003100
O-Ring, 30/pk	2740928202
TSD collector assembly	390607900
Lower FID insulator #17311	2100003200
Crunch washer, 25/pk	1500334701
FID flame tip jet with nut, 0.020 in	200193800
Flow tube assembly	200187600

**\*Formerly Varian systems, now Bruker products**




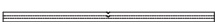

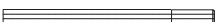
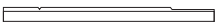




### TIPS & TOOLS

For a comprehensive vial compatibility chart, identification guide, septum recommendations, visit [www.agilent.com/chem/vialsposter](http://www.agilent.com/chem/vialsposter)

# Agilent CrossLab Parts and Supplies for PerkinElmer GC Systems

## Liners for AutoSystem, AutoSystem XL, Clarus Systems

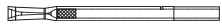

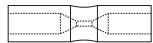

Description	ID (mm)	OD (mm)	Length (mm)	Volume (μL)	Unit	Similar to OEM Part No.	Agilent Ultra Inert Deactivation	Similar to OEM Part No.	Agilent Original Deactivation
<b>Split/Splitless Liners</b>									
 PSS straight	2.0	4.0	86.2		5/pk	N6502002	8003-0153		8003-0103
 PSS straight with bottom restriction	2.0	4.0	86.2	260	5/pk	N6121004	8003-0158		
 PSS on-column	2.0	4.0	86.2	250	5/pk	N6101539	8003-0165	N6101539	8003-0110
 PSS straight	1.0	4.0	86.2	65	5/pk	N6121006	8003-0157		
<b>Split/Large Volume Splitless Liners</b>									
 Straight with bottom restriction	4.0	6.2	92.1	1150	5/pk	N6121001	8003-0159	N6121001	8003-0105
<b>Splitless Liners</b>									
 Straight	2.0	6.2	92.1	300	5/pk	N6101372	8003-0162	N6101372	8003-0107
<b>Split Liners</b>									
 Straight-through	4.0	6.2	92.1	1150	5/pk		8003-0151		8003-0101
 Straight, wool	4.0	6.2	92.1	1100	5/pk	N6121020	8003-0160	N6121020	8003-0106
 Straight with bottom restriction	4.0	6.2	92.1	1100	5/pk	N6101052	8003-0166	N6101052	8003-0111

(Continued)

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Parts and Supplies for PerkinElmer GC Systems

### Liners for AutoSystem, AutoSystem XL, Clarus Systems

Description	ID (mm)	OD (mm)	Length (mm)	Volume (µL)	Unit	Similar to OEM Part No.	Agilent Ultra Inert Deactivation	Similar to OEM Part No.	Agilent Original Deactivation
<b>Direct Liners</b>									
 Gooseneck, drilled hole on top, wool	4.0	6.2	92.1		5/pk	N6121022	8003-0155		
<b>Other Liners</b>									
 Packed column, straight	3.0	6.2	112	800	5/pk	N6121000	8003-0163	N6121000	8003-0108
 Programmable on-column, hour glass	2.2	4.0	16		5/pk			N6101703	8003-0109*
 PTV, 0.25 mm id restriction, recessed gooseneck	1.0	2.0	88	70	5/pk		8003-0154		8003-0104

\*p/n 8003-0109 is not deactivated

### Liner O-rings

Description	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
Non-stick fluoroelastomer O-ring	10/pk	N9302783	8010-0401
Non-stick fluoroelastomer O-ring, PSS Injector	10/pk	N6101747	8003-0202
Silicone O-ring	10/pk	N6101374	8003-0203
Graphite O-ring, PSS Injector	10/pk	N6101751	8003-0204
Graphite O-ring	10/pk	N6101378	8003-0205



Graphite O-rings, 8003-0205

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.



## Agilent CrossLab Parts and Supplies for PerkinElmer GC Systems

### Column Ferrules

#### Capillary Column Ferrules

Model	Fitting Size (in)	Ferrule ID (mm)	Column ID (mm)	Hole	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
<b>85% Polyimide/15% Graphite Capillary Column Ferrules</b>							
AutoSystem, AutoSystem	1/16	0.4	0.25	1	10/pk	09920104	8010-0310
XL, Clarus	1/16	0.4	0.25	2	10/pk	04972392	8010-0312
	1/16	0.5	0.32	1	10/pk	09920105	8010-0311
	1/16	0.5	0.32	2	10/pk	N9306000	8003-0216
	1/16	0.8	0.53	1	10/pk	09920107	8010-0313
<b>Graphite Capillary Column Ferrules</b>							
AutoSystem, AutoSystem	1/16	0.4	0.25	1	10/pk		8010-0301
XL, Clarus	1/16	0.5	0.32	1	10/pk	09903700	8010-0302
	1/16	0.5	0.32	2	10/pk	N9306001	8010-0303
	1/16	0.8	0.53	1	10/pk	09920141	8010-0304
<b>Polyimide Capillary Column Ferrules</b>							
AutoSystem, AutoSystem	1/16	0.3	0.18 or smaller	1	10/pk		8010-0306
XL, Clarus	1/16	0.4	0.25	1	10/pk		8010-0307
	1/16	0.5	0.32	1	10/pk		8010-0308
	1/16	0.8	0.53	1	10/pk		8010-0309

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Parts and Supplies for PerkinElmer GC Systems

## Packed Column Ferrules

Model	Fitting Size (in)	Ferrule ID (in)	Column OD (in)	Hole	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
<b>85% Polyimide/15% Graphite Packed Column Ferrules</b>							
AutoSystem, AutoSystem XL, Clarus	1/4	1/4	1/4	1	10/pk	09903739	8010-0314
	1/8	1/8	1/8	1	10/pk	N9302081	8003-0219
	1/16	1/16	1/16	1	10/pk	09920127	8010-0315
<b>Graphite Packed Column Ferrules</b>							
AutoSystem, AutoSystem XL, Clarus	1/4	1/4	1/4	1	10/pk	09920140	8010-0305
	1/8	1/8	1/8	1	10/pk	09903915	8003-0212
	1/16	1/16	1/16	1	10/pk	02450972	8003-0211
<b>Polyimide Packed Column Ferrules</b>							
AutoSystem, AutoSystem XL, Clarus	1/4	1/4	1/4	1	10/pk	N9301361	8003-0223
	1/8	1/8	1/8	1	10/pk	N9301360	8003-0222
	1/16	1/16	1/16	1	10/pk		8003-0221

## Column Nuts

Description	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
Column nut, 1/16 in	2/pk	09903392	8003-0311

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Parts and Supplies for PerkinElmer GC Systems

### Autosampler Syringes for PerkinElmer GC Systems

<b>Model</b>	<b>Volume (µL)</b>	<b>Description</b>	<b>Needle Gauge/Length (mm)/Tip</b>	<b>Similar to OEM Syringe Part No.</b>	<b>Agilent CrossLab Syringe Part No.</b>	<b>Similar to OEM Replacement Needle and Plunger Repair Kit Part No.</b>	<b>Agilent CrossLab Replacement Needle and Plunger Repair Kit Part No.</b>
AutoSystem, AutoSystem XL, Clarus	0.5	Removable needle	23/70/cone tip	N6101252	8003-0005	N6101469	8003-0006
AutoSystem, AutoSystem XL, Clarus		Removable needle	26/70/bevelled cone tip		8003-0007		8003-0008
AutoSystem, AutoSystem XL, Clarus	5	Fixed needle	23/70/cone tip	N6101251	8003-0001		
AutoSystem, AutoSystem XL, Clarus		Fixed needle, gas tight	23/70/cone tip	N6101390	8003-0002		
AutoSystem, AutoSystem XL, Clarus		Fixed needle	26/70/cone tip	N6101380	8003-0003		
AutoSystem, AutoSystem XL, Clarus	50	Fixed needle	23/70/cone tip	N6101760	8003-0004		

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Parts and Supplies for PerkinElmer GC Systems

## Inlet Septa

## Non-Stick Bleed and Temperature Optimized (BTO) Septa

Description	Agilent CrossLab Part No. 50/pk	Similar to OEM Part No.	Agilent CrossLab Part No. 100/pk
11 mm, CenterGuide	8010-0223	N9302972	8010-0224

## Non-Stick Advanced Green Septa

Description	Agilent CrossLab Part No. 50/pk	Similar to OEM Part No.	Agilent CrossLab Part No. 100/pk
11 mm, CenterGuide	8010-0207	N6621028 N9306219	8010-0208



Long-life septa, 8010-0239, 8010-0240

## Non-Stick Long-Life Septa

Description	Agilent CrossLab Part No. 50/pk	Agilent CrossLab Part No. 100/pk
11 mm, CenterGuide	8010-0239	8010-0240




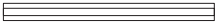




## General Purpose Septa

Description	Agilent CrossLab Part No. 50/pk	Similar to OEM Part No.	Agilent CrossLab Part No. 100/pk
11 mm	8010-0255	54019985	8010-0256

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

# Agilent CrossLab Supplies for Shimadzu GC Systems






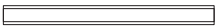




## Liners for 2014 Systems

Description	ID (mm)	OD (mm)	Length (mm)	Volume (μL)	Unit	Similar to OEM Part No.	Agilent Ultra Inert Deactivation	Similar to OEM Part No.	Agilent Original Deactivation
<b>Splitless Liners</b>									
 Single taper, wool	3.5	5.0	95		5/pk	221-48876-02	8001-0160		
 Double taper, drilled hole near top	3.5	5.0	95		5/pk	220-94734-01	8001-0158		
 Double taper, drilled hole near bottom	3.5	5.0	95		5/pk	220-94734-02	8001-0159		
 Straight-through	2.6	5.0	95	500	5/pk	220-94767-00	8001-0151	220-94767-00	8001-0101
<b>Split Liners</b>									
 Straight with middle restriction	3.5	5.0	95	800	5/pk	221-41444-01	8001-0156	221-41444-01	8001-0106
 Straight with middle restriction, wool	3.5	5.0	95	800	5/pk	220-90784-00	8001-0157		
 Straight-through	3.4	5.0	95	860	5/pk		8001-0153		8001-0103
<b>Direct Liners</b>									
 For 0.53 mm id column	2.6	5.0	95	450	5/pk	220-94768-00	8001-0152	220-94768-00	8001-0102

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Supplies for Shimadzu GC Systems








## Liners for 2010 and 2010 Plus Systems

Description	ID (mm)	OD (mm)	Length (mm)	Volume (µL)	Unit	Similar to OEM Part No.	Agilent Ultra Inert Deactivation	Similar to OEM Part No.	Agilent Original Deactivation
<b>Split/Splitless Liners</b>									
 Single taper	3.4	5.0	95		5/pk	961-01480-07	8001-0154		8001-0104
<b>Splitless Liners</b>									
 Single taper, wool	3.5	5.0	95		5/pk	221-48335-01 221-48876-02	8001-0160		
 Double taper, drilled hole near top	3.5	5.0	95		5/pk	220-94734-01	8001-0158		
 Double taper, drilled hole near bottom	3.5	5.0	95		5/pk	220-94734-02	8001-0159		
 Straight-through	2.6	5.0	95	500	5/pk	220-94767-00	8001-0151	220-94767-00	8001-0101
<b>Split Liners</b>									
 Straight-through	3.4	5.0	95	860	5/pk		8001-0153		8001-0103
 Straight with middle restriction	3.5	5.0	95	800	5/pk	221-41444-01	8001-0156	221-41444-01	8001-0106
 Straight with middle restriction, wool	3.5	5.0	95	800	5/pk	220-90784-00	8001-0157		
<b>Other Liners</b>									
 PTV	1.25	3.5	95	100	5/pk	221-49300-00	8001-0163		
 SPME or Purge and Trap, straight	0.75	5.0	95	50	5/pk	220-94769-00	8001-0162		

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Supplies for Shimadzu GC Systems

### Liners for 17A Systems


Description	ID (mm)	OD (mm)	Length (mm)	Volume (μL)	Unit	Similar to OEM Part No.	Agilent Ultra Inert Deactivation	Similar to OEM Part No.	Agilent Original Deactivation
<b>Splitless Liners</b>									
 Single taper, wool	3.5	5.0	95		5/pk	221-48335-01 221-48876-02	8001-0160		
 Double taper, drilled hole near top	3.5	5.0	95		5/pk	220-94734-01	8001-0158		
 Double taper, drilled hole near bottom	3.5	5.0	95		5/pk	220-94734-02	8001-0159		
 Straight-through	2.6	5.0	95	500	5/pk	220-94767-00	8001-0151	220-94767-00	8001-0101
<b>Split Liners</b>									
 Straight with middle restriction, wool	3.5	5.0	95	800	5/pk	220-90784-00	8001-0157		
 Straight-through	3.4	5.0	95	860	5/pk		8001-0153		8001-0103
<b>Direct Liners</b>									
 For 0.53 mm id column	2.6	5.0	95	450	5/pk	220-94768-00	8001-0152	220-94768-00	8001-0102

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.



## Agilent CrossLab Supplies for Shimadzu GC Systems

### Liners for 14 Systems

Description	ID (mm)	OD (mm)	Length (mm)	Volume (µL)	Unit	Agilent Ultra Inert Deactivation	Agilent Original Deactivation
<b>Split/Splitless Liners</b>							
 2.0 mm middle gooseneck	3.4	5.0	99	850	5/pk	8001-0155	8001-0105

### Liner O-rings



Graphite liner O-rings, 8001-0202

Description	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
Non-stick fluoroelastomer O-ring	10/pk	036-11203-84	8001-0201
Graphite O-ring, split	10/pk	221-48393-91	8001-0202
Graphite O-ring, splitless	10/pk	221-47222-91	8001-0203

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.



## Agilent CrossLab Supplies for Shimadzu GC Systems

### Column Ferrules

#### Capillary Column Ferrules

Model	Fitting Size (in)	Ferrule ID (mm)	Column ID (mm)	Hole	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
<b>85% Polyimide/15% Graphite Capillary Column Ferrules</b>							
QP5000/5050 Standard MS	1/16	0.3	0.18 or smaller	1	10/pk	220-90700-01	8001-0224
	1/16	0.4	0.25	1	10/pk	220-90700-02	8001-0221
	1/16	0.5	0.32	1	10/pk	220-90700-03	8001-0222
	1/16	0.8	0.53	1	10/pk	220-90700-04	8001-0223
QP2010	1/16	0.4	0.25	1	10/pk	220-90418-14	8010-0310
	1/16	0.4	0.25	2	10/pk	225-19056-00	8010-0312
	1/16	0.5	0.32	1	10/pk	220-90418-15	8010-0311
	1/16	0.8	0.53	1	10/pk	220-90418-18	8010-0313
<b>Graphite Capillary Column Ferrules</b>							
2010, 2010 Plus, 2014, 17A, 14A	1/16	0.4	0.25	1	10/pk	220-90765-00	8001-0211
	1/16	0.5	0.32	1	10/pk	221-32126-05	8001-0212
	1/16	0.8	0.53	1	10/pk	221-32126-08	8001-0213

#### Packed Column Ferrules

Model	Fitting Size (in)	Ferrule ID (in)	Column OD (in)	Hole	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
<b>85% Polyimide/15% Graphite Packed Column Ferrules</b>							
QP5000/5050 Standard MS	1/4	1/4	1/4	1	10/pk	225-09028-00	8010-0314
QP5000/5050 Wide Bore MS	1/16	1/16	1/16	1	10/pk	220-90418-28	8010-0315
QP2010	1/16	1/16	1/16	1	10/pk		8010-0315
17A	5 mm	5 mm	5 mm	1	10/pk	221-46403-92	8001-0214

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.



Graphite capillary column ferrules, 8001-0213

## Agilent CrossLab Supplies for Shimadzu GC Systems

### Column Nuts

Description	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
Column nut, slotted, 6-sided	2/pk	221-32705-00	8001-0311
Column nut, no slot, 6-sided	2/pk	221-41533-00	8001-0312

### Autosampler Syringes for Shimadzu GC Systems

Model	Volume (µL)	Description	Needle Gauge/Length (mm)/Tip	Similar to OEM Syringe Part No.	Agilent CrossLab Syringe Part No.	Similar to OEM Replacement Needle and Plunger Repair Kit Part No.	Agilent CrossLab Replacement Needle Part No.
AOC-14, AOC-17, AOC-20	5	Removable needle	23/42/cone tip		8001-0010		8001-0011
AOC-14, AOC-17, AOC-20	10	Removable needle	23/42/cone tip	220-90282-20	8001-0004	220-90281-20	8001-0005, 2/pk
AOC-14, AOC-17, AOC-20	10	Removable needle	26/42/cone tip	220-90282-21	8001-0006	220-90281-21	8001-0007, 2/pk
AOC-14, AOC-17, AOC-20	50	Removable needle	23/42/cone tip	221-45243-00	8001-0012		8001-0014
AOC-14, AOC-17, AOC-20	250	Removable needle, gas tight	23/42/cone tip	221-45244-00	8001-0013		8001-0014

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.



### TIPS & TOOLS

For a comprehensive vial compatibility chart, identification guide, septum recommendations, visit [www.agilent.com/chem/vialsposter](http://www.agilent.com/chem/vialsposter)



## Agilent CrossLab Supplies for Shimadzu GC Systems

### Inlet Septa

#### Non-Stick Bleed and Temperature Optimized (BTO) Septa

Description	Agilent CrossLab Part No. 50/pk	Agilent CrossLab Part No. 100/pk
Shimadzu plug	8010-0231	8010-0232

#### Non-Stick Advanced Green Septa

Description	Similar to OEM Part No.	Agilent CrossLab Part No. 50/pk	Agilent CrossLab Part No. 100/pk
Shimadzu plug	220-90547-00 220-94781-00	8010-0215	8010-0216

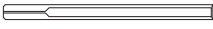









#### General Purpose Septa

Description	Agilent CrossLab Part No. 50/pk	Agilent CrossLab Part No. 100/pk
Shimadzu plug	8010-0263	8010-0264

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

# Agilent CrossLab Supplies for Thermo Scientific GC Systems

## Liners for Trace, Focus Systems

Description	ID (mm)	OD (mm)	Length (mm)	Volume (μL)	Unit	Similar to OEM Part No.	Agilent Ultra Inert Deactivation	Similar to OEM Part No.	Agilent Original Deactivation
<b>Splitless Liners</b>									
 Single taper	5.0	8.0	105	1750	5/pk	45350033	8002-0153	45350033	8002-0103
 Single taper	3.0	8.0	105		5/pk	45350032	8002-0154	45350032	8002-0104
<b>Split Liners</b>									
 Straight	5.0	8.0	105	2000	5/pk	45350030	8002-0151	45350030	8002-0101
 Straight	3.0	8.0	105	750	5/pk	45350031	8002-0152	45350031	8002-0102
<b>PTV Liners</b>									
 Straight	2.0	2.75	120	375	5/pk	45322045	8002-0156*	45322045	8002-0106*
 Straight with bottom restriction	2.0	2.75	120	375	5/pk	45352057	8002-0157	45352057	8002-0107
 6 baffles	2.0	2.75	120		5/pk	453T2120	8002-0160*		
 Straight	1.75	2.75	120	300	5/pk		8002-0155		8002-0105
 Straight	1.0	2.75	120	90	5/pk	45352054	8002-0161		
 3 baffles	1.0	2.75	120		5/pk	45352062	8002-0159*		

\*Use in Trace systems only

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Supplies for Thermo Scientific GC Systems

### Liner O-rings

Description	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
Non-stick fluoroelastomer O-ring, sintered liner	10/pk	29031305	8002-0201
Non-stick fluoroelastomer O-ring	10/pk	29030306	8010-0401
Graphite O-ring, 8 mm id	2/pk	29033406	8002-0203
Graphite O-ring, PTV	2/pk	29013417	8002-0204

## Column Ferrules

### Capillary Column Ferrules

Model	Fitting Size (in)	Ferrule ID (mm)	Column ID (mm)	Hole	Unit	Similar to OEM Part No.	Agilent CrossLab Part No.
<b>85% Polyimide/15% Graphite Capillary Column Ferrules</b>							
Injectors/Detectors	1/16	0.4	0.25	1	10/pk	290VT186	8002-0220
	1/16	0.5	0.32	1	10/pk	290VT187	8002-0221
	1/16	0.8	0.53	1	10/pk	290VT188	8002-0222
Any GC/MS Interface	1/16	0.4	0.25	1	10/pk	29033496	8010-0310
	1/16	0.5	0.32	1	10/pk	29033497	8010-0311
<b>Graphite Capillary Column Ferrules</b>							
Trace/Focus	M4	0.3	0.18	1	10/pk		8002-0211
Injectors/Detectors (not for GC/MS Interface)	M4	0.4	0.25	1	10/pk	29053488	8002-0212
	M4	0.5	0.32	1	10/pk	29053487	8002-0213
	M4	0.8	0.53	1	10/pk	29053486	8002-0214
Injectors/Detectors	1/16	0.4	0.25	1	10/pk		8002-0215
	1/16	0.5	0.32	1	10/pk		8002-0216
	1/16	0.8	0.53	1	10/pk		8002-0217

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Supplies for Thermo Scientific GC Systems

### Column Nuts

Description	Unit	Similar to	Agilent CrossLab
		OEM Part No.	Part No.
Column nut, stainless steel, split/splitless injector	2/pk	35032423	8002-0311
Column nut, brass	2/pk	290BT239	8002-0312

### Autosampler Syringes for Thermo GC Systems

Model	Volume (µL)	Description	Needle Gauge/ Length (mm)/Tip	Similar to OEM Syringe Part No.	Agilent CrossLab Syringe Part No.	Similar to OEM Replacement Needle or Plunger Part No.	Agilent CrossLab Replacement Needle or Plunger Part No.
TriPlus, AS3000	0.5	Plunger-in-needle	23/50/cone tip	36504045	8010-0355		8010-0367*
TriPlus	5	Fixed needle	26/50/cone tip	36504047	8010-0353		
TriPlus, AS3000, AS2000, AS200, AS800	10	Fixed needle	25/50/cone tip	36500525	8002-0003		
TriPlus, AS2000	10	Fixed needle	23/80/cone tip	36520061	8002-0002		
TriPlus, AS2000	10	Fixed needle	26/80/cone tip	36502019	8002-0001		
TriPlus, AS2000, AS200, AS800	100	Fixed needle, gas tight	23/50/cone tip		8010-0354		8010-0368**
TriPlus, AS2000	100	Removable needle, gas tight	23/50/side hole tip	36520050	8002-0004	36540040	8002-0005***

\*Needle and plunger repair kit

\*\*Replacement plunger

\*\*\*Replacement needle

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Supplies for Thermo Scientific GC Systems

### Inlet Septa

#### Non-Stick Bleed and Temperature Optimized (BTO) Septa

Description	Similar to OEM Part No.	Agilent CrossLab Part No. 50/pk	Similar to OEM Part No.	Agilent CrossLab Part No. 100/pk
9 mm, CenterGuide	31303240	8010-0217		8010-0218
9.5 mm		8010-0219		8010-0220
10 mm		8010-0221		8010-0222
11 mm, CenterGuide		8010-0223		8010-0224
11.5 mm, CenterGuide	31303230	8010-0225		8010-0226
<b>Description</b>		<b>24/pk</b>		<b>48/pk</b>
12.7 mm, CenterGuide		8010-0227	31303228	8010-0228
17 mm, CenterGuide		8010-0229	31303211	8010-0230

#### Non-Stick Advanced Green Septa

Description	Similar to OEM Part No.	Agilent CrossLab Part No. 50/pk	Similar to OEM Part No.	Agilent CrossLab Part No. 100/pk
9 mm, CenterGuide	313G3240	8010-0201		8010-0202
9.5 mm		8010-0203		8010-0204
10 mm		8010-0205		8010-0206
11 mm, CenterGuide	313G3230	8010-0207		8010-0208
11.5 mm, CenterGuide		8010-0209		8010-0210
<b>Description</b>		<b>24/pk</b>		<b>48/pk</b>
12.7 mm, CenterGuide		8010-0211	313G3228	8010-0212
17 mm, CenterGuide		8010-0213	313G3211	8010-0214



Non-stick advanced green septum, 11 mm, CenterGuide, 8010-0207

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.

## Agilent CrossLab Supplies for Thermo Scientific GC Systems



Long-life septa, 8010-0239, 8010-0240

**Non-Stick Long-Life Septa**

<b>Description</b>	<b>Agilent CrossLab Part No. 50/pk</b>	<b>Agilent CrossLab Part No. 100/pk</b>
9 mm, CenterGuide	8010-0233	8010-0234
11 mm, CenterGuide	8010-0239	8010-0240
11.5 mm, CenterGuide	8010-0241	8010-0242
<b>Description</b>	<b>24/pk</b>	<b>48/pk</b>
12.7 mm, CenterGuide	8010-0243	8010-0244
17 mm, CenterGuide	8010-0245	8010-0246

**General Purpose Septa**

<b>Description</b>	<b>Agilent CrossLab Part No. 50/pk</b>	<b>Agilent CrossLab Part No. 100/pk</b>
9 mm	8010-0249	8010-0250
9.5 mm	8010-0251	8010-0252
10 mm	8010-0253	8010-0254
11 mm	8010-0255	8010-0256
11.5 mm	8010-0257	8010-0258
12.7 mm	8010-0259	8010-0260
17 mm	8010-0261	8010-0262

The cross references to the original equipment manufacturer (OEM) part numbers listed here serve as a recommendation that the Agilent CrossLab products are viable alternatives to OEM products. CrossLab products are compatible with the corresponding OEM instruments, although in some cases, the CrossLab products may have slightly different designs as compared to the OEM counterparts. All Agilent CrossLab supplies are backed by Agilent's 90-day money-back warranty.



# Agilent CrossLab Supplies for CTC GC Autosamplers

## Autosampler Syringes for CTC CombiPAL and GC PAL

Volume (µL)	Description	Needle Gauge/ Length (mm)/Tip	Agilent CrossLab Syringe Part No.	Agilent CrossLab Replacement Needle or Plunger Part No.
0.5	Plunger-in-needle	23/50/cone tip	8010-0355	8010-0367*
5	Fixed needle	23/50/cone tip	8010-0356	
10	Fixed needle	23/50/cone tip	8010-0351	
	Fixed needle, gas tight	23/50/cone tip	8010-0371	8010-0359**
	Fixed needle	26/50/cone tip	8010-0352	
	Fixed needle, gas tight	26/50/cone tip	8010-0357	8010-0359**
	Fixed needle	26/50/bevel tip	8010-0358	
25	Fixed needle	26/50/cone tip	8010-0360	
100	Removable needle, gas tight	23/50/side hole tip	8002-0004	8002-0005***
	Fixed needle	26/50/cone tip	8010-0361	
250	Fixed needle, gas tight	26/50/cone tip	8010-0362	

Volume (mL)	Description	Needle Gauge/ Length (mm)/Tip	Agilent CrossLab Syringe Part No.	Agilent CrossLab Replacement Needle or Plunger Part No.
1	Fixed needle, gas tight, headspace	23/56/side hole tip	8010-0363	8010-0365
2.5	Fixed needle, gas tight, headspace	23/56/side hole tip	8010-0364	8010-0366

\*Needle and plunger repair kit

\*\*Replacement plunger

\*\*\*Replacement needle



Agilent PAL Sampler

## Agilent J&W GC columns

### The story behind Agilent J&W GC Columns

In 2000, Agilent Technologies, the inventor of fused silica GC tubing, merged with J&W Scientific, the creator of the first GC stationary phase made from cross-linked siloxane polymers. In 2010, Agilent acquired Varian adding PLOT, Select, VF, CP-Sil, UltiMetal, and packed to the existing Ultra Inert, High Efficiency, LTM, PAH, and Custom GC columns. Our foundation of GC expertise, combined with these vital acquisitions, we have built Agilent J&W into the most extensive and innovative GC column offering in the world.

### Put over 40 years of Agilent quality and innovation behind your every separation

Agilent J&W offers the broadest portfolio of the most innovative GC columns in the world, with over 3500 part numbers. Our portfolio offers the best inertness for acids/bases/mixed functional compounds, the lowest bleed levels and the tightest column-to-column reproducibility. So when you put industry-leading Agilent J&W GC columns to work in your lab, you can have the utmost confidence in your column, and in every separation.



## The most inert and lowest bleed columns for sensitivity and performance

Agilent J&W columns have the widest range of standard, GC/MS and Ultra Inert stationary phases proven to deliver consistent column inertness and exceptionally low column bleed with high upper temperature limits, ensuring accurate peak identification and quantification. Column bleed can decrease spectral integrity, reduce uptime, and shorten column life. Column activity contributes to severe peak tailing, as well as compound loss or degradation for active compounds (e.g. acids and bases), leading to inaccurate quantification.

## Better precision for better results

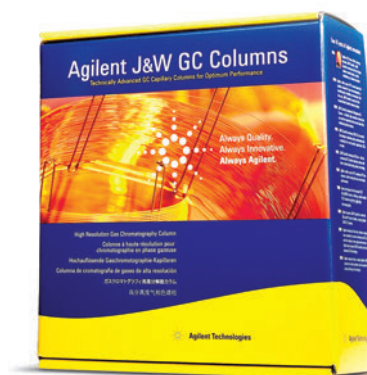
Agilent J&W columns adhere to tight retention factor (k) specifications, promoting consistent retention and separation. They also feature narrow retention indexes and a high number of theoretical plates per meter, ensuring narrow peaks and improving the resolution of closely eluting peaks.

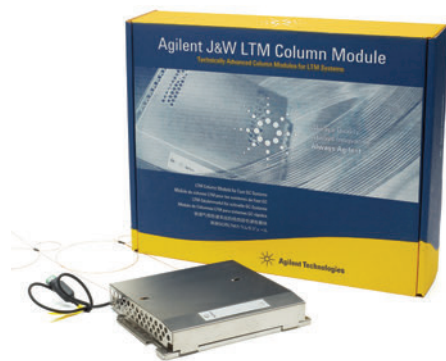
## The industry's tightest quality control specifications

Agilent's industry-leading testing ensures the most reliable qualitative and quantitative results, and unmatched column-to-column reproducibility, for your most challenging compounds. Offering the industry's only Ultra Inert testing, we test each column for peak height ratios and tailing for acids, bases, and other chromatographically demanding compounds so you can have utmost confidence in your trace-level separations.

And, with Agilent's industry-leading instruments, services, global technical support, and quick shipment from Agilent regional logistic centers, Agilent's whole solution provides you with even more confidence in your column, and in your every separation.

To learn more about Agilent J&W GC columns please visit [www.agilent.com/chem/mygccolumns](http://www.agilent.com/chem/mygccolumns)





LTM II standard format with 5 in column toroid

## Agilent J&W LTM II Column Modules

### 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



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

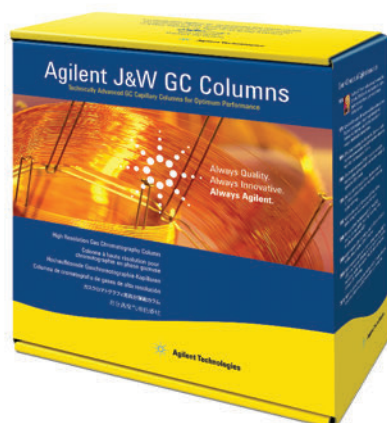
### Shorten analytical cycle times and boost your high speed gas chromatography capabilities

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](http://www.agilent.com/chem/LTMcol)





## GC Capillary Columns

### More than just essential products... reliable results!

With the highest inertness, lowest bleed levels, and the tightest column-to-column reproducibility, Agilent J&W GC Capillary columns perform better than any columns on the market.

**Ultra Inert Columns** – allow you to perform trace level analysis – including the analysis of acids, bases, or other active compounds – with the utmost confidence. They also help ensure an inert GC flow path that is essential for sensitivity, performance, and the integrity of your analytical results.

**High Efficiency Columns** – are ideal for applications that require reduced analysis time, such as high-throughput screening, fast process monitoring, fast QC analyses, and fast method development.

**Low-bleed GC/MS Columns** – are specifically designed to chromatograph a broad range of trace-level samples, and offer low bleed and high inertness even at higher temperatures.

**Premium Polysiloxane Columns** – are stable, robust, and versatile and are available in a wide variety of stationary phases.

**Polyethylene Glycol (PEG) Columns** – offer a variety of unique phase characteristics to meet the varying needs of your laboratory, thanks to Agilent's strict quality control of the cross-linking and deactivation processes.

**Specialty Columns** – meet Agilent's uncompromising standards for high-temperature, life science, pesticide, petroleum, semivolatile, and volatile applications.

**PLOT Columns** – deliver superior separation for compounds that are gases at room temperature. They are also ideal for analyzing fixed gases, low molecular weight hydrocarbon isomers, volatile polymer compounds, and reactive analytes such as gases, amines, and hydrides.

On the following pages you will find details on our complete line of innovative Agilent J&W GC columns. For more information, contact your local Agilent representative or Agilent Authorized Distributor. Or you can order online at [www.agilent.com/chem/store](http://www.agilent.com/chem/store).

## Table of Contents

<b>Column Selection Principles .....</b>	<b>247</b>	<b>Premium Polysiloxane Columns...318</b>	<b>Specialty Columns .....</b>	<b>362</b>
<b>GC Column Application and Method Guides.....</b>	<b>262</b>	DB-1 .....	<i>High Temperature Columns .....</i>	<b>362</b>
<b>Ultra Inert GC Columns .....</b>	<b>286</b>	HP-1 .....	DB-1ht .....	<b>362</b>
DB-1ms Ultra Inert .....	<b>289</b>	CP-Sil 5 CB.....	DB-5ht .....	<b>363</b>
HP-1ms Ultra Inert.....	<b>289</b>	Ultra 1 .....	DB-17ht.....	<b>364</b>
DB-5ms Ultra Inert .....	<b>290</b>	Ultra 2.....	VF-5ht and VF-5ht UltiMetal.....	<b>365</b>
HP-5ms Ultra Inert.....	<b>290</b>	DB-5.....	<i>Petroleum Columns.....</i>	<b>366</b>
DB-35ms Ultra Inert.....	<b>291</b>	HP-5.....	Lowox .....	<b>366</b>
DB-624 Ultra Inert .....	<b>291</b>	CP-Sil 8 CB.....	GS-OxyPLOT .....	<b>366</b>
DB-Select 624 UI for <467> .....	<b>292</b>	CP-Sil 13 CB .....	CP-Sil 5 CB for Formaldehyde .....	<b>367</b>
DB-UI 8270D Ultra Inert .....	<b>292</b>	DB-35.....	HP-PONA .....	<b>367</b>
<b>Agilent J&amp;W High Efficiency GC Capillary Columns.....</b>	<b>293</b>	HP-35 .....	CP-Sil PONA CB.....	<b>368</b>
<b>Low-bleed GC/MS Columns.....</b>	<b>294</b>	DB-17.....	CP-Sil PONA for ASTM D5134.....	<b>368</b>
DB-1ms.....	<b>295</b>	HP-50+.....	DB-Petro .....	<b>369</b>
HP-1ms.....	<b>296</b>	CP-Sil 24 CB .....	HP-1 Aluminum Clad.....	<b>369</b>
VF-1ms .....	<b>297</b>	DB-23.....	DB-2887.....	<b>370</b>
DB-5ms.....	<b>299</b>	DB-200.....	DB-HT SimDis .....	<b>370</b>
HP-5ms.....	<b>301</b>	DB-210.....	CP-SimDist.....	<b>371</b>
VF-5ms .....	<b>302</b>	DB-225.....	CP-SimDist UltiMetal .....	<b>372</b>
DB-XLB.....	<b>304</b>	CP-Sil 43 CB .....	CP-Sil 2 CB.....	<b>373</b>
VF-Xms .....	<b>305</b>	DB-1301.....	CP-TCEP for Alcohols in Gasoline .....	<b>373</b>
DB-35ms .....	<b>306</b>	CP-1301 .....	DB-Sulfur SCD.....	<b>374</b>
VF-35ms .....	<b>307</b>	DB-1701.....	Select Low Sulfur .....	<b>375</b>
DB-17ms .....	<b>308</b>	CP-Sil 19 CB .....	CP-Sil 5 CB for Sulfur.....	<b>375</b>
VF-17ms .....	<b>309</b>	<b>Polyethylene Glycol (PEG) Columns.....</b>	Select for Permanent Gases – Dual Column.....	<b>376</b>
VF-23ms .....	<b>310</b>	DB-WAX and DB-WaxFF .....	Select Al <sub>2</sub> O <sub>3</sub> MAPD.....	<b>376</b>
VF-200ms .....	<b>311</b>	DB-WAXetr.....	Biodiesel Capillary GC Columns .....	<b>377</b>
DB-225ms .....	<b>312</b>	HP-INNOWax .....	Select Biodiesel.....	<b>379</b>
VF-WAXms.....	<b>313</b>	CP-Wax 52 CB .....	Select Silanes .....	<b>380</b>
VF-624ms and VF-1301ms .....	<b>315</b>	DB-FFAP .....	CP-Volamine .....	<b>381</b>
VF-1701ms .....	<b>317</b>	HP-FFAP .....	CP-Sil 8 CB for Amines.....	<b>382</b>
		CP-Wax 58 FFAP CB.....	CP-Wax for Volatile Amines and Diamines .....	<b>382</b>
		Carbowax 20M and HP-20M .....	PoraPLOT Amines .....	<b>383</b>

(Continued)

## Table of Contents (Continued)

**Specialty Columns (Continued)**

<i>Pesticides Columns</i> .....	<b>384</b>
DB-CLP1 and DB-CLP2.....	<b>384</b>
VF-5 Pesticides.....	<b>385</b>
DB-1701P.....	<b>386</b>
VF-1701 Pesticides.....	<b>386</b>
CP-Sil 8 CB for Pesticides.....	<b>387</b>
CP-Sil 19 CB for Pesticides.....	<b>387</b>
DB-608.....	<b>388</b>
HP-PAS5.....	<b>388</b>
Rapid-MS.....	<b>389</b>
<i>PAH Columns</i> .....	<b>390</b>
Select PAH.....	<b>390</b>
DB-EUPAH.....	<b>390</b>
CP-Sil PAH CB UltiMetal.....	<b>391</b>
<i>Semivolatiles Columns</i> .....	<b>392</b>
DB-UI 8270D for Semivolatiles.....	<b>392</b>
CP-Sil 8 CB for PCB.....	<b>393</b>
DB-5.625.....	<b>394</b>
HP-5ms Semivolatile.....	<b>395</b>
CP-Sil 5/C18 CB for PCB.....	<b>395</b>
DB-Dioxin.....	<b>396</b>
CP-Sil 88 for Dioxins.....	<b>396</b>
<i>Volatiles Columns</i> .....	<b>397</b>
DB-624 Ultra Inert.....	<b>397</b>
DB-624.....	<b>398</b>
CP-Select 624 CB.....	<b>399</b>
DB-VRX.....	<b>400</b>
HP-VOC.....	<b>401</b>
DB-502.2.....	<b>402</b>
DB-MTBE.....	<b>402</b>
CP-Select CB for MTBE.....	<b>403</b>
DB-TPH.....	<b>403</b>
Select Mineral Oil.....	<b>404</b>

*Foods, Flavors and Fragrance Columns*.....

	<b>405</b>
HP-88.....	<b>405</b>
CP-Sil 88.....	<b>406</b>
Select FAME.....	<b>407</b>
CP-Sil 88 for FAME.....	<b>407</b>
CP-Wax 57 CB.....	<b>408</b>
CP-Carbowax 400 for Volatiles in Alcohol.....	<b>408</b>
CP-Wax 57 CB for Glycols and Alcohols.....	<b>409</b>
CP-TAP CB for Triglycerides.....	<b>409</b>
CP-FFAP CB for Free Fatty Acids in Dairy Products.....	<b>410</b>
CycloSil-B.....	<b>410</b>
Cyclodex-B.....	<b>411</b>
HP-Chiral $\beta$ .....	<b>411</b>
CP-Chirasil Val.....	<b>412</b>
CP-Chirasil-Dex CB.....	<b>412</b>
CP-Cyclodextrin- $\beta$ -2,3,6-M-19.....	<b>413</b>
<i>Life Sciences Columns</i> .....	<b>414</b>
DB-ALC1 and DB-ALC2.....	<b>414</b>
VF-DA.....	<b>415</b>
DB-5ms EVDX.....	<b>415</b>
DB-Select 624 UI for <467>.....	<b>416</b>
HP-Fast Residual Solvent.....	<b>416</b>

**Metal Columns**.....

<b>PLOT Columns</b> .....	<b>420</b>
PLOT PT.....	<b>420</b>
PoraBOND Q.....	<b>422</b>
PoraBOND U.....	<b>423</b>
PoraPLOT Q and PoraPLOT Q-HT.....	<b>424</b>
HP-PLOT Q.....	<b>425</b>
GS-Q.....	<b>426</b>
PoraPLOT U and PoraPLOT S.....	<b>427</b>

**PLOT Columns (Continued)**

HP-PLOT U.....	<b>428</b>
HP-PLOT Al <sub>2</sub> O <sub>3</sub> KCl.....	<b>428</b>
GS-Alumina KCl.....	<b>429</b>
CP-Al <sub>2</sub> O <sub>3</sub> /KCl and CP-Al <sub>2</sub> O <sub>3</sub> /Na <sub>2</sub> SO <sub>4</sub> .....	<b>430</b>
HP-PLOT Al <sub>2</sub> O <sub>3</sub> S.....	<b>432</b>
GS-Alumina.....	<b>433</b>
HP-PLOT Al <sub>2</sub> O <sub>3</sub> M.....	<b>434</b>
GS-GasPro.....	<b>434</b>
CP-SilicaPLOT.....	<b>435</b>
CarboBOND and CarboPLOT P7.....	<b>436</b>
GS-CarbonPLOT.....	<b>437</b>
HP-PLOT Molesieve.....	<b>438</b>
CP-Molsieve 5Å.....	<b>439</b>
Particle Traps for use with PLOT Columns.....	<b>440</b>
<b>Non-Bonded Stationary Phases</b> .....	<b>441</b>
<b>Guard Columns</b> .....	<b>445</b>
<b>LTM Column Modules</b> .....	<b>447</b>
<b>Fused Silica Tubing</b> .....	<b>464</b>
<b>Stainless Steel Tubing</b> .....	<b>469</b>
<b>Packed GC Columns</b> .....	<b>470</b>
<b>Custom GC Column Ordering</b> .....	<b>481</b>
<b>GC Column Test Standards</b> .....	<b>482</b>
<b>Column Installation and Troubleshooting</b> .....	<b>484</b>



# Column Selection Principles

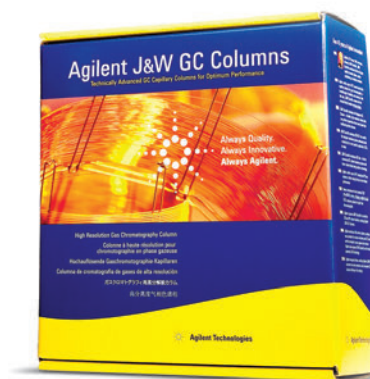
## Narrow your choices, save time, and reduce trial and error

Selecting the right capillary column for your application can be an uncertain (and sometimes difficult) task. If possible, you should begin by consulting sample applications provided by GC manufacturers and suppliers – or described in published Application Notes.

In addition, the following pages will help you:

- Choose a stationary phase – your most critical decision – based on factors such as selectivity, polarity, and phenyl content.
- Understand how column diameter influences factors like efficiency, solute retention, head pressure, and carrier gas flow rates.
- Determine which column length will affect solute retention, column head pressure, column bleed – and cost.
- Appreciate the difference between thin-film and thick-film columns with regard to capacity, inertness, bleed, and upper temperature limit.

While there are no foolproof techniques, shortcuts, tricks or secrets to column selection, there are some guidelines and concepts that simplify the process. There are four major column parameters to consider: stationary phase, diameter, length, and film thickness.





## Selecting Stationary Phases

Choosing the best stationary phase is the most important decision when selecting a capillary column. Unfortunately, it is also the most difficult and ambiguous decision. The most reliable method is to consult the large collection of example applications provided by column manufacturers, GC manufacturers and in published literature. While an exact example application may not be available, enough information can usually be obtained to simplify the decision or reduce the number of potential columns. The most difficult situation is when no previous information is available. Stationary phase selection is much easier even if only one chromatogram is available for all or most of the sample compounds. The most reliable method is to consult the large collection of example applications provided by GC column and hardware manufacturers and published in literature.

The concepts of stationary phase selectivity and polarity are very useful when selecting stationary phases. For best performance, start with the general purpose Agilent J&W Ultra Inert 1 ms and 5ms columns to get the lowest column bleed and column activity for a wide range of analytes, including active compounds and trace level samples.

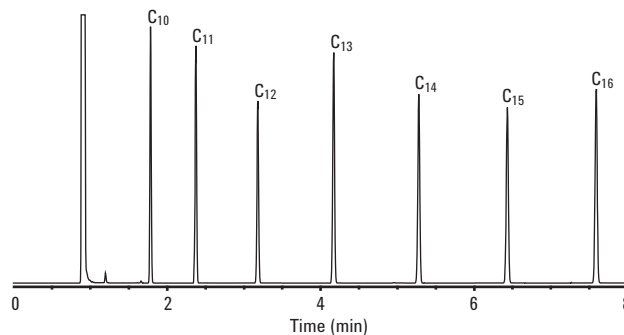
Synonymous use of the terms polarity and selectivity is not accurate, but it is very common. Selectivity is determined by the physicochemical interactions of the solute molecules with the stationary phase. Polarity is determined by the structure of the stationary phase. Polarity does have an effect on separation; however, it is only one of the many stationary phase properties that influence peak separation (see the next section on polarity).

Selectivity can be thought of as the ability of the stationary phase to differentiate between two solute molecules by differences in their chemical or physical properties. Separation is obtained if the interactions between the stationary phase and solutes are different. For liquid or gum stationary phase (polysiloxanes and polyethylene glycols), there are three major interactions: dispersion, dipole, and hydrogen bonding. The following is a simplified and condensed explanation of the interactions for polysiloxane and polyethylene glycol stationary phases.

Dispersion is the dominant interaction for all polysiloxane and polyethylene glycol stationary phases. Dispersion can be simplified into the concept of volatility. Simply stated, the more volatile a solute, the faster it elutes from the column (i.e., shorter retention time). However, this order can be altered by the effect of solute and stationary phase polarities, and the other interactions. Solute boiling points are sometimes used as a measure of compound volatility. That is, compounds elute in the order of their increasing boiling points. Unfortunately, boiling points cannot be universally applied to the dispersion interactions. Boiling points are fairly valid when dealing with compounds with similar structures, functional groups or homologous series (**Figure 1**). When dealing with compounds with mixed functional groups, the boiling points simplification often fails (**Figure 2**). If compound boiling points differ by more than 30 °C, they usually can be separated by most stationary phases (there are exceptions). If compound boiling points differ by less than 10 °C, the boiling point simplification becomes less certain and more likely to be in error (except for compounds in a homologous series).

**Figure 1: Boiling Point Elution Order for Homologous Series****Column:** DB-1, 15 m x 0.25 mm, 0.25  $\mu$ m**Carrier:** Helium at 30 cm/s**Oven:** 60 °C for 1 min, 60-180 °C at 20 °C/min

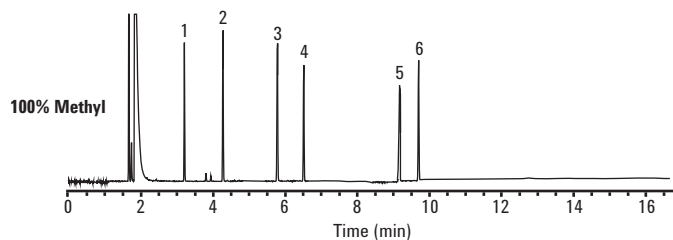
	<b>Boiling Point (°C)</b>
1. n-Decane (C <sub>10</sub> )	174
2. n-Undecane (C <sub>11</sub> )	196
3. n-Dodecane (C <sub>12</sub> )	216
4. n-Tridecane (C <sub>13</sub> )	234
5. n-Tetradecane (C <sub>14</sub> )	253
6. n-Pentadecane (C <sub>15</sub> )	268
7. n-Hexadecane (C <sub>16</sub> )	287



Homologous series of hydrocarbons. The solutes elute in order of their increasing boiling points; however, the peaks are not spaced in proportion to their respective boiling points.

**Figure 2: Deviation from Boiling Point Order****Column:** DB-1, 30 m x 0.25 mm, 0.25  $\mu$ m

	<b>Boiling Point (°C)</b>
1. Toluene	111
2. Hexanol	157
3. Phenol	182
4. Decane (C <sub>10</sub> )	174
5. Naphthalene	219
6. Dodecane (C <sub>12</sub> )	216



Solutes outside of the homologous series do not elute in the boiling point order.

If the stationary phase is capable of dipole interaction, it enhances its power to separate solutes whose dipole moments are different. Only some stationary phases are able to exploit this interaction. Polyethylene glycols, and cyanopropyl and trifluoropropyl substituted polysiloxanes readily undergo the dipole interactions; methyl or phenyl substituted groups do not undergo a dipole interaction (**Table 1**). The amount of peak separation for solutes with different dipoles often changes if a stationary phase with a different interaction is used (**Figure 3**). If the dipole difference between compounds is small, a greater amount of the appropriate group is needed (e.g., a 50% cyanopropylphenyl-methyl polysiloxane instead of a 14% cyanopropylphenyl-methyl polysiloxane). It is difficult to accurately predict the magnitude of the separation change for all of the peaks. Empirical results have shown that dipole interaction stationary phases are well suited for samples containing compounds that have base or central structures to which different groups are attached in various positions. Examples include substituted aromatics, halocarbons, pesticides and drugs.

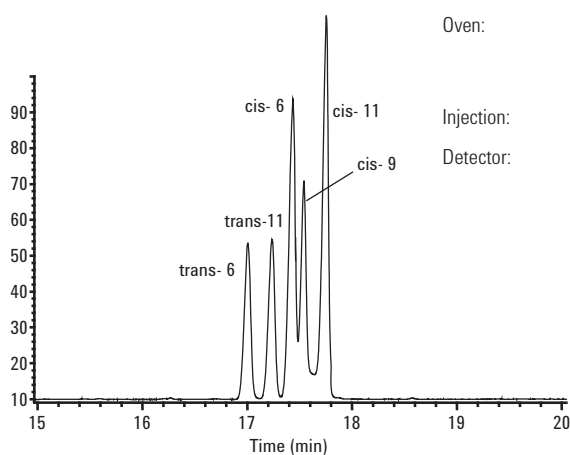
**Table 1: Stationary Phase Interactions**

Functional Group	Dispersion	Dipole	Hydrogen Bonding
Methyl	Strong	None	None
Phenyl	Strong	None to weak	Weak
Cyanopropyl	Strong	Very strong	Moderate
Trifluoropropyl	Strong	Moderate	Weak
PEG	Strong	Strong	Moderate

### Figure 3: Dipole Interactions

Column: HP-88, 30 m x 0.25 mm, 0.25  $\mu$ m

Molecular weight and boiling points are virtually identical for these fatty acid methyl ester (FAME) isomers, with only the dipole interactions due to the hydrogen isomeric positions on the molecules being different. Only strong dipole interactions in the stationary phase can provide chromatographic separation for these types of compounds.



### C-18:1 cis and trans isomers on HP-88

Carrier: Hydrogen, 2 mL/min constant flow

Oven: 120 °C, 1 min, 10 °C/min to 175 °C, 10 min  
5 °C/min to 210 °C, 5 min  
5 °C/min to 230 °C, 5 min

Injection: 1  $\mu$ L

Detector: FID, 250 °C

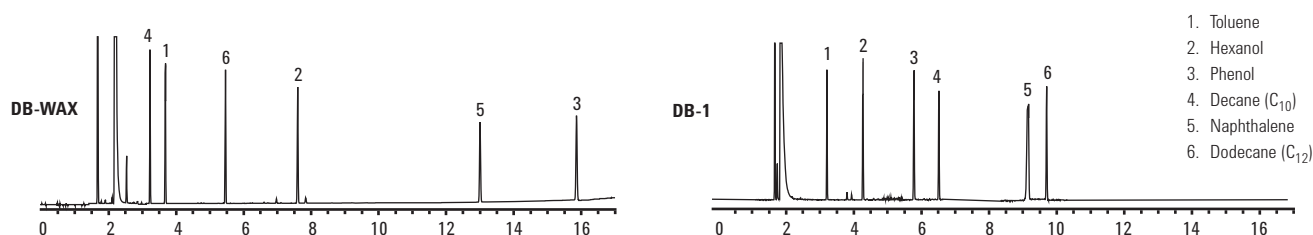
The hydrogen bonding interaction occurs if there is hydrogen bonding between the solute molecules and the stationary phase. **Table 2** lists the types of compounds that can form hydrogen bonds along with their relative bonding strengths. It is the difference in the strength of the hydrogen bonding that is critical. The same stationary phases that undergo dipole interactions also undergo hydrogen bonding interactions. The amount of peak separation for solutes whose hydrogen bonding potentials differ often changes if a stationary phase with a different amount of hydrogen bonding interaction is used (**Figure 4**). If the hydrogen bonding difference between compounds is small, a great amount of the appropriate group is needed (e.g., a polyethylene glycol instead of a 14% cyanopropylphenyl-methyl polysiloxane). It is difficult to accurately predict the magnitude of the separation change for all of the peaks. Sometimes the desired separation is obtained, but another set of peaks now co-elute with the new stationary phase.

**Table 2: Relative Hydrogen Bonding Strengths**

Strength	Compounds
Strong	Alcohols, carboxylic acids, amines
Moderate	Aldehydes, esters, ketones
Weak to none	Hydrocarbons, halocarbons, ethers

**Figure 4: Hydrogen Bonding Interactions**

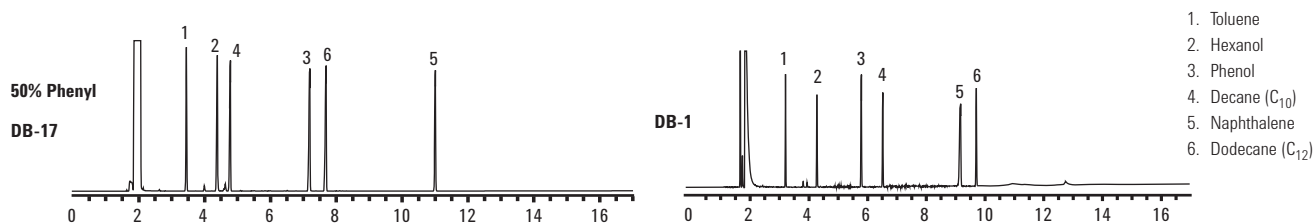
Column: 15 m x 0.25 mm, 0.25  $\mu$ m



DB-1 does not undergo hydrogen bonding interactions. The change in the elution order of hexanol and phenol with DB-WAX is a combination of the dipole and hydrogen bonding interaction.

**Figure 5: Phenyl Content Retention**

Column: 15 m x 0.25 mm, 0.25  $\mu$ m



The aromatics increase in retention relative to the hydrocarbons for the DB-17 columns. DB-17 contains 50% phenyl substitution. DB-1 contains no phenyl substitution.

Another stationary phase characteristic that may effect retention in a predictable manner is the phenyl content. In general, the higher the phenyl content of the stationary phase, the higher the retention of aromatic solutes relative to aliphatic solutes. This does not mean that aromatic solutes are more retained (e.g., higher *k*) by high phenyl content stationary phases, but that aromatic solutes are more retained relative to aliphatic solutes. **Figure 5** shows an example of this retention behavior.

## Polarity

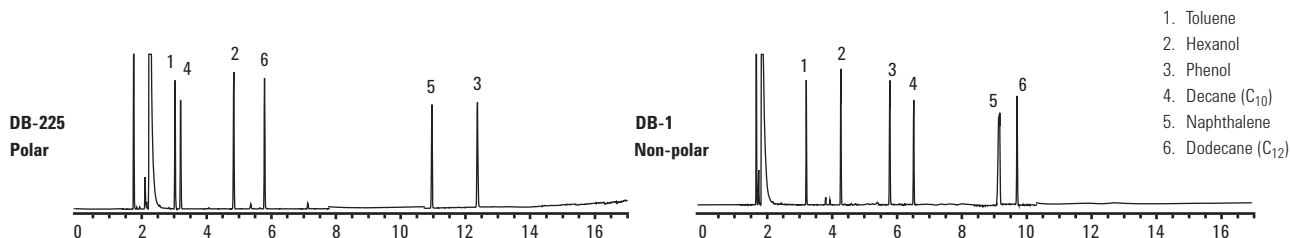
Stationary phase polarity is determined by the polarity of the substituted groups and their relative amounts. **Table 3** lists a variety of stationary phases in order of their increasing polarity. Polarity is often erroneously used to select columns or to determine separation characteristics. Stationary phase polarity is only one of many factors that affect retention and separation.

While polarity is not directly related to selectivity, it has a pronounced effect on compound retention, thus separation. For compounds of similar volatility, greater retention is obtained for solutes with polarities similar to the stationary phase. In other words, polar compounds are more strongly retained by a polar stationary phase than a less polar stationary phase, and vice versa. This effect can be seen in **Figure 6**. The changes in retention and elution order can be largely attributed to the changes in stationary phase polarity. Changes in the amount of phenyl substitution, and dipole and hydrogen bonding interactions also contribute to the changes; however, it is difficult to assess the magnitude of their individual contributions.

Separation and efficiency have to be considered together and not as separate column attributes, as each contributes to peak resolution. When the stationary phase provides adequate resolution between peaks, higher efficiency is not needed. Shorter or larger diameter columns and less than optimal GC conditions can be used in these situations. When resolution is not adequate, there is a need for higher column efficiency.

**Figure 6: Polarity – Retention Relationship**

Column: 15 m x 0.25 mm, 0.25  $\mu$ m



The alcohols (polar) increase in retention relative to hydrocarbon (non-polar) for the DB-225 column. DB-225 is more polar than DB-1.

In addition to retention, stationary phase polarity influences other column characteristics. There is a general trend between stationary phase polarity and column lifetime, temperature limits, bleed and efficiency. Column life, temperature limits and efficiency tend to be higher for more non-polar stationary phases. These are general trends and not absolute certainties. Low bleed stationary phases sometimes go against this trend.

**Table 3: Stationary Phase Polarity**

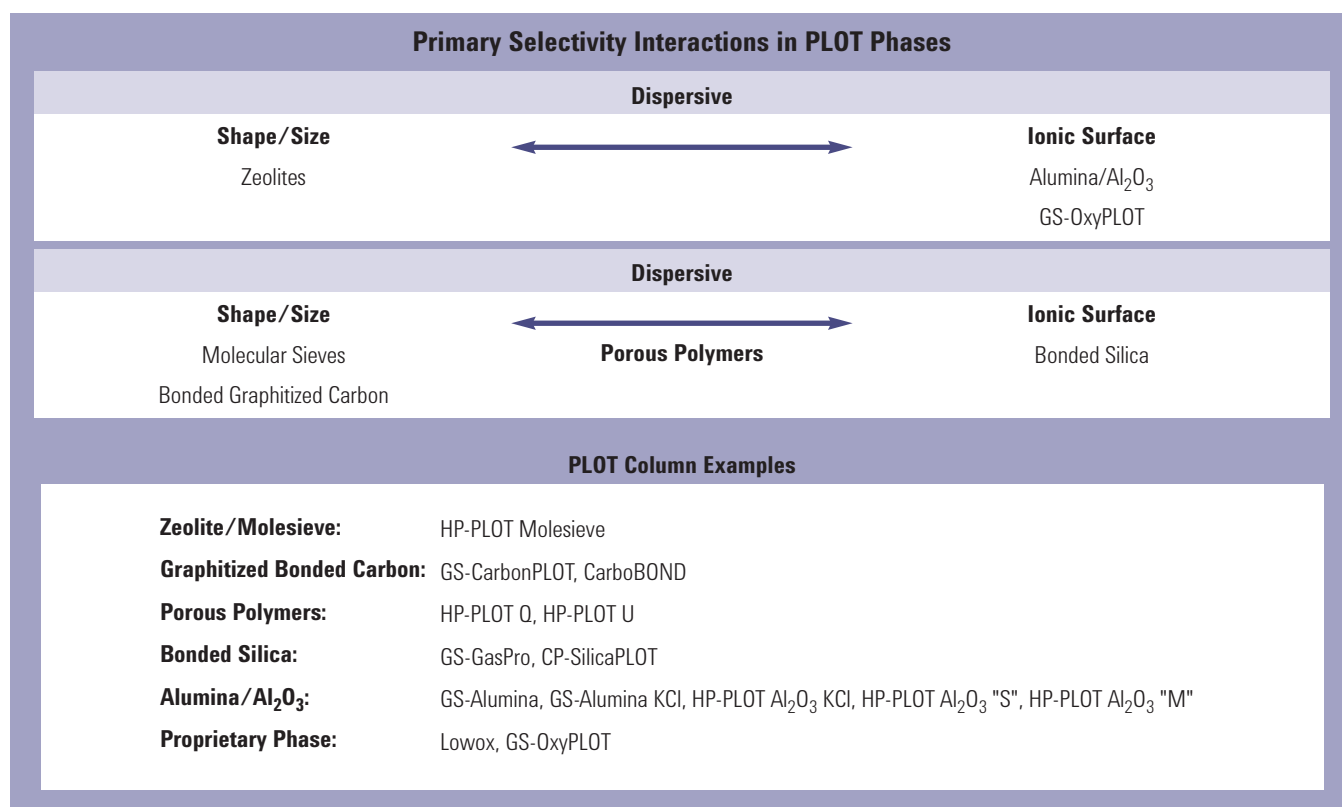
Low Polarity			Mid Polarity			High Polarity		
CP-Sil 2	DB & HP-1ms UI	DB & HP-5ms UI	DB-XLB	DB-225ms	DB-ALC1	HP-88	DB-WAX	CP-TCEP
DB-MTBE	DB & HP-1ms	DB & HP-5ms	VF-Xms	DB-225	DB-Dioxin	CP-Sil 88	DB-WAXetr	
CP-Select CB MTBE	VF-1 ms	VF-5ms	DB-35ms UI	CP-Sil 43 CB	DB-200	DB-23	HP-INNOWax	
	DB & HP-1	DB & HP-5	DB & VF-35ms	VF-1701 ms	VF-200ms	VF-23 ms	VF-WAXms	
	CP-Sil 5 CB	CP-Sil 8 CB	DB & HP-35	DB-1701	DB-210		CP-Wax 57 CB	
	Ultra 1	Ultra 2	DB & VF-17ms	CP-Sil 19 CB	DX-4		DB & HP-FFAP	
	DB-1ht	VF-DA	DB-17	DB-ALC2			DB-WAX FF	
	DB-2887	DB-5.625	HP-50+	DX-1			CP-FFAP CB	
	DB-Petro/PONA	DB & VF-5ht	DB-17ht				CP-WAX 58 FFAP CB	
	CP-Sil PONA CB	CP-Sil PAH CB	DB-608				CP-WAX 52 CB	
	DB-HT SimDis	Select Biodiesel	DB-TPH				CP-WAX 51	
	CP-SimDis	SE-54	DB-502.2				CP-Carbowax 400	
	CP-Volamine		HP-VOC				Carbowax 20M	
	Select Mineral Oil		DB-VRX				HP-20M	
	HP-101		DB-624				CAM	
	SE-30		DB-624ms/UI					
	DB-Sulfur SCD		VF-624ms					
			DB-Select 624 UI					
			DB-1301					
			VF-1301ms					
			CP-Sil 13 CB					

## Gas-Solid or PLOT Columns

PLOT (Porous Layer Open Tubular) columns are intended for the separation of very volatile solutes (primarily gases) without the need for cryogenic or sub-ambient cooling of the oven. Separations that would require column temperatures below 35 °C, even with thick film liquid stationary phase can be obtained at temperatures above 35 °C with PLOT columns.

Gas-solid or PLOT column stationary phases are physically different than polysiloxanes and polyethylene glycols. Gas-solid stationary phase are small, porous particles. The particles are stuck to the inner wall of the capillary tubing using a binder or similar means. Solute are separated based on differences in their adsorption properties. Since the particles are porous, size and shape differentiation also occurs.

Alumina PLOT columns are well suited for the separation of C<sub>1</sub>-C<sub>10</sub> hydrocarbons and small aromatics. The KCl version of the Alumina PLOT column changes the retention order for some of the hydrocarbons. The PLOT Q column provides slightly better separation for C<sub>1</sub>-C<sub>3</sub> hydrocarbons, but C<sub>4</sub> and higher hydrocarbons are better separated with an Alumina PLOT column. PLOT Q exhibits extremely long retention times and very broad peaks for C<sub>6</sub> and higher hydrocarbons and aromatics. PLOT Q separates sulfur gases from each other and from most light hydrocarbons. Molesieve PLOT columns are used to separate many noble and permanent gases. GS-GasPro columns combine many of the features of the various other PLOT columns. Light hydrocarbons, inorganic gases and solvents are some of the samples suitable for GS-GasPro.





## Stationary Phase Selection Summary

1. If no information or ideas about which stationary phase to use is available, start with a DB-1 or DB-5.
2. Low-bleed ("ms") columns are usually more inert and have higher temperature limits. Ultra Inert 1ms, 5ms, and 35ms columns provide the lowest column bleed and highest column inertness for a wide range of analytes, including active compounds and trace level samples.
3. Use the least polar stationary phase that provides satisfactory resolution and analysis times. Non-polar stationary phases have superior lifetimes compared to polar phases.
4. Use a stationary phase with a polarity similar to that of the solutes. This approach works more times than not; however, the best stationary phase is not always found using this technique.
5. If poorly separated solutes possess different dipoles or hydrogen bonding strengths, change to a stationary phase with a different amount (not necessarily more) of the dipole or hydrogen bonding interaction. Other co-elutions may occur upon changing the stationary phase, thus the new stationary phase may not provide better overall resolution.
6. If possible, avoid using a stationary phase that contains a functionality that generates a large response with a selective detector. For example, cyanopropyl containing stationary phases exhibit a disproportionately large baseline rise (due to column bleed) with NPDs.
7. A DB-1 or DB-5, DB-1701, DB-17, and DB-WAX cover the widest range of selectivities with the smallest number of columns.
8. PLOT columns are used for the analysis of gaseous samples at above ambient column temperatures.

### 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](http://www.agilent.com/chem/GCsupplies)



**Table 4:**  
**Column Efficiency vs. Diameter**

Column ID Diameter (mm)	Theoretical Plates/Meter
0.10	12,500
0.18	6,600
0.20	5,940
0.25	4,750
0.32	3,710
0.45	2,640
0.53	2,240

Maximum efficiency for a solute with  $k=5$ 

## Column Diameter

Column diameter has an influence over five parameters of primary concern. They are efficiency, retention, pressure, carrier gas flow rate, and capacity.

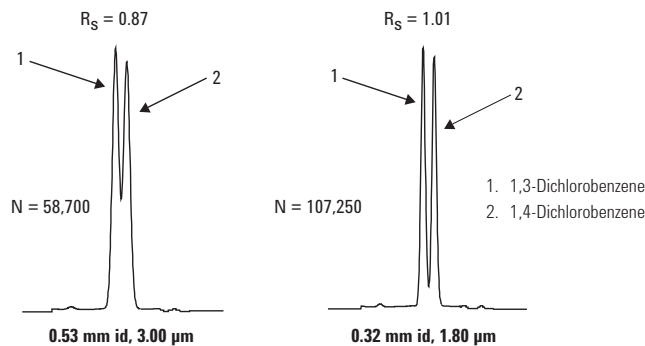
**Column efficiency** ( $N/m$ ) is inversely proportional to column diameter. The efficiencies listed in **Table 4** show that smaller diameter columns have higher theoretical plates per meter. Resolution is a square root function of the theoretical plate number. Therefore, doubling column efficiency theoretically increases resolution only by 1.41 times (the square root of 2), but closer to 1.2-1.3 times in real practice. Smaller diameter columns are used when peak separation is small and high column efficiency (i.e., narrow peaks) is needed. **Figure 7** shows the difference in resolution for two different diameter columns.

**Solute retention** is inversely proportional to column diameter, for isothermal temperature conditions. For temperature program conditions, the change is  $1/3-1/2$  of the isothermal value. Column diameters are rarely selected based on retention. **Figure 7** shows the difference in retention for two different diameter columns.

**Column head pressure** is approximately an inverse squared function of the column radius. For example, a 0.25 mm id column requires about 1.7 times the head pressure of a 0.32 mm id column of the same length (also, carrier gas and temperature). Column head pressures increase or decrease dramatically with changes in column diameter. Column diameters of 0.18 mm id or larger are used for standard GC analysis due to the very high pressures needed for smaller diameter columns. Wider diameter columns, especially shorter ones (e.g., 15 m x 0.32 mm id), are impractical for use in GC/MS systems. The vacuum at the exit of the column greatly reduces the required head pressure, and it is difficult to maintain or control very low head pressures.

**Figure 7: Column Diameter – Comparison of Resolution and Retention**

Column: DB-624, 30 m



At constant pressure, **carrier gas flow rates** increase as column diameters increase. For applications or hardware requiring high flow rates, larger diameter columns are normally used. Headspace and purge & trap systems require higher carrier gas flow rates for proper operation. 0.45 or 0.53 mm id columns are used with these systems so that the higher flow rates can be used. Special considerations must be taken if small diameter columns are used in these types of systems. This includes the use of cryogenic interfaces or ovens, or interfacing through split injectors. Added complexity and/or cost, or sample loss, are involved with these techniques. For applications or hardware requiring low carrier gas flow rates, smaller diameter columns are normally used. GC/MS is the typical system requiring low carrier gas flow rates, and therefore, 0.25 mm id and smaller id columns are used in these applications.

**Column capacity** increases as the column diameter increases. The actual column capacity also depends on the stationary phase, solute and film thickness. **Table 5** lists typical capacity ranges for a variety of column diameters.

**Table 5: Column Capacity in ng**

Film Thickness (µm)	Column Inside Diameter (mm)			
	0.18-0.20	0.25	0.32	0.53
0.10	20-35	25-50	35-75	50-100
0.25	35-75	50-100	75-125	100-250
0.50	75-150	100-200	125-250	250-500
1.00	150-250	200-300	250-500	500-1000
3.00		400-600	500-800	1000-2000
5.00		1000-1500	1200-2000	2000-3000

## Column Diameter Selection Summary

1. Use **0.15, 0.18 or 0.25 mm id columns** when higher column efficiencies are needed. 0.15 and 0.18 mm id columns are especially well suited for GC/MS systems with low pumping capacities. Smaller diameter columns have the lowest capacities and require the highest head pressures.
2. Use **0.32 mm id columns** when higher sample capacity is needed. They often provide better resolution of earlier eluting solutes for splitless injections or large injection volumes (>2 µL) than 0.25 mm id columns.
3. Use **0.45 mm id columns** when only a Megabore direct injector is available and higher column efficiency is desired. Well suited for high carrier gas flow rate situations, such as with purge & trap, headspace samplers, and valve injection applications.
4. Use **0.53 mm id columns** when only a Megabore direct injector is available. Well suited for high carrier gas flow rate situations, such as with purge & trap and headspace samplers. 0.53 mm id columns have the highest sample capacities at constant  $d_f$ .



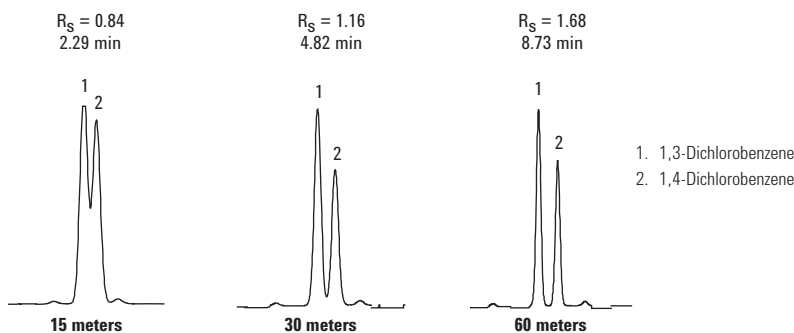
## Column Length

Column length influences three parameters of major concern. They are efficiency, retention (analysis time) and carrier gas pressure.

**Column efficiency (N)** is proportional to column length. Resolution is a square root function of the theoretical plate number. For example, doubling column length (thus efficiency) theoretically increases resolution by only 1.41 times (closer to 1.2-1.3 times in practice). Longer columns are used when peak separation is small and high column efficiency (i.e., narrow peaks) is needed. **Figure 8** shows the difference in resolution for three different lengths.

**Figure 8: Column Length – Comparison of Resolution and Retention**

**Column:** DB-624  
 15 m x 0.53 mm, 0.30 μm  
 30 m x 0.53 mm, 0.30 μm  
 60 m x 0.53 mm, 0.30 μm



**Solute retention** is proportional to column length for isothermal temperature conditions. For temperature program conditions, the change is 1/3-1/2 of the isothermal value. When efficiency is increased by lengthening the column, there is a significant increase in analysis time. **Figure 8** shows the difference in retention for three different lengths.

**Column head pressure** is nearly proportional to column length. Pressure is usually not an issue unless the column has a very small or large diameter. Long, small diameter columns require extremely high head pressures, and short, wide diameter columns require very low head pressures. Neither situation is very practical and may be a limiting factor. Choice of carrier gas will also have an impact on column pressure.

**Column bleed** increases as column length increases. Longer columns have more stationary phase, thus more degradation products are produced. The increase in bleed with longer columns is not large and should not be a deterrent to using a longer column when one is necessary.

**Column cost** is directly related to column length. Doubling column length nearly doubles the price of the column. When efficiency is increased by lengthening the column, there is a significant increase in column cost. When considered in conjunction with the increase in analysis time, lengthening the column should be the last reasonable option for increasing efficiency.

Shorter columns cost more per meter than longer columns. Cutting longer columns into shorter lengths seems like a good method to save money, but it is not recommended. The quality of the smaller pieces cannot be guaranteed and may not be the same as the original, intact column. Theoretically, each piece should provide satisfactory and consistent results. In practice, this does not always occur. The probability of individual piece variation is higher when shorter pieces are cut from the original column. Greater variability between individual pieces is observed as column length, film thickness and stationary phase polarity increases, and column diameter decreases. Finally, there is the increased chance of tubing breakage when rewinding the shorter columns on other cages. Technically, cutting a column into shorter pieces voids the performance warranty.

## Column Length Selection Summary

1. Start with **25-30 meter columns** when the best length is unknown.
2. **10-15 meter columns** are well suited for samples containing very well separated solutes or very few solutes. Shorter lengths are used for very small diameter columns to reduce head pressures.
3. **50-60 meter columns** should be used when resolution is not possible by other means (smaller diameter, different stationary phase, change in column temperature). Best suited for complex samples containing a large number of solutes. Long columns have long analysis times and higher cost.

## Column Film Thickness

Column film thickness influences five major parameters: retention, resolution, bleed, inertness and capacity.

For isothermal conditions, solution retention is directly proportional to film thickness. For temperature program conditions, the change is 1/3-1/2 of the isothermal value. Thicker film columns are used to obtain higher retention for very volatile solutes. Volatile solutes normally requiring cryogenic (subambient) cooling with standard film thickness columns can be sufficiently retained at temperatures above 30 °C. Changing to a thicker film column has a net effect of providing equal or greater retention at a higher column temperature. Thicker film columns are typically used for volatile compounds like solvents and select gases. Thinner film columns are used to reduce the retention of highly retained solutes. Highly retained solutes can be eluted faster or at a lower temperature. Changing to a thinner film column has the net effect of providing equal or less retention at a lower column temperature. Thinner film columns are typically used for high boiling or molecular weight compounds. **Figure 9** shows the difference in retention for two different film thicknesses.

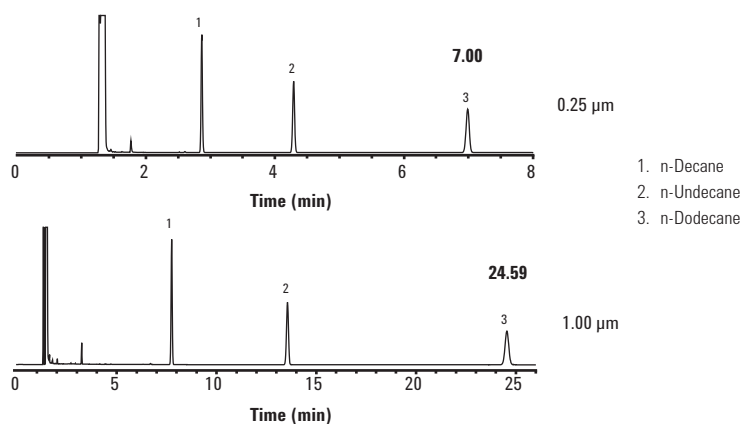
Solutes with  $k$  values less than 2 are very difficult to resolve due to insufficient retention by the column. Changing to a thicker film column results in better resolution since solute retention is increased. The resolution improvement depends on the solute  $k$  value for the original column. For solutes with  $k$  values of about 5 or less, increasing their retention results in improved resolution. For solute peaks with values of 5-10, increasing their retention provides a small to moderate increase in resolution. For peaks with  $k$  values above 10, increasing their retention often results in no resolution improvement and sometimes a loss of resolution. Increasing film thickness to improve the resolution of early eluting peaks may result in a resolution loss for later eluting peaks.

**Figure 9: Column Film Thickness – Comparison of Resolution and Retention**

**Column:** DB-1, 30 m x 0.32 mm

**Carrier:** Helium at 38 cm/s

**Oven:** 100 °C isothermal



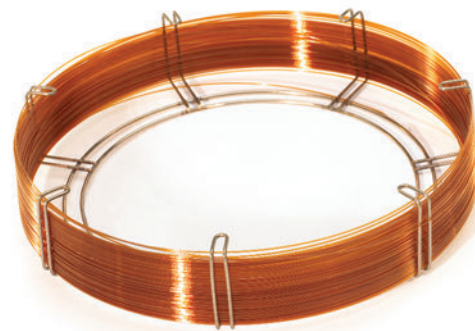
For a given stationary phase, column bleed increases as film thickness increases. Since thicker film columns are more retentive, later eluting peaks may shift into a region of much higher column bleed when increasing film thickness. The upper temperature limits of thick film columns may be lower due to their higher bleed levels.

Thicker film columns are more inert. There is more stationary phase to shield the solutes from the tubing surface. Peak tailing for active compounds can often be reduced or eliminated with a thicker film column.

Thicker film columns have higher solute capacities. When one solute is present in significantly higher amounts, the resulting broad peak may interfere or co-elute with an adjacent peak. Changing to a thicker film column may reduce peak broadening, thus co-eluting. **Table 5** lists typical capacity ranges for a variety of film thickness.

## Column Film Thickness Selection Summary

1. For **0.18-0.32 mm id columns**, a film thickness of 0.18-0.25  $\mu\text{m}$  is average or standard (i.e., not thin or thick) and used for most analyses.
2. For **0.45-0.53 mm id columns**, a film thickness of 0.8-1.5  $\mu\text{m}$  is average or standard (i.e., not thin or thick) and used for most analyses.
3. **Thick film columns** are used to retain and resolve volatile solutes (e.g., light solvents, gases). Thick columns are more inert and have higher capacities. Thick film columns exhibit higher column bleed and decreased upper temperature limits.
4. **Thin film columns** are used to minimize the retention of high boiling, high molecular weight solutes (e.g., steroids, triglycerides). Thin film columns are less inert, have lower capacities and exhibit lower column bleed.



## GC Column Application and Method Guides

Application	Specific Application	Agilent Phases
Biodiesel	EN14105 Free/Total Glycerin	Biodiesel, Select Biodiesel
	ASTM D6584 Free/Total Glycerin	Biodiesel, Select Biodiesel
	EN14103 FAME Analysis	Biodiesel, Select Biodiesel
	EN14110 Residual Methanol	Biodiesel, Select Biodiesel
	EN14106 Free Glycerol	Select Biodiesel
Chiral	Chiral $\gamma$ -lactones and terpenes	CycloSil-B
	Optical isomers of acids, alcohols, amino acids, aromatic hydrocarbons, diols, flavors, aromas, ketones, organic acids and phenols	Cyclodex-B
	Chiral compounds using a nitrogen selective detector	HP-Chiral $\beta$
	Optical isomers of acids, alcohols, amino acids, aromatic, diols, flavor, aromas, ketones, organic acids and phenols	CP-Chirasil-Dex CB, CP-Cyclodextrin- $\beta$ -2,3,6-M-19
	Amino acids, optical isomers	CP-Chirasil-Dex CB, CP-Cyclodextrin- $\beta$ -2,3,6-M-19
Foods, Flavors and Fragrances	FAME up to C <sub>26</sub> , cis, trans, fast resolution FAME	Select FAME
	Best separation for cis, trans FAME analyses up to 260 °C	HP-88, CP-Sil 88 for FAME
	Volatiles	CP-Carbowax 400 for Volatiles in Alcohol
	Unsaturated triglycerides	CP-TAP CB for Triglycerides
	Flavors, aromas, free fatty acids C <sub>1</sub> -C <sub>26</sub>	DB-WAX, HP-WAX, CP-FFAP CB
	Glycols, diols, alcohols	CP-Wax 57 CB for Glycols and Alcohols, DB-WAX
Life Sciences	Blood alcohol analysis	DB-ALC1 and DB-ALC2
	Drugs of abuse confirmation	DB-5ms EVDX
	USP solvents, common solvents	DB-Select 624UI for <467>, DB-624, VF-624ms
	Drugs of abuse confirmation	DB-35ms Ultra Inert, VF-DA
Pesticides	Organochlorine pesticides and PCBs	DB-CLP1 and DB-CLP2, DB-35ms Ultra Inert, DB-17ms, DB-XLB
	Chlorinated pesticides and PCBs	DB-608
	Trace levels of pesticides in food and environmental samples	DB-35ms Ultra Inert, DB-XLB, VF-1701 Pesticides, DB-1701P
	Chlorinated, nitrogen, phosphorus pesticides	CP-Sil 8 CB for Pesticides, DB-35ms Ultra Inert, DB-5ms Ultra Inert
	Chlorinated, nitrogen, phosphorus pesticides, trace level DDT and Endrin	CP-Sil 19 CB for Pesticides, DB-35ms, DB-XLB

(Continued)



Application	Specific Application	Agilent Phases	
Polycyclic Aromatic Hydrocarbons	EU regulated PAHs	DB-EUPAH	
	PAHs in environmental and food samples	Select PAH	
	C <sub>5</sub> -C <sub>80</sub> , PAH and polar compounds	CP-Sil PAH CB UltiMetal	
	EU and EPA regulated PAHs	VF-17ms for PAH	
Petroleum	Simulated distillation using ASTM Method D2887	DB-2887	
	C <sub>5</sub> -C <sub>120</sub> simulated distillation	DB-HT SimDis, CP-SimDist UltiMetal	
	PONA and PIANO analysis	HP-PONA, DB-Petro, CP-Sil PONA CB	
	ASTM D5134	CP-Sil PONA for ASTM D5134	
	C <sub>1</sub> -C <sub>10</sub> hydrocarbons	Select Al <sub>2</sub> O <sub>3</sub> MAPD, Alumina PLOT PT family	
	C <sub>1</sub> -C <sub>6</sub> alcohols, aromatic C <sub>6</sub> -C <sub>10</sub>	CP-TCEP for Alcohols in Gasoline	
	Sulfur impurities in propylene streams	DB-Select SCD, Select Low Sulfur	
	Polar and non-polar volatile compounds, especially chlorosilanes with different substituents such as alkyl groups, or groups with ether, hydroxy and nitrile bonds	Select Silanes	
	C <sub>1</sub> -C <sub>6</sub> amines, alcohols, NH <sub>3</sub> , water, solvents, ethanol amines	CP-Volamine	
	C <sub>3</sub> -C <sub>20</sub> amines, alkanol amines	CP-Sil 8 CB for Amines	
	C <sub>3</sub> -C <sub>8</sub> amines and diamines	CP-Wax for Volatile Amines and Diamines	
	C <sub>4</sub> -C <sub>10</sub> amines, diamines and aromatic amines	CP-Wax 51 for Amines	
	Oxygenates in C <sub>1</sub> -C <sub>10</sub> hydrocarbons	CP-Lowox, GS-OxyPLOT	
	C <sub>1</sub> -C <sub>10</sub> hydrocarbons	GS-OxyPLOT	
	Methanol, formaldehyde and formic acid in water	CP-Sil 5 CB for Formaldehyde	
	C <sub>1</sub> -C <sub>12</sub> hydrocarbons	CP-Squalane	
	Volatile oxygenates and halogenated hydrocarbons	CP-Propox	
	Semivolatiles	Polychlorinated dibenzodioxins (PCDDs) and dibenzofurans (PCDFs)	DB-Dioxin
		Dioxins and dibenzo furan	CP-Sil 88 for Dioxins, DB-Dioxin
EPA Semivolatiles Methods 625, 1625, 8270 and CLP protocols		DB-UI 8270D, DB-5ms Ultra Inert, DB-5.625, HP-5ms Semivolatile	
PCB, detailed analysis		CP-Sil 5/C18 CB for PCB	
PCB		CP-Sil 8 CB for PCB, DB-XLB	

(Continued)

Application	Specific Application	Agilent Phases
Volatiles	EPA Methods 502.2, 524.2 and 8260	DB-624 Ultra Inert, DB-VRX
	Volatile priority pollutants and residual solvents	DB-624 Ultra Inert, DB-624, VF-624ms
	Halogenated hydrocarbons and solvents	CP-Select 624 CB
	EPA Methods 502.2, 524.2 and 8260	HP-VOC
	EPA Method 502.2	DB-502.2
	MTBE in soil and water	DB-MTBE
	Oxygenates and solvents	CP-Select CB for MTBE
	Total petroleum hydrocarbons (TPHs), soil analysis, and LUFT	DB-TPH
	C <sub>5</sub> -C <sub>40</sub> hydrocarbons	Select Mineral Oil
Metal	High temperature analysis and process applications	UltiMetal and DB-ProSteel
Non-Bonded	Amino acid derivatives, essential oils	HP-101
	Drugs, glycols, pesticides, steroids	HP-17
	Amines, basic compounds	CAM
	Alcohols, free acids, essential oils, ethers, glycols, solvents	Carbowax 20M and HP-20M
	Generic	SE-30 and SE-54



**TIPS & TOOLS**

Search the application library to find GC applications and standard methods of all types, old and new. To view, please visit [www.agilent.com/chem/library](http://www.agilent.com/chem/library)

## EPA Method

Drinking Water			
EPA Method	Application	Recommended Column	Part No.
501, 501.3	Measurement of trihalomethanes in drinking water by GC/MS and selected ion monitoring	DB-VRX, 30 m x 0.25 mm, 1.40 $\mu$ m	122-1534
		DB-624, 30 m x 0.25 mm, 1.40 $\mu$ m	122-1334
		VF-624ms, 30 m x 0.25 mm, 1.40 $\mu$ m	CP9102
		DB-624 Ultra Inert, 30 m x 0.25 mm, 1.40 $\mu$ m	122-1334UI
502.2	Volatile organic compounds in water by purge and trap capillary column GC with photoionization and electrolytic conductivity detectors in series	DB-VRX, 60 m x 0.25 mm, 1.40 $\mu$ m	122-1564
		DB-624, 60 m x 0.25 mm, 1.40 $\mu$ m	122-1364
		VF-624ms, 60 m x 0.25 mm, 1.40 $\mu$ m	CP9103
		DB-624 Ultra Inert, 60 m x 0.25 mm, 1.40 $\mu$ m	122-1364UI
		VF-624ms, 30 m x 0.25 mm, 1.40 $\mu$ m	CP9102
503.1	Volatile aromatic and unsaturated organic compounds in water by purge and trap gas chromatography	DB-VRX, 30 m x 0.25 mm, 1.40 $\mu$ m	122-1534
		DB-624, 30 m x 0.25 mm, 1.40 $\mu$ m	122-1334
504.1	1,2-Dibromoethane (EDB) and 1,2-dibromo-3-chloropropane (DB CP), GC, microextraction	DB-CLP1, 30 m x 0.32 mm, 0.25 $\mu$ m	123-8232
		DB-CLP2, 30 m x 0.32 mm, 0.50 $\mu$ m	123-8336
		DB-VRX, 30 m x 0.25 mm, 1.40 $\mu$ m	122-1534
		DB-624, 30 m x 0.25 mm, 1.40 $\mu$ m	122-1334
		DB-624 Ultra Inert, 30 m x 0.25 mm, 1.40 $\mu$ m	122-1334UI
		VF-1ms, 30 m x 0.32 mm, 1.00 $\mu$ m	CP8926
505	Analysis of organohalide pesticides and commercial polychlorinated biphenyl (PCB) products in water by microextraction and GC	VF-1701ms, 30 m x 0.32 mm, 1.00 $\mu$ m	CP9163
		DB-CLP1, 30 m x 0.32 mm, 0.25 $\mu$ m	123-8232
		DB-CLP2, 30 m x 0.32 mm, 0.50 $\mu$ m	123-8336
		DB-XLB, 30 m x 0.25 mm, 0.50 $\mu$ m	122-1236
		VF-1ms, 30 m x 0.32 mm, 1.00 $\mu$ m	CP8926
506	Determination of phthalate and adipate esters in drinking water by liquid-liquid extraction or liquid-solid extraction and GC with photoionization detection	VF-17ms, 30 m x 0.32 mm, 0.50 $\mu$ m	CP8991
		DB-5ms, 30 m x 0.25 mm, 0.25 $\mu$ m	122-5532
		VF-5ms, 30 m x 0.32 mm, 0.25 $\mu$ m	CP8955
507	Determination of nitrogen and phosphorus-containing pesticides in water by GC with a nitrogen phosphorus detector	VF-1ms, 30 m x 0.32 mm, 0.25 $\mu$ m	CP8924
		DB-35ms, 30 m x 0.25 mm, 0.25 $\mu$ m	122-3832
		DB-5ms, 30 m x 0.25 mm, 0.25 $\mu$ m	122-5532
		VF-5 Pesticides, 30 m x 0.25 mm, 0.25 $\mu$ m	CP9074
		VF-1701 Pesticides, 30 m x 0.25 mm, 0.25 $\mu$ m	CP9070

(Continued)

Drinking Water

EPA Method	Application	Recommended Column	Part No.
508	Determination of chlorinated pesticides in water by GC with an electron capture detector	DB-CLP1, 30 m x 0.32 mm, 0.25 µm	123-8232
		DB-CLP2, 30 m x 0.32 mm, 0.50 µm	123-8336
		DB-35ms Ultra Inert, 30 m x 0.32 mm, 0.25 µm	123-3832UI
		DB-XLB, 30 m x 0.32 mm, 0.50 µm	123-1236
		DB-608, 30 m x 0.32 mm, 0.50 µm	123-1730
		VF-5 Pesticides, 30 m x 0.25 mm, 0.25 µm	CP9074
		VF-1701 Pesticides, 30 m x 0.25 mm, 0.25 µm	CP9070
508.1	Determination of chlorinated pesticides, herbicides, and organohalides by liquid-solid extraction and electron capture GC	DB-CLP1, 30 m x 0.32 mm, 0.25 µm	123-8232
		DB-CLP2, 30 m x 0.32 mm, 0.50 µm	123-8336
		DB-35ms Ultra Inert, 30 m x 0.32 mm, 0.25 µm	123-3832UI
		DB-XLB, 30 m x 0.32 mm, 0.50 µm	123-1236
		VF-5 Pesticides, 30 m x 0.25 mm, 0.25 µm	CP9074
515	Determination of chlorinated herbicides in drinking water	DB-35ms Ultra Inert, 30 m x 0.32 mm, 0.25 µm	123-3832UI
		DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-5532UI
		HP-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	19091S-433UI
		DB-1701, 30 m x 0.25 mm, 0.25 µm	122-0732
515.3	Determination of chlorinated acids in drinking water by liquid-liquid extraction, derivatization and GC with electron capture detection	DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-5532UI
		HP-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	19091S-433UI
		DB-1701, 30 m x 0.25 mm, 0.25 µm	122-0732
		VF-1701ms, 30 m x 0.25 mm, 0.25 µm	CP9151
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
515.4	Determination of chlorinated acids in drinking water by liquid-liquid microextraction, derivatization, and fast GC with electron capture detection	DB-5ms Ultra Inert, 20 m x 0.18 mm, 0.18 µm	121-5522UI
		HP-5ms Ultra Inert, 20 m x 0.18 mm, 0.18 µm	19091S-577UI
		DB-1701, 20 m x 0.18 mm, 0.18 µm	121-0722
		VF-1701ms, 30 m x 0.25 mm, 0.25 µm	CP9151
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
521	Determination of nitrosamines in drinking water by solid phase extraction and capillary column gas chromatography with large volume injection and chemical ionization tandem mass spectrometry (MS/MS)	DB-5ms Ultra Inert, 30 m x 0.25 mm, 1.00 µm	122-5533UI
		HP-5ms Ultra Inert, 30 m x 0.25 mm, 1.00 µm	19091S-233UI
		VF-5ms, 30 m x 0.25 mm, 1.00 µm	CP8946

(Continued)

## Drinking Water

EPA Method	Application	Recommended Column	Part No.
524.2	Measurement of purgeable organic compounds in water by capillary GC/MS	DB-VRX, 60 m x 0.25 mm, 1.40 µm	122-1564
		DB-624, 60 m x 0.25 mm, 1.40 µm	122-1364
		DB-624 Ultra Inert, 60 m x 0.25 mm, 1.40 µm	122-1364UI
		HP-VOC, 60 m x 0.20 mm, 1.10 µm	19091R-306
		DB-VRX, 20 m x 0.18 mm, 1.00 µm	121-1524
		DB-624, 20 m x 0.18 mm, 1.00 µm	121-1324
		DB-624 Ultra Inert, 60 m x 0.25 mm, 1.40 µm	122-1364UI
		VF-624ms, 30 m x 0.25 mm, 1.40 µm	CP9102
		VF-624ms, 60 m x 0.25 mm, 1.40 µm	CP9103
525, 525.2	Determination of organic compounds in drinking water by liquid-solid extraction and capillary column GC/MS	HP-5ms, 30 m x 0.25 mm, 0.50 µm	19091S-133
		VF-5 Pesticides, 30 m x 0.25 mm, 0.25 µm	CP9074
526	Determination of selected semivolatile organic compounds in drinking water by solid phase extraction and capillary column GC/MS	DB-5ms, 30 m x 0.25 mm, 0.25 µm	122-5532
		HP-5ms, 30 m x 0.25 mm, 0.25 µm	19091S-433
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
527	Determination of selected pesticides and flame retardants in drinking water by solid phase extraction and capillary column GC/MS	DB-5ms, 30 m x 0.25 mm, 0.25 µm	122-5532
		HP-5ms, 30 m x 0.25 mm, 0.25 µm	19091S-433
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
528	Determination of phenols in drinking water by solid phase extraction and capillary column GC/MS	DB-5ms, 30 m x 0.25 mm, 0.25 µm	122-5532
		DB-XLB, 30 m x 0.25 mm, 0.25 µm	122-1232
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
529	Determination of explosives and related compounds in drinking water by solid phase extraction and capillary column GC/MS	DB-5ms Ultra Inert, 15 m x 0.25 mm, 0.25 µm	122-5512UI
		HP-5ms Ultra Inert, 15 m x 0.25 mm, 0.25 µm	19091S-431UI
		VF-5ms, 15 m x 0.25 mm, 0.25 µm	CP8939
551	Determination of chlorination disinfection byproducts and chlorinated solvents in drinking water by liquid-liquid extraction and gas chromatography with electron capture detection	DB-5ms, 30 m x 0.25 mm, 1.00 µm	122-5533
		DB-1, 30 m x 0.25 mm, 1.00 µm	122-1033
		DB-210, 30 m x 0.25 mm, 0.50 µm	122-0233
		VF-1301ms, 30 m x 0.25 mm, 1.00 µm	CP9054
551.1	Determination of chlorination disinfection byproducts, chlorinated solvents, and halogenated pesticides/herbicides in drinking water by liquid-liquid extraction and GC with electron capture detection	DB-5ms, 30 m x 0.25 mm, 1.00 µm	122-5533
		DB-1, 30 m x 0.25 mm, 1.00 µm	122-1033
		DB-1301, 30 m x 0.25 mm, 1.00 µm	122-1333
		VF-1ms, 30 m x 0.25 mm, 1.00 µm	CP8913
		VF-1301ms, 30 m x 0.25 mm, 1.00 µm	CP9054

(Continued)

Drinking Water

EPA Method	Application	Recommended Column	Part No.
552	Determination of haloacetic acids in drinking water by liquid-liquid extraction, derivatization, and gas chromatography with electron capture detection	DB-35ms Ultra Inert, 30 m x 0.32 mm, 0.25 µm	123-3832UI
		DB-XLB, 30 m x 0.32 mm, 0.50 µm	123-1236
		DB-1701, 30 m x 0.25 mm, 0.25 µm	122-0732
		DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-5532UI
		HP-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	19091S-433UI
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
552.1	Determination of haloacetic acids and dalapon in drinking water by ion-exchange liquid-solid extraction and gas chromatography with an electron capture detector	DB-CLP1, 30 m x 0.32 mm, 0.25 µm	123-8232
		DB-CLP2, 30 m x 0.32 mm, 0.50 µm	123-8336
		DB-35ms Ultra Inert, 30 m x 0.32 mm, 0.25 µm	123-3832UI
		DB-XLB, 30 m x 0.32 mm, 0.50 µm	123-1236
552.2	Determination of haloacetic acids and dalapon in drinking water by liquid-liquid extraction, derivatization GC with electron capture detection	DB-CLP1, 30 m x 0.32 mm, 0.25 µm	123-8232
		DB-CLP2, 30 m x 0.32 mm, 0.50 µm	123-8336
		DB-35ms Ultra Inert, 30 m x 0.32 mm, 0.25 µm	123-3832UI
		DB-XLB, 30 m x 0.32 mm, 0.50 µm	123-1236
		VF-1701ms, 30 m x 0.25 mm, 0.25 µm	CP9151
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
552.3	Determination of haloacetic acids and dalapon in drinking water by liquid-liquid microextraction, derivatization, and GC with electron capture detection	DB-CLP1, 30 m x 0.32 mm, 0.25 µm	123-8232
		DB-CLP2, 30 m x 0.32 mm, 0.50 µm	123-8336
		DB-5ms, 30 m x 0.25 mm, 0.25 µm	122-5532
		DB-1701, 30 m x 0.25 mm, 0.25 µm	122-0732
		VF-1701ms, 30 m x 0.25 mm, 0.25 µm	CP9151
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
556	Determination of carbonyl compounds in drinking water by pentafluorobenzylhydroxylamine derivatization and capillary GC with electron capture detection	DB-5ms, 30 m x 0.25 mm, 0.25 µm	122-5532
		DB-1701, 30 m x 0.25 mm, 0.25 µm	122-0732
		VF-1701ms, 30 m x 0.25 mm, 0.25 µm	CP9151
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944

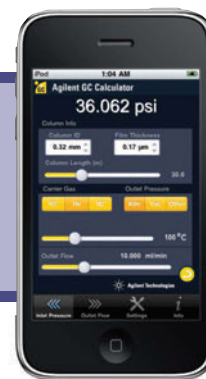
## Waste Water

EPA Method	Application	Column	Part No.
601	Purgeable halocarbons	DB-VRX, 60 m x 0.25 mm, 1.40 $\mu$ m	122-1564
		DB-624, 75 m x 0.45 mm, 2.55 $\mu$ m	124-1374
		DB-624, 60 m x 0.25 mm, 1.40 $\mu$ m	122-1364
		VF-624ms, 75 m x 0.53 mm, 3.00 $\mu$ m	CP9108
		VF-624ms, 60 m x 0.32 mm, 1.80 $\mu$ m	CP9105
		VF-5ms, 30 m x 0.25 mm, 0.25 $\mu$ m	CP8944
602	Purgeable aromatics	DB-624, 75 m x 0.53 mm, 3.00 $\mu$ m	125-1374
		DB-624, 30 m x 0.25 mm, 1.40 $\mu$ m	122-1334
		DB-VRX, 30 m x 0.25 mm, 1.40 $\mu$ m	122-1534
		VF-624ms, 75 m x 0.53 mm, 3.00 $\mu$ m	CP9108
		VF-5ms, 30 m x 0.25 mm, 0.25 $\mu$ m	CP8944
		VF-624ms, 30 m x 0.25 mm, 1.40 $\mu$ m	CP9102
603	Acrolein and acrylonitrile	DB-624, 30 m x 0.25 mm, 1.40 $\mu$ m	122-1334
		DB-VRX, 30 m x 0.25 mm, 1.40 $\mu$ m	122-1534
		VF-WAXms, 30 m x 0.25 mm, 1.00 $\mu$ m	CP9206
		VF-624ms, 30 m x 0.25 mm, 1.40 $\mu$ m	CP9102
604	Phenols	DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 $\mu$ m	122-5532UI
		DB-XLB, 30 m x 0.25 mm, 0.25 $\mu$ m	122-1232
		VF-5ms, 60 m x 0.32 mm, 1.80 $\mu$ m	CP9105
		VF-5ms, 30 m x 0.25 mm, 0.25 $\mu$ m	CP8944
605	Benzidines	DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 $\mu$ m	122-5532UI
		DB-608, 30 m x 0.25 mm, 0.25 $\mu$ m	122-6832
606	Phthalate esters	DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 $\mu$ m	122-5532UI
		DB-608, 30 m x 0.25 mm, 0.25 $\mu$ m	122-6832
		VF-5ms, 30 m x 0.25 mm, 0.25 $\mu$ m	CP8944
607	Nitrosamines	DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 $\mu$ m	122-5532UI
		CP-Sil 8 CB for Amines, 30 m x 0.32 mm, 1.00 $\mu$ m	CP7596

(Continued)

## TIPS &amp; TOOLS

Get fast and easy GC pressure and flow calculations at your fingertips with Agilent's GC Calculator Application – [www.agilent.com/chem/gcapp](http://www.agilent.com/chem/gcapp)



Waste Water

EPA Method	Application	Column	Part No.
608	Organochlorine pesticides and PCBs	DB-35ms Ultra Inert, 30 m x 0.32 mm, 0.25 µm	123-3832UI
		DB-XLB, 30 m x 0.32 mm, 0.50 µm	123-1236
		DB-17ms, 30 m x 0.32 mm, 0.25 µm	123-4732
		VF-5 Pesticides, 30 m x 0.25 mm, 0.25 µm	CP9074
		VF-1701 Pesticides, 30 m x 0.25 mm, 0.25 µm	CP9070
		VF-17ms, 30 m x 0.25 mm, 0.25 µm	CP8982
609	Nitroaromatics and isophorone	HP-5ms, 30 m x 0.25 mm, 0.50 µm	19091S-133
		DB-5ms, 30 m x 0.25 mm, 0.50 µm	122-5536
		DB-608, 30 m x 0.25 mm, 0.25 µm	122-6832
		VF-5ms, 30 m x 0.53 mm, 1.50 µm	CP8976
		VF-5ms, 30 m x 0.25 mm, 0.50 µm	CP8945
610	Polynuclear aromatic hydrocarbons	DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-5532UI
		DB-5ms, 30 m x 0.32 mm, 0.25 µm	123-5532
		DB-17ms, 30 m x 0.25 mm, 0.25 µm	122-4732
		VF-17ms, 30 m x 0.25 mm, 0.25 µm	CP8982
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
611	Haloethers	VF-5ms, 30 m x 0.53 mm, 1.50 µm	CP8976
		VF-5ms, 30 m x 0.25 mm, 0.50 µm	CP8945
612	Chlorinated hydrocarbons	DB-5ms, 30 m x 0.32 mm, 0.50 µm	123-5536
		HP-5ms, 30 m x 0.32 mm, 0.50 µm	19091S-113
		DB-1, 30 m x 0.32 mm, 0.50 µm	123-103E
		VF-5ms, 30 m x 0.25 mm, 0.10 µm	CP8943
		VF-35ms, 30 m x 0.25 mm, 0.25 µm	CP8877
		VF-200ms, 30 m x 0.25 mm, 1.00 µm	CP8860
613	2,3,7,8-Tetrachlorodibenzo-p-dioxin	DB-5ms Ultra Inert, 60 m x 0.25 mm, 0.25 µm	122-5562UI
		CP-Sil 88 for Dioxins, 50 m x 0.25 mm, 0.20 µm	CP7588
		VF-5ms, 60 m x 0.25 mm, 0.10 µm	CP8948
614	The determination of organophosphorus pesticides in municipal and industrial wastewater	DB-35ms, 30 m x 0.25 mm, 0.25 µm	122-3832
		DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-5532UI
615	Chlorinated herbicides	DB-35ms Ultra Inert, 30 m x 0.32 mm, 0.25 µm	123-3832UI
		VF-1701 Pesticides, 30 m x 0.25 mm, 0.25 µm	CP9070
		VF-5 Pesticides, 30 m x 0.25 mm, 0.25 µm	CP9074

(Continued)



## Waste Water

EPA Method	Application	Column	Part No.
619	Triazine pesticides	DB-35ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-3832UI
		DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-5532UI
		VF-17ms, 30 m x 0.25 mm, 0.50 µm	CP8983
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
622	The determination of organophosphorus pesticides in municipal and industrial wastewater	DB-35ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-3832UI
		DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-5532UI
624	Purgeables	DB-VRX, 60 m x 0.25 mm, 1.40 µm	122-1564
		DB-624, 60 m x 0.25 mm, 1.40 µm	122-1364
		HP-VOC, 60 m x 0.20 mm, 1.10 µm	19091R-306
		DB-VRX, 20 m x 0.18 mm, 1.00 µm	121-1524
		DB-624, 20 m x 0.18 mm, 1.00 µm	121-1324
		VF-624ms, 75 m x 0.53 mm, 3.00 µm	CP9108
		VF-624ms, 60 m x 0.32 mm, 1.80 µm	CP9105
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
625	Base/neutrals and acids	HP-5ms Ultra Inert, 30 m x 0.25 mm, 0.50 µm	19091S-133UI
		VF-5 Pesticides, 30 m x 0.25 mm, 0.25 µm	CP9074
		VF-1701 Pesticides, 30 m x 0.25 mm, 0.25 µm	CP9070
		VF-200ms, 30 m x 0.25 mm, 0.25 µm	CP8858
1613	Tetra- through octa-chlorinated dioxins and furans by isotope dilution HRGC/HRMS	DB-5ms Ultra Inert, 60 m x 0.25 mm, 0.25 µm	122-5562UI
		CP-Sil 88 for Dioxins, 50 m x 0.25 mm, 0.20 µm	CP7588
		VF-5ms, 60 m x 0.25 mm, 0.25 µm	CP8960
1624	Volatile organic compounds by isotope dilution GC/MS	DB-624, 60 m x 0.25 mm, 1.40 µm	122-1364
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
1625	Semivolatile organic compounds by isotope dilution GC/MS	DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-5532UI
		HP-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	19091S-433UI
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
8021	Volatile halogenated & aromatic organic compounds	DB-VRX, 60 m x 0.25 mm, 1.40 µm	122-1564
		DB-624, 60 m x 0.25 mm, 1.40 µm	122-1364

Solid Waste			
EPA Method	Application	Column	Part No.
8010	Volatile halogenated organic compounds list by EPA method 8021	DB-VRX, 60 m x 0.25 mm, 1.40 µm	122-1564
		DB-608, 30 m x 0.53 mm, 0.50 µm	125-6837
8011	1,2-Dibromoethane and 1,2-dibromo-3-chloropropane by microextraction and GC	DB-624, 30 m x 0.25 mm, 1.40 µm	122-1334
		DB-624 Ultra Inert, 30 m x 0.25 mm, 1.40 µm	122-1334UI
		DB-VRX, 30 m x 0.25 mm, 1.40 µm	122-1534
		VF-1ms, 30 m x 0.32 mm, 0.25 µm	CP8924
8015	Nonhalogenated organics by GC	DB-624, 30 m x 0.25 mm, 1.40 µm	122-1334
		DB-624 Ultra Inert, 30 m x 0.25 mm, 1.40 µm	122-1334UI
		DB-VRX, 30 m x 0.25 mm, 1.40 µm	122-1534
8015c	Nonhalogenated organics by GC	DB-WAX, 30 m x 0.25 mm, 0.50 µm	122-7033
		DB-5, 30 m x 0.25 mm, 1.00 µm	122-5033
		HP-5, 30 m x 0.25 mm, 1.00 µm	19091J-233
		VF-WAXms, 30 m x 0.53 mm, 1.00 µm	CP9215
		CP-Sil 8 CB, 30 m x 0.53 mm, 1.50 µm	CP8736
8020	Volatile aromatic organic compounds list by EPA method 8021	DB-624, 30 m x 0.25 mm, 1.40 µm	122-1334
		DB-624 Ultra Inert, 30 m x 0.25 mm, 1.40 µm	122-1334UI
		DB-VRX, 30 m x 0.25 mm, 1.40 µm	122-1534
8021, CLP Volamines	Volatile halogenated & aromatic organic compounds	DB-VRX, 60 m x 0.25 mm, 1.40 µm	122-1564
		DB-608, 30 m x 0.53 mm, 0.50 µm	125-6837
8021b	Aromatic and halogenated volatiles by GC	VF-624ms, 60 m x 0.53 mm, 3.00 µm	CP9107
		VF-624ms, 60 m x 0.25 mm, 1.40 µm	CP9103
8031	Acrylonitrile by GC	DB-624, 30 m x 0.25 mm, 1.40 µm	122-1334
		DB-624 Ultra Inert, 30 m x 0.25 mm, 1.40 µm	122-1334UI
		DB-VRX, 30 m x 0.25 mm, 1.40 µm	122-1534
		PoraBOND Q, 25 m x 0.53 mm, 10.00 µm	CP7354
8032	Acrylamide by GC	CP-Wax 58 FFAP CB, 25 m x 0.53 mm, 2.00 µm	CP7654
8033	Acetonitrile by GC with nitrogen phosphorus detection	DB-WAX, 15 m x 0.25 mm, 0.50 µm	122-7013
		HP-INNOWax, 15 m x 0.25 mm, 0.50 µm	19091N-231
		VF-WAXms, 15 m x 0.53 mm, 1.00 µm	CP9226
8040, 8041, 8041a	Phenols by gas chromatography	DB-5ms, 30 m x 0.25 mm, 0.25 µm	122-5532
		DB-XLB, 30 m x 0.25 mm, 0.25 µm	122-1232
		VF-5ms, 30 m x 0.53 mm, 1.50 µm	CP8976
		VF-1701ms, 30 m x 0.53 mm, 1.00 µm	CP9171
		VF-17ms, 30 m x 0.53 mm, 1.00 µm	CP9001

(Continued)

<b>Solid Waste</b>			
<b>EPA Method</b>	<b>Application</b>	<b>Column</b>	<b>Part No.</b>
8060	Phthalate esters	DB-5ms, 30 m x 0.25 mm, 0.25 µm	122-5532
		DB-608, 30 m x 0.53 mm, 0.50 µm	125-6837
8061	Phthalate esters by GC with electron capture detection (GC/ECD)	DB-5ms, 30 m x 0.25 mm, 0.25 µm	122-5532
		DB-608, 30 m x 0.53 mm, 0.50 µm	125-6837
		VF-1701ms, 30 m x 0.53 mm, 1.00 µm	CP9171
8070, 8070a	Nitrosamines by gas chromatography	DB-5ms, 30 m x 0.25 mm, 0.25 µm	122-5532
		CP-Sil 8 CB for Amines, 30 m x 0.53 mm, 1.00 µm	CP7597
		VF-17ms, 30 m x 0.53 mm, 1.50 µm	CP9002
8081, 8081a	Organochlorine pesticides by gas chromatography	DB-CLP1, 30 m x 0.32 mm, 0.25 µm	123-8232
		DB-CLP2, 30 m x 0.32 mm, 0.50 µm	123-8336
		DB-35ms, 30 m x 0.32 mm, 0.25 µm	123-3832
		DB-XLB, 30 m x 0.32 mm, 0.50 µm	123-1236
		VF-5ms, 30 m x 0.25 mm, 1.00 µm	CP8946
		VF-35ms, 30 m x 0.25 mm, 1.00 µm	CP8879
8082, CLP Pesticides, 8082a	Polychlorinated biphenyls (PCBs) by gas chromatography	DB-CLP1, 30 m x 0.32 mm, 0.25 µm	123-8232
		DB-CLP2, 30 m x 0.32 mm, 0.50 µm	123-8336
		DB-35ms, 30 m x 0.32 mm, 0.25 µm	123-3832
		DB-XLB, 30 m x 0.32 mm, 0.50 µm	123-1236
		VF-5ms, 30 m x 0.25 mm, 1.00 µm	CP8946
		VF-35ms, 30 m x 0.25 mm, 1.00 µm	CP8879
8090	Nitroaromatics and isophorone	DB-5ms, 30 m x 0.25 mm, 1.00 µm	122-5533
		DB-608, 30 m x 0.53 mm, 0.50 µm	125-6837
		HP-5ms, 30 m x 0.25 mm, 0.50 µm	19091S-133
8091	Nitroaromatics and cyclic ketones by GC	VF-5ms, 30 m x 0.53 mm, 1.50 µm	CP8976
		VF-1701ms, 30 m x 0.53 mm, 1.00 µm	CP9171
8095	Explosives by GC	DB-225, 15 m x 0.53 mm, 1.00 µm	125-2212
		HP-5, 15 m x 0.53 mm, 1.50 µm	19095J-321
		DB-5, 15 m x 0.53 mm, 1.50 µm	125-5012
		VF-1ms, 15 m x 0.53 mm, 1.50 µm	CP8967
8100	Polynuclear aromatic hydrocarbons	DB-5ms, 30 m x 0.25 mm, 0.25 µm	122-5532
		DB-5ms, 30 m x 0.32 mm, 0.25 µm	123-5532
		DB-1ms, 30 m x 0.25 mm, 0.25 µm	122-0132
		DB-17ms, 30 m x 0.25 mm, 0.25 µm	122-4732
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944

(Continued)

Solid Waste			
EPA Method	Application	Column	Part No.
8111	Haloethers by GC	DB-5ms, 30 m x 0.25 mm, 1.00 µm	122-5533
		HP-5ms, 30 m x 0.25 mm, 0.50 µm	19091S-133
		DB-1701, 30 m x 0.25 mm, 1.00 µm	122-0733
		VF-1701ms, 30 m x 0.53 mm, 1.00 µm	CP9171
8120	Chlorinated hydrocarbons by gas chromatography	DB-5ms, 30 m x 0.32 mm, 0.50 µm	123-5536
		HP-5ms, 30 m x 0.32 mm, 0.50 µm	19091S-113
		DB-1, 30 m x 0.32 mm, 0.50 µm	123-103E
8121	Chlorinated hydrocarbons by GC: capillary column technique	DB-5ms, 30 m x 0.32 mm, 0.50 µm	123-5536
		HP-5ms, 30 m x 0.32 mm, 0.50 µm	19091S-113
		DB-1, 30 m x 0.32 mm, 0.50 µm	123-103E
		VF-200ms, 30 m x 0.53 mm, 1.00 µm	CP8868
		VF-WAXms, 30 m x 0.53 mm, 1.00 µm	CP9215
		VF-5ms, 30 m x 0.53 mm, 1.50 µm	CP8976
		VF-1701ms, 30 m x 0.53 mm, 1.00 µm	CP9171
8131	Aniline and selected derivatives by GC	DB-5ms Ultra Inert, 30 m x 0.25 mm, 1.00 µm	122-5533UI
		HP-5ms Ultra Inert, 30 m x 0.25 mm, 0.50 µm	19091S-133UI
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
		CP-Sil 8 CB for Amines, 30 m x 0.25 mm, 0.25 µm	CP7598
8140	Organophosphorus pesticides by GC-NPD	DB-35ms, 30 m x 0.25 mm, 0.25 µm	122-3832
		DB-5ms, 30 m x 0.25 mm, 0.25 µm	122-5532
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
8141a, 8141b	Organophosphorus compounds by gas chromatography: capillary column technique	DB-35ms, 30 m x 0.25 mm, 0.25 µm	122-3832
		DB-5ms, 30 m x 0.25 mm, 0.25 µm	122-5532
		VF-200ms, 30 m x 0.53 mm, 1.00 µm	CP8868
		VF-35ms, 30 m x 0.53 mm, 1.00 µm	CP8888
		VF-5ms, 30 m x 0.53 mm, 1.00 µm	CP8975
		VF-1ms, 30 m x 0.53 mm, 1.00 µm	CP8969
8150	Chlorinated herbicides	DB-35ms, 30 m x 0.32 mm, 0.25 µm	123-3832

(Continued)

## Solid Waste

EPA Method	Application	Column	Part No.
8151, 8151b	Chlorinated herbicides by GC using methylation or pentafluorobenzoylation derivatization: capillary column technique	DB-CLP1, 30 m x 0.32 mm, 0.25 µm	123-8232
		DB-CLP2, 30 m x 0.32 mm, 0.50 µm	123-8336
		DB-35ms Ultra Inert, 30 m x 0.32 mm, 0.25 µm	123-3832UI
		DB-5ms Ultra Inert, 30 m x 0.32 mm, 0.25 µm	123-5532UI
		HP-5ms Ultra Inert, 30 m x 0.32 mm, 0.25 µm	19091S-413UI
		VF-5 Pesticides, 30 m x 0.25 mm, 0.25 µm	CP9074
		VF-5ms, 30 m x 0.32 mm, 1.00 µm	CP8957
		VF-35ms, 30 m x 0.25 mm, 0.25 µm	CP8877
8240	Volatile chlorinated and aromatic hydrocarbons	VF-1701 Pesticides, 30 m x 0.25 mm, 0.25 µm	CP9070
		DB-VRX, 20 m x 0.18 mm, 1.00 µm	121-1524
		DB-624, 20 m x 0.18 mm, 1.00 µm	121-1324
		DB-624 Ultra Inert, 60 m x 0.25 mm, 1.40 µm	122-1364UI
		DB-VRX, 60 m x 0.25 mm, 1.40 µm	122-1564
		DB-608, 30 m x 0.53 mm, 0.50 µm	125-6837
		HP-VOC, 60 m x 0.20 mm, 1.10 µm	19091R-306
		VF-624ms, 60 m x 0.25 mm, 1.40 µm	CP9103
8260/CLP-VOCs	Volatile organic compounds by gas chromatography/mass spectroscopy (GC/MS): capillary column technique method	DB-624 Ultra Inert, 60 m x 0.25 mm, 1.40 µm	122-1364UI
		DB-VRX, 60 m x 0.25 mm, 1.40 µm	122-1564
		DB-608, 30 m x 0.53 mm, 0.50 µm	125-6837
		DB-VRX, 20 m x 0.18 mm, 1.00 µm	121-1524
8260b	Volatile organic compounds by GC/MS	DB-624, 20 m x 0.18 mm, 1.00 µm	121-1324
		DB-VRX, 20 m x 0.18 mm, 1.00 µm	121-1524
		DB-624, 20 m x 0.18 mm, 1.00 µm	121-1324
		VF-5ms, 30 m x 0.25 mm, 1.00 µm	CP8946
		VF-624ms, 60 m x 0.32 mm, 1.80 µm	CP9105
		DB-624 Ultra Inert, 60 m x 0.32 mm, 1.80 µm	123-1364UI
		DB-VRX, 60 m x 0.25 mm, 1.40 µm	122-1564
8261	Volatile organic compounds by vacuum distillation in combination with GC/MS spectrometry (VD/GC/MS)	DB-624, 20 m x 0.18 mm, 1.00 µm	121-1324
		DB-VRX, 20 m x 0.18 mm, 1.00 µm	121-1524
		DB-608, 30 m x 0.53 mm, 0.50 µm	125-6837
		DB-VRX, 60 m x 0.25 mm, 1.40 µm	122-1564
		DB-624 Ultra Inert, 20 m x 0.18 mm, 1.00 µm	121-1324UI
		VF-624ms, 60 m x 0.25 mm, 1.40 µm	CP9103

(Continued)

## Solid Waste

EPA Method	Application	Column	Part No.
8270, 8270d	Semivolatile organic compounds by gas chromatography/mass spectrometry (GC/MS)	DB-UI 8270D Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-9732
		DB-UI 8270D, 20 m x 0.18 mm, 0.36 µm	121-9723
		HP-5ms, 30 m x 0.25 mm, 0.50 µm	19091S-133
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
		VF-5ms, 30 m x 0.25 mm, 0.50 µm	CP8945
		VF-5ms, 30 m x 0.25 mm, 1.00 µm	CP8946
8275a	Semivolatile organic compounds (PAHs and PCBs) in soils/sludges and solid wastes using thermal extraction/gas chromatography/mass spectrometry (TE/GC/MS)	DB-5ms, 30 m x 0.25 mm, 1.00 µm	122-5533
		HP-5ms, 30 m x 0.25 mm, 0.50 µm	19091S-133
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
		VF-5ms, 30 m x 0.25 mm, 0.50 µm	CP8945
		VF-5ms, 30 m x 0.25 mm, 1.00 µm	CP8946
8280b	Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) by high resolution gas chromatography/low resolution mass spectrometry (HRGC/LRMS)	DB-5ms Ultra Inert, 60 m x 0.25 mm, 0.25 µm	122-5562UI
		CP-Sil 8 CB, 30 m x 0.25 mm, 0.25 µm	CP8751
8290b	Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) by high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS)	DB-5ms Ultra Inert, 60 m x 0.25 mm, 0.25 µm	122-5562UI
		CP-Sil 8 CB, 30 m x 0.25 mm, 0.25 µm	CP8751
		CP-Sil 88 for Dioxins, 50 m x 0.25 mm, 0.20 µm	CP7588
8410	Gas chromatography/Fourier transform infrared (GC/FTIR) spectrometry for semivolatile organics: capillary column	HP-5ms, 30 m x 0.32 mm, 1.00 µm	19091S-213
		DB-5ms, 30 m x 0.32 mm, 1.00 µm	123-5533
		VF-5ms, 30 m x 0.32 mm, 0.25 µm	CP8955
8430	Analysis of bis(2-chloroethyl) ether and hydrolysis products by direct aqueous injection (GC/FTIR)	DB-WAX, 30 m x 0.25 mm, 0.50 µm	122-7033
		HP-INNOWax, 30 m x 0.25 mm, 0.50 µm	19091N-233
		VF-WAXms, 30 m x 0.53 mm, 1.00 µm	CP9215



## TIPS &amp; TOOLS

The Agilent J&W DB-624UI GC columns are optimized for fast analysis of volatile compounds. Learn more at [www.agilent.com/chem/624UI](http://www.agilent.com/chem/624UI)

## United States Pharmacopoeia (USP) GC Phases

USP	Phase Composition	Agilent Phase Recommendation
G1	Dimethylpolysiloxane oil	HP-1*, DB-1*, HP-1ms*, DB-1ms*, VF-1ms, HP-1ms UI, DB-1ms UI, CP-Sil 5 CB, CP-Sil 5 CB Low Bleed/MS
G2	Dimethylpolysiloxane gum	HP-1*, DB-1*, HP-1ms*, DB-1ms*, VF-1ms, HP-1ms UI, DB-1ms UI, CP-Sil 5 CB, CP-Sil 5 CB Low Bleed/MS, CP-SimDist
G3	50% Phenyl 50% methylpolysiloxane	DB-17*, HP-50+*, VF-17ms, CP-Sil 24 CB, CP-Sil 24 CB Low Bleed/MS
G5	3-cyanopropyl polysiloxane	DB-23, VF-23ms, Select for FAME, CP-Sil 88
G6	Trifluoropropylmethylpolysilicone	DB-200, DB-210, VF-200ms
G7	50% 3-cyanopropyl 50% phenylmethylsilicone	DB-225, DB-225ms, CP-Sil 43 CB
G8	80% Bis(3-cyanopropyl) 20% 3-cyanopropylphenylpolysiloxane or 90% 3-cyanopropyl 10% phenylmethylsiloxane	HP-88, VF-23ms
G14	Polyethylene glycol (average molecular weight of 950-1,050)	DB-WAX, VF-WAXms, CP-Wax 52 CB
G15	Polyethylene glycol (average molecular weight of 3,000-3,700)	DB-WAX, VF-WAXms, CP-Wax 52 CB
G16	Polyethylene glycol (average molecular weight of 15,000)	DB-WAX*, VF-WAXms, CP-Wax 52 CB
G17	75% Phenyl 25% methylpolysiloxane	DB-17, HP-50+, VF-17ms, CP-Sil 24 CB, CP-Sil 24 CB Low Bleed/MS
G19	25% Phenyl 25% cyanopropylmethylsilicone	DB-225*, DB-225ms, CP-Sil 43 CB
G20	Polyethylene glycol (average molecular weight of 380-420)	DB-WAX, VF-WAXms, CP-Wax 52 CB
G25	Polyethylene glycol TPA (Carbowax 20M terephthalic acid)	DB-FFAP*, HP-FFAP*, CP-Wax 58 (FFAP) CB, CP-FFAP CB
G27	5% Phenyl 95% methylpolysiloxane	DB-5*, HP-5*, HP-5ms*, DB-5ms, VF-5ms, DB-5ms UI, HP-5ms UI, VF-5ht, CP-Sil 8 CB, CP-Sil 8 CB Low Bleed/MS
G28	25% Phenyl 75% methylpolysiloxane	DB-35, HP-35, DB-35ms, VF-35ms, DB-35ms UI
G32	20% Phenylmethyl 80% dimethylpolysiloxane	DB-35, HP-35, DB-35ms, VF-35ms
G35	Polyethylene glycol & diepoxide esterified with nitroterephthalic acid	DB-FFAP*, HP-FFAP*, CP-Wax 58 (FFAP) CB, CP-FFAP CB
G36	1% Vinyl 5% phenylmethylpolysiloxane	DB-5, HP-5, HP-5ms, DB-5ms, VF-5ms, VF-5ht, CP-Sil 8 CB, CP-Sil 8 CB Low Bleed/MS
G38	Phase G1 plus a tailing inhibitor	DB-1, HP-1, HP-1ms, DB-1ms, VF-1ms, CP-Sil 5 CB, CP-Sil 5 CB Low Bleed/MS
G39	Polyethylene glycol (average molecular weight of 1,500)	DB-WAX, VF-WAXms, CP-Wax 52 CB
G41	Phenylmethyldimethylsilicone (10% phenyl substituted)	DB-5, HP-5, HP-5ms, DB-5ms, VF-5ms, VF-5ht, CP-Sil 8 CB, CP-Sil 8 CB Low Bleed/MS
G42	35% Phenyl 65% dimethylvinylsiloxane	DB-35*, HP-35*, DB-35ms, VF-35ms, DB-35ms UI
G43	6% Cyanopropylphenyl 94% dimethylpolysiloxane	DB-624*, DB-1301, VF-624ms, VF-1301ms, CP-1301, DB-Select 624 UI
G45	Divinylbenzene-ethylene glycol-dimethacrylate	HP-PLOT U*, CP-PoraBOND U, CP-PoraPLOT U
G46	14% Cyanopropylphenyl 86% methylpolysiloxane	DB-1701*, VF-1701ms, CP-Sil 19 CB, CP-Sil 19 CB Low Bleed/MS

\*Indicates an exact equivalent

## TIPS &amp; TOOLS

Gain extra confidence to meet high standards with Agilent's solution for the revised USP <467>. Visit [www.agilent.com/chem/usp467](http://www.agilent.com/chem/usp467)



ASTM Methods			
Method	Title	Recommended Agilent Column	Part No.
D1945	Standard Test Method for the Analysis of Natural Gas by GC	HP-PLOT Molesieve, 15 m x 0.53 mm, 50.00 µm	19095P-MS9
		HP-PLOT Q PT, 15 m x 0.53 mm, 40.00 µm	19095P-Q03PT
		CP-Molsieve 5Å, 10 m x 0.53 mm, 50.00 µm	CP7537
		PoraPLOT Q-HT, 10 m x 0.53 mm, 20.00 µm	CP7558
D1946	Standard Test Method for the Analysis of Reformed Gas by GC	HP-PLOT Molesieve, 15 m x 0.53 mm, 50.00 µm	19095P-MS9
		HP-PLOT Q PT, 15 m x 0.53 mm, 40.00 µm	19095P-Q03PT
		CP-Molsieve 5Å, 10 m x 0.53 mm, 50.00 µm	CP7537
		CP-Molsieve 5Å, 25 m x 0.25 mm, 30.00 µm	CP7533
D1983	Standard Test Method for Fatty Acid Composition by Gas-Liquid Chromatography of Methyl Esters	DB-WAX, 30 m x 0.25 mm, 0.25 µm	122-7032
D2163	Standard Test Method for the Analysis of Liquefied Petroleum (LP) Gases and Propene Concentrates by GC	HP-PLOT Al <sub>2</sub> O <sub>3</sub> KCl PT, 30 m x 0.53 mm, 15.00 µm	19095P-K23PT
		HP-PLOT Al <sub>2</sub> O <sub>3</sub> S PT, 30 m x 0.53 mm, 15.00 µm	19095P-S23PT
D2195	Standard Test Methods for Pentaerythritol	CP-Sil 5 CB, 30 m x 0.53 mm, 1.50 µm	CP8735
D2268	Standard Test Method for Analysis of High-Purity n-Heptane and Isooctane by Capillary GC	DB-1, 60 m x 0.25 mm, 0.50 µm	122-106E
D2306	Standard Test Method for C <sub>8</sub> Aromatic Hydrocarbons by GC	HP-INNOWax, 60 m x 0.25 mm, 0.25 µm	19091N-136
D2360	Standard Test Method for Trace Impurities in Monocyclic Aromatic Hydrocarbons by GC	HP-INNOWax, 60 m x 0.32 mm, 0.25 µm	19091N-116
D2426	Standard Test Method for Butadiene Dimer and Styrene in Butadiene Concentrates by GC	DB-1, 30 m x 0.53 mm, 5.00 µm	125-1035
		CP-Sil 5 CB, 30 m x 0.53 mm, 1.50 µm	CP8735
D2427	Standard Test Method for Determination of C <sub>2</sub> through C <sub>5</sub> Hydrocarbons in Gasoline by GC	DB-1, 30 m x 0.53 mm, 5.00 µm	125-1035
		GS-Alumina PT, 30 m x 0.53 mm,	115-3532PT
		CP-Al <sub>2</sub> O <sub>3</sub> /KCl PT, 50 m x 0.53 mm, 10.00 µm	CP7518PT
D2245	Standard Test Method for Identification of Oils and Oil Acids in Solvent-Reducible Paints	CP-Sil 88 for FAME, 50 m x 0.25 mm, 0.20 µm	CP7488
D2504	Standard Test Method for Noncondensable Gases in C <sub>2</sub> and Lighter Hydrocarbon Products by GC	HP-PLOT Molesieve, 30 m x 0.53 mm, 50.00 µm	19095P-MS0
		CarboBOND, 25 m x 0.53 mm, 10.00 µm	CP7374
D2505	Standard Test Method for Ethylene, Other Hydrocarbons, and Carbon Dioxide in High-Purity Ethylene by GC	GS-GasPro, 60 m x 0.32 mm	113-4362

(Continued)



ASTM Methods			
Method	Title	Recommended Agilent Column	Part No.
D2580	Standard Test Method for Phenols in Water by Gas-Liquid Chromatography	CP-FFAP CB, 25 m x 0.53 mm, 1.00 µm	CP7486
D2593	Standard Test Method for Butadiene Purity and Hydrocarbon Impurities by GC	GS-Alumina PT, 30 m x 0.53 mm	115-3532PT
		CP-Al <sub>2</sub> O <sub>3</sub> /KCl PT, 50 m x 0.32 mm, 5.00 µm	CP7515PT
		CP-Al <sub>2</sub> O <sub>3</sub> /KCl PT, 50 m x 0.53 mm, 10.00 µm	CP7518PT
D2712	Standard Test Method for Hydrocarbon Traces in Propylene Concentrates by GC	GS-Alumina PT, 50 m x 0.53 mm	115-3552PT
D2743	Standard Practices for Uniformity of Traffic Paint Vehicle Solids by Spectroscopy and Gas Chromatography	CP-Sil 88 for FAME, 50 m x 0.25 mm, 0.20 µm	CP7488
D2804	Standard Test Method for Purity of Methyl Ethyl Ketone by GC	DB-WAX, 30 m x 0.53 mm, 1.00 µm	125-7032
		DB-210, 15 m x 0.53 mm, 1.00 µm	125-0212
		CP-Wax 52 CB, 30 m x 0.32 mm, 0.50 µm	CP8763
		CP-Wax 52 CB, 30 m x 0.53 mm, 1.00 µm	CP8738
D2887	Standard Test Method for Boiling Range Distribution of Petroleum Fractions by GC	DB-2887, 10 m x 0.53 mm, 3.00 µm	125-2814
		CP-SimDist UltiMetal, 5 m x 0.53 mm, 0.88 µm	CP7570
		CP-SimDist UltiMetal, 10 m x 0.53 mm, 2.65 µm	CP7582
		CP-SimDist UltiMetal, 5 m x 0.53 mm, 0.17 µm	CP7532
Extended D2887	Standard Test Method for Boiling Range Distribution of Petroleum Fractions by GC, to C <sub>60</sub>	HP-1, 10 m x 0.53 mm, 0.88 µm	19095Z-021
		HP-1, 5 m x 0.53 mm, 0.88 µm	19095Z-020
D2908	Standard Practice for Measuring Volatile Organic Matter in Water by Aqueous-Injection GC	CP-Select 624 CB, 30 m x 0.32 mm, 1.80 µm	CP7414
		CP-Select 624 CB, 75 m x 0.53 mm, 3.00 µm	CP7417
		CP-Wax 52 CB, 30 m x 0.32 mm, 0.50 µm	CP8763
		CP-Wax 52 CB, 30 m x 0.53 mm, 1.00 µm	CP8738
D3054	Standard Test Method for Analysis of Cyclohexane by GC	DB-1, 60 m x 0.32 mm, 0.50 µm	123-106E
D3168	Standard Practice for Qualitative Identification of Polymers in Emulsion Paints	CP-Sil 5 CB, 30 m x 0.32 mm, 1.00 µm	CP8760
		CP-Sil 5 CB, 30 m x 0.53 mm, 1.50 µm	CP8735
D3257	Standard Test Method for Aromatics in Mineral Spirits by GC	DB-624, 30 m x 0.53 mm, 3.00 µm	125-1334
D3271	Standard Practice for Direct Injection of Solvent-Reducible Paints into a Gas Chromatograph for Solvent Analysis	PoraPLOT Q, 25 m x 0.53 mm, 20.00 µm	CP7554
		CP-Wax 52 CB, 30 m x 0.53 mm, 1.00 µm	CP8738

(Continued)

ASTM Methods			
Method	Title	Recommended Agilent Column	Part No.
D3328	Standard Test Methods for Comparison of Waterborne Petroleum Oils by Gas Chromatography	CP-Sil 5 CB, 30 m x 0.32 mm, 3.00 µm	CP8687
		CP-Sil 5 CB, 30 m x 0.53 mm, 3.00 µm	CP8677
D3329	Standard Test Method for Purity of Methyl Isobutyl Ketone by GC	DB-WAX, 30 m x 0.53 mm, 1.00 µm	125-7032
		DB-624, 30 m x 0.45 mm, 2.55 µm	124-1334
		CP-Wax 52 CB, 60 m x 0.53 mm, 1.00 µm	CP8798
D3432	Standard Test Method for Unreacted Toluene Diisocyanates in Urethane Prepolymers and Coating Solutions by GC	HP-1ms, 30 m x 0.32 mm, 1.00 µm	19091S-713
D3447	Standard Test Method for Purity of Halogenated Organic Solvents	DB-624, 30 m x 0.53 mm, 3.00 µm	125-1334
D3452	Standard Practice for Rubber – Identification by Pyrolysis-Gas Chromatography	CP-Sil 5 CB, 30 m x 0.53 mm, 1.50 µm	CP8735
D3465	Standard Test Method for Purity of Monomeric Plasticizers by Gas Chromatography	CP-Sil 5 CB, 25 m x 0.32 mm, 0.52 µm	CP8430
		CP-Sil 5 CB, 30 m x 0.53 mm, 1.50 µm	CP8735
D3524	Standard Test Method for Diesel Fuel Diluent in Used Diesel Engine Oils by Gas Chromatography	CP-SimDist UltiMetal, 10 m x 0.53 mm, 0.53 µm	CP7592
D3545	Standard Test Method for Alcohol Content and Purity of Acetate Esters by GC	DB-624, 30 m x 0.53 mm, 3.00 µm	125-1334
D3606	Standard Test Method for Determination of Benzene and Toluene in Finished Motor and Aviation Gasoline by Gas Chromatography	VF-1ms, 15 m x 0.25 mm, 0.10 µm	CP8906
		CP-TCEP for Alcohols in Gasoline, 50 m x 0.25 mm, 0.40 µm	CP7525
D3687	Standard Test Method for Analysis of Organic Vapors Collected by the Activated Charcoal Tube Adsorption Method	DB-WAX, 30 m x 0.53 mm, 1.00 µm	125-7032
		DB-WAX, 30 m x 0.45 mm, 0.85 µm	124-7032
		CP-Wax 52 CB, 30 m x 0.32 mm, 0.50 µm	CP8763
		CP-Wax 52 CB, 30 m x 0.53 mm, 1.00 µm	CP8738
D3695	Standard Test Method for Volatile Alcohols in Water by Direct Aqueous-Injection GC	DB-WAX, 30 m x 0.53 mm, 1.00 µm	125-7032
		CP-SimDist UltiMetal, 10 m x 0.53 mm, 0.53 µm	CP7592
D3710	Standard Test Method for Boiling Range Distribution of Gasoline and Gasoline Fractions by GC	DB-2887, 10 m x 0.53 mm, 3.00 µm	125-2814
D3749	Standard Test Method for Residual Vinyl Chloride Monomer in Poly(Vinyl Chloride) Resins by Gas Chromatographic Headspace Technique	PoraBOND Q, 10 m x 0.32 mm, 5.00 µm	CP7350
		PoraBOND Q PT, 10 m x 0.53 mm, 10.00 µm	CP7353PT

(Continued)

ASTM Methods			
Method	Title	Recommended Agilent Column	Part No.
D3760	Standard Test Method for Analysis of Isopropylbenzene (Cumene) by GC	DB-WAX, 60 m x 0.32 mm, 0.25 µm	123-7062
		HP-1, 50 m x 0.32 mm, 0.52 µm	19091Z-115
		CP-Xylenes, 50 m x 0.53 mm	CP7428
D3792	Standard Test Method for Water Content of Coatings by Direct Injection Into a Gas Chromatograph	PoraBOND Q PT, 25 m x 0.32 mm, 5.00 µm	CP7351PT
		PoraBOND Q PT, 25 m x 0.53 mm, 10.00 µm	CP7354PT
D3797	Standard Test Method for Analysis of o-Xylene by GC	HP-INNOWax, 60 m x 0.32 mm, 0.50 µm	19091N-216
		CP-Xylenes, 50 m x 0.53 mm	CP7428
D3798	Standard Test Method for Analysis of p-Xylene by GC	HP-INNOWax, 60 m x 0.32 mm, 0.50 µm	19091N-216
		CP-Xylenes, 50 m x 0.53 mm	CP7428
D3871	Standard Test Method for Purgeable Organic Compounds in Water Using Headspace Sampling	DB-VRX, 75 m x 0.45 mm, 2.55 µm	124-1574
D3876	Standard Test Method for Methoxyl and Hydroxypropyl Substitution in Cellulose Ether Products by Gas Chromatography	CP-Sil 5 CB, 30 m x 0.32 mm, 1.00 µm	CP8760
		CP-Sil 5 CB, 30 m x 0.53 mm, 1.50 µm	CP8735
D3893	Standard Test Method for Purity of Methyl Amyl Ketone and Methyl Isoamyl Ketone by GC	DB-VRX, 30 m x 0.45 mm, 2.55 µm	124-1534
D3973	Standard Test Method for Low-Molecular Weight Halogenated Hydrocarbons in Water	DB-VRX, 30 m x 0.45 mm, 2.55 µm	124-1534
D4059	Standard Test Method for Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography	CP-Sil 8 CB for PCB, 50 m x 0.25 mm, 0.25 µm	CP7482
D4275	Standard Test Method for Determination of Butylated Hydroxy Toluene (BHT) in Polymers of Ethylene and Ethylene – Vinyl Acetate (EVA) Copolymers by Gas Chromatography	CP-Sil 5 CB, 30 m x 0.32 mm, 3.00 µm	CP8687
		CP-Sil 5 CB, 30 m x 0.53 mm, 3.00 µm	CP8677
D4322	Standard Test Method for Residual Acrylonitrile Monomer Styrene-Acrylonitrile Copolymers and Nitrile Rubber by Headspace Gas Chromatography	PoraBOND Q PT, 25 m x 0.53 mm, 10.00 µm	CP7354PT
D4367	Standard Test Method for Benzene in Hydrocarbon Solvents by Gas Chromatography	VF-1ms, 15 m x 0.25 mm, 0.10 µm	CP8906
		CP-TCEP for Alcohols in Gasoline, 50 m x 0.25 mm, 0.40 µm	CP7525
D4415	Standard Test Method for Determination of Dimer in Acrylic Acid	DB-FFAP, 30 m x 0.32 mm, 0.25 µm	123-3232
D4424	Standard Test Method for Butylene Analysis by GC	HP-PLOT Al <sub>2</sub> O <sub>3</sub> S PT, 50 m x 0.53 mm, 15.00 µm	19095P-S25PT
		CP-Al <sub>2</sub> O <sub>3</sub> /Na <sub>2</sub> SO <sub>4</sub> , 25 m x 0.53 mm, 10.00 µm	CP7567
D4443	Standard Test Method for Residual Vinyl Chloride Monomer Content in PPB Range in Vinyl Chloride Homo- and Co-Polymers by Headspace GC	DB-VRX, 30 m x 0.45 mm, 2.55 µm	124-1534

(Continued)

ASTM Methods			
Method	Title	Recommended Agilent Column	Part No.
D4492	Standard Test Method for Analysis of Benzene by Gas Chromatography	CP-TCEP for Alcohols in Gasoline, 50 m x 0.25 mm, 0.40 µm	CP7525
D4509	Standard Test Methods for Determining the 24-Hour Gas (AIR) Space Acetaldehyde Content of Freshly Blown PET Bottles	PoraBOND Q PT, 25 m x 0.32 mm, 5.00 µm	CP7351PT
		PoraBOND Q PT, 25 m x 0.53 mm, 10.00 µm	CP7354PT
D4534	Test Method for Benzene Content of Cyclic Products by Gas Chromatography	CP-TCEP for Alcohols in Gasoline, 50 m x 0.25 mm, 0.40 µm	CP7525
D4735	Standard Test Method for Determination of Trace Thiophene in Refined Benzene by GC	DB-FFAP, 30 m x 0.45 mm, 0.85 µm	124-3232
		CP-Wax 58 FFAP CB, 25 m x 0.53 mm, 1.00 µm	CP7614
D4768	Standard Test Method for Analysis of 2,6-Ditertiary-Butyl Para-Cresol and 2,6-Ditertiary-Butyl Phenol in Insulating Liquids by Gas Chromatography	CP-Wax 58 FFAP CB, 25 m x 0.53 mm, 1.00 µm	CP7614
D4864	Standard Test Method for Determination of Traces of Methanol in Propylene Concentrates by GC	DB-WAX, 30 m x 0.45 mm, 0.85 µm	124-7032
D4947	Standard Test Method for Chlordane and Heptachlor Residues in Indoor Air	DB-5, 30 m x 0.53 mm, 1.50 µm	125-5032
		DB-608, 30 m x 0.53 mm, 0.83 µm	125-1730
D4961	Standard Test Method for GC Analysis of Major Organic Impurities in Phenol Produced by the Cumene Process	DB-FFAP, 30 m x 0.45 mm, 0.85 µm	124-3232
		HP-PLOT Q PT, 15 m x 0.53 mm, 40.00 µm	19095P-Q03PT
D4983	Standard Test Method for Cyclohexylamine Morpholine and Diethylaminoethanol in Water and Condensed Steam by Direct Aqueous Injection GC	HP-5ms, 30 m x 0.32 mm, 1.00 µm	19091S-213
		CAM, 30 m x 0.53 mm, 1.00 µm	115-2132
D5008	Standard Test Method for Ethyl Methyl Pentanol Content and Purity Value of 2-Ethylhexanol by GC	HP-1, 15 m x 0.53 mm, 5.00 µm	19095Z-621
		HP-INNOWax, 30 m x 0.32 mm, 0.25 µm	19091N-113
D5060	Standard Test Method for Determining Impurities in High-Purity Ethylbenzene by GC	HP-INNOWax, 60 m x 0.32 mm, 0.50 µm	19091N-216
		CP-Wax 52 CB, 60 m x 0.32 mm, 0.50 µm	CP8773
D5075	Standard Test Method for Nicotine in Indoor Air	DB-5, 30 m x 0.53 mm, 1.50 µm	125-5032
		DB-5, 30 m x 0.32 mm, 1.00 µm	123-5033
D5134	Standard Test Method for Detailed Analysis of Petroleum Naphthas Through n-Nonane by Capillary GC	HP-PONA, 50 m x 0.20 mm, 0.50 µm	19091S-001
		CP-Sil PONA for ASTM D5134, 50 m x 0.21 mm, 0.50 µm	CP7531
D5135	Standard Test Method for Analysis of Styrene by Capillary GC	HP-INNOWax, 60 m x 0.32 mm, 0.50 µm	19091N-216
		CP-Wax 52 CB, 60 m x 0.32 mm, 0.50 µm	CP8773
D5175	Standard Test Method for Organohalide Pesticides and Polychlorinated Biphenyls in Water by Microextraction and GC	DB-1, 30 m x 0.32 mm, 1.00 µm	123-1033
		DB-608, 30 m x 0.32 mm, 0.50 µm	123-1730
		DB-XLB, 30 m x 0.25 mm, 0.25 µm	122-1232

(Continued)

ASTM Methods			
Method	Title	Recommended Agilent Column	Part No.
D5303	Standard Test Method for Trace Carbonyl Sulfide in Propylene by GC	GS-GasPro, 30 m x 0.32 mm	113-4332
		HP-PLOT Q PT, 30 m x 0.53 mm, 40.00 µm	19095P-Q04PT
D5307	Standard Test Method for Determination of Boiling Range Distribution of Crude Petroleum by GC	HP-1, 7.5 m x 0.53 mm, 5.00 µm	19095Z-627
D5310	Standard Test Method for Tar Acid Composition by Capillary GC	HP-5ms, 30 m x 0.25 mm, 0.25 µm	19091S-433
		DB-225ms, 30 m x 0.25 mm, 0.25 µm	122-2932
D5316	Standard Test Method for 1, 2-Dibromoethane and 1, 2-Dibromo-3-Chloropropane in Water by Microextraction and GC	HP-1ms, 30 m x 0.32 mm, 1.00 µm	19091S-713
		DB-624, 30 m x 0.45 mm, 2.55 µm	124-1334
D5317	Standard Test Method for Determination of Chlorinated Organic Acid Compounds in Water by GC with Electron Capture Detector	HP-5ms, 30 m x 0.25 mm, 0.25 µm	19091S-433
		DB-1701, 30 m x 0.25 mm, 0.25 µm	122-7732
		DB-XLB, 30 m x 0.25 mm, 0.25 µm	122-1232
		DB-35ms, 30 m x 0.25 mm, 0.25 µm	122-3832
D5320	Standard Test Method for Determination of 1, 1-Trichloroethane and Methylene Chloride in Stabilized Trichloroethylene and Tetrachloroethylene	DB-1, 30 m x 0.53 mm, 3.00 µm	125-1034
		DB-VRX, 30 m x 0.32 mm, 1.80 µm	123-1534
D5399	Standard Test Method for Boiling Point Distribution of Hydrocarbon Solvents by GC	DB-2887, 10 m x 0.53 mm, 3.00 µm	125-2814
D5441	Standard Test Method for Analysis of Methyl Tert-Butyl Ether (MTBD) by GC	HP-PONA, 50 m x 0.20 mm, 0.50 µm	19091S-001
		DB-Petro, 100 m x 0.25 mm, 0.50 µm	122-10A6E
D5442	Standard Test Method for Analysis of Petroleum Waxes by GC	DB-1, 25 m x 0.32 mm, 0.25 µm	123-1022
		DB-5, 15 m x 0.25 mm, 0.25 µm	122-5012
D5475	Standard Test Method for Nitrogen- and Phosphorus-Containing Pesticides in Water by GC with a Nitrogen Phosphorus Detector	HP-5ms, 30 m x 0.25 mm, 0.25 µm	19091S-433
		DB-1701, 30 m x 0.25 mm, 0.25 µm	122-7732
		DB-XLB, 30 m x 0.25 mm, 0.25 µm	122-1232
		DB-35ms, 30 m x 0.25 mm, 0.25 µm	122-3832
D5480	Standard Test Method for Engine Oil Volatility by GC	DB-PS1, 15 m x 0.53 mm, 0.15 µm	145-1011
D5501	Standard Test Method for Determination of Ethanol Content of Denatured Fuel Ethanol by GC	HP-1, 100 m x 0.25 mm, 0.50 µm	19091Z-530
D5504	Standard Test Method for Determination of Sulfur Compounds in Natural Gas and Gaseous Fuels by Gas Chromatography and Chemiluminescence	DB-Sulfur SCD, 70 m x 0.53 mm, 4.30 µm	G3903-63003
		CP-Sil 5 CB for Sulfur, 30 m x 0.32 mm, 4.00 µm	CP7529

(Continued)

ASTM Methods			
Method	Title	Recommended Agilent Column	Part No.
D5507	Standard Test Method for Determination of Trace Organic Impurities in Monomer Grade Vinyl Chloride by Capillary Column/Multi-dimensional GC	HP-PLOT Q PT, 15 m x 0.53 mm, 40.00 µm	19095P-Q03PT
		HP-PLOT U PT, 30 m x 0.53 mm, 20.00 µm	19095P-U04PT
D5508	Standard Test Method for Determination of Residual Acrylonitrile Monomer in Styrene-Acrylonitrile Co-polymer Resins and Nitrile-Butadiene Rubber by Headspace Capillary GC	HP-PLOT Q PT, 30 m x 0.53 mm, 40.00 µm	19095P-Q04PT
D5580	Standard Test Method for Determination of Benzene, Toluene, Ethylbenzene, p/m-Xylene, C <sub>9</sub> and Heavier Aromatics, and Total Aromatics in Finished Gasoline by GC	DB-1, 30 m x 0.53 mm, 5.00 µm	125-1035
		CP-TCEP for Alcohols in Gasoline, 50 m x 0.25 mm, 0.40 µm	CP7525
		CP-Sil 5 CB, 30 m x 0.53 mm, 5.00 µm	CP8775
		VF-1ms, 15 m x 0.25 mm, 0.10 µm	CP8906
D5599	Standard Test Method for Determination of Oxygenates in Gasoline by GC and Oxygen Selective Flame Ionization Detection	DB-5, 30 m x 0.25 mm, 0.25 µm	122-5032
D5623	Standard Test Method for Sulfur Compounds in Light Petroleum Liquids by GC and Sulfur Selective Detection	DB-Sulfur SCD, 60 m x 0.32 mm, 4.20 µm	G3903-63001
		HP-1, 30 m x 0.32 mm, 4.00 µm	19091Z-613
D5713	Standard Test Method for Analysis of High Purity Benzene for Cyclohexane Feedstock by Capillary GC	DB-Petro, 50 m x 0.20 mm, 0.50 µm	128-1056
D5739	Standard Practice for Oil Spill Source Identification by GC and Positive Ion Electron Impact Low Resolution Mass Spectrometry	DB-5, 30 m x 0.25 mm, 0.25 µm	122-5032
		DB-TPH, 30 m x 0.32 mm, 0.25 µm	123-1632
D5769	Standard Test Method for Determination of Benzene, Toluene, and Total Aromatics in Finished Gasoline by GC/MS	HP-1, 60 m x 0.25 mm, 1.00 µm	19091Z-236
D5790	Standard Test Method for Measurement of Purgeable Organic Compounds in Water by Capillary Column GC/MS	DB-VRX, 60 m x 0.25 mm, 1.40 µm	122-1564
		DB-VRX, 20 m x 0.18 mm, 1.00 µm	121-1524
		DB-624, 60 m x 0.25 mm, 1.40 µm	122-1364
		DB-624, 20 m x 0.18 mm, 1.00 µm	121-1324
D5812	Standard Test Method for Determination of Organochlorine Pesticides in Water by Capillary Column GC	HP-5ms, 30 m x 0.25 mm, 0.25 µm	19091S-433
		DB-1701, 30 m x 0.25 mm, 0.25 µm	122-7732
		DB-XLB, 30 m x 0.25 mm, 0.25 µm	122-1232
		DB-35ms, 30 m x 0.25 mm, 0.25 µm	122-3832

(Continued)

ASTM Methods			
Method	Title	Recommended Agilent Column	Part No.
D5917	Standard Test Method for Trace Impurities in Monocyclic Aromatic Hydrocarbons by GC and External Calibration	HP-INNOWax, 60 m x 0.32 mm, 0.25 µm	19091N-116
D5974	Standard Test Method for Fatty and Rosin Acids in Tall Oil Fraction Products by Capillary GC	DB-23, 60 m x 0.25 mm, 0.25 µm	122-2362
D5986	Standard Test Method for Determination of Oxygenates, Benzene, Toluene, C <sub>8</sub> -C <sub>12</sub> Aromatics and Total Aromatics in Finished Gasoline by GC/FTIR	HP-1, 60 m x 0.53 mm, 5.00 µm	19095Z-626
D6144	Standard Test Method for Trace Impurities in Alpha-Methylstyrene by Capillary GC	HP-1, 60 m x 0.25 mm, 1.00 µm	19091Z-236
D6159	Standard Test Method for Determination of Hydrocarbon Impurities in Ethylene by GC	HP-PLOT Al <sub>2</sub> O <sub>3</sub> KCl PT, 50 m x 0.53 mm, 15.00 µm	19095P-K25PT
		GS-Alumina PT, 50 m x 0.53 mm	115-3552PT
		DB-1, 30 m x 0.53 mm, 5.00 µm	125-1035
D6160	Standard Test Method for Determination of PCBs in Waste Materials by GC	HP-5ms, 30 m x 0.32 mm, 0.25 µm	19091S-413
		DB-XLB, 30 m x 0.25 mm, 0.25 µm	122-1232
D6352	Standard Test Method for Boiling Range Distribution of Petroleum Distillates in Boiling Range from 174 to 700 °C by GC	DB-HT Sim Dis, 5 m x 0.53 mm, 0.15 µm	145-1001
D6387	Standard Test Methods for Composition of Turpentine and Related Terpene Products by Capillary Gas Chromatography	CP-Wax 52 CB, 30 m x 0.32 mm, 0.50 µm	CP8763
		CP-Wax 52 CB, 30 m x 0.53 mm, 1.00 µm	CP8738
D6417	Standard Test Method for Estimation of Engine Oil Volatility by Capillary GC	DB-HT Sim Dis, 5 m x 0.53 mm, 0.15 µm	145-1001
D6584	Standard Test Method for Determination of Total Monoglyceride, Total Diglyceride, Total Triglyceride, and Free and Total Glycerin in B-100 Biodiesel Methyl Esters by Gas Chromatography	Select Biodiesel, 15 m x 0.32 mm, 0.10 µm	CP9078
D6806	Standard Practice for Analysis of Halogenated Organic Solvents and Their Admixtures by Gas Chromatography	CP-Sil 5 CB, 50 m x 0.53 mm, 5.00 µm	CP7685
E1616	Standard Test Method for Analysis of Acetic Anhydride Using GC	HP-1, 50 m x 0.32 mm, 0.52 µm	19091Z-115
E1863	Standard Test Method for Analysis of Acrylonitrile by GC	DB-WAXetr, 60 m x 0.32 mm, 1.00 µm	123-7364
E0202	Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols	DB-624, 30 m x 0.53 mm, 3.00 µm	125-1334
		CP-Wax 57 CB for Glycols and Alcohols, 25 m x 0.25 mm, 0.20 µm	CP7615
E0475	Standard Test Method for Assay of Di-tert-Butyl Peroxide Using GC	HP-5, 30 m x 0.53 mm, 5.00 µm	19095J-623

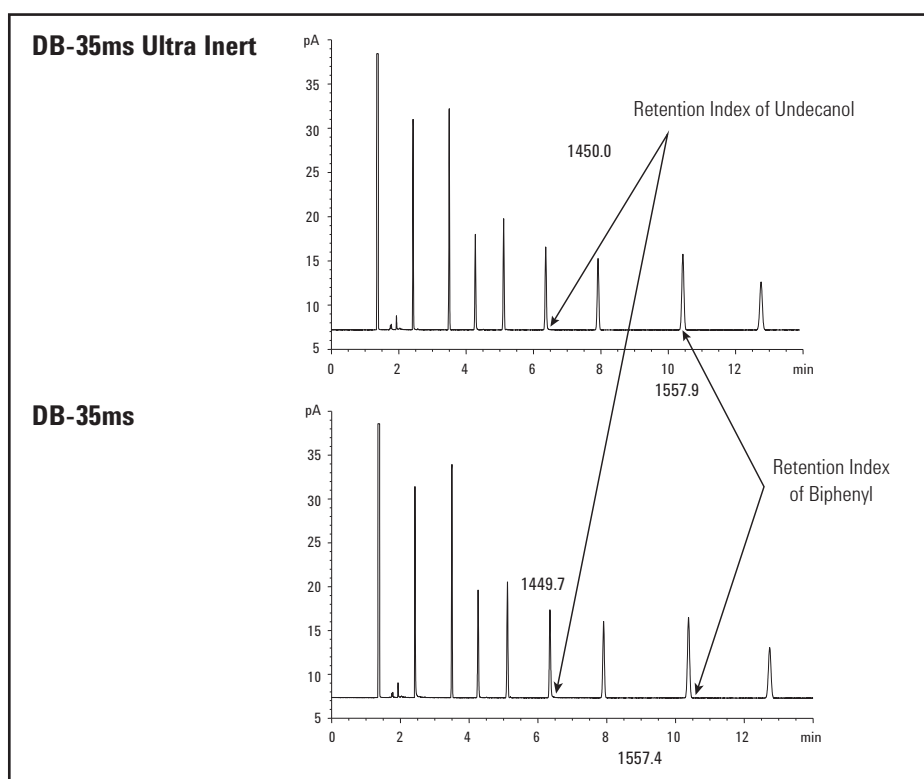
# GC Capillary Columns

## Agilent J&W Ultra Inert GC Columns

### Perform trace-level analysis with the utmost confidence

As the GC industry's premier measurement company, Agilent is uniquely positioned to ensure the inertness of the surfaces your sample touches, so you can achieve the parts-per-billion – or parts-per-trillion – detection levels for your most demanding analyses. Agilent Ultra Inert components work together to deliver industry-leading results: the Agilent GC instrument, Ultra Inert liner and Agilent J&W Ultra Inert GC column family.

The Agilent J&W Ultra Inert GC column family pushes industry standards for consistent column inertness and exceptionally low column bleed, resulting in lower detection limits and more accurate data for difficult analytes. Each Ultra Inert column is tested with the industry's most demanding test probe mixture and we prove it with a performance summary sheet shipped with each column.



With Agilent J&W Ultra Inert GC columns, selectivity remains the same, allowing you to confidently integrate Ultra Inert columns into your current methods.



# The industry's most rigorous test probe mixture ensures consistent column inertness – and results

A strong test probe mixture can highlight deficiencies in column activity, while a weak mixture can actually mask such deficiencies.

The test probes in Agilent's Ultra Inert test probe mixture have low molecular weights, low boiling points and no steric shielding of their active groups. These characteristics allow the probative portion of the test molecules to penetrate – and fully interact with – the stationary phase and column surface.

### Commonly used, less demanding test probes

1. 1-Octanol	4. 2,6-Dimethylaniline	7. 1-Decanol
2. n-Undecane	5. n-Dodecane	8. n-Tridecane
3. 2,6-Dimethylphenol	6. Naphthalene	9. Methyldecanoate

## TIPS & TOOLS

### Clearly Better Inertness

To learn more and order your free poster, visit [www.agilent.com/chem/inert](http://www.agilent.com/chem/inert)

**Ensuring an inert GC flow path has never been more critical**

An excellent sample can create trouble. Incomplete active and inert components can simply mask off any deficiencies caused by flow path activity.

A low inert flow path can cause peak splitting and appear flat. It can mask or fully activate contaminants, which can result in misinterpretation of problem resolution present in the sample.

Resolving or verifying suspect analysis results requires better productivity and faster your bottom line.

Invaluable results can be lost, ultimately, compromised in terms of environmental safety, food quality, and consumer drug abuse prevention.

The poster provides vital education to help you lower your detection limit and sensitivity capacity prior analysis by ensuring the most inert flow path.

**Optimizing your GC flow path for inertness**

Sample inlet

GC column

Detector

Peak shapes

Retention times

**Top 5 TIPS for GC flow path INERTNESS**

1. Maximize the inlet
2. Purge sample first at all stages
3. Select a column with optimized inertness
4. Remember your detector
5. Use a gas purifier

**Agilent Ultra Inert test probes**

**Agilent J&W Ultra Inert GC columns**

**Agilent GC 1900 and GC 1905**

Strongest and performance and productivity

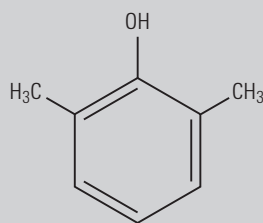
The Measure of Excellence

Agilent Technologies

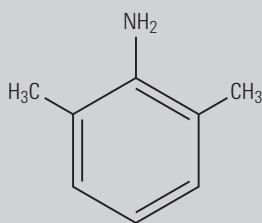
## Agilent's more demanding Ultra Inert test probe mixture for 5ms, 1ms, and 35ms Ultra Inert columns

Ultra Inert 5ms Columns			Ultra Inert 1ms Columns			Ultra Inert 35ms Columns		
Elution Order	Test Probe	Functional Test	Elution Order	Test Probe	Functional Test	Elution Order	Test Probe	Functional Test
1.	1-Propionic acid	Basicity	1.	1-Propionic acid	Basicity	1.	1-Octene	Polarity
2.	1-Octene	Polarity	2.	1-Octene	Polarity	2.	1-Butyric acid	Basicity
3.	n-Octane	Hydrocarbon marker	3.	n-Octane	Hydrocarbon marker	3.	n-Nonane	Hydrocarbon marker
4.	4-Picoline	Acidity	4.	1,2-Butanediol	Silanol	4.	4-Picoline	Acidity
5.	n-Nonane	Hydrocarbon marker	5.	4-Picoline	Acidity	5.	n-Propylbenzene	Polarity
6.	Trimethyl phosphate	Acidity	6.	Trimethyl phosphate	Acidity	6.	1-Heptanol	Silanol, Polarity
7.	1,2-Pentanediol	Silanol	7.	n-Propylbenzene	Hydrocarbon marker	7.	1,2-Pentanediol	Silanol
8.	n-Propylbenzene	Hydrocarbon marker	8.	1-Heptanol	Silanol	8.	3-Octanone	Polarity
9.	1-Heptanol	Silanol	9.	3-Octanone	Polarity	9.	Trimethyl phosphate	Acidity
10.	3-Octanone	Polarity	10.	tert-Butylbenzene	Hydrocarbon marker	10.	tert-Butylbenzene	Hydrocarbon marker
11.	n-Decane	Efficiency	11.	n-Decane	Efficiency	11.	n-Undecane	Efficiency

## Chemical Structures

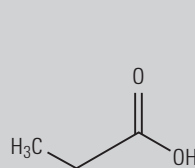


2,6-Dimethylphenol

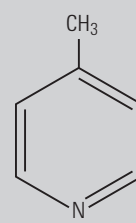


2,6-Dimethylaniline

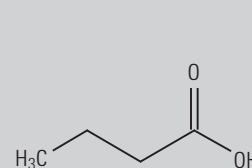
**Weak probe molecules:** The acidic and basic portions of these molecules are shielded by the two methyl groups on their phenyl rings, making them less probative.



1-Propionic acid



4-Picoline



1-Butyric acid

**Strong probe molecules:** The probes in Agilent's Ultra Inert test probe mixture are highly probative of the stationary phase and surface. Note, too, that the active end of each compound is available to interact with any active sites on the column.

**DB-1ms Ultra Inert**

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
<i>0.18</i>	<i>20</i>	<i>0.18</i>	<i>-60 to 325/350</i>	<i>121-0122UI</i>	
0.25	15	0.25	-60 to 325/350	122-0112UI	
	30	0.25	-60 to 325/350	122-0132UI	122-0132UIE
	60	0.25	-60 to 325/350	122-0162UI	
0.32	15	0.25	-60 to 325/350	123-0112UI	
	30	0.25	-60 to 325/350	123-0132UI	

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

**HP-1ms Ultra Inert**

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>19091S-677UI</i>
0.25	15	0.25	-60 to 325/350	19091S-931UI
	30	0.25	-60 to 325/350	19091S-933UI
		0.50	-60 to 325/350	19091S-633UI
		1.00	-60 to 325/350	19091S-733UI
0.32	15	0.25	-60 to 325/350	19091S-911UI
	25	0.52	-60 to 325/350	19091S-612UI
	30	0.25	-60 to 325/350	19091S-913UI
		1.00	-60 to 325/350	19091S-713UI

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

**Similar Phases:** SPB-1, Rtx-1, BP-1, OV-1, OV-101, 007-1(MS), SP-2100, SE-30, ZB-1, AT-1, MDN-1, ZB-1, ZB-1ms

**TIPS & TOOLS**

Learn how to ensure an inert GC flow path with the *Agilent Ultra Inert Solutions Brochure*.  
Order yours at [www.agilent.com/chem/Ulorder](http://www.agilent.com/chem/Ulorder)



**DB-5ms Ultra Inert**

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>-60 to 325/350</i>	<i>121-5522UI</i>		<i>121-5522UILTM</i>
		<i>0.36</i>	<i>-60 to 325/350</i>	<i>121-5523UI</i>		<i>121-5523UILTM</i>
0.25	15	0.25	-60 to 325/350	122-5512UI		122-5512UILTM
		1.00	-60 to 325/350	122-5513UI		
	25	0.25	-60 to 325/350	122-5522UI		122-5522UILTM
	30	0.25	-60 to 325/350	122-5532UI	122-5532UIE	122-5532UILTM
		0.50	-60 to 325/350	122-5536UI		122-5536UILTM
		1.00	-60 to 325/350	122-5533UI		122-5533UILTM
	50	0.25	-60 to 325/350	122-5552UI		
	60	0.25	-60 to 325/350	122-5562UI		
1.00		-60 to 325/350	122-5563UI			
0.32	30	0.25	-60 to 325/350	123-5532UI	123-5532UIE	
		0.50	-60 to 325/350	123-5536UI		
		1.00	-60 to 325/350	123-5533UI		
	60	1.00	-60 to 325/350	123-5563UI		

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

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

**HP-5ms Ultra Inert**

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
<b>HP-5ms Ultra Inert</b>						
<i>0.18</i>	<i>20</i>	<i>0.18</i>	<i>-60 to 325/350</i>	<i>19091S-577UI</i>		<i>19091S-577UILTM</i>
0.25	15	0.25	-60 to 325/350	19091S-431UI		19091S-431UILTM
		30	0.25	-60 to 325/350	19091S-433UI	19091S-433UIE
		0.50	-60 to 325/350	19091S-133UI		19091S-133UILTM
		1.00	-60 to 325/350	19091S-233UI		19091S-233UILTM
	60	0.25	-60 to 325/350	19091S-436UI		
0.32	30	0.25	-60 to 325/350	19091S-413UI		19091S-413UILTM
		1.00	-60 to 325/350	19091S-213UI		19091S-213UILTM

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

**Similar Phases:** Rtx-5ms, Rxi-5ms, Rxi-5Sil MS, PTE-5, BPX-5, AT-5ms, ZB-5ms, SLB-5ms, Equity-7

**DB-35ms Ultra Inert**

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
<i>0.18</i>	<i>20</i>	<i>0.18</i>	<i>50 to 340/360</i>	<i>121-3822UI</i>
0.25	15	0.25	50 to 340/360	122-3812UI
	30	0.25	50 to 340/360	122-3832UI
0.32	15	0.25	50 to 340/360	
	30	0.25	50 to 340/360	123-3832UI

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

**Similar Phases:** *Rtx-35, Rtx-35ms, Rxi-35Sil MS, SPB-35, AT-35, Sup-Herb, MDN-35, BPX-34, ZB-35, ZB-35 ht*

**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**

Complete your Ultra Inert flow path with the industry leading Agilent Ultra Inert Inlet Liner, [www.agilent.com/chem/uiliner](http://www.agilent.com/chem/uiliner)



**DB-Select 624 UI for <467>**

<b>ID (mm)</b>	<b>Length (m)</b>	<b>Film (µm)</b>	<b>Temp Limits (°C)</b>	<b>7 in Cage</b>
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

**DB-UI 8270D Ultra Inert**

<b>ID (mm)</b>	<b>Length (m)</b>	<b>Film (µm)</b>	<b>Temp Limits (°C)</b>	<b>7 in Cage</b>
<i>0.18</i>	<i>20</i>	<i>0.36</i>	<i>-60 to 325/350</i>	<i>121-9723</i> <i>621-9723, 6/pk*</i>
0.25	30	0.25	-60 to 325/350	122-9732
			-60 to 325/350	622-9732, 6/pk*
		0.50	-60 to 325/350	122-9736

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

\*Only available in the U.S.



# Agilent J&W High Efficiency GC Capillary Columns

High efficiency, high-throughput, and high resolution without the high costs

This leading-edge column technology is ideal for applications that require faster run times, such as high-throughput screening, fast process monitoring, and fast method development. In fact, Agilent High Efficiency GC columns can reduce your sample run time by 50% or more without compromising resolution.

Unlike other manufacturers' 0.1 mm id columns, Agilent's 0.15 and 0.18 mm id High Efficiency Capillary GC columns are compatible with all standard pressure capillary GC and GC/MS instruments – without expensive high-pressure modifications. They also give you:

- The flexibility to choose between helium and hydrogen carrier gases. You can stay with a helium carrier if you wish to simplify method development, or switch to a hydrogen carrier to further reduce your analysis time.
- The ability to separate samples using less carrier gas, which can lead to longer intervals between cylinder changes, increased uptime, and a lower cost per sample.

In addition, these flexible columns easily adapt to a wide variety of environmental, petrochemical, flavor/fragrance, clinical toxicology, and pharmaceutical sample matrices.

The Agilent J&W High Efficiency GC columns throughout this section are displayed using italicized descriptions and part numbers in the ordering tables.

## Low-bleed GC/MS Columns

There is a rapidly increasing population of benchtop GC/MS instruments in analytical laboratories that analyze a widening range of trace level, higher temperature samples. These samples require increasingly inert, lower bleed, higher temperature columns. In response to this growing need, Agilent Technologies designed several "ms" columns to chromatograph a broader range of low level samples and generate lower bleed even at higher temperatures.

What makes an Agilent J&W low-bleed column exceptional? Unique polymer chemistry and proprietary surface deactivation, both of which have contributed to columns that adhere to the tightest quality control specifications in the industry for bleed, inertness, selectivity and efficiency. Agilent J&W "ms" columns utilize special surface deactivation and siloxane chemistries which enhance the chromatographic performance of siloxane polymers.

The mass spectrum of septum bleed can look very much like GC column bleed, so the two are often confused. An easy way to tell the two apart: column bleed will be indicated by a rise in the baseline, not peaks. If you see bleed peaks, these generally come from lower quality septa or septa being used beyond their operating limits. To minimize septa contributions to background bleed, use quality Agilent BTO, Long-Life, or Advanced Green septa.



### 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](http://www.agilent.com/chem/sampleprep)

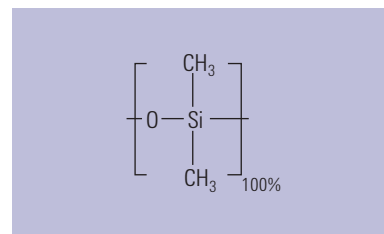




## DB-1ms

- 100% Dimethylpolysiloxane
- Identical selectivity to DB-1
- Non-polar
- Very low bleed characteristics, ideal for GC/MS
- Improved acid performance compared to standard 100% dimethylpolysiloxane columns
- Improved signal-to-noise ratio for better sensitivity and mass spectral integrity
- 340/360 °C upper temperature limit
- Excellent general purpose column
- Bonded and cross-linked
- Solvent rinsable

**Similar Phases:** SPB-1, Rtx-1, BP-1, OV-1, OV-101, 007-1(MS), SP-2100, SE-30, ZB-1, AT-1, MDN-1, ZB-1, ZB-1ms



Structure of DB-1ms

### DB-1ms

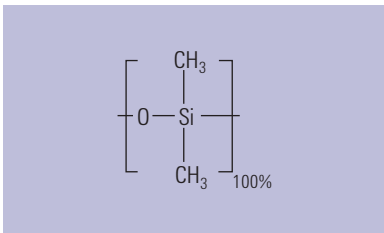
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890
						LTM II Module
0.10	10	0.10	-60 to 340/360	127-0112		127-0112LTM
		0.40	-60 to 340/360	127-0113		
	20	0.10	-60 to 340/360	127-0122		
		0.40	-60 to 340/360	127-0123		127-0123LTM
<i>0.18</i>	<i>20</i>	<i>0.18</i>	<i>-60 to 340/360</i>	<i>121-0122</i>		<i>121-0122LTM</i>
0.20	12	0.33	-60 to 340/350	128-0112		
	25	0.33	-60 to 340/350	128-0122	128-0122E	128-0122LTM
0.25	15	0.25	-60 to 340/360	122-0112	122-0112E	122-0112LTM
		30	0.10	-60 to 340/360	122-0131	
	60	0.25	-60 to 340/360	122-0132	122-0132E	
		0.25	-60 to 340/360	122-0162		
0.32	15	0.25	-60 to 340/360	123-0112		
		30	0.10	-60 to 340/360	123-0131	
	60	0.25	-60 to 340/360	123-0132		
		0.25	-60 to 340/360	123-0162		

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

### TIPS & TOOLS

Learn how the Agilent 5975T LTM GC/MSD can deliver the rapid, reliable results you need in the field or in the lab,  
[www.agilent.com/chem/5975T](http://www.agilent.com/chem/5975T)





Structure of HP-1ms

## HP-1ms

- 100% Dimethylpolysiloxane
- Identical selectivity to HP-1
- Non-polar
- Low bleed characteristics
- Excellent general purpose column
- Improved signal-to-noise ratio for better sensitivity and mass spectral integrity
- Bonded and cross-linked
- Solvent rinsable

**Similar Phases:** Rtx-1ms, Rxi-1ms, MDN-1, AT-1, ZB-1ms, Equity-1

### HP-1ms

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>-60 to 325/350</i>	<i>19091S-677</i>		<i>19091S-677LTM</i>	
0.20	25	0.33	-60 to 325/350	19091S-602	19091S-602E		
0.25	15	0.25	-60 to 325/350	19091S-931			
		0.10	-60 to 325/350	19091S-833		19091S-833LTM	
		0.25	-60 to 325/350	19091S-933	19091S-933E	19091S-933LTM	
		0.50	-60 to 325/350	19091S-633		19091S-633LTM	
		1.00	-60 to 325/350	19091S-733	19091S-733E	19091S-733LTM	
0.32	60	0.25	-60 to 325/350	19091S-936	19091S-936E		
		15	0.25	-60 to 325/350	19091S-911		
		25	0.52	-60 to 325/350	19091S-612		
		30	0.25	-60 to 325/350	19091S-913	19091S-913E	
		1.00	-60 to 325/350	19091S-713		19091S-713LTM	
60	0.25	-60 to 325/350	19091S-916				

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

## VF-1ms

- Highly inert, non-polar 100% dimethylpolysiloxane phase, low-bleed GC column providing increased sensitivity over a broad array of applications
- Ultra low bleed specification of 1 pA at 325 °C (30 m, 0.25 mm, 0.25 µm) for trace analysis with MS
- QC test results for retention index, efficiency, selectivity and bleed is reported with every column
- 0.15 mm id columns available for high efficiency GC and GC/MS analyses
- Supplied with EZ-GRIP to simplify column installation, coupling and operation

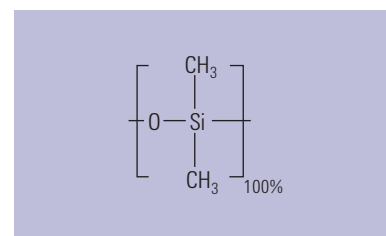
**Similar Phases:** Rtx-1ms, Rxi-1ms, MDN-1, AT-1, ZB-1ms, Equity-1

### VF-1ms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.10	10	0.10	-60 to 325/350	CP8900	
		0.40	-60 to 325/350	CP8901	
	20	0.10	-60 to 325/350	CP8902	
		0.40	-60 to 325/350	CP8903	
<i>0.15</i>	<i>10</i>	<i>0.15</i>	<i>-60 to 325/350</i>	<i>CP9030</i>	
		<i>0.15</i>	<i>-60 to 325/350</i>	<i>CP5881</i>	
	<i>20</i>	<i>0.15</i>	<i>-60 to 325/350</i>	<i>CP9031</i>	
		<i>0.60</i>	<i>-60 to 325/350</i>	<i>CP9032</i>	
0.20	12	0.33	-60 to 325/350	CP8904	
	25	0.33	-60 to 325/350	CP8905	

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

(Continued)



Structure of VF-1ms



Column shown with EZ-GRIP

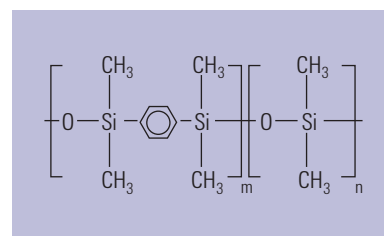
**VF-1ms**

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	
0.25	15	0.10	-60 to 325/350	CP8906		
		0.25	-60 to 325/350	CP8907		
		1.00	-60 to 325/350	CP8908	CP890815	
	25	0.25	-60 to 325/350	CP8909		
		0.40	-60 to 325/350	CP8910		
	30	0.10	-60 to 325/350	CP8911		
		0.25	-60 to 325/350	CP8912	CP891215	
		1.00	-60 to 325/350	CP8913		
	50	0.25	-60 to 325/350	CP8914		
0.40		-60 to 325/350	CP8915			
60	0.25	-60 to 325/350	CP8916			
	1.00	-60 to 325/350	CP8917			
0.32	15	0.10	-60 to 325/350			
		0.25	-60 to 325/350	CP8919		
		1.00	-60 to 325/350			
	25	0.25	-60 to 325/350	CP8921		
		0.40	-60 to 325/350	CP8922		
	30	0.10	-60 to 325/350	CP8923		
		0.25	-60 to 325/350	CP8924		
		0.50	-60 to 325/350	CP8925		
	50	1.00	-60 to 325/350	CP8926		
		0.25	-60 to 325/350			
	60	0.40	-60 to 325/350	CP8928		
		0.25	-60 to 325/350	CP8929		
	0.53	15	1.00	-60 to 325/350	CP8930	
			0.50	-60 to 325/350	CP8965	
		30	1.50	-60 to 325/350	CP8967	
0.50	-60 to 325/350		CP8968			
1.00	-60 to 325/350		CP8969			
1.50	-60 to 310/335		CP8970			

## DB-5ms

- Phenyl Arylene polymer virtually equivalent to a (5%-Phenyl)-methylpolysiloxane
- Non-polar
- Very low bleed characteristics, ideal for GC/MS
- Excellent inertness for active compounds
- Improved signal-to-noise ratio for better sensitivity and mass spectral integrity
- Bonded and cross-linked
- Solvent rinsable
- Exact replacement of HP-5TA
- Close equivalent to USP Phase G27
- Test mix available

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



Structure of DB-5ms

### TIPS & TOOLS

Learn more about the Agilent 7890B GC System at [www.agilent.com/chem/7890BGC](http://www.agilent.com/chem/7890BGC)



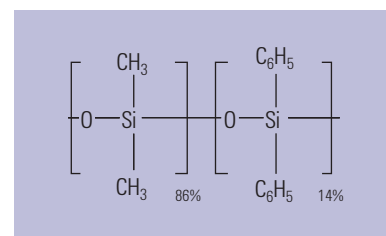
**DB-5ms**

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>-60 to 325/350</i>	<i>121-5522</i>	<i>121-5522E</i>	<i>121-5522LTM</i>
		<i>0.36</i>	<i>-60 to 325/350</i>	<i>121-5523</i>		<i>121-5523LTM</i>
	<i>40</i>	<i>0.18</i>	<i>-60 to 325/350</i>	<i>121-5542</i>		
0.20	12	0.33	-60 to 325/350	128-5512		
	25	0.33	-60 to 325/350	128-5522		128-5522LTM
	50	0.33	-60 to 325/350	128-5552		
0.25	15	0.10	-60 to 325/350	122-5511		122-5511LTM
		0.25	-60 to 325/350	122-5512		122-5512LTM
		0.50	-60 to 325/350	122-5516		
		1.00	-60 to 325/350	122-5513		
	25	0.25	-60 to 325/350	122-5522		122-5522LTM
		0.40	-60 to 325/350			
	30	0.10	-60 to 325/350	122-5531		
		0.25	-60 to 325/350	122-5532	122-5532E	122-5532LTM
		0.50	-60 to 325/350	122-5536	122-5536E	
		1.00	-60 to 325/350	122-5533	122-5533E	122-5533LTM
	50	0.25	-60 to 325/350	122-5552		
	60	0.10	-60 to 325/350	122-5561		
		0.25	-60 to 325/350	122-5562	122-5562E	
1.00		-60 to 325/350	122-5563			
0.32	15	0.10	-60 to 325/350	123-5511		
		0.25	-60 to 325/350	123-5512		123-5512LTM
		1.00	-60 to 325/350	123-5513		123-5513LTM
	25	0.52	-60 to 325/350	123-5526		
	30	0.10	-60 to 325/350	123-5531		
		0.25	-60 to 325/350	123-5532	123-5532E	
		0.50	-60 to 325/350	123-5536		123-5536LTM
		1.00	-60 to 325/350	123-5533		123-5533LTM
	60	0.10	-60 to 325/350	123-5561		
		0.25	-60 to 325/350	123-5562		
		0.50	-60 to 325/350	123-5566		
		1.00	-60 to 325/350	123-5563		
	0.53	15	1.50	-60 to 300/320	125-5512	
30		0.50	-60 to 300/320	125-5537		
		1.00	-60 to 300/320	125-553J		125-553JLTM
		1.50	-60 to 300/320	125-5532		125-5532LTM

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

## HP-5ms

- (5%-Phenyl)-methylpolysiloxane
- Identical selectivity to HP-5
- Non-polar
- Very low bleed characteristics, ideal for GC/MS
- Excellent 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



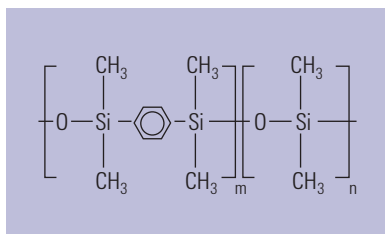
Structure of HP-5ms

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

### HP-5ms

ID						7890/6890
(mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	LTM II Module
<i>0.18</i>	<i>20</i>	<i>0.18</i>	<i>-60 to 325/350</i>	<i>19091S-577</i>		<i>19091S-577LTM</i>
0.20	12	0.33	-60 to 325/350	19091S-101		19091S-101LTM
	25	0.33	-60 to 325/350	19091S-102	19091S-102E	19091S-102LTM
	50	0.33	-60 to 325/350	19091S-105		
0.25	15	0.10	-60 to 325/350	19091S-331		19091S-331LTM
		0.25	-60 to 325/350	19091S-431		19091S-431LTM
		1.00	-60 to 325/350	19091S-231		
	30	0.10	-60 to 325/350	19091S-333		
		0.25	-60 to 325/350	19091S-433	19091S-433E	19091S-433LTM
		0.50	-60 to 325/350	19091S-133		
		1.00	-60 to 325/350	19091S-233	19091S-233E	
	60	0.10	-60 to 325/350	19091S-336		
0.25		-60 to 325/350	19091S-436	19091S-436E		
0.32	25	0.52	-60 to 325/350	19091S-112	19091S-112E	
	30	0.10	-60 to 325/350	19091S-313		
		0.25	-60 to 325/350	19091S-413	19091S-413E	19091S-413LTM
		0.50	-60 to 325/350	19091S-113		
		1.00	-60 to 325/350	19091S-213		
60	0.25	-60 to 325/350	19091S-416			

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



Structure of VF-5ms

## VF-5ms

- Highly inert 5% phenylmethyl column for increased sensitivity, accuracy and instrument uptime
- Minimal column bleed improves sensitivity – ultra low bleed specification of 1 pA at 325 °C (30 m x 0.25 mm, 0.25  $\mu$ m)
- Slightly higher polarity than VF-1ms, results in improved selectivity for aromatic compounds; selectivity and excellent inertness make these columns applicable for a wide range of semi-polar and even polar compounds
- 0.15 mm id columns available for high efficiency GC and GC/MS analyses
- QC test results for retention index, efficiency, selectivity and bleed is reported with every column
- Supplied with EZ-GRIP to simplify column installation, coupling and operation

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

### VF-5ms

ID (mm)	Length (m)	Film ( $\mu$ m)	Temp Limits (°C)	7 in Cage	5 in Cage
0.10	10	0.40	-60 to 325/350	CP8934	
<i>0.15</i>	<i>10</i>	<i>0.15</i>	<i>-60 to 325/350</i>	<i>CP9034</i>	
	<i>15</i>	<i>0.15</i>	<i>-60 to 325/350</i>	<i>CP9035</i>	
	<i>20</i>	<i>0.15</i>	<i>-60 to 325/350</i>	<i>CP9036</i>	
		<i>0.30</i>	<i>-60 to 325/350</i>	<i>CP9037</i>	
	<i>0.60</i>	<i>-60 to 325/350</i>	<i>CP9038</i>		
0.20	<i>40</i>	<i>0.15</i>	<i>-60 to 325/350</i>	<i>CP9039</i>	
	12	0.33	-60 to 325/350	CP8935	
	25	0.33	-60 to 325/350	CP8936	
	50	0.33	-60 to 325/350	CP8937	

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

(Continued)

### TIPS & TOOLS



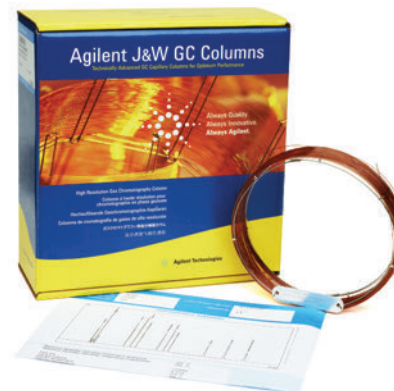
As part of Agilent's ongoing commitment to be your partner in chromatography, we have created a series of GC Troubleshooting videos, featuring Daron Decker, GC Applications Specialist, and Herb Brooks, Agilent Service Engineer. To view the videos, visit [www.agilent.com/chem/gctroubleshooting](http://www.agilent.com/chem/gctroubleshooting)





**VF-5ms**

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.25	15	0.10	-60 to 325/350	CP8938	
		0.25	-60 to 325/350	CP8939	
		0.50	-60 to 325/350	CP8963	
		1.00	-60 to 325/350	CP8940	
	25	0.25	-60 to 325/350	CP8941	
	30	0.10	-60 to 325/350	CP8943	
		0.25	-60 to 325/350	CP8944	CP8944I5
		0.50	-60 to 325/350	CP8945	
		1.00	-60 to 325/350	CP8946	
	50	0.25	-60 to 325/350	CP8947	
	60	0.10	-60 to 325/350	CP8948	
		0.25	-60 to 325/350	CP8960	
1.00		-60 to 325/350	CP8949		
0.32	15	0.10	-60 to 325/350	CP8950	
		0.25	-60 to 325/350	CP8951	
	25	0.52	-60 to 325/350	CP8953	
	30	0.25	-60 to 325/350	CP8955	
		0.50	-60 to 325/350	CP8956	
		1.00	-60 to 325/350	CP8957	
	50	0.25	-60 to 325/350	CP8958	
		0.40	-60 to 325/350	CP8959	
	60	0.25	-60 to 325/350	CP8961	
		1.00	-60 to 325/350	CP8962	
0.53	15	0.50	-60 to 325/350	CP8971	
	30	0.50	-60 to 325/350	CP8974	
		1.00	-60 to 325/350	CP8975	
		1.50	-60 to 310/335	CP8976	



Column on 5 in cage

## DB-XLB

- Exceptionally low bleed
- Low polarity
- Extended temperature limit of 340/360 °C
- Unique selectivity
- Excellent inertness for active compounds
- Ideal for confirmational analyses
- Excellent for pesticides, herbicides, PCBs and PAHs
- Ideal for GC/MS
- Bonded and cross-linked
- Solvent rinsable

**Note:** DB-XLB is designed for inhibiting column bleed at high temperatures. It also appears to have inadvertently inherited an exceptional ability for separating many PCB congeners when used with MS detection. This stellar performance was maximized after careful optimization of the column dimensions, temperature programs, and carrier gas flow conditions.

(Frame, G. *Analytical Chemistry News & Features*, Aug. 1, 1997, 468A-475A)

**Similar Phases:** Rtx-XLB, MDN-12, ZB-XLB, ZB-XLB HT

### DB-XLB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	7890/6890 LTM II Module
<i>0.18</i>	<i>20</i>	<i>0.18</i>	<i>30 to 340/360</i>	<i>121-1222</i>	
	<i>30</i>	<i>0.18</i>	<i>30 to 340/360</i>	<i>121-1232</i>	
0.20	25	0.33	30 to 340/360	128-1222	
0.25	15	0.10	30 to 340/360	122-1211	122-1211LTM
		0.25	30 to 340/360	122-1212	
	30	0.10	30 to 340/360	122-1231	
		0.25	30 to 340/360	122-1232	122-1232LTM
		0.50	30 to 340/360	122-1236	
	60	1.00	30 to 340/360	122-1233	
0.32	30	0.25	30 to 340/360	123-1232	
		0.50	30 to 340/360	123-1236	
	60	0.25	30 to 340/360	123-1262	
0.53	15	1.50	30 to 320/340	125-1212	
	30	1.50	30 to 320/340	125-1232	

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

## VF-Xms

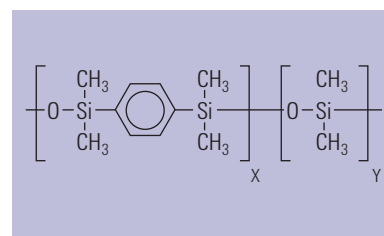
- High arylene modified phase for accurate results
- Isothermal applications up to 340 °C for a broad application range
- Ideal for confirmational analyses – more polar alternative to 5% phenyl columns
- Ultra low bleed delivers ultimate sensitivity and signal-to-noise ratio
- Provides exceptionally high selectivity for semivolatle compounds such as pesticides and delivers high resolution with short analysis time
- Very unique selectivity for chlorinated compounds
- QC test results for retention index, efficiency, selectivity and bleed is reported with every column
- 0.15 mm id columns available for high efficiency GC and GC/MS analyses
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

**Similar Phases:** Rtx-XLB, MDN-12, ZB-XLB, ZB-XLB HT

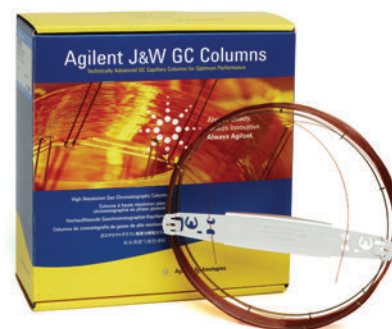
### VF-Xms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
<i>0.15</i>	<i>20</i>	<i>0.15</i>	<i>30 to 340/360</i>	<i>CP9041</i>
0.20	25	0.33	30 to 340/360	CP8801
0.25	30	0.10	30 to 340/360	CP8805
		0.25	30 to 340/360	CP8806
		0.50	30 to 340/360	CP8807
0.32	60	0.25	30 to 340/360	CP8809
	30	0.25	30 to 340/360	CP8813
	60	0.25	30 to 340/360	CP8816

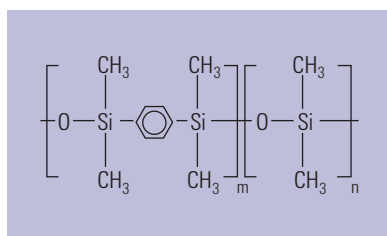
Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers



Structure of VF-Xms



Column shown with EZ-GRIP



Structure of DB-35ms

## DB-35ms

- Virtually equivalent to a (35%-phenyl)-methylpolysiloxane
- Mid-polarity
- Very low bleed characteristics, ideal for GC/MS
- Extended temperature limit of 340/360 °C
- Excellent inertness for active compounds
- Ideal for confirmational analyses
- Bonded and cross-linked
- Solvent rinsable
- Replaces HP-35ms
- Close equivalent to USP Phase G42

**Similar Phases:** Rtx-35, Rtx-35ms, Rxi-35Sil MS, SPB-35, AT-35, Sup-Herb, MDN-35, BPX-34, ZB-35, ZB-35 ht

### DB-35ms

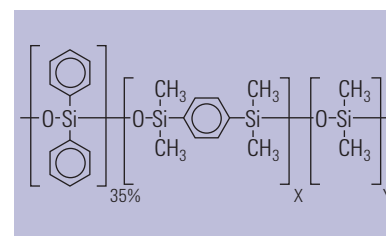
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
<i>0.18</i>	<i>20</i>	<i>0.18</i>	<i>50 to 340/360</i>	<i>121-3822</i>		
0.20	15	0.33	50 to 340/360	128-3812		
	25	0.33	50 to 340/360	128-3822		
0.25	15	0.25	50 to 340/360	122-3812		
	30	0.15	50 to 340/360	122-3831		
	30	0.25	50 to 340/360	122-3832	122-3832E	122-3832LTM
	60	0.25	50 to 340/360	122-3862		
0.32	15	0.25	50 to 340/360	123-3812		
	30	0.25	50 to 340/360	123-3832	123-3832E	
0.53	30	0.50	50 to 320/340	125-3837		
	30	1.00	50 to 320/340	125-3832		

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

## VF-35ms

- Stabilized arylene-modified equivalent of a 35% phenylmethyl phase
- Ideal for dual column confirmational analyses
- Ultra low bleed, highly stable column with a programmable maximum temperature of 360 °C
- Medium polarity column ideal for trace environmental and chemical analyses
- 0.15 mm id columns available for high efficiency GC and GC/MS analyses
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

**Similar Phases:** Rtx-35, Rtx-35ms, Rxi-35Sil MS, SPB-35, AT-35, Sup-Herb, MDN-35, BPX-34, ZB-35, ZB-35 ht

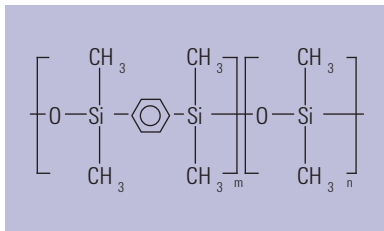


Structure of VF-35ms

### VF-35ms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
<i>0.15</i>	<i>10</i>	<i>0.15</i>	<i>40 to 340/360</i>	<i>CP5887</i>
	<i>20</i>	<i>0.15</i>	<i>40 to 340/360</i>	<i>CP5889</i>
0.20	15	0.33	40 to 340/360	CP8872
	25	0.33	40 to 340/360	CP8873
0.25	15	0.25	40 to 340/360	CP8874
		0.10	40 to 340/360	CP8875
	30	0.25	40 to 340/360	CP8877
		0.50	40 to 340/360	CP8878
		1.00	40 to 340/360	CP8879
	60	0.25	40 to 340/360	CP8880
0.32	30	0.25	40 to 340/360	CP8882
		0.50	40 to 340/360	CP8883
		1.00	40 to 340/360	CP8884
0.53	30	1.00	40 to 325/350	CP8888

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



Structure of DB-17ms

## DB-17ms

- Virtually equivalent to (50%-phenyl)-methylpolysiloxane
- 320/340 °C upper temperature limit
- Very low bleed mid-polarity column, ideal for GC/MS
- Excellent inertness for active compounds
- Enhanced mass spectral integrity
- Bonded and cross-linked
- Solvent rinsable
- Excellent choice for CLP pesticides

**Similar Phases:** Rxi-17Sil MS, Rtx-50, 007-17, SP-2250, SPB-50, BPX-50, SPB-17, AT-50

### DB-17ms

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 320/340</i>	<i>121-4722</i>		<i>121-4722LTM</i>
0.25	15	0.15	40 to 320/340	122-4711		122-4711LTM
		0.25	40 to 320/340	122-4712		122-4712LTM
	30	0.15	40 to 320/340	122-4731		
		0.25	40 to 320/340	122-4732	122-4732E	122-4732LTM
0.32	15	0.25	40 to 320/340	123-4712		
	30	0.25	40 to 320/340	123-4732		123-4732LTM

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



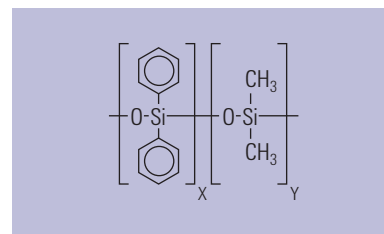
### TIPS & TOOLS

View the latest GC column focused applications, products and educational resources at [www.agilent.com/chem/myGCColumns](http://www.agilent.com/chem/myGCColumns)

## VF-17ms

- 50% phenyl/50% dimethylpolysiloxane, medium polarity phase
- Ultra low bleed
- Proprietary deactivation technology and manufacturing process improves column stability, resulting in improved column-to-column repeatability and column lifetimes
- Ideal for environmental and clinical methods
- Ultra low bleed specification at 2 pA at 325 °C (0.25 mm x 30 m, 0.25 µm)
- Ideal EPA confirmation column for ultimate confidence
- Bonded and cross-linked
- Solvent rinsable
- 0.15 mm id columns available for high efficiency GC and GC/MS analyses
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

**Similar Phases:** Rxi-17Sil MS, Rtx-50, 007-17, SP-2250, SPB-50, BPX-50, SPB-17, AT-50

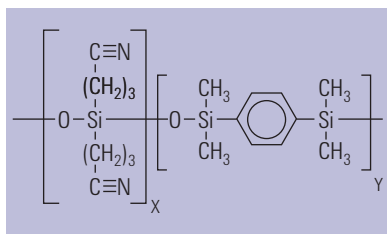


Structure of VF-17ms

### VF-17ms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.10	10	0.20	40 to 330/360	CP8977	
<i>0.15</i>	<i>10</i>	<i>0.15</i>	<i>40 to 330/360</i>	<i>CP5882</i>	
	<i>15</i>	<i>0.15</i>	<i>40 to 330/360</i>	<i>CP5883</i>	
	<i>20</i>	<i>0.15</i>	<i>40 to 330/360</i>	<i>CP5884</i>	
0.25	15	0.25	40 to 330/360	CP8979	
	15	0.50	40 to 330/360	CP8980	
	30	0.15	40 to 330/360	CP8981	
				CP8982	CP898215
				CP8983	
	60	0.25	40 to 330/360	CP8984	
0.32	15	0.15	40 to 330/360	CP8986	
		0.25	40 to 330/360	CP8990	
		0.50	40 to 330/360	CP8991	
0.53	15	1.00	40 to 330/360	CP8996	
		1.50	40 to 310/340	CP8998	
	30	1.00	40 to 310/340	CP9001	
		1.50	40 to 310/340	CP9002	

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



Structure of VF-23ms

## VF-23ms

- High polarity and highly substituted cyanopropyl low bleed phase
- Engineered for accurate analysis of very polar analytes
- 100% bonded phase permits column rinsing to enhance column lifetime
- Operating temperature up to 260 °C
- Expands application ranges to higher molecular weight compounds
- 0.15 mm id columns available for high efficiency GC and GC/MS analyses
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

**Similar Phases:** SP-2330, Rtx-2330, 007-23, AT-Silar, BPX-70, SP-2340

### VF-23ms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.25	30	0.15	40 to 260/260	CP8821	
		0.25	40 to 260/260	CP8822	CP882215
	60	0.25	40 to 260/260	CP8824	CP882415
0.32	30	0.25	40 to 260/260	CP8827	
		60	0.15	40 to 260/260	CP8828
			0.25	40 to 260/260	CP8829
0.53	30	0.50	40 to 245/245	CP8831	



## VF-200ms

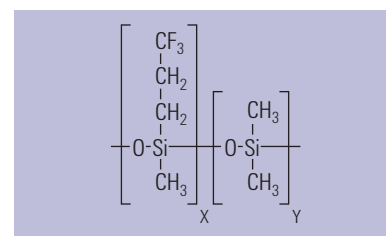
- Trifluoropropyl phase has very high temperature stability and can be used routinely up to 350 °C
- Ideally suited for analyses of ketones, aldehydes, nitro- or chloro-containing compounds, PAHs, unsaturated compounds, silanes, and CFCs
- Optimized deactivation for symmetrical peak shape
- Ultra-low bleed for trace analysis
- 0.15 mm id columns available for high efficiency GC and GC/MS analyses
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

**Similar Phases:** Rtx-200

### VF-200ms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	
<i>0.15</i>	<i>20</i>	<i>0.15</i>	<i>0 to 325/350</i>	<i>CP5891</i>		
		<i>0.60</i>	<i>0 to 325/350</i>	<i>CP5892</i>		
0.25	15	0.25	0 to 325/350	CP8855		
		30	0.10	0 to 325/350	CP8857	
			0.25	0 to 325/350	CP8858	
			0.50	0 to 325/350	CP8859	CP885915
			1.00	0 to 325/350	CP8860	
60	0.25	0 to 325/350	CP8861			
0.32	30	0.50	0 to 325/350	CP8864		
		1.00	0 to 325/350	CP8865		
0.53	30	0.50	0 to 300/325	CP8867		
		1.00	0 to 300/325	CP8868		

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



Structure of VF-200ms

## DB-225ms

- Virtually equivalent to (50%-cyanopropylphenyl)-methylpolysiloxane
- Mid/high polarity
- Excellent for separations of cis- and trans-fatty acid methyl esters (FAMES)
- Low bleed
- Bonded and cross-linked
- Solvent rinsable
- Close equivalent to USP Phase G7

**Similar Phases:** SP-2330, Rtx-225, BP-225, OV-225, 007-225, AT-225

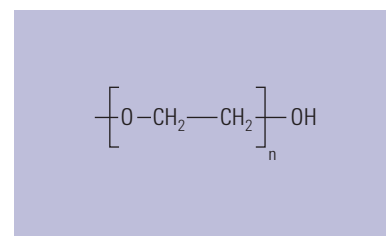
### DB-225ms

ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	7890/6890		
				7 in Cage	5 in Cage	LTM II Module
0.25	15	0.25	40 to 240	122-2912		122-2912LTM
	30	0.25	40 to 240	122-2932	122-2932E	122-2932LTM
	60	0.25	40 to 240	122-2962		
0.32	30	0.25	40 to 240	123-2932		

## VF-WAXms

- Specially designed WAX phase designed for accurate MS results with polar compounds
- Operating temperature range of 20 °C to 250 °C
- Improves signal-to-noise ratio for trace analyses
- Ideal for GC/MS food, flavor and fragrance applications, especially where trace analyses are required
- Ultra low bleed provides increased sensitivity and extended column lifetime at higher temperatures
- Improved performance with no change in the typical selectivity of PEG
- 0.15 mm id columns available for high efficiency GC and GC/MS analyses
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

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



Structure of VF-WAXms

### VF-WAXms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	
0.10	10	0.10	20 to 250/260	CP9219		
		0.20	20 to 250/260	CP9218		
	20	0.10	20 to 250/260	CP9229		
<i>0.15</i>	<i>15</i>	<i>0.15</i>	<i>20 to 250/260</i>	<i>CP9201</i>		
	<i>20</i>	<i>0.15</i>	<i>20 to 250/260</i>	<i>CP9220</i>		
	<i>30</i>	<i>0.15</i>	<i>20 to 250/260</i>	<i>CP9202</i>		
0.25	15	0.25	20 to 250/260	CP9203		
		0.50	20 to 250/260	CP9221		
	25	0.20	20 to 250/260	CP9204		
		30	0.25	20 to 250/260	CP9205	CP920515
			0.50	20 to 250/260	CP9222	
	60	0.25	1.00	20 to 240	CP9206	
			0.25	20 to 250/260	CP9207	
		0.50	20 to 240	CP9223		

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

(Continued)

**VF-WAXms**

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.32	30	0.25	20 to 250/260	CP9212	
		0.50	20 to 250/260	CP9210	
		1.00	20 to 240	CP9211	
	60	0.25	20 to 250/260	CP9214	
		0.50	20 to 240	CP9225	
		1.00	20 to 230	CP9213	
0.53	15	1.00	20 to 250/260	CP9226	
		2.00	20 to 240		
	30	1.00	20 to 240	CP9215	
		2.00	20 to 230	CP9216	
	60	1.00	20 to 230	CP9228	
		2.00	20 to 220	CP9217	



**TIPS & TOOLS**

As a special MS-type phase, the VF-WAXms column generates less bleed, and therefore less noise and higher signal-to-noise ratios for critical components.

## VF-624ms and VF-1301ms

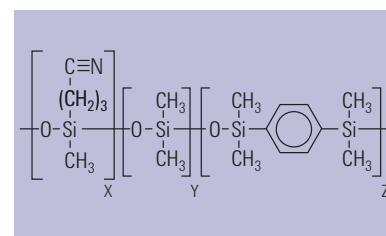
- VF-624ms is designed for analyzing solvents according to EPA Methods 524, 624 and 8260, as well as USP 467
- VF-1301ms ultra-low-bleed thin-film has a similar selectivity to 624 and is suitable for semivolatile organic solvents, as well as PCBs and pesticides
- Enhanced selectivity for USP 467 eliminates co-elution of benzene and 1,2-dichloroethane
- Mid polarity
- Low bleed
- 0.15 mm id columns available for high efficiency GC and GC/MS analyses
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

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

### VF-624ms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
<i>0.15</i>	<i>15</i>	<i>0.84</i>	<i>-40 to 280/300</i>	<i>CP9101</i>	
	<i>20</i>	<i>0.84</i>	<i>-40 to 280/300</i>	<i>CP9100</i>	
	<i>30</i>	<i>0.84</i>	<i>-40 to 280/300</i>	<i>CP9109</i>	
	<i>40</i>	<i>0.84</i>	<i>-40 to 280/300</i>	<i>CP9110</i>	
0.25	30	1.40	-40 to 280/300	CP9102	CP910215
	60	1.40	-40 to 280/300	CP9103	CP910315
0.32	30	1.80	-40 to 280/300	CP9104	CP910415
	60	1.80	-40 to 280/300	CP9105	
0.53	30	3.00	-40 to 280/300	CP9106	CP910615
	60	3.00	-40 to 265/280	CP9107	
	75	3.00	-40 to 265/280	CP9108	

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



Structure of VF-624ms and VF-1301ms

**Similar Phases:** Rtx-1301, PE-1301

**VF-1301ms**

ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	7 in Cage
0.10	10	1.00	-40 to 280/300	CP9066
0.25	30	0.25	-40 to 280/300	CP9053
		1.00	-40 to 280/300	CP9054
	60	0.25	-40 to 280/300	CP9055
		1.00	-40 to 280/300	CP9056
0.32	15	0.25	-40 to 280/300	CP9057
		1.00	-40 to 280/300	CP9058
0.53	15	1.00	-40 to 280/300	CP9062
	30	1.00	-40 to 280/300	CP9063
		1.50	-40 to 280/300	CP9064

**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](http://www.agilent.com/chem/GCsupplies)



## VF-1701ms

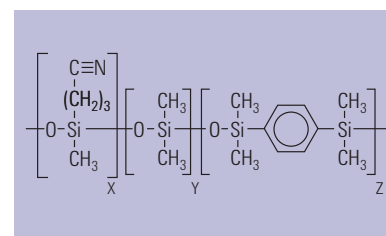
- Ultra-low bleed 14% cyanopropyl/phenyl/86% polydimethylsiloxane phase
- Mid polarity
- Ideal for pesticides, PCBs and semi-volatile organic compounds
- Highly inert for difficult analytes such as p,p'-DDT
- Deactivated for accurate trace analysis
- Engineered for reduced bleed, (bleed specification is 2 pA at 280 °C for a 0.25 mm x 60 m, 0.25 µm id column)
- 0.15 mm id columns available for high efficiency GC and GC/MS analyses
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

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

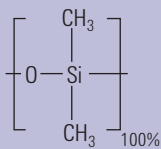
### VF-1701ms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
<i>0.15</i>	<i>20</i>	<i>0.15</i>	<i>-20 to 280/300</i>	<i>CP9145</i>	
0.25	30	0.15	-20 to 280/300	CP9150	
		0.25	-20 to 280/300	CP9151	CP915115
		1.00	-20 to 280/300	CP9152	CP915215
	60	0.25	-20 to 280/300	CP9154	
		1.00	-20 to 280/300	CP9156	
0.32	30	0.25	-20 to 280/300	CP9162	
		1.00	-20 to 280/300	CP9163	
	60	0.25	-20 to 280/300	CP9165	
		1.00	-20 to 280/300	CP9166	
0.53	30	0.50	-20 to 280/300	CP9170	
		1.00	-20 to 280/300	CP9171	

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



Structure of VF-1701ms



Structure of DB-1

## Premium Polysiloxane Columns

Polysiloxanes are the most common stationary phases. They are available in the greatest variety and are stable, robust and versatile. Standard polysiloxanes are characterized by the repeating siloxane backbone. Each silicon atom contains two functional groups. The type and percent level of substitution of the groups distinguish each stationary phase and its properties.

### DB-1

- 100% Dimethylpolysiloxane
- Non-polar
- Excellent general purpose column
- Wide range of applications
- Low bleed
- High temperature limit
- Bonded and cross-linked
- Solvent rinsable
- Wide range of column dimensions available
- Equivalent to USP Phase G2

**Similar Phases:** SPB-1, Rtx-1, BP-1, OV-1, OV-101, 007-1(MS), SP-2100, SE-30, ZB-1, AT-1, MDN-1, ZB-1

### DB-1

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890
						LTM II Module
0.05	10	0.05	-60 to 325/350	126-1012		
		0.20	-60 to 325/350	126-1013		
0.10	5	0.12	-60 to 325/350	127-100A		127-100ALTM
		0.10	-60 to 325/350	127-1012	127-1012E	
	0.40	-60 to 325/350	127-1013	127-1013E	127-1013LTM	
		0.10	-60 to 325/350	127-1022	127-1022E	
	0.40	-60 to 325/350	127-1023		127-1023LTM	
		40	0.20	-60 to 325/350	127-1046	127-1046E
	0.40	-60 to 325/350	127-1043			

(Continued)



**DB-1**

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890
						LTM II Module
<i>0.15</i>	<i>10</i>	<i>1.20</i>	<i>-60 to 325/350</i>	<i>12A-1015</i>		<i>12A-1015LTM</i>
<i>0.18</i>	<i>10</i>	<i>0.18</i>	<i>-60 to 325/350</i>	<i>121-1012</i>	<i>121-1012E</i>	<i>121-1012LTM</i>
		<i>0.20</i>	<i>-60 to 325/350</i>	<i>121-101A</i>		<i>121-101ALTM</i>
		<i>0.40</i>	<i>-60 to 325/350</i>	<i>121-1013</i>		<i>121-1013LTM</i>
	<i>20</i>	<i>0.18</i>	<i>-60 to 325/350</i>	<i>121-1022</i>	<i>121-1022E</i>	<i>121-1022LTM</i>
		<i>0.40</i>	<i>-60 to 325/350</i>	<i>121-1023</i>		<i>121-1023LTM</i>
	<i>40</i>	<i>0.40</i>	<i>-60 to 325/350</i>	<i>121-1043</i>		
<i>0.20</i>	<i>12</i>	<i>0.33</i>	<i>-60 to 325/350</i>	<i>128-1012</i>		<i>128-1012LTM</i>
	<i>25</i>	<i>0.33</i>	<i>-60 to 325/350</i>	<i>128-1022</i>		<i>128-1022LTM</i>
	<i>30</i>	<i>0.80</i>	<i>-60 to 325/350</i>	<i>128-1034</i>		
	<i>50</i>	<i>0.33</i>	<i>-60 to 325/350</i>	<i>128-1052</i>		
<i>0.25</i>	<i>15</i>	<i>0.10</i>	<i>-60 to 325/350</i>	<i>122-1011</i>		
		<i>0.25</i>	<i>-60 to 325/350</i>	<i>122-1012</i>		<i>122-1012LTM</i>
		<i>1.00</i>	<i>-60 to 325/350</i>	<i>122-1013</i>		
	<i>25</i>	<i>0.25</i>	<i>-60 to 325/350</i>	<i>122-1022</i>		<i>122-1022LTM</i>
	<i>30</i>	<i>0.10</i>	<i>-60 to 325/350</i>	<i>122-1031</i>		
		<i>0.25</i>	<i>-60 to 325/350</i>	<i>122-1032</i>	<i>122-1032E</i>	<i>122-1032LTM*</i>
		<i>0.50</i>	<i>-60 to 325/350</i>	<i>122-103E</i>		<i>122-103ELTM</i>
		<i>1.00</i>	<i>-60 to 325/350</i>	<i>122-1033</i>	<i>122-1033E</i>	<i>122-1033LTM</i>
	<i>50</i>	<i>0.25</i>	<i>-60 to 325/350</i>	<i>122-1052</i>		
	<i>60</i>	<i>0.10</i>	<i>-60 to 325/350</i>	<i>122-1061</i>		
		<i>0.25</i>	<i>-60 to 325/350</i>	<i>122-1062</i>		
		<i>0.50</i>	<i>-60 to 325/350</i>	<i>122-106E</i>		
		<i>1.00</i>	<i>-60 to 325/350</i>	<i>122-1063</i>		
	<i>100</i>	<i>0.50</i>	<i>-60 to 325/350</i>	<i>122-10AE</i>		
	<i>150</i>	<i>1.00</i>	<i>-60 to 325/350</i>	<i>122-10G3</i>		

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

(Continued)

**DB-1**

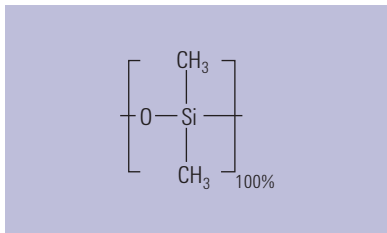
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890	
						LTM II Module	
0.32	15	0.10	-60 to 325/350	123-1011		123-1011LTM	
		0.25	-60 to 325/350	123-1012		123-1012LTM	
		1.00	-60 to 325/350	123-1013			
		3.00	-60 to 280/300	123-1014			
		5.00	-60 to 280/300	123-1015		123-1015LTM	
	25	0.12	-60 to 325/350	123-1027			
		0.25	-60 to 325/350	123-1022			
		0.52	-60 to 325/350	123-1026			
		1.05	-60 to 325/350	123-102F			
	30	0.10	-60 to 325/350	123-1031			
		0.25	-60 to 325/350	123-1032			123-1032LTM
		0.50	-60 to 325/350	123-103E			123-103ELTM
		1.00	-60 to 325/350	123-1033	123-1033E		123-1033LTM
		1.50	-60 to 300/320	123-103B			123-103BLTM
		3.00	-60 to 280/300	123-1034			
		5.00	-60 to 280/300	123-1035			123-1035LTM
	50	0.25	-60 to 325/350	123-1052			
		0.52	-60 to 325/350	123-1056			
		1.05	-60 to 325/350	123-105F			
		1.20	-60 to 325/350	123-105C			
5.00		-60 to 280/300	123-1055				
60	0.10	-60 to 325/350	123-1061				
	0.25	-60 to 325/350	123-1062	123-1062E			
	0.50	-60 to 325/350	123-106E				
	1.00	-60 to 325/350	123-1063	123-1063E			
	1.50	-60 to 300/320	123-106B	123-106BE			
	2.00	-60 to 280/300	123-106G				
	3.00	-60 to 280/300	123-1064	123-1064E			
	5.00	-60 to 280/300	123-1065	123-1065E			
0.45	30	1.27	-60 to 325/350	124-1032			
		2.55	-60 to 260/280	124-1034			

(Continued)



## DB-1

ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	7 in Cage	5 in Cage	7890/6890
						LTM II Module
0.53	5	2.65	-60 to 325/350	125-100B		
		5.00	-60 to 325/350	125-1005		125-1005LTM
7.5	1.50	-60 to 325/350	125-1002			
10	2.65	-60 to 260/280	125-10HB	125-10HBE	125-10HBLTM	
		5.00	-60 to 260/280	125-10H5		
15	0.15	-60 to 340/360	125-1011	125-1011E	125-1011LTM	
		-60 to 320/340	125-101K			
		-60 to 300/320	125-1017			
		-60 to 300/320	125-101J			
		-60 to 300/320	125-1012	125-1012E	125-1012LTM	
		-60 to 260/280	125-1014			
		-60 to 260/280	125-1015			125-1015LTM
25	1.00	-60 to 300/320	125-102J			
		5.00	-60 to 260/280	125-1025		125-1025LTM
30	0.10	-60 to 340/360	125-1039			
		-60 to 320/340	125-103K	125-103KE	125-103KLTM	
		-60 to 300/320	125-1037			
		-60 to 300/320	125-103J		125-103JLTM	
		-60 to 300/320	125-1032		125-1032LTM	
		-60 to 260/280	125-103B			
		-60 to 260/280	125-1034	125-1034E	125-1034LTM	
		-60 to 260/280	125-1035	125-1035E	125-1035LTM	
50	5.00	-60 to 260/280	125-1055			
60	1.00	-60 to 300/320	125-106J	125-106JE		
		-60 to 300/320	125-1062	125-1062E		
		-60 to 260/280	125-1064			
		-60 to 260/280	125-1065	125-1065E		
105	5.00	-60 to 260/280	125-10B5			



Structure of HP-1

## HP-1

- 100% Dimethylpolysiloxane
- Non-polar
- Excellent general purpose column – "Industry Standard"
- Wide range of applications
- Superior performance for low molecular weight alcohols (<C<sub>5</sub>)
- High temperature limit
- Bonded and cross-linked
- Solvent rinsable
- Wide range of column dimensions available
- Equivalent to USP Phase G2

**Similar Phases:** SPB-1, Rtx-1, BP-1, OV-1, OV-101, 007-1(MS), SP-2100, SE-30, ZB-1, AT-1, MDN-1, ZB-1

### HP-1

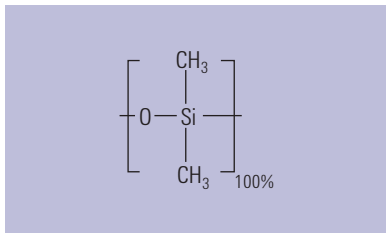
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
<i>0.18</i>	<i>20</i>	<i>0.18</i>	<i>-60 to 325/350</i>	<i>19091Z-577</i>	<i>19091Z-577E</i>	
0.20	12	0.33	-60 to 325/350	19091-60312		
	17	0.11	-60 to 325/350	19091Z-008		
	25	0.11	-60 to 325/350	19091Z-002		19091Z-002LTM
		0.33	-60 to 325/350	19091Z-102	19091Z-102E	
		0.50	-60 to 325/350	19091Z-202		19091Z-202LTM
	50	0.11	-60 to 325/350	19091Z-005		
		0.33	-60 to 325/350	19091Z-105		
		0.50	-60 to 325/350	19091Z-205		
0.25	15	0.10	-60 to 325/350	19091Z-331		
		0.25	-60 to 325/350	19091Z-431		
		1.00	-60 to 325/350	19091Z-231		
	30	0.10	-60 to 325/350	19091Z-333		
		0.25	-60 to 325/350	19091Z-433	19091Z-433E	
		1.00	-60 to 325/350	19091Z-233	19091Z-233E	
	60	0.25	-60 to 325/350	19091Z-436		
		1.00	-60 to 325/350	19091Z-236	19091Z-236E	
		100	0.50	-60 to 325/350	19091Z-530	19091Z-530E

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

(Continued)

HP-1

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.32	15	0.25	-60 to 325/350	19091Z-411		
		1.00	-60 to 325/350	19091Z-211		
	25	0.17	-60 to 325/350	19091Z-012		19091Z-012LTM
		0.52	-60 to 325/350	19091Z-112	19091Z-112E	
		1.05	-60 to 325/350	19091Z-212		
	30	0.10	-60 to 325/350	19091Z-313		19091Z-313LTM
		0.25	-60 to 325/350	19091Z-413	19091Z-413E	
		1.00	-60 to 325/350	19091Z-213	19091Z-213E	
		3.00	-60 to 260/280	19091Z-513	19091Z-513E	
		4.00	-60 to 260/280	19091Z-613		19091Z-613LTM
		5.00	-60 to 260/280	19091Z-713	19091Z-713E	19091Z-713LTM
	50	0.17	-60 to 325/350	19091Z-015		
		0.52	-60 to 325/350	19091Z-115	19091Z-115E	
		1.05	-60 to 325/350	19091Z-215		
	60	0.25	-60 to 325/350	19091Z-416		
1.00		-60 to 325/350	19091Z-216	19091Z-216E		
5.00		-60 to 260/280	19091Z-716			
0.53	5	0.15	-60 to 320/400	19095Z-220		
		0.88	-60 to 320/400	19095Z-020		
		2.65	-60 to 260/280	19095S-100	19095S-100E	
	7.5	5.00	-60 to 260/280	19095Z-627		
	10	0.88	-60 to 300/320	19095Z-021	19095Z-021E	19095Z-021LTM
		2.65	-60 to 260/280	19095Z-121	19095Z-121E	19095Z-121LTM
	15	0.15	-60 to 320/400	19095Z-221	19095Z-221E	
		1.50	-60 to 300/320	19095Z-321		
		3.00	-60 to 260/280	19095Z-421		
		5.00	-60 to 260/280	19095Z-621		
	30	0.88	-60 to 300/320	19095Z-023	19095Z-023E	19095Z-023LTM
		1.50	-60 to 300/320	19095Z-323	19095Z-323E	
		2.65	-60 to 260/280	19095Z-123	19095Z-123E	19095Z-123LTM
		3.00	-60 to 260/280	19095Z-423	19095Z-423E	
		5.00	-60 to 260/280	19095Z-623	19095Z-623E	19095Z-623LTM
	60	5.00	-60 to 260/280	19095Z-626		



Structure of CP-Sil 5 CB

## CP-Sil 5 CB

- 100% Dimethylpolysiloxane
- Non-polar
- General purpose phase
- Bonded and cross-linked
- Solvent rinsable
- Available in fused silica or UltiMetal
- Separation almost entirely based on boiling points, making this column suitable for a wide range of applications with a broad temperature range
- High temperature limit
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

**Similar Phases:** SPB-1, Rtx-1, BP-1, OV-1, OV-101, 007-1(MS), SP-2100, SE-30, ZB-1, AT-1, MDN-1, ZB-1

### CP-Sil 5 CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.10	10	0.10	-60 to 330/350	CP7311	
		0.12	-60 to 330/350	CP7310	
<i>0.15</i>	<i>10</i>	<i>0.12</i>	<i>-60 to 330/350</i>	<i>CP7684</i>	
		<i>2.00</i>	<i>-60 to 325/350</i>	<i>CP7682</i>	
	<i>25</i>	<i>0.12</i>	<i>-60 to 330/350</i>	<i>CP7694</i>	
		<i>1.20</i>	<i>-60 to 325/350</i>	<i>CP7693</i>	
		<i>2.00</i>	<i>-60 to 325/350</i>	<i>CP7692</i>	
0.20	25	0.33	-60 to 325/350	CP7622	
0.25	10	0.12	-60 to 330/350	CP7700	
		0.25	-60 to 330/350	CP8510	
	25	0.12	-60 to 330/350	CP7710	
		0.25	-60 to 330/350	CP7441	
		0.40	-60 to 325/350	CP7709	
		1.20	-60 to 325/350	CP7670	CP7670I5
	30	0.10	-60 to 330/350	CP8710	
		0.25	-60 to 330/350	CP8741	CP8741I5
		1.00	-60 to 325/350	CP8770	
	50	0.12	-60 to 330/350	CP7720	
		0.25	-60 to 330/350	CP7443	CP7443I5
		0.40	-60 to 325/350	CP7719	
	60	0.25	-60 to 330/350	CP8743	
		1.00	-60 to 325/350	CP8780	

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

(Continued)

## CP-Sil 5 CB

ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	7 in Cage	5 in Cage
0.32	10	0.12	-60 to 330/350	CP7730	
		1.20	-60 to 325/350	CP7758	
	15	0.10	-60 to 330/350	CP8529	
		0.25	-60 to 325/350	CP8530	
		3.00	-60 to 325/350	CP8550	
		1.00	-60 to 325/350	CP8540	
		5.00	-60 to 300/325	CP8560	
	25	0.12	-60 to 330/350	CP7740	
		0.25	-60 to 325/350	CP7442	
		0.40	-60 to 325/350	CP7739	
		0.52	-60 to 325/350	CP8430	
		1.20	-60 to 325/350	CP7760	
		5.00	-60 to 300/325	CP7680	CP7680I5
	30	0.25	-60 to 325/350	CP8742	
		1.00	-60 to 325/350	CP8760	
		3.00	-60 to 310/335	CP8687	CP8687I5
		5.00	-60 to 300/325	CP8688	CP8688I5
	50	0.12	-60 to 330/335	CP7750	CP7750I5
		0.25	-60 to 325/350	CP7444	
		0.40	-60 to 325/350	CP7749	CP7749I5
1.20		-60 to 325/350	CP7770	CP7770I5	
5.00		-60 to 300/325	CP7690	CP7690I5	
60	0.25	-60 to 325/350	CP8744		
	1.00	-60 to 325/350	CP8870		
	3.00	-60 to 310/335	CP8689		
	5.00	-60 to 300/325	CP8690	CP8690I5	

(Continued)

**CP-Sil 5 CB**

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	
0.53	10	1.00	-60 to 315/340	CP7625		
		2.00	-60 to 305/330	CP7620		
		5.00	-60 to 290/325	CP7645		
	15	0.15	-60 to 330/350	CP8673		
		1.50	-60 to 305/330	CP8674		
		3.00	-60 to 300/325	CP8675		
		5.00	-60 to 290/325	CP8676		
	20	5.00	-60 to 290/325	CP8774		
	25	1.00	-60 to 315/340	CP7635		
		2.00	-60 to 305/330	CP7630		
		5.00	-60 to 290/325	CP7675		
	30	1.50	-60 to 305/330	CP8735	CP8735I5	
		2.00	-60 to 305/330	CP8730		
		3.00	-60 to 300/325	CP8677		
		5.00	-60 to 290/325	CP8775		
	50	1.00	-60 to 315/340	CP7695		
		2.00	-60 to 305/330	CP7640		
		5.00	-60 to 290/325	CP7685	CP7685I5	
60	1.50	-60 to 305/330	CP8799			
	5.00	-60 to 290/325	CP8685			
100	0.50	-60 to 325/350	CP7608			
	5.00	-60 to 290/325	CP7688			

**CP-Sil 5 CB UltiMetal**

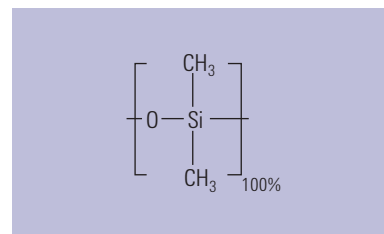
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.53	10	2.00	-60 to 325/350	CP7150
		5.00	-60 to 325/350	CP6666
	25	0.50	-60 to 325/350	CP7135
		2.00	-60 to 325/350	CP7160
		5.00	-60 to 325/350	CP6670
	50	1.00	-60 to 325/350	CP7140
		2.00	-60 to 325/350	CP7170
		5.00	-60 to 325/350	CP6671



## Ultra 1

- 100% Dimethylpolysiloxane
- Non-polar
- Equivalent to HP-1 with tighter specifications for retention index and capacity factors
- Bonded and cross-linked
- Solvent rinsable

**Similar Phases:** SPB-1, Rtx-1, BP-1, 007-1(MS)



Structure of Ultra 1

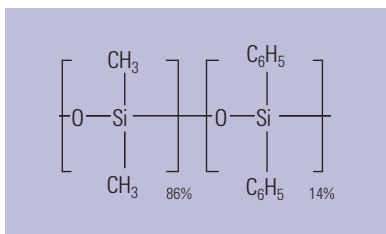
### Ultra 1

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.20	12	0.33	-60 to 325/350	19091A-101	
		0.11	-60 to 325/350	19091A-008	
	17	0.33	-60 to 325/350	19091A-108	
		0.11	-60 to 325/350	19091A-002	
	25	0.33	-60 to 325/350	19091A-102	19091A-102E
			0.11	-60 to 325/350	19091A-005
0.32	25	0.33	-60 to 325/350	19091A-105	
		0.17	-60 to 325/350	19091A-012	
	50	0.52	-60 to 325/350	19091A-112	
		0.17	-60 to 325/350	19091A-015	
	50	0.52	-60 to 325/350	19091A-115	

### 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](http://www.agilent.com/chem/CrossLab)





Structure of Ultra 2

## Ultra 2

- (5%-Phenyl)-methylpolysiloxane
- Non-polar
- Equivalent to HP-5 with tighter specifications for retention index and capacity factors
- Bonded and cross-linked
- Solvent rinsable

**Similar Phases:** SPB-5, Rtx-5, BP-5, CB-5, 007-5, 2B-5

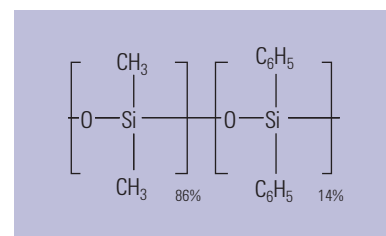
### Ultra 2

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890
						LTM II Module
0.20	12	0.33	-60 to 325/350	19091B-101		19091B-101LTM
		0.11	-60 to 325/350	19091B-002		
	0.33	-60 to 325/350	19091B-102	19091B-102E	19091B-102LTM	
	50	0.11	-60 to 325/350	19091B-005		
		0.33	-60 to 325/350	19091B-105	19091B-105E	
0.32	25	0.17	-60 to 325/350	19091B-012	19091B-012E	
		0.52	-60 to 325/350	19091B-112		19091B-112LTM
	50	0.17	-60 to 325/350	19091B-015		
		0.52	-60 to 325/350	19091B-115	19091B-115E	

## DB-5

- (5%-Phenyl)-methylpolysiloxane
- Non-polar
- Excellent general purpose column
- Wide range of applications
- Low bleed
- High temperature limit
- Bonded and cross-linked
- Solvent rinsable
- Wide range of column dimensions available
- Equivalent to USP Phase G27

**Similar Phases:** SPB-5, Rtx-5, BP-5, OV-5, 007-2(MPS-5), SE-52, SE-54, XTI-5, PTE-5, ZB-5, AT-5, MDN-5, ZB-5



Structure of DB-5

## DB-5

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7890/6890		
				7 in Cage	5 in Cage	LTM II Module
0.10	10	0.10	-60 to 325/350	127-5012	127-5012E	127-5012LTM
		0.17	-60 to 325/350	127-501E		127-501ELTM
		0.33	-60 to 325/350	127-501N		
		0.40	-60 to 325/350	127-5013		127-5013LTM
	20	0.10	-60 to 325/350	127-5022		
		0.40	-60 to 325/350	127-5023		
<i>0.15</i>	<i>10</i>	<i>1.20</i>	<i>-60 to 300/320</i>	<i>12A-5015</i>		<i>12A-5015LTM</i>
<i>0.18</i>	<i>10</i>	<i>0.18</i>	<i>-60 to 325/350</i>	<i>121-5012</i>	<i>121-5012E</i>	<i>121-5012LTM</i>
		<i>0.40</i>	<i>-60 to 325/350</i>	<i>121-5013</i>		<i>121-5013LTM</i>
	<i>20</i>	<i>0.18</i>	<i>-60 to 325/350</i>	<i>121-5022</i>	<i>121-5022E</i>	<i>121-5022LTM</i>
		<i>0.40</i>	<i>-60 to 325/350</i>	<i>121-5023</i>		<i>121-5023LTM</i>
	<i>40</i>	<i>0.18</i>	<i>-60 to 325/350</i>	<i>121-5042</i>		

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

(Continued)

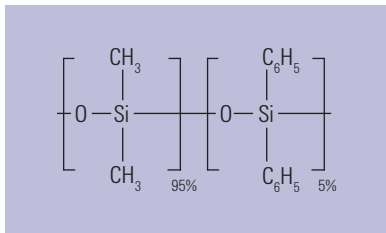
**DB-5**

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890	
						LTM II Module	
0.20	12	0.33	-60 to 325/350	128-5012			
	15	0.20	-60 to 325/350	128-50H7			
	25	0.33	-60 to 325/350	128-5022		128-5022LTM	
	50	0.33	-60 to 325/350	128-5052			
0.25	15	0.10	-60 to 325/350	122-5011			
		0.25	-60 to 325/350	122-5012		122-5012LTM	
		0.50	-60 to 325/350	122-501E			
		1.00	-60 to 325/350	122-5013			
	25	0.25	-60 to 325/350	122-5022			
	30	0.10	-60 to 325/350	122-5031			
		0.25	-60 to 325/350	122-5032	122-5032E	122-5032LTM	
		0.50	-60 to 325/350	122-503E		122-503ELTM	
		1.00	-60 to 325/350	122-5033	122-5033E	122-5033LTM	
	50	0.25	-60 to 325/350	122-5052			
	60	0.10	-60 to 325/350	122-5061			
		0.25	-60 to 325/350	122-5062			
		0.50	-60 to 325/350	122-506E			
		1.00	-60 to 325/350	122-5063			
	0.32	10	0.50	-60 to 325/350	123-500E		123-500ELTM
			1.00	-60 to 325/350	123-500		
15		0.10	-60 to 325/350	123-5011			123-5011LTM
		0.25	-60 to 325/350	123-5012	123-5012E	123-5012LTM	
		1.00	-60 to 325/350	123-5013	123-5013E	123-5013LTM	
25		0.17	-60 to 325/350	123-502D			
		0.25	-60 to 325/350	123-5022		123-5022LTM	
		0.52	-60 to 325/350	123-5026			
		1.05	-60 to 325/350	123-502F			
30		0.10	-60 to 325/350	123-5031			
		0.25	-60 to 325/350	123-5032	123-5032E	123-5032LTM	
		0.50	-60 to 325/350	123-503E		123-503ELTM	
		1.00	-60 to 325/350	123-5033	123-5033E		
		1.50	-60 to 325/350	123-503B		123-503BLTM	
50		0.25	-60 to 325/350	123-5052			
		0.52	-60 to 325/350	123-5056			
	1.00	-60 to 325/350	123-5053				
60	0.25	-60 to 325/350	123-5062				
	1.00	-60 to 325/350	123-5063				

(Continued)

## DB-5

ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	7 in Cage	5 in Cage	7890/6890		
						LTM II Module		
0.45	30	0.42	-60 to 300/320	124-5037				
		1.27	-60 to 300/320	124-5032				
0.53	10	2.65	-60 to 260/280	125-50HB				
		15	0.25	-60 to 300/320	125-501K			
			0.50	-60 to 300/320	125-5017			
	1.00		-60 to 300/320	125-501J				
	25	5.00	1.50	-60 to 300/320	125-5012	125-5012E	125-5012LTM	
			5.00	-60 to 260/280	125-5025			
	30	0.25	0.25	-60 to 300/320	125-503K			
			0.50	-60 to 300/320	125-5037			
			0.88	-60 to 300/320	125-503D			
			1.00	-60 to 300/320	125-503J			
			1.50	-60 to 300/320	125-5032	125-5032E	125-5032LTM	
			2.65	-60 to 260/280	125-503B			
			3.00	-60 to 260/280	125-5034			
60	5.00	5.00	-60 to 260/280	125-5035	125-5035E	125-5035LTM		
		1.50	-60 to 300/320	125-5062				
		5.00	-60 to 260/280	125-5065	125-5065E			



Structure of HP-5

## HP-5

- (5%-Phenyl)-methylpolysiloxane
- Non-polar
- Excellent general purpose column
- Wide range of applications
- High temperature limit
- Bonded and cross-linked
- Solvent rinsable
- Wide range of column dimensions available
- Equivalent to USP Phase G27

**Similar Phases:** SPB-5, Rtx-5, BP-5, OV-5, 007-2(MPS-5), SE-52, SE-54, XTI-5, PTE-5, ZB-5, AT-5, MDN-5, ZB-5

### HP-5

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>-60 to 325/350</i>	<i>19091J-577</i>	<i>19091J-577E</i>	<i>19091J-577LTM</i>
0.20	12	0.33	-60 to 325/350	19091J-101		
	17	0.33	-60 to 325/350	19091J-108		
	25	0.11	-60 to 325/350	19091J-002		
		0.33	-60 to 325/350	19091J-102	19091J-102E	
		0.50	-60 to 325/350	19091J-202		
	50	0.11	-60 to 325/350	19091J-005		
		0.33	-60 to 325/350	19091J-105	19091J-105E	
		0.50	-60 to 325/350	19091J-205		

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

(Continued)

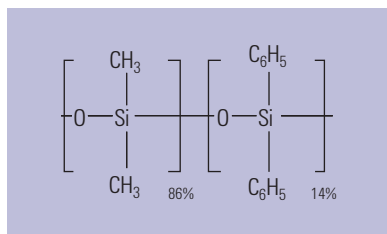
## HP-5

ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	7 in Cage	5 in Cage	7890/6890
						LTM II Module
0.25	5	0.10	-60 to 325/350	19091J-330		19091J-330LTM
	15	0.25	-60 to 325/350	19091J-431	19091J-431E	
		1.00	-60 to 325/350	19091J-231		
	30	0.10	-60 to 325/350	19091J-333		
		0.25	-60 to 325/350	19091J-433	19091J-433E	19091J-433LTM
		1.00	-60 to 325/350	19091J-233		19091J-233LTM
	60	0.25	-60 to 325/350	19091J-436	19091J-436E	
1.00		-60 to 325/350	19091J-236			
0.32	15	0.25	-60 to 325/350	19091J-411		19091J-411LTM
	25	0.17	-60 to 325/350	19091J-012		
		0.52	-60 to 325/350	19091J-112	19091J-112E	
		1.05	-60 to 325/350	19091J-212		
	30	0.10	-60 to 325/350	19091J-313		
		0.25	-60 to 325/350	19091J-413	19091J-413E	19091J-413LTM
		0.50	-60 to 325/350	19091J-113	19091J-113E	19091J-113LTM
		1.00	-60 to 325/350	19091J-213	19091J-213E	
	50	0.17	-60 to 325/350	19091J-015		
		0.52	-60 to 325/350	19091J-115	19091J-115E	
1.05		-60 to 325/350	19091J-215	19091J-215E		
60	0.25	-60 to 325/350	19091J-416			
	1.00	-60 to 325/350	19091J-216	19091J-216E		
0.53	10	2.65	-60 to 260/280	19095J-121	19095J-121E	19095J-121LTM
	15	1.50	-60 to 300/320	19095J-321		
		5.00	-60 to 260/280	19095J-621		
	30	0.88	-60 to 300/320	19095J-023	19095J-023E	
		1.50	-60 to 300/320	19095J-323	19095J-323E	
		2.65	-60 to 260/280	19095J-123	19095J-123E	
		5.00	-60 to 260/280	19095J-623	19095J-623E	

## TIPS &amp; TOOLS

Learn more about Agilent's top-ranked service and support at [www.agilent.com/chem/services](http://www.agilent.com/chem/services)





Structure of CP-Sil 8 CB

## CP-Sil 8 CB

- (5%-Phenyl)-methylpolysiloxane
- Non-polar
- General purpose phase
- Bonded and cross-linked
- Solvent rinsable
- Low bleed
- High column-to-column reproducibility
- Wide choice of dimensions available
- Available in fused silica and UltiMetal
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

**Similar Phases:** SPB-5, Rtx-5, BP-5, OV-5, 007-2(MPS-5), SE-52, SE-54, XTI-5, PTE-5, ZB-5, AT-5, MDN-5, ZB-5

### CP-Sil 8 CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
<i>0.15</i>	<i>10</i>	<i>0.12</i>	<i>-60 to 330/350</i>	<i>CP7884</i>	
0.25	15	0.25	-60 to 330/350	CP8511	
		1.00	-60 to 325/350	CP8521	
	25	0.12	-60 to 330/350	CP7711	
		0.25	-60 to 330/350	CP7451	
		1.20	-60 to 325/350	CP7671	
	30	0.25	-60 to 330/350	CP8751	
		1.00	-60 to 325/350	CP8771	
	50	0.12	-60 to 330/350	CP7721	
		0.25	-60 to 330/350	CP7453	CP7453I5
		0.40	-60 to 325/350	CP7769	
	60	0.10	-60 to 325/350	CP8750	
		0.25	-60 to 330/350	CP8753	
		1.00	-60 to 325/350	CP8781	

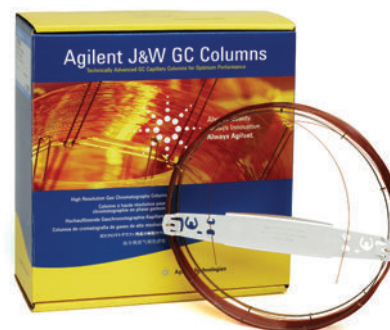
Agilent J&W High Efficiency GC columns are displayed using italicized descriptions and part numbers

(Continued)



**CP-Sil 8 CB**

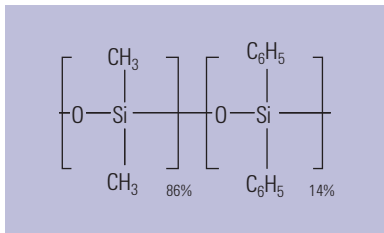
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.32	10	0.12	-60 to 330/350	CP7731	
		5.00	-60 to 300/325	CP8014	
	15	0.25	-60 to 325/350	CP8531	
		1.00	-60 to 325/350	CP8541	
	25	0.12	-60 to 330/350	CP7741	CP77415
		0.25	-60 to 325/350	CP7452	
		0.40	-60 to 325/350	CP7779	
		0.52	-60 to 325/350	CP8431	
		1.20	-60 to 325/350	CP7761	
		5.00	-60 to 300/325	CP7681	
		30	0.10	-60 to 330/350	CP8791
	50	0.25	-60 to 325/350	CP8752	
		1.00	-60 to 325/350	CP8761	
		5.00	-60 to 330/350	CP7751	CP77515
	60	0.25	-60 to 325/350	CP7454	
		0.40	-60 to 325/350	CP7789	
		1.20	-60 to 325/350	CP7771	
		5.00	-60 to 300/325	CP7691	CP76915
1.00		-60 to 325/350	CP8871		
0.53	10	2.00	-60 to 305/330	CP7621	
		5.00	-60 to 290/325	CP7646	
	15	1.50	-60 to 305/330	CP8678	
	25	2.00	-60 to 305/330	CP7631	
		1.00	-60 to 315/340	CP7636	
		5.00	-60 to 290/325	CP7656	
	30	0.50	-60 to 325/350	CP8716	
		1.50	-60 to 305/330	CP8736	CP873615
		5.00	-60 to 290/325	CP8756	
	50	1.00	-60 to 315/340	CP7696	
		2.00	-60 to 305/330	CP7641	
		5.00	-60 to 290/325	CP7666	
	60	1.50	-60 to 305/330	CP8796	
	100	5.00	-60 to 290/325	CP7676	



Column shown with EZ-GRIP

**CP-Sil 8 CB UltiMetal**

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.53	25	5.00	-60 to 325/350	CP6680
	50	0.50	-60 to 325/350	CP7196



Structure of CP-Sil 13 CB  
(with 14% phenyl substitution)

## CP-Sil 13 CB

- 14% Phenyl/86% dimethylpolysiloxane
- Mid polarity phase
- Specially developed for the analysis of medium polarity compounds
- Ideal for confirmational analyses using ECD
- Bonded and cross-linked
- Solvent rinsable
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

**Similar Phases:** Rtx-20

### CP-Sil 13 CB

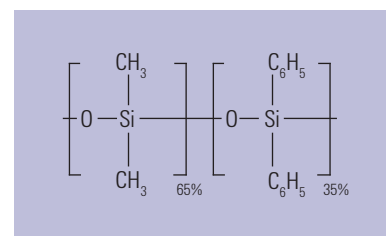
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
<i>0.15</i>	<i>25</i>	<i>0.40</i>	<i>-25 to 300/330</i>	<i>CP7813</i>	
0.25	25	0.20	-25 to 300/330	CP7906	
		1.20	-25 to 300/330	CP7977	
	50	0.20	-25 to 300/330	CP7907	
		0.40	-25 to 300/330	CP7917	
0.32	25	0.20	-25 to 300/330	CP7926	CP7926I5
		0.40	-25 to 300/330	CP7936	
		1.20	-25 to 300/330	CP7946	
	50	0.40	-25 to 300/330	CP7937	
		1.20	-25 to 300/330	CP7947	
0.53	25	1.00	-25 to 300/330	CP7619	
		2.00	-25 to 300/330	CP7649	
	50	1.00	-25 to 300/330	CP7629	
		2.00	-25 to 300/330	CP7659	

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

## DB-35

- (35%-Phenyl)-methylpolysiloxane
- Mid polarity – slightly more polar than HP-35
- Low bleed
- Inert to active solutes
- Ideal for confirmational analyses
- Bonded and cross-linked
- Solvent rinsable
- Equivalent to USP Phase G42

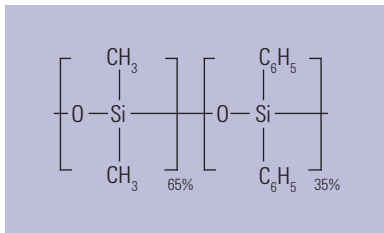
**Similar Phases:** Rtx-35, Rtx-35ms, Rxi-35Sil MS, SPB-35, AT-35, Sup-Herb, MDN-35, BPX-34, ZB-35, ZB-35 ht



Structure of DB-35

## DB-35

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890
						LTM II Module
0.25	30	0.25	40 to 300/320	122-1932		
	60	0.25	40 to 300/320	122-1962		
0.32	30	0.25	40 to 300/320	123-1932		
		0.50	40 to 300/320	123-1933	123-1933E	123-1933LTM
0.53	15	1.00	40 to 280/300	125-1912		
	30	0.50	40 to 280/300	125-1937		
		1.00	40 to 280/300	125-1932		125-1932LTM



Structure of HP-35

## HP-35

- (35%-Phenyl)-methylpolysiloxane
- Mid polarity – slightly less polar than DB-35
- Inert to active solutes
- Ideal for confirmational analyses
- Bonded and cross-linked
- Solvent rinsable
- Equivalent to USP Phase G42

**Similar Phases:** Rtx-35ms, Rxi-35Sil MS, SPB-35, AT-35, Sup-Herb, MDN-35, BPX-34, ZB-35, ZB-35 ht

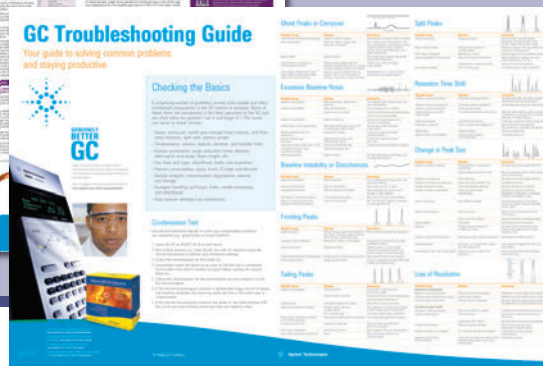
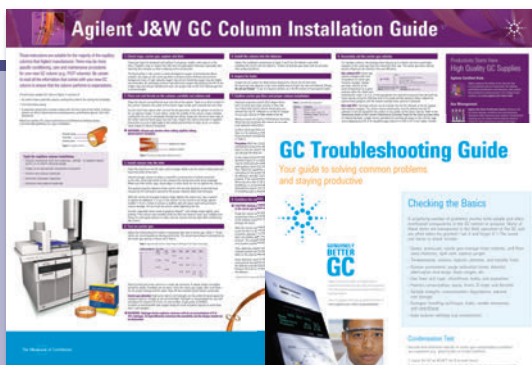
### HP-35

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890
						LTM II Module
0.25	15	0.25	40 to 300/320	19091G-131	19091G-131E	19091G-131LTM
	30	0.25	40 to 300/320	19091G-133		
0.32	30	0.25	40 to 300/320	19091G-113		
		0.50	40 to 300/320	19091G-213		



### TIPS & TOOLS

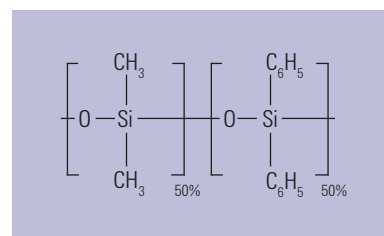
Order your free GC troubleshooting and GC column installation posters at [www.agilent.com/chem/GCposteroffer](http://www.agilent.com/chem/GCposteroffer)



## DB-17

- (50%-Phenyl)-methylpolysiloxane
- Mid polarity – slightly more polar than HP-50+
- Excellent for confirmational analyses
- Bonded and cross-linked
- Solvent rinsable
- Equivalent to USP Phase G3

**Similar Phases:** Rtx-50, 007-17(MPS-50), SP-2250, SPB-50, ZB-50, AT-50

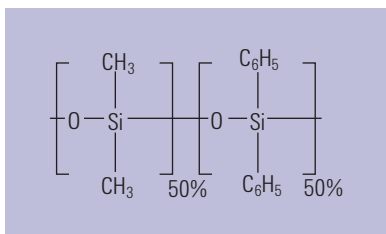


Structure of DB-17

### DB-17

ID (mm)	Length (m)	Length		Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
		Film (µm)					
0.10	10	0.10		40 to 280/300	127-1712		127-1712LTM
		0.20		40 to 280/300	127-1713		
	20	0.10		40 to 280/300	127-1722		
0.18	20	0.18		40 to 280/300	121-1722		121-1722LTM
		0.30		40 to 280/300	121-1723		
0.25	15	0.25		40 to 280/300	122-1712		
		0.50		40 to 280/300	122-1713	122-1713E	
	30	0.15		40 to 280/300	122-1731	122-1731E	
		0.25		40 to 280/300	122-1732	122-1732E	122-1732LTM
		0.50		40 to 280/300	122-1733		
60	0.25		40 to 280/300	122-1762			
0.32	15	0.15		40 to 280/300	123-1711		
		0.25		40 to 280/300	123-1712		
		0.50		40 to 280/300	123-1713		
	30	0.15		40 to 280/300	123-1731		
		0.25		40 to 280/300	123-1732	123-1732E	123-1732LTM
		0.50		40 to 280/300	123-1733	123-1733E	
		60	0.25		40 to 280/300	123-1762	
0.53	5	2.00		40 to 280/300	125-1704		
	15	0.25		40 to 260/280	125-1711		
		0.50		40 to 260/280	125-1717		
		1.00		40 to 260/280	125-1712		125-1712LTM
		1.50		40 to 260/280	125-1713		125-1713LTM
	30	0.25		40 to 260/280	125-1731		
		0.50		40 to 260/280	125-1737		
		1.00		40 to 260/280	125-1732	125-1732E	125-1732LTM
		1.50		40 to 260/280	125-1733		
60		1.00		40 to 260/280	125-1762		

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



Structure of HP-50+

## HP-50+

- (50%-Phenyl)-methylpolysiloxane
- Mid polarity – slightly less polar than DB-17
- Excellent for confirmational analyses
- Bonded and cross-linked
- Solvent rinsable
- Equivalent to USP Phase G3

**Similar Phases:** Rtx-50, 007-17(MPS-50), SP-2250, SPB-50, ZB-50, AT-50

### HP-50+

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7890/6890	
				7 in Cage	5 in Cage LTM II Module
0.20	12	0.31	40 to 280/300	19091L-101	
0.25	5	0.15	40 to 280/300	19091L-330	19091L-330LTM
	15	0.25	40 to 280/300	19091L-431	19091L-431LTM
	30	0.15	40 to 280/300	19091L-333	
		0.25	40 to 280/300	19091L-433	19091L-433LTM
	0.50	40 to 280/300	19091L-133		
0.32	30	0.25	40 to 280/300	19091L-413	19091L-413E
		0.50	40 to 280/300	19091L-113	19091L-113E
	60	0.25	40 to 280/300	19091L-416	
0.53	15	1.00	40 to 260/280	19095L-021	19095L-021LTM
	30	0.50	40 to 260/280	19095L-523	
		1.00	40 to 260/280	19095L-023	19095L-023E

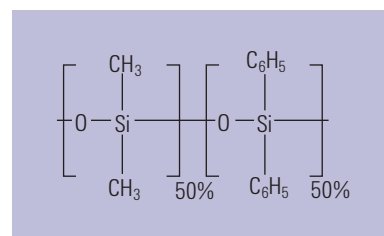
## CP-Sil 24 CB

- 50% Phenyl/50% dimethylpolysiloxane
- Mid polarity phase
- Specially suitable for analysis of amines, drugs and pesticides
- Ideal for analysis using ECD
- Excellent confirmation column in combination with CP-Sil 5 CB or CP-Sil 8 CB
- Bonded and cross-linked
- Solvent rinsable
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

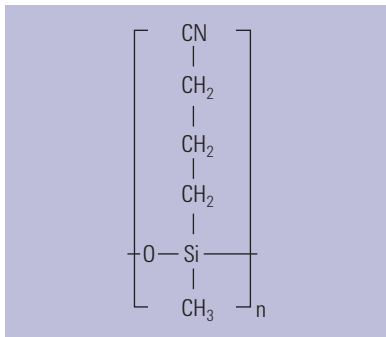
**Similar Phases:** Rtx-50, 007-17(MPS-50), SP-2250, SPB-50, ZB-50, AT-50

### CP-Sil 24 CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.25	15	0.25	40 to 280/300	CP7820	
	30	0.25	40 to 280/300	CP7821	
		0.50	40 to 280/300	CP7824	
0.32	60	0.25	40 to 280/300	CP7822	CP782215
	15	0.25	40 to 280/300	CP7830	
	30	0.25	40 to 280/300	CP7831	
0.53	30	60	0.25	40 to 280/300	CP7832
		0.50	40 to 280/300	CP7834	CP183415
		1.00	40 to 265/290	CP7871	CP787115



Structure of CP-Sil 24 CB



Structure of DB-23

## DB-23

- (50%-Cyanopropyl)-methylpolysiloxane
- High polarity
- Designed for separation of fatty acid methyl esters (FAMES)
- Excellent resolution for cis- and trans-isomers
- Bonded and cross-linked
- Solvent rinsable
- Replaces HP-23
- Close equivalent to USP Phase G5

**Similar Phases:** SP-2330, Rtx-2330, 007-23, AT-Silar, BPX-70, SP-2340

### DB-23

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7890/6890		
				7 in Cage	5 in Cage	LTM II Module
<i>0.18</i>	<i>20</i>	<i>0.20</i>	<i>40 to 250/260</i>	<i>121-2323</i>		
0.25	15	0.25	40 to 250/260	122-2312		
		0.15	40 to 250/260	122-2331		
	60	0.25	40 to 250/260	122-2332	122-2332E	122-2332LTM
		0.15	40 to 250/260	122-2361	122-2361E	
0.32	30	0.25	40 to 250/260	123-2332	123-2332E	
	60	0.25	40 to 250/260	123-2362		
0.53	15	0.50	40 to 230/240	125-2312		
	30	0.50	40 to 230/240	125-2332		

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



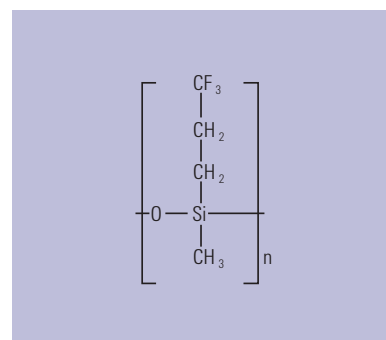
## DB-200

- (35% Trifluoropropyl)-methylpolysiloxane
- 300/320 °C temperature limit
- Mid polarity – more polar than DB-1701 or DB-17
- Ideal for difficult-to-separate positional isomers
- Unique interactions with compounds containing nitro, halogen and carbonyl groups
- Low ECD bleed
- Unique selectivity
- Close equivalent to USP Phase G6

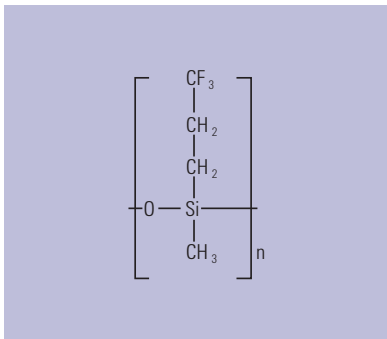
**Similar Phases:** Rtx-200

### DB-200

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	7890/6890
					LTM II Module
0.25	30	0.25	30 to 300/320	122-2032	122-2032LTM
		0.50	30 to 300/320	122-2033	122-2033LTM
0.32	30	0.25	30 to 300/320	123-2032	
		0.50	30 to 300/320	123-2033	
0.53	30	1.00	30 to 280/300	125-2032	



Structure of DB-200



Structure of DB-210

## DB-210

- (50%-Trifluoropropyl)-methylpolysiloxane
- High polarity
- Excellent for US EPA Methods 8140 and 609
- Bonded and cross-linked
- Solvent rinsable
- Exact replacement of HP-210
- Close equivalent to USP Phase G6

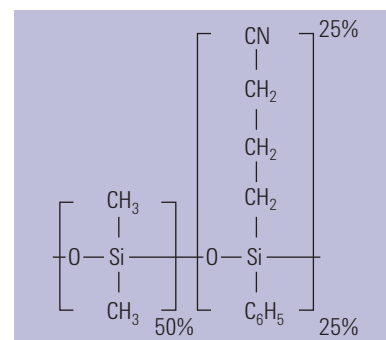
**Similar Phases:** SP-2401

### DB-210

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7890/6890		
				7 in Cage	5 in Cage	LTM II Module
0.25	15	0.25	45 to 240/260	122-0212		
	30	0.25	45 to 240/260	122-0232	122-0232E	
		0.50	45 to 240/260	122-0233		
0.32	15	0.50	45 to 240/260	123-0213		
	30	0.25	45 to 240/260	123-0232		
		0.50	45 to 240/260	123-0233		
0.53	15	1.00	45 to 220/240	125-0212		
	30	1.00	45 to 220/240	125-0232		125-0232LTM

## DB-225

- (50%-Cyanopropylphenyl)-dimethylpolysiloxane
- Mid/high polarity
- Excellent for separations of cis- and trans-fatty acid methyl esters (FAMEs)
- Bonded and cross-linked
- Solvent rinsable
- Exact replacement of HP-225
- Close equivalent to USP Phase G7



Structure of DB-225

**Similar Phases:** SP-2330, Rtx-225, BP-225, OV-225, 007-225, AT-225

### DB-225

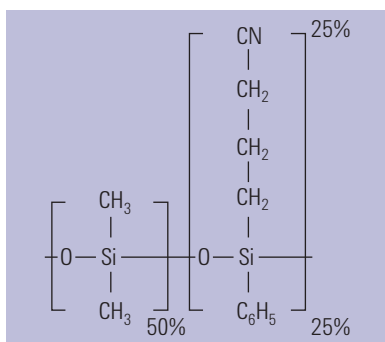
ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.10	20	0.10	40 to 220/240	127-2222		
<i>0.18</i>	<i>20</i>	<i>0.20</i>	<i>40 to 220/240</i>	<i>121-2223</i>		
0.25	15	0.25	40 to 220/240	122-2212		122-2212LTM
	30	0.15	40 to 220/240	122-2231		
		0.25	40 to 220/240	122-2232		122-2232LTM
0.32	30	0.25	40 to 220/240	123-2232	123-2232E	
0.53	15	1.00	40 to 200/220	125-2212		
	30	0.50	40 to 200/220	125-2237		
		1.00	40 to 200/220	125-2232		

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

### TIPS & TOOLS

Need assistance selecting a column for your method? Contact our chromatography technical specialists at [www.agilent.com/chem/TechRep](http://www.agilent.com/chem/TechRep)





Structure of CP-Sil 43 CB

## CP-Sil 43 CB

- 25% Cyanopropyl/25% phenyl/50% dimethylpolysiloxane phase
- Mid polarity
- Separates aromatic from aliphatic hydrocarbons with selectivity equivalent to OV-255
- Bonded and cross-linked
- Solvent rinsable
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

**Similar Phases:** SP-2330, Rtx-225, BP-225, OV-225, 007-225, AT-225

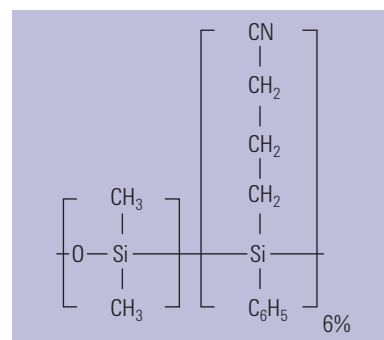
### CP-Sil 43 CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	25	0.20	45 to 200/225	CP7715
	50	0.20	45 to 200/225	CP7725
0.32	25	0.20	45 to 200/225	CP7745

## DB-1301

- (6%-Cyanopropyl-phenyl) methylpolysiloxane
- Equivalent to USP Phase G43
- Low/mid polarity
- Bonded and cross-linked
- Exact replacement of HP-1301 and HP-1701
- Solvent rinsable

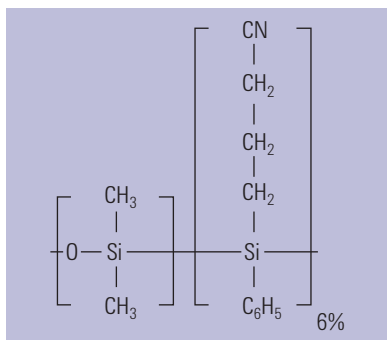
**Similar Phases:** Rtx-1301, PE-1301



Structure of DB-1301

## DB-1301

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890
						LTM II Module
0.25	30	0.25	-20 to 280/300	122-1332	122-1332E	
		1.00	-20 to 280/300	122-1333		
	60	0.25	-20 to 280/300	122-1362		
		1.00	-20 to 280/300	122-1363	122-1363E	
0.32	30	0.25	-20 to 280/300	123-1332		
		1.00	-20 to 280/300	123-1333		
	60	1.00	-20 to 280/300	123-1363		
0.53	15	1.00	-20 to 260/280	125-1312		
	30	1.00	-20 to 260/280	125-1332		
		1.50	-20 to 260/280	125-1333		125-1333LTM



Structure of CP-1301

## CP-1301

- 6% Cyanopropyl-phenyl/94% dimethylpolysiloxane
- Mid polarity
- Ideal for analysis of herbicides, pesticides and many pharmaceutical products
- High column-to-column reproducibility
- Good inertness for better quality of data, even with thick films
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation
- Bonded and cross-linked
- Solvent rinsable

**Similar Phases:** Rtx-1301, PE-1301

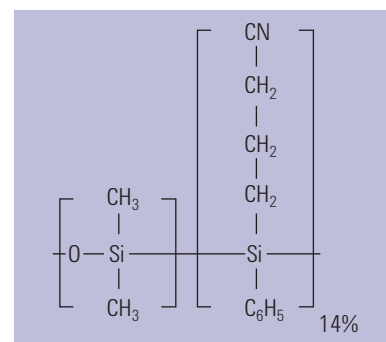
### CP-1301

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	60	1.00	-25 to 265/280	CP8605
0.32	30	0.25	-25 to 280/280	CP8607
		1.00	-25 to 265/280	CP8610
0.53	30	1.00	-25 to 265/280	CP8613

## DB-1701

- (14% Cyanopropyl-phenyl)-methylpolysiloxane
- Low/mid polarity
- Bonded and cross-linked
- Exact replacement of HP-1301 and HP-1701
- Solvent rinsable

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



Structure of DB-1701

### DB-1701

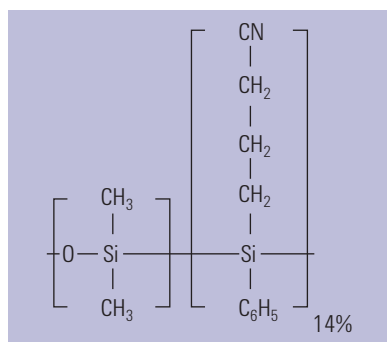
ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890	
						LTM II Module	
0.10	20	0.10	-20 to 280/300	127-0722			
		0.40	-20 to 280/300	127-0723			
<i>0.18</i>	<i>10</i>	<i>0.40</i>	<i>-20 to 280/300</i>	<i>121-0713</i>			
	<i>20</i>	<i>0.18</i>	<i>-20 to 280/300</i>	<i>121-0722</i>			<i>121-0722LTM</i>
0.25	15	0.25	-20 to 280/300	122-0712			
		1.00	-20 to 280/300	122-0713			122-0713LTM
		30	0.15	-20 to 280/300	122-0731		
	60	0.25	-20 to 280/300	122-0732	122-0732E		122-0732LTM
		1.00	-20 to 280/300	122-0733	122-0733E		122-0733LTM
		0.15	-20 to 280/300	122-0761			
0.32	15	0.25	-20 to 280/300	123-0712			123-0712LTM
		1.00	-20 to 280/300	123-0713			
		30	0.15	-20 to 280/300	123-0731		
	60	0.25	-20 to 280/300	123-0732	123-0732E		
		1.00	-20 to 280/300	123-0733	123-0733E		
		1.00	-20 to 280/300	123-0763	123-0763E		
0.53	15	1.00	-20 to 260/280	125-0712	125-0712E		125-0712LTM
	30	0.25	-20 to 260/280	125-0731			
		0.50	-20 to 260/280	125-0737			
		1.00	-20 to 260/280	125-0732	125-0732E		
		1.50	-20 to 260/280	125-0733			
	60	1.00	-20 to 260/280	125-0762	125-0762E		

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

### TIPS & TOOLS

Agilent also offers DB-624 columns for the analysis of volatile priority pollutants and residual solvents.





Structure of CP-Sil 19 CB

## CP-Sil 19 CB

- 14% Cyanopropyl-phenyl/86% dimethylpolysiloxane
- Mid polarity
- Ideal for many environmental, food and beverage, and pharmaceutical applications
- Useful as confirmation column
- Bonded and cross-linked
- Solvent rinsable
- Broad range of configurations available
- Supplied with an EZ-GRIP to simplify column installation, coupling and operation

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

### CP-Sil 19 CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	
<i>0.15</i>	<i>25</i>	<i>0.50</i>	<i>-25 to 275/300</i>	<i>CP7340</i>	
0.25	10	0.20	-25 to 275/300	CP7702	
		0.20	-25 to 275/300	CP7712	
		0.40	-25 to 275/300	CP7809	
		1.20	-25 to 275/300	CP7672	
	30	0.25	-25 to 275/300	CP8712	
		1.00	-25 to 275/300	CP8562	
	50	0.20	-25 to 275/300	CP7722	
	60	0.25	-25 to 275/300	CP8722	
	0.32	10	0.20	-25 to 275/300	CP7732
			0.25	-25 to 275/300	CP8542
25		0.20	-25 to 275/300	CP7742	
		0.40	-25 to 275/300	CP7829	
		1.20	-25 to 275/300	CP7762	
30		0.25	-25 to 275/300	CP8842	
		1.00	-25 to 275/300	CP8762	
50		0.20	-25 to 275/300	CP7752	
		0.40	-25 to 275/300	CP7839	
		1.20	-25 to 275/300	CP7772	
60		0.15	-25 to 275/300	CP8662	
		1.00	-25 to 275/300	CP8772	
0.53		10	2.00	-25 to 275/300	CP7647
			1.00	-25 to 275/300	CP7637
	25	2.00	-25 to 275/300	CP7657	
		1.00	-25 to 275/300	CP8737	
	30	1.00	-25 to 275/300	CP8737	
		2.00	-25 to 275/300	CP7667	
	50	1.00	-25 to 275/300	CP7697	

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

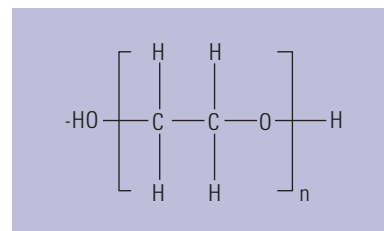


## Polyethylene Glycol (PEG) Columns

Agilent offers a full range of PEG columns. Even though each phase is based on the polyethylene glycol polymer, strict control of the cross-linking and deactivation processes result in a variety of unique phase characteristics to meet your varying analysis needs.

### DB-WAX and DB-WaxFF

- Polyethylene glycol (PEG)
- Equivalent to USP Phase G16
- High polarity
- Lower temperature limit of 20 °C is the lowest of any bonded PEG phase; improves resolution of low boiling point analytes
- Column-to-column reproducibility
- Bonded and cross-linked
- Exact replacement of HP-WAX
- Solvent rinsable
- DB-WaxFF is a highly reproducible, specially tested microbore DB-Wax for fragrance analysis



Structure of polyethylene glycol (PEG)  
This structure is applicable for all  
WAX and FFAP phases.

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

**DB-WAX and DB-WaxFF**

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
<b>DB-WAX</b>						
0.05	10	0.05	20 to 250/260	126-7012		
		0.10	20 to 240/250	126-7013		
0.10	10	0.10	20 to 250/260	127-7012	127-7012E	127-7012LTM
		0.20	20 to 240/250	127-7013		127-7013LTM
	20	0.10	20 to 250/260	127-7022		127-7022LTM
		0.20	20 to 240/250	127-7023	127-7023E	127-7023LTM
<i>0.18</i>	<i>10</i>	<i>0.18</i>	<i>20 to 250/260</i>	<i>121-7012</i>		<i>121-7012LTM</i>
	<i>20</i>	<i>0.18</i>	<i>20 to 250/260</i>	<i>121-7022</i>		<i>121-7022LTM</i>
		<i>0.30</i>	<i>20 to 240/250</i>	<i>121-7023</i>		<i>121-7023LTM</i>
	<i>40</i>	<i>0.18</i>	<i>20 to 250/260</i>	<i>121-7042</i>	<i>121-7042E</i>	
		<i>0.30</i>	<i>20 to 240/250</i>	<i>121-7043</i>		
0.20	25	0.20	20 to 250/260	128-7022		
	30	0.20	20 to 250/260	128-7032		128-7032LTM
	50	0.20	20 to 250/260	128-7052		

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

(Continued)

## DB-WAX and DB-WaxFF

ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	7 in Cage	5 in Cage	7890/6890
						LTM II Module
<b>DB-WAX</b>						
0.25	15	0.25	20 to 250/260	122-7012	122-7012E	122-7012LTM
		0.50	20 to 240/250	122-7013		122-7013LTM
	30	0.15	20 to 250/260	122-7031		
		0.25	20 to 250/260	122-7032	122-7032E	122-7032LTM
		0.50	20 to 240/250	122-7033	122-7033E	122-7033LTM
	60	0.15	20 to 250/260	122-7061		
		0.25	20 to 250/260	122-7062	122-7062E	
0.50		20 to 240/250	122-7063	122-7063E		
0.32	15	0.25	20 to 250/260	123-7012		123-7012LTM
		0.50	20 to 240/250	123-7013		123-7013LTM
	30	0.15	20 to 250/260	123-7031		
		0.25	20 to 250/260	123-7032	123-7032E	123-7032LTM
		0.50	20 to 240/250	123-7033	123-7033E	123-7033LTM
	60	0.25	20 to 250/260	123-7062		
		0.50	20 to 240/250	123-7063	123-7063E	
0.45	30	0.85	20 to 230/240	124-7032		
0.53	15	0.50	20 to 230/240	125-7017		
		1.00	20 to 230/240	125-7012	125-7012E	
	30	0.25	20 to 230/240	125-7031		125-7031LTM
		0.50	20 to 230/240	125-7037		
		1.00	20 to 230/240	125-7032	125-7032E	125-7032LTM
	60	1.00	20 to 230/240	125-7062	125-7062E	
	<b>DB-WaxFF</b>					
0.10	20	0.20	20 to 240/250	127-7023FF		

## DB-WAXetr

- Polyethylene glycol (PEG)
- Extended temperature range (etr)
- High polarity
- Excellent column-to-column repeatability
- Bonded and cross-linked
- Solvent rinsable
- Equivalent to USP Phase G16

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

### DB-WAXetr

ID (mm)	Length (m)	Film (μm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890
						LTM II Module
0.20	25	0.40	30 to 250/260	128-7323		
0.25	30	0.25	30 to 260/280	122-7332	122-7332E	122-7332LTM
		0.50	30 to 250/260	122-7333		
	60	0.25	30 to 260/280	122-7362		
		0.50	30 to 250/260	122-7363		
0.32	15	0.25	30 to 260/280	123-7312		
		1.00	30 to 250/260	123-7314		
	30	0.25	30 to 260/280	123-7332		
		0.50	30 to 250/260	123-7333		
		1.00	30 to 250/260	123-7334		123-7334LTM
	50	1.00	30 to 250/260	123-7354	123-7354E	
	60	0.25	30 to 260/280	123-7362		
		0.50	30 to 250/260	123-7363		
1.00		30 to 250/260	123-7364			
0.53	15	1.00	30 to 240/260	125-7312		
		2.00	50 to 230/250	125-7314		
	30	1.00	30 to 240/260	125-7332	125-7332E	
		1.50	30 to 230/240	125-7333		125-7333LTM
		2.00	50 to 230/250	125-7334	125-7334E	
	60	1.00	30 to 240/260	125-7362		

## 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
	50	0.50	20 to 250/265	CP8746	
		0.20	20 to 250/265	CP7723	CP7723I5
60	0.25	20 to 250/265	CP8723		
	0.50	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 ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	7 in Cage	5 in Cage
0.32	10	1.00	20 to 250/265	CP7628	
		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 ( $\mu\text{m}$ )	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	CP7168
			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 ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	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](http://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

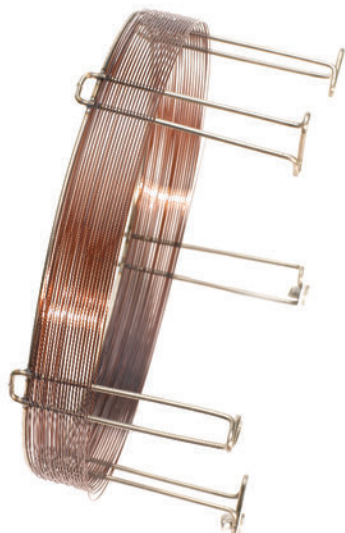
Because the Carbowax 20M and the HP-20M are not bonded or cross-linked, we do not recommend solvent rinsing. DB-WAX is the recommended bonded alternate for the HP-20M.

### 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](http://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 ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	7 in Cage	5 in Cage
0.53	10	10.00	0 to 350/350	CP8587	CP858715

### GS-OxyPLOT

- Accurate analysis of ppm/ppb level oxygenates in  $\text{C}_1$  to  $\text{C}_{10}$  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  $350^{\circ}\text{C}$ ) 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 ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	7 in Cage
0.32	60	8.00	-60 to 300/325	CP7475

## HP-PONA

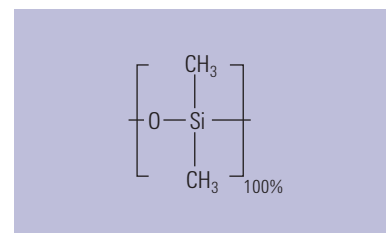
- 100% Dimethylpolysiloxane
- Configured for the analysis of petroleum process products
- Tested to ensure the resolution of m-xylene from p-xylene and of cyclopentane from 2,3-dimethylbutane
- PONA, PIANO
- High resolution
- Bonded and cross-linked
- Solvent rinsable

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

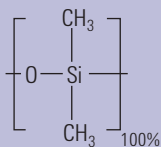
**Similar Phases:** Petrocol DH, SPB-1, 007-1, Rtx-1, MXT-1, Rtx-1PONA, Rtx-DHA

### HP-PONA

Description	ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	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

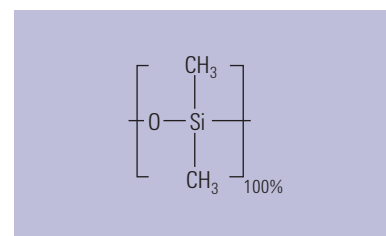
- 100% Dimethylpolysiloxane
- Configured for the analysis of petroleum process products
- PONA, PIANO
- High resolution
- Bonded and cross-linked
- Solvent rinsable

**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)	7 in Cage	5 in Cage	7890/6890
						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 C<sub>6</sub> to C<sub>110+</sub>
- 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

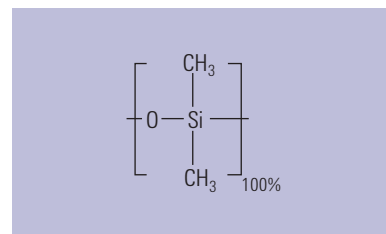
- For simulated distillation analysis up to C<sub>100</sub>
- High temperature non-polar stationary phase
- Low bleed improves quantitation
- High temperature polyimide coating extends lifetime

CP-SimDist fused silica columns are guaranteed for simulated distillation up to C<sub>100</sub>. 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 C<sub>120</sub> 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 H<sub>2</sub>S, 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](http://www.agilent.com/chem/CustomColumn)

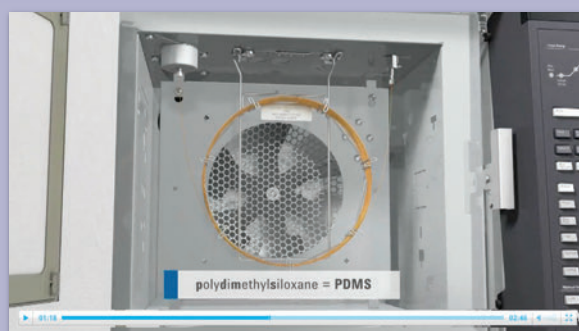
### DB-Sulfur SCD

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](http://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 C<sub>7</sub> mercaptan for high productivity
- Non-polar phase provides accurate separations based on volatility
- High inertness, elutes SO<sub>2</sub> 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/CO<sub>2</sub> Column, CP7429

## Select for Permanent Gases – Dual Column

- Set of two parallel columns: CP-Molsieve 5Å for permanent gases and PoraBOND Q for CO<sub>2</sub> 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 CO<sub>2</sub> 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 <sub>2</sub>	300/325	CP7429
Select Permanent Gases/HR	300/325	CP7430

## Select Al<sub>2</sub>O<sub>3</sub> 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 Al<sub>2</sub>O<sub>3</sub> 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 ( $\mu\text{m}$ )	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 C<sub>20</sub> 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 ( $\mu\text{m}$ )	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](http://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 ( $\mu\text{m}$ )	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](http://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  $\mu\text{m}$  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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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 C<sub>18</sub> 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 ( $\mu\text{m}$ )	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](http://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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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](http://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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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
- C<sub>4</sub> to C<sub>40</sub> 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	
<b>Retention gap</b>						
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](http://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

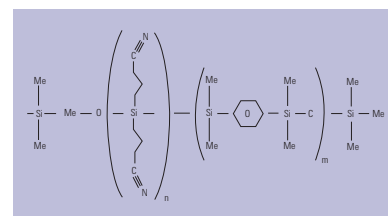
- (88%-Cyanopropyl)aryl-polysiloxane
- 250/320 °C upper temperature limits
- High polarity
- Designed for separation of cis-trans fatty acid methyl esters (FAMES)
- Even better separation than DB-23 of cis-trans isomers

**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

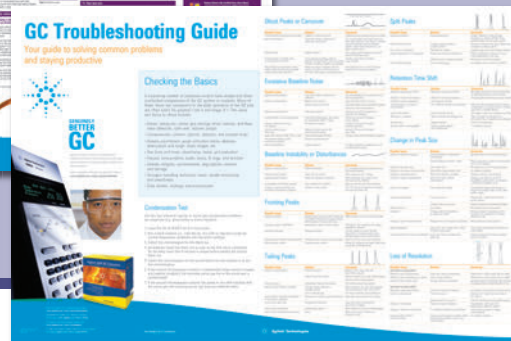
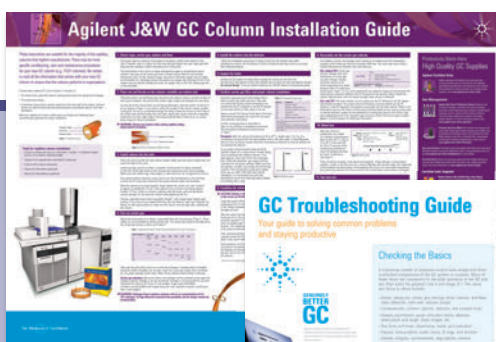
### CP-Sil 88

ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	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](http://www.agilent.com/chem/GCposteroffer)





## Select FAME

- Tuned for optimal cis-trans separation of FAMES, especially C<sub>18</sub> 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<sub>18:1</sub> 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 C<sub>6</sub> to C<sub>26</sub> 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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	7 in Cage
0.25	25	0.10	355/370	CP7463

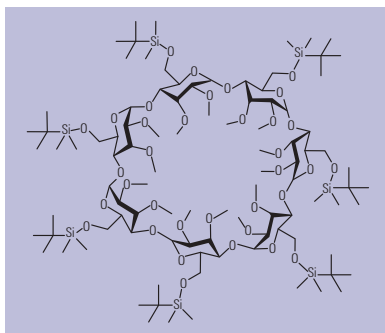
## CP-FFAP CB for Free Fatty Acids in Dairy Products

- Ideal for flavors, aromas and free fatty acids C<sub>1</sub>-C<sub>26</sub>
- Separates C<sub>2</sub>-C<sub>24</sub> 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%  $\beta$ -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- $\beta$  DEXm,  $\beta$ -DEX 110,  $\beta$ -DEX 120

### Cyclodex-B

ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	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 $\beta$

- $\beta$ -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  $\beta$ -cyclodextrin: 10% and 20%
- 20%  $\beta$ -cyclodextrin best choice for initial screening

**Similar Phases:** LIPODEX C, Rt- $\beta$  DEXm,  $\beta$ -DEX 110,  $\beta$ -DEX 120

### HP-Chiral $\beta$

ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	Temp Limits ( $^{\circ}\text{C}$ )	7 in Cage	5 in Cage
<b>HP-Chiral 10<math>\beta</math></b>					
0.25	30	0.25	30 to 240/250	19091G-B133	
<b>HP-Chiral 20<math>\beta</math></b>					
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 ( $\mu\text{m}$ )	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- $\beta$  DEXm,  $\beta$ -DEX 110,  $\beta$ -DEX 120

### CP-Chirasil-Dex CB

ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	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- $\beta$ -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- $\beta$ -2,3,6-M-19

ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	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](http://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](http://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
<b>DB-ALC1</b>						
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	
<b>DB-ALC2</b>						
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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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	
<b>Simulated distillation/high temperature</b>						
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
0.32	CP9094	CP9094I5				
30	0.10	CP9092				
	0.32	CP9096				

(Continued)

**Metal Columns**

Phase	ID (mm)	Length (m)	Film (µm)	7 in Cage	5 in Cage	
<b>Simulated distillation/high temperature</b>						
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		
<b>Standard phases and PEG</b>						
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	
				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	

(Continued)



**Metal Columns**

Phase	ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	7 in Cage	5 in Cage
<b>Standard phases and PEG</b>					
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	
<b>PLOT columns</b>					
PoraPLOT Q UltiMetal	0.53	10	20.00	CP6953	
		25	20.00	CP6954	
CP-Al <sub>2</sub> O <sub>3</sub> /KCl UltiMetal	0.53	50	10.00	CP6918	
CP-Al <sub>2</sub> O <sub>3</sub> /Na <sub>2</sub> SO <sub>4</sub> UltiMetal	0.53	50	10.00	CP6968	
CP-Molsieve 5Å UltiMetal	0.53	10	50.00	CP6937	
		25	50.00	CP6938	CP693815
<b>Select application columns</b>					
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

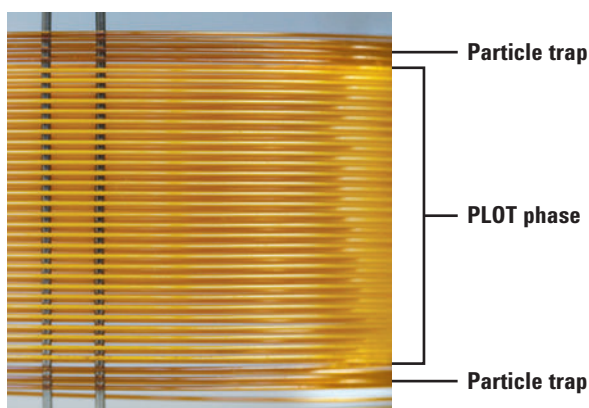
## PLOT Columns

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 <sub>2</sub> O <sub>3</sub> KCl PT	0.32	50	8.00	-60 to 200	19091P-K15PT
HP-PLOT Al <sub>2</sub> O <sub>3</sub> KCl PT	0.53	30	15.00	-60 to 200	19095P-K23PT
HP-PLOT Al <sub>2</sub> O <sub>3</sub> 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 <sub>2</sub> O <sub>3</sub> /KCl PT	0.32	50	5.00	-100 to 200/200	CP7515PT
CP-Al <sub>2</sub> O <sub>3</sub> /KCl PT	0.53	25	10.00	-100 to 200/200	CP7517PT
CP-Al <sub>2</sub> O <sub>3</sub> /KCl PT	0.53	50	10.00	-100 to 200/200	CP7518PT
CP-Al <sub>2</sub> O <sub>3</sub> /Na <sub>2</sub> SO <sub>4</sub> PT	0.32	50	5.00	-100 to 200/200	CP7565PT
CP-Al <sub>2</sub> O <sub>3</sub> /Na <sub>2</sub> SO <sub>4</sub> PT	0.53	50	10.00	-100 to 200/200	CP7568PT
HP-PLOT Al <sub>2</sub> O <sub>3</sub> S PT	0.32	25	8.00	-60 to 200	19091P-S12PT
HP-PLOT Al <sub>2</sub> O <sub>3</sub> S PT	0.32	50	8.00	-60 to 200	19091P-S15PT
HP-PLOT Al <sub>2</sub> O <sub>3</sub> S PT	0.53	30	15.00	-60 to 200	19095P-S23PT
HP-PLOT Al <sub>2</sub> O <sub>3</sub> 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 <sub>2</sub> O <sub>3</sub> 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 C<sub>1</sub>-C<sub>3</sub> isomers and alkanes to C<sub>12</sub>, CO<sub>2</sub>, 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](http://www.agilent.com/chem/myGCcolumns)

## PoraPLOT U and PoraPLOT S

- The most polar porous polymer PLOT column ideal for halogenated compounds, C<sub>1</sub>-C<sub>6</sub> 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 C<sub>1</sub>-C<sub>7</sub> hydrocarbons, CO<sub>2</sub>, 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 Al<sub>2</sub>O<sub>3</sub> KCl

- Least "polar" alumina phase
- Aluminum oxide deactivated with KCl
- Standard column choice for light hydrocarbon analysis – C<sub>1</sub>-C<sub>8</sub> 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, Al<sub>2</sub>O<sub>3</sub>/KCl, AB-PLOT Al<sub>2</sub>O<sub>3</sub> KCl, AT-Alumina

### HP-PLOT Al<sub>2</sub>O<sub>3</sub> 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  $\text{Al}_2\text{O}_3$  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-Al<sub>2</sub>O<sub>3</sub>/KCl and CP-Al<sub>2</sub>O<sub>3</sub>/Na<sub>2</sub>SO<sub>4</sub>

- Aluminum oxide PLOT columns offer high selectivity for separating ppm levels of C<sub>1</sub>-C<sub>5</sub> 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 Al<sub>2</sub>O<sub>3</sub> surface while the Na<sub>2</sub>SO<sub>4</sub> deactivation provides a polar surface. Unsaturated compounds such as ethylene and acetylene (ethyne) are retained longer.

### Selectivity Through KCl or Na<sub>2</sub>SO<sub>4</sub> Deactivation

**Note:** Aluminum oxide PLOT columns are deactivated using KCl or Na<sub>2</sub>SO<sub>4</sub> treatments which provide a reproducible and stable deactivation up to 200 °C. The KCl salt deactivation results in a relatively apolar Al<sub>2</sub>O<sub>3</sub> surface, while the Na<sub>2</sub>SO<sub>4</sub> deactivation provides a polar surface. Unsaturated compounds such as ethylene and acetylene (ethyne) are retained longer.

**Similar Phases:** Al<sub>2</sub>O<sub>3</sub>/KCl, Rt-Alumina PLOT, Alumina PLOT, RT-Alumina BOND/KCl, Alumina chloride PLOT, AB-PLOT Al<sub>2</sub>O<sub>3</sub> KCl

#### CP-Al<sub>2</sub>O<sub>3</sub>/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-Al<sub>2</sub>O<sub>3</sub>/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:** Al<sub>2</sub>O<sub>3</sub>/Na<sub>2</sub>SO<sub>4</sub>, Rt-Alumina PLOT, Alumina PLOT, Rt-Alumina BOND/Na<sub>2</sub>SO<sub>4</sub>, MXT-AluminaBOND/Na<sub>2</sub>SO<sub>4</sub>, Alumina sulfate PLOT

**CP-Al<sub>2</sub>O<sub>3</sub>/Na<sub>2</sub>SO<sub>4</sub>**

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-Al<sub>2</sub>O<sub>3</sub>/Na<sub>2</sub>SO<sub>4</sub> 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 Al<sub>2</sub>O<sub>3</sub> S

- Middle range of "polarity" for alumina phases
- Aluminum oxide deactivated with sodium sulfate
- Excellent general use column for light hydrocarbon analysis – C<sub>1</sub>-C<sub>8</sub> hydrocarbon isomers
- Best for resolving acetylene from butane and propylene from isobutane

**Similar Phases:** Al<sub>2</sub>O<sub>3</sub>/Na<sub>2</sub>SO<sub>4</sub>, Rt-Alumina PLOT, Alumina PLOT, Rt-Alumina BOND/Na<sub>2</sub>SO<sub>4</sub>, MXT-AluminaBOND/Na<sub>2</sub>SO<sub>4</sub>, Alumina sulfate PLOT, AT-Alumina

### HP-PLOT Al<sub>2</sub>O<sub>3</sub> 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 – C<sub>1</sub>-C<sub>8</sub> hydrocarbon isomers
- Separates C<sub>1</sub>-C<sub>4</sub> 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 CO<sub>2</sub> 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:** Al<sub>2</sub>O<sub>3</sub>/KCl, Al<sub>2</sub>O<sub>3</sub>/Na<sub>2</sub>SO<sub>4</sub>, Rt-Alumina PLOT, Alumina PLOT, AB-PLOT Al<sub>2</sub>O<sub>3</sub> 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 Al<sub>2</sub>O<sub>3</sub> M

- Most "polar" alumina phase (similar to GS-Alumina)
- Aluminum oxide deactivated with proprietary deactivation
- Good general use column for light hydrocarbon analysis – C<sub>1</sub>-C<sub>8</sub> hydrocarbon isomers
- Good for resolving acetylene from butane and propylene from isobutane

**Similar Phases:** AB-PLOT Al<sub>2</sub>O<sub>3</sub> M, BGB-PLOT Al<sub>2</sub>O<sub>3</sub> M, AT-Alumina

### HP-PLOT Al<sub>2</sub>O<sub>3</sub> M

ID						
(mm)	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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 C<sub>1</sub>-C<sub>4</sub> 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	CP857015
	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](http://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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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
- O<sub>2</sub>, N<sub>2</sub>, CO and CH<sub>4</sub> 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/O<sub>2</sub> 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*

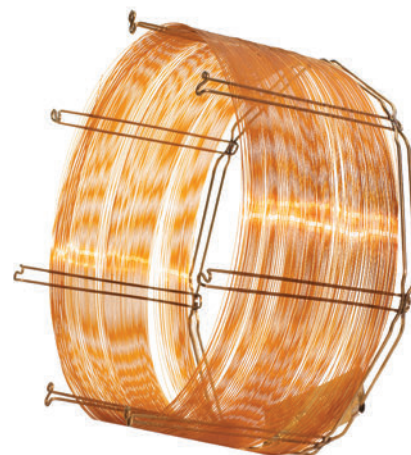
\*Includes CP-UltiMetal connector

### 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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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
			60	0.25	5
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](http://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-Δ<sup>9</sup>-Tetrahydrocannabinol-9-Carboxylic Acid in Hair* (publication # 5990-7535EN), [www.agilent.com/chem/library](http://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  $\mu\text{m}$  film column configuration (calibration mix C<sub>5</sub>-C<sub>44</sub>). For fast LTM analysis of ASTM D2887, with Agilent analyzer G3445B#653, the 0.5  $\mu\text{m}$  film column is used (calibration mix C<sub>5</sub>-C<sub>40</sub>).

### LTM II Columns

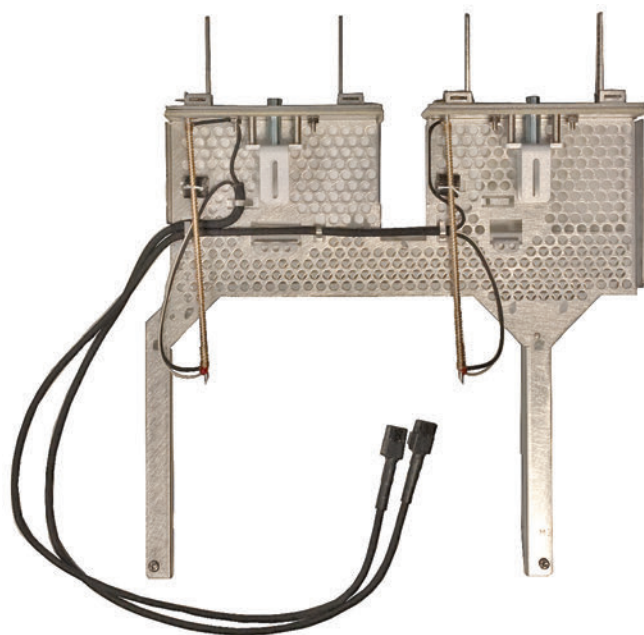
Phase	Description	ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	Part No.
DB-Sim-Dist	LTM II	0.25	4	0.25	G3900-65004
DB-Sim-Dist	LTM II	0.25	4	0.50	G3900-65003

## 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:

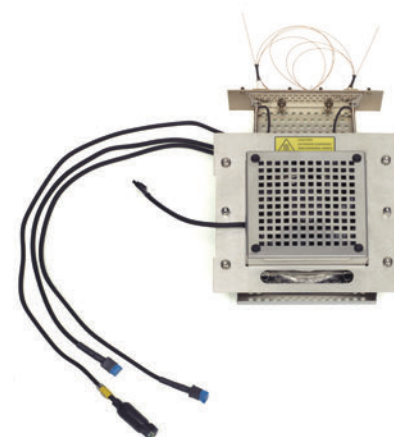
- Faster heating and cooling times – as low as one minute or less – for more rapid analytical cycle times
- Excellent retention time repeatability and performance comparable to conventional GC
- Less power consumption for longer in-field operation
- Integrated module design to facilitate easy column 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](http://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 ( $\mu\text{m}$ )	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 ( $\mu\text{m}$ )	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
			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 ( $\mu\text{m}$ )	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		0.50	122-7033LTM
			0.25	123-7012LTM
			0.50	123-7013LTM
	0.32	15	0.25	123-7032LTM
0.50			123-7033LTM	
0.25			125-7031LTM	
0.53	30	0.25	125-7032LTM	
		1.00	125-7032LTM	
DB-WAXetr	0.25	30	0.25	122-7332LTM
			0.32	123-7334LTM
			0.53	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 ( $\mu\text{m}$ )	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 & TOOLS**For more information about LTM II Column Modules, visit [www.agilent.com/chem/ltmlcol\\_ii](http://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)

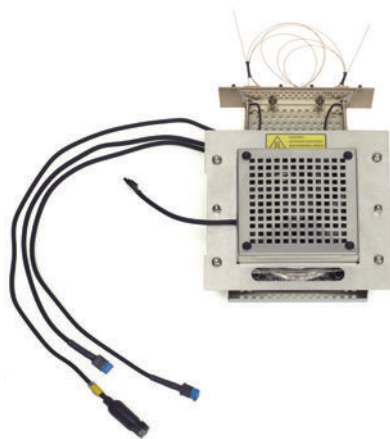


**Agilent J&W LTM II Low Thermal Mass Column Modules  
for 7890A/B Series GC Systems**

Phase	ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	Part No.
HP-PLOT Al <sub>2</sub> O <sub>3</sub> KCl	0.25	30	5.00	19091P-K33LTM
	0.53	30	15.00	19095P-K23LTM
HP-PLOT Al <sub>2</sub> O <sub>3</sub> 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&amp;W LTM Column Modules for Transportable 5975T GC/MSD Systems

Phase	ID (mm)	Length (m)	Film ( $\mu\text{m}$ )	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 &amp; TOOLS

For more information about LTM Column Modules for 5975T, visit [www.agilent.com/chem/5975t\\_ltm\\_col](http://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

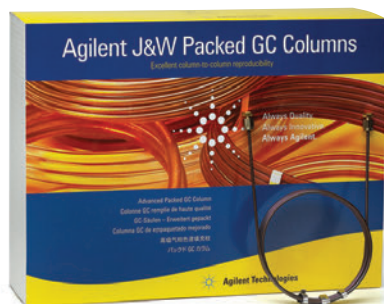
UltiMetal Plus stainless steel capillary tubing can be used as retention gaps, guard columns, or transfer lines.

### 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/packedcolumnsordering](http://www.agilent.com/chem/packedcolumnsordering)

### 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% H<sub>3</sub>PO<sub>4</sub>**

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

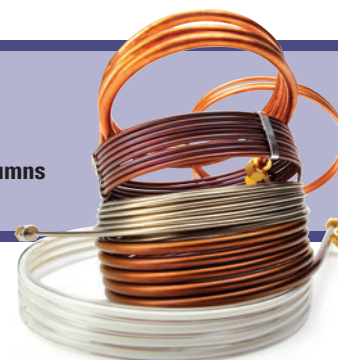
**12% UC W982**

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](http://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](http://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](http://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](http://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 H<sub>2</sub>O <1 ppm and O<sub>2</sub> <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](http://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.

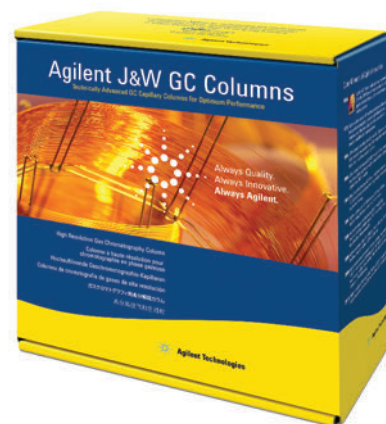
A broken column is not always fatal. If a broken column was maintained at a high temperature either continuously or with multiple temperature program runs, damage to the column is very likely. The back half of the broken column has been exposed to oxygen at elevated temperatures which rapidly damages 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 (H<sub>2</sub>SO<sub>4</sub>), nitric (HNO<sub>3</sub>), phosphoric (H<sub>3</sub>PO<sub>4</sub>), and chromic (CrO<sub>3</sub>). The bases include potassium hydroxide (KOH), sodium hydroxide (NaOH), and ammonium hydroxide (NH<sub>4</sub>OH). 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 NH<sub>4</sub>OH in the column is short. This tends to eliminate or minimize any damage by these compounds. Thus, if HCl or NH<sub>4</sub>OH 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
<b>Decrease in separation</b>		
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
<b>Increase in peak width</b>		
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.**

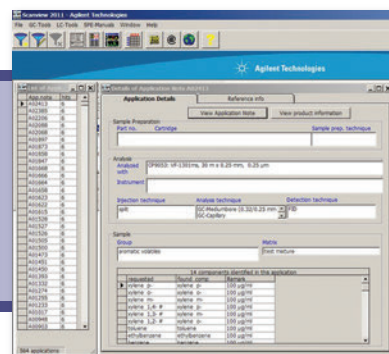
**Energy and Fuels** – here you'll find applications – such as the analysis of sulfur compounds in propylene – that you can use right away to meet regulatory requirements, improve efficiency, and maintain good environmental stewardship. **Turn to page 576.**

**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](http://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

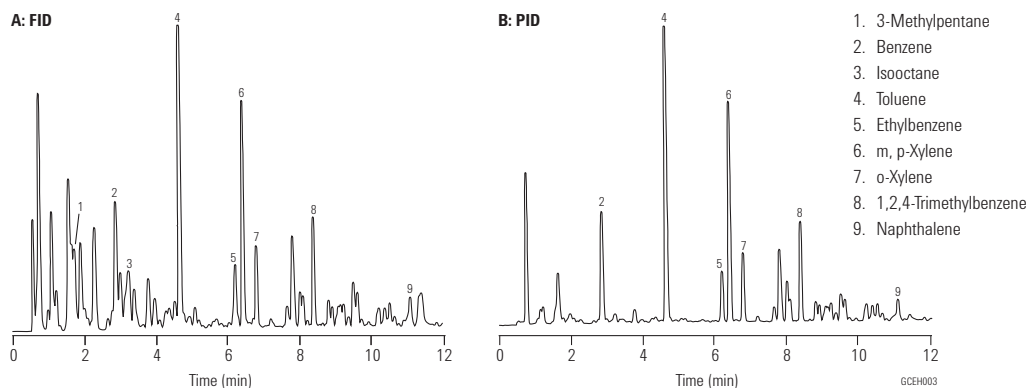
**Oven:** 40 °C for 2 min,  
40-200 °C at 12 °C/min,  
200 °C for 5 min

**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

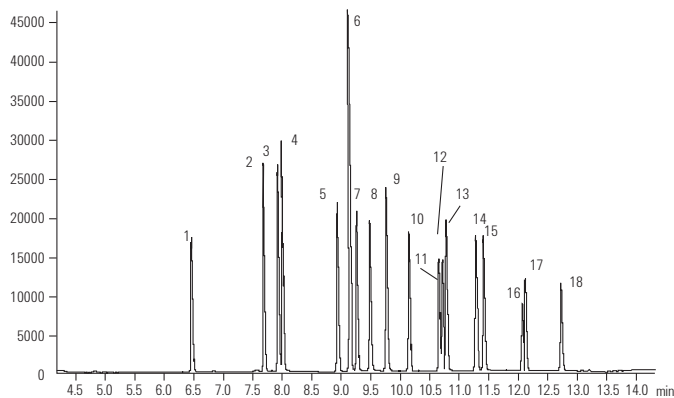
Detector: MS  
280 °C

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

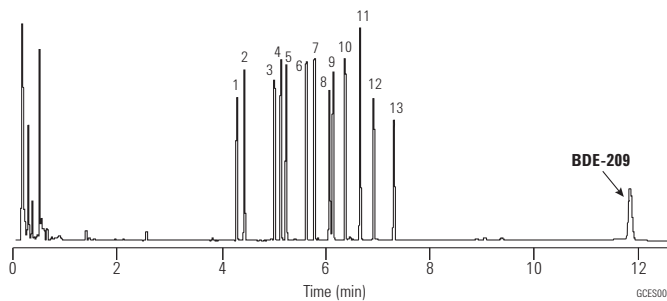
Injection: Split, 250 °C  
Split ratio 20:1

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

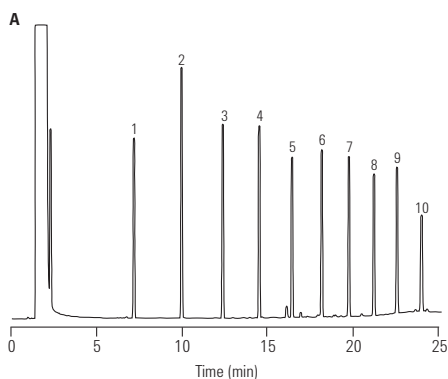
#### Suggested Supplies

**Septum:** 11 mm Advanced Green septa, 5183-4759

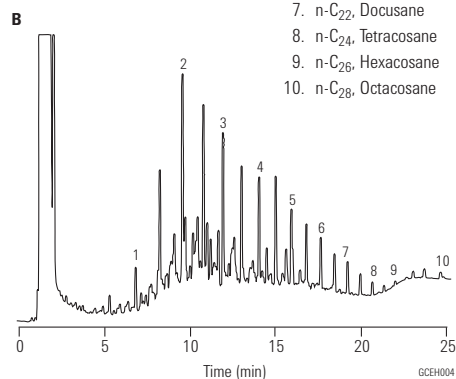
**Liner:** Direct connect, single taper, deactivated, 4 mm id, G1544-80730

**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-C<sub>10</sub>, Decane
2. n-C<sub>12</sub>, Dodecane
3. n-C<sub>14</sub>, Tetradecane
4. n-C<sub>16</sub>, Hexadecane
5. n-C<sub>18</sub>, Octadecane
6. n-C<sub>20</sub>, Eicosane
7. n-C<sub>22</sub>, Docosane
8. n-C<sub>24</sub>, Tetracosane
9. n-C<sub>26</sub>, Hexacosane
10. n-C<sub>28</sub>, Octacosane

### Analysis of Polycyclic Aromatic Hydrocarbons

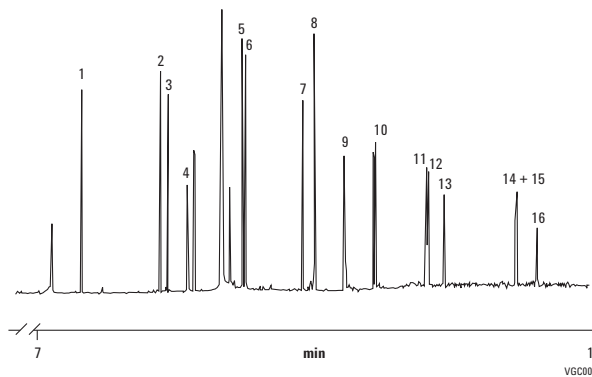
**Column:** VF-Xms  
CP8805  
30 m x 0.25 mm, 0.10 µm

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

**Carrier:** Helium, 60 kPa

**Injection:** Split, T=275 °C

**Detector:** Agilent Ion Trap MS



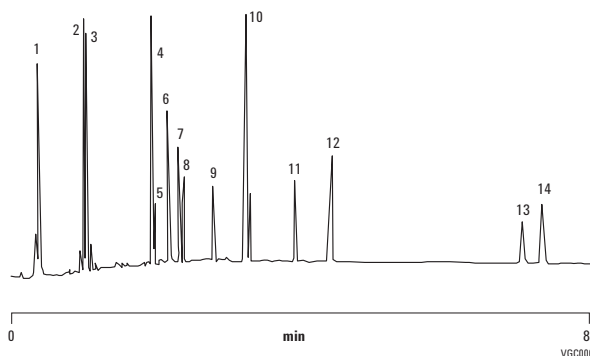
1. Naphthalene
2. Acenaphthylene
3. Acenaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Fluoranthene
8. Pyrene
9. Chrysene
10. Benzo[a]anthracene
11. Benzo[k]fluoranthene
12. Benzo[b]fluoranthene
13. Benzo[a]pyrene
14. Indeno[1,2,3-cd]pyrene
15. Dibenzo[a,h]anthracene
16. Benzo[g,h,i]perylene

### 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

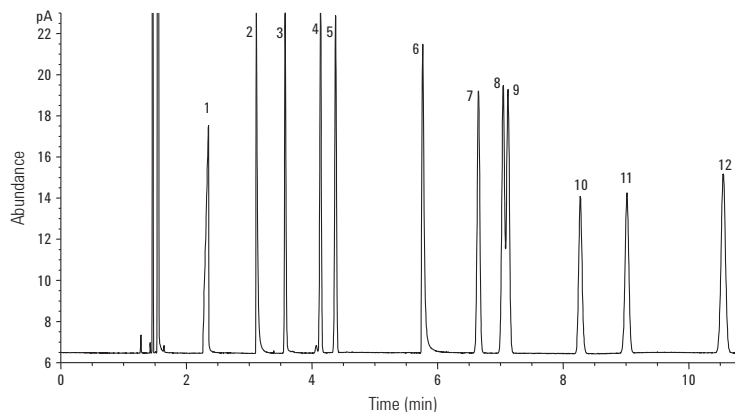
1. 2,3,7,8-TCDD
2. 2,3,7,8-TCDF
3. 1,2,3,7,8-PeCDF
4. 1,2,3,4,7,8-HxCDF
5. 1,2,3,6,7,8-HxCDF
6. 2,3,4,7,8-PeCDF
7. 1,2,3,4,7,8-HxCDD + 1,2,3,7,8-PeCDD
8. 1,2,3,6,7,8-HxCDD
9. 1,2,3,7,8,9-HxCDD
10. 1,2,3,4,6,7,8-HxCDF
11. 2,3,4,6,7,8-HpCDD
12. 1,2,3,4,6,7,8-HpCDD
13. 1,2,3,4,6,7,8,9-OCDF
14. 1,2,3,4,6,7,8,9-OCDD



### 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

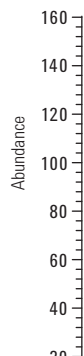
**Sampler:** Agilent 7683B, 5.0 µL syringe  
(p/n 5188-5246),  
1.0 µL splitless injection,  
5 ng each component on-column

**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/min<sup>2</sup> 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.

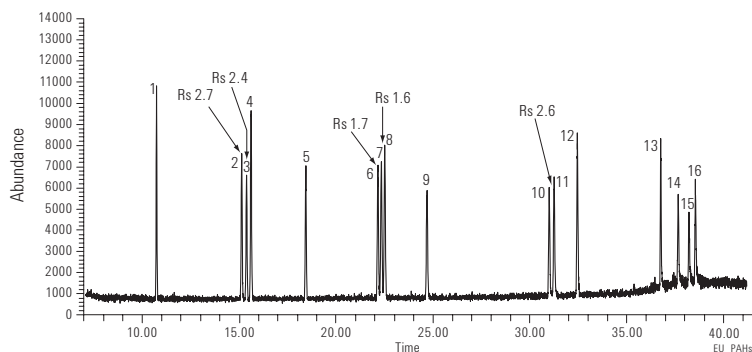
**Suggested Supplies**

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

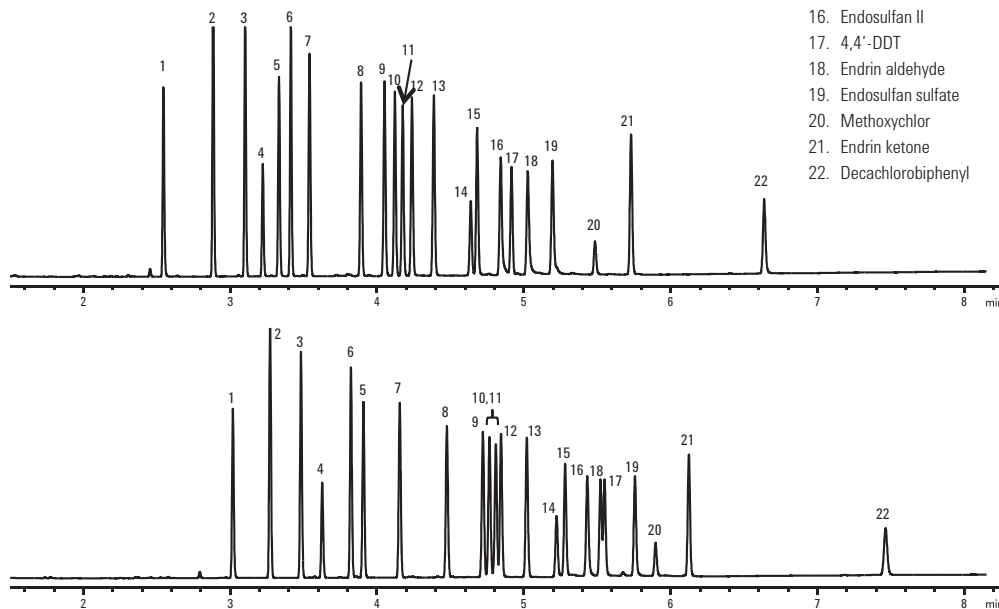
**Sampler:** Agilent 7693

**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

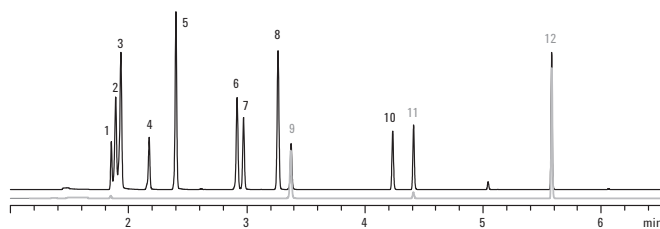
**Oven:** 50 °C, hold 1.5 min, 20 °C/min to 95 °C,  
40 °C/min to 175 °C, hold 1.25 min

**Injection:** 2 µL, splitless, 200 °C

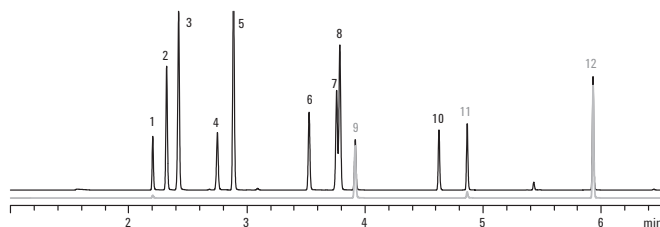
**Detector:** µECD, 300 °C

**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.

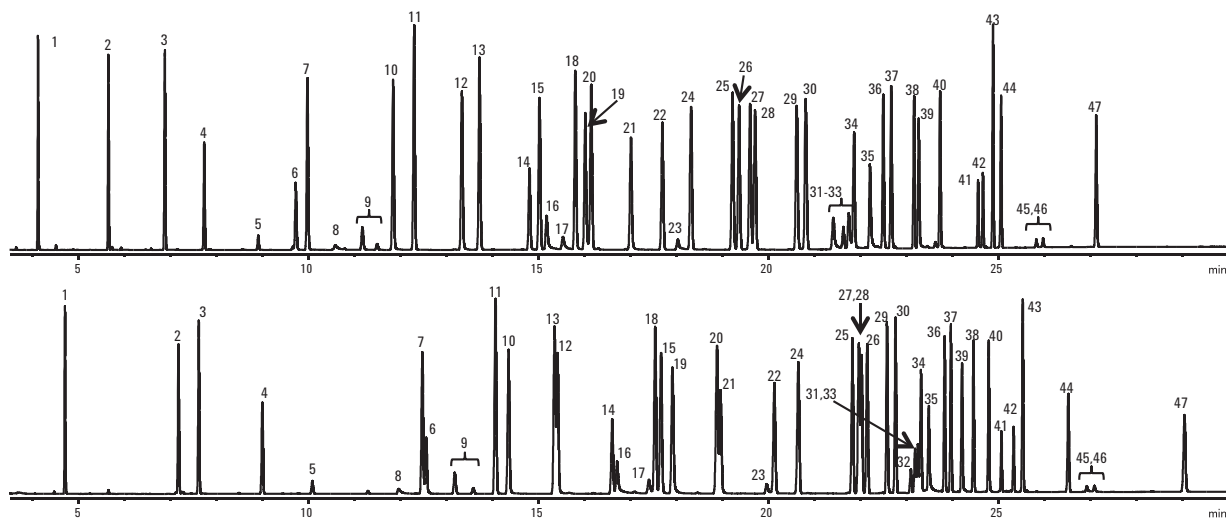
**Organochlorine Pesticides, EPA Method 8081B**

**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

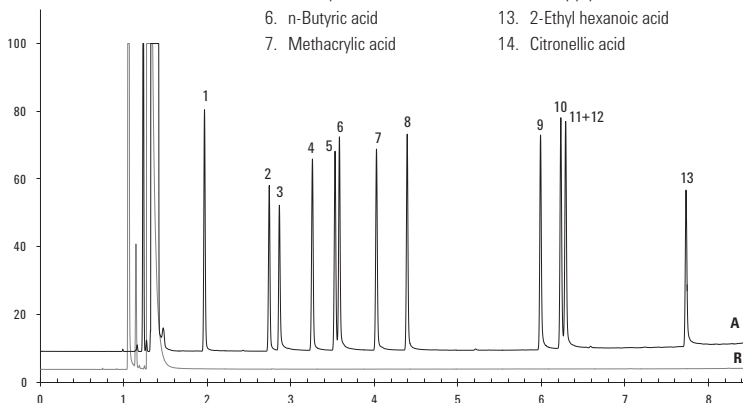
Inlet: 250 °C, 1 µL, split 1:200

Inlet liner: 4 mm, glass wool

Detector: FID at 260 °C

Organic acid mix C<sub>1</sub>-C<sub>10</sub> (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

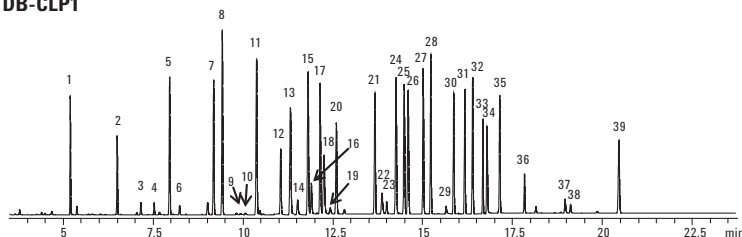
Oven: 35 °C, hold 5.75 min, 20 °C/min to 95 °C, 40 °C/min to 200 °C, hold 1.25 min

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

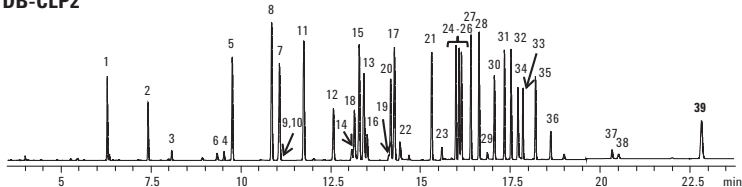
Injection: 2 µL splitless, 200 °C

Detector: µECD, 300 °C

DB-CLP1



DB-CLP2



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

### 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

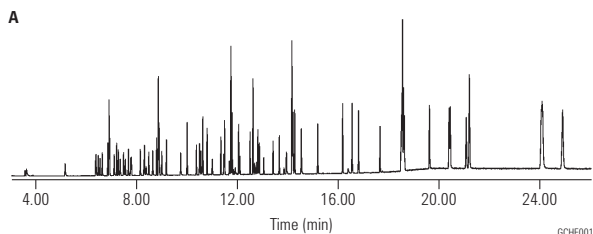
Carrier: He constant flow mode, 1.1 mL/min

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

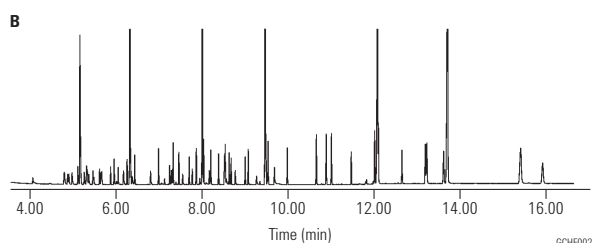
Injection: Splitless 0.5 µL injected at 300 °C,  
QuickSwap pressure 5.0 psi during acquisition,  
80.0 psi during backflush with inlet set to  
1.0 psi during backflush

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](http://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)

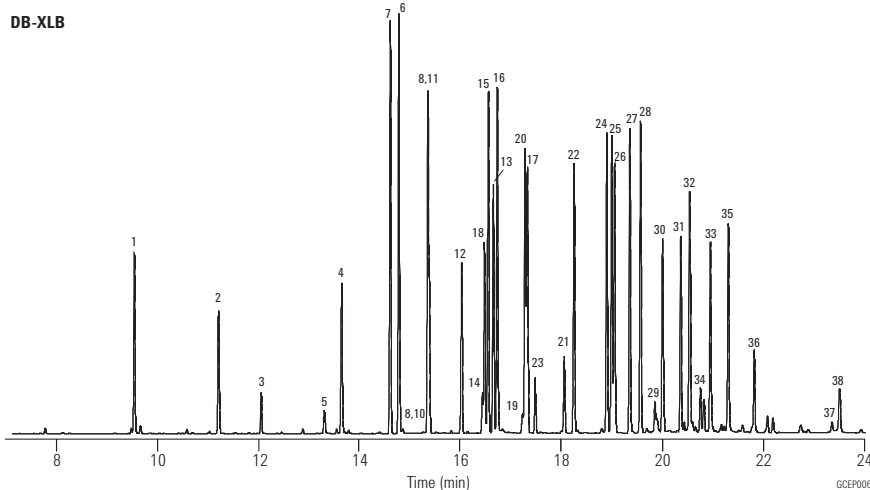
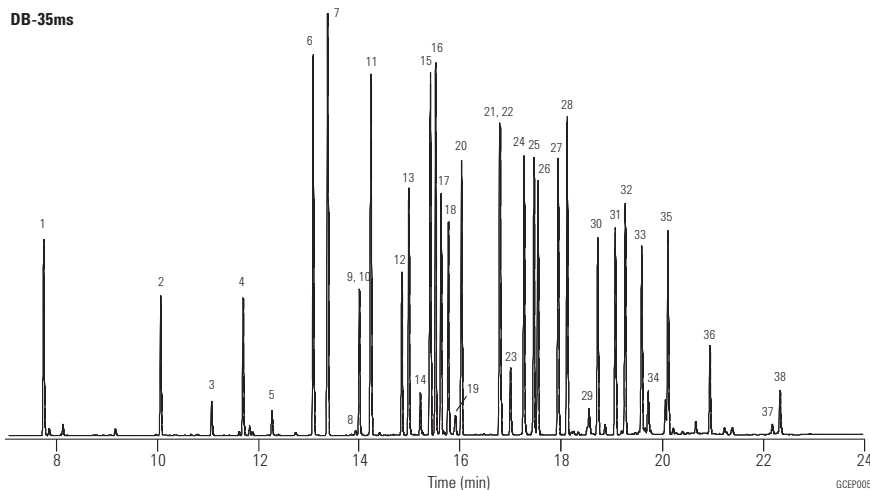
**Sample:** 50 µg per component

**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)

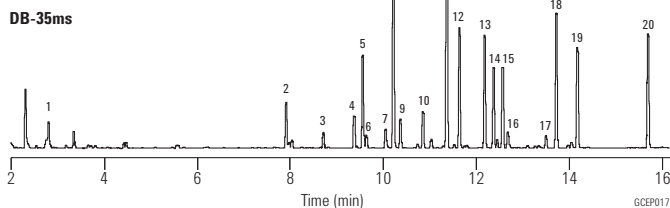
**Sample:** 50 pg per component

**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

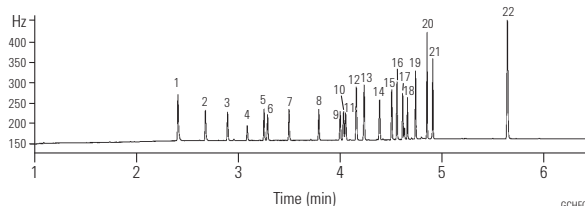
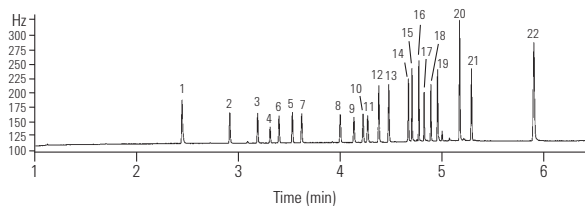
**Carrier:** Hydrogen (69 cm/s at 120 °C,  
ramped at 99 mL/min to  
106 cm/s at 4.4 min)

**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)

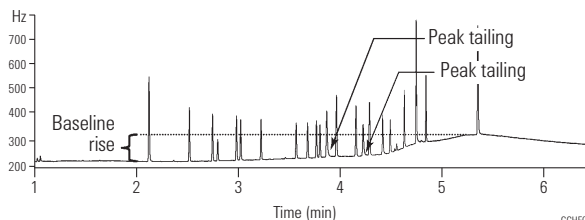
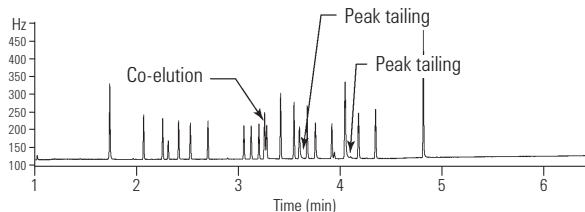
**Detector:** µECD 320 °C; nitrogen makeup;  
constant column + makeup flow 60 mL/min

**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

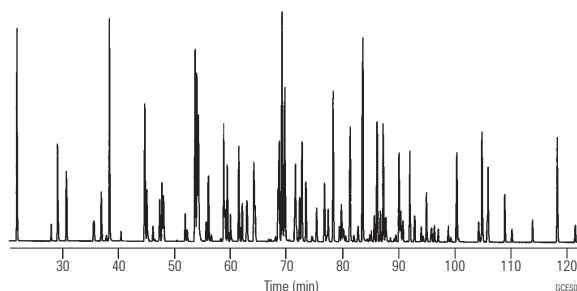
**Carrier:** Helium at 37 cm/s, measured at 150 °C

**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

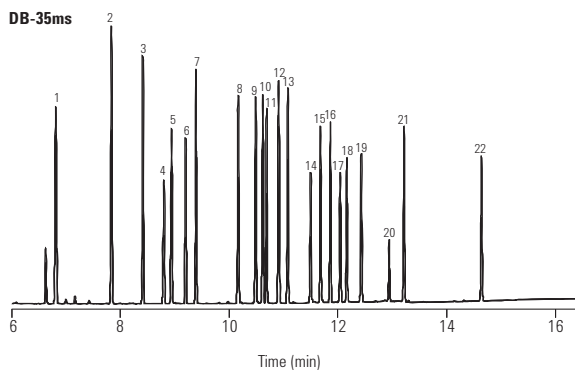
**Carrier:** Helium at 45 cm/s  
(EPC in constant flow mode)

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

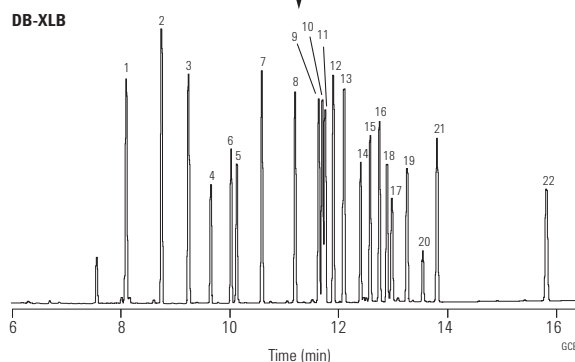
**Injection:** Splitless, 250 °C  
30 s purge activation time

**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)

**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

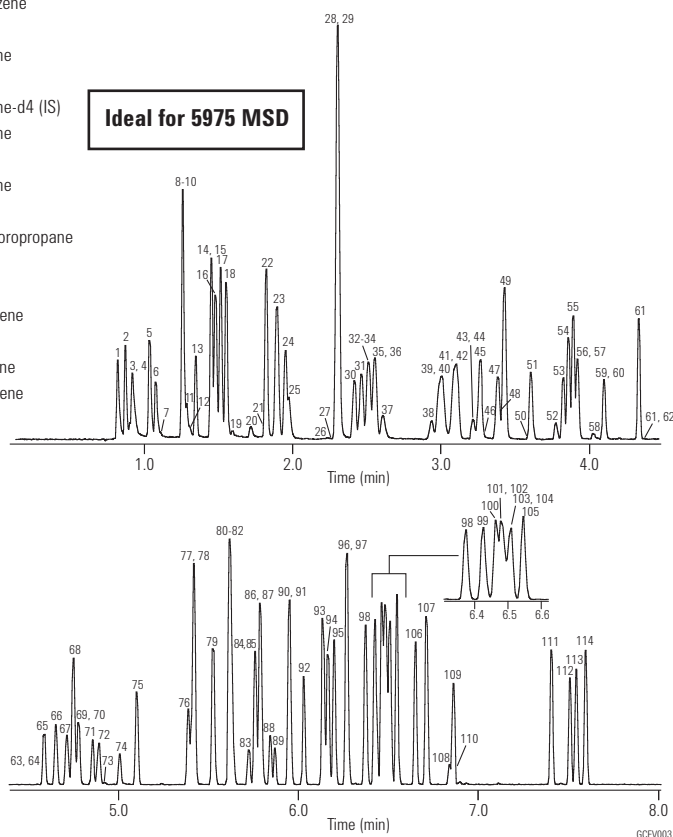
**Sampler:** Purge and trap (Tekmar 3100)  
Purge: 11 min  
Trap: VoCarb 3000  
Preheat: 245 °C  
Desorb: 250 °C for 1 min  
Bake: 260 °C for 10 min  
Line & valve: 100 °C

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

**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

**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

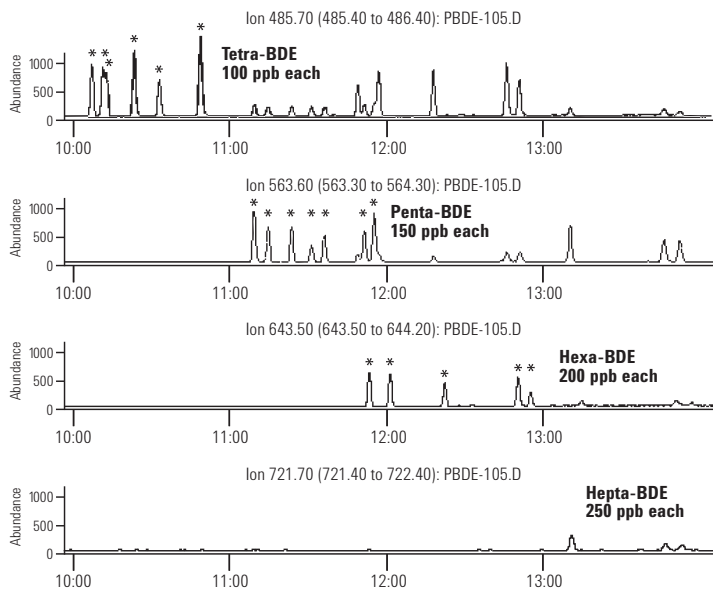
**Carrier:** Helium at 38 cm/s at 100 °C (1.2 mL/min),  
constant flow mode

**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](http://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

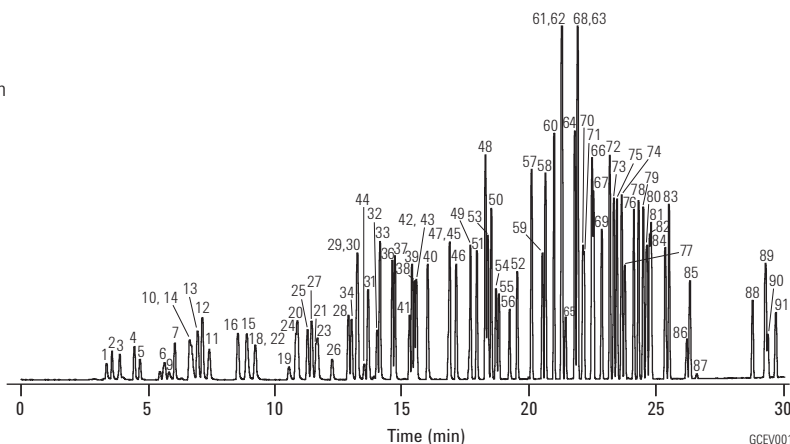
**Detector:** MSD, 235 °C transfer line  
Full scan 35-260 amu (m/z 44 subtracted)

**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**

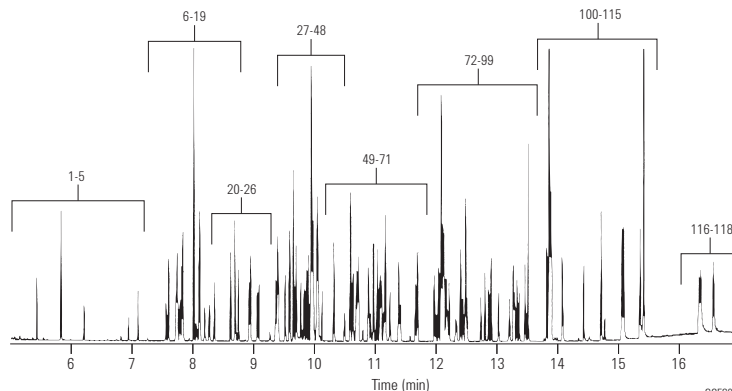
**Septum:** 11 mm Advanced Green septa, 5183-4759

**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

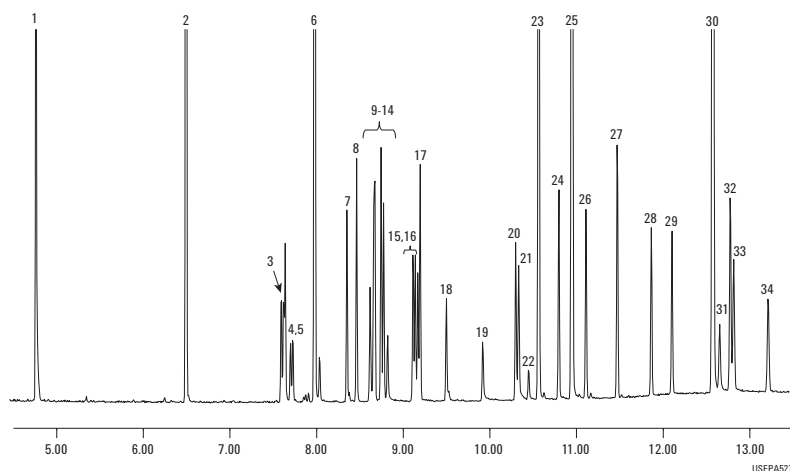
**Carrier:** Helium, 52 cm/s, constant flow

**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. Oxychlorane                | 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

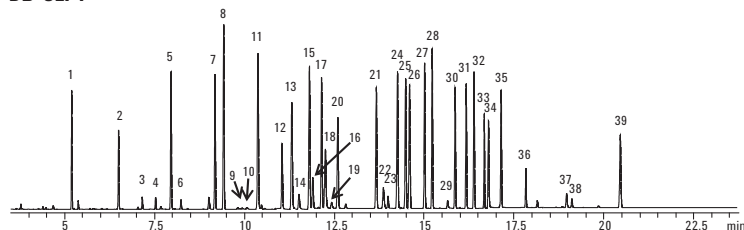
Injection: 2 µL, splitless, 250 °C

Detector: µCED, 340 °C

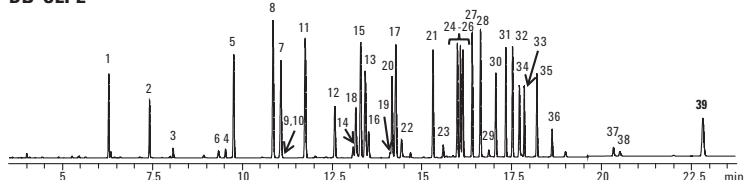
Sample: 100 ng/mL EPA 508.1 analytes,  
100 ng/mL pesticide surrogate mix

- |  |   |
|--|---|
| 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

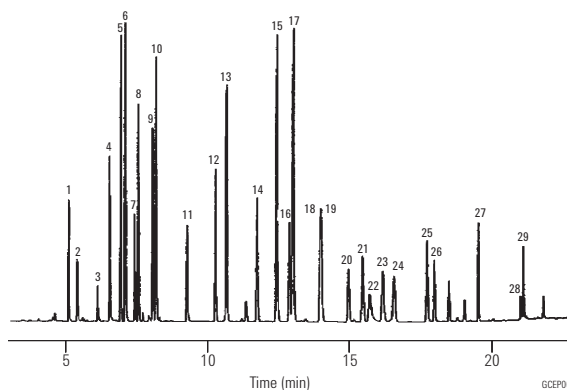
**Oven:** 80 °C for 1 min  
80-180 °C at 30 °C/min  
180-205 °C at 3 °C/min  
205 °C for 4 min  
205-290 °C at 2 °C/min  
290 °C for 2 min

**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)

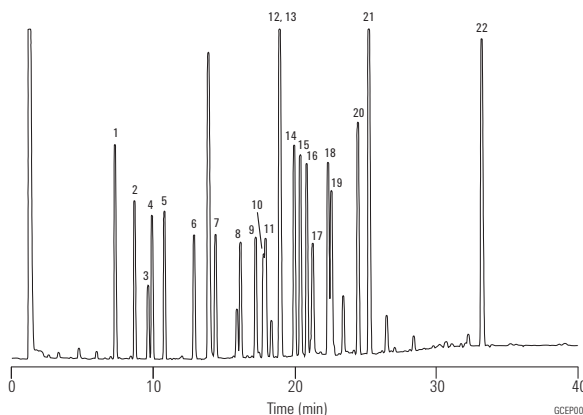
**Oven:** 150-275 °C at 4 °C/min  
275 °C for 30 min

**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

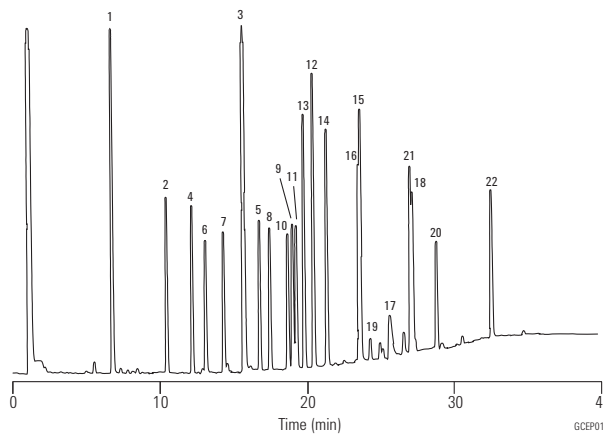
- |                                      |                             |
|--------------------------------------|-----------------------------|
| 1. 2,4,5,6-Tetrachloro-m-xylene (IS) | 12. Dieldrin                |
| 2. α-BHC                             | 13. p,p'-DDE                |
| 3. β-BHC                             | 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  $\mu$ m

**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  $\mu$ L of 100  $\mu$ g/ $\mu$ L standard in isoctane

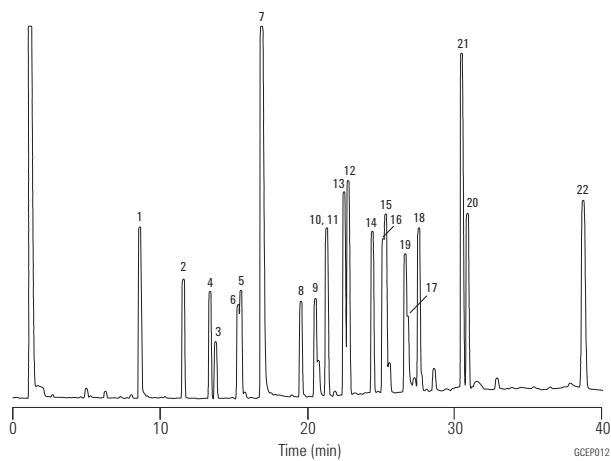
- |                                      |                             |
|--------------------------------------|-----------------------------|
| 1. 2,4,5,6-Tetrachloro-m-xylene (IS) | 12. Dieldrin                |
| 2. $\alpha$ -BHC                     | 13. p,p'-DDE                |
| 3. $\beta$ -BHC                      | 14. Endrin                  |
| 4. $\gamma$ -BHC                     | 15. Endosulfan II           |
| 5. $\delta$ -BHC                     | 16. p,p'-DDD                |
| 6. Heptachlor                        | 17. Endrin aldehyde         |
| 7. Aldrin                            | 18. Endosulfan sulfate      |
| 8. Heptachlor epoxide                | 19. p,p'-DDT                |
| 9. $\gamma$ -Chlordane               | 20. Endrin ketone           |
| 10. Endosulfan I                     | 21. Methoxychlor            |
| 11. $\alpha$ -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  $\mu$ L 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

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

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

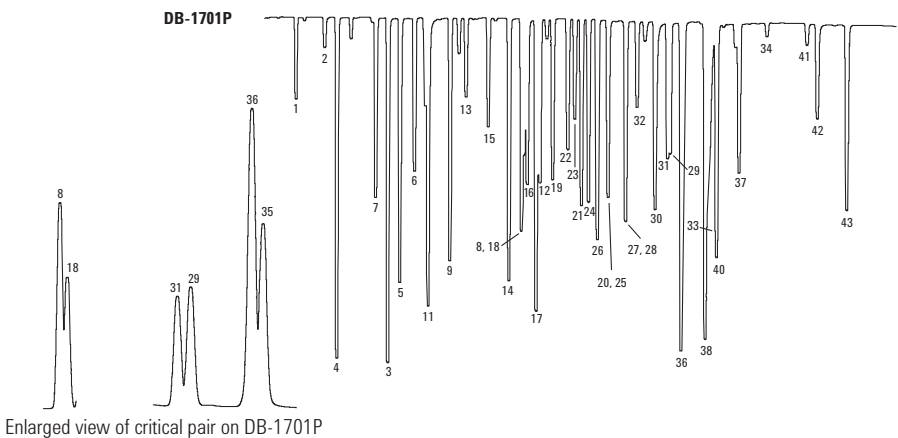
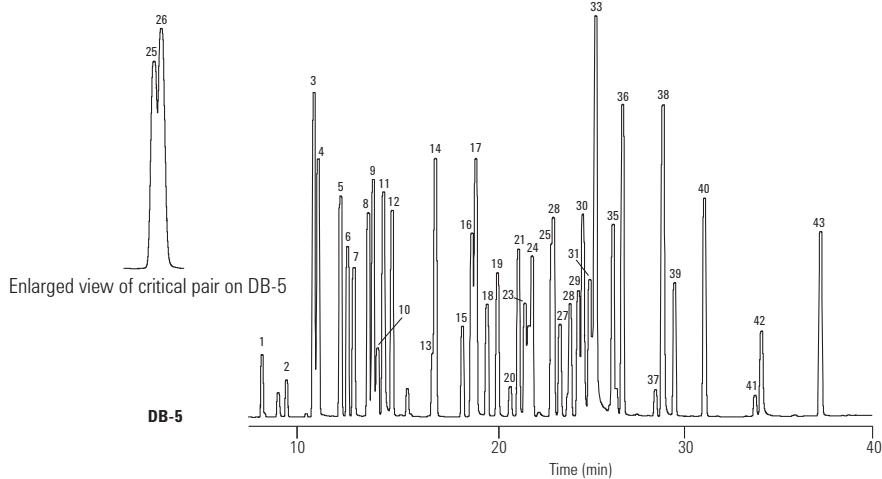
Carrier: Helium at 29.2 cm/s, measured at 150 °C

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

Injection: Splitless, 200 °C

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

Sample: 2.0 µL, 20-200 pg/µL

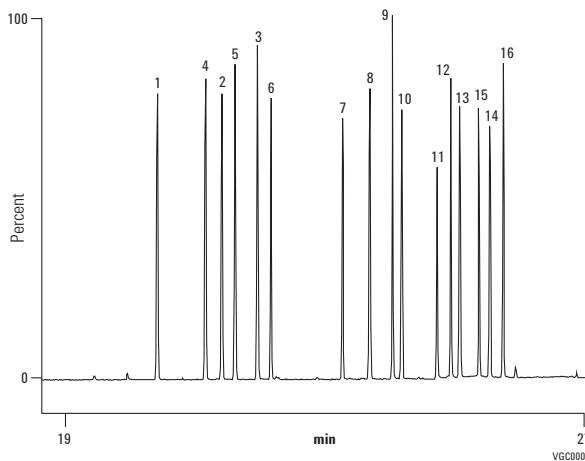


1. Etridiazole
2. Chloroneb
3. Propachlor
4. Tetrachloro-m-xylene (IS)
5. Trifluralin
6. α-BHC
7. Hexachlorobenzene
8. β-BHC
9. γ-BHC
10. Pentachloronitrobenzene
11. p,p'-Dichlorobiphenyl
12. δ-BHC
13. Heptachlor
14. Alachlor
15. Aldrin
16. Chlorpyrifos
17. DCPA
18. Isodrin
19. Heptachlor epoxide
20. 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

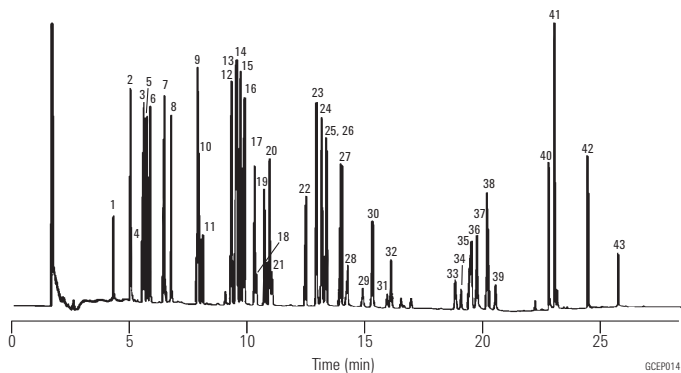
### Nitrogen/Phosphorus Containing Pesticides, EPA Method 507

**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

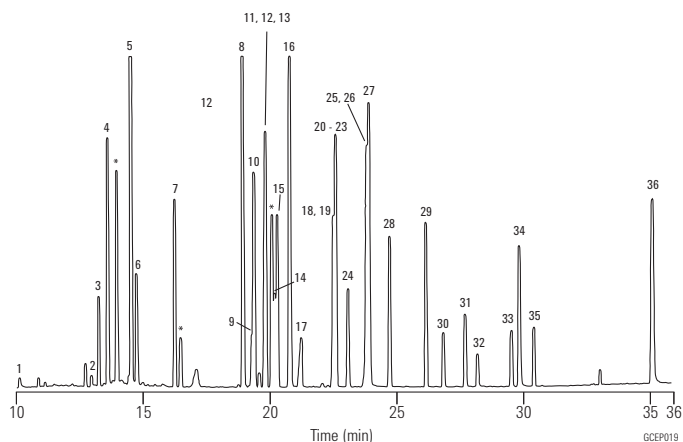
#### Suggested Supplies

**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

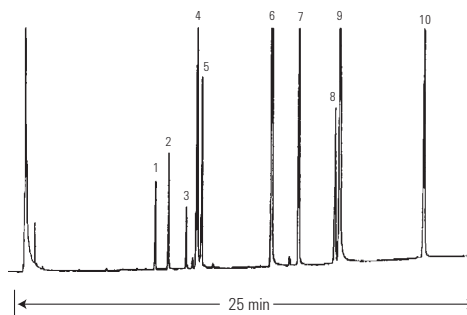
**Carrier:** Helium at 35 cm/s

**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   |





### C<sub>1</sub> and C<sub>2</sub> 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

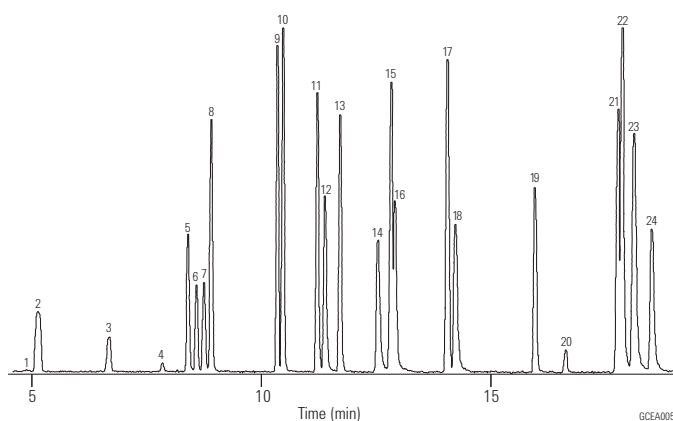
**Injection:** Splitless, 250 °C  
0.20 min purge activation time

**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)

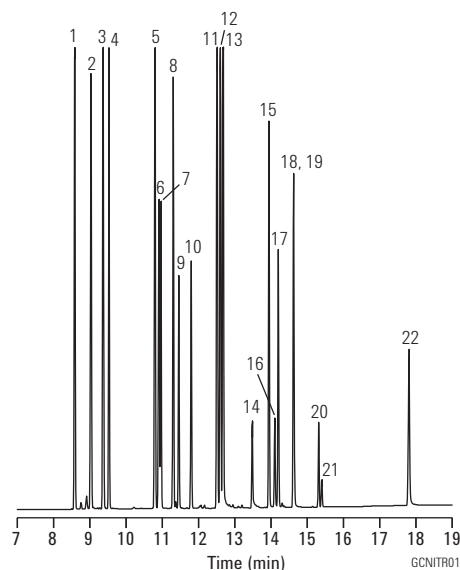
**Column:** DB-35  
125-1937  
30 m x 0.53 mm, 0.50 µm

**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

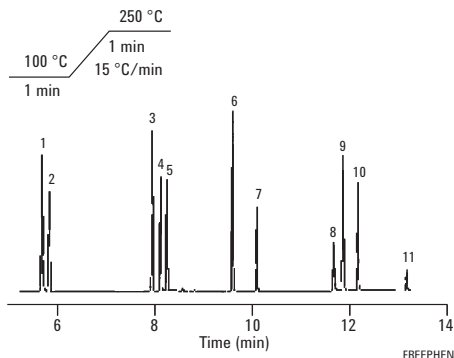
**Free Phenols**

**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



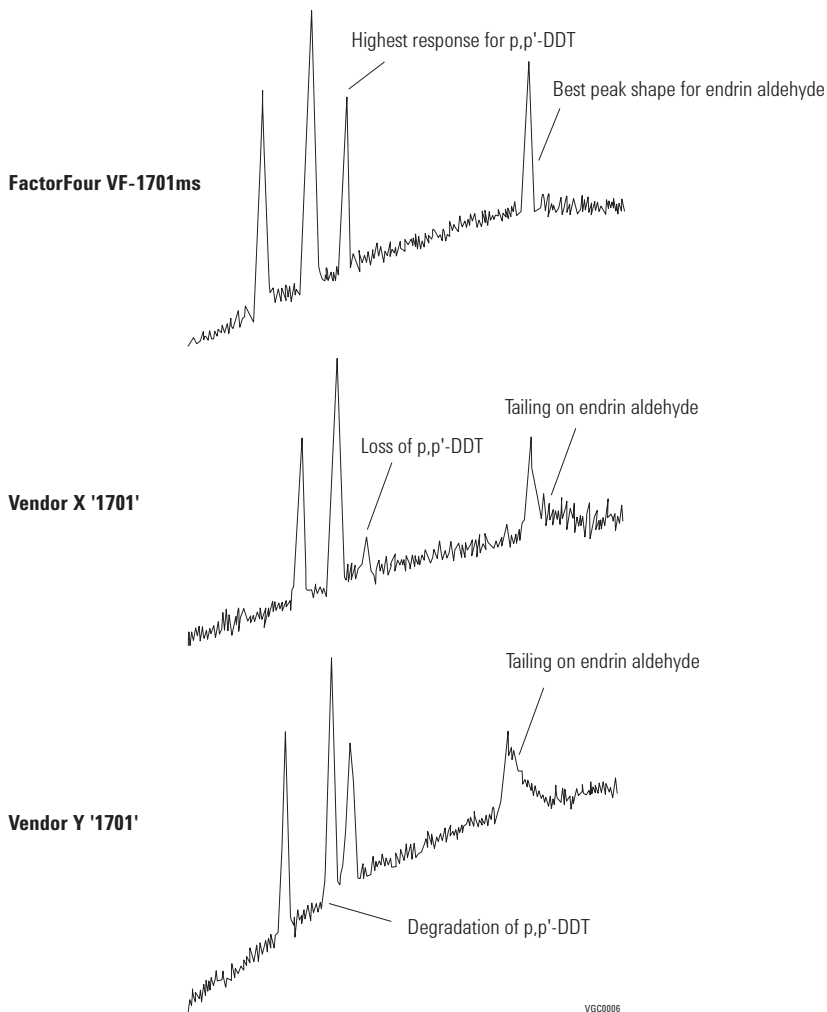
1. Phenol
2. 2-Chlorophenol
3. 2,4-Dimethylphenol
4. 2-Nitrophenol
5. 2,4-Dichlorophenol
6. 4-Chloro-3-methylphenol
7. 2,4,6-Trichlorophenol
8. 2,4-Dinitrophenol
9. 4-Nitrophenol
10. 2-Methyl-4,6-dinitrophenol
11. Pentachlorophenol

**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 µg



VGC0006

**Organochlorine Pesticides to EPA 625 via GC/MS**

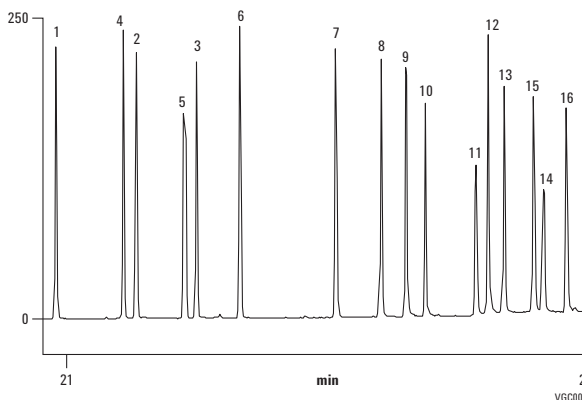
**Column:** VF-35ms  
CP8877  
30 m x 0.25 mm, 0.25 µm

**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

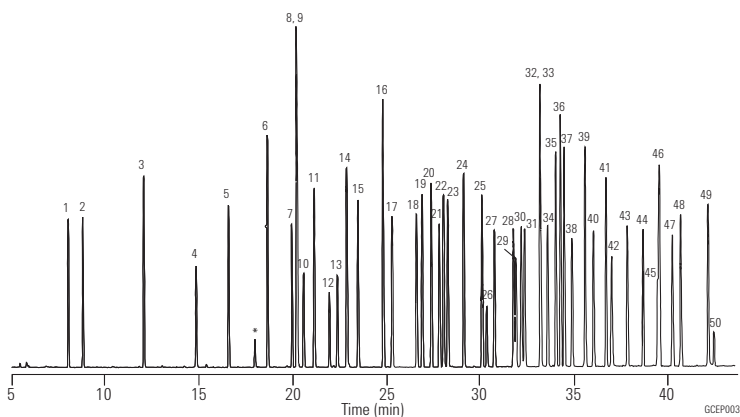
**Carrier:** Helium at 35 cm/s, measured at 50 °C

**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

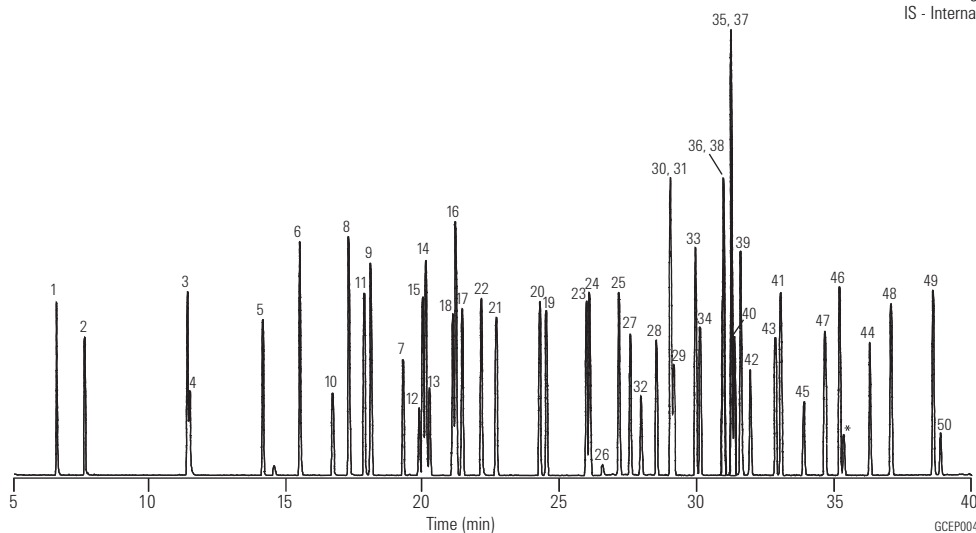
**Detector:** MSD, 300 °C transfer line  
Full scan at m/z 50-500

**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  $\mu$ m

**Instrument:** Agilent 7890 GC/Agilent 5975C Series GC/MSD

**Sampler:** Agilent 7683B automatic liquid sampler,  
5.0  $\mu$ L 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  $\mu$ L splitless; 250  $^{\circ}$ C, purge flow 60 mL/min  
at 0.25 min, gas saver on at 2 min 20 mL/min

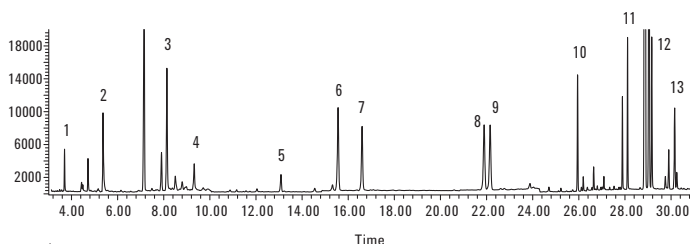
**Carrier:** Helium, constant pressure 43.5 psi at 95  $^{\circ}$ C

**Oven:** 95  $^{\circ}$ C (1.3 min), 15  $^{\circ}$ C/min to 125  $^{\circ}$ C, 5  $^{\circ}$ C/min to  
165  $^{\circ}$ C, 2.5  $^{\circ}$ C/min to 195  $^{\circ}$ C, 20  $^{\circ}$ C/min to 280  $^{\circ}$ C  
(3.75 min)

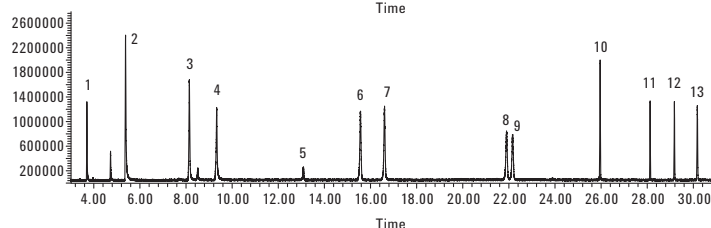
**Postrun Backflush:** 5 min at 280  $^{\circ}$ C, PCM 1 pressure 70 psi during  
backflush, 2 psi inlet pressure during backflush

**Detector:** 310  $^{\circ}$ C transfer line, 310  $^{\circ}$ C source, 150  $^{\circ}$ 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

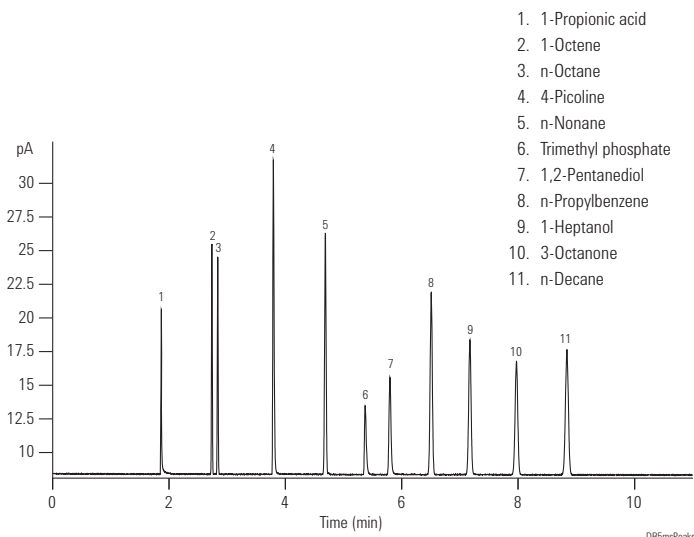
**Oven:** 65 °C isothermal

**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

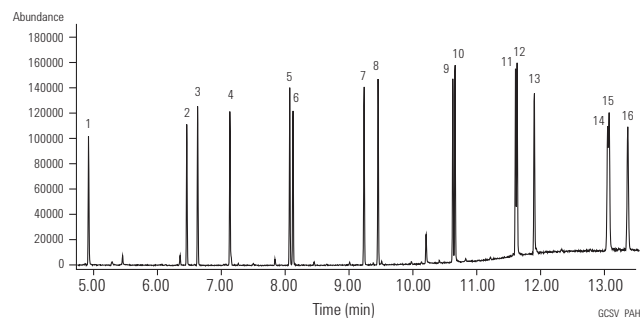
**Carrier:** Helium constant flow 30 cm/s

**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

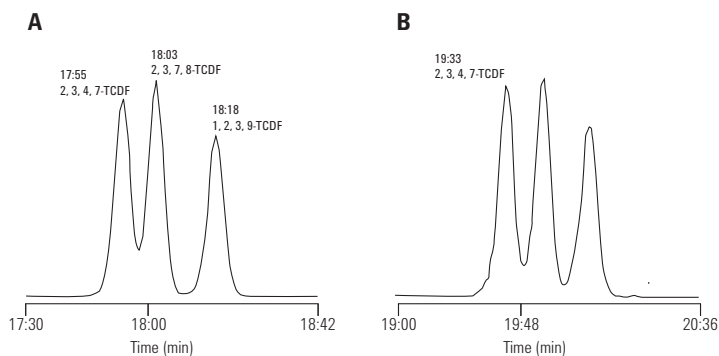
**Column A:** DB-225  
122-2232  
30 m x 0.25 mm, 0.25 µm

**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

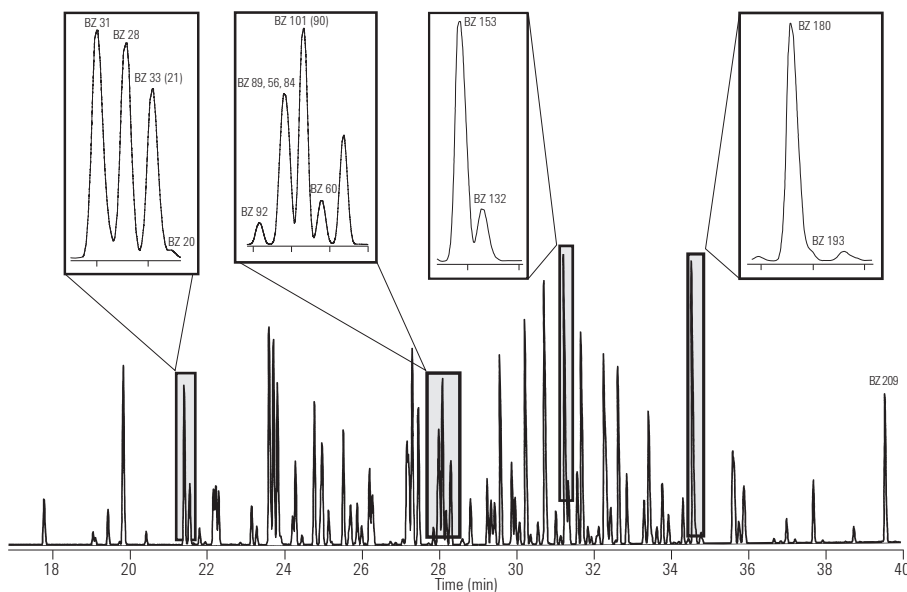
Sample: 2 µL dilute Aroclor mixture

#### 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

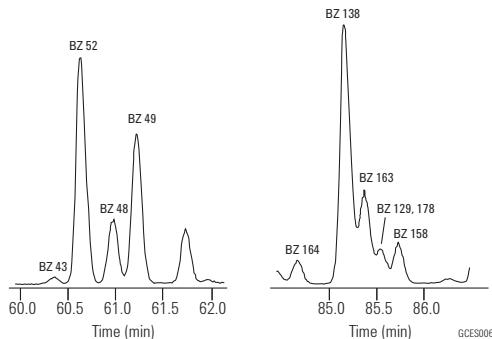
Carrier: Helium at 34.2 cm/s, measured at 150 °C

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

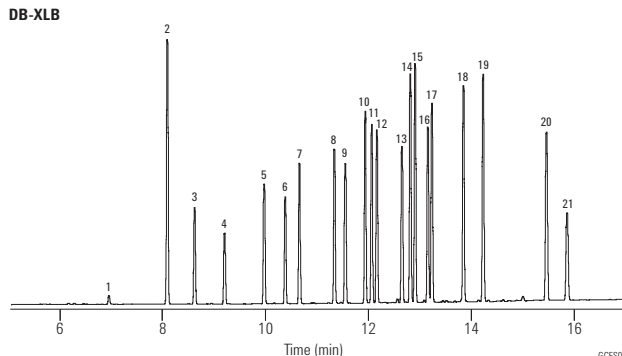
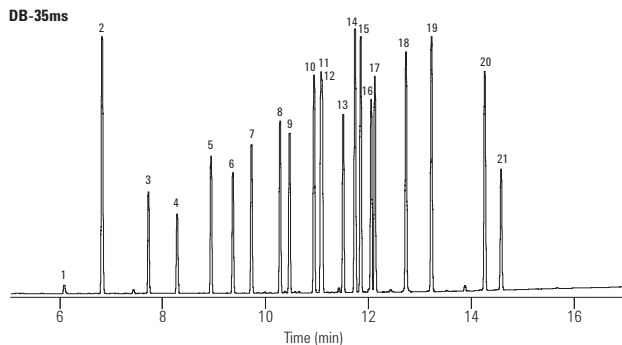
Carrier: Helium at 45 cm/s  
(EPC in constant flow mode)

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



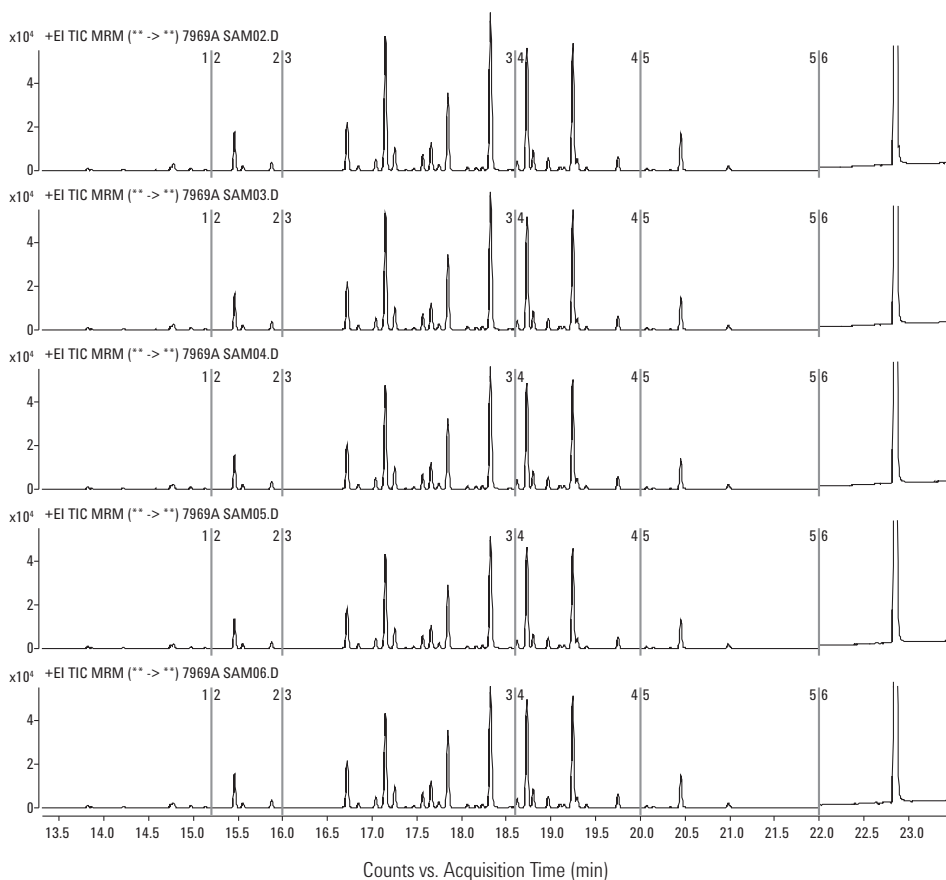
**Automated Cleanup of PCB extracts from Waste Oil  
Using 7696A Sample Prep Workbench**

**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

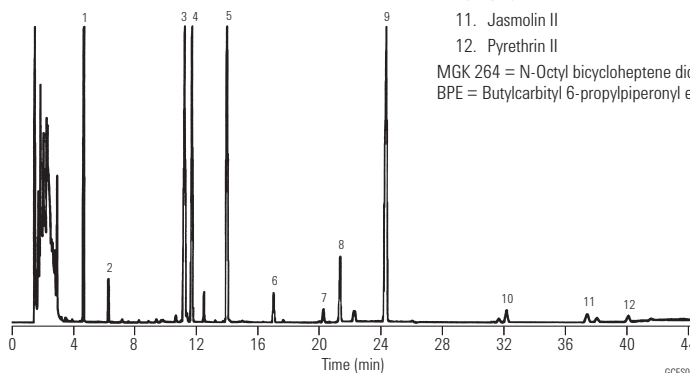
**Injection:** Split, 250 °C  
 Split ratio 1:20

**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

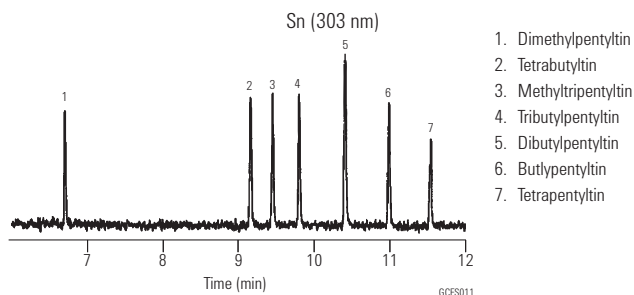


*Chromatogram courtesy of Khan Nguyen and Richard Moorman of Sandoz Agro Inc.*

**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

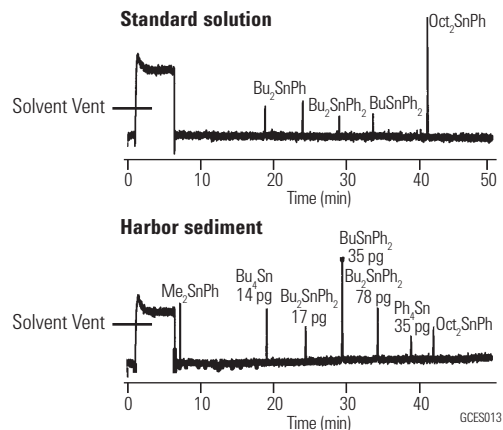
**Suggested Supplies**

**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

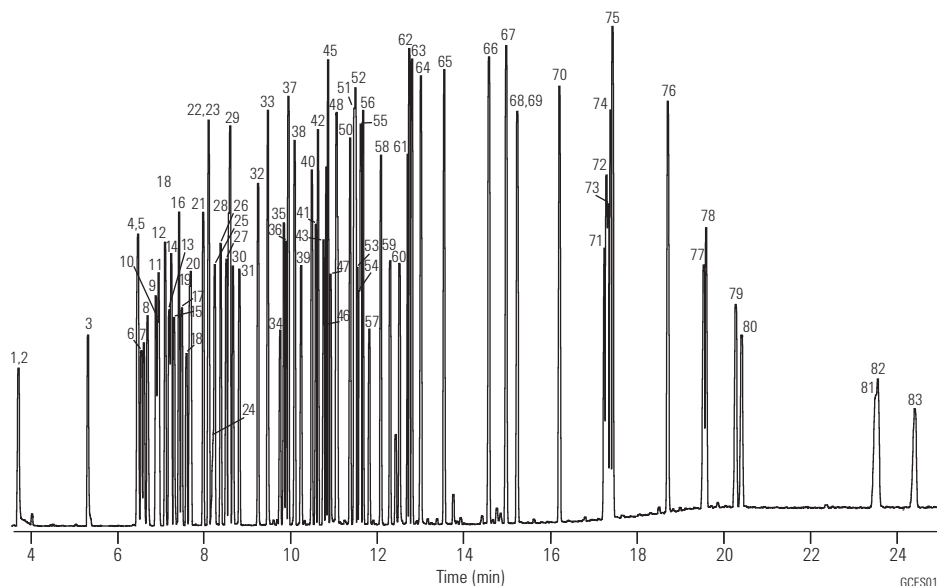
**Suggested Supplies**

**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        |



GCES015

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

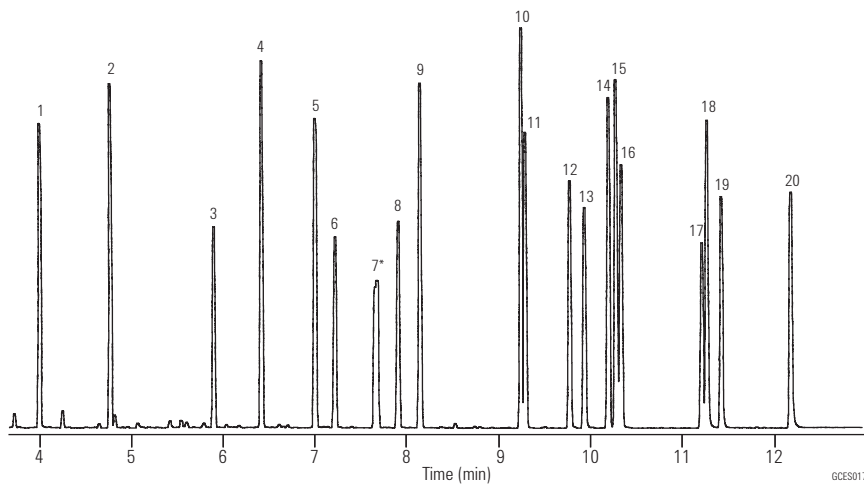
**Sample:** 1 µL of 20 ng/µL  
Method 8061 mixture (AccuStandard) in hexane

**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**

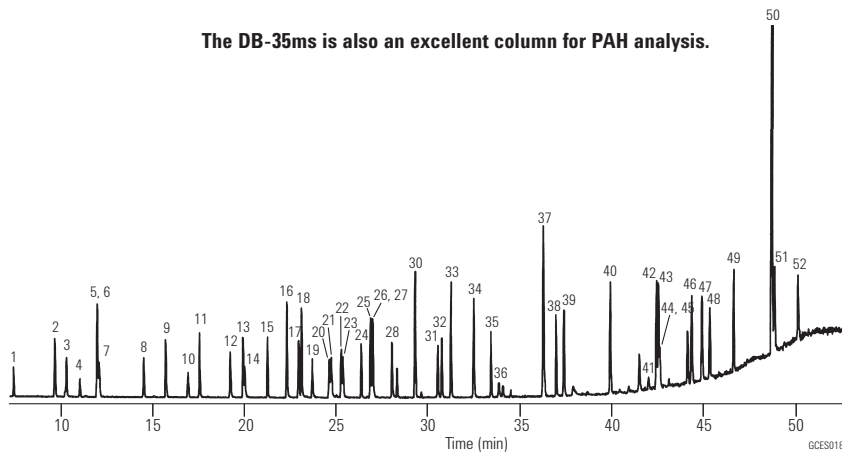
**Septum:** 11 mm Advanced Green septa, 5183-4759

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

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

	<b>Ions</b>		<b>Ions</b>
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

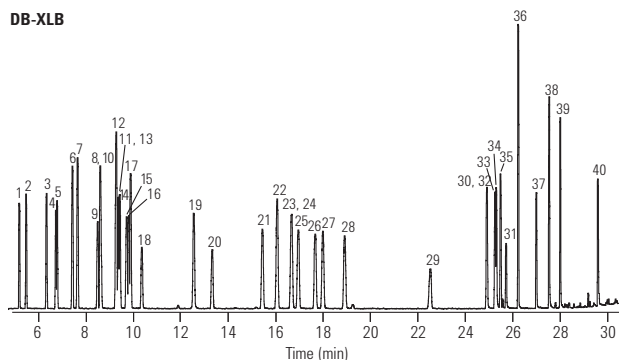
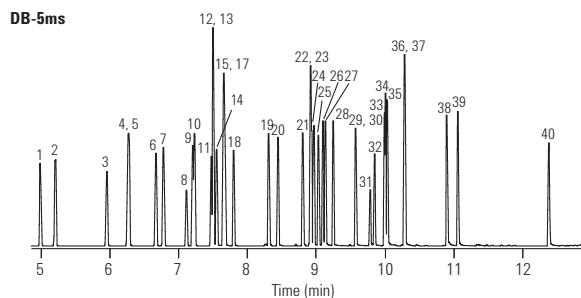
**Injection:** Pulsed splitless, 200 °C  
Pulse pressure & time: 25 psi for 1 min  
Purge flow & time: 50 mL/min for 0.25 min  
Gas saver flow & time: 20 mL/min for 3 min

**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



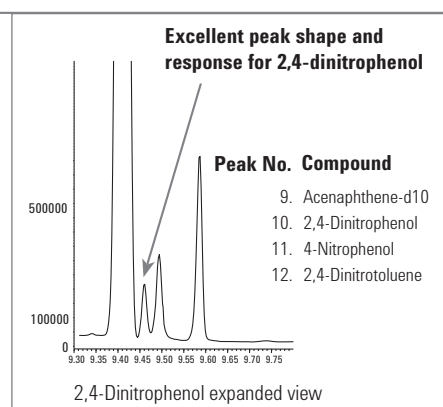
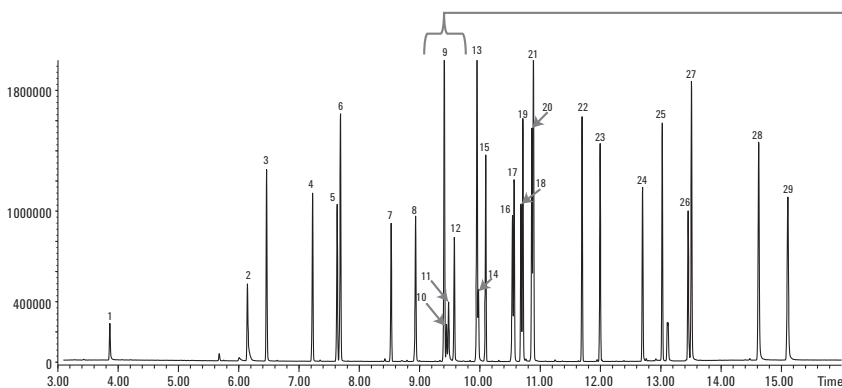
GCES019

**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                  |                            |

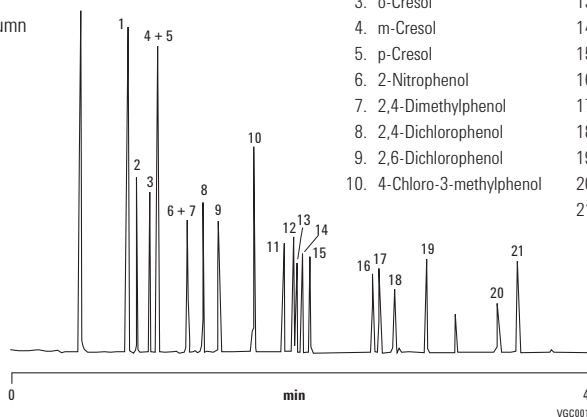


**High Resolution Phenol Analysis by GC/MS**

**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) |



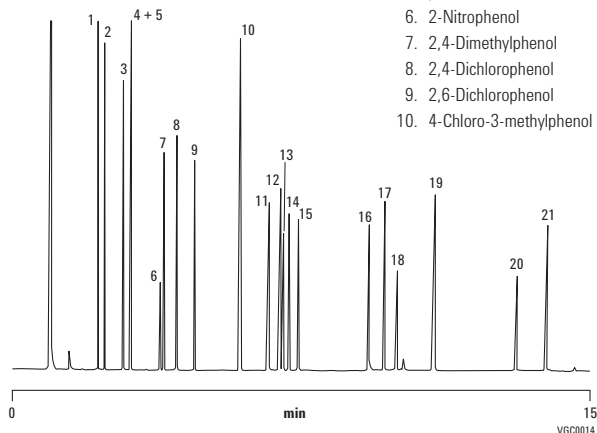


**Phenols According to EPA Method 8040**

**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: H<sub>2</sub>, 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) |

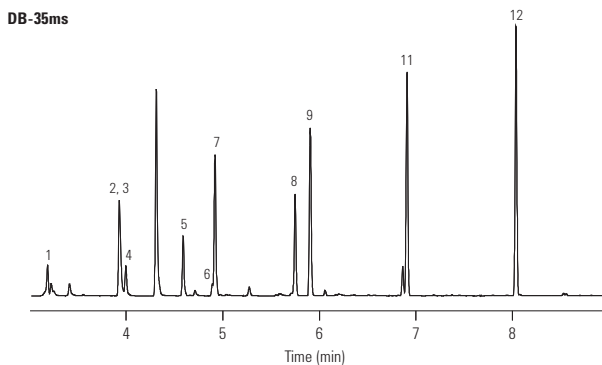


**EPA Method 552.2**

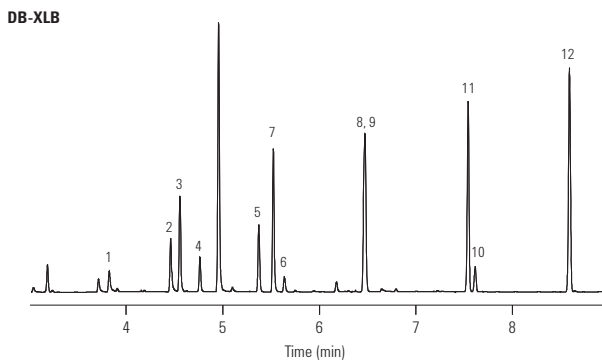
**Column:** DB-35ms  
123-3832  
30 m x 0.32 mm, 0.25 µm

**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

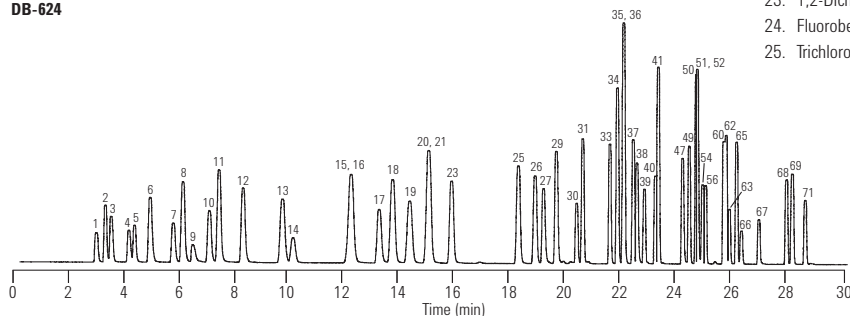
**Sample:** 20 ppb per component in 5 mL water

### Suggested Supplies

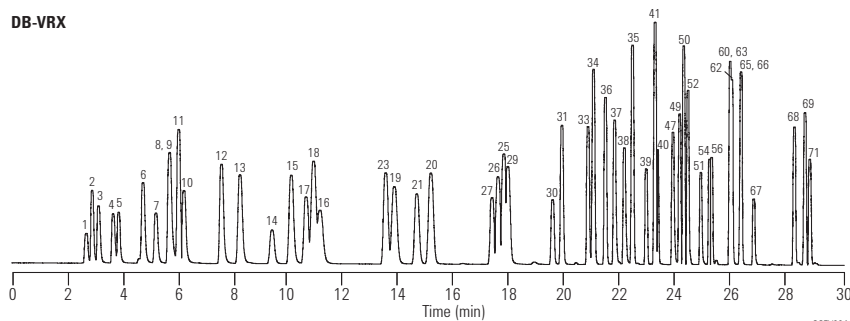
**Liner:** Direct, 1.5 mm id, 18740-80200  
**Seal:** Gold plated seal, 18740-20885  
**Septum:** 11 mm Advanced Green septa, 5183-4759

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

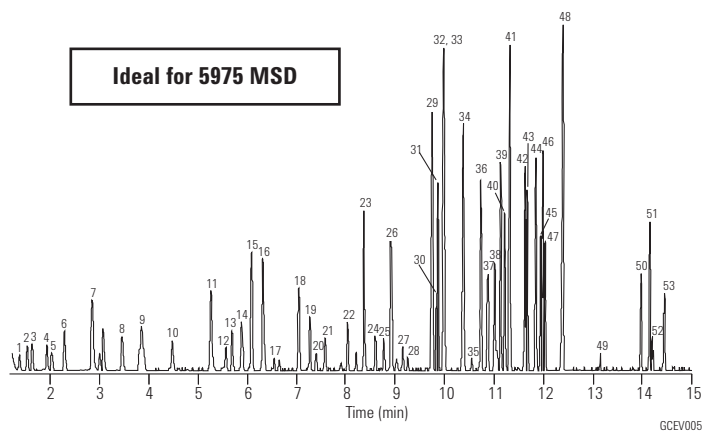
**Suggested Supplies**

**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

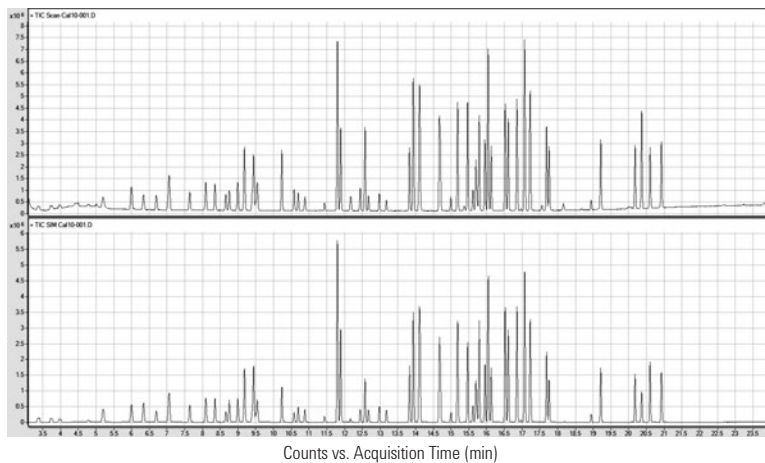
**Injection:** Split, 4:1, 160 °C for 5 min, purge 100 mL/min for 1 min

**Detector:** 5977A MSD, simultaneous Scan/SIM mode

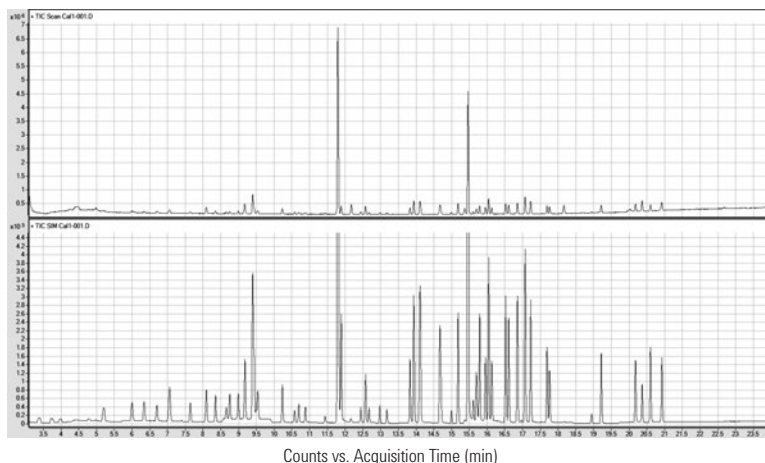
**Sample:** Standard VOC mix

**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

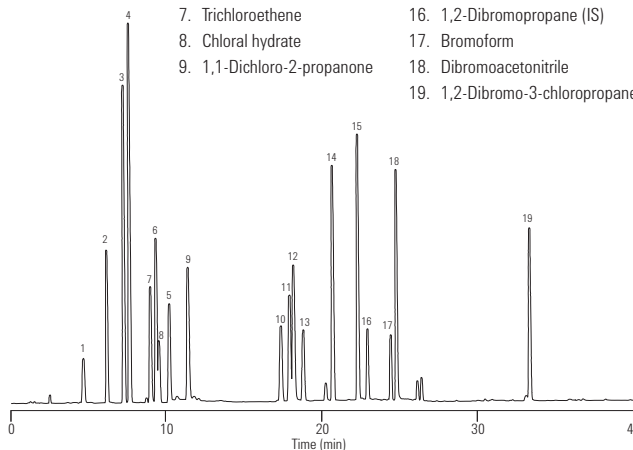
31. 1,1,2-Trichloroethane	12.443 79-00-5
32. Tetrachloroethene	12.580 127-18-4
33. 1,3-Dichloropropane	12.673 142-28-9
34. Dibromochloromethane	12.981 124-48-1
35. 1,2-Dibromoethane	13.175 106-93-4
36. Chlorobenzene	13.830 108-90-7
37. 1,1,1,2-Tetrachloroethane	13.939 630-20-6
38. Ethylbenzene	13.934 100-41-4
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**

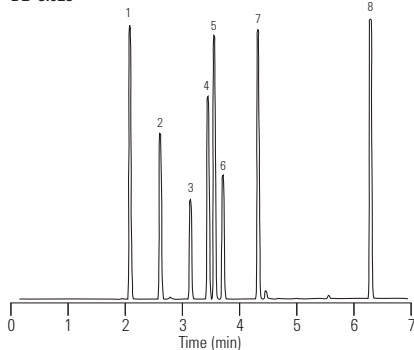
**Column:** DB-5.625  
122-5632  
30 m x 0.25 mm, 0.50 µm  
**Column:** DB-624  
122-1334  
30 m x 0.25 mm, 1.40 µm

**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

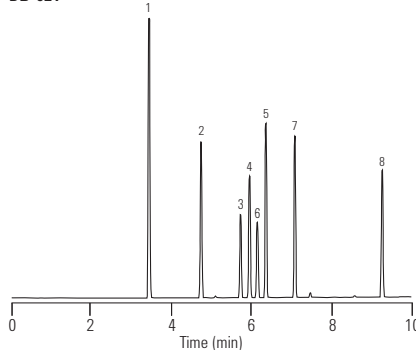
**Suggested Supplies**

**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

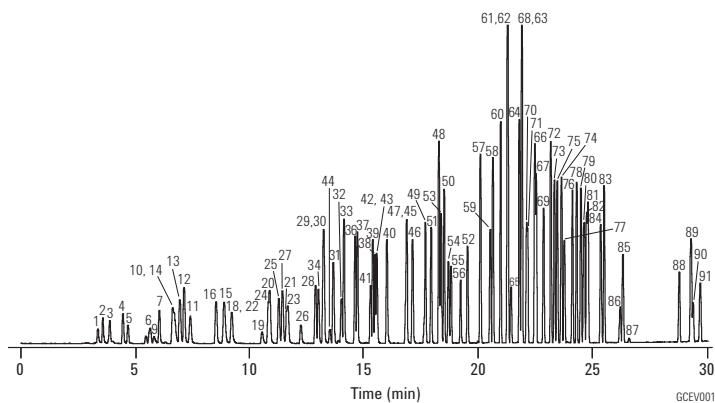
**Detector:** MSD, 235 °C transfer line  
Full scan 35-260 amu (m/z 44 subtracted)

**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

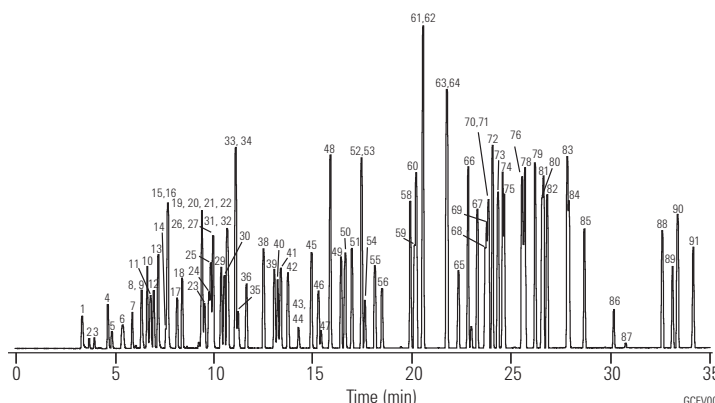
**Detector:** MSD, 235 °C transfer line  
Full scan 35-260 amu (m/z 44 subtracted)

**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  $\mu$ m

**Carrier:** Helium at 25 cm/s measured off of CO<sub>2</sub> 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

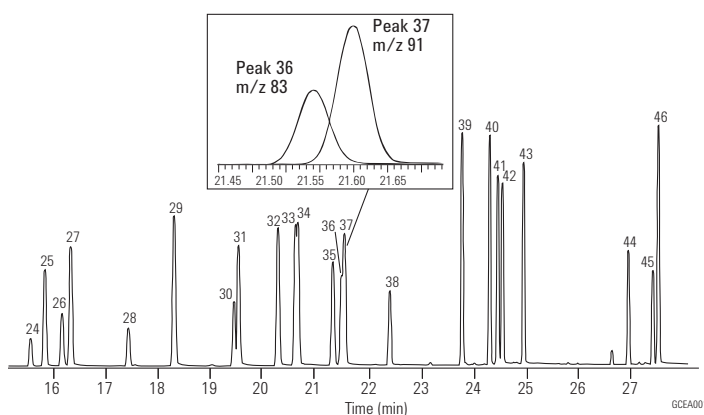
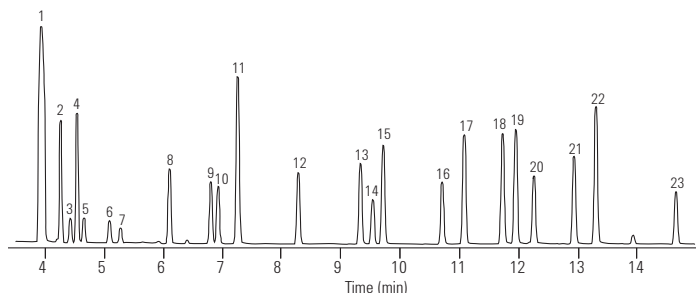
### Suggested Supplies

**Septum:** 11 mm Advanced Green septa, 5183-4759

**Liner:** Direct, 1.5 mm id, 18740-80200

**Seal:** Gold plated seal, 18740-20885

- |   |                               |
|---|-------------------------------|
| 1. CO <sub>2</sub>                                    | 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

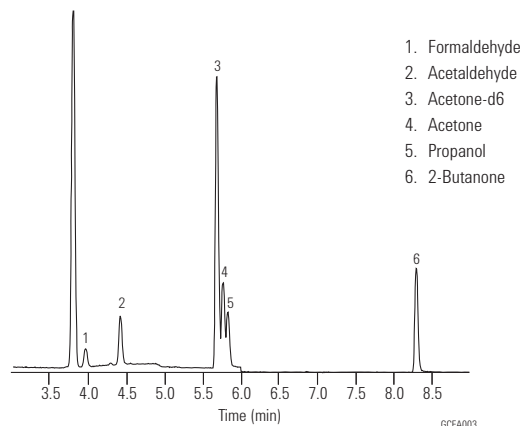
#### Suggested Supplies

**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

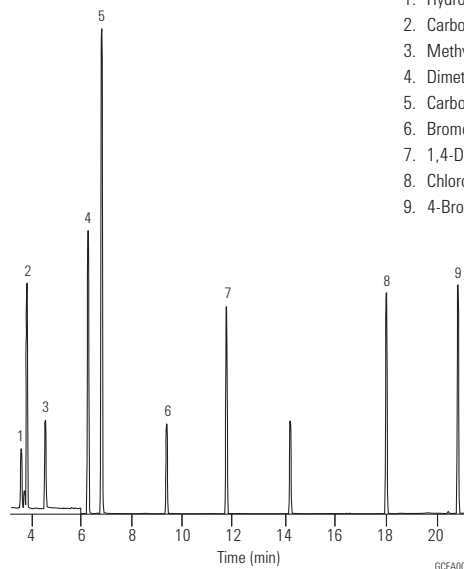
**Sampler:** Entech 7100 cryogenic sample preconcentrator

**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.





**N<sub>2</sub>O I**

**Column:** HP-PLOT Q  
19095P-Q04  
30 m x 0.53 mm, 40.00 μm

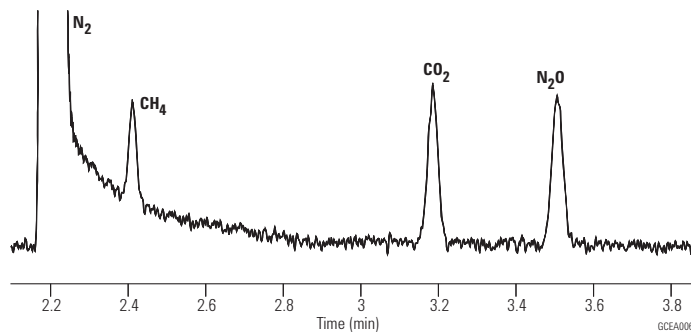
Carrier: Helium, 5 psi (approximately 8 mL/min)

Oven: 35 °C isothermal

Injection: 250 μL, injected  
Split ratio 1:3

Detector: TCD, 200 °C

Sample: Approximately 200 ppmv methane  
200 ppmv CO<sub>2</sub>  
250 ppmv N<sub>2</sub>O (nitrogen balance gas)

**N<sub>2</sub>O II**

**Column:** HP-PLOT Molesieve  
19095P-MS6  
30 m x 0.53 mm, 25.00 μm

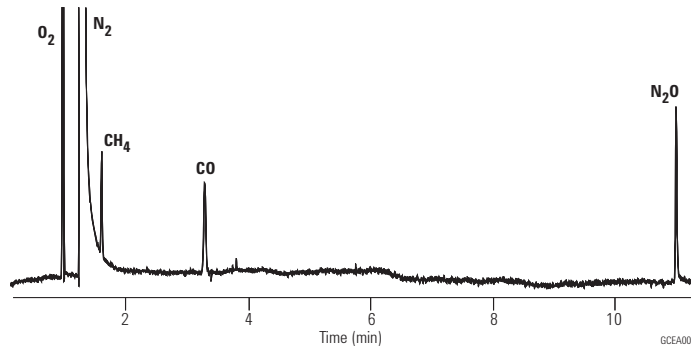
Carrier: Helium, 6 psi (approximately 10 mL/min)

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 CO<sub>2</sub>  
250 ppmv N<sub>2</sub>O (nitrogen balance gas)

**N<sub>2</sub>O III**

**Column:** GS-CarbonPLOT  
113-3133  
30 m x 0.32 mm, 3.00 μm

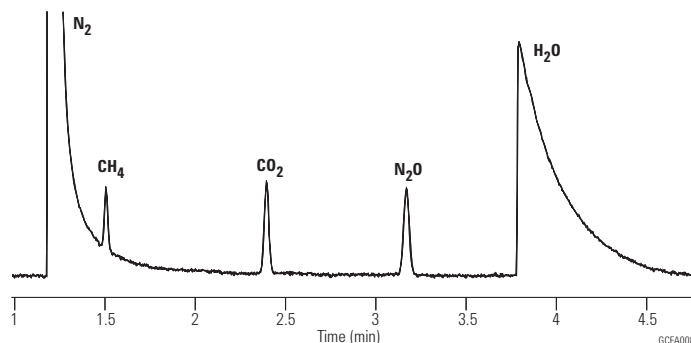
Carrier: Helium, 12 psi (approximately 3 mL/min)

Oven: 35 °C isothermal

Injection: 250 μL injected  
Split ratio 1:4

Detector: TCD, 200 °C

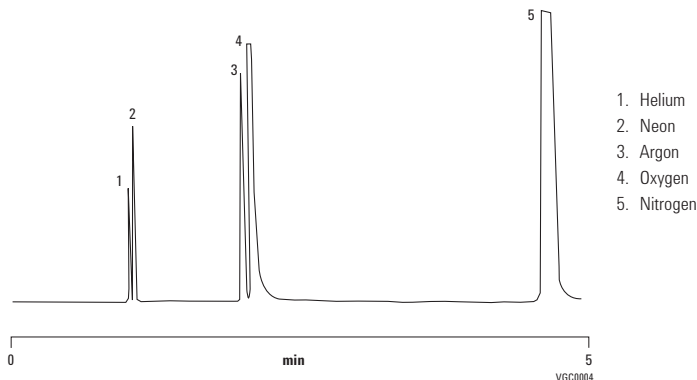
Sample: Approximately 200 ppmv methane  
200 ppmv CO<sub>2</sub>  
250 ppmv N<sub>2</sub>O (nitrogen balance gas)



**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: H<sub>2</sub>  
Oven: 30 °C  
Injection: Split, 100 mL/min  
Detector: TCD

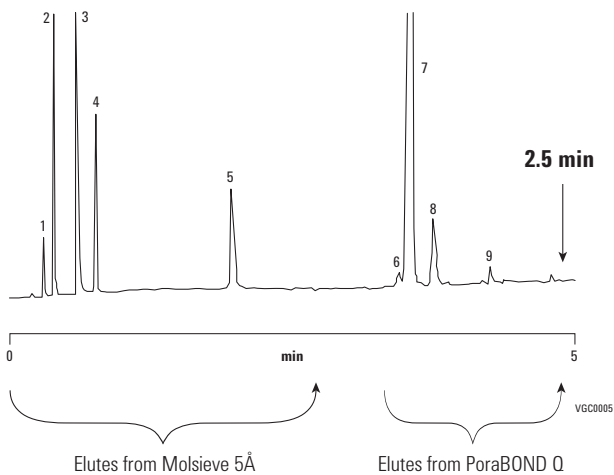


1. Helium
2. Neon
3. Argon
4. Oxygen
5. Nitrogen

**Fast Analysis of Permanent Gases and CO<sub>2</sub> using Tandem PLOT Columns**

**Column:** Select for Permanent Gases/CO<sub>2</sub>  
CP7429

Sample: 10 µL  
Sample Conc: % level  
Carrier: H<sub>2</sub>, 60 kPa  
Oven: 45 °C  
Injection: Split, 50 mL/min  
Detector: µ-TCD



1. He (from ms-5Å)
2. O<sub>2</sub> (from ms-5Å)
3. N<sub>2</sub> (from ms-5Å)
4. Methane (from ms-5Å)
5. CO (from ms-5Å)
6. He (from PBQ)
7. N<sub>2</sub> + O<sub>2</sub> + CO (from PBQ)
8. Methane (from PBQ)
9. CO<sub>2</sub> (from PBQ)

**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

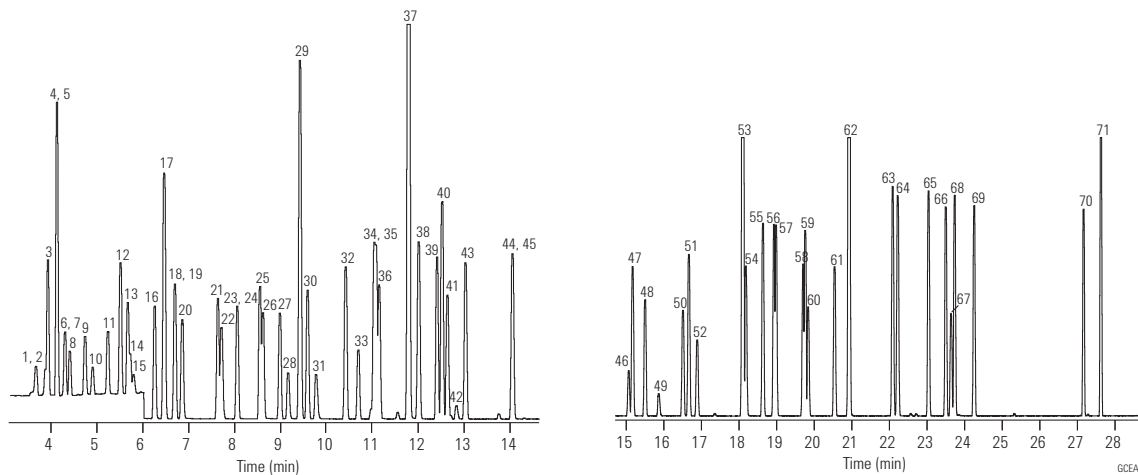
**Suggested Supplies**

**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

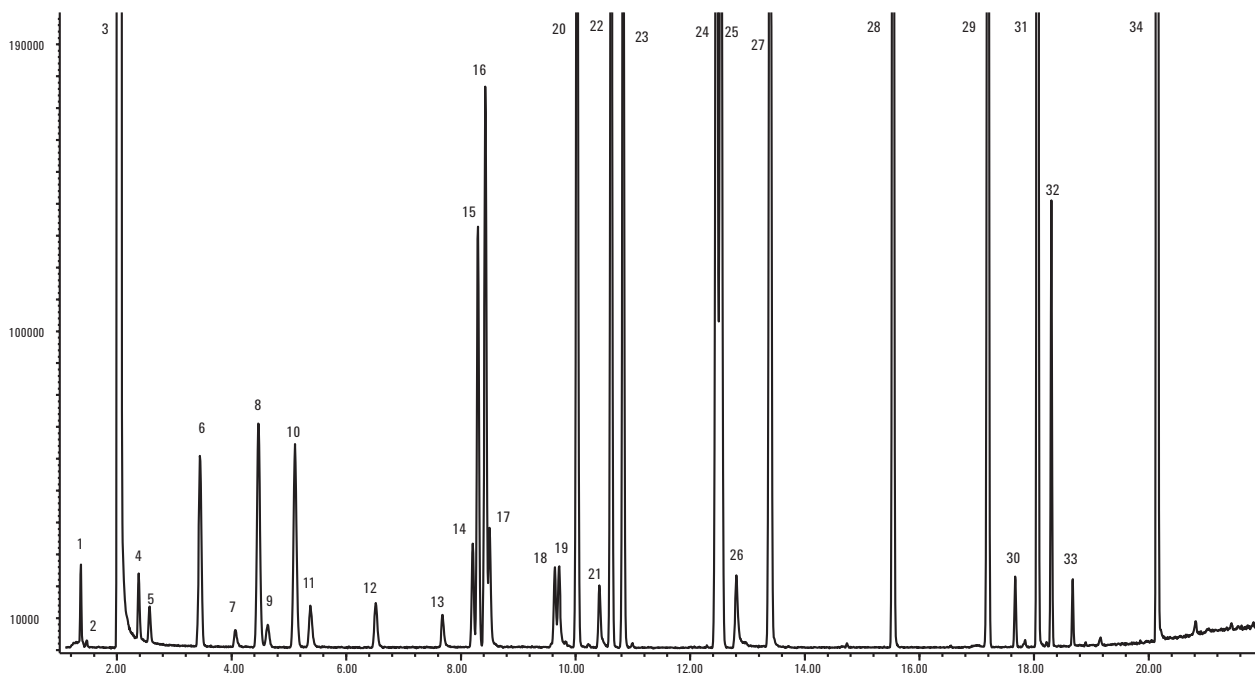
Inlet: Split/splitless, 220 °C, 1 µL, split 20:1

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

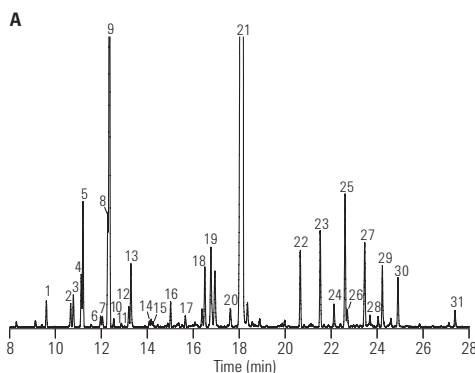
**Column B:** DB-1  
121-1022  
20 m x 0.18 mm, 0.18 µm

**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

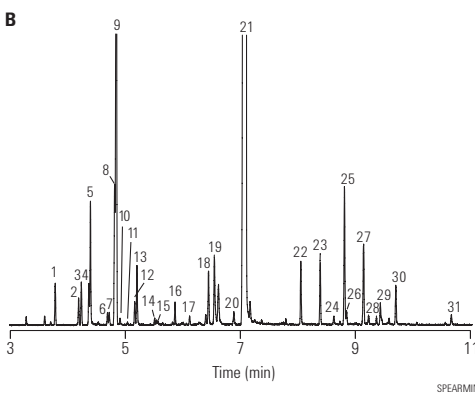
**Injection:** 250 °C, Split 40:1, 1 µL injection

**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

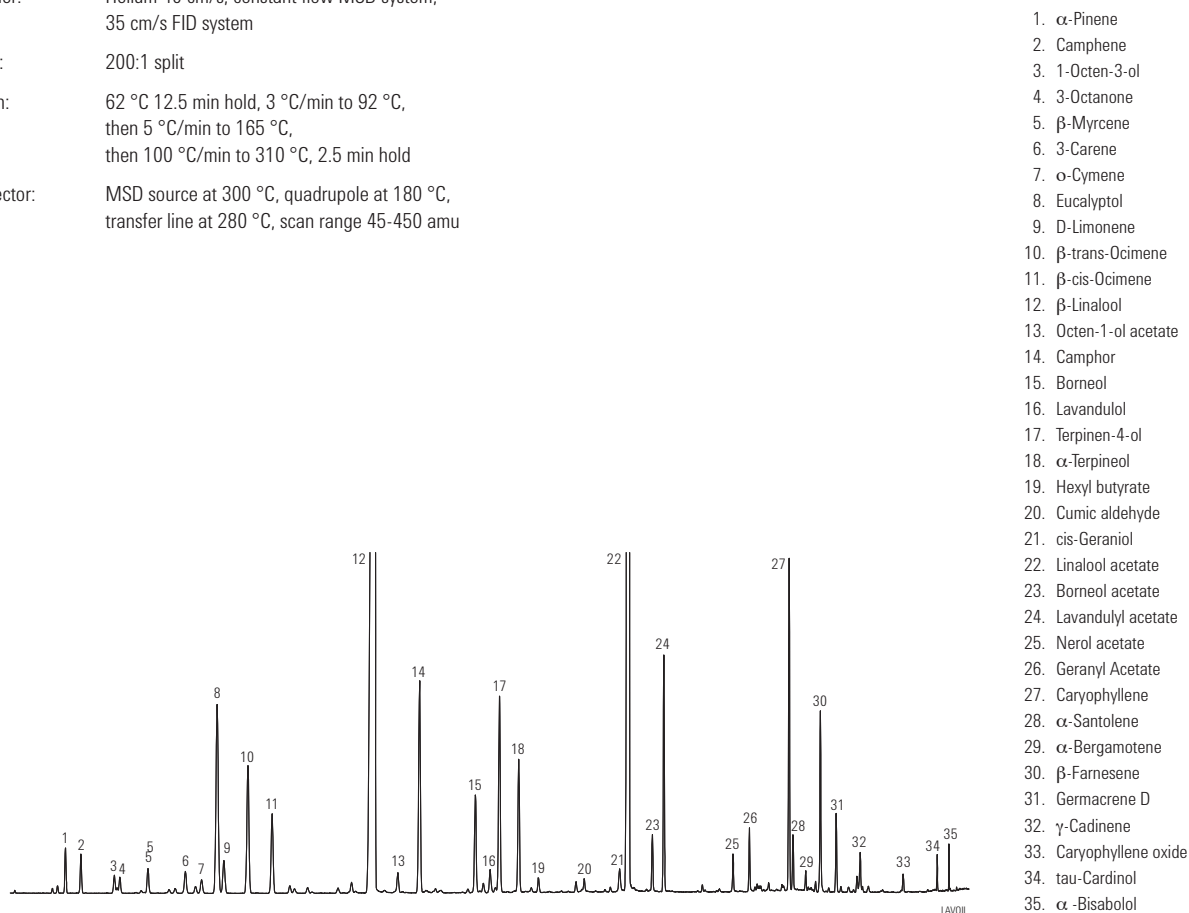
**Detector:** MSD source at 300 °C, quadrupole at 180 °C,  
transfer line at 280 °C, scan range 45-450 amu

#### 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

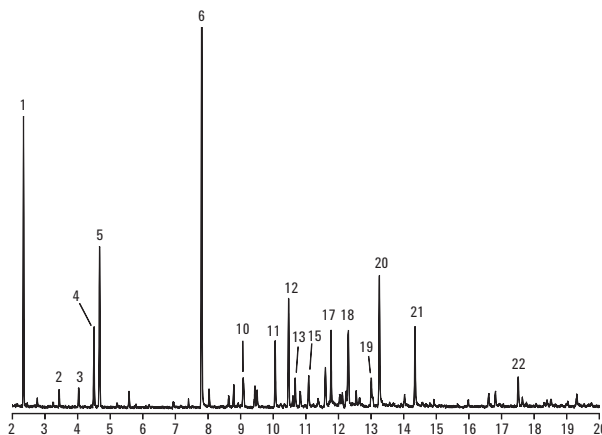
**Carrier:** Hydrogen at 44.3 cm/s  
 Measured at 45 °C

**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

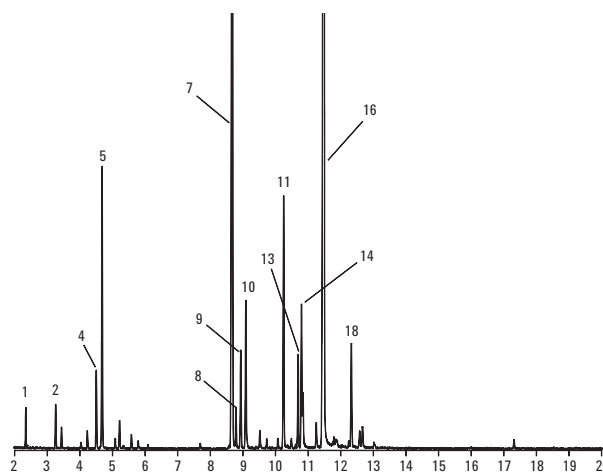
**Detector:** MSD full scan at m/z 40-500  
 250 °C transfer line

**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

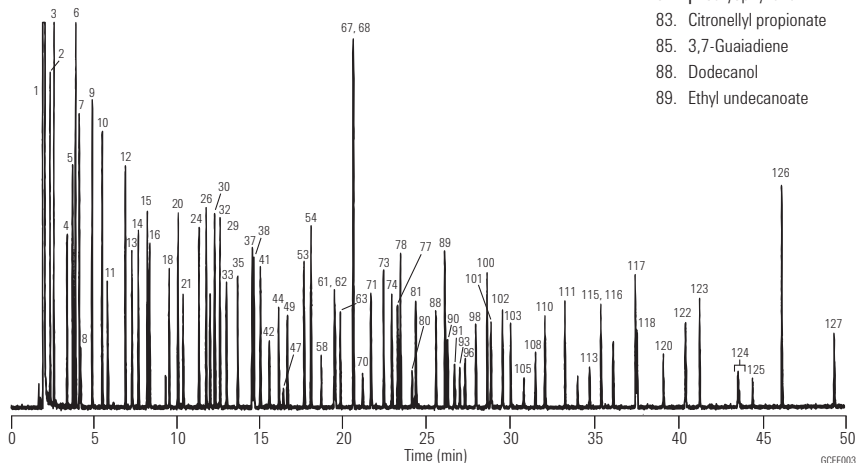
**Liner:** Split, single taper, low pressure drop, glass wool, 5183-4647

**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

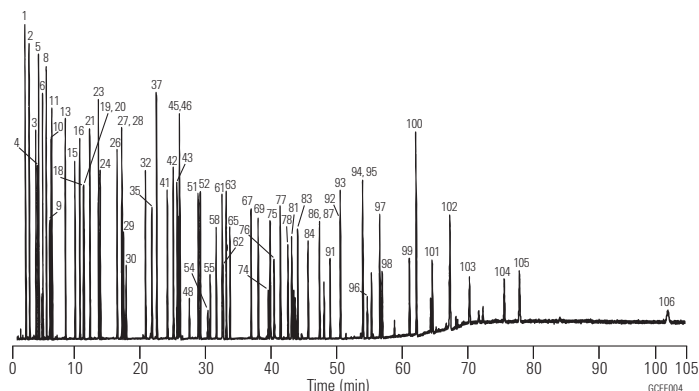
**Liner:** Split, single taper, low pressure drop, glass wool, 5183-4647

**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. Geraniol             | 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

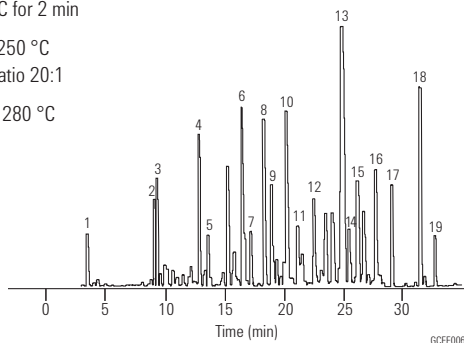
**Column:** HP-INNOWax  
19091N-133  
30 m x 0.25 mm, 0.25 µm

**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     |                       |

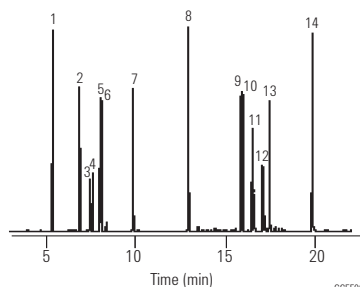
### Chiral Compounds in Essential Oils and Fragrances

**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

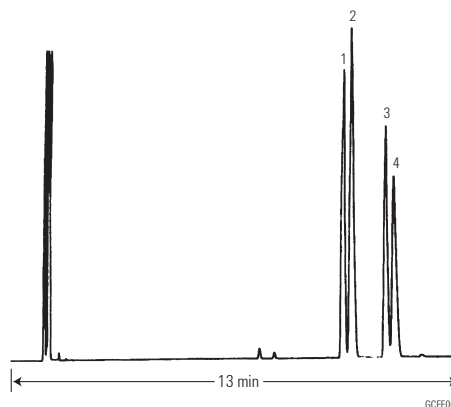
**Carrier:** Hydrogen, 55 cm/s

**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

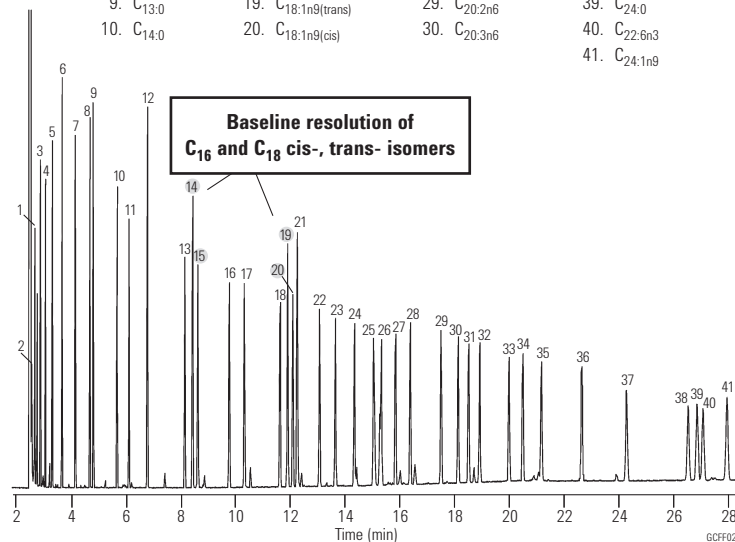
**Oven:** 130 °C for 1.0 min  
130-170 °C at 6.5 °C/min  
170-215 °C at 2.75 °C/min  
215 °C for 12 min  
215-230 °C at 40 °C/min  
230 °C for 3 min

**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 <sub>6:0</sub>   | 11. C <sub>14:1n5</sub>        | 21. C <sub>18:1n7</sub>       | 31. C <sub>20:4n6</sub> |
| 2. C <sub>7:0</sub>   | 12. C <sub>15:0</sub>          | 22. C <sub>18:2n6</sub>       | 32. C <sub>20:3n3</sub> |
| 3. C <sub>8:0</sub>   | 13. C <sub>16:0</sub>          | 23. C <sub>18:3n6</sub>       | 33. C <sub>20:5n3</sub> |
| 4. C <sub>9:0</sub>   | 14. C <sub>16:1n7(trans)</sub> | 24. C <sub>18:3n3</sub>       | 34. C <sub>22:0</sub>   |
| 5. C <sub>10:0</sub>  | 15. C <sub>16:1n7(cis)</sub>   | 25. C <sub>18:2(d9,11)</sub>  | 35. C <sub>22:1n9</sub> |
| 6. C <sub>11:0</sub>  | 16. C <sub>17:0</sub>          | 26. C <sub>18:2(d10,12)</sub> | 36. C <sub>22:2n6</sub> |
| 7. C <sub>12:0</sub>  | 17. C <sub>17:1</sub>          | 27. C <sub>20:0</sub>         | 37. C <sub>22:4n6</sub> |
| 8. BHT                | 18. C <sub>18:0</sub>          | 28. C <sub>20:1n9</sub>       | 38. C <sub>22:5n3</sub> |
| 9. C <sub>13:0</sub>  | 19. C <sub>18:1n9(trans)</sub> | 29. C <sub>20:2n6</sub>       | 39. C <sub>24:0</sub>   |
| 10. C <sub>14:0</sub> | 20. C <sub>18:1n9(cis)</sub>   | 30. C <sub>20:3n6</sub>       | 40. C <sub>22:6n3</sub> |
|                       |                                |                               | 41. C <sub>24:1n9</sub> |



**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

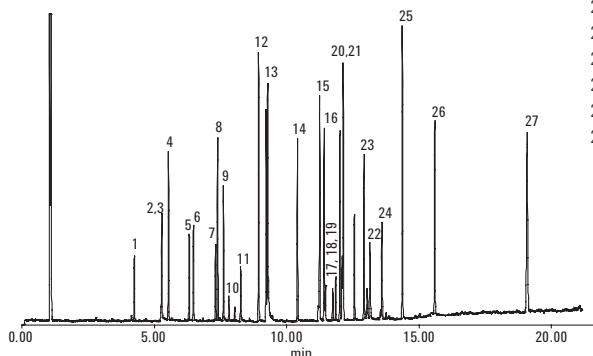
**Carrier:** Helium, 1.0 mL/min

**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

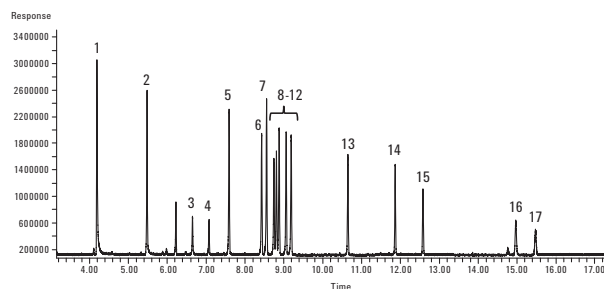
**Oven:** 95 °C (0.5 min), 25 °C/min to 210 °C, 10 °C/min to 250 °C (0.5 min),  
20 °C to 290 °C (4.5 min)

**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 (N<sub>2</sub>) 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](http://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

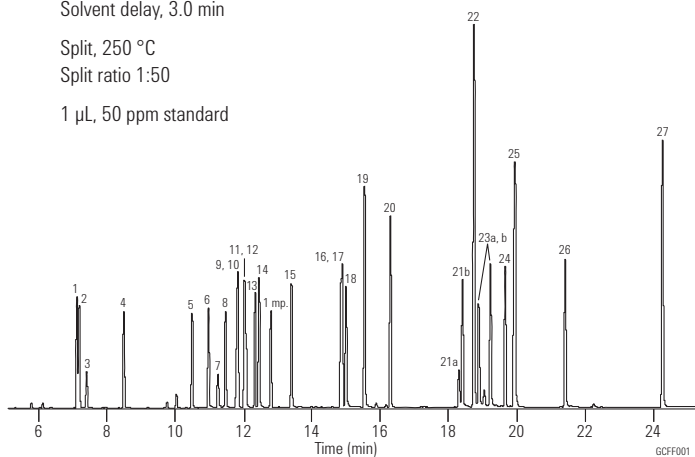
**Oven:** 50 °C in 1 min, 8 °C/min to 250 °C,  
250-300 °C at 35 °C/min  
300 °C hold, 5 min  
5973N MSD in scan (40-350 amu)  
Solvent delay, 3.0 min

**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

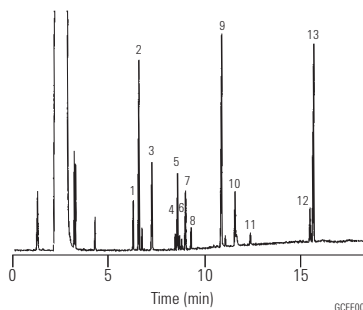
**Oven:** 80 °C for 1 min  
80-210 °C at 8 °C/min  
210 °C for 2 min

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

**Detector:** IRD, 280 °C  
Wide Band MCT, 550 to 4000 cm<sup>-1</sup>

#### 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  $\mu$ m

**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

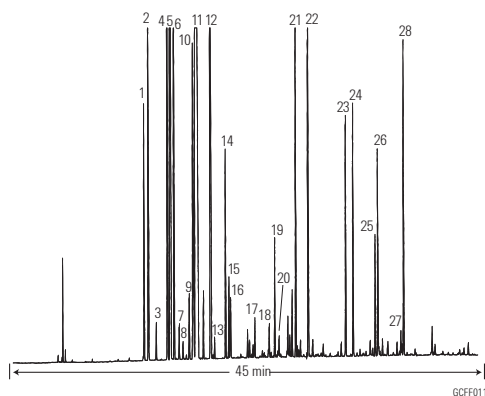
#### Suggested Supplies

**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  $\mu$ L tapered, FN 23-26s/42/HP, 5181-1273



- |                           |  |
|---------------------------|--|
| 1. $\alpha$ -Thujone      | 15. Linalool                             |
| 2. $\beta$ -Thujone       | 16. Nonanal                              |
| 3. Camphene               | 17. Citronellal                          |
| 4. Sabinene               | 18. Terpinen-4-ol                        |
| 5. $\beta$ -Pinene        | 19. $\alpha$ -Terpineol                  |
| 6. Myrcene                | 20. Decanal                              |
| 7. Octanal                | 21. Neral                                |
| 8. $\alpha$ -Phellandrene | 22. Geranial                             |
| 9. $\alpha$ -Terpinene    | 23. Neryl acetate                        |
| 10. <i>r</i> -Cymene      | 24. Geranyl acetate                      |
| 11. $\delta$ -Limonene    | 25. $\beta$ -Caryophyllene               |
| 12. $\gamma$ -Terpinene   | 26. <i>trans</i> - $\alpha$ -Bergamotene |
| 13. Octanol               | 27. $\alpha$ -Humulene                   |
| 14. Terpinolene           | 28. $\beta$ -Bisabolene                  |

### Cold-pressed Orange Oil

**Column:** DB-5  
127-5022  
20 m x 0.10 mm, 0.10  $\mu$ m

**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

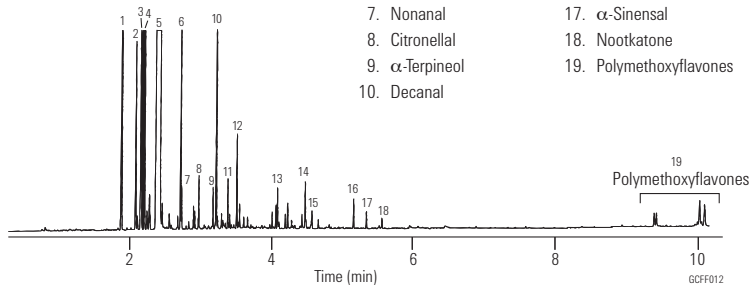
**Septum:** 11 mm Advanced Green septa, 5183-4759

**Liner:** Split, single taper, low pressure drop, glass wool, 5183-4647

**Seal:** Gold plated seal, 18740-20885

**Syringe:** 5  $\mu$ L tapered, FN 23-26s/42/HP, 5181-1273

Chromatogram courtesy of Tastemaker



- |                        |                         |
|------------------------|-------------------------|
| 1. $\alpha$ -Pinene    | 11. Neral               |
| 2. Sabinene            | 12. Geranial            |
| 3. Myrcene             | 13. Dodecenal           |
| 4. Octanal             | 14. Valencene           |
| 5. Limonene            | 15. Cadinene            |
| 6. Linalool            | 16. $\beta$ -Sinensal   |
| 7. Nonanal             | 17. $\alpha$ -Sinensal  |
| 8. Citronellal         | 18. Nootkatone          |
| 9. $\alpha$ -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

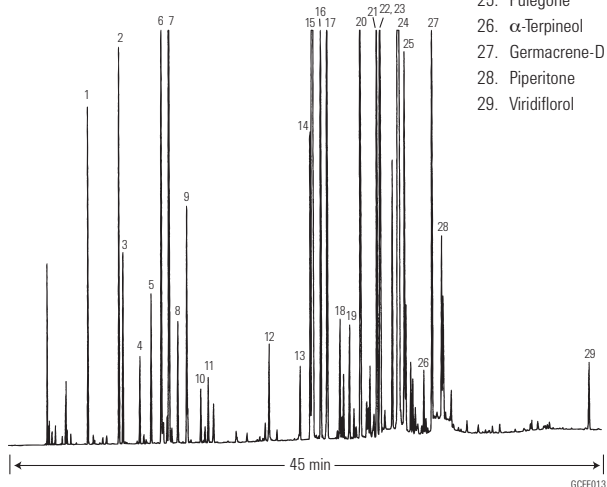
**Sample:** 1 µL neat

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   |



GCFF013

### 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

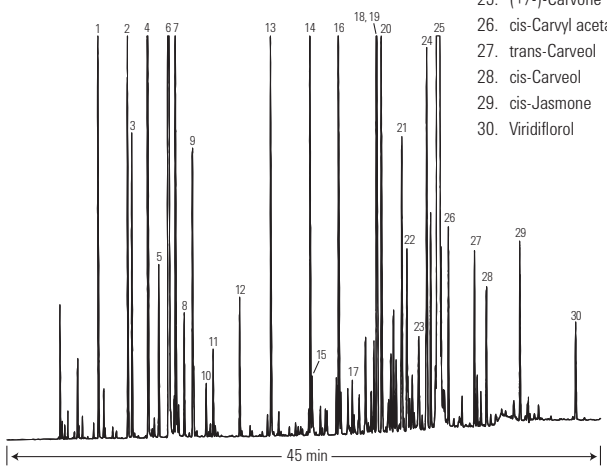
**Sample:** 1 µL neat

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         |



GCFF014

### Ylang Ylang Oil

**Column:** DB-XLB  
122-1232  
30 m x 0.25 mm, 0.25 μm

**Carrier:** Helium at 34 cm/s, measured at 50 °C

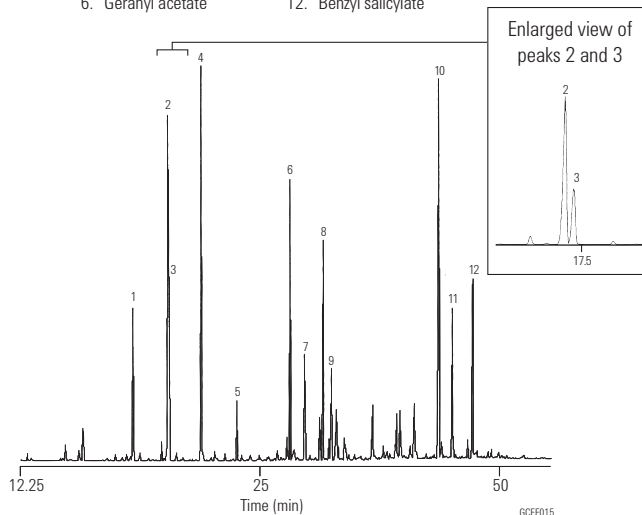
**Oven:** 50 °C for 1 min  
50-250 °C at 3.5 °C/min

**Injection:** Split, 250 °C  
Split ratio 1:125

**Detector:** MSD, 310 °C transfer line  
full scan at m/z 35-550

**Sample:** 1 μL 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

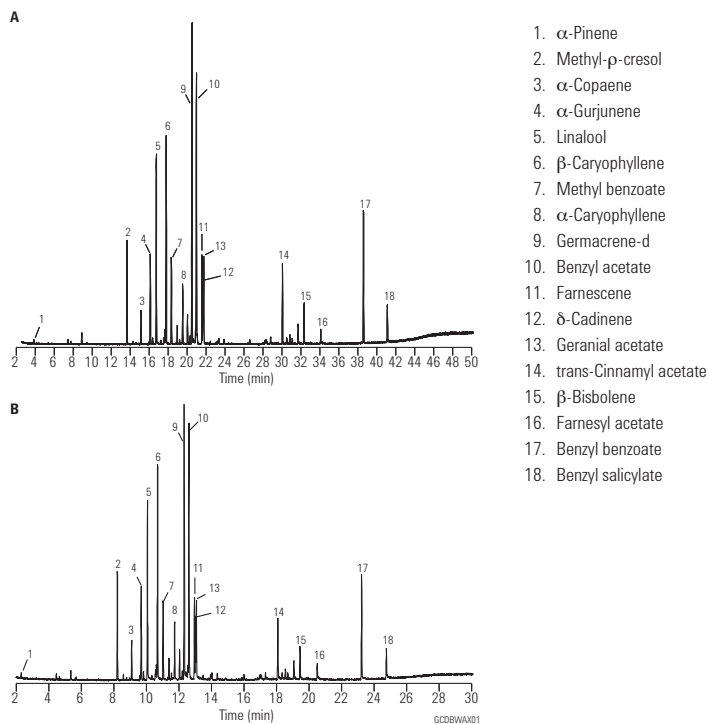
- Septum:** 11 mm Advanced Green septa, 5183-4759
- Liner:** Split, single taper, low pressure drop, glass wool, 5183-4647
- Seal:** Gold plated seal, 18740-20885
- Syringe:** 5 μL tapered, FN 23-26s/42/HP, 5181-1273

### Ylang Ylang Oil

**Column:** DB-WAX  
121-7022  
20 m x 0.18 mm, 0.18 μm

**Carrier:** A: Helium 26.3 cm/s measured at 45 °C  
B: Hydrogen 44.3 cm/s measured at 45 °C

**Oven:** A: 45 °C hold 1.28 min  
4.68 °C/min to 250 °C hold 21.81 min  
B: 45 °C hold 0.77 min  
7.79 °C/min to 250 °C hold 13.09 min





### Rosemary Oil

**Column:** CycloSil-B  
112-6632  
30 m x 0.25 mm, 0.25 µm

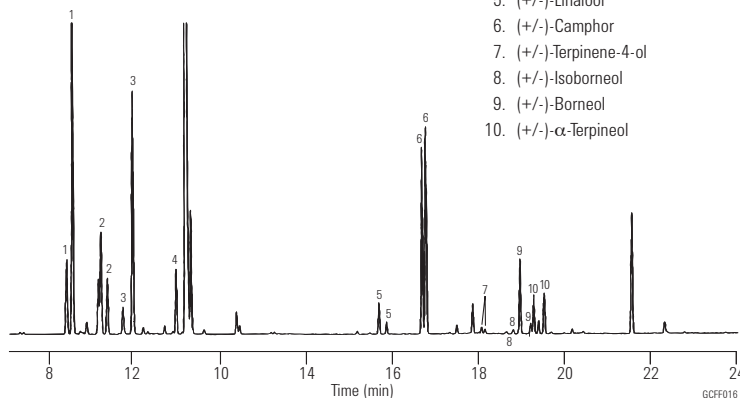
**Carrier:** Hydrogen at 40 cm/s, measured at 60 °C

**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. (+/-)- $\alpha$ -Pinene
2. (+/-)-Camphene
3. (+/-)- $\beta$ -Pinene
4. (+/-)-Limonene
5. (+/-)-Linalool
6. (+/-)-Camphor
7. (+/-)-Terpinene-4-ol
8. (+/-)-Isoborneol
9. (+/-)-Borneol
10. (+/-)- $\alpha$ -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

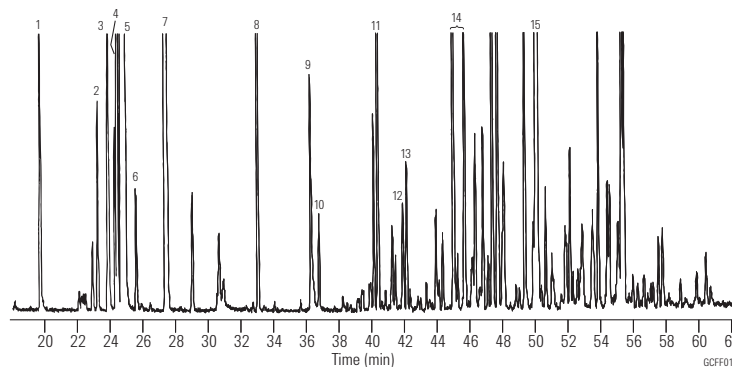
**Oven:** 40-190 °C at 2 °C/min

**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.  $\gamma$ -Terpinene
6. Nonanol
7. 2-Ethyl-1-Hexanol
8. Linalool
9. Decanol
10. Terpinen-4-ol
11. Phenethylalcohol
12.  $\alpha$ -Terpineol
13. BHT



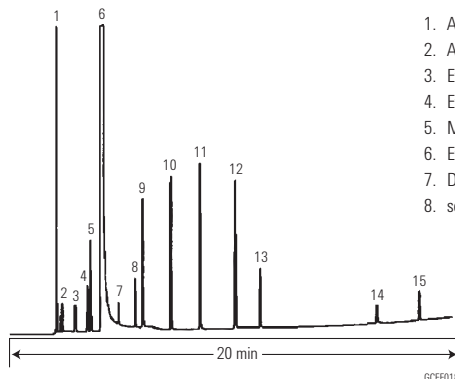
#### Suggested Supplies

- 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

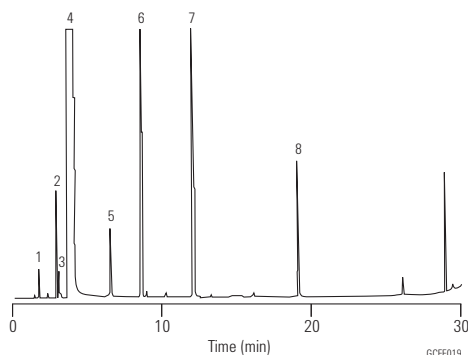


- 1. Acetaldehyde
- 2. Acetone
- 3. Ethyl formate
- 4. Ethyl acetate
- 5. Methanol
- 6. Ethanol
- 7. Diacetyl
- 8. sec-Butanol
- 9. n-Propanol
- 10. Isobutanol
- 11. n-Butanol
- 12. Isoamyl alcohol
- 13. n-Amyl alcohol
- 14. Acetic acid
- 15. Propionic acid

### 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

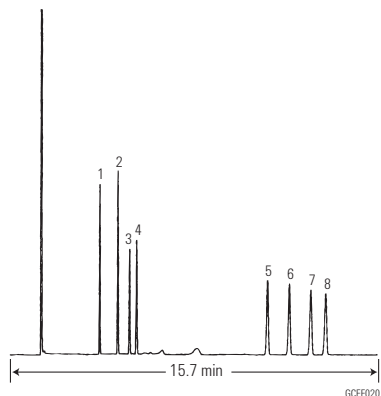


- 1. Acetaldehyde
- 2. Ethyl acetate
- 3. Methanol
- 4. Ethanol
- 5. Acetic acid
- 6. n-Propanol
- 7. Isobutanol
- 8. 2-Methyl-1-butanol or 3-methyl-1-butanol

### 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

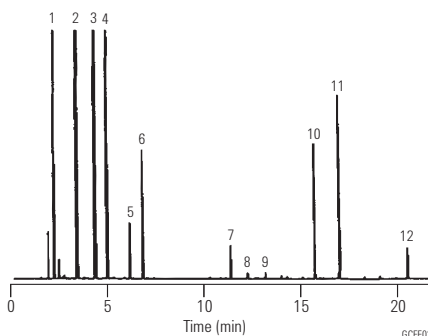
**Column:** HP-INNOWax  
19091N-213  
30 m x 0.32 mm, 0.50 µm

**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

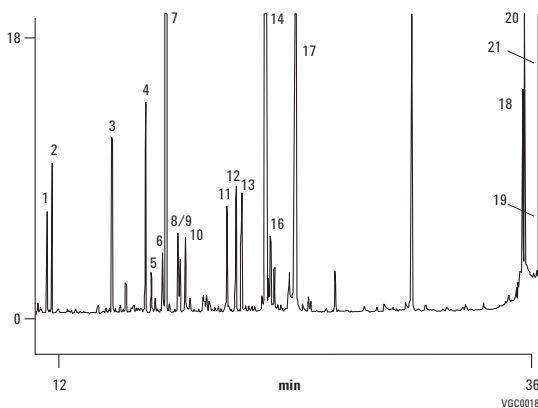
**Sample Conc:** 40 ppb

**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

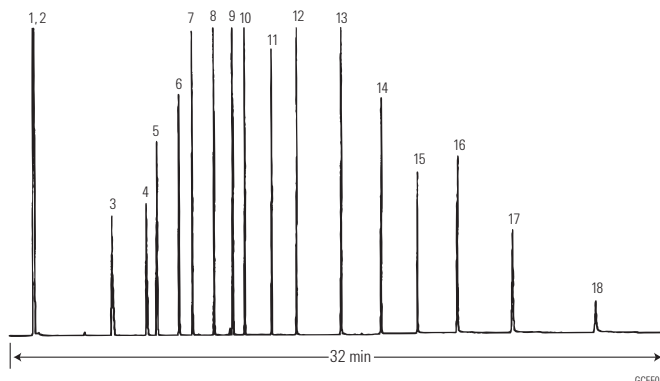
**Carrier:** Helium at 40 cm/s, measured at 100 °C

**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

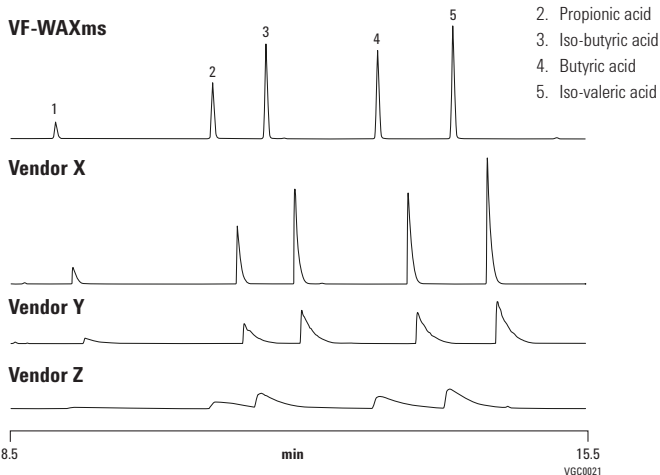
**Sample:** Acid sample, 0.1% (Cyclohexane), 1.0 µL

**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

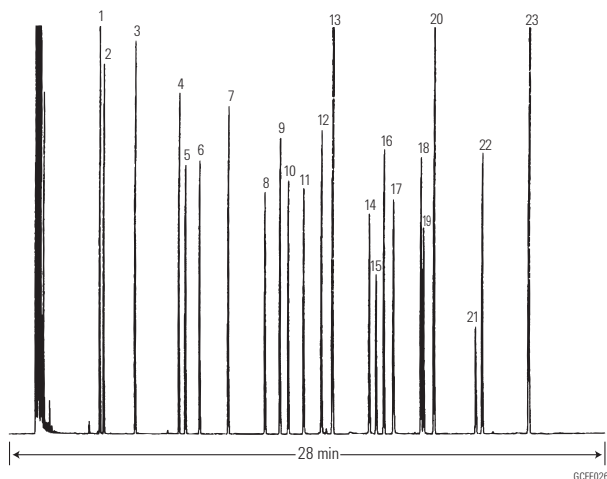
**Oven:** 150 °C for 4 min  
150-250 °C at 4 °C/min

**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 <sub>11:0</sub>            | Methyl undecanoate                      |
| 2. 2-OH C <sub>10:0</sub>       | Methyl 2-hydroxydecanoate               |
| 3. C <sub>12:0</sub>            | Methyl laurate                          |
| 4. C <sub>13:0</sub>            | Methyl tridecanoate                     |
| 5. 2-OH C <sub>12:0</sub>       | Methyl 2-hydroxydodecanoate             |
| 6. 3-OH C <sub>12:0</sub>       | Methyl 3-hydroxydodecanoate             |
| 7. C <sub>14:0</sub>            | Methyl myristate                        |
| 8. 12-Me C <sub>14:0</sub>      | Methyl 12-methyltetradecanoate          |
| 9. C <sub>15:0</sub>            | Methyl pentadecanoate                   |
| 10. 2-OH C <sub>14:0</sub>      | Methyl 2-hydroxytetradecanoate          |
| 11. 3-OH C <sub>14:0</sub>      | Methyl 3-hydroxytetradecanoate          |
| 12. C <sub>16:1</sub>           | Methyl palmitoleate                     |
| 13. C <sub>16:0</sub>           | Methyl palmitate                        |
| 14. 14-Me C <sub>16:0</sub>     | Methyl 14-methylhexadecanoate           |
| 15. 9,10-diMe C <sub>16:0</sub> | Methyl cis-9,10-methyl hexadecanoate    |
| 16. C <sub>17:0</sub>           | Methyl heptadecanoate                   |
| 17. 2-OH C <sub>16:0</sub>      | Methyl 2-hydroxyhexadecanoate           |
| 18. C <sub>18:1</sub>           | Methyl oleate                           |
| 19. C <sub>18:1</sub>           | Methyl elaidate                         |
| 20. C <sub>18:0</sub>           | Methyl stearate                         |
| 21. 9,10-diMe C <sub>18:0</sub> | Methyl cis-9,10-methylene octadecanoate |
| 22. C <sub>19:0</sub>           | Methyl nonadecanoate                    |
| 23. C <sub>20:0</sub>           | Methyl arachidate                       |

### Separation of cis-trans FAME Isomers

**Column:** Select FAME  
CP7421  
200 m x 0.25 mm

**Sample:** 0.5 µL

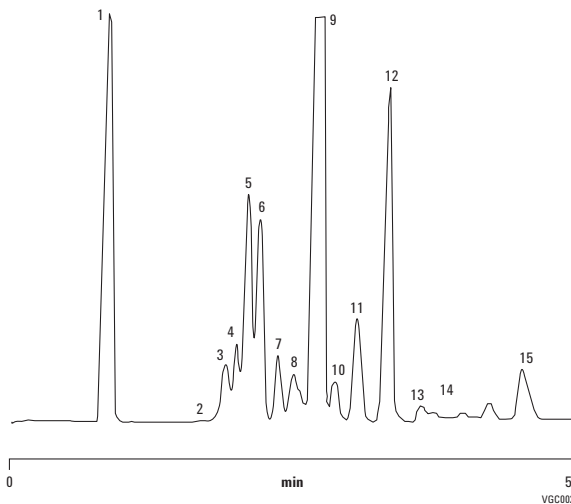
**Sample Conc:** 5 ng approx. per component on the column

**Carrier:** Helium, 520 kPa

**Oven:** 185 °C

**Injection:** Split, 1:20

**Detector:** FID



- |                                   |
|-----------------------------------|
| 1. C <sub>18:0</sub>              |
| 2. C <sub>18:1</sub> 7 trans      |
| 3. C <sub>18:1</sub> 8 trans      |
| 4. C <sub>18:1</sub> 9 trans      |
| 5. C <sub>18:1</sub> 10 trans     |
| 6. C <sub>18:1</sub> 11 trans     |
| 7. C <sub>18:1</sub> 12 trans     |
| 8. C <sub>18:1</sub> 13 trans + ? |
| 9. C <sub>18:1</sub> 9 cis        |
| 10. C <sub>18:1</sub> 10 cis      |
| 11. C <sub>18:1</sub> 11 cis      |
| 12. C <sub>18:1</sub> 12 cis      |
| 13. C <sub>18:1</sub> 13 cis      |
| 14. C <sub>18:1</sub> 14 cis      |
| 15. C <sub>18:1</sub> 15 cis      |

### 69 Component FAME Mix

**Column:** HP-88  
112-8867  
60 m x 0.25 mm, 0.20 μm

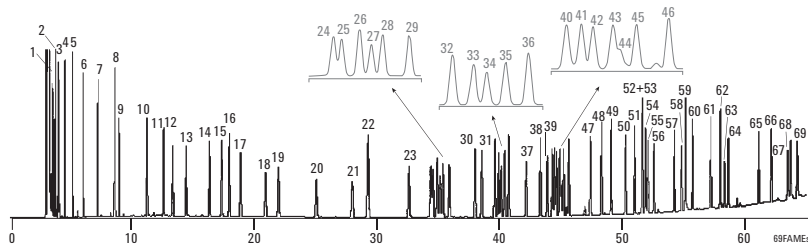
**Carrier:** He at 1.4 mL/min constant flow

**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 CHCl<sub>3</sub>

**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 <sub>4:0</sub> )                | 20. Linolelaic acid methyl ester (C <sub>18:2n6t</sub> )                         |
| 2. Caproic acid methyl ester (C <sub>6:0</sub> )                | 21. γ-Linolenic acid methyl ester (C <sub>18:3n6</sub> )                         |
| 3. Caprylic acid methyl ester (C <sub>8:0</sub> )               | 22. Linolenic acid methyl ester (C <sub>18:3n3</sub> )                           |
| 4. Capric acid methyl ester (C <sub>10:0</sub> )                | 23. Arachidic acid methyl ester (C <sub>20:0</sub> )                             |
| 5. Undecanoic acid methyl ester (C <sub>11:0</sub> )            | 24. cis-11,14-Eicosadienoic acid methyl ester (C <sub>20:2</sub> )               |
| 6. Lauric acid methyl ester (C <sub>12:0</sub> )                | 25. cis-8,11,14-Eicosadienoic acid methyl ester (C <sub>20:2</sub> )             |
| 7. Tridecanoic acid methyl ester (C <sub>13:0</sub> )           | 26. cis-8,11,14-Eicosatrienoic acid methyl ester (C <sub>20:3n6</sub> )          |
| 8. Myristic acid methyl ester (C <sub>14:0</sub> )              | 27. Heneicosanoic acid methyl ester (C <sub>21:0</sub> )                         |
| 9. Myristoleic acid methyl ester (C <sub>14:1</sub> )           | 28. cis-11,14,17-Eicosatrienoic acid methyl ester (C <sub>20:3n3</sub> )         |
| 10. Pentadecanoic acid methyl ester (C <sub>15:0</sub> )        | 29. Arachidonic acid methyl ester (C <sub>20:4n6</sub> )                         |
| 11. cis-10-Pentadecenoic acid methyl ester (C <sub>15:1</sub> ) | 30. cis-5,8,11,14,17-Eicosapentaenoic acid methyl ester (C <sub>20:5n3</sub> )   |
| 12. Palmitic acid methyl ester (C <sub>16:0</sub> )             | 31. Behenic acid methyl ester (C <sub>22:0</sub> )                               |
| 13. Palmitoleic acid methyl ester (C <sub>16:1</sub> )          | 32. Erucic acid methyl ester (C <sub>22:1n9</sub> )                              |
| 14. Heptadecanoic acid methyl ester (C <sub>17:0</sub> )        | 33. cis-13,16-Docosadienoic acid methyl ester (C <sub>22:2</sub> )               |
| 15. cis-10-Heptadecenoic acid methyl ester (C <sub>17:1</sub> ) | 34. Tricosanoic acid methyl ester (C <sub>23:0</sub> )                           |
| 16. Stearic acid methyl ester (C <sub>18:0</sub> )              | 35. Lignoceric acid methyl ester (C <sub>24:0</sub> )                            |
| 17. Oleic acid methyl ester (C <sub>18:1n9c</sub> )             | 36. cis-4,7,10,13,16,19-Docosahexaenoic acid methyl ester (C <sub>22:6n3</sub> ) |
| 18. Elaidic acid methyl ester (C <sub>18:1n9t</sub> )           | 37. Nervonic acid methyl ester (C <sub>24:1</sub> )                              |
| 19. Linoleic acid methyl ester (C <sub>18:2n6c</sub> )          |  |

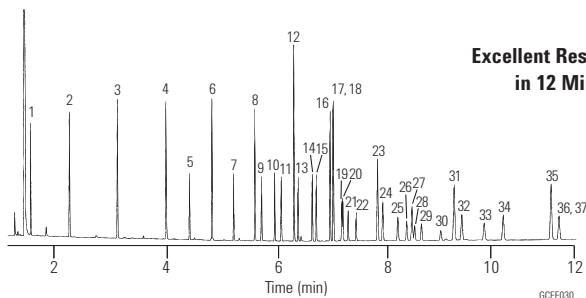
#### Suggested Supplies

**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



**Excellent Resolution  
in 12 Min!**

**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

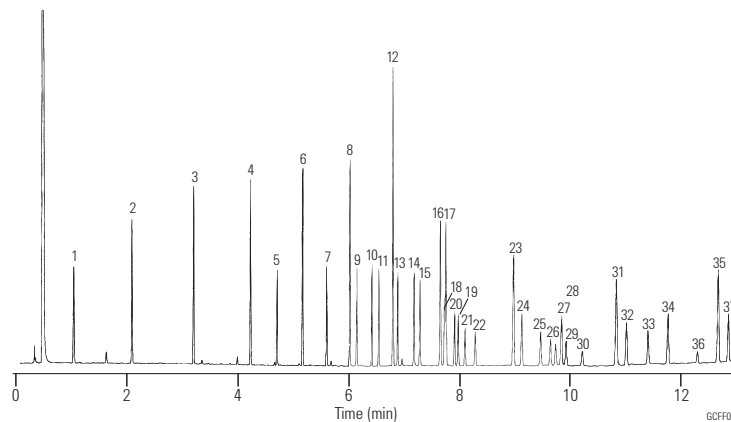
**Injection:** Split, 250 °C  
Split ratio 1:30

**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

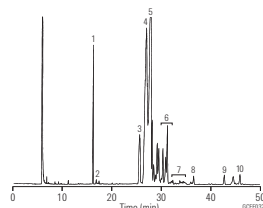
**Carrier:** Helium at 15 cm/s (0.44 mL/min),  
measured at 150 °C

**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

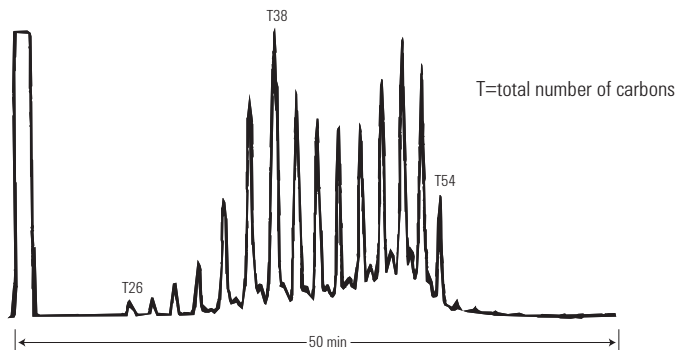
**Carrier:** Hydrogen at 55 cm/s, measured at 250 °C

**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

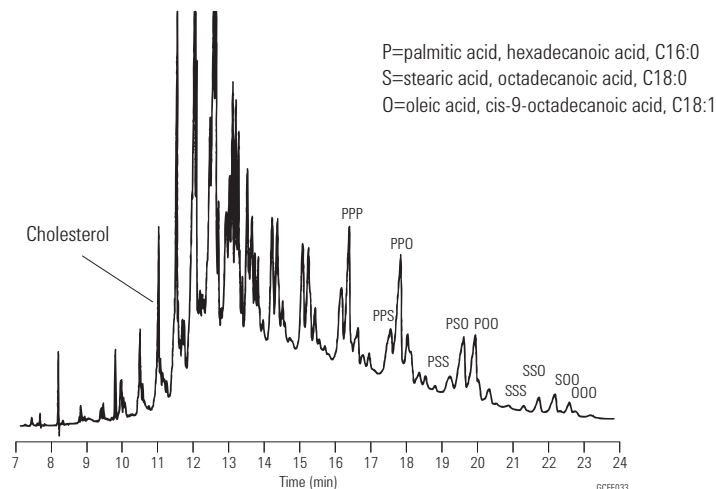
**Carrier:** Hydrogen at 40 cm/s

**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

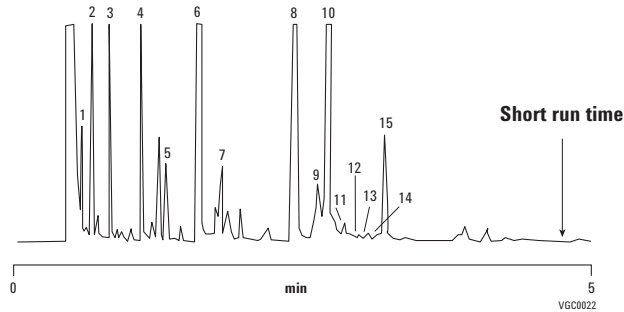
Sample: 0.5 µL ca. 5 ng per component on column

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

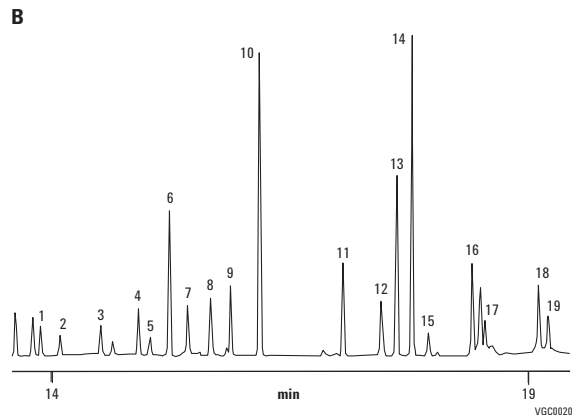
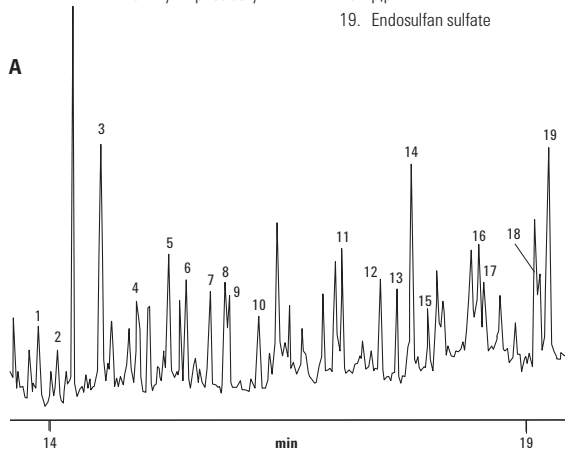
Carrier: He, 1.2 mL/min, constant flow

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

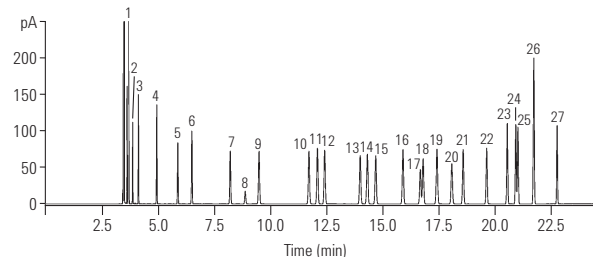
**Column:** HP-INNOWax  
19091N-216  
60 m x 0.32 mm, 0.50  $\mu$ m

**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  $\mu$ L

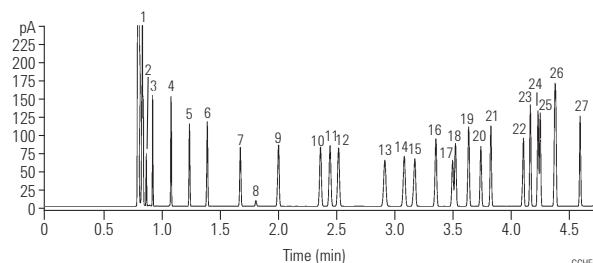
**Column:** HP-INNOWax  
19091N-577  
20 m x 0.18 mm, 0.18  $\mu$ m

**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  $\mu$ 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

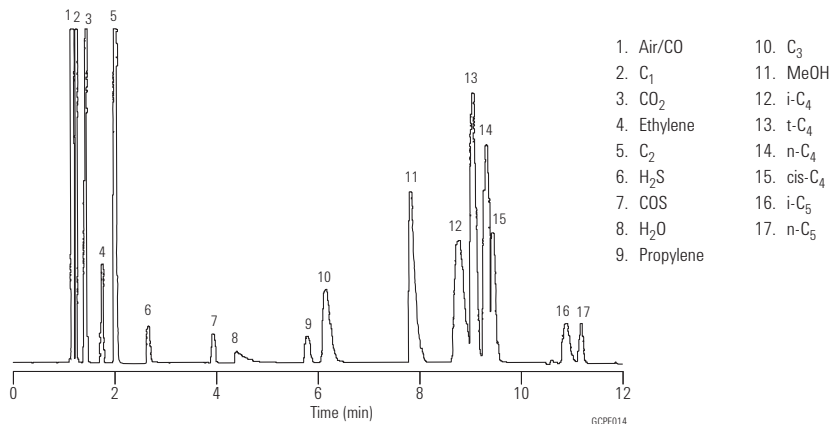
**Sample:** Refinery gas and others

#### 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

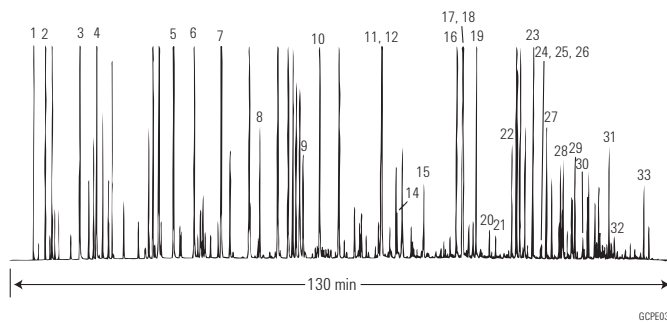
**Detector:** FID, 250 °C  
Nitrogen makeup gas  
at 30 mL/min

**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

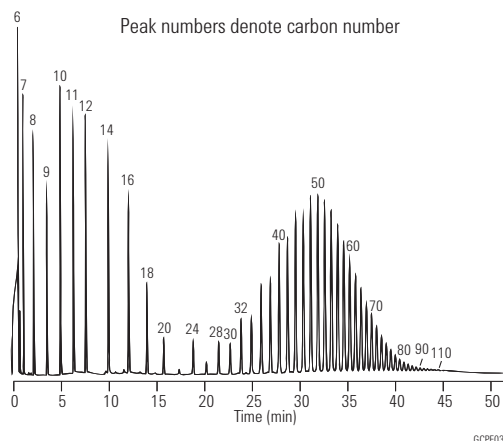
**Carrier:** Helium at 18 mL/min, measured at 35 °C

**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 CS<sub>2</sub>

**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

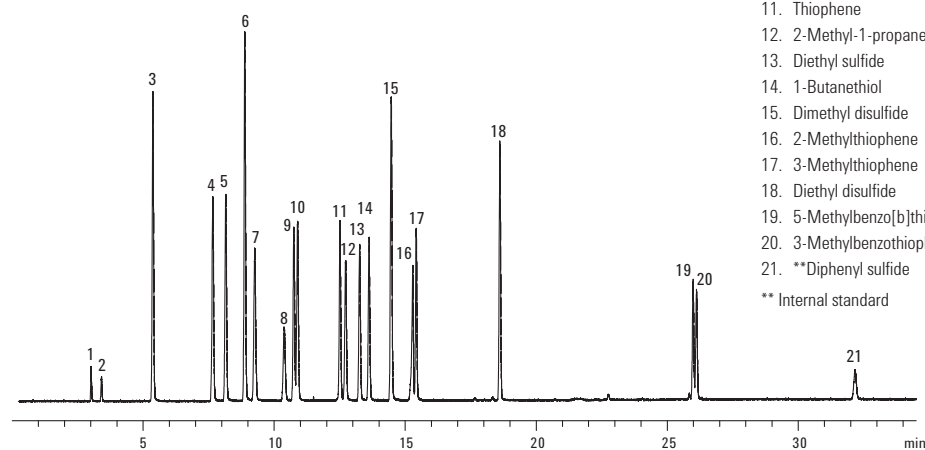
**Suggested Supplies**

**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 <sub>2</sub> S	2000
2.	Carbonyl sulfide	463-58-1	COS	2000
3.	Methanethiol	74-93-1	CH <sub>3</sub> SH	2000
4.	Ethanethiol	75-08-1	C <sub>2</sub> H <sub>5</sub> SH	2000
5.	Dimethyl sulfide	75-18-3	(CH <sub>3</sub> ) <sub>2</sub> S	2000
6.	Carbon disulfide	75-15-0	CS <sub>2</sub>	2000
7.	2-Propanethiol	75-33-2	C <sub>3</sub> H <sub>7</sub> S	2000
8.	2-Methyl-2-propanethiol	75-66-1	C <sub>4</sub> H <sub>10</sub> S	2000
9.	1-Propanethiol	107-03-9	C <sub>3</sub> H <sub>7</sub> S	2000
10.	Ethyl methyl sulfide	624-89-5	C <sub>2</sub> H <sub>5</sub> SCH <sub>3</sub>	2000
11.	Thiophene	110-02-1	C <sub>4</sub> H <sub>4</sub> S	2000
12.	2-Methyl-1-propanethiol	513-44-0	C <sub>4</sub> H <sub>10</sub> S	2000
13.	Diethyl sulfide	352-93-2	(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> S	2000
14.	1-Butanethiol	109-79-5	C <sub>4</sub> H <sub>10</sub> S	2000
15.	Dimethyl disulfide	624-92-0	(CH <sub>3</sub> ) <sub>2</sub> S <sub>2</sub>	2000
16.	2-Methylthiophene	554-14-3	C <sub>5</sub> H <sub>6</sub> S	2000
17.	3-Methylthiophene	616-44-4	C <sub>5</sub> H <sub>6</sub> S	2000
18.	Diethyl disulfide	110-81-6	(C <sub>2</sub> H <sub>5</sub> S) <sub>2</sub>	2000
19.	5-Methylbenzo[b]thiophene	14315-14-1	C <sub>9</sub> H <sub>8</sub> S	2000
20.	3-Methylbenzothiophene	1455-18-1	C <sub>9</sub> H <sub>8</sub> S	2000
21.	**Diphenyl sulfide	139-66-2	C <sub>12</sub> H <sub>10</sub> S	2000

\*\* Internal standard

**Sulfur Compounds in Propylene (1 ppm)**

**Column:** GS-GasPro  
113-4332  
30 m x 0.32 mm

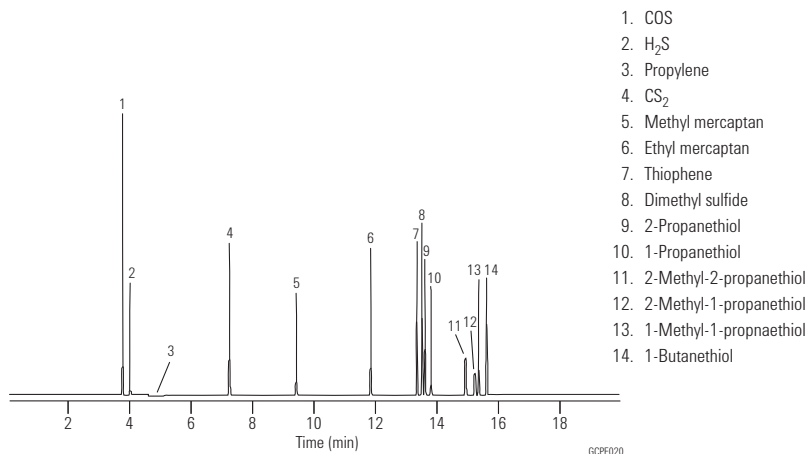
Oven: 60 °C for 2.5 min  
60-250 °C at 10 °C/min

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. H<sub>2</sub>S
3. Propylene
4. CS<sub>2</sub>
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

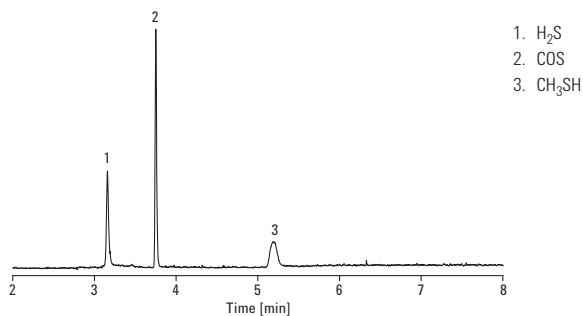
Carrier: Helium, constant flow, 2.0 mL/min

Injection: Gas sampling valve  
220 °C, split 1:10

Detector: SCD, 200 °C

Sample: Polypropylene matrix containing  
~300 ppb H<sub>2</sub>S and CH<sub>3</sub>SH, ~500 ppb COS

Injection Volume: 1 mL



1. H<sub>2</sub>S
2. COS
3. CH<sub>3</sub>SH

**C<sub>1</sub> to C<sub>4</sub> Hydrocarbon Mix**

**Column:** PoraPLOT Q PT  
CP7550PT  
10 m x 0.32 mm, 10.00  $\mu$ m

Carrier: Helium, 1 mL/min in constant flow mode

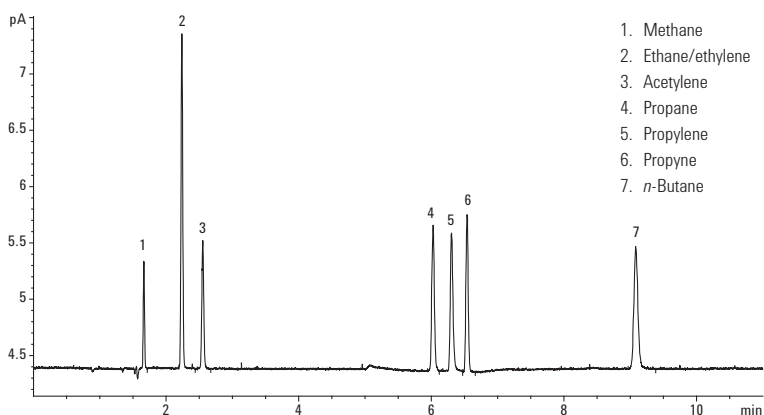
Oven: 50 °C (5 min) then to 120 °C at 50 °C/min,  
hold 4.6 min

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  $\mu$ m

Carrier: Helium, 2 mL/min in constant flow mode

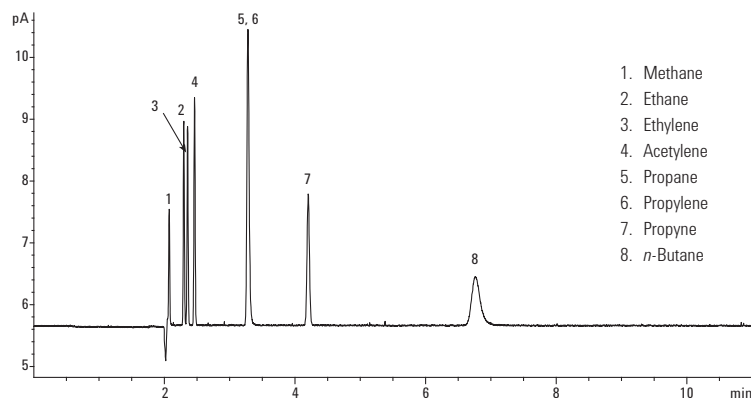
Oven: 85 °C isothermal

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  $\mu$ m film, with attached manufacturer-prepared integrated dual-ended particle trap, showing the lack of particles or spikes on FID.

**Column:** HP-PLOT Al<sub>2</sub>O<sub>3</sub> KCI PT  
19095P-K25PT  
50 m x 0.53 mm, 15.00  $\mu$ m

Carrier: Helium, 3 mL/min in constant flow mode

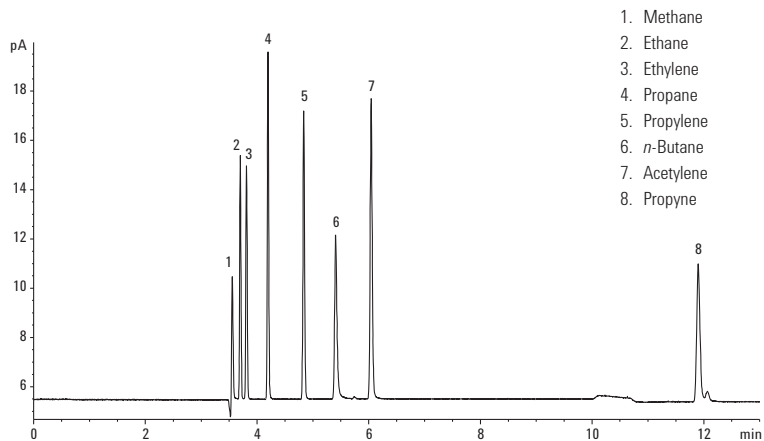
Oven: 100 °C (10 min) then to 120 °C at 30 °C/min,  
hold 3 min

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



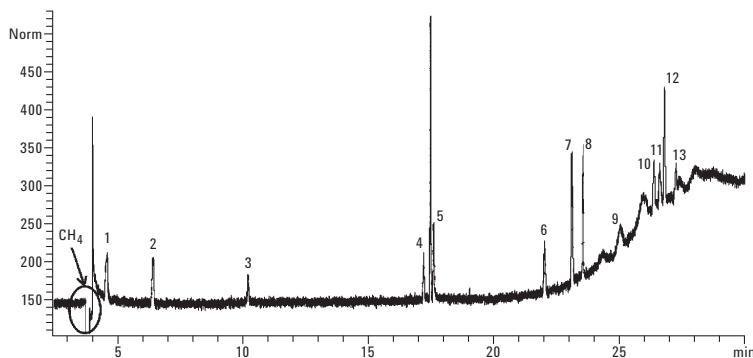
HP-PLOT Al<sub>2</sub>O<sub>3</sub> KCI PT, 50 m x 0.53 mm, 15  $\mu$ m film, with integrated dual-ended particle trap, showing lack of particles or spikes on FID.

### 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

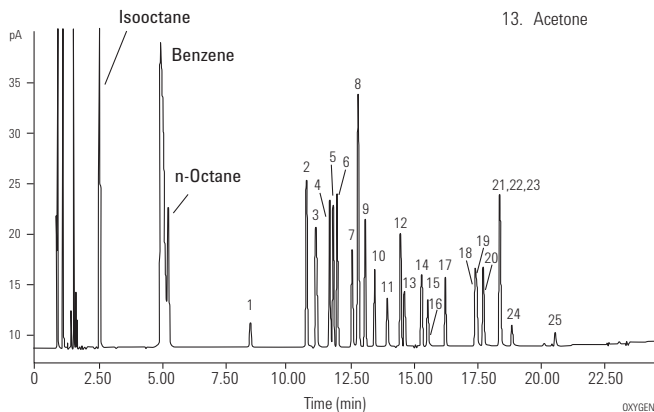
**Column:** GS-OxyPLOT  
115-4912  
10 m x 0.53 mm

**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**

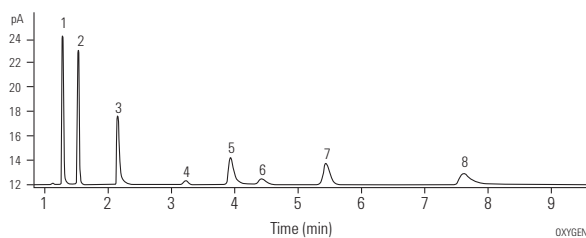
**Column:** GS-OxyPLOT  
115-4912  
10 m x 0.53 mm

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

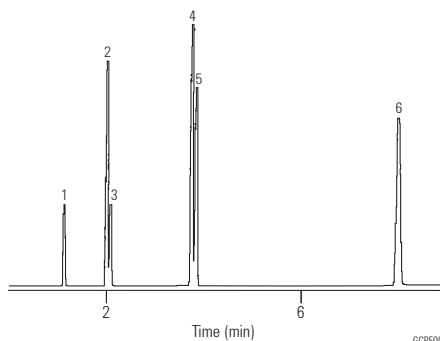
Sample: 250 µL

**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

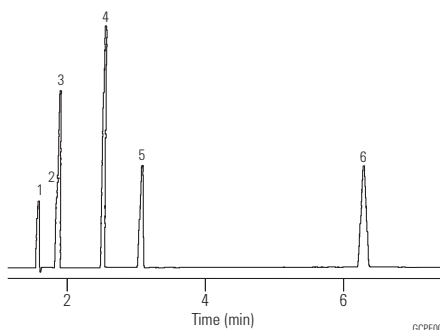
Sample: 250 µL

**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, CO<sub>2</sub>, 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

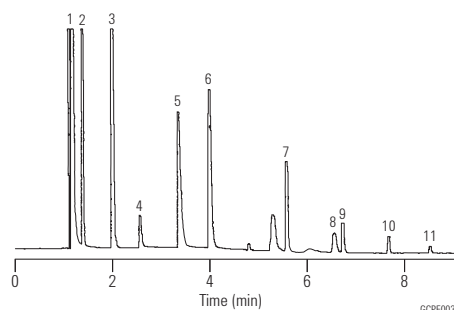
**Sample:** 0.25 cc natural gas sample, methane, 80%+

#### 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. CO<sub>2</sub>
3. Ethane
4. H<sub>2</sub>S
5. Water
6. C<sub>3</sub>
7. i-C<sub>4</sub>/n-C<sub>4</sub>
8. neo-C<sub>5</sub>
9. i-C<sub>5</sub>/n-C<sub>5</sub>
10. C<sub>6</sub>
11. C<sub>7</sub>

### Natural Gas

**Column:** HP-PLOT Al<sub>2</sub>O<sub>3</sub> 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

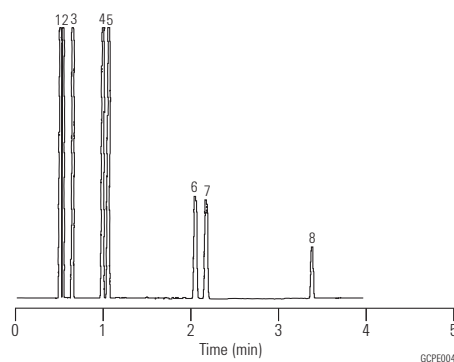
**Sample:** 5 µL natural gas, p/n 5080-8756

#### 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 Al<sub>2</sub>O<sub>3</sub> S  
19095P-S25  
50 m x 0.53 mm, 15.00 μm

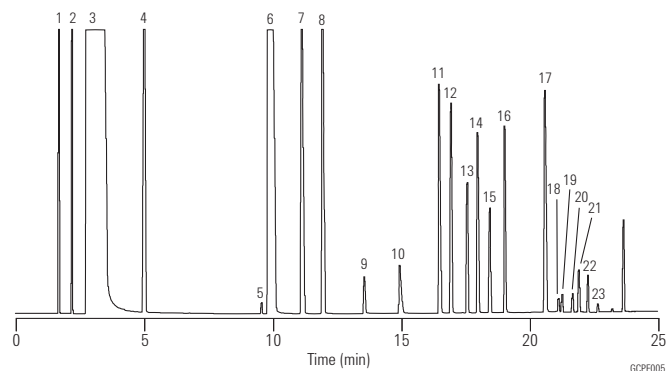
**Carrier:** Helium, 50 cm/s (35 °C),  
7 mL/min constant flow

**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

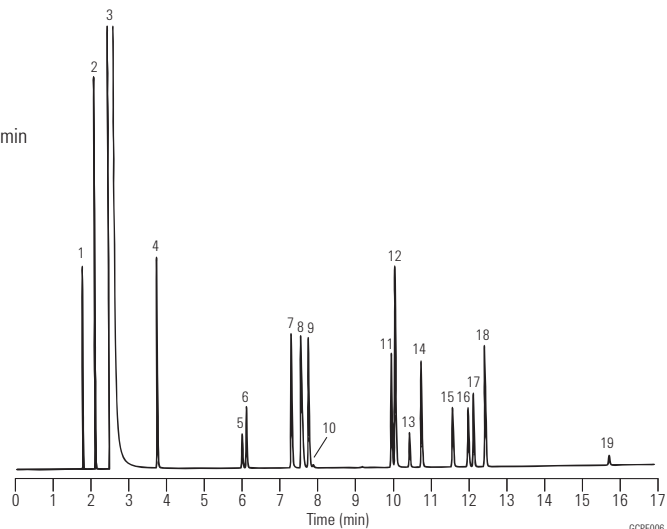
**Carrier:** Helium at 8 mL/min, measured at 35 °C

**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

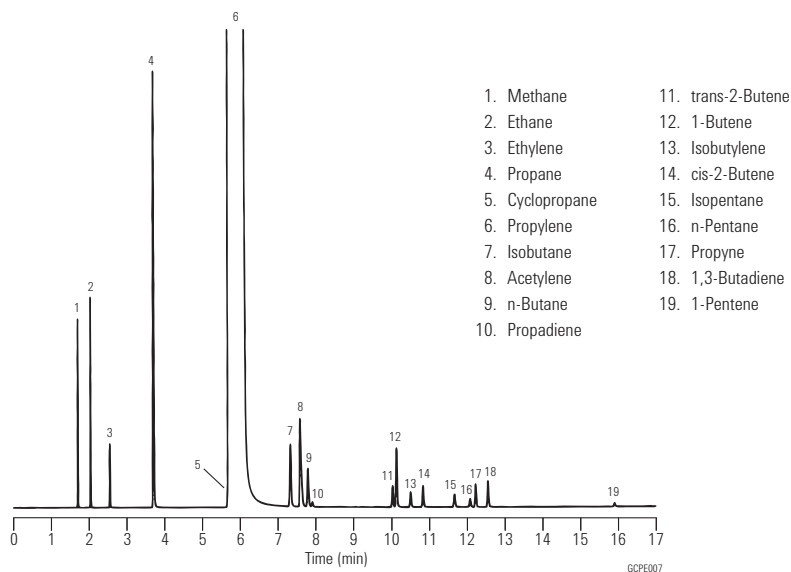
**Sample:** 0.2 mL of trace  
hydrocarbons in propylene

### 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

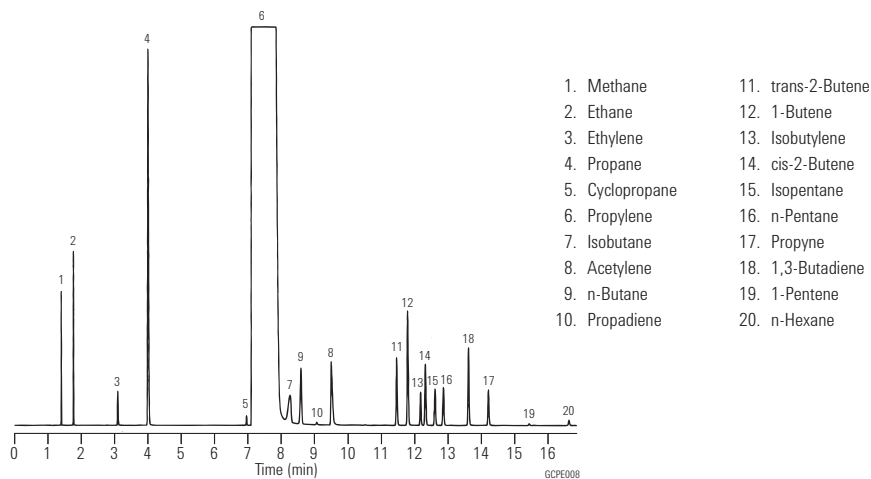
**Sample:** 0.2 mL of trace  
hydrocarbons in propylene

### 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  $\mu$ 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  $\mu$ L

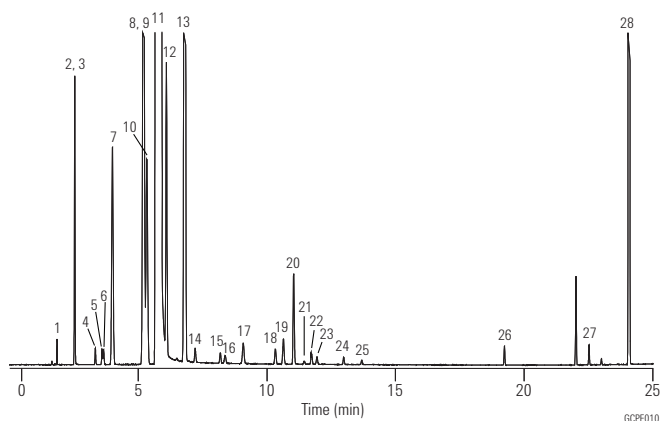
**Suggested Supplies**

**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**

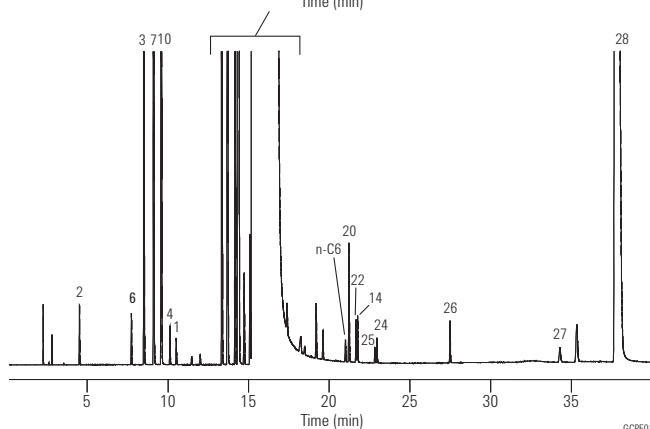
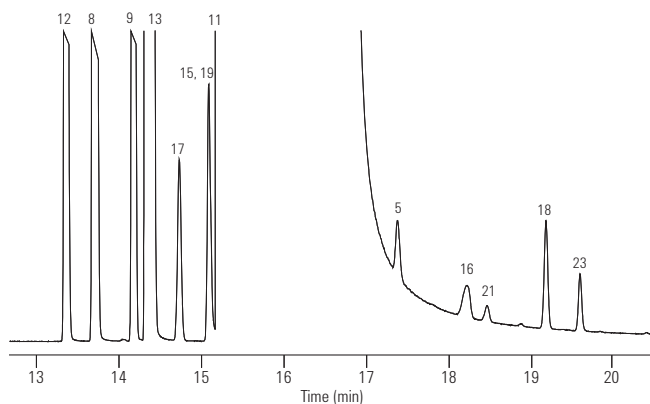
**Septum:** 11 mm Advanced Green septa, 5183-4759

**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

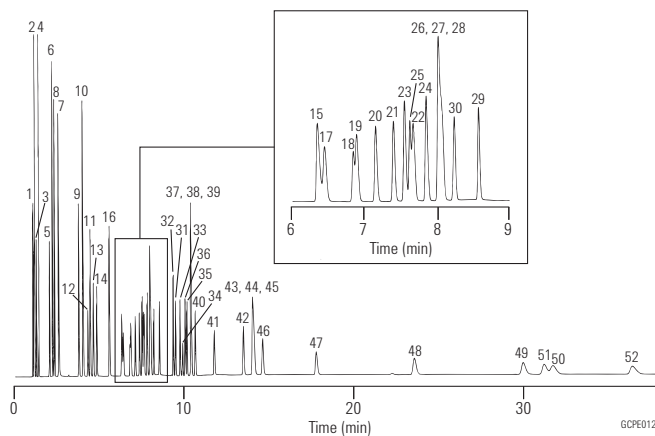
**Sample:** 300 µL injection of 100 ppmv  
SUMMA canister mixture

## 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

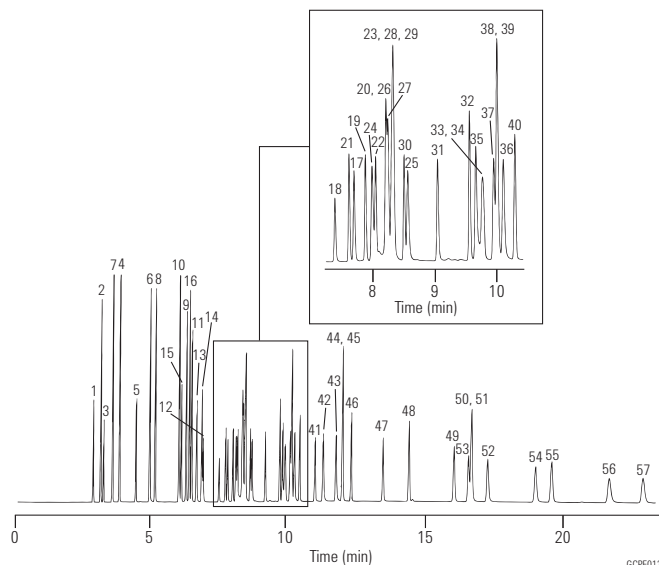
**Sample:** 500 µL injection of 100 ppmv  
SUMMA canister mixture

### 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 Al<sub>2</sub>O<sub>3</sub> 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

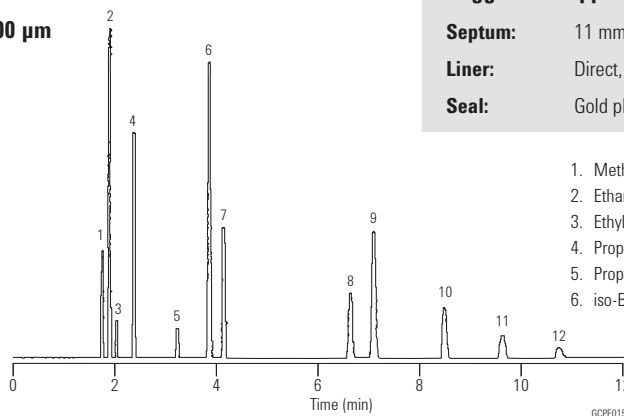
**Sample:** 5 µL

**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**

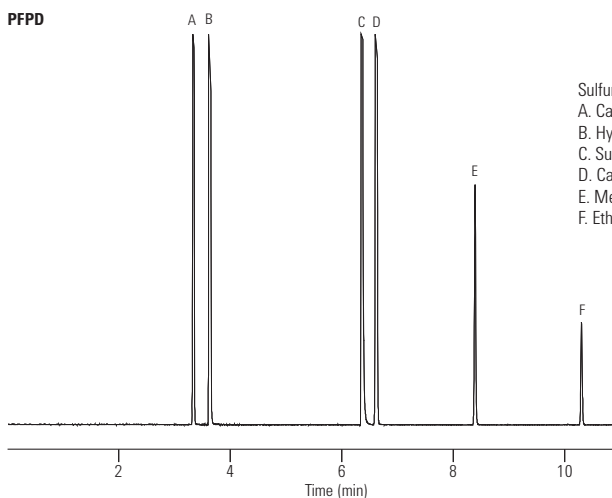
**Column:** GS-GasPro  
113-4332  
30 m x 0.32 mm

**Carrier:** Helium, 10 psig, 2.0 mL/min at 60 °C

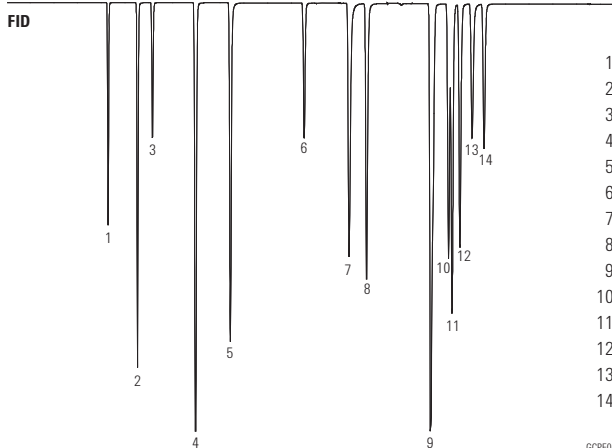
**Oven:** 60 °C for 2 min, 20 °C/min to 260 °C  
and hold

**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

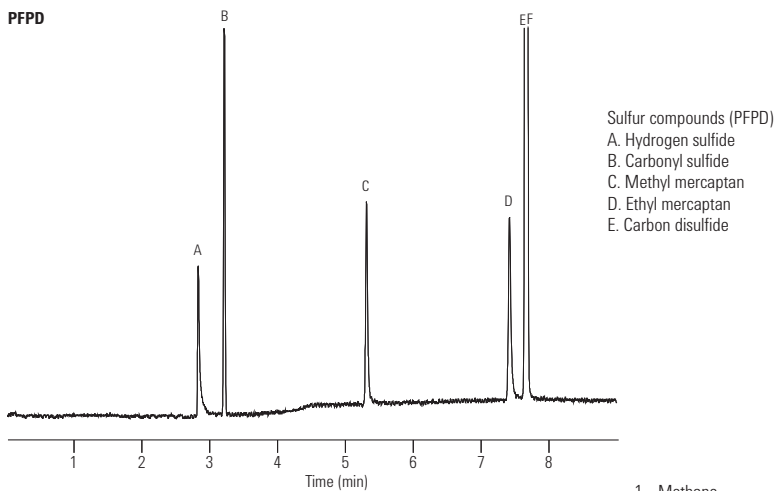
**Column:** GS-Q  
113-3432  
30 m x 0.32 mm, 0.20 µm

**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

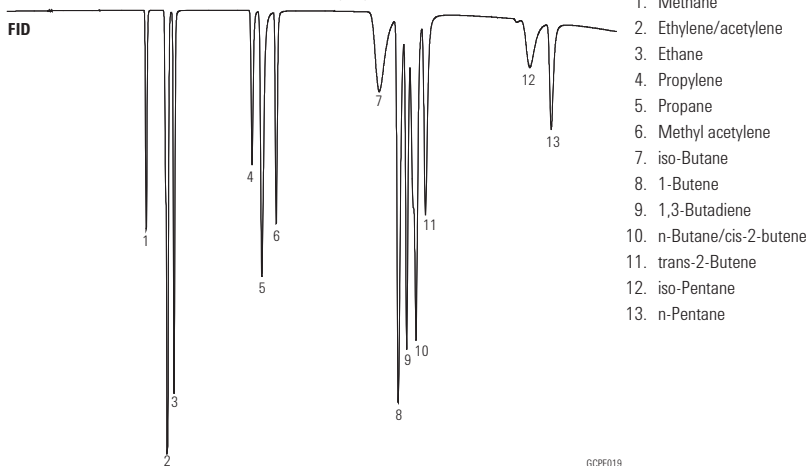


#### Suggested Supplies

**Septum:** 11 mm Advanced Green septa, 5183-4759

**Liner:** Direct, 1.5 mm id, 18740-80200

**Seal:** Gold plated seal, 18740-20885



GCPE019

### Sulfur Compounds in Propylene (1 ppm)

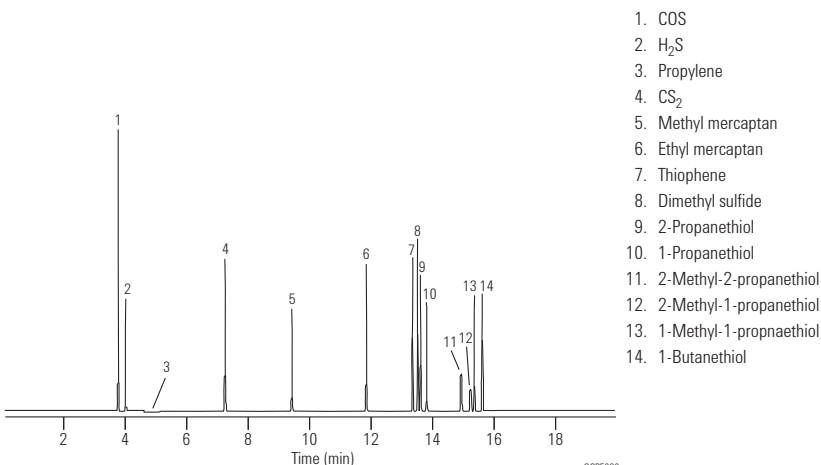
**Column:** GS-GasPro  
113-4332  
30 m x 0.32 mm

**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

GCPE020

**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

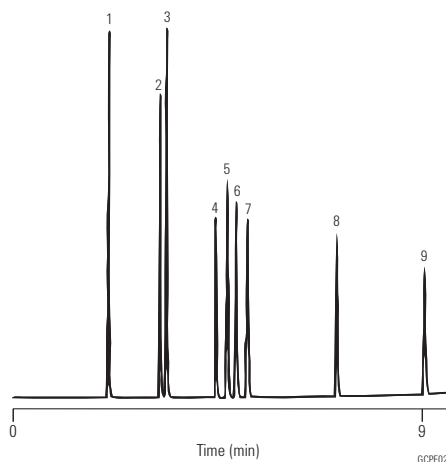
**Sample:** 0.2 mL

**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

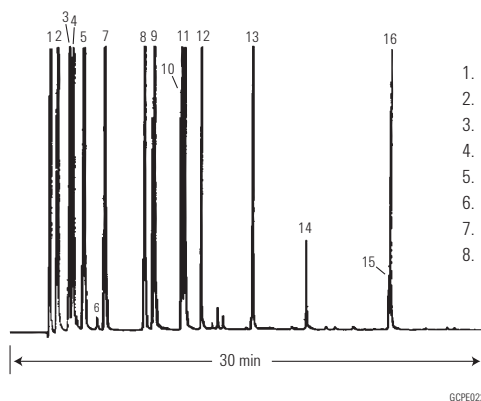
**Sample:** 0.5 mL

**Suggested Supplies**

**Septum:** 11 mm Advanced Green septa, 5183-4759

**Liner:** Direct, 1.5 mm id, 18740-80200

**Seal:** Gold plated seal, 18740-20885

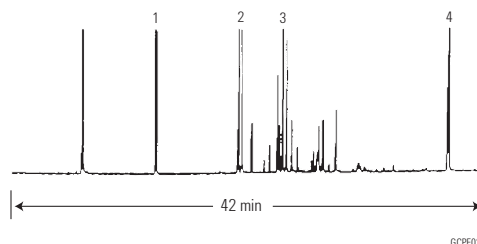


- |                                      |                            |
|--------------------------------------|----------------------------|
| 1. Hydrogen sulfide                  | 9. Isobutyl mercaptan      |
| 2. Methyl mercaptan                  | 10. n-Butyl mercaptan      |
| 3. Ethyl mercaptan                   | 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

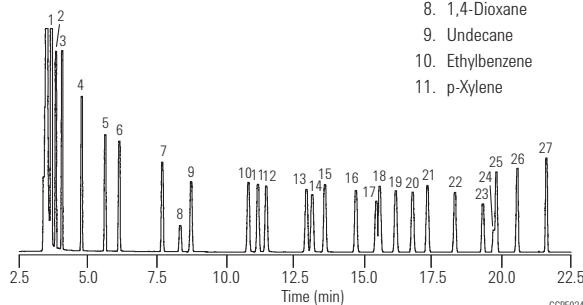


1. Thiophene
2. Methyl thiophenes
3. Ethyl and dimethyl thiophenes
4. Benzothiophene

**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

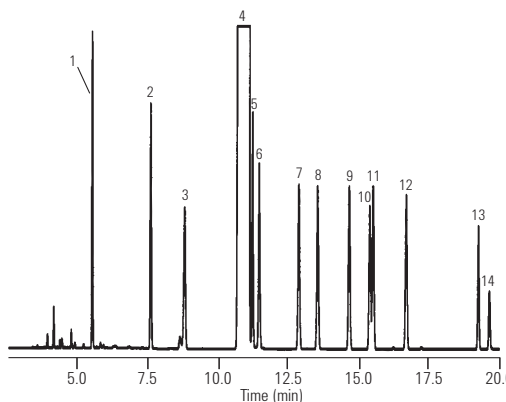


- |                  |                           |
|------------------|---------------------------|
| 1. Heptane       | 12. m-Xylene              |
| 2. Cyclohexane   | 13. Cumene                |
| 3. Octane        | 14. Dodecane              |
| 4. Nonane        | 15. o-Xylene              |
| 5. 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

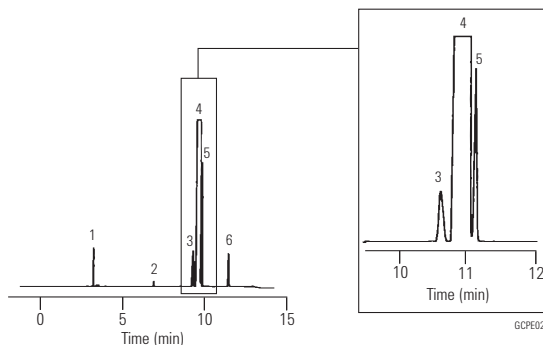
**Carrier:** Helium, 32 cm/s, 19.9 psi (60 °C),  
2.5 mL/min constant flow

**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

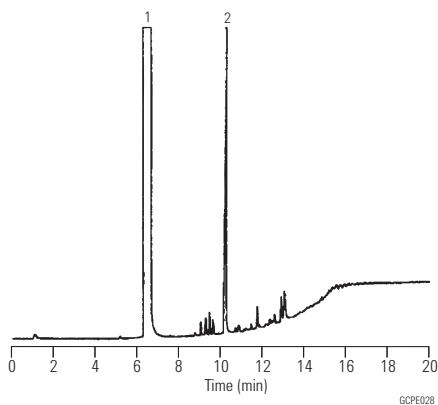
**Suggested Supplies**

**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

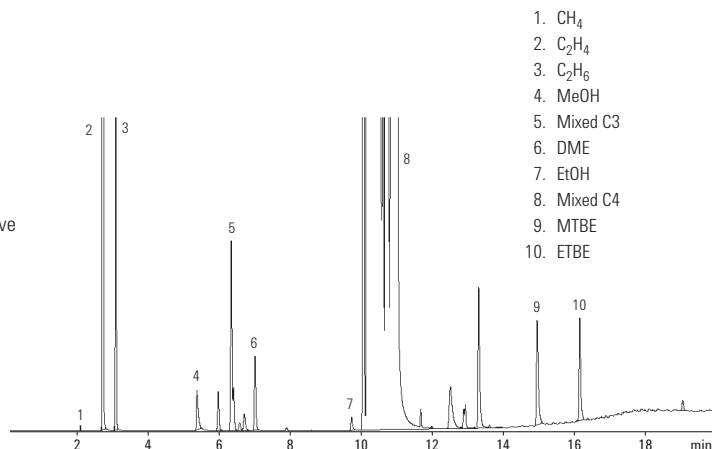
**Carrier:** Helium, constant flow mode, 35 cm/s, 45 °C

**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

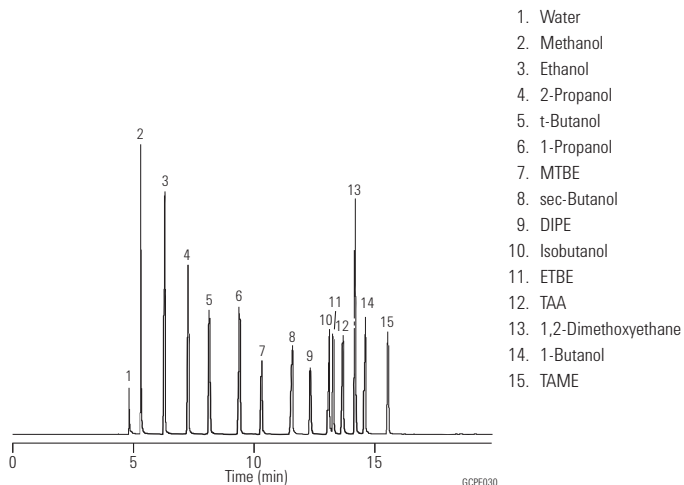
**Carrier:** Helium, 30 cm/s constant flow

**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

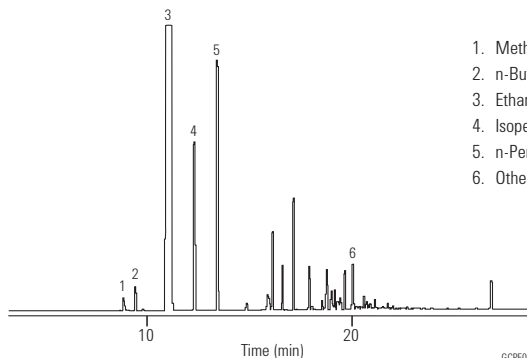
**Carrier:** Helium 24 cm/s

**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

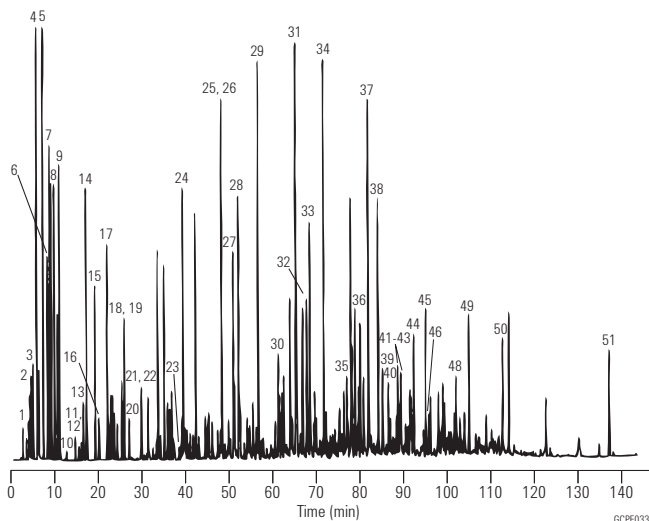
**Carrier:** Helium at 16.7 cm/s, measured at 35 °C

**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

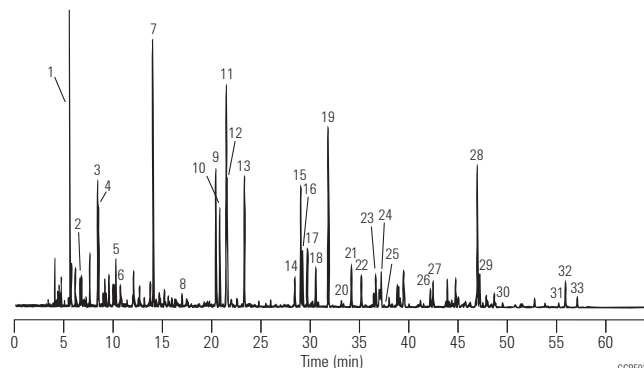
**Oven:** 50 °C for 1 min  
50-190 °C at 2 °C/min  
190 °C for 1 min

**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

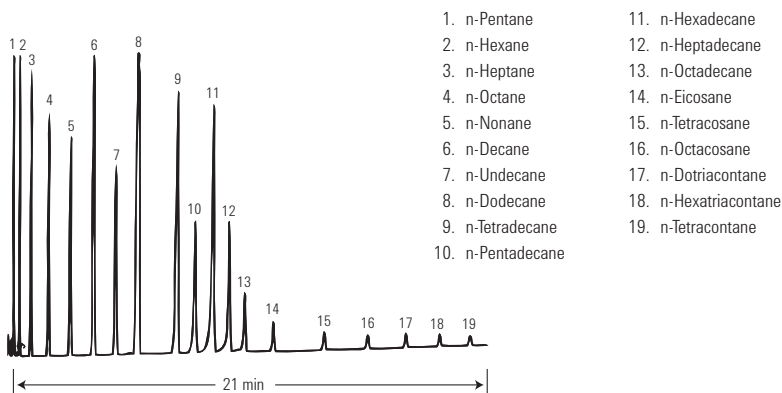
#### Suggested Supplies

**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

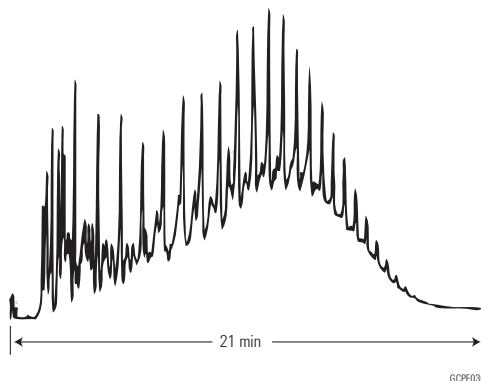
**Syringe:** 10 µL tapered, FN 23-26s/42/HP, 5181-1267



**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



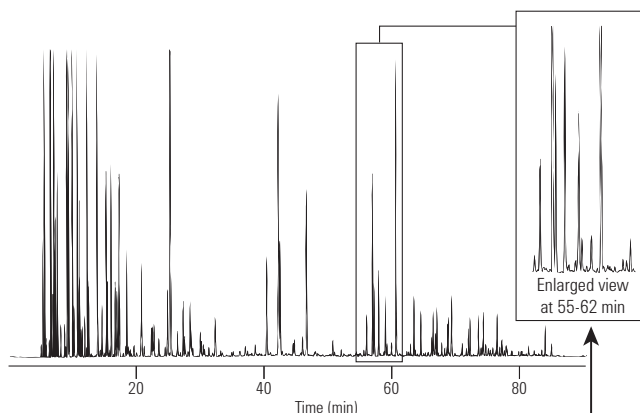
**Suggested Supplies**

- 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

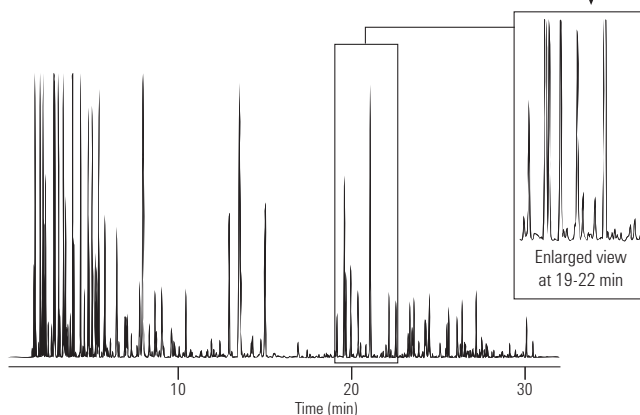


**Compare Resolution**

**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  $\mu$ m

Sample: 0.1  $\mu$ L

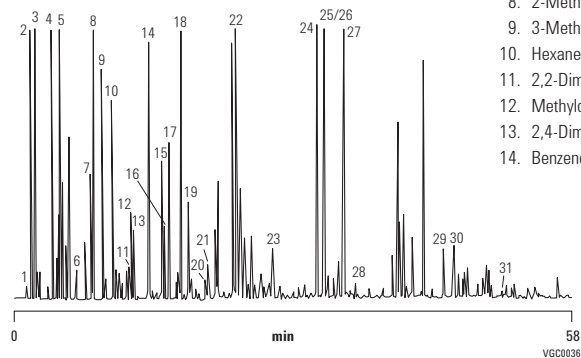
Carrier: Helium, 240 kPa (2.4 bar, 34 psi)

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  $\mu$ m

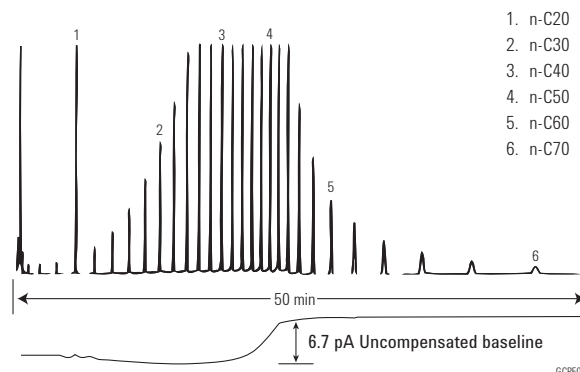
Carrier: Helium at 8 mL/min

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  $\mu$ L  
3% solution in CS<sub>2</sub>



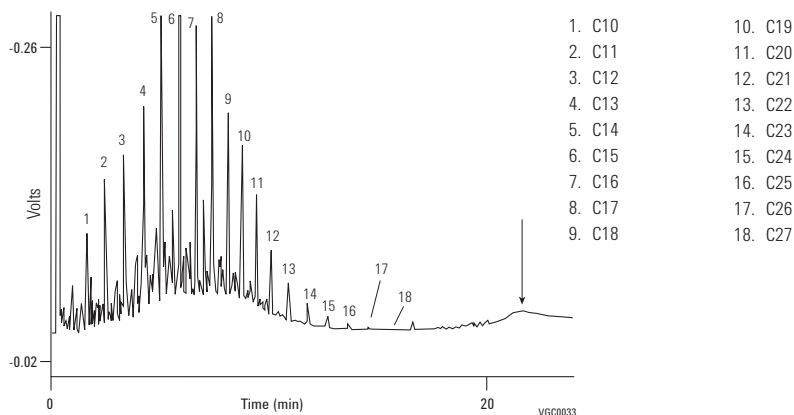
**Diesel Analysis**

**Column:** VF-5ht Fused Silica  
CP9047  
15 m x 0.32 mm, 0.10 µm

**Carrier:** H<sub>2</sub>, 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

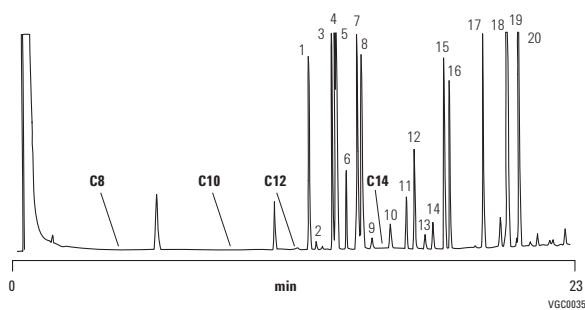
**Carrier:** He, 28.8 kPa (0.288 bar, 4.1 psi)

**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

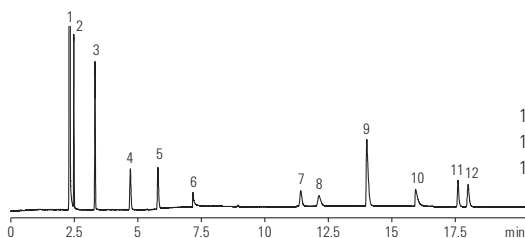
**Carrier:** Hydrogen, constant flow mode, 40 cm/s, 32 °C

**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

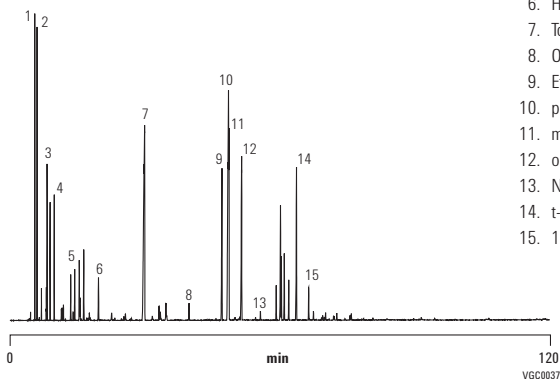
**Carrier:** Helium

**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  $\mu$ 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  $\mu$ L of 0.01-0.05% each solvent in CS<sub>2</sub>

## Suggested Supplies

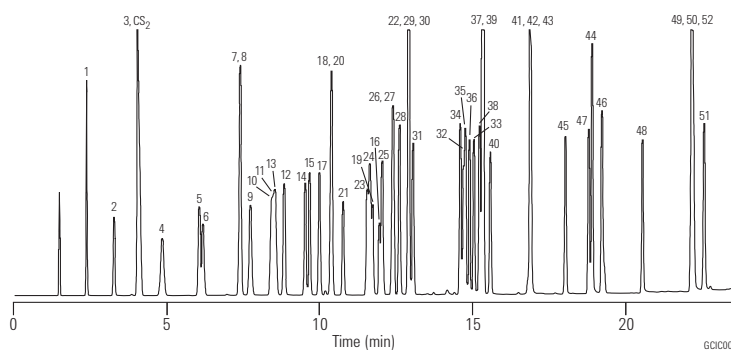
**Septum:** 11 mm Advanced Green septa, 5183-4759

**Liner:** Split, single taper, low pressure drop, glass wool, 5183-4647

**Seal:** Gold plated seal kit, 5188-5367

**Syringe:** 5  $\mu$ 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. $\alpha$ -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. $\alpha$ -Ethylphenethyl alcohol   |
| 25. 4-Methyl-2-pentanol                      | 51. $\beta$ -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

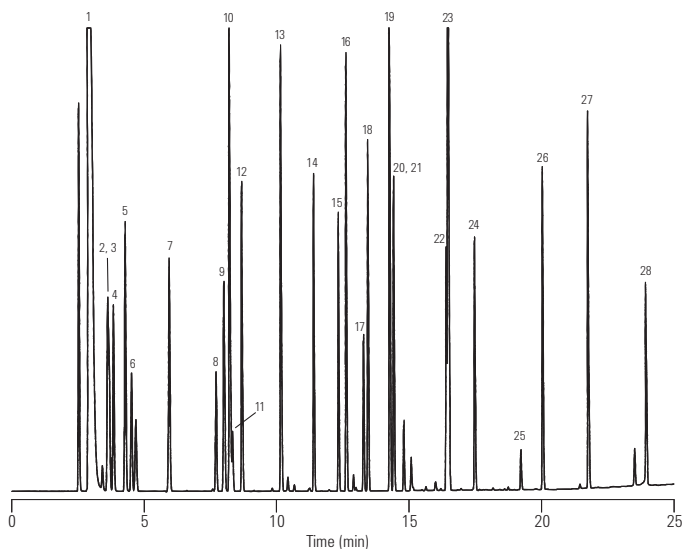
**Suggested Supplies**

**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

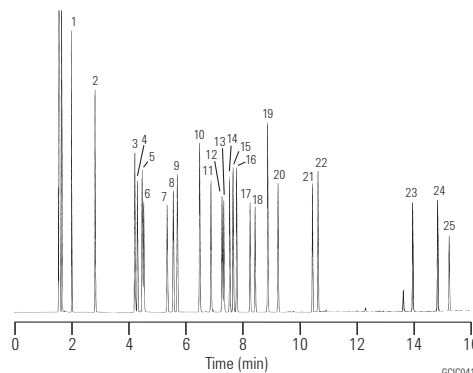
#### Suggested Supplies

**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

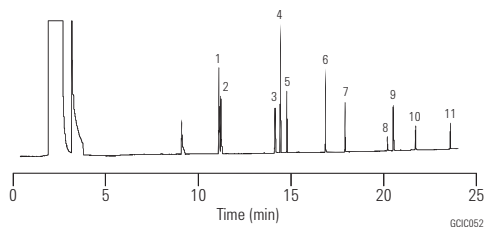
#### Suggested Supplies

**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

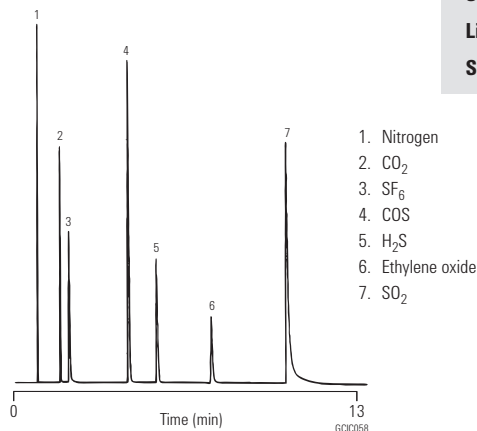
**Carrier:** Helium at 53 cm/s

**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

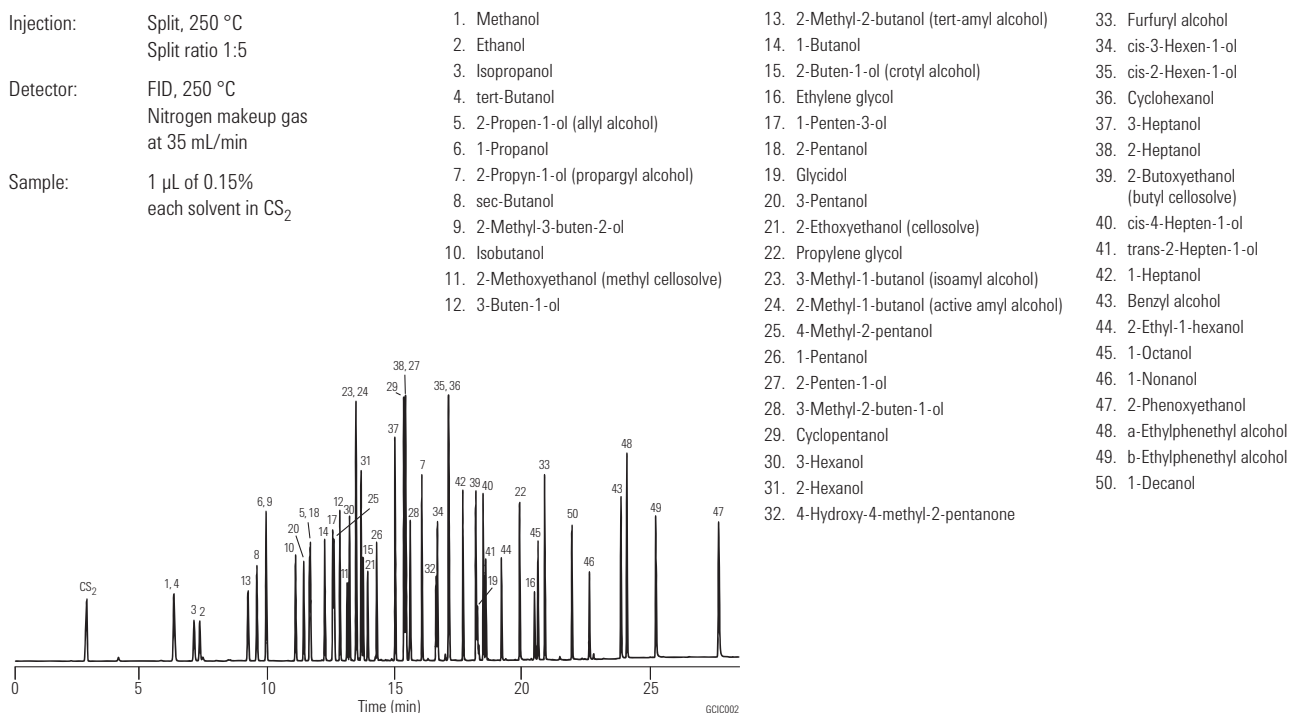
**Carrier:** Helium at 50 cm/s,  
measured at 40 °C

**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 CS<sub>2</sub>



## 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

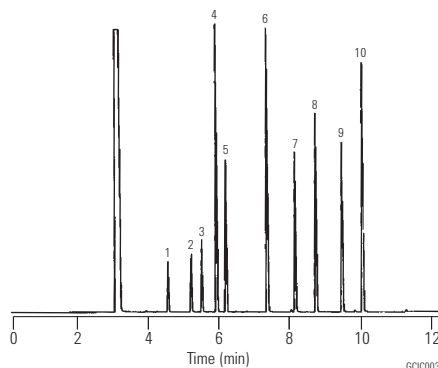
**Carrier:** Helium, 29 cm/s, 3.0 psi (45 °C)

**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

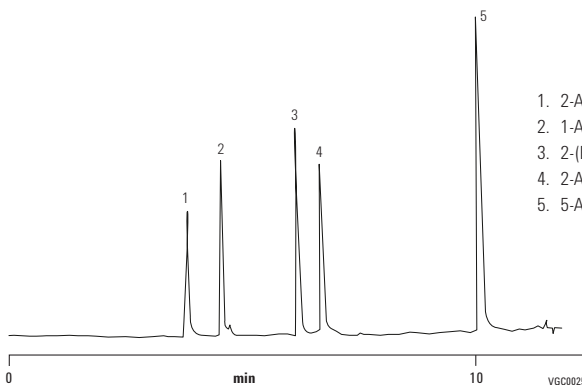
**Solvent:** Water

**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

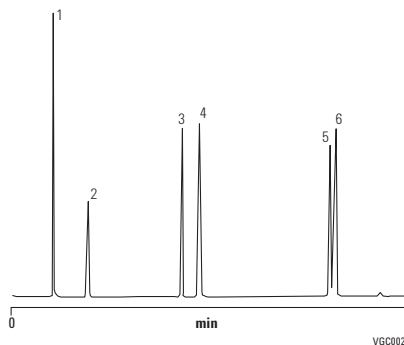
**Solvent:** Methanol

**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

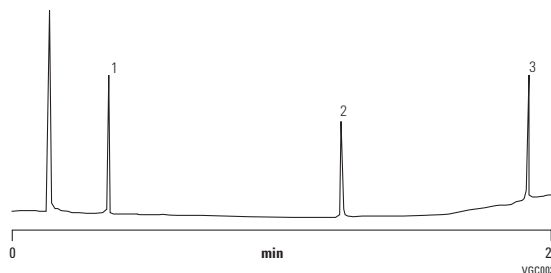
Solvent: Methanol

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

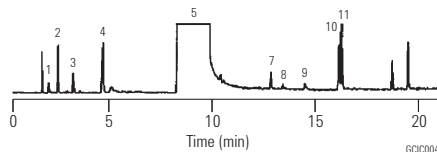
**Suggested Supplies**

**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**

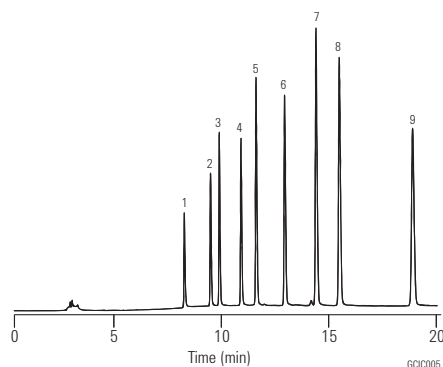
**Column:** DB-WAXetr  
125-7332  
30 m x 0.53 mm, 1.00 µm

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/C<sub>4</sub>-C<sub>5</sub> Isomers

**Column:** HP-INNOWax  
19091N-133  
30 m x 0.25 mm, 0.25 µm

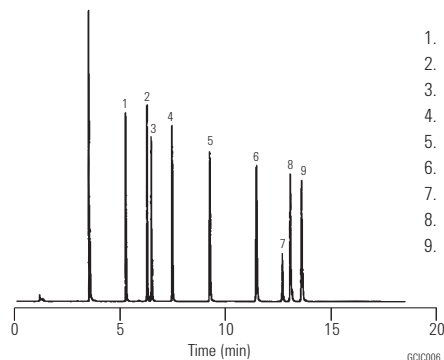
**Carrier:** Helium 42 cm/s, 24 psi (120 °C)  
1.8 mL/min constant flow

**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

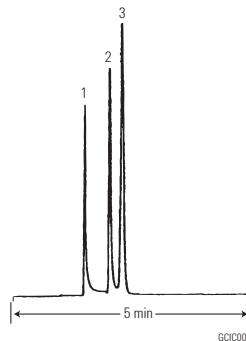
**Column:** DB-1  
125-1035  
30 m x 0.53 mm, 5.00 µm

**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

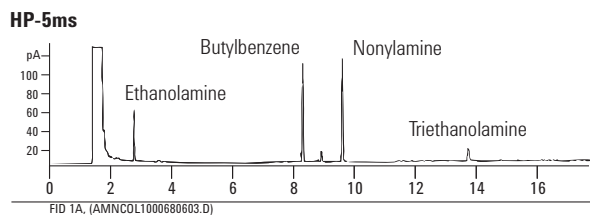
**Carrier:** Helium, constant pressure 9.79 psi

**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

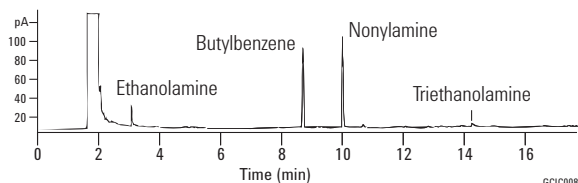
**Injection:** On-column  
Oven tracking mode

**Detector:** FID, 300 °C

**Sample:** 0.5 µL of each standard in methanol



#### non-Agilent 5% phenyl amines column



**Primary Amines**

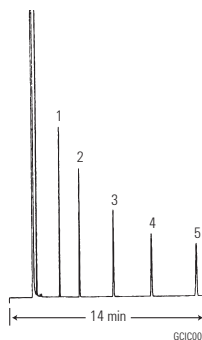
**Column:** CAM  
112-2132  
30 m x 0.25 mm, 0.25  $\mu$ m

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  $\mu$ m

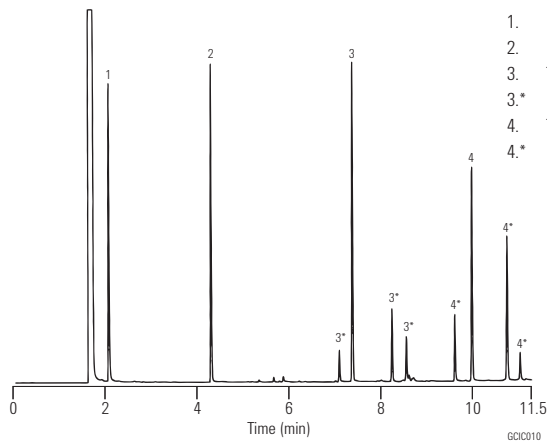
Carrier: Helium at 30 cm/s, measured at 100 °C

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  $\mu$ L of 100 ng/ $\mu$ 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

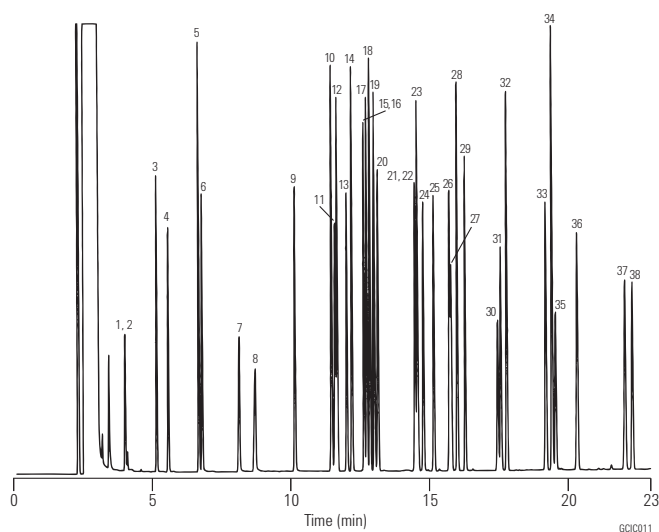
#### Suggested Supplies

**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**

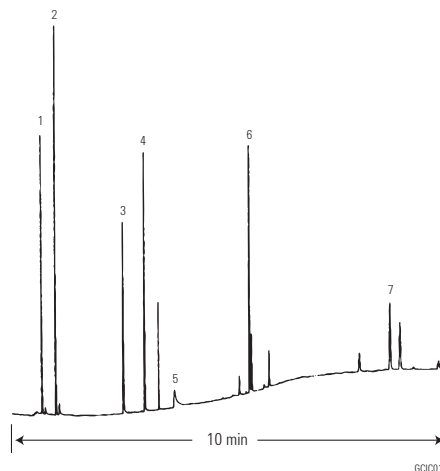
**Column:** CAM  
112-2132  
30 m x 0.25 mm, 0.25 µm

**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

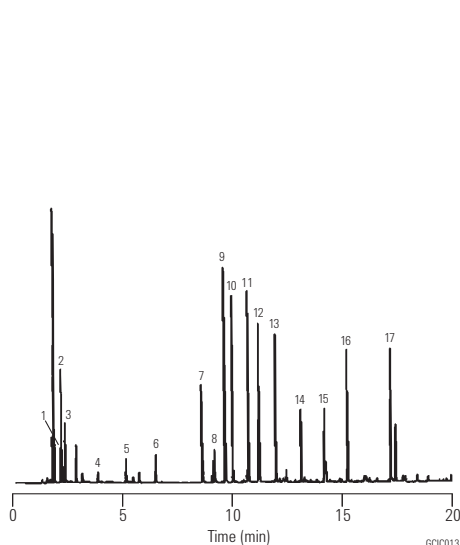
**Suggested Supplies**

**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

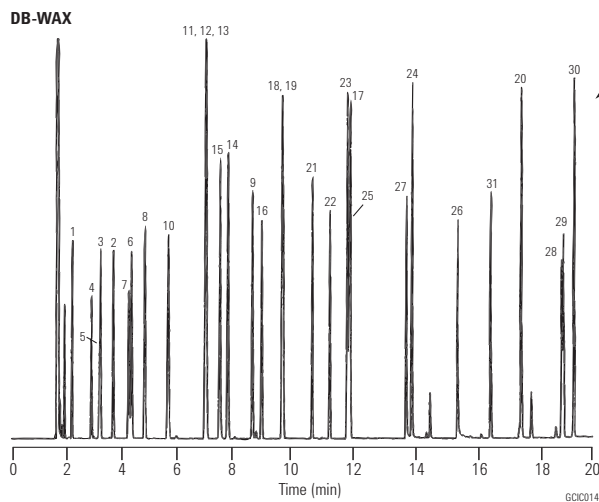
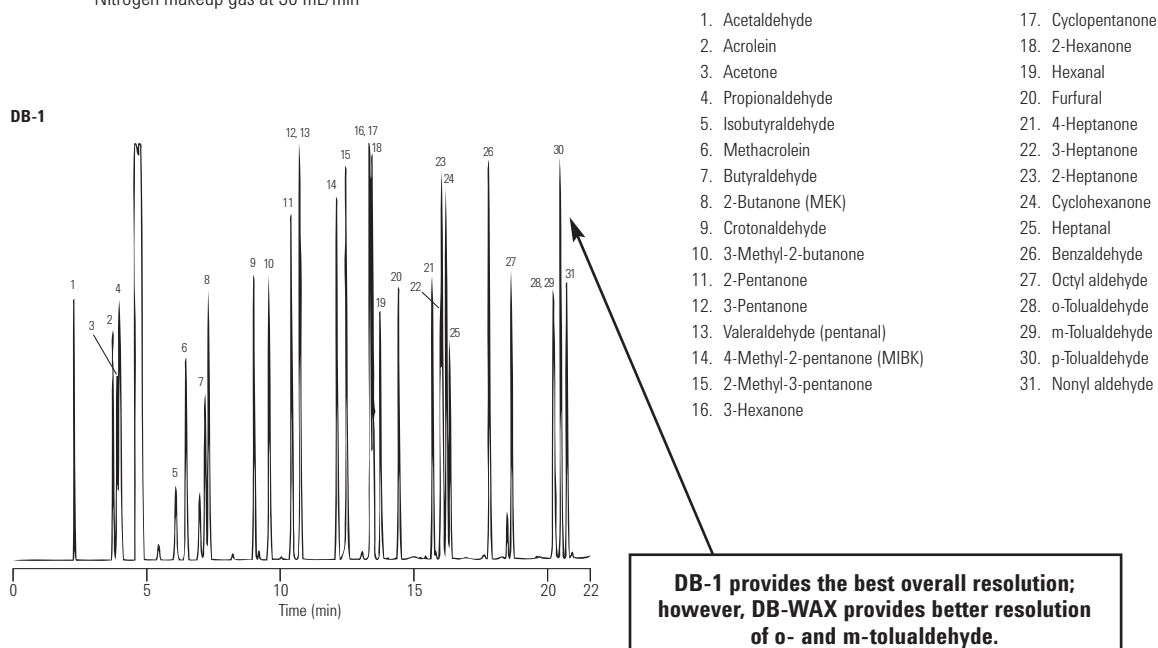
**Oven:** 40 °C for 5 min  
40-210 °C at 10 °C/min

**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**

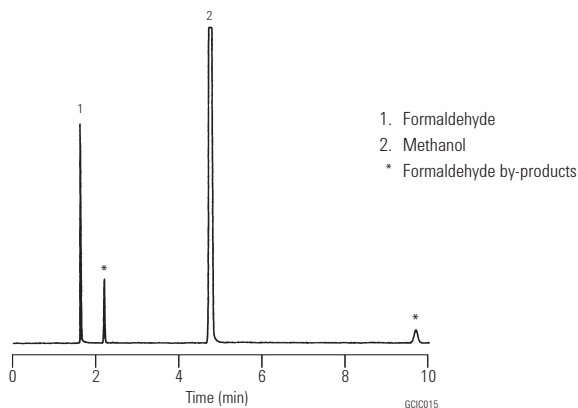
**Column:** DB-WAX  
123-7033  
30 m x 0.32 mm, 0.50  $\mu$ m

**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  $\mu$ 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

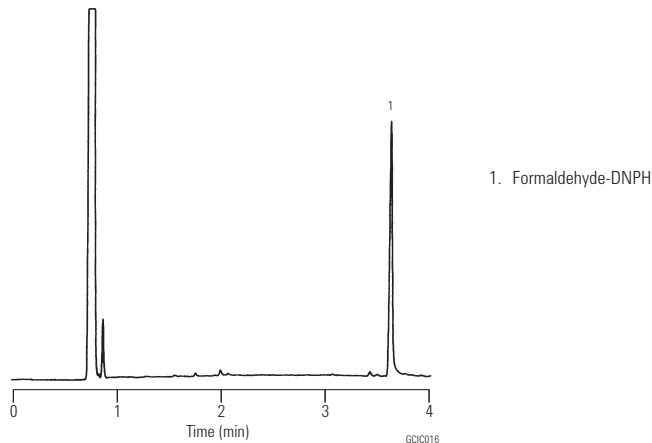
**Suggested Supplies**

**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  $\mu$ L tapered, FN 23-26s/42/HP, 5181-1267



**PFBHA Derivative**

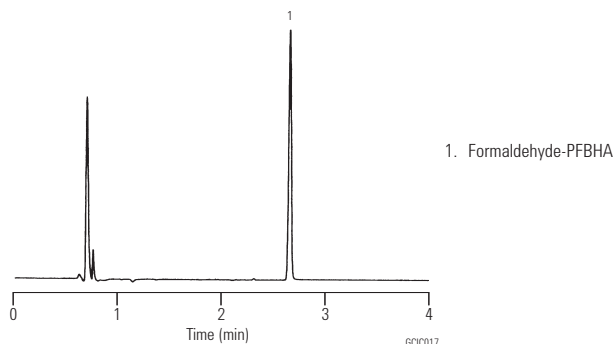
**Column:** DB-1  
123-1012  
15 m x 0.32 mm, 0.25 µm

**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



**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

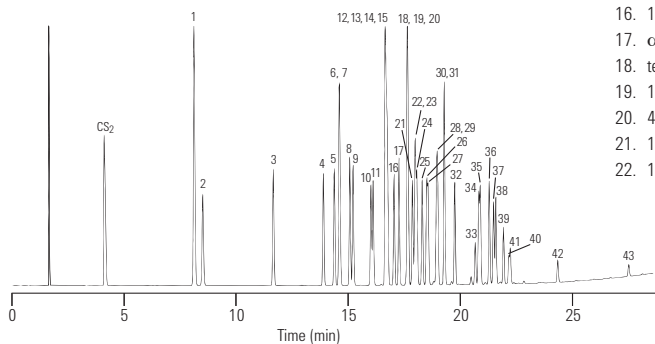
**Oven:** 40 °C for 5 min  
40-260 °C at 10 °C/min

**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

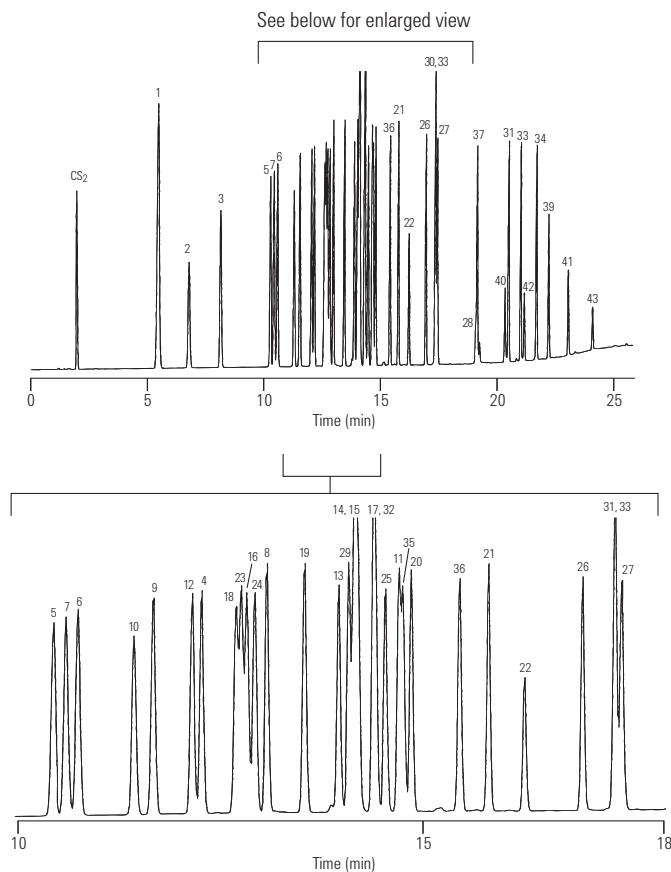
**Septum:** 11 mm Advanced Green septa, 5183-4759

**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

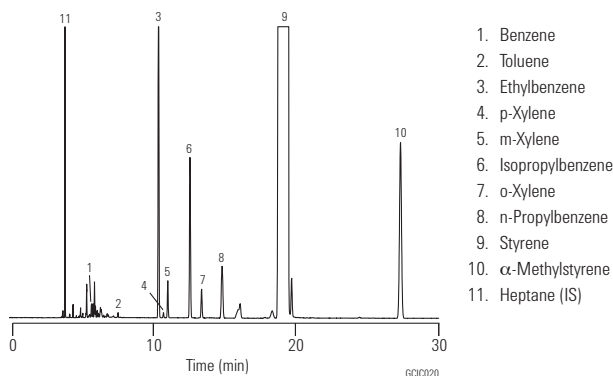
#### Suggested Supplies

**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

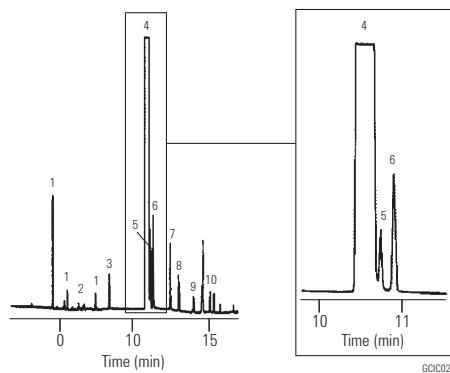
**Carrier:** Helium, 32 cm/s, 19.9 psi (60 °C)  
2.5 mL/min constant flow

**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

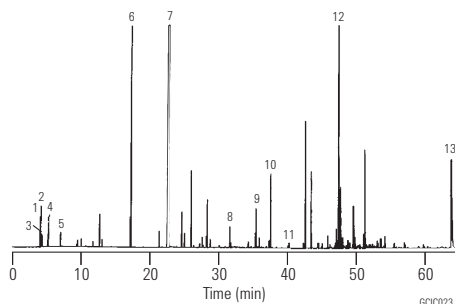
**Carrier:** Helium, 30 psi, 12 mL/min

**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

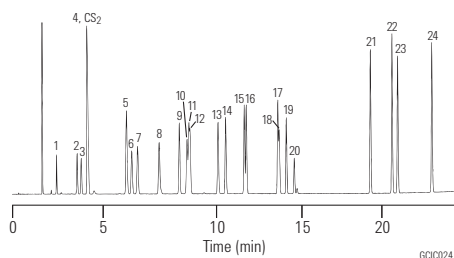
**Column:** DB-1  
125-1034  
30 m x 0.53 mm, 3.00 µm

**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

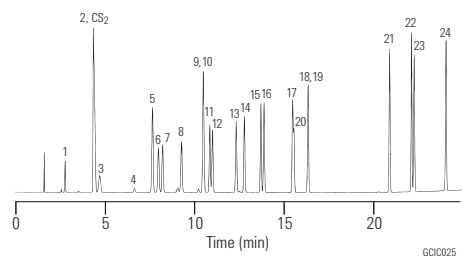
**Oven:** 40 °C for 5 min  
40-260 °C at 10 °C/min  
260 °C for 3 min

**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

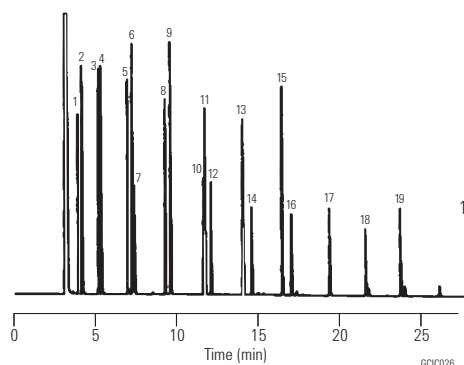
**Injection:** Split, 250 °C  
Split ratio 25:1

**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

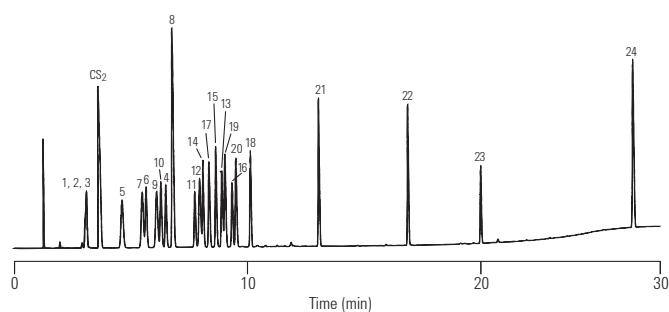
**Suggested Supplies**

**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

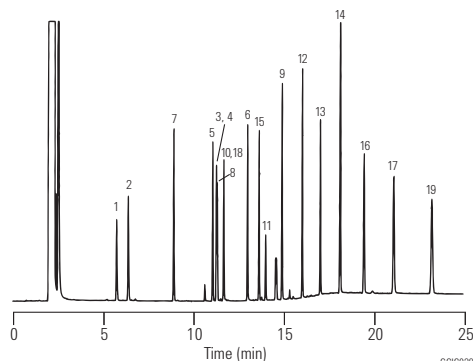
**Suggested Supplies**

**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

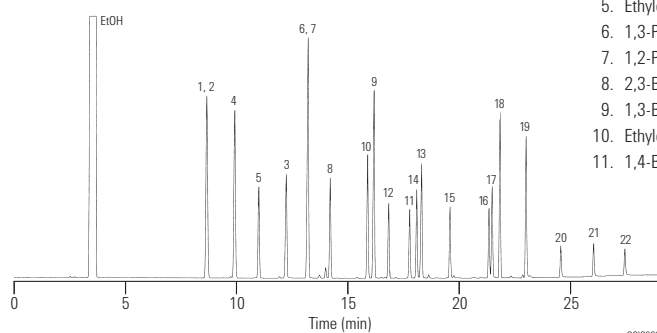
**Oven:** 40 °C for 5 min  
40-260 °C at 10 °C/min  
260 °C for 3 min

**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

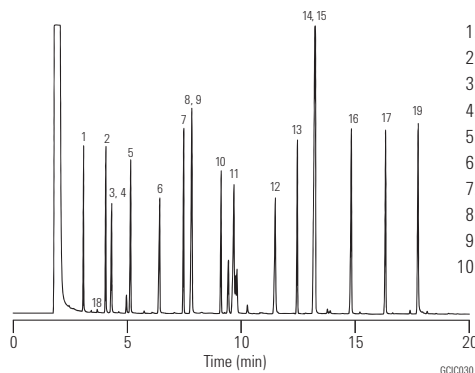
**Injection:** Split, 250 °C

**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  $\mu$ 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  $\mu$ L

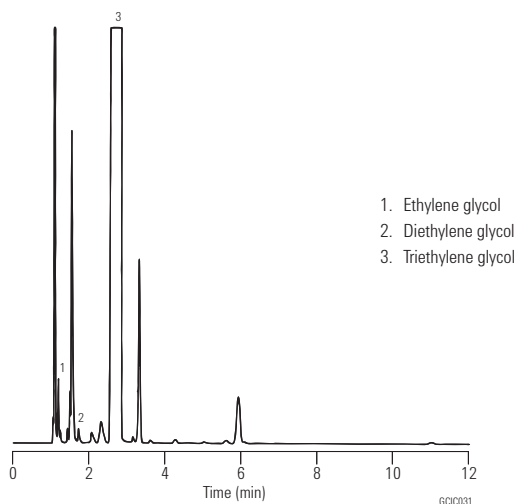
**Suggested Supplies**

**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  $\mu$ 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  $\mu$ 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  $\mu$ L

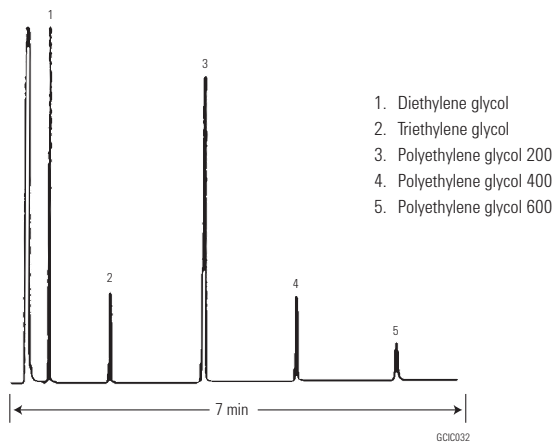
**Suggested Supplies**

**Septum:** 11 mm Advanced Green septa, 5183-4759

**Liner:** Liner, splitless, single-taper, glass wool, deactivated, 5062-3587

**Seal:** Gold plated seal, 18740-20885

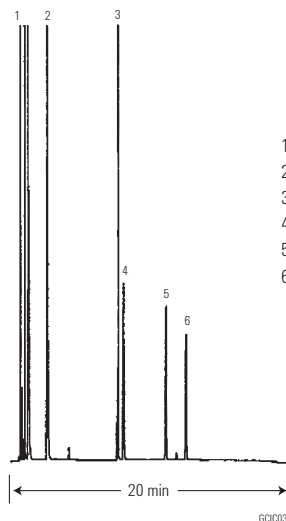
**Syringe:** 10  $\mu$ L tapered, FN 23-26s/42/HP, 5181-1267



### 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

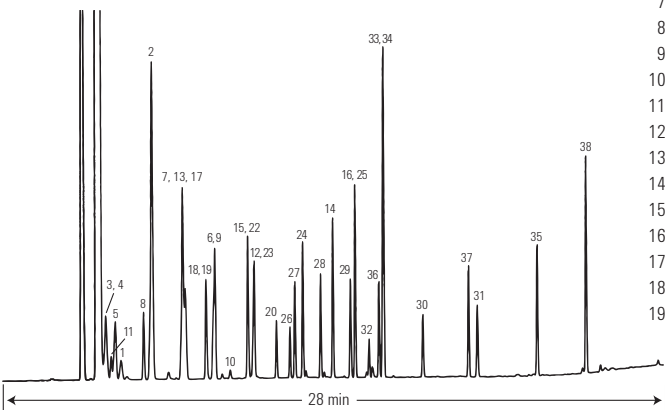
### Halogenated Hydrocarbons II

**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) | 20. Iodoform                           |
| 2. 1,1-Dichloroethene                         | 21. cis-1,3-Dichloropropene            |
| 3. Bromoethane (ethyl bromide)                | 22. Dibromomethane                     |
| 4. Iodomethane                                | 23. Bromodichloromethane               |
| 5. 3-Chloropropene (allyl chloride)           | 24. 1,3-Dichloropropane                |
| 6. 1-Chlorobutane                             | 25. 1,1-Dichloropropane                |
| 7. 2,2-Dichloropropane                        | 26. trans-1,3-Dichloropropene          |
| 8. trans-1,2-Dichloroethene                   | 27. 1,1,2-Trichloroethane              |
| 9. 1,1,1-Trichloroethane                      | 28. 1,2-Dibromoethane (EDB)            |
| 10. Carbon tetrachloride                      | 29. 1,1,1,2-Tetrachloroethane          |
| 11. Methylene chloride                        | 30. Pentachloroethane                  |
| 12. Trichloroethene                           | 31. Hexachloroethane                   |
| 13. Chloroform                                | 32. Bromoform                          |
| 14. Tetrachloroethene                         | 33. trans-1,4-Dichloro-2-butene        |
| 15. 1,2-Dichloropropane                       | 34. 1,2,3-Trichloropropane             |
| 16. 1-Chlorohexane                            | 35. Hexachlorobutadiene                |
| 17. Bromochloromethane                        | 36. 1,1,2,2-Tetrachloroethane          |
| 18. 1,1-Dichloroethane                        | 37. 1,2-Dibromo-3-chloropropane (DBCP) |
| 19. 1,2-Dichloroethane                        | 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

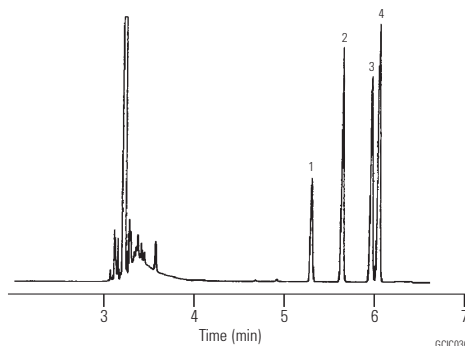
**Suggested Supplies**

**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

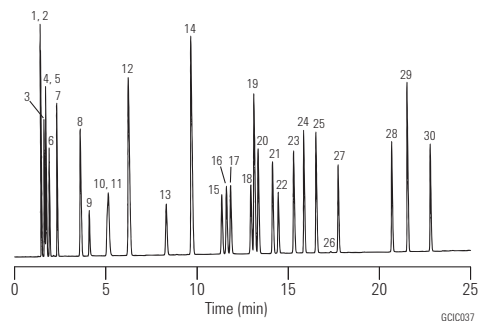
**Suggested Supplies**

**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

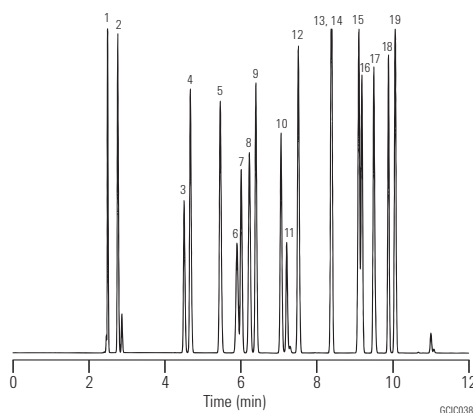
**Oven:** 50 °C for 5 min  
50-170 °C at 10 °C/min

**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

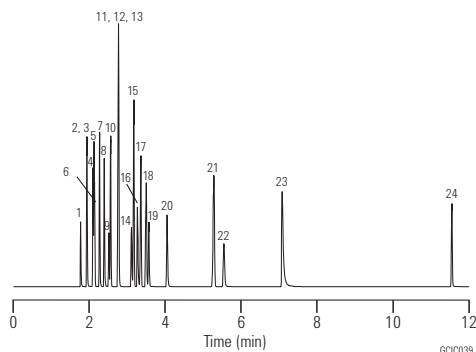
**Injection:** Split, 250 °C  
Split ratio 1:100

**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  $\mu$ m

**Carrier:** Helium, 30 psi

**Oven:** 70-200 °C at 5 °C/min  
200 °C for 2 min

**Injection:** Split

**Detector:** TCD

**Sample:** 1  $\mu$ L

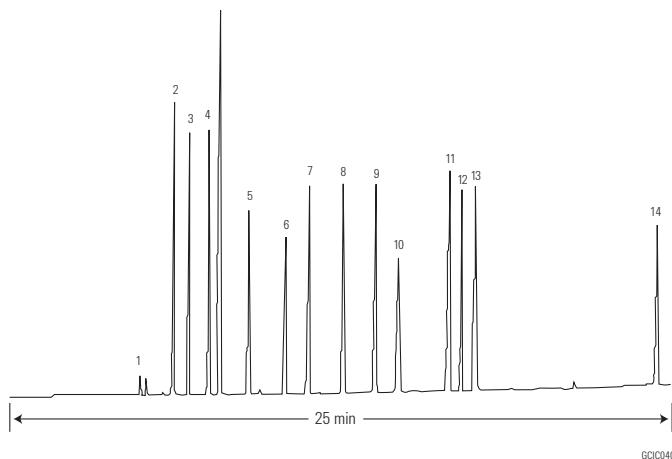
**Suggested Supplies**

**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  $\mu$ L 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  $\mu$ m

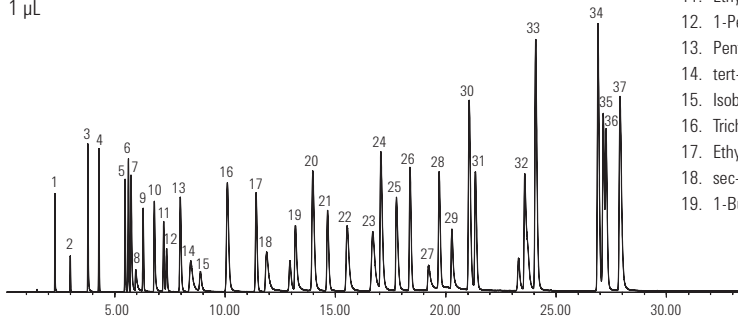
**Carrier:** Helium, 1.5 mL/min

**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  $\mu$ L



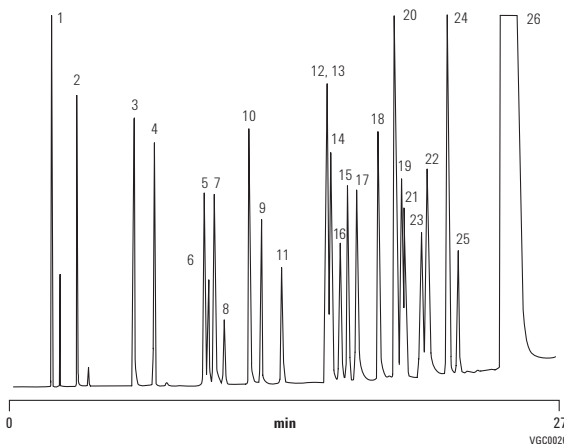
- |                        |                            |
|------------------------|----------------------------|
| 1. Methyl alcohol      | 20. Benzene                |
| 2. Acetaldehyde        | 21. Hexane                 |
| 3. Ethanol             | 22. 1,4-Dioxane            |
| 4. Acetonitrile        | 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



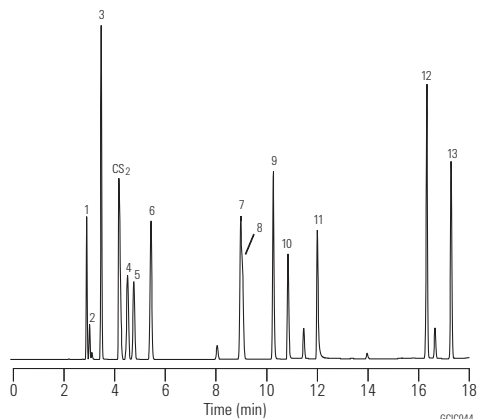
### Nitrogen-based Solvents I

**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

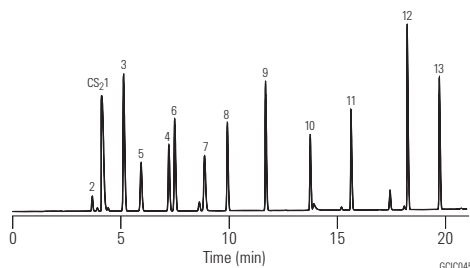
**Suggested Supplies**

**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

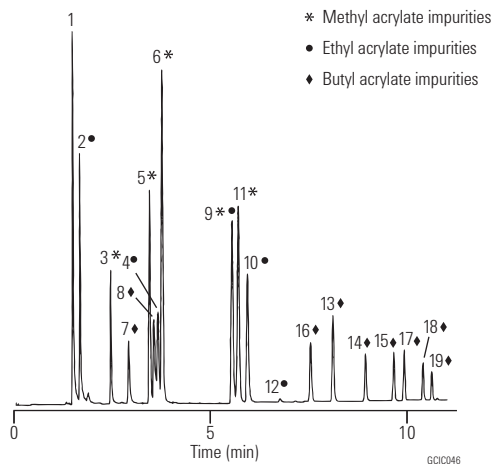
**Suggested Supplies**

**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

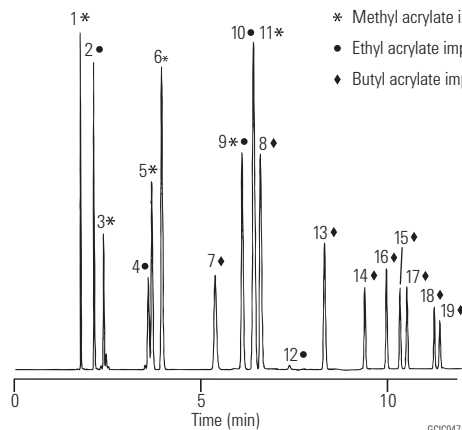
**Oven:** 35 °C for 5 min,  
35-200 °C at 10 °C/min

**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

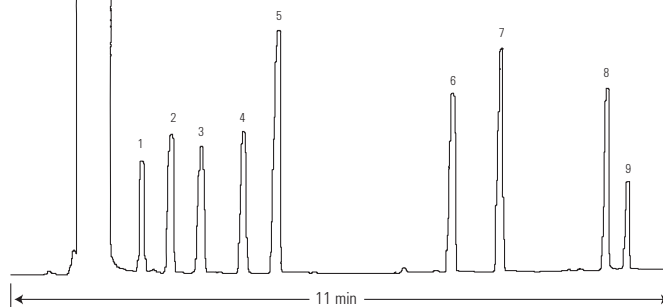
**Carrier:** Hydrogen

**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 µm

**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

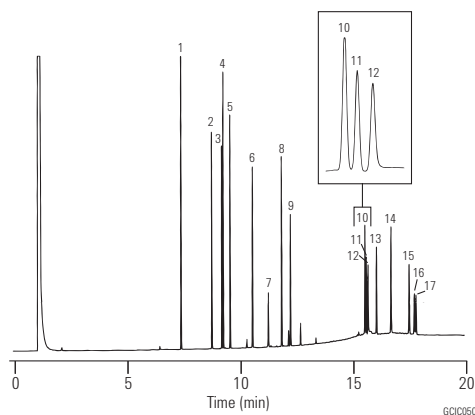
**Injection:** Splitless, 280 °C  
0.50 min purge activation time

**Detector:** FID, 320 °C  
Nitrogen makeup gas at 30 mL/min

**Sample:** 1 µL 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 µL 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 µm

**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

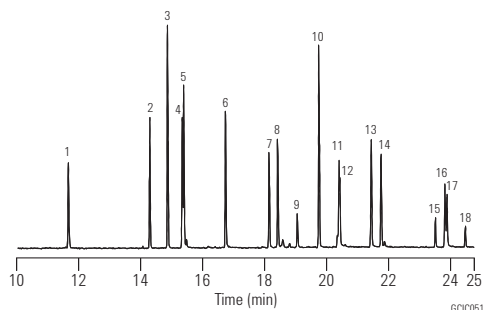
**Injection:** Splitless, 250 °C  
30 s purge activation time

**Detector:** MSD, 325 °C transfer line

**Sample:** 1 µL of 25 ng/µL 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 µL 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

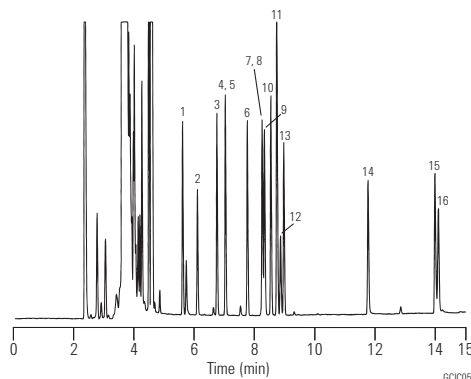
**Injection:** Split, 250 °C  
Split ratio 1:50

**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

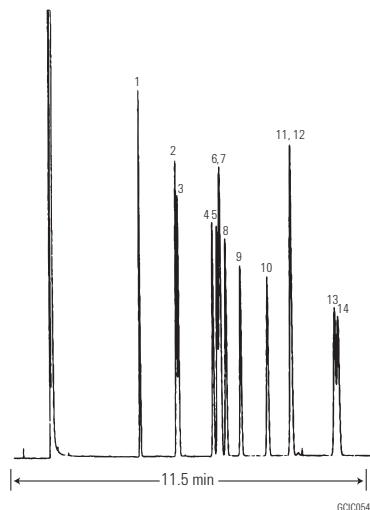
**Oven:** 165 °C isothermal

**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

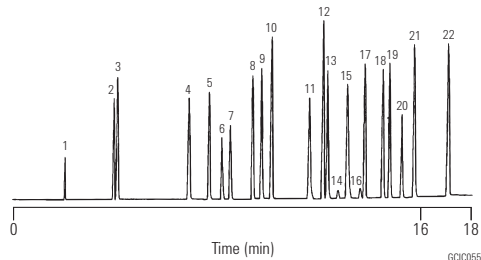
**Sample:** 1 µL

**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 <sub>4</sub>                                  | 12. cis-ClCH=CHCl                                     |
| 2. CHClF <sub>2</sub> (Freon 22)                    | 13. CHCl <sub>3</sub>                                 |
| 3. CCl <sub>2</sub> F <sub>2</sub> (Freon 12)       | 14. CCl <sub>4</sub>                                  |
| 4. ClCF <sub>2</sub> CF <sub>2</sub> Cl (Freon 114) | 15. CCl <sub>4</sub>                                  |
| 5. CHCl <sub>2</sub> F (Freon 21)                   | 16. CCl <sub>4</sub>                                  |
| 6. CCl <sub>3</sub> F (Freon 11)                    | 17. CH <sub>3</sub> CH <sub>2</sub> I                 |
| 7. CF <sub>2</sub> Br <sub>2</sub> (Freon 12B2)     | 18. CH <sub>2</sub> Br <sub>2</sub>                   |
| 8. CH <sub>3</sub> I                                | 19. CHCl <sub>2</sub> Br                              |
| 9. CH <sub>2</sub> Cl <sub>2</sub>                  | 20. C <sub>4</sub> F <sub>9</sub> I                   |
| 10. trans-ClCH=CHCl                                 | 21. CHClBr <sub>2</sub>                               |
| 11. CF <sub>3</sub> CCl <sub>3</sub> (Freon 113)    | 22. CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> I |

**Ethylene Oxide**

**Column:** DB-WAX  
122-7032  
30 m x 0.25 mm, 0.25 µm

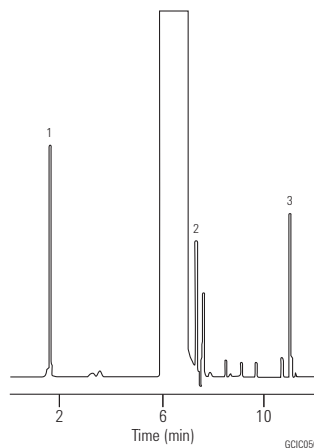
**Carrier:** Helium at 1 mL/min

**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

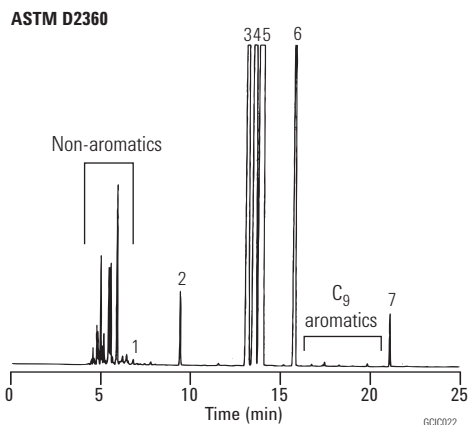
**Column:** DB-WAXetr  
123-7362  
60 m x 0.32 mm, 0.25 µm

**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

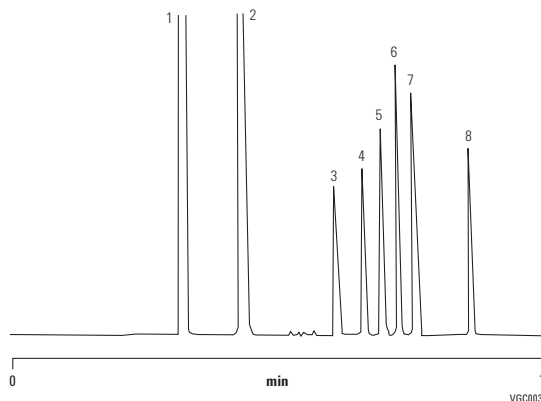
**Sample Conc:** 10-20%

**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

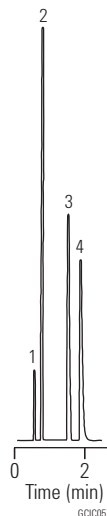
**Carrier:** Helium at 45 cm/s

**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 µm

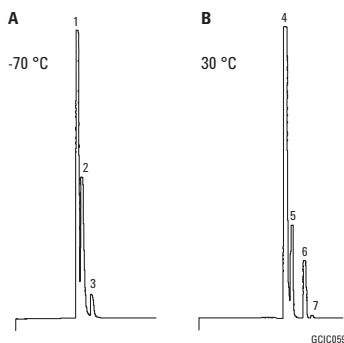
**Carrier:** Helium, 35 cm/s

**Oven:** A: -70 °C isothermal  
B: 30 °C isothermal

**Injection:** Split ratio 25:1

**Detector:** FPD, 535 µm filter

**Sample:** 1 µL



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

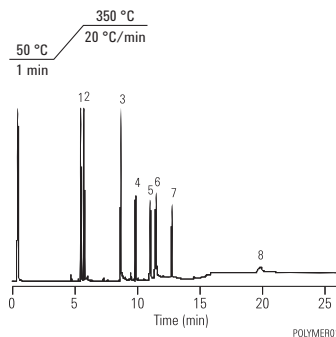
### Polymer Additives

**Column:** HP-35 (use only 10 m)  
19091G-013  
30 m x 0.32 mm, 0.15 µm

**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 µL 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

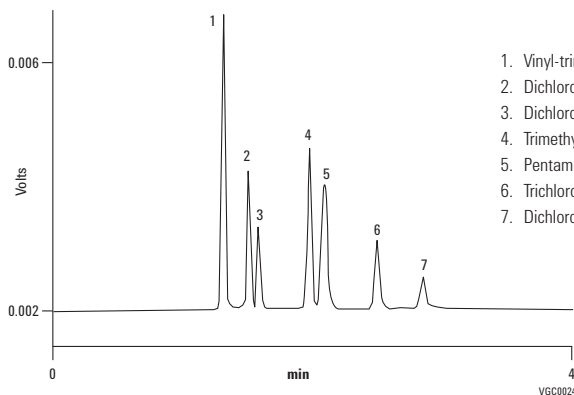
**Column:** VF-200ms  
CP8860  
30 m x 0.25 mm, 1.00 µm

**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

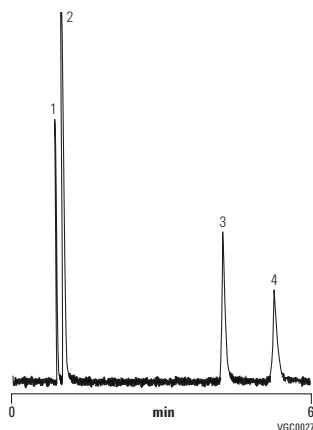
Sample: ±100 ppm

Carrier: H<sub>2</sub>

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 Al<sub>2</sub>O<sub>3</sub>  
CP7432  
50 m x 0.53 mm

Sample Conc: Approx 100 ppm in nitrogen, synthetic standard

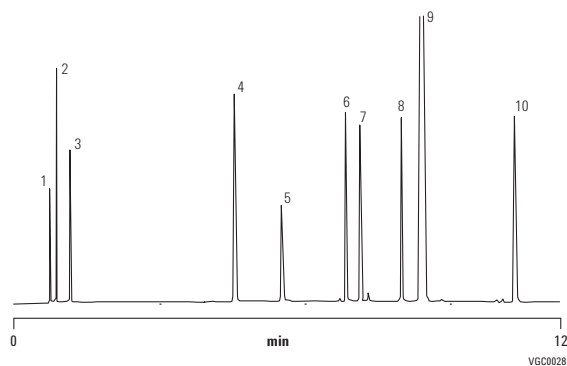
Carrier: Helium, 4 psig, 4 min to 11 psig, 0.5 psig/min, 2 min

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

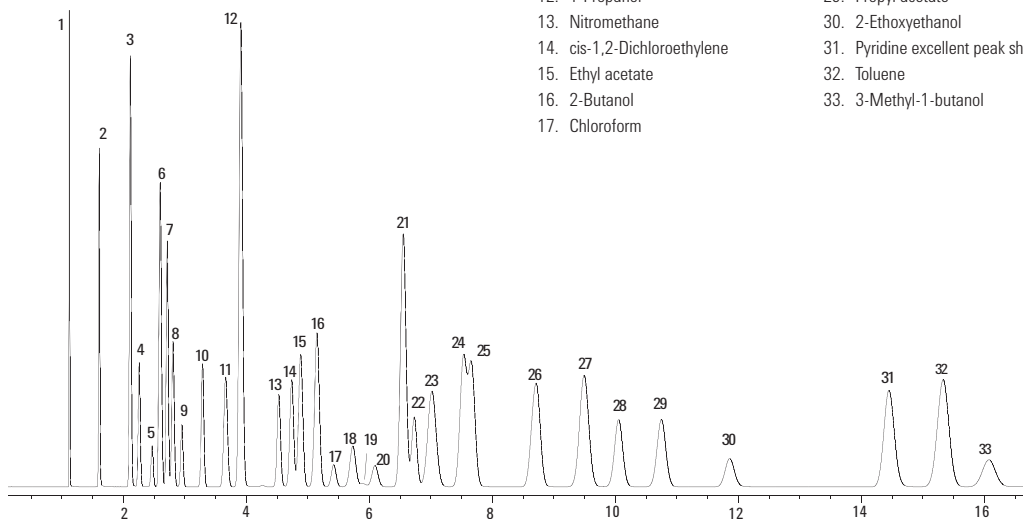
**Oven:** 40 °C 20 min hold, then 10°/min to 170 °C

**Injection:** 20 Hz

**Detector:** FID at 240 °C, H<sub>2</sub> at 30 mL/min  
Air at 400 mL/min  
N<sub>2</sub> 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

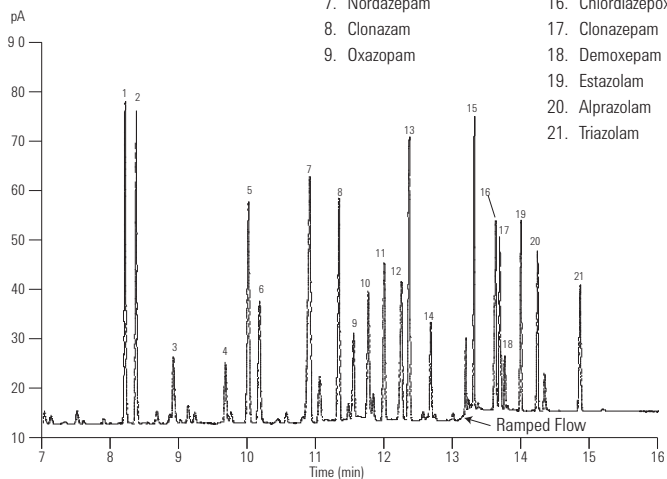
**Injection:** Pulsed splitless, 280 °C  
20 psi pulse pressure for 0.38 min  
50 mL/min purge at 0.40 min  
Direct connect liner (p/n G1544-80730)

**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

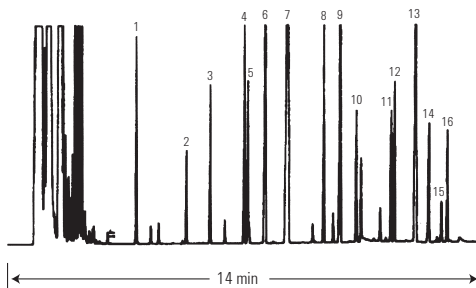
**Detector:** FID, 300 °C  
Nitrogen makeup gas at 30 mL/min

**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

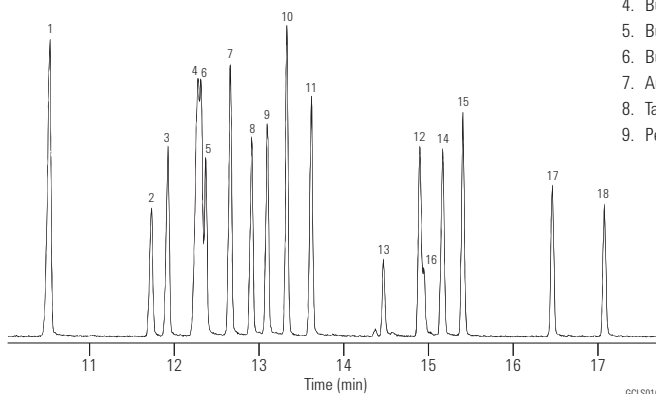
**Injection:** Splitless, 250 °C  
30 s purge activation time

**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. Barbitol      | 10. Methohexital        |
| 2. Allobarbitol  | 11. Secobarbital        |
| 3. Aprobarbitol  | 12. Hexobarbital        |
| 4. Butabarbital  | 13. Thiopental          |
| 5. Butethal      | 14. Cyclopentylbarbital |
| 6. Butalbital    | 15. Mephobarbital       |
| 7. Amobarbital   | 16. Thiamylal           |
| 8. Talbutal      | 17. Phenobarbital       |
| 9. Pentobarbital | 18. Alphenal            |



GCLS010

**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

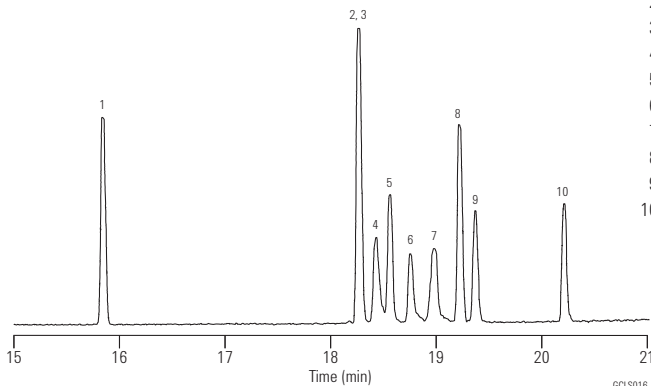
**Injection:** Splitless, 250 °C  
30 s purge activation time

**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              |



GCLS016

### 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

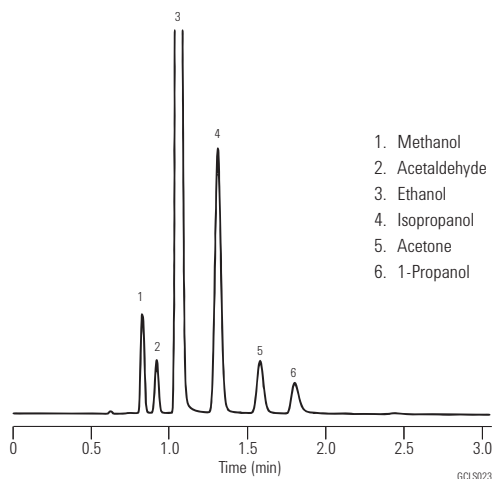
**Detector:** FID, 300 °C  
Nitrogen makeup gas  
at 23 mL/min

#### 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

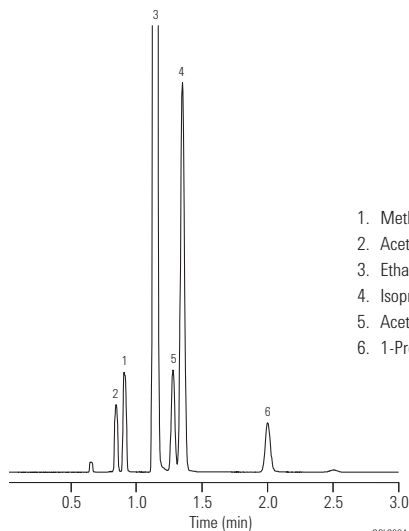
**Sample:** 0.1% Ethanol,  
0.001% Others

#### 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

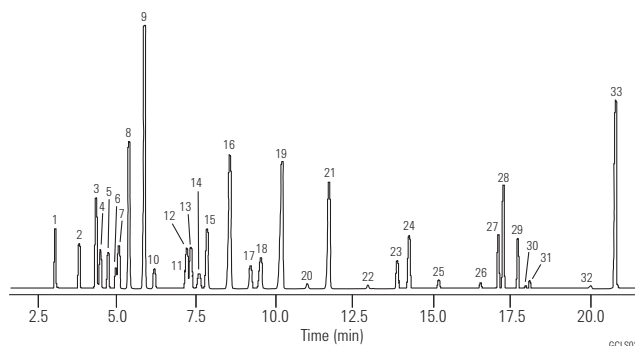
**Sampler:** Headspace  
Plate 140 °C  
Transfer line, valve 250 °C  
Sample loop 2 mL

**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)

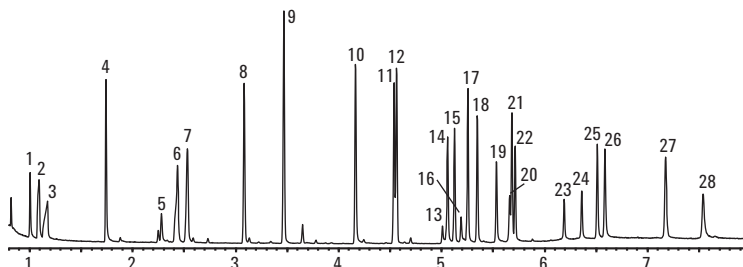
**Backflush:** Post run: 1 min 1 psi inlet, 75 psi aux EPC

**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 H<sub>2</sub> 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

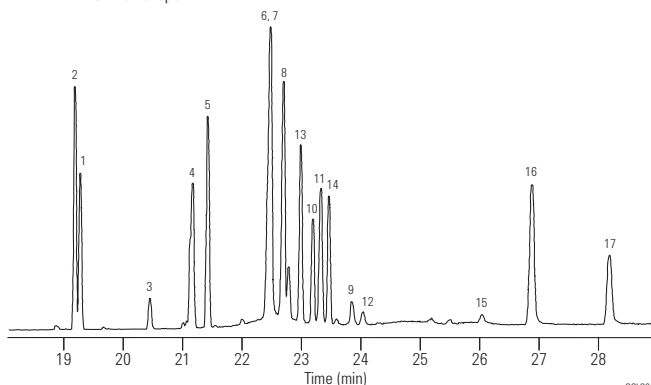
**Carrier:** Helium at 31 cm/s, measured at 50 °C

**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

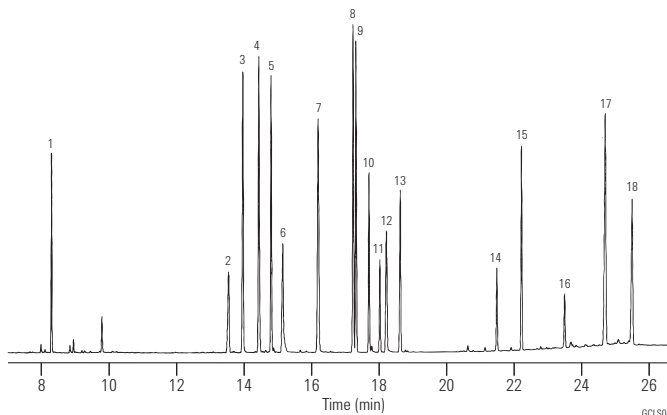
**Oven:** 50 °C for 1.0 min  
50-125 °C at 25 °C/min  
125-325 °C at 10 °C/min  
325 °C for 5 min

**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

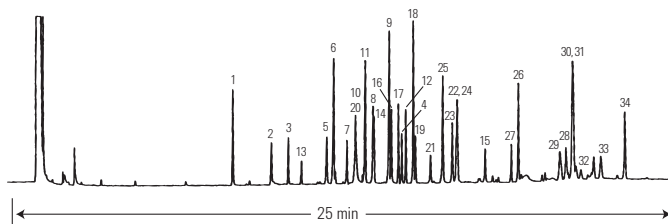
**Liner:** General purpose split/splitless liner, taper,  
glass wool, 5183-4711

**Seal:** Gold plated seal, 18740-20885

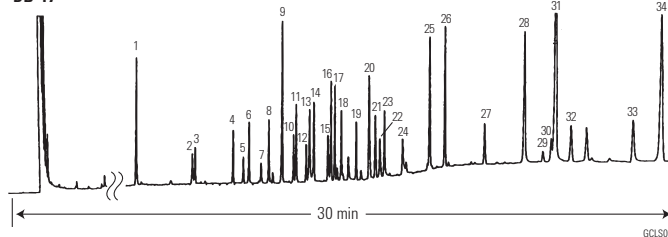
**Syringe:** 10 µL tapered, FN 23-26s/42/HP,  
5181-1267

	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. Aprobital	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



### Urine Drug Screen

**Column:** Ultra 2  
19091B-115  
50 m x 0.32 mm, 0.52 µm

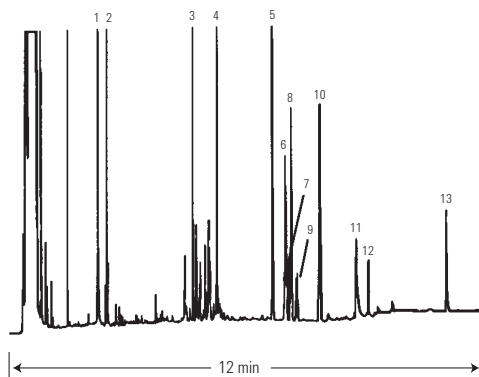
**Carrier:** Hydrogen, 80 cm/s

**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

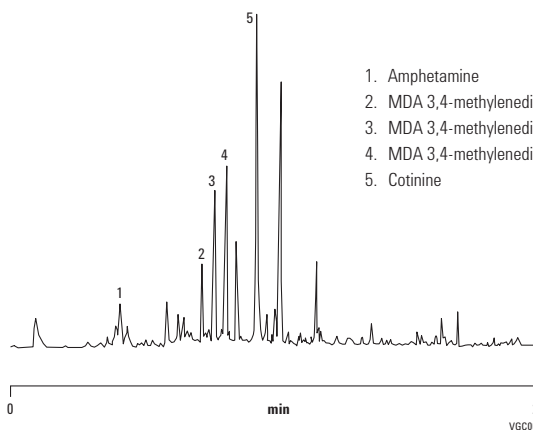
**Pressure:** 58.7 kPa, 2.2 min to 97 kPa, 58 kPa/min to 132 kPa,  
3 kPa/min to 180 kPa, 12 kPa/min

**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

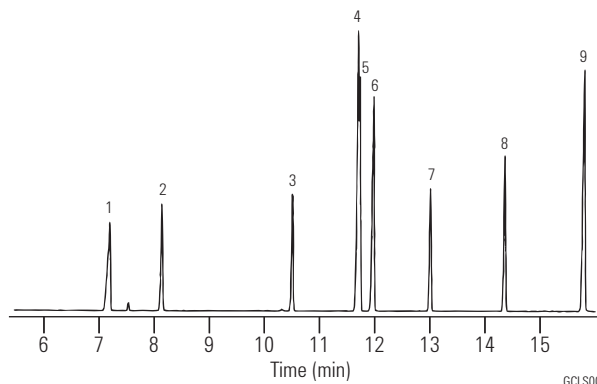
**Oven:** 55 °C for 1 min  
55-130 °C at 25 °C/min  
130-325 °C at 15 °C/min

**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

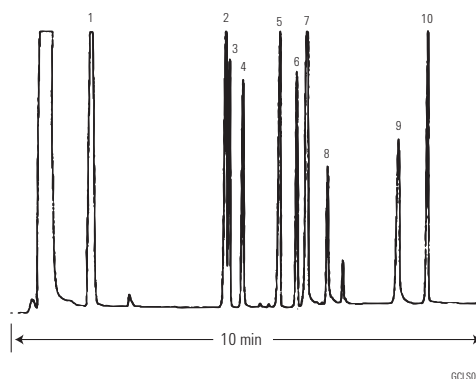
**Oven:** 160 °C for 2 min  
160-275 °C at 15 °C/min

**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 |                    |

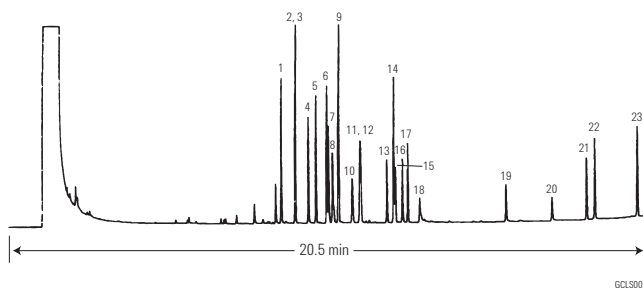
#### Suggested Supplies

**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



GCL5007

### Antiepileptic Drugs

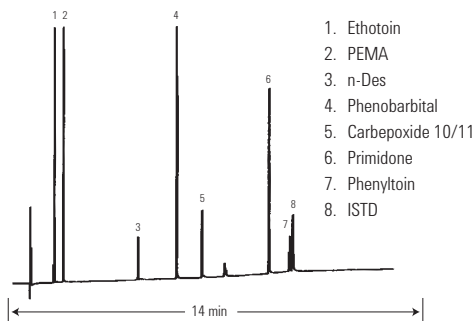
**Column:** Ultra 2  
19091B-012  
25 m x 0.32 mm, 0.17 µm

**Carrier:** Helium, 14 psi

**Oven:** 100-230 °C at 15 °C/min

**Injection:** Split ratio 35:1

**Detector:** NPD



GCL5009

#### 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

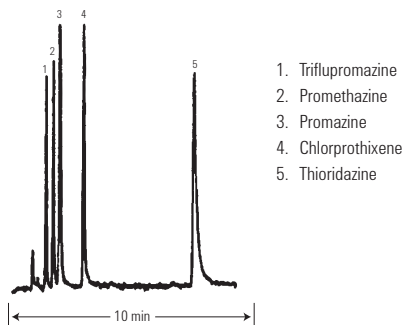
**Column:** Ultra 2  
19091B-011  
12 m x 0.20 mm, 0.33 µm

**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



GCL5009

#### 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 μm

**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 μL

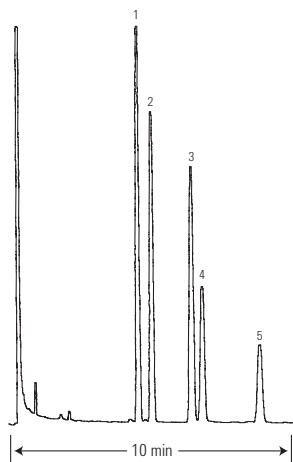
#### Suggested Supplies

**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. Fentanyl
2. Sufentanyl
3. Carfentanyl
4. Lofentanyl
5. Alfentanyl

GC1S012

### Tocopherols

**Column:** DB-17ms  
122-4732  
30 m x 0.25 mm, 0.25 μm

**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 μL of 1-10 ng/μL in isoctane

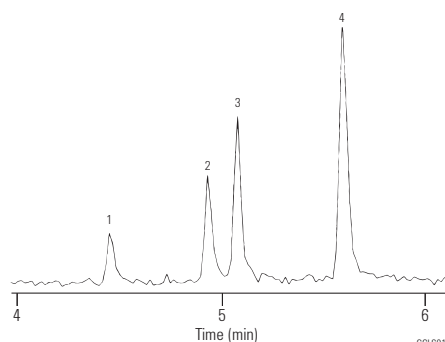
#### Suggested Supplies

**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 μL tapered, FN 23-26s/42/HP, 5181-1273



1. δ-Tocopherol
2. β-Tocopherol
3. γ-Tocopherol
4. α-Tocopherol

GC1S013

### 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

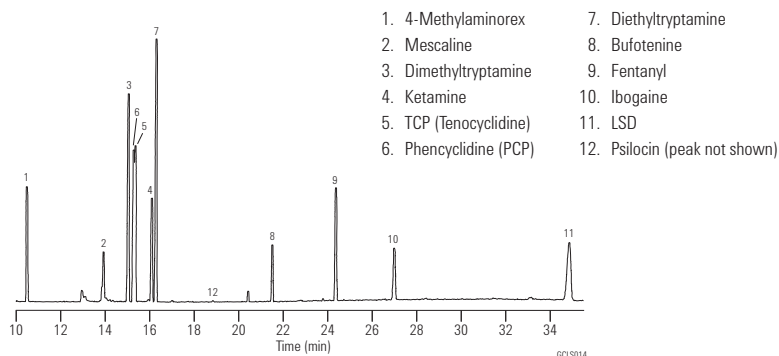
**Injection:** Splitless, 250 °C  
30 s purge activation time

**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

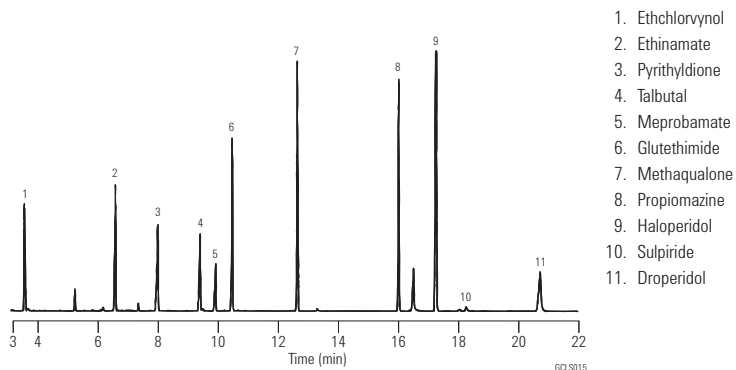
**Injection:** Splitless, 250 °C  
45 s purge activation time

**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

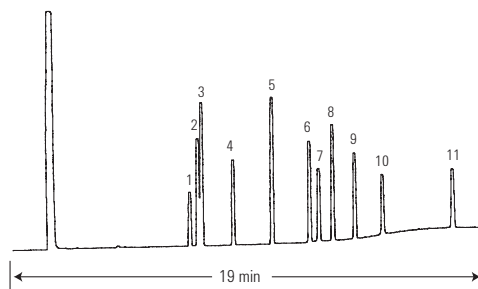
**Carrier:** Helium at 40 cm/s, measured at 140 °C

**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

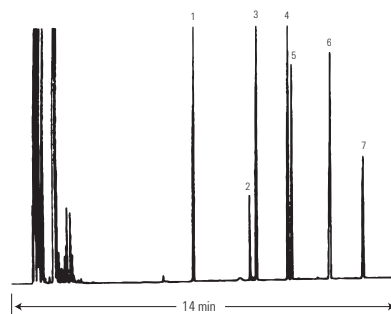
**Carrier:** Helium at 39 cm/s, measured at 100 °C

**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

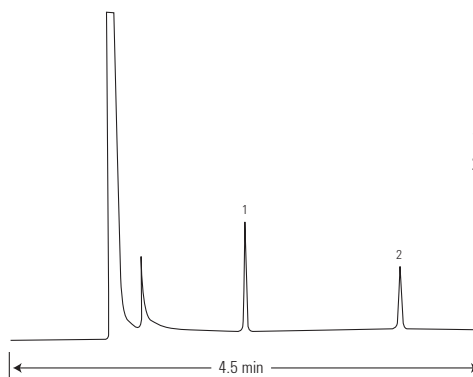
**Column:** DB-FFAP  
122-3232  
30 m x 0.25 mm, 0.25 µm

**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

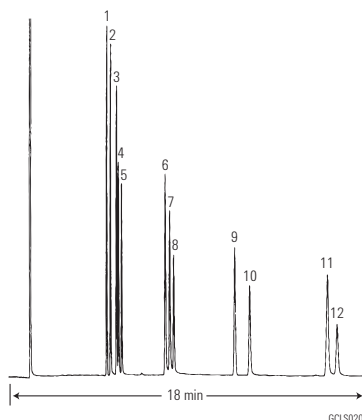
**Carrier:** Hydrogen at 44 cm/s

**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. Coprostanone (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

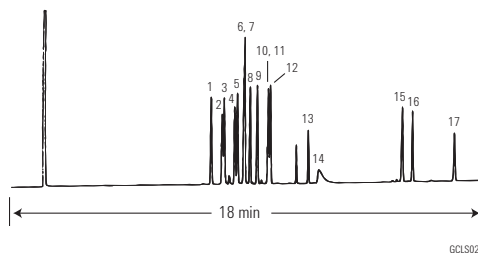
**Carrier:** Helium at 40 cm/s, measured at 180 °C

**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 ( $\Delta^9$ -THC) and Major Metabolites – TMS Derivatives**

**Column:** DB-5  
123-5032  
30 m x 0.32 mm, 0.25  $\mu$ 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  $\mu$ L of 0.1  $\mu$ g/ $\mu$ L each in pyridine

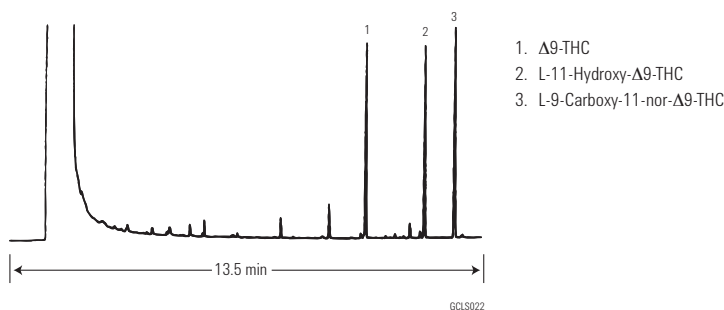
**Suggested Supplies**

**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  $\mu$ 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  $\mu$ 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

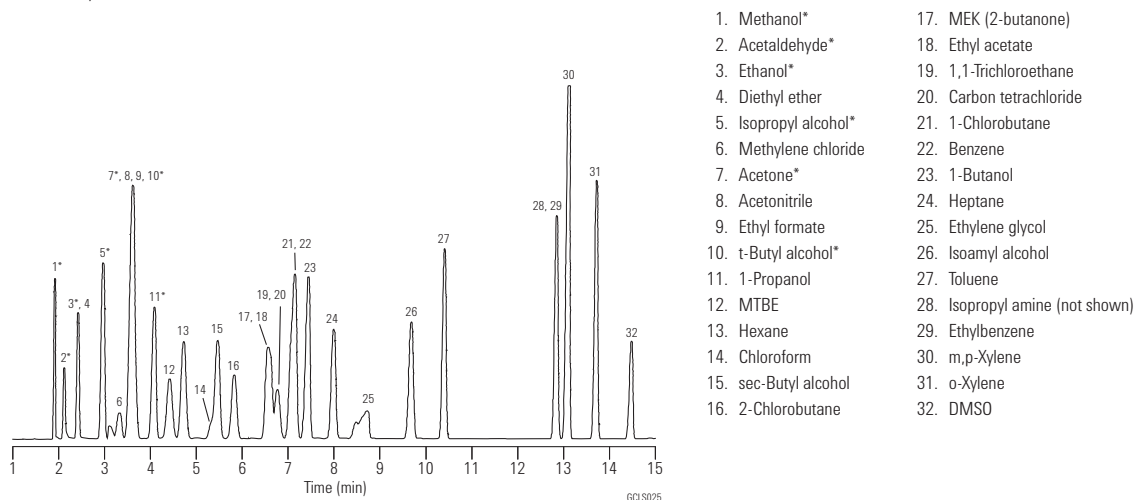
**Detector:** FID, 300 °C

**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

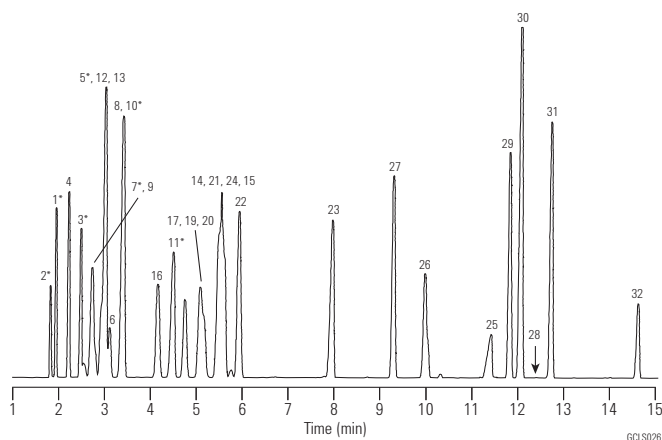
**Detector:** FID, 300 °C

#### Suggested Supplies

**Septum:** 11 mm Advanced Green septa, 5183-4759

**Liner:** Direct, 1.5 mm id, 18740-80200

**Seal:** Gold plated seal, 18740-20885



- |                       |                                 |
|-----------------------|---------------------------------|
| 1. Methanol*          | 17. MEK (2-butanone)            |
| 2. Acetaldehyde*      | 18. Ethyl acetate               |
| 3. Ethanol*           | 19. 1,1-Trichloroethane         |
| 4. Diethyl ether      | 20. Carbon tetrachloride        |
| 5. Isopropyl alcohol* | 21. 1-Chlorobutane              |
| 6. Methylene chloride | 22. Benzene                     |
| 7. Acetone*           | 23. 1-Butanol                   |
| 8. Acetonitrile       | 24. Heptane                     |
| 9. Ethyl formate      | 25. Ethylene glycol             |
| 10. t-Butyl alcohol*  | 26. Isoamyl alcohol             |
| 11. 1-Propanol        | 27. Toluene                     |
| 12. MTBE              | 28. Isopropyl amine (not shown) |
| 13. Hexane            | 29. Ethylbenzene                |
| 14. Chloroform        | 30. m,p-Xylene                  |
| 15. sec-Butyl alcohol | 31. o-Xylene                    |
| 16. 2-Chlorobutane    | 32. DMSO                        |

### Residual Solvents, USP 467

**Column:** DB-624  
125-1334  
30 m x 0.53 mm, 3.00 µm

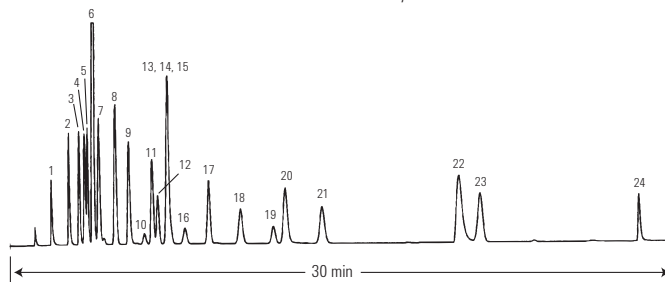
**Carrier:** Helium at 35 cm/s, measured at 40 °C

**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

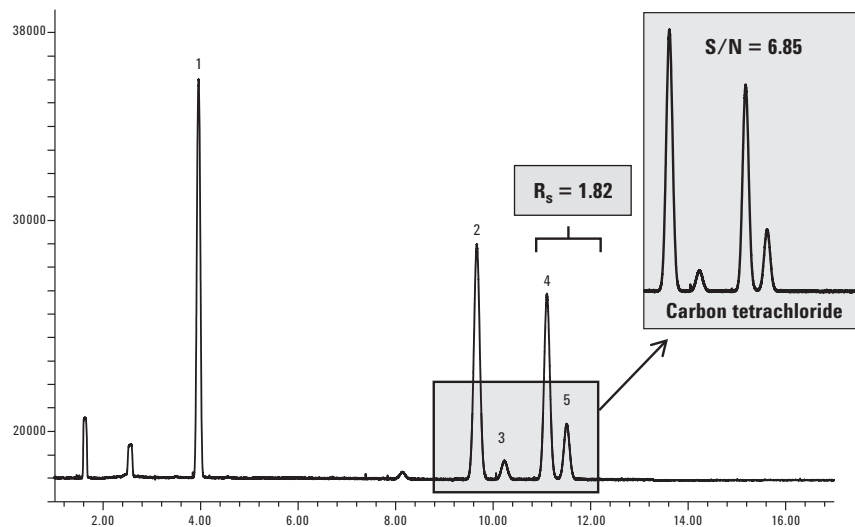
**Detector:** FID: 250 °C, H<sub>2</sub> 30 mL/min, air 400 mL/min,  
N<sub>2</sub> constant col + makeup = 30 mL/min

**Suggested Supplies**

**Septum:** Non-stick bleed and temperature optimized (BTO) septa, 11 mm, 50/pk, 5183-4757

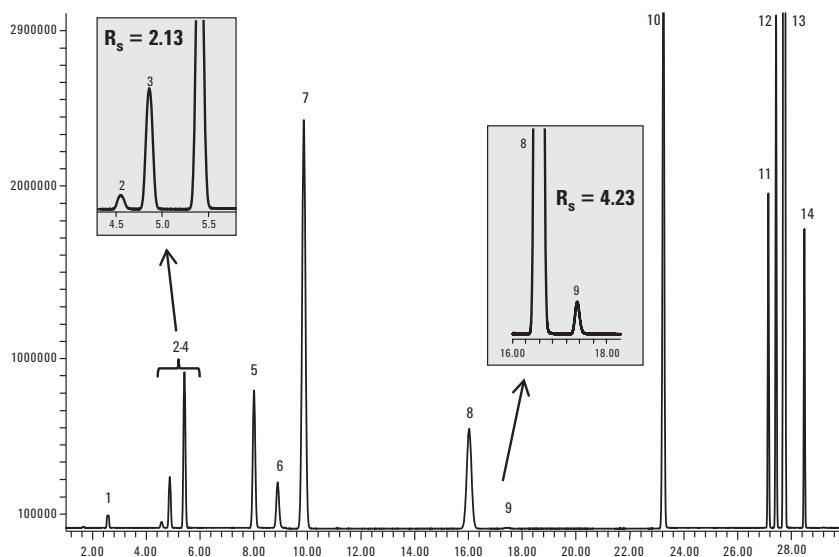
**Liner:** Liner, GC, Ultra Inert, straight, 1 mm id, 5190-4047

**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-133LTM.....	355, 460	19091S-133UI.....	271, 274, 290
19091A-015.....	327	19091J-202.....	332	19091N-136.....	278, 355	19091S-133UILTM.....	290, 460
19091A-101.....	327	19091J-205.....	332	19091N-136E.....	355	19091S-139.....	395
19091A-102.....	327	19091J-212.....	333	19091N-202.....	355	19091S-213.....	276, 282, 301
19091A-102E.....	327	19091J-213.....	333	19091N-205.....	355	19091S-213UI.....	290
19091A-105.....	327	19091J-213E.....	333	19091N-205E.....	355	19091S-213UILTM.....	290, 460
19091A-108.....	327	19091J-215.....	333	19091N-213.....	355	19091S-231.....	301
19091A-112.....	327	19091J-215E.....	333	19091N-213E.....	355	19091S-233.....	301
		19091J-216.....	333	19091N-216.....	281-282, 355		

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- $\beta$ -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 $\beta$	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  
 VF-5 Pesticides.....385  
 VF-5ht.....365  
 VF-5ms.....302-303  
 VF-624ms.....315  
 VF-DA.....415  
 VF-WAXms.....313-314  
 VF-Xms.....305  
 Metal Columns.....417  
**Column Selection**  
 Column Diameter.....256-257  
 Column Film Thickness.....260-261  
 Column Length.....258-259  
 Gas-Solid or PLOT Columns.....254  
 Polarity.....252-253  
 Selecting Stationary Phases.....248-251  
 Stationary Phase Selection Summary.....255  
 Custom Ordering.....481  
**Fused Silica Tubing**  
 Deactivated.....464-467  
 Undeactivated.....468  
**Guard Columns**  
 DuraGuard.....445  
 EZ-Guard.....446  
**Installation and Troubleshooting**  
 Causes of Column Performance  
 Degradation.....488-493  
 Evaluating the Problem.....494-495  
 Quick Reference Guide.....485-487  
**Troubleshooting Guides**  
 Baseline Instability or Disturbances.....496  
 Change in Peak Size.....498  
 Excessive Baseline Noise.....496  
 Loss of Resolution.....499  
 Retention Time Shift.....498  
 Split Peaks.....497  
 Tailing Peaks.....497  
**LTM Column Modules**.....447-463  
**Packed Columns**  
 0.1% SP-1000.....479  
 1.5% OV-101.....476  
 10% Carbowax 20M (G16, GS1).....471  
 10% Carbowax 20M (G16, GS1) + 2% KOH.....471  
 10% OV-101.....476  
 10% PEG-20M.....477  
 10% SE-30.....478  
 10% UC W982.....480  
 12% UC W982.....480  
 15% Carbowax 1540.....470  
 15% Hallcomid M-18.....472  
 15% SP-2100.....479  
 20% Carbowax 20M (G16, GS1).....471  
 20% OV-101.....476  
 20% PEG-20M.....477  
 20% Sebaconitrile.....479  
 20% Sebaconitrile/2% H3PO4.....479  
 20% TCEP.....480  
 25% DC-200 (500 cSt).....472  
 25% SP-2100.....479  
 30% DC 200/500.....472  
 30% DC-200 (500 cSt).....472  
 35% DC-200 (500 cSt).....472  
 5% Carbowax 20M (G16, GS1).....470  
 7% Carbowax M + 3% Polyphenolether  
 6 ring + 2% KOH.....471  
 Carbosieve S-II.....470

Carboxen-1000.....471  
 Chromosorb 101.....471  
 Chromosorb 102.....471  
 HayeSep A.....473  
 HayeSep D.....473  
 HayeSep DB.....473  
 HayeSep N.....473  
 HayeSep N + HayeSep R 1:1.....473  
 HayeSep P.....473  
 HayeSep Q.....474  
 HayeSep R.....474  
 HayeSep T.....474  
 MolSieve 13X.....476  
 MolSieve 5A.....475  
 Porapak N.....477  
 Porapak N + Porapak R 1:1.....477  
 Porapak Q.....478  
 Porapak OS.....478  
 Porapak R.....478  
 Porapak T.....478  
 Silica Gel.....479  
 Test Standards.....482-483

**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

MSD Contamination.....142-145  
 MSD Electron Multipliers and Replacement  
 Horn.....165  
 MSD Filaments.....162  
 Maintenance Schedule.....141  
 Quadrupole Mass Filter.....164  
 Recommended MS Interface Connections.....148  
**Standards**  
 Analyzer Kit Standards.....181  
 Test and Performance Samples.....182  
**Vacuum Systems and Pumps**.....166  
 Diffusion Pump.....168  
 Foreline Pump.....170  
 Pressure Symptoms.....166-167  
 Quiet Cover.....169  
 Vent Valve Supplies.....163  
**Inlet Liners**.....24-25  
**Specialty Injection**  
 Direct Connect.....32  
 MultiMode Inlet Heavy Matrix.....31  
 PTV.....32  
 Split, Original Deactivation.....29  
 Splitless, Original Deactivation.....30  
 Ultra Inert.....28  
**Inlet Septa**.....17  
 Advanced Green.....19  
 Bleed and Temperature Optimized (BTO).....18  
 General Purpose.....21  
 Long-Life.....19  
**Inlet Systems**  
 Cool On-Column.....78-80  
 Flip Top Inlet Sealing System.....68  
 Multimode.....76-77  
 Programmable Temperature Vaporizer (PTV).....81-87  
 Purged Packed.....88-91  
 Split/Splitless Inlet Seals.....67, 69-75  
 Large Valve Oven.....46  
 Liner O-rings.....33  
 Maintenance Schedule.....14-15  
 Markes Thermal Desorption.....65-66  
 Merlin Microseal.....22-23  
 Oven Exhaust Deflector.....123  
**Purge and Trap Systems**  
 Archon.....64  
 Teledyne Tekmar.....62-63  
**Sample Introduction Systems**  
 7693A Automatic Liquid Sampler.....50  
 7697A Headspace Sampler.....52-53  
 Automatic Liquid Sampler.....51  
 G1883A Network Headspace Sampler.....55  
 G1888A Network Headspace Sampler.....54  
 G3520A XLSI Accessory.....53  
**Syringes**.....183  
 7673/7683 On-Column Autosampler Syringes.....191  
 Blue Line Autosampler Syringes for 7693A ALS  
 Advanced Sample Enhancement.....188  
 Fitted Plungers.....187  
 PTFE-Tipped Plungers.....188  
**Gold Standard Autosampler Syringes**  
 Straight Needle, 23 and 26s Gauge.....190  
 Tapered Needle, 23-26s Gauge.....189  
 HP 7670/71/72 Autosampler Syringes.....191  
 Needle Gauge.....184  
 Needle Termination.....185  
 Needle Tip Design.....185  
**Valves and Loops**.....47-49

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 Fuels .....576  
 Environmental  
 Air Analysis.....549  
 Hydrocarbons.....501  
 Pesticides and Herbicides.....506  
 Semivolatiles .....532  
 Volatiles .....544  
 Food, Flavor and Fragrance.....554  
 Industrial Chemical .....602  
 Forensic Toxicology and Pharma .....635

**CrossLab Supplies**

Bruker, Varian GC Systems  
 Autosampler Syringes.....210  
 Capillary Column Ferrules .....209  
 Column Nuts .....210  
 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) Injector .....215  
 1177 Split/Splitless Injector.....213  
 Inlet Liners  
 1060/1061 Injector .....208  
 1075/1077 Injector .....208  
 1078/1079 Injector .....207-208  
 1093/1094 Injector .....207-208  
 1177 Injector .....206-220  
 Inlet Septa.....211-212  
 Liner O-rings .....208  
 Packed Column Ferrules.....210  
 CTC GC Autosamplers  
 Autosampler Syringes.....239  
 Column Ferrules.....195-196  
 Inlet Liners .....193-194  
 Inlet Septa .....199-201  
 Advanced Green .....203  
 Bleed and Temperature Optimized (BTO) .....202  
 General Purpose .....205  
 Long-Life.....204  
 Liner O-rings .....195

Perkin Elmer GC Systems  
 Autosampler Syringes.....225  
 Capillary Column Ferrules .....223  
 Column Nuts .....224  
 Inlet Liners  
 AutoSystem.....221-222  
 AutoSystem XL.....221-222  
 Clarus.....221-222  
 Inlet Septa.....226  
 Liner O-rings .....222  
 Packed Column Ferrules.....224  
 Shimadzu GC Systems  
 Autosampler Syringes.....232  
 Capillary Column Ferrules .....231  
 Column Nuts .....232  
 Inlet Liners  
 14 Systems .....230  
 17A Systems .....229  
 2010 and 2010 Plus Systems .....228  
 2014 Systems.....227  
 Inlet Septa.....233  
 Liner O-rings .....230  
 Packed Column Ferrules.....231  
 Syringes .....197-198  
 Thermo Scientific GC Systems  
 Autosampler Syringes.....236  
 Capillary Column Ferrules .....235  
 Column Nuts .....236  
 Inlet Liners  
 Focus Systems.....234  
 Trace Systems.....234  
 Inlet Septa.....237-238  
 Liner O-rings .....235



# 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 <sub>2</sub> , 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 <sub>1</sub> to C <sub>4</sub> Hydrocarbon Mix .....	580
C <sub>1</sub> and C <sub>2</sub> 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 <sub>2</sub> 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 <sub>4</sub> -C <sub>5</sub> 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

<b>H</b>			
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		
		<b>P</b>	
<b>I</b>		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
<b>L</b>		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
<b>M</b>		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
<b>N</b>		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		<b>R</b>	
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	
<b>O</b>		(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	<b>S</b>	
Organochlorine Pesticides IV.....	523	Sedative Hypnotics.....	646
Organochlorine Pesticides		Selected Oxygenates.....	582
to EPA 625 via GC/MS.....	529	Semivolatiles 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
		<b>T</b>	
		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
		<b>U</b>	
		US EPA Method 8061 (Phthalate Esters).....	539
		Underivatized Drugs of Abuse –	
		Agilent Fast Toxicology Analyzer.....	639
		Unleaded Gasoline.....	501, 577
		Urine Drug Screen.....	642
		<b>V</b>	
		Volatile Amines.....	608
		<b>Y</b>	
		Ylang Ylang Oil.....	566

# Compound Index

<b>A</b>			
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 $\alpha$ -Androstan-17 $\alpha$ -ol-3-one (stanolone)	648
Acenaphthylene	503, 518, 532, 538	Androsterone	648
Acephate	531, 562	5- $\beta$ -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>B</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[b]fluoroanthene	540
Amyl acetate	554, 569, 617-618	Benzo[c]fluorene	505
Amyl alcohol	554	2,3-Benzofluorene	540
n-Amyl alcohol	568	Benzo[g,h,i]perylene	503, 505, 518, 532, 538, 540
Amyl butyrate	569	Benzo[a]pyrene	503, 518, 532, 538, 540
Amyl cinnamic alcohol	561	Benzo[e]pyrene	540
Amyl cinnamyl alcohol	563	Benzoic acid	538
Amyl cinnamyl aldehyde	561	Benzonitrile	610, 626-627
n-Amyl mercaptan	592	Benzophenone	558-559
		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
		$\alpha$ -Bergamotene	556
		trans- $\alpha$ -Bergamotene	564
		$\alpha$ -BHC	506, 508, 511, 513-514, 518, 520-525, 529-530
		$\beta$ -BHC	506, 508, 511, 513-514, 518, 520-525, 529-530
		$\delta$ -BHC	506, 508, 511, 513-514, 518, 520-525, 529-530
		$\gamma$ -BHC	506, 508, 511, 513-514, 518, 520-525, 529-530
		BHEB	633
		BHT	561, 567, 633
		Bifenthrin	519
		Bioallethrin	519
		Biphenyl	540
		$\beta$ -Bisabolene	559, 564, 566
		$\alpha$ -Bisabolol	556
		Borneol	556, 558-560, 567
		Borneol acetate	556
		Bornyl acetate	557-558
		$\alpha$ -Bourbonene	555
		$\beta$ -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-Butadiene	586-587, 634	Butyl ethyl ether	619	Cetearyl octanoate	558-559	
1,3-Butadiene	553, 584-591, 634	Butyl heptanoate	618	Chloral hydrate	509, 547	
Butalbitol	637	1-Butyl mercaptan	592	Chloramben	512	
Butanal	611	n-Butyl mercaptan	592	Chlorcyclizine	641, 644	
1,3-Butandiol	619, 622	tert-Butyl mercaptan	581, 592	$\alpha$ -Chlordane	506, 508, 511, 513-514, 518, 520-524, 529-530	
1,4-Butandiol	619	sec-Butyl methacrylate	628	$\gamma$ -Chlordane	506, 508, 511, 513-514, 518, 520-524, 529-530	
2,3-Butandiol	619	Butyl methyl ether	619	Chlordiazepoxide	636	
Butane	599, 601	tert-Butyl methyl ether (MTBE)	553	Chloroacetic acid	543	
iso-Butane	583, 590-591	Butyl propionate	618, 627-628	Chloroacetonitrile	515, 517, 548	
n-Butane	577, 580, 583-590, 596, 634	4-tert-Butyltoluene	614-615	2-Chloroaniline	610, 629	
n-Butane/cis-2-butene	591	Butyl valerate	618	3-Chloroaniline	610, 629	
1,3-Butanediol	620	2-Butyne (dimethylacetylene)	586-587	4-Chloroaniline	538, 610, 629	
1,4-Butanediol	620	1-Butyne (ethylacetylene)	586-587	Chlorobenzene	515, 517, 544-546, 548-549, 553, 604, 614-615, 623, 625, 651	
2,3-Butanediol	620	2-sec-Butyl-4,6-dinitrophenol (dionseb)	542, 543	Chlorobenzene-d5	550, 553, 549	
2,3-Butanedione (VDK)	554	Butyraldehyde	600, 612	Chlorobenzilate	508, 511, 518, 520-521, 524, 529-530	
2,3-Butanedione (diacetyl)	558-559	Butyric acid	570, 607-608, 611	4-Chlorobenzonitrile	610	
1-Butanethiol	578-579, 581, 591	iso-Butyric acid	611	2-Chlorobiphenyl	518	
Butanol	626-628	n-Butyric acid	509	1-Chlorobutane	515, 517, 548, 603, 622, 649-650	
1-Butanol	515, 554, 595, 600, 602, 605-606, 625, 649-650	Butyric acid methyl ester	572, 573	2-Chlorobutane	649-650	
2-Butanol	554, 635, 639	<b>C</b>			Chlorodibromoacetic acid	543
iso-Butanol	606	Cadinene	564	1-Chloro-1,1-difluoroethane	527	
n-Butanol	568, 624, 650	$\delta$ -Cadinene	557-559, 566	Chlorodifluoromethane	527	
sec-Butanol	568, 595, 602, 605, 624, 650	$\gamma$ -Cadinene	556-557	2-Chloro-4,6-dinitroaniline	629	
tert-Butanol	595, 602, 605, 624, 650	Caffeine	636, 640-641, 647	Chloroethane	515, 517, 527, 544-546, 548-549, 553	
2-Butanone (MEK)	515, 517, 548, 550, 553, 600, 612, 626, 639	Camphene	556, 558-559, 560, 564, 567	2-Chloroethanol	515, 631	
2-Butanthiol	581	Camphor	556, 558-559, 597	bis(2-Chloroethoxy) methane	538	
Butene	617	Capric acid methyl ester	561, 572, 573	bis(2-Chloroethyl) ether	538	
Butene-1	584, 586-587	Caproic acid methyl ester	561, 572, 573, 607	2-Chloroethyl vinyl ether	544	
1-Butene	584-585, 588-591, 617, 634	Caprylic acid methyl ester	561, 572, 573	1-Chloro-3-fluorobenzene	517, 544, 548	
cis-2-Butene	584-590	Captafol	508, 529-530	Chloroform	507, 509, 515, 517, 544-549, 553, 603, 622, 624, 635, 649-650	
trans-2-Butene	584-591	Captan	524, 529-530	1-Chlorohexane	515, 603, 622	
1-Butene/methyl acetylene	590	d-Carane	557	1-Chloro isooctane	623	
3-Buten-1-ol	602, 605	Carbamazepine	640, 643	3-Chloro isooctane	623	
2-Buten-1-ol (crotyl alcohol)	602, 605	Carbazole	538, 540	4-Chloro isooctane	623	
Butethal	637	Carbepoxide 10/11	644	bis(2-Chloroisopropyl) ether	538, 544	
Butylpentytin	537	Carbinoxamine	644	Chloromethane	515, 517, 527, 544-546, 548-549, 553	
2-Butoxyethanol	602, 605	Carbon dioxide	549, 552, 577, 583, 601, 605	4-Chloro-2-methylaniline	629	
bis(2-n-Butoxyethyl) phthalate	539	CO/air	552, 601	4-Chloromethyl 2,2'-dimethyl pentane	623	
Butyl acetate	617-618, 627-628	Carbon disulfide	517, 546, 548, 550, 553, 578, 579, 591	2-Chloro-5-methylphenol	541	
n-Butyl acetate	625	Carbon monoxide	582	4-Chloro-2-methylphenol	541	
sec-Butyl acetate	617-618	Carbon tetrachloride	507, 509, 515, 517, 544-549, 553, 603, 622, 635, 649-651	4-Chloro-3-methylphenol	528, 538, 541-543, 604	
n-Butylbenzene	517, 544, 546, 548, 576, 593, 597, 604, 632	Carbonyl sulfide (COS)	550, 577-579, 581, 591, 605, 634	2-Chloronaphthalene	538	
tert-Butyl acetate	617-618	Carbophenothion	524, 562	Chloroneb	508, 511, 518, 520-521, 524, 529-530	
Butyl acrylate	627-628	Carboxin	518, 525-526	2-Chloro-4-nitroaniline	629	
n-Butyl acrylate	628	tau-Cardinol	556	4-Chloro-2-nitroaniline	629	
n-Butyl alcohol	581, 625	3-Carene	556	1-Chloro-4-nitrobenzene	614-615	
s-Butyl alcohol	581	Carfentanyl	645	4-Chloro-3-nitrobenzotrifluoride	529-530	
sec-Butyl alcohol	624-625, 649-650	Carvacrol	560	Chloropentafluoroethane	527	
tert-Butyl alcohol	515, 581, 625, 649-650	cis-Carveol	563, 565	2-Chlorophenol	502, 528, 538, 541-543, 604, 630	
Butyl aldehyde	554, 581	trans-Carveol	555, 563, 565	3-Chlorophenol	502	
Butylate	518, 525	Carvone	565	4-Chlorophenol	502, 541	
Butylbenzene	515, 577, 608, 614-615	l-Carvone	555	4-Chlorophenyl-phenyl ether	538	
s-Butylbenzene	576, 593	Carvone phenylethyl acetate	558	Chloropicrin	509, 547	
sec-Butylbenzene	515, 517, 544-546, 548, 577, 593, 604, 614-615	cis-Caryyl acetate	555, 565	Chloroprene	544	
tert-Butylbenzene	515, 517, 544-546, 548, 576, 593, 601, 604, 614-615	Caryophyllene	556	2-Chloropropane	544	
Butyl benzyl phthalate	538, 539	$\alpha$ -Caryophyllene	566	2-Chloropropene	594	
Butyl caproate	618	$\beta$ -Caryophyllene	555, 557-559, 564-566	3-Chloropropene (allyl chloride)	553, 603, 622	
Butyl cellosolve	625	Caryophyllene oxide	556	3-Chloropropionitrile	515	
Butyl cellosolve acetate	625	Celestolide	558	Chloropropylate	508, 529-530	
Butylene	601	Cellosolve acetate	625			
Butyl ether	619	Cetearyl decanoate	558-559			

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- $\alpha$ -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	<b>D</b>		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	$\alpha$ , $\alpha$ -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
$\alpha$ -Copaene.....	555, 558-559, 566	1-Dehydrotestosterone acetate.....	648	Dichloroacetonitrile.....	509, 547
Coprostane (5- $\beta$ -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
$\alpha$ -Endosulfan.....	575	Ethyl dodecanoate.....	558-559	Fenarimol.....	518, 525
$\beta$ -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- $\alpha$ -Estradiol.....	648	Ethyl heptanoate.....	558-559	Fluridone.....	518, 525-526
$\beta$ -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	<b>G</b>	
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	$\alpha$ -Ethylphenethyl alcohol.....	602, 605	cis-Geraniol.....	556
bis(2-Ethylhexyl) adipate.....	518	$\beta$ -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	$\alpha$ -Gurjunene.....	566
		Eugenyl acetate.....	558-559		
		Eugenyl methyl ether.....	559		
				<b>H</b>	
		<b>F</b>		Halazepam.....	636, 640
		Farnesene.....	566	Haloperidol.....	646
		$\beta$ -Farnesene.....	556	Halothane.....	632
		t- $\beta$ -Farnesene.....	557	Helium.....	552
		trans- $\beta$ -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 epoxide .....506, 508, 511, 513-514,  
518, 520-525, 529-530, 542  
2,2',3,3',4,4',6-Heptachlorobiphenyl .....518  
Heptadec-1-ene .....558  
Heptadecane .....536  
n-Heptadecane .....597  
Heptadecanoic acid methyl ester .....572, 573  
cis-10-Heptadecenoic acid methyl ester .....572, 573  
Heptanal .....554, 611-612  
1,7-Heptandiol .....619, 620  
Heptane .....576, 593, 601, 616, 623,  
625, 639, 649-650  
n-Heptane .....553, 577, 588-589,  
596-597, 624, 635, 650  
Heptanoic acid .....570, 607, 611  
n-Heptanoic acid .....509  
1-Heptanol .....532, 602, 605-606  
2-Heptanol .....602, 605  
3-Heptanol .....602, 605  
2-Heptanone .....612  
3-Heptanone .....612  
4-Heptanone .....612  
cis-4-Hepten-1-ol .....602, 605  
trans-2-Hepten-1-ol .....602, 605  
Hercolyn D  
(tetrahydro & dihydro methyl abietate) .....558  
Heroin .....194, 637, 639-641, 647  
Hexabromobenzene (HBB) .....524  
Hexabromobiphenyl .....519  
Hexacosane .....503  
Hexachlorobenzene .....508, 518, 520, 524, 529-530, 538  
Hexachlorobezene .....511, 521  
2,2',4,4',5,6'-Hexachlorobiphenyl .....518  
Hexachlorobutadiene .....515, 517, 538, 544-546,  
548, 553, 603, 622  
Hexachloro-1,3-butadiene .....549  
 $\beta$ -Hexacholorcyclohexane .....575  
 $\delta$ -Hexacholorcyclohexane .....575  
 $\gamma$ -Hexacholorcyclohexane .....575  
Hexachlorocyclopentadiene .....508, 511, 518, 538,  
542, 603, 622  
Hexachloroethane .....515, 517, 538, 548, 603, 622  
Hexachloropentadiene .....529-530  
Hexadecane .....503  
n-Hexadecane .....249, 597  
Hexadecanoic acid .....570  
2,4-Hexadienal .....557  
Hexanal .....554, 611-612  
1,6-Hexandiol .....619  
Hexane .....517, 548, 599, 601, 623-626, 639, 649-650  
n-Hexane .....553, 577, 583-585, 588-589,  
596-597, 624, 635, 650  
1,6-Hexanediol .....620  
Hexanoic acid .....611  
Hexanol .....249, 251-252, 558-559  
1-Hexanol .....554, 602, 606  
2-Hexanol .....602, 605  
3-Hexanol .....602, 605  
2-Hexanone .....517, 548, 553, 612  
3-Hexanone .....612  
n-Hexatriacontane .....597  
Hexazinone .....518-519, 525-527  
Hexchlorocyclopentadiene .....520  
cis-2-Hexen-1-ol .....602, 605  
cis-3-Hexen-1-ol .....602, 605  
cis-2-Hexene .....588-589  
trans-2-Hexene .....588-589  
Hexobarbital .....637, 641  
Hexyl acetate .....558-559  
Hexyl butyrate .....556  
Hexyl cinnamaldehyde .....563  
Hexyl cinnamic aldehyde .....561  
Hexylene glycol .....558-559  
Hexyl 2-ethylhexyl phthalate .....539  
1-Hexyl mercaptan .....592  
n-Hexyl mercaptan .....592  
Hexyl methacrylate .....628  
 $\alpha$ -Humulene .....564  
Hydrocarbon .....616  
Hydrocodone .....639, 641  
Hydrogen oxide .....577  
Hydrogen sulfide .....550, 577-579, 581, 583,  
591, 592, 601, 605, 634  
Hydroxy acetate .....607  
Hydroxy citronellal .....558-559, 561, 563  
4-Hydroxy-4-methyl-2-pentanone .....602, 605  
Hydroxyphenamate .....641  
Hydroxypropionitrile .....515  
Hydroxypropyl acrylate .....628  
Hydroxyzine .....644
- I**
- Ibogaine .....640, 646  
Ibuprofen .....641, 647  
Imipramine .....642  
Indan .....596-597  
Indeno[1,2,3-c,d]pyrene .....503, 505, 518, 532, 538  
Inositol .....568  
Iodobenzene .....614-615  
Iodoform .....603, 622  
Iodomethane .....517, 544, 548, 603, 622  
Irgafos .....633  
Irganox .....633  
Isoamyl acetate .....554, 569, 617-618  
Isoamyl alcohol .....554, 568, 649-650  
Isoamyl butyrate .....569  
Isoamyl mercaptan .....592  
Isoamyl salicylate .....558, 560  
Isoborneol .....558-560, 567  
Isobutane .....584-589, 599  
Isobutanol .....515, 568, 581, 595, 602, 605, 626-628  
Iso-butene .....634  
Isobutyl acetate .....554, 558-559, 617-618, 624, 627-628  
Isobutyl acrylate .....627-628  
Isobutyl alcohol .....554  
Isobutyl aldehyde .....554, 581  
Isobutylbenzene .....577, 604, 614-615  
Isobutylene .....584-587  
Isobutyl mercaptan .....592  
Isobutyl propionate .....627-628  
Isobutyraldehyde .....582, 600, 612, 625  
Isobutyric acid .....509, 570, 607-608  
Isocaproic acid .....570, 607  
Isodrin .....508, 524, 529-530  
Isoeugenol .....563  
trans-Isoeugenol .....563  
Isomenthol .....557  
Isomenthone .....555, 557-559  
d-Isomethone .....565  
Isonox .....633  
Isooctane .....577, 588-589, 596-597, 623-624, 635  
Isopentane .....577, 584-589, 596  
Isopentanoic acid .....509  
Isophorone .....518, 538, 542  
Isoprene .....586-589  
Isopropanol .....554, 581, 602, 605,  
624-625, 638, 650  
Isopropyl acetate .....617-618, 624, 639  
Isopropyl acrylate .....627-628  
Isopropyl alcohol .....515, 553, 624-625, 649-650  
Isopropyl amine .....649-650  
Isopropyl benzene .....515, 517, 544-546, 548,  
577, 588, 589, 593, 604, 614-616  
Isopropyl ether .....619  
Isopropyl mercaptan .....592  
Isopropyl myristate .....558-559  
2-Isopropylphenol .....630  
Isopropyltoluene .....515  
4-Isopropyltoluene .....545-546  
p-Isopropyltoluene .....517, 544, 548  
Isovaleraldehyde .....581, 600  
Isovaleric acid .....570, 607
- J**
- Jasmolin I .....536  
Jasmolin II .....536  
cis-Jasmone .....555, 565
- K**
- Kelthane .....508, 529-530  
Kepone .....519  
Ketamine .....646, 647  
Krypton .....582
- L**
- L-9-Carboxy-11-nor- $\delta$ 9-THC .....649  
L-11-Hydroxy- $\delta$ 9-THC .....649  
Lactose .....569  
Lactulose .....569  
Lauric acid methyl ester .....572, 573  
Lavandulol .....556  
Lavandulyl acetate .....556  
Levulinic acid .....509  
Lidocaine .....640, 643, 647  
Lignoceric acid methyl ester .....572, 573  
Lilial .....561, 563  
Limonene .....555, 558-560, 563-564, 565, 567  
 $\delta$ -Limonene .....556-557, 564  
S-(-)-Limonene .....567  
Linalool .....555, 558-561, 563-567  
 $\beta$ -Linalool .....556  
Linalool acetate .....556  
cis-Linalool oxide .....558-559  
trans-Linalool oxide .....558-559  
Linalyl acetate .....558-560  
Linoleic acid methyl ester .....572, 573  
Linolelaidic acid methyl ester .....572, 573  
Linolenic acid methyl ester .....572, 573  
 $\gamma$ -Linolenic acid methyl ester .....572, 573  
Lofentanyll .....645  
Lorazepam .....636, 639-640  
Lormetazepam .....636  
Lyrall .....561  
Lyrall 1 .....563  
Lyrall 2 .....563  
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 enedioxyamphetamin.....	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	Methylenedioxyamphetamin (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-Octanediol.....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  
 Oxychlordane.....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-Pentanediol.....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](mailto: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.













































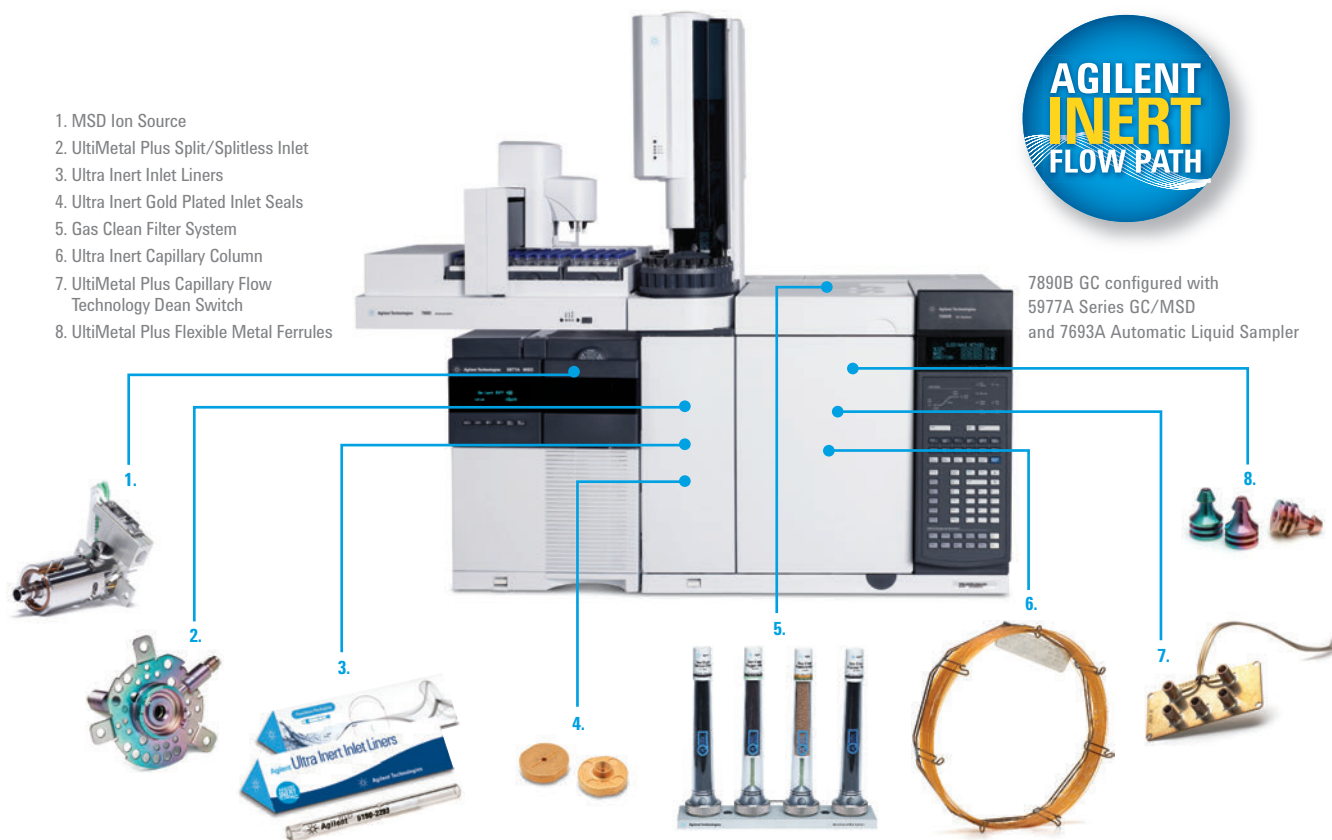
# ENSURING AN INERT GC FLOW PATH HAS NEVER BEEN MORE CRITICAL

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.

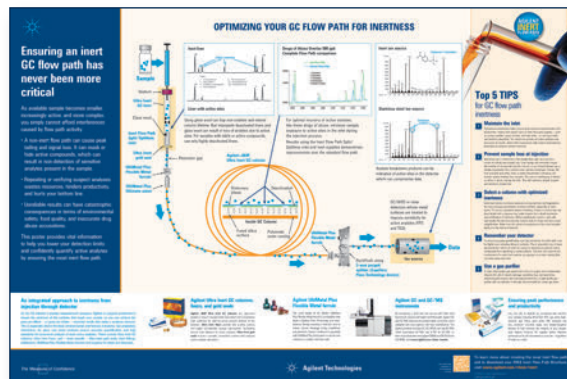
1. MSD Ion Source
2. UltiMetal Plus Split/Splitless Inlet
3. Ultra Inert Inlet Liners
4. Ultra Inert Gold Plated Inlet Seals
5. Gas Clean Filter System
6. Ultra Inert Capillary Column
7. UltiMetal Plus Capillary Flow Technology Dean Switch
8. UltiMetal Plus Flexible Metal Ferrules



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](http://agilent.com/chem/inert)



20  
15|16

**For more information**

Buy online:

[www.agilent.com/chem/store](http://www.agilent.com/chem/store)

Contact us:

[www.agilent.com/chem/contactus](http://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

