GC AND GC/MS

Your Essential Resource for Columns & Supplies

2015|16



Agilent Technologies

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.



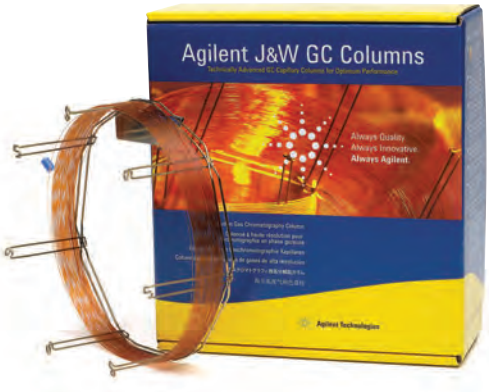
GC and GC/MS supplies

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

Agilent Solutions, Services and Support **4**

Featured Products **8**

Agilent Parts and Supplies **14**

GC and GC/MS Maintenance Schedule **14**

Bulk GC Supplies **16**

Inlet Septa **17**

Inlet Liners **24**

Agilent Ultra Inert Liners **26**

Capillary Column Ferrules and Nuts **34**

GC Column Connection Supplies **40**

Capillary Flow Technology Supplies **42**

Press-fit Capillary Column Connectors **44**

Graphpak Capillary Connectors **45**

Large Valve Oven **46**

Valves and Loops **47**

Sample Introduction Systems **50**

Agilent Vials and Closures for GC, GC/MS and GC/HS **56**

Headspace Vials and Closures **56**

High Performance Septa **57**

CombiPAL Headspace Vials and Closures **59**

Crimping and Decapping Tools **60**

Teledyne Tekmar Purge and Trap Supplies **62**

Markes Thermal Desorption **65**

Inlet Systems **67**

Split/Splitless Inlets **69**

Multimode Inlet **76**

Cool On-Column Inlets **78**

Programmable Temperature Vaporizer (PTV) Inlets **81**

Purged Packed Inlets **88**

Detector Systems **92**

Flame Ionization Detector (FID) **92**

Electron Capture Detector (ECD) **100**

Thermal Conductivity Detector (TCD) **103**

Flame Photometric Detector (FPD) **108**

Nitrogen Phosphorus Detector (NPD) **116**

Nitrogen and Sulfur Chemiluminescence Detectors **122**

GC Standards **124**

7820A GC System **125**

GC/MS Parts and Supplies **141**

MSD Contamination **142**

Ion Source **149**

MSD Filaments **162**

Vent Valve Supplies **163**

Gas Clean Filters **164**

Quadrupole Mass Filter **164**

MSD Electron Multipliers and Replacement Horn **165**

Vacuum Systems and Pumps **166**

Diffusion Pump **168**

Quiet Cover **169**

Foreline Pump **170**

7000 Triple Quadrupole GC/MS **171**

7200 Q-TOF for GC/MS **175**

240-MS Ion Trap Parts and Supplies **178**

220-MS Parts and Supplies **180**

GC/MS Standards **181**

Agilent Syringes **183**

Agilent CrossLab GC Parts and Supplies **192**
Product Introductions **193**
Supplies for Bruker, Varian GC Systems **206**
Supplies for PerkinElmer GC Systems **221**
Supplies for Shimadzu GC Systems **227**
Supplies for Thermo Scientific GC Systems **234**
Supplies for CTC GC Autosamplers **239**
Agilent J&W GC Columns **240**
Column Selection **247**
Column Selection Principles **247**
GC Column Application and Method Guides **262**
Agilent J&W Ultra Inert GC Columns **286**
Agilent J&W High Efficiency GC Capillary Columns **293**
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**

Applications **500**
Environmental **501**
Hydrocarbons **501**
Pesticides and Herbicides **506**
Semivolatiles **532**
Volatiles **544**
Air Analysis **549**
Food, Flavor and Fragrance **554**
Energy and Fuels **576**
Industrial Chemical **602**
Forensic Toxicology and Pharma **635**
Indices **652**
Ordering Information **684**



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 expresssion 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

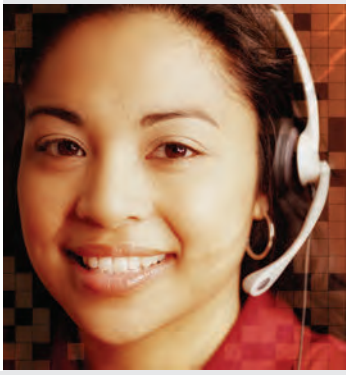
The Agilent Value Promise – 10 Years of Guaranteed Value

AGILENT VALUE PROMISE

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** 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**

Need more information?

Visit **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.





Agilent Analyzers and Application Kits

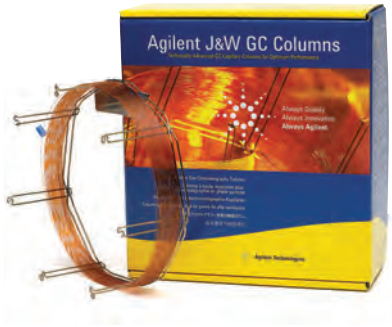
Bringing a new application online can stretch your lab to the limit. Agilent GC, Micro GC, GC/MS, and GC/MS/MS analyzers are factory preconfigured and pre-tested to get you up and running in the shortest possible time.

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
Gas Management		
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).
Sample Introduction and Inlets		
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

Item	Typical Schedule	Actions/Comments
Columns		
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.
Detectors		
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.
Mass Selective Detectors		
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



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

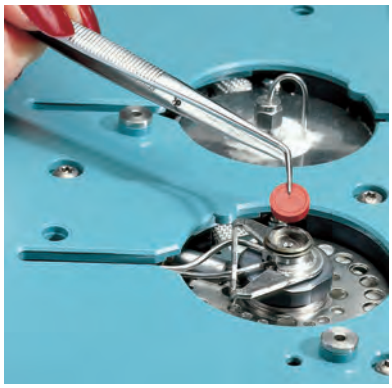
Ideal for high usage laboratories, our bulk supplies provide the quality and consistency of Agilent chromatography supplies in convenient and economical packaging. We currently offer Agilent inlet liners, septa, gold inlet seals, and liner O-rings in bulk packaging.

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

Bulk GC Supplies

Description		Unit	Part No.
Ultra Inert Liners			
	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
Liners			
	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
Seals			
Ultra Inert gold plated seal, includes washer		50/pk	5190-6149
Certified gold plated seal kit, includes washer		10/pk	5190-2209
O-Rings			
Non-stick fluorocarbon O-ring for Flip Top		100/pk	5190-2268
Certified non-stick fluorocarbon O-ring		100/pk	5190-2269
Septa			
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



Inlet 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

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

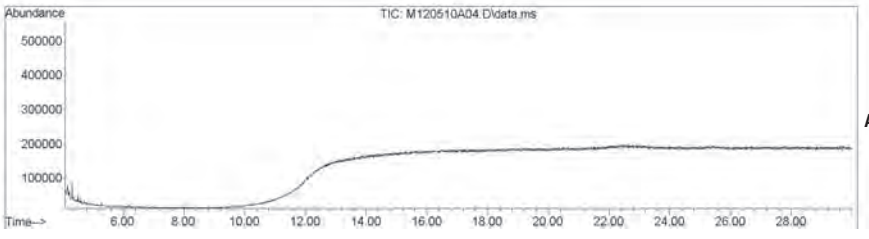


BTO septa, 5183-4757

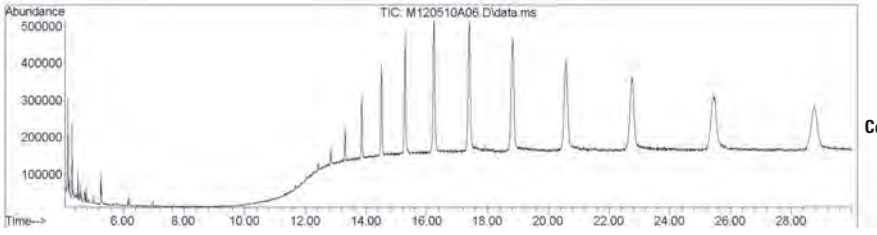
Non-Stick Bleed and Temperature Optimized (BTO) Septa

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



Agilent BTO Septa with CenterGuide



Competitor's High-Temperature Septa without CenterGuide

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

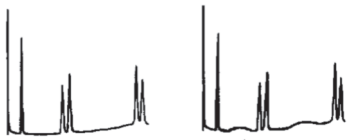
Non-Stick Long-Life Septa

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



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.



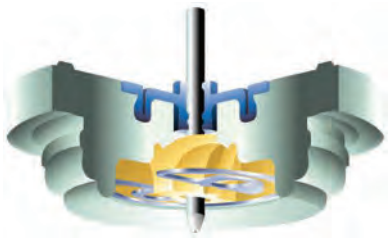
General purpose gray septa

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



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
General Purpose Merlin Microseal (3-100 psi)	
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
Low Pressure Merlin Microseal (1-45 psi)	
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.
For Bruker/Varian GCs*	
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
Syringes for Merlin Microseal	
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**





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.

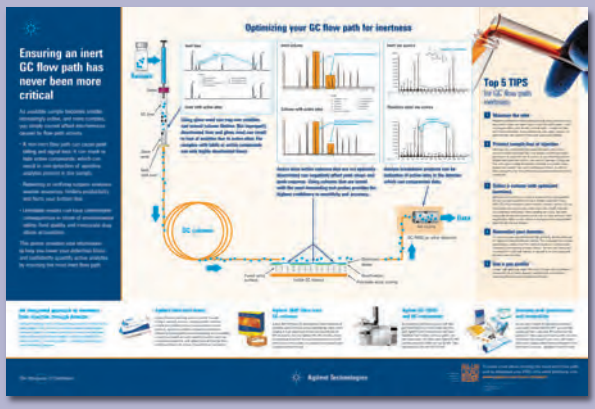
TIPS & TOOLS

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**



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
• Straight tubes used in split injection with autosamplers	• Directs sample onto head of column and limits analyte exposure to bottom of inlet • Minimizes decomposition and discrimination	• Contain sample within glass liner limiting contact with metal inlet surface • Thought to limit loss through septum purge

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.

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

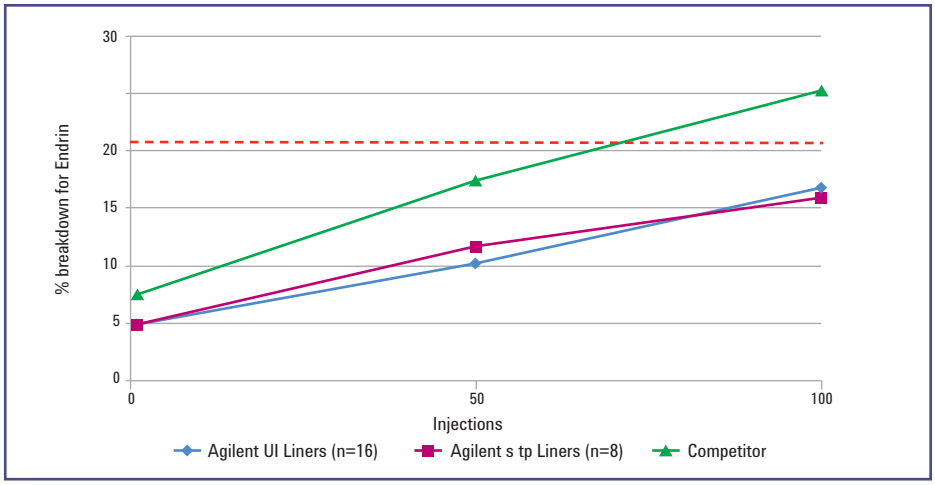


Agilent's proprietary manufacturing process produces Ultra Inert liners that are rigorously tested and certified to ensure exceptional batch-to-batch uniformity, low (to no) bleed or background contamination, and superior coverage – even with highly active compounds. This rigorous process includes:

- 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**



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*
Split Inlet Liners						
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
Splitless Inlet Liners						
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.

TIPS & TOOLS

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

Agilent Original Deactivation Split Liners

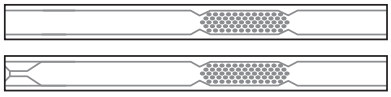
Description	Volume (µL)	ID (mm)	1/pk	5/pk	25/pk	100/pk
Single Taper Split Liners						
Single taper, glass wool, deactivated, low pressure drop	870	4	5183-4647	5183-4701	5183-4702	5190-2275
Single taper, glass wool, deactivated	870	4	5183-4711	5183-4712	5183-4713	
Straight Split Liners						
Straight,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



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**

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**

Agilent Original Deactivation Splitless Liners



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

Agilent Original Deactivation Splitless Liners

Description	Volume (µL)	ID (mm)	1/pk	5/pk	25/pk	100/pk
Single Taper Splitless Liners						
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
Double Taper Splitless Liners						
Double taper, deactivated	800	4	5181-3315	5183-4705	5183-4706	5190-2272
Straight Splitless Liners						
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		
Direct Inlet Liners						
Straight, non-deactivated (for gas samples, headspace, or purge & trap)	140	1.5	18740-80200	5183-4709	5183-4710	

TIPS & TOOLS

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

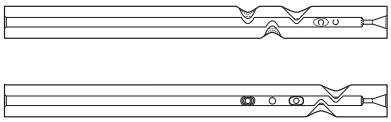
Turn to page 193.



Agilent Specialty Injection Liners

Agilent Specialty Injection Liners

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



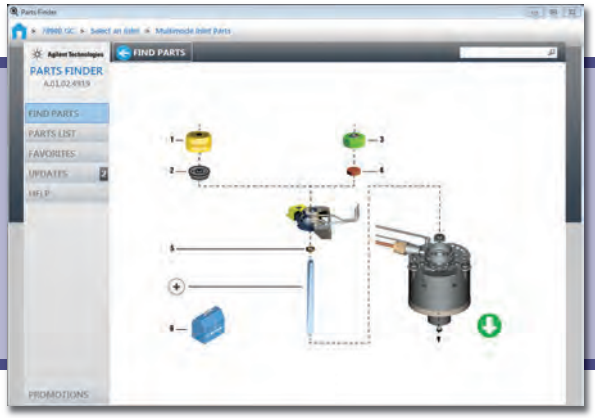
Single taper dimpled splitless liner, 5190-2296, 5190-2297

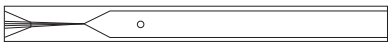


Straight split liner with cup, glass wool, and packing, 18740-60840

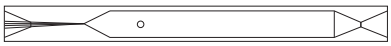
TIPS & TOOLS

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**





Single taper direct connect liner, G1544-80730



Dual taper direct connect liner, G1544-80700

Direct Connect

Description	ID (mm)	Part No.
Direct Connect		
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.
PTV Liners			
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
Liners for High Temperature PTV Inlet, G3506A			
PTV liner, high temperature, quartz	713	3.4	5188-5313
PTV liner, high temperature, borosilicate	668	3.4	5188-5356

Liner O-Rings



Liner O-rings, 5188-5365

- 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

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

Ferrule Type	Upper Temp. Limit	Usages	Advantages	Limitations
Graphite (100%)	450 °C	• General purpose for capillary columns • Suitable for FID and NPD • Recommended for high temperature and cool on-column applications	• Easy-to-use stable seal • Higher temperature limit • Can be removed easily	• Not for MS or oxygen-sensitive detectors • Soft, easily deformed or destroyed • Possible system contamination
Polyimide/graphite (85%/15%)	350 °C	• General purpose for capillary columns • Recommended for MS and oxygen-sensitive detectors • Most reliable leak-free connection	• Mechanically robust • Long lifetime	• Not reusable • Flows at elevated temperature • Must re-tighten frequently
Polyimide (100%)	280 °C	• Isothermal operation • Can be reused or removed easily • Excellent sealing material when making metal or glass connections	• Mechanically robust • Long lifetime • Can be reused or removed easily	• Leaks after temperature cycle • Flows at elevated temperature • Must re-tighten frequently
UltiMetal Plus Flexible Metal Ferrules	450 °C	• Designed for Capillary Flow Technology fittings • Compatible with Agilent inlet and detector fittings • Suitable with MS interface using the swaging nut G2855-20555	• Inert surface • Robust seal • Pre-swaged for precise height into fitting	Overtightening of stainless steel nut can damage fitting

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 recommened 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**



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.
Recommended	
Nut	
Self Tightening column nut, for MS interface	5190-5233
Ferrule	
250 µm Polyimide/graphite ferrule, 10/pk	5181-3323
320 µm Polyimide/graphite ferrule, 10/pk	5062-3514
Tools	
MS interface column installation tool	G1099-20030
Column installation tool for 5975T	G3880-20030
Traditional	
Nut	
MS interface column nut, female	05988-20066
Ferrule	
0.4 mm Polyimide/graphite ferrule, 10/pk	5062-3508
0.5 mm Polyimide/graphite ferrule, 10/pk	5062-3506
Tools	
MS interface column installation tool	G1099-20030
Column installation tool for 5975T	G3880-20030
Alternative	
Nut	
Swaging nut, for MS interface with Flexible Metal ferrules	G2855-20555
Ferrule	
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
Tools	
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**



Recommended Inlet Connections

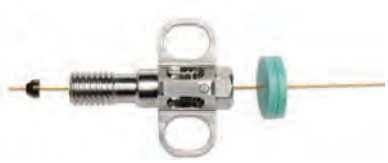
Description	Part No.
Recommended	
Nut	
Self Tightening column nut, for inlet/detector	5190-6194
Ferrule	
250 µm Polyimide/graphite ferrule, 10/pk	5181-3323
320 µm Polyimide/graphite ferrule, 10/pk	5062-3514
Tools	
Column installation pre-swaging tool, graphite ferrules	G3440-80217
Traditional	
Nut	
Universal column nut, 2/pk	5181-8830
Ferrule	
250 µm Polyimide/graphite ferrule, 10/pk	5181-3323
320 µm Polyimide/graphite ferrule, 10/pk	5062-3514
Tools	
Column installation pre-swaging tool, graphite ferrules	G3440-80217
Inert Flow Path	
Nut	
Column nut for long or long two-hole ferrules	05921-21170
Ferrule	
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
Tools	
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

GC Column Connection Supplies



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

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.

Column Nuts

Description	Part No.
Short Nuts	
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
Long Nuts	
MS interface column nut, female	05988-20066
Column nut for long or long two-hole ferrules	05921-21170
Accessories	
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.
Two Hole			
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
No Hole			
Capillary column long ferrule		10/pk	5181-3308
Capillary column short ferrule		10/pk	5190-4054
High Temperature PTV Inlet SS/Graphite			
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



Ultra Inert universal press fit connector, 5190-6979



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

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 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.
Capillary Detector Port Connector		
0.32/0.25	0.4	5021-7166
0.53	0.7	5021-7164
Capillary Divider for Simultaneous Sampling		
0.32/0.25	0.53	5021-7148
0.53	0.7	5021-7146
Capillary Injection Port Connector		
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.



Graphpak connector for Agilent capillary detectors



Graphpak divider for simultaneous sampling



Capillary injection port connector, 5021-7170

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



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**

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 G3440-20008	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	

A.



D.



B.



E.

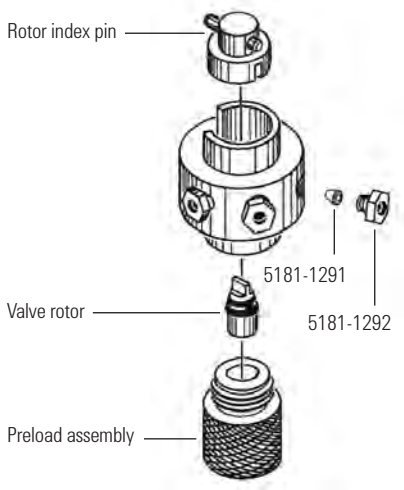


C.

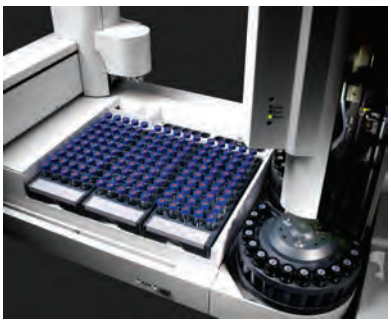


F.





Valve body, disassembled



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



Diffusion caps for 4 mL vials, 07673-40180

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

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 µL 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 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)	G4556-67010
UltiMetal Plus Inert sample probe	G4556-60125
6-port valve, replacement rotor, WT series, 300 psi, 350 °C	1535-4952
Standards	
OQ/PV Headspace Sample Contains 2 g/L t-butyl disulfide, 1,2-dichlorobenzene, and nitrobenzene in ethanol	5182-9733

(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.
Transfer Line Components	
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

Description	Part No.
Stainless Steel Sample Loops	
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
Probes and Unions	
Sample probe, deactivated	2322700011
M6 union, brass	2302533140
Union, zero dead volume, deactivated	2307230001
Union	2307232901
Transfer Line Needles and Unions	
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
Tubing	
Tubing, solenoids to 6-port valve, deactivated	410105017
Tubing, probe to 6-port valve, deactivated	1300502506
Transfer line, 1.45 m	G1890-60000
Standards	
OQ/PV Headspace Sample Contains 2 g/L t-butyl disulfide, 1,2-dichlorobenzene, and nitrobenzene in ethanol	5182-9733
PM Kits	
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

Description	Part No.
Needles	
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
Fittings	
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
Valves	
Restrictor, stainless steel	321-002-HSP
Valve, solenoid vent Kalrez	3600500001
Valve, solenoid vial pressurization	3600500002
Tubing and Transfer Lines	
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
Repair, Leak Test, and OQ/PV Supplies	
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
10 mL, 23 x 46 mm			
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	
20 mL, 23 x 75 mm			
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**

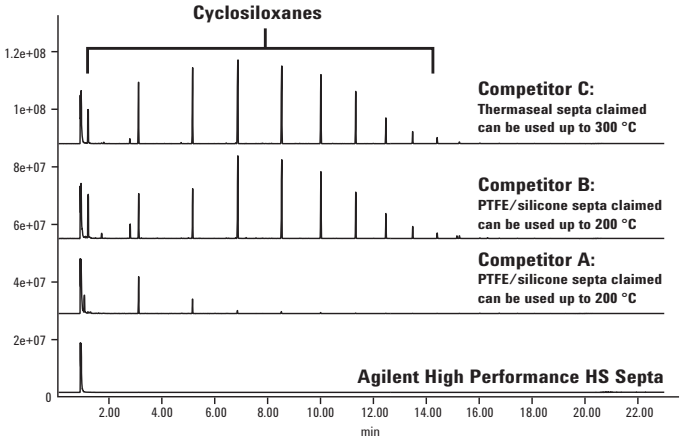


High Performance Septa

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

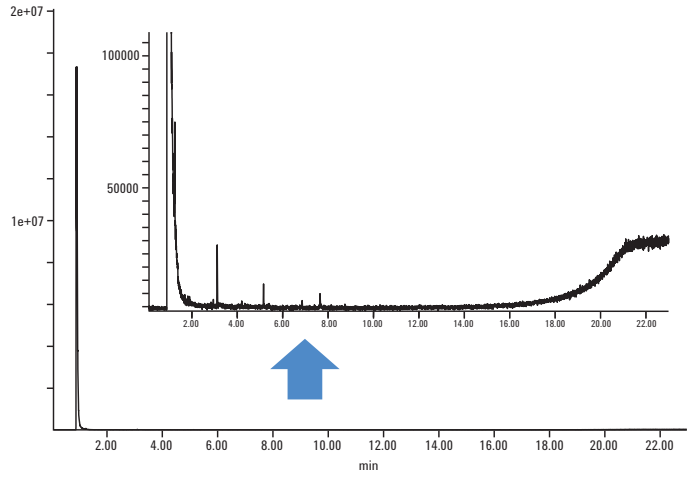


GC/MS conditions

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 equib 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
10 mL, 23 x 46 mm	
Clear	5188-5392
Amber	5188-6538
20 mL, 23 x 75 mm	
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/pk	14-3823-000
Screw caps for 40 mL vials, 24/pk	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, Vocarb 3000, Stratum and Atomx P&T	5188-8820
Trap, Vocarb 4000	5188-8821
Trap, BTEX	5188-8822
Trap, Tenax, #1A	5188-1447
Trap, VPH, #11	5188-1448

Stratum and Atomx traps are U-shaped



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



Atomx Purge and Trap Concentrator

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, Vocarb 3000, 7695 and 3100 P&T	5182-0775
Trap, Vocarb 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

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 system

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_2-C_{14}, UNITY 2		MKI-U-T3ATX-2S
Cold trap, air toxics, C_2-C_{14}, 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_6-C_{40}, UNITY 2		MKI-U-T1HBL-2S
Cold trap, ozone precursor, UNITY 2		MKI-U-T17O3P-2S
Cold trap, sulfur, UNITY 2		MKI-U-T6SUL-2S
Cold trap, chemical weapons, C_6-C_{40}, UNITY 2		MKI-U-T10CW-2S
Cold trap, green house gases, UNITY 2		MKI-U-T16GHG-2S



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_5 to n-C_{20}.	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_5 to C_{14}, 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_3 to n-C_{12}.	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_3 to n-C_{30}.	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







Flip Top Inlet Sealing System installation kit, 5188-2717

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

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

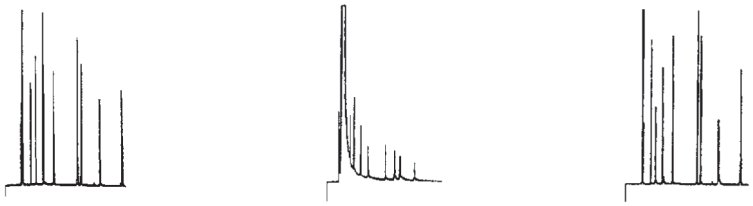
You can also improve the reproducibility and linearity of peak areas and avoid backflash by matching:

- 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	Tailing Solvent Peaks	Wrong Peak Ratios
Correct column positioning in both injection port and FID	Column positioned incorrectly in the injection port or possible ferrule particle in the carrier gas flow path	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		
Parameter	**Selection/Setting**	**Rationale**
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

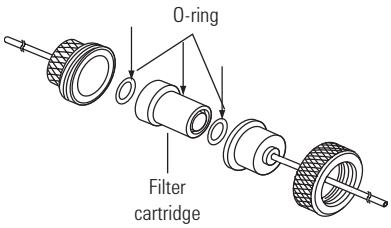
Parameter	Selection/Setting	Rationale
Inlet temperature	Just above highest boiling point of solutes (+20 °C)	Ensures flash vaporization Reduce if degradation occurs Use higher for dirty samples and higher-boiling solutes
Inlet liner	Large volume >0.8 mL	Use with autoinjector
	Small volume <0.2 mL	Use 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.

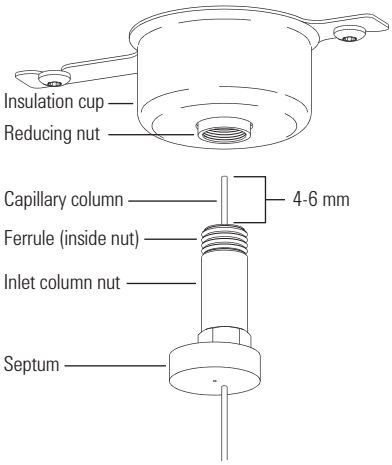
*Change every 6 months



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.



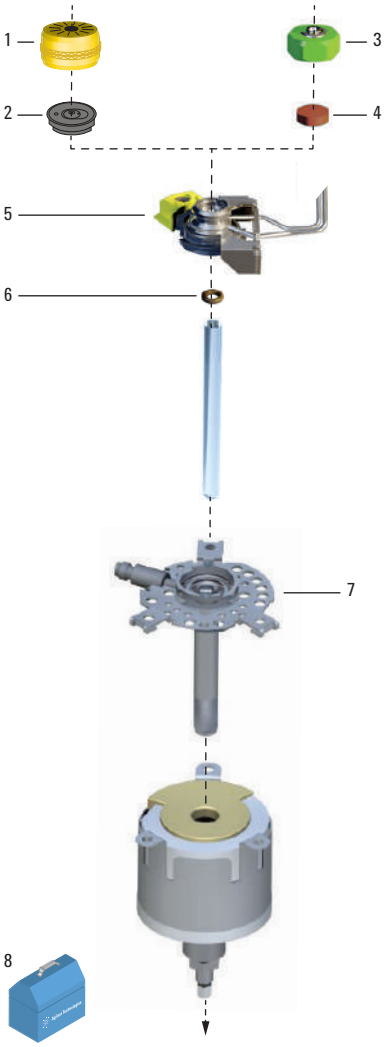
WARNINGS & CAUTION

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**



Split/Splitless Inlet assembly (top)



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



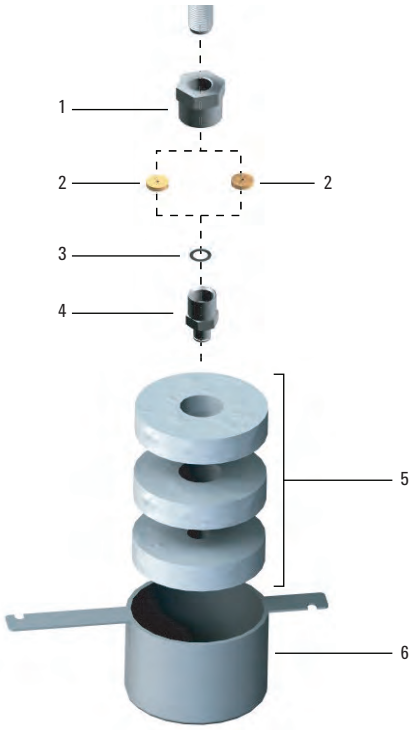
Column installation pre-swaging tool, graphite ferrules, G3440-80217

7890/6890/6850 Split/Splitless Inlet Supplies (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
	Graphite O-ring for split liner	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

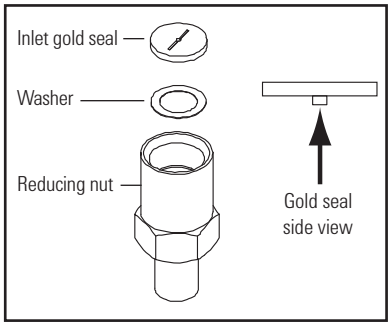
7890/6890/6850 Split/Splitless Inlet Supplies (Bottom)

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



Split/splitless inlet assembly (bottom)

Gold seal on the split/splitless inlet





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**

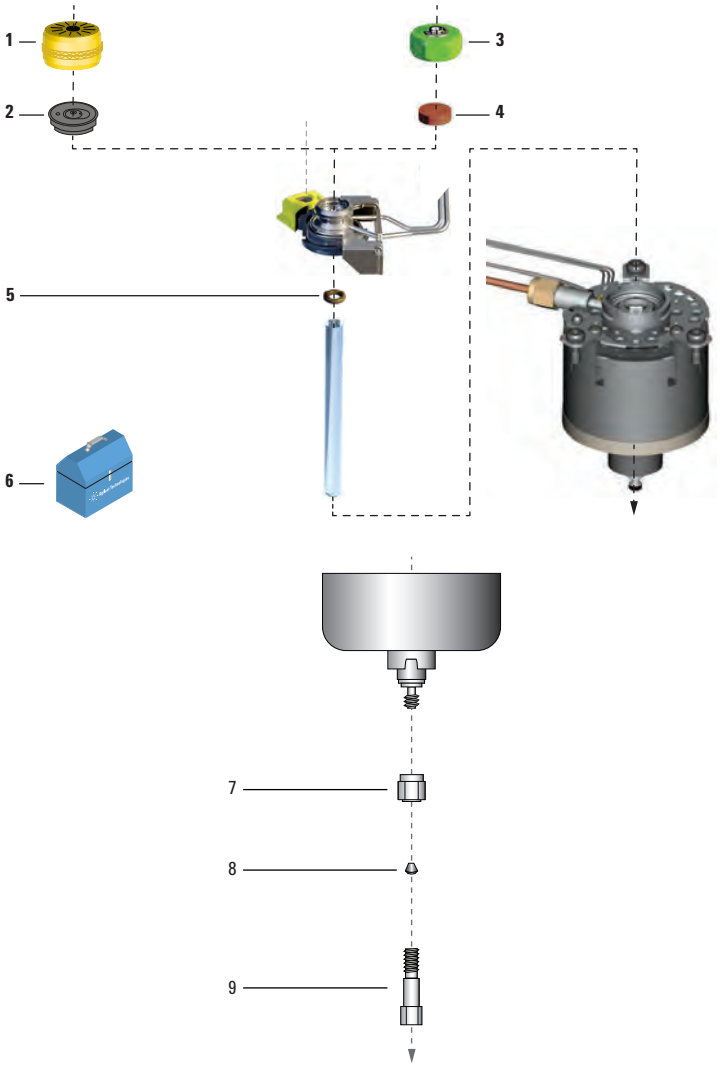
Multimode Inlet

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, **see page 37**.		
9	For complete offering of column nuts, **see page 40**.		

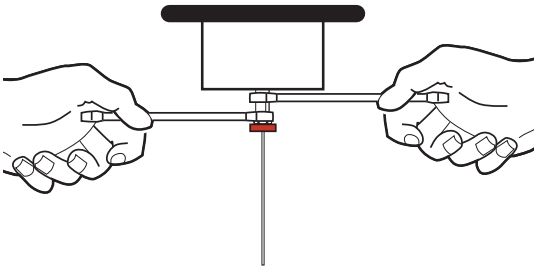


Exploded parts view of the Multimode Inlet

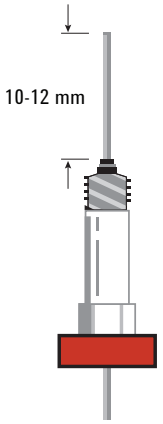
Installing a Capillary Column in a Multimode Inlet

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.

Step 2



Step 5



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.

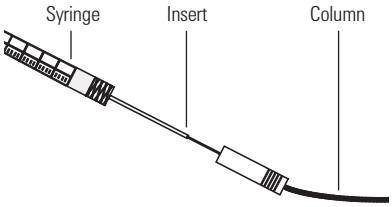
TIPS & TOOLS

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

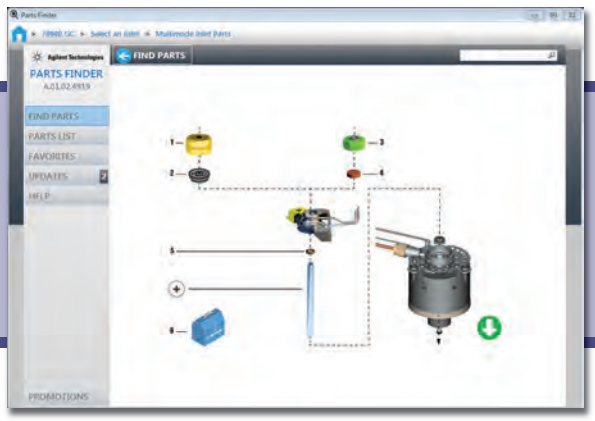
1. Gently insert the column into the inlet until it bottoms.
2. Insert the column nut into the inlet fitting and finger tighten.
3. Tighten the column nut an additional 1/4 turn with a wrench or until the column does not move. Use two wrenches to support inlet (5/16 in and 1/4 in).
4. If using an automatic 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**



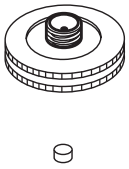
Changing the Septum on the Cool On-Column Inlet

1. Replace the septum.

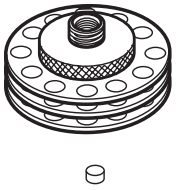
   If you are using a septum nut, grasp the knurling and unscrew. Remove the old septum with tweezers. Use tweezers to install a new septum. Push the septum into the septum nut until properly seated. Firmly tighten the nut.

   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.

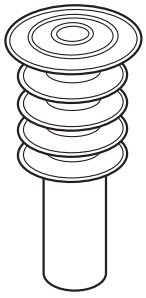
For 250/320 µm automated injections



For 530 µm automated injections



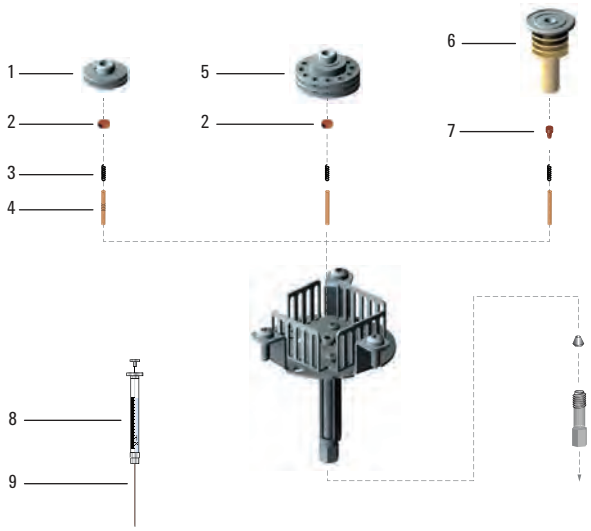
For 200 µm manual injections with fused silica needle



Septum



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_2, or liquid CO_2). 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)

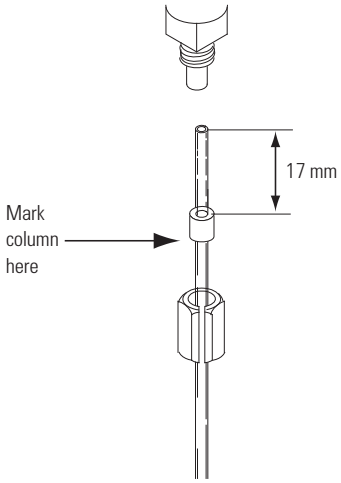
Parameter	Selection/Setting	Rationale
Injection mode	Cold split	For general use and sample screening
	Cold splitless	For trace analysis
	Cold solvent vent	LVI
Inlet temperature ramp rate	Adjustable (i.e., 2 °C/s to 720 °C/s max)	Use slower ramp rates for labile, complex, or large volume samples Use faster 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 5-50 µL for LVI	Use lower volumes for volatile solvents and fast ramp rates 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_2 cooling jacket			G2617-60508
PTV LN_2 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

Description	Column ID (mm)	Unit	Part No.
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_2 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

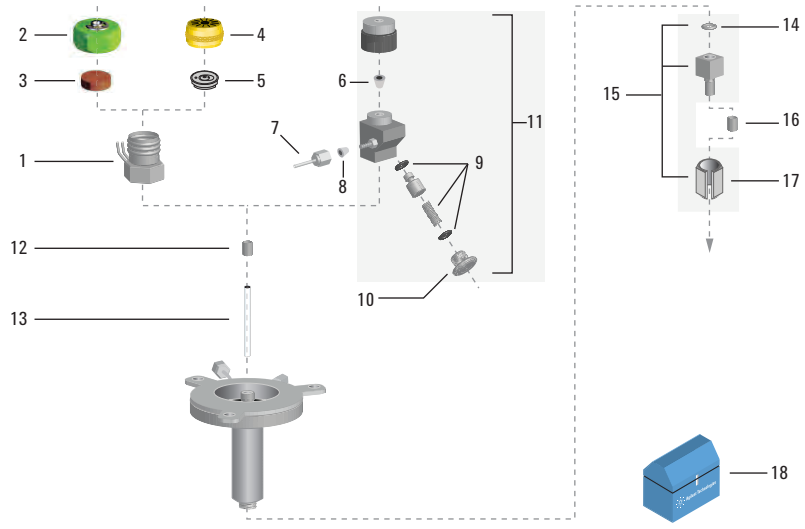
PTV Inlet Body

Item	Description	Unit	Part No.
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

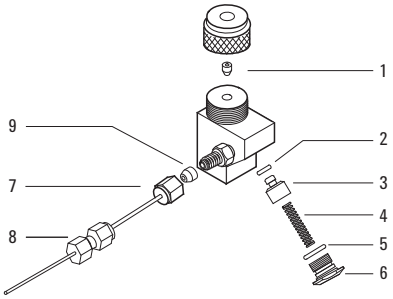
Item	Description	Unit	Part No.
14	Silver seal		5182-9763
15	Graphpak 2M inlet adapter, 0.53 mm		5182-9762
	Graphpak 2M inlet adapter, 0.32/0.25 mm		5182-9761
	Graphpak 2M inlet adapter, 0.2 mm		5182-9754
16	Ferrules for Graphpak 2M inlet, 0.32 mm	10/pk	5182-9769
	Ferrules for Graphpak 2M inlet, 0.2 mm	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 Inlet Body Parts

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.
Liners for Septumless PTV Inlet, G3501A, G3502A, G3503A			
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
Liners for High Temperature PTV Inlet, G3506A			
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_2 carrier gas
	10-60 mL/min	Use with He or H_2 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

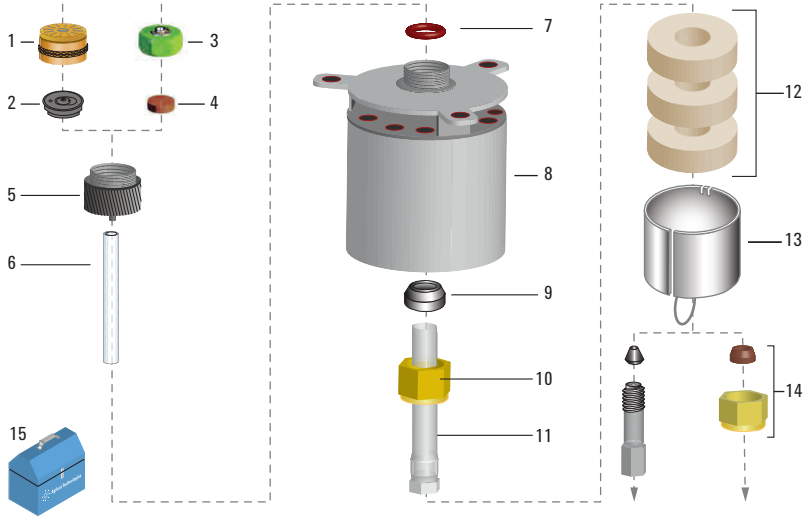
Leaks

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

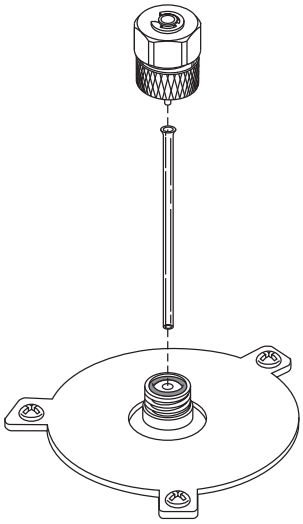
Item	Description	Unit	Part No.
1	Merlin Microseal high pressure nut		5182-3445
2	Merlin Microseal general purpose replacement septum 3 to 100 psi		5182-3444
	Merlin Microseal low pressure replacement septum		5181-8815
3	Septum nut, purged inlets		18740-60835
4	Non-stick advanced green septa, 11 mm	50/pk	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, **see page 40**.		
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

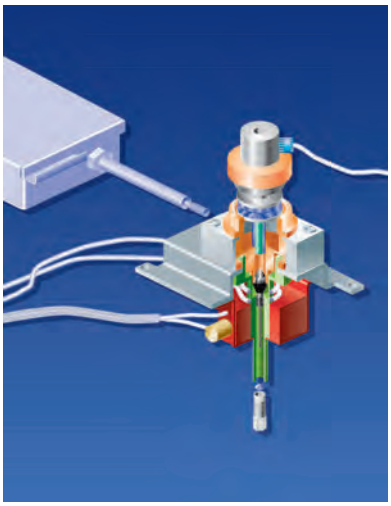
Description	Unit	Part No.
QuickPick purged packed inlet PM kit Includes 5 non-stick BTO septa, 1 O-ring, 1 ferrule, and 1 disposable glass liner		5188-6498
Merlin Microseal		5182-3444
Merlin Microseal high pressure nut		5182-3445
Septum nut, purged inlets		18740-60835
Non-stick bleed and temperature 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_2 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_2 and air purity is ≥99.9995%. Check traps and filters in the gas supply lines. The FID background signal should be ≤20 pA when the flame is lit and stablized.
- 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.**

Installing a Capillary Column in the FID

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.

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.

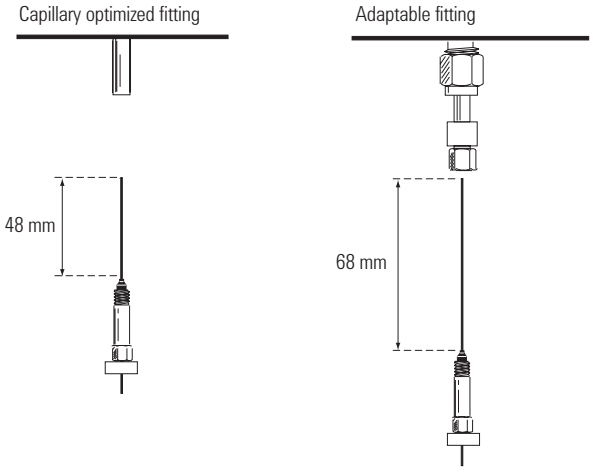
   b. Finger tighten the column nut, then withdraw the column about 1 mm. Tighten the nut an additional 1/4 turn with a wrench.

   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



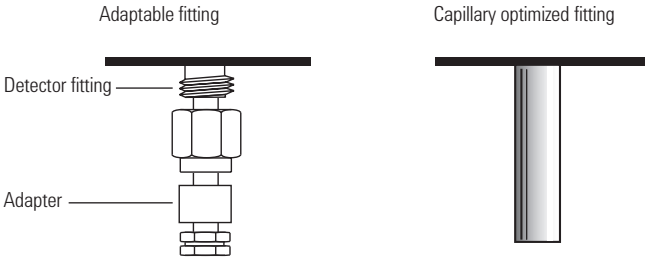
Adaptable FID Jet, 19244-80560

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.

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

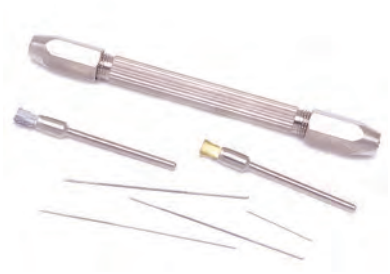


Jet Cleaning Procedure

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.

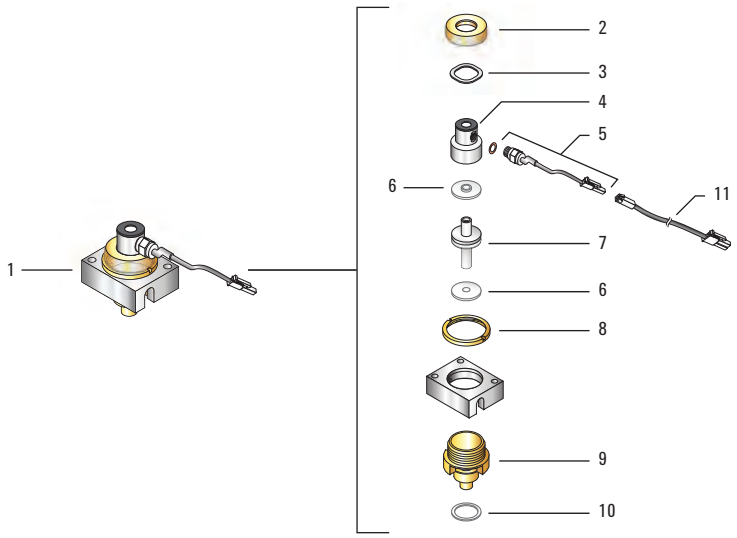
   Note: from this point on, handle the parts only with forceps!
5. Remove the jet from the bath and rinse it thoroughly, first with hot tap water and then with a small amount of GC-grade methanol.
6. Blow the jet dry with a burst of compressed air or nitrogen, and then place the jet on a paper towel and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



FID cleaning kit, 9301-0985

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

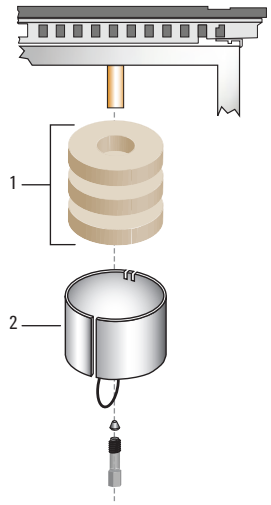
Item	Description	Unit	Part No.
1	FID collector assembly		G1531-60690
2	Collector nut		19231-20940
3	Washer, spring, wavey, 19.0 to 19.81 mm id, 24.5 mm od		3050-1246
4	Hastelloy ignitor castle (optional)		19231-21060
	Ignitor castle		19231-20910
5	Ignitor glow plug assembly		19231-60680
6	Collector insulator		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



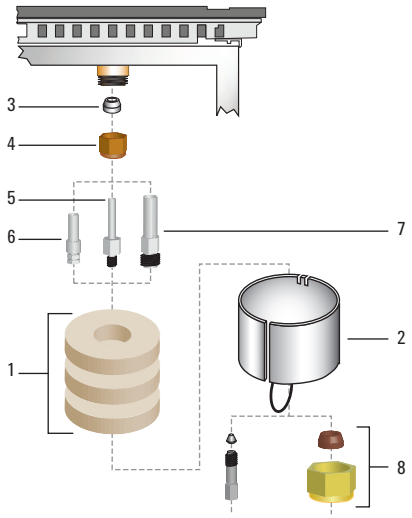
Flame Ionization Detector (FID) assembly

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 µECD. All sample passes through the indent in the mixing liner of the µECD. 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 µECD, 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.

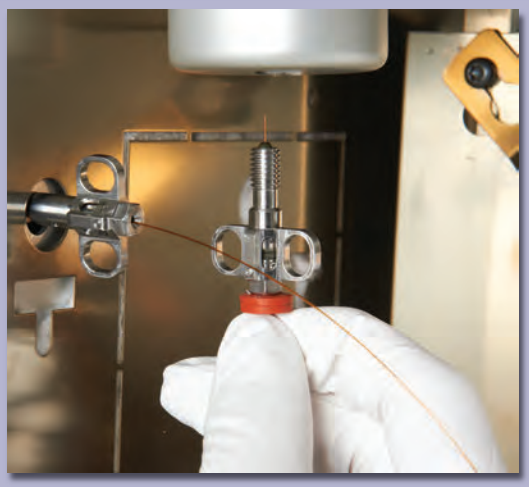
TIPS & TOOLS

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**



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 ^{63}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.

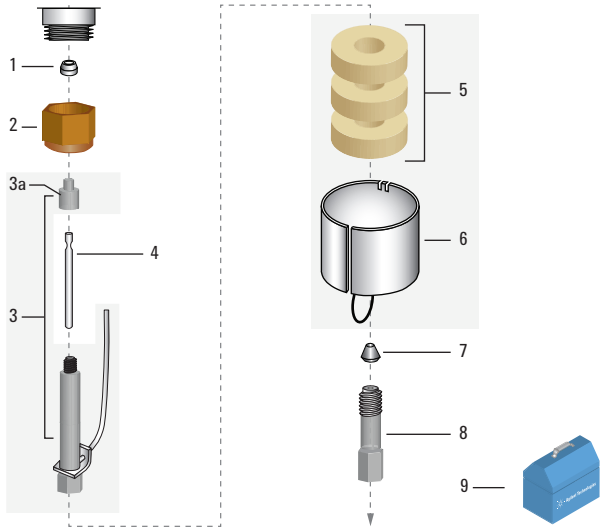
ECD Wipe Test

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, **see page 37**.		
8	For complete offering of column nuts, **see page 40**.		
9	GC electron capture detector standard in isooctane	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.

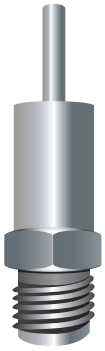
Some types of contaminants can be removed by temperature bake out.

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

Description	Unit	Part No.
For 1/8 in SS Packed Column Installation		
Polyimide/graphite ferrule, 1/8 in	10/pk	0100-1332
1/8 in nut, brass	10/pk	5180-4103
For 1/4 in SS Packed Column Installation		
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
For Capillary Column Installation (Standard)		
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 µm, 1.0 mm id graphite ferrule	10/pk	5080-8773
320 µm, 0.5 mm id graphite ferrule	10/pk	5080-8853
TCD sample Solution of 0.33% C_{14}, C_{15}, and C_{16} normal alkanes in hexane (w/w).	3 x 0.5 mL ampoules	18711-60060
FID and TCD sample This sample is used for the HP 5880, 5890 and 6890 with a FID or TCD. Solution of 0.033% C_{14}, C_{15}, and C_{16} normal alkanes in hexane.	3 x 0.5 mL ampoules	18710-60170



1/8 in stainless steel packed column



1/4 in packed column adapter, G1532-20710



Standard design

Installing a Capillary Column in the TCD

WHAT YOU NEED:

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

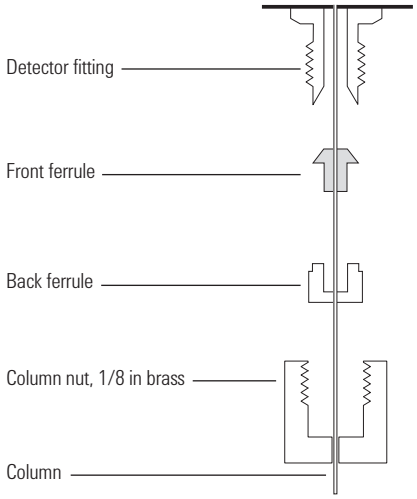
1. Gather the required supplies and tools.
2. Assemble the ferrules and 1/8 in brass Swagelok nut on the column.
3. Score the column using a glass scribing tool. The score must be square to ensure a clean break.
4. Break off the column end by supporting it against the column cutter opposite the scribe. 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.



Glow plug, 0854-0141

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 diagrams. 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.

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:

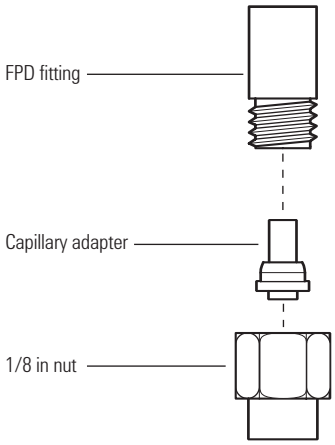
- Large air leaks at the inlet or detector can reduce the percentage of the hydrogen-air mixture at the detector and cause ignition problems.
- Large injections of certain samples can cause flameouts or quenching that cause the detector to attempt to relight, interrupting your analysis.
- Condensation 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.

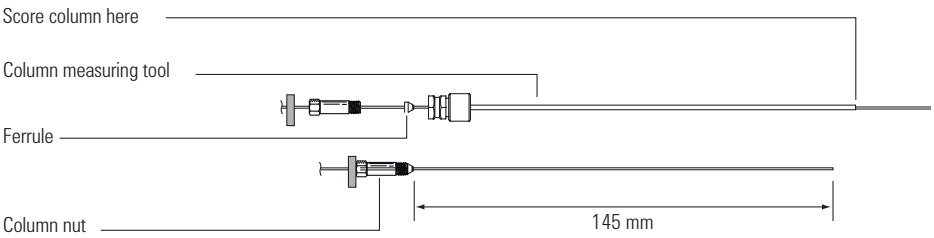
WHAT YOU NEED:

- 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

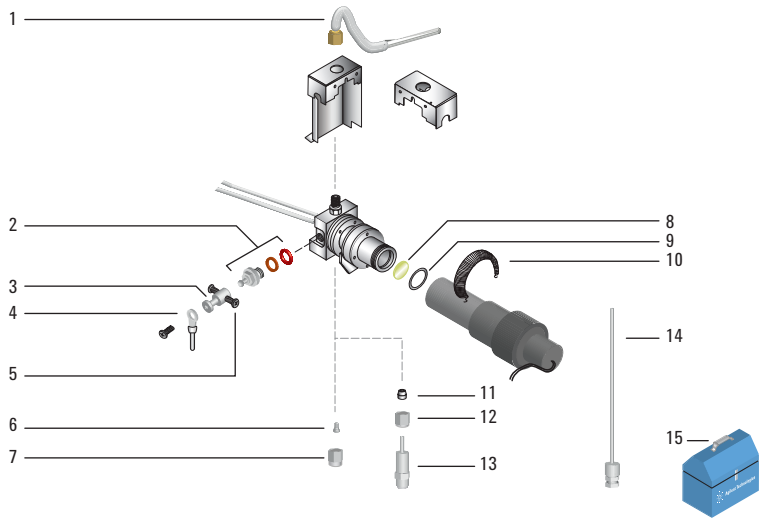
1. Gather the required supplies and tools.
2. Load the GC maintenance method and wait for the GC to become ready.
3. Assemble a septum, column nut, and ferrule on the end of the column.
4. Insert the end of the column through the column measuring tool so that the end protrudes beyond the tool.
5. Tighten 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

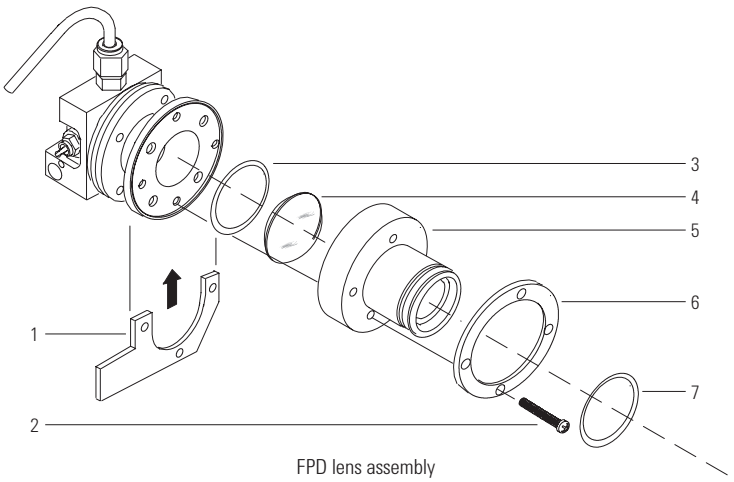
Item	Description	Unit	Part No.
1	FPD exit tube assembly, aluminum		19256-60700
	FPD exit tube assembly, stainless steel		19256-20705
2	FPD ignitor replacement kit		19256-60800
3	Collet for glow plug		19256-20690
4	Ignitor cable assembly		G1535-60600
5	Screw, M3 x 66 mm, T10		0515-0680
6	Capillary adapter 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
14	Column tool brazement		19256-80640
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



FPD lens assembly

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:

- Blos bead
- White ceramic bead
- Black ceramic bead

Compared to the white ceramic bead, the Blos 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.



Blos NPD bead assembly, G3434-60806

NPD Beads

Description	Part No.
Blos 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**

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

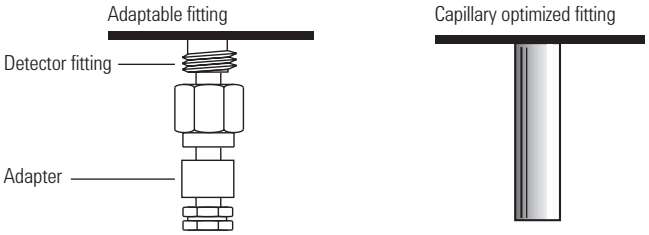
Description	Jet Tip ID	Length (mm)	Part No.
Jets for capillary optimized fittings			
Capillary with extended jet (recommended)	0.29 mm (0.011 in)	51.5	G1534-80580
Capillary	0.29 mm (0.011 in)	42.8	G1531-80560
Capillary	0.47 mm (0.018 in)	42.8	G1531-80620
Jets for adaptable fittings			
Capillary with 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

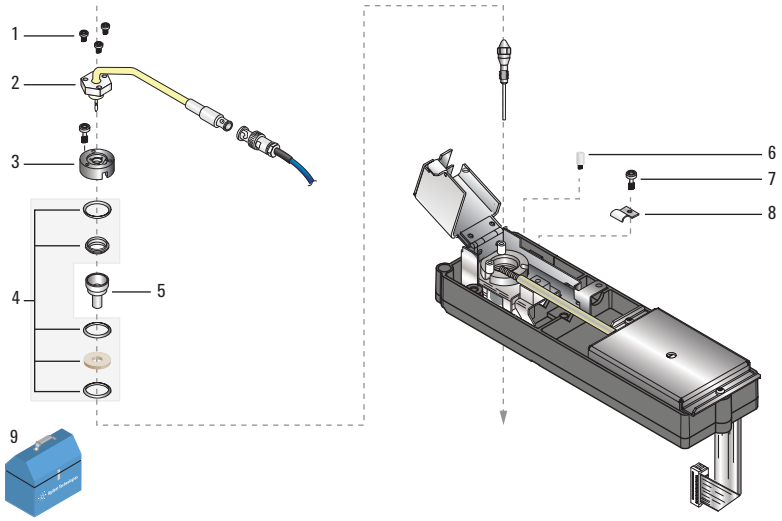


Capillary with extended jet, for adaptable fittings, G1534-80590



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

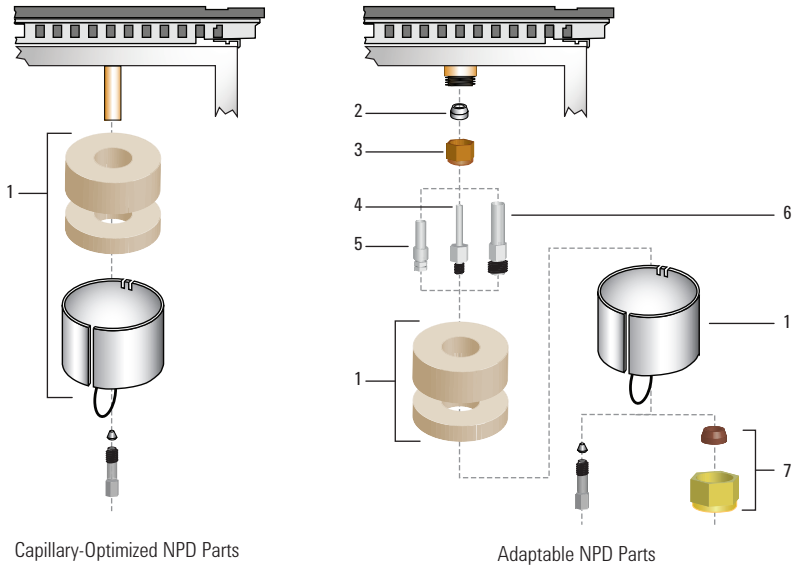
Item	Description	Part No.
1	Screw, T-10, M3 x 8 mm	0515-2726
2	NPD white bead assembly	G1534-60570
	Blos NPD bead assembly	G3434-60806
	NPD black ceramic bead assembly	5183-2007
3	NPD lid weldment	G1534-80510
4	NPD ceramic insulator kit Includes 2 metal C-rings (top and bottom), 2 alumina insulators (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	18789-60060
	1/4 in nut driver for FID jet, drilled shaft	8710-1561
	NPD flow adapter	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**.		



Capillary-Optimized NPD Parts

Adaptable NPD Parts

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

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



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

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_2 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.
Qualitative Simulated Distallation Standards	
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
Qualitative Petrochemical Standards	
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
Miscellaneous Qualitative Standards	
Nickel Catalyst Test Sample	19354-60510
Nickel Catalyst refill	5080-8761
MIDI System Calibration Standard	19298-60500

7820A GC System

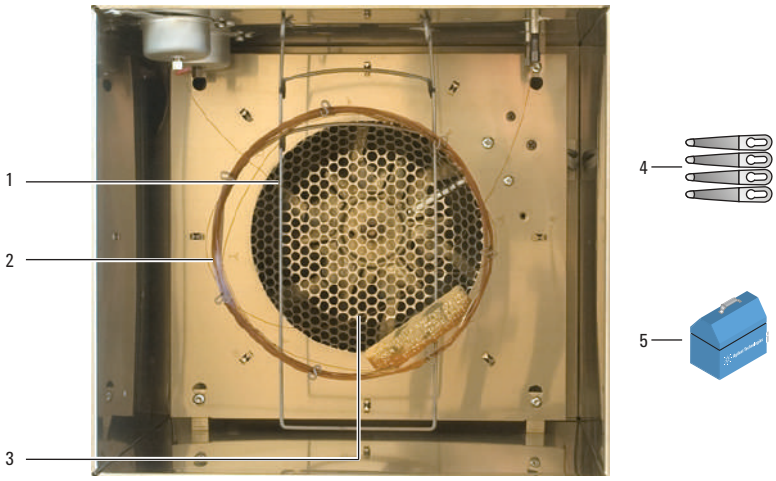
Reliability and value

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.

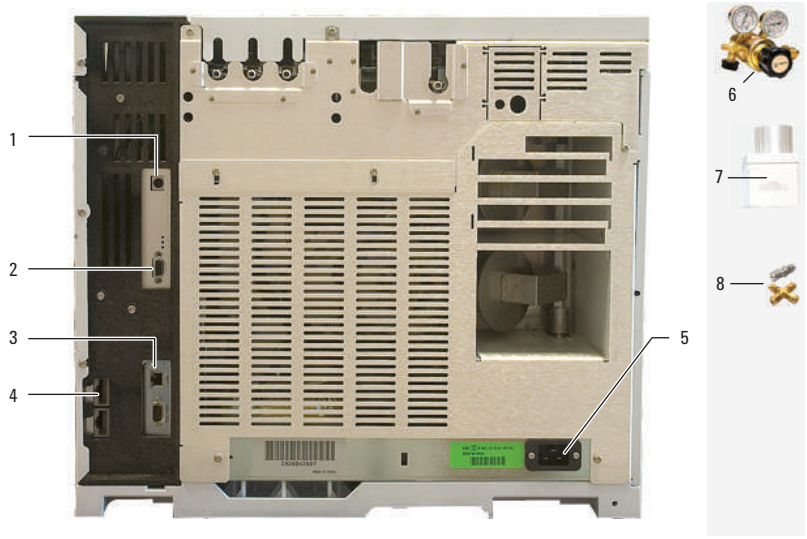


7820A GC System



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

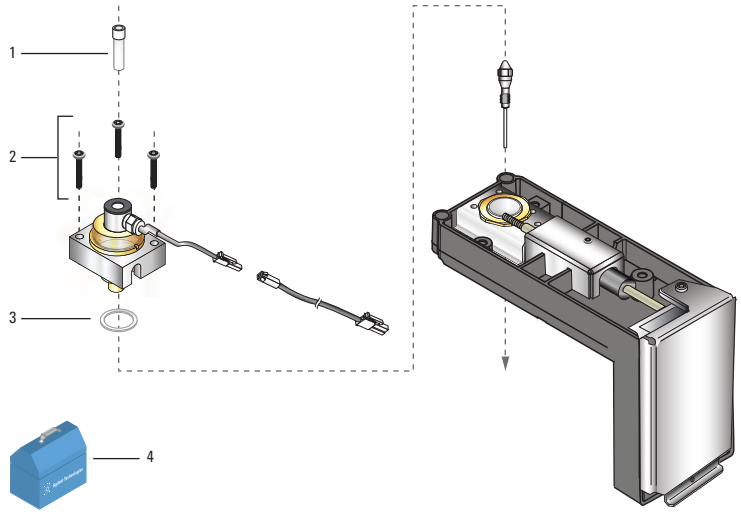


7820A Back View

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

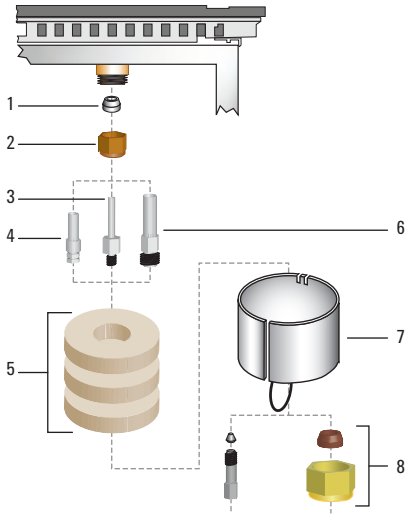
Item	Description	Unit	Part No.
6	Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA590, industrial air, with 1/8 in fitting, for 1/4 in tubing purchase a 1/4 in adapter		5183-4645*
	Regulator, 2-stage, brass body, stainless steel diaphragms, 125 psi max, CGA350, hydrogen, argon/methane, 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



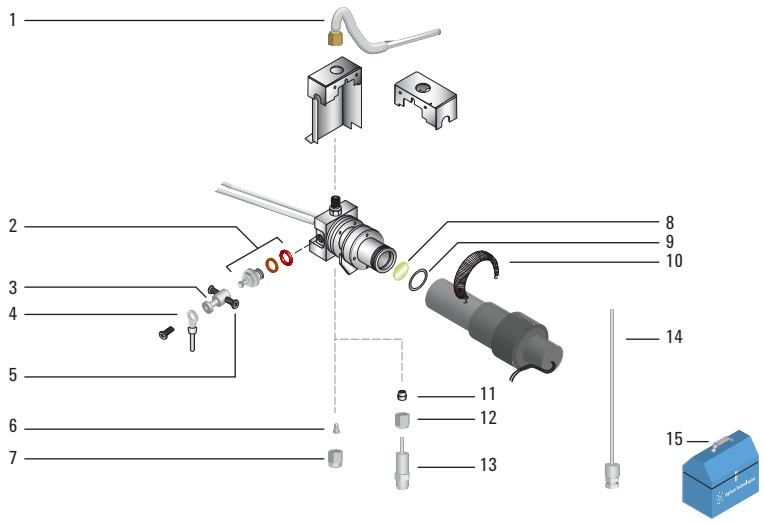
7820A FID Parts Bottom

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, **see page 37**.		



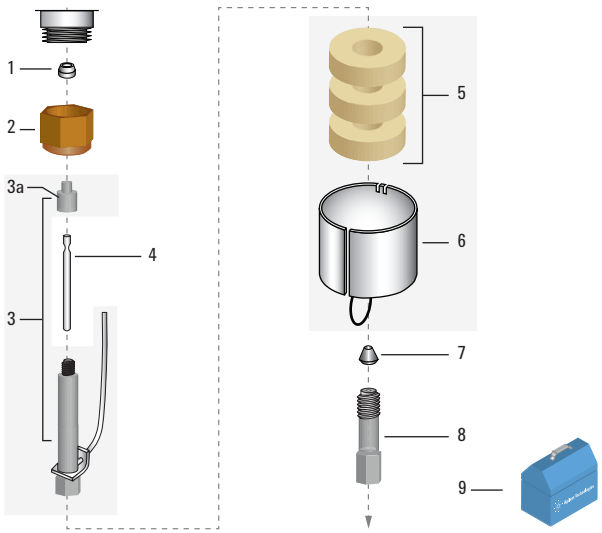
7820A FID Jets

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

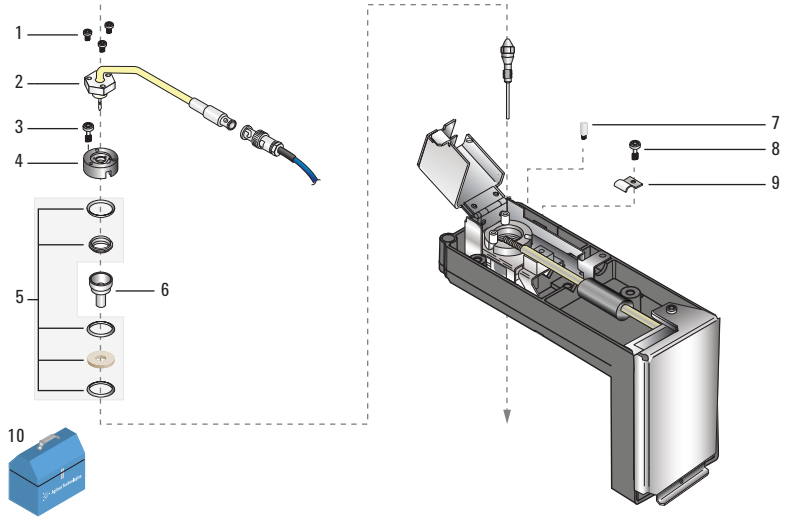
Item	Description	Unit	Part No.
1	FPD exit tube assembly		19256-60700
	FPD vent tube assembly		19256-20705
2	FPD ignitor replacement kit		19256-60800
3	Collet for glow plug		19256-20690
4	Ignitor cable assembly		G1535-60600
5	Screw, M3 x 66 mm, T10		0515-0680
6	Capillary adapter seat, FPD		19256-21140
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
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



7820A Micro ECD Parts

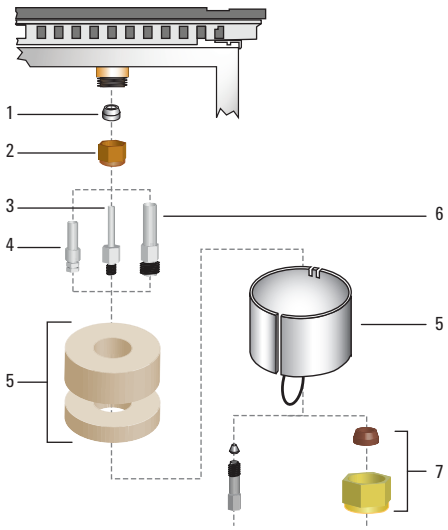
Item	Description	Unit	Part No.
1	Polyimide ferrule, 1/4 in	10/pk	5080-8774
2	1/4 in nut, brass	10/pk	5180-4105
3	Micro ECD makeup gas adapter, 7890 Micro ECD makeup gas adapter weldment assembly for new version detector, connected to EPC with tubing blocks		G3433-63000
	Old Micro ECD mug adapter Micro 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, **see page 37**.		
8	Universal column nut	2/pk	5181-8830
9	GC electron capture detector standard in isooctane	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



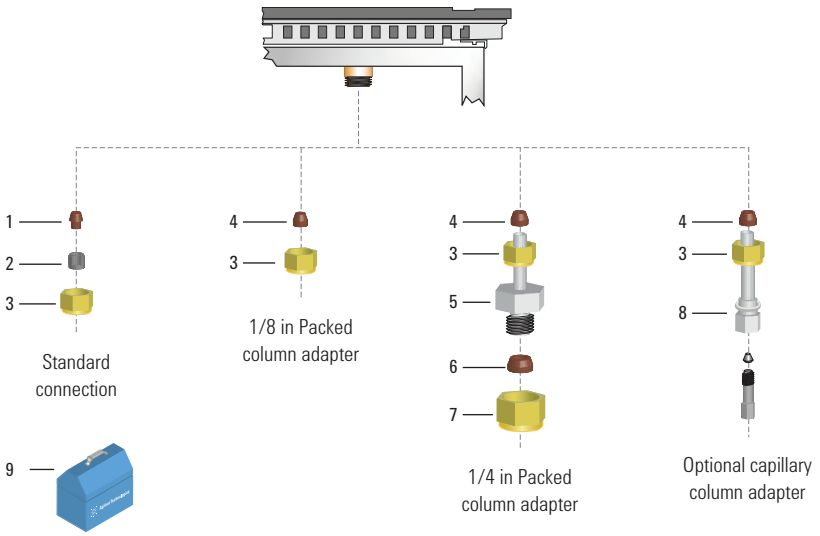
7820A NPD Parts – Bottom

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, **see page 37**.		



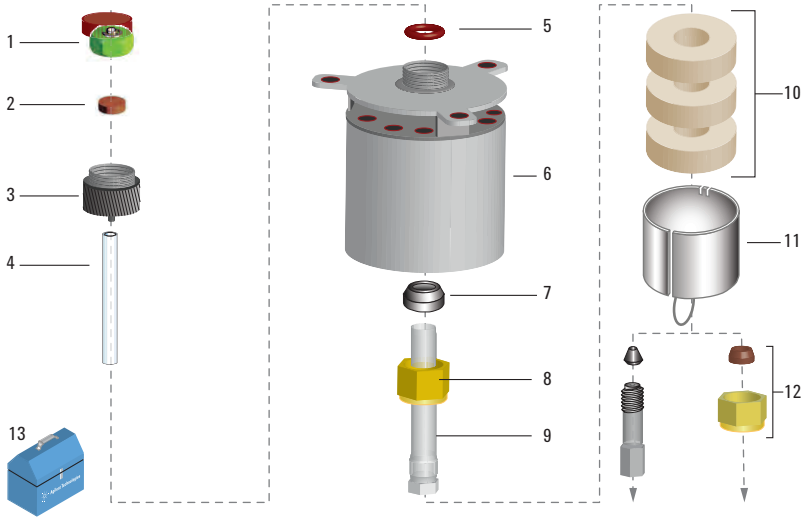
7820A NPD Jets

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



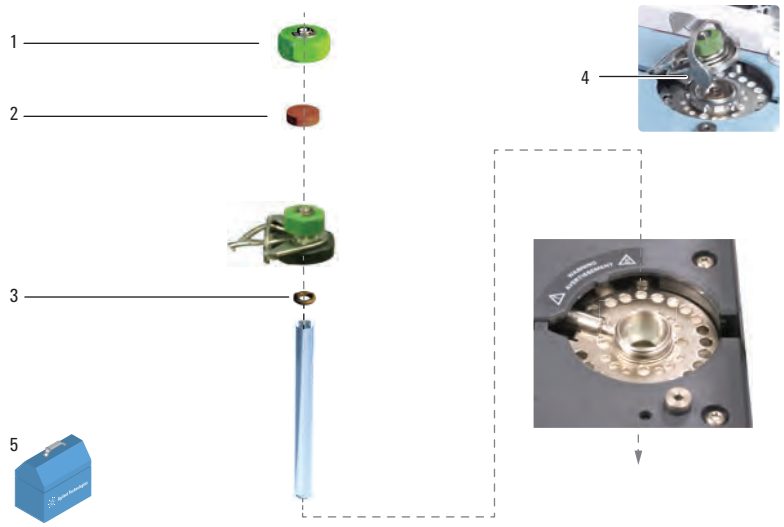
7820A TCD Parts

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



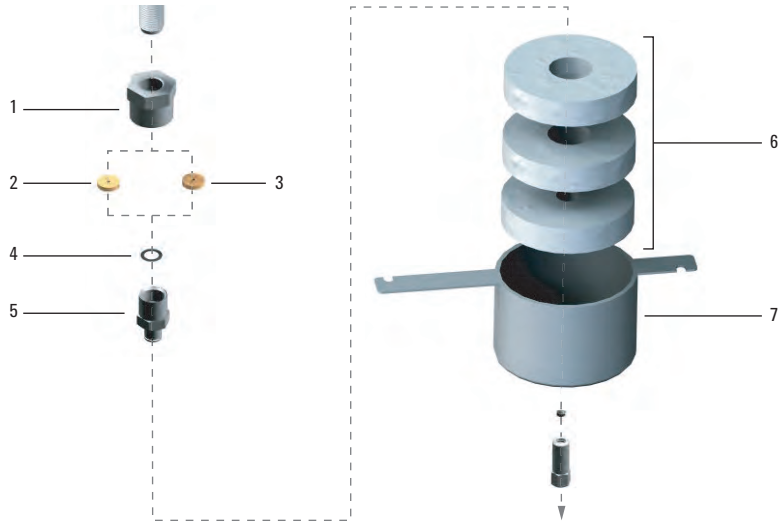
7820A Purged Packed Inlet Parts

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 µL internal volume	5/pk	5181-3382
	Disposable glass liner, 170 µL 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 µm 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, **see page 37**.		
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



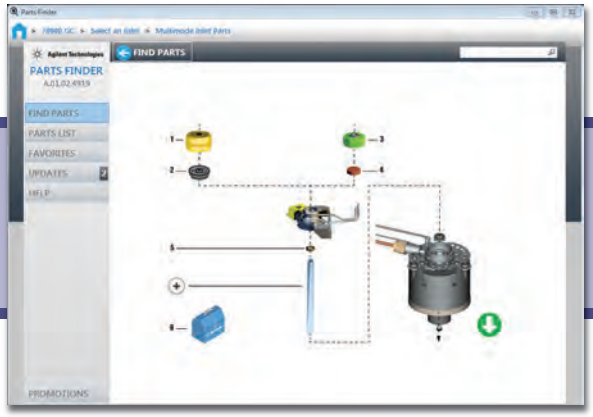
7820A Split/Splitless Inlet Parts (Top)

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



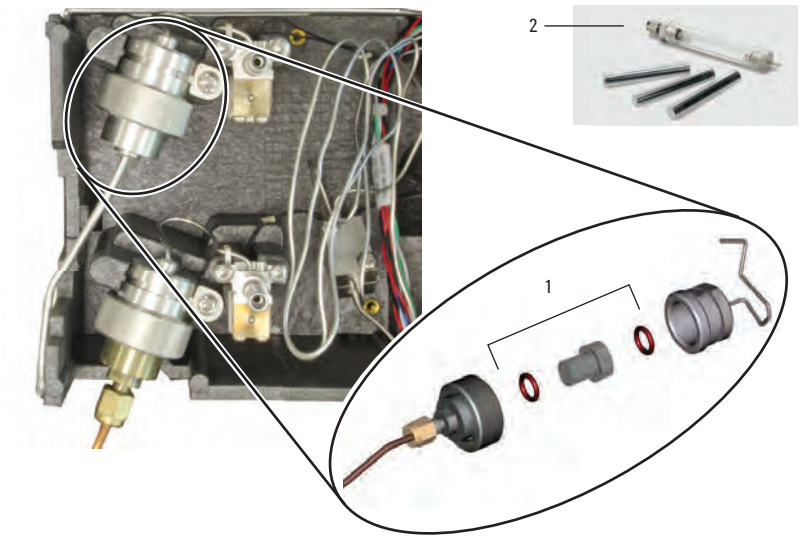
7820A Split/Splitless Inlet Parts (Bottom)

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**



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

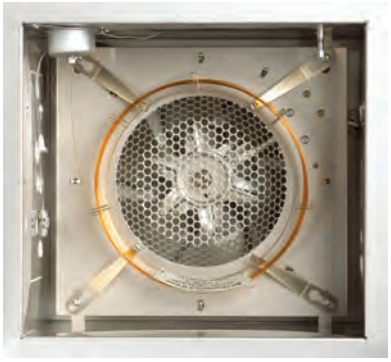
- Higher than normal vacuum manifold pressure or foreline pressure
- Higher than normal background
- Peaks characteristic of air (m/z 18, 28, 32, and 44 or m/z 14 and 16)
- Poor sensitivity
- Low relative abundance of m/z 502 (this varies with the tune program and MSD used)

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	CI gas
18, 28, 32, 44 or 14, 16	H_20, N_2, O_2, CO_2, CO_2 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.
MS Interface Supplies	
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
Tools	
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
Gas Filters	
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



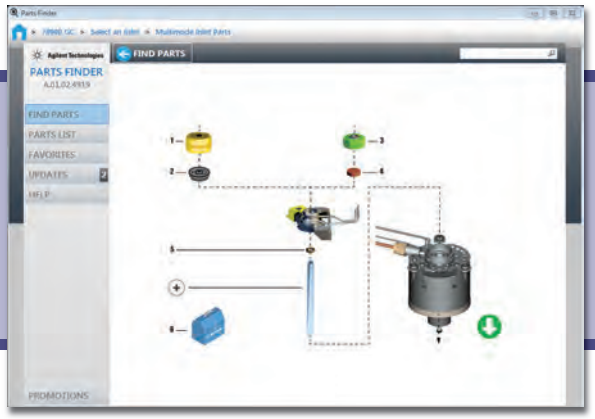
Column installation tool, G1099-20030



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**



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.
Recommended	
Nut	
Self Tightening column nut, for MS interface	5190-5233
Ferrule	
250 µm Polyimide/graphite ferrule, 10/pk	5181-3323
320 µm Polyimide/graphite ferrule, 10/pk	5062-3514
Tools	
MS interface column installation tool	G1099-20030
Column installation tool for 5975T	G3880-20030
Traditional	
Nut	
MS interface column nut, female	05988-20066
Ferrule	
0.4 mm Polyimide/graphite ferrule, 10/pk	5062-3508
0.5 mm Polyimide/graphite ferrule, 10/pk	5062-3506
Tools	
MS interface column installation tool	G1099-20030
Column installation tool for 5975T	G3880-20030
Alternative	
Nut	
Swaging nut, for MS interface with Flexible Metal ferrules	G2855-20555
Ferrule	
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
Tools	
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.

EI Source Selection Guide

Inert Ion Source

To ensure accurate quantification and high sensitivity, the entire GC/MSD flow path must be highly insert, 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 Availabe 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**

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**

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 progrmmable 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**

EI 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 analyis (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 **www.agilent.com/chem/library**

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	G2591C
	Highest sensitivity	



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)

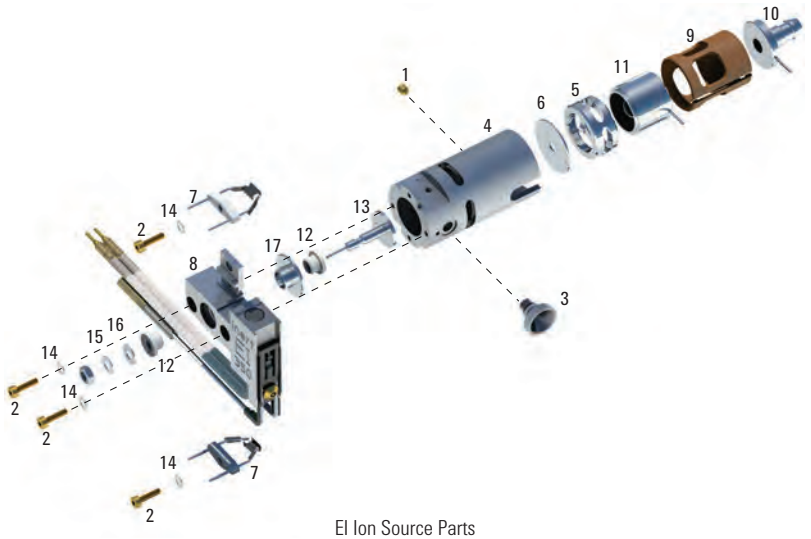
Item	Description	Part No.
1	Set screw for lens stack	G1999-20022
2	Cap screw, gold plated	G1999-20021
3	Transfer line socket	G1099-20136
4	Ion source body	G1099-20130
5	Drawout cylinder	G1072-20008
6	Drawout plate, 3 mm	05971-20134
	Drawout plate, 6 mm	G3163-20530
7	Filament assembly, high temperature (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



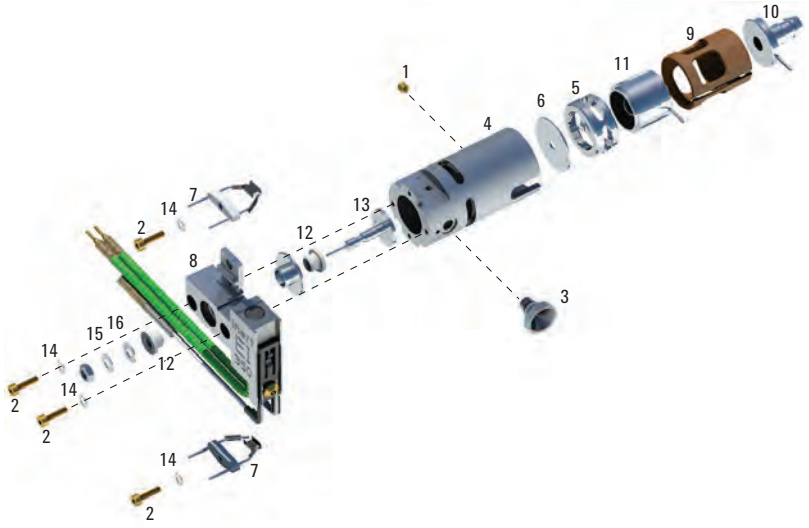
Repeller insulator, G1099-20133



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

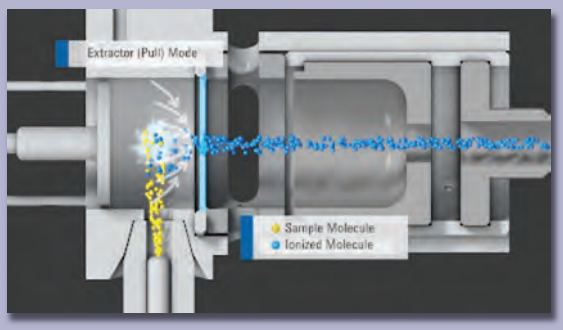
Extractor EI Source

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.

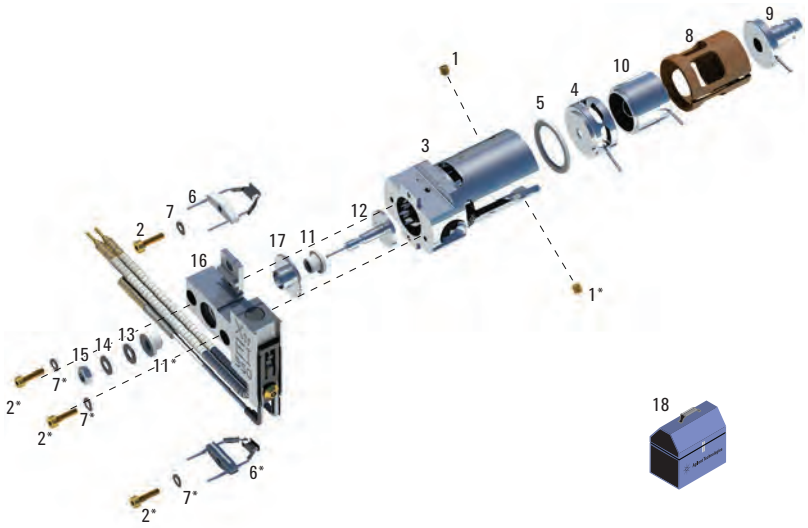
TIPS & TOOLS

A video description of the Extractor EI Source is available at **www.chem.agilent.com/chem/resolve**

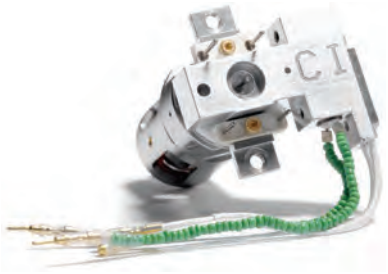


5977/7000C Extractor Ion Source Parts

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:

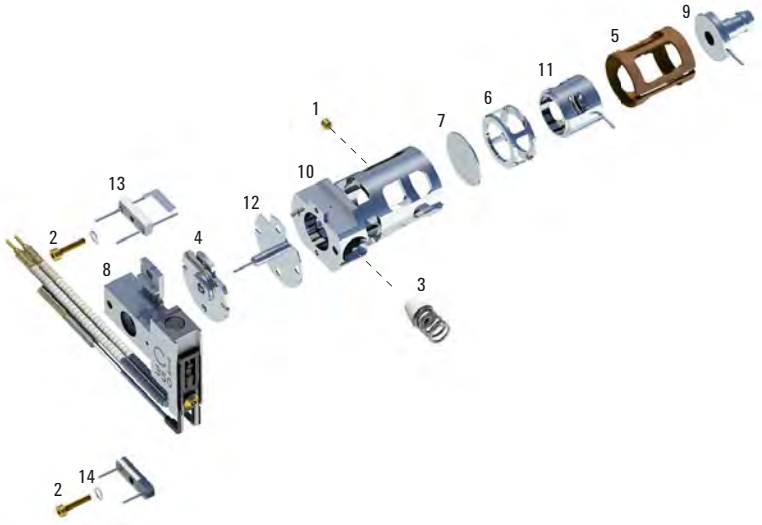
- The CI ion source may not look dirty, but deposits left by chemical ionization are very difficult to remove. Clean the CI ion source thoroughly.
- Use a round wooden toothpick to gently clean out the electron entrance hole in the source body and the ion exit hole in the drawout plate.
- Do not use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

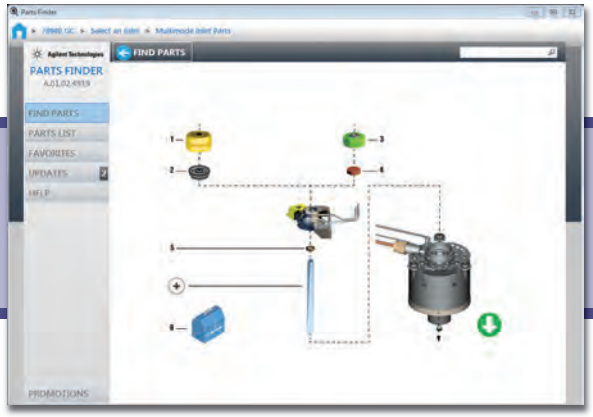
Item	Description	Part No.
1	Set screw for lens stack	G1999-20022
2	Cap screw, gold plated	G1999-20021
3	Interface tip seal/spring	G1999-60412
4	Repeller insulator	G1999-20433
5	Lens insulator	G3170-20540
6	Drawout cylinder	G1999-20444
7	Drawout plate	G1999-20446
8	5977 CI 350 repeller assembly	G3170-60416
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**



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.

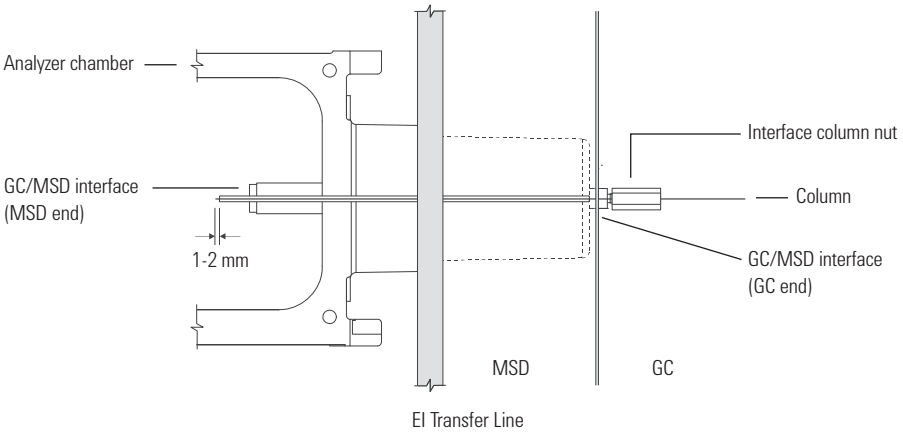


TIPS & TOOLS

View recommended MS interface connections.

Turn to page 38.

Installing a capillary column in the GC/MSD interface

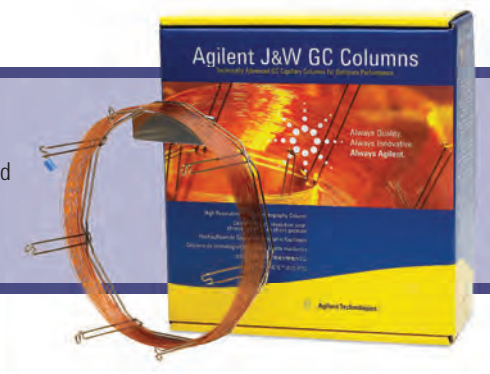


TIPS & TOOLS

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**



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

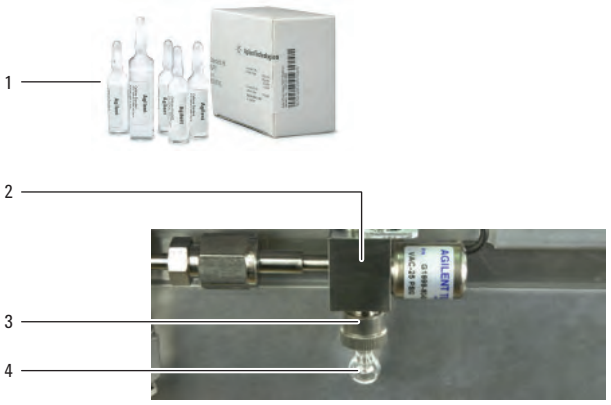


Filament assembly (CI), G7005-60072

TIPS & TOOLS

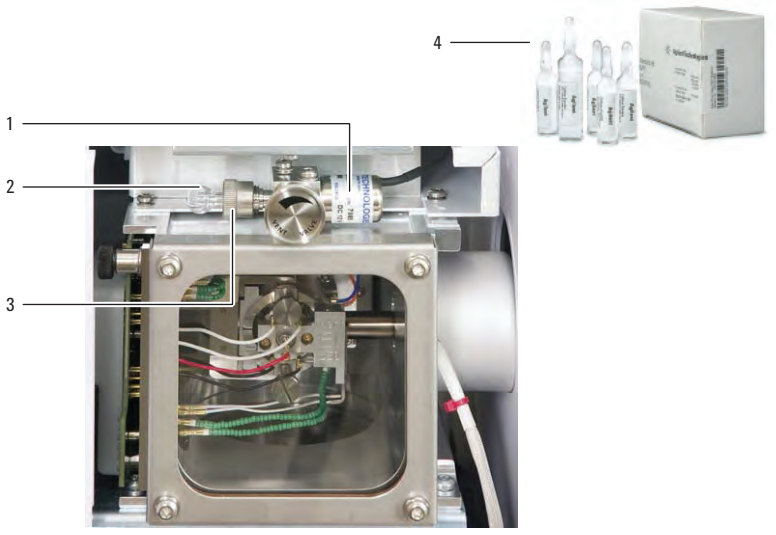
It is very useful to switch from one filament to the other every three months so that when a filament fails, you know the other will fail soon. This will allow you to change both filaments at the same time. Since the GC/MS system is already vented, it's a good idea to replace other supplies in the flowpath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

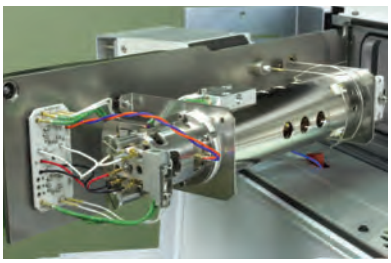
Gas Clean Filters

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



Triple axis electron multiplier, G3170-80103

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

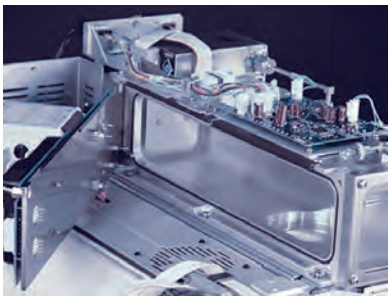
MSD Electron Multipliers and Replacement Horn

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 x 10^{-6} to 1.4 x 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	
• Pressure is above 100 mTorr. • Pressure for a given column flow has increased over time	• Column (carrier gas) flow is too high • Wrong carrier gas • Air leak (normally at transferline interface) • Foreline pump oil level is low or oil is contaminated • Foreline hose is constricted • Foreline gauge is not working correctly • Foreline pump is not working correctly
Foreline pressure is too low	
• Pressure is below 20 mTorr.	• Column (carrier gas) flow is too low • Wrong carrier gas • Column plugged or crushed by an overtightened nut • Empty or insufficient carrier gas supply • Bent or pinched carrier gas tubing • Foreline gauge is not working correctly
Vacuum manifold pressure is too high	
• Pressure is above 1.4×10^{-4} Torr. • Pressure for a given column flow has increased over time	• Column (carrier gas) flow is too high • Wrong carrier gas • Air leak • Foreline pump is not working correctly • Diffusion pump fluid level is low or fluid is contaminated • Defective gauge controller • Faulty ion gauge tube
Vacuum manifold pressure is too low	
• Pressure is below 1.4×10^{-4} Torr.	• Column (carrier gas) flow is too low • Wrong carrier gas • Column plugged or crushed by an overtightened nut • Empty or insufficient carrier gas supply • Bent or pinched carrier gas tubing • Defective gauge controller • Faulty ion gauge tube

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**



Quiet Cover GC/MS

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

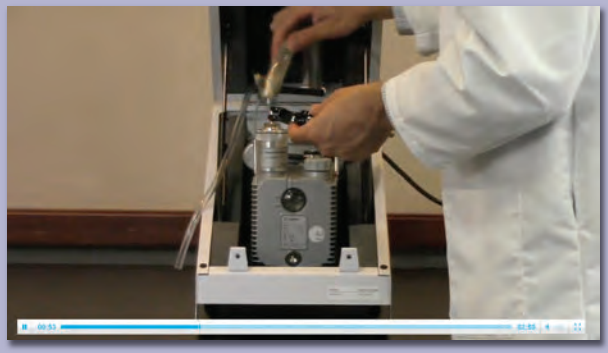
*Parts required for use with Quiet Cover DS and a 7200 GC-QTOF



Quiet Cover GC/MS, with open-access cover

TIPS & TOOLS

Find out how to quiet your rough pump once and for all at **www.agilent.com/chem/quietcovervideo**





Quiet Cover DS, G6012A



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

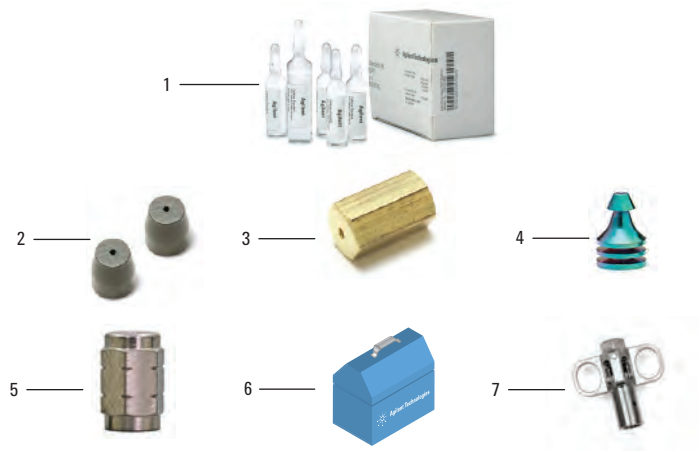
Precision, reliability and the lowest detection limits

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 ≤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



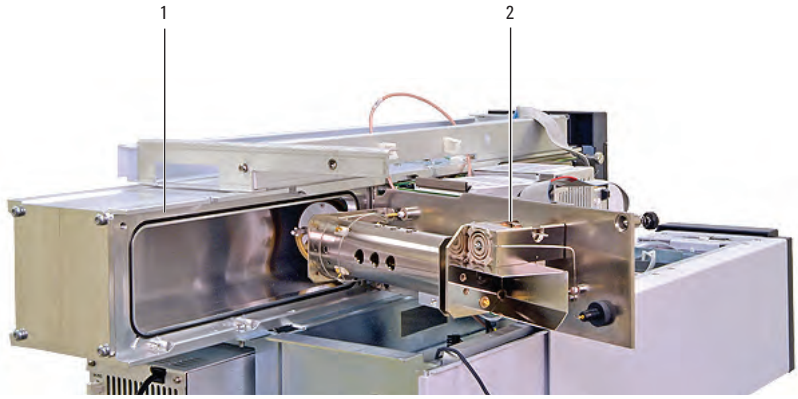
7000 Triple Quad GC/MS Interface Parts and Standards

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**



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

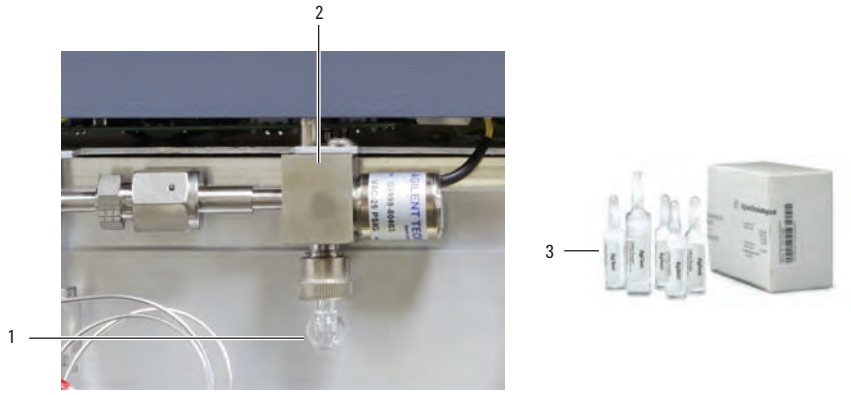
Detection and selectivity of targets and unknowns with complete confidence



7200 Q-TOF for GC/MS

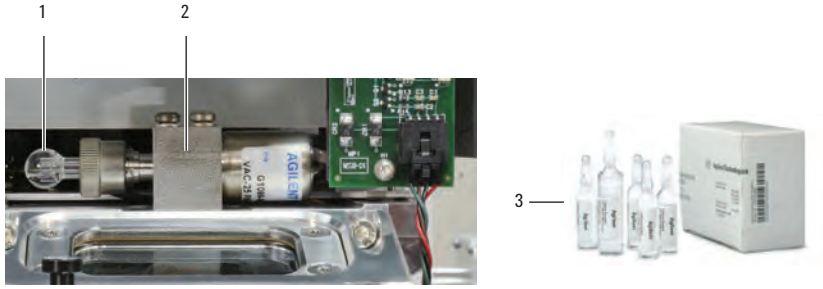
Complex matrix analyses demand your best qualitative GC data. That's why we designed the Agilent 7200 Q-TOF for GC/MS, the world's first Q-TOF purpose built specifically for gas chromatography. The 7200 Q-TOF redraws the boundaries of GC/MS technology by combining the separation power of Agilent's 7890 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.

- 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.



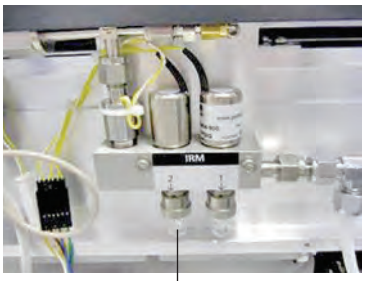
7200A Q-TOF CI Calibration Valves

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**

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^n 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

Description	Part No.
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
GC/MS Standards	
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
Vacuum Supplies	
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
GC/MS Standards	
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



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 nonadeconate 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 Test and Performance Samples

	Description	Part No.	5977/ 5975 Series	5973 Series	5972 Series	GCD	7000 Series	7200 Series
Tuning Samples								
EI Tune	PFTBA sample, certified, 10 g, 5.32 mL	8500-0656	✓	✓	✓	✓	✓	✓
CI Tune	PFDTD calibrant	8500-8510	✓	✓			✓	✓
Performance Verification Samples								
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					✓	
Checkout Samples								
HighMass	PHFT, 100 pg/µL	5188-5357	✓					
Semivolatile	GC/MS tuning standard, DFTPP	8500-5995	✓	✓	✓	✓		
Volatile	p-Bromofluorobenzene (BFB), 25 µg/mL	8500-5851	✓	✓	✓	✓		
MSD sampler	Solution of dodecane, biphenyl, p-cholorodiphenyl, 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.

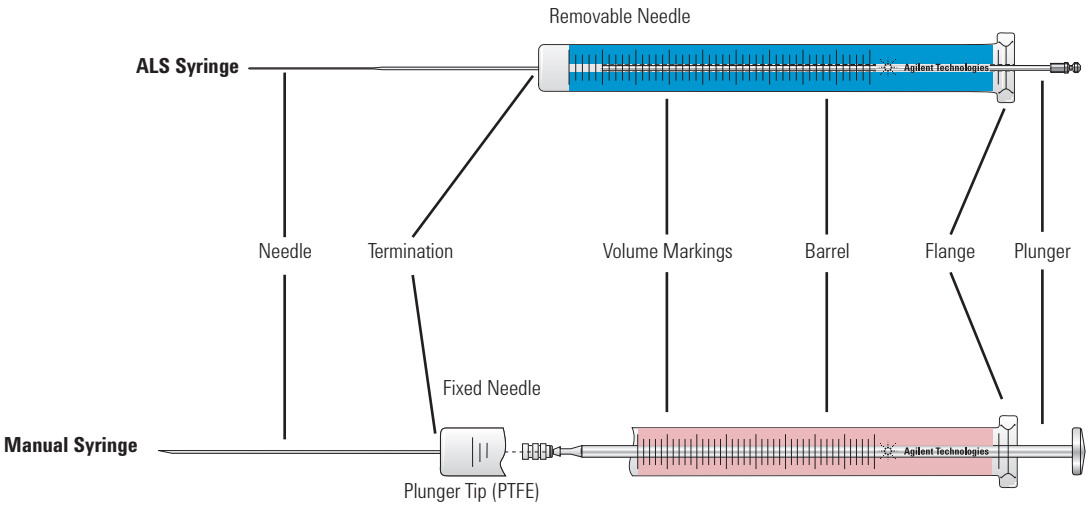
PTFE-Tipped Syringes for Gases and Liquids

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



Reference drawing (not to scale)

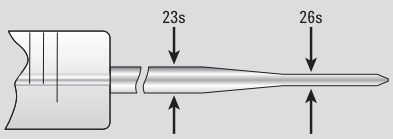


Needle Gauge

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

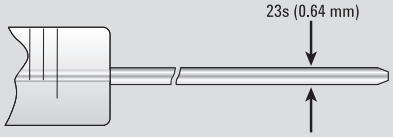
	OD		ID	
Gauge	**mm**	**in**	**mm**	**in**
22	0.71	0.028	0.41	0.016
23s	0.635	0.025	0.11	0.0045
25	0.50	0.020	0.20	0.008
26s	0.47	0.0184	0.11	0.0045



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

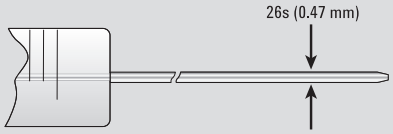


Single Gauge 23 or 23s (0.64 mm)

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

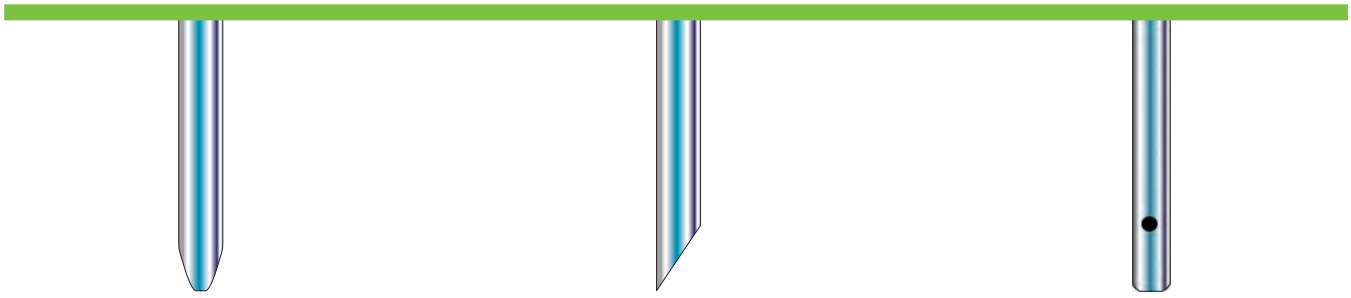
Note: Needles with an 'S' following the gauge are more durable, with a thicker needle wall and smaller id bore.

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

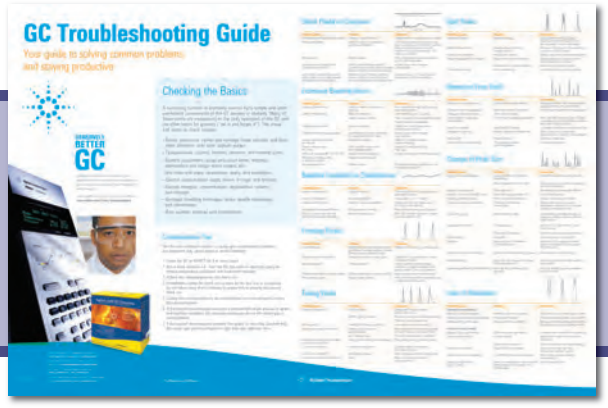
Agilent Blue Line Autosampler Syringes for 7693A ALS

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 µL 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**



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 syringe, G4513-80205



Blue line autosampler syringe, G4513-80204

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 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.



Needles, replacement, G4513-80236

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
	Replacement needle	3/pk	23-26/42/HP	G4513-80225
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



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 (µL)	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 µL 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 µL 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 µL syringe			5181-3365
	Tapered, removable		23-26s/42/HP	5181-3356
	Replacement plunger with PTFE tip for removable needle 10 µL 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	5183-0316
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.

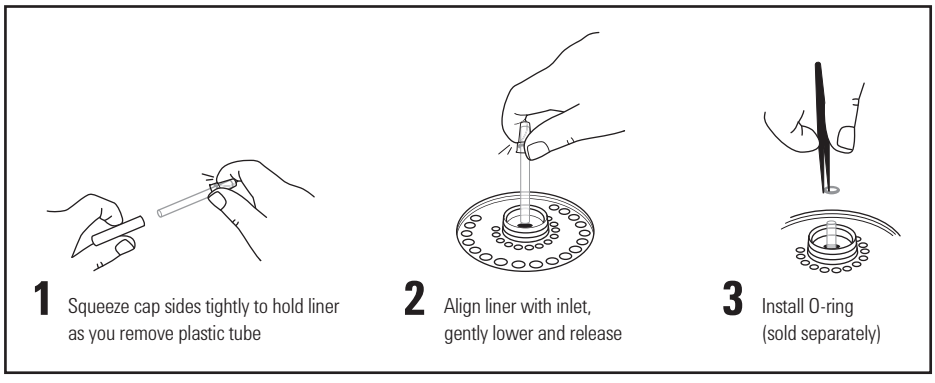
Agilent CrossLab Liners with Ultra Inert Deactivation

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**



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

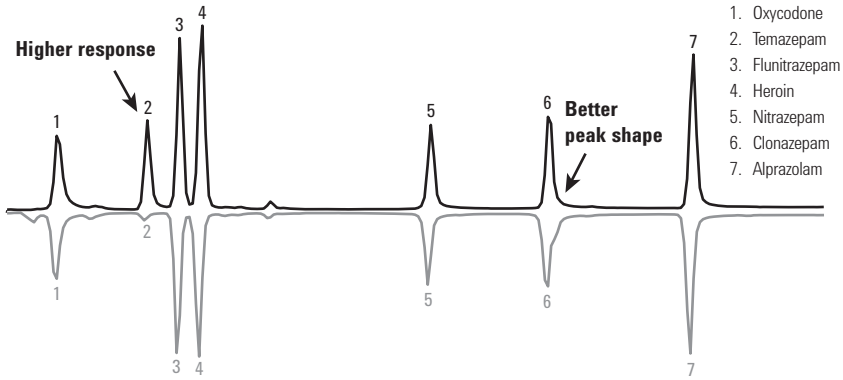
✓ Sample pyrolysis

✓ 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	• General purpose for capillary columns • Suitable for FID and NPD • Recommended for high temperature and cool on-column applications	• Easy-to-use stable seal • Higher temperature limit • Can be removed easily	• Not for MS or oxygen-sensitive detectors • Soft, easily deformed or destroyed • Possible system contamination
Polyimide/graphite (85%/15% or 60%/40%)	350 °C	• General purpose for capillary columns • Recommended for MS and oxygen-sensitive detectors • Most reliable leak-free connection	• Mechanically robust • Long lifetime	• Not reusable • Flows at elevated temperature • Must re-tighten frequently
Polyimide (100%)	280 °C	• Isothermal operation • Can be reused or removed easily • Excellent sealing material when making metal or glass connections	• Mechanically robust • Long lifetime • Can be reused or removed easily	• Leaks after temperature cycle • Flows at elevated temperature • Must re-tighten frequently

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:

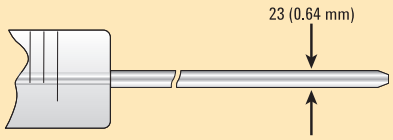
- Lot number printed directly on the barrel with a corresponding Certificate of Conformance
- Illuminating backing strip, for effortless viewing of the volume scale
- Environmentally friendly packaging and improved design that reduces waste
- Individually packaged for contaminant-free use right out of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

Typical Needle Gauge Dimensions

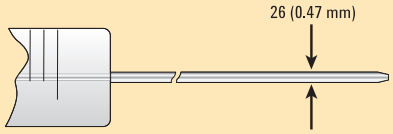
	OD		ID	
Gauge	**mm**	**in**	**mm**	**in**
23	0.64	0.0248	0.11	0.0043
25	0.50	0.0197	0.20	0.0079
26	0.47	0.0184	0.11	0.0043



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

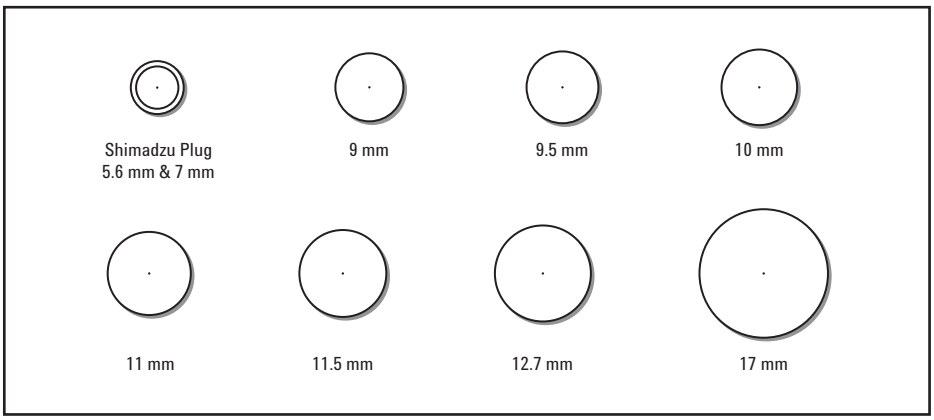


Agilent CrossLab Inlet Septa Selection Guide

GC Manufacturer	Instrument Model	Diameter (mm)	Diameter (in)
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 Finnigan	Trace 2000 Series	9.5	
	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

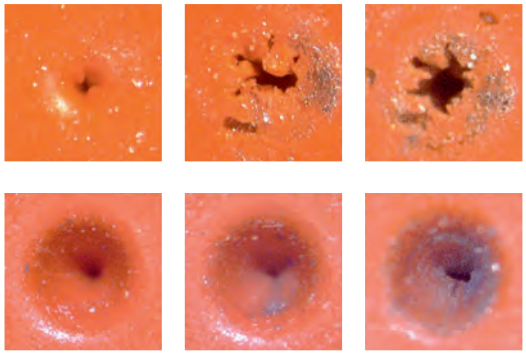


BTO septa, 8010-0223, 8010-0224

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.

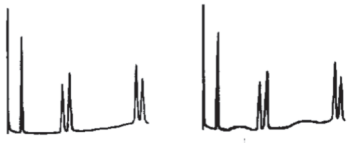
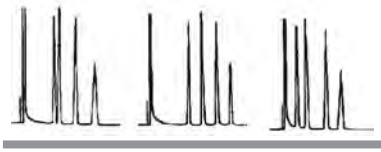


CrossLab general purpose inlet septa, 8010-0257

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

Septa Troubleshooting

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

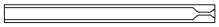
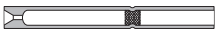
	Description	ID (mm)	OD (mm)	Length (mm)	Volume (µL)	Unit	Similar to OEM Part No.	Agilent Ultra Inert Deactivation	Similar to OEM Part No.	Agilent Original Deactivation
Split/Splitless Liners										
	Single taper	4.0	6.3	78.5	1000	5/pk	RT207992145 SG092017	8004-0151	SG092017	8004-0101
	Single taper, 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
Splitless Liners										
	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
Split Liners										
	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		
Direct Liners										
	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
Split/Splitless Liners										
	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
Splitless Liners										
	Single taper	2.0	5.0	54	170	5/pk	RT207122145 SG092039	8004-0161	SG092039	8004-0109
Split Liners										
	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		
Other Liners										
	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
Direct Liners										
	SPI for 0.25/0.32 mm id columns	0.5	4.6	54	10	5/pk	190010906	8004-0167		
	SPI 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
Split Liners										
	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
Direct Liners										
	Double gooseneck	0.9	6.3	72	1000	5/pk	392611943	8004-0168		



Graphite liner O-ring, 8004-0202

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.

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.
60% Polyimide/40% Graphite Capillary Column Ferrules							
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
Polyimide Capillary Column Ferrules							
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
Graphite Capillary Column Ferrules							
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.
60% Polyimide/40% graphite Packed Column Ferrules							
1093, 1061, 1041	1/4	1/4	1/4	1	10/pk	CR213400	8004-0217*
Graphite Packed Column Ferrules							
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 septa, 10 mm, 50/pk, 8010-0221

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 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
General Purpose Septa		
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 & TOOLS

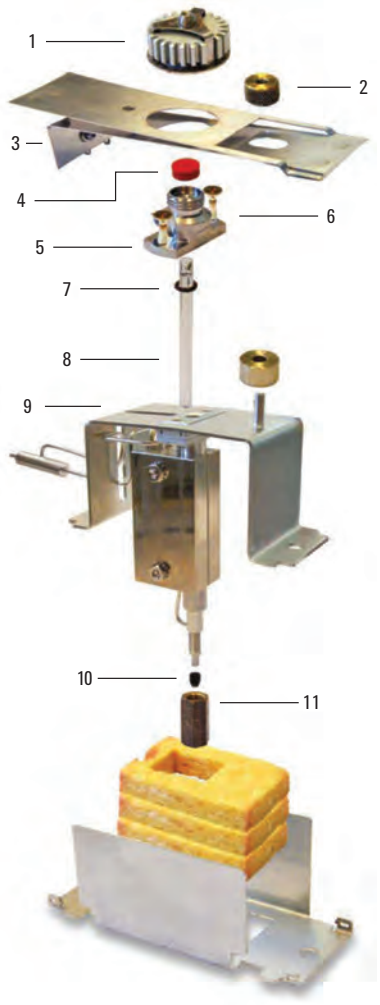
For a comprehensive vial compatibility chart, identification guide, septum recommendations, visit **www.agilent.com/chem/vialsposter**

Agilent CrossLab Supplies for Bruker, Varian* GC Systems

Injector Replacement Parts and Supplies

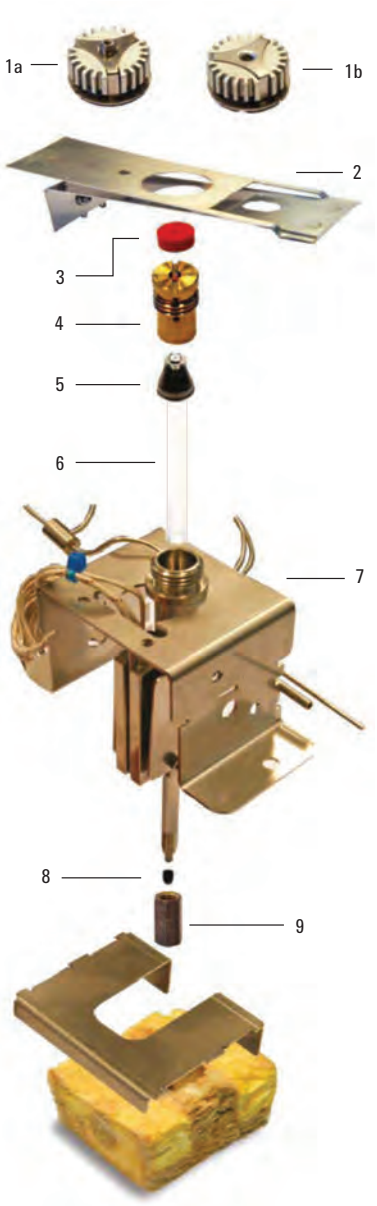
1177 Split/Splitless Injector

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, **see page 209**.	
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, **see page 209**.	
9	Bottom nut	8004-0311

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



TIPS & TOOLS

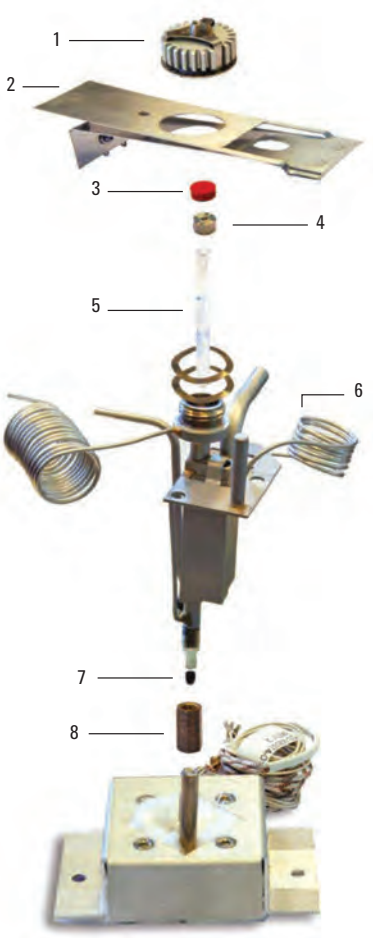
For a comprehensive vial compatibility chart, identification guide, septum recommendations, visit **www.agilent.com/chem/vialsposter**

Agilent CrossLab Supplies for Bruker, Varian* GC Systems

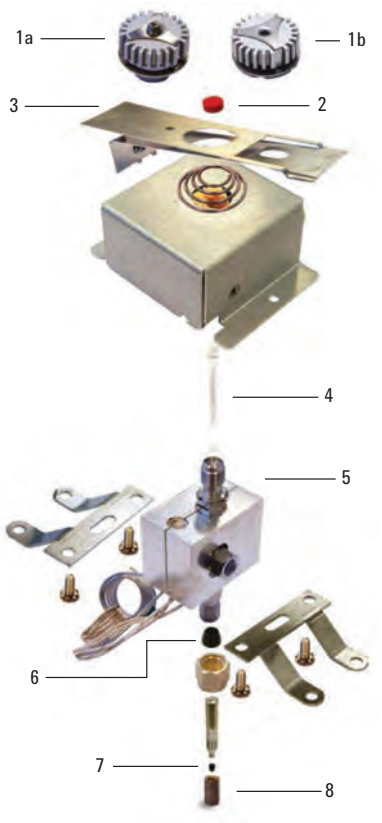
1093 Cool On-Column (COC) Injector

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

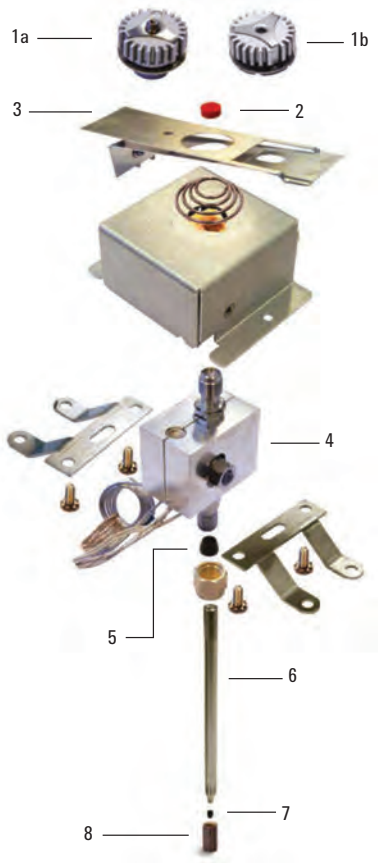
Item	Description	Agilent CrossLab and Agilent Part No.
1a	Injector nut	390812700
1b	Injector nut	392595501
	Injector nut wrench	390842300
2	Septum, 9.5 mm	
	BTO	8010-0219
	Advanced Green	8010-0203
	Septum pick	7200008400
3	Automatic start switch	390820601
4	Glass liner	8004-0168
5	Injector body, EFC23	392548301
6	Graphite/polyimide ferrule	8004-0217
	Graphite ferrule	8010-0305
7	For replacement ferrules, see complete CrossLab column ferrules ordering information, **see page 209**.	
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, **see page 209**.	
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)

Description	Agilent Part No.
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_2), 2 channels	392561290

Flame Ionization Detector (FID)

Description	Agilent Part No.
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**

Agilent CrossLab Parts and Supplies for PerkinElmer GC Systems

Liners for AutoSystem, AutoSystem XL, Clarus Systems

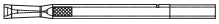
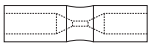
	Description	ID (mm)	OD (mm)	Length (mm)	Volume (µL)	Unit	Similar to OEM Part No.	Agilent Ultra Inert Deactivation	Similar to OEM Part No.	Agilent Original Deactivation
Split/Splitless Liners										
	PSS straight	2.0	4.0	86.2		5/pk	N6502002	8003-0153		8003-0103
	PSS straight with bottom restriction	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		
Split/Large Volume Splitless Liners										
	Straight with bottom restriction	4.0	6.2	92.1	1150	5/pk	N6121001	8003-0159	N6121001	8003-0105
Splitless Liners										
	Straight	2.0	6.2	92.1	300	5/pk	N6101372	8003-0162	N6101372	8003-0107
Split Liners										
	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
Direct Liners										
	Gooseneck, drilled hole on top, wool	4.0	6.2	92.1		5/pk	N6121022	8003-0155		
Other Liners										
	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



Graphite O-rings, 8003-0205

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

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.
85% Polyimide/15% Graphite Capillary Column Ferrules							
AutoSystem, AutoSystem XL, Clarus	1/16	0.4	0.25	1	10/pk	09920104	8010-0310
	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
Graphite Capillary Column Ferrules							
AutoSystem, AutoSystem XL, Clarus	1/16	0.4	0.25	1	10/pk		8010-0301
	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
Polyimide Capillary Column Ferrules							
AutoSystem, AutoSystem XL, Clarus	1/16	0.3	0.18 or smaller	1	10/pk		8010-0306
	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.
85% Polyimide/15% Graphite Packed Column Ferrules							
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
Graphite Packed Column Ferrules							
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
Polyimide Packed Column Ferrules							
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

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 and Plunger Repair Kit Part No.
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



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

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

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

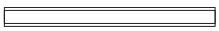
General Purpose Septa

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

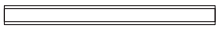
Liners for 2014 Systems

	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
Splitless Liners										
	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
Split Liners										
	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
Direct Liners										
	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

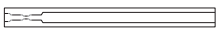
Liners for 2010 and 2010 Plus Systems

	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
Split/Splitless Liners										
	Single taper	3.4	5.0	95		5/pk	961-01480-07	8001-0154		8001-0104
Splitless Liners										
	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
Split Liners										
	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		
Other Liners										
	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
Splitless Liners										
	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
Split Liners										
	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
Direct Liners										
	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
Split/Splitless Liners								
	2.0 mm middle gooseneck	3.4	5.0	99	850	5/pk	8001-0155	8001-0105



Graphite liner O-rings, 8001-0202

Liner O-rings

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.
85% Polyimide/15% Graphite Capillary Column Ferrules							
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
Graphite Capillary Column Ferrules							
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.
85% Polyimide/15% Graphite Packed Column Ferrules							
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**

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
Splitless Liners										
	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
Split Liners										
	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
PTV Liners										
	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.
85% Polyimide/15% Graphite Capillary Column Ferrules							
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
Graphite Capillary Column Ferrules							
Trace/Focus Injectors/Detectors (not for GC/MS Interface)	M4	0.3	0.18	1	10/pk		8002-0211
	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 OEM Part No.	Agilent CrossLab 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
Description		**24/pk**		**48/pk**
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
Description		**24/pk**		**48/pk**
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

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

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

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



Agilent PAL Sampler

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

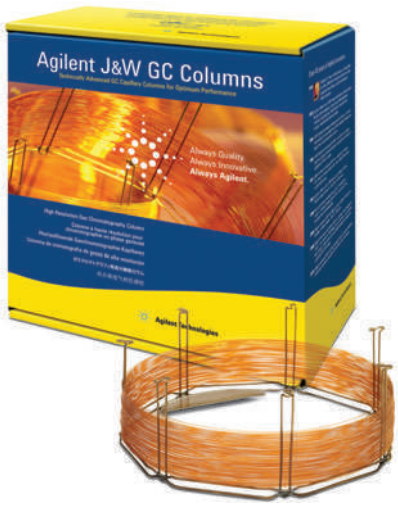
Agilent J&W GC columns

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.

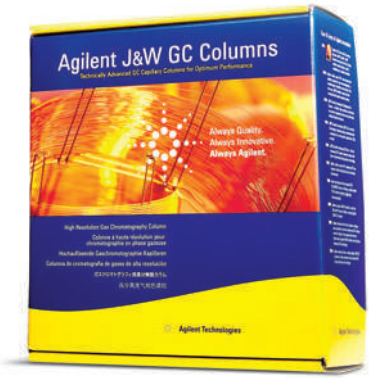
Put over 40 years of Agilent quality and innovation behind your every separation

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

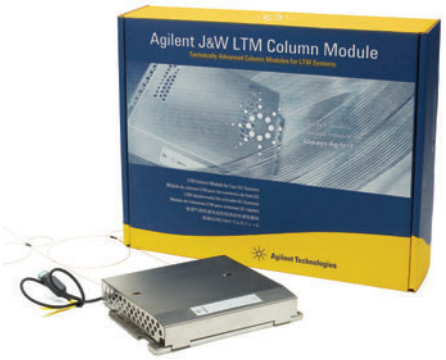
Agilent J&W columns adhere to tight retention factor (k) specifications, promoting consistent retention and separation. They also feature narrow retention indexes and a high number of theoretical plates per meter, ensuring narrow peaks and improving the resolution of closely eluting peaks.

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



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

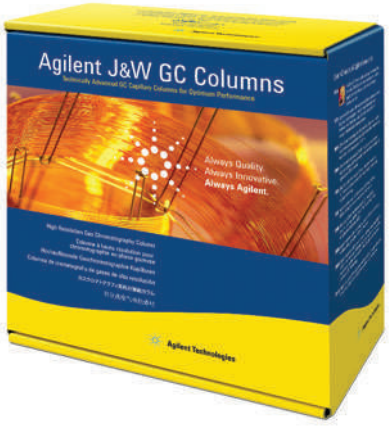


Shorten analytical cycle times and boost your high speed gas chromatography capabilities

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**



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**.

Table of Contents

Column Selection Principles 247

GC Column Application and Method Guides.....262

Ultra Inert GC Columns 286

DB-1ms Ultra Inert 289
HP-1ms Ultra Inert.....289
DB-5ms Ultra Inert 290
HP-5ms Ultra Inert.....290
DB-35ms Ultra Inert 291
DB-624 Ultra Inert 291
DB-Select 624 UI for <467> 292
DB-UI 8270D Ultra Inert 292

Agilent J&W High Efficiency GC Capillary Columns.....293

Low-bleed GC/MS Columns.....294

DB-1ms.....295
HP-1ms.....296
VF-1ms 297
DB-5ms.....299
HP-5ms.....301
VF-5ms 302
DB-XLB.....304
VF-Xms 305
DB-35ms 306
VF-35ms 307
DB-17ms 308
VF-17ms 309
VF-23ms 310
VF-200ms 311
DB-225ms 312
VF-WAXms.....313
VF-624ms and VF-1301ms 315
VF-1701ms 317

Premium Polysiloxane Columns...318

DB-1 318
HP-1 322
CP-Sil 5 CB.....324
Ultra 1 327
Ultra 2 328
DB-5 329
HP-5 332
CP-Sil 8 CB.....334
CP-Sil 13 CB 336
DB-35 337
HP-35 338
DB-17 339
HP-50+.....340
CP-Sil 24 CB 341
DB-23 342
DB-200.....343
DB-210.....344
DB-225.....345
CP-Sil 43 CB 346
DB-1301.....347
CP-1301 348
DB-1701.....349
CP-Sil 19 CB 350

Polyethylene Glycol (PEG) Columns.....351

DB-WAX and DB-WaxFF 351
DB-WAXetr 354
HP-INNOWax 355
CP-Wax 52 CB 356
DB-FFAP 358
HP-FFAP 359
CP-Wax 58 FFAP CB.....360
Carbowax 20M and HP-20M 361

Specialty Columns 362

High Temperature Columns **362**
DB-1ht 362
DB-5ht 363
DB-17ht 364
VF-5ht and VF-5ht UltiMetal.....365
Petroleum Columns..... **366**
Lowox 366
GS-OxyPLOT 366
CP-Sil 5 CB for Formaldehyde 367
HP-PONA 367
CP-Sil PONA CB.....368
CP-Sil PONA for ASTM D5134 368
DB-Petro 369
HP-1 Aluminum Clad.....369
DB-2887.....370
DB-HT SimDis 370
CP-SimDist.....371
CP-SimDist UltiMetal 372
CP-Sil 2 CB.....373
CP-TCEP for Alcohols in Gasoline ...373
DB-Sulfur SCD.....374
Select Low Sulfur 375
CP-Sil 5 CB for Sulfur.....375
Select for Permanent Gases – Dual Column.....376
Select Al_2O_3 MAPD.....376
Biodiesel Capillary GC Columns 377
Select Biodiesel.....379
Select Silanes 380
CP-Volamine 381
CP-Sil 8 CB for Amines.....382
CP-Wax for Volatile Amines and Diamines 382
PoraPLOT Amines 383

(Continued)

Table of Contents (Continued)

Specialty Columns (Continued)

Pesticides Columns **384**
- DB-CLP1 and DB-CLP2 ..... **384**
- VF-5 Pesticides **385**
- DB-1701P **386**
- VF-1701 Pesticides **386**
- CP-Sil 8 CB for Pesticides **387**
- CP-Sil 19 CB for Pesticides **387**
- DB-608 ..... **388**
- HP-PAS5 ..... **388**
- Rapid-MS **389**

PAH Columns **390**
- Select PAH **390**
- DB-EUPAH **390**
- CP-Sil PAH CB UltiMetal **391**

Semivolatiles Columns **392**
- DB-UI 8270D for Semivolatiles **392**
- CP-Sil 8 CB for PCB **393**
- DB-5.625 ..... **394**
- HP-5ms Semivolatile **395**
- CP-Sil 5/C18 CB for PCB **395**
- DB-Dioxin **396**
- CP-Sil 88 for Dioxins **396**

Volatiles Columns **397**
- DB-624 Ultra Inert **397**
- DB-624 ..... **398**
- CP-Select 624 CB **399**
- DB-VRX **400**
- HP-VOC **401**
- DB-502.2 ..... **402**
- DB-MTBE **402**
- CP-Select CB for MTBE **403**
- DB-TPH **403**
- Select Mineral Oil **404**

Foods, Flavors and Fragrance Columns **405**
- HP-88 ..... **405**
- CP-Sil 88 ..... **406**
- Select FAME **407**
- CP-Sil 88 for FAME **407**
- CP-Wax 57 CB **408**
- CP-Carbowax 400 for Volatiles in Alcohol **408**
- CP-Wax 57 CB for Glycols and Alcohols **409**
- CP-TAP CB for Triglycerides **409**
- CP-FFAP CB for Free Fatty Acids in Dairy Products **410**
- CycloSil-B **410**
- Cyclodex-B **411**
- HP-Chiral β **411**
- CP-Chirasil Val **412**
- CP-Chirasil-Dex CB **412**
- CP-Cyclodextrin-β-2,3,6-M-19 ..... **413**

Life Sciences Columns **414**
- DB-ALC1 and DB-ALC2 ..... **414**
- VF-DA **415**
- DB-5ms EVDX **415**
- DB-Select 624 UI for <467> **416**
- HP-Fast Residual Solvent **416**

Metal Columns **417**

PLOT Columns **420**
- PLOT PT **420**
- PoraBOND Q **422**
- PoraBOND U **423**
- PoraPLOT Q and PoraPLOT Q-HT **424**
- HP-PLOT Q **425**
- GS-Q **426**
- PoraPLOT U and PoraPLOT S **427**

PLOT Columns (Continued)
- HP-PLOT U **428**
- HP-PLOT Al_2O_3 KCl **428**
- GS-Alumina KCl **429**
- CP-Al_2O_3/KCl and CP-Al_2O_3/Na_2SO_4 ..... **430**
- HP-PLOT Al_2O_3 S **432**
- GS-Alumina **433**
- HP-PLOT Al_2O_3 M **434**
- GS-GasPro **434**
- CP-SilicaPLOT **435**
- CarboBOND and CarboPLOT P7 ..... **436**
- GS-CarbonPLOT **437**
- HP-PLOT Molesieve **438**
- CP-Molsieve 5Å **439**
- Particle Traps for use with PLOT Columns **440**

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**

Column Selection Principles

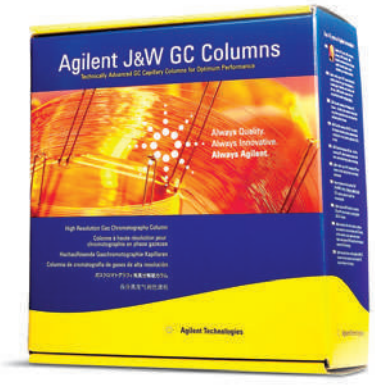
Narrow your choices, save time, and reduce trial and error

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 1ms 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).

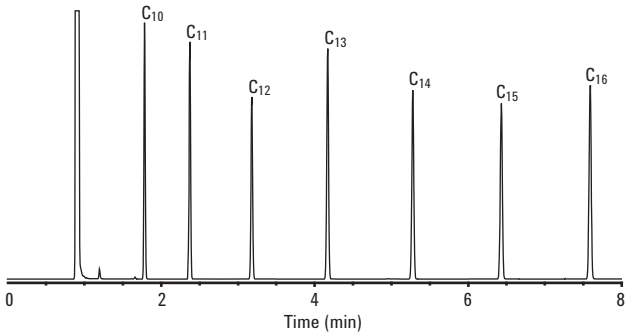
Figure 1: Boiling Point Elution Order for Homologous Series

Column: **DB-1, 15 m x 0.25 mm, 0.25 µm**

Carrier: Helium at 30 cm/s

Oven: 60 °C for 1 min, 60-180 °C at 20 °C/min

	Boiling Point (°C)
1. n-Decane (C_{10})	174
2. n-Undecane (C_{11})	196
3. n-Dodecane (C_{12})	216
4. n-Tridecane (C_{13})	234
5. n-Tetradecane (C_{14})	253
6. n-Pentadecane (C_{15})	268
7. n-Hexadecane (C_{16})	287

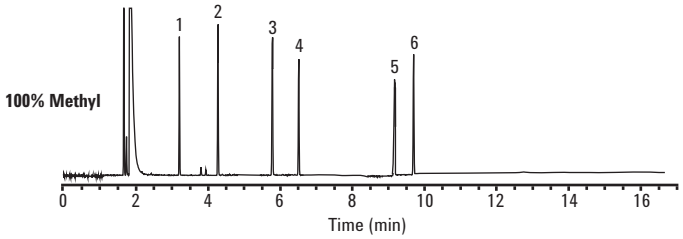


Homologous series of hydrocarbons. The solutes elute in order of their increasing boiling points; however, the peaks are not spaced in proportion to their respective boiling points.

Figure 2: Deviation from Boiling Point Order

Column: **DB-1, 30 m x 0.25 mm, 0.25 µm**

	Boiling Point (°C)
1. Toluene	111
2. Hexanol	157
3. Phenol	182
4. Decane (C_{10})	174
5. Naphthalene	219
6. Dodecane (C_{12})	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.

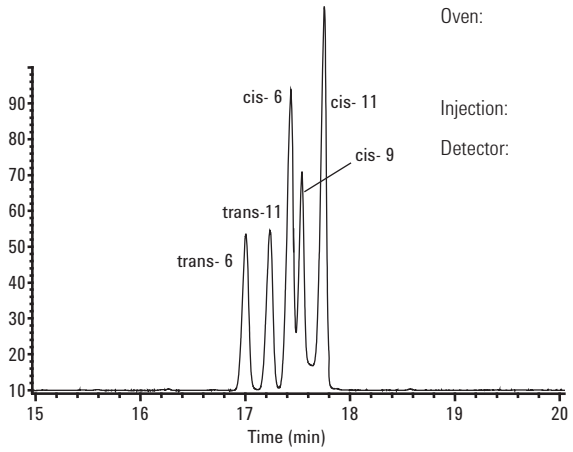
Table 1: Stationary Phase Interactions

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 µm**

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 µL
Detector:	FID, 250 °C

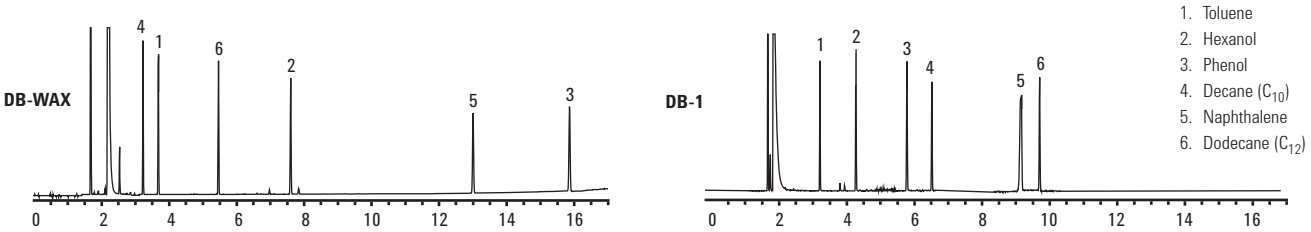
The hydrogen bonding interaction occurs if there is hydrogen bonding between the solute molecules and the stationary phase. **Table 2** lists the types of compounds that can form hydrogen bonds along with their relative bonding strengths. It is the difference in the strength of the hydrogen bonding that 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

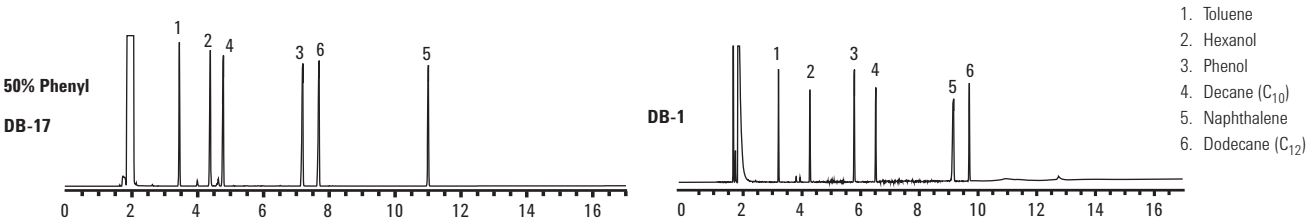
Column: 15 m x 0.25 mm, 0.25 µm



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 µm



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

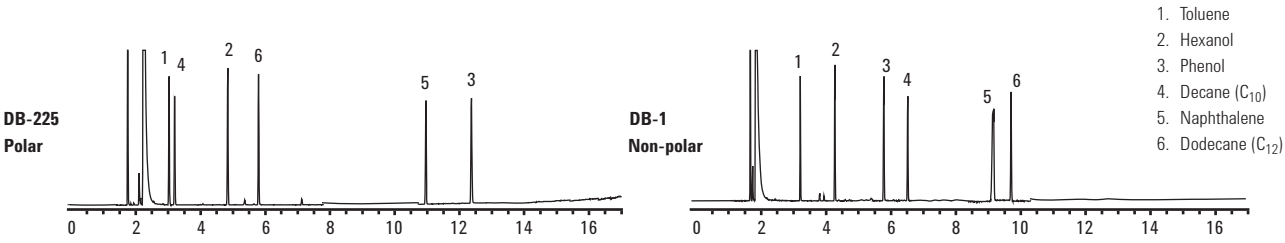
Stationary phase polarity is determined by the polarity of the substituted groups and their relative amounts. **Table 3** lists a variety of stationary phases in order of their increasing polarity. Polarity is often erroneously used to select columns or to determine separation characteristics. Stationary 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 affect 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 µm



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. Solutes 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_1-C_{10} 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_1-C_3 hydrocarbons, but C_4 and higher hydrocarbons are better separated with an Alumina PLOT column. PLOT Q exhibits extremely long retention times and very broad peaks for C_6 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.

Primary Selectivity Interactions in PLOT Phases

Dispersive

Shape/Size		**Ionic Surface**
Zeolites	⟷	Alumina/Al_2O_3
		GS-OxyPLOT

Dispersive

Shape/Size		**Ionic Surface**
Molecular Sieves	**Porous Polymers**	Bonded Silica
Bonded Graphitized Carbon		

PLOT Column Examples

Zeolite/Molesieve:	HP-PLOT Molesieve
Graphitized Bonded Carbon:	GS-CarbonPLOT, CarboBOND
Porous Polymers:	HP-PLOT Q, HP-PLOT U
Bonded Silica:	GS-GasPro, CP-SilicaPLOT
Alumina/Al_2O_3:	GS-Alumina, GS-Alumina KCl, HP-PLOT Al_2O_3 KCl, HP-PLOT Al_2O_3 "S", HP-PLOT Al_2O_3 "M"
Proprietary Phase:	Lowox, GS-OxyPLOT

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**



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.

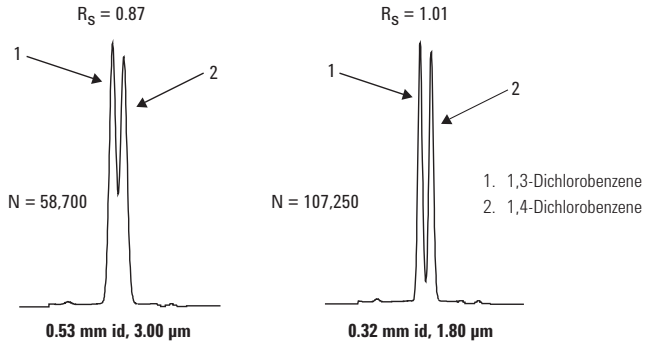
Column efficiency (N/m) is inversely proportional to column diameter. The efficiencies listed in **Table 4** show that smaller diameter columns have higher theoretical plates per meter. Resolution is a square root function of the theoretical plate number. Therefore, doubling column efficiency theoretically 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.



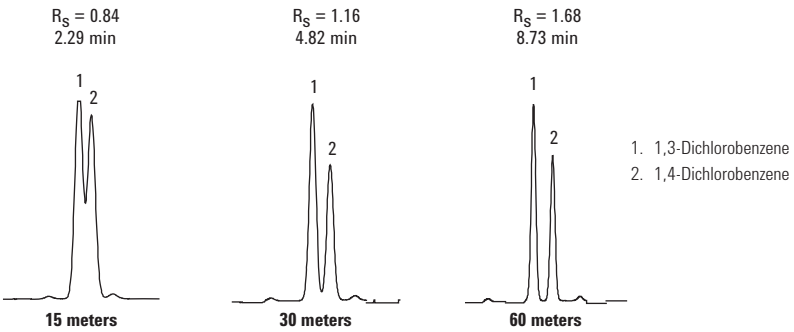
Column Length

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.

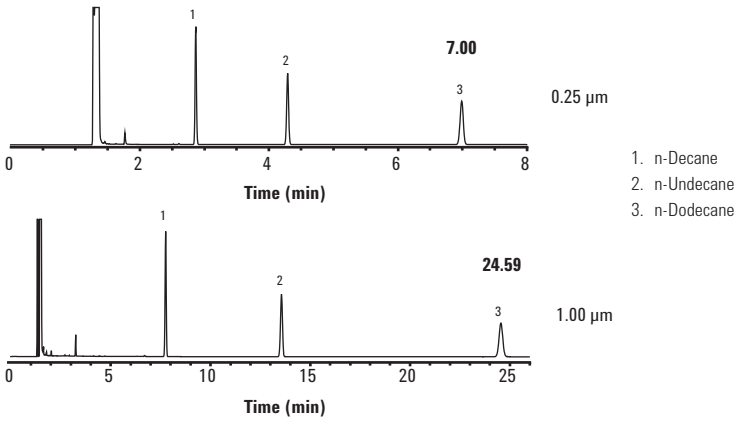
Solutes with k values less than 2 are very difficult to resolve due to insufficient retention by the column. Changing to a thicker film column results in better resolution since solute retention is increased. The resolution improvement depends on the solute k value for the original column. For solutes 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



1. n-Decane
2. n-Undecane
3. n-Dodecane

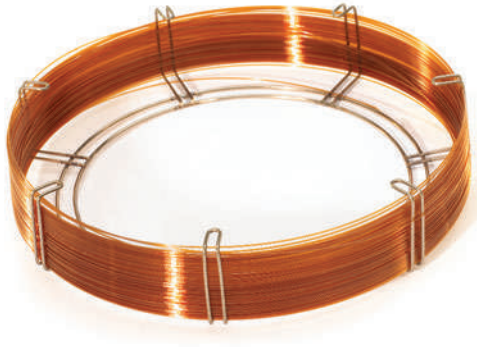
For a given stationary phase, column bleed increases as film thickness increases. Since thicker film columns are more retentive, later eluting peaks may shift into a region of much higher column bleed when increasing film thickness. The upper temperature limits of thick film columns may be lower due 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 µm 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 µm 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 γ-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 β
	Optical isomers of acids, alcohols, amino acids, aromatic, diols, flavor, aromas, ketones, organic acids and phenols	CP-Chirasil-Dex CB, CP-Cyclodextrin-β-2,3,6-M-19
	Amino acids, optical isomers	CP-Chirasil-Dex CB, CP-Cyclodextrin-β-2,3,6-M-19
Foods, Flavors and Fragrances	FAME up to C_{26}, 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_1-C_{26}	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_5-C_{80}, 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_5-C_{120} 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_1-C_{10} hydrocarbons	Select Al_2O_3 MAPD, Alumina PLOT PT family
	C_1-C_6 alcohols, aromatic C_6-C_{10}	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_1-C_6 amines, alcohols, NH_3, water, solvents, ethanol amines	CP-Volamine
	C_3-C_{20} amines, alkanol amines	CP-Sil 8 CB for Amines
	C_3-C_8 amines and diamines	CP-Wax for Volatile Amines and Diamines
	C_4-C_{10} amines, diamines and aromatic amines	CP-Wax 51 for Amines
	Oxygenates in C_1-C_{10} hydrocarbons	CP-Lowox, GS-OxyPLOT
	C_1-C_{10} hydrocarbons	GS-OxyPLOT
	Methanol, formaldehyde and formic acid in water	CP-Sil 5 CB for Formaldehyde
	C_1-C_{12} 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_5-C_{40} 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**

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 µm	122-1534
		DB-624, 30 m x 0.25 mm, 1.40 µm	122-1334
		VF-624ms, 30 m x 0.25 mm, 1.40 µm	CP9102
		DB-624 Ultra Inert, 30 m x 0.25 mm, 1.40 µm	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 µm	122-1564
		DB-624, 60 m x 0.25 mm, 1.40 µm	122-1364
		VF-624ms, 60 m x 0.25 mm, 1.40 µm	CP9103
		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
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 µm	122-1534
		DB-624, 30 m x 0.25 mm, 1.40 µm	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 µm	123-8232
		DB-CLP2, 30 m x 0.32 mm, 0.50 µm	123-8336
		DB-VRX, 30 m x 0.25 mm, 1.40 µm	122-1534
		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
		VF-1ms, 30 m x 0.32 mm, 1.00 µm	CP8926
		VF-1701ms, 30 m x 0.32 mm, 1.00 µm	CP9163
505	Analysis of organohalide pesticides and commercial polychlorinated biphenyl (PCB) products in water by microextraction and 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-XLB, 30 m x 0.25 mm, 0.50 µm	122-1236
		VF-1ms, 30 m x 0.32 mm, 1.00 µm	CP8926
		VF-17ms, 30 m x 0.32 mm, 0.50 µm	CP8991
506	Determination of phthalate and adipate esters in drinking water by liquid-liquid extraction or liquid-solid extraction and GC with photoionization detection	DB-5ms, 30 m x 0.25 mm, 0.25 µm	122-5532
		VF-5ms, 30 m x 0.32 mm, 0.25 µm	CP8955
		VF-1ms, 30 m x 0.32 mm, 0.25 µm	CP8924
507	Determination of nitrogen and phosphorus-containing pesticides in water by GC with a nitrogen phosphorus detector	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-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

(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
		VF-5ms, 30 m x 0.32 mm, 1.00 µm	CP8957
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 µm	122-1564
		DB-624, 75 m x 0.45 mm, 2.55 µm	124-1374
		DB-624, 60 m x 0.25 mm, 1.40 µm	122-1364
		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
602	Purgeable aromatics	DB-624, 75 m x 0.53 mm, 3.00 µm	125-1374
		DB-624, 30 m x 0.25 mm, 1.40 µm	122-1334
		DB-VRX, 30 m x 0.25 mm, 1.40 µm	122-1534
		VF-624ms, 75 m x 0.53 mm, 3.00 µm	CP9108
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
		VF-624ms, 30 m x 0.25 mm, 1.40 µm	CP9102
603	Acrolein and acrylonitrile	DB-624, 30 m x 0.25 mm, 1.40 µm	122-1334
		DB-VRX, 30 m x 0.25 mm, 1.40 µm	122-1534
		VF-WAXms, 30 m x 0.25 mm, 1.00 µm	CP9206
		VF-624ms, 30 m x 0.25 mm, 1.40 µm	CP9102
604	Phenols	DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-5532UI
		DB-XLB, 30 m x 0.25 mm, 0.25 µm	122-1232
		VF-5ms, 60 m x 0.32 mm, 1.80 µm	CP9105
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
605	Benzidines	DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-5532UI
		DB-608, 30 m x 0.25 mm, 0.25 µm	122-6832
606	Phthalate esters	DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-5532UI
		DB-608, 30 m x 0.25 mm, 0.25 µm	122-6832
		VF-5ms, 30 m x 0.25 mm, 0.25 µm	CP8944
607	Nitrosamines	DB-5ms Ultra Inert, 30 m x 0.25 mm, 0.25 µm	122-5532UI
		CP-Sil 8 CB for Amines, 30 m x 0.32 mm, 1.00 µm	CP7596

(Continued)

TIPS & TOOLS

Get fast and easy GC pressure and flow calculations at your fingertips with Agilent's GC Calculator Application – **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)

Solid Waste

EPA Method	Application	Column	Part No.
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 pentafluorobenzylation 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
		VF-1701 Pesticides, 30 m x 0.25 mm, 0.25 µm	CP9070
8240	Volatile chlorinated and aromatic hydrocarbons	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
		DB-624 Ultra Inert, 60 m x 0.25 mm, 1.40 µm	122-1364UI
8260/CLP-VOCs	Volatile organic compounds by gas chromatography/mass spectroscopy (GC/MS): capillary column technique method	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
		DB-624, 20 m x 0.18 mm, 1.00 µm	121-1324
8260b	Volatile organic compounds by GC/MS	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
		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
8261	Volatile organic compounds by vacuum distillation in combination with GC/MS spectrometry (VD/GC/MS)	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
		DB-624, 20 m x 0.18 mm, 1.00 µm	121-1324
		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 & 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**

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 & TOOLS

Gain extra confidence to meet high standards with Agilent's solution for the revised USP <467>. Visit **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-QO3PT
		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-QO3PT
		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 Liquified Petroleum (LP) Gases and Propene Concentrates by GC	HP-PLOT Al_2O_3 KCl PT, 30 m x 0.53 mm, 15.00 µm	19095P-K23PT
		HP-PLOT Al_2O_3 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_8 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_2 through C_5 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_2O_3/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_2 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_2O_3/KCl PT, 50 m x 0.32 mm, 5.00 µm	CP7515PT
		CP-Al_2O_3/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_{60}	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_2O_3 S PT, 50 m x 0.53 mm, 15.00 µm	19095P-S25PT
		CP-Al_2O_3/Na_2SO_4, 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-QO3PT
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 Pentonol 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-QO4PT
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-QO3PT
		HP-PLOT U PT, 30 m x 0.53 mm, 20.00 µm	19095P-UO4PT
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-QO4PT
D5580	Standard Test Method for Determination of Benzene, Toluene, Ethylbenzene, p/m-Xylene, C_9 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_8-C_{12} 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_2O_3 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

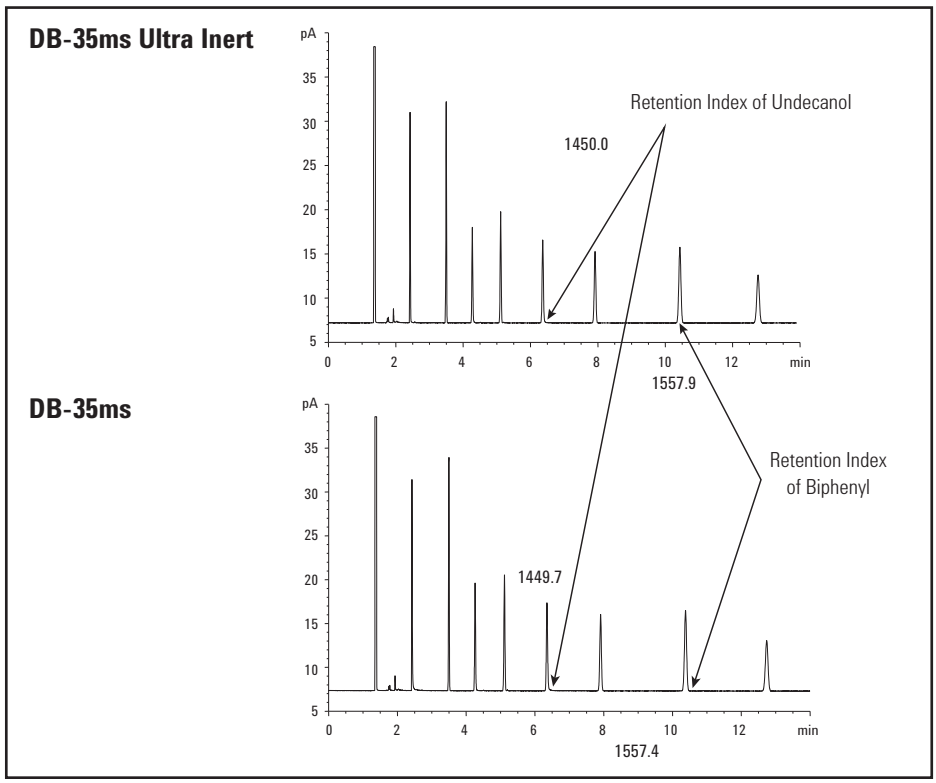
GC Capillary Columns

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.

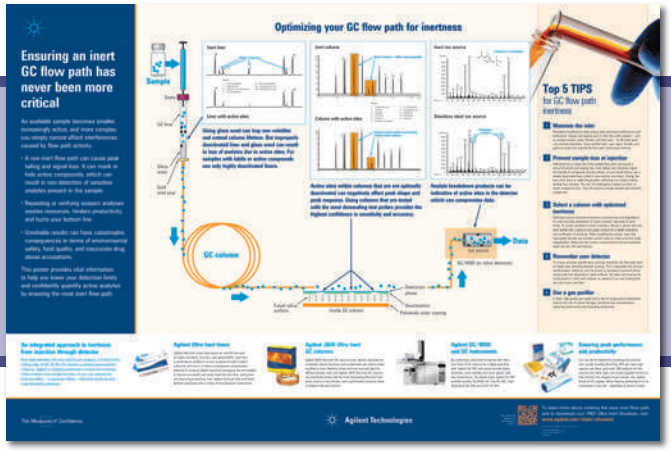
The test probes in Agilent's Ultra Inert test probe mixture have low molecular weights, low boiling points and no steric shielding of their active groups. These characteristics allow the probative portion of the test molecules to penetrate – and fully interact with – the stationary phase and column surface.

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

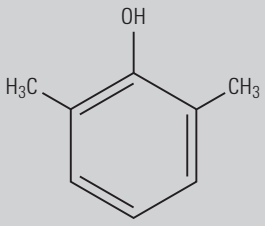
To learn more and order your free poster, visit
www.agilent.com/chem/inert



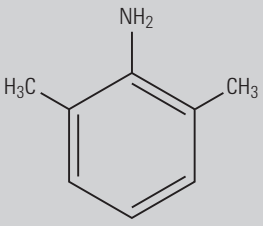
Agilent's more demanding Ultra Inert test probe mixture for 5ms, 1ms, and 35ms Ultra Inert columns

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

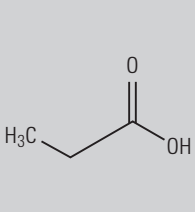


2,6-Dimethylphenol

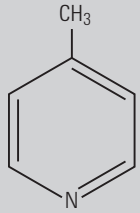


2,6-Dimethylaniline

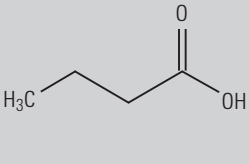
Weak probe molecules: The acidic and basic portions of these molecules are shielded by the two methyl groups on their phenyl rings, making them less probative.



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
0.18	*20*	*0.18*	*-60 to 325/350*	*121-0122UI*	
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

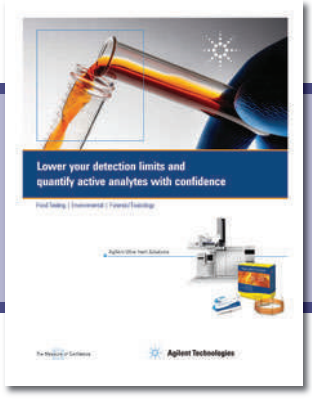
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.18	*20*	*0.18*	*-60 to 325/350*	*19091S-677UI*
0.25	15	0.25	-60 to 325/350	19091S-931UI
	30	0.25	-60 to 325/350	19091S-933UI
		0.50	-60 to 325/350	19091S-633UI
		1.00	-60 to 325/350	19091S-733UI
0.32	15	0.25	-60 to 325/350	19091S-911UI
	25	0.52	-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/UIorder**



DB-5ms Ultra Inert

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.18	*20*	*0.18*	*-60 to 325/350*	*121-5522UI*		*121-5522UILTM*
		0.36	*-60 to 325/350*	*121-5523UI*		*121-5523UILTM*
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
HP-5ms Ultra Inert						
0.18	*20*	*0.18*	*-60 to 325/350*	*19091S-577UI*		*19091S-577UILTM*
0.25	15	0.25	-60 to 325/350	19091S-431UI		19091S-431UILTM
	30	0.25	-60 to 325/350	19091S-433UI	19091S-433UIE	19091S-433UILTM
		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
0.18	*20*	*0.18*	*50 to 340/360*	*121-3822UI*
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
0.18	*20*	*1.00*	*-20 to 260*	*121-1324UI*
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**



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

DB-UI 8270D Ultra Inert

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.18	*20*	*0.36*	*-60 to 325/350*	*121-9723*
				*621-9723, 6/pk**
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.

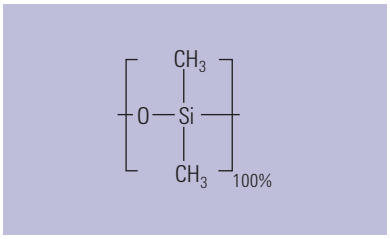
TIPS & TOOLS

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**



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



Structure of DB-1ms

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

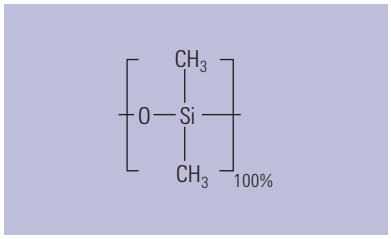
DB-1ms

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
0.18	*20*	*0.18*	*-60 to 340/360*	*121-0122*		*121-0122LTM*
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		
		0.25	-60 to 340/360	122-0132	122-0132E	
	60	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		
		0.25	-60 to 340/360	123-0132		
	60	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



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

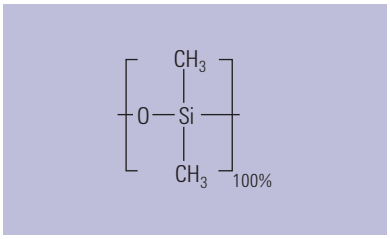
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.18	*20*	*0.18*	*-60 to 325/350*	*19091S-677*		*19091S-677LTM*
0.20	25	0.33	-60 to 325/350	19091S-602	19091S-602E	
0.25	15	0.25	-60 to 325/350	19091S-931		
	30	0.10	-60 to 325/350	19091S-833		19091S-833LTM
		0.25	-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
	60	0.25	-60 to 325/350	19091S-936	19091S-936E	
0.32	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



Structure of VF-1ms

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	
0.15	*10*	*0.15*	*-60 to 325/350*	*CP9030*	
	15	*0.15*	*-60 to 325/350*	*CP5881*	
	20	*0.15*	*-60 to 325/350*	*CP9031*	
		0.60	*-60 to 325/350*	*CP9032*	
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)

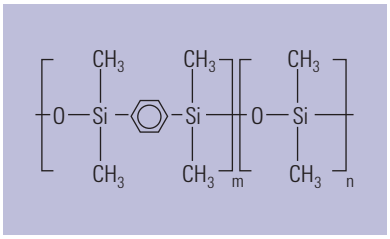


Column shown with EZ-GRIP

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	CP8908I5
	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	CP8912I5
		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	
		1.00	-60 to 325/350	CP8926	
	50	0.25	-60 to 325/350		
		0.40	-60 to 325/350	CP8928	
	60	0.25	-60 to 325/350	CP8929	
		1.00	-60 to 325/350	CP8930	
0.53	15	0.50	-60 to 325/350	CP8965	
		1.50	-60 to 325/350	CP8967	
	30	0.50	-60 to 325/350	CP8968	
		1.00	-60 to 325/350	CP8969	
		1.50	-60 to 310/335	CP8970	

DB-5ms



Structure of 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



TIPS & TOOLS

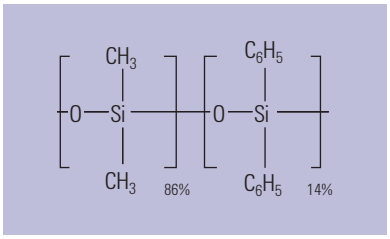
Learn more about the Agilent 7890B GC System at **www.agilent.com/chem/7890BGC**

DB-5ms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.18	*20*	*0.18*	*-60 to 325/350*	*121-5522*	*121-5522E*	*121-5522LTM*
		0.36	*-60 to 325/350*	*121-5523*		*121-5523LTM*
	40	*0.18*	*-60 to 325/350*	*121-5542*		
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



Structure of HP-5ms

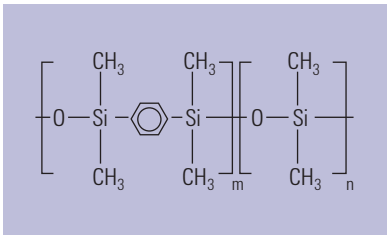
- (5%-Phenyl)-methylpolysiloxane
- Identical selectivity to HP-5
- Non-polar
- Very low bleed characteristics, ideal for GC/MS
- Excellent inertness for active compounds including acidic and basic compounds
- Improved signal-to-noise ratio for better sensitivity and mass spectral integrity
- Bonded and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

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

HP-5ms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.18	*20*	*0.18*	*-60 to 325/350*	*19091S-577*		*19091S-577LTM*
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 µm)
- 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 (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.10	10	0.40	-60 to 325/350	CP8934	
0.15	*10*	*0.15*	*-60 to 325/350*	*CP9034*	
	15	*0.15*	*-60 to 325/350*	*CP9035*	
	20	*0.15*	*-60 to 325/350*	*CP9036*	
		0.30	*-60 to 325/350*	*CP9037*	
		0.60	*-60 to 325/350*	*CP9038*	
	40	*0.15*	*-60 to 325/350*	*CP9039*	
0.20	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)

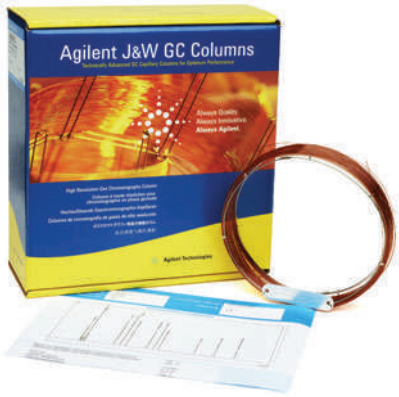
TIPS & TOOLS

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**



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

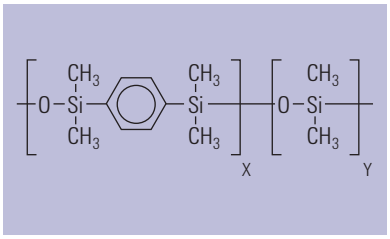
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	7890/6890 LTM II Module
0.18	*20*	*0.18*	*30 to 340/360*	*121-1222*	
	30	*0.18*	*30 to 340/360*	*121-1232*	
0.20	25	0.33	30 to 340/360	128-1222	
0.25	15	0.10	30 to 340/360	122-1211	122-1211LTM
		0.25	30 to 340/360	122-1212	
	30	0.10	30 to 340/360	122-1231	
		0.25	30 to 340/360	122-1232	122-1232LTM
		0.50	30 to 340/360	122-1236	
		1.00	30 to 340/360	122-1233	
	60	0.25	30 to 340/360	122-1262	
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 semivolatile 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



Structure of VF-Xms

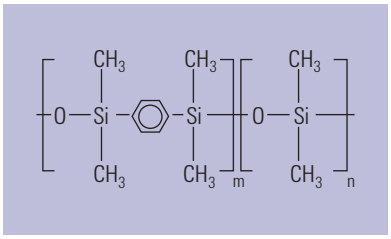
VF-Xms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.15	*20*	*0.15*	*30 to 340/360*	*CP9041*
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
	60	0.25	30 to 340/360	CP8809
0.32	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



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

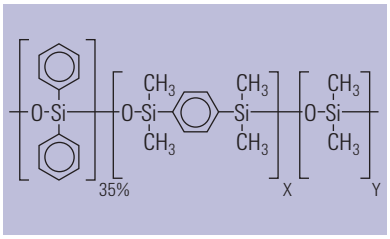
Similar Phases: Rtx-35, Rtx-35ms, Rxi-35Sil MS, SPB-35, AT-35, Sup-Herb, MDN-35, BPX-34, ZB-35, ZB-35 ht

DB-35ms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.18	*20*	*0.18*	*50 to 340/360*	*121-3822*		
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



Structure of VF-35ms

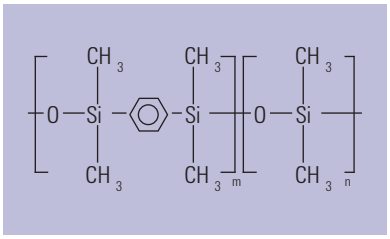
- Stabilized arylene-modified equivalent of a 35% phenylmethyl phase
- Ideal for dual column confirmational analyses
- Ultra low bleed, highly stable column with a programmable maximum temperature of 360 °C
- Medium polarity column ideal for trace environmental and chemical analyses
- 0.15 mm id columns 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

VF-35ms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.15	*10*	*0.15*	*40 to 340/360*	*CP5887*
	20	*0.15*	*40 to 340/360*	*CP5889*
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
	30	0.10	40 to 340/360	CP8875
		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

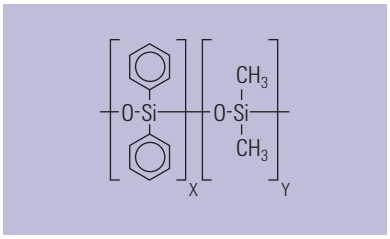
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.18	*20*	*0.18*	*40 to 320/340*	*121-4722*		*121-4722LTM*
0.25	15	0.15	40 to 320/340	122-4711		122-4711LTM
		0.25	40 to 320/340	122-4712		122-4712LTM
	30	0.15	40 to 320/340	122-4731		
		0.25	40 to 320/340	122-4732	122-4732E	122-4732LTM
	60	0.25	40 to 320/340	122-4762		
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**

VF-17ms



Structure of VF-17ms

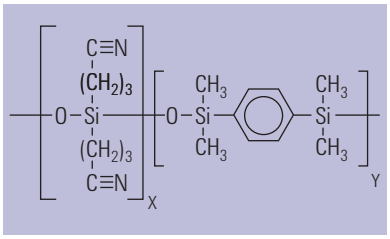
- 50% phenyl/50% dimethylpolysiloxane, medium polarity phase
- Ultra low bleed
- Proprietary deactivation technology and manufacturing process improves column stability, resulting in improved column-to-column repeatability and column lifetimes
- Ideal for environmental and clinical methods
- Ultra low 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

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	
0.15	*10*	*0.15*	*40 to 330/360*	*CP5882*	
	15	*0.15*	*40 to 330/360*	*CP5883*	
	20	*0.15*	*40 to 330/360*	*CP5884*	
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	
		0.25	40 to 330/360	CP8982	CP8982I5
		0.50	40 to 330/360	CP8983	
	60	0.25	40 to 330/360	CP8984	
0.32	15	0.15	40 to 330/360	CP8986	
	30	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

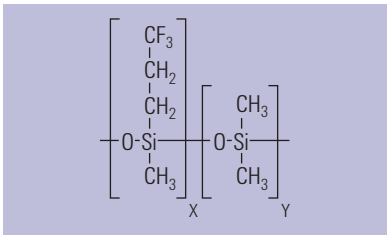
- High polarity and highly substituted cyanopropyl low bleed phase
- Engineered for accurate analysis of very polar analytes
- 100% bonded phase permits column rinsing to enhance column lifetime
- Operating temperature up to 260 °C
- Expands application ranges to higher molecular weight compounds
- 0.15 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	CP8822I5
	60	0.25	40 to 260/260	CP8824	CP8824I5
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



Structure of 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
0.15	*20*	*0.15*	*0 to 325/350*	*CP5891*	
		0.60	*0 to 325/350*	*CP5892*	
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	CP8859I5
		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

DB-225ms

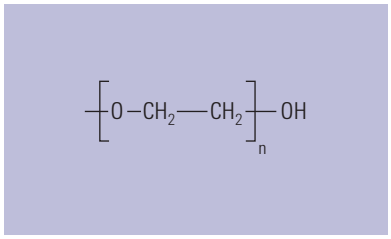
- Virtually equivalent to (50%-cyanopropylphenyl)-methylpolysiloxane
- Mid/high polarity
- Excellent for separations of cis- and trans-fatty acid methyl esters (FAMEs)
- Low bleed
- Bonded and cross-linked
- Solvent rinsable
- Close equivalent to USP Phase G7

Similar Phases: SP-2330, Rtx-225, BP-225, OV-225, 007-225, AT-225

DB-225ms

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 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



Structure of 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: SUPELCOWAX 10, SUPEROX II, CB-WAX, Stabilwax, BP-20, 007-CW, Carbowax, Rtx-WAX, ZB-WAX, ZB-WAX plus

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	
0.15	*15*	*0.15*	*20 to 250/260*	*CP9201*	
	20	*0.15*	*20 to 250/260*	*CP9220*	
	30	*0.15*	*20 to 250/260*	*CP9202*	
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	CP9205I5
		0.50	20 to 250/260	CP9222	
		1.00	20 to 240	CP9206	
	60	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	

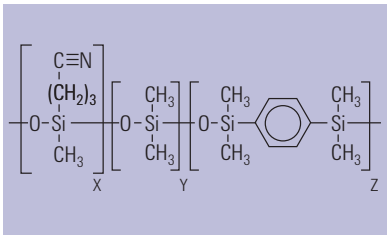


TIPS & TOOLS

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



Structure of VF-624ms and VF-1301ms

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
0.15	*15*	*0.84*	*-40 to 280/300*	*CP9101*	
	20	*0.84*	*-40 to 280/300*	*CP9100*	
	30	*0.84*	*-40 to 280/300*	*CP9109*	
	40	*0.84*	*-40 to 280/300*	*CP9110*	
0.25	30	1.40	-40 to 280/300	CP9102	CP9102I5
	60	1.40	-40 to 280/300	CP9103	CP9103I5
0.32	30	1.80	-40 to 280/300	CP9104	CP9104I5
	60	1.80	-40 to 280/300	CP9105	
0.53	30	3.00	-40 to 280/300	CP9106	CP9106I5
	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

Similar Phases: Rtx-1301, PE-1301

VF-1301ms

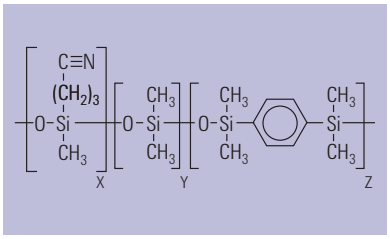
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.10	10	1.00	-40 to 280/300	CP9066
0.25	30	0.25	-40 to 280/300	CP9053
		1.00	-40 to 280/300	CP9054
	60	0.25	-40 to 280/300	CP9055
		1.00	-40 to 280/300	CP9056
0.32	15	0.25	-40 to 280/300	CP9057
		1.00	-40 to 280/300	CP9058
0.53	15	1.00	-40 to 280/300	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**



VF-1701ms



Structure of VF-1701ms

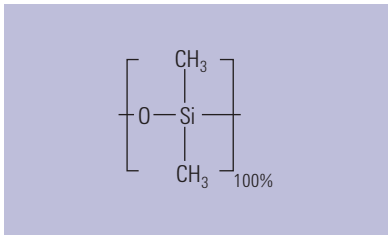
- Ultra-low bleed 14% cyanopropyl/phenyl/86% polydimethylsiloxane phase
- Mid polarity
- Ideal for pesticides, PCBs and semi-volatile organic compounds
- Highly inert for difficult analytes such as p,p'-DDT
- Deactivated for accurate trace analysis
- Engineered for reduced bleed, (bleed specification 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
0.15	*20*	*0.15*	*-20 to 280/300*	*CP9145*	
0.25	30	0.15	-20 to 280/300	CP9150	
		0.25	-20 to 280/300	CP9151	CP9151I5
		1.00	-20 to 280/300	CP9152	CP9152I5
	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 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
	10	0.10	-60 to 325/350	127-1012	127-1012E	
		0.40	-60 to 325/350	127-1013	127-1013E	127-1013LTM
	20	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
0.15	*10*	*1.20*	*-60 to 325/350*	*12A-1015*		*12A-1015LTM*
0.18	*10*	*0.18*	*-60 to 325/350*	*121-1012*	*121-1012E*	*121-1012LTM*
		0.20	*-60 to 325/350*	*121-101A*		*121-101ALTM*
		0.40	*-60 to 325/350*	*121-1013*		*121-1013LTM*
	20	*0.18*	*-60 to 325/350*	*121-1022*	*121-1022E*	*121-1022LTM*
		0.40	*-60 to 325/350*	*121-1023*		*121-1023LTM*
	40	*0.40*	*-60 to 325/350*	*121-1043*		
0.20	12	0.33	-60 to 325/350	128-1012		128-1012LTM
	25	0.33	-60 to 325/350	128-1022		128-1022LTM
	30	0.80	-60 to 325/350	128-1034		
	50	0.33	-60 to 325/350	128-1052		
0.25	15	0.10	-60 to 325/350	122-1011		
		0.25	-60 to 325/350	122-1012		122-1012LTM
		1.00	-60 to 325/350	122-1013		
	25	0.25	-60 to 325/350	122-1022		122-1022LTM
	30	0.10	-60 to 325/350	122-1031		
		0.25	-60 to 325/350	122-1032	122-1032E	122-1032LTM*
		0.50	-60 to 325/350	122-103E		122-103ELTM
		1.00	-60 to 325/350	122-1033	122-1033E	122-1033LTM
	50	0.25	-60 to 325/350	122-1052		
	60	0.10	-60 to 325/350	122-1061		
		0.25	-60 to 325/350	122-1062		
		0.50	-60 to 325/350	122-106E		
		1.00	-60 to 325/350	122-1063		
	100	0.50	-60 to 325/350	122-10AE		
	150	1.00	-60 to 325/350	122-10G3		

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

(Continued)

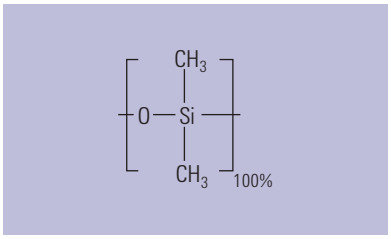
DB-1

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 (µm)	Temp Limits (°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
		0.25	-60 to 320/340	125-101K		
		0.50	-60 to 300/320	125-1017		
		1.00	-60 to 300/320	125-101J		
		1.50	-60 to 300/320	125-1012	125-1012E	125-1012LTM
		3.00	-60 to 260/280	125-1014		
		5.00	-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		
		0.25	-60 to 320/340	125-103K	125-103KE	125-103KLTM
		0.50	-60 to 300/320	125-1037		
		1.00	-60 to 300/320	125-103J		125-103JLTM
		1.50	-60 to 300/320	125-1032		125-1032LTM
		2.65	-60 to 260/280	125-103B		
		3.00	-60 to 260/280	125-1034	125-1034E	125-1034LTM
		5.00	-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	
		1.50	-60 to 300/320	125-1062	125-1062E	
		3.00	-60 to 260/280	125-1064		
		5.00	-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_5)
- 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

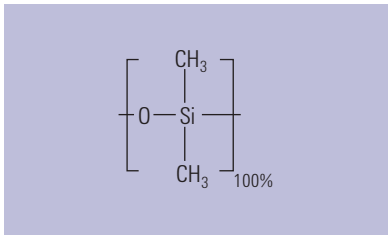
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.18	*20*	*0.18*	*-60 to 325/350*	*19091Z-577*	*19091Z-577E*	
0.20	12	0.33	-60 to 325/350	19091-60312		
	17	0.11	-60 to 325/350	19091Z-008		
	25	0.11	-60 to 325/350	19091Z-002		19091Z-002LTM
		0.33	-60 to 325/350	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	
0.15	*10*	*0.12*	*-60 to 330/350*	*CP7684*	
		2.00	*-60 to 325/350*	*CP7682*	
	25	*0.12*	*-60 to 330/350*	*CP7694*	
		1.20	*-60 to 325/350*	*CP7693*	
		2.00	*-60 to 325/350*	*CP7692*	
0.20	25	0.33	-60 to 325/350	CP7622	
0.25	10	0.12	-60 to 330/350	CP7700	
	15	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 (µm)	Temp Limits (°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	

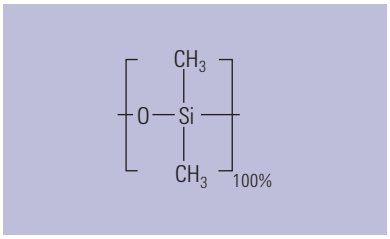
CP-Sil 5 CB UltiMetal

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

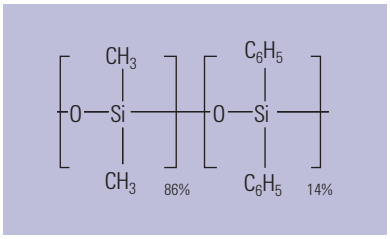
Ultra 1

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	
	17	0.11	-60 to 325/350	19091A-008	
		0.33	-60 to 325/350	19091A-108	
	25	0.11	-60 to 325/350	19091A-002	
		0.33	-60 to 325/350	19091A-102	19091A-102E
	50	0.11	-60 to 325/350	19091A-005	
		0.33	-60 to 325/350	19091A-105	
0.32	25	0.17	-60 to 325/350	19091A-012	
		0.52	-60 to 325/350	19091A-112	
	50	0.17	-60 to 325/350	19091A-015	
		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**





Structure of Ultra 2

Ultra 2

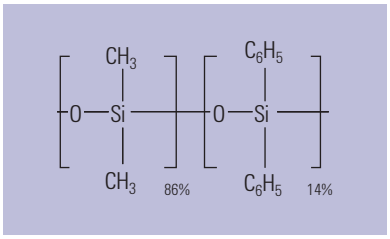
- (5%-Phenyl)-methylpolysiloxane
- Non-polar
- Equivalent to HP-5 with tighter specifications for retention index and capacity factors
- Bonded and cross-linked
- Solvent rinsable

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
	25	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



Structure of 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

DB-5

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 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		
0.15	*10*	*1.20*	*-60 to 300/320*	*12A-5015*		*12A-5015LTM*
0.18	*10*	*0.18*	*-60 to 325/350*	*121-5012*	*121-5012E*	*121-5012LTM*
		0.40	*-60 to 325/350*	*121-5013*		*121-5013LTM*
	20	*0.18*	*-60 to 325/350*	*121-5022*	*121-5022E*	*121-5022LTM*
		0.40	*-60 to 325/350*	*121-5023*		*121-5023LTM*
	40	*0.18*	*-60 to 325/350*	*121-5042*		

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

(Continued)

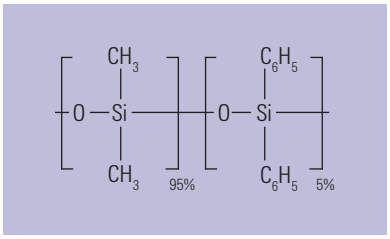
DB-5

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
	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 (µm)	Temp Limits (°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		
		1.50	-60 to 300/320	125-5012	125-5012E	125-5012LTM
	25	5.00	-60 to 260/280	125-5025		
	30	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		
		5.00	-60 to 260/280	125-5035	125-5035E	125-5035LTM
	60	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
0.18	*20*	*0.18*	*-60 to 325/350*	*19091J-577*	*19091J-577E*	*19091J-577LTM*
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

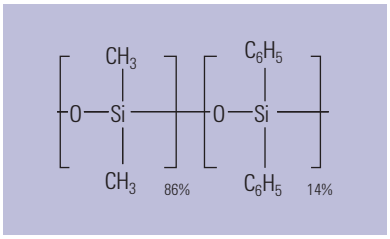
(Continued)

HP-5

ID (mm)	Length (m)	Film (µm)	Temp Limits (°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 & TOOLS

Learn more about Agilent's top-ranked service and support at **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
0.15	*10*	*0.12*	*-60 to 330/350*	*CP7884*	
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

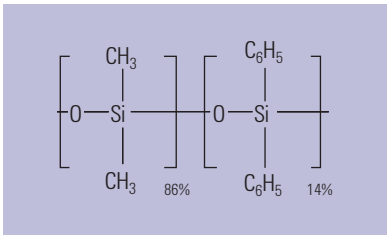
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.32	10	0.12	-60 to 330/350	CP7731	
		5.00	-60 to 300/325	CP8014	
	15	0.25	-60 to 325/350	CP8531	
		1.00	-60 to 325/350	CP8541	
	25	0.12	-60 to 330/350	CP7741	CP7741I5
		0.25	-60 to 325/350	CP7452	
		0.40	-60 to 325/350	CP7779	
		0.52	-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	
		0.25	-60 to 325/350	CP8752	
		1.00	-60 to 325/350	CP8761	
	50	0.12	-60 to 330/350	CP7751	CP7751I5
		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	CP7691I5
	60	0.25	-60 to 325/350	CP8754	
		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	CP8736I5
		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

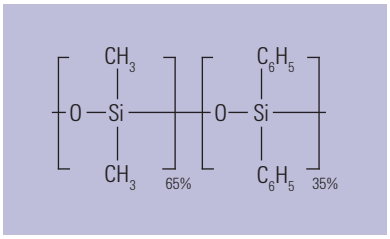
Similar Phases: Rtx-20

CP-Sil 13 CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.15	*25*	*0.40*	*-25 to 300/330*	*CP7813*	
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



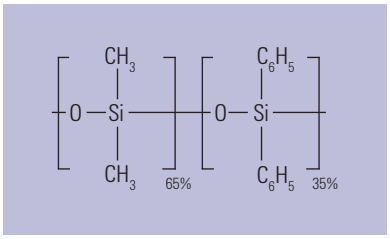
Structure of DB-35

- (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

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

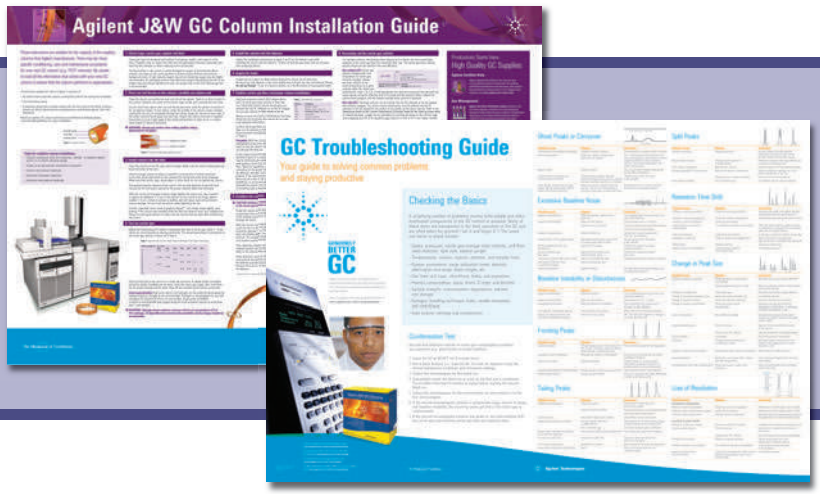
Similar Phases: Rtx-35ms, Rxi-35Sil MS, SPB-35, AT-35, Sup-Herb, MDN-35, BPX-34, ZB-35, ZB-35 ht

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

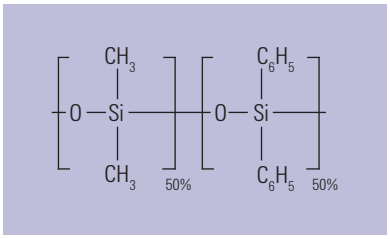
Order your free GC troubleshooting and GC column installation posters at **www.agilent.com/chem/GCposteroffer**



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

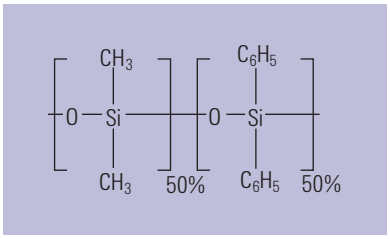


Structure of DB-17

DB-17

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
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+

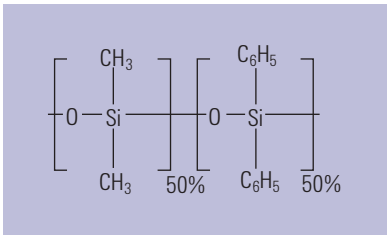
- (50%-Phenyl)-methylpolysiloxane
- Mid polarity – slightly less polar than DB-17
- Excellent for confirmational analyses
- Bonded and cross-linked
- Solvent rinsable
- Equivalent to USP Phase G3

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)	7 in Cage	5 in Cage	7890/6890 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



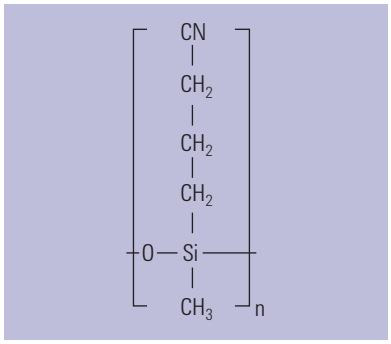
Structure of CP-Sil 24 CB

- 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	
	60	0.25	40 to 280/300	CP7822	CP7822I5
0.32	15	0.25	40 to 280/300	CP7830	
	30	0.25	40 to 280/300	CP7831	
	60	0.25	40 to 280/300	CP7832	
0.53	30	0.50	40 to 280/300	CP7834	CP1834I5
		1.00	40 to 265/290	CP7871	CP7871I5



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

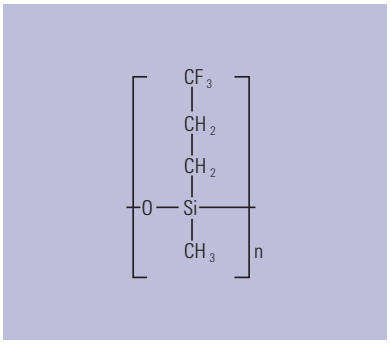
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.18	*20*	*0.20*	*40 to 250/260*	*121-2323*		
0.25	15	0.25	40 to 250/260	122-2312		
	30	0.15	40 to 250/260	122-2331		
		0.25	40 to 250/260	122-2332	122-2332E	122-2332LTM
	60	0.15	40 to 250/260	122-2361	122-2361E	
		0.25	40 to 250/260	122-2362	122-2362E	
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

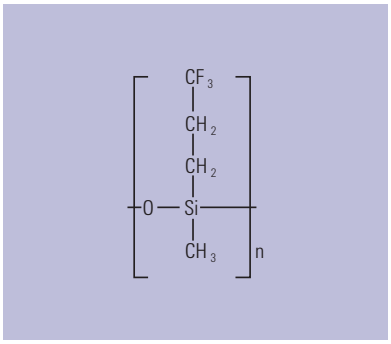
Similar Phases: Rtx-200



Structure of DB-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-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

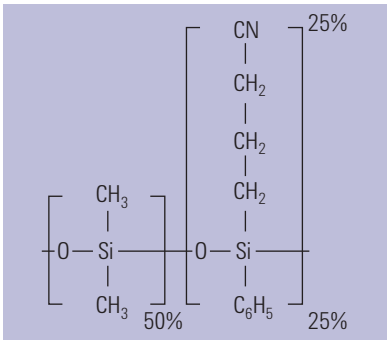
Similar Phases: SP-2401

DB-210

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 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

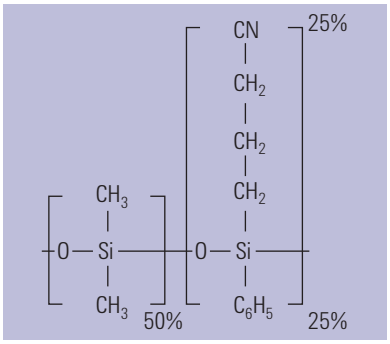
DB-225

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		
0.18	*20*	*0.20*	*40 to 220/240*	*121-2223*		
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**



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

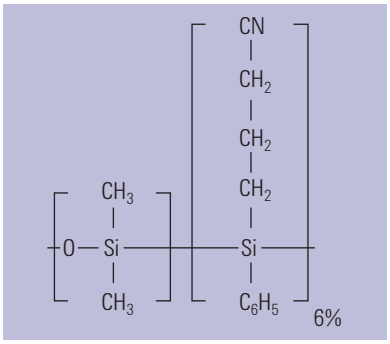
CP-Sil 43 CB

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

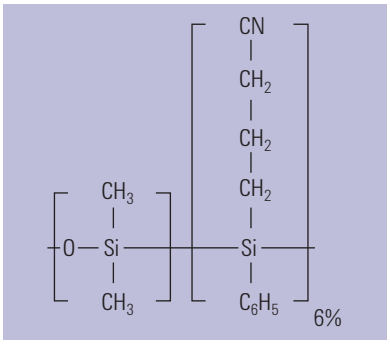
Similar Phases: Rtx-1301, PE-1301



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

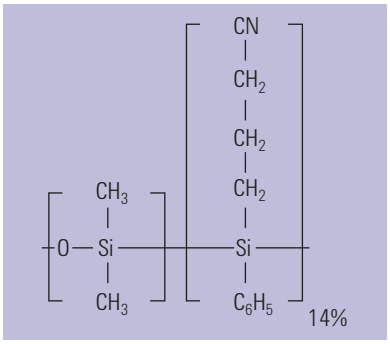
CP-1301

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

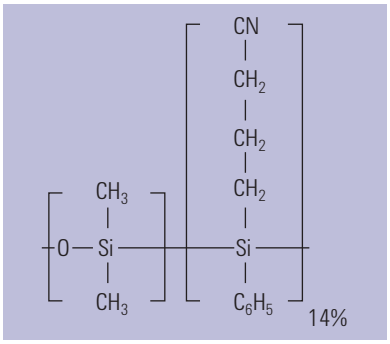
DB-1701

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		
0.18	*10*	*0.40*	*-20 to 280/300*	*121-0713*		
	20	*0.18*	*-20 to 280/300*	*121-0722*		*121-0722LTM*
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		
		0.25	-20 to 280/300	122-0732	122-0732E	122-0732LTM
		1.00	-20 to 280/300	122-0733	122-0733E	122-0733LTM
	60	0.15	-20 to 280/300	122-0761		
		0.25	-20 to 280/300	122-0762		
		0.50	-20 to 280/300	122-0766		
		1.00	-20 to 280/300	122-0763	122-0763E	
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		
		0.25	-20 to 280/300	123-0732	123-0732E	
		1.00	-20 to 280/300	123-0733	123-0733E	
	50	1.00	-20 to 280/300	123-0753		
	60	0.25	-20 to 280/300	123-0762		
		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

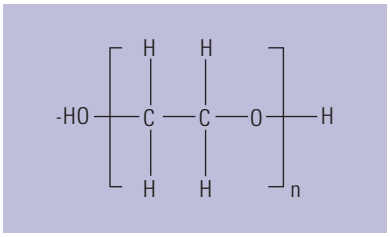
CP-Sil 19 CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.15	*25*	*0.50*	*-25 to 275/300*	*CP7340*
0.25	10	0.20	-25 to 275/300	CP7702
	25	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
	15	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
	25	1.00	-25 to 275/300	CP7637
		2.00	-25 to 275/300	CP7657
	30	1.00	-25 to 275/300	CP8737
	50	2.00	-25 to 275/300	CP7667
		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.



Structure of polyethylene glycol (PEG)
This structure is applicable for all
WAX and FFAP phases.

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

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
DB-WAX						
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
0.18	*10*	*0.18*	*20 to 250/260*	*121-7012*		*121-7012LTM*
	20	*0.18*	*20 to 250/260*	*121-7022*		*121-7022LTM*
		0.30	*20 to 240/250*	*121-7023*		*121-7023LTM*
	40	*0.18*	*20 to 250/260*	*121-7042*	*121-7042E*	
		0.30	*20 to 240/250*	*121-7043*		
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 (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
DB-WAX						
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	
DB-WaxFF						
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
0.18	*20*	*0.18*	*40 to 260/270*	*19091N-577*	*19091N-577E*	*19091N-577LTM*
0.20	25	0.20	40 to 260/270	19091N-102		19091N-102LTM
		0.40	40 to 260/270	19091N-202		
	50	0.20	40 to 260/270	19091N-105	19091N-105E	
		0.40	40 to 260/270	19091N-205	19091N-205E	
0.25	5	0.15	40 to 260/270	19091N-030		19091N-030LTM
	15	0.10	40 to 260/270	19091N-331		
		0.25	40 to 260/270	19091N-131	19091N-131E	
		0.50	40 to 260/270	19091N-231		
	30	0.15	40 to 260/270	19091N-033		
		0.25	40 to 260/270	19091N-133	19091N-133E	19091N-133LTM
		0.50	40 to 260/270	19091N-233	19091N-233E	
	60	0.15	40 to 260/270	19091N-036		
		0.25	40 to 260/270	19091N-136	19091N-136E	
		0.50	40 to 260/270	19091N-236		
0.32	15	0.25	40 to 260/270	19091N-111		
	30	0.15	40 to 260/270	19091N-013		19091N-013LTM
		0.25	40 to 260/270	19091N-113	19091N-113E	
		0.50	40 to 260/270	19091N-213	19091N-213E	
	60	0.25	40 to 260/270	19091N-116		
		0.50	40 to 260/270	19091N-216	19091N-216E	
0.53	15	1.00	40 to 240/250	19095N-121		
	30	1.00	40 to 240/250	19095N-123	19095N-123E	19095N-123LTM
	60	1.00	40 to 240/250	19095N-126		

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	
0.15	*15*	*0.12*	*20 to 250/265*	*CP7791*	
	25	*0.25*	*20 to 250/265*	*CP7792*	
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
		1.20	20 to 250/265	CP7673	CP7673I5
	30	0.15	20 to 250/265	CP8745	
		0.25	20 to 250/265	CP8713	CP8713I5
		0.50	20 to 250/265	CP8746	
	50	0.20	20 to 250/265	CP7723	CP7723I5
	60	0.25	20 to 250/265	CP8723	
		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 (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.32	10	1.00	20 to 250/265	CP7628	
	15	0.15	20 to 250/265	CP8533	
		0.25	20 to 250/265	CP8543	
		0.50	20 to 250/265	CP8553	
	25	0.20	20 to 250/265	CP7743	
		0.40	20 to 250/265	CP7879	
		1.20	20 to 250/265	CP7763	
	30	0.25	20 to 250/265	CP8843	
		0.50	20 to 250/265	CP8763	
	50	0.20	20 to 250/265	CP7753	
		0.40	20 to 250/265	CP7889	
		1.20	20 to 250/265	CP7773	CP7773I5
	60	0.25	20 to 250/265	CP8853	
		0.50	20 to 250/265	CP8773	
		1.20	20 to 250/265	CP8073	CP8073I5
0.53	10	2.00	20 to 250/265	CP7648	
	15	1.00	20 to 250/265	CP8718	
	25	1.00	20 to 250/265	CP7638	
		2.00	20 to 250/265	CP7658	CP7658I5
	30	1.00	20 to 250/265	CP8738	CP8738I5
	50	1.00	20 to 250/265	CP7698	CP7698I5
		2.00	20 to 250/265	CP7668	
	60	1.00	20 to 250/265	CP8798	
	100	2.00	20 to 250/265	CP7678	

CP-Wax 52 CB UltiMetal

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

TIPS & TOOLS

Agilent also offers CAM columns for amine analysis.



CP-Wax 58 FFAP CB

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

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

CP-Wax 58 FFAP CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.20	25	0.30	20 to 250/275	CP7787	
	50	0.30	20 to 250/275	CP7797	
0.25	25	0.20	20 to 250/275	CP7717	CP7717I5
	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	
	25	1.00	20 to 250/275	CP7614	
		2.00	20 to 250/275	CP7654	
	50	1.00	20 to 250/275	CP7624	
		2.00	20 to 250/275	CP7664	



TIPS & TOOLS

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

Carbowax 20M and HP-20M

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

Similar Phases: Rt-CW20M F&F

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

Carbowax 20M

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	7890/6890 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)	7 in Cage	5 in Cage	7890/6890 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 matrixes.

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)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.25	15	0.10	-60 to 400	122-5711	122-5711E	122-5711LTM
	30	0.10	-60 to 400	122-5731		122-5731LTM
0.32	10	0.10	-60 to 400	123-5701		123-5701LTM
	15	0.10	-60 to 400	123-5711	123-5711E	
	30	0.10	-60 to 400	123-5731	123-5731E	

DB-17ht

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

Similar Phases: Rtx-65TG, BPX50

DB-17ht

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



TIPS & TOOLS

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

VF-5ht and VF-5ht UltiMetal

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

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

VF-5ht

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

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

VF-5ht UltiMetal

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

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

Petroleum Columns

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

Lowox

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

Lowox

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.53	10	10.00	0 to 350/350	CP8587	CP8587I5

GS-OxyPLOT

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

GS-OxyPLOT

ID (mm)	Length (m)	Temp Limits (°C)	7 in Cage	5 in Cage
0.53	10	350	115-4912	115-4912E

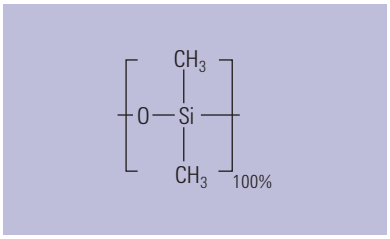
CP-Sil 5 CB for Formaldehyde

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

CP-Sil 5 CB for Formaldehyde

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.32	60	8.00	-60 to 300/325	CP7475

HP-PONA



Structure of HP-PONA

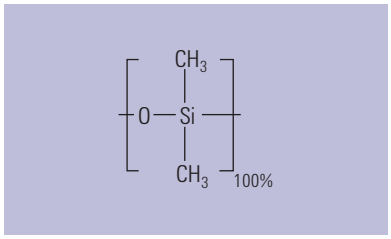
- 100% Dimethylpolysiloxane
- Configured for the analysis of petroleum process products
- Tested to ensure the resolution of m-xylene from p-xylene and of cyclopentane from 2,3-dimethylbutane
- PONA, PIANO
- High resolution
- Bonded and cross-linked
- Solvent rinsable

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

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

HP-PONA

Description	ID (mm)	Length (m)	Film (µm)	Temp Limits (°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 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	CP7531I5
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

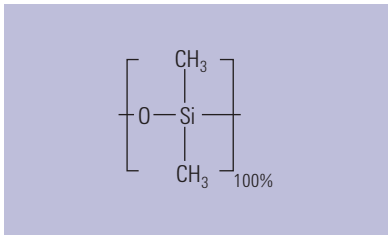
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.21	50	0.50	250/275	CP7531

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



Structure of DB-Petro



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

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_6 to C_{110+}
- 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

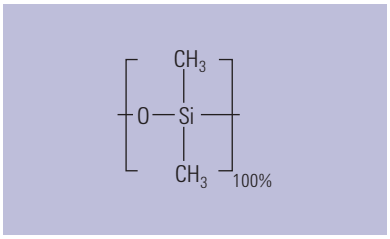
For fast simulated distillation for ASTM method D7798-13, see the LTM columns.

Turn to page 447.

CP-SimDist

- For simulated distillation analysis up to C_{100}
- 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_{100}. These columns are low bleed, typically only 4-5 pA at 400 °C. The high temperature stationary phase and polyimide coating extend column lifetime.



Structure of CP-SimDist

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	CP7522I5
	10	0.10	375/400	CP7541	

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_{120} 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	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	CP7525I5

DB-Sulfur SCD

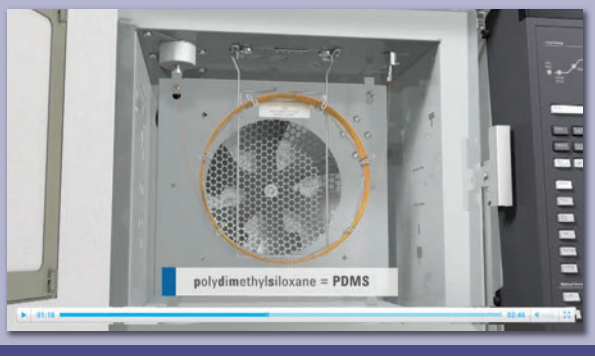
- Engineered for sulfur chemiluminescence detection (SCD) to provide low bleed performance and reduced SCD ceramic tube fouling
- Extends SCD signal stability which greatly reduces instrument downtime and operational cost for detector maintenance
- Excellent peak shape for a wide range of reactive sulfur compounds from H_2S, COS, mercaptans and thiophenes
- 100% Dimethyl polysiloxane stationary phase (PDMS) as specified in ASTM methods such as D5623 and D5504
- Custom configurations are available through the custom column shop, **www.agilent.com/chem/CustomColumn**

DB-Sulfur SCD

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

TIPS & TOOLS

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



Select Low Sulfur

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

Select Low Sulfur

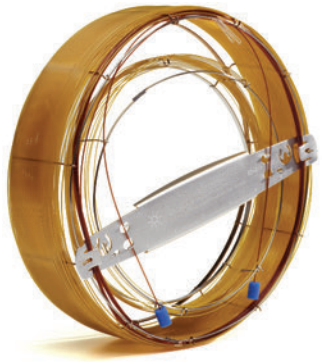
ID (mm)	Length (m)	Temp Limits (°C)	7 in Cage
0.32	60	185	CP8575

CP-Sil 5 CB for Sulfur

- Optimized for analysis of volatile sulfur compounds
- Trace analysis of sulfur compounds to C_7 mercaptan for high productivity
- Non-polar phase provides accurate separations based on volatility
- High inertness, elutes SO_2 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_2 Column, CP7429

Select for Permanent Gases – Dual Column

- Set of two parallel columns: CP-Molsieve 5Å for permanent gases and PoraBOND Q for CO_2 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_2 in a single run
- Coupled, tested and securely mounted on EZ-GRIP column mount
- For resolution of the difficult-to-separate argon/oxygen and helium/neon pairs, use CP7530 Select Permanent Gases/HR (High Resolution) column

Select for Permanent Gases – Dual Column

Description	Temp Limits (°C)	7 in Cage
Select Permanent Gases/CO_2	300/325	CP7429
Select Permanent Gases/HR	300/325	CP7430

Select Al_2O_3 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_2O_3 MAPD

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

Agilent J&W Biodiesel Capillary GC Columns



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

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

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

Biodiesel EN14103 FAME Analysis

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

Biodiesel EN14110 Residual Methanol

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

Biodiesel Capillary GC Columns

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

Biodiesel Test Samples

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

Select Biodiesel

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

Technical Specifications

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

Select Biodiesel

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

Select Silanes

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

Select Silanes

ID (mm)	Length (m)	Film (µm)	Temp Limits (°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	CP7447I5
	60	265/275	CP7448	CP7448I5

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_{20} 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
0.15	*25*	*2.00*	*325/350*	*CP7599*	
0.25	30	0.25	325/350	CP7598	CP7598I5
	30	0.50	325/350	CP7595	CP7595I5
0.32	30	1.00	325/350	CP7596	CP7596I5
0.53	30	1.00	325/350	CP7597	

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

CP-Wax for Volatile Amines and Diamines

Similar Phases: Stabilwax DB

CP-Wax for Volatile Amines and Diamines

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

PoraPLOT Amines

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

PoraPLOT Amines

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.32	25	10.00	-100 to 220/220	CP7591
0.53	25	20.00	-100 to 220/220	CP7594

Pesticides Columns

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

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

DB-CLP1 and DB-CLP2

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

DB-CLP1 and DB-CLP2

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

TIPS & TOOLS

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



VF-5 Pesticides

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

VF-5 Pesticides

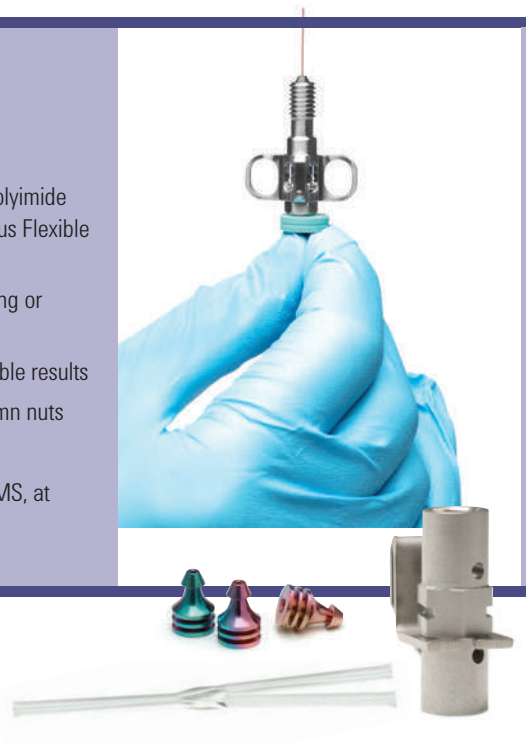
ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	30	0.25	-60 to 325/350	CP9074
	50	0.25	-60 to 325/350	CP9073
0.32	30	0.25	-60 to 325/350	CP9075

TIPS & TOOLS

Tips and tricks for making better connections...

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

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



DB-1701P

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

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

DB-1701P

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

VF-1701 Pesticides

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

VF-1701 Pesticides

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

CP-Sil 8 CB for Pesticides

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

CP-Sil 8 CB for Pesticides

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

CP-Sil 19 CB for Pesticides

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

CP-Sil 19 CB for Pesticides

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

DB-608

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

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

DB-608

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

HP-PAS5

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

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

HP-PAS5

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

Rapid-MS

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

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

Rapid-MS

ID (mm)	Length (m)	Film (µm)	Temp Limits (°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 benzofluoranthene (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
0.15	*15*	*0.10*	*40 to 325/350*	*CP7461*
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
0.18	*20*	*0.14*	*40 to 320/340*	*121-9627*
0.25	60	0.25	40 to 320/340	122-96L2

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

CP-Sil PAH CB UltiMetal

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

CP-Sil PAH CB UltiMetal

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

Semivolatiles Columns

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

DB-UI 8270D for Semivolatiles

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

DB-UI 8270D for Semivolatiles

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.18	*20*	*0.36*	*-60 to 325/350*	*121-9723*
			-60 to 325/350	*621-9723, 6/pk**
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 US

CP-Sil 8 CB for PCB

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

CP-Sil 8 CB for PCB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°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
0.18	*20*	*0.18*	*-60 to 325/350*	*121-5621*
		0.36	*-60 to 325/350*	*121-5622*
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	122-5661
0.32	30	0.25	-60 to 325/350	123-5631
		0.50	-60 to 325/350	123-5632

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

HP-5ms Semivolatile



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

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

HP-5ms Semivolatile

ID (mm)	Length (m)	Film (µm)	Temp Limits (°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_{18} substitution
- Provides high signal-to-noise ratios for ECD detectors
- Optimized column length for separation of critical isomer pairs:
  28/31, 56/60, 149/118, 105/153/132 and 170/190

CP-Sil 5/C18 CB for PCB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°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
0.18	*20*	*1.00*	*-20 to 260*	*121-1324UI*
0.25	30	1.40	-20 to 260	122-1334UI
	60	1.40	-20 to 260	122-1364UI
0.32	30	1.80	-20 to 260	123-1334UI
	60	1.80	-20 to 260	123-1364UI
0.53	30	3.00	-20 to 260	125-1334UI
	75	3.00	-20 to 260	125-1374UI

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

TIPS & TOOLS

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

DB-624

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

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

DB-624

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

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

CP-Select 624 CB

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

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

CP-Select 624 CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.15	*25*	*0.84*	*265/280*	*CP7411*	
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	CP7416I5
	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
0.18	*20*	*1.00*	*-10 to 260*	*121-1524*		*121-1524LTM*
	40	*1.00*	*-10 to 260*	*121-1544*	*121-1544E*	
0.25	30	1.40	-10 to 260	122-1534		122-1534LTM
	60	1.40	-10 to 260	122-1564	122-1564E	
0.32	30	1.80	-10 to 260	123-1534		
	60	1.80	-10 to 260	123-1564		
0.45	30	2.55	-10 to 260	124-1534		
	75	2.55	-10 to 260	124-1574		

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

HP-VOC

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

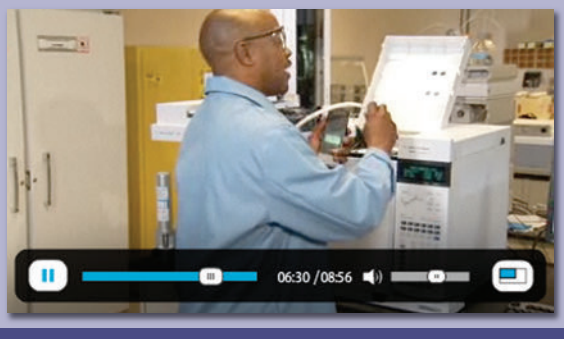
Similar Phases: NON-PAKD, Rtx-Volatiles, PE-Volatiles, 007-624, Rtx-VRX, Rtx-VGC

HP-VOC

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

TIPS & TOOLS

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



DB-502.2

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

DB-502.2

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.32	60	1.80	0 to 260/280	123-1464
0.53	105	3.00	0 to 260/280	125-14A4

DB-MTBE

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

DB-MTBE

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.45	30	2.55	35 to 260/280	124-0034

CP-Select CB for MTBE

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

CP-Select CB for MTBE

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	50	0.25	200/200	CP7528

DB-TPH

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

DB-TPH

ID (mm)	Length (m)	Film (µm)	Temp Limits (°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_4 to C_{40} 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	CP7491I5
	15	0.10	-60 to 390/400	3/pk	CP749103	
	15	0.10	-60 to 390/400	6/pk	CP749106	
Retention gap						
0.53	4.0		-60 to 325/350	3/pk	CP8015	

TIPS & TOOLS

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



Food, Flavors and Fragrances Columns



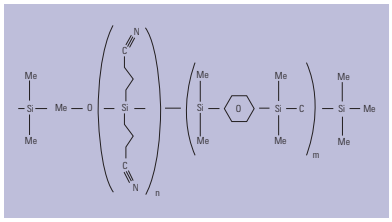
Food and flavor analyses place stringent demands on capillary columns. Samples have many components that are difficult to resolve and column-to-column reproducibility becomes critical. Agilent J&W GC columns are ideal for meeting these needs. Our rigorous quality control specifications and extensive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

HP-88

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

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

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



Structure of HP-88

HP-88

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 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

CP-Sil 88

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

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

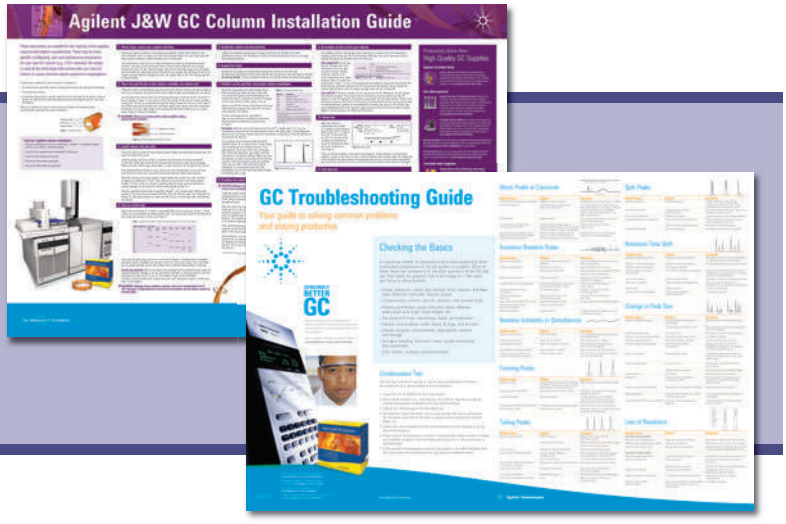
CP-Sil 88

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



TIPS & TOOLS

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



Select FAME

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

Select FAME

ID (mm)	Length (m)	Temp Limits (°C)	7 in Cage	5 in Cage
0.25	50	275/290	CP7419	CP7419I5
	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_6 to C_{26} range

CP-Sil 88 for FAME

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

CP-Wax 57 CB

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

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

CP-Wax 57 CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.15	*30*	*0.12*	*20 to 200/225*	*CP97721*	
0.25	25	0.20	20 to 200/225	CP97713	
	50	0.20	20 to 200/225	CP97723	CP97723I5
	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	CP97753I5
		1.20	20 to 200/225	CP97773	
0.53	25	1.00	20 to 200/225	CP97638	
	25	2.00	20 to 200/225	CP97658	

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

CP-Carbowax 400 for Volatiles in Alcohol

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

CP-Carbowax 400 for Volatiles in Alcohol

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.32	50	0.20	60/80	CP7527

CP-Wax 57 CB for Glycols and Alcohols

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

CP-Wax 57 CB for Glycols and Alcohols

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	25	0.20	200/200	CP7615
0.53	25	0.50	225/250	CP7617

CP-TAP CB for Triglycerides

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

CP-TAP CB for Triglycerides

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	25	0.10	350/360	CP7483

CP-TAP CB UltiMetal

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	25	0.10	355/370	CP7463

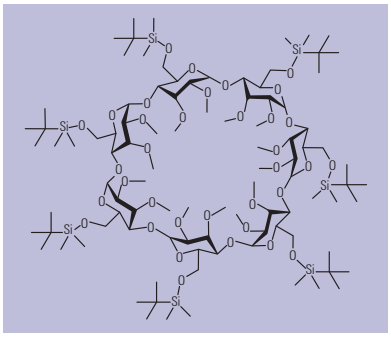
CP-FFAP CB for Free Fatty Acids in Dairy Products

- Ideal for flavors, aromas and free fatty acids C_1-C_{26}
- Separates C_2-C_{24} 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
0.15	*25*	*0.25*	*250/275*	*CP7686*	
0.32	25	0.30	250/275	CP7485	CP7485I5
0.53	25	1.00	250/275	CP7486	

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



Structure of CycloSil-B

CycloSil-B

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

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

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

CycloSil-B

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

Cyclodex-B

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

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

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

Cyclodex-B

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage	7890/6890 LTM II Module
0.25	30	0.25	50 to 230/250	112-2532	112-2532E	112-2532LTM
	60	0.25	50 to 230/250	112-2562		
0.32	30	0.25	50 to 230/250	113-2532	113-2532E	

HP-Chiral β

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

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

HP-Chiral β

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
HP-Chiral 10β					
0.25	30	0.25	30 to 240/250	19091G-B133	
HP-Chiral 20β					
0.25	30	0.25	30 to 240/250	19091G-B233	19091G-B233E
0.32	30	0.25	30 to 240/250	19091G-B213	

CP-Chirasil Val

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

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

CP-Chirasil Val

Description	ID (mm)	Length (m)	Film (µm)	Temp Limits (°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	CP7495I5

CP-Chirasil-Dex CB

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

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

CP-Chirasil-Dex CB

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.25	25	0.25	200/200	CP7502	CP7502I5
0.32	25	0.25	200/200	CP7503	

CP-Cyclodextrin-β-2,3,6-M-19

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

CP-Cyclodextrin-β-2,3,6-M-19

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.25	25	0.25	225/250	CP7500	CP7500I5
	50	0.25	225/250	CP7501	

TIPS & TOOLS

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



TIPS & TOOLS

Tips and tricks for making better connections...

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

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



Life Sciences Columns

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

DB-ALC1 and DB-ALC2

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

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

DB-ALC1 and DB-ALC2

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

VF-DA

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

VF-DA

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.20	12	Optimized	-60 to 325/350	CP8964

DB-5ms EVDX

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

DB-5ms EVDX

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.20	25	0.33	-60 to 325/350	128-8522

DB-Select 624 UI for <467>

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

DB-Select 624 UI for <467>

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

HP-Fast Residual Solvent

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

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

HP-Fast Residual Solvent

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

Metal Columns

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

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

Metal Columns

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

(Continued)

Metal Columns

Phase	ID (mm)	Length (m)	Film (µm)	7 in Cage	5 in Cage
Simulated distillation/high temperature					
VF-5ht UltiMetal with retention gap UltiMetal	0.25	15	0.10	CP9091	
	0.32	15	0.10	CP9095	
	0.25	30	0.10	CP9093	
	0.32	30	0.10	CP9097	
Standard phases and PEG					
DB-PS1	0.53	15	0.15	145-1011	
		30	1.50	145-1032	
CP-Sil 5 CB	0.53	10	2.00	CP7150	
			5.00	CP6666	
		25	0.50	CP7135	
			1.00	CP7130	
			2.00	CP7160	
			5.00	CP6670	
		50	1.00	CP7140	
			2.00	CP7170	
			5.00	CP6671	
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, 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 (µm)	7 in Cage	5 in Cage
Standard phases and PEG					
CP-Sil 8 CB UltiMetal	0.53	25	5.00	CP6680	
		50	0.50	CP7196	
				CP6681	
CP-Sil 13 CB UltiMetal	0.53	25	1.00	CP7141	
DB-PSWAX	0.53	30	1.00	145-7032	
CP-Wax 52 CB UltiMetal	0.53	10	1.00	CP7148	
		25	2.00	CP7178	
		50	1.00	CP7168	
			2.00	CP7179	
PLOT columns					
PoraPLOT Q UltiMetal	0.53	10	20.00	CP6953	
		25	20.00	CP6954	
CP-Al_2O_3/KCl UltiMetal	0.53	50	10.00	CP6918	
CP-Al_2O_3/Na_2SO_4 UltiMetal	0.53	50	10.00	CP6968	
CP-Molsieve 5Å UltiMetal	0.53	10	50.00	CP6937	
		25	50.00	CP6938	CP6938I5
Select application columns					
DB-PS624	0.53	30	3.00	145-1334	
CP-Sil PAH CB UltiMetal	0.25	25	0.12	CP7440	
CP-TAP CB	0.25	25	0.10	CP7463	
Select Biodiesel With retention gap	0.32	10	0.10	CP9076	
		15	0.10	CP9078	
Select Biodiesel	0.32	10	0.10	CP9077	
		15	0.10	CP9079	



Column shown with EZ-GRIP

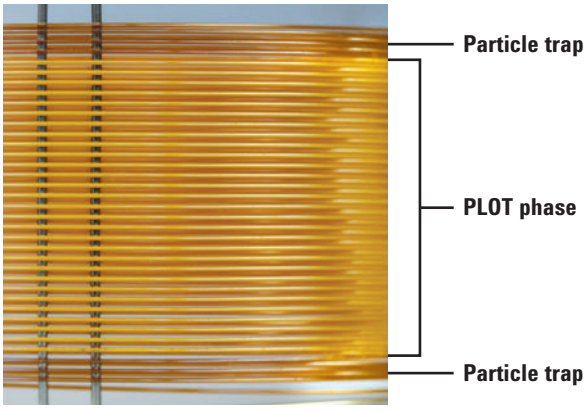
PLOT Columns

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-QO3PT
HP-PLOT Q PT	0.32	30	20.00	-60 to 270/290	19091P-QO4PT
HP-PLOT Q PT	0.53	15	40.00	-60 to 270/290	19095P-QO3PT
HP-PLOT Q PT	0.53	30	40.00	-60 to 270/290	19095P-QO4PT
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-UO4PT
HP-PLOT Al_2O_3 KCl PT	0.32	50	8.00	-60 to 200	19091P-K15PT
HP-PLOT Al_2O_3 KCl PT	0.53	30	15.00	-60 to 200	19095P-K23PT
HP-PLOT Al_2O_3 KCl PT	0.53	50	15.00	-60 to 200	19095P-K25PT
PoraPLOT U PT	0.53	25	20.00	-100 to 190/190	CP7584PT
CP-Al_2O_3/KCl PT	0.32	50	5.00	-100 to 200/200	CP7515PT
CP-Al_2O_3/KCl PT	0.53	25	10.00	-100 to 200/200	CP7517PT
CP-Al_2O_3/KCl PT	0.53	50	10.00	-100 to 200/200	CP7518PT
CP-Al_2O_3/Na_2SO_4 PT	0.32	50	5.00	-100 to 200/200	CP7565PT
CP-Al_2O_3/Na_2SO_4 PT	0.53	50	10.00	-100 to 200/200	CP7568PT
HP-PLOT Al_2O_3 S PT	0.32	25	8.00	-60 to 200	19091P-S12PT
HP-PLOT Al_2O_3 S PT	0.32	50	8.00	-60 to 200	19091P-S15PT
HP-PLOT Al_2O_3 S PT	0.53	30	15.00	-60 to 200	19095P-S23PT
HP-PLOT Al_2O_3 S PT	0.53	50	15.00	-60 to 200	19095P-S25PT
GS-Alumina PT	0.53	30		-60 to 200	115-3532PT
GS-Alumina PT	0.53	50		-60 to 200	115-3552PT
HP-PLOT Al_2O_3 M PT	0.53	50	15.00	-60 to 200	19095P-M25PT
CP-Molsieve 5A PT	0.32	30	10.00	-200 to 300	CP7534PT
CP-Molsieve 5A PT	0.32	25	30.00	-200 to 300	CP7536PT
CP-Molsieve 5A PT	0.53	25	50.00	-200 to 300	CP7538PT
CP-Molsieve 5A PT	0.53	50	50.00	-200 to 300	CP7539PT

PoraBOND Q

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

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

PoraBOND Q

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

PoraBOND U

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

Similar Phases: Rt-U-BOND

PoraBOND U

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



PoraPLOT Q and PoraPLOT Q-HT

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

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

PoraPLOT Q

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

PoraPLOT Q UltiMetal

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

PoraPLOT Q-HT

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

HP-PLOT Q



- Bonded polystyrene-divinylbenzene based column
- Polarity between Porapak-Q and Porapak-N
- Excellent column for C_1-C_3 isomers and alkanes to C_{12}, CO_2, methane, air/CO, oxygenated compounds, sulfur compounds and solvents
- Replaces packed gas-solid columns
- Separates ethane, ethylene and ethyne (acetylene)
- Improved resolution in less time than conventional packed columns
- Minimal conditioning time required – 1 hour
- Preferred "Q" column due to its robust nature

Similar Phases: Rt-QPLOT, SupelQ PLOT

HP-PLOT Q

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

GS-Q

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

Similar Phases: Rt-QPLOT, SupelQ PLOT

GS-Q

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



TIPS & TOOLS

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

PoraPLOT U and PoraPLOT S

- The most polar porous polymer PLOT column ideal for halogenated compounds, C_1-C_6 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_1-C_7 hydrocarbons, CO_2, 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-UO4	19091P-UO4E		19091P-UO4LTM
0.53	15	20.00	-60 to 190	19095P-UO3			
	30	20.00	-60 to 190	19095P-UO4	19095P-UO4E	19095P-UO4PT	19095P-UO4LTM

HP-PLOT Al_2O_3 KCl

- Least "polar" alumina phase
- Aluminum oxide deactivated with KCl
- Standard column choice for light hydrocarbon analysis – C_1-C_8 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_2O_3/KCl, AB-PLOT Al_2O_3 KCl, AT-Alumina

HP-PLOT Al_2O_3 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: Al_2O_3/KCl, Al_2O_3/Na_2SO_4, Rt-Alumina PLOT, Alumina PLOT, AB-PLOT Al_2O_3 KCl, AT-Alumina

GS-Alumina KCl

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

CP-Al_2O_3/KCl and CP-Al_2O_3/Na_2SO_4

- Aluminum oxide PLOT columns offer high selectivity for separating ppm levels of C_1-C_5 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_2O_3 surface while the Na_2SO_4 deactivation provides a polar surface. Unsaturated compounds such as ethylene and acetylene (ethyne) are retained longer.

Selectivity Through KCl or Na_2SO_4 Deactivation

Note: Aluminum oxide PLOT columns are deactivated using KCl or NA_2SO_4 treatments which provide a reproducible and stable deactivation up to 200 °C. The KCl salt deactivation results in a relatively apolar Al_2O_3 surface, while the NA_2SO_4 deactivation provides a polar surface. Unsaturated compounds such as ethylene and acetylene (ethyne) are retained longer.

Similar Phases: Al_2O_3/KCl, Rt-Alumina PLOT, Alumina PLOT, RT-Alumina BOND/KCl, Alumina chloride PLOT, AB-PLOT Al_2O_3 KCl

CP-Al_2O_3/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_2O_3/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_2O_3/Na_2SO_4, Rt-Alumina PLOT, Alumina PLOT, Rt-Alumina BOND/Na_2SO_4, MXT-AluminaBOND/Na_2SO_4, Alumina sulfate PLOT

CP-Al_2O_3/Na_2SO_4

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_2O_3/Na_2SO_4 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_2O_3 S

- Middle range of "polarity" for alumina phases
- Aluminum oxide deactivated with sodium sulfate
- Excellent general use column for light hydrocarbon analysis – C_1-C_8 hydrocarbon isomers
- Best for resolving acetylene from butane and propylene from isobutane

Similar Phases: Al_2O_3/Na_2SO_4, Rt-Alumina PLOT, Alumina PLOT, Rt-Alumina BOND/Na_2SO_4, MXT-AluminaBOND/Na_2SO_4, Alumina sulfate PLOT, AT-Alumina

HP-PLOT Al_2O_3 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_1-C_8 hydrocarbon isomers
- Separates C_1-C_4 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_2 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_2O_3/KCl, Al_2O_3/Na_2SO_4, Rt-Alumina PLOT, Alumina PLOT, AB-PLOT Al_2O_3 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_2O_3 M

- Most "polar" alumina phase (similar to GS-Alumina)
- Aluminum oxide deactivated with proprietary deactivation
- Good general use column for light hydrocarbon analysis – C_1-C_8 hydrocarbon isomers
- Good for resolving acetylene from butane and propylene from isobutane

Similar Phases: AB-PLOT Al_2O_3 M, BGB-PLOT Al_2O_3 M, AT-Alumina

HP-PLOT Al_2O_3 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_2 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_2 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_1-C_4 isomers in the presence of water
- No negative influence on retention or peak shape when water is present in the sample
- Inert surface preparation results in no decomposition pentadienes or freons

Similar Phases: GS-GasPro

CP-SilicaPLOT

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

TIPS & TOOLS

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



CarboBOND and CarboPLOT P7

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

CarboBOND

CarboBOND

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.53	25	5.00	-100 to 200/300	CP7371
		10.00	-100 to 200/300	CP7374
	50	5.00	-100 to 200/300	CP7372
		10.00	-100 to 200/300	CP7375

CarboPLOT P7

CarboPLOT P7

ID (mm)	Length (m)	Film (µm)	Temp Limits (°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_2, N_2, CO and CH_4 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_2 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
	30	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 ºC

CP-Molsieve 5Å UltiMetal

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

Particle Traps for use with PLOT Columns

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

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

Particle Traps for use with PLOT Columns

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

Particle Traps for PoraPLOT Columns

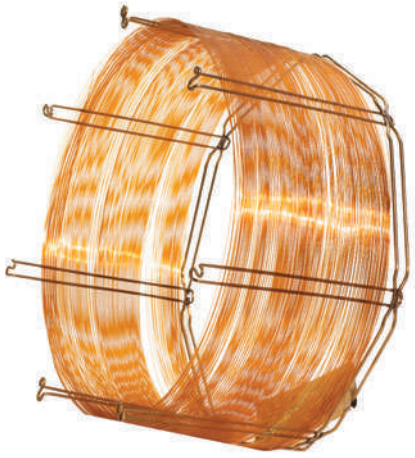
ID (mm)	Length (m)	Material	Part No.
0.32	2.5	Fused Silica	CP4016
0.53	2.5	Fused Silica	CP4017
0.53	2.5	UltiMetal	CP4018*

*Includes CP-UltiMetal connector

Particle Trap Connectors for PoraPLOT Columns

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

Columns with Non-Bonded Stationary Phases



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

HP-101

- 100% Dimethylpolysiloxane

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

HP-101

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage	5 in Cage
0.20	25	0.20	-60 to 280	19091Y-102	
0.32	25	0.30	-60 to 280	19091Y-012	19091Y-012E
	50	0.30	-60 to 280	19091Y-015	

HP-17

- 50% Phenyl and 50% methyl siloxane

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

HP-17

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

DX-1 and DX-4

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

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

DX-1

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.32	30	1.00	50 to 250/270	123-6133

DX-4

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.25	30	0.25	50 to 250/270	122-6432
	60	0.25	50 to 250/270	122-6462
0.32	15	0.25	50 to 250/270	123-6412
	30	0.25	50 to 250/270	123-6432

SE-30 and SE-54

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

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

SE-30

ID (mm)	Length (m)	Film (µm)	Temp Limits (°C)	7 in Cage
0.32	30	0.25	0 to 325/350	113-3032

SE-54

ID (mm)	Length (m)	Film (µm)	Temp Limits (°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.

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.

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
DB-5.625	*0.25*	*30*	*0.25*	*5*	*122-5631G5*
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



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



EZ-Guard

EZ-Guard

Phase	ID (mm)	Length (m)	Film (µm)	Guard Length (m)	Part No.
VF-1ms	0.20	12	0.33	5	CP9023
	0.25	30	0.25	5	CP9010
			0.25	10	CP9011
VF-5ms	0.25	15	0.25	5	CP9021
		30	0.25	5	CP9012
			0.25	10	CP9013
			0.50	5	CP9014
			0.50	10	CP9015
		60	0.25	5	CP9016
VF-Xms	0.25	30	0.10	10	CP9022
			0.25	10	CP9019
VF-17ms	0.25	30	0.25	5	CP9024
			0.25	10	CP9025
VF-1701ms	0.25	30	0.25	5	CP9176
			0.25	10	CP9177
VF-35ms	0.25	30	0.25	5	CP9026
			0.25	10	CP9027

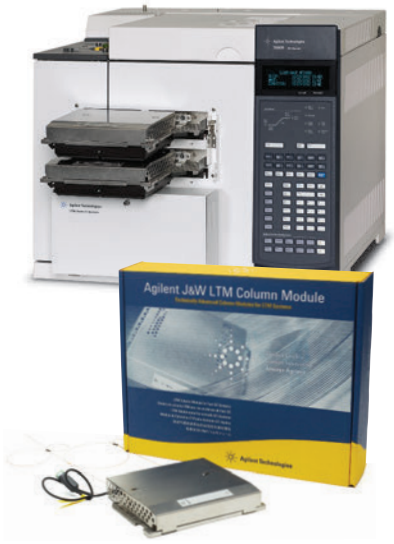
LTM Column Modules

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

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

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

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



LTM II standard format with 5 in column toroid

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

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

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

All LTM II column modules are packaged with:

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

TIPS & TOOLS

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



TIPS & TOOLS

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



LTM Solution for Ultra Sensitive THCA Application

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

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

LTM II Columns

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

TIPS & TOOLS

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



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

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

ASTM recently released a new method, ASTM D7798-13, for fast simulated distillation, and so Agilent developed the Fast Simulated Distillation Analyzer (G3445B#658) to address this new method. Note that this method is similar to ASTM D2887. The new method does not address high temperature simulated distillation or extended simulated distillation. For ASTM D7798-13, Agilent uses the standard 0.25 µm film column configuration (calibration mix C_5-C_{44}). For fast LTM analysis of ASTM D2887, with Agilent analyzer G3445B#653, the 0.5 µm film column is used (calibration mix C_5-C_{40}).

LTM II Columns

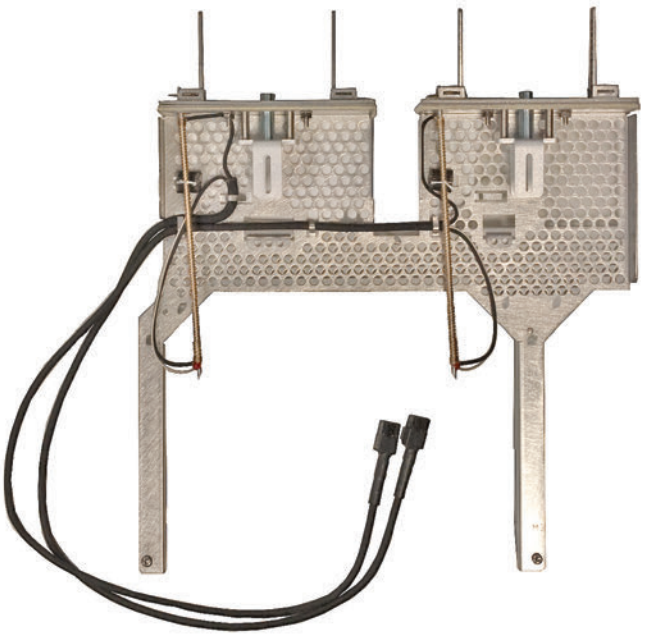
Phase	Description	ID (mm)	Length (m)	Film (µm)	Part No.
DB-Sim-Dist	LTM II	0.25	4	0.25	G3900-65004
DB-Sim-Dist	LTM II	0.25	4	0.50	G3900-65003

LTM II Transfer Line Module

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

LTM II Transfer Line Module

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



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

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

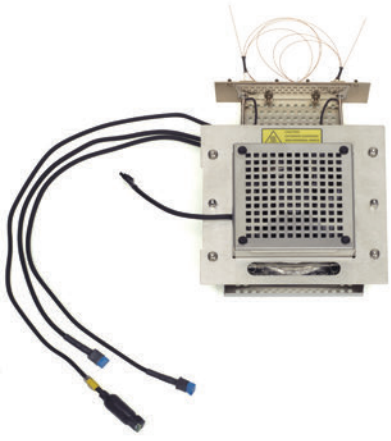
- Faster heating and cooling times – as low as one minute or less – for more rapid analytical cycle times
- Excellent retention time repeatability and performance comparable to conventional GC
- Less power consumption for longer in-field operation
- Integrated module design to facilitate easy column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



5975T LTM GC/MSD



Replacement column toroid for LTM 5975T column modules



5975T complete column module

TIPS & TOOLS

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

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

Custom LTM Column Ordering

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

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

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

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

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

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



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

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

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

(Continued)

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

Phase	ID (mm)	Length (m)	Film (µm)	Part No.
DB-1	0.53	5	5.00	125-1005LTM
		10	2.65	125-10HBLTM
		15	0.15	125-1011LTM
			1.50	125-1012LTM
			5.00	125-1015LTM
		25	5.00	125-1025LTM
		30	0.25	125-103KLTM
			1.00	125-103JLTM
			1.50	125-1032LTM
			3.00	125-1034LTM
			5.00	125-1035LTM
DB-1301	0.53	30	1.50	125-1333LTM
DB-17	0.10	10	0.10	127-1712LTM
	0.18	20	0.18	121-1722LTM
	0.25	30	0.25	122-1732LTM
	0.32	30	0.25	123-1732LTM
	0.53	15	1.00	125-1712LTM
		15	1.50	125-1713LTM
		30	1.00	125-1732LTM
DB-1701	0.18	20	0.18	121-0722LTM
	0.25	15	1.00	122-0713LTM
		30	0.25	122-0732LTM
		30	1.00	122-0733LTM
	0.32	15	0.25	123-0712LTM
	0.53	15	1.00	125-0712LTM
DB-1701P	0.25	30	0.25	122-7732LTM
DB-17ht	0.25	5	0.15	122-1801LTM
		30	0.15	122-1831LTM
DB-17ms	0.18	20	0.18	121-4722LTM
	0.25	15	0.15	122-4711LTM
		15	0.25	122-4712LTM
		30	0.25	122-4732LTM
	0.32	30	0.25	123-4732LTM

(Continued)

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

Phase	ID (mm)	Length (m)	Film (µm)	Part No.
DB-1ht	0.25	30	0.10	122-1131LTM
	0.32	5	0.25	123-1102LTM
		15	0.10	123-1111LTM
DB-1ms	0.10	10	0.10	127-0112LTM
		20	0.40	127-0123LTM
	0.18	20	0.18	121-0122LTM
	0.20	25	0.33	128-0122LTM
	0.25	15	0.25	122-0112LTM
		30	0.25	122-0132LTM
DB-200	0.25	30	0.25	122-2032LTM
			0.50	122-2033LTM
DB-210	0.53	30	1.00	125-0232LTM
DB-225	0.25	15	0.25	122-2212LTM
		30	0.25	122-2232LTM
DB-225ms	0.25	15	0.25	122-2912LTM
		30	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
	0.53	30	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	10	0.18	121-5012LTM
			0.40	121-5013LTM
		20	0.18	121-5022LTM
			0.40	121-5023LTM
	0.20	25	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
	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
		25	0.25	122-5522LTM
		30	0.25	122-5532LTM
			1.00	122-5533LTM
	0.32	15	0.25	123-5512LTM
			1.00	123-5513LTM
		30	0.50	123-5536LTM
			1.00	123-5533LTM
	0.53	30	1.50	125-5532LTM
			1.00	125-553JLTM

(Continued)

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

Phase	ID (mm)	Length (m)	Film (µm)	Part No.
DB-5ms Ultra Inert	0.18	20	0.18	121-5522UILTM
			0.36	121-5523UILTM
	0.25	15	0.25	122-5512UILTM
		25	0.25	122-5522UILTM
		30	0.25	122-5532UILTM
			0.50	122-5536UILTM
			1.00	122-5533UILTM
DB-608	0.32	30	0.50	123-1730LTM
DB-624	0.18	20	1.00	121-1324LTM
	0.20	10	1.12	128-1314LTM
		25	1.12	128-1324LTM
	0.25	30	1.40	122-1334LTM
	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
		15	0.10	127-32H2LTM
	0.25	30	0.25	122-3232LTM
	0.32	30	0.25	123-3232LTM
			0.50	123-3233LTM
			1.00	123-3234LTM
	0.53	15	0.50	125-3217LTM
DB-VRX	0.18	20	1.00	121-1524LTM
	0.25	30	1.40	122-1534LTM

(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
		30	0.25	122-7032LTM
			0.50	122-7033LTM
	0.32	15	0.25	123-7012LTM
			0.50	123-7013LTM
		30	0.25	123-7032LTM
			0.50	123-7033LTM
	0.53	30	0.25	125-7031LTM
			1.00	125-7032LTM
DB-WAXetr	0.25	30	0.25	122-7332LTM
	0.32	30	1.00	123-7334LTM
	0.53	30	1.50	125-7333LTM
DB-XLB	0.25	15	0.10	122-1211LTM
		30	0.25	122-1232LTM
GS-CarbonPLOT	0.32	30	3.00	113-3133LTM
	0.53	30	3.00	115-3133LTM
GS-Q	0.32	30	0.00	113-3432LTM

(Continued)

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

Phase	ID (mm)	Length (m)	Film (µm)	Part No.
HP-1	0.20	25	0.11	19091Z-002LTM
			0.50	19091Z-202LTM
	0.32	25	0.17	19091Z-012LTM
		30	0.10	19091Z-313LTM
			4.00	19091Z-613LTM
			5.00	19091Z-713LTM
	0.53	10	0.88	19095Z-021LTM
			2.65	19095Z-121LTM
		30	0.88	19095Z-023LTM
			2.65	19095Z-123LTM
			5.00	19095Z-623LTM
HP-1ms	0.18	20	0.18	19091S-677LTM
	0.25	30	0.10	19091S-833LTM
			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	19091J-330LTM
		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	19091L-330LTM
		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/ltmcol_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
	0.20	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
	0.25	15	0.25	19091S-431UILTM
		30	0.25	19091S-433UILTM
			0.50	19091S-133UILTM
			1.00	19091S-233UILTM
	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
	0.25	30	0.25	19091F-433LTM
	0.32	25	0.50	19091F-112LTM
	0.53	10	1.00	19095F-121LTM
		30	1.00	19095F-123LTM
HP-INNOWax	0.18	20	0.18	19091N-577LTM
	0.20	25	0.20	19091N-102LTM
	0.25	5	0.15	19091N-030LTM
		30	0.25	19091N-133LTM
	0.32	30	0.15	19091N-013LTM
	0.53	30	1.00	19095N-123LTM

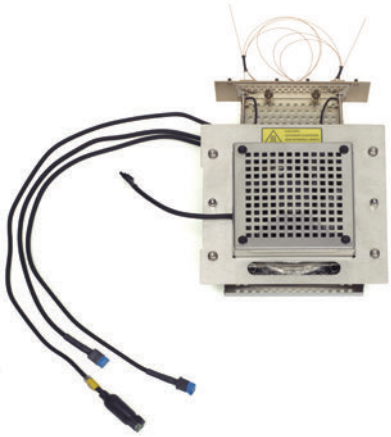
(Continued)

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

Phase	ID (mm)	Length (m)	Film (µm)	Part No.
HP-PLOT Al_2O_3 KCl	0.25	30	5.00	19091P-K33LTM
	0.53	30	15.00	19095P-K23LTM
HP-PLOT Al_2O_3 S	0.32	25	8.00	19091P-S12LTM
HP-PLOT Molesieve	0.32	15	25.00	19091P-MS7LTM
		30	25.00	19091P-MS8LTM
	0.53	30	50.00	19095P-MS0LTM
HP-PLOT Q	0.32	15	20.00	19091P-QO3LTM
		30	20.00	19091P-QO4LTM
	0.53	15	40.00	19095P-QO3LTM
		30	40.00	19095P-QO4LTM
HP-PLOT U	0.32	30	10.00	19091P-UO4LTM
	0.53	30	20.00	19095P-UO4LTM
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
	0.25	15	0.25	222-0112LTM	G3900-63016
		30	0.25	222-0132LTM	G3900-63017
DB-1ht	0.25	15	0.10	222-1111LTM	G3900-63018
		30	0.10	222-1131LTM	G3900-63019
HP-1ms	0.18	20	0.18	29091S-677LTM	G3900-63040
	0.25	30	0.10	29091S-833LTM	G3900-63041
		15	0.25	29091S-931LTM	G3900-63042
DB-5ms	0.18	20	0.18	221-5522LTM	G3900-63013
	0.25	15	0.25	222-5512LTM	G3900-63030
		30	0.25	222-5532LTM	G3900-63004
DB-5ht	0.25	30	0.10	222-5731LTM	G3900-63033
		15	0.10	222-5711LTM	G3900-63032

(Continued)

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

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

TIPS & TOOLS

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

Fused Silica Tubing

Deactivated Tubing

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

Deactivated Fused Silica

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

(Continued)

Deactivated Fused Silica

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

* 7 in cage

Deactivated Fused Silica High Temperature (400 °C)

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

Retention Gaps

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

Retention Gaps Apolar Deactivated

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

Retention Gaps Medium Polar Deactivated

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

Retention Gaps Polar Deactivated

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

Retention Gaps in Three Polarities

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

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

Restriction for Rapid-MS

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

Guard Column MSD

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

Large Volume Guard

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

Undeactivated Fused Silica

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

Undeactivated Fused Silica

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

Stainless Steel Tubing

UltiMetal Plus Stainless Steel Capillary Tubing

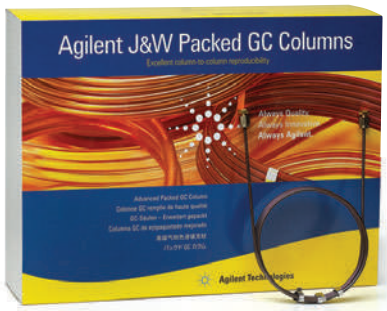
UltiMetal Plus stainless steel capillary tubing can be used as retention gaps, guard columns, or transfer lines.

UltiMetal Plus Stainless Steel Capillary Tubing

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

ProSteel Deactivated

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



Agilent J&W Packed GC Columns

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

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

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

And, you can create your custom configurations
by visiting **www.agilent.com/chem/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% Polyphenolether 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_3PO_4

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

Silica Gel

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

0.1% SP-1000

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

15% SP-2100

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

25% SP-2100

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

20% TCEP

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

* Specially coiled for Large Valve Oven, 41 mm mandrel

10% UC W982

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

12% UC W982

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

TIPS & TOOLS

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



Custom GC Column Ordering



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

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

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

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

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

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

Agilent J&W GC Column Test Standards

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

Agilent J&W GC Column Test Standards

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

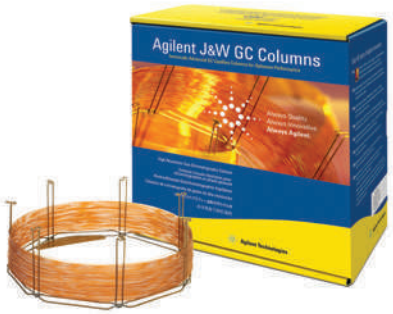
Test Standards for Agilent J&W CP and VF Columns

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

TIPS & TOOLS

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





Column Installation and Troubleshooting

Quick reference guides and tips to ensure peak performance

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

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

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

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

Capillary Column Installation Quick Reference Guide

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

Precolumn Installation Check List

1. Replace oxygen, moisture, and hydrocarbon traps as needed.
2. Clean the injection port, replace critical injection port seals, replace injection port liners, and change septa as needed.
3. Check detector seals, and replace as necessary. Clean or replace detector jets as necessary.
4. Carefully inspect the column for damage or breakage.
5. Check your GC manufacturer's gas pressure requirements and verify gas cylinder delivery pressures to ensure that an adequate supply of carrier, makeup, and fuel gases are available. Minimum recommended carrier gas purity percentages are: helium 99.995% and hydrogen 99.995%, with H_20 <1 ppm and O_2 <0.5 ppm.
6. Gather the necessary installation tools: You will need a column cutter, column nuts, column nut wrench, ferrules, a magnifying loupe, and typewriter correction fluid.

Installing the Column

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

(Continued)

Table 6:

Ferrule Sizes

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



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

TIPS & TOOLS

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

Conditioning and Testing the Column

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

Table 7:

Approximate Head Pressures (psig)							
	Column ID (mm)						
Column Length (m)	**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

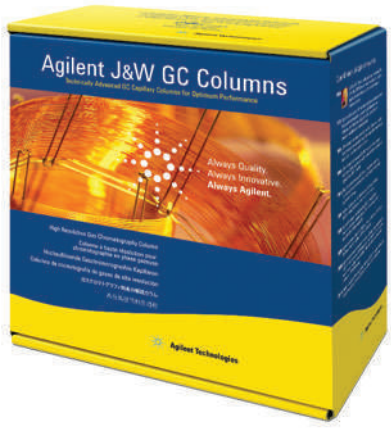
Fused silica columns break wherever there is a weak point in the polyimide coating. The polyimide coating protects the fragile but flexible fused silica tubing. The continuous heating and cooling of the oven, vibrations caused by the oven fan, and being wound on a circular cage all place stress on the 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_2SO_4), nitric (HNO_3), phosphoric (H_3PO_4), and chromic (CrO_3). The bases include potassium hydroxide (KOH), sodium hydroxide (NaOH), and ammonium hydroxide (NH_4OH). 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_4OH in the column is short. This tends to eliminate or minimize any damage by these compounds. Thus, if HCl or NH_4OH 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.

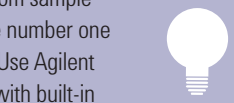
Occasionally, contaminants originate from materials in gas lines and traps, ferrule and septa particles, or anything coming in contact with the sample (vials, solvents, syringes, pipettes, etc.). These types of contaminants are probably responsible when a contamination problem suddenly develops and similar 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.

Table 8:

Solvent Volumes for Rinsing Columns

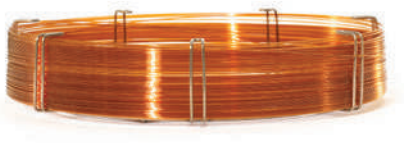
Column ID (mm)	Solvent Volume (mL)
0.18-0.2	3-4
0.25	4-5
0.32	6-7
0.45	7-8
0.53	10-12

Using larger volumes will not damage the column

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.





Evaluating the Problem

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

Checking the Obvious

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

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

The Most Common Problems

Ghost Peaks or Carryover

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

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

Condensation Test

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

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

Troubleshooting Guides

Excessive Baseline Noise

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

Baseline Instability or Disturbances

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

Tailing Peaks

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

Split Peaks

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

Retention Time Shift

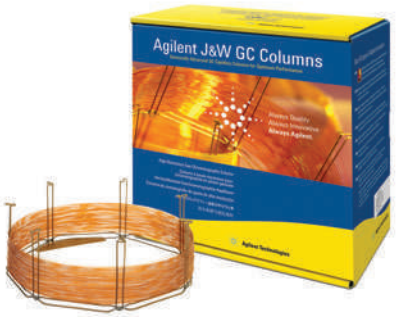
Possible Cause	Solution	Comments
Change in carrier gas velocity	Check the carrier gas velocity	All peaks will shift in the same direction by approximately the same amount
Change in column temperature	Check the column temperature	Not all peaks will shift by the same amount
Change in column dimension	Verify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

Change in Peak Size

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

Loss of Resolution

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



GC and GC/MS Applications

Industry-specific applications from your partner in chromatography

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

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

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

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

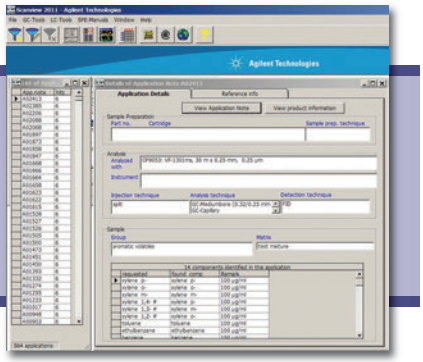
Energy and Fuels – here you'll find applications – such as the analysis of sulfur compounds in propylene – that you can use right away to meet regulatory requirements, improve efficiency, and maintain good environmental stewardship. **Turn to page 576.**

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

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

TIPS & TOOLS

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



Environmental Applications, Hydrocarbons

Unleaded Gasoline

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

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

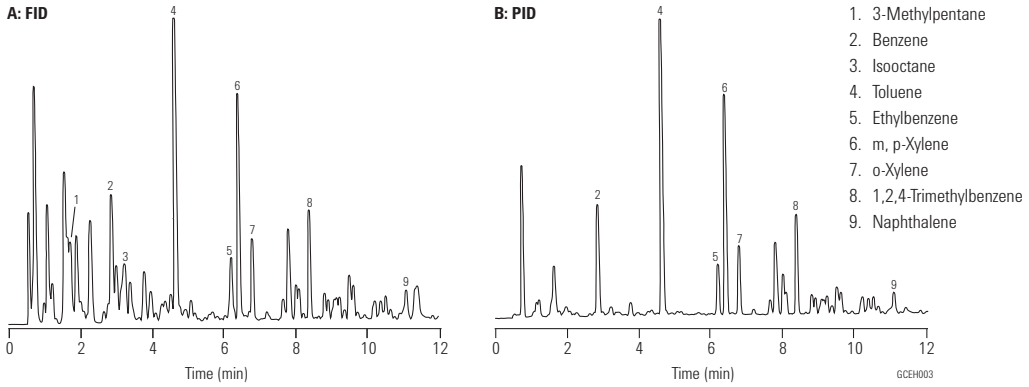
Oven: 40 °C for 2 min,
40-200 °C at 12 °C/min,
200 °C for 5 min

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

Injection: LVI (Low Volume Injector)

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

Sample: 115 ppb gasoline in 5 mL water



Determination of Chlorophenols in Water and Soil

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

Oven: 60 °C, 30 °C/min to 300 °C

Carrier: He 80 kPa, 0.8 bar, 5.7 psi

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

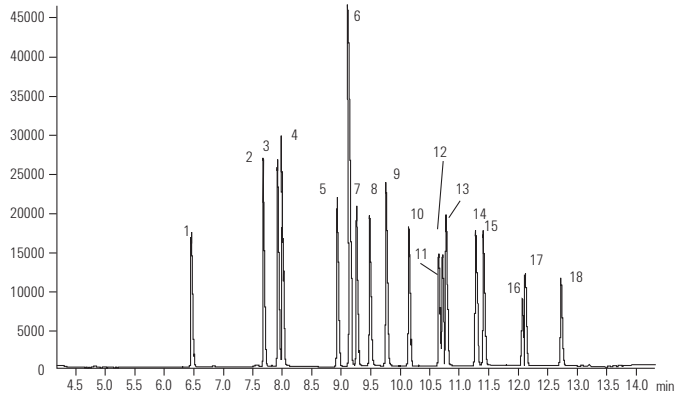
Detector: MS
280 °C

Sample: Isohexane

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

Dr. Weßling, Laboratorien GmbH

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

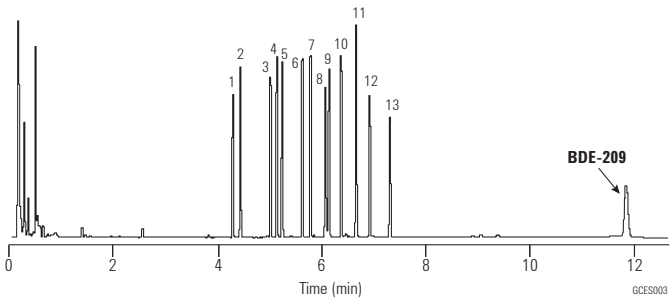
Injection: Split, 250 °C
Split ratio 20:1

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)
2. 2,4,4'-TriBDE (BDE-28)
3. 2,3',4',6-Tetra-BDE (BDE-71)
4. 2,2',4,4'-Tetra-BDE (BDE-47)
5. 2,3',4,4'-TetraBDE (BDE-66)
6. 2,2',4,4',6-PentaBDE (BDE-100)
7. 2,2',4,4',5-PentaBDE (BDE-99)
8. 2,2',3,4,4'-PentaBDE (BDE-85)
9. 2,2',4,4',5,6'-HexaBDE (BDE-154)
10. 2,2',4,4',5,5'-HexaBDE (BDE-153)
11. 2,2',3,4,4',5'-HexaBDE (BDE-138)
12. 2,2',3,4,4',5',6-HeptaBDE (BDE-183)
13. 2,3,3',4,4',5,6-HeptaBDE (BDE-190)
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

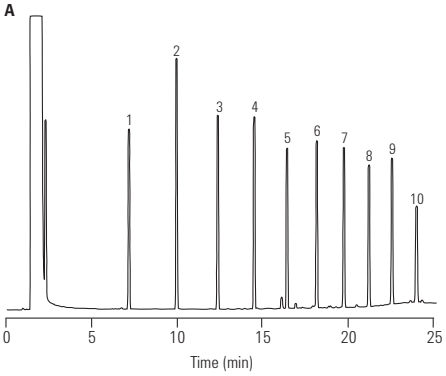
Septum: 11 mm Advanced Green septa, 5183-4759

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

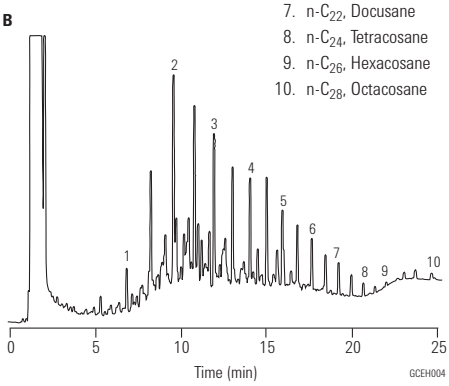
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

1. n-C_{10}, Decane
2. n-C_{12}, Dodecane
3. n-C_{14}, Tetradecane
4. n-C_{16}, Hexadecane
5. n-C_{18}, Octadecane
6. n-C_{20}, Eicosane
7. n-C_{22}, Docusane
8. n-C_{24}, Tetracosane
9. n-C_{26}, Hexacosane
10. n-C_{28}, Octacosane

Diesel fuel standard
50 ng/component



Diesel fuel
0.6 mg/mL



Analysis of Polycyclic Aromatic Hydrocarbons

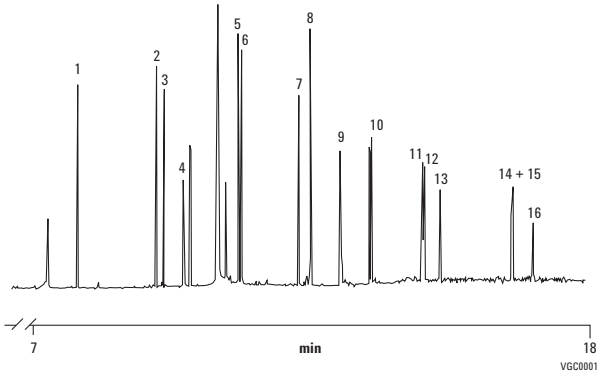
Column: **VF-Xms**
CP8805
30 m x 0.25 mm, 0.10 µm

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. Dibenz[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

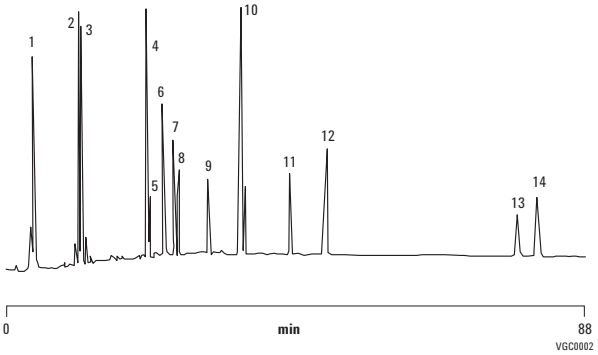
Sample Conc: 100-400 pg/µL

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

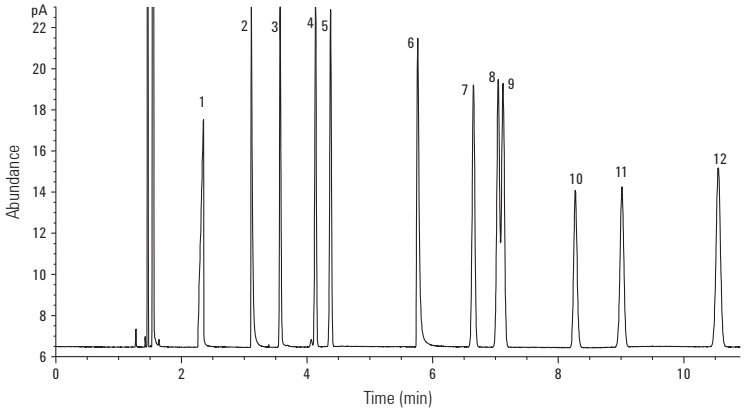
Oven: 30 °C (1.0 min), 15 °C/min to 100 °C,
20 °C/min to 240 °C (0.5 min),
15 °C to 325 °C (6.7 min)

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

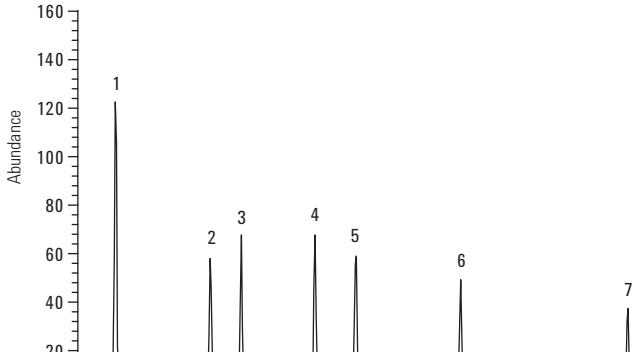
Oven: 150 to 325 °C (17 °C/min), hold 5 min

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

Suggested Supplies

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

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



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

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^2 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 dibenz[a,h]anthracene. This application demonstrates that the DB-EUPAH column can provide excellent sensitivity and selectivity for the analysis of EU regulated PAHs.

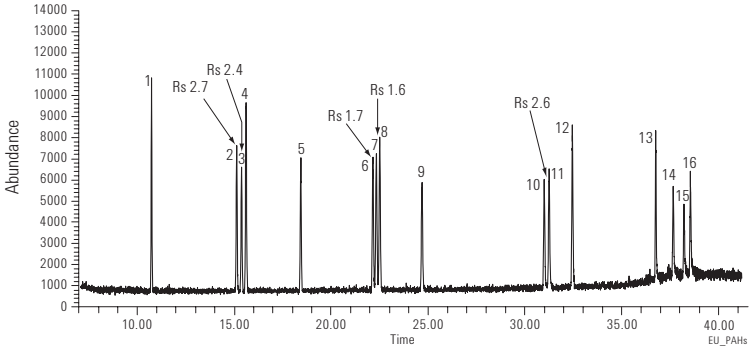
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

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

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



Environmental Applications, Pesticides and Herbicides

Fast CLP Pesticides

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

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

Instrument: Agilent 7890 GC with dual µECD

Carrier: Helium, constant flow 3.5 mL/min

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

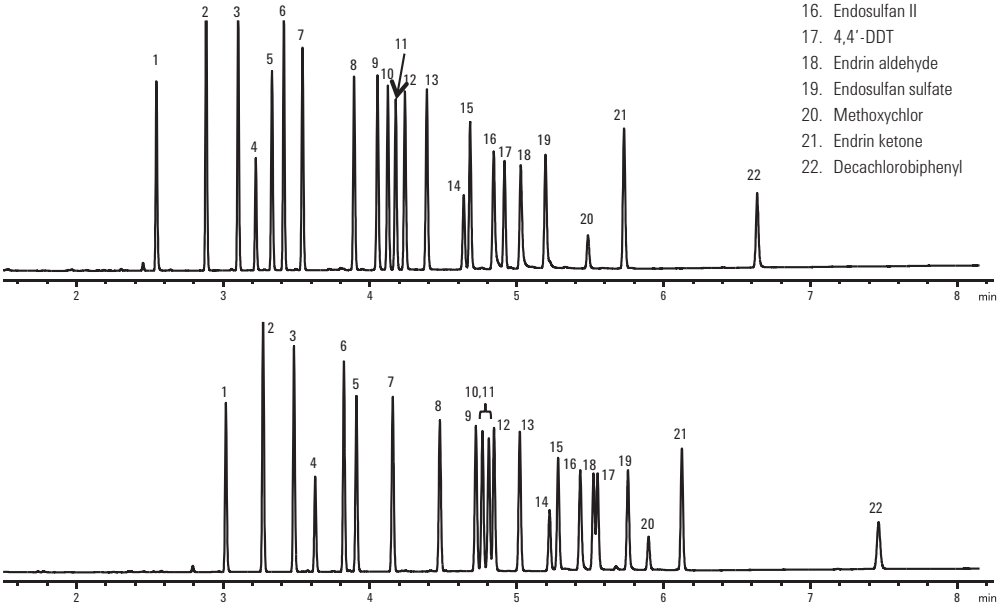
Sampler: Agilent 7693

Injection: 1 µL splitless

Detector: µECD at 340 °C

Sample: 50 ng/mL CLP Pesticides

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



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

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

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

Carrier: Helium, constant flow, 3.75 mL/min

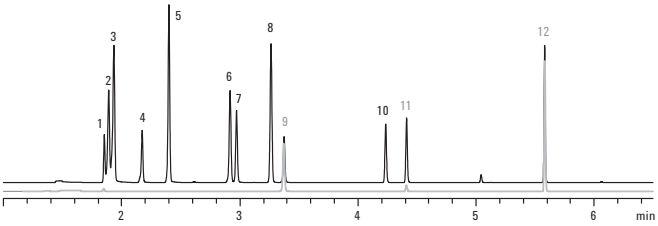
Oven: 50 °C, hold 1.5 min, 20 °C/min to 95 °C, 40 °C/min to 175 °C, hold 1.25 min

Injection: 2 µL, splitless, 200 °C

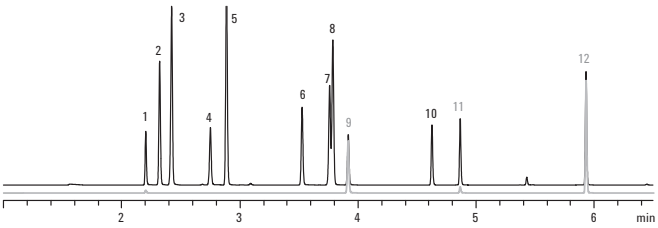
Detector: µECD, 300 °C

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

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

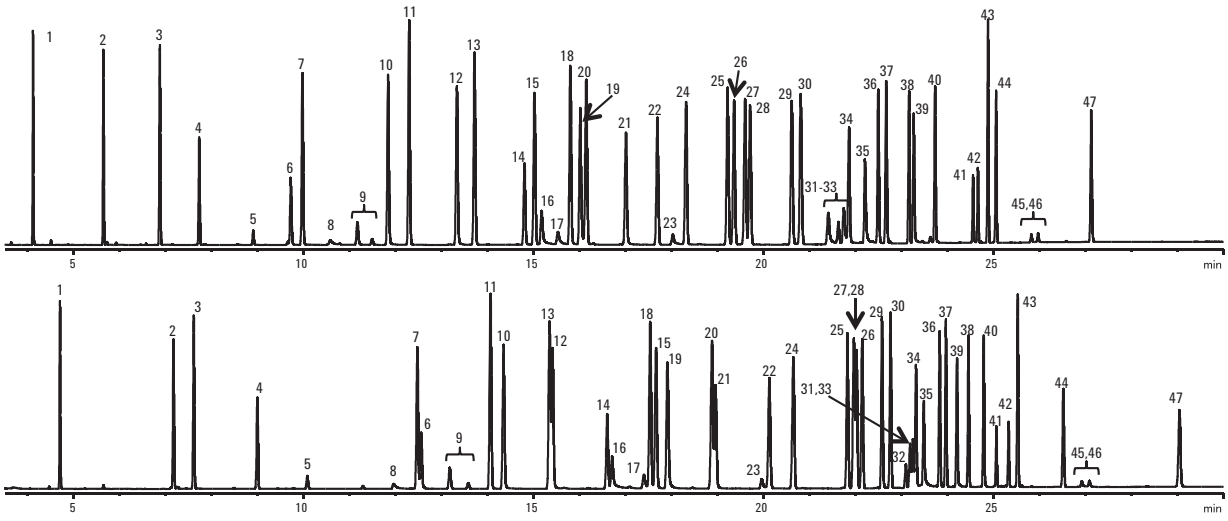
Sampler: Agilent 7693

Injection: 2 µL, splitless

Detector: µECD at 325 °C

Sample: 50 ng/mL 8081B analytes

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



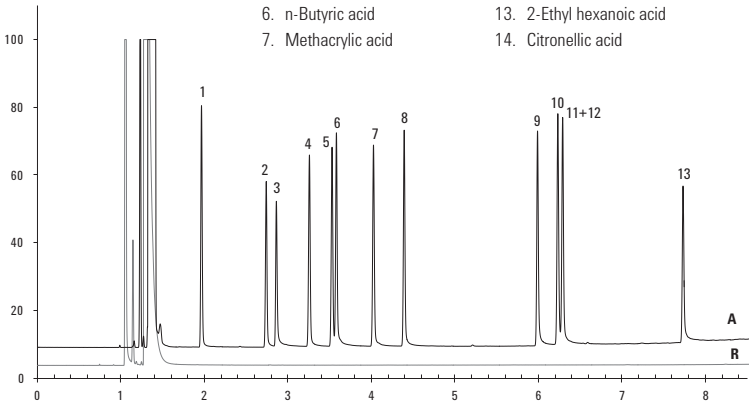
DB-624UI Organic Acid Performance

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_1-C_{10} (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)
2. Acetic acid
3. Propionic acid
4. Acrylic acid
5. Isobutyric acid
6. n-Butyric acid
7. Methacrylic acid
8. Isopentanoic acid
9. n-Pentanoic acid
10. n-Heptanoic acid
11. Levulinic acid
12. 2-Propyl pentanoic acid
13. 2-Ethyl hexanoic acid
14. Citronellic acid



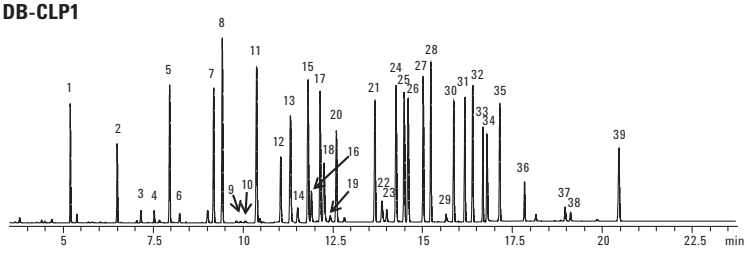
EPA Method 551 – Chlorinated Solvents, Trihalomethanes (THMs), and Disinfection Byproducts (DBPs)

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

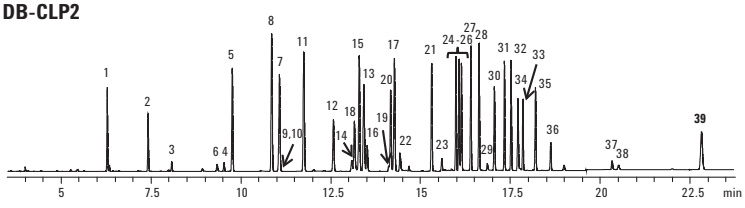
Column: **DB-CLP2**
123-8336
30 m x 0.32 mm, 0.50 µm

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

Analysis of Semivolatiles

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

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

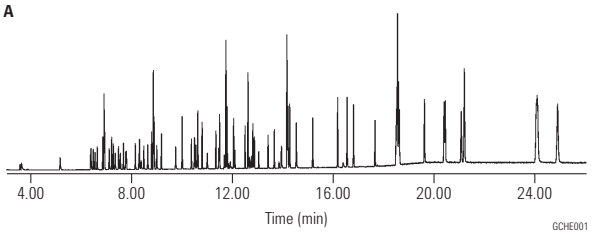
Carrier: He constant flow mode, 1.1 mL/min

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

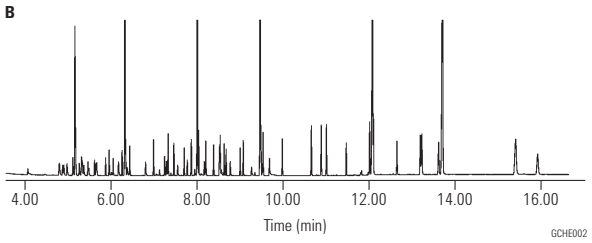
Injection: Splitless 0.5 µL injected at 300 °C,
QuickSwap pressure 5.0 psi during acquisition,
80.0 psi during backflush with inlet set to
1.0 psi during backflush

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

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



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



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



TIPS & TOOLS

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

Pesticides, EPA 508.1

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

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

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

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

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

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

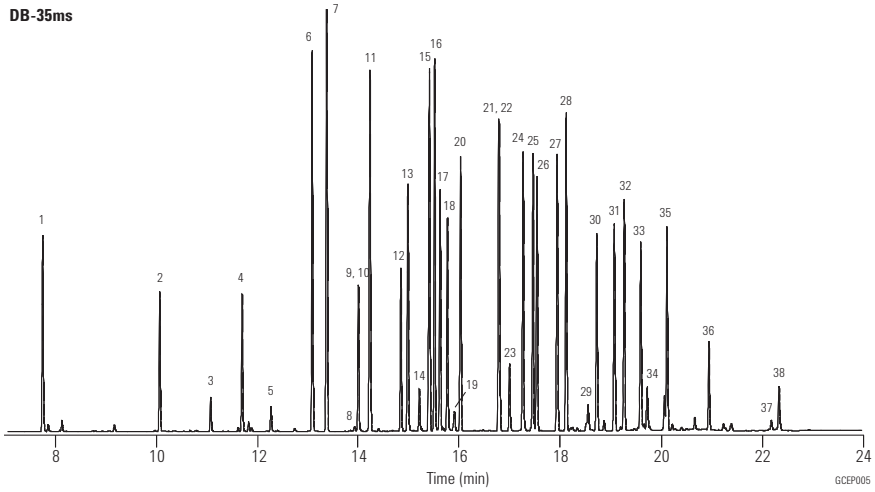
Sample: 50 pg per component

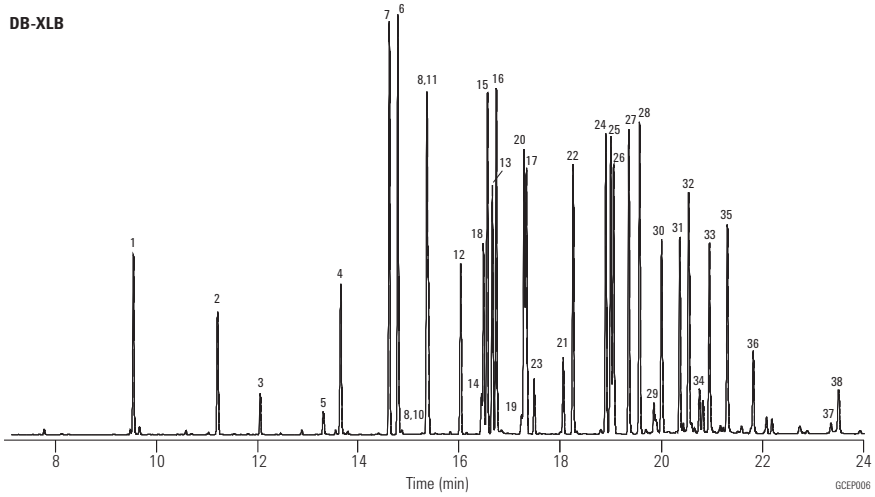
Suggested Supplies

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





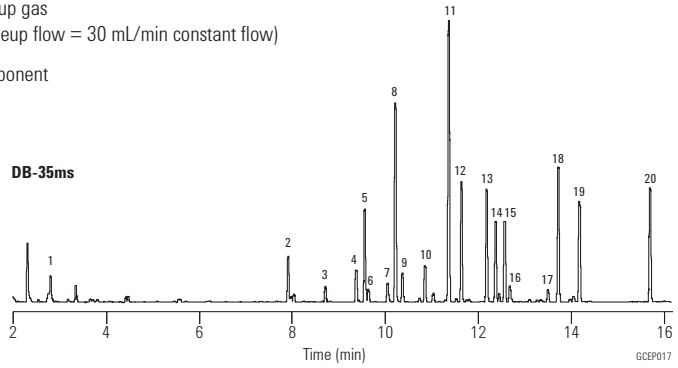
1. Hexachlorocyclopentadiene
2. Etridiazole
3. Chloroneb
4. Trifluralin
5. Propachlor
6. Hexachlorobezene
7. α-BHC
8. Atrazine
9. Pentachloronitrobenzene
10. Simazine
11. γ-BHC
12. β-BHC
13. Heptachlor
14. Alachlor
15. δ-BHC
16. Chlorothalonil
17. Aldrin
18. Metribuzin
19. Metolachlor
20. DCPA
21. 4,4'-Dibromobiphenyl
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. Acifluorofen

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

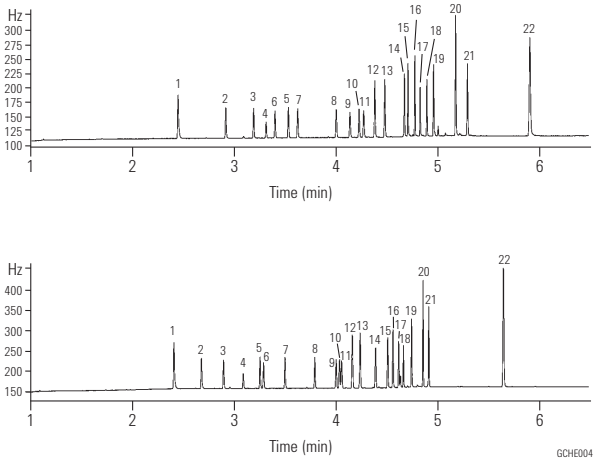
Carrier: Hydrogen (69 cm/s at 120 °C, ramped at 99 mL/min to 106 cm/s at 4.4 min)

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)

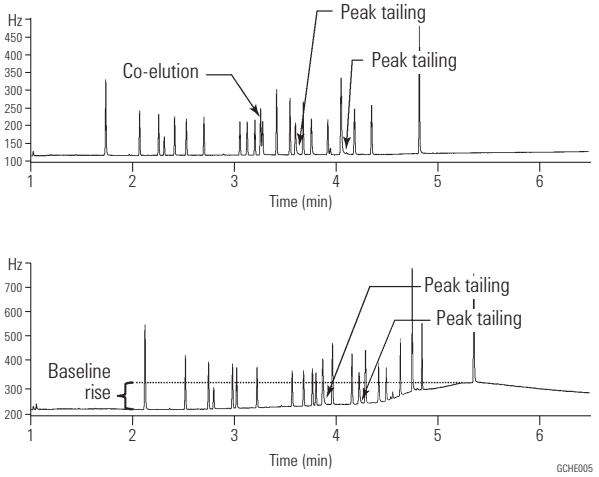
Detector: µECD 320 °C; nitrogen makeup; constant column + makeup flow 60 mL/min

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

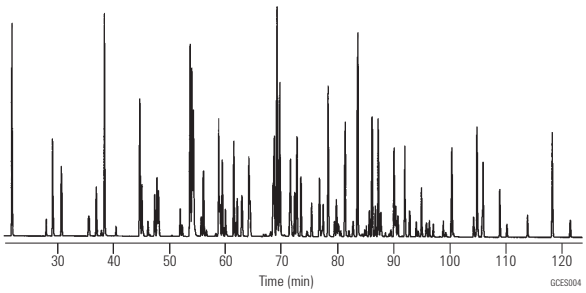
Carrier: Helium at 37 cm/s, measured at 150 °C

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 isooctane, 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

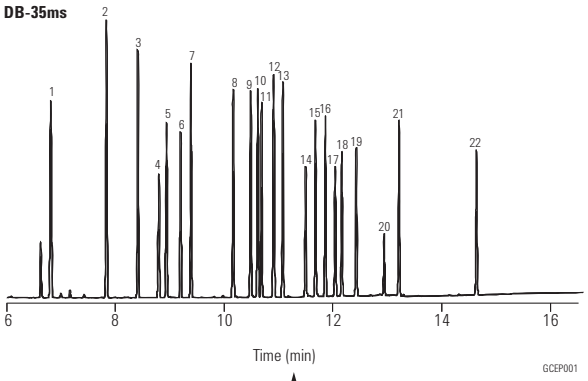
Carrier: Helium at 45 cm/s
(EPC in constant flow mode)

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

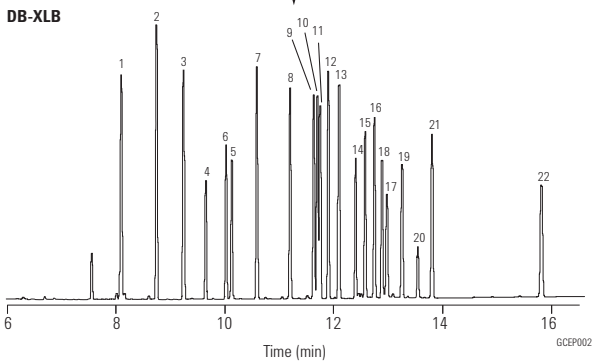
Injection: Splitless, 250 °C
30 s purge activation time

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

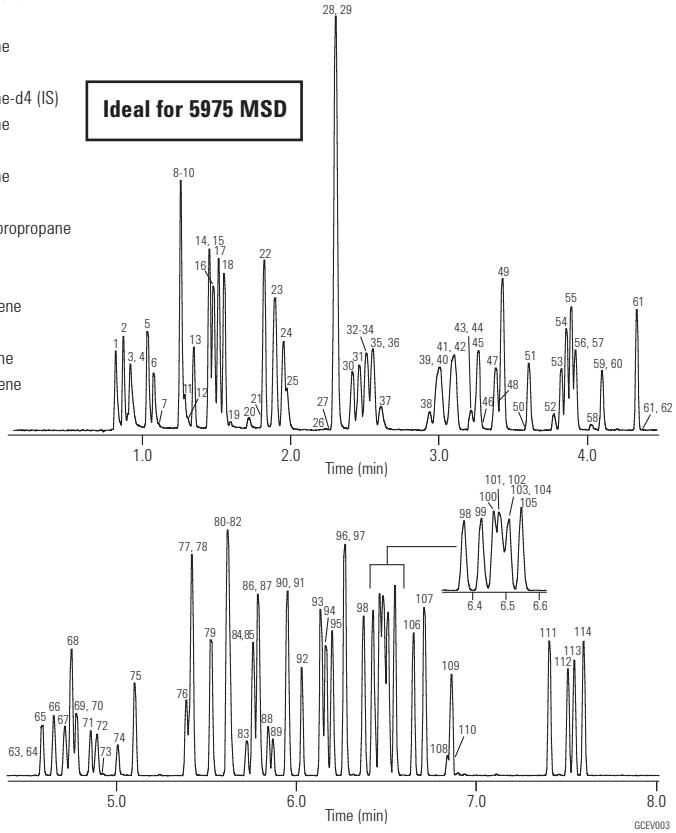
Injection: Split, 150 °C
Split ratio 60:1

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

Ideal for 5975 MSD



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

PBDEs

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

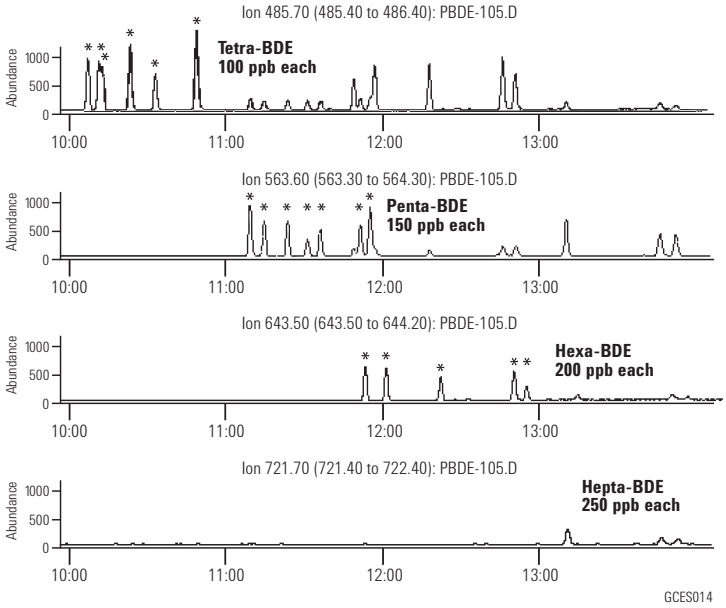
Carrier: Helium at 38 cm/s at 100 °C (1.2 mL/min), constant flow mode

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

Injection: Cool on-column, oven-track mode

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

Sample: 0.5 µL



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

EPA Volatiles by GC/MS (Split Injector)

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

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

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

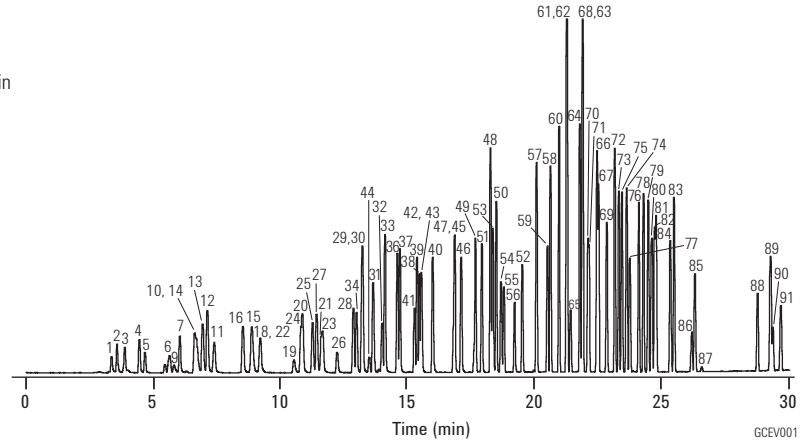
Sampler: Purge and trap (O.I.A. 4560)
Purge: Helium for 11 min at 40 mL/min
Trap: Tenax/Silica Gel/Carbosieve
Preheat: 175 °C
Desorb: 220 °C for 0.6 min

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

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

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759
Liner: Direct, 1.5 mm id, 18740-80200
Seal: Gold plated seal kit, 5188-5367



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

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

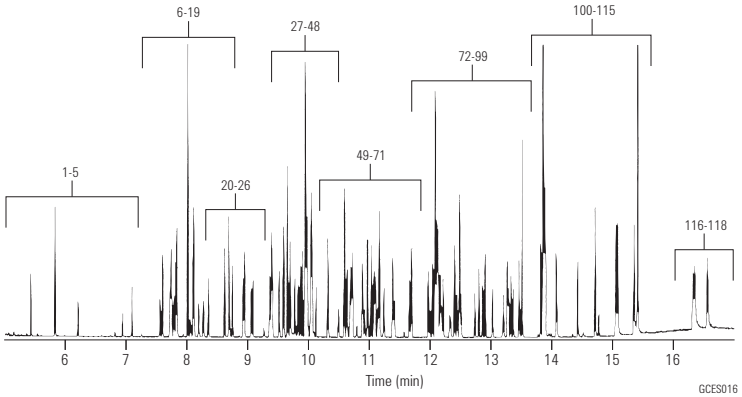
Detector:
MSD, 325 °C transfer line
Full scan m/z 45-450

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

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

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



Pesticides and Fire Retardants (US EPA 527)

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

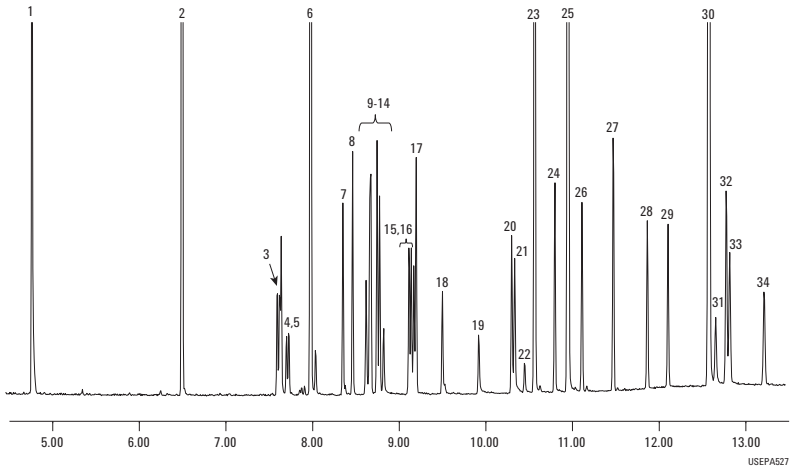
Carrier: Helium, 52 cm/s, constant flow

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

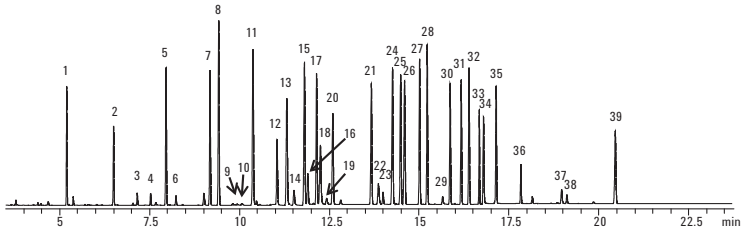
Injection: 2 µL, splitless, 250 °C

Detector: µCED, 340 °C

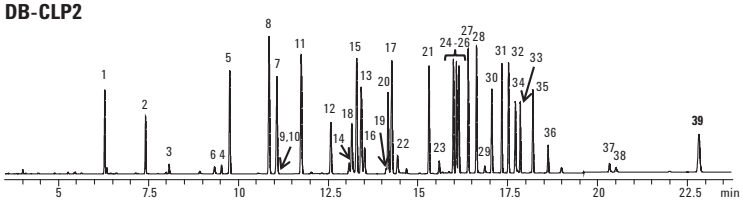
Sample: 100 ng/mL EPA 508.1 analytes, 100 ng/mL pesticide surrogate mix

1. Hexchlorocyclopentadiene
2. Etridiazole
3. Chloroneb
4. Trifluralin
5. Tetrachloro-m-xylene (surrogate standard)
6. Propachlor
7. Hexachlorobenzene
8. α-BHC
9. Atrazine
10. Simazine
11. γ-BHC
12. ß-BHC
13. Heptachlor
14. Alachlor
15. δ-BHC
16. Chlorothalonil
17. Aldrin
18. Metribuzin
19. Metolachlor
20. DCPA
21. Heptachlor epoxide
22. Cyanazine
23. Butachlor
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
39. Decachlorobiphenyl (surrogate standard)

DB-CLP1



DB-CLP2



The DB-CLP1 column separates all chlorinated pesticide and herbicide analytes acording 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

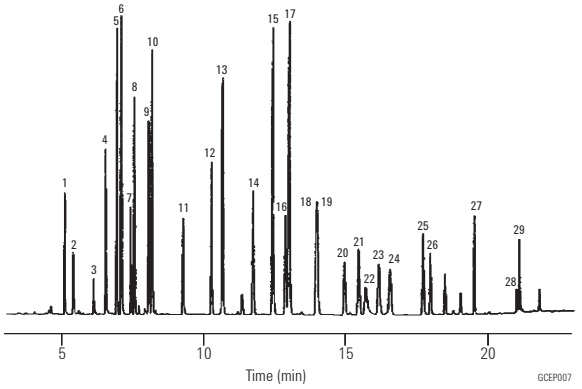
Suggested Supplies

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



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 pg/µL standard in isooctane

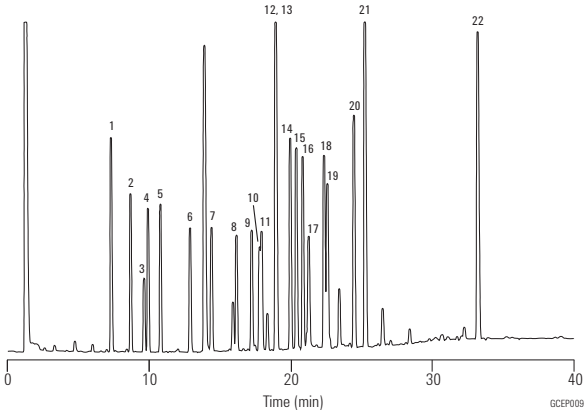
Suggested Supplies

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

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



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

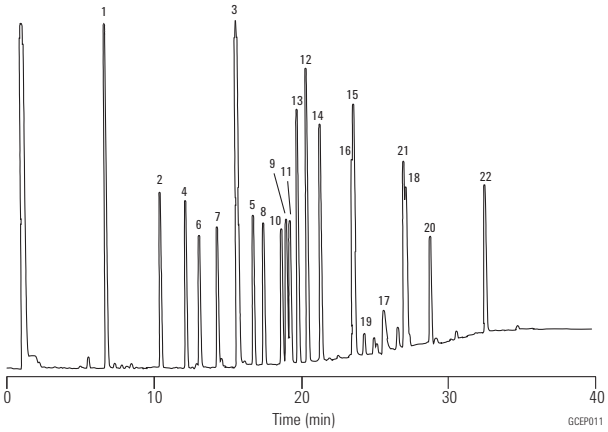
Suggested Supplies

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



Organochlorine Pesticides IV

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

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

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

Injection: Splitless, 250 °C

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

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

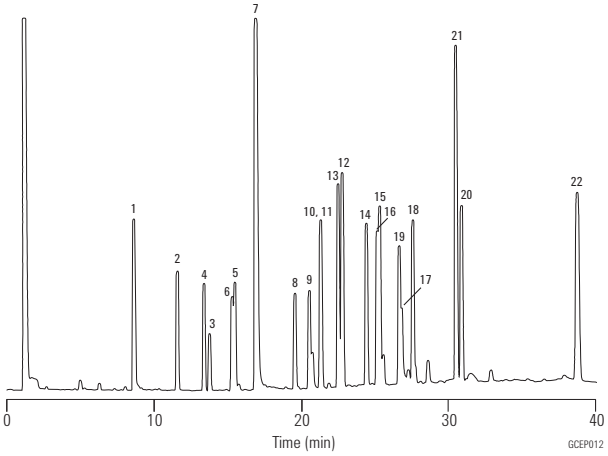
Suggested Supplies

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



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

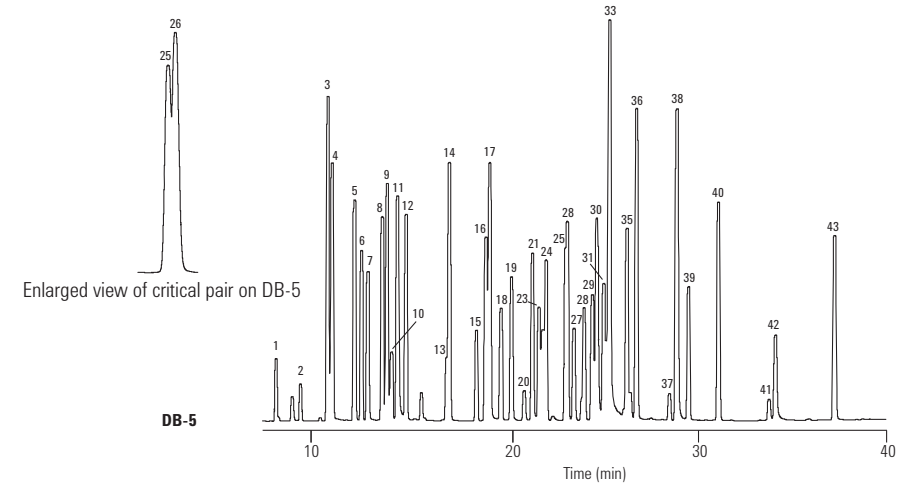
Carrier: Helium at 29.2 cm/s, measured at 150 °C

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

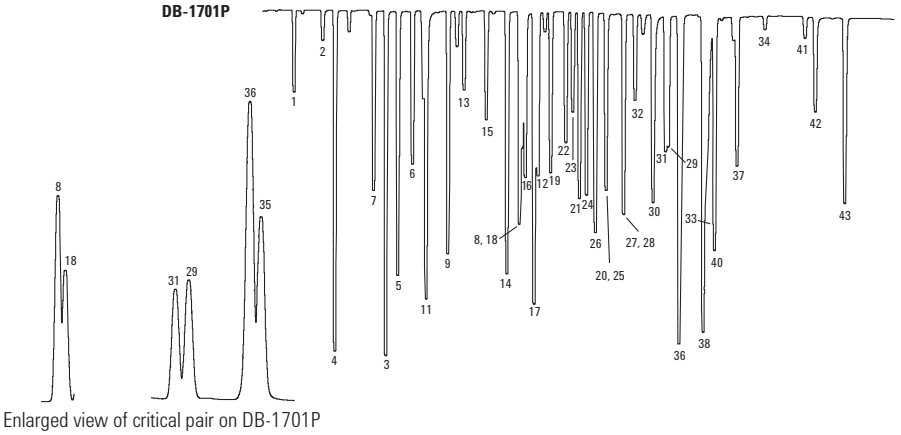
Injection: Splitless, 200 °C

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

Sample: 2.0 µL, 20-200 pg/µL



Enlarged view of critical pair on DB-5



Enlarged view of critical pair on DB-1701P

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. Carbophenothion
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

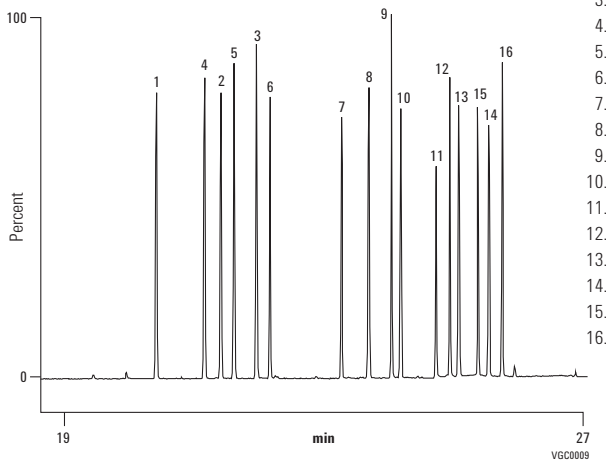
Sample: 1.0 µL

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

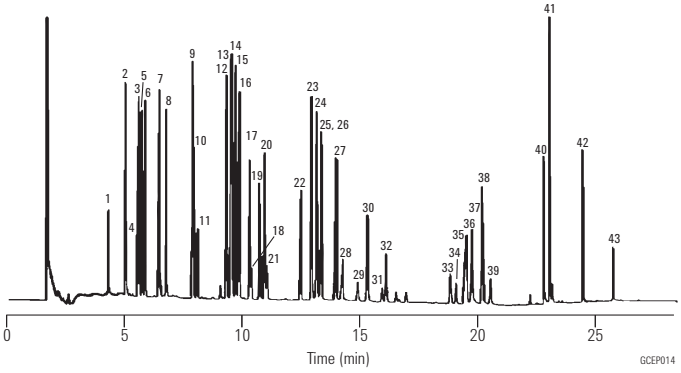
Detector: NPD, 290 °C
Helium makeup gas at 30 mL/min

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
2. EPTC
3. Butylate
4. Mevinphos
5. Vernolate
6. Pebulate
7. Tebuthiuron
8. Molinate
9. Ethoprop
10. Cycloate
11. Chlorpropham
12. Atraton
13. Simazine
14. Prometon
15. Atrazine
16. Propazine
17. Terbufos
18. Pronamide
19. Diazinon
20. Disulfoton
21. Terbacil
22. Metribuzin
23. Simetryn
24. Alachlor
25. Ametryn
26. Prometryn
27. Terbutryn
28. Bromacil
29. Metolachlor
30. Triadimefon
31. MGK-264
32. Diphenamid
33. Stirifos
34. Butachlor
35. Fenamiphos
36. Napropamide
37. Tricyclazole
38. Merphos
39. Carboxin
40. Norflurazon
41. Hexazinone
42. Fenarimol
43. Fluridone

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

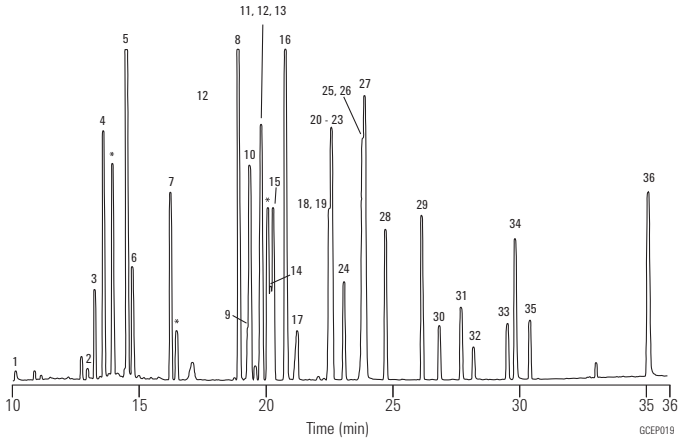
Sample: 2 µL x 10-50 ng/µL solution
in acetone

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
2. Diuron
3. EPTC
4. Dichlobenil
5. Vernolate
6. Pebulate
7. Molinate
8. Sulfallate
9. Atraton
10. Prometon
11. Atrazine
12. Propazine
13. Simazine
14. Terbuthylazine
15. Pronamide
16. Secbumeton
17. Terbacil
18. Alachlor
19. Propanil
20. Ametryn
21. Prometryn
22. Simetryn
23. Metribuzin
24. Terbutryn
25. Metolachlor
26. Bromacil
27. Dacthal
28. Diphenamid
29. Butachlor
30. Napropamide
31. Carboxin
32. Tricyclazole
33. Norflurazon
34. Hexazinone
35. Difolatan
36. Fluridone

* Impurity

Herbicides II

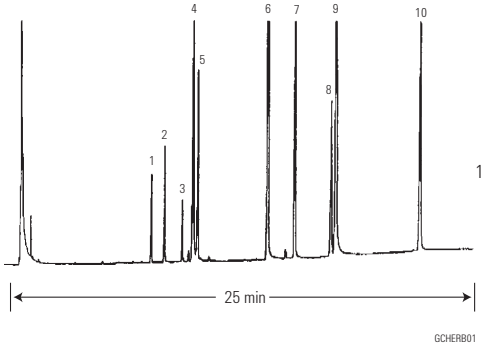
Column: **DB-210**
122-0232
30 m x 0.25 mm, 0.25 µm

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_1 and C_2 Halocarbons (Freons)

Column: **GS-GasPro**
113-4362
60 m x 0.32 mm

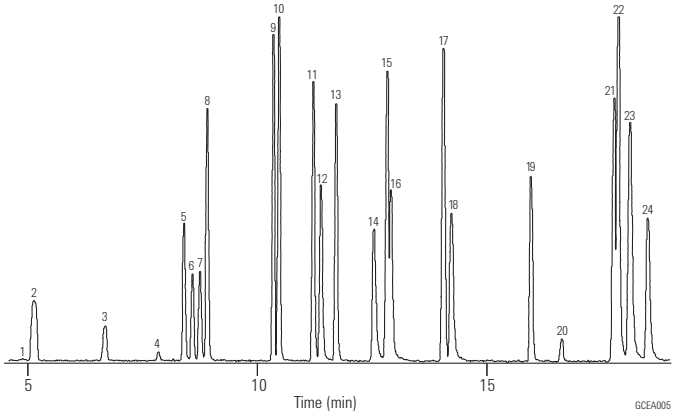
Carrier: Helium at 35 cm/s, constant velocity

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-1,1,1,2-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)

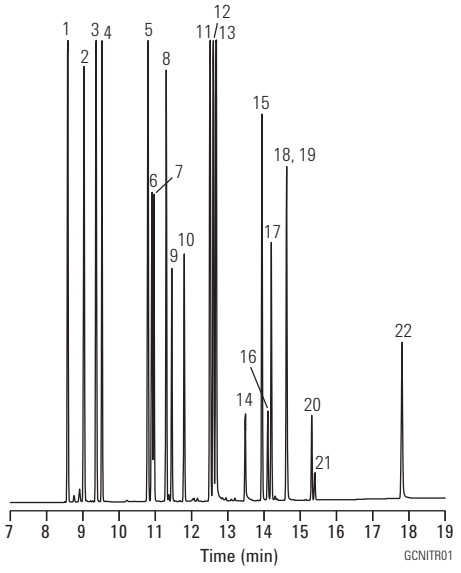
Column: **DB-35**
125-1937
30 m x 0.53 mm, 0.50 µm

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. Paarlan
18. Prowl
19. Bromacil
20. Oxadiazon
21. GOAL
22. Hexazinone

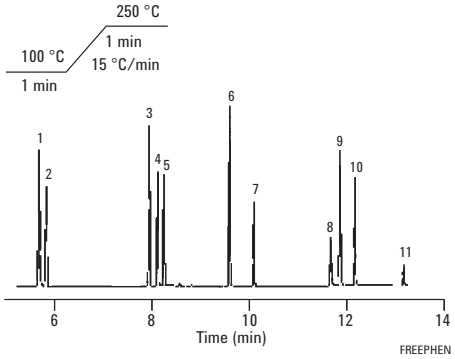
Free Phenols

Column: **HP-50+**
19091L-433
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen, constant flow 45 cm/s

Injection: Split, 100:1

Detector: FID, 300 °C



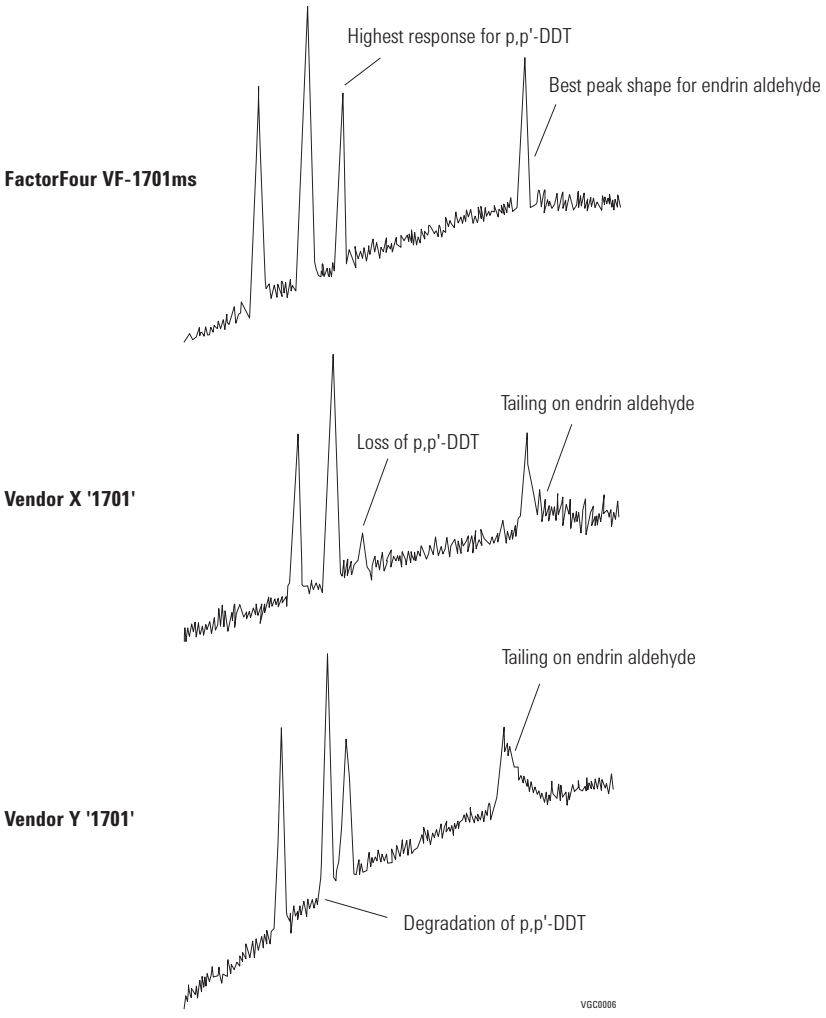
1. Phenol
2. 2-Chlorophenol
3. 2,4-Dimethylphenol
4. 2-Nitrophenol
5. 2,4-Dichlorophenol
6. 4-Chloro-3-methylphenol
7. 2,4,6-Trichlorophenol
8. 2,4-Dinitrophenol
9. 4-Nitrophenol
10. 2-Methyl-4,6-dinitrophenol
11. Pentachlorophenol

EPA 625 Halogenated Pesticides on "1701" Type Phases

Column: **VF-1701 Pesticides**
CP9070
30 m x 0.25 mm, 0.25 µm

Oven: 150 °C, 5 °C/min to 275 °C

Injection: Split: T=275 °C
ECD: T=275 °C, 2 pg



Organochlorine Pesticides to EPA 625 via GC/MS

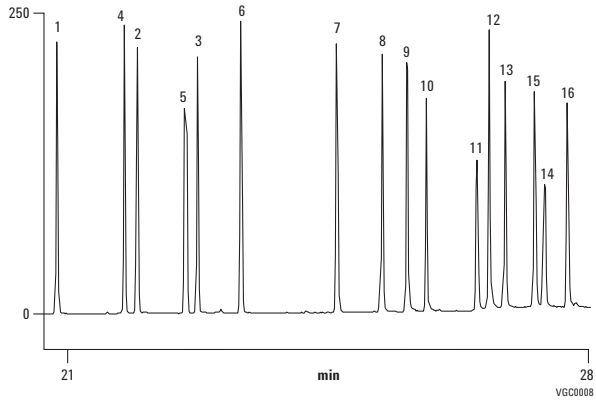
Column: **VF-35ms**
CP8877
30 m x 0.25 mm, 0.25 µm

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

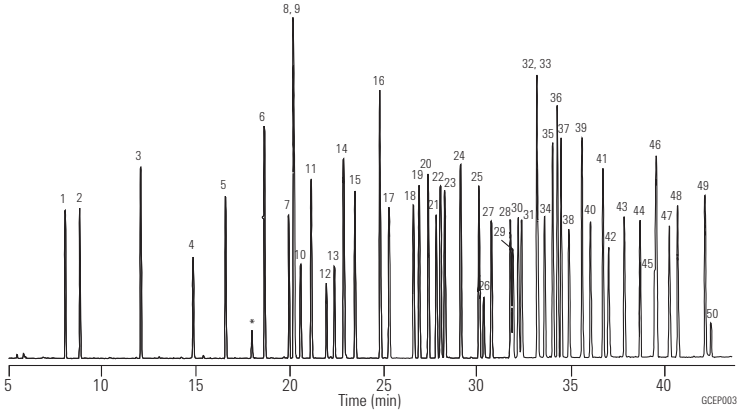
Carrier: Helium at 35 cm/s, measured at 50 °C

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.



Standards used were a composite of individual solutions supplied courtesy of AccuStandard Inc., 25 Science Park, New Haven, CT 06511, 800-442-5290.

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

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

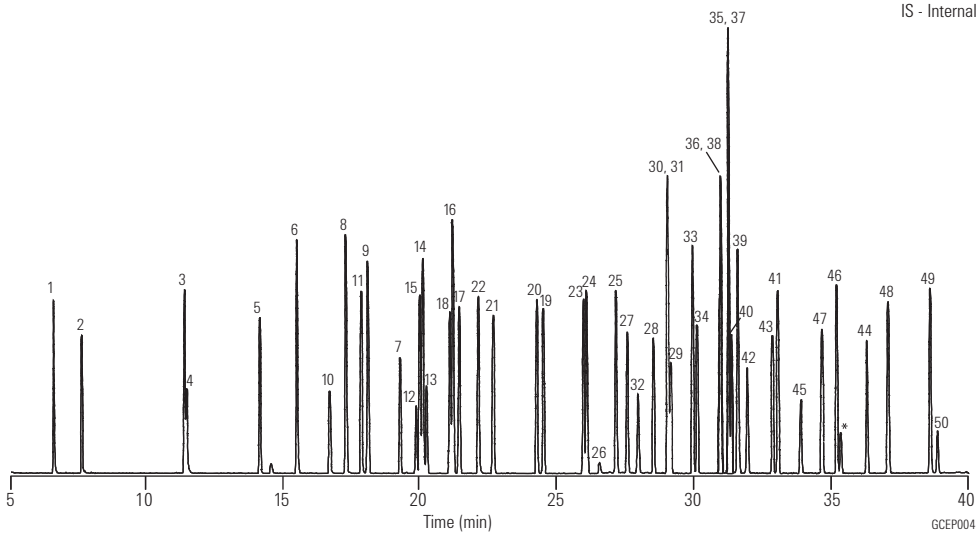
Detector: MSD, 300 °C transfer line
Full scan at m/z 50-500

Sample: 1 µL of 35 µg/mL composite 8081A standards, AccuStandard Inc.

Standards used were a composite of individual solutions supplied courtesy of AccuStandard Inc., 25 Science Park, New Haven, CT 06511, 800-442-5290.

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

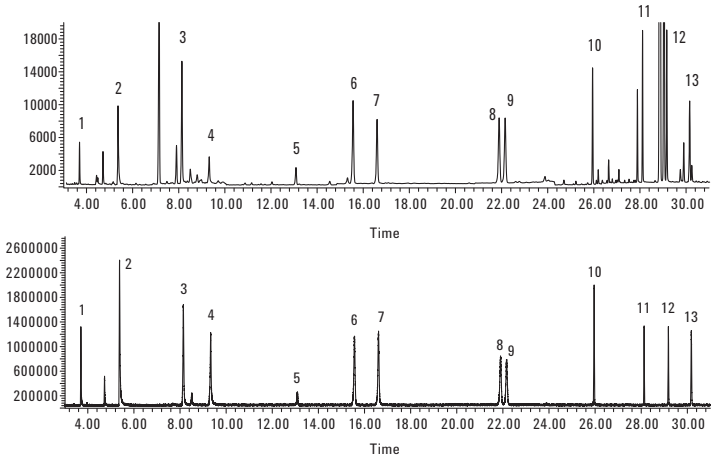
* Breakdown Products
SS - Surrogate Standard
IS - Internal Standard



Organophosphorus Pesticides in Apple Matrix

Column: **DB-35ms Ultra Inert**
121-3822UI
20 m x 0.18 mm, 0.18 µm

Instrument:	Agilent 7890 GC/Agilent 5975C Series GC/MSD
Sampler:	Agilent 7683B automatic liquid sampler, 5.0 µL syringe (p/n 5181-1273)
CFT Device:	Purged 2-way splitter (p/n G3180B) Split Ratio MSD:FPD = 3:1
MSD Restrictor:	1.2 m x 0.15 mm id deactivated fused silica tubing
FPD Restrictor:	1.4 m x 0.15 mm id deactivated fused silica tubing
PCM 1:	3.8 psi constant pressure
Inlet:	1 µL splitless; 250 °C, purge flow 60 mL/min at 0.25 min, gas saver on at 2 min 20 mL/min
Carrier:	Helium, constant pressure 43.5 psi at 95 °C
Oven:	95 °C (1.3 min), 15 °C/min to 125 °C, 5 °C/min to 165 °C, 2.5 °C/min to 195 °C, 20 °C/min to 280 °C (3.75 min)
Postrun Backflush:	5 min at 280 °C, PCM 1 pressure 70 psi during backflush, 2 psi inlet pressure during backflush
Detector:	310 °C transfer line, 310 °C source, 150 °C quad



1. Oxydemeton-methyl
2. Methamidophos
3. Mevinphos
4. Acephate
5. Naled
6. Diazinon
7. Dimethoate
8. Chlorpyrifos
9. Malathion
10. Methidathion
11. TPP (surrogate std)
12. Phosmet

MSD (SIM): 600 ng/mL

FPD (P): 200 ng/mL

GC/MS-SIM and FPD chromatograms of a matrix matched organophosphorus pesticides standard analyzed on an Agilent J&W DB-35ms UI column. The effluent spilt 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

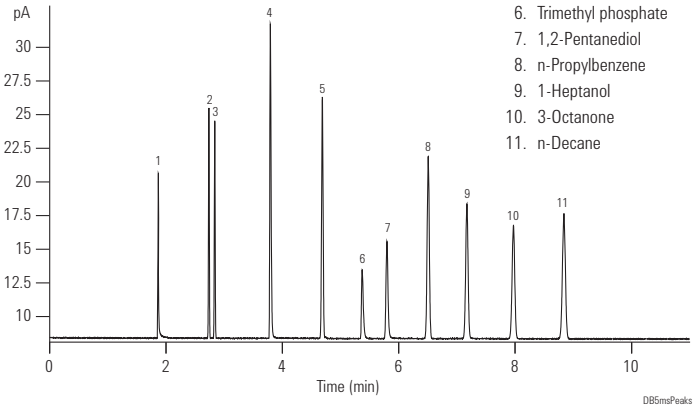
Sampler: Agilent 7683B, 0.5 µL syringe
(p/n 5188-5246), 0.02 µL split injection

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.

1. 1-Propionic acid
2. 1-Octene
3. n-Octane
4. 4-Picoline
5. n-Nonane
6. Trimethyl phosphate
7. 1,2-Pentanediol
8. n-Propylbenzene
9. 1-Heptanol
10. 3-Octanone
11. n-Decane



Trace Level Polycyclic Aromatic Hydrocarbon (PAH) Analyses

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

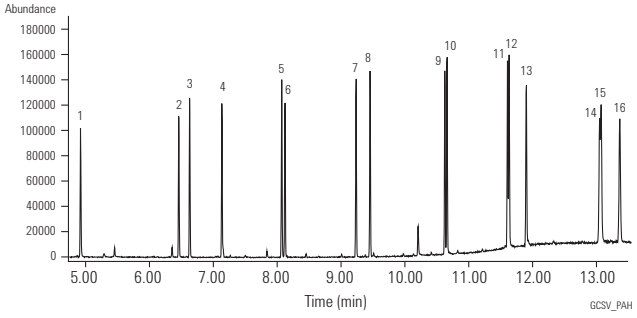
Carrier: Helium constant flow 30 cm/s

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



Tetrachlorodibenzo-p-furans

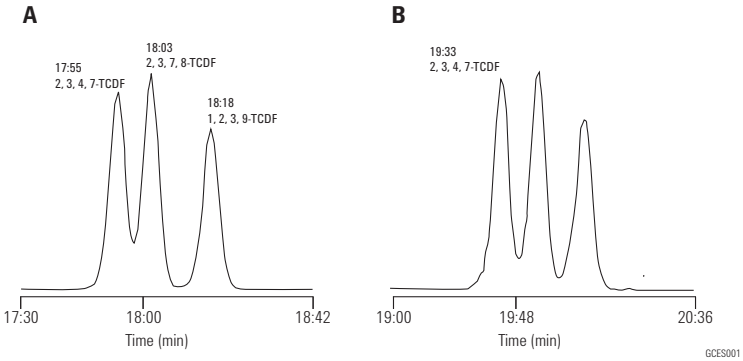
Column A: **DB-225**
122-2232
30 m x 0.25 mm, 0.25 µm

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

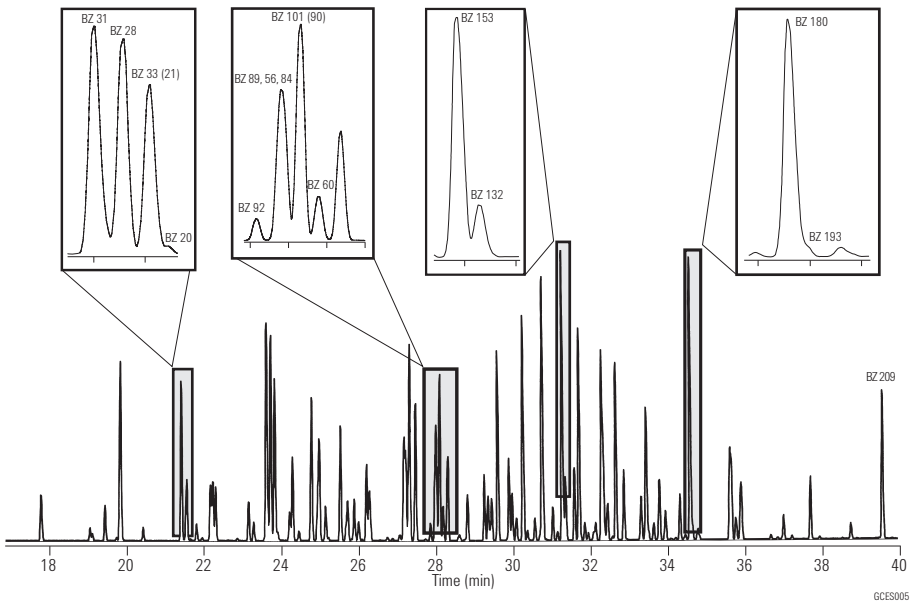
Sample: 2 µL dilute Aroclor mixture

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

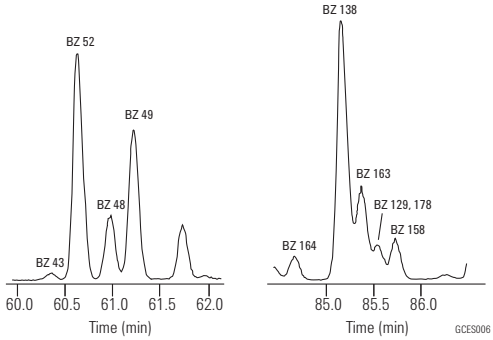
Carrier: Helium at 34.2 cm/s, measured at 150 °C

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

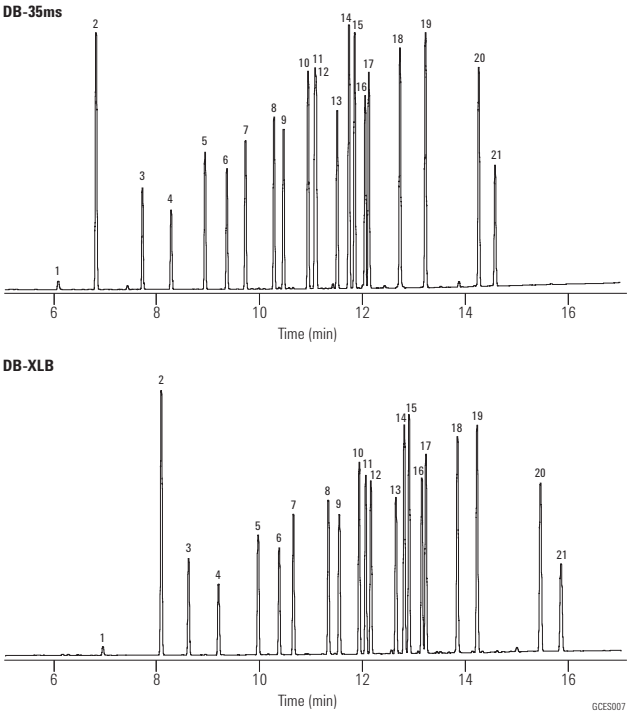
Carrier: Helium at 45 cm/s
(EPC in constant flow mode)

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

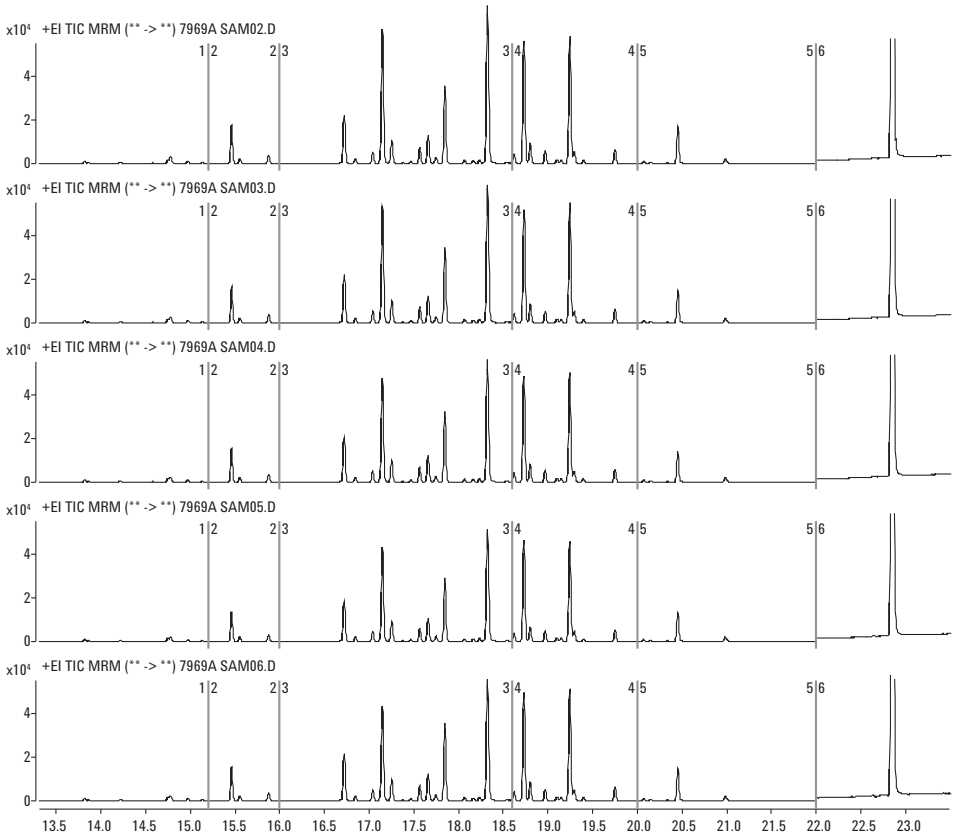
Oven: 80 °C (1 min), 10 °C/min to 305 °C, 7.5 min hold

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
Octachloronapthalene (IS):	404.0 > 404.0 (CE OV)

Sample: Reference sample BCR-449, five aliquots



Counts vs. Acquisition Time (min)

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

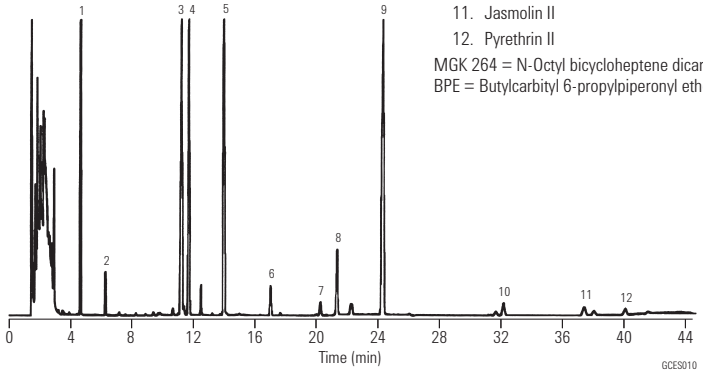
Oven: 180 °C for 11 min
180-200 °C at 10 °C/min
200 °C for 8 min
200-210 °C at 10 °C/min
210 °C for 18 min
210-245 °C at 30 °C/min
245 °C for 4 min

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

Detector: FID, 300 °C
Helium makeup gas at 30 mL/min

Sample: 1 µL

Chromatogram courtesy of Khan Nguyen and Richard Moorman of Sandoz Agro Inc.



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

Organotin Compounds I

Column: **HP-1**
19091Z-012
25 m x 0.32 mm, 0.17 µm

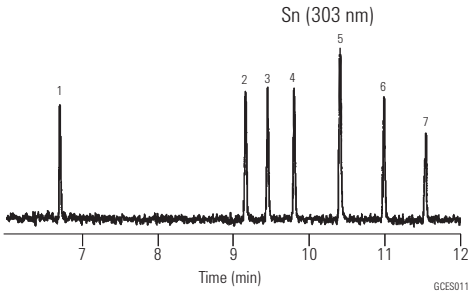
Carrier: Helium, 100 kPa

Oven: 50 °C for 1 min
50-260 °C at 15 °C/min

Injection: Splitless

Detector: AED, 330 °C

Sample: 1 µL



1. Dimethylpentyltin
2. Tetrabutyltin
3. Methyltripentyltin
4. Tributylpentyltin
5. Dibutylpentyltin
6. Butlypentyltin
7. Tetrapentyltin

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

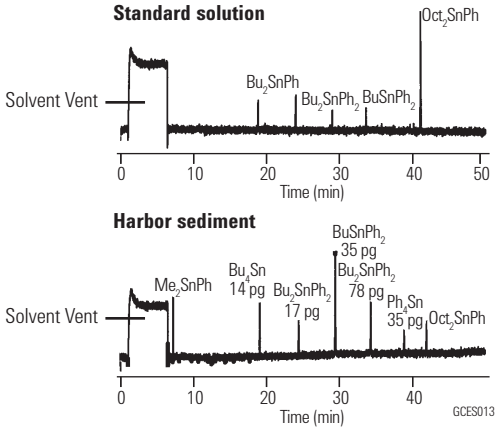
Carrier: Helium, 0.75 mL/min constant flow

Oven: 60-360 °C at 5 °C/min

Injection: Splitless, 300 °C

Detector: AED, 300 °C
Hg selective at 254 mm

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	Injection:	Splitless, 250 °C 30 mL/min purge flow at 0.35 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	Detector:	5973 MSD, 310 °C transfer line Scan range 35-500 amu, 3.25 scans/s
		Sample:	1 µL of 50 ng standard

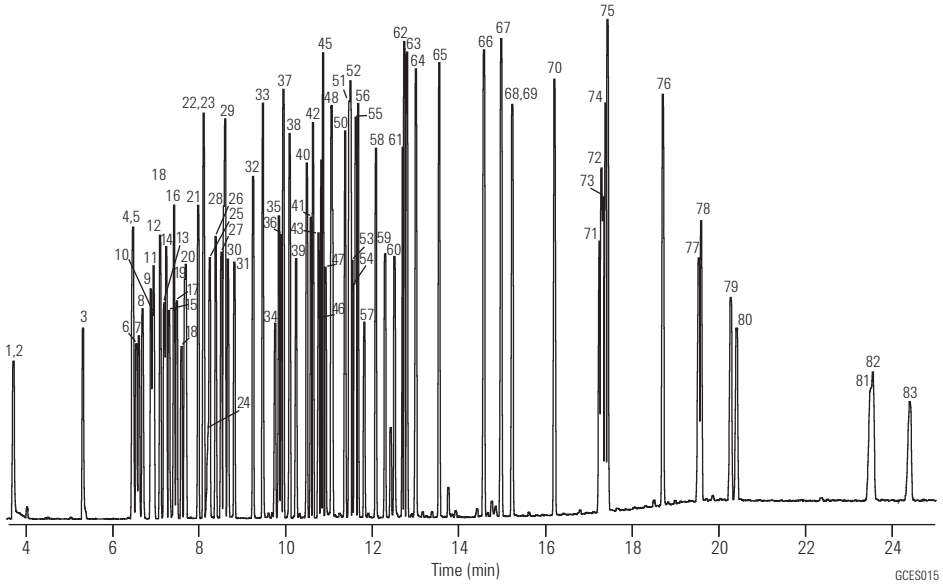
Suggested Supplies

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
2. Pyridine
3. 2-Fluorophenol
4. Phenol-d5
5. Phenol
6. Aniline
7. Bis(2-chloroethyl) ether
8. 2-Chlorophenol
9. 1,3-Dichlorobenzene
10. 1,4-Dichlorobenzene-d4
11. 1,4-Dichlorobenzene
12. Benzyl alcohol
13. 1,2-Dichlorobenzene
14. 2-Methylphenol
15. Bis(2-chloroisopropyl) ether
16. 4-Methylphenol
17. n-Nitroso-di-n-propylamine
18. Hexachloroethane
19. Nitrobenzene-d5
20. Nitrobenzene
21. Isophorone
22. 2-Nitrophenol
23. 2,4-Dimethylphenol
24. Benzoic acid
25. Bis(2-chloroethoxy) methane
26. 2,4-Dichlorophenol
27. 1,2,4-Trichlorobenzene
28. Naphthalene-d8
29. Naphthalene
30. 4-Chloroaniline
31. Hexachlorobutadiene
32. 4-Chloro-3-methylphenol
33. 2-Methylnaphthalene
34. Hexachlorocyclopentadiene
35. 2,4,6-Trichlorophenol
36. 2,4,5-Trichlorophenol
37. 2-Fluorobiphenyl
38. 2-Chloronaphthalene
39. 2-Nitroaniline
40. Dimethyl phthalate
41. 2,6-Dinitrotoluene
42. Acenaphthylene
43. 3-Nitroaniline
44. Acenaphthene-d10
45. Acenaphthene
46. 2,4-Dinitrophenol
47. 4-Nitrophenol
48. Dibenzofuran
49. 2,4-Dinitrotoluene
50. Diethyl phthalate
51. 4-Chlorophenyl-phenyl ether
52. Fluorene
53. 4-Nitroaniline
54. 4,6-Dinitro-2-methylphenol
55. n-Nitrosodiphenylamine
56. Azobenzene
57. 2,4,6-Tribromophenol
58. 4-Bromophenyl-phenylether
59. Hexachlorobenzene
60. Pentachlorophenol
61. Phenanthrene-d10
62. Phenanthrene
63. Anthracene
64. Carbazole
65. Di-n-butyl phthalate
66. Fluoranthene
67. Pyrene
68. Terphenyl-d14
69. Benzidine
70. Butylbenzylphthalate
71. 3,3'-Dichlorobenzidine
72. Benzo[a]anthracene
73. Chrysene-d12
74. Chrysene
75. Bis(2-ethylhexyl) phthalate
76. Di-n-octylphthalate
77. Benzo[b]fluoranthene
78. Benzo[k]fluoranthene
79. Benzo[a]pyrene
80. Perylene-d12
81. Indeno[1,2,3-cd]pyrene
82. Dibenz[a,h]anthracene
83. Benzo[g,h,i]perylene



A variety of HP-5ms and DB-5ms columns can be used for 8270 and similar semivolatiles applications. The column shown above was chosen to maximize inertness and robustness to residues with a thicker 0.5 µm film, but the price paid is a slightly longer run time.
An HP-5ms, 30 m x 0.25 mm id, 0.25 µm, p/n 19091S-433 would give shorter run times, with slightly less inertness and robustness.
A DB-5ms, 30 m x 0.25 mm id, 0.25 µm, p/n 122-5532, would give slightly less inertness, but offer better resolution of PAHs such as benzo[b]fluoranthene and benzo[k]fluoranthene.
A DB-5ms, 20 m x 0.18 mm x 0.18 µm, p/n 121-5522, can offer significantly reduced run times with a modest loss of inertness.

US EPA Method 8061 (Phthalate Esters)

Column: **DB-5ms**
121-5522
20 m x 0.18 mm, 0.18 µm

Carrier: Helium at 49 cm/s, measured at 80 °C
constant flow program

Oven: 80 °C for 0.5 min
80-160 °C at 30 °C/min
160-320 °C at 15 °C/min

Injection: Splitless, 300 °C
30 s purge activation time

Detector: MSD, 325 °C transfer line
Full scan m/z 50-400

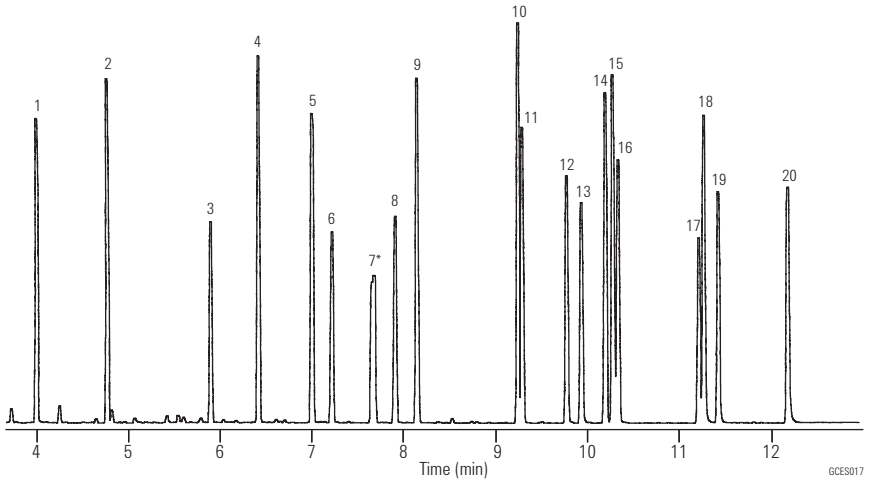
Sample: 1 µL of 20 ng/µL
Method 8061 mixture (AccuStandard) in hexane

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

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



1. Dimethyl phthalate
2. Diethyl phthalate
3. Benzyl benzoate (IS)
4. Diisobutyl phthalate
5. Di-n-butyl phthalate
6. Bis(4-methoxyethyl) phthalate
7. Bis(4-methyl-2-pentyl) phthalate *
8. Bis(2-ethoxyethyl) phthalate
9. Diamyl phthalate
10. Dihexyl phthalate
11. Butyl benzyl phthalate
12. Hexyl 2-ethylhexyl phthalate
13. Bis(2-n-butoxyethyl) phthalate
14. Dicyclohexyl phthalate
15. Bis(2-ethylhexyl) phthalate
16. Diphenyl phthalate (SS)
17. Diphenyl isophthalate (SS)
18. Di-n-octyl phthalate
19. Dibenzyl phthalate (SS)
20. Dinonyl phthalate

* Two isomers
IS - Internal Standard
SS - Surrogate Standard

PAHs

Column: **DB-17ms**
122-4732
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at: 34.1 cm/s, measured at 150 °C

Oven: 95 °C for 0.5 min
95-340 °C at 5 °C/min
340 °C for 5 min

Injection: Split, 300 °C
Split ratio 1:40

Detector: MSD, 340 °C transfer line
Scan 80-330 amu

Sample: 2 µL, PAH standard

Suggested Supplies

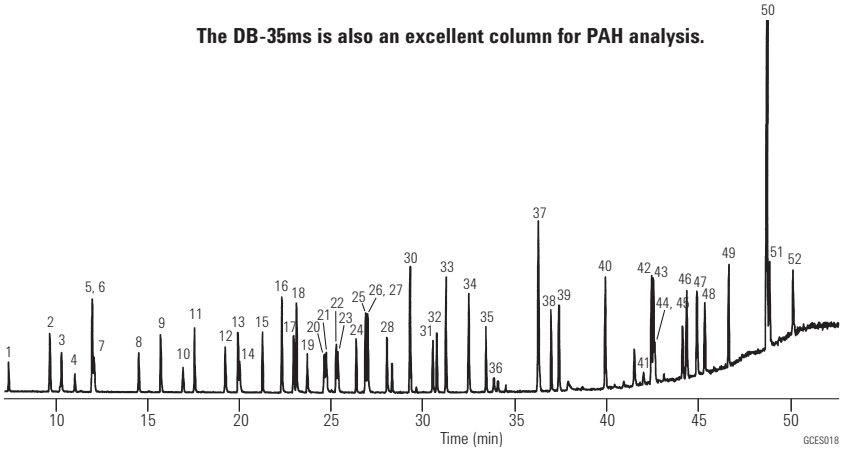
Septum: 11 mm Advanced Green septa, 5183-4759

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

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

		Ions			Ions
1.	Naphthalene	128	27.	3,6-Dimethylphenanthrene	206, 191
2.	2-Methylnaphthalene	142, 141	28.	1,3-Dinitronaphthalene	126, 218
3.	1-Methylnaphthalene	142, 141	29.	1,5-Dinitronaphthalene	218, 114
4.	Azulene	128	30.	Fluoranthene	202
5.	Acenaphthene	154	31.	2,2'-Dinitrobiphenyl	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]fluoroanthene	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

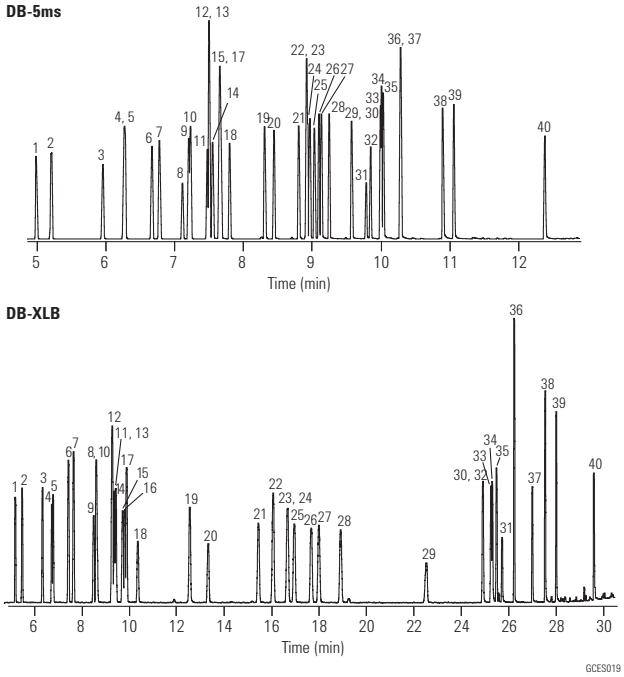
Detector: MSD, 320 °C transfer line
Quadrupole at 150 °C
Source at 230 °C

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

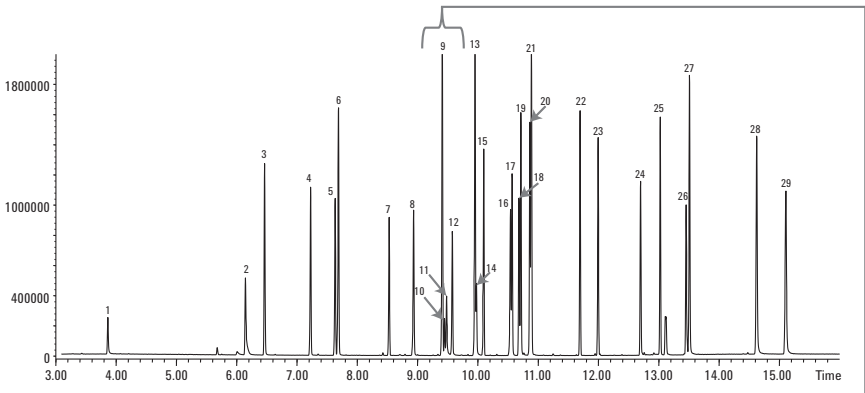


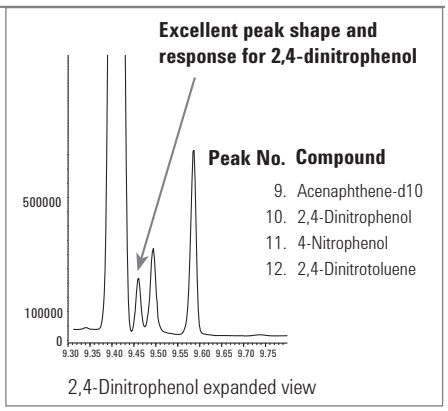
1. Phenol
2. 2-Chlorophenol
3. 2-Methylphenol
4. 4-Methylphenol
5. 3-Methylphenol
6. 2-Chloro-5-methylphenol
7. 2,6-Dimethylphenol
8. 2-Nitrophenol
9. 2,4-Dimethylphenol
10. 2,5-Dimethylphenol
11. 2,4-Dichlorophenol
12. 2,3-Dimethylphenol
13. 2,5-Dichlorophenol
14. 2,3-Dichlorophenol
15. 2-Chlorophenol
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

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

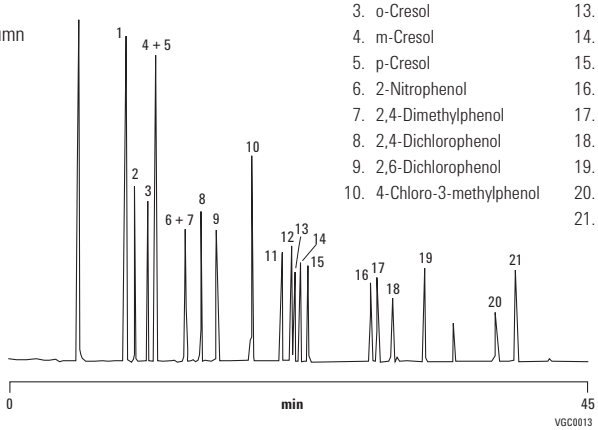
1. N-Nitrosodimethylamine
2. Aniline
3. 1,4-Dichlorobenzene-d4
4. Isophorone
5. 1,3-Dimethyl-2-nitrobenzene
6. Naphthalene
7. Hexachlorocyclopentadiene
8. Mevinphos
9. Acenaphthene-d10
10. 2,4-Dinitrophenol
11. 4-Nitrophenol
12. 2,4-Dinitrotoluene
13. Fluorene
14. 4,6,-Dinitro-2-methyl phenol
15. Trifluralin
16. Simazine
17. Atrazine
18. Pentachlorophenol
19. Terbufos
20. Chlorothalonil
21. Phenanthrene-d10
22. Aldrin
23. Heptachlor epoxide
24. Endrin
25. 4,4'-DDT
26. 3,3'-Dichlorobenzidine
27. Chrysene d-12
28. Benzo[b]fluoranthene
29. Perylene-d12





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
2. 2-Chlorophenol
3. o-Cresol
4. m-Cresol
5. p-Cresol
6. 2-Nitrophenol
7. 2,4-Dimethylphenol
8. 2,4-Dichlorophenol
9. 2,6-Dichlorophenol
10. 4-Chloro-3-methylphenol
11. 2,3,5-Trichlorophenol
12. 2,4,6-Trichlorophenol
13. 2,4,5-Trichlorophenol
14. 2,3,4-Trichlorophenol
15. 2,3,6-Trichlorophenol
16. 4-Nitrophenol
17. 2,4-Dinitrophenol
18. 2,3,5,6 Tetrachlorophenol
19. 2-Methyl-4,6-dinitrophenol
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

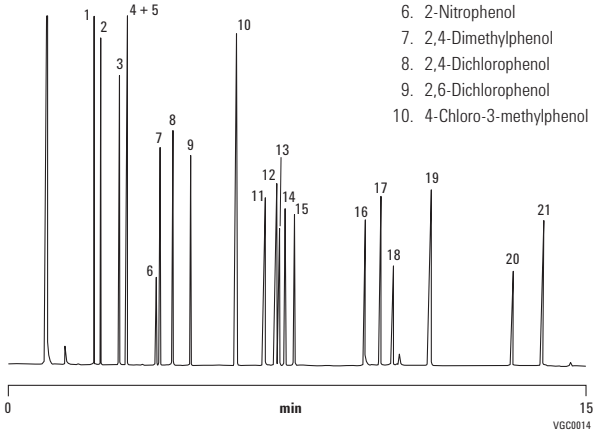
Sample Conc: 1 ppm

Oven: 80 °C to 200 °C, 8 °C/min

Carrier: H_2, 150 kPa (1.5 bar, 21 psi)

Injection: Split, 100 mL/min

Detector: FID



1. Phenol
2. 2-Chlorophenol
3. o-Cresol
4. m-Cresol
5. p-Cresol
6. 2-Nitrophenol
7. 2,4-Dimethylphenol
8. 2,4-Dichlorophenol
9. 2,6-Dichlorophenol
10. 4-Chloro-3-methylphenol
11. 2,3,5-Trichlorophenol
12. 2,4,6-Trichlorophenol
13. 2,4,5-Trichlorophenol
14. 2,3,4-Trichlorophenol
15. 2,3,6-Trichlorophenol
16. 4-Nitrophenol
17. 2,4-Dinitrophenol
18. 2,3,5,6-Tetrachlorophenol
19. 2-Methyl-4,6-dinitrophenol
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

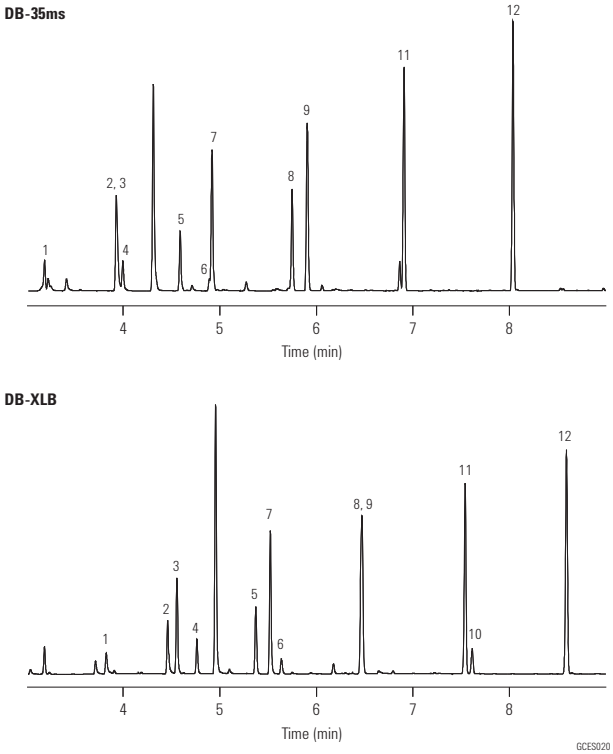
Carrier: Helium at 45 cm/s
(EPC in constant flow mode)

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

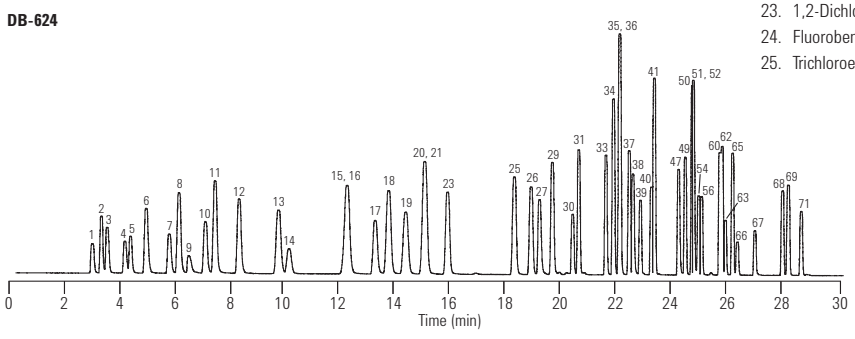
Detector: A: PID (O.I.A. 4430), 200 °C Helium makeup gas at 20 mL/min
B: ELCD (O.I.A. 4420), with NiCat reaction tube in the halogen mode, 950 °C reactor temperature

Sample: 20 ppb per component in 5 mL water

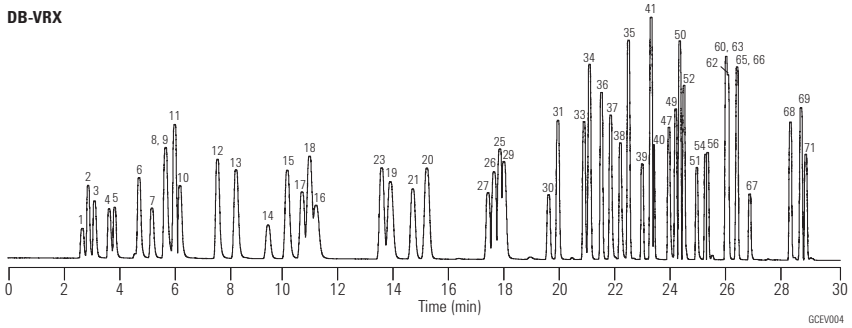
Suggested Supplies

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

DB-624



DB-VRX



GCEV004

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-Xlyene
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

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)

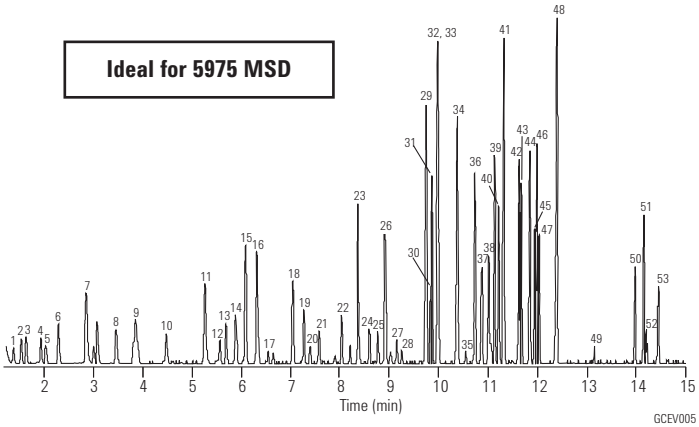
Oven: 35 °C for 4 min
35-200 °C at 15 °C/min
200 °C for 0.1 min
60-200 °C at 17 °C/min

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

Ideal for 5975 MSD



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
2. Chloromethane
3. Vinyl chloride
4. Bromomethane
5. Chloroethane
6. Trichlorofluoromethane
7. 1,1-Dichloroethene
8. Methylene chloride
9. trans-1,2-Dichloroethene
10. 1,1-Dichloroethane
11. 2,2-Dichloropropane
12. Bromochloromethane
13. Chloroform
14. 1,1,1-Trichloroethane
15. Carbon tetrachloride
16. Benzene
17. Fluorobenzene
18. Trichloroethene
19. 1,2-Dichloropropane
20. Dibromomethane
21. Bromodichloromethane
22. cis-1,3-Dichloropropene
23. Toluene
24. trans-1,3-Dichloropropene
25. 1,1,2-Trichloroethane
26. Tetrachloroethene
27. Dibromochloromethane
28. 1,2-Dibromomethane
29. Chlorobenzene
30. 1,1,1,2-Tetrachloroethane
31. Ethylbenzene
32. m-Xylene
33. p-Xylene
34. o-Xylene
35. Bromoform
36. Isopropylbenzene
37. Bromofluorobenzene
38. Bromobenzene
39. n-Propylbenzene
40. 2-Chlorotoluene
41. 1,3,5-Trimethylbenzene
42. tert-Butylbenzene
43. 1,2,4-Trimethylbenzene
44. sec-Butylbenzene
45. 1,3-Dichlorobenzene
46. 4-Isopropyltoluene
47. 1,4-Dichlorobenzene
48. 1,2-Dichlorobenzene
49. 1,2-Dibromo-3-chloropropane
50. 1,2,4-Trichlorobenzene
51. Hexachlorobutadiene
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

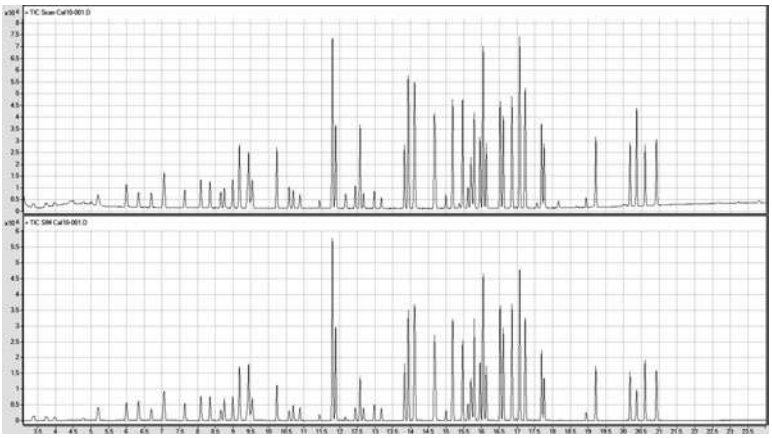
Injection: Split, 4:1, 160 °C for 5 min, purge 100 mL/min for 1 min

Detector: 5977A MSD, simultaneous Scan/SIM mode

Sample: Standard VOC mix

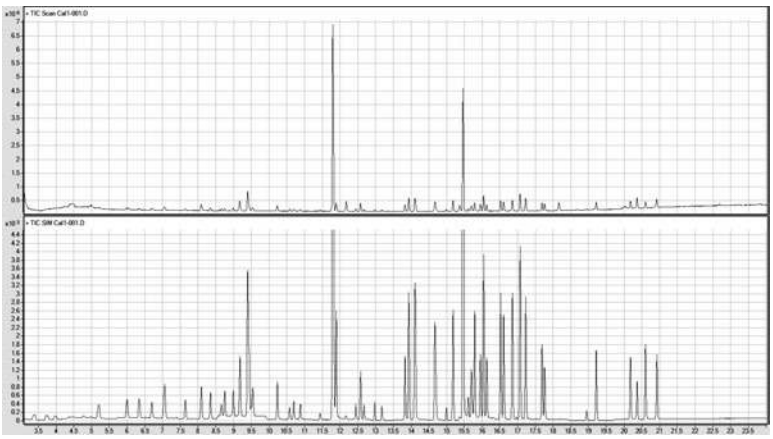
Sample Conc: 10 µg/L

		RT, min	CAS Number
1.	Dichlorodifluoromethane	3.387	75-71-8
2.	Chloromethane	3.734	74-87-3
3.	Vinyl chloride	3.980	75-01-4
4.	Bromomethane	4.390	74-83-9
5.	Chloroethane	4.788	75-00-3
6.	Trichlorofluoromethane	5.202	75-69-4
7.	1,1-Dichloroethene	5.998	75-34-4
8.	Carbon disulfide	6.338	75-15-0
9.	Dichloromethane	6.701	75-09-2
10.	Methyl tert-butyl ether	7.046	1634-04-4
11.	trans-1,2-Dichloroethene	7.069	156-60-5
12.	1,1-Dichloroethane	7.644	75-34-3
13.	Ethyl tert-butyl ether	8.091	637-92-3
14.	cis-1,2-Dichloroethene	8.353	156-59-2
15.	2,2-Dichloropropane	8.370	594-20-7
16.	Bromochloromethane	8.656	74-97-5
17.	Chloroform	8.756	67-66-3
18.	1,1,1-Trichloroethane	8.995	71-55-6
19.	1,1-Dichloro-1-propene	9.177	563-58-6
20.	Carbon tetrachloride	9.189	56-23-5
21.	Benzene	9.440	71-43-2
22.	1,2-Dichloroethane	9.497	107-06-2
23.	tert-Amyl methyl ether	9.540	994-05-8
24.	Trichloroethene	10.232	79-01-6
25.	1,2-Dichloropropane	10.576	78-87-5
26.	Dibromomethane	10.699	74-95-3
27.	Bromodichloromethane	10.884	75-27-4
28.	cis-1,3-Dichloropropene	11.437	10061-01-5
29.	Toluene	11.890	108-88-3
30.	trans-1,3-Dichloropropene	12.165	10061-02-6
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



Counts vs. Acquisition Time (min)

10 µg/L VOC Standard Scan and SIM Traces



Counts vs. Acquisition Time (min)

1 µg/L VOC Standard Scan and SIM Traces

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

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

Injection: Splitless, 200 °C
15 s purge activation time

Detector: ECD, 300 °C

Sample: 1 µL of 50 pg/µL, AccuStandard

Suggested Supplies

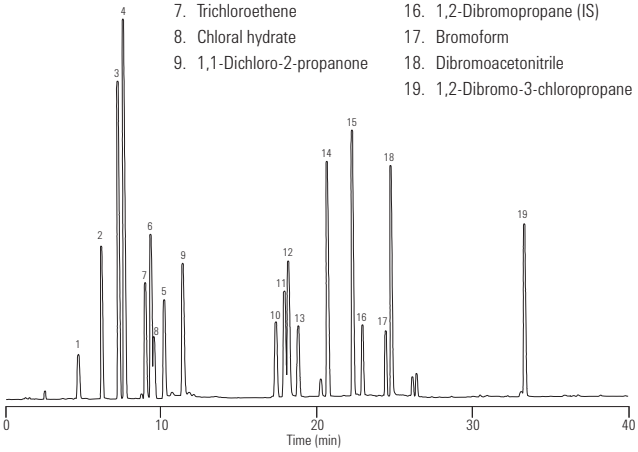
Septum: 11 mm Advanced Green septa, 5183-4759

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. Chloroform
2. 1,1,1-Trichloroethane
3. Carbon tetrachloride
4. Trichloroacetonitrile
5. Dichloroacetonitrile
6. Bromodichloromethane
7. Trichloroethene
8. Chloral hydrate
9. 1,1-Dichloro-2-propanone
10. Chloropicrin
11. Dibromochloromethane
12. Bromochloroacetonitrile
13. 1,2-Dibromoethane
14. Tetrachloroethene
15. 1,1,1-Trichloropropanone
16. 1,2-Dibromopropane (IS)
17. Bromoform
18. Dibromoacetonitrile
19. 1,2-Dibromo-3-chloropropane



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

Oven: 40 °C for 2 min
40-140 °C at 12 °C/min

Injection: Split, 250 °C
Split ratio 1:50

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

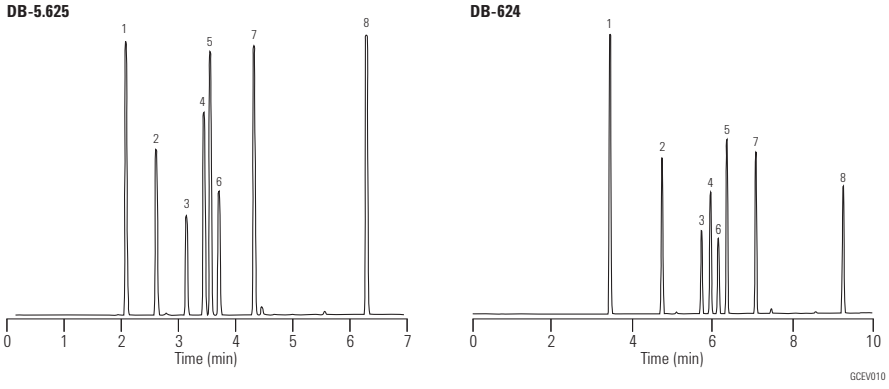
Sample: 1 µL of headspace of neat mixture

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



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

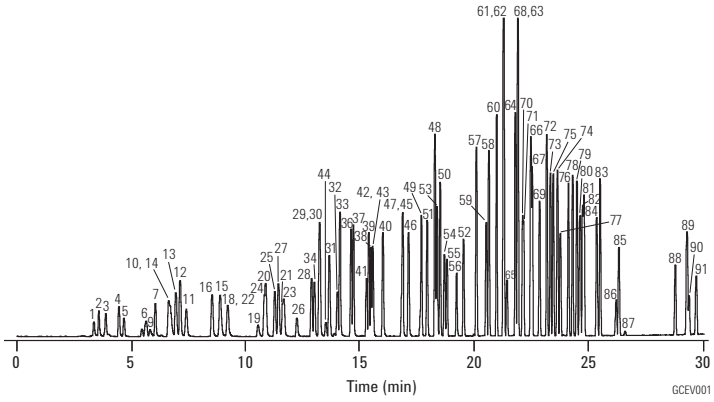
Sampler: Purge and trap (O.I.A. 4560)
Purge: Helium for 11 min at 40 mL/min
Trap: Tenax/Silica Gel/Carbosieve
Preheat: 175 °C
Desorb: 220 °C for 0.6 min

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

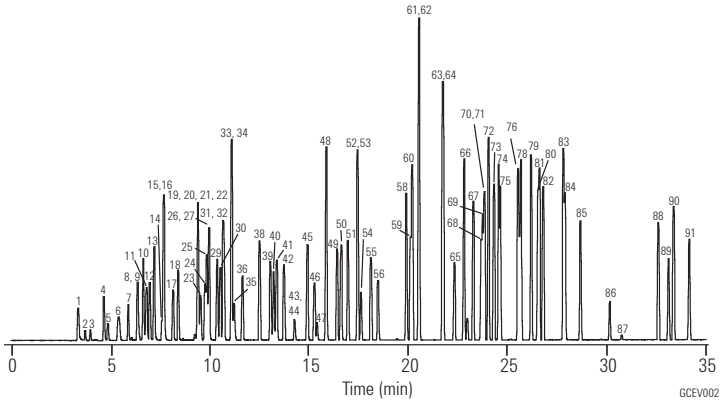
Sampler: Purge and trap (O.I.A. 4560)
Purge: Helium for 11 min at 40 mL/min
Trap: Tenax/Silica Gel/Carbosieve
Preheat: 175 °C
Desorb: 220 °C for 0.6 min

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

IS - Internal Standard
SS - Surrogate Standard

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 µm

Carrier: Helium at 25 cm/s measured off of CO_2 at 35 °C
constant flow mode

Oven: 35 °C for 5 min
35-120 °C at 5 °C/min
120-220 °C at 30 °C/min
220 °C for 5 min

Injection: Entech 7100 cryogenic sample preconcentrator

Detector: MSD
Full scan of m/z 40-250

Sample: 400 mL of a 10 ppbV TO-14 standard
and 100 mL of a 20 ppbv IS/SS standard

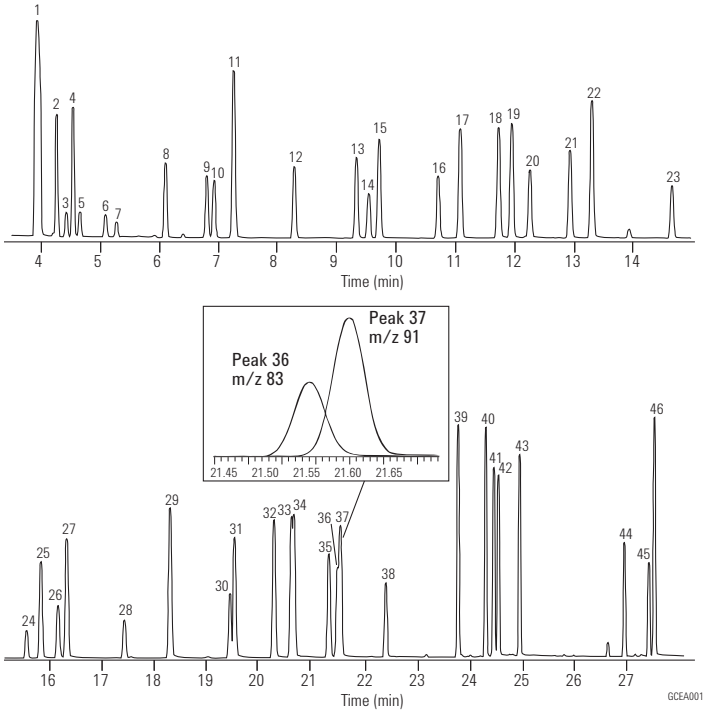
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885

1. CO_2
2. Freon 12 (dichlorodifluoromethane)
3. Chloromethane
4. Freon 114 (1,2-dichloro-1,1,2,2-tetrafluoroethane)
5. Vinyl chloride
6. Bromomethane
7. Chloroethane
8. Freon 11 (trichlorofluoromethane)
9. 1,1-Dichloroethene
10. Methylene chloride
11. Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)
12. 1,1-Dichloroethane
13. cis-1,2-Dichloroethene
14. Bromochloromethane (IS)
15. Chloroform
16. 1,2-Dichloroethane
17. 1,1,1-Trichloroethane
18. Benzene
19. Carbon tetrachloride
20. 1,4-Difluorobenzene (IS)
21. 1,2-Dichloropropane
22. Trichloroethene
23. cis-1,3-Dichloropropene
24. trans-1,3-Dichloropropene
25. 1,1,2-Trichloroethane
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

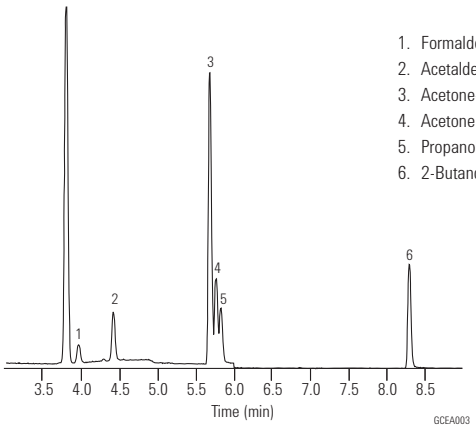
Agilent wishes to thank Entech Instruments for providing this chromatogram.

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. Formaldehyde
2. Acetaldehyde
3. Acetone-d6
4. Acetone
5. Propanol
6. 2-Butanone

Sulfur in Air

Column: **DB-5ms**
123-5563
60 m x 0.32 mm, 1.00 µm

Carrier: Helium, 1.5 mL/min

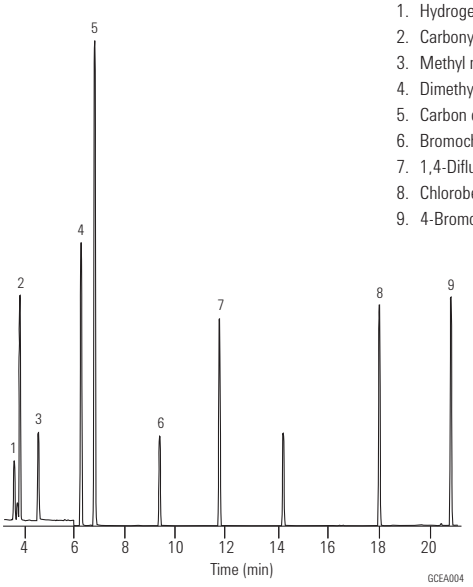
Oven: 35 °C for 5 min
35-140 °C at 6 °C/min
140-220 °C at 15 °C/min
220 °C for 3 min

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

Agilent wishes to thank Entech Instruments for providing this chromatogram.



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

N_2O I

Column: **HP-PLOT Q**
19095P-Q04
30 m x 0.53 mm, 40.00 µm

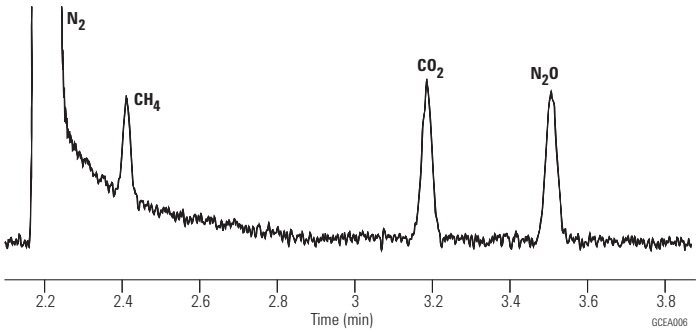
Carrier: Helium, 5 psi (approximately 8 mL/min)

Oven: 35 °C isothermal

Injection: 250 µL, injected
Split ratio 1:3

Detector: TCD, 200 °C

Sample: Approximately 200 ppmv methane
200 ppmv CO_2
250 ppmv N_2O (nitrogen balance gas)



N_2O II

Column: **HP-PLOT Molesieve**
19095P-MS6
30 m x 0.53 mm, 25.00 µm

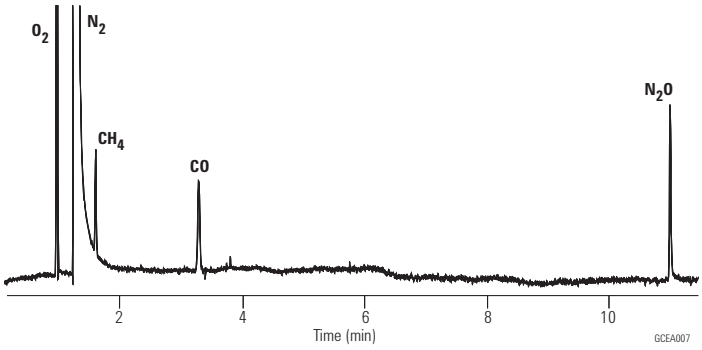
Carrier: Helium, 6 psi (approximately 10 mL/min)

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_2
250 ppmv N_2O (nitrogen balance gas)



N_2O III

Column: **GS-CarbonPLOT**
113-3133
30 m x 0.32 mm, 3.00 µm

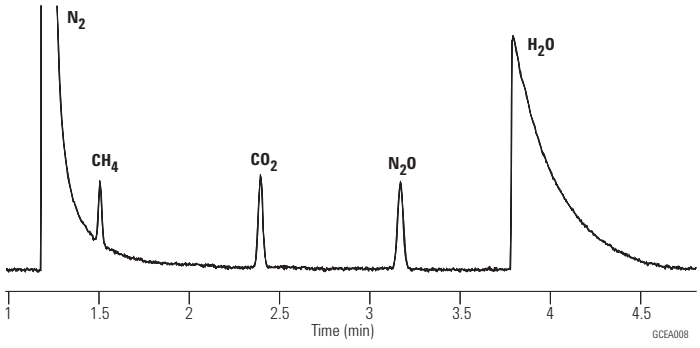
Carrier: Helium, 12 psi (approximately 3 mL/min)

Oven: 35 °C isothermal

Injection: 250 µL injected
Split ratio 1:4

Detector: TCD, 200 °C

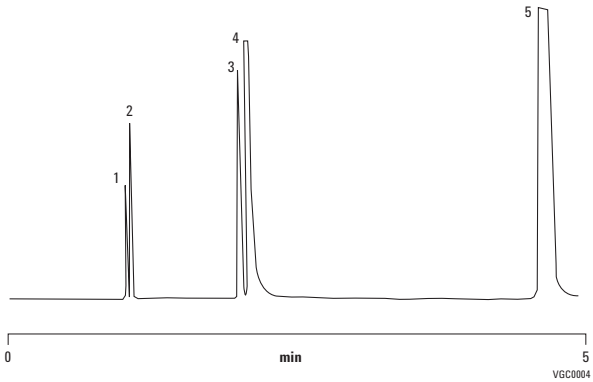
Sample: Approximately 200 ppmv methane
200 ppmv CO_2
250 ppmv N_2O (nitrogen balance gas)



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_2
Oven: 30 °C
Injection: Split, 100 mL/min
Detector: TCD

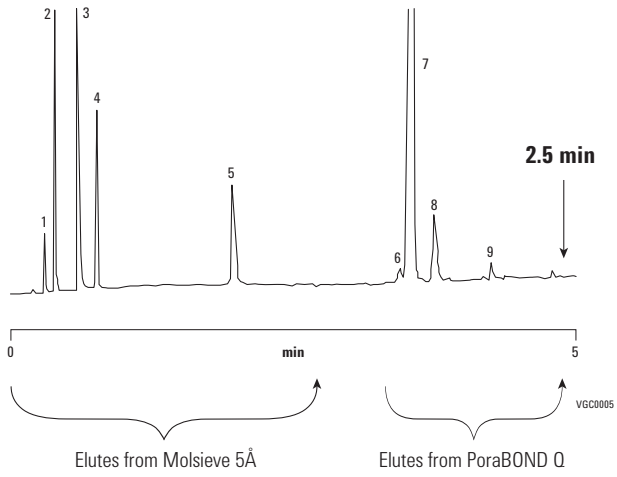


1. Helium
2. Neon
3. Argon
4. Oxygen
5. Nitrogen

Fast Analysis of Permanent Gases and CO_2 using Tandem PLOT Columns

Column: **Select for Permanent Gases/CO_2**
CP7429

Sample: 10 µL
Sample Conc: % level
Carrier: H_2, 60 kPa
Oven: 45 °C
Injection: Split, 50 mL/min
Detector: µ-TCD



1. He (from ms-5Å)
2. O_2 (from ms-5Å)
3. N_2 (from ms-5Å)
4. Methane (from ms-5Å)
5. CO (from ms-5Å)
6. He (from PBQ)
7. $N_2 + O_2 + CO$ (from PBQ)
8. Methane (from PBQ)
9. CO_2 (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

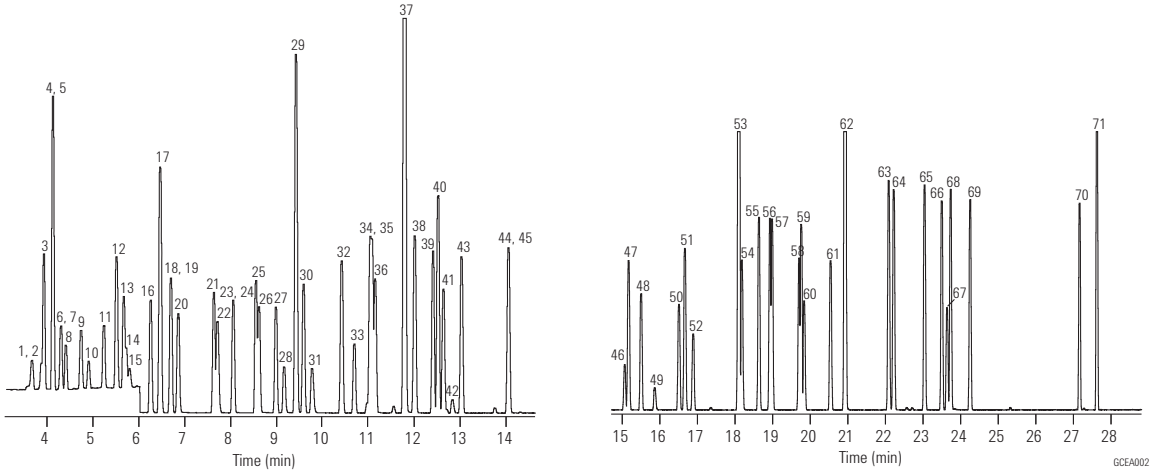
Detector:
GC/MS 6890/5973N
Scan 29-180 amu 0-6 min
33-280 amu 6-30 min
Electron impact 70 eV

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)

Suggested Supplies

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

		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

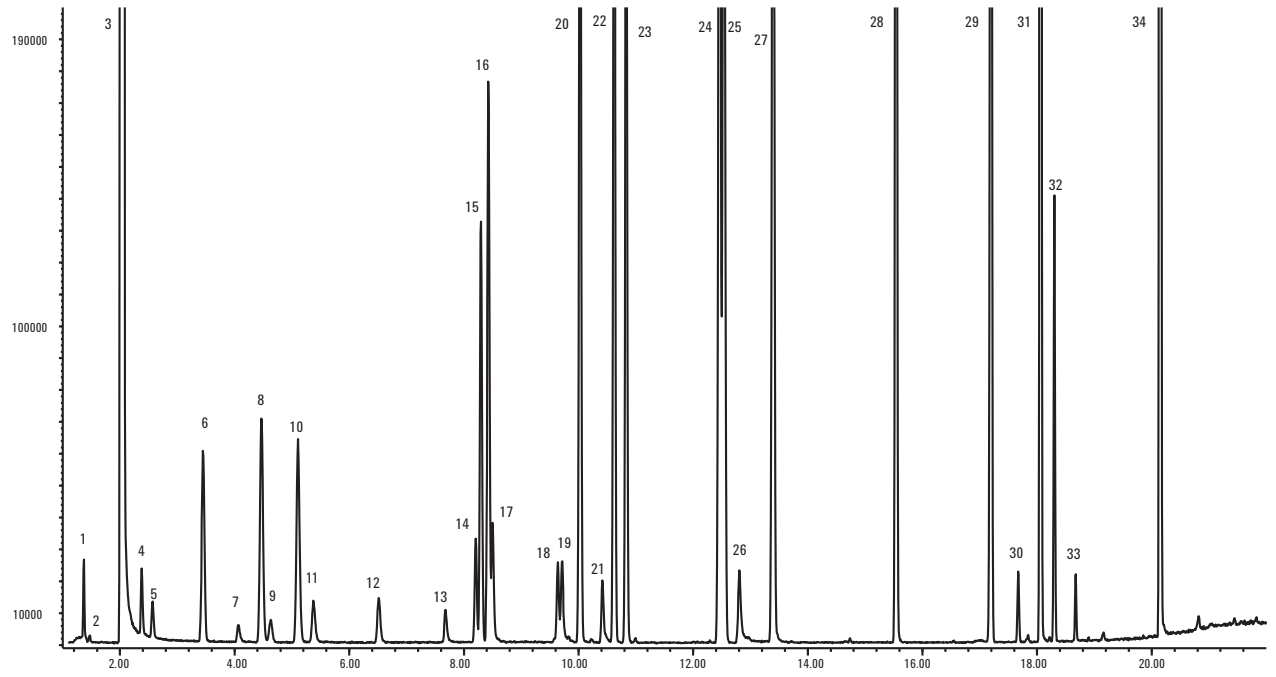
Inlet: Split/splitless, 220 °C, 1 µL, split 20:1

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
2. Methanol
3. Ethanol
4. Acetone
5. Isopropanol
6. Isobutyl aldehyde
7. 1-Propanol
8. Butyl aldehyde
9. 2,3 Butanedione (VDK)
10. Ethyl acetate
11. 2-Butanol
12. Isobutyl alcohol
13. 1-Butanol
14. 2,3 Pentanedione (VDK)
15. Ethyl propanoate
16. Propyl acetate
17. 3-Pentanol
18. Isoamyl alcohol
19. Active amyl alcohol
20. Isobutyl acetate
21. 1-Pentanol
22. Ethyl butanoate
23. Hexanal
24. Isoamyl acetate
25. Active amyl acetate
26. 1-Hexanol
27. Heptanal
28. Octanal
29. 1,3,5-Trioxane impurity
30. 1,3,5-Trioxane impurity
31. Ethyl caprylate
32. 1-Phenyl ethyl acetate
33. Benzaldehyde, 3 methoxy
34. Ethyl caprate



Spearmint Oil

Column A: **DB-1**
122-1032
30 m x 0.25 mm, 0.25 µm

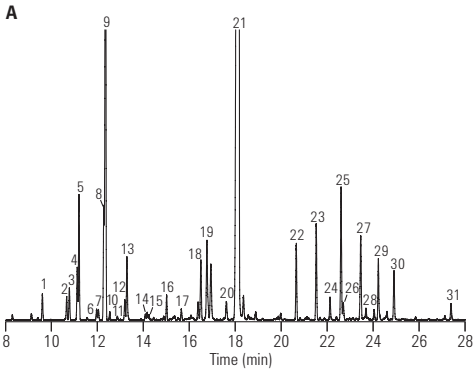
Column B: **DB-1**
121-1022
20 m x 0.18 mm, 0.18 µm

Carrier: A: Helium 25 cm/s measured at 40 °C
B: Hydrogen 47 cm/s measured at 40 °C

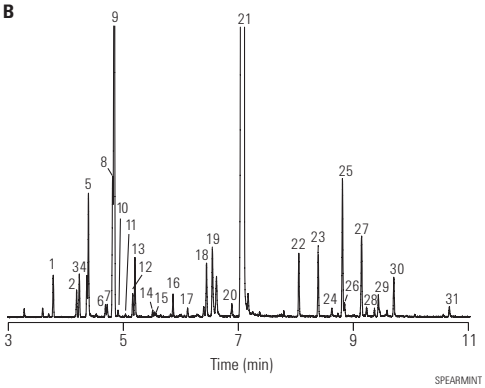
Oven: A: 40 °C hold 1 min, 5 °C/min to 290 °C
B: 40 °C hold 0.38 min, 13 °C/min to 290 °C hold 13.09 min

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



Faster method with a high efficiency DB-1, 20 m x 0.18 mm, 0.18 µm column and hydrogen carrier



1. α-Pinene
2. Sabinene
3. β-Pinene
4. 3-Octanol
5. Myrcene
6. α-Terpinene
7. ρ-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

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

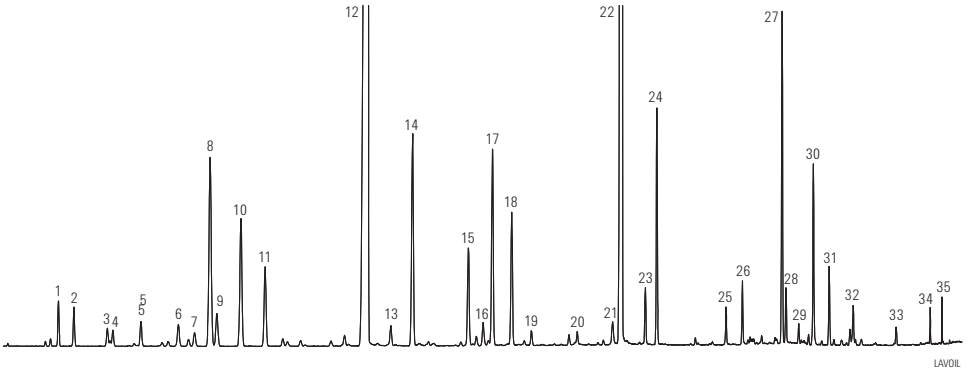
Detector: MSD source at 300 °C, quadrupole at 180 °C, transfer line at 280 °C, scan range 45-450 amu

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



1. α-Pinene
2. Camphene
3. 1-Octen-3-ol
4. 3-Octanone
5. β-Myrcene
6. 3-Carene
7. o-Cymene
8. Eucalyptol
9. D-Limonene
10. β-trans-Ocimene
11. β-cis-Ocimene
12. β-Linalool
13. Octen-1-ol acetate
14. Camphor
15. Borneol
16. Lavandulol
17. Terpinen-4-ol
18. α-Terpineol
19. Hexyl butyrate
20. Cumic aldehyde
21. cis-Geraniol
22. Linalool acetate
23. Borneol acetate
24. Lavandulyl acetate
25. Nerol acetate
26. Geranyl Acetate
27. Caryophyllene
28. α-Santolene
29. α-Bergamotene
30. β-Farnesene
31. Germacrene D
32. γ-Cadinene
33. Caryophyllene oxide
34. tau-Cardinol
35. α -Bisabolol

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

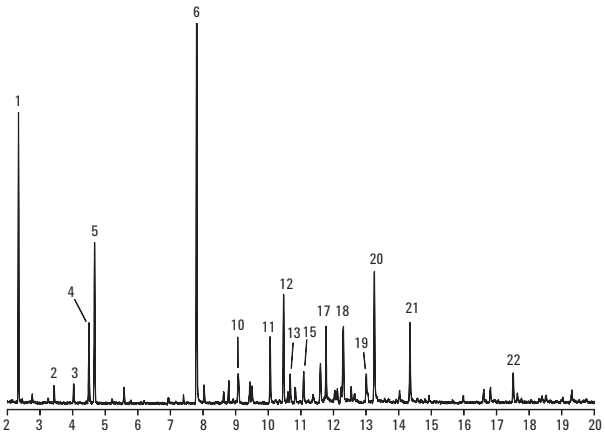
Carrier: Hydrogen at 44.3 cm/s
Measured at 45 °C

Oven: 45 °C hold 0.77 min
7.79 °C/min to 250 °C

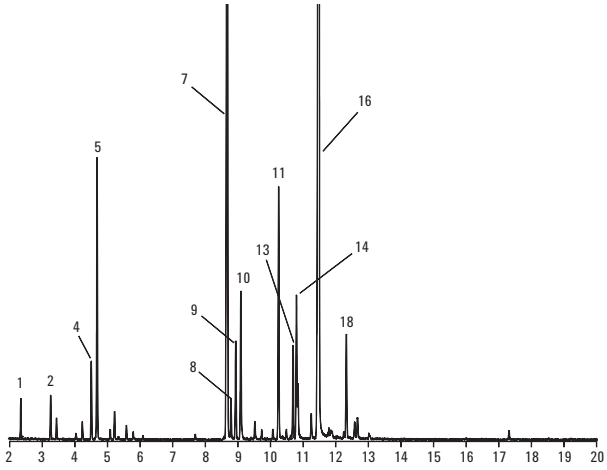
Injection: Split 1:30, 250 °C
1 µL of 1:35 oil in acetone

Detector: MSD full scan at m/z 40-500
250 °C transfer line

Wild chamomile



Peppermint



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

Fragrance Reference Standard

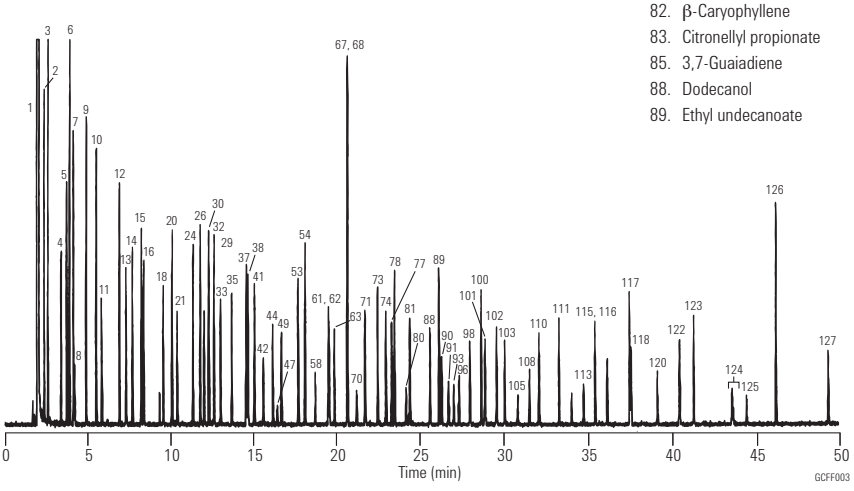
Column:	**DB-1** **122-1032** **30 m x 0.25 mm, 0.25 µm**
Carrier:	Helium at 25 cm/s, measured at 150 °C
Oven:	40 °C for 1 min 40-290 °C at 5 °C/min
Injection:	Split, 250 °C Split ratio 1:50
Detector:	MSD, 300 °C transfer line
Sample:	1 µL of a 1:20 dilution of neat sample in acetone

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
2. 2,3-Butanedione (diacetyl)
3. Ethyl acetate
4. 2,3-Pentanedione (acetyl propionyl)
5. Ethyl propionate
6. Methyl butyrate
7. 3-Methylbutyl alcohol
8. 2-Methylbutyl alcohol
9. Isobutyl acetate
10. Ethyl butyrate
11. Furfural
12. Ethyl isovalerate
13. Hexanol
14. Allyl butyrate
15. Ethyl pentanoate
16. Hexylene glycol
17. α-Thujone
18. Benzaldehyde
19. α-Pinene
20. Camphene
21. 3,5,5-Trimethylhexanol
22. Sabinene
23. β-Pinene
24. Ethyl hexanoate
25. Myrcene
26. Hexyl acetate
cis-Linalool oxide
Methyl benzoate
trans-Linalool oxide
28. Methyl-cresol
29. Benzyl alcohol
30. para-Cymene
31. 1,8-Cineol
32. Limonene
33. 2,6-Dimethylhept-5-enal
34. γ-Terpinene
35. Octanol
37. Ethyl heptanoate
38. Linalool
39. Benzene ethanol
41. Rose oxide, cis-rose
42. Rose oxide, trans-rose
43. Camphor
44. Citronellal
45. Benzyl acetate
46. Menthone
47. Isoborneol
48. Isomenthone
49. Borneol
51. Terpinen-4-ol
52. α-Terpineol
53. Ethyl octanoate
54. Octyl acetate
56. Fenchyl acetate
57. Citronellol
58. Neral
59. Carvone
Phenylethyl acetate
60. Geraniol
61. Linalyl acetate
62. Geranial
63. Hydroxycitronellal
64. Citronellyl formate
66. Bornyl acetate
67. Vertenex (isomer 1)
68. Ethyl nonanoate
69. Geranyl formate
70. Vertenex (isomer 2)
71. γ-Nonalactone
72. Citronellyl acetate
73. Neryl acetate
74. Geranyl acetate
76. Diphenyl oxide
78. Ethyl decanoate
79. α-Copaene
80. Florazone (isomer 1)
81. Florazone (isomer 2)
82. β-Caryophyllene
83. Citronellyl propionate
85. 3,7-Guaiadiene
88. Dodecanol
89. Ethyl undecanoate
90. Eugenyl acetate
91. Frambinone (raspberry ketone)
93. Isoamyl salicylate
94. δ-Cadinene
95. cis-Nerolidol
96. Rosatol (rosetone)
Geranyl butyrate
97. trans-Nerolidol
98. n-Amyl salicylate
99. Phenyl ethyl tiglate
100. Ethyl dodecanoate
101. Benzophenone
102. Dibenzyl ether
103. γ-Dodecalactone
104. Citronellyl tiglate
105. Evernyl
106. Geranyl tiglate
107. Geranyl-2-methyl valerate
108. Celestolide
109. Heptadec-1-ene
110. Benzyl benzoate
111. Ethyl tetradecanoate
112. Benzyl salicylate
113. Tonalid
114. Nonadec-1-ene
115. Isopropylmyristate
116. Ethyl pentadecanoate
Nonadecane
117. Ethyl hexadecanoate
118. Musk T (ethylene brassylate)
119. Eicosane
120. Cinnamyl phenyl acetate
121. Heneicosane
122. Phenyl ethyl cinnamate
123. Ethyl octadecanoate
124. Hercolyn 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

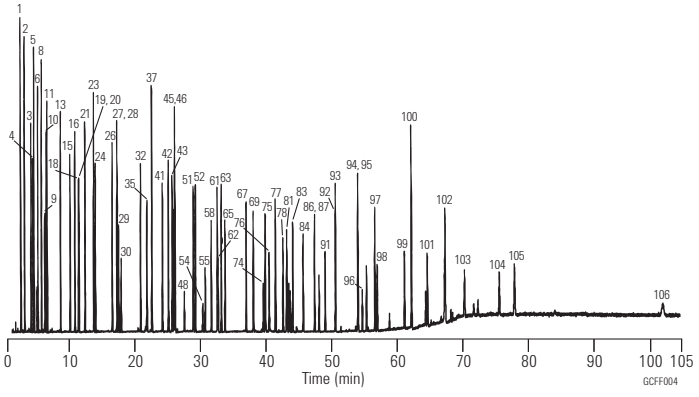
Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

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
2. Ethyl acetate
3. Ethyl propionate
4. 2,3-Butanedione (diacetyl)
5. Methyl butyrate
6. Isobutyl acetate
7. α-Pinene
8. Ethyl butyrate
9. 2,3-Pentanedione (acetyl propionyl)
10. Camphene
11. Ethyl isovalerate
12. β-Pinene
13. Ethyl pentanoate
14. Myrcene
15. Allyl butyrate
16. Limonene
17. 1,8-Cineol
18. 3,5,5-Trimethylhexanol
19. 3-Methylbutyl alcohol
20. 2-Methylbutyl alcohol
21. Ethyl hexanoate
22. γ-Terpinene
23. p-Cymene
24. Hexyl acetate
25. Terpinolene
26. Ethyl heptanoate
27. 2,6-Dimethylhept-5-enal (melonal)
28. Rose oxide, cis-rose
29. Hexanol
30. Rose oxide, trans-rose
31. Methyl-para-cresol
32. Ethyl octanoate
33. cis-Linalool oxide
34. Menthone
35. Furfural
36. trans-Linalool oxide
37. Octyl acetate
38. Isomenthone
39. α-Copaene
40. Camphor
41. Benzaldehyde
42. Ethyl nonanoate
43. Linalool
44. Linalyl acetate
45. Vertenex (isomer 1)
46. Octanol
47. β-Caryophyllene
48. Vertenex (isomer 2)
49. Terpinen-4-ol
50. Methyl benzoate
51. Hexylene glycol
52. Ethyl decanoate
53. Citronellyl acetate
54. Isoborneol
55. Neral
56. α-Terpineol
57. Geranyl formate
58. Borneol
59. β-Bisabolene
60. Benzyl acetate
61. Neryl acetate
62. Geranial
63. Ethyl undecanoate
64. δ-Cadinene
65. Geranyl acetate
66. Citronellol
67. Ethyl dodecanoate
68. Geraniol
69. Benzyl alcohol
70. Geranyl butyrate
71. Nonadecane
72. Benzene ethanol
73. Nonadec-1-ene
74. Florazone (isomer 1)
75. Florazone (isomer 2)
76. Hydroxycitronellal
77. Dodecanol
78. Diphenyl oxide
79. Citronellyl tiglate
80. Eugenyl methyl ether
81. γ-Nonalactone
83. Ethyl tetradecanoate
84. n-Amyl salicylate
85. Geranyl tiglate
86. Ethyl pentadecanoate
87. Isopropylmyristate
90. Phenyl ethyl tiglate
91. Rosatol (rosetone)
92. Eugenyl acetate
93. Ethyl hexadecanoate
94. γ-Dodecalactone
95. Dibenzyl ether
96. Tonalid
97. Ethyl octadecanoate
98. Benzophenone
99. Benzyl benzoate
100. Cetearyl octanoate
101. Musk T (ethylene brassylate)
102. Cetearyl decanoate
103. Frambinone (raspberry ketone)
104. Cinnamyl phenyl acetate
105. Phenyl ethyl cinnamate
106. Cinnamyl cinnamate



Perfume

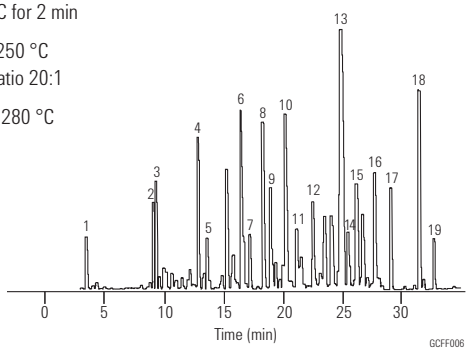
Column: **HP-INNOWax**
19091N-133
30 m x 0.25 mm, 0.25 µm

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
2. Linalool
3. Linalyl acetate
4. Benzyl acetate
5. Citronellol
6. Benzene ethanol
7. α-Methyl ionone
8. Carvacrol and geraniol
9. Isoamyl salicylate
10. n-Amyl salicylate
11. Commamyl acetate
12. Acetyl cedrene
13. Diethyl phthalate
14. Tonalid
15. Coumarin
16. Musk xylene
17. Benzyl benzoate
18. Benzyl salicylate
19. Musk ketone

Chiral Compounds in Essential Oils and Fragrances

Column: **HP-Chiral 20β**
19091G-B233
30 m x 0.25 mm, 0.25 µm

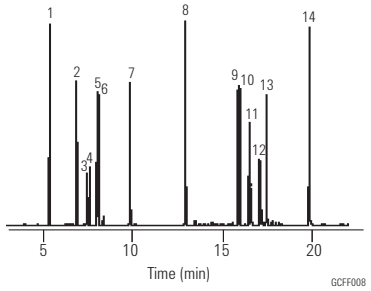
Carrier: Hydrogen, 39 cm/s,
constant pressure

Oven: 65 °C for 1 min
65-170 °C at 5 °C/min

Injection: Split, 250 °C
Split ratio 30:1

Detector: FID, 300 °C

Sample: 1 µL
0.25 ng/µL each
analyte in Hexane



1. 1,2-Dimethylbenzene
2. Myrcene
3. (-)-Camphene
4. (+)-Camphene
5. (+)-β-Pinene
6. 1S-(-)-β-Pinene
7. Cineole
8. (R)-(+)-Citronellal
9. 1S,2R,5S-(+)-Menthol
10. 1R,2S,5R-(-)-Menthol
11. α-Terpineol
12. (+/-)-Isoborneol
13. (+)-Borneol
14. trans-Cinnamaldehyde

Menthol

Column: **Cyclodex-B**
112-2532
30 m x 0.25 mm, 0.25 µm

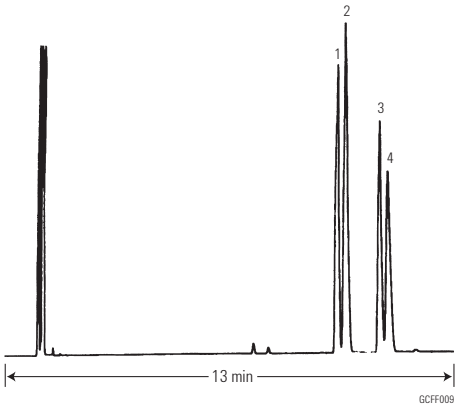
Carrier: Hydrogen, 55 cm/s

Oven: 105 °C isothermal

Injection: Split, 250 °C
Split ratio 1:100

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

Sample: 1 µL of 1 µg/µL each chloroform



1. (+)-Neomenthol
2. (-)- Neomenthol
3. (+)-Menthol
4. (-)-Menthol

FAMEs

Column: **DB-23**
122-2362
60 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 43 cm/s,
constant pressure mode

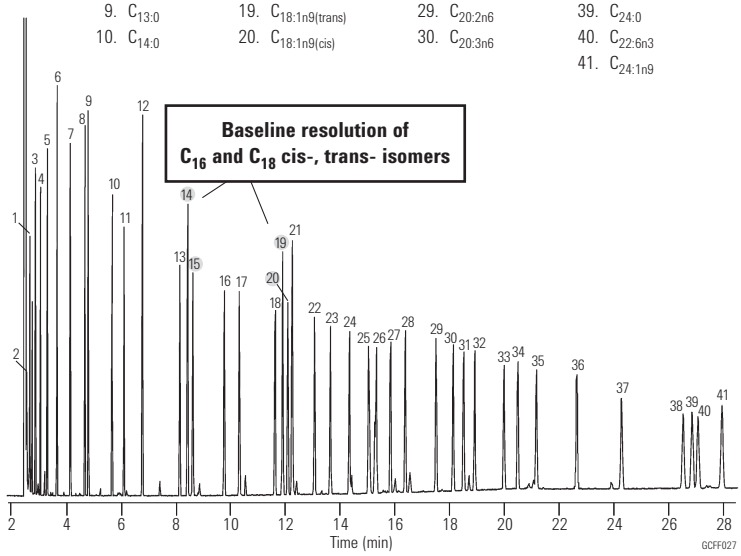
Oven: 130 °C for 1.0 min
130-170 °C at 6.5 °C/min
170-215 °C at 2.75 °C/min
215 °C for 12 min
215-230 °C at 40 °C/min
230 °C for 3 min

Injection: Split, 270 °C
Split ratio 50:1

Detector: FID, 280 °C

Chromatogram provided courtesy of Steve Watkins and Jeremy Ching, FAME Analytics, http://www.fameanalytics.com

1. $C_{6:0}$
2. $C_{7:0}$
3. $C_{8:0}$
4. $C_{9:0}$
5. $C_{10:0}$
6. $C_{11:0}$
7. $C_{12:0}$
8. BHT
9. $C_{13:0}$
10. $C_{14:0}$
11. $C_{14:1n5}$
12. $C_{15:0}$
13. $C_{16:0}$
14. $C_{16:1n7(trans)}$
15. $C_{16:1n7(cis)}$
16. $C_{17:0}$
17. $C_{17:1}$
18. $C_{18:0}$
19. $C_{18:1n9(trans)}$
20. $C_{18:1n9(cis)}$
21. $C_{18:1n7}$
22. $C_{18:2n6}$
23. $C_{18:3n6}$
24. $C_{18:3n3}$
25. $C_{18:2(d9,11)}$
26. $C_{18:2(d10,12)}$
27. $C_{20:0}$
28. $C_{20:1n9}$
29. $C_{20:2n6}$
30. $C_{20:3n6}$
31. $C_{20:4n6}$
32. $C_{20:3n3}$
33. $C_{20:5n3}$
34. $C_{22:0}$
35. $C_{22:1n9}$
36. $C_{22:2n6}$
37. $C_{22:4n6}$
38. $C_{22:5n3}$
39. $C_{24:0}$
40. $C_{22:6n3}$
41. $C_{24:1n9}$



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

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

Analysis of Fragrance and Allergens

Column: **VF-WAXms**
CP9205
30 m x 0.25 mm, 0.25 µm

Oven: 100 °C to 250 °C with 10 °C/min

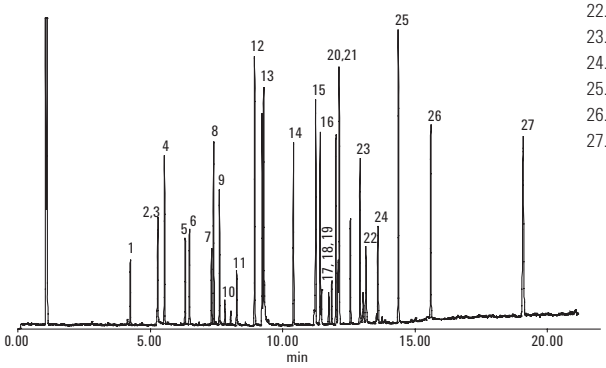
Carrier: Helium, 1.0 mL/min

Injection: Split 1:30, T=250 °C

Detector: GC/MS Ion Trap
Trap: 200 °C
Manifold: 60 °C

Sample: 0.1 µL, Fragrances mixture (500 ppm)

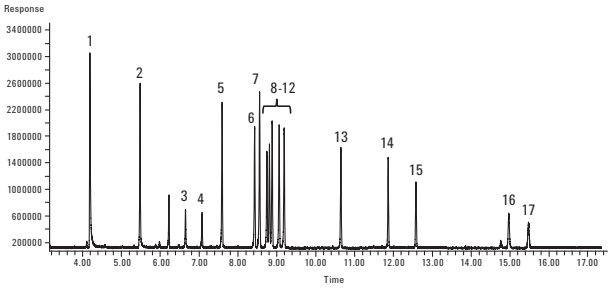
1. Linalool
2. Methyl heptine carbonate
3. Phenyl acetaldehyde
4. Methyl chavicol
5. Methyl octine carbonate
6. Citronellol
7. Geraniol
8. Methyl gamma ionone
9. Benzyl alcohol
10. Cinnamaldehyde
11. Hydroxy citronellal
12. Methyl eugenol
13. Lilial
14. Eugenol
15. Amyl cinnamyl aldehyde
16. Anisic alcohol
17. Cinnamyl alcohol
18. Farnesol isomer I + II
19. Farnesol isomer III
20. iso-Eugenol
21. Hexyl cinnamic aldehyde
22. Lyral (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 Backflush:	7.5 min at 290 °C, Aux EPC pressure 54 psi during 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_2) 60 mL/min

1. Methamidophos
2. Acephate
3. Omethoate
4. Diazinon
5. Dimethoate
6. Pirimiphos-methyl
7. Parathion-methyl
8. Malathion
9. Chlorpyrifos
10. Fenitrothion
11. Parathion
12. Fenthion
13. Methidathion
14. Carbophenothion
15. Triphenyl-phosphate (surrogate std)
16. Azinphos-methyl
17. Azinphos-ethyl



GC/FPD chromatogram of a 100 ng/mL matrix-matched organophosphorus pesticide standard with analyte protectant analyzed on an Agilent J&W DB-35ms UI GC column.

TIPS & TOOLS

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

Fragrance Allergens

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

Carrier: Helium, 1.2 mL/min,
constant pressure of 70 kPa

Oven: 50 °C in 1 min, 8 °C/min to 250 °C,
250-300 °C at 35 °C/min
300 °C hold, 5 min
5973N MSD in scan (40-350 amu)
Solvent delay, 3.0 min

Injection: Split, 250 °C
Split ratio 1:50

Sample: 1 µL, 50 ppm standard

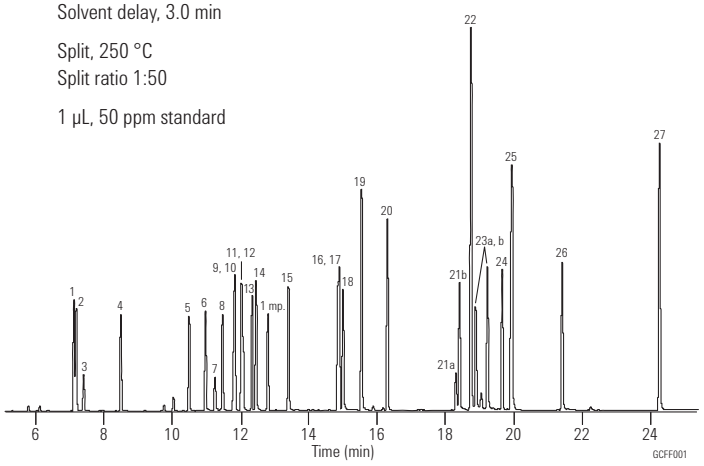
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

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



1. Limonene
2. Benzyl alcohol
3. Phenyl acetaldehyde
4. Linalool
5. Methyl heptine carbonate
6. Citronellol
7. Neral
8. Geraniol
9. Citral (geranial)
10. Cinnamaldehyde
11. Anisyl alcohol
12. Hydroxy citronellal
13. Methyl octine carbonate
14. Cinnamic alcohol
15. Eugenol
16. Coumarin
17. Cinnamyl acetate
18. Isoeugenol
19. Alpha isomethyl ionone
20. Lilial (BMHCA)
21a. Lyral 1
21b. Lyral 2
22. Amyl cinnamyl alcohol
23a. Farnesol 1
23b. Farnesol 1
24. Hexyl cinnamaldehyde
25. Benzyl benzoate
26. Benzyl salicylate
27. Benzyl cinnamate

Flavor Mixture

Column: **Ultra 2**
19091B-112
25 m x 0.32 mm, 0.52 µm

Carrier: Helium, 90 kPa, 2.2 mL/min constant flow

Oven: 80 °C for 1 min
80-210 °C at 8 °C/min
210 °C for 2 min

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

Detector: IRD, 280 °C
Wide Band MCT, 550 to 4000 cm^{-1}

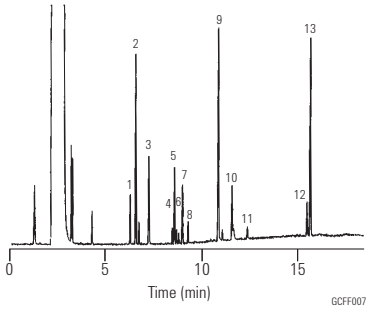
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

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



1. Fenchone
2. Thujone
3. Benzaldehyde
4. trans-Carveol
5. Farnesol
6. cis-Carveol
7. trans-Geraniol
8. Citral
9. Eugenol
10. Vanillin
11. trans-Isoeugenol
12. trans-Citronellyl tiglate
13. cis-Citronellyl tiglate

Lemon Oil

Column: **DB-5**
127-5022
20 m x 0.10 mm, 0.10 µm

Carrier: Hydrogen at 60 cm/s, measured at 40 °C

Oven: 40 °C for 3 min
40-185 °C at 30 °C/min
185 °C for 3 min

Injection: Split, 275 °C
Split ratio 1:275

Detector: Nitrogen makeup gas at 30 mL/min

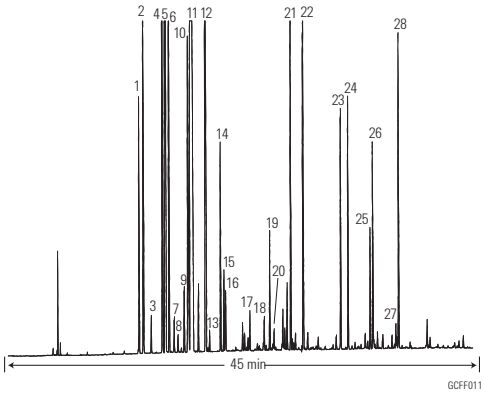
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

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



1. α-Thujone
2. β-Thujone
3. Camphene
4. Sabinene
5. β-Pinene
6. Myrcene
7. Octanal
8. α-Phellandrene
9. α-Terpinene
10. r-Cymene
11. δ-Limonene
12. γ-Terpinene
13. Octanol
14. Terpinolene
15. Linalool
16. Nonanal
17. Citronellal
18. Terpinen-4-ol
19. α-Terpineol
20. Decanal
21. Neral
22. Geranial
23. Neryl acetate
24. Geranyl acetate
25. β-Caryophyllene
26. trans-α-Bergamotene
27. α-Humulene
28. β-Bisabolene

Cold-pressed Orange Oil

Column: **DB-5**
127-5022
20 m x 0.10 mm, 0.10 µm

Carrier: Hydrogen at 60 cm/s, measured at 70 °C

Oven: 70 °C for 1 min
70-250 °C at 30 °C/min
250-310 °C at 20 °C/min
310 °C for 2 min

Injection: Split, 275 °C
Split ratio 1:275

Detector: FID, 350 °C
Nitrogen makeup gas at 30 mL/min

Chromatogram courtesy of Tastemaker

Suggested Supplies

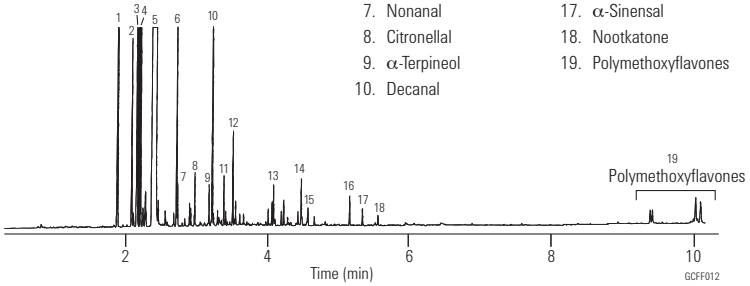
Septum: 11 mm Advanced Green septa, 5183-4759

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
2. Sabinene
3. Myrcene
4. Octanal
5. Limonene
6. Linalool
7. Nonanal
8. Citronellal
9. α-Terpineol
10. Decanal
11. Neral
12. Geranial
13. Dodecenal
14. Valencene
15. Cadinene
16. β-Sinensal
17. α-Sinensal
18. Nootkatone
19. Polymethoxyflavones



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

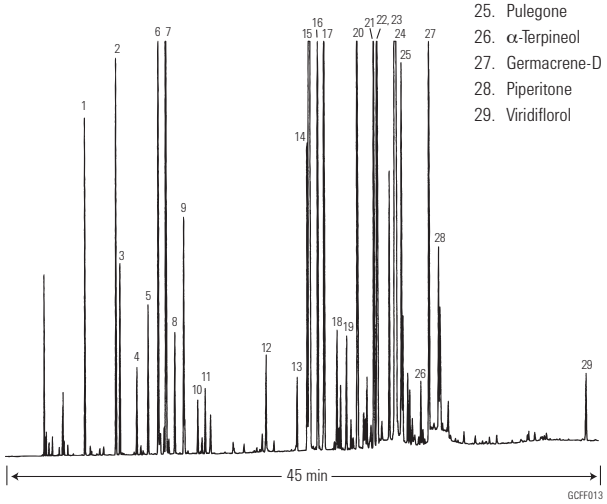
Septum: 11 mm Advanced Green septa, 5183-4759

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
2. β-Pinene
3. Sabinene
4. Myrcene
5. α-Terpinene
6. (+/-)-Limonene
7. 1,8-Cineol
8. cis-Ocimene
9. Terpinene
10. r-Cymene
11. γ-Terpinolene
12. 3-Octanol
13. 1-Octen-3-ol
14. trans-Sabinene hydrate
15. (+/-)-Methone
16. Methofuran
17. d-Isomethone
18. β-Bourbonene
19. Linalool
20. Menthyl acetate
21. Neomenthol
22. Terpinen-4-ol
23. β-Caryophyllene
24. (+/-)-Menthol
25. Pulegone
26. α-Terpineol
27. Germacrene-D
28. Piperitone
29. Viridiflorol



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

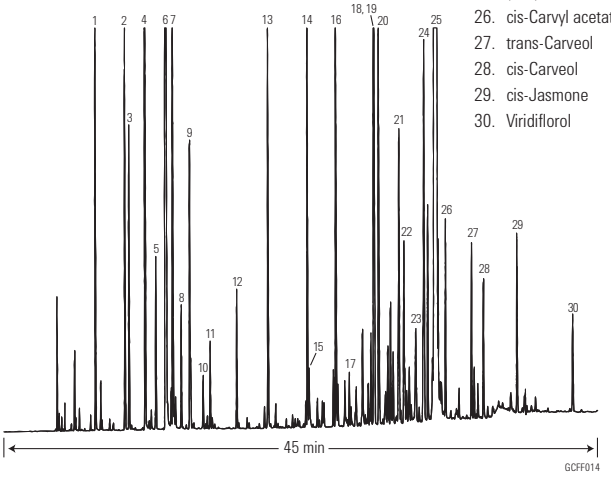
Septum: 11 mm Advanced Green septa, 5183-4759

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
2. β-Pinene
3. Sabinene
4. Myrcene
5. α-Terpinene
6. (+/-)-Limonene
7. 1,8-Cineol
8. cis-Ocimene
9. γ-Terpinene
10. r-Cymene
11. Terpinolene
12. 3-Octylacetate
13. 3-Octanol
14. trans-Sabinene hydrate
15. (+/-)-Methone
16. β-Bourbonene
17. Linalool
18. Terpinen-4-ol
19. β-Caryophyllene
20. Dihydro carvone
21. trans-Dihydro carvyl
22. trans-β-Farnesene
23. α-Terpineol
24. Germacrene-D
25. (+/-)-Carvone
26. cis-Carvyl acetate
27. trans-Carveol
28. cis-Carveol
29. cis-Jasmone
30. Viridiflorol



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

Suggested Supplies

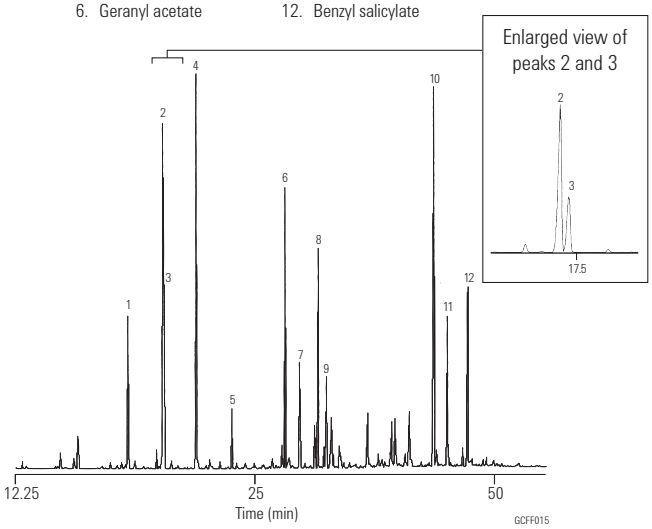
Septum: 11 mm Advanced Green septa, 5183-4759

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. r-Methylansiole
2. Linalool
3. Methylbenzoate
4. Benzylacetate
5. Geraniol
6. Geranyl acetate
7. β-Caryophyllene
8. Cinnamyl acetate
9. Germacrene-D
10. Benzyl benzoate
11. Farnesol acetate
12. Benzyl salicylate

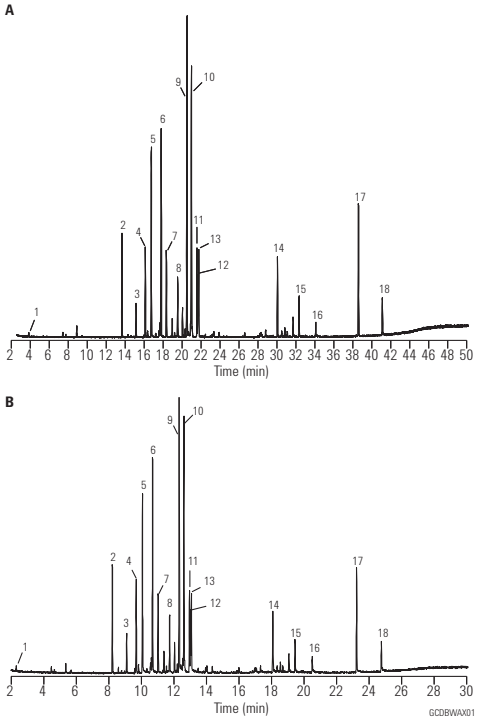


Ylang Ylang Oil

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



1. α-Pinene
2. Methyl-ρ-cresol
3. α-Copaene
4. α-Gurjunene
5. Linalool
6. β-Caryophyllene
7. Methyl benzoate
8. α-Caryophyllene
9. Germacrene-d
10. Benzyl acetate
11. Farnescene
12. δ-Cadinene
13. Geranial acetate
14. trans-Cinnamyl acetate
15. β-Bisbolene
16. Farnesyl acetate
17. Benzyl benzoate
18. Benzyl salicylate

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

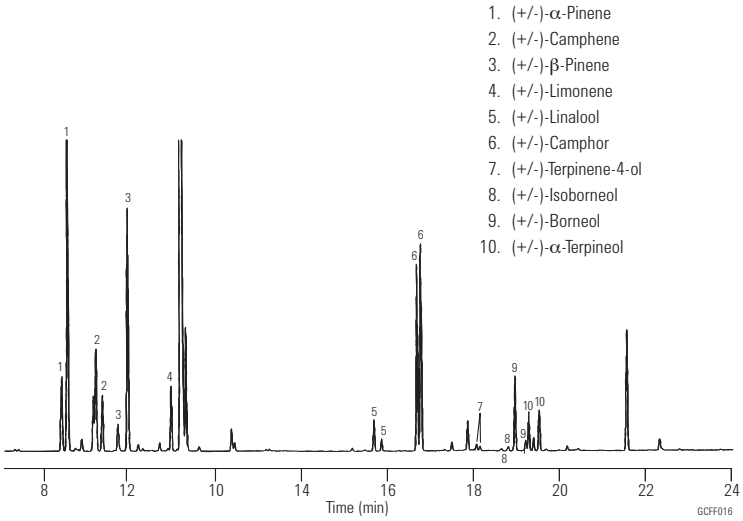
Suggested Supplies

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

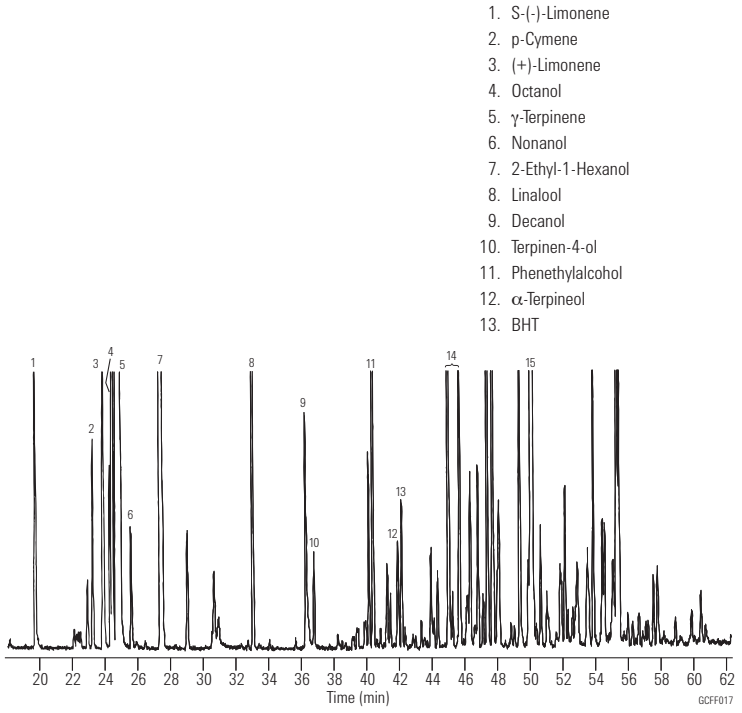
Suggested Supplies

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



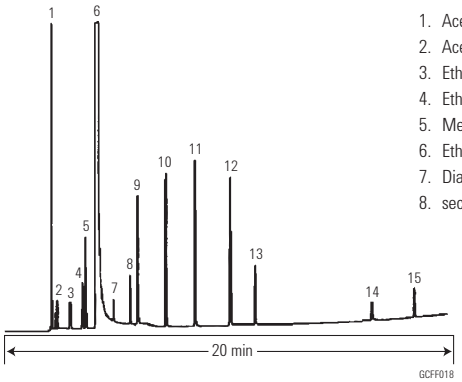
Alcohol Beverage Standard

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

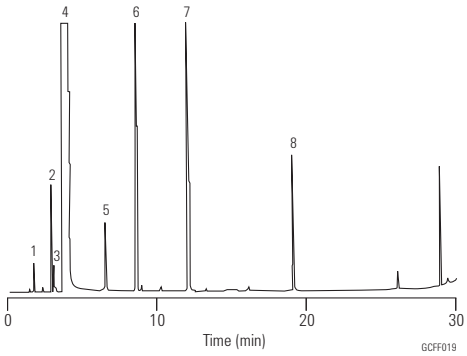
Carrier: Helium, 33 cm/s, 15.5 psi (35 °C)
1.5 mL/min constant flow

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

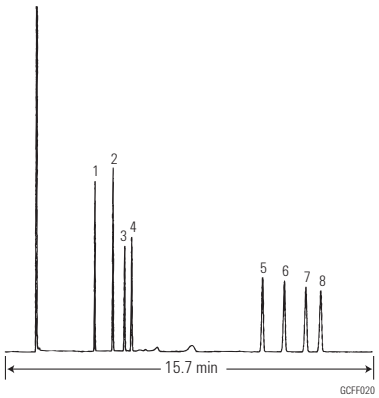
Carrier: Hydrogen at 36.5 cm/s

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

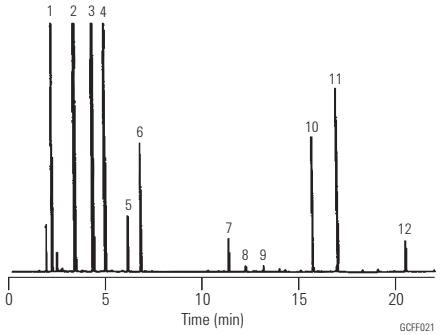
Column: **HP-INNOWax**
19091N-213
30 m x 0.32 mm, 0.50 µm

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

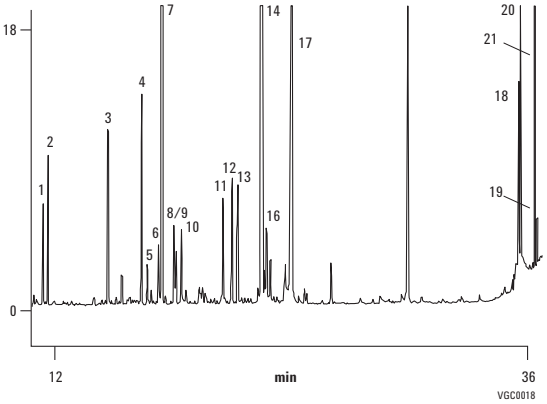
Sample Conc: 40 ppb

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
2. Erythritol
3. Rhamnose 1
4. Rhamnose 2
5. Xylose 1
6. Arabitol
7. Ribitol
8. 3-0-Methylglucose 1
9. Xylose 2
10. Rhamnitol
11. 3-0-Methylglucose 2
12. Glucuronic acid-1,5-lactone
13. Ribose 2
14. Manitol
15. Sorbitol (not identified)
16. Galactitol
17. Glucuronic acid
18. Lactulose
19. Lactose
20. Sucrose
21. Threhalose

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

Suggested Supplies

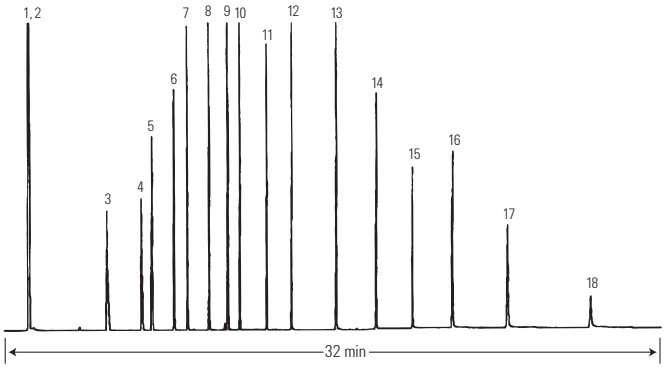
Septum: 11 mm Advanced Green septa, 5183-4759

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. Acetone
2. Formic acid
3. Acetic acid
4. Propionic acid
5. Isobutyric acid
6. Butyric acid
7. Isovaleric acid
8. Valeric acid (pentanoic acid)
9. Isocaproic acid
10. Caproic acid (hexanoic acid)
11. Heptanoic acid
12. Octanoic acid
13. Decanoic acid
14. Dodecanoic acid
15. Tetradecanoic acid
16. Hexadecanoic acid
17. Octadecanoic acid
18. Arachidic acid (eicosanoic acid)



Acids

Column: **VF-WAXms**
CP9205
30 m x 0.25 mm, 0.25 µm

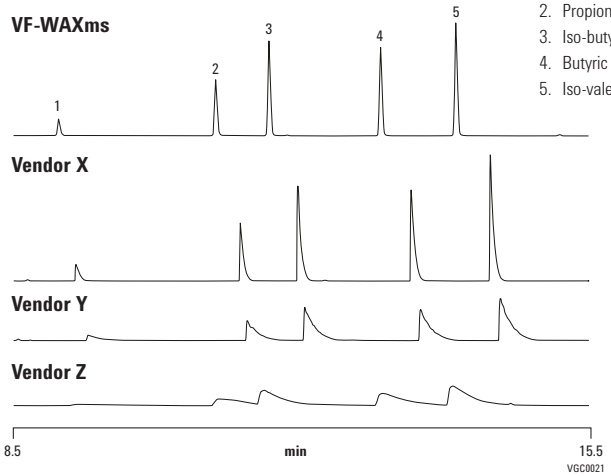
Sample: Acid sample, 0.1% (Cyclohexane), 1.0 µL

Carrier: Hydrogen, 75 kPa

Oven: 60 °C to 200 °C, 5 °C/min

Injection: 250 °C, split 100 mL/min

1. Acetic acid
2. Propionic acid
3. Iso-butyric acid
4. Butyric acid
5. Iso-valeric acid



Bacterial Fatty Acid Methyl Esters

Column: **DB-5**
122-5032
30 m x 0.25 mm, 0.25 µm

Carrier: Hydrogen at 42 cm/s

Oven: 150 °C for 4 min
150-250 °C at 4 °C/min

Injection: Split ratio 1:100

Detector: FID
Nitrogen makeup gas at 30 mL/min

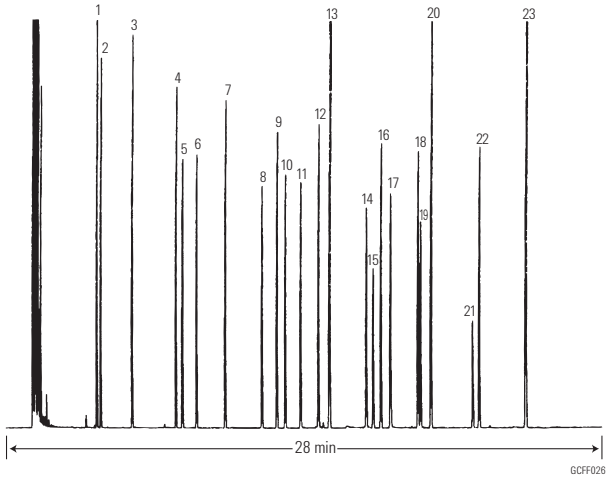
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

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



1. $C_{11:0}$ Methyl undecanoate
2. 2-OH $C_{10:0}$ Methyl 2-hydroxydecanoate
3. $C_{12:0}$ Methyl laurate
4. $C_{13:0}$ Methyl tridecanoate
5. 2-OH $C_{12:0}$ Methyl 2-hydroxydodecanoate
6. 3-OH $C_{12:0}$ Methyl 3-hydroxydodecanoate
7. $C_{14:0}$ Methyl myristate
8. 12-Me $C_{14:0}$ Methyl 12-methyltetradecanoate
9. $C_{15:0}$ Methyl pentadecanoate
10. 2-OH $C_{14:0}$ Methyl 2-hydroxytetradecanoate
11. 3-OH $C_{14:0}$ Methyl 3-hydroxytetradecanoate
12. $C_{16:1}$ Methyl palmitoleate
13. $C_{16:0}$ Methyl palmitate
14. 14-Me $C_{16:0}$ Methyl 14-methylhexadecanoate
15. 9,10-diMe $C_{16:0}$ Methyl cis-9,10-methyl hexadecanoate
16. $C_{17:0}$ Methyl heptadecanoate
17. 2-OH $C_{16:0}$ Methyl 2-hydroxyhexadecanoate
18. $C_{18:1}$ Methyl oleate
19. $C_{18:1}$ Methyl elaidate
20. $C_{18:0}$ Methyl stearate
21. 9,10-diMe $C_{18:0}$ Methyl cis-9,10-methylene octadecanoate
22. $C_{19:0}$ Methyl nonadecanoate
23. $C_{20:0}$ Methyl arachidate

Separation of cis-trans FAME Isomers

Column: **Select FAME**
CP7421
200 m x 0.25 mm

Sample: 0.5 µL

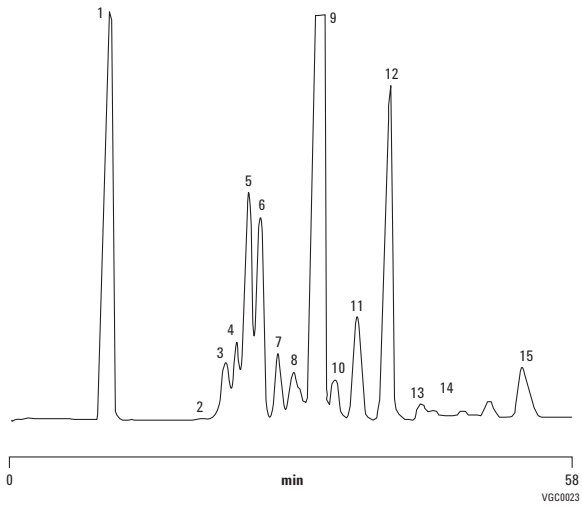
Sample Conc: 5 ng approx. per component on the column

Carrier: Helium, 520 kPa

Oven: 185 °C

Injection: Split, 1:20

Detector: FID



1. C18:0
2. C18:1 7 trans
3. C18:1 8 trans
4. C18:1 9 trans
5. C18:1 10 trans
6. C18:1 11 trans
7. C18:1 12 trans
8. C18:1 13 trans + ?
9. C18:1 9 cis
10. C18:1 10 cis
11. C18:1 11 cis
12. C18:1 12 cis
13. C18:1 13 cis
14. C18:1 14 cis
15. C18:1 15 cis

69 Component FAME Mix

Column: **HP-88**
112-8867
60 m x 0.25 mm, 0.20 µm

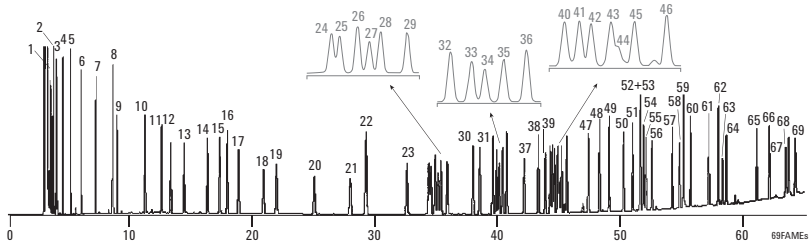
Carrier: He at 1.4 mL/min constant flow

Oven: 125 °C
125 °C to 145 °C at 8 °C/min
145 °C for 26 min
145 °C to 220 °C at 2 °C/min
220 °C for 1 min

Injection: Split, 250 °C
Split ratio 50:1
1 µL of 70 ppm each in $CHCl_3$

Detector: FID, 260 °C

1. nC6:0
2. nC7:0
3. nC8:0
4. nC9:0
5. nC10:0
6. nC11:0
7. nC12:0
8. C12:1 (11c)
9. nC13:0
10. nC14:0
11. C14:1 (9t)
12. C14:1 (9c)
13. nC15:0
14. C15:1 (10t)
15. C15:1 (10c)
16. C15:1 (14c)
17. nC16:0
18. C16:1 (9t)
19. C16:1 (9c)
20. nC17:0
21. C17:1 (10t)
22. C17:1 (10c)
23. nC18:0
24. C18:1 (6t)
25. C18:1 (9t)
26. C18:1 (11t)
27. nC18:1 (6c)
28. C18:1 (9c)
29. C18:1 (11c)
30. nC18:2 (9t,12t)
31. C19:1 (10t)
32. nC19:0
33. C19:1 (7t)
34. C18:2 (9c,12c)
35. C19:1 (7c)
36. C19:1 (10c)
37. C18:3 g(6c,9c,12c)
38. nC20:0
39. C18:3 (9c,12c,15c)
40. C20:1 (5c)
41. C19:2 (10c,13c)
42. C20:1 (11t)
43. C18:2 CONJ
44. C20:1 (8c)
45. C20:1 (11c)
46. C18:2 (10t,12c)
47. nC21:0
48. C20:2 (11c,14c)
49. C21:1 (12c)
50. C20:3 (8c,11c,14c)
51. nC22:0
52. C22:1 (13t)
53. C20:4 (5c,8c,11c,14c)
54. C20:3 (11c,14c,17c)
55. C21:2 (12c,15c)
56. C22:1 (13c)
57. nC23:0
58. C20:5 (EPA)
59. C22:2 (13c,16c)
60. C23:1 (14c)
61. nC24:0
62. C22:3 (13c,16c,19c)
63. C22:4 (7c,10c,13c,16c)
64. C24:1 (15c)
65. C22:5 (DPA)
66. C22:6 (DHA)
67. C18:1-12 Hydroxy (9t)
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

Suggested Supplies

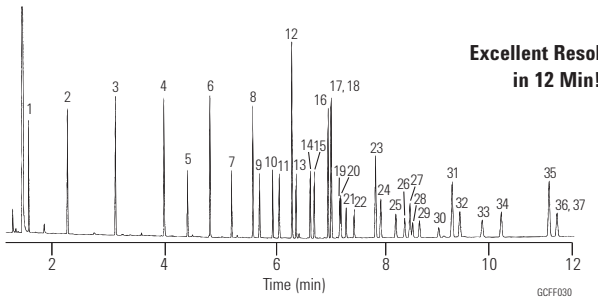
Septum: 11 mm Advanced Green septa, 5183-4759

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 ($C_{4:0}$)
2. Caproic acid methyl ester ($C_{6:0}$)
3. Caprylic acid methyl ester ($C_{8:0}$)
4. Capric acid methyl ester ($C_{10:0}$)
5. Undecanoic acid methyl ester ($C_{11:0}$)
6. Lauric acid methyl ester ($C_{12:0}$)
7. Tridecanoic acid methyl ester ($C_{13:0}$)
8. Myristic acid methyl ester ($C_{14:0}$)
9. Myristoleic acid methyl ester ($C_{14:1}$)
10. Pentadecanoic acid methyl ester ($C_{15:0}$)
11. cis-10-Pentadecenoic acid methyl ester ($C_{15:1}$)
12. Palmitic acid methyl ester ($C_{16:0}$)
13. Palmitoleic acid methyl ester ($C_{16:1}$)
14. Heptadecanoic acid methyl ester ($C_{17:0}$)
15. cis-10-Heptadecenoic acid methyl ester ($C_{17:1}$)
16. Stearic acid methyl ester ($C_{18:0}$)
17. Oleic acid methyl ester ($C_{18:1n9c}$)
18. Elaidic acid methyl ester ($C_{18:1n9t}$)
19. Linoleic acid methyl ester ($C_{18:2n6c}$)
20. Linolelaidic acid methyl ester ($C_{18:2n6t}$)
21. γ-Linolenic acid methyl ester ($C_{18:3n6}$)
22. Linolenic acid methyl ester ($C_{18:3n3}$)
23. Arachidic acid methyl ester ($C_{20:0}$)
24. cis-11-Eicosenoic acid methyl ester ($C_{20:1}$)
25. cis-11,14-Eicosadienoic acid methyl ester ($C_{20:2}$)
26. cis-8,11,14-Eicosatrienoic acid methyl ester ($C_{20:3n6}$)
27. Heneicosanoic acid methyl ester ($C_{21:0}$)
28. cis-11,14,17-Eicosatrienoic acid methyl ester ($C_{20:3n3}$)
29. Arachidonic acid methyl ester ($C_{20:4n6}$)
30. cis-5,8,11,14,17-Eicosapentaenoic acid methyl ester ($C_{20:5n3}$)
31. Behenic acid methyl ester ($C_{22:0}$)
32. Erucic acid methyl ester ($C_{22:1n9}$)
33. cis-13,16-Docosadienoic acid methyl ester ($C_{22:2}$)
34. Tricosanoic acid methyl ester ($C_{23:0}$)
35. Lignoceric acid methyl ester ($C_{24:0}$)
36. cis-4,7,10,13,16,19-Docosahexaenoic acid methyl ester ($C_{22:6n3}$)
37. Nervonic acid methyl ester ($C_{24:1}$)



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

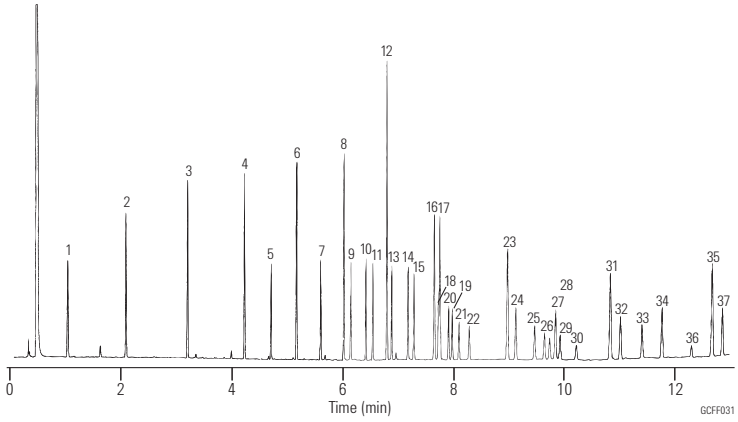
Septum: 11 mm Advanced Green septa, 5183-4759

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)
2. Caproic acid methyl ester (C6:0)
3. Caprylic acid methyl ester (C8:0)
4. Capric acid methyl ester (C10:0)
5. Undecanoic acid methyl ester (C11:0)
6. Lauric acid methyl ester (C12:0)
7. Tridecanoic acid methyl ester (C13:0)
8. Myristic acid methyl ester (C14:0)
9. Myristoleic acid methyl ester (C14:1)
10. Pentadecanoic acid methyl ester (C15:0)
11. cis-10-Pentadecenoic acid methyl ester (C15:1)
12. Palmitic acid methyl ester (C16:0)
13. Palmitoleic acid methyl ester (C16:1)
14. Heptadecanoic acid methyl ester (C17:0)
15. cis-10-Heptadecenoic acid methyl ester (C17:1)
16. Stearic acid methyl ester (C18:0)
17. Oleic acid methyl ester (C18:1n9c)
18. Elaidic acid methyl ester (C18:1n9t)
19. Linoleic acid methyl ester (C18:2n6c)
20. Linolelaidic acid methyl ester (C18:2n6t)
21. γ-Linolenic acid methyl ester (C18:3n6)
22. Linolenic acid methyl ester (C18:3n3)
23. Arachidic acid methyl ester (C20:0)
24. cis-11-Eicosenoic acid methyl ester (C20:1)
25. cis-11,14-Eicosadienoic acid methyl ester (C20:2)
26. cis-8,11,14-Eicosatrienoic acid methyl ester (C20:3n6)
27. Heneicosanoic acid methyl ester (C21:0)
28. cis-11,14,17-Eicosatrienoic acid methyl ester (C20:3n3)
29. Arachidonic acid methyl ester (C20:4n6)
30. cis-5,8,11,14,17-Eicosapentaenoic acid methyl ester (C20:5n3)
31. Behenic acid methyl ester (C22:0)
32. Erucic acid methyl ester (C22:1n9)
33. cis-13,16-Docosadienoic acid methyl ester (C22:2)
34. Tricosanoic acid methyl ester (C23:0)
35. Lignoceric acid methyl ester (C24:0)
36. cis-4,7,10,13,16,19-Docosahexaenoic acid methyl ester (C22:6n3)
37. Nervonic acid methyl ester (C24:1)



Canola Oil Margarine Partially Hydrogenated FAMEs AOCS Method 1c-89

Column: **DB-23**
122-2362
60 m x 0.25 mm, 0.25 µm

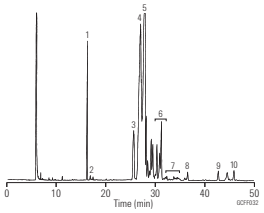
Carrier: Helium at 15 cm/s (0.44 mL/min), measured at 150 °C

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

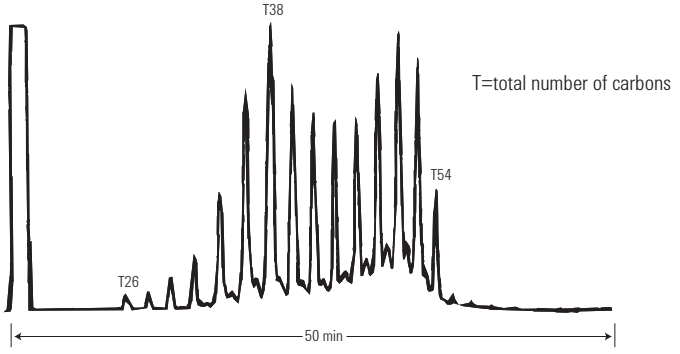
Carrier: Hydrogen at 55 cm/s, measured at 250 °C

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

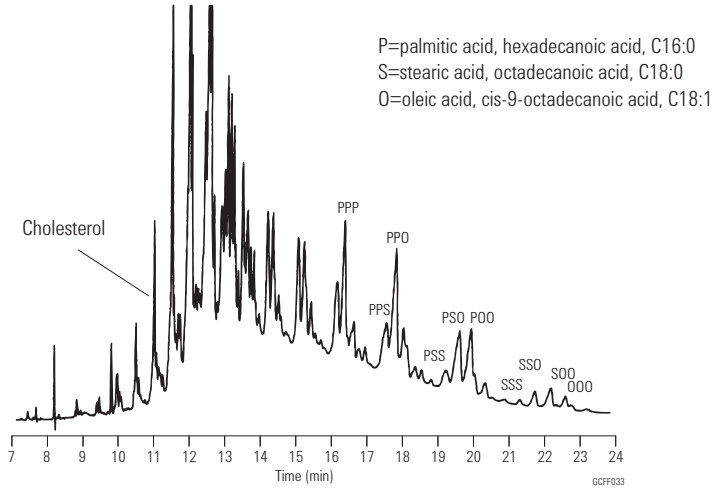
Carrier: Hydrogen at 40 cm/s

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

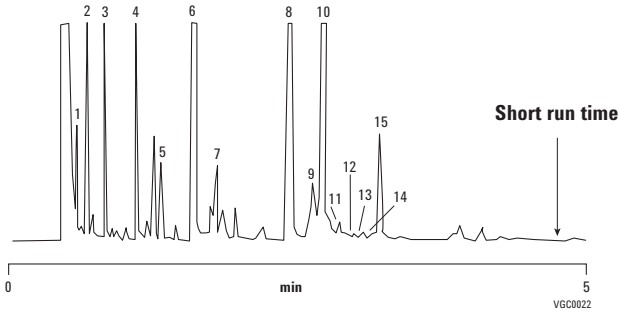
Sample: 0.5 µL ca. 5 ng per component on column

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

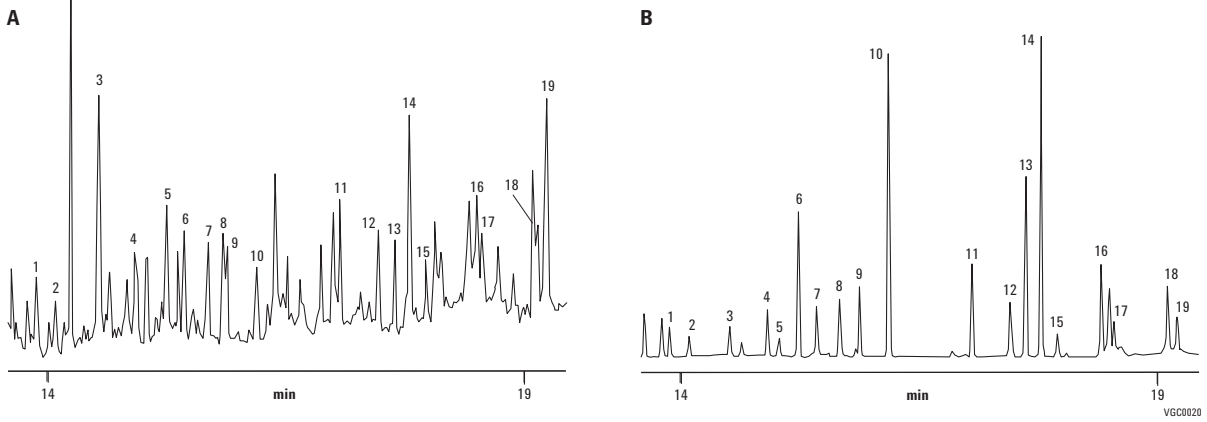
Oven: 70 °C (3.0 min), 25 °C to 190 °C/min (0.0 min) to 10 °C/min to 320 °C (10 min)

Injection: 1079 with carbofrit liner

Detector: A: Ion Trap in MS/MS, full scan
B: MS/MS

1. β-HCH
2. γ-HCH
3. δ-HCH
4. + Vinclozolin
5. Pyrimiphos methyl
6. + Malathion
7. Chloropyrifos
8. Ethyl parathion
9. Pyrimiphos ethyl
10. Bromofos
11. o,p'-DDE
12. α-Endosulfan
13. p,p'-DDE
14. o,p'-DDD
15. Dieldrin
16. p,p'-DDD
17. b Endosulfan
18. p,p'-DDT
19. Endosulfan sulfate

1. β-HCH
2. γ-HCH
3. δ-HCH
4. + Vinclozolin
5. Methyl parathion
6. Pyrimiphos methyl
7. + +Fenitrothion
8. Chloropyrifos
9. Pyrimiphos ethyl
10. Promofos
11. o,p'-DDE
12. α-Endosulfan
13. p,p'-DDE
14. o,p'-DDD
15. Dieldrin
16. p,p'-DDD
17. b Endosulfan
18. p,p'-DDT
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 µm

Carrier: Helium at 20 psi constant pressure mode

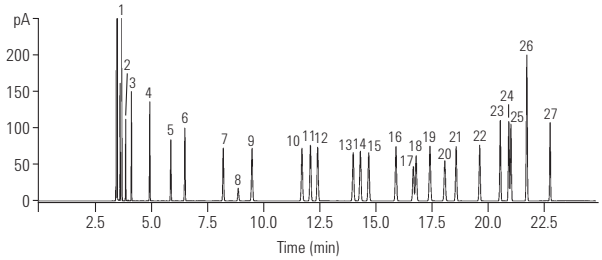
Oven: 75 °C (10 min); 3 °C/min to 100 °C (0 min)
10 °C/min to 145 °C (0 min)

Injection: Split/splitless at 250 °C
100:1 split ratio

Detector: FID at 250 °C

Sample: 1.0 µL

Unified aromatic solvent method



Column: **HP-INNOWax**
19091N-577
20 m x 0.18 mm, 0.18 µm

Carrier: Helium at 33 psi constant pressure mode

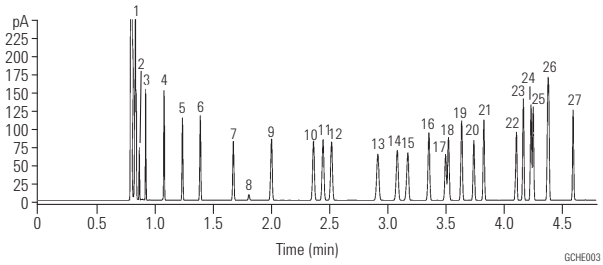
Oven: 70 °C (3 min); 45 °C/min to 145 °C (1 min)

Injection: Split/splitless at 250 °C
100:1 to 600:1 split ratio

Detector: FID at 250 °C

Sample: 0.2 to 1.0 µL

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

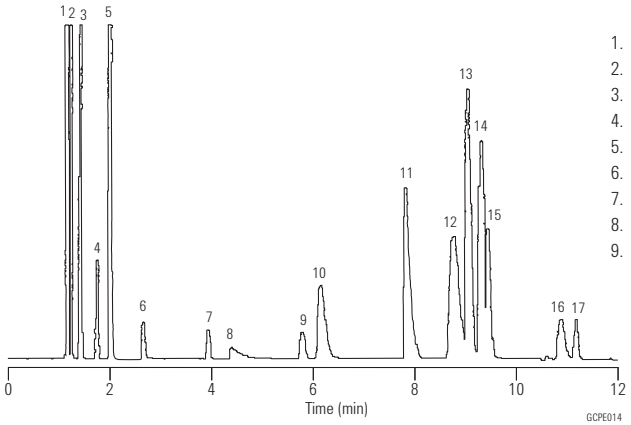
Sample: Refinery gas and others

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



1. Air/CO
2. C_1
3. CO_2
4. Ethylene
5. C_2
6. H_2S
7. COS
8. H_2O
9. Propylene
10. C_3
11. MeOH
12. i-C_4
13. t-C_4
14. n-C_4
15. cis-C_4
16. i-C_5
17. n-C_5

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

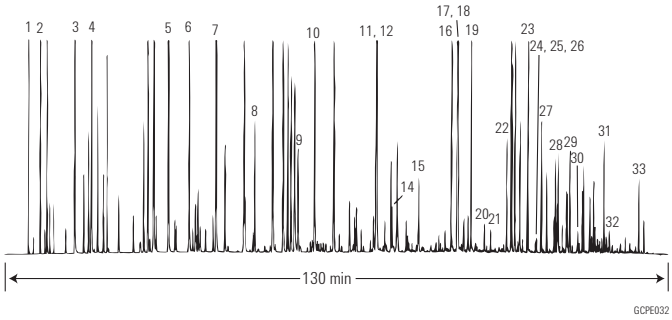
Injection: Split, 200 °C
Split ratio 1:300

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

Sample: 1 µL of neat sample

1. Methane
2. n-Butane
3. Isopentane
4. n-Pentane
5. n-Hexane
6. Methylcyclopentane
7. Benzene
8. Cyclohexane
9. Isooctane
10. n-Heptane
11. Toluene *
12. 2,3,3-Trimethylpentane
13. 2-Methylheptane
14. 4-Methylheptane
15. n-Octane
16. Ethylbenzene
17. m-Xylene **
18. p-Xylene
19. o-Xylene
20. n-Nonane
21. Isopropylbenzene
22. Propylbenzene
23. 1,2,4-Trimethylbenzene
24. Isobutylbenzene
25. sec-Butylbenzene
26. n-Decane
27. 1,2,3-Trimethylbenzene
28. Butylbenzene
29. n-Undecane
30. 1,2,4,5-Tetramethylbenzene
31. Naphthalene
32. Dodecane
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

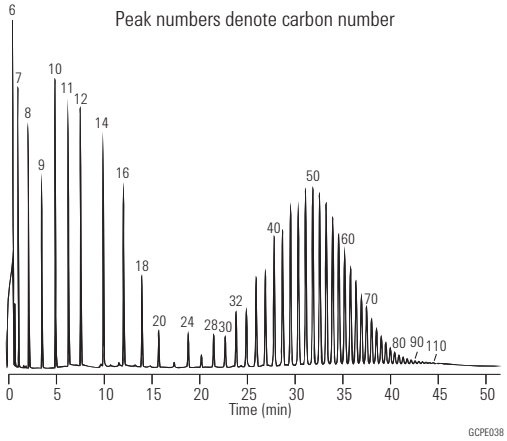
Carrier: Helium at 18 mL/min, measured at 35 °C

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_2



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

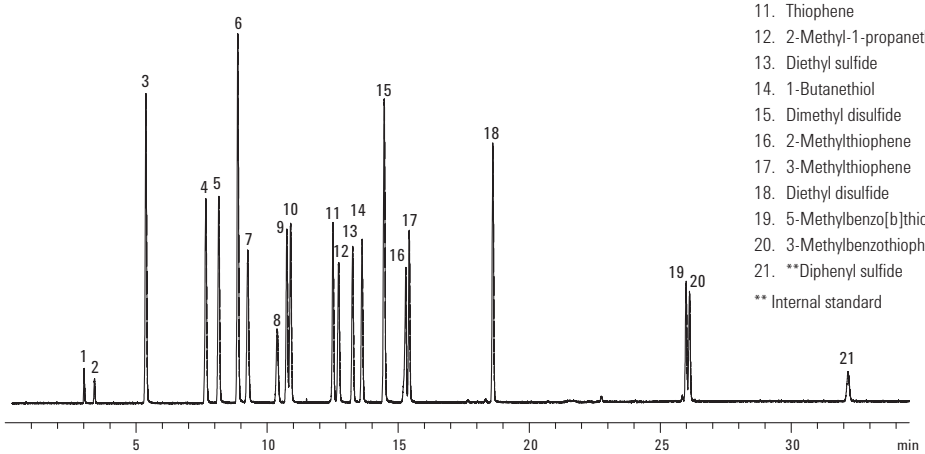
Burner temperature: 800 °C

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_2S	2000
2. Carbonyl sulfide	463-58-1	COS	2000
3. Methanethiol	74-93-1	CH_3SH	2000
4. Ethanethiol	75-08-1	C_2H_5SH	2000
5. Dimethyl sulfide	75-18-3	$(CH_3)_2S$	2000
6. Carbon disulfide	75-15-0	CS_2	2000
7. 2-Propanethiol	75-33-2	C_3H_8S	2000
8. 2-Methyl-2-propanethiol	75-66-1	$C_4H_{10}S$	2000
9. 1-Propanethiol	107-03-9	C_3H_8S	2000
10. Ethyl methyl sulfide	624-89-5	$C_2H_5SCH_3$	2000
11. Thiophene	110-02-1	C_4H_4S	2000
12. 2-Methyl-1-propanethiol	513-44-0	$C_4H_{10}S$	2000
13. Diethyl sulfide	352-93-2	$(C_2H_5)_2S$	2000
14. 1-Butanethiol	109-79-5	$C_4H_{10}S$	2000
15. Dimethyl disulfide	624-92-0	$(CH_3S)_2$	2000
16. 2-Methylthiophene	554-14-3	C_5H_6S	2000
17. 3-Methylthiophene	616-44-4	C_5H_6S	2000
18. Diethyl disulfide	110-81-6	$(C_2H_5S)_2$	2000
19. 5-Methylbenzo[b]thiophene	14315-14-1	C_9H_8S	2000
20. 3-Methylbenzothiophene	1455-18-1	C_9H_8S	2000
21. **Diphenyl sulfide	139-66-2	$C_{12}H_{10}S$	2000

** Internal standard

Sulfur Compounds in Propylene (1 ppm)

Column: **GS-GasPro**
113-4332
30 m x 0.32 mm

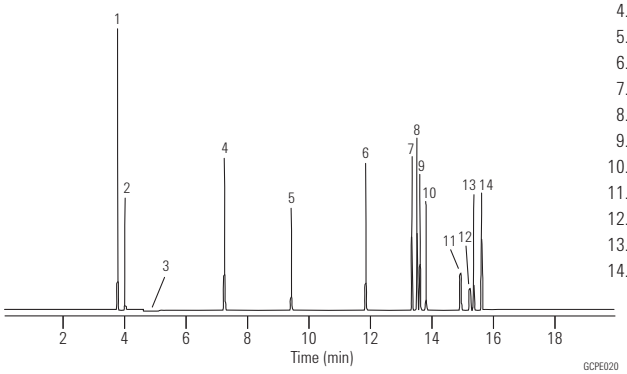
Oven: 60 °C for 2.5 min
60-250 °C at 10 °C/min

Injection: OI Analytical Volatiles Inlet
Split ratio 5:1
200 µL gas sampling valve

Detector: OI Analytical Model 5380 PFPD

Sample: 1 ppm sulfur compounds in propylene

Chromatogram courtesy of OI Analytical



1. COS
2. H_2S
3. Propylene
4. CS_2
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-propnaethiol
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

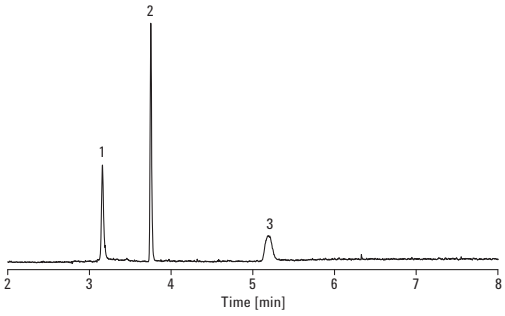
Carrier: Helium, constant flow, 2.0 mL/min

Injection: Gas sampling valve
220 °C, split 1:10

Detector: SCD, 200 °C

Sample: Polypropylene matrix containing
~300 ppb H_2S and CH_3SH, ~500 ppb COS

Injection Volume: 1 mL



1. H_2S
2. COS
3. CH_3SH

C_1 to C_4 Hydrocarbon Mix

Column: **PoraPLOT Q PT**
CP7550PT
10 m x 0.32 mm, 10.00 µm

Carrier: Helium, 1 mL/min in constant flow mode

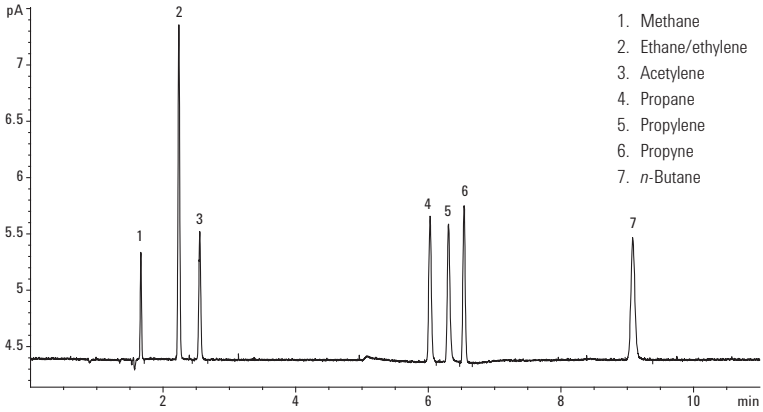
Oven: 50 °C (5 min) then to 120 °C at 50 °C/min, hold 4.6 min

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 µm

Carrier: Helium, 2 mL/min in constant flow mode

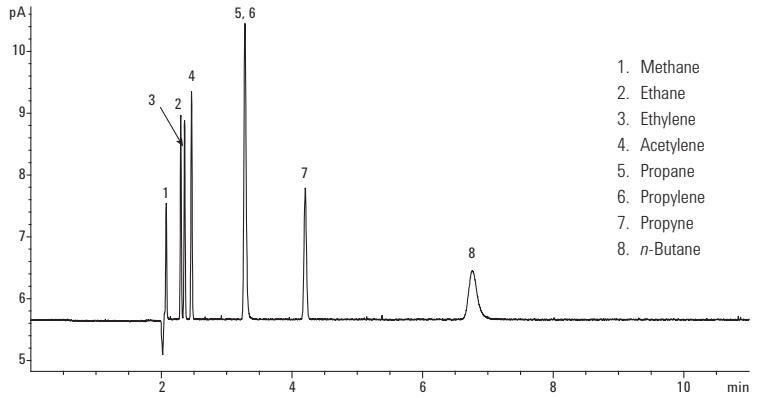
Oven: 85 °C isothermal

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 µm film, with attached manufacturer-prepared integrated dual-ended particle trap, showing the lack of particles or spikes on FID.

Column: **HP-PLOT Al_2O_3 KCl PT**
19095P-K25PT
50 m x 0.53 mm, 15.00 µm

Carrier: Helium, 3 mL/min in constant flow mode

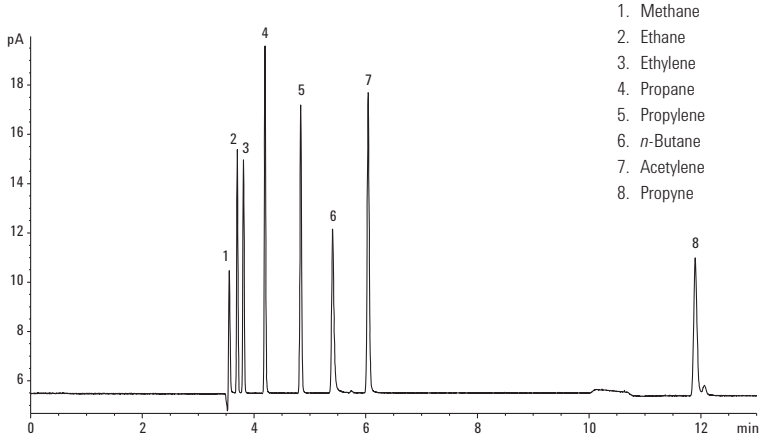
Oven: 100 °C (10 min) then to 120 °C at 30 °C/min, hold 3 min

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



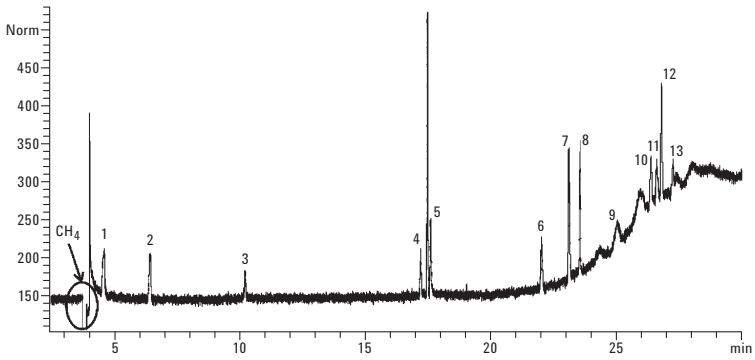
HP-PLOT Al_2O_3 KCl PT, 50 m x 0.53 mm, 15 µm film, with integrated dual-ended particle trap, showing lack of particles or spikes on FID.

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-Butanthiol	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**

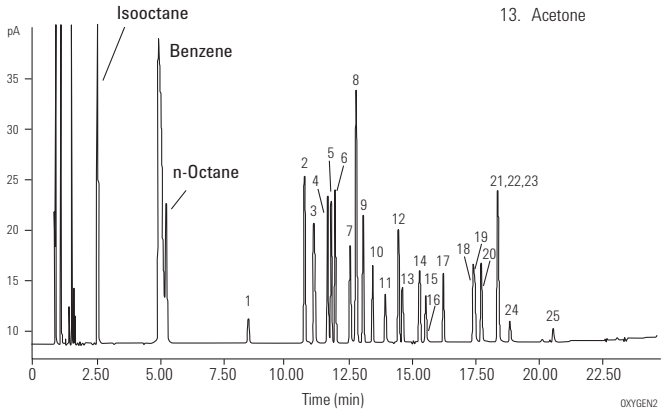
Column: **GS-OxyPLOT 115-4912 10 m x 0.53 mm**

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
2. Diethyl ether
3. Acetaldehyde
4. Ethyl t-butyl ether
5. Methyl t-butyl ether
6. Diisopropyl ether
7. Propionaldehyde
8. Tert-amyl methyl ether
9. Propyl ether
10. Isobutylaldehyde
11. Butylaldehyde
12. Methanol
13. Acetone
14. Isovaleraldehyde
15. Valeraldehyde
16. Methyl ethyl ketone
17. Ethanol
18. n-Propanol
19. Isopropanol
20. Allyl alcohol
21. Isobutanol
22. t-Butyl alcohol
23. s-Butyl alcohol
24. n-Butyl alcohol
25. 2-Methyl-2 pentanol

Selected Oxygenates

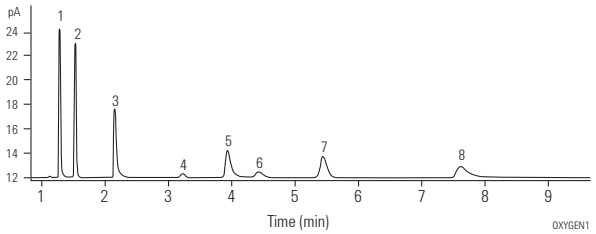
Column: **GS-OxyPLOT**
115-4912
10 m x 0.53 mm

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

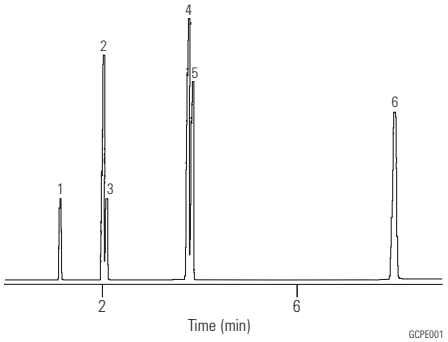
Sample: 250 µL

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

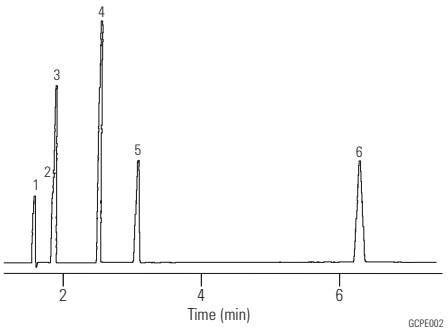
Sample: 250 µL

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_2, 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

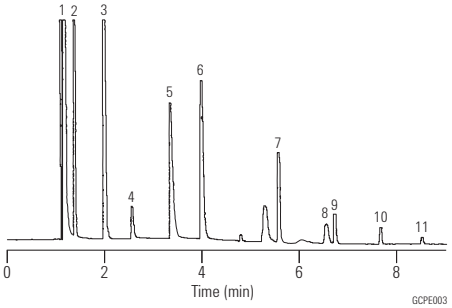
Sample: 0.25 cc natural gas sample, methane, 80%+

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_2
3. Ethane
4. H_2S
5. Water
6. C_3
7. i-C_4/n-C_4
8. neo-C_5
9. i-C_5/n-C_5
10. C_6
11. C_7

Natural Gas

Column: **HP-PLOT Al_2O_3 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

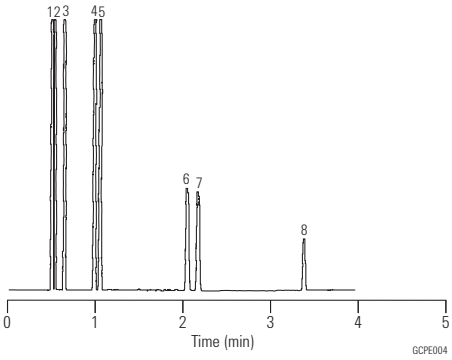
Sample: 5 µL natural gas, p/n 5080-8756

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_2O_3 S**
19095P-S25
50 m x 0.53 mm, 15.00 µm

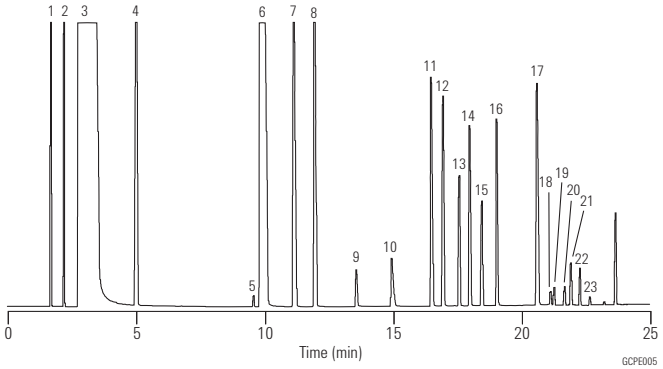
Carrier: Helium, 50 cm/s (35 °C),
7 mL/min constant flow

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

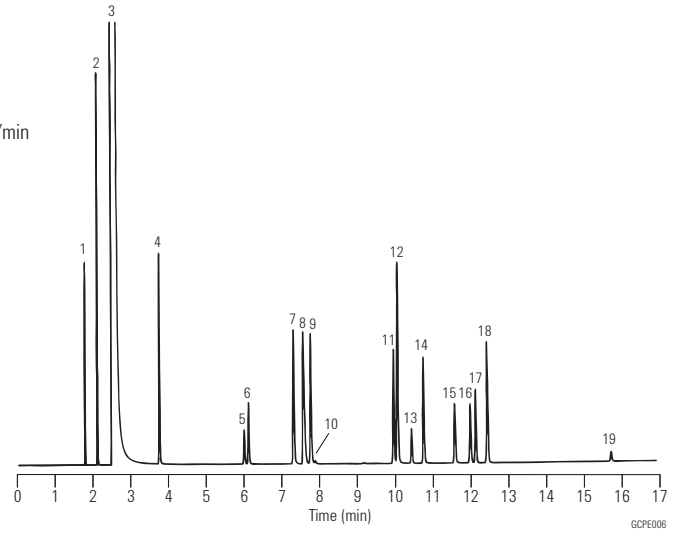
Carrier: Helium at 8 mL/min, measured at 35 °C

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

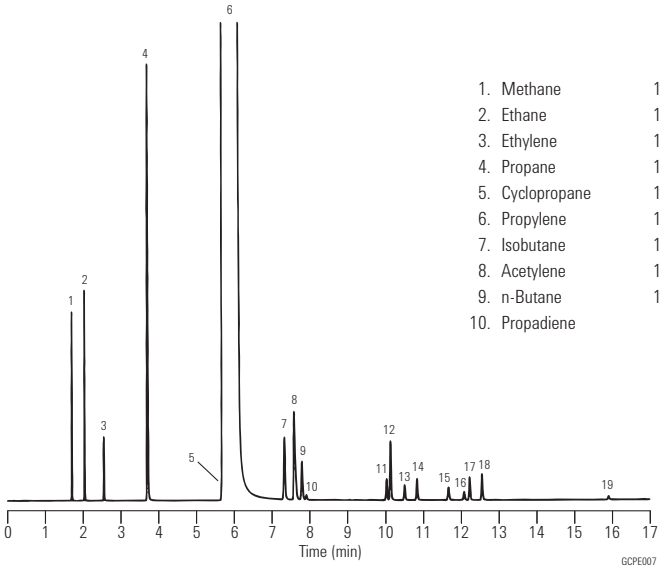
Sample: 0.2 mL of trace hydrocarbons in propylene

Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Direct, 1.5 mm id, 18740-80200

Seal: Gold plated seal, 18740-20885



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

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

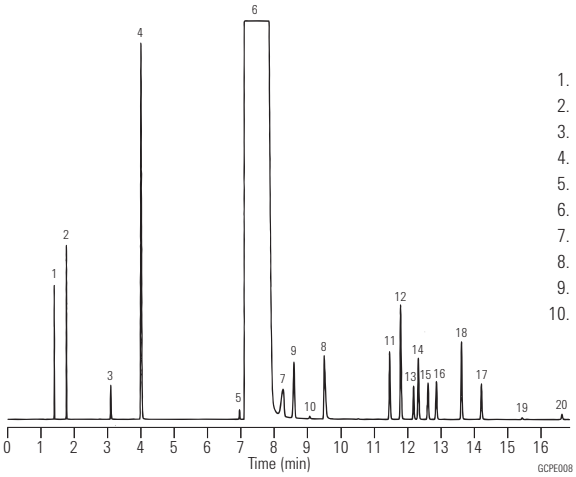
Sample: 0.2 mL of trace hydrocarbons in propylene

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. 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
20. n-Hexane

1,3-Butadiene

Column: **DB-624**
128-1324
25 m x 0.20 mm, 1.12 µm

Carrier: Helium at 1.0 mL/min

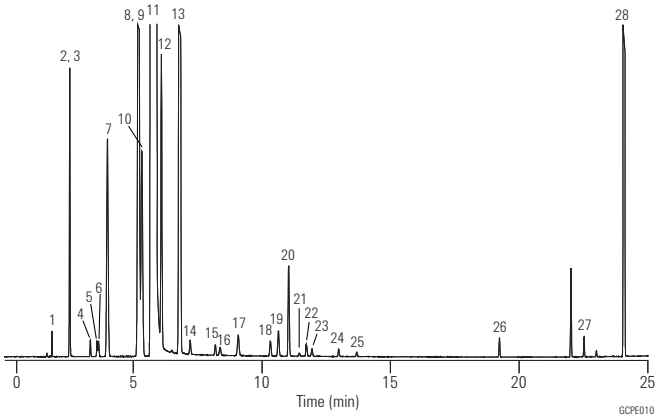
Oven: -20 °C for 3 min
-20 °C to 20 °C at 4 °C/min
20 °C to 200 °C at 8 °C/min
200 °C for 10 min

Injection: Split, 250 °C
Split ratio 1:150

Detector: FID, 250 °C

Sample: 0.5 µL

Agilent Technologies wishes to thank DCG Industries (Pearland, TX) for providing this chromatogram.



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)	

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

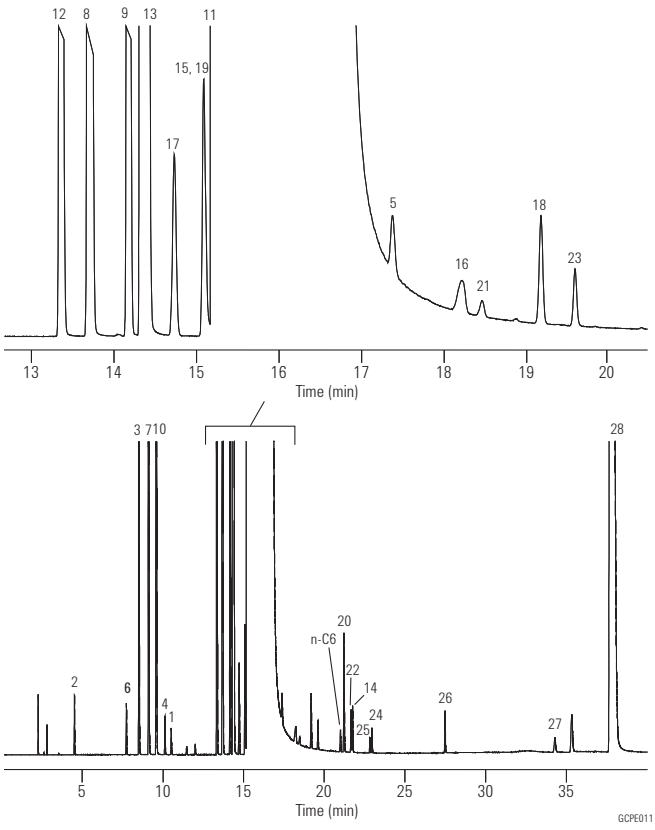
Sample: 0.5 µL

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)	

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

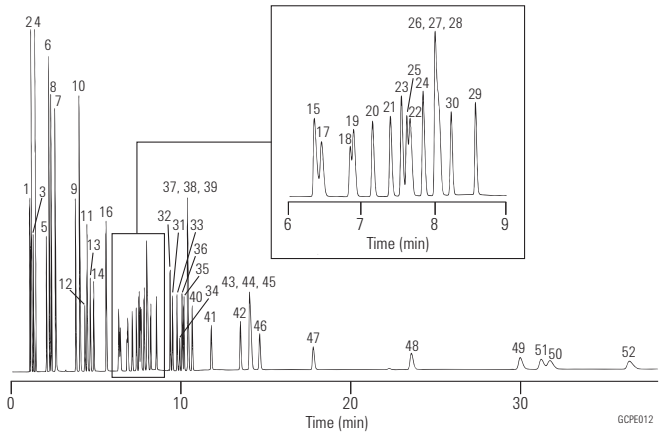
Sample: 300 µL injection of 100 ppmv
SUMMA canister mixture

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
2. Ethane
3. Ethylene
4. Propane
5. Propylene
6. Isobutane
7. Acetylene
8. n-Butane
9. trans-2-Butene
10. 1-Butene
11. cis-2-Butene
12. Cyclopentane
13. Isopentane
14. n-Pentane
15. Propyne
16. 1,3-Butadiene
17. Cyclopentene
18. 3-Methyl-1-butene
19. trans-2-Pentene
20. 2-Methyl-2-butene
21. 1-Pentene
22. cis-2-Pentene
23. Methylcyclopentane
24. 2,2-Dimethylbutane
25. Cyclohexane
26. 2,3-Dimethylbutane
27. 2-Methylpentane
28. 3-Methylpentane
29. Isoprene
30. n-Hexane
31. 4-Methyl-1-pentene
32. trans-2-Hexene
33. 2-Methyl-1-pentene
34. cis-2-Hexene
35. 2,4-Dimethylpentane
36. Methylcyclohexane
37. 2,3-Dimethylpentane
38. 2-Methylhexane
39. 3-Methylhexane
40. n-Heptane
41. Benzene
42. Isooctane (2,2,4-trimethylpentane)
43. 2,3,4-Trimethylpentane
44. 3-Methylheptane
45. 2-Methylheptane
46. n-Octane
47. Toluene
48. n-Nonane
49. Ethylbenzene
50. m-Xylene
51. p-Xylene
52. o-Xylene

Extended Hydrocarbon Analysis II

Column: **GS-GasPro**
113-4362
60 m x 0.32 mm

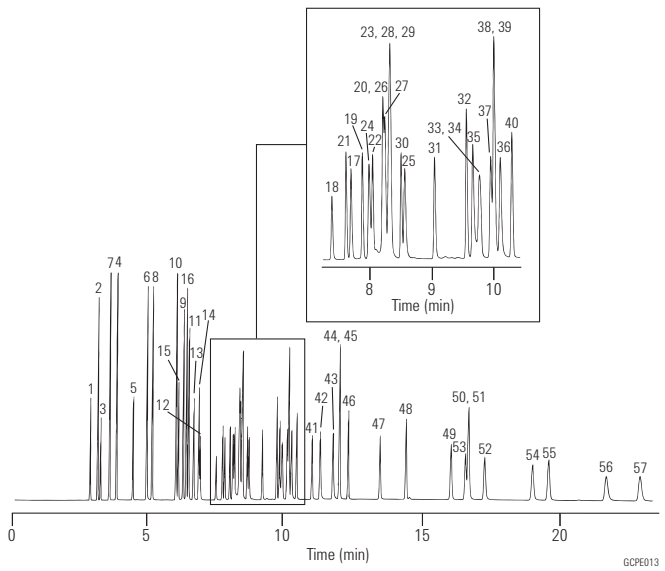
Carrier: Helium at 40 cm/s (3.3 mL/min), measured at 80 °C

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
2. Ethane
3. Ethylene
4. Propane
5. Propylene
6. Isobutane
7. Acetylene
8. n-Butane
9. trans-2-Butene
10. 1-Butene
11. cis-2-Butene
12. Cyclopentane
13. Isopentane
14. n-Pentane
15. Propyne
16. 1,3-Butadiene
17. Cyclopentene
18. 3-Methyl-1-butene
19. trans-2-Pentene
20. 2-Methyl-2-butene
21. 1-Pentene
22. cis-2-Pentene
23. Methylcyclopentane
24. 2,2-Dimethylbutane
25. Cyclohexane
26. 2,3-Dimethylbutane
27. 2-Methylpentane
28. 3-Methylpentane
29. Isoprene
30. n-Hexane
31. 4-Methyl-1-pentene
32. trans-2-Hexene
33. 2-Methyl-1-pentene
34. cis-2-Hexene
35. 2,4-Dimethylpentane
36. Methylcyclohexane
37. 2,3-Dimethylpentane
38. 2-Methylhexane
39. 3-Methylhexane
40. n-Heptane
41. Benzene
42. Isooctane (2,2,4-trimethylpentane)
43. 2,3,4-Trimethylpentane
44. 3-Methylheptane
45. 2-Methylheptane
46. n-Octane
47. Toluene
48. n-Nonane
49. Ethylbenzene
50. m-Xylene
51. p-Xylene
52. o-Xylene
53. Styrene
54. Isopropylbenzene (cumene)
55. n-Propylbenzene
56. 1,3,5-Trimethylbenzene
57. 1,2,4-Trimethylbenzene

Refinery Gas

Column: **HP-PLOT Al_2O_3 S**
19095P-S25
50 m x 0.53 mm, 15.00 µm

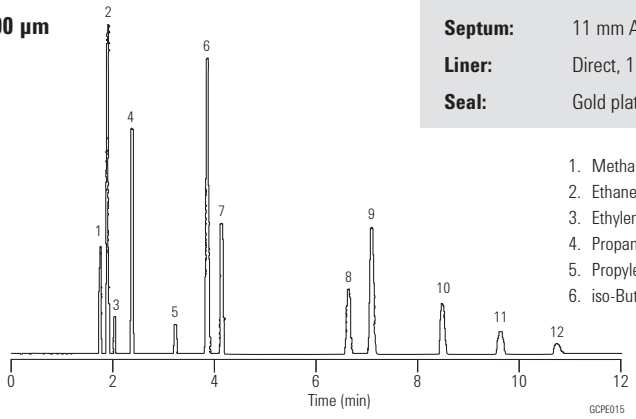
Carrier: Helium 7 mL/min

Oven: 100 °C isothermal

Injection: Split, 250 °C
Split ratio 100:1

Detector: FID, 250 °C

Sample: 5 µL



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

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 I

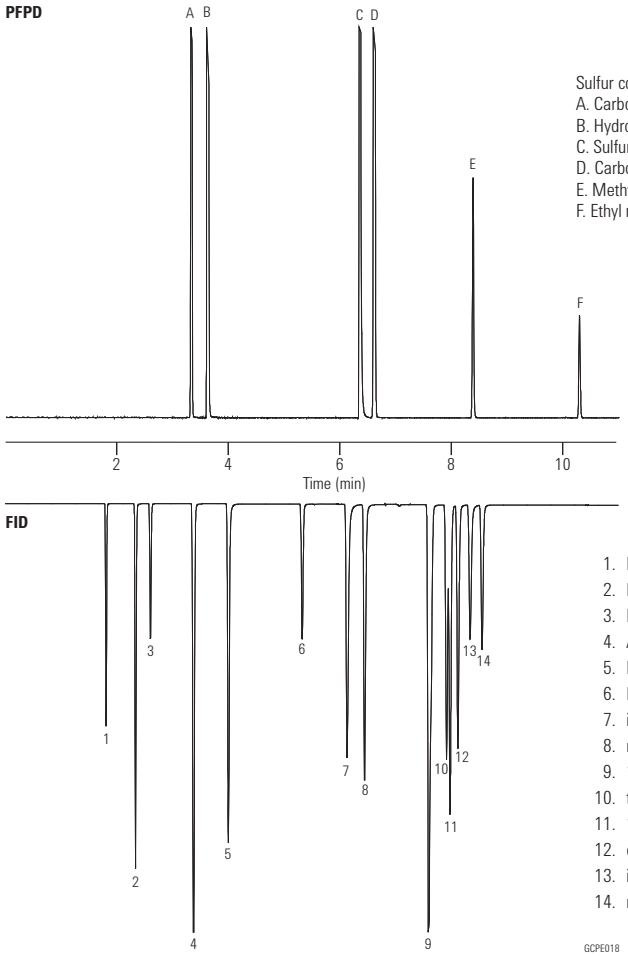
Column: **GS-GasPro**
113-4332
30 m x 0.32 mm

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

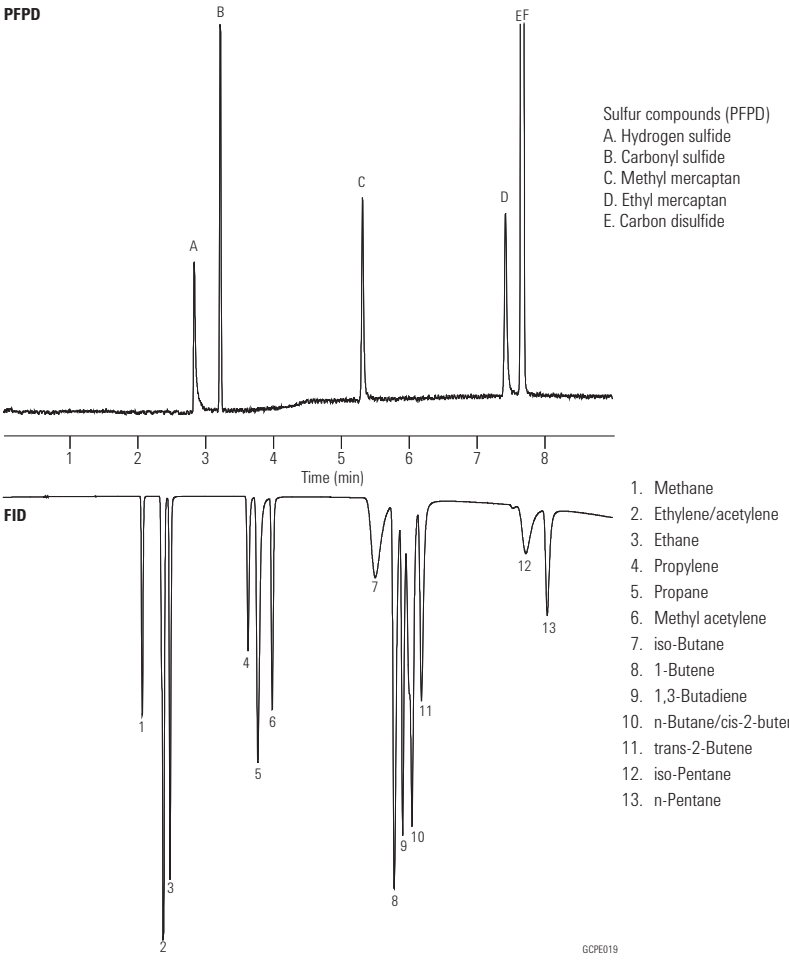
Column: **GS-Q**
113-3432
30 m x 0.32 mm, 0.20 µm

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



Sulfur compounds (PFPD)
A. Hydrogen sulfide
B. Carbonyl sulfide
C. Methyl mercaptan
D. Ethyl mercaptan
E. Carbon disulfide

1. Methane
2. Ethylene/acetylene
3. Ethane
4. Propylene
5. Propane
6. Methyl acetylene
7. iso-Butane
8. 1-Butene
9. 1,3-Butadiene
10. n-Butane/cis-2-butene
11. trans-2-Butene
12. iso-Pentane
13. 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 Compounds in Propylene (1 ppm)

Column: **GS-GasPro**
113-4332
30 m x 0.32 mm

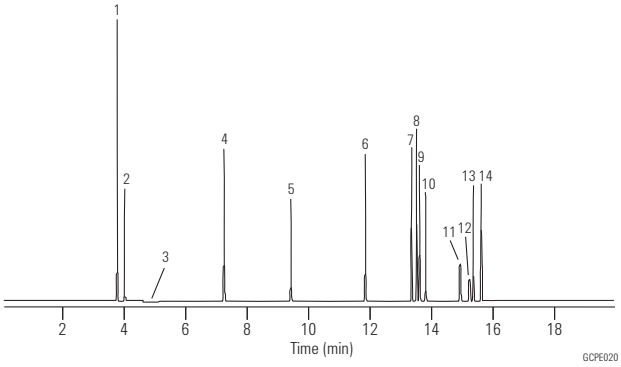
Oven: 60 °C for 2.5 min
60-250 °C at 10 °C/min

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_2S
3. Propylene
4. CS_2
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-propnaethiol
14. 1-Butanethiol

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

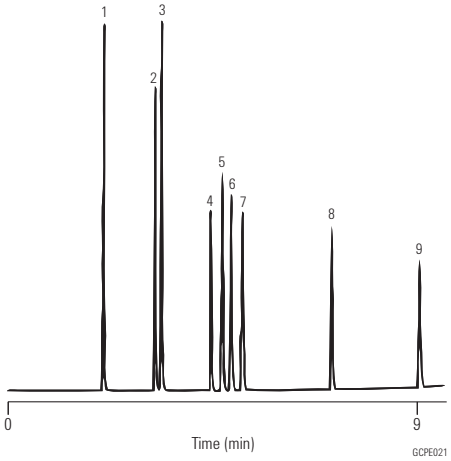
Sample: 0.2 mL

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-1propyl 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

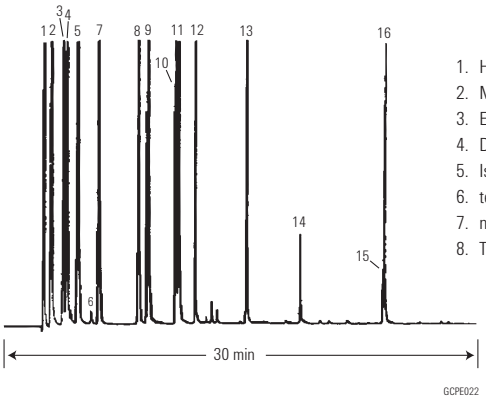
Sample: 0.5 mL

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
2. Methyl mercaptan
3. Ethyl mercaptan
4. Dimethyl sulfide
5. Isopropyl mercaptan
6. tert-Butyl mercaptan
7. n-Propyl mercaptan
8. Thiophene and sec-butyl mercaptan
9. Isobutyl mercaptan
10. n-Butyl mercaptan
11. tert-Amyl mercaptan
12. Isoamyl mercaptan
13. n-Amyl mercaptan
14. n-Hexyl mercaptan
15. tert-Dibutyl disulfide
16. n-Octyl mercaptan

Sulfur Compounds in Naphtha

Column: **HP-PONA**
19091S-001
50 m x 0.20 mm, 0.50 µm

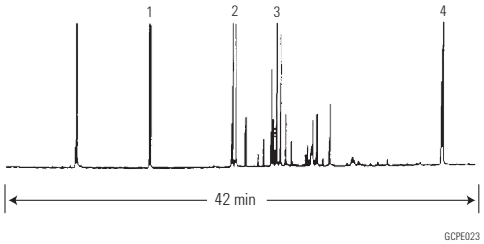
Carrier: Helium, 26 cm/s

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

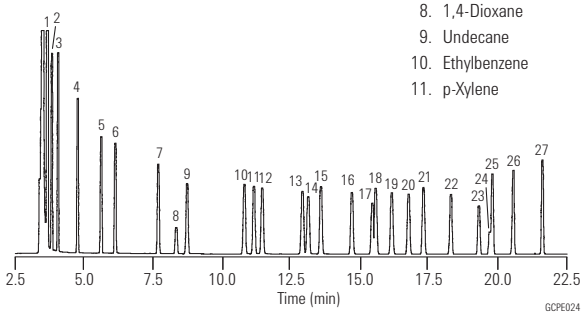
Column: **HP-INNOWax**
19091N-216
60 m x 0.32 mm, 0.50 µm

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
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. tert-Butylbenzene
20. sec-Butylbenzene
21. Styrene
22. Tridecane
23. Diethylbenzene isomer
24. Diethylbenzene isomer
25. n-Butylbenzene
26. α-Methylstyrene
27. Phenylacetylene

Aromatics Analysis – Ethylbenzene Impurities

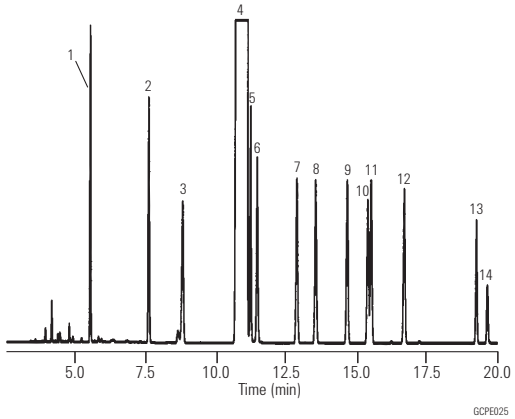
Column: **HP-INNOWax**
19091N-216
60 m x 0.32 mm, 0.50 µm

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

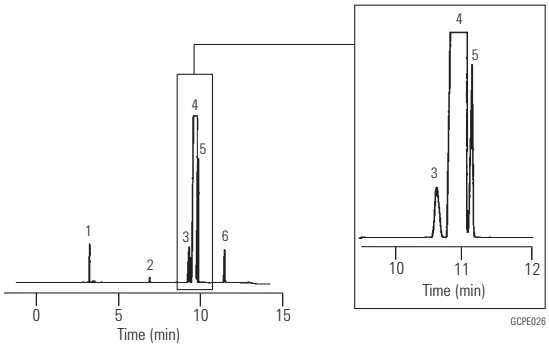
Carrier: Helium, 32 cm/s, 19.9 psi (60 °C),
2.5 mL/min constant flow

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-QO4
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

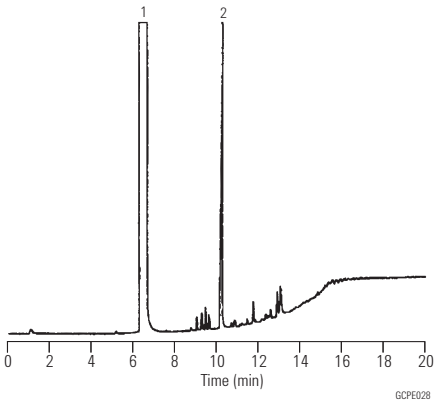
Suggested Supplies

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

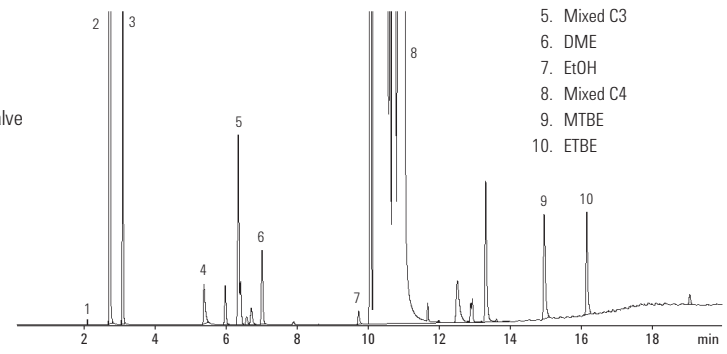
Carrier: Helium, constant flow mode, 35 cm/s, 45 °C

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



1. CH_4
2. C_2H_4
3. C_2H_6
4. MeOH
5. Mixed C3
6. DME
7. EtOH
8. Mixed C4
9. MTBE
10. ETBE

Oxygenates in Gasoline ASTM D5599 (GC-OFID)

Column: **HP-1**
19091Z-236
60 m x 0.25 mm, 1.00 µm

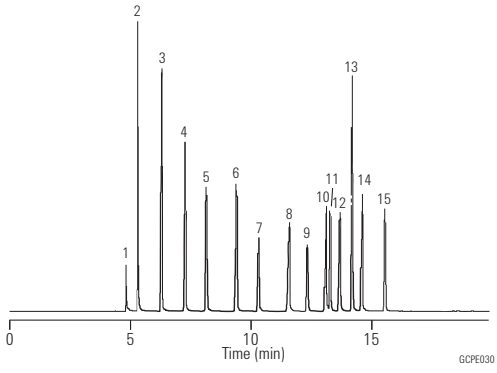
Carrier: Helium, 30 cm/s constant flow

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



1. Water
2. Methanol
3. Ethanol
4. 2-Propanol
5. t-Butanol
6. 1-Propanol
7. MTBE
8. sec-Butanol
9. DIPE
10. Isobutanol
11. ETBE
12. TAA
13. 1,2-Dimethoxyethane
14. 1-Butanol
15. TAME

Denatured Fuel Ethanol – ASTM D5501

Column: **HP-1**
19091Z-530
100 m x 0.25 mm, 0.50 µm

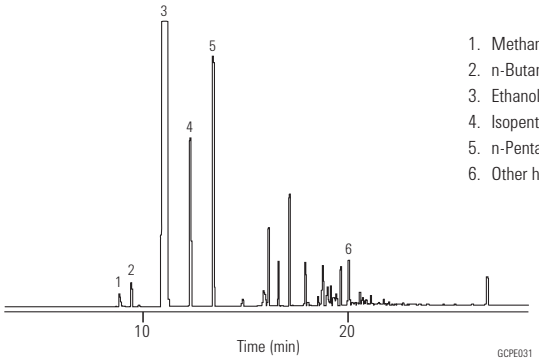
Carrier: Helium 24 cm/s

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

PONA Mix as Specified by AFNOR Method #2

Column: **DB-Petro**
128-1056
50 m x 0.20 mm, 0.50 µm

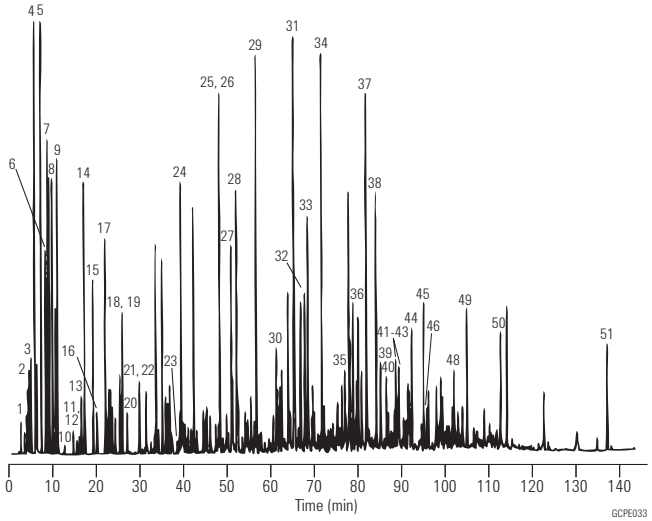
Carrier: Helium at 16.7 cm/s, measured at 35 °C

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 reformate



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

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

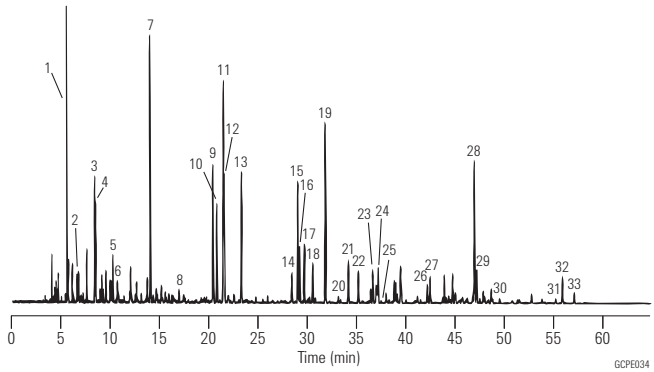
Oven: 50 °C for 1 min
50-190 °C at 2 °C/min
190 °C for 1 min

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)
2. n-Hexane
3. Benzene-d6 (IS)
4. Benzene
5. Isooctane
6. n-Heptane
7. Toluene
8. n-Octane
9. Ethylbenzene-d10 (IS)
10. Ethylbenzene
11. m-Xylene
12. p-Xylene
13. o-Xylene
14. n-Propylbenzene
15. 1-Methyl-3-ethylbenzene
16. 1-Methyl-4-ethylbenzene
17. 1,3,5-Trimethylbenzene
18. 1-Methyl-2-ethylbenzene
19. 1,2,4-Trimethylbenzene
20. n-Decane
21. 1,2,3-Trimethylbenzene
22. Indan
23. 1,4-Diethylbenzene
24. n-Butylbenzene (valley)
25. 1,2-Diethylbenzene
26. 1,2,4,5-Tetramethylbenzene
27. 1,2,3,5-Tetramethylbenzene
28. Naphthalene-d8 (IS)
29. Naphthalene
30. n-Dodecane
31. Pentamethylbenzene
32. 2-Methylnaphthalene
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

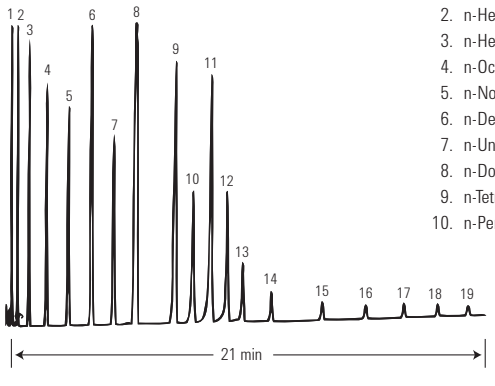
Septum: Non-stick bleed and temperature optimized (BTO) septa, 11 mm, 50/pk, 5183-4757

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

1. n-Pentane
2. n-Hexane
3. n-Heptane
4. n-Octane
5. n-Nonane
6. n-Decane
7. n-Undecane
8. n-Dodecane
9. n-Tetradecane
10. n-Pentadecane
11. n-Hexadecane
12. n-Heptadecane
13. n-Octadecane
14. n-Eicosane
15. n-Tetracosane
16. n-Octacosane
17. n-Dotriacontane
18. n-Hexatriacontane
19. n-Tetracontane



Reference Gas Oil

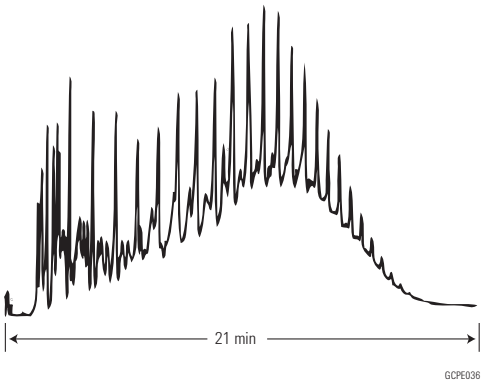
Column: **DB-2887**
125-2814
10 m x 0.53 mm, 3.00 µm

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

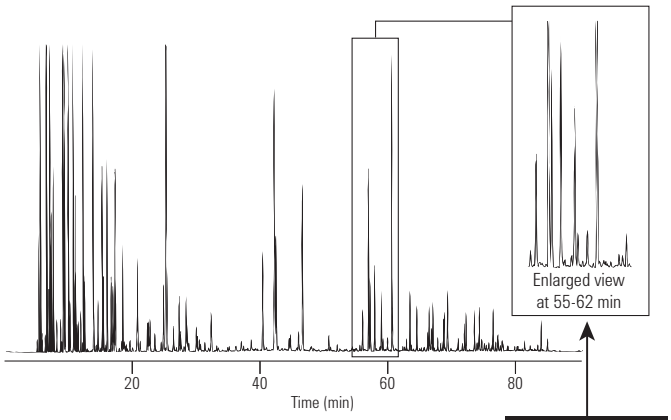
Carrier: Hydrogen at 31 cm/s

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

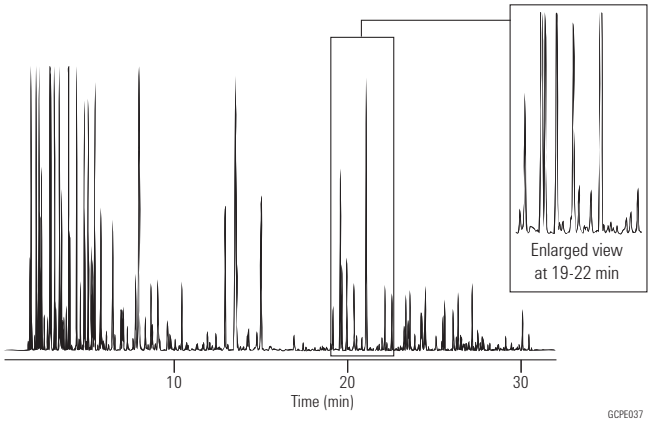
Carrier: Hydrogen at 34.8 cm/s

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 µm

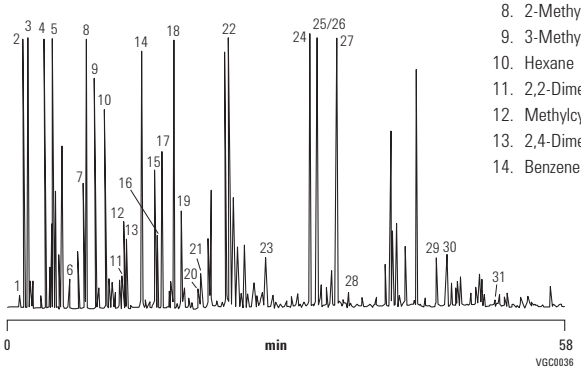
Sample: 0.1 µL

Carrier: Helium, 240 kPa (2.4 bar, 34 psi)

Oven: 35 °C (7 min) to 250 °C, 3 °C/min

Injection: Split, 80 mL/min

Detector: FID



1. Propane
2. Isobutane
3. Butane
4. 2-Methylbutane
5. Pentane
6. 2,2-Dimethylbutane
7. 2,3-Dimethylbutane
8. 2-Methylpentane
9. 3-Methylpentane
10. Hexane
11. 2,2-Dimethylpentane
12. Methylcyclopentane
13. 2,4-Dimethylpentane
14. Benzene
15. 2-Methylhexane
16. 2,3-Dimethylpentane
17. 3-Methylhexane
18. Tert. amyl methyl ether (TAME)
19. Unknown
20. 2,2-Dimethylhexane
21. Methylcyclohexane
22. Toluene
23. Octane
24. Ethylbenzene
25. p-Xylene
26. m-Xylene
27. o-Xylene
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 µm

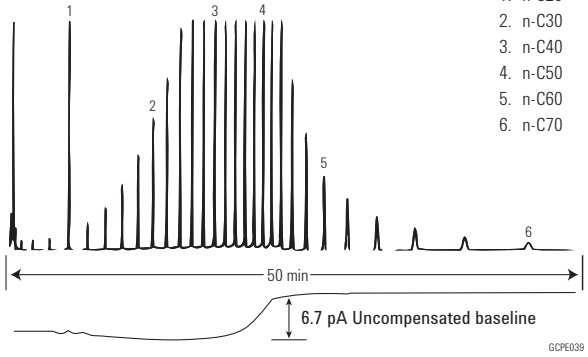
Carrier: Helium at 8 mL/min

Oven: 120-360 °C at 10 °C/min

Injection: Split ratio 1:500

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

Sample: 0.5 µL
3% solution in CS_2



1. n-C20
2. n-C30
3. n-C40
4. n-C50
5. n-C60
6. n-C70

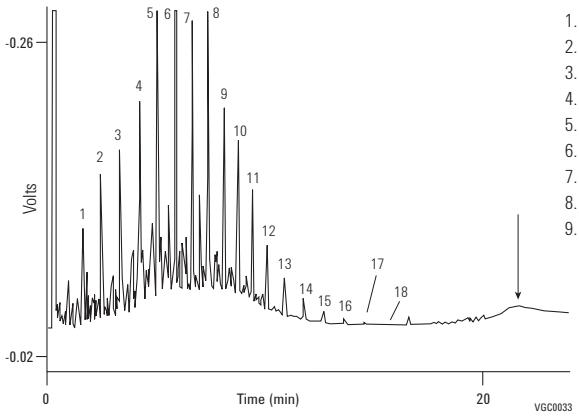
Diesel Analysis

Column: **VF-5ht Fused Silica CP9047 15 m x 0.32 mm, 0.10 µm**

Carrier: H_2, 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



1. C10
2. C11
3. C12
4. C13
5. C14
6. C15
7. C16
8. C17
9. C18
10. C19
11. C20
12. C21
13. C22
14. C23
15. C24
16. C25
17. C26
18. C27

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

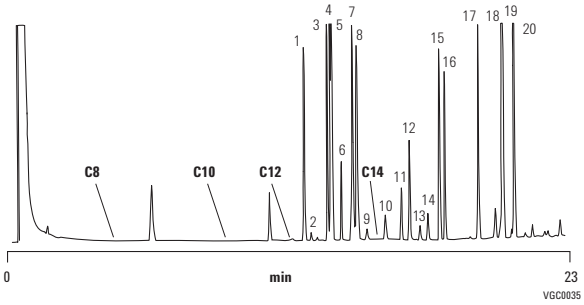
Carrier: He, 28.8 kPa (0.288 bar, 4.1 psi)

Oven: 50 °C (5 min) to 240 °C, 10 °C/min

Injection: Split, T=250 °C

Detector: FID, T=250 °C

1. Acetaldehyde
2. Diethyl ether
3. Ethyl tert-butyl ether
4. Methyl tert-butyl ether
5. Diisopropyl ether
6. Propionaldehyde (propanol)
7. Tert-amyl methyl ether
8. Dipropyl ether
9. Isobutyraldehyde
10. Butyraldehyde
11. Methanol
12. Acetone
13. Isovaleraldehyde
14. Valeraldehyde
15. 2-Butanone
16. Ethanol
17. 1-Propanol
18. 2-Methyl-1-propanol (isobutanol)
19. 2-Methyl-2-propanol (tert-butanol)
20. 1-Butanol



Analysis of Process Gas

Column: **HP-PLOT Q PT**
19095P-Q04PT
30 m x 0.53 mm, 40.00 µm

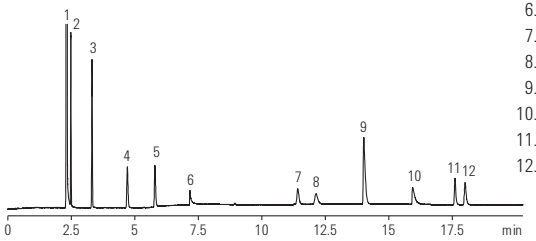
Instrument: Agilent 7890A

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

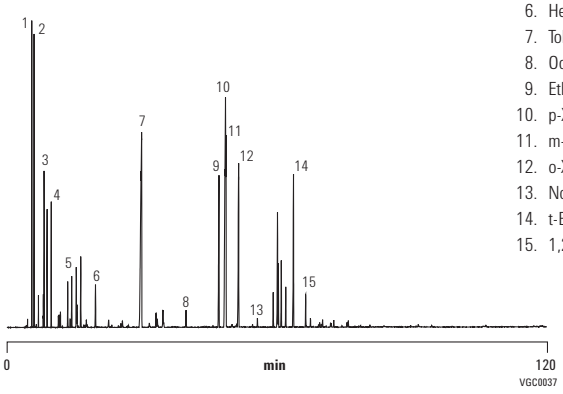
Sample: 0.2 µL

Carrier: Helium

Oven: 35 ºC (30 min) at 2 ºC/min to 200 ºC (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 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

Sample: 1 µL of 0.01-0.05% each solvent in CS_2

Suggested Supplies

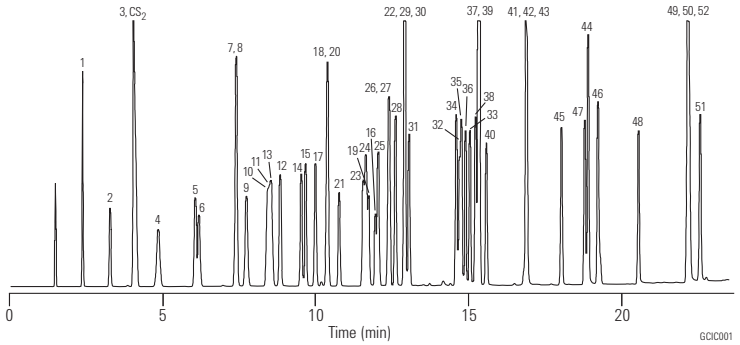
Septum: 11 mm Advanced Green septa, 5183-4759

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

1. Methanol
2. Ethanol
3. Isopropanol
4. tert-Butanol
5. 2-Propen-1-ol (allyl alcohol)
6. 1-Propanol
7. 2-Propyn-1-ol (propargyl alcohol)
8. sec-Butanol
9. 2-Methyl-3-buten-2-ol
10. Isobutanol
11. 2-Methoxyethanol (methyl cellosolve)
12. 3-Buten-1-ol
13. 2-Methyl-2-butanol (tert-amyl alcohol)
14. 1-Butanol
15. 2-Buten-1-ol (crotyl alcohol)
16. Ethylene glycol
17. 1-Penten-3-ol
18. 2-Pentanol
19. Glycidol
20. 3-Pentanol
21. 2-Ethoxyethanol (cellosolve)
22. Propylene glycol
23. 3-Methyl-1-butanol (isoamyl alcohol)
24. 2-Methyl-1-butanol (active amyl alcohol)
25. 4-Methyl-2-pentanol
26. 1-Pentanol
27. 2-Penten-1-ol
28. 3-Methyl-2-buten-1-ol
29. Cyclopentanol
30. 3-Hexanol
31. 2-Hexanol
32. 4-Hydroxy-4-methyl-2-pentanone
33. Furfuryl alcohol
34. cis-3-Hexen-1-ol
35. 1-Hexanol
36. cis-2-Hexen-1-ol
37. Cyclohexanol
38. 3-Heptanol
39. 2-Heptanol
40. 2-Butoxyethanol (butyl cellosolve)
41. cis-4-Hepten-1-ol
42. trans-2-Hepten-1-ol
43. 1-Heptanol
44. Benzyl alcohol
45. 2-Ethyl-1-hexanol
46. α-Methylphenyl alcohol
47. 1-Octanol
48. 1-Nonanol
49. 2-Phenoxyethanol
50. α-Ethylphenethyl alcohol
51. β-Ethylphenethyl alcohol
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

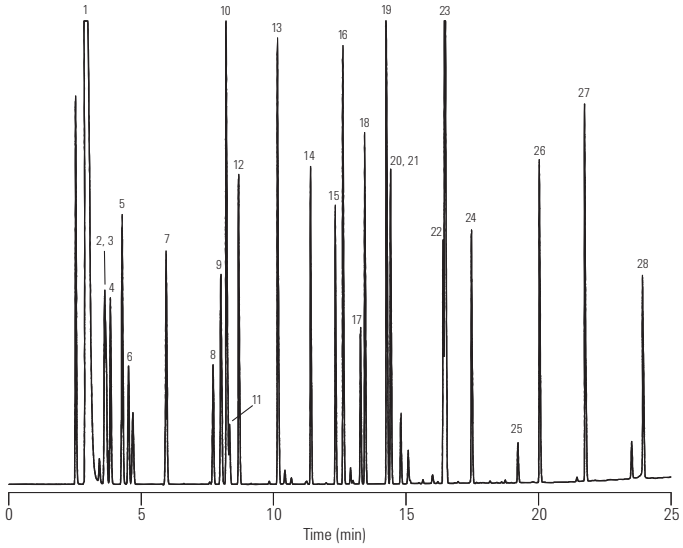
Suggested Supplies

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

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

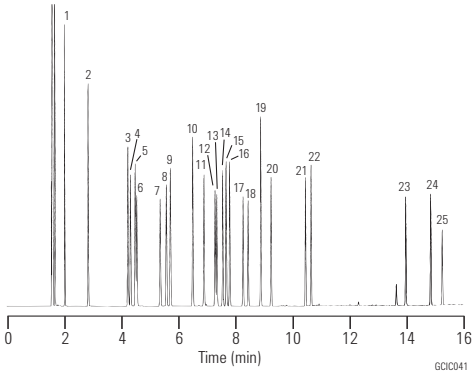
Suggested Supplies

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
2. Toluene
3. Ethylbenzene
4. Chlorobenzene
5. p-Xylene
6. m-Xylene
7. o-Xylene
8. Styrene
9. Isopropylbenzene
10. n-Propylbenzene
11. 2-Chlorotoluene
12. 3-Chlorotoluene
13. 4-Chlorotoluene
14. tert-Butylbenzene
15. sec-Butylbenzene
16. Isobutylbenzene
17. 1,3-Dichlorobenzene
18. 1,4-Dichlorobenzene
19. n-Butylbenzene
20. 1,2-Dichlorobenzene
21. 1,3-Diisopropylbenzene
22. 1,4-Diisopropylbenzene
23. 2-Nitrotoluene
24. 3-Nitrotoluene
25. 4-Nitrotoluene

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

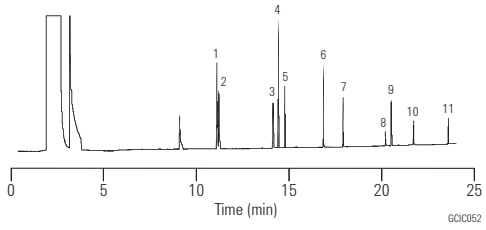
Suggested Supplies

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

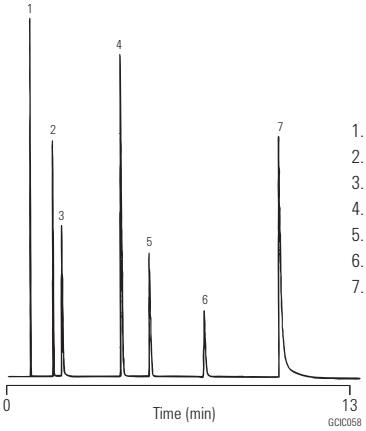
Carrier: Helium at 53 cm/s

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



1. Nitrogen
2. CO_2
3. SF_6
4. COS
5. H_2S
6. Ethylene oxide
7. SO_2

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

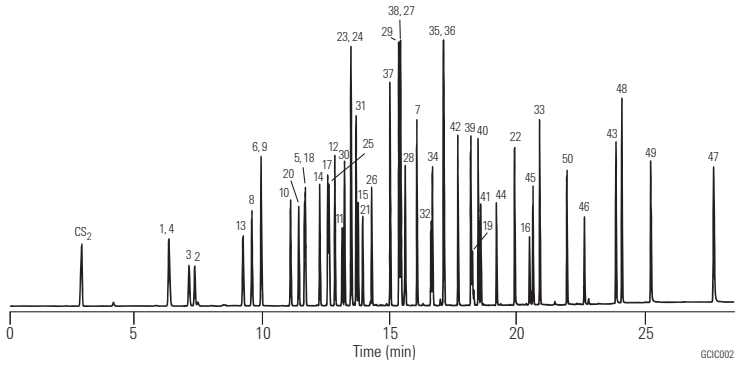
Detector: FID, 250 °C
Nitrogen makeup gas
at 35 mL/min

Sample: 1 µL of 0.15%
each solvent in CS_2

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

1. Methanol
2. Ethanol
3. Isopropanol
4. tert-Butanol
5. 2-Propen-1-ol (allyl alcohol)
6. 1-Propanol
7. 2-Propyn-1-ol (propargyl alcohol)
8. sec-Butanol
9. 2-Methyl-3-buten-2-ol
10. Isobutanol
11. 2-Methoxyethanol (methyl cellosolve)
12. 3-Buten-1-ol
13. 2-Methyl-2-butanol (tert-amyl alcohol)
14. 1-Butanol
15. 2-Buten-1-ol (crotyl alcohol)
16. Ethylene glycol
17. 1-Penten-3-ol
18. 2-Pentanol
19. Glycidol
20. 3-Pentanol
21. 2-Ethoxyethanol (cellosolve)
22. Propylene glycol
23. 3-Methyl-1-butanol (isoamyl alcohol)
24. 2-Methyl-1-butanol (active amyl alcohol)
25. 4-Methyl-2-pentanol
26. 1-Pentanol
27. 2-Penten-1-ol
28. 3-Methyl-2-buten-1-ol
29. Cyclopentanol
30. 3-Hexanol
31. 2-Hexanol
32. 4-Hydroxy-4-methyl-2-pentanone
33. Furfuryl alcohol
34. cis-3-Hexen-1-ol
35. cis-2-Hexen-1-ol
36. Cyclohexanol
37. 3-Heptanol
38. 2-Heptanol
39. 2-Butoxyethanol (butyl cellosolve)
40. cis-4-Hepten-1-ol
41. trans-2-Hepten-1-ol
42. 1-Heptanol
43. Benzyl alcohol
44. 2-Ethyl-1-hexanol
45. 1-Octanol
46. 1-Nonanol
47. 2-Phenoxyethanol
48. a-Ethylphenethyl alcohol
49. b-Ethylphenethyl alcohol
50. 1-Decanol



Alcohols III

Column: **HP-INNOWax**
19095N-123
30 m x 0.53 mm, 1.00 µm

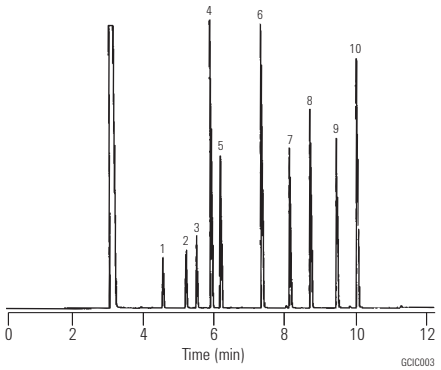
Carrier: Helium, 29 cm/s, 3.0 psi (45 °C)

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

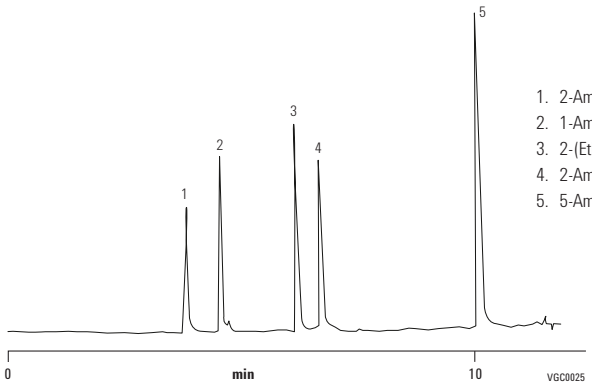
Solvent: Water

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-propaol
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

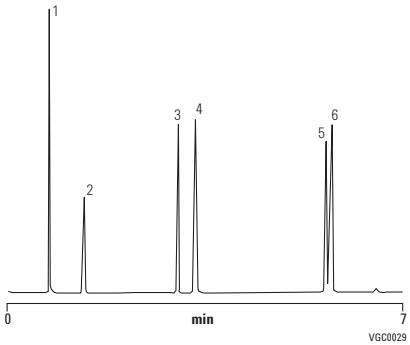
Solvent: Methanol

Carrier: Helium, 50 kPa, 55 cm/s

Oven: 35 °C (0.5 min) to 240 °C, 30 °C/min

Injection: Split

Detector: MS



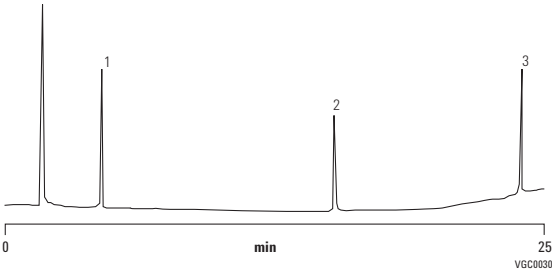
1. Methanol
2. IPA
3. Mono ethylene glycol
4. MMEA methyl monoethanolamine
5. Diethanolamine
6. MDEA methyl diethanolamine

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)

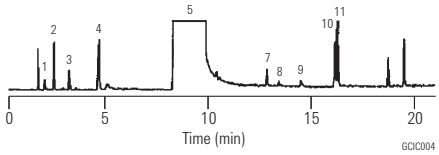
Ethoxyethanol

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
2. Ethyl formate
3. Ethyl alcohol
4. Water
5. 2-Ethoxyethanol
6. 2-Ethoxyethyl acetate
7. Hydroxy acetate
8. Acetic acid
9. Formic acid
10. Ethylene glycol/monoformate
11. Ethylene glycol/monoacetate

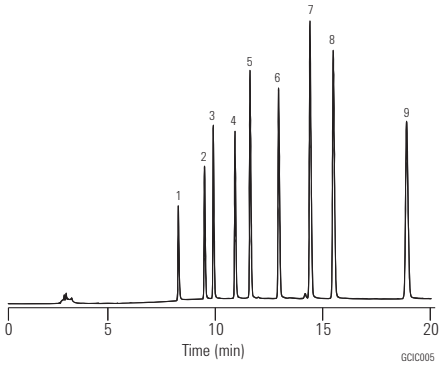
Organic Acids

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
2. Propionic acid
3. Isobutyric acid
4. Butyric acid
5. Isovaleric acid
6. Valeric acid (pentanoic acid)
7. Isocaproic acid
8. Caproic acid (hexanoic acid)
9. Heptanoic acid

Free Organic Acids/C_4-C_5 Isomers

Column: **HP-INNOWax**
19091N-133
30 m x 0.25 mm, 0.25 µm

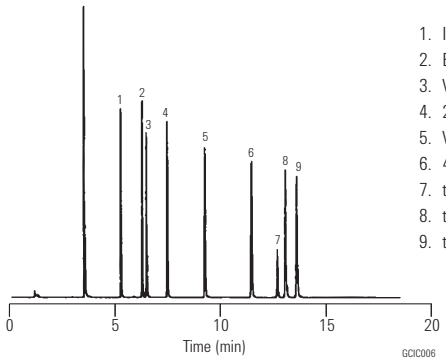
Carrier: Helium 42 cm/s, 24 psi (120 °C)
1.8 mL/min constant flow

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-butenoic acid
8. trans-3-Pentenoic acid
9. trans-2-Pentenoic acid

Volatile Amines

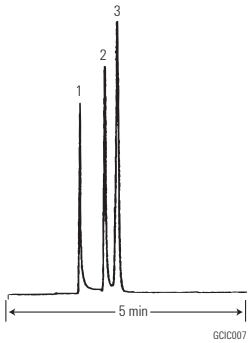
Column: **DB-1**
125-1035
30 m x 0.53 mm, 5.00 µm

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

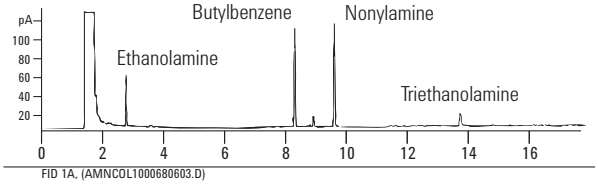
Oven: 75 °C for 0.5 min
75-250 °C at 10 °C/min
250-320 °C at 25 °C/min
320 °C for 5 min

Injection: On-column
Oven tracking mode

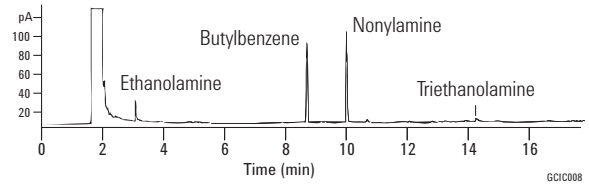
Detector: FID, 300 °C

Sample: 0.5 µL of each standard in methanol

HP-5ms



non-Agilent 5% phenyl amines column



Primary Amines

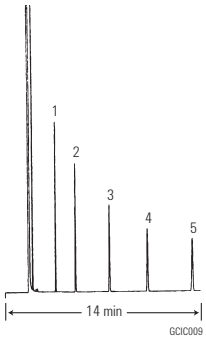
Column: **CAM**
112-2132
30 m x 0.25 mm, 0.25 µm

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 µm

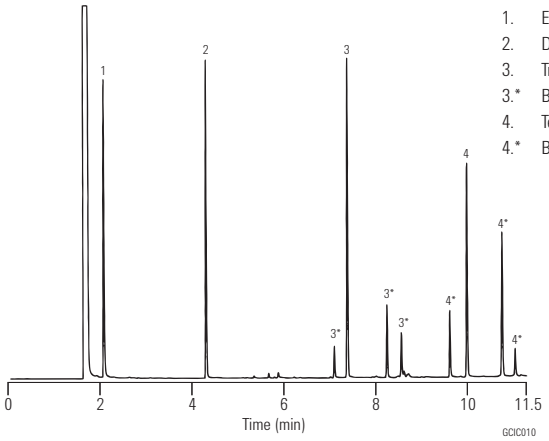
Carrier: Helium at 30 cm/s, measured at 100 °C

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 µL of 100 ng/µL standard in methanol



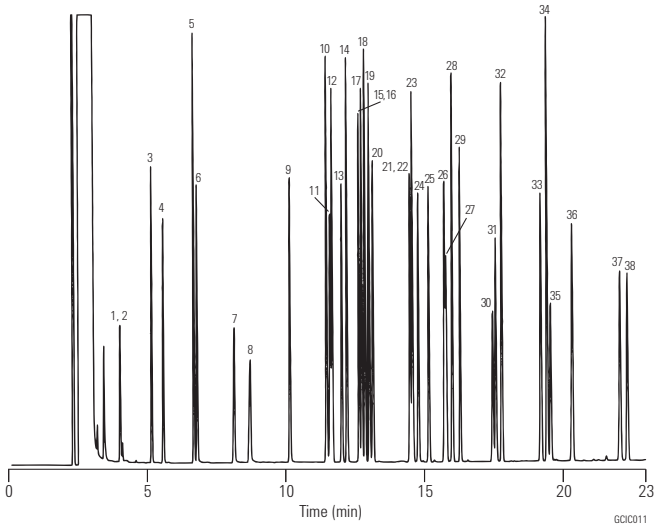
1. Ethylenediamine
2. Diethylenetriamine
3. Triethylenetetramine
3.* Branched and piperazine analogs of peak 3
4. Tetraethylenepentamine
4.* Branched and piperazine analogs of peak 4

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
2. Propionitrile
3. Diisopropylamine
4. Triethylamine
5. Pyridine
6. Pyrimidine
7. Pyrazole
8. Acrylamide
9. Pyridazine
10. Aniline
11. 3-Bromopyridine
12. Benzonitrile
13. 3-Cyanopyridine
14. Benzylamine
15. n-Octylamine
16. 1-Methyl-2-pyrrolidine
17. N,N-Dimethylbenzylamine
18. Phenylethylamine
19. N-Benzylmethylamine
20. 2-Cyanopyridine
21. 2-Chloroaniline
22. n-Nonylamine
23. 2,4-Dimethylaniline
24. 4-Chlorobenzonitrile
25. 2,6-Dimethylaniline
26. 3-Chloroaniline
27. 4-Chloroaniline
28. N,N-Diethylaniline
29. n-Decylamine
30. 4-Bromoaniline
31. 3,4-Diaminotoluene
32. 2,6-Diethylaniline
33. 2-Nitroaniline
34. Dicyclohexylamine
35. 3,4-Dichloroaniline
36. 3-Nitroaniline
37. 4-Nitroaniline
38. Diphenylaniline

Amines in Water

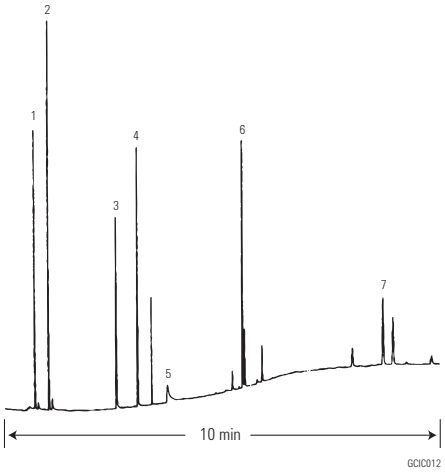
Column: **CAM**
112-2132
30 m x 0.25 mm, 0.25 µm

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

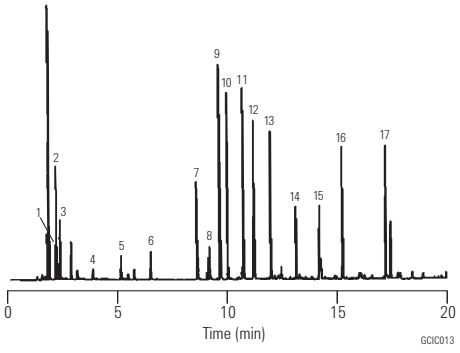
Injection: Split, 250 °C
Split ratio 40:1

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

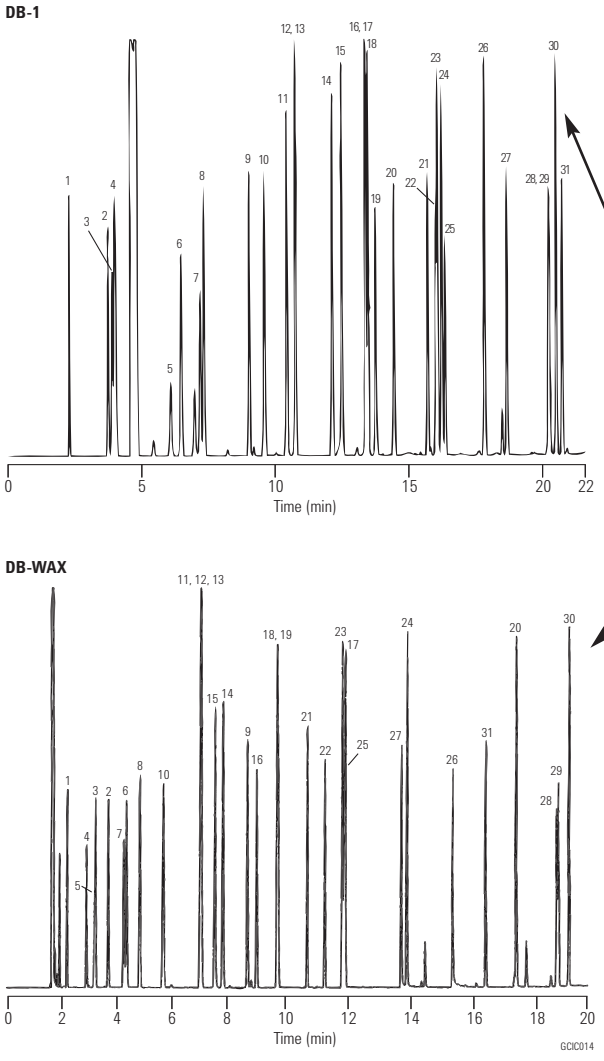
Septum: 11 mm Advanced Green septa, 5183-4759

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

1. Acetaldehyde
2. Acrolein
3. Acetone
4. Propionaldehyde
5. Isobutyraldehyde
6. Methacrolein
7. Butyraldehyde
8. 2-Butanone (MEK)
9. Crotonaldehyde
10. 3-Methyl-2-butanone
11. 2-Pentanone
12. 3-Pentanone
13. Valeraldehyde (pentanal)
14. 4-Methyl-2-pentanone (MIBK)
15. 2-Methyl-3-pentanone
16. 3-Hexanone
17. Cyclopentanone
18. 2-Hexanone
19. Hexanal
20. Furfural
21. 4-Heptanone
22. 3-Heptanone
23. 2-Heptanone
24. Cyclohexanone
25. Heptanal
26. Benzaldehyde
27. Octyl aldehyde
28. o-Tolualdehyde
29. m-Tolualdehyde
30. p-Tolualdehyde
31. Nonyl aldehyde



DB-1 provides the best overall resolution; however, DB-WAX provides better resolution of o- and m-tolualdehyde.

Formaldehyde Underivatized

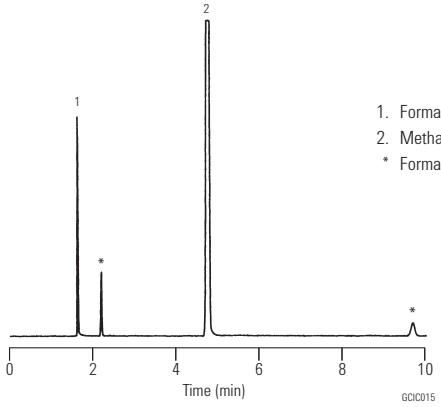
Column: **DB-WAX**
123-7033
30 m x 0.32 mm, 0.50 µm

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



1. Formaldehyde
2. Methanol
* Formaldehyde by-products

Formaldehyde-DNPH Derivative

Column: **DB-1**
123-1012
15 m x 0.32 mm, 0.25 µm

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

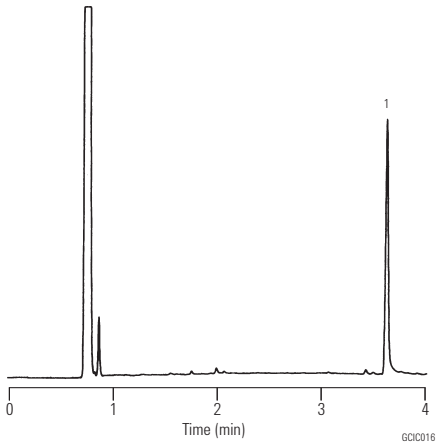
Suggested Supplies

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



1. Formaldehyde-DNPH

PFBHA Derivative

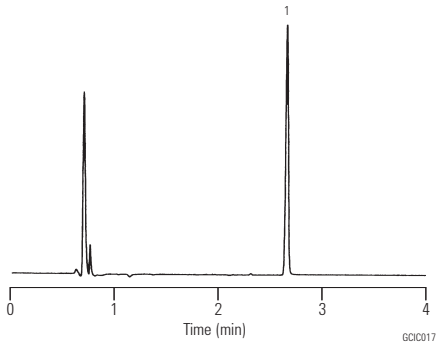
Column: **DB-1**
123-1012
15 m x 0.32 mm, 0.25 µm

Carrier: Helium at 40 cm/s, measured at 60 °C

Oven: 60-100 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:100

Detector: FID, 375 °C
Nitrogen makeup gas at 35 mL/min



1. Formaldehyde-PFBHA

Aromatics I

Column: **DB-1**
125-1034
30 m x 0.53 mm, 3.00 µm

Carrier: Helium at 30 cm/s, measured at 40 °C

Oven: 40 °C for 5 min
40-260 °C at 10 °C/min

Injection: Split, 250 °C
Split ratio 1:10

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

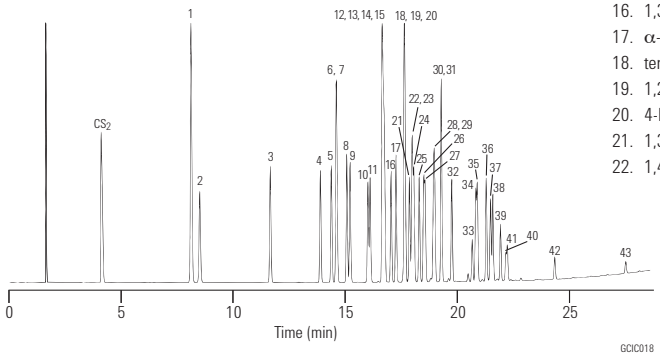
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

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



1. Benzene
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
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

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

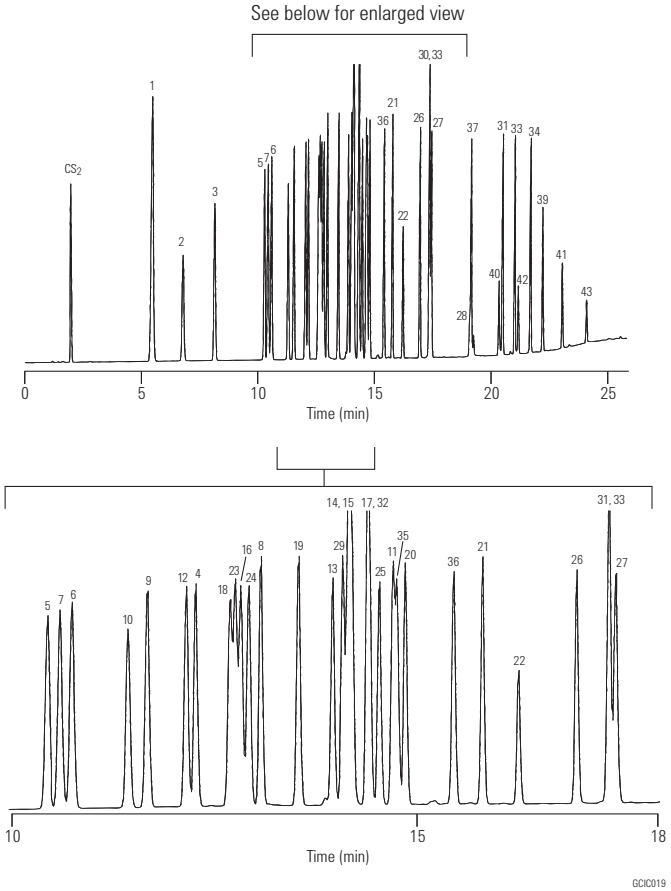
Suggested Supplies

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

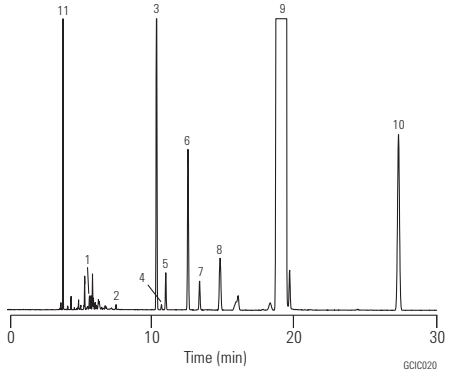
Suggested Supplies

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



1. Benzene
2. Toluene
3. Ethylbenzene
4. p-Xylene
5. m-Xylene
6. Isopropylbenzene
7. o-Xylene
8. n-Propylbenzene
9. Styrene
10. α-Methylstyrene
11. Heptane (IS)

Impurities in Ethylbenzene

Column: **HP-INNOWax**
19091N-216
60 m x 0.32 mm, 0.50 µm

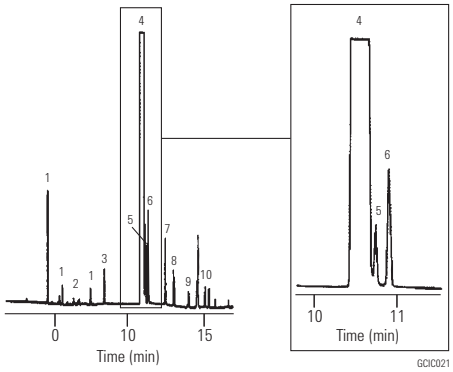
Carrier: Helium, 32 cm/s, 19.9 psi (60 °C)
2.5 mL/min constant flow

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%+



1. Hydrocarbon
2. Benzene
3. Toluene
4. Ethylbenzene
5. p-Xylene
6. m-Xylene
7. Cumene
8. o-Xylene
9. Propylbenzene
10. Styrene

Pyrolysates of Polystyrene

Column: **Ultra 1**
19091A-105
50 m x 0.20 mm, 0.33 µm

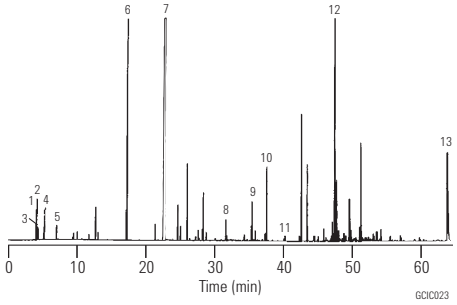
Carrier: Helium, 30 psi, 12 mL/min

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_2CH_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

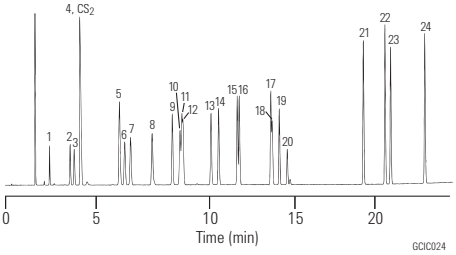
Suggested Supplies

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
2. Ethyl formate
3. Methyl acetate
4. Vinyl acetate
5. Ethyl acetate
6. Propyl formate
7. Methyl propionate
8. Isopropyl acetate
9. Ethyl acrylate
10. tert-Butyl acetate
11. Ethyl propionate
12. Propyl acetate
13. sec-Butyl acetate
14. Isobutyl acetate
15. Propyl propionate
16. Butyl acetate
17. Isoamyl acetate
18. Amyl acetate
19. 2-Ethoxyethyl acetate
20. 2-Methylbutyl acetate
21. Methyl benzoate
22. Benzyl acetate
23. Ethyl benzoate
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

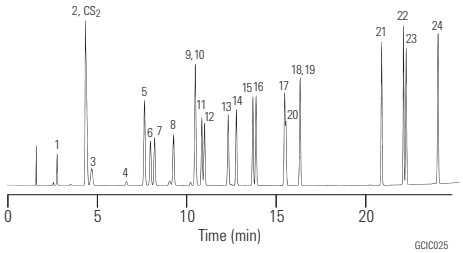
Suggested Supplies

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
2. Ethyl formate
3. Methyl acetate
4. Vinyl acetate
5. Ethyl acetate
6. Propyl formate
7. Methyl propionate
8. Isopropyl acetate
9. Ethyl acrylate
10. tert-Butyl acetate
11. Ethyl propionate
12. Propyl acetate
13. sec-Butyl acetate
14. Isobutyl acetate
15. Propyl propionate
16. Butyl acetate
17. Isoamyl acetate
18. Amyl acetate
19. 2-Ethoxyethyl acetate
20. 2-Methylbutyl acetate
21. Methyl benzoate
22. Benzyl acetate
23. Ethyl benzoate
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

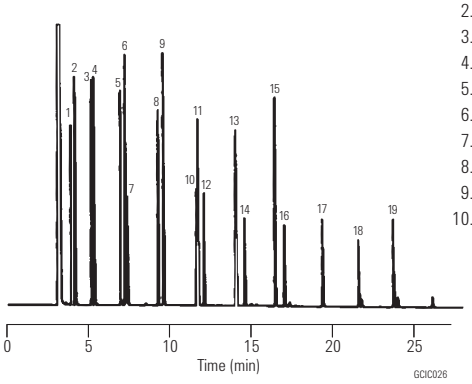
Suggested Supplies

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
2. Propyl acetate
3. Ethyl butyrate
4. Propyl propionate
5. Propyl butyrate
6. Ethyl valerate
7. Butyl propionate
8. Propyl valerate
9. Ethyl caproate
10. Butyl valerate
11. Propyl caproate
12. Methyl decanoate
13. Butyl caproate
14. Methyl dodecanoate
15. Butyl heptanoate
16. Methyl tetradecanoate
17. Methyl hexadecanoate
18. Methyl octadecanoate
19. Methyl eicosenoate

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

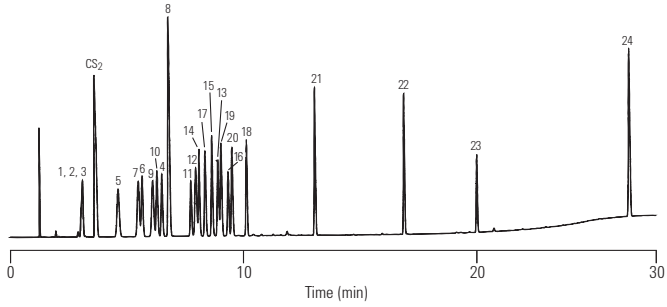
Suggested Supplies

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
2. Ethyl vinyl ether
3. Ethyl ether
4. 1,3-Dioxalane
5. Methyl-tert-butyl ether (MTBE)
6. Allyl ethyl ether
7. Isopropyl ether
8. Tetrahydrofuran (THF)
9. tert-Amyl methyl ether
10. Butyl methyl ether
11. Glyme (propylene glycol dimethyl ether)
12. tert-Amyl methyl ether
13. Diglyme (diethylene glycol dimethyl ether)
14. Propyl ether
15. Allyl ether
16. 1,4-Dioxane
17. Butyl ethyl ether
18. Epichlorohydrin
19. Tetrahydropyran
20. Acetal (acetaldehyde diethyl acetal)
21. Butyl ether
22. Pentyl ether
23. Triglyme (triethylene glycol dimethyl ether)
24. Benzyl ether

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

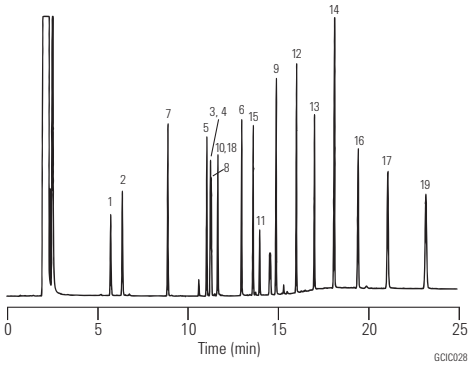
Suggested Supplies

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
2. Ethylene glycol monoethyl ether
3. 1,3-Propandiol
4. 1,2-Propandiol (propylene glycol)
5. 2,3-Butandiol
6. 1,3-Butandiol
7. Ethylene glycol monobutyl ether
8. Diethylene glycol monomethyl ether
9. 1,4-Butandiol
10. Diethylene glycol monoethyl ether
11. Dipropylene glycol
12. 1,5-Pentandiol
13. 1,6-Hexandiol
14. 1,7-Heptandiol
15. Diethylene glycol monobutyl ether
16. 1,8-Octandiol
17. 1,9-Nonandiol
18. Ethylene glycol
19. 1,10-Decandiol

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

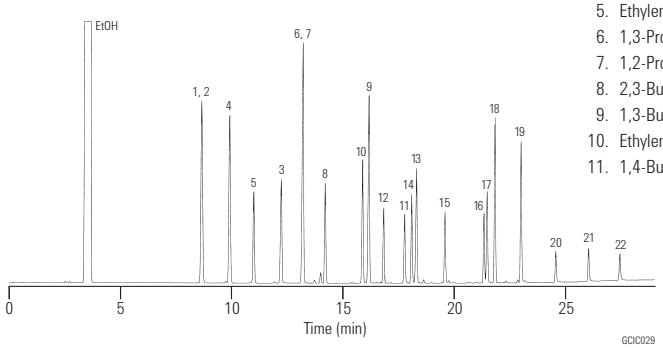
Oven: 40 °C for 5 min
40-260 °C at 10 °C/min
260 °C for 3 min

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
2. Glyme
3. Ethylene glycol
4. Diglyme
5. Ethylene glycol monoethyl ether
6. 1,3-Propanediol
7. 1,2-Propanediol (propylene glycol)
8. 2,3-Butanediol
9. 1,3-Butanediol
10. Ethylene glycol monobutyl ether
11. 1,4-Butanediol
12. Diethylene glycol monomethyl ether
13. Diethylene glycol
14. Diethylene glycol monoethyl ether
15. 1,5-Pentanediol
16. 1,6-Hexanediol
17. Diethylene glycol monobutyl ether
18. Triglyme
19. 1,7-Heptanediol
20. 1,8-Octanediol
21. 1,9-Nonanediol
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

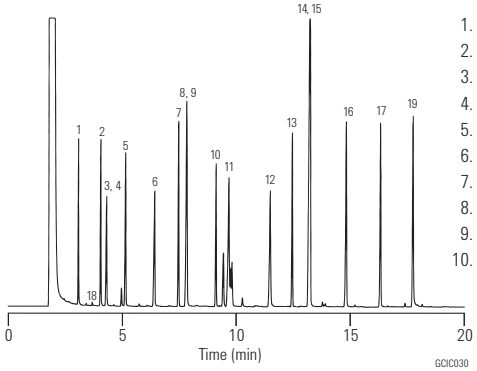
Injection: Split, 250 °C

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
2. Ethylene glycol monoethyl ether
3. 1,3-Propanediol
4. 1,2-Propanediol
5. 2,3-Butanediol
6. 1,3-Butanediol
7. Ethylene glycol monobutyl ether
8. Diethylene glycol monomethyl ether
9. 1,4-Butanediol
10. Diethylene glycol monoethyl ether
11. Dipropylene glycol
12. 1,5-Pentanediol
13. 1,6-Hexanediol
14. 1,7-Heptanediol
15. Diethylene glycol monobutyl ether
16. 1,8-Octanediol
17. 1,9-Nonanediol
18. Ethylene glycol
19. 1,10-Decanediol

Triethylene Glycol and Impurities

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: 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 µL

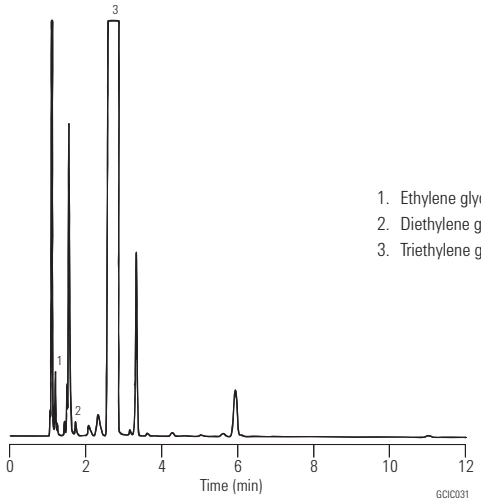
Suggested Supplies

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. Ethylene glycol
2. Diethylene glycol
3. Triethylene glycol

Ethylene Glycol Mixture

Column: **Ultra 1**
19091A-101
12 m x 0.20 mm, 0.33 µm

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 µL

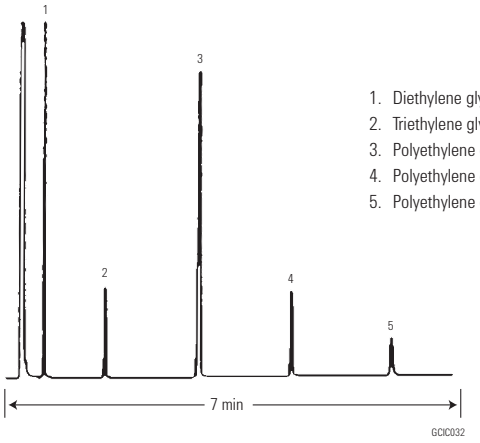
Suggested Supplies

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



1. Diethylene glycol
2. Triethylene glycol
3. Polyethylene glycol 200
4. Polyethylene glycol 400
5. Polyethylene glycol 600

Glycols/Diols

Column: **HP-1**
19095Z-023
30 m x 0.53 mm, 0.88 µm

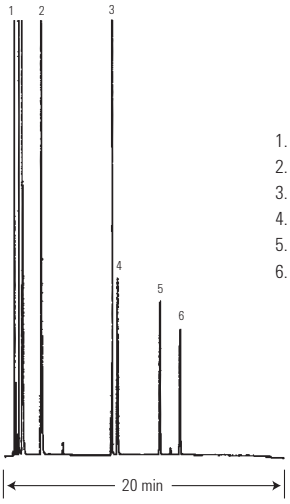
Carrier: Helium

Oven: 50 °C for 3 min
50-180 °C at 8 °C/min

Injection: On-column

Detector: FID, 250 °C

Sample: 1 µL



1. Ethylene glycol
2. 1,3-Butandiol
3. Ethylene glycol phenyl ether
4. 1,7-Hepatanediol
5. 1,9-Nonanediol
6. 1,10-Decanediol

Halogenated Hydrocarbons II

Column: **DB-1**
123-1034
30 m x 0.32 mm, 3.00 µm

Carrier: Helium at 35 cm/s, measured at 35 °C

Oven: 35 °C for 5 min
35-245 °C at 10 °C/min
245 °C for 2 min

Injection: Split, 250 °C
Split ratio 1:100

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

Sample: In pentane

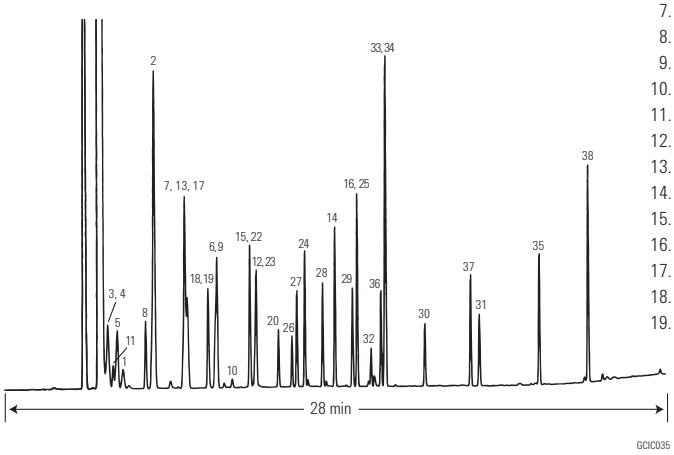
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

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



1. 1,1,2-Trichlorotrifluoroethane (freon 113)
2. 1,1-Dichloroethene
3. Bromoethane (ethyl bromide)
4. Iodomethane
5. 3-Chloropropene (allyl chloride)
6. 1-Chlorobutane
7. 2,2-Dichloropropane
8. trans-1,2-Dichloroethene
9. 1,1,1-Trichloroethane
10. Carbon tetrachloride
11. Methylene chloride
12. Trichloroethene
13. Chloroform
14. Tetrachloroethene
15. 1,2-Dichloropropane
16. 1-Chlorohexane
17. Bromochloromethane
18. 1,1-Dichloroethane
19. 1,2-Dichloroethane
20. Iodoform
21. cis-1,3-Dichloropropene
22. Dibromomethane
23. Bromodichloromethane
24. 1,3-Dichloropropane
25. 1,1-Dichloropropane
26. trans-1,3-Dichloropropene
27. 1,1,2-Trichloroethane
28. 1,2-Dibromoethane (EDB)
29. 1,1,1,2-Tetrachloroethane
30. Pentachloroethane
31. Hexachloroethane
32. Bromoform
33. trans-1,4-Dichloro-2-butene
34. 1,2,3-Trichloropropane
35. Hexachlorobutadiene
36. 1,1,2,2-Tetrachloroethane
37. 1,2-Dibromo-3-chloropropane (DBCP)
38. Hexachlorocyclopentadiene

Chlorinated Isooctane

Column: **HP-INNOWax**
19091N-136
60 m x 0.25 mm, 0.25 µm

Carrier: Helium, 33 cm/s, 35.7 psi (80 °C) 2 mL/min

Oven: 80 °C isothermal

Injection: Split, 250 °C
Split ratio 150:1

Detector: FID, 300 °C

Sample: Monochloro isomers, 0.5 µL

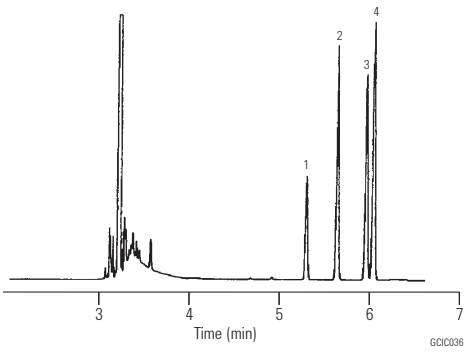
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

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



1. 1-Chloro isooctane
2. 4-Chloromethyl 2,2'-dimethyl pentane
3. 3-Chloro isooctane
4. 4-Chloro isooctane

Solvents I

Column: **DB-WAXetr**
125-7332
30 m x 0.53 mm, 1.00 µm

Carrier: Helium at 30 cm/s,
measured at 40 °C

Oven: 40 °C for 5 min
40-140 °C at 5 °C/min

Injection: Split, 250 °C

Detector: FID, 250 °C

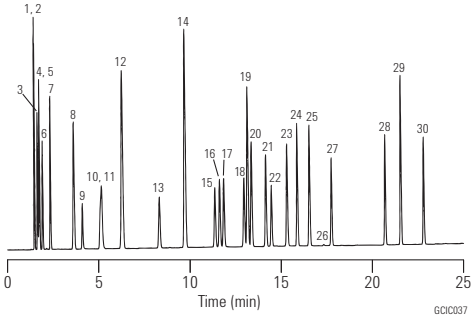
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

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



1. 3-Methylpentane
2. Hexane
3. Isooctane
4. Methyl-tert-butyl ether (MTBE)
5. Heptane
6. Cyclohexane
7. Octane
8. Nonane
9. Methanol
10. Ethanol
11. Benzene
12. Decane
13. Toluene
14. Undecane
15. Ethylbenzene
16. p-Xylene
17. m-Xylene
18. Cumene
19. Dodecane
20. o-Xylene
21. Propylbenzene
22. Chlorobenzene
23. Mesitylene
24. Styrene
25. 1,2,4-Trimethylbenzene
26. Naphthalene
27. 4-Chlorotoluene
28. 1,3-Dichlorobenzene
29. 1,4-Dichlorobenzene
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

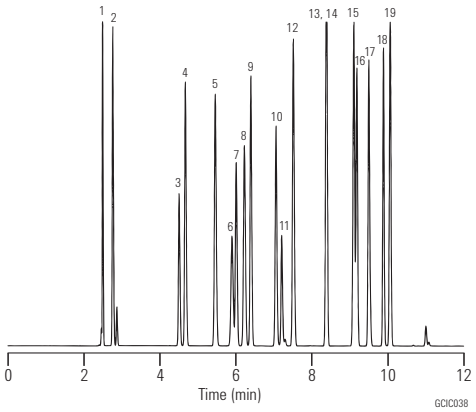
Suggested Supplies

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

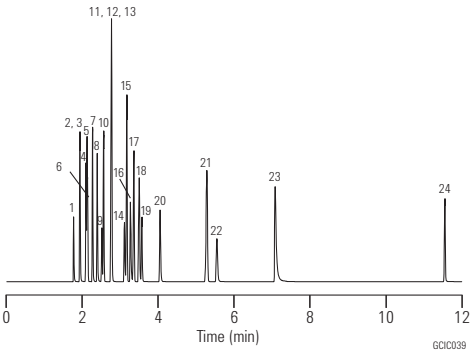
Suggested Supplies

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
2. Ethanol
3. Ethyl ether
4. Isopropanol
5. n-Hexane
6. Methylene chloride
7. tert-Butanol
8. n-Propanol
9. Chloroform
10. Cyclohexane
11. sec-Butanol
12. n-Heptane
13. Acetone
14. Acetonitrile
15. Benzene
16. Tetrahydrofuran (THF)
17. Trichloroethylene
18. n-Butanol
19. Ethyl acetate
20. Methyl ethyl ketone (MEK)
21. Toluene
22. 1,4-Dioxane
23. Pyridine
24. Dimethylformamide (DMF)

Solvents IV

Column: **HP-1**
19091Z-205
50 m x 0.20 mm, 0.50 µm

Carrier: Helium, 30 psi

Oven: 70-200 °C at 5 °C/min
200 °C for 2 min

Injection: Split

Detector: TCD

Sample: 1 µL

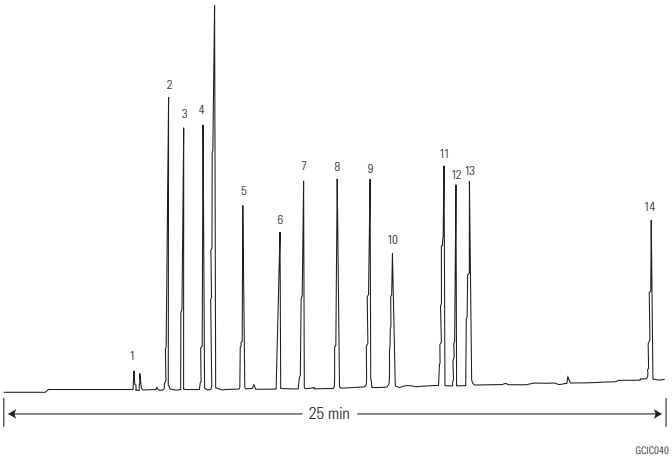
Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

Liner: Split, single taper, low pressure drop, glass wool, 5183-4647

Seal: Gold plated seal, 18740-20885

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



1. Isopropanol
2. Methyl ethyl ketone
3. Ethyl acetate
4. n-Butyl alcohol
5. Ethyl cellosolve
6. Methyl isobutyl ketone
7. Toluene
8. n-Butyl acetate
9. Diacetone alcohol
10. p-Xylene
11. Cellosolve acetate
12. o-Xylene
13. Butyl cellosolve
14. Butyl cellosolve acetate

Solvents

Column: **PoraBOND Q PT**
CP7348PT
25 m x 0.25 mm, 3.00 µm

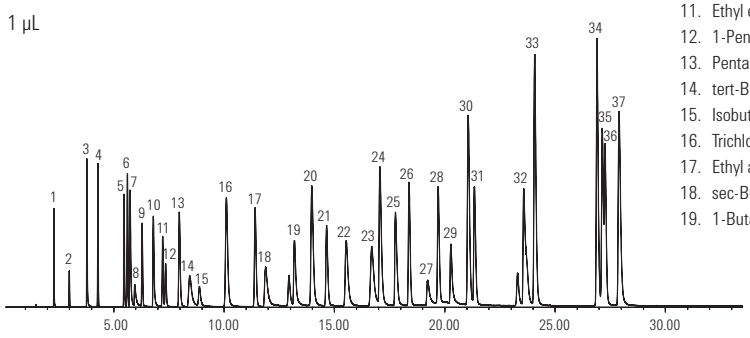
Carrier: Helium, 1.5 mL/min

Oven: 90 °C to 140 °C at 10 °C/min
140 °C for 5 min
140 °C to 210 °C at 4 °C/min
210 °C for 6 min

Injection: Split, 250 °C, split ratio 1:150

Detector: MSD, 280 °C transfer line
Full scan at m/z 30-350

Sample: 1 µL



1. Methyl alcohol
2. Acetaldehyde
3. Ethanol
4. Acetonitrile
5. Acetone
6. Methylene chloride
7. Isopropyl alcohol
8. 2-Propanamine
9. Ethyl formate
10. 1-Propanol
11. Ethyl ether
12. 1-Pentene
13. Pentane
14. tert-Butyl alcohol
15. Isobutyraldehyde
16. Trichloromethane
17. Ethyl acetate
18. sec-Butyl alcohol
19. 1-Butanol
20. Benzene
21. Hexane
22. 1,4-Dioxane
23. Ethyl tert-butyl ether
24. Pyridine
25. N,N-dimethylformamide
26. N-Propyl acetate
27. 3-Methyl-1-butanol
28. n-Propyl ether
29. 1-Pentanol
30. Toluene
31. Heptane
32. N,N-dimethylacetamide
33. Chlorobenzene
34. Ethylbenzene
35. m-Xylene
36. p-Xylene
37. o-Xylene

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

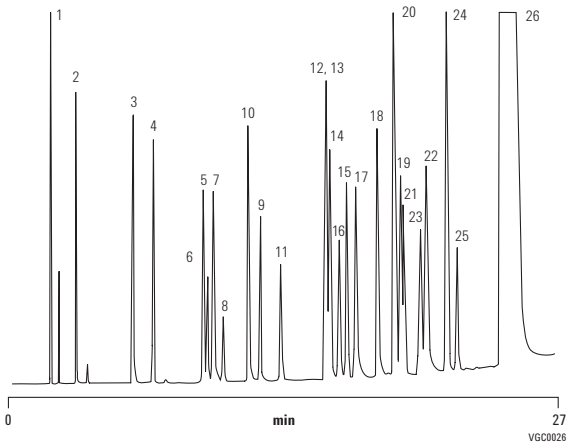
Solvent: DMSO

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

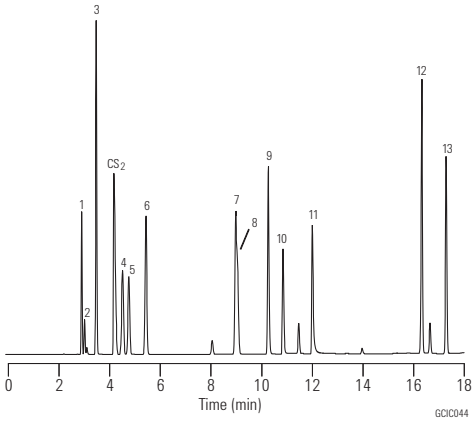
Suggested Supplies

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

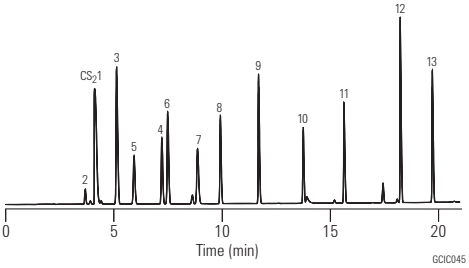
Suggested Supplies

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. Benzonitrile
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

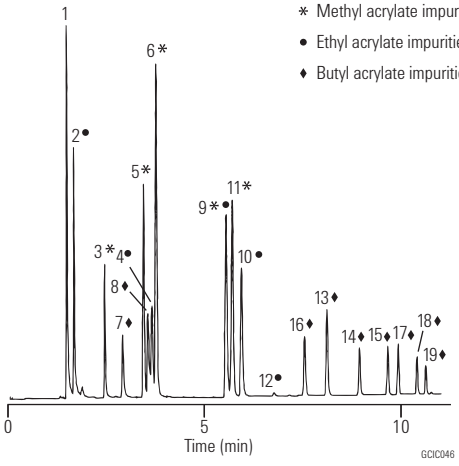
Suggested Supplies

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



* 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

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

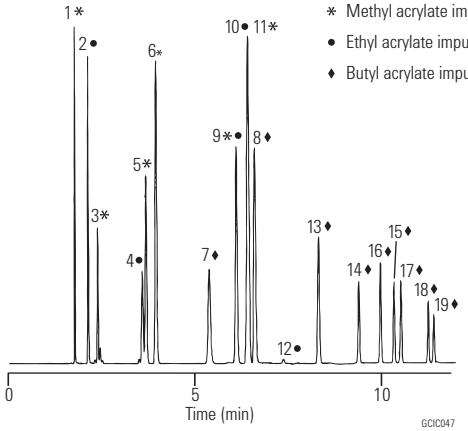
Suggested Supplies

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

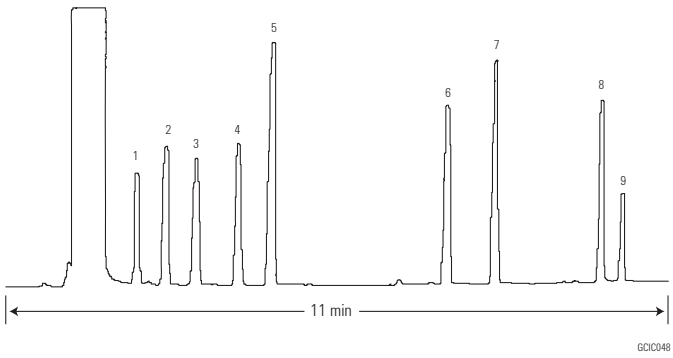
Carrier: Hydrogen

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

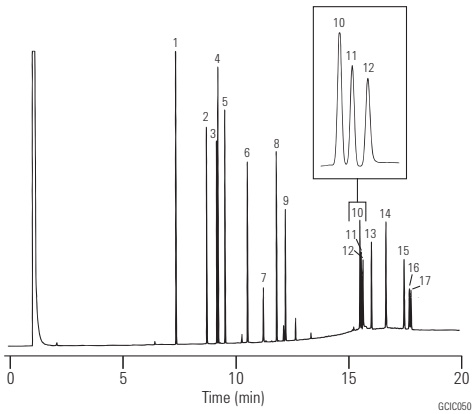
Suggested Supplies

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

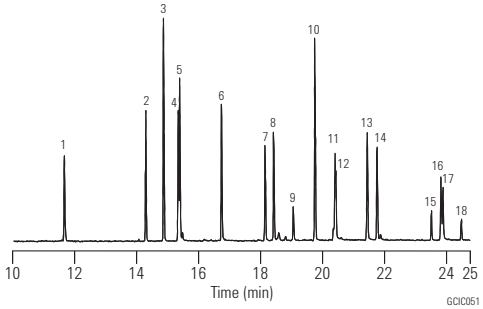
Suggested Supplies

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

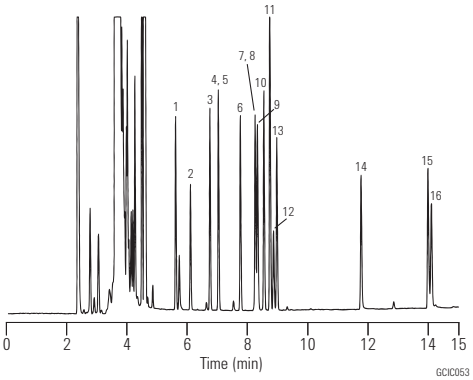
Suggested Supplies

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

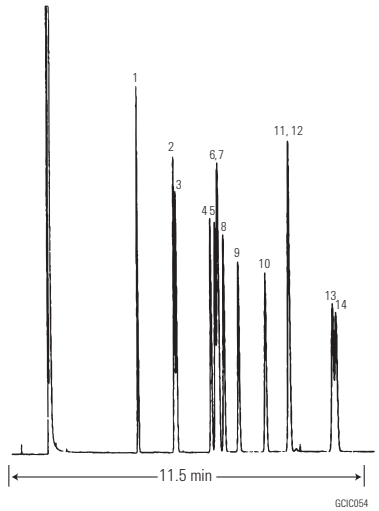
Suggested Supplies

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

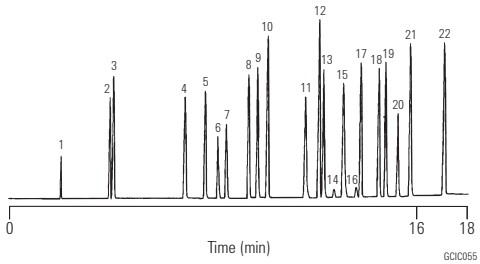
Sample: 1 µL

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_4
2. $CHClF_2$ (Freon 22)
3. CCl_2F_2 (Freon 12)
4. $ClCF_2CF_2Cl$ (Freon 114)
5. $CHCl_2F$ (Freon 21)
6. CCl_3F (Freon 11)
7. CF_2Br_2 (Freon 12B2)
8. CH_3I
9. CH_2Cl_2
10. trans-ClCH=CHCl
11. CF_3CCl_3 (Freon 113)
12. cis-ClCH=CHCl
13. $CHCl_3$
14. CCl_4
15. CCl_4
16. CCl_4
17. CH_3CH_2I
18. CH_2Br_2
19. $CHCl_2Br$
20. C_4F_9I
21. $CHClBr_2$
22. $CH_3CH_2CH_2I$

Ethylene Oxide

Column: **DB-WAX**
122-7032
30 m x 0.25 mm, 0.25 µm

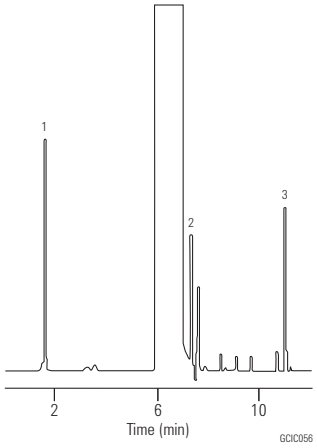
Carrier: Helium at 1 mL/min

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

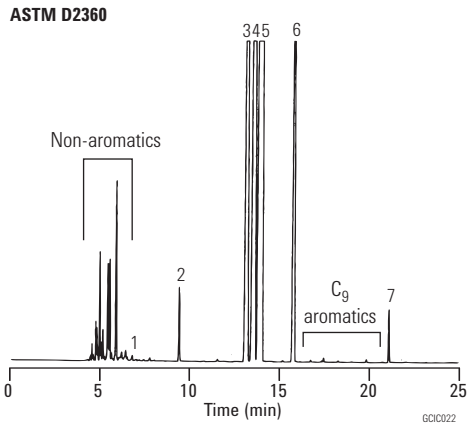
Column: **DB-WAXetr**
123-7362
60 m x 0.32 mm, 0.25 µm

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

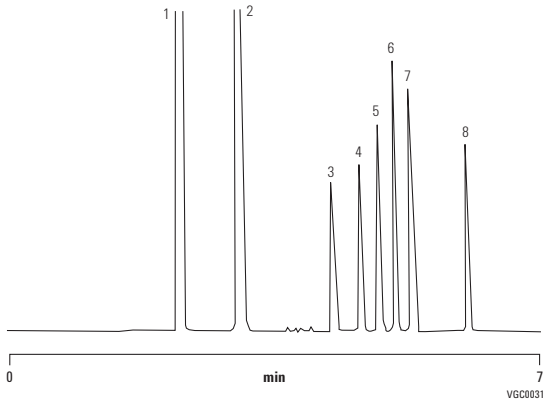
Sample Conc: 10-20%

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

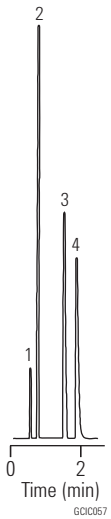
Carrier: Helium at 45 cm/s

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

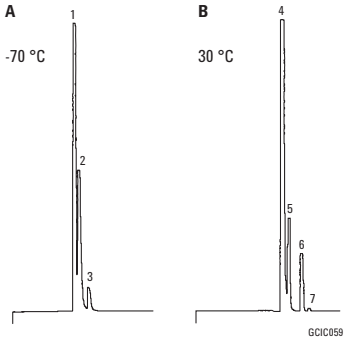
Carrier: Helium, 35 cm/s

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

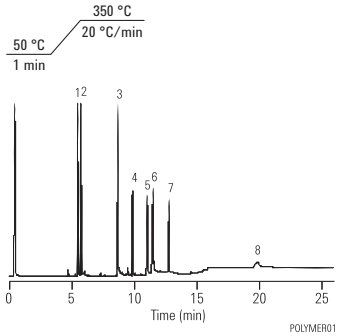
Polymer Additives

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

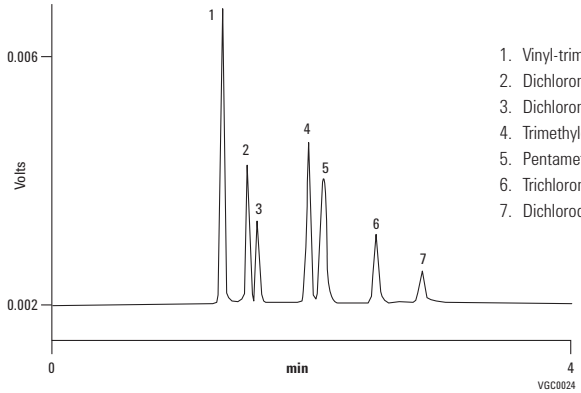
Column: **VF-200ms**
CP8860
30 m x 0.25 mm, 1.00 µm

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

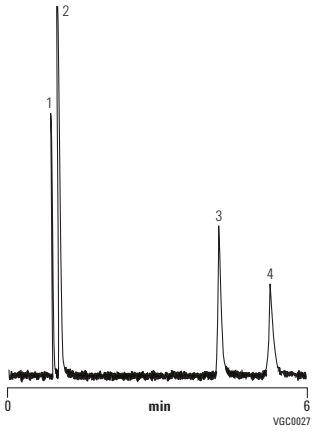
Sample: ±100 ppm

Carrier: H_2

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_2O_3**
CP7432
50 m x 0.53 mm

Sample Conc: Approx 100 ppm in nitrogen, synthetic standard

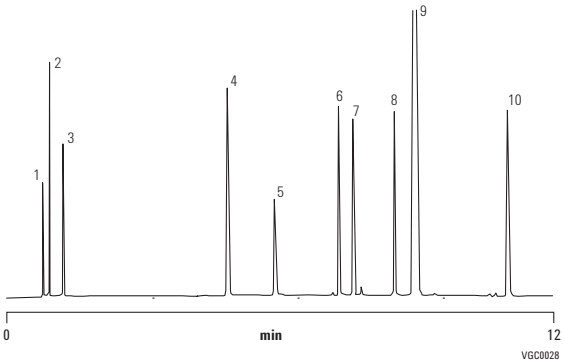
Carrier: Helium, 4 psig, 4 min to 11 psig, 0.5 psig/min, 2 min

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

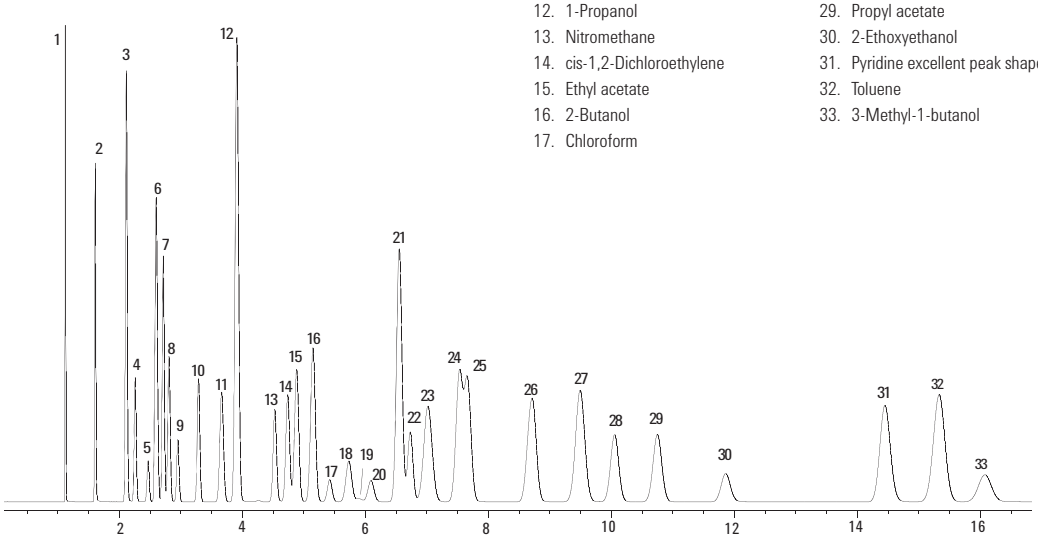
Oven: 40 °C 20 min hold, then 10°/min to 170 °C

Injection: 20 Hz

Detector: FID at 240 °C, H_2 at 30 mL/min
Air at 400 mL/min
N_2 makeup at 35 mL/min
(constant column + makeup)

Sample: FID signal

1. Methane
2. Methanol
3. Ethanol
4. Diethyl ether
5. 1,1-Dichloroethylene
6. 2-Propanol
7. Acetonitrile
8. Methyl acetate
9. Dichloromethane
10. trans-1,2-Dichloroethylene
11. n-Hexane
12. 1-Propanol
13. Nitromethane
14. cis-1,2-Dichloroethylene
15. Ethyl acetate
16. 2-Butanol
17. Chloroform
18. 1,1,1-Trichloroethane
19. Cyclohexane
20. Carbon tetrachloride
21. Benzene
22. 1,2-Dichloroethane
23. Isooctane (2,2,4-trimethylpentane)
24. 3-Methyl-2-butanone
25. n-Heptane
26. Trichloroethylene
27. Methylcyclohexane
28. 1,4-Dioxane
29. Propyl acetate
30. 2-Ethoxyethanol
31. Pyridine excellent peak shape
32. Toluene
33. 3-Methyl-1-butanol



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

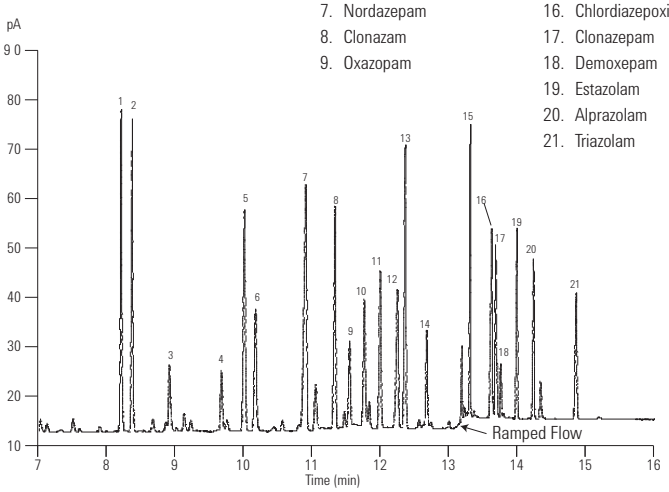
Injection: Pulsed splitless, 280 °C
20 psi pulse pressure for 0.38 min
50 mL/min purge at 0.40 min
Direct connect liner (p/n G1544-80730)

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
2. Halazepam
3. Oxazepam
4. Lorazepam
5. Diazepam
6. Desalkyl aurazepam
7. Nordazepam
8. Clonazam
9. Oxazopam
10. Temazepam
11. Flunitrazepam
12. Bromazepam
13. Prazepam
14. Lormetazepam
15. Nitrazepam
16. Chlordiazepoxide
17. Clonazepam
18. Demoxepam
19. Estazolam
20. Alprazolam
21. Triazolam



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

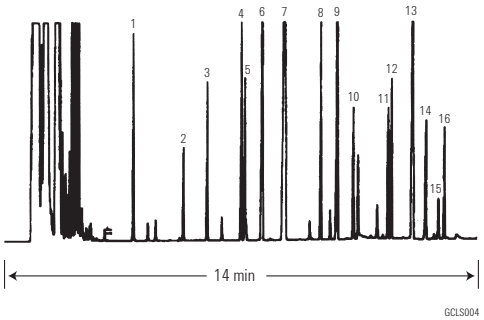
Detector: FID, 300 °C
Nitrogen makeup gas at 30 mL/min

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



Barbiturates

Column: **DB-35ms**
122-3832
30 m x 0.25 mm, 0.25 µm

Carrier: Helium at 31 cm/s, measured at 50 °C

Oven: 50 °C for 0.5 min
50-150 °C at 25 °C/min
150-300 °C at 10 °C/min

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

Detector: MSD, 280 °C transfer line
full scan at m/z 40-270

Suggested Supplies

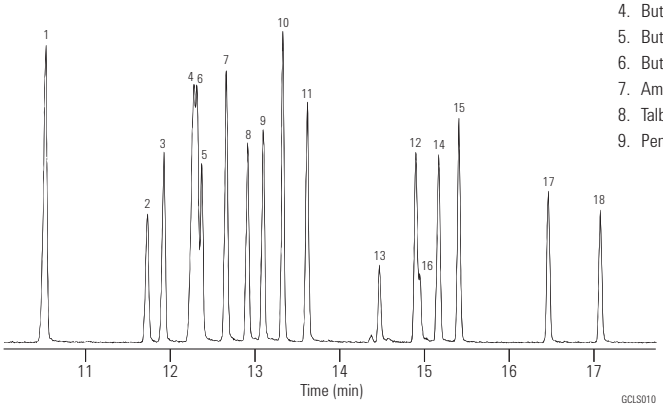
Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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

1. Barbital
2. Allobarbital
3. Aprobarbital
4. Butabarbital
5. Butethal
6. Butalbital
7. Amobarbital
8. Talbutal
9. Pentobarbital
10. Methohexital
11. Secobarbital
12. Hexobarbital
13. Thiopental
14. Cyclopentylbarbital
15. Mephobarbital
16. Thiamylal
17. Phenobarbital
18. Alphenal



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

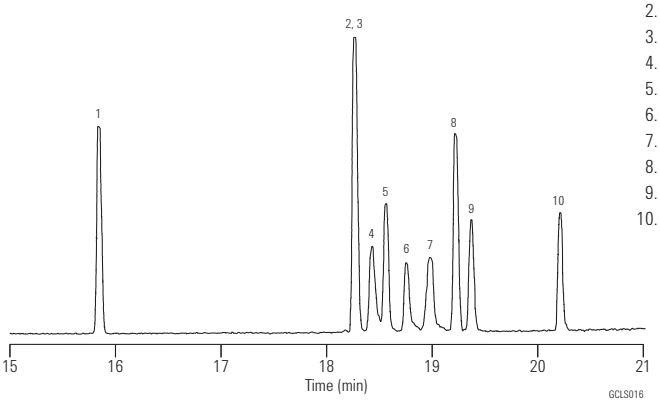
Septum: 11 mm Advanced Green septa, 5183-4759

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



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

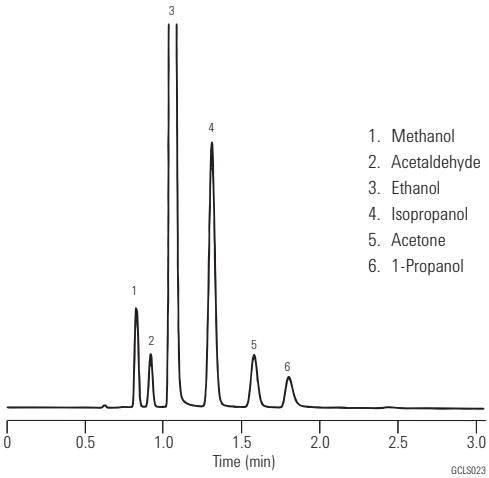
Sampler: Headspace

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

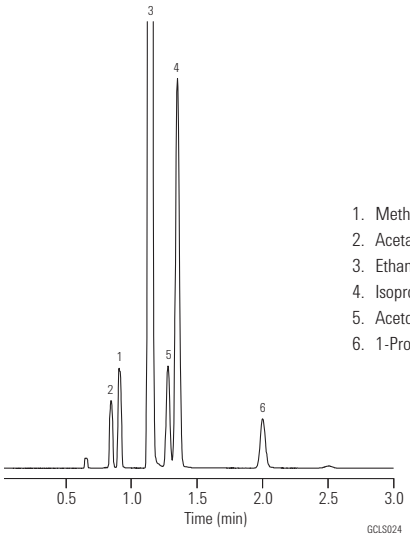
Injection: Split, 250 °C
Split ratio 1:10

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

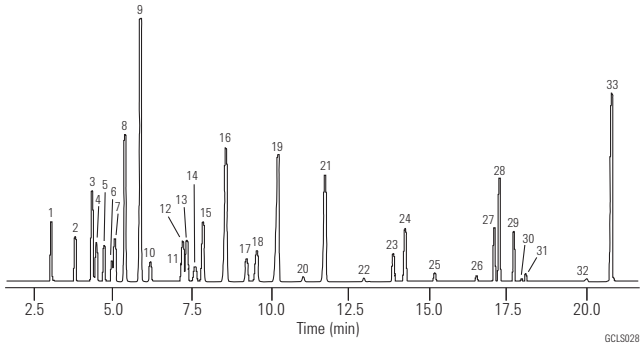
Suggested Supplies

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. Ethanol
3. Acetone
4. 2-Propanol
5. Acetonitrile
6. Methylene chloride
7. 2-Methyl-2-propanol (tert-butanol)
8. MTBE
9. Hexane
10. 1-Propanol
11. DMI impurity
12. 2-Butanone (MEK)
13. Ethyl acetate
14. 2-Butanol
15. Tetrahydrofuran
16. Cyclohexane
17. Isopropyl acetate
18. 1,2-Dimethoxyethane
19. Heptane
20. 1-Methoxy-2-propanol
21. Methylcyclohexane
22. 2-Ethoxyethanol
23. MIBK (2-Pentanone)
24. Toluene
25. 1-Pentanol
26. n,n-Dimethylformamide (DMF)
27. Ethyl benzene
28. m,p-Xylene
29. o-Xylene
30. Dimethyl sulfoxide (DMSO)
31. n,n-Dimethylacetamide
32. n-Methylpyrrolidone
33. 1,3-Dimethyl-2-imidazolidinone (DMI)



Special thanks to Julie Kancler, Brian Wallace, Teledyne.

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)

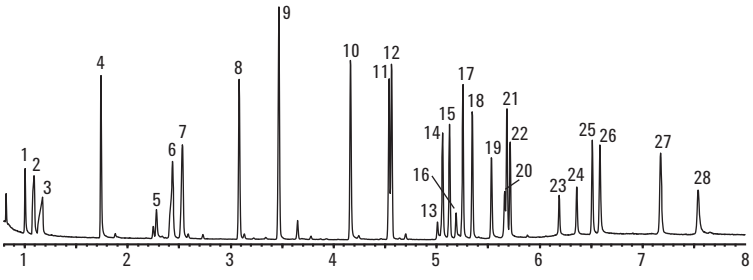
Backflush: Post run: 1 min 1 psi inlet, 75 psi aux EPC

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: Blos bead 300 °C H_2 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
2. Phentermine
3. Methamphetamine
4. Nicotine
5. Methylenedioxyamphetamine (MDA)
6. Methylenedioxymethamphetamine (MDMA)
7. Methylenedioxyethylamphetamine
8. Meperidine
9. Phencyclidine
10. Methadone
11. Cocaine
12. SKF-525a (RTL compound)
13. Oxazepam
14. Tetrahydrocannabinol
15. Codeine
16. Lorazepam
17. Diazepam
18. Hydrocodone
19. Oxycodone
20. Temazepam
21. Diacetylmorphine
22. Flunitrazepam
23. Nitrazepam
24. Clonazepam
25. Alprazolam
26. Verapamil
27. Strychnine
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

Suggested Supplies

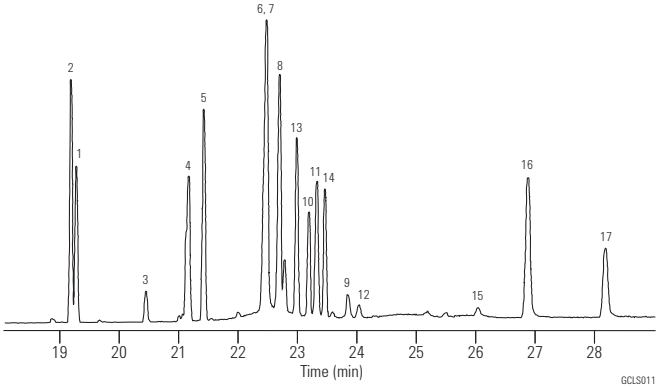
Septum: 11 mm Advanced Green septa, 5183-4759

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. Medazepam
2. Halazepam
3. Oxazepam
4. Lorazepam
5. Diazepam
6. Demoxepam
7. Desmethyldiazepam
8. Clobazam
9. Temazepam
10. Flunitrazepam
11. Delorazepam
12. Bromazepam
13. Prazepam
14. Flurazepam
15. Clonazepam
16. Alprazolam
17. Triazolam



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

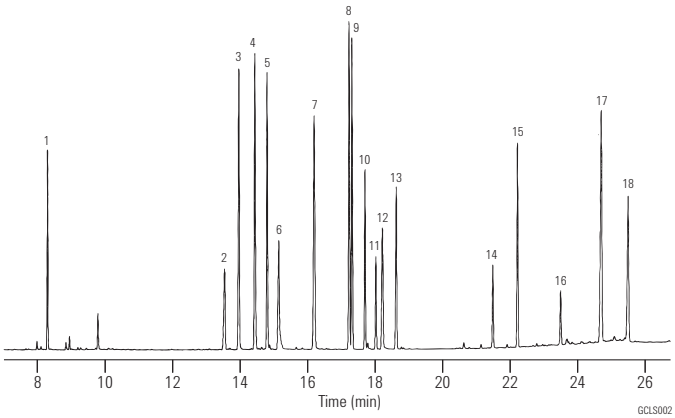
Oven: 50 °C for 1.0 min
50-125 °C at 25 °C/min
125-325 °C at 10 °C/min
325 °C for 5 min

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
2. Caffeine
3. Glutethimide
4. Lidocaine
5. PCP
6. Phenobarbital
7. Methadone primary metabolite
8. Methaqualone
9. Methadone
10. Cocaine
11. Desipramine
12. Carbamazepine
13. Trimipramine
14. Heroin
15. Fentanyl
16. Ibogaine
17. Triazolam
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

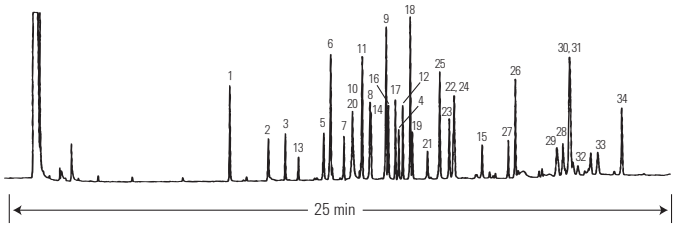
Liner: General purpose split/splitless liner, taper, glass wool, 5183-4711

Seal: Gold plated seal, 18740-20885

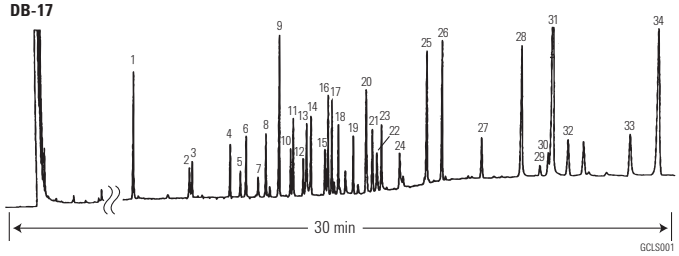
Syringe: 10 µL tapered, FN 23-26s/42/HP, 5181-1267

		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.	Allobarbital	13.91	12.02	22.	Methapyrilene	18.72	16.68
6.	Aprobarbital	14.14	12.27	23.	Thenyldiamine	18.87	16.85
7.	Butabarbital	14.56	12.76	24.	Phenobarbital	19.11	16.29
8.	Secobarbital	14.87	14.31	25.	Bromopheniramine	19.71	17.39
9.	Pentobarbital	15.41	13.73	26.	Chlorcyclizine	20.75	19.13
10.	Phenacetin	15.72	12.94	27.	Cocaine	21.32	18.88
11.	Amobarbital	15.87	13.43	28.	Pyrrobutamine	22.79	20.89
12.	Benzphetamine	16.14	14.96	29.	Codeine	24.27	20.66
13.	Acetaminophen	16.34	11.12	30.	Diazepam	25.27	21.13
14.	Hydroxyphenamate	16.47	15.31	31.	Morphine	25.36	21.12
15.	Dimenhydrinate	16.93	13.79	32.	Hydrocodone	25.98	21.26
16.	Meprobamate	17.12	14.44	33.	Oxymorphone	28.27	22.21
17.	Benactyzine	17.26	14.71	34.	Heroin	29.32	23.14

DB-5



DB-17



Urine Drug Screen

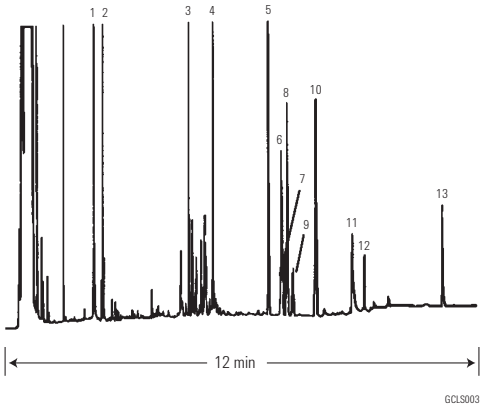
Column: **Ultra 2**
19091B-115
50 m x 0.32 mm, 0.52 µm

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. Proposyphene
7. Amitriptyline
8. Cocaine
9. Imipramine
10. Cyheptamide (ISTD)
11. Codeine
12. Diazepam
13. Flurazepam

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

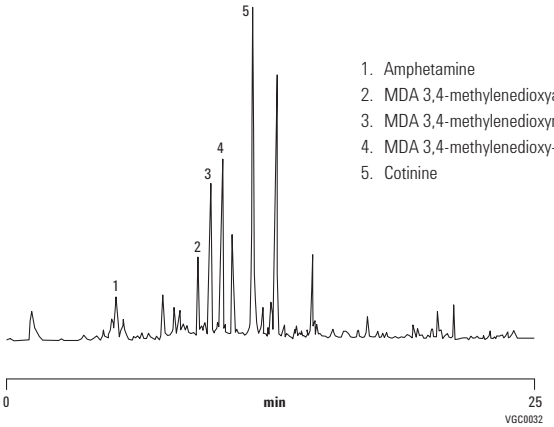
Oven: 70 °C, 1.2 min to 200 °C,
20 °C/min to 270 °C,
7 °C/min to 320 °C, 20 °C/min

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

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

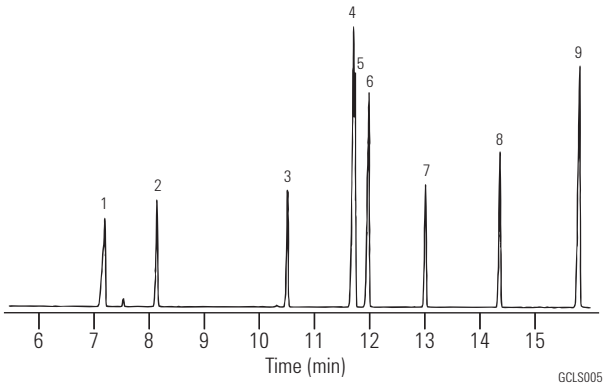
Suggested Supplies

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. Salicylamide
2. Benzocaine
3. Lidocaine
4. Procaine
5. Nefopam
6. Mepivacaine
7. Tetracaine
8. Butacaine
9. Dibucaine

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

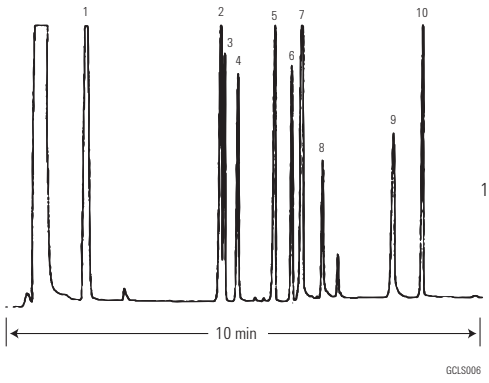
Suggested Supplies

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. Ethosuximide
2. Methsuximide
3. Phensuximide
4. N-Desmethyl methsuximide
5. Phenylethylmalonamide
6. Phenobarbital
7. Primidone
8. Carbamazepine
9. Phenytoin
10. 5-Methyl-5-phenylhydantoin

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

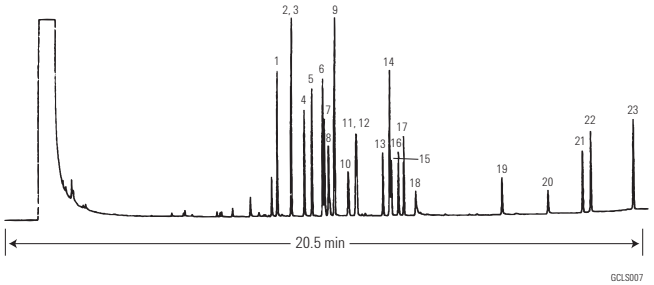
Oven: 55 °C for 1 min
55-175 °C at 30 °C/min
175-320 °C at 10 °C/min
320 °C for 1 min

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
2. Dimenhydrinate
3. Diphenhydramine
4. Doxylamine
5. Phenyltoloxamine
6. Tripelennamine
7. Methapyrilene
8. Chlorpheniramine
9. Cyclizine
10. Carbinoxamine
11. Diphenylpyraline
12. Bromopheniramine
13. Thonzylamine
14. Chlorcyclizine
15. Pyrilamine
16. Triprolidine
17. Promethazine
18. Antazoline
19. Clemizole
20. Hydroxyzine
21. Meclizine
22. Cinnanzine
23. Buclizine



Suggested Supplies

Septum: 11 mm Advanced Green septa, 5183-4759

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

Seal: Gold plated seal, 18740-20885

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

Antiepileptic Drugs

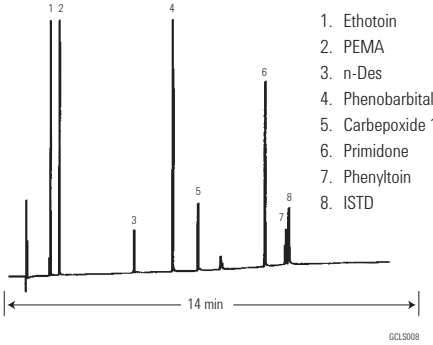
Column: **Ultra 2**
19091B-012
25 m x 0.32 mm, 0.17 µm

Carrier: Helium, 14 psi

Oven: 100-230 °C at 15 °C/min

Injection: Split ratio 35:1

Detector: NPD



1. Ethotoin
2. PEMA
3. n-Des
4. Phenobarbital
5. Carbepoxide 10/11
6. Primidone
7. Phenyltoin
8. ISTD

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

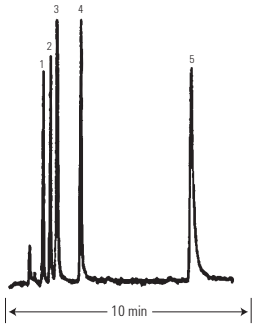
Column: **Ultra 2**
19091B-101
12 m x 0.20 mm, 0.33 µm

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



1. Trifluprомazine
2. Promethazine
3. Promazine
4. Chlorprothixene
5. Thioridazine

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

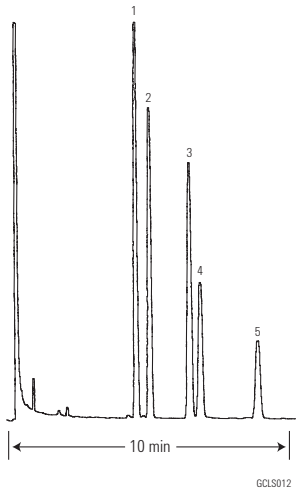
Suggested Supplies

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

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 isooctane

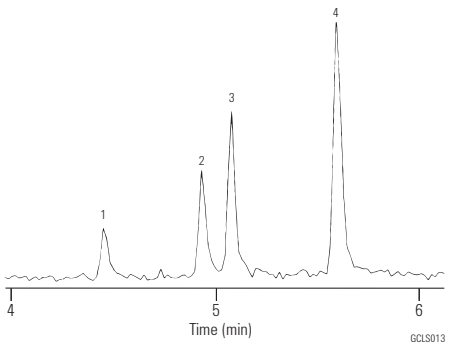
Suggested Supplies

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

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

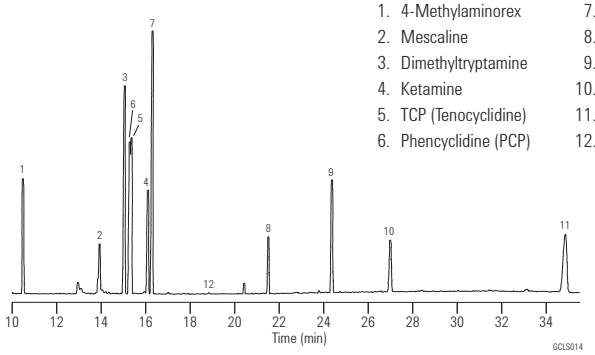
Suggested Supplies

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



1. 4-Methylaminorex
2. Mescaline
3. Dimethyltryptamine
4. Ketamine
5. TCP (Tenocyclidine)
6. Phencyclidine (PCP)
7. Diethyltryptamine
8. Bufotenine
9. Fentanyl
10. Ibogaine
11. LSD
12. Psilocin (peak not shown)

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

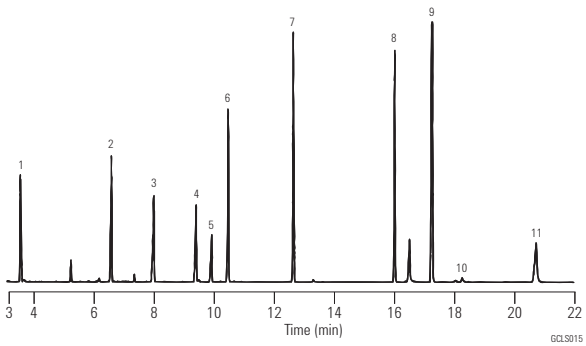
Suggested Supplies

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



1. Ethchlorvynol
2. Ethinamate
3. Pyrithyldione
4. Talbutal
5. Meprobamate
6. Glutethimide
7. Methaqualone
8. Propiomazine
9. Haloperidol
10. Sulpiride
11. Droperidol

Narcotics and Adulterants

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

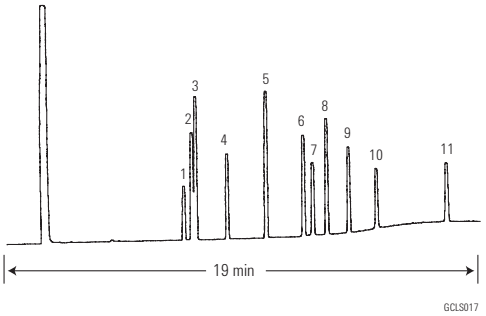
Carrier: Helium at 40 cm/s, measured at 140 °C

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. Diacetylmorphone (heroin)
10. Quinine
11. Strychnine

Over-the-Counter Pain Killers – TMS Derivatives

Column: **DB-5**
121-5023
20 m x 0.18 mm, 0.40 µm

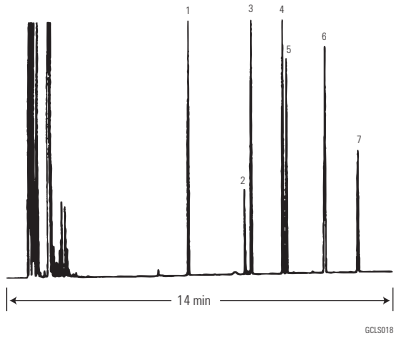
Carrier: Helium at 39 cm/s, measured at 100 °C

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

Aspirin and Ibuprofen in Methanol

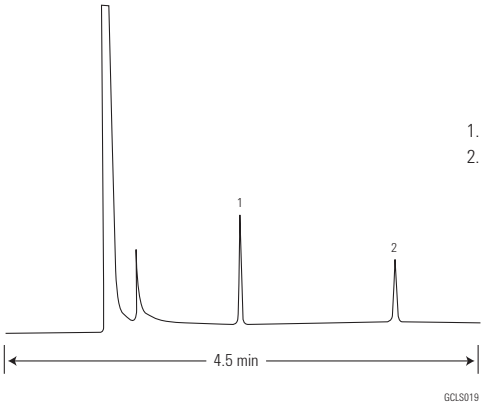
Column: **DB-FFAP**
122-3232
30 m x 0.25 mm, 0.25 µm

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

Free Steroids

Column: **DB-17**
122-1731
30 m x 0.25 mm, 0.15 µm

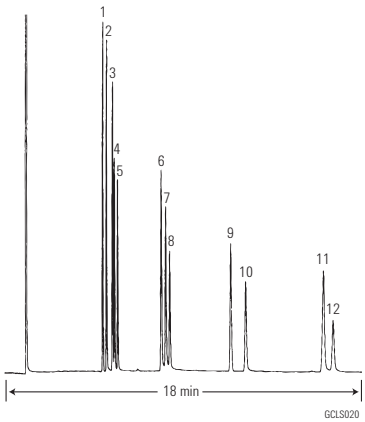
Carrier: Hydrogen at 44 cm/s

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. Coprostane (5-ß-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

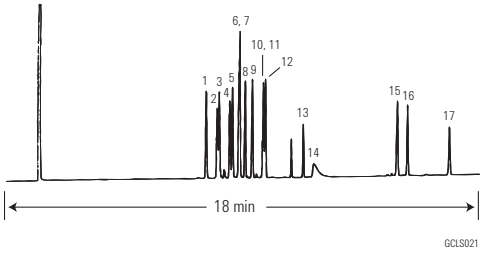
Oven: 180-320 °C at 10 °C/min
320 °C for 4 min

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)
2. 5α-Androstan-17α-ol-3-one (stanolone)
3. 19-Nortestosterone (nandrolone)
4. Mesterolone
5. Testosterone
6. 1-Dehydrotestosterone (boldenone)
7. 17α-Methyltestosterone
8. 1-Dehydro-17-α-methyltestosterone (methandrostenolone)
9. Norethandrolone
10. 1-Dehydrotestosterone acetate
11. Oxymetholone
12. 19-Nortestosterone-17-propionate
13. 4-Chlortestosterone-17-acetate (clostebol)
14. Stanozolol
15. 1-Dehydrotestosterone benzoate
16. 19-Nortestosterone-17-decanoate
17. 1-Dehydrotestosterone undecylenate



Marijuana (Δ9-THC) and Major Metabolites – TMS Derivatives

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

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

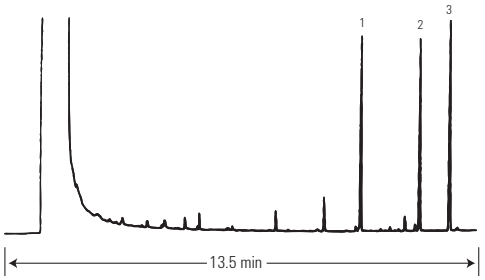
Injection: Splitless, 250 °C
30 s purge activation time

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

Sample: 1 µL of 0.1 µg/µL 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 µL tapered, FN 23-26s/42/HP, 5181-1267



1. Δ9-THC
2. L-11-Hydroxy-Δ9-THC
3. L-9-Carboxy-11-nor-Δ9-THC

Blood Pollutants I

Column: **DB-ALC1**
125-9134
30 m x 0.53 mm, 3.00 µm

Carrier: Helium, 36 cm/s, measured at 40 °C

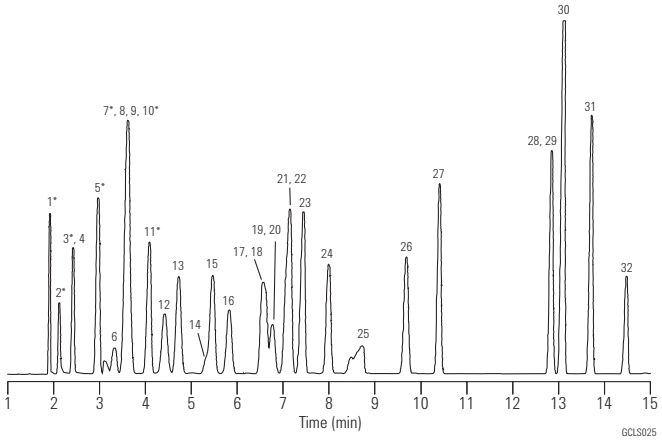
Oven: 40 °C for 5 min
40-210 °C at 10 °C/min

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*
2. Acetaldehyde*
3. Ethanol*
4. Diethyl ether
5. Isopropyl alcohol*
6. Methylene chloride
7. Acetone*
8. Acetonitrile
9. Ethyl formate
10. t-Butyl alcohol*
11. 1-Propanol
12. MTBE
13. Hexane
14. Chloroform
15. sec-Butyl alcohol
16. 2-Chlorobutane
17. MEK (2-butanone)
18. Ethyl acetate
19. 1,1-Trichloroethane
20. Carbon tetrachloride
21. 1-Chlorobutane
22. Benzene
23. 1-Butanol
24. Heptane
25. Ethylene glycol
26. Isoamyl alcohol
27. Toluene
28. Isopropyl amine (not shown)
29. Ethylbenzene
30. m,p-Xylene
31. o-Xylene
32. DMSO

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

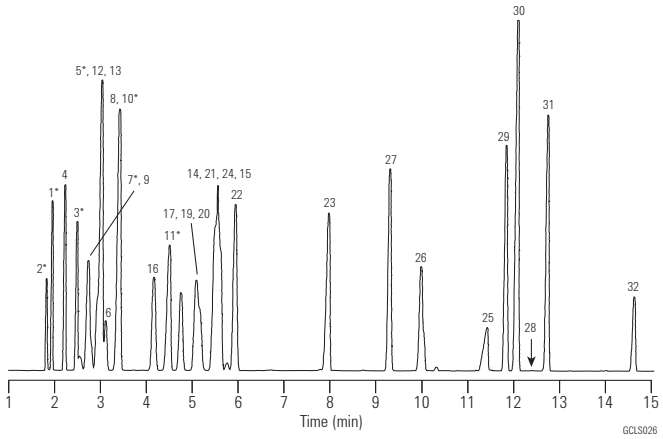
Detector: FID, 300 °C

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*
2. Acetaldehyde*
3. Ethanol*
4. Diethyl ether
5. Isopropyl alcohol*
6. Methylene chloride
7. Acetone*
8. Acetonitrile
9. Ethyl formate
10. t-Butyl alcohol*
11. 1-Propanol
12. MTBE
13. Hexane
14. Chloroform
15. sec-Butyl alcohol
16. 2-Chlorobutane
17. MEK (2-butanone)
18. Ethyl acetate
19. 1,1-Trichloroethane
20. Carbon tetrachloride
21. 1-Chlorobutane
22. Benzene
23. 1-Butanol
24. Heptane
25. Ethylene glycol
26. Isoamyl alcohol
27. Toluene
28. Isopropyl amine (not shown)
29. Ethylbenzene
30. m,p-Xylene
31. o-Xylene
32. DMSO

Residual Solvents, USP 467

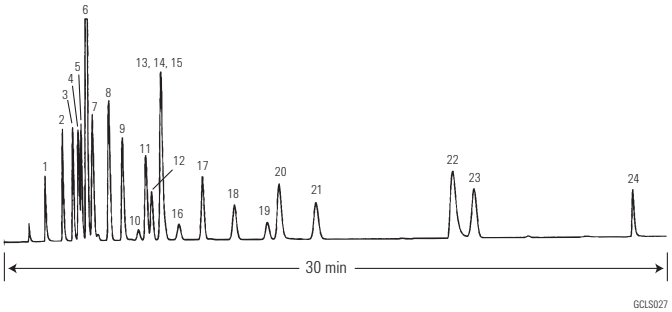
Column: **DB-624**
125-1334
30 m x 0.53 mm, 3.00 µm

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
2. Ethanol
3. Ethyl ether
4. Acetone
5. Isopropanol
6. Acetonitrile
7. Methylene chloride
8. tert-Butanol
9. n-Hexane
10. n-Propanol
11. Methyl ethyl ketone (MEK)
12. Ethyl acetate
13. Tetrahydrofuran (THF)
14. Chloroform
15. sec-Butanol
16. Cyclohexane
17. Benzene
18. n-Heptane
19. Trichloroethylene
20. n-Butanol
21. 1,4-Dioxane
22. Pyridine
23. Toluene
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

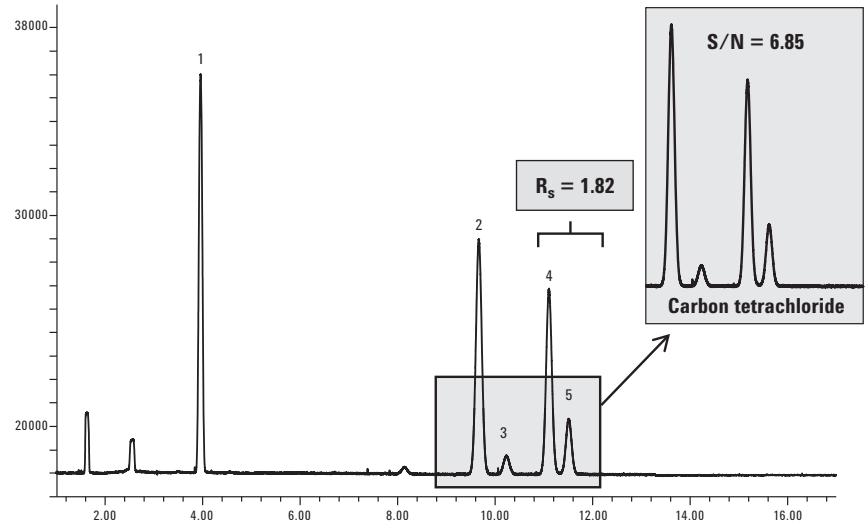
Carrier:	Helium, 2.2 mL/min constant flow at 40 °C
Oven:	40 °C for 20 min, then 10 °C/min to 240 °C 5 min
Inlet:	MMI, 140 °C, 1 µL split 5:1
Inlet liner:	1 mm straight single taper Ultra Inert liner
Sample Conc:	1.0 mL loop
Detector:	FID: 250 °C, H_2 30 mL/min, air 400 mL/min, N_2 constant col + makeup = 30 mL/min

Suggested Supplies

Septum: Non-stick bleed and temperature optimized (BTO) septa, 11 mm, 50/pk, 5183-4757

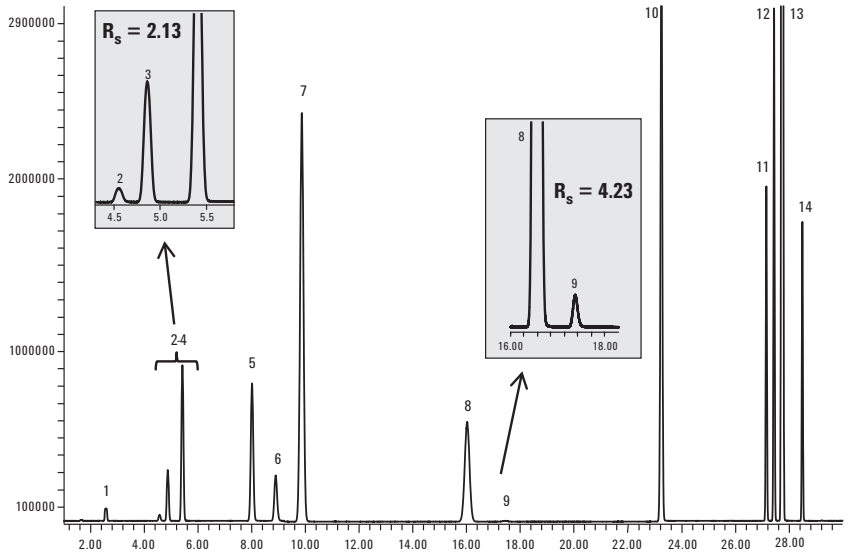
Liner: Liner, GC, Ultra Inert, straight, 1 mm id, 5190-4047

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. 0-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
0100-0161....127
0100-0549....169
0100-1324....41
0100-1325....41
0100-1326....41
0100-1331....41
0100-1332....41, 91, 99, 105, 113, 129, 131, 136-137
0100-1342....41
0100-1344....41
0100-1365....41
0100-1375....41, 85, 87
0100-1378....41
0100-1379....41
0100-1381....41
0100-1389....80
0100-1597....169
0100-2138....122-123
0100-2430....122-123
0100-2594....53
0100-2595....53
0101-0282....48
0101-0299....48
0101-0300....48
0101-0301....48
0101-0302....48
0101-0303....48
0101-0304....48
0101-0355....48
0101-0403....48
0101-0532....48
0101-0584....47
0101-0585....47
0101-0633....48
0101-0636....47
0101-0637....47
0101-0638....47
0101-0639....47
0101-0666....48
0101-0667....48
0101-0946....47
0101-0947....47
0101-0948....48
0101-0954....48
0101-0955....48
0101-0956....48
0101-0957....48
0101-1001....48
0101-1472....47
0101-1473....47
03396-61010....127
0515-0680....113, 115, 131
0515-0683....114
0515-2495....120, 133
0515-2712....128
0515-2726....120, 133
0535-0071....157
05890-61525....50
05890-80660....49
05921-21170....39-40
05970-60045....182
05971-20134....151, 154
05971-20143....154-155, 157
05971-60571....163, 176
05971-80103....165
05980-20018....146, 176-177
05980-60051....146, 174
05988-20066....38, 40, 148, 172
07673-20570....51
07673-40180....50
07673-60840....51
0960-0897....162
1000-1437....113-115, 131
1000-1438....114
112-2032....361
112-2032LTM....361, 453
112-2112....442
112-2132....442
112-2133....442
112-2133LTM....442, 453
112-2162....442
112-2532....411
112-2532E....411
112-2532LTM....411, 453
112-2562....411
112-5432....444
112-5462....444
112-6632....410
112-6632LTM....410, 453
112-8837....126, 405
112-8837E....405
112-8837LTM....405, 460
112-8867....405
112-8867E....405
112-88A7....405
112-88A7E....405
113-2032....361
113-2132....442
113-2132LTM....442, 453
113-2133....442
113-2532....411
113-2532E....411
113-3032....444
113-3112....437
113-3132....437
113-3133....437
113-3133LTM....437, 458
113-3162....437
113-3432....426
113-3432E....426
113-3432LTM....426, 458
113-4302....434
113-4312....434
113-4332....283, 434
113-4362....278, 434
113-5432....444
113-6632....410
113-6632LTM....410, 453
115-2132....282, 442
115-2132LTM....442, 453
115-3113....437
115-3133....437
115-3133LTM....437, 458
115-3332....429
115-3352....429
115-3352E....429
115-3352PT....429
115-3412....426
115-3422....426
115-3432....426
115-3432E....426
115-3432PT....421, 426
115-34H2....426
115-3532....433
115-3532PT....278-279, 421, 433
115-3552....433
115-3552PT....279, 285, 421, 433
115-4912....366
115-4912E....366
121-0122....295
121-0122LTM....295, 455
121-0122UI....289
121-0713....349
121-0722....266, 349
121-0722LTM....349, 454
121-1012....319
121-1012E....319
121-1012LTM....319, 453
121-1013....319
121-1013LTM....319, 453
121-101A....319
121-101ALTM....319, 453
121-1022....319
121-1022E....319
121-1022LTM....319, 453
121-1023....319
121-1023LTM....319, 453
121-1043....319
121-1222....304
121-1232....304
121-1324....267, 271, 275, 284, 398
121-1324E....398
121-1324LTM....398, 457
121-1324UI....275, 291, 397
121-1524....267, 271, 275, 284, 400
121-1524LTM....400, 457
121-1544....400
121-1544E....400
121-1722....339
121-1722LTM....339, 454
121-1723....339
121-2223....345
121-2323....342
121-3822....306
121-3822UI....291
121-4722....308
121-4722LTM....308, 454
121-5012....329
121-5012E....329
121-5012LTM....329, 455
121-5013....329
121-5013LTM....329, 455
121-5022....329
121-5022E....329
121-5022LTM....329, 455
121-5023....329
121-5023LTM....329, 455
121-5042....329
121-5522....126, 300
121-5522E....300
121-5522LTM....300, 456
121-5522UI....266, 290
121-5522UILTM....290, 457
121-5523....300
121-5523LTM....300, 456
121-5523UI....290
121-5523UILTM....290, 457
121-5542....300
121-5621....394
121-5622....394
121-7012....352
121-7012LTM....352, 458
121-7013LTM....458
121-7022....352
121-7022LTM....352, 458
121-7023....352
121-7023LTM....352, 458
121-7042....352
121-7042E....352
121-7043....352
121-9627....390
121-9723....264, 276, 292, 392
122-0112....295
122-0112E....295
122-0112LTM....295, 455
122-0112UI....289
122-0131....295
122-0132....126, 273, 295
122-0132E....295
122-0132LTM....455
122-0132UI....289
122-0132UIE....289
122-0162....295
122-0162UI....289
122-0212....344
122-0232....344
122-0232E....344
122-0233....267, 344
122-0334UI....292, 416
122-0364UI....292, 416
122-0712....349
122-0713....349
122-0713LTM....349, 454
122-0731....349
122-0732....126, 266, 268, 349
122-0732E....349
122-0732LTM....349, 454
122-0733....274, 349
122-0733E....349
122-0733LTM....349, 454
122-0761....349
122-0762....349
122-0763....349
122-0763E....349
122-0766....349
122-1011....319
122-1012....319
122-1012LTM....319, 453
122-1013....319
122-1022....319
122-1022LTM....319, 453

122-1022LTM....319, 453
122-1031....319
122-1032....319
122-1032E....319
122-1032G....445
122-1032LTM....319, 453
122-1033....267, 319
122-1033E....319
122-1033LTM....319, 453
122-103E....319
122-103ELTM....319, 453
122-1052....319
122-1061....319
122-1062....319
122-1063....319
122-106E....278, 319
122-10A6....369
122-10A6E....283, 369
122-10AE....319
122-10G3....319
122-1111....362
122-1111E....362
122-1131....362
122-1131LTM....455
122-1211....304
122-1211LTM....304, 458
122-1212....304
122-1231....304
122-1232....267, 269, 272, 282-285, 304
122-1232G....445
122-1232LTM....304, 458
122-1233....304
122-1236....265, 304
122-1262....304
122-1332....347
122-1332E....347
122-1333....267, 347
122-1334....265, 269, 272, 398
122-1334E....398
122-1334LTM....398, 457
122-1334UI....265, 272, 291, 397
122-1362....347
122-1363....347
122-1363E....347
122-1364....265, 267, 269, 271, 284, 398
122-1364E....398
122-1364UI....265, 267, 275, 291, 397
122-1534....265, 269, 272, 400
122-1534LTM....400, 457
122-1564....265, 267, 269, 271-272, 275, 284, 400
122-1564E....400
122-1712....339
122-1713....339
122-1713E....339
122-1731....339
122-1731E....339
122-1732....339
122-1732E....339
122-1732LTM....339, 454
122-1733....339
122-1762....339
122-1801....364
122-1801LTM....364, 454
122-1811....364
122-1831....364
122-1831LTM....364, 454
122-1932....337
122-1962....337
122-2032....343
122-2032LTM....343, 455
122-2033....343
122-2033LTM....343, 455
122-2212....345
122-2212LTM....345, 455
122-2231....345
122-2232....345
122-2232LTM....345, 455
122-2312....342
122-2331....342
122-2332....342
122-2332E....342
122-2332LTM....342, 455
122-2361....342
122-2361E....342
122-2362....285, 342
122-2362E....342
122-2461....396
122-2462....396
122-2912....312
122-2912LTM....312, 455
122-2932....283, 312
122-2932E....312
122-2932LTM....312, 455
122-2962....312
122-3212....358
122-3232....358
122-3232E....358
122-3232LTM....358, 457
122-3233....358
122-3262....358
122-3262E....358
122-3263....358
122-3812....306
122-3812UI....291
122-3831....306
122-3832....265, 270, 274, 283-284, 306
122-3832E....306
122-3832LTM....306, 455
122-3832UI....271, 291
122-3862....306
122-4711....308
122-4711LTM....308, 454
122-4712....308
122-4712LTM....308, 454
122-4731....308
122-4732....270, 273, 308
122-4732E....308
122-4732LTM....308, 454
122-4762....308
122-5002LTM....456
122-5011....330
122-5012....283, 330
122-5012LTM....330, 456
122-5013....330
122-501E....330
122-5022....330
122-5031....330
122-5032....284, 330
122-5032E....330
122-5032LTM....330, 456
122-5033....272, 330
122-5033E....330
122-5033LTM....330, 456
122-503E....330
122-503ELTM....330, 456
122-5052....330
122-5061....330
122-5062....330
122-5063....330
122-506E....330
122-5511....300
122-5511LTM....300, 456
122-5512....300
122-5512LTM....300, 456
122-5512UI....267, 290
122-5512UILTM....290, 457
122-5513....300
122-5513UI....290
122-5516....300
122-5522....300
122-5522LTM....300, 456
122-5522UI....290
122-5522UILTM....290, 457
122-5531....300
122-5532....265, 267-268, 272-274, 300
122-5532E....300
122-5532G....445
122-5532LTM....300, 456
122-5532UI....266, 268-271, 290
122-5532UIE....290
122-5532UILTM....290, 457
122-5533....267, 273-274, 276, 300
122-5533E....300
122-5533G....445
122-5533LTM....300, 456
122-5533UI....266, 274, 290
122-5533UILTM....290, 457
122-5536....270, 300
122-5536E....300
122-5536G....445
122-5536UI....290
122-5536UILTM....290, 457
122-5552....300
122-5552UI....290
122-5561....300
122-5562....300
122-5562E....300
122-5562G....445
122-5562UI....270-271, 276, 290
122-5563....300
122-5563UI....290
122-5631....394
122-5631G5....445
122-5632....394
122-5633....394
122-5661....394
122-5711....363
122-5711E....363
122-5711LTM....363, 456
122-5731....363
122-5731LTM....363, 456
122-6432....443
122-6462....443
122-6832....269-270, 388
122-7012....353
122-7012E....353
122-7012LTM....353, 458
122-7013....272, 353
122-7013LTM....353, 458
122-7031....353
122-7032....278, 353
122-7032E....353
122-7032LTM....353, 458
122-7033....272, 276, 353
122-7033E....353
122-7033LTM....353, 458
122-7061....353
122-7062....353
122-7062E....353
122-7063....353
122-7063E....353
122-7332....354
122-7332E....354
122-7332LTM....354, 458
122-7333....354
122-7362....354
122-7363....354
122-7732....283-284, 386
122-7732LTM....386, 454
122-96L2....390
122-9732....276, 292, 392
122-9736....292, 392
123-0112....295
123-0112UI....289
123-0131....295
123-0132....295
123-0132UI....289
123-0162....295
123-0213....344
123-0232....344
123-0233....344
123-0334UI....292, 416
123-0364UI....292, 416
123-0712....349
123-0712LTM....349, 454
123-0713....349
123-0731....349
123-0732....349
123-0732E....349
123-0733....349
123-0733E....349
123-0753....349
123-0762....349
123-0763....349
123-0763E....349
123-100ALTM....453
123-1011....320
123-1011LTM....320, 453
123-1012....320
123-1012LTM....320, 453
123-1013....320
123-1014....320
123-1015....320
123-1015LTM....320, 453
123-1022....283, 320
123-1026....320
123-1027....320
123-102F....320
123-1031....320

123-1032 320
123-1032LTM 320, 453
123-1033 ..... 282, 320
123-1033E 320
123-1033LTM 320, 453
123-1034 320
123-1035 320
123-1035LTM 320, 453
123-103B 320
123-103BLTM 320, 453
123-103E 270, 274, 320
123-103ELTM 320, 453
123-1052 320
123-1055 320
123-1056 320
123-105C 320
123-105F 320
123-1061 320
123-1062 320
123-1062E 320
123-1063 320
123-1063E 320
123-1064 320
123-1064E 320
123-1065 320
123-1065E 320
123-106B 320
123-106BE 320
123-106E 279, 320
123-106G 320
123-1102LTM 455
123-1111 362
123-1111LTM 362, 455
123-1131 362
123-1131E 362
123-1232 304
123-1236 ..... 266, 268, 270, 273, 304
123-1262 304
123-1332 347
123-1333 347
123-1334 398
123-1334E 398
123-1334LTM 398, 457
123-1334UI 291, 397
123-1363 347
123-1364 398
123-1364E 398
123-1364UI 275, 291, 397
123-1464 402
123-1534 ..... 283, 400
123-1564 400
123-1632 ..... 284, 403
123-1711 339
123-1712 339
123-1713 339
123-1730 ..... 266, 282, 388
123-1730LTM 388, 457
123-1731 339
123-1732 339
123-1732E 339
123-1732LTM 339, 454
123-1733 339
123-1733E 339
123-1762 339
123-1811 364
123-1831 364
123-1861 364
123-1932 337
123-1933 337
123-1933E 337
123-1933LTM 337, 455
123-2032 343
123-2033 343
123-2232 345
123-2232E 345
123-2332 342
123-2332E 342
123-2362 342
123-2932 312
123-3212 358
123-3223 358
123-3232 ..... 281, 358
123-3232E 358
123-3232LTM 358, 457
123-3233 358
123-3233LTM 358, 457
123-3234 358
123-3234LTM 358, 457
123-3253 358
123-3262 358
123-3263 358
123-3264 358
123-3812 306
123-3832 ..... 273-274, 306
123-3832E 306
123-3832UI 266, 268, 270, 275, 291
123-4712 308
123-4732 ..... 270, 308
123-4732LTM 308, 454
123-5003LTM 456
123-500E 330
123-500ELTM 330, 456
123-5011 330
123-5011LTM 330, 456
123-5012 330
123-5012E 330
123-5012LTM 330, 456
123-5013 330
123-5013E 330
123-5013LTM 330, 456
123-5022 330
123-5022LTM 330, 456
123-5026 330
123-502D 330
123-502F 330
123-5031 330
123-5032 330
123-5032E 330
123-5032LTM 330, 456
123-5033 ..... 282, 330
123-5033E 330
123-503B 330
123-503BLTM 330, 456
123-503E 330
123-503ELTM 330, 456
123-5052 330
123-5053 330
123-5056 330
123-5062 330
123-5063 330
123-5511 300
123-5512 300
123-5512LTM 300, 456
123-5513 300
123-5513LTM 300, 456
123-5526 300
123-5531 300
123-5532 ..... 270, 273, 300
123-5532E 300
123-5532UI 275, 290
123-5532UIE 290
123-5533 ..... 276, 300
123-5533LTM 300, 456
123-5533UI 290
123-5536 ..... 270, 274, 300
123-5536LTM 300, 456
123-5536UI 290
123-5561 300
123-5562 300
123-5563 300
123-5563UI 290
123-5566 300
123-5631 394
123-5632 394
123-5701 363
123-5701LTM 363, 456
123-5711 363
123-5711E 363
123-5731 363
123-5731E 363
123-6133 443
123-6412 443
123-6432 443
123-7012 353
123-7012LTM 353, 458
123-7013 353
123-7013LTM 353, 458
123-7031 353
123-7032 353
123-7032E 353
123-7032LTM 353, 458
123-7033 353
123-7033E 353
123-7033LTM 353, 458
123-7062 ..... 281, 353
123-7063 353
123-7063E 353
123-7312 354
123-7314 354
123-7332 354
123-7333 354
123-7334 354
123-7334LTM 354, 458
123-7354 354
123-7354E 354
123-7362 354
123-7363 354
123-7364 ..... 285, 354
123-7722 386
123-7732 386
123-8232 ..... 265-266, 268, 273, 275, 384
123-8336 ..... 265-266, 268, 273, 275, 384
123-9134 414
123-9134LTM 414, 457
123-9234 414
123-9234E 414
123-BD01 378
123-BD11 378
123-BD34 378
124-0034 402
124-1032 320
124-1034 320
124-1334 ..... 280, 283, 398
124-1334LTM 398, 457
124-1374 ..... 269, 398
124-1534 ..... 281, 400
124-1574 ..... 281, 400
124-3232 ..... 282, 358
124-5032 331
124-5037 331
124-7032 ..... 280, 282, 353
125-0212 ..... 279, 344
125-0232 344
125-0232LTM 344, 455
125-0334UI 292, 416
125-0712 349
125-0712E 349
125-0712LTM 349, 454
125-0731 349
125-0732 349
125-0732E 349
125-0732G 445
125-0733 349
125-0737 349
125-0762 349
125-0762E 349
125-1002 321
125-1005 321
125-1005LTM 321, 454
125-100B 321
125-1011 321
125-1011E 321
125-1011LTM 321, 454
125-1012 321
125-1012E 321
125-1012LTM 321, 454
125-1014 321
125-1015 321
125-1015LTM 321, 454
125-1017 321
125-101J 321
125-101K 321
125-1025 321
125-1025LTM 321, 454
125-102J 321
125-1032 321
125-1032LTM 321, 454
125-1034 ..... 283, 321
125-1034E 321
125-1034LTM 321, 454
125-1035 ..... 278, 284-285, 321
125-1035E 321
125-1035LTM 321, 454
125-1037 321
125-1039 321
125-103B 321
125-103J 321
125-103JLTM 321, 454
125-103K 321
125-103KE 321
125-103KLTM 321, 454
125-1055 321

125-1062 321
125-1062E 321
125-1064 321
125-1065 321
125-1065E 321
125-106J 321
125-106JE 321
125-10B5 321
125-10H5 321
125-10HB 321
125-10HBE 321
125-10HBLTM 321, 454
125-1131 362
125-1212 304
125-1232 304
125-1312 347
125-1314 398
125-1332 347
125-1333 347
125-1333LTM 347, 454
125-1334 ..... 279-280, 285, 398
125-1334E 398
125-1334G5 445
125-1334LTM 398, 457
125-1334UI 291, 397
125-1364 398
125-1364E 398
125-1374 ..... 269, 398
125-1374E 398
125-1374UI 291, 397
125-14A4 402
125-1704 339
125-1711 339
125-1712 339
125-1712LTM 339, 454
125-1713 339
125-1713LTM 339, 454
125-1717 339
125-1730 ..... 282, 388
125-1731 339
125-1732 339
125-1732E 339
125-1732LTM 339, 454
125-1733 339
125-1737 339
125-1762 339
125-1912 337
125-1932 337
125-1932LTM 337, 455
125-1937 337
125-2032 343
125-2212 ..... 273, 345
125-2232 345
125-2237 345
125-2312 342
125-2332 342
125-2814 ..... 279-280, 283, 370
125-2814E 370
125-2814LTM 370, 455
125-3212 358
125-3217 358
125-3217LTM 358, 457
125-3231 358
125-3232 358
125-3232E 358
125-3233 358
125-3237 358
125-3262 358
125-32H2 358
125-3832 306
125-3837 306
125-5012 ..... 273, 331
125-5012E 331
125-5012LTM 331, 456
125-5017 331
125-501J 331
125-501K 331
125-5025 331
125-5032 ..... 282, 331
125-5032E 331
125-5032LTM 331, 456
125-5034 331
125-5035 331
125-5035E 331
125-5035LTM 331, 456
125-5037 331
125-503B 331
125-503D 331
125-503J 331
125-503K 331
125-5062 331
125-5065 331
125-5065E 331
125-50HB 331
125-5512 300
125-5532 300
125-5532LTM 300, 456
125-5537 300
125-5537G 445
125-553J 300
125-553JLTM 300, 456
125-6837 ..... 272-273, 275, 388
125-7012 353
125-7012E 353
125-7017 353
125-7031 353
125-7031LTM 353, 458
125-7032 ..... 279-280, 353
125-7032E 353
125-7032LTM 353, 458
125-7037 353
125-7062 353
125-7062E 353
125-7312 354
125-7314 354
125-7332 354
125-7332E 354
125-7333 354
125-7333LTM 354, 458
125-7334 354
125-7334E 354
125-7362 354
125-7732 386
125-9134 414
125-9134E 414
125-9234 414
126-1012 318
126-1013 318
126-7012 352
126-7013 352
127-0112 295
127-0112LTM 295, 455
127-0113 295
127-0122 295
127-0123 295
127-0123LTM 295, 455
127-0722 349
127-0723 349
127-100A 318
127-100ALTM 318, 453
127-1012 318
127-1012E 318
127-1013 318
127-1013E 318
127-1013LTM 318, 453
127-1022 318
127-1022E 318
127-1023 318
127-1023LTM 318, 453
127-1043 318
127-1046 318
127-1046E 318
127-1712 339
127-1712LTM 339, 454
127-1713 339
127-1722 339
127-2222 345
127-3212 358
127-3212LTM 358, 457
127-32H2 358
127-32H2LTM 358, 457
127-5012 329
127-5012E 329
127-5012LTM 329, 455
127-5013 329
127-5013LTM 329, 455
127-501E 329
127-501ELTM 329, 455
127-501N 329
127-5022 329
127-5023 329
127-7012 352
127-7012E 352
127-7012LTM 352, 458
127-7013 352
127-7013LTM 352, 458
127-7022 352
127-7022LTM 352, 458
127-7023 352
127-7023E 352
127-7023FF 353
127-7023LTM 352, 458
128-0112 295
128-0122 295
128-0122E 295
128-0122LTM 295, 455
128-1012 319
128-1012LTM 319, 453
128-1022 319
128-1022LTM 319, 453
128-1034 319
128-1052 319
128-1056 ..... 284, 369
128-1222 304
128-1314LTM 457
128-1324 398
128-1324E 398
128-1324LTM 398, 457
128-3812 306
128-3822 306
128-5012 330
128-5022 330
128-5022LTM 330, 455
128-5052 330
128-50H7 330
128-5512 300
128-5522 300
128-5522LTM 300, 456
128-5552 300
128-7022 352
128-7032 352
128-7032LTM 352, 458
128-7052 352
128-7323 354
128-8522 415
12A-1015 319
12A-1015LTM 319, 453
12A-5015 329
12A-5015LTM 329, 455
1300502506 54
14-3823-000 62
14-6855-000 62
14-8911-003 63
1400-0015 ..... 120, 133
145-1001 ..... 285, 370, 417-418
145-1009 ..... 370, 417-418
145-1011 ..... 283, 418
145-1032 418
145-1334 419
145-2814 417-418
145-7032 419
1460-1160 ..... 113, 115, 131
1460-1914 126
1500334701 ..... 218, 220
1535-4952 ..... 47, 52
1535-4954 47
160-1010-1 464
160-1010-10 464
160-1010-5 464
160-2200-10 468
160-2200-5 468
160-2205-1 464
160-2205-10 464
160-2205-5 464
160-2250-10 468
160-2250-5 468
160-2255-1 465
160-2255-10 465
160-2255-30 465
160-2255-5 ..... 43, 53, 465
160-2320-10 468
160-2320-5 468
160-2325-1 465
160-2325-10 465
160-2325-30 465
160-2325-5 ..... 43, 53, 465
160-2455-1 465
160-2455-10 465
160-2455-5 ..... 53, 465
160-2530-10 468
160-2530-5 468
160-2535-1 465
160-2535-10 465
160-2535-30 465

160-2535-5 ..... 43, 53, 465
160-2610-10 468
160-2610-5 468
160-2615-1 464
160-2615-10 464
160-2615-5 464
160-2625-1 ..... 43, 464
160-2625-10 ..... 43, 464
160-2625-5 ..... 43, 464
160-2634-10 468
160-2634-5 468
160-2635-1 464
160-2635-10 464
160-2635-5 464
160-2644-10 468
160-2644-5 468
160-2650-10 468
160-2650-5 468
160-2655-1 464
160-2655-10 464
160-2655-5 464
160-2660-5 468
160-2815-5 465
160-2825-5 465
160-2845-10 465
160-2845-5 465
160-2855-10 465
160-2855-5 465
160-2865-10 465
160-2865-5 465
160-4535-5 ..... 53, 469
169-0013-HSP 55
18596-40015 51
18710-20119 ..... 96, 119, 130, 135
18710-60170 ..... 105, 136
18711-60060 ..... 105, 136
18713-60040 ..... 102, 132
18713-60050 ..... 102, 132
18740-20800 ..... 75, 139
18740-20880 ..... 67, 139
18740-60830 ..... 74, 76, 138
18740-60835 ..... 74, 76, 83, 85, 90-91, 137-138
18740-60840 31
18740-80190 31
18740-80200 30
18740-80220 30
18789-60060 ..... 120, 133
18789-80070 ..... 96, 130
18900-21000 48
18900-60640 124
19091-21050 468
19091-60312 322
19091-60620E 464
19091-63000 80
19091A-002 327
19091A-005 327
19091A-008 327
19091A-012 327
19091A-015 327
19091A-101 327
19091A-102 327
19091A-102E 327
19091A-105 327
19091A-108 327
19091A-112 327
19091A-115 327
19091B-002 328
19091B-005 328
19091B-012 328
19091B-012E 328
19091B-015 328
19091B-101 328
19091B-101LTM 328, 461
19091B-102 328
19091B-102E 328
19091B-102LTM 328, 461
19091B-105 328
19091B-105E 328
19091B-112 328
19091B-112LTM 328, 461
19091B-115 328
19091B-115E 328
19091F-102 359
19091F-102E 359
19091F-102LTM 359, 460
19091F-105 359
19091F-105E 359
19091F-112 359
19091F-112E 359
19091F-112LTM 359, 460
19091F-115 359
19091F-115E 359
19091F-413 359
19091F-433 359
19091F-433E 359
19091F-433LTM 359, 460
19091G-113 338
19091G-131 338
19091G-131E 338
19091G-131LTM 338, 459
19091G-133 338
19091G-213 338
19091G-B133 411
19091G-B213 411
19091G-B233 411
19091G-B233E 411
19091J-002 332
19091J-005 332
19091J-012 333
19091J-015 333
19091J-101 332
19091J-102 332
19091J-102E 332
19091J-105 332
19091J-105E 332
19091J-108 332
19091J-112 333
19091J-112E 333
19091J-113 333
19091J-113E 333
19091J-113LTM 333, 459
19091J-115 333
19091J-115E 333
19091J-202 332
19091J-205 332
19091J-212 333
19091J-213 333
19091J-213E 333
19091J-215 333
19091J-215E 333
19091J-216 333
19091J-216E 333
19091J-231 333
19091J-233 ..... 272, 333
19091J-233LTM 333, 459
19091J-236 333
19091J-313 333
19091J-330 333
19091J-330LTM 333, 459
19091J-333 333
19091J-411 333
19091J-411LTM 333, 459
19091J-413 333
19091J-413E 333
19091J-413LTM 333, 459
19091J-416 333
19091J-431 333
19091J-431E 333
19091J-433 333
19091J-433E 333
19091J-433LTM 333, 459
19091J-436 333
19091J-436E 333
19091J-577 332
19091J-577E 332
19091J-577LTM 332, 459
19091L-101 340
19091L-113 340
19091L-113E 340
19091L-133 340
19091L-330 340
19091L-330LTM 340, 459
19091L-333 340
19091L-413 340
19091L-413E 340
19091L-416 340
19091L-431 340
19091L-431LTM 340, 459
19091L-433 340
19091L-433LTM 340, 459
19091N-013 355
19091N-013LTM 355, 460
19091N-030 355
19091N-030LTM 355, 460
19091N-033 355
19091N-036 355
19091N-102 355
19091N-102LTM 355, 460
19091N-105 355
19091N-105E 355
19091N-111 355
19091N-113 ..... 282, 355
19091N-113E 355
19091N-116 ..... 278, 285, 355
19091N-131 355
19091N-131E 355
19091N-133 355
19091N-133E 355
19091N-133LTM 355, 460
19091N-136 ..... 278, 355
19091N-136E 355
19091N-202 355
19091N-205 355
19091N-205E 355
19091N-213 355
19091N-213E 355
19091N-216 ..... 281-282, 355
19091N-216E 355
19091N-231 ..... 272, 355
19091N-233 ..... 276, 355
19091N-233E 355
19091N-236 355
19091N-331 355
19091N-577 355
19091N-577E 355
19091N-577LTM 355, 460
19091P-K15 428
19091P-K15E 428
19091P-K15PT 421, 428
19091P-K33 428
19091P-K33LTM 428, 461
19091P-M15 434
19091P-M15E 434
19091P-MS4 438
19091P-MS4E 438
19091P-MS7 438
19091P-MS7LTM 438, 461
19091P-MS8 438
19091P-MS8LTM 438, 461
19091P-QO3 425
19091P-QO3LTM 425, 461
19091P-QO3PT 421, 425
19091P-QO4 425
19091P-QO4E 425
19091P-QO4LTM 425, 461
19091P-QO4PT 421, 425
19091P-S12 432
19091P-S12LTM 432, 461
19091P-S12PT 421, 432
19091P-S15 432
19091P-S15E 432
19091P-S15PT 421, 432
19091P-S33 432
19091P-UO4 428
19091P-UO4E 428
19091P-UO4LTM 428, 461
19091R-303 401
19091R-306 ..... 267, 271, 275, 401
19091R-316 401
19091R-319 401
19091S-001 ..... 282-283, 367
19091S-001E 367
19091S-010 388
19091S-101 301
19091S-101LTM 301, 460
19091S-102 301
19091S-102E 301
19091S-102LTM 301, 460
19091S-105 301
19091S-111LTM 460
19091S-112 301
19091S-112E 301
19091S-113 ..... 270, 274, 301
19091S-133 ..... 267, 270, 273-274, 276, 301
19091S-133UI 271, 274, 290
19091S-133UILTM 290, 460
19091S-139 395
19091S-213 ..... 276, 282, 301
19091S-213UI 290
19091S-213UILTM 290, 460
19091S-231 301
19091S-233 301

19091S-233E....301
19091S-233UI....266, 290
19091S-233UILTM....290, 460
19091S-313....301
19091S-331....301
19091S-331LTM....301, 460
19091S-333....301
19091S-336....301
19091S-413....285, 301
19091S-413E....301
19091S-413LTM....301, 460
19091S-413UI....275, 290
19091S-413UILTM....290, 460
19091S-416....301
19091S-431....301
19091S-431LTM....301, 460
19091S-431UI....267, 290
19091S-431UILTM....290, 460
19091S-433....267, 283-284, 301
19091S-433E....301
19091S-433LTM....301, 460
19091S-433UI....266, 268, 271, 290
19091S-433UIE....290
19091S-433UILTM....290, 460
19091S-436....301
19091S-436E....301
19091S-436UI....290
19091S-577....301
19091S-577LTM....301, 460
19091S-577UI....266, 290
19091S-577UILTM....290, 460
19091S-602....296
19091S-602E....296
19091S-612....296
19091S-612UI....289
19091S-633....296
19091S-633LTM....296, 459
19091S-633UI....289
19091S-677....296
19091S-677LTM....296, 459
19091S-677UI....289
19091S-713....280, 283, 296
19091S-713LTM....296, 459
19091S-713UI....289
19091S-733....296
19091S-733E....296
19091S-733LTM....296, 459
19091S-733UI....289
19091S-833....296
19091S-833LTM....296, 459
19091S-911....296
19091S-911UI....289
19091S-913....296
19091S-913E....296
19091S-913UI....289
19091S-916....296
19091S-931....296
19091S-931UI....289
19091S-933....296
19091S-933E....296
19091S-933LTM....296, 459
19091S-933UI....289
19091S-936....296
19091S-936E....296
19091W-012....361
19091W-012E....361
19091W-012LTM....361, 459
19091W-015....361
19091W-015E....361
19091W-102....361
19091W-105....361
19091Y-012....441
19091Y-012E....441
19091Y-015....441
19091Y-102....441
19091Z-002....322
19091Z-002LTM....322, 459
19091Z-005....322
19091Z-008....322
19091Z-012....323
19091Z-012LTM....323, 459
19091Z-015....323
19091Z-102....322
19091Z-102E....322
19091Z-105....322
19091Z-112....323
19091Z-112E....323
19091Z-115....281, 285, 323
19091Z-115E....323
19091Z-202....322
19091Z-202LTM....322, 459
19091Z-205....322, 367
19091Z-205E....367
19091Z-211....323
19091Z-212....323
19091Z-213....323
19091Z-213E....323
19091Z-215....323
19091Z-216....323
19091Z-216E....323
19091Z-231....322
19091Z-233....322
19091Z-233E....322
19091Z-236....284-285, 322
19091Z-236E....322
19091Z-313....323
19091Z-313LTM....323, 459
19091Z-331....322
19091Z-333....322
19091Z-411....323
19091Z-413....323
19091Z-413E....323
19091Z-416....323
19091Z-431....322
19091Z-433....322
19091Z-433E....322
19091Z-436....322
19091Z-513....323
19091Z-513E....323
19091Z-530....283, 322, 367
19091Z-530E....322, 367
19091Z-577....322
19091Z-577E....322
19091Z-613....284, 323
19091Z-613LTM....323, 459
19091Z-713....323
19091Z-713E....323
19091Z-713LTM....323, 459
19091Z-716....323
19095F-120....359
19095F-120E....359
19095F-121....359
19095F-121LTM....359, 460
19095F-123....359
19095F-123E....359
19095F-123LTM....359, 460
19095J-023....333
19095J-023E....333
19095J-121....333
19095J-121E....333
19095J-121LTM....333, 459
19095J-123....333
19095J-123E....333
19095J-321....273, 333
19095J-323....333
19095J-323E....333
19095J-621....333
19095J-623....285, 333
19095J-623E....333
19095L-021....340
19095L-021LTM....340, 459
19095L-023....340
19095L-023E....340
19095L-121....441
19095L-523....340
19095N-121....355
19095N-123....355
19095N-123E....355
19095N-123LTM....355, 460
19095N-126....355
19095P-K23....428
19095P-K23LTM....428, 461
19095P-K23PT....278, 421, 428
19095P-K25....428
19095P-K25E....428
19095P-K25PT....285, 421, 428
19095P-M23....434
19095P-M25....434
19095P-M25PT....421, 434
19095P-MS0....278, 438
19095P-MS0E....438
19095P-MS0LTM....438, 461
19095P-MS5....438
19095P-MS6....438
19095P-MS6E....438
19095P-MS9....278, 438
19095P-QO3....425
19095P-QO3E....425
19095P-QO3LTM....425, 461
19095P-QO3PT....278, 282, 284, 421, 425
19095P-QO4....425
19095P-QO4E....425
19095P-QO4LTM....425, 461
19095P-QO4PT....283-284, 421, 425
19095P-S21....432
19095P-S23....432
19095P-S23PT....278, 421, 432
19095P-S25....432
19095P-S25E....432
19095P-S25PT....281, 421, 432
19095P-UO3....428
19095P-UO4....428
19095P-UO4E....428
19095P-UO4LTM....428, 461
19095P-UO4PT....284, 421, 428
19095R-420....401
19095R-429....401
19095S-100....323
19095S-100E....323
19095S-200....369
19095S-205....369
19095V-420....416
19095V-420E....416
19095V-420LTM....416, 460
19095W-121....361
19095W-123....361
19095Z-020....279, 323
19095Z-021....279, 323
19095Z-021E....323
19095Z-021LTM....323, 459
19095Z-023....323
19095Z-023E....323
19095Z-023LTM....323, 459
19095Z-121....323
19095Z-121E....323
19095Z-121LTM....323, 459
19095Z-123....323
19095Z-123E....323
19095Z-123LTM....323, 459
19095Z-220....323
19095Z-221....323
19095Z-221E....323
19095Z-321....323
19095Z-323....323
19095Z-323E....323
19095Z-421....323
19095Z-423....323
19095Z-423E....323
19095Z-621....282, 323
19095Z-623....323
19095Z-623E....323
19095Z-623LTM....323, 459
19095Z-626....285, 323
19095Z-627....283, 323
1909BD-113....378
19231-20910....98
19231-20940....98
19231-20980....98
19231-21050....128
19231-21060....98
19231-60680....98
19231-80520....99, 121, 129, 134
19231-80530....99, 121, 129, 134
19233-20755....102, 132
19234-60700....90, 99, 102, 129, 132, 137
19234-60715....90, 99, 102, 129, 132, 137
19234-60720....91, 121, 134
19243-00070....75, 139
19243-80530....90-91, 137
19243-80540....90-91, 137
19243-80570....90-91, 137
19244-80540....90-91, 137
19244-80560....96, 119, 130, 135
19244-80610....99, 121, 129, 134
19244-80620....96, 119, 130, 135
19245-20510....80
19245-20515....80
19245-20525....80
19245-20580....80
19245-20780....80
19245-40050....80

19245-60760....80
19245-80521....80
19251-60540....29
19251-80680....126
19256-00090....114
19256-00200....114
19256-00320....114
19256-20690....113, 115, 131
19256-20705....113, 131
19256-20900....114
19256-20910....113-115, 131
19256-21140....113, 131
19256-21150....113, 131
19256-60510....114
19256-60700....113, 131
19256-60750....115
19256-60800....113, 131
19256-80000....114
19256-80010....113-115, 131
19256-80640....113, 115, 131
19258-20830....55
19258-20870....55
19298-60500....124
19301-60660....128
19320-80625....80
19325-60660....48
19354-60510....124
200-0010....482
200-0032....482
200-0070....482
200-0110....482
200-0113....482
200-0185....482
200-0310....482
200-0370....482
200187500....218
200187600....220
200193800....218, 220
210-3003....30
210-3003-5....30
210-4004-5....29
210-4022-5....29
2100003100....220
2100003200....218, 220
221-0122LTM....462
221-1324LTM....463
221-1524LTM....463
221-3822LTM....463
221-4722LTM....463
221-5522LTM....462
221-5522UILTM....462
221-6822LTM....463
222-0112LTM....462
222-0132LTM....462
222-0732LTM....463
222-1032LTM....462
222-1111LTM....462
222-1131LTM....462
222-1334LTM....463
222-1534LTM....463
222-2912LTM....463
222-2932LTM....463
222-3212LTM....463
222-3232LTM....463
222-3812LTM....463
222-3832LTM....463
222-4712LTM....463
222-4732LTM....463
222-5512LTM....462
222-5512UILTM....462
222-5532LTM....462
222-5532UILTM....462
222-5711LTM....462
222-5731LTM....462
222-7013LTM....463
222-7033LTM....463
2302533140....54
2307230001....54
2307232901....54
232-2790010-EHS....55
232-2790012-EHS....55
2321700003....54-55
2321700004....54-55
2322590004....54-55
2322590005....54-55
2322700011....54
2710100200....179
2710100400....179
2710100500....179
2722990700....180
2735000500....179
2740236100....220
2740292400....219
2740928202....220
29091N-133LTM....463
29091N-577LTM....463
29091R-303LTM....463
29091S-431UILTM....462
29091S-433LTM....463
29091S-433UILTM....462
29091S-577UILTM....462
29091S-677LTM....462
29091S-833LTM....462
29091S-931LTM....462
301-011-HSP....55
301-015-HSP....55
301-016-HSP....55
301-017-HSP....55
301-152-HSP....55
301-169-HSP....55
301-170-HSP....55
301-205-HSP....55
301-211-HSP....55
301-212-HSP....55
3050-0891....154-155, 157
3050-1246....98
3050-1301....154-155, 157
3050-1374....157
3050-1375....154-155, 159
3150-0602....84
321-002-HSP....55
321-055-HSP....55
321-056-HSP....55
321-057-HSP....55
325-062-HSP....55
325-132-HSP....55
325-185-HSP....55
35900-60670....127
35900-60800....127
35900-60920....127
3600500001....55
3600500002....55
390607400....220
390607401....220
390607900....220
390812700....216-217
390820601....213-217
390842300....213-217
391821100....215
391866306....215
391866308....213
391867600....214
392017401....179
392027300....179-180
392030500....179-180
392035300....179-180
392043700....180
392047100....180
392511901....219-220
392512800....220
392513800....219
392514300....219-220
392514500....219-220
392515101....219
392515102....219
392515103....219
392515104....219
392515105....219
392515500....219-220
392517100....219
392517600....219
392517700....219
392517800....219
392517901....219
392519200....219
392543101....217
392544001....214
392544011....214
392544391....219
392548201....217
392548301....216
392560591....218
392561290....218
392567111....179
392585291....218
392585292....218
392595501....216-217
392597101....213
392597301....213
392597302....213
392597303....213
392597501....213
392599401....213
392599411....213
392599501....213
392609901....23
392609902....22
392609903....23
393001991....180
393010918....179
393010920....179
393010924....179
393011391....180
393031501....180
393050292....180
393050293....180
393050392....180
393050393....180
393050492....180
393050493....180
393053501....180
393053502....179-180
393060191....180
393065201....182
393082491....179
393101291....179
393112601....179
393112702....179
393113001....179
393161001....179
393164493....179
393167593....179
393171201....179
393175101....179
393706201....146, 174
393847701....179
394958700....218
394966601....214-215
410105017....54
4177-0607....53
430-1020....126
450-1000....86, 90, 137
480-0003....86, 90, 137
500-2114....37
500-2118....37
5020-8292....40
5020-8293....40
5020-8294....40
5021-7107....127
5021-7133....45
5021-7134....45
5021-7136....45
5021-7137....45
5021-7146....45
5021-7148....45
5021-7164....45
5021-7166....45
5021-7168....45
5021-7169....45
5021-7170....45
5040-4667....61
5040-4668....61
5040-4669....61
5040-4671....61
5060-9086....124
5061-5869....75, 139
5061-5886....114
5061-5890....114
5061-5896....146, 174
5062-3506....37-38, 148, 172
5062-3507....37, 172
5062-3508....37-38, 148
5062-3511....37
5062-3512....37
5062-3513....37
5062-3514....37-39, 148
5062-3515....37
5062-3516....37
5062-3519....47
5062-3525....45, 84, 86
5062-3538....37, 115
5062-3580....40
5062-3581....40
5062-3587....30

5062-9508 47
5062-9509 47
5062-9510 47
5062-9511 47
5067-0226 56
5067-0227 56
5067-0234 58
5080-5400 ..... 86, 90, 137, 146, 174
5080-8716 124
5080-8728-100 21
5080-8728-50 21
5080-8732 ..... 90-91, 137
5080-8750 ..... 91, 99, 127, 129, 137
5080-8751 ..... 91, 99, 129, 134
5080-8752 ..... 121, 134
5080-8753 ..... 121, 134
5080-8755 124
5080-8756 124
5080-8759 124
5080-8761 124
5080-8768 124
5080-8769 124
5080-8773 105
5080-8774 ..... 90-91, 99, 102, 105, 121, 129, 132, 134, 136-137
5080-8853 ..... 37, 105
5080-8858 482
5080-8894-100 21
5080-8896-50 ..... 21, 90
5080-8898 ..... 90-91, 137
5180-4103 ..... 99, 105-106, 129, 136-137
5180-4105 ..... 90-91, 99, 102, 105, 121, 129, 132, 134, 136-137
5180-4124 136
5180-4150 128
5180-4152 128
5180-4165 ..... 98, 128
5180-4168 ..... 33, 74, 76, 138
5180-4173 ..... 33, 74, 76, 138
5180-4196 127
5181-1260 ..... 21, 80
5181-1261 21
5181-1267 189
5181-1273 189
5181-1291 48-49
5181-1292 48-49
5181-3308 ..... 37, 40, 172
5181-3315 30
5181-3316 30
5181-3316i 30
5181-3319 189
5181-3321 189
5181-3322 37
5181-3323 ..... 37-39, 148, 172
5181-3351 440
5181-3352 440
5181-3354 189
5181-3356 189
5181-3358 189-190
5181-3360 189
5181-3361 189
5181-3365 189
5181-3382 ..... 90-91, 137
5181-3388 40
5181-7459 47
5181-7460 47
5181-8806 190
5181-8808 190
5181-8809 190
5181-8810 189
5181-8811 190
5181-8813 190
5181-8815 ..... 22, 74, 76, 90
5181-8816 ..... 22, 74, 76
5181-8818 30
5181-8830 ..... 39-40, 91, 99, 105, 121, 129, 132, 134, 137
5181-8833 22
5181-8836 ..... 53, 126
5181-8839 22
5181-8863 146
5181-8866 191
5182-0551 50
5182-0773 63
5182-0774 63
5182-0775 63
5182-0781 63
5182-0783 63
5182-0794 62
5182-0795 62
5182-0796 62
5182-0830 190
5182-0831 ..... 80, 191
5182-0832 ..... 189, 191
5182-0833 ..... 80, 191
5182-0834 190
5182-0835 189
5182-0836 ..... 80, 191
5182-0837 56
5182-0838 56
5182-0839 58
5182-0840 58
5182-0844 62
5182-0845 62
5182-0846 62
5182-0847 62
5182-0848 62
5182-0849 62
5182-0850 62
5182-0851 62
5182-0852 62
5182-0853 22
5182-0875 190
5182-3442 ..... 22, 74, 76
5182-3444 ..... 22, 74, 76, 83, 85, 90-91
5182-3445 ..... 22, 74, 76, 83, 85, 90-91
5182-3466 147
5182-3477 ..... 106, 136
5182-9622 191
5182-9626 191
5182-9633 80
5182-9645 80
5182-9651 87
5182-9652 ..... 67, 75, 139
5182-9673 ..... 106, 136
5182-9676 ..... 106, 136
5182-9677 ..... 106, 136
5182-9679 ..... 106, 136
5182-9722 ..... 120, 133
5182-9733 ..... 52, 54-55
5182-9734 191
5182-9747 84-86
5182-9748 ..... 84-85, 87
5182-9749 84-85
5182-9754 ..... 83, 86
5182-9756 ..... 83, 86
5182-9757 ..... 84, 87
5182-9758 ..... 84, 87
5182-9759 ..... 84, 87
5182-9760 ..... 84-85, 87
5182-9761 ..... 83, 86
5182-9762 ..... 83, 86
5182-9763 ..... 83, 86
5182-9768 ..... 83, 86
5182-9769 ..... 83, 86
5182-9770 ..... 83, 86
5182-9775 ..... 84, 87
5182-9799 191
5183-0314 189
5183-0316 190
5183-0318 ..... 87, 190
5183-2007 ..... 116, 120, 133
5183-2036 ..... 32, 85, 87
5183-2037 ..... 32, 87
5183-2038 ..... 32, 87
5183-2042 189
5183-2058 ..... 87, 190
5183-4474 56
5183-4475 56
5183-4477 58
5183-4478 58
5183-4479 58
5183-4480 58
5183-4641 127
5183-4642 127
5183-4644 127
5183-4645 127
5183-4647 28-30
5183-4691 29
5183-4692 29
5183-4693 30
5183-4694 30
5183-4695 30
5183-4696 30
5183-4697 31
5183-4698 31
5183-4699 31
5183-4700 31
5183-4701 28-31
5183-4702 28-31
5183-4703 30
5183-4704 30
5183-4705 30
5183-4706 30
5183-4707 30
5183-4708 30
5183-4709 30
5183-4710 30
5183-4711 29
5183-4712 29
5183-4713 29
5183-4728 190
5183-4729 190
5183-4730 190
5183-4732 ..... 40, 105
5183-4741 64
5183-4757 ..... 18, 74, 76, 90-91, 137-138
5183-4757-100 ..... 18, 74, 76, 138
5183-4758 ..... 18, 80
5183-4759 ..... 19, 85, 90, 137
5183-4759-100 ..... 19, 85
5183-4760 ..... 19, 80
5183-4761 ..... 19, 74, 76, 85, 90, 137-138
5183-4761-100 ..... 19, 74, 76, 85, 138
5183-4762 ..... 19, 80
5188-1181 169
5188-1447 63
5188-1448 63
5188-2717 ..... 68, 138
5188-2753 59
5188-2759 59
5188-5241 ..... 75, 139
5188-5245 ..... 113, 115, 131
5188-5246 190
5188-5247 190
5188-5311 33
5188-5312 40
5188-5313 ..... 32, 85, 87
5188-5314 40
5188-5315 40-41
5188-5316 124
5188-5317 124
5188-5347 ..... 172, 182
5188-5348 ..... 172, 182
5188-5356 ..... 32, 85, 87
5188-5357 ..... 172, 182
5188-5365 ..... 33, 74, 76, 138, 163, 176
5188-5366 ..... 33, 68, 138
5188-5367 ..... 67, 75, 139
5188-5370 190
5188-5371 190
5188-5372 128
5188-5379 482
5188-5392 59
5188-5953 ..... 113, 115, 131
5188-6471 31
5188-6493 ..... 74, 138
5188-6495 140
5188-6496 ..... 74, 138
5188-6497 ..... 74, 138
5188-6498 ..... 90-91, 137
5188-6537 59
5188-6538 59
5188-8813 63
5188-8814 63
5188-8815 63
5188-8816 63
5188-8817 63
5188-8818 63
5188-8819 63
5188-8820 63
5188-8821 63
5188-8822 63
5190-0468 181
5190-0471 181
5190-0472 181
5190-0473 181
5190-0490 181
5190-0491 181
5190-0492 181

5190-0493....181
5190-0494....181
5190-0513....181
5190-0531....177
5190-0585....172
5190-1407....378
5190-1408....378
5190-1409....378
5190-1410....378
5190-1426....32, 85, 87
5190-1437....53
5190-1438....53
5190-1441....181
5190-1445....63
5190-1446....63
5190-2209....16, 67, 75, 139
5190-2231....63
5190-2232....63
5190-2233....63
5190-2234....63
5190-2235....63
5190-2238....56
5190-2239....56
5190-2257....58
5190-2258....58
5190-2265....54
5190-2266....54
5190-2268....16, 33, 68, 138
5190-2269....16, 33
5190-2270....16, 30
5190-2271....16, 30
5190-2272....16, 30
5190-2275....16, 29
5190-2285....56
5190-2286....56
5190-2287....56
5190-2288....56
5190-2292....28
5190-2293....28
5190-2294....28
5190-2295....28
5190-2296....31
5190-2297....28, 31
5190-3151....62
5190-3152....62
5190-3153....62
5190-3154....62
5190-3157....16, 18
5190-3158....16, 19
5190-3162....28
5190-3163....28
5190-3164....28
5190-3165....28
5190-3166....28
5190-3167....28
5190-3168....28
5190-3169....28
5190-3170....16, 28
5190-3171....16, 28
5190-3172....16, 28
5190-3173....16, 28
5190-3188....60
5190-3189....60
5190-3190....60
5190-3191....60
5190-3192....60
5190-3193....190
5190-3976....64
5190-3978....64
5190-3983....28
5190-4006....28, 31
5190-4007....28
5190-4047....28, 31
5190-4048....28, 31
5190-4054....37, 40
5190-4061....60
5190-4062....60
5190-4063....60
5190-4064....60
5190-4065....60
5190-4066....60
5190-4067....60
5190-5233....38, 40, 148, 172
5190-6144....67, 75
5190-6145....67, 75
5190-6149....16, 67
5190-6168....28, 53
5190-6194....39-40, 91
5190-6979....44
5190-6980....44
5190-6981....47
5190-6982....47
5958-9441....51
5958-9442....51
5958-9443....51
5958-9444....51
5958-9445....51
5958-9450....51
5982-0024....181
5982-0025....181
6040-0289....173-174
6040-0798....170
6040-0809....170
6040-0834....170
6040-1361....170
621-9723....292, 392
622-9732....292, 392
6410090050....54
7200008400....213-217
8001-0004....232
8001-0005....232
8001-0006....232
8001-0007....232
8001-0010....232
8001-0011....232
8001-0012....232
8001-0013....232
8001-0014....232
8001-0101....227-229
8001-0102....227, 229
8001-0103....227-229
8001-0104....228
8001-0105....230
8001-0106....227-228
8001-0151....227-229
8001-0152....227, 229
8001-0153....227-229
8001-0154....228
8001-0155....230
8001-0156....227-228
8001-0157....227-229
8001-0158....227-229
8001-0159....227-229
8001-0160....227-229
8001-0162....228
8001-0163....228
8001-0201....230
8001-0202....230
8001-0203....230
8001-0211....231
8001-0212....231
8001-0213....231
8001-0214....231
8001-0221....231
8001-0222....231
8001-0223....231
8001-0224....231
8001-0311....232
8001-0312....232
8002-0001....236
8002-0002....236
8002-0003....236
8002-0004....236, 239
8002-0005....236, 239
8002-0101....234
8002-0102....234
8002-0103....234
8002-0104....234
8002-0105....234
8002-0106....234
8002-0107....234
8002-0151....234
8002-0152....234
8002-0153....234
8002-0154....234
8002-0155....234
8002-0156....234
8002-0157....234
8002-0159....234
8002-0160....234
8002-0161....234
8002-0201....235
8002-0203....235
8002-0204....235
8002-0211....235
8002-0212....235
8002-0213....235
8002-0214....235
8002-0215....235
8002-0216....235
8002-0217....235
8002-0220....235
8002-0221....235
8002-0222....235
8002-0311....236
8002-0312....236
8003-0001....225
8003-0002....225
8003-0003....225
8003-0004....225
8003-0005....225
8003-0006....225
8003-0007....225
8003-0008....225
8003-0101....221
8003-0103....221
8003-0104....222
8003-0105....221
8003-0106....221
8003-0107....221
8003-0108....222
8003-0109....222
8003-0110....221
8003-0111....221
8003-0151....221
8003-0153....221
8003-0154....222
8003-0155....222
8003-0157....221
8003-0158....221
8003-0159....221
8003-0160....221
8003-0162....221
8003-0163....222
8003-0165....221
8003-0166....221
8003-0202....222
8003-0203....222
8003-0204....222
8003-0205....222
8003-0211....224
8003-0212....224
8003-0216....223
8003-0219....224
8003-0221....224
8003-0222....224
8003-0223....224
8003-0311....224
8004-0001....210
8004-0002....210
8004-0003....210
8004-0004....210
8004-0005....210
8004-0006....210
8004-0007....210
8004-0101....206
8004-0102....206
8004-0103....206
8004-0104....206
8004-0105....206
8004-0106....206
8004-0107....206
8004-0108....207
8004-0109....207
8004-0110....207
8004-0111....208
8004-0112....207
8004-0113....206
8004-0114....206
8004-0116....206
8004-0118....207
8004-0119....206
8004-0151....206
8004-0152....206
8004-0153....206
8004-0154....206
8004-0155....206
8004-0156....206
8004-0157....206
8004-0158....206
8004-0159....207
8004-0160....207
8004-0161....207
8004-0162....207, 215

8004-0163....208
8004-0164....207, 214
8004-0165....206, 213
8004-0167....207, 215
8004-0168....208, 216
8004-0170....206
8004-0171....207
8004-0173....206
8004-0176....207
8004-0178....206
8004-0201....208, 211, 213, 226, 233, 237
8004-0202....208, 213
8004-0203....208
8004-0204....208, 214
8004-0211....209
8004-0212....209
8004-0213....209
8004-0214....209
8004-0215....209
8004-0216....209
8004-0217....210, 215-217
8004-0218....209
8004-0219....209
8004-0311....210, 213-217
8004-0312....210, 215
8010-0201....203, 211, 213, 237
8010-0202....203, 211, 237
8010-0203....203, 211, 216-217, 237
8010-0204....203, 211, 237
8010-0205....203, 211, 237
8010-0206....203, 211, 237
8010-0207....203, 211, 226, 237
8010-0208....203, 211, 226, 237
8010-0209....203, 211, 214-215, 237
8010-0210....203, 211, 237
8010-0211....203, 237-238
8010-0212....203, 237-238
8010-0213....203, 237
8010-0214....203, 237
8010-0215....203, 233
8010-0216....203, 233
8010-0217....202, 211-213, 237
8010-0218....202-205, 211, 226, 233, 237-238
8010-0219....202, 211, 216-217, 237
8010-0220....202, 211, 237
8010-0221....202, 211, 237
8010-0222....202, 211, 237
8010-0223....202, 211, 226, 237
8010-0224....202, 211, 226, 237
8010-0225....202, 211, 214-215, 237
8010-0226....202, 211, 237
8010-0227....202, 237
8010-0228....202, 237
8010-0229....202, 237
8010-0230....202, 237
8010-0231....202, 233
8010-0232....202, 233
8010-0233....204, 212-213, 238
8010-0234....204, 212, 238
8010-0239....204, 212, 226, 238
8010-0240....204, 212, 226, 238
8010-0241....204, 212, 214-215, 238
8010-0242....204, 212, 238
8010-0243....204, 238
8010-0244....204, 238
8010-0245....204, 238
8010-0246....204, 238
8010-0249....205, 212, 238
8010-0250....205, 212, 238
8010-0251....205, 212, 238
8010-0252....205, 212, 238
8010-0253....205, 212, 238
8010-0254....205, 212, 238
8010-0255....205, 212, 226, 238
8010-0256....205, 212, 226, 238
8010-0257....205, 212, 238
8010-0258....205, 212, 238
8010-0259....205, 238
8010-0260....205, 238
8010-0261....205, 238
8010-0262....205, 238
8010-0263....205, 233
8010-0264....205, 233
8010-0301....209, 223
8010-0302....209, 223
8010-0303....209, 223
8010-0304....209, 223
8010-0305....210, 215-217, 224
8010-0306....209, 223
8010-0307....209, 223
8010-0308....209, 223
8010-0309....209, 223
8010-0310....223, 231, 235
8010-0311....223, 231, 235
8010-0312....223, 231
8010-0313....223, 231
8010-0314....224, 231
8010-0315....224, 231
8010-0351....239
8010-0352....239
8010-0353....236
8010-0354....236
8010-0355....236, 239
8010-0356....239
8010-0357....239
8010-0358....239
8010-0359....239
8010-0360....239
8010-0361....239
8010-0362....239
8010-0363....239
8010-0364....239
8010-0365....239
8010-0366....239
8010-0367....236, 239
8010-0368....236
8010-0371....239
8010-0401....222, 235
8120-5342....127
8120-6360....127
8120-6894....127
8120-6903....127
8120-8619....127
8120-8620....127
8120-8621....127
8120-8622....127
8121-0070....127
8121-0161....127
8121-0675....127
8121-0710....127
8121-0723....127
8121-0940....127
8121-1222....127
8121-1301....127
8121-1787....127
8500-0656....146, 177, 182
8500-1233....146
8500-5440....172, 182
8500-5808....182
8500-5851....182
8500-5995....182
8500-6812....482
8500-6813....482
8500-8510....163, 176
8500-8510....182
8650-0029....146, 174
8650-0030....146, 172, 174
8710-0510....40, 147, 172
8710-0899....147
8710-0900....147
8710-1220....147
8710-1346....74, 138
8710-1561....120, 133
8710-1615....147
8710-1622....147
8829951700....170, 179
8829953800....179
9300003590....179
9301-0658....80
9301-0713....23, 87, 190
9301-0714....190
9301-0718....58
9301-0719....58
9301-0721....58
9301-0723....50
9301-0725....190
9301-0891....190
9301-0892....23, 87, 190
9301-0976....58
9301-1031....50
9310-4828....146, 174
998-0000053-EHS....55
C-102SSC....66
C-AT010C....66
C-B010M....66
C-BIO10....66
C-BTX1UG....66
C-CF020....66
C-CPLOK....66
C-DF010....66
C-G1CM10....66
C-GAT010C....66
C-GT010....66
C-HY010C....66
C-PL010....66
C-TBE10....66
C-TBP1C1C....66
C-TBP1CXC....66
C-TBP1TC....66
C-TNXTA....66
C-UN010C....66
CP0031....483
CP108194....467
CP1305....474
CP1306....475
CP1307....473
CP1308....474
CP1309....476
CP1483....475
CP17973....147, 164
CP17977....147
CP17988....147, 164
CP2045....475
CP2046....475
CP2050....479
CP2055....474
CP2058....472
CP2059....476
CP2062....473
CP2065....475
CP2068....473
CP2073....478
CP4016....440
CP4017....440
CP4018....440
CP4788....440
CP4789....440
CP4795....440
CP4796....440
CP5881....297
CP5882....309
CP5883....309
CP5884....309
CP5887....307
CP5889....307
CP5891....311
CP5892....311
CP6172....406
CP6173....406
CP6174....406
CP6175....406
CP6530....379
CP6540....372, 417-418
CP6550....372, 417-418
CP6571....469
CP6572....469
CP6573....469
CP6574....469
CP6575....469
CP6576....469
CP6577....469
CP6578....469
CP6579....469
CP6580....469
CP6581....469
CP6666....326, 418
CP6670....326, 418
CP6671....326, 418
CP6680....335, 419
CP6681....419
CP67569....418
CP68186....467
CP68187....467
CP6918....419, 431
CP6937....419, 439
CP6938....419, 439
CP6938I5....419, 439
CP6953....419, 424
CP6954....419, 424
CP6968....419, 431
CP7128....357
CP7130....418

CP7135....326, 418
CP7140....326, 418
CP7141....419
CP7148....357, 419
CP7150....326, 418
CP7160....326, 418
CP7168....357, 419
CP7170....326, 418
CP7178....357, 419
CP7179....357, 419
CP7196....335, 419
CP7310....324
CP7311....324
CP7334....356
CP7335....356
CP7340....350
CP7347....422
CP7348....422
CP7348PT....421-422
CP7350....280, 422
CP7350I5....422
CP7351....422
CP7351I5....422
CP7351PT....281-282, 421-422
CP7352....422
CP7352I5....422
CP7352PT....421-422
CP7353....422
CP7353I5....422
CP7353PT....280, 421-422
CP7354....272, 422
CP7354I5....422
CP7354PT....281-282, 421-422
CP7355....422
CP7371....436
CP7372....436
CP7374....278, 436
CP7375....436
CP7381....423
CP7406....387
CP7407....387
CP7409....387
CP7411....399
CP7412....399
CP7413....399
CP7414....279, 399
CP7415....399
CP7416....399
CP7416I5....399
CP7417....279, 399
CP7418....399
CP7419....407
CP7419I5....407
CP7420....407
CP7421....407
CP7422....382
CP7424....382
CP7428....281
CP7429....376
CP7430....376
CP7431....376
CP7432....376
CP7433....376
CP7434....380
CP7435....380
CP7437....380
CP7440....391, 419
CP7441....324
CP7442....325
CP7443....324
CP7443I5....324
CP7444....325
CP7446....381
CP7447....381
CP7447I5....381
CP7448....381
CP7448I5....381
CP7451....334
CP7452....335
CP7453....334
CP7453I5....334
CP7454....335
CP7461....390
CP7462....390
CP7463....409, 419
CP7475....367
CP7476....395
CP7477....395
CP7481....387
CP7482....281, 393
CP7483....409
CP7485....410
CP7485I5....410
CP7486....279, 410
CP7487....407
CP7488....278-279, 407
CP7489....407
CP7491....404
CP749103....404
CP749106....404
CP7491I5....404
CP7494....412
CP7495....412
CP7495I5....412
CP7498....396
CP7500....413
CP7500I5....413
CP7501....413
CP7502....412
CP7502I5....412
CP7503....412
CP7504....387
CP7511....430
CP7512....372, 417-418
CP7512I5....372
CP7513....436
CP7514....436
CP7515....430
CP7515I5....430
CP7515PT....279, 421, 430
CP7517....430
CP7517PT....421, 430
CP7518....430
CP7518PT....278-279, 421, 430
CP7519....430
CP7521....371
CP7522....371
CP7522I5....371
CP7525....280-282, 284, 373
CP7525I5....373
CP7527....408
CP7528....403
CP7529....283, 375
CP7530....368
CP7531....282, 368
CP7531I5....368
CP7532....279, 372, 417-418
CP7532I5....372, 417
CP7533....278, 439
CP7534....439
CP7534I5....439
CP7534PT....421, 439
CP7535....439
CP7535I5....439
CP7536....439
CP7536PT....421, 439
CP7537....278, 439
CP7538....439
CP7538I5....439
CP7538PT....421, 439
CP7539....439
CP7539PT....421, 439
CP7540....439
CP7540I5....439
CP7541....371
CP7542....372, 417-418
CP7543....439
CP7544....439
CP7548....424
CP7549....424
CP7550....424
CP7550I5....424
CP7550PT....421, 424
CP7551....424
CP7551I5....424
CP7551PT....421, 424
CP7552....424
CP7553....424
CP7554....279, 424
CP7554I5....424
CP7554PT....421, 424
CP7555....424
CP7556....424
CP7557....424
CP7557PT....421, 424
CP7558....278, 424
CP7559....424
CP7562....372, 417-418
CP7565....431
CP7565I5....431
CP7565PT....421, 431
CP7567....281, 431
CP7568....431
CP7568PT....421, 431
CP7569....372, 417-418
CP7569I5....372, 417
CP7570....279, 372, 417-418
CP7571....372, 417-418
CP7572....372, 417-418
CP7574....427
CP7576....430
CP7577....430
CP7579....427
CP7580....427
CP7581....427
CP7582....279, 372, 417-418
CP7583....427
CP7584....427
CP7584PT....421, 427
CP7586....431
CP7587....431
CP7588....270-271, 276, 396
CP7591....383
CP7592....280, 372, 417-418
CP7593....372, 417-418
CP7594....383
CP7595....382
CP7595I5....382
CP7596....269, 382
CP7596I5....382
CP7597....273, 382
CP7598....274, 382
CP7598I5....382
CP7599....382
CP7608....326
CP7614....282, 360
CP7615....285, 409
CP7617....409
CP7619....336
CP7620....326
CP7621....335
CP7622....324
CP7624....360
CP7625....326
CP7628....357
CP7629....336
CP7630....326
CP7631....335
CP7635....326
CP7636....335
CP7637....350
CP7638....357
CP7640....326
CP7641....335
CP7645....326
CP7646....335
CP7647....350
CP7648....357
CP7649....336
CP7654....272, 360
CP7656....335
CP7657....350
CP7658....357
CP7658I5....357
CP7659....336
CP7664....360
CP7665....360
CP7666....335
CP7667....350
CP7668....357
CP7670....324
CP7670I5....324
CP7671....334
CP7672....350
CP7673....356
CP7673I5....356
CP7675....326
CP7676....335
CP7678....357
CP7680....325
CP7680I5....325
CP7681....335
CP7682....324
CP7684....324

CP7685....285, 326
CP7685I5....326
CP7686....410
CP7688....326
CP7690....325
CP7690I5....325
CP7691....335
CP7691I5....335
CP7692....324
CP7693....324
CP7694....324
CP7695....326
CP7696....335
CP7697....350
CP7698....357
CP7698I5....357
CP7700....324
CP7702....350
CP7703....356
CP7709....324
CP7710....324
CP7711....334
CP7712....350
CP7713....356
CP7713I5....356
CP7714....373
CP7715....346
CP7717....360
CP7717I5....360
CP7719....324
CP7720....324
CP7721....334
CP7722....350
CP7723....356
CP7723I5....356
CP7725....346
CP7727....360
CP7730....325
CP7731....335
CP7732....350
CP7739....325
CP7740....325
CP7741....335
CP7741I5....335
CP7742....350
CP7743....357
CP7745....346
CP7747....360
CP7749....325
CP7749I5....325
CP7750....325
CP7750I5....325
CP7751....335
CP7751I5....335
CP7752....350
CP7753....357
CP7754....373
CP7757....360
CP7758....325
CP7760....325
CP7761....335
CP7762....350
CP7763....357
CP7764....373
CP7767....360
CP7769....334
CP7770....325
CP7770I5....325
CP7771....335
CP7772....350
CP7773....357
CP7773I5....357
CP7775....356
CP7777....360
CP7778....360
CP7779....335
CP7785....356
CP7787....360
CP7789....335
CP7791....356
CP7792....356
CP7797....360
CP7809....350
CP7813....336
CP7820....341
CP7821....341
CP7822....341
CP7822I5....341
CP7824....341
CP7829....350
CP7830....341
CP7831....341
CP7832....341
CP7834....341
CP7839....350
CP7871....341
CP7871I5....341
CP7879....357
CP7884....334
CP7889....357
CP7906....336
CP7907....336
CP7917....336
CP7926....336
CP7926I5....336
CP7936....336
CP7937....336
CP7945....368
CP7946....336
CP7947....336
CP7977....336
CP8003....465
CP8007....466
CP8008....466
CP8009....466
CP8014....335
CP8015....404, 466
CP8016....466
CP8017....466
CP8018....466
CP8019....466
CP8070....467
CP8073....357
CP8073I5....357
CP8080....467
CP8087....466
CP8088....466
CP8089....466
CP8090....467
CP81025....475
CP81069....474
CP81071....476
CP81073....474
CP8120....408
CP8121....389, 467
CP8128....466
CP8129....466
CP8131....389
CP8132....389
CP8133....389
CP8134....389, 466
CP8135....466
CP8186....467
CP8187....467
CP8430....280, 325
CP8431....335
CP8510....324
CP8511....334
CP8513....356
CP8521....334
CP8529....325
CP8530....325
CP8531....335
CP8533....357
CP8540....325
CP8541....335
CP8542....350
CP8543....357
CP8550....325
CP8553....357
CP8560....325
CP8562....350
CP8564....435
CP8566....435
CP8567....435
CP8568....435
CP8570....435
CP8570I5....435
CP8571....435
CP8575....375
CP8587....366
CP8587I5....366
CP8605....348
CP8607....348
CP8610....348
CP8613....348
CP8662....350
CP86677....474
CP86678....474
CP8673....326
CP8674....326
CP8675....326
CP8676....326
CP8677....280-281, 326
CP8678....335
CP8685....326
CP8687....280-281, 325
CP8687I5....325
CP8688....325
CP8688I5....325
CP8689....325
CP8690....325
CP8690I5....325
CP8710....324
CP8712....350
CP8713....356
CP8713I5....356
CP8716....335
CP8718....357
CP8722....350
CP8723....356
CP8730....326
CP8735....278-281, 326
CP8735I5....326
CP8736....272, 335
CP8736I5....335
CP8737....350
CP8738....279-280, 285, 357
CP8738I5....357
CP8741....324
CP8741I5....324
CP8742....325
CP8743....324
CP8744....325
CP8745....356
CP8746....356
CP8748....356
CP8750....334
CP8751....276, 334
CP8752....335
CP8753....334
CP8754....335
CP8756....335
CP8760....279, 281, 325
CP8761....335
CP8762....350
CP8763....279-280, 285, 357
CP8770....324
CP8771....334
CP8772....350
CP8773....282, 357
CP8774....326
CP8775....284, 326
CP8780....324
CP8781....334
CP8791....335
CP8796....335
CP8798....280, 357
CP8799....326
CP8801....305
CP8805....305
CP8806....305
CP8807....305
CP8809....305
CP8813....305
CP8816....305
CP8821....310
CP8822....310
CP8822I5....310
CP8824....310
CP8824I5....310
CP8827....310
CP8828....310
CP8829....310
CP8831....310
CP8842....350
CP8843....357
CP8853....357
CP8855....311
CP8857....311
CP8858....271, 311
CP8859....311
CP8859I5....311
CP8860....270, 311

CP8861....311
CP8864....311
CP8865....311
CP8867....311
CP8868....274, 311
CP8870....325
CP8871....335
CP8872....307
CP8873....307
CP8874....307
CP8875....307
CP8877....270, 275, 307
CP8878....307
CP8879....273, 307
CP8880....307
CP8882....307
CP8883....307
CP8884....307
CP8888....274, 307
CP8900....297
CP8901....297
CP8902....297
CP8903....297
CP8904....297
CP8905....297
CP8906....280-281, 284, 298
CP8907....298
CP8908....298
CP8908I5....298
CP8909....298
CP8910....298
CP8911....298
CP8912....298
CP8912I5....298
CP8913....267, 298
CP8914....298
CP8915....298
CP8916....298
CP8917....298
CP8919....298
CP8921....298
CP8922....298
CP8923....298
CP8924....265, 272, 298
CP8925....298
CP8926....265, 298
CP8928....298
CP8929....298
CP8930....298
CP8934....302
CP8935....302
CP8936....302
CP8937....302
CP8938....303
CP8939....267, 303
CP8940....303
CP8941....303
CP8943....270, 303
CP8944....266-271, 273-274, 276, 303
CP8944I5....303
CP8945....270, 276, 303
CP8946....266, 273, 275-276, 303
CP8947....303
CP8948....270, 303
CP8949....303
CP8950....303
CP8951....303
CP8953....303
CP8955....265, 276, 303
CP8956....303
CP8957....267, 275, 303
CP8958....303
CP8959....303
CP8960....271, 303
CP8961....303
CP8962....303
CP8963....303
CP8964....415
CP8965....298
CP8967....273, 298
CP8968....298
CP8969....274, 298
CP8970....298
CP8971....303
CP8974....303
CP8975....274, 303
CP8976....270, 272-274, 303
CP8977....309
CP8979....309
CP8980....309
CP8981....309
CP8982....270, 309
CP8982I5....309
CP8983....271, 309
CP8984....309
CP8986....309
CP8990....309
CP8991....265, 309
CP8996....309
CP8998....309
CP9001....272, 309
CP9002....273, 309
CP9010....446
CP9011....446
CP9012....446
CP9013....446
CP9014....446
CP9015....446
CP9016....446
CP9019....446
CP9021....446
CP9022....446
CP9023....446
CP9024....446
CP9025....446
CP9026....446
CP9027....446
CP9030....297
CP9031....297
CP9032....297
CP9034....302
CP9035....302
CP9036....302
CP9037....302
CP9038....302
CP9039....302
CP9041....305
CP9044....365
CP9045....365
CP9046....365
CP9047....365
CP9048....365
CP9053....316
CP9054....267, 316
CP9055....316
CP9056....316
CP9057....316
CP9058....316
CP9062....316
CP9063....316
CP9064....316
CP9066....316
CP9070....265-266, 270-271, 275, 386
CP9071....386
CP9072....386
CP9073....385
CP9074....265-267, 270-271, 275, 385
CP9075....385
CP9076....379, 419
CP9077....379, 419
CP9078....285, 379, 419
CP9079....379, 419
CP9080....379
CP9083....379
CP9090....365, 417
CP9091....365, 418
CP9092....365, 417
CP9093....365, 418
CP9094....365, 417
CP9094I5....365, 417
CP9095....365, 418
CP9096....365, 417
CP9097....365, 418
CP9100....315
CP9101....315
CP9102....265, 267, 269, 315
CP9102I5....315
CP9103....265, 267, 272, 275, 315
CP9103I5....315
CP9104....315
CP9104I5....315
CP9105....269, 271, 275, 315
CP9106....315
CP9106I5....315
CP9107....272, 315
CP9108....269, 271, 315
CP9109....315
CP9110....315
CP9145....317
CP9150....317
CP9151....266, 268, 317
CP9151I5....317
CP9152....317
CP9152I5....317
CP9154....317
CP9156....317
CP9162....317
CP9163....265, 317
CP9165....317
CP9166....317
CP9170....317
CP9171....272-274, 317
CP9176....446
CP9177....446
CP9201....313
CP9202....313
CP9203....313
CP9204....313
CP9205....313
CP9205I5....313
CP9206....269, 313
CP9207....313
CP9210....314
CP9211....314
CP9212....314
CP9213....314
CP9214....314
CP9215....272, 274, 276, 314
CP9216....314
CP9217....314
CP9218....313
CP9219....313
CP9220....313
CP9221....313
CP9222....313
CP9223....313
CP9225....314
CP9226....272, 314
CP9228....314
CP9229....313
CP97638....408
CP97658....408
CP97713....408
CP97721....408
CP97723....408
CP97723I5....408
CP97743....408
CP97753....408
CP97753I5....408
CP97763....408
CP97773....408
CR213105....209
DY50295500....64
DY50296800....64
DY50390600....64
DY50402400....64
DY50540700....64
DY50546100....64
DY50546390....64
DY50548400....64
DY50549100....64
DY50549290....64
DY50549500....64
DY50551400....64
DY50559800....64
DY50559900....64
DY50572600....64
DY50573990....64
DY50574190....64
DY50574390....64
DY50574500....64
DY70001990....64
DY70007691....64
DY70007701....64
DY70007791....64
DY70008101....64
DY70008590....64
G1072-20008....154-155
G1099-20030....38, 126, 147-148, 172
G1099-20130....154
G1099-20132....154
G1099-20133....154-155, 157
G1099-20136....154-155
G1099-60566....146

G1099-80039....170
G1530-60560....127
G1530-60570....127
G1530-60930....127
G1530-61230....126
G1530-61580....126
G1530-61610....126
G1530-61640....126
G1530-80650....123, 127
G1531-20690....98
G1531-20700....98
G1531-20740....98
G1531-21090....98
G1531-60690....98
G1531-80560....96, 119
G1531-80620....96, 119
G1532-20710....105, 113, 121, 131, 134, 136
G1532-60675....107
G1532-60685....107
G1532-60690....107
G1532-60695....107
G1532-80540....105, 136
G1534-20530....120, 133
G1534-20590....120, 133
G1534-60570....116, 120, 133
G1534-60640....120, 133
G1534-80510....120, 133
G1534-80580....119
G1534-80590....119, 135
G1535-00010....114
G1535-00030....114
G1535-60600....113, 115, 131
G1535-60610....114
G1535-80520....114
G1540-30025....48
G1540-30026....48
G1540-30027....48
G1540-30028....48
G1540-80013....90
G1544-20590....75, 139
G1544-60585....74
G1544-80700....32
G1544-80730....32
G1544-80731....32
G1545-80520....80
G1888-60701....55
G1888-60702....54
G1888-60703....54
G1888-60704....54
G1890-60000....54
G1960-80303....174
G1999-20021....154-155, 159
G1999-20022....154-155, 159
G1999-20430....159
G1999-20432....159
G1999-20433....159
G1999-20443....159
G1999-20444....159
G1999-20446....159
G1999-60412....159
G1999-60452....163, 176
G1999-80410....147, 164
G2397-20540....102, 132
G2397-80520....102
G2589-20043....155
G2589-20044....155, 157
G2589-20045....151, 155
G2589-20100....151, 155
G2591B....153
G2591C....153
G2591D....153
G2617-20510....84
G2617-60506....83
G2617-60507....83, 85, 87
G2617-60508....83
G2617-60510....84
G2617-80540....84
G2617-80550....85, 87
G2618-80500....83, 85
G2619-60501....83
G2630-60710....123
G2630-61230....107
G2646-60500....123
G2647-60501....113, 131
G2648-60501....113, 131
G2855-20530....43, 49
G2855-20532....49
G2855-20555....38, 40, 43, 49, 148, 172
G2855-20590....43, 53
G2855-40001....53
G2855-60200....38, 43, 53, 148, 172
G2855-60570....53
G2933-85001....123
G2933-85003....123
G3163-20530....154
G3170-20126....154-155, 157, 159
G3170-20530....154-155
G3170-20540....159
G3170-60053....157
G3170-60204....163
G3170-60416....159
G3170-80001....162
G3170-80002....163, 176-177
G3170-80002....146, 174
G3170-80008....165
G3170-80100....165
G3170-80103....165, 173-174
G3182-61580....42
G3182-61581....42
G3184-60065....43
G3188-20509....49
G3188-27501....37-39, 41, 43, 49, 148, 172
G3188-27502....37-39, 41, 43, 49, 148, 172
G3188-27503....37, 41, 43, 49, 172
G3188-27504....49, 172
G3188-27505....49
G3188-27506....49
G3397A....162
G3397B....162
G3430-60011....74
G3431-60680....98
G3432-60220....107
G3432-60221....107
G3433-63000....102, 132
G3434-60806....116, 120
G3435-60350....115
G3435-81330....115
G3435-81360....115
G3440-05012....181
G3440-20003....48
G3440-20004....48
G3440-20005....48
G3440-20007....48
G3440-20008....48
G3440-20033....49
G3440-20035....49
G3440-20037....49
G3440-60033....49
G3440-60035....49
G3440-60136....49
G3440-60233....49
G3440-60234....49
G3440-60236....49
G3440-60300....49
G3440-60310....49
G3440-60333....49
G3440-60334....49
G3440-60336....49
G3440-60600....49
G3440-60610....49
G3440-60620....49
G3440-80217....39-40, 74, 76
G3440-80218....39-40, 74, 76
G3440-81664....49
G3440-81665....49
G3440-85007....181
G3440-85009....181
G3440-85012....181
G3440-85013....181
G3440-85017....181
G3440-85018....181
G3440-85026....181
G3440-85027....181
G3440-85028....181
G3440-85029....181
G3440-85035....181
G3440-85036....181
G3451-80501....90, 137
G3452-20512....76
G3452-60570....74
G3452-60586....74
G3452-60730....74
G3452-60835....53
G3452-80570....74
G3480-20002....48
G3480-60663....48
G3480-67585....74
G3500-80000....87
G3504-20504....40
G3504-60620....53
G3507-60660....48
G3510-20018....76
G3520-20210....53
G3591-70001....478
G3591-70002....475
G3591-70003....475
G3591-70004....475
G3591-70005....474
G3591-70006....474
G3591-70007....474
G3591-70008....475
G3591-70009....478
G3591-70010....478
G3591-70011....474
G3591-70012....471
G3591-70013....475
G3591-70014....478
G3591-70015....476
G3591-70016....471
G3591-70017....476
G3591-70018....478
G3591-74001....474
G3591-80000....480
G3591-80001....472
G3591-80002....474
G3591-80003....476
G3591-80004....474
G3591-80006....480
G3591-80007....479
G3591-80008....479
G3591-80011....473
G3591-80012....476
G3591-80013....478
G3591-80014....479
G3591-80015....479
G3591-80016....478
G3591-80017....475
G3591-80019....474
G3591-80020....474
G3591-80021....471
G3591-80022....475
G3591-80023....474
G3591-80025....476
G3591-80026....479
G3591-80027....472
G3591-80028....476
G3591-80029....479
G3591-80030....472
G3591-80031....476
G3591-80032....472
G3591-80033....474
G3591-80034....480
G3591-80035....476
G3591-80036....477
G3591-80037....473
G3591-80039....472
G3591-80040....480
G3591-80043....476
G3591-80044....477
G3591-80045....473
G3591-80046....475
G3591-80047....474
G3591-80048....476
G3591-80049....480
G3591-80051....478
G3591-80052....478
G3591-80053....478
G3591-80054....476
G3591-80055....471
G3591-80056....475
G3591-80058....476
G3591-80059....477
G3591-80060....473
G3591-80061....475
G3591-80062....475
G3591-80063....479
G3591-80064....475
G3591-80065....475
G3591-80066....478
G3591-80067....472
G3591-80068....479

G3591-80071....479
G3591-80072....477
G3591-80074....475
G3591-80075....475
G3591-80077....475
G3591-80082....472
G3591-80083....478
G3591-80084....470
G3591-80085....476
G3591-80086....477
G3591-80087....477
G3591-80088....473
G3591-80090....475
G3591-80091....473
G3591-80093....476
G3591-80094....480
G3591-80095....470
G3591-80096....478
G3591-80097....476
G3591-80098....476
G3591-80099....471
G3591-80100....474
G3591-80101....476
G3591-80103....475
G3591-80104....475
G3591-80105....470
G3591-80106....478
G3591-80107....475
G3591-80108....479
G3591-80110....477
G3591-80119....477
G3591-80120....478
G3591-80121....474
G3591-80122....477
G3591-80123....477
G3591-80124....474
G3591-80135....478
G3591-80136....478
G3591-80137....478
G3591-80138....478
G3591-80139....471
G3591-80140....472
G3591-80141....479
G3591-80142....479
G3591-80156....473
G3591-80157....478
G3591-80158....473
G3591-80160....472
G3591-80161....472
G3591-80162....476
G3591-80170....479
G3591-80171....479
G3591-80176....479
G3591-81000....480
G3591-81001....472
G3591-81002....474
G3591-81003....476
G3591-81004....474
G3591-81006....480
G3591-81007....479
G3591-81008....479
G3591-81011....473
G3591-81012....476
G3591-81013....478
G3591-81014....479
G3591-81015....479
G3591-81016....478
G3591-81017....475
G3591-81019....474
G3591-81020....474
G3591-81021....471
G3591-81022....475
G3591-81023....474
G3591-81025....476
G3591-81026....479
G3591-81027....472
G3591-81028....476
G3591-81029....479
G3591-81030....472
G3591-81031....476
G3591-81032....472
G3591-81033....474
G3591-81034....480
G3591-81035....476
G3591-81036....477
G3591-81037....473
G3591-81039....472
G3591-81040....480
G3591-81043....476
G3591-81044....477
G3591-81045....473
G3591-81046....475
G3591-81047....474
G3591-81048....476
G3591-81049....480
G3591-81050....471
G3591-81051....478
G3591-81052....478
G3591-81053....478
G3591-81054....476
G3591-81055....471
G3591-81056....475
G3591-81058....476
G3591-81059....477
G3591-81060....473
G3591-81061....475
G3591-81062....475
G3591-81063....479
G3591-81064....475
G3591-81065....475
G3591-81066....478
G3591-81067....472
G3591-81068....479
G3591-81071....479
G3591-81072....477
G3591-81074....475
G3591-81075....475
G3591-81077....475
G3591-81082....472
G3591-81083....478
G3591-81084....470
G3591-81085....476
G3591-81086....477
G3591-81087....477
G3591-81088....473
G3591-81090....475
G3591-81091....473
G3591-81093....476
G3591-81094....480
G3591-81095....470
G3591-81096....478
G3591-81097....476
G3591-81098....476
G3591-81099....471
G3591-81100....474
G3591-81101....476
G3591-81102....474
G3591-81103....475
G3591-81104....475
G3591-81105....470
G3591-81106....478
G3591-81119....477
G3591-81120....478
G3591-81121....474
G3591-81122....477
G3591-81123....477
G3591-81135....478
G3591-81136....478
G3591-81137....478
G3591-81138....478
G3591-81139....471
G3591-81140....472
G3591-81141....479
G3591-81142....479
G3591-81143....474
G3591-81146....474
G3591-81147....475
G3591-81149....475
G3591-81156....473
G3591-81157....478
G3591-81160....472
G3591-81161....472
G3591-81162....476
G3591-81176....479
G3591-81209....475
G3591-81210....473
G3591-81211....473
G3591-81212....473
G3591-81213....473
G3591-81214....476
G3591-81215....480
G3591-82000....480
G3591-82001....472
G3591-82002....474
G3591-82003....476
G3591-82004....474
G3591-82011....473
G3591-82012....476
G3591-82013....478
G3591-82014....479
G3591-82015....479
G3591-82016....478
G3591-82017....475
G3591-82020....474
G3591-82022....475
G3591-82023....474
G3591-82025....476
G3591-82026....479
G3591-82029....479
G3591-82032....472
G3591-82033....474
G3591-82035....476
G3591-82036....477
G3591-82037....473
G3591-82039....472
G3591-82040....480
G3591-82043....476
G3591-82044....477
G3591-82048....476
G3591-82049....480
G3591-82050....471
G3591-82051....478
G3591-82053....478
G3591-82063....479
G3591-82064....475
G3591-82067....472
G3591-82072....477
G3591-82082....472
G3591-82084....470
G3591-82087....477
G3591-82088....473
G3591-82093....476
G3591-82095....470
G3591-82099....471
G3591-82101....476
G3591-82102....474
G3591-82104....475
G3591-82106....478
G3591-82119....477
G3591-82121....474
G3591-82122....477
G3591-82123....477
G3591-82135....478
G3591-82136....478
G3591-82137....478
G3591-82139....471
G3591-82140....472
G3591-82159....474
G3591-82176....479
G3850-60014....147
G3870-20021....157
G3870-20135....154, 157
G3870-20440....157
G3870-20444....151, 157
G3870-20445....157
G3870-20446....157
G3870-20448....151
G3870-20449....151
G3870-20530....157
G3870-60171....157
G3870-60172....154
G3870-60179....155
G3880-20030....38, 147-148
G3880-80010....162
G3880-80011....162
G3900-63001....462
G3900-63002....462
G3900-63003....463
G3900-63004....462
G3900-63005....462
G3900-63006....463
G3900-63007....463
G3900-63008....463
G3900-63009....462
G3900-63010....463
G3900-63011....463
G3900-63012....463
G3900-63013....462
G3900-63014....462
G3900-63015....463
G3900-63016....462
G3900-63017....462
G3900-63018....462
G3900-63019....462

G3900-63020....463
G3900-63021....463
G3900-63022....463
G3900-63023....463
G3900-63024....463
G3900-63025....463
G3900-63026....463
G3900-63027....463
G3900-63028....463
G3900-63029....463
G3900-63030....462
G3900-63031....462
G3900-63032....462
G3900-63033....462
G3900-63034....463
G3900-63035....463
G3900-63036....463
G3900-63037....463
G3900-63038....462
G3900-63039....462
G3900-63040....462
G3900-63041....462
G3900-63042....462
G3900-64016....450
G3900-65001....448
G3900-65003....449
G3900-65004....449
G3903-61004....448
G3903-63001....284, 374
G3903-63002....374
G3903-63003....283, 374
G3903-63004....374
G3903-65002....448
G4333-63000....132
G4513-20561....50
G4513-40525....50
G4513-40529....50
G4513-60560....188
G4513-60561....188
G4513-80200....187
G4513-80201....187
G4513-80202....187
G4513-80203....188
G4513-80204....187
G4513-80205....187
G4513-80206....187
G4513-80208....188
G4513-80209....23, 187
G4513-80210....188
G4513-80211....187
G4513-80212....187
G4513-80213....23, 187
G4513-80215....187
G4513-80216....187
G4513-80218....187
G4513-80219....188
G4513-80220....188
G4513-80221....188
G4513-80222....188
G4513-80223....188
G4513-80224....187
G4513-80225....187-188
G4513-80226....187
G4513-80227....188
G4513-80228....188
G4513-80229....187
G4513-80233....188
G4513-80234....187
G4513-80235....187
G4513-80236....187-188
G4513-80239....187
G4513-80240....187
G4513-80241....188
G4513-80242....187
G4513-80243....187
G4513-80244....187
G4514-60610....127
G4514-60710....50
G4514-67505....50
G4525-60701....50
G4525-60702....50
G4525-60703....50
G4525-60704....50
G4556-60019....52
G4556-60125....52
G4556-67010....52
G4556-90500....52
G6012A....169
G6014A....169, 179
G6600-60037....123
G6600-60038....122
G6600-67007....122-123
G6600-67008....122-123
G6600-80018....41, 122-123
G6600-80042....122
G6600-80043....122-123
G6600-80044....122-123
G6600-80045....122
G6600-80050....122
G6600-80051....122-123
G6600-80063....122
G6600-80072....122-123
G6600-85000....123
G6600-85001....122-123
G6600-85002....122-123, 170
G7005-60061....154-155, 162, 174
G7005-60072....159, 162, 174
MKI-C-QSC10....65
MKI-MTD-1169....65
MKI-MTD-1204....65
MKI-SERUTD-5065....66
MKI-U-COV06....65
MKI-U-COV07....65
MKI-U-COV10....65
MKI-U-DISK1....65
MKI-U-DISK3....65
MKI-U-T10CW-2S....65
MKI-U-T11GPC....65
MKI-U-T11GPC-2S....65
MKI-U-T12ME....65
MKI-U-T12ME-2S....65
MKI-U-T13DHS....65
MKI-U-T13DHS-2S....65
MKI-U-T15ATA-2S....65
MKI-U-T16GHG-2S....65
MKI-U-T17O3P-2S....65
MKI-U-T1HBL-2S....65
MKI-U-T3ATX....65
MKI-U-T3ATX-2S....65
MKI-U-T6SUL-2S....65
MKI-U-T9TNX....65
MKI-U-T9TNX-2S....65
MKI-UTD-5064....66
MKI-Z-0285....65
MKI-Z-0351....65
RDT-1020....52, 140
RDT-1023....140
RMSN-2....164

Product Index

Agilent J&W GC Columns

Application and Method Guides
ASTM Methods 278-285
Application Cross Reference Guide 262-264
EPA Methods
Drinking Water 265-268
Solid Waste 272-276
Waste Water 269-271
United States Pharmacopoeia (USP)
GC Phases 277
Capillary Columns
By Group
Foods, Flavors and Fragrances 405
High Temperature 362
Life Sciences 414
Low-bleed GC/MS 294
Non-Bonded 441
PAH 390
PLOT 420
Pesticides 384
Petroleum 366
Polyethylene Glycol (PEG) 351-413
Premium Polysiloxane 318
Semivolatiles 392
Ultra Inert 286
Volatiles 397
By Stationary Phase
Biodiesel 377-378
CAM 442
CarboBOND 436
CarboPLOT P7 436
Carbowax 20M and HP-20M 361
CP-1301 348
CP-Al2O3/KCl 430-431
CP-Al2O3/Na2SO4 430-431
CP-Carbowax 400 for Volatiles in Alcohol 408
CP-Chirasil Val 412
CP-Chirasil-Dex CB 412
CP-Cyclodextrin-β-2,3,6-M-19 413
CP-FFAP CB for Free Fatty Acids in Dairy Products 410
CP-Molsieve 5Å 439
CP-Select 624 CB 399
CP-Select CB for MTBE 403
CP-Sil 13 CB 336
CP-Sil 19 CB 350
CP-Sil 19 CB for Pesticides 387
CP-Sil 2 CB 373
CP-Sil 24 CB 341
CP-Sil 43 CB 346
CP-Sil 5 CB 324-326
CP-Sil 5 CB for Formaldehyde 367
CP-Sil 5 CB for Sulfur 375
CP-Sil 5/C18 CB for PCB 395
CP-Sil 8 CB 334-335
CP-Sil 8 CB for Amines 382
CP-Sil 8 CB for PCB 393
CP-Sil 8 CB for Pesticides 387
CP-Sil 88 406
CP-Sil 88 for Dioxins 396
CP-Sil 88 for FAME 407
CP-Sil PAH CB UltiMetal 391
CP-Sil PONA CB 368
CP-Sil PONA for ASTM D5134 368
CP-SilicaPLOT 435
CP-SimDist 371-372
CP-TAP CB for Triglycerides 409
CP-TCEP for Alcohols in Gasoline 373
CP-Volamine 381
CP-Wax 52 CB 356-357
CP-Wax 57 CB 408
CP-Wax 57 CB for Glycols and Alcohols 409
CP-Wax 58 FFAP CB 360
CP-Wax for Volatile Amines and Diamines 382
CycloSil-B 410
Cyclodex-B 411
DB-1 318-321
DB-1301 347
DB-17 339
DB-1701 349
DB-1701P 386
DB-17ht 364
DB-17ms 308
DB-1ht 362
DB-1ms 295
DB-1ms Ultra Inert 289
DB-200 343
DB-210 344
DB-225 345
DB-225ms 312
DB-23 342
DB-2887 370
DB-35 337
DB-35ms 306
DB-35ms Ultra Inert 291
DB-5 329-331
DB-5.625 394
DB-502.2 402
DB-5ht 363
DB-5ms 299-300
DB-5ms EVDX 415
DB-5ms Ultra Inert 290
DB-608 388
DB-624 398
DB-624 Ultra Inert 291, 397
DB-ALC1 414
DB-ALC2 414
DB-CLP1 384
DB-CLP2 384
DB-Dioxin 396
DB-EUPAH 390
DB-FFAP 358
DB-HT SimDis 370
DB-MTBE 402
DB-Petro 369
DB-Select 624 UI for <467> 292, 416
DB-Sulfur SCD 374
DB-TPH 403
DB-UI 8270D Ultra Inert 292
DB-UI 8270D for Semivolatiles 392
DB-VRX 400
DB-WAX 351-353
DB-WAX FF 351-353
DB-WAXetr 354
DB-XLB 304
DX-1 443
DX-4 443
GS-Alumina 433
GS-Alumina KCl 429
GS-CarbonPLOT 437
GS-GasPro 434
GS-OxyPLOT 366
GS-Q 426
HP-1 322-323
HP-1 Aluminum Clad 369
HP-101 441
HP-17 441
HP-1ms 296
HP-1ms Ultra Inert 289
HP-20M 361
HP-35 338
HP-5 332-333
HP-50+ 340
HP-5ms 301
HP-5ms Semivolatile 395
HP-5ms Ultra Inert 290
HP-88 405
HP-Chiral β 411
HP-FFAP 359
HP-Fast Residual Solvent 416
HP-INNOWax 355
HP-PAS5 388
HP-PLOT Al2O3 KCl 428
HP-PLOT Al2O3 M 434
HP-PLOT Al2O3 S 432
HP-PLOT Molesieve 438
HP-PLOT Q 425
HP-PLOT U 428
HP-PONA 367
HP-VOC 401
Lowox 366
PoraBOND Q 422
PoraBOND U 423
PoraPLOT Amines 383
PoraPLOT Q 424
PoraPLOT Q-HT 424
PoraPLOT S 427
PoraPLOT U 427
Rapid-MS 389
SE-30 444
SE-54 444
Select Al2O3 MAPD 376
Select Biodiesel 379
Select FAME 407
Select Low Sulfur 375
Select Mineral Oil 404
Select PAH 390
Select Silanes 380
Select for Permanent Gases 376
Ultra 1 327
Ultra 2 328
VF-1301ms 315-316
VF-1701 Pesticides 386
VF-1701ms 317
VF-17ms 309
VF-1ms 297-298
VF-200ms 311
VF-23ms 310

VF-35ms....307
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 5Å....475
Porapak N....477
Porapak N + Porapak R 1:1....477
Porapak Q....478
Porapak QS....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 Quadropole 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
Quadropole 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_2, and Methane in a Natural Gas Sample 583
Benzodiazepines I 636
Benzodiazepines II 640
Blood Alcohols I (Static Headspace/Split) 638
Blood Alcohols II (Static Headspace/Split) 638
Blood Pollutants I 649
Blood Pollutants II 650
Bourbon 568
Butter Triglycerides I 574
Butter Triglycerides II 574

C

C_1 to C_4 Hydrocarbon Mix 580
C_1 and C_2 Halocarbons (Freons) 527
CLP Pesticides 514
Canola Oil Margarine Partially Hydrogenated FAMEs AOCS Method 1c-89 574
Chiral Compounds in Essential Oils and Fragrances 560
Chlorinated Isooctane 623
Chlorinated Pesticides, EPA Method 508 521
Citrus Flavored Carbonated Beverage (Soda) 567
CLP Pesticides 514
Cold-pressed Orange Oil 564
Column Performance for USP <467> Standards 651
Common Drug Screen 641
Congeners in DIN Method PCBs 533

D

DB-624UI 1 µL/L Fermented Beverage Standard Mix 554
DB-624UI Organic Acid Performance 509
DB-Select 624 UI for <467> Megabore Early Eluting Peaks 635
Denatured Fuel Ethanol – ASTM D5501 596
Detailed Hydrocarbon Analysis of Petroleum Naphthas Through N-nonane Using ASTM D5134 601
Determination of Chlorophenols in Water and Soil 502
Diesel Analysis 600
Diesel Fuel 503
Dioxins and Dibenzofurans 504
Direct Comparison for Rapid CLP (Contract Laboratory Program) Pesticide Analysis 513
Drug Screen 640

E

EPA 625 Halogenated Pesticides on "1701" Type Phases 528
EPA Air Analysis Compendium Method TO-14 Standard 549
EPA Air Analysis Method TO-15 (1 ppbv standard) 553
EPA Method 504.1 – 1,2 dibromoethane (EDB), 1,2-dibromo-3-chloropropane (DBCP), and 1,2,3-trichloropropane (123TCP) 507
EPA Method 508.1 – Chlorinated Pesticides and Herbicides 520
EPA Method 525.2 518
EPA Method 551 547
EPA Method 551 – Chlorinated Solvents, Trihalomethanes (THMs), and Disinfection Byproducts (DBPs) 509
EPA Method 552.2 543
EPA Volatiles by GC/MS (Split Injector) 517, 548
Essential Oils 557
Esters I 617
Esters II 618
Esters III 618
Ethers 619
Ethoxyethanol 607
Ethylene 584
Ethylene Glycol Mixture 621
Ethylene Oxide 631
Ethylene Oxide Synthetic Standard 594
European Red List Volatiles 547
Extended Analyte List for EPA Method 8021 (ELCD) 544
Extended Hydrocarbon Analysis I 588
Extended Hydrocarbon Analysis II 589
Extended Temperature Program Resolving Congeners 52 and 138 534

F

FAME Standard 572, 573
FAMEs 561
Fast Analysis of Aromatic Solvent 576
Fast Analysis of Permanent Gases and CO_2 using Tandem PLOT columns 552
Fast CLP Pesticides 506
Fast Screening of FAME Isomers in Butter 575
Fast Separation of Silanes 633
Fast VOC Analysis 545
Fentanyls 645
Flavor Mixture 563
Formaldehyde Underivatized 613
Formaldehyde, 50 ppb 550
Formaldehyde-DNPH Derivative 613
Fragrance Allergens 563
Fragrance Reference Standard 558, 559
Free Organic Acids/C_4-C_5 Isomers 608
Free Phenols 528
Free Steroids 648

G

Gasoline Unleaded ASTM D5769 599
Glycols I 619
Glycols II 620
Glycols III 620
Glycols/Diols 622

H

Hallucinogens....646
Halocarbons....631
Halogenated Hydrocarbons I....603
Halogenated Hydrocarbons II....622
Halothane....632
Herbicides I....526
Herbicides II....526
High Resolution Phenol Analysis by GC/MS....542
High Resolution Separation of Xylene Isomers....632
High Speed VOC, EPA Method 8260....515

I

Impurities in Ethylbenzene....616
Impurities in Ethylene....584
Impurities in Mixed Xylenes....632
Impurities in Propylene....585
Impurities in Styrene....616
Impurities in p-Xylene – ASTM D3798....594
Inorganic Gases....605
Inorganic Hydride Gases....633

L

Lavender Oil Characterization....556
Lemon Oil....564

M

Marijuana (Δ9-THC) and Major Metabolites – TMS Derivatives....649
Menthol....560
Mercaptans....592

N

N_2O I....551
N_2O II....551
N_2O III....551
Narcotics....637
Narcotics and Adulterants....647
Natural Gas....583
Nitrogen Containing Herbicides (EPA Method 507)....527
Nitrogen-based Solvents I....626
Nitrogen-based Solvents II....627
Nitrogen/Phosphorus Containing Pesticides, EPA Method 507....525
Noble Gases....582
n-Paraffin Standard....578

O

Organic Acids....570, 607
Organochlorine Pesticides....521, 525
Organochlorine Pesticides I EPA Method 8081A....529
Organochlorine Pesticides II EPA Method 8081A....530
Organochlorine Pesticides III....522
Organochlorine Pesticides IV....523
Organochlorine Pesticides to EPA 625 via GC/MS....529
Organochlorine Pesticides, DB-5/DB-1701P....524
Organochlorine Pesticides, EPA Method 8081B....508
Organophosphorous Pesticides in Apple Matrix....531
Organophosphorus Pesticide Residues in Olive Oil Extract....562
Organotin Compounds I....537
Organotin Compounds II....537
Over-the-Counter Pain Killers – TMS Derivatives....647
Oxygenates in Gasoline ASTM D5599 (GC-OFID)....595

P

PAHs....540
PBDEs....516
PBDEs by ECD....502
PCBs by EPA Method 8082....534
PFBHA Derivative....614
PONA Mix as Specified by AFNOR Method #2....596
Peppermint Oil....565
Perfume....560
Permanent Gases....582
Permanent Gases on a Thick Film Molsieve Column....552
Pesticides and Fire Retardants (US EPA 527)....519
Pesticides in Sunflower Oil....575
Pesticides, EPA 508.1....511
Phenols....541
Phenols According to EPA Method 8040....543
Phenols I....604
Phenols II....630
Phenols III....630
Phenoxy Acid Herbicides – Methyl Derivatives, EPA 8151A....512
Polybrominated Diphenyl Ethers (PBDEs)....505
Polyethylene....599
Polyethyleneamines....609
Polymer Additives....633
Primary Amines....609
Propylene....585
Pyrethrins....536
Pyrolysates of Polystyrene....617

R

Reference Gas Oil....598
Refinery Gas....590
Refinery Gas I....577
Regular Unleaded Gasoline (California Phase 1) – "Normal" GC Run I....598
Regular Unleaded Gasoline (California Phase 1) – "Normal" GC Run II....598
Residual Solvents, DMI Diluent....639
Residual Solvents, USP 467....650
Rosemary Oil....567

S

Sedative Hypnotics....646
Selected Oxygenates....582
Semivolatile Compounds, US EPA Method 8270....538
Separation of TMS-derivatized Sugars using VF-1ms....569
Separation of cis-trans FAME Isomers....571
Simulated Distillation....597
Solvents....625
Solvents I....623
Solvents II....624
Solvents III....624
Solvents IV....625
Spearmint Oil....555
Spearmint Oil (Western)....565
Strawberry Syrup....569
Substituted Anilines....629
Sulfur Compounds in Naphtha....593
Sulfur Compounds in Natural Gas – Synthetic Mixture....592
Sulfur Compounds in Propylene (1 ppm)....579, 591
Sulfur Gas Analysis in Light Hydrocarbon Streams I....590
Sulfur Gas Analysis in Light Hydrocarbon Streams II....591
Sulfur Gases....634
Sulfur Impurities in Propylene....579
Sulfur Standards in Toluene....578
Sulfur in Air....550

T

Tetrachlorodibenzo-p-furans....533
Tocopherols....645
Trace Active Amines, 10 ng on-column....608
Trace Level Polycyclic Aromatic Hydrocarbon (PAH) Analyses....532
Trace Oxygenates in Light Hydrocarbon Matrices....581
Trace Sulfur Compounds in Methane (50 ppbv)....581
Tricyclic Antipsychotics....644
Triethylene Glycol and Impurities....621

U

US EPA Method 8061 (Phthalate Esters)....539
Underivatized Drugs of Abuse – Agilent Fast Toxicology Analyzer....639
Unleaded Gasoline....501, 577
Urine Drug Screen....642

V

Volatile Amines....608

Y

Ylang Ylang Oil....566

Compound Index

A

Acenaphthalene 540
Acenaphthalene-d10....519
Acenaphthene 503, 532, 538, 540
Acenaphthene-d10 ....518, 538, 542
Acenaphthylene....503, 518, 532, 538
Acephate 531, 562
Acetal (acetaldehyde diethyl acetal)....619
Acetaldehyde 550, 553, 568, 581, 600, 612, 625, 638, 649-650
Acetaminophen....641, 647
Acetic acid....509, 568, 570, 607, 611
Acetone....515, 517, 548, 550, 553-554, 558-559, 568, 570, 581-582, 600, 612, 624-626, 632, 638-639, 649-650
Acetone-d6 550
Acetonitrile....515, 624-627, 635, 639, 649-651
Acetyl aldehyde 554
Acetylcedrene 560
6-Acetylcodeine 637, 647
Acetylene 580, 584-590
Acetylsalicylic acid (aspirin) 647
Acifluorofen....512
Acrolein....515, 612, 626-627
Acrylamide....610
Acrylic acid....509
Acrylonitrile 515, 517, 548, 626-627
Air/CO....577, 583, 601
Alachlor....508, 511, 518, 520, 524-526, 529-530
Aldrin 506, 508, 511, 513-514, 518, 520-525, 529-530, 542
Alfentanyl 645
Allobarbital 637, 641
Allyl acrylate 628
Allyl alcohol....515, 581
Allyl butyrate....558-559
Allyl chloride....515, 517, 544, 548
Allyl ether 619
Allyl ethyl ether....619
Alpha isomethyl ionone 563
Alphenal....637
Alprazolam....194, 636, 639-640
Ametryn....518, 525-526
2-Aminoazotoluene....629
2-Amino-1-butanol 606
2-Amino-ethanol....606
Aminoethylethanolamine....611
n-(2-Aminoethyl) piperazine....611
2-Aminonaphthalene 629
1-Amino-4-nitronaphthalene 540
5-Amino-1-pentanol 606
1-Amino-2-propaol 606
Amitriptyline....642
Amobarbital 637, 641
Amphetamine 636, 639, 642
Amyl acetate....554, 569, 617-618
Amyl alcohol 554
n-Amyl alcohol....568
Amyl butyrate 569
Amyl cinnamic alcohol....561
Amyl cinnamyl alcohol....563
Amyl cinnamyl aldehyde....561
n-Amyl mercaptan....592
tert-Amyl mercaptan....592
tert-Amyl methyl ether (TAME)....515, 546, 581, 595, 599, 600, 619
n-Amyl salicylate 558-560
5α-Androstan-17α-ol-3-one (stanolone) 648
Androsterone 648
5-β-Androsterone....648
Aniline 538, 542, 610, 629
Anisic alcohol 561
Anisyl alcohol 563
Antazoline....644
Anthracene 503, 518, 532, 538, 540
Anthracene-d10 519
Aprobarbital 637, 641
Arabinitol 568
Arabitol....569
Arachidic acid (eicosanoic acid) 570
Arachidic acid methyl ester....572, 573
Arachidonic acid methyl ester....572, 573
Argon 552, 582
Arsine 633
Atraton 525-526
Atrazine 511, 518-520, 525-527, 542
Azinphos-ethyl....562
Azinphos methyl....531, 562
Azobenzene....538
Azulene 540

B

Balan....527
Barbital....637
BDE 505, 519
Behenic acid methyl ester 572, 573
Benactyzine....641
Bentazone 512
Benthiocarb....519
Benz[a]anthracene....505, 518, 532
Benz[a]anthracene-7,12-dione 540
Benzaldehyde 558-559, 563, 612
Benzaldehyde, 3 methoxy 554
1,2-Benzanthracene....540
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
Benzene-d6 597
Benzene ethanol....558-560
Benzidine....538, 629
Benzo[a]anthracene....503, 538
Benzocaine....643
Benzo[b]fluoranthene 503, 505, 518, 532, 538, 542
Benzo[j]fluoranthene....505
Benzo[k]fluoranthene 503, 505, 518, 532, 538, 540
Benzo[b]fluoroanthene 540
Benzo[c]fluorene 505
2,3-Benzofluorene 540
Benzo[g,h,i]perylene 503, 505, 518, 532, 538, 540
Benzo[a]pyrene 503, 518, 532, 538, 540
Benzo[e]pyrene....540
Benzoic acid 538
Benzonitrile....610, 626-627
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
α-Bergamotene....556
trans-α-Bergamotene....564
α-BHC..506, 508, 511, 513-514, 518, 520-525, 529-530
β-BHC..506, 508, 511, 513-514, 518, 520-525, 529-530
δ-BHC..506, 508, 511, 513-514, 518, 520-525, 529-530
γ-BHC...506, 508, 511, 513-514, 518, 520-525, 529-530
BHEB 633
BHT 561, 567, 633
Bifenthrin....519
Bioallethrin....519
Biphenyl....540
β-Bisabolene....559, 564, 566
α-Bisabolol....556
Borneol....556, 558-560, 567
Borneol acetate 556
Bornyl acetate....557-558
α-Bourbonene....555
β-Bourbonene 555, 565
BPE (PB)....536
Bromacil....518-519, 525-527
Bromazepam....636, 640
Bromoacetic acid....543
Bromoacetone....515
4-Bromoaniline....610, 629
Bromobenzene 515, 517, 544-546, 548, 614-615
2-Bromobiphenyl 529-530
Bromochloroacetic acid....543
Bromochloroacetonitrile 509, 547
Bromochlorodifluoromethane....527
Bromochloromethane....515, 517, 544-546, 548- 550, 553, 622
Bromodichloroacetic acid....543
Bromodichloromethane 507, 509, 515, 517, 544-548, 553, 622
2-Bromo-4,6-dinitroaniline....629
Bromoethane (ethyl bromide) 553, 622
Bromofluorobenzene 545
4-Bromofluorobenzene....515, 517, 550, 548-549, 553
Bromoform 507, 509, 515, 517, 544-548, 553, 622
Bromofos....575
Bromomethane 515, 517, 544-546, 548-549, 553
1-Bromo-2-nitrobenzene....508, 529-530
Bromopheniramine....641, 644
4-Bromophenyl-phenylether 538
3-Bromopyridine 610
Bromotrifluoromethane....527
Buclizine 644
Bufotenine....646
Butabarbital....637, 641
Butacaine 643
Butachlor 518, 520, 525-526

1,2-Butadiene 586-587, 634
1,3-Butadiene 553, 584-591, 634
Butalbital 637
Butanal 611
1,3-Butandiol 619, 622
1,4-Butandiol 619
2,3-Butandiol 619
Butane 599, 601
iso-Butane 583, 590-591
n-Butane 577, 580, 583-590, 596, 634
n-Butane/cis-2-butene 591
1,3-Butanediol 620
1,4-Butanediol 620
2,3-Butanediol 620
2,3 Butanedione (VDK) 554
2,3-Butanedione (diacetyl) 558-559
1-Butanethiol 578-579, 581, 591
Butanol 626-628
1-Butanol 515, 554, 595, 600, 602, 605-606, 625, 649-650
2-Butanol 554, 635, 639
iso-Butanol 606
n-Butanol 568, 624, 650
sec-Butanol 568, 595, 602, 605, 624, 650
tert-Butanol 595, 602, 605, 624, 650
2-Butanone (MEK) 515, 517, 548, 550, 553, 600, 612, 626, 639
2-Butanthiol 581
Butene 617
Butene-1 ....584, 586-587
1-Butene 584-585, 588-591, 617, 634
cis-2-Butene 584-590
trans-2-Butene 584-591
1-Butene/methyl acetylene 590
3-Buten-1-ol 602, 605
2-Buten-1-ol (crotyl alcohol) 602, 605
Butethal 637
Butlypentyltin 537
2-Butoxyethanol 602, 605
bis(2-n-Butoxyethyl) phthalate 539
Butyl acetate 617-618, 627-628
n-Butyl acetate 625
sec-Butyl acetate 617-618
n-Butylbenzene 517, 544, 546, 548, 576, 593, 597, 604, 632
tert-Butyl acetate 617-618
Butyl acrylate 627-628
n-Butyl acrylate 628
n-Butyl alcohol 581, 625
s-Butyl alcohol 581
sec-Butyl alcohol 624-625, 649-650
tert-Butyl alcohol 515, 581,625, 649-650
Butyl aldehyde 554,581
Butylate 518, 525
Butylbenzene 515, 577, 608, 614-615
s-Butylbenzene 576, 593
sec-Butylbenzene 515, 517, 544-546, 548, 577, 593, 604, 614-615
tert-Butylbenzene 515, 517, 544-546, 548, 576, 593, 601, 604, 614-615
Butyl benzyl phthalate 538, 539
Butyl caproate 618
Butyl cellosolve 625
Butyl cellosolve acetate 625
Butylene 601
Butyl ether 619
Butyl ethyl ether 619
Butyl heptanoate 618
1-Butyl mercaptan 592
n-Butyl mercaptan 592
tert-Butyl mercaptan 581, 592
sec-Butyl methacrylate 628
Butyl methyl ether 619
tert-Butyl methyl ether (MTBE) 553
Butyl propionate 618, 627-628
4-tert-Butyltoluene 614-615
Butyl valerate 618
2-Butyne (dimethylacetylene) 586-587
1-Butyne (ethylacetylene) 586-587
2-sec-Butyl-4,6-dinitrophenol (dionseb) 542, 543
Butyraldehyde 600, 612
Butyric acid 570, 607-608, 611
iso-Butyric acid 611
n-Butyric acid 509
Butyric acid methyl ester 572, 573

C

Cadinene 564
δ-Cadinene 557-559, 566
γ-Cadinene 556-557
Caffeine 636, 640-641, 647
Camphene 556, 558-559, 560, 564, 567
Camphor 556, 558-559, 597
Capric acid methyl ester 561, 572, 573
Caproic acid methyl ester 561, 572, 570, 573, 607
Caprylic acid methyl ester 561, 572, 573
Captafol 508, 529-530
Captan 524, 529-530
d-Carane 557
Carbamazepine 640, 643
Carbazole 538, 540
Carbepoxide 10/11 644
Carbinoxamine 644
Carbon dioxide 549, 552, 577, 583, 601, 605
CO/air 552, 601
Carbon disulfide 517, 546, 548, 550, 553, 578, 579, 591
Carbon monoxide 582
Carbon tetrachloride 507, 509, 515, 517, 544-549, 553, 603, 622, 635, 649-651
Carbonyl sulfide (COS) 550, 577-579, 581, 591, 605, 634
Carbophenothion 524, 562
Carboxin 518, 525-526
tau-Cardinol 556
3-Carene 556
Carfentanyl 645
Carvacrol 560
cis-Carveol 563, 565
trans-Carveol 555, 563, 565
Carvone 565
l-Carvone 555
Carvone phenylethyl acetate 558
cis-Carvyl acetate 555, 565
Caryophyllene 556
α-Caryophyllene 566
β-Caryophyllene 555, 557-559, 564-566
Caryophyllene oxide 556
Celestolide 558
Cellosolve acetate 625
Cetearyl decanoate 558-559
Cetearyl octanoate 558-559
Chloral hydrate 509, 547
Chloramben 512
Chlorcyclizine 641, 644
α-Chlordane 506, 508, 511, 513-514, 518, 520-524, 529-530
γ-Chlordane 506, 508, 511, 513-514, 518, 520-524, 529-530
Chlordiazepoxide 636
Chloroacetic acid 543
Chloroacetonitrile 515, 517, 548
2-Chloroaniline 610, 629
3-Chloroaniline 610, 629
4-Chloroaniline 538, 610, 629
Chlorobenzene 515, 517, 544-546, 548-549, 553, 604, 614-615, 623, 625, 651
Chlorobenzene-d5 ....550, 553, 549
Chlorobenzilate 508, 511, 518, 520-521, 524, 529-530
4-Chlorobenzonitrile 610
2-Chlorobiphenyl 518
1-Chlorobutane 515, 517, 548, 603, 622, 649-650
2-Chlorobutane 649-650
Chlorodibromoacetic acid 543
1-Chloro-1,1-difluoroethane 527
Chlorodifluoromethane 527
2-Chloro-4,6-dinitroaniline 629
Chloroethane 515, 517, 527, 544-546, 548-549, 553
2-Chloroethanol 515, 631
bis(2-Chloroethoxy) methane 538
bis(2-Chloroethyl) ether 538
2-Chloroethyl vinyl ether 544
1-Chloro-3-fluorobenzene 517, 544, 548
Chloroform 507, 509, 515, 517, 544-549, 553, 603, 622, 624, 635, 649-650
1-Chlorohexane 515, 603, 622
1-Chloro isooctane 623
3-Chloro isooctane 623
4-Chloro isooctane 623
bis(2-Chloroisopropyl) ether 538, 544
Chloromethane 515, 517, 527, 544-546, 548-549, 553
4-Chloro-2-methylaniline 629
4-Chloromethyl 2,2'-dimethyl pentane 623
2-Chloro-5-methylphenol 541
4-Chloro-2-methylphenol 541
4-Chloro-3-methylphenol 528, 538, 541-543, 604
2-Chloronaphthalene 538
Chloroneb 508, 511, 518, 520-521, 524, 529-530
2-Chloro-4-nitroaniline 629
4-Chloro-2-nitroaniline 629
1-Chloro-4-nitrobenzene 614-615
4-Chloro-3-nitrobenzotrifluoride 529-530
Chloropentafluoroethane 527
2-Chlorophenol 502, 528, 538, 541-543, 604, 630
3-Chlorophenol 502
4-Chlorophenol 502, 541
4-Chlorophenyl-phenyl ether 538
Chloropicrin 509, 547
Chloroprene 544
2-Chloropropane 544
2-Chloropropene 594
3-Chloropropene (allyl chloride) 553, 603, 622
3-Chloropropionitrile 515
Chloropropylate 508, 529-530

Chloropyrifos....575
4-Chlorostyrene....614-615
2-Chloro-1,1,1,2-tetrafluoroethane....527
Chlorothalonil....508, 511, 518, 520-521, 529-530, 542
2-Chlorotoluene....515, 517, 544-546, 548, 604, 614-615
3-Chlorotoluene....546, 604, 614-615
4-Chlorotoluene....515, 517, 544, 546, 548, 604, 614-615, 623
Chlorotrifluoromethane....527
Chlorpheniramine....641, 644
Chlorpropham....518, 525
Chlorprothixene....644
Chlorpyrifos....524, 526, 531, 562
4-Chlortestosterone-17-acetate (clostebol)....648
5-α-Cholestane....648
Cholesterol....648
Chrysene....503, 505, 518, 532, 538, 540
Chrysene-d12....518-519, 538, 542
1,8-Cineol....555, 558-559, 565
Cineole....560
Cinerin I....536
Cinerin II....536
Cinnamaldehyde....561, 563
trans-Cinnamaldehyde....560
Cinnamic alcohol....563
Cinnamyl acetate....563, 566
trans-Cinnamyl acetate....566
Cinnamyl alcohol....561
Cinnamyl cinnamate....558-559
Cinnamyl phenyl acetate....558-559
Cinnanzine....644
Citral....563
Citronellal....558, 564
Citronellic acid....509
Citronellol....557-561, 563, 569
Citronellyl acetate....558-559
Citronellyl formate....557-558
Citronellyl propionate....558
Citronellyl tiglate....558-559
cis-Citronellyl tiglate....563
trans-Citronellyl tiglate....563
Clemizole....644
Clobazam....640
Clonazam....636
Clonazepam....194, 636, 639-640
Cocaine....639-642, 647
Codeine....637, 639, 641-642, 647
Commamyl acetate....560
α-Copaene....555, 558-559, 566
Coprostane (5-ß-cholestane)....648
Cotinine....642
Coumarin....560-561, 563
2-Cresol....630
3-Cresol....630
4-Cresol....630
m-Cresol....542-543, 630
o-Cresol....542-543, 630
p-Cresol....542-543, 630
Crotonaldehyde....515, 612
Cumene....576, 593, 616, 623, 632
Cumic aldehyde....556
Cyanazine....511, 518, 520, 526
2-Cyanopyridine....610
3-Cyanopyridine....610
Cyclizine....644
Cycloate....518, 525
Cyclohexane....553, 576-577, 588-589, 593, 623-624, 626, 635, 639, 650-651
Cyclohexanol....602, 605-606
Cyclohexanone....612
2-Cyclohexyl-4,6-dinitrophenol....541
Cyclohexyl methacrylate....628
Cyclopenta[c,d]pyrene....505
Cyclopentane....588-589, 596, 601
Cyclopentanol....602, 605
Cyclopentanone....612
Cyclopentene....588-589
1-Cyclopentene....596
Cyclopentylbarbital....637
Cyclopropane....584-587
Cyheptamide....642
o-Cymene....556
p-Cymene....558, 559, 567
r-Cymene....555, 564-565

D

2,4-D....512
Dalapon....512, 543
2,4-DB....512
4,4'-DDD....506, 508, 511, 513, 514, 520-521, 525, 529
o,p'-DDD....524, 575
p,p'-DDD....518, 521-524, 529-530, 575
4,4'-DDE....506, 508, 511, 513, 514, 520-521, 525, 529
p,p'-DDE....518, 521-524, 529-530, 575
o,p'-DDE....524, 575
4,4'-DDT....506, 508, 511, 513, 514, 520-521, 525, 528, 529, 542
o,p'-DDT....524
p,p'-DDT....518, 521-524, 529-530, 575
Decabromobiphenyl ether (decaBDE)....502
Decachlorobiphenyl....506, 508, 513-514, 520-524, 534.
Decanal....564, 611
1,10-Decandiol....619
Decane....249, 251-252, 503, 576, 593, 599, 623
n-Decane....249, 260, 532, 577, 596-597
1,10-Decanediol....619, 620, 622
Decanoic acid....570, 611
Decanol....567
1-Decanol....602, 605
n-Decylamine....609-610
DEF....518
1-Dehydro-17-a-methyltestosterone (methandrostenolone)....648
Dehydroisoandrosterone (prasterone)....648
1-Dehydrotestosterone acetate....648
1-Dehydrotestosterone benzoate....648
1-Dehydrotestosterone (boldenone)....648
1-Dehydrotestosterone undecylenate....648
Delorazepam....640
Demoxepam....636, 640
n-Des....644
Desalkyl aurazepam....636
Desipramine....640
Desmethyldiazepam....640
n-Desmethyl methsuximide....643
Dextromethorphan....637
Diacetone alcohol....625
Diacetyl....568
Diacetylmorphone (heroin)....194, 637, 639-641, 647
Di-allate A....529-530
Di-allate B....529-530
2,4-Diaminoanisole....629
2,4-Diaminotoluene....629
3,4-Diaminotoluene....610
Diamyl phthalate....539
Diazepam....636, 639-642
Diazinon....518, 525, 531, 562
Dibenz[a,h]anthracene....503, 505, 518, 532, 538
1,2,3,4-Dibenzanthracene....540
1,2,5,6-Dibenzanthracene....540
Dibenzo[a,e]pyrene....505
Dibenzo[a,h]pyrene....505
Dibenzo[a,i]pyrene....505
Dibenzo[a,l]pyrene....505
Dibenzofuran....538, 540
Dibenzo-p-dioxin....540
Dibenzothiophene....540
Dibenzyl ether....558-559
Dibenzyl phthalate....539
Diborane....633
Dibromoacetic acid....543
Dibromoacetonitrile....509, 547
1,2-Dibromobenzene....549
4,4'-Dibromobiphenyl....511
Dibromochloromethane....507, 509, 515, 517, 544-548, 553
1,2-Dibromo-3-chloropropane (DBCP)....507-509, 515, 517, 529-530, 544-548, 603, 622
1,2-Dibromoethane (EDB)....507, 509, 515, 517, 544, 546-549, 553, 603, 622
Dibromofluoromethane....515
Dibromomethane....515, 517, 544-546, 548, 622
1,2-Dibromomethane....545
α, α-Dibromo-m-xylene....529-530
2,6-Dibromo-4-nitroaniline....629
4,4'-Dibromooctafluorobiphenyl....512
2,4-Dibromophenol....541
1,2-Dibromopropane....547
2,3-Dibromopropionic acid....543
1,2-Dibromo-1,1,2,2-tetrafluoroethane....527
Dibucaine....643
Dibutyl chlorendate....529-530
tert-Dibutyl disulfide....592
Dibutyl ether....627-628
Dibutylpentyltin....537
Dicamba....512
Dichlobenil....526
Dichlone....508
Dichloroacetic acid....543
Dichloroacetonitrile....509, 547
3,4-Dichloroaniline....610, 629
1,2-Dichlorobenzene....515, 517, 538, 544-546, 548-549, 553, 604, 614-615, 623
1,3-Dichlorobenzene....256, 258, 515, 517, 538, 544-546, 548-549, 553, 604, 614-615, 623
1,4-Dichlorobenzene....256, 258, 515, 517, 538, 544-546, 548-549, 553, 604, 614-615, 623
1,4-Dichlorobenzene-d4....515, 538, 542
3,3'-Dichlorobenzidine....538, 542, 629
3,5-Dichlorobenzoic acid....512
2,3-Dichlorobiphenyl....518

p,p'-Dichlorobiphenyl....524
cis-Dichlorobutene....515
cis-1,4-Dichlorobutene....544
trans-Dichlorobutene....515
trans-1,4-Dichloro-2-butene....517, 548, 603, 622
Dichlorodifluoromethane....515, 517, 527, 544, 546, 548, 549, 553
Dichlorodimethyl silane....633
Dichloroethane-d4....515
1,1-Dichloroethane....515, 517, 544-549, 553, 603, 622
1,2-Dichloroethane....515, 517, 544, 546-549, 553, 603, 622, 635, 651
cis-1,2-Dichloroethane....651
trans-1,2-Dichloroethane....651
1,1-Dichloroethene....515, 517, 544-546, 548-549, 553, 603, 622, 651
cis-1,2-Dichloroethene....515, 517, 544, 546, 548-549, 553
trans-1,2-Dichloroethene....515, 517, 544-546, 548, 553, 622
1,1-Dichloroethylene....547, 635
cis-1,2-Dichloroethylene....635
trans-1,2-Dichloroethylene....635
1,1-Dichloro-1-fluoroethane....527
Dichlorofluoromethane....527, 545
Dichloromethane....527, 546, 626, 633, 635, 651
Dichloromethyl silane....633
2,6-Dichloro-4-nitroaniline....629
2,3-Dichlorophenol....502, 541
2,4-Dichlorophenol....502,528, 538, 541-543, 604, 630
2,5-Dichlorophenol....502, 541
2,6-Dichlorophenol....502, 541-543
3,4-Dichlorophenol....502, 541
3,5-Dichlorophenol....502, 541
Dichloroprop....512
1,1-Dichloropropane....622
1,2-Dichloropropane....515, 517, 544-546, 548-549, 553, 603, 622
1,3-Dichloropropane....515, 517, 544, 546, 548, 622
2,2-Dichloropropane....515, 517, 544-546, 548, 622
1,3-Dichloro-2-propanol....515
1,1-Dichloro-2-propanone....509, 517, 547-548
1,1-Dichloropropene....515, 517, 544, 548
1,1-Dichloro-1-propene....546
cis-1,2-Dichloropropene....603
cis-1,3-Dichloropropene....515, 517, 544-546, 548-549, 553, 622
trans-1,2-Dichloropropene....603
trans-1,3-Dichloropropene....515, 517, 544-546, 548-549, 553, 622
Dichlorotetrafluoroethane....553
1,2-Dichloro-1,1,2,2-tetrafluoroethane....527, 549
2,2-Dichloro-1,1,1-trifluoroethane....527
Dichlorvos....518, 525
Dicyclohexylamine....609-610
Dicyclohexyl phthalate....539
Dieldrin....506, 508, 511, 513-514, 518, 520-525, 529-530, 575
Diethanolamine (DEA)....606, 607
Diethylamine....610
n,n-Diethylaniline....610
2,6-Diethylaniline....610
Diethylbenzene....593
1,2-Diethylbenzene....576, 597
1,3-Diethylbenzene....576, 596
1,4-Diethylbenzene....597
Diethylbenzene isomer....593
Diethyl disulfide....578
Diethylene glycol....620-621
Diethylene glycol monobutyl ether....619, 620
Diethylene glycol monoethyl ether....619, 620
Diethylene glycol monomethyl ether....619, 620
Diethylenetriamine....611
Diethyl ether....517, 548, 581, 600, 626, 632, 635, 649-650
1,2-Diethyl-4-ethylbenzene....596
1,3-Diethyl-5-ethylbenzene....596
Diethyl formamide (DEF)....518
Diethyl phthalate....518, 538-539, 560
Diethyl sulfide....578, 581
Diethyltryptamine....646
1,4-Difluorobenzene....550, 517, 548-549, 553
1,1-Difluoroethane....527
Difolatan....526
Diglyme....619, 620
Dihexyl phthalate....539
9,10-Dihydroanthracene....540
trans-Dihydro carveol acetate....555
Dihydro carvone....555, 565
trans-Dihydro carvyl....565
Dihydrocodeine....637
Dihydropentaborane....633
Diisobutyl phthalate....539
Diisopropylamine....610
1,3-Diisopropylbenzene....604, 614-615
1,4-Diisopropylbenzene....604, 614-615
Diisopropyl ether (DIPE)....515, 581, 595, 600
Dimenhydrinate....641, 644
Dimethoate....519, 531, 562
3,3'-Dimethoxybenzidine....629
1,2-Dimethoxyethane....595, 639
Dimethoxyethane (DME)....595
n,n-Dimethylacetamide....625, 639
Dimethylamine....608
Dimethylamphetamine....636
2,4-Dimethylaniline....610
2,6-Dimethylaniline....610, 629
7,12-Dimethylbenz[a]anthracene....540
1,2-Dimethylbenzene....560
n,n-Dimethylbenzylamine....610
2,2-Dimethylbutane....588-589, 596, 599
2,3-Dimethylbutane....588-589, 596, 599
Dimethyl disulfide....578
Dimethyl ether (DME)....581, 601
Dimethylformamide (DMF)....624, 626-627, 650
n,n-Dimethylformamide....625-626, 639
2,6-Dimethylhept-5-enal (melonal)....558, 559
2,2-Dimethylhexane....517, 548, 599
1,3-Dimethyl-2-imidazolidinone (DMI)....639
2,6-Dimethylnaphthalene....540
1,2-Dimethyl-2-nitrobenzene....519
1,3-Dimethyl-2-nitrobenzene....518, 542
2,2-Dimethylpentane....596, 599
2,3-Dimethylpentane....588-589, 599
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
Dimethyl phthalate....518, 538, 539
Dimethyl sulfide....550, 578-579, 581, 591-592, 626
Dimethyl sulfoxide (DMSO)....626-627, 639, 649-650
Dimethyl tetrachloroterephthalate (DCPA)....508, 511-512, 518, 520-521, 524, 526, 529-530
Dimethyltryptamine....646
Di-n-butyl phthalate....518, 538, 539
2,4-Dinitroaniline....629
2,2'-Dinitrobiphenyl....540
2,7-Dinitrofluorene....540
4,6,-Dinitro-2-methyl phenol....538, 542
1,3-Dinitronaphthalene....540
1,5-Dinitronaphthalene....540
2,4-Dinitrophenol....528, 538, 541-543, 604, 630
2,5-Dinitrophenol....541
2,4-Dinitrotoluene....518, 538, 542
2,6-Dinitrotoluene....518, 538
Di-n-octyl phthalate....538, 539
Dinonyl phthalate....539
Dinoseb....512, 541
1,3-Dioxalane....619
1,4-Dioxane....515, 553, 576, 593, 619, 624-626, 635, 650-651
Diphenamid....518, 525-526
Diphenhydramine....644
Diphenylaniline....610
9,10-Diphenylanthracene....540
Diphenyl isophthalate....539
Diphenyl oxide....558-559
Diphenyl phthalate....539
Diphenyl pyraline....644
Diphenyl sulfide....578
Dipropylene glycol....619-620
Dipropyl ether....600
Disulfoton....518, 525
Diuron....526
cis-13,16-Docosadienoic acid methyl ester....572, 573
cis-4,7,10,13,16,19-Docosahexaenoic acid methyl ester....572, 573
Docusane....503
Dodecahydrotriphenylene....540
γ-Dodecalactone....558-559
Dodecane....249, 251-252, 503, 576-577, 593, 623
n-Dodecane....249, 260, 582, 596-597
Dodecanoic acid....570
Dodecanol....558-559
Dodecenal....564
n-Dotriacontane....597
Doxylamine....641, 644
Droperidol....646
Dursban (chlorpyrifos)....518, 519

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
Endosulfan II 506, 508, 511, 513-514, 518, 520-525, 529-530
α-Endosulfan 575
β–Endosulfan 575
Endosulfan sulfate 506, 508, 511, 513-514, 518, 520-525, 529-530, 575
Endrin 506, 508, 511, 513-514, 518, 520-525, 529-530, 542
Endrin aldehyde 506, 508, 511, 513-514, 518, 520-525, 528-530
Endrin ketone 506, 508, 513-514, 518, 521-524, 529-530
Ephedrine 636
Epiandrosterone (trans-androsterone) 648
Epichlorohydrin 515, 619
EPTC 518, 525-526
Eptam 527
Erucic acid methyl ester 572, 573
Erythritol 569
Esfenvalerate 519
Estazolam 636
17-α-Estradiol 648
β-Estradiol 648
Estriol 648
Estrone 648
Ethane 580, 583-585, 588-591, 596, 601, 634
Ethane/ethylene 580
Ethanethiol 578
Ethanol 515, 554, 568, 581, 595-596, 600, 602, 605, 623-628, 635, 638-639, 649-650
Ethanolamine 608
Ethchlorvynol 646
Ethinamate 646
Ethoprop 518, 525-526
Ethosuximide 643
Ethotoin 644
2-Ethoxyethanol 602, 605, 607, 635, 639
bis(2-Ethoxyethyl) phthalate 539
2-Ethoxyethyl acetate 607, 617-618
2-Ethyl-1-hexanol 567
bis(2-Ethylhexyl) adipate 518
bis(2-Ethylhexyl) phthalate 518, 538-539
Ethyl acetate 515, 553-554, 558-559, 568-569, 617-618, 624-628, 635, 639, 649-650
Ethyl acetylene 634
Ethyl acrylate 617-618, 626-628
Ethyl alcohol 607
2-(Ethylamino)-ethanol 606
Ethyl and dimethyl thiophenes 593
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
Ethylbenzene-d10 597
Ethyl benzoate 569, 617-618
Ethyl butanoate 554
2-Ethyl-1-butanol 606
Ethyl t-butyl ether (ETBE) 515, 546, 581, 595, 600, 625,
Ethyl butyrate 558-559, 569, 618
Ethyl caprate 554
Ethyl caproate 618
Ethyl caprylate 554
Ethyl cellosolve 625
Ethyl decanoate 558-559
Ethyl dodecanoate 558-559
Ethylene 577, 580, 584-585, 588-590, 601, 634
Ethylene/acetylene 591
Ethylenediamine 611
Ethylene 595
Ethylene glycol 602, 605, 619-622, 649-650
Ethylene glycol monoacetate 607
Ethylene glycol monobutyl ether 619-620
Ethylene glycol monoethyl ether 619-620
Ethylene glycol monoformate 607
Ethylene glycol monomethyl ether 619-620
Ethylene glycol phenyl ether 622
Ethylene oxide 594, 605, 607, 631
Ethyl ether 515, 619, 624-625, 650
Ethyl formate 568, 607, 617-618, 624-625, 649-650
Ethyl heptanoate 558-559
Ethyl hexadecanoate 558-559
Ethyl hexanoate 558-559
2-Ethyl hexanoic acid 509
2-Ethyl-1-hexanol 602, 605
Ethyl isovalerate 558-559
Ethyl mercaptan 579, 581, 591-592
Ethyl methacrylate 515, 517, 548, 628
Ethyl methyl sulfide 578
Ethyl morphine 637
Ethyl nonanoate 558-559
Ethyl octadecanoate 558-559
Ethyl octanoate 558-559
Ethyl parathion 575
Ethyl pentadecanoate 559
Ethyl pentadecanoate nonadecane 558
Ethyl pentanoate 558-559
α-Ethylphenethyl alcohol 602, 605
β-Ethylphenethyl alcohol 602, 605
2-Ethylphenol 630
4-Ethylphenol 630
Ethyl-3-phenyl oxiran carboxylate 569
Ethyl propanoate 554
Ethyl propionate 558-559, 617-618, 627-628
Ethyl tetradecanoate 558-559
4-Ethyltoluene 553
m-Ethyltoluene 576, 593
p-Ethyltoluene 576, 593
Ethyl undecanoate 558-559
Ethyl valerate 618
Ethyl vinyl ether 619
Etridiazole 508, 511, 520-521, 524
Eucalyptol 556-557
Eugenol 561, 563
iso-Eugenol 561
Evernyl 558
Eugenyl acetate 558-559
Eugenyl methyl ether 559

F

Farnescene 566
β-Farnesene 556
t-β-Farnesene 557
trans-β-Farnesene 555, 565
Farnesol 563
Farnesol 1 563
Farnesol acetate 566
Farnesol isomer 561
Farnesyl acetate 566
Fenamiphos 518-519, 525
Fenarimol 518, 525
Fenchone 563
Fenchyl acetate 558
Fenitrothion 562, 575
Fentanyl 640, 645-646
Fenthion 562
Fenvalerate 519
Florazone 558-559
Flunitrazepam 194, 636, 639-640
Fluoranthene 503, 532, 538, 540
Fluorene 503, 518, 532, 538, 540, 542
Fluorobenzene 515, 517, 544, 545, 548, 614-615
2-Fluorobiphenyl 538
2-Fluorophenol 538
Flurazepam 640, 642
Fluridone 518, 525-526
Fonofos 526
Formaldehyde 550, 553, 613
Formaldehyde-DNPH 613
Formaldehyde-PFBHA 614
Formic acid 509, 570, 607
Frambinone (raspberry ketone) 558-559
Fucitol 568
Furan 619
Furfural 558-559, 612
Furfuryl alcohol 602, 605

G

Galactitol 568-569
Geranial 558-559, 564
Geranial acetate 566
Geraniol 558-559, 560, 561, 563, 566, 569
cis-Geraniol 556
trans-Geraniol 563
Geranyl acetate 556, 558-559, 564, 566
Geranyl butyrate 559
Geranyl formate 558-559
Geranyl-2-methyl valerate 558
Geranyl tiglate 558-559
Germacrene-d 555, 556, 565, 566
Gesatamine (atraton) 518
Glucitol 568
Glucuronic acid 569
Glucuronic acid-1,5-lactone 569
Glutethimide 640, 646
Glycidol 602, 605
Glyme 620
Glyme (propylene glycol dimethyl ether) 619, 620
GOAL 527
3,7-Guaiadiene 558
α-Gurjunene 566

H

Halazepam 636, 640
Haloperidol 646
Halothane 632
Helium 552
Heneicosane 558
Heneicosanoic acid methyl ester 572, 573
1,7-Hepatanediol 620
Heptachlor 506, 508, 511, 513-514, 518, 520-525, 529-530

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
β-Hexacholorcyclohexane....575
δ-Hexacholorcyclohexane....575
γ-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
α-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-δ9-THC....649
L-11-Hydroxy-δ9-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
δ-Limonene....556-557, 564
S-(-)-Limonene....567
Linalool....555, 558-561, 563-567
β-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
γ-Linolenic acid methyl ester....572, 573
Lofentanyl....645
Lorazepam....636, 639-640
Lormetazepam....636
Lyral....561
Lyral 1....563
Lyral 2....563
Lysergic acid diethylamide (LSD)....640, 646

M

β-Maaliene....557
Malathion....519, 531, 562, 575
Manitol....569
Mannitol....568
Meclizine....644
Medazepam....636, 640
Menthofuran....557
Menthol (MeOH)....557, 560, 565, 577, 595
Menthone....557-559
Menthyl acetate....565
Meperidine....639, 642
Mephobarbital....637
Mepivacaine....643
Meprobamate....641, 646
Merphos....518, 525
Mescaline....646
Mesitylene....623
Mesterolone....648
Methacrolein....612, 626-627
Methacrylic acid....509
Methacrylonitrile....515, 517, 548, 626-627
Methadone....639-640, 642
Methamidophos....531, 562
Methamphetamine....636, 639, 642
Methane....552, 577, 580, 582-585, 588-591, 601, 626, 634-635
Methanethiol....578
Methanol....554, 568, 581-582, 595-596, 600-602, 605-606, 613, 623-624, 626-628, 635, 638-639, 649-651
Methapyrilene....641, 644
Methaqualone....640, 646
Methidathion....531, 562
Methofuran....565
Methohexital....637
Methone....565
Methoprene....536
Methoxychlor....506, 508, 511, 513-514, 518, 520-524, 529-530
2-Methoxyethanol....602, 605, 626
bis(4-methoxyethyl) phthalate....539
2-Methoxy-5-methylaniline....629
1-Methoxy-2-propanol....639
Methsuximide....643
Methyl acetate....617-618, 627-628, 635
Methyl acetylene....591
Methyl acrylate....515, 517, 548, 627-628
Methyl alcohol....625
Methylamine....608
4-Methylaminorex....646
r-Methylansiole....566
2-Methylanthracene....540
9-Methylanthracene....540
Methyl arachidate....571
Methyl benzoate....558-559, 566, 617-618
5-Methylbenzo[b]thiophene....578
3-Methylbenzothiophene....578
2-Methyl butanal....611
2-Methylbutane....599
2-Methyl-1-butanol....568, 602, 605, 611
2-Methyl-2-butanol....602, 605
3-Methyl-1-butanol....568, 602, 605, 625, 635
3-Methyl-2-butanone....612, 635
2-Methyl-3-buten-2-ol....602, 605
3-Methyl-2-buten-1-ol....602, 605
2-Methyl-1-butene....596
2-Methyl-2-butene....584, 588-589, 596
3-Methyl-1-butene....586-589
trans-2-Methyl-2-butenoic acid....608
2-Methylbutyl acetate....617-618
2-Methylbutyl alcohol....558-559
3-Methylbutyl alcohol....558-559
Methyl t-butyl ether (MTBE)....515, 595, 639, 649-650
Methyl butyrate....558-559
2-Methyl butyric acid....608
Methyl chavicol....561
3-Methylcholanthrene....540
2-Methyl-4-chlorophenoxyacetic acid (MCPA)....512
Methyl chlorophenoxypropionic acid (MCPP)....512
5-Methylchrysene....505
Methyl-cresol....558
Methyl-p-cresol....559
Methyl-r-cresol....566
Methylcyclohexane....588-589, 599, 635, 639, 651
Methylcyclopentane....577, 588-589, 596, 599
1-Methyl-1-cyclopentene....596
Methyl decanoate....618
Methyl-2,4-dichlorophenylacetate....512
Methyl diethanolamine (MDEA)....606
4-Methyl-2,5-dimethoxyamphetamine (STP)....636
2-Methyl-4,6-dinitrophenol....528, 541-543, 604
Methyl dodecanoate....618
Methyl eicosenoate....618
Methyl elaidate....571
4,4′-Methylenedianiline....629
3,4-Methyl enedioxyamphetamine....642
3,4-Methyl enedioxyethylamphetamine....642
3,4-Methyl enedioxymethamphetamine....642
Methyl ethyl ketone (2-butanone)....649, 650
Methyl isobutyl ketone (MIBK)....639
α-Methyl ionone....560
Methyl cis-9,10-methylene octadecanoate....571
Methyl cis-9,10-methyl hexadecanoate....571
Methylene chloride....515, 517, 544-545, 548-549, 553, 603, 622, 624-625, 639, 649-650
Methylenedioxyamphetamine (MDA)....636, 639
Methylenedioxyethylamphetamine (MDE)....636, 639
Methylenedioxymethamphetamine (MDMA)....636, 639
Methyl ephedrine....636
1-Methyl-2-ethylbenzene....597
1-Methyl-3-ethylbenzene....597
1-Methyl-4-ethylbenzene....597
Methyl ethyl ketone (MEK)....581, 624-625, 650
Methyl ethyl sulfide....581
Methyl eugenol....561
2-Methylfluoranthene....540
Methyl formate....617-618
Methyl γ ionone....561
3-0-Methylglucose 1....569
3-0-Methylglucose 2....569
Methyl heptadecanoate....571
2-Methylheptane....577, 588-589, 596
3-Methylheptane....588-589, 596
4-Methylheptane....577
Methyl heptine carbonate....561, 563
Methyl hexadecanoate....618
2-Methylhexane....588-589, 599
3-Methylhexane....588-589, 599
Methyl 2-hydroxydecanoate....571
Methyl 2-hydroxydodecanoate....571
Methyl 3-hydroxydodecanoate....571
Methyl 2-hydroxyhexadecanoate....571
Methyl 2-hydroxytetradecanoate....571
Methyl 3-hydroxytetradecanoate....571
Methyl isobutyl ketone....624-625
Methyl laurate....571
Methyl mercaptan....550, 579, 581, 591-592
Methyl methacrylate....515, 517, 548, 627-628
Methyl 14-methylhexadecanoate....571
Methyl 12-methyltetradecanoate....571
Methyl monoethanolamine (MMEA)....606
Methyl myristate....571
1-Methylnaphthalene....540, 597
2-Methylnaphthalene....538, 540, 596-597
2-Methyl-5-nitroaniline....629
Methyl nonadecanoate....571
Methyl octadecanoate....618
Methyl octine carbonate....561, 563
Methyl oleate....571
Methyl palmitate....571
Methyl palmitoleate....571
Methyl paraoxon....518
Methyl parathion....575
Methyl pentadecanoate....571
2-Methylpentane....588-589, 596, 599
3-Methylpentane....501, 588-589, 596, 599, 623
2-Methyl-2 pentanol....581
3-Methyl-3-pentanol....606
4-Methyl-2-pentanol....602, 605-606
2-Methyl-3-pentanone....612
4-Methyl-2-pentanone (MIBK)....517, 548, 553, 612
2-Methyl-1-pentene....588-589, 596
4-Methyl-1-pentene....588-589
bis(4-Methyl-2-pentyl) phthalate....539
α-Methylphenyl alcohol....602
2-Methylphenol....538, 541
3-Methylphenol....541
4-Methylphenol....538, 541
5-Methyl-5-phenylhydantoin....643
2-Methyl-1-propanethiol....578-579, 581, 591
2-Methyl-2-propanethiol....578-579, 591
2-Methyl-1-propanol (isobutanol)....600
2-Methyl-2-propanol (tert-butanol)....600, 639
Methyl propionate....617-618, 627-628
1-Methyl-1-propnaethiol....579, 591
1-Methyl-3-propylbenzene....596
1-Methyl-1-propyl mercaptan....592
2-Methyl-1propyl mercaptan....592
2-Methyl-2-propyl mercaptan....592
1-Methyl-2-pyrrolidine....610
1-Methyl-2-pyrrolidinone....626-627
n-Methylpyrrolidone....639
Methyl stearate....571
α-Methylstyrene....576, 593, 614-616
4-Methylstyrene....614-615
Methyl sulfide....634
Methyl tert-butyl ether (MTBE)....517, 546, 548, 581-582, 597, 600, 619, 623
17α-Methyltestosterone....648
Methyl tetradecanoate....618
2-Methylthiophene....578
3-Methylthiophene....578
Methyl thiophenes....593
Methyl tridecanoate....571
Methyltripentyltin....537

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-Nonandiol....619
Nonane....576, 593, 599, 601, 623
n-Nonane....532, 577, 588-589, 596-597
1,9-Nonanediol....620, 622
Nonanol....567
1-Nonanol....602, 605
Nonyl aldehyde....612
Nonylamine....608
n-Nonylamine....609-610
Nootkatone....564
Norcodeine....637
Nordazepam....636
Norethandrolone....648
Norflurazon....518-519, 525-526
Normorphine....637
19-Nortestosterone (nandrolone)....648
19-Nortestosterone-17-decanoate....648
19-Nortestosterone-17-propionate....648

O

cis-Ocimene....555, 565
trans-Ocimene....555
β-cis-Ocimene....556
β-trans-Ocimene....556
Octacosane....503
n-Octacosane....597
2,2',3,3',4,5',6,6'-Octachlorobiphenyl....518
1,2,3,4,6,7,8,9-Octachlorodibenzodioxin....504
1,2,3,4,6,7,8,9-Octachlorodibenzofurans....504
Octadecane....503, 536
n-Octadecane....597
Octadecanoic acid....570
Octanal....554, 564, 611
1,8-Octandiol....619
Octane....576, 593, 599, 601, 623
isooctane....501
n-Octane....532, 577, 588-589, 596-597
1,8-Octanediol....620
Octanoic acid....570, 611
Octanol....558-559, 564, 567
1-Octanol....602, 605
3-Octanol....555, 565
3-Octanone....532, 556
1-Octene....532
1-Octen-3-ol....556, 565
Octen-1-ol acetate....556
Octyl acetate....558-559
3-Octyl acetate....555, 565
Octyl aldehyde....612
n-Octylamine....609-610
n-Octyl mercaptan....592
Oleic acid methyl ester....572, 573
Omethoate....562
Ordram....527
Oxadiazon....527
Oxazepam....636, 639-640
Oxazopam....636
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-Pentandiol....619
Pentane....599, 601, 603, 617, 625-626
iso-Pentane....583, 590-591, 601
n-Pentane....577, 583-591, 596-597
1,2-Pentanediol....532
1,5-Pentanediol....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

trans-Permethrin....508, 511, 518, 520-521, 524, 529-530
Perthane....508, 529-530
Perylene....540
Perylene-d12....518-519, 538, 542
α-Phellandrene....564
Phenacetin....636, 641
Phenanthrene....503, 518, 532, 538, 540
Phenanthrene-d10....518, 538, 542
Phencyclidine (PCP)....639, 640, 642, 646
Phenethylalcohol....567
Pheniramine....644
Phenmetrazine....641
Phenobarbital....637, 640-641, 643-644
Phenol....249, 251-252, 502, 528, 538, 541-543, 604, 630
Phenol-d5....538
2-Phenoxyethanol....602, 605
Phensuximide....643
Phentermine....636, 639
Phenyl acetaldehyde....561, 563
Phenylacetone....636
Phenylacetylene....576, 593
9-Phenylanthracene....540
Phenyl ephedrine....636
1-Phenyl ethyl acetate....554
Phenylethylamine....610
Phenyl ethyl cinnamate....558-559
Phenylethylmalonamide....643
Phenyl ethyl tiglate....558-559
2-Phenylnaphthalene....540
Phenyltoin....644
Phenyltoloxamine....644
Phenytoin....643
Phorate....526
Phosmet....531
Phosphine....633
Phylethylmalonamide (PEMA)....644
Picloram....512
4-Picoline....532
α-Pinene....555-559, 564-567
β-Pinene....555, 557-560, 564-565, 567
Piperazine....611
Piperitone....565
Pirimiphos-methyl....562
Polyethylene glycol....621
Polymethoxyflavones....564
Prazepam....636, 640
Prebane (terbutryn)....518
Primidone....643-644
Procaine....641, 643, 647
Progesterone....648
Promazine....644
Promethazine....644
Prometon....518, 525-526
Prometryn....518-519, 525-526
Promofos....575
Pronamide....518, 525-526
Propachlor....508, 511, 518, 520-521, 524, 526-527, 529-530
Propadiene....584-587, 634
Propanal....553
2-Propanamine....625
1,3-Propandiol....619
1,2-Propandiol (propylene glycol)....619
Propane....580, 583-591, 596, 599, 601, 617
1,2-Propanediol (propylene glycol)....620
1,3-Propanediol....620
1-Propanethiol....578-579, 591
2-Propanethiol....578-579, 581, 591
Propanil....526
Propanoic acid....611
Propanol....550
1-Propanol....515, 554, 595, 600, 602, 605-606, 625-626, 635, 638-639, 649-650
2-Propanol....595, 626, 635, 639
n-Propanol....568, 581, 624, 650
Propargyl alcohol....515
Propazine....518-519, 525-527
Propene....553
2-Propen-1-ol (allyl alcohol)....602, 605
Propiolactone....515
Propiomazine....646
Propionaldehyde....581, 600, 612
Propionic acid....509, 568, 570, 607
1-Propionic acid....532
Propionitrile....515, 517, 548, 610, 626-627
Proposyphene....642
Propyl acetate....554, 617-618, 635
n-Propyl acetate....625
Propylbenzene....515, 576-577, 593, 614-616, 623
n-Propylbenzene....517, 532, 544-546, 548, 588-589, 593, 596-597, 604, 616
Propyl benzoate....617-618
Propyl butyrate....618
Propyl caproate....618
Propylene....577, 579-580, 584-591, 601, 617
Propylene glycol....602, 605
Propyl ether....581, 619
n-Propyl ether....625
Propyl formate....617-618
1-Propyl mercaptan....592
2-Propyl mercaptan....592
n-Propyl mercaptan....592
2-Propyl pentanoic acid....509
Propyl propionate....617-618
Propyl valerate....618
Propyne....580, 584-587, 588-589
2-Propyn-1-ol (propargyl alcohol)....602, 605
Prowl....527
Psilocin....646
Pulegone....565
Pyrazole....610
Pyrene....503, 518, 532, 538, 540
Pyrene-d10....518
Pyrethrin I....536
Pyrethrin II....536
Pyridazine....610
Pyridine....515, 538, 610, 624-627, 635, 650
Pyrilamine....644
Pyrimidine....610
Pyrimiphos ethyl....575
Pyrimiphos methyl....575
Pyrithyldione....646
Pyrrobutamine....641

Q

Quinine....647

R

Rhamnitol....568-569
Rhamnose 1....569
Rhamnose 2....569
Ribitol....568-569
Ribose 2....569
Ro-Neet....527
Rosatol (rosetone)....559
Rosatol (rosetone) geranyl butyrate....558
Rose oxide, cis-rose....558-559
Rose oxide, trans-rose....558-559

S

Sabinene....555, 558, 564-565
trans-Sabinene hydrate....555, 565
Salicylamide....643
α-Santolene....556
Secbumeton....526
Secobarbital....637, 641
Selenide....633
Sencor....527
Simazine....511, 518, 520, 525-527, 542
Simetryn....518, 525-526
α-Sinensal....564
β-Sinensal....564
Sorbitol....569
Stanozolol....648
Stearic acid methyl ester....572, 573
Stigmasterol....648
Stirifos....525
Strawberry aldehyde....569
Strychnine....639, 647
Styrene....515, 517, 544, 546, 548-549, 553, 576, 588-589, 593, 604, 614-617, 623, 632
Styrene dimer....617
Styrene oxide....614, 615
Styrene trimer....617
Sucrose....569
Sufentanyl....645
Sulfallate....526
Sulfur dioxide....605, 634
Sulpiride....646
Sutan....527

T

Talbutal....637, 646
Tebuthiuron....518, 525
Temazepam....194, 636, 639-640
Tenocyclidine (TCP)....646
Terbacil....518, 525-527
Terbufos....518, 525-526, 542
Terbufos sulfone....519
Terbuthylazine....526
Terbutryn....525-526
Terphenyl-d14....538
Terpinene....565
α-Terpinene....555, 564-565
γ-Terpinene....555, 557-559, 564-565, 567
Terpinen-4-ol....555-556, 558-559, 564-565, 567
α-Terpineol....556, 558-560, 564-565, 567
Terpinolene....555, 559, 564-565
γ-Terpinolene....565
Terrazole....518, 529-530

Testosterone 648
2,2',4,4'-Tetrabromodiphenyl ether 502
2,3',4,4'- Tetrabromodiphenyl ether 502
2,3',4',6- Tetrabromodiphenyl ether 502
Tetraborane 633
Tetrabutyltin 537
Tetracaine 643
1,2,4,5-Tetrachlorobenzene 614-615
2,2',4,4'-Tetrachlorobiphenyl 518
2,3,7-8-Tetrachlorodibenzodioxin (TCDD) 504
2,3,7,8- Tetrachlorodibenzofuran (TCDF) 504
Tetrachloroethane 507, 509
1,1,1,2-Tetrachloroethane 515, 517, 544-546, 548, 603, 622
1,1,2,2-Tetrachloroethane 515, 517, 544, 546, 548-549, 553, 603, 622
Tetrachloroethene 515, 517, 544-549, 553, 622
Tetrachloroethylene 547
Tetrachloro-m-xylene (TCMS) 506, 508, 513-514, 520, 524, 529-530, 534
2,4,5,6-Tetrachloro-m-xylene 521-523
2,3,4,5-Tetrachlorophenol 502, 541
2,3,4,6-Tetrachlorophenol 502, 541
2,3,5,6-Tetrachlorophenol 502, 541-543
Tetrachlorvinphos (stirifos) 518
n-Tetracontane 597
Tetracosane 503
n-Tetracosane 597
Tetradecane 503, 596
n-Tetradecane 249, 582, 597
Tetradecanoic acid 570
Tetraethylenepentamine 611
1,1,1,2-Tetrafluoroethane 527
1,1,2,2-Tetrafluoroethane 527
Tetrahydrocannabinol 639
δ9-tetrahydrocannabinol (THC) 649
1,2,3,4-Tetrahydrofluoranthene 540
Tetrahydrofuran (THF) 517, 548, 553, 619, 624, 626, 639, 650, 651
Tetrahydropyran 619
1,2,3,5-Tetramethylbenzene 596-597
1,2,4,5-Tetramethylbenzene 577, 596-597
Tetrapentyltin 537
Thenyldiamine 641
Thiamine pyrophosphate (TPP) 531
Thiamylal 637
Thiazopyr 519
4,4′-Thiodianiline 629
Thiopental 637
Thiophene 578-579, 581, 591, 592, 593
Thioridazine 644
Thonzylamine 644
Threhalose 569
Threitol 569
Thujone 563
α-Thujone 558, 564
β-Thujone 564
Tillam 518, 527
Tinuvin P 633
α-Tocopherol 645
β-Tocopherol 645
δ-Tocopherol 645
γ-Tocopherol 645
Tolban 527
o-Tolidine 629
m-Tolualdehyde 612
o-Tolualdehyde 612
p-Tolualdehyde 612
Toluene 249, 251-252, 501, 515, 517, 544-546, 548-549, 553, 576, 577, 586-589, 593-594, 596-597, 599, 601, 604, 614-617, 623-625, 632, 635, 639, 649-651
Toluene-d8 ....515, 549
o-Toluidine 629
Tonalid 558-560
Trazodone 639
Treflan 527
2,2',4-TriBDE (BDE-17) 502
2,4,4'-TriBDE (BDE-28) 502
Triacetonamine (TAA) 595
Triadimefon 518, 525
Triazolam 636, 640
Tribromoacetic acid 543
2,4,6-Tribromophenol 538
Tributylpentyltin 537
Trichloroacetic acid 543
Trichloroacetonitrile 509, 547
2,4,5-Trichloroaniline 629
1,2,3-Trichlorobenzene 515, 517, 544-546, 548, 614-615
1,2,4-Trichlorobenzene 515, 517, 538, 544-546, 548-549, 553, 614-615
1,3,5-Trichlorobenzene 546, 614-615
2,4,5-Trichlorobiphenyl 518
Trichloroethane 507, 509, 624
1,1-Trichloroethane 649-650
1,1,1-Trichloroethane 507, 509, 515, 517, 544-549, 553, 603, 622, 635, 651
1,1,2-Trichloroethane 507, 509, 515, 517, 544-546, 548-549, 553, 603, 622
Trichloroethene 515, 517, 544-549, 553, 622
Trichloroethylene 547, 624, 626, 635, 650
Trichlorofluoromethane 515, 517, 527, 544-546, 548, 549, 553
1,1,2-trichloro-1,2,2-trifluoroethane) 549
Trichloromethane 625-626
Trichloromethyl silane 633
2,3,4-Trichlorophenol 502, 541-543
2,3,5-Trichlorophenol 502, 541-543
2,3,6-Trichlorophenol 502, 541-543
2,4,5-Trichlorophenol 502, 538, 541-543
2,4,6-Trichlorophenol 502, 528, 538, 541-543, 630
3,4,5-Trichlorophenol 502, 541
2,4,5-Trichlorophenoxyacetic acid 512
1,2,3-Trichloropropane 507, 509, 515, 517, 543-544, 546, 548, 603, 622
1,1,1-Trichloropropanone 547
1,1,1-Trichloro-2-propanone 509
1,1,2-Trichloro-1,2,2-trifluoroethane 527, 553
1,1,2-Trichlorotrifluoroethane 603, 622
Tricosanoic acid methyl ester 572, 573
Tricyclazole 518, 525-526
Tridecane 576-577, 593
n-Tridecane 249, 582
Tridecanoic acid methyl ester 572, 573
Triethanolamine (TEA) 607, 608
Triethylamine 610, 626-627
Triethylene glycol 621
Triethylenetetramine 611
1,1,1-Trifluoroethane 527
Trifluoromethane 527
Trifluorotoluene 544
Triflupromazine 644
Trifluralin 508, 511, 518, 520-521, 524, 529-530, 542
Triglyme (triethylene glycol dimethyl ether) 619, 620
Trimethylamine 608
2,4,5-Trimethylaniline 629
1,2,3-Trimethylbenzene (hemimellitene) 546, 577, 596-597, 599, 601, 614-615
1,2,4-Trimethylbenzene (pseudocumene) 501, 515, 517, 544-546, 548-549, 553, 577, 588-589, 596-597, 614-615, 623
1,3,5-Trimethylbenzene (mesitylene) 515, 517, 544-546, 548-549, 553, 588-589, 596-597, 614-615
Trimethylchloro silane 633
3,5,5-Trimethylhexanol 558-559
2,2,4-Trimethylpentane (isooctane) 553
2,3,3-Trimethylpentane 577, 596
2,3,4-Trimethylpentane 588-589
2,3,5-Trimethylphenol 630
Trimethyl phosphate 532
Trimipramine 640
2,4,6-Trinitrophenol 604
1,3,5-Trioxane impurity 554
Tripelennamine 644
Triphenyl phosphate 518, 519, 562
Triprolidine 644

U

Undecane 576, 593, 599, 623
n-Undecane 249, 260, 577, 596-597
Undecanoic acid methyl ester 572, 573

V

Valencene 564
Valeraldehyde (pentanal) 581, 600, 612
Valeric acid (pentanoic acid) 570, 607, 608, 611
iso-Valeric acid 611
Valerolactone 608
Vanillin 563
Verapamil 639
Vernam 527
Vernolate 518, 525-526
Vertenex 558-559
Vinclozolin 519, 575
Vinyl acetate 553, 617-618
Vinyl chloride 515, 517, 544-546, 548-549, 553
Vinyl-trimethyl silane 633
Viridiflorol 555, 565

W

Water 583, 595, 607

X

Xenon 582
m-Xylene 515, 517, 544-546, 548-549, 553, 576-577, 588-589, 593-594, 596-597, 599, 601, 604, 614-616, 623, 625, 632
m,p-Xylene 501,639, 649-651

o-Xylene 501, 515, 517, 544-546, 548-549, 553, 576-577, 588-589, 593-594, 596-597, 599, 601, 604, 614-616, 623, 625, 632, 639, 649-651
p-Xylene 515, 517, 544-546, 548-549, 553, 576-577, 588-589, 593-594, 596-597, 599, 601, 604, 614-616, 623, 625, 632
2,3-Xylenol 630
2,4-Xylenol 630
2,5-Xylenol 630
2,6-Xylenol 630
3,4-Xylenol 630
3,5-Xylenol 630
Xylose 1.....569
Xylose 2.....569

Ordering Information

Easy Ordering Terms and Conditions

Discounts and Delivery

Agilent Technologies specializes in fast delivery. In the US, if you call before 2 PM EST, we will ship your order that day. You may also request overnight express delivery before 6 PM EST and you will have your order the next day. Volume discounts on a variety of individual products are offered when the entire quantity is shipped to one address at one time.

A shipping and handling fee will be added to your order unless the purchase is over $2000 US for orders place online or over $4000 for orders place via phone. Special shipping (i.e., overnight in the US) is available in most regions at an additional cost.

Agilent is required to collect all state and local sales taxes unless the buyer's tax-exempt certificate is on file with Agilent Technologies. Please be prepared to provide a copy if it is not on file, when placing your order.

Please check with your Agilent Customer Service Representative, local Authorized Distributor, or the Agilent website for current prices, special offers, promotions and discounts when placing your order.

Satisfaction Guaranteed

If you are not satisfied with your Agilent product within the first 60 days, you may return your purchase in its original condition for a full refund or credit. A return policy statement is included in every Agilent shipment and posted under Product Information on the website. In the US and Canada, please call for a Return Authorization form and return instructions at **1-800-227-9770**. If your Agilent product was purchased from a distributor, please contact the distributor.

Shipping Damages

If items are damages in transit, please follow the instructions below:

- If a shipment is visibly damaged upon arrival, do not accept it until the person making the delivery has endorsed the bill of lading with statement for the extent of the damage.
- If any damage is found after unpacking, retain all cartons and inner packaging and immediately request an inspection from the carrier.
- Notify the Agilent Customer Contact Center at **1-800-227-9770** about the damaged shipment so that we can make the appropriate sales adjustment and/or provide you with return instructions (Sales order number, product number and quantity damaged will be needed).

Easy Ways To Order

- Phone: **1-800-227-9770** (option 1, 1) in the US and Canada – Mon-Fri, 8AM to 8PM EST
- Fax: **1-302-633-8901** in the US
- Email: **cag_sales-na@agilent.com** in the US and Canada
- Online: **www.agilent.com/chem** in the US and Canada

Payment Options

- In the US, Visa, MasterCard, Discover and American Express are accepted with a minimum order of $20 (not applicable in all countries).
- Email ePay@agilent.com to make an electronic payment using the ACH/EFT (Automated Clearing House/Electronic Funds Transfer) method.
- Establish a charge account through your Agilent Customer Service Representative or Your Local Agilent sales office. An account number will be assigned to you for charging your purchases. Payment terms are net 30 days from the invoice date. All orders are subject to credit approval.

We will be happy to supply a price quote via, phone, email or fax if you need it in writing.

Warranties

All Agilent Technologies products in this catalog are designed and manufactured to stringent standards under the Agilent quality system registered to ISO 9001. At Agilent, we back every product with a 90-day warranty and a money-back guarantee. If Agilent receives notice of defects during the warranty period. Agilent shall, at its option, either repair or replace products which prove to be defective. If Agilent is unable, within a reasonable time, to repair or replace any product to a condition as warranted, the buyer shall be entitled to a refund of the purchase price upon return of the product to Agilent. The warranty period for each product begins on the day of shipment.

This warranty shall not apply to any defect, failure, or damage caused by improper use or improper or inadequate maintenance or care. This warranty is exclusive and no other warranty, whether written or oral, is expressed or implied. Agilent specifically disclaims the implied warranties of merchantability and fitness for particular purposes. The remedies provided herein are the buyer's sole and exclusive remedies. In no event shall Agilent be liable for direct, indirect, special, incidental, or consequential damages (including loss of profits) whether based on contract, tort, or any other legal theory.

Agilent Technologies Order Form

Outside the U.S. and Canada, please contact your local Agilent office or Authorized Distributor when ordering.

Agilent Technologies

Order Date	Purchase Order or Credit Card Number & Expiration	Taxable Y or N?	Yes	No

Name:	If No, please provide Certificate #
Title:	
Phone:	Fax:
Company:	Email:

	Shipping Address	Billing Address
Company:		
Street:		
Room/Bldg/Dept:		
City:		
State/Province/Country:		
Zip/Postal Code:		
Deliver to:		

Part Number	Description	Quantity	Price	Total Cost

Special Instructions:

Subtotal:	
Tax:	
Total:	

For Assistance: Please call the Agilent Technologies Customer Contact Center at 1-800-227-9770 (U.S. and Canada)
Email Node: cag_sales-na@agilent.com
Fax Number: 302-633-8901 U.S. and Canada
Note: 1. All pricing, tax, discount, and availability information is subject to verification by Agilent Technologies.
2. Shipping and handling is free for orders over $2000 US.

Agilent Technologies Order Form

Outside the U.S. and Canada, please contact your local Agilent office or Authorized Distributor when ordering.

Agilent Technologies

Order Date	Purchase Order or Credit Card Number & Expiration	Taxable Y or N?	Yes	No

Name:	If No, please provide Certificate #
Title:	
Phone:	Fax:
Company:	Email:

	Shipping Address	Billing Address
Company:		
Street:		
Room/Bldg/Dept:		
City:		
State/Province/Country:		
Zip/Postal Code:		
Deliver to:		

Part Number	Description	Quantity	Price	Total Cost

Special Instructions:

Subtotal:	
Tax:	
Total:	

For Assistance: Please call the Agilent Technologies Customer Contact Center at 1-800-227-9770 (U.S. and Canada)
Email Node: cag_sales-na@agilent.com
Fax Number: 302-633-8901 U.S. and Canada

Note: 1. All pricing, tax, discount, and availability information is subject to verification by Agilent Technologies.
2. Shipping and handling is free for orders over $2000 US.

Agilent Technologies Order Form

Outside the U.S. and Canada, please contact your local Agilent office or Authorized Distributor when ordering.

Agilent Technologies

Order Date	Purchase Order or Credit Card Number & Expiration	Taxable Y or N?	Yes	No

Name:	If No, please provide Certificate #
Title:	
Phone:	Fax:
Company:	Email:

	Shipping Address	Billing Address
Company:		
Street:		
Room/Bldg/Dept:		
City:		
State/Province/Country:		
Zip/Postal Code:		
Deliver to:		

Part Number	Description	Quantity	Price	Total Cost

Special Instructions:

Subtotal:	
Tax:	
Total:	

For Assistance: Please call the Agilent Technologies Customer Contact Center at 1-800-227-9770 (U.S. and Canada)
Email Node: cag_sales-na@agilent.com
Fax Number: 302-633-8901 U.S. and Canada
Note: 1. All pricing, tax, discount, and availability information is subject to verification by Agilent Technologies.
2. Shipping and handling is free for orders over $2000 US.

Agilent Technologies Order Form

Outside the U.S. and Canada, please contact your local Agilent office or Authorized Distributor when ordering.

Agilent Technologies

Order Date	Purchase Order or Credit Card Number & Expiration	Taxable Y or N?	Yes	No

Name:	If No, please provide Certificate #
Title:	
Phone:	Fax:
Company:	Email:

	Shipping Address	Billing Address
Company:		
Street:		
Room/Bldg/Dept:		
City:		
State/Province/Country:		
Zip/Postal Code:		
Deliver to:		

Part Number	Description	Quantity	Price	Total Cost

Special Instructions:

Subtotal:	
Tax:	
Total:	

For Assistance: Please call the Agilent Technologies Customer Contact Center at 1-800-227-9770 (U.S. and Canada)
Email Node: cag_sales-na@agilent.com
Fax Number: 302-633-8901 U.S. and Canada
Note: 1. All pricing, tax, discount, and availability information is subject to verification by Agilent Technologies.
2. Shipping and handling is free for orders over $2000 US.

Agilent Technologies Order Form

Outside the U.S. and Canada, please contact your local Agilent office or Authorized Distributor when ordering.

Agilent Technologies

Order Date	Purchase Order or Credit Card Number & Expiration	Taxable Y or N?	Yes	No

Name:	If No, please provide Certificate #
Title:	
Phone:	Fax:
Company:	Email:

	Shipping Address	Billing Address
Company:		
Street:		
Room/Bldg/Dept:		
City:		
State/Province/Country:		
Zip/Postal Code:		
Deliver to:		

Part Number	Description	Quantity	Price	Total Cost

Special Instructions:

Subtotal:	
Tax:	
Total:	

For Assistance: Please call the Agilent Technologies Customer Contact Center at 1-800-227-9770 (U.S. and Canada)
Email Node: cag_sales-na@agilent.com
Fax Number: 302-633-8901 U.S. and Canada
Note: 1. All pricing, tax, discount, and availability information is subject to verification by Agilent Technologies.
2. Shipping and handling is free for orders over $2000 US.

Agilent Technologies Order Form

Outside the U.S. and Canada, please contact your local Agilent office or Authorized Distributor when ordering.

Agilent Technologies

Order Date	Purchase Order or Credit Card Number & Expiration	Taxable Y or N?	Yes	No

Name:	If No, please provide Certificate #
Title:	
Phone:	Fax:
Company:	Email:

	Shipping Address	Billing Address
Company:		
Street:		
Room/Bldg/Dept:		
City:		
State/Province/Country:		
Zip/Postal Code:		
Deliver to:		

Part Number	Description	Quantity	Price	Total Cost

Special Instructions:

Subtotal:	
Tax:	
Total:	

For Assistance: Please call the Agilent Technologies Customer Contact Center at 1-800-227-9770 (U.S. and Canada)
Email Node: cag_sales-na@agilent.com
Fax Number: 302-633-8901 U.S. and Canada
Note: 1. All pricing, tax, discount, and availability information is subject to verification by Agilent Technologies.
2. Shipping and handling is free for orders over $2000 US.

Agilent Technologies Order Form

Outside the U.S. and Canada, please contact your local Agilent office or Authorized Distributor when ordering.

Agilent Technologies

Order Date	Purchase Order or Credit Card Number & Expiration	Taxable Y or N?	Yes	No

Name:	If No, please provide Certificate #
Title:	
Phone:	Fax:
Company:	Email:

	Shipping Address	Billing Address
Company:		
Street:		
Room/Bldg/Dept:		
City:		
State/Province/Country:		
Zip/Postal Code:		
Deliver to:		

Part Number	Description	Quantity	Price	Total Cost

Special Instructions:

Subtotal:	
Tax:	
Total:	

For Assistance: Please call the Agilent Technologies Customer Contact Center at 1-800-227-9770 (U.S. and Canada)
Email Node: cag_sales-na@agilent.com
Fax Number: 302-633-8901 U.S. and Canada
Note: 1. All pricing, tax, discount, and availability information is subject to verification by Agilent Technologies.
2. Shipping and handling is free for orders over $2000 US.

Agilent Technologies Order Form

Outside the U.S. and Canada, please contact your local Agilent office or Authorized Distributor when ordering.

Agilent Technologies

Order Date	Purchase Order or Credit Card Number & Expiration	Taxable Y or N?	Yes	No

Name:	If No, please provide Certificate #
Title:	
Phone:	Fax:
Company:	Email:

	Shipping Address	Billing Address
Company:		
Street:		
Room/Bldg/Dept:		
City:		
State/Province/Country:		
Zip/Postal Code:		
Deliver to:		

Part Number	Description	Quantity	Price	Total Cost

Special Instructions:

Subtotal:	
Tax:	
Total:	

For Assistance: Please call the Agilent Technologies Customer Contact Center at 1-800-227-9770 (U.S. and Canada)
Email Node: cag_sales-na@agilent.com
Fax Number: 302-633-8901 U.S. and Canada
Note: 1. All pricing, tax, discount, and availability information is subject to verification by Agilent Technologies.
2. Shipping and handling is free for orders over $2000 US.

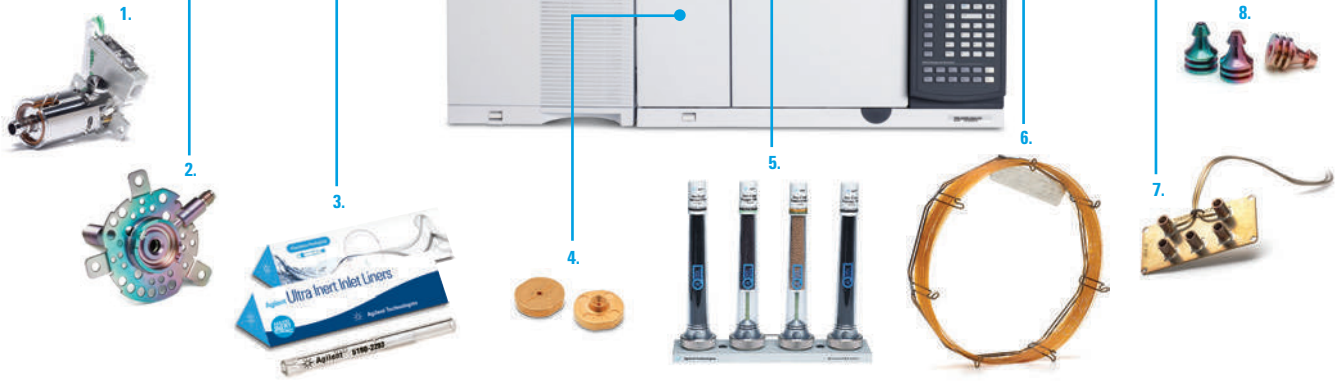
ENSURING AN INERT GC FLOW PATH HAS NEVER BEEN MORE CRITICAL

For labs that need to perform trace level analysis on very active compounds, **Agilent Inert Flow Path solutions** ensure a reliably inert flow path for higher sensitivity, accuracy, and reproducibility. These analyses can now be done with the utmost confidence because each lot of Agilent Inert Flow Path components are qualified using chromatographic QC tests to provide reliable, consistent inertness that spans the entire flow path.

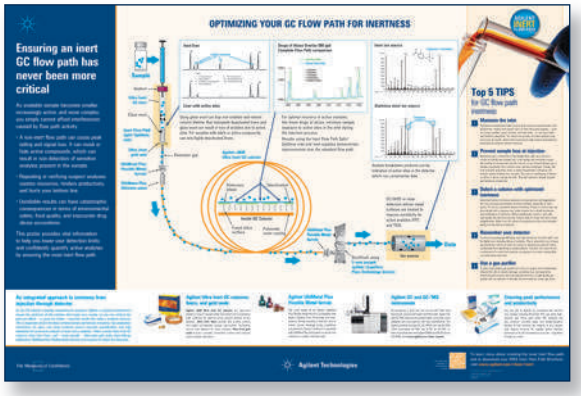
1. MSD Ion Source
2. UltiMetal Plus Split/Splitless Inlet
3. Ultra Inert Inlet Liners
4. Ultra Inert Gold Plated Inlet Seals
5. Gas Clean Filter System
6. Ultra Inert Capillary Column
7. UltiMetal Plus Capillary Flow Technology Dean Switch
8. UltiMetal Plus Flexible Metal Ferrules



7890B GC configured with 5977A Series GC/MSD and 7693A Automatic Liquid Sampler



Learn more about creating an inert flow path, and order the poster at **agilent.com/chem/inert**



20
15|16

For more information

Buy online:
www.agilent.com/chem/store

Contact us:
www.agilent.com/chem/contactus

This information is subject to change without notice.
© Agilent Technologies, Inc. 2016
Published in March 8, 2016
5991-5213EN

Agilent Technologies

THE ESSENTIAL CHROMATOGRAPHY & SPECTROSCOPY CATALOG

20
15|16

GC AND GC/MS

Agilent Technologies