

# Gas Management

## Gas Purification

Impure gases can cause installation delays, premature instrument failure, and flawed results. Purification is one of the most important steps you can take to optimize your system performance.

Agilent brings the highest performance of gas purifiers to gas chromatographers. We manufacture purifiers in a variety of sizes and configurations to remove oxygen, moisture, and hydrocarbons. We recommend that each gas chromatograph use a gas purification system with removable cartridges such as Gas Clean or Renewable. These systems ensure the highest quality gas and contain indicators to allow for timely replacement before other consumables, like columns and liners, are damaged and sensitivity decreases. Agilent Gas Purifiers are a cost effective safety and preventive measure to assure the supply of the highest purity gas to your GC and GC/MS instrumentation with considerable savings in laboratory gas costs. We also carry a line of in-line purifiers to provide high capacity or economy solutions for customers. Please refer to the Gas Purifier Selection Guide to determine which gas purifiers you should use, see page 95.

## Carrier Gas Purification

The Carrier Gas Purification illustration on the next page shows the most common gas purification configurations used in gas chromatography.

Regardless of which purification system is employed, proper installation and maintenance are required to achieve optimal performance. A purifier that is not maintained will eventually expire and become ineffective, or worse, a source of contamination.

## Helpful Hints for Purification Success

- Keep number of fittings in gas line to a minimum
- Install purifiers in a convenient location close to the GC
- Use purifier log books to determine maintenance and cartridge replacement schedules
- Use indicating traps closest to the GC so you can determine when to change the traps that are upstream



Gas Clean Filters

### TIPS & TOOLS

View the latest Agilent J&W GC column focused applications, products and educational resources at [www.agilent.com/chem/mygccolumns](http://www.agilent.com/chem/mygccolumns)

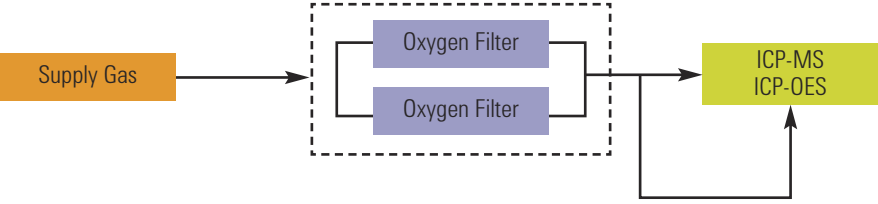
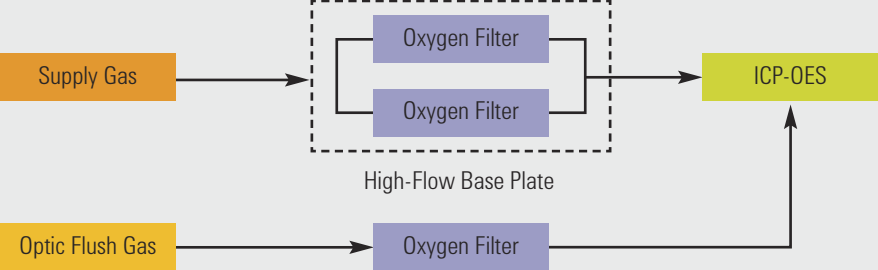




## Connection Diagrams for Common Detectors

Detector	Connection Diagrams
<p><b>ECD</b> Electron Capture Detector</p>	<p>The diagram shows two parallel gas paths. The top path starts with 'Carrier Gas' (green box) flowing through an 'Oxygen Filter' (purple box) and a 'Moisture Filter' (teal box) to a 'Column' (yellow box). The bottom path starts with 'Nitrogen' (light green box) flowing through an 'Oxygen Filter' (purple box) and a 'Moisture Filter' (teal box). From the second 'Moisture Filter', two lines branch out: one labeled 'Anode Purge Gas' goes down and then right to the 'ECD' (yellow box); the other labeled 'Make-Up Gas' goes down and then right to the 'ECD'. The output from the 'Column' also flows down and then right to the 'ECD'.</p>
<p><b>FID</b> Flame Ionization Detector (Carrier Gas = Make-Up Gas)</p>	<p>The diagram shows three gas paths. The top path is 'Carrier Gas' (yellow box) through an 'Oxygen Filter' (purple box) and a 'Moisture Filter' (teal box) to a 'Column' (yellow box). The middle path is 'Hydrogen' (magenta box) through a 'Charcoal Filter' (grey box). The bottom path is 'Air' (blue box) through a 'Charcoal Filter' (grey box). The outputs from the two 'Charcoal Filters' merge and flow to the 'FID' (yellow box). The output from the 'Column' also flows down and then right to the 'FID'.</p>
<p><b>FID</b> Flame Ionization Detector (Carrier Gas differs from Make-Up Gas)</p>	<p>The diagram shows four gas paths. The top path is 'Carrier Gas' (green box) through a 'GC/MS Filter' (magenta box) to a 'Column' (yellow box). The second path is 'Make-Up Gas' (brown box) through a 'Charcoal Filter' (grey box). The third path is 'Hydrogen' (magenta box) through a 'Charcoal Filter' (grey box). The fourth path is 'Air' (blue box) through a 'Charcoal Filter' (grey box). The outputs from the two 'Charcoal Filters' (Hydrogen and Air) merge and flow to the 'FID' (yellow box). The output from the 'Column' also flows down and then right to the 'FID'.</p>

Detector	Connection Diagrams
<p><b>FPD</b> Flame Photometric Detector</p> <p><b>PFPD</b> Pulsed Flame Photometric Detector</p>	
<p><b>MS (ITD, MSD)</b> Ion Trap Detector, Mass Selective Detector</p> <p>Two Possibilities (see diagrams to the right)</p>	
<p><b>NPD, PND</b> Nitrogen-Phosphorus Detector</p> <p><b>TID, TSD</b> Thermionic Detector (Carrier Gas = Make-Up Gas)</p>	
<p><b>TCD</b> Thermal Conductivity Detector</p>	

## Connection Diagrams Analyzers and Generators

Detector	Connection Diagrams
<p><b>ICP-OES/ICP-MS</b></p> <p>Inductively Coupled Plasma-Optical Emission Spectrometry/Mass Spectrometry</p> <p>(Plasma Gas = Nebulizer Gas)</p>	
<p><b>ICP-OES</b></p> <p>Inductively Coupled Plasma-Optical Emission</p> <p>(Different Optic Flush Gas)</p>	
<p><b>Total Organic Carbon (TOC) Analyzer</b></p>	
<p><b>Zero-Air Generator</b></p>	

**Key:**

**GC/MS Filter:** A triple filter that removes oxygen, moisture, and hydrocarbons

**Oxygen Filter:** A filter that removes oxygen

**Moisture Filter:** A filter that removes water

**Charcoal Filter:** A filter that removes hydrocarbons

**CO<sub>2</sub> Filter:** A filter that removes carbon dioxide

## In-Line Gas Traps

The purpose of gas traps is to remove detrimental impurities from carrier and detector gases. Combination traps are available which remove moisture, oxygen, and/or organics with a single trap. The effectiveness of the traps depends on the initial quality of the gas.

Constant exposure of capillary columns to oxygen and moisture, especially at high temperatures, results in rapid and severe column damage. The use of oxygen and moisture traps for the carrier gas may extend column life and protect the instrument. Any moisture or oxygen introduced into the gas stream due to a leak will be removed by the trap until it expires.

## Big Universal Traps

Big Universal Traps utilize a layered, multi-adsorbent bed packing of the most effective, highest capacity adsorbent materials available today for the removal of oxygen, moisture, hydrocarbons, carbon dioxide, and carbon monoxide from helium gas streams. The volume of the various adsorbent materials in the Big Universal Trap was developed through rigorous testing and evaluation in order to ensure that breakthrough of the five major contaminant groups occurs as simultaneously as possible as each material achieves complete saturation.

One Big Universal Trap unit will easily purify the contents of thirteen "K" size cylinders of 99.997% purity helium to a cumulative level of 100 µg/L of O<sub>2</sub>, H<sub>2</sub>O, CO<sub>2</sub>, CO, and hydrocarbons at a flow rate of up to 8 L/min. All tube fittings are Swagelok stainless steel, fitted with 40 µm stainless steel frits for particulate control. Maximum pressure is 250 psi.

Big Universal Traps are more economical than other purifiers, offering nearly three times the capacity.

Big Universal Traps are ideal for any GC or GC/MS application where helium is employed and assurance of purity is essential. Combining the contents of three individual in-line traps into a single unit reduces the number of potential leaks and the possibility of aspirating contaminants into the gas stream. A single purifier also simplifies installation and replacement.



Big universal trap

### TIPS & TOOLS

Big universal traps have nearly three times the capacity of other purifiers.



## Capacity Data

High Purity Helium-99.997%		Removal Capacity
O <sub>2</sub>	< 5 mg/L	1.07 L
THC*	< 1 mg/L	20 g
H <sub>2</sub> O	< 5 mg/L	46 g

\*Total Hydrocarbons, analysis limited to three contaminant groups

## Effluent Concentration

## Research Grade Helium-99.9999%

Impurities	< 1 mg/L	H <sub>2</sub> O	< 0.2 mg/L
N <sub>2</sub>	< 0.5 mg/L	H <sub>2</sub>	< 0.2 mg/L
O <sub>2</sub>	< 0.5 mg/L	Ar	< 0.1 mg/L
THC*	< 0.1 mg/L	Ne	< 0.5 mg/L
CO+CO <sub>2</sub>	< 0.1 mg/L		

\*Total Hydrocarbons, analysis limited to three contaminant groups

## Big Universal Traps (RMS Series)

Description	1/8 in	1/4 in
	Part No.	Part No.
Hydrogen	RMSHY-2	RMSHY-4
Helium (Ar/Me)	RMSH-2	RMSH-4
Nitrogen	RMSN-2	RMSN-4
<b>Trap Mounting Clips</b>		
Big Mounting Clip, 2/pk	UMC-5-2	UMC-5-2

## Big Traps

- Pressure: Up to 250 psig
- 750 cm<sup>3</sup> gas purifiers
- Ideal for bulk purification applications or where several instruments are plumbed from a single gas source
- One piece of heavy-walled aluminum tube eliminates potential leaks
- Equipped with sintered stainless steel frits to prevent particulate contamination



Big moisture trap

### Big Moisture Traps (BMT Series)

Description	Capacity	Efficiency	1/8 in	1/4 in
			Part No.	Part No.
Big Moisture Trap	130 g H <sub>2</sub> O	Reduction of H <sub>2</sub> O to less than 5 µg/L	BMT-2	BMT-4
<b>Mounting Clips</b>				
Big Mounting Clip, 2/pk			UMC-5-2	UMC-5-2

### Big Oxygen Traps (BOT Series)

Description	Capacity	Efficiency	1/8 in	1/4 in
			Part No.	Part No.
Big Oxygen Trap	3 L O <sub>2</sub> or 3.2 g	Reduction of O <sub>2</sub> to less than 1 µg/L	BOT-2	BOT-4
<b>Trap Mounting Clips</b>				
Big Mounting Clip, 2/pk			UMC-5-2	UMC-5-2

### Big Hydrocarbon Traps (BHT Series)

Description	Capacity	Efficiency	1/8 in	1/4 in
			Part No.	Part No.
Big Hydrocarbon Trap	80 g of medium to heavy molecular weight hydrocarbons	Reduction of C <sub>4</sub> hydrocarbons to less than 15 µg/L	BHT-2	BHT-4
<b>Mounting Clips</b>				
Big Mounting Clip, 2/pk			UMC-5-2	UMC-5-2

## Indicating Moisture Traps

This is an advanced-design gas filter for applications requiring high-efficiency moisture removal with the benefit of a depletion indicator. The adsorbing materials are Molecular Sieve 5Å and cobalt-free indicator, held in a sturdy glass tube. The gas to be purified contacts only glass, metal and the absorbent.

The indicator changes color from greenish-yellow to blue at about 5% relative humidity to signal leaks in the system; the molecular sieve removes moisture to trace levels. The glass tube is sealed with a special dual sealing system for extra protection from leaks. An internal frit at each end prevents particulate contamination. The inner glass tube in the Moisture Trap is enclosed in a plastic outer tube for safety. Dimensions: 3.5 cm x 26 cm, maximum pressure 6.8 bar (100 psig).

Dual Seal Design: In this design the glass inner tube is protected by a sealed outer plastic tube. Even if the glass tube fails, the gas system is fully protected against leaks.

Description	1/8 in Part No.	1/4 in Part No.
Glass Indicating Moisture Trap	5182-9211	5182-9411



Glass Indicating Moisture Trap



## Indicating Oxygen Traps

This is an improved, compact indicating filter for high-efficiency oxygen removal, suitable for use with chromatography carrier gas streams. It removes oxygen to low-ppb levels, with an indicator that changes color from green to gray when adsorption capacity is depleted. The adsorbent forms copper oxide in the presence of oxygen; no gas is generated.

The Glass Indicating Oxygen Trap is recommended as a downstream indicator for high-capacity traps. It can be used with non-oxidizing gases such as He, Ar, N<sub>2</sub>, H<sub>2</sub> or CH<sub>4</sub>, with maximum recommended flow rate of 150 cc/min. The absorbents are held in a heavy-walled inner glass tube, shielded by an outer clear plastic tube for increased safety. Maximum pressure is 6.8 bar (100 psig). Approximate dimensions are 3.5 cm x 26 cm including fittings.

Dual Seal Design: In this design the glass inner tube is protected by a sealed outer plastic tube. Even if the glass tube fails, the gas system is fully protected against leaks.

Description	1/8 in Part No.	1/4 in Part No.
Glass Indicating Oxygen Trap	5182-9201	5182-9401
Glass Indicating Oxygen Trap, Stainless Steel Fitting	5182-9202	5182-9402



Glass Indicating Oxygen Trap

## Oxygen Traps

- Reduces oxygen to less than 1 µg/L
- Environmentally safe

This trap removes the oxygen rather than converting it to another form of contamination.



Economy non-indicating oxygen trap

Description	Size (cc)	1/8 in Part No.	1/4 in Part No.
<b>Economy Non-Indicating Oxygen Traps (OT1 Series)</b>			
Oxygen Trap	70	OT1-2	OT1-4
<b>Trap Mounting Clips</b>			
Mounting clip for OT1 traps		MC-1	MC-1

## Hydrocarbon Traps

### Hydrocarbon Traps



Hydrocarbon trap, HT200-2

Description	Size (cc)	1/8 in Part No.	1/4 in Part No.
Hydrocarbon Trap	200	HT200-2	HT200-4
Capillary Grade Hydrocarbon Trap	100	HT3-2	HT3-4
<b>Mounting Clips</b>			
Mounting clip for HT200 Series		MC-1	MC-1

**Ability of Activated Carbon to Remove Substances from Gases  
Using Hydrocarbon Traps**

<b>Compound</b>	<b>Efficiency</b>	<b>Compound</b>	<b>Efficiency</b>
acetone	excellent	dissolved oils	excellent
hypochlorous acid	excellent	nitrobenzenes	excellent
alcohol	excellent	nitrotoluene	excellent
amines	very good	ethyl acetate	excellent
inorganic acids	none	ethyl alcohol	excellent
ammonia	poor	organic acids	excellent
iodine	excellent	ethyl chloride	excellent
amyl acetate	excellent	oxalic acid	excellent
isopropyl acetate	excellent	ethyl ether	excellent
amyl alcohol	excellent	ozone	excellent
isopropyl alcohol	excellent	fluoride	poor
benzene	excellent	phenol	excellent
ketones	excellent	formaldehyde	poor
butyl acetate	excellent	potassium permanganate	excellent
butyl alcohol	excellent	propyl acetate	excellent
lactic acids	excellent	glycol	excellent
by-products-organic	very good	propyl alcohol	excellent
lysol	excellent	propyl chloride	excellent
calcium hypochlorite	excellent	hydrogen bromide	satisfactory
mercaptans	excellent	hydrogen chloride	poor
carbon dioxide	none	sodium hypochlorite	excellent
methyl acetate	excellent	hydrogen fluoride	none
chlorobenzene	excellent	solvents	excellent
methyl alcohol	excellent	hydrogen iodide	satisfactory
chlorine	excellent	sulfuric acid	satisfactory
methyl bromide	excellent	hydrogen selenide	satisfactory
chlorophenol	excellent	hydrogen sulfide	satisfactory
methyl chloride	excellent	toluene	excellent
chlorophyl	excellent	trichloroethylene	excellent
methyl ethyl ketone	excellent	xylene	excellent
cresol	excellent		

## Combination Traps

### Oxygen/Moisture Traps

Oxygen/moisture adsorbents team up to give you two functionalities in the same trap. Unlike some oxygen/moisture traps, these traps are disposable.

Consider the safety, performance, and cost advantages of Agilent capillary-grade oxygen/moisture traps (OT3) compared to heated, catalytic traps.

- Optimized for maximum surface area and capacity
- Leak-free, one-piece design (tested to 2000 psi)
- Bed material treated with ultra-high purity helium
- Filter design: prevents channeling, promotes efficient scrubbing

In addition to inert gases (nitrogen, helium, argon, and krypton), the Agilent OT3 Trap treats streams of hydrogen, alkanes, alkenes, aliphatic hydrocarbon gases, low boiling aromatics, carbon dioxide, carbon monoxide, and argon-methane.



Agilent OT3 trap

#### Oxygen/Moisture Traps (OT3 Series)

Description	Capacity	Efficiency	Size (cc)	1/8 in Part No.	1/4 in Part No.
OT3 Trap	500 mL O <sub>2</sub> 2 g H <sub>2</sub> O	< 15 µg/L	100	OT3-2	OT3-4
Trap Mounting Clips					
Mounting clip				MC-1	MC-1

#### HOW DOES IT WORK?



The Agilent OT3 Trap contains a highly active, metal-containing, scrubbing material in an inert, aluminum body.

## Hydrocarbon/Moisture Traps

- Replace most mixed bed traps supplied by GC manufacturers
- Mounting panel

### Hydrocarbon/Moisture Traps (HMT Series)

Description	Size (cc)	1/8 in Part No.	1/4 in Part No.
Hydrocarbon/Moisture Trap	200	HMT200-2	HMT200-4
Mounting Clips			
Mounting clip		MC-1	MC-1

### Combination Traps for Chemical Ionization MS

Description	Fitting (in)	Part No.
Chemical Ionization for MS*	1/8	G1999-80410

\*Isobutane or methane applications only

## Universal/External Split Vent Trap

- Protects lab from contaminants released by split injection systems
- Stops environmental pollution by trapping and eliminating a broad range of contaminants
- Easy to change
- Comes with three packs of replacement cartridges

### Universal/External Split Vent Trap

Description	Part No.
Universal/external split vent trap with 3 cartridges, 1/8 in Swagelok fitting	RDT-1020
Replacement cartridges, 3/pk	RDT-1023



Hydrocarbon/Moisture trap



Split vent trap and cartridges, RDT-1020

### TIPS & TOOLS

Remember to replace split vent cartridge every six months.

