Guide to Minimizing Septa Problems

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Septum bleed can be the source of problems when analyzing samples by capillary gas chromatography. It occurs when volatile compounds, such as monomers or additives, are emitted from the septum. Septum bleed is amplified with capillary gas chromatography because capillary columns have higher efficiency and operate at much lower flow rates than packed columns. There are many variables that affect the amount of septum bleed during sample analysis (such as inlet temperature, initial hold time, compression, etc.). Most of these variables can be controlled by the analyst. The single most important variable in minimizing septum bleed is the quality of the septa you are using. A high quality, low-bleed septum greatly reduces the need to adjust these GC variables.

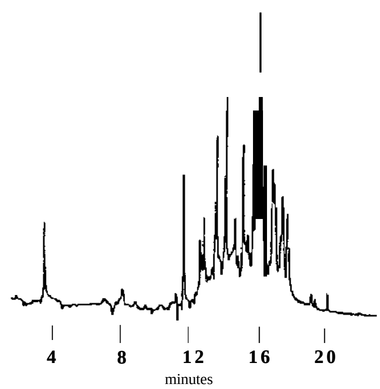
What is Septum Bleed?

Septum bleed occurs when volatile compounds are emitted from the septum. It is exhibited during a temperature programmed run by either a baseline rise and/or extraneous peaks not associated with the sample or the column. Septum bleed is most noticeable during a temperature programmed run because the volatiles emitted from the septum collect on the head of the column during the cool down period and the initial hold time. These volatiles then elute during subsequent runs. However, under isothermal conditions, septum bleed is a continuous, steady state that appears as part of the normal background.

Figure 1 shows septum bleed during a temperature programmed run at high sensitivity and injection port temperature. Typically, septum bleed occurs at column temperatures between 150°C and 300°C.

The septum emits volatile compounds that come from monomers used during manufacturing or additives used to control characteristics such as thermal stability, puncturability, or resilience. Each brand of septa off-gases different types of volatile compounds and yields different bleed profiles. Mass spectral evaluation of septum bleed indicates the typical off-gassing compounds. Septum bleed can originate from phthalate esters (used to soften the septum or from plastic packaging), low molecular weight siloxane monomers and solvents (used to make sibcone rubber), hydrocarbons (used on tools that die-cut the septa), or carboxylic acids (from finger oils or perfumes when handling septa). Figure 2 shows mass spectral data from three different septa samples.

Figure 1 - Typical septum bleed observed in a temperature programmed run with a very hot injector at high sensitivity.



30m, 0.53mm ID, 0.25um Rtx"-1 (cat.# 10125)

Oven temp.:	40°C to 300°C @ 15C/min.
Inj. & det. temp.:	330°C
Injection mode:	Direct
Linear velocity:	80cm/sec.
Carrier gas:	Hydrogen
Attn.:	1 x 10-11 AFS

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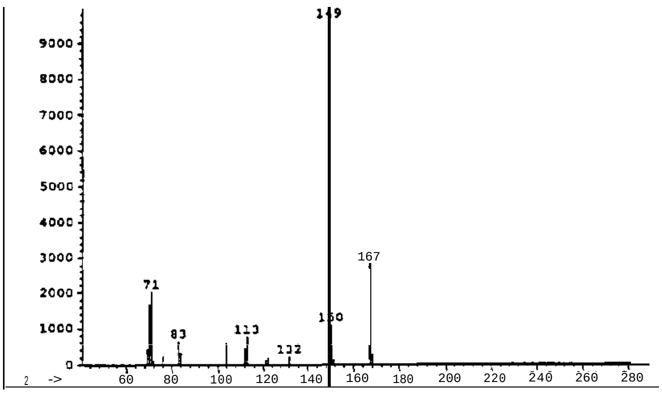
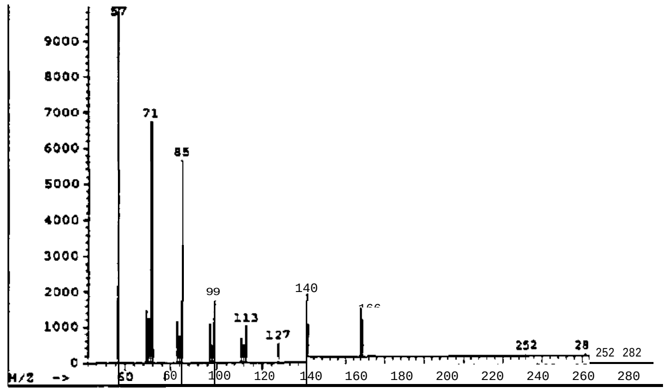
Figure 2 - MSD data reveals the presence of phthalates, siloxanes, and hydrocarbons off-gassing from several septum samples.

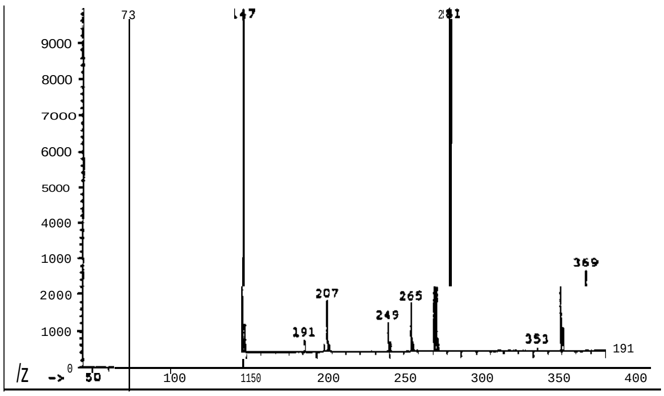
Phthalates



Hydrocarbons



Siloxanes



15m. 0.53mm ID, l.0um Rtx-1 (cat.# 10152)

Oven temp.:	**40°C** (hold 15 min.) to 280C @ 15C/min. **(hold 30 min.)**
Detector:	**HP 5971A MSD**
Carrier gas:	**Helium**
Linear velocity:	**20cm/sec.**
Scan rate:	**1.5sec./scan Scan range: 45-300 AMU**
Ionization:	**EI**

Test Procedure: A uniform piece was cut from the center of each septum type and installed into a clean splitless sleeve. The injection port was heated to 250°C for 15 min., then turned off.

Bleed Comparisons of Six Commercially Available Septa by Capillary GC FID, ECD, and MSD

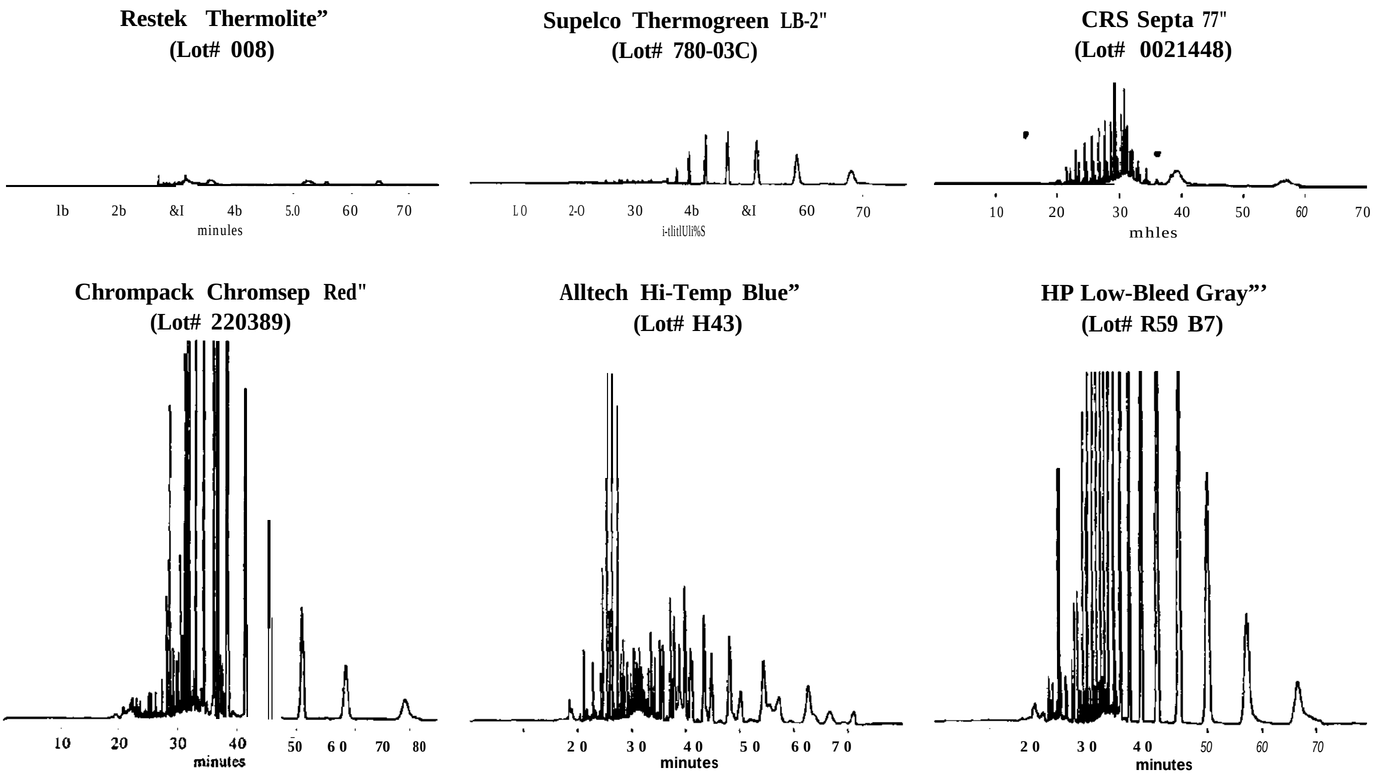
Many of the variables that contribute to septum bleed (inlet temperature, initial hold time, and compression) can be controlled by the analyst. Optimizing these variables significantly reduces the amount of bleed seen during sample analysis. If a low quality, high bleed septum is used, no matter how these variables are optimized, significant septum bIeed is apparent. Use a high quality, bleed septum and reduce the need to adjust these variables.

The bleed characteristics of six commercially available low-bleed septa were monitored. All septa were evaluated by FID, ECD, and MSD.

FID Comparison of Six Low-Bleed Septa

Flame Ionization Detection (FID) was first used to examine the difference in septum bleed between six commercially available low-bleed septa. The FID responds to organic compounds that ionize in a hydrogen/air flame. Off-gassing volatiles that respond on an FID include hydrocarbons, low molecuIar weight siloxanes, solvents, and phthalate esters. Figure 3 shows the FID bIeed testing resultson the following septa: Restek Thermolite”, Supelco Thermogreen LB-Z: CRS Septa 77QD, Chrompack Chromsep Red", Alltech Hi-Temp Blue”, and HP Low-Bleed Gray”.

Figure 3 - FID comparison of six low-bleed septa shows that Thermolite septa exhibit the least amount of off-gassing material



l5m, 0.53mm lD, l.0um Rtx"-1 (cat.# 10152)

Oven temp.:	40°C (hold 15 min.) to 280’C@ 15C/min. (hold 30 min.)	**Linear velocity:**	40cm/sec. (flow rate: 5cc/min.)
Inj. & det. temp.:	300°C	**FID sensitivity:**	256 x 10-11 AFS
Carrier gas:	Hydrogen	**Split vent:**	I00cc/min.
		Splitless hold time:	0.50 min.

Test procedure: A uniform piece was cut From the center face of each septum type and installed into a clean splitless sleeve. The injection port was heated to 250°C for 15 min., then turned off.

Testing parameters for comparison studies:

A splitless sleeve was placed into the GC inlet and a blank run was made to confirm system cleanliness. After verifying system cleanliness, a sample of unconditioned septa was cored from the center face of each septum and cut in half. Using forceps, an equal weight of each septum was placed into the clean, conditioned splitless sleeve. The sleeve was placed into a cooled inlet (40/60°C). The system was thoroughly checked for leaks with a Gow-Mac leak detector.

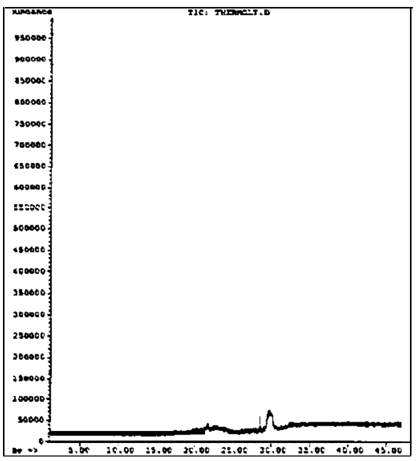
The injection port was then heated to 250”C, while the GC oven was held at 40°C. After 15 minutes at 40”C, the oven was programmed to 280°C @l 15”C/min. to elute the bleed volatiles that had accumulated on the head of the column. After the 15 minute initial hoId, the inlet system was cooled to prevent additional accumulation of septum bleed in the inlet sleeve, At the end of each the septum was removed from the sleeve and a blank run was performed to verify system cleanliness and prevent cross-contamination. Two different lots of each septa were tested in triplicate to confirm reproducibility.

MSD Comparison of Six Low-Bleed Septa

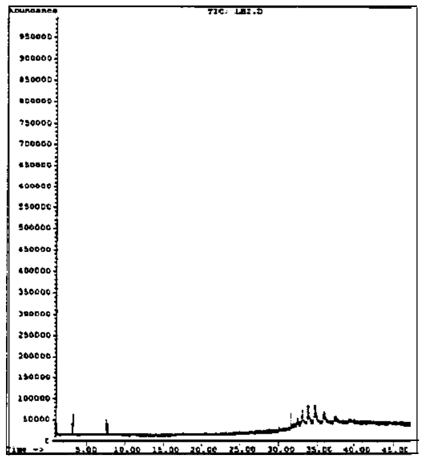
Using low-bleed septa with an MSD is also very important. The MSD is a universal detector that responds to virtually any organic species that can be chromatographed. It can also be used to yield specific information on the compounds off-gassing from the septum. Figure 5 shows total ion chromatograms of septum bleed from the same six septa used in the previous studies. The total ion abundance has been normalized so that all bleed levels for each septum are on the same scale.

*Figure **5** - Thermolite septa exhibit the lowest bleed by MSD compared to six commercially available low-bleed septa.*

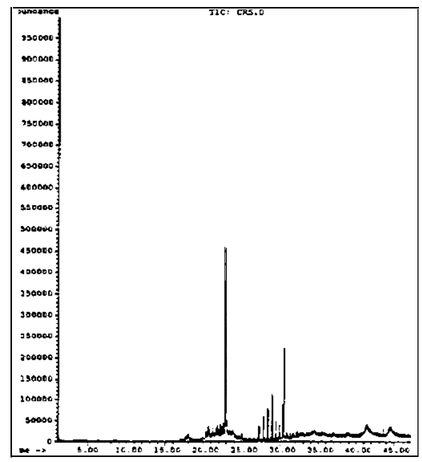
Restek Thermolite
(Lot# 010)



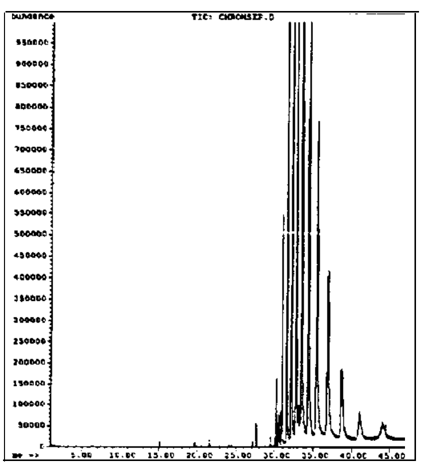
Supelco Thermogreen LB-2
(Lot# 780-03C)



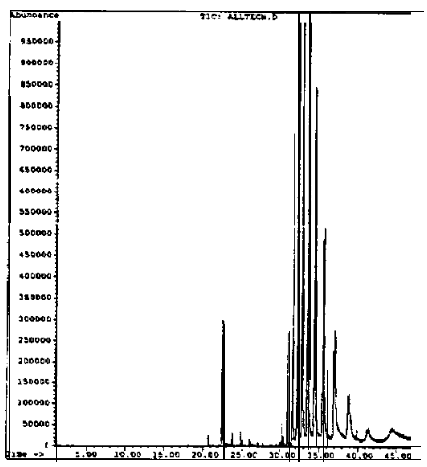
CRS Septa 77
(Lot# 0021-4413)



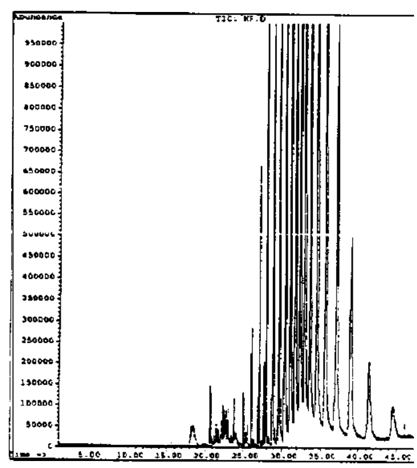
Chrompack Chromsep Red
(Lot# 040788)



Alltech Hi-Temp Blue
(Lot# 243)



HP Low-Bleed Gray
(Lot# R59 B8)



15m, 0.53mm ID, l.0um Rtx"-1 (cat.# 10152)

Oven temp.:	40°C (hold 15 min.) to 280°C @ 15C/min. (hold 30 min.)	Linear velocity:	20cm/sec
		Scan rate:	1 sec./scan
Detector:	HP 5971A MSD	**Scan range:**	45-300AMU
Carrier gas:	Helium	Ionization:	El

Test procedure: A uniform piece was cut from the center face of each septum type and installed into a clean splitless sleeve. The injection port was heated to 250°C for 15 min., then turned off.

Why is Septum Bleed Such a Problem with Capillary Columns?

Chromatographers have long realized that septum bleed can create many problems during sample analysis. In an attempt to minimize septum bleed problems, capillary injectors have been designed with purge systems to reduce the amount of off-gassing volatiles that can collect at the head of the column. However, septum particles can fall inside the inlet sleeve and create bleed problems that cannot be controlled with a septum purge system. Injection mode, flow rate, and column efficiency are the three primary reasons that capillary columns tend to amplify septum bleed.

1. Injection Mode

In the split or splitless injection modes, most of the off-gassing volatiles are swept away through the split or purge vent, minimizing bleed problems. However, many analysts use the direct injection mode, particularly with 0.32 or 0.53mm ID capillary columns. The direct injection mode tends to amplify the bleed problem since all of the off-gassing volatiles from the septum are trapped on the head of the column. Figure 6 shows a comparison of septum bleed in the direct and split injection modes. Septum bleed is almost non-existent in the split mode, but is significant in the direct injection mode.

2. Capillary Column Flow Rate

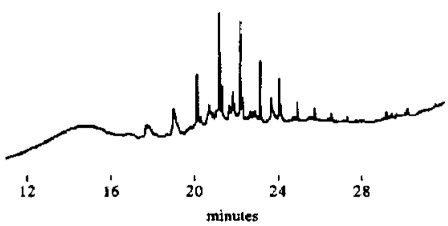
Column flow rate plays a major role in septum bleed problems with capillary columns. Capillary columns operate at much lower flow rates (less than 5cc/min.) than packed columns (20 to 40cc/min.), making septum bleed much more pronounced. The higher flow rates used with packed columns dilute the amount of septum breed seen during a run.

3. Capillary Column Efficiency

Capillary columns also have higher theoretical plates and efficiency than packed columns. A typical 6 foot by 2mm ID packed column has approximately 3,500 theoretical plates, while a 30 meter, 0.53mm ID capillary column has approximately 48,000 theoretical plates. Because of this high resolving power, septum bleed on a capillary column appears as very sharp, distinct peaks.

***Figure** 6 Septa ofs-gassing is more prevalent in the direct injection mode than in the split mode.*

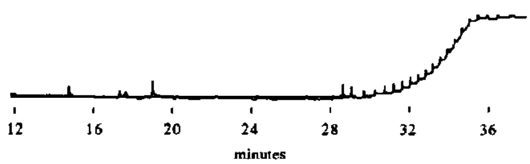
Direct Injection



30m, 0.53mm ID, l.0um Rtx"-1 (cat.# 10155)

Oven temp.:	**40C to 300°C @15C/min.**
Inj. & det. temp.:	**330C**
Linear velocity:	**40cm/sec.**
Carrier gas:	Hydrogen
Attn.:	4 x 10-11" AFS

Split Injection (40cc/min split flow rate)



15m, 0.53mm ID, 0.1um Rtx"-1 (cat.# 10107)

Oven temp.:	**40C to 340 @ 15"C/min.**
Inj. & det. temp.:	**340°C**
Linear velocity:	**40cm/sec.**
Carrier gas:	Hydrogen
Attn.:	8 x 10-11 AFS

Other Variables Affecting Septum Bleed

Septum bleed can be minimized by understanding and controlling the factors that contribute to it.

Septum Quality

The single most important factor in minimizing septum bleed is the quality of the septa. Some septa bleed far more than others because of the silicone rubber quality and the amount of chemicals added. Low quality, high-bleed septa can have extremely detrimental effects on sample analysis. Septum bleed eluting during a GC run often interferes with sample component quantitation and identification. Septum bleed can cause extreme baseline instability with sensitive detectors such as ECDs, NPDs, and MSDs. Figure 7 shows septum bleed interfering in the analysis of chlorinated pesticides on an ECD. Septum bleed eluting from 12 to I6 minutes makes accurate quantitation impossible. Co-eluting septum bleed at 25 minutes makes identification unreliable.

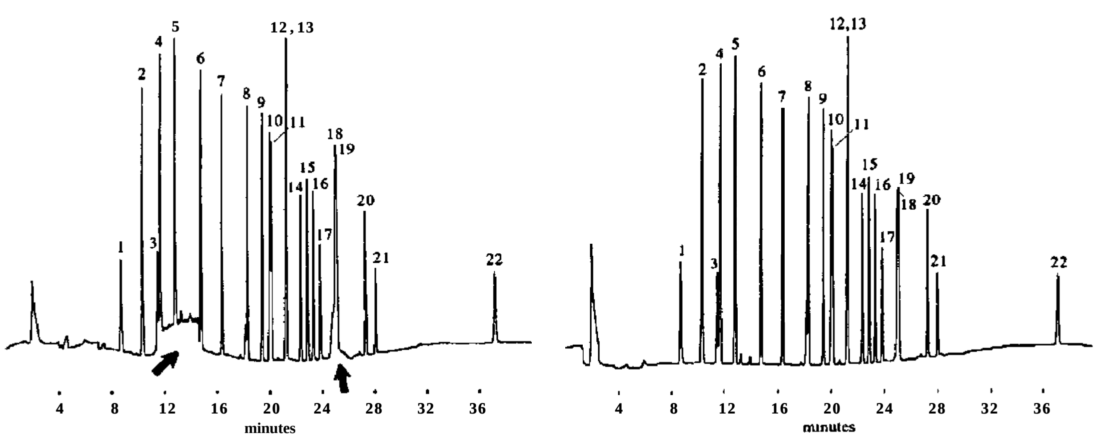
Septum Conditioning

Septum bleed is most prominent when the septum is first installed. Differences in bleed from unconditioned and conditioned septa are shown in Figure 8. Notice that the amount of septum bleed is greatly reduced after overnight conditioning at 300°C. Changing the septum at the end of the day or work shift to allow sufficient conditioning time is recommended. It is not recommended to condition septum in bulk quantities in a glass beaker inside the GC oven because the heat will not be distributed evenly, the septum will not condition equally and will not yield the same bleed profiles. Also, excessive heat can over-condition, resulting in brittleness.

Figure 7 · Septum bleed interferes with pesticide analysis.

1. **2,4,5,6-tetrachloro-m-xylene (IS)**
2. a-BHC
3. I%BHC
4. y-BHC
5. b-BHC
6. **Heptachlor**
7. Aidrin
8. Heptachlor epoxide
9. y-chlordane
10. Endosulfan I
11. a-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. Mcthoxychlor
22. Decachlorobiphenyl (IS)

HP Low-Bleed Gray (L# R59 B8) — **Restek Thermolite** (L# **010)**



30m, 0.53mm ID, OSOum RtX-5 (cat.# 10240)

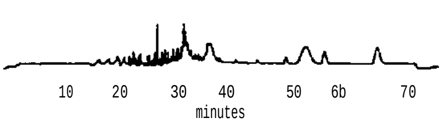
Oven temp.:	150°C to 275°C @ 4"C/min. (hold 15 min.)
Inj. & det. temp.:	**250°C / 300°C**
Carrier gas:	Helium
Linear velocity:	**40cm/sec. (flow rate: l0cc/min.)**
ECD sensitivity:	**8 x l0-11** AFS

1.0u1 direct injection of 50pg pesticide standard using a Uniliner"

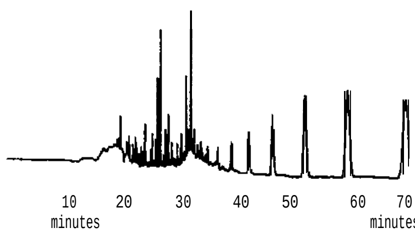
Figure 8 - Septum bleed is greatly reduced after conditioning.

Study 1 - Typical bleed profile of three unconditioned low-bleed septa.

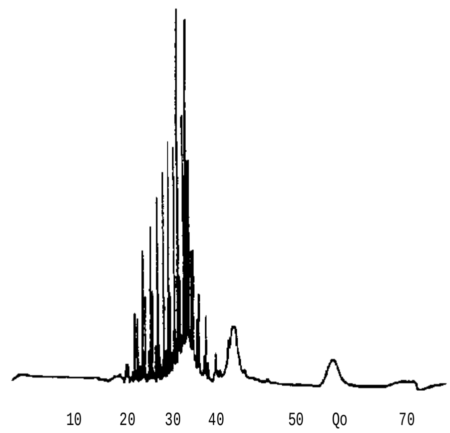
Thermolite
(L# Sep-008)



Thermogreen LB-2
(L# 48891 E)

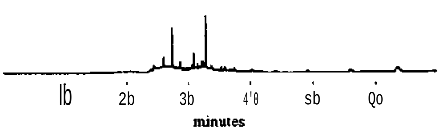


Red Septa 77
(L# 00214413)

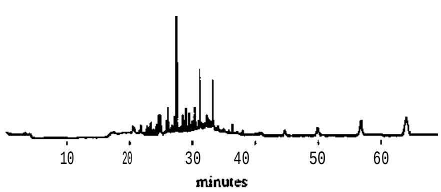


Study 2 - Bleed levels decreased by a factor of 10 after overnight conditioning.

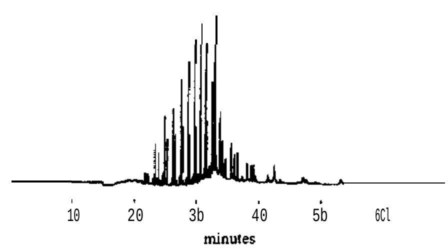
Thermolite
(L# Sep-008)



Thermogreen LB-2
(L# **4889 1** E)



Red Septa 77
(L# 00214413)



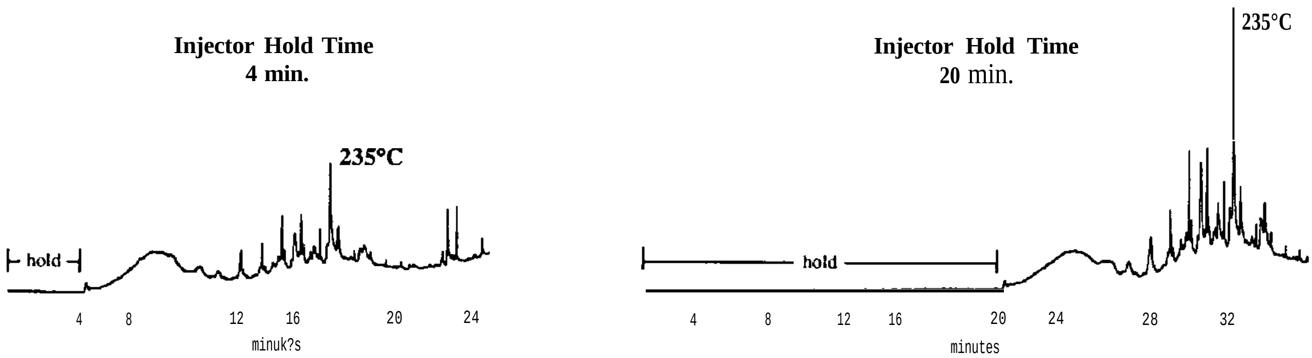
15m, 0.53mm ID, l.0um Rtx"-5 (cat.# 10252)

Oven temp.:	40C (hold 15 min.) to 280°C @ 15C/min. (hold 40 min.)
Inj. temp.:	250C for 15 min., then off
Det. temp.:	**300°C**
Carrier gas:	Hydrogen
FID **sensitivity:**	**256 x** l0-122 AFS

Initial Hold Time

The longer a capillary column remains at a low temperature, a greater amount of bleed collects at the head of the column. This results in significant bleed during a subsequent programmed run. Figure 9 shows the difference between a column held at 40°C for 4 minutes and one held for 20 minutes. The 20 minute initial hold time concentrates much more septum bleed on the head of the column. It is important to minimize the amount of time the column remains at the initial oven temperature so the off-gassing volatiles from the septum cannot collect at the head of the column. If the GC oven has remained at a low temperature for long periods of time, making a blank run to remove accumulated septum bleed is recommended. If the initial hold time cannot be altered, decrease the injection port temperature by 20°C. This reduces the amount of off-gassing from the septum. Additionally, the GC oven temperature can be held at 150°C overnight to prevent off-gassing volatiles from collecting on the head of the column.

***Figure** 9 - The longer the initial hold time, the more septa bleed accumulates at the head of the column.*



30m, 0.53mm ID, l.0um Rtx"-1 (cat.# 10155)

Oven temp.:	40"C (hold 4 min.) to 300°C @ 15C/min. 40°C (hold 20 min.) to 300°C @ 15C/min.
Inj. & det. temp.:	300°C
Injection mode:	direct
Linear velocity:	40cm/scc.
Carrier gas:	Hydrogen
Attn.:	4 x 10-11 AFS

Inlet Temperature

More monomers off-gas from the septum producing higher septum bleed at higher inlet temperatures. The inlet temperature should be minimized to reduce septum bleed, but must be set high enough to vaporize the sample. Figure 10 shows the effects of inlet temperatures on septum bleed.

***Figure 10** - Septum bleed increases as the injector temperature increases.*

30m, 0.53mm ID, l.0um Rtx"-1 (cat.# 10155)

Oven temp.:	**40°C to 300°C @ 15C/min.**	**Linear velocity:**	**40cm/sec.**
Det. temp.:	**300C**	**Carrier gas:**	**Hydrogen**
Injection mode:	**direct**	**Attn.:**	**4 x 10-11** AFS

Septum Durability

When the syringe needle punctures a septum during an injection, small fragments may tear away and drop inside the inlet sleeve and column. Always keep ***syringe needles sharp to reduce septa coring.*** As septum fragments accumulate inside the sleeve, bleed and adsorption of active compounds increase. Therefore, it is desirable to have a septum that is soft enough for easy needle penetration but resilient enough to minimize fragmentation.

Septum Compression

Over-tightening the septum nut can result in increased septum bleed. This causes the extrusion of the septum from the septum nut and increases the exposed surface. Increased compression also makes it harder for the syringe needle to penetrate, causing the needle to bend and creating more fragments.

Detector Sensitivity and Selectivity

Bleed is also dependent on detector sensitivity and selectivity. The higher the detector sensitivity, the greater the septum bleed appears. Specific detectors may also be more selective to the off-gassing volatiles emitted from the septum and can enhance the appearance of septum bleed.

Septum Troubleshooting

Make troubleshooting faster and easier by closely monitoring the instrument and operations. Maintaining reliable records of when septa were installed and changed, and which samples and sizes were injected will speed up troubleshooting and reduce GC down time.

How Do You Troubleshoot Septum Bleed?

Knowing how septum bleed originates, what causes it, and why it is worse with capillary columns enables chromatographers to quickly troubleshoot the problem. Often other chromatographic problems such as sample contamination in the stationary phase are mistaken for septum bleed. The following steps will help determine if you have septum bleed and explain how to eliminate it.

Determining If You Have Septum Bleed

Follow these troubleshooting techniques to determine whether the cause of bleed and ghost peaks is from the septum or from the carrier gas or column contaminants.

1. Reduce the injection port temperature to 50°C. Make a blank temperature programmed run under the same GC conditions used for the sample analysis. Run the blank twice. The first blank run clears the column of any septum bleed that could have accumulated on the head of the column during the injector cool down period. The second run allows you to determine if septum bleed is present.

- If the second blank run shows diminished ghost peaks, you are probably experiencing septum bleed. Replace the septum with a high quality, low-bleed Thermolite septa. Refer to the septa evaluation by FID, ECD, and MSD for comparisons, or refer to "Other Variables Affecting Septum Bleed" in this bulletin.
- If ghost peaks are still present after the second blank run, then septum bleed is probably not the cause and other variables in the chromatographic system should be investigated. These variables are discussed in the next section.

2. Reducing the injection port temperature to troubleshoot septum bleed determines whether the contamination is coming from the inlet. This contamination may be coming from the septum, but it could also be coming from septum particles in the inlet sleeve, residue on the sleeve, or from the injector housing itself. Isolate the septum from the rest of the injector by covering the septum with cleaned aluminum foil.

- Make a blank run under the same temperature program used during sample analysis. This clears the system of bleed that may have accumulated during the cool down cycle of the last run. Make a second blank run to check the system for septum bleed. If the ghost peaks are eliminated, then septum bleed was the cause of contamination. If the ghost peaks are still present, contamination is coming from the carrier gas or from another source within the injector.

If the ghost peaks dissappear after isolating the inlet and making blank runs, the septum is contaminating the system and causing bleed. To eliminate septum bleed, use high quality, low-bleed Thermolite septa. If possible, decrease the inlet temperature to reduce septa off-gassing.

Problems That Could be Mistaken for Septum Bleed

The following variables are easily mistaken for septum bleed:

1. Dirty Syringe
Poorly maintained syringes lead to ghost peaks, short septum life, and septum particles in the inlet sleeve. Clean the syringe after each injection and visually examine the point for burrs.

- ▼ To clean the syringe, fill the volume with pure solvent (usually the same solvent as used in the sample). Allow the solvent to dissolve the soluble materials in the syringe for a full minute, then discard the solvent from the syringe. Heat the syringe needle in a spare injection port to vaporize the rinsing solvents. Repeat this process two to three times. Often, it is helpful to use multiple solvents (non-polar then polar) to remove all materials.

- ▼ Remove the plunger and gently wipe it with a clean tissue. (Caution: Do not remove the plunger with a wire-in-the-needle syringe). After rinsing, dry the syringe needle and plunger with a gentle stream of nitrogen or air. Then, heat the syringe needle in a spare injection port to vaporize the rinsing solvents.

2. High Molecular Weight Contaminants
Often, samples contain high molecular weight compounds or contaminants, sample decomposition products, or glassware cleaning agents. If the capillary column is not programmed high enough in temperature to elute the high molecular weight compounds, the heavy compounds remain in the stationary phase and elute in the next run. Carefully monitor the ghost peak retention times to differentiate this problem from septum bleed. If the ghost peaks elute at the same retention time in each blank run, then the problem is coming from the inlet. If the retention times shift from run-to-run, then the contamination is probably caused by sample carryover from a previous run. To eliminate this problem, always use high purity solvents while diluting calibration standards, thoroughly clean syringes, and change the final hold time of the temperature program to allow the high molecular weight materials to completely elute from the column.

3. Sample Adsorption
Sample components can adsorb on poorly deactivated inlet liners and elute in subsequent runs. Adsorptive compounds such as pesticides, phenols, glycols, and flavor volatiles often cling to the septum and contaminate the system. Adsorption can also occur if a high molecular weight sample is not sufficiently vaporized and remains in the injection port. To eliminate this problem, clean or replace the injector liner with a clean deactivated sleeve and change or clean any other inlet parts that come into contact with the sample.

To eliminate sample components from adsorbing into the septum, change the septum frequently. Always use a low-bleed, high-quality septum.

5. Carrier Gas Contamination
Oxygen, moisture, and hydrocarbons often contaminate carrier gases. Always use high purity grade carrier gas and install high performance gas purifiers. To troubleshoot carrier gas contamination, replace the carrier gas tank with a fresh tank and replace any suspect purifiers. If ghost peaks and/or baseline disturbances go away, the carrier gas was the source of the contamination. Lag time for carrier gas contamination disappearance is 12 to 24 hours after changing the tank. Another cross-check for carrier gas contamination is to examine all other GCs using carrier gas from the same tank. If the gas is contaminated, the other GCs will also exhibit ghost peaks.

6. Carrier Gas or Make-up Gas Line Contamination
Gas lines in the GC can be contaminated by two major sources; tubing contaminates and sample backflash. When installing new carrier gas lines on the GC, always rinse the tubing with multiple solvents such as methanol, methylene chloride, or acetone and dry in an oven under a flow of carrier gas. Alternatively, pre-cleaned tubing can be used. Often hydrocarbons or cutting oils used to manufacture the tubing contaminate the inside of the tubing. Another source of carrier gas line contamination results from injecting too much sample into the injection port. This can create sample backflash into carrier gas lines. To eliminate this problem, always minimize the sample size being injected and operate the septum purge at 3-5cc/min. Solvent rinsing and heating the carrier gas lines removes contamination.

Septum Leaks

A number of factors can cause a septum to leak. As the temperature of the septum is increased, it loses its elasticity and ability to seal. This loss of elasticity occurs from the temperature of the inlet and the duration between septum changes. The use of large diameter syringe needles can also contribute to septum leaks. If the needle is damaged (burrs or bent tips), the septum can start leaking after only a few injections.

Syringe burrs decrease septum lifetime and cause premature leakage.

The tightness of the septum nut is also important. Over-tightening the septum can cause leaks, inconsistent performance, and decrease the septum life. Large injection port temperature changes may loosen septum nuts, resulting in leaks.

With manual injections, the needle punctures the septum in many different places, resulting in septum coring. After several injections, a large hole is created causing a septum leak. Leak check the septum frequently to help prevent these problems.

A leaking septum exhibits many of the following symptoms:

a) Cycling or unstable baseline
b) Loss of sensitivity (a leaky syringe shows the same characteristics).
c) Erratic quantitation
d) Retention time shifts
e) Column deterioration
f) Detector instabitity

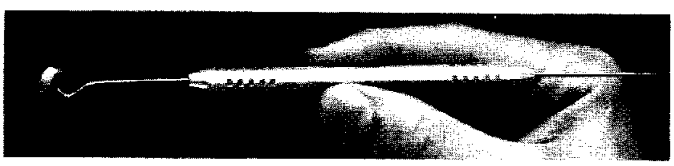
Leak Detection

Never use liquid leak detectors on a capillary system. Small amounts of the liquid leak detector can enter through the fittings, contaminate the GC system and possibly damage the analytical column. Septum leaks are commonly found by a thermal conductivity detector (Gow-Mac Leak Detector). The Gow-Mac Leak Detector (cat.# 20130) is able to detect minute leaks with either helium or hydrogen carrier gas. The Gow-Mac uses air as a reference and measures the difference in thermal conductivity between the helium or hydrogen and the reference gas. When nitrogen is used as a carrier gas, the difference in conductivity between nitrogen and air is small, resulting in reduced sensitivity.

The Gaw-Mac is preferred for leak detection because of its high sensitivity and because it does not contaminate the GC system.

Leak Prevention

Change the septum on a daily basis, or at least weekly, if the instrument is used continually. It is preferable to change the septum before a leak develops to prevent the loss of valuable instrument time and to ensure more reliable data. If the septum is changed at the end of the day, it conditions during the night and the system is ready to use in the morning.



Septum pullers make daily maintenance easy.

Septum Maintenance

How to Change a Septum

Reduce the column temperature (below SOY) and change the septum when the column is cool. Before re-heating the column, allow it to purge 15 minutes to remove any O_2, and H_2O from the air that may have entered the column. It is critical that the column not be exposed to air while it is hot. This can cause stationary phase oxidation and decrease column life.

Tightening the Septum Nut

The tightness of the septum nut is important to prevent excessive bleeding and leaking. A correctly tightened septum allows a maximum number of injections to be made. Over-tightening tends to extrude the septum and increases the amount of septum bleed. Under-tightening reduces the septum's ability to seal.

Handling the Septum

It is important to minimize contact when installing and handling the septum. Always handle the septum with clean tweezers, forceps, or cotton gloves instead of fingers. Contaminants such as finger oils, perfumes, make-up, fingernail polish, and skin creams can adsorb onto the septum and create ghost peaks during sample analysis.

Capillary Chromatography Accessories

Thermolite" Septa

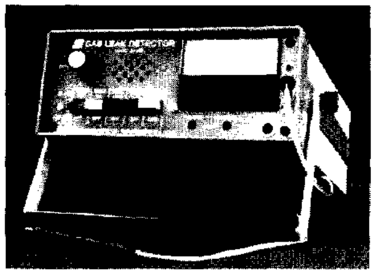
Receive a free can cooler, coffee mug, or stein with the purchase of Thermolite Septa!

Septum Diameter	25-Pack cat.#	50-Pack cat.#	l00-Pack cat.#
5mm (3/16")	20351	20352	20353
6mm (1/4")	20355	20356	20357
9.5mm (3/16")	20359	20360	20361
10mm (0.4")	20378	20379	20380
I lmm (7/16")	20363	20364	20365
12.5mm (l/2")	20367	20368	20369
Shimadzu Plug	20372	20373	20374

Instrument	Septum Size
Hewlett-Packard	
5890 series	l0mm/llmm
5700 series	9.5mm/10mm
Varian	
Packed column injector	9.5mm/l0mm
Split/splitless injector	lOmm/l Imm
Perkin Elmer	
Sigma series, 900, 990	11mm
8000 series	llmm
AutoSys	llmm
Tracor	
550,560	9.5mm
220,222	12.5mm
Gow-Mac (al1 models)	9.5mm

Gow-Mac Leak Detector

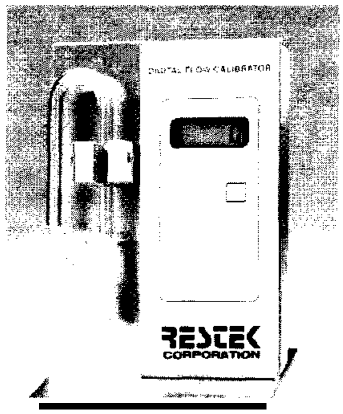
Leaks in a gas chromatographic system increase detector noise, cause baseline instability, shorten column lifetimes, waste expensive carrier gas, and increase the error of analyses. A Gow-Mac thermal conductivity leak detector is not a luxury, it is a must for all capillary chromatographers. In fact, a Gow-Mac leak detector is so sensitive that it detects the instantaneous, minute leak caused while a syringe penetrates the septum during an injection.



The Gow-Mac is a portable unit that operates on line voltage or an internal, rechargeable, lead/acid gel battery. It also incorporates an audible alarm as well as a visual readout device. This unit is set for 115V/60Hz operating voltage, but is internally switchable to 230V/60Hz.
cat.# 20130

Restek's Digital Flow Calibrator

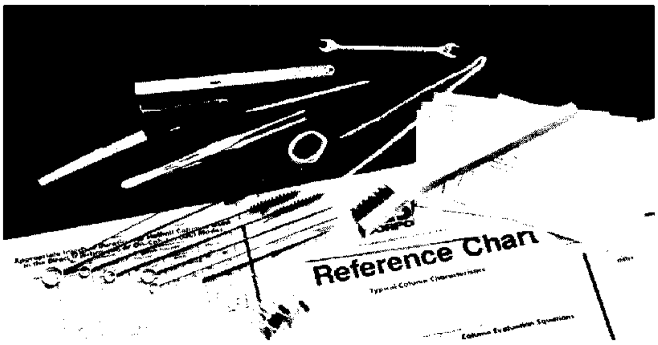
Restek's Digital Flow Calibrator is designed to measure and calibrate gas flows used in capillary chromatography. The flow calibrator is capable of measuring flow rates of .5 - 500mls/min. accurately, regardless of the gas type, It is an excellent tool for measuring the split vent flow and detector gas flows. This battery operated flow calibrator is easy to operate and is capable of displaying the split ratio.
cat.# 20123



Restek's Wizards are ready to take your orders
Monday - Friday, Sam - 7pm EST.
Call 800-356-l 6881

MLE Capillary Tool Kit

This kit contains all of the tools necessary for installing and maintaining capillary columns.



- Rubber-tipped Slide-lok tweezers
- 15cm compact steel ruler
- Sapphire scribe
- Pocket magnifier
- Pin vise with three drills (0.41,0.51, 0.8mm)
- Four-inch tapered needle file
- Six stainless steel jet reamers (0.25 - 0.65mm)
- Five self-adhesive capillary column labels
- Septum puller
- Three nylon brushes (l/8”, 3/16”, l/4”)
- Pipe cleaner (one-foot)
- l/4” - 5/16” wrench
- One-meter of high temperature string
- Three stainless steel brushes (3/16”, l/4”, 3/S”)
- Stainless steel toothbrush
- Glass wool puller/inserter
- Capillary reference poster

cat.# 20118

FID/Injector Cleaning Kit

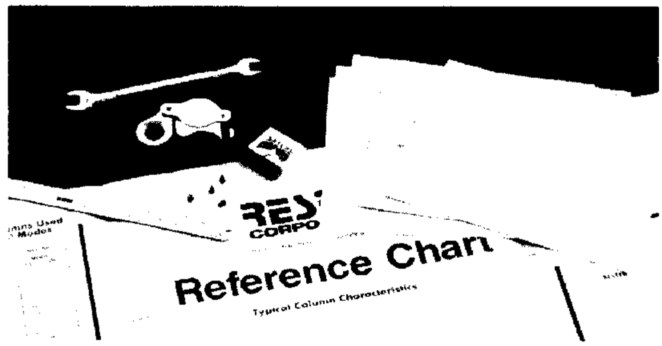
This kit contains everything needed to keep your FID and injection ports clean.

- Nylon tube brushes (l/8”, 3/16”, l/4”) and pipe cleaner
- Stainless steel tube brushes (l/8”, 3/16”, l/4”)
- Stainless steel surface brush
- Stainless steel reamers
- Emery cloth

cat.# 20120

Mini MLE Capillary Tool Kit

This kit contains all of the bare essentials needed to install a capillary column.



- Ceramic scoring wafer
- Pocket magnifier
- 15cm compact steel ruler
- l/4” - 5/16” wrench
- 0.5 & 0.8mm ID graphite ferrules
- Self-adhesive capillary column labels
- Capillary reference poster

cat.# 20119

Septum Puller

This is an excellent tool to have on hand in the lab. The hooked end is used for removing stuck septa and o-rings. The sharp, pointed end is handy for removing stuck ferrules and ferrule fragments.
cat.# 20117

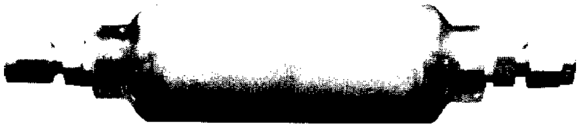
Mini FS Wool Puller/Inserter

Used for inserting and removing glass or fused silica wool from injection port liners.
cat.# 20114,2-pk.

Install a Moisture or Oxygen Trap to Insure O2 - H2O-free Carrier Gas

Columns last longer, show less bleed, and detector noise is minimized when the carrier gas is purified.

Indicating Hydrocarbon Trap
(for compressed air)



Restores FID baseline stability when using air compressors.
Removes trace hydrocarbons from compressed air lines down to Sppm.
Adsorbent color changes from pink to red as trap adsorbs oil vapors.
1/4" Indicating Hydrocarbon Trap: cat.# 20636
l/8" Indicating Hydrocarbon Trap: cat.# 20637

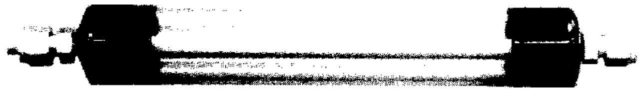
High Capacity Indicating Oxygen Trap

Indicator changes color as 0, & H,O are trapped.
Lasts longer than three smaller traps.
Usable with multiple GC systems.
Removes trace contaminants from carrier gases.
Usable with all carrier gases.
Includes cartridge housing and one cartridge.
l/4" tube compression fittings: cat.# 20623
l/S" tube compression fittings: cat.# 20624
Refill cartridge (fits l/4 or l/S"): cat.# **20625**

Indicating Moisture Trap

Reduces noise for high sensitivity detectors.
Indicator changes color as H,O is trapped.
Heavy-walled glass body prevents 0, & H,O infusion which often occurs with plastic purifiers.
Integral protective plastic shield for maximum safety.
40pm frit prevents microparticulate damage to needle valves and flow controllers.
Pre-purged with helium for fast stabilization time.
l/4" female Swagelok" fittings: cat.# 20604
l/8" female Swagelok" fittings: cat-# 20605

Indicating Oxygen Trap



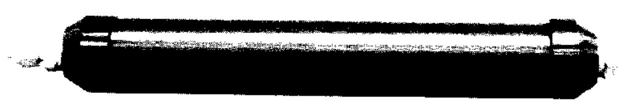
Indicator changes color as 0, and moisture are trapped.
- Heavy-walled glass body prevents 0, & H,O infusion which often occurs with plastic purifiers.
Integral protective plastic shield for maximum safety.
40um frit prevents microparticulate damage to needle valves and flow controllers.
Vespel sealing rings used, not leaky rubber o-rings.
l/4' female SwagelokVittings: cat.# 20603
l/8" female Swagelok'Wtings: cat.# 20602

Return your unbroken traps and give them a new life!
Regenerated Trap (l/4" fittings): cat.# 20617
Regenerated Trap (l/8" fittings): cat.# 20616

High Capacity Oxygen Trap

Most effective oxygen trap available.
Long life, typically lasts for over 200cf cylinders.
9 Traps carrier gas contaminating moisture.
l/4" female Swagelok Fittings:: cat.# 20600
l/S" female Swagelok Fittings: cat.# 20601

Hydrocarbon Trap



Removes trace carrier gas impurities which is a must for sensitive detectors such as ECDs, PIDs, and MS.
Built-in 20pm frit prevents particulate contamination.
Contains fine mesh coconut shell activated carbon.
Stops carrier gas interferences with purge & trap systems.
Refillable and rechargeable.
l/4" tube compression fittings: cat.# 20628
l/S" tube compression fittings: 20627
Carbon refill (two recharges): cat.# **20626**

Restek Corporation 110 Benner Circle Bellefonte, PA 16823-8812 Fax: 814-353-1309