

Air Sampling / Monitoring

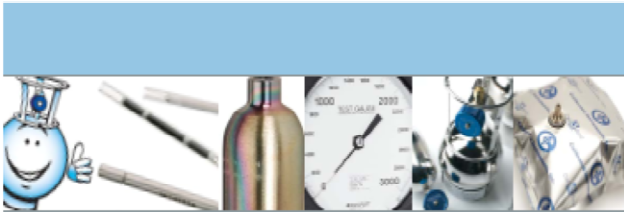
Restek :

Silco Canisters
Siltek/Sulfinert
(Deactivation of SS)

NUTECH

Unique

VOC Preconcentrator
Thermal Desorption Systems
Canister Cleaning Systems
Sampling Timers



Air Monitoring Products

Gas Sampling Bags
 new!



- air sampling canisters
- thermal desorption unit tubes
- gas sampling bags
- sample cylinders
- gas standards
- accessories
- applications

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TECHNICAL GUIDE
A Guide to Passive Air Sampling
 Equipment Needed and Practical Techniques
 for Collecting Air Samples



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Methods of Air Sampling and Analysis
 THIRD EDITION
 JAMES P. LODGE, JR., EDITOR

INTER-SOCIETY COMMITTEE
 AIHA, ACG, AICHE, APWA,
 ASME, ADAC, HPS, ISA

Methods of Air Sampling and Analysis, 3rd Edition
 J. P. Lodge, CRC Press LLC, 1988, 784pp.
 cat.# 20493

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Air Monitoring Products, From Our Lab to Yours

At Restek, we are proud to offer a diversified line of high quality products for sampling organics in air, for both the environmental and petroleum markets. Our innovative products reflect our customers' needs and the latest technology. We invite your comments and ideas.

Email me at Irene.degraff@restek.com.

Irene DeGraff

Air & SPE Product Marketing Manager



www.restek.com

- Register to order online through our enhanced e-commerce system.
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- Troubleshooting and support in the Expert Center.
- 24/7 ordering.

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SilcoCan™ Canisters



Canisters are the gold standard for ambient VOC monitoring.



did you know?

SilcoCan™ Canisters are cleaned prior to shipping.

- Excellent stability for long-term storage of sulfur-containing volatile organic compounds.
- More accurate sampling.

SilcoCan™ Air Monitoring Canisters Ideal for low-level reactive sulfur (1-20ppb), TO-14, or TO-15 compounds

Features	Benefits
Siltek® treated.	High inertness—ensures sample stability.
High-purity, 3/4-turn valve with stainless steel diaphragms.	No sample adsorption at the valve, for more accurate results; easy to use.
Vacuum/pressure gauge (optional).	Ascertain internal conditions at a glance.
Variety of sizes.	Meet extensive range of sampling needs.
Stable to 250°C.	Heat canister to 250°C for superior cleaning.
Siltek® valve available (add suffix "-650" to cat.#).	Completely passive sample pathway for maximum sample stability.

Optional gauge

- Quickly confirm vacuum or pressure inside canister.
- Monitor pressure changes.
- Fully protected by canister frame.
- Can be heated to 90°C during cleaning.

Newest surface technology

To ensure sample stability, SilcoCan™ canisters are deactivated with Restek's innovative Siltek® surface treatment, which chemically bonds a fused silica layer to the metal inner surface of the canister. This layer offers unsurpassed inertness for active compounds, including polar and sulfur-containing molecules. It will not crack, chip, or flake off, despite harsh handling in the field or during transport.



Enhanced valve and canister bracket

Canister holder and valve bracket protect canister, tube stub, and valve.

1/4" tube stub

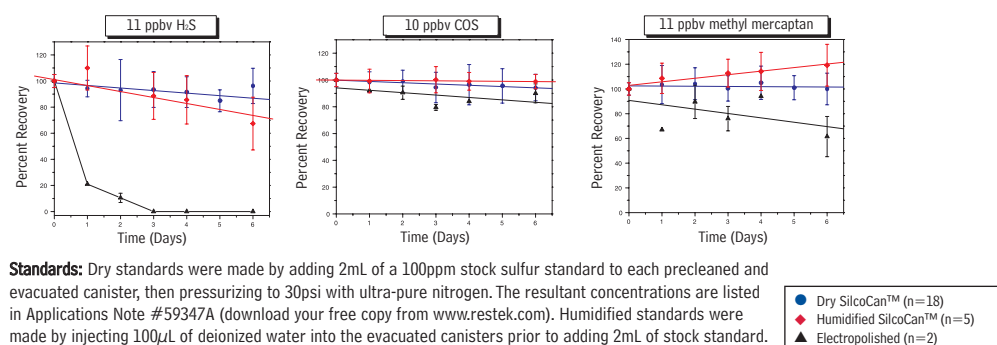
Allows user to interchange valves.

Serial-controlled label

For quick, sure identification.

Whether you are monitoring for TO-14, TO-15, or reactive sulfur compounds, SilcoCan™ canisters are your best choice for inertness. In Tedlar® bags, the stability of low-level (100ppbv) sulfur volatile organic compounds (VOCs) is poor, even within 24 hours of sampling. Sulfur compounds react with the metal surface in electropolished canisters, so these canisters are unsuitable for collecting and storing low-level sulfur VOCs. SilcoCan™ air monitoring canisters, which feature a Siltek® treated surface, offer excellent storage stability for sulfur VOCs at very low levels (1–20ppbv), under dry or humid conditions. The versatility of the SilcoCan™ canister makes it an excellent choice for collecting and storing TO-14 or TO-15 compounds (Figure 2).

Figure 1 SilcoCan™ canisters effectively store very low levels of sulfur compounds.



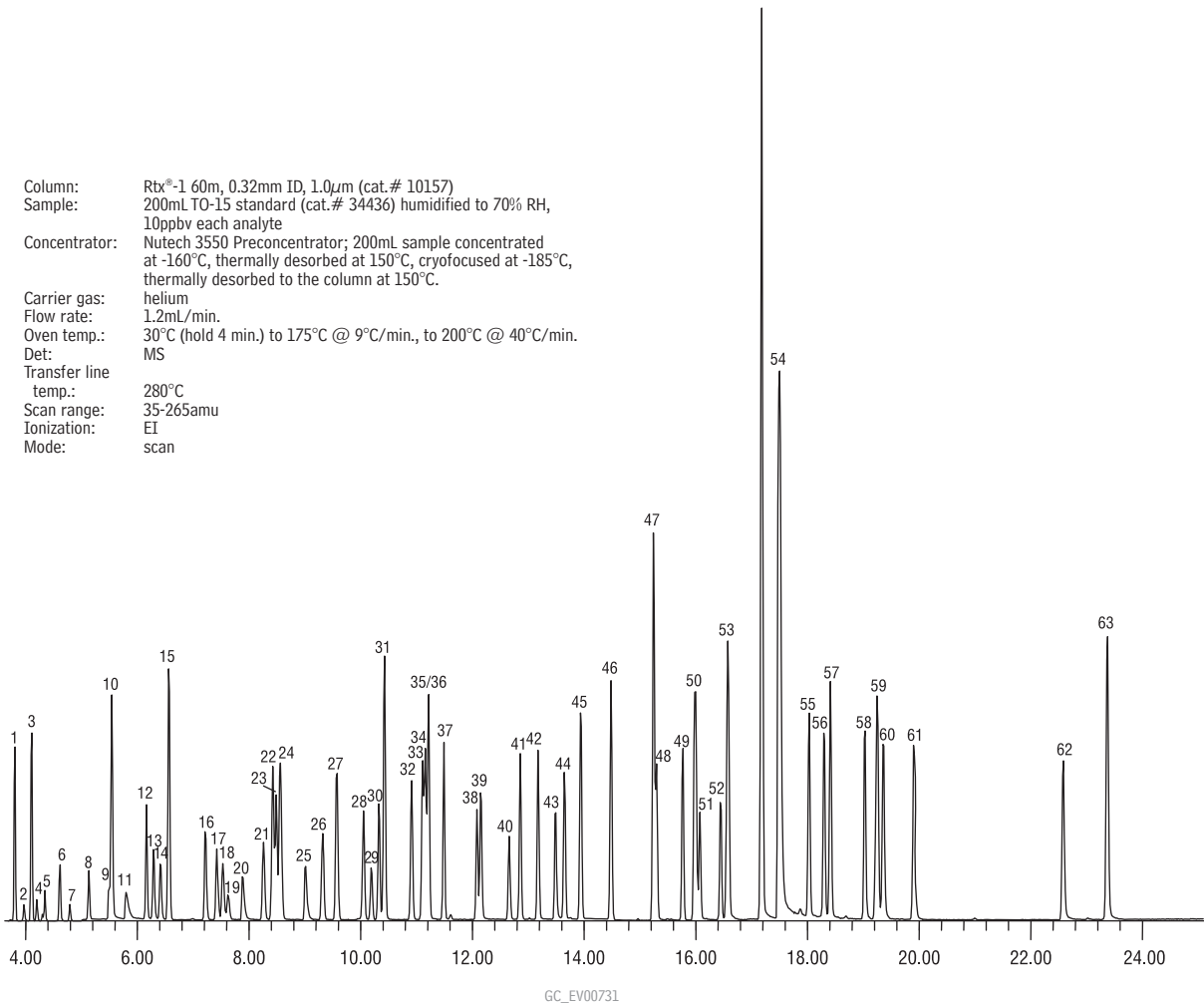
Standards: Dry standards were made by adding 2mL of a 100ppm stock sulfur standard to each pre-cleaned and evacuated canister, then pressurizing to 30psi with ultra-pure nitrogen. The resultant concentrations are listed in Applications Note #59347A (download your free copy from www.restek.com). Humidified standards were made by injecting 100µL of deionized water into the evacuated canisters prior to adding 2mL of stock standard. This produced 50% RH.

GC Column: Rtx®-1, 60m, 0.53mm ID, 7.0µm; **Detector:** Sievers Model 355 Sulfur Chemiluminescence Detector



Figure 2 TO-15 volatile organics at 10ppbv exhibit excellent stability after 15 days in a SilcoCan™ canister.

Column: Rtx®-1 60m, 0.32mm ID, 1.0µm (cat.# 10157)
 Sample: 200mL TO-15 standard (cat.# 34436) humidified to 70% RH, 10ppbv each analyte
 Concentrator: Nutech 3550 Preconcentrator; 200mL sample concentrated at -160°C, thermally desorbed at 150°C, cryofocused at -185°C, thermally desorbed to the column at 150°C.
 Carrier gas: helium
 Flow rate: 1.2mL/min.
 Oven temp.: 30°C (hold 4 min.) to 175°C @ 9°C/min., to 200°C @ 40°C/min.
 Det: MS
 Transfer line temp.: 280°C
 Scan range: 35-265amu
 Ionization: EI
 Mode: scan



GC_EV00731

Compound	ppbv	16. Freon® TF	9.6	33. bromodichloromethane	10.0	50. <i>m</i> - & <i>p</i> -xylene	16.0
1. dichlorofluoromethane	9.2	17. <i>trans</i> -1,2-dichloroethene	9.2	34. trichloroethene	9.8	51. bromoform	8.3
2. chloromethane	9.6	18. 1,1-dichloroethane	9.5	35. 1,4-dioxane	12.0	52. styrene	7.6
3. dichlorotetrafluoroethane	8.6	19. methyl <i>tert</i> -butyl ether	9.2	36. 2,2,4-trimethylpentane	10.0	53. 1,1,2,2-tetrachloroethane	8.3
4. vinyl chloride	8.5	20. methyl ethyl ketone	9.0	37. <i>n</i> -heptane	9.4	54. <i>o</i> -xylene	8.0
5. 1,3-butadiene	8.6	21. <i>cis</i> -1,2-dichloroethene	9.3	38. <i>cis</i> -1,3-dichloropropene	12.0	55. 2-chlorotoluene	10.0
6. bromomethane	8.8	22. bromochloromethane	10.0	39. methyl isobutyl ketone	10.0	56. 4-ethyltoluene	9.4
7. chloroethane	7.9	23. <i>n</i> -hexane	9.2	40. <i>trans</i> -1,3-dichloropropene	11.0	57. 1,3,5-trimethylbenzene	10.0
8. bromoethene	8.5	24. chloroform	9.9	41. 1,1,2-trichloroethane	11.0	58. 1,2,4-trimethylbenzene	10.0
9. acetone	8.9	25. tetrahydrofuran	8.4	42. toluene	12.0	59. 1,3-dichlorobenzene	10.0
10. trichlorofluoromethane	9.7	26. 1,2-dichloroethane	9.0	43. methyl butyl ketone	11.0	60. 1,4-dichlorobenzene	10.0
11. isopropyl alcohol	9.2	27. 1,1,1-trichloroethane	9.4	44. dibromochloromethane	12.0	61. 1,2-dichlorobenzene	10.0
12. 1,1-dichloroethene	9.5	28. benzene	9.2	45. 1,2-dibromoethane	12.0	62. 1,2,4-trichlorobenzene	12.0
13. methylene chloride	8.7	29. carbon tetrachloride	8.3	46. tetrachloroethene	12.0	63. hexachlorobutadiene	11.0
14. 3-chloropropene	8.7	30. cyclohexane	9.3	47. chlorobenzene-d5	10.0		
15. carbon disulfide	8.8	31. 1,4-difluorobenzene	10.0	48. chlorobenzene	8.0		
		32. 1,2-dichloropropane	9.8	49. ethylbenzene	9.0		

SilcoCan™ Canisters, Canister Carrying Supplies

Get the ultimate insurance plan—order your SilcoCan™ canister with a Siltek® treated valve.

also available

For additional gauge and valve options, see [page 9](#).

SilcoCan™ Air Monitoring Canisters

- High quality, metal-to-metal seal, 2/3-turn valve with stainless steel diaphragms.
- Sizes to support a wide range of sampling needs.
- 2-port or 3-port valve available; 3-port valve includes 30" Hg/60psi vacuum/pressure gauge (other gauges available).
- Unsurpassed inertness, even for sulfur-containing or brominated compounds.
- For critical applications, order a Siltek® treated valve—add suffix “-650” to the catalog number of the canister.

Description	qty.	1L Volume	3L Volume	6L Volume	15L Volume
		cat.#	cat.#	cat.#	cat.#
SilcoCan Canister, 1/4" Valve	ea.	24180	24181	24182	24183
SilcoCan Canister, Siltek Treated 1/4" Valve	ea.	24180-650	24181-650	24182-650	24183-650
SilcoCan Canister with Gauge, 1/4" Valve	ea.	24140	24141	24142	24143
SilcoCan Canister with Gauge, Siltek Treated 1/4" Valve	ea.	24140-650	24141-650	24142-650	24143-650
SilcoCan Canister with No Valve	ea.	22090	22091	22092	22093

Restek canisters are originally equipped with high-quality Parker Hannifin diaphragm valves. Each valve is helium leak-tested to 4 x 10⁹cc/sec. The all-stainless steel construction eliminates contamination and withstands temperatures from -100°C to 250°C. Other features include a compression outlet fitting and a 1/4" inlet and outlet.

Dimensions/Weights of SilcoCan™ Air Canisters

Can Volume	Dimensions (height x sphere diameter)		Weight	
	1 liter	8.5 x 5.25"	21.6 x 13.3cm	2.5 lbs
3 liter	11.5 x 7.25"	29.2 x 18.4cm	4 lbs	1.81kg
6 liter	12.5 x 9.25"	31.8 x 23.5cm	7 lbs	3.18kg
15 liter	17 x 12.25"	43.2 x 31.1cm	13 lbs*	5.90kg

*16 lbs shipped UPS Air, 22 lbs shipped Fed Ex (USA).

for example
applications

see [pages 26–31](#)

Quickly confirm vacuum or pressure. Request a high-quality gauge mounted on your SilcoCan™ or TO-Can™ canister.

Alternative Mounted Vacuum/Pressure Gauges

The standard vacuum/pressure range on a SilcoCan™ or TO-Can™ canister fitted with a gauge is 30" Hg to 60psi. To have a different gauge mounted on your canister, add the appropriate suffix number to the canister catalog number.*

Gauge	Suffix
30" Hg/15psi	-651
30" Hg/30psi	-652

*No price difference for these substituted gauges.

Restek canisters are shipped in boxes with handles for easy transportation.



Canister Carrying Supplies

Canister Carrying Box Kit

6-liter carrying boxes with plastic handles simplify canister transport. These boxes also accommodate our passive sampling kit. 4 carrying boxes and one shipping box per kit.

Description	qty.	cat.#
Canister Carrying Box Kit	kit	24215

Canister Carrying Case

- Heavy-duty, all-aluminum design, fits two 6L SilcoCan™ or TO-Can™ canisters tightly without foam.
- Weight: 9 lbs.
- Inside dimensions: length 18", width 9 1/8", height 12 1/2" (46 x 23 x 32cm).
- No organic contaminants from foam or plastics.

Description	qty.	cat.#
Deluxe Canister Carrying Case	ea.	24226



Improved TO-Can™ Air Monitoring Canisters (Summa Can Equivalent)

Optimized for EPA Methods TO-14 and TO-15, and ASTM D5466

- Proprietary electropolished surface that maintains compound stability.
- High quality, metal-to-metal seal, 2/3-turn valve with stainless steel diaphragms.
- 2-port or 3-port valve available; 3-port valve includes 30" Hg/60psi vacuum/pressure gauge (other gauges available).



Features	Benefits
Metal to metal seat, valve with stainless steel diaphragms.	No sample adsorption, for more accurate results.
Vacuum/pressure gauge (optional).	Ascertain internal conditions at a glance.
Stable to 250°C.	Heat canister to 250°C for superior cleaning.

US EPA Compendium of Air Methods TO-14 and TO-15 regulate the collection, storage, and analysis of volatile organic compounds (VOCs) using treated air sampling canisters. Restek offers a complete line of TO-Can™ canisters (SUMMA can equivalent), electropolished using a proprietary process and extensively cleaned using an ultrasonic method. This ensures a high-quality, passivated surface that maintains the stability of TO-14/TO-15 compounds during storage. The frame surrounds the electropolished canister, eliminating the need for weld marks on the sphere, thereby preventing active sites on the canister. The Parker Hannifin metal-to-metal diaphragm valve supports the excellent performance of the canister.

The unique holder attaches the handle and base to the canister without welds, and protects the canister, tube stub, and valve. The 2/3-turn diaphragm valve has a metal-to-metal seat and a temperature limit of 250°C. We leak check the system with helium to ensure the TO-Can™ canister and valve are leak-tight, then pressurize the canister with contaminant-free nitrogen before we ship it.

Description	qty.	1L Volume		3L Volume		6L Volume		15L Volume	
		cat.#	cat.#	cat.#	cat.#	cat.#	cat.#		
TO-Can Canister, 1/4" Valve	ea.	24172	24173	24174	24175	24176	24177	24178	24179
TO-Can Canister with Gauge, 1/4" Valve	ea.	24176	24177	24178	24179	24176	24177	24178	24179
TO-Can Canister with No Valve	ea.	22094	22095	22096	22097	22094	22095	22096	22097

Restek canisters are originally equipped with high-quality Parker Hannifin diaphragm valves. Each valve is helium leak-tested to 4 x 10⁻⁶cc/sec. The all-stainless steel construction eliminates contamination and withstands temperatures from -100°C to 250°C. Other features include a compression outlet fitting and a 1/4" inlet and outlet. For additional gauge and valve options, see page 9.

Alternative Mounted Vacuum/Pressure Gauges

The standard vacuum/pressure range on a SilcoCan™ or TO-Can™ canister fitted with a gauge is 30" Hg to 60psi. To have a different gauge mounted on your canister, add the appropriate suffix number to the canister catalog number.*

Gauge	Suffix
30" Hg/15psi	-651
30" Hg/30psi	-652

*No price difference for these substituted gauges.

TO-Can™ Canisters with Swagelok® SS4H Bellows-Sealed Valve

- All metal flow path prevents sample adsorption, giving more accurate results.
- Withstands temperatures of up to 300°C.
- Rugged performance in the field.

Restek now offers Swagelok® SS4H canister valves on our TO-Can™ canisters. Valves are bellows-sealed for durability and meet all EPA requirements for air monitoring by methods TO-14 and TO-15.

Description	qty.	1 Liter Volume		3 Liter Volume		6 Liter Volume		15 Liter Volume	
		cat.	cat.	cat.	cat.	cat.	cat.		
TO-Can Canister with 1/4" Swagelok SS4H Bellows-Sealed Valve	ea.	22105	22106	22107	22108	22105	22106	22107	22108

Replacement valves are available on page 9.

please note

- SUMMA® canister equivalent.
- Excellent analyte recovery—even after 14 days of storage.

did you know?

TO-Can™ Canisters are cleaned prior to shipping.



Quickly confirm vacuum or pressure. Request a high-quality gauge mounted on your SilcoCan™ or TO-Can™ canister.

new!



also available

We also offer sampling kits, sampling bags, and a range of gas reference standards to meet your environmental gas sampling requirements. See pages 11 and 17–24.



Canister Maintenance/Canister Reconditioning

How to Extend Canister Life

What reduces canister performance and longevity? Leakage is the most common reason for canister failure, but contamination and damage to the fused silica lining can also send canisters to the scrap yard prematurely. Here are some tips to protect your investment:



Neil Mosesman
Marketing Manager
20+ years of service!

1. Prevent leaks

Use proper handling to avoid these 3 leading causes of leaks.

a. Particles in the valve

You can prevent particles from entering the valve by always using a 2 or 7 μ m particulate filter during sampling and on your canister cleaning equipment. Also, protect the valve inlet by replacing brass dust cap when not in use. The EPA-recommended metal-to-metal sealing valves provide the greatest inertness, but tend to be more sensitive to particulate damage than other valve types.

b. Galled thread fittings

Avoid galled thread fittings by using a gap gauge to prevent overtightening of compression fittings. Turning only 1/4 turn past finger-tight is another rule of thumb to prevent overtightening. Use brass compression fittings on stainless steel, during nonsampling activities, such as cleaning or calibration, to minimize thread damage. Galled threads may also cause a poor connection to vacuum/pressure gauges, resulting in inaccurate measurement and misleading conclusion that canister leakage exists.

c. Overtightened valve

Canister valves are designed to close securely with hand tightening only. Overtightening a valve closure with a wrench can damage the valve seat where the seal is made.

2. Reduce contamination

a. Segregate high concentration (ppm) cans and trace concentration (ppb) cans. Use dedicated canisters, or gas sampling bags, for ppm level sampling, since it is extremely difficult to remove impurities from ppm sampling to a level suitable for trace sampling.

b. Clean the entire sampling train as you would the can to minimize introduction of contaminants into a clean can. Maximum temperature is 80°C on the gauge and 90°C on Restek's Veriflo flow controller.

c. High temperature (>100°C) humidified air (steam cleaning) provides the most effective way to remove contamination from electropolished cans (TO-Can™ or SUMMA® canisters), but can damage fused silica lined cans. See #3 below for proper cleaning of fused silica lined cans.

3. Avoid damage to fused silica lined cans

Be sure to follow method recommendations when cleaning your canisters to avoid damaging the fused silica lining. Cleaning studies of SilcoCan™ canisters using humidified air and heat at 80°C and 125°C have shown reduced recoveries of sulfur compounds, when compared to using nitrogen under the same conditions. This irreversible damage is due to oxidation of the surface, creating active sites that may affect the recovery of reactive or polar compounds. Strong acids and bases may also result in damage to the internal can surface.

Reconditioning Service for SilcoCan™ or TO-Can™ Canisters

Normal wear and tear on a canister may result in valve damage and leakage. We offer a reconditioning service in which we will replace the valve, clean, and leak test the canister for much less than the cost to replace the entire canister. If you would like this service, please follow the instructions below:

1. Contact Customer Service at 800-356-1688, ext. 3, or contact your Restek representative and place an order for part number 560838 using your company purchase order.
2. Obtain a return authorization number to affix on the outside of the shipping container.
3. Clean canister before shipment to Restek.
4. Return canister intact. Do not remove valves or gauges that were part of the original canister.



Alternative Gauges and Valves for Air Monitoring Canisters

1/4" Replacement Valves for Air Monitoring Canisters*

- High quality, metal-to-metal seal, 2/3-turn valve with stainless steel diaphragms.
- 2-port or 3-port valve available; 3-port valve includes 30" Hg/60psi vacuum/pressure gauge (other gauges available).

Description	qty.	Non-Treated Valve		Siltek®-Treated Valve	
		cat.#	qty.	cat.#	
1/4" Replacement Valve (2-port)	ea.	24145	ea.	24144	
1/4" Replacement Valve (3-port)	ea.	24147	ea.	24146	

*All Restek canisters are originally equipped with high-quality Parker Hannifin diaphragm valves. Each valve is helium leak-tested to 4×10^{-9} cc/sec. The all-stainless steel construction eliminates contamination and withstands temperatures from -100°C to 250°C. Other features include a compression outlet fitting and a 1/4" inlet and outlet.



Canister valve (Siltek®-treated)

Swagelok® SS4H Bellows-Sealed Valve, 1/4-inch, 2-Port, Stainless Steel

- All metal flow path prevents sample adsorption, giving more accurate results.
- Unique serial number on each valve for complete traceability.
- Withstands temperatures of up to 300°C.
- Rugged performance in the field.
- Fast delivery from Restek!

Restek now offers Swagelok® SS4H canister valves. These popular, rugged valves are available separately or already assembled on our TO-Can™ canisters. Valves are bellows-sealed for durability and meet all EPA requirements for air monitoring by methods TO-14 and TO-15.

Description	qty.	cat.
Replacement 1/4" Swagelok SS4H Bellows-Sealed Valve	ea.	24148

Replacement 1/4" Swagelok SS4H Bellows-Sealed Valves are available on SilcoCan™ canisters as a custom product. Contact Technical Service for more information.

new!



Replacement Combination Vacuum/Pressure Gauges

2-inch vacuum/pressure gauges, 316 stainless steel with 1/8" NPT fitting and center back mount.

Description	qty.	cat.#
30"Hg/15psi Vacuum/Pressure Gauge	ea.	24100
30"Hg/30psi Vacuum/Pressure Gauge	ea.	24104
30"Hg/60psi Vacuum/Pressure Gauge	ea.	24108



Vacuum Gauges

High-quality vacuum gauges with 316 stainless steel wetted surfaces. 30" Hg.

Description	qty.	cat.#
2-Inch Vacuum Gauge; 1/8" NPT	ea.	24269
2-Inch Vacuum Gauge; 1/4" NPT	ea.	24270
1 1/2-Inch Vacuum Gauge; 1/8" NPT	ea.	24120

Ashcroft Test Gauges

- Accurate measurement of vacuum to 30"Hg and pressure to 60psi.
- Available in both analog and digital formats.
- Accuracy to +/- 0.25%.

High accuracy test gauges are recommended for verifying the vacuum/pressure in canisters before and after sampling. The 6-inch face on the analog gauge allows for easy reading. The digital gauge operates on two AAA batteries and offers an unambiguous readout. Both gauges have an accuracy of +/- 0.25% and all metal wetted parts.

Description	qty.	cat.#
Analog Test Gauge, 6" diameter, 1/4" NPT	ea.	24285
Digital Test Gauge, 3" diameter, 1/4" NPT	ea.	24268

new!





new!

Canister Air Sampling Timer

- Program up to 12 timed events!
- Capable of both manual and automated operation.
- Perfect for either grab or time-integrated sampling.
- Long battery life; recharges conveniently using the USB port on any PC.
- All stainless steel sample flow path ensures inertness, improving accuracy.



These timers are designed to simplify both automated and manual air sampling. The easy-to-use keypad and graphic display facilitate the programming of up to 12 timed events. They offer the convenience of remote start/stop sampling and permit intermittent sampling throughout a test period. The LCD remains in sleep mode when not in use, greatly extending battery life. Timers are compatible with any canister and flow controller.

Features include: solenoid valve for sampling control, 1/4" Swagelok® inlet and outlet fittings, highly inert stainless steel flow path, and water-proof exterior for outdoor use.

Description	qty.	cat.#
Canister Air Sampling Timer	ea.	24267

Canister and passive air sampling kit must be purchased separately.

**did you know?****SilcoCan™ and TO-Can™ Canisters are Cleaned Prior to Shipping**

After assembly, every Restek SilcoCan™ and TO-Can™ canister is evacuated to 50mTorr, then pressurized with humidified nitrogen to 30psi. The cleaning system is programmed to repeat this cycle three times to ensure thorough cleaning. We ship our canisters clean and under pressure at 30psi with dry nitrogen.



The ultimate in controlled heating, for reliably cleaning your air canisters!

Air Canister Heating Jacket

- Closely simulates oven environment—heats entire canister and valve.
- Two temperature settings, 75°C and 150°C.*
- Prevents sample condensation, for accurate subsampling.
- Easily fits canister up to 6 liters.
- Lightweight; comfortable to the touch when heated.
- Connect up to five Canister Heating Jackets to one 15 amp circuit.

Description	qty.	cat.#
Air Canister Heating Jacket (110 volt)	ea.	24123

*Not CE certified.

Humidification Chamber

When cleaning SilcoCan™ or TO-Can™ canisters, it is important to use humidified air or nitrogen to help remove volatile organic contaminants. We incorporated our humidification chamber into the design of our cleaning system. Restek's humidification chamber is made of acrylic and withstands pressure up to 90psi. The 1/4-inch inlet and outlet compression fittings allow easy connection to pressure lines on your cleaning system. Our humidification chamber also has an easy-to-open lid for filling with water.



Restek's canister cleaning system with humidification chamber.



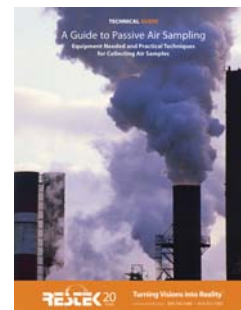
Humidification Chamber

Description	qty.	cat.#
Humidification Chamber	ea.	24282

Passive Air Sampling Kits

- Provide accurate integrated sampling without a sampling pump.
- Siltek® treated components ensure a very inert surface.
- Excellent for sampling times from 0.5 hour to 125 hours.

Restek's passive air sampling kit incorporates all the hardware necessary to collect air samples, and is easy to assemble for field sampling.* The improved filter design greatly reduces the number of potential leak sites. The passive air sampling kit is available in seven sampling flow ranges, and in stainless steel or Siltek® treated finish. The stainless steel kit is ideal to partner with TO-Can™ air sampling canister for TO-14A and TO-15 methods. Use the Siltek® treated version with SilcoCan™ canisters, when collecting low-level volatile sulfur compounds, or other active compounds.



free literature

A Guide to Passive Air Sampling: Equipment Needed and Practical Techniques for Collecting Air Samples

Download your free copy from www.restek.com.

Technical Guide
lit. cat.# 59977B

400cc	Canister Volume*/Sampling Time				Flow (sccm)	Orifice size	Siltek® Treated Sampling Kits	Stainless Steel Sampling Kits
	1 Liter	3 Liter	6 Liter	15 Liter				
8 hour	24 hour	48 hour	125 hour	—	0.5–2	0.0008"	24217	24216
2 hour	4 hour	12 hour	24 hour	60 hour	2–4	0.0012"	24160	24165
1 hour	2 hour	6 hour	12 hour	30 hour	4–8	0.0016"	24161	24166
—	1 hour	4 hour	8 hour	20 hour	8–20	0.0020"	24162	24167
—	—	2 hour	3 hour	8 hour	20–40	0.0030"	24163	24168
—	—	—	1.5 hour	4 hour	40–80	0.0060"	24164	24169
—	—	—	0.5 hour	1 hour	80–350	0.0090"	22101	22100

*Air sampling canisters sold separately.

1. Veriflo® SC423XL flow controller

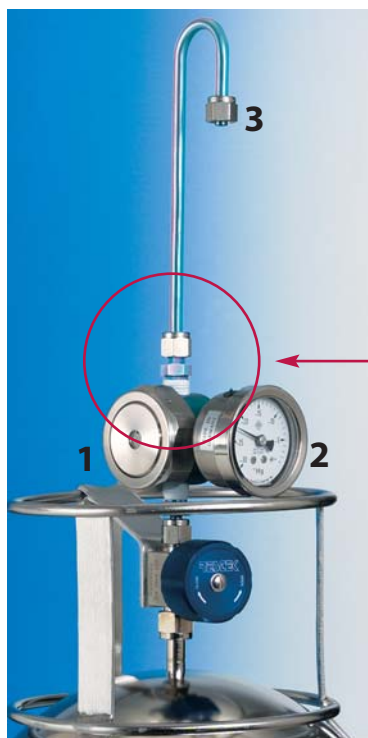
This flow controller is the heart of the sampling train. It is a high-quality device designed to maintain a constant mass flow as the pressure changes from 30" Hg to 5" Hg (we recommend you stop sampling at or before 5" Hg of vacuum). All wetted parts of the flow controller can be Siltek® treated.

2. Stainless steel vacuum gauge

Fitted to the flow controller, the gauge monitors canister vacuum change during sampling.

3. 1/4-inch Siltek® sample inlet

The 0.3m x 1/4-inch tubing includes a stainless steel nut on the inlet end, to prevent water droplets from accumulating at the edge of the tubing, where they could be pulled into the sampling train.



All fitting connections are 1/4" tube, except where noted.



4. 2-micron frit filter and washer

Located prior to the critical orifice to prevent airborne particles from clogging the critical orifice. Replaceable. Available in stainless steel, or Siltek® treated for optimum inertness.

5. Interchangeable critical orifice

An interchangeable ruby critical orifice allows you to control the flow with very high precision. To select the correct critical orifice for your sample, see table above. Available in stainless steel, or Siltek® treated for optimum inertness.

please note

For individual components, see page 12.

Buy only the parts you need!

Replacement Orifices

Use these orifices with a Veriflo® 423XL flow controller to change the flow range for alternative sampling times.

Flow (sccm)	Orifice size	Siltek® Treated		Stainless Steel	
		cat.#		cat.#	
0.5–2	0.0008"	24219		24218	
2–4	0.0012"	24233		24245	
4–8	0.0016"	24234		24246	
8–20	0.0020"	24235		24247	
20–40	0.0030"	24236		24248	
40–80	0.0060"	24237		24249	
80–350	0.0090"	22099		22098	



Critical orifice



2µm Frit Filters

For use in critical orifice fitting. Includes washers.

Description	qty.	cat.#
Siltek Replacement Frit Filter	3-pk.	24171
Stainless Steel Replacement Frit Filter	3-pk.	24170



Frit filters
(top: Siltek® treated)
(bottom: stainless steel)

Veriflo® Flow Controllers

Veriflo® 423XL flow controllers are offered in a Siltek® and a stainless steel version. The flow device is available with or without a critical orifice. (Vacuum gauge sold separately.)

The critical orifice in a Veriflo® flow controller is interchangeable. Order orifices for alternate sampling times, or replacement orifices, separately.

Flow (sccm)	Orifice size	Siltek® Treated		Stainless Steel	
		cat.#		cat.#	
0.5–2	0.0008"	24232		24229	
2–4	0.0012"	24255		24260	
4–8	0.0016"	24256		24261	
8–20	0.0020"	24257		24262	
20–40	0.0030"	24258		24263	
40–80	0.0060"	24259		24264	
80–350	0.0090"	22103		22102	
—	no orifice	24238		24239	



Flow controller



7µm In-Line Filter

This 316 stainless steel filter is designed to collect particles larger than 7 microns. We offer a Siltek® version and a stainless steel version. 1/4" compression fitting on both ends.

Description	qty.	cat.#
Siltek 7µm In-Line Filter	ea.	24265
Stainless Steel 7µm In-Line Filter	ea.	24266

Note: frit only is not replaceable.



Sample Inlets

- 1/4" stainless steel compression fitting on each end.
- One end connects to flow controller or canister; nut on other end serves as rain guard.
- Includes nuts and ferrules.
- Two different lengths for use with large canisters and miniature canisters.

Description	qty.	Siltek® Treated		Stainless Steel	
		cat.#		cat.#	
Sample Inlet, 6" Length	ea.	26210		26209	
Sample Inlet, 1.5" Length	ea.	26212		26211	

Miniature Air Sampling Canisters

- Ideal for indoor air, personal, emergency response, or soil gas sampling.
- 400cc or 1,000cc.
- Low pressure applications not exceeding 40psig.
- Available with quick-connect fitting that is compatible with sampling and analysis instruments.
- Also available with nontreated or Sulfinert® treated valve.

These small canisters are designed for controlled sampling, such as personal air sampling, as an alternative to tube and pump samplers. The 1,000cc canister is suitable for sampling volatile organic compounds in air according to US EPA Methods TO-14 and TO-15.

Restek offers these products in stainless steel or with Sulfinert® treatment, for greatest inertness. We continue to offer passive coating technologies that are unmatched in the air sampling industry—try a Sulfinert® treated canister and achieve the ultimate in analyte stability.

Miniature Air Sampling Canisters with Quick-Connect Stem Fittings

Description	Volume	qty.	cat.#
Electro-Polished Miniature Canister with Quick-Connect Stem Fitting	400cc	ea.	24188
	1000cc	ea.	24194
Sulfinert Treated Miniature Canister with Quick-Connect Stem Fitting	400cc	ea.	24189
	1000cc	ea.	24195
	400cc	ea.	24190
Sulfinert Treated Miniature Canister with Sulfinert Treated Quick-Connect Stem Fitting	1000cc	ea.	24196

Quick-Connect Fittings for Miniature Air Sampling Canisters

Connection: 1/4" tube fitting.

Description	qty.	cat.#
Quick-Connect Stem Fitting	ea.	24185
Sulfinert Treated Quick-Connect Stem Fitting	ea.	24186
Quick-Connect Stem Protector, Stainless Steel	ea.	24121
Quick-Connect Body Fitting	ea.	24187

Note: Quick-connect body fitting (cat.# 24187) must be ordered separately to sample with quick-connect stem fitting.

Attach quick-connect body fitting to stem fitting to open canister. Attach quick-connect stem protector to stem fitting when not sampling to prevent canister from accidentally opening.

Miniature Air Sampling Canisters with Metal-Seated Diaphragm Valve

Description	Volume	qty.	cat.#
Electro-Polished Miniature Canister with Metal-Seated Diaphragm Valve	400cc	ea.	24191
	1000cc	ea.	24197
Sulfinert Treated Miniature Canister with Metal-Seated Diaphragm Valve	400cc	ea.	24192
	1000cc	ea.	24198
Sulfinert Treated Miniature Canister with Sulfinert Treated Diaphragm Valve	400cc	ea.	24193
	1000cc	ea.	24199

Miniature Air Sampling Canisters with Nut & Ferrule

Description	Volume	qty.	cat.#
Electro-Polished Miniature Canister with Nut & Ferrule	400cc	ea.	24205
	1000cc	ea.	24206
Sulfinert Treated Miniature Canister with Nut & Ferrule	400cc	ea.	24207
	1000cc	ea.	24208

Gap Inspection Gauge

- Confirm that fittings are sufficiently tightened.
- For use with 1/4", 3/8", 1/2" Swagelok® fittings.
- For Swagelok® fittings in new installations only.

Description	qty.	cat.#
Gap Inspection Gauge	ea.	22624



Dimensions:
 400cc = 2.75" diameter,
 5.35" long (7 x 13.6cm)
 1,000cc = 2.75" diameter,
 11.92" long (7 x 30cm)



24121



Thermal Desorption Unit Tubes



method applications

Method	Application
US EPA	TO-17
ASTM	D-6196
NIOSH	2549
DIN EN ISO	16017

Specifications

Dimensions: 1/4" OD x 3-1/2" long
 Low sampling rates:
 0.01-0.20 L/min.
 (<10L total volume)
 Long-term storage caps are
 supplied with conditioned tubes

Thermal Desorption Unit (TDU) Tubes

- Variety of sorbents to collect a wide range of VOCs.
- Use glass tubes for maximum inertness in active sampling.
- Choose stainless steel tubes for either active or passive sampling. No sampling pump necessary for passive sampling with diffusion caps!
- Individually etched with unique serial number for convenient sample identification.
- Available unconditioned or preconditioned and ready to sample. Tubes are reusable after thermal desorption.

High-quality thermal desorption tubes by Markes International are now available from Restek. These sorbent tubes are suitable for ppt to ppm concentrations of volatile organic compounds (VOCs) in ambient, indoor, and industrial hygiene environments. Available in both stainless steel and glass (for thermally labile VOCs), they fit Markes ULTRA-UNITY, PerkinElmer, and Shimadzu thermal desorbers. Packed tubes come with a report detailing the total mass of sorbent in the tube; conditioned tubes also include a blank chromatogram.

Thermal Desorption Tube Sorbent	Applications
Tenax TA	Vapor phase organics from C6/7 to C26
Graphitized Carbon	Vapor phase organics from C5/6 to C14
Tenax GR/Carbopack B	Vapor phase organics from <i>n</i> -C5/6 to <i>n</i> -C20 (EPA Methods TO-14/TO-15/TO-17)
Carbopack B/Carbosieve SIII	Vapor phase organics from <i>n</i> -C2/3 to <i>n</i> -C12/14 (EPA Methods TO-14/TO-15/TO-17)
Tenax TA/Graphitized Carbon/Carboxen 1000	Vapor phase organics from C2/3 to C20
Carbopack C/Carbopack B/Carbosieve SIII	Vapor phase organics from <i>n</i> -C2/3 to <i>n</i> -C16/20 (EPA Methods TO-14/TO-15/TO-17)

Thermal Desorption Unit Tubes, Unconditioned and Conditioned & Capped



24061



24062



24067

Description	qty.	Unconditioned		Conditioned & Capped	
		Stainless Steel	Glass	Stainless Steel	Glass
		cat.#	cat.#	cat.#	cat.#
TDU Tubes, Tenax TA	10-pk.	24056	24062	24080	24086
TDU Tubes, Graphitized Carbon	10-pk.	24057	24063	24081	24087
TDU Tubes, Tenax GR/Carbopack B	10-pk.	24058	24064	24082	24088
TDU Tubes, Carbopack B/Carbosieve SIII	10-pk.	24059	24065	24083	24089
TDU Tubes, Tenax TA/Graphitized Carbon/Carboxen 1000	10-pk.	24060	24066	24084	24090
TDU Tubes, Carbopack C/Carbopack B/Carbosieve SIII	10-pk.	24061	24067	24085	24091

Thermal Desorption Unit Tubes, Empty

- Empty tubes for direct desorption of VOCs in liquids, solids, or pastes.
- Stainless steel: front sorbent retaining gauze fitted, rear gauze and gauze retaining spring supplied.
- Glass: with glass frit positioned 15mm from sampling end.



24054



24055

Description	qty.	Stainless Steel	Glass
		cat.#	cat.#
TDU Tubes, Empty	10-pk.	24054	24055

Thermal Desorption Unit Tubes, Calibration



24071

Description	qty.	Stainless Steel	Glass
		cat.#	cat.#
TDU Tubes, Calibration, Tenax TA 1cm Bed	10-pk.	24075	24076
Calibration Solution Loading Rig		ea.	24077
Calibration Solution Loading Rig 9.5mm Replacement Septa		10-pk.	24078
Certified Reference Standard, 100ng BTX on Tenax TA		10-pk.	24079

Thermal Desorption Unit Tubes, Accessories



24070



24074

Description	Benefits/Uses	qty.	cat.
1/4" Brass Cap and PTFE Ferrules	Use for long-term storage of blank/sampled tubes.	20-pk.	24068
1/4" PTFE Ferrules	Long-term storage caps.	20-pk.	24069
CapLok Tool	Use for tightening long-term storage caps.	ea.	24070
Pen Clip		10-pk.	24071
TubeMate Tool	Assists with tube packing.	ea.	24072
1/4" Stainless Steel Union and PTFE Ferrules	Use for connecting tubes in series.	10-pk.	24073
Diffusion Caps	Required for diffusive sampling with stainless steel tubes.	10-pk.	24074



Thermal Desorption Tubes vs. Canister Sampling

Which VOC Sampling Technique is Right for You?

Thermal desorption tubes provide a complementary option to canisters for sampling VOCs. Both techniques have advantages and disadvantages, and their features must be evaluated for suitability relative to the sampling environment and analytical capabilities. Table I outlines the similarities and differences between these techniques; use this handy comparison to determine which equipment is best for you.

Table I Comparison of thermal desorption tube and canister sampling for VOCs.

Similarities Between Thermal Desorption Tubes and Canisters

- Reusable sampling device.
- Long product lifetime.
- Long-term sample stability.
- Blank certification required prior to sampling.
- Sample concentration required before GC/MS analysis.
- Dry purge helpful to remove moisture before GC injection.
- Ppt sensitivity.
- Method acceptance.
- Collection of wide range of VOCs with single device.
- Useful for screening of unknowns.
- Leak tightness critical to maintaining sample integrity and preventing contamination of a clean device.

Differences Between Thermal Desorption Tubes and Canisters

	Thermal Desorption Tubes	Canisters
Methods	US EPA TO-17 ASTM D6196 ISO 16017 ISO 16000-6 NIOSH 2549	US EPA TO-14, TO-15 ASTM D5466 OSHA PV2120 NIOSH Protocol Draft
	World-wide acceptance	Gold standard for US ambient air market
Applications	Ambient air, indoor air, industrial hygiene Material emissions Food & flavor Chemical weapons	Ambient air, indoor air, vapor intrusion, emergency response
	C3 to C30	<C3 to ~C10
Handling	Light weight for personal monitoring and general ease of use	Larger and heavier; more costly to ship
Sampling	Active sampling with sampling pump or diffusive sampling without pump is possible with determined diffusion coefficients for each compound.	Passive sampling, no sampling pump required. Long-term sampling possible without battery to recharge.
	Integrated sampling only	Grab & integrated sampling
	Concentrated sample	Whole air
	Proper sorbent selection recommended in methodology.	N/A
	Must sample below sorbent breakthrough volumes to avoid sample loss and irreversible adsorption on sorbent	N/A
	Large sample volumes >100L	Sample volume is function of canister size, 15L max
Analysis	Tube dimensions are instrument specific	Compatible with all manufacturer sample concentrators
	1 injection, more injections possible for some instrumentation	Multiple sample injections
	Concentration range ppt to ppm	Ppt to ppm
	Some sorbents prone to artifact formation.	Low blanks when properly cleaned.
Storage	Sample storage at 4°C recommended for multi-bed tubes to prevent potential migration of compounds to more retentive sorbent which maybe difficult to recover.	Room temperature
Cleaning	Analytical process automatically cleans tube for reuse. Cleans as it analyzes. Conditioning/cleaning and analysis incorporated in one thermal desorption unit.	Canister cleaning requires separate equipment as additional step prior to background certification and sampling.
Cost	-130 each	-700 each



tech guides

Thermal desorption application guides are available for a broad range of markets. Request your FREE copy today using these part numbers.

Environmental Air Monitoring and Occupational Health & Safety
EVTG1034

Residual Volatiles & Materials Emissions Testing
GNTG1035

Defense & Forensic
CFTG1036

Food, Flavor, Fragrance & Odor Profiling
FFTG1037

Ultra-Clean Resin, PUFs

Sampling Supplies for Semivolatiles in Air

Everything you need for sampling semivolatile compounds in air: Ultra-Clean resin, PUF sampling cartridges.



Restek's Ultra-Clean resin eliminates the hassle of cleaning and testing resin for air sampling.

Ultra-Clean Resin: Equivalent to XAD-2 Resin; Exclusively from Restek!

- For adsorbing semivolatiles in air.
- Cleaned, GC tested and certified by TO-13 protocol.
- Available in 100 gram quantities.

Although resin is an excellent adsorbent for trapping PAHs, it requires extensive clean-up because many of its impurities are PAH compounds. To enable you to eliminate time-consuming clean-up but still meet TO-13 method requirements, we do the cleaning for you! Ultra-Clean resin complies with the specified maximum contamination levels—we test each batch by capillary GC/flame ionization detector to ensure cleanliness.

method applications

Method	Applications
EPA 23	Dioxins
EPA TO-13A	PAHs
ASTM D6209	PAHs

Description	cat.#	1-4 bottles	5-9 bottles	10+ bottles
Ultra-Clean Resin, 100 grams	24230			

SDVB Resin

- Styrene/divinylbenzene, equivalent to XAD-2 resin.
- Untreated, packaged in 1kg plastic containers.
- Spherical, 20 to 60 mesh particles.

Description	qty.	cat.#
SDVB Resin	1kg	24053

Cleaned Polyurethane Foam (PUF) Cartridges

- Pre-cleaned and ready to use for collection of semivolatiles (pesticides, PCBs, PAHs).
- Both large high-volume (220-280L/min.) and small low-volume (1-5L/min.) PUFs available.
- Suitable for ambient, indoor, and industrial hygiene applications.
- PUF/XAD-2 "sandwiches" capture a wider range of semivolatiles.



method applications

Method	Applications	cat.#
EPA TO-10A	Organochlorine and organophosphorous pesticides, carbamate, pyrethrin, triazine, and urea pesticides	22116
EPA IP-7	Polycyclic aromatic hydrocarbons (PAHs)	22114
EPA IP-8	Organochlorine and organophosphorous pesticides, carbamate, pyrethrin, triazine, and urea pesticides	22116
ASTM D4861	Organochlorine and organophosphorous pesticides, PCB	22116
ASTM D4947	Chlordane and heptachlor residues	22116
Research	Pesticides	22117
EPA TO-4A	Organochlorine pesticides, PCBs	22114
EPA TO-9A	Polychlorinated dibenzo- <i>p</i> -dioxins (PCDDs)	22114
EPA TO-13A	Polycyclic aromatic hydrocarbons (PAHs)	22114
EPA 600/8-80-038	Organochlorine pesticides, PCBs, PAHs	22115
ASTM D6209	Polycyclic aromatic hydrocarbons (PAHs)	22114

Description	qty.	cat.#
Cleaned PUF Plug (7.6cm length, 6cm diameter)	ea.	24295
Large PUF Cartridge, 65mm OD x 125mm length, 75mm PUF	ea.	22114
Large PUF/XAD Cartridge, 65mm OD x 125mm length, 25mm PUF/10g XAD-2/50mm PUF	ea.	22115
Small PUF Cartridge, 22mm OD x 100mm length, 76mm PUF	ea.	22116
Small PUF/XAD Cartridge, 22mm OD x 100mm length, 30mm PUF/1.5g XAD-2/30mm PUF	ea.	22117



Large PUF Cartridge



Small PUF Cartridge

new!



Cali-5-Bond Gas Sampling Bags

- Totally nonpermeable and opaque, providing UV protection.
- Chemically inert—extremely rugged and portable.
- Extra strength—5 mil (0.14mm) thick.
- Easy to use.

Cali-5-Bond air and gas sampling bags provide a simple, reliable, and economic method of collecting air, gas, and liquid samples. The 5-layer construction (made by a patented process) ensures the physical integrity of any sample taken, providing a truly representative sample of the collection environment. Both grab and time-integrated samples can be taken with the use of a sampling pump. The twist-type valve with hose-barb connection enables secure attachment of 3/16" ID sample tubing. The septum port allows easy access via a gas-tight syringe. Bags should not be used at temperatures above 50°C (125°F) and should never be over inflated.

Description		qty.	cat.#
0.5L	6" x 8"	5-pk.	24092
1L	8" x 8"	5-pk.	24093
2L	8" x 12"	5-pk.	24094
5L	8" x 23"	5-pk.	24095
10L	16" x 15"	5-pk.	24096
22L	16" x 25"	5-pk.	24097
44L	24" x 25"	5-pk.	24098

new!



AIR MONITORING

Tedlar® Sampling Bags

- Find the bags you need—we offer sizes from 0.5 liters to 100 liters.
- Unique all-in-one septum and valve fitting make these lightweight and easy to use.
- Polypropylene or stainless steel valve.

The unique design of these Tedlar® sample bags incorporates the sampling septum directly in the valve, providing easier use and lighter weight than other styles. We offer two types of bags: one with a polypropylene valve and one with a stainless steel valve. Both valves conveniently connect to 3/16" ID Teflon® tubing.



Description		Polypropylene Valve		Stainless Steel Valve	
	qty.	cat.#		cat.#	
0.5L	6" x 6"	10-pk.	22049		22038
1L	7" x 7"	10-pk.	22050		22039
3L	9.5" x 10"	10-pk.	22051		22040
5L	12" x 12.5"	10-pk.	22052		22041
10L	11.75" x 22"	10-pk.	22053		22042
12L	13" x 24"	10-pk.	22054		22043
25L	17.5" x 24"	5-pk.	22055		22044
40L	24" x 24.25"	5-pk.	22056		22045
80L	28.25" x 32.5"	5-pk.	22057		22046
100L	28" x 36"	3-pk.	22058		22047
Replacement Septum	10-pk.	22059			22048



Gas Standards

please note

Gas standards are subject to hazardous materials shipping fees by most freight carriers.

it's a fact

Higher concentration =
MORE STANDARD
for your money!

cylinder design

Spectra 104L Cylinders:

Aluminum construction

Size: 8 x 24 cm.

Volume/Pressure:

104 liters of gas

@ 1,800psi

CGA-180

outlet fitting.

Weight:

1.5 lbs./0.7 kg



Scotty 110L Cylinders

(Pi-marked Cylinders for EU Regulations):

Aluminum construction

Size: 8.3 x 29.5 cm.

Volume/Pressure:

110 liters of gas

@ 1,800psi

CGA-180

outlet fitting.

Weight:

2.2 lbs./1 kg

U.S. D.O.T. Specs:

3AL2216



ordering note

Other cylinder sizes available on request.

also available

See page 20 for high-purity regulator.

Environmental Air Monitoring Gas Standards

Our high-quality air monitoring gas calibration standards are provided by Spectra Gases and Scott Specialty Gases. Mixes are produced gravimetrically using NIST (National Institute of Science and Technology) traceable weights. Each comes with a Certificate of Analysis and unique serial number. All cylinders are disposable and do not require rental or demurrage fees. Recertification of cylinders is available directly with our suppliers. All cylinders are drop-shipped from our suppliers to provide fast delivery and the "freshest" standard possible. 12-month stability on all cylinders unless otherwise specified.

TO-14A Calibration Mix (39 components)

benzene
bromomethane
carbon tetrachloride
chlorobenzene
chloroform
chloromethane
1,2-dibromoethane
m-dichlorobenzene
o-dichlorobenzene
p-dichlorobenzene
dichlorodifluoromethane
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethene
cis-1,2-dichloroethene
1,2-dichloropropane
cis-1,3-dichloropropene
trans-1,3-dichloropropene
dichlorotetrafluoroethane
ethyl benzene

1ppm in nitrogen, 104 liters @ 1,800psi

cat. # 34400 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34400-PI (ea.)

100ppb in nitrogen, 104 liters @ 1,800psi

cat. # 34421 (ea.)

100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34421-PI (ea.)

TO-14A 41 Component Mix (41 components)

acrylonitrile
benzene
bromomethane
1,3-butadiene
carbon tetrachloride
chlorobenzene
chloroform
chloromethane
1,2-dibromoethane
m-dichlorobenzene
o-dichlorobenzene
p-dichlorobenzene
dichlorodifluoromethane
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethene
cis-1,2-dichloroethene
1,2-dichloropropane
cis-1,3-dichloropropene
trans-1,3-dichloropropene
dichlorotetrafluoroethane

1ppm in nitrogen, 104 liters @ 1,800psi

cat. # 34430 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34430-PI (ea.)

100ppb in nitrogen, 104 liters @ 1,800psi

cat. # 34431 (ea.)

100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34431-PI (ea.)

TO-14A 43 Component Mix (43 components)

acrylonitrile
benzene
bromomethane
1,3-butadiene
carbon tetrachloride
chlorobenzene
chloroform
chloromethane
3-chloropropene
1,2-dibromoethane
m-dichlorobenzene
o-dichlorobenzene
p-dichlorobenzene
dichlorodifluoromethane
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethene
cis-1,2-dichloroethene
1,2-dichloropropane
cis-1,3-dichloropropene
trans-1,3-dichloropropene
dichlorotetrafluoroethane

1ppm in nitrogen, 104 liters @ 1,800psi

cat. # 34432 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34432-PI (ea.)

100ppb in nitrogen, 104 liters @ 1,800psi

cat. # 34433 (ea.)

100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34433-PI (ea.)

TO-14A GC/MS Tuning Mix

4-bromofluorobenzene

1ppm in nitrogen, 104 liters @ 1,800psi

cat. # 34406 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34406-PI (ea.)

100ppb in nitrogen, 104 liters @ 1,800psi

cat. # 34424 (ea.)

100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34424-PI (ea.)

TO-14A Aromatics Mix (14 components)

benzene
chlorobenzene
m-dichlorobenzene
o-dichlorobenzene
p-dichlorobenzene
ethyl benzene
styrene

toluene
1,2,4-trichlorobenzene
1,2,4-trimethylbenzene
1,3,5-trimethylbenzene
m-xylene
o-xylene
p-xylene

1ppm in nitrogen, 104 liters @ 1,800psi

cat. # 34404 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34404-PI (ea.)

100ppb in nitrogen, 104 liters @ 1,800psi

cat. # 34423 (ea.)

100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34423-PI (ea.)



TO-14A Chlorinated Hydrocarbon Mix

(19 components)

carbon tetrachloride	hexachloro-1,3-butadiene
chloroform	methyl chloride
1,1-dichloroethane	methylene chloride
1,2-dichloroethane	1,1,2,2-tetrachloroethane
1,1-dichloroethene	tetrachloroethylene
<i>cis</i> -1,2-dichloroethylene	1,1,1-trichloroethane
1,2-dichloropropane	1,1,2-trichloroethane
<i>cis</i> -1,3-dichloropropene	trichloroethene
<i>trans</i> -1,3-dichloropropene	vinyl chloride
ethyl chloride	
1ppm in nitrogen, 104 liters @ 1,800psi	
cat. # 34402 (ea.)	
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	
cat. # 34402-PI (ea.)	
100ppb in nitrogen, 104 liters @ 1,800psi	
cat. # 34422 (ea.)	
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	
cat. # 34422-PI (ea.)	

TO-14A Internal Standard Mix

bromochloromethane	1,4-difluorobenzene
chlorobenzene-d5	
1ppm in nitrogen, 104 liters @ 1,800psi	
cat. # 34412 (ea.)	
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	
cat. # 34412-PI (ea.)	
100ppb in nitrogen, 104 liters @ 1,800psi	
cat. # 34427 (ea.)	
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	
cat. # 34427-PI (ea.)	

TO-14A Internal Standard/Tuning Mix

bromochloromethane	chlorobenzene-d5
1-bromo-4-fluorobenzene (4-bromofluorobenzene)	1,4-difluorobenzene
1ppm in nitrogen, 104 liters @ 1,800psi	
cat. # 34408 (ea.)	
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	
cat. # 34408-PI (ea.)	
100ppb in nitrogen, 104 liters @ 1,800psi	
cat. # 34425 (ea.)	
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	
cat. # 34425-PI (ea.)	

TO-15 Subset 25 Component Mix (25 components)

acetone	4-ethyltoluene
allyl chloride	heptane
benzyl chloride*	hexane
bromodichloromethane	2-hexanone (MBK)
bromoform	4-methyl-2-pentanone
1,3-butadiene	methyl <i>tert</i> -butyl ether (MTBE)
2-butanone (MEK)	2-propanol
carbon disulfide*	propylene
cyclohexane	tetrahydrofuran
dibromochloromethane	2,2,4-trimethylpentane
<i>trans</i> -1,2-dichloroethene	vinyl acetate
1,4-dioxane	vinyl bromide
ethyl acetate	
1ppm in nitrogen, 104 liters @ 1,800psi	
cat. # 34434 (ea.)	
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	
cat. # 34434-PI (ea.)	
100ppb in nitrogen, 104 liters @ 1,800psi	
cat. # 34435 (ea.)	
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	
cat. # 34435-PI (ea.)	

*Stability of this compound cannot be guaranteed.

TO-15 64 Component Mix

(64 components)

acetone	trichlorofluoromethane (Freon® 11)
acrolein	dichlorodifluoromethane (Freon® 12)
benzene	1,1,2-trichloro-1,2,2-trifluoroethane (Freon® 113)
benzyl chloride*	1,2-dichlorotetrafluoroethane (Freon® 114)
bromodichloromethane	heptane
bromoform	hexachloro-1,3-butadiene
bromomethane	hexane
1,3-butadiene	2-hexanone (MBK)
2-butanone (MEK)	4-methyl-2-pentanone (MIBK)
carbon disulfide*	methylene chloride
carbon tetrachloride	methyl <i>tert</i> -butyl ether (MTBE)
chlorobenzene	methyl methacrylate
chloroethane	2-propanol
chloroform	propylene
chloromethane	styrene
cyclohexane	1,1,2,2-tetrachloroethane
dibromochloromethane	tetrachloroethene
1,2-dichlorobenzene	tetrahydrofuran
1,3-dichlorobenzene	toluene
1,4-dichlorobenzene	1,2,4-trichlorobenzene
1,1-dichloroethane	1,1,1-trichloroethane
1,2-dichloroethane	1,1,2-trichloroethane
1,1-dichloroethene	trichloroethene
<i>cis</i> -1,2-dichloroethene	1,2,4-trimethylbenzene
<i>trans</i> -1,2-dichloroethene	1,3,5-trimethylbenzene
1,2-dichloropropane	vinyl acetate
<i>cis</i> -1,3-dichloropropene	vinyl chloride
<i>trans</i> -1,3-dichloropropene	<i>m</i> -xylene
1,4-dioxane	<i>o</i> -xylene
ethanol*	<i>p</i> -xylene
ethyl acetate	
ethyl benzene	
ethylene dibromide (1,2-dibromoethane)	
4-ethyltoluene	

1ppm in nitrogen, 104 liters @ 1,800psi	
cat. # 34436 (ea.)	
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	
cat. # 34436-PI (ea.)	
100ppb in nitrogen, 104 liters @ 1,800psi	
cat. # 34437 (ea.)	
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	
cat. # 34437-PI (ea.)	

*Stability of this compound cannot be guaranteed.

TO-14A/TO-15/TO-17 Performance Test Standard

Restek is pleased to offer the Performance Testing/VOC Audit Sample Program in cooperation with Spectra Gases. This is an on-going testing program in which laboratories, and/or other users of VOC standards, are able to evaluate their own capabilities, as well as compare their results and accuracy against other laboratories. As a participant in the program, you will receive a disposable cylinder, directly from Spectra Gases, containing multiple unknown TO-14A/TO-15 components at varying concentrations that are to be identified, quantified, and reported via the Spectra Gases P-T Audit Program forms. The results will be published and distributed for peer review. To ensure confidentiality, all participating laboratories will be anonymous, and only the individual laboratory will know their own results. To provide statistical analysis, the audit sample will be shipped to all laboratories at the same time, once a year during the fourth quarter.

170 liters @ 2,015psi	
cat. # 34560 (ea.)	

updated!

new!

Pi-marked Gas Cylinders Now Available for EU Countries

Our new Pi-marked gas standards from Scott Specialty Gases meet the requirements of Transportable Pressure Equipment Directive (TPED) implemented in 2001 that regulates the safe transport of pressurized containers used throughout the European community.

please note

Gas standards are subject to hazardous materials shipping fees by most freight carriers.

new!

cylinder design**TO-14A/TO-15/TO-17 Performance Test Standard**

Size: 5A disposable (3.2" x 12")

Volume/Pressure:

170L @ 2,015psi

CGA 180 outlet fitting

Weight: 2.2lbs.

cylinder
design

Spectra 104L Cylinders:

Aluminum construction

Size: 8 x 24 cm.

Volume/Pressure:

104 liters of gas
@ 1,800psi

CGA-180

outlet fitting.

Weight:

1.5 lbs./0.7 kg



Scotty 110L Cylinders

(Pi-marked Cylinders for
EU Regulations):

Aluminum construction

Size: 8.3 x 29.5 cm.

Volume/Pressure:

110 liters of gas
@ 1,800psi

CGA-180

outlet fitting.

Weight:

2.2 lbs./1 kg

U.S. D.O.T. Specs:

3AL2216



BTEX Gas Mix

benzene	<i>m</i> -xylene
ethylbenzene	<i>o</i> -xylene
toluene	<i>p</i> -xylene

1ppm in nitrogen, 104 liters @ 1,800psi

cat. # 34414 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34414-PI (ea.)

100ppb in nitrogen, 104 liters @ 1,800psi

cat. # 34428 (ea.)

100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34428-PI (ea.)

BTEX and MTBE Gas Mix

benzene	<i>m</i> -xylene
ethylbenzene	<i>o</i> -xylene
methyl <i>tert</i> -butyl ether (MTBE)	<i>p</i> -xylene
toluene	

1ppm in nitrogen, 104 liters @ 1,800psi

cat. # 34541 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34541-PI (ea.)

100ppb in nitrogen, 104 liters @ 1,800psi

cat. # 34542 (ea.)

100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34542-PI (ea.)

Sulfur 5-Component Mix

12-month stability. +/- 10% accuracy.

carbonyl sulfide	hydrogen sulfide
dimethyl sulfide	methyl mercaptan
ethyl mercaptan	

1ppm in nitrogen, 110 liters @ 1,800psi

cat. # 34561 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34561-PI (ea.)

new!

Spectra Gas 7621 High-Purity VOC Regulator

- Single-stage, stainless steel.
- Two pressure gauges and CGA-180 fitting.
- 3,000psig maximum inlet pressure.
- Stainless steel diaphragm and Kel-F® seat.
- 1/8-inch tube compression outlet.
- Low internal volume: 3.03cc.
- Accurate pressure control even at low flow rates.
- Individually tested for leaks and impurities.

Description	qty.	cat.#
0–30psig outlet pressure gauge	ea.	21572
0–100psig outlet pressure gauge	ea.	21572-R100

Massachusetts APH Mix (26 components)

benzene	<i>p</i> -isopropyltoluene
1,3-butadiene	methyl <i>tert</i> -butyl ether
butylcyclohexane	1-methyl-3-ethylbenzene
cyclohexane	<i>n</i> -nonane
<i>n</i> -decane	<i>n</i> -octane
2,3-dimethylheptane	toluene
2,3-dimethylpentane	toluene-d8 (IS)
<i>n</i> -dodecane	1,2,3-trimethylbenzene
ethylbenzene	1,3,5-trimethylbenzene
<i>n</i> -heptane	<i>n</i> -undecane
<i>n</i> -hexane	<i>o</i> -xylene
isopentane	<i>m/p</i> -xylene (combined)
isopropylbenzene	

1ppm in nitrogen, 104 liters @ 1,800psi

cat. # 34540 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34540-PI (ea.)

Japan Calibration Mix (9 components)

acrylonitrile	dichloromethane
benzene	tetrachloroethylene
1,3-butadiene	trichloroethylene
chloroform	vinyl chloride

1,2-dichloroethane

1ppm in nitrogen, 104 liters @ 1,800psi

cat. # 34418 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34418-PI (ea.)

ordering note

Other cylinder sizes available on request.

for reference
booksVisit www.restek.com

Ozone Precursor Mixture/PAMS (57 components)

acetylene	isopropylbenzene
benzene	methylcyclohexane
<i>n</i> -butane	methylcyclopentane
1-butene	2-methylheptane
<i>cis</i> -2-butene	3-methylheptane
<i>trans</i> -2-butene	2-methylhexane
cyclohexane	3-methylhexane
cyclopentane	2-methylpentane
<i>n</i> -decane	3-methylpentane
<i>m</i> -diethylbenzene	<i>n</i> -nonane
<i>p</i> -diethylbenzene	<i>n</i> -octane
2,2-dimethylbutane	<i>n</i> -pentane
2,3-dimethylbutane	1-pentene
2,3-dimethylpentane	<i>cis</i> -2-pentene
2,4-dimethylpentane	<i>trans</i> -2-pentene
<i>n</i> -dodecane	propane
ethane	<i>n</i> -propylbenzene
ethylbenzene	propylene
ethylene	styrene
<i>m</i> -ethyltoluene	toluene
<i>o</i> -ethyltoluene	1,2,3-trimethylbenzene
<i>p</i> -ethyltoluene	1,2,4-trimethylbenzene
<i>n</i> -heptane	1,3,5-trimethylbenzene
<i>n</i> -hexane	2,2,4-trimethylpentane
1-hexene	2,3,4-trimethylpentane
isobutane	<i>n</i> -undecane
isopentane	<i>o</i> -xylene
isoprene	<i>m/p</i> -xylene (combined)

1ppm in nitrogen, 104 liters @ 1,800psi
cat. # 34420 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (PI-marked Cylinder)
cat. # 34420-PI (ea.)

100ppb in nitrogen, 104 liters @ 1,800psi
cat. # 34429 (ea.)

100ppb in nitrogen, 110 liters @ 1,800psi (PI-marked Cylinder)
cat. # 34429-PI (ea.)

Ozone Precursor/PAMS Mix (57 components at EPA concentrations: ppbC)

acetylene	40	isopropylbenzene	40
benzene	30	methylcyclohexane	30
<i>n</i> -butane	40	methylcyclopentane	25
1-butene	30	2-methylheptane	25
<i>cis</i> -2-butene	35	3-methylheptane	25
<i>trans</i> -2-butene	25	2-methylhexane	25
cyclohexane	40	3-methylhexane	25
cyclopentane	20	2-methylpentane	20
<i>n</i> -decane	30	3-methylpentane	40
<i>m</i> -diethylbenzene	40	<i>n</i> -nonane	25
<i>p</i> -diethylbenzene	25	<i>n</i> -octane	30
2,2-dimethylbutane	40	<i>n</i> -pentane	25
2,3-dimethylbutane	50	1-pentene	25
2,3-dimethylpentane	50	<i>cis</i> -2-pentene	35
2,4-dimethylpentane	40	<i>trans</i> -2-pentene	25
<i>n</i> -dodecane	40	propane	40
ethane	25	<i>n</i> -propylbenzene	30
ethylbenzene	25	propylene	25
ethylene	20	styrene	40
<i>m</i> -ethyltoluene	25	toluene	40
<i>o</i> -ethyltoluene	30	1,2,3-trimethylbenzene	25
<i>p</i> -ethyltoluene	40	1,2,4-trimethylbenzene	40
<i>n</i> -heptane	25	1,3,5-trimethylbenzene	25
<i>n</i> -hexane	30	2,2,4-trimethylpentane	30
1-hexene	60	2,3,4-trimethylpentane	25
isobutane	25	<i>n</i> -undecane	30
isopentane	40	<i>o</i> -xylene	25
isoprene	40	<i>m/p</i> -xylene (combined)	40

20-60ppb C in nitrogen, 104 liters @ 1,800psi
cat. # 34445 (ea.)

20-60ppb C in nitrogen, 110 liters @ 1,800psi (PI-marked Cylinder)
cat. # 34445-PI (ea.)



Silvia Martinez
Innovations Chemist
5+ years of service!



also available

Custom air standards!
Visit www.restek.com for our custom air standards ordering form.

Jumbo Syringe

Clear acrylic syringes, ideal for holding and dispensing large volumes of gas. An adjustable plunger on the O-ring ensures that the syringe is gas-tight over a long period of time. The central port is supplied with a luer-lock fitting; the secondary port is supplied with a septum nut. This enables access to the gas sample for adding standards or removing a sub-sample. The plunger stem is detachable, making sample storage easy.



1,000mL Jumbo Syringe

Volume	Model	SGE cat.#	qty.	Restek cat.#
500mL	500MAR-LL-GT	009910	ea.	21275
1000mL	1000MAR-LL-GT	009920	ea.	21276
2000mL	2000MAR-LL-GT	009930	ea.	21277

Syringe O-Rings

Syringe Volume	SGE cat.#	qty.	Restek cat.#
500mL	032527	ea.	21278
1000mL	032532	ea.	21279



O-Rings for 1000mL & 500mL Syringes



Scott Transportable Pure Gases and Mixtures in 14-, 48-, and 110-Liter Sizes

We offer a wide range of Scott Transportable Gases, from pure gases for purging or calibrating to multi-component mixes which are ideal for peak identification work.

The 14-liter container has a CGA 160 connection for more precise integration with analytical systems. The 48-liter cylinder has a CGA 165 connection, and can deliver large volumes of sample. The 110-liter cylinder has a CGA 180 connection.

Scotty® 14

Contents: 14 liters
Pressure: 240psig (17 bar)
Outlet Fitting: CGA 160

Weight: 1.5 lbs/0.7 kg
Dimensions: 3" diameter x 11" height (7.6 x 28cm)
D.O.T. Specifications: 4B240

Please note: this cylinder is not approved for use in Canada.

Scotty® 48

Contents: 48 liters
Pressure: 300psig (21 bar)
Outlet Fitting: CGA 165

Weight: 1.75 lbs/0.8 kg
Dimensions: 4" diameter x 16 1/4" height (10.2 x 41cm)
D.O.T. Specifications: 39 NRC

Scotty® 110 (Pi-marked Cylinders for EU Regulations)

Contents: 110 liters
Pressure: 1800psig (124 bar)
Outlet Fitting: CGA 180

Weight: 2.2 lbs/1 kg
Dimensions: 3.25" diameter x 11.625" height (8.3 x 29.5cm)
D.O.T. Specifications: 3AL2216

Description	Shelf Life	Scotty® 14	Scotty® 48	Scotty® 110
		(14 Liter) cat.#	(48 Liter) cat.#	(110 Liter) cat.#
Pure Gases				
Air, zero (THC < 1ppm)	2 yrs.	34448	34449	34449-PI
Argon, 99.995%	2 yrs.	34457	—	34457-PI
Carbon dioxide, 99.80%	2 yrs.	34451	34452	34452-PI
Hydrogen, 99.99%	2 yrs.	34453	—	34453-PI
Methane, 99.00%	2 yrs.	34454	—	34454-PI
Oxygen, 99.60%	2 yrs.	34455	—	34455-PI

new!

Pi-marked Gas Cylinders Now Available for EU Countries

Our new Pi-marked gas standards from Scott Specialty Gases meet the requirements of Transportable Pressure Equipment Directive (TPED) implemented in 2001 that regulates the safe transport of pressurized containers used throughout the European community.

Two-Component Mixtures

Description	Shelf Life	Scotty® 14 (14 Liter) cat.#	Scotty® 48 (48 Liter) cat.#	Scotty® 110 (110 Liter) cat.#
Benzene in air (1ppm)	1 yr.	—	34458	34458-PI
Benzene in air (100ppm)	1 yr.	—	34459	34459-PI
1,3-Butadiene in nitrogen (10ppm)	2 yrs.	34460	34461	34461-PI
Carbon dioxide in helium (100ppm)	2 yrs.	34462	—	34462-PI
Carbon dioxide in nitrogen (100ppm)	2 yrs.	34463	34464	34464-PI
Carbon dioxide in nitrogen (1000ppm)	2 yrs.	34465	34466	34466-PI
Ethylene in air (8-10ppm)	2 yrs.	34467	34468	34468-PI
Ethylene in helium (100ppm)	2 yrs.	34489	—	34489-PI
Hydrogen in helium (100ppm)	2 yrs.	34469	—	34469-PI
Hydrogen in nitrogen (1%)	2 yrs.	34471	34472	34472-PI
Hydrogen in nitrogen (100ppm)	2 yrs.	34473	34474	34474-PI
Methane in helium (100ppm)	2 yrs.	34476	34477	34477-PI
Methane in nitrogen (100ppm)	2 yrs.	34478	—	34478-PI
Methane in nitrogen (1%)	2 yrs.	34482	34483	34483-PI
Nitrogen in helium (100ppm)	2 yrs.	34479	—	34479-PI
Nitrous oxide in nitrogen (1ppm)	2 yrs.	34484	34485	34485-PI
Oxygen in helium (100ppm)	2 yrs.	34480	—	34480-PI
Oxygen in nitrogen (2%)	2 yrs.	34487	34488	34488-PI
Oxygen in nitrogen (6%)	2 yrs.	34491	34492	34492-PI
1,1,1-Trichloroethane in nitrogen (10ppm)	2 yrs.	—	34493	34493-PI
Trichloroethylene in nitrogen (10ppm)	2 yrs.	34494	34495	34495-PI
Vinyl chloride in nitrogen (1ppm)	2 yrs.	34496	34497	34497-PI
Vinyl chloride in nitrogen (10ppm)	2 yrs.	34498	34499	34499-PI
Vinyl chloride in nitrogen (50ppm)	2 yrs.	34500	—	34500-PI
Vinyl chloride in nitrogen (100ppm)	2 yrs.	34501	—	34501-PI
Vinyl chloride in nitrogen (1000ppm)	2 yrs.	34502	—	34502-PI



Description	Shelf Life	Scotty® 14 (14 Liter) cat.#	Scotty® 48 (48 Liter) cat.#	Scotty® 110 (110 Liter) cat.#
Multi-Component Mixtures				
Carbon monoxide, carbon dioxide, hydrogen and oxygen in nitrogen (0.5% each)	2 yrs.	34504	34505	34505-PI
Carbon monoxide, carbon dioxide, hydrogen and oxygen in nitrogen (1% each)	2 yrs.	34507	34508	34508-PI
Carbon monoxide, carbon dioxide, methane, ethane, ethylene and acetylene in nitrogen (1% each)	1 yr.	—	34511	34511-PI
Carbon monoxide, carbon dioxide, nitrogen, and oxygen, (5% each) and methane and hydrogen (4% each) in helium	2 yrs.	34512	—	34512-PI
Carbon monoxide (7%), carbon dioxide (15%) and oxygen (5%) in nitrogen	2 yrs.	34514	—	34514-PI
Carbon monoxide (7%), oxygen (4%), carbon dioxide (15%) and methane (4.5%) in nitrogen	2 yrs.	34515	34516	34516-PI
C1-C6 <i>n</i> -Paraffins: methane, ethane, propane, butane, pentane, hexane in nitrogen (15ppm each)	2 yrs.	34518	34519	34519-PI
C1-C6 <i>n</i> -Paraffins: methane, ethane, propane, butane, pentane, hexane in helium (100ppm each)	2 yrs.	34521	34522	34522-PI
C1-C6 <i>n</i> -Paraffins: methane, ethane, propane, butane, pentane, hexane in helium (1000ppm each)	2 yrs.	34524	34525	34525-PI
C1-C6 <i>n</i> -Paraffins: methane, ethane, propane, butane, pentane, hexane in nitrogen (100ppm each)	2 yrs.	34527	34528	34528-PI
C2-C6 Olefins: ethylene, propylene, 1-butene, 1-pentene, 1-hexene in helium (100ppm each)	2 yrs.	34529	34530	34530-PI
C2-C6 Olefins: ethylene, propylene, 1-butene, 1-pentene, 1-hexene in nitrogen (100ppm each)	2 yrs.	34531	34532	34532-PI
Branched Paraffins: 2,2-dimethylbutane, 2,2-dimethylpropane, isobutane, 2-methylbutane, 2-methylpentane, 3-methylpentane in nitrogen (15ppm each)	2 yrs.	34534	—	34534-PI
Methane, ethane, ethylene, acetylene, propane, propylene, <i>n</i> -butane, propyne in nitrogen (15ppm each)	1 yr.	—	34537	34537-PI
<i>n</i> -butane, isobutane, <i>cis</i> -2-butene, <i>trans</i> -2-butene, 1-butene, isobutylene, 1,3-butadiene, ethyl acetylene in nitrogen (15ppm each)	1 yr.	—	34539	34539-PI

also available

Custom air standards!
Visit www.restek.com for our custom air standards ordering form.

Regulators for use with 14-liter and 48-liter Scott Transportable Gases

Specifications:

Maximum Inlet Pressure: 300psig
 Outlet Pressure Range: 2–10psig
 Maximum Delivery Pressure: 25psig
 Operating Temperature Range: 35°F to 150°F (2°C to 65°C)
 Outlet Connection: 1/4" female NPT

Materials of Construction:

Body: Brass
 Diaphragm: Viton®
 Seat: Acetal
 Seal: Viton®

Use the CGA 160 inlet connection with 14-liter Scott Transportable Gases. Use the CGA 165 inlet connection with 48-liter Scott Transportable Gases.

Description	qty.	cat.#
Regulator with CGA 160 Inlet Connection	ea.	22690
Regulator with CGA 165 Inlet Connection	ea.	22691



also available

Regulators with CGA-180 connections for the 110L cylinders are listed on page 20.

Syringe Adapter Kit for Single-Stage VOC Regulator

Use to withdraw sample from a high-pressure cylinder after pressure reduction through the high-purity VOC single-stage regulator.

Kit contains one nickel-plated brass 1/4" NPT to female luer fitting, which can be used with an A-2 Luer syringe (cat.# 20162 or 20163), and one stainless steel 1/4" NPT x 1/8" compression fitting with septum (can be used with any syringe needle).

Description	qty.	cat.#
Syringe Adapter Kit	kit	21118



Natural Gas and Refinery Gas Standards

Natural Gas and Refinery Gas Standards

- Each available in three varying concentrations.
- Mini-regulator designed specially for these standards.

Natural Gas Standards

Available in three mixes, from lean to rich. Each has an extended list of C6+ components.

	Natural Gas Standard #1 cat.# 34438, ea. % each compound**	Natural Gas Standard #2 cat.# 34439, ea. % each compound**	Natural Gas Standard #3 cat.# 34440, ea. % each compound**
nitrogen	1.000	2.500	5.000
carbon dioxide	0.500	1.000	1.500
methane UHP	94.750	85.250	70.000
ethane UHP	2.000	5.000	9.000
propane	0.750	3.000	6.000
isobutane	0.300	1.000	3.000
n-butane	0.300	1.000	3.000
isopentane	0.150	0.500	1.000
n-pentane	0.150	0.500	1.000
hexanes plus EX2*	0.100	0.250	0.500
Concentration	mole	mole	mole
Volume	13.16L @ 200psig	13.16L @ 200psig	5.5L @ 75psig
Ideal Heating Value (Dry BTU/SCF)	1048 gross	1142 gross	1317 gross

*Contact Restek or your Restek representative for a complete list of hexanes plus EX2.

**Precise concentrations are provided on the data sheet included with each cylinder and may vary slightly from those listed here.

Refinery Gas Standards

Available in three mixes with varying C5 unsaturates or extended C6+ components.

	Refinery Gas Standard #1 cat.# 34441, ea. % each compound**	Refinery Gas Standard #2 cat.# 34442, ea. % each compound**	Refinery Gas Standard #5 cat.# 34443, ea. % each compound**
hydrogen	40.750	12.500	12.500
argon	0.500	1.000	1.000
nitrogen	4.000	37.200	37.200
carbon monoxide	1.000	1.000	1.000
carbon dioxide	3.000	3.000	3.000
methane	8.500	5.000	5.000
ethane	6.000	4.000	4.000
ethylene	2.000	2.000	2.000
acetylene	—	1.000	1.000
propane	7.000	6.000	6.000
propylene	3.000	3.000	3.000
propadiene	0.850	1.000	1.000
cyclopropane	—	0.040	—
isobutane	6.000	5.000	5.000
n-butane	4.000	4.000	4.000
isobutylene	2.000	1.000	1.000
1,3 butadiene	3.000	3.000	3.000
cis-2-butene	2.000	2.000	2.000
trans-2-butene	2.000	3.000	3.000
butene-1	2.000	2.000	2.000
2-methyl-2-butene	—	0.200	0.200
isopentane	1.000	1.000	1.000
n-pentane	1.000	1.000	1.000
cis-2-pentene	—	0.400	0.400
trans-2-pentene	—	0.160	0.200
pentene-1	—	0.400	0.400
n-hexane	0.500	0.100	—
hexanes plus EX	—	—	0.100
Concentration	mole	mole	mole
Volume	5.2L @ 70psig	4.9L @ 60psig	4.6L @ 60psig

**Precise concentrations are provided on the data sheet included with each cylinder and may vary slightly from those listed here.

Mini-Regulator for natural gas and refinery gas standards

- 0–300psig inlet pressure range.
- 0–15psig outlet pressure range.
- Supplied with 0–15psig outlet pressure gauge, brass CGA 170 nut and nipple.

Description	qty.	cat.#
Mini-Regulator	ea.	22032

Please note: gas standards on this page are not available in Pi-marked cylinders for EU countries.



cylinder
design

DCG Partnership Cylinders:

Size: 7.6 x 24 cm.

CGA-170/110 connection.

U.S. D.O.T. Specs:

DOT-4B-240ET

Please note: This cylinder is not approved for use in Canada.



Sulfinert® Treated Swagelok® Sample Cylinders

- Stable storage of samples containing ppb levels of sulfur compounds.
- Manufactured by Swagelok®; US DOT rated to 1,800psi (12,411kPa) at room temperature.
- 304 grade stainless steel with 1/4" female NPT threads on both ends.

Ideal for collecting and storing samples, such as natural gas or beverage-grade carbon dioxide, because active compounds remain stable during transport.

Description	Size	qty.	cat.#
Sulfinert Sample Cylinder	75cc	ea.	24130
Sulfinert Sample Cylinder	150cc	ea.	24131
Sulfinert Sample Cylinder	300cc	ea.	24132
Sulfinert Sample Cylinder	500cc	ea.	24133
Sulfinert Sample Cylinder	1000cc	ea.	24134
Sulfinert Sample Cylinder	2250cc	ea.	21394

also available

Certificates are available upon request.



Sulfinert® Treated Alta-Robbins Sample Cylinder Valves

- All wetted parts are Sulfinert® treated for inertness.
- Compatible with Sulfinert® treated Swagelok® sample cylinders.
- Large, durable, Kel-F® seat ensures leak-free operation; temperature range: -40°C to 120°C.
- Valves rated to 3,500psig.

Description	qty.	cat.#
1/4" NPT Exit	ea.	21400
1/4" Compression Exit	ea.	21401
1/4" NPT with Dip Tube*	ea.	21402
1/2" NPT with 2,850psi Rupture Disc	ea.	21403
1/4" NPT Male Inlet x 1/4" Female Outlet with 2,850psi Rupture Disc	ea.	21404

*To order catalog #21402 (Sulfinert Alta-Robbins Sample Cylinder Valve, 1/4" NPT with Dip Tube), please call Customer Service at 800-356-1688, ext. 3, or contact your Restek representative. Specify dip tube length or % outage when ordering (maximum length = 5.25" / 13.3cm). Note: End of part will not be treated after cutting tube to length.



AIR MONITORING

Sulfinert® Treated Rupture Disc Tee

2,850psig (19,650kPa) rating; 1/4" NPT connections.

Description	qty.	cat.#
Sulfinert Treated Rupture Disc Tee (1/4" NPT connections)	ea.	21396
Replacement Rupture Disc (not Sulfinert treated)	ea.	24298



Sulfinert® Treated Ultra-High Pressure Sample Cylinders and Valves

- Stable storage of samples containing sulfur compounds and mercury.
- Cylinders manufactured by Swagelok® and US DOT rated to 5,000psig.
- Valves rated to 6,000psig.
- 316 grade stainless steel with 1/4" female NPT threads on both ends.

Ideal for collecting samples at gas wellhead or other applications requiring sampling at extremely high pressures.

Sample Cylinders	Size	qty.	cat.#
Sulfinert Sample Cylinder	150cc	ea.	22111
Sulfinert Sample Cylinder	300cc	ea.	22112
Sulfinert Sample Cylinder	500cc	ea.	22113
Sample Cylinder Valves		qty.	cat.#
Sulfinert Treated Sample Cylinder Valve, 1/4" Male NPT (both ends)		ea.	22109
Sulfinert Treated Sample Cylinder Valve, 1/4" Male NPT x 1/4" Female NPT		ea.	22110



new!

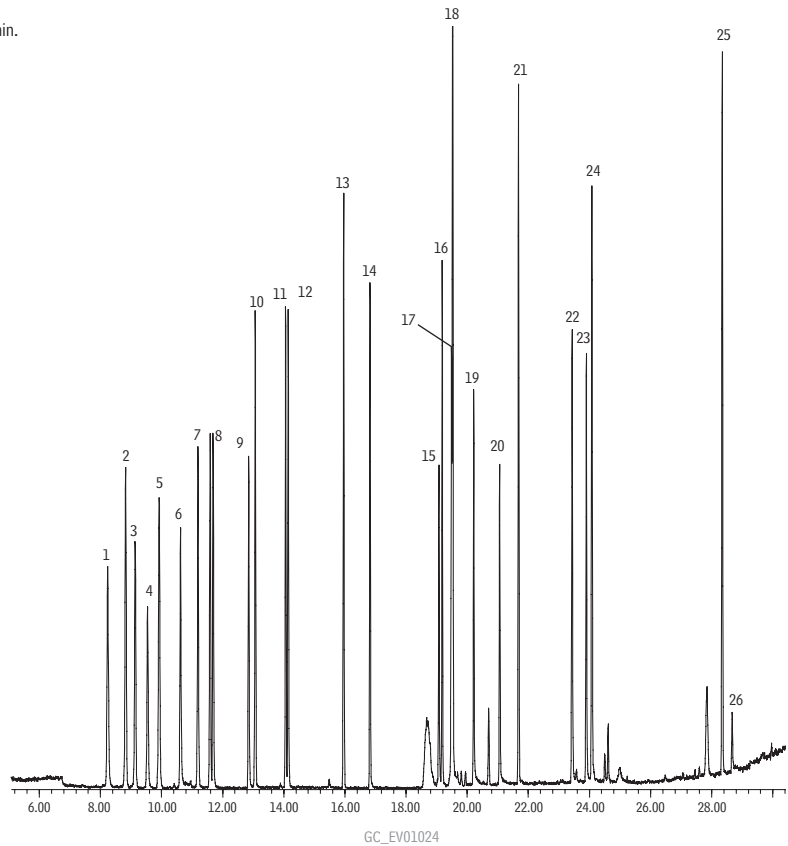
Sulfinert® treatment means ULTIMATE inertness!



Microbial VOCs on Rxi®-1ms

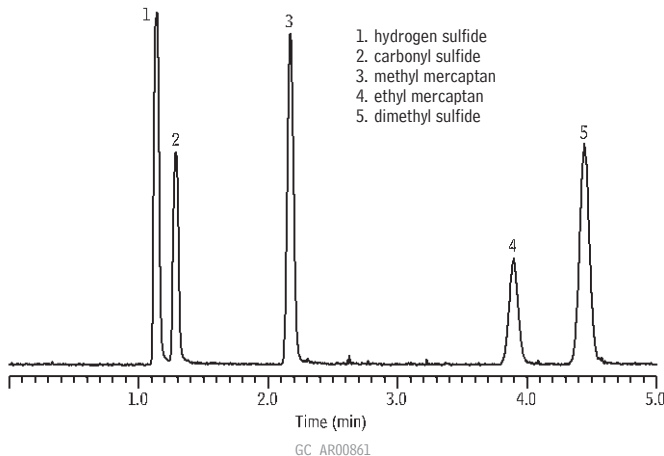
Column: Rxi®-1ms, 60m, 0.25mm ID, 1.00µm (cat.# 13356)
 Sample: microbial volatile organic compounds, 50 ppbv, 60% RH
 Inj.: 1.0µL split (split ratio 10:1), 1mm split inlet liner (cat.# 20972)
 Inj. temp.: 200°C
 Carrier gas: helium, constant flow
 Flow rate: 1.5mL/min.
 Oven temp.: 10°C (hold 1 min.) to 260°C @ 8°C/min.
 Det.: HP 6890/5973 GC/MS
 5 min. solvent delay
 Transfer line temp.: 260°C
 Scan range: 35 to 350amu
 Ionization: EI
 Mode: scan
 Other: Nutech 8900DS Preconcentrator
 Conditions:
 Sample = 200mL from canister
 Cryotrap = -160°C
 Desorb = 20°C
 Cryofocuser = 200°C
 Desorb = 200°C

Compound	Rt (min.)
1. 2-butanone	8.2390
2. 2-methyl-furan	8.8180
3. 3-methyl-furan	9.1400
4. 2-methyl-1-propanol	9.5400
5. 2-methyl-2-butanol	9.9190
6. 1-butanol	10.6270
7. 3-methyl-2-butanol	11.1840
8. 2-pentanol	11.6920
9. 2-methyl-1-butanol	12.8500
10. dimethyl-disulfide	13.0640
11. 3-hexanone	14.0580
12. 2-hexanone	14.1440
13. chlorobenzene-d5	15.9590
14. 2-heptanone	16.8240
15. 1-octen-3-ol	19.0760
16. 3-octanone	19.1760
17. 3-octanol	19.4830
18. 2-pentyl-furan	19.5260
19. 2-ethyl-1-hexanol	20.2120
20. 1-octanol	21.0630
21. 2-isopropyl-3-methoxypyrazine	21.6780
22. isoborneol	23.4290
23. α-terpineol	23.9010
24. 2-methylisoborneol	24.0790
25. geosmin	28.3470
26. 1-dodecanol	28.6680



Sulfur Compounds

Rxi®-1ms



1. hydrogen sulfide
2. carbonyl sulfide
3. methyl mercaptan
4. ethyl mercaptan
5. dimethyl sulfide

Column: Rxi®-1ms, 30m, 0.32mm ID, 4.00µm (cat.# 13396)
 Sample: hydrogen sulfide, carbonyl sulfide, methyl mercaptan, ethyl mercaptan, dimethyl sulfide, 100 ppbv each in helium
 Inj.: 1µL splitless, direct
 Sample loop temp.: 30°C
 Carrier gas: helium, constant pressure
 Linear velocity: 48cm/sec. @ 30°C
 Oven temp.: 30°C
 Det.: sulfur chemiluminescence detector
 Det. temp.: 800°C

Sample storage & transfer:
 SilcoCan™ air monitoring canister with Siletek® treated 1/4" valve (cat.# 24182-650);
 Sulfinert® treated gas sample loop, 1cc (cat.# 22848); Sulfinert® treated gas sample loop,
 10cc (custom order)

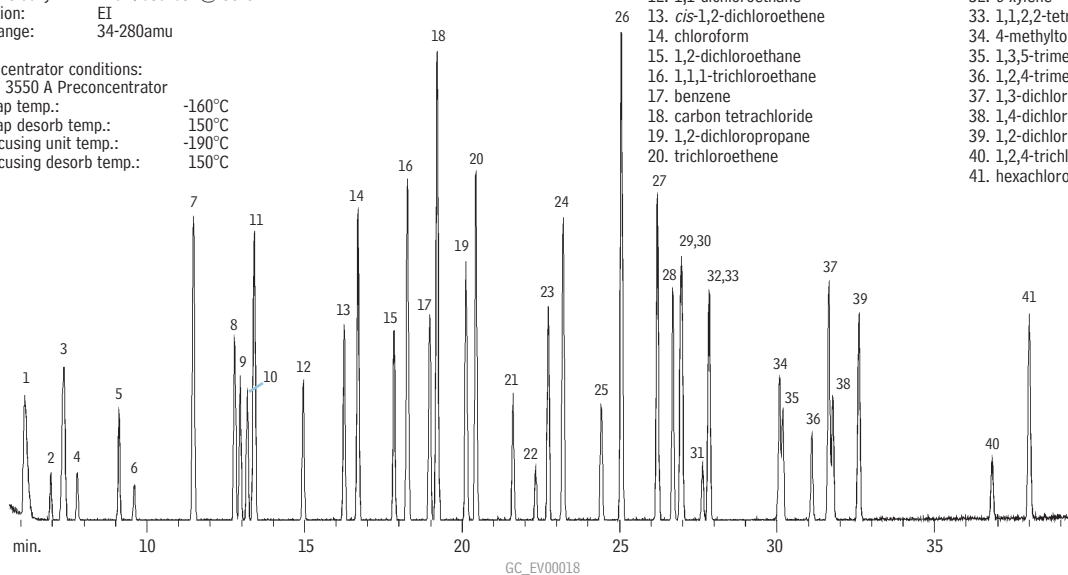
US EPA TO-14 Compounds

Rtx®-1

Column: Rtx®-1, 60m, 0.32mm ID, 3.0µm (cat.# 10187)
 Sample: 5mL of 2ppm TO-14 standard.
 Oven temp.: 30°C (hold 4 min.) to 250°C @ 7°C/min. (hold 15 min.)
 Detector: MS
 Det. temp.: 250°C
 Carrier gas: helium
 Linear velocity: 21cm/sec. set @ 30°C
 Ionization: EI
 Scan range: 34-280amu

Preconcentrator conditions:
 Nutech 3550 A Preconcentrator
 Cryotrap temp.: -160°C
 Cryotrap desorb temp.: 150°C
 Cryofocusing unit temp.: -190°C
 Cryofocusing desorb temp.: 150°C

1. dichlorodifluoromethane
2. chloromethane
3. 1,2-dichlorotetrafluoroethane
4. vinyl chloride
5. bromomethane
6. chloroethane
7. trichlorofluoromethane
8. 1,1-dichloroethene
9. methylene chloride
10. 3-chloropropene
11. 1,1,2-trichloro-1,2,2-trifluoroethane
12. 1,1-dichloroethane
13. *cis*-1,2-dichloroethene
14. chloroform
15. 1,2-dichloroethane
16. 1,1,1-trichloroethane
17. benzene
18. carbon tetrachloride
19. 1,2-dichloropropane
20. trichloroethene
21. *cis*-1,3-dichloropropene
22. *trans*-1,3-dichloropropene
23. 1,1,2-trichloroethane
24. toluene
25. 1,2-dibromoethane
26. tetrachloroethene
27. chlorobenzene
28. ethylbenzene
29. *m*-xylene
30. *p*-xylene
31. styrene
32. *o*-xylene
33. 1,1,2,2-tetrachloroethane
34. 4-methyltoluene
35. 1,3,5-trimethylbenzene
36. 1,2,4-trimethylbenzene
37. 1,3-dichlorobenzene
38. 1,4-dichlorobenzene
39. 1,2-dichlorobenzene
40. 1,2,4-trichlorobenzene
41. hexachlorobutadiene

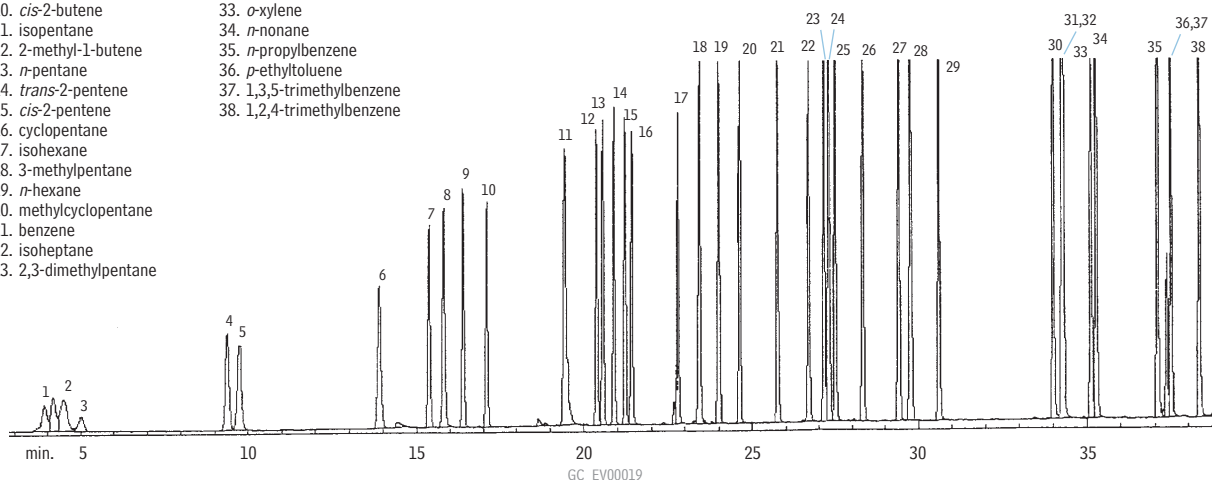


Ozone Precursors

Rtx®-1

Column: Rtx®-1, 60m, 0.32mm ID, 3.0µm (cat.# 10187)
 Sample: 0.5L of C2-C9 gas standard cryogenically concentrated;
 15nL/component desorbed onto column.
 Oven temp.: -60°C (hold 5 min.) to 100°C @ 8°C/min., to
 150°C @ 6°C/min., then to 240°C @ 8°C/min.
 Carrier gas: helium
 Linear velocity: 30cm/sec. (flow rate: 1.8cc/min.)
 FID sensitivity: 64 x 10¹² AFS

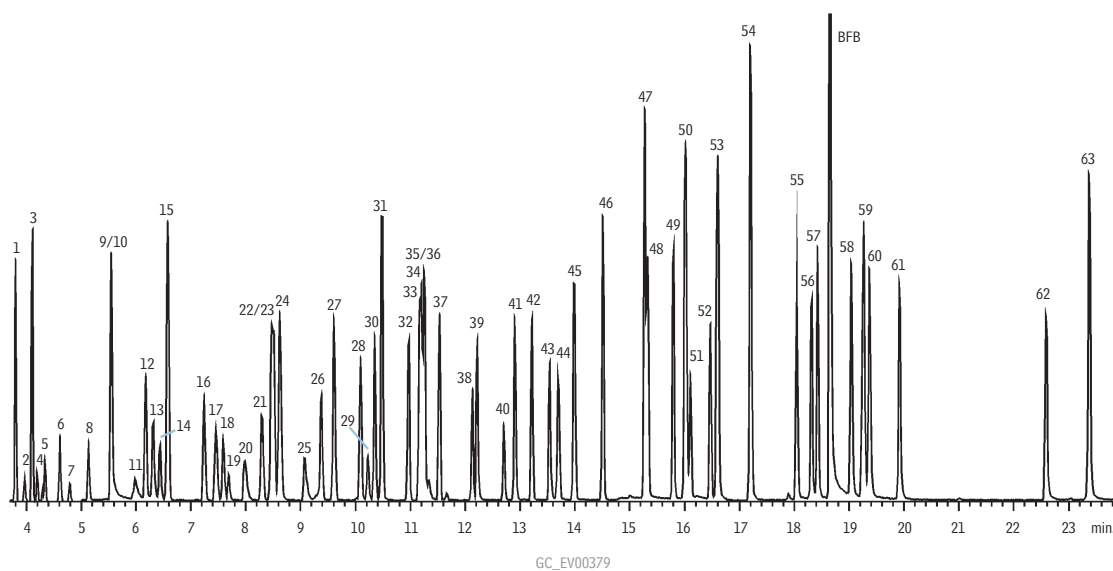
1. ethylene
2. acetylene
3. ethane
4. propylene
5. propane
6. isobutane
7. 1-butene
8. *n*-butane
9. *trans*-2-butene
10. *cis*-2-butene
11. isopentane
12. 2-methyl-1-butene
13. *n*-pentane
14. *trans*-2-pentene
15. *cis*-2-pentene
16. cyclopentane
17. isohexane
18. 3-methylpentane
19. *n*-hexane
20. methylcyclopentane
21. benzene
22. isoheptane
23. 2,3-dimethylpentane
24. 3-methylhexane
25. 2,2,4-trimethylpentane
26. *n*-heptane
27. methylcyclohexane
28. 2,2,3-trimethylpentane
29. toluene
30. ethylbenzene
31. *m*-xylene
32. *p*-xylene
33. *o*-xylene
34. *n*-nonane
35. *n*-propylbenzene
36. *p*-ethyltoluene
37. 1,3,5-trimethylbenzene
38. 1,2,4-trimethylbenzene



Permission to publish this chromatogram granted by Radian Corporation.

US EPA TO-14/TO-15 Compounds

Rtx®-1



GC_EV00379

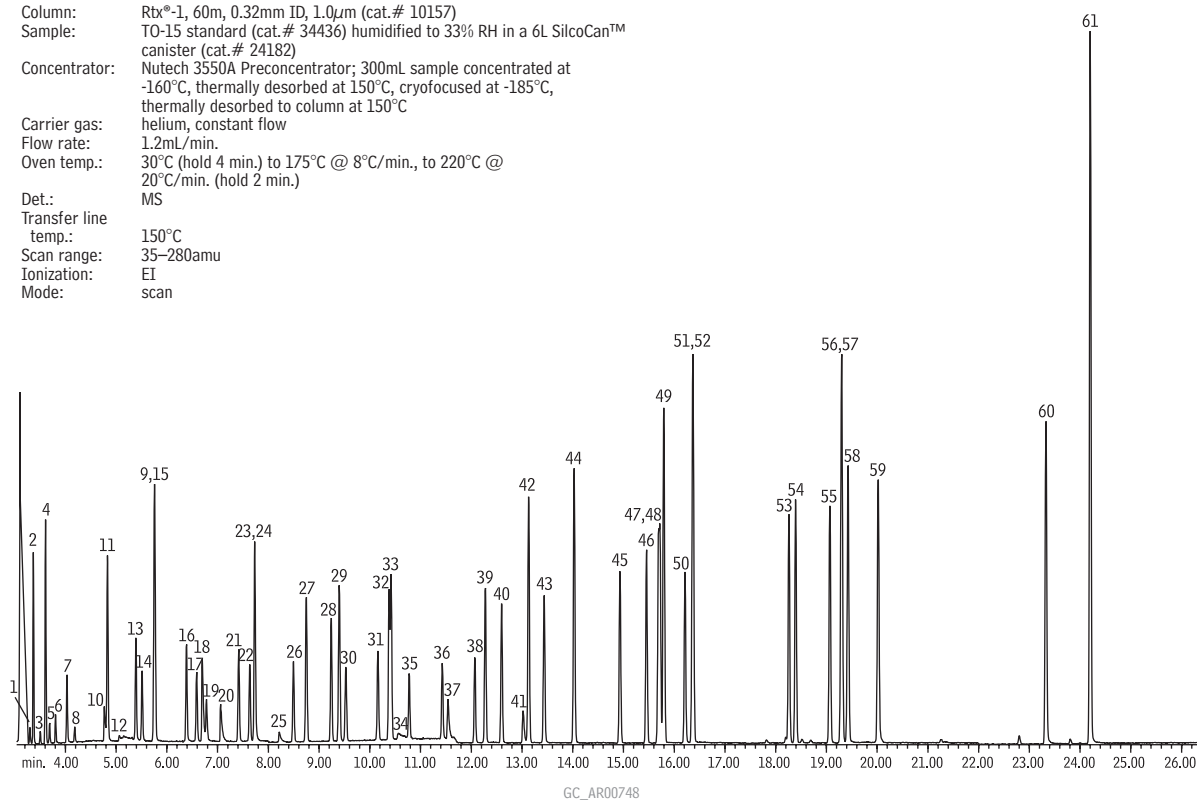
Column: Rtx®-1, 60m, 0.32mm ID, 1.0 μ m (cat.# 10157)
 Sample: 200mL of 10ppbv TO-15 standard, injected into TO-Can™ canister and humidified to 70% RH.
 Concentrator: Nutech 3550 Preconcentrator
 200mL of sample concentrated at -160°C, thermally desorbed at 150°C, and cryofocused at -185°C
 Oven temp.: 30°C (hold 4 min.) to 175°C @ 9°C/min. to 220°C @ 40°C/min.
 Carrier gas: helium @ 1.2mL/min.
 Det.: Agilent 5971 MS
 Scan range: 35-265amu

- | | | |
|--------------------------------------|---------------------------------------|-------------------------------|
| 1. dichlorofluoromethane | 23. <i>n</i> -hexane | 45. 1,2-dibromoethane |
| 2. chloromethane | 24. chloroform | 46. tetrachloroethene |
| 3. dichlorotetrafluoroethane | 25. tetrahydrofuran | 47. chlorobenzene-d5 (IS) |
| 4. vinyl chloride | 26. 1,2-dichloroethane | 48. chlorobenzene |
| 5. 1,3-butadiene | 27. 1,1,1-trichloroethane | 49. ethylbenzene |
| 6. bromomethane | 28. benzene | 50a. <i>m</i> -xylene |
| 7. chloroethane | 29. carbon tetrachloride | 50b. <i>p</i> -xylene |
| 8. bromoethene | 30. cyclohexane | 51. bromoform |
| 9. acetone | 31. 1,4-difluorobenzene (IS) | 52. styrene |
| 10. trichlorofluoromethane | 32. 1,2-dichloropropane | 53. 1,1,2,2-tetrachloroethane |
| 11. isopropyl alcohol | 33. bromodichloromethane | 54. <i>o</i> -xylene |
| 12. 1,1-dichloroethene | 34. trichloroethene | 55. 2-chlorotoluene |
| 13. methylene chloride | 35. 1,4-dioxane | 56. 4-ethyltoluene |
| 14. 3-chloropropene | 36. 2,2,4-trimethylpentane | 57. 1,3,5-trimethylbenzene |
| 15. carbon disulfide | 37. <i>n</i> -heptane | 58. 1,2,4-trimethylbenzene |
| 16. Freon® TF | 38. <i>cis</i> -1,3-dichloropropene | 59. 1,3-dichlorobenzene |
| 17. <i>trans</i> -1,2-dichloroethene | 39. methyl isobutyl ketone | 60. 1,4-dichlorobenzene |
| 18. 1,1-dichloroethane | 40. <i>trans</i> -1,3-dichloropropene | 61. 1,2-dichlorobenzene |
| 19. methyl <i>tert</i> -butyl ether | 41. 1,1,2-trichloroethane | 62. 1,2,4-trichlorobenzene |
| 20. methyl ethyl ketone | 42. toluene | 63. hexachlorobutadiene |
| 21. <i>cis</i> -1,2-dichloroethene | 43. methyl butyl ketone | |
| 22. bromochloromethane (IS) | 44. dibromochloromethane | |

Chromatogram courtesy of Gina Maio, Severn Trent Laboratories, Inc., Burlington, VT.

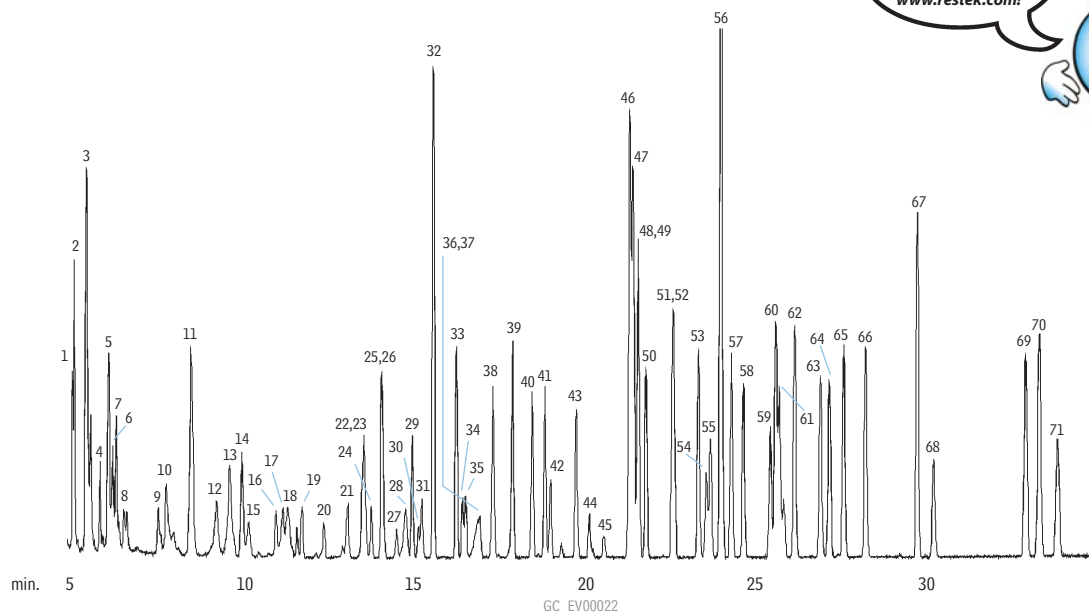
US EPA TO-15 Compounds Rtx®-1

Column: Rtx®-1, 60m, 0.32mm ID, 1.0µm (cat.# 10157)
 Sample: TO-15 standard (cat.# 34436) humidified to 33% RH in a 6L SilcoCan™ canister (cat.# 24182)
 Concentrator: Nutech 3550A Preconcentrator; 300mL sample concentrated at -160°C, thermally desorbed at 150°C, cryofocused at -185°C, thermally desorbed to column at 150°C
 Carrier gas: helium, constant flow
 Flow rate: 1.2mL/min.
 Oven temp.: 30°C (hold 4 min.) to 175°C @ 8°C/min., to 220°C @ 20°C/min. (hold 2 min.)
 Det.: MS
 Transfer line temp.: 150°C
 Scan range: 35–280amu
 Ionization: EI
 Mode: scan



- | | | |
|--|---------------------------------------|-------------------------------|
| 1. propylene | 22. hexane | 43. 1,2-dibromoethane |
| 2. Freon®-12 (dichlorodifluoromethane) | 23. chloroform | 44. tetrachloroethylene |
| 3. chloromethane | 24. ethyl acetate | 45. chlorobenzene |
| 4. Freon®-114 (dichlorotetrafluoroethane) | 25. tetrahydrofuran | 46. ethylbenzene |
| 5. vinyl chloride | 26. 1,2-dichloroethane | 47. <i>p</i> -xylene |
| 6. 1,3-butadiene | 27. 1,1,1-trichloroethane | 48. <i>m</i> -xylene |
| 7. bromomethane | 28. benzene | 49. bromoform |
| 8. chloroethane | 29. carbon tetrachloride | 50. styrene |
| 9. carbon disulfide | 30. cyclohexane | 51. <i>o</i> -xylene |
| 10. acetone | 31. 1,2-dichloropropane | 52. 1,1,2,2-tetrachloroethane |
| 11. Freon®-11 (trichlorofluoromethane) | 32. trichloroethylene | 53. 4-ethyltoluene |
| 12. isopropyl alcohol | 33. bromodichloromethane | 54. 1,3,5-trimethylbenzene |
| 13. 1,1-dichloroethene | 34. 1,4-dioxane | 55. 1,2,4-trimethylbenzene |
| 14. methylene chloride | 35. heptane | 56. 1,3-dichlorobenzene |
| 15. Freon®-113 (1,1,2-trichloro-1,2,2-trifluoroethane) | 36. <i>cis</i> -1,3-dichloropropene | 57. benzyl chloride |
| 16. <i>trans</i> -1,2-dichloroethene | 37. methyl isobutyl ketone | 58. 1,4-dichlorobenzene |
| 17. 1,1-dichloroethane | 38. <i>trans</i> -1,3-dichloropropene | 59. 1,2-dichlorobenzene |
| 18. methyl <i>tert</i> -butyl ether | 39. 1,1,2-trichloroethane | 60. 1,2,4-trichlorobenzene |
| 19. vinyl acetate | 40. toluene | 61. hexachloro-1,3-butadiene |
| 20. methyl ethyl ketone | 41. methyl butyl ketone | |
| 21. <i>cis</i> -1,2-dichloroethene | 42. dibromochloromethane | |

Air Toxins Rtx®-502.2

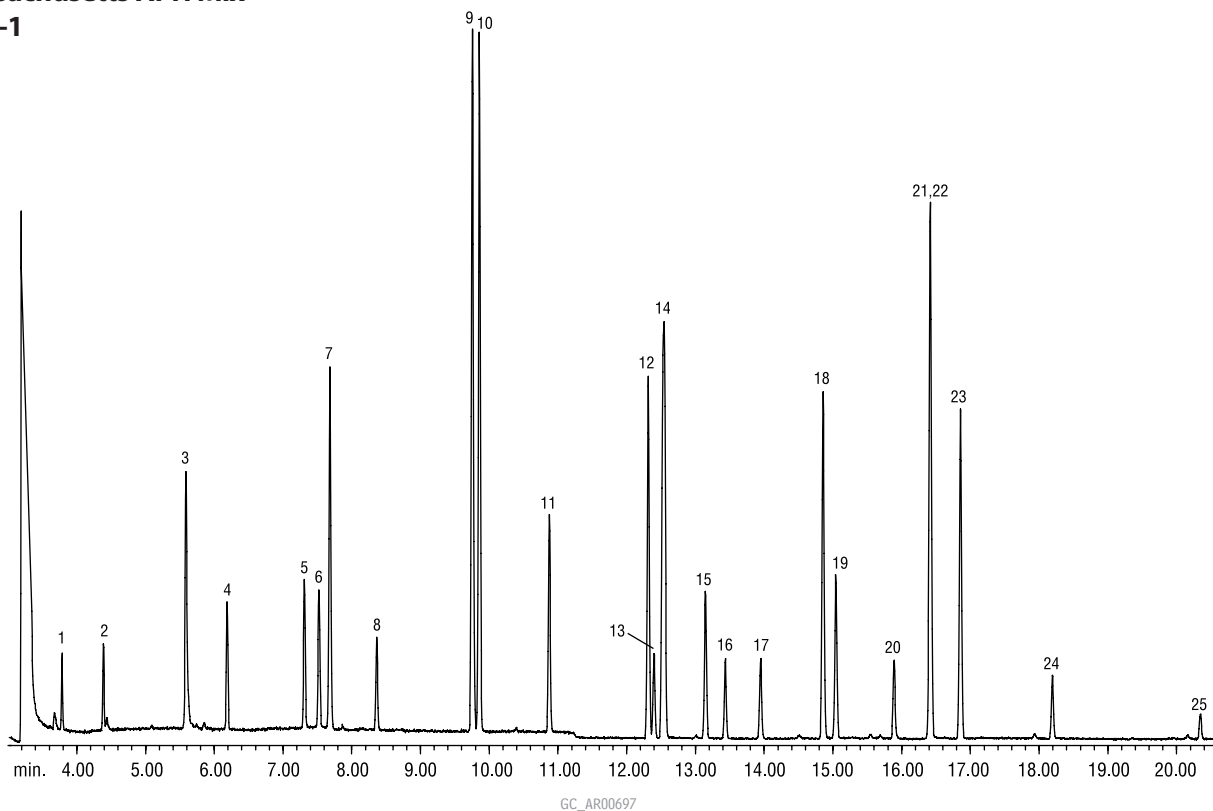


1. chlorodifluoromethane	19. <i>trans</i> -1,2-dichloroethene	37. bromodichloromethane	55. 1,1,1,2-tetrachloroethane
2. dichlorodifluoromethane	20. 1,1-dichloroethane	38. 4-methyl-2-pentanone	56. 4-bromofluoromethane
3. dichlorotetrafluoroethane	21. methyl ethyl ketone	39. octane	57. <i>n</i> -propylbenzene
4. chloromethane	22. <i>cis</i> -1,2-dichloroethene	40. toluene	58. 1,3,5-trimethylbenzene
5. butane	23. methacrylonitrile	41. 2-hexanone	59. α -methylstyrene
6. vinyl chloride	24. chloroform	42. 1,1,2-trichloroethane	60. <i>tert</i> -butylbenzene
7. 1,3-butadiene	25. bromochloromethane	43. tetrachloroethene	61. 1,2,4-trimethylbenzene
8. acetaldehyde	26. tetrahydrofuran	44. dibromochloromethane	62. <i>sec</i> -butylbenzene
9. bromomethane	27. 1,1,1-trichloroethane	45. 1,2-dibromoethane	63. 1,3-dichlorobenzene
10. chloroethane	28. <i>n</i> -butanol	46. chlorobenzene-d5	64. 1,4-dichlorobenzene
11. trichlorofluoromethane	29. heptane	47. chlorobenzene	65. butylbenzene
12. isopropanol	30. 1,2-dichloroethane	48. <i>m</i> -xylene	66. 1,2-dichlorobenzene
13. acetone	31. benzene	49. <i>p</i> -xylene	67. dodecane
14. 1,1-dichloroethene	32. 1,4-difluorobenzene	50. 2-heptanone	68. dibromochloropropane
15. acetonitrile	33. trichloroethene	51. styrene	69. 1,2,4-trichlorobenzene
16. dichloromethane	34. ethyl methacrylate	52. <i>o</i> -xylene	70. hexachlorobutadiene
17. acrylonitrile	35. 1,2-dichloropropane	53. isopropylbenzene	71. naphthalene
18. 1-propanol	36. 1,4-dioxane	54. bromoform	

Column: Rtx®-502.2, 60m, 0.32mm ID, 1.8 μ m (cat.# 10920)
 Sample: 500mL of 10ppbv standard concentrated on an AEROCAN 6000 using a glass bead trap at 165°C then desorbed at 200°C for 4 min. @ 1mL/min., cryofocused @ -175°C then desorbed @ 150°C
 Oven temp.: 35°C (hold 6 min.) to 120°C @ 15°C/min., then to 200°C @ 5°C/min., then to 220°C @ 25°C/min. (hold 10 min.)
 Det. & det. temp.: Agilent-5971A GC/MS, 280°C
 Carrier gas: helium @ 1mL/min.
 Linear velocity: 20cm/sec.
 Scan range: 28-260amu
 Solvent delay: 4 min.

Permission to publish this chromatogram granted by Tekmar Company.

Massachusetts APH Mix Rtx®-1



Column: Rtx®-1, 60m, 0.32mm ID, 1.0 μ m (cat.# 10157)
 Sample: Massachusetts APH Mix, (cat.# 34446)
 Concentrator: Nutech 3550A Air Preconcentrator, 100mL of a 40ppbv standard concentrated at -160°C, thermally desorbed at 150°C and cryofocused at -185°C
 Carrier gas: helium
 Flow rate: 1mL/min.
 Oven temp.: 35°C (hold 1 min.) to 220°C @ 8°C/min.
 Det: MS, Agilent 5971
 Transfer line temp.: 250°C
 Scan range: 35-280amu
 Ionization: EI
 Mode: scan

1. 1,3-butadiene
 2. isopentane
 3. methyl *tert*-butyl ether
 4. hexane
 5. benzene
 6. cyclohexane
 7. 2,3-dimethylpentane
 8. heptane
 9. toluene-D8
 10. toluene
 11. octane
 12. ethylbenzene
 13. 2,3-dimethylheptane

14a. *m*-xylene
 14b. *p*-xylene
 15. *o*-xylene
 16. nonane
 17. isopropylbenzene
 18. 1-methyl-3-ethylbenzene
 19. 1,3,5-trimethylbenzene
 20. decane
 21. 1,2,3-trimethylbenzene
 22. *p*-isopropyltoluene
 23. butylcyclohexane
 24. undecane
 25. dodecane

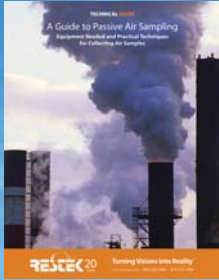
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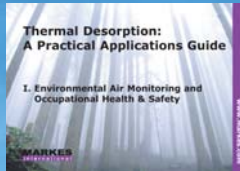
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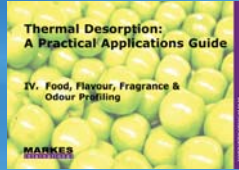
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A Guide to Passive Air Sampling
(lit. cat.# 59977B)



TDU Application Guide, Environmental Air Monitoring and Occupational Health & Safety
(lit. cat.# EVTG1034)



TDU Application Guide, Food, Flavor, Fragrance & Odor Profiling
(lit. cat.# FFTG1037)



TDU Application Guide, Defense and Forensic
(lit. cat.# CFTG1036)



TDU Application Guide, Residual Volatiles & Materials Emissions Testing
(lit. cat.# GNTG1035)



Restek Airmail
quarterly publication
(lit. cat.# GNFL1015)



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Lit. Cat.# GNMC1062-INT
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Air Monitoring

Canisters & Accessories

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Air Canisters for VOC Monitoring

SilcoCan® & TO-Can® Air Monitoring Canisters

- Get high performance canisters from the innovators of fused silica coating technology.
- Variety of options available, including SUMMA can equivalent.
- Standard fittings compatible with all instrumentation and accessories.
- Exclusive manufacturer of 1 L spherical canister.
- Repair service available to extend canister life.

Canister Options

Sizes	1, 3, 6, 15 L
Valves	Parker® diaphragm, Swagelok® bellows
Interior Coating	Electropolished, Siltek® treated
Gauges	3 vacuum/pressure ranges

Applications

Ambient Air - US EPA TO-14A, TO-15, ASTM D5466
Indoor Air
Vapor Intrusion
Emergency Response

Dimensions/Weights of Air Canisters

Can Volume	Dimensions (height x sphere diameter)		Weight	
	1 liter	8.5 x 5.25"	21.6 x 13.3cm	2.5 lbs
3 liter	11.5 x 7.25"	29.2 x 18.4cm	4 lbs	1.81kg
6 liter	12.5 x 9.25"	31.8 x 23.5cm	7 lbs	3.18kg
15 liter	17 x 12.25"	43.2 x 31.1cm	13 lbs	5.90kg



did you know?

SilcoCan® and TO-Can® canisters are cleaned prior to shipping.

- Excellent stability for long-term storage of sulfur-containing volatile organic compounds.
- More accurate sampling.

Canister product listings are on **pages 410-411** or go to **www.restek.com/air** for more air monitoring products and solutions.

Anatomy of a SilcoCan® Canister

Optional gauge

- Quickly confirm vacuum or pressure inside canister.
- Monitor pressure changes.
- Fully protected by canister frame.
- Can be heated to 90°C during cleaning.

Newest surface technology

To ensure sample stability, SilcoCan® canisters are deactivated with Restek's innovative Siltek® surface treatment, which chemically bonds a fused silica layer to the metal inner surface of the canister. This layer offers unsurpassed inertness for active compounds, including polar and sulfur-containing molecules. It will not crack, chip, or flake off, despite harsh handling in the field or during transport.



Enhanced valve and canister bracket

Canister holder and valve bracket protect canister, tube stub, and valve.

1/4" tube stub

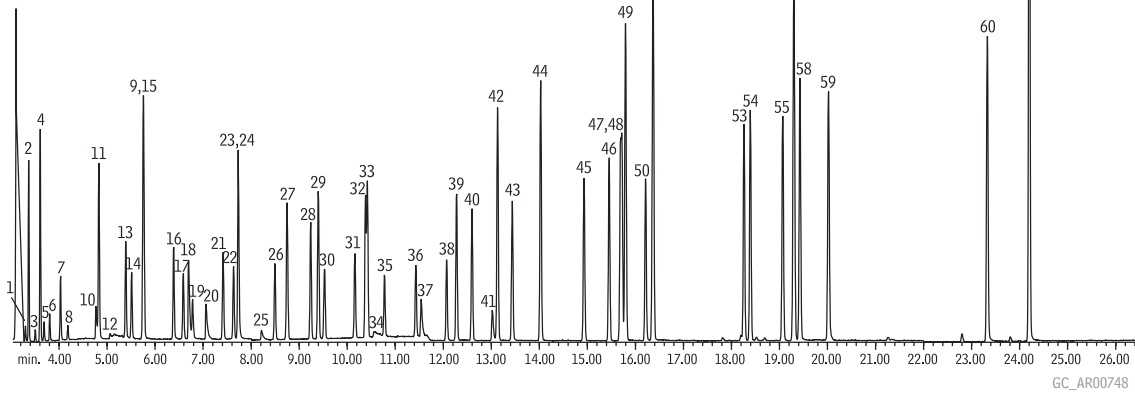
Allows user to interchange valves.

Serial-controlled label

For quick, sure identification.

US EPA TO-15 compounds on an Rtx®-1 column.

Column: Rtx®-1, 60m, 0.32mm ID, 1.0µm (cat.# 10157)
 Sample: TO-15 standard (cat.# 34436) humidified to 33% RH in a 6L SilcoCan® canister (cat.# 24182)
 Concentrator: Nutech 3550A Preconcentrator; 300mL sample concentrated at -160°C, thermally desorbed at 150°C, cryofocused at -185°C, thermally desorbed to column at 150°C
 Carrier gas: helium, constant flow
 Flow rate: 1.2mL/min.
 Oven temp.: 30°C (hold 4 min.) to 175°C @ 8°C/min., to 220°C @ 20°C/min. (hold 2 min.)
 Det.: MS
 Transfer line temp.: 150°C
 Scan range: 35–280amu
 Ionization: EI
 Mode: scan



GC_AR00748

- | | | | |
|---|--|---------------------------------------|-------------------------------|
| 1. propylene | 15. Freon® 113 | 30. cyclohexane | 46. ethylbenzene |
| 2. Freon® 12 (dichlorodifluoromethane) | 1,1,2-trichloro-1,2,2-trifluoroethane) | 31. 1,2-dichloropropane | 47. <i>p</i> -xylene |
| 3. chloromethane | 16. <i>trans</i> -1,2-dichloroethene | 32. trichloroethylene | 48. <i>m</i> -xylene |
| 4. Freon® 114 (dichlorotetrafluoroethane) | 17. 1,1-dichloroethane | 33. bromodichloromethane | 49. bromoform |
| 5. vinyl chloride | 18. methyl <i>tert</i> -butyl ether | 34. 1,4-dioxane | 50. styrene |
| 6. 1,3-butadiene | 19. vinyl acetate | 35. heptane | 51. <i>o</i> -xylene |
| 7. bromomethane | 20. methyl ethyl ketone | 36. <i>cis</i> -1,3-dichloropropene | 52. 1,1,2,2-tetrachloroethane |
| 8. chloroethane | 21. <i>cis</i> -1,2-dichloroethene | 37. methyl isobutyl ketone | 53. 4-ethyltoluene |
| 9. carbon disulfide | 22. hexane | 38. <i>trans</i> -1,3-dichloropropene | 54. 1,3,5-trimethylbenzene |
| 10. acetone | 23. chloroform | 39. 1,1,2-trichloroethane | 55. 1,2,4-trimethylbenzene |
| 11. Freon® 11 (trichlorofluoromethane) | 24. ethyl acetate | 40. toluene | 56. 1,3-dichlorobenzene |
| 12. isopropyl alcohol | 25. tetrahydrofuran | 41. methyl butyl ketone | 57. benzyl chloride |
| 13. 1,1-dichloroethene | 26. 1,2-dichloroethane | 42. dibromochloromethane | 58. 1,4-dichlorobenzene |
| 14. methylene chloride | 27. 1,1,1-trichloroethane | 43. 1,2-dibromoethane | 59. 1,2-dichlorobenzene |
| | 28. benzene | 44. tetrachloroethylene | 60. 1,2,4-trichlorobenzene |
| | 29. carbon tetrachloride | 45. chlorobenzene | 61. hexachloro-1,3-butadiene |



24182

Canisters are the gold standard for ambient VOC monitoring.

Get the ultimate insurance plan—order your SilcoCan® canister with a Siltek® treated valve.

SilcoCan® Air Monitoring Canisters

Ideal for low-level reactive sulfur (1-20 ppb), TO-14A, or TO-15 compounds

- High quality, metal-to-metal seal, 2/3-turn valve with stainless steel diaphragms.
- Sizes to support a wide range of sampling needs.
- 2-port or 3-port valve available; 3-port valve includes -30" Hg/60psi vacuum/pressure gauge (other gauges available).
- Unsurpassed inertness, even for sulfur-containing or brominated compounds.
- For critical applications, order a Siltek® treated valve—add suffix “-650” to the catalog number of the canister.

Features

Benefits

Siltek® treated.	High inertness—ensures sample stability.
High-purity, 2/3-turn valve with stainless steel diaphragms.	No sample adsorption at the valve, for more accurate results; easy to use.
Vacuum/pressure gauge (optional).	Ascertain internal conditions at a glance.
Variety of sizes.	Meet extensive range of sampling needs.
Stable to 250°C.	Heat canister to 250°C for superior cleaning.
Siltek® valve available (add suffix “-650” to cat.#).	Completely passive sample pathway for maximum sample stability.

Description	1L Volume		3L Volume		6L Volume		15L Volume	
	cat.#	price	cat.#	price	cat.#	price	cat.#	price
Parker Diaphragm Valve								
w/ Parker Diaphragm Valve	24180		24181		24182		24183	
w/ Parker Diaphragm Valve, Siltek Treated	24180-650		24181-650		24182-650		24183-650	
w/ Parker Diaphragm Valve, and Gauge*	24140		24141		24142		24143	
w/ Parker Diaphragm Valve, Siltek Treated, and Gauge*	24140-650		24141-650		24142-650		24143-650	
without Valve	22090		22091		22092		22093	

*Range of standard gauge is -30"Hg to 60psi.
For additional gauge and valve options, see pages 412-413.

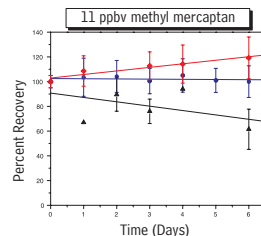
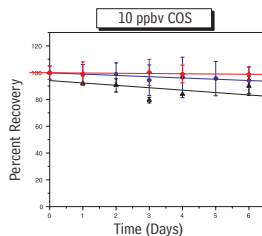
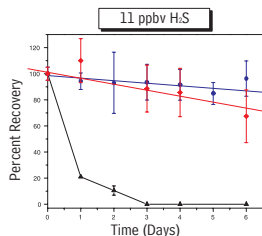


also available

We also offer sampling kits, sampling bags, and a range of gas reference standards to meet your environmental gas sampling requirements. See **pages 414-432**.

Whether you are monitoring for TO-14A, TO-15, or reactive sulfur compounds, SilcoCan® canisters are your best choice for inertness. In Tedlar® bags, the stability of low-level (100 ppbv) sulfur volatile organic compounds (VOCs) is poor, even within 24 hours of sampling. Sulfur compounds react with the metal surface in electropolished canisters, so these canisters are unsuitable for collecting and storing low-level sulfur VOCs. SilcoCan® air monitoring canisters, which feature a Siltek® treated surface, offer excellent storage stability for sulfur VOCs at very low levels (1–20 ppbv), under dry or humid conditions. The versatility of the SilcoCan® canister makes it an excellent choice for collecting and storing TO-14A or TO-15 compounds.

SilcoCan® canisters effectively store very low levels of sulfur compounds.



Standards: Dry standards were made by adding 2mL of a 100ppm stock sulfur standard to each pre-cleaned and evacuated canister, then pressurizing to 30psi with ultra-pure nitrogen. The resultant concentrations are listed in Applications Note #59347A (download your free copy from www.restek.com). Humidified standards were made by injecting 100µL of deionized water into the evacuated canisters prior to adding 2mL of stock standard. This produced 50% RH.

GC Column: Rtx®-1, 60m, 0.53mm ID, 7.0µm; **Detector:** Sievers Model 355 Sulfur Chemiluminescence Detector

- Dry SilcoCan® (n=18)
- Humidified SilcoCan® (n=5)
- Electropolished (n=2)

Improved TO-Can® Air Monitoring Canisters (SUMMA Can Equivalent)

Optimized for EPA Methods TO-14A and TO-15, and ASTM D5466

- Proprietary electropolished surface that maintains compound stability.
- High quality, metal-to-metal seal, 2/3-turn valve with stainless steel diaphragms or Bellows design.
- 2-port or 3-port valve available for diaphragm valve; 3-port valve includes -30" Hg/60 psi vacuum/pressure gauge (other gauges available).

Features

Metal to metal seat, valve with stainless steel diaphragms.
Vacuum/pressure gauge (optional).
Stable to 250°C.

Benefits

No sample adsorption, for more accurate results.
Ascertain internal conditions at a glance.
Heat canister to 250°C for superior cleaning.



please note

- SUMMA canister equivalent.
- Excellent analyte recovery—even after 14 days of storage.

did you know?

TO-Can® canisters are cleaned prior to shipping.

Quickly confirm vacuum or pressure. Request a high-quality gauge mounted on your SilcoCan® or TO-Can® canister.



US EPA Compendium of Air Methods TO-14A and TO-15 regulate the collection, storage, and analysis of volatile organic compounds (VOCs) using treated air sampling canisters. Restek offers a complete line of TO-Can® canisters (SUMMA can equivalent), electropolished using a proprietary process and extensively cleaned using an ultrasonic method. This ensures a high-quality, passivated surface that maintains the stability of TO-14A/TO-15 compounds during storage. The frame surrounds the electropolished canister, eliminating the need for weld marks on the sphere, thereby preventing active sites on the canister. The Parker® Hannifin metal-to-metal diaphragm valve supports the excellent performance of the canister.

The unique holder attaches the handle and base to the canister without welds, and protects the canister, tube stub, and valve. The 2/3-turn diaphragm valve has a metal-to-metal seat and a temperature limit of 250°C. We leak check the system with helium to ensure the TO-Can® canister and valve are leak-tight, then pressurize the canister with contaminant-free nitrogen before we ship it.

Description	1L Volume		3L Volume		6L Volume		15L Volume	
	cat.#	price	cat.#	price	cat.#	price	cat.#	price
Parker Diaphragm Valve								
w/ Parker Diaphragm Valve	24172		24173		24174		24175	
w/ Parker Diaphragm Valve, and Gauge*	24176		24177		24178		24179	
Swagelok SS4H Bellows Valve								
w/ Swagelok SS4H Bellows Valve	22105		22106		22107		22108	
without Valve	22094		22095		22096		22097	

*Range of standard gauge is -30"Hg to 60psi.
For additional gauge and valve options, see pages 412-413.

Alternative Mounted Vacuum/Pressure Gauges
The standard vacuum/pressure range on a SilcoCan® or TO-Can® canister fitted with a gauge is -30" Hg to 60 psi. To have a different gauge mounted on your canister, add the appropriate suffix number to the canister catalog number.*

Gauge	Suffix
-30" Hg/15psi	-651
-30" Hg/30psi	-652

*No price difference for these substituted gauges.

free literature



A Guide to Whole Air Canister Sampling: Equipment Needed and Practical Techniques for Collecting Air Samples

Ambient air sampling involves collecting a representative sample of ambient air for analysis. There are two general approaches: 1) "whole air" sampling with canisters or Tedlar® bags and 2) "in-field concentration" sampling using sorbent tubes or cold traps. In this guide, we focus on collecting whole air samples in canisters, a flexible technique with many applications.

Download your free copy from www.restek.com

Technical Guide
lit. cat.# EVTG1073





Valves and Gauges for Air Monitoring Applications



24144

Replacement Parker® Diaphragm Valves

- High quality, metal-to-metal seal, 2/3-turn valve with stainless steel diaphragms.
- 2-port or 3-port valve available.

Description	Stainless Steel Valve		Siltek-Treated Valve	
	cat.#	price	cat.#	price
1/4" Replacement Valve (2-port)	24145	\$235	24144	
1/4" Replacement Valve (3-port)	24147	\$245	24146	

*All Restek canisters are originally equipped with high-quality Parker Hannifin diaphragm valves. Each valve is helium leak-tested to 4 x 10⁻²cc/sec. The all-stainless steel construction eliminates contamination and withstands temperatures from -100°C to 250°C. Other features include a compression outlet fitting and a 1/4" inlet and outlet.



24148

Replacement Swagelok® SS4H Bellows Valve

- All metal flow path prevents sample adsorption, giving more accurate results.
- Unique serial number on each valve for complete traceability.
- Withstands temperatures of up to 300 °C.
- Rugged performance in the field.
- Fast delivery from Restek!

Restek offers Swagelok® SS4H canister valves. These popular, rugged valves are available separately or already assembled on our TO-Can® canisters. Valves are bellows-sealed for durability and meet all EPA requirements for air monitoring by methods TO-14A and TO-15.

Description	qty.	cat.	price
Replacement 1/4" Swagelok SS4H Bellows-Sealed Valve (2-port)	ea.	24148	

Replacement 1/4" Swagelok SS4H Bellows-Sealed Valves are available on SilcoCan canisters as a custom product. Contact Technical Service for more information.

Replacement Combination Vacuum/Pressure Gauges

2-inch vacuum/pressure gauges, 316 stainless steel with 1/8" NPT fitting and center back mount. Recommended for use with canisters.

Description	qty.	cat.#	price
-30"Hg/15psi Vacuum/Pressure Gauge	ea.	24100	
-30"Hg/30psi Vacuum/Pressure Gauge	ea.	24104	
-30"Hg/60psi Vacuum/Pressure Gauge	ea.	24108	

Alternative Mounted Vacuum/Pressure Gauges

The standard vacuum/pressure range on a SilcoCan® or TO-Can® canister fitted with a gauge is -30" Hg to 60 psi. To have a different gauge mounted on your canister, add the appropriate suffix number to the canister catalog number.*

Gauge	Suffix
-30" Hg/15psi	-651
-30" Hg/30psi	-652

*No price difference for these substituted gauges.



24120

Vacuum Gauges

High-quality vacuum gauges with 316 stainless steel wetted surfaces. -30" Hg to 0" Hg. Recommended for use with passive sampling kits. All are rear mount.

Description	Fittings	qty.	cat.#	price
2" Vacuum Gauge	1/8" NPT	ea.	24269	
2" Vacuum Gauge	1/4" NPT	ea.	24270	
1 1/2" Vacuum Gauge	1/8" NPT	ea.	24120	

Ashcroft® Test Gauges

- Accurate measurement of vacuum to -30" Hg and pressure to 60 psi.
- Available in both analog and digital formats.
- Accuracy to +/- 0.25%.
- Gauge connector to canister valve available.

High accuracy test gauges are recommended for verifying the vacuum/pressure in canisters before and after sampling. The 6-inch face on the analog gauge allows for easy reading. The digital gauge operates on 2 AAA batteries and offers an unambiguous readout. Both gauges have an accuracy of +/- 0.25% and all metal wetted parts.



Description	qty.	cat.#	price
Analog Test Gauge, 6" diameter, 1/4" NPT	ea.	24285	
Digital Test Gauge, 3" diameter, 1/4" NPT	ea.	24268	
Ashcroft Gauge Connector to Canister Valve, stainless steel, connects 1/4" male NPT to 1/4" male compression fitting	ea.	22121	



Choose the Appropriate Device for Your Sampling Needs



	Canister	Gas Sampling Bag	Solvent Desorption Tube
Media Type	whole air	whole air	adsorption
Sensitivity	ppb	ppm	ppm
Technique	passive (no pump)	active	active
Sample Type	grab or integrated	grab	integrated
Analyte	wide range of VOCs	wide range of VOCs & permanent gases	sorbent specific
Applications	ambient, IAQ, emergency response, IH	ambient, IAQ emission	IAQ, IH
Durability	reusable	one time use	one time use
Inertness	excellent	fair	fair
Stability	30 day	48 hrs	varies by analyte
Sample Volume	0.4–6 L	0.5–100 L	varies by analyte
Sampling Time	minutes to days	minutes to hours	minutes to hours

See pages 408-411 for canisters. See page 423 for gas sampling bags. See page 425 for canister and thermal desorption tube comparison.



Passive Air Sampling Kits—Integrated

- Provide accurate integrated sampling without a sampling pump.
- Siltek® treated components ensure accurate sampling of active components.
- Excellent for sampling times from 0.5 hour to 125 hours.

Restek's passive air sampling kit incorporates all the hardware necessary to collect air samples, and is easy to assemble for field sampling.* The improved filter design greatly reduces the number of potential leak sites.

The passive air sampling kit is available in seven sampling flow ranges, and in stainless steel or Siltek® treated finish. The stainless steel kit is ideal to partner with the Restek TO-Can® air sampling canister for TO-14A and TO-15 methods. Use the Siltek® treated version with the Restek SilcoCan® air sampling canister when collecting low-level volatile sulfur compounds, or other active compounds.

also available

Miniature air sampling kits. See **page 420**.

Canister and flow controller repair service. See **page 422**.

Canister Volume*/Sampling Time					Flow (mL/min.)	Orifice size	Siltek Treated Sampling Kits	Stainless Steel Sampling Kits
400cc	1 Liter	3 Liter	6 Liter	15 Liter				
8 hour	24 hour	48 hour	125 hour	—	0.5–2	0.0008"	24217	24216
2 hour	4 hour	12 hour	24 hour	60 hour	2–4	0.0012"	24160	24165
1 hour	2 hour	6 hour	12 hour	30 hour	4–8	0.0016"	24161	24166
—	1 hour	4 hour	8 hour	20 hour	8–15	0.0020"	24162	24167
—	—	2 hour	3 hour	8 hour	15–30	0.0030"	24163	24168
—	—	—	1.5 hour	4 hour	30–80	0.0060"	24164	24169
—	—	—	0.5 hour	1 hour	80–340	0.0090"	22101	22100

*Air sampling canisters sold separately. See pages 410-411.

1. Veriflo® SC423XL flow controller

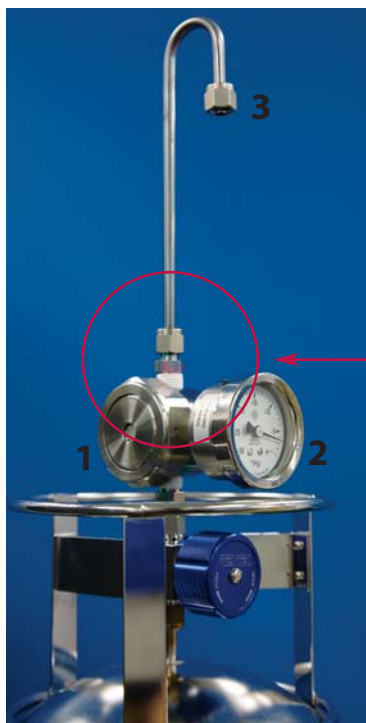
This flow controller is the heart of the sampling train. It is a high-quality device designed to maintain a constant mass flow as the pressure changes from -30" Hg to 7" Hg (we recommend you stop sampling at or before 7" Hg of vacuum). All wetted parts of the flow controller can be Siltek® treated.

2. Stainless steel vacuum gauge, 1/8" NPT

Fitted to the flow controller, the gauge monitors canister vacuum change during sampling.

3. 1/4-inch Siltek® sample inlet

The 0.3 m x 1/4-inch tubing includes a stainless steel nut on the inlet end, to prevent water droplets from accumulating at the edge of the tubing, where they could be pulled into the sampling train.



All fitting connections are 1/4" tube, except where noted.



4. 2-micron frit filter and washer

Located prior to the critical orifice to prevent airborne particles from clogging the critical orifice. Replaceable. Available in stainless steel, or Siltek® treated for optimum inertness.

5. Interchangeable critical orifice

An interchangeable ruby critical orifice allows you to control the flow with very high precision.

To select the correct critical orifice for your sample, see table above. Available in stainless steel, or Siltek® treated for optimum inertness.

please note

For individual components, see **page 415**.

Buy only the parts you need!

Replacement Orifices

Use these orifices with a Veriflo® 423XL flow controller to change the flow range for alternative sampling times.

Flow	Orifice size	Siltek Treated		Stainless Steel	
		cat.#	price	cat.#	price
0.5–2 mL/min.	0.0008"	24219		24218	
2–4 mL/min.	0.0012"	24233		24245	
4–8 mL/min.	0.0016"	24234		24246	
8–15 mL/min.	0.0020"	24235		24247	
15–30 mL/min.	0.0030"	24236		24248	
30–80 mL/min.	0.0060"	24237		24249	
80–340 mL/min.	0.0090"	22099		22098	



Critical orifice



24249

2 µm Frit Filters

For use in critical orifice fitting. Includes washers.

Description	qty.	cat.#	price
Replacement Frit Filter, Siltek Treated	3-pk.	24171	
Replacement Frit Filter, Stainless Steel	3-pk.	24170	



24171

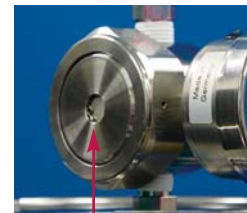
24170

Veriflo® Flow Controllers

Veriflo® 423XL flow controllers are offered in a Siltek® and stainless steel version. The flow device is available with or without a critical orifice. (Vacuum gauge sold separately.)

The critical orifice in a Veriflo® flow controller is interchangeable. Order orifices for alternate sampling times, or replacement orifices, separately.

Flow	Orifice size	Siltek Treated		Stainless Steel	
		cat.#	price	cat.#	price
0.5–2 mL/min.	0.0008"	24232		24229	
2–4 mL/min.	0.0012"	24255		24260	
4–8 mL/min.	0.0016"	24256		24261	
8–15 mL/min.	0.0020"	24257		24262	
15–30 mL/min.	0.0030"	24258		24263	
30–80 mL/min.	0.0060"	24259		24264	
80–340 mL/min.	0.0090"	22103		22102	
	without orifice	24238		24239	



Flow controller



24262

7µm In-Line Filter

This 316 stainless steel filter is designed to collect particles larger than 7 microns. We offer Siltek® and stainless steel versions (1/4" compression fitting on both ends).

Description	qty.	cat.#	price
7µm In-Line Filter, Siltek Treated	ea.	24265	
7µm In-Line Filter, Stainless Steel	ea.	24266	

Note: frit is not replaceable.



24266

Sample Inlets

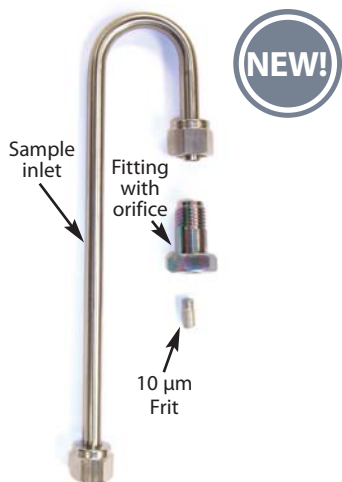
- 1/4" stainless steel compression fitting on each end.
- One end connects to flow controller or canister; nut on other end serves as rain guard.
- Includes nuts and ferrules.
- Two different lengths for use with large canisters and miniature canisters.

Description	qty.	Siltek Treated		Stainless Steel	
		cat.#	price	cat.#	price
Sample Inlet, 6" Length	ea.	26210		26209	
Sample Inlet, 1.5" Length	ea.	26212		26211	



26209

26211



Unassembled kit components

NEW!

Passive Air Sampling Kits—Grab

- Use with 1, 3, or 6 L canisters, for qualitative grab air sampling.
- Variety of orifice sizes, for fast sampling from 5 to 60 minutes.
- 1/4" compression fitting connects directly to canister valve inlet.
- Replaceable frit protects orifice and valve from particulates.
- Sample inlet design minimizes water entry into sampling train.
- Individual replacement components available.

Canister Volume/Sampling Time (min.)			Flow (mL/min.)	Orifice Size	Siltek Treated Grab Sampling Kits		Stainless Steel Grab Sampling Kits	
1 L Canister	3 L Canister	6 L Canister			cat.#	price	cat.#	price
60	—	—	15	0.0018"	26280		26263	
30	—	—	20	0.0020"	26281		26264	
15	60	—	45	0.0030"	26282		26265	
—	30	60	80	0.0040"	26283		26266	
5	15	30	150	0.0055"	26284		26267	
—	—	15	300	0.0080"	26285		26268	
—	5	—	390	0.0090"	26286		26269	
—	—	5	>1,000	0.0130"	26287		26270	

Air sampling canisters sold separately. See pages 410-411.

Replacement Fittings for Grab Sampling Kits

Includes fitting and orifice.

Orifice Size	Siltek Treated Replacement Fitting w/Orifice		Stainless Steel Replacement Fitting w/Orifice	
	cat.#	price	cat.#	price
0.0018"	26288		26271	
0.0020"	26289		26272	
0.0030"	26290		26273	
0.0040"	26291		26274	
0.0055"	26292		26275	
0.0080"	26293		26276	
0.0090"	26294		26277	
0.0130"	26295		26278	

Replacement 10 µm Frits for Grab Sampling Kits

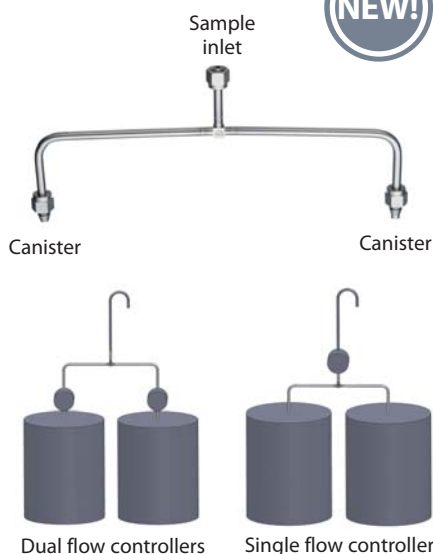
Description	qty.	Siltek Treated		Stainless Steel	
		cat.#	price	cat.#	price
10µm Frit for Grab Sampling Kit	3-pk.	26296		26279	



Assembled kit on canister

Air sampling canisters sold separately.

NEW!



Dual Canister Sampling Manifold

- Duplicate sampling with all size canisters using 1 or 2 flow controllers.
- Precise dimensions (9.5" wide x 3.5" high) provide accurate splitting of sample between two canisters.
- One-piece design means fewer leaks.
- Thick walled stainless steel tubing is rugged enough for field use.
- 1/4" compression connections.

Field duplicates of canister samples frequently result in analyte concentrations with high relative standard deviations. In addition, field duplicates do not differentiate laboratory performance from sampling variability. Restek's Dual Canister Sampling Manifold (DCSM) minimizes sampling variability through a single sample inlet and flow controller by which the sample is evenly collected between two canisters. Use of a single flow controller eliminates flow rate variability, as well as environmental variables common with collocated samples. The DCSM may also be used with 2 flow controllers to monitor individual canister vacuum.

Description	Stainless Steel		Sulfinert Treated	
	cat.#	price	cat.#	price
Dual Canister Sampling Manifold	24998	\$112	24999	

Note: Do not use the DCSM as a handle to pick up 2 canisters!

Passive Air Sampling Kits—Soil Gas

This unique grab sampler is specifically designed for soil gas sampling by allowing the connection of tubing coming from the soil gas sample port. The innovative design minimizes connections and leaks and houses a critical orifice in the tee fitting. It also incorporates a vacuum gauge and 2 µm frit filter.

Assembled sampler includes:

- Stainless steel tee with orifice.
- 1½" vacuum gauge (-30" Hg to 0" Hg).
- 2 µm frit filter for insertion into ¼" compression sample inlet.
- ¼" port connector to canister valve.

The ¼" compression inlet and outlet allows easy connection to the canister valve and also to the tubing from the sample port. Several orifice sizes provide sampling times from 20 min. to 10 hours on a 6 L canister. Individual replacement parts are available, providing a cost-effective alternative to replacing the entire sampler.



Assembled kit on canister

Air sampling canisters sold separately.

Sampling Time		Flow	Orifice Size	Siltek Treated Soil Gas Samper Kit		Stainless Steel Soil Gas Samper Kit	
for 1 L Canister	for 6 L Canister			cat.#	price	cat.#	price
4 min.	20 min.	210 mL/min.	0.0065"	22935		22930	
6 min.	30 min.	150 mL/min.	0.0055"	22936		22931	
10 min.	1 hr.	80 mL/min.	0.0040"	22937		22932	
45 min.	4 hr.	19 mL/min.	0.0020"	22938		22933	
2 hr.	10 hr.	6 mL/min.	0.0014"	22939		22934	

*Air sampling canisters sold separately. See pages 410-411.

Replacement Tees w/Orifice for Soil Gas Sampler Kits

Orifice Size	Siltek Treated Replacement Tee w/Orifice		Stainless Steel Replacement Tee w/Orifice	
	cat.#	price	cat.#	price
0.0065"	22945		22940	
0.0055"	22946		22941	
0.0040"	22947		22942	
0.0020"	22948		22943	
0.0014"	22949		22944	



Use Restek's Electronic Leak Detector for tracer gas detection before soil gas sampling. See page 204.

Replacement Parts for Soil Gas Sampler Kits

Description	qty.	cat.#	price
Vacuum Gauge, 1 ½"	ea.	24120	
Replacement Frit Filter, Stainless Steel	3-pk.	24170	
Replacement Frit Filter, Siltek Treated	3-pk.	24171	
Port Connector, ¼", Siltek/Sulfinert Treated	ea.	21549	
Port Connector, ¼", Stainless Steel	2-pk.	21936	
Nut & Ferrule Set, ½", Stainless Steel	5-pk.	21911	
Nut, ¼", Stainless Steel	10-pk.	21902	

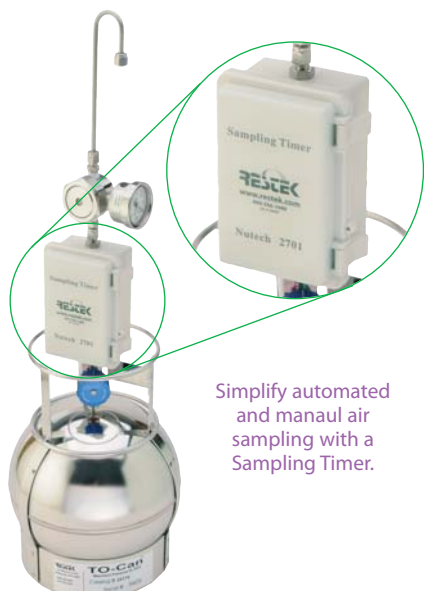


also available

VCO® Fittings

- Use VCO® fittings for rapid assembly to cleaning system.
 - Protect canister valves, flow controllers, and cleaning system fittings.
- See page 322.





Simplify automated and manual air sampling with a Sampling Timer.

Canister and passive air sampling kit must be purchased separately.

Canister Air Sampling Timer

- Program up to 12 timed events!
- Capable of both manual and automated operation.
- Perfect for either grab or time-integrated sampling.
- Long battery life; recharges conveniently using the USB port on any PC.
- All stainless steel sample flow path ensures inertness, improving accuracy.



These timers are designed to simplify both automated and manual air sampling. The easy-to-use keypad and graphic display facilitate the programming of up to 12 timed events. They offer the convenience of remote start/stop sampling and permit intermittent sampling throughout a test period. The LCD remains in sleep mode when not in use, greatly extending battery life. Timers are compatible with any canister and flow controller.

Features include: solenoid valve for sampling control, 1/4" Swagelok® inlet and outlet fittings, highly inert stainless steel flow path, and water-proof exterior for outdoor use.

Description	qty.	cat.#	price
Canister Air Sampling Timer	ea.	24267	



TO-Clean Canister Cleaning System

High capacity, fully automated, easy to use canister cleaning oven dramatically increases lab efficiency.

- EPA Method TO-14A/15 compliant.
- Powerful pump can achieve 50 mTorr in 30 minutes for twelve 6 L canisters.
- Custom-built trays for different canister sizes.
- One year limited warranty.
- Fully assembled and ready to use.

TO-Clean from Wasson-ECE Instrumentation is a revolutionary canister cleaning system designed to take the guesswork out of canister cleaning. The system is fully automated, allowing the user to start a cleaning cycle and walk away. This is a high performance system that is easy to use and consistently produces excellent results.



Dimensions:
44"H x 48"W x 27"L
Weight: 525 lbs

Feature	Benefit
Large capacity—holds 12 6L cans or 24 1L cans.	Twice the capacity of other ovens for faster turnaround.
Embedded touch screen controller.	No separate computer needed.
Adjustable oven control up to 110 °C.	Cleans canisters AND valves faster and more completely than heating bands.
10 user defined methods.	Each cleaning cycle parameter can be configured separately to minimize overall cycle time.
Edwards RV-8 vacuum pump.	Cheaper to run and maintain than 2 pump alternatives.
Vacuum and pressure stainless steel cold traps.	Keeps the system clean—no contamination from the pump or dirty canisters.

	Restek	Entech
Capacity	Twelve-6 L cans	Six-6 L cans
Software	Included	Separate

www.restek.com/air

for **more info**

Download **EVTS1186.pdf** from www.restek.com

Description	qty.	cat.#	price
TO-Clean Oven, 120V, 60Hz	ea.	22916	
TO-Clean Oven, 220/230V, 50/60Hz	ea.	22917	
Optional Accessories (not included with TO-Clean Oven)	qty.	cat.#	price
Dewar, glass, 4300mL stainless steel u-tube trap	ea.	22918	
Oven Cart, 29"H x 27"W x 49"D, 12 gauge steel, push handle and casters	ea.	22919	
1L Option: includes tubing, fittings, and inserts for 24 1L canisters	ea.	22920	
Humidification Chamber	ea.	24282	

Shipping: FedEx Ground, unless otherwise requested. Costs vary depending on ship-to location.

Note: Ovens are built on demand, therefore, a ten week lead time is required on all orders. A limited cancellation and return policy applies to TO-Clean ovens; contact Restek Customer Service for details.

Air Canister Heating Jacket

- Closely simulates oven environment—heats entire canister and valve.
- Two temperature settings, 75 °C and 150 °C.*
- Prevents sample condensation, for accurate sub-sampling.
- Easily fits canister up to 6 liters.
- Lightweight; comfortable to the touch when heated.
- Connect up to five Canister Heating Jackets to one 15 amp circuit.



The ultimate in controlled heating, for reliably cleaning your air canisters!

Description	qty.	cat.#	price
Air Canister Heating Jacket (110 volt)	ea.	24123	

*Not CE certified.

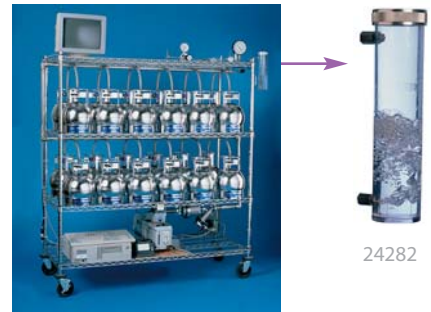
Humidification Chamber

When cleaning SilcoCan® or TO-Can® canisters, it is important to use humidified air or nitrogen to help remove volatile organic contaminants. We incorporated our humidification chamber into the design of our cleaning system. Restek's humidification chamber is made of acrylic and withstands pressure up to 90 psi. The 1/4-inch inlet and outlet compression fittings allow easy connection to pressure lines on your cleaning system. Our humidification chamber also has an easy-to-open lid for filling with water.

Description	qty.	cat.#	price
Humidification Chamber	ea.	24282	

did you **know?**

After assembly, every Restek SilcoCan® and TO-Can® canister is evacuated to 50 mTorr, then pressurized with humidified nitrogen to 30 psi. The cleaning system is programmed to repeat this cycle two times to ensure thorough cleaning. We ship our canisters clean and under pressure at 30 psi with dry nitrogen.



Restek's canister cleaning system with humidification chamber.

Air Canister Tripod

- Lightweight (9 pounds) and compact, for easy storage and transport.
- Extends from 6' to 9' high.
- Large base provides enhanced stability, without additional supports.
- Sturdy, rugged metal design, for outdoor sampling and transport.



Restek's Air Canister Tripod holds two canisters simultaneously for collocated ambient air sampling. The custom-designed bracket holds most 1, 3, and 6 L canisters securely, without any tools.*



Air Canister Tripod conveniently holds 2 air canisters.

Description	qty.	cat.#	price
Air Canister Tripod	ea.	24151	

*Air sampling canisters sold separately. See pages 410-411.

Canister Carrying Supplies

Canister Carrying Box Kit

6-liter carrying boxes with plastic handles simplify canister transport. These boxes also accommodate our passive sampling kit. 4 carrying boxes and 1 shipping box per kit.

Description	qty.	cat.#	price
Canister Carrying Box Kit	kit	24215	

Canister Carrying Case

- Heavy-duty, all-aluminum design, fits two 6 L SilcoCan® or TO-Can® canisters tightly without foam.
- Weight: 9 lbs.
- Inside dimensions: length 18", width 9 1/8", height 12 1/2" (46 x 23 x 32 cm).
- No organic contaminants from foam or plastics.



24226

Description	qty.	cat.#	price
Deluxe Canister Carrying Case	ea.	24226	



24215

Restek canisters are shipped in boxes with handles for easy transportation.





Expand Air Sampling with Mini-Cans & Accessories

Replacement Partspage #
 Flow Controller415
 Gauge412
 Orifices415
 Sample Inlet415

- Grab and integrated sampling without sampling pump.
- 8-hr integrated sample possible with 400 cc mini-can.
- Siltek® coating delivers high level of inertness for H₂S & other reactive compounds.
- Versatile enough for many applications:
 - Indoor air
 - Industrial hygiene
 - Soil gas
 - Emergency response



Miniature Air Sampling Kits

- Provide accurate integrated sampling without a sampling pump.
- Convenient smaller size connects easily to miniature canisters.
- Available in stainless steel or Siltek® treated components for greater inertness.

Restek's passive air sampling kit incorporates all the hardware necessary to collect air samples, and is easy to assemble for field sampling.* Kit includes flow controller, critical orifice, 2 µm frit filter, vacuum gauge, and sample inlet. The gauge (cat.# 24120) and sample inlet (cat.#s 26211, 26212) are downsized for partnering with smaller canisters. Refer to page 414 for sampling kit details and pages 412 and 415 for individual components.

Canister Volume*/Sampling Time			Orifice size	Siltek Treated Sampling Kits	Stainless Steel Sampling Kits
400cc	1 Liter	Flow			
8 hour	24 hour	0.5–2 mL/min.	0.0008"	26253	26252
2 hour	4 hour	2–4 mL/min.	0.0012"	26255	26254
1 hour	2 hour	4–8 mL/min.	0.0016"	26257	26256
—	1 hour	8–15 mL/min.	0.0020"	26259	26258

*Air sampling canisters sold separately.



Mini-Can Accessories

These accessories enhance mini-can usage and provide flexibility in their application, from personal to area to vapor intrusion sampling.

Sampling Belt:

- Adjustable up to 50"
- 2 velcro straps securely hold mini-can or other sampling device
- Straps slide anywhere on belt
- Versatile usage for personal wear or hanging for area sampling



Sampling Belt & Personal Sample Inlet

Personal Sample Inlet:

- 3' long x 1/16" OD all Teflon® tubing
- Convenient clip can be moved along length of tubing for proper attachment in breathing zone
- Teflon® reducing ferrule allows direct connection from 1/16" tubing to 1/4" flow controller without another fitting

Mini-Can Stand:

- Collapsible for easy storage and transport
- 2 out of 3 legs move to accommodate uneven surfaces
- Holds 2 3/4" diameter cans securely
- Small footprint—12" diameter x 6.5" height



Mini-Can Stand

Mini-Can and Sampling Kit not included.

Description	qty.	cat.#	price
Sampling Belt	ea.	22122	
Personal Sample Inlet (includes: 3' x 1/16" OD Teflon tubing, Clip, Teflon Reducing Ferrule, 1/4" SS nut)	ea.	22123	
Mini-Can Stand	ea.	22124	

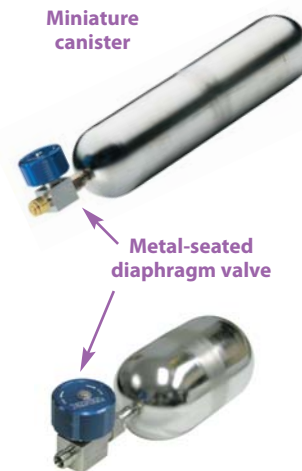
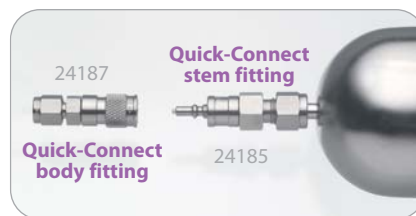
Miniature Air Sampling Canisters

- Ideal for indoor air, personal, emergency response, or soil gas sampling.
- 400 cc or 1,000 cc.
- Available with quick-connect fitting that is compatible with sampling and analysis instruments.
- Also available with nontreated or Siltek® treated valve.

These small canisters are designed for controlled sampling, such as personal air sampling, as an alternative to tube and pump samplers. The 1,000 cc canister is suitable for sampling volatile organic compounds in air according to US EPA Methods TO-14A and TO-15.

Restek offers these products in stainless steel or Siltek® treated, for greatest inertness. We continue to offer passive coating technologies that are unmatched in the air sampling industry—try a Siltek® treated canister to achieve the ultimate in analyte stability.

Description	qty.	400cc		1,000cc	
		cat.#	price	cat.#	price
Miniature Canister with Quick-Connect Stem Fittings					
Electropolished Stainless Steel	ea.	24188		24194	
Siltek Treated	ea.	24189		24195	
Siltek Treated, with Siltek Treated Quick-Connect Stem Fitting	ea.	24190		24196	
Miniature Canister with Parker Diaphragm Valve					
Electropolished Stainless Steel	ea.	24191		24197	
Siltek Treated	ea.	24192		24198	
Siltek Treated, with Parker Diaphragm Valve, Siltek Treated	ea.	24193		24199	
Miniature Canister without Valve					
Electropolished Stainless Steel	ea.	24205		24206	
Siltek Treated	ea.	24207		24208	



Dimensions:
 400cc = 2.75" diameter, 5.35" long (7 x 13.6cm)
 1,000cc = 2.75" diameter, 11.92" long (7 x 30cm)


Quick-Connect Fittings for Miniature Air Sampling Canisters
 Connection: 1/4" tube fitting.

Description	qty.	cat.#	price
Quick-Connect Stem Fitting	ea.	24185	
Quick-Connect Stem Fitting, Siltek Treated	ea.	24186	
Quick-Connect Stem Protector, Stainless Steel	ea.	24121	
Quick-Connect Body Fitting	ea.	24187	

Note: Quick-connect body fitting (cat.# 24187) must be ordered separately to sample with quick-connect stem fitting.



Attach quick-connect body fitting to stem fitting to open canister. Attach quick-connect stem protector to stem fitting when not sampling to prevent canister from accidentally opening.



Get Mini!

Mini-Can Options

Sizes	400 cc, 1000 cc
Valves	Quick connect, diaphragm
Interior Coating	Electropolished, Siltek treated
Sample Inlets	Area, personal
Flow ranges	0.5-15 mL/min.

i tech tip

Use a Gap Inspection Gauge to confirm fittings are sufficiently tightened. See page 325.



How to Extend Canister Life

What reduces canister performance and longevity? Leakage is the most common reason for canister failure, but contamination and damage to the fused silica lining can also send canisters to the scrap yard prematurely. Here are some tips to protect your investment:

1. Prevent leaks

Use proper handling to avoid these 3 leading causes of leaks.

a. Particles in the valve

You can prevent particles from entering the valve by always using a 2 or 7 μm particulate filter during sampling and on your canister cleaning equipment. Also, protect the valve inlet by replacing the brass dust cap when not in use. The EPA-recommended metal-to-metal sealing valves provide the greatest inertness, but tend to be more sensitive to particulate damage than other valve types.

b. Galled thread fittings

Avoid galled thread fittings by using a gap gauge to prevent overtightening of compression fittings. Turning only $\frac{1}{4}$ turn past finger-tight is another rule of thumb to prevent overtightening. Use brass compression fittings on stainless steel, during nonsampling activities, such as cleaning or calibration, to minimize thread damage. Galled threads may also cause a poor connection to vacuum/pressure gauges, resulting in inaccurate measurement and misleading conclusion that canister leakage exists.

c. Overtightened valve

Canister valves are designed to close securely with hand tightening only. Overtightening a valve closure with a wrench may damage the valve seat where the seal is made.

2. Reduce contamination

a. Segregate high concentration (ppm) cans and trace concentration (ppb) cans. Use dedicated canisters, or gas sampling bags, for ppm level sampling, since it is extremely difficult to remove impurities from ppm sampling to a level suitable for trace sampling.

b. Clean the entire sampling train as you would the can to minimize introduction of contaminants into a clean can. Maximum temperature is 80 °C on the gauge and 90 °C on Restek's Veriflo® flow controller.

c. High temperature (>100 °C) humidified air (steam cleaning) provides the most effective way to remove contamination from electropolished cans (TO-Can® or SUMMA® canisters), but can damage fused silica lined cans. See #3 below for proper cleaning of fused silica lined cans.

3. Avoid damage to fused silica lined cans

Be sure to follow method recommendations when cleaning your canisters to avoid damaging the fused silica lining. Cleaning studies of SilcoCan® canisters using humidified air and heat at 80 °C and 125 °C have shown reduced recoveries of sulfur compounds, when compared to using nitrogen under the same conditions. This irreversible damage is due to oxidation of the surface, creating active sites that may affect the recovery of reactive or polar compounds. Strong acids and bases may also result in damage to the internal can surface.



Canister and Flow Controller Repair Service

Save money and increase performance with Restek's canister and flow controller repair service.

Normal wear and tear on canisters and components can result in damage causing leakage. Restek's repair service allows you to extend the life of your equipment for much less than the cost to replace with new products. Contact Customer Service at 800-356-1688, or your Restek representative, to take advantage of this service. You will be given instructions and an SRV # to return the parts to us.

Sampling Kit/Flow Controller Repair

Includes all new rubber seals in flow controller and orifice and frit replacement
cat.# 550131

Canister Repair

Includes valve replacement, leak test & cleaning
cat.# 560838

Tedlar® Sampling Bags

- Find the bags you need—we offer sizes from 0.5 liters to 100 liters.
- Unique all-in-one septum and valve fitting make these lightweight and easy to use.
- Polypropylene or stainless steel valve.
- Both valves conveniently connect to 3/16" ID Teflon® tubing.

Description			Polypropylene Valve		Stainless Steel Valve	
		qty.	cat.#	price	cat.#	price
0.5L	6" x 6"	10-pk.	22049		22038	
1L	7" x 7"	10-pk.	22050		22039	
3L	9.5" x 10"	10-pk.	22051		22040	
5L	12" x 12.5"	10-pk.	22052		22041	
10L	11.75" x 22"	10-pk.	22053		22042	
12L	13" x 24"	10-pk.	22054		22043	
25L	17.5" x 24"	5-pk.	22055		22044	
40L	24" x 24.25"	5-pk.	22056		22045	
80L	28.25" x 30.5"	5-pk.	22057		22046	
100L	28" x 36"	3-pk.	22058		22047	

Description	qty.	cat.#	price
Teflon Faced Silicone Replacement Septum, 4mm diameter	10-pk.	22104	



tech tip

Use septum puller (cat.# 20117) to replace septum in sampling bag valve.



Description	qty.	cat.#	price
Septum Puller	ea.	20117	\$16.25

also available

Multi-layer foil bags

Visit www.restek.com

Vacuum Bag Sampler

- Fast bag sampling without sample passing through pump.
- Bag capacity up to 10 L.

The Model 1062 Vacuum Bag Sampler provides fast sampling with zero cross-contamination. A vacuum created in the box draws air into the sampling bag without drawing it through the vacuum pump first, as is the case with standard air sampling pumps, thereby preventing contamination of the sample. This bag sampler can fill a 10 L bag in two minutes with an automatic shut-off switch, which stops the sample bag from overfilling. The filling rate is adjusted with a vent rotometer valve. An external battery recharging port enables continuous operation with battery charger. In addition, the quick exhaust valve allows for fast removal of the sampling bag. The sampler comes with a universal power adapter/charger, battery, instruction manual, and 1-year limited warranty.

Specifications:	
Sampling Bag:	1 bag up to 10L size
Running Time:	8 hours
Flow Rate (Fill Rate):	1-5L/min.
Power Requirements:	12V battery, 4.5 amp
Charge Time:	9 hours
Dimensions:	9" x 14.6" x 21.7"
Weight:	17 lbs

Description	qty.	cat.#	price
Vacuum Bag Sampler Model 1062 (includes: power adapter, battery, manual)	ea.	22118	
Replacement Battery for Vacuum Bag Sampler Model 1062	ea.	22119	
Universal Battery Charger for Vacuum Bag Sampler Model 1062 (115/230 VAC)	ea.	22120	



Features:

- Observation window on case lid
- Sample inlet accepts 1/4" OD tubing
- Case designed for rugged outdoor use
- CE certified

ChromaBLOGraphy
 Topical and timely insights from top chromatographers.
 Visit us at blog.restek.com



method **applications**

Method	Application
US EPA	TO-17
ASTM	D6196
NIOSH	2549
DIN EN ISO	16017

Specifications

Dimensions: 1/4" OD x 3 1/2" long
 Low sampling rates: 0.01-0.20 L/min.
 (<10L total volume)
 Long-term storage caps are supplied
 with conditioned tubes

Thermal Desorption Unit (TDU) Tubes

- Variety of sorbents to collect a wide range of VOCs, including Tenax® and carbon sorbents.
- Use glass tubes for maximum inertness in active sampling.
- Choose stainless steel tubes for either active or passive sampling. No sampling pump necessary for passive sampling with diffusion caps!
- Individually etched with unique serial number for convenient sample identification.
- Available unconditioned or preconditioned and ready to sample. Tubes are reusable after thermal desorption.

High-quality thermal desorption tubes by Markes International. These sorbent tubes are suitable for ppt to ppm concentrations of volatile organic compounds (VOCs) in ambient, indoor, and industrial hygiene environments. Available in both stainless steel and glass (for thermally labile VOCs), they fit Markes ULTRA-UNITY™, PerkinElmer, and Shimadzu thermal desorbers. Packed tubes come with a report detailing the total mass of sorbent in the tube; conditioned tubes also include a blank chromatogram.

Thermal Desorption Tube Sorbent	Vapor Phase Organics Applications
Tenax® TA	C6/7 to C26
Graphitized Carbon	C5/6 to C14
Tenax® GR/Carbopack™ B	n-C5/6 to n-C20 (EPA Methods TO-14A/TO-15/TO-17)
Carbopack™ B/Carbosieve™ SIII	n-C2/3 to n-C12/14 (EPA Methods TO-14A/TO-15/TO-17)
Tenax® TA/Graphitized Carbon/Carboxen™ 1000	C2/3 to C20
Carbopack™ C/Carbopack™ B/Carbosieve™ SIII	n-C2/3 to n-C16/20 (EPA Methods TO-14A/TO-15/TO-17)

Thermal Desorption Unit Tubes (Unconditioned and Conditioned & Capped)

Description	qty.	Unconditioned		Conditioned & Capped	
		Stainless Steel cat.#	Glass price	Stainless Steel cat.#	Glass price
TDU Tubes, Tenax TA	10-pk.	24056	24062	24080	24086
TDU Tubes, Graphitized Carbon	10-pk.	24057	24063	24081	24087
TDU Tubes, Tenax GR/Carbopack B	10-pk.	24058	24064	24082	24088
TDU Tubes, Carbopack B/Carbosieve SIII	10-pk.	24059	24065	24083	24089
TDU Tubes, Tenax TA/Graphitized Carbon/Carboxen 1000	10-pk.	24060	24066	24084	24090
TDU Tubes, Carbopack C/Carbopack B/Carbosieve SIII	10-pk.	24061	24067	24085	24091

Thermal Desorption Unit Tubes (Empty)

- Empty tubes for direct desorption of VOCs in liquids, solids, or pastes.
- Stainless steel: front sorbent-retaining gauze fitted, rear gauze and gauze retaining spring supplied.
- Glass: with glass frit positioned 15 mm from sampling end.

Description	qty.	Stainless Steel cat.#	Glass price
TDU Tubes, Empty	10-pk.	24054	24055

Thermal Desorption Unit Tubes (Calibration)

Description	qty.	Stainless Steel cat.#	Glass price
TDU Tubes, Calibration, Tenax TA 1cm Bed	10-pk.	24075	24076
Calibration Solution Loading Rig	ea.		24077
Calibration Solution Loading Rig Replacement Septa, 9.5mm	10-pk.		24078
Certified Reference Standard, 100ng BTX on Tenax TA	10-pk.		24079

Thermal Desorption Unit Tubes (Accessories)

Description	Benefits/Uses	qty.	cat.	price
1/4" Brass Cap and PTFE Ferrules	Long-term storage of blank/sampled tubes.	20-pk.	24068	
1/4" PTFE Ferrules	Long-term storage caps.	20-pk.	24069	
CapLok Tool	Use for tightening long-term storage caps.	ea.	24070	
Pen Clip		10-pk.	24071	
TubeMate Tool	Assists with tube packing.	ea.	24072	
1/4" Stainless Steel Union and PTFE Ferrules	Use for connecting tubes in series.	10-pk.	24073	
Diffusion Caps	Required for diffusive sampling with stainless steel tubes.	10-pk.	24074	



Thermal Desorption Tubes vs. Canister Sampling

Which VOC Sampling Technique is Right for You?

Thermal desorption tubes provide a complementary option to canisters for sampling VOCs. Both techniques have advantages and disadvantages, and their features must be evaluated for suitability relative to the sampling environment and analytical capabilities. Table I outlines the similarities and differences between these techniques; use this handy comparison to determine which equipment is best for you.

Table I Comparison of thermal desorption tube and canister sampling for VOCs.

Similarities Between Thermal Desorption Tubes and Canisters

- Reusable sampling device.
- Long product lifetime.
- Long-term sample stability.
- Blank certification required prior to sampling.
- Sample concentration required before GC/MS analysis.
- Dry purge helpful to remove moisture before GC injection.
- Ppt sensitivity.
- Method acceptance.
- Collection of wide range of VOCs with single device.
- Useful for screening of unknowns.
- Leak tightness critical to maintaining sample integrity and preventing contamination of a clean device.

Differences Between Thermal Desorption Tubes and Canisters

	Thermal Desorption Tubes	Canisters
Methods	US EPA TO-17 ASTM D6196 ISO 16017 ISO 16000-6 NIOSH 2549	US EPA TO-14A, TO-15 ASTM D5466 OSHA PV2120 NIOSH Protocol Draft
	World-wide acceptance	Gold standard for US ambient air market
Applications	Ambient air, indoor air, industrial hygiene Material emissions Food & flavor Chemical weapons	Ambient air, indoor air, vapor intrusion, emergency response
	C3 to C30	<C3 to ~C10
Handling	Light weight for personal monitoring and general ease of use	Larger and heavier; more costly to ship
Sampling	Active sampling with sampling pump or diffusive sampling without pump is possible with determined diffusion coefficients for each compound.	Passive sampling, no sampling pump required. Long-term sampling possible without battery to recharge.
	Integrated sampling only	Grab & integrated sampling
	Concentrated sample	Whole air
	Proper sorbent selection recommended in methodology.	N/A
	Must sample below sorbent breakthrough volumes to avoid sample loss and irreversible adsorption on sorbent	N/A
	Large sample volumes >100L	Sample volume is function of canister size, 15 L max
Analysis	Tube dimensions are instrument specific	Compatible with all manufacturer sample concentrators
	1 injection, more injections possible for some instrumentation	Multiple sample injections
	Concentration range ppt to ppm	ppt to ppm
	Some sorbents prone to artifact formation.	Low blanks when properly cleaned.
Storage	Sample storage at 4°C recommended for multi-bed tubes to prevent potential migration of compounds to more retentive sorbent, which may be difficult to recover.	Room temperature
Cleaning	Analytical process automatically cleans tube for reuse. Cleans as it analyzes. Conditioning/cleaning and analysis incorporated in one thermal desorption unit.	Canister cleaning requires separate equipment as additional step prior to background certification and sampling.
Cost	\$50–130 each	\$200–700 each



free literature

A Guide to Whole Air Canister Sampling: Equipment Needed and Practical Techniques for Collecting Air Samples

lit. cat.# EVTG1073



Thermal Desorption Tubes: Versatile Air Sampling for a Wide Range of Applications

lit. cat.# EVFL1065

Download your copies from www.restek.com



tech guides

Thermal desorption application guides are available for a broad range of markets. Request your FREE copy today using these part numbers.

Environmental Air Monitoring and Occupational Health & Safety

lit. cat.# EVTG1034

Residual Volatiles & Materials Emissions Testing

lit. cat.# GNTG1035

Defense & Forensic

lit. cat.# CFTG1036

Food, Flavor, Fragrance & Odor Profiling

lit. cat.# FFTG1037





Restek's Ultra-Clean resin eliminates the hassle of cleaning and testing resin for air sampling.

Sampling Supplies for Semivolatiles in Air

Everything you need for sampling semivolatile compounds in air: Ultra-Clean resin, PUF sampling cartridges.

Ultra-Clean Resin

- For adsorbing semivolatiles in air.
- Cleaned, GC tested and certified.
- Available in 100 gram quantities.

Although resin is an excellent adsorbent for trapping PAHs, it requires extensive clean-up because many of its impurities are PAH compounds. To enable you to eliminate time-consuming clean-up, we do the cleaning for you! We test each batch by capillary GC/flame ionization detector to ensure cleanliness.

method applications

Method	Applications
EPA TO-13A	PAHs in Ambient Air
ASTM D6209	PAHs in Ambient Air
EPA Method 23	Dioxins in Stationary Source Emissions
EPA Method 0010	Semivolatiles in Stationary Source Emissions

Description	cat.#	Price-per-bottle		
		1-4 bottles	5-9 bottles	10+ bottles
Ultra-Clean Resin, 100 grams	24230			

SDVB Resin

- Styrene/divinylbenzene, equivalent to XAD-2 resin.
- Untreated, packaged in 1 kg plastic containers.
- Spherical, 20 to 60 mesh particles.

Description	qty.	cat.#	price
SDVB Resin	1kg	24053	

Larger quantities available upon request.

Cleaned Polyurethane Foam (PUF) Cartridges

- Precleaned and ready to use for collection of semivolatiles (pesticides, PCBs, PAHs).
- Both large high-volume (220-280 L/min.) and small low-volume (1-5 L/min.) PUFs available.
- Suitable for ambient, indoor, and industrial hygiene applications.
- PUF/XAD-2 "sandwiches" capture a wider range of semivolatiles.



method applications

Method	Applications	cat.#
EPA TO-10A	Organochlorine and organophosphorous pesticides, carbamate, pyrethrin, triazine, and urea pesticides	22116
EPA IP-7	Polycyclic aromatic hydrocarbons (PAHs)	22114
EPA IP-8	Organochlorine and organophosphorous pesticides, carbamate, pyrethrin, triazine, and urea pesticides	22116
ASTM D4861	Organochlorine and organophosphorous pesticides, PCB	22116
ASTM D4947	Chlordane and heptachlor residues	22116
Research	Pesticides	22117
EPA TO-4A	Organochlorine pesticides, PCBs	22114
EPA TO-9A	Polychlorinated dibenzo- <i>p</i> -dioxins (PCDDs)	22114
EPA TO-13A	Polycyclic aromatic hydrocarbons (PAHs)	22114
EPA 600/8-80-038	Organochlorine pesticides, PCBs, PAHs	22115
ASTM D6209	Polycyclic aromatic hydrocarbons (PAHs)	22114

Description	qty.	cat.#	price
Cleaned PUF Plug (7.6cm length, 6cm diameter)	ea.	24295	
Large PUF Cartridge, 65mm OD x 125mm length, 75mm PUF	ea.	22114	
Large PUF/XAD Cartridge, 65mm OD x 125mm length, 25mm PUF/10g XAD-2/50mm PUF	ea.	22115	
Small PUF Cartridge, 22mm OD x 100mm length, 76mm PUF	ea.	22116	
Small PUF/XAD Cartridge, 22mm OD x 100mm length, 30mm PUF/1.5g XAD-2/30mm PUF	ea.	22117	



22114



22115



22116



22117

also available

Untreated PUF Plugs

Visit www.restek.com

Environmental Air Monitoring Gas Standards

Our high-quality air monitoring gas calibration standards are provided by Spectra/Linde and Scott/Air Liquide—meeting lab requirements for two separate sources of calibration standards. Mixes are produced gravimetrically using NIST (National Institute of Science and Technology) traceable weights. Each comes with a Certificate of Analysis and unique serial number. All cylinders are disposable and do not require rental or demurrage fees. Recertification of cylinders is available directly with our suppliers. All cylinders are drop-shipped from our suppliers to provide fast delivery and the “freshest” standard possible. 12-month stability on all cylinders unless otherwise specified.

TO-14A Calibration Mix (39 components)

benzene	ethyl chloride
bromomethane	hexachloro-1,3-butadiene
carbon tetrachloride	methylene chloride
chlorobenzene	styrene
chloroform	1,1,2,2-tetrachloroethane
chloromethane	tetrachloroethylene
1,2-dibromoethane	toluene
<i>m</i> -dichlorobenzene	1,2,4-trichlorobenzene
<i>o</i> -dichlorobenzene	1,1,1-trichloroethane
<i>p</i> -dichlorobenzene	1,1,2-trichloroethane
dichlorodifluoromethane	trichloroethene
1,1-dichloroethane	trichlorofluoromethane
1,2-dichloroethane	1,1,2-trichlorotrifluoroethane
1,1-dichloroethene	1,2,4-trimethylbenzene
<i>cis</i> -1,2-dichloroethene	1,3,5-trimethylbenzene
1,2-dichloropropane	vinyl chloride
<i>cis</i> -1,3-dichloropropene	<i>m</i> -xylene
<i>trans</i> -1,3-dichloropropene	<i>o</i> -xylene
dichlorotetrafluoroethane	<i>p</i> -xylene
ethyl benzene	
1ppm in nitrogen, 104 liters @ 1,800psi cat. # 34400 (ea.)	
100ppb in nitrogen, 104 liters @ 1,800psi cat. # 34421 (ea.)	
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder) cat. # 34400-PI (ea.)	
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder) cat. # 34421-PI (ea.)	

TO-14A 41 Component Mix (41 components)

acrylonitrile	ethyl benzene
benzene	ethyl chloride
bromomethane	hexachloro-1,3-butadiene
1,3-butadiene	methylene chloride
carbon tetrachloride	styrene
chlorobenzene	1,1,2,2-tetrachloroethane
chloroform	tetrachloroethylene
chloromethane	toluene
1,2-dibromoethane	1,2,4-trichlorobenzene
<i>m</i> -dichlorobenzene	1,1,1-trichloroethane
<i>o</i> -dichlorobenzene	1,1,2-trichloroethane
<i>p</i> -dichlorobenzene	trichloroethene
dichlorodifluoromethane	trichlorofluoromethane
1,1-dichloroethane	1,1,2-trichlorotrifluoroethane
1,2-dichloroethane	1,2,4-trimethylbenzene
1,1-dichloroethene	1,3,5-trimethylbenzene
<i>cis</i> -1,2-dichloroethene	vinyl chloride
1,2-dichloropropane	<i>m</i> -xylene
<i>cis</i> -1,3-dichloropropene	<i>o</i> -xylene
<i>trans</i> -1,3-dichloropropene	<i>p</i> -xylene
dichlorotetrafluoroethane	
1ppm in nitrogen, 104 liters @ 1,800psi cat. # 34430 (ea.)	
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder) cat. # 34430-PI (ea.)	
100ppb in nitrogen, 104 liters @ 1,800psi cat. # 34431 (ea.)	
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder) cat. # 34431-PI (ea.)	

please note

Gas standards are subject to hazardous materials shipping fees by most freight carriers. All calibration gas standards are nonreturnable due to DOT hazardous shipping requirements.

TO-14A 43 Component Mix (43 components)

acrylonitrile	ethyl benzene
benzene	ethyl chloride
bromomethane	4-ethyltoluene
1,3-butadiene	hexachloro-1,3-butadiene
carbon tetrachloride	methylene chloride
chlorobenzene	styrene
chloroform	1,1,2,2-tetrachloroethane
chloromethane	tetrachloroethylene
3-chloropropene	toluene
1,2-dibromoethane	1,2,4-trichlorobenzene
<i>m</i> -dichlorobenzene	1,1,1-trichloroethane
<i>o</i> -dichlorobenzene	1,1,2-trichloroethane
<i>p</i> -dichlorobenzene	trichloroethene
dichlorodifluoromethane	trichlorofluoromethane
1,1-dichloroethane	1,1,2-trichlorotrifluoroethane
1,2-dichloroethane	1,2,4-trimethylbenzene
1,1-dichloroethene	1,3,5-trimethylbenzene
<i>cis</i> -1,2-dichloroethene	vinyl chloride
1,2-dichloropropane	<i>m</i> -xylene
<i>cis</i> -1,3-dichloropropene	<i>o</i> -xylene
<i>trans</i> -1,3-dichloropropene	<i>p</i> -xylene
dichlorotetrafluoroethane	
1ppm in nitrogen, 104 liters @ 1,800psi cat. # 34432 (ea.)	
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder) cat. # 34432-PI (ea.)	
100ppb in nitrogen, 104 liters @ 1,800psi cat. # 34433 (ea.)	
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder) cat. # 34433-PI (ea.)	

2nd Source TO-14A/TO-15 Gas Calibration Standards

- Standards from TWO manufacturers provide second source on one order.
- 12 month stability in transportable cylinders.
- Drop shipped for fast delivery and maximum shelf life.



- A. Spectra (Linde)**
104L Cylinders
- B. Scotty (Air Liquide)**
110L Cylinders
(Pi-marked Cylinders for EU Regulations)

For regulators, see page 433.



For more available gas standards, visit www.restek.com/air



TO-14A GC/MS Tuning Mix

4-bromofluorobenzene	
1ppm in nitrogen, 104 liters @ 1,800psi	cat. # 34406 (ea.)
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34406-PI (ea.)
100ppb in nitrogen, 104 liters @ 1,800psi	cat. # 34424 (ea.)
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34424-PI (ea.)

TO-14A Aromatics Mix (14 components)

benzene	toluene
chlorobenzene	1,2,4-trichlorobenzene
<i>m</i> -dichlorobenzene	1,2,4-trimethylbenzene
<i>o</i> -dichlorobenzene	1,3,5-trimethylbenzene
<i>p</i> -dichlorobenzene	<i>m</i> -xylene
ethyl benzene	<i>o</i> -xylene
styrene	<i>p</i> -xylene
1ppm in nitrogen, 104 liters @ 1,800psi	cat. # 34404 (ea.)
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34404-PI (ea.)
100ppb in nitrogen, 104 liters @ 1,800psi	cat. # 34423 (ea.)
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34423-PI (ea.)

TO-14A Chlorinated Hydrocarbon Mix (19 components)

carbon tetrachloride	hexachloro-1,3-butadiene
chloroform	methyl chloride
1,1-dichloroethane	methylene chloride
1,2-dichloroethane	1,1,2,2-tetrachloroethane
1,1-dichloroethene	tetrachloroethylene
<i>cis</i> -1,2-dichloroethylene	1,1,1-trichloroethane
1,2-dichloropropane	1,1,2-trichloroethane
<i>cis</i> -1,3-dichloropropene	trichloroethene
<i>trans</i> -1,3-dichloropropene	vinyl chloride
ethyl chloride	
1ppm in nitrogen, 104 liters @ 1,800psi	cat. # 34402 (ea.)
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34402-PI (ea.)
100ppb in nitrogen, 104 liters @ 1,800psi	cat. # 34422 (ea.)
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34422-PI (ea.)

TO-14A Internal Standard Mix (3 components)

bromochloromethane	1,4-difluorobenzene
chlorobenzene-d5	
1ppm in nitrogen, 104 liters @ 1,800psi	cat. # 34412 (ea.)
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34412-PI (ea.)
100ppb in nitrogen, 104 liters @ 1,800psi	cat. # 34427 (ea.)
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34427-PI (ea.)

TO-14A Internal Standard/Tuning Mix (4 components)

bromochloromethane	chlorobenzene-d5
1-bromo-4-fluorobenzene (4-bromofluorobenzene)	1,4-difluorobenzene
1ppm in nitrogen, 104 liters @ 1,800psi	cat. # 34408 (ea.) \$690
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34408-PI (ea.)
100ppb in nitrogen, 104 liters @ 1,800psi	cat. # 34425 (ea.)
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34425-PI (ea.)

TO-15 Subset 25 Component Mix (25 components)

acetone	4-ethyltoluene
allyl chloride	heptane
benzyl chloride*	hexane
bromodichloromethane	2-hexanone (MBK)
bromoform	4-methyl-2-pentanone
1,3-butadiene	methyl <i>tert</i> -butyl ether (MTBE)
2-butanone (MEK)	2-propanol
carbon disulfide*	propylene
cyclohexane	tetrahydrofuran
dibromochloromethane	2,2,4-trimethylpentane
<i>trans</i> -1,2-dichloroethene	vinyl acetate
1,4-dioxane	vinyl bromide
ethyl acetate	
1ppm in nitrogen, 104 liters @ 1,800psi	cat. # 34434 (ea.)
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34434-PI (ea.)
100ppb in nitrogen, 104 liters @ 1,800psi	cat. # 34435 (ea.)
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34435-PI (ea.)

*Stability of this compound cannot be guaranteed.

TO-15 65 Component Mix (65 components)

acetone	1,2-dichlorotetrafluoroethane (Freon 114)
acrolein	heptane
benzene	hexachloro-1,3-butadiene
benzyl chloride*	hexane
bromodichloromethane	2-hexanone (MBK)
bromoform	4-methyl-2-pentanone (MIBK)
bromomethane	methylene chloride
1,3-butadiene	methyl <i>tert</i> -butyl ether (MTBE)
2-butanone (MEK)	methyl methacrylate
carbon disulfide*	naphthalene
carbon tetrachloride	2-propanol
chlorobenzene	propylene
chloroethane	styrene
chloroform	1,1,2,2-tetrachloroethane
chloromethane	tetrachloroethene
cyclohexane	tetrahydrofuran
dibromochloromethane	toluene
1,2-dichlorobenzene	1,2,4-trichlorobenzene
1,3-dichlorobenzene	1,1,1-trichloroethane
1,4-dichlorobenzene	1,1,2-trichloroethane
1,1-dichloroethane	1,2-dichloroethane
1,2-dichloroethane	1,1-dichloroethene
1,1-dichloroethene	<i>cis</i> -1,2-dichloroethene
<i>cis</i> -1,2-dichloroethene	<i>trans</i> -1,2-dichloroethene
<i>trans</i> -1,2-dichloroethene	1,2-dichloropropane
1,2-dichloropropane	<i>cis</i> -1,3-dichloropropene
<i>cis</i> -1,3-dichloropropene	<i>trans</i> -1,3-dichloropropene
<i>trans</i> -1,3-dichloropropene	1,4-dioxane
1,4-dioxane	ethanol*
ethanol*	ethyl acetate
ethyl acetate	ethyl benzene
ethyl benzene	ethylene dibromide (1,2-dibromoethane)
ethylene dibromide (1,2-dibromoethane)	4-ethyltoluene
4-ethyltoluene	trichlorofluoromethane (Freon 11)
trichlorofluoromethane (Freon 11)	dichlorodifluoromethane (Freon 12)
dichlorodifluoromethane (Freon 12)	1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)
1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)	
1ppm in nitrogen, 104 liters @ 1,800psi	cat. # 34436 (ea.)
1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34436-PI (ea.)
100ppb in nitrogen, 104 liters @ 1,800psi	cat. # 34437 (ea.)
100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)	cat. # 34437-PI (ea.)

*Stability of this compound cannot be guaranteed.

Now with Naphthalene!



TO-14A/TO-15/TO-17 Performance Test Standard

Restek is pleased to offer the Performance Testing/VOC Audit Sample Program in cooperation with Spectra/Linde. This is an on-going testing program in which laboratories, and/or other users of VOC standards, are able to evaluate their own capabilities, as well as compare their results and accuracy against other laboratories. As a participant in the program, you will receive a disposable cylinder, directly from Spectra/Linde, containing multiple unknown TO-14A/TO-15 components at varying concentrations that are to be identified, quantified, and reported via the Spectra/Linde P-T Audit Program forms. The results will be published and distributed for peer review. To ensure confidentiality, all participating laboratories will be anonymous, and only the individual laboratory will know their own results. To provide statistical analysis, the audit sample will be shipped to all laboratories at the same time, once a year during the fourth quarter.

cylinder design

Performance Test Standard

Size: 5A disposable (3.2" x 12")
Volume/Pressure: 150L @ 1,800 psig
CGA 180 outlet fitting
Weight: 2.2 lbs

150 liters @ 1,800psig
cat. # 34560 (ea.) \$1040

BTEX Gas Mix (6 components)

benzene	<i>m</i> -xylene
ethylbenzene	<i>o</i> -xylene
toluene	<i>p</i> -xylene

1ppm in nitrogen, 104 liters @ 1,800psi
cat. # 34414 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)
cat. # 34414-PI (ea.)

100ppb in nitrogen, 104 liters @ 1,800psi
cat. # 34428 (ea.)

100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)
cat. # 34428-PI (ea.)

BTEX and MTBE Gas Mix (7 components)

benzene	<i>m</i> -xylene
ethylbenzene	<i>o</i> -xylene
methyl <i>tert</i> -butyl ether (MTBE)	<i>p</i> -xylene
toluene	

1ppm in nitrogen, 104 liters @ 1,800psi
cat. # 34541 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)
cat. # 34541-PI (ea.)

100ppb in nitrogen, 104 liters @ 1,800psi
cat. # 34542 (ea.)

100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)
cat. # 34542-PI (ea.)



Higher Concentration =
MORE STANDARD for
your money!

Sulfur 5-Component Mix (5 components)

12-month stability. +/- 10% accuracy.

carbonyl sulfide	hydrogen sulfide
dimethyl sulfide	methyl mercaptan
ethyl mercaptan	

1ppm in nitrogen, 110 liters @ 1,800psi
cat. # 34561 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)
cat. # 34561-PI (ea.)

Massachusetts APH Mix (26 components)

benzene	<i>p</i> -isopropyltoluene
1,3-butadiene	methyl <i>tert</i> -butyl ether
butylcyclohexane	1-methyl-3-ethylbenzene
cyclohexane	naphthalene
<i>n</i> -decane	<i>n</i> -nonane
2,3-dimethylheptane	<i>n</i> -octane
2,3-dimethylpentane	toluene
<i>n</i> -dodecane	1,2,3-trimethylbenzene
ethylbenzene	1,3,5-trimethylbenzene
<i>n</i> -heptane	<i>n</i> -undecane
<i>n</i> -hexane	<i>o</i> -xylene
isopentane	<i>m/p</i> -xylene (combined)
isopropylbenzene	

1ppm in nitrogen, 104 liters @ 1,800psi
cat. # 34540 (ea.)

140-450ppb in nitrogen, 90 liters @ 1,500psig (Pi-marked Cylinder)
cat. # 34540-PI (ea.)



Japan Calibration Mix (9 components)

acrylonitrile	dichloromethane
benzene	tetrachloroethylene
1,3-butadiene	trichloroethylene
chloroform	vinyl chloride
1,2-dichloroethane	

1ppm in nitrogen, 104 liters @ 1,800psi
cat. # 34418 (ea.)

1ppm in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)
cat. # 34418-PI (ea.)

cylinder design

Spectra (Linde) 104L Cylinders:

Aluminum construction
Size: 8 x 24 cm
Volume/Pressure: 104 liters of gas @ 1,800 psi
CGA-180 outlet fitting.
Weight: 1.5 lbs/0.7 kg



Scotty (Air Liquide) 110L Cylinders (Pi-marked Cylinders for EU Regulations):

Aluminum construction
Size: 8.3 x 29.5 cm
Volume/Pressure: 110 liters of gas @ 1,800 psi
CGA-180 outlet fitting.
Weight: 2.2 lbs/1 kg
US DOT Specs: 3AL2216



did you know?

Pi-marked Gas Cylinders for EU Countries

Our Pi-marked gas standards from Scotty/Air Liquide meet the requirements of the Transportable Pressure Equipment Directive (TPED) implemented in 2001 that regulates the safe transport of pressurized containers used throughout the European community.

Custom Gas Calibration Standards Quote

www.restek.com/customgas





Ozone Precursor Mixture/PAMS (57 components)

acetylene	isopropylbenzene
benzene	methylcyclohexane
<i>n</i> -butane	methylcyclopentane
1-butene	2-methylheptane
<i>cis</i> -2-butene	3-methylheptane
<i>trans</i> -2-butene	2-methylhexane
cyclohexane	3-methylhexane
cyclopentane	2-methylpentane
<i>n</i> -decane	3-methylpentane
<i>m</i> -diethylbenzene	<i>n</i> -nonane
<i>p</i> -diethylbenzene	<i>n</i> -octane
2,2-dimethylbutane	<i>n</i> -pentane
2,3-dimethylbutane	1-pentene
2,3-dimethylpentane	<i>cis</i> -2-pentene
2,4-dimethylpentane	<i>trans</i> -2-pentene
<i>n</i> -dodecane	propane
ethane	<i>n</i> -propylbenzene
ethylbenzene	propylene
ethylene	styrene
<i>m</i> -ethyltoluene	toluene
<i>o</i> -ethyltoluene	1,2,3-trimethylbenzene
<i>p</i> -ethyltoluene	1,2,4-trimethylbenzene
<i>n</i> -heptane	1,3,5-trimethylbenzene
<i>n</i> -hexane	2,2,4-trimethylpentane
1-hexene	2,3,4-trimethylpentane
isobutane	<i>n</i> -undecane
isopentane	<i>o</i> -xylene
isoprene	<i>m/p</i> -xylene (combined)

1ppm in nitrogen, 104 liters @ 1,800psi

cat. # 34420 (ea.)

1ppm in nitrogen, 30 liters @ 500psi (Pi-marked Cylinder)

cat. # 34420-PI (ea.)

100ppb in nitrogen, 104 liters @ 1,800psi

cat. # 34429 (ea.)

100ppb in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34429-PI (ea.)

Ozone Precursor/PAMS Mix

(57 components at EPA concentrations: ppbC)

acetylene	40	isopropylbenzene	40
benzene	30	methylcyclohexane	30
<i>n</i> -butane	40	methylcyclopentane	25
1-butene	30	2-methylheptane	25
<i>cis</i> -2-butene	35	3-methylheptane	25
<i>trans</i> -2-butene	25	2-methylhexane	25
cyclohexane	40	3-methylhexane	25
cyclopentane	20	2-methylpentane	20
<i>n</i> -decane	30	3-methylpentane	40
<i>m</i> -diethylbenzene	40	<i>n</i> -nonane	25
<i>p</i> -diethylbenzene	25	<i>n</i> -octane	30
2,2-dimethylbutane	40	<i>n</i> -pentane	25
2,3-dimethylbutane	50	1-pentene	25
2,3-dimethylpentane	50	<i>cis</i> -2-pentene	35
2,4-dimethylpentane	40	<i>trans</i> -2-pentene	25
<i>n</i> -dodecane	40	propane	40
ethane	25	<i>n</i> -propylbenzene	30
ethylbenzene	25	propylene	25
ethylene	20	styrene	40
<i>m</i> -ethyltoluene	25	toluene	40
<i>o</i> -ethyltoluene	30	1,2,3-trimethylbenzene	25
<i>p</i> -ethyltoluene	40	1,2,4-trimethylbenzene	40
<i>n</i> -heptane	25	1,3,5-trimethylbenzene	25
<i>n</i> -hexane	30	2,2,4-trimethylpentane	30
1-hexene	60	2,3,4-trimethylpentane	25
isobutane	25	<i>o</i> -xylene	30
isopentane	40	<i>m/p</i> -xylene (combined)	25
isoprene	40		40

20-60ppbC in nitrogen, 104 liters @ 1,800psi

cat. # 34445 (ea.)

20-60ppbC in nitrogen, 110 liters @ 1,800psi (Pi-marked Cylinder)

cat. # 34445-PI (ea.)



24129

Small Cylinder Stand

- Supports and stabilizes disposable gas cylinders.
- Fits cylinders up to 3³/₈" (8 cm) in diameter.
- Adjustable screw secures cylinder in place.

This cylinder stand is designed to support small diameter cylinders, such as 104 L and 110 L disposable cylinders. It is a simple, safe, and economical way to stabilize the position of small cylinders, while keeping them within close proximity. The stand is constructed of heavyweight painted steel and includes an adjustable screw for safely securing cylinders.

Description	qty.	cat.#	price
Small Cylinder Stand	ea.	24129	

2nd Source TO-14A/TO-15 Gas Calibration Standards

- Standards from TWO manufacturers provide second source on one order.
- 12 month stability in transportable cylinders.
- Drop shipped for fast delivery and maximum shelf life.



A.



B.

**A. Spectra (Linde)
104L Cylinders**

**B. Scotty (Air Liquide)
110L Cylinders
(Pi-marked Cylinders
for EU Regulations)**

For regulators,
see page 433.



For more available gas standards,
visit www.restek.com/air

Natural Gas and Refinery Gas Standards

- Each available in three varying concentrations.
- Mini-regulator designed specially for these standards.

Natural Gas Standards

Available in three mixes, from lean to rich. Each has an extended list of C6+ components.

	Natural Gas Standard #1 cat.# 34438, ea. % each compound**	Natural Gas Standard #2 cat.# 34439, ea. % each compound**	Natural Gas Standard #3 cat.# 34440, ea. % each compound**
nitrogen	1.000	2.500	5.000
carbon dioxide	0.500	1.000	1.500
methane UHP	94.750	85.250	70.000
ethane UHP	2.000	5.000	9.000
propane	0.750	3.000	6.000
isobutane	0.300	1.000	3.000
<i>n</i> -butane	0.300	1.000	3.000
isopentane	0.150	0.500	1.000
<i>n</i> -pentane	0.150	0.500	1.000
hexanes plus*	0.100	0.250	0.500
Concentration	mole	mole	mole
Volume	13.16L @ 200psig	13.16L @ 200psig	5.5L @ 75psig
Ideal Heating Value (Dry BTU/SCF)	1048 gross	1142 gross	1317 gross

Refinery Gas Standards

Available in three mixes with varying C5 unsaturates or extended C6+ components.

	Refinery Gas Standard #1 cat.# 34441, ea. % each compound**	Refinery Gas Standard #2 cat.# 34442, ea. % each compound**	Refinery Gas Standard #5 cat.# 34443, ea. % each compound**
hydrogen	40.750	12.500	12.500
argon	0.500	1.000	1.000
nitrogen	4.000	37.200	37.200
carbon monoxide	1.000	1.000	1.000
carbon dioxide	3.000	3.000	3.000
methane	8.500	5.000	5.000
ethane	6.000	4.000	4.000
ethylene	2.000	2.000	2.000
acetylene	—	1.000	1.000
propane	7.000	6.000	6.000
propylene	3.000	3.000	3.000
propadiene	0.850	1.000	1.000
cyclopropane	—	0.040	—
isobutane	6.000	5.000	5.000
<i>n</i> -butane	4.000	4.000	4.000
isobutylene	2.000	1.000	1.000
1,3 butadiene	3.000	3.000	3.000
<i>cis</i> -2-butene	2.000	2.000	2.000
<i>trans</i> -2-butene	2.000	3.000	3.000
butene-1	2.000	2.000	2.000
2-methyl-2-butene	—	0.200	0.200
isopentane	1.000	1.000	1.000
<i>n</i> -pentane	1.000	1.000	1.000
<i>cis</i> -2-pentene	—	0.400	0.400
<i>trans</i> -2-pentene	—	0.160	0.200
pentene-1	—	0.400	0.400
<i>n</i> -hexane	0.500	0.100	—
hexanes plus	—	—	0.100
Concentration	mole	mole	mole
Volume	5.2L @ 70psig	4.9L @ 60psig	4.6L @ 60psig

*Contact Restek or your Restek representative for a complete list of hexanes plus.

**Precise concentrations are provided on the data sheet included with each cylinder and may vary slightly from those listed here.

please note

Gas standards on this page are not available in Pi-marked cylinders for EU countries.



cylinder design

DCG Partnership Cylinders:

Size: 7.6 x 24 cm

CGA-170/110 connection.

US DOT Specs: DOT-4B-240ET

Please note: This cylinder is not approved for use in Canada.



also available

See page 433 for regulators.



Scott/Air Liquide Transportable Pure Gases and Mixtures

We offer a wide range of Scott/Air Liquide transportable gases, from pure gases for purging or calibrating to multi-component mixes which are ideal for peak identification work.

The 14-liter container has a CGA 160 connection for more precise integration with analytical systems. The 48-liter cylinder has a CGA 165 connection, and can deliver large volumes of sample. The 110-liter cylinder has a CGA 180 connection.

See regulators pages 433-434 for cylinder information.

Description	Shelf Life	Scotty 14 (14 Liter)		Scotty 48 (48 Liter)		Scotty 110 (110 Liter)	
		cat.#	price	cat.#	price	cat.#	price
Pure Gases							
Air, zero (THC < 1ppm)	2 yrs.	34448		34449		34449-PI	
Argon, 99.995%	2 yrs.	34457		—	—	34457-PI	
Carbon dioxide, 99.80%	2 yrs.	34451		34452		34452-PI	
Hydrogen, 99.99%	2 yrs.	34453		—	—	34453-PI	
Methane, 99.00%	2 yrs.	34454		—	—	34454-PI	
Oxygen, 99.60%	2 yrs.	34455		—	—	—	—

Two-Component Mixtures

Benzene in air (1ppm)	1 yr.	—	—	34458		34458-PI	
Benzene in air (100ppm)	1 yr.	—	—	34459		34459-PI	
1,3-Butadiene in nitrogen (10ppm)	2 yrs.	34460		34461		34461-PI	
Carbon dioxide in helium (100ppm)	2 yrs.	34462		—	—	34462-PI	
Carbon dioxide in nitrogen (100ppm)	2 yrs.	34463		34464		34464-PI	
Carbon dioxide in nitrogen (1000ppm)	2 yrs.	34465		34466		34466-PI	
Ethylene in air (8-10ppm)	2 yrs.	34467		34468		34468-PI	
Ethylene in helium (100ppm)	2 yrs.	34489		—	—	34489-PI	
Hydrogen in helium (100ppm)	2 yrs.	34469		—	—	34469-PI	
Hydrogen in nitrogen (1%)	2 yrs.	34471		34472		34472-PI	
Hydrogen in nitrogen (100ppm)	2 yrs.	34473		34474		34474-PI	
Methane in helium (100ppm)	2 yrs.	34476		34477		34477-PI	
Methane in nitrogen (100ppm)	2 yrs.	34478		—	—	34478-PI	
Methane in nitrogen (1%)	2 yrs.	34482		34483		34483-PI	
Nitrogen in helium (100ppm)	2 yrs.	34479		—	—	34479-PI	
Nitrous oxide in nitrogen (1ppm)	2 yrs.	34484		34485		34485-PI	
Oxygen in helium (100ppm)	2 yrs.	34480		—	—	34480-PI	
Oxygen in nitrogen (2%)	2 yrs.	34487		34488		34488-PI	
Oxygen in nitrogen (6%)	2 yrs.	34491		34492		34492-PI	
1,1,1-Trichloroethane in nitrogen (10ppm)	2 yrs.	—		34493		34493-PI	
Trichloroethylene in nitrogen (10ppm)	2 yrs.	34494		34495		34495-PI	
Vinyl chloride in nitrogen (1ppm)	2 yrs.	34496		34497		34497-PI	
Vinyl chloride in nitrogen (10ppm)	2 yrs.	34498		34499		34499-PI	
Vinyl chloride in nitrogen (50ppm)	2 yrs.	34500		—	—	34500-PI	
Vinyl chloride in nitrogen (100ppm)	2 yrs.	34501		—	—	34501-PI	
Vinyl chloride in nitrogen (1000ppm)	2 yrs.	34502		—	—	34502-PI	

Multi-Component Mixtures

Carbon monoxide, carbon dioxide, hydrogen and oxygen in nitrogen (0.5% each)	2 yrs.	34504		34505		34505-PI	
Carbon monoxide, carbon dioxide, hydrogen and oxygen in nitrogen (1% each)	2 yrs.	34507		34508		34508-PI	
Carbon monoxide, carbon dioxide, methane, ethane, ethylene and acetylene in nitrogen (1% each)	1 yr.	—	—	34511		34511-PI	
Carbon monoxide, carbon dioxide, nitrogen, and oxygen, (5% each) and methane and hydrogen (4% each) in helium	2 yrs.	34512		—	—	34512-PI	
Carbon monoxide (7%), carbon dioxide (15%) and oxygen (5%) in nitrogen	2 yrs.	34514		—	—	34514-PI	
Carbon monoxide (7%), oxygen (4%), carbon dioxide (15%) and methane (4.5%) in nitrogen	2 yrs.	34515		34516		34516-PI	
C1-C6 <i>n</i> -Paraffins: methane, ethane, propane, butane, pentane, hexane in nitrogen (15ppm each)	2 yrs.	34518		34519		34519-PI	
C1-C6 <i>n</i> -Paraffins: methane, ethane, propane, butane, pentane, hexane in helium (100ppm each)	2 yrs.	34521		34522		34522-PI	
C1-C6 <i>n</i> -Paraffins: methane, ethane, propane, butane, pentane, hexane in helium (1000ppm each)	2 yrs.	34524		34525		34525-PI	
C1-C6 <i>n</i> -Paraffins: methane, ethane, propane, butane, pentane, hexane in nitrogen (100ppm each)	2 yrs.	34527		34528		34528-PI	
C2-C6 Olefins: ethylene, propylene, 1-butene, 1-pentene, 1-hexene in helium (100ppm each)	2 yrs.	34529		34530		34530-PI	
C2-C6 Olefins: ethylene, propylene, 1-butene, 1-pentene, 1-hexene in nitrogen (100ppm each)	2 yrs.	34531		34532		34532-PI	
Branched Paraffins: 2,2-dimethylbutane, 2,2-dimethylpropane, isobutane, 2-methylbutane, 2-methylpentane, 3-methylpentane in nitrogen (15ppm each)	2 yrs.	34534		—	—	34534-PI	
Methane, ethane, ethylene, acetylene, propane, propylene, <i>n</i> -butane, propyne in nitrogen (15ppm each)	1 yr.	—	—	34537		34537-PI	
<i>n</i> -butane, isobutane, <i>cis</i> -2-butene, <i>trans</i> -2-butene, 1-butene, iso-butylene, 1,3-butadiene, ethyl acetylene in nitrogen (15ppm each)	1 yr.	—	—	34539		34539-PI	



Gas Regulators for Transportable Cylinders

For this cylinder:

DCG Partnership Cylinders:
Size: 7.6 x 24 cm
CGA-170/110 connection.
US DOT Specs: DOT-4B-240ET
Please note: This cylinder is not approved for use in Canada.



Use this regulator:

Mini-Regulator for natural gas and refinery gas standards

- 0–300 psig inlet pressure range.
- 0–15 psig outlet pressure range.
- Supplied with 0–15 psig outlet pressure gauge, brass CGA 170 nut and nipple.



22032

Description	qty.	cat.#	price
Mini-Regulator	ea.	22032	

For these cylinders:

Spectra (Linde) 104L:
 Aluminum construction
 Size: 8 x 24 cm
 Volume/Pressure:
 104 liters of gas
 @ 1,800 psi
 CGA-180 outlet fitting.
 Weight: 1.5 lbs/0.7 kg



Scotty® (Air Liquide) 110L (Pi-marked Cylinders for EU Regulations):
 Aluminum construction
 Size: 8.3 x 29.5 cm
 Volume/Pressure:
 110 liters of gas @ 1,800 psi
 CGA-180 outlet fitting.
 Weight: 2.2 lbs/1 kg
 DOT Specifications: 3AL2216



Use these regulators:

Spectra Gas 7621 High-Purity VOC Regulator

- Single-stage, stainless steel.
- Two pressure gauges and CGA-180 fitting.
- 3,000 psig maximum inlet pressure.
- Stainless steel diaphragm and Kel-F® seat.
- 1/8-inch tube compression outlet.
- Low internal volume: 3.03 cc.
- Accurate pressure control even at low flow rates.
- Individually tested for leaks and impurities.



21572

Description	qty.	cat.#	price
0–30psig outlet pressure gauge	ea.	21572	
0–100psig outlet pressure gauge	ea.	21572-R100	

See next page for a syringe adapter kit.

Continued on next page.



For these cylinders:

Scotty® (Air Liquide) 14

Contents: 14 liters
 Pressure: 240 psig (17 bar)
 Outlet Fitting: CGA 160
 Weight: 1.5 lbs/0.7 kg
 Dimensions: 3" diameter x
 11" height (7.6 x 28 cm)
 DOT Specifications: 4B240



Scotty® (Air Liquide) 48

Contents: 48 liters
 Pressure: 300 psig (21 bar)
 Outlet Fitting: CGA 165
 Weight: 1.75 lbs/0.8 kg
 Dimensions: 4" diameter x
 16 1/4" height (10.2 x 41 cm)
 DOT Specifications: 39 NRC



Use these regulators:

Regulators

for use with 14-liter and 48-liter Scott (Air Liquide) Transportable Gases

Specifications:

Maximum Inlet Pressure: 300 psig
 Outlet Pressure Range: 2–10 psig
 Maximum Delivery Pressure: 25 psig
 Operating Temperature Range:
 35 °F to 150 °F (2 °C to 65 °C)
 Outlet Connection: 1/4" female NPT

Materials of Construction:

Body: Brass
 Diaphragm: Viton®
 Seat: Acetal
 Seal: Viton®

Use the CGA 160 inlet connection with 14-liter Scott/Air Liquide Transportable Gases. Use the CGA 165 inlet connection with 48-liter Scott/Air Liquide Transportable Gases.



Description	qty.	cat.#	price
Regulator, CGA 160 Inlet Connection	ea.	22690	
Regulator, CGA 165 Inlet Connection	ea.	22691	



Syringe Adapter Kit for Single-Stage VOC Regulator

Use to withdraw sample from a high-pressure cylinder after pressure reduction through the high-purity VOC single-stage regulator.

Kit contains one nickel-plated brass 1/4" NPT to female luer fitting, which can be used with an A-2 Luer syringe (cat.# 20162 or 20163, see page 385), and one stainless steel 1/4" NPT x 1/8" compression fitting with septum (can be used with any syringe needle).

Description	qty.	cat.#	price
Syringe Adapter Kit	kit	21118	

also available

Single-Stage and Dual-Stage
 Ultra-High Purity Gas Regulators
 See pages 309–311.



Gas Sampling

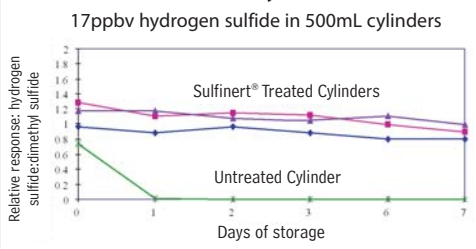
Sample Cylinders435
 Sample Cylinder Valves436
 Gas Sampling Valves & Loops437

Sample Cylinders

- Range of cylinder sizes, 75 cc to 2,250 cc.
- All cylinders have 1/4" female NPT threads on both ends.
- TPED compliant cylinders available for EU community.

Swagelok® sample cylinders are made of 304L and 316L stainless steel to resist corrosion and DOT rated to 1,800 and 5,000 psig (TPED cylinders rated to 1,450 and 4,350 psig), which allows sampling at gas wellheads as well as on-site refineries. Each cylinder is hydrostatically tested to at least 5/3 the working pressure.

Sulfur compounds are stable in Sulfinert® treated stainless steel systems.



Sample cylinders now available in stainless steel.

Sample Cylinders, High Pressure

304L stainless steel; DOT rating to 1,800 psig (TPED cylinders to 1,450 psig).

Size	1,800psig, 304L SS				TPED, 1,450psig, 304L SS			
	Stainless Steel		Sulfinert Treated		Stainless Steel		Sulfinert Treated	
	cat.#	price	cat.#	price	cat.#	price	cat.#	price
75cc	22921		24130		22921-PI		24130-PI	
150cc	22922		24131		22922-PI		24131-PI	
300cc	22923		24132		22923-PI		24132-PI	
500cc	22924		24133		22924-PI		24133-PI	
1000cc	22925		24134		22925-PI		24134-PI	
2250cc	22926		21394		22926-PI		21394-PI	

Applications:

- ASTM D1265
- Hydrocarbon sampling in refineries & petrochemical plants

Analyzing sulfur or mercury?

- Our unique Sulfinert® coating provides stable storage of sulfur and mercury at ppb levels.
- Inert coating doesn't flake; more durable than Teflon®.

Sample Cylinders, Ultra-High Pressure

316L stainless steel; DOT rating to 5,000 psig (TPED cylinders to 4,350 psig).

Size	5,000psig, 316L SS				TPED, 4,350psig, 316L SS			
	Stainless Steel		Sulfinert Treated		Stainless Steel		Sulfinert Treated	
	cat.#	price	cat.#	price	cat.#	price	cat.#	price
150cc	22927		22111		22927-PI		22111-PI	
300cc	22928		22112		22928-PI		22112-PI	
500cc	22929		22113		22929-PI		22113-PI	

also available

Certificates are available upon request.



www.restek.com 435



Sample Cylinder Valves

- Multiple valve configurations, including dip tube and rupture disks.
- Large, durable, Kel-F® seat ensures leak-free operation.
- Temperature range: -40°C to 120°C

Alta-Robbins' unique valve design incorporates a fully contained soft seat which provides durability and longer lifetime. Tight shut-off is easily achieved with very low torque, yet the valve is rugged enough to withstand overtightening.

Multiple valve configurations are available for both high pressure and ultra-high pressure sample cylinders. An outage tube or dip tube provides a headspace above liquefied gases so that, should expansion occur with an increase in temperature, the pressure is not dramatically increased. Outage is expressed as a % of the total cylinder volume, based on the ratio of the length of headspace to the total length of the cylinder, with a maximum available outage of 50%. The dip tube is welded directly to the male inlet of the valve and cut to a length of up to 5.25 inches. Rupture discs function to protect sample cylinders from over-pressurization by venting to the atmosphere. The pressure rating on the rupture disc should always be lower than the cylinder.



Description	Stainless Steel		Sulfinert Treated	
	cat.#	price	cat.#	price
1,500 psig DOT Pressure Rating				
1/4" Male NPT x 1/4" Male NPT	26297		21400	
1/4" Male NPT x 1/4" Female NPT	26298		26299	
1/2" Male NPT x 1/4" Male Compression	26300		21401	
1/4" Male NPT x 1/4" Male NPT w/5.25" Dip Tube*	26301		21402*	
1/4" Male NPT x 1/4" Male NPT w/1,800 psi Rupture Disc	26302		26303	
1/4" Male NPT x 1/4" Female NPT w/1,800 psi Rupture Disc	26304		26305	
Replacement Rupture Disc, 1,800 psig	26320			
5,000 psig DOT Pressure Rating				
1/4" Male NPT x 1/4" Male NPT	26306		26307	
1/4" Male NPT x 1/4" Female NPT	26308		26309	
1/4" Male NPT x 1/4" Male Compression	26310		26311	
1/4" Male NPT x 1/4" Male NPT w/5.25" Dip Tube*	26312		26313	
1/4" Male NPT x 1/4" Male NPT w/2,850 psi Rupture Disc	26314		26315	
1/4" Male NPT x 1/4" Female NPT w/2,850 psi Rupture Disc	26316		26317	
Replacement Rupture Disc, 2,850 psig	26324			



free literature

Solutions for Gas Sampling

lit. cat.# PCFL1308

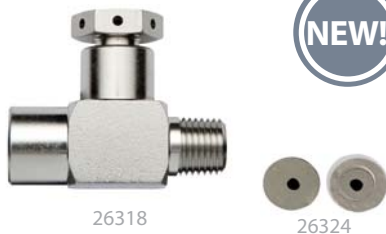
Download your copy from www.restek.com

*To order catalog #21402 (Sulfinert Alta-Robbins Sample Cylinder Valve, 1/4" NPT with Dip Tube), please call Customer Service at 800-356-1688, ext. 3, or contact your Restek representative. Specify dip tube length or % outage when ordering (maximum length = 5.25"/ 13.3cm). Note: End of part will not be treated after cutting tube to length.



Rupture Disc Tee

Unlike other designs, Alta-Robbins rupture disc tee is NOT permanently soldered to the disc, making the discs replaceable. Discs are easily changed without removing the valve or tee from the cylinder. These tees are designed to be installed into existing systems to provide reliable over-pressure protection.



Description	Stainless Steel		Sulfinert Treated	
	cat.#	price	cat.#	price
1,800 psig DOT Pressure Rating				
Rupture Disc Tee, 1/4" Male NPT x 1/4" Female NPT	26318		26319	
Replacement Rupture Disc	26320			
2,850 psig DOT Pressure Rating				
Rupture Disc Tee, 1/4" Male NPT x 1/4" Female NPT	26322		26323	
Replacement Rupture Disc	26324			



Metering Control Valves

- Reduces pressure between sample cylinder and GC injector.
- Maintains fine metering control.
- Contains Kel-F® seat.



Description	Stainless Steel		Sulfinert Treated	
	cat.#	price	cat.#	price
3,500 psig DOT Pressure Rating				
Metering Control Valve, 1/4" Male NPT x 1/4" Male NPT	26326		26327	

Gas Sampling Valves and Sample Loops (Sulfinert® Treated)

- Ideal for samples containing low concentrations of sulfur or other active compounds.
- Sample loop sizes from 5 µL to 5 cc.

Sulfinert® treatment eliminates active sites in the valve or loop, for better recovery of active compounds.

Gas Sampling Valves

(1/16" Fittings, 0.40 mm Port Diameter; "W Type" Valve)

Description	qty.	cat.#	price
Sulfinert Gas Sampling Valve; 4-Port	ea.	20584	
Sulfinert Gas Sampling Valve; 6-Port	ea.	20585	
Sulfinert Gas Sampling Valve; 10-Port	ea.	20586	



20585

Replacement Rotors (Not Coated)

Description	qty.	cat.#	price
Replacement Rotor (not coated) for 4-Port Sulfinert Gas Sampling Valve	ea.	20587	
Replacement Rotor (not coated) for 6-Port Sulfinert Gas Sampling Valve	ea.	20588	
Replacement Rotor (not coated) for 10-Port Sulfinert Gas Sampling Valve	ea.	20589	

Gas Sample Loops

(1/16" fittings, for "W Type" valves)

Description	Size	qty.	cat.#	price
Sample Loops, Sulfinert Treated	5µL	ea.	22840	
Sample Loops, Sulfinert Treated	10µL	ea.	22841	
Sample Loops, Sulfinert Treated	20µL	ea.	22842	
Sample Loops, Sulfinert Treated	25µL	ea.	22843	
Sample Loops, Sulfinert Treated	50µL	ea.	22844	
Sample Loops, Sulfinert Treated	100µL	ea.	22845	
Sample Loops, Sulfinert Treated	250µL	ea.	22846	
Sample Loops, Sulfinert Treated	500µL	ea.	22847	
Sample Loops, Sulfinert Treated	1mL	ea.	22848	
Sample Loops, Sulfinert Treated	2mL	ea.	22849	
Sample Loops, Sulfinert Treated	5mL	ea.	22850	



Jumbo Syringe

Clear acrylic syringes, ideal for holding and dispensing large volumes of gas. An adjustable plunger on the O-ring ensures that the syringe is gas-tight over a long period of time. The central port is supplied with a luer-lock fitting; the secondary port is supplied with a septum nut. This enables access to the gas sample for adding standards or removing a subsample. The plunger stem is detachable, making sample storage easy.



21276

Volume	Model	SGE cat.#	qty.	Restek cat.#	price
500mL	500MAR-LL-GT	009910	ea.	21275	
1000mL	1000MAR-LL-GT	009920	ea.	21276	
2000mL	2000MAR-LL-GT	009930	ea.	21277	

Syringe O-Rings

Syringe Volume	SGE cat.#	qty.	Restek cat.#	price
500mL	032527	ea.	21278	
1000mL	032532	ea.	21279	



21279

21278



For more information on all air monitoring canisters and products, visit www.restek.com/air



AIR VOC PRECONCENTRATOR SYSTEM

2010 Product Catalog



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Importers & Manufacturers
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NUTECH PRODUCT PROFILE

GD Environmental Supplies, Inc. is a provider of GC and GCMS inlet systems for VOC analysis. Dr. Dai, the founder of GD Environmental, has over 30 years experience in providing technology, instrument design and providing services to the laboratory market on a global basis. We have taken the NUTECH brand that has over 100 systems in place and have improved the capabilities of both the hardware and software of those systems. We have introduced a "New" line of preconcentrators, auto samplers, canister cleaning systems, standard and sample dilution systems. We provide a thermal desorber, automatic canister sampling system and headspace autosampler. GD Environmental has a staff based in Dallas, Texas to provide technical support, application support and offers service contracts to all their customers.



GD Environmental has entered into an exclusive sales and marketing agreement with New Star Environmental who will provide all the sales support, such as supporting local sales representatives, visiting US EPA, OSHA, Homeland Security Agency, all state EPA offices and regional

EPA offices, contract laboratories and all other laboratories. Sam Lanasa and Rob Ford have over 35 years experience and former key managers at Thermo Electron, both managed NUTECH when it was part of Graseby.



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NUTECH PRODUCTS

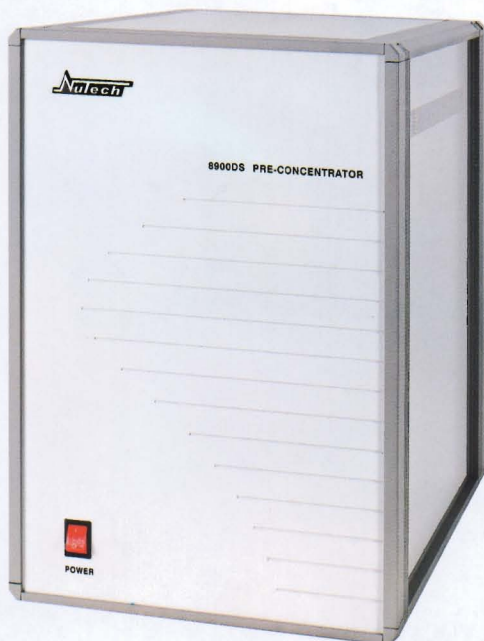


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NUTECH 8900 PRECONCENTRATOR

This preconcentrator has all the most advanced hardware and software than any other manufacturer of VOC preconcentrators in the market and many unique features that separate us from the competition for the analysis of EPA: TO-14 and TO-15 compounds. The advanced temperature control is one example how we can control variation under +/- 2°C, assuring stable and accurate analysis.

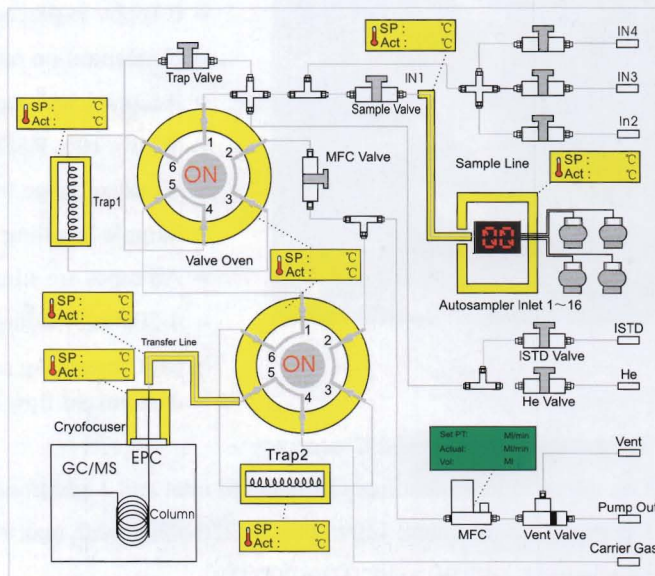


HARDWARE FEATURES

- High sensitivity and wide detection range
- Three stage module: two cryogenic traps and one cryofocuser
- High accuracy and repeatability
- Friendly sample handling
- Three additional sample inlets
- USB interface and user friendly software
- QA/QC, leak check, sequence and method table printouts

SOFTWARE FEATURES

- Built to EPA TO-14, TO-15 methods
- Ability to configure/change methods
- Bypass trap 1 and/or bypass cryofocuser without hardware changes
- Intuitive gas path graphic display
- Adjust sequence control during run
- Comprehensive QA/QC report
- Windows 2000, XP and Vista compatible
- Friendly table print format.



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NUTECH 8900 PRECONCENTRATOR

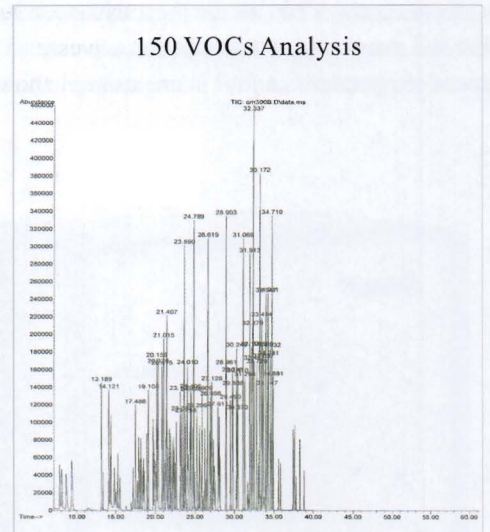
UNIQUE FEATURES

HARDWARE:

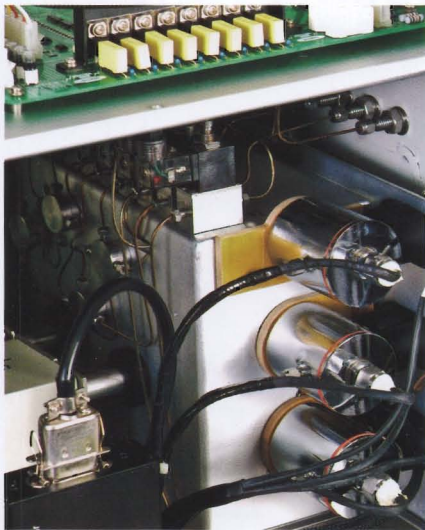
- Switch power supply
- Advanced temperature control
- Compact PCB board

SOFTWARE:

- QA/QC print out end-user friendly
- QA/QC reports listed in a rolling calendar
- Dynamic gas flow display and flow direction for all sample paths



NUTECH 8900 SPECIFICATIONS



- Three stage cryogenic traps
- Glass bead: -190°C to 250°C
- Tenax multimedia trap: -190°C to 250°C
- Cryofocuser: -190°C to 250°C
- Sensitivity and detection range
- 0.1ppbv to percent level for most VOCs
- Concentration ratio: >1000:1
- Accuracy and repeatability
- Within 10% RSD for most VOC compounds with a sample
- Loading range of 4-1000ml
- Sample handling
- All tubes are silica coated stainless steel
- 4-2000ml loading range with 0-100% relative humidity
- MFC operating range 5-120ml/min with +/-2% accuracy with an optional customized flow range
- Temperature control: +/-2°C accuracy
- Gas inlets: independent internal standard inlet and 3 additional sample inlets 16 sample inlets with optional autosampler
- Operating environment: 110v/60hz or 220v/50hz with max 1500w, 0-40°C /90% RH operating range.
- Dimensions: 14”(W)×20”(H)×20”(D)
- Weight: 65 lbs.

NUTECH 3602 SERIES AUTOSAMPLER

This instrument works with either the Nutech 8900 or Nutech 3551, it holds up to 16 canisters (all sizes) and Tedlar™ bags. The autosampler is a vertical design which saves valuable laboratory space and makes it easier to add and remove canisters. The canister hold plate is made in stainless steel and can be flipped up when not in use.

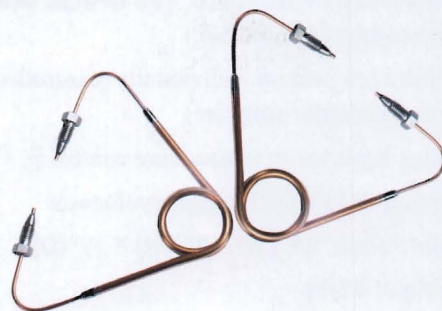


FEATURES

- Space saving
- Easy to add or remove canisters
- Automated analysis of 16 Silonite® or SUMMA passivated canisters in accordance with EPA methods TO-14 and TO-15
- Back-flushing of each line after analysis under software control
- Automatic leak-check prior to opening canister valves
- Interfaces with 8900/3551, 2502 software

SPECIFICATIONS

- Work with 8900, 3551 or any commercial concentrator
- Two models available:
 - Model 3602 tower design
 - Model 3603 tower design (smaller footprint)
- 16 channels with silica coated SS tube
- Leak check each position with QA/QC reports (controlled by preconcentrator software)
- Flush each position individually (controlled by preconcentrator software)
- 16 position valve heated with temperature control @ +/-2°C
- Dimensions:
 - Model 3602: 35" (W) × 59" (H) × 18" (D)
 - Model 3603: 30" (W) × 59" (H) × 15" (D)
- Weight:
 - Model 3602: 33 lbs.
 - Model 3603: 29 lbs.



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NUTECH 3606 AUTOSAMPLER WITH LOOP INJECTION

This instrument works in conjunction with the GC or GC/GCMS or independently as an automatic loop injection inlet. The 3606 holds up to 22 canisters (all sizes) and Tedlar™ bags, with the loop injection valve installed, the autosampler can also be attached directly to a GC or GCMS without the need of the 8900 Preconcentrator when analyzing concentrations exceeding 0.1 ppm. The autosampler is a vertical design which saves valuable laboratory space and makes it easier to add and remove canisters. The canister hold plate is made of stainless steel and can be flipped up when not in use.

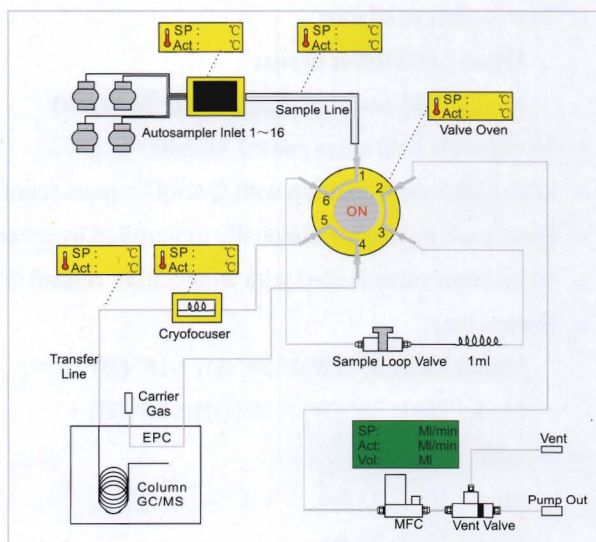


FEATURES

- Space saving
- Easy to add or remove canisters
- Flexibility to perform either automated analysis of 22 Silonite® or SUMMA passivated canisters in accordance with EPA methods TO-14 and TO-15 with the Model 8900 Preconcentrator or by a direct loop injection to the GC or GC/GCMS.
- Back-flushing of each line after analysis under software control
- Automatic leak-check prior to opening canister valves

SPECIFICATIONS

- Works with with any commercial GC or GC/GCMS as well as Nutech 8900 or Nutech 3551 Preconcentrator
- 22 channels
- Leak check each position with QA/QC reports (controlled by preconcentrator software)
- Flush each position individually (controlled by preconcentrator software)
- Valve heated with temperature control @ +/-2°C
- Option: split injection and cryofocuser
- Dimensions: 35”(W)×59”(H)×18”(D)
- Weight: 35 lbs.



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NUTECH 2502DS AUTOMATIC THERMAL DESORPTION SYSTEM

The Nutech 2502DS system automatically analyzes VOCs following EPA methods TO-17, TO-1 and TO-2. The system handles tenax, charcoal, molecular sieve cartridges and other types of adsorbent tube cartridges. The Nutech 2502DS works with all commercial GC and GC/MS. Our system has a built in cryofocuser, wide range temperature control and user-friendly software.

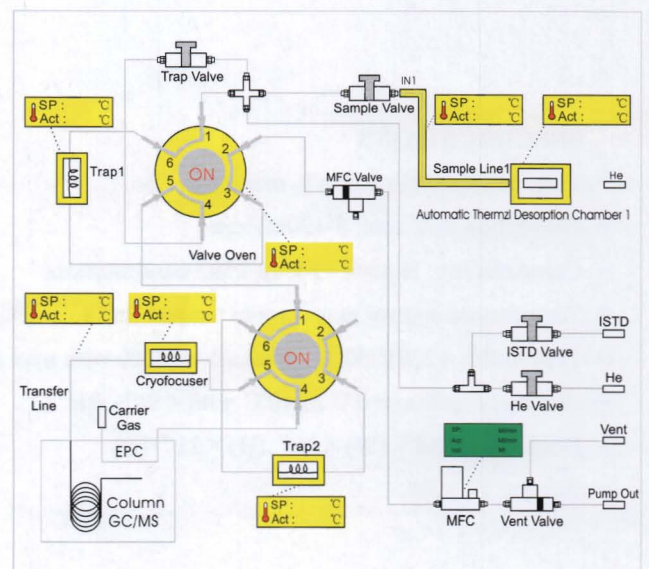


FEATURES

- Performs EPA methods: TO-17, TO-1 and TO-2
- Handles all types of cartridges and adsorbent tubes
- Compatible with all GC/GC-MS
- Built-in cryofocuser
- Friendly software with gas flow direction
- Heated transfer line connects directly with column

SPECIFICATIONS

- Thermal desorption temperature range: 20°C - 300°C
 - Cartridge size: 1/4" width, 3.5" length
 - Thermal desorption media: He, Air or N2
 - Thermal desorption flow: 5 to 120ml/min
 - Option flow
- Software: compatible with Windows®2000, XP and Vista
- Power: 110 V/60Hz or 220 V/50Hz with max. 1500W, -5°C to 50°C/90%RH
 - Sensitivity: 0.2ppb or lower for most compounds
 - Dimensions: 22"(W)×25"(H)×30"(D)
 - Weight: 62 lbs.

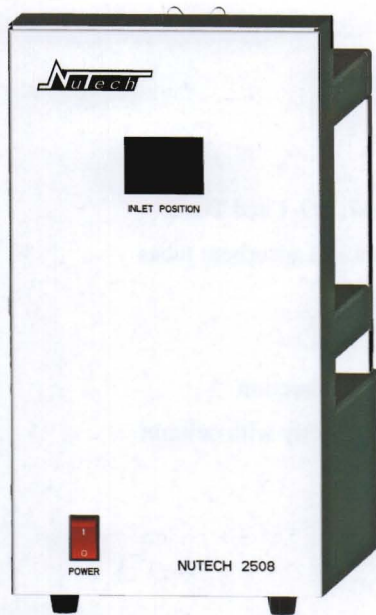


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NUTECH 2508 THERMAL DESORPTION AUTO SAMPLER

The Nutech 2508 has the latest design, using the newest technology available for air analysis.



APPLICATIONS

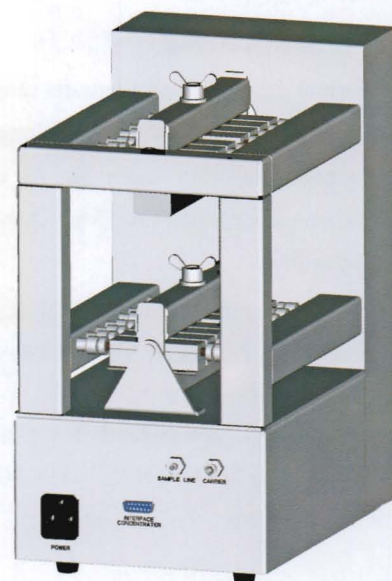
- Automated thermal desorption unit suitable for USEPA TO-1, TO-2 and TO-3 method.
- Handles media such as Tenax, charcoal, or multi media tube samples.
- Can be used as a VOCs testing device for materials.

FEATURES

- 16 positions with an automatic sequence.
- Controlled desorption gas flow rate by an analog or digital flow meter.
- Heated sample desorption jacket with accurate temperature control.
- Easy operation and control system.
- Bench top installation designed to save space.
- Desorbed gases can be collected into either canisters or Tedlar bags as well as directly into an analytical instrument such as Nutech 2502 or 8900.

SPECIFICATIONS

- Tube position: minimum 8, maximum 16
- Desorption flow rate: 5-120ml/min
- Compatibility: Nutech 8900 or 2502 concentrators
- Temperature control range: room temperature to 300°C
- 110V/60Hz, (220V/50Hz optional) +/- 10% with max 500W power supplies
- Working condition: 0°C to 40°C with < 90% RH
- Dimensions: 14" (W) × 20" (H) × 21" (D)
- Weight: 12.1 lbs.



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NUTECH 2500DS THERMAL DESORPTION UNIT

The Nutech 2500DS Thermal Desorption unit is designed for a single tube thermal desorption application.



APPLICATIONS

- This single tube thermal desorption unit is suitable for USEPA TO-1, TO-2 and TO-3 methods.
- Handles media such as Tenax, charcoal, or multi media tube samples.
- Can be used as a VOCs testing device for materials.

FEATURES

- Unit is lightweight and portable.
- Single tube compatible with all preconcentrators.
- Desorption gas flow rate is controlled by preconcentrators.
- Independent temperature control.
- Easy operation and control system.
- Bench top installation designed to save space.
- Desorbed gases can be collected into either canisters or Tedlar bags as well as directly into an analytical instrument such as Nutech 2502 or 8900.

SPECIFICATIONS

- Tube position: 1
- Desorption flow rate: 5-120ml/min
- Compatibility: Nutech 8900 or 2502 concentrators
- Temperature control range: room temperature to 300°C
- 110V/60Hz, (220V/50Hz optional) +/- 10% with max 500W power supplies
- Working condition: 0°C to 40°C with < 90% RH
- Dimensions: 5" (W) x 5" (H) x 56" (D)
- Weight: 1.1 lbs.

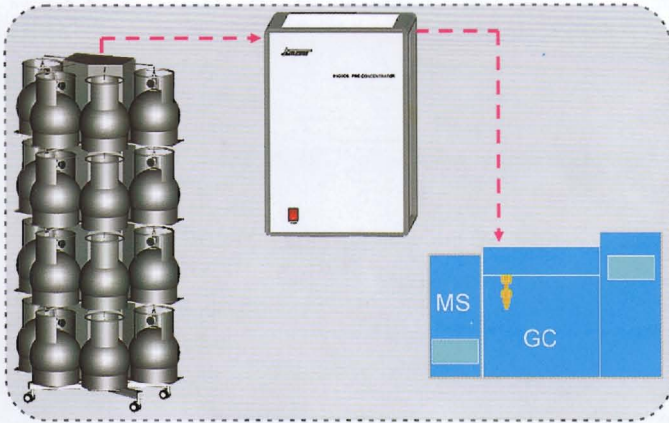


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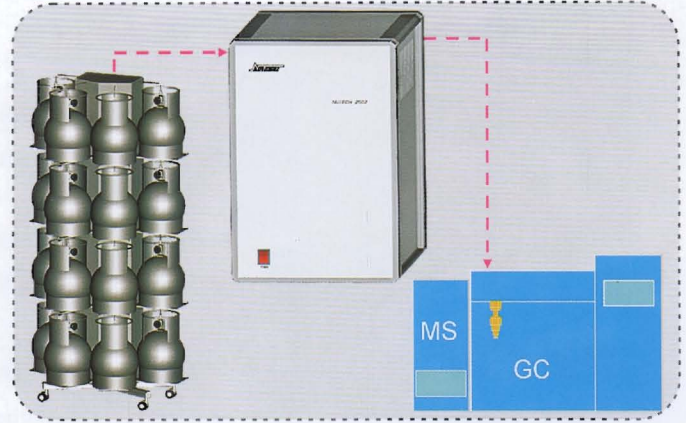
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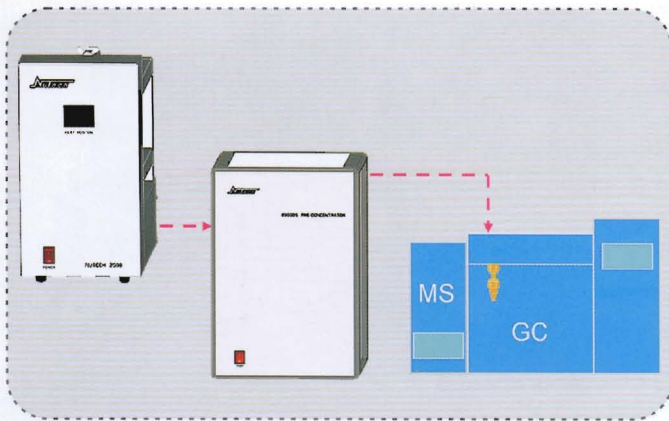
SUGGESTED INSTRUMENT CONFIGURATIONS



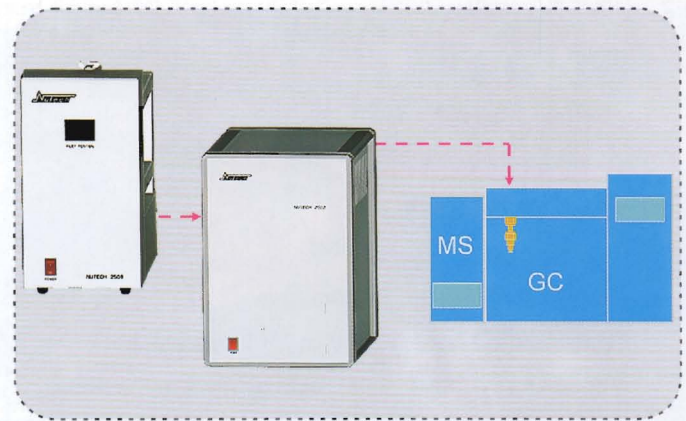
3602-8900: Nutech 3602 autosampler with 8900 preconcentrator is the best tool for air VOC analysis. It has 16 canister positions with an additional 3 inlets for canisters.



3602-2502: This set up combines thermal desorption and cryo concentration. It has 16 canister positions with an additional 3 inlets for canisters as well as one channel for thermal desorption.



2508-8900: This configuration combines thermal desorption and cryo concentration, but focuses on thermal desorption. It handles 16 position cartridge tube and an additional tube for thermal desorption and as well as 3 inlets for cryo concentration.



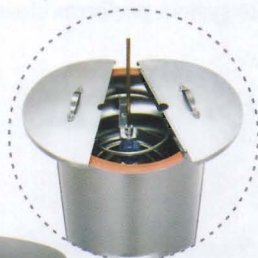
2508-2502: Nutech 2508 thermal desorption autosampler with 2502 Thermal Desorption concentrator can handle 1/4"X3.5" tube cartridge. This configuration is best for thermal desorption application and handles air VOC and semi-VOC analysis, using 16 tubes plus one additional tube.

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NUTECH HEATED MANIFOLD FOR SEMI-VOLATILE APPLICATIONS

The Nutech Heated Manifold is designed for a special application for semi volatile compound analysis.



APPLICATION

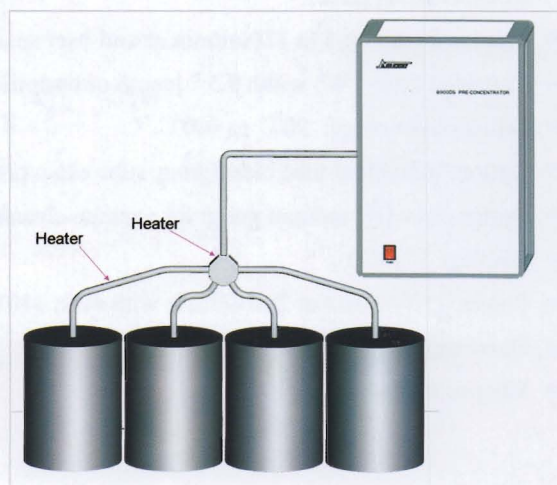
- For semi volatile compounds analysis using a preconcentration system such as cryogenic system or thermal desorption system.

FEATURES

- 1, 2, 4, and 16 positions are available.
- Each canister is individually enclosed and heated.
- All sample lines are heated from end to end leading to the instrument inlet.
- Independent temperature control system can control temperature from 25°C to 300°C.
- Easily fits canisters up to 6 liters.

SPECIFICATIONS

- Canister heating jacket 23" (D) × 20" (H)
- Temperature control range: room temperature 25°C to 300°C
- Temperature control accuracy : +/- 2°C
- 110V/60Hz, (220V/50Hz optional) +/- 10% with max 500W power supplies
- Working condition: 0°C to 40°C with < 90% RH
- Weight: 10 lbs.



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NUTECH 2505DS PROGRAMMABLE CARTRIDGE AUTO CLEANER

The Nutech 2505DS was designed to follow the protocol to clean and condition cartridges according to EPA methods TO-17, TO-1, TO-2 and other thermal desorption tubes. The Nutech 2505DS cleans and conditions thermal desorption cartridges at different temperature ranges, handles tenax, charcoal, molecular sieve SS cartridges and many other types. The unit is completely programmable, user friendly software allowing technician to walk away while system performs cleaning cycle.



FEATURES

- Automatically cleans and conditions up to 16 cartridges at different temperature ranges
- Constant flow control
- Programmable flow rates
- Programmable temperature settings
- Eight positions with an option to 16 positions
- Automatic temperature control
- Accepts most types of cartridges
- Easy to clean

SPECIFICATION

- Flow rate setting: 5 to 120ml/min or end-user specified range
- Cartridge size: 1/4" width 3.5" length or customer designed size
- Temperature range: 20°C to 400°C
- Option: individual tube clean/group tube clean program
- Option: 24v DC vacuum pump for vacuum cleaning
- Display: 3" LCD
- Power: 110V/60Hz or 220V/50Hz with max. 110W, -5°C to 50°C
- Dimensions: 12"(W) × 14"(H) × 16"(D)
- Weight: 62 lbs.



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NUTECH 2100 SERIES CANISTER CLEANING SYSTEM

The cleanliness of the canister is very critical to the overall accuracy of the detection of TO-14 and TO-15 compounds in the sample. Canisters are reused by evacuating and refilling with nitrogen or zero air multiple times to assure previous VOCs are completely eliminated. The Nutech 2100 oven heating system maintains the canisters in a controlled temperature range upwards to 200°C. Sample temperature controlled heating strips are available.



FEATURES

- Embedded system with touch screen LCD panel enables easy operation
- Manifold assembly with 4, 6, 8, 12 canisters
- Operates independently without computer
- Temperature controlled heating strips
- Flexible stainless steel tube connection for canisters and manifold

SPECIFICATIONS

- Canister heating: Automatic temperature control
- Vacuum system:
 - Model 2100-2 with two pumps (Turbo Pump and Diaphragm Pump)
 - Model 2100 with one pump (Edward pump)
- Humidifier:
 - Built-in pure water humidifier system with water level display
 - Automatically humidifies the gas stream into canisters
- Automation: Can program cleaning cycles from 1 to 99 cycles or clean manually
- Pure gas supply
 - Nitrogen, zero air between 0 to 50 psig
- Operation environment: 110 V/60Hz or 220V/50Hz with max. 1500W, 0-40°C/90%RH operating range
- Dimensions: 22" (W) × 25" (H) × 30" (D)
- Weight: 62 lbs.

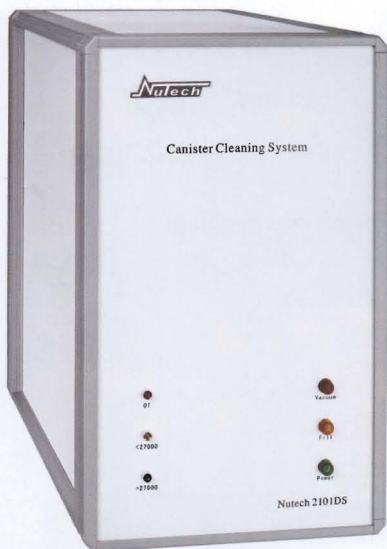


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NUTECH 2101DS COMPUTER CONTROLLED CAN CLEAN SYSTEM

The Nutech 2101DS is a computer controlled canister cleaning system. The 2101DS can be run with Windows® XP, Windows® Vista and Windows® 7 system. A dynamic flow path is shown on the screen and the QA/QC report can be printed.



APPLICATIONS

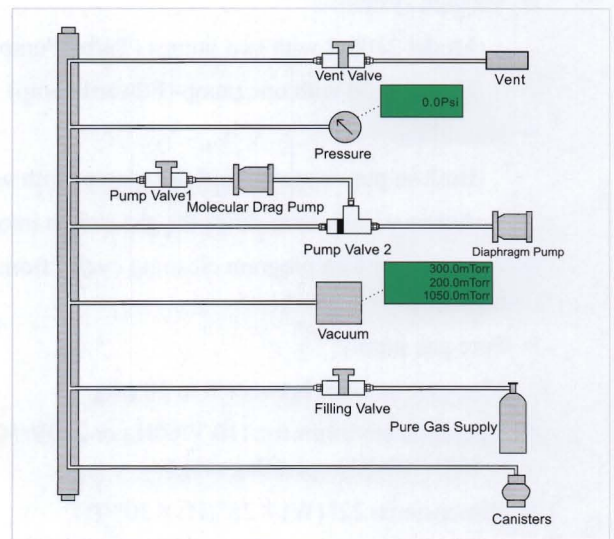
- Cleans 1, 3, 6, 15L canisters
- Cleans Tedlar® bags
- Canister humidification and canister leak check

FEATURES

- Auto clean and auto leak check
- Oven heating or heating strips
- Dynamic gas flow path display
- Auto QA/QC reports
- Dual pump system
- On screen review with print option

SPECIFICATIONS

- Windows® XP, Windows® Vista, and Windows® 7 compatible
- Holds up to 16 canisters
- Max vacuum: < 50 mtorr
- 110V/60Hz, (220V/50Hz optional) +/- 10% with max 100W power supplies
- Working condition: 0°C to 40°C with < 90% RH
- Dimensions: 18”(W)×30”(H)×25”(D)
- Weight: 26.4 lbs.



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NUTECH 2110 CANISTER HEATING OPTIONS



Standard up-right 8 positions



Oven holds either 6 3L, 4 6L or 2 15L canisters



Desktop 4 position



Heating strips and individual heating jacket

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NUTECH 2200 SERIES DYNAMIC STANDARD AND SAMPLE DILUTION SYSTEM

The Nutech 2200 system was designed for the end-user to either make calibration standards from a high concentration source as well as to pressurize the sample canister: which is under vacuum, to an acceptable pressure and calculate the dilution factor. The dilutor prepares ppb level standards from ppm level certified cylinders. The dilutor can be expanded to accommodate 6 mass flow controllers, blend cylinder standards with a diluent gas under equilibrium conditions for superior reproducibility. The Nutech 2200 has two separate channels, one for the standard and a second channel for the sample dilution.



FEATURES

- Easy operation with built-in microcontroller
- Separate standard and sample dilution channel to avoid cross contamination
- Liquid injection adaptor for liquid source standard
- The initial pressure of sample canister can be read and displayed, the final pressure can be set by end-user, program can automatically calculate the dilution factors and finish the dilution

OPTIONS

- Prepare standards from liquids
- Heated oven for canisters
- Humidified air inlet
- Multiple standard inlet configuration

SPECIFICATIONS

- System configuration: Separate standard and sample channels for standard and sample dilution
- Mass flow controller
 - Flow rate: 5 to 100ml/min, accuracy: <2% RSD
 - Multi mass flow controller for multi channel dilution
 - Flow rate option: 5ml/min To 1000ml/min
- Operating environment: 110 V/60Hz or 220 V/50Hz with max. 100w, 0-40°C, 90%RH operating range
- Dimensions:
 - Model 2200A (compact): 13"(W)×5.5"(H)×17"(D)
 - Model 2201A: 11"(W)×17"(H)×12"(D)
- Weight:
 - Model 2200A: 18 lbs.
 - Model 2201A: 17 lbs.

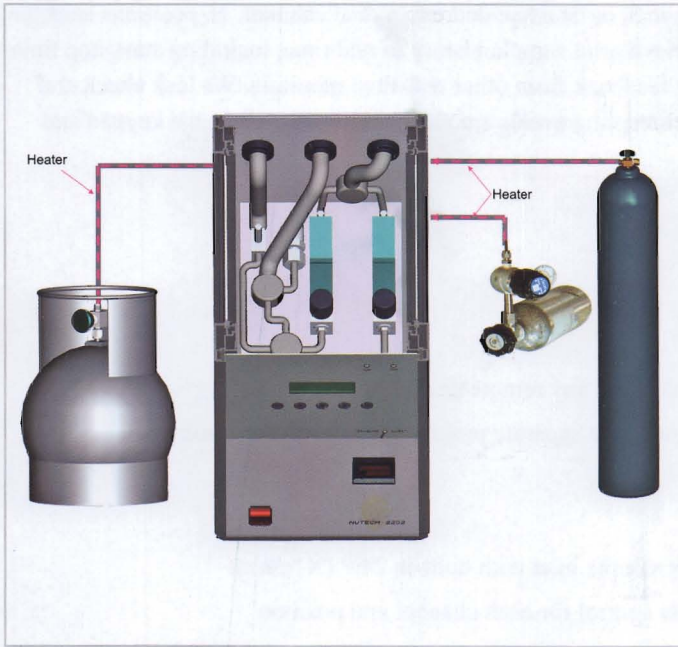


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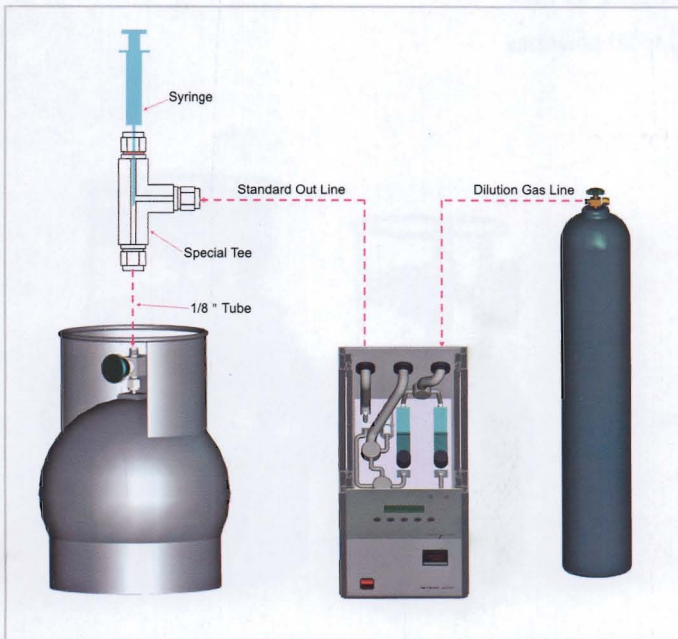
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2200 SERIES WITH LIQUID INJECTION / HEATED LINE / DUAL MFC SYSTEM



Heated System

- Nutech 2202 is designed for some specific applications
- A heated line design for improved standard preparation
- A second MFC installed for ultra lower flow rate usage
- The end to end heated tube avoids possible cold spot
- Dilute 1.0ppm standard to 0.1-100ppb in a single step
- Temperature controlled 25-150°C
- Micro computer control



Liquid Injection

- With liquid injection option, the standard can be made from pure liquid.
- Easy operation and control.
- All standard lines are silica coated.
- Special liquid injection adaptor included to avoid any dead volume.
- Heated tubes to canister, standards, and supply gases available.
- The calculation chart for pure liquid standard injection volume or weight will be supplied.
- Instructions for making organic sulfur compound standards are available upon request.

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NUTECH 2600DS AUTOMATIC CANISTER SAMPLING SYSTEM

The Nutech 2600DS delivers a tremendous level of instrument control and an extensive compound recovery range. The system can be scaled to meet your application needs; can operate as a single channel, or be expanded into a dual channel, 16 positions canister sampler. We have built-in Windows touch button and can record/retrieve/print sample history in real time, including start/stop time. Schedule sampling times or initiate sampling events locally or using feedback from other real-time monitors. We leak check and flush to maintain low blank levels and improve sample integrity. All sampling events are easily programmed via the keypad and LCD display.



FEATURES

- Accept TTI signal from any remote device
- 8 canister positions with separate programmable sampling event
- LCD display
- Built-in printer
- Passive or active sample inlet with built-in 24V DC pump
- Independent flow control for each channel and position
- Remote start sampling
- Time integrated sampling
- Sample flow controlled by MFC
- Can be extended to 20 positions

SPECIFICATIONS

- Mass flow controller
Flow rate: 5 to 120ml/min, accuracy: <2% RSD
- Operation environment: 110 V/60Hz or 220 V/60Hz with max. 250W, 0-40°C/90%RH
- Dimensions: 8”(W)×16”(H)×13”(D)
- Weight: 24 lbs.



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NUTECH 2602DS PROGRAMMABLE CARTRIDGE AUTO SAMPLER

The Nutech 2602DS was designed to follow the protocol of EPA Method TO-17, TO-1, TO-2, TO-11 and other thermal desorption techniques. The Nutech 2602DS has the ability to program up to eight sample events and accept a TTI signal, can program flow rates for 1, 2, 4, 6, 8, 12, 24, 36, 48 hours. The system has an efficient pump that assures constant flow rates, handles Tenax SS cartridges, charcoal cartridges, molecular sieve cartridges and carbonyl sampling cartridges. The 2602DS has first generation electronic control, friendly software and a large LCD display.



FEATURES

- Program 8 events in a 7 day period with TTI signal accept capability
- Adjustable flow rate
- Programmable time duration
- Stable constant flow
- Handles Tenax SS cartridges, charcoal cartridges, molecular sieve cartridges
- Accommodates carbonyl sampling cartridges
- Friendly software
- Flexible cartridge connection
- Can be extended to 20 positions

SPECIFICATIONS

- Cartridge size: 1/4" width 3.5" length carbonyl sampling cartridge
- Flow rate: adjustable 5 to 120ml/min
- Event setting: 7 day with programmable start and stop
- Sample pump: built in 24 V DC diaphragm pump
- Display: 3" LCD
- Power: 110 V/60Hz or 220 V/50Hz with max. 110W, -5°C to 50°C
- Dimensions: 12"(W)×14"(H)×16"(D)
- Weight: 10 lbs.



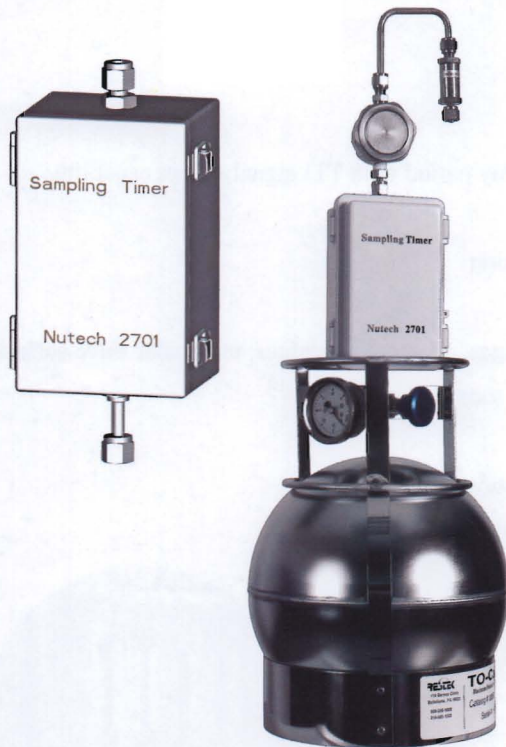
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NUTECH 2701 PROGRAMMABLE FIELD CANISTER TIMER

The Nutech 2701 Canister Sampling Timer is designed for canister field sampling. The unit can be set for either time integration or grab samples. The timer can be easily programmed for 8 events in a 7-day period with start and stop times and works with any commercial flow controller.



APPLICATIONS

- Emergency response
- Homeland security
- Indoor air quality
- Hazardous waste sites
- EPA air toxic networks

FEATURES

- Latch valve design
- Light in weight
- Battery life can last for 3 months with a single charge
- Attaches easily to any commercial canister
- LCD display
- Water and weatherproof for field use

SPECIFICATIONS

- Meets sampling protocols: EPA Methods TO-14 and TO-15
- Battery: Rechargeable lithium ion with 2500 mAh
- Sample Path: All silica coated SS tubing
- Fittings: Swagelok
- Display: 3" LCD
- Option of stainless steel case
- Working temperature range: -30°C to 50°C
- Dimensions: 4"(W) × 6"(H) × 3"(D)
- Weight: < 1 lb



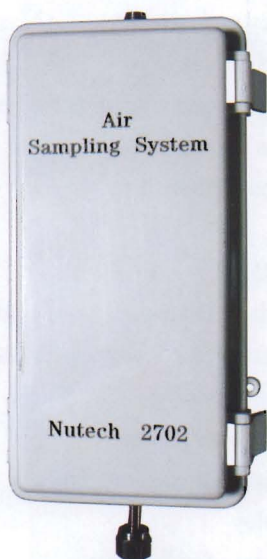
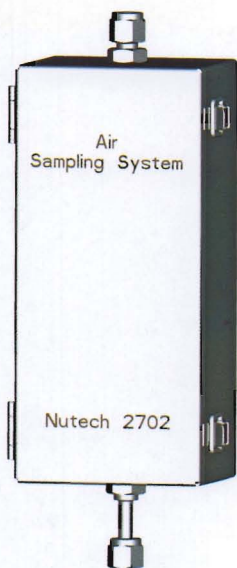
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NUTECH 2702 DIGITAL PROGRAMMABLE FIELD CANISTER SAMPLER

The Nutech 2702 Canister Sampler is designed for canister field sampling. The unit can be set for either time integration or grab samples. The Sampler can be easily programmed for 8 events in a 7-day period with start and stop times and is equipped with an adjustable digital flow control. The unit attaches easily to any commercial canister.



APPLICATIONS

- Emergency response
- Homeland security
- Indoor air quality
- Hazardous waste sites
- EPA air toxic networks

FEATURES

- Combines flow control and sample timer in one unit
- Adjustable flow settings from 2 to 120 ml/min
- Electronic MFC
- State-of-the-art digital flow control
- Battery life lasts for 48 hours with continuous operation
- Attaches easily to any commercial canister
- LCD display
- Waterproof for use in the field

SPECIFICATIONS

- Meets sampling protocols: EPA methods TO-14 and TO-15
- Battery: Rechargeable lithium ion with 6500 mAh
- MFC: Electronic with digital display +/-5% accuracy
- Sample path: All silica coated SS tubing
- Fittings: Swagelok
- Display: 3" LCD
- Option of stainless steel case
- Working temperature range: -30°C to 50°C
- Dimensions: 4"(W) × 8"(H) × 3"(D)
- Weight: 2 lbs



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NUTECH 2800 HEADSPACE AUTOSAMPLER

The Nutech 2800 Headspace Autosampler is designed for handling large volume headspace samples from a liquid or solid matrix. The system is used with the Nutech 8900 for handling large volume headspace or can directly introduce the headspace gases to any GC or GC/MS inlet. The Nutech 2800 Headspace Autosampler can be configured as a single inlet or it can utilize multi-inlets.



APPLICATIONS

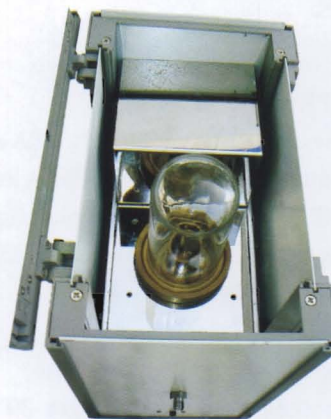
- Emergency response
- Homeland security
- Food industry and fragrance analysis
- Hazardous waste sites
- EPA air toxic networks

FEATURES

- Large volume headspace up to 500 ml volume
- Temperature controlled transfer line
- Easy sample loading
- Micro computer control
- Both AC and DC power supply
- LCD display
- Carrying case for field use

SPECIFICATIONS

- 24V DC or 110/220V AC
- Headspace volume: 500 ml
- Water sample vial volume: 44 ml US standard vial
- Headspace temperature: Room temperature to 90°C +/- 3°C
- Heated sample line: 1/8" SS from headspace to sample outlet; 15°C to 90°C
- Sample out: 1/8" Swagelok union
- Set point headspace and sample line temperature: Room temperature to 90°C
- Solenoid valve control sample injecting to GC
- Equilibrium time: 1 to 300 minutes with audible when equilibrium reached
- Portable case with handle (optional)
- Maximum time to reach set point temperature: <30 minutes
- Total power: 70W
- Dimensions: 8" (W) × 16" (H) × 13" (D)
- Weight: 15 lbs.



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SAMPLING CANISTERS

Canisters are used for the collection of TO-14 and TO-15 compounds, as well as all other air samples. The canisters are the most important part of the whole air VOC analysis. We support two types of canisters: the Silco Can™ Air Monitoring Canisters and the TO-Can™ Air Monitoring Canisters (SUMMA® equivalent).



FEATURES OF SilcoCan™ CANISTERS

- Reliable analyte recovery even after 14 days storage
- Wide selection of valves
- Newest surface technology
- Effectively store low level sulfur compounds (1-20 ppb)
- Wide range of sizes: 0.4, 1, 3, 6 and 15 liters
- Serial controlled label
- Enhanced valve and canister bracket

FEATURES OF TO-CAN™ CANISTERS

- SUMMA® equivalent
- Proprietary electropolish surface
- High quality, metal-to-metal seal
- 2-port or 3-port valve available
- Valve with SS diaphragms
- Unique holder attaches handle and base without welds
- All metal flow paths
- Wide range of sizes: 0.4, 1, 3, 6 and 15 liters
- Withstands temperatures up to 300°C
- Rugged performance in the field

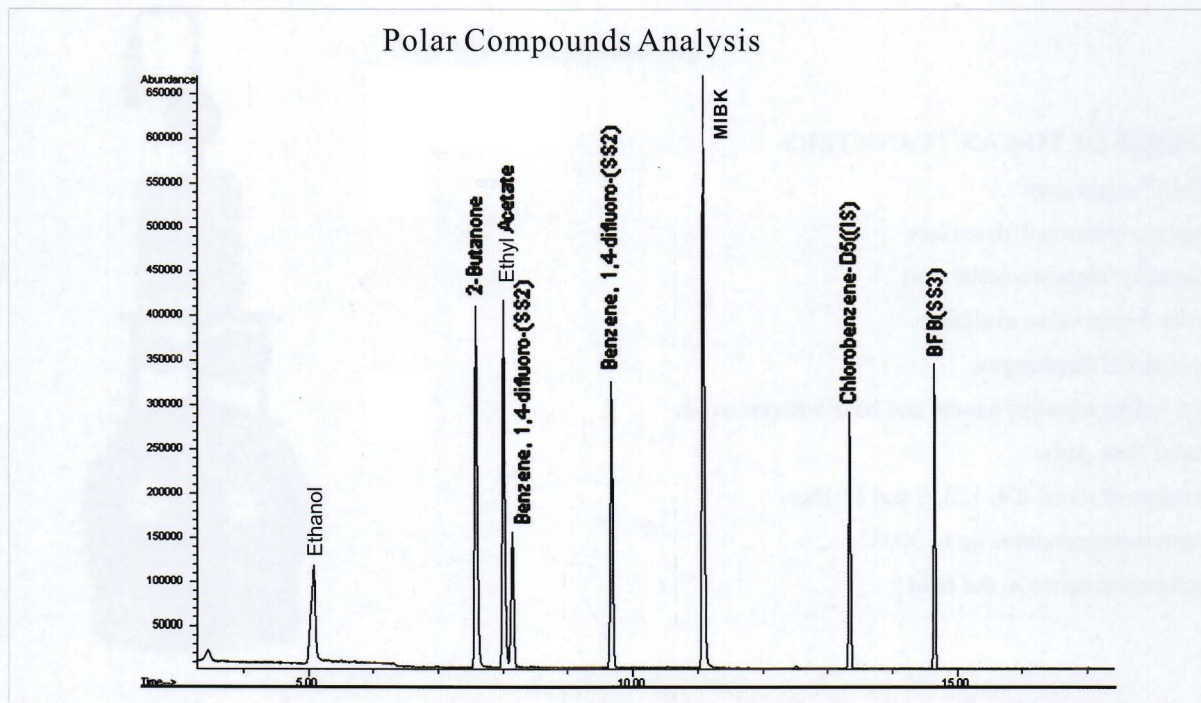
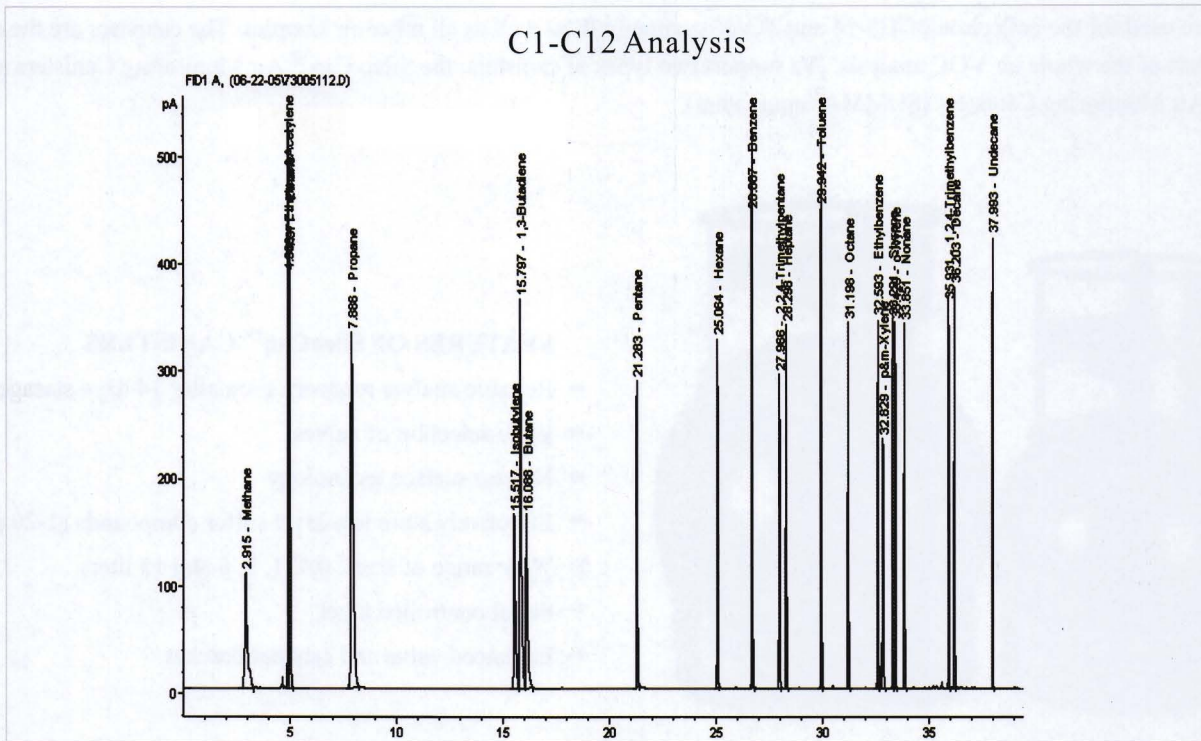


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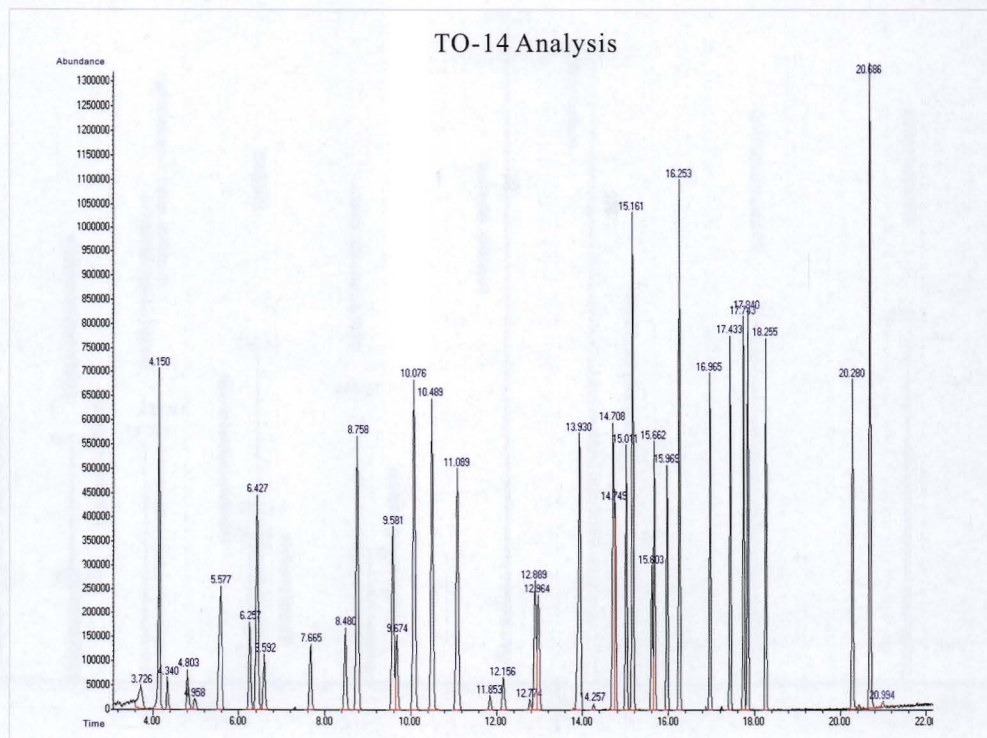
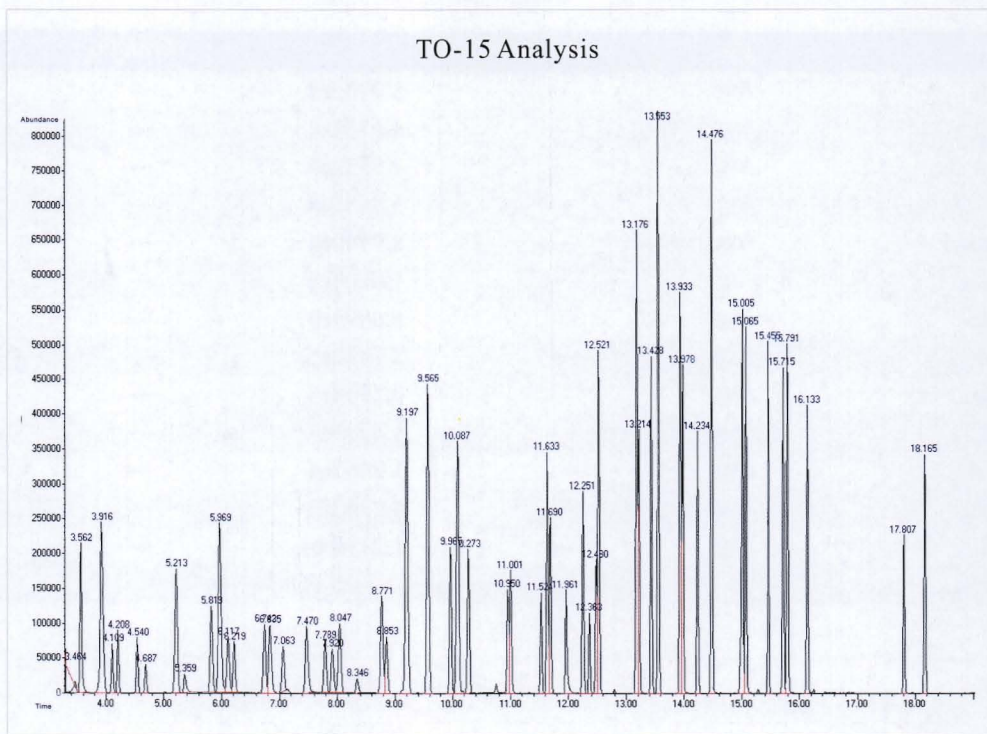
NUTECH 3551, 8900 APPLICATION



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NUTECH 3551, 8900 APPLICATION

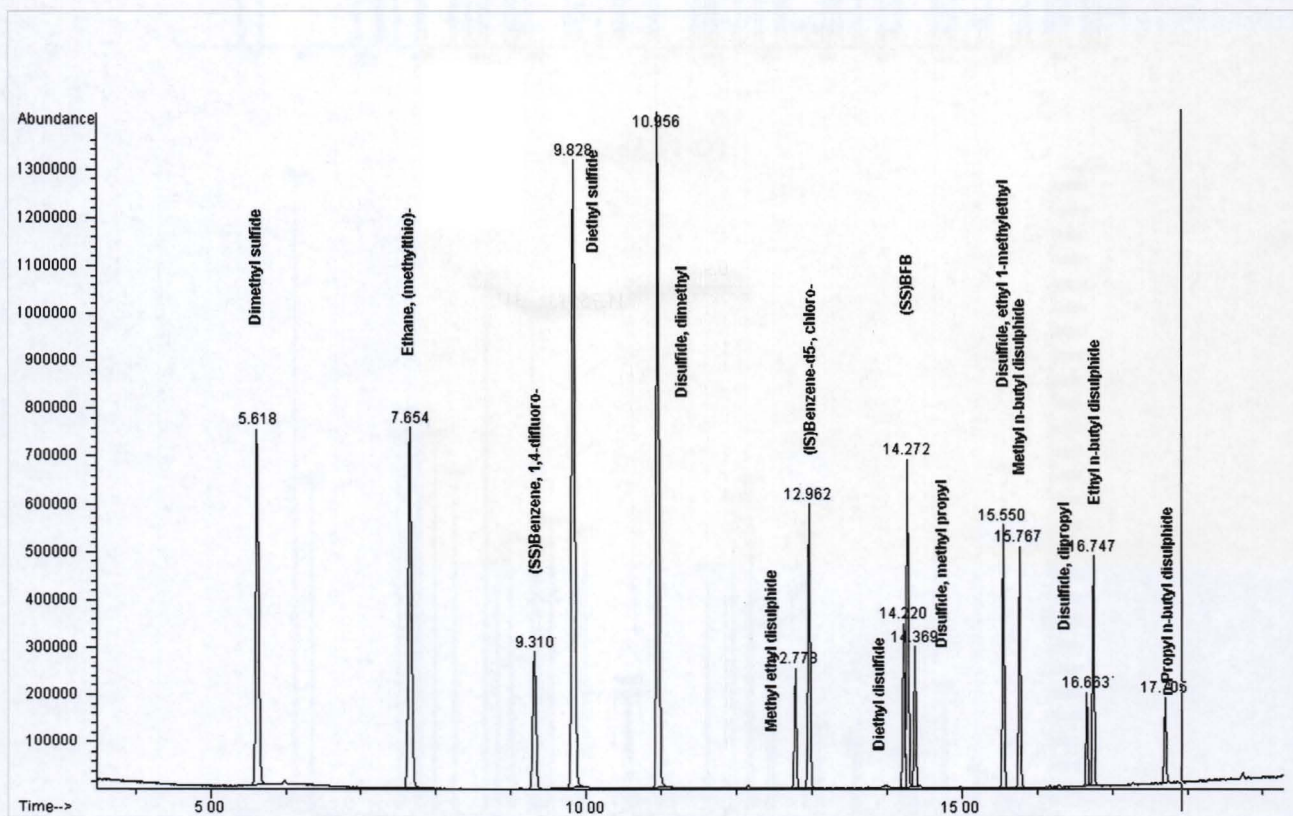


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CALIBRATION REPORT FOR ORGANIC SULFUR COMPOUNDS ON GC/MS

Compound	Fit	Constant	Linear	Quad	RSD/Cf
Dimethyl sulfide	Avg	---	3.9902e4	---	0.0941
Ethane, (methyl...	Avg	---	4.6754e4	---	0.0702
(ss)Benzene, 1,4...	Avg	---	4.5533e5	---	0.0434
Diethyl sulfide	Avg	---	5.8655e4	---	0.0982
Disulfide, dimethyl	Avg	---	8.9340e4	---	0.0886
Methyl ethyl dis...	Avg	---	1.0108e4	---	0.1456
Diethyl disulfide	Avg	---	5.6893e3	---	0.1548
(ss)Benzene, 1-b...	Avg	---	3.1422e5	---	0.0964
Disulfide, methy...	Avg	---	9.2934e3	---	0.1223
Disulfide, ethyl...	Avg	---	1.4793e4	---	0.1467
Methyl n-butyl d...	Avg	---	1.3467e4	---	0.1410
Disulfide, dipro...	Avg	---	4.2362e3	---	0.2089
Ethyl n-butyl di...	Avg	---	1.2190 e4	---	0.1773
I(IS)Benzene-d5-,...	-----ISTD-----				



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PAMS APPLICATION BY GC-FID

	12010901	12010902	12010904	12010905	12010906	12010907	12010908			
	100ml/25ppb	100ml/25ppb	100ml/25ppb	100ml/25ppb	100ml/25ppb	100ml/25ppb	100ml/25ppb	AVER	STDEV	%
Propene	270.70105	266.09937	266.50064	268.94882	267.46765	265.08722	267.94971	267.5364	1.88511	0.705
Propane	180.41054	177.64302	177.35532	179.45921	178.63042	174.61588	178.13466	178.0356	1.841286	1.034
Isobutane	176.47578	171.32278	172.30287	173.76163	173.4055	171.11703	172.26768	172.9505	1.834362	1.061
1-Butene	194.62486	191.715	191.92059	193.09163	191.39774	190.61365	192.05536	192.2027	1.301873	0.677
Butane	187.02298	182.6059	183.29585	184.26697	183.89793	183.457	183.18947	183.9623	1.449212	0.785
trans-2-Butene	171.5574	168.01332	168.82678	169.27023	169.21782	168.78783	167.71346	169.0553	1.247874	0.738
3-methyl-1-butene	248.18373	243.18143	243.46587	245.40901	245.31375	245.94937	243.8369	245.0486	1.746435	0.713
Isopentane	447.68497	439.16302	440.05289	442.87738	441.54913	443.89395	440.48236	442.2434	2.904229	0.657
1-Pentene	223.11433	218.50249	218.81696	220.82587	220.80121	221.30553	219.28589	220.3789	1.626581	0.738
Pentane	217.57945	213.86162	214.27542	215.95639	215.46651	216.65369	215.25209	215.5779	1.295339	0.601
2-methyl-2-butene	223.62483	219.37149	219.11401	221.48141	221.81531	222.42821	220.13937	221.1392	1.665332	0.753
Isoprene	434.27289	425.02652	425.23972	429.07162	429.88132	430.52261	425.7142	428.5327	3.418082	0.798
trans-2-pentene	218.2849	214.145	213.82956	215.96213	216.49072	217.38078	215.43492	215.9326	1.623211	0.752
cis-2-pentene	269.18469	264.32394	264.50916	267.39288	267.15317	267.84714	265.41788	266.547	1.83032	0.687
2,2-dimethyl-butane	257.26285	252.10397	252.36957	255.06688	255.07219	255.88222	253.54813	254.4723	1.88737	0.742
4-methyl-1-pentene	749.75397	736.98981	736.5683	744.35883	744.15546	747.6781	740.92938	742.9191	5.040057	0.678
Cyclopentene	216.11435	212.21159	212.57991	214.52876	213.88852	215.39102	213.21904	213.9905	1.444631	0.675
2-methyl-pentane	226.24963	222.83968	222.87782	225.05052	224.98003	225.81816	223.88542	224.5288	1.359675	0.606
Cyclopentane	214.96239	207.27757	207.17764	210.17801	211.97057	206.94466	197.30737	207.974	5.562127	2.674
2,3-dimethyl-butane	266.41452	261.59601	261.59311	264.42404	264.21313	265.15869	262.53885	263.7055	1.848321	0.701
3-methyl-pentane	253.82855	252.44849	252.54538	254.49211	252.95219	259.33371	264.16974	255.6815	4.434217	1.734
2-methyl-1-pentene	257.79431	253.20149	252.87068	255.95335	256.17532	256.75073	254.29037	255.2909	1.863838	0.730
Hexane	306.94275	301.35263	301.2999	304.83035	304.51785	305.68243	302.85272	303.9255	2.161193	0.711
cis-Hexene	266.81641	262.11496	261.96359	264.7919	264.33167	265.37546	263.01086	264.0578	1.789622	0.678
2,4-dimethyl-pentane	305.96173	300.27795	300.93634	304.28845	303.21744	305.88156	303.21716	303.3972	2.213348	0.730
methyl-Cyclopentane	565.13782	557.40247	556.42413	570.95001	562.80017	568.05707	563.73206	563.5005	5.271676	0.936
2-methyl-Hexane	316.37	308.70288	309.86572	304.93674	311.75513	311.42596	307.89758	310.1363	3.589755	1.157
Benzene	619.37445	605.59088	606.68433	613.71118	614.35742	615.3623	613.52649	612.6582	4.878599	0.796
2,3-dimethyl-pen...	303.34494	294.84827	295.80264	299.37347	299.46109	300.69431	300.22424	299.107	2.914901	0.975
3-methyl-Hexane	304.81042	300.29095	299.47745	303.61078	303.08932	304.45966	301.41089	302.4499	2.079413	0.688
Heptane	340.76782	333.52783	333.79666	337.73471	337.61398	338.34109	335.31393	336.728	2.631668	0.782
methyl-Cyclohexane	343.71091	335.02673	335.43457	339.37326	339.96149	340.28329	337.02472	338.6879	3.071974	0.907
2,3,4-trimethyl-pentane	334.56793	329.15152	326.65646	330.4758	330.86041	331.05899	327.80737	330.0826	2.569473	0.778
Toluene	622.64276	602.71893	604.65771	612.40869	615.04285	613.42059	608.13953	611.2902	6.784	1.120
Octane	621.1767	588.46582	597.5307	601.74274	611.67609	594.68018	595.2702	601.5061	11.26758	1.873
Ethylbenzene	596.91821	572.19629	577.508	583.94989	590.64337	582.66437	581.1792	583.5799	8.175126	1.401
Nonane	529.70367	505.26297	509.95505	515.68469	523.80664	513.98615	513.01508	515.9163	8.302361	1.609
Styrene	700.78497	574.65314	597.41638	598.61829	636.49994	558.66632	480.28473	592.4177	68.04249	11.48
o-Xylene	14.68597	16.59451	16.31661	16.24535	15.38944	17.20747	19.43787	16.55389	1.513425	9.142
isopropyl-Benzene	133.14691	172.19612	162.99602	166.01402	153.95331	176.41562	215.24065	168.5661	25.02964	14.85
propyl-Benzene	284.76306	261.49878	267.33395	268.9386	278.35803	265.71808	267.43759	270.5783	8.07124	2.983
.alpha.-Pinene	277.36688	262.84628	263.17972	263.94885	273.03622	259.11581	260.36353	265.6939	6.823092	2.568
1,3,5-trimethyl-...	258.08658	214.61861	233.41261	233.1776	249.42299	225.35909	221.19165	233.6099	15.4507	6.614

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NUTECH 8900 PERFORMANCE - REPEATABILITY

Instruments: Nutech 8900DS Preconcentrator with Agilent 6890/5973 GC/MS

Standard Gas: EPA TO-14, 50 ppb

Run 7 replicate of TO-14 standard using 4 ml sample volume of standard gas at 50 ml/min flow rate. The results are shown in the following table:

Target Compounds	AVG	SD	RPD%
Dichlorodifluoromethane	0.306	0.012	4.14
Chloromethane	0.105	0.008	7.78
Dichlorotetrafluoroethane	0.306	0.012	4.14
Ethene, chloro-	0.054	0.006	12.63
Methane, bromo-	0.028	0.008	28.50
Ethene, 1,1-dichloro	0.148	0.004	2.83
Ethane, 1,1,2-trichloro-1,	0.211	0.010	5.06
Methylene Chloride	0.063	0.006	10.83
Ethane, 1,1-dichloro-	0.158	0.007	4.77
Ethene, 1,2-dichloro-, (Z)	0.083	0.005	6.05
Bromochloromethane(SS1)	0.368	0.004	1.09
Chloroform	0.256	0.006	2.60
Ethane, 1,1,1-trichloro-	0.337	0.013	4.12
Ethane, 1,2-dichloro-	0.188	0.013	7.08
Benzene	0.218	0.013	6.13
Carbon tetrachloride	0.326	0.019	6.05
Benzene, 1,4-difluoro(SS2)	1.462	0.065	4.44
Trichloroethylene	0.115	0.023	19.93
Cis-1,3-dichloropropene	0.059	0.006	11.65
Toluene	0.294	0.013	4.46
Ethane, 1,1,2-trichloro-	0.083	0.006	7.87
Tetrachloroethylene	0.192	0.015	8.11
1,2-Dibromoethane	0.098	0.016	6.58
Benzene, chloro-	0.197	0.016	8.12
Ethylbenzene	0.539	0.057	10.59
Xylenes(p+m)	0.701	0.052	7.50
Styrene	0.094	0.007	7.82
O-Xylene	0.309	0.011	3.71
Ethane, 1,1,2,2-tetrachloro	0.111	0.007	7.15
Benzene, 1-bromo-4-fluoro-(SS3)	0.746	0.059	8.01
Benzene, 1,2,3-trimethyl-	0.208	0.011	5.32
Benzene, 1,2,4-trimethyl-	0.206	0.012	6.08
Benzene, 1,2-dichloro-	0.129	0.005	4.19
Benzene, 1,3-dichloro-	0.128	0.007	5.71
Benzene, 1,4-dichloro-	0.101	0.011	11.19

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NUTECH 3551 PERFORMANCE - REPEATABILITY

Instruments: Nutech 3551DS Preconcentrator with Agilent 6890/5973 GC/MS

Standard Gas: EPA TO-14, 50 ppb

Run 7 replicate independent experiments of TO-14 standard analysis using 100 ml sample volume of standard gas at 100 ml/min flow rate. The results are shown in the following table:

Target Compounds	AVG	SD	RPD%
Dichlorodifluoromethane	0.305	0.0081	2.66
Chloromethane	0.125	0.0028	2.23
Dichlorotetrafluoroethane	0.305	0.0081	2.66
Ethene, chloro-	0.074	0.002	2.70
Methane, bromo-	0.060	0.0023	3.87
Chloroethane	0.037	0.0012	3.10
Trichloromonofluoromethane	0.367	0.0083	2.27
Ethene, 1,1-dichloro	0.154	0.0053	3.42
Ethane, 1,1,2-trichloro	0.215	0.0075	3.45
Methylene chloride	0.069	0.0027	3.82
Ethane, 1,1-dichloro-	0.177	0.0027	1.51
Ethene, 1,2-dichloro-, (Z)	0.110	0.0022	1.98
Bromochloromethane(SS1)	0.419	0.0069	1.65
Chloroform	0.272	0.0046	1.69
Ethane, 1,1,1-trichloro-	0.362	0.0046	1.26
Ethane, 1,2-dichloro-	0.216	0.0029	1.35
Benzene	0.366	0.0065	1.77
Carbon tetrachloride	0.400	0.0043	1.07
Benzene, 1,4-difluoro(SS2)	2.424	0.0255	1.05
Trichloroethylene	0.201	0.0025	1.23
Ethane, 1,2-chloro-	0.033	0.0009	2.77
Cis-1,3-dichloropropene	0.071	0.0021	2.89
Trans-1,3-dichloropropene	0.021	0.0005	2.57
Toluene	0.257	0.0038	1.46
Ethane, 1,1,2-trichloro-	0.092	0.0011	1.20
Tetrachloroethylene	0.169	0.0028	1.61
1,2-dibromoethane	0.109	0.0026	2.37
Benzene, chloro-	0.219	0.0012	0.56
Ethylbenzene	0.380	0.0038	1.00
Xylene(p+m)	0.310	0.0028	0.91
Styrene	0.134	0.001	0.76
Benzene, 1,4-dimethyl-	0.315	0.0019	0.61
Ethane, 1,1,2,2-tetrachloro	0.190	0.0041	2.17
Benzene, 1-bromo-4-fluoro-(SS3)	0.851	0.0098	1.14
Benzene, 1,2,3-trimethyl-	0.316	0.0039	1.22
Benzene, 1,2,4-trimethyl-	0.345	0.0046	1.33
Benzene, 1,2-dichloro-	0.263	0.0039	1.47
Benzene, 1,3-dichloro-	0.263	0.0046	1.75
Benzene, 1,4-dichloro-	0.239	0.0036	1.49
Benzene, 1,2,4-trichloro-	0.182	0.0052	2.84
1,1,2,3,4,4-Hexachloro-1,3-butadiene	0.221	0.0048	2.18

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H2S AND ORGANIC SULFUR COMPOUNDS APPLICATION ON GC/MS

Method Path: D:\gcms method\METHODS\
 Method File: four Sulfide20100201.M
 Title: four Sulfide
 Last Update: Mon Feb 01 18:04:28 2010
 Response Via: Initial Calibration

Calibration Files

1 = 02011006 2 = 02011004 3 = 02011005

Calibration Table

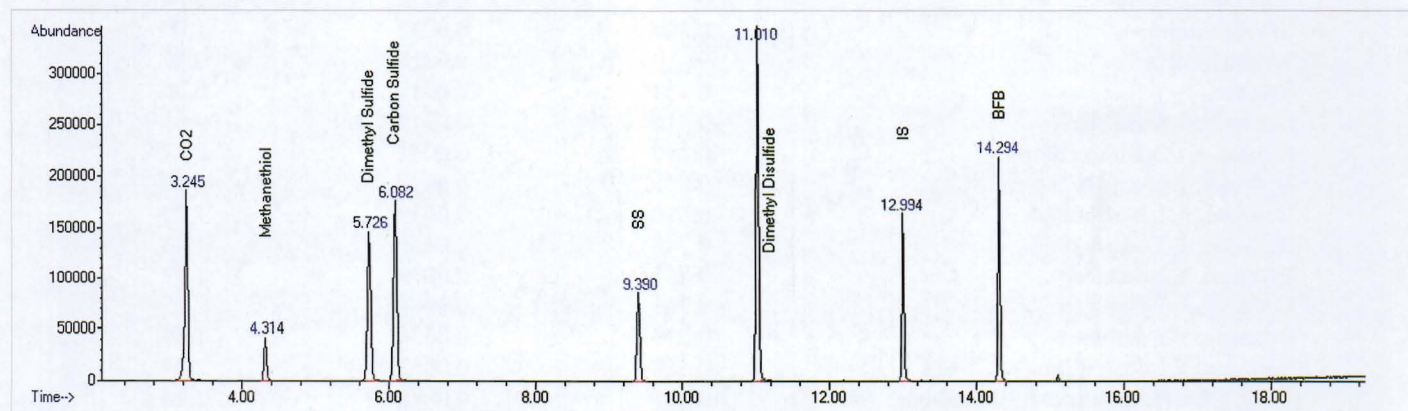
Compound	Fit	Constant	Linear	Quad	RSD/Cf
is)Benzene-d5-, ...			-----ISTD-----		
Hydrogen sulfide	Avg	---	0.0146	---	0.2920
Methanethiol	Avg	---	0.0765	---	0.1479
Dimethyl sulfide	Avg	---	0.0983	---	0.0683
ss)Benzene, 1,4-...	Avg	---	0.9909	---	0.0074
Disulfide, dimet...	Avg	---	0.0200	---	0.2690
ss)Benzene, 1-br...	Avg	---	0.7051	---	0.0232

four Sulfide20100201.M Mon Feb 01 18:04:35 2010

MDL Study for Three Marcaptans

Tested by: GC-MS, 2010, on Nutech 3551

Data File	02021036	02021037	02021038	02021039	02021040	02021041	02021042			
Run number	1	2	3	4	5	6	7			
Target Compounds	Relative Response, in ppbv							Avg	SD	MDL
1) methanethiol	3.82	4.50	4.19	4.99	4.77	4.32	4.30	4.41	0.39	1.21
2) dimethyl sulfide	7.69	8.02	7.44	7.78	8.04	8.32	8.14	7.92	0.30	0.94
3) disulfide dimethyl	2.70	2.52	2.01	1.88	2.10	2.08	1.96	2.18	0.31	0.97



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ACCESSORIES

A Tedlar Bag is an alternative sampling container for air VOC analysis. The Tedlar Bag is made from a DuPont special material PVF film with a PEF-coated septa to keep the gas sample stable and leak free.

GD Environmental Supplies manufactures high quality Tedlar bags with standard volumes of 1, 3, 5 and 10 liters.



CALIBRATION STANDARDS

GD Environmental Supplies offers NIST Traceable calibration standards from Spectra Gases, Inc.

TO-14, 39 Compounds Standard

TO-14, 41 Compounds Standard

TO-15, 62 Compounds Standard

PAMS, 62 Compounds Standard

Other client specified standards

Regulators

INITIAL INSTALLATION AND TOOLS

GD Environmental provides all the necessary installation kits and tools for the initial installation and additional maintenance. We are a single resource for all turnkey solutions. GD Environmental will integrate all system parts from sample inlet to final MS data handling. We will help to set up all the necessary performance methods including preconcentrator methods and GC/MS methods. We will assist with all applications and research projects.



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ACCESSORIES



Canister Heating Jacket



Personal Sampling Pump



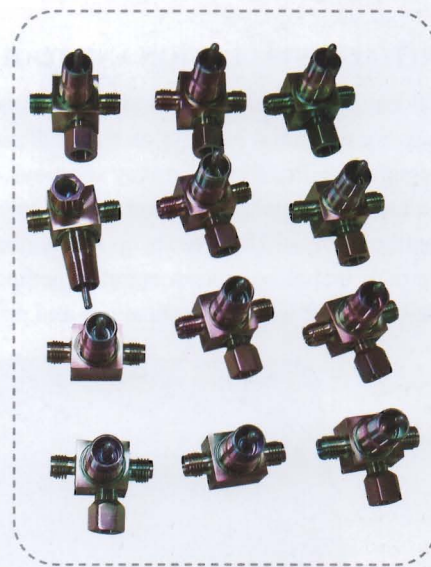
Replacement Canister Valve



Tedlar Bag Sampler



Vacuum Gauge & Flow controller (orifice)



Silica Coated Valves and other parts

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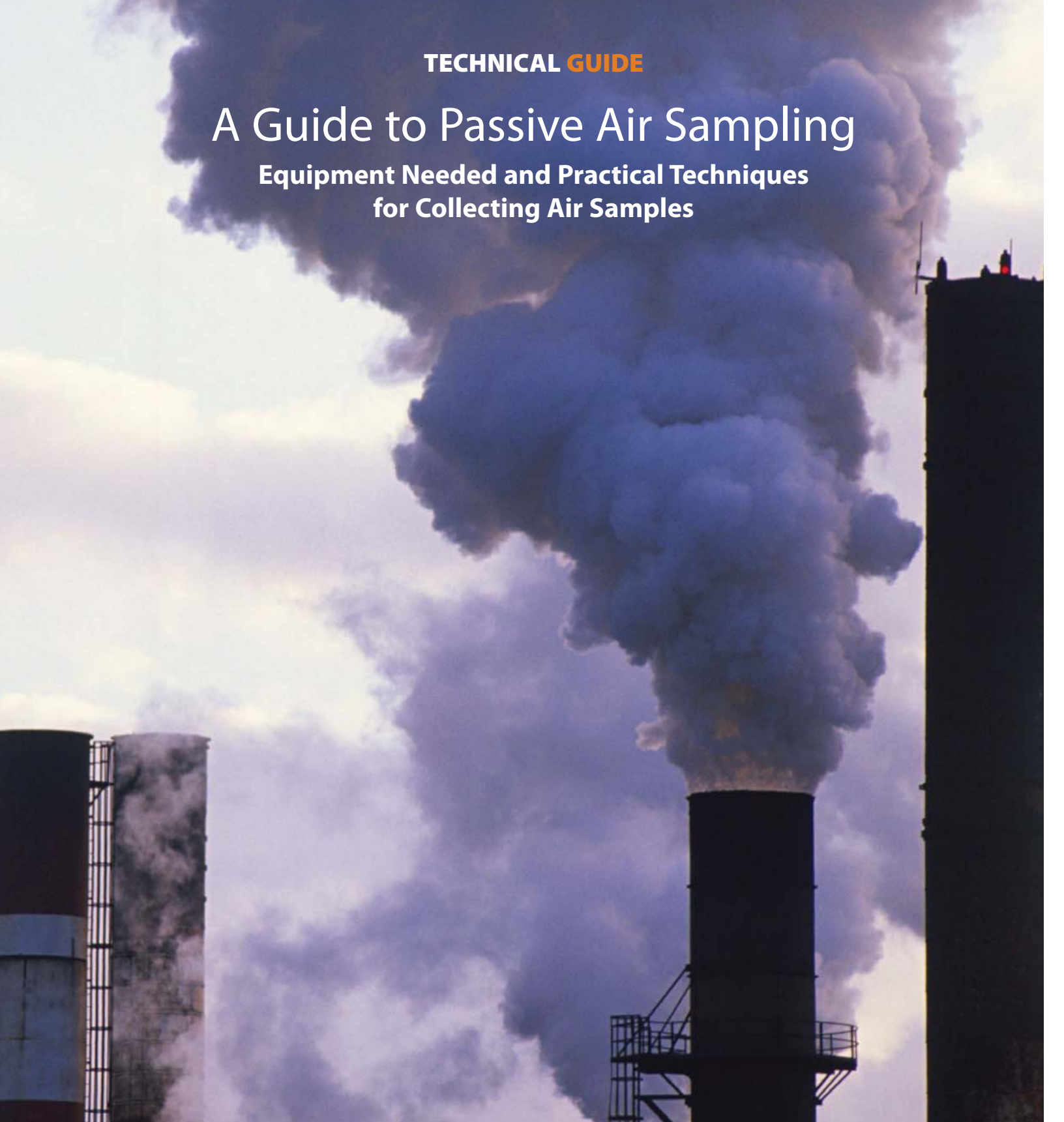
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TECHNICAL **GUIDE**

A Guide to Passive Air Sampling

Equipment Needed and Practical Techniques
for Collecting Air Samples



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dependable execution

One of our standing goals is to provide you with practical information to help you obtain reliable data from your chromatographic and peripheral systems. This guide describes equipment needed and practical techniques to follow when collecting passive air samples, using canisters. It is a compilation of information based on our experience and that of experts in this field. We would like to thank the individuals who provided invaluable assistance in the development of this guide: Dr. Eric Winegar of Applied Measurements Science, Joachim Pleil of the US Environmental Protection Agency, John Yokoyama of Performance Analytical, and Jerry Winberry of Envirotech Solutions.

If you have any questions, or have input for future editions of this guide, please feel free to contact us at Restek Corporation.



David M. Shelow

Air Monitoring Products

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I. Introduction

Ambient air sampling involves collecting a representative sample of ambient air for analysis. If the environment is not changing, or if only a qualitative sample is needed, a simple “grab” sample can be obtained. For example, an evacuated sample canister can be opened and sample rapidly collected at a non-controlled rate, usually over several seconds, until the container attains equilibrium with atmospheric pressure. Generally this qualitative approach is used when unknown analytes must be identified, when the air contains high concentrations of analytes at certain (short) times, or when an odor is noticed and a sample must be obtained quickly. Paired grab samples (before/after or smell/no smell) often are employed to qualitatively diagnose a perceived problem.

To obtain a more representative sample requires time-integrated sampling. A flow restrictor is used to spread the sample collection flow over a specific time period, to ensure an “average” composited or time-weighted average (TWA) sample. A TWA sample will accurately reflect the mean conditions of the ambient air in the environment and is preferred when, for regulatory or health reasons, a typical exposure concentration is required for a situation that may have high variability, as in an occupational setting.

There are two general approaches to collecting air samples: 1) “whole air” sampling with canisters or Tedlar® bags and 2) “in-field concentration” sampling using sorbent tubes or cold traps. In this guide we focus on collecting whole air samples in canisters. Within this approach, two sampling techniques commonly are used: passive sampling and non-passive (active) sampling, distinguished by the absence or use of an active pumping device, respectively.

In passive sampling an air sample is pulled through a flow controller into an evacuated canister over a chosen period of time, ranging from 5 minutes to 24 hours. The sampling period and the flow rate determine the canister volume required. In active sampling, a pump is used to push the sample through a mass flow controller and into the canister. Additional sample can be collected, relative to the amount that can be collected by passive sampling, by pressurizing the canister with sample. Commonly the sample is pressurized to 15psig, effectively doubling the sample volume. Sampling can be time-integrated (e.g., an 8-hour sample), or a dip tube design can be used to establish a flow through the system and flush the sample container with sample, then, after a specified time, the exit valve is closed and the container is pressurized with sample.

Although active sampling is very flexible, a drawback to using a pump is the need for additional quality assurance requirements for sample integrity (i.e., no artifacts or loss of analytes). Additionally, a pump requires a battery or line power source, which may pose logistic difficulty in remote field-site sampling.

II. Equipment Used for Passive Air Sampling

To ensure a valid sample when using a passive sampling technique, it is important that the flow rate not change greatly during the time interval specified for the integrated sample. The proper sampling equipment helps accomplish this objective. A typical passive sampling train should include the following components, all constructed of stainless steel: a sampling inlet, a sintered metal particle filter, a critical orifice, a flow controlling device, a vacuum gauge, and a canister (Figure 1).

Sampling Inlet

The sampling inlet - the entrance to the sampling train - typically is cleaned stainless steel tubing, either 1/4" ID or 1/8" ID. US EPA Compendium Method TO-14/15 recommends sampling at a height of 2 meters above the ground. In a highly trafficked area, this would minimize the problem of dust particles entering the sampling train. This height is not mandatory, however, and it is common practice to use an inlet that is 12" (approximately 1/3 meter) high. The EPA also recommends having the entrance of the sampling inlet face

downward, to prevent raindrops from entering the inlet. In some sampling trains a 1/8" or 1/4" nut at the entrance of the inlet keeps water droplets away from the edge of the inlet, where they could be drawn into the sampling train with the sample.

Particle Filter

Installed in the sampling train prior to the flow-controlling device, the particle filter prevents airborne particles from entering the sample flow path. Particles could partially obstruct the flow path and alter the flow rate during sampling. In extreme cases, particles could plug the flow path and stop the sample flow. The smallest orifice commonly used in a passive sampling train is 0.0012" (approximately 30 micrometers). Without a particle filter, dust particles could occlude this opening as they accumulate in the orifice fitting. Particles also can affect the leak integrity of the valve, and possibly can damage the valve. Two types of filters are used for this application, frit filters and in-line filters (Figure 2). A variety of models of each type are available; most are of sintered stainless steel and have 2-, 5-, or 7-micron pores. Obviously, the smaller the pores, the less likely are potential problems from airborne particles. EPA Compendium Method TO-14A/15 recommends using a particle filter with 2-micron pores.

Critical Orifice

The critical orifice (Figure 3, page 4) restricts the flow to a specified range. In conjunction with the flow controller, this allows the canister to fill at a specified rate over a specified time period. The most common critical orifice design is a series of interchangeable stainless steel 1/4" NPT to 1/4" compression unions, each fitted with a precisely bored sapphire orifice. Each orifice provides a specific flow range (Table 1). Stability over a wide range of temperatures makes sapphire the construction material of choice. Typically during field sampling, the sampling train is subjected to temperature fluctuations that would cause metals to contract or expand, affecting the diameter of the aperture and thereby affecting flow. Sapphire will not expand or contract across any ambient temperature extremes incurred during sampling.

A critical orifice can be used as the sole flow-restricting device, but it cannot ensure uniform flow. The source pressure of the flow changes during sampling, and the flow rate through the orifice also would change, producing an invalid time-integrated sample. It is important that a highly consistent flow rate be maintained during passive sampling. This is accomplished by the flow controller that incorporates the critical orifice.

Flow Controller

The flow controller (Figure 3, page 4) maintains a constant sample flow over the integrated time period, despite changes in the vacuum in the canister or in the environmental temperature (Figure 4, page 5). In the Veriflo™ Model SC423 XL Flow Controller shown in Figure 3, the critical orifice acts as a flow restrictor, upstream of a constant back pressure. This constant back pressure is established by the balance between the mechanical spring rate of the diaphragm and the pressure differential across the diaphragm. The latter is established by the pressure difference between the atmospheric pressure and the vacuum in the canister and the flow through the critical orifice. The net result is a constant flow.

Table 1 Critical orifice diameter vs flow rate.

Orifice Diameter (in.)	Flow Rate Range (sccm)	Canister Volume / Sampling Time			
		1L	3L	6L	15L
0.0008	0.5-2	24 hr.	48 hr.	125 hr.	--
0.0012	2-4	4 hr.	12 hr.	24 hr.	60 hr.
0.0016	4-8	2 hr.	6 hr.	12 hr.	30 hr.
0.0020	8-20	1 hr.	4 hr.	8 hr.	20 hr.
0.0030	20-40	--	2 hr.	3 hr.	8 hr.
0.0060	40-80	--	--	1 hr.	3 hr.

Figure 1 A complete sampling train is needed for reliable passive sampling.

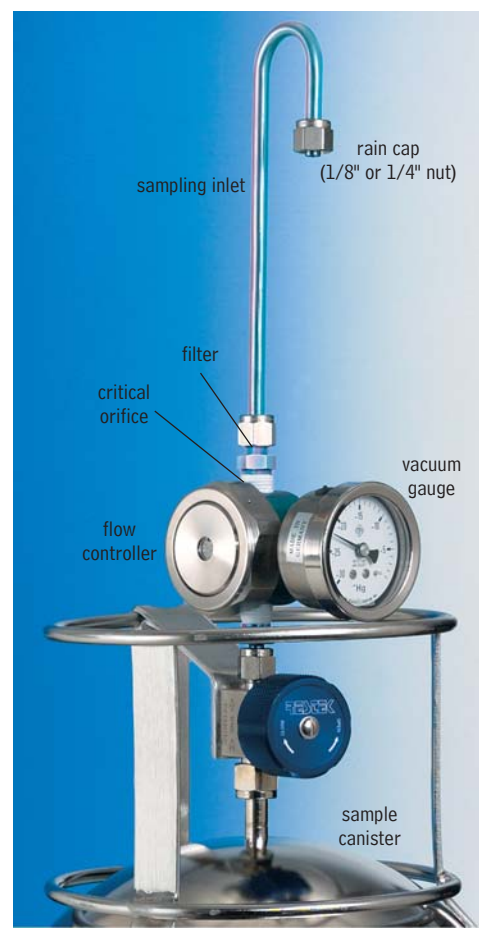


Figure 2 Filters used in sampling trains.

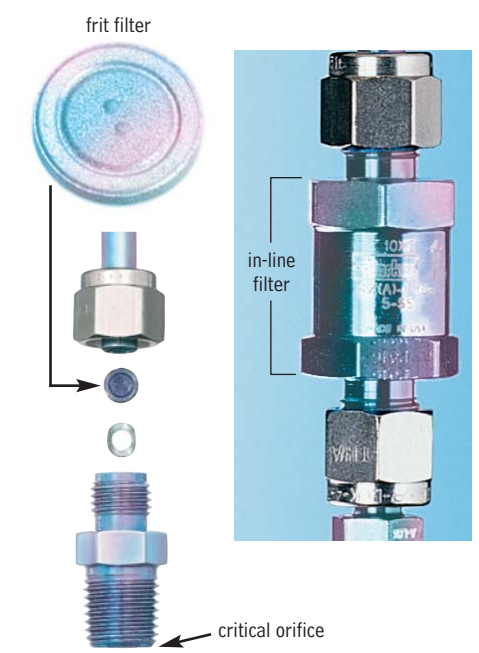


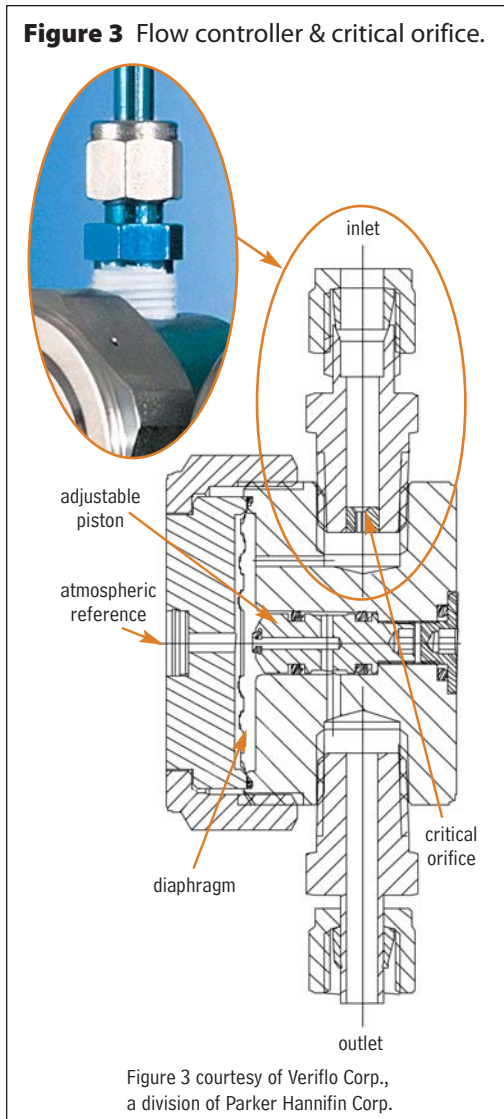
Figure 3 Flow controller & critical orifice.

Figure 3 courtesy of Veriflo Corp.,
a division of Parker Hannifin Corp.

The critical orifice determines the flow range. The adjustable piston is used to set a specific, fixed flow rate within the flow range. An adjustment to the position of the piston changes the back pressure, which changes the pressure differential across the critical orifice. If the piston is lowered away from the diaphragm, the flow rate will increase. If the piston is raised toward the diaphragm, the flow rate will decrease. This flow controller will accurately maintain a constant flow despite changes in vacuum over a range of 30" Hg to 7" Hg. Flow is constant until the vacuum range of the device is exceeded, making the flow controller unable to maintain the constant pressure differential. In Figure 5, for example, the flow rate is constant from 29.9" Hg to approximately 7" Hg, at which point the flow rate decreases because the flow controller is unable to maintain the proper pressure differential. This control will allow the user to collect approximately 5 liters of sample in a 6-liter canister. This is an extremely important factor in obtaining valid time-integrated samples through passive sampling. We will discuss this point further in the Field Sampling section of this guide.

Vacuum Gauge

A vacuum gauge enables sampling personnel to visually monitor changes in the vacuum in the canister during sampling. If the flow rate changes unexpectedly (e.g., due to a leak or an incorrect setting), the vacuum gauge will indicate a disproportionately high or low vacuum in the canister, and corrective action can be taken (i.e., flow adjusted) in time to ensure a valid sample. This type of vacuum gauge is attached to the sampling train, for use in the field. The vacuum gauge should be of high quality, to ensure that it does not introduce contaminants into the sample. All wetted parts in the vacuum gauge shown in Figure 6 (page 7) are constructed of stainless steel; the gauge is accurate to within 1% of full scale.

To monitor pressure in the canister before and after sampling, use a more accurate measuring device. Test gauges built by Ashcroft are accurate to 0.25% of full scale. These sensitive gauges should not be used in the field - they typically are wall mounted in the lab. Once used for sampling, a gauge must be cleaned, and should be certified clean. Procedures are described later in this guide.

Canister

The canister is a stainless steel vessel designed to hold vacuum to less than 10 mTorr or pressure to 40 psig. Canisters are available in a range of volumes: 850 mL, 1.0 liter, 1.8 liter, 3.0 liter, 6.0 liter, 15 liter, and 35 liter. The size of canister used usually depends on the concentration of the analytes in the sample, the sampling time, the flow rate, and the sample volume required for the sampling period (Table 1, page 3). Typically, smaller canisters are used for more concentrated samples, such as soil gas collection, 3-liter and 6-liter canisters are used to obtain integrated (TWA) ambient air samples at sampling times of up to 24 hours, and large 15-liter and 35-liter canisters are used for reference standards. Sampling time will be limited by the combination of canister size and the flow rate at which the sample is to be collected.

A well-designed canister is essential to the success of the sampling project. First, the canister should be made of stainless steel, so the collected sample will not permeate through the vessel wall or degrade due to exposure to light during shipment to the analytical laboratory. Second, the interior surface of the canister should be inert, to reduce the potential for interactions with the analytes in the sample. Third, all canisters involved in a particular application should be of consistent volume, to simplify calculating sample volumes. Finally, the canister should have a high quality valve that resists abuse in the field (e.g., overtightening that potentially could cause leaks). An inferior valve can fail, causing sample loss and incurring replacement costs. It can be more expensive to sample again than to replace a valve.

Two types of canisters are available, the difference being the interior surface. The traditional canister is the stainless steel SUMMA® canister. The interior of

Figure 4 A flow controller will maintain a constant sample flow despite changes in canister pressure or environmental temperature.

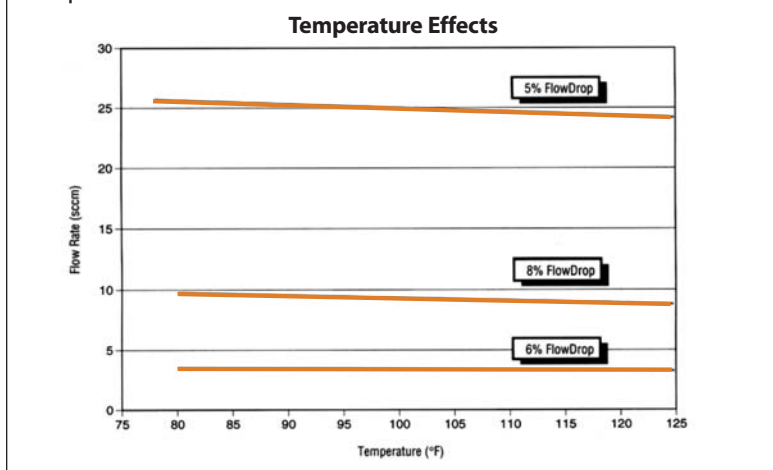
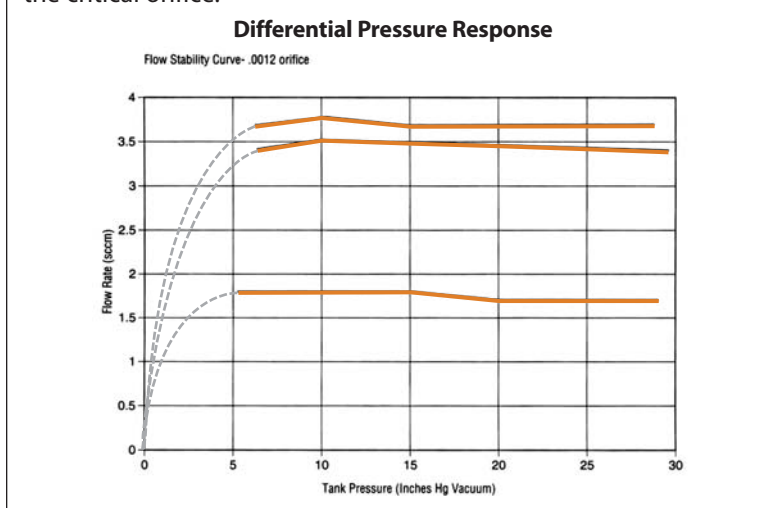


Figure 5 A flow controller will maintain a constant sample flow until it is unable to maintain a stable pressure differential across the critical orifice.



Figures 4 and 5 courtesy of Veriflo Corp., a division of Parker Hannifin Corp.

a SUMMA® canister is electropolished, using a polishing procedure (developed by Molecotrics) that enriches the nickel and chromium surface and makes it more inert than untreated stainless steel. The new generation of sampling canister is typified by the SilcoCan™ canister. Like the SUMMA® canister, the SilcoCan™ canister is made of stainless steel, and the interior is electropolished, but in an additional step - Siltek® treatment - an inert layer is chemically bonded to the interior surface. Siltek® treatment makes the surface inert not only for relatively inactive organic compounds, but also for compounds that are reactive with metal surfaces, such as sulfur-containing compounds. Thus, surface deactivation for SilcoCan™ canisters exceeds that for SUMMA® canisters.

Canister Valve

The valve on a sampling canister must be of high quality, with the following characteristics: leak integrity, a metal seat (to eliminate offgassing of seat components into the sample and memory effects in the seat material), stainless



a plus 1 story

Barry was asked to build and test 20 air sampling canisters, for shipping the same day at 11:30am. He worked nonstop, until the canisters were assembled, quality checked, and packaged for shipment, ensuring a customer had the canisters in time for an important project.

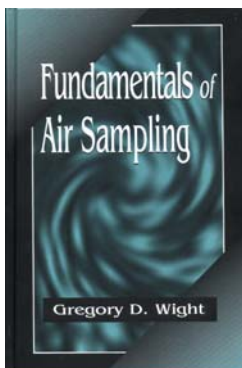
Barry Spicer, Jr.,
Restek Performance Coatings Technician

steel wetted surfaces, and a packless design (a completely enclosed system, to ensure no contamination from lubricants or packing material). Various valves are used on various models of canisters; the most commonly used valves are the Nupro 4H4 series metal bellows valve and the Parker Hannafin diaphragm valve with metal seat. At Restek we incorporate the Parker Hannafin diaphragm valve on canisters because of its ability to hold vacuum, its durability and longevity, and a maximum temperature limit (250°C) that is much higher than that for a bellows valve. Further, a Parker Hannafin diaphragm valve can be rebuilt if it is damaged; it does not have to be replaced.

The connection of the valve to the canister is critical. The connection must be leak tight, to ensure a correct sampling flow rate, but extreme caution must be taken to prevent overtightening the tube compression fittings.

Siltek® and Sulfinert® Treatment

Siltek® treatment is a proprietary process, developed by Restek Corporation, through which an inert layer is chemically bonded to a metal surface. The surface produced by this treatment is virtually inert to active compounds. The stainless steel pathway described in this guide is sufficient for sampling atmospheres containing only non-reactive compounds, but for reactive compounds the entire sampling pathway should be Siltek® treated to eliminate contact between the reactive analytes and the metal surfaces. Siltek® treatment can be applied to the interior surfaces of the canister and valve, to ensure an inert sample pathway. If the samples will contain reduced sulfur-containing analytes, an alternative proprietary Restek deactivation process, Sulfinert® treatment, is the most effective means of deactivating the sample pathway and canister.



Fundamentals of Air Sampling

This book explains the fundamentals of air sampling, develops the theory of gas measurement, and presents several how-to examples of calibration and use of air and gas sampling devices. Other topics include the basics of pressure measurement and units conversion, and specific discussions regarding the use of a Volatile Organic Sampling Train or a SUMMA®-polished canister sampling system.

G. D. Wight, CRC Press LLC, 1994, 272pp., cat.# 20492

III. Preparing the Sampling Train for Use

The sampling train must be prepared in the laboratory before it can be used in the field. The train must be assembled and leak tested, the flow rate must be set, and the train must be certified clean. All of the following information should be documented for the chain of custody for the passive sampling train and the sample collected with it.

Assemble, Leak Test, and Set the Flow Rate of the Passive Sampling Train

Choose the critical orifice (Table 1, page 3) according to the sampling period and flow rate you anticipate using (Table 2). This will ensure an accurate and valid sample. There should be a marking on the outside of the critical orifice fitting indicating the size of the orifice. In a clean environment, assemble the sampling train components as shown in Figure 1 (page 3). It is imperative that you leak test the assembled train. If the sampling train leaks during sampling, the final partial pressure in the canister will not be the desired final partial pressure, making the sample invalid. The most common reason for invalid samples is leaks within the sampling train. There are two ways to leak test the train:

1. Pass helium gas through the flow controller and use a sensitive helium leak detector to test for leaks (e.g., Restek Leak Detector).
2. Cap the inlet, attach the sampling train to an evacuated canister, open the valve on the canister and evacuate the sampling train.

Close the valve and monitor any pressure change in the static sampling train. Leaks of less than 1 mL/min. can be detected in 1-2 minutes.

This is a good practical test - the small internal volume of the passive sampling train, combined with even a small leak, will produce a large change in monitored pressure.

After you are certain the sampling train is leak-free, set the desired sampling flow rate.

To set the desired flow rate follow these steps:

1. Remove the protective cap from the back of the Veriflo™ Flow Controller SC423XL body.
2. Connect either an evacuated canister or a vacuum source to the outlet of the sampling train.
3. Connect a high quality calibrated flow meter (i.e., mass flow meter, rotameter, GC-type flow sensor, e.g., Restek Flowmeter 6000, cat. #21622) to the inlet of the train.
4. Apply vacuum by opening the canister or turning on the vacuum source.
5. With a 3mm hex (Allen) wrench, adjust the piston gap screw to achieve the desired flow rate (Table 2). Between adjustments allow the flow to equilibrate for several minutes.
6. Replace the protective cap onto the back of the Veriflo™ Flow Controller body.

Cleanliness: Certifying the Sampling Train for Use

US EPA Compendium Method TO-14A/TO-15 requires that the sampling train be certified clean prior to use. Certify the train by passing a humidified, high-purity air stream through the train, concentrating the exit gas on a trap, and analyzing the gas by gas chromatography / mass spectroscopy or other selective detector. For the sampling train to pass certification the analytical system should not detect greater than 0.2ppbv of any target VOC.

The certified sampling train should be carefully packaged in aluminum foil or in a clean container for storage or for shipment into the field. Care in packaging is critical. Careless handling could affect the preset flow rate. When the sampling train is ready for sampling, prepare the canister.

IV. Preparing the Canister for Sampling

Preparing a canister for sampling involves certifying the canister clean, evacuating the canister to final pressure for use, and identifying the canister. All information acquired during these processes is needed for the chain of custody.

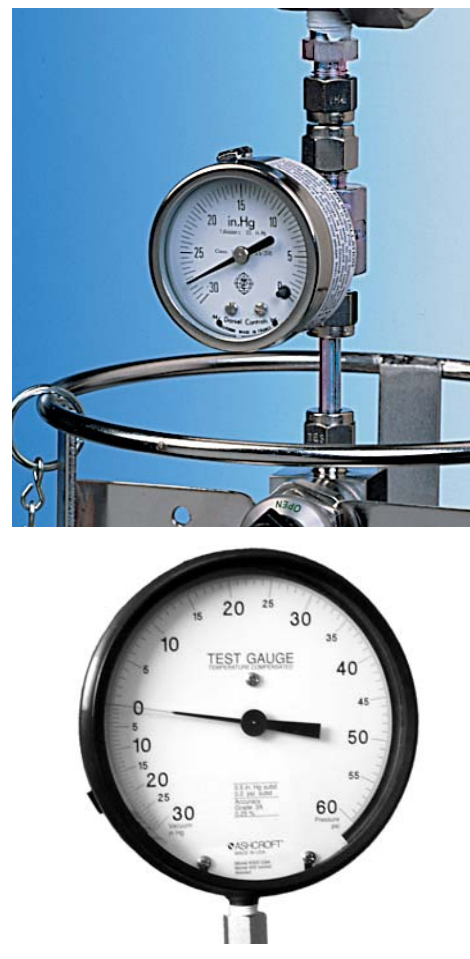
Certifying the cleanliness of the canister is important toward ensuring that results reported are solely from the site sampled, and not admixed with residue from a previous site or from contaminated laboratory air. To certify a canister clean, fill the canister with humidified air, pass the air from the canister through an adsorbent trap and analyze the adsorbent for target VOCs by GC/MS or other selective detector. Two US EPA methods discuss canister certification: EPA Compendium TO-12 and EPA Compendium TO-14A/TO-15. To comply with EPA Compendium Methods TO-14A/TO-15, the analytical system should not detect greater than 0.2ppbv of any target VOC. To comply with EPA Compendium Method TO-12 the analytical system, GC/FID, should not detect greater than 0.02ppmvC hydrocarbons. Although batch certification of canister cleanliness is a relatively common practice, we recommend certifying and documenting each canister individually. Detailed cleaning instructions are presented in Section VIII. Cleaning the Canister (page 12).

Table 2 Flow rates for integrated sampling, using a 6-liter canister and sampling on the flat portion of the flow curve for the flow controller (Figure 5).

Sampling Period (hours)	0.5	0.75	1	2	4	8	12	16	24
Flow Rate Range (mL/min.)	133-167	89-111	67-83	33-42	17-21	8-10	5.6-6.9	4.2-5.2	2.8-3.5

Collected volume is 4-5 liters (flow = volume in mL / sampling time in min.).

Figure 6 Conventional vacuum gauge and high-accuracy test gauge.



Some laboratories certify a canister for VOC stability by introducing a low concentration test mixture into the canister and measuring degradation over a specified time period. If the canister meets the specification, it is certified for use. We recommend using such studies to ensure the effectiveness of a canister or group of canisters for a proposed application.

Once the canister is certified clean, evacuate the canister to a final vacuum of 10-50mtorr, using either the canister cleaning system or a clean final vacuum system. This vacuum is critical to ensure the correct amount of sample is collected. Use an accurate test gauge or digital pressure tester to ensure final vacuum has been reached and document the final vacuum reading for the chain of custody. Install a brass plug nut into the canister valve to ensure no contamination can enter the sample pathway during shipment to the field.

Allot an individual identity to the canister, either with a label and serial number or with a bar code.

Some analysts prefer to introduce surrogate standards into the canister prior to sampling. Debate on this practice revolves around theories that there are potential loss issues due to low humidity and inadequate surface passivation by water. Neither Restek chemists nor our consulting experts recommend adding surrogates to the canisters. If you choose to introduce surrogates into your canisters prior to sampling be sure to recheck the vacuum reading for each canister after adding the surrogates, and record the reading.

did you know?

Restek canisters are shipped in boxes with handles for ease of carrying and transporting, eliminating costly carrying cases.



V. Field Sampling, Using a Passive Sampling Train and Canister

It is important to mention again that the sampling train and canister must be leak tested and certified clean prior to use. To properly begin field sampling, we recommend bringing a "practice" evacuated canister and a flow measuring device with you to the field. Use this canister to verify the flow rate through the passive sampling train prior to using the train to obtain samples of record. To verify the flow rate, connect the passive sampling train to the "practice" canister. Attach a flow meter to the inlet of the sampling train. Open the canister, and measure the flow rate through the sampling train. If the flow rate is within +/- 10% of the flow rate set in the lab, the train is ready to be used on the formal sampling canister. If the flow rate is not within these limits, adjust the flow rate by adjusting the piston gap screw.

When the flow rate is confirmed, record the rate as the canister flow rate for the chain of custody form.

To begin sampling, using the formal sampling canister, follow these steps:

1. Remove the brass plug nut from the canister valve.
2. If you are using a test gauge, attach the gauge to the canister and record the vacuum reading. If you choose not to use a test gauge under field conditions, record the reading on the vacuum gauge that is part of the passive sampling train.
3. Attach the verified passive sampling train to the canister.
4. Record the begin sampling time and necessary meteorological data.
5. Open the canister valve and begin sampling.
6. Periodically check the canister throughout the sampling period to ensure the partial pressure reading is accurate and sampling is proceeding as planned.
7. Once the sampling period is complete, close the valve and remove the sampling train. Check the final partial pressure within the canister, using the test gauge or the vacuum gauge in the sampling train.

There are four possible scenarios:

- A. Ideally there will be a vacuum of 7"-4" Hg in the canister (see, e.g., Table 3 on page 10).
 - B. If more than 7" Hg vacuum remains, less sample was collected than initially anticipated. The sample will be valid, but the detection limit may be higher than expected. You might have to pressurize the canister prior to the analysis, which will dilute the sample, then you will have to use a dilution factor to determine final concentrations of target compounds.
 - C. A vacuum of less than 4" Hg indicates the sample might be skewed toward the initial part of the sampling period. This assumption usually is valid because the flow rate through the flow controller will fall once the vacuum falls below 5" Hg (Figure 5, page 5), when the change in pressure across the flow controller diaphragm becomes too small and the flow controller is unable to maintain a constant flow. Although flow was not constant over the entire sampling period, the sample might be usable because sample was collected over the entire interval.
 - D. If the ending vacuum is less than 1" Hg the sample should be considered invalid because it will be impossible to tell when the sample flow stopped.
8. Record the final partial pressure in the canister and replace the plug nut.

Information that should be acquired at the sampling site includes the start time and interval time, the stop time, atmospheric pressure and temperature and, for ambient sampling, wind direction. Include elevation if it is a factor. These parameters often prove very useful toward interpreting results.

After sampling, the canisters are sent back to the laboratory, where the final vacuum is measured once again, with a test gauge. Using the initial vacuum and final vacuum, the sample volume collected can be determined from Equation 1:

Equation 1:

$$\text{sample volume} = \frac{\text{pressure change}^*}{\text{atmospheric reference pressure}} \times \text{canister volume}$$

*initial pressure - final pressure

Example: A sample is collected in a 6-liter canister. The initial gauge pressure reading when the canister left the lab was 29.92" Hg vacuum; the final gauge pressure reading when the canister was returned to the lab was 7" Hg vacuum.

$$\text{sample volume} = [(29.92\text{''Hg} - 7\text{''Hg}) / 29.92\text{''Hg}] \times 6\text{L} = 4.59 \text{ liters collected.}$$

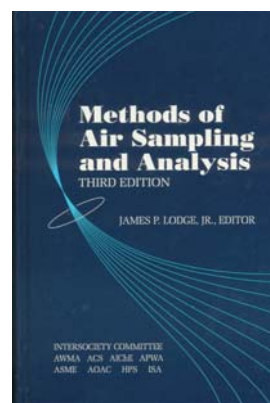
It is also a good practice to recheck the flow rate after sampling, because this will affect the sample volume (Equation 2). Laboratories typically allow a maximum deviation of +/-10% to +/-25% between the initial flow rate and the post-sampling flow rate.

Equation 2:

$$\text{sample volume} = [(\text{initial flow rate} + \text{post-sampling flow rate})/2] \times \text{sampling time}$$

Example: A flow controller was set at 3.3mL/min. After obtaining a 24 hour sample the flow rate was 3.0mL/min.

$$\text{sample volume} = [(3.3\text{mL/min.} + 3.0\text{mL/min.}) / 2] \times 1440 \text{ min.} = 4536\text{mL.}$$



Methods of Air Sampling and Analysis, 3rd Edition

This book includes precise directions for analyzing a long list of air contaminants. All contaminants one can analyze or monitor using a given method are consolidated to facilitate use. An excellent reference manual for all analytical laboratories conducting air analyses.

J. P. Lodge, CRC Press LLC, 1988, 784pp., **cat.# 20493**

VI. Analysis of Collected Samples

Once received by the lab, each canister is identified from the information in the chain of custody report. The final partial pressure is checked to ensure no leaks appeared during transport. It might be necessary to pressurize a canister prior to the analysis; do this by adding humidified nitrogen or air to the canister to a pressure greater than 5 psig or higher, depending on the sample volume needed for analysis or for suitably diluting the sample (e.g., Table 4). The need to dilute is determined by the preconcentrator instrument. Some air preconcentrators can be operated while the canister is under slight vacuum. Check with your instrument manuals, or with the manufacturer, to determine if you must dilute your samples prior to analysis.

Equation 3:

$$\text{dilution factor} = (P_{\text{after dilution}} + P_{\text{lab atmosphere}}) / (P_{\text{lab atmosphere}} - P_{\text{before dilution}})$$

The dilution factor is calculated from the post-sampling pressure (before dilution), the final pressure (after dilution), and the atmospheric pressure in the laboratory. The factor for converting "Hg to psi = 0.491.

Example: At the end of a sampling period the gauge pressure in a canister was 7"Hg. The canister was pressurized with nitrogen to 14.7psig (1 Atm.).

The dilution factor is $(14.7 + 14.7) / (14.7 - (7 \times 0.491)) = 2.61$

Table 3 Final vacuum and volume of sample collected in 6-liter canister.

Final Vacuum ("Hg)	29"	27"	25"	23"	20"	17"	15"	12"	10"	7"	5"	3"	0"
Sample Volume (liters)	0	0.58L	0.99L	1.39L	1.99L	2.59L	2.99L	3.59L	3.99L	4.60L	5.0L	5.40L	6L

To analyze the sample, withdraw an aliquot of the sample from the canister. For low level ambient air analysis, withdraw 250-500 mL of sample from the canister and concentrate the analytes by using a mass flow controller and a cryogenically cooled trap (e.g., glass beads and/or a solid sorbent). Desorb the concentrated analytes from the trap and deliver them to a cryofocuser, to focus the sample bandwidth prior to introduction onto the GC column. A 60m x 0.32mm ID x 1.0µm Rtx®-1 column typically is used for EPA Method TO-14A or Method TO-15 ambient air analysis; an MSD is a common detector. Figure 7 shows a typical TIC spectrum for a TO-14A/TO15 ambient air analysis.

Procedures used in these chromatographic analyses generally include a multi-point calibration, using gas standards. Therefore calculations of organic compounds in collected samples are straightforward - only volumes analyzed and dilution rates are needed to determine sample concentrations. High concentration calibration gas standards are commercially available (e.g., 1ppmv or 100ppbv); introduce an aliquot of stock material into a canister and dilute with humidified air or nitrogen. After analyzing the calibration standards, determine the response factor for each analyte, using the peak area counts per concentration.

After analyzing the multipoint calibration standards and calculating peak area/concentration response factors, analyze the "real world" samples. If an "unknown" sample has not been diluted apply the corresponding response fac-

Table 4 Dilution factors to adjust final sampling pressure to **14.7psig** for a 6-liter canister.

Final Vacuum ("Hg)	29"	27"	25"	23"	20"	17"	15"	12"	10"	7"	5"	3"	0"
Sample Volume (liters)	0	0.58L	0.99L	1.39L	1.99L	2.59L	2.99L	3.59L	3.99L	4.60L	5.0L	5.40L	6L
Dilution Factor	63.77	20.37	12.12	8.63	6.02	4.63	4.01	3.34	3.00	2.61	2.40	2.22	2.00

frequently asked question

Where can I find EPA Air Toxic Methods?

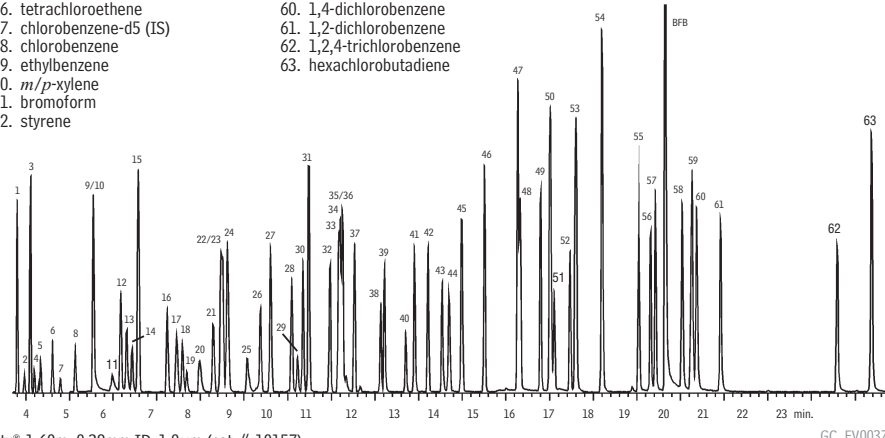
pdf files of US EPA Air Toxic Methods are available at this web address: www.epa.gov/ttn/amtic/airtox.html

Figure 7 TLC spectrum for a TO-14/TO-15 ambient air analysis.

1. dichlorofluoromethane
2. chloromethane
3. dichlorotetrafluoroethane
4. vinyl chloride
5. 1,3-butadiene
6. bromomethane
7. chloroethane
8. bromoethene
9. acetone
10. trichlorofluoromethane
11. isopropyl alcohol
12. 1,1-dichloroethene
13. methylene chloride
14. 3-chloropropene
15. carbon disulfide
16. Freon® TF
17. *trans*-1,2-dichloroethene
18. 1,1-dichloroethane
19. methyl *tert*-butyl ether
20. methyl ethyl ketone
21. *cis*-1,2-dichloroethene
22. bromochloromethane (IS)
23. *n*-hexane
24. chloroform
25. tetrahydrofuran
26. 1,2-dichloroethane
27. 1,1,1-trichloroethane
28. benzene
29. carbon tetrachloride
30. cyclohexane
31. 1,4-difluorobenzene (IS)
32. 1,2-dichloropropane
33. bromodichloromethane
34. trichloroethene
35. 1,4-dioxane
36. 2,2,4-trimethylpentane
37. *n*-heptane
38. *cis*-1,3-dichloropropene

39. methyl isobutyl ketone
40. *trans*-1,3-dichloropropene
41. 1,1,2-trichloroethane
42. toluene
43. methyl butyl ketone
44. dibromochloromethane
45. 1,2-dibromoethane
46. tetrachloroethene
47. chlorobenzene-d5 (IS)
48. chlorobenzene
49. ethylbenzene
50. *m/p*-xylene
51. bromoform
52. styrene

53. 1,1,2,2-tetrachloroethane
54. *o*-xylene
55. 2-chlorotoluene
56. 4-ethyltoluene
57. 1,3,5-trimethylbenzene
58. 1,2,4-trimethylbenzene
59. 1,3-dichlorobenzene
60. 1,4-dichlorobenzene
61. 1,2-dichlorobenzene
62. 1,2,4-trichlorobenzene
63. hexachlorobutadiene



Rtx®-1 60m, 0.32mm ID, 1.0µm (cat.# 10157).
 Sample: 200mL of 10ppbv TO-15 standard (cat.# 34436), injected into TO-Can™ canister and humidified to 70% RH.
 Concentrator: Nutech 3550 Preconcentrator
 200mL of sample concentrated at -160°C, thermally desorbed at 150°C, and cryofocused at -185°C.
 Oven temp.: 30°C (hold 4 min.) to 175°C @ 9°C/min. to 220°C @ 40°C/min.
 Carrier gas: helium @ 1.2mL/min.
 Det.: Agilent 5971 MS
 Scan range: 35-265amu

tor to each “unknown” analyte peak area to get the reporting limit concentration of the “unknown” in the analysis (typically in ppbv). If you have diluted the canister to get a positive pressure, however, you must apply the dilution factor to the concentration values. This is done by multiplying the reporting limit by the dilution factor.

VII. Cleaning the Passive Sampling Train

The cleanliness of the sampling train is critical to collecting accurately representative samples. Practices followed for cleaning passive sampling equipment between uses range from purging the sampling pathway with humidified nitrogen or air for many hours to heating the pathway during a purge to disassembling each component, sonicating the pieces in solvent, and oven baking the pieces prior to re-assembly. The most suitable mode of cleaning depends on the concentrations of analytes of interest, and contaminants, in the previous sample collected.

The particle filter must be thoroughly cleaned between uses. Disassemble the filter, then remove the larger particles from the frit by blowing particle-free nitrogen through the frit from the outlet surface toward the inlet surface. After the larger particles are removed sonicate or rinse the filter parts in methanol, then bake the parts in an oven at 130°C to remove any residual organic vapors.

The critical orifice and flow controller can be cleaned in either of two ways. The first method is to disassemble the flow controller and clean all the metal parts with methanol. This will remove any high boiling compounds that have condensed onto the wetted areas of the controller. Heat the cleaned parts in an oven at 130°C to remove residual organic vapors. Do not sonicate in solvent or bake any of the non-metallic parts, such as O-rings; they will be damaged during these steps. Do not rinse the vacuum gauge with methanol. The vacuum gauge may be heated, but do not exceed 80°C; higher temperatures will damage the face and the laminated safety glass lens. Heating to 80°C will not affect the mechanical operation of the spiral bourdon tube in the vacuum gauge.

A less involved method of cleaning the flow controller is to use a heating jacket or heat gun to heat the components of the assembled sampling train, while purging the system with nitrogen. As organic compounds are heated and desorbed from the interior surfaces the nitrogen gas sweeps them out of the sampling equipment.

Preparing the Clean Passive Sampling Train for Re-use

After the sampling train components have been cleaned, reassemble the system, check for leaks, set the desired flow rate, and certify the sampling system clean. Follow the procedures described previously in this guide. Package the clean sampling train to prevent contact with airborne contaminants.

VIII. Cleaning the Canister

Every air sampling canister, whether new or previously used, must be cleaned and certified before it is used for sampling. Some laboratories batch test and certify canisters, in which after cleaning, one canister out of 10 is tested and certified clean. We recommend certifying each canister clean prior to use, however, especially if there is potential for litigation.

For many years there has been much discussion as to what constitutes a proper procedure for cleaning canisters. US EPA Method TO-14A has provided guidance, and in the last 5-10 years many automated commercially available canister cleaning systems have evolved. Unfortunately, because these systems are quite expensive, and some designs have limitations, many analysts design their own systems and methodologies for cleaning canisters. The cleaning procedure described in this section is a practical approach that will ensure canisters are suitably cleaned for ambient air sampling, whether you are using a commercially available cleaning system or a system of your own design. There are minor differences when cleaning SilcoCan™ or SUMMA® canisters. We will discuss these differences in this procedure.

Air Versus Nitrogen

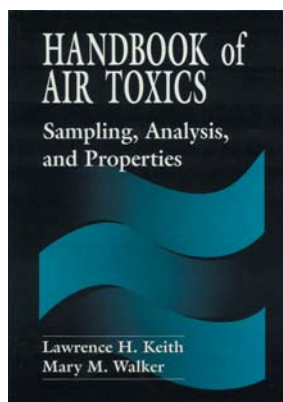
The two gases recommended for cleaning canisters are humidified ultra-high purity air and ultra-high purity nitrogen. The water in the humidified gas hydrolyzes impurities in the canister and, according to theory, will occupy the active sites on the interior surface, displacing the impurities and allowing them to be removed. Air is recommended when oxidation of the interior surface is desired. The oxygen content of air, 21%, is sufficient for this surface oxidation; it is not necessary to use pure oxygen gas. Nitrogen is equally effective for cleaning ambient air canisters, but, of course, nitrogen will not oxidize the surface of the canister.

Heat or No Heat

Many user-designed canister cleaning systems do not heat the canisters. Typically this does not create a problem when cleaning canisters that are used in ambient air collection, but as a safeguard we recommend heating the canisters during the cleaning process. Compounds collected in most ambient air samples are in the low ppbv range, and can be removed from a canister by multiple cycles of pressurization with humidified air or nitrogen followed by evacuation. If there are higher concentrations of contaminants in the canister, however, heat might be required to clean the canister satisfactorily.

Be aware that adding heat and humidified gas to a canister potentially can create a steam pressure vessel. Some commercial cleaning systems incorporate a pressure release valve to ensure the pressure does not exceed the pressure rating of the canisters.

A heating option can be added to a user-designed canister cleaning system by using an oven, heat bands, insulated jackets, or an infrared source.



Handbook of Air Toxics. Sampling, Analysis and Properties

This reference book contains physical and chemical data for all the chemicals in the National Toxicology Program's Chemical Database and all substances indicated in the US EPA Clean Air Act Amendments.

L. H. Keith and M. M. Walker, CRC Press LLC, 1995, 640pp., cat.# 21373

Oven

Some canister cleaning systems are incorporated within an oven. The supply line for the humidified air stream and the line to the vacuum system are plumbed directly into the oven. In this arrangement the entire canister, including the valve, will be heated, and this will help remove contaminants if both the valve and the canister are dirty. Typically, when using heat, it is helpful to create steam from the humidified air stream. An oven temperature of at least 120°C is required, but higher temperatures often are used. Remember that heat can shorten the lifetime of the Nupro valve on a SUMMA® canister (see step 3 in Cleaning Method, below).

Space is a concern with oven systems. Most commercial ovens are not very large and this restricts the number of canisters that can be cleaned at one time. However, clean-up times are shorter with heat than without heat, so more cleaning cycles can be completed in a week.

Heat Bands

A band heater placed around the equator of the canister typically will be capable of heating the canister to approximately 130°C. There is a heat gradient, and the valve might only receive radiant heat (approximately 70-100°C). In most sampling situations, however, this lower temperature should be sufficient for effectively removing contaminants from the valve.

Insulated Heat Jackets

Insulated heat jackets can be obtained to surround and heat each canister. These jackets typically have a silicone or Teflon®-coated fiberglass fabric exterior and a fiberglass insulation interior. Some operate at a fixed temperature; others can provide variable temperature, up to 400-500°F. Restek's heating jacket, described at right on this page, offers significant advantages over most other commercial designs, which do not encompass the valve area.

Infrared Heat

An infrared heating system includes an infrared heat source and a reflective panel similar to the cylinder drying rack on a gas cylinder system. The infrared source and the reflective panel are placed on opposing sides of the canisters. Infrared rays from the source heat the canisters; rays that pass the canisters strike the reflective panel and heat the canisters from the opposing side.

The Cleaning System

The cleaning system must provide a humidified air stream and include a good vacuum source, a cold trap to collect impurities during cleaning, and accurate gauges to read vacuum and pressure. A heat source is optional, but is highly recommended in some circumstances, as discussed above. The system can be designed to clean 4 to 24 six-liter canisters. Figure 8 (page 14) shows an example of a "homemade" system designed to clean 24 six-liter canisters. This design does not employ heat, but a heater easily can be added (see Heat or No Heat, page 12). It provides a humidified air stream to all canisters and the roughing pump on the bottom shelf is the vacuum source. This system is computer operated to minimize labor, but this is not necessary.

Cleaning Method

1. Connect all canisters to the cleaning system, then release any pressure within any of the canisters. Put the system under vacuum, to evacuate the canisters. US EPA Method TO-14A/15 recommends evacuating the system to 50 mTorr for 1 hour, but a reduced pressure of 23-25" Hg is sufficient for general cleaning.
2. After the canisters have been under vacuum for approximately 1 hour, pressurize the canisters with humidified air or nitrogen*. Pressurization will dilute the impurities and the moist air will hydrolyze them. Pressurize canisters to 5 psig if they will be heated or to 30 psig if they will not be heated. Proceed to step 3 when the system has equilibrated at the designated pressure.



The ultimate in controlled heating, for reliably cleaning your air canisters!

Air Canister Heating Jacket

- Closely simulates oven environment—heats entire canister.
- Two temperature settings, 75°C and 150°C.
- Prevents sample condensation, for accurate sub-sampling.
- Easily fits canister up to 6 liters.
- Lightweight; comfortable to the touch when heated.
- Connect up to five Canister Heating Jackets to one 15 amp circuit.

The Restek Canister Heating Jacket will help you clean your canisters faster and more efficiently. The novel design ensures the entire canister, including the valve, is heated during the cleaning cycle, to remove contaminants most effectively. It also can be used to keep the sample heated during aliquot removal, which helps prevent condensation and assure accurate data for larger molecules. The two heat settings let you match the temperature to the volatility of your sample components. If you try one in your system, we think you'll want more.

Description	qty.	cat.#
Air Canister Heating Jacket (110 volt)	ea.	24123

*please note

If you are cleaning SilcoCan™ canisters, and will be using heat, use humidified nitrogen, not air.

Figure 8 User-designed system for cleaning 24 six-liter canisters.



- Heat the pressurized canisters to 120 - 250°C, depending on the type of canister being cleaned. Do not allow the temperature of a SUMMA® canister to exceed 155°C, because the Nupro valve it employs has Viton® O-rings and requires greases that cannot be exposed to high temperatures. Many commercial cleaning systems avoid this problem by ensuring the valve is not within the heated zone. The canister below the valve is heated but the valve receives only radiant heat. In contrast, the Parker Hannifin diaphragm valve in a SilcoCan™ canister is far less heat sensitive, allowing the canister to be cleaned at temperatures up to 250°C, to help remove less labile impurities.

Heat the canisters filled with humidified air for at least 1 hour.

- Re-evacuate the canisters to remove the desorbed impurities. Allow the canisters to equilibrate for 1 hour.
- Determine if the canisters have been cleaned effectively by following the procedure in Certifying the Canister, below. US EPA methods recommend testing every canister until a reliable procedure is developed.

Repeat steps 1-5 as necessary; the number of cycles will be determined by how dirty the canisters are and how easily they are cleaned. We recommend developing a cleaning procedure that matches your specific sampling procedure, by testing the canisters for cleanliness after each cycle and determining the number of cycles necessary for proper cleaning. If the canisters are not heated, the number of cycles required to clean the canisters might be higher.

- Once a canister is clean, prepare it for collecting a sample by evacuating it to 10-50 mTorr. If your system is leak-tight, you can do this by using a roughing pump, but many commercial systems include a molecular drag pump to reach final vacuum quickly.

IX. Certifying the Canister

We recommend certifying canisters for both cleanliness and for analyte stability. To certify a canister clean, pressurize the canister to 14.7 psig with humidified ultra-high purity air or nitrogen after it has gone through the cleaning cycles. The humid air or nitrogen stream must be certified clean before it can be used for canister certification. Analyze an aliquot of the canister content by GC/MS or GC/FID/ECD. US EPA Method TO-14A/15 specifies a canister must contain less than 0.2 ppbv of any target VOC compound (Figure 9); EPA Method TO-12 specifies less than 0.02 ppmC, as detected by GC/FID. If a canister does not meet specification, it must be re-cleaned and re-tested for certification.

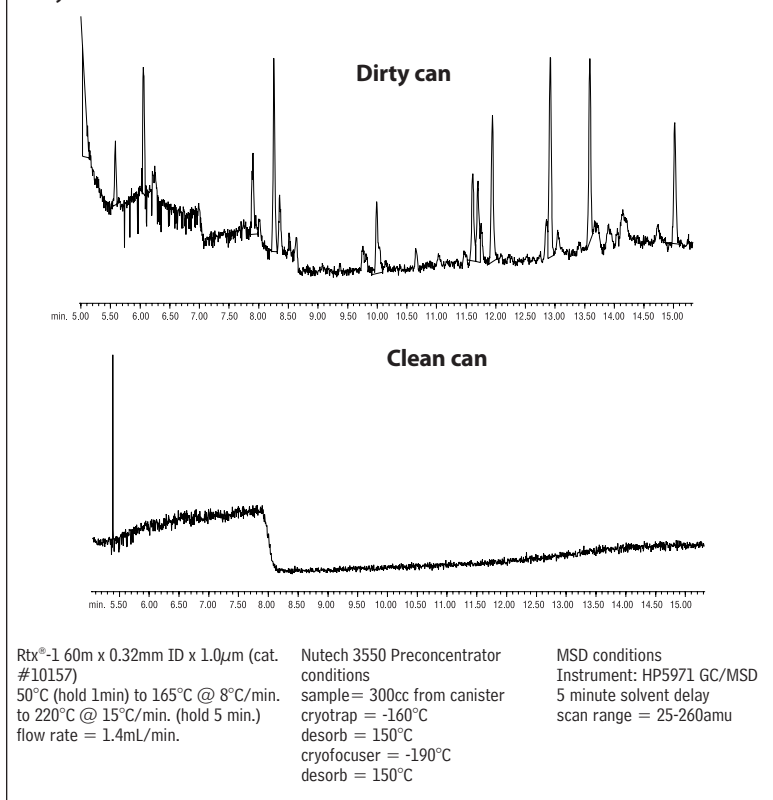
To certify a canister for analyte stability, introduce a low working concentration of a characterized test mix into the canister. Analyze an aliquot of the contents of the canister immediately after introducing the test mixture and at periodic intervals. We recommend monitoring for changes for a minimum of 2 weeks, or for a timeframe similar to your anticipated holding period. Responses should not decrease more than 20% over this period.

Commercially available standards are available for stability testing, but we recommend you make your own test mixture that is comparable to the target compound list that the canister will hold. For example, if you are analyzing sulfur compound content in ambient air, prepare a sulfur-specific test mix and evaluate the canister's performance for sulfurs. Maintain a log sheet for each canister, and record the test results and certification. This will be a permanent record for each canister. Some labs certify canisters for certain compounds and use a canister only for this specific application.

X. Conclusion

A well designed and properly prepared passive sampling system helps ensure accurate, useful information is obtained from an air sampling project. In this guide, we describe the components of the system, procedures for assembling the system and preparing it for sampling, and the sampling procedure. Cleaning system options and procedures for cleaning a used sampling train and canister for certification prior to a subsequent sampling also are presented. The following section describes Restek products designed to help collect and analyze air samples.

Figure 9 Aliquots from a canister before and after cleaning with 2 cycles of humidified air while heated to 200°C.



Pressure Conversion Table

Pressure	PSI	atm	kg/cm ²	torr	kPa	bar	inches Hg
PSI =	1	0.068	0.0703	51.713	6.8948	0.06895	2.0359
atm =	14.696	1	1.0332	760	101.32	1.0133	29.921
kg/cm ² =	14.223	0.967	1	735.5	98.06	0.9806	28.958
torr =	0.0193	0.00132	0.00136	1	0.1330	0.00133	0.0394
kPa =	0.1450	0.00987	0.0102	7.52	1	0.0100	0.2962
bar =	14.5038	0.9869	1.0197	751.88	100	1	29.5300
in Hg =	0.49612	0.0334	0.0345	25.400	3.376	0.03376	1

Multiply units in the left-most column by the conversion factors listed in the columns to the right.
e.g., 10PSI x 0.068 = 0.68atm, 10 bar x 29.5300 = 295.300 inches Hg

XI. Air Sampling Products

SilcoCan™ Air Monitoring Canisters

Siltek® treated - ideal for low-level reactive sulfur compounds (1-20ppb)

- Unsurpassed inertness, even for sulfur-containing or brominated compounds.
- Sizes from 1 to 15 liters support a wide range of sampling needs.
- Optional 3-port valve allows attachment of vacuum/pressure gauge for monitoring canister pressure.
- For critical applications, order a Siltek® treated valve - add suffix "-650" to the catalog number of the canister.



Alternative Vacuum/Pressure Gauges

The standard vacuum/pressure range on a SilcoCan™ or TO-Can™ canister fitted with a gauge is 30" Hg to 60psig. To order a different gauge for the canister, add the appropriate suffix number to the canister catalog number. There is no price difference for these alternative gauges.

Gauge	Suffix
30" Hg/15psi	-651
30" Hg/30psi	-652

For ultimate inertness, we treat SilcoCan™ air monitoring canisters with our unique Siltek® passivation technology. Even highly active components, at low parts-per-billion concentrations, can be readily sampled and stored without loss. The valve is a high quality, metal-to-metal seal, 2/3-turn valve with metal diaphragms. Both stainless steel and Siltek® treated valves are available, in both the 2-port and 3-port configurations.

Description	qty.	cat.#
1L Volume		
SilcoCan™ Canister, 1/4" Valve	ea.	24180
SilcoCan™ Canister, Siltek®-Treated 1/4" Valve	ea.	24180-650
SilcoCan™ Canister with Gauge, 1/4" Valve	ea.	24140
SilcoCan™ Canister with Gauge, Siltek®-Treated 1/4" Valve	ea.	24140-650
3L Volume		
SilcoCan™ Canister, 1/4" Valve	ea.	24181
SilcoCan™ Canister, Siltek®-Treated 1/4" Valve	ea.	24181-650
SilcoCan™ Canister with Gauge, 1/4" Valve	ea.	24141
SilcoCan™ Canister with Gauge, Siltek®-Treated 1/4" Valve	ea.	24141-650
6L Volume		
SilcoCan™ Canister, 1/4" Valve	ea.	24182
SilcoCan™ Canister, Siltek®-Treated 1/4" Valve	ea.	24182-650
SilcoCan™ Canister with Gauge, 1/4" Valve	ea.	24142
SilcoCan™ Canister with Gauge, Siltek®-Treated 1/4" Valve	ea.	24142-650
15L Volume		
SilcoCan™ Canister, 1/4" Valve	ea.	24183
SilcoCan™ Canister, Siltek®-Treated 1/4" Valve	ea.	24183-650
SilcoCan™ Canister with Gauge, 1/4" Valve	ea.	24143
SilcoCan™ Canister with Gauge, Siltek®-Treated 1/4" Valve	ea.	24143-650

TO-Can™ Air Monitoring Canisters

Optimized for US EPA Methods TO-14 and TO-15

- High quality, metal-to-metal seal, 2/3-turn valve with metal diaphragms.
- Sizes from 1 to 15 liters.
- Optional 30" Hg/60psig vacuum/pressure gauge (other gauges available).

Description	qty.	cat.#
1L Volume		
TO-Can™ Canister, 1/4" Valve	ea.	24172
TO-Can™ Canister with Gauge, 1/4" Valve	ea.	24176
3L Volume		
TO-Can™ Canister, 1/4" Valve	ea.	24173
TO-Can™ Canister with Gauge, 1/4" Valve	ea.	24177
6L Volume		
TO-Can™ Canister, 1/4" Valve	ea.	24174
TO-Can™ Canister with Gauge, 1/4" Valve	ea.	24178
15L Volume		
TO-Can™ Canister, 1/4" Valve	ea.	24175
TO-Can™ Canister with Gauge, 1/4" Valve	ea.	24179

did you know?

We ship our canisters cleaned, batch-tested per USEPA TO-14, and under 30psig pressure with dry nitrogens.

Refer to our catalog or our website for replacement pressure gauges.

1/4" Replacement Valves for Air Monitoring Canisters*



Description	Stainless Steel Valve		Siltek®-Treated Valve	
	qty.	cat.#	qty.	cat.#
1/4" Replacement Valve (2-port)	ea.	24145	ea.	24144
1/4" Replacement Valve (3-port)	ea.	24147	ea.	24146

*All Restek canisters are originally equipped with these high-quality Parker Hannifin diaphragm valves. Each valve is helium leak-tested to 4 x 10⁻⁶cc/sec. The all-stainless steel construction eliminates contamination and withstands temperatures from -100°C to 250°C. Compression outlet fitting, indicator plate to display open or closed position, 1/4" inlet and outlet.

Miniature Air Sampling Canisters—an alternative to tube and pump samplers

- Ideal for indoor air, personal, emergency response, or soil gas sampling (applications ≤ 40psig).
- Available with quick-connect (1/4" tube) fitting, compatible with sampling and analysis instruments.
- Available with non-treated or Sulfinert®-treated valve.
- 1000cc canister suitable for US EPA Methods TO-14 and TO-15.

Description	Volume	qty.	cat.#
Electro-Polished Miniature Canister with Quick-Connect Stem Fitting	400cc	ea.	24188
	1000cc	ea.	24194
Sulfinert®-Treated Miniature Canister with Quick-Connect Stem Fitting	400cc	ea.	24189
	1000cc	ea.	24195
Sulfinert®-Treated Miniature Canister with Sulfinert®-Treated Quick-Connect Stem Fitting	400cc	ea.	24190
	1000cc	ea.	24196
Electro-Polished Miniature Canister with Metal-Seated Diaphragm Valve	400cc	ea.	24191
	1000cc	ea.	24197
Sulfinert®-Treated Miniature Canister with Metal-Seated Diaphragm Valve	400cc	ea.	24192
	1000cc	ea.	24198
Sulfinert®-Treated Miniature Canister with Sulfinert®-Treated Diaphragm Valve	400cc	ea.	24193
	1000cc	ea.	24199
Electro-Polished Miniature Canister with Nut & Ferrule	400cc	ea.	24205
	1000cc	ea.	24206
Sulfinert®-Treated Miniature Canister with Nut & Ferrule	400cc	ea.	24207
	1000cc	ea.	24208



Metal-seated diaphragm valve

Dimensions:
400cc = 2.75" diameter,
5.35" long
1000cc = 2.75" diameter,
11.92" long

Quick-Connect Fittings for Miniature Air Sampling Canisters (1/4" tube fitting)

Description	qty.	cat.#
Quick-Connect Stem Fitting	ea.	24185
Sulfinert®-Treated Quick-Connect Stem Fitting	ea.	24186
Quick-Connect Body Fitting	ea.	24187

Air Monitoring Gas Standards (see our catalog or website for others)

TO-14A Calibration Mix (39 components)

benzene	ethyl chloride
bromomethane	hexachloro-1,3 butadiene
carbon tetrachloride	methylene chloride
chlorobenzene	styrene
chloroform	1,1,2,2-tetrachloroethane
chloromethane	tetrachloroethylene
1,2-dibromoethane	toluene
<i>m</i> -dichlorobenzene	1,2,4-trichlorobenzene
<i>o</i> -dichlorobenzene	1,1,1-trichloroethane
<i>p</i> -dichlorobenzene	1,1,2-trichloroethane
dichlorodifluoromethane	trichloroethene
1,1-dichloroethane	trichlorofluoromethane
1,2-dichloroethane	1,1,2 trichlorotrifluoroethane
1,1-dichloroethene	1,2,4-trimethylbenzene
<i>cis</i> -1,2-dichloroethene	1,3,5-trimethylbenzene
1,2-dichloropropane	vinyl chloride
<i>cis</i> -1,3-dichloropropene	<i>m</i> -xylene
<i>trans</i> -1,3-dichloropropene	<i>o</i> -xylene
dichlorotetrafluoroethane	<i>p</i> -xylene
ethyl benzene	

In nitrogen, 104 liters @ 1800psig

1ppm	100ppb
34400 (ea.)	34421 (ea.)

TO-15 62 Component Mix (62 components)

acetone	4-ethyltoluene
benzene	trichlorofluoromethane (Freon® 11)
benzyl chloride*	dichlorodifluoromethane (Freon® 12)
bromodichloromethane	1,1,2-trichloro-1,2,2-trifluoroethane (Freon® 113)
bromoform	1,2-dichlorotetrafluoroethane (Freon® 114)
bromomethane	heptane
1,3-butadiene	hexachloro-1,3-butadiene
2-butanone (MEK)	hexane
carbon disulfide*	2-hexanone (MBK)
carbon tetrachloride	4-methyl-2-pentanone (MIBK)
chlorobenzene	methylene chloride
chloroethane	methyl <i>tert</i> -butyl ether (MTBE)
chloroform	2-propanol
chloromethane	propylene
cyclohexane	styrene
dibromochloromethane	1,1,2,2-tetrachloroethane
1,2-dichlorobenzene	tetrachloroethene
1,3-dichlorobenzene	tetrahydrofuran
1,4-dichlorobenzene	toluene
1,1-dichloroethane	1,2,4-trichlorobenzene
1,2-dichloroethane	1,1,1-trichloroethane
1,1-dichloroethene	1,1,2-trichloroethane
<i>cis</i> -1,2-dichloroethene	trichloroethene
<i>trans</i> -1,2-dichloroethene	1,2,4-trimethylbenzene
1,2-dichloropropane	1,3,5-trimethylbenzene
<i>cis</i> -1,3-dichloropropene	vinyl acetate
<i>trans</i> -1,3-dichloropropene	vinyl chloride
1,4-dioxane	<i>m</i> -xylene
ethanol*	<i>o</i> -xylene
ethyl acetate	<i>p</i> -xylene
ethyl benzene	
ethyl dibromide (1,1-dibromoethane)	

In nitrogen, 104 liters @ 1800psig

6-month stability

1ppm	100ppb
34436 (ea.)	34437 (ea.)

*Stability of this compound cannot be guaranteed.

cylinder design

Aluminum construction.

Size: 8 x 24 cm.

Volume/Pressure: 104 liters

of gas @ 1800psig.

Outlet Fitting: CGA-180.

Weight: 1.5 lbs.



did you know?

Spectra Gas manufactures our high-quality air monitoring gas standards and is:

- Official supplier of PAMS (ozone precursor) calibration gas to US EPA.

- Only vendor of 62-component TO-15 gas standard.

- Rigorous quality control guarantees the stability and reproducibility of every Spectra Gases mix.

Passive Air Sampling Kits

Better Performance at a Better Value

- Improved design eliminates leaks at the filter.
- Siltek®-treated components ensure a very inert surface.
- Excellent for sampling times from 1 hour to 125 hours, or grab sampling.

Restek's passive air sampling kit incorporates all hardware necessary to collect air samples, and is easy to assemble for field sampling.* The improved filter design greatly reduces the number of potential leak sites.

The passive air sampling kit is available in six sampling flow ranges, and in stainless steel or Siltek® treated finish. The stainless steel kit is ideal to partner with the Restek TO-Can™ air sampling canister for TO-14A and TO-15 methods. Use the Siltek®-treated version with the Restek SilcoCan™ air sampling canister when collecting low-level volatile sulfur compounds, or other active compounds.

Air Sampling Kits

400cc	Canister Volume*/Sampling Time				Flow (sccm)	Orifice size	Siltek®-Treated Sampling Kits	Stainless Steel Sampling Kits
	1 Liter	3 Liter	6 Liter	15 Liter				
8 hour	24 hour	48 hour	125 hour	—	0.5–2	0.0008"	24217	24216
2 hour	4 hour	12 hour	24 hour	60 hour	2–4	0.0012"	24160	24165
1 hour	2 hour	6 hour	12 hour	30 hour	4–8	0.0016"	24161	24166
—	1 hour	4 hour	8 hour	20 hour	8–20	0.0020"	24162	24167
—	—	2 hour	3 hour	8 hour	20–40	0.0030"	24163	24168
—	—	—	1 hour	3 hour	40–80	0.0060"	24164	24169

*Air sampling canisters sold separately.

1. Veriflo™ SC423XL flow controller

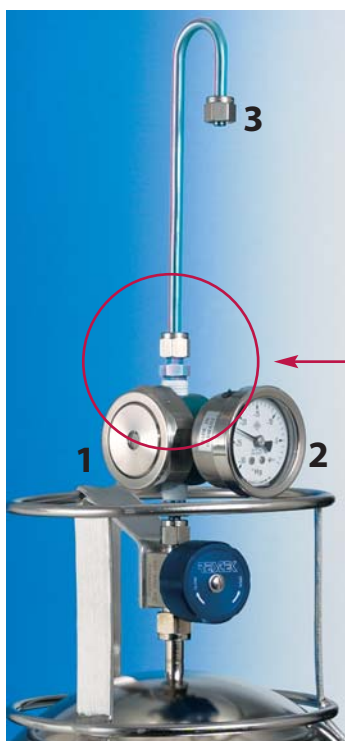
This flow controller is the heart of the sampling train. It is a high-quality device designed to maintain a constant mass flow as the pressure changes from 30" Hg to 5" Hg (we recommend you stop sampling at or before 5" Hg of vacuum). All wetted parts of the flow controller can be Siltek®-treated.

2. Stainless steel vacuum gauge

Fitted to the flow controller, the gauge monitors canister pressure change during sampling.

3. 1/4-inch Siltek® sample inlet

The 2m x 1/4-inch tubing includes a stainless steel nut on the inlet end, to prevent water droplets from accumulating at the edge of the tubing, where they could be pulled into the sampling train.



All fitting connections are 1/4" tube, except where noted.



4. 2-micron frit filter and washer

Located prior to the critical orifice to prevent airborne particles from clogging the critical orifice. Replaceable. Available in stainless steel, or Siltek®-treated for optimum inertness.

5. Interchangeable critical orifice

An interchangeable sapphire critical orifice allows you to control the flow with very high precision. To select the correct critical orifice for your sample, see table above. Available in stainless steel, or Siltek®-treated for optimum inertness.

a plus 1 story

"Restek has consistently provided high quality chromatography columns and supplies to me for well over a decade. Over the last two years, I have extensively been involved with air analysis, TO-15, etc., and Restek provides the highest quality canisters, mini-cans, and flow controllers in the market today."

Scott Van Etten, IH Laboratory Manager, EMSL Analytical

Buy only the parts you need!

Replacement Orifices

Use these orifices to change the flow range for alternative sampling times. Interchangeable with Veriflo™ 423XL orifices.

Flow (sccm)	Orifice size	Siltek®-Treated cat.#	Stainless Steel cat.#
0.5–2	0.0008"	24219	24218
2–4	0.0012"	24233	24245
4–8	0.0016"	24234	24246
8–20	0.0020"	24235	24247
20–40	0.0030"	24236	24248
40–80	0.0060"	24237	24249



Siltek® critical orifice

2µm Frit Filters

For use in critical orifice fitting. Includes washers.

Description	qty.	cat.#
Siltek® Replacement Frit Filter	3-pk.	24171
Stainless Steel Replacement Frit Filter	3-pk.	24170



Veriflo™ Flow Controllers

Veriflo™ 423XL flow controllers are offered in a Siltek® and a stainless steel version, with or without a critical orifice. (Vacuum gauge sold separately.) The critical orifice is interchangeable. Order replacement orifices or orifices for alternate sampling times separately.

Flow (sccm)	Orifice size	Siltek®-Treated cat.#	Stainless Steel cat.#
0.5–2	0.0008"	24232	24229
2–4	0.0012"	24255	24260
4–8	0.0016"	24256	24261
8–20	0.0020"	24257	24262
20–40	0.0030"	24258	24263
40–80	0.0060"	24259	24264
—	no orifice	24238	24239

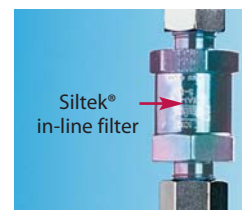


Veriflo SC423XL flow controller

7µm In-Line Filter

This 316 stainless steel filter is designed to collect particles larger than 7 microns. We offer a Siltek® version and a stainless steel version.

Description	qty.	cat.#
Siltek® 7µm In-Line Filter	ea.	24265
Stainless Steel 7µm In-Line Filter	ea.	24266



Siltek® in-line filter

Siltek® tee

2-Inch Vacuum Gauge

Restek's high-quality 2-inch vacuum gauge incorporates 316 stainless steel wetted surfaces.

Description	qty.	cat.#
2-Inch Vacuum Gauge; 1/8" NPT	ea.	24269
2-Inch Vacuum Gauge; 1/4" NPT	ea.	24270



High-quality vacuum gauge

Three simple words...

Plus 1™

Exceeding your expectations in everything we do.

Innovation

Turning visions into reality.

Execution

On-time delivery of products and services.

Restek's vision is to be the company that chromatographers trust, by providing the highest quality, most innovative products and services throughout the world.

We will soon reach our goal of 100% employee ownership. As owners, our success depends on your success.



Lit. Cat.# 59977B
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