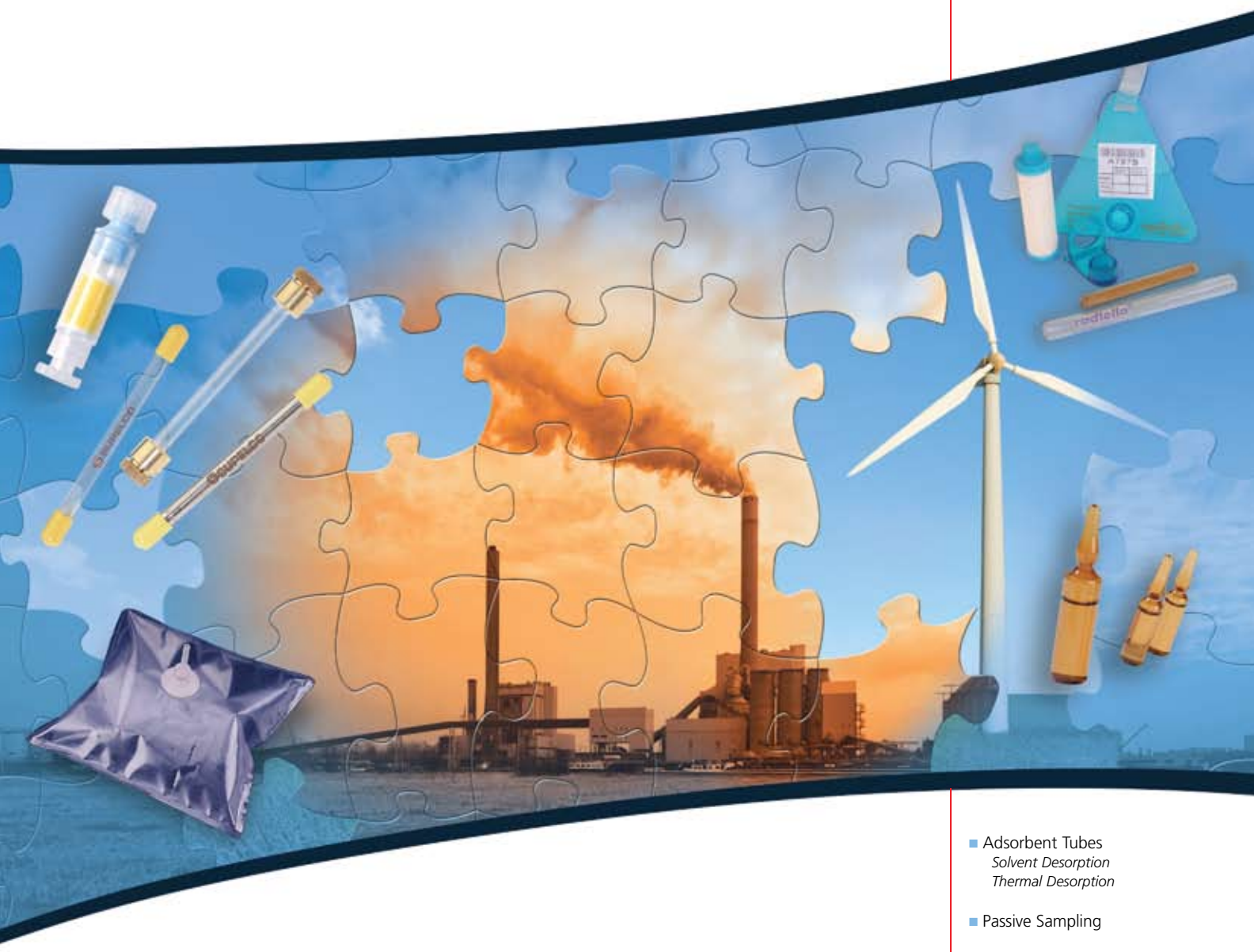
SUPELCO® Analytical

Air Monitoring

A Complete Line of Products for Air Monitoring



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Introduction

Supelco is proud to offer this comprehensive catalog featuring our air monitoring product line with new innovative products. We have more than 30 years expertise in adsorbent technology, which enables us to provide innovative solutions to meet a wide range of air monitoring needs for industrial hygiene, ambient air, and industrial source emissions applications.

Our sampling media are designed to meet sampling and analysis criteria according to NIOSH, OSHA, EPA, and ASTM methods. Our proprietary adsorbents, such as Carbopack™ graphitized carbon blacks and Carboxen™ carbon molecular sieves, exhibit unique and superior performance characteristics for a wide range of applications. Because we manufacture these materials on-site, we can assure both their quality and availability. We are an ISO 9001 company. Our highly qualified staff is dedicated to offering reliable products and customized solutions to meet your unique needs. This quality is also trusted by the National Aeronautics and Space Administration (NASA) who used Supelco materials for their space mission Cassini-Huygens to the Saturn moon, Titan and Galileo mission to Jupiter (To learn more, see page 9).

We are your one-stop supplier for your air monitoring needs and offer the complete solution from sample collection to analysis and quantification. We offer sampling pumps, sampling devices, chemical standards, vials, syringes, and chromatography columns. The convenience of a single, trusted source for all of your laboratory and air monitoring needs is unsurpassed. For a complete listing of complementary products, request a copy of our general products catalog or visit us online at *sigma-aldrich.com/supelco*

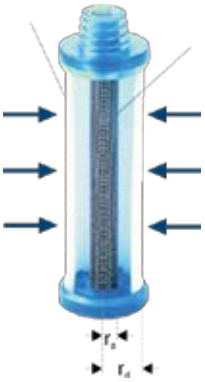
Types of Air Sampling

Active Sampling

Active

In active sampling, the air/gas sample is actively pumped or drawn into or through a sampling media. Media can be filters, adsorbent tubes, wash bottles, or gas sampling containers. In addition to capturing analytes of interest from the air, the active sampling device must ensure minimal background interference, exhibit sufficient capacity or breakthrough volume for the application for which it is intended, and provide an acceptable pressure drop during sampling.

Passive Sampling



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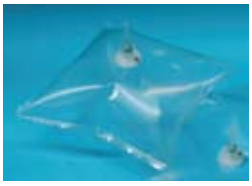
Passive/diffusive sampling relies on the unassisted molecular diffusion of gaseous agents (analytes) through a diffusive surface onto an adsorbent. Unlike active sampling, passive samplers require no pumps, have no moving parts, are simple to use, and offer results comparable to active samplers.

Whole Air Sampling



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A whole air sample is collected when the air is drawn into some sort of containment vessel such as a Tedlar™ bag or glass bulb. The method of collection is easy and the compounds of interest are recovered directly from the vessel. Recovery is a function of several factors which include, the surface area of the vessel, the chemistry and vapor pressure of the contaminants, the influence of various matrix effects, and the ability to begin with a vessel free of contamination. Supelco offers Tedlar Gas Sampling Bags and Bulbs to meet your whole air sampling needs.

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Adsorbents for Air Monitoring

Carbon Adsorbent Materials

The commitment to carbon adsorbent technology at Supelco has been ongoing for more than two decades. This effort has been critical to the advancement of chromatography products like GC columns and sample preparation products. Today, Supelco has over 87 different carbons ranging in particle size from 1–1000 µm and surface areas from 1–1500 m^2/g. Our efforts have been broad in scope, and have ranged from purification process development to research focusing on the thermodynamic and kinetic properties of adsorbents. Understanding the performance characteristics of adsorbents has been our primary goal.

The unique and valuable characteristics of the Supelco carbons warranted their inclusion in NASA experiments on the 1995 Galileo Mission to Jupiter; the 2005 Cassini-Huygens Mission to Titan-the largest moon of Saturn; and the 2008 Phoenix Mission to Mars. If you do not see a specialty carbon adsorbent that meets your needs, contact our Technical Service group at ***techservice@sial.com*** to inquire about custom materials. In addition to our specialty carbon adsorbents, we also offer popular adsorbents, such as activated charcoal, polymer materials, and silica gel.

Graphitized Carbon Black (GCB)

Unlike activated charcoals, which are porous, graphitized carbon blacks (GCBs) are generally non-porous, highly hydrophobic. Consequently, the entire surface of these materials is available for interactions that depend solely on dispersion (London) forces. Because we prepare our GCBs at temperatures >2500 °C, the high purity nature of the resulting carbon material ensures effective release/desorption of the analyte of interest. Carbotrap™ signifies material that is 20/40-mesh size, whereas Carbopack signifies material that is smaller than this mesh/particle size.

Products containing Carbotrap B, Carbotrap C, and Carbotrap F graphitized carbon blacks trap a wide range of airborne organic compounds, from C4-C5 hydrocarbons to polychlorinated biphenyls and other large molecules. Carbotrap (formerly called Carbotrap B)adsorbent has a surface area of 100 m^2/g and can be used for monitoring many airborne C5-C12 compounds. The smaller surface areas of Carbotrap C and Carbotrap F adsorbents, 10 m^2/g and 5 m^2/g, respectively, make these materials useful for trapping and efficiently releasing larger molecules in the C9-C30 range.

Unlike most GCBs, Carbopack X is porous. Its surface area of 240 m^2/g provides greater adsorption strength than other GCBs; hence it is a unique bridge between GCBs and carbon molecular sieves. Carbopack Y, with a surface area of 24 m^2/g, bridges the characteristics of Carbopack B and Carbopack C.

These adsorbents offer excellent thermal stability, which ensures minimal bleed at thermal desorption temperatures, and their coarse 20/40 and 40/60 mesh particle size prevents high pressure drop across the tube. Hydrophobic properties minimize sample displacement by water, enabling you to obtain accurate samples despite high humidity. Trapped compounds can be desorbed by solvent or thermal desorption, at virtually 100% desorption efficiency.

Carbopack B, Carbopack C, and Carbopack F GCBs are essentially the same adsorbents as Carbotrap, Carbotrap C, and Carbotrap F, respectively, but in a 60/80 mesh size. These materials often are used in narrow bore tubes (1-2 mm I.D.) for sample refocusing or very low flow sampling (e.g., <20 mL/min).

Graphitized Carbon Blacks

Description	Pkg.	Cat. No.
Carbotrap		
20/40 mesh	10 g	**20287**
Carbopack B		
60/80 mesh	10 g	**20273**
Carbotrap C		
20/40 mesh	10 g	**20309**
20/40 mesh	500 g	**11047-U**
Carbopack C		
60/80 mesh	10 g	**10257**
Carbotrap X		
20/40 mesh	10 g	**10435-U**
Carbopack X		
40/60 mesh	10 g	**10436**
60/80 mesh	10 g	**10437-U**
Carbotrap Y		
20/40 mesh	10 g	**10460-U**
Carbopack Y		
40/60 mesh	10 g	**10461-U**
60/80 mesh	10 g	**10462**
Carbopack Z		
60/80 mesh	10 g	**11051-U**

Carbon Molecular Sieve (CMS)

Carbosieve

A carbon molecular sieve (CMS) particle is the carbon skeletal framework remaining after the pyrolysis of a polymeric precursor. These materials are primarily used for collecting very small molecular-sized compounds (C2, C5). The size and shape of the analyte molecule and the size and shape of the pores in the CMS particle determine how well the analyte is adsorbed and desorbed. Because our CMSs are prepared from high purity polymers, the resulting material is a high purity carbon, effective in the release/desorption of adsorbed analytes for quantification. Carbosieve S-III and our Carboxen carbon molecular sieves have upper temperature limits of at least 400 °C.

- **Carbosieve S-III** is a large surface area (approximately 820 m^2/g) and 15-40 Å pores make this spherical carbon molecular sieve excellent for trapping small airborne molecules, such as chloromethane. Although hydrophobic, it retains slightly more water during sampling than does Carboxen-569. The pure carbon framework permits thermal desorption of analyte molecules without loss.
- **Carbosieve S-II** (mostly used in GC columns) is recommended for analyzing mixtures of permanent gases (H_2, O_2, Ar, CO and CO_2) and C1-C2 hydrocarbons (methane, ethane, ethylene, acetylene). Maximum temperature 225 °C with oxygen-free carrier gas.
- **Carbosieve G** (mostly used in GC columns) is recommended for analyzing C1-C3 hydrocarbons. Maximum Temperature <200 °C with oxygen free carrier gas.

Carbon Molecular Sieves

Description	Pkg.	Cat. No.
Carbosieve S-II		
60/80 mesh	10 g	**10189**
Carbosieve S-III		
60/80 mesh	10 g	**10184**
Carbosieve G		
40/60 mesh	5 g	**10197**
60/80 mesh	5 g	**10198**

Carboxen

Carboxen carbon molecular sieves are hydrophobic, ensuring accurate sampling at high humidities. Carboxen-563 and Carboxen-564 are our preferred versions of Ambersorb® XE-340 and Ambersorb XE-347 adsorbents – the carboxen adsorbents have higher capacity (breakthrough volume) for many volatile organic compounds (VOCs). Carboxen-563 is used for analyzing water quality or airborne compounds. Its range for airborne compounds is similar to that of Carboxen-564, but with a somewhat lower capacity.

Carboxen-564 is effective for monitoring many C2-C5 VOCs.

Carboxen-569 is a 20/45-mesh material with no Ambersorb equivalent. High hydrophobicity makes it useful for sampling in high humidity (use a 4 mm I.D. or larger tube). Relative to Carboxen-563 and Carboxen-564, Carboxen-569 has greater capacity for organic molecules and less capacity for water.

NEW! **Carboxen-572** is a CMS possessing a tapered pore structure with open, throughput micropores. It is a highly efficient CMS and compares directly to the Carboxen-1000 (one of our most efficient CMS carbons used for purge-trap, and air sampling applications). The primary difference between the Carboxen-572 and the Carboxen-1000 is the particle size distribution (Carboxen-572 = 20/45 mesh and Carboxen-1000 = 60/80 mesh).

Carboxen-1000 is for low volume sampling of very volatile compounds, such as vinyl chloride. Its large surface area and optimized microporosity enable it to effectively and efficiently adsorb and desorb smaller molecular size compounds, providing excellent chromatography without a need for cryogenic cooling. This 60/80-mesh adsorbent is used primarily in narrow bore tubes that are desorbed directly into the chromatographic column.

Carboxen-1001 is a 60/80 mesh material used to trap and retain small compounds. It can be used as the final bed in multi-bed adsorbent tubes, to minimize breakthrough. It is similar to Carboxen-569 in strength and hydrophobicity.

Carboxen-1003 is a carbon molecular sieve with a large surface area and hydrophobic surface characteristics, which provide a combination of efficient adsorption/desorption and good hydrophobicity.

Carboxen *(Contd.)*

Carboxen-1012 is a highly-activated, inert carbon molecular sieve (CMS) possessing large micropores. It has been used effectively for aqueous phase adsorption of organic compounds, or for air sampling of C4-C6 compounds.

Carboxen-1018 is a microporous CMS possessing a large percentage of narrow (~6-7 angstroms) micropores for adsorption/desorption of small analytes such as ethane, acetylene, ethylene and the C3 hydrocarbons. This CMS is a hydrophobic, inert, strong adsorbing porous carbon, as is the Carboxen-1021. Both are used in **breath sampling tubes** developed for ethane, acetaldehyde and other small molecules present in exhaled breath samples.

Carboxen-1021 is a highly-microporous carbon molecular sieve designed for air sampling of small molecules. It is similar to Carboxen-1018, with a large percentage of small micropores (5-6 angstroms; smaller than the Carboxen-1018), and is more hydrophobic than the Carboxen-1018.

Carboxen

Description	Pkg.	Cat. No.
Carboxen-563		
20/45 mesh	10 g	**10263**
Carboxen-564		
20/45 mesh	10 g	**10264**
Carboxen-569		
20/45 mesh	10 g	**10269**
20/45 mesh	500 g	**11048-U**
NEW! Carboxen-572		
20/45 mesh	10 g	**11072-U**
Carboxen-1000		
40/60 mesh	50 g	**10477-U**
60/80 mesh	10 g	**10478-U**
Carboxen-1003		
40/60 mesh	10 g	**10471**
Carboxen-1016		
60/80 mesh	10 g	**11021-U**

Choosing Carbon Adsorbents

For multi-bed tubes, use the weaker adsorbent in front of the stronger adsorbent. For example, use Carbopack C in front of Carbopack B.

Relative Analyte Size▲	Recommended Materials (listed weakest to strongest)
>C20	Carbotrap F, Carbopack F
C12-C20	Carbotrap C, Carbopack C, Carbotrap Y, Carbopack Y
C5-C12	Carbotrap B, Carbopack B
C3-C9	Carboxen 1016, Carbotrap X, Carbopack X, Carbopack Z
C2-C5	Carboxen 569, Carbosieve G, Carboxen 1000, Carbosieve S-III, Carboxen 1021, Carboxen 1018, Carboxen 1003, Carboxen 1012

▲ Analyte size relative to n-Alkanes. Consider all atoms, not just Carbon. For example, even though 1,2-Dichloroethane is a C2, the two Chlorine atoms give it a relative size between C4 and C5.

NEW!
Carbon Adsorbent Sampler Kits


E000926

Often choosing the right adsorbent or combination of adsorbents can be difficult. The goal in selecting the proper adsorbent is to choose one or more that can retain a specific analyte, or group of analytes, for a specific sample volume. However, equally important is that the adsorbent(s) must also be able to release the analyte(s) during the desorption process.

By using one of the Supelco Carbon Adsorbent Sampler Kits, the method developer obtains a cost-effective way to evaluate several carbon adsorbents when designing adsorbent-based applications and products. Once the appropriate material has been identified, Supelco is ready to work with you to produce larger quantities to your specifications.

Carbon Adsorbent Sampler Kits

Description	Cat. No.
Graphitized Carbon Black Kit 20/40 Mesh	
5 g each of Carbotrap F, Carbotrap C, Carbotrap Y, Carbotrap B, Carbotrap X	**13027-U**
Graphitized Carbon Black Kit 60/80 Mesh	
5 g each of Carbopack F, Carbopack C, Carbopack Y, Carbopack B, Carbopack X, Carbopack Z	**13026-U**
Carbon Molecular Sieve Kit	
5 g each of Carboxen-569, Carboxen-1000, Carboxen-1003, Carboxen-1012, Carboxen-1016, Carboxen-1018, Carboxen-1021, Carbosieve G, Carbosieve S-III	**13028-U**

Physical Characteristics of Supelco Carbon Adsorbents

Adsorbent	BET Surface Area● (m^2/g)	Density (g/mL)	Porosity (mL/g) micro -	meso-	macro-	Micropore Diameter (Å)
Carbotrap Kit (20/40 mesh graphitized carbon black)						
Carbotrap F	5	0.69	-	-	-	-
Carbotrap C	10	0.68	-	-	-	-
Carbotrap Y	24	0.45	-	-	-	-
Carbotrap B	100	0.37	-	-	-	-
Carbotrap X	240	0.43	-	0.62	-	100
Carbopack Kit (60/80 mesh graphitized carbon black)						
Carbopack F	5	0.64	-	-	-	-
Carbopack C	10	0.68	-	-	-	-
Carbopack Y	24	0.42	-	-	-	-
Carbopack B	100	0.35	-	-	-	-
Carbopack Z	220	0.18	-	1.73	-	255
Carbopack X	240	0.41	-	0.62	-	100
Carbon Molecular Sieve Kit						
Carboxen-1016	75	0.40	-	0.34	-	-
Carboxen-569	485	0.58	0.20	0.14	0.10	5 - 8
Carboxen-1021▼	600	0.62	0.30	-	-	5 - 8
Carboxen-1018▼	675	0.60	0.35	-	-	6 - 8
Carbosieve S-III◆	975	0.61	0.35	0.04	-	4 - 11
Carboxen-1003	1000	0.46	0.38	0.26	0.28	5 - 8
Carbosieve G	1160	-	0.49	0.02	-	6 - 15
Carboxen-1000	1200	0.48	0.44	0.16	0.25	10 - 12
Carboxen-1012	1500	0.50	-	0.66	-	19 - 21

● Brunauer, Emmett, Teller (BET) surface area calculations

▼ microporous, monoporous carbon sieve

◆ closed pore structure

Polymeric Adsorbents

Supelpak™ Adsorbents

Supelpak-2 is a purified form of Amberlite® XAD®-2 resin, designed for minimal background interference when monitoring semivolatile contaminants. It has been cleaned to meet and exceed US EPA-recommended criteria for purity, as outlined in the EPA's Level 1 Environmental Assessment Procedures Manual. Supelpak-2 is used in the following US EPA methodologies: SW-846 Method 0010, Modified Method 5 Sampling Train for Principal Organic Hazardous Compounds (POHCs); TO-13 - PAHs in ambient air; and IP-7 - PAHs in indoor air. It is the best resin to use for standard air sampling methods requiring resin tested for background TCO (Total Chromatographic Organics) level.

Supelpak-2

Matrix:	styrene-divinylbenzene
Surface Area:	~300 m^2/g
Density:	1.02 g/mL, 25 °C (true wet) 1.07 g/mL, 25 °C (skeletal)
Particle Size:	20/60 mesh
Pore Volume:	~0.65 mL/g
Mean Pore Size:	90 Å
Max Temp.:	200 °C

Supelpak-2B is a form of Amberlite XAD-2 resin specially cleaned to USEPA specifications for the Great Lakes National Program Office (GLNPO) program, for sampling and analysis of PCBs from large volumes of water.

Supelpak-2SV is a form of purified Amberlite XAD-2 that has been specifically cleaned and tested for optimal performance in capturing and extraction of semivolatile organics.

Supelpak Adsorbents

Description	Pkg.	Cat. No.
Supelpak-2		
20/60 mesh	100 g	**20279**
20/60 mesh	1 kg	**21130-U**
Supelpak-2B		
20/60 mesh	100 g	**13670**
NEW! Supelpak-2SV		
20/60 mesh	100 g	**13673-U**
20/60 mesh	250 g	**13682-U**
20/60 mesh	1 kg	**13674-U**

Porous Polymers

- **Tenax® TA** is a porous material based on 2,6-diphenylene oxide polymer. It is used to trap volatile and semivolatile compounds with an upper temperature limit of 350 °C. It has a low affinity for water and methanol. When sampling for very volatile analytes with Tenax TA, a carbon molecular sieve typically is used as a backup.
- **Supelpak-TA** is a refined (screened) Tenax TA.
- **Tenax GR** is a composite material containing 30% graphite carbon and 70% Tenax TA. Compared to Tenax TA, it has a higher retention volume for most compounds and is twice as dense. Like Tenax TA, it has a low affinity for water or methanol and has an upper temperature limit of 350 °C.
- **Chromosorb® 106** is a styrenedivinylbenzene polymer used to trap small molecules. It has a surface area of 750 m^2/g and an upper temperature limit of 250 °C.
- **Porapak™ N** is a divinylbenzene-ethyleneglycol dimethacrylate polymer.

Porous Polymers, Bulk

Description	Pkg.	Cat. No.
Tenax TA		
60/80 mesh	10 g	**11982**
Supelpak TA		
60/80 mesh	100 g	**12168-U**
Tenax GR		
20/35 mesh	500 g	**11049-U**
Chromosorb 106		
60/80 mesh	50 g	**20225**
Porapak N		
50/80 mesh	75 cc	**20324**

General Purpose Adsorbents

Activated Coconut Charcoal

Activated coconut charcoal has been used extensively as a general purpose adsorbent due to its ability to adsorb/desorb a wide range of volatile analytes.

Description	Pkg.	Cat. No.
Activated Charcoal		
20/40 mesh	10 g	**10275**

Silica Gel

Silica gel has been used extensively as a general purpose adsorbent due to its ability to adsorb/desorb a wide range of volatile analytes, in particular, those that are polar. Care must be taken when sampling in humid environments due to its affinity for water.

Description	Pkg.	Cat. No.
Davison Silica Gel, Grade 12		
60/80 mesh	100 g	**20290-U**

Adsorbents for Air Monitoring

Adsorbent Cross Reference

Adsorbent	Supelco Equivalent or Substitute
Ambersorb 347	Carboxen 564
Anasorb CMS	Carboxen-564, Carboxen-1000, Carbosieve S-III
Anasorb CSC	Coconut charcoal
Anasorb GCB1	Carbopack B, Carbotrap B
Anasorb GCB2	Carbopack C, Carbotrap C
Anasorb 708	Chromosorb 108
Anasorb 727	XAD-4
Anasorb 747	Carboxen-564, Carboxen-1000, Carbosieve S-III

Adsorbent	Supelco Equivalent or Substitute
Carbograph 1	Carbopack B, Carbotrap B
Carbograph 2	Carbopack C, Carbotrap C
Carbosphere	Carboxen-1000
Graphpac-GC	Carbopack B, Carbotrap B,
Carbopack C	Carbotrap C
Purosieve	Carboxen-1000
Spherocarb	Carboxen-1000
Tenax GC	Tenax TA

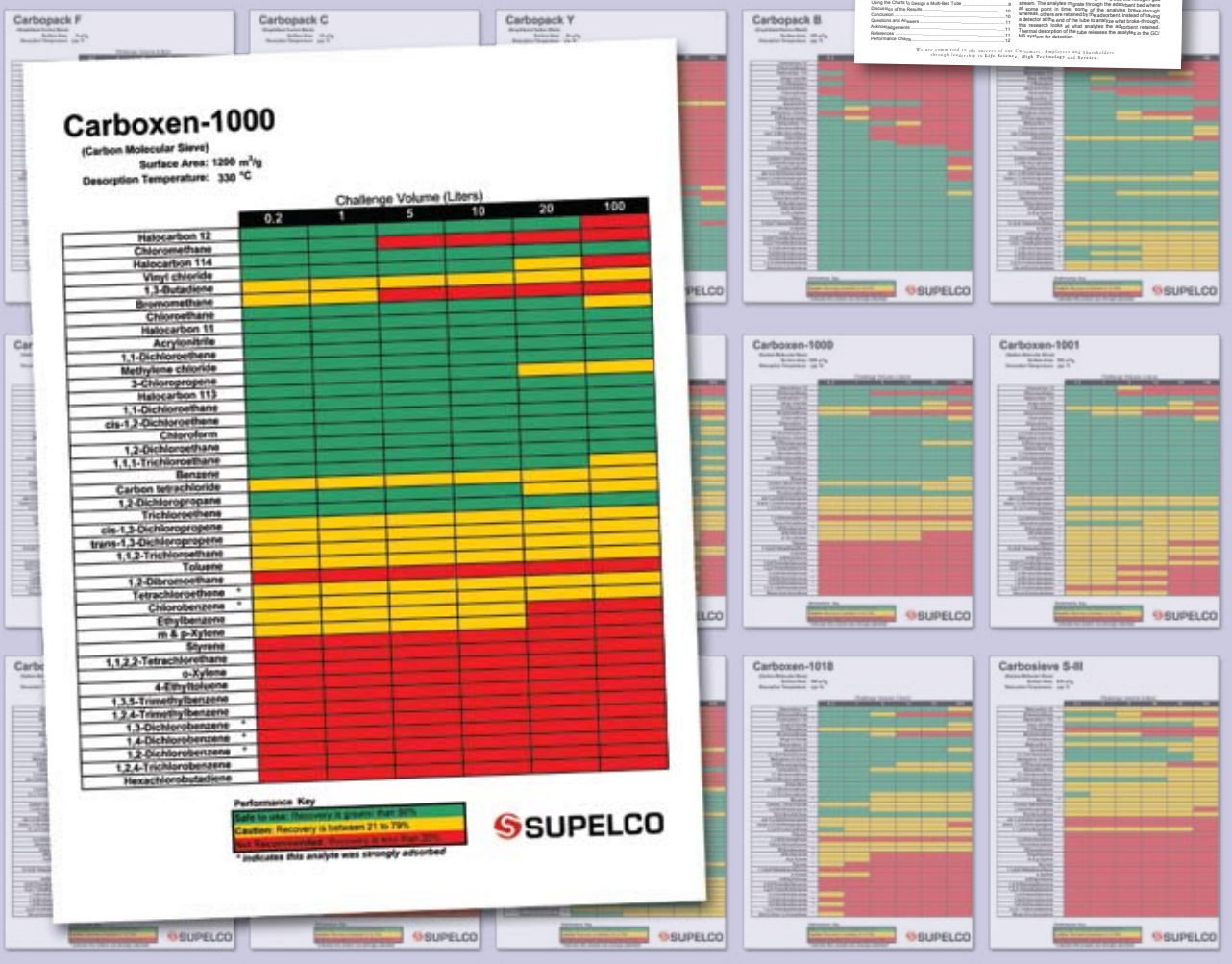
For more in-depth information:

Visit our web site, ***sigma-aldrich.com/supelco*** and view T402025 (EQF), *"A Tool for Selecting an Adsorbent for Thermal Desorption Applications,"* which includes adsorption/desorption data on 43 common air pollutants on 24 different adsorbents, and T402026 (EQG), *"Characterization of Adsorbents for Sample Preparation Process,"* which describes the past, present, and future of carbon adsorbent research at Supelco.


SUPELCO

Technical Report

A Tool for Selecting an Adsorbent for Thermal Desorption Applications



Did you know..

Space, the Final Frontier.

The National Aeronautics and Space Administration (NASA) has been studying planets in our solar system for several decades. The missions attempt to obtain a breadth of knowledge by gathering data on the electromagnetic spectrum, magnetic fields, particle analyses, and atmosphere constituents of these planets. Some information may lead to determining the birth of the solar system and origins of life on Earth. To assist in these studies, Supelco designed unique carbon adsorbents for analyzing atmospheric constituents under the arduous constraints of space exploration.

The Galileo Probe, which arrived at Jupiter in 1995, employed a column packed with a Carbosieve carbon molecular sieve adsorbent, as part of a mass spectrometer experiment. This adsorbent was developed to separate and quantify the gases in Jupiter's atmosphere — methane, water, argon, neon, hydrogen sulfide, krypton, xenon, ammonia, and isotopes of helium and hydrogen. The adsorption / desorption properties of the adsorbent allowed concentration of these gases of interest, and their subsequent desorption to a mass spectrometer sensor for analysis.

NASA's project, the Cassini-Huygens Mission to Saturn, is a journey to the ringed planet that will last approximately seven years. Exploration will continue for four years. A total of 27 experiments will be performed, with the involvement of a number of international space agencies, academic institutions, and industrial partners. Supelco participated in composing the atmosphere sampling experiments. The Cassini spacecraft consists of two parts — the Saturn orbiter will collect data, communicate with Earth, and power the spacecraft; the Huygens probe will separate from the orbiter and travel to Titan, Saturn's largest moon. A gas chromatograph/mass spectrometer (GC-MS) in the Huygens probe will analyze the organic components of Titan's atmosphere. Light hydrocarbons will be concentrated using a new, porous graphitized carbon developed at Supelco specifically for this application. This carbon will trap the C2 to C8 hydrocarbon fraction — an important indicator of the presence of life.

Supelco scientists graphitized a carbon molecular sieve to optimize the analysis of light hydrocarbons and efficiently release the trapped analytes under conditions specific to a totally new GC-MS flow design. The carbon molecular sieve base withstands the vibrations of the launch and entry into Titan's atmosphere. Also onboard the Huygens probe is another carbon molecular sieve, Carboxen-1004. As the atmosphere of Titan is believed to be similar to that of ancient Earth, Supelco provided an adsorbent that will trap permanent gases. Scientists working at the University of Paris, packed a microcolumn with Carboxen-1004, for in situ GC-MS analysis.

Supelco's carbon laboratory is one of the finest in the world. In addition to developing new carbon molecular sieves and making recent developments with porous graphitized carbon, we also produce a variety of graphitized carbon blacks (GCBs).

We can prepare carbons in sub-micron particle sizes (for capillary GC applications) to 1.0 mm sizes (for sample preparation applications where pressure drop considerations are required). Some carbons are available in larger sizes. The temperature capability of our furnace reaches 3000 °C, and its capacity extends from bench- to pilot-scale. We pride ourselves on being able to tailor carbon adsorbents to specific applications. The graphitized carbon molecular sieve designed specifically for NASA is just one example. Supelco carbon adsorbents are available in bulk, packed in columns, sampling tubes, or gas purifiers. Custom requests are welcome, even if your demands are earthbound.

Active Sampling

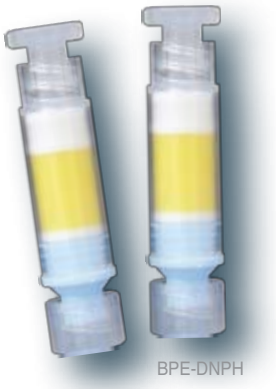
LpDNPH (Low Pressure) Products

LpDNPH cartridges are air-sampling devices designated for sampling carbonyls (e.g. formaldehyde) in ambient, indoor, and industrial atmospheres. Carbonyls are trapped on a high purity silica adsorbent coated with 2,4-dinitrophenylhydrazine (DNPH), where they are converted to hydrazone derivatives. The derivatives are eluted from the cartridge with acetonitrile and analyzed by HPLC.

LpDNPH cartridge benefits:

- High purity adsorbent for better accuracy and trace analysis.
- High sensitivity, low background.
- Low pressure drop, enables use at high sampling rates (1.5-2 L/min), or long pump performance
- New packaging, for maximum sample integrity
- Manufactured in controlled environment
- Meets EPA, OSHA, NIOSH and ASTM specifications

NEW! *BPE-DNPH* Cartridge*



This innovative product is dual-layered and designed to enable the end-user to simultaneously analyze ozone and aldehydes in their sample; or for use as an inline ozone scrubber and aldehyde analysis in one tube. It incorporates a bed of 1,2-bis(4-pyridyl) ethylene (BPE) coated silica and a bed of DNPH coated silica. This product is also not affected by high humidity. Two uses, your choice.

Description	Pkg.	Cat. No.
BPE-DNPH, 90/260 mg Rezorian	10	54269-U
BPE-DNPH, 90/260 mg Rezorian	50	54270-U

Reference: Uchiyama,S.Anal. Chem. 2008, 80, 3285-3290
**Patent Pending*

DNPH Rezorian™ Cartridge

Rezorian cartridges are made of polypropylene with polyethylene frits. The end-fittings are luer lock syringe connections that can be used to connect a pump tubing or two cartridges in a series (piggybacked) to monitor breakthrough or to increase capacity.

Description	Pkg.	Cat. No.
DNPH, 350 mg, Rezorian	10	54074-U
DNPH, 350 mg, Rezorian	50	54075-U

S10 Cartridge

The design of the S10 cartridge makes it easy to use in the field and the laboratory. Reusable adapters are available for connecting the cartridge to the sampling pump. The built-in reservoir eliminates the need to attach a syringe for sample extraction/elution.

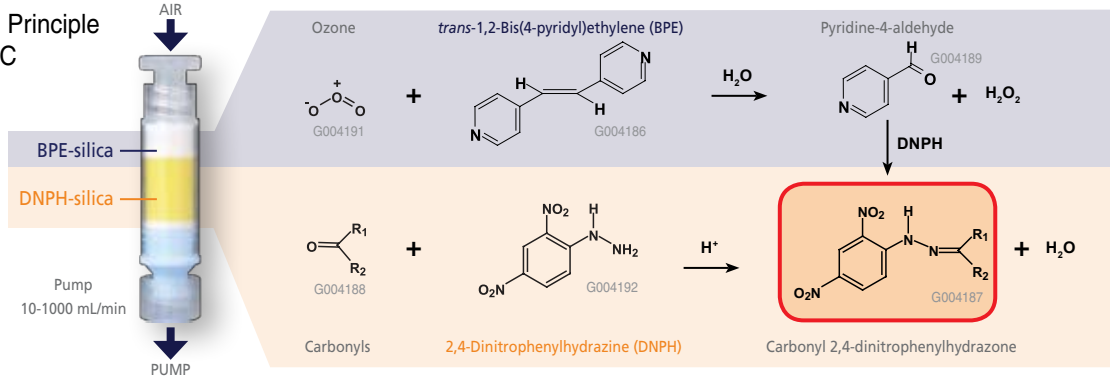
Description	Pkg.	Cat. No.
LpDNPH S10, 3 mL/350 mg	50	21014
LpDNPH S10, 3 mL/350 mg	10	21026-U
LpDNPH S10, 3 mL/350 mg (1 per nylon bag)	50	54072-U
LpDNPH S10 Starter Kit	10	21024-U
Kit includes one tube adapter and ten 1/8" male luer fittings		

S10x Cartridge

The S10x cartridge is shorter than the S10 cartridge and designed to fit automated systems.

Description	Pkg.	Cat. No.
LpDNPH S10x, 350 mg	10	505293

Reaction Principle and HPLC



S10L Cartridge

The S10L cartridge offers a reversible design and is for analysts who prefer shorter dimensions and does not need an adaptor for sampling. The cartridge is eluted by connecting to a syringe barrel (empty SPE tube) that acts as a reservoir for gravity-fed elution solvent. Meets EPA TO-11A requirements.

Description	Pkg.	Cat. No.
LpDNPH S10L, 350 mg Reversible	10	505358
LpDNPH S10L, 350 mg Reversible	50	505361-U

H Series Cartridges

The H series of LpDNPH cartridges contain higher loadings of 2,4-DNPH and/or larger bed weights compared to the S10 cartridges. This provides a higher capacity for carbonyls making the H series cartridges the preferred choice for use in high concentration environments. The H series is available in H10 (350 mg), H30 (1 g) and H300 (10 g) cartridges.

Description	Pkg.	Cat. No.
LpDNPH H10, 3 mL/350 mg	10	**505315**
LpDNPH H10, 3 mL/350 mg	50	**505320-U**
LpDNPH H30, 6 mL/1 g	10	**505323**
LpDNPH H300, 20 mL/10 g	10	**505331**

ORBO-DNPH Tube

The ORBO-DNPH tube contains 120 mg of 2,4-DNPH packed into a glass tube with break seal at both ends, each measuring 6 mm O.D. x 90 mm long.

Description	Pkg.	Cat. No.
ORBO-DNPH, 120 mg/6 mm O.D. x 90 mm L	10	**20081-U**

Ozone Scrubber

This cartridge offers a reversible design, like the S10L cartridge and contains 1.5 g of high purity potassium iodide. KI traps the ozone, which causes a negative formaldehyde interference in DNPH-coated devices. Luer endfittings enable you to connect this cartridge directly to the inlet of any DNPH cartridge with a luer tip. Testing (200 ppb ozone, 50% RH, 25C) has shown the scrubber to have an ozone capacity of 100,000 ppb/hr. The ozone scrubber is also available in the Rezorian hardware.

Description	Pkg.	Cat. No.
Ozone Scrubber, 1.5 g, Reversible	10	**505285**
Ozone Scrubber, 1.5 g, Rezorian	10	**54078-U**

LpDNPH Cartridge Specifications

Adsorbent:	Chromatographic grade, high purity silica gel coated with: DNPH: 2,4-dinitrophenylhydrazine BPE: trans-1,2-bis(4-pyridyl)ethylene
Particle Size:	150-250 µm (60/100 mesh)
DNPH Loading:	0.29% (1 mg/cartridge) 0.38% (1 mg/cartridge, BPE-DNPH) 0.86% (3 mg/cartridge, H series) 0.21% (0.25 mg/cartridge, ORBO-DNPH)
Capacity (total carbonyls):	75 µg (S10 series, BPE-DNPH) 225 µg (H10) 643 µg (H30) 6.4 mg (H300) 18.8 µg (ORBO-DNPH) 26 µg ozone capacity (BPE-DNPH)
Cartridge Length:	7.4 cm (S10) 3.8 cm (S10x) 4.0 cm (S10L) 4.0 cm (Rezorian, BPE-DNPH) 9.0 cm (ORBO-DNPH)
Background:	**SPE Style Cartridges**: <0.06 µg formaldehyde, <0.10 µg acetaldehyde, <0.30 µg acetone **ORBO-DNPH**: <0.025 µg formaldehyde, <0.035 µg acetaldehyde, <0.120 µg acetone
Pressure Drop:	<7 KPA at 1.5L/min (S10) (<28 inches water/<2.1 inches mercury) <20 inches water at 167 mL/min
Storage:	Refrigerate (4 °C), protect from light
Shelf Life:	12 months

HPLC Column Reference

For HPLC columns suitable for carbonyl-DNPH analysis, see page 12.

Adapters and Fittings

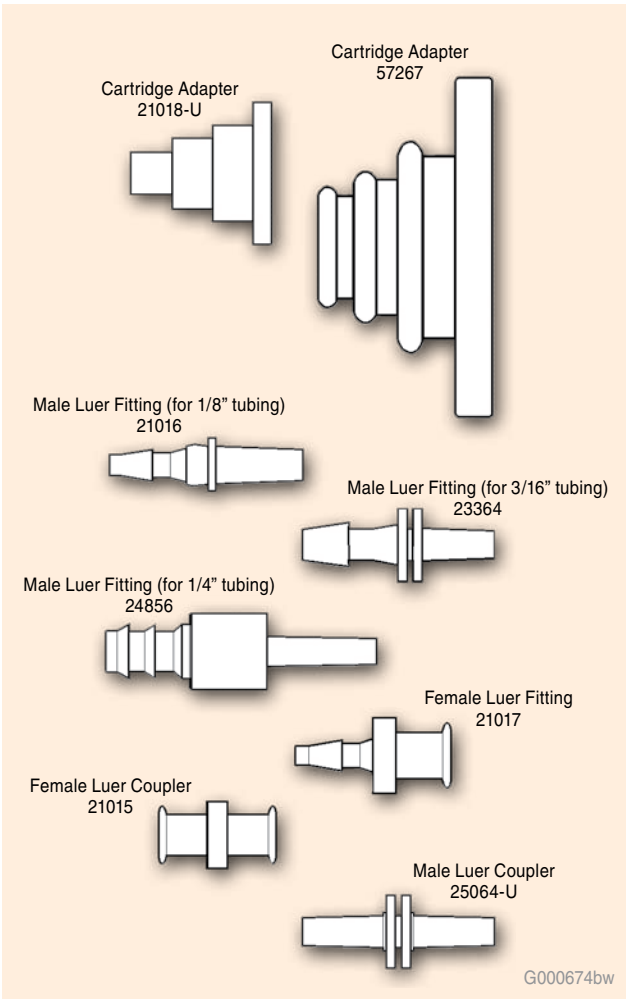
We offer a selection of reusable adapters and fittings for connecting our cartridges to a sampling pump and other devices.

E000981

Accessories

Description	Pkg.	Cat. No.
Connectors		
Cartridge Adapters for S10, H10, H30	10	**21018-U**
Cartridge Adapters for H300	6	**57267**
Male Luer Fittings for 1/8" Tubing	20	**21016**
Male Luer Fittings for 3/16" Tubing	20	**23364**
Male Luer Fittings for 1/4" Tubing	10	**24856**
Female Luer Fittings	20	**21017**
Female Luer Couplers	20	**21015**
Male Luer Couplers	20	**25064-U**
Male Luer Plugs	12	**504351**
Lapel Clips	6	**21019-U**
Syringe Barrels, 6 mL	30	**57242**
Glass Reservoirs, 5 mL	5	**20015-U**
Universal Elution Rack	1	**21043-U**
Analytical Columns Suitable for Carbonyl-DNPH Analysis		
Ascentis C18, 15 cm x 4.6 mm I.D., 3 µm	1	**581322-U**
Ascentis C18, 25 cm x 4.6 mm I.D., 5 µm	1	**581325-U**
Ascentis RP-Amide, 15 cm x 4.6 mm I.D., 3 µm	1	**565322-U**
Ascentis RP-Amide, 25 cm x 4.6 mm I.D., 5 µm	1	**565325-U**

Visit our website for detailed analysis and description.



Universal Elution Rack

Fast and convenient sample preparation without the use of a vacuum

Our versatile elution rack can be used with a variety of air monitoring tubes and receiving vessels, including our LpDNPH cartridges, for simultaneous gravity feed extraction up to 12 samples. By using the assembly plates in various combinations, you can configure the unit to accept:

P000131

- Closed cartridges (S10L)
- 1,3, or 6 mL syringe style cartridges
- 5 or 10 mL flasks
- 2 or 4 mL vials
- Test tubes up to 15 mm I.D. x 10 cm

For more in-depth information:

Aldehyde Method Applications

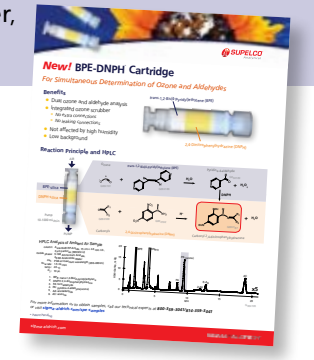
US EPA TO11A – Method for Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC)

US EPA IP-6A – Determination of Formaldehyde and Other Aldehydes in Indoor Air Using a Solid Sorbent Cartridge

US EPA Technical Assistance Document – Sampling and Analysis of Ozone Precursors

ASTM D5197 – Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air Active Sampler Methodology

Visit ***sigma-aldrich.com/air_monitoring*** to request the NEW **BPE-DNPH Flyer**, T408066 (KJB)



ORBO Solvent Desorption Tubes

ORBO Solvent Desorption Tubes are packed in glass with sealed ends. ORBO Tubes are mostly dual-layered and contain one larger bed of adsorbent followed by a smaller back-up bed to capture any sample break-through. The beds contain separators typically of glass wool or foam to secure the beds in place.

G000211

ORBO No.	Matrix	Bed Wt. A/B (mg)	O.D. x Length (mm)	SKC Equivalent	Pkg.	Cat. No.
ORBO Charcoal						
ORBO 32 Large	Activated Coconut Charcoal (20/40)	400/200	8 x 100	226-09	50	**20228**
ORBO 32 Small	Activated Coconut Charcoal (20/40)	100/50	6 x 75	226-01	50	**20267-U**
ORBO 33	Activated Petroleum Charcoal (20/40)	700/390	8 x 150	226-35	50	**20259**
ORBO 34	Activated Coconut Charcoal (special)	400/200	8 x 105	-	25	**20211**
ORBO 303	Petroleum Charcoal (20/40)	100/50	6 x 75	226-38		**custom order**
ORBO 304	Charcoal (low Ni) (20/40)	120/60	6 x 80	-	50	**20041**
ORBO 306	Petroleum Charcoal (20/40)	400/200	8 x 105	-	50	**20073-U**
ORBO 351	4-tert-butyl catechol on charcoal	100/50	6 x 75	226-73	50	**20042**
ORBO 353	HBr on Petroleum Charcoal	100/50	6 x 75	226-38-03	25	**20044**
ORBO 354	Charcoal (AVL Barneby Cheney, 580-19)	100/50	6 x 75	226-67	50	**20045**
ORBO 356	4-tert-butyl catechol on charcoal	400/200	8 x 110	-	50	**20047**
Silica Gel						
ORBO 52 Small	Activated Silica Gel(20/40)	150/75	6 x 75	226-10	50	**20229**
ORBO 52 Large	Activated Silica Gel (45/60)	150/150	8 x 75	226-48	50	**20263**
ORBO 53	Activated Silica Gel (20/40) with glass fiber filter	400/200	7 x 100	226-10-03	50	**20265**
ORBO 502	Activated Silica Gel (20/45)	100/50	6 x 75	226-51	50	**20030-U**
ORBO 506	Activated Silica Gel (45/60)	300/150	8 x 75	226-10-04	50	**20032**
ORBO 507	Silica Gel (20/40)	520/260	8 x 110	226-15	50	**20870-U**
ORBO-DNPH	2,4-DNPH coated Silica Gel	120	6 x 90	-	10	**20081-U**
Florisil						
ORBO 60	Florisil Magnesium Silicate (30/45)	100/50	6 x 75	226-39	50	**20351**
ORBO Carbon						
ORBO 76 (3 bed)	TEA-Coated Molesieve with Oxidizer	400/800/400	7 x 125	226-40	25	**20826-U**
ORBO 77	H_2SO_4-Treated Carbon Bead (20/30)	500/100	8 x 150	226-29	50	**20036**
ORBO 78	Carboxen-564	400/200	6 x 100	-	25	**20355**
ORBO 90	Carboxen-564 (for group MEK)	160/80	6 x 75	226-81	25	**20358**
ORBO 91	Carbosieve S-III	130/65	6 x 75	226-121	25	**20360**
ORBO 91T (3 bed)	Carbotrap B/Carbosieve S-III x 2	100/200/100	7 x 150	-	25	**20366-U**
ORBO 92	Carboxen-564 (for group vinyl acetate)	160/80	6 x 75	226-81	25	**20362**
ORBO 100	HBr on Carbotrap (20/40)	350/175	7 x 110	-	25	**20255-U**
ORBO 101	Carbotrap (20/40)	100/50	6 x 70	-	25	**20254-U**
ORBO Porous Polymers						
ORBO 23	2-(Hydroxymethyl) piperidine on Supelpak-20 (20/40)	120/60	6 x 85	226-118	25	**20257-U**
ORBO 24	2-(Hydroxymethyl) piperidine on Supelpak-20 (20/40)	150/75	6 x 105	226-117	25	**20231**
ORBO 25	2-(Hydroxymethyl)piperidine on Supelpak-20 (20/40)	450/225	8 x 115	226-27	25	**20357**
ORBO 42 Small	Supelpak-20E (20/40)	66/33	6 x 75	-	50	**20262**
ORBO 42 Large	Supelpak-20P (20/40)	100/50	10 x 100	-	50	**20264-U**
ORBO 43	Supelpak-20U (20/40)	100/50	8 x 100	226-30-04	50	**20258**
ORBO 44	Supelpak-20E (20/40)	100/50	8 x 100	226-30-04	50	**20260-U**
ORBO 47	Supelpak-70	100/50	6 x 90	226-95	50	**20349**
ORBO 49P	Supelpak-20P (20/40) with glass fiber filter	270/140	OVS-2 Tube	226-30-16	10	**20350**
ORBO 65M	XAD-4 (w/MCE filter)	160/80	OVS-2 Tube	-	10	**20028-U**
ORBO 65P	XAD-4 (w/Glass Fiber Filter)	160/80	OVS-2 Tube	-	10	**20029-U**
ORBO 70	5% Na_2CO_3 on Chromosorb P (30/60)	355/165	8 x 100	-	50	**20256-U**
ORBO 402	Tenax TA (35/60)	100/50	8 x 100	226-35-03	50	**20832-U**
ORBO 403	Tenax TA (60/80), acetone/methanol treated	100/50	6 x 85	-	50	**20034**
ORBO 601	XAD-8 (16/50), single bed	100	6 x 75	226-30-08	50	**20048**
ORBO 605	XAD-2 (20/50)	100/50	6 x 100	-	50	**20049**
ORBO 608	XAD-2 (20/50)	150/75	8 x 110	226-30-05	50	**20050-U**
ORBO 609	XAD-2 (20/50)	400/200	8 x 110	226-30-06	50	**20051**
ORBO 613	XAD-4	80/40	6 x 75	226-93	50	**20052**
ORBO 615	XAD-7 (15/50)	100/50	6 x 75	226-94	50	**20053**
ORBO 655	XAD-7 (20/60), Phosphoric Acid Treated	80/40	6 x 75	226-98	50	**20054**
ORBO 657	XAD-7 (20/60),1-(2-pyridyl) piperazine coated)	80/40	6 x 90	-	50	**20055**
ORBO 706	Chromosorb 102 (20/40)	100/50	8 x 100	226-107	50	**20057**
ORBO 711	Chromosorb 106 (60/80)	600/300	10 x 115	226-111	50	**20059**
ORBO 1102	Poropak P (50/80)	100/50	6 x 75	226-114	50	**20062**
ORBO 1103	Poropak Q (50/80)	150/75	6 x 100	226-115	50	**20063**
ORBO Accessories						
Puller/Inserter Tool					2	**22406**
ORBO Tube Cutter					1	**20596**
Tube Cutter Replacement Blade					1	**20575**

ORBO PUF Cartridges

Polyurethane foam (PUF) cartridges exhibit a low-pressure drop across the cartridge that facilitates high volume sampling. Several US EPA and ASTM methods require a PUF adsorbent cartridge for monitoring semivolatiles in stack, ambient, indoor, and workplace atmospheres. Refer to the tables below for descriptions of our PUF cartridges. The PUF plugs for these cartridges are thoroughly cleaned and tested to ensure absence of contamination.

P000745

Specifications for Small PUF Plug (Low Volume)

	ORBO 1000 Small PUF	ORBO 1500 PUF/XAD-2/PUF
Sampling Rate:	1-5 L/min	1-5 L/min
PUF Density:	0.022 g/cm³	0.022 g/cm³
Dimensions: (O.D. x L)	22 mm x 7.6 cm	22 mm x 30 mm/ 1.5 g XAD-2/22 mm x 30 mm
Applications:	ASTM D4861 Pesticides/ PCBs	Pesticides/PCBs
	ASTM D4947 Chlordane/ Heptachlor	
	EPA IP-8 Pesticides/PCBs	
	EPA TO-10A Pesticides/PCBs	

Specifications for Large PUF Plug (High Volume)

	ORBO 2000 Large PUF	ORBO 2500 PUF/XAD-2/PUF
Sampling Rate:	20-225 L/min	20-225 L/min
PUF Density:	0.022 g/cm³	0.022 g/cm³
Dimensions: (O.D. x L)	6 cm x 7.6 cm	6 cm x 30 mm/10 g XAD-2/6 cm x 30 mm
Applications:	ASTM D6209 PAHs	Pesticides/PCBs
	EPA IP-7 PAHs	PAHs
	EPA TO-4A Pesticides/PCBs	Dioxins
	EPA TO-9A	Dioxins
	EPA TO-13	PAHs

Small PUF Cartridges

Description	Pkg.	Cat. No.
ORBO 1000 PUF Cartridge, Assembly	3	20557
ORBO 1500 PUF Cartridge PUF/ XAD-2/PUF	3	21233-U
Glass Holder for Small PUF	1	20556
Cleaned Small PUF Plug	3	20600-U

Large PUF Cartridges

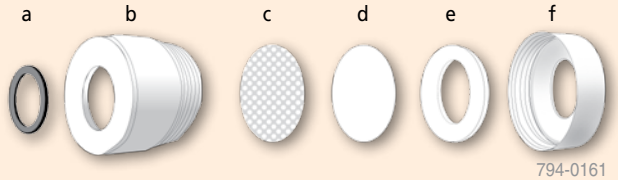
Description	Pkg.	Cat. No.
ORBO 2000 PUF Cartridge, Assembly	1	20037
ORBO 2500 PUF Cartridge, PUF/XAD-2/PUF	1	21235-U
Cleaned Large PUF Plug, 7.6 cm	1	20038
Glass Holder & Screen for Large PUF	1	20563
Stainless Steel Screen	2	21008-U

Filter Cartridge

An optional filter cartridge can be attached to the inlet of an ORBO 1000 or 1500 cartridge to trap aerosol and particulate forms of semi-volatiles. The filter cartridge contains a replaceable 32 mm diameter quartz microfiber filter with a stainless steel support screen.

Filter Cartridge Assembly includes 1 o-ring (a), 1 filter cartridge body (b), 1 stainless steel screen (c), 1 quartz filter (d), 1 filter ring (e), 1 cartridge screw cap (f), and 2 end caps.

Filter Cartridge consists of 1 o-ring (a), 1 filter cartridge body (b), 1 filter ring (e), and 1 cartridge screw cap (f).



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Note: b and c only available when purchased as the complete assembly.

Filter Cartridge

Description	Pkg.	Cat. No.
Filter Cartridge Assembly	1	21031
Filter Cartridge	1	21033
Replacement Parts		
Quartz Filter, 32 mm diameter (d)	10	21038
O-ring for Filter Cartridge (a)	2	21037
Filter Ring (e)	1	21035
Filter Cartridge End Caps	2	21041-U
Filter Cartridge Body (f)	1	21035

Filters and Cassettes

We have carefully selected these cassettes, filters and accessories to best meet your air sampling needs. These products, cited in numerous US Occupational Health and Safety Administration (OSHA) and National Institute of Occupational Safety and Health (NIOSH) methods, are universally respected for quality and reliability.

Coated Filters

ORBO 80 Coated 1,2-PP Filter is a 1-(2-pyridyl) piperazine coated glass fiber filter used for sampling diisocyanates in air (OSHA Methods 42 and 47).

Description	Pkg.	Cat. No.
ORBO 80 Coated Filter	25	20811
ORBO 80 Coated Filter w/Cassettes, unassembled	25	20812-U

Analytical Column for Isocyanate Derivative Analysis

Description	Pkg.	Cat. No.
SUPELCOSIL™ LC-CN HPLC Column		
25 cm x 4.6 mm I.D., 5 µm	1	58231

Related Chemical Standards

Isocyanate Derivative Standards – 1-(2-Pyridyl)piperazine derivatives. Each solution contains 1000 µg/mL in 1 mL dimethyl sulfoxide

Description	Cat. No.
2,6-TDI Derivative	
2,6-bis(4-(2-Pyridyl)-1-piperazinylcarbamyl) toluene	48144
2,4-TDI Derivative	
2,4-bis(4-(2-Pyridyl)-1-piperazinylcarbamyl) toluene	48145
1,6-HDI Derivative	
1,6-bis (4-(2-Pyridyl)-1-piperazinylcarbamyl) hexane	48146
4-4'-MDI Derivative	
4,4-bis (4-(2-Pyridyl)-1-piperazinylcarbamyl) diphenyl methane	48147

For more in-depth information:

Methods and Applications

OSHA Method 42 – Diisocyanates

OSHA Method 47 – Methylene Bisphenyl Isocyanate (MDI)

Application Note 31 – Monitor Airborne Diisocyanates Using ORBO 80 Coated Filters. Request T394031 at *sigma-aldrich.com/air_monitoring*

Membrane Filters and Cassettes for Air Monitoring of Fibers, Asbestos and Metals

Membrane Filter: Mixed Cellulose Ester (MCE) GN-4 Metricel®

P000662

We offer preassembled 3-piece design cassette which includes a GN-4 Metricel membrane and support pad. Banded cassettes are available for critical applications. The banded cassettes assure an air-tight seal, are leak-proof and tamper-resistant.

- 0.8 mm GN-4 Metricel (mixed cellulose esters) membrane filters have a low fiber background count.
- Accepted for air monitoring of fibers, asbestos fibers, and airborne metals such as lead (NIOSH Methods 7400 and 7402).
- Can be used to monitor respirable particulates such as silica, metal and dusts.

Description	Pkg.	Cat. No.
25 mm, pore 0.8 mm		
Three-piece unit w/GN-4 Metricel membrane and Support Pad	50	23371
Three-piece unit w/GN-4 Metricel membrane and Support Pad (banded)	50	23374
GN-4 Metricel Membrane Filter, 25 mm, plain	100	23380-U
37 mm, pore 0.8 mm		
Three-piece unit w/GN-4 Metricel membrane and Support Pad	50	23368
GN-4 Metricel Membrane Filter, 37 mm, plain	100	23381
GN-6 Metricel (0.45 mm) Membrane Filter, 37 mm, plain	100	23379

PTFE Membrane Filters

Zefluor™ Membrane Filters are suitable for monitoring acid rain, polynuclear aromatic hydrocarbons (PAHs) and particulates. Meets NIOSH specifications. Zefluor membrane filters feature a low-chemical background for highly sensitive determinations.

Zylon™ Membrane Filters are recommended for monitoring dyes, benzidine, o-tolidine, o-dianisidine (NIOSH Method 5013) and feature a low-chemical background for highly sensitive determinations.

TF-1000 (PTFE) Membrane Filters are recommended for general sampling of airborne particulate matter.

Description	Pkg.	Cat. No.
25 mm PTFE Membrane Filters		
Zefluor Membrane Filter, 25 mm, pore 0.5 mm	100	**23395**
37 mm PTFE Membrane Filters		
Zefluor Membrane Filter, 37 mm, pore 1 mm	50	**23391**
Zefluor Membrane Filter, 37 mm, pore 2 mm	50	**23390-U**
Zylon Membrane Filter, 37 mm, pore 5 mm	50	**23389**
TF-1000 Membrane Filter, 37 mm, pore 1 mm	50	**23383**

Additional Filters

Borosilicate Glass Fiber Filters are binding agent free and are recommended by the US EPA for high volume air sampling to collect atmospheric particles and aerosols.

GLA-5000 Polyvinyl chloride (PVC) Membrane filters feature low ash and moisture pick-up, light tare weight, and are gravimetrically stable. Suitable for multiple NIOSH analytical methods including silica monitoring.

Description	Pkg.	Cat. No.
Borosilicate Glass Fiber Filters		
A/E Glass Fiber Filter, 13 mm, pore 1 mm	500	**23376**
A/E Glass Fiber Filter, 25 mm, pore 1 mm	500	**23377**
A/E Glass Fiber Filter, 37 mm, pore 1 mm	500	**23378**
PVC Membrane Filters		
GLA-5000 PVC Membrane Filter, 37 mm, pore 5 mm	100	**23387**

Cassettes and Filter Accessories

Description	Pkg.	Cat. No.
Cassettes		
Empty 13 mm cassette – 2 piece, with washer	5	**23367**
Empty 25 mm cassette – 3 piece, unassembled	50	**23372**
Empty 37 mm cassette – 2 piece, unassembled	100	**23380-U**
Empty 37 mm cassette – 3 piece, unassembled (includes space ring)	100	**23370-U**
Support Pad (for 37 mm O.D Cassettes)		
Filter Support Pad, 37 mm	100	**23385**
Filter Support Pad, 37 mm	500	**23382**
Accessories		
PTFE Washer for 13 mm Cassette	1	**23388**
Sealing Band for 25 mm Cassette	100	**23365**
Sealing Band for 37 mm Cassette	100	**23366**

NEW! Mercury Emissions Sampling Tubes

Experience and Proven Track Record of Performance

P001177

Mercury Sampling Traps are designed for short-term and continuous sampling of total mercury emissions in combustion flue gas streams according to 40 CFR Part 75 Appendix K. Compared to competing technologies, our mercury sampling traps have revolutionized mercury vapor monitoring in two important ways.

- Generates accurate and precise multi-point mercury measurements
- Permits practical, economical long-term continuous mercury monitoring solutions

Supelco has a long-standing partnership (15 years) with Frontier GeoSciences (FGS), respected leaders in the mercury and trace metals characterization industry. Together our experience provides you with Mercury Sampling Traps that are proven and tested in the industry.

- Supelco and Frontier GeoSciences – 15 years of technical collaboration
- FGS/Supelco Traps – principle traps used to validate EPA Method 30B and Appendix K

And feature:

- FSTM Sorbent – Iodinated charcoal developed by Frontier GeoSciences, only available from FGS and Supelco.
- Low mercury background
- High-capacity mercury loading
- Reliability and proven track record of performance

Looking for **spiked traps, mercury analysis and RATA certification**? In the US, contact Frontier GeoSciences at 206-622-6960 or visit their website at *frontiergeosciences.com*. Frontier provides a guarantee with every spiked trap. Frontier's analytical mercury analysis method is based on compliance Method EPA 1631 Revision E (co-authored by EPA and FGS) using cold vapor atomic fluorescence spectroscopy (CVAS) detection. Frontier is NELAC accredited for sorbent trap analysis.

Did you know?

Frontier GeoSciences Inc. is an advanced research and analytical laboratory specializing in the determination and characterization of mercury and other trace metals in the environment.

EPA Method 30B (RATA) Traps (unspiked):

Monitoring: 1-2 hours
Sorbent: FSTM Iodinated Charcoal
Measurement Dimensions: 6 mm OD x 200 mm L
Sorbent Beds: 2 bed, 3 bed
Tube Ends: Glass open

Description	Pkg.	Cat. No.
Method 30B (RATA), 6 mm, 2 bed	25	2270-U
Method 30B (RATA), 6 mm, 3 bed	25	2274-U

Appendix K Traps (unspiked):

Monitoring: 1-10 days
Sorbent: FSTM Iodinated Charcoal
Measurement Dimensions: 10 mm O.D. x 240 mm L
Sorbent Beds: 2 bed, 3 bed
Tube ends: One glass open, one tapered end

Description	Pkg.	Cat. No.
Appendix K, 10 mm, 2 bed	25	2272-U
Appendix K, 10 mm, 3 bed	25	2273-U

For Indoor/Ambient Total Mercury Monitoring

Description	Pk	Cat. No.
10 mm, 300 mg/300 mg FSTM adsorbent	25	2271-U

For more in-depth information

EPA Method 30B RATA* (Draft) is a reference method for measuring total vapor phase mercury (Hg) emissions from coal-fired combustion sources using sorbent trap sampling and an extractive or thermal analytical technique. *RATA = Initial Relative Accuracy Test Audit. ***http://www.epa.gov/mercury*** (Controlling Power Plant Emissions)

40 CFR Part 75 Appendix K (formerly US EPA Method 324) is the EPA Clean Air Mercury Rule (CAMR). It was issued to reduce and cap mercury emissions from coal-fired power plants. This regulation outlines Continuous Emissions Monitoring (CEM) compliance monitoring of total vapor phase mercury using sorbent trap monitoring systems. ***http://ecfr.gpoaccess.gov*** (Title 40, Parts 72-80)

Detector Tubes and Pumps

MSA/Auer Detector Tubes

MSA/Auer Detector tubes contain treated adsorbent granules that react with specific compound(s) in the air sample causing the adsorbent to change color. A sample is collected by attaching the detector tube to a special bellows-type pump that draws a known volume of air with each stroke. After sampling, the length of the adsorbent bed that has undergone the color change is measured from a graduated scale printed on the tube, allowing direct readings of the vapor concentration – no extraction, no analysis, and no calculations are required.

Detector tubes are particularly useful in situations where quick screening is required, such as Haz-Mat Response, and for use in various industries in which specific, routine groups of compounds are monitored regularly. These MSA tubes and pumps are interchangeable with Draeger tubes and pumps.

MSA/Auer Detector Tubes

Analyte Group	Range (ppm)	Pkg.	Cat. No.
Triethylamine	5-30	10	**28184-U**
Ammonia	2-500	10	**28161-U**
Bromobenzene	5-500	10	**28162-U**
Benzene	0.5-25	10	**28163-U**
Chlorine	0.2-30	10	**28164-U**
Carbon Monoxide	5-1000	10	**28166-U**
Carbon Monoxide	10-3000	10	**28167-U**
Carbon Dioxide	0.1-7.0% (v/v)	10	**28168-U**
Carbon Dioxide	100-3000	10	**28169-U**
Formaldehyde	0.1- 55	10	**28171-U**
Hydrogen Sulfide	1-200	10	**28172-U**
Hydrogen Sulfide	100-4000	10	**28173-U**
Hydrogen Chloride	1-30	10	**28174-U**
Hexane	20-3200	10	**28175-U**
Nitrous Fumes	0.5-50	10	**28176-U**
Nitrous Fumes	50-3000	10	**28177-U**
Nitrogen Dioxide	0.5-50	10	**28178-U**
Ozone	0.05-5	10	**28179-U**
Phosphine	0.05-3	10	**28181-U**
Sulfur Dioxide	0.5-25	10	**28182-U**
1,1,2-Trichlorethane	10-170	10	**28183-U**

Toximeter II Auto Detector Tube Pump

Preset number of 100 mL pump strokes. Doubles as a sampling pump for other tubes, bags, impingers. Constant flow rate of 300 mL/min for adsorbent tubes with 8 hours of operating time. Fault recognition for low battery of obstructed flow. Rechargeable NiCd battery pack included.

E000056C

Description	Pkg.	Cat. No.
Detector Tube Pump		
Toximeter II, Automatic	1	**28188-U**
Omega Battery Charger		
110 V, units charged: 1	1	**28157-U**
240 V, units charged: 1	1	**28158-U**

Kwik Draw Deluxe Detector Tube Pump

One hand operation, simply squeeze handle to compress bellows, features a stroke counter and end-of-stroke indicator. Consistent 100 mL sample draw.

P000660

Gas-Tester II Detector Tube Pump

This pump offers both a stroke counter and end-of-stroke indicator with a unique locking system. Consistent 100 mL sample draw.

E000057

Description	Pkg.	Cat.No.
Kwik Draw Deluxe Detector Tube Pump	1	**28185-U**
Gas-Tester II Detector Tube Pump	1	**28186-U**

Thermal Desorption Tubes

For Active & Passive* Sampling

Supelco is recognized as the world leader in adsorbent technology. Our evaluation and development of air sampling adsorbents has produced the industry's most comprehensive selection of adsorbent tubes – Carbotrap tubes – offering superior performance for trapping and thermally desorbing organic compounds. Selection of the proper adsorbent(s) is critical to achieving the best results for a thermal desorption application. An ideal adsorbent tube will trap and retain compounds of interest for the entire sampling period, then allow total analyte desorption without thermal decomposition. The rate of release will be as rapid as possible, to minimize analysis time and provide the most efficient separation, especially when the analytes are desorbed directly to a chromatographic column held at ambient or above-ambient temperature. Thermal stability is also an important attribute of an ideal adsorbent. Stable adsorbents ensure the best detection limits by minimizing the possibility of breakdown products interfering with quantification in addition to a long lifetime.

Multi-Bed Adsorbent Tubes

Because no single adsorbent is capable of trapping and efficiently releasing all compounds, many Carbotrap thermal desorption tubes contain more than one adsorbent. Multiple beds of adsorbents enable you to analyze a wider range of compounds in a single sampling.

In multi-bed adsorbent tubes, the adsorbents are arranged in order of increasing adsorbent strength, from sample inlet to sample outlet. The largest molecules in the sample are trapped by the first bed of adsorbent, preventing them from coming into contact with stronger materials that could release them too slowly – or not at all. Smaller molecules are trapped by the succeeding, stronger beds. To avoid forcing analytes through an adsorbent that is too strong, desorption flow is always in the direction opposite of sample collection flow.

*Carbopack X for Passive Sampling. pg. 21.

Tube Construction

The design of a thermal desorption tube and its contents is critical to a well-performing air monitoring system. Glass tube blanks are manufactured to close tolerances, to ensure consistent lot-to-lot performance. As discussed, the adsorbents must retain the desired compounds effectively, release them quickly and completely, and be thermally stable at the temperatures required for analyte desorption. Every thermal desorption tube we make meets these criteria. After extensive thermal conditioning, we seal each tube. For convenient and reliable identification, we mark each of our glass tubes with a permanent unique number. Thermal desorption tubes are most commonly made of glass or stainless steel, with glass wool, wire gauze, or glass frits to hold the adsorbents in place. Tube lengths and outside diameters are dictated by the instrument of choice. Tubes having a large internal volume (4 mm I.D. or greater) are typically used for sampling because they hold relatively large size beds of adsorbents. In many cases, however, analytical results can be improved by transferring the analytes from the large I.D. sampling tube to a tube of smaller I.D. (1-2 mm), thus "focusing" the sample into a smaller volume. Subsequent desorption from the smaller ID tube to the chromatography column gives a higher linear velocity of desorption flow through the tube, delivering the sample to the column more rapidly and in a much narrower band.

Empty Tubes

We mark these specially cleaned glass tubes with an arrow to indicate sampling flow direction. Fill them in this direction with successively stronger adsorbents. You can fill an empty 4 mm I.D. tube with adsorbents for air sampling, or with a solid sample (soil, plastic, etc.) for a thermal extraction analysis. Use our empty 1 mm I.D. and 2 mm I.D tubes to create your own focusing tubes for better chromatography.

When you intend to trap especially sensitive compounds, use an adsorbent tube with a frit in the inlet, rather than a glass wool plug. The frit will hold the adsorbent in place without adsorbing or decomposing the analytes; glass wool plugs can adsorb or degrade sensitive compounds.

Custom-Made Thermal Desorption Tubes

We routinely manufacture thermal desorption tubes on request, for standard methods or customer-specific applications. Our in-house glass and machine shops fabricate glass and metal tubes to be compatible with commercially available desorption systems, or to unique specifications. We offer the widest range of adsorbent materials, including porous polymers (Chromosorb, Porapak, Tenax), carbon molecular sieves (Carbosieve, Carboxen), graphitized carbons (Carbopack, Carbotrap), and activated charcoals. Prices for custom prepared tubes are comparable to prices for our stock items.

For more information see the Custom Tube Order Form, page 51.

Overview on Carbotrap Thermal Desorption Tubes with Multiple Beds

Tube Name	Adsorbents	Compounds
Carbotrap 100	Carbotrap B	C-5-C12 compounds in air
Carbotrap 150	Glass beads, Carbotrap C	Large molecules in air or aqueous samples
Carbotrap 200	Glass beads, Carbotrap B, Carbosieve S-III	C2-C14 compounds in air
Carbotrap 201	Carbopack B, Carboxen-1000	Focusing semivolatile to very volatile compounds
Carbotrap 202	Carbopack B, Carbopack C	C5-C20 compounds in air
Carbotrap 217	Carbotrap B, Carboxen-1000	TO-17 compounds & other volatile compounds in air
Carbotrap 300	Carbotrap C, Carbotrap B, Carbosieve S-III	C2 and larger compounds in air
Carbotrap 301	Carbopack C, Carbopack B, Carboxen-1000	Focusing volatile and semivolatile compounds
Carbotrap 302	Carbopack C, Carbopack B, Carboxen-1001	Volatile compounds in aqueous solutions
Carbotrap 317	Carbotrap C, Carbotrap B, Carboxen-1000	TO-17 compounds and other volatile and semivolatile compounds in air
Carbotrap 349	Carbopack Y, Carbopack B, Carboxen-1003	NIOSH 2549: Volatile organic compounds in air
Carbotrap 370	Carbopack F, Carbopack C, Carbopack B	C5-C30 compounds thermally extracted from solid samples; focusing semivolatile compounds
Carbotrap 400	Carbotrap F, Carbotrap C, Carbotrap B, Carboxen-569	C2 and larger compounds in aqueous samples

For PerkinElmer Instruments

Supelco offers both Stainless Steel and Glass pre-packed sampling tubes that are fully compatible with the ATD-50 the ATD-400, and the TurboMatrix instrument. Each tube has a unique number. The tubes are available either pre-conditioned and ready for use with brass Swagelok end caps or unconditioned.

We also offer unconditioned tubes that must be conditioned as described.

- Each tube is sealed with Swagelok fittings.
- Fits: ATD-50, ATD-400 and TurboMatrix. 1/4 in. O.D. × 3.5 in. Long.
- Stainless steel 5 mm I.D., glass 4 mm I.D.

Stainless Steel

O.D. x length: 1/4 in. x 3 1/2 in., I.D.: 5 mm

Description	Pkg.	Application	Cat. No.
Preconditioned			
Carbotrap 100	10	ASTM D6196	**25052**
Carbotrap 202	10		**25058-U**
Carbotrap 300	10	EPA TO-17	**25050**
Carbotrap 349	10	NIOSH 2549	**25057-U**
Air Toxics	10	EPA TO-14	**25051**
Carbosieve S-III	10	EPA TO-2	**25053**
Tenax GR	10	Extends range of Tenax TA	**25054**
Tenax TA	10	EPA TO-1, EPA IP-1B	**25055**
Chromosorb 106	10	ASTM D6196, MDHS 72	**25056-U**

E000993

Description	Pkg.	Application	Cat. No.
NEW! Unconditioned			
Carbopack B	10	ASTM D6196	**28939-U**
Air Toxics	10	EPA TO-14	**28938-U**
Carbosieve SIII	10	EPA TO-2	**28942-U**
Carbotrap 300	10	EPA TO-17	**28937-U**
Carbotrap 349	10	NIOSH 2549, EPA IP-1B	**28949-U**
Tenax GR	10	Extends range of Tenax TA	**28946-U**
Tenax TA	10	EPA TO-1, EPA IP-1B	**28947-U**
Chromosorb 106	10	ASTM D6196, MDHS 72	**28948-U**
Empty			
SS Tube w/screens	1		**25049**
SS Tube w/screens w/PTFE analytical endcaps for TMX	10		**28014-U**
	50		**28015-U**

NEW! Supel-Inert Passive Sampling Device with Carbopack X for Thermal Desorption

E000973

Our new Carbopack X adsorbent tube was developed in collaboration with the US EPA for diffusive monitoring of **1,3-Butadiene** and 24 other VOC's. Monitoring 1,3-Butadiene is important due to the adverse health effects of this compound at trace atmospheric levels. (i.e. 0.03 µg/m³). The major sources of 1,3-Butadiene are combustion engines and tobacco smoking. In addition to 1,3-Butadiene, Carbopack X can effectively retain and release other VOC's of interest in the C4-C10 range. Suitable for vapor intrusion. Diffusion cap purchased separately. Diffusion cap w/silicone membrane recommended for sampling higher humidity environments. Decreases sampling rate by approximately 10%.*

Deactivated – Stainless Steel Tube

OD x length: 1/4 in. x 3 1/2 in., ID: 5 mm

Description	Application	Pkg.	Cat. No.
Preconditioned			
Carbopack X	1,3-Butadiene, EPA-TO-17 Compounds	10	**59701-U**
Passive Sampling Accessories			
Pen Clips for SS Tubes		10	**28016-U**
Diffusion Caps (standard)		10	**28017-U**
Diffusion Caps (w/silicone membrane)		10	**28018-U**

For more in-depth information:

T408041H – New Carbopack X Metal-Passivated Adsorbent Tube for 24-Hour Diffusive Sampling of 1,3-Butadiene and 24 Additional Volatile Organic Compounds

The US EPA website that describes the Detroit Exposure and Aerosol Research Study (DEARS): *http://www.epa.gov/dears*

Glass

E000994

O.D. x length: 1/4 in. x 3 1/2 in., I.D.: 4 mm

Description	Application	Pkg.	Cat. No.
Preconditioned			
Carbotrap 100	ASTM D6196	10	**25087**
Carbotrap 202		10	**25093-U**
Carbotrap 300	EPA TO-17	10	**25085**
Carbotrap 349	NIOSH 2549, EPA IP-1B	10	**25092-U**
Air Toxics	EPA TO-14	10	**25086**
Carbosieve S-III	EPA TO-2	10	**25088**
Tenax GR	Extends range of Tenax TA	10	**25089**
Tenax TA	EPA TO-1, EPA IP-1B	10	**25090-U**
Chromosorb 106	ASTM D6196, MDHS 72	10	**25091**
NEW! Unconditioned			
Air Toxics	EPA TO-14	10	**28953-U**
Carbosieve S-III	EPA TO-2	10	**28956-U**
Carbotrap 100	ASTM D6196	10	**28954-U**
Carbotrap 202		10	**28967-U**
Carbotrap 300	EPA TO-17	10	**28952-U**
Carbotrap 349	NIOSH 2549, EPA IP-1B	10	**28966-U**
Tenax GR	Extends range of Tenax TA	10	**28957-U**
Tenax TA	EPA TO-1, EPA IP-1B	10	**28958-U**
Chromosorb 106	ASTM D6196, MDHS 72	10	**28965-U**
Empty			
Glass Tube w/PTFE Analytical Endcaps for TMX		1	**25084**
Glass Tube w/PTFE Analytical Endcaps for TMX		10	**28013-U**
ATD-400 Accessories (See page 20)			
Washed Stainless Steel Clip for ATD-400		100	**23393-U**

Accessories

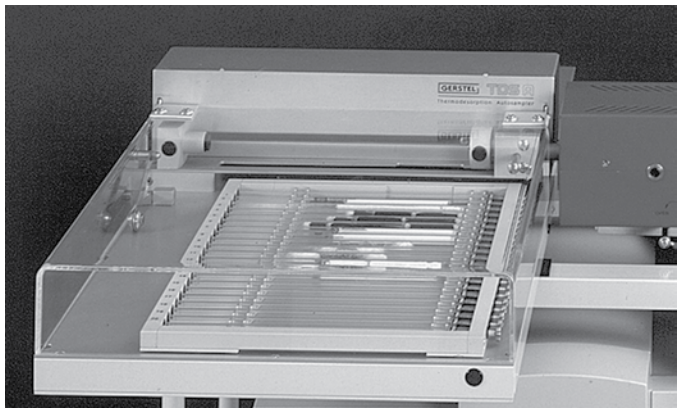
Description	Pkg.	Cat. No.
Storage Endcaps (For Glass and Stainless Steel Tubes)		
Replacement ferrules for TMX Brass Caps	20	**28012-U**
TurboMatrix™ Brass Caps	20	**28011-U**
PTFE Analytical Endcaps for TMX	20	**28002-U**
PTFE Analytical Endcaps for ATD-400	20	**28019-U**
TDS³ Storage Container		
For ATD-50, ATD-400, TurboMatrix	1	**25097-U**

*References

1. C.M. Linton, J.L. Brown, and W.R. Betz, Novel Coating Technology to Enhance Inertness of Stainless Steel Passive Monitoring Thermal Desorption Tubes, Pittsburgh Conference 2005 Poster T406029, Supelco, Bellefonte, PA.
2. W.A. McClenny, K.D. Oliver, H.H. Jacumin, Jr., E.H. Daughtrey, Jr., D.A. Whitaker. 2005. 24 h diffusive sampling of toxic VOCs in air onto Carbopack X solid adsorbent followed by thermal desorption/GC/MS analysis–laboratory studies. J. Environ. Monit. 7:248-256.
3. R.W. Williams, A.F. Vette, D.A. Whitaker, C.W. Croghan, P.A. Jones, H. Daughtrey, K. Oliver, H. Jacumin, D.D. Williams, C.E. Rodes, J.W. Thornburg, J.S. Herrington, and J. Zhang. The impact of passive sampling methodologies used in the DEARS. Presented at the National Environmental Monitoring Conference (NEMC), Cambridge, MA, August 20-24, 2007.

For Gerstel ThermoDesorption System

Supelco offers both stainless steel and glass pre-packed sampling tubes that are fully compatible with the Gerstel TDS and TDSA instruments. Each tube is thermally conditioned and batch tested for backpressure and background. The pre-packed tubes are sealed in our exclusive TDS³ storage containers. All of the pre-packed glass sampling tubes incorporate a glass frit at the inlet, which increases their performance, and are individually numbered. The stainless steel tubes use a stainless steel screen at both inlet and outlet to keep the adsorbent beds secure during use.



E000840

Stainless Steel

O.D. x length: 6 mm x 7 in., I.D.: 4 mm
Fits Models: TDS A & TDS 2

Description	Application	Pkg.	Cat. No.
Carbotrap 300	EPA TO-17	1	**28273-U**
Carbosieve S-III	EPA TO-2	1	**28274-U**
Tenax GR	Extends range of Tenax TA	1	**28272-U**
Tenax TA	EPA TO-1, EPA IP-1B	1	**28271-U**
Chromosorb 106	ASTM D6196, MDHS 72	1	**28275-U**
Empty SS GERSTEL Tube		1	**28276-U**
Screens for SS GERSTEL Tube		10	**28277-U**

Glass

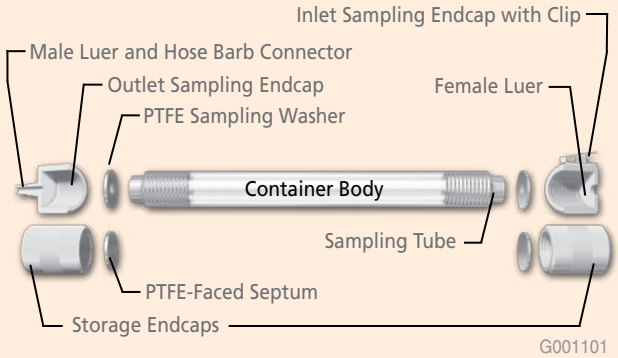
O.D. x length: 6 mm x 7 in., I.D.: 4 mm

Description	Application	Pkg.	Cat. No.
Carbotrap 300	EPA TO-17	1	**28283-U**
Carbotrap 202		1	**28313-U**
Carbotrap 217	EPA TO-17	1	**28312-U**
Carbotrap 349	NIOSH 2549, EPA IP-1B	1	**28311-U**
Carbosieve S-III	EPA TO-2	1	**28284-U**
Tenax GR	Extends range of Tenax TA	1	**28282-U**
Tenax TA	EPA TO-1, EPA IP-1B	1	**28281-U**
Chromosorb 106	ASTM D6196, MDHS 72	1	**28285-U**
Empty Fritted		1	**28286-U**
Empty non-Fritted		1	**28287-U**

Accessories

Description	Pk	Cat. No.
TDS³ Storage Container for TDS2/TDS/A	1	**25095-U**
TDS³ Storage Container for TDU (60 mm Tubes)	1	**28307-U**

TDS³ Storage Container



G001101

For additional TDS³ containers and accessories, see page 25.

For CDS/Dynatherm Instruments

Supelco offers a complete line of both pre-packed and empty tubes for the Dynatherm Thermal Desorbers. Each tube is individually numbered, thermally conditioned, and batch tested for backpressure and background. The pre-packed standard sampling tubes are sealed in our exclusive TDS³ storage containers and the fast-flow tubes are sealed with Swagelok® fittings. All of the pre-packed glass sampling tubes incorporate a glass frit at the inlet, which increases their performance. The focusing tubes are used to refocus the sample for better chromatography of the early eluting compounds.


P000679

Glass

O.D. x length: 6 mm x 4.5 in., I.D.: 4 mm
Fits models: ACEM-9300, ACEM-900 850/890 TDU, MTDU and OI Analytical Air Tube Desorber or DMP-16

Description	Application	Pkg.	Cat. No.
Glass Fritted Sampling Tubes			
Carbotrap 100	ASTM D6196	1	**20872**
Carbotrap 150		1	**20381**
Carbotrap 200		1	**20873**
Carbotrap 217	EPA TO-17	1	**20895-U**
Carbotrap 300	EPA TO-17	1	**20875**
Carbotrap 302		1	**20356**
Carbotrap 317	EPA TO-17	1	**20877**
Carbotrap 349	NIOSH 2549, EPA IP-1B	1	**20243**
Carbotrap 400		1	**20882**
Tenax TA	EPA TO-1, EPA IP-1B	1	**20896-U**
Empty Fritted		1	**20235-U**
Non-Fritted Glass Sampling Tubes			
Carbotrap 100	ASTM D6196	1	**20238**
Carbotrap 200		1	**20242**
Carbotrap 300	EPA TO-17	1	**20379**
Carbotrap 400		1	**20359**
Empty non-Fritted		1	**20380-U**

Fast Flow

These glass tubes have a 7 mm I.D. that allows faster flow rates to pass through tubes while sampling.

O.D. x length: 10 mm x 4.5 in., I.D.: 7 mm
Fits models: ACEM-9300, IACEM-980, ACEM-900 and MTDU equipped with fast-flow "FF" option
Sealed with Swageloks

Description	Application	Pkg.	Cat. No.
Carbotrap 217	EPA TO-17	1	**20724**
Carbotrap 317	EPA TO-17	1	**20881**
Tenax TA	EPA TO-1, EPA IP-1B	1	**20894**

Focusing Tubes

Fits models: 850/890 TDU

Description	Pkg.	Cat. No.
Carbotrap 200 - 2 mm x 6 mm x 4.5 in.	1	**20244**
Carbotrap 201 - 1 mm x 6 mm x 4.5 in.	1	**20361**
Carbotrap 300 - 2 mm x 6 mm x 4.5 in.	1	**20382**
Carbotrap 301 - 1 mm x 6 mm x 4.5 in. (I.D. tapers to 0.75 mm)	1	**20354**
Carbotrap 370 - 2 mm x 6 mm x 4.5 in.	1	**20373**
Empty - 2 mm x 6 mm x 4.5 in.	1	**20237**
For Model ACEM900/901FF		
Carbotrap 201 - 1 mm x 6 mm x 7.5 in.	1	**20865**

NEW!

Color-Coded Tenax TA Tube

Glass Fritted Standard Sampling Tubes

Simplify your field sampling process and reduce error in the field with our color-coded glass fritted sampling tubes. Each color can represent a different sample in the field or a different testing protocol the laboratory. All tubes contain Tenax TA.


E000986

O.D. x length: 6 mm x 4.5 in. I.D.: 4 mm
Fits models: ACEM-9300, ACEM-900 850/890 TDU, MTDU and OI Analytical Air Tube Desorber or DMP-16
Application: EPA TO-1, EPA IP-1B

Description	Pkg.	Cat. No.
White Dot	1	**11271-U**
Black Dot	1	**11272-U**
Red Dot	1	**11273-U**
Green Dot	1	**11274-U**

CDS Adsorbent Tube

O.D. x length: 6.25 mm x 3 in., I.D. 3.9 mm

Description	Application	Pkg.	Cat. No.
Carbotrap 300	EPA TO-17	1	**20372**

Stainless Steel

Length: 115 mm

Description	Application	Pkg.	Cat. No.
Tenax TA	EPA TO-1, EPA IP-1B	1	**20367-U**

Accessories

Description	Pkg.	Cat. No.
TDS³ Storage Container for Dynatherm	1	**25096-U**
Fits Standard Tubes 850/890 & ACEM 900-901FF		

VOST Stack Sampling Tubes

VOST Tubes (Volatile Organic Sampling Train) are designed to meet specifications in US EPA SW-846, Method 0030. Each tube is individually numbered, pre-conditioned, and sealed with stainless steel Swagelok fittings before stored in a glass storage container. Each lot is tested for background and backpressure.

9960072

O.D. x length: 16 mm x 5 in. (1/4 in O.D. ends)
Fits models: Dynatherm 9300 TDA

Description	Application	Pkg.	Cat. No.
VOST Stack Sampling Tube			
Tenax TA, 35/60	EPA 0031, EPA SW-846, EPA 0030	1	20074-U
Tenax TA, 35/60: Petroleum charcoal	EPA 0031, EPA SW-846, EPA 0030	1	20075-U
Empty glass VOST Tube		1	21993
VOST Storage Container		1	21998
Analytical Column			
SPB-624 Fused Silica Capillary Column, 75 m x 0.53 mm I.D., 3 µm film		1	25432

For Teledyne Tekmar Instruments

Supelco offers both glass and stainless steel tubes for Teledyne Tekmar instruments. Our prepacked tubes are thermally conditioned and tested for background levels and backpressure. The 1/4 in. O.D. tubes are sealed in our exclusive TDS^3 storage container and the 1/2 in. O.D. tubes are sealed in a glass storage container. Fits AEROTrap 6000 instrument.

9960072

Stainless Steel

These stainless steel tubes have a 5 mm I.D. that allows faster flow rates to pass through tubes while sampling.

O.D. x length: 1/4 in. x 7 in., I.D.: 5 mm
Fits models: AEROTrap 6000

Description	Application	Pkg.	Cat. No.
Carbotrap 100	ASTM D6196	1	20241
Carbotrap 300	EPA IP-1B	1	20370-U
Tenax TA	EPA TO-1, EPA IP-1B	1	20913-U
Empty SS Tekmar Tube, 5 mm I.D.		1	20920-U
O.D. x length: 1/2 in. x 7 in., I.D.: 12 mm			
Tenax TA	EPA TO-1, EPA IP-1B	1	20984
Empty SS Tekmar Tube, 12 mm I.D.		1	20924

Glass

O.D. x length: 1/2 in. x 7 in., I.D.: 10 mm

Description	Application	Pkg.	Cat. No.
Carbotrap 300	EPA IP-1B	1	20983
Empty Glass Tekmar Tube, 10 mm I.D.		1	20922
O.D. x length: 4 in x 7 in., I.D.: 4 mm			
Carbotrap 300	EPA IP-1B	1	20912-U
Empty Glass Tekmar Tube, 4 mm I.D.		1	20918

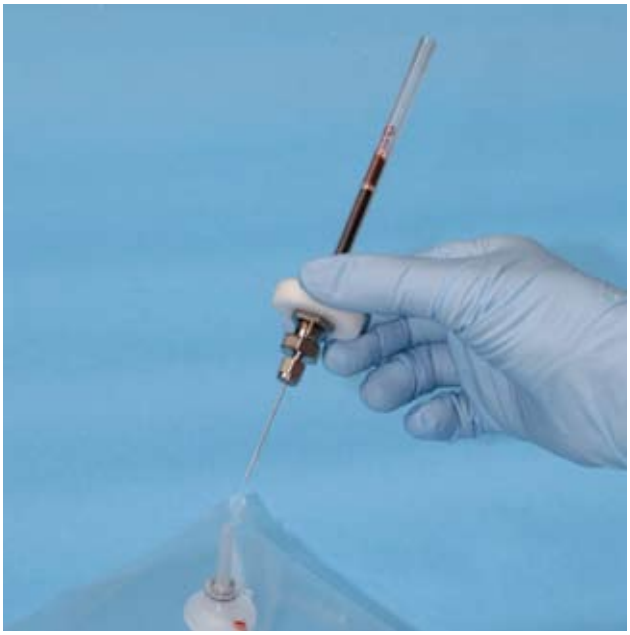
Accessories

Description	Pkg.	Cat. No.
TDS^3 Storage Container for Tekmar Tube	1	25095-U
Storage Container for 1/2 in. x 7 in. TD Tube	1	20853

Thermal Desorption Accessories

NEW!

Needle Sampling Kit for Thermal Desorption Tubes



E000991

The needle sampling kit is an accessory designed to assist users of thermal desorption tubes to attach a needle to the inlet of the tube for various sampling applications. The kit includes ferrules for thermal tubes with outside diameters of 1/4 in. or 6 mm. Choose the ferrule for the size of tube you are using.

The kit includes the following:

- Stainless steel 22s gauge needle with a bevel point
- Stainless steel fitting
- Acetal/stainless steel thumbwheel
- 1/4 in. PTFE ferrule (white)
- 1/4 in. M-2 VESPEL® ferrule (orange)
- 6 mm M-2A VESPEL graphite ferrule (black)

Description	Pkg.	Cat. No.
Needle Sampling Kit for Thermal Desorption Tubes	1	29023-U
Replacement Needles		
22s gauge 2" long with #2 bevel point●	3	20798
22s gauge 2" long with #3 blunt point	3	20862

Description	Max. Temp.	Qty.	Cat. No.
Replacement Ferrules			
0.8 mm I.D. M-2A for 22s gauge needle■	400 °C	10	22489
1/4 in. I.D. M-2 for 1/4 O.D. tubes■ (orange)	350 °C	10	22320-U
1/4 in. I.D. M-2A for 1/4 O.D. tubes (black)	400 °C	10	22481
1/4 in. I.D. PTFE for 1/4 O.D. tubes■ (white)	250 °C	10	29024-U
6 mm I.D. M-2A for 6, O.D. tubes■ (black)	400 °C	10	22393
Replacement thumbwheel	100 °C	1	28529-U

● Size and type of needle included with this kit
■ Size and type of ferrule included with this kit
For a complete description of the various needle types, see the Supelco catalog.

TDS³ Storage Container

E000992

Use our TDS³ storage sampling system to simplify the Thermal Desorption sample prep process. The TDS³ storage containers will maintain the sample integrity of both the tubes to be sampled or those which already have a sample adsorbed. The optional Sampling Caps (25069) convert the TDS³ storage container into a convenient tube holder that makes connecting the tube to the sampling pump very easy.

Description	Pkg.	Cat. No.
TDS³ Storage Container by Instrument Manufacturer/Model		
PerkinElmer, Markes Unity, and DANI Tubes	1	25097-U
Dynatherm Standard Tubes	1	25096-U
Chrompack TD Tubes	1	25098-U
GERSTEL TDS/TDS²/TDSA Tubes	1	25095-U
GERSTEL 60 mm Tubes	1	28307-U
Tekmar AEROTrap 6000 Tubes	1	25095-U
Envirochem, 810 Tubes	1	25100-U
TDS³ Storage Container Accessories		
Replacement Septa for all TDS³ containers	50	25073
Male Luer Plug	12	504351
Female Luer Cap	12	57098
Sampling caps w/washers for ½ in TDS³	10	25069
Tubing Adapter		
For use with 1/8 in. tubing to male luer	20	21016
For use with 3/16 in. tubing to male luer	20	23364
For use with 1/4 in. tubing to male luer	10	24856
Tubing Coupler		
For use with male to male luer	20	25064-U

PTFE Packed Column Ferrule

I.D. 1/4 in., configured for 1/4 O.D. column
Maximum Temperature: 250 °C

Description	Pkg.	Cat. No.
Ferrule, PTFE – 1/4 in.	10	29024-U

ATIS Adsorbent Tube Injector System

Sample Preparation Device for Thermal and Solvent Desorption Tubes

The Supelco ATIS is a sample preparation device for adsorbent tubes. The Adsorbent Tube Injector System employs the technique of flash vaporization to vaporize the sample into a continuous flow of inert gas, which carries the sample to the adsorbent tube. The sample pathway is constructed of glass and stainless steel. The calibration standard is injected by a syringe through a replaceable septum in the center of the injection glassware, which is heated.

P001253

Benefits:

- Inject calibration standards directly onto adsorbent tube to calibrate your analytical system
- Inject surrogates and system monitoring compounds onto adsorbent tubes before or after sampling
- Removes moisture from tubes prior to analysis (dry purge)
- Connect air-sampling bag to the ATIS outlet to vaporize calibration standards to assure complete vaporization
- Easy installation – plumb into a regulated source of nitrogen or helium and plug into appropriate electrical source

The ATIS will accept either 1/4 in. or 6 mm O.D. Thermal Desorption tubes. Included with this system:

- Luer/hose barb adapter to connect a variety of solvent desorption tubes
- Injection glassware
- Constant flow controller with an on/off valve - flow range: 0-100 mL/min
- Heating source - temperature range: ambient to 120 °C
- Spare parts along with all the necessary fittings and tubing

Description	Pkg.	Cat. No.
ATIS System, 110V	1	28520-U
ATIS System, 230V	1	28521-U
Replacement Luer/Hose Barb	1	28525-U
Replacement Standard Injection Glassware	1	28526-U
Replacement Thumbwheel Nut	1	28529-U

Purge and Trap/Humidifier Module for the ATIS

A separate module is available that will allow you to purge aqueous samples onto an adsorbent tube at ambient temperatures. This module can also be used to generate a dynamic humidified stream of the carrier gas for spiking calibration standards. The purge and trap module includes purge and trap glassware, and a separate flow controller that allows the user to set a separate purge (wet) flow rate independently of the dry flow rate. The purge and trap module accepts standard 22 mL threaded vials to simplify your sample prep.

P000851

Description	Pkg.	Cat. No.
ATIS Purge and Trap/Humidifier Module	1	28522-U
ATIS Replacement Purge and Trap/ Humidifier Glassware	1	28527-U
ATIS Replacement Purge and Trap Transfer Tube	1	28528-U

Thermal Extraction Glassware

Use the ATIS to thermally extract samples onto an adsorbent tube. The opening of the glassware will accept solid samples up to 1/2 in. (13 mm) in diameter and up to 3 in. long (76 mm) to be inserted into the glassware. The extraction glassware simply slides into the ATIS heating block. Two types of glass joints are available.

P000850

Description	Pkg.	Cat. No.
Extraction Glassware w/Ground Joint	1	28524-U
Extraction Glassware w/Micro Connector	1	28523-U

Supelco GC Capillary Columns

SUPELCO® Analytical

Supelco is dedicated to the development of leading-edge technology to meet the needs of our loyal customer base.

- Special purpose columns for many specific applications
- Columns for general purpose uses
- Each capillary column individually tested to ensure quality
- Guaranteed satisfactory performance
- Superior technical service before and after your purchase

For more information, visit ***sigma-aldrich.com/gc*** or contact Supelco Technical Service at ***800-359-3041*** (USA and Canada only), ***814-359-3041***, or email ***techservice@sial.com***

Column Selection by Industry

Supelco has developed the most extensive line of special purpose columns designed for industry specific applications. These columns are manufactured to deliver high resolution, great analyte response, low bleed, and long column life; allowing analysts to achieve the analytical performance they require. This easy-to-read phase selection chart is conveniently arranged to simplify the process of selecting the proper phase. Simply locate your application to identify the recommended phase.

These columns can be used with methodologies for determining indoor air quality as well as outdoor organic compounds.

	Indoor Air Quality - EPA IP-8	Indoor Air Quality - NIOSH 1003	Indoor Air Quality - NIOSH 1403	Indoor Air Quality - NIOSH 1500/1501	Indoor Air Quality - NIOSH 2530	Indoor Air Quality - NIOSH 2542	Indoor Air Quality - NIOSH 5503	Indoor Air Quality - OSHA 53	Indoor Air Quality - OSHA 56	Indoor Air Quality - OSHA 62	Indoor Air Quality - OSHA 80	Toxic Organics - TO-1/TO-2	Toxic Organics - TO-4/TO-10	Toxic Organics - TO-9	Toxic Organics - TO-13	Toxic Organics - TO-14/TO-15/TO-17	Hazardous Air Pollutants
SPB™-HAP																	■
Equity®-1			■	■		■		■	■			■				■	
SLB™-5ms	■				■		■			■			■	■	■		
VOCOL™		■															
SPB-608													■				
Equity-1701													■				
SPB-225														■			
SUPELCOWAX™ 10											■						
SP™-2331														■			

Solutions Sampling

Impingers and Bubblers

E000252

Our borosilicate glass impingers (for particles) and bubblers (for gases and vapors) are ideal for NIOSH and OSHA methods that require collection of airborne contaminants by drawing them into solution.

Standard Impinger and Bubbler

Length:	186 mm (7.3 in.)
Reservoir Length:	152 mm (6 in.)
Reservoir Capacity:	25 mL
Graduations:	5 mL
Glass Joint:	24/40 taper
Impinger:	Standard Glass Stem
Bubbler:	Fritted Glass Stem

Volume (mL)	Pkg.	Cat. No.
Standard Impinger	1	20270-U
Standard Bubbler	1	64835-U

Threaded Midget Impingers and Bubblers

E000251

Threaded midget impingers and bubblers make your sampling process more convenient. The vial can be capped after sampling, thus reducing sample handling in the field – no transferring of samples from the reservoir to a separate vial. The reservoir may be easily replaced with a standard or graduated screw-top vial.

Specifications:

	Threaded Midget Impinger	Threaded Midget Bubbler	Spill Resistant Midget Bubbler
Length (without vial):	143 mm (5 5/8 in.)	143 mm (5 5/8 in.)	143 mm (5 5/8 in.)
Vial Capacity (mL):	22	22	40
Thread (mm):	20	20	24
Graduation Mark (mL):	-	15	15
Pack Size (ea):	2	1	1
Cat. No.:	**64712-U**	**64834-U**	**64832**

Replacement Vials, screw top (cap not included)

Description	Pkg.	Cat. No.
Clear Vials		
22 mL vial, 23 mm x 85 mm, thread 24-400	100	**27173**
40 mL vial, 29 mm x 82 mm, thread 24-400	100	**27184**
40 mL vial, 28 mm x 95 mm, thread 24-400	100	**27184**
Amber Vials		
22 mL vial, 23 mm x 85 mm, thread 20-400	100	**27073-U**
40 mL vial, 29 mm x 82 mm, thread 24-400	100	**27185-U**
40 mL vial, 28 mm x 95 mm, thread 24-400	100	**27382**

Impinger Accessories


9960284

In-Line Impinger Trap

Bottom cap allows easy emptying – 15 mL capacity for absorbing solution. Can be packed with charcoal or other adsorbent (sold separately). Cap and PTFE liner included. Length 152 mm (6 in.): 20 mm threads.


9950155

Impinger Holder

Insert your impinger, bubbler, or in-line trap in this holder and attach to your lapel, shirt pocket or belt.

Description	Pkg.	Cat. No.
In-line Impinger Trap w/20 mm Thread	1	**64833**
Impinger Holder	1	**20271**

Plastic Clips/PTFE Sleeves


9130299

Plastic clips fit over the connection on our 24/40 taper ground glass joints to ensure secure connections. Use the PTFE sleeves in ground glass joints for inert, tight seals without the possibility of frozen joints. For use with standard impingers and bubblers.

Volume (mL)	Pkg.	Cat. No.
Plastic Clip for use with 24/40	1	**64764**
PTFE Sleeve for use with 24/40	1	**64761**

Passive Sampling

Overview

Passive/diffusive sampling relies on the unassisted molecular diffusion of gaseous agents (analytes) through a diffusive surface onto an adsorbent. Unlike active (pumped) sampling, passive samplers require no electricity (expensive pumps), have no moving parts, and are simple to use (no pump operation or calibration). After sampling, the adsorbed analytes are desorbed off the adsorbent by solvent or thermal desorption.

Benefits of Passive/Diffusive Sampling:

- Compact, portable, unobtrusive, and inexpensive
- Offers indication of average pollution levels over time periods of 8 hours to weeks/months
- Requires no supervision, is non-flammable, and noiseless
- Low cost allows for sampling at multiple locations (e.g., for highlighting pollution "hotspots"; or determining long term data trends in a specific geographical area)
- Amenable to personal monitoring (breathing zone), indoor air analysis, and outdoor ambient air analysis

Fick's Law:

$$\frac{dm}{dt} = D \cdot S \cdot \frac{dC}{dl}$$

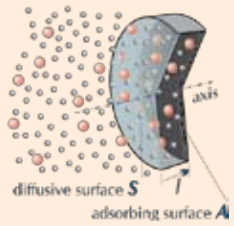
Where,
- Q = dm/dt = adsorbed mass m during time t (sampling rate)
- D = diffusion coefficient (constant for each analyte)
- S = diffusive surface
- dC/dl = concentration gradient
- K = geometric constant of the sampler

To determine C:

$$C\left[\mu g \cdot m^{-3}\right] = \frac{m[\mu g]}{Q[mL \cdot min^{-1}] \cdot t[min]} \cdot 1{,}000{,}000$$

From Fick's Law, we know that the sampling rate (Q) is a function of the diffusion coefficient of a given analyte (D) and the geometric constant of the sampler (K): Q = D x K The diffusion coefficient (D) always remains constant for a given analyte; therefore, to improve sampling rate (Q), the geometric constant (K) must be improved: K = S/l where S is diffusive surface and l is the distance between the diffusive and adsorbing surface.

Configuration of a Diffusive Gas-Sampling Device (Axial)

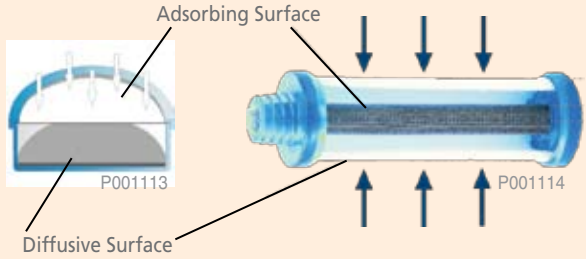


Most commercially available passive/diffusive samplers are planar or axial in shape and offer lower sampling rates and limited sampling capacity. As a result, sensitivity can suffer during short-term analysis (due to low sampling rates), or long-term sampling (analyte back diffusion to low capacity). A radial coaxial design circumvents this issue by improving the geometry, resulting in up to 10X higher sampling rates.

Example Sampling Rates for Benzene (25 °C)

Axial Sampler
7-8 mL/min.

Radial Sampler
80 mL/min.



radiello

What is Radiello?

In the mid 1990s, Dr. Vincenzo Cocheo, Director of the Fondazione Salvatore Maugeri (FSM), Padova, Italy, in collaboration with the European Commission Joint Research Center and other institutions, developed and patented a revolutionary diffusive sampling design - Radial symmetry (now a registered trademarked as radiello). It consists of a microporous cylindrical polypropylene diffusive body. Housed within the diffusive body is a removable cartridge adsorbent. Each cartridge adsorbent contains a unique adsorbent that is application specific. The radial symmetry design offers a very large diffusive surface relative to the adsorbing surface allowing for an exponential increase in uptake rate when compared to traditional passive samplers. This translates to shorter necessary sampling times that are close to the range of active sampling.

Radiello offers Higher Capacity

With active sampling, i.e. using a pump, adsorbed gaseous compounds move through the axial sampler (adsorbent tube) as a gaussian peak. This means only a part of the adsorbent bed is used for trapping the analyte, and in addition, it is forced through the tube by the sample flow. Eventually breakthrough will occur.

In the diffusive radiello samplers, the analytes are not forced through the adsorbent cartridge which results in a more complete use of the adsorbent bed and a higher capacity, providing longer possible sampling times or broader concentration ranges.
To read more about the capacity comparison between active and passive sampling, please request the radiello brochure (T406090 - IXV) or visit tghe website *sigma-aldrich.com/radiello*

How to Use Radiello Samplers

Assembly of the Radiello sampler is simple. Sampling using Radiello monitors begins with a quick assembly of the support plate.

1. Transfer adsorbent cartridge from the storage container into the appropriate diffusive body.

2a. Screw diffusive body into triangular support plate.

2b. Use vertical adapter for personal sampling.

3. Document date and time on the enclosed barcode label and insert label into sampler pocket.

Sampling has begun.

4. At the conclusion of sampling, transfer the adsorbent cartridge from the diffusive body to the original storage container, and document date, time, and temperature on the barcode label. Transfer label to the storage container and send this to the lab for analysis.

5. Desorb and analyze adsorbing cartridge.

1.

P001117

3.

P001120

2a.

P001118

4.

P001121

2b.

P001119

5.

P001122

P001123

Outdoor Shelters

Protective outdoor shelters are recommended for environmental/ambient air sampling (available as easy to assemble & use accessory, see page 35).

Desorption and Analysis

For each compound/compound group, the Fondazione Salvatore Maugeri has developed detailed desorption and analytical protocols involving analytical techniques typical of most independent, academic, industrial, and regulatory laboratories. Detailed desorption and analytical conditions are available in the Radiello manual (IYP) which can be viewed and downloaded at ***sigma-aldrich.com/radiello.***

Analytical services are available in the US and to European customers directly through the Fondazione Salvatore Maugeri. For more information, please contact the Fondazione Salvatore Maugeri IRCCS under email ***fsmpd@fsm.it*** or refer to web ***radiello.com***

Official Methods

Radiello Samplers are suitable for a variety of methods for diffusive sampling, but are explicitly listed in the following:

- **EN 14412:2004 Indoor Air Quality** – Diffusive samplers for the determination of concentrations of gases and vapors
- **EN 14662-5:2005 Ambient Air Quality** – Standard method for measurement of benzene concentrations
- **ISO/FDIS 16200-2 Workplace Air Quality** – Sampling and analysis of VOCs by solvent desorption/gas chromatography

For more in-depth information:

More official method listings can be found in the Radiello brochure T406090 (IXV), The Radiello CD (IXW) and the Radiello Manual (IYP). To request this information, visit ***sigma-aldrich.com/radiello***

Radiello Products and Accessories

Cartridge Adsorbents

Cat. No.	Matrix	Compounds	Pkg.	Radiello No.
RAD165	2,4-DNPH Coated Florisil®	Aldehydes	20	Code 165
RAD145	350 mg Carbograph 4 (35/50)	BTEX/VOC's (Thermal Desorption)	20	Code 145
RAD130	Activated charcoal (30/50)	BTEX/VOC's (CS_2 Desorption)	20	Code 130
RAD166	Microporous PE Impregnated w/ wet TEA	HF, NO_2, and SO_2	20	Code 166
RAD172	Microporous PE w/4,4'-dipyridylethylene coated silica	Ozone (O_3)	20	Code 172
RAD170	Microporous PE Coated with Zinc Acetate	Hydrogen Sulfide (H_2S)	20	Code 170
RAD168	Microporous PE Impregnated w/Phosphoric Acid	Ammonia (NH_2)	20	Code 168
RAD132	Mix of Molesieve and activated charcoal (30/50)	Anaesthetic gases and vapors	20	Code 132
RAD147	250 mg Tenax TA (20/35)	Phenolic compounds (Thermal Desorption)	20	Code 147
RAD169	Silica Gel (100-400 µm particles)	HCl	20	Code 169

Radiello Diffusive Bodies

RAD120 P001129

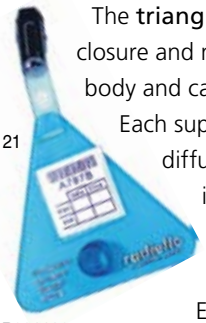
RAD120-1 P001130

RAD120-2 P001131

RAD120-3 P001132

Cat. No.	Color	Configured for	Body	Pkg.	Radiello No.
RAD120	White	General Use	Polyethylene	20	Code 120
RAD1201	Blue	Light Sensitive Compounds	Polyethylene	20	Code 120-1
RAD1202	Yellow	Reduced Sampling Rates	Polyethylene	20	Code 120-2
RAD1203	Grey	Anaesthetic Gases and Vapors	Permeative Silicone	20	Code 120-3

Radiello Key Components



RAD121

P001136

The **triangular support plate** acts as both a closure and means of suspension for the diffusive body and cartridge adsorbent during sampling. Each support plate is threaded for easy diffusive body attachment. Each plate includes a clip and transparent adhesive pocket to hold the barcode label.

RAD190 P001137

Each **Barcode Label** is self-adhesive with a unique barcode for the unmistakable identification of the cartridge adsorbent during sampling, desorption and analysis.

RAD1221

P001138

RAD122

P001139

The **Vertical Adapter** is available to position the diffusive body vertically on the triangular support plate for personal (breathing zone) sampling.

Description	Pkg.	Cat. No
Triangle Support Plate	20	RAD121
Radiello Clips	20	RAD195
Bar Code Labels	198	RAD190
Radiello Vertical Adapter		
Threaded for Standard Use	20	RAD122
Non-Threaded for Ready-to-Use Samplers	20	RAD1221

New! Radiello VOC/BTEX Starter Kits for Chemical and Thermal Desorption

Handy trial size includes everything you need to make the first steps with the Radiello passive/diffusive air samplers. Each containing one complete sampler plus an additional adsorbent cartridge. No additional parts are needed.

P001111

Each kit includes:

- 1 Diffusive body
- 1 Vertical adapter
- 1 Triangular base plate
- 2 Adsorbent cartridges and barcode label
- 1 Instruction sheet

Cat. No.	Matrix	Compounds	Pkg.	Radiello No.
RAD130S	Activated charcoal (30/50), activated	BTEX/VOC's (CS2 Desorption)	1	Code 130S
RAD145S	Carbograph 4 (35/50)	BTEX/VOC's (Thermal Desorption)	1	Code 145S

Radiello Ready-to-Use Diffusive Sampler

Radiello Cartridge Adsorbents

The Radiello ready-to-use (RTU) diffusive samplers come preassembled with the cartridge adsorbent pre-contained within the diffusive body, and sealed with a polycarbonate screw-thread cap. To avoid premature sampling, the entire unit is enclosed in an airtight polypropylene (PP) container.

They are snapped to the ready-to-use vertical adapter, pre-fixed to the triangular support plate. Once sampling is complete, the diffusive sampling unit is removed from the support plate and resealed into the PP container. The RTU diffusive samplers are ideal for workplace sampling but not recommended for low concentrations in outdoor or domestic environments.

Shelf life: 3 months

P001132

P001133

Each ready to use sampler includes:

- A sampler unit (sealed diffusive body with cartridge adsorbent)
- Glass or plastic tube for storage prior to analysis
- Ready-to-use vertical adapter
- Barcode label
- Polypropylene container

Note: Please order Triangular Support Plates separately

Cat. No.	Diffusive Body	Cartridge Adsorbent	Compounds	Pkg.	Radiello No.
RAD1231	RAD120 White	RAD130	BTEX/VOC's (CS_2 Desorption)	5	Code 123-1
RAD1232	RAD1202 Yellow	RAD145	BTEX/VOC's (Thermal Desorption)	5	Code 123-2
RAD1233	RAD1201 Blue	RAD166	HF, NO_2, and SO_2	5	Code 123-3
RAD1234	RAD1201 Blue	RAD165	Aldehydes	5	Code 123-4
RAD1235	RAD1201 Blue	RAD172	Ozone (O_3)	5	Code 123-5
RAD1236	RAD120 White	RAD170	Hydrogen Sulfide (H_2S)	5	Code 123-6
RAD1237	RAD1201 Blue	RAD168	Ammonia (NH_2)	5	Code 123-7
RAD1238	RAD120 White	RAD169	HCl	5	Code 123-8

Anesthetic Gases and Vapor Sampler (Sterile)

This kit is developed to sample nitrous oxide, isofluorane, ethrane, halothane, and sevorane in surgical theaters. Parts for one complete sampler are packed separately in one sealed and sterile bag. Pack of 10 sterile bags.

E000985

Sterile bag contains:

- 1 permeative body
- 1 support plate
- 1 vertical adapter
- 1 adsorbing cartridge

Cat. No.	Description	Pkg.
RAD125	Anesthetic Gas Sampler	10

Accessories & Replacement Parts

Radiello Outdoor Shelter

The protective outdoor shelter is designed to accommodate up to four Radiello samplers and is recommended for outdoor/ambient sampling. The shelter allows for adequate ventilation while simultaneously protecting the samplers from harsh weather conditions. It can be mounted to a variety of outdoor fixtures such as lamp-posts, traffic lights, and telephone poles of various diameters. It can be easily transported from one lab and mounted without the use of tools. Dimensions: 159 mm x 230 mm, pack of 10 and includes 20 mounting strips.

P001140

P001141

Description	Pkg.	Cat. No.
Radiello Outdoor Shelter	10	RAD196
Replacement Mounting Strips	100	RAD198

Radiello On-Field Thermometer and Temperature Reader

Uptake rates are dependent on temperature; therefore concentration values obtained during sampling will be more accurate if precise temperature values are recorded during sampling. The thermometer acts like a mini (< 1 cm^3 in size) temperature measurement station that can be mounted on the triangular support plate in conjunction with the diffusive body that is pre-attached to a vertical adapter. The thermometer offers a precision of ± 0.5 °C between –20 to 80 °C and can log up to 2048 data points allowing you to record one reading every 15 min. for 22 days, every 30 min. for 43 days and every 60 min. for 85 days. It requires no batteries and is amenable to harsh weather conditions.

P001145

Thermometer

RAD127

P001146

A Temperature **Reader** (purchased separately) connects the thermometer to your PC (via RS232 serial port) allowing the user to program the thermometer prior to sampling and download readings after sampling. Each thermometer has a unique serial number for easy identification. A user-friendly software package is included with the reader to perform statistical and graphic analysis.

Description	Pkg.	Cat. No.
Reader	1	RAD127
Standard Use Configuration		
Thermometer plus vertical adapter (RAD122)	3	RAD126
Ready-to-Use Configuration (for RTU samplers)		
Thermometer plus RTU vertical adapter (RAD1221)	3	RAD1261

Radiello Filtration Kit

The filtration kit consists of a graduated polypropylene syringe and 13 mm diameter syringe filters with 0.45 µm porosity. It is ideal for filtering aqueous samples prior to reversed-phase HPLC and ion-chromatography.

RAD174

P001149

Description	Pkg.	Cat. No.
Radiello Filtration Kit	20	RAD174

Calibration Kits

Radiello BTEX Calibration Kits

The BTEX Calibration Kit is available for CS2 Desorption and Thermal Desorption, both kits are designed for analysis of BTEX in urban environments. The kit may be used for both routine calibration and quality control. The calibration kit includes: 12 cartridge adsorbents of which three are blanks, and the remaining nine are divided into three concentration groups preloaded with BTEX to simulate 7-day exposures (100,800 minutes). Concentrations are described in the listed tables below. The values shown are indicative. Actual concentrations are certified for each lot. Cartridges are stable for at least 12 months when stored at 4 °C.

CS2 Desorption Kit

Includes: 12 RAD130 Cartridge Adsorbents
Simulated Concentrations in µg/m³
Exposure Limit: 7 days equivalent

	Group 1	Group 2	Group 3
Benzene	1	10	50
Toluene	2	20	100
Ethylbenzene	1	10	50
m-xylene	1	10	50
p-xylene	1	10	50
o-xylene	1	10	50

Description	Pkg.	Cat. No.
CS2 Desorption Kit	1 kit	RAD405

Thermal Desorption Kit

Includes: 12 RAD145 Cartridge Adsorbents
Simulated Concentrations in µg/m³
Exposure Limit: 7 days equivalent

	Group 1	Group 2	Group 3
Benzene	1	5	25
Toluene	2	10	50
Ethylbenzene	1	5	25
m-xylene	1	5	25
p-xylene	1	5	25
o-xylene	1	5	25

Description	Pkg.	Cat. No.
Thermal Desorption Kit	1 kit	RAD407

VOC Calibration Kit (Chemical Desorption) (Workplace Environment)

P001150

The VOC Calibration Kit is ideal for conducting scheduled quality control runs when analyzing workplace environments. The calibration kit includes: 12 cartridge adsorbents of which three are blanks, and the remaining nine are divided into three concentration groups preloaded with VOC's to simulate 8-hour (480 minutes) exposure. Concentrations are described in the listed table below. The values shown are indicative. Actual concentrations are certified for each lot. The composition of VOC's represents a broad range of polarity. The spiked concentrations represent 0.5, 1.0, and 2.0 times the threshold limit values (TLV) for each compound. VOC's are spiked onto the cartridges by injecting vaporized VOC standards in CS2 under nitrogen flow. Cartridges are stable for at least four months when stored at 4 °C.

Includes: 12 RAD130 Cartridge Adsorbents
Simulated Concentrations in µg/m³
Exposure Limit: 8 hours equivalent

	Group 1	Group 2	Group 3
Benzene	0.1	0.2	0.4
Toluene	19	38	76
Ethylbenzene	12	24	48
m-xylene	12	24	48
p-xylene	12	24	48
o-xylene	12	24	48
Butanol	15	30	60
2-ethyoxyethyl acetate	2.5	5	10

Description	Pkg.	Cat. No.
VOC Calibration Kit	1 kit	RAD406

Calibration Standards

Aldehyde Calibration Standard

The aldehyde calibration standard consists of nine 2,4-dinitrophenylhydrazones (2,4-DNPH) diluted in acetonitrile. Actual concentrations for each component are certified for each lot. The standard stock solution is shipped in a pierceable-septum crimped cap. Cartridges are stable for at least four months when stored at 4 °C.

50 µg/mL of each compound in acetonitrile (aldehyde equivalent)
Exception: Acrolein (10 µg/mL)

Components

Formaldehyde-2,4-DNPH
Acetaldehyde-2,4-DNPH
Acrolein-2,4-DNPH
Propanal-2,4-DNPH
Butanal-2,4-DNPH
Isopentanal-2,4-DNPH
Pentanal-2,4-DNPH
Hexanal-2,4-DNPH
Benzaldehyde-2,4-DNPH

Description	Pkg.	Cat. No.
Aldehyde Calibration Standard	10 mL	RAD302

Methylene Blue Calibration Standard for H_2S (Hydrogen Sulfide)

The hydrogen sulfide calibration standard contains a Methylene blue concentrate that, once diluted 1:50 (v/v) with water, provides the same absorbance value of hydrogen sulfide at 665 nm at a concentration of 1.145 µg/mL sulfide ions. This concentration value is the highest absorbance value within linear range of the spectrophotometer and can be used as a stock solution to prepare standards for the calibration curve. The concentrate is suitable for preparing up to 50 calibration curves and is stable for at least 1 year.

Description	Pkg.	Cat. No.
Methylene Blue Calibration Standard	100 mL	RAD171

DSD-DNPH

NEW! - *DSD-DNPH Passive Sampling Device*

High Efficiency Diffusive Sampler for Determination of Aldehydes and Ketones in Indoor Air

The DSD-DNPH diffusive sampler was introduced first in Japan and was an integral device for monitoring carbonyls in indoor air, specifically related to "sick house syndrome". Sick house syndrome results from exposure to building materials that emit VOC's such as formaldehyde. Common building materials known to emit formaldehyde are: adhesives, paints, plywood, and wallpaper.


E000962

The DSD-DNPH is comprised of a porous polyethylene tube, which acts as the diffusive membrane, to which is attached a small syringe barrel used for the elution of the analytes from the adsorbent. Because the diffusive membrane is round, it permits exposure from all sides, making it unique compared to other diffusive samplers. Silica gel coated with 2,4-dinitrophenylhydrazine (DNPH) acts as the adsorbent and moves from the diffusive end during sample collection to the syringe end for sample extraction, by inverting the device. Aldehydes and ketones diffuse through the membrane reacting with DNPH to form stable derivatives. The DNPH-derivatives are then eluted with acetonitrile and analyzed by high performance liquid chromatography (HPLC).

Simple

Versatile

Safe

Benefits:

- Specified in OSHA 1007 Method for Determination of Aldehydes
- Collection and analysis of carbonyls without transfer of the adsorbent, which minimizes the risk of contamination
- High-purity adsorbent provides collection of ppb levels of a wide range of carbonyls in a convenient, easy-to-use configuration
- Excellent uptake rates – faster, stable for wind, temperature and humidity
- Stable blank data – important LOQ
- Simple elution
- Versatile – use for indoor air, personal sampling, and ambient air

Description	Pkg.	Cat. No.
DSD-DNPH Diffusive Sampling Device	10	28221-U
Accessories		
Perforated Holder	10	28222-U
Female Luer Fitting to Tubing 5/32 in.	20	28224-U
Lapel Clip	10	21019-U
Filtration Column w/o frit 6 mL	30	57242
Plastic color-coded cap insert	100	000J004
Visiprep™-DL vacuum manifold	1	57044
Visi-1™ Sample Processor	1	57080-U
Calibration Standards		
TO-11/IP-6A Aldehyde/Ketone-DNPH Mix	1	47285-U
Formaldehyde-DNPH	1 mL	47177
Acetaldehyde-DNPH	1 mL	47340-U
Acetone-DNPH	1 mL	47341
Acrolein-DNPH	1 mL	47342
Propionaldehyde	1 mL	47181
Analytical Columns for Carbonyl DNPH Analysis		
Discovery RP Amide, 25 cm x 4.6 mm I.D., 5µm	1	505064
Ascentis C18, 15 cm x 4.6 mm I.D., 3 µm	1	581322-U
Ascentis C18, 25 cm x 4.6 mm I.D., 5 µm	1	581325-U
Ascentis RP-Amide, 15 cm x 4.6 mm I.D., 3 µm	1	565322-U
Ascentis RP-Amide, 25 cm x 4.6 mm I.D., 5 µm	1	565325-U

For more in-depth information:

OSHA 1007: Method for Determination of Aldehydes

Visit ***sigma-aldrich.com/air_monitoring*** to obtain the following:

T708004 DSD-DNPH Application Manual for complete sampling and analysis information.

T408065 (KIX) DSD-DNPH Flyer for summary of performance, features and benefits.

T400128 (DIC) Poster: High Efficiency Diffusive Sampler for Determination of Aldehydes and Ketones

References

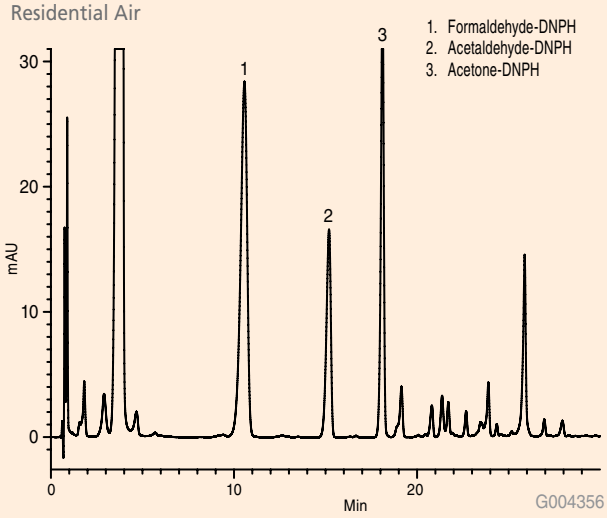
1. S. Uchiyama, S Aoyagi, ad Ando, Masanori, "Evaluation of a Diffusive Sampler for Measurement of Carbonyl Compounds in Air", Atmospheric Environment, 2004, 38, 6319-6326.
2. S. Uchiyama and S Hasegawa, "A Reactive Sensitive Diffusion Sampler for the Determination of Aldehydes and Ketones in Ambient Air", Atmospheric Environment, 1999, 33, 1999-2005.

DNPH Product Applications

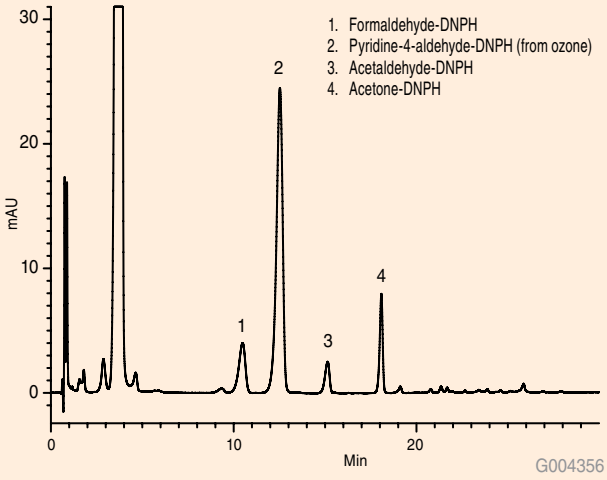
Ozone and Carbonyls: Residential and Laboratory Air

column: Ascentis C18, 15 cm x 4.6 mm I.D., 5 µm particles (581324-U)
mobile phase: 2 mM ammonium acetate in water:acetonitrile (65:35, 10 min. hold), gradient to 75% acetonitrile at 25 min. (5 min. hold)
flow rate: 1.9 mL/min.
det: UV-Vis, 360 nm
injection: 20 µL
sampling cartridge: BPE-DNPH Rezorian Cartridge (54269-U)
sampling: 90 mL/min for 24 hours
extraction: 3 mL acetonitrile/DMSO (70:30), allow to set 2 hours before HPLC injection

Residential Air



Laboratory Air



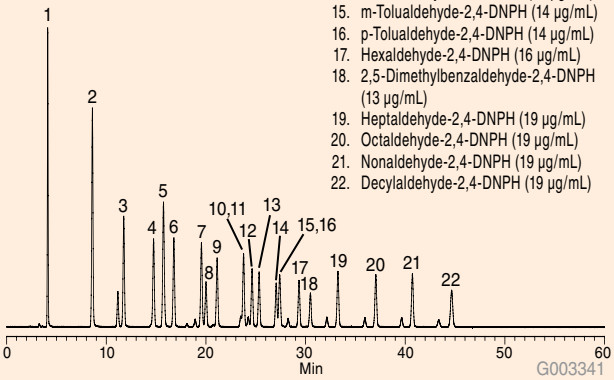
Analysis of 21 Aldehyde / Ketone DNPH Derivatives Using Ascentis RP-Amide

This application demonstrates the suitability of the Ascentis RP-Amide for the analysis of 21 aldehyde ketone derivatives.

column: Ascentis RP-Amide, 15 cm x 4.6 mm I.D., 3 µm particles (565322-U)
mobile phase A: 60:40, water:acetonitrile
mobile phase B: 25:75, water:acetonitrile
flow rate: 1.5 mL/min.
temp.: 30 °C
det.: UV at 360 nm
injection: 10 µL
sample: as listed in mobile phase
gradient:

Min	%A	%B
0	100	0
5	100	0
25	40	60
40	0	100
60	0	100

1. Dinitrophenylhydrazine (100 µg/mL)
2. Formaldehyde-2,4-DNPH (40 µg/mL)
3. Acetaldehyde-2,4-DNPH (29 µg/mL)
4. Acetone-2,4-DNPH (23 µg/mL)
5. Acrolein-2,4-DNPH (24 µg/mL)
6. Propionaldehyde-2,4-DNPH (23 µg/mL)
7. Crotonaldehyde-2,4-DNPH (20 µg/mL)
8. 2-Butanone-2,4-DNPH (10 µg/mL)
9. Butyraldehyde-2,4-DNPH (20 µg/mL)
10. Benzaldehyde-2,4-DNPH (15 µg/mL)
11. Cyclohexanone-2,4-DNPH (10 µg/mL)
12. Isovaleraldehyde-2,4-DNPH (18 µg/mL)
13. Valeraldehyde-2,4-DNPH (18 µg/mL)
14. o-Tolualdehyde-2,4-DNPH (14 µg/mL)
15. m-Tolualdehyde-2,4-DNPH (14 µg/mL)
16. p-Tolualdehyde-2,4-DNPH (14 µg/mL)
17. Hexaldehyde-2,4-DNPH (16 µg/mL)
18. 2,5-Dimethylbenzaldehyde-2,4-DNPH (13 µg/mL)
19. Heptaldehyde-2,4-DNPH (19 µg/mL)
20. Octaldehyde-2,4-DNPH (19 µg/mL)
21. Nonaldehyde-2,4-DNPH (19 µg/mL)
22. Decylaldehyde-2,4-DNPH (19 µg/mL)



Did you know?

Supelco has a wide range of Air Monitoring Application Notes available on request and on our website. Please contact Technical Service at 800-359-3041 or visit our website for more application information.

SPME

SPME for Air Sampling – Grab Sampling

SPME is another way to perform Grab sampling. It is highly sensitive, simple-to-use and easy to deploy in the field.

SPME consists of a coated fiber that can be exposed to the air. Analytes are trapped on the fiber and are later thermally desorbed in the hot injector block of a gas chromatograph.

SPME requires no solvents or complicated apparatus. It can concentrate volatile and nonvolatile compounds in both gaseous and liquid samples for analysis by GC, GC-MS, or HPLC

SPME Fiber Assortment Kits Suitable for Air Sampling

Each kit contains one each specified fiber

For use with	Needle	Cat. No.
SPME StableFlex™ Fiber Assortment Kit		
Kit Contains: 65 µm PDMS/DVB coating, 50/30 µm DVB/Carboxen/PDMS coating, 85 µm Carboxen/PDMS, and 85 µm Polyacrylate coating		
Manual Holder	24 gauge	**57550-U**
Autosampler	24 gauge	**57551-U**
Autosampler	23 gauge	**57284-U**
SPME Fiber Assortment Kit 1 for Volatile and Semi-Volatiles		
Kit Contains: 100 µm PDMS, 7 µm PDMS, and 85 µm Polyacrylate coating		
Manual Holder	24 gauge	**57306**
Autosampler	24 gauge	**57307**
Autosampler	23 gauge	**57285-U**
SPME Fiber Assortment Kit 4 for Flavors and Odors		
Kit Contains: 100 µm PDMS, 65 µm PDMS/DVB, and 75 µm Carboxen PDMS coating		
Manual Holder	24 gauge	**57324-U**
Autosampler	24 gauge	**57235-U**
Autosampler	23 gauge	**57287-U**
SPME Fiber Assortment Kit 5 for Flavors and Odors		
Kit Contains: 100 µm PDMS, 65 µm PDMS/DVB, and 85 µm Carboxen/PDMS coating and 50/30 µm DVB/Carboxen/PDMS coating		
Autosampler	23 gauge (4 each)	**57362-U**

For more in-depth information:

For more information on SPME, please visit us on our website ***sigma-aldrich.com/spme*** and request the most recent edition of the SPME CD. You can view detailed applications and informative materials and video sequences demonstrating the use of SPME.

SPME Portable Field Samplers

The portable field samplers collect organic compounds in air. In our studies, the sampler allowed us to monitor typical HPLC and GC solvents at ppb levels common in laboratory air. Three fibers are available: a polydimethylsiloxane (PDMS)/Carboxen fiber for trace levels of volatiles, a general-purpose PDMS fiber and a PDMS/DVB for semi-volatiles and larger volatile compounds.

Five slots in the needle guide/depth gauge control the depth of needle insertion into a sample container, or into the injection port during fiber desorption.

Assemblies contain 24 gauge needles. 23 gauge and other coatings available as custom (on request).

Description	Pkg.	Cat. No.
SPME Portable Field Sampler		
100 µm polydimethylsiloxane	2	**504823**
75 µm Carboxen/polydimethylsiloxane	2	**504831**
65 µm PDMS/DVB StableFlex fiber	2	**57359-U**
Thermogreen® LB-2 Septa		
Diam. 5.0 mm (3/16 in.)	50	**20638**
SPME Septum Removing Tool		
For Portable Field Sampler	1	**504858**

SPME Fiber Holder

The holder protects/guides the fiber assembly and controls exposure of the fiber during analyte adsorption and desorption. The holder is reusable indefinitely and accepts the replaceable fiber assembly. First time users must order both a holder and a fiber assembly.

Fiber holders are available for:

- Manual sampling
- Automated sampling or HPLC analysis
- CTC CombiPAL™ and Varian® 8400/8410 autosampler

Description	Pkg.	Cat. No.
SPME Fiber Holder, for use with manual sampling	1	**57330-U**
SPME Fiber Holder, for use with Autosampler or HPLC, Varian	1	**57331**
SPME Fiber Holder, for use with CTC CombiPAL, GERSTEL MPS 2 and Thermo TriPlus Autosamplers	1	**57347-U**

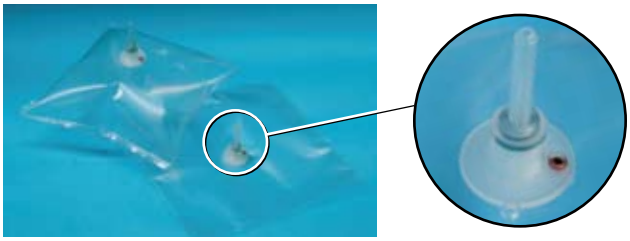
Whole Air Sampling

Overview

A whole air sample is collected when the air is drawn into some sort of containment vessel such as a Tedlar bag, stainless steel or glass canister. The method of collection is easy and the compounds of interest are recovered directly from the vessel. Recovery is a function of several factors which include, the surface area of the vessel, the chemistry and vapor pressure of the contaminants, the influence of various matrix effects, and the ability to begin with a vessel free of contamination. Supelco offers Gas Sampling Bags (Tedlar) and Glass Bulbs for whole air sampling.

Tedlar Gas Sampling Bags

Tedlar gas sampling bags are recommended in many US EPA methods including TCLP and Methods TO-3 (VOCs), TO-12 (NMOC), TO-14A (VOCs), TO-15 (VOCs), ASTM D-5504 (reduced sulfur compounds) and a variety of atmospheric gas methods.



E000995 E000996

Benefits:

- Patented 2-in-1 valve with unique push-pull device operates with one hand so you have your other hand free for other operations.
- Valve consistently achieves a positive open or closed setting.
- Unique valve and seam-sealing process ensures bags are sturdy and leak-proof under demanding sampling conditions.
- 2-mil Dupont Tedlar material for superior inertness and impermeability.
- Bags assembled in a controlled environment, eliminating contamination during manufacture.

Max Vol. (L)	W x Depth (in.)	Pkg.	Cat. No.
1	7 x 7	10	**24633**
2	9 x 9	10	**24654**
5	12 x 12	10	**24655**
10	12 x 19	10	**24634**
25	18 x 24	5	**24656**

Gas Sampling Bulbs

Glass sampling bulbs may be used as an alternative to Tedlar bags to trap and transport a gas sample. To analyze the sample, take an aliquot (through the plug-type septum). Our bulbs are oven annealed to prevent damage during transportation and on-site use.

9970169

Sampling Bulbs with Glass Stopcocks

Volume (mL)	Pkg.	Cat. No.
Glass Stopcock		
125	1	**22146-U**
250	1	**22147-U**
500	1	**22148-U**
1000	1	**22144-U**
PTFE Stopcock		
125	1	**22161**
250	1	**22162-U**
500	1	**22163-U**
1000	1	**22145-U**
Stopcock Plug	1	**64779-U**
Thermogreen LB-1 Septa for Shimadzu		
Cylindrical w/half-hole	100	**20668**

Static Dilution Bottle

- Two-liter, round-bottom flask with a threaded neck
- Accommodates a Mininert® valve

9960281

Use the static dilution bottle to prepare gaseous volatile organic standards, using a technique developed by the US EPA for air analyses. Simply inject neat compound through the valve and allow it to vaporize; then withdraw the aliquots using a gas-tight syringe. Multicomponent standards are conveniently prepared and may be stored for at least one week.

Description	Pkg.	Cat. No.
Static Dilution Bottle w/Mininert Valve	1	**21992**
Septum inserter, for use with Mininert Valves	1	**33311**
Replacement Mininert Septa, length 0.308 in. × O.D. 0.125 in.	50	**33310-U**
Mininert Valve, for use with 24/400 mm thread	12	**33304**

Air Monitoring Pumps & Accessories

Air Sampling Pumps

Escort Elf Air Sampling Pump and Accessories

An electronic laminar flow sensor in this easy-to-operate, state-of-the-art sampling pump provides constant flow control, unaffected by changes in battery voltage, temperature, sample load, or altitude. An internal secondary standard calibrates the pump continuously, requiring only monthly calibration with a primary standard. A built-in counter monitors total operating time, and reminds you when a primary calibration is required. The pump also features a low battery function with an indicator light, and blocked flow detection. LED readout alternately displays flow rate and elapsed sampling time. It may not be used with Tedlar bags. Order charger separately.

Gemini Twin Port Sampler

This pump attachment is designed for low flow industrial hygiene sampling, such as gas and vapor monitoring, using sorbent tubes. Two needle valves provide independent flow control for simultaneous collection on two tubes, but can also be used for a single tube by closing the flow to one valve. The sampler is compatible with any personal sampling pump capable of 1.5 L/min flow rate and a load of 25 in. of water. Total flow cannot exceed 500 mL/min. Each sampler comes with two tube protectors, one for small tubes (<2 in. long) and one for large tubes (<4.5 in. long), and the tubing required to connect the sampler to the sampling pump.

P000747

Description	Pk	Cat. No
Escort Elf Sampling Pump	1	28160-U
Gemini Twin Port Sampler	1	28118-U

Accessories

Description	Pkg.	Cat. No.
Omega Battery Charger		
12 Volt	1	28155-U
110 Volt, units charged: 1	1	28157-U
240 Volt, units charged: 1	1	28158-U
120 V/240 V, units charged: 5	1	28159-U

PAS-500 Micro Air Sampler

9940285

This low flow pump is lightweight (4 oz.) and compact (7 in. high), fitting easily into your shirt pocket. The adsorbent tube connects directly to the inlet of the pump. This sampler is versatile, adapts to fit both 6 mm and 8 mm tubes and the flow range is 40-200 cc/min. The low flow adapter enables you to sample at 20 cc/min.

This unit is powered by a convenient and easily replaceable 9-volt battery. The full flow regulation feature provides constant voltage to the pump, even as battery voltage drops. It is intrinsically safe – a built-in resistor limits the power current, preventing any short circuit.

Description	Pkg.	Cat. No.
PAS-500 Micro Air Sampler with Low Flow Orifice		
Includes sampler, 6 mm tube holder, screwdriver, and 9-volt battery	1	24865
Tube Holder for PAS-500 Pump		
For use with 6 mm adsorbent tube	1	24867
For use with 8 mm adsorbent tube	1	24868
For use with detector tube	1	24869
Carrying Case for PAS-500		
Single pump case	1	24871
Eight pump case	1	24872

Field Sampling Pumps for Active and Whole Air Samplers

E000129

E000018

Description	Recommended For	Pkg.	Cat. No.
Model 1060 Bag Sampler	Single 1-2 Liter Tedlar Bags	1	24622-U
Model 1062 Bag Sampler	Single 1-10 Liter Tedlar Bags	1	24623
Model 1063 Bag Sampler	Six 1 Liter Tedlar Bags	1	24647
Model 1067 Tube Sampler* (Dual Channel)	Adsorbent Tubes (ORBO & TD)	1	507113

*Includes universal charger

Accessories

Description	Pkg.	Cat. No.
Battery Charger		
For Model 1060, 110V	1	24643
For Models 1062 & 1063, 110V	1	24644
Universal Charger, 110V/240V For use with 1060,1062,1063 &1067	1	24697-U
Replacement Battery for Field Sampling Pump		
For Model 1060	1	24635
For Models 1062, 1063, & 1067	1	24636
Critical Orifice for 1063 Bag Sampler		
Flow Rate: 1 mL/min	1	24667
Flow Rate: 10 mL/min	1	24668
Filter, SS, 40 µm	1	24672

Bubble Flow Meters

P000854

Description	Pkg.	Cat. No.
Bubble Meter Kit, 500 mL	1	20414
Bubble Meter Kit, 1000 mL	1	20415
Replacement Bubble Meter, 500 mL	1	20427-U
Replacement Bubble Meter, 1000 mL	1	20428-U
Stopwatch	1	23011

P000299

Flow Calibration Devices for Air Sampling Pumps

P000853

Description	Pkg.	Cat. No.
Mini-Buck Flow Calibrator		
Model M-5*, Flow Rate 1-6000 mL/min	1	24843
Model M-30*, Flow Rate 1-30 mL/min	1	24845
Battery Charger for M-5/M-30, 110V	1	24844
Battery Charger for M-5/M-30, 220V	1	24846

*Battery charger not included with 24843 and 24845, order separately

Digital Flow Calibrator

9130186

Measures volumetric flows between 5 to 5.000 mL/min with accuracy to within ±3% of the reading. A microprocessor indicates fault and low battery conditions and automatically adjusts the meter to the air flow rate. Comes complete with a 9-volt battery, Tygon tubing, and instructions.

Description	Pkg.	Cat. No.
Humonics Flowmeter		
Model 650, Flow range: 5-5000 mL/min	1	22912

Air Monitoring Standards

ASTM Methods

American Society for Testing and Materials (ASTM) Methods

The following standards are for use with methods developed under ASTM Committee D-22, described in the Annual Book of ASTM Methods, Volume 11.03, Atmospheric Analysis, Occupational Health and Safety. The standards are quantitative formulations for use as chromatographic calibration or spiking solutions. Products include a Certificate of Analysis describing lot-specific production and analytical information. Free data packets are available for most of these products. Data packets contain data on raw materials and final production. Request the data packet when ordering the standard; the order number is the same as that for the standard, preceded by the letters DP.

ASTM D5197 Method Description: Analysis of Aldehydes in Air

Description standard type calibration	Concentration	Pkg.	Cat. No.
TO11/IP-6A Aldehyde/Ketone-DNPH Mix	15 µg/mL each component in acetonitrile (aldehyde equivalent)	1 mL	47285-U

Acetaldehyde-2,4-dinitrophenylhydrazone
Acetone-2,4-dinitrophenylhydrazone
Acrolein-2,4-dinitrophenylhydrazone
Benzaldehyde-2,4-dinitrophenylhydrazone
Butyraldehyde-2,4-dinitrophenylhydrazone
Crotonaldehyde-2,4-dinitrophenylhydrazone
2,5-Dimethylbenzaldehyde-2,4-dinitrophenylhydrazone
Formaldehyde-2,4-dinitrophenylhydrazone
Hexaldehyde-2,4-dinitrophenylhydrazone
Isovaleraldehyde-2,4-dinitrophenylhydrazone
Propionaldehyde-2,4-dinitrophenylhydrazone
o-Tolualdehyde-2,4-dinitrophenylhydrazone
m-Tolualdehyde-2,4-dinitrophenylhydrazone
p-Tolualdehyde-2,4-dinitrophenylhydrazone
Valeraldehyde-2,4-dinitrophenylhydrazone

California Air Resources Board (CARB) Methods

Analysis of Carbonyls in Ambient Air

California Air Resources Board (CARB) – The following quantitative formulations were developed to support the analysis of aldehydes in ambient air by CARB Method 1004. Analysis is of the dinitrophenylhydrazine (DNPH) derivatives by HPLC-UV. **Concentrations stated are of the equivalent carbonyl before derivatization, except where noted.** The Certificate of Analysis accompanying these products states both DNPH derivatized and non-derivatized concentrations.

Description standard type calibration	Concentration	Pkg.	Cat. No.
CARB Carbonyl-DNPH Mix 1	in acetonitrile (varied)	1 mL	47649-U

Acetaldehyde-2,4-dinitrophenylhydrazone, 1000 µg/mL
Acetone-2,4-dinitrophenylhydrazone, 500 µg/mL
Acrolein-2,4-dinitrophenylhydrazone, 500 µg/mL
Benzaldehyde-2,4-dinitrophenylhydrazone, 500 µg/mL
Butyraldehyde-2,4-dinitrophenylhydrazone, 500 µg/mL
Formaldehyde-2,4-dinitrophenylhydrazone, 1500 µg/mL
Propionaldehyde-2,4-dinitrophenylhydrazone, 500 µg/mL

CARB Method 1004 DNPH Mix 1	3 µg/mL in acetonitrile (aldehyde equivalent)	1 mL	47650-U
CARB Method 1004 DNPH Mix 2	30 µg/mL in acetonitrile (aldehyde equivalent)	1 mL	47651-U

Acetaldehyde-2,4-dinitrophenylhydrazone
Acetone-2,4-dinitrophenylhydrazone
Acrolein-2,4-dinitrophenylhydrazone
Benzaldehyde-2,4-dinitrophenylhydrazone
2-Butanone-2,4-dinitrophenylhydrazone
Butyraldehyde-2,4-dinitrophenylhydrazone
Crotonaldehyde-2,4-dinitrophenylhydrazone
Formaldehyde-2,4-dinitrophenylhydrazone
Hexaldehyde-2,4-dinitrophenylhydrazone
Methacrolein-2,4-dinitrophenylhydrazone
Propionaldehyde-2,4-dinitrophenylhydrazone
m-Tolualdehyde 2,4-dinitrophenylhydrazone
Valeraldehyde-2,4-dinitrophenylhydrazone

European Mixes

DNPH Mixes - The following dinitrophenylhydrazine (DNPH) standards were developed in response to European requests for working and calibration check standards for the ambient air analysis of carbonyl emissions from automobile exhaust. Methods for this analysis are equivalent to California Air Resources Board 1004 (Sacramento, CA, USA). Concentrations are of the equivalent carbonyl quantity before derivatization. The Certificate of Analysis accompanying each of these products states both DNPH-derivatized and non-derivatized concentrations.

Description standard type calibration	Concentration	Pkg.	Cat. No.
Carbonyl-DNPH Mix 1	20 µg/mL in acetonitrile (except where indicated; aldehyde equivalent) *Acetaldehyde-2,4-dinitrophenylhydrazone* *Acetone-2,4-dinitrophenylhydrazone* *Acrolein-2,4-dinitrophenylhydrazone* *Benzaldehyde-2,4-dinitrophenylhydrazone* *2-Butanone-2,4-dinitrophenylhydrazone* *Butyraldehyde-2,4-dinitrophenylhydrazone* *Crotonaldehyde-2,4-dinitrophenylhydrazone* *Formaldehyde-2,4-dinitrophenylhydrazone, 40 µg/mL* *Hexaldehyde-2,4-dinitrophenylhydrazone* *Methacrolein-2,4-dinitrophenylhydrazone* *Propionaldehyde-2,4-dinitrophenylhydrazone* *p-Tolualdehyde 2,4-dinitrophenylhydrazone* *Valeraldehyde-2,4-dinitrophenylhydrazone*	1 mL	**47672-U**
Carbonyl-DNPH Mix 2	2 µg/mL in acetonitrile (except where indicated; aldehyde equivalent) *Acetaldehyde-2,4-dinitrophenylhydrazone* *Acetone-2,4-dinitrophenylhydrazone* *Acrolein-2,4-dinitrophenylhydrazone* *Benzaldehyde-2,4-dinitrophenylhydrazone* *2-Butanone-2,4-dinitrophenylhydrazone* *Butyraldehyde-2,4-dinitrophenylhydrazone* *Crotonaldehyde-2,4-dinitrophenylhydrazone* *Cyclohexanone 2,4-dinitrophenylhydrazone, 5 µg/mL* *Formaldehyde-2,4-dinitrophenylhydrazone, 4 µg/mL* *Hexaldehyde-2,4-dinitrophenylhydrazone* *Methacrolein-2,4-dinitrophenylhydrazone* *Propionaldehyde-2,4-dinitrophenylhydrazone* *p-Tolualdehyde 2,4-dinitrophenylhydrazone* *Valeraldehyde-2,4-dinitrophenylhydrazone*	1 mL	**47671-U**
Cyclohexanone-2,4-DNPH solution	500 µg/mL in acetonitrile	1 mL	**47673-U**

Oximes

PFBHA (O-(2,3,4,5,6-pentafluorobenzyl)hydroxylamine) derivatives do not decompose at an elevated temperature. For this reason, PFBHA derivatives are a good alternative to 2,4-DNPH derivatives when using GC.

Material purity ≥98% by GC except where noted.

Description	Material Number	Pkg.
Acetaldehyde-O-pentafluorphenylmethyl-oxime purum	15875	10 mg
Acetone-O-pentafluorphenylmethyl-oxime purum	44114	10 mg, 50 mg
Acrolein-O-pentafluorphenylmethyl-oxime purum (≥95%)	65819	10 mg, 50 mg
Crotonaldehyde-O-pentafluorphenylmethyl-oxime purum	42094	10 mg
Formaldehyde-O-pentafluorphenylmethyl-oxime purum	41558	10 mg
Glutaraldehyde bis-O-pentafluorophenylmethyl-oxime purum	03718	10 mg
Propionaldehyde O-pentafluorophenylmethyl-oxime purum	43508	10 mg
Valeraldehyde O-pentafluorophenylmethyl-oxime purum	66156	10 mg, 50 mg

DAIH

(2-Diphenylacetyl-indan-1,3-dione-1-ethylidenehydrazone) derivatives of aldehydes and ketones.

Material purity ≥98% by GC.

Description	Material Number	Pkg.
Acetaldehyde, DAIH derivative	14423	50 mg
Acetone, DAIH derivative	02819	50 mg
Acrolein, DAIH derivative	13173	50 mg
Crotonaldehyde, DAIH derivative	55556	50 mg
Cyclohexanone, DIAH derivative	91547	50 mg
Formaldehyde, DAIH derivative	06947	50 mg
Propionaldehyde, DAIH derivative	51299	50 mg

Aldehyde & Ketone DNPH Derivatives, Neats & Solutions

These solutions of DNPH derivatives are designed as quantitative calibration mixtures where a multi-component solution is not suitable. At concentration indicated in 1 mL (actual filling 1.1-1.2 mL) acetonitrile, in amber glass ampul.

Description	Concentration	Pkg.	Cat. No.
2,5-Dimethylbenzaldehyde-2,4-DNPH		100 mg	442321-U
2-Butanone-2,4-DNPH		100 mg	442339
2-Butanone-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47344
Acetaldehyde-2,4-DNPH solution	1000 µg/mL in acetonitrile	1 mL	47340-U
Acetaldehyde-2,4-DNPH solution	1000 µg/mL in acetonitrile	5 x 1 mL	4M7340-U
Acetaldehyde-2,4-DNPH		100 mg	442434
Acetone-2,4-DNPH		50 mg	442436
Acrolein-2,4-DNPH solution	1000 µg/mL in acetonitrile	1 mL	47342
Acrolein-2,4-DNPH		25 mg	442441
Benzaldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47343
Benzaldehyde-2,4-DNPH		100 mg	442469
Butyraldehyde-2,4-DNPH solution	1000 µg/mL in acetonitrile	1 mL	47345-U
Butyraldehyde-2,4-DNPH		100 mg	442504
Crotonaldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47175-U
Crotonaldehyde-2,4-DNPH		100 mg	442529
Cyclohexanone DNPH solution	500 µg/mL in acetonitrile	1 mL	47673-U
Cyclohexanone DNPH		10 mg	442533
Decanal 2,4-dinitrophenylhydrazone		100 mg	33852
Formaldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47177
Formaldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	5 x 1 mL	4M7177
Formaldehyde-2,4-DNPH		100 mg	442597
Formaldehyde-2,4-DNPHydrazide solution	100 µg/mL in acetonitrile	3 x 2 mL	49208-U
Glutaraldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47564-U
Heptanal 2,4-dinitrophenylhydrazone		100 mg	33848
Hexaldehyde-2,4-DNPH solution	1000 µg/mL in acetonitrile	1 mL	47178-U
Hexaldehyde-2,4-DNPH		100 mg	442614
Isobutyraldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47886
Isovaleraldehyde-2,4-DNPH solution	1000 µg/mL in acetonitrile	1 mL	47179
Methacrolein-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47180-U
Methacrolein-2,4-DNPH		100 mg	442639
Nonanal 2,4-dinitrophenylhydrazone		100 mg	33851
Octanal 2,4-dinitrophenylhydrazone		100 mg	33849
o-Phthaldialdehyde-$(DNPH)_2$ solution	10 µg/mL in acetonitrile/DMSO (7:3)	1 mL	47032-U
m-Tolualdehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47183
o-Tolualdehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47182
o-Tolualdehyde-2,4-DNPH		100 mg	442722
p-Tolualdehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47184-U
p-Tolualdehyde-2,4-DNPH		100 mg	442735
Propionaldehyde-2,4-DNPH solution	1000 µg/mL in acetonitrile	1 mL	47181
Propionaldehyde-2,4-DNPH		100 mg	442768
Valeraldehyde-2,4-DNPH solution	100 µg/mL in acetonitrile	1 mL	47185-U
Valeraldehyde-2,4-DNPH		100 mg	442834

Analytical Columns for Carbonyl DNPH Analysis

Discovery RP Amide, 25 cm x 4.6 mm I.D., 5 µm	1	505064
Ascentis C18, 15 cm x 4.6 mm I.D., 3 µm	1	581322-U
Ascentis C18, 25 cm x 4.6 mm I.D., 5 µm	1	581325-U
Ascentis RP-Amide, 15 cm x 4.6 mm I.D., 3 µm	1	565322-U
Ascentis RP-Amide, 25 cm x 4.6 mm I.D., 5 µm	1	565325-U

Alternative Aldehyde and Ketone Derivatives

NIOSH and OSHA Methods

NIOSH and OSHA Methods for Workplace Atmospheres

The following standards are for use with methods listed in OSHA and NIOSH manuals of methods for analysis of workplace contaminants. The standards are quantitative formulations for use as chromatographic calibration or spiking solutions. Products include a Certificate of Analysis describing lot-specific production and analytical information.

Free data packets containing data on raw materials and final production are available for most products. Request the data packet when ordering the standard; the order number is the same as that for the standard, preceded by the letters DP.

NIOSH 2541/OSHA 52: Analysis of Formaldehyde in Indoor Air

Description standard type calibration	Concentration	Pkg.	Cat. No.
Formaldehyde Oxazolidine solution	2000 µg/mL in toluene	1 mL	48414

US EPA IP Methods

Compendium of Methods for the Determination of Air

The following standards are for use with EPA document number EPA/600/4-90/010. The standards are quantitative formulations for use as chromatographic calibration or spiking solutions. Products include a Certificate of Analysis describing lot-specific production and analytical information. Free data packets are available for these products. Data packets contain data on raw materials and final production. Request the data packet when ordering the standard; the order number is the same as that for the standard, preceded by the letters DP.

IP1: Analysis of Volatile Organics (BP 80-200 °C) in Indoor Air by GC-MS

Description standard type calibration	Concentration		Pkg.	Cat. No.
EPA TO-1 Toxic Organic Mix 1A	2 mg/mL each component in methanol		1 mL	48896
Benzene	*Heptane*	*o-Xylene*		
Cumene	*1-Heptene*	*m-Xylene*		
Ethylbenzene	*Toluene*	*p-Xylene*		
EPA TO-1 Toxic Organic Mix 1B	2 mg/mL each component in methanol		1 mL	48897
Acrylonitrile	*Chlorobenzene*	*1,3-Dichloropropane*		
Allyl chloride	*Chloroform*	*Tetrachloroethylene*		
Bromobenzene	*1,2-Dibromoethane*	*1,1,1-Trichloroethane*		
Bromoform	*1,2-Dichloroethane*	*Trichloroethylene*		
Carbon tetrachloride	*1,2-Dichloropropane*			

IP6: Analysis of Aldehydes and Ketones in Indoor Air by HPLC/UV

Description standard type calibration	Concentration		Pkg.	Cat. No.
TO-11/IP-6A Aldehyde/Ketone-DNPH Mix	15 µg/mL each component in acetonitrile (aldehyde equivalent)		1 mL	47285-U
			3 × 1 mL	4M7285-U
Acetaldehyde-2,4-dinitrophenylhydrazone	*Crotonaldehyde-2,4-dinitrophenylhydrazone*	*Propionaldehyde-2,4-dinitrophenylhydrazone*		
Acetone-2,4-dinitrophenylhydrazone	*2,5-Dimethylbenzaldehyde 2,4-dinitrophenylhydrazone*	*o-Tolualdehyde 2,4-dinitrophenylhydrazone*		
Acrolein-2,4-dinitrophenylhydrazone	*Formaldehyde-2,4-dinitrophenylhydrazone*	*m-Tolualdehyde 2,4-dinitrophenylhydrazone*		
Benzaldehyde-2,4-dinitrophenylhydrazone	*Hexaldehyde-2,4-dinitrophenylhydrazone*	*p-Tolualdehyde 2,4-dinitrophenylhydrazone*		
Butyraldehyde-2,4-dinitrophenylhydrazone	*Isovaleraldehyde 2,4-dinitrophenylhydrazone*	*Valeraldehyde-2,4-dinitrophenylhydrazone*		

US EPA TO Methods

Toxic Organic Compounds in Air (TO)

TO-1: Volatile Organic Compounds

Description standard type calibration	Concentration		Pkg.	Cat. No.
EPA TO-1 Toxic Organic Mix 1A	2 mg/mL each component in methanol		1 mL	48896
Benzene	*Heptane*	*o-Xylene*		
Cumene	*1-Heptene*	*m-Xylene*		
Ethylbenzene	*Toluene*	*p-Xylene*		
EPA TO-1 Toxic Organic Mix 1B	2 mg/mL each component in methanol		1 mL	48897
Acrylonitrile	*Chlorobenzene*	*1,3-Dichloropropane*		
Allyl chloride	*Chloroform*	*Tetrachloroethylene*		
Bromobenzene	*1,2-Dibromoethane*	*1,1,1-Trichloroethane*		
Bromoform	*1,2-Dichloroethane*	*Trichloroethylene*		
Carbon tetrachloride	*1,2-Dichloropropane*			

TO-2: Volatile Organic Compounds

Description standard type calibration	Concentration		Pkg.	Cat. No.
EPA Toxic Organic Mix 2A	2 mg/mL each component in methanol		1 mL	48898
Dichloromethane	*Vinyl chloride*	*Vinylidene chloride*		

TO-5/TO-11: Aldehydes and Ketones by HPLC/UV

Description standard type calibration	Concentration		Pkg.	Cat. No.
TO11/IP-6A Aldehyde/Ketone-DNPH Mix	15 µg/mL each component in acetonitrile (aldehyde equivalent)		1 mL 3 x 1 mL	47285-U 4M7285-U
Acetaldehyde-2,4-dinitrophenylhydrazone	*Benzaldehyde-2,4-dinitrophenylhydrazone*	*2,5-Dimethylbenzaldehyde-2,4-dinitro-phenylhydrazone*		
Acetone-2,4-dinitrophenylhydrazone	*Butyraldehyde-2,4-dinitrophenylhydrazone*			
Acrolein-2,4-dinitrophenylhydrazone	*Crotonaldehyde-2,4-dinitrophenylhydrazone*	*Formaldehyde-2,4-dinitrophenylhydrazone*		

TO-11A Formaldehyde by HPLC

Description	Concentration		Pkg.	Cat. No.
TO-11A Six Component Carbonyl-DNPH Mix	15 µg/mL each component in acetonitrile		1.5 mL	48149-U
Acetaldehyde-2,4-dinitrophenylhydrazone	*Acrolein-2,4-dinitrophenylhydrazone*	*Formaldehyde-2,4-dinitrophenylhydrazone*		
Acetone-2,4-dinitrophenylhydrazone	*Crotonaldehyde-2,4-dinitrophenylhydrazone*	*Propionaldehyde-2,4-dinitrophenylhydrazone*		

TO-15/17 Volatile Organic Compounds by GC-MS

Description	Concentration	Pkg.	Cat. No.
TO-15/17 Calibration Mix (62 components)	100 ppb each in N_2	110 L	**41974-U**
	1 ppm each in N_2	110 L	**41973-U**

Acetone
Benzene
*Benzyl chloride**
Bromoform
Bromomethane
Bromodichloromethane
1,3-Butadiene
2-Butanone (MEK)
*Carbon disulfide**
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Cyclohexane
Chloromethane
Dibromochloromethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloropropane
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
1,4-Dioxane
*Ethanol**
Ethyl acetate
Ethylbenzene
Ethyl dibromide (1,2-dibromoethane)
4-Ethyltoluene
Freon® 11 (Trichlorofluoromethane)
Freon 12 (Dichlorodifluoromethane)
Freon 113 (1,1,2-Trichlorotrifluoroethane)
Freon 114 (1,2-Dichlorotetrafluoroethane)
Heptane
Hexachloro-1,3-butadiene
Hexane
2-Hexanone (MBK)
4-Methyl-2-pentanone (MIBK)
Methylene chloride
Methyl-tert-butylether (MTBE)
*2-Propanol**
Propylene
Styrene
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Tetrahydrofuran
Toluene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
1,2,4-Trichlorobenzene
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Vinyl acetate
Vinyl chloride
m-Xylene
o-Xylene
p-Xylene

Blend Tolerance and Analytical Accuracy = +/- 25% (**41974-U**)

TO-15/17 Subset 25 Component Calibration Mix	100 ppb in N_2	110 L	**41979-U**
	1 ppm in N_2	110 L	**41978-U**

Acetone
Allyl chloride
*Benzyl chloride**
Bromodichloromethane
Bromoform
1,3-Butadiene
2-Butanone (MEK)
*Carbon disulfide**
Cyclohexane
Dibromochloromethane
1,4-Dioxane
Ethyl acetate
4-Ethyltoluene
Heptane
Hexane
2-Hexanone (MBK)
4-Methyl-2-pentanone (MIBK)
Methyl-tert-butylether (MTBE)
*2-Propanol**
Propylene
Tetrahydrofuran
trans-1,2-Dichloroethene
2,2,4-Trimethylpentane
Vinyl acetate
Vinyl bromide

*** Blend Tolerance and Analytical Accuracy = +/- 25% (41979-U)**

TO-15 SUBSET A (12 Components)	1 ppm in N_2	110 L	**41983-U**

Acetonitrile
Acrylonitrile
Allyl chloride
*Benzyl chloride**
1,3-Butadiene
Ethyl bromide
Hexane
Methyl ethyl ketone
Methyl-isobutyl-ketone
2,2,4-Trimethylpentane
Vinyl acetate
Vinyl bromide

*** Blend Tolerance and Analytical Accuracy = +/- 25%**

Ozone Precursor / PAMS Method

Description	Concentration	Pkg.	Cat. No.
Ozone Precursor / PAMS Mix (57 components)	100 ppb each in N_2	110 L	41975-U
	1 ppm each in N_2	110 L	41976-U
	EPA Conc. ppbC in N_2	110 L	41977-U

Acetylene
Benzene
n-Butane
1-Butene
cis-2-Butene
trans-2-Butene
Cyclohexane
Cyclopentane
n-Decane
m-Diethylbenzene
p-Diethylbenzene
2,2-Dimethylbutane
2,3-Dimethylbutane
2,3-Dimethylpentane
2,4-Dimethylpentane
n-Dodecane
Ethane
Ethylbenzene
Ethylene
m-Ethyltoluene
o-Ethyltoluene
p-Ethyltoluene
n-Heptane
n-Hexane
1-Hexene
Isobutane
Isopentane
Isoprene
Isopropylbenzene
Methylcyclohexane
Methylcyclopentane
2-Methylheptane
3-Methylheptane
2-Methylhexane
3-Methylhexane
2-Methylpentane
3-Methylpentane
n-Nonane
n-Octane
n-Pentane
1-Pentene
cis-2-Pentene
trans-2-Pentene
Propane
n-Propylbenzene
Propylene
Styrene
Toluene
1,2,3-Trimethylbenzene
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
2,2,4-Trimethylpentane
2,3,4-Trimethylpentane
n-Undecane
m/p-Xylene (combined)
o-Xylene

Alternative VOC Methods

Description	Concentration	Pkg.	Cat. No.
Massachusetts APH Mix (26 components)	EPA Concentrations, in N_2	110 L	41982-U

	ppmv		ppmv		ppmv
Benzene	*0.5*	*n-Heptane*	*0.25*	*Toluene*	*2*
1,3-Butadiene	*1*	*n-Hexane*	*0.5*	*Toluene-d_8 (IS)*	*0.5*
Butylcyclohexane	*1*	*Isopentane*	*0.5*	*1,2,3-Trimethylbenzene*	*1*
Cyclohexane	*0.5*	*Isopropylbenzene*	*0.25*	*1,3,5-Trimethylbenzene*	*0.5*
n-Decane	*0.25*	*p-Isopropyltoluene*	*1*	*n-Undecane*	*0.25*
2,3-Dimethylheptane	*0.25*	*1-Methyl-3-ethylbenzene*	*1*	*m- & p-Xylene (50% each)*	*2*
2,3-Dimethylpentane	*1*	*Methyl tert-butyl ether (MTBE)*	*1*	*o-Xylene*	*0.5*
n-Dodecane	*0.25*	*n-Nonane*	*0.25*		
Ethylbenzene	*1*	*n-Octane*	*0.5*		

Japanese Air Monitoring Methods

Description	Concentration	Pkg.	Cat. No.
Japanese 50-Component Indoor Air Standard	100 µg/mL in methanol:water (95:5)	1 x 1 mL	49148-U
	100 µg/mL in methanol:water (95:5)	3 x 1 mL	4M9148-U
	1000 µg/mL in methanol:water (97:3)	1 x 1 mL	49149-U

Acetone
1-Butanol
Chloroform
Dibromochloromethane
Dichloromethane
Dodecane
Ethylbenzene
4-Ethyltoluene
Hexane
Nonane
Pentadecane
1-Propanol
Tetrachloroethylene
Toluene
1,2,3-Trimethylbenzene
2,2,4-Trimethylpentane (isooctane)
o-Xylene
Benzene
2-Butanone
Decanal
1,4-Dichlorobenzene
1,2-Dichloropropane
Ethanol
2-Ethyltoluene
Heptane
(R)-(+)-Limonene
1-Nonanol
(1S)-(-)-alpha-Pinene
2-Propanol
Tetradecane
Trichloroethylene
1,2,4-Trimethylbenzene
Undecane
p-Xylene
Bromodichloromethane
Butyl acetate
Decane
1,2-Dichloroethane
2,4-Dimethylpentane
Ethyl acetate
3-Ethyltoluene
Hexadecane
4-Methyl-2-pentanone
Octane
(-)-beta-Pinene
Styrene
1,2,4,5-Tetramethylbenzene
Tridecane
1,3,5-Trimethylbenzene (mesitylene)
m-Xylene

Japan Calibration Mix (9 components)	1 ppm in N_2	110 L	41981-U

1,2-Dichloroethane
1,3-Butadiene
Acrylonitrile
Benzene
Chloroform
Dichloromethane
Tetrachloroethylene
Trichloroethylene
Vinyl chloride
Balance Gas - Nitrogen

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❍ Solvent Desorption Tubes or ❍ Thermal Desorption Tubes ❍ Repeat Order? (Previous MR#)

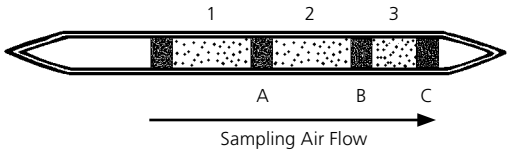
Quote Number: _____

Number of Tubes: _____

Application _____

Tube Specifications

Solvent Desorption Tubes



❍ 6 mm O.D. glass _____

❍ 7 mm O.D. glass _____

❍ 8 mm O.D. glass _____

❍ 10 mm O.D. glass _____

❍ Other O.D.: _____

Length: _____

_____

Retaining Plugs:

Silanized glass wool	❍ A	❍ B	❍ C
Glass wool	❍ A	❍ B	❍ C
Foam	❍ A	❍ B	❍ C

❍ Stainless steel clip

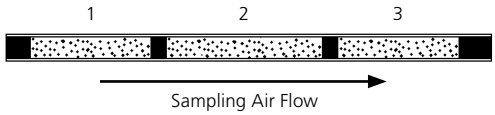
Adsorbent(s) and Bed Weight(s):[1]

1. _____

2. _____

3. _____

Thermal Desorption Tubes



❍ Glass

❍ Stainless steel

Dimensions:

O.D.: _____ I.D.: _____

Length: _____

Length: _____

Length of heated zone of instrument: _____

Retaining Plugs:

❍ Fritted (in glass tubes only)
❍ Glass wool
❍ Screens (in stainless steel tubes only)
❍ Stainless steel clip (in glass tubes only)

TDU Instrument*: Model No.: _____

❍ CDS Analytical	❍ Chrompak	❍ Dynatherm
❍ Entech	❍ Envirochem	❍ GERSTEL
❍ Markes International	❍ OI Analytical	❍ PerkinElmer
❍ Teledyne-Tekmar		

*If your instrument is not listed, please contact Technical Service.

Adsorbent(s) and Bed Weight(s) or Length(s):[1]

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