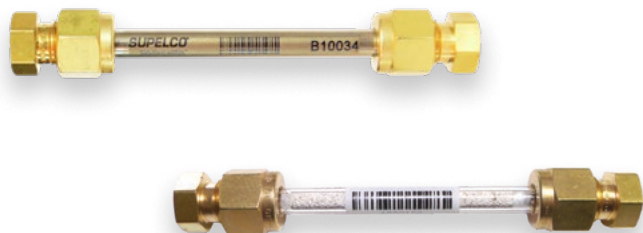


# Thermal Desorption Tubes with Unique Barcodes



## Features and Benefits

- All the Carbotrap® products are supplied with our adsorbent technology inside
- More consistent back pressure from tube-to-tube
- Easy-to-read markings on the stainless-steel tubes
- Glass-fritted tubes with a frit at an optimized location
- TDS<sup>3</sup>™ storage container or brass end-cap sealed pre-conditioned tubes
- Read-easy barcodes resistant to many pre-conditioning cycles



## What's Inside the Tube – Product Naming Guide\*

Product names you know and trust, like Carbotrap® 300, were developed by the Supelco® scientists in collaboration with the US EPA for the Toxic Organic (TO) methods.

### What does the naming mean?

The Carbotrap® products have our registered trademark and are the flagship of our expertise in unique carbon technology.

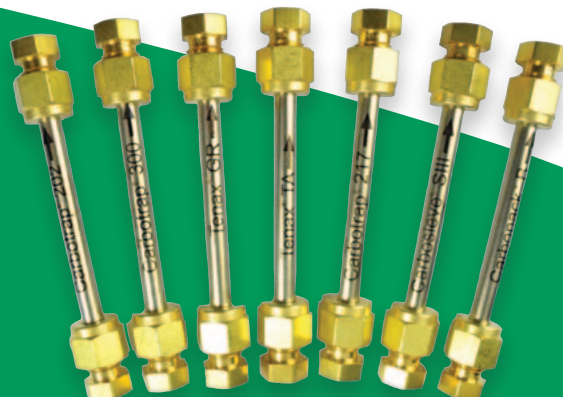
### What do the numbers mean?

- 100 series: Thermal desorption tubes containing single adsorbent bed
- 200 series: Thermal desorption tubes containing dual adsorbent beds
- 300 series: Thermal desorption tubes containing three adsorbent beds
- 400 series: Thermal desorption tubes containing four adsorbent beds; exception Carbotrap® T420 TD Tube

\*As the Supelco® adsorbent tube configurations are developed at our production facility, the authenticity of the adsorbents, the supreme quality and reputable value of every tube is guaranteed.

Product Name	Adsorbent	Applications
Carbotrap® 100	Carbotrap® B	C5-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 semi-volatile to very volatile compounds
Carbotrap® 202	Carbopack™ B, Carbopack™ C	C5-C20 compounds in air
Carbotrap® 217	Carbotrap® B, Carboxen® 1000	TO-17 compounds and 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 semi-volatile 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 semi-volatiles in air
Carbotrap® 349	Carbopack™ Y, Carbopack™ B, Carboxen® 1003	NIOSH 2549: Volatile organic compounds
Carbotrap® 370	Carbopack™ F, Carbopack™ C, Carbopack™ B	C5-C30 compounds thermally extracted from solid samples; focusing semi-volatile compounds
Carbotrap® 400	Carbotrap® F, Carbotrap® C, Carbotrap® B, Carboxen® 569	C2 and larger compounds in aqueous samples
Carbotrap® T420	Proprietary	Terpene compounds in air

\*Product quality can only be guaranteed when the tubes and adsorbents originate from our Supelco® production facility.



## Product Information

Our thermal desorption tubes are available in either glass-fritted or stainless-steel tubing with a unique barcode label.

Dimensions: ¼ in. O.D. (6.35 mm) × 3.5 in L (89 mm)

### Unconditioned Thermal Desorption Tubes with Barcode

Package Size: 10 Tubes

Stainless Steel Cat. No.	Glass Fritted Cat. No.	Description	Applications
30131-U	30132-U	Tenax® TA (35/60)	EPA TO-1, EPA IP-1B
30133-U	30134-U	Tenax® TA (60/80)	EPA TO-1, EPA IP-1B
30135-U	30136-U	Carbopack™ B	ASTM D6196; Wide range of VOCs
30137-U	30138-U	Carbotrap® 217 for "Air Toxics"	EPA TO-14-Air Toxics; EPA TO-17
30139-U	30141-U	Carbotrap® 300	US EPA: TO-1, TO-2, TO-3, TO-17



### Preconditioned Thermal Desorption Tubes

Stainless Steel – Package Size: 10 tubes

TDS <sup>3</sup> Cat. No.	Brass End-cap Cat. No.	Description	Applications
20010-U	29741-U	Tenax® TA (60/80)	EPA TO-1, EPA IP-1B
20011-U	29742-U	Tenax® GR (60/80)	Extends range of Tenax® TA
20012-U	29743-U	Carbosieve™ S-III	EPA TO-2
20013-U	29744-U	Carbotrap® 217 for "Air Toxics"	EPA TO-14-Air Toxics; EPA TO-17
20083-U	29745-U	Carbotrap® 202 (40/60)	EPA TO-17
21705-U	29746-U	Carbotrap® 300	US EPA: TO-1, TO-2, TO-3, TO-17
28687-U	NA	Carbotrap® T420	Terpenes in Air



### Glass-Fritted

Package Size: 10 Tubes

TDS <sup>3</sup> Cat. No.	Brass End-cap Cat. No.	Description	Applications
29530-U	29747-U	Tenax® TA (35/60)	EPA TO-1, EPA IP-1B
29539-U	29748-U	Tenax® TA (60/80)	EPA TO-1, EPA IP-1B
29549-U	29749-U	Tenax® GR (60/80)	Extends range of Tenax® TA
29531-U	29750-U	Carbotrap® 217 for "Air Toxics"	EPA TO-14-Air Toxics; EPA TO-17
29532-U	29751-U	Carbotrap® 300	EPA: TO-1, TO-2, TO-3, TO-17
29533-U	29752-U	Carbotrap® 349	NIOSH 2549, US EPA IP-1B
29534-U	29753-U	Carboxen® 569 (20/45)	-
29535-U	29754-U	Carbopack™ B	ASTM D6196; Wide range of VOCs
29536-U	29755-U	Graphsphere™ 2016 (60/80)	-
29537-U	29756-U	Carbopack™ X	1,3-Butadiene; US EPA: TO-17
28689-U	NA	Carbotrap® T420	Terpenes in Air



### Glass (No Frit) Sealed with Brass End Caps

Package Size: 10 Tubes

Cat. No.	Description	Applications
28715-U	Tenax® TA (60/80)	EPA TO-1, EPA IP-1B
28718-U	Tenax® TA (60/80); Carboxen® 1018 (60/80)	EPA TO-1, EPA IP-1B; EPA TO-17

### Empty Tubes

Package Size: 10 Tubes

Cat. No.	Description
21822-U	Empty stainless-steel TD Tube sealed in a TDS <sup>3</sup> ™ storage container
29538-U	Empty glass-fritted TD Tube sealed in a TDS <sup>3</sup> ™ storage container
28714-U	Empty glass (non-fritted) TD Tube sealed with brass endcaps

## Fenceline Monitoring for Benzene

Compliant with US EPA Method 325B



### Overview

The US EPA first used our adsorbent technology in 1981 with the development of the first thermal desorption tubes as an alternative to sampling volatile organic compounds with bulky canisters and less sensitive solvent desorption methods. When passive monitoring using thermal desorption tubes began in 2003, the US EPA deployed the specially coated stainless steel thermal desorption tube packed with Carbopack™ X for the Detroit Exposure and Aerosol Research Study (DEARS). The deactivated Carbopack™ X SS TD tubes have been deployed in the field for the DEARS as well as in the development of EPA method 325B with passive sampling uptake rates validated by the US EPA for the VOCs of interest for Fenceline Monitoring; they have over a decades history of repeated and proven performance.

**Table 1: Validated<sup>1</sup> US EPA Sampling Rates for Carbopack™ X Deactivated Stainless Steel Thermal Desorption Tube**

Compound Name	CAS#	75% RH Eff. Sampling rate <sup>a</sup> /cm <sup>3</sup> min <sup>-1</sup>	75% RH Eff. Uptake rate <sup>a</sup> /ng ppmv <sup>-1</sup> min <sup>-1</sup>	Martin et al. ref. 3 (ref 2-4)	35% RH rate = 75% RH Rate Times
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 14)	76-14-2	0.44 ± 0.08	3.12 ± 0.60		1.06
1,3-Butadiene	106-99-0	0.61 ± 0.11	1.36 ± 0.24	1.24 ± 0.16	0.88
Trichlorofluoromethane (CFC 11; Freon-11; R-11)	75-69-4	0.51 ± 0.07	2.87 ± 0.39		0.98
1,1-Dichloroethene (1,1-DCE)	75-35-4	0.57 ± 0.14	2.27 ± 0.54		0.91
3-Chloropropene	107-05-1	0.51 ± 0.30	1.61 ± 0.96		0.83
1,1,2-Trichloro-1,2,2-trifluoroethane (CFC 113; Freon-113)	76-13-1	0.46 ± 0.05	3.58 ± 0.42		0.98
1,1-Dichloroethane	75-34-3	0.57 ± 0.10	2.34 ± 0.42		1.12
cis-1,2-Dichloroethene (1,2-DCE)	156-59-2	0.58 ± 0.08	2.31 ± 0.30		0.96
1,2-Dichloroethane (DCE)	107-06-2	0.57 ± 0.08	2.34 ± 0.33		0.97
1,1,1-Trichloroethane	71-55-6	0.51 ± 0.10	2.80 ± 0.54		1.11
Benzene	71-43-2	0.67 ± 0.11	2.15 ± 0.36	1.99 ± 0.48	1.12
Carbon Tetrachloride (CCl <sub>4</sub> )	56-23-5	0.51 ± 0.06	3.24 ± 0.36		1.17
1,2-Dichloropropane	78-87-5	0.52 ± 0.10	2.41 ± 0.45		0.91
Trichloroethene (TCE)	79-01-6	0.50 ± 0.05	2.74 ± 0.30		1.07
1,1,2-Trichloroethane (1,1,2-TCA)	79-00-5	0.49 ± 0.13	2.69 ± 0.72		0.91
Toluene	108-88-3	0.52 ± 0.14	1.98 ± 0.51	2.23 ± 0.52	1.01
Tetrachloroethene (PERC)	127-18-7	0.48 ± 0.05	3.27 ± 0.36		1.01
Chlorobenzene (MCB)	108-90-7	0.51 ± 0.06	2.35 ± 0.30		0.99
Ethylbenzene	100-41-4	0.46 ± 0.07	2.03 ± 0.30		0.99
<i>m,p</i> -Xylene	<i>m</i> -108-38-3 <i>p</i> -106-42-3	0.46 ± 0.09	2.00 ± 0.39		0.99
Styrene	100-42-5	0.50 ± 0.14	2.12 ± 0.57		0.96
<i>o</i> -Xylene	95-47-6	0.46 ± 0.12	2.01 ± 0.54	1.79 ± 0.41	0.99
4-Ethyltoluene	622-96-8	0.41 ± 0.11	2.03 ± 0.57		0.93
1,3,5-Trimethylbenzene	108-67-8	0.41 ± 0.10	1.72 ± 0.42		0.96
<i>m</i> -Dichlorobenzene (mDCB)	541-73-1	0.44 ± 0.07	2.68 ± 0.45		0.97
<i>p</i> -Dichlorobenzene (pDCB)	106-46-7	0.45 ± 0.05	2.71 ± 0.30		0.97
<i>o</i> -Dichlorobenzene (oDCB)	95-50-1	0.45 ± 0.06	2.72 ± 0.36		0.98

<sup>a</sup> At 22 ± 2 °C at 760 Torr. Also ± values are based on 3σ values

### Featured Products

Cat. No.	Description	Pkg
<b>28686-U</b>	Pre-Conditioned FLM SS TD Tube packed w/ Carbopack™ X	10
<b>28666-U</b>	Preconditioned FLM SS TD Tube packed with Carbopack™ B	10
<b>23094-U</b>	Pre-Conditioned Swagelok® Assembly	20
<b>25097-U</b>	TDS <sup>3</sup> ™ Storage Container	1

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- McClenny, W.A., 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.

## Carbotrap® T420 Thermal Desorption Tube for Sampling Terpenes in Air

The Carbotrap® T420 tube is specifically designed for capturing terpenes from air matrices for a wide range of applications. The tube is packed with two beds of graphitized carbon adsorbents that work together to efficiently retain (during sampling) and release (during analysis) the terpenes associated with cannabis, hemp, hops and other botanicals. The hydrophobic properties of these adsorbents make the tube well suited for collecting active air samples in humid atmospheres such as a greenhouse.



### Features & Benefits

- Efficiently retains and releases terpenes associated with cannabis, hemp, hops and other terpene fragrant plants
- Optimized for sampling terpenes in a wide-range of applications such as: industrial hygiene, environmental emissions and terpene drift; terpene odor concentration; non-destructive live plant profiling and headspace air of plant materials
- Designed for sampling in high humidity environments such as indoor greenhouse environments
- Available in both glass-fritted and stainless steel TD tubes—¼ in. O.D. x 3.5 in. L (6.35 mm O.D. x 89 mm long).
- Preconditioned & QC tested to ensure low background levels
- Easy sample identification and tracking—a unique number with corresponding durable barcode on each tube

### Product Storage Accessories

#### TDS<sup>3</sup>™ (Thermal Desorption Tube Storage and Sampling System) Storage Containers

After conditioning, it is advisable to store the tubes in our reusable TDS<sup>3</sup>™ containers as an alternative to brass endcaps. The TDS<sup>3</sup>™ system eliminates the internal dead volume, minimizes the risk of contamination from external sources, and protects the tubes from damage. Also, no need to carry tools to the field.

Cat. No.	Description
25097-U	TDS <sup>3</sup> ™ for use with PerkinElmer® ATD-50, ATD-400, Turbomatrix, for use with Markes International Unity
25095-U	TDS <sup>3</sup> ™ for use with Gerstel TDS 2/TDS/A, for use with Tekmar® AEROTrap 6000
28307-U	TDS <sup>3</sup> ™ for use with Gerstel 60mm TDU Tubes
25069	TDS <sup>3</sup> ™ Sampling Caps with Washers
25073	Replacement Septa for TDS <sup>3</sup> ™ storage containers

#### Precleaned and Assembled Swagelok® End Fittings

For use with thermal desorption tubes having an outer diameter of ¼ inch. Ideally for use with unconditioned thermal desorption tubes that are conditioned in-house before use. Saves you the trouble of an extra step by giving you ready-for-use, precleaned, and conditioned end-fittings.

Cat. No.	Description
23094-U	Precleaned and Assembled End Fittings, pk of 20



### Recommended Sample Collection Volumes by Application

Application	Observed Terpene Odor	Recommended Sampling Volume
Testing of live plants and headspace of the actual plant material	Very Strong	0.1 to 0.2 Liters
Indoor sampling of greenhouse	Strong	1 to 2 Liters
Outdoor sampling near growing location	Detectable	2 to 5 Liters
Outdoor sampling	Undetectable	5 to 10 Liters

Note: Terpene odor thresholds will be different among users so keep this in mind when choosing a sample volume for your application.

Cat. No.	Description	Qty.
<b>Products for Sample Collection</b>		
28689-U	Carbotrap® T420, Glass-Fritted TD Tube, Preconditioned	10 ea
28687-U	Carbotrap® T420, Stainless Steel TD Tube, Preconditioned	10 ea
<b>Terpenes Certified Reference Materials for Analysis</b>		
CRM40755	Terpene CRM Mix A: 14 Analytes, 2000 µg/mL each component in methanol	1 mL ampule
CRM40937	Terpene CRM Mix B: 20 Analytes, 2000 µg/mL each component in methanol	1 mL ampule
64643-500MG-F	β-Myrcene (neat)	1 ea
<b>Recommended GC Capillary Column</b>		
28471-U	SLB®-5ms Capillary GC Column L × I.D. 30 m × 0.25 mm, df 0.25 µm	1 ea

#### Storage End Caps for ¼ in. O.D. Thermal Desorption Tubes

Package Size: 20

Cat. No.	Description
28012-U	Replacement Ferrules for TMX Brass Caps
28011-U	Brass storage caps for use with TurboMatrix
28002-U	PTFE End Caps for TurboMatrix
28019-U	PTFE Storage Container Caps for use with PerkinElmer® ATD-400



## For Gerstel Thermo Desorption System

Fits Instrument Models: TDSA and TDS2

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

- Available in both stainless steel and glass fritted
- Unique numbers on every tube for traceability
- All products are preconditioned and are sealed in our exclusive TDS<sup>3</sup>™ Storage Containers
- Custom configurations available

### Preconditioned Thermal Desorption Tubes

Package Size: 1 Tube

Sealed in TDS<sup>3</sup>™ Storage Container

Cat. No.	Description	Applications
Glass-Fritted/Barcoded		
28283-U	Carbotrap® 300	EPA: TO-1, TO-2, TO-3, TO-17
28312-U	Carbotrap® 217	EPA TO-14-Air Toxics; EPA TO-17
28311-U	Carbotrap® 349	NIOSH 2549, US EPA IP-1B
28282-U	Tenax® GR	Extends Range of Tenax TA
28281-U	Tenax® TA	EPA TO-1, EPA IP-1B



## 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.

Dimensions: 16 mm O.D. x 5 in. L (¼ in. O.D. ends)

Package Size: 1 Tube

Fits models: Dynatherm 9300 TDA

Cat. No.	Description
20074-U	Tenax® TA (35/60 mesh)
20075-U	Tenax® TA (35/60): Petroleum charcoal (2:1)
21993	Empty glass VOST Tube
21998	Empty VOST Storage Container



## Sampling Pumps

### Escort Elf® Sampling Pump

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. 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 through 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./5 cm long) and one for large tubes (<4.5 in./12.5 cm long) and the tubing required to connect the sampler to the sampling pump.

Cat. No.	Description	Qty.
28160-U	Escort Elf® Sampling Pump	1
28118-U	GEMINI® Twin Port Sampler	1
<b>Accessories</b>		
28155-U	Omega Battery Charger 12 Volt	1
28157-U	110 Volt, units charged: 1	1
28158-U	240 Volt, units charged: 1	1
28159-U	120 Volt/240 Volt, units charged: 5	1



### Model 1067 Ambient Air Sampler

This Dual Channel Ambient Air Sampler was developed to meet the requirements of US EPA Method TO-17. Precision needle valves provide stable flow rates for two independently controlled flow channels for sorbent tube sampling over a range of 5-500 mL/min.

Cat. No.	Description	Qty.
507113	Model 1067 Tube Sampler (Dual Channel)	1
24697-U	Universal Charger, 110 V/240 V	1



### PAS-500 Micro Air Sampler

This low flow pump is lightweight (4 oz./114 g) and compact (7 in./17.8 cm), 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 and 8 mm O.D. tubes, and the flow range is 5-200 mL/min. The low flow adapter enables you to sample at 20 mL/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. Not suitable for sampling in explosive environments - not EX rated.

Cat. No.	Description	Qty.
<b>PAS-500 Micro Air Sampler with Low Flow Orifice</b>		
24865	Includes sampler, 6 mm O.D. tube holder, screwdriver and two 9-Volt batteries	1
<b>Tube Holder for PAS-500 Pump</b>		
24867	For use with 6 mm O.D. adsorbent tube	1
24868	For use with detector tube	1
24869	For use with 8 mm O.D. adsorbent tube	1
<b>Carrying Case for PAS-500</b>		
24871	Single pump case	1



# Supelco®

Analytical Products

MilliporeSigma  
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Burlington, MA 01803

**SigmaAldrich.com**

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