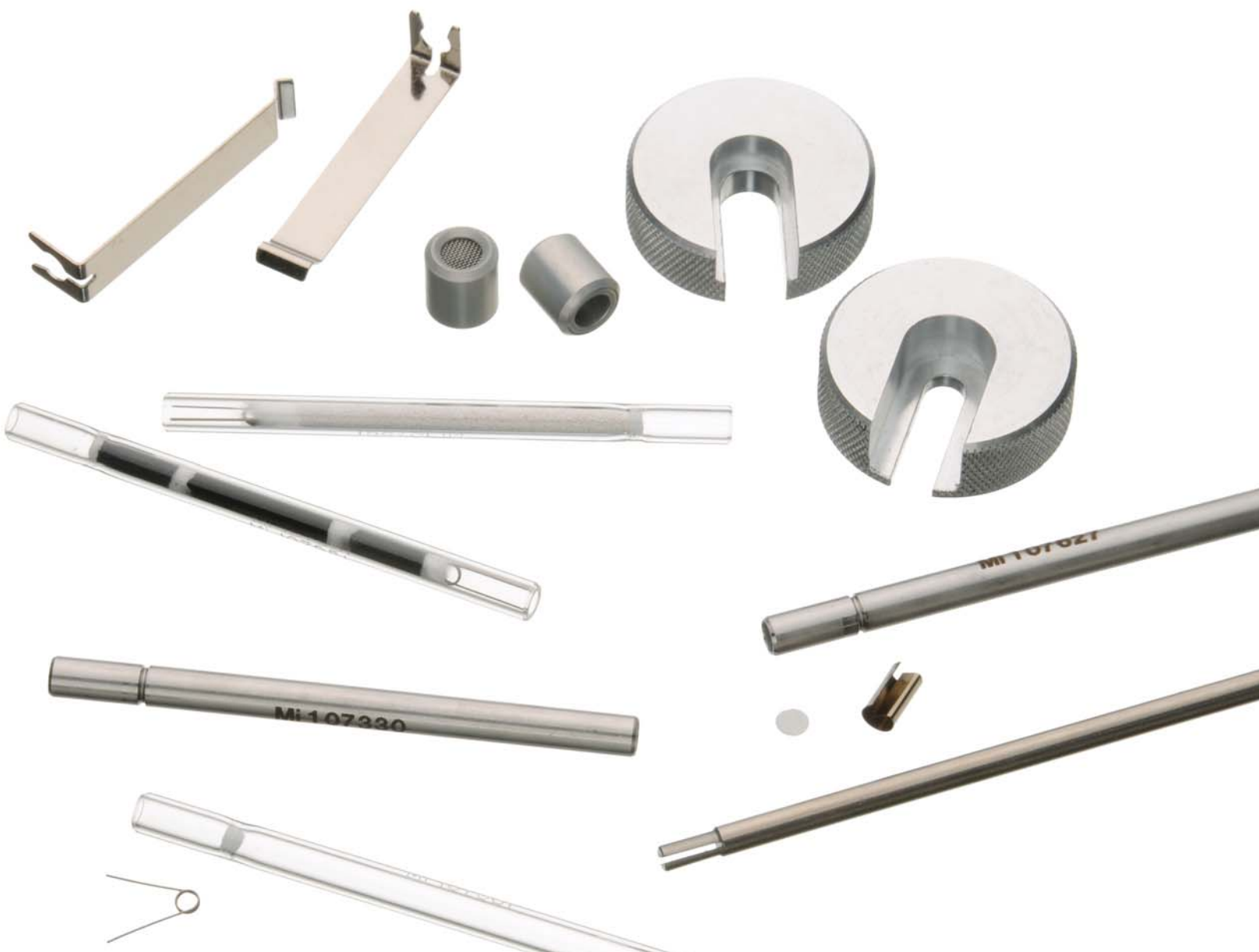


# Thermal Desorption Tubes

## Versatile Air Sampling for a Wide Range of Applications

- **Sensitive**—concentrated sample collection to ppb/ppt levels.
- **Versatile**—variety of sorbents to collect wide range of VOCs.
- **Efficient**—reusable, time-saving alternative to solvent desorption tubes.



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## Thermal Desorption: A Versatile Technique for a Wide Range of VOC Applications

### What is Thermal Desorption?

Thermal desorption (TD) is a highly sensitive alternative to conventional sample collection procedures for volatile and semivolatile compounds, such as solvent desorption tubes. It is more efficient than other extraction methods and allows the selective concentration of target analytes, making it ideal for trace-level analysis by gas chromatography (GC/MS) across a wide range of applications. Thermal desorption is the process of collection and desorption of analytes from solid sorbents using heat and a flow of inert gas, rather than solvent extraction. Analytes are then focused on a cold trap prior to entering the analytical column, resulting in higher responses and narrow, more symmetric peaks. This is accomplished by interfacing a thermal desorption unit with a GC/MS (Figure 1). TD is highly sensitive and can significantly lower detection limits, by as much as  $10^3$ , as it allows water to be purged, further facilitating the selective concentration of the compounds of interest. Thermal desorption tubes can be sampled actively with a sampling pump, or passively with a diffusion cap, and are reusable.

### Applications

Thermal desorption has many air monitoring applications in a wide variety of industries including industrial hygiene, environmental air monitoring, odor profiling in the food and flavor industry, defense and forensic applications, and material emissions testing. TD is also compatible with many sample matrices in addition to air including solids (powders, fibers, films and granules), resins, pastes, liquids, and emulsions (Figure 2). Common applications include:

- Workplace exposure monitoring.
- Indoor/outdoor air testing.
- Soil, water, and biological volatiles.
- Residual volatiles, solvents etc.
- Odor profiling for flavor and fragrance testing.
- Fire debris, chemical warfare agents.
- Material emissions from numerous consumer products.

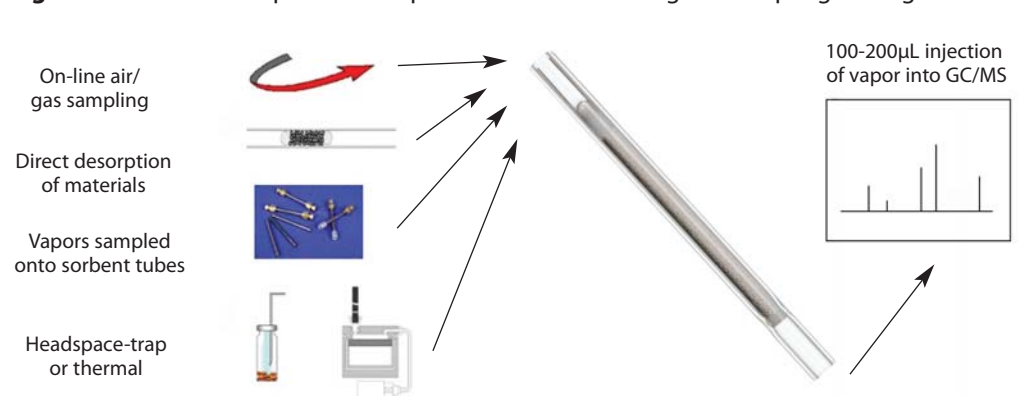
Thermal desorption works well for almost all volatile, and many semivolatile compounds, and concentrations from ppm to ppt can be analyzed reliably. TD can be used for any volatile organic compound that is easily analyzed by GC, provided the sample matrix is compatible with the high temperatures required. Generally, this technique is not suitable for less volatile compounds, or compounds that are either not compatible with standard gas chromatography, or that require special care during GC analysis (e.g., on-column injection). Almost all other volatile compounds respond well, and a variety of sorbents are available to maximize the range of VOCs collected. Specifications and method applications for Restek thermal desorption tubes can be found on page 3.

Significant sensitivity and efficiency improvements can be realized through thermal desorption. It is a versatile technique, suitable to many GC applications that require trace-level analysis of volatile compounds. Compare thermal desorption tubes to canister sampling using the chart on page 4 to determine which technique is right for you.

**Figure 1** Thermal desorption from Markes International.



**Figure 2** Thermal desorption is compatible with a wide range of sampling strategies.



## Thermal Desorption Unit (TDU) Tubes

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

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

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

## method applications

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

### Specifications

Dimensions: 1/4" OD x 3-1/2" long

Low sampling rates:

0.01-0.20 L/min.

(<10L total volume)

Long-term storage caps are supplied with conditioned tubes

## Thermal Desorption Unit Tubes, Unconditioned and Conditioned & Capped

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



## Thermal Desorption Unit Tubes, Empty

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



## Thermal Desorption Unit Tubes, Calibration

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



## Thermal Desorption Unit Tubes, Accessories

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



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## Thermal Desorption Tubes vs. Canister Sampling

Use the information below to determine which VOC sampling technique is best suited for your application.

### Similarities Between Thermal Desorption Tubes and Canisters

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

### Differences Between Thermal Desorption Tubes and Canisters

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

### tech guides

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



**Environmental Air Monitoring and Occupational Health & Safety**  
EVTG1034



**Residual Volatiles & Materials Emissions Testing**  
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**Food, Flavor, Fragrance & Odor Profiling**  
FFTG1037



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