



TO-17 Tube Style 1



Introduction

Global anthropogenic VOC (volatile organic compounds) emissions are estimated about 142 teragrams of carbon per year and growing, even though the majority of total VOC is still produced by plants. The United States is the largest contributor with 21% of the total global VOC emissions. The Clean Air Act, which was last amended in 1990, requires US EPA to set National Ambient Air Quality Standards.

US EPA Method TO-17: "Determination of volatile organic compounds in ambient air using active sampling onto sorbent tubes" describes a TD-GC/MS based monitoring method for VOC in ambient air at 0.5 to 25 parts per billion (ppbv) concentration levels. The method is based on multi-sorbent tubes carefully selected for the suitable target compounds, and allows some flexibility in tube design to fit individual needs. However, three tube styles (called Tube Style 1, 2, and 3) are recommended and specified in TO-17.

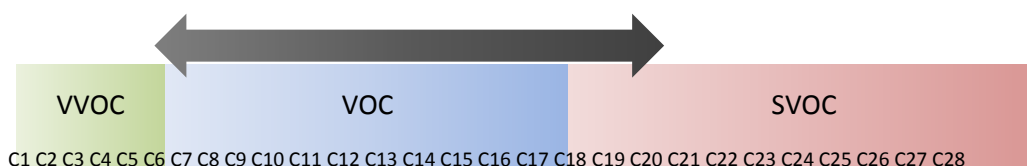


This method replaces earlier sorbent based EPA Methods TO-1 and TO-2 and provides an alternative to canister-based EPA Method TO-15. The target compound list is the same as TO-15 (i.e., subsets of the 97 VOCs listed as hazardous air pollutants in the Clean Air Act Amendments of 1990).

Tube Style 1 Configuration

- 30 mm Tenax[®] GR plus 25 mm of Carbograph[™] 1
- Sorbents are separated by 3 mm glass wool
- Carbograph[™] 1 is equivalent to Carbopack[™] B

Volatility Range C6~C20



Volatility Range – Continued

- C6 ~ C20 for air volumes of 2 L at any humidity
- Air volume can be extended to 5 L for C7 and above

Temperatures

Maximum Temperature:	350°C
Conditioning Temperature:	320°C
Desorption Temperature:	300°C

Pros

- Covers a relatively wide range of volatility
- Made with very popular sorbents whose characteristics have been thoroughly studied

Cons

- Relatively small breakthrough for Benzene
- Tenax® GR limits the desorption temperature and background noise of the tube

Technical Guide

TO-17 Tube Style 1



- TO-17 Tube Style 1 is a dual-bed tube suitable for active/pumped sampling
- If passive sampling is required, try Tenax® GR tube (Camsco Part Number **SU60527**) for similar volatility range
- The relatively high background of Tenax® GR is not ideal for trace analysis, but good enough for general purposes

Comparison to other Tubes

- US EPA Compendium Method TO-1 published the use of Tenax® GC for sampling nonpolar VOC, we look at TO-17 Tube Style 1 as a “Strengthened Tenax® GR Tube”, where an extra bed of Carbograph™ 1 is added in the back to help avoid breakthrough at the lower end of the volatility range covered by Tenax® GR.
- Similarly, we make a “Strengthened Tenax® TA Tube” which features the same configuration but with Tenax® TA instead of Tenax® GR (Camsco Part Number **SU60540**)

References

US EPA Method TO-17: Determination of volatile organic compounds in ambient air using active sampling onto sorbent tubes. EPA/625/R-96/010b, 1999

US EPA Methods TO-1 and TO-2, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. EPA 600/4-84-041, 1984

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E. Hunter Daughtrey, K. D. Oliver, J. R. Adams, K. G. Kronmiller, W. A. Lonneman, W. A. McClenny, A comparison of sampling and analysis methods for low-ppbC levels of volatile organic compounds in ambient air, J. Environ. Monit., 2001, 3, 166-174

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