



Designation: E3189 – 19

Standard Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Static Headspace Concentration onto an Adsorbent Tube¹

This standard is issued under the fixed designation E3189; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes the procedure for separation of ignitable liquid residues from fire debris samples using static headspace concentration onto an adsorbent tube, for subsequent solvent elution or thermal desorption.

1.2 Static headspace concentration onto an adsorbent tube involves removal of a headspace extract from a sample container (typically a jar, can, or bag), through a small hole punctured in the container, using a syringe or pump.

1.3 Static headspace concentration systems for adsorption onto an adsorbent tube are illustrated and described.

1.4 This practice is suitable for preparing extracts from fire debris samples containing a range of volumes (μL to mL) of ignitable liquid residues, with sufficient recovery for subsequent qualitative analysis **(1)**.²

1.5 Alternative headspace concentration methods are listed in Section 2 (see Practices **E1388**, **E1412**, **E1413**, and **E2154**).

1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.7 *This standard cannot replace knowledge, skills, or abilities acquired through education, training, and experience (Practice **E2917**) and is to be used in conjunction with professional judgment by individuals with such discipline-specific knowledge, skills, and abilities.*

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.9 *This international standard was developed in accordance with internationally recognized principles on standard-*

ization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:³

E1388 Practice for Static Headspace Sampling of Vapors from Fire Debris Samples

E1412 Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Passive Headspace Concentration With Activated Charcoal

E1413 Separation of Ignitable Liquid Residues from Fire Debris Samples by Dynamic Headspace Concentration onto an Adsorbent Tube

E1459 Guide for Physical Evidence Labeling and Related Documentation

E1492 Practice for Receiving, Documenting, Storing, and Retrieving Evidence in a Forensic Science Laboratory

E1618 Test Method for Ignitable Liquid Residues in Extracts from Fire Debris Samples by Gas Chromatography-Mass Spectrometry

E1732 Terminology Relating to Forensic Science

E2154 Practice for Separation and Concentration of Ignitable Liquid Residues from Fire Debris Samples by Passive Headspace Concentration with Solid Phase Microextraction (SPME)

E2451 Practice for Preserving Ignitable Liquids and Ignitable Liquid Residue Extracts from Fire Debris Samples

E2917 Practice for Forensic Science Practitioner Training, Continuing Education, and Professional Development Programs

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology **E1732**.

¹ This practice is under the jurisdiction of ASTM Committee **E30** on Forensic Sciences and is the direct responsibility of Subcommittee **E30.01** on Criminalistics.

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² The boldface numbers in parentheses refer to a list of references at the end of this standard.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *dynamic headspace concentration, n*—an extraction technique in which a portion of the headspace vapors is exchanged from the sample container and concentrated onto an adsorbent medium through applied positive or negative pressure.

3.2.2 *static headspace, n*—an extraction technique in which a portion of the headspace vapors is removed from the sample container.

3.2.3 *static headspace concentration, n*—an extraction technique in which a portion of the headspace vapors is removed from the sample container and concentrated onto an adsorbent medium.

4. Summary of Practice

4.1 Headspace vapors from the sample container are collected and concentrated onto an adsorbent tube through a needle or plastic tip connected to the inlet of the adsorbent tube and inserted into the container by means of a small hole punctured in the container, and using a syringe or pump connected to the outlet of the adsorbent tube. The adsorbent tube is subsequently desorbed thermally or eluted with solvent prior to instrumental analysis (typically by gas chromatography-mass spectrometry (GC-MS)).

4.2 The technique of static headspace concentration onto an adsorbent tube is illustrated in Fig. 1. The sample container may be heated before sampling, as outlined in Section 8, but the adsorbent tube is not.

5. Significance and Use

5.1 This practice is useful for preparing extracts from fire debris for subsequent qualitative analysis by gas chromatography-mass spectrometry, see Test Method E1618.

5.2 This practice is capable of removing a portion of the headspace vapors, containing quantities smaller than 0.1 $\mu\text{L/L}$ of ignitable liquid residues, from a sample container and concentrating the ignitable liquid residues onto an adsorbent medium (1).

5.2.1 Recovery from fire debris samples will vary, depending on factors including debris temperature, adsorbent temperature, container size, adsorptive material, headspace volume, sampling volume or sampling time and flow rate, and adsorptive competition from the sample matrix (2).

5.3 The principal concepts of static headspace concentration are similar to those of static headspace (Practice E1388) and dynamic headspace concentration (Practice E1413). The static headspace concentration technique can be more sensitive than the static headspace technique and less sensitive than the dynamic. The static techniques do however leave the sample in a condition suitable for resampling, as only a portion, typically less than 10 %, of the headspace is withdrawn from a sample container (3).

5.3.1 Re-sampling and analysis is possible with static headspace concentration onto an adsorbent tube, because only a portion of the headspace from the container is removed (3). Taking multiple headspace samples will continuously reduce the concentration of ignitable liquid vapors present, which can result in a change in relative composition of components and eventually non-recovery when the questioned headspace originally contained very low quantities of ignitable liquid residues (less than 0.1 $\mu\text{L/L}$).

5.4 Common solid adsorbent/desorption procedure combinations in use are activated carbon/solvent elution and Tenax⁴ TA/thermal desorption.

5.5 Solid adsorbent/desorption procedures not specifically described in this standard can be used as long as the practice has been validated as outlined in Section 11.

6. Apparatus

6.1 Static Headspace Concentration Sampling Apparatus:

6.1.1 *Sampling Device*—A device capable of concentrating volatile compounds in air, consisting of an adsorbent tube with the outlet connected to an air-tight syringe or pump and the inlet connected to a needle or plastic tip.

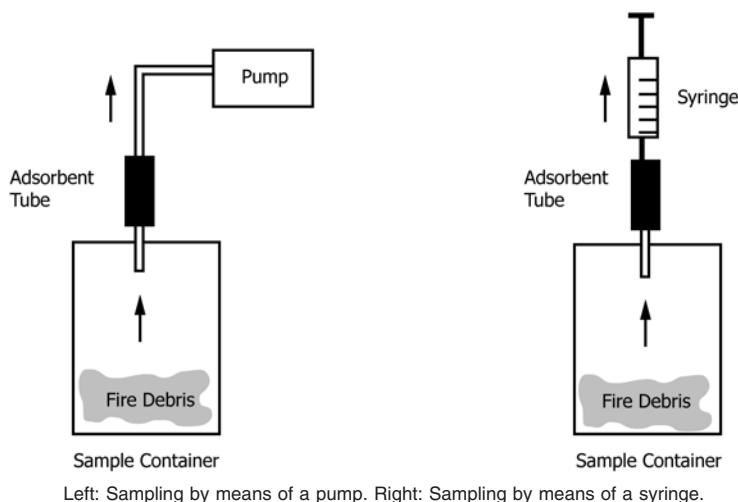


FIG. 1 Illustration of Static Headspace Concentration onto an Adsorbent Tube

⁴ Tenax is a trademark of Teijin Carbon America, Inc., Rockwood, TN.