



Designation: **E1388 – 12 E1388 – 17**

Standard Practice for Static Headspace Sampling of Headspace Vapors from Fire Debris Samples¹

This standard is issued under the fixed designation E1388; 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 removing ~~small quantities of ignitable liquid vapor from samples of fire debris by sampling vapor from the headspace of the debris container.~~ a fire debris container for the purpose of detecting or identifying ignitable liquid residues.

1.2 Separation and concentration procedures are listed in the referenced documents. (See Practices [E1386](#), [E1412](#), [E1413](#), and [E2154](#).)

1.3 This practice offers a set of instructions for performing one or more specific operations. This standard cannot replace knowledge, skill, or ability acquired through appropriate education, training, and experience and should be used in conjunction with sound professional judgment.

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

1.5 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization 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:*²

[E1386 Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Solvent Extraction](#)

[E1412 Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Passive Headspace Concentration With Activated Charcoal](#)

[E1413 Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Dynamic Headspace Concentration](#)

[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](#)

[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](#)

3. Summary of Practice

3.1 ~~The sample, headspace of an item is sampled, preferably in its original container, is heated in order to volatilize any ignitable liquid residues present in the debris. After heating, the headspace is sampled and analyzed by gas chromatography-mass spectrometry for analysis by an appropriate technique (for example, gas chromatography-mass spectrometry). The container may be heated prior to sampling to increase the volatility of any ignitable liquid residues.~~

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. Current edition approved Feb. 1, 2012/July 15, 2017. Published March 2012/July 2017. Originally approved in 1990. Last previous edition approved in 2005/2012 as [E1388 – 05/E1388 – 12](#). DOI: [10.1520/E1388-12.10.1520/E1388-17](#).

² 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.

4. Significance and Use

4.1 This procedure practice is particularly useful for screening sampling fire debris samples to determine relative ignitable liquid concentrations and possible ignitable liquid class to screen for the presence of ignitable liquid residues prior to extraction with other techniques. It is most appropriate for sampling light to medium range ignitable liquids (such as light oxygenates, lacquer thinners, and other similar volatile compounds or products), and less appropriate for sampling ignitable liquids that have compounds in the heavy range.^{3, 4, 5}

4.1.1 When sampled for screening purposes, the instrumentation typically utilized is a gas chromatograph with either a mass spectrometer (GC-MS, refer to Test Method [E1618](#)) or flame ionization detector (GC-FID).

4.2 This practice is useful when volatile oxygenated products such as alcohols or lacquer thinners are generally less efficient at recovering limited quantities of ignitable liquids than Practices [E1386](#) suspected, [E1412](#), [E1413](#), and [E2154](#), particularly for higher boiling compounds.

4.3 This practice is the least sensitive of the sample preparation techniques and may not detect quantities of less than 10 µL of an ignitable liquid.

4.3 Because this—The separation takes place in a closed container, container and the sample remains in approximately the same condition in which it was submitted. Repeat and interlaboratory analyses are therefore—Since only a small aliquot of the sample headspace is removed for analysis, sample reanalysis may be possible.

4.4 High concentrations of highly volatile compounds can saturate the headspace, inhibiting the recovery of less volatile components and leading to the detection or identification of only the more volatile compounds in the sample.

4.5 Due to variables in the debris—This practice is intended for use in conjunction with other extraction techniques, such as those described in Practices [E1386](#), [E1412](#), [E1413](#), and [E2154](#) sample condition prior to headspace sampling, complete reproducibility of chromatograms may be difficult to obtain, when analysis of a sample for all classes of ignitable liquids is required or desired.

4.5.1 To obtain greater reproducibility, use one of the separation procedures which results in a solution of the ignitable liquid residue (see Practices [E1386](#), [E1412](#), and [E1413](#)).

NOTE 1—The headspace specimen (the portion in the syringe) is consumed in the analysis. Preserve an extract for potential reanalysis (see Practice [E2451](#)) using an alternative separation and concentration practice, such as those described in Practices [E1386](#), [E1412](#), and [E1413](#), if preservation is required per laboratory policies.

4.5.2 To obtain greater sensitivity for petroleum distillates and oxygenated products, use solid phase microextraction. (See Practice [E2154](#).)

4.6 High concentrations of highly volatile compounds may swamp the headspace, inhibiting the recovery of less volatile components.

5. Apparatus

5.1 *Heating System*—An oven, heating mantle or hot plate designed to fit the oven or equivalent, capable of reproducible temperature operation for the desired range that can accommodate the evidence container.

5.1.1 An oven is recommended to achieve a constant temperature throughout the system.

5.2 *Temperature Measuring Device*—A thermometer or thermocouple capable of measuring temperatures in the range from 40 to 150°C: required range of operation.

5.3 *Disposable or reusable gas-tight syringes*, A gas-tight syringe capable of reproducibility introducing sample sizes reproducibly sampling in the range from 0.5 to 52.0 mL.

5.4 Disposable 20-cc syringes:

5.4 Disposable 16–20 gauge syringe needles: *Disposable or reusable syringe needles*.

5.5 *Gas-tight vials and caps*.

5.6 A drill, punch, tool or other device to puncture holes in sample containers: device capable of creating holes in evidence containers (for example, drill, hole punch, hammer and nail).

5.7 *Tape, rubber sleeve stoppers, or equivalent*, Headspace sample vials: capable of sealing holes in evidence containers.

6. Sample Preparation

6.1 Observe the appropriate procedures for handling and documentation of all submitted samples as described in Guide [E1459](#) and Practice [E1492](#).

³ Ettling, B. V., and Adams, M. F., "The Study of Accelerant Residues in Fire Remains," *Journal of Forensic Sciences*, Vol 13, No. 1, 1968, pp. 76–89.

⁴ Stauffer, E., Dolan, J. A., and Newman, R., *Fire Debris Analysis*, Boston, MA: Academic Press, 2008.

⁵ Hinshaw, J. V., "Headspace Sampling," *LCGC Europe*, Vol 24, No. 10, 2011.