



Designation: D7892 – 22

Standard Test Method for Determination of Total Organic Halides, Total Non-Methane Hydrocarbons, and Formaldehyde in Hydrogen Fuel by Gas Chromatography/Mass Spectrometry¹

This standard is issued under the fixed designation D7892; 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 The gas chromatography/mass spectrometry (GC/MS) procedure described in this test method is used to determine concentrations of total organic halides and total non-methane hydrocarbons (TNMHC) in hydrogen by measurement of individual target halocarbons (Table 1) and hydrocarbons (including formaldehyde, Table 1 and Table 2), respectively.

1.2 Mention of trade names in this test method does not constitute endorsement or recommendation for use. Other manufacturers' equipment or equipment models can be used.

1.3 *Units*—The values stated in SI units are to be regarded as standard.

1.4 *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.*

1.5 *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

D4150 Terminology Relating to Gaseous Fuels

D7606 Practice for Sampling of High Pressure Hydrogen and Related Fuel Cell Feed Gases

2.2 SAE Standard:³

SAE J2719 Hydrogen Fuel Quality for Fuel Cell Vehicles

3. Terminology

3.1 *Definitions*—For definitions of general terms used in D03 Gaseous Fuels standards, refer to Terminology D4150.

3.2 Abbreviations:

3.2.1 GC—gas chromatograph

3.2.2 m/e —mass to charge ratio

3.2.3 MS—mass spectrometer

3.2.4 $ppb(v)$ —parts per billion as a volume

3.2.5 $ppm(v)$ —parts per million as a volume

3.2.6 UHP—ultra high purity

4. Summary of Test Method

4.1 The target compounds in Table 1 and Table 2, which may be contained in a 400 mL hydrogen sample, are cryogenically frozen or concentrated onto a glass bead trap at -150°C . The target compounds are slowly desorbed by warming to 10°C and transferred to a Tenax trap cooled to -60°C using desorption flow rate of 10 mL/min. This process leaves water in the glass bead trap and dehydrates the sample. The Tenax trap is then desorbed by heating to 180°C and the target compounds cyro-focused at -170°C at the entrance to a GC column (see 6.5). The cyro-focusing section is then rapidly heated up to 80°C to release the cryo-focused target compounds, which are eventually eluted from the column and analyzed using a mass spectrometer scanning from m/e 23 to 100 for initial 4.5 min and from m/e 34 to 550 the remaining analytical time. The retention times of the target compounds are listed in Table 1 and Table 2 under the chromatographic conditions in 6.5.

5. Significance and Use

5.1 Low operating temperature fuel cells such as PEMFCs require high purity hydrogen for optimal performance and

¹ This test method is under the jurisdiction of ASTM Committee D03 on Gaseous Fuels and is the direct responsibility of Subcommittee D03.14 on Hydrogen and Fuel Cells.

Current edition approved June 1, 2022. Published July 2022. Originally approved in 2015. Last previous edition approved in 2015 as D7892 – 15. DOI: 10.1520/D7892-22.

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.

³ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.