



Designation: ~~D7676~~—18 D7676 – 23

## Standard Practice for Screening Organic Halides Contained in Hydrogen or Other Gaseous Fuels<sup>1</sup>

This standard is issued under the fixed designation D7676; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This practice covers the screening of organic halide content of gaseous fuels using electron capture detection. Although primarily intended for determining organic halides in hydrogen used as a fuel for fuel cell or internal combustion engine powered vehicles, this screening method can also be used, if qualified, to measure organic halides in other gaseous fuels and gaseous matrices.

1.2 The procedure described in this method was designed to screen organic halides in hydrogen to a level much less than required by SAE J2719 and the California Code of Regulations, Title 4, Division 9, Chapter 6, Article 8, Sections 4180 – 4181. It will yield false positive result to other compounds that show response to the ~~ECD detector~~, electron capture detector (ECD). Samples that do not pass the criteria of this screening process shall be tested to quantify and qualify the contaminants using Test Method **D7892**.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered 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:<sup>2</sup>

[D1265 Practice for Sampling Liquefied Petroleum \(LP\) Gases, Manual Method](#)

[D3700 Practice for Obtaining LPG Samples Using a Floating Piston Cylinder](#)

[D4150 Terminology Relating to Gaseous Fuels](#)

[D7606 Practice for Sampling of High Pressure Hydrogen and Related Fuel Cell Feed Gases](#)

[D7892 Test Method for Determination of Total Organic Halides, Total Non-Methane Hydrocarbons, and Formaldehyde in Hydrogen Fuel by Gas Chromatography/Mass Spectrometry](#)

<sup>1</sup> This practice 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 Dec. 15, 2018; Nov. 1, 2023. Published February 2019; November 2023. Originally approved in 2018. Last previous edition approved in 2018 as D7676 – 18. DOI: [10.1520/D7676-18.10.1520/D7676-23](https://doi.org/10.1520/D7676-18.10.1520/D7676-23).

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

2.2 *ISO Standard:*<sup>3</sup>

~~ISO TS 14687-2:14687 Hydrogen Fuel — Product Specification— Part 2: Proton Exchange Membrane (PEM) Fuel Cell Applications for Road Vehicles~~

2.3 *SAE Standard:*<sup>4</sup>

~~SAE J2719 Hydrogen Fuel Quality for Fuel Cell Vehicles~~

2.4 *Additional Document:*<sup>5</sup>

~~California Code of Regulations Title 4, Division 9, Chapter 6, Article 8, Sections 4180 – 4181~~

### 3. Terminology

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

3.2 ~~*Definitions*~~: *Definitions of Terms Specific to This Standard:*

3.2.1 *electron capture detector (ECD), n*—detects organic halides by the reduction of a standing detector current due to the capture of detector current electrons by the halogenated hydrocarbons.

~~3.1.2 *fuel cell grade hydrogen, n*—hydrogen satisfying the specifications in SAE J2719.~~

3.2.2 *organic halide, n*—any compound containing carbon and a halogen (fluorine, chlorine, bromine, or iodine).

3.2.3 *total organic halides, n*—the sum concentration of all compounds containing carbon and at least one halide (fluorine, chlorine, bromine, or iodine).

3.3 *Acronyms:*

3.3.1 *ECD*—electron capture detector

3.3.2 *GC*—gas chromatograph

### 4. Summary of Screening Method

4.1 The screening of organic halides in hydrogen and other gaseous fuels can be challenging due to need to measure total organic halides to ~~0.05  $\mu\text{mol}/\text{mol}$  (50 ppb)~~ to satisfy hydrogen fuel contaminant requirements specified in ~~ISO TS 14687-2, 14687, SAE J2719, and the California Code of Regulations.~~

4.2 Organic halides, at any detectable concentration, are not normally present in hydrogen. Any contamination observed will be due to improper maintenance or cleaning of equipment; therefore, any positive result should be cause for further testing and evaluation.

4.3 A gas chromatograph (GC) equipped with an ECD detector and gas sampling system with a 1 mL sample loop is typically used. The GC column is replaced by a length of blank tubing. Carrier gas and detector flows are set to manufacturer's specifications.

4.4 The sample gas is injected into the inlet of the GC-ECD system through the blank tubing and the ECD detector. A signal is produced as organic halides pass through the detector. The signal is sent to a computer, integrator, or other recording device.

4.5 This standard is intended to provide a pass/fail test of presence of organic halides. Its use to rigorously quantify organic halides in gaseous fuels has not been demonstrated. Some fuels may contain contaminants that would preclude the use of this method.

### 5. Significance and Use

5.1 Low operating temperature fuel cells such as proton exchange membrane fuel cells (PEFCs) require high purity hydrogen for

<sup>3</sup> Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

<sup>4</sup> Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.

<sup>5</sup> Available from California Department of Food and Agriculture, 1220 N Street, Sacramento, CA 95814, <https://www.cdffa.ca.gov>.