



Standard Test Method for Hydrogen Purity Analysis Using a Continuous Wave Cavity Ring-Down Spectroscopy Analyzer¹

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1. Scope

1.1 This test method describes contaminant determination in fuel-cell-grade hydrogen as specified in relevant ASTM and ISO standards using cavity ring-down spectroscopy (CRDS). This standard test method is for the measurement of one or multiple contaminants including, but not limited to, water (H_2O), oxygen (O_2), methane (CH_4), carbon dioxide (CO_2), carbon monoxide (CO), ammonia (NH_3), and formaldehyde (H_2CO), henceforth referred to as “analyte.”

1.2 This test method applies to CRDS analyzers with one or multiple sensor modules (see 3.3 for definition), each of which is designed for a specific analyte. This test method describes sampling apparatus design, operating procedures, and quality control procedures required to obtain the stated levels of precision and accuracy.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

D4150 Terminology Relating to Gaseous Fuels
D5287 Practice for Automatic Sampling of Gaseous Fuels
D7265 Specification for Hydrogen Thermophysical Property Tables

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.

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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.

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

D7649 Test Method for Determination of Trace Carbon Dioxide, Argon, Nitrogen, Oxygen and Water in Hydrogen Fuel by Jet Pulse Injection and Gas Chromatography/Mass Spectrometer Analysis

D7653 Test Method for Determination of Trace Gaseous Contaminants in Hydrogen Fuel by Fourier Transform Infrared (FTIR) Spectroscopy

2.2 ISO Standards:³

ISO/DIS 14687-2 Hydrogen fuel—Product specification—Part 2: Proton exchange membrane (PEM) fuel cell applications for road vehicles

ISO/DIS 14687-3 Hydrogen fuel—Product Specification—Part 3: Proton exchange membrane (PEM) fuel cell applications for stationary appliances

2.3 U.S.-Specific Standards:

SAE J2719-2011 (2011) Hydrogen Fuel Quality for Fuel Cell Vehicles⁴

2.3.7 California Code of Regulations, Title 4, Division 9, Chapter 6, Article 8, Sections 4180-4181 – Hydrogen fuel quality requirements⁵

Environmental Protection Agency 40 CFR: Protection of the Environment, Appendix B to Part 136 – Definition and Procedure for the Determination of the Method Detection Limit⁶

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology **D4150**.

3.2 Acronyms:

3.2.1 *AIST*, *n*—National Institute of Advanced Industrial Science and Technology

³ Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, <http://www.iso.org>.

⁴ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

⁵ Available from the California Office of Administrative Law, 300 Capitol Mall, Suite 1250, Sacramento, CA 95814, <http://www.oal.ca.gov/ccr.htm>.

⁶ Available from United States Environmental Protection Agency (EPA), William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20004, <http://www.epa.gov>.