

**SIGNIFICANCE TO COMMERCIALIZATION**

← *More Critical*

	<b>A: Essential To or Enables Commercialization</b>	<b>B: Important to Commercialization</b>	<b>C: Supports Commercialization</b>
<b>Highest Effort</b>	<p><b>ICAO Technical Instructions</b></p> <p><b>IEC Micro Fuel Cell Safety Standards</b></p> <p><b>Indoor refueling (fork lifts and other applications)</b></p> <p><b>US DOT Harmonization NPRM – HM215K</b></p> <p><b>ICC Model Codes</b></p> <p><b>NFPA 52</b> Vehicle Fuel Systems Code</p> <p><b>UL 2267</b> Fuel Cell Power Systems for Installation in Industrial Trucks</p> <p><b>CSA America HGV 4</b> Series for Fuel Dispensing Equipment and Components</p> <p>Modeling of a spectrum of fork lift hydrogen leak sizes and frequencies</p> <p><b>CSA America HPIT 1</b> Hydrogen Powered Industrial Trucks</p> <p>Fracture mechanics data suitable to develop design standards similar to ASME KD-10 with a suitable factor of safety for fuel cell fork lift tanks.</p> <p><b>Hydrogen Sensors</b> Standards UL 2075 ISA 12.13.01 Other Applications Requirements Regulations</p> <p><b>CSA America HPIT 2</b> Fuelling Hydrogen Powered Industrial Trucks</p> <p><b>SAE J 2919</b> Compressed Hydrogen Fuel Systems in Fuel Cell Powered Industrial Trucks</p>	<p>Micro Fuel Cell Interchangeability Standards IEC 62282-6-300</p> <p><b>UL 1741</b> Inverters, Converters and Controllers for Use in Independent Power Systems</p> <p><b>IEEE 1547.XX</b>, Interconnection of Distributed Generation – Application Guides</p> <p>State Permitting Templates (C&amp;S Gaps Analysis): California</p> <p><b>ISO/NP 14687-3</b> Hydrogen Fuel – Product specification – Part 3: proton exchange membrane (PEM) fuel cell application for stationary applications</p> <p><b>CSA America HGV 3.1</b> Fuel System Components for Hydrogen Gas Powered Vehicles</p> <p><b>SAE J 2600</b> Compressed Hydrogen Vehicle Fueling Connection Devices</p> <p><b>SAE J 2799 - TIR</b> 70 MPa Compressed Hydrogen Surface Vehicle Refueling Connection Device and Optional vehicle to Station Communication</p> <p><b>SAE J 2783</b> Liquid Hydrogen Surface Vehicle Refueling Connection Devices</p>	<p><b>ASME B31.12 H2</b> Piping and Pipeline Code</p> <p><b>SAE J 2572</b> Recommended Practice for Measuring the Exhaust Emissions, Energy Consumption and Range of Fuel Cell Powered Electric Vehicles using Compressed Gaseous Hydrogen</p>

**SAE 2600 & 2601** increased activity due to specialty vehicle use

**Hydrogen Dispenser Metrology**

**Inter-Laboratory Testing to validate ASTM protocols**

**International Organization for Legal Metrology (IOML) OIML R 81** Dynamic Measuring Devices and Systems for Cryogenic Liquids

**International Organization for Legal Metrology (IOML) OIML R 139** Compressed Gaseous Fuel Measuring Systems for Vehicles

**ISO/CD 14687-2** Hydrogen Fuel - Product Specification Part 2: PEM fuel cell applications for road vehicles

**SAE J 2719** Hydrogen Quality Guideline for Fuel Cell Vehicles

**ASTM D7550-09** Standard Test Method for Ion Chromatography Based Determination of Cations in Hydrogen and Other Fuel Cell Feed Gases

**ASTM WK4548** Standard Test Method for Determination of Trace Contaminants in Hydrogen and Related Fuel Cell Feed Gases

**ASTM WK5847** Standard Practice for Sampling of High Pressure Hydrogen and Related Fuel Cell Feed Stocks

**ASTM WK6527** Standard Test Method for Ion Selective Electrode Based Determination of Ammonia in Hydrogen

**ASTM WK6624** Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Hydrogen

**ASTM WK8150** Standard Test method for Determination of Ammonia in Hydrogen by Gas Chromatography and Nitrogen Chemiluminescence

**ASTM WK9688** Standard Test Method for Determination and Sampling of Particulate Matter in High Pressure Hydrogen Gaseous Fuel with In-Stream

Filter

**ASTM WK10196** Standard Test Method for Determination of Ammonia and Trace Water in Hydrogen and Other Fuel Cell Gaseous Fuels by Infrared Spectroscopy

**ASTM WK21162** Standard Test Method for the Characterization of Particles from Hydrogen Fuel Streams by Scanning Electron Microscope

**ASTM WK21597** Microscopic Measurement of Particulates in Hydrogen Fuel

**ASTM WK21611** Gravimetric Measurement of Particulate Concentration in Hydrogen Fuel

**ASTM WK22378** Standard Test Method for Analysis of Total Hydrocarbon Content in Hydrogen Fuel Using a THC Analyzer

**ASTM WK23815** Standard Test Method for Determination of Total Halocarbons Contained in Hydrogen and Other Gaseous Fuels

**ASTM WK24073** Standard Test Method for Determination of Trace Hydrogen Sulfide, Methyl Mercaptan and Carbonyl Sulfide in Hydrogen Fuel

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<b>Moderate Effort</b>	<p><b>CSA HGV 4.X Series</b></p> <p><b>NFPA 2</b> Hydrogen Technologies</p> <p><b>NFPA 55</b> Storage, Use and Handling of Compressed Gases and Cryogenic Fluids in Portable in Portable and Stationary Containers, Cylinders and Tanks</p> <p><b>Global Technical Regulations (GTRs) for Vehicles</b></p> <p><b>Micro Fuel Cell Transportation Regulations</b></p> <p><b>ANSI/CSA America FC1-2001</b> Fuel Cell Power Systems (Safety)</p> <p><b>IEC 62282-3-1 (2007-04)</b> Stationary Fuel Cell Power Systems - Safety</p> <p><b>NFPA 853</b>, Fuel Cell Installation</p> <p><b>NFPA 70</b> (National Electrical Code) <b>Article 692</b>, Fuel Cell Systems</p> <p>Revision to <b>FMVSS 305</b> and <b>SAE J1766</b>, Post Collision Electrical Safety in Vehicles</p> <p><b>FMVSS</b> for High-Pressure Compressed Hydrogen Storage in Vehicles, <b>CSA NGV/HGV</b>,</p> <p><b>SAE J2579- H2 Storage Systems (design &amp; performance)</b></p> <p><b>SAE J 2578</b> Recommended Practice for General Fuel Cell Vehicle Safety</p> <p><b>IEC 62282-6-300 (2009-06)</b> Micro Fuel Cell Power Systems - Fuel Cartridge Interchangeability</p> <p><b>HIPOC</b> (Hydrogen Industry Panel on Codes) Hydrogen Quality Standards(<b>ASTM, CGA, ISO, SAE</b>)</p> <p><b>New York City Construction &amp; Fire Codes</b></p> <p><b>Cargo Shipping regulations of Fuel Cells, Fuel Cell</b></p>	<p>California Air Resources Board Emissions Regulations for Stationary Generation</p> <p>Portable Fuel Cell Regulations</p> <p><b>UL 2266</b> on Fuel Cells in Telecomm applications</p> <p><b>UL 2265</b> - Micro Fuel Cell Safety</p> <p><b>ANSI/CSA America FC3-2004</b> Portable Fuel Cell Power Systems (Safety)</p> <p><b>IEEE 1547</b> - Interconnection of Distributed Generation</p> <p><b>ISO TC 197 WG#9</b> – Hydrogen Generators</p> <p><b>ISO TC 22 SC21</b> Hydrogen Vehicle Standards</p> <p>Hydrogen Sensor Standards – <b>ISO TC 197, UL 2075, ANSI/ISA 12.13.01/02</b></p> <p><b>IEC 62282-5-1 (2007-02)</b> Portable Fuel Cell Appliances – Safety</p> <p><b>IEC/PAS 62282-6-1</b> (2006-02) Micro Fuel Cell Power Systems - Safety</p> <p><b>IEC 62282-6-100</b> Micro Fuel Cell Power Systems – Safety</p> <p><b>ISO 13985</b> Liquid Hydrogen, Land Vehicle Fuel Tanks</p> <p><b>ISO/TS 15869</b> Gaseous Hydrogen Blends &amp; Hydrogen Fuels - Land Vehicles Fuel Tanks</p> <p><b>ISO TS 20100</b> Gaseous Hydrogen - Service Stations</p> <p><b>ISO 26142</b> Hydrogen Detector Apparatus</p> <p><b>SAE J 2601</b> Compressed Hydrogen Vehicle Fueling Communication Devices</p> <p><b>SAE J 2615</b> Performance Test Procedure of Fuel Cell Systems for Automotive Applications</p> <p><b>SAE J 2616</b> Performance Test Procedure of Fuel Processor Subsystem of Automotive Fuel Cell System</p>	<p><b>Stack Material &amp; Components</b> Protocols / Round Robins / Standardization / Investigations</p> <p><b>IEC 62282-3-2 (2006-03)</b> Stationary Fuel Cell Power Systems - Performance Test Methods</p> <p><b>ASME PTC 50</b> – Fuel Cell Performance</p> <p><b>ASME</b> Materials for a Hydrogen Economy</p> <p><b>FCTESTNET/QA</b></p> <p><b>IEC 62282-3-201</b> Small stationary polymer electrolyte fuel cell power system – Performance test method</p> <p><b>IEC/TS 62282-1 (2005-03)</b> Terminology</p> <p><b>IEC 62282-2 (2004-03)</b> Fuel Cell Modules</p> <p><b>IEC 62282-3-3 (2007-11)</b> Stationary Fuel Cell Power Systems - Installation</p> <p><b>IEC 62282-6-200 (2007-11)</b> Micro Fuel Cell Power Systems - Performance</p> <p><b>IEC 62282-7-1 TS Ed.1</b> Single Cell Test method for Polymer Electrolyte Fuel Cells</p> <p>IEC TC 105 Ad Hoc Group #1 Identification of the market needs for standardization work of fuel cell systems for propulsion and auxiliary power units</p> <p><b>ASTM WK7637</b> Measurement of Electrochemical Performance of Single Cell Planar Solid Oxide Fuel Cells</p> <p><b>UL 2075</b> Gas and Vapor Detectors and Sensors</p> <p><b>Outline of Investigation UL Subject 2264 B</b> Gaseous Hydrogen Generation Appliances - Water Reaction</p> <p><b>Outline of Investigation UL Subject 2265 A</b> Hand</p>

	<p><b>Cartridges, Fuel Cell Engines and Fuel Cell Vehicles</b></p> <p>UN Sub-Committee of Experts          ICAO Dangerous Goods Panel          IMO Dangerous Goods Code          ADR/ADN Joint Meeting          US DOT          Transport Canada</p> <p><b>IEC 62282-6-100</b> Micro Fuel Cell Safety</p> <p><b>ISO 17268:2006</b> Compressed Hydrogen Surface Vehicle - Refueling Connection Devices</p> <p><b>SAE J 2579</b> Recommended Practice for Fuel Systems in Fuel Cell and Other Hydrogen Vehicles</p> <p><b>SAE J 1766</b> Recommended Practice for Electric and Hybrid Electric Vehicle Battery Systems Crash Integrity Testing</p>	<p><b>SAE J 2617</b> Performance Test Procedure of PEM Fuel Cell Stack Subsystem for Automotive Application</p> <p><b>SAE J 2722</b> Recommended Practice for the Durability Testing of PEM Fuel Cell Stacks</p>	<p>Held or Transportable Fuel Cell Power Units with Fuel Containers - Methanol Fuel Cartridges</p> <p><b>Outline of Investigation UL Subject 2265 C</b> Hand Held or Transportable Fuel Cell Power Units with Fuel Containers - Borohydride Fuel Cartridges</p>
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<b>Low Effort</b>	<p><b>ISO 16111</b> Transportable Gas Storage Devices - Hydrogen Absorbed in Reversible Metal Hydrides</p> <p><b>CSA America HPRD1</b> Basic Requirements for Pressure Relief Devices for Compressed Hydrogen Vehicle Fuel Containers</p> <p><b>UL Subject 2266</b> Electromagnetic Compatibility, Electrical Safety, and Physical Protection of Stationary and Portable Fuel Cell Power Systems for Use with Commercial Network Telecommunication Equipment</p>	<p><b>SAE</b> performance, sustainability, and terminology documents for Fuel Cell Vehicles</p> <p><b>SAE J 2594</b> Fuel Cell Recyclability Guidelines</p> <p><b>SAE J 2760</b> Pressure Terminology Used in Fuel Cells and Other Hydrogen Vehicle Applications</p> <p><b>SAE J 2574</b> Information Report - Fuel Cell Electric Vehicle Terminology</p> <p><b>ISO 22734-1:2008</b> Hydrogen Generators Using Electrolysis Process</p> <p><b>ISO 16110-1</b> Hydrogen Generators Using Fuel Processing Technologies Part 1: Safety</p> <p><b>ISO 16110-2</b> Hydrogen Generators Using Fuel Processing Technologies Part 2: Test Method for Performance</p> <p>CSA America HGV2 Standards for Hydrogen Vehicle Fuel Containers</p>	<p>Standardized Industry Error Codes</p> <p><b>ASME B31.12</b> Performance based standard for approving Hydrogen components</p> <p>Propane Quality (Odorant) Standards</p> <p>IEC TC 105 Working Group #6 Fuel Cell Systems for Propulsion and Auxiliary Power Units</p> <p><b>ISO/PAS 15594</b> Airport Hydrogen Fuelling Facility Operation</p> <p><b>ISO TR 15916:2004</b> Basic Considerations for the Safety of Hydrogen Systems</p> <p><b>CSA America FC4</b> Fuel Cell Modules</p> <p><b>CSA America FC5</b> Hydrogen Generators</p> <p><b>CSA America FC11</b> Hand Held or Hand Transportable Fuel Cell Power Units with Fuel Containers</p> <p><b>UL Subject 2264 A</b> Gaseous Hydrogen Generation Appliances - Electrolyzer Technology Waiting for international standard ISO TC197 WG#8</p> <p><b>UL Subject 2264 C</b> (Joint activity with CSA America; FC5) Gaseous Hydrogen Generation Appliances - Fuel Processing Technology Waiting for international standard ISO TC197 WG#9</p>

Most recent changes are **HIGHLIGHTED**.