



Regulatory Affairs Matrix

March 31, 2024 Version

FCHEA’s Regulatory Affairs Matrix is a tool designed to report progress in the development of codes, standards, and regulations of interest to our members. Redline/strike-out markings depict changes over the past quarter. In addition to status updates on each document, position of items within the matrix provides information regarding application, activity level, and importance of the effort to commercialization.

The matrix is divided into clusters based upon application, such as infrastructure, portable power, stationary, etc. Applications are depicted in the far-right column. Level of activity is represented vertically, with items with the highest level of activity appearing towards the top of the matrix. Position within the columns represent the importance of the effort to industry commercialization timeframes.

The matrix is updated on a quarterly basis and reviewed with members during our technical working group meetings. Feedback is used to evaluate importance to commercialization and identify new efforts for future tracking.

For questions or updates regarding this matrix, please contact Karen Quackenbush by email at kquackenbush@fchea.org.

Significance to Commercialization
 More Critical ←
Highest Effort

| A. Essential To or Enables Commercialization | B. Important to Commercialization | C. Supports Commercialization | |
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| | <p>ISO 19880-2: Gaseous hydrogen filling station dispensers Comments from DIS are being resolved. Next stage is FDIS.</p> <p>ISO 17268 Gaseous Hydrogen Land Vehicle Refuelling Connection Devices: ISO/TC 197</p> | <p>NFPA 55: Compressed Gases and Cryogenic Fluids Code: 2023 edition has been published. The 2026 edition is now open for input until January 4, 2024. o ———— NFPA 55 Public Input is available online at https://submittals.nfpa.org/TerraViewWeb/V</p> | <p>INFRASTRUCTURE</p> <p>Transportation WG (all)</p> |

agreed to create a multipart series, based ISO/AWI 17268; to revise ISO/AWI 17268 “Gaseous hydrogen land vehicle refuelling connection devices” as ISO/AWI 17268-1 for a 24-month project duration. New title is proposed to be Gaseous Hydrogen land vehicle refuelling connection devices – Part 1: Flow capacities up to and including 120 g/s. This project will be developed by WG 5 under Vienna agreement. Work is now underway.

ISO/TC 197 invited United States to formally submit an NP to develop ISO/AWI 17268-2 “Gaseous hydrogen – Land vehicle refuelling connection devices” for a 36-month project duration. New title is proposed to be Gaseous Hydrogen land vehicle refuelling connection devices – Part 2: Flow capacities greater than 120 g/s. This project will be developed by WG 5, with Livio Gambone as project leader, under Vienna agreement.

ISO/AWI 17268-3 Gaseous hydrogen land vehicle refuelling connection devices — Part 3: Cryo-compressed hydrogen gas: Ballot to create the project has passed. Work is beginning.

ISO 19880-4: Gaseous Hydrogen Fueling Stations – Part 4 – Compressors: New Schedule to be confirmed once CD is circulated and project is officially restarted.

CSA B107 – Enclosed Hydrogen Equipment. Work has begun on a new standard that will address safety requirements related to hydrogen

[iewerPage.jsp?id=55-2023.ditap&draft=true&toc=false](#)
A task group is working to resolve any hydrogen overlap between NFPA 2 and NFPA 55. NFPA 2 will own all of the scope for hydrogen, so instead of extracting material from NFPA 55, it will be deleted from NFPA 55 and moved to NFPA 2. [The First Draft report will be posted by October 25, 2024.](#)

~~ISO CD 19885 -1, -2, -3 Gaseous hydrogen – Fuelling protocols for hydrogen fuelled vehicles – Parts 1, 2 and 3~~
~~Multiset of documents consisting of three key parts:~~

~~1. Design and development process for fueling protocols~~

A standard design and development process to ensure that work is conducted in a transparent manner to improve understanding and facilitate acceptance and implementation of a fueling protocol in dispensing systems. DIS ballot is closing.

~~ISO 19885-22–Definition of communications between the vehicle and dispenser control systems~~

Provide basic information needed by the developer of fueling protocols to define the methodology and data to be transmitted between the vehicle and dispenser control system. ~~Work is underway. Ballot currently out to restart this activity, create a new Working Group and nominate a Convenor.~~

Distribution WG
(NFPA 55, CSA B107)
Commercial WG
(NFPA 55, CSA B107)

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| | <p>equipment use inside an enclosure. <u>The committee is dispositioning Public Review and CSA Editorial comments. Public review ended on 24 December, 2023. Contact Mark Duda (mark.duda@csagroup.org) with questions or for additional information.</u></p> | <p>ISO 19885-3. High Flow Hydrogen Fueling Protocols for Heavy Duty Road Vehicles A universal and versatile HF (above 60 g/s) hydrogen fuelling protocol for HD applications including buses and trucks with primary focus on H70 Heavy-Duty High-Flow road vehicles and systems with large hydrogen capacity at gaseous hydrogen fueling stations. Part 1 is expected to be published soon. Part 2 will be balloted for restart and moved to a different working group with a new convener. Part 3 to be being balloted for restart and a new Project Leader.</p> | |
| | <p>ISO 19880-8- Gaseous hydrogen -- Fueling stations -- Part 8: Hydrogen quality control. DIS is out for vote and comment <u>voting closed. Awaiting results.</u></p> <p>ISO/AWI 14687: Hydrogen fuel quality Product specification – DIS is out for vote and comment.</p> <p>ISO 19880-9, Gaseous hydrogen — Fuelling stations — Part 9: Sampling for fuel quality analysis – Passed DIS vote. Next step is FDIS <u>FDIS registered for formal approval and publication.</u></p> | <p>ISO TS 19870 Methodology for Determining the Greenhouse Gas Emissions Associated with the Production, Conditioning and Transport of Hydrogen to Consumption Gate- Published December 2023. During the plenary meeting in November, ISO/TC 197/SC 1 agreed to create a multi-standard series based on ISO/TS 19870 “Methodology for determining the greenhouse gas emissions associated with the production, conditioning and transport of hydrogen to consumption gate” as a seed document as follows:</p> <ul style="list-style-type: none"> • ISO 19870-1 on H2 production to production gate. • ISO 19870-2 on LH2 to consumption gate. • ISO 19870-3 on NH3 to consumption gate. • ISO 19870-4 on LOHC to consumption gate. | <p>FUELS</p> <p>Transportation WG (All)</p> <p>Production WG (ISO/AWI 14687; ISO/NP TS 19870)</p> |

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| | | <p>ISO 13985: Liquid hydrogen — Land vehicle fuel tanks: A new revisions has been approved. Seeking interested parties to join WG 1.</p> | |
| | <p>IEC 62282-6-101 Micro Fuel Cell Power Systems – Safety- General Requirements The following documents recently completed CIB processing are in final publication:</p> <p>IEC 62282-6-101: Micro fuel cell power systems – Safety – General requirements IEC 62282-6-106 Micro fuel cell power systems – Safety – Indirect Class 8 (corrosive) compounds IEC 62282-6-107 Micro fuel cell power systems – Safety – Indirect water-reactive (Division 4.3) compounds. Submitted for FDIS ballot. Awaiting official results.</p> <p>Drones/UAS Commercial drones must be registered with the FAA. Non-commercial drones (hobby) no longer need to be registered with the FAA, but rules are in flux.</p> <p>Further FAA guidance for UAS: https://www.faa.gov/uas/resources/uas_regulations_policy/</p> <p>Rules for UAS are also being developed by ISO/TC 20 SC 16. Although there are no rules currently under development specific to hydrogen or fuel cells, this SC is very active developing and revising rules that would apply to such systems. https://www.iso.org/committee/5336224.html.</p> | <p>IEC 62282-6-300 Ed.2 - Fuel Cartridges – extended publication stability date to 2024.</p> <p>IEC 62282-6-200 Ed.3 - Micro Fuel Cells – Performance – stability date is now 2024.</p> <p>IEC 62282-6-401: Fuel cell technologies – Part 6-401: Micro fuel cell power systems – Power, data interchangeability and performance test methods for laptop computers: Addressing comments from CDV.</p> <p>Airworthiness certification guidelines: To fly a UAV above 55lbs in FAA airspace requires three types of additional certification. These include airworthiness certification of the aircraft. Guidelines exist for this but they are designed for manned airplanes and rotorcraft. Monitor for hydrogen and/or fuel cell applicability. See CFR, Title 14: Aeronautics and Space, PART 21— CERTIFICATION PROCEDURES FOR PRODUCTS AND ARTICLES</p> <p>ASTM WK60937: New Specification for Design of Fuel Cells for Use in Unmanned Aircraft Systems (UAS) under development. Negative vote in ballot requires addressing and reballoting.</p> | <p>MICRO</p> <p>Power WG (IEC docs) Transportation WG (all)</p> |

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| <p>NFPA 2: Hydrogen Technologies Code: 2023 edition has been published and is available at https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=2. Several Technical Interim Amendments have been balloted. The 2026 edition is open for public input until January 4, 2024 <u>underway</u>. The First Draft meeting is scheduled for the week of April 7, 2024. <u>First draft posting date is October 25, 2024.</u></p> | <p>ASME B31.12 Hydrogen Piping and Pipelines, will be due for its next revision soon. B31.12 was last published in 2019. B31.12 European International Working Group is in the works.</p> | <p>IEC 62282-7-2 ED 2 Fuel cell technologies – Part 7-2: Test methods – Single cell and stack performance tests for solid oxide fuel cells (SOFCs): Addressing comments from CD circulation.</p> <p>CSA CHMC 1, Test methods for evaluating material compatibility in compressed hydrogen applications – Metals: This project is to revise the existing edition of CHMC 1 to address updates in testing methods and clarify requirements. The kick-off meeting was scheduled for December 14, 2023. Please contact Iris Monner (iris.monner@csagroup.org) if interested in joining this work.</p> | <p>GENERAL</p> <p>Distribution WG (all)</p> <p>All WGs (NFPA 2)</p> |

Significance to Commercialization
 More Critical ←
 Moderate Effort

A. Essential To or Enables Commercialization

SAE/EuroCAE AS6858: Installation of Fuel Cell Systems in Large Civil Aircraft: This document is starting revision. It will be a joint SAE/EuroCAE publication. Experts are being sought.

B. Important to Commercialization

International Maritime Organization (IMO) SUB-COMMITTEE ON CARRIAGE OF CARGOES AND CONTAINERS: Developing Requirements for use of low flashpoint fuels on marine vessels – including provisions for fuel cells, bulk liquid hydrogen storage, and other fuels.
<http://www.imo.org/en/OurWork/Safety/Pages/Default.aspx>

SAE AS6679 - Liquid Hydrogen Storage for Aviation: This document defines the technical guidelines for the safe integration, operation and maintenance, and for certification of Liquid Hydrogen Storage Systems (LHSS) in aircraft. This document also defines guidelines for safe refuelling operation of hydrogen for aircraft. It is currently under revision. Hydrogen experts are sought.

SAE AS7373 - Gaseous Hydrogen Storage for General Aviation - This document defines the technical guidelines for the safe integration, operation and maintenance, and for certification of Gaseous Hydrogen Storage Systems (GHSS) in general aviation. This document also defines guidelines for safe refuelling operation of gaseous

C. Supports Commercialization

ASME BPV: Section VIII committee opened a project to explore options for proposed changes to mandate requirements for cell stack assemblies. Code Case 3078 has been approved for electrolyzers, and a task force has been established to set requirements for cell stack assemblies for fuel cells and electrolyzers for the 2025 revision of ASME BPVC Section VIII.

ISO/CD TR 17326: Fuel cell road vehicles — Cold start performances under sub-zero temperature — Vehicles fuelled with compressed hydrogen is In editing for FDIS ballot.

CSA SPE-701 – Hydrogen fuel storage containers for aviation applications - New project.

ISO/AWI 19888-1: Hydrogen Technologies Aerial Vehicles - Part 1: Liquid Hydrogen Fuel Storage System
New project launched in ISO/TC 197 SC1. This project specifies the requirements for design, material, construction, manufacture, testing,

TRANSPORTATION

Transportation WG (all except IEC, ASME and CGA)

Power WG (IEC, ASME)

Distribution WG (CGA)

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| | hydrogen for aircraft. It is currently under revision. Hydrogen experts are sought. | <u>and inspection of a refillable fuel system for liquid hydrogen used in the hydrogen-powered aerial vehicle, including manned and unmanned aerial vehicles. This work will consider an appropriate fuelling protocol that reflects conditions during the liquid hydrogen fuelling process.</u> | |
| <p>Global Technical Regulations (GTRs) for Vehicles: GTR for H2 and FC vehicles Phase II underway</p> <p>http://www.unece.org/fileadmin/DAM/trans/doc/2017/wp29/ECE-TRANS-WP29-2017-056e.pdf.</p> <p>GTR 13 Phase 2 was approved by GRSP. Awaiting results of WP 29 vote.</p> | <p>ISO 19887 Gaseous Hydrogen - Fuel system components for hydrogen fuelled vehicles has been established as a joint working group (JWG 30) between ISO/TC 197 and ISO/TC 22/SC 41 under the responsibility of ISO/TC 197. Work is ongoing. WD developed using CSA HGV 3.1 as seed document.</p> <p>WD also harmonizing with UN GTR No. 13, Phase 2.</p> <p>The document has been approved as a Draft International Standard.</p> | <p>SAE J2600: Compressed Hydrogen Surface Vehicle Fueling Connection Devices - Being revised in conjunction with ISO 17268.</p> <p>SAE J2572: Recommended Practice for Measuring Fuel Consumption and Range of Fuel Cell and Hybrid Fuel Cell Vehicles Fuelled by Compressed Gaseous Hydrogen voting in process<u>has been published. To be removed in next edition of the matrix.</u></p> <p>SAE J2799: Hydrogen Surface Vehicle to Station Communications Hardware and Software – ballot in process<u>sent to Motor Vehicle Council for approval.</u></p> | <p>VEHICLES</p> <p>Transportation WG (all)</p> |
| <p>NFPA 855: Standard for the Installation of Stationary Energy Storage Systems: 2023 edition <u>has</u> been published. 2026 edition was open for public input until June 1, 2023. First Draft Report Posting Date: March 21, 2024. Public Comment Closing Date: May 30, 2024.</p> | <p>ICC International Fire Code: ICC currently has 456 references of hydrogen gas in ICC codes and is engaging with industry to focus on keeping codes and standards up-to-date and addressing any code gaps regarding hydrogen technology. Work has in advance of the next revision cycles for the IFGC, IFC, and potentially others. An ICC Hydrogen Working Group has been established. The ICC The Hydrogen Fuel Gas WG recently completed their effort focusing on facilitating the use of hydrogen blends in buildings. It has been brought to ICC’s</p> | <p>ISO WG 21: Gaseous hydrogen fueling station compressors: Work continues to develop a CD.</p> <p>ISO 19880-5 WG 22 Gaseous hydrogen fueling stations– Dispenser hoses and hose assemblies CD ballot has been completed. WG 22 is polling to determine date for a virtual meeting to address the comments received.<u>WG 22 has been meeting to address</u></p> | <p>INFRASTRUCTURE</p> <p>Power WG (NFPA 855, CGA G-5.5, ICC, ISO 22734, FC 4, UL)</p> <p>Production WG (all CGA, ISO 22734, FC 4)</p> |

SAE J2601: Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles – open for revision

U.S. Weights and Measures Standards - [A final report on national conference of weights and measure committee reviewing hydrogen activities will be available soon. The final reports of decisions made during the July 30– August 3, 2023 108th National Conference on Weights and Measures \(NCWM\) Annual Meeting in Norfolk, VA are planned for publication in the October/November 2023 timeframe.](#)

attention that based on the amount of H2 admixture with natural gas that traditional pipe sizing methodology for natural gas may need result in an increase in size dependent upon the amount of H2 admixture added for blending. AGA will provide additional sizing tables if determined necessary. ICC’s goals for 2024 will be to develop jurisdictional permitting and plan review guidance for US Clean Hydrogen Hub projects, inspection checklists and best practice guidance documents for building and fire officials for H2 production, storage, distribution, and end use. Additionally, ICC will also seek to assist in the development and implementation of H2 installer credentialing to support safe installation and maintenance of H2 systems.

CGA G-5: Hydrogen - CGA has started the process of designating this as an ANSI standard. The ANS committee has resolved all proposed changes. Next step is a 45-day public review. <https://portal.cganet.com/WorkItem/Details.aspx?id=22-019>

CGA G-5.5 – Hydrogen Vent Systems: Deadline to submit proposed changes for next edition is 03/04/2026. https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=26-3 The task force- met 19 and 20 October 2023 to review test results.

CGA G-5.4, Standard for hydrogen piping systems at user locations - Deadline to submit proposed changes for next edition is 12/22/2024.

[remaining comments and is on target to register a DIS in May 2024.](#)

ISO 19880-6 WG 23: Gaseous hydrogen fueling station fittings. WG 23 now working to resolve CD comments. Project was administratively cancelled on May 1, with an expectation to ballot restarting the work when the DIS is ready to be registered.

SAE J2601/4: Ambient Temperature Fixed Orifice Fueling – establishes the protocol and process limits for hydrogen fueling of light duty vehicles when the fuel delivery temperature is not pre-cooled, so called “ambient fueling” designated by Table 1 of SAE J2601-2014. ~~Comment resolution underway.~~ [Reconciliation is complete. Document sent back to SAE for rebalot.](#)

SAE TIR J2601/5 High-Flow Prescriptive Fueling Protocols for Gaseous Hydrogen Powered Medium and Heavy-Duty Vehicles : HD Fueling using the MC Method (title may change): Under development. Draft posted. [Has been published. To be removed in next revision of the matrix.](#)

CSA HGV 5.1, Residential hydrogen fuelling appliances-- This project is to develop a NEW

Commercial WG (ICC, all CGA, ISO 22734, FC 4)

Transportation WG (ICC, All SAE, CGA, and ISO, except ISO 22734, US Weights and Measures)

https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=24-54

CGA G-5.6, Hydrogen pipeline systems: Deadline to submit proposed changes for next edition is 8/1/2023.

https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=19-018

CGA work item 21-127, Transfer and unloading of hydrogen at near-consumer use points – Work initiated to develop a new standard to update traditional hydrogen delivery practices for industrial users to improve practices for retail applications.

ISO 22734-1: Hydrogen generators using water electrolysis Test protocols and safety Requirements – Revision of ISO 22734:2019

~~in order to establish any additional safety requirements and test methods needed for:~~

- ~~i. operation of water electrolysis systems coupled with the electricity distribution grid and/or fluctuating and intermittent renewable energy sources (RES) in a dynamic mode.~~
- ~~ii. safety requirements for venting of oxygen~~
- ~~iii. requirements for scale up including electrolyser systems installed into buildings~~
- ~~iv. other areas, such as

 - ~~a. including learnings from other enclosed systems (e.g. HRS) and pre-normative research projects;~~~~

standard for Residential fueling appliances. Project was kicked off in October 2023. Content development continues has stalled.

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| | <p>b. safety integrated systems; c. power electronics for connection to the grid; and d. specific requirements when incorporated into specific applications, e.g. as part of HRS, or hydrogen grid injection system e. (additionally) input from other stakeholders, e.g. IEC/TC 31, is currently in DIS stage.</p> <p>ISO 19880-7: Gaseous hydrogen Fueling stations O rings – The new IS shall be harmonized with existing ISO 3601 family Fluid Power Systems O rings. List of types and quality acceptance criteria of O rings, back up rings, which are described in ISO 3601 1, 3, 4, are considered to be referenced In the new IS. Special features of groove design and materials for high pressure hydrogen seal are to be discussed in the new IS. CD comment period closing.</p> | | |
| | <p>CGA work item 21-128, Noise from hydrogen venting and hydrogen systems operations – Work is underway to develop a new standard to reduce the noise from hydrogen system operations, including venting, particularly at retail applications where hydrogen system noise is greater than ambient noise.</p> <p>CGA work item 22-107, Hydrogen system best practices— Developing a new standard to capture recommended best practices for handling hydrogen, filling containers, starting up systems,</p> | <p>ISO TR 15916: <i>Basic considerations for the safety of hydrogen systems</i>, is open for revision under WG 29. Comments from the CD circulation have been addressed. TC 197 plans to will move the document to become a Technical Specification (Normative). <u>The effort to revise as a Technical Specification is starting.</u></p> <p>PWI 105-1: Group title: WG 105 General Safety Standard – new activity starting.</p> | <p>GENERAL All WGs (all)</p> |

maintaining hydrogen systems, and similar topics to ensure safe practices for those new to the hydrogen space and to share best practices with those already experienced with hydrogen. The task force has completed the first draft, which is now going through staff review and then membership review. The task force will meet to resolve comments from staff review.

CGA new work item – TBD – call for experts

Work has begun on a new bi-national standard, entitled “Hydrogen production intensity quantification and verification”. The purpose of this bi-national standard is to determine the emissions profile of hydrogen production accurately and consistently based on production methods. A more accurate classification system could replace or supplement the current colour classification in place (i.e., gray, blue, and green hydrogen). The bi-national quantification standard aims to include the following:

- A process to establish life cycle assessment boundaries for each hydrogen production method, from cradle to gate
- Determination of the appropriate hydrogen quality specification to ensure quantification of production is resulting in equivalent comparisons and,
- Establishment of validation and verification requirements to provide assurance of emission profiles.

CGA work item 22-116, Hydrogen separation distances – New activity. CGA is developing a globally harmonized standard on the methodology for developing separation distances between hydrogen systems and exposures. The standard will provide details on mitigation techniques for reducing required distances, particularly in near-consumer locations (such as vehicular fueling) where room is limited. The JWG has met multiple times via web conferences and met in person February 6-7 to continue work on the draft. 2024 web conferences are scheduled for 21 March 2024, 3 April 2024, and 2 May 2024. The working group has a first outline and continues to add content. The JWG met via web conference 5 April 2023, 4 May 2023, 18 May 2023, 8 June 2023, 7 July 2023, 30 August 2023, 29 September 2023, 27 October 2023, 17 November 2023, and 15 December 2023 via web conference. An in-person meeting scheduled for 6-7 February 2024 at CGA headquarters in McLean, VA.

CGA H-4, Terminology associated with hydrogen fuel technologies - Deadline to submit proposed changes for next edition is 12/1/2024. However, all the content has been added to the updated version of CGA G-5. Once CGA G-5 has been issued, CGA H-4 will be retired. For updates use the following link:
https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=24-59

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| | | <p>CGA work item 22-127, Hydrogen education plan: CGA is developing a globally harmonized standard on hydrogen emergency response and safe hydrogen handling training. The JWGW has finished work on the draft document.</p> | |
| <p>CSA FC 6: Fuel cell/water electrolysis module— CSA Group is developing the first edition of the binational CSA FC 6 * C22.2 No. 62282-2-100 – Fuel Cell Technologies – Part 2-100: Fuel cell modules – Safety (IEC 62282-2-100, MOD). This project will be adopting IEC 62282-2-100— Fuel Cell Technologies – Part 2-100: Fuel cell modules – Safety for US and Canada. The committee will be expanding the scope of the adoption to include water electrolysis modules including cell stacks as the requirements will be similar to fuel cell modules and there is an immediate industry need for a water electrolysis module safety standard. Contact Mark Duda (mark.duda@csagroup.org) with questions or for additional information.</p> | <p>IEC 62282-3-100 Stationary fuel cell power systems – Safety 3rd edition revision underway.</p> <p>IEC 62282-2-400 ED1: Fuel cell technologies— Part 2-400: Fuel cell modules— Calculation of Rated Power and Power Density of a PEM stack and PEM module – new activity underway.</p> <p>IEC 62282-3-202 ED1: Fuel cell technologies— Part 3-202: Stationary fuel cell power systems— Performance test methods for small fuel cell power systems that can be complemented with a supplementary heat generator for multiple units operation by an energy management system. Underway. In CD stage.</p> <p><u>IEC 62282-3-300: Fuel cell technologies - Part 3-300: Stationary fuel cell power systems – Installation</u> <u>Revision started.</u></p> <p><u>IEC 62282-8-101: Fuel cell technologies - Part 8-101: Energy storage systems using fuel cell modules in reverse mode - Test procedures for the performance of solid oxide single cells and stacks, including reversible operation</u></p> | <ul style="list-style-type: none"> • ISO/DIS 19884, Gaseous hydrogen – Cylinders and tubes for stationary storage: ISO/TC 197 agreed to create a multi-part document developed by WG 15“Cylinders and tubes for stationary storage” with Proposed Convenor John Eihusen, in order to: <ul style="list-style-type: none"> • renumber ISO 19884 to be ISO 19884-“Gaseous Hydrogen Cylinders and tubes for stationary storage – Part1: General Requirement”; CD failed. Project has been cancelled, although it may be restarted at some point in the future. • create ISO/TR 19884-2“Gaseous Hydrogen Cylinders and tubes for stationary storage – Part 2: Material test data of class A materials (steels and aluminum alloys) compatible to hydrogen service” for a 24-month project duration, with Project Leader Prof. Nobuhiro Yoshikawa; • create ISO/TR 19884-3“Gaseous Hydrogen Cylinders and | <p>STATIONARY</p> <p>Power WG (all)</p> <p>Distribution WG (ISO/DIS 19884)</p> |

Revision started.

IEC 62282-8-102: Fuel cell technologies - Part 8-102: Energy storage systems using fuel cell modules in reverse mode - Test procedures for the performance of single cells and stacks with proton exchange membrane, including reversible operation

Revision started.

ASME PTC 46, new appendix on electrolyzers, recruiting for experts. Work is expected to begin Spring 2024.

tubes for stationary storage – Pressure cycle test data to demonstrate shallow pressure cycle estimation method” for a 24-month project duration, with Project Leader Prof. Nobuhiro Yoshikawa.

ASME PTC 50, the Fuel Cell Power System Performance Testing Code, began revision work. This effort is expected to help standardize performance reporting across the industry.

IEC 62282-3-200: Part 3-200: Stationary fuel cell power systems-- Performance test methods – Revision underway. CD comments being addressed.

IEC 62282-8-201 Ed.2 Fuel cell technologies-- Part 8-201: Energy storage systems using fuel cell modules in reverse mode-- Test procedures for the performance of power-to-power systems – Revision underway. CD posted. Awaiting results.

IEC 62282-9-101: Evaluation methodology for the environmental performance of fuel cell power systems based on life cycle thinking-- Streamlined life-cycle considered environmental performance characterization of stationary fuel cell combined heat and power systems for residential applications – Revision to start soon.

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| | | <p>IEC 62932-2-2: Flow battery energy systems for stationary applications-- Part 2-2: Safety Requirements – planning next edition.</p> | |
| | <p>IEC 62282-5-100:2018: Portable Fuel Cell Appliances – Safety: Published. Not yet adopted in U.S. Seeking interest. <u>To be removed in next edition of this matrix until IEC to opens document for revision in 2023.</u></p> | | <p>PORTABLE</p> <p>Power WG (all)</p> |

Significance to Commercialization

More Critical ←

Lowest Effort

| A. Essential To or Enables Commercialization | B. Important to Commercialization | C. Supports Commercialization | |
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| | <p>SAE AIR 8466, Hydrogen Fueling of Aircraft, in both gaseous and liquid form: 2023 version of the H2-Aero Whitepaper from the vertical flight society to be used as a basis.</p> <p>SAE H2-Aero Whitepaper download (VFS Website-public): https://vtol.org/download.cfm?downloadfile=FDA0AB2D-B06C-15F1-5AD5823F326F5CDE&typename=dmFile&fieldname=filename.</p> | <p>IEC 63341-3 ED1. Railway applications-- Rolling stock-- Part 3: Fuel cell systems for propulsion-- Performance requirements and test methods. Assigned to JWG 51. Addressing CD comments.</p> | <p>TRANSPORTATION</p> <p>Transportation WG (all)</p> |
| | <p>SAE J1766: Recommended Practice for Electric, Fuel Cell and Hybrid Electric Vehicle Crash Integrity Testing – revised. Action needed. Awaiting GTR 13 Phase 2</p> <p>ISO 19881: Gaseous hydrogen – Land vehicle fuel containers and ISO 19882: Gaseous hydrogen – Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers (AWI 19981 and AWI 19882) have been opened for revision. These had been previously put on hold. Activities will focus on incorporating Type 3</p> | <p>SAE TIR J3202: Recommended Practice for Measuring and Simulating Fuel Consumption and Range of Heavy Duty Fuel Cell Hybrid Road Vehicles Fueled by Compressed Gaseous Hydrogen – underway.</p> <p>CSA HGV 2, Compressed hydrogen gas vehicle fuel containers— This project is a revision of an existing standard. Content development meetings have concluded and the public review period closed July 11. The TSC is dispositioning comments and ballot to Technical Committee is being planned.</p> | <p>VEHICLES</p> <p>Transportation WG (all)</p> |

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| | <p>and conformable container designs, and working on harmonization with UN GTR 13 Phase II. The WG is working towards consensus on acceptable materials and a suitable ground storage standard that can be used globally. Work is underway. A DIS has been registered for both documents.</p> | <p>SAE J2990/1: Gaseous Hydrogen and Fuel Cell Vehicle First and Second Responder Recommended Practice – Revision initiated. Meeting scheduled to address comments.</p> <p>SAE J3294: Guidance for Material Selection for use in Hydrogen Systems. Meeting scheduled to address<u>Soliciting</u> comments.</p> <p><u>IEC PNW 105-1035: Unmanned aircraft systems – General requirements and test methods for hydrogen fuel gas pipes of gaseous fuel cell powered UAV.</u> <u>(specifically excludes stacks)</u> <u>Preliminary work item starting. ISO/TC 20/SC 16 is leading the effort, with IEC/TC 105 invited to participate.</u></p> <p><u>IEC PNW 105-1036: Unmanned aircraft systems – General requirements and test methods for the attachable hydrogen cylinders of gaseous hydrogen fuel cell Powered UAV.</u> <u>Preliminary work item starting. ISO/TC 20/SC 16 is leading the effort, with IEC/TC 105 invited to participate.</u></p> | |
| | <p>OSHA Requirements for Hydrogen FCHEA HCTF new activity-- At the present time, 29 CFR has a long list of requirements for hydrogen systems and also provides guidance for hydrogen pressure vessels and associated equipment that is long out of date. These requirements can be seen here:</p> | <p>CGA H-3 cryogenic hydrogen storage: The ANS committee has resolved all the proposed changes, including a request to add flow arrows to the flow diagrams. This publication is in staff review prior to Council Ballot. After council approval, H-3 will be sent for 45-day</p> | <p>INFRASTRUCTURE</p> <p>All WGs (OSHA)</p> <p>Transportation WG (All CSA, NIST, ASTM)</p> |

http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9749

It is recommended that these requirements be replaced by the up-to-date requirements of NFPA 2.

CGA H-14, HYCO plant gas leak detection and response practices: Deadline to submit proposed changes for next edition was 12/8/2023.
https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=23-045

CGA H-15, Safe catalyst handling in HYCO plants: Deadline to submit proposed changes for next edition is 9/1/2025.
https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=25-59

CGA H-17, Small scale hydrogen production and delivery: New publication not released yet. Council ballot due 9 Aug 2023, IHC Association approvals due 7 Sept 2023. Pending no comments, estimated publish date by the end of September.
<https://portal.cganet.com/WorkItem/Details.aspx?id=18-093>

CGA P-28, OSHA process safety management and EPA risk management plan guidance document for bulk liquid hydrogen supply systems: Deadline to submit proposed changes for next edition is 08/01/2027
https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=25-49.

public review after council approval to move through the ANS process.

CGA H-5 standard for bulk storage systems
 CGA has started working on resolving the proposed changes and will issue G-5 as an ANSI standard. For updates on the work item progress see
<https://portal.cganet.com/WorkItem/Details.aspx?id=22-019>

ANSI/CGA H-5, Standard for bulk hydrogen supply systems
 The deadline to submit proposed changes for the next edition is 2/26/2024.
https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=24-010

CGA G-5.3, Commodity specification for hydrogen - Deadline to submit proposed changes for next edition was 5/1/2023. A total of 7 PCs have been submitted. PC resolution is ongoing.
https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=22-013

CSA HGV 5.2 - Hydrogen Fueling Systems:
~~TSC Chairs have dispositioned comments from ballot. The document is being prepared to publish in early 2024. Working with the TC and TSC Chairs to disposition. A second ballot is being planned.~~

CSA HGV 4.3 – Fueling parameter evaluation
~~Document has been revised for use as a~~

Production WG (All CGA)

Distribution WG (All CGA)

Power WG (ISO)

CGA PS-31, Position statement on cleanliness for proton exchange membranes hydrogen piping / components: Deadline to submit proposed changes for next edition is 6/12/2025.
https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=25-16

CGA PS-33, Position statement on the use of LPG or propane tanks as compressed hydrogen storage buffers: Deadline to submit proposed changes for next edition is 12/10/2026.
https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=25-41

CGA PS-46, Position statement on roofs over hydrogen storage systems: Deadline to submit proposed changes for next edition was 3/6/2023.
https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=23-012

ISO AWI TR 22734-2 Hydrogen generators using water electrolysis – Part 2: Testing guidance for performing electricity grid service
 This activity has been transferred to the newly-formed ISO/TC 197 SC 1. The project has not yet been posted to the SC 1 webpage.

CSA HGV 4.8, Compressors: This project is to revise an existing edition of HGV 4.8 compressor standard to address updates in compressor technology. CSA seeks compressor manufacturers to join the TSC. Please contact Sara Marxen (sara.marxen@csagroup.org) if interested in joining this work.

~~certification document and–The document is being prepared for Technical Committee Ballot in early 2024.Public review closed October 8, 2023. Meeting with TSC Chairs will be scheduled soon to review comments.~~

CSA HGV 4.5, Priority and sequencing equipment for hydrogen vehicle fueling -
 This project is to develop a standard to REINSTATE an updated edition of a Priority and Sequencing standard. Draft document is being prepared to publish.

CGA H-10, Combustion safety for steam reformer operation: ~~Deadline to submit proposed changes for next edition is 9/21/2024.~~
https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=23-038~~Deadline to submit proposed changes for next edition was 12/1/2023.~~
https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=23-038

CGA H-11, Safe start-up and shutdown practices for steam reformers: Deadline to submit proposed changes for next edition is 8/11/2025.
https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=25-30

CGA H-12, Mechanical integrity of syngas outlet systems: Deadline to submit proposed changes for next edition is 6/1/2023.
https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=21-016

CSA B401.3, Hydrogen vehicle and trailer maintenance facilities code: [This project is a new Canadian code that will be aligned with existing maintenance facility requirements in CSA B401.1 \(natural gas\) and existing hydrogen requirements – BNQ 1784-000 and NFPA 2 and 30A.](#) ~~This project is to start a new standard that will be aligned with existing maintenance facility requirements in CSA B401.1 (natural gas) and existing hydrogen requirements – BNQ 1784-000 and NFPA 2 and 30A. Please contact Iris Monner (iris.monner@csagroup.org) if interested in joining this work.~~

CGA H-13, Hydrogen pressure swing adsorber (PSA) mechanical integrity requirements: Council ballot due 21 Aug 2023, IHC Association approvals due 18 Sept 2023. Pending no comments, estimated publish date by the end of September. https://portal.cganet.com/Publication/Workpace/Outline.aspx?work_id=22-027

CGA P-48, Position statement on clarification of existing hydrogen setback distances and development of new hydrogen setback distances in NFPA 55: Deadline to submit proposed changes for next edition was 2/12/2021. Standard has been on hold until NFPA 2:2023 has been issued. Now that NFPA 2:2023 has been issued, work will restart on updates to PS-48 to point to NFPA 2 for hydrogen. For updates see the link below: <https://portal.cganet.com/WorkItem/Details.aspx?id=21-062>

ASTM D7634 Visualizing Particulate Sizes – Interlaboratory study in progress.
ASTM D7653 – 18: Standard Test Method for Determination of Trace Gaseous Contaminants in Hydrogen Fuel by Fourier Transform Infrared (FTIR) Spectroscopy

Interlaboratory study in progress. Looking for funding to purchase the cylinders for the study.

ASTM D7675-15: Standard Test Method for the Determination of Total Hydrocarbons in Hydrogen by FID Based Total Hydrocarbon (THC) Analyzer

This test method describes a procedure for total hydrocarbons (THC) measurement in hydrogen intended as a fuel for fuel cells on a C1 Basis. Total Hydrocarbons on a C1 basis is an analytical technique where total carbon is determined, and all of the hydrocarbons are assumed to have the same response as Methane. Sensitivity from 0.1 part per million (ppm, $\mu\text{mole/mole}$) up to 1000 parts per million (ppm, $\mu\text{mole/mole}$) concentration are achievable. Higher concentrations can be analyzed using appropriate dilution techniques. This test method can be applied to other gaseous samples requiring analysis of trace constituents provided an assessment of potential interferences has been accomplished. Proposed revision WK 70956. Interlaboratory study in progress.

ASTM D7651 Gravimetric Measurement of Particulate Concentration - Interlaboratory study required. Looking for a technical expert to lead this effort.

ASTM D7892 Total Organic Halides, Total Non-Methane Hydrocarbons, and Formaldehyde by GC-MS - Interlaboratory study in progress. Looking for funding to purchase the cylinders for the study.

ASTM D7941/7941M-14: Standard Test Method for Hydrogen Purity Analysis Using a Continuous Wave Cavity Ring-Down Spectroscopy Analyzer

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 contaminant including, but not limited to, water, oxygen, methane, carbon dioxide, carbon monoxide, ammonia and formaldehyde.

Awaiting results of ballot at the subcommittee level.

ASTM D7606 Sampling of High Pressure Hydrogen - Work group WK85676 was started. Discuss heavy duty sampling and harmonization with ISO 19880-9. Monthly meetings.

ASTM D7676 Screening Method for Organic Halides in Gaseous Fuels – Standard open for review.

ASTM Aviation Hydrogen - Work group WK85474 has been started. Looking for experts to join this group.

ASTM Natural Gas, Hydrogen Blends for Use as a Motor Vehicle Fuel - Ballot closed and received one negative.

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| | <p>ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air: published every two years. The 2019-2020 edition of the International Civil Aviation Organization’s (“ICAO”) Technical Instructions for the Safe Transport of Dangerous Goods by Air (Doc 9284) (“TIs”), upon which the Dangerous Goods (Consignment by Air) (Safety) Ordinance (CAP. 384) and Air Navigation (Dangerous Goods) Regulations (Schedule 16 to CAP. 448C) are based, went into effect on 1 January 2019.</p> <p>https://www.cad.gov.hk/english/pdf/2019-2020%20ICAO%20TI%20Major%20Changes.pdf</p> | | <p>CARGO</p> <p>Transportation WG (all)</p> |
| | <p>IEEE 1547: IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces - IEEE SCC21 has started to revise IEEE 1547-2018 Interconnection Standard.</p> <p>IEEE P1547.10 Recommended Practice for DER Gateway Platforms has begun work on their next revision.</p> | <p>IEC/TC 105 AHG 11: New Work Item on accelerated stress testing for SOFCs and PEMs.</p> <p>IEC 62282-9-102: Evaluation methodology for the environmental performance of fuel cell power systems based on life cycle thinking – Product category rules for environmental product declarations of stationary fuel cell power systems and alternative systems for residential applications – anticipating revision work to start.</p> <p>IEEE P1547.3/D3.07, Draft Guide for Cybersecurity of Distributed Energy Resources Interconnected with Electric Power Systems:</p> | <p>STATIONARY</p> <p>Power WG (all)</p> |

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| | | <p>This document provides guidelines for Cybersecurity of Distributed Energy Resources (DER) interconnection with Electric Power Systems (EPS). To be updated to provide guidance by referring to the cybersecurity features available in the protocols specified by IEEE Std, 1547-2018 (IEEE Std 1815, IEEE Std 2030.5, Sunpec Modbus), along with new cybersecurity concepts and technologies that have been developed over recent years. Document has been published, and will be removed in the next edition of the matrix.</p> | |
| | | <p>Drones/UAS</p> <p>Many activities in in ISO/TC 20 SC 16: SCOPE: Standardization in the field of unmanned aircraft systems (UAS) including, but not limited to, classification, design, manufacture, operation (including maintenance) and safety management of UAS operations.</p> <p>These activities are not specific to fuel cells for drones, but will be applicable to drones using any technologies. For further information, see https://www.iso.org/committee/5336224.html.</p> | <p>MICRO</p> <p>Transportation WG (all)</p> |

Please note that details of standards and activities that have been published but not currently under revision are no longer shown in the matrix. They are added back to the matrix when the activity enters revision cycle.

List of Frequently-Used Acronyms:



CD - Committee Draft

2CD - Second Committee Draft (Did not reach consensus first time)

CD2 - same as above

CDV - Committee draft for vote (term used by IEC to distinguish between a document out for comment only and one ready for vote)

DIS - Draft International Standard (achieved consensus to move from CD phase)

FDIS - Final Draft International Standard (passed DIS vote)

WG - Working Group

IEC - International Electrotechnical Commission - the international standards body for electrochemical devices, including fuel cells, which is covered by Technical Committee 105 (TC 105)

TC - Technical Committee