

Codes, Standards and Regulatory Framework for Hydrogen Value Chain Development in Alberta

Anirudha Joshi

Graduate Research Assistant, Department of Chemical Engineering, University of Alberta

Dr. Fereshteh Sattari

Research Director, Lynch School of Engineering Safety and Risk Management, Department of Chemical Engineering, University of Alberta

Dr. Mohd Adnan Khan

Research Fellow, TheTransition Accelerator; Assistant Professor, Department of Chemical Engineering, University of Alberta

Dr. Lianne M. Lefsrud, P.Eng.

Risk Innovation and Sustainability Chair and Professor, Lynch School of Engineering Safety and Risk Management, Department of Chemical Engineering, University of Alberta

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Table of Contents

1 Introduction.....	3
2 Authorities Having Jurisdictions (AHJ)	3
3 Hydrogen value chain and segments	4
4 Potential Regulatory Framework for hydrogen project/facility development in Alberta.....	7
5 Observations	17
6 Next steps.....	17
7 References	18
8 Appendix A	21

List of Tables

Table 1: List of responsible AHJ's in Alberta for regulating hydrogen projects	3
Table 2: Segment 1 – Hydrogen production	5
Table 3: Segment 2 – Hydrogen storage	5
Table 4: Segment 3 – Hydrogen distribution/delivery	6
Table 5: Segment 4 – Hydrogen end-use	6
Table 6: Potential Provincial acts/permits/approvals with applicability to hydrogen segments	8
Table 7: Segment 1a: Hydrogen production via methane pyrolysis - Applicable standards .	21
Table 8: Segment 1b: Hydrogen production via Electrolysis - Applicable standards.....	21
Table 9: Segment 2: Hydrogen storage - Applicable standards	23
Table 10: Segment 3a: Hydrogen distribution/delivery via tube trailer - Applicable standards	27
Table 11: Segment 3b: Hydrogen distribution/delivery via pipelines - Applicable standards	28
Table 12: Segment 3c: Hydrogen distribution/delivery via railways - Applicable standards .	30
Table 13: Segment 4a: Hydrogen end-use: Refueling station - Applicable standards.....	31
Table 14: Segment 4b: Hydrogen end-use: Heavy duty vehicles - Applicable standards	35
Table 15: Segment 4c: Hydrogen end-use: Domestic/Commercial applications - Applicable standards	43
Table 16: Segment 4d: Hydrogen end-use: Power generation - Applicable standards	45

List of Figures

Figure 1: Hydrogen value chain development divided into segments.....	4
Figure 2: Potential regulatory for establishing a hydrogen facility/project in Alberta.....	7

1 Introduction

The province of Alberta released its vision and goals for deploying hydrogen across domestic and international markets in the Alberta Hydrogen Roadmap in November 2021, with the next step being the development of a transparent regulatory framework [1]. To establish a regulatory framework for hydrogen, it is crucial to identify the relevant Authorities Having Jurisdiction (AHJs) and their responsibilities in regulating different segments of the hydrogen value chain in Alberta.

2 Authorities Having Jurisdictions (AHJ)

Various regulatory bodies would oversee different segments of the hydrogen process, ranging from production to distribution/delivery and ultimately to end-use. It is important to note that there may be overlapping responsibilities of different AHJs for different segments in the hydrogen value chain, such as transfer points for the commodity. Therefore, it is important to examine applicability of different acts/approvals/permits required to establish, operate, and maintain future hydrogen projects/facilities in Alberta. Table 1 shows the list of identified AHJ's are/might be responsible for different segments in the development of the hydrogen value chain in Alberta.

Table 1: List of responsible AHJ's in Alberta for regulating hydrogen projects

ID	Responsible AHJ
1	Ministry of Environment and Protected Areas (AEP)
2	Alberta Energy Regulator (AER)
3	Alberta Boilers Safety Association (ABSA)
4	Alberta Utilities Commission (AUC)
5	Municipal Affairs
6	Aboriginal Consultation Office (ACO)
7	Alberta Transportation
8	Nav Canada
9	Ministry of Arts, Culture and Status of Women
10	Safety Standards Council of Canada
11	Measurement Canada
12	Energy and Minerals
13	Canadian Standards Association

3 Hydrogen value chain and segments

To examine the applicability of different Authorities Having Jurisdiction (AHJs) and regulatory requirements, the hydrogen value is divided into four segments and ten sub-segments, as shown in Figure 1.

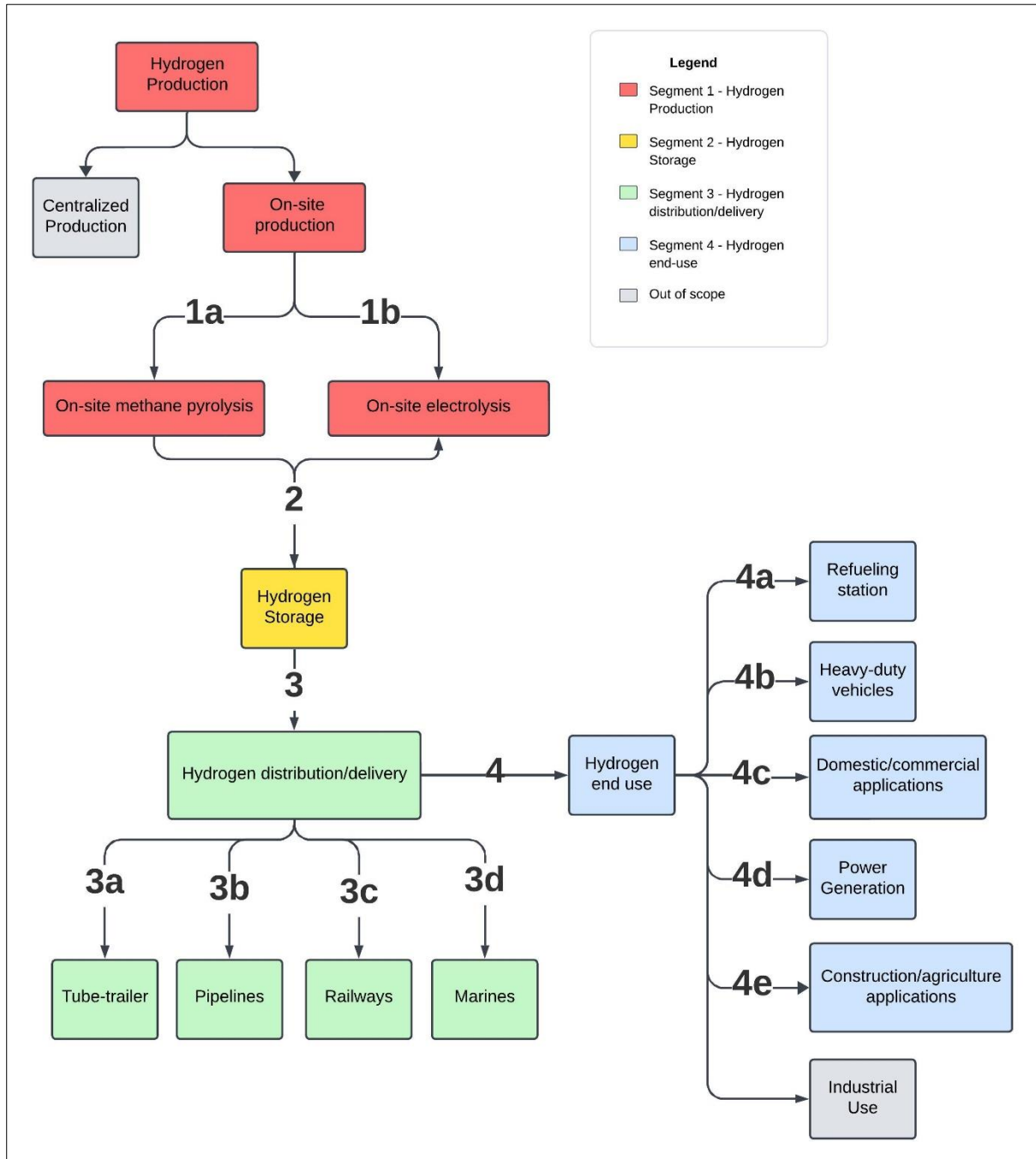


Figure 1: Hydrogen value chain development divided into segments.

The hydrogen segments and sub-segments are broadly described from Table 2 to Table 5.

Table 2: Segment 1 – Hydrogen production

Potential AHJ's responsible	1, 2, 3, 4, 5, 7, 9, 10	
Sub-Segment	1a [2,3]	1b [3]
Segment Description	Hydrogen production via on-site methane-pyrolysis	Hydrogen production via on-site electrolysis
Segment Input material	Fossil methane feedstock (Natural gas) or Biomethane	Water
Energy Input	Fuel (for heating purpose) /electricity	on-grid electricity
		off-grid electricity
Segment Components	Pyrolysis reactor	Electrolyzer system
	Gas conditioning equipment	Water treatment
	Waste heat recovery system	Gas conditioning
	Closed-loop cooling water system	Power source
	Flare system	Hydrogen storage
	Carbon storage	Oxygen storage
	Utilities and infrastructure.	Site clearing and preparation
	Site clearing and preparation	
Segment Output	Hydrogen	Hydrogen
	Black carbon	Oxygen

Table 3: Segment 2 – Hydrogen storage

Segment Material	Liquid or gaseous Hydrogen
Potential AHJ's responsible	1,2,3,5
Segment components	Compressed gas tanks
	Cryogenic liquified tanks
	Exhausted Wells
	Liquid organic hydrogen carriers (LOHCs)*
	Salt Caverns

* Note: At present, there are no specific codes and standards for the conversion of hydrogen to LOHC and vice versa for storage and delivery purposes. For transportation via rail, certain LOHCs present environmental and health hazards like toluene and benzyl toluene [4–6]. Based on this, it is highly possible that LOHC's would be categorized as a class 6 Toxic and infectious substance (Class 6.1 Packing Group Dangerous Goods: that consists of toxic, liquid, organic substances) as per Transportation of Dangerous Goods (TDG) [7]. Therefore, Table 9 and Table 12 provide some potential standards that can include LOHC in future.

Table 4: Segment 3 – Hydrogen distribution/delivery

Segment Material	Liquid or gaseous Hydrogen			
Potential AHJ's responsible	1, 2, 3, 4, 5, 7, 10, 11			
Sub-segment	3a	3b	3c	3d
Description	Delivery via tube-trailers	Delivery via pipelines	Delivery via Railways	Delivery via Marines

Table 5: Segment 4 – Hydrogen end-use

Segment Material	Liquid or gaseous Hydrogen				
Potential AHJ's responsible	1, 2, 3, 4, 5, 6, 7, 9, 10, 11				
Sub-segment	4a	4b	4c	4d	4e
Description	Refueling station	Heavy-duty vehicles and maintenance facility (like repair garages)	Domestic/Commercial applications	Power generation	Construction/ agriculture heavy equipment

All potential standards identified for the hydrogen mentioned above segments have been attached as Appendix A. Note: The standards identified for sub-segment 4e (hydrogen end-use in heavy equipment for construction/agriculture) are consolidated with those for sub-segment 4b (hydrogen end-use in heavy-duty transport) considering the inter-applicability of standards between the sub-segments and lack of specific standards for hydrogen-powered agricultural and construction types of equipment.

4 Potential Regulatory Framework for hydrogen project/facility development in Alberta

Figure 1 presents the regulatory framework developed considering the regulatory landscape for establishing a petrochemical facility in Alberta as the basis [4, 5]. The regulatory framework outlines the potential acts and regulations that might apply to proposed hydrogen projects/facilities and identifies AHJs involved in approvals and permitting the hydrogen infrastructure in Alberta. The framework highlights the upstream pathway that might be applicable before the local municipality permits regulatory approval for a hydrogen facility. The downstream pathway would consist of land-use zoning, building codes, fire codes, and certifications that are majorly administered and regulated by local municipalities (For example, permit applications and policies by Sturgeon County [8]).

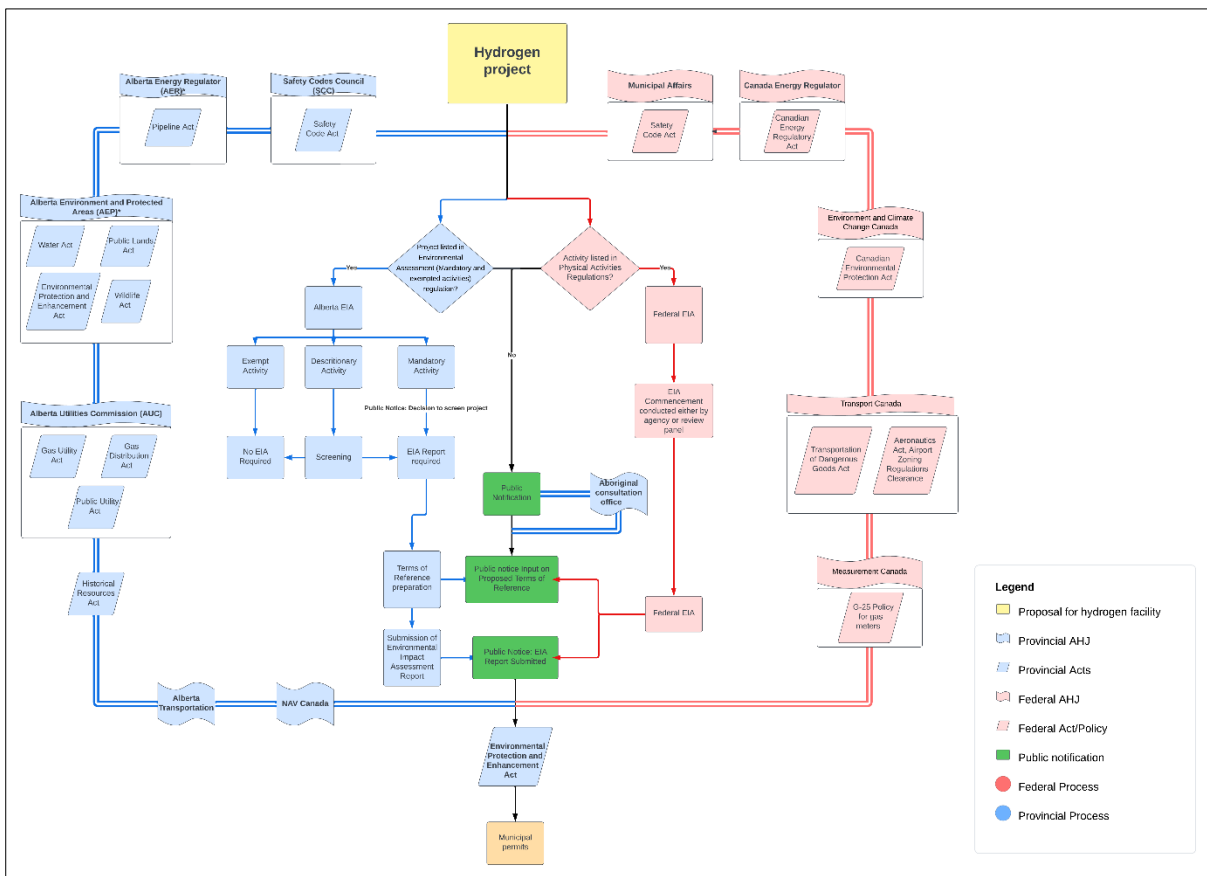


Figure 2: Potential regulatory for establishing a hydrogen facility/project in Alberta

Table 6 illustrates the applicability of different acts/permits/approvals and AHJ's that potentially might be required for different hydrogen segments in Alberta. Additionally, the related documents in the form of directives, regulations, amendments, and codes that are currently applicable in the province under anticipated acts are also identified.

Table 6: Potential Provincial acts/permits/approvals with applicability to hydrogen segments

Act/Approval/ Permit	Responsible AHJ	Applicability of act/approval/permit to hydrogen segments	Relevant directives/régulations/codes applicable	Hydrogen value chain Segments				
				1a	1b	2	3	4
Carbon Capture and Storage Statutes Amendment Act	AER	The act provides framework to facilitate large-scale Carbon Capture and Storage (CCS) projects in Alberta. Segment 1a of the value chain involves on-site hydrogen production via methane pyrolysis of fossil methane (Natural gas) or biomethane. These facilities producing if are accompanied by an underground pore space to store carbon approval under Carbon Capture and Storage Statutes Amendment Act may be required depending on whether carbon is just captured or also utilized. Approvals may be needed under the Mines and Minerals Act for pore space allocation for carbon capture, evaluation permits under Carbon Sequestration Tenure Regulations and approvals under Oil and Gas Conservation Act for CO ₂ injection schemes.	Carbon Capture and Storage Funding Act [9] Carbon Capture and Storage Funding Regulation [10] Carbon Sequestration Tenure Regulation [11]	✓				

Act/Approval/ Permit	Responsible AHJ	Applicability of act/approval/permit to hydrogen segments	Relevant directives/régulations/codes applicable	Hydrogen value chain Segments				
				1a	1b	2	3	4
Environmental Impact Assessment (EIA) [12]	AEP	The Environmental Protection and Enhancement Act (EPEA) establishes the process for conducting environmental assessments of proposed projects and activities in Alberta. Currently, the EPEA does not explicitly specify hydrogen production facilities, pipelines, or other value chain segments as requiring EIAs. However, the Director has broad discretion to request an EIA for any project deemed to potentially impact the environment. While uncertainty exists, it is assumed that segments 1,2 and 4 might require an EIA based on the project scale, location, technology present	Alta. Reg. 111/93 [13]	✓	✓	✓		✓
Safety Codes Act (SCA) [14]	Municipal Affairs	The Safety Codes Act (SCA) administered by the Municipal Affairs establishes legislative framework for establishing safety codes related to building, fire protection, pressure equipment, electrical systems, gas installations, plumbing, and private sewage disposal systems in Alberta. SCA can be enforced by relevant AHJ dependent on the type of hydrogen segment. For example, pressure equipment involved in all the hydrogen segments that operate at pressures greater than 15 psi (103 kPa) should be designed under ABSA's Pressure Equipment Safety Regulations and	Alberta Building Code (ABC) [15] National Fire Code – 2019 [16] Gas codes, standards, and respective regulations [17] National Plumbing Code of Canada 2020 CSA C22.1-21 Canadian Electrical Code (2022) [18]	✓	✓	✓	✓	✓

Act/Approval/ Permit	Responsible AHJ	Applicability of act/approval/permit to hydrogen segments	Relevant directives/régulations/codes applicable	Hydrogen value chain Segments				
				1a	1b	2	3	4
		anything under 15 psi should be regulated under the Gas Code Regulations.	<p>Alberta Electrical Utility Code (2016) Boilers and pressure vessels codes [15]</p> <p>Private Sewage Disposal Systems Regulation 2016 [19]</p>					
Pipeline Act [20]	AER	The Pipeline Act in Alberta establishes regulatory oversight for the construction and operation of oil and gas pipelines within the province and is administered by the AER. The AER's authority under the Pipeline Act currently involves smaller pipelines connecting wellheads to processing facilities and then to larger lines. Jurisdictional oversight of hydrogen pipelines in Alberta will potentially depend on whether the systems are standalone utility assets, integrated into provincial oil and gas infrastructure, or cross provincial/international borders. AER will be responsible for regulating pipelines within the borders of the province. Cross-provincial hydrogen pipelines will come	<p>CSA Z662-23: Oil and Gas Pipeline Systems [21]</p> <p>Pipeline Rules [22]</p> <p>Directive 077: Pipelines – Requirements and Reference Tools [23]</p>	✓	✓		✓	✓

Act/Approval/ Permit	Responsible AHJ	Applicability of act/approval/permit to hydrogen segments	Relevant directives/régulations/codes applicable	Hydrogen value chain Segments				
				1a	1b	2	3	4
		under the regulation of the Canada Energy Regulator (CER)						

Act/Approval/Permit	Responsible AHJ	Applicability of act/approval/permit to hydrogen segments	Relevant directives/régulations/codes applicable	Hydrogen value chain Segments				
				1a	1b	2	3	4
Water Act [24]	AER/AEP	The Water Act sets out requirements for the establishment of water management framework addressing diversion and use of water in Alberta. All hydrogen segments will need the provision of water either for direct use as in segment 1b as process input, as well as for indirect uses such as construction and operation of hydrogen facilities. A license under the water act will be required to divert water for use hydrogen segments. Under the Responsible Energy Development Act (REDA), AER is responsible for reviewing Water Act approvals for energy resource development, whereas AEP is responsible for regulating water requirements for municipalities, agriculture, and forestry. The potential approval for the proposed HRS facility under the Water Act may be evaluated based on both design and location considerations. At the time of writing, it is uncertain what nature of hydrogen projects falls under the jurisdiction of either the AER or AEP for Water Act approvals.	<p>Water Codes of Practice [25]</p> <p>Guide to preparing a complete Water Act Application for a licence or an approval. [26]</p> <p>Guidelines for Licensing Water Diversion Projects [27]</p>	✓	✓	✓	✓	✓

Act/Approval/ Permit	Responsible AHJ	Applicability of act/approval/permit to hydrogen segments	Relevant directives/régulations/codes applicable	Hydrogen value chain Segments				
				1a	1b	2	3	4
Public Lands Act [28]	AER/AEP	Allocation, sale, transfer, or use of public land (land of the Crown) in Alberta is regulated under the Public Lands Act. The regulatory body governing this act is based on the type of project being developed. Currently AER regulates land use for oil, gas, oil sands and coal activity whereas AEP regulates land use for agricultural, commercial, and industrial sector and is responsible for policy, regulation, and legislation development regarding use of public land. Facility layout for segments 1,2 and 4 may require approval under the Public Lands Act	Exploration Regulation [29] Public Lands Administration Regulation [30]	✓	✓			
EPEA [12]	AER/AEP	Approval and registrations might be required under the EPEA for hydrogen value chain segments. Currently no hydrogen-related activity is listed as a designated activity. For existing steam methane reforming plants for hydrogen production in the province, AEP issued approvals under EPEA for the establishment of steam methane reforming plants for hydrogen production by apparently considering it as a chemical manufacturing plant. AER is responsible for administering EPEA framework for gas processing plants. It is currently unclear as to AER or AEP will be responsible for	Approvals and Registrations Procedure Regulation Activities Designation Regulation [31] Environmental Protection and Enhancement (Miscellaneous) Regulation [32]	✓	✓	✓		✓

Act/Approval/ Permit	Responsible AHJ	Applicability of act/approval/permit to hydrogen segments	Relevant directives/régulations/codes applicable	Hydrogen value chain Segments				
				1a	1b	2	3	4
		administering approvals for different segments of hydrogen value chain						
Wildlife Act [33]	AEP	The Wildlife Act covers the protection and conservation of wildlife in Alberta. Hydrogen segment 1,2 and 4 might require approvals under the Wildlife Act based on the proximity to wildlife areas, or site- specific triggers that can impact the wildlife.		✓	✓	✓		✓
Gas Utility Act [34] Gas Distribution Act [35]	AUC	The AUC regulates the gas utilities under the Gas Utility Act of Alberta whereas the Gas Distribution Act outlines for design, construction, operation and maintenance of rural gas utilities and low-pressure distribution systems in Alberta. Currently, neither of the acts explicitly address hydrogen as gas although legislative amendment to extend the definition of "gas" by including hydrogen-natural gas blend (up to 20 vol % of hydrogen) have	AR 58/2015 Code of Conduct Regulation [36] AR 184/2003 Default Gas Supply Regulation [37] AR 53/1999 Gas Utilities Exemption Regulation [38]	✓	✓		✓	✓

Act/Approval/ Permit	Responsible AHJ	Applicability of act/approval/permit to hydrogen segments	Relevant directives/régulations/codes applicable	Hydrogen value chain Segments				
				1a	1b	2	3	4
		been proposed. Blending of hydrogen in natural gas distribution system is applicable for hydrogen segment 3 and 4 in distribution and end-use applications	AR 186/2003 Roles, Relationships and Responsibilities Regulation [39] AR 257/2007 Gas Utilities Designation Regulation [40]					
Public Utility Act		The definition of a "public utility" under Alberta's Public Utilities Act is broad, referencing services or commodities provided "directly or indirectly to or for the public." This definition could potentially capture assets used for hydrogen production and pure hydrogen pipeline transport. Although, the act empowers the AUC to exempt entities from utility regulation thus providing the flexibility to deal with over-regulatory consequences. Legal Amendment to avoid capture of hydrogen production and pure hydrogen pipelines were proposed by concerned parties	AR 194/2006 Public Utilities Designation Regulation (consolidated to AR 186/2009) [41]					

Act/Approval/Permit	Responsible AHJ	Applicability of act/approval/permit to hydrogen segments	Relevant directives/régulations/codes applicable	Hydrogen value chain Segments				
				1a	1b	2	3	4
Dangerous Goods Transportation and Handling Act [42]	Ministry of Transportation and Economic Corridors	Dangerous Goods Transportation and Handling Act provides for the secure transportation and proper handling of products, substances, and organisms. Federal Transportation of Dangerous Goods Regulations (TDGR) and the provincial Dangerous Goods Transportation and Handling Regulation cover the use of bulk tanks for transporting dangerous goods in Alberta. The act will be applicable to all means of transports carrying dangerous goods. Segments 3 and 4 would need approvals and permits for distributing/delivering hydrogen under this act.	Transportation of Dangerous Goods Regulations (TDGR) [43] Dangerous Goods Transportation and Handling Regulation [44]				✓	✓

5 Observations

The provincial regulatory mapping identified uncertainty around which authorities (AER or AEP) will govern key aspects of future hydrogen facilities in Alberta. While no single agency regulates all hydrogen activities, creating a unified application process through AER or AEP could streamline oversight and ease the regulatory burden for project developers. As seen in the case of BC, the government has consolidated oversight by designating the BC Energy Regulator (formerly BC Oil and Gas Commission) as the provincial regulator across production, distribution and use by passing the Energy Statues Amendment Act [3].

6 Next steps

Following are the immediate and ongoing steps for regulatory gap analysis:

- Identifying and examining provincial permits applicable for the establishment hydrogen projects/facilities in Alberta.
- Examine permitting pathways and municipal review capabilities to enable hydrogen facility development across Alberta. This involves assessing municipal permit processes.
- Identifying applicable standards and the potential changes needed to accommodate the use of hydrogen.

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8 Appendix A

Table 7: Segment 1a: Hydrogen production via methane pyrolysis - Applicable standards

Country	Code/Standard	Description	Applicability
CAN	CSA B149.1	Natural Gas and Propane Installation Code	Specification
CAN	CSA Z662 – 23	Oil and gas pipeline systems	Specification
CAN	CSA 6.18-02 (R2022)	Service Regulators for Natural Gas	Specification
CAN	CAN/CSA-E61558-1:12 (R2022)	Safety of power transformers, power supplies, reactors	Safety
CAN/US	ANSI Z21.93-2017 (R2022) /CSA 6.30-2017 (R2022)	Excess flow valves for natural gas and propane gas with pressures up to 5 psig	Specification
US	BPVC Section III	Division 5-High Temperature Reactors	Specification
INT	ISO 22974:2023	Petroleum and natural gas industry — Pipeline transportation systems — Pipeline integrity assessment specification	Specification
INT	ISO/TR 27912:2016	Carbon dioxide capture -- Carbon dioxide capture systems, technologies and processes	Specification

Table 8: Segment 1b: Hydrogen production via Electrolysis - Applicable standards

Country	Code/Standard	Description	Applicability
CAN	CAN/BNQ 1784-000	Canadian Hydrogen Installation Code	Safety
CAN/US	CSA/ANSI B22734	Hydrogen generators using water electrolysis - Industrial, commercial, and residential applications. Adoption of the ISO standard with MOD	Standard
CAN/US	CSA B107	Enclosed Hydrogen Equipment - Safety Withdrawn	Standard
US	ASME B31.12 - 2019	Hydrogen Piping and Pipelines (part of ASME 831 series Piping and Pipelines)	Safety
US	ASME STP-PT-006 - 2007	Design Guidelines for Hydrogen Piping and Pipelines	Safety
US	ASME BPVC	Boiler and Pressure Vessel Code	Safety
US	CSA Publication G5	Hydrogen	Information
US	CGA Publication G5.3	Commodity Specification for Hydrogen	Specification
US	CGA publication G5.5	Standard for Hydrogen Vent Systems	Safety
US	CGA publication H4	Terminology Associated with Hydrogen Fuel Technologies, Third Edition	Terminology

Country	Code/Standard	Description	Applicability
US	CGA publication H5	Bulk Hydrogen Supply Systems - Third Edition	Safety
US	CGA Publication P6	Standard Density Data, Atmospheric Gases and Hydrogen	Information
US	CGA PS-31-2007 (R2014)	Cleanliness for PEM Hydrogen Piping / Components	Specification
US	CGA PS-31-2007 (R2019)	Cleanliness For Proton Exchange Membranes Hydrogen Piping/Components	Specification
US	CGA PS-48-2016	CGA Position Statement on Clarification of Existing Hydrogen Setback Distances And Development Of New Hydrogen Setback Distances In NFPA 55	Safety
US	National Fire Protection Association (NFPA): NFPA-2: 2023	Hydrogen Technologies Code	Safety
US	NFPA 55	Storage, Use and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks	Safety
US	NFPA 70 Article 692	National Electrical Code — Fuel Cell Systems	Safety
US	SAE J 2600-2015	Compressed Hydrogen Surface Vehicle Fuelling Connection Devices	Standard
INT	ISO 22734:2019	Hydrogen generators using water electrolysis. Industrial, commercial, and residential application	Safety
INT	ISO 14687:2019	Hydrogen fuel Product specification	Specification
INT	ISO 16528-1:2007	Boilers and pressure vessels Part 1: Performance requirements	Performance
INT	ISO 4126-1:2013	Safety devices for protection against excessive pressure Part 1: Safety valves	Safety
INT	IEC 62282-8-201:2020	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	Performance
INT	IEC 62282-8-101:2020	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	Performance

Country	Code/Standard	Description	Applicability
INT	IEC 62282-8-102:2019	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	Performance
INT	UL Subject 2264 D	Portable Water Electrolysis Type Hydrogen Generators	Specification
INT	ISO 19880-1	Gaseous Hydrogen Fueling Station - General Requirements	Specification
INT	SAEJ2719: 2020	Hydrogen Fuel Quality for Fuel Cell Vehicles	Safety
INT	ISO 22770:2019	Hydrogen generators using fuel processing technologies - Safety and performance requirements.	Standard
China	GB 19773-2005	Specification of hydrogen purification system on pressure swing adsorption	Specification
China	GB/T 19774-2005	Specification of water electrolyte system for producing hydrogen	Specification
China	GB/T 37562-2019	Technical conditions of pressurized water electrolysis system for hydrogen production	Specification

Table 9: Segment 2: Hydrogen storage - Applicable standards

Country	Code/Standard	Description	Applicability
CAN	BNQ 1784-000	Canadian Hydrogen Installation Code	Ground H2 systems / infrastructure
CAN	CAN/CSA B51-19	Boiler, Pressure Vessel, and Pressure Piping Code	H2 Storage
CAN	CAN/CSA-B72-M	Installation Code for Lightning Protection Systems	Ground based H2 systems lightning protection.
CAN	CSA B339	Cylinders, spheres, and tubes for the transportation of dangerous goods	H2 storage
CAN	CSA B340	Selection, use, handling and filling of cylinders, spheres, tubes and other containers for the transportation of gases in Class 2	H2 storage
CAN	CSA B620	Highway tanks and TC portable tanks for the transportation of dangerous goods	H2 Storage
CAN	CSA B625:20	Portable tanks for the transport of dangerous goods	H2 Storage
CAN	CSA Z341	Storage of Hydrocarbon in Underground Formations	H2 Storage

Country	Code/Standard	Description	Applicability
CAN	CAN/BNQ 1784-000	Electrical Systems in Hydrogen Installations	H2 Storage
CAN	CSA HPIT2	Compressed Hydrogen Station and Components for Fuelling Industrial Trucks	H2 Storage
CAN	CSA B149.3	Code for field approval of fuel-related components on appliances and equipment	H2 Storage
CAN	CSA Z662-23	Oil and gas pipeline systems	H2 Storage
CAN	CSA HPIT1	Compressed Hydrogen Powered Industrial Trucks On-Board Fuel Storage and Handling Components	H2 Storage
CAN	CSA B341 - UN	Pressure receptacles and multiple-element gas containers for the transport of dangerous goods.	H2 Storage
CAN	CSA SPE-2.1.3	Best practices for defueling, decommissioning, and disposal of compressed hydrogen gas vehicle fuel containers.	H2 Storage
CAN	CSA HPIT 1	Compressed hydrogen-powered industrial truck on-board fuel storage and handling components	H2 Storage
CAN/US	CSA/ANSI HGV2	Standards for Hydrogen Vehicle Fuel Containers	H2 Storage
CAN/US	CSA/ANSI HPRDI	Basic Requirements for Pressure Relief Devices for Compressed Hydrogen Vehicle Fuel Containers	H2 Storage
CAN/US	CSA/ANSI SPE 2.3.1	Best practices for defueling, decommissioning and disposal of compressed hydrogen gas vehicle fuel containers	H2 Storage
CAN/US	ANSI/CSA CHMC 1	Test methods for evaluating material compatibility in compressed hydrogen applications - Metals	H2 Storage
CAN/US	ANSI/CSA CHMC 2	Test methods for evaluating material compatibility in compressed hydrogen applications - Polymers	H2 Storage
CAN/US	CSA/ANSI HGV 4.1 to 4.10	HGV Series for H2 fuelling stations and vehicle components	H2 Storage
CAN/US	CSA/ANSI HGV 5.1	Standard for Bulk Hydrogen Supply Systems (an American National Standard)	H2 Storage
CAN/US	CSA/ANSI HGV 5.2	Compact Hydrogen Fuelling Systems	H2 Storage
CAN/US	ANSI CSA HPRD1	Thermal Activated Pressure Relief Devices for Compressed Hydrogen Vehicle Fuel Containers	H2 Storage
CAN/US	CSA/ANSI HGV 3.1	Fuel system Components for Compressed Hydrogen Gas Powered Vehicles	H2 Storage
CAN/US	UL 2267	Standard For Fuel Cell Power Systems for Installation In Industrial Electric Trucks	H2 Storage
US	ASME BPVC Section VIII, Division 3	Rules for Construction of Pressure Vessels Division 3, Alternate Rules High-Pressure Vessels Article KD-10 Special Requirements for Vessels in High-Pressure Gaseous Hydrogen Transport and Storage...	Construction of Pressure Vessels

Country	Code/Standard	Description	Applicability
US	ASME BPVC-Section X	Fiber-Reinforced Plastic Pressure Vessels	Construction of Pressure Vessels
US	CGA- G5.4	Standard for Hydrogen Piping Systems at Consumer Sites	Piping near storage
US	CGA H-1	Service Conditions for Portable, Reversible Metal Hydride Systems	Specification
US	CGA H-2	Guidelines for the Classification and Labeling of Hydrogen Storage Systems with Hydrogen Absorbed in Reversible Metal Hydrides	Information
US	CGA H-3	Cryogenic Hydrogen Storage	Information
US	CGA P-12	Safe Handling of Cryogenic Liquids	Safety
US	CGA P-28	Risk Management Plan Guidance Document For Bulk Liquid Hydrogen Systems	Safety
US	CGA P-41	Locating Bulk Liquid Storage Systems in Courts	Safety
US	CGA PS-33	CGA Position Statement on Use of LPG or Propane Tank as Compressed Hydrogen Storage Buffers	Information
US	CGA PS-46	Position Statement - Roofs Over Hydrogen	Information
US	CGA PS-48	CGA Position Statement on Clarification Of Existing Hydrogen Setback Distances And Development Of New Hydrogen Setback Distances In NFPA 55	Information
US	CSA FC5	Hydrogen Generators Using Fuel Processing Technologies – Part 1: Safety	Safety
US	CSA HGV2	Standards for Hydrogen Vehicle Fuel Containers	Safety
US	CSA HGV4.1	Hydrogen Dispensers	Safety
US	CSA HGV4.3	Fueling Parameters for Hydrogen Dispensing System	Safety
US	CSA HGV4.6	Manually Operated Valves Used in Gaseous Hydrogen Vehicle Fueling Stations	Safety
US	CSA HPIT1	Compressed Hydrogen Powered Industrial Trucks (forklifts) On- Board Fuel Storage and Handling Components	Safety
US	National Fire Protection Association (NFPA): NFPA-2: 2023	Hydrogen Technologies Code	Safety
US	NFPA 855	Standard for the Installation of Stationary Energy Storage Systems	H2 Storage
US	NFPA 55	Storage, Use and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks	Safety
US	CGA H-5-2020	Standard for Bulk Hydrogen Supply Systems (an American National Standard)	H2 Storage
US	CGA V-9	Compressed Gas Association Standard for Compressed gas Cylinder Valves	H2 Storage
US	CGA V-1	Standard for compressed gas cylinder valve outlet and inlet connections	H2 Storage

Country	Code/Standard	Description	Applicability
US	NFPA 2	Hydrogen Technologies Code	H2 Storage
US	ASME B31.12	Hydrogen Piping and Pipelines	H2 Storage
US	CGA H-3	Cryogenic Hydrogen Storage	H2 Storage
US	CGA P-12-2017	Safe Handling Of Cryogenic Liquid	H2 Storage
US	CGA V-23	Standard for Cylinder Connections on Portable Cryogenic Liquid Cylinders	H2 Storage
US	CGA P-28	OHSA Process safety management and EPA risk management plan guidance document for bulk liquid hydrogen supply systems	H2 Storage
US	CGA P-41	Locating bulk liquid storage systems in courts	H2 Storage
US	SAE J2579	Standard for Fuel Systems in Fuel Cell and Other Hydrogen Vehicles	H2 Storage
US	SAE J2578	Recommended practice for general fuel cell vehicle safety (US)	H2 Storage
US	SAE J2615	Testing performance of fuel cell systems for automotive applications	H2 Storage
US	SAE J3121	Hydrogen vehicle crash test lab safety guidelines	H2 Storage
US	NFPA 505	Fire Safety Standards for Powered Industrial Trucks, Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations	H2 Storage
US	SAE J2601-3	Fuelling protocol for gaseous hydrogen powered industrial trucks	H2 Storage
INT	ISO 16111	Transportable Gas Storage Devices - Hydrogen Absorbed in Reversible Metal Hydrides	H2 Storage
INT	ISO 19881	Gaseous hydrogen -- Land vehicle fuel containers	Safety
INT	ISO TS 20100	Gaseous Hydrogen – Service Stations	H2 Storage
INT	ISO/AWI TR 19884	Gaseous Hydrogen - Cylinders and tubes for stationary storage	Safety
INT	ISO 21014	Cryogenic Vessels — Cryogenic insulation performance	LH2 storage and distribution systems
INT	ISO 21028-1	Cryogenic Vessels — Toughness requirements for materials at cryogenic temperature — Part 1: Temperatures below - 80°C.	LH2 storage and distribution systems
INT	ISO 23208	Cryogenic vessels — Cleanliness for cryogenic service	H2 Storage
INT	OIML R 81	Dynamic measuring devices and systems for cryogenic liquids	LH2 filling and/or refueling
INT	ISO/TR 15916-15	Basic considerations for the safety of hydrogen systems	Potential Guidelines for conversion to LOHC

Country	Code/Standard	Description	Applicability
INT	ISO 1388-1:1981	Ethanol for industrial use — Methods of test — Part 1: General	Potential standard for conversion to LOHC

Table 10: Segment 3a: Hydrogen distribution/delivery via tube trailer - Applicable standards

Country	Code/Standard	Description	Applicability
CAN	CSA B51:19	Boiler, pressure vessel, and pressure piping code	Hydrogen gas delivery via truck
CAN	CSA B339	Cylinders, spheres, and tubes for the transportation of dangerous goods	Hydrogen gas delivery via truck
CAN	CSA B340	selection, use, handling and filling of cylinders, spheres, tubes, and other containers for the transportation of gases in Class 2	Hydrogen gas delivery via truck
CAN	CSA HPIT 1	Compressed Hydrogen Powered Industrial Trucks On-Board Fuel Storage and Handling Components	Hydrogen gas delivery via truck
CAN	CSA B341	UN pressure receptacles and multiple-element gas containers for the transport of dangerous goods	Hydrogen gas delivery via truck
CAN	CSA B620	Highway tanks and TC portable tanks for the transportation of dangerous goods	Hydrogen gas delivery via truck
CAN	CSA B622	Selection and use of highway tanks, TC portable tanks, and ton containers for the transportation of dangerous goods, Class 2	Hydrogen gas delivery via truck
CAN	CSA B625	Portable tanks for the transport of dangerous goods	Hydrogen gas delivery via truck
CAN	CSA SPE-2.1.3	Best practices for defueling, decommissioning, and disposal of compressed hydrogen gas vehicle fuel containers	Hydrogen gas delivery via truck
CAN/US	CSA/ANSI HGV 4.1	Hydrogen-dispensing systems	Hydrogen gas delivery via truck
CAN/US	ANSI/CSA HGV 4.2*	Hoses For Compressed Hydrogen Fuel Stations, Dispensers And Vehicle Fuel Systems	Hydrogen gas delivery via truck

Country	Code/Standard	Description	Applicability
CAN/US	CSA/ANSI HGV 4.3	Test methods for hydrogen fuelling parameter evaluation	Hydrogen gas delivery via truck
CAN/US	CSA/ANSI HGV 4.4	Gaseous hydrogen — Fuelling stations — Valves	Hydrogen gas delivery via truck
CAN/US	ANSI/CSA HGV 4.5	Priority and sequencing equipment for hydrogen vehicle fuelling	Hydrogen gas delivery via truck
CAN/US	CSA ANSI/CSA HGV 4.6	Manually Operated Valves For Use In Gaseous Hydrogen Vehicle Fuelling Stations	Hydrogen gas delivery via truck
CAN/US	CSA ANSI/CSA HGV 4.7	Automatic Valves For Use In Gaseous Hydrogen Vehicle Fuelling Stations	Hydrogen gas delivery via truck
CAN/US	ANSI/CSA HGV 4.8	Hydrogen Gas Vehicle Fuelling Station Compressor Guidelines	Hydrogen gas delivery via truck
CAN/US	CSA/ANSI HGV 4.9	Hydrogen Fuelling Stations	Hydrogen gas delivery via truck
CAN/US	ANSI/CSA HGV 4.10	Standard for fittings for compressed hydrogen gas and hydrogen rich gas mixtures	Hydrogen gas delivery via truck
CAN/US	CSA/ANSI HGV 2	Compressed hydrogen gas vehicle fuel containers	Hydrogen gas delivery via truck
CAN/US	CSA/ANSI HPRD 1	Thermal Activated Pressure Relief Devices for Compressed Hydrogen Vehicle Fuel Containers	Hydrogen gas delivery via truck
CAN/US	CSA/ANSI HGV 3.1	Fuel System Components for Compressed Hydrogen Gas Powered Vehicles	Hydrogen gas delivery via truck
US	CGA H-5-2020	Standard for Bulk Hydrogen Supply Systems (an American National Standard)	Hydrogen gas delivery via truck
US	CGA V-10	High Pressure Gas Trailer Connections	Hydrogen gas delivery via truck
US	CGA V-1	Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections	Hydrogen gas delivery via truck

Table 11: Segment 3b: Hydrogen distribution/delivery via pipelines - Applicable standards

Country	Code/Standard	Description	Applicability
CAN	BNQ 1784-000	Canadian Hydrogen Installation Code	Ground H2 systems / infrastructure
CAN	CSA-851-part 3	Compressed Natural Gas and Hydrogen Refuelling Station Pressure Piping	GH2 piping / distribution systems

Country	Code/Standard	Description	Applicability
		Systems and Ground Storage Vessels	
CAN	CAN/CSA B51-19	Boiler, Pressure Vessel, and Pressure Piping Code	GH2 storage, piping, and equipment.
CAN	CSA Z662 – 2023	Currently unavailable	H2 Pipeline systems
US	ASME 831.12	Hydrogen Piping and Pipelines (part of ASME 831 Series Piping and Pipelines)	H2 piping
US	ASME STP-PT-006	Design Guidelines for Hydrogen Piping and Pipelines	H2 piping
US	ASME BPVC	Boiler and Pressure Vessel Code	GH2 storage, piping, and equipment.
US	CGA publication H4	Terminology Associated with Hydrogen Fuel Technologies	General H2 comprehension and training. Convention on language and terms.
US	CSA publication H5	Installation Standard for Bulk Hydrogen Supply Systems; total process	H2 systems / infrastructure, operations, maintenance, and training
US	CSA publication P12	Safe Handling of Cryogenic Liquids	LH2 safe handling for operations / maintenance
US	CGA Publication P28	Risk Management Plan Guidance Document for Bulk Liquid Hydrogen Systems	LH2 HAZOP and Risk Management Planning
US	CGA publication P41	Locating Bulk Liquid Storage Systems in Courts	LH2 cryogenic storage areas
US	ASME B31.8	Gas Transmission and Distribution Piping Systems	Gas Transmission and distribution
US	CGA- G5.4 S	Standard for Hydrogen Piping Systems at Consumer Sites	Piping
US	CGA G-5.6	Hydrogen Pipeline Systems	Pipeline
US	ASME B31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids	Pipeline
US	ASME B31.8S	Managing System Integrity of Gas Pipelines	Pipeline
US	ANSI/NACE TM0284-2016	Evaluation of Pipeline and Pressure Vessel Steels for Resistance to Hydrogen-Induced Cracking	Safety

Country	Code/Standard	Description	Applicability
INT	ISO 21014	Cryogenic Vessels — Cryogenic insulation performance	LH2 storage and distribution systems
INT	ISO 21028-1	Cryogenic Vessels — Toughness requirements for materials at cryogenic temperature — Part 1: Temperatures below - 80°C.	LH2 storage and distribution systems
INT	ISO 16528-1:2007	Boilers and pressure vessels — Part 1: Performance requirements	GH2 piping, and equipment.
INT	ISO/TS 19883:2017	Safety of pressure swing adsorption systems for hydrogen separation and purification	GH2 piping, and equipment.
INT	ISO 2.1029-1:2004	Cryogenic vessels – Transportable vacuum insulated vessels of not more than 1000 L volume – Part 1: Design, fabrication, inspection and tests	Transportation of H2 fuels
EUR	EGA Doc 121/04	Hydrogen Pipeline Systems. Limited to gaseous products with a temperature range between -40C and 175C, total pressure from 1 MPa to 21 MPa.	GH2 piping / distribution systems
EUR	EIGA Doc 121/04	Hydrogen Pipeline Systems. Limited to gaseous products with a temperature range between -40C and 175C, total pressure from 1 MPa to 21 MPa.	GH2 piping / distribution systems
US	ASME B31-12	Hydrogen Piping and Pipelines	GH2 piping

Table 12: Segment 3c: Hydrogen distribution/delivery via railways - Applicable standards

Country	Code/Standard	Description	Applicability
CAN	CSA B51:19	Boiler, pressure vessel, and pressure piping code	Hydrogen gas delivery via railway
CAN	CSA B339	Cylinders, spheres, and tubes for the transportation of dangerous goods	Hydrogen gas delivery via railway

Country	Code/Standard	Description	Applicability
CAN	CSA B340	selection, use, handling and filling of cylinders, spheres, tubes, and other containers for the transportation of gases in Class 2	Hydrogen gas delivery via railway
CAN	CSA B339	Cylinders, spheres, and tubes for the transportation of dangerous goods	Liquid hydrogen delivery via railway
CAN	CSA B340	selection, use, handling and filling of cylinders, spheres, tubes, and other containers for the transportation of gases in Class 2	Liquid hydrogen delivery via railway
CAN	CSA B625	Portable tanks for the transport of dangerous goods	Liquid hydrogen delivery via railway
CAN	CSA B620/B622	Highway tanks and TC portable tanks for the transportation of dangerous goods	Liquid hydrogen delivery via railway
CAN/US	CSA/ANSI HGV	Series for Hydrogen fueling stations and vehicle components	Hydrogen gas delivery via railway
INT	CSA B625	Portable tanks for the transport of dangerous goods	LOHC by rail
CAN	6.1-3 UN292 I 3, 9-66	Class 6.1 Packing Group - Dangerous Goods	Potential standard for LOHC
CAN	6.1 UN281 I 3, 0-66	Class 6.1 Packing Group - Dangerous Goods (Toxic, liquid, organic, no's)	Potential standard for LOHC

Table 13: Segment 4a: Hydrogen end-use: Refueling station - Applicable standards

Country	Code/Standard	Description	Applicability
CAN	BNQ 1784-000	Canadian Hydrogen Installation Code	Ground H2 systems / infrastructure
CAN	CAN/CSA B51-19	Boiler, Pressure Vessel, and Pressure Piping Code	GH2 storage, piping, and equipment.
CAN	CAN/CSA-B72-M	Installation Code for Lightning Protection Systems	Ground based H2 systems lightning protection.
CAN	CSA-851-part 3	Compressed Natural Gas and Hydrogen Refuelling Station Pressure Piping Systems and Ground Storage Vessels	GH2 piping / distribution systems
CAN/US	CSA/ANSI HGV2	Standards for Hydrogen Vehicle Fuel Containers	GH2 storage systems
CAN/US	CSA/ANSI HPRDI	Basic Requirements for Pressure Relief Devices for Compressed Hydrogen Vehicle Fuel Containers	GH2 storage PRDs

Country	Code/Standard	Description	Applicability
CAN/US	CSA/ANSI SPE 2.3.1	Best practices for defueling, decommissioning, and disposal of compressed hydrogen gas vehicle fuel containers	GH2 storage — end of life procedures
US	ASME 831.12	Hydrogen Piping and Pipelines (part of ASME 831 Series Piping and Pipelines)	H2 piping
US	ASME STP-PT-006	Design Guidelines for Hydrogen Piping and Pipelines	H2 piping
US	ASME BPVC	Boiler and Pressure Vessel Code	GH2 storage, piping, and equipment.
US	CGA Publication G5.5	Hydrogen Vent Systems	H2 vent systems
US	CGA Publication H3	Cryogenic Hydrogen Storage	LH2 storage systems
US	CGA publication H4	Terminology Associated with Hydrogen Fuel Technologies	General H2 comprehension and training. Convention on language and terms.
US	CSA publication H5	Installation Standard for Bulk Hydrogen Supply Systems; total process	H2 systems / infrastructure, operations, maintenance, and training
US	CSA publication H14	HYCO Plant Gas Leak Detection and Response Practices	Leak detection for ground H2 storage / fueling systems and transfer operations.
US	CSA publication P12	Safe Handling of Cryogenic Liquids	LH2 safe handling for operations / maintenance
US	CGA Publication P28	Risk Management Plan Guidance Document for Bulk Liquid Hydrogen Systems	LH2 HAZOP and Risk Management Planning
US	CGA publication P41	Locating Bulk Liquid Storage Systems in Courts	LH2 cryogenic storage areas
US	CGA Publication PS46	Position Statement — Roofs Over Hydrogen Storage Systems	GH2. storage systems
US	CGA publication PS48	CGA Position Statement on Clarification of Existing Hydrogen Setback Distances and Development of New Hydrogen Setback Distances in NFPA 55	H2 systems / infrastructure
US	NFPA 55	Storage, use and Handling of Compressed Gases and Cryogenic Fluids in portable and Stationary Containers, Cylinders, and Tanks	H2 storage systems / equipment
US	OSHA 29 CFR part	Standards - 29 CFR 1910.101 - Compressed gases (general requirements).	H2 storage
US	NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases or Vapours and of	H2 systems / infrastructure

Country	Code/Standard	Description	Applicability
		Hazardous (Classified) Locations for Electrical Installations in Chemical process Areas	
US	FAA 14 CFR part 420	License to Operate a Launch Site	GH2 safety requirements
US	CGA publication C-1-2016	Methods for Pressure Testing Compressed Gas Cylinders	GH2 storage systems
US	CSA HPIT2 s	Dispensing systems and components for fueling hydrogen powered industrial truck	Specification
US	Plan No. 20083235-T-469	Compressed Hydrogen Surface Vehicle Refueling Connection Devices	Specification
US	SAE TIR J2601/3	Fueling Protocols for Gaseous Hydrogen Powered Industrial Trucks (forklifts)	Specification
US	SAE J2799	70 MPa Compressed Hydrogen Surface Vehicle Refueling Connection Device and Optional Vehicle to Station Communication	Specification
US	CSA HGV4.1	Hydrogen Dispensers	Specification
US	CSA HGV4.2	Hose and Hose Assemblies for Hydrogen Vehicles and Dispensing Systems	Specification
US	CSA HGV4.3	Fueling Parameters for Hydrogen Dispensing System	Specification
US	CSA HGV4.4	Gaseous Hydrogen – Fueling Stations - Valves	Specification
US	CSA HGV4.6	Manually Operated Valves Used in Gaseous Hydrogen Vehicle Fueling Stations	Specification
US	CSA HGV4.7	Automatic Pressure Operated Valves for Use in Gaseous Hydrogen Vehicle Fueling Stations	Specification
US	CSA HGV4.8	Hydrogen Gas Vehicle Fueling Stations Compressor Guidelines	Specification
US	CSA HGV4.9	Fueling System Guideline	Specification
US	CSA HGV 19880-3	Gaseous Hydrogen – Fueling stations - Valves	Specification
US	SAE J2799	70 MPa Compressed Hydrogen Surface Vehicle Refueling Connection Device and Optional Vehicle to Station Communication	Specification
INT	ISO 13984	Liquid Hydrogen Land Vehicle Fueling System Interface	LH2 refueling system / equipment
INT	ISO 13985	Liquid Hydrogen – Land Vehicle Fuel Tanks	LH2 storage tanks
INT	ISO 17268	Gaseous Hydrogen Land Vehicle Refueling Connection Devices	GH2 storage systems
INT	ISO 19078:2013	Inspection of the cylinder installation, and requalification of high-pressure cylinders for the on-board storage of natural gas as a	GH2 storage systems

Country	Code/Standard	Description	Applicability
		fuel for automotive vehicles (NOTE: many hydrogen standards have been adapted from natural gas standards)	
INT	ISO 19881	Gaseous Hydrogen – Land vehicle fuel containers	GH2 storage tanks
INT	ISO 19882	Gaseous Hydrogen – Thermally active pressure relief devices for compressed hydrogen vehicle fuel containers	GH2 storage TPRDs
INT	ISO/AWI TR 19884-2	Gaseous hydrogen and tubes for stationary storage Cylinders	GH2 storage
INT	ISO 21010	Cryogenic Vessels — Gas / Materials Compatibility	LH2 storage and distribution systems
INT	ISO 21010-3	Cryogenic Vessels Pressure relief accessories for cryogenic service capacity determination Part 3: Sizing and	LH2 storage PRDs
INT	ISO 21014	Cryogenic Vessels — Cryogenic insulation performance	LH2 storage and distribution systems
INT	ISO 21028-1	Cryogenic Vessels — Toughness requirements for materials at cryogenic temperature — Part 1: Temperatures below -80°C.	LH2 storage and distribution systems
INT	ISO 23208	Cryogenic vessels — Cleanliness for cryogenic service	H2 Storage
INT	OIML R 81	Dynamic measuring devices and systems for cryogenic liquids	LH2 filling and/or refueling
INT	ISO 16528-1:2007	Boilers and pressure vessels — Part 1: Performance requirements	GH2 piping, and equipment.
INT	ISO/TS 19883:2017	Safety of pressure swing adsorption systems for hydrogen separation and purification	GH2 piping, and equipment.
INT	ISO 7866:2012	Gas cylinders — Refillable seamless aluminium alloy gas cylinders — Design, construction and testing	GH2 storage systems
INT	ISO 11119-1:2020	Gas cylinders — Design, construction and testing of refillable composite gas cylinders and tubes	GH2 storage systems
INT	ISO 11119-2:2020	Gas cylinders — Design, construction and testing of refillable composite gas cylinders and tubes	GH2 storage systems
INT	ISO 11119-3:2020	Gas cylinders — Design, construction and testing of refillable composite gas cylinders and tubes	GH2 storage systems
INT	ISO 11114-1:2012	Gas cylinders — Compatibility Of cylinder and valve materials with gas contents — Part 1: Metallic materials	Material compatibility, GH2 storage systems
INT	ISO 2.1029-1:2004	Cryogenic vessels – Transportable vacuum insulated vessels of not more than 1000 L volume – Part 1:	Information

Country	Code/Standard	Description	Applicability
		Design, fabrication, inspection and tests	
INT	ISO 13984	Liquid Hydrogen - Land Vehicle Fueling System Interface	Specification
INT	ISO 17268	Gaseous Hydrogen Land Vehicle Refueling Connection Devices	Specification
INT	ISO 19880-7	Gaseous Hydrogen - Fueling Station – Part 7: O-rings	Specification
INT	ISO 19880-1	Gaseous Hydrogen Fueling Station - General Requirements	Specification
INT	ISO 19880-2	Gaseous Hydrogen Fueling Station Dispensers	Specification
INT	ISO 19880-3	Gaseous hydrogen -- Fueling stations -- Part 3: Valves	Specification
INT	ISO 19880-4	Gaseous Hydrogen Fueling Station - Compressors	Specification
INT	ISO 19880-5	Gaseous Hydrogen - Fueling Station – Part 5: Hoses	Specification
INT	ISO 19880-6	Gaseous Hydrogen Fueling Station - Fittings	Specification
INT	ISO 19880-8	Gaseous Hydrogen Fueling Station - Part 8: Hydrogen Quality Control	Specification
INT	ISO 19885-3	Gaseous Hydrogen – Fuelling protocols for hydrogen-fuelled vehicles Part 3: High flow hydrogen fuelling protocols for heavy duty road vehicles	Specification
INT	ISO TS 20100	Gaseous Hydrogen – Service Stations	Specification
EUR	EGA Doc 121/04	Hydrogen Pipeline Systems. Limited to gaseous products with a temperature range between –40C and 175C, total pressure from 1 MPa to 21 MPa.	GH2 piping / distribution systems

Table 14: Segment 4b: Hydrogen end-use: Heavy duty vehicles - Applicable standards

Country	Code/Standard	Description	Applicability
CAN	BNQ 1784-000	Canadian Hydrogen Installation Code	Ground H2 systems / infrastructure
CAN	CSA PRD 1	Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers	Hydrogen buses/trucks
CAN	CSA C22.2 No. 107.1	Power conversion equipment	Hydrogen buses, trucks, freight trains, locomotives
CAN	CSA B335	Safety standard for lift trucks	Hydrogen airport vehicles, trucks
CAN	CSA B109.1:21	Compressed natural gas vehicle installation code	H2 Powered Forklifts

Country	Code/Standard	Description	Applicability
CAN	SPE 2.1.1	Best practices for defueling, decommissioning, and disposal of compressed natural gas vehicle fuel containers and liquefied natural gas vehicle fuel tanks	H2 Powered Forklifts
CAN	SPE 2.2.1	Best practices for CNG vehicle system leak inspection.	H2 Powered Forklifts
CAN	CSA B51, Part 2	High pressure cylinders for the on-board storage of natural gas and hydrogen as fuels for automotive vehicles	H2 Powered Forklifts
CAN/US	CSA HPRD 1	Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers (CAN + US)	H2 Powered vehicles/cars
CAN/US	CSA HGV 2	Compressed hydrogen gas vehicle containers (CAN + US)	Hydrogen buses/trucks
CAN/US	CSA/ANSI HGV 3.1	Fuel System Components for Compressed Hydrogen Gas Powered Vehicles	H2 Powered vehicles/cars
CAN/US	CSA SPE-2.1.3	Best practices for defueling, decommissioning, and disposal of compressed hydrogen gas vehicle fuel containers	Hydrogen buses/trucks
CAN/US	CSA/ANSI HGV 2	Compressed hydrogen gas vehicle fuel containers	Hydrogen buses, trucks, freight trains, locomotives
CAN/US	CSA/ANSI HPRD 1	Thermal Activated Pressure Relief Devices for Compressed Hydrogen Vehicle Fuel Containers	Hydrogen buses, trucks, freight trains, locomotives
CAN/US	CSA/ANSI FC 1 - CSA C22.2 No. 62282-3-100	Fuel cell technologies - Part 3-100: Stationary fuel cell power systems – Safety (Adopted IEC 62282-3-100:2019, second edition, 2019-02, with Canadian and U.S. deviations)	Hydrogen buses, trucks, freight trains, locomotives
CAN/US	CAN/CSA C22.2 No. 62282-2	Fuel cell technologies - Part 2: Fuel cell modules (Adopted IEC 62282-2:2012, second edition, 2012-03, with Canadian deviations)	Hydrogen buses, trucks, freight trains, locomotives
CAN/US	ANSI/CSA AMERICA FC 3-2004 (R2021)	Portable Fuel Cell Power Systems	Hydrogen buses, trucks, freight trains, locomotives
CAN/US	CSA/ANSI FC 1 CSA C22.2 No. 62282-3-100	Fuel cell technologies - Part 3-100: Stationary fuel cell power systems – Safety (Adopted IEC 62282-3-100:2019, second edition, 2019-02, with Canadian and U.S. deviations)	Hydrogen buses, trucks, freight trains, locomotives

Country	Code/Standard	Description	Applicability
CAN/US	CSA/ANSI FC 6	Fuel cell technologies - Part 2: Fuel cell modules (Adopted IEC 62282-2:2012, second edition, 2012-03, with United States deviations)	Hydrogen buses, trucks, freight trains, locomotives
CAN/US	CSA/ANSI NGV 1	Compressed natural gas vehicle (NGV) fuelling connection devices	H2 Powered Forklifts
CAN/US	CSA/ANSI NGV 2:23	Compressed natural gas vehicle fuel containers	H2 Powered Forklifts
CAN/US	CSA/ANSI NGV 3.1	Fuel system components for compressed natural gas-powered vehicles	H2 Powered Forklifts
CAN/US	CSA/ANSI NGV 6.1	CNG fuel storage and delivery systems for road vehicles	H2 Powered Forklifts
CAN/US	CSA/ANSI PRD 1	Pressure relief devices for CNG fuel containers	H2 Powered Forklifts
CAN/US	CSA/ANSI NGV 2	Compressed natural gas vehicle fuel containers	H2 Powered vehicles/cars
US	SAE J2601/2	Fueling Protocol for Gaseous Hydrogen Powered Heavy Duty Vehicles	Heavy Duty Vehicles
US	SAE J2601/3	Fueling Protocol for Gaseous Hydrogen Powered Industrial Trucks	Industrial Trucks
US	CSA HPIT 1	Compressed hydrogen powered industrial truck on-board fuel storage and handling component	Industrial Trucks
US	ANSI/CSA HGV 3.1	Fuel system components for compressed hydrogen gas powered vehicles	Fuel system
US	ANSI/CSA HGV 4.3	Test methods for hydrogen fueling parameter evaluation	Test method
US	CSA HGV4.9	Fueling System Guideline	Information
US	CSA HPIT1	Compressed Hydrogen Powered Industrial Trucks (forklifts) On-Board Fuel Storage and Handling Components	Specification
US	CSA HPIT2	Dispensing systems and components for fueling hydrogen powered industrial trucks	Specification
US	SAE J2578	Recommended practice for general fuel cell vehicle safety (US)	H2 Powered vehicles/cars
US	SAE J2579	Standard for Fuel Systems in Fuel Cell and Other Hydrogen Vehicles	H2 Powered vehicles/cars
US	SAE J2600	Compressed Hydrogen Surface Vehicle Fuelling Connection Devices	H2 Powered vehicles/cars
US	SAE J2601	Fuelling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles	H2 Powered vehicles/cars

Country	Code/Standard	Description	Applicability
US	SAE J2601-2*	Fuelling Protocols for Heavy Duty Gaseous Surface Vehicles.	H2 Powered vehicles/cars
US	SAE J2601-4	Ambient temperature for fixed orifice fuelling (light duty, no pre-cooling) (US)	H2 Powered vehicles/cars
US	SAE J2601-5	High-Flow prescriptive fuelling protocols for gaseous hydrogen Powertech medium and heavy-duty vehicles	H2 Powered vehicles/cars
US	SAE J2719	Hydrogen fuel quality for fuel cell vehicles (US)	H2 Powered vehicles/cars
US	SAE J2799	Hydrogen Surface vehicle to station communications hardware and software	H2 Powered vehicles/cars
US	SAE J1766	Recommended practice for electric, fuel cell and hybrid electric vehicle crash integrity testing	Hydrogen buses, trucks, freight trains, locomotives
US	SAE J2615	Testing performance of fuel cell systems for automotive applications	Hydrogen buses, trucks, freight trains, locomotives
US	SAE J3121	Hydrogen vehicle crash test lab safety guidelines	Hydrogen buses, trucks, freight trains, locomotives
US	SAE J2617	Recommended practice for testing performance of PEM fuel cell stack sub-system for automotive applications	Hydrogen buses, trucks, freight trains, locomotives
US	NFPA 505	Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations	Hydrogen airport vehicles, trucks
INT	ISO/AWI 19885-3	Gaseous hydrogen — Fuelling protocols for hydrogen-fuelled vehicles — Part 3: High flow hydrogen fuelling protocols for heavy duty road vehicles	Safety - Under development
INT	IEC 62282-4-102	Fuel cell power systems for industrial electric trucks - Performance test methods	Specification
INT	IEC 62282-4-101	Fuel cell power systems for propulsion other than road vehicles and auxiliary power units (APU) - Safety of electrically powered industrial trucks	Specification
INT	ISO/TR 11954:2010	Fuel Cell Road Vehicles- Road Maximum Speed Measurement	Specification
INT	ISO 23828	Fuel Cell Road Vehicle- Energy Consumption Measurement Part	Specification

Country	Code/Standard	Description	Applicability
		1: Vehicles fueled with compressed hydrogen	
INT	ISO 19885-3	Gaseous Hydrogen – Fuelling protocols for hydrogen-fuelled vehicles Part 3: High flow hydrogen fuelling protocols for heavy duty road vehicles	Specification
INT	ISO/ANSI 12619-1:2014	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 1: General requirements and definitions.	H2 Powered Forklifts
INT	ISO 12619-2:2014	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 2: Performance and general test methods.	H2 Powered Forklifts
INT	ISO 12619-2:2014/Amendment 1: 2016	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 2: Performance and general test methods – Amendment 1.	H2 Powered Forklifts
INT	ISO 12619-3:2014	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 3: Pressure regulator.	H2 Powered Forklifts
INT	ISO 12619-3:2014/Amendment 1: 2016	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 3: Pressure regulator – Amendment 1.	H2 Powered Forklifts
INT	ISO 12619-4:2016	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 4: Check valve.	H2 Powered Forklifts
INT	ISO 12619-5:2016	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 5: Manual cylinder valve.	H2 Powered Forklifts
INT	ISO 12619-6:2017	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 6: Automatic valve.	H2 Powered Forklifts

Country	Code/Standard	Description	Applicability
INT	ISO 12619-7:2017	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 7: Gas injector.	H2 Powered Forklifts
INT	ISO 12619-8:2017	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 8: Pressure indicator.	H2 Powered Forklifts
INT	ISO 12619-9:2017	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 9: Pressure relief valve (PRV).	H2 Powered Forklifts
INT	ISO 12619-10:2017	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 10: Pressure relief device (PRD).	H2 Powered Forklifts
INT	ISO 12619-11:2017	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 11: Excess flow valve.	H2 Powered Forklifts
INT	ISO 12619-12:2017	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 12: Gas-tight housing and ventilation hoses.	H2 Powered Forklifts
INT	ISO 12619-13:2017	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 13: Rigid fuel line in stainless steel.	H2 Powered Forklifts
INT	ISO 12619-14:2017	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 14: Flexible fuel line.	H2 Powered Forklifts
INT	ISO 12619-15:2017	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 15: Filter.	H2 Powered Forklifts
INT	ISO 12619-16:2017	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 16: Fittings.	H2 Powered Forklifts
INT	ISO 16380	Standard for a Blended fuels refueling connector (this	H2 Powered Forklifts

Country	Code/Standard	Description	Applicability
		document is also under revision).	
INT	ISO 21266-1	Road vehicles — Compressed gaseous hydrogen (CGH ₂) and hydrogen/natural gas blends fuel systems — Part 1: Safety requirements ¹	H2 Powered Forklifts
INT	ISO 21266-2	Road vehicles — Compressed gaseous hydrogen (CGH ₂) and hydrogen/natural gas blends fuel systems — Part 2: Test methods ¹	H2 Powered Forklifts
INT	ISO 17268	Gaseous hydrogen – Land vehicle refuelling connection devices	H2 Powered vehicles/cars
INT	ISO 19881:2018	Gaseous hydrogen — Land vehicle fuel containers	H2 Powered vehicles/cars
INT	ISO 19882	Gaseous hydrogen – Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers	H2 Powered vehicles/cars
INT	ISO 19887	Gaseous hydrogen – Fuel system components for hydrogen fuelled vehicles	H2 Powered vehicles/cars
INT	ISO 19885	Fuelling protocols for hydrogen-fuelled vehicles – Part 3: High flow hydrogen fuelling protocols for heavy duty road vehicles	H2 Powered vehicles/cars
INT	ISO 14687	Hydrogen fuel quality - Product specification	H2 Powered vehicles/cars
INT	UN GTR No. 13	Global technical regulation on Hydrogen and Fuel Cell Vehicles (HFCV)	H2 Powered vehicles/cars
INT	ECE R134	Uniform provisions concerning the approval of motor vehicles and their components with regard to the safety-related performance of hydrogen fuelled vehicles (HFCV)	H2 Powered vehicles/cars
INT	ISO 13984:1999	Liquid hydrogen – Land vehicle fuelling system interface	Hydrogen buses/trucks
INT	ISO 13985	Liquid Hydrogen - Land Vehicle fuel tanks	Hydrogen buses/trucks
INT	ISO 15869	Gaseous hydrogen and hydrogen blends — Land vehicle fuel tanks	Hydrogen buses/trucks
INT	ISO 23273	Fuel cell road vehicles - Safety specifications - Protection against hydrogen hazards for vehicles fuelled with compressed hydrogen	Hydrogen buses/trucks
INT	ISO 12619	Road vehicles — Compressed gaseous hydrogen (CGH ₂) and	Hydrogen buses/trucks

Country	Code/Standard	Description	Applicability
		hydrogen/natural gas blends fuel system components	
INT	ISO 19078	Gas cylinders - Inspection of the cylinder installation, and requalification of high-pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles	Hydrogen buses, trucks, freight trains, locomotives
INT	IEC 62282-5-100	Fuel cell technologies - Part 5-100: Portable fuel cell power systems - Safety	Hydrogen buses, trucks, freight trains, locomotives
INT	UL 2267	Standard For Fuel Cell Power Systems for Installation In Industrial Electric Trucks	Hydrogen airport vehicles, trucks
INT	ISO 6966-1:2005	Aircraft ground equipment — Basic requirements — Part 1: General design requirements	Hydrogen airport vehicles, trucks
INT	ISO 6966-2:2014	Aircraft ground equipment — Basic requirements — Part 2: Safety requirements	Hydrogen airport vehicles, trucks
INT	ISO 8268:1987	Air cargo equipment — Automobile transport devices — Basic requirements	Hydrogen airport vehicles, trucks
INT	ISO 9666:1993 Aircraft	Self-propelled lavatory-servicing vehicle — Functional requirements	Hydrogen airport vehicles, trucks
INT	ISO 9678:1991	Aircraft — Self-propelled potable-water vehicle	Hydrogen airport vehicles, trucks
INT	ISO 10841:1996	Aircraft — Catering vehicle for large capacity aircraft — Functional requirements	Hydrogen airport vehicles, trucks
INT	ISO 11077:2014	Aircraft ground equipment — De-icers — Functional requirements	Hydrogen airport vehicles, trucks
INT	IEC 62282-2-100:2020 Fuel cell technologies - Part 2-100:	Fuel Cell Technologies – Part 2-100 Fuel Cell Modules – Safety	High pressure and low pressure dispensing
INT	IEC 62282-4-102	Fuel cell technologies - Part 4-102: Fuel cell power systems for industrial electric trucks - Performance test methods	H2 powered Trucks, Locomotives
INT	ISO/ANSI 12619-1:2014	Road vehicles – Compressed gaseous hydrogen (CGH2) and hydrogen/natural gas blends fuel system components – Part 1: General requirements and definitions.	Hydrogen powered forklifts, trucks, buses, cars
INT	IEC 60079-10-1 Ed. 3.0 b:2020	Explosive Atmospheres - Part 10-1: Classification of Areas - Explosive Gas Atmospheres	High pressure and low pressure dispensing

Country	Code/Standard	Description	Applicability
China	GB/T 31037.1-2014	Fuel cell power system used for industrial lift truck applications Part 1: Safety	Specification
Japan	JIS C 62282-4-101 y	Fuel cell technologies – Part 4-101 Fuel cell power system for electrically powered trucks – Safet	Specification
Japan	JIS C 62282-4-102	Fuel cell technologies – Part 4-102 Fuel cell power system for electrically powered trucks – Performance test methods	Specification
	NFPA 2	Hydrogen Technologies Code	Specification

Table 15: Segment 4c: Hydrogen end-use: Domestic/Commercial applications - Applicable standards

Country	Code/Standard	Description	Applicability
CAN	CAN/BNQ 1784-000	Canadian Hydrogen Installation Code	H2 heating appliances
CAN	CGA 3.2-1976 (R2009)	Industrial and Commercial Gas-Fired Package Furnaces	H2 heating appliances
CAN	Z83.8/CSA 2.6	Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters, and Gas-Fired Duct Furnaces	H2 heating appliances
CAN	CSA/Z21.57	Recreational Vehicle Cooking Gas Appliances	H2 heating appliances
CAN	CAN1-1.16	Recreational Vehicle Cooking Gas Appliances	H2 heating appliances
CAN	NOI/PINS - Z21.106	Hydrogen fueled appliances and related accessories.	Natural gas - hydrogen blend heating appliances
CAN/US	ANSI Z21.1-2016/CSA 1.1-2016	Household Cooking Gas Appliances	Natural gas - hydrogen blend heating appliances
CAN/US	ANSI Z21.10.1-2019/CSA 4.1-2019	Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less	H2 heating appliances
CAN/US	ANSI Z21.10.3-2019/CSA 4.3-2019	Gas-fired water heaters, volume III, storage water heaters with input ratings above 75,000 Btu per hour, circulating and instantaneous	H2 heating appliances

Country	Code/Standard	Description	Applicability
CAN/US	CSA B149.3	Code for field approval of fuel-related components on appliances and equipment	H2 heating appliances
CAN/US	Z21.89/CSA 1.18	Outdoor Cooking Specialty Gas Appliances	H2 heating appliances
CAN/US	CSA and CSA/ANSI Z21/83*	Suite of standards – gas burning appliances and controls	Natural gas - hydrogen blend heating appliances
CAN/US	CSA P	suite of standards for Energy efficiency	Natural gas - hydrogen blend heating appliances
CAN/US	CSA Research	appliances and controls testing for H2 blend - ongoing	Natural gas - hydrogen blend heating appliances
CAN/US	ANSI Z83.4-2017/CSA 3.7-2017	Non-Recirculating Direct Gas-Fired Heating And Forced Ventilation Appliances For Commercial And Industrial Application	Natural gas - hydrogen blend heating appliances
CAN/US	CSA/ANSI Z21/83*	Suite of standards – gas burning appliances and controls	H2 heating appliances
CAN	CSA P	Suite of standards for Energy efficiency	H2 heating appliances
CAN	CSA Research	Appliances and controls testing for H2 blend - ongoing	H2 heating appliances
CAN	CSA/Z21.42	Gas-Fired illuminating Appliances	H2 heating appliances
CAN/US	CSA/ANSI Z21.47-21/CSA 2.3-2021	Gas-Fired Central Furnaces	Natural gas - hydrogen blend heating appliances
INT	ANSI Z21.13-2017/CSA 4.9-2017 (R2022)	Gas-fired low-pressure steam and hot water boilers	Natural gas - hydrogen blend heating appliances
INT	ULC/ORD-C795 (2021) 1st Edition	Commercial - Industrial Gas - Fired Package Boilers	Natural gas - hydrogen blend heating appliances
Australia	Z21.58/CSA 1.6	Outdoor Cooking Gas Appliances	H2 heating appliances
Australia	ANSI Z21.56-2013/CSA 4.7-2013	Gas-Fired Pool Heaters	Natural gas - hydrogen blend heating appliances

Country	Code/Standard	Description	Applicability
BSI	CSA P.2	Test Method for Measuring the Annual Fuel Utilization Efficiency of Residential Gas-Fired or Oil-Fired Furnaces and Boilers	H2 heating appliances
BSI	CSA/ANSI 3.21:19	Industrial gas-fired natural draft heaters for installation in non-hazardous and hazardous locations in oil and gas process applications	H2 heating appliances
Europe	NOI/PINS - Z21.106	Hydrogen fueled appliances and related accessories.	H2 heating appliances
Europe	CSA P.10	Performance of Integrated Mechanical Systems for Residential Heating and Ventilation	H2 heating appliances
Europe	CSA/ANSI Z21.47 CSA 2.3	Gas-fired central furnaces	H2 heating appliances
Europe	Z83.18	Recirculating Direct Gas-Fired Heating and Forced Ventilation Appliances for Commercial and Industrial Applications	H2 heating appliances
Europe	UL 795 8th Edition	Edition 8 Commercial-Industrial Gas Heating Equipment	Natural gas - hydrogen blend heating appliances
Europe	ANSI Z83.11-2016/CSA 1.8-2016	Gas Food Service Equipment	Natural gas - hydrogen blend heating appliances

Table 16: Segment 4d: Hydrogen end-use: Power generation - Applicable standards

Country	Code/Standard	Description	Applicability
CAN	CSA TIL No. R-18	Requirements for Portable Fuel Cell Power Generating Systems	Portable fuel & Micro fuel cell power systems
CAN	CSA B107	Enclosed Hydrogen Equipment - Safety	Power production – Stationary fuel cell power systems Includes: - Stationary fuel cell power systems - Stationary - indoor UPS systems
CAN	CSA C282	Emergency electrical power supply for buildings	H2 Gas turbine
CAN	CSA 22.2 No. 100	Motors And Generators	H2 Gas turbine

Country	Code/Standard	Description	Applicability
CAN/US	ANSI/CSA AMERICA FC 3-2004 (R2021)	Portable Fuel Cell Power Systems	Portable fuel & Micro fuel cell power systems
CAN/US	CSA/ANSI FC3/ CSA AMERICA FC3	Portable Fuel Cell Power systems	Portable fuel & Micro fuel cell power systems
CAN/US	CAN/CSA C22,2 No.62282-2	Fuel cell technologies - Part 2: Fuel cell modules (IEC 62282-2:2012, MOD)	Portable fuel & Micro fuel cell power systems
CAN/US	CSA/ANSI FC 1:21/CSA C22,2 No. 62282-3-100:21	Fuel Cell technologies - Part 3-100: Stationary fuel cell power systems - Safety (Adopted IEC 62282-3-100:2019, second edition, 2019-02, with Canadian and U.S. deviations)	Power production – Stationary fuel cell power systems Includes: - Stationary fuel cell power systems - Stationary - indoor UPS systems
CAN/US	CAN/CSA C22.2 No. 62282-2	Fuel cell technologies — Part 2: Fuel cell modules (IEC 62282-2:2012, MOD)	Power production – Stationary fuel cell power systems Includes: - Stationary fuel cell power systems - Stationary - indoor UPS systems
CAN/US	CSA/ANSI FC 1	Fuel Cell Technologies - Part 3-100: Stationary Fuel Cell Power Systems - Safety (IEC 62282-3-100:12, MOD)	Power production – Stationary fuel cell power systems Includes: - Stationary fuel cell power systems - Stationary - indoor UPS systems
CAN/US	CSA/ANSI FC 6	Fuel cell technologies - Part 2: Fuel cell modules (Adopted IEC 62282-2:2012, second edition, 2012-03, with United States deviations)	Power production – Stationary fuel cell power systems Includes: - Stationary fuel cell power systems - Stationary - indoor UPS systems
CAN/US	CSA/ANSI 13.1	Combined heat and power appliances	Power production – Stationary fuel cell power systems Includes: - Stationary fuel cell power systems - Stationary - indoor UPS systems

Country	Code/Standard	Description	Applicability
CAN/US	CAN/CSA-B138.1-17/CAN/CSA-B138.2-17 (R2022)	Portable oil-burning equipment - Packaged equipment requirements/Installation requirements	H2 Gas turbine
CAN/US	ANSI/ASME B133.9-1994 (R2001)	Measurement of Exhaust Emissions from Stationary Gas Turbine Engines	H2 Gas turbine
CAN/US	UL 2200,	Stationary Engine Generator Assemblies (Standard for UC/CAN) (Stationary Combustion Engines and Gas Turbines)	H2 Gas turbine
CAN/US	UL 1004-1	Standard for Rotating Electrical Machines - General Requirements.	H2 Gas IC Engine
CAN/US	UL 1004-4 Ed. 3-2018	Standard for Electric Generators	H2 Gas IC Engine
CAN/US	UL 2200	Stationary Engine Generator Assemblies (Standard for UC/CAN) (Stationary Combustion Engines and Gas Turbines)	H2 Gas IC Engine
US	ASME B31.1	Power Piping	Piping
US	CSA FC5	Hydrogen Generators Using Fuel Processing Technologies – Part 1: Safety	Safety
CAN/US	CSA/ANSI FC6	Fuel Cell Modules	Portable fuel & Micro fuel cell power systems
US	ANSI/PGMA G300	Safety and Performance of Portable Generators	H2 Gas turbine
US	NFPA 110	Standard for Emergency and Standby Power Systems	H2 Gas turbine
US	ASME B133.8	Gas Turbine Installation Sound Emissions, 11th Edition, 2022	H2 Gas turbine
US	ASME PTC 4.4-2008 (R2013)	Gas Turbine Heat Recovery Steam Generators - Performance Test Codes	H2 Gas turbine
US	ASME PTC 22	Performance Test Code on Gas Turbines, 2014 Edition, December 31, 2014	H2 Gas turbine

Country	Code/Standard	Description	Applicability
US	ASTM STP809	Stationary Gas Turbine Alternative Fuels, 1983 Edition, 1983	H2 Gas turbine
US	API STD 616	Gas Turbines for the Petroleum, Chemical, and Gas Industry Services, 6th Edition, September 2022	H2 Gas turbine
US	NFPA 37-2021, NFPA 37	Standard for The Installation and Use of Stationary Combustion Engines and Gas Turbines	H2 Gas turbine
US	SAE ARP 4050A-2017	Balancing Machines - Description and Evaluation Vertical, Two-Plane, Hard-Bearing Type for Gas Turbine Rotors	H2 Gas turbine
US	SAE ARP 5323A-2017	Balancing Machines - Description and Evaluation Vertical, Single-Plane, Hard-Bearing Type for Gas Turbine Rotors	H2 Gas turbine
US	SAE AIR 4391A-1999 (SAE AIR4391A-1999)	Industrial and Marine Gas Turbine Engine Starting Systems	H2 Gas turbine
US	ANSI/AIAA G-095A-2017	Guidelines for hydrogen system design, materials selection, operations, storage, and transportation, National Aeronautics and Space Administration	H2 Gas IC Engine
INT	IEC/TS 62282-9-101	Provides a streamlined quantification methodology of major environmental impacts of stationary fuel cell power systems with or without supplementary heat generator for residential applications based on their typical demand for electricity and heat.	Methodology

Country	Code/Standard	Description	Applicability
INT	IEC/TS 62282-8-301	Energy storage systems using fuel cell modules in reverse mode – Power to methane energy systems based on solid oxide cell including reversible operation	Performance test method
INT	IEC 62282-3-202	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	Performance test method
INT	ISO 16110-1	Hydrogen Generators Using Fuel Processing Technologies	Safety
INT	Working Party 29	Global Regulations on Pollution and the Environment Global Technical Regulations (GTR)Hydrogen Vehicles - Liquid Hydrogen, Gaseous Hydrogen	Regulation
INT	IEC 60034-3:2007**	Rotating electrical machines - Part 3: Specific requirements for synchronous generators driven by steam turbines or combustion gas turbines.	H2 Gas turbine
INT	ISO 11086	Gas turbines – Vocabulary, last reviewed and confirmed in 2017	H2 Gas turbine
INT	ISO 19859:2016	Gas Turbine Applications - Requirements for Power Generation	H2 Gas turbine
INT	ISO 19860:2005	Gas Turbines - Data Acquisition and Trend Monitoring System Requirements for Gas Turbine Installations	H2 Gas turbine

Country	Code/Standard	Description	Applicability
INT	ISO 20816-4:2018	Mechanical Vibration - Measurement and Evaluation of Machine Vibration - Part 4: Gas Turbines In Excess Of 3 MW, With Fluid-Film Bearings	H2 Gas turbine
INT	ISO 20816-2:2017	Mechanical Vibration - Measurement and Evaluation of Machine Vibration - Part 2: Land-Based Gas Turbines, Steam Turbines and Generators In Excess Of 40 MW, With Fluid-Film Bearings And Rated Speeds Of 1 500 R/Min, 1 800 R/Min, 3 000 R/Min And 3 600 R/Min	H2 Gas turbine
INT	ISO 21789:2022	Gas turbine applications — Safety	H2 Gas turbine
INT	ISO 21905:2020	Gas turbine exhaust systems with or without waste heat recovery	H2 Gas turbine
INT	ISO 22266-1:2022	Mechanical vibration — Torsional vibration of rotating machinery — Part 1: Evaluation of steam and gas turbine generator sets due to electrical excitation (ISO 22266-1:2022 Product CSA Group)	H2 Gas turbine
INT	ISO 2314	Gas turbines — Acceptance tests, 3rd Edition, December 15, 2009	H2 Gas turbine
INT	ISO 3977-3	Gas Turbines - Procurement - Part 3: Design Requirements, 2nd Edition, August 15, 2004	H2 Gas turbine
INT	IEC 60034-22:2009	Rotating electrical machines - Part 22: AC generators for reciprocating internal combustion (RIC) engine driven generating sets.	H2 Gas IC Engine

Country	Code/Standard	Description	Applicability
INT	IEC TS 62257-7-3:2018	Recommendations for renewable energy and hybrid systems for rural electrification - Part 7-3: Generator set - Selection of generator sets for rural electrification systems	H2 Gas IC Engine
INT	IEC 88528-11:2004	Reciprocating internal combustion engine driven alternating current generating sets - Part 11: Rotary uninterruptible power systems - Performance requirements and test methods	H2 Gas IC Engine
INT	ISO 3046-3 3rd Edition	June 15, 2006, Reciprocating Internal Combustion Engines - Performance - Part 3: Test Measurements	H2 Gas IC Engine
INT	ISO 8528-1:2018	Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets - Part 1: Application, Ratings and Performance	H2 Gas IC Engine
INT	ISO 8528-2:2018	Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets - Part 2: Engines	H2 Gas IC Engine
INT	ISO 8528-3:2020	Reciprocating internal combustion engine driven alternating current generating sets — Part 3: Alternating current generators for generating sets	H2 Gas IC Engine
INT	ISO 8528-4:2005	Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets - Part 4: Control gear and Switchgear	H2 Gas IC Engine
INT	ISO 8528-5:2022	Reciprocating internal combustion engine driven alternating current generating sets — Part 5: Generating sets	H2 Gas IC Engine

Country	Code/Standard	Description	Applicability
INT	ISO 8528-6:2005	Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets - Part 6: Test Methods	H2 Gas IC Engine
INT	ISO 8528-10:2022	Reciprocating internal combustion engine driven alternating current generating sets — Part 10: Measurement of airborne noise	H2 Gas IC Engine
INT	ISO 8528-12:2022	Reciprocating internal combustion engine driven alternating current generating sets — Part 12: Emergency power supply to safety services	H2 Gas IC Engine
INT	ISO 8528-13:2016	Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets - Part 13: Safety	H2 Gas IC Engine
INT	ISO 18888:2017	Gas Turbine Combined Cycle Power Plants - Thermal Performance Tests	H2 Gas turbine
CHINA	GB/T 27748.1-2017	Stationary fuel cell generation power system – Part 1	Safety
CHINA	GB/T 27748.3-2017	Stationary fuel cell power generation system – Part 3	Installation
CHINA	GB/T 27748.4-2017	Stationary fuel cell power generation system – Part 4	Small fuel cell power generation system – Performance test method
CHINA	GB/T 31037.2-2014	Fuel cell power generation system for industrial lifting vehicles Part 2	Technical conditions
CHINA	GB/T 33979-2017	Test method for low temperature characteristics of proton exchange membrane fuel cell power generation system	Test method
Europe	DS/EN 12601 2011 Edition, January 6, 2011.	Reciprocating internal combustion engine driven generating sets – Safety	H2 Gas IC Engine