Hydrogen Vehicle and Infrastructure Codes and Standards Citations

This document lists codes and standards typically used for U.S. hydrogen vehicle and infrastructure projects. To determine which codes and standards apply to a specific project, identify the codes and standards currently in effect within the jurisdiction where the project will be located. Some jurisdictions also have unique ordinances or regulations that could apply.

Learn about codes and standards basics at www.afdc.energy.gov/afdc/codes_standards_basics.html.

Find hydrogen vehicle and infrastructure codes and standards in these categories:

- Annual Inspections and Approvals
- General Station Requirements
- Gaseous Hydrogen Storage, Compression, and Generation Systems
- Liquefied Hydrogen Storage Systems
- Dispensing Systems
- Piping and Tubing for All Systems
- Valving and Fittings for All Systems
- Venting and Other Equipment
- Fire Safety

Annual Inspections and Approvals

Inspection Requirements

**CGA G-5.4, Standard for Hydrogen Piping Systems at Consumer Locations (Compressed Gas Association, 2005)**
- 7.0 Maintenance and Repair

**CGA G-5.5, Hydrogen Vent Systems (Compressed Gas Association, 2004)**
- 9 Maintenance

- 406.2 Frequency (of employee training)
- 901.6 Inspection, Testing, and Maintenance
- 901.6.2 Records (of systems inspection and maintenance)
- 2206.2.1.1 Inventory Control for Underground Tanks
- 3204.5.2 Corrosion Protection
- 3205.4 Filling and Dispensing

**Personnel Issues and Training**

- 406 Employee Training and Response Procedures
- 2209.4 Dispensing into Motor Vehicles at Self-Service Hydrogen Motor Fuel-Dispensing Facilities

- 9.4 Operating Requirements for Attended Self-Service Motor Fuel Dispensing Facilities

**NFPA 55, Compressed Gases and Cryogenic Fluids Code** *(National Fire Protection Association, 2010)*

- 4.6 Personnel Training
- 4.7 Fire Department Liaison

**Operation Approvals—Dispensing**

**International Fire Code** *(International Code Council, 2009)*

- 2204.2 Attended Self-Service Motor Fuel-Dispensing Facilities
- 2204.3 Unattended Self-Service Motor Fuel-Dispensing Facilities
- 2209.4 Dispensing into Motor Vehicles at Self-Service Hydrogen Motor Fuel-Dispensing Facilities


- 6.2 General Requirements
- 6.3 Requirements for Dispensing Devices

**Operation Approvals—Fire and Emergency Planning**

**International Fire Code** *(International Code Council, 2009)*

- 404 Fire Safety and Evacuation Plan
- 406 Employee Training and Response Procedures
- 407 Hazard Communication
- 906 Portable Fire Extinguishers
- 907 Fire Alarm and Detection Systems
- 2209.3.2.6.2 Fire-Extinguishing Systems
- 2209.4 Dispensing into Motor Vehicles at Self-Service Hydrogen Motor Fuel-Dispensing Facilities
- 2209.5.1 Protection from Vehicles
- 2209.5.2 Emergency Shutoff Valves
- 2209.5.3 Emergency Shutdown Controls
- 2209.5.4 Venting of Hydrogen Systems


- 7.3.5 Fixed Fire Protection

- 6.3.7 Requirements for Dispensing Devices

**General Station Requirements**

**Site Requirements for Fueling Stations**


- 6.6.1 Weather Protection- Classification of Weather Protection as an Indoor Versus Outdoor Area
- 6.12 Gaseous Hydrogen Detection Systems
- 6.17.1 Mechanical Exhaust Ventilation

**Canopy Tops**


- 406.5.2.1 Canopies use to support gaseous hydrogen systems


- 2209.3.2.6 Canopy Tops
- 2209.3.3 Canopies

**Fuel Delivery**


- 105.6.8 Compressed Gases
- 105.6.10 Cryogenic Fluids
- 2205.1 Tank Filling Operation for Class I, II, or IIIA Liquids
- 3205.4 Filling and Dispensing

**Vehicle Access**


- 105.6.8 Compressed Gases

**Weather Protection**


- 2209.3.2.2 Weather Protection
- 2704.13 Weather Protection

**General Safety Requirements**


- 2209.5 Safety Precautions
- 2211.7 Repair Garages for Vehicles Fueled by Lighter-than-Air Fuels
- 2211.8 Defueling of Hydrogen from Motor Vehicle Fuel Storage Containers
3003 General Requirements
3203 General Safety Requirements
3503 General Requirements

Repair Facilities
- 2211.7 Repair Garages for Vehicles Fueled by Lighter-than-Air Fuels
- 2211.8 Defueling of Hydrogen from Motor Vehicle Fuel Storage Containers

Gaseous Hydrogen Storage, Compression, and Generation Systems

*NFPA 2 Hydrogen Technologies Code (National Fire Protection Association, 2011)*
- 7.1.1.3 Building Occupancy Classification for Hydrogen Storage
- 7.1.3 Listed and Approved Hydrogen Equipment
- 7.1.4 Metal Hydride Systems (including systems on industrial trucks)
- 7.1.5 Containers, Cylinders, and Tanks (this section refers to both the ASME BPB Section XIII or Transport Canada, Transportation of Dangerous Goods Regulations)
- 7.1.5.5 Pressure-Relief Devices
- 7.1.6 Labeling Requirements
- 7.1.6.4 Piping Systems
- 7.1.7 Security (including physical protection and securing containers)
- 7.1.8 Valve Protection
- 7.1.9 Separation from Hazardous Conditions
- 7.1.10 Service and Repair
- 7.1.11 Unauthorized Use
- 7.1.12 Containers, Cylinders, and Tanks Exposed Fire
- 7.1.13 Leaks, Damage, or Corrosion
- 7.1.14 Surfaces (on which containers would be placed)
- 7.1.15 Piping (including reference to ASME B31.12, Process Piping)
- 7.1.16 Valves (required accessibility)
- 7.1.17 Vent Pipe Termination
- 7.1.18 Cathodic Protection
- 7.1.19 Transfer (reference to CGA P-1 Safe Handling of Compressed Gases in Containers)
7.1.21 Emergency Shut-off Valves
7.1.22 Excess Flow Control (requirements for leak detection and emergency shut-off or excess flow control)
7.1.23 Ignition Control
7.2 Nonbulk GH2
7.2.1 Nonbulk GH2 General (separation from incompatible materials)
7.2.2 Nonbulk GH2 Storage (includes separation distances for nonbulk GH2 storage systems, systems 5,000 scf or less)
7.2.3 Nonbulk GH2 Use
7.2.4 Nonbulk GH2 Handling
7.3 Bulk GH2 Systems
7.3.1 Bulk GH2 Systems General Requirements
7.3.2 Bulk GH2 Systems Storage (contains Table 7.3.2.3.1.2 (a), (b), and (c) for above ground system separation distances)
7.3.3 Bulk GH2 Systems Use
7.3.4 Handling of Bulk GH2 Systems

7.2209.5 Safety Precautions
7.23003 General Requirements
7.23503 General Requirements

**Storage Containers**
*CGA PS-20, Direct Burial of Gaseous Hydrogen Storage Tanks (Compressed Gas Association, 2006)*

*CGA PS-21, Adjacent Storage of Compressed Hydrogen and Other Flammable Gases (Compressed Gas Association, 2005)*

7.22703.2.1 Design and Construction of Containers, Cylinders, and Tanks
7.23003.2 Design and Construction
7.23503.1.2 Storage Containers

**Compression Systems and Equipment**
7.22209.2 Equipment
7.22209.3 Location on Property
7.22209.5.3.1 System Requirements
7.222209.5.4.2.1 Minimum Rate of Discharge
Design of Gaseous Storage Systems—Barrier Walls
- 2209.3.1.1 Barrier Wall Construction – Gaseous Hydrogen

On-Site Hydrogen Production
- 2209.3.1 Separation from Outdoor Exposure Hazards

- 703.1 General Requirements

Natural Gas

Liquefied Hydrogen Storage Systems

*NFPA 2 Liquefied Hydrogen Requirements*
*NFPA 2 Hydrogen Technologies Code (National Fire Protection Association, 2011)*
- 8.1.2 Containers – Design, Construction, and Maintenance (refers to ASME BPV, Rules for Unfired Pressure Vessels and Transport Canada *Transportation of Dangerous Goods Regulations*)
- 8.1.3 Design (of systems)
- 8.1.3.1 Piping Systems (refers to ASME B31.3 Process Piping)
- 8.1.4 Pressure Relief Devices (refers to CGA S-1.1 through 1.3)
- 8.1.5 Pressure Relief Vent Piping
- 8.1.6 Marking (refers to NFPA 704 Standard System for the Identification of the Hazards of Materials for Emergency Response)
- 8.1.7 Security
- 8.1.8 Separation from Hazardous Conditions
- 8.1.9 Electrical Wiring and Equipment (general reference to NFPA 70 National Electrical Code)
- 8.1.10 Service and Repair
- 8.1.11 Unauthorized Use
- 8.1.12 Leaks, Damage, and Corrosion
- 8.1.13 Lighting
- 8.1.14 Emergency Shutoff Valves
- 8.1.15 Dispensing Areas
• 8.1.16 Operations (for mobile fueling equipment)
• 8.2 Nonbulk LH2 (storage, handling and use shall be in accordance with Chapter 1–6 and 8 as applicable)
• 8.3 Bulk LH2 Systems (cutoff is = or > 150 liters)
• 8.3.1.2.1.1 Fire Resistance for Steel Supports
• 8.3.1.2.1.2 Container Marking
• 8.3.1.2.2 Vent System Requirements (including reference to CGAG-5.5)
• 8.3.1.2.3 Piping, Tubing, and Fittings (including reference to ASME B31.3 Process Piping)
• 8.3.1.2.4 Equipment Assembly (including location of emergency shutoff valves)
• 8.3.1.2.5 LH2 Vaporizers
• 8.3.1.2.6 Electrical Systems (sets electrically classified areas and refer to NFPA 70)
• 8.3.1.2.7 Bonding and Grounding
• 8.3.1.2.8 Stationary Pumps and Compressors
• 8.3.1.2.9 Emergency Shutdown System
• 8.3.2 Bulk LH2 Systems Storage
• 8.3.2.1.4.1 Construction of the Inner Vessel
• 8.3.2.1.4.2 Construction of the Vacuum Jacket (Outer Vessel)
• 8.3.2.1.4.3 Nonstandard Containers (can be used with AHJ approval)
• 8.3.2.1.4.4 Concrete Containers
• 8.3.2.1.4.5 Foundations and Supports
• 8.3.2.2 Indoor Storage
• 8.3.2.2.2 Detaching Buildings (including requirements for explosion control)
• 8.3.2.3 Outdoor Storage
• 8.3.2.4 Aboveground Tanks
• 8.3.2.4.2 Physical Protection
• 8.3.2.4.3 Flood Protection
• 8.3.2.4.4 Drainage
• 8.3.2.4.5 Siting Locations (Including Table 8.3.2.4.5.1 Minimum Distance from Liquefied Hydrogen Systems to Exposures)
• 8.3.2.5 Underground Tanks
• 8.3.3 Bulk LH2 Systems Use
- 8.3.3.1.5 Inspection (requirements for annual inspection and recordkeeping)
- 8.3.4 Bulk LH2 Systems Handling
- 8.3.4.2 Carts and Trucks
- 8.3.4.4 Closed Containers
- 8.3.4.5 Cargo Transport Unloading
- 8.3.4.6 Overfilling

**Liquid Hydrogen Storage—Equipment Location**


- 2209.3 Location on Property
- 3203.5.4 Physical Protection
- 3203.6 Separation from Hazardous Conditions
- 3204.3.1.1 Location
- 3204.4.2 Location
- 3504 Storage

**Liquid Hydrogen Storage—Storage Containers**


- 2703.2 Systems, Equipment, and Processes
- 3203.1 Containers
- 3203.5 Security
- 3203.6 Separation from Hazardous Conditions
- 3204.3.1 Stationary Containers
- 3204.4 Underground Tanks

**Dispensing Systems**

*NFPA 2 Hydrogen Technologies Code (National Fire Protection Association, 2011)*

- 10.2.1 System Approvals
- 10.3.1.1 System Component Qualifications
- 10.3.1.4 Pressure Relief Devices
- 10.3.1.5 Pressure Guages
- 10.3.1.6 Pressure Regulators
- 10.3.1.7 Fuel Lines and Piping Systems
- 10.3.1.8 Hose and Hose Connections
• 10.3.1.9 Valves
• 10.3.1.10 System Testing
• 10.3.1.11 System Maintenance
• 10.3.1.12 Equipment Security and Vehicle Protection
• 10.3.1.13 Compressed and Gas Processing Systems
• 10.3.1.14 Vehicle Fueling Dispenser System Operation
• 10.3.1.15 Vehicle Fueling Connection
• 10.3.1.16 Installation of Electrical Equipment
• 10.3.1.17 Stray or Impressed Currents and Bonding
• 10.3.1.18 Installation of Emergency Shutdown Equipment
• 10.3.1.19 Fire Protection
• 10.3.2.2.3.1.3 Separation Distances for Outdoor Gaseous Hydrogen Dispensing Systems

Vaporizers


- 2209.2 Equipment
- 2209.3 Location on Property
- 3203.1.3 Foundations and Supports
- 3203.2.2 Vessels or Equipment Other than Containers
- 3203.5.3 Securing of Vaporizers


- 708 Design of Liquefied Hydrogen Systems Associated with Hydrogen Vaporization Operations

**Dispensing, Operations, and Maintenance Safety—Gaseous Hydrogen**

**CGA G-5.5, Hydrogen Vent Systems (Compressed Gas Association, 2004)**

- 9 Maintenance


- 2204 Dispensing Operations
- 2209.4 Dispensing into Motor Vehicles at Self-Service Hydrogen Motor Fuel-Dispensing Facilities


- 9.2.2 Tank Filling and Bulk Delivery
- 9.4 Operating Requirements for Attended Self-Service Motor Fuel Dispensing Facilities
• 9.5 Operating Requirements for Unattended Self-Service Motor Fuel Dispensing Facilities

Dispensing, Operations, and Maintenance Safety—Liquid Hydrogen
• 9 Maintenance

• 2204 Dispensing Operations
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• 9.5 Operating Requirements for Unattended Self-Service Motor Fuel Dispensing Facilities

Piping and Tubing for All Systems


• F323.4(5) Specific Material Considerations—Metals
• IX K305 Pipe

CGA G-5.4, Standard for Hydrogen Piping Systems at Consumer Locations (Compressed Gas Association, 2005)
• 3.1 General
• 3.2 Piping Materials
• 5.0 Installation
• 5.1 Piping Installation General
• 5.2 Piping Installation Above Ground Installation
• 5.3 Piping Installation Underground Installation

• 101.2.1 Gaseous Hydrogen Systems
• 704 Piping, Use, and Handling
- 10.0 External Piping

Valving and Fittings for All Systems

- IX K306 Fittings, Bends, and Branch Connections
- IX K307 Valves and Specialty Components

CGA G-5.4, Standard for Hydrogen Piping Systems at Consumer Locations (Compressed Gas Association, 2005)
- 3.3.2 Isolation Valves
- 3.3.3 Emergency Isolation Valves
- 3.3.4 Excess Flow Valves
- 3.3.5 Check Valves
- 3.3.7 Gasket and Sealing Materials
- 3.3.8 Additional Requirements
- 5.0 Installation
- 5.1 Installation General

Venting and Other Equipment

- 6.0 Vent System
- 6.2 Sizing
- 6.3 Design
- 6.4 Materials
- 6.5 Components
- 7 Installation

- 2209.5.4 Venting of Hydrogen Systems
- 2211.8.1.2 Atmospheric Venting of Hydrogen from Motor Vehicle Fuel Storage Containers
- 3003.16.8 Connections
- 3005.5 Venting
- 3203.3 Pressure Relief Vent Piping
- 3204.4.5 Venting of Underground Tanks
Fire Safety

Construction

- 911 Explosion Control
- 2209.5 Safety Precautions

- 706.3 Outdoor Gaseous Hydrogen Systems

*NFPA 52, Vehicular Gaseous Fuel Systems Code (National Fire Protection Association, 2010)*
- 9.12 Stray or Impressed Currents and Bonding

*NFPA 55, Compressed Gases and Cryogenic Fluids Code (National Fire Protection Association, 2010)*
- 7.1.6 Separation from Hazardous Conditions

Equipment

- 404 Fire Safety and Evacuation Plan
- 406 Employee Training and Response Procedures
- 407 Hazard Communication
- 906 Portable Fire Extinguishers
- 907 Fire Alarm and Detection Systems
- 2209.4 Dispensing into Motor Vehicles at Self-Service Hydrogen Motor Fuel-Dispensing Facilities
- 2209.5 Safety Precautions

Signage

- 2204.3.5 Emergency Procedures
- 2209.5.2.1 Identification

*CGA H-3 Cryogenic Hydrogen Storage (Compressed Gas Association, 2006)*
- 6.0 Tank Design and Manufacturing Criteria
- 7.0 Inner Vessel
- 8.0 Outer Jacket