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
- Balance of Plant
- Canopy Tops
- Compressed Hydrogen Gas Storage
- Compression Systems and Equipment
- Design
- Dispensing
- Dispensing, Operations, and Maintenance Safety
- Fire Safety
- Liquid Hydrogen Storage
- On-Site Hydrogen Production
- Operation Approvals
- Setbacks and Footprints
- Outdoor Gaseous Systems
- Transportation
- Vaporizers

Annual Inspections

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

- 9 Maintenance

- 406.2 Frequency
- 901.6.2 Records
- 907.2 Inspection, Testing, and Maintenance
- 2206.2.1.1 Inventory Control for Underground Tanks
• 3204.5.2 Corrosion Protection
• 3205.4 Filling and Dispensing

• 9.2.15 General System Requirements

Balance of Plant

Piping & Tubing

• F323.4(5) Specific Material Considerations-Metals
• IX K305 Pipe
• ASME B31.12, Hydrogen Piping and Pipelines

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

• 2201.1 Scope
• 2209.3.2.3 Indoors
• 2209.3.2.6 Canopy Tops
• 3501.1 Scope

• 101.2.1 Gaseous Hydrogen Systems
• 704 Piping, Use, and Handling
• 705 Testing of Hydrogen Piping Systems

• 9.8 Installation of Piping and Hoses
• 9.9 System Testing
- 11.2.3 Piping, Tubing, and Fittings

CGA H-3 Cryogenic Hydrogen Storage (Compressed Gas Association, 2006)
- 10.0 External piping

Pressure Relief
CGA S-1.3, PRD Standards Part 3 - Stationary Storage Containers for Compressed Gases (Compressed Gas Association, 2005)
- 5.3.2 Nonliquid Compressed Gases

- 2209.2.1 Approved Equipment
- 2209.5.4.2 Pressure Relief Devices
- 3003.3 Pressure Relief Devices
- 3203.2 Pressure Relief Devices
- 3203.3 Pressure Relief Vent Piping
- 3203.5.4 Physical Protection
- 3203.8 Service and Repair
- 3205.1.2.3.2 Shutoff Valves on Piping

- 703.3 Pressure Relief Devices

- 5.4 Pressure Relief Devices
- 5.6 Pressure Gauges
- 5.7 Pressure Regulators
- 9.6 Installation of Pressure Regulators
- 9.7 Installation of Pressure Gauges
- 14.6 Pressure Relief Devices

- 7.1.2.5 Pressure-Relief Devices
- 10.2.1 Pressure-Relief Devices
Valving & Fittings

*ASME B31.3, Process Piping (American Society of Mechanical Engineers, 2006)*
- 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

- 2209.5.2 Emergency Shutoff Valves
- 2211.8.1.2.4 Grounding and bonding
- 2703.2.2 Piping, Tubing, Valves, and Fittings
- 2703.9.3 Protection from Vehicles
- 2703.10.1 Valve Protection
- 2705.1.10 Liquid Transfer
- 3003.6 Valve Protection
- 3005.3 Piping Systems
- 3005.4 Valves
- 3203.2.6 Shutoffs Between Pressure Relief Devices and Containers
- 3205.1.2 Piping Systems
- 3205.3.2 Emergency Shutoff Valves
- 3503.1.3 Emergency Shutoff

*NFPA 52, Vehicular Gaseous Fuel Systems Code (National Fire Protection Association, 2010)*
- 5.9 Valves

Venting and Other Equipment

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

- 703.4 Venting

- 5.5 Vent Pipe Termination
- 9.3.3.3 Indoors

- 10.2.2 Pressure-Relief Devices

**Canopy Tops**

- 406.5.2.1 Canopies use to support gaseous hydrogen systems

- 2209.3.2.6 Canopy Tops
- 2209.3.3 Canopies

- 9.3.2.3 Outdoors
Compressed Hydrogen Gas Storage

Equipment Location

- 2209.3 Location on Property
- 3503 General Requirements
- 3504 Storage

*NFPA 52, Vehicular Gaseous Fuel Systems Code (National Fire Protection Association, 2010)*
- 9.3 System Siting

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

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
- 3503 General Requirements

*NFPA 52, Vehicular Gaseous Fuel Systems Code (National Fire Protection Association, 2010)*
- 9.2.3 Equipment Security and Vehicle Protection
- 9.2.4 Out of Service Bulk Storage
- 9.2.5 Equipment Security and Vehicle Protection
- 9.2.6 Cargo Transport Unloading
- 9.2.7 Control Device Icing
- 9.2.8 Vehicle Ignition Classification
- 9.2.9 Fueling Connection Leak Prevention
- 9.2.10 Compression and Processing Equipment
- 9.2.11 Reference to NFPA 37 for Compressor Installations
- 9.2.12 Electrical Classification for Compressors
- 9.2.13 Liquid Carryover Prevention
- 9.2.14 Detection for Dispensing Equipment
- 9.2.15 General System Requirements
9.2.16 General System Requirements


- 7.1.4 Security

**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)
  - 2703.2.1 Design and Construction of Containers, Cylinders, and Tanks
  - 3003.2 Design and Construction
  - 3503.1.2 Storage Containers


- 5.3 Design and Construction of Containers

**Compression Systems and Equipment**


- 2209.2 Equipment
- 2209.3 Location on Property
- 2209.5.3.1 System Requirements
- 2209.5.4.2.1 Minimum Rate of Discharge


- 9.2.7 Control Device Icing
- 9.2.8 Vehicle Ignition Classification
- 9.2.9 Fueling Connection Leak Prevention
- 9.2.10 Compression and Processing Equipment
- 9.2.11 Reference to NFPA 37 for Compressor Installations
- 9.2.12 Electrical Classification for Compressors
- 9.2.13 Liquid Carryover Prevention
- 9.2.14 Detection for Dispensing Equipment
- 9.3.1 General
- 14.8 Stationary Pumps and Compressors
Design

Barrier Walls
• 2209.3.1.1 Barrier Wall Construction – Gaseous Hydrogen

Equipment
• 2209.2 Equipment

• 9.2 General System Requirements

Fuel Stations
• 35 Flammable Gases
• 2209.1 General

• 7.3 Motor Fuel Dispensing Facilities

• 9.3 System Siting
• 14.2 Facility Design

• 7.1.6 Separation from Hazardous Conditions

Weather Protection
• 2209.3.2.2 Weather Protection
• 2704.13 Weather Protection

Dispensing

Electrical Equipment
• 2201.5 Electrical
• 2205.4 Sources of Ignition
• 2209.2.3 Electrical Equipment
• 2211.3.1 Equipment
• 2211.8.1.2.4 Grounding and bonding
• 2703.9.4 Electrical Wiring and Equipment
• 3003.8 Wiring and Equipment
• 3003.16.14 Classified Areas
• 3203.7 Electrical Wiring and Equipment
• 3503.1.5.1 Bonding of Electrically Conductive Materials and Equipment


• 6.7 Emergency Electrical Disconnects
• 8 Electrical Installations


• 9.11 Installation of Electrical Equipment
• 9.12 Stray or Impressed Currents and Bonding

**Fuel Lines**

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

• 3.0 Piping System Criteria


• 2201 Scope
• 2209.3.2.3 Indoors
• 2209.3.2.6 Canopy Tops
• 3501.1 Scope


• 101.2.1 Gaseous Hydrogen Systems
• 704 Piping, Use, and Handling
• 705 Testing of Hydrogen Piping Systems


• 5.8 Fuel Lines

**Gaseous Dispensers**


• 2209.2 Equipment
• 2209.3 Location on Property
- 2209.4 Dispensing into Motor Vehicles at Self-Service Hydrogen Motor Fuel-Dispensing Facilities

- 9.2 General System Requirements
- 9.3 System Siting

**Hoses and Connectors**
- 2209.2 Equipment

- 5.10 Hose and Hose Connections

**Liquid Dispensers**
- 2206.7.4 Dispenser Emergency Valve
- 2206.7.5 Dispenser Hose
- 2206.7.6 Fuel Delivery Nozzles
- 2209.2 Equipment
- 2209.3 Location on Property
- 2209.4 Dispensing into Motor Vehicles at Self-Service Hydrogen Motor Fuel-Dispensing Facilities

- 6.3 Requirements for Dispensing Devices

- 14 Liquid Hydrogen Fueling Facilities

**Vehicle Connectors**
*NFPA 52, Vehicular Gaseous Fuel Systems Code (National Fire Protection Association, 2010)*
- 5.11 Vehicle Fueling Connection

**SAE J2600, Compressed Hydrogen Surface Vehicle Refueling Connection Devices (Society of Automotive Engineers, 2002)**
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


- 9.13 System Operation
- 9.14 Fire Protection
- 9.15 Maintenance System

Liquid 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


- 14.4.6 Liquid Hydrogen Vehicle Dispensing Systems
• 14.4.9 Liquid Hydrogen Vehicle Dispensing Systems
• 14.4.10 Liquid Hydrogen Vehicle Dispensing Systems
• 14.4.11 Liquid Hydrogen Vehicle Dispensing Systems
• 14.13 Maintenance

Fire Safety

Construction


• 911 Explosion Control
• 2209.5 Safety Precautions


• 706.3 Outdoor Gaseous Hydrogen Systems


• 9.12 Stray or Impressed Currents and Bonding


• 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

*NFPA 52, Vehicular Gaseous Fuel Systems Code (National Fire Protection Association, 2010)*

• 9.2.3 Equipment Security and Vehicle Protection
• 9.2.4 Out of Service Bulk Storage
• 9.2.5 Equipment Security and Vehicle Protection
• 9.2.15 General System Requirements
• 9.3.3 Indoors
• 9.14 Fire Protection
• 14.2.4 Indoor Fueling
• 14.4.3 Liquid Hydrogen Vehicle Dispensing Systems

Signage

- 2204.3.5 Emergency Procedures
- 2209.5.2.1 Identification

*NFPA 52, Vehicular Gaseous Fuel Systems Code (National Fire Protection Association, 2010)*
- 9.3.3.12 Warning Signs

*NFPA 55, Compressed Gases and Cryogenic Fluids Code (National Fire Protection Association, 2010)*
- 6.12 Hazard Identification Signs
- 10.2.4 Marking
- 11.3.1.4 General

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

*NFPA 55, Compressed Gases and Cryogenic Fluids Code (National Fire Protection Association, 2010)*
- 11.3.1 General
- 11.3.2 Specific Requirements

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

• 14.2 Facility Design

**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

• 5.3 Design and Construction of Containers

• 11.3.2 Specific Requirements
• 11.4.2 Underground Tanks

**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

**On-Site Hydrogen Production**

• 2209.3.1 Separation from Outdoor Exposure Hazards

• 703.1 General Requirements

• 5.2 System Approvals
Operation Approvals

Dispensing

- 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

*NFPA 52, Vehicular Gaseous Fuel Systems Code (National Fire Protection Association, 2010)*
- 14.4.1 Liquid Hydrogen Vehicle Dispensing Systems
- 14.4.2 Liquid Hydrogen Vehicle Dispensing Systems
- 14.4.3 Liquid Hydrogen Vehicle Dispensing Systems
- 14.4.11 Liquid Hydrogen Vehicle Dispensing Systems

Fire And Emergency Planning

- 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
- 9.2.16 General System Requirements
- 9.10.5 Installation of Emergency Shutdown Equipment

- 4.1 Permits
- 4.2 Emergency Plan
- 7.1.6 Separation from Hazardous Conditions

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

- 6.3.7 Requirements for Dispensing Devices

- 9.2.3 Equipment Security and Vehicle Protection

- 10.3 Location of Gaseous Hydrogen Systems

Ignition Control
- 2209.3.2.3.3 Ignition Source Control
- 3503.1.4 Ignition Source Control

- 4.8 Ignition Source Controls
- 7.6.3 Ignition Source Control

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


• 4.6 Personnel Training

• 4.7 Fire Department Liaison

**Signage**


• 2204.3.5 Emergency Procedures

• 2209.3.2.3.2 Smoking

• 2209.3.2.6.3 Signage

• 2209.5.2.1 Identification


• 9.3.3.12 Warning Signs


• 4.9 Signs

**Vehicle Access**


• 105.6.8 Compressed Gases

• 105.6.10 Cryogenic Fluids

• 105.6.39 Repair Garages and Motor Fuel-Dispensing Facilities

• 404.3.2 Fire Safety Plans

• 3205.4 Filling and Dispensing


• 6.3.7 Requirements for Dispensing Devices


• 9.2.3 Equipment Security and Vehicle Protection

• 14.2.1.6 General
• 14.4.2 Liquid Hydrogen Vehicle Dispensing Systems
• 14.4.5 Liquid Hydrogen Vehicle Dispensing Systems

• 10.3 Location of Gaseous Hydrogen Systems

### Setbacks and Footprints

**Liquid Systems**

• 2209.3.1 Separation from Outdoor Exposure Hazards

• 14.2.2 Siting

• 11.3.2.1 Specific Requirements
• 11.3.2.2 Specific Requirements

### Outdoor Gaseous Systems

• 2209.3.1 Separation from Outdoor Exposure Hazards

• 9.3.1.3 General

• 10.3.2.1 Specific Requirements
• 10.3.2.2 Minimum Distance

### Transportation

**Compressed Hydrogen Gas**

*CGA P-1, Safe Handling of Compressed Gases in Containers (Compressed Gas Association, 2006)*
• 4.1 Transportation Regulating Authorities
• 4.2 Container Regulations
• 4.3 Container Filling Regulations
• 4.4 Regulating Authorities of Employee Safety and Health
- 6.2 Flammable Gases

- 2705 Use, Dispensing, and Handling
- 3005.7 Transfer
- 3505 Use

- 4 General Requirements
- 7.3.1.10 Use and Handling

**Liquid Hydrogen**
**CGA P-12, Safe Handling of Cryogenic Liquids (Compressed Gas Association, 2005)**
- 5.5.4 Additional Safety Practices for Liquid Hydrogen
- 6.4 Hydrogen Fires
- 7.9 Handling Considerations for Hydrogen and Helium Transfer

- 2705 Use Dispensing and Handling
- 3201.1 Scope
- 3203.6.1.1 Point-of-Fill Connections
- 3205.4.2 Vehicle Loading and Unloading Areas

- 14.3 Cargo Transport Unloading

- 4 General Requirements
- 8.3.5 Overfilling
- 8.13.1.2 Attended Delivery
- 8.13.10.3 Filling and Dispensing

**Natural Gas**
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

- 11.2.5 Liquefied Hydrogen Vaporizers