
# ANSI/CGA H-5—2014

# STANDARD FOR BULK HYDROGEN SUPPLY SYSTEMS

## SECOND EDITION

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NOTE—Technical changes from the previous edition are underlined.

NOTE—Appendix A (Informative) is for information only.

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Approved as an American National Standard on September 8, 2014.

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# 1 Introduction

This standard contains minimum requirements for locating/siting, selecting equipment, installing, starting up, maintaining, and removing bulk hydrogen supply systems.

# 2 Scope

Two types of bulk hydrogen supply systems are covered in this standard: liquid and gaseous.

A bulk gas hydrogen supply system is one that contains more than 5000 scf (141.6 $m^3$) of hydrogen. A bulk liquid supply system is one that contains more than 39.7 gal (150 L) of hydrogen. Requirements of this standard are limited to systems operating up to 15 000 psi (103.4 MPa).[1, 2]

For the purpose of this standard, a liquid system is defined as one where hydrogen is delivered to the supply system and stored on-site in liquid form. Hydrogen is supplied in either liquid or gaseous form to the end user's requirement. When required, pumps and/or compressors are used to increase the hydrogen pressure before it is supplied to the end user. When required, coded vessels are used to store gaseous hydrogen before it is supplied to the end user. The system is considered to be a bulk liquid system instead of a bulk gaseous system because the hydrogen is delivered from the hydrogen supplier to the storage system in liquid form.

For the purpose of this standard, a gas system is defined as one where hydrogen is delivered to the supply system, stored, and is supplied to the end user's requirement in gaseous form.

See Figures A-1, A-2, A-3, A-4, A-5, and A-6 in Appendix A for typical gas and liquid system flow diagrams.

This standard applies to hydrogen supply systems containing any of the following equipment. Not all hydrogen systems include all the equipment listed. More details about hydrogen applications can be found in CGA G-5, *Hydrogen* and *Handbook of Compressed Gases*. [2, 3].

Hydrogen supply systems include:

- cryogenic hydrogen storage tank, either aboveground or belowground;
- gas storage vessels, either aboveground or belowground;
- heat exchangers (including vaporizers);
- valves including manual and automatic shutoff valves, and check valves;
- pressure control equipment including regulators and control valves;
- piping (pipe and tubing);
- cryogenic pumps;
- cryogenic and warm gas compressors;
- snubbers and pulsation dampeners; and
- monitoring and control systems including electrical and instrumentation.

The bulk hydrogen supply system terminates at the source valve or where the gas or liquid hydrogen supply first enters the supply line.

[1] kPa (MPa) shall indicate gauge pressure unless otherwise noted as (kPa, abs [MPa, abs]) for absolute pressure or (kPa, differential [MPa, differential]) for differential pressure. All kPa values are rounded off per CGA P-11, *Metric Practice Guide for the Compressed Gas Industry* [1].

[2] References are shown by bracketed numbers and are listed in order of appearance in the reference section.

# 3 Definitions

For the purpose of this standard, the following definitions apply.

Additional detailed definitions can be found in CGA H-4, *Terminology Associated with Hydrogen Fuel Technologies* [4].

## 3.1 Publication terminology

### 3.1.1 Shall
Indicates that the procedure is mandatory. Shall is used wherever the criterion for conformance to specific recommendations allows no deviation.

### 3.1.2 Should
Indicates that a procedure is recommended.

### 3.1.3 May
Indicate that the procedure is optional.

### 3.1.4 Will
Is used only to indicate the future, not a degree of requirement.

### 3.1.5 Can
Indicates a possibility or ability.

## 3.2 Technical definitions

### 3.2.1 Bulk hydrogen compressed gas system
Assembly of equipment that consists of, but is not limited to, storage containers, pressure regulators, pressure relief devices (PRDs), compressors, manifolds, and piping, with a storage capacity of more than 5000 scf (141.6 $m^3$) of compressed hydrogen gas that terminates at the source valve.

### 3.2.2 Bulk liquefied hydrogen system
Assembly of equipment that consists of, but is not limited to, storage containers, pressure regulators, PRDs, vaporizers, liquid pumps, compressors, manifolds, and piping, with a storage capacity of more than 39.7 gal (150 L) of liquefied hydrogen that terminates at the source valve.

### 3.2.3 Cavitation
Undesirable vapor bubble formation and subsequent bubble collapse of a saturated or slightly subcooled liquid in a pump that can cause loss of prime and damage the pump.

### 3.2.4 Combustible
Measure of how easily a substance will ignite.

### 3.2.5 Composite cylinder
Cylinder manufactured with a combination of metal and fiber with a protective resin matrix.

### 3.2.6 Cryogenic compressor
Power-driven machine that reduces the volume of cold gas vapor and increases its pressure to liquefy it or maintain it at a high pressure.

### 3.2.7 Cryogenic pump
Device for increasing the pressure of cryogenic fluids.

### 3.2.8 Electrically classified area
Location in which a combustible gas is or can be present in the atmosphere in sufficient concentrations to produce an ignitable mixture.