

INCH-POUND

BB-H-886E  
24 February 2011  
SUPERSEDING  
BB-H-886D  
11 January 2001

## FEDERAL SPECIFICATION

## HYDROGEN

The General Services Administration has authorized the use of this federal specification by all federal agencies.

## 1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers three grades of gaseous hydrogen for use in cutting and welding, and as a lifting medium for meteorological and other balloons; for fuel, hydrogenation, and water chemistry applications; and for semiconductor, analytical and special applications (see 6.1).

1.2 Classification. The hydrogen shall be of the following grades, as specified (see 6.2).

Grade A - 99.95 percent hydrogen  
Grade B - 99.99 percent hydrogen  
Grade C - 99.999 percent hydrogen

## 2. APPLICABLE DOCUMENTS

2.1 Government publications. The issues of the following documents, in effect on the date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

## Federal Standard

FED-STD-313 - Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

Beneficial comments, recommendations, additions, deletions, clarifications, etc. and any data that may improve this document should be sent to: [STDZNMGT@dla.mil](mailto:STDZNMGT@dla.mil) or Defense Logistics Agency Aviation VEB, 8000 Jefferson Davis Highway, Richmond, VA 23297-5616. Since contact information can change, you may want to verify the currency of this address information using the ASSIST database at <https://assist.daps.dla.mil/>.

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## Commercial Item Description

A-A-59860 - Valves, Cylinder, Gas (for Compressed or Liquefied Gases)

(Activities outside the federal government may obtain copies of federal standards and commercial item descriptions as specified in the General Information section of the Index of Federal Specifications, Standards and Commercial Item Descriptions. The index is for sale on a subscription basis from the General Services Administration, Federal Supply Service, Specification Section, East 470 L'Enfant Plaza SW, Suite 8100, Washington, DC 20407.)

(Single copies of this specification, and other federal specifications, standards, and commercial item descriptions required by activities outside the federal government for bidding purposes are available without charge from the General Services Administration, Federal Supply Service, Specification Section, East 470 L'Enfant Plaza SW, Suite 8100, Washington, DC 20407.)

(Federal government activities may obtain copies of federal standardization documents and the Index of Federal Specifications, Standards and Commercial Item Descriptions from established distribution points in their agencies. Electronic copies may be obtained from <https://assist.daps.dla.mil/>.)

## Military Standards

MIL-STD-101 - Color Code for Pipelines and for Compressed Gas Cylinders  
 MIL-STD-1411 - Inspection and Maintenance of Compressed Gas Cylinders

(Copies of military standards required by contractors in connection with specific procurement functions are available from the Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094. Electronic copies may be obtained from <https://assist.daps.dla.mil/>.)

## Federal Regulations

29 CFR 1910.1200 - Hazard Communication  
 49 CFR 171-185 - Hazardous Materials Regulations

(The Code of Federal Regulations (CFR) is for sale on a subscription basis from the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954. When indicated, reprints of certain regulations may be obtained from the federal agency responsible for issuing them. Electronic copies may be obtained from <http://www.gpoaccess.gov/ecfr/>.)

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2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on the date of invitation for bids or request for proposal shall apply.

## Compressed Gas Association (CGA)

CGA C-1	- Methods for Pressure Testing Compressed Gas Cylinders
CGA C-5	- Wall Stress Requalification Criteria for High Pressure Seamless Steel Cylinders
CGA C-6	- Standards for Visual Inspection of Steel Compressed Gas Cylinders
CGA C-11	- Recommended Practices for Inspection of Compressed Gas Cylinders at Time of Manufacture
CGA G-5	- Hydrogen
CGA G-5.3	- Commodity Specification for Hydrogen
CGA P-15	- Filling of Industrial and Medical Nonflammable Compressed Gas Cylinders
CGA S-1.1	- Pressure Relief Device Standards Part 1 - Cylinders for Compressed Gases
CGA TB-17	- Test Methods for Evaluating Paints and Coatings on Refillable Steel Compressed Gas Cylinders
CGA V-9	- Compressed Gas Association Standard for Compressed Gas Cylinder Valves

(Application for copies should be addressed to the Compressed Gas Association, 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923. Electronic copies may be obtained from <http://www.cganet.com/>.)

## 3. REQUIREMENTS

3.1 Material. The material shall conform to the requirements of type I (gaseous) hydrogen as specified in CGA G-5.3 and shown in table I.

TABLE I. Requirements.<sup>1</sup>

Limiting characteristics	Grade A ppm (v/v) <sup>2</sup>	Grade B ppm (v/v)	Grade C ppm (v/v)
CGA G-5.3 Quality Verification Level	QVL B <sup>3</sup>	QVL D	QVL L
Hydrogen, minimum (percent by volume)	99.95	99.99	99.999
Water vapor	34	3.5	3.5
Total hydrocarbon content (as methane)	10	5	1

<sup>1</sup> Additional information on the properties and handling of hydrogen may be found in CGA G-5.

<sup>2</sup> Quantities are in parts per million by volume (ppm (v/v)) unless otherwise noted.

<sup>3</sup> QVL B for type I (gaseous) hydrogen.

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3.2 Cylinders and valves. The hydrogen shall be contained in government-furnished cylinders in accordance with 49 CFR 171-185, and equipped with valves in accordance with A-A-59860 (see 6.2). When specified (see 6.2), cylinders shall be furnished by the supplier, which shall be in accordance with 49 CFR 171-185, and shall be equipped with valves in accordance with A-A-59860. When specified (see 6.2), the hydrogen shall be contained in supplier-owned, Department of Transportation-approved cylinders, equipped with valves in accordance with CGA V-9 and pressure relief devices in accordance with CGA S-1.1.

3.2.1 Painting. Government-owned and furnished cylinders shall be color-coded and stenciled in accordance with MIL-STD-101. The paint and the painting process shall be by any method or system that will provide a finish that meets the requirements of CGA TB-17.

3.3 Hydrogen cylinder and valve maintenance.

a. Government-owned and furnished hydrogen cylinders shall be inspected, maintained, and when necessary, reconditioned in accordance with MIL-STD-1411 to meet all serviceability requirements of 49 CFR 171-185. Supplier-owned hydrogen cylinders shall be inspected, maintained, and when necessary, reconditioned in accordance with CGA C-1, CGA C-5, CGA C-6, CGA C-11, and CGA S-1.1, to meet all serviceability requirements of 49 CFR 171-185.

b. Hydrogen valves requiring maintenance shall be repaired as applicable, and be cleaned free of insects, webs, dirt, paint, corrosion, oil, and grease.

3.4 Leakage. Cylinders and valves shall not leak after being filled (see 4.3.6).

3.5 Capacity. Unless otherwise specified (see 6.2), containers of gaseous hydrogen shall be filled to their rated service pressure in accordance with CGA P-15.

3.6 Workmanship. Cylinders shall show no evidence of bulging or distortion.

3.7 Material safety data sheet (MSDS). Manufacturers shall prepare and submit a MSDS in accordance with FED-STD-313 and meeting the requirements of 29 CFR 1910.1200.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the government. The government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to the prescribed requirements.

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4.2 Quality conformance inspection.

4.2.1 Tests and examinations. Perform the content and capacity tests, and examinations of table II. Any defects in the content or capacity tests shall be cause for rejection of the lot. A lot for testing the content and capacity shall be defined as the number of containers filled from the same source during an uninterrupted filling sequence and offered for examination at one time. Any defects found in the examinations of the containers shall be cause for the rejection of only those defective containers.

TABLE II. Tests and examinations of preparation for delivery.

Test/Examinations	Defect	Inspection level
Content	Not as specified in 3.1	One sample per lot, as per 4.2.1
Container	Not as specified in 3.2	100%
Paint	Not as specified in 3.2.1	100%
Maintenance	Not as specified in 3.3	100%
Leakage	Not as specified in 3.4	100%
Capacity	Not as specified in 3.5	One sample per lot, as per 4.2.1
Workmanship	Not as specified in 3.6	100%
Marking on container	Not as specified in 5.1	100%
Packaging and packing	Not as specified in 5.2	100%

4.3 Test methods.

4.3.1 Sampling. Samples for testing the content and capacity in table II shall be from filled containers and shall be one sample unit per lot.

4.3.2 Hydrogen content determination. Hydrogen content shall be determined in accordance with the analytical procedures specified by CGA G-5.3. The minimum hydrogen content shall be 99.95 percent for grade A, 99.99 percent for grade B, and 99.999 percent for grade C. Otherwise, compliance with the minimum requirements has not been met and shall constitute failure of this test.

4.3.3 Impurities determination. The sample shall be analyzed for the impurities listed as limiting characteristics in CGA G-5.3 using the analytical procedures specified therein. Unless otherwise specified in the contract or purchase order (see 6.2), these impurities shall not exceed the maximum quantity specified for the appropriate QVL.

4.3.4 Documentation. Records of the analysis and the qualifying concentrations used must be kept on file for two years, and available upon the government's request.

4.3.5 Leakage. Each cylinder, after filling, shall be tested for leakage by applying a soap solution to all portions of the valve, the junction of the valve and cylinder, and the safety device on the cylinder. Care shall be taken to ensure that the solution used does not contaminate the valve outlet. Any evidence of gas leakage, as evidenced by bubbling of the soap solution, shall constitute failure of this test. Failure of this test shall be cause for rejection of the cylinder.

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## 5. PACKAGING

5.1 Marking. The cylinders shall be marked in accordance with 49 CFR 171-185, and as specified in the contract or order (see 6.2). The markings shall not be omitted, incorrect, illegible, or of improper size, location, sequence, or method of application.

5.2 Packaging and packing. The hydrogen of a single grade shall be packaged and packed together in accordance with the contract or order (see 6.2).

## 6. NOTES

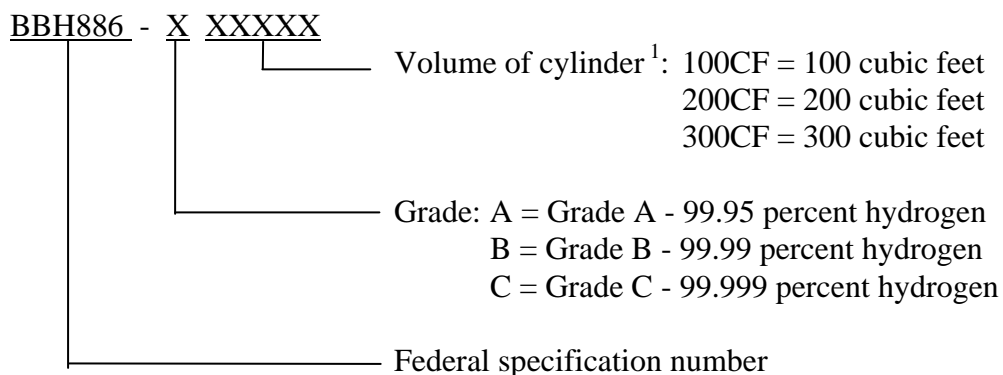
INFORMATION FOR GUIDANCE ONLY. (This section contains information of a general or explanatory nature that is helpful, but is not mandatory.)

6.1 Intended use. Grade A hydrogen is intended for use in general industrial applications such as cutting, welding, and as a lifting medium for meteorological and other balloons. Grade B hydrogen, a higher purity grade, is intended for use in fuel, hydrogenation and water chemistry applications. Grade C is of the highest purity and is use in semiconductor, analytical and special applications.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Grade required (see 1.2).
- c. Type of cylinder and valve (see 3.2).
- d. When supplier is to furnish cylinders (see 3.2).
- e. When hydrogen is to be contained in supplier-owned cylinders (see 3.2).
- f. When cylinders are to be filled to less than their rated service pressure (see 3.5).
- g. Any allowable variance from specified impurity levels (see 4.3.3).
- h. Packaging requirements (see 5.1 and 5.2).

6.3 Part or identification number (PIN). The following part or identification number numbering procedure is for government purposes and does not constitute a requirement for the contractor.



<sup>1</sup> The volume of the cylinder may be modified for ease of procurement and is not otherwise limited. The volume codes listed above are not all inclusive and are provided only for example.

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6.4 Basis of purchase. The basis of purchase should be the cubic foot, based upon normal atmospheric conditions. Hydrogen is commercially available in cylinders of various rated capacities, with capacities of approximately 200 and 300 cubic feet being common. The quantity in cubic feet for each cylinder size is provided in the characteristics data of the applicable stock number. Normally, hydrogen cylinders will be filled to the following standard conditions: 1800, 2000, 2265, or 2400 pounds per square inch gauge (psig) at 70 °F (21.1 °C). In cases where the only cylinder available is rated for a higher pressure than requested, Department of Transportation regulations allow for cylinders to be filled to less than the marked service pressure. Also, cylinders specially qualified under 49 CFR to bear the plus (+) mark, have been approved for special filling limits up to 10 percent above the marked service pressure.

6.5 Subject term (key word) listing.

Balloon, meteorological  
Cutting  
Cylinder  
Gas chromatograph  
Lifting medium  
Valve  
Welding

6.6 Safety considerations. Hydrogen has a very wide flammability range of 4 to 74 percent in air, and burns with an almost invisible flame. The following applies to gaseous hydrogen:

- a. Opening a hydrogen cylinder valve to remove dirt or dust may cause self-ignition.
- b. Using hydrogen from a cylinder without using a suitable pressure regulator is hazardous.
- c. Hydrogen has a very low ignition energy and can be ignited by static electricity.
- d. Hydrogen heats when expanded and may self-ignite.
- e. By displacing the oxygen in air, hydrogen can act as an asphyxiant.
- f. Hydrogen, being very light, may accumulate in high spots if there is inadequate ventilation.

6.7 Changes from previous issue. Asterisks (or vertical lines) are not used in this revision to identify changes with respect to the previous issue due to the extensive changes.

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MILITARY INTERESTS:

Custodians:

Navy - SH

Air Force - 68

DLA - GS

CIVIL AGENCY  
COORDINATING ACTIVITY:

GSA - FAS

Preparing Activity:

DLA - GS3

(Project 6830-2010-004)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST database at <https://assist.daps.dla.mil/>.