

**INCH-POUND**  
BB-H-886D  
11 January 2001  
SUPERSEDING  
BB-H-886C  
10 April 1978

## 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 two grades of gaseous hydrogen for use in cutting and welding and as a lifting medium for meteorological and other balloons (see 6.1).

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

Grade A - 99.0 percent by volume

Grade B - 99.5 percent by volume

#### 2. APPLICABLE DOCUMENTS

2.1 Government publications. The following documents, of the issues 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.

(Activities outside the Federal Government may obtain copies of federal specifications, 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 Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center Richmond, ATTN: DSCR-VBD, Richmond, VA 23297-5610, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 6830

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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(Single copies of this standard, and other federal specifications 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, Suite 8100, 470 L'Enfant Plaza, SW, 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.)

#### MILITARY SPECIFICATION

MIL-DTL-2 - Valve, Cylinder, Gas (for Compressed or Liquefied Gases),  
General Specification for.

(Copies of military specifications required by contractors in connection with specific procurement functions are obtained from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

#### CODE OF FEDERAL REGULATIONS (CFR)

Title 29, Part 1910.1200 - Hazardous Communication.

Title 49, Parts 100 to 185 - Transportation.

(The Code of Federal Regulations is for sale on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. When indicated, reprints of certain regulations may be obtained from the federal agency responsible for issuing them.)

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 date of invitation for bids or request for proposal shall apply.

#### GAS COMPRESSED ASSOCIATION, INCORPORATED

CGA C-1 - Methods for Hydrostatic Testing of Compressed Gas Cylinders  
CGA C-5 - Cylinder Service Life - Seamless Steel High Pressure 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

(Private sector and civil agencies may purchase copies of these voluntary standards from the Compressed Gas Association, Inc., 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 Material. The material shall conform to the requirements shown in table I.

TABLE I. Requirements.\*

Limiting characteristics	Grade A % by volume	Grade B % by volume
Hydrogen, minimum	99.0	99.5
Water	none condensed	none condensed
Hydrocarbons (condensed)	-	none

\* Gaseous hydrogen, certified to conform to quality verification level (QVL) A of CGA G-5.3, may be used in place of either Grade A or Grade B hydrogen in this table (see 4.3.1). Gaseous hydrogen meeting QVL A of CGA G-5.3 is a minimum of 99.8 percent hydrogen (mole/mole). Additional information on the properties and handling of hydrogen may be found in CGA G-5.

3.2 Cylinders and valves. The hydrogen shall be contained in government furnished cylinders in accordance with 49 CFR, Parts 100-185, and equipped with valves with outlet connections in accordance with MIL-DTL-2. When specified (see 6.2), cylinders shall be furnished by the supplier, shall be in accordance with 49 CFR, Parts 100-185, and shall be equipped with valves in accordance with MIL-DTL-2. When specified (see 6.2), the hydrogen shall be contained in supplier-owned Department of Transportation approved cylinders.

3.3 Hydrogen cylinder and valve maintenance.

a. Hydrogen cylinders shall be inspected and maintained in accordance with CGA C-1, CGA C-5, CGA C-6, and CGA C-11.

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

3.4 Leakage. Cylinders and valves shall not leak after being filled (see 4.3.5).

3.5 Capacity. Unless otherwise specified (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.

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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.

#### 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 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.

Tests/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%
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 Hydrogen test methods.

4.3.1 Alternative hydrogen test provision. If gaseous hydrogen certified to conform to QVL A of CGA G-5.3 (see table I footnote) is used, the number of procedures can be reduced. In section 4.3, only the leakage test, 4.3.5, would need to be performed. Gaseous hydrogen conforming to QVL A is a minimum of 99.8 percent hydrogen and a maximum of 10 parts per million total hydrocarbon content (as methane), both figured on a mole/mole basis. It also contains no condensed water.

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

4.3.3 Hydrogen content determination. Hydrogen content shall be determined by the combustion method as follows:

4.3.3.1 Apparatus. The apparatus shall consist of a combustion pipette of conventional design, a gas measuring burette, and a leveling bulb. Mercury shall be used as the confining agent.

4.3.3.2 Procedure. Draw approximately 100 milliliters (mL) of the sample into the measuring burette with the volume measured at atmospheric pressure and  $25 \pm 2$  °C. Transfer the sample to the combustion pipette. Prepare a mixture of approximately equal parts of pure oxygen and air in the measuring burette (approximately 100 mL) and then connect to the combustion pipette. Heat the platinum wire to dull redness by means of an electrical current controlled by a rheostat and slowly pass the air-oxygen mixture from the burette to the pipette. When nearly all of the air-oxygen mixture has been added to the pipette, stop the addition but continue to heat the platinum wire to dull redness for approximately 1 minute. Cool the pipette and return the residual gas to the measuring burette and measure the residual gas.

$$\text{Percent hydrogen} = \frac{(A + B - C) \times 100}{15A}$$

Where:

- A = milliliters of hydrogen
- B = milliliters of air-oxygen mixture
- C = milliliters of residual gas

The minimum hydrogen content shall be 99.0 percent for Grade A and 99.5 percent for Grade B. Otherwise, compliance with the minimum requirements has not been met and shall constitute failure of this test.

4.3.4 Water and hydrocarbons (condensed). (See 6.6, safety considerations, prior to performing this test.) Support the cylinder in an inverted position (valve at the bottom) for 5 minutes. The cylinder and contents should be at room temperature or above 32 °F (0 °C). Open the cylinder valve slightly (use caution) while the cylinder remains inverted, and vent the hydrogen with a barely audible flow into an open dry container for 1 minute. (NOTE: A rapid gas flow may cause any liquid to disperse and not collect in the container.) Any free water or condensed hydrocarbons (oil) issuing from the valve shall be sufficient cause for rejection.

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, Parts 170-185 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 one grade shall be packaged and packed in accordance with the contract or order (see 6.2).

## 6. NOTES

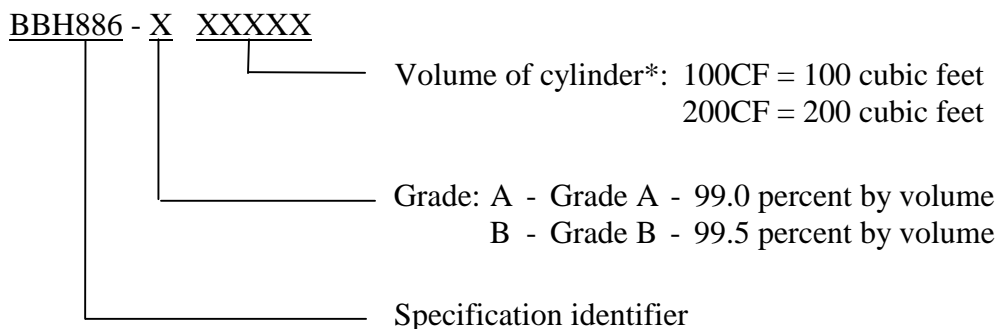
(This section contains information of a general or explanatory nature that is helpful, but is not mandatory.)

6.1 Intended use. Grade A hydrogen is intended for use in cutting, welding, and as a lifting medium for meteorological and other balloons. Grade B hydrogen, a higher purity grade, is intended for use where freedom from hydrocarbons is necessary.

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 hydrogen is to be contained in supplier-owned cylinders (see 3.2).
- e. When supplier is to furnish cylinders (see 3.2).
- f. When cylinders are to be filled to less than their rated service pressure (see 3.5).
- g. Packaging, packing, and marking required (see 5).

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.



\* The volume of the cylinder may be modified for ease of procurement and is not otherwise limited.

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 100 and 200 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.

6.5 Subject term (key word) listing.

Mercury

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. Cracking 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. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

MILITARY INTERESTS:

Custodians:

Navy - SH

Air Force - 68

CIVIL AGENCY  
COORDINATING ACTIVITY:

GSA - 7FXE

Preparing Activity:

DLA - GS3

(Project 6830-1041)

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

<b>I RECOMMEND A CHANGE:</b>		<b>1. DOCUMENT NUMBER</b> BB-H-886D	<b>2. DOCUMENT DATE (YYYYMMDD)</b> 2001JAN11
<b>DOCUMENT TITLE</b> HYDROGEN			
<b>4. NATURE OF CHANGE</b> ( <i>Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.</i> )			
<b>5. REASON FOR RECOMMENDATION</b>			
<b>6. SUBMITTER</b>			
a. NAME ( <i>Last, First, Middle Initial</i> )		b. ORGANIZATION	
c. ADDRESS ( <i>Include Zip Code</i> )		d. TELEPHONE ( <i>Include Area Code</i> ) (1) Commercial (2) DSN ( <i>if applicable</i> )	<b>7. DATE SUBMITTED</b> (YYYYMMDD)
<b>8. PREPARING ACTIVITY</b>			
a. NAME Defense Supply Center Richmond		b. TELEPHONE ( <i>Include Area Code</i> ) (1) Commercial (804) 279-5019 (2) DSN 695-5019	
c. ADDRESS ( <i>Include Zip Code</i> ) ATTN: DSCR-VBD (C. Hammond) 8000 Jefferson Davis Highway Richmond, VA 23297-5610		<b>IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:</b> DEFENSE STANDARDIZATION PROGRAM OFFICE (DLSC-LM) 8725 John J. Kingman Road, Suite 2533 Fort Belvoir, Virginia 22060-6221 Telephone (703) 767-6888 DSN 427-6888	