

INCH POUND  
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SUPERSEDING  
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## MILITARY SPECIFICATION

### CYLINDERS, STEEL, COMPRESSED GAS, NON-SHATTERABLE, SEAMLESS, 1800 PSI AND 2100 PSI

This specification is approved for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

\* 1.1 Scope. This specification covers the requirements for 1800 psi and 2100 psi compressed gas storage, non-shatterable, steel cylinders of seamless construction.

\* 1.2 Classification. The cylinders shall be of the following types and classes, as specified by the applicable part number (see 6.2.1b).

Type A - Internal taper thread  
Type B - External thread  
Type C - Internal straight thread

Class 1 - 1800 PSI ( 12,400 KPa ) rated pressure  
Class 2 - 2100 PSI ( 14,500 KPa ) rated pressure

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

\* 2.1.1 Specifications and standards. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation. (see 6.2.C)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Systems Engineering and Standardization Department (Code 53), Naval Air Engineering Center, Lakehurst, NJ 08733-5100, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

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## SPECIFICATIONS

## FEDERAL

BB-A-1034	Air, Compressed, for Breathing Purposes
BB-N-411	Nitrogen, Technical
TT-C-490	Cleaning Methods and Pretreatment of Ferrous Surfaces for Organic Coatings
TT-E-489	Enamel, Alkyd, Gloss (for Exterior and Interior Surfaces)
TT-L-32	Lacquer, Cellulose Nitrate, Gloss, for Aircraft Use
TT-P-1757	Primer Coating, Zinc Chromate, Low moisture Sensitivity
PPP-B-636	Boxes, Shipping, Fiberboard
PPP-B-640	Boxes, Fiberboard, Corrugated, Triple-wall

## MILITARY

MIL-P-116	Preservation, Methods of
MIL-C-5501	Cap and Plug, Protective, Dust and Moisture Seal
MIL-O-27210	Oxygen, Aviator's Breathing, Liquid and Gas
MIL-T-27730	Tape, Antiseize, Tetrafluoroethylene, with Dispenser
MIL-M-43719	Marking, Materials and Markers, Adhesive, Elastomeric, Pigmented, General Specification for
MIL-C-81302	Cleaning Compound, Solvent, Trichlorotrifluoroethane

## STANDARDS

## FEDERAL

FED-STD-151	Metals: Test Methods
FED-STD-595	Colors

## MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection By Attributes
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## STANDARDS (Continued)

## MILITARY

MIL-STD-129	Marking For Shipment And Storage
MIL-STD-130	Identification Marking of U.S. Military Property
MS26545	Cylinder, Compressed Gas, Nonshatterable

(Unless otherwise indicated, copies of federal and military specifications, and handbooks are available from the Standardization Documents Order Desk, Bldg 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2. Other Government documents, and publications. The following other Government documents and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

## DEFENSE STANDARDIZATION MANUAL

SD-6	Provisions Governing Qualification
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\* (Unless otherwise indicated, copies of defense standardization manuals are available from the Standardization Documents Order Desk, Bldg 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

## DEPARTMENT OF TRANSPORTATION

Code of Federal Regulations (CFR)

Title 49-Transportation, Parts 100-199

(Application for copies should be address to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402).

\* 2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documets cited in the solicitation. (see 6.2.c).

## COMPRESSED GAS ASSOCIATION (CGA)

Pamphlet No. C-1	Methods of Hydrostatic Testing of Compressed Gas Cylinders
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(Application for copies of CGA pamphlets should be addressed to Compressed Gas Association, Inc., Crystal Gateway 1, Suite 501, 1235 Jefferson Davis Highway, Arlington, VA 22202)

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(Non-government standards and other publications are normally available from the organizations which prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

\* 2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related MS standards), 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 Qualification. The cylinder furnished under this specification shall be a product which is authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4.3 and 6.4). Qualification of any one type of cylinder (shown on MS26545) will qualify a supplier, at his request, for cylinders of different volumes (shown on MS26545), within specified limits, but of the same type provided the material and manufacturing process is the same. Listed below are the applicable volumes:

INTERNAL VOLUME	
CUBIC INCHES	LITERS
10 to 50	0.163 to 0.82
51 to 515	0.836 to 8.446
516 to 2040	8.462 to 33.43

3.2 First article. When specified (see 6.2.d), samples shall be subjected to first article inspection (see 6.5) in accordance with 4.4.

3.3 DOT requirements. Cylinders shall conform to DOT Specification 3A or 3AA.

3.4 Materials. Materials shall conform to applicable specifications and shall be as specified herein and on applicable drawings. Materials which are not covered by specifications, or which are not specifically described herein, shall be of the best quality, of the lightest practicable weight, and suitable for the purpose intended.

3.5 Design and construction. The design and construction of the cylinders shall be in accordance with the applicable part number of MS26545, as specified in the contract or order (see 6.2.b). Cylinders shall be fabricated to form seamless construction and shall have been subjected to the initial permanent volumetric expansion test within 18 months prior to delivery.

#### 3.5.1 Wire wrapping.

3.5.1.1 U.S. Army/U.S. Air Force. If wire wrapping is used, the cylinder shall be identified as having wire wrapping in accordance with MS26545.

3.5.1.2 Naval Air System Command. Wire wrapping not acceptable.

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3.5.2 Neck. Shrink rings or supporting collars shall not be used for strengthening the neck of the cylinder.

3.5.3 Closure. Unless otherwise specified, the threaded port of each cylinder shall be closed by a metal, removable, threaded plug or cap conforming to MIL-C-5501 or a commercially equivalent metal plug or cap, to protect the threads and prevent entrance of foreign matter or moisture.

3.6 Performance.

3.6.1 Visual examination and dimensional check.

3.6.1.1 Visual examination. When visually examined as specified in 4.7.1.1, the cylinders shall conform to the requirements of this specification. Table IV, Classification of Defects for Visual Examination, shall be used to classify and enumerate the defects.

3.6.1.2 Dimensional check. When dimensionally checked as specified in 4.7.1.2, the cylinders shall conform to the requirements of MS26545, as applicable.

3.6.2 Cleanliness (oxygen cylinders).

3.6.2.1 Non-Volatile residue. When tested as specified in 4.7.2.1, the residue from the solvent used for the rinse shall not exceed that of the clean solvent by more than .0015 grams per square foot of part surface area.

3.6.2.2 Particulate test. When tested as specified in 4.7.2.2, the solvent rinse shall not contain more than 5 particles between 100 and 175 micrometers per 100 ml of solvent; and no particles larger than 175 micrometers.

3.6.2.3 Halogen test. When tested as specified in 4.7.2.3, there shall be no evidence of cleaning compound residue.

3.6.3 Leakage.

3.6.3.1 Procedure I. When tested as specified in 4.7.3.1, the cylinders shall meet the leakage requirements of DOT 3A or 3AA, as applicable.

3.6.3.2 Procedure II. When tested as specified in 4.7.3.2, the cylinders shall not show any evidence of gas bubbles after 2 minutes of submergence.

3.6.4 Permanent volumetric expansion. When tested as specified in 4.7.4, the cylinders shall not have a permanent volumetric expansion greater than 10 percent of the total volumetric expansion.

\* 3.6.5 Burst pressure. When tested as specified in 4.7.5, class 1 cylinders shall not burst at a pressure less than 4,500 psi (31,027 KPa) and class 2 cylinders shall not burst at a pressure less than 5,250 psi (36,199 KPa). Failure of cylinders shall occur in a ductile manner.

3.6.6 Endurance. When tested as specified in 4.7.6, the cylinders shall not show any evidence of material failure.

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3.6.7 Flattening. When tested as specified in 4.7.7, the cylinders shall not show any evidence of cracking when examined visually without any magnification.

3.6.8 Macrostructure defects. When tested as specified in 4.7.8, the cylinders shall not show any evidence of abnormal segregation, pipes, cracks, seams or abnormal change in structure from the surface to the center.

3.6.9 Fragmentation resistance.

3.6.9.1 Procedure I. When tested as specified in 4.7.9.1, the cylinders shall remain in one piece. If wire wrapping is used, the wire wrapping may come loose from the cylinder.

3.6.9.2 Procedure II. When tested as specified in 4.7.9.2, the cylinders shall be allowed to separate into two pieces for oxygen or air charged cylinders and four pieces for carbon dioxide charged cylinders. The projected area of any piece shall not be less than 2.0 square inches. The cylinder shall exhibit no evidence of shattering with small irregular pieces or splinters. If wire wrapping is used, the wire wrapping may come loose from the cylinder.

3.7 Weight. The weight of the cylinder shall not exceed the values specified on MS26545.

3.8 Interchangeability. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable.

3.9 Color. The color of the cylinder shall be in accordance with the applicable color number of FED-STD-595 as shown on MS26545.

3.10 Finish. The external and internal surface shall be cleaned in accordance with Method I or VI of TT-C-490. The internal surface of cylinders fabricated of material other than corrosion-resistant steel shall be treated in accordance with Type I of TT-C-490. The external finish of all cylinders shall not crack, chip, or scale during normal service life or under extreme environmental conditions. The paint system shall be suitable for the intended use and shall be in accordance with local air pollution requirements. Extreme caution shall be exercised to prevent contamination during painting.

3.11 Identification. The cylinders shall be marked for identification in accordance with MIL-STD-130.

\* 3.11.1 Stamped markings. The cylinders shall be permanently and legibly marked using metal stamping on the shoulder, head or neck. The markings shall be at least 1/4 inch high, if space permits, and shall consist of the following:

- a. The service pressure rating in units of pounds per square inch (psi) and kilopascals (kPa), i.e. 1800 psi (12,400 kPa) or 2100 psi (14,500 kPa)
- b. Applicable (MS) part number.

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- c. Manufacturer's symbol or \*CAGE (Commercial And Government Entity) Code.
- d. Serial number.
- e. Date of permanent volumetric expansion test (month and year, and identifying symbol in accordance with DOT requirements), located in a manner to allow addition of subsequent dates.

\* 3.11.2 Additional markings. The following additional markings shall be applied by stencilling or clear pressure sensitive decal in two places diametrically opposite of each other:

- a. The name of the gas.
- b. The service pressure rating in units of pounds per square inch (psi) and kilopascals (kPa), i.e. 1800 psi (12,400 kPa) or 2100 psi (14,500 kPa) (NOT APPLICABLE FOR CARBON DIOXIDE CYLINDERS)

The size of the markings and the space between each row of markings shall be a minimum of .12 times the outer diameter of the cylinder. The adhesive on the decal shall conform to MIL-M-43719, Type M, Class N, for example, CLASS A TYPE 1.

3.12 Workmanship. The cylinders shall be uniform in quality and shall be free from irregularities or defects which could adversely affect safety, performance, reliability or durability.

#### 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 supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of Sections 3 and 5. The inspections set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of

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manufacturing operations, is as acceptable practice to ascertain conformance to requirements, however this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classification of inspection. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.3).
- b. First article inspection (see 4.4).
- c. Quality conformance inspection (see 4.5).

4.3 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in Table I.

4.3.1 Qualification samples. Qualification samples shall consist of the following:

- a. Nine cylinders of each type (Part Number) for which qualification testing has been authorized.
- b. Two sets of manufacturer's drawings in accordance with SD-6.
- c. When applicable, certification from the original manufacturer that the distributor requesting qualification status is authorized to distribute the item, or to rebrand and distribute the item, as applicable.
- d. A statement of certification from Department of Transportation approved laboratory (with supporting data) that the cylinders meet DOT 3A or 3AA requirements.

Samples shall be forwarded to a test facility set forth in the letter of authorization to submit samples (see 6.4). The samples shall be plainly identified by securely attached durable tags marked with the following information:

Sample submitted by (name) (date) for qualification inspection in accordance with the requirements of MIL-C-7905G and number under authorization (reference authorizing letter and number, see 6.4)

4.3.2 Retention of Qualified Products Listing (QPL). The retention of qualification listings shall consist of verification every two years to determine compliance of the listed item with the requirements of this specification. Verification shall be by manufacturer's certification unless otherwise specified by the activity responsible for the QPL.

4.4 First article inspection. First article inspection shall consist of the examinations and tests specified in Table II, listed sequence mandatory. If there is no Qualified Products Listing for the part number being procured, first article testing shall consist of the tests specified in Table I.

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4.4.1 First article samples. Unless otherwise specified, as soon as practicable after award of a contract or order, the manufacturer shall submit four cylinders of each part number specified in the contract or order; and a statement of certification from a Department of Transportation approved laboratory (with supporting data) that the cylinders meet DOT 3A or 3AA requirements, as applicable. The samples shall be representative of the construction, workmanship, components, and materials to be used during production. When a manufacturer is in continuous production of these cylinders from contract to contract, submission of further first article samples on the new contract may be waived at the discretion of the acquiring activity (see 6.2.d). Approval of the first article samples or the waiving of the first article inspection does not exclude the requirements of submitting to the quality conformance inspection. The first article samples shall be furnished to the Government as directed by the contracting officer (see 6.2.e).

4.4.1.1 First article information. Upon completion of the first article inspection program, the Government activity responsible for conducting the inspection program (see 6.2.e) shall report to the contracting officer the results of the inspection program, with appropriate recommendations.

4.4.1.2 First article sample disposition. The samples will be destroyed during the inspection program and will not be returned to the contractor.

4.5 Quality conformance inspection. Quality conformance inspection shall consist of the examinations and tests specified in Table III (Listed Sequence Mandatory). The sampling and inspection levels and acceptance criteria shall conform to MIL-STD-105.

4.5.1 Sampling.

4.5.1.1 Inspection lot.

4.5.1.1.1 Cylinder. An inspection lot size shall be expressed in units of one cylinder of the same size, made essentially under the same conditions and from the same materials and components. The sample unit shall be one cylinder.

4.5.1.1.2 Packaging. An inspection lot size shall be expressed in units of one fully prepared shipping container, containing cylinders fully prepared for delivery, made from essentially the same materials and components. The sample unit shall be one shipping container, containing cylinders fully prepared for delivery with the exception that it need not be sealed.

4.5.1.2 Sampling for tests and examinations of cylinders. The sample size, acceptance criteria, tests, and examinations required for the cylinders shall be as specified in Table III.

4.6 Test Conditions.

4.6.1 Gas. Unless otherwise specified, the gas used in testing the cylinders shall be oxygen conforming to MIL-O-27210, Type I, or nitrogen conforming to BB-N-411, Type I, Class I, Grade B, or air conforming to BB-A-1034.

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4.6.2 Temperature and Pressure. Unless otherwise specified, tests shall be conducted at local ambient temperature and barometric pressure. Test instruments shall be calibrated or adjusted according to their required usage in conducting individual tests. The temperature and barometric pressure shall be recorded at the time of inspection and, when required, the test results shall be corrected to normal temperature and pressure (NTP) conditions. NTP conditions are 70°F (21.1°C) and 29.92 inches of mercury (101.3 kPa).

4.6.3 Antiseize tape. To prevent damage to the cylinder threads or valves, male pipe threads of fittings installed in cylinders during tests shall be properly coated with antiseize tape conforming to MIL-T-27730 before being installed in the cylinder. The tape shall be applied according to instructions specified in MIL-T-27730. Tape shall be prevented from entering the inside of the fittings.

4.6.4 Wire wrapping. If wire wrapping is used, all tests, except fragmentation resistance (see 4.7.9), shall be performed without wire wrapping.

#### 4.7 Inspection methods.

##### 4.7.1 Visual examination and dimensional check.

4.7.1.1 Visual examination. Every cylinder shall be visually examined for conformance to the requirements of 3.6.1.1.

4.7.1.2 Dimensional check. The cylinders shall be dimensionally checked for conformance to the requirements of 3.6.1.2.

4.7.1.3 Packaging. Each of the fully prepared shipping containers containing cylinders selected as a sample unit from the lot shall be examined to determine that the packaging, packing, and marking conform to this specification. The classification of defects, Table V, shall be used to classify the defects found.

4.7.2 Cleanliness (oxygen cylinders). The cleanliness test shall consist of the non-volatile residue test (see 4.7.2.1), particulate test (see 4.7.2.2), and the halogen test (see 4.7.2.3).

4.7.2.1 Non-volatile residue test. To perform this test, place a clean plug in the outlet of the cylinder and clean the surface around the plug and the cylinder outlet with cleaning compound solvent conforming to MIL-C-81302, Type I. Wipe dry with a clean, lint free cloth. Calculate the internal surface area of the cylinder. Using the internal surface area of the cylinder and a ratio of 200 ml per sq. ft. (2.15 l/m<sup>2</sup>), calculate the required amount of solvent (MIL-C-81302, Type I) to be used. In no case shall less than 150 ml of solvent be used. Remove the plug from the cylinder and pour in the solvent. Install the plug in the cylinder to seal the outlet. Place the cylinder on its side and roll back and forth for a minimum of 10 minutes, in a manner to wash the entire internal surface. Immediately after completing the internal wash cycle, remove the plug and pour the solvent from the cylinder into a beaker. One half of the solvent used for the rinse shall be used for

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determining weight of residue and the other half of the solvent shall be used for determining particle content (see 4.7.2.2). The weight of the residue is determined by separately evaporating to dryness one half of the solvent used for the rinse and an equal amount of clean solvent. Attempts shall be made to recover evaporated solvent for re-use. When tested in this manner, the cylinders shall conform to the requirements of 3.6.2.1. Upon successful completion of this test, the remaining one half of the solvent shall be subjected to the test specified in 4.7.2.2.

4.7.2.2 Particulate test. Upon successful completion of the test specified in 4.7.2.1, examine the remaining one half of the solvent used for the rinse of particles. To determine the particle content, filter the solvent through a 1.2 micro milipore, or equivalent, membrane filter and inspect the filter surface for conformance to the requirements of 3.6.2.2. Upon successful completion of this test, the cylinders shall be subjected to the test specified in 4.7.2.3.

4.7.2.3 Halogen test. Upon successful completion of the test specified in 4.7.2.2, the cylinders shall be tested to detect any solvent residue. A Halogen or Halide detector, having a minimum sensitivity of not less than  $3 \times 10^{-4}$  standard cc's per second, shall be used for this test. The cylinders shall conform to the requirements of 3.6.2.3.

#### 4.7.3 Leakage.

4.7.3.1 Procedure I. The cylinder shall be tested for leakage as specified in the leakage test of DOT 3A or 3AA, as applicable. The cylinder shall pass the requirements specified in 3.6.3.1.

\* 4.7.3.2 Procedure II. The cylinder shall be charged to its design (class requirement) rated pressure with a +50/-0 psig (+345/-0 kPa) tolerance. With this pressure maintained, the cylinder shall be submerged in water for 2 minutes. All parts of the cylinder shall be covered with at least 1 inch (25.4mm) of water. The cylinder shall pass the requirements specified in 3.6.3.2.

4.7.4 Permanent volumetric expansion. Permanent volumetric expansion of the cylinder shall be determined as specified in the hydrostatic test of Pamphlet C-1 of the Compressed Gas Association. The cylinder shall pass the requirements specified in 3.6.4. The cylinder shall have passed this test within 18 months prior to delivery.

\* 4.7.5 Burst pressure. The cylinders shall be hydrostatically pressurized at a rate that does not exceed 25,000 psi (172,370 kPa) per minute to a maximum pressure of 95.24 percent (%) of the minimum burst pressure specified in 3.6.5, for class 1 and class 2 cylinders. The cylinders shall be maintained pressurized for three minutes. The pressure shall then be increased to destruction at a rate that does not exceed 12,000 psi (82,735 kPa) per minute and the burst pressure recorded. The cylinders shall conform to the requirements of 3.6.5.

\* 4.7.6 Endurance test. The cylinders shall be hydrostatically pressurized to their rated pressures (specified in 1.2)  $\pm 50$  psig ( $\pm 345$  kPa) and the pressure released to obtain an internal pressure of  $50 \pm 50$  psig ( $345 \pm 345$  kPa). This shall constitute one cycle. The charging and discharging shall be

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repeated for 20,000 cycles. The cylinders shall conform to the requirements of 3.6.6. The cylinders shall then be subjected to and pass the permanent volumetric expansion test.

4.7.7 Flattening. The cylinder shall be flattened to six times the wall thickness between wedge-shaped knife edges with a 60-degree (1.05 rad) included angle and rounded to a 1/2 inch (13mm) radius. The knife edge shall be applied perpendicularly to the longitudinal axis of the cylinder at the center of the cylinder. The cylinder shall conform to the requirements of 3.6.7.

4.7.8 Macrostructure (deep acid etch). Longitudinal sections from the cylinder shall be etched in an aqueous solution containing 50 percent hydrochloric acid by volume and maintained at a temperature of  $160^{\circ} \pm 10^{\circ}\text{F}$  ( $71^{\circ} \pm 5^{\circ}\text{C}$ ) for sufficient time to show the presence of defects. The sections shall then be visually examined by a metallographist and shall conform to the requirements specified in 3.6.8.

4.7.9 Fragmentation resistance. Oxygen shall be the charging gas for oxygen cylinders, carbon dioxide for charging carbon dioxide cylinders, and air for charging cylinders of other usages (see 4.6.1).

4.7.9.1 Procedure I. Cylinders greater than 2-1/2 inches in diameter shall be subjected to gunfire under the following conditions:

- a. The cylinder shall be charged to rated service pressure (carbon dioxide cylinders shall be charged to rated capacity) at gun range ambient air temperature.
- b. The cylinder may be supported but not constrained.
- c. The ammunition shall be .50 caliber M-2, armor-piercing.
- d. The range shall be 50 yards (45.7 m) maximum.
- e. The various cylinders taken for test shall be tested, each progressively, in a different position. The cylinder positions shall be as follow:
  - (1) With the longitudinal axis of the cylinder normal to the line of fire.
  - (2) With the longitudinal axis of the cylinder 45 degrees (.785 rad) from normal toward the gun position.
  - (3) With the longitudinal axis of the cylinder parallel to the line of fire with inlet port face away from the gun position.
- f. All shots shall be tumbled. A suggested method for projectile tumbling is shown in figure 1.
- g. The tumbled projectile shall have a minimum velocity of 2,600 ft/sec (792 m/s) at the point of impact with the cylinder.

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- h. The minimum size entry hole made by the tumbled projectile shall be one-half inch by one and one-half inch (13mm by 39mm).
- i. Verify that the projectile trajectory and tumble are satisfactory. This may be determined by the location and visual appearance of a hole made by the passage of the projectile through vertically suspended sheets of paper at the target area.

The cylinder shall pass the requirements specified in 3.6.9.1.

4.7.9.2 Procedure II. Cylinders 2-1/2 inches or less in diameter shall be subjected to gunfire under the following conditions:

- a. The cylinder shall be charged to its rated service pressure (carbon dioxide cylinders shall be charged to rated capacity) at gun range ambient air temperature.
- b. The cylinder may be supported but not constrained.
- c. The ammunition shall be .30 caliber armor piercing, with a muzzle velocity of  $2800 \pm 100$  feet per second ( $853 \pm 30$  m/s).
- d. The range shall be approximately 20 yards (18.3m).
- e. Shots shall not be tumbled.
- f. The various units taken for tests shall be positioned as indicated in 4.7.9.1e.

The cylinders shall pass the requirements specified in 3.6.9.2.

## 5 PACKAGING

5.1 Preservation. Preservation shall be level A or C, as specified by the acquiring activity (see 6.2.1f).

5.1.1 Level A. Each cylinder shall be preserved and packaged in accordance with Method IC of MIL-P-116, without the use of contact preservatives. Cleaning shall be accomplished without the use of petroleum derivative solvents. The cylinder port shall be sealed with a metal cap or plug conforming to MIL-C-5501 or commercially equivalent metal cap or plug. When installing aluminum caps or plugs, caution shall be exercised in the application and tensioning of same to preclude the shearing of particles from the softer metal fittings. After cleaning, package each cylinder in a close-fitting box conforming to PPP-B-636. The container closure shall be accomplished in accordance with applicable procedures specified in the appendix of PPP-B-636.

5.1.2 Level C. The cylinder shall be individually packaged in a manner that will prevent physical damage or environmental deterioration during transit from the shipping point to the original consignee. As a minimum, the cylinder port shall be plugged or capped, as applicable, with metal fittings

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only, conforming to MIL-C-5501, or commercial equivalent. When installing aluminum caps or plugs, caution shall be exercised in the application and tensioning of same to preclude shearing particles off the softer metal fittings.

5.2 Packing. Packing shall be level A, B or C as specified by the acquiring activity (see 6.2.1f). Insofar as practicable, shipping containers shall effect a close fit, contain identical quantities and be of uniform dimensional configuration. For levels A and B the gross weight of boxes shall not exceed 200 pounds (90.7 kg).

5.2.1 Level A. A cylinder packaged as specified in 5.1.1 shall be packed for shipment in a Fiberboard, Corrugated, Triple Wall box conforming to PPP-B-640, Class 2 (weather-resistant) style E. The closure sealing and reinforcing (banding) of the container shall be accomplished in accordance with the procedures specified in the appendix of the container specification.

5.2.2 Level B. A cylinder packaged as specified in 5.1.1 shall be packed for shipment as specified in 5.2.1, except that the fiberboard shipping container conforming to PPP-B-640 shall be Class 1 (nonweather resistant), Style E.

5.2.3 Level C. A cylinder packaged as specified in 5.1.1 shall be packed for shipment in a manner that will afford protection against damage during transit from the shipping point to the original consignee. Containers used shall be in accordance with Uniform Freight Classification Rules, or regulations of other carriers applicable to the mode of transportation utilized.

5.3 Marking. Each unit and shipping container shall be marked in accordance with MIL-STD-129. In addition, the following precautionary marking shall be required on each unit package and shipping container:

CAUTION

DO NOT ALLOW PETROLEUM CONTAMINANTS OF ANY KIND  
TO BE USED/STORED ON OR ABOUT THESE CYLINDERS.

## 6 NOTES

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

6.1 Intended use. The cylinders covered by this specification are intended for use in storing compressed gas, such as air, aviator's breathing oxygen and liquefied carbon dioxide.

\* 6.2. Acquisition requirements. Acquisition documents should specify the following:

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- a. Title, number, and date of this specification, including amendments.
- b. Applicable part number (see 1.2 and 3.5).
- c. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
- d. Whether first article inspection is waived (see 4.4.1).
- e. Name and address of the first article inspection laboratory (see 4.4.1) and the name of the Government activity responsible for conducting the first article inspection program (see 4.4.1.1).
- f. Cylinders subjected to destructive tests (see Table III) shall not be shipped or considered as part of the contract or order.
- g. Applicable levels of preservation, packaging, and packing (see 5.1 and 5.2), including marking requirements (see 5.3).
- h. Applicable methods of cleaning and preservation.

6.3. Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The application Data Item Description (DID'S) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirement List (DD Form 1423) must be prepared to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
4.4.1.1	DI-T-5329	First article inspection report	Use contractor format

The above DID's were those cleared as of the date of this specification. the current use of DOD 5010.12-L Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of contractors is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible

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to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the Commander, Naval Air Systems Command, Department of the Navy, Washington, D.C., 20361; however, information on, or authorization to submit qualification samples shall be obtained from the Commanding Officer, Naval Air Development Center, Warminster, PA 18974, Attention: Code 6031.

6.4.1 Drawings. When requested, the manufacturer shall submit engineering drawings and inspection reports in accordance with SD-6.

6.5 First article. When a first article is required, the item shall be tested and should be a first article sample. The contracting officer should include specific instructions in all acquisition documents regarding arrangements for examinations, tests and approval of the first article.

6.6 International standardization. Certain provisions (3.11.2), of this specification are the subject of international standardization agreement (STANAG 3056). When amendment, revision, or cancellation of this specification is proposed, the departmental custodians will inform their respective Departmental Standardization Offices so that appropriate action may be taken respecting the international agreement concerned.

\*6.7 Subject term (key word) listing.

Compressed gas  
Cylinder  
Non-shatterable  
Seamless  
Steel  
Trichlorotrifluoroethane  
1800 psi  
2100 psi

6.8 Changes from previous issue. Asterisks or verticle lines are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:  
Army - AV  
Air Force - 99

Preparing activity:  
Navy - AS  
(Project 1660-0581)

Review activities:  
Air Force - 11 and 71  
International interest (see 6.6)

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TABLE I. Qualification inspection.

Inspection	Requirement Paragraph(s)	Test Method Paragraph(s)
Visual examination	3.6.1.1	4.7.1.1
Dimensional examination	3.6.1.2	4.7.1.2
Cleanliness (oxygen cylinders)	3.6.2.1, 3.6.2.2, 3.6.3.3	4.7.2.1, 4.7.2.2, 4.7.2.3
Leakage (procedure II)	3.6.3.2	4.7.3.2
Permanent volumetric expansion	3.6.4	4.7.4
Burst pressure	3.6.5	4.7.5
Endurance	3.6.6	4.7.6
Flattening	3.6.7	4.7.7
Macrostructure	3.6.8	4.7.8
Fragmentation resistance	3.6.9.1 or 3.6.9.2, as applicable	4.7.9.1 or 4.7.9.2, as applicable

TABLE II. First article inspection.

Inspection	Requirement Paragraph(s)	Test Method Paragraph(s)
Visual examination	3.6.1.1	4.7.1.1
Dimensional examination	3.6.1.2	4.7.1.2
Cleanliness (oxygen cylinders)	3.6.2.1, 3.6.2.2, 3.6.2.3	4.7.2.1, 4.7.2.2, 4.7.2.3
Leakage (procedure II)	3.6.3.2	4.7.3.2
Permanent volumetric expansion	3.6.4	4.7.4
Burst pressure	3.6.5	4.7.5

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TABLE III. Quality conformance inspection.

Inspection	Method	Sample size	Acceptance criteria
Visual examination (See classification of defects)	4.7.1.1	a. Every cylinder for critical defects.  b. Inspection Level II for minor defects.	a. Reject all units with any critical defects.  b. An acceptable quality level of 2.5 defects per hundred units for minor defects.
Dimensions	4.7.1.2	Inspection Level S-2 <u>1/</u>	Acceptance number zero, rejection number 1.
Leakage (procedures I or II)	4.7.3.1 and 4.7.3.2	Every cylinder.	Reject all defective units.
Permanent volumetric expansion	4.7.4	Every cylinder.	Reject all defective units.
Cleanliness (oxygen cylinders)	4.7.2.1, 4.7.2.2, 4.7.2.3	Inspection Level S-3 <u>1/</u>	Acceptance number zero, rejection number 1.
Burst pressure <u>2/</u>	4.7.5	Inspection Level S-1 <u>1/</u>	Acceptance number zero, rejection number 1.
Packaging	4.7.1.3	Inspection Level S-2 <u>1/</u>	Total acceptable quality level of 4.0 percent defective.

1/ The sample size shall be based only on the applicable sample size code letter corresponding to the specified inspection level of MIL-STD-105.

2/ This is a destructive test (see 6.2.1e).

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TABLE IV. Classification of defects for visual examination of the cylinder.

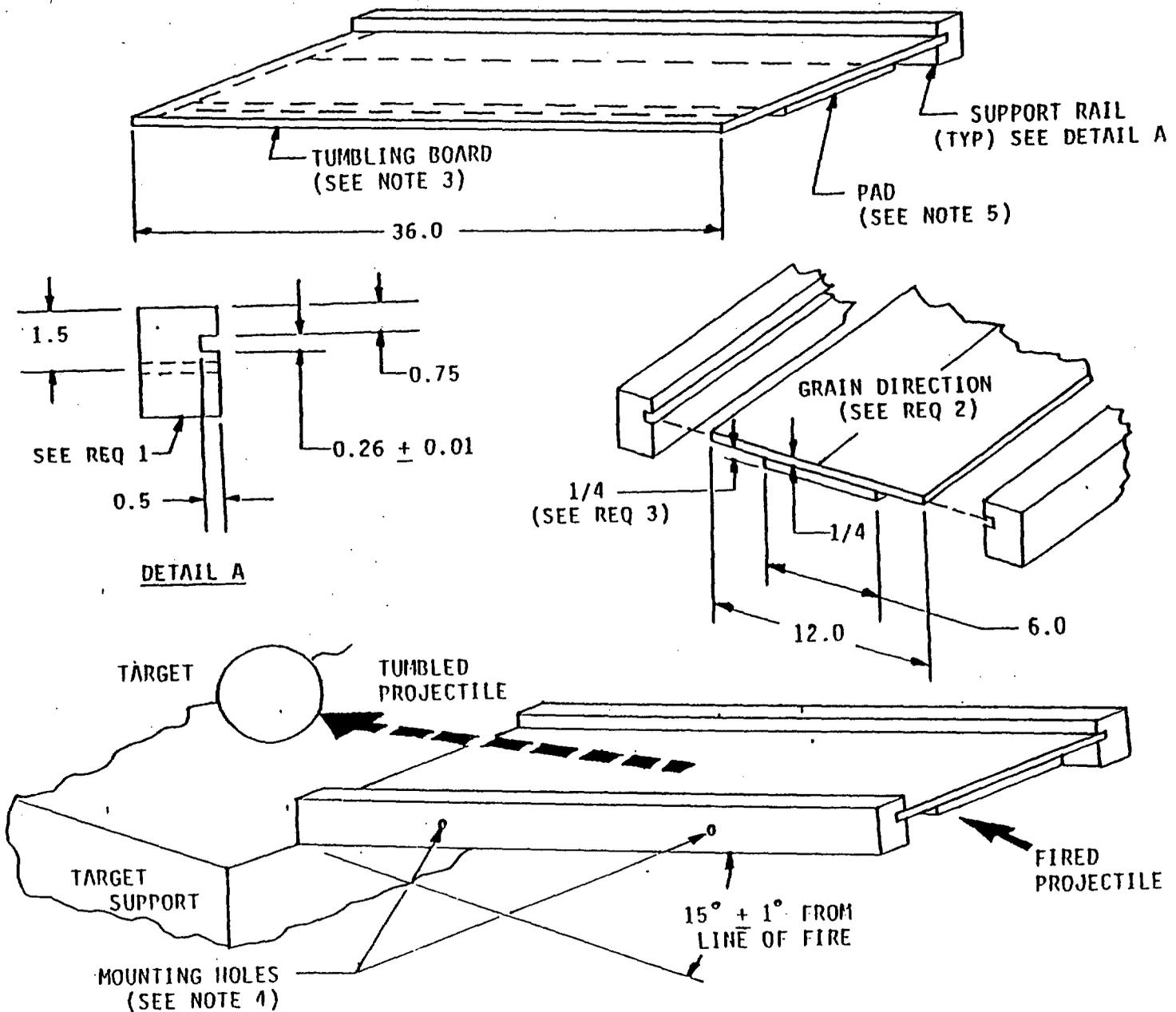
Defects	Critical	Minor
Incorrect outlet configuration	X	
Incorrect or defective threads	X	
Incorrect, incomplete, or faulty finish		X
Incorrect type or class	X	
Flaw in material <u>1/</u>	X	
Incorrect or incomplete marking		X
Incorrect color		X
Loose particles inside the cylinder	X	
Rust or scale	X	
Irregularities in the internal surface greater than 1/16 inch	X	
Existence of any foreign material, solid or liquid	X	

1/ Cracks in the spun sections of cylinders, such as those caused by changes in temperature during the spinning process, shall be accepted. There shall be no cracks in the cylindrical section of the cylinder wall.

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TABLE V. List of defects for packaging.

Item	Defects
Exterior and interior markings	Missing, incorrect, incomplete, illegible; of improper size, location, sequence, or method of application; markings not the same on the interior and exterior containers.
Packaging and packing materials	Any nonconforming component; any component missing, damaged, or otherwise defective.
Workmanship	Inadequate application of the components such as incomplete closure of the unit package, intermediate package, container flaps, loose strappings, etc.; bulging or distortion of the containers.
Exterior and interior weight or content	Number per container is more or less than required; gross or net weight exceeds the requirements.



## REQUIREMENTS:

1. LUMBER, 2x3 - FINISH SIZE
2. BOARD, PLYWOOD-GRADE A-A, EXTERIOR TYPE, 3 PLY
3. SHEET, RUBBER-STYRENE-BUTADIENE (SBR), 55 ± 5 DUROMETER (SHORE A)

## NOTES:

1. DIMENSIONS IN INCHES
2. TOLERANCE: DECIMALS + 0.1, FRACTIONS + 1/64
3. TUMBLING BOARD MAY BE MOVED IN THE SUPPORT RAILS FOR REPEATED FIRINGS
4. MOUNTING HOLES METHOD USED TO SUPPORT TUMBLING BOARD IS OPTIONAL, HOWEVER, THE BOARD MUST BE RIGIDLY MOUNTED.
5. PAD SHALL BE CEMENTED TO ENTIRE LENGTH OF TUMBLING BOARD USING A COMMERCIAL CONTACT CEMENT

FIGURE 1. Projectile tumbling method.

# 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>		1. DOCUMENT NUMBER MIL-C-7905G	2. DOCUMENT DATE (YYMMDD) 24 August 1990
3. DOCUMENT TITLE Cylinders, Steel, Compressed Gas, Non-Shatterable, Seamless, 1800PSI & 2100 <sup>PSI</sup>			
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)			
5. REASON FOR RECOMMENDATION			
6. SUBMITTER			
a. NAME (Last, First, Middle Initial)		b. ORGANIZATION	
c. ADDRESS (Include Zip Code)		d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (if applicable)	7. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY			
a. NAME Commanding Officer NAEC, SESD Code 53		b. TELEPHONE (Include Area Code) (1) Commercial (201) 323-7457	(2) AUTOVON 624-7457
c. ADDRESS (Include Zip Code)  Lakehurst, NJ 08733-5100		IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	