DEPARTMENT OF TRANSPORTATION
HAZARDOUS MATERIALS REGULATIONS BOARD
WASHINGTON, D.C. 20590

[49 CFR Parts 171, 173, 178]

[Docket No. HM-69; Notice 70-25]

TRANSPORTATION OF HAZARDOUS MATERIALS

Cylinder Specifications

The Hazardous Materials Regulations Board is considering amending the Department's Hazardous Materials Regulations to provide a specification for a nonreusable (nonrefillable) cylinder for certain compressed gases and to eliminate existing specifications 9, 40, and 41. Also, a new paragraph (k) is proposed for addition to § 173.301 to specify that certain cylinders, including the new specification proposed herein, must be shipped in outside packagings with their valves protected.

Interested persons are invited to give their views on this proposal. Communications should identify the docket number and be submitted in duplicate to the Secretary, Hazardous Materials Regulations Board, Department of Transportation, 400 Sixth Street SW., Washington, DC 20590. Communications received on or before March 9, 1971, will be considered before final action is taken on the proposal. All comments received will be available for examination by terested persons at the Office of the retary, Hazardous Materials Regulais Board, both before and after the osing date for comments.

The basis for this proposal is a petition of the Compressed Gas Association, Inc., and more than 100 special permits issued during the last 12 years. In its petition, the Compressed Gas Association submitted a draft of a proposed specification designated by it as DOT-42. Since the number 42 is designated for aluminum drums, the specification designation has been changed to DOT-39.

In reviewing the proposal, the Board has concluded that adoption of this specification will eliminate any need for specifications 9, 40, and 41. Comments are invited as to continuing need for manufacture of these specifications. Existing cylinders would be authorized until there would no longer be a need for their authorization.

The proposed new specification is primarily performance oriented. There are proposed limitations as to the type of metal to be used. Design for the cylinder would be based upon the pressure of the intended contents at 130° F., described as the "test pressure". The performance pressure (burst) test, would be a function of the test pressure. The marked service pressure would be limited to a maximum of 80 percent of the test pressure. A cylinder would be marked to indicate both service and test pressures. Rather than designating these pressures according to the different types of gases thorized, the regulations in paragraphs and (f) of § 173.301 would apply.

Consistent with the terms of most of the outstanding special permits, the specification would be limited to 55 pounds water capacity for service pressures of 500 p.s.i. or less, and 10 pounds water capacity for service pressures in excess of 500 p.s.i. For flammable gases, cylinder size would be limited to 75 cubic inches. The CGA petition proposed certain exemptions for safety relief devices. The Board is not proposing any exemption for relief devices for cylinders made under this specification. Further, the Board believes safety valves should be required for cylinders intended for liquefied flammable gases to reduce the hazard of total release of contents should a cylinder accidentally be overfilled or exposed to high temperatures of short duration.

There are two major performance tests proposed; a "burst" test and a flattening (crush) test. The emphasis is placed on the "burst" test since the Board believes it the more significant and reliable of the two. A minimum burst criteria is specified plus restrictions on the allowable manner of failure. The manner of failure at burst is a basic safety consideration. In developing the testing requirements, it became evident that the imposition of test requirements on a production line from the beginning-of-forming operations could cause manufacturers some difficulty. Such a limitation is not being proposed at this time for inclusion in the definition of a lot. However, if it is determined that the proposed definition of a lot is inadequate, an appropriate change will be made to insure that tests are truly representative of the production of all cylinders.

A manufacturer's registration system is proposed as part of this Notice. At this time, it is not proposed to establish a licensing or certification scheme. As stated in § 173.24, the specification identification marking of a packaging is a certification that it complies with all specification requirements. The proposed issuance of registration numbers to manufacturers would be a ministerial function to facilitate the identification of manufacturers. Although the Board is considering licensing in this area, and others, such substantive regulations will not take place without separate rulemaking action.

The Board is placing emphais on the nonreusable limitation of this specification by proposing a penalty statement as part of the specification marking requirement. The regulations concerned with the marking "NRC" is found presently in paragraph (i) of § 173.28.

The Board agrees with the CGA proposal, as modified herein, since the proposed cylinder will be: (1) Overpacked at all times during transportation, (2) limited to noncorrosive gases, (3) nonreusable and not subject to cyclic stresses resulting from refilling, (4) equipped with safety devices, (5) made of ductile materials, and (6) the subject of continuous performance tests.

In consideration of the foregoing, the Board proposes to amend Parts 171, 173, and 178 as follows:

I. Part 171:

In § 171.7, paragraph (c)(12) would be added to read as follows:

§ 171.7 Matter incorporated by reference.

* * * * *

(c) * * *

(12) Aluminum Association: The Aluminum Association, 420 Lexington Avenue, New York, NY 10017.

* * * * *

II. Part 173:

(A) In § 173.34 paragraph (d)(1) Note 1 and (d)(2) would be amended to read as follows:

§ 173.34 Qualification, maintenance, and use of cylinders.

* * * * *

(d) * * *

(1) * * *

NOTE 1: Safety relief devices are required on specs. 9, 40, 41, and 39 (§ 178.65 of this chapter) cylinders. Metal safety relief valves are required on specification 39 cylinders used for liquefied flammable gases. Fusible safety relief devices are not authorized on specification 39 cylinders.

* * * * *

(2) Except for specification 39 cylinders and for acetylene in solution, safety relief devices are not required on cylinders charged with nonliquefied gas under pressure of 300 p.s.i. or less at 70° F.

* * * * *

(B) In § 173.301, paragraph (h) table would be amended by adding "DOT-39" in the last column following "DOT-38"; paragraph (k) would be added to read as follows:

§ 173.301 General requirements for shipment of compressed gases in cylinders.

* * * * *

(k) *Outside packagings.* Specifications 2P, 2Q, 3E, 3HT, 4D, 4DA, 4DS, 9, 39, 40, and 41 must be shipped in strong outside packagings.

(1) Outside packagings must provide protection against accidental functioning of and damage to valves under conditions normally incident to transportation.

(C) In § 173.302 paragraph (a)(4) would be added to read as follows:

§ 173.302 Charging of cylinders with nonliquefied compressed gases.

(a) * * *

(4) Specification 39 (§ 178.65 of this chapter). For flammable gases, internal volume must not exceed 75 cubic inches.

* * * * *

(D) In § 173.304 paragraph (a)(1) would be amended; paragraph (a)(2) table miscellaneous entries and Note 8 would be amended and Note 9 would be added; paragraph (d)(3)(i) except Note 1 would be amended to read as follows:

§ 173.304 Charging of cylinders with liquefied compressed gas.

(a) * * *

(1) Specification 3,[1] 3A, 3AA, 3B, 3BN, 3D, 3E, 4, 4A, 4B, 4BA, 4B–ET, 4BW, 9,[1] 25,[1] 26,[1] 38,[1] 39, 40,[1] or 41,[1] (§§ 178.36, 178.37, 178.38, 178.39, 178.41, 178.42, 178.48, 178.49, 178.50, 178.51, 178.55, 178.61, 178.63, 178.65, 178.66, 178.67 of this chapter), except that specifications 9, 39, 40, and 41 containers must not be charged and shipped with mixtures containing pyrophoric liquids carbon bisulfide (disulfide), ethyl chloride, ethylene oxide, nickel carbonyl, spirits of nitroglycerin, or poisonous materials (class A, B, or C), unless specifically prescribed in this part.

(i) For flammable gases, the internal volume of a specification 39 cylinder must not exceed 75 cubic inches.

(2) * * *

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[1] Use of existing cylinders authorized, but new construction not authorized.

Kind of gas	Maximum permitted filling density (see Note 1)	Containers marked as shown in this column or of the same type with higher service pressure must be used except as provided in § 173.34 (a), (b), § 173.301(j) (see notes following table).
* * *	* * *	* * *
Carbon dioxide, liquefied (See Notes 3, 4, 7, and 8).	68	DOT-3A1800; DOT-3AA1800; DOT-3; DOT-3E1800; DOT-3HT2000; DOT-39.
Carbon dioxide-nitrous oxide mixture (see Notes 7 and 8).	68	DOT-3A1800; DOT-3AA1800; DOT-3; DOT-3E1800; DOT-3HT2000; DOT-39.
Cyclopropane (see Notes 8 and 9)	55	DOT-3A225; DOT-3A480X; DOT-3AA225; DOT-3B225; DOT-4A225; DOT-4AA480; DOT-4B225; DOT-4BA225; DOT-4BW225; DOT-4B240ET; DOT-7-300; DOT-3; DOT-3E1800; DOT-39.
Dichlorodifluoromethane (see Note 8)	119	DOT-3A225; DOT-3AA225; DOT-3B225; DOT-4A225; DOT-4B225; DOT-4BA225; DOT-4BW225; DOT-4B240ET; DOT-4E225; DOT-9; DOT-39; DOT-41; DOT-3E1800.
Dichlorodifluoromethane and difluoroethane mixture (constant boiling mixture) (see Note 8).	Not liquid full at 130° F.	DOT-3A240; DOT-3AA240; DOT-3B240; DOT-3E1800; DOT-4A240; DOT-4B240; DOT-4BA240; DOT-4BW240; DOT-9; DOT-39.
Difluoromonochloroethane (see Note 8)	100	DOT-3A150; DOT-3AA150; DOT-3B150; DOT-4B150; DOT-4BA225; DOT-4BW225; DOT-3E1800; DOT-39.
Ethane (see Notes 8 and 9)	35.8	DOT-3A1800; DOT-3AA1800; DOT-3; DOT-3E1800; DOT-39.
Ethane (see Notes 8 and 9)	36.8	DOT-3A2000; DOT-3AA2000; DOT-39.
Ethylene (see Notes 8 and 9)	31.0	DOT-3A1800; DOT-3AA1800; DOT-3; DOT-3E1800; DOT-39.
Ethylene (see Notes 8 and 9)	32.5	DOT-3A2000; DOT-3AA2000; DOT-39.
Ethylene (see Notes 8 and 9)	35.5	DOT-3A2400; DOT-AA2400; DOT-39.
Liquefied nonflammable gases, liquids other than those classified as flammable, corrosive, or poisonous, and mixtures or solutions thereof, charged with nitrogen, carbon dioxide, or air (see Notes 7 and 8)	Not liquid full at 130° F.	DOT-3A300; DOT-3AA300; DOT-3HT900; DOT-4B300; DOT-4BA300; DOT-4BW300; DOT-4D300; DOT-4DA500; DOT-4DS500; DOT-3E1800; DOT-39.
Monochlorodifluoromethane (see Note 8)	105	DOT-3A240; DOT-3AA240; DOT-3B240; DOT-4B240; DOT-4BA240; DOT-4BW240; DOT-4B240ET; DOT-4E240; DOT-39; DOT-41 DOT-3E1800.
Monochloropentafluoroethane (see Note 8).	110	DOT-3A225; DOT-3AA225; DOT-3B225; DOT-4A225; DOT-4B225; DOT-4BA225; DOT-4BW225; DOT-3E1800; DOT-39.
Monochlorotrifluoromethane (see Note 8).	100	DOT-3A1800; DOT-3AA1800; DOT-3; DOT-3E1800; DOT-39.
Nitrous oxide (see Notes 7 and 8)	68	DOT-3A1800; DOT-3AA1800; DOT-3; DOT-3E1800; DOT-3HT2000; DOT-39.
Sulfur dioxide (see Note 8)	125	DOT-3A225; DOT-3AA225; DOT-3B225; DOT-4A225; DOT-4B225; DOT-4BA225; DOT-4BW225; DOT-4B240ET; DOT-3; DOT-4; DOT-25; DOT-26-150; DOT-38; DOT-39; DOT-3E1800.
* * *	* * *	* * *

* * * * *

NOTE 8: See § 173.301(k).

NOTE 9: When used for shipment of flammable gases, the internal volume of a specification 39 cylinder must not exceed 75 cubic inches.

* * * * *

(d) * * *

(3) * * *

(i) Specification 3,[1] 3A, 3AA, 3B, 3E, 4A, 4B, 4BA, 4B240ET, 4BW240, 4B240X,[1] 4B240FLW, 4E, 4, 9,[1] 25,[1] 26,[1] 38,[1] 39, or 41[1] (§§ 178.36, 178.37, 178.38, 178.42, 178.49, 178.50, 178.51, 178.55, 178.61, 178.54, 178.68, 178.48, 178.63, 178.65, 178.67, of this chapter. The internal volume of a specification 39 cylinder must not exceed 75 cubic inches.

* * * * *

II. Part 178:

A) In Part 178 table of contents 178 .66, and 178.67 would be icel .78.65 would be added as ows:

65 Specification 39; nonreusable (nonrefillable) cylinder.

78.63 [Canceled]

B) Section 178.63 would be canceled.

C) Section 178.65 would be added to d as follows:

78.65 Specification 39; nonreusable (nonrefillable) cylinder.

78.65–1 Compliance.

Each cylinder must meet the applicable uirements of § 173.24 of this chapter.

78.65–2 Type, size, service pressure, and test pressure.

) Type: Each cylinder must be of nless, welded, or brazed construction. erical pressure vessels are authorized covered by the references to cylin- in this specification.

) Size limitation: Maximum water acity may not exceed:

) 55 pounds (1,526 cubic inches) for rvice pressure of 500 p.s.i.g. or less,

) 10 pounds (277 cubic inches) for a ice pressure in excess of 500 p.s.i.g.

) Service pressure: The marked ice pressure may not exceed 80 per- of the test pressure.

) Test pressure: The test pressure is pres[illegible] of contents at 130° F. or 180 g ever is greater.

) erm "pressure of contents" ise[illegible] this specification means the l pressure of all the materials to be ped in the cylinder.

78.65–3 Inspection by whom and where.

spection of each cylinder must be ormed by a competent inspector with nical analyses and tests performed in limits of the United States. Dis- rested inspectors, acceptable to the eau of Explosives, are required for nders having marked service pres- s higher than 900 p.s.i.g.

78.65–4 Duties of inspector.

) The inspector must determine that material used complies with the re- ements of this specification.

b) The inspector must verify compli- e with the requirements of subsection f this section by making a chemical lysis or obtaining a certified chemical lysis from the material manufacturer each heat of material (ladle analysis eptable). If an analysis is not pro- d by the material manufacturer, a mple from each coil, sheet, or tube st be analyzed.

) The inspector must determine that h cylinder is made and marked in mpliance with this specification by:

) Complete internal and external pection;

) Verification of proper heat treat- nt (if any);

) ion of samples to be tested;

) ssing all tests; and

) reparation of required report.

§ 178.65–5 Material; steel or aluminum.

(a) Steel: The steel analysis must conform to the following:

	Ladle analysis	Check analysis
Carbon, maximum percent	0.12	0.15
Phosphorus, maximum percent	0.04	0.05
Sulfur, maximum percent	0.05	0.06

(b) Aluminum: Aluminum not authorized for service pressures in excess of 500 p.s.i.g. Analysis of aluminum must conform to Aluminum Association standards designated for alloys 1100, 1170, 3003, 5052, 5086, 5154, 6061, and 6063 specified in its publication entitled "Aluminum Standards and Data" (1970–71 edition dated December 1969).

(c) Material with seams, cracks, laminations, or other injurious defects not permitted.

(d) Material used must be identified by any suitable method.

§ 178.65–6 Manufacture.

(a) General manufacturing requirements are as follows:

(1) Dirt and scale must be removed prior to inspection and processing.

(2) The surface finish must be uniform and reasonably smooth.

(3) Inside surfaces must be clean, dry, and free of loose particles.

(4) No defect of any kind is permitted if it is likely to weaken a finished cylinder.

(b) Requirements for seams:

(1) Brazing is not authorized on aluminum cylinders.

(2) Brazing material must have a melting point of not lower than 1,000° F.

(3) Brazed seams must be assembled with proper fit to insure complete penetration of the brazing material throughout the brazed joint.

(4) Minimum width of brazed joints must be at least four times the thickness of the shell wall.

(5) Brazed seams must have design strength equal to or greater than 1.5 times the minimum strength of the shell wall.

(6) Welded seams must be properly aligned and welded by a method that provides clean, uniform joints with adequate penetration.

(7) Welded joints must have strength equal to or greater than the minimum strength of the shell material.

(c) Attachments to the cylinder are permitted by any means which will not be detrimental to the integrity of the cylinder.

§ 178.65–7 Wall thickness.

(a) The minimum wall thickness must be such that the wall stress at test pressure does not exceed the yield strength of the material of the finished cylinder wall.

(b) Calculation of the stress for cylinders must be made by the formula:

$$S=\frac{P(1.3D^2+0.4d^2)}{D^2-d^2}$$

where

S=Wall stress, in p.s.i.;
P=Test pressure;
D=Outside diameter, in inches;
d=Inside diameter, in inches.

(c) Calculation of the stress for spheres must be made by the formula:

$$S=\frac{PD}{4t}$$

where

S=Wall stress, in p.s.i.;
P=Test pressure;
D=Outside diameter, in inches;
t=Minimum wall thickness, in inches.

§ 178.65–9 Openings.

(a) Openings are permitted in heads only.

(b) All openings and their reinforcements must be within an imaginary circle, concentric to the axis of the cylinder. The diameter of the circle may not exceed 80 percent of the outside diameter of the cylinder. The plane of the circle must be parallel to the plane of a circumferential weld and normal to the long axis of the cylinder.

(c) Unless a head has adequate thickness, each opening must be reinforced by a securely attached fitting, boss, pad, collar, or other suitable means.

§ 178.65–10 Safety devices.

Safety devices must meet the requirements of § 173.34(d) of this chapter.

§ 178.65–11 Pressure tests.

(a) Each cylinder must be tested at an internal pressure of at least the test pressure and must be held at that pressure for at least 30 seconds.

(1) The leakage must be conducted by submersion under water or by some other method that will be equally sensitive.

(2) If the cylinder leaks, evidences visible distortion, or any other defect, while under test, it must be rejected.

(b) One cylinder taken from the beginning of each lot, and one from each 1,000 or less successively produced within the lot thereafter, must be hydrostatically tested to destruction. The entire lot must be rejected if—

(1) A failure occurs at a gauge pressure less than 2.0 times the test pressure,

(2) A failure initiates in a weld or the heat affected zone thereof;

(3) A failure is other than in the sidewall of a cylinder longitudinal with its long axis, or

(4) In a sphere, a failure occurs in any opening, reinforcement, or at a point of attachment.

(c) A "lot" is defined as the quantity of cylinders successively produced per production shift (not exceeding 10 hours) having identical size, design, construction, material, heat treatment, finish, and quality.

§ 178.65–12 Flattening test.

(a) One cylinder must be taken from the beginning of production of each lot (as defined above) and subjected to a flattening test.

(1) The flattening test must be made on a cylinder that has been tested at test pressure.

(2) A ring taken from a cylinder may be flattened as an alternative to a test on a complete cylinder. A circumferential body weld, when present, must be included at the midwidth of a test ring.

(3) The flattening must be between 60° included-angle, wedge shaped knife edges, rounded to a 0.5 inch radius.

t) Cylinders and test rings must not k when flattened so that their outer faces are not more than six times wall thickness apart when made of steel or not more than 10 times wall thickness apart when made of aluminum.

(b) If any cylinder or ring cracks when subjected to the specified flattening test, the lot of cylinders represented by the test must be rejected.

§ 178.65–13 Rejected cylinders.

(a) If the cause for rejection of a lot is determinable, and if by test or inspection defective cylinders are eliminated from the lot, the remaining cylinders must be qualified as a new lot under §§ 178.65–11 and 178.65–12.

(b) Repairs to welds are permitted. Following repair, a cylinder must pass the pressure test specified in paragraph (a) of § 178.65–11.

§ 178.65–14 Marking.

(a) The markings required by this section must be durable and waterproof. The requirements of § 173.24(c)(1) (ii) and (iv) of this chapter do not apply to this section.

(b) Required markings are as follows:

(1) DOT–39.
(2) NRC.
(3) The service pressure.
(4) The test pressure.
(5) The registration number (M****) of the manufacturer.
(6) The lot number.
(7) The date of manufacture if the t number does not establish the date manufacture.
8) The following statement:

Federal Law Forbids Transportation if Refilled—Penalty up to $10,000 Fine and 10 Years Imprisonment (18 U.S.C. 831–835).

(c) The markings required by paragraph (b) (1) through (5) of this section must be in numbers and letters at least ⅛-inch high and displayed sequentially. For example:

DOT-39 NRC 250/500 M1001

(d) No person may mark any cylinder with the specification identification "DOT–39" unless (1) it was manufactured in compliance with the requirements of this section and (2) its manufacturer has a registration number (M****) from the Office of Hazardous Materials, Department of Transportation, Washington, D.C. 20590.

§ 178.65–15 Inspector's report.

(a) The inspector's report must be retained by the manufacturer for a period of 3 years and must be available for examination by representatives of the Department.

(b) The report must be legible, and contain at least the following information:

INSPECTION REPORT COVERING THE MANUFACTURE OF SPECIFICATION DOT-39 CYLINDERS OR SPHERES

The cylinders (spheres) covered by this report were manufactured for _____ _____ located at _____ They were manufactured by _____ located at _____ whose Department of Transportation registration number is M_____. The cylinders are _____ inches in diameter (OD) and _____ inches in length. They have a design test pressure of _____ p.s.i.g. and a marked service pressure of _____ p.s.i.g. Each has an internal volume of _____ cubic inches (nominal).

These containers were made by process of _____.

The metal used was identified by heat or analysis numbers as shown on the "Record of Chemical Analysis of Metal" attached hereto.

The metal used was verified as to chemical analysis and record thereof is attached hereto.

All material and each cylinder was inspected. All accepted material was found free from seams, cracks, laminations, and other defects which might prove injurious to the strength of the cylinder. The processes of manufacture and heat treatment (if any) were observed and found satisfactory.

My record of tests and inspections for each lot covered by this report is as follows:

Lot No.	Lot quantity	Lot tests		All cylinders	
		Burst-pressure*	Flattening test**	Pressure tests**	Visual inspection**

*Enter the lowest actual failure pressure of all cylinders tested within the lot.
**Enter "Pass" or "Fail".

_____ _____
(Inspector's name (print)) (Inspector's signature)

_____ _____
(Date) (Inspector's employer (Company name))

§ 178.66 [Canceled]

(D) Section 178.66 would be canceled.

§ 178.67 [Canceled]

(E) Section 178.67 would be canceled.

This proposal is made under the authority of sections 831–835 of title 18, United States Code, section 9 of the Department of Transportation Act (49 U.S.C. 1657), and title VI and section 902 (h) of the Federal Aviation Act of 1958 (49 U.S.C. 1421–1430 and 1472(h)).

Issued in Washington, D.C., on December 4, 1970.

W. M. BENKERT,
Captain, U.S. Coast Guard, By direction of the Commandant, U.S. Coast Guard.

CARL V. LYON,
Acting Administrator, Federal Railroad Administration.

ROBERT A. KAYE,
Director, Bureau of Motor Carrier Safety, Federal Highway Administration.

SAM SCHNEIDER,
Board Member, For the Federal Aviation Administration.

[F.R. Doc. 70–16541; Filed, Dec. 10, 1970; 8:45 a.m.]