amended by Pub. L. 91-469 (84 Stat. 1036); Pub. L. 97-31 (Aug. 6, 1981); 49 CFR 1.66 (46 FR 47456, Sept. 28, 1981).

(Catalog of Federal Domestic Assistance Program No. 11-507 U.S. Merchant Marine Academy (Kings Point)).

Dated: December 16, 1931.

By Order of the Maritime Administrator, Maritime Administration.

Robert J. Patton, Jr.,

Secretary.

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Research and Special Programs Administration

49 CFR Parts 171, 173 and 178

[Docket No. HM-176; Amdt. Nos. 171-63, 173-52, 178-69]

Specification and Usage Requirements for 3AL Seamless, Aluminum Cylinders

AGENCY: Materials Transportation Bureau (MTB), Research and Special Programs Administration, DOT.

ACTION: Final rule.

SUMMARY: This final rule amends the Hazardous Materials Regulations by establishing a specification requirement for seamless aluminum cylinders made of definitely prescribed alloys. These new cylinders are designated DOT Specification 3AL. Included in the final rule are requirements governing the use of these cylinders for shipment of certain hazardous materials. Because this final rule eliminates the need for 7 exemptions authorizing the use of over 3 million existing cylinders, these exemptions are terminated on the effective date of the final rule.

EFFECTIVE DATE: July 2, 1982.

FOR FURTHER INFORMATION CONTACT: Arthur Mallen, Chief, Technology Division, Office of Hazardous Materials Regulation, Materials Transportation Bureau, U.S. Department of Transportation, 400 7th St. S.W., Washington, D.C. 20590 (202-755-4906).

SUPPLEMENTARY INFORMATION: On August 14, 1980, the MTB published a notice of proposed rulemaking (NPRM) (Docket HM-176; Notice 80-7; 45 FR 54907) which proposed to establish a new seamless aluminum cylinder specification and authorize the use of this cylinder for certain hazardous materials. The NPRM was based in part on the Compressed Gas Association's (CGA) petition dated November 3, 1975, and Airco Industrial Gases (AIG) petition dated April 2, 1979, to add a new high pressure aluminum cylinder specification to Part 178. Comment was invited in that notice with a closing date of November 1, 1980. Based on the comments received and the MTB's evaluation thereof, the proposals in the NPRM with certain revisions are being incorporated as amendments to the Hazardous Materials Regulations.

It is the MTB's intention that existing seamless aluminum cylinders, authorized for use under exemptions, be covered under this rule, thereby eliminating the need for aluminum cylinder exemptions. Accordingly, a new paragraph (c) has been added to § 173.23 to cover cylinders previously authorized under exemptions.

The following is a section by section summary of the comments received on various parts of the notice.

Part 171

Section 171.7

One commenter suggested that the correct ASTM Tension testing method for aluminum is "ASTM B 557," rather than the proposed "ASTM E-8" which is for steel products. MTB agrees and has changed the new paragraph (d)(5)(x) to reference the correct method.

Part 173

One commenter endorsed the NPRM proposal to prohibit the use of 3AL cylinders for poisonous A materials and strong oxidizers. This commenter stated that since aluminum starts degrading at temperatures above 450°F the prohibition was appropriate in the absence of extensive (fire) tests to verify safety. Other commenters posed the opposite view by submitting a list of hazardous materials that are compatible with aluminum. They claim that the restrictions of 49 CFR 173.21 and 173.24 provide adequate safeguards for shipping these hazardous materials. Based on these latter commenters, MTB has reversed its NPRM position and has amended appropriate paragraphs in §§ 173.328, 173.332, 173.336, 173.337 and 173.351 to authorize the use of 3AL cylinders for Poison A materials and strong oxidizers previously authorized for shipment under exemptions.

Section 173.34

One commenter agreed that the 5 year retest is appropriate. Two commenters, on the other hand, claimed that the 5 year retest is discriminatory, and suggested that a 10 year retest is proper since existing regulations allow a 10 year retest for 3A and 3AA steel cylinders and a 12 year retest for 4E aluminum cylinders. Rejection rate for cylinders inspected in 1979 was presented as a basis for concluding that aluminum cylinders are as good as steel cylinders. Notwithstanding these comments, a 5 year retest will be required based on the following:

1. The 10 year retest for 3A and 3AA cylinders is based on extensive experience. The behavior of 3AL cylinders to high pressure cycling with various hazardous materials is not known.

2. No data comparable to the rejection elastic expansion (which is part of the basis for the extension of the retest interval for 3A or 3AA cylinders) was presented for aluminum cylinders.

3. Aluminum, while being resistant to corrosion by some hazardous materials, is very susceptible to damage by other hazardous materials.

4. The comparison of the 3AL to the 4E is not valid with respect to service pressure, burst, or condition of material. The 4E cylinder has a 4:1 burst to service pressure ratio and a limited [500 psi, max.] service pressure; the 3AL has an unlimited service pressure and a 2.5:1 burst to service pressure ratio. Further, the 4E cylinder derives its mechanical properties from cold work while the 3AL cylinder derives its mechanical properties from heat treatment.

In Subparts D and E, §§ 173.119(m)(9), 173.126, 173.134(a)(1), 173.135(a)(8), 173.136(a)(5), 173.137(a)(3), 173.138, 173.141(a)(9), 173.245(a)(28), 173.251(a)(1), and 173.280(a)(6) are amended to prohibit the use of aluminum cylinders for these flammable liquids and corrosive materials. Section 173.121 is amended to authorize shipment of carbon bisulfide in aluminum cylinders. These amendments are based on the compatibility data submitted by several commenters.

Section 173.301

Several commenters suggested that manifolding for 3AL cylinders containing certain gases should be allowed, pointing out that the exemptions allowed manifolding. MTB agrees. Paragraphs (d)(2) and (d)(3) are revised to allow manifolding of aluminum cylinders. However, cylinders containing nitrogen trifluoride and boron trichloride are prohibited from manifolding based on the incompatibility of these gases with aluminum.

Section 173.302(a)

Based on several comments received, paragraph (a)(4)(ii) is revised to allow the use of stainless steel valves; paragraph (a)(4)(iii) is revised to redefine lot size and permit any cleaning agent equivalent to those specified in the Specification that are not capable of reacting with oxygen. A paragraph (a)(5) is added to authorize the following:

1. Permit continued shipment of nonflammable gases which have previously been shipped;

2. Permit stainless steel valves for aluminum cylinders for oxygen service; and

3. Permit the use of equivalent but non-reacting cleaning agents to meet the requirements of RR-C-901(b) standard.

Because there was not sufficient justification presented, the ban on the use of tapered threads on aluminum cylinders used in oxygen service is retained.

Section 173.302(f)

Several commenters opposed the filling limitations imposed on the 3AL cylinder containing carbon monoxide. However, since no supporting data was presented, the filling limitation is retained.

Section 173.304

Good cause was shown to the MTB by commenter who suggested that the final amendments to paragraph (a)(2) should appropriately include all liquefied compressed gases that have been shipped to date in aluminum cylinders, especially two such gases, nitrous oxide and vinyl fluoride. The MTB concurs, and amends paragraph (a)(2) to include these two gases. Since nitrous oxide has similar oxidizing properties as oxygen, a new paragraph (a)(4) is added requiring cylinders used in nitrous oxide service be subjected to the same cleanliness requirements as oxygen cylinders. In addition, a new paragraph (a)(3) has been added to enumerate certain n.o.s. gases (subject to § 173.301(f)) which are not listed in § 172.101 that may be shipped in aluminum cylinders based on past experience gained through exemptions.

Section 173.351

The MTB on its own initiative is amending § 173.351 to authorize the shipment of hydrocyanic acid solutions not over 5 percent concentration in containers authorized for hydrocyanic solutions over 5 percent concentration.

Part 178

Section 178.46-4

Several commenters were opposed to the proposed language regarding inspector performance of chemical analysis, wall thickness measurement and reporting of volumetric capacity and tare weight. Based on the comments received, final § 178.46-4 allows the inspector to verify compliance with the chemical analyses and wall thickness requirement by performing, or witnessing the performance of the chemical analysis or the wall thickness measurement.

The duties of "reporting volumetric capacity and tare weight" and "verifying that design qualification tests have been performed prior to initial manufacture of a new design or a design change" have been added to § 178.46-4, the former upon the request of one commenter, the latter to provide verification of compliance with § 178.46-6(f) and (g).

Section 178.46-5

Paragraph (a) begins by providing that starting stock must be cast stock, or must be traceable to scalped cast stock. Several commenters raised objections to the proposed requirements for the following reasons:

(1) Extruded and forged stocks are equal to or better than cast stock;

(2) This requirement would inhibit significant cost reductions using state of art technological innovations;

(3) The hot extrusion process is a self scalping method for producing defect-free rod;

(4) Cast stock is not available in sizes under 4 inches in diameter;

(5) Use of extruded stock would be prohibited but the use of wrought stock would be permitted;

(6) Traditional aluminum industry practice accepts certification as a means of meeting the alloy chemistry limits without specific chemical analysis or traceability to starting stock;

(7) Cylinders of acceptable quality have been produced using unscalped cast stock under DOT-E 7042; and

(8) Use of grain size not exceeding 250 microns is too severe and not warranted since it is possible to control grain size growth during manufacture. Furthermore, supply of such material is limited to a few sophisticated aluminum producers.

Notwithstanding the above objections, the requirements in § 178.46-5(a) of the NPRM will be adopted in the final rule based on the following rationale.

(1) The statement that the hot extrusion process produces a defect free rod is valid only when producing rods. When producing cylinders by the backward extrusion process, the "oxide skin" is retained in the cylinder and would contribute to the weakening of the cylinder.

(2) For the purpose of manufacturing cylinders, it is questionable as to whether extruded stock and forged stock are comparable to cast stock. A commenters' rationale for the wide use of extruded and forged stock in critical aircraft usage is not a valid comparison, as aircraft structural components are of limited life and subject to frequent inspection; DOT 3AL cylinders have an unlimited life and a 5 year retest and reinspection schedule. Such critical aircraft components are not used in the "as forged" or "as extruded" condition. They are extensively machined prior to use.

(3) Material with specific certified chemistry and with proper grain size (not over 250 microns average) is available.

(4) The exemption process is available to accommodate validated "state of the art" improvements, as well as certain practices deemed appropriate.

Based on the comments received regarding the proposed elongation requirements, § 178.46-5(d) provides in Note 4, a less severe criteria for specimens taken from thin walled cylinders (3/16 inch or less wall thickness) and authorizes a retest without reheat treatment using a round 4D bar if the test method using the flat specimen fails. Also, § 178.46-5(e) allows ultrasonic inspection to be done either before or after parting, although, the added inspection after parting would necessitate more inspections due to the larger number of smaller pieces to inspect.

Section 178.46-6

Commenters were in general agreement that the MTB should lower its proposed design qualification cycle test requirement in paragraph (6)(f). The MTB concurs, in part, and the final rule will provide a reduced design qualification cycle test of at least 10,000 cycles (from 0 to test pressure). The proposed alternate 100,000 cycles (from 0 to service pressure) requirement is retained in the final rule since this cycling requirement was required for the design qualification of all the exemption cylinders and also is in the original proposal for rulemaking. A maximum rate of pressurization of 200 psi per second has been added to final paragraph (6)(f)(2) to assure that test cylinders experience the full pressurization effects as well as to provide uniform pressurization rates. This rate is based on a consensus of opinion expressed by certain cylinder manufacturers.

One commenter questioned the necessity of specifying in paragraph 6(d) a minimum base thickness for free standing cylinders, suggesting that this parameter applied only to cylinders with spun bottoms. The MTB disagrees. The two times the sidewall thickness applies to all types of free standing cylinders to provide wear allowance. This thickness should not be mistaken for the bottom thickness which is provided in paragraph 6(c) of this section.

One commenter questioned the knuckle radius specified in § 178.46–6(c) because he felt that the requirement of the qualification cycle test would eliminate any poorly designed cylinder. MTB disagrees. The cycle test is a general test and its test results would not show specific deficiencies in the design. Data furnished to the MTB during the exemption phase of this matter indicates the validity of the specified knuckle radius.

One commenter suggested that the service pressure parameter is too loose and suggested that any change in service pressure is a significant change. The commenter also suggested that a 30 percent change in bottom thickness be considered a design change. The MTB only agrees with the latter. The MTB believes that any service pressure change is too restrictive. Based on data obtained from other manufacturers, it is believed that a 10 percent change in service pressure is appropriate. The MTB also adds any increase in quantity or size of openings as a significant change since this affects the safety of cylinders appreciably.

Section 178.46–7

Two conflicting comments were received regarding the minimum wall thickness requirement for a cylinder with a diameter of 5 inches or more. The first commenter supplied data which suggested a 0.085 inch minimum wall thickness requirement, showing calculations which indicate that this thickness would give a maximum wall stress below the required calculated stress for a 5 inch diameter cylinder. Because the thickness is much thinner than that required of a 3A or 3AA cylinder which has a greater puncture resistance than the 3AL cylinder, it was not adopted in the final rule. The second commenter supplied data which suggested a 0.170 inch minimum wall thickness to provide more thickness to prevent catastrophic failure if a low pressure cylinder were accidentally filled to 1800 psi. MTB considers this proposal too severe. Consequently, the proposed minimum thickness requirement in the NPRM is adopted in the final rule.

Several commenters also requested that paragraph 7(a) of this section be revised to allow the use of the measured physical properties of the aluminum for establishing the minimum thickness required. Because MTB intends and believes that the wording in the NPRM allows the use of measured values, it has been incorporated in the final rule.

Section 178.46–11

Several commenters objected to the rejection and maximum test pressure criteria (last 2 sentences of paragraph (b)) of the NPRM as severely restrictive. Alternative criteria were proposed including (1) a specific test procedure, (2) proposal to limit the number of pressurizations corresponding to a stress that does not exceed yield strength, and (3) permit unlimited pressurizations since the cylinder is known to withstand 10,000 test pressure cycles. The first proposed alternative was not accepted as it prohibits other procedures that may work; furthermore the proposed procedure is covered by the proposed NPRM wording. The second proposed alternative was also rejected as the yield strength is not available to the retester who also uses this test procedure. The third proposal was not accepted since every successive retest requires a test pressure increased by 100 psi (or 10 percent of test pressure whichever is less). The cycle test uses the minimum pressure. The need of retests due to defect in apparatus or procedure can be minimized by knowledge of the test procedure and equipment and exercising care when testing. The wording used in the final rule is the same as that proposed in the NPRM, as some control must be exercised over the number of retests (and corresponding reheat treatments) permitted because of the unique properties of aluminum.

Section 178.46–12

Several commenters objected to the proposed 9t flattening test criteria of paragraph (c) as being too severe and proposed, as an alternative, the 10t criteria proposed in the CGA petition. The MTB felt that the 10t test criteria would not be severe enough to verify transverse ductility and so proposed in the exemptions the 9t criteria. Test data gathered under the exemptions show that the 9t criteria is readily attainable. In this section, several commenters proposed interchangeability of either the flattening test or the bend test, as they both measure ductility. The MTB agrees. The MTB, on its own, is allowing the use of alternate bend test to also qualify lots that fail the flattening test without reheat treatment.

Section 178.46–13

Several commenters proposed that the proper reference for mechanical testing is ASTM B 557–79, since the metal is aluminum not steel. MTB agrees. The final rule will reference ASTM B 557–79 instead of E 8–79. This action will also take care of the request to define the use of the 4D bar.

Section 178.46–15

The final rule corrects the omission of the marking example in paragraph (a)(2), by adding the symbol "XY" which was inadvertently omitted in the NPRM.

Section 178.46–16

A commenter suggested that the inspector's report form, relative to the reporting of wall thickness, be changed in the final rule to allow the acceptance of go-nogo gauge measurements. The MTB concurs. The final rule provides this. The final rule also corrects the proposed inspector's report form by—

1. Adding "Company" after lines 6 and 8.

2. Deleting as unnecessary, from the third paragraph of the report form the last two entries relating to maximum wall stress and internal pressure.

The Materials Transportation Bureau has determined that this regulation is not a major rule under the terms of Executive Order 12291 and DOT implementing procedures (44 FR 11034) and does not require a Regulatory Impact analysis, nor does it require an environmental impact statement under the National Environmental Policy Act (49 U.S.C. 4321 et. seq). A regulatory evaluation and environmental assessment is available for review in the Docket. I certify that this amendment will not, as promulgated, have a significant economic impact on a substantial number of small entities. Additionally, this amendment will not affect not-for-profit enterprises, or small governmental jurisdictions. For a number of years there were seven exemptions issued to cylinder manufacturers for authorization to manufacture seamless aluminium cylinders. This number of cylinder manufacturers has not increased and the publication of the final rule covering aluminum cylinders is not expected to proliferate the present number of seven manufacturers, therefore, Office of Management and Budget requirements relating to information collection and recordkeeping are not applicable.

In consideration of the foregoing, Parts 171, 173, and 178 of Title 49 Code of Federal Regulations are amended as set forth below.

PART 171—GENERAL INFORMATION, REGULATIONS AND DEFINITIONS

1. In § 171.7, paragraphs (d)(5)(x), (xi), (xii) and (d)(25) are added; and paragraph (d)(19) is revised to read as follows:

§ 171.7 Matter incorporated by reference.

* * * * *

(d) * * *

(5) * * *

(x) ASTM B 557–79 is titled "Tension Testing Wrought and Cast Aluminum and Magnesium—Alloy Products" 1979 Edition.

(xi) ASTM B–221–76 is titled "Standard Specification for Aluminum Alloy Extruded Bars, Rods, Shapes and Tubes," 1976 Edition.

(xii) ASTM E 290–77 is titled "Semi-Guided Bend Test for Ductility of Metallic Materials," 1977 edition.

* * * * *

(19) Federal Specification RR–C–901b is titled "Federal Specification, Cylinders, Compressed Gas: With Valve or Plug and Cap; ICC 3AA RR–C901b, August 1, 1967."

* * * * *

(25) Aluminum Associations' Handbook is titled "Aluminum Standards and Data," Sixth Edition, 1979.

* * * * *

PART 173—SHIPPERS—GENERAL REQUIREMENTS FOR SHIPMENTS AND PACKAGINGS

2. In § 173.23, paragraph (c) is added to read as follows:

§ 173.23 Previously authorized packaging.

* * * * *

(c) Seamless aluminum cylinders manufactured for use under DOT E 6498, E 6576, E 6688, E 7042, E 7446, E 8384, and E 8422 may be continued in use, and must be remarked in compliance with Specification 3 AL (§ 178.46 of this subchapter) before or at the time of the first retest following July 2, 1982. The required marking must appear immediately after the exemption mark which may be retained or obliterated by peening.

3. In § 173.34, the Table in paragraph (e) is amended by adding an entry "3 AL" immediately following the entry "3A, 3AA"; and paragraphs (e)(4) and (f)(4) are revised to read as follows:

§ 173.34 Qualification, maintenance and use of cylinders.

* * * * *

(e) * * *

Specification under which cylinder was made	Minimum retest pressure (p.s.i.)	Retest period (years)
* * * * *		
3AL	⅝ times service pressure	5
* * * * *		

* * * * *

(4) A cylinder must be condemned when it leaks, or when internal or external corrosion, denting, bulging, or evidence of rough usage exists to the extent that the cylinder is likely to be weakened appreciably, or when the permanent expansion exceeds 10 percent of the total expansion, except that for DOT 4E aluminum cylinders, when the permanent expansion exceeds 12 percent of the total expansion. Except for DOT 3AL and DOT 4E aluminum cylinders, a cylinder condemned for excessive permanent expansion may be reheat-treated. (See paragraph (g) of this section.) DOT 4 series cylinders, condemned for other than excessive permanent expansion, may be repaired and rebuilt as otherwise provided in this section.

* * * * *

(f) * * *

(4) DOT 3AL and DOT 4E aluminum cylinders may not be reheat treated and must be removed from service.

* * * * *

4. In § 173.119, paragraph (m)(9) is revised to read as follows:

§ 173.119 Flammable liquids not specifically provided for.

* * * * *

(m) * * *

(9) Specification steel or nickel cylinders as prescribed for any compressed gas except acetylene. All cylinder valves must be protected by one of the methods described in § 173.301(g) (1), (2), or (3) of this part. See § 173.34(e)(16).

* * * * *

5. In § 173.121, a new paragraph (a)(7) is added to read as follows:

§ 173.121 Carbon bisulfide (disulfide).

(a) * * *

(7) Specification cylinders as prescribed for any compressed gas except acetylene.

6. Section 173.126 is revised to read as follows:

§ 173.126 Nickel carbonyl.

Nickel carbonyl must be packed in specification steel or nickel cylinders as prescribed for any compressed gas except acetylene. A cylinder used exclusively for nickel carbonyl may be given a complete external visual inspection in lieu of the interior hydrostatic pressure test required by § 173.34(e) of this part. Visual inspection must be in accordance with CGA Pamphlet C–6. All cylinder valves must be protected by one of the methods described in § 173.301(g) (1), (2) or (3) of this part.

7. In § 173.134, the introduction to paragraph (a)(1) is revised to read as follows:

§ 173.134 Pyroforic liquids, n.o.s.

(a) * * *

(1) Specification steel or nickel cylinders prescribed for any compressed gas except acetylene having a minimum design pressure of 175 pounds per square inch are authorized. Cylinders with valves must be:

* * * * *

8. In § 173.135, paragraph (a)(6) is revised to read as follows:

§ 173.135 Diethyl dichlorosilane, dimethyl dichlorosilane, ethyl dichlorosilane, ethyl trichlorosilane, methyl trichlorosilane, trimethyl chlorosilane, and vinyl trichlorosilane.

(a) * * *

(6) Specification steel or nickel cylinders as prescribed for any compressed gas except acetylene.

* * * * *

9. In § 173.136, paragraph (a)(5) is revised to read as follows:

§ 173.136 Methyl dichlorosilance and trichlorosilane.

(a) * * *

(5) Specification steel or nickel cylinders as prescribed for any compressed gas except acetylene.

* * * * *

10. In § 173.137, paragraph (a)(3) is revised to read as follows:

§ 173.137 Lithium aluminum hydride, ethereal.

(a) * * *

(3) Specification steel or nickel cylinders as prescribed for any compressed gas except acetylene. Valves or fittings must be protected from injury by a metal cap or equally efficient device securely attached to the cylinder.

11. Section 173.138 is revised to read as follows:

§ 173.138 Pentaborane.

Specification steel or nickel cylinders prescribed for any compressed gas except acetylene are authorized. Each cylinder must be protected with a valve protection cap or must be packed in a strong wooden box and blocked therein so as to protect the valve from injury under conditions normally incident to transportation. Cylinders not exceeding 2 inches in diameter nor 6 inches in length, excluding the length of the valve, may also be packed in strong solid fiberboard boxes, having no outside dimension less than 4 inches, completely filled with layers of strong corrugated

fiberboard, the center of which shall be cut out to fit the cylinder valve, and otherwise so designed that neither the cylinder nor the valve will be in contact with the wall of the box under conditions normally incident to transportation.

12. In § 173.141, paragraph (a)(9) is revised to read as follows:

§ 173.141 Amyl mercaptan, butyl mercaptan, ethyl mercaptan, isopropyl mercaptan, propyl mercaptan, and aliphatic mercaptan mixtures.

(a) * * *

(9) Specification steel or nickel cylinders as prescribed for any compressed gas except acetylene.

* * * * *

13. In § 173.245, paragraph (a)(28) is revised to read as follows:

§ 173.245 Corrosive liquids not specifically provided for.

(a) * * *

(28) Specification steel or nickel cylinders prescribed for any compressed gas except acetylene are authorized. All cylinder valves must be protected by one of the methods described in § 173.301(g) (1), (2), or (3) of this part. See § 173.34(e)(16).

* * * * *

14. In § 173.251, paragraph (a)(1) is revised to read as follows:

§ 173.251 Boron trichloride and boron tribromide.

(a) * * *

(1) Specification steel or nickel cylinders as prescribed for any compressed gas except acetylene.

* * * * *

15. In § 173.280, paragraph (a)(6) is revised to read as follows:

§ 173.280 Trichlorosilanes.

(a) * * *

(6) Specification steel or nickel cylinders as prescribed for any compressed gas except acetylene.

* * * * *

16. In § 173.301, paragraphs (d)(2) and (3) are revised; the table in paragraph (h) is amended by revising the heading and by adding the entry "3AL" immediately following the entry "DOT 3A," as follows:

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

* * * * *

(d) * * *

(2) Manifolding is authorized for specification cylinders containing the following nonliquefied gases: boron trifluoride, carbon monoxide, ethylene, hydrogen, hydrocarbon gases, methane, and nitrogen trifluoride, except that aluminum cylinders are not authorized for boron trifluoride or nitrogen trifluoride service; provided individual cylinders are equipped with approved pressure relief devices as required by § 173.34(d) or § 173.315(i) of this part: *and provided further,* that each cylinder is equipped with an individual shutoff valve that must be tightly closed while in transit. Manifold branch lines of these individual shutoff valves must be sufficiently flexible to prevent injury to the valves which otherwise might result from the use of rigid branch lines. A temperature measuring device may be inserted in one cylinder of a manifold installation in place of the shutoff valve.

(3) Manifolding is authorized for specification cylinders containing the following gases: ethane, ethylene, hydrogen chloride, liquefied hydrocarbon gas, liquefied petroleum gas and propylene, except that aluminum cylinders are not authorized for hydrogen chloride and liquefied hydrocarbon gas service, provided each cylinder is equipped with approved pressure relief devices as required by § 173.34(d) or § 173.315(i) of this part: *and provided further,* that each cylinder is equipped with an individual shutoff valve that must be tightly closed while in transit. Each cylinder must be separately charged and means must be provided to insure that no interchange of cylinder contents can occur during transportation. Manifold branch lines to these individual shutoff valves must be sufficiently flexible to prevent injury to the valves which otherwise might result from the use of rigid branch lines.

* * * * *

(h) * * *

PACKAGINGS	
DOT 3AL	

* * * * *

17. In § 173.302, a new paragraph (a)(5) is added; and paragraphs (a)(4)(ii), (iii), and (f) are revised to read as follows:

§ 173.302 Charging of cylinders with nonliquefied compressed gases.

(a) * * *

(4) * * *

(ii) Cylinder must be equipped only with brass or stainless steel valve; and

(iii) Each cylinder must be cleaned in compliance with the requirements of Federal Specification RR-C-901b, dated August 1, 1967, paragraphs 3.7.2 and 3.8.2. Cleaning agents equivalent to those specified in RR-C-901b, may be used; however any cleaning agent must not be capable of reacting with oxygen. One cylinder selected at random from a group of 200 or less cleaned at the same time, must be tested for oil contamination in accordance with specification RR-C-901b paragraph 4.4.2.3 and meet the standard of cleanliness specified.

(5) Specification 3AL (§ 178.46 of this subchapter) cylinders are authorized only for the following nonliquefied gases: air, argon, carbon monoxide, diborane, ethylene, helium, mercury free hydrogen, krypton, methane, nitrogen, neon, oxygen and xenon. When used in oxygen service, aluminum cylinders must be in compliance with the following conditions:

(i) Cylinder must be equipped only with brass or stainless steel valve;

(ii) Cylinder must have only straight threads in the opening;

(iii) Each cylinder must be cleaned in compliance with the requirements of Federal Specification RR-C-901b, dated August 1, 1967, paragraphs 3.7.2, and 3.8.2. Cleaning agents equivalent to those specified in RR-C-901b may be used; however, any cleaning agent must not be capable of reacting with oxygen. One cylinder selected at random from a group of 200 or less, cleaned at the same time, must be tested for oil contamination in accordance with Specification RR-C-901b, paragraph 4.4.2.3, and meet the standard of cleanliness specified; and

(iv) Cylinder must have a marked service pressure not exceeding 3000 psi.

* * * * *

(f) *Carbon monoxide.* Carbon monoxide must be shipped in a specification 3A, 3AX, 3AA, 3AAX, 3AL, 3, 3E, or 3T, (§§ 178.36, 178.37, 178.46, 178.42, 178.45 of this subchapter) cylinder having a minimum service pressure of 1,800 psig. The pressure in the cylinder must not exceed 1000 psig at 70° F. except that if the gas is dry and sulfur free, the cylinder may be charged to five-sixths of the cylinder service pressure or 2000 psig, whichever is the lesser.

* * * * *

18. In § 173.304, the table in paragraph (a)(2) is amended by adding DOT 3AL cylinders with various service pressures for certain hazardous materials, and by adding footnote 11; paragraphs (a)(3) and (a)(4) are added; and paragraph (d)(3)(i) is revised to read as follows:

§ 173.304 Charging of cylinders with liquefied compressed gas.

(a) * * *

(2) * * *

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).
	Percent	
Anhydrous ammonia	54	DOT-4; DOT-3A480; DOT-3AA480; DOT-3AX[illegible]; DOT-4A480; DOT-3; DOT-4AA480; DOT-3E1800; DOT-3AL480.
Bromotrifluoromethane (R-13B1 or 1301).	124	DOT-3A400; DOT-3AA400; DOT-3B400; DOT-4A400; DOT-4AA480; DOT-4B400; DOT-4BW400; DOT-3E1600; DOT-39; DOT-3AL400.
Carbon dioxide, liquefied (see Notes 4, 7, and 8).	68	DOT-3A1800; DOT-3AX1800; DOT-3AA1800; DOT-3AAX1800; DOT-3; DOT-3E1800; DOT-3T1800; DOT-3HT2000; DOT-39; DOT-3AL1800.
Carbon dioxide, nitrous oxide mixture (see Notes 7, and 8).	68	DOT-3A1800; DOT-3AX1800; DOT-3AA1800; DOT-3AAX1800; DOT-3; DOT-3E1800; DOT-3T1800; DOT-3HT2000; DOT-39; DOT-3AL1800.
Chlorodifluoroethane (R-142b) or 1-chloro-1, 1-difluoroethane (see Note 8).	100	DOT-3A150; DOT-3AA150; DOT-3B150; DOT-4B150; DOT-4BA225; DOT-4BW225; DOT-3E1[illegible]; DOT-39; DOT-3AL150.
Chlorodifluoromethane (R-22) (See Note 8).		DOT-3A240; DOT-3AA240; DOT-3B240; DOT-4B240; DOT-4BA240; DOT-4BW240; DOT-4B240ET; DOT-4E240; DOT-39; DOT-41; DOT-3E1800; DOT-3ALA240.
Chloropentafluoroethane (R-115) (see Note 8).		DOT-3A225; DOT-3AA225; DOT-3B225; DOT-4A225; DOT-3AA225; DOT-3B225; DOT-4BW225; DOT-3E1800; DOT-39; DOT-3AL225.
Chlorotrifluoromethane (R-13) (see Note 8).		DOT-3A1800; DOT-3AA1800; DOT-3; DOT-3E1800; DOT-39; DOT-3AL1800.
Cyclopropane (see Notes 8 and 9)	55	DOT-3A225; DOT-3A480X; DOT-3AA225; DOT-3B225; DOT-4A225; DOT-4AA480; DOT-4B225; DOT-4BA225; DOT-4BB225; DOT-4B240ET; DOT-3; DOT-3E1800; DOT-39; DOT-3AL225.
Dichlorodifluoromethane (R-12) (see Note 8).		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; DOT-3AL225.
Difluoroethane (R-152a) (see Note 8)	79	DOT-3A150; DOT-3AA150; DOT-3B150; DOT-4B150; DOT-4BA225; DOT-4BW225; DOT-3E1800; DOT-3AL150.
Ethane (see Notes 8 and 9)	35.8	DOT-3A1800; DOT-3AX1800; DOT-3AA1800; DOT-3AAX1800; DOT-3; DOT-3E1800; DOT-3T1800; DOT-39; DOT-3AL1800.
Ethane (see Notes 8 and 9)	36.8	DOT-3A2000; DOT-3AX2000; DOT-3AA2000; DOT-3AAX2000; DOT-3T2000; DOT-39; DOT-3AL2000.
Ethylene (see Notes 8 and 9)	36.8	DOT-3A200; DOT-3AX2000; DOT-3AA2000; DOT-3AAX1800; DOT-3; DOT-3E1600; DOT-3T1600; DOT-39; DOT-3AL1800.
Ethylene (see Notes 8 and 9)	32.5	DOT-3A2000; DOT-3AX2000; DOT-3AA2000; DOT-3AAX2000; DOT-3T2000; DOT-39; DOT-3AL2000.
Ethylene (see Notes 8 and 9)	35.5	DOT-3A2400; DOT-3AX2400; DOT-3AA2400; DOT-3AAX2400; DOT-3T2400; DOT-39; DOT-3AL2400.
Hydrogen sulfide (see Note 10)	62.5	DOT-3A480; DOT-3AA480; DOT-3B480; DOT-4A480; DOT-4B480; DOT-4BA480; DOT-4BW480; DOT-26-480; DOT-3E1600; DOT-3AL480.
Methylacetylene-propadiene, stabilized (see Note 5).	Not liquid full at 130° F	DOT-4B240 without brazed seams; DOT-4BA240 without brazed seams; DOT-3A240; DOT-3AA240; DOT-3B240; DOT-3E1800; DOT-4BW240; DOT-4E240; DOT-4B240ET; DOT-4; DOT-41; DOT-3AL240
Nitrous oxide (see Notes 7, 8, and 11)	68	DOT-3A1800; DOT-3AX1800; DOT-3AA1800; DOT-3AAX1800; DOT-3; DOT-3E1800; DOT-3T1800; DOT-3HT2000; DOT-39; DOT-3AL1800.
Refrigerant gas, n.o.s. or Dispersant gas, n.o.s.(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-4E240; DOT-9; DOT-39; DOT-3AL240.
Sulfur dioxide (see Note 8)	125	DOT-3A225; DOT-3AA225; DOT-3B225; DOT-4A225; DOT-4B225; DOT-4BA225; DOT-4B240ET; DOT-3; DOT-4; DOT-25; DOT-26-150; DOT-39; DOT-33; DOT-3EL800; DOT-3AL225.
Sulfur hexafluoride	120	DOT-3A1000; DOT-3AA1000; DOT-3; DOT-3E1800; DOT-3AL1000.
Vinyl chloride (see Note 5)	64	DOT-4B150 without brazed seams; DOT-4BA225 without brazed seams; DOT-4BW225; DOT-3A150; DOT-3AA150; DOT-25; DOT-3E1800; DOT-3AL150.
Vinyl fluoride, inhibited	62	DOT-3A1800; DOT-3AA1800; DOT-3E1800; DOT-3AL1800.

NOTE 11: See § 173.304(a)(4).

(3) Specification 3AL (§ 178.46 of this subchapter) cylinders are authorized also for the following liquefied gases: cyclobutane, hydrogen selenide, propylene, silane, bromochlorodifluoromethane, vinyl bromide, and dimethyl ether.

(4) Specification DOT 3AL (§ 178.46 of this subchapter) cylinders when used in nitrous oxide service must be in compliance with out following conditions:

(i) Cylinder must be equipped only with brass or stainless steel valve; and

(ii) Each cylinder must be cleaned in compliance with the requirements of Federal Specification RR-C-901b paragraphs 3.7.2 and 3.8.2. Cleaning agents equivalent to those specified in RR-C-901b may be used; however, any cleaning agent must not be capable of reacting with oxygen. One cylinder selected at random from a group of 200 or less cleaned at the same time must be tested for oil contamination in accordance with Specification RR-C-901b paragraph 4.4.2.3 and meet the standard of cleanliness specified.

* * * * *

(d) * * *

(3) * * *

(i) Specification 3,[1] 3A, 3AA, 3B, 3E, 3AL, 4B, 4BA, 4B240FLW, 4B240ET, 4BW, 4B240X,[1] 4E, 4,[1] 4A,[1] 9,[1] 25,[1] 26,[1] 38,[1] 39, or 41[1] (§§ 178.36, 178.37, 178.38, 178.42, 178.46, 178.50, 178.51, 178.54, 178.55, 178.61, 178.65, 178.68 of this subchapter) cylinders. The internal volume of a specification 39 cylinder must not exceed 75 cubic inches.

* * * * *

19. In § 173.328, paragraph (a)(2) is revised to read as follows:

§ 173.328 Poison A materials not specifically provided for.

(a) * * *

(2) Specification 3A1800, 3AA1800, 3AL1800, or 3E1800 (§§ 178.36, 178.37, 178.42, 178.46 of this subchapter) cylinders.

(i) Specifications 3A, 3AA and 3AL cylinders must not exceed 125 pounds water capacity (nominal). Cylinders must have valve protection or be packed in strong wooden or metal boxes as described in § 173.327(a)(2). Specification 3AL cylinders are authorized only for arsine, carbonyl sulfide, and phosphine service.

* * * * *

20. In §173.332, paragraph (a)(2) is revised as follows:

§ 173.332 Hydrocyanic acid, liquid (prussic acid) and hydrocyanic acid liquefied.

(a) * * *

(2) Specification 3A480, 3AA480, 3A480X[1] or 3AL1800 (§ 178.36, 178.37, 178.46 of this subchapter) metal cylinders of not over 278 pounds water capacity (nominal); valve protection cap must be used and be at least 9/16-inch thick, gas-tight, with 9/16-inch faced seat for gasket and with United States standard form thread; the cap must be

capable of preventing injury or distortion of the valve when it is subjected to an impact caused by allowing the cylinder, prepared as for shipment, to fall from an upright position with side of cap striking a solid steel object projecting not more than 6 inches above floor level.

* * * * *

21. In § 173.336, paragraph (a)(2) is revised to read as follows:

§ 173.336 Nitrogen dioxide, liquid; nitrogen peroxide, liquid; and nitrogen; tetroxide, liquid.

(a) * * *

(2) Specification 3A480, 3AA480, 3AL1800, or 25[1] (§§ 178.36, 178.37, or 178.46 of this subchapter) metal cylinders with valve removed are authorized. Valve opening must be closed by means of a solid metal plug with tapered thread properly luted to prevent leakages; valve protection cap must be used and be at least 3/16-inch thick, gas-tight, with 3/16-inch faced seat for gasket and with United States standard form thread.

* * * * *

22. In § 173.337, paragraphs (a) (1) and (2) are revised to read as set forth below and paragraphs (a)(3) and (4) are removed.

§ 173.337 Nitric oxide.

(a) * * *

(1) Specification 3A1800, 3AA1800, 3E1800, or 3AL2800 (§§ 178.36, 178.37, 178.42, or 178.46 of this subchapter) cylinders charged to a pressure of not more than 750 psi at 70° F. Cylinders must be equipped with a valve of stainless steel and valve seat of material which will not be deteriorated by contact with nitric oxide or nitrogen dioxide. Cylinders or valves may not be equipped with safety devices of any type. Valve outlets must be sealed by a solid threaded cap or plug and an inert gasketing material.

(i) Specification 3E1800 cylinders must be packed in strong wooden boxes of such design as to protect valves from injury or accidental functioning under conditions incident to transportation. Each outside package must be plainly marked "Inside containers comply with prescribed specifications."

(ii) Specification 3A, 3AA, and 3AL cylinders must have their valves protected by metal caps securely attached to the cylinders and be of sufficient strength to protect the valves from injury during transit, or by packing in strong wooden boxes of such design as to protect valves from injury or accidental functioning under conditions incident to transportation. Each outside package must be plainly marked "Inside containers comply with prescribed specifications."

(2) Specification 106A500X (§§ 179.300, 179.301 of this subchapter) tank car tanks. Nitric oxide charge in each tank may not exceed 200 psig at 70° F. Each tank must be equipped with gas-tight valve protection cap (see § 179.302 of this subchapter). Each valve outlet must be sealed by a threaded solid plug or a threaded cap with inert luting or gasket material. Valves must be of stainless steel and the caps, plugs, and valve seats must be of material that will not be deteriorated by contact with nitric oxide or nitrogen dioxide. The tank may not be equipped with any safety relief device.

23. § 173.351 is revised to read as follows:

§ 173.351 Hydrocyanic acid solutions.

Hydrocyanic acid solutions not over 5 percent hydrocyanic acid must be packaged in specification containers as follows:

(a) As prescribed in § 173.332.

(b) Specification 15A, 15B, 15C, 16A, 19A or 19B (§§ 178.168, 178.169, 178.170, 178.185, 178.190 or 178.191 of this subchapter) wooden boxes with inside glass bottles not over 1 pound capacity each for solutions of not over 5 percent hydrocyanic acid and not over 5 pints capacity each for solutions of not over 2 percent strength. Completed package, with glass packaging filled with water, must be capable of withstanding six four-foot drops onto solid concrete in the following order: bottom, four sides, and top, without breakage.

24. In § 173.354, paragraph (a)(3) is revised to read as follows:

§ 173.354 Motor fuel antiknock compound or tetraethyl lead.

(a) * * *

(3) Specification steel or nickel cylinders as prescribed for any compressed gas except acetylene.

* * * * *

25. In § 173.358, paragraph (a)(7) is revised to read as follows:

§ 173.358 Hexaethyl tetraphosphate; methyl parathion; organic phosphate compound; organic phosphorous compound; parathion; tetraethyl dithio pyrophosphate; and tetraethyl phyrophosphate, liquid.

(a) * * *

(7) Specification cylinders as prescribed for any compressed gas except acetylene. DOT 3AL cylinders are authorized only for parathion and methyl parathion service.

* * * * *

PART 178—SHIPPING CONTAINER SPECIFICATIONS

26. § 178.46 is added to read as follows:

§ 178.46 Specification 3AL; seamless cylinders made of definitely prescribed aluminum alloys.

§ 178.46-1 Compliance.

Each specification 3AL seamless cylinder must comply with this section.

§ 178.46-2 Size and service pressure.

(a) The maximum water capacity is 1000 pounds.

(b) The minimum service pressure is 150 psig (see § 173.300(h) of this subchapter).

§178.46-3 Inspection.

Inspections and verifications must be performed by an independent inspection agency approved in writing by the Associate Director for HMR in accordance with § 173.300a of this subchapter. Chemical analyses and tests as specified must be made within the United States unless otherwise approved in writing by the Associated Director for HMR in accordance with § 173.300b of this subchapter.

§ 178.46-4 Duties of the inspector.

(a) The inspector shall determine that all materials comply with this specification before releasing those materials for cylinder manufacture.

(b) The inspector shall verify compliance with the provisions of § 178.46-5(d)(1) by:

(1) Performing or witnessing the performance of the chemical analyses on each melt or cast lot or other unit of starting material; or

(2) Obtaining a certified chemical analysis from the material or cylinder manufacturer for each melt, or cast of material; or

(3) Obtaining a certified check analysis on one cylinder out of each lot of 200 cylinders or less, if a certificate containing data to indicate compliance with the material specification is obtained.

(c) The inspector shall verify ultrasonic inspection of all material by inspection or by obtaining the material producer's certificate of ultrasonic inspection. Ultrasonic inspection must be performed or verified as having been performed in accordance with § 178.46-5(e).

(d) The inspector shall determine that each cylinder complies with this specification by:

(1) Making a complete internal inspection before closing;

(2) Making a complete external inspection;

(3) Verifying that heat treatment was proper;

(4) Selecting the samples for all tests;

(5) Selecting the samples for check analyses performed by other than the material producer;

(6) Witnessing each test;

(7) Verifying that the prescribed minimum thickness was met by measuring or witnessing the measurement of the wall thickness;

(8) Verifying that the identification of material is proper;

(9) Verifying the threads, by gauge;

(10) Reporting volumetric capacity, tare weight, and minimum thickness noted;

(11) Determining that each cylinder is marked in compliance with the specification; and

(12) Preparing and providing the required report to the cylinder maker, purchaser, and the Associate Director for HMR.

(e) Prior to initial production of any design or design change, verify that the design qualification tests prescribed in § 178.46-6(f) have been performed with acceptable results.

(f) In this specification, a "lot" means of group of cylinders successively produced having the same:

(1) Size and configuration;

(2) Specified material of construction;

(3) Process of manufacture and heat treatment;

(4) Equipment of manufacture and heat treatment; and

(5) Conditions of time, temperature and atmosphere during heat treatment.

In no case may the lot size exceed 200 cylinders, but any cylinder processed for use in the required destructive physical testing need not be counted as being one of the 200.

§ 178.46-5 Authorized material and identification of material.

(a) Starting stock must be cast stock that is later scalped prior to extrusion of the cylinder shell. If starting stock is not cast stock, it must be traceable to cast stock that has been scalped prior to extrusion.

(b) Material with seams, cracks, laminations, or other defects likely to weaken the finished cylinder may not be used.

(c) Material must be identified by a suitable method that will identify the alloy, the aluminum producer's cast number, the solution heat treat batch number and the lot number.

(d) The material must be of uniform quality. Only the following heat treatable aluminum alloys are permitted:

(1) CHEMICAL COMPOSITION LIMITS [1]

Aluminum association alloy designation No.	Chemical composition								Other [2]		Al
	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Each	Total	
6351	0.7-1.3	0.50 maximum.	0.10 maximum.	0.40-0.8	0.40-0.8		0.20 maximum.	0.20 maximum.	0.05 maximum.	0.15 maximum.	Remainder.
6061	0.40-0.8	0.7 maximum.	0.15-0.40	0.15 maximum.	0.8-1.2	0.04-0.35	0.25 maximum.	0.15 maximum.	0.05 maximum.	0.15 maximum.	Remainder.

[1] ASTM B 221-76 Standard Specification for Aluminum-Alloy Extruded Bars, Rods Shapes, and Tubes, Table 1 Chemical Composition Limits.

[2] Analysis is regularly made only for the elements for which specific limits are shown, except for unalloyed aluminum. However, the presence of other element is suspected to be, or in the course of routine analysis is indicated to be in excess of specified limits, further analysis is made to determine that these other elements are not in excess of the amount specified. (Aluminum Association Standards and Data—Sixth Edition 1979.)

(2) MECHANICAL PROPERTY LIMITS

Alloy and temper	Tensile strength—PSI		Elongation—percent minimum for 2" or 4D [1] test specimen
	Ultimate—minimum	Yield—minimum	
6351-T6	42,000	37,000	[2] 14
6061-T6	38,000	35,000	[2] 14

[1] "D" represents specimen diameter.

[2] When cylinder wall is not over 3/16-inch thick, 10 percent elongation is authorized when using a 2" or 4D test specimen.

(e) All starting stock must be 100 percent ultrasonically inspected, along the length at right angles to the central axis from two positions at 90° to one another. The equipment and continuous scanning procedure must be capable of detecting and rejecting internal defects such as cracks which have an ultrasonic response greater than that of a calibration block with a 5/64-inch diameter flat bottomed hole.

(f) Cast stock must have uniform equiaxed grain structure not to exceed 250 microns average.

(g) Any starting stock not complying with the above must be rejected.

§ 178.46-6 Manufacture.

(a) Cylinder shells must be manufactured by the backward extrusion method and have a cleanliness level adequate to ensure proper inspection.

(b) No fissure or other defect is acceptable that is likely to weaken the finished cylinder below the design strength requirements. A reasonably smooth and uniform surface finish is required. If not originally free from such defects, the surface may be machined or otherwise conditioned to eliminate these defects.

(c) The thickness of the cylinder base may not be less than the prescribed minimum wall thickness of the cylindrical shell. The cylinder base must have a basic torispherical, hemispherical, or ellipsoidal interior base configuration where the dish radius is no greater than 1.2 times the inside diameter of the shell. The knuckle radius may not be less than 12 percent of the inside diameter of the shell.

(d) For free standing cylinders, the base thickness must be at least two times the minimum wall thickness along the line of contact between the cylinder base and the floor when the cylinders are in the vertical position.

(e) Welding or brazing is prohibited.

(f) Each new design and any significant change to any acceptable design must be qualified for production by testing prototype samples as follows:

(1) Three samples must be subjected to 100,000 pressure reversal cycles between zero and service pressure or 10,000 pressure reversal cycles between zero and test pressure, at a rate not in excess of 10 cycles per minute without failure.

(2) Three samples must be pressurized to destruction and failure must not occur at less than 2.5 times the marked cylinder service pressure. Each cylinder must remain in one piece. Failure must initiate in the cylinder sidewall in a longitudinal direction. Rate of pressurization must not exceed 200 psi per second.

(g) In this specification "significant change" means a 10 percent or greater

change in cylinder wall thickness, service pressure, or diameter; a 30 percent or greater change in water capacity or base thickness; any change in material; over 100 percent increase in size of openings; or any change in the number of openings.

§ 178.46-7 Wall thickness.

(a) The minimum wall thickness must be such that the wall stress at the minimum specified test pressure will not exceed 80 percent of the minimum yield strength nor exceed 67 percent of the minimum ultimate tensile strength as verified by physical tests in § 178.46-13.

(b) Calculations must be made by the formula:

$$S=[P(1.3\ D^2+0.4d^2)]/[D^2-d^2]$$

Where:

S=Wall stress in pounds per square inch;
P=Prescribed minimum test pressure in pounds per square inch (see § 178.46-11(c));
D=Outside diameter in inches; and
d=Inside diameter in inches.

(c) The minimum wall thickness for any cylinder with an outside diameter greater than 5 inches must be 0.125 inch.

§ 178.46-8 Openings.

(a) Openings are permitted in heads only.

(b) The size of any centered opening in a head may not exceed one-half the outside diameter of the cylinder.

(c) Other openings are permitted in the head of a cylinder if:

(1) Each opening does not exceed 2.625 inches in diameter, or one-half the outside diameter of the cylinder; whichever is less;

(2) Each opening is separated from each other by a ligament; and

(3) Each ligament which separates two openings must be at least three times the average of the diameters of the two openings.

(d) All openings must be circular.

(e) All openings must be threaded. Threads must comply with the following:

(1) Each thread must be clean cut, even, without any checks, and to gauge.

(2) Taper threads, when used, must be the American Standard Pipe Thread (NPT) type complying with the USDC, NBS Handbook H-28, Part III, Section VII, or the National Gas Taper Thread (NGT) standard complying with NBS Handbook H-28, Part II, Sections VII and IX.

(3) Straight threads conforming with National Gas Straight Thread (NGS) standards are authorized. These threads must comply with NBS Handbook H-28, Part II, Sections VII and IX.

§ 178.46-9 Heat treatment.

Prior to any test, all cylinders must be subjected to a solution heat treatment and aging treatment appropriate for the aluminum alloy used.

§ 178.46-10 Pressure relief devices and protection for valves, pressure relief devices, and other connections.

Pressure relief devices and protection arrangements for valves, pressure relief devices, and other connections must comply with §§ 173.34(d) and 173.301(g) of this subchapter.

§ 178.46-11 Hydrostatic test.

(a) Each cylinder must be subjected to an internal test pressure using the water jacket equipment and method or other suitable equipment and method. The testing apparatus must be operated in a manner so as to obtain accurate data. The pressure gauge used must permit reading to an accuracy of one percent. The expansion gauge must permit reading the total expansion to an accuracy of either one percent or 0.1 cubic centimeter.

(b) The test pressure must be maintained for a sufficient period of time to assure complete expansion of the cylinder. In no case may the pressure be held less than 30 seconds. If, due to failure of the test apparatus, the required test pressure cannot be maintained, the test may be repeated at a pressure increased by 10 percent or 100 psi, whichever is lower. If the test apparatus again fails to maintain the test pressure, the cylinder being tested must be rejected. Any internal pressure applied to the cylinder before any official test may not exceed 90 percent of the test pressure.

(c) The minimum test pressure is the greatest of the following:

(1) 450 psi regardless of service pressure;

(2) Two times the service pressure for cylinders having service pressure less than 500 psi; or

(3) Five-thirds times the service pressure for cylinders having a service pressure of at least 500 psi.

(d) Permanent volumetric expansion may not exceed 10 percent of total volumetric expansion at test pressure.

§ 178.46-12 Flattening test.

(a) The flattening test must be performed on one cyliner taken at random out of each lot of 200 or less by placing the cylinder between wedge shaped knife edges having a 60° included angle, and rounded in accordance with the following table. The longitudinal axis of the cylinder must be at an angle 90° to the knife edges during the test.

TABLE

Cylinder wall thickness in inches	Radius in inches
Under .150	.500
.150 to .249	.875
.250 to .349	1.500
.350 to .449	2.125
.450 to .549	2.750
.550 to .649	3.500
.650 to .749	4.125

(b) An alternate bend test in accordance with ASTM E 290-77 using a mandrel diameter not more than 6 times the wall thickness is authorized to qualify lots that fail the flattening test of this section without reheat treatment. If used, this test must be performed on two samples from one cylinder taken at random out of each lot of 200 cylinders or less.

(e) Each test cylinder must withstand flattening to nine times the wall thickness without cracking. When the alternate bend test is used, the test specimens shall remain uncracked when bent inward around a mandrel in the direction of curvature of the cylinder wall until the interior edges are at a distance apart not greater than the diameter of the mandrel.

§ 178.46-13 Mechanical properties test.

(a) Two test specimens cut from one cylinder representing each lot of 200 cylinders or less must be tested. The results of the test must conform to at least the minimum acceptable mechanical property limits for aluminum alloys as specified in § 178.46-5(d)(2).

(b) Specimens must be 4D bar or gauge length 2 inches with width not over 1½ inch taken in the direction of extrusion approximately 180° from each other; *provided* that gauge length at least 24 times thickness with width not over 6 times thickness is authorized, when cylinder wall is not over 3/16 inch thick. The specimen, exclusive of grip ends, may not be flattened. Grip ends may be flattened to within one inch of each end of the reduced section. When the size of the cylinder does not permit securing straight specimens, the specimens may be taken in any location or direction and may be straightened or flattened cold by pressure only, not by blows. When such specimens are used, the inspectors's report must show that the specimens were so taken and prepared. Heating of specimens for any purpose is forbidden.

(c) The yield strength in tension must be the stress corresponding to a permanent strain of 0.2 percent of the gauge length.

(1) The yield strength must be determined by either the "offset"

method or the "extension under load" method as prescribed in ASTM Standard B–557–79.

(2) In using the "extension under load" method, the total strain (or "extension under load") corresponding to the stress at which the 0.2 percent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gauge length under appropriate load and adding thereto 0.2 percent of the gauge length. Elastic extension calculations must be based on an elastic modulus of 10,000,000 psi. In the event of controversy, the entire stress-strain diagram must be plotted and the yield strength determined from the 0.2 percent offset.

(3) For the purpose of strain measurement, the initial strain must be set while the specimen is under a stress of 6,000 psi, the strain indicator reading being set at the calculated corresponding strain.

(4) Cross-head speed of the testing machine may not exceed ⅛ inch per minute during yield strength determination.

§ 178.46–14 Rejected cylinder.

Reheat treatment of rejected cylinders is authorized one time; subsequent thereto, cylinders must pass all prescribed tests to be acceptable.

§ 178.46–15 Marking.

(a) Each cylinder must be plainly and permanently marked, by stamping on the cylinder shoulder, top head, or neck, in the following order:

(1) The specification marking "DOT 3AL" must appear first on the cylinder followed immediately by the service pressure (for example: DOT–3AL 1800).

(2) The serial number and an identifying symbol or letters appear next; location of the number to be just below or immediately following the DOT mark; location of the symbol to be just below or immediately following the number. The symbol and numbers must be those of the maker. The symbol must be registered with the Associate Director for HMR. No duplication is authorized.

Examples

DOT–3AL 1800
1234
XY
or: DOT–3AL 1800–1234–XY.

(3) The date of test (such as 5–81 for May 1981), so placed that the dates of subsequent tests can be easily added, appears next followed by the inspector's official mark.

(4) Marks must be at least ¼ inch high if space permits.

(b) Other marks are authorized provided they are made in low stress areas other than the side wall and are not of a size and depth that will create harmful stress concentrations. Such marks may not conflict with any DOT required markings.

§ 178.46–16 Inspector's report.

Required to be clear, legible, and in the following form:

(Place) _____
(Date) _____
Gas Cylinders:
Manufactured for —— Company
Location at _____
Manufactured by —— Company
Location at _____
Consigned to _____
Location at _____
Quantity _____
Size _____ inches outside diameter by _____ inches long
Marks stamped into the shoulder of the cylinder are:
Specification DOT _____
Serial numbers _____ to _____ inclusive
Identifying symbol (registered) _____
Cylinder manufacturer's identification symbol _____
Inspector's mark _____
Test date _____
Tare weights (yes or no)
Other marks (if any) _____
These cylinders were made by process of _____
The cylinders were heat treated by the process of _____
(alloy and temper designation).

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

All material and each cylinder were inspected; all that were accepted were 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 of cylinders were supervised and found to be efficient and satisfactory.

The cylinder walls were measured and the minimum thickness noted was at least equal to the minimum design thickness. The outside diameter was determined to be _____ inches. The wall stress was calculated to be _____ pounds per square inch under an internal pressure of _____ pounds per square inch. The required minimum thickness is _____ inch.

Hydrostatic tests, flattening tests, tensile tests of material, and other tests, as prescribed in Specification DOT–3AL were made in the presence of the inspector and all material and cylinders accepted were found to be in compliance with that specification. Records thereof are attached hereto.

I hereby certify that all of these cylinders proved satisfactory in every way and comply with the Department of Transportation Specification 3AL except as follows:
Exceptions _____

(Signed) _____
(Inspector) _____
(Place) _____
(Date) _____

Record of Chemical Analyses of Material for Cylinders

Numbered _____ to _____ inclusive.
Size _____ inches outside diameter by _____ inches long.
Made by _____ Company.
For _____ Company.

Note.—Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file," or by attaching a copy of the certificate.

Alloy designation*	Cylinders represented (serial Nos.)	Chemical analyses										
		Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Others		Al
										Ea.	Total	

*Aluminum Association Alloy Designation Number

The analyses were made by
(Signed)
(Place)
(Date)

Record of Physical Tests of Material for Cylinders

Numbered _____ to _____ inclusive.
Size _____ inches outside diameter by _____ inches long.
Made by _____ Company.
For _____ Company.

Test No.	Cylinders represented by test (serial Nos.)	Yield strength at 0.2 percent offset (lbs. per sq. inch)	Tensile strength (pounds per sq. inch)	Elongation (percent in ——— size specimen)	Flattening test (record as multiple of t)

(Signed)
(Place)
(Date)

Record of Hydrostatic Tests on Cylinders

Numbered ——— to ——— inclusive.
Size ——— inches outside diameter by ——— inches long.
Made by ——— Company.

Serial Nos. of cylinders tested arranged numerically	Actual test pressure (lbs. per sq. inch)	Total expansion (cubic centimeters)[1]	Permanent expansion (cubic centimeters)[1]	Percent ratio of permanent expansion to total expansion (Actual value)	Tare weight (lbs)[2]	Volumetric capacity

[1] If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressures, then the basic data on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquids, etc., must also be given.
[2] Do not include removable cap but state whether with or without valve. These weights must be accurate to a tolerance of 1 percent.

(Signed)
(Place)
(Date)

[49 U.S.C. 1803, 1804, 1808; 49 CFR 1.53, App. A to Part 1]

Issued in Washington, D.C. on November 25, 1981.

L. D. Santman,
Director, Materials Transportation Bureau.

[FR Doc. 81-36318 Filed 12-23-81; 8:45 am]
BILLING CODE 4910-60-M

INTERSTATE COMMERCE COMMISSION

49 CFR Part 1136

[Ex Parte No. MC-122 (Sub-No. 3)]

Interpretation-Intercorporate Hauling

AGENCY: Interstate Commerce Commission.

ACTION: Notice of interpretative rule change.

SUMMARY: Final rules have been promulgated at 49 CFR 1136 which implement 49 U.S.C. 10524 (b) and (c), which define compensated intercorporate hauling (CIH) operations, and render them exempt from our carrier licensing regulations on compliance with certain conditions. The Commission has determined that there is no prohibition against a transportation firm using an affiliated CIH carrier for the transportation of company traffic. Conversely, the CIH exemption does not extend to the for-hire transportation of traffic tendered the carrier by non-affiliates. 49 CFR 1136.1 is modified in light of this finding.

EFFECTIVE DATE: December 24, 1981.

ADDRESS: Copies of the complete decision are available, upon request, from: The Office of the Secretary, Interstate Commerce Commission, 12th & Constitution Avenue, N.W., Washington, DC 20423.

FOR FURTHER INFORMATION CONTACT:
Melvin Werner, (202) 275-7985, or Edward E. Guthrie, (202) 275-7691

SUPPLEMENTARY INFORMATION: In a notice published at 45 FR 45528 (July 3, 1980), the Commission adopted interim rules implementing 49 U.S.C. 10524 (b) and (c), which define compensated intercorporate hauling (CIH) operations, and render them exempt from our carrier licensing regulations on compliance with certain conditions.

One of the comments to the interim rules, submitted by Cape Air Freight, requested a declaratory order finding that for-hire carriers may not use affiliates operating under the CIH exemption to transport traffic of their customers.

Notice of Cape Air's petition and of several other inquiries was published in Ex Parte No. MC-122 (Sub-No. 3), 45 FR 86768 (December 31, 1980). We have considered the comments of interested parties and conclude that 49 CFR 1136.1 should be revised to indicate certain limitations on operations under the CIH exemption. This interpretation does not preclude any notice from being filed as long as statutory requirements are otherwise met.

49 CFR 1136.1, promulgated December 31, 1980, provides:

§ 1136.1 Scope.

Compensated transportation service by a member of a corporate family for other members of the same corporate family ("Compensated Incorporate Hauling" or "CIH") is exempt from Commission regulation except for certain notice requirements. To qualify for the exemption, the participants shall be members of the corporate family in which the parent owns, directly or indirectly, a 100-percent interest in the subsidiaries. These regulations prescribe procedures for compliance with the notice requirements of 49 U.S.C. 10524 (b) and (c).

PART 1136—COMPENSATED INTERCORPORATE HAULING OPERATION

§ 1136.1 [Amended]

To advise the public of our findings in this proceeding we conclude that an additional clause should be added to the next-to-the last sentence of 49 CFR 1136.1. Accordingly, the next to the last sentence of § 1136.1 is amended by adding the following clause to follow the word "subsidiaries": * * *, except no corporation engaged primarily in operations as a for-hire carrier may use an affiliate operating under the exemption of 49 U.S.C. 10524(b), for movement of freight tendered to it in its capacity as a carrier. * * *

We are not providing a comment period for this modification because the proceeding from which it derives has provided a forum for adequate discussion of the issues. The language which has been added to 49 CFR 1136.1 is interpretative, and does not indicate a change in CIH policy. See 49 CFR 1136.3(g). Its intent is merely to assist prospective CIH operators to recognize the limits of the exemption.

This notice interprets a rule and will be effective upon publication of this notice in the Federal Register (see 5 U.S.C. 553(d)(2)). In addition, there is good cause to make the interpretation effective immediately so that carriers now providing service and those that intend to file CIH notices in the near future may understand the scope of the