

(3) *Molten metals and molten glass.* This section does not apply to packagings used for transportation of molten metals and molten glass by rail when movement is restricted to operating speeds less than 15 miles per hour. (See §172.203(g)(3) of this subchapter for shipping paper requirements.)

(4) *Solid elevated temperature materials.* A material which meets the definition of a solid elevated temperature material is excepted from all requirements of this subchapter except §172.325 of this subchapter.

[Amdt. 173-227, 58 FR 3349, Jan. 8, 1993, as amended by Amdt. 173-234, 58 FR 51532, Oct. 1, 1993; 173-237, 59 FR 28493, June 2, 1994; 62 FR 51560, Oct. 1, 1997; 63 FR 52849, Oct. 1, 1998; 65 FR 50461, Aug. 18, 2000; 66 FR 33436, June 21, 2001; 66 FR 45382, Aug. 28, 2001; 67 FR 61013, Sept. 27, 2002]

§ 173.249 Bromine.

When §172.101 of this subchapter specifies that a hazardous material be packaged under this section, only the following bulk packagings are authorized, subject to the requirements of subparts A and B of part 173 of this subchapter and the special provisions specified in column 7 of the §172.101 table.

(a) Class DOT 105A300W or 105A500W tank cars. Class 105A500W tank cars may be equipped with manway cover plates, pressure relief valves, vent valves, and loading/unloading valves that are required on Class 105A-300W tank cars. Tank cars must conform with paragraphs (d) through (f) of this section.

(b) Specification MC 310, MC 311, MC 312 or DOT 412 cargo tank motor vehicles conforming with paragraphs (d) through (f) of this section. The total quantity in one tank may not be less than 88 percent nor more than 96 percent of the volume of the tank. Cargo tanks in bromine service built prior to August 31, 1991 may continue in service under the requirements contained in §173.252(a)(4) of this part in effect on September 30, 1991.

(c) UN portable tanks conforming to tank code T22 (see §172.102 of this subchapter) or specification IM 101 portable tanks conforming with paragraphs (d) through (f) of this section. Except when transported as a residue, the

total quantity in one tank may not be less than 88% nor more than 92% of the volume of the tank.

(d) The tank must be made from nickel-clad or lead-lined steel plate. Nickel cladding or lead lining must be on the inside of the tank. Nickel cladding must comprise at least 20 percent of the required minimum total thickness. Nickel cladding must conform to ASTM B 162 (IBR, see §171.7 of this subchapter). Lead lining must be at least 4.763 mm (0.188 inch) thick. All tank equipment and appurtenances in contact with the lading must be lined or made from metal not subject to deterioration by contact with lading.

(e) Maximum filling density is 300 percent of the tank's water capacity. Minimum filling density is 287 percent of the tank's water capacity. Maximum water capacity is 9,253 kg (20,400 pounds) for DOT 105A300W tank cars. Maximum quantity of lading in DOT 105A300W tank cars is 27,216 kg (60,000 pounds). Maximum water capacity is 16,964 kg (37,400 pounds) for DOT 105A500W tank cars and DOT 105A500W tank cars equipped as described in paragraph (a) of this section. Maximum quantity of lading in DOT 105A500W tank cars is 49,895 kg (110,000 pounds).

(f) Tank shell and head thickness for cargo tank motor vehicles and portable tanks must be at least 9.5 mm (0.375 inch) excluding lead lining.

[Amdt. 173-224, 55 FR 52663, Dec. 21, 1990, as amended at 56 FR 66275, Dec. 20, 1991; 68 FR 75745, Dec. 31, 2003; 69 FR 76174, Dec. 20, 2004]

Subpart G—Gases; Preparation and Packaging

§ 173.300 [Reserved]

§ 173.301 General requirements for shipment of compressed gases in cylinders and spherical pressure vessels.

(a) *General qualifications for use of cylinders.* As used in this subpart, *filled* or *charged* means an introduction or presence of a hazardous material in a cylinder. A Class 2 material (gas) offered for transportation in a cylinder must be prepared in accordance with this section and §§173.301a through 173.305, as applicable.

§ 173.301

49 CFR Ch. I (10–1–05 Edition)

(1) Compressed gases must be in metal cylinders and containers built in accordance with the DOT and ICC specifications, as shown in this paragraph (a)(1), in effect at the time of manufacture, and requalified and marked as required by the specification and the regulation for requalification, if applicable:

Packagings

- 2P
- 2Q
- ICC-3¹
- 3A
- 3AA
- 3AL
- 3AX
- 3A480X
- 3AAX
- 3B
- 3BN
- 3E
- 3HT
- 3T
- 4AA480
- 4B
- 4B240ET
- 4BA
- 4BW
- 4D
- 4DA
- 4DS
- 4E
- 4L
- 8
- 8AL
- 39

(2) A cylinder must be filled in accordance with this part. Before each filling of a cylinder, the person filling the cylinder must visually inspect the outside of the cylinder. A cylinder that has a crack or leak, is bulged, has a defective valve or a leaking or defective pressure relief device, or bears evidence of physical abuse, fire or heat damage, or detrimental rusting or corrosion, may not be filled and offered for transportation. A cylinder may be repaired and requalified only as prescribed in subpart C of part 180 of this subchapter.

(3) Pressure relief devices must be tested for leaks before a filled cylinder is shipped from the cylinder filling plant. It is expressly forbidden to repair a leaking fusible plug device where the leak is through the fusible metal or between the fusible metal and the

opening in the plug body, except by removal and replacement of the pressure relief device.

(4) A cylinder that previously contained a Class 8 material must be requalified in accordance with §180.205(e) of this subchapter.

(5) When a cylinder with a marked pressure limit is prescribed, another cylinder made under the same specification but with a higher marked pressure limit is authorized. For example, a cylinder marked "DOT-4B500" may be used when "DOT-4B300" is specified.

(6) No person may fill a cylinder overdue for periodic requalification with a hazardous material and then offer it for transportation. The prohibition against offering a cylinder for transportation that is overdue for periodic requalification does not apply to a cylinder filled prior to the requalification due date.

(7) A cylinder with an authorized service life may not be offered for transportation in commerce after its authorized service life has expired. However, a cylinder in transportation or a cylinder filled prior to the expiration of its authorized service life may be transported for reprocessing or disposal of the cylinder's contents. After emptying, the cylinder must be condemned in accordance with §180.205 of this subchapter.

(8) The pressure of the hazardous material at 55 °C (131 °F) may not exceed 5/4 of the service pressure of the cylinder. Sufficient outage must be provided so the cylinder will not be liquid full at 55 °C (131 °F).

(9) Specification 2P, 2Q, 3E, 3HT, spherical 4BA, 4D, 4DA, 4DS, and 39 cylinders must be packed in strong non-bulk outer packagings. The outside of the combination packaging must be marked with an indication that the inner packagings conform to the prescribed specifications.

(b) *Cylinder markings.* Required markings on a cylinder must be legible and must meet the applicable requirements of subpart C of part 180 of this subchapter. Additional information may be marked on the cylinder provided it does not affect the required markings prescribed in the applicable cylinder specification.

¹Use of existing cylinders is authorized. New construction is not authorized.

(c) *Toxic gases and mixtures.* Cylinders containing toxic gases and toxic gas mixtures meeting the criteria of Division 2.3 Hazard Zone A or B must conform to the requirements of §173.40 and CGA Pamphlets S-1.1 and S-7 (IBR, see §171.7 of this subchapter). A DOT 39 cylinder may not be used for toxic gases or toxic gas mixtures meeting the criteria for Division 2.3, Hazard Zone A or B.

(d) *Gases capable of combining chemically.* A filled cylinder may not contain any gas or material capable of combining chemically with the cylinder's contents or with the cylinder's material of construction, so as to endanger the cylinder's serviceability. After September 30, 2002, DOT 3AL cylinders made of aluminum alloy 6351-T6 may not be filled and offered for transportation with pyrophoric gases; however, if it is otherwise serviceable and conforms to the regulations in effect on September 30, 2002, a DOT 3AL cylinder made of aluminum alloy 6351-T6 and filled before October 1, 2002, may be transported for reprocessing or disposal of the cylinder's contents until April 1, 2003.

(e) *Ownership of cylinder.* A cylinder filled with a hazardous material may not be offered for transportation unless it was filled by the owner of the cylinder or with the owner's consent.

(f) *Pressure relief device systems.* (1) Except as provided in paragraphs (f)(5) and (f)(6) of this section, a cylinder filled with a gas and offered for transportation must be equipped with one or more pressure relief devices sized and selected as to type, location, and quantity, and tested in accordance with CGA S-1.1 (compliance with paragraph 9.1.1.1 of CGA S-1.1 is not required) and S-7. The pressure relief device must be capable of preventing rupture of the normally filled cylinder when subjected to a fire test conducted in accordance with CGA C-14 (IBR, see §171.7 of this subchapter), or, in the case of an acetylene cylinder, CGA C-12 (IBR, see §171.7 of this subchapter).

(2) After December 31, 2003, a pressure relief device, when installed, must be in communication with the vapor space of a cylinder containing a Division 2.1 (flammable gas) material.

(3) For a specification 3, 3A, 3AA, 3AL, 3AX, 3AXX, 3B, 3BN, or 3T cylinder filled with gases in other than Division 2.2, beginning with the first requalification due after December 31, 2003, the burst pressure of a CG-1, CG-4, or CG-5 pressure relief device must be at test pressure with a tolerance of plus zero to minus 10%. An additional 5% tolerance is allowed when a combined rupture disk is placed inside a holder. This requirement does not apply if a CG-2, CG-3 or CG-9 thermally activated relief device or a CG-7 reclosing pressure valve is used on the cylinder.

(4) A pressure relief device is required on a DOT 39 cylinder regardless of cylinder size or filled pressure. A DOT 39 cylinder used for liquefied Division 2.1 materials must be equipped with a metal pressure relief device. Fusible pressure relief devices are not authorized on a DOT 39 cylinder containing a liquefied gas.

(5) A pressure relief device is not required on—

(i) A cylinder 305 mm (12 inches) or less in length, exclusive of neck, and 114 mm (4.5 inches) or less in outside diameter, except when the cylinder is filled with a liquefied gas for which this part requires a service pressure of 1800 psig or higher or a nonliquefied gas to a pressure of 1800 psig or higher at 21 °C (70 °F);

(ii) A cylinder with a water capacity of less than 454 kg (1000 lbs) filled with a nonliquefied gas to a pressure of 300 psig or less at 21 °C (70 °F), except for a DOT 39 cylinder or a cylinder used for acetylene in solution; or

(iii) A cylinder containing a Class 3 or a Class 8 material without pressurization, unless otherwise specified for the hazardous material.

(6) A pressure relief device is prohibited on a cylinder filled with a Division 2.3 or 6.1 material in Hazard Zone A.

(g) *Manifolding cylinders in transportation.*

(1) Cylinder manifolding is authorized only under conditions prescribed in this paragraph (g). Manifolder cylinders must be supported and held together as a unit by structurally adequate means. Except for Division 2.2 materials, each cylinder must be equipped with an individual shutoff

valve that must be tightly closed while in transit. Manifold branch lines must be sufficiently flexible to prevent damage to the valves that otherwise might result from the use of rigid branch lines. Each cylinder must be individually equipped with a pressure relief device as required in paragraph (f) of this section, except that pressure relief devices on manifolded horizontal cylinders that are mounted on a motor vehicle or framework may be selected as to type, location, and quantity according to the lowest marked pressure limit of an individual cylinder in the manifolded unit. The pressure relief devices selected for the manifolded unit must have been tested in accordance with CGA pamphlets S-1.1 and S-7 (IBR, see §171.7 of this subchapter). Pressure relief devices on manifolded horizontal cylinders filled with a compressed gas must be arranged to discharge unobstructed to the open air. In addition, for Division 2.1 (flammable gas) material, the PRDs must be arranged to discharge upward to prevent any escaping gas from contacting personnel or any adjacent cylinders. Valves and pressure relief devices on manifolded cylinders filled with a compressed gas must be protected from damage by framing, a cabinet, or other method. Manifolding is authorized for cylinders containing the following gases:

- (i) Nonliquefied (permanent) compressed gases authorized by §173.302.
- (ii) Liquefied compressed gases authorized by §173.304. Each manifolded cylinder containing a liquefied compressed gas must be separately filled and means must be provided to ensure no interchange of cylinder contents can occur during transportation.
- (iii) Acetylene as authorized by §173.303.

(2) For the checking of tare weights or replacing solvent, the cylinder must be removed from the manifold. This requirement is not intended to prohibit filling acetylene cylinders while manifolded.

(h) *Cylinder valve protection.* (1) A cylinder used to transport a hazardous material must meet the requirements specified in this paragraph (h). The following cylinders are not subject to the

cylinder valve protection requirements in this paragraph (h):

- (i) A cylinder containing only a Division 2.2 material without a Division 5.1 subsidiary hazard;
- (ii) A cylinder containing a Class 8 liquid corrosive only to metal;
- (iii) A cylinder with a water capacity of 4.8 liters (293 in³) or less containing oxygen, compressed;
- (iv) A cylinder containing oxygen, refrigerated liquid (cryogenic liquid);
- (v) A Medical E cylinder with a water capacity of 4.9 liters (300 in³) or less;
- (vi) A fire extinguisher; or
- (vii) A “B” style cylinder with a capacity of 40 ft³ (1.13 m³) or an “MC” style cylinder with a capacity of 10 ft³ (0.28m³) containing acetylene.

(2) For cylinders manufactured before October 1, 2007, a cylinder must have its valves protected by one of the following methods:

- (i) By equipping the cylinder with securely attached metal caps of sufficient strength to protect valves from damage during transportation;
- (ii) By boxing or crating the cylinders so as to protect valves from damage during transportation;
- (iii) By constructing the cylinder so that the valve is recessed into the cylinder or otherwise protected to the extent that it will not be subjected to a blow when the container is dropped onto a flat surface; or
- (iv) By loading the cylinders in an upright position and securely bracing the cylinders in rail cars or motor vehicles, when loaded by the consignor and unloaded by the consignee.

(3) For cylinders manufactured on or after October 1, 2007, each cylinder valve assembly must be of sufficient strength or protected such that no leakage occurs when a cylinder with the valve installed is dropped 1.8 m (6 ft.) or more onto a non-yielding surface, such as concrete or steel, impacting the valve assembly or protection device at an orientation most likely to cause damage. The cylinder valve assembly protection may be provided by any method meeting the performance requirement in this paragraph (h)(3). Examples include:

- (i) Equipping the cylinder with a securely attached metal cap.

(ii) Packaging the cylinder in a box, crate, or other strong outside packaging conforming to the requirements of § 173.25.

(iii) Constructing the cylinder such that the valve is recessed into the cylinder or otherwise protected.

(i) *Cylinders mounted on motor vehicles or in frames.* Seamless DOT specification cylinders longer than 2 m (6.5 feet) are authorized for transportation only when horizontally mounted on a motor vehicle or in an ISO framework or other framework of equivalent structural integrity. Cylinders may not be transported by rail in container on freight car (COFC) or trailer on flat car (TOFC) service except under conditions approved by the Associate Administrator for Safety, Federal Railroad Administration. The cylinder must be configured as follows:

(1) Each cylinder must be fixed at one end of the vehicle or framework with provision for thermal expansion at the opposite end attachment;

(2) The valve and pressure relief device protective structure must be sufficiently strong to withstand a force equal to twice the weight of the cylinder and framework assembly with a safety factor of four, based on the ultimate strength of the material used; and

(3) The pressure relief device must be arranged to discharge unobstructed to the open air. In addition, for Division 2.1 (flammable gas) material, the pressure relief devices must be arranged to discharge upward to prevent any escaping gas from contacting personnel or any adjacent cylinders.

(j) *Non-specification cylinders in domestic use.* Except as provided in paragraphs (k) and (l) of this section, a filled non-DOT specification cylinder, other than a DOT exemption cylinder or a cylinder used as a fire extinguisher in conformance with § 173.309, may not be offered for transportation or transported to, from, or within the United States.

(k) *Importation of foreign cylinders for discharge within a single port area.* A cylinder manufactured to other than a DOT specification and certified as being in conformance with the transportation regulations of another country may be authorized, upon written

request to and approval by the Associate Administrator, for transportation within a single port area, provided—

(1) The cylinder is transported in a closed freight container;

(2) The cylinder is certified by the importer to provide a level of safety at least equivalent to that required by the regulations in this subchapter for a comparable DOT specification cylinder; and

(3) The cylinder is not refilled for export unless in compliance with paragraph (l) of this section.

(l) *Filling of foreign cylinders for export.* A cylinder not manufactured, inspected, tested and marked in accordance with part 178 of this subchapter, or a cylinder manufactured to other than a DOT specification or exemption, may be filled with a gas in the United States and offered for transportation and transported for export, if the following conditions are met:

(1) The cylinder has been requalified and marked with the month and year of requalification in accordance with subpart C of part 180 of this subchapter, or has been requalified as authorized by the Associate Administrator.

(2) In addition to other requirements of this subchapter, the maximum filling density, service pressure, and pressure relief device for each cylinder conform to the requirements of this part for the gas involved.

(3) The bill of lading or other shipping paper identifies the cylinder and includes the following certification: “This cylinder has (These cylinders have) been qualified, as required, and filled in accordance with the DOT requirements for export.”

(m) *Canadian cylinders in domestic use.* A Canadian Transport Commission (CTC) specification cylinder manufactured, originally marked and approved in accordance with the CTC regulations and in full conformance with the Canadian Transport of Dangerous Goods (TDG) Regulations (IBR, see § 171.7 of this subchapter) is authorized for the transportation of a hazardous material to, from or within the United States under the following conditions:

(1) The CTC specification corresponds with a DOT specification and the cylinder markings are the same as those specified in this subchapter except that

§ 173.301a

49 CFR Ch. I (10–1–05 Edition)

they were originally marked with the letters “CTC” in place of “DOT”;

(2) The cylinder has been requalified under a program authorized by the Canadian TDG regulations or requalified in accordance with the requirements in §180.205 within the prescribed requalification period provided for the corresponding DOT specification;

(3) When the regulations authorize a cylinder for a specific hazardous material with a specification marking prefix of “DOT”, a cylinder marked “CTC” which otherwise bears the same markings that would be required of the specified “DOT” cylinder may be used; and

(4) Transport of the cylinder and the material it contains is in all other respects in conformance with the requirements of this subchapter (*e.g.* valve protection, filling requirements, operational requirements, etc.).

(n) *Metal attachments.* Metal attachments to cylinders must have rounded or chamfered corners, or be otherwise protected, so as to prevent the likelihood of causing puncture or damage to other hazardous materials packages. This requirement applies to anything temporarily or permanently attached to the cylinder, such as metal skids.

[67 FR 51643, Aug. 8, 2002, as amended at 67 FR 61289, Sept. 30, 2002; 68 FR 24660, May 8, 2003; 68 FR 32680, June 2, 2003; 68 FR 75742, 75745, Dec. 31, 2003; 70 FR 34075, June 13, 2005]

§ 173.301a Additional general requirements for shipment of specification cylinders.

(a) *General.* The requirements in this section are in addition to the requirements in §173.301 and apply to the shipment of gases in specification cylinders.

(b) *Authorized cylinders not marked with a service pressure.* For authorized cylinders not marked with a service pressure, the service pressure is designated as follows:

Specification marking	Service Pressure psig
3	1800
3E	1800
8	250

(c) *Cylinder pressure at 21 °C (70 °F).* The pressure in a cylinder at 21 °C (70 °F) may not exceed the service pressure

for which the cylinder is marked or designated, except as provided in §173.302a(b). For certain liquefied gases, the pressure at 21 °C (70 °F) must be lower than the marked service pressure to avoid having a pressure at a temperature of 55 °C (131 °F) that is greater than permitted.

(d) *Cylinder pressure at 55 °C (131 °F).* The pressure in a cylinder at 55 °C (131 °F) may not exceed 5/4 times the service pressure, except:

(1) For a cylinder filled with acetylene, liquefied nitrous oxide, or carbon dioxide.

(2) For a cylinder filled in accordance with §173.302a(b), the pressure in the cylinder at 55 °C (131 °F) may not exceed 5/4 times the filling pressure.

(3) The pressure at 55 °C (131 °F) of Hazard Zone A and, after December 31, 2003, Hazard Zone B materials, may not exceed the service pressure of the cylinder. Sufficient outage must be provided so that the cylinder will not be liquid full at 55 °C (131 °F).

(e) *Grandfather clause.* A cylinder in domestic use prior to the date on which the specification for the cylinder was first made effective may be used if the cylinder has been properly tested and otherwise conforms to the requirements applicable to the gas with which it is charged.

[67 FR 51645, Aug. 8, 2002, as amended at 67 FR 61289, Sept. 30, 2002; 68 FR 24661, May 8, 2003]

§ 173.301b [Reserved]

§ 173.302 Filling of cylinders with non-liquefied (permanent) compressed gases.

(a) *General requirements.* A cylinder filled with a nonliquefied compressed gas (except gas in solution) must be offered for transportation in accordance with the requirements of this section and §§173.301, 173.301a, 173.302a, and 173.305, as applicable. Where more than one section applies to a cylinder, the most restrictive requirements must be followed.

(b) *Aluminum cylinders in oxygen service.* Each aluminum cylinder filled with oxygen must meet all of the following conditions: