



U.S. Department  
of Transportation

Pipeline and Hazardous  
Materials Safety  
Administration

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APR 19 2017

Mr. Cameron Banks  
Account Manager  
Swagelok Northern California  
3393 West Warren Avenue  
Fremont, CA 94538

Reference No. 16-0187

Dear Mr. Banks:

This letter is in response to your November 14, 2016, email requesting clarification of the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180) applicable to cylinder valve integrity. In your email, you cite the valve pressure capability requirements under § 173.40(c)(1) as an example of valve integrity for cylinders used in toxic-by-inhalation service. Specifically, you ask whether the valve of a Department of Transportation (DOT) Specification 4B cylinder must meet either the minimum service pressure or test pressure requirements of the HMR.

You are correct in your citation that for cylinders in toxic-by-inhalation service "each plug or valve must...be capable of withstanding the test pressure of the cylinder without damage or leakage" as stated in § 173.40(c)(1). The HMR do not include a similar requirement (such as valve pressure ratings) for cylinders not in toxic-by-inhalation service; however, there are valve requirements provided in the general requirements for cylinders (see § 173.301). For DOT Specification 4B cylinders, § 178.50(h) specifies the thread requirements, including engaged threads and shear strength.

I hope this information is helpful. Please contact us if we can be of further assistance.

Sincerely,

T. Glenn Foster  
Chief, Regulatory Review and Reinvention Branch  
Standards and Rulemaking Division

**Dodd, Alice (PHMSA)**

Stevens  
178.50(a)  
cylinders  
16-0187

**From:** INFOCNTR (PHMSA)  
**Sent:** Monday, November 14, 2016 1:50 PM  
**To:** Hazmat Interps  
**Subject:** FW: letter of clarification regarding valve ratings for 49 CFR 178.50(a) Spec 4B steel cylinders?  
**Attachments:** 49 CFR 178.50 - Specification 4B welded or brazed steel cylinders.pdf; CFR 173.40 c.JPG  
**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

Hi Shante/Alice,

Please submit this as a letter of interpretation. Mr. Banks spoke with Eamonn.

Please let me know if you have any questions.

Thanks,  
Jordan

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**From:** Banks, Cameron J. [mailto:cbanks@swagelok.com]  
**Sent:** Monday, November 14, 2016 12:41 PM  
**To:** PHMSA HM InfoCenter  
**Subject:** letter of clarification regarding valve ratings for 49 CFR 178.50(a) Spec 4B steel cylinders?

DOT,

CFR 178.50 (a) clearly states that a DOT 4B cylinder has to have a service pressure of "at least 150 but not over 500 psig". It seems common sense that any valves attached to such a cylinder would also require the same minimum rating ("at least 150 psig"), but I've been unable to find that requirement stated explicitly anywhere. Can you confirm that any attached valves need to meet the 150 psig minimum service pressure?

I do see that for 6.1 Hazard Zone A materials (toxics, basically), CFR 173.40 (c) (1) states that "each plug or valve...be capable of withstanding the test pressure of the cylinder without damage or leakage." This reference to cylinder test pressure (as opposed to service pressure) seems to set a relatively high standard for the attached valves, suggesting that they would have to withstand 3x or more of the actual cylinder service pressure. Is that correct, or was the intent to specify service pressure in this case?

Thank you,

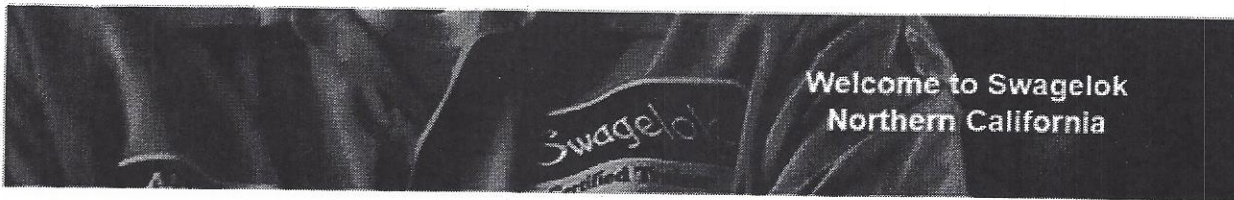
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CFR (/cfr/text) › Title 49 (/cfr/text/49) › Subtitle B (/cfr/text/49/subtitle-B) › Chapter I (/cfr/text/49/chapter-I) › Part 178 (/cfr/text/49/part-178) › Subpart C (/cfr/text/49/part-178/subpart-C) › Section 178.50

## 49 CFR 178.50 - Specification 4B welded or brazed steel cylinders.

eCFR (/cfr/text/49/178.50?qt-cfr\_tabs=0#qt-cfr\_tabs) Authorities (U.S. Code) (/cfr/text/49/178.50?qt-cfr\_tabs=1#qt-cfr\_tabs)

Rulemaking (/cfr/text/49/178.50?qt-cfr\_tabs=2#qt-cfr\_tabs) What Cites Me (/cfr/text/49/178.50?qt-cfr\_tabs=3#qt-cfr\_tabs)

Beta! (/lii/ecfr\_beta) The text on the eCFR tab represents the unofficial eCFR text at [ecfr.gov](http://ecfr.gov).

### § 178.50 Specification 4B welded or brazed steel cylinders.

(a) **Type, size, and service pressure.** A DOT 4B is a welded or brazed steel cylinder with longitudinal seams that are forged lap-welded or brazed and with water capacity (nominal) not over 1,000 pounds and a service pressure of at least 150 but not over 500 psig. Cylinders closed in by spinning process are not authorized.

(b) **Steel.** Open-hearth, electric or basic oxygen process steel of uniform quality must be used. Content percent may not exceed the following: Carbon, 0.25; phosphorus, 0.045; sulphur, 0.050.

(c) **Identification of material.** Material must be identified by any suitable method except that plates and billets for hotdrawn cylinders must be marked with the heat number.

(d) **Manufacture.** Cylinders must be manufactured (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=8bdc6d41890e7cd2bb14f08a0c28946&term\_occur=1&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50) using equipment and processes adequate to ensure that each cylinder produced conforms to the requirements of this subpart. No defect (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=51f8be37857e06aa9d5a242e6c8b1cd0&term\_occur=1&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50) is permitted that is likely to weaken the finished cylinder appreciably. A reasonably smooth and uniform surface finish is required. Exposed bottom welds on cylinders over 18 inches long must be protected by footings. Welding procedures and operators (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=0647def6117826997d6402a64662fd46&term\_occur=1&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50) must be qualified in accordance with CGA Pamphlet C-3 (IBR, see § 171.7 (<https://www.law.cornell.edu/cfr/text/49/171.7>) of this subchapter). Seams must be made as follows:

(1) **Welded or brazed circumferential seams.** Heads attached by brazing must have a driving fit with the shell (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=2568b33a83ea5eed613016527d1d0bb9&term\_occur=2&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50), unless the shell (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=2568b33a83ea5eed613016527d1d0bb9&term\_occur=1&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50) is crimped, swedged, or curled over the skirt or flange (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=76ea16926e9f1de9821c42734c4a8cdb&term\_occur=1&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50) of the head, and be thoroughly brazed until complete penetration by the brazing material of the brazed joint is secured. Depth of brazing from end of shell (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=2568b33a83ea5eed613016527d1d0bb9&term\_occur=3&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50) must be at least four times the thickness of shell (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=2568b33a83ea5eed613016527d1d0bb9&term\_occur=4&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50) metal.

(2) **Longitudinal seams in shells.** Longitudinal seams must be forged lap welded, by copper brazing, by copper alloy brazing, or by silver alloy brazing. Copper alloy composition must be: Copper, 95 percent minimum; Silicon, 1.5 percent to 3.85 percent; Manganese, 0.25 percent to 1.10 percent. The melting point of the silver alloy brazing material must be in excess of 1000 °F. When brazed, the plate edge must be lapped at least eight times the thickness of plate, laps being held in position, substantially metal to metal, by riveting or electric spot-welding; brazing must be done by using a suitable flux and by placing brazing material on one side of seam and applying heat until this material shows uniformly along the seam of the other side.

(e) **Welding or brazing.** Only the attachment of neckrings, footings, handles, bosses, pads, and valve protection rings to the tops and bottoms of cylinders by welding or brazing is authorized. Such attachments and the portion of the container to which they are attached must be made of weldable steel, the carbon content of which may not exceed 0.25 percent except in the case of 4130X steel which may be used with proper welding procedure.

(f) **Wall thickness.** The wall thickness (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=9d631188119ca31df2c14ed1d1260aaf&term\_occur=1&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50) of the cylinder must comply with the following requirements:

(1) For cylinders with outside diameters over 6 inches the minimum wall thickness (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=9d631188119ca31df2c14ed1d1260aaf&term\_occur=2&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50) must be 0.090 inch. In any case, the minimum wall thickness (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=9d631188119ca31df2c14ed1d1260aaf&term\_occur=3&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50)

must be such that calculated wall stress at minimum test pressure (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=ad759af2b6a4c90ae53eda946b42bcb&term\_occur=1&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50)

(paragraph (i)(4) of this section) may not exceed the following values:

(i) 24,000 psi for cylinders without longitudinal seam.

(ii) 22,800 psig for cylinders having copper brazed or silver alloy brazed longitudinal seam.



(iii) 18,000 psi for cylinders having forged lapped welded longitudinal seam.

(2) Calculation must be made by the formula:

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

Where:

S = wall stress in psi;

P = minimum test pressure prescribed for water jacket test or 450 psig whichever is the greater;

D = outside diameter in inches;

d = inside diameter in inches.

(g) **Heat treatment.** Cylinder body and heads, formed by drawing or pressing, must be uniformly and properly heat treated prior to tests.

(h) **Opening in cylinders.** Openings in cylinders must conform to the following:

(1) Each opening in cylinders, except those for safety devices, must be provided with a fitting, boss, or pad, securely attached to cylinder by brazing or by welding or by threads. Fitting, boss, or pad must be of steel suitable for the method of attachment employed, and which need not be identified or verified as to analysis except that if attachment is by welding, carbon content may not exceed 0.25 percent. If threads are used, they must comply with the following:

(i) Threads must be clean cut, even without checks, and tapped to gauge.

(ii) Taper threads to be of length not less than as specified for American Standard taper pipe threads.

(iii) Straight threads, having at least 4 engaged threads, to have tight fit and calculated shear strength at least 10 times the test pressure

(/definitions/index.php?

width=840&height=800&iframe=true&def\_id=fad759af2b6a4c90ae53eda946b42bcb&term\_occur=2&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50) of the cylinder; gaskets required, adequate to prevent leakage.

(iv) A brass fitting may be brazed to the steel boss or flange (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=76ea16926e9f1de9821c42734c4a8c8b&term\_occur=2&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50) on cylinders used as component parts of hand fire extinguishers.

(2) The closure of a fitting, boss, or pad must be adequate to prevent leakage.

(i) **Hydrostatic test.** Cylinders must withstand a hydrostatic test as follows:

(1) The test must be by water-jacket, or other suitable method, operated so as to obtain accurate data. The pressure gauge must permit reading to an accuracy of 1 percent. The expansion gauge must permit reading of total expansion (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=9ac735b4a0448d725d94bb514d8fcc4&term\_occur=1&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50) to an accuracy either of 1 percent or 0.1 cubic centimeter.

(2) Pressure must be maintained for at least 30 seconds and sufficiently longer to ensure complete expansion. Any internal pressure applied after heat-treatment and previous to the official test may not exceed 90 percent of the test pressure (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=fad759af2b6a4c90ae53eda946b42bcb&term\_occur=4&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50).

If, due to failure of the test apparatus, the test pressure (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=fad759af2b6a4c90ae53eda946b42bcb&term\_occur=3&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50) cannot be maintained, the test may be repeated at a pressure increased by 10 percent or 100 psig, whichever is the lower.

(3) Permanent volumetric expansion may not exceed 10 percent of total volumetric expansion at test pressure (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=fad759af2b6a4c90ae53eda946b42bcb&term\_occur=5&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50).

(4) Cylinders must be tested as follows:

(i) At least one cylinder selected at random out of each lot of 200 or less must be tested as outlined in paragraphs (i)(1), (i)(2), and (i)(3) of this section to at least two times service pressure.

(ii) All cylinders not tested as outlined in paragraph (i)(4)(i) of this section must be examined under pressure of at least two times service pressure and show no defect (/definitions/index.php?

width=840&height=800&iframe=true&def\_id=51f8be37857e06aa9d5a242e6c8b1cd0&term\_occur=2&term\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50).

(j) **Flattening test.** After the hydrostatic test, a flattening test must be performed on one cylinder 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, rounded to 1/2-inch radius. The longitudinal axis of the cylinder must be at a 90-degree angle to knife edges during the test. For lots of 30 or less, flattening tests are authorized to be made on a ring at least 8 inches long cut from each cylinder and subjected to same heat treatment as the finished cylinder.

(k) **Physical test.** A physical test must be conducted to determine yield strength, tensile strength, elongation, and reduction of area of material as follows:

(1) The test is required on 2 specimens cut from 1 cylinder, or part thereof heat-treated as required, taken at random out of each lot of 200 or less. For lots of 30 or less, physical tests are authorized to be made on a ring at least 8 inches long cut from each cylinder and subjected to same heat treatment as the finished cylinder.

(2) Specimens must conform to the following:

(i) A gauge length of 8 inches with a width of not over 1 1/2 inches, a gauge length of 2 inches with a width of not over 1 1/2 inches, or a gauge length at least 24 times the thickness with a width not over 6 times the thickness is authorized when a cylinder wall is not over 3/16 inch thick.

(ii) 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.

(iii) When size of 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 specimens are so taken and prepared, the inspector's report must show in connection with record of physical tests detailed information in regard to such specimens.

(iv) Heating of a specimen for any purpose is not authorized.

(3) The yield strength in tension must be the stress corresponding to a permanent strain of 0.2 percent of the gauge length. The following conditions apply:

(i) The yield strength must be determined by either the "offset" method or the "extension under load" method as prescribed in ASTM E 8 (IBR, see § 171.7 (<https://www.law.cornell.edu/cfr/text/49/171.7>) of this subchapter).

(ii) 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 30,000,000. In the event of controversy, the entire stress-strain diagram must be plotted and the yield strength determined from the 0.2 percent offset.

(iii) For the purpose of strain measurement, the initial strain must be set while the specimen is under a stress of 12,000 psi, and strain indicator reading must be set at the calculated corresponding strain.

(iv) Cross-head speed of the testing machine may not exceed 1/8 inch per minute during yield strength determination.

(l) **Acceptable results for physical and flattening tests.** Either of the following is an acceptable result:

(1) An elongation of at least 40 percent for a 2-inch gauge length or at least 20 percent in other cases and yield strength not over 73 percent of tensile strength. In this instance, a flattening test is not required.

(2) When cylinders are constructed of lap welded pipe, flattening test is required, without cracking, to 6 times the wall thickness ([/definitions/index.php?width=840&height=800&iframe=true&def\\_id=9d631188119ca31df2c14ed1d1260aaf&term\\_occur=4&term\\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50](/definitions/index.php?width=840&height=800&iframe=true&def_id=9d631188119ca31df2c14ed1d1260aaf&term_occur=4&term_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50)). In such case, the rings (crop ends) cut from each end of pipe, must be tested with the weld 45° or less from the point of greatest stress. If a ring fails, another from the same end of pipe may be tested.

(m) **Rejected cylinders.** Reheat treatment is authorized for rejected cylinder ([/definitions/index.php?width=840&height=800&iframe=true&def\\_id=e59f069188b967310d2a0dbb0949ddc3&term\\_occur=1&term\\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50](/definitions/index.php?width=840&height=800&iframe=true&def_id=e59f069188b967310d2a0dbb0949ddc3&term_occur=1&term_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50)).

Subsequent thereto, cylinders must pass all prescribed tests to be acceptable. Repair ([/definitions/index.php?width=840&height=800&iframe=true&def\\_id=dbec91207d619b4c33a6286cd57ff9aa&term\\_occur=1&term\\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50](/definitions/index.php?width=840&height=800&iframe=true&def_id=dbec91207d619b4c33a6286cd57ff9aa&term_occur=1&term_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50)) of brazed seams by brazing and welded seams by welding is authorized.

(n) **Markings.** Markings ([/definitions/index.php?width=840&height=800&iframe=true&def\\_id=0b38c26decbe8619dfb323ecb5fc2483&term\\_occur=1&term\\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50](/definitions/index.php?width=840&height=800&iframe=true&def_id=0b38c26decbe8619dfb323ecb5fc2483&term_occur=1&term_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50))

must be stamped plainly and permanently in any of the following locations on the cylinder:

(1) On shoulders and top heads when they are not less than 0.087-inch thick.

(2) On side wall adjacent to top head for side walls which are not less than 0.090 inch thick.

(3) On a cylindrical portion of the shell ([/definitions/index.php?width=840&height=800&iframe=true&def\\_id=2568b33a83ea5eed613016527d1d0bb9&term\\_occur=5&term\\_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50](/definitions/index.php?width=840&height=800&iframe=true&def_id=2568b33a83ea5eed613016527d1d0bb9&term_occur=5&term_src=Title:49:Subtitle:B:Chapter:I:Part:178:Subpart:C:178.50))

which extends beyond the recessed bottom of the cylinder, constituting an integral and non-pressure part of the cylinder.

(4) On a metal plate attached to the top of the cylinder or permanent part thereof; sufficient space must be left on the plate to provide for stamping at least six retest dates; the plate must be at least 1/16-inch thick and must be attached by welding, or by brazing. The brazing rod must melt at a temperature of 1100 °F. Welding or brazing must be along all the edges of the plate.

(5) On the neck, neckring, valve boss, valve protection sleeve, or similar part permanently attached to the top of the cylinder.

(6) On the footing permanently attached to the cylinder, provided the water capacity of the cylinder does not exceed 25 pounds.

[Amdt. 178-114, 61 FR 25942 ([http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname={1996}\\_register&position=all&page=25942](http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname={1996}_register&position=all&page=25942)), May 23, 1996, as amended at 62 FR 51561 ([http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname={1997}\\_register&position=all&page=51561](http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname={1997}_register&position=all&page=51561)), Oct. 1, 1997; 66 FR 45385 ([http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname={2001}\\_register&position=all&page=45385](http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname={2001}_register&position=all&page=45385)), 45388, Aug. 28, 2001; 67 FR 51653 ([http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname={2002}\\_register&position=all&page=51653](http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname={2002}_register&position=all&page=51653)), Aug. 8, 2002; 68 FR 75748 ([http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname={2003}\\_register&position=all&page=75748](http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname={2003}_register&position=all&page=75748)), Dec. 31, 2003]

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### **§ 173.40 General packaging requirements for toxic materials packaged in cylinders.**

When this section is referenced for a Hazard Zone A or B hazardous material elsewhere in this subchapter, the requirements in this section are applicable to cylinders used for that material.

#### **(a) Authorized cylinders.**

(1) A cylinder must conform to a DOT specification or a UN standard prescribed in subpart C of part 178 of this subchapter, except that acetylene cylinders and non-refillable cylinders are not authorized. The use of UN tubes and MEGCs is prohibited for Hazard Zone A materials.

(2) The use of a specification 3AL cylinder made of aluminum alloy 6351-T6 is prohibited for a Division 2.3 Hazard Zone A material or a Division 6.1 Hazard Zone A material.

(3) A UN composite cylinder certified to ISO-11119-3 is not authorized for a Division 2.3 Hazard Zone A or B material.

(4) For UN seamless cylinders used for Hazard Zone A materials, the maximum water capacity is 85 L.

**(b) Outage and pressure requirements.** For DOT specification cylinders, the pressure at 55 °C (131 °F) of Hazard Zone A and 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).

**(c) Closures.** Each cylinder containing a Hazard Zone A material must be closed with a plug or valve conforming to the following:

(1) Each plug or valve must have a taper-threaded connection directly to the cylinder and be capable of withstanding the test pressure of the cylinder without damage or leakage. For UN pressure receptacles, each valve must be capable of withstanding the test pressure of the pressure receptacle and be connected directly to the pressure receptacle by either a taper thread or other means which meets the requirements of ISO 10692-2: (IBR, see § 171.7 of this subchapter).

(2) Each valve must be of the packless type with non-perforated diaphragm, except that, for corrosive materials, a valve may be of the packed type with an assembly made gas-tight by means of a seal cap with gasketed joint attached to the valve body or the cylinder to prevent loss of material through or past the packing.