



CGA P-15—2022

STANDARD FOR THE FILLING OF NONFLAMMABLE COMPRESSED GAS CYLINDERS

SIXTH EDITION

This document licensed for the sole use of the purchaser. It may not be shared with any other person or used after the expiration date without the express written permission of the CGA. Any unauthorized use, reproduction, distribution, or modification of this printed page will result in a \$5,000 liquidated damages fee plus loss of access to CGA publications for one year for your company.

Full document details: CGA P-15-2022



Documents
Document Sharing Hub

PLEASE NOTE:

The information contained in this document was obtained from sources believed to be reliable and is based on technical information and experience currently available from members of the Compressed Gas Association, Inc. and others. However, the Association or its members, jointly or severally, make no guarantee of the results and assume no liability or responsibility in connection with the information or suggestions herein contained. Moreover, it should not be assumed that every acceptable commodity grade, test or safety procedure or method, precaution, equipment or device is contained within, or that abnormal or unusual circumstances may not warrant or suggest further requirements or additional procedure.

This document is subject to periodic review, and users are cautioned to obtain the latest edition. The Association invites comments and suggestions for consideration. In connection with such review, any such comments or suggestions will be fully reviewed by the Association after giving the party, upon request, a reasonable opportunity to be heard. Proposed changes may be submitted via the Internet at our website, www.cganet.com.

This document should not be confused with federal, state, provincial, or municipal specifications or regulations; insurance requirements; or national safety codes. While the Association recommends reference to or use of this document by government agencies and others, this document is purely voluntary and not binding unless adopted by reference in regulations.

A listing of all publications, audiovisual programs, safety and technical bulletins, and safety posters is available via the Internet at our website at www.cganet.com. For more information contact CGA at Phone: 703-788-2700, ext. 799. E-mail: customerservice@cganet.com.

Work Item 20-011
Safety and Health Committee

NOTE—Technical changes from the previous edition are underlined.

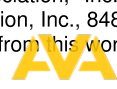
NOTE—Appendix A (Informative) is for information only.

NOTE—Appendices B and C (Normative) are a requirement.

SIXTH EDITION: 2022
FIFTH EDITION: 2016
FOURTH EDITION: 2005
THIRD EDITION: 1999

© 2022 The Compressed Gas Association, Inc. All rights reserved.

All materials contained in this work are protected by United States and international copyright laws. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical including photocopying, recording, or any information storage and retrieval system without permission in writing from The Compressed Gas Association, Inc. All requests for permission to reproduce material from this work should be directed to The Compressed Gas Association, Inc., 8484 Westpark Drive, Suite 220, McLean, VA 22102. You may not alter or remove any trademark, copyright or other notice from this work.

 **Documents**
Document Sharing Hub

Contents	Page
1 Introduction.....	1
2 Scope	1
3 Definitions.....	1
4 Cylinder specifications.....	4
5 Prefill inspection of compressed gas cylinders.....	5
5.1 Visual inspection.....	5
5.2 Cylinder markings.....	6
5.3 Valve inspection	11
5.4 Hammer (dead ring) test (for steel cylinders only).....	12
5.5 Testing for internal contaminants	13
6 Cylinder labeling	14
7 Cylinder filling	14
7.1 Preparation for cylinder filling	14
7.2 Venting of residual gas	15
7.3 Cylinder filling of nonflammable, nonliquefied compressed gases	16
7.4 Cylinder filling of nonflammable, liquefied compressed gases	19
8 Quality control	21
8.1 Analytical testing.....	21
8.2 General considerations.....	21
8.3 Analytical program for medical gas products.....	21
8.4 Analytical program for food gas products	22
8.5 Analytical program for breathing air.....	22
9 References	22
Figures	
Figure 1—Example of UN steel cylinder required markings	7
Figure 2—Example of UN aluminum alloy cylinder required markings	7
Figure 3—Example of DOT/TC steel cylinder required markings	8
Figure 4—Example of DOT/TC aluminum alloy cylinder required markings	8
Figure 5—Example of composite cylinder required markings	9
Appendices	
Appendix A—Example of high pressure and liquefied cylinder fill checklist for use by gas suppliers (Informative).....	25
Appendix B—Temperature-pressure filling charts—U.S. customary units (Normative)	26
Appendix C—Temperature-pressure filling chart—Metric (Normative)	31
Appendices Tables	
Table B-1—Compressed air temperature-pressure filling chart.....	26
Table B-2—Argon temperature-pressure filling chart.....	27
Table B-3—Helium temperature-pressure filling chart	28
Table B-4—Nitrogen temperature-pressure filling chart.....	29
Table B-5—Oxygen temperature-pressure filling chart.....	30
Table C-1—Compressed air temperature-pressure filling chart.....	31
Table C-2—Argon temperature-pressure filling chart	32
Table C-3—Helium temperature-pressure filling chart.....	33
Table C-4—Nitrogen temperature-pressure filling chart	34
Table C-5—Oxygen temperature-pressure filling chart.....	35

1 Introduction

Compressed gas cylinders are filled and used each day without incident and have been for many years. There is no reason why cylinders cannot be filled safely and be safe for consumers to use if procedures are followed that recognize and control the possible hazards associated with the filling and use of compressed gas cylinders.

The filling of compressed gas cylinders requires complying with all applicable federal, state, provincial, and local regulations. Personnel shall be familiar with these regulatory requirements. In addition to the requirements for industrial gases, medical and food gases require compliance with additional regulations. These requirements are addressed in other CGA publications.

2 Scope

This publication describes the recommended industry practices and precautionary measures for filling certain liquefied and nonliquefied, nonflammable industrial, medical, and food gas cylinders not exceeding 125 lb (57 kg) water capacity. It should not be assumed that every safety precaution is included here.

This publication only covers the filling of DOT 3A, DOT 3AA, DOT 3AL, TC 3AM, TC 3AAM, TC 3ALM, authorized United Nations (UN) equivalents for these cylinders, and composite cylinders with the following gases: air, argon, carbon dioxide, helium, nitrogen, nitrous oxide, and oxygen.

This publication does not cover equipment design specifications to perform these filling operations.

This publication does not address automated or palletized cylinder filling operations or the filling of cylinders that are clustered or bundled.

This publication does not cover the filling of the following cylinders:

- Insulated refrigerated liquid cylinders such as DOT 4L and home cryogenic oxygen base units, with cryogenic liquids or refrigerated liquids. The filling of these cylinders is addressed in other CGA publications;
- Portable high pressure cylinders from other high pressure cylinders, either gas to gas (e.g., oxygen) or liquefied compressed gas to liquefied compressed gas (e.g., carbon dioxide), commonly known as transfilling; and
- Portable high pressure cylinders from home oxygen concentrators.

This publication does not cover the filling of:

- gas mixtures of any type, including reconstituted or blended air used for breathing or other purposes; and
- flammable, specialty, or liquefied petroleum gases that require additional procedures and special precautions to be taken.

3 Definitions

For the purpose of this publication, the following definitions apply.

3.1 Publication terminology

3.1.1 Shall

Indicates that the procedure is mandatory. It is used wherever the criterion for conformance to specific recommendations allows no deviation.

3.1.2 Should

Indicates that a procedure is recommended.

3.1.3 May

Indicates that the procedure is optional.

3.1.4 Will

Is used only to indicate the future, not a degree of requirement.

3.1.5 Can

Indicates a possibility or ability.

3.2 Technical definitions**3.2.1 Certificate of analysis (COA)**

Document supplied by the manufacturer that lists the specific analytical results of a shipment of product.

3.2.2 Condemned

Cylinder no longer fit for service and for which rework is not allowed.

3.2.3 Cylinder owner

Business or individual holding the legal title for the container(s).

3.2.4 Cylinder

Pressure vessel having a circular cross section of 454 kg (1000 lb) water capacity or less designed for pressures higher than 40 psia and constructed in accordance with DOT or TC specifications [1, 2].¹

3.2.5 Equivalency Certificate

Approved variances to Transport Canada's (TC's) *Transportation of Dangerous Goods (TDG) Regulations*.

NOTE—Equivalency certificates were formerly called permit for equivalent level of safety. See TC's *Transportation of Dangerous Goods (TDG) Regulations* (for example, TC-SU 1234) [2].

3.2.6 Fill density

Percent ratio of the weight of gas in a packaging to the weight of water that container will hold at 60 °F (16 °C) (1 lb of water = 27.737 in³ at 60 °F).

NOTE—In CSA B340, *Selection and use of cylinders, spheres, tubes and other containers for the transportation of dangerous goods, Class 2*, the reference temperature is 15 °C [3]. See DOT regulations given in Title 49 of the U.S. *Code of Federal Regulations* (49 CFR) Part 173.304a, or in Canada consult CSA B340 [1, 3].

3.2.7 Food gas

Gases, alone or in combination with other gases, that are foods as defined in the United States by 201(f) of the *Federal Food, Drug and Cosmetic Act*, or used as ingredients, processing aids, propellants, or temperature control/packaging agents defined as a food additive by 201(s) of the *Federal Food, Drug and Cosmetic Act*. Food gases are additives as defined in the *Canadian Food and Drug Regulations*, Part B, Division 16 [4, 5].

3.2.8 Gross weight

Weight of an empty cylinder and valve assembly plus the weight of the product filled.

NOTE—This is the cylinder tare weight added to the contents weight without the hose attached.

3.2.9 Industrial gas

Term generally applied to those commodity gases used for a wide variety of processes other than medical or food.

3.2.10 Legal fill weight

Maximum allowable weight of the liquefied gas product based on the fill density prescribed by 49 CFR 173.304a or CSA B340 [3, 2].

¹ References are shown by bracketed numbers and are listed in order of appearance in the reference section.

3.2.11 Mass weight (M)

Weight of the cylinder only, does not include the valve or any other attachments or contents.

NOTE—For example, cylinders manufactured after 2002 will be marked M-??-lb (XX kg), where ?? equals the mass weight in pounds and XX equal the mass weight in kilograms.

3.2.12 Medical gas

Gas alone or in combination with other gases that is a drug or device as defined in the U.S. by the Federal *Food, Drug, and Cosmetic Act*, 21 USC 321(g)(1) or 321(h) [4]. In Canada, medical gas means any gas or mixture of gases manufactured, sold, or represented for use as a drug per C.02.002 of the Food and Drug Regulations [5].

3.2.13 Nonflammable compressed gas

Any material (or mixture) that:

- exerts in the packaging a pressure of 200 kPa (29.0 psi) or greater at 20 °C (68 °F), is a liquefied gas or is a cryogenic liquid;² and
- does not meet the definition of a flammable gas or poisonous gas [1].

NOTE—These limits are determined at 101.3 kPa (14.7 psia) of pressure and a temperature of 20 °C (68 °F).

3.2.14 Pigtail

High pressure rigid tubing or flexible hose used to transfer gas media between cylinders, manifolds, and equipment such as regulators.

NOTE—The term pigtail originally comes from rigid leads that have one or two loops and look like a pig's tail.

3.2.15 Reject

Determination that a cylinder is not permitted to be filled or used for transportation of dangerous goods without repair, requalification, etc.

3.2.16 Requalification

Mandated periodic hydrostatic or ultrasonic (UE) reinspection requirement for cylinders given in 49 CFR 180 or CSA B339, *Cylinders, Spheres, and Tubes for the Transportation of Dangerous Goods* [3, 7].

NOTE—Also known as retest. This activity includes visual inspection, a test (e.g., a hydrostatic pressure test, UE, etc.), record keeping, allowable repair(s) if any, and marking.

3.2.17 Retest date

Date that the cylinder was last retested or requalified.

NOTE—This date is usually stamped directly onto the cylinder although there are exceptions in certain cases for thin walled cylinders such as composite or fiber wrapped cylinders.

3.2.18 Service pressure

Rated pressure at reference temperature as permanently indicated on the cylinder.

NOTE—For example, for cylinders marked “DOT” or “CTC 3AA 2265,” the service pressure is 2265 psi at 70 °F (21.1 °C). For metricated Canadian cylinders the service pressure on a cylinder marked “TC 3AAM 174” is 174 bar (17.4 MPa) at 15 °C.

3.2.19 Special permit

Approved variances to U.S. DOT 49 CFR requirements.

NOTE—Formerly called exemptions. See 49 CFR Part 107, Subpart B [1].

² kPa shall indicate gauge pressure unless otherwise noted as (kPa, abs) for absolute pressure or (kPa, differential) for differential pressure. All kPa values are rounded off per CGA P-11, *Guideline for Metric Practice in the Compressed Gas Industry* [9].

3.2.20 Tare weight (T)Weight of an empty cylinder and associated valve components.

NOTE—This is marked as the T weight, on the current TC cylinder. For example, cylinders manufactured after 2002 will be marked T-??-lb (XX kg), where ?? equals the tare weight in pounds and XX equal the tare weight in kilograms. $T = M + \text{Valve and other permanent attachments (excluding removable caps)}$.

3.2.21 Test date

Date stamped or otherwise marked by the manufacturer to indicate the original date of qualification.

3.2.22 Test pressure

Minimum pressure at which a cylinder shall be tested as prescribed in the specifications for compressed gas cylinders by DOT or TC [1, 2].

4 Cylinder specifications

Industrial, medical, and food gases are used, stored, and transported in commerce in high pressure cylinders, tubes, and liquid cylinders. Compressed gas cylinders, when constructed according to applicable DOT, TC, or UN specifications and maintained in accordance with DOT or TC hazardous material regulations, can be considered safe for the purpose for which they are intended. Do not use any cylinders not specified or approved for transportation by the DOT or TC.

At the time of publication of this standard, there is a reciprocity agreement between the United States and Canada that permits the use of DOT specification cylinders (DOT, ICC) in Canada and TC specification cylinders (CRC, CTC, BTC) in the United States. Cylinder requalification is also addressed in the reciprocity agreement. See 49 CFR 180 or CSA B339 [1, 7].

The most common DOT/TC/UN specifications for high pressure compressed gas cylinders are:

- DOT 3A/3AA—This is a seamless steel cylinder with a (nominal) water capacity not over 1000 lb (454 kg) and a service pressure of at least 150 psi (10 bar). Typically, 3A are constructed of manganese steel and 3AA are constructed of chrome molybdenum;
- TC 3AM—This is a seamless carbon steel, carbon manganese steel, or intermediate manganese steel cylinders with a minimum service pressure of 1.0 MPa (150 psi);
- TC 3AAM—This is a seamless alloy steel cylinder with a minimum service pressure of 1.0 MPa (150 psi);
- DOT 3AL/TC 3ALM—This is a seamless aluminum cylinder, not over 1000 lb (464 kg) water capacity (nominal) and a service pressure of at least 150 psi (10 bar). This cylinder is made of specific aluminum alloys.
- Composite/fiber reinforced high pressure cylinder—These cylinders are produced by the application of resin-impregnated, high strength continuous fibers over an inner liner (metallic or polymer). These cylinders typically have a higher pressure rating than traditional high pressure cylinders. Specifications include TC 3FCM, TC 3CCM, TC 3HWM, and UN ISO 11119-1, -2, -3, and -4.
- UN ISO 9809-1, -2, -3, and -4 are refillable seamless steel gas cylinders:
 - UN ISO 9809-1 are quenched and tempered steel cylinders with a tensile strength less than 1100 MPa
 - UN ISO 9809-2 are quenched and tempered steel cylinders with a tensile strength greater than or equal to 1100 MPa
 - UN ISO 9809-3 are normalized steel cylinders
 - UN ISO 9809-4 are stainless steel cylinders with a tensile strength less than 1100 MPa; and
- UN ISO 7866 are refillable aluminum alloy cylinders.

5 Prefill inspection of compressed gas cylinders

Prefill qualification of cylinders is a necessary step in all filling operations to ensure the cylinder is safe for continued use. Prefill qualification of compressed gas cylinders is required by DOT in 49 CFR Parts 100-185 and by TC in the *TDG Regulations* [1, 2, 3, 8].

Prefill qualification for medical and food gases is also required by U.S. Food and Drug Administration (FDA), various state agencies, and by Health Canada. See CGA M-2, *General Guide for the Manufacture of Medical Gases Classified as Drugs*, for further information [8].

Each time a cylinder is presented for filling, the following steps shall be performed by a qualified trained technician, unless indicated as not applicable for a type of cylinder, valve, or gas product:

- visual inspection as described in 5.1;
- cylinder markings inspection as described in 5.2;
- valve inspection as described in 5.3;
- odor test as described in 5.5.1; and
- labeling as described in Section 6.

Additional inspection requirements such as the hammer test described in 5.4 may be specified in a filling company's standard operating procedures (SOP).

Any cylinders failing to pass the inspection criteria shall be rejected, marked with the deficiency and/or the repairs to be made, and removed from service for further inspection and maintenance in accordance with the filling company's SOP.

5.1 Visual inspection

5.1.1 Cleanliness

Inspect each cylinder for cleanliness. Cylinders should not be externally contaminated such that internal or external deterioration can occur from the contaminant such as grease, biohazards, or hydrocarbon material. If contamination is evident on the cylinder or the valve, the cylinder shall be rejected and either cleaned or condemned in accordance with the filling company's SOP.

Specifically, oxidizing gas cylinders contaminated with a hydrocarbon substance on the valve or cylinder surfaces shall be cleaned before being filled in accordance with CGA G-4.1, *Cleaning of Equipment for Oxygen Service* [9].

Remove dirt, loose paint, adhesive tape, old lot numbers, or unauthorized labels in accordance with the filling company's SOP.

For information on cleaning externally contaminated medical gas cylinders, see CGA P-83, *Guidelines for Cleaning Externally Contaminated Medical Gas Containers* [10].

5.1.2 Damage

Each steel cylinder shall be inspected to ensure the cylinder is free of arc burns and evidence of exposure to fire or excessive heat. It should also be inspected for cuts, digs, gouges, dents, corrosion, and pitting or evidence that the cylinder has had unauthorized repairs to disguise damage or been modified to be used for illegal purposes. Flat-bottom cylinders shall stand upright without leaning. Cylinders should not be bulged, out of round, bowed, or have other defects. CGA C-6, *Standard for Visual Inspection of Steel Compressed Gas Cylinders*, shall be used for determining external damage [11].

Each aluminum alloy cylinder shall be carefully inspected to ensure the cylinder is free of evidence of exposure to fire or excessive heat, cuts, digs, gouges, dents, and corrosion. Flat-bottom cylinders shall stand upright without leaning. Cylinders should not be bulged, out of round, bowed, or have other defects. When aluminum alloy

cylinders have a heat-indicating system, inspect the cylinder for indications of heat impingements or exposures in accordance with the heat indicating system's requirements. See CGA C-28, Guideline for Heat Exposure Indicating Systems on Aluminum Alloy Cylinders [11]. CGA C-6.1, *Standard for Visual Inspection of High Pressure Aluminum Alloy Compressed Gas Cylinders*, shall be used for determining external damage [12].

Composite cylinders shall be further inspected for loss of resin, broken fibers, lifting of fibers from the surface, loose fibers, or areas where there is a "frost" appearance in the composite material larger than half a square inch. CGA C-6.2, *Standard for Visual Inspection and Requalification of Fiber Reinforced High Pressure Cylinders*, shall be used for determining external damage [13].

Cylinders with suspected defects shall be removed from service for further evaluation, remediation, or condemnation.

5.1.3 Neckring inspection

Cylinders with neckrings shall be examined to ensure that the threads are not damaged and the neckring is firmly attached to the cylinder.

5.1.4 Paint condition

In accordance with the filling company's SOP, inspect the cylinder for appropriate paint condition. Aluminum alloy cylinders are often only painted on the shoulder. Medical cylinders shall be color coded in accordance with CGA C-9, *Standard Color Marking of Compressed Gas Containers for Medical Use* [15].

5.2 Cylinder markings

Information stamped directly onto the cylinder is regulated by authorities such as DOT, TC, and others. Each required marking on a cylinder shall be maintained so that it is legible. Additional information may be stamped on the cylinder as long as it does not affect the required markings. No stamps or indentation may be made on the sidewall of the cylinder unless specifically permitted in the applicable specification. Most markings on cylinders shall not be altered or removed. Unless allowed by regulatory requirements, a cylinder with altered required markings cannot be filled. Alterations, including changes to the service pressure, shall be verified in accordance with the filling company's SOP prior to fill.

In lieu of stamped markings, composite cylinders shall utilize a label with the required markings. Special permit cylinders often require the application of an additional marking, such as a sticker, identifying the exemption being complied with.

See Figure 1 for an example of markings for a UN steel cylinder.

See Figure 2 for an example of markings for a UN aluminum alloy cylinder.

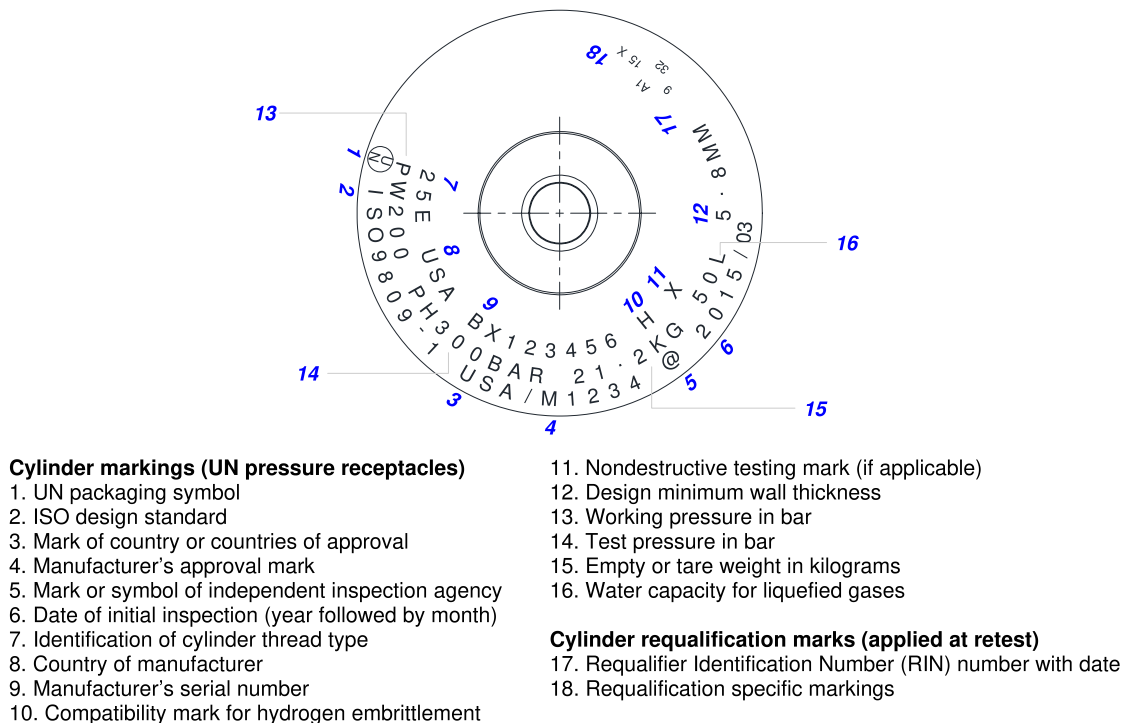
See Figure 3 for an example of markings for a DOT/TC steel cylinder.

See Figure 4 for an example of markings for a DOT/TC aluminum alloy cylinders.

See Figure 5 for an example of a label for a composite cylinder.

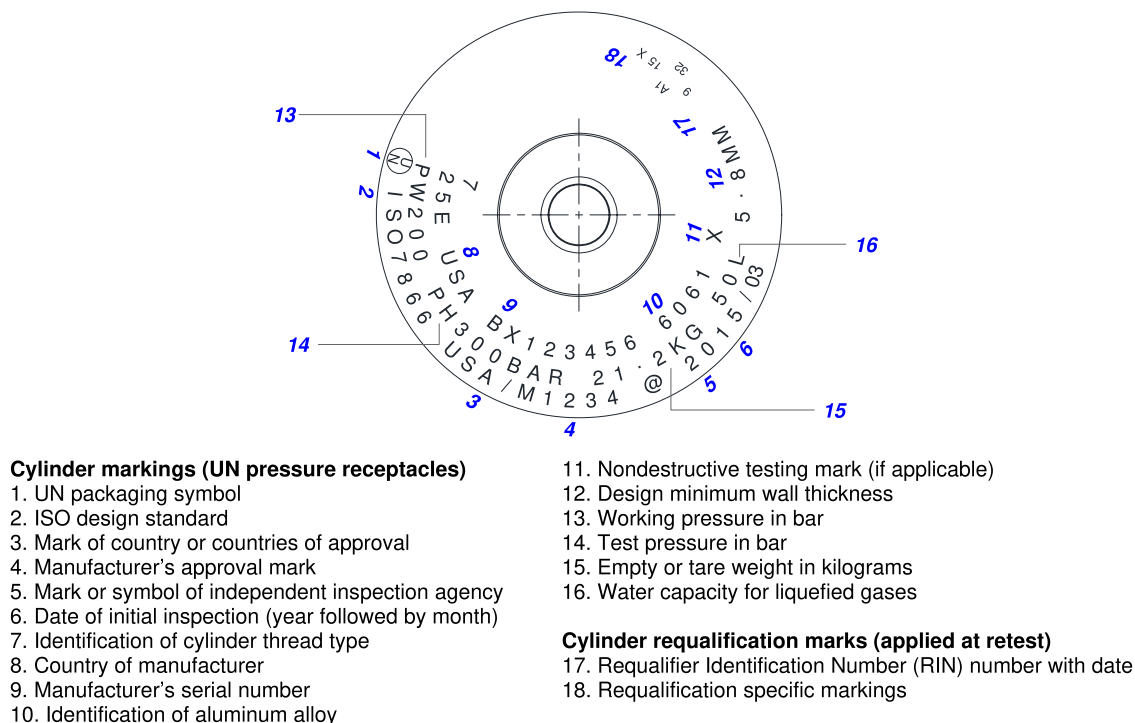
5.2.1 Cylinder ownership

Determine the cylinder's ownership before filling. 49 CFR 173.301 and CSA B340 state that cylinders shall not be filled for shipment except by the owner or with the owner's consent [1, 3].



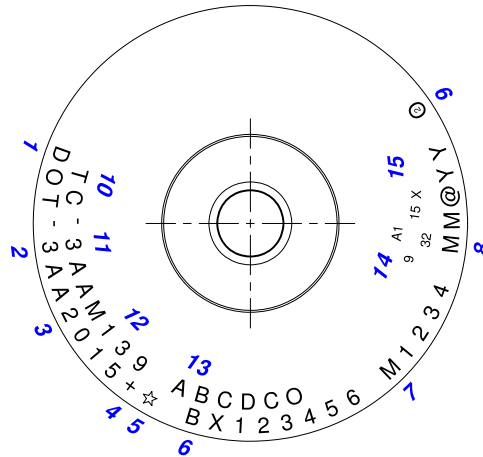
NOTE—Other markings are authorized provided they do not conflict with the regulatory markings.

Figure 1—Example of UN steel cylinder required markings



NOTE—Other markings are authorized provided they do not conflict with the regulatory markings.

Figure 2—Example of UN aluminum alloy cylinder required markings



Cylinder markings (DOT)

1. U.S. regulatory body
2. Design specification designation
3. Service pressure (psi)
4. 10% overfill marking
5. Ten-year retest mark
6. Manufacturer serial number
7. Manufacturer DOT authorization 'M' code
8. Original hydro test date with independent inspectors mark
9. Cleaned for oxygen use (optional marking where applicable)

Cylinder markings (TC)

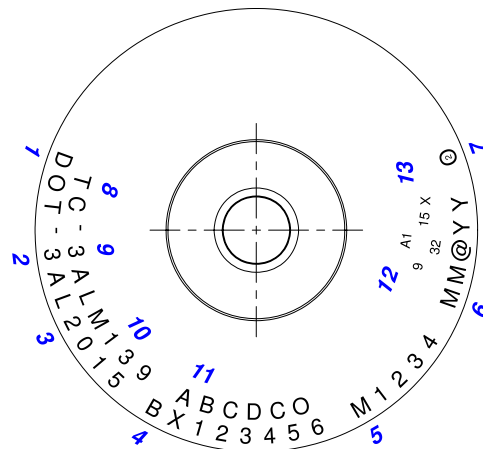
10. Canadian regulatory body
11. Design specification designation
12. Service pressure (bar)
13. Manufacturer

Cylinder requalification marks (applied at retest)

14. Requalifier Identification Number (RIN) number with date
15. Requalification specific markings

NOTE—Other markings are authorized provided they do not conflict with the regulatory markings.

Figure 3—Example of DOT/TC steel cylinder required markings



Cylinder markings (DOT)

1. U.S. regulatory body
2. Design specification designation
3. Service pressure (psi)
4. Manufacturer serial number
5. Manufacturer DOT authorization 'M' code
6. Original hydro test date with independent inspector's mark
7. Cleaned for oxygen use (optional marking where applicable)

Cylinder markings (TC)

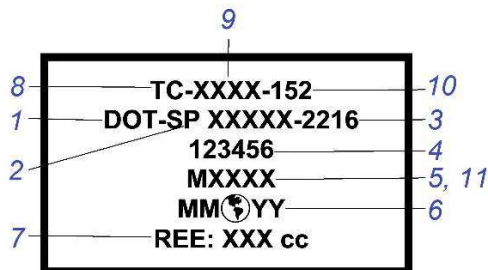
8. Canadian regulatory body
9. Design specification designation
10. Service pressure (bar)
11. Manufacturer

Cylinder requalification marks (applied at retest)

12. Requalifier Identification number (RIN) number with date
13. Requalification specific markings

NOTE—Other markings are authorized provided they do not conflict with the regulatory markings.

Figure 4—Example of DOT/TC aluminum alloy cylinder required markings

**Cylinder markings (DOT)**

1. U.S. regulatory body
2. Special permit (optional marking where applicable)
3. Service pressure (psi)
4. Manufacturer serial number
5. Manufacturer DOT authorization 'M' code
6. Original test date with independent inspector's mark
7. Rejection elastic expansion

Cylinder markings (TC)

8. Canadian regulatory body
9. Equivalency certificate (optional marking where applicable)
10. Service pressure (bar)
11. Manufacturer

NOTE—Other markings are authorized provided they do not conflict with the regulatory markings.

Figure 5—Example of composite cylinder required markings

5.2.2 Transportation authority/cylinder specification/service pressure

Inspect each cylinder for the transportation authority marking. For DOT, the marking is “DOT”; for Transport Canada, it is “TC.” On older cylinders the markings ICC may be found, which is allowed and stands for the U.S. Interstate Commerce Commission and CTC may be found, which is allowed and stands for Canadian Transportation Commission. Only DOT-, TC-, ICC-, and CTC-marked cylinders are permitted in the United States, unless the cylinder is manufactured to a UN standard and authorized for use in the United States.

For UN cylinders, inspect the cylinder for a “USA” country of approval marking, stamped on the cylinder, to be acceptable for transport to, from, or within the United States.

5.2.2.1 DOT specification cylinders

Inspect the cylinder authority specification stamp marking. Allowable markings for cylinders included in this publication are DOT 3A or DOT 3AA (for cylinders made of steel) and DOT 3AL (for cylinders made of aluminum alloy). Composite/fiber reinforced high pressure cylinder are marked with SP-[X], where the [X] is the special permit number issued to the cylinder manufacturer by DOT.

Equivalent cylinders to the previously mentioned specifications with the prefix ICC, which indicates U.S. Interstate Commerce Commission that predated DOT, may also be filled.

5.2.2.2 TC specification cylinders

5.2.2.2.1 Cylinders manufactured on or after 1 January 1993

Inspect the cylinder authority specification stamp marking. Cylinders in Canada shall meet the requirements set out in section 5.10 of the *TDG Regulations* [2]. This section requires that cylinders manufactured beginning 1 January 1993 shall be manufactured in accordance with CSA B339, *Cylinders, spheres, and tubes for the transportation of dangerous goods*, i.e., the markings indicate the cylinder has been manufactured to a TC recognized specification. Cylinders in accordance with CSA B339 are commonly referred to as “TC approved” cylinders [7]. This is indicated by a “TC” preceding the specification, i.e., TC-3AAM, TC-3-ALM, etc. The cylinders shall also be selected and used in accordance with CSA B340 [3].