



CGA C-6—2022
STANDARD FOR VISUAL
INSPECTION OF STEEL
COMPRESSED GAS
CYLINDERS

THIRTEENTH EDITION

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 24-014
Cylinder Specifications Committee

NOTE—Technical changes from the previous edition are underlined.

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

THIRTEENTH EDITION: 2022
TWELFTH EDITION: 2019
ELEVENTH EDITION: 2013
TENTH EDITION: 2007

© 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.

Contents	Page
1 Introduction.....	1
2 Scope	1
3 Definitions.....	2
4 Inspection equipment	6
4.1 Depth gauges, metallic scales, etc.	6
4.2 Ultrasonic devices	7
4.3 Magnetic particle inspection	7
4.4 Penetrant inspection materials	7
4.5 Weight scales	7
5 Markings.....	7
6 Low pressure cylinders exempt from pressure testing	7
6.1 Preparation for inspection	7
6.2 Exterior inspection	7
6.3 Inspection report.....	15
7 Low pressure cylinders subject to pressure testing.....	16
7.1 Preparation for inspection	17
7.2 Internal inspection	17
8 High pressure cylinders.....	17
8.1 Preparation for inspection	17
8.2 Hammer test.....	17
8.3 Exterior inspection.....	18
8.4 Internal inspection	26
9 References	26
10 Additional references.....	27

Figures

Figure 1—Crevice corrosion near the cylinder footing.....	2
Figure 2—Crevice corrosion (cutaway view).....	3
Figure 3—General corrosion with pitting	3
Figure 4—General corrosion with pitting on cylinder wall	3
Figure 5—Isolated pitting	4
Figure 6—Line corrosion.....	4
Figure 7—Measuring the length of a dent.....	5
Figure 8—Relative pitted depth corrosion loss	9
Figure 9—Bulged cylinder on left, normal cylinder on right.....	13
Figure 10—Cylinder section with removable boot on left; cylinder section with permanent boot on right (cutaway side view).....	16
Figure 11—Cylinder section with removable boot on left; cylinder section with permanent boot on right (cutaway bottom view).....	16
Figure 12—Inspection requirements for corrosion limits.....	18
Figure 13a—Evaluation of pit diameters for an isolated pit.....	20
Figure 13b—Evaluation of pit diameters for isolated pits.....	20
Figure 14a—Evaluation of cluster pitting that may be considered an isolated pit.....	21
Figure 14b—Evaluation of cluster pitting that shall be considered an area of general corrosion	21
Figure 15—Bulged fire-damaged cylinder.....	23
Figure 16—Example of an attachment.....	24
Figure 17—Example of an attachment (cylinder with a removable boot).....	25
Figure 18—Example of an attachment.....	25

Tables

Table 1—DOT minimum allowable design thickness (t_d) for common sizes of low pressure cylinders 10
Table 2—TC minimum allowable design thickness (t_d) for common sizes of low pressure cylinders 11
Table 3—Factors for calculation of minimum allowable design thickness (t_d) for DOT-3A and DOT-3AA
high pressure cylinders 19

Appendix

Appendix A—Sample visual inspection report form (which may be used for
cylinder requalification) (Informative) 28

1 Introduction

Title 49 of the U.S. *Code of Federal Regulations* (49 CFR), Parts 100-180, Hazardous Materials Regulations of the U.S. Department of Transportation (DOT) as well as the regulations of Transport Canada (TC) require that a cylinder is condemned when it leaks, when there is internal or external corrosion, denting, bulging, or when evidence of rough usage exists to the extent that the cylinder is likely to be weakened appreciably [1].¹ Until 1970, U.S. regulations applicable to compressed gas cylinders were under the authority of the Interstate Commerce Commission (ICC). Therefore, older cylinders can be identified by an ICC stamping. Such cylinders are now regulated according to DOT requirements.

NOTE—Under prescribed conditions of use, a formal visual inspection has been authorized in lieu of the periodic pressure requalification for certain low pressure cylinders used for noncorrosive gas service. See 49 CFR 180.209 for DOT requirements or Clause 24 of CSA B339, *Cylinders, spheres, and tubes for the transportation of dangerous goods*, for TC requirements [1, 2]. For further information on pressure requalification test methods, see CGA C-1, *Methods for Pressure Testing Compressed Gas Cylinders and Tubes* [3].

NOTE—Wherever reference is made to DOT regulations, similar requirements can be found in TC regulations. Older cylinders can be marked CTC, BTC, or CRC.

2 Scope

This standard provides cylinder users (requalifiers, owners, fillers, operators, etc.) with criteria to accept, reject, and condemn steel compressed gas cylinders. This standard does not cover all circumstances for each individual cylinder type and condition of lading.

NOTE—Special permit cylinders may contain their own visual inspection criteria in the special permit. Equivalency certificate cylinders may contain their own visual inspection criteria in the equivalency certificate.

In situations where a particular cylinder design type is not covered by this standard, users shall modify their inspection procedures. If a particular compressed gas service has unique detrimental effects on a cylinder's internal or external condition, these shall also be considered by the user.

Experience in the inspection of cylinders is an important factor in determining the acceptability of a given cylinder for continued service. Users lacking this experience who have questionable cylinders should return them to a manufacturer of the same type of cylinders or to a competent requalification agency for re-inspection.

Suggestions contained in this standard do not apply to cylinders manufactured under specification DOT-3HT, CTC-3HT, or TC-3HTM. Because of the special provisions of this specification, separate recommendations covering service life and standards for visual inspection of these cylinders are contained in CGA C-8, *Standard for Requalification of DOT-3HT, CTC-3HT, and TC-3HTM Seamless Steel Cylinders* [4].

For cylinders manufactured under specification DOT-8, DOT-8AL, CTC-8, CTC-8AL, CTC-8WC, TC-8WM, or TC-8WAM, see CGA C-13, *Standard for Periodic Visual Inspection and Requalification of Acetylene Cylinders* [5].

For aluminum alloy cylinders, see CGA C-6.1, *Standard for Visual Inspection of High Pressure Aluminum Alloy Compressed Gas Cylinders*; CGA C-6.2, *Standard for Visual Inspection and Requalification of Fiber Reinforced High Pressure Cylinders*; and CGA C-6.3, *Standard for Visual Inspection of Low Pressure Aluminum Alloy Compressed Gas Cylinders* [6, 7, 8].

Inspection procedures include preparation of cylinders for inspection, exterior inspection, interior inspection (if required), nature and extent of damage to be looked for, and tests that indicate the conditions of the cylinder, etc. A sample inspection report for low pressure cylinders exempt from pressure testing is shown in Appendix A. This sample inspection report may be revised to suit user or regulatory requirements.

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