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CGA C-10—2019

**GUIDELINE TO PREPARE
CYLINDERS AND TUBES FOR
GAS SERVICE AND
CHANGES IN GAS SERVICE**

SIXTH EDITION

CGA

Compressed Gas Association

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NOTE—Technical changes from the previous edition are underlined.

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

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1 Introduction

This publication has been prepared as a guide to assist those persons establishing procedures for changing cylinders from one gas service to another. It is necessary that this guide is general in nature, although some specific recommendations are included, particularly regarding seamless steel and welded steel cylinders. It is assumed that persons using this publication are knowledgeable in the handling of compressed gases and familiar with the chemical and physical properties of the commodities they charge into cylinders and the contaminants that are likely to be found there. Cylinders that have been restricted to certain applications such as medical cylinders and have been filled with gases of a known quality may justifiably be processed in a manner other than those covered by these general recommendations.

It is occasionally desirable to change compressed gas cylinders from one gas service to another. Some of these service changes can be made easily. Others require a careful inspection of the interior and exterior of the cylinder to detect the presence of corrosion products or contaminants that shall be removed for safety reasons or to avoid undesirable contamination of the contained gas. Also, there are some compressed gas cylinders that shall be restricted to the service that they are in and not changed at all.

When cylinders are changed from one gas service to another, a thorough inspection of the cylinders shall be conducted. This inspection is done to accumulate information on how well the cylinder performed in its previous service, to ensure the cylinder is suitable for its proposed new gas service, and to determine the necessary action to be taken to prepare the cylinder for the change of service.

This publication does not attempt to identify each and every aspect of an inspection of the cylinder, valve, and pressure relief device (PRD), which is the responsibility of the party changing service.

2 Scope

2.1 Cylinders and tubes for which procedures apply

The cleaning recommendations contained in this publication are intended for cylinders of water capacities from 0.5 L to 454 L and tubes up to 3000 L that are fabricated in accordance with specifications promulgated by the U.S. Department of Transportation (DOT) in the United States and the Canadian Transport Commission (CTC) or Transport Canada (TC) in Canada and are authorized for reuse [1, 2, 3, 4].¹ Unless otherwise specified, when the word “cylinder” is used in this publication, it applies to both cylinders and tubes.

In general, the references made in this publication apply equally to DOT specifications and regulations in the United States and TC specifications and regulations in Canada [1, 2, 3, 4].

In the United States new cylinders are prefaced by “DOT” or “UN” and in Canada new cylinder specifications are prefaced by “TC” or “UN”. Older U.S. cylinders are prefaced by “ICC” and older Canadian cylinders are prefaced by “CTC”. Cylinders marked “CTC/DOT” or “TC/DOT” are authorized for service in both the United States and Canada. These procedures also apply to these older cylinder specifications.

These recommendations do not apply to:

- nonrefillable and composite cylinders;
- cylinders with internal linings, plating, or treatments; and
- cargo tanks, portable tanks, and tank cars.

These recommendations are not intended to address the requirements for cylinders in nonmedical gas service being changed to medical or food grade gas service except as required in [CGA M-18, Standard for the Change of Product and Change of Grade for High Pressure and Refrigerated Liquid Containers](#) [5].

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

These containers may require special techniques that can best be prescribed by the container manufacturer. These containers may have other requirements set forth by additional government agencies such as DOT, Food and Drug Administration (FDA), TC, and Canadian Health Products and Food Branch Inspectorate (HPFBI).

2.2 Application of recommended guidelines

This publication provides general guidelines that shall be considered whenever a cylinder is being changed from one gas service to another.

This publication contains guidelines and some references to federal regulations that are of assistance in determining whether a cylinder is qualified for use in a specific gas service.

It should be noted that these guidelines also apply to the preparation of new cylinders that are being placed into any gas service for the first time.

2.3 Gas property categorization

For the purposes of this publication, the gases for which cylinder changes are most frequently desired have been separated into several categories. This separation takes into consideration the chemical and physical reactivity of the gases and of the contaminants that are most frequently encountered.

The recommendations in this publication may not be applicable to gases or mixtures that are not referenced in the categorization paragraphs. Recommendations for the cleaning of cylinders that have contained such gases shall be obtained from the manufacturer of the gases.

2.4 Contaminant detection

This publication describes the various tests and inspection procedures that are recommended for the detection of possible contamination or the presence of corrosion products.

These procedures are applicable to the change of cylinders from one gas service to another and also as routine refilling procedures that may be applicable to all cylinders.

2.5 Contaminant removal

This publication contains detailed cleaning procedures that have been found to be satisfactory for the removal of various types of contaminants and corrosion products from the exteriors and interiors of cylinders.

Additional procedures that are developed by individual cylinder owners should be equally satisfactory as those given here for cylinders or should be compatible for use with cylinders of nonferrous construction.

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.

4 Guidelines to determine cylinders suitable for change of service

4.1 Cylinders authorized by federal regulations

Cylinders that are authorized for use with specific compressed gases and the filling requirements that apply are designated in Title 49 of the U.S. *Code of Federal Regulations* (49 CFR) Parts 173.301-173.316 inclusive [1]. The conditions under which containers may or may not be reused after their first filling are set forth in 49 CFR 173.28 [1]. The requirements for the continuing qualification and maintenance are described in 49 CFR 180 Subpart C [1]. Similarly, consult the current TC regulations for Canadian requirements [2, 3, 4]. Persons filling a cylinder with gas for the first time or changing a cylinder to a new gas service shall consult these regulations to ensure that the cylinder is authorized for the proposed gas service.

4.2 Cylinders restricted to specific service

Some cylinders are restricted to specific uses because of their design and shall not be transferred to another service. Examples of such cylinders are as follows.

4.2.1 Specifications CTC/DOT-8, CTC/DOT-8AL, CTC-8WC, TC-8WM, and TC-8WAM (acetylene cylinders)

Cylinders for acetylene service are specially designed and constructed. They shall never be transferred to any other gas service from acetylene service. Cylinders from other gas services shall never be transferred to acetylene service. See 49 CFR 173.303, current TC regulations, and [CGA G-1, Acetylene](#) [1, 2, 3, 4, 6].

4.2.2 Specification CTC/DOT-4L and TC-4LM (cryogenic liquefied gas cylinders)

These cylinders are fabricated of special materials and are uniquely constructed for cryogenic liquefied gas service. The construction can be such that they are suitable for use only with a specific cryogenic liquid. Cryogenic liquefied gas cylinders shall not be changed from one cryogenic gas service to another unless the manufacturer or the gas supplier confirms that they are suitable for the new service. If these cylinders become contaminated, the manufacturer or other agency familiar with the design and construction details of the particular cylinder shall be consulted for appropriate cleaning procedures.

4.2.3 Specifications CTC/DOT-39/TC-39M, CTC/TC/DOT-2P, and CTC/TC/DOT-2Q (nonrefillable containers)

Cylinders fabricated and marked in accordance with these specifications are authorized only as single-fill containers. Following their initial filling, they shall never again be filled with any gas or transferred to any other gas service. See 49 CFR 173.28 and current TC regulations [1, 2, 3, 4].

4.3 Gases that can affect cylinder condition

Cylinders that have been in certain gas services can be subjected to unusual conditions that can affect the future serviceability of the cylinder or render it unsuitable for use in any other gas service. Cylinders in such services are subject to rigid requalification procedures or may be prohibited from use in other gas services. Examples are as follows.

4.3.1 Carbon monoxide and mixtures greater than 20% carbon monoxide

Carbon steel cylinders in carbon monoxide and mixtures greater than 20% carbon monoxide service can be subject to intergranular corrosion, frequently referred to as stress corrosion. Such corrosion is not normally visible to the human eye. Cylinders (excluding tubes) that have been in carbon monoxide service shall be requalified using ultrasonic examination (UE) before service change. See [CGA C-20, Requalification Standard for Metallic, DOT and TC 3-Series Gas Cylinders and Tubes Using Ultrasonic Examination](#) [7]. Tubes that have been used in carbon monoxide service shall be requalified using 100% UE or acoustic emission (AE)/UE before service change, see [CGA C-20](#) [7]. Requalification is not required for cylinders in mixture services containing less than