CGA G-4.1—2004

CLEANING EQUIPMENT FOR OXYGEN SERVICE

FIFTH EDITION

COMPRESSED GAS ASSOCIATION, INC.
4221 Walney Road, 5th Floor
Chantilly, VA 20151
Phone: 703-788-2700
Fax: 703-961-1831
E-mail: cga@cganet.com

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NOTE—Technical changes from the previous edition are underlined.

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1 Scope

The cleaning methods described in this publication are intended for cleaning equipment used in the production, storage, distribution, and use of liquid and gaseous oxygen. This publication does not replace or supersede any regulatory cleaning procedures or cleaning requirements specified by a national authority. Examples of such equipment (illustrative of the primary intent of this publication) are stationary storage tanks, cargo tankers, and tank cars; pressure vessels such as heat exchangers and rectification columns; and associated piping, valves, and instrumentation. The cleaning methods, however, are not limited to this equipment. With proper consideration or modification, these methods may be used in cleaning other oxygen service equipment such as cylinders, cylinder valves, regulators, welding torches, pipelines, compressors and pumps where regulatory requirements do not specify cleaning methods.

For additional information on cleaning for oxygen service see the list of additional references in Section 15.

NOTE—CGA C-10, *Recommended Procedures for Changes of Gas Service for Compressed Gas Cylinders,* includes the conversion of cylinders to oxygen service [1].[1] Where the requirements for this conversion differ from the recommendations of CGA G-4.1, the recommendations of CGA C-10 should take precedence.

NOTE—CGA has clarified to the industry that equipment and systems handling any gas in excess of 23.5% oxygen by volume shall be designed as if that equipment and system is handling oxygen (CGA PS-13, *CGA Position Statement on Definition of a Threshold Oxygen-Mixture Concentration Requiring Special Cleaning of Equipment*) [2]. Thus, cleaning and preparation of oxygen equipment should apply to equipment where oxygen is in excess of 23.5% oxygen. At pressures above 2400 psig (16 500 kPa) (those typically found in cylinders), consideration may be given to reducing the concentration at which special cleaning should be used.

2 Objectives

Oxygen equipment and systems including all components and parts thereof shall be adequately cleaned to remove harmful contamination prior to the introduction of oxygen. Harmful contamination includes both organic and inorganic material such as oils, greases, paper, fiber, rags, wood, coal dust, solvents, weld slag, rust, sand, and dirt, which if not removed could cause a combustion reaction in an oxygen atmosphere or result in an unacceptable product purity.

This publication presents methods for cleaning oxygen service equipment. When properly used, these cleaning methods and subsequent inspections result in the degree of cleanliness required for the safe operation of oxygen service equipment and the necessary product purity required in CGA G-4.3, *Commodity Specification for Oxygen* [3]. Suggested levels of contamination and ways of determining if a component or system is sufficiently clean for oxygen service are given along with procedures for keeping such equipment clean before it is placed in service.

Cleaning a component or system for oxygen service involves the removal of contaminants including the surface residue from manufacturing, hot work, and assembly operations, as well as the removal of all cleaning agents and the prevention of recontamination before final assembly, installation, and use. These cleaning agents and contaminants include solvents, acids, alkalis, thread lubricants, filings, dirt, scale, slag, weld splatter, organic material (such as oil, grease, crayon, and paint), lint, and other foreign materials.

The removal of injurious contaminants can be accomplished by cleaning all parts and maintaining this condition during construction, by completely cleaning the system after construction, or by a combination of the two.

For the purposes of this publication, water shall be defined as potable water. Some customers' applications might require a higher quality water to achieve or maintain the desired cleanliness.

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