CGA

Compressed Gas Association

The Standard For Safety Since 1913

CGA G-4.11—2017

RECIPROCATING COMPRESSORS FOR OXYGEN SERVICE

SECOND EDITION

PREFACE

As part of a program of harmonization of industry standards, the Compressed Gas Association (CGA) has issued CGA G-4.11, *Reciprocating Compressors for Oxygen Service* jointly produced by members of the International Harmonization Council and originally published by the European Industrial Gases Association (EIGA) as EIGA Doc 10, *Reciprocating Compressors for Oxygen Service*.

This publication is intended as an international harmonized standard for the worldwide use and application of all members of the Asia Industrial Gases Association (AIGA), Compressed Gas Association (CGA), European Industrial Gases Association (EIGA), and Japan Industrial and Medical Gases Association (JIMGA). Each association's technical content is identical, except for regional regulatory requirements and minor changes in formatting and spelling.

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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.

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Atmospheric Gases and Equipment Committee

NOTE—Technical changes from the previous edition are underlined.

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FIRST EDITION: 2015

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1 Introduction

Oxygen compression represents a special risk in that the compressor can burn violently. This publication defines design and operating parameters for reciprocating oxygen compressors. Compliance with this publication will reduce the likelihood of, and the hazards arising from, a fire in a compressor to be equal or lower than those commonly accepted in the air separation industry. There is less demanding technology in a reciprocating compressor than in a centrifugal one. Potential rubbing velocities, gas velocities, and inventories are all lower. For these reasons, more flexibility in design is allowed in a reciprocating compressor than in a centrifugal compressor as defined in CGA G-4.13, *Centrifugal Compressors for Oxygen Service* [1].[1]

This publication has made a significant contribution to the safe compression of oxygen primarily because the suppliers and users have fully and frankly shared their philosophies and experiences. It is recognized by the working group members that the feedback of operating experiences makes a powerful contribution to safe operation and design. This publication requires that all those who build and operate reciprocating oxygen compressors that have been specified to comply with this publication should contribute towards it by fully reporting the circumstances surrounding oxygen fires.

For the purpose of safe operation of the compressor and its auxiliaries, the user and the supplier shall establish full agreement on the possible and expected modes of compressor operation (for example, specified operating points, normal operating range, startup and shutdown).

2 Scope

This publication applies to conventional ringed and labyrinth compressors in any geometric configuration having a crosshead and distance piece. Most operating experience exists in compressors greater than 17 700 ft^3/hr (500 Nm^3/hr) at pressures up to 1230 psi (8.5 MPa) with oxygen purity of 90% or greater and with maximum 10 ppm water (volume basis).[2] Additionally, experience suggests that at a discharge pressure less than 29 psi (0.2 MPa) the likelihood of ignition is low and the consequence of ignition slight since the trapped inventory is small and fire is difficult to sustain at low pressures. This working group believes the publication can be applied to 1450 psi (10 MPa) without further precaution.

The safe and reliable compression of oxygen using reciprocating compressors can only be achieved by the successful combination of many factors. This publication identifies and addresses the following factors.

2.1 Design of the compressor system

- robust and well proven compressor design;
- safe materials in critical areas;
- comprehensive instrumentation; and
- safety shutdown system.

2.2 Cleaning, preservation, and inspection

- correct and properly enforced procedures and well trained personnel.

2.3 Erection, testing, and commissioning

- trained erection personnel; and
- comprehensive testing program to verify the design.

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

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