# CGA G-4.7—2019

# STATIONARY, ELECTRIC-MOTOR-DRIVEN, CENTRIFUGAL LIQUID OXYGEN PUMPS

## FIFTH EDITION



CGA
Compressed Gas Association
*The Standard For Safety Since 1913*

## PREFACE

As part of a program of harmonization of industry standards, the Compressed Gas Association (CGA) has published CGA G-4.7, *Stationary, Electric-Motor-Driven, Centrifugal Liquid Oxygen Pumps,* jointly produced by members of the International Harmonization Council.

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 web site, www.cganet.com.

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NOTE—Technical changes from the previous edition are underlined.

FIFTH EDITION: 2019
FOURTH EDITION: 2014
THIRD EDITION: 2005
SECOND EDITION: 2003

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# 1 Introduction

Like many current processes, pumping liquid oxygen is accompanied by some degree of hazard that needs to be recognized and addressed. The hazards include liquid under pressure, cryogenic temperatures, volume and pressure increases due to vaporization, and the ability of oxygen to aid ignition and accelerate combustion. An incident can result in: (1) burning through a pump casing or adjacent piping, releasing a powerful jet of liquid or gas with entrained molten metal, and metal oxides; or (2) the rupturing of motor housings, beltboxes, or gearboxes with explosive force throwing metal fragments like shrapnel. Either can be fatal to unprotected personnel and can damage adjacent equipment. The consequences of these incidents can extend to 100 ft (30.5 m) or greater.

To address these hazards, this publication has been prepared by a group of experts in centrifugal liquid oxygen pumping systems, representing oxygen producers and oxygen equipment manufacturers, and is based on technical information and experience currently available. Current industrial experience involves pump installations where the liquid oxygen concentration is 95 mol % or greater at maximum operating pressures of approximately 1740 psi (120 bar) and 600 kW electric motor output.

To the extent that they exist, national laws supersede the suggested practices listed in this publication. It should not be assumed that every local standard, test, safety procedure, or method is contained in these recommendations or that abnormal or unusual circumstances may not warrant additional requirements or procedures.

# 2 Scope and purpose

This publication is written as a reference when specifying stationary, electric-motor-driven, centrifugal liquid oxygen pump designs and installations, and is a guide for the operation and maintenance of this equipment. This publication is based on experience in manufacturing and operating these pumps and it is applicable to those pumps operating on liquids containing greater than 95% oxygen.

It is not intended to cover other types of pumps such as reciprocating or vehicle mounted. While many parts of this publication can be used as the basis for those other types of pumps, it is not written considering all the special features of those designs. In addition, it does not attempt to include design and installation criteria for all cryogenic pumps but focuses on those specifically related to oxygen safety.

Unless a specific risk assessment allows deviations, the user shall follow the requirements of this publication when specifying pumping equipment for oxygen-enriched liquid mediums with oxygen concentrations between 23.5 mol % and 95 mol %.

Some of the practices presented represent conservative compromise and not all situations are covered. The user is cautioned that this publication is not a design handbook and does not eliminate the need for competent engineering judgment and interpretation. It does not purport to address all the safety problems or hazards associated with liquid oxygen pump use. It is the responsibility of the user of this publication to consult with qualified technical personnel, to establish appropriate safety and health practices, and to determine the applicability of regulatory limitations.

The purpose of this publication is to furnish qualified technical personnel with technical information to use in designing new liquid oxygen pump installations. It provides considerations that will enhance safe and reliable operation of liquid oxygen pumps.

The information contained in this publication may also benefit existing installations or those in the project phase. However, some of the requirements and recommendations in this publication may not always be practical or applicable with regards to the design and configuration of existing liquid oxygen pump systems. Requirements and recommendations related to operations and maintenance should be considered.