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**INSTALLATION GUIDE FOR STATIONARY,
ELECTRIC-MOTOR-DRIVEN,
CENTRIFUGAL LIQUID OXYGEN PUMPS**

FOURTH EDITION

CGA
Compressed Gas Association

The Standard For Safety Since 1913

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1 Introduction

Pumping liquid oxygen, like many current processes, 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 more.

To address these hazards, this publication has been prepared by a group of specialists in centrifugal liquid oxygen pumping systems, representing major oxygen producers in various countries of Europe and North America and is based on the technical information and experience currently available to the authors.

The industrial gases companies have engaged through the International Harmonization Council (IHC), comprised of the Asia Industrial Gases Association (AIGA), Compressed Gas Association (CGA), European Industrial Gases Association (EIGA), and Japan Industrial and Medical Gases Association (JIMGA), in a process of developing harmonized safety practices and this publication is one of them.

Furthermore, 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. The authors make no representations or warranties on the information in or the completeness of this publication and disclaim all warranties, express or implied including, but not limited to, the warranty of merchantability and the warranty of fitness for a particular use or purpose.

2 Scope and purpose

2.1 Scope

2.1.1 Current industrial practice

This guide contains a summary of current industrial practices and is based on the combined knowledge, experience, and practices of major liquid oxygen producers. It is written as a reference document 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. It is not intended to cover other types of pumps such as reciprocating or vehicle mounted. While many parts of this guide 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. Most industrial experience involves pump installations where the liquid oxygen concentration is 95 mol % or greater. The installer shall exercise sound engineering judgment when specifying pumping equipment for oxygen-enriched liquid mediums with oxygen concentrations between 25 mol % and 95 mol %.

2.1.2 Engineering judgment

Some of the practices presented represent conservative compromise, and not all situations are described. The designer is cautioned that this guide 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 associated with liquid oxygen pump use. It is the responsibility of whoever uses this guide to consult with qualified technical personnel, to establish appropriate safety and health practices, and to determine the applicability of regulatory limitations before use.

2.2 Purpose

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