CGA

Compressed Gas Association

The Standard For Safety Since 1913

# CGA G-4.10—2017

## USE OF NONMETALLIC MATERIALS IN HIGH PRESSURE OXYGEN BREATHING GAS APPLICATIONS

SECOND EDITION

## PREFACE

As part of a program of harmonization of industry standards, the Compressed Gas Association (CGA) has issued CGA G-4.10, *Use of Nonmetallic Materials In High Pressure Oxygen Breathing Gas Applications*, jointly produced by members of the International Harmonization Council and originally published by the European Industrial Gases Association (EIGA) as EIGA Doc 73, *Non-Metallic Materials In High Pressure Breathing Gas Applications*.

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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# 1 Introduction

Nonmetallic materials such as plastics, elastomers, and lubricants are known to be the most critical materials used in high pressure oxygen and oxygen mixture supply systems. These materials are typically found in valves, regulators, nonreturn valves, and flexible hoses where their uses include seat inserts, O-rings, gaskets, and regulator diaphragms.

The risk of ignition inherent in this use has been well known for many years and applies to any high pressure oxygen application. As a consequence, toxic products could be released by ignition (or thermal decomposition) of nonmetallic materials in high pressure oxygen breathing gas systems. Depending on the type of nonmetallic material, application, quantity of toxic gases produced, concentration levels, and the duration of exposure, these gases could cause serious injury or death. Consequently, certain countries such as France and Japan have issued regulations to reduce toxicity incidents resulting from the use of certain nonmetallic materials. Those who plan to design these breathing systems should refer to any applicable regulations or legislation.

High pressure breathing oxygen and breathing oxygen mixture supply systems require specialized design, appropriate maintenance, and adherence to proven safe operating procedures. Important considerations include:

- material specifications;
- galling and friction;
- velocity limitations;
- impingement;
- static discharge;
- electric arcs;
- adiabatic compression; and
- cleaning for oxygen service.

# 2 Scope and purpose

## 2.1 Scope

This publication addresses high pressure oxygen breathing gas systems with pressures greater than or equal to 435 psi (3000 kPa) and with an oxygen content greater than 23.5% by volume.[1,2] It applies in particular to nonmetallic materials which if they ignite or decompose could contaminate the gas stream with toxic products. The recommendation of this publication can be beneficially applied at pressures less than 435 psi (3000 kPa).

This publication is to be applied to high pressure customer breathing installations (for example, hospitals and homecare) where the ignition of nonmetallic materials creates an immediate risk of inhalation of toxic products. This includes all elements of that installation from cylinder valve to point of use.

This publication is not intended to apply to cylinder filling centers though it is recommended that the toxicity issue is addressed by a risk assessment of the filling system design.

NOTE—Ceramics and glass are excluded from the scope of this document.

## 2.2 Purpose

This publication is intended to help prevent incidents resulting from toxic products, either of sufficient quantity or significant toxicity that could be created by the ignition or decomposition of nonmetallic materials in high pressure

[1] kPa shall indicate gauge pressure unless otherwise noted as (kPa, abs) for absolute pressure or (kPa, differential) for differential pressure. All kPa values are rounded off per CGA P-11, *Metric Practice Guide for the Compressed Gas Industry* [1].

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