

**CGA P-1—2008**

**SAFE HANDLING OF  
COMPRESSED GASES  
IN CONTAINERS**

**ELEVENTH EDITION**



**PLEASE NOTE:**

The information contained in this document was obtained from sources believed to be reliable and is based on technical information and experience currently available from members of the Compressed Gas Association, Inc. and others. However, the Association or its members, jointly or severally, make no guarantee of the results and assume no liability or responsibility in connection with the information or suggestions herein contained. Moreover, it should not be assumed that every acceptable commodity grade, test or safety procedure or method, precaution, equipment or device is contained within, or that abnormal or unusual circumstances may not warrant or suggest further requirements or additional procedure.

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](http://www.cganet.com).

This document should not be confused with federal, state, provincial, or municipal specifications or regulations; insurance requirements; or national safety codes. While the Association recommends reference to or use of this document by government agencies and others, this document is purely voluntary and not binding unless adopted by reference in regulations.

A listing of all publications, audiovisual programs, safety and technical bulletins, and safety posters is available via the Internet at our website at [www.cganet.com](http://www.cganet.com). For more information contact CGA at Phone: 703-788-2700, ext. 799. E-mail: [customerservice@cganet.com](mailto:customerservice@cganet.com).

Work Item 10-034  
Safety and Health Committee

---

NOTE—Technical changes from the previous edition are underlined.

ELEVENTH EDITION: 2008  
TENTH EDITION: 2006  
NINTH EDITION: 2000  
EIGHTH EDITION: 1991

© 2008 The Compressed Gas Association, Inc. All rights reserved.

All materials contained in this work are protected by United States and international copyright laws. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical including photocopying, recording, or any information storage and retrieval system without permission in writing from The Compressed Gas Association, Inc. All requests for permission to reproduce material from this work should be directed to The Compressed Gas Association, Inc., 14501 George Carter Way, Suite 103, Chantilly VA 20151. You may not alter or remove any trademark, copyright or other notice from this work.

<b>Contents</b>	<b>Page</b>
1 Introduction.....	1
2 Scope .....	1
3 Definitions.....	1
4 Regulations and standards applicable to compressed gases in containers .....	4
4.1 Transportation regulating authorities .....	4
4.2 Container regulations .....	5
4.3 Container filling regulations .....	5
4.4 Regulating authorities of workplace safety and health .....	5
5 General safe handling rules for compressed gas containers .....	5
5.1 Personnel .....	5
5.2 Content identification .....	5
5.3 User responsibilities .....	6
5.4 General precautions .....	6
5.5 Valve protection caps and valve outlet caps and plugs.....	7
5.6 Safe handling of containers .....	7
5.7 Transfilling .....	7
5.8 Storing containers.....	8
5.9 Connecting a container and withdrawing its content .....	9
5.10 Transportation in passenger vehicles.....	10
5.11 Emergency response.....	10
6 Safe handling and storage rules for compressed gas by hazard class .....	11
6.1 Hazard class.....	11
6.2 Flammable gases .....	12
6.3 Asphyxiant gases (including inert).....	14
6.4 Oxidizing gases .....	14
6.5 Corrosive and toxic gases .....	15
6.6 Gas mixtures .....	16
6.7 Cryogenic liquids .....	16
7 Precautions for tank cars, cargo, and portable tanks .....	17
8 Security issues .....	18
8.1 Facility security .....	18
8.2 Distribution security .....	18
9 References .....	19
10 Additional references.....	21
 <b>Appendices</b>	
Appendix A—Cylinder nesting (Normative).....	23
Appendix B—Hazards of common compressed gases (Informative).....	24
 <b>Appendix Figures</b>	
Figure A-1—Properly nested cylinders .....	23
Figure A-2—Improperly nested cylinders.....	23
 <b>Appendix Table</b>	
Table B-1—More common compressed gases and their associated hazards .....	25

## 1 Introduction

Users of compressed gas should become familiar with the properties and inherent hazards of the products they use. Valuable information about each specific gas is contained in its product labeling and material safety data sheet (MSDS). Read this information and inform others of the importance of understanding and applying the precautions established within the available safety literature.

## 2 Scope

This guideline is primarily for the users of compressed gases in containers and is based upon accepted good practices. Some precautions are also applicable to gas suppliers and distributors. It should not be assumed that all applicable safety and security precautions or regulations are contained here. The term “container” as used in this publication shall refer to portable compressed gas cylinders and liquid containers made in accordance with the U.S. Department of Transportation (DOT), Transport Canada (TC), or the American Society of Mechanical Engineers (ASME) specifications [1, 2, 3].<sup>1</sup> Additional information covering small cylinders can be found in CGA SB-27, *Safe Use and Handling of Small Cylinders* [4].

## 3 Definitions

For the purpose of this publication, the following definitions apply.

### 3.1 Absolute pressure

Based on a zero pressure reference point such as the perfect vacuum at normal temperature and pressure.

NOTE—Absolute pressure is commonly denoted as psia or kPa, abs.<sup>2</sup>

### 3.2 Apparatus

Accessory equipment such as valves, pressure relief devices (PRDs), regulators, etc., used with compressed gas containers.

### 3.3 Charging

Synonym sometimes used by regulatory agencies for the word filling.

### 3.4 Compressed gas

#### 3.4.1 Flammable gas

Any material that is a gas at 20 °C (68 °F) or less and 101.3 kPa (14.7 psia) of pressure (a material that has a boiling point of 20 °C [68 °F] or less at 101.3 kPa [14.7 psia]) that:

- is ignitable at 101.3 kPa (14.7 psia) when in a mixture of 13 % or less by volume with air; or
- has a flammable range at 101.3 kPa (14.7 psia) with air of at least 12 % regardless of the lower limit.

The limits specified shall be determined at 101.3 kPa (14.7 psia) of pressure and a temperature of 20 °C (68 °F) in accordance with ASTM E681-85, *Standard Test Method for Concentration Limits of Flammability of Chemicals* or other approved equivalent methods [6].

#### 3.4.2 Nonflammable, nonpoisonous compressed gas

Any material (or mixture) that:

- exerts in the packaging an absolute pressure of 280 kPa (40.6 psia) or greater at 20 °C (68 °F); and
- does not meet the definition of a flammable gas or gas poisonous by inhalation [1].

<sup>1</sup> References are shown by bracketed numbers and are listed in order of appearance in the reference section.

<sup>2</sup> 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* [5].