



**CGA S-1.1—2022
PRESSURE RELIEF DEVICE
STANDARDS—PART 1—
CYLINDERS FOR
COMPRESSED GASES**

SIXTEENTH 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 website, 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. For more information contact CGA at Phone: 703-788-2700, ext. 799. E-mail: customerservice@cganet.com.

Work Item 22-025
Cylinder Valve Committee

NOTE—Technical changes from the previous edition are underlined.

NOTE—Appendix A (Informative) is for information only.

NOTE—Appendices B and C (Normative) are requirements.

FOREWORD

On April 16, 1981, the United States Department of Transportation promulgated new regulations to 49 CFR 173.34(d), which eliminated the need for pressure relief device approval by the Bureau of Explosives of the Association of American Railroads. It is the responsibility of the individual manufacturer or shipper to conduct his own flow and/or fire tests on new pressure relief device combinations to show compliance with CGA S-1.1 and CGA C-14 as applicable, and to retain test records of the compliance.

SIXTEENTH EDITION: 2022
FIFTEENTH EDITION: 2019
FOURTEENTH EDITION: 2011
THIRTEENTH EDITION: 2007

© 2022 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., 8484 Westpark Drive, Suite 220, McLean, VA 22102. You may not alter or remove any trademark, copyright or other notice from this work.

Contents	Page
1 Introduction.....	1
2 Scope	1
3 Definitions.....	2
4 Types of pressure relief devices.....	6
4.1 Type CG-1.....	6
4.2 Type CG-2.....	6
4.3 Type CG-3.....	6
4.4 Type CG-4.....	6
4.5 Type CG-5.....	6
4.6 Type CG-7.....	7
4.7 Type CG-8.....	7
4.8 Type CG-9.....	7
4.9 Type CG-10.....	7
4.10 Type CG-11.....	8
4.11 Type CG-12.....	8
5 Application requirements for pressure relief devices.....	8
5.1 General.....	8
5.2 CG-1 rupture disk devices	9
5.3 CG-7 pressure relief valves.....	9
5.4 CG-2, CG-3, and CG-9 fusible plug devices and CG-10 fusible trigger devices.....	10
5.5 CG-8 rupture disk/pressure relief valves	10
5.6 Piping of pressure relief devices.....	11
5.7 Relief devices for tubes mounted in tube trailers or modules.....	11
6 Design and construction requirements for pressure relief devices.....	12
6.1 General requirements.....	12
6.2 Material, design, and construction of a pressure relief device.....	12
6.3 CG-4 and CG-5 combination rupture disk/fusible plug devices.....	12
6.4 Flow capacity of pressure relief devices (nonliquefied gas)	13
6.5 Flow capacity of pressure relief devices (liquefied gas).....	13
6.6 Flow capacity of pressure relief valves (nonliquefied gas).....	14
6.7 Flow capacity of pressure relief valves (liquefied gas).....	15
6.8 Flow testing methods.....	15
6.9 Acetylene cylinders.....	15
6.10 CG-10 devices.....	15
7 Manufacturer's tests	16
7.1 Test of fusible alloy.....	16
7.2 Tests of CG-2, CG-3, and CG-9 fusible plugs and CG-10 fusible trigger devices.....	16
7.3 Tests of CG-1 rupture disk devices	18
7.4 Tests of CG-4 and CG-5 combination rupture disk/fusible plug pressure relief devices	19
7.5 Tests of CG-8 rupture disk/pressure relief valve	19
7.6 Tests of CG-7 pressure relief valves	19
7.7 Testing of repaired pressure relief devices.....	20
7.8 Performance tests for CG-10 and CG-12 devices.....	20
7.9 Performance tests for CG-11 devices	23
7.10 Performance tests for CG-12 devices	25

8	Identification requirements	25
8.1	Manufacturer marking.....	26
8.2	Manufacture and/or replacement date.....	26
8.3	Value units.....	26
8.4	Marking of individual parts.....	26
8.5	Fusible plugs or devices with fusible trigger.....	26
8.6	Combination devices (CG-8, CG-12).....	27
8.7	Coding	27
8.8	Markings for propylene service.....	27
8.9	Markings for hydrogen service in tubes.....	27
9	Maintenance requirements for pressure relief devices.....	27
9.1	General practices	27
9.2	Routine checks when filling cylinders.....	28
9.3	Routine checks after filling cylinders with pure gases or mixtures	28
10	Periodic replacement of pressure relief devices.....	28
10.1	CG-7 pressure relief valve.....	28
10.2	CG-8 rupture disk/pressure relief valve.....	29
10.3	CG-11 and CG-12 pressure relief valve	29
11	References	39
12	Additional references.....	40

Tables

Introduction to Tables.....	29
Table 1—Types of pressure relief devices	29
Table 2—Alphabetical list of gases and devices assigned	30
Table 3—Temperature correction factors to 60 °F	37
Table 4—Basic orifice factors flange taps for flow in ft ³ per minute	38
Table 5—Identification requirements for pressure relief devices	39

Appendices

Appendix A—CG-7 pressure relief valves used in propylene service (Informative).....	41
Appendix B—Basis for sizing of pressure relief devices (Normative)	43
Appendix C—Requalification procedures for CG-7 pressure relief valves (Normative).....	45

1 Introduction

This standard represents the minimum requirements for pressure relief devices (PRDs) considered to be appropriate and adequate for use on cylinders with a water capacity less than or equal to 1000 lb (454 kg). Refer also to Title 49 of the U.S. *Code of Federal Regulations* (49 CFR), CSA B340, *Selection and use of cylinders, spheres, tubes, and other containers for the transportation of dangerous goods, Class 2*, and/or CSA B342, *Selection and use of UN pressure receptacles, multiple-element gas containers, and other pressure receptacles for the transport of dangerous goods, Class 2* [1, 2, 3].¹ This standard also applies to composite overwrapped pressure vessels (COPVs), DOT-3AX, DOT-3AAX, and DOT-3T cylinders with a water capacity greater than 1000 lb (454 kg) as well as United Nations (UN) pressure receptacles with a water capacity up to 3000 kg, and which comply with the design specifications and charging (filling) and maintenance regulations of the U.S. Department of Transportation (DOT) or the corresponding specifications and regulations of Transport Canada (TC) [1, 4].

When cylinders that conform to the specification requirements of DOT or TC but are used in services beyond the jurisdiction of any of these authorities, it is recommended that the state, provincial/territorial, city, and other local regulatory authorities over these cylinders be guided by this standard in determining PRD requirements provided that the cylinders are charged and maintained in accordance with DOT or TC regulations.

It is further recognized that there can be cylinders that are used in services beyond the jurisdiction of DOT or TC that do not conform to the specification requirements of either authority. The authority having jurisdiction (AHJ) over such cylinders should be guided by this standard in determining PRD requirements provided that such cylinders are considered by the authority as having a construction at least equal to the equivalent DOT or TC specification requirements and they are charged and maintained in accordance with DOT or TC requirements.

A number of states, provinces/territories, cities, and other local regulatory authorities have pressure vessel laws and regulations that include requirements for PRDs. This standard is prepared specifically for compressed gas cylinders, and the PRDs may not be acceptable unless special permission is obtained from the AHJ. For cylinders that come within the jurisdiction of state, provincial/territorial, and local regulatory authorities, the user should check for compliance with all such regulations.

For newly constructed cylinders that come within the jurisdiction of DOT or TC, PRDs shall comply with requirements of this standard. The intent of this standard is to minimize the number and optimize the types of approved PRDs specified for each specific gas. This standard does not prohibit the continued use of previously approved and installed devices unless stated otherwise in this standard, 49 CFR, CSA B340, and/or CSA B342 [1, 2, 3]. However, if a PRD is replaced, the new device shall meet the requirements of this standard.

It is the filler's responsibility to ensure that the PRD is correct.

2 Scope

This standard applies to the selection of PRDs for a single component compressed gas in cylinders. For selection of PRDs for compressed gas mixtures in cylinders, see CGA S-7, *Standard Method for Selecting Pressure Relief Devices for Compressed Gas Mixtures in Cylinders* [5].

This standard does not cover PRD requirements for CTC/DOT-4L and TC-4LM insulated cylinders containing cryogenic liquids, see CGA S-1.2, *Pressure Relief Device Standards—Part 2—Portable Containers for Compressed Gases* [6]. This standard does not cover PRD requirements for multi-unit tank car tanks (DOT106A/TC106A and DOT110A-W/TC110A), see 49 CFR 179.300-15 and CGSB 43.147, *Construction, Modification, Qualification, Maintenance, and Selection and Use of Means of Containment for the Handling, Offering for Transport, or Transporting of Dangerous Goods by Rail*, as appropriate [1, 7].

This standard includes tables that provide information pertaining to PRDs. Table 1 contains information on the different types of PRDs. Table 2 provides a list of gases and their PRD assignments. Table 3 contains temperature correction factors. Table 4 includes values for basic orifice factors flange taps for flow in ft³/minute.

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