

PRESSURE RELIEF DEVICE STANDARDS—PART 1— CYLINDERS FOR COMPRESSED GASES

FOURTEENTH EDITION



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Work Item 10-058 Cylinder Valve Committee

NOTE—Technical changes from the previous edition are underlined.

NOTE—Appendices A and B (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 now becomes 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, CGA C-12, and CGA C-14 as applicable, and to retain test records of the compliance.

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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 of 1000 lb (454 kg) of water or less. Refer also to Title 49 of the U.S. *Code of Federal Regulations* (49 CFR) or CSA B340, *Selection and Use of Cylinders, Spheres, Tubes, and Other Containers for the Transportation of Dangerous Goods, Class 2* [1, 2].¹ This standard also applies to DOT-3AX, DOT-3AAX, and DOT-3T cylinders with a water capacity of over 1000 lb (454 kg) of water, 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, 3].

This standard <u>does not</u> cover requirements for PRDs for CTC/DOT-4L and TC-4LM insulated cylinders containing cryogenic liquids (<u>see CGA S-1.2</u>, <u>Pressure Relief Device Standards—Part 2—Portable Containers for</u> <u>Compressed Gases</u>) [4]. 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, 5].

This standard includes Tables 1 to <u>5</u>, which provide information pertaining to PRDs. Table 1 contains information on the different types of PRDs. Table 2 contains the fire, toxicity, state of the gas, and corrosiveness (FTSC) code classification for gases. Table 3 provides a list of gases and their PRD assignments. Table 4 contains temperature correction factors. Table 5 includes values for basic orifice factors flange taps for flow in cubic feet per minute.

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, local, or other authorities having jurisdiction 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 authorities having jurisdiction 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 might not be acceptable unless special permission is obtained from the authority having jurisdiction. 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 Table 3, 49 CFR, and/or CSA B340 [1, 2]. 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.

For PRD standards for bulk transport containers and stationary storage containers, see CGA S-1.2 and CGA S-1.3, *Pressure Relief Device Standards—Part 3—Stationary Storage Containers for Compressed Gases* [4, 6].

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

2 Definitions

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

2.1 Approach channel

Passage or passages through which fluid must pass from the cylinder to reach the operating parts of the PRD.

2.2 CG-10 activation time

Time for a CG-10 device to achieve its full rated flow capacity using a standardized activation test (see 6.8.1.5).

2.3 CG-10 design life

Time the CG-10 device is designed to provide operation, within its design specification, while in normal service and use.

2.4 CG-10 service life

Specific term to be applied to those devices (CG-10) that have been shown by special analysis or testing to demonstrate a fixed service life within its service (see 6.8.1.8 and 6.8.1.9).

2.5 Combination rupture-disk/fusible-plug device

Rupture disk in combination with a low temperature melting material intended to prevent bursting of the disk at its predetermined bursting pressure unless the temperature is high enough to first cause yielding or melting of the fusible material.

2.6 Compressed gas in solution

Nonliquefied compressed gas that is dissolved in a solvent (such as acetylene dissolved in acetone).

2.7 Compressed gas

Any material that exerts in the container an absolute pressure of at least 280 kPa (40.6 psi) at 20 °C (68 °F).²

2.8 Cryogenic liquid

Liquid with a normal boiling point below –90 °C (–130 °F) at 1 atm pressure absolute.

2.9 Cylinders

Pressure vessels as described in 49 CFR 171.8 and applicable TC regulations [1, 2].

2.10 Discharge channel

Passage or passages beyond the operating parts of the PRD through which fluid must pass to reach the atmosphere.

2.11 Flow capacity

For a PRD, the capacity in cubic feet per minute (cubic meters per minute or cubic meters per second) of free air discharged at the required flow rating pressure.

2.12 Flow rating pressure

Inlet static pressure at which the flow capacity of a PRD is measured for flow capacity rating purposes.

2.13 Free air or free gas

Air or gas measured at a pressure of 14.696 psia and at 60 °F (101.325 kPa abs at 15.6 °C).

2.14 Fusible plug device

Nonreclosing PRD designed to function by yielding or melting of a plug of fusible material within the specified temperature range (see Section 3).

² 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* [7].

2.15 Fusible trigger device

Nonreclosing PRD designed to function by activation of a trigger incorporating a fusible material that yields, melts, or is otherwise activated by heat.

NOTE—The trigger activates a mechanism that permits the release of gas.

2.16 Hazard zone A

Material with a toxicity LC_{50} less than or equal to 200 ppm.

2.17 Hazard zone B

Material with a toxicity LC₅₀ greater than 200 ppm and less than or equal to 1000 ppm.

2.18 Hazard zone C

Material with a toxicity LC₅₀ greater than 1000 ppm and less than or equal to 3000 ppm.

2.19 Hazard zone D

Material with a toxicity LC_{50} greater than 3000 ppm and less than or equal to 5000 ppm.

2.20 Lethal concentration fifty (LC₅₀)

Concentration of a substance in air, exposure to which for a specified length of time is expected to cause the death of 50% of the entire defined experimental animal population.

2.21 Liquefied compressed gas

A gas when packaged under pressure for transportation that is partially liquid at temperatures above -50 °C (-58 °F). A liquefied compressed gas is further categorized as follows:

- High pressure liquefied gas with a critical temperature between -50 °C (-58 °F) and 65 °C (149 °F); and
- Low pressure liquefied gas with a critical temperature above 65 °C (149 °F).

2.22 Metal hydride

Compound consisting of a metal alloy and hydrogen.

NOTE—As it pertains to this standard, these compounds are used in a metal hydride system where the hydrogen absorbs and desorbs from the metal alloy.

2.23 Metal hydride system

Group of components assembled as a package to contain metal-hydrogen compound(s) for which there exists an equilibrium condition where the metal alloy(s), hydrogen gas, and the metal-hydrogen compound(s) co-exist.

NOTE—Changes in pressure, temperature, and/or electrical potential shifts the equilibrium favoring the formation or decomposition of the metal-hydrogen compound(s) with respect to the metal alloy(s) and hydrogen gas.

2.24 Nonliquefied compressed gas

A gas when packaged under pressure for transportation is entirely gaseous at -50 °C (-58 °F) with a critical temperature less than or equal to -50 °C (-58 °F).

2.25 Pressure control valve

Device that vents only to maintain the operating pressure in the container under normal working conditions.

2.26 Pressure opening

Orifice in a PRD through which pressure is relieved.

NOTE—In a rupture disk device, this is the orifice against which the disk functions.