CGA S-7—2013

STANDARD METHOD FOR SELECTING PRESSURE RELIEF DEVICES FOR COMPRESSED GAS MIXTURES IN CYLINDERS

FIFTH EDITION

COMPRESSED GAS ASSOCIATION, INC.

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Work Item 09-030
Cylinder Valve Committee

NOTE—Technical changes from the previous edition are underlined.

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

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

FIFTH EDITION: 2013
FOURTH EDITION: 2005
THIRD EDITION: 2003
SECOND EDITION: 1996

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1 Introduction

This standard presents a method for selecting pressure relief devices (PRDs) for compressed gas mixtures packaged in cylinders having water capacities of 1000 lb (454 kg) (see U.S. Department of Transportation (DOT) Title 49 of the U.S. Code of Federal Regulations (49 CFR) Part 173.301[f]). This standard also applies to DOT 3AX, 3AAX, and 3T cylinders having water capacities over 1000 lb (454 kg) that comply with the specifications, charging, and maintenance regulations of DOT or the corresponding specifications and regulations of Transport Canada (TC) [1, 2].[1]

The task is more involved than the method for determining the appropriate valve outlet connections for gas mixtures. For the latter, as described in CGA V-7, *Standard Method of Determining Cylinder Valve Outlet Connections for Industrial Gas Mixtures*, mixture component rating numbers are assigned to the various compressed gases based on the physical properties of the gases: flammability, toxicity, state of the gas, and corrosivity (FTSC) [3]. The higher the mixture component rating number (1 through 6), the more influential that gas becomes in determining the outlet connection for the mixture in which that gas is a component.

Valve outlet connection assignments are broadly separated into connections for groups of gases having similar properties such as high and low pressure, flammability, corrosivity, toxicity, and inertness. Since 1978 this system has proven satisfactory in avoiding hazardous connections.

The physical characteristics of a mixture consisting of several pure gases could be dramatically different depending on the concentration of each gas in the mixture. Depending on these concentrations, a mixture could be flammable or nonflammable, toxic or nontoxic, liquefied or nonliquefied, and corrosive or noncorrosive. Since the mixture is released to the atmosphere when the relief device functions, the characteristics of the escaping gas mixture must be well defined.

It was concluded that a method would have to be established for assigning the relief device for each mixture, just as is done for pure gases in CGA S-1.1, *Pressure Relief Device Standards—Part 1—Cylinders for Compressed Gases* [4]. To use this method, the FTSC code must be determined (see Appendix A). In some cases, determining the FTSC number is straightforward. However, in other cases the appropriate FTSC number is not as obvious, and in most cases this determination is the responsibility of the gas mixture producer. It must be understood that some of the considerations made in determining the selection of the PRD used in this standard are based on experience.

The method outlined in this standard is designed to handle the proliferation of mixtures entering the commercial market.

The continued use of previously recognized and installed devices is not restricted by this edition of the standard. However, if a PRD is replaced, the new device shall meet the requirements of this standard.

2 Scope

This method is applicable to the determination of the PRD to use with compressed gas mixtures in cylinders defined in Section 1.

This method is limited to those compressed gas mixtures with known flammability, toxicity, state, and corrosivity. In addition, the DOT/TC rating and dimensions of the cylinder and the final pressure must be known.

For the selection of PRDs for a single component compressed gas, see CGA S-1.1 [4]. For multicomponent compressed gases (mixtures), the method for selection of relief devices in this standard shall be used. Where a mixture is predominantly made up of a single component in a mixture, the gas producer shall determine whether the properties of this mixture dictate it being treated as a single component compressed gas or a gas mixture.

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

3 Definitions

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

3.1 Algorithm
Series of formatted questions that when answered in sequence will result in the selection of one or more PRDs.

3.2 Blanketing or pressurizing
Pressurization of the vapor space above a liquefied gas or liquid for the purpose of liquid withdrawal.

3.3 Compressed gas
Any material that exerts in a container an absolute pressure of at least 40.6 psia (280 kPa, abs) at 68 °F (20 °C).[2]

3.4 Final pressure
Charged settled pressure at 70 °F (21.1 °C).

3.5 Gas mixture
Purposeful combination of two or more commodities resulting in a compressed gas.

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

3.7 Hazard zone B
Material with a toxicity LC_{50} greater than 200 ppm and less than or equal to 1000 ppm.

3.8 Hazard zone C
Material with a toxicity LC_{50} greater than 1000 ppm and less than or equal to 3000 ppm.

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

3.10 Lethal concentration fifty (LC_{50})
Concentration of a substance in air for which exposure for a specified length of time is expected to cause the death of 50% of the entire defined experimental animal population.

NOTE—See CGA P-20, *Standard for the Classification of Toxic Gas Mixtures* [6].

3.11 Producer
Site where the compressed gas mixture is packaged into cylinders and the personnel who perform the work.

4 Types of pressure relief devices

Types of PRDs are designated as follows:

4.1 Type CG-1

A rupture disk.

4.1.1 Limitations

Since this is a pressure operated device designed to release the entire contents of the container, there is no way to prevent the complete release of the contents, either because of normal functioning or premature rupture of the device.

[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* [5].