

**CGA C-7—2020**

**GUIDE TO CLASSIFICATION  
AND LABELING OF  
COMPRESSED GASES**

**ELEVENTH EDITION  
(Corrected 5/6/2020)**



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This publication is dedicated in the memory of Kevin Paradis, who served as an active participant of the Committee that developed this publication.

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Work Item 20-001  
Hazard Communication Committee

NOTE—Due to the extensive changes in this document, technical changes from the previous edition are not identified.

NOTE—Appendices A, B, C, D, E, F, G and H (Normative) are requirements.

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## 1 Introduction

The compressed gas industry has developed precautionary labels and markings for use on containers of compressed gases, cryogenic liquids, and other hazardous materials for the purpose of identifying the contents, warning of principal physical, health, and environmental hazards, and providing appropriate precautionary information following the *Globally Harmonized System of Classification and Labelling of Chemicals* (GHS) as allowed by the U.S. Occupational Safety and Health Administration (OSHA) [1].<sup>1</sup>

GHS was established by the United Nations (UN) to develop a means of hazard classification and communication via labels, pictograms, and consistent hazard language on a global basis. Internationally, competent authorities may adopt the GHS in whole or in part and may also require additional information on labels.

## 2 Scope

The Compressed Gas Association (CGA) has prepared this publication to state the general principles for labels and markings and give recommended minimum requirements for many hazardous gases and selected liquids. Additional information may be shown by gas suppliers if desired.

The methods of preparing label information established by GHS as required by Title 29 of the U.S. *Code of Federal Regulations* (29 CFR) Part 1910.1200 (OSHA's Hazard Communication Standard) have been followed to meet the specific labeling and marking needs of the compressed gas industry [1, 2]. OSHA's Hazard Communication Standard and the currently referenced edition of GHS shall be used in conjunction with this publication when classifying products and creating labels [2, 1].

This publication is not intended to address state, provincial, territorial, or local regulatory label and marking requirements such as the "Proposition 65" warnings required by the state of California. This publication does not fully address the requirements of the Canadian Hazardous Product Regulations-Workplace Hazardous Materials Information System 2015 (WHMIS 2015), which has adopted the Fifth Revised Edition of GHS [3]. The example labels in this guideline for Canadian transport comply with WHMIS 2015 [3].

Labels shall be applied to compressed gas and cryogenic liquid containers to identify the container contents and to warn of principal physical and health hazards associated with the container and its contents. Containers in transportation not exceeding 454 kg (1000 lb) water capacity require the U.S. Department of Transportation (DOT) and Transport Canada (TC) hazard label.

Labels as given herein with regard to cylinder handling and storage information may be modified with respect to format so they can be applied as required to fixed storage vessels, portable tanks, tube trailers, cargo tanks, or other packaging.

Labels shown in this publication are examples of labels and markings that warn of principal physical and health hazards involved in the handling and use of these specific products. The words label or labeling as used in this publication include labels, markings, decals, tags, stenciling, and similar methods of presenting precautionary information.

Appendix A illustrates the basic marking consisting of DOT or TC proper shipping name; identification number; and 30-mm (1.25-in) diamond, which is permitted under conditions authorized by DOT and TC regulations as an alternative to the DOT/TC 100-mm (3.9-in) diamond label and marking [4, 5].

Appendices B, C, and portions of F provide additional labeling and marking information to aid in complying with applicable regulations of the U.S. Food and Drug Administration (FDA) for the labeling of medical gases, including mixtures, that are classified as drugs and medical devices.

Appendix D includes the GHS classifications and codes for corresponding hazard and precautionary statements, signal word, and GHS pictograms for the pure gases listed in this publication. This Appendix also contains DOT's transportation classifications and CGA-developed hazard and precautionary statements.

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

Appendix E provides a decision tree to determine the classification of gaseous mixtures in accordance with OSHA's Hazard Communication Standard [2].

Appendix G lists the codes and the preferred wording for the corresponding GHS/OSHA/CGA hazard and precautionary statements. This information can be used in conjunction with Appendix E to determine the precautionary statements that shall be included on mixtures of the pure gases listed in this publication.

Appendix H provides additional hazard and precautionary statements to convey further information specific to hazards in the compressed gas industry. Rules for their use on labels also appear in this Appendix.

### 3 Responsibility

It is the responsibility of the gas supplier to ensure that the labels adequately warn of physical, health, and environmental hazards, provide appropriate precautionary measures, and comply with applicable governmental regulations. These regulations include the requirements of DOT, U.S. Environmental Protection Agency (EPA), FDA, OSHA, and, in Canada, TC and Health Products and Food Branch Inspectorate (HPFBI).

It is also the responsibility of the gas supplier to monitor all applicable state, provincial, territorial, and local regulations.

Those handling and using compressed gas containers have a responsibility to read and follow the recommendations from the precautionary information on labels, markings, and the safety data sheets (SDSs). It is also important that users obtain the knowledge and expertise to safely use the gas, container, and related apparatus.

The most important information on any gas container label or marking is the name of the product in the container. Every user shall check the name of the product on the container label or marking before use to be sure that the product is suitable for the particular application. This product identification should bring to the user's mind the product's physical and health hazards and safety precautions. These precautions should be followed to handle and use the product safely.

The handler or user of compressed gas containers shall not rely on the color of the container to identify the product. The availability of more than one hundred gases and innumerable mixtures makes it impossible to develop a practical color marking system for industrial containers.

Compressed gas container labels and markings are not an instruction manual for operating equipment in conjunction with the container. Operating instructions for gas-use apparatus should be obtained by the user from the manufacturer or supplier of the equipment. These instructions should be read and understood before using the apparatus with a particular gas.

### 4 Definitions

The following terms are used in this publication. The definitions apply specifically to the use of these terms on labels for compressed gas containers.

#### 4.1 Publication terminology

##### 4.1.1 Shall

Indicates that the procedure is mandatory. It is used wherever the criterion for confirmation to specific recommendations allows no deviation.

##### 4.1.2 Should

Indicates that a procedure is recommended.

##### 4.1.3 May

Indicates that the procedure is optional.

NOTE—GHS uses the term "may" in its hazard and precautionary statements to indicate a possibility or ability.

##### 4.1.4 Will

Is used only to indicate the future, not a degree of requirement.

**4.1.5 Can**

Indicates a possibility or ability.

**4.2 Technical definitions****4.2.1 Acute toxicity estimate (ATE)**

Numerical value that is used to evaluate acute toxicity.

NOTE—For an ingredient, the ATE is derived from the lethal concentration ( $LC_{50}$ ), if available, or a converted acute toxicity point estimate that is based on an experimentally obtained range or the classification category. For a gas mixture, the ATE is calculated for inhalation toxicity based on the ATE values for all relevant ingredients and the percentage concentration in the product.

**4.2.2 Adequate ventilation**

Condition falling within any or all of the following categories:

- Ventilation to reduce levels of the air contaminant below that which may cause personal injury or illness;  
  
NOTE—Values have been established by many sources for specific chemicals such as permissible exposure limits, threshold limit values, and short-term exposure limits.
- Ventilation sufficient to prevent accumulation to a concentration of contaminant vapor in air at a level in excess of 25% of the level set for the lower flammable limit [6]; or
- Ventilation sufficient to prevent oxygen-deficient (less than 19.5%) or oxygen-enriched (greater than 23.5%) atmospheres [2].

**4.2.3 Corrosive liquid or gas**

Liquid or gas when in contact with living tissue causes full thickness destruction of the human skin within a specified period of time [4].

NOTE—In this publication, this term shall not refer to action on metal surfaces.

**4.2.4 Critical temperature**

Temperature above which a pure gas cannot be liquefied, regardless of the degree of compression.

**4.2.5 Cryogenic liquid**

Refrigerated liquefied gas having a boiling point colder than  $-90\text{ }^{\circ}\text{C}$  ( $-130\text{ }^{\circ}\text{F}$ ) at 101.3 kPa, abs (14.7 psia) [4].<sup>2</sup>

**4.2.6 Flammable gas**

Gas having a flammable range with air at  $20\text{ }^{\circ}\text{C}$  and a standard pressure of 101.3 kPa and is classified in one of the two categories:

- Category 1—Gases, which at  $20\text{ }^{\circ}\text{C}$  and a standard pressure of 101.3 kPa:
  - are ignitable when in a mixture of 13% or less by volume in air; or
  - have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit; or
- Category 2—Gases, other than those of Category 1, which, at  $20\text{ }^{\circ}\text{C}$  and a standard pressure of 101.3 kPa, have a flammable range while mixed in air [2].

NOTE—Ammonia and methyl bromide may be regarded as special cases for some regulatory purposes.

<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, *Guideline for Metric Practice in the Compressed Gas Industry* [7].

#### 4.2.7 Flammable liquid

A liquid having a flash point of not more than 93 °C and is classified in one of four categories:

- Category 1—Flash point < 23 °C and initial boiling point ≤ 35 °C;
- Category 2—Flash point < 23 °C and initial boiling point > 35 °C;
- Category 3—Flash point ≥ 23 °C and ≤ 60 °C; or
- Category 4—Flash point > 60 °C and ≤ 93 °C [2].

#### 4.2.8 Flash point

Minimum temperature at which a substance gives off flammable vapors that when in contact with sparks or flame ignites when tested in accordance with Title 49 of the U.S. *Code of Federal Regulations* (49 CFR) Part 173.1201 [4].

#### 4.2.9 Gas

Normally formless fluid that occupies the space of enclosure and can be changed to the liquid or solid state by the effect of increased pressure, decreased temperature, or both. A gas diffuses.

##### 4.2.9.1 Gases under pressure

Gases are classified, according to their physical state when packaged, in one of four groups.

##### 4.2.9.2 Compressed gas (non-liquefied compressed gas)

Gas which when packaged under pressure is entirely gaseous at –50 °C (–58 °F); including all gases with a critical temperature less than or equal to –50 °C (–58 °F) [4].

##### 4.2.9.3 Liquefied gas (liquefied compressed gas)

Gas when packaged under pressure, is partially liquid at temperatures above –50 °C (–58 °F). A distinction is made between:

- High pressure liquefied gas: a gas with a critical temperature between –50 °C (–58 °F) and 65 °C (149 °F); and
- Low pressure liquefied gas: a gas with a critical temperature above 65 °C (149 °F) [4].

##### 4.2.9.4 Refrigerated liquefied gas

Gas when packaged is made partially liquid because of its low temperature.

##### 4.2.9.5 Dissolved gas

Non-liquefied compressed gas which, when packaged under pressure, is dissolved in a liquid phase solvent.

#### 4.2.10 Health hazard

Chemical which is classified as posing one of the following hazardous effects: acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); or aspiration hazard [2].

NOTE—The criteria for determining whether a chemical is classified as a health hazard are detailed in Appendix A to §1910.1200—Health Hazard Criteria [2].

##### 4.2.10.1 Carcinogen (cancer hazard or cancer suspect agent)

Chemical substance or mixture of chemical substances which induces cancer or increases its incidence.

##### 4.2.10.2 Irritation

Result of a chemical, either liquid or gas (not a corrosive chemical), that causes a reversible inflammatory effect on living tissue at the site of contact (such as eyes, skin, or respiratory tract).

##### 4.2.10.3 Toxic

Gas or liquid that creates an immediate hazard to health by inhalation, ingestion, or skin absorption and can be fatal in low concentrations.



**4.2.11 High pressure gas**

Liquefied or compressed gas in a container that has a pressure of 3450 kPa (500 psi) or higher at 21.1 °C (70 °F).

**4.2.12 Label**

Printed and graphic material that contains hazard and precautionary statements, pictograms, and other regulatory requirements applied to a compressed gas or liquid container.

**4.2.13 LC<sub>50</sub>**

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.

NOTE—LC<sub>50</sub> is usually measured as ppm (mol/mol).

**4.2.14 Liquid**

Substance or mixture which at 50 °C (122 °F) has a vapor pressure of not more than 300 kPa (44 psi), which is not completely gaseous at 20 °C (68 °F) and at a standard pressure of 101.3 kPa (14.7 psi), and which has a melting point or initial melting point of 20 °C (68 °F) or less at a standard pressure of 101.3 kPa (14.7 psi) [2].

**4.2.15 Mixture**

Mixture or a solution composed of two or more substances in which they do not react.

**4.2.16 Oxidizing gas**

Any gas that can, generally by providing oxygen, cause or contribute to the combustion of other material more than air does.

NOTE—Pure gases or mixtures with an oxidizing potential greater than 23.5% oxygen in nitrogen by volume as defined in ISO 10156:2010 or an equivalent testing method are regarded as oxidizing for DOT, TC, and OSHA regulatory purposes [8].

**4.2.17 Pyrophoric gas**

Gas that ignites spontaneously in air at or below a temperature of 54 °C (130 °F).

**5 Label and marking description****5.1 U.S. Department of Transportation/Transport Canada**

DOT and TC labels and markings are color-coded, 100 mm (3.9 in), diamond-shaped labels and markings for labeling hazardous materials specified in DOT's *Hazardous Materials Regulations* found in 49 CFR and the *Transportation of Dangerous Goods Regulations* of TC [4, 5]. A reduction in the size of the diamond-shaped labels is permitted under conditions authorized by DOT and TC regulations, as detailed in Appendix A.

The appropriate hazard symbol shall be shown in the upper corner of the diamond(s). The appropriate hazard class number or division number shall be displayed in the lower corner of the diamond label for both primary and subsidiary hazard labels and markings. In the United States, text indicating the hazard such as flammable gas is not required on the diamond, except when the text "oxygen" is required as detailed in Appendix A, Figure A-6 [4]. In Canada, such text is not permitted on labels except for shipments originating from the United States under the reciprocity provisions of the TC regulations [5]. Wherever practical, the marking shall be located at the valve end of the container and off the cylindrical part of the body.

Compressed gas containers shall be legibly marked with the DOT or TC proper shipping name and the product identification number preceded by UN or NA. Marking shall be by means of stenciling, stamping, or labeling, and shall not be easily removable [4, 5].

Containers containing a hazardous substance that meet or exceed the reportable quantity as listed in Appendix A of the Hazardous Materials Table in 49 CFR 172.101 shall be marked with the letters RQ [4].

In the United States, containers of 2.3 toxic gases or ammonia shall be marked with the words INHALATION HAZARD. These markings shall appear in association with the proper shipping name [4]. The required label for materials classified as 2.3 toxic gases is shown in Figure 1. If the label or marking does not include the words INHALATION HAZARD, it shall be marked elsewhere on the package [4].

For air shipments of packages and overpacks containing cryogenic liquids, the cryogenic liquid handling labels and markings shall be used in addition to the nonflammable gas (Division 2.2) hazard label as shown in Figure 2 [9].

Vessel transportation of cylinders containing gases listed as marine pollutants in Appendix B of the Hazardous Materials Table in 49 CFR 172.101 shall be marked with the marine pollutant mark in association with the hazard warning label as in Figure 3 [4].

## 5.2 U.S. Occupational Safety and Health Administration

Applicable GHS pictograms, as illustrated in Figure 4, shall be affixed to indicate hazards in the workplace. The GHS pictogram shall be no less than 10 mm (0.39 in) on each side inclusive of the red border and oriented as a square-on-point (diamond) [10]. If a label has a DOT transport pictogram, Appendix C.2.3.3 of the OSHA Hazard Communication Standard states that the corresponding Hazard Communication Standard pictogram shall not appear. However, OSHA's Brief 3636 states: "...DOT does not view the Hazard Communication Standard pictogram as a conflict and for international trade both pictograms may need to be present on the label. Therefore, OSHA intends to revise C.2.3.3. In the meantime, the agency will allow both DOT and HC pictograms for the same hazard on a label." [4, 2, 11]. TC and Health Canada do not require but allow the use of the TC label and GHS pictogram on the same label [5, 3].



Figure 1—Inhalation hazard label

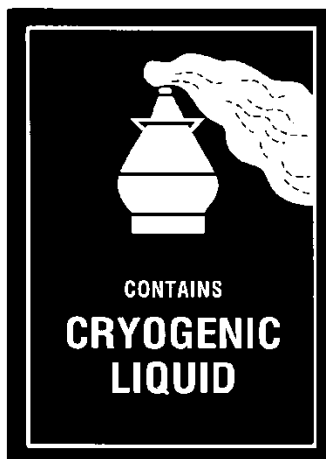
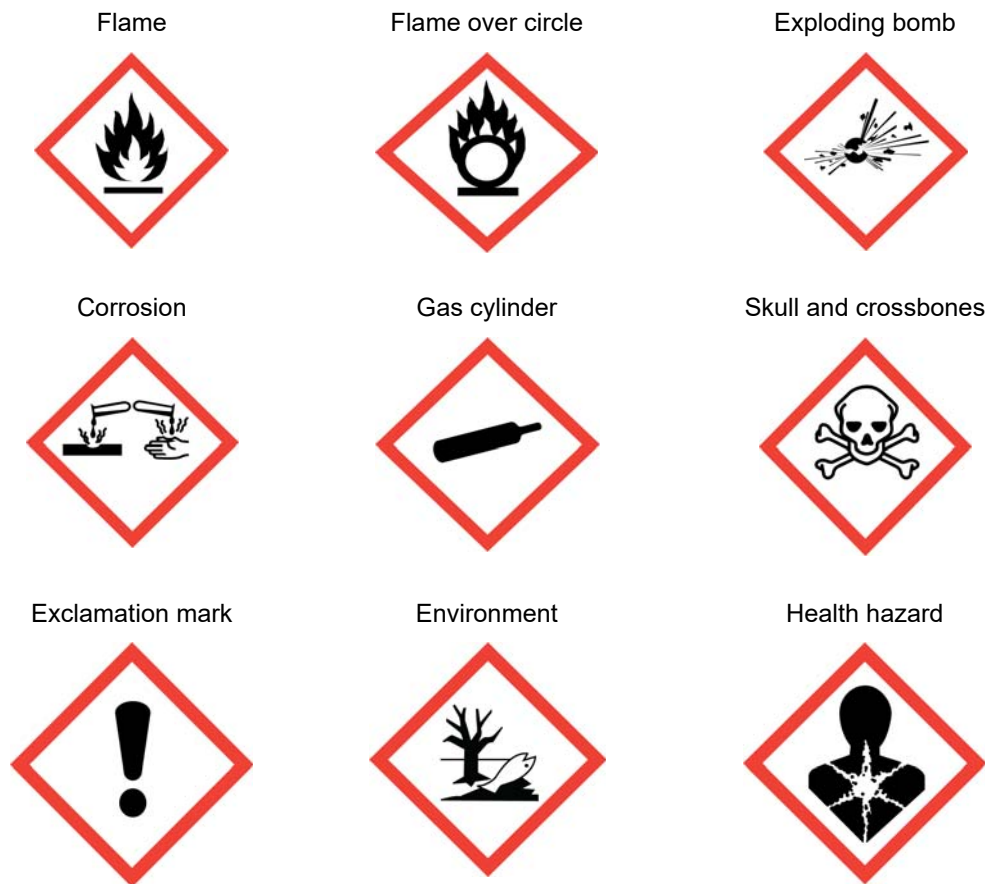


Figure 2—Cryogenic liquid label



**Figure 3—Marine pollutant mark**



NOTE—Use of the Environment pictogram is allowed in the United States but may be required by some countries when shipping internationally.

**Figure 4—GHS pictograms**