

**CGA C-7—2011**

**GUIDE TO PREPARATION  
OF PRECAUTIONARY  
LABELING AND MARKING  
OF COMPRESSED  
GAS CONTAINERS**

**NINTH EDITION**



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NOTE—Technical changes from the previous edition are underlined.

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

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**ADDENDUM INFORMATION:****Guidance for Compliance with GHS Requirements**

This publication, CGA C-7 (9th edition), includes an addendum that provides guidance for compliance with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). The text of CGA C-7 (9th edition), as of the date of publication, reflects current U.S. regulatory requirements.

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.

The Compressed Gas Association prepared this addendum to guide users on implementation practices in regions that have adopted GHS requirements. This addendum provides examples of gas labels and pictograms to meet GHS requirements, but does not address possible modifications or additional information that may be required by the regional competent authority. At this time, GHS requirements have not been adopted in the U.S. It is the reader's responsibility to be aware of regional regulations and implementation schedules. When the GHS system is fully implemented in the U.S., this addendum will replace CGA C-7, 9th edition.

<b>Contents</b>	<b>Page</b>
1 Introduction.....	5
2 Scope .....	5
3 Responsibility .....	5
4 Definitions.....	6
5 Label and marking descriptions.....	8
6 General principles .....	10
6.1 Gas mixtures .....	10
6.2 DOT-4L/TC-4LM liquid cylinders .....	10
7 Specific requirements.....	10
8 Precautionary label groupings.....	12
9 Illustrative precautionary labels .....	15
9.1 Asphyxiant gases .....	16
9.2 Flammable gases .....	19
9.3 Flammable liquids.....	23
9.4 Pyrophoric materials.....	24
9.5 Oxidizing gases .....	26
9.6 Cryogenic liquids .....	29
9.7 Toxic (poison) liquids and gases .....	33
9.8 Toxic (poison), corrosive liquids and gases.....	44
9.9 Toxic (poison), oxidizing, and corrosive gases.....	53
9.10 Corrosive liquids and gases .....	57
10 References .....	60
11 Additional references.....	61
<b>Figures</b>	
Figure 1—Inhalation hazard label .....	9
Figure 2—Cryogenic liquid label .....	9
Figure 3—Marine pollutant label .....	9
<b>Appendices</b>	
Appendix A—CGA marking system for compressed gas cylinders (Normative).....	62
Appendix B—CGA labeling guide for compressed medical gases classified as drugs (Normative) .....	68
Appendix C—CGA labeling guide for compressed gases classified as medical devices (Normative).....	77
Appendix D—CGA labeling guide for DOT-4L/TC-4LM and similar cylinders (Normative).....	86
Alphabetical index of gas labels.....	87
<b>Appendices figures</b>	
Figure A-1—Basic markings .....	64
Figure A-2—Basic markings for multiple labels .....	65
Figure A-3—Examples of CGA marking system .....	66
Figure A-4—Examples of CGA marking system for U.S. domestic shipment of oxygen and ammonia as described in A.4 DOT/TC label dimensions and modifications.....	67
Figure B-1—Example of a small ownership sticker.....	69
Figure B-2—Example of a separate sticker containing supplementary information.....	69
Figure D-1—Example of industrial cryogenic identity decal.....	86
<b>Alphabetical index of gas labels</b> .....	87

## 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.

## 2 Scope

The Compressed Gas Association (CGA) has prepared this publication to state the general principles for labels and markings and gives recommended minimum requirements for many gases and other hazardous materials. Additional information may be shown by gas suppliers if desired. For other gases not presented in this publication, precautionary labels and markings may be prepared by incorporating the applicable portions contained herein.

The methods of preparing precautionary label and marking information established by the most current edition of ANSI Z129.1, *Hazardous Industrial Chemicals Precautionary Labeling*, have been followed in this guide but were modified as necessary to meet the specific labeling and marking needs of the compressed gas industry [1].<sup>1</sup>

CGA has not prepared this publication to address all current state, province, territory, or local regulatory label and marking requirements, e.g., the "Proposition 65" warnings required by the state of California.

Precautionary labels and markings 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.

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

Precautionary labels and markings 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 [2, 3].

Appendix B provides 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 classified as drugs.

Appendix C provides additional labeling and marking information to aid in complying with applicable regulations of FDA for the labeling and marking of medical gases classified as medical devices.

## 3 Responsibility

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

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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.

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 material safety data sheet (safety data sheets). It is also important that users obtain the knowledge and expertise to safely use the gas, container, and related apparatus.

The most important safety statement 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. Where a reference is listed after a term, the definition is taken from that referenced document.

### 4.1 Adequate ventilation

A 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 [1];

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 [1]; or
- Ventilation sufficient to prevent oxygen-deficient (less than 19.5%) or oxygen-enriched (greater than 23.5%) atmospheres.

### 4.2 Cancer hazard or cancer suspect agent

A gas or liquid classified as a carcinogen or potential carcinogen by the National Toxicology Program (NTP), International Agency for Research on Cancer (IARC), or by Title 29 of the U.S. *Code of Federal Regulations* (29 CFR) Part 1910, Subpart Z, pursuant to OSHA's hazard communication standard in 29 CFR 1910.1200 [4, 5, 6].

### 4.3 Corrosive liquid or gas

A liquid or gas when in contact with living tissue causes destruction of the tissue by chemical action.

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

### 4.4 Critical temperature

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

#### 4.5 Cryogenic liquid

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

#### 4.6 Flammable gas

Any material that is a gas at  $20^{\circ}\text{C}$  ( $68^{\circ}\text{F}$ ) or less and 101.3 kPa, abs (14.7 psia) of pressure [a material that has a boiling point of  $20^{\circ}\text{C}$  ( $68^{\circ}\text{F}$ ) or less at 101.3 kPa, abs (14.7 psia)] that:

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

NOTE—The limits specified shall be determined at 101.3 kPa (14.7 psia) of pressure and a temperature of  $20^{\circ}\text{C}$  ( $68^{\circ}\text{F}$ ) in accordance with ASTM E681.85, *Standard Test Method for Concentration Limits of Flammability of Chemicals (Vapors and Gases)* or other approved equivalent methods [8].

#### 4.7 Flammable liquid

Any liquid having a flash point of not more than  $60.5^{\circ}\text{C}$  ( $141^{\circ}\text{F}$ ) with the following exceptions:

- Any liquid meeting one of the definitions specified in 49 CFR 173.115 [2];
- Any mixture having one or more components with a flash point of  $60.5^{\circ}\text{C}$  ( $141^{\circ}\text{F}$ ) or higher that make up at least 99% of the total volume of the mixture if the mixture is not offered for transportation or transported at or above its flash point;
- Any liquid with a flash point greater than  $35^{\circ}\text{C}$  ( $95^{\circ}\text{F}$ ) that does not sustain combustion according to ASTM D4206-96, *Standard Test Method for Sustained Burning of Liquid Mixtures Using the Small Scale Open-Cup Apparatus*, or the procedure in Appendix H of 49 CFR 173 [9, 2];
- Any liquid with a flash point greater than  $35^{\circ}\text{C}$  ( $95^{\circ}\text{F}$ ) and with a fire point greater than  $100^{\circ}\text{C}$  ( $212^{\circ}\text{F}$ ) according to ISO 2592, *Determination of flash and fire points—Cleveland open cup method* [10]; or
- Any liquid with a flash point greater than  $35^{\circ}\text{C}$  ( $95^{\circ}\text{F}$ ) that is in a water-miscible solution with a water content of more than 90% by mass.

#### 4.8 Flash point

The minimum temperature at which a substance gives off flammable vapors that when in contact with sparks or flame ignites when tested in accordance with 49 CFR 173.120(c) [2].

#### 4.9 Gas

A 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 [1].

##### 4.9.1 Gases under pressure

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

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

A gas which when packaged under pressure is entirely gaseous at  $-50^{\circ}\text{C}$ ; including all gases with a critical temperature less than or equal to  $-50^{\circ}\text{C}$ .

##### 4.9.1.2 Liquefied gas (liquefied compressed gas)

A gas when packaged under pressure, is partially liquid at temperatures above  $-50^{\circ}\text{C}$ . A distinction is made between:

- High pressure liquefied gas—a gas with a critical temperature between  $-50^{\circ}\text{C}$  and  $+65^{\circ}\text{C}$ ; and
- Low pressure liquefied gas—a gas with a critical temperature above  $+65^{\circ}\text{C}$ .

<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* [7].

**4.9.1.3      Refrigerated liquefied gas**

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

**4.9.1.4      Dissolved gas**

A gas when packaged under pressure is dissolved in a liquid phase solvent.

**4.10      High pressure gas**

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

**4.11      Irritation**

The 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) [1].

**4.12      Mixture**

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

**4.13      Oxidizing gas**

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

NOTE—Mixtures containing up to 23.5% vol % oxygen may be regarded as not oxidizing for some regulatory purposes.

**4.14      Toxic (poison)**

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

**4.15      Pyrophoric gas**

A gas that ignites spontaneously in dry or moist air at or below a temperature of 54.4 °C (130 °F) [1].

**5      Label and marking descriptions**

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 [2, 3]. 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-4 [2]. 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 [3].

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 [2, 3].

Wherever practical, the marking shall be located at the valve end of the container and off the cylindrical part of the body.

Containers containing a hazardous substance that meet or exceed the reportable quantity as listed in Appendix A of the Hazardous Materials Table (49 CFR 172.101) shall be marked with the letters RQ [2].

In the United States, containers of 2.3 toxic (poison) gases or ammonia shall be marked with the words INHALATION HAZARD. These markings shall appear in association with the proper shipping name [2]. The required label for materials classified as 2.3 poison gas 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 [2].



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 [11].

Vessel transportation of cylinders containing gases listed as marine pollutants in Appendix B to the Hazardous Materials Table (172.101) shall be marked with the marine pollutant mark in association with the hazard warning label as in Figure 3 [2].



Figure 1—Inhalation hazard label

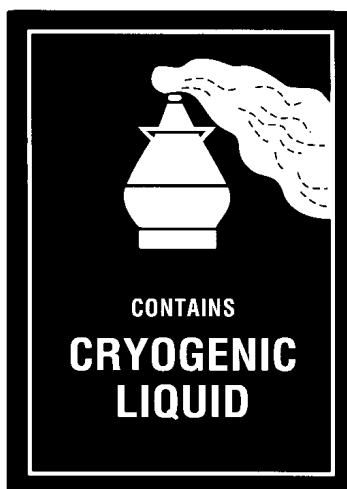


Figure 2—Cryogenic liquid label



Figure 3—Marine pollutant label

## 6 General principles

The following is a guide to the general principles in preparing precautionary labels and markings for compressed gas containers. For effectiveness, all precautionary statements on labels and markings should be brief, accurate, and expressed in simple, easily understood terms.

Precautionary information should be used only as appropriate. Excessive information should not be used. Unnecessary wording on labels and markings could develop a disregard for the labels and markings. It is desirable to use uniform precautionary wording when indicating the same hazards for different gases.

Precautionary statements should be in legible type that is in contrast by typography or layout with other printed matter on the labels and markings. The labels and markings should be displayed in a conspicuous place on the container so it can easily be read by the handler or user.

### 6.1 Gas mixtures

Gas mixtures can have properties that are similar to or that vary in kind or degree from those of the individual components. Precautionary labels and markings for mixtures can be based on the physical and health hazards of the finished mixture product if that product has been tested as a whole or, in the United States, based on the physical and health hazards of its ingredients in accordance with the criteria given in OSHA's hazard communication standard in 29 CFR 1910.1200 [6].

### 6.2 DOT-4L/TC-4LM liquid cylinders

All DOT-4L/TC-4LM liquid cylinders shall have additional product identification visible from all directions. Refer to Appendix D for additional instructions.

## 7 Specific requirements

### 7.1 Label content

In addition to the DOT/TC (UN/TDG) labels and markings required on gases, precautionary labeling shall include:

- signal word;
- statement of hazard;
- precautionary measures;
- first aid instructions in case of contact or exposure;
- instructions for container handling and storage; and
- name and address of the manufacturer, importer, or other responsible party.

Precautionary labels and markings may also include antidotes, notes to physicians, and instructions in case of fire, spill, or leak.

### 7.2 Proper shipping names

When required to be in conformance with DOT/TC regulations, the product name and identification number shall be as they appear in the DOT Hazardous Materials Table (49 CFR 172.101) or similar regulations of TC [2, 3]. For not otherwise specified (N.O.S.) listings, the chemical or commonly accepted name of the product shall also appear.

Additionally, for mixtures that do not appear in the table by name, the technical names of at least two components most predominately contributing to the hazards of the mixture or solution shall be marked on the label in parentheses in association with the proper shipping name.

### 7.3 Mixture classification

Refer to the following specific sections to determine the labeling requirements for gas mixtures containing toxic (poison), flammable, or oxidizing gases.

#### 7.3.1 Toxic (poison)

For mixtures containing toxic (poison) components, refer to the guidelines in CGA P-20, *Standard for the Classification of Toxic Gas Mixtures*, to determine labeling of the mixtures [12].

#### 7.3.2 Flammable

For mixtures containing flammable components, refer to the guidelines in CGA P-23, *Standard for Categorizing Gas Mixtures Containing Flammable and Nonflammable Components*, to determine labeling of the mixture [13].

#### 7.3.3 Oxidizing

Mixtures containing oxygen greater than 23.5% require an oxidizer label.

### 7.4 Signal word

The signal word shall indicate the relative degree of severity of a hazard in the diminishing order of DANGER, WARNING, or CAUTION. When a product has more than one hazard, only the signal word corresponding to the class of the greatest immediate hazard shall be used.

#### 7.4.1 Danger

The signal word DANGER should be used on labels and markings of flammable, toxic (poison), corrosive, and similar gases where the release of gas to the atmosphere would create an immediate physical hazard or significant acute or chronic health hazard.

#### 7.4.2 Warning

The signal word WARNING should be used on labels and markings of gases such as oxygen, nitrous oxide, and cryogenic liquids where a release of gas or liquid creates a less than immediate hazard but can be hazardous to health or property under certain conditions.

#### 7.4.3 Caution

The signal word CAUTION should be used on labels of gases such as argon, helium, nitrogen, and carbon dioxide where the release of gas creates no immediate hazard to health or property except that associated with a characteristic such as pressure or displacement of air.

### 7.5 Statement of hazard

A statement of hazard (such as FLAMMABLE GAS) gives notice of the hazards present in connection with the customary or reasonably anticipated handling or use of the product and should follow the signal word. If a product has several hazardous properties, a statement of each significant hazard should be included. The most serious hazard should be listed first.