LABELLING OF GAS CONTAINERS

(including associated equipment)

AIGA 017/05

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KEYWORDS

- CLASSIFICATION
- CYLINDER
- HAZARD
- LABELLING
- SAFETY
- SYMBOL
- COMPRESSED
- LIQUEFIED
- REFRIGERATED

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1 Introduction

The use of industrial gases is widespread and permeates almost all industries worldwide. While recognizing their benefits , there are hazards associated with their use. Misuse or ignorance could have adverse effects on people and the environment; it is therefore important to understand, in order to control, if not eliminate, these hazards.

Industrial gases are classified as '***chemicals***'; as such, they are controlled and regulated under the same sets of laws and regulations that apply to all other chemicals. However, as there are a huge number of gaseous products available, it is almost impossible for any entity to regulate the use of each individual gas.

Over the years, a number of countries or organizations have developed laws or regulations that require information to be prepared and communicated to those using the chemicals. This has culminated in the issuance of the Globally Harmonised System (GHS) of Classification and Labelling of Chemicals by the United Nations (UN).

Labelling is one part of hazard communication that also includes Material Safety Data Sheets (MSDS). By providing industrial gases users with information on the identities and hazards of these gases, it allows appropriate protective measures to be implemented in the local environment.

This AIGA document is intended as a simple and concise guide for manufacturers, distributors and transporters of industrial gases in the labelling of gas containers and associated equipment that they handle and transport. Much of the content in this document is based on the referenced documents in Section 4.

2 Scope and purpose

2.1 Scope

This guide limits itself to the requirements for labelling of gas containers for a select list of the most commonly used industrial, medical and specialty gases in compressed, refrigerated, liquefied or dissolved state carried in:

- cylinders;
- cylinder bundles (clusters) or pallets;
- portable cryogenic liquid containers, including pressurized liquefied gas containers;
- tube trailers for compressed gas transportation;
- ISO containers for refrigerated gas transport and storage;
- bulk tankers for refrigerated gas transportation; and
- liquid storage vessels.

Gas mixtures are not included in the scope of this document. For information on gas mixtures, EIGA 906/02 on "Classification, Labelling and Safety Data Sheet Guide" and UN GHS "Purple Book" may be referred to.

2.2 Purpose

The purpose of this document is to provide a simplified guide for the labelling of gas containers based on hazard classification to ensure safe and consistent practices. It aims:

- to provide clear information on the contents inside a gas container, hazards, precautions, storage and emergency requirements associated with the handling and transport of the contents by an individual or party; and
- to recommend practical ways of implementing and meeting the specific needs of the users.

This document is meant as a user-friendly guide. The appendices have been designed in such a way that they can also be used as slides for presentation purposes.

It is not the purpose of this document to integrate or reproduce the content of various national legislations, but rather to serve as a guide to help in the identification of container contents, and to ensure safe and proper handling of a container (and its contents).

3 Definitions

ADR means the European Agreement concerning the International Carriage of Dangerous Goods by Road, as amended.

Carcinogen means a chemical substance or a mixture of chemical substances which induce cancer or increase its incidence.

Chemical identity means a name that will uniquely identify a chemical. This can be a name that is in accordance with the nomenclature systems of the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS), or a technical name.

Compressed gas means a gas which when packaged under pressure is entirely gaseous at –50 degree C; including all gases with a critical temperature $\leq$ 50 degree C.

Corrosive to metal means a substance or a mixture which by chemical action will materially damage, or even destroy, metals.

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

Dissolved gas means a gas which when packaged under pressure is dissolved in a liquid phase solvent.

Explosive substance means a solid or liquid substance (or mixture of substances) which is in itself capable by chemical reaction of producing gas at such a temperature and pressure, and at such a speed as to cause damage to the surroundings. Pyrotechnic substances are included even when they do not evolve into gases.

Flammable gas means a gas having a flammable range with air at 20 degree C and a standard pressure of 101.3kPa.

Flash point means the lowest temperature (corrected to a standard pressure of 101.3 kPa) at which the application of an ignition source causes the vapour of a liquid to ignite under specified test conditions.

Gas means a substance which (i) at 50 degree C has a vapour pressure greater than 300 kPa; or (ii) is completely gaseous at 20 degree C at a standard pressure of 101.3 kPa.

GHS means the “Globally Harmonised System of Classification and Labelling of Chemicals”, known also as the “Purple Book”.

Hazard category means the division of criteria within each hazard class, e.g. oral acute toxicity includes five hazard categories and flammable liquids include four hazard categories. These categories compare hazard severity within a hazard class and should not be taken as a comparison of hazard categories more generally.

Hazard class means the nature of the physical, health or environmental hazard, e.g. flammable solid, carcinogen, oral acute toxicity.

Hazard statement means a statement assigned to a hazard class and category that describes the nature of the hazards of a hazardous product, including, where appropriate, the degree of hazard.

Label means an appropriate group of written, printed or graphic information concerning a hazardous product, selected as relevant to the target sector(s), that is affixed to, printed on, or attached to the immediate container of a hazardous products, or to the outside packaging of a hazardous product

Label element means one type of information that has been harmonized for use in a label, e.g. pictogram and signal word

Liquefied gas means a gas which when packaged under pressure, is partially liquid at temperatures of above –50 degree C. A distinction is made between:

- high pressure liquefied gas: a gas with a critical temperature of between – 50 degree C and + 65 degree C; and
- low pressure liquefied gas: a gas with a critical temperature of above +65 degree C.

MSDS means Material Safety Data Sheet.

Oxidizing gas means any gas which may, generally by providing oxygen, cause or contribute to the combustion of other materials more than air does.

Pictogram means a graphical composition that may include a symbol plus other graphic elements, such as a border or background pattern that is intended to convey specific information.

Precautionary statement means a phrase (and/or pictogram) that describes recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to a hazardous product, or improper storage or handling of a hazardous product.

Product identifier means the name or number used for a hazardous product on a label or in the MSDS. It provides a unique means by which the product user can identify the substance or mixture within a particular setting e.g. transport, consumer or workplace.

Recommendations on the Transport of Dangerous Goods, Model Regulations means the latest revised edition of the United Nations publication bearing this title, and any published amendment thereto. This is also known as the “Orange Book”.

Refrigerated liquefied gas means a gas which when packaged is made partially liquid because of its low temperature.

RID means The Regulations Concerning the International Carriage of Dangerous Goods by Rail [Annex 1 to Appendix B (Uniform Rules concerning the Contract for International Carriage of Goods by Rail) (CIM) of COTIF (Convention Concerning International Carriage by Rail)], as amended.

Signal word means a word used to indicate the relative level of severity of hazard and is used to alert the reader to a potential hazard on the label. The GHS uses ‘Danger’ and ‘Warning’ as signal words.

Skin corrosion means the production of irreversible damage to the skin following the application of a test substance for up to 4 hours.

Supplemental label element means any additional non-harmonised type of information supplied on the container of a hazardous product that is not required or specified under the GHS. In some cases, this information may be required by other competent authorities or it may be additional information provided at the discretion of the manufacturer/distributor.

Symbol means a graphical element intended to succinctly convey information.

Technical name means a name that is generally used in commerce, regulations and codes to identify a substance or mixture, other than the IUPAC or CAS name, and that is recognized by the scientific community. Examples of technical names include those used for complex mixtures (e.g. petroleum fractions or natural products), pesticides (e.g. ISO or ANSI systems), dyestuffs (Colour Index system) and minerals.

4 Classification

Classification refers to the hazard classification of gases. It is an important issue with straightforward and immediate consequences on the labelling of gas containers. There are also many other downstream

consequences in relation to various statutory compliances such as the construction of pressure equipment, major accidents and waste management.

Classification of the gases for the purpose of determining the labelling content is based mainly on three aspects, namely:

- physio and chemical properties
- health hazards
- transport and handling[1]

Appendix A details the classification of some of the most commonly used gases. Manufacturers, distributors and importers of gases that are not included in Appendix A will have to access the relevant data concerning the properties of such gases. On the basis of the gathered information, they should package and label these gases accordingly. For this purpose, EIGA document 907/02 on "Classification, Labelling and Safety Data Sheet Guide "and UN GHS "Purple Book", may be referred to.

1 - For use of the content, more information in the form of Material Safety Data Sheet may be required

5 Labelling

5.1 General

The purpose of labelling gas containers is to give the carrier and the user of the gases clear, indelible and concise indications of the hazards of the gases and some safety advice on how to handle them. Labelling is the immediate consequence of the classification process.

5.2 Label content

Label content shall contain the following information:

- name of the gas
- Signal word – "Danger or Warning**"** hazard symbol and class for primary and secondary hazards
- Risk phrases (hazard statements)
- Safety phrases (handling instructions)
- supplier identification and contact numbers

Information on the above label elements are summarized in Appendices A to C for selected commonly used gases.

Additionally, supplementary label elements such as those listed below may be included on the label for reference or as required by local regulations:

- UN number
- chemical formula
- first aid advice
- Hazchem number (only on bulk transport containers)
- emergency respondent's contact details (only on bulk transport containers).

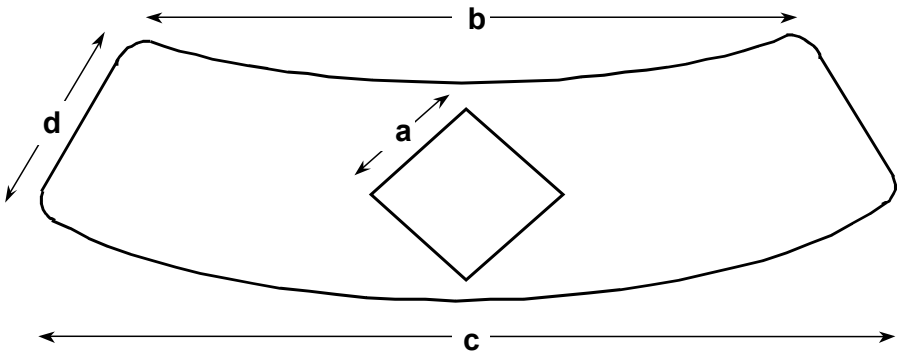
Information on the supplementary label elements for selected commonly used gases are not included in this guide.

Note: The language to be used on the label is not defined in this guideline, as this may be subject to local requirements.

5.3 Types of labels

5.3.1 Label for cylinders

Commonly, the label is affixed onto the shoulder of the cylinder as shown in Appendix E1. A sample of a commonly used ***Shoulder Label*** is shown in Figure 1. The dimensions given should be used only as guidelines. However, when designing a label, emphasis should be on the visibility of its contents.



Cylinder	a	b	c	d
D < 75	10	45	60	23
75 < D < 180	15	67	90	30
D > 180	25	112	150	45
Dimensions in mm				

Figure 1 : Dimensions of Shoulder Label and Hazard Diamond

The hazard symbols are to be indicated within the diamond shaped box in the shoulder label. The recommended size of the diamond is shown above.

In cases where two or three hazard diamonds are necessary, the subsidiary hazard diamond(s) shall be placed to the right of the primary hazard diamond. In configurations where the hazard diamonds overlap, the primary hazard diamond shall partially cover the subsidiary hazard diamond(s) so that in all cases, the primary hazard diamond remains un-obscured. A few examples are given in Figure 2.

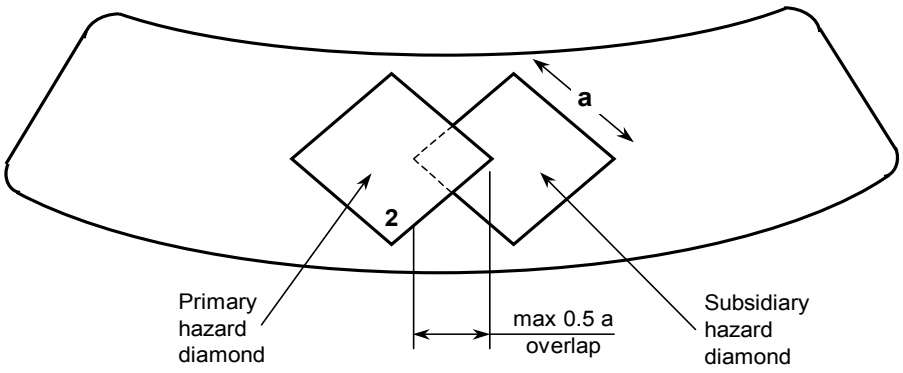


Fig. 2a : Primary and subsidiary hazard diamonds and double panel

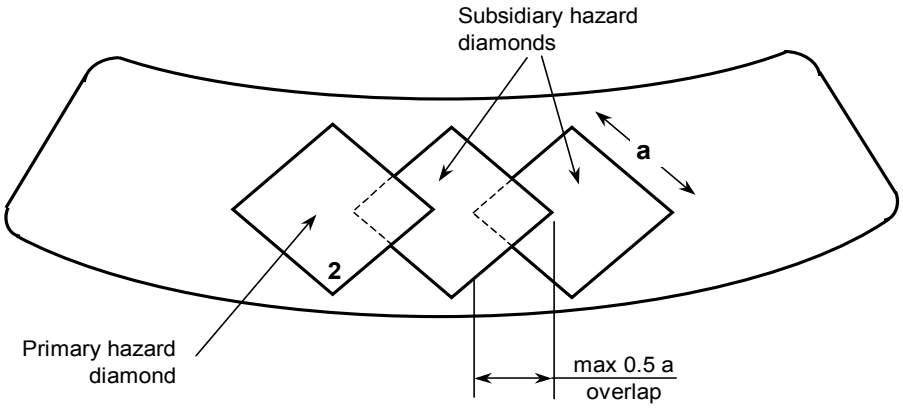


Fig. 2b : Primary and two subsidiary hazard diamonds arranged in line and double panel

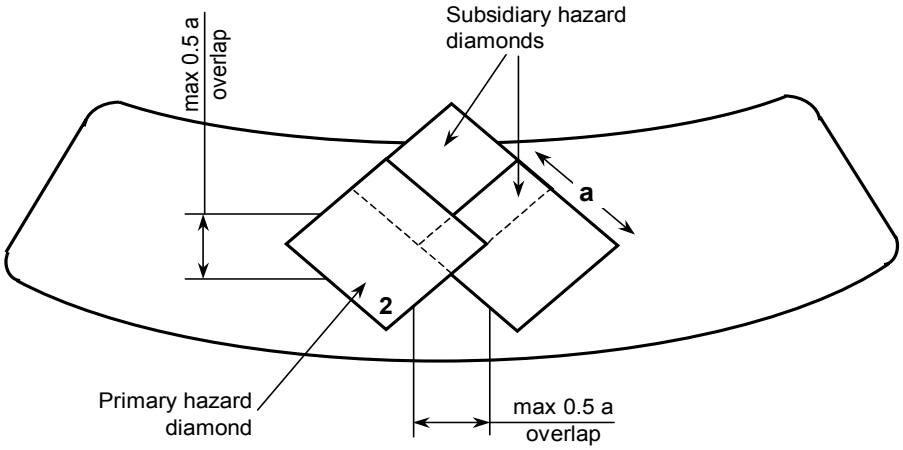


Fig. 2c : Primary and two subsidiary hazard diamonds arranged in a triangle and double panel

Figure 2 : Arrangements of primary and subsidiary hazard diamonds and double panels

It is obvious, though, that in view of the number of risk and safety phrases assigned to some gases, the shoulder label cannot accommodate all the required content. In such cases, along with a shoulder label, an additional label can be used elsewhere on the body, close to the shoulder label. This can be rectangular in shape, of an appropriate size proportionate to the cylinder diameter, and its content clearly visible.

It is suggested that the shoulder label, if used in combination with a body label and/or stenciling on the body, should at least retain the name or generic name of the gas and the hazard symbol(s).

5.3.2 Label for cylinder bundles, clusters or pallets

For assemblies of cylinders, known as bundles, the following methods of labelling are recommended:

a) either all-visible cylinders are labelled as suggested for single cylinders; or

b) as a minimum, one set of transport danger label(s) with a minimum size of 100 mm x 100 mm is affixed on each side of the bundle. A label as suggested for single cylinders shall also be affixed close to the withdrawal connection(s).

A sample of this label is shown in Appendix E2.

5.3.3 Label for portable cryogenic liquid containers

The size of the labels should be proportionate to the container size and, most importantly, the content should be clearly legible.

The most commonly used labels for this purpose are rectangular in shape and the recommended size is 200 mm in width x 300 mm in length.

A sample of this label is shown in Appendix E3.

5.3.4 Label for tube trailers, bulk tankers, ISO containers and storage vessels

The size of the labels should be proportionate to the container size and, most importantly, the content should be clearly legible.

The most commonly used labels for this purpose are rectangular in shape and the recommended size is 600 mm in width x 800 mm in length.

A sample of this label is shown in Appendix E4.

5.3.5 Work example of standardized label for oxygen

Name:	Oxygen compressed (from Appendix A)
Hazard Symbol Pictogram:	Non-flammable 2.2 (primary) & Oxidizer (secondary). The 2 diamond pictograms, with the primary diamond overlapping the secondary diamond (from Appendix A)
Signal Word:	Warning (to include this column in Appendix A)
Risk Phrase:	Contact with combustible material may cause fire (Appendix A & C- R8)
Safety Phrase:	Keep away from combustible material (Appendix A & D –S17)
Supplier Identification:	ABC Gas Supplier Address xxxx Telephone xxxx

6 References

The following documents were used as references to this publication:

European Industrial Gases Association, EIGA 906/02/E: Classification, Labelling and Safety Data Sheet Guide.
Website: www.eiga.org

International Air Transport Association (IATA): Dangerous Goods Regulations (DGR)
Website: www.iata.org

International Maritime Organization: “International Maritime Dangerous Goods (IMDG) Code Volume II - Dangerous Goods List”

International Organization For Standardization ISO 7225:1994(E): Gas cylinders – precautionary labels.
Website: www.iso.org

United Nations (UN) publication: “Recommendations on the transport of dangerous goods, Model Regulations”, also called the ‘Orange Book.’
Website: www.unece.org/trans/danger/publi/

United Nations (UN) publication: “Globally Harmonized System (GHS) of Classification and Labelling of Chemicals”, also called the ‘Purple Book’.
Website: www.unece.org/trans/danger/publi/

Appendix A: Hazard Classification

Hazard Classification - List of Common Industrial & Medical & Specialty Gases (Excluding Mixtures)

No	Common Gas Name	Proper Shipping Name	Chemical Formula	UN No	Primary Hazard Classification	UN DG Code	Secondary Hazard Classification	Signal Word	Risk Phrases (R) See Note Below	Safety Phrases (S)	HAZCHEM No.
Industrial Gases											
1	Acetylene	Acetylene, dissolved	C_2H_2	1001	Flammable	2.1	None	Danger	5-6-12	9-6-33	2(S)E
2	Air	Air, compressed		1002	Non-Flammable	2.2	None	Warning	G3	51	2(T)
3	Argon	Argon, compressed	Ar	1006	Non-Flammable	2.2	None	Warning	G3	51	2(T)
4	Carbon Dioxide	Carbon Dioxide	CO_2	1013	Non-Flammable	2.2	None	Warning	G3	51	2RE
5	Helium	Helium, compressed	He	1046	Non-Flammable	2.2	None	Warning	G3	51	2(T)
6	Hydrogen	Hydrogen	H_2	1049	Flammable	2.1	None	Danger	12	9-16-33	2(S)E
7	Liquid Argon	Argon, refrigerated liquid	Ar	1951	Non-Flammable	2.2	None	Warning	G4	39-51	2RE
8	Liquid Carbon Dioxide	Carbon Dioxide, refrigerated liquid	CO_2	2187	Non-flammable	2.2	None	Warning	G4	51	2RE
9	Liquid Helium	Helium, refrigerated liquid	He	1963	Non-Flammable	2.2	None	Warning	G4	39-51	2R
10	Liquid Nitrogen	Nitrogen, refrigerated liquid	N_2	1977	Non-Flammable	2.2	None	Warning	G4	39-51	2RE
11	Liquid Oxygen	Oxygen, refrigerated liquid	O_2	1073	Non-Flammable	2.2	Oxidizer	Warning	8	17	2PE
12	Nitrogen	Nitrogen, compressed	N_2	1066	Non-Flammable	2.2	None	Warning	G3	51	2(T)
13	Nitrous Oxide	Nitrous Oxide, compressed	N_2O	1070	Non-Flammable	2.2	Oxidizer	Warning	8	9-17	2R
14	Oxygen	Oxygen, compressed	O_2	1072	Non-Flammable	2.2	Oxidizer	Warning	8	17	2(S)
15	Liquid Nitrous Oxide	Nitrous Oxide, refrigerated liquid	N_2O	2201	Non-Flammable	2.2	Oxidizer	Warning	8	9-17	
Specialty Gases											
16	Ammonia	Ammonia, anhydrous liquefied	NH_3	1005	Toxic	2.3	None	Danger	10-23-34-50	9-16-26-36/37/39-45-61	2RE
17	Arsine	Arsine	AsH_3	2188	Toxic	2.3	Flammable	Danger	12-26-48/20-50/53	9-16-28-33-36/37-45-60-61	2PE
18	Boron Trichloride	Boron Trichloride	BCl_3	1741	Non-Flammable	2.2	Corrosive	Warning	14-26/28-34	9-26-28-36/37/39-45	4WE
19	Boron Trifluoride	Boron Trifluoride	BF_3	1008	Toxic	2.3	None	Danger	14-26-35	9-26-28-36/37/39-45	
20	Butane	Butane	C_4H_{10}	1011	Flammable	2.1	None	Danger	12	9-16	2WE
21	Carbon Monoxide	Carbon Monoxide	CO	1016	Toxic	2.3	Flammable	Danger	61-12-23-48/23	53-45	2SE
22	Chlorine	Chlorine	Cl_2	1017	Toxic	2.3	None	Danger	23-36/37/38-50	9-45-61	2XE
23	Chlorine Trifluoride	Chlorine Trifluoride	ClF_3	1749	Toxic	2.3	Corrosive & Oxidizer	Danger	8-23-35	9-17-26-36/37/39-45	
24	Diborane	Diborane, compressed	B_2H_6	1911	Toxic	2.3	Flammable	Danger	16-26	1-9-16-33-36-45	

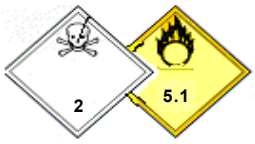
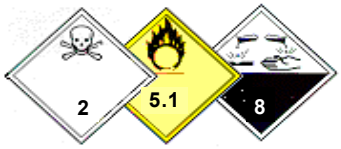
No	Common Gas Name	Proper Shipping Name	Chemical Formula	UN No	Primary Hazard Classification	UN DG Code	Secondary Hazard Classification	Signal Word	Risk Phrases (R) See Note Below	Safety Phrases (S)	HAZCHEM No.
25	Ethane	Ethane, compressed	C_2H_6	1035	Flammable	2.1	None	Danger	12	9-16-33	2PE
26	Ethylene	Ethylene, compressed	C_2H_4	1962	Flammable	2.1	None	Danger	12	9-16-33	2PE
27	Ethylene Oxide	Ethylene Oxide	C_2H_4O	1040	Toxic	2.3	Flammable	Danger	12-45-46-23-36/37/38	53-45	2PE
28	Hexafluoroethane	Hexafluoroethane, compressed	C_2F_6	2193	Non-flammable	2.2	None	Warning	G3	51	
29	Hydrogen Chloride	Hydrogen Chloride, anhydrous	HCl	1050	Non-flammable	2.2	Corrosive	Warning	23-35	9-26-36737/39-45	2RE
30	Hydrogen Fluoride	Hydrogen Fluoride, anhydrous	HF	1052	Toxic	2.3	None	Danger	26/27/28-35	7/9-26-36/37/39-45	4WE
31	Hydrogen Sulphide	Hydrogen Sulphide	H_2S	1053	Toxic	2.3	Flammable	Danger	12-26-50	9-16-28-36/37-45-61	2WE
32	Isobutane	Isobutane	iso-C_4H_{10}	1969	Flammable	2.1	None	Danger	12	9-16	2WE
33	Krypton	Krypton, compressed	Kr	1056	Non-flammable	2.2	None		G3	51	2(T)
34	Methane	Methane, compressed	CH_4	1971	Flammable	2.1	None	Danger	12	9-16-33	2(S)E
35	Neon	Neon, compressed	Ne	1065	Non-flammable	2.2	None		G3	51	2(T)
36	Nitric Oxide	Nitric Oxide	NO	1660	Toxic	2.3	None	Danger	8-26-34	1-9-17-26-36/37/39-45	2RE
37	Nitrogen Trifluoride	Nitrogen Trifluoride	NF_3	2451	Toxic	2.3	Oxidizer	Danger	8	9-17-23	
38	Phosphine	Phosphine	PH_3	2199	Toxic	2.3	Flammable	Danger	12-17-26	1-9-16-33-36-45	2WE
39	Propane	Propane	C_3H_8	1978	Flammable	2.1	None	Danger	12	9-16	2WE
40	Propylene	Propylene	C_3H_6	1077	Flammable	2.1	None	Danger	12	9-16-33	2WE
41	Silane	Silane	SiH_4	2203	Flammable	2.1	None	Danger	12-17	9-16-33	2SE
42	Sulphur Dioxide	Sulphur Dioxide, liquefied	SO_2	1079	Toxic	2.3	None	Danger	23-34	9-26-36/37/39-45	2RE
43	Sulphur Hexafluoride	Sulphur Hexafluoride	SF_6	1080	Non-flammable	2.2	None	Warning	G3	51	2RE
44	Tetrafluoromethane	Tetrafluoromethane	CF_4	1982	Non-flammable	2.2	None	Warning	G3	51	
45	Trifluoromethane	Trifluoromethane	CHF_3	1984	Non-flammable	2.2	None	Warning	G3	51	
46	Tungsten Hexafluoride	Tungsten Hexafluoride	WF_6	2196	Toxic	2.3	None	Danger	26-35	1-9-26-36/37/39-45	
47	Xenon	Xenon, compressed	Xe	2036	Non-flammable	2.2	None	Warning	G3	51	2(T)

This Appendix is compiled from the data available in European Industrial Gases Association EIGA 906/02/E: Classification, Labelling and Safety Data Sheet Guide.

Note: Gases for which a specific Risk or Safety phrase cannot be used, general caution statements, such as those below, may be used:

G1 -- Danger extremely flammable
G2 -- Danger may cause or intensify fire; oxidiser
G3 -- Warning, contains gas under pressure may explode if heated
G4 – Warning, contains refrigerated gas; may cause cryogenic burns or injury

Appendix B: Hazard Symbol

Possible Hazard Symbol Combinations	
Division 2.1 **Flammable Gases**	
Division 2.2 **Non-Flammable and Non-Toxic**	
Non-Flammable Non-Toxic And Oxidising(5.*1*)	
Division 2.3 **Toxic Gases**	
Toxic and Corrosive (8)	
Toxic and Flammable 2.1	
Toxic and Oxidising (5.1)	
Toxic and Oxidising (5.1) and Corrosive (8)	
Toxic and Flammable (2.1) and Corrosive (8)	

Appendix C: Risk Phrases

Risk Phrases (Hazard Statement)

Risk No	Risk Phrase		Risk No	Risk Phrase
R5	Heating may cause an explosion.		R46	May cause heritable genetic damage.
R6	Explosive with or without contact with air.		R49	May cause cancer by inhalation.
R7	May cause fire.		R50	Very toxic to aquatic organisms.
R8	Contact with combustible material may cause fire.		R51	Toxic to aquatic organisms.
R10	Flammable.		R52	Harmful to aquatic organisms.
R11	Highly flammable.		R53	May cause long-term adverse effects to the aquatic environment.
R12	Extremely flammable.		R59	Dangerous for the ozone layer.
R14	Reacts violently with water.		R60	May impair fertility.
R17	Spontaneously flammable in air.		R61	May cause harm to the unborn child.
R19	May form explosive peroxides.		R62	Possible risk of impaired fertility.
R20	Harmful by inhalation.		R63	Possible risk of harm to the unborn child.
R21	Harmful in contact with skin.		R64	May cause harm to breastfed babies.
R22	Harmful if swallowed.		R68	Possible risks of irreversible effects.
R23	Toxic by inhalation.		R20/21	Harmful by inhalation and in contact with skin.
R25	Toxic if swallowed.		R20/22	Harmful by inhalation and if swallowed.
R26	Very toxic by inhalation.		R21/22	Harmful in contact with skin and if swallowed.
R28	Very toxic if swallowed.		R23/25	Toxic by inhalation and if swallowed.
R34	Cause burns (to eyes, respiratory system and skin).		R24/25	Toxic in contact with skin and if swallowed.
R35	Cause severe burns (to eyes, respiratory system and skin).		R26/27	Very toxic by inhalation and in contact with skin.
R36	Irritating to eyes.		R26/28	Very toxic by inhalation and if swallowed.
R37	Irritating to respiratory system.		R36/37	Irritating to eyes and respiratory system.
R38	Irritating to skin.		R36/38	Irritating to eyes and skin.
R40	Limited evidence of a carcinogenic effect.		R37/38	Irritating to respiratory system and skin.
R41	Risk of serious damage to eyes.		R48/20	Harmful: danger of serious damage to health by prolonged exposure through inhalation.
R43	May cause sensitization by skin contact.		R48/23	Toxic: danger of serious damage to health by prolonged exposure through inhalation.
R45	May cause cancer.			

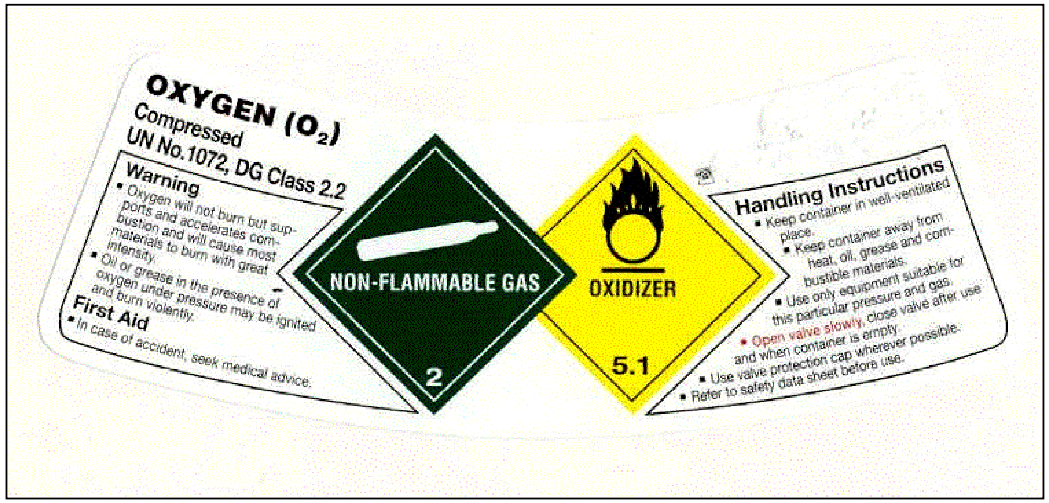
Risk No	Risk Phrase		Risk No	Risk Phrase
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects to the aquatic environment.		R26/27/28	Very toxic by inhalation, in contact with skin and if swallowed.
R51/53	Toxic to aquatic organisms, may cause long-term adverse effects to the aquatic environment.		R36/37/38	Irritating to eyes, respiratory system and skin.
R52/53	Harmful to aquatic organisms, may cause long-term adverse effects to the aquatic environment.		R48/20/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R20/21/22	Harmful by inhalation, in contact with skin and if swallowed.		R48/23/24/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
R23/24/25	Toxic by inhalation, in contact with skin and if swallowed.			

Appendix D: Safety Phrases

Safety Phrases (Handling Instruction)

Safety No	Safety Phrase		Safety No	Safety Phrase
S1	Keep locked up.		S39	Wear eye/face protection.
S2	Keep out of the reach of children.		S41	In case of fire and/or explosion, o not breathe fumes.
S3	Keep in a cool place.		S45	In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S7	Keep container tightly closed.		S51	Use only in well-ventilated areas.
S8	Keep container dry.		S53	Avoid exposure, obtain special instructions before use.
S9	Keep container in well-ventilated place.		S59	Refer to manufacturer/supplier for information on recovery/recycling.
S15	Keep away from heat.		S60	This material and its container must be disposed of as hazardous waste.
S16	Keep away from ignition sources - no smoking.		S61	Avoid release to the environment. Refer to special instructions/Material Safety Data Sheets
S17	Keep away from combustible material.		S1/2	Keep locked up and out of the reach of children.
S23	Do not breathe the gas.		S3/7	Keep container tightly closed in a cool place.
S24	Avoid contact with skin.		S7/8	Keep container tightly closed and dry.
S25	Avoid contact with eyes.		S7/9	Keep container tightly closed and in well ventilated place.
S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.		S20/21	When using, do not eat, drink or smoke.
S27	Take off immediately all contaminated clothing.		S24/25	Avoid contact with skin and eyes.
S28	After contact with skin, wash immediately with plenty of ... (to be specified by the manufacturer).		S36/37	Wear suitable protective clothing and gloves.
S29	Do not empty into drains.		S37/39	Wear suitable gloves and eye/face protection.
S33	Take precautionary measures against static discharges.		S3/9/14	Keep in a cool well-ventilated place away from ... (incompatible materials to be indicated by the manufacturer).
S36	Wear suitable protective clothing.		S36/37/39	Wear suitable protective clothing, gloves and eye/face protection.
S38	In case of insufficient ventilation, wear suitable respiratory equipment.			

Appendix E1: Label placement & description for cylinders

Label placement and label description for compressed gas cylinders (individual)	
	

Appendix E1 (continued)

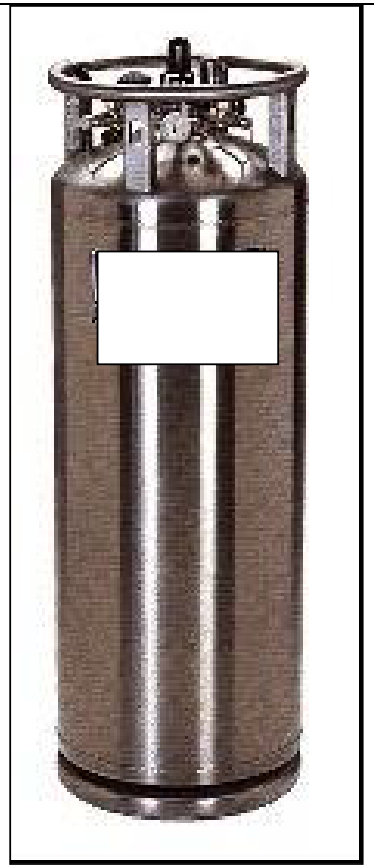
Sample of label for compressed gas cylinders (individual)

Appendix E2: Label placement for cylinders (palletized)

Label placement for compressed gas cylinders (palletized)		
		

Appendix E3: Label placement for portable cryogenic gas container

Label placement & size of a portable cryogenic gas container



Appendix E3 (continued)

Sample of a label for portable cryogenic gas container

HANDLING INSTRUCTION:

- Keep container upright at all times.
- Keep container away from heat and ignition sources.
- Do not allow oil, grease or fuel to come into contact with container.
- Do not drop container.
- Handle container with extreme care.

SPECIALIST ADVICE:

Supplier's LOGO
Supplier's Name
Supplier's Address

Emergency ☎: **(XX) 1234 5678**
(XX) 9876 5432

OXYGEN

Refrigerated Liquid

- **UN No.: 1073**
- **UN Class: 2.2**
- **UN Subsidiary Risk: 5.1**

DANGER:

- Oxidizer; strongly supports combustion. May cause or intensify fire. Keep away from combustible material.
- May react violently with oil or grease.
- Store and use in well -ventilated area.

WARNING:

- Contains refrigerated gas. Extremely cold; may cause cryogenic burns, frostbite or injury. Avoid contact with clothing, skin and eyes.
- Liquid or cold gas will freeze air and vent lines. After use, close valve and/or cap off co ntainer.
- Wear appropriate personal protective equipment.

FIRST AID:

- In case of burns or frostbite, rinse with plenty of warm water.
- Obtain medical treatment immediately and seek medical advice.

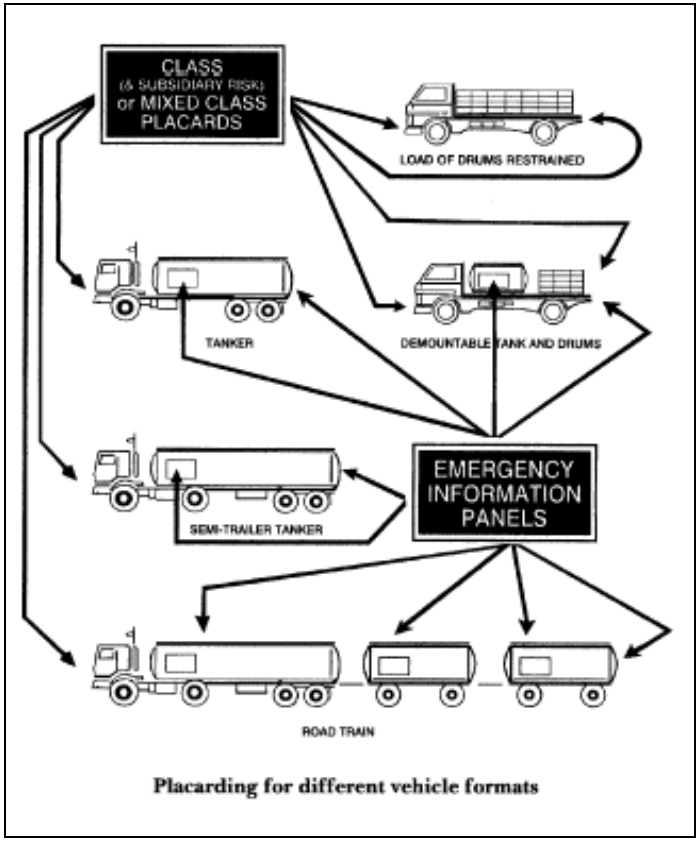
OTHER INFORMATION:

- Refer to or call supplier for container operating instruction and gas safety data sheet.

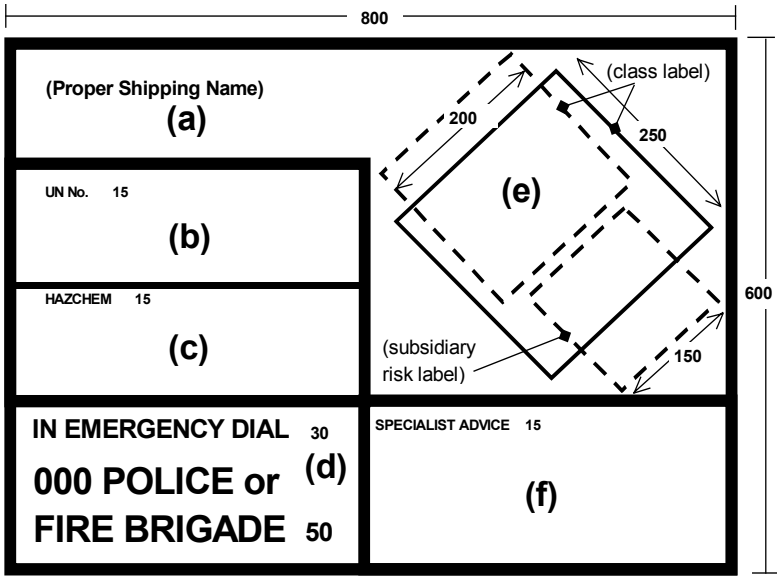
DO NOT REMOVE THIS PRODUCT LABEL

Appendix E4: Label placement for transportable liquefied and compressed gas containers

Label placement & size for transportable liquefied and compressed gas containers (Tube trailers, bulk tankers, ISO containers)



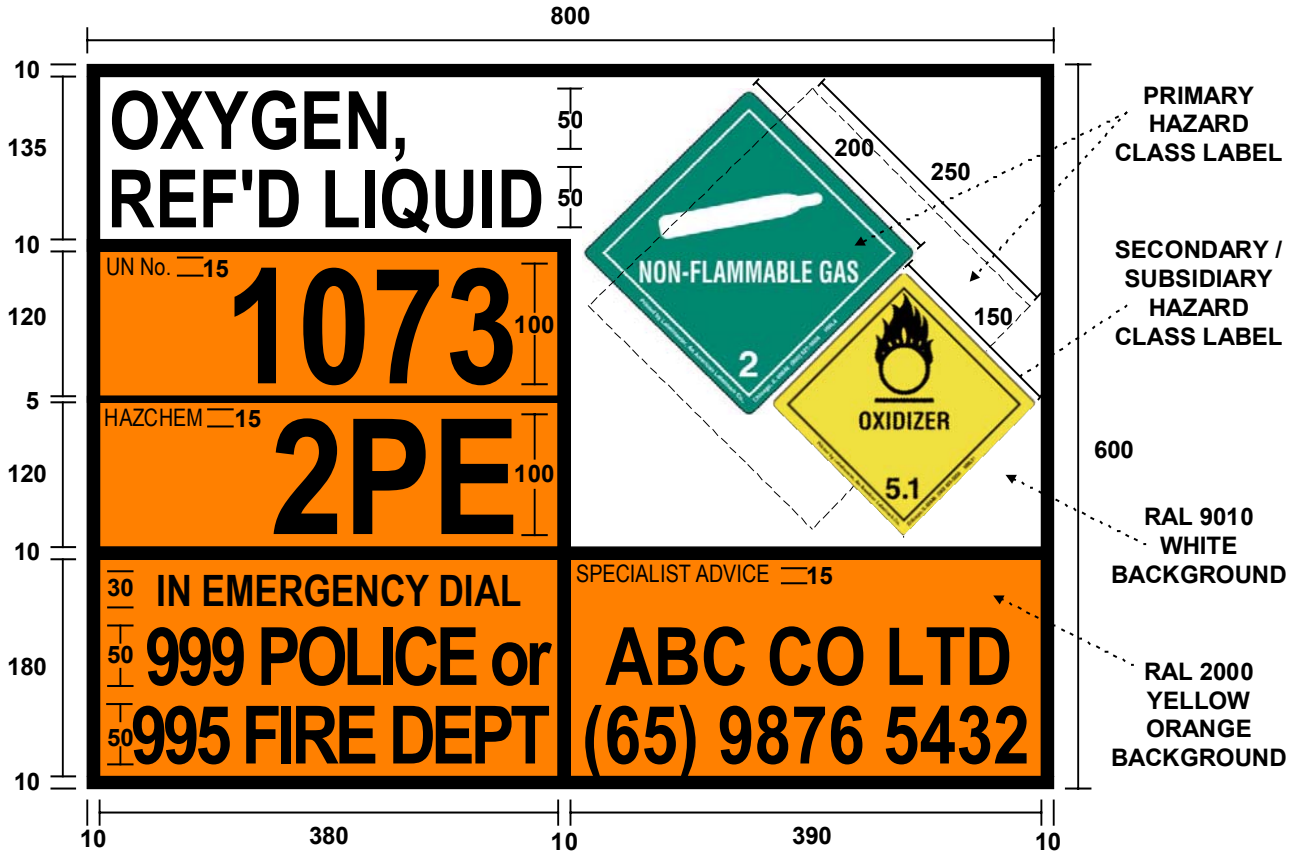
Placarding for different vehicle formats



Content	Letter Size
(a) Shipping Name	(50mm)
(b) UN No.	(100mm)
(c) HAZCHEM No.	(100mm)
(d) Agency	(50mm)
(e) Class Label	
(f) Organization	(50mm)

Appendix E4: (continue)

Sample of label for a transportable "oxygen refrigerated liquid" gas container



NOTE: ALL DIMENSIONS ARE IN MM