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Gas cylinders — Gases and gas mixtures — Determination of corrosiveness for the selection of cylinder valve outlet

Bouteilles à gaz — Gaz et mélanges de gaz — Détermination de la corrosivité pour le choix des raccords de sortie de robinets

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 2, *Cylinder fittings*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 23, *Transportable gas cylinders*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 13338:2017), which has been technically revised. The main changes are as follows:

— the corrosiveness of gases and gases mixtures has been clarified;

— the definition of FTSC codes for corrosiveness gases and gas mixtures has been clarified in Clause 4;

— minor editorial changes have been made in Table 1.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

ISO 5145 specifies the dimensions of different valve outlets for different compatible gas groups. These compatible gas groups are determined according to practical criteria defined in ISO 14456.

These criteria are based on certain physical, chemical, toxic and corrosive properties of the gases. In particular, the gas corrosiveness is considered in this document.

The aim of this document is to assign a classification category for each gas that takes into account the tissue corrosiveness of the gas for skin, eyes and the respiratory tract as well as the potential for a corrosiveness related acid/base chemical reaction.

For gas mixtures containing corrosive components, a calculation method based on the additivity method of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)[3] is proposed.

However, for gas mixtures containing corrosive gas components, some valve outlets standards require the use of the corrosive category regardless of the corrosive gas concentration.

Gas cylinders — Gases and gas mixtures — Determination of corrosiveness for the selection of cylinder valve outlet

1 Scope

This document specifies the following, in order to determine the corrosiveness of gases and gas mixtures so that a suitable outlet connection can be assigned to each of them:

— for pure gases and some liquids, a complete list indicating their corrosiveness;

— for gas mixtures, a calculation method, in the absence of experimental data, relating to the corrosiveness of each of their components.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
tissue corrosiveness
<gases or gas mixtures> ability of a gas to damage or destroy living tissues (eyes, skin and mucous membranes)

Note 1 to entry: It corresponds to GHS hazard class “Skin corrosion/irritation” Cat. 1, 1A, 1B or 1C, or to GHS hazard class “Serious eye damage/eye irritation”, Cat. 1.

3.2
irritant
property of a gas which can cause a temporary reaction to the skin, eyes and mucous membranes

Note 1 to entry: It corresponds to GHS hazard class “Skin corrosion/irritation”, Cat. 2, or to GHS hazard class “Serious eye damage/eye irritation”, Cat. 2.

4 Classification

Gas cylinder connections should take into account all aspects of corrosiveness as reflected in the subdivisions of the C code of the FTSC code (which includes tissue corrosiveness and acid/base chemical reactivity). The subdivisions of the FTSC code are given below and repeated in the footer of Table 1:

— 0: non-corrosive;

— 1: non-halogen acid forming;

— 2: basic;

— 3: halogen acid forming.

In addition, gases and gas mixtures are classified into the following tissue corrosiveness categories:

— C: corrosive (irreversible damage);

— i: irritant (reversible damage);

— nc: non-corrosive, non-irritant;

which are indicated for information in the column “Tissue corrosiveness category” of Table 1.

5 Categories of corrosiveness for pure gases

The corrosiveness of single gases is indicated in Table 1. Column 4 lists the subdivision of the C code of the FTSC code. Column 5 lists the tissue corrosiveness category.

Table 1 — Corrosiveness categories of pure gases

Gas/liquid name	Chemical formula	Synonym	FTSC C code	Tissue corrosiveness category [c]
Ammonia[a]	NH_3	R717	2	C
Antimony pentafluoride[a]	SbF_5		3	C
Arsine	AsH_3		0	nc
Bis-trifluoromethylperoxide	$(CF_3)_2O_2$		0	nc
Boron trichloride	BCl_3	Boron chloride	3	C
Boron trifluoride	BF_3	Boron fluoride	3	C
Bromine pentafluoride[a]	BrF_5		3	C
Bromine trifluoride[a]	BrF_3		3	C
Bromoacetone[a]	CH_3COCH_2Br		3	C
1,3-Butadiene, stabilized	$CH_2 = CH\text{-}CH = CH_2$		0	nc
Carbon monoxide	CO		0	nc
Carbonyl fluoride	CF_2O		3	C
Carbonyl sulfide	COS	Carbonoxylsulfide	1	C
Chlorine	Cl_2		3	C
Chlorine pentafluoride	ClF_5		3	C
Chlorine trifluoride	ClF_3		3	C
Chloromethane	CH_3Cl	Methyl chloride R40	0	nc
Chlorotrifluoroethylene, stabilized	C_2ClF_3		0	nc
Cyanogen	$(CN)_2$		0	i
Cyanogen chloride	ClCN		3	C
Cyclopropane	C_3H_6	Trimethylene	0	nc

Key FTSC (see ISO 14456)

0 = non-corrosive

1 = non-halogen acid forming

2 = basic

3 = halogen acid forming

[a] Some products, being liquid at normal ambient conditions, are included in this grouping because valve outlets are necessary when these products are supplied together with a propellant in a pressure container.

[b] This category is conservative and is used to indicate that this a weak acid.

[c] This column is for guidance only. For more information, see Reference [3].

Table 1 *(continued)*

Gas/liquid name	Chemical formula	Synonym	FTSC C code	Tissue corrosiveness category [c]
Deuterium chloride	DCl		3	C
Deuterium fluoride	DF		3	C
Deuterium selenide	D_2Se		1[b]	i
Deuterium sulfide	D_2S		1[b]	i
Diborane	B_2H_6		0	nc
Dibromodifluoromethane[a]	CBr_2F_2	R12B2	0	nc
Dichlorosilane	SiH_2Cl_2		3	C
Diethylzinc[a]	$(C_2H_5)_2Zn$		0	nc
Dimethylamine	$(CH_3)_2NH$		2	C
Dimethylsilane	$(CH_3)_2SiH_2$		0	nc
Diphosgene[a]	$C_2O_2Cl_4$		3	C
Ethyldichloroarsine[a]	$C_2H_5AsCl_2$		3	C
Ethylene oxide	C_2H_4O	Oxirane	0	i
Fluorine	F_2		3	C
Germane	GeH_4		0	nc
Heptafluorobutyronitrile[a]	C_4F_7N		0	nc
Hexafluoroacetone	C_3F_6O	Perfluoroacetone	3	C
Hexafluorocyclobutene	C_4F_6		0	nc
Hydrogen bromide	HBr	Hydrobromic acid (anhydrous)	3	C
Hydrogen chloride	HCl	Hydrochloric acid (anhydrous)	3	C
Hydrogen cyanide	HCN	Hydrocyanic acid (anhydrous)	1[b]	i
Hydrogen fluoride[a]	HF	Hydrofluoric acid (anhydrous)	3	C
Hydrogen iodide	HI	Hydroiodic acid (anhydrous)	3	C
Hydrogen selenide	H_2Se		1[b]	i
Hydrogen sulfide	H_2S		1[b]	i
Iodine pentafluoride[a]	IF_5		3	C
Iodotrifluoromethane	CF_3I	Trifluoromethyl iodide	0	nc
Methyl bromide	CH_3Br	Bromomethane	0	i
Methyl mercaptan	CH_3SH	Methanethiol	1[b]	i
Methyl vinyl ether (inhibited)	C_3H_6O	Methoxyethylene	0	nc

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Table 1 *(continued)*

Gas/liquid name	Chemical formula	Synonym	FTSC C code	Tissue corrosiveness category [c]
Methyldichloroarsine[a]	CH_3AsCl_2		3	C
Methylsilane	CH_3SiH_3		0	nc
Monoethylamine[a]	$C_2H_5NH_2$	Ethylamine R631	2	C
Monomethylamine	CH_3NH_2	Methylamine R630	2	C
Nickel carbonyl[a]	$Ni(CO)_4$	Nickel tetracarbonyl	0	nc
Nitric oxide	NO	Nitrogen oxide	1	C
Nitrogen dioxide	NO_2	Nitrogen(IV) oxide	1	C
Nitrogen trifluoride	NF_3		0	i
Nitrosyl chloride	$NOCl$		3	C
Oxygen difluoride	F_2O		3	C
Ozone (note: “not filled into cylinders”)	O_3		0	i
Pentaborane[a]	B_5H_{10}		0	nc
Pentafluoropropionitrile	C_3F_5N		0	nc
Perfluoro-2-butene	C_4F_8		0	nc
Phenylcarbylamine chloride[a]	$C_6H_5NCCl_2$		3	C
Phosgene	$COCl_2$	Carbonyl chloride	3	C
Phosphine	PH_3		0	nc
Phosphorus pentafluoride	PF_5		3	C
Phosphorus trifluoride	PF3		3	C
Propylene oxide	C_3H_6O	Methyl oxirane	0	i
Silane	SiH_4	Silicon tetrahydride	0	nc
Silicon tetrachloride[a]	$SiCl_4$		3	c
Silicon tetrafluoride	SiF_4	Tetrafluorosilane R764	3	C
Stibine	SbH_3	Antimony hydride	0	nc
Sulfur dioxide	SO_2		1	C
Sulfur tetrafluoride	SF_4		3	C
Sulfuryl fluoride	SO_2F_2		0	nc
Tetraethyllead[a]	$(C_2H_5)_4Pb$		0	nc
Tetrafluorohydrazine	N_2F_4		3	C
Tetramethyllead	$(CH_3)_4Pb$		0	nc
Triethylaluminum[a]	$(C_2H_5)_3AI$		0	nc
Triethylborane	$(C_2H_5)_3B$		0	nc
Trifluoroacetonitrile[a]	C_2F_3N		0	C

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