BRITISH STANDARD

BS EN
720-1:1999

Transportable gas cylinders — Gases and gas mixtures —

Part 1: Properties of pure gases

The European Standard EN 720-1:1999 has the status of a British Standard

ICS 23.020.30; 71.100.20; 75.160.30

National foreword

This British Standard is the English language version of EN 720-1:1999.

The UK participation in its preparation was entrusted by Technical Committee PVE/3, Gas containers, to Subcommittee PVE/3/1, Valve fittings for gas cylinders, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 8, an inside back cover and a back cover.

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English version

Transportable gas cylinders — Gases and gas mixtures — Part 1: Properties of pure gases

Bouteilles à gaz transportables — Gaz et mélanges de gaz —
Partie 1: Propriétés des gaz purs

Ortsbewegliche Gasflaschen — Gase und Gasgemische —
Teil 1: Eigenschaften von Einzel — Gasen

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 23, Transportable gas cylinders, the Secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 1999, and conflicting national standards shall be withdrawn at the latest by October 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This European Standard has been submitted for reference into the RID and/or in the technical annexes of the ADR. Therefore in this context the standards listed in the normative references and covering basic requirements of the RID/ADR not addressed within the present standard are normative only when the standards themselves are.

Contents

Introduction

In Europe there are 2 existing Directives which deal with the classification of gases. One relates to Dangerous Substances and Preparations, the other to the Transport of Dangerous Goods (ADR). These Directives have several conflicting classifications, e.g. toxicity is expressed in volume parts per million (p.p.m.V) in the ADR Directive and in milligrams per litre (mg/l) in the Substances and Preparations Directive.

The purpose of this standard is to list the properties of individual gases to facilitate the selection of valve outlets.

This is different from the scope of the two Directives mentioned above, which are concerned with hazard identification and transport matters respectively.

Consequently this standard is not in conflict with either of the two above Directives as it specifically addresses the risks of misconnection of equipment e.g. Chlorine is not an oxidant according to Transport Regulations, but the risk of mixing this gas with flammable gas is well known and is addressed in this standard.

1 Scope

The purpose of this part of EN 720 is to define the properties of gases on the basis of four main physical–chemical criteria i.e. fire potential, toxicity, state of gas and corrosiveness (see clause **3**) for the purpose of the selection of suitable valve outlets.

NOTE See **3.4** for the definition of corrosiveness.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 720-2, *Classification of gases and gas mixtures — Part 2: Gases and gas mixtures — Determination of fire potential and oxidizing ability.*

EN ISO 11114-1, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 1: Metallic materials.*

3 Definitions

For the purpose of this European Standard, the following definitions apply.

3.1

fire potential

a gas or gas mixture is said to be flammable in air if it will ignite in air at atmospheric pressure and at a temperature of 20 °C. The minimum content of gas or gas mixture at which it ignites is called the lower flammability limit in air. This limit is determined at atmospheric pressure and at a temperature of 20 °C

a gas or a gas mixture which is less oxidizing than air is not able, at atmospheric pressure, to support the combustion of substances, which are flammable in air

3.2

toxicity

toxicity is characterized by the 50 % lethal concentration. In this standard the 50 % lethal concentration (LC_{50}) is the concentration of a gas in air, expressed in p.p.m.V., administered in a single exposure during a short period of time (24 h or less) to a group of young adult albino rats (males and females) which results in the death of half of the animals in a period of at least 14 days (see **5.2**)

3.3

state of gas

the physical state in which gases may be stored and transported in cylinders. Four categories are adopted:

— deeply refrigerated liquefied;

— liquefied;

— compressed;

— dissolved

3.4

corrosiveness

ability of the gas to damage or to destroy external living tissues (eyes and skin). Gases are assigned a corrosiveness category. This is not to be confused with corrositivity of gases with metallic materials (see EN ISO 11114-1)

4 Properties of gas mixtures

From the properties of the various components given in clause **6**, the properties of the gas mixtures may be determined by using the appropriate standard on gas mixtures concerning each of the physico-chemical criteria indicated in clause **1** (see EN 720-2 for the fire potential).

5 Code number

To be able to recognize the properties of a gas, a code number (FTSC) is given. This code number assigned to each gas is based on the following four physico-chemical criteria:

Category I: fire potential, defining the gas behaviour with respect to flammability (see **3.1**);

Category II: toxicity determined by the 50 % lethal concentration (see **3.2**);

Category III: gas state, defining the physical state of the contents in the cylinder at 15 °C within a given pressure range (see **3.3**);

Category IV: corrosiveness (see **3.4**).

Each category is composed of different sub-divisions, each identified by a different digit. In this way a gas, in a given state, is characterized by a series of four digits (one digit per category) as shown in **5.1** to **5.5**.

5.1 Fire potential (category I)

For fire potential, gases are divided in 6 subdivisions:

Subdivision 0: inert (any gas not classified under subdivisions 1 to 5 below);

Subdivision 1: supports combustion (oxidizing gas having an oxidant potential equal to or less than that of air);

Subdivision 2: flammable (gas having flammable limits in air) (see **3.1**);

Subdivision 3: spontaneously flammable;

Subdivision 4: highly oxidizing (see **3.1**) (oxidizing gas having an oxidant potential greater than that of air);

Subdivision 5: flammable and subject to decomposition or polymerization.

5.2 Toxicity (category II)

For toxicity, gases are divided into five subdivisions:

Subdivision 0: life supporting;

Subdivision 1: asphyxiant (when LC_{50} is greater than 15 000 p.p.m.V);

Subdivision 2: toxic and asphyxiant (when 200 p.p.m.V $\leq LC_{50} \leq$ 5 000 p.p.m.V);

Subdivision 3: very toxic and asphyxiant (when $LC_{50} \leq$ 200 p.p.m.V);

Subdivision 9: harmful and asphyxiant (when 5 000 p.p.m.V $\leq LC_{50}$ 15 000 p.p.m.V)

where LC_{50} values correspond to 1 h exposure and mortality in 14 days and with p.p.m.V corresponding to the parts per million by volume.

5.3 State of the gas in the cylinder at 15 °C (category III)

For state of the gas, gases are divided into 8 subdivisions:

Subdivision 0: liquefied gas at 35 bar or less;

Subdivision 1: liquefied gas at over 35 bar;

Subdivision 2: liquid withdrawal — liquefied gas (optional);

Subdivision 3: dissolved gas;

Subdivision 4: 35 bar or less — gas only (including cryogenic gas withdrawal);

Subdivision 5: medium pressure range, compressed gases from 35 bar up to and including 250 bar;

Subdivision 7: high pressure range, above 250 bar and up to and including 400 bar;

Subdivision 8: very high pressure, above 400 bar.

NOTE Subdivision 6 is not used here because it is used by the U.S.

5.4 Corrosiveness (category IV)

For corrosiveness, gases are divided into 4 subdivisions:

Subdivision 0: non-corrosive;

Subdivision 1: non-halogen acid forming;

Subdivision 2: basic;

Subdivision 3: halogen acid forming.

5.5 Designation of the code

This code is called FTSC code:

F: for fire potential, defining the gas behaviour with respect to flammability;

T: for toxicity;

S: for gas state, defining the physical state of the contents in the cylinder at 15 °C within a given pressure range;

C: for corrosiveness.

6 List of gases

NOTE For compressed gases the third digit used in this standard is a 5. Most of these gases may be filled at higher pressure and consequently the relevant digit 7 or 8 shall then be used. For liquefied gases the third digit used in this standard is 0 or 1 (depending on the pressure). Most of these gases may be used with liquid withdrawal and consequently the relevant digit 2 shall then be used (irrespective of the pressure).

Gas	Synonym	Code Number
Acetylene	Ethyne	5130
Air		1050
Allene	Propadiene	2100
Ammonia	R717	2902
Antimony pentafluoride		0303
Argon		0150
Arsine		2300
Bis-trifluoromethylperoxide		4300
Boron trichloride	Boron chloride	0203
Boron trifluoride	Boron fluoride	0253
Bromine pentafluoride		4303
Bromine trifluoride		4303
Bromoacetone		0203
Bromochlorodifluoromethane	R12B1	0100
Bromochloromethane		0100
Bromotrifluoromethane	Trifluorobromomethane R13B1	0100
Bromotrifluoroethylene	R113B1	2100
1,3-Butadiene (inhibited)		5100
Butane		2100
1-Butene	Butylene	2100
2-Butene	Butylene	2100
Carbon dioxide	Carbonic acid R744 anhydride	0110
Carbon monoxide		2250
Carbonylfluoride		0213
Carbonyl sulfide	Carbonoxylsulfide	2201
Chlorine		4203
Chlorine pentafluoride		4303
Chlorine trifluoride		4203
1-Chloro-1,1-difluoroethane	R142b	2100
1-Chloro-1,2,2,2 tetrafluoroethane	R124	0100
1-Chloro-2,2,2 trifluoroethane	R133a	0100
Chlorodifluoromethane	Monochlorodifluoromethane R22	0100
Chlorofluoromethane		2100
Chloroheptafluorocyclobutane	C317	0100
Chloromethane	Methyl chloride R40	2900
Chloropentafluoroethane	Monochloropentafluoroethane R115	0100
Chlorotrifluoromethane	Monochlorotrifluoromethane	0100
Chlorotrifluoroethylene	R1113	5200
Coal gas		Mixture
Cyanogen		2200
Cyanogen chloride		0303
Cyclopropane	Trimethylene	2100
Deuterium		2150
Deuterium chloride		0213
Deuterium fluoride		0203
Deuterium selenide		2301
Deuterium sulfide		2201
Diborane		5350
Dibromodifluoromethane	R12B2	0100
1,2-Dibromotetrafluoroethane	R114B2	0100

Gas	Synonym	Code Number
2,2-Dichloro-1,1,1 trifluoroethane	R123	0100
Dichloro-2-chlorovinylarsine	Lewisite	0303
1,2-Dichlorodifluoroethylene	R1112a	0100
Dichlorodifluoromethane	R12	0100
Dichlorofluoromethane	R21	0100
1,2-Dichlorohexafluorocyclobutane	C316	0100
Dichlorosilane		2203
1,1-Dichlorotetrafluoroethane	R114a	0100
1,2-Dichlorotetrafluoroethane	R114	0100
Diethylzinc		3300
1,1-Difluoroethane	Ethylidene fluoride R152a	2100
1,1-Difluoroethylene	Vinylidene fluoride R1132a	2110
Difluoromethane	Methlylene fluoride	0110
Dimethyl ether	Methyl ether	2100
Dimethylamine		2902
2,2-Dimethylpropane	Neopentane Tetramethylmethane	2100
Dimethylsilane		2100
Diphosgene		0303
Ethane	R170	2100
Ethylchloride (flamable liquid)	Chloroethane R160	2100
Ethyl ether	R1150	2100
Ethylacetylene	1-Butyne	2100
Ethyldichloroarsine		0303
Ethylene	Ethene	2150
Ethylene oxide	Oxirane	5200
Fluorine		4343
Fluoroethane	Ethyl fluoride	2100
Germane		2300
Helium		0150
Heptafluorobutyronitrile		2300
Hexafluoroacetone	Hexafluoropropan-2; perfluoroacetone	0203
Hexafluorocyclobutene		2100
Hexafluoroethane	Perfluoroethane R116	0100
Hexafluoropropylene	Hexafluoropropene	0100
Hydrogen		2150
Hydrogen bromide	Hydrobromic acid (anhydrous)	0203
Hydrogen chloride	Hydrochloric acid (anhydrous)	0213
Hydrogen cyanide	Hydrocyanic acid (anhydrous)	5301
Hydrogen fluoride	Hydrofluoric acid (anhydrous)	0203
Hydrogen iodide	Hydroiodic acid (anhydrous)	0203
Hydrogen selenide		2301
Hydrogen sulfide		2201
Iodotrifluoromethane	Trifluoromethyl iodide	0100
Iodine pentafluoride		4303
Isobutane	Trimethylmethane R601	2100
Isobutylene	Isobutene; 2-methylpropene	2100
Krypton		0150
Methane	R50	2150
Methyl acetylene	Allylene; propyne	2100
Methyl bromide	Bromomethane	0200

Gas	Synonym	Code Number
Methyl Ethyl Ether	Ethyl Methyl Ether	2100
Methyl fluoride	Fluoromethane R41	2110
Methyl mercaptan	Methanethiol	2201
Methyl-3-Butene	Isoamvlene – Isopropvlethvlene	2100
Methyldichloroarsine		030
Methylsilane		2100
Methylvinylether (inhibited)	Methoxyethylene	5100
Monoethylamine	Ethylamine R631	2102
Monomethylamine	Methylamine R630	2902
Mustard gas		0303
Natural gas		2150
Neon		0150
Nitric oxide	Nitrogen (II) oxide	4351
Nickel carbonyl	Nickel tetracarbonyle	2300
Nitrogen		0150
Nitrogen dioxide	Liquid dioxide Nitrogen (IV) oxide Dinitrogentetraoxide peroxide Nitrogen tetroxide	4301
Nitrogen trioxide	Nitrogen sesquioxide Dinitrogen trioxide Nitrogen Nitrogen (III) oxide	4301
Nitrosyl chloride		0303
Nitrous oxide		4110
Octafluorocyclobutane	Perfluorocyclobutane C318	0100
Octafluoropropane	Perfluoropropane R218	0100
Oxygen		4050
Oxygen difluoride		4343
Ozone		4330
Pentaborane		3300
Pentachlorofluoroethane		0100
Pentafluoroethane	R125	0100
Pentafluoroethyliodide		0100
Pentafluoropropionitrile		2300
Perfluoro-2-butene		0900
Perfluorobutane		0100
Phenylcarbylamine chloride		0303
Phosgene	Carbonyl chloride	0303
Phosphine		3310
Phosphorus pentafluoride		0303
Phosphorus trifluoride		0203
Propane	R290	2100
Propylene	Propene R1270	2100
Propylene oxide	Methyl oxirane	5900
Silane	Silicone tetrahydride	3150
Silicon tetrachloride		0203
Silicon tetrafluoride	Tetrafluorosilane R764	0253
Stibine	Antimonyhydride	5300
Sulfur dioxide		0201
Sulfur hexafluoride		0100
Sulfur tetrafluoride		0303

Gas	Synonym	Code Number
Sulfuryl fluoride		0203
1,1,1,2-Tetrachlorodifluoroethane	R112a	0100
1,1,1,2,2-Tetrachlorodifluoroethane	R112	0100
Tetraethyl lead		2300
1,1,1,2-Tetrafluoroethane	R134a	0100
1,1,2,2-Tetrafluoro-1 chloroethane		0100
Tetrafluoroethylene	Carbon tetrafluoride R1114	0100
Tetrafluoromethane	Carbon tetrafluoride R14	0150
Tetramethyl lead		2200
Trichlorofluoromethane	Trichloromonofluoromethane R11	0100
1,1,1-Trichlorotrifluoroethane	R113a	0100
1,1,1-Trichlorotrifluoroethane	R113	0100
Triethyl aluminium		3300
Triethyl borane		3200
Trifluoroacetonitrile		2200
1,1,1-Trifluoroethane	R143a	2100
Trifluoroethylene		2200
Trifluoromethane	Fluoroform R23	0100
Trimethylamine		2902
Trimethylstibine		3300
Trimethylsilane		2100
Tungsten hexafluoride		0303
Uranium hexafluoride		0303
Vinyl Bromide (inhibited)		5100
Vinyl Chloride (inhibited)	Chloroethylene R1140	5100
Vinyl Fluoride (inhibited)	Fluoroethylene R1141	5100
Xenon		0150

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