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Gas cylinders — Gas properties and associated classification (FTSC) codes

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National foreword

This British Standard is the UK implementation of ISO 14456:2015.

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Foreword

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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 58, *Gas cylinders*, SC 2, *Cylinder fittings*.

Introduction

This International Standard establishes a method of allocating a four-digit code number (FTSC) to any gas, liquids that are transported under pressure or mixture of gases contained in cylinders. This code number categorizes the gas, liquids that are transported under pressure or gas mixture in terms of its physical-chemical properties and/or flammability, toxicity, state of the gas, and corrosiveness (see 4.1). FTSC is the abbreviation of these properties.

The FTSC code enables a gas, liquids that are transported under pressure or gas mixture to be assigned to one of the 15 “compatible” gas groups.

The FTSC codes and the method for their determination are currently given in ISO 5145:2014, Annex A for use in the selection of valve outlets. This annex from ISO 5145 will be removed when the present standard is published.

The properties and the selection criteria are aligned as appropriate with the Globally Harmonized System for the Classification and Labelling of Chemicals (GHS).

INTERNATIONAL STANDARD ISO 14456:2015(E)

Gas cylinders — Gas properties and associated classification (FTSC) codes

1 Scope

This International Standard gives a list of FTSC (fire potential, i.e. "oxidizing potential and flammability", toxicity, state of the gas, and corrosiveness) codes determined according to the relevant properties of gases and of some liquids that are transported under pressure.

It does not cover gas material compatibility which is covered by ISO 11114 (all parts).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10156, *Gases and gas mixtures — Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets*

ISO 10298, *Determination of toxicity of a gas or gas mixture*

ISO 10286:2015, *Gas cylinders — Terminology*

3 Terms and definitions

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

3.1
gas mixture
combination of different single gases deliberately mixed in specified proportions

[SOURCE: ISO 10286:2015, definition 704]

3.2
liquefied gas
gas, which, when packaged for transport, is partially liquid (or solid) at temperature above −50 °C

[SOURCE: ISO 10286:2015, definition 706]

3.3
compressed gas
gas, which, when packaged under pressure for transport, is entirely gaseous at −50 °C

Note 1 to entry: This category includes all gases with a critical temperature less than or equal to −50 °C.

[SOURCE: ISO 10286:2015, definition 705]

3.4
lethal concentration 50
LC_{50}
concentration of a gas (or a gas mixture) in air administered by 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 leads to the death of half of the animals in at least 14 d

[SOURCE: ISO 10298:2010, definition 2.1]

4 Gas properties

4.1 Numerical gas code (FTSC)

4.1.1 General

The code number assigned to a gas or liquid is based on the following four physical-chemical properties:

a) Category I (F): fire potential, defining the gas behaviour with respect to combustion;

b) Category II (T): acute toxicity;

c) Category III (S): gas state, defining the physical state of the fluid in the cylinder at 15 °C within a given pressure range;

d) Category IV (C): corrosiveness (ability to damage or destroy living tissues: eyes, skin, and mucous membranes).

Each category is subdivided into different characteristics (subdivisions), 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 illustrated below.

4.1.2 Fire potential, category I

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

Subdivision 1: supports combustion (gas having an oxidizing power equal to or less than a mixture containing 23,5 % of oxygen in nitrogen);

Subdivision 2: flammable (gas having flammability limits in air);

NOTE 1 See ISO 10156 for more information.

Subdivision 3: pyrophoric (spontaneously flammable);

Subdivision 4: oxidizing (gas having an oxidizing power greater than a mixture containing 23,5 % O_2 in N_2);

NOTE 2 See ISO 10156 for more information.

Subdivision 5: chemically unstable (flammable and subject to rapid decomposition or polymerization).

NOTE 3 When considering the properties of gases from subdivisions 1 and 4, the following applies:

a) Subdivision 4 considers the risk of accelerating combustion more than air does;

b) For gas material compatibility with gases under pressure of subdivisions 1 and 4, it is considered that the risk of ignition exists when the oxygen partial pressure is more than 30 bar;

c) For valves outlet selection (for example, see ISO 5145), the risk is to mix a flammable gas (subdivision 2 and/or 3) with a gas of subdivision 1 and/or 4.

4.1.3 Acute toxicity, category II

Subdivision 0: supporting human life;

Subdivision 1: non-toxic $LC_{50\ rat\ 1h}$ > 0,5 % by volume (5 000 ppm);

Subdivision 2: toxic; 0,02 % by volume (200 ppm) < $LC_{50\ rat\ 1h}$ ≤ 0,5 % by volume (5 000 ppm);

Subdivision 3: very toxic $LC_{50\ rat\ 1h}$ < 0,02 % by volume (200 ppm).

NOTE See ISO 10298 for more information.

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

All pressures for compressed gases are working pressures according to the definition given in ISO 10286.

For liquefied gases, this is the developed pressure at 65 °C (normally equal to the cylinder test pressure).

Subdivision 0: liquefied gas of 35 bar or less;

Subdivision 1: liquefied gas at a pressure greater than 35 bar;

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

Subdivision 3: dissolved gas;

Subdivision 4: gas phase withdrawal at 35 bar or less;

Subdivision 5: compressed gas between 35 bar and 250 bar (Europe);

Subdivision 6: compressed gas between 35 bar and 207 bar (North America);

Subdivision 7: compressed gas above 207 bar (North America) or 250 bar (Europe).

NOTE 1 Subdivisions 5 and 6 have been adopted as a result of a compromise between the European and the North American approach. The European preference for a limit of 250 bar reflects the current tendency towards higher pressure applications. The current North American practice requires a limit of 207 bar for which their pressure reducing valves are designed. This is the working pressure at the referenced temperature of 15 °C. Therefore, three pressure classes have been retained. Other jurisdictions might use different values.

Either subdivision 5 or subdivision 6 shall be used, never both. The selection of either subdivision will determine the applicable pressure for subdivision 7.

Subdivision 5 or 6: medium pressure range, each user being required to select one subdivision exclusively to determine the upper limit of the medium pressure range (i.e. 182 bar or 250 bar).

Subdivision 7: high pressure range, the lower limit (182 bar or 250 bar) of which depends on the subdivision selected for the medium pressure range.

After the introduction of subdivisions 5, 6, and 7, a number of pressure ranges have been (or are being) established to make the selection of the proper cylinder valve outlet connection (e.g. 500 bar, 800 bar, sub atmospheric pressure. These ranges have been chosen to protect downstream regulators and other ancillary equipment from over-pressurized conditions. Consequently, for the tables in 5.3, the third digit (S) used for all compressed gases is “5” to indicate that this is a compressed gas.

NOTE 2 Subdivisions 8 and 9 have been allocated for liquid withdrawal cylinders of cryogenic gases in the USA.

4.1.5 Corrosiveness, category IV

Subdivision 0: non-corrosive;

Subdivision 1: non-halogen acid forming;

Subdivision 2: basic;

Subdivision 3: halogen acid forming.

NOTE See ISO 13338 for more information.

5 List of gases and liquids with the corresponding FTSC codes

5.1 Basic principles and single gases

The FTSC code enables the assignment of any gas (including gas mixtures) or any liquid to be packaged under pressure one of the 15 "compatible" gas groups listed in the table below.

NOTE Attention is drawn to the fact that the only purpose of the numerical code is to group compatible gases together in order that particular valve outlets might be assigned to each group. Use of the code is limited only to the assignment of valve outlets.

Table 1 — Characteristics of groups

Group	Characteristics
1	Non-flammable, non-toxic gases and qualifying gas mixtures, less stable thermally than group 3
2[b]	Carbon dioxide
3	Non-flammable, non-toxic, and thermally stable gases (except carbon dioxide) and qualifying gas mixtures
4	Non-flammable, toxic, and corrosive (or corrosive by hydrolysis) gases and qualifying gas mixtures
5[b]	Air
6	Flammable and non-toxic gases and qualifying gas mixtures
7	Flammable, toxic, and corrosive (basic) gases and qualifying gas mixtures
8	Flammable, toxic, and corrosive (acidic) or non-corrosive gases and qualifying gas mixtures
9	Spontaneously flammable gases and qualifying gas mixtures
10[b]	Oxygen[a]
11[b]	Nitrous oxide
12	Oxidant, toxic, and/or corrosive gases and qualifying gas mixtures
13	Flammable gases and qualifying gas mixtures subject to decomposition or polymerization
14[b]	Acetylene
15	Oxidant, non-toxic, and non-corrosive gas mixtures

[a] In ISO 5145, characteristics of group 10 is "oxygen and high pressure oxidant". Terms and "high pressure oxidant" will be removed during the next revision of ISO 5145.

[b] Groups 2, 5, 10, 11, and 14 only contain one single gas and are assigned to individual named gases from which mixtures and other gases are excluded.

5.2 Assignment of a gas mixture to a group

For the purposes of this International Standard, a gas mixture is defined as an intentional combination of two or more gases, which might be either in the gaseous phase or liquefied under pressure when in a gas cylinder.

NOTE This International Standard does not attempt to identify gas mixtures which can be safely and satisfactorily prepared; this is the responsibility of the gas manufacturer. It does not describe any methods or techniques for preparing gas mixtures.

The principle of allocation of a four-digit numerical code (FTSC) to gas mixtures is the same as that for single gases. The allocation of the FTSC code to a gas mixture, which allows the assignment of this mixture to one of the group of gases and gas mixtures (see Table 1), depends on the flammability, oxidizing ability,

toxicity, and corrosiveness of the final mixture. The determination of flammability and oxidizing ability is given in ISO 10156, that of toxicity in ISO 10298, and that for corrosiveness in ISO 13338.

Mixtures containing spontaneously flammable gases (i.e. pyrophoric gases such as silane in Table 10) shall be considered as spontaneously flammable gas mixtures if the content of the pyrophoric gas(es) is more than 1 % (by volume).

NOTE Tables 2 to 15 are based on, but have been expanded, from ISO 5145. These tables will be removed when this International Standard has been published and ISO 5145 will be revised.

Table 16 gives the complete list of gases in alphabetical order.

5.3 Tables of compatible groups of gases and liquids

Table 2 — Gases and gas/liquid mixtures belonging to group 1 (non-flammable, non-toxic gases and gas mixtures, less stable thermally than group 3)

Gas	FTSC code	Synonym	CAS Number
Bromochlorodifluoromethane	0100	R12B 1	353–59–3
Bromochloromethane[a]	0100	Halon 1011	74–97–5
Bromotrifluoromethane	0100	Trifluorobromomethane R13B1	75–63–8
Chlorodifluoromethane	0100	Monochlorodifluoromethane R22	75–46–6
Chlorodifluoromethane and Chloropentafluoroethane	0100	R502	azeotropic mixture
Chloroheptafluorocyclobutane[a]	0100	C317	377–41–3
Chloropentafluoroethane	0100	Monochloropentafluoroethane R115	76–15–3
1-Chloro-1,2,2,2-tetrafluoroethane	0100	R124	28–37–89–0
1-Chloro-2,2,2-trifluoroethane	0100	R 133a	75–88–7
Chlorotrifluoromethane	0100	Monochlorotrifluoromethane R1 3	75–72–9
Chlorotrifluoromethane and Trifluoromethane	0100	R503	azeotropic mixture
1, 2-Dibromotetrafluoroethane[a]	0100	R114B2	174–73–2
1, 2-Dichlorodifluoroethylene	0100	R1112a	79–35–6
Dichlorodifluoromethane	0100	R12	75–71–8
Dichlorodifluoromethane and 1,1-Difluoroethane	0100	R500	azeotropic mixture
Dichlorofluoromethane	0100	R21	75–43–4
1,2-Dichlorohexafluorocyclobutane[a]	0100	C316	356–18–3
1,1-Dichlorotetrafluoroethane	0100	R1 14a	374–07–2
1,2-Dichlorotetrafluoroethane	0100	R 114	76–14–2
2,2-Dichloro-1,1,1–trifluoro ethane[a]	0100	R 123	306–83–2
Difluoromethane, Pentafluoroethane, and 1,1,1,2-Tetrafluoroethane	0100	R407A, R407B, R407C	zeotropic mixture
Heptafluoropropane	0100	R227	431–89–0
Hexafluoroethane	0100	Perfluoroethane R1 16	76–16–4
Hexafluoropropylene	0100	Hexafluoropropene R 1216	116–15–4

[a] Some products, being liquid at normal ambient conditions, are included since they might be supplied in non-pressurized containers. They are included in this grouping because valve outlets are necessary when these products are supplied together with a propellant in a pressurized container.

Table 2 *(continued)*

Gas	FTSC code	Synonym	CAS Number
Octafluorobut-2-ene	0100	R1318	360–89–4
Octafluorocyclobutane	0100	Perfluorocyclobutane RC 318	115–25–3
Octafluoropropane	0100	Perfluoropropane R 218	76–19–7
Pentachlorofluoroethane[a]	0100		29756–45–4
Pentafluoroethane	0100	R125	354–33–6
Pentafluoroethane, 1,1,1-Trifluoroethane, and 1,1,1,2-Tetrafluoroethane	0100	R404A	zeotropic mixture
Pentafluoroethyliodide[a]	0100		354–64–3
Perfluorobutane	0100	R610	355–25–9
Sulfur hexafluoride	0100		2551–62–4
1,1,1,2-Tetrachlorodifluoroethane (solid)	0100	R112a	76–11–9
1,1,2,2-Tetrachlorodifluoroethane[a]	0100	R112	76–12–0
1,1,2,2-Tetrafluoro-1-chloroethane	0100	R124a	354–25–6
1,1,1,2-Tetrafluoroethane	0100	R134a	811–97–2
Trichlorofluoromethane[a]	0100	Trichloromonofluoromethane, R11	75–69–4
1,1,1-Trichlorotrifluoroethane[a]	0100	R113a	354–58–5
1,1,2-Trichlorotrifluoroethane[a]	0100	R113	76–13–1
Trifluoromethane	0100	Fluoroform, R23	75–46–7

[a] Some products, being liquid at normal ambient conditions, are included since they might be supplied in non-pressurized containers. They are included in this grouping because valve outlets are necessary when these products are supplied together with a propellant in a pressurized container.

Table 3 — Gases belonging to group 2 (carbon dioxide)

Gas	FTSC code	Synonym	CAS Number
Carbon dioxide	0110	Carbonic acid anhydride R744	124–38–9

Table 4 — Gases and gas mixtures belonging to group 3 (non-flammable, non-toxic, and thermally stable gases and gas mixtures)

Gas	FTSC code	Synonym	CAS Number
Argon	0150		7440–37–1
Helium	0150		7440–59–7
Krypton	0150		7439–90–9
Neon	0150		7440–01–9
Nitrogen	0150		7727–37–9
Xenon	0110[a]		7440–63–3
Tetrafluoromethane	0150	Carbon tetrafluoride R14	75–73–0

[a] FTCS code due to the critical point of the gas of above 15 °C.

Table 5 — Gases and gas mixtures belonging to group 4 (non-flammable, toxic, and corrosive (or corrosive by hydrolysis) gases and gas mixtures)

Gas	FTSC code	Synonym	CAS Number
Antimony pentafluoride[a]	0303		7783–70–2
Boron trichloride	0203	Boron chloride	10294–34–5
Boron trifluoride	0253	Boron fluoride	7637–07–2
Bromoacetone[a]	(0303)-**2203**[b]		598–31–2
Carbonyl-fluoride	0213		353–50–4
Cyanogen chloride	0303		506–77–4
Deuterium chloride	0213		7698–05–7
Deuterium fluoride	0203		14333–26–7
Dibromodifluoromethane[a]	0100	R12B2	75–61–6
Dichloro-2-chlorovinyl arsine[a]	0303	Lewisite	541–25–3
Diphosgene[a]	0303		503–38–8
Ethyldichloroarsine[a]	0303		598–14–1
Hexafluoroacetone	0203	1,1,1,3,3,3,-hexafluoro-2-propanone	684–16–2
Hydrogen bromide	0203	Hydrobromic acid (anhydrous)	10035–10–6
Hydrogen chloride	0213	Hydrochloric acid (anhydrous)	7647–01–0
Hydrogen fluoride[a]	0203	Hydrofluoric acid (anhydrous)	7664–39–3
Hydrogen iodide	0203	Hydroiodic acid (anhydrous)	10034–85–2
Iodotrifluoromethane	(0200)-**0100**[b]	Trifluoromethyl iodide	2314–97–8
Methyl bromide	(0300)-**2200**[b]	Bromomethane	74–83–9
Methyldichloroarsine[a]	0303		593–89–5
Nitrosyl chloride	0303		2696–92–6
Perfluoro-2-butene	(0200)-**0100**[b]	Octafluorobutene; R1318	360–89–4
Phenylcarbylamine Chloride[a]	(0303)-**2303**[b]		622–44–6
Phosgene	0303	Carbonyl chloride	75–44–5
Phosphorus pentafluoride	0203		7647–19–0
Phosphorus trifluoride	0203		7783–55–3
Silicon tetrachloride[a]	0203		10026–04–7
Silicon tetrafluoride	0253	Tetrafluorosilane R764	7783–61–1
Sulfur dioxide	0201		7446–09–5
Sulfur tetrafluoride	0303		7783–60–0
Sulfuryl fluoride	0300	Sulfuryl difluoride	2699–79–8
Tungsten hexafluoride	0203		7783–82–6
Uranium hexafluoride (liquid/solid, class 7)	0303		7783–81–5

The FTSC codes in brackets are from the first version of ISO 5145 (1990). This explains why the corresponding gases are in this table.

[a] Some products, being liquid at normal ambient conditions, are included since they might be supplied in non-pressurized containers. They are included in this grouping because valve outlets are necessary when these products are supplied together with a propellant in a pressurized container.

[b] To be consistent with ISO 10298, the former FTSC code is completed by the new one in bold figures corresponding to the new toxicity level.

Table 6 — Gases belonging to group 5 (air)

Gas	FTSC code	Synonym	CAS Number
Air	1050		132259–10–0

Table 7 — Gases and gas mixtures belonging to group 6 (flammable and non-toxic gases and gas mixtures)

Gas	FTSC code	Synonym	CAS Number
Allene	2100	Propadiene	463–49–0
Bromotrifluoro ethylene	2100	R113B1	589–73–2
Butane	2100		106–97–8
1-Butene	2100	Butylene	106–98–9
Cis-2-Butene	2100	Butylene	590–18–1
Trans-2-Butene	2100	Butylene	624–64–6
1-Chloro-1,1-difluoroethane	2100	R142b	75–68–3
Chlorofluoromethane	2100	R31	593–70–4
Deuterium	2150		7782–39–0
1,1-Difluoroethane	2100 2110	Ethylidene fluoride R 152a	75–37–6
Difluoromethane	2100 2110	Methylene fluoride R 32	75–10–5
1,1-Difluoroethylene	2110	Vinylidene fluoride R1 132a	75–38–7
Dimethylether	2100	Methyl ether	115–10–6
2,2-Dimethylpropane[a]	2100	Tetramethylmethane	463–82–1
Ethane	2110	R170	74–84–0
Ethylacetylene	2100	1-Butyne	107–00–6
Ethylchloride[a]	2100	Chloroethane R160	75–00–3
Ethylfluoride	2100	R161	95508–16–0
Ethylene	2150	Ethene	74–85–1
Ethyl ether[a]	2100	R1150	60–29–7
Hydrogen	2150		1333–74–0
Isobutane	2100	Trimethylmethane R601	75–28–5
Isobutylene	2100	2-Methylpropene**; Isobutene**	115–11–7
Methane	2150	R50	74–82–8
Methylacetylene	2100	Allylene; Propyne	74–99–7
3-Methyl-1-butene[a]	2100	Isoamylene:Isopropylethylene	563–45–1
Methyl ethyl ether	2100	Ethyl methyl ether	540–67–0
Methyl fluoride	2110	Fluoromethane R41	593–53–3
Natural gas	2150		mixture
Propane	2100	R290	74–98–6
Propylene	2100	Propene R1270	115–07–1
2,2,2,3-Tetrafluoropropene	2100	R1234yf	754–12–1

[a] Some products, being liquid at normal ambient conditions, are included since they might be supplied in non-pressurized containers. They are included in this grouping because valve outlets are necessary when these products are supplied together with a propellant in a pressurized container.

Table 7 *(continued)*

Gas	FTSC code	Synonym	CAS Number
1,1,1-Trifluoroethane	2100	R1 43a	420–46–2

[a] Some products, being liquid at normal ambient conditions, are included since they might be supplied in non-pressurized containers. They are included in this grouping because valve outlets are necessary when these products are supplied together with a propellant in a pressurized container.

Table 8 — Gases and gas mixtures belonging to group 7 (flammable, toxic, and corrosive (basic) gases and gas mixtures)

Gas	FTSC code	Synonym	CAS Number
Ammonia	2102	R717	7664–41–7
Dimethylamine	2102		124–40–3
Monoethylamine[a]	2102	Ethylamine R631	75–04–7
Monomethylamine	2102	Methylamine R630	74–89–5
Trimethylamine	2102		75–5-3

[a] Some products, being liquid at normal ambient conditions, are included since they might be supplied in non-pressurized containers. They are included in this grouping because valve outlets are necessary when these products are supplied together with a propellant in a pressurized container.

Table 9 — Gases and gas mixtures belonging to group 8 (flammable, toxic, and corrosive (acidic) or non-corrosive gases and gas mixtures)

Gas	FTSC code	Synonym	CAS Number
Arsine	2300		7784–42–1
Carbon monoxide	2250		630–08–0
Carbonyl sulfide	2201	Carbonoxylsulfide	463–58–1
Chloromethane	(2200)-**2100** [b]	Methyl chloride R40	74–87–3
Cyanogen	2200		460–19–5
Cyclopropane	(2200)-**2100** [b]	Trimethylene	75–19–4
Deuterium selenide	2301		13536–95–3
Deuterium sulfide	2201		13536–94–2
Dichlorosilane	2203		4109–96–0
Dimethylsilane	(2300)-**2100** [b]		1111–74–6
Fluoroethane	(2300)-**2100** [b]	Ethyl fluoride **R161**	353–36–6
Germane	2200		7782–65–2
Heptafluorobutyronitrile[a]	2300		375–00–8
Hexafluorocyclobutene	2100		697–11–0
Hyrogen selenide	2301		7783–07–5
Hydrogen sulfide	2201		7783–06–4
Methyl mercaptan	2201	Methanethiol	74–93–1
Methylsilane	(2300)-**2100** [b]		992–94–9
Nickel carbonyl[a]	2300	Nickel tetracarbonyl	13463–39–3
Pentafluoropropionitrile	2300		422–04–8
Tetraethyl lead[a]	2300		78–00–2
Tetramethyl lead[a]	2200		75–74–1
Trifluoroacetonitrile	2200		353–85–5

Table 9 *(continued)*

Gas	FTSC code	Synonym	CAS Number
Trifluoroethylene	2200		359–11–5
Trimethylsilane	(2300)-**2100** [b]		993–07–7
The FTSC codes in brackets are from the first version of ISO 5145 (1990). This explains why the corresponding gases are in this table.			
[a] Some products, being liquid at normal ambient conditions, are included since they might be supplied in non-pressurized containers. They are included in this grouping because valve outlets are necessary when these products are supplied together with a propellant in a pressurized container.			
[b] To be consistent with ISO 10298, the former FTSC code is completed by the new one in bold figures corresponding to the new toxicity level.			

Table 10 — Gases and gas mixtures belonging to group 9 [pyrophoric (spontaneously flammable) gases and gas mixtures]

Gas	FTSC code	Synonym	CAS Number
Diethylzinc[a]	3100		557–20–0
Pentaborane[a]	3300		19624–22–7
Phosphine	3310		7803–51–2
Silane	3150	Silicon tetrahydride	7803–62–5
Triethyl aluminium[a]	3100		97–93–8
Triethyl borane	3200		97–94–9
Trimethylstibine[a]	3300		594–10–5
[a] Some products, being liquid at normal ambient conditions, are included since they might be supplied in non-pressurized containers. They are included in this grouping because valve outlets are necessary when these products are supplied together with a propellant in a pressurized container.			

Table 11 — Gases belonging to group 10 (oxygen)

Gas	FTSC code	Synonym	CAS NUMBER
Oxygen	4050		7782–44–7

Table 12 — Gases belonging to group 11 (nitrous oxide)

Gas	FTSC code	Synonym	CAS Number
Nitrous oxide	4110		10024–97–2

Table 13 — Gases and gas mixtures belonging to group 12 (oxidant, toxic, and/or corrosive gases and gas mixtures)

Gas	FTSC Code	Synonym	CAS Number
Bis-trifluoromethylperoxide	4300		927–84–4
Bromine pentafluoride[a]	4303		7789–30–2
Bromine trifluoride[a]	4303		7787–71–5
Chlorine	4203		7782–50–5
Chlorine pentafluoride	4303		13637–63–3
Chlorine trifluoride	4203		7790–91–2
[a] Some products, being liquid at normal ambient conditions, are included since they might be supplied in non-pressurized containers. They are included in this grouping because valve outlets are necessary when these products are supplied together with a propellant in a pressurized container.			

Table 13 *(continued)*

Gas	FTSC Code	Synonym	CAS Number
Fluorine	4343		7782–41–4
Iodine pentafluoride[a]	4303		7783–66–6
Nitric oxide	4351	Nitrogen(II) oxide	10102–43–9
Nitrogen dioxide	4301		10102–44–0
Nitrogen tetraoxide	4301	Dinitrogen tetraoxide	10544–72–6
Nitrogen trifluoride	4150		7783–54–2
Nitrogen trioxide	4301	Dinitrogen trioxide	10544–73–7
Oxygen difluoride	4343		7783–47–7
Ozone	4330		10028–15–6
Tetrafluorohydrazine	4343		10036–47–2

[a] Some products, being liquid at normal ambient conditions, are included since they might be supplied in non-pressurized containers. They are included in this grouping because valve outlets are necessary when these products are supplied together with a propellant in a pressurized container.

Table 14 — Gases and gas mixtures belonging to group 13 (flammable gases and gas mixtures subject to rapid decomposition or polymerization)

Gas	FTSC code	Synonym	CAS Number
1,3-Butadiene, stabilized	5100		106–99–0
Chlorotrifluoroethylene, stabilized	5200	R1113	79–38–9
Diborane	5350		19287–45–7
Ethylene oxide	5200	Oxirane	75–21–8
Hydrogen cyanide, stabilized[a]	5301	Hydrocyanic acid (anhydrous)	74–90–8
Propylene oxide[a]	5100	Methyl oxirane	75–56–9
Stibine	5300	Antimony hydride	7803–52–3
Tetrafluoroethylene, stabilized	5100	R1114	116–14–3
Vinyl bromide, stabilized	5100		593–60–2
Vinyl chloride, stabilized	5100	Chloroethylene R1 140	75–01–4
Vinyl fluoride, stabilized	5100	Fluoroethylene R1 141	75–02–5
Methyl vinyl ether, stabilized	5100	Methoxyethylene	107–25–5

[a] Some products, being liquid at normal ambient conditions, are included since they might be supplied in non-pressurized containers. They are included in this grouping because valve outlets are necessary when these products are supplied together with a propellant in a pressurized container.

Table 15 — Gases and gas mixtures belonging to group 14 (acetylene)

Gas	FTSC code	Synonym	CAS Number
Acetylene	5130	Ethyne	74–86–2

Table 16 — Gases in alphabetical order

Gas	FTSC code	Synonym	CAS Number
Acetylene	5130	Ethyne	74–86–2
Air	1050		
Allene	2100	Propadiene	463–49–0

Table 16 *(continued)*

Gas	FTSC code	Synonym	CAS Number
Ammonia	2102	R717	7664–41–7
Antimony pentafluoride[a]	0303		7783–70–2
Argon	0150		7440–37–1
Arsine	2300		7784–42–1
Bis-trifluoromethylperoxide	4300		927–84–4
Boron trichloride	0203	Boron chloride	10294–34–5
Boron trifluoride	0253	Boron fluoride	7637–07–02
Bromine pentafluoride[a]	4303		7789–30–2
Bromine trifluoride[a]	4303		7787–71–5
Bromoacetone[a]	(0303)-**2203**[b]		598–31–2
Bromochlorodifluoromethane	0100	R1 2B 1	353–59–3
Bromochloromethane[a]	0100	Halon 1011	74–97–5
Bromotrifluoro ethylene	2100	R 1 13B1	589–73–2
Bromotrifluoromethane	0100	Trifluorobromomethane R13B1	75–63–8
Butane	2100		106–97–8
1,3-Butadiene, stabilized	5100		106–99–0
1-Butene	2100	Butylene	106–98–9
Cis-2-Butene	2100	Butylene	590–18–1
Carbon dioxide	0110	Carbonic acid anhydride R744	124–38–9
Carbon monoxide	2250		630–08–0
Carbonyl-fluoride	0213		353–50–4
Carbonyl sulfide	2201	Carbonoxylsulfide	463–58–1
Chlorine	4203		7782–50–5
Chlorine pentafluoride	4303		13637–63–3
Chlorine trifluoride	4203		7790–91–2
1-Chloro-1,1-difluoroethane	2100	R1 42b	75–68–3
Chlorodifluoromethane	0100	Monochlorodifluoromethane R22	75–46–6
Chlorodifluoromethane and Chloropentafluoroethane	0100	R502	azeotropic mixture
Chlorofluoromethane	2100	R31	593–70–4
Chloroheptafluorocyclobutane[a]	0100	C317	377–41–3
Chloromethane	(2200)-**2100** [b]	Methyl chloride R40	74–87–3
Chloropentafluoroethane	0100	Monochloropentafluoroethane R115	76–15–3
Chloro-1,2,2,2-tetrafluoroethane	0100	R124	28–37–89–0
Chloro-2,2,2-trifluoroethane	0100	R 133a	75–88–7
Chlorotrifluoroethylene, stabilized	5200	R1113	79–38–9
Chlorotrifluoromethane	0100	Monochlorotrifluoromethane R1 3	75–72–9
Chlorotrifluoromethane and Trifluoromethane	0100	R503	azeotropic mixture

Table 16 *(continued)*

Gas	FTSC code	Synonym	CAS Number
Cyanogen	2200		460–19–5
Cyanogen chloride	0303		506–77–4
Cyclopropane	(2200)-**2100** [b]	Trimethylene	75–19–4
Deuterium	2150		7782–39–0
Deuterium chloride	0213		7698–05–7
Deuterium fluoride	0203		14333–26–7
Deuterium selenide	2301		13536–95–3
Deuterium sulfide	2201		13536–94–2
Diborane	5350		19287–45–7
Dibromodifluoromethane[a]	0100	R12B2	75–61–6
1, 2-Dibromotetrafluoroethane[a]	0100	R114B2	174–73–2
Dichloro-2-chlorovinyl arsine[a]	0303	Lewisite	541–25–3
1, 2-Dichlorodifluoroethylene	0100	R1112a	79–35–6
Dichlorodifluoromethane	0100	R12	75–71–8
Dichlorodifluoromethane and 1,1-Difluoroethane	0100	R500	azeotropic mixture
Dichlorofluoromethane	0100	R21	75–43–4
1,2-Dichlorohexafluorocyclobutane[a]	0100	C316	356–18–3
Dichlorosilane	2203		4109–96–0
1,1-Dichlorotetrafluoroethane	0100	R1 14a	374–07–2
1,2-Dichlorotetrafluoroethane	0100	R 114	76–14–2
2,2-Dichloro-1,1,1–trifluoro ethane[a]	0100	R 123	306–83–2
Diethylzinc a	3100		557–20–0
1,1-Difluoroethane	2110	Ethylidene fluoride R 152a	75–37–6
1,1-Difluoroethylene	2110	Vinylidene fluoride R1 132a	75–38–7
Difluoromethane	2100	Methylene fluoride R 32	75–10–5
Difluoromethane, Pentafluoroethane, and 1,1,1,2-Tetrafluoroethane	0100	R407A, R407B, R407C	azeotropic mixture
Dimethylamine	2102		124–40–3
Dimethylether	2100	Methyl ether	115–10–6
2,2-Dimethylpropane[a]	2100	Tetramethylmethane	463–82–1
Dimethylsilane	(2300)-**2100** [b]		1111–74–6
Diphosgene[a]	0303		503–38–8
Ethane	2110	R170	74–84–0
Ethylacetylene	2100	1-Butyne	107–00–6
Ethylchloride[a]	2100	Chloroethane R160	75–00–3
Ethyldichloroarsine[a]	0303		598–14–1
Ethylene	2150	Ethene	74–85–1
Ethylene oxide	5200	Oxirane	75–21–8
Ethyl ether[a]	2100	R1150	60–29–7
Ethylfluoride	2100	R161	95508–16–0

Table 16 *(continued)*

Gas	FTSC code	Synonym	CAS Number
Fluorine	4343		7782–41–4
Fluoroethane	(2300)-**2100** [b]	Ethyl fluoride R161	353–36–6
Germane	2200		7782–65–2
Helium	0150		7440–59–7
Heptafluorobutyronitrile[a]	2300		375–00–8
Heptafluoropropane	0100	R227	431–89–0
Hexafluoroacetone	0203	1,1,1,3,3,3,-hexafluoro-2-propanone	684–16–2
Hexafluorocyclobutene	2100		697–11–0
Hexafluoroethane	0100	Perfluoroethane R1 16	76–16–4
Hexafluoropropylene	0100	Hexafluoropropene R 1216	116–15–4
Hydrogen	2150		1333–74–0
Hydrogen bromide	0203	Hydrobromic acid (anhydrous)	10035–10–6
Hydrogen chloride	0213	Hydrochloric acid (anhydrous)	7647–01–0
Hydrogen cyanide, stabilized[a]	5301	Hydrocyanic acid (anhydrous)	74–90–8
Hydrogen fluoride[a]	0203	Hydrofluoric acid (anhydrous)	7664–39–3
Hydrogen iodide	0203	Hydroiodic acid (anhydrous)	10034–85–2
Hydrogen selenide	2301		7783–07–5
Hydrogen sulfide	2201		7783–06–4
Iodine pentafluoride[a]	4303		7783–66–6
Iodotrifluoromethane	(0200)-**0100** [b]	Trifluoromethyl iodide	2314–97–8
Isobutane	2100	Trimethylmethane R601	75–28–5
Isobutylene	2100	2-Methylpropene; Isobutene	115–11–7
Krypton	0150		7439–90–9
Methane	2150	R50	74–82–8
Methylacetylene	2100	Allylene; Propyne	74–99–7
Methyl bromide	(0300)-**2200** [b]	Bromomethane	74–83–9
3-Methyl-1-butene[a]	2100	Isoamylene:Isopropylethylene	563–45–1
Methyldichloroarsine[a]	0303		593–89–5
Methyl ethyl ether	2100	Ethyl methyl ether	540–67–0
Methyl fluoride	2110	Fluoromethane R41	593–53–3
Methyl mercaptan	2201	Methanethiol	74–93–1
Methylsilane	(2300)-**2100** [b]		992–94–9
Methyl vinyl ether, stabilized	5100	Methoxyethylene	107–25–5
Monoethylamine[a]	2102	Ethylamine R631	75–04–7
Monomethylamine	2102	Methylamine R630	74–89–5
Natural gas	2150		Mixture
Neon	0150		7440–01–9
Nickel carbonyl[a]	2300	Nickel tetracarbonyl	13463–39–3
Nitric oxide	4351	Nitrogen(II) oxide	10102–43–9
Nitrogen	150		7727–37–9

Table 16 *(continued)*

Gas	FTSC code	Synonym	CAS Number
Nitrogen dioxide	4301		10102–44–0
Nitrogen tetraoxide	4301	Dinitrogen tetraoxide	10544–72–6
Nitrogen trifluoride	4150		7783–54–2
Nitrogen trioxide	4301	Dinitrogen trioxide	10544–73–7
Nitrosyl chloride	0303		2696–92–6
Nitrous oxide	4110		10024–97–2
Octafluorobut-2-ene	0100	R1318	360–89–4
Octafluorocyclobutane	0100	Perfluorocyclobutane RC 318	115–25–3
Octafluoropropane	0100	Perfluoropropane R 218	76–19–7
Oxygen	4050		7782–44–7
Oxygen difluoride	4343		7783–47–7
Ozone	4330		10028–15–6
Pentaborane[a]	3300		19624–22–7
Pentachlorofluoroethane[a]	0100		29756–45–4
Pentafluoroethane	0100	R125	354–33–6
Pentafluoroethane, 1,1,1-Trifluoroethane, and 1,1,1,2-Tetrafluoroethane	0100	R404A	azeotropic mixture
Pentafluoroethyliodide[a]	0100		354–64–3
Pentafluoropropionitrile	2300		422–04–8
Perfluorobutane	0100	R610	355–25–9
Perfluoro-2-butene	(0200)- **0100** [b]	Octafluorobutene; R1318	360–89–4
Phenylcarbylamine Chloride[a]	(0303)-**2303** [b]		622–44–6
Phosgene	0303	Carbonyl chloride	75–44–5
Phosphine	3310		7803–51–2
Phosphorus pentafluoride	0203		7647–19–0
Phosphorus trifluoride	0203		7783–55–3
Propane	2100	R290	74–98–6
Propylene	2100	Propene R1270	115–07–1
Propylene oxide[a]	5100	Methyl oxirane	75–56–9
Silane	3150	Silicon tetrahydride	7803–62–5
Silicon tetrachloride[a]	0203		10026–04–7
Silicon tetrafluoride	0253	Tetrafluorosilane R764	7783–61–1
Stibine	5300	Antimony hydride	7803–52–3
Sulfur dioxide	0201		7446–09–5
Sulfur hexafluoride	0100		2551–62–4
Sulfur tetrafluoride	0303		7783–60–0
Sulfuryl fluoride	0300	Sulfuryl difluoride	2699–79–8
Tetrachlorodifluoroethane (solid)	0100	R112a	76–11–9
1,1,2,2-Tetrachlorodifluoroethane[a]	0100	R112	76–12–0
Tetraethyl lead[a]	2300		78–00–2
1,1,2,2-Tetrafluoro-1-chloroethane	0100	R124a	354–25–6

Table 16 *(continued)*

Gas	FTSC code	Synonym	CAS Number
1,1,1,2-Tetrafluoroethane	0100	R134a	811–97–2
Tetrafluoroethylene, stabilized	5100	R1114	116–14–3
Tetrafluorohydrazine	4343		10036–47–2
Tetrafluoromethane	0150	Carbon tetrafluoride R14	75–73–0
2,2,2,3-Tetrafluoropropene	2100	R1234yf	754–12–1
Tetramethyl lead[a]	0220		75–74–1
Trans-2-Butene	2100	Butylene	624–64–6
Trichlorofluoromethane[a]	0100	Trichloromonofluoromethane, R11	75–69–4
1,1,1-Trichlorotrifluoroethane[a]	0100	R113a	354–58–5
1,1,2-Trichlorotrifluoroethane[a]	0100	R113	76–13–1
Triethyl aluminium[a]	3100		97–93–8
Triethyl borane	3200		97–94–9
Trifluoroacetonitrile	2200		353–85–5
1,1,1 -Trifluoroethane	2100	R1 43a	420–46–2
Trifluoroethylene	2200		359–11–5
Trifluoromethane	0100	Fluoroform, R23	75–46–7
Trimethylamine	2102		75–5-3
Trimethylsilane	(2300)-**2100** [b]		993–07–7
Trimethylstibine[a]	3300		594–10–5
Tungsten hexafluoride	0203		7783–82–6
Uranium hexafluoride (liquid/solid, class 7)	0303		7783–81–5
Vinyl bromide, stabilized	5100		593–60–2
Vinyl chloride, stabilized	5100	Chloroethylene R1 140	75–01–4
Vinyl fluoride, stabilized	5100	Fluoroethylene R1 141	75–02–5
Xenon	0110[c]		7440–63–3

The FTSC codes in brackets are from the first version of ISO 5145 (1990).

[a] Some products, being liquid at normal ambient conditions, are included since they might be supplied in non-pressurized containers. They are included in this grouping because valve outlets are necessary when these products are supplied together with a propellant in a pressurized container.

[b] To be consistent with ISO 10298, the former FTSC code is completed by the new one in bold figures corresponding to the new toxicity level.

[c] FTSC code due to the critical point of the gas of above 15 °C.

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