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AMENDMENT 2
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**Refrigerating systems and heat
pumps — Safety and environmental
requirements —**

Part 1:
**Definitions, classification and
selection criteria**

**AMENDMENT 2: Update of Annex A and
the refrigerant tables**

*Systèmes frigorifiques et pompes à chaleur — Exigences de sécurité et
d'environnement —*

Partie 1: Définitions, classification et critères de choix

*AMENDEMENT 2: Mise à jour de l'Annexe A et des tableaux de fluides
frigorigènes*



Reference number
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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).

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This document was prepared by Technical Committee ISO/TC 86, *Refrigeration and air-conditioning*, Subcommittee SC 1, *Safety and environmental requirements for refrigerating systems*.

A list of all parts in the ISO 5149 series can be found on the ISO website.

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Refrigerating systems and heat pumps — Safety and environmental requirements —

Part 1: Definitions, classification and selection criteria

AMENDMENT 2: Update of Annex A and the refrigerant tables

Clause 3

Replace the introductory paragraph with the following:

For the purposes of this document, the terms and definitions given in ISO 817 and the following 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 <http://www.electropedia.org/>

3.7.2

In the SOURCE, replace "2.5" with "3.1.5, modified".

3.7.3

Reverse the order of the "Note 1 to entry" and the SOURCE. In the indication of the SOURCE, replace "2.1.44" with "3.1.43, modified — Note 1 to entry has been added".

3.7.9

In the indication of the SOURCE, replace "2.32" with "3.1.35, modified".

3.10.3

Delete Note 1 to entry.

3.10.4

Delete Note 1 to entry.

Annex A, Table A.1

In row A – a, delete “Toxicity limit × Room volume or see A.5” from Location classification column I and add “Toxicity limit × Room volume” in its place. Add the following note:

NOTE The national variations to this table do not alter any requirements from those specified in this document. This table was revised to remove the incorrect inference that Clause A.5 can be applied to location Classification I. The text of Clause A.5 states that it is only application to location Classification II.

A.5.1, list

Replace the third dashed indent with the following:

- for appliances with more than one indoor unit, individual indoor unit cooling capacity shall not exceed 35 kW when tested in accordance with ISO 5151, ISO 13253, or ISO 15042 at T1 conditions;
- for heating, only appliances with more than one indoor unit, individual indoor unit heating capacity shall not exceed 35 kW when tested in accordance with ISO 5151, ISO 13253, or ISO 15042 at H1 conditions;

A.5.2.3

Replace the reference to "Table B.1" with "Table A.3".

Annex B, Tables B.1, B.2 and B.3.

Replace [Tables B.1](#), [B.2](#) and [B.3](#) with the following:

Table B.1 — Refrigerants designation

Refrigerant number	Chemical name ^b	Chemical formula	Safety group	Practical limit kg/m ³	ATEL/ ODL ^f kg/m ³	Flammability LFL ^g kg/m ³	Vapour density 25°C, 101,3 kPa ^a kg/m ³	Relative molar mass ^a	Normal boiling point ^a °C	ODP ^{a,d}	GWP ^{a,e} (100 yr ITH)	Auto-ignition temperature °C
Methane series												
11	Trichlorofluoromethane	CCl ₃ F	A1	0,3	0,006 2	NF	5,62	137,4	24	1	4 750	ND
12	Dichlorodifluoromethane	CCl ₂ F ₂	A1	0,5	0,088	NF	4,94	120,9	-30	1	10 900	ND
12B1	Bromochlorodifluoromethane	CBrClF ₂	ND	0,2	ND	NF	6,76	165,4	-4	3	1 890	ND
13	Chlorotrifluoromethane	CClF ₃	A1	0,5	ND	NF	4,27	104,5	-81	1	14 400	ND
13B1	Bromotrifluoromethane	CBrF ₃	A1	0,6	ND	NF	6,09	148,9	-58	10	7 140	ND
14	Carbon tetrafluoride	CF ₄	A1	0,4	0,40	NF	3,60	88,0	-128	0	7 390	ND
22	Chlorodifluoromethane	CHClF ₂	A1	0,3	0,21	NF	3,54	86,5	-41	0,055	1 810	635
23	Trifluoromethane	CHF ₃	A1	0,68	0,15	NF	2,86	70,0	-82	0	14 800	765
30	Dichloromethane (methylene chloride)	CH ₂ Cl ₂	B1	0,017	ND	NF	3,47	84,9	40	ND	8,7	662
32	Difluoromethane (methylene fluoride)	CH ₂ F ₂	A2L	0,061	0,30	0,307	2,13	52,0	-52	0	675	648
50	Methane	CH ₄	A3	0,006	ND	0,032	0,654	16,0	-161	0	25	645

NOTE 1 See Tables B.2 and B.3 for zeotropic and azeotropic blends.

NOTE 2 NA signifies not applicable.

NOTE 3 ND signifies not determined.

NOTE 4 NF signifies non flammable.

^a The vapour density, normal boiling point, ODP, and GWP are not part of this International Standard, and are provided for information purposes only.

^b The preferred chemical name is followed by the popular name in parentheses.

^c Sublimes. Triple point is -56,6 °C at 5,2 bar.

^d Adopted under the Montreal Protocol.

^e Data from IPCC 4th assessment report 2007. When not available, WMO Scientific assessment of ozone depletion 2010 is used as first priority and then the UNEP RTOC 2010 report.

^f Acute-Toxicity Exposure Limit or Oxygen Deprivation Limit, whichever is lower, values taken from ISO 817.

^g Lower Flammability Limit.

^h Data from UNEP RTOC 2010 report.

ⁱ Data from WMO Scientific assessment of ozone depletion 2010.

Table B.1 (continued)

Refrigerant number	Chemical name ^a	Chemical formula	Safety group	Practical limit kg/m ³	ATEL/ ODL ^f kg/m ³	Flammability LFL ^g kg/m ³	Vapour density 25°C, 101,3 kPa ^a kg/m ³	Relative molar mass ^a	Normal boiling point ^a °C	ODP ^{a,d}	GWP ^{a,e} (100 yr ITH)	Auto-ignition temperature °C
Ethane series												
113	1,1,2-trichloro-1,2,2-trifluoroethane	CCl ₂ CClF ₂	A1	0,4	0,02	NF	7,66	187,4	48	0,8	6 130	ND
114	1,2-dichloro-1,1,2,2-tetrafluoroethane	CClF ₂ CClF ₂	A1	0,7	0,14	NF	6,99	170,9	4	1	10 000	ND
115	Chloropentafluoroethane	CClF ₂ CF ₃	A1	0,76	0,76	NF	6,32	154,5	-39	0,6	7 370	ND
116	Hexafluoroethane	CF ₃ CF ₃	A1	0,68	0,68	NF	5,64	138,0	-78	0	12 200	ND
123	2,2-dichloro-1,1,1-trifluoroethane	CHCl ₂ CF ₃	B1	0,10	0,057	NF	6,25	152,9	27	0,02	77	730
124	2-chloro-1,1,1,2-tetrafluoroethane	CHClFCF ₃	A1	0,41	0,056	NF	5,58	136,5	-12	0,022	609	ND
125	Pentafluoroethane	CHF ₂ CF ₃	A1	0,39	0,37	NF	4,91	120,0	-49	0	3 500	733
134a	1,1,1,2-tetrafluoroethane	CH ₂ FCF ₃	A1	0,25	0,21	NF	4,17	102,0	-26	0	1 430	743
141b	1,1-dichloro-1-fluoroethane	CH ₃ CCl ₂ F	ND	0,053	0,072	0,363	4,78	116,9	32	0,11	725	532
142b	1-chloro-1,1-difluoroethane	CH ₃ CClF ₂	A2	0,049	0,10	0,329	4,11	100,5	-10	0,065	2 310	750
143a	1,1,1-trifluoroethane	CH ₃ CF ₃	A2L	0,048	0,48	0,282	3,44	84,0	-47	0	4 470	750

NOTE 1 See Tables B.2 and B.3 for zeotropic and azeotropic blends.

NOTE 2 NA signifies not applicable.

NOTE 3 ND signifies not determined.

NOTE 4 NF signifies non flammable.

^a The vapour density, normal boiling point, ODP, and GWP are not part of this International Standard, and are provided for information purposes only.

^b The preferred chemical name is followed by the popular name in parentheses.

^c Sublimes. Triple point is -56,6 °C at 5,2 bar.

^d Adopted under the Montreal Protocol.

^e Data from IPCC 4th assessment report 2007. When not available, WMO Scientific assessment of ozone depletion 2010 is used as first priority and then the UNEP RTOC 2010 report.

^f Acute-Toxicity Exposure Limit or Oxygen Deprivation Limit, whichever is lower, values taken from ISO 817.

^g Lower Flammability Limit.

^h Data from UNEP RTOC 2010 report.

ⁱ Data from WMO Scientific assessment of ozone depletion 2010.

Table B.1 (continued)

Refrigerant number	Chemical name ^b	Chemical formula	Safety group	Practical limit kg/m ³	ATEL/ ODL ⁱ kg/m ³	Flammability LFL ^g kg/m ³	Vapour density 25°C, 101,3 kPa ^a kg/m ³	Relative molar mass ^a	Normal boiling point ^a °C	ODP ^{a,d}	GWP ^{a,e} (100 yr ITH)	Auto-ignition temperature °C
152a	1,1-difluoroethane	CH ₃ CHF ₂	A2	0,027	0,14	0,130	2,70	66,0	-25	0	124	455
170	Ethane	CH ₃ CH ₃	A3	0,008 6	0,008 6	0,038	1,23	30,1	-89	0	5,5	515
Propane series												
218	Octafluoropropane	CF ₃ CF ₂ CF ₃	A1	1,84	0,85	NF	7,69	188,0	-37	0	8 830	ND
227ea	1,1,1,2,3,3,3-heptafluoropropane	CF ₃ CHF ₂ CF ₃	A1	0,63	0,63	NF	6,95	170,0	-15	0	3 220	ND
236fa	1,1,1,3,3,3-hexafluoropropane	CF ₃ CH ₂ CF ₃	A1	0,59	0,34	NF	6,22	152,0	-1	0	9 810	ND
245fa	1,1,1,3,3-pentafluoropropane	CF ₃ CH ₂ CHF ₂	B1	0,19	0,19	NF	5,48	134,0	15	0	1 030	ND
290	Propane	CH ₃ CH ₂ CH ₃	A3	0,008	0,09	0,038	1,80	44,1	-42	0	3,3	470
Ethene Series												
E170	Dimethyl Ether	CH ₃ OCH ₃	A3	0,013	0,079	0,064	1,88	46	-25	0	1	235
1130 (E)	Trans-1,2-dichloroethene	CHCl=CHCl	B2	0,004	0,004	0,258	1,15	96,9	48	0	0	ND
1132a	1,1-difluoroethylene	CF ₂ =CH ₂	A2	0,026	0,073	0,131		64,0	-83	0	1	ND
1150	Ethene (ethylene)	CH ₂ = CH ₂	A3	0,006	ND	0,036	1,15	28,1	-104	0	3,7	ND

NOTE 1 See Tables B.2 and B.3 for zeotropic and azeotropic blends.

NOTE 2 NA signifies not applicable.

NOTE 3 ND signifies not determined.

NOTE 4 NF signifies non flammable.

^a The vapour density, normal boiling point, ODP, and GWP are not part of this International Standard, and are provided for information purposes only.^b The preferred chemical name is followed by the popular name in parentheses.^c Sublimes. Triple point is -56,6 °C at 5,2 bar.^d Adopted under the Montreal Protocol.^e Data from IPCC 4th assessment report 2007. When not available, WMO Scientific assessment of ozone depletion 2010 is used as first priority and then the UNEP RTOC 2010 report.^f Acute-Toxicity Exposure Limit or Oxygen Deprivation Limit; whichever is lower, values taken from ISO 817.^g Lower Flammability Limit.^h Data from UNEP RTOC 2010 report.ⁱ Data from WMO Scientific assessment of ozone depletion 2010.

Table B.1 (continued)

Refrigerant number	Chemical name ^b	Chemical formula	Safety group	Practical limit kg/m ³	ATEL/ ODL ^f kg/m ³	Flammability LFL ^g kg/m ³	Vapour density 25°C, 101,3 kPa ^a kg/m ³	Relative molar mass ^a	Normal boiling point ^a °C	ODP ^{a,d}	GWP ^{a,e} (100 yr ITH)	Auto-ignition temperature °C
Propene series												
1224yd (Z)	cis-2,3,3,3-tetrafluoro-1-chloro-1-propene	CF ₃ CH=CHCF ₃	A1	0,364	0,364	NF		148,5	14	~0		ND
1233zd (E)	Trans-1-chloro-3,3,3-trifluoroprop-1-ene	CF ₃ CH=CHCl	A1	0,086	0,086	NF	5,34	130,5	18,1	~0	4,5	ND
1234yf	2,3,3,3-tetrafluoroprop-1-ene	CF ₃ CF=CH ₂	A2L	0,058	0,47	0,289	4,66	114,0	-26	0	4 ⁱ	405
1234ze (E)	trans-1,3,3,3-tetrafluoroprop-1-ene	CF ₃ CH=CFH	A2L	0,061	0,28	0,303	4,66	114,0	-19	0	7 ⁱ	368
1270	Propene (propylene)	CH ₃ CH=CH ₂	A3	0,008	0,001 7	0,046	1,72	42,1	-48	0	1,8	455
Butene series												
1336mzz (E)	trans-1,1,1,4,4,4-hexafluoro-2-butene	CF ₃ CH=CHCF ₃	A1	0,048	0,048	NF	6,93	164,1	7,4	0	16	ND
1336mzz (Z)	cis-1,1,1,4,4,4-hexafluoro-2-butene	CF ₃ CH=CHCF ₃	A1	0,087	0,087	NF	6,93	164,1	33,4	0	9	ND

NOTE 1 See Tables B.2 and B.3 for zeotropic and azeotropic blends.

NOTE 2 NA signifies not applicable.

NOTE 3 ND signifies not determined.

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^a The vapour density, normal boiling point, ODP, and GWP are not part of this International Standard, and are provided for information purposes only.

^b The preferred chemical name is followed by the popular name in parentheses.

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^d Adopted under the Montreal Protocol.

^e Data from IPCC 4th assessment report 2007. When not available, WMO Scientific assessment of ozone depletion 2010 is used as first priority and then the UNEP RTOC 2010 report.

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^g Lower Flammability Limit.

^h Data from UNEP RTOC 2010 report.

ⁱ Data from WMO Scientific assessment of ozone depletion 2010.

Table B.1 (continued)

Refrigerant number	Chemical name ^b	Chemical formula	Safety group	Practical limit kg/m ³	ATEL/ ODL ⁱ kg/m ³	Flammability LFL ^g kg/m ³	Vapour density 25°C, 101,3 kPa ^a kg/m ³	Relative molar mass ^a	Normal boiling point ^a °C	ODP ^{a,d}	GWP ^{a,e} (100 yr ITH)	Auto-ignition temperature °C
Other hydrocarbons												
600	Butane	CH ₃ CH ₂ CH ₂ CH ₃	A3	0,008 9	0,002 4	0,038	2,38	58,1	0	0	4,0	365
600a	2-methyl propane (isobutane)	CH(CH ₃) ₂ CH ₃	A3	0,011	0,059	0,043	2,38	58,1	-12	0	~20 ^h	460
601	Pentane	CH ₃ CH ₂ CH ₂ CH ₂ CH ₃	A3	0,008	0,002 9	0,035	2,95	72,1	36	0	~20 ^h	ND
601a	2-methyl butane (isopentane)	(CH ₃) ₂ CHCH ₂ CH ₃	A3	0,008	0,002 9	0,038	2,95	72,1	27	0	~20 ^h	ND
Cyclic organic compounds												
C318	Octafluorocyclobutane	-(CF ₂) ₄ -	A1	0,81	0,65	NF	8,18	200,0	-6	0	10 300	ND
Inorganic compounds												
717	Ammonia	NH ₃	B2L	0,000 35	0,000 22	0,116	0,700	17,0	-33	0	<1 ^h	630
744	Carbon dioxide	CO ₂	A1	0,1	0,072	NF	1,80	44,0	-78 ^c	0	1	NA
NOTE 1 See Tables B.2 and B.3 for zeotropic and azeotropic blends.												
NOTE 2 NA signifies not applicable.												
NOTE 3 ND signifies not determined.												
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^a The vapour density, normal boiling point, ODP, and GWP are not part of this International Standard, and are provided for information purposes only.												
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^f Acute-Toxicity Exposure Limit or Oxygen Deprivation Limit, whichever is lower, values taken from ISO 817.												
^g Lower Flammability Limit.												
^h Data from UNEP RTOC 2010 report.												
ⁱ Data from WMO Scientific assessment of ozone depletion 2010.												

Table B.2 — Refrigerant designations of zeotropic blends (R-400 series)

Refrigerant number	Composition ^c mass %	Composition tolerances %	Safety group	Practical limit ^d kg/m ³	ATEL/ODL ^e kg/m ³	Flammability LFL ^h kg/m ³	Vapour density 25 °C, 101,3 kPa ^a kg/m ³	Relative molar mass ^a	Bubble point/dew point ^a at 101,3 kPa °C	ODP ^{a,e}	GWPa ^{a,f} (100 yr ITH)	Auto-ignition temperature °C
401A	R-22/152a/124 (53/13/34)	±2/±0,5/-1,5/±1	A1/A1	0,30	0,10	NF	3,86	94,4	-33,4/-27,8	0,037	1 180	681
401B	R-22/152a/124 (61/11/28)	±2/±0,5/-1,5/±1	A1/A1	0,34	0,11	NF	3,80	92,8	-34,9/-29,6	0,04	1 290	685
401C	R-22/152a/124 (33/15/52)	±2/±0,5/-1,5/±1	A1/A1	0,24	0,083	NF	4,13	101,0	-28,9/-23,3	0,03	933	ND
402A	R-125/290/22 (60/2/38)	±2/±0,1/-1,0/±2	A1/A1	0,33	0,27	NF	4,16	101,6	-49,2/-47,0	0,021	2 790	723
402B	R-125/290/22 (38/2/60)	±2/±0,1/-1,0/±2	A1/A1	0,32	0,24	NF	3,87	94,7	-47,2/-44,8	0,033	2 420	641
403A	R-290/22/218 (5/75/20)	+0,2 -2,0/±2/±2	A1/A2	0,33	0,24	0,480	3,76	92,0	-44,0/-42,4	0,041	3 120	ND
403B	R-290/22/218 (5/56/39)	+0,2 -2,0/±2/±2	A1/A1	0,41	0,29	NF	4,22	103,3	-43,9/-42,4	0,031	4 460	ND
404A	R-125/143a/134a (44/52/4)	±2/±1/±2	A1/A1	0,52	0,52	NF	3,99	97,6	-46,5/-45,7	0	3 920	728
405A	R-22/152a/142b/C318 (45/7/5,5/42,5)	±2/±1/±1/±2 ^b	ND	ND	0,26	ND	4,58	111,9	-32,8/-24,4	0,028	5 330	ND
406A	R-22/600a/142b (55/4/41)	±2/±1/±1	A2/A2	0,13	0,14	0,302	3,68	89,9	-32,7/-23,5	0,057	1 940	ND
407A	R-32/125/134a (20/40/40)	±2/±2/±2	A1/A1	0,33	0,31	NF	3,68	90,1	-45,2/-38,7	0	2 110	685
407B	R-32/125/134a (10/70/20)	±2/±2/±2	A1/A1	0,35	0,33	NF	4,21	102,9	-46,8/-42,4	0	2 800	703
407C	R-32/125/134a (23/25/52)	±2/±2/±2	A1/A1	0,31	0,29	NF	3,53	86,2	-43,8/-36,7	0	1 770	704
407D	R-32/125/134a (15/15/70)	±2/±2/±2	A1/A1	0,41	0,25	NF	3,72	91,0	-39,4/-32,7	0	1 630	ND
407E	R-32/125/134a (25/15/60)	±2/±2/±2	A1/A1	0,40	0,27	NF	3,43	83,8	-42,8/-35,6	0	1 550	ND
407F	R-32/125/134a (30/30/40)	±2/±2/±2	A1/A1	0,32	0,32	NF	3,36	82,1	-46,1/-39,7	0	1 820	ND
407G	R-32/125/134a (2,5/2,5/95,0)	±0,5/±0,5/±1,0	A1/A1	0,21	0,21	NF	4,20	100,0	-29,2/-27,2	0	1 463	ND

^a ODP, GWP, vapour density, "bubble point", and "dew point" temperatures are not part of this International Standard; they are provided for information only. The "bubble point temperature" is defined as the liquid saturation temperature of a refrigerant at the specified pressure, the temperature at which a liquid refrigerant first begins to boil. The bubble point of a zeotropic refrigerant blend, at constant pressure, is lower than the dew point. The "dew point temperature" is defined as the vapour saturation temperature of a refrigerant at the specified pressure, the temperature at which the last drop of liquid refrigerant boils. The dew point of a zeotropic refrigerant blend, at constant pressure, is higher than the bubble point.

^b The sum of the composition tolerances for R152a and R142b shall be between 0 and -2 %.

^c Blend components are conventionally listed in order of increasing normal boiling point.

^d Practical Limit, calculated from the values for the individual components as listed in [Table B.1](#).

^e Ozone Depletion Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^f Global Warming Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^g Acute-Toxicity Exposure Limit or Oxygen Deprivation Limit, whichever is lower.

^h Lower Flammability Limit which is based on WCF for 2L flammable refrigerants.

Table B.2 (continued)

Refrigerant number	Composition ^c mass %	Composition tolerances	Safety group	Practical limit ^d	ATEL/ODL ^e	Flammability LFL ^h	Vapour density 25 °C, 101,3 kPa ^a	Relative molar mass ^a	Bubble point/dew point ^a at 101,3 kPa	ODP ^{a,e}	GWPs ^{a,f} (100 yr ITH)	Auto-ignition temperature
		%		kg/m ³	kg/m ³	kg/m ³	kg/m ³		°C			°C
407H	R-32/125/134a (32,5/15,0/52,5)	±1,0/±1,0/±2,0	A1/A1	0,38	0,38	NF	3,28	79,1	-44,7/-37,6	0	1 495	ND
407I	R-32/125/134a (19,5/8,5/72,0)	+1,0 -2,0/+2,0 -1,0/±2,0	A1/A1	0,25	0,25	NF	3,61	86,9	-39,8/-33,0	0	1 459	ND
408A	R-125/143a/22 (7/46/47)	±2/±1/±2	A1/A1	0,41	0,33	NF	3,56	87,0	-44,6/-44,1	0,026	3 150	ND
409A	R-22/124/142b (60/25/15)	±2/±2/±1	A1/A1	0,16	0,12	NF	3,98	97,4	-34,7/-26,3	0,048	1 580	ND
409B	R-22/124/142b (65/25/10)	±2/±2/±1	A1/A1	0,17	0,12	NF	3,95	96,7	-35,8/-28,2	0,048	1 560	ND
410A	R-32/125 (50/50)	+0,5 -1,5/+1,5 -0,5	A1/A1	0,44	0,42	NF	2,97	72,6	-51,6/-51,5	0	2 090	ND
410B	R-32/125 (45/55)	±1/±1	A1/A1	0,43	0,43	NF	3,09	75,6	-51,5/-51,4	0	2 230	ND
411A	R-1270/22/152a (1,5/87,5/11,0)	+0,-1/+2,-0/+0,-1	A1/A2	0,04	0,074	0,186	3,37	82,4	-39,6/-37,1	0,048	1 600	ND
411B	R-1270/22/152a (3/94/3)	+0,-1/+2,-0/+0,-1	A1/A2	0,05	0,044	0,239	3,40	83,1	-41,6/-40,2	0,052	1 710	ND
412A	R-22/218/142b (70/5/25)	±2/±2/±1	A1/A2	0,07	0,07	0,329	3,77	92,2	-36,5/-28,9	0,055	2 290	ND
413A	R-218/134a/600a (9/88/3)	±1/±2/+0 -1	A1/A2	0,08	0,21	0,375	4,25	104,0	-29,4/-27,4	0	2 050	ND
414A	R-22/124/600a/142b (51,0/28,5/4,0/16,5)	±2/±2/±0,5/+0,5 -1,0	A1/A1	0,10	0,10	NF	3,96	96,9	-33,2/-24,7	0,045	1 480	ND
414B	R-22/124/600a/142b (50,0/39,0/1,5/9,5)	±2/±2/±0,5/+0,5 -1,0	A1/A1	0,096	0,096	NF	4,16	101,6	-33,1/-24,7	0,042	1 360	ND
415A	R-22/152a (82/18)	±1/±1	A2	0,04	0,19	0,188	3,35	81,9	-37,5/-34,7	0,028	1 510	ND
415B	R-22/152a (25,0/75,0)	±1/±1	A2	0,03	0,15	0,13	2,87	70,2	-23,4/-21,8	0,009	546	ND
416A	R-134a/124/600 (59,0/39,5/1,5)	+0,5 -1,0/+1,0 -0,5/+0,1 -0,2	A1/A1	0,064	0,064	NF	4,58	111,9	-23,4/-2,8	0,009	1 080	ND

^a ODP, GWP, vapour density, "bubble point", and "dew point" temperatures are not part of this International Standard; they are provided for information only. The "bubble point temperature" is defined as the liquid saturation temperature of a refrigerant at the specified pressure, the temperature at which a liquid refrigerant first begins to boil. The bubble point of a zeotropic refrigerant blend, at constant pressure, is lower than the dew point. The "dew point temperature" is defined as the vapour saturation temperature of a refrigerant at the specified pressure, the temperature at which the last drop of liquid refrigerant boils. The dew point of a zeotropic refrigerant blend, at constant pressure, is higher than the bubble point.

^b The sum of the composition tolerances for R152a and R142b shall be between 0 and -2 %.

^c Blend components are conventionally listed in order of increasing normal boiling point.

^d Practical Limit, calculated from the values for the individual components as listed in [Table B.1](#).

^e Ozone Depletion Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^f Global Warming Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^g Acute-Toxicity Exposure Limit or Oxygen Deprivation Limit, whichever is lower.

^h Lower Flammability Limit which is based on WCF for 2L flammable refrigerants.

Table B.2 (continued)

Refrigerant number	Composition ^c mass %	Composition tolerances	Safety group	Practical limit ^d	ATEL/ODL ^e	Flammability LFL ^h	Vapour density 25 °C, 101,3 kPa ^a	Relative molar mass ^a	Bubble point ^a /dew point ^a at 101,3 kPa	ODP ^{a,e}	GWPa,f (100 yr ITH)	Auto-ignition temperature °C
417A	R-125/134a/600 (46,6/50,0/3,4)	±1,1/±1,0/+0,1-0,4	A1/A1	0,15	0,057	NF	4,36	106,7	-38,0/-32,9	0	2 350	ND
417B	R-125/134a/600 (79,0/18,3/2,7)	±1,0/±1,0/+0,1-0,5	A1/A1	0,069	0,069	NF	4,63	113,1	-44,9/-41,5	0	3 030	ND
417C	R-125/134a/600 (19,5/78,8/1,7)	±1,0/±1,0/+0,1-0,5	A1/A1	0	0,089	NF	4,24	103,73	-32,7 / -29,2	0	4,3	ND
418A	R-290/22/152a (1,5/96,0/2,5)	±0,5/±1,0/±0,5	A1/A2	0,06	0,20	0,31	3,46	84,6	-41,7/-40,0	0,033	1 740	ND
419A	R-125/134a/E170 (77/19/4)	±1/±1/±1	A1/A2	0,05	0,31	0,25	4,47	109,3	-42,6/-36,0	0	2 970	ND
419B	R-125/134a/E170 (48,5/48,0/3,5)	±1,0/±1,0/±0,5	A1/A2	0,06	0,31	0,25	4,47	109,3	-42,6/-36,0	0	2 970	ND
420A	R-134a/142b (88/12)	+1-0/0-1	A1/A1	0,18	0,18	NF	4,16	101,8	-24,9/-24,2	0,005	1 540	ND
421A	R-125/134a (58,0/42,0)	±1,0/±1,0	A1/A1	0,28	0,28	NF	4,57	111,7	-40,8/-35,5	0	2 630	ND
421B	R-125/134a (85,0/15,0)	±1,0/±1,0	A1/A1	0,33	0,33	NF	4,78	116,9	-45,7/-42,6	0	3 190	ND
422A	R-125/134a/600a (85,1/11,5/3,4)	±1,0/±1,0/+0,1-0,4	A1/A1	0,29	0,29	NF	4,65	113,6	-46,5/-44,1	0	3 140	ND
422B	R-125/134a/600a (55,0/42,0/3,0)	±1,0/±1,0/+0,1-0,5	A1/A1	0,25	0,25	NF	4,44	108,5	-40,5/-35,6	0	2 530	ND
422C	R-125/134a/600a (82,0/15,0/3,0)	±1,0/±1,0/+0,1-0,5	A1/A1	0,29	0,29	NF	4,64	113,4	-45,3/-42,3	0	3 090	ND
422D	R-125/134a/600a (65,1/31,5/3,4)	+0,9-1,1/±1,0/+0,1-0,4	A1/A1	0,26	0,26	NF	4,49	109,9	-43,2/-38,4	0	2 730	ND

^a ODP, GWP, vapour density, "bubble point", and "dew point" temperatures are not part of this International Standard; they are provided for information only. The "bubble point temperature" is defined as the liquid saturation temperature of a refrigerant at the specified pressure, the temperature at which a liquid refrigerant first begins to boil. The bubble point of a zeotropic refrigerant blend, at constant pressure, is lower than the dew point. The "dew point temperature" is defined as the vapour saturation temperature of a refrigerant at the specified pressure, the temperature at which the last drop of liquid refrigerant boils. The dew point of a zeotropic refrigerant blend, at constant pressure, is higher than the bubble point.

^b The sum of the composition tolerances for R152a and R142b shall be between 0 and -2 %.

^c Blend components are conventionally listed in order of increasing normal boiling point.

^d Practical Limit, calculated from the values for the individual components as listed in [Table B.1](#).

^e Ozone Depletion Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^f Global Warming Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^g Acute-Toxicity Exposure Limit or Oxygen Deprivation Limit, whichever is lower.

^h Lower Flammability Limit which is based on WCF for 2L flammable refrigerants.

Table B.2 (continued)

Refrigerant number	Composition ^c mass %	Composition tolerances	Safety group	Practical limit ^d	ATEL/ODL ^g	Flammability LFL ^h	Vapour density 25 °C, 101,3 kPa ^a	Relative molar mass ^a	Bubble point/dew point ^a at 101,3 kPa	ODP ^{a,e}	GWPs ^{a,f} (100 yr ITH)	Auto-ignition temperature
		%		kg/m ³	kg/m ³	kg/m ³	kg/m ³		°C			°C
422E	R-125/134a/600a (58,0/39,3/2,7)	±1,0/+1,7 -1,3/ +0,3 -0,2	A1/A1	0,26	0,26	NF	4,47	111,3	-41,8 / -36,4	0	2 592	ND
423A	R-134a/227ea (52,5/47,5)	±1,0/±1,0	A1/A1	0,30	0,30	NF	5,15	126,0	-24,2/-23,5	0	2 280	ND
424A	R-125/134a/600a/601a (50,5/47,0/0,9/1,0/0,6)	±1,0/±1,0/+0,1-0,2/ +0,1-0,2/+0,1-0,2	A1/A1	0,10	0,10	NF	4,43	108,4	-39,1/-33,3	0	2 440	ND
425A	R-32/134a/227ea (18,5/69,5/12,0)	±0,5/±0,5/±0,5	A1/A1	0,27	0,27	NF	3,69	90,3	-38,1/-31,3	0	1 510	ND
426A	R-125/134a/600/601a (5,1/93,0/1,3/0,6)	±1,0/±1,0/+0,1-0,2/ +0,1-0,2	A1/A1	0,083	0,083	NF	4,16	101,6	-28,5/-26,7	0	1 510	ND
427A	R-32/125/143a/134a (15,0/25,0/10,0/50,0)	±2,0/±2,0/±2,0/±2,0	A1/A1	0,29	0,29	NF	3,70	90,4	-43,0/-36,3	0	2 140	ND
427B	R-32/125/143a/134a (20,6/25,6/19,0/34,8)	+1,0 -2,0/+2,0 -1,0/±2,0/±2,0	A1/A1	0,35	0,35	NF	3,53	85,0	-46,2/-40,1	0	2 382	ND
428A	R-125/143a/290/600a (77,5/20,0/0,6/1,9)	±1,0/±1,0/+0,1-0,2/ +0,1-0,2	A1/A1	0,37	0,37	NF	4,40	107,5	-48,3/-47,5	0	3 610	ND
429A	R-E170/152a/600a (60,0/10,0/30,0)	±1,0/±1,0/±1,0	A3/A3	0,010	0,098	0,052	2,08	50,8	-26,0/-25,6	0	19	ND
430A	R-152a/600a (76,0/24,0)	±1,0/±1,0	A3/A3	0,017	0,10	0,084	2,61	63,9	-27,6/-27,4	0	99	ND
431A	R-290/152a (71,0/29,0)	±1,0/±1,0	A3/A3	0,009	0,10	0,044	2,00	48,8	-43,1/-43,1	0	38	ND
432A	R-1270/E170 (80,0/20,0)	±1,0/±1,0	A3/A3	0,008	0,002 1	0,039	1,75	42,8	-46,6/-45,6	0	2	ND
433A	R-1270/290 (30,0/70,0)	±1,0/±1,0	A3/A3	0,007	0,005 5	0,036	1,78	43,5	-44,6/-44,2	0	3	ND
433B	R-1270/290 (5,0/95,0)	±1,0/±1,0	A3/A3	0,005	0,025	0,032	1,80	44,0	-42,7/-42,5	0	3	ND

^a ODP, GWP, vapour density, "bubble point", and "dew point" temperatures are not part of this International Standard; they are provided for information only. The "bubble point temperature" is defined as the liquid saturation temperature of a refrigerant at the specified pressure, the temperature at which a liquid refrigerant first begins to boil. The bubble point of a zeotropic refrigerant blend, at constant pressure, is lower than the dew point. The "dew point temperature" is defined as the vapour saturation temperature of a refrigerant at the specified pressure, the temperature at which the last drop of liquid refrigerant boils. The dew point of a zeotropic refrigerant blend, at constant pressure, is higher than the bubble point.

^b The sum of the composition tolerances for R152a and R142b shall be between 0 and -2 %.

^c Blend components are conventionally listed in order of increasing normal boiling point.

^d Practical Limit, calculated from the values for the individual components as listed in [Table B.1](#).

^e Ozone Depletion Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^f Global Warming Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^g Acute-Toxicity Exposure Limit or Oxygen Deprivation Limit, whichever is lower.

^h Lower Flammability Limit which is based on WCF for 2L flammable refrigerants.

Table B.2 (continued)

Refrigerant number	Composition ^c mass %	Composition tolerances %	Safety group	Practical limit ^d kg/m ³	ATEL/ODL ^e kg/m ³	Flammability LFL ^h kg/m ³	Vapour density 25 °C, 101,3 kPa ^a kg/m ³	Relative molar mass ^a	Bubble point/dew point ^a at 101,3 kPa °C	ODP ^{a,e}	GWP ^{a,f} (100 yr ITH)	Auto-ignition temperature °C
433C	R-1270/290 (25,0/75,0)	±1,0/±1,0	A3/A3	0,006	0,006 6	0,032	1,78	43,6	-44,3/-43,9	0	3	ND
434A	R-125/143a/134a/600a (63,2/18,0/16,0/2,8)	±1,0/±1,0/±1,0/ +0,1-0,2	A1/A1	0,32	0,32	NF	4,32	105,7	-45,0/-42,3	0	3 250	ND
435A	R-E170/152a (80,0/20,0)	±1,0/±1,0	A3/A3	0,014	0,09	0,069	2,00	49,0	-26,1/-25,9	0	26	ND
436A	R-290/600a (56,0/44,0)	±1,0/±1,0	A3/A3	0,006	0,073	0,032	2,02	49,3	-34,3/-26,2	0	11	ND
436B	R-290/600a (52,0/48,0)	±1,0/±1,0	A3/A3	0,007	0,071	0,033	2,00	49,9	-33,4/-25,0	0	11	ND
436C	R-290/600a (95,0/5,0)	±1,2/±1,2	A3/A3	0,007	0,087	0,032	1,85	44,6	-41,5/-39,5	0	4	ND
437A	R-125/134a/600/601 (19,5/78,5/1,4/0,6)	+0,5-1,8/+1,5-0,7/ +0,1-0,2/+0,1-0,2	A1/A1	0,081	0,081	NF	4,24	103,7	-32,9/-29,2	0	1 810	ND
438A	R-32/125/134a/600/601a (8,5/45,0/44,2/1,7/0,6)	+0,5-1,5/+1,5/+1,5/ +0,1-0,2/+0,1-0,2	A1/A1	0,079	0,079	NF	4,05	99,1	-43,0/-36,4	0	2 260	ND
439A	R-32/125/600a (50,0/47,0/3,0)	±1,0/±1,0/±0,5	A2/A2	0,061	0,34	0,304	2,91	71,2	-52,0/-51,8	0	1 980	ND
440A	R-290/134a/152a (0,6/1,6/97,8)	±0,1/±0,6/±0,5	A2/A2	0,025	0,14	0,124	2,71	66,2	-25,5/-24,3	0	144	ND
441A	R-170/290/600a/600 (3,1/54,8/6,0/36,1)	±0,3/±2,0/±0,6/±2,0	A3/A3	0,006 3	0,006 3	0,032	1,98	48,3	-41,9/-20,4	0	5	ND
442A	R-32/125/134a/152a/227ea (31,0/31,0/30,0/3,0/5,0)	±1,0/±1,0/±1,0/ ±0,5/±1,0	A1/A1	0,33	0,33	NF	3,35	81,8	-46,5/-52,7	0	1 890	ND
443A	R-1270/290/600a (55,0/40,0/5,0)	±2,0/±2,0/±1,2	A3/A3	0,003	0,003	0,036	1,80	43,47	-44,8 / -41,2	0	2,5	ND

^a ODP, GWP, vapour density, "bubble point", and "dew point" temperatures are not part of this International Standard; they are provided for information only. The "bubble point temperature" is defined as the liquid saturation temperature of a refrigerant at the specified pressure, the temperature at which a liquid refrigerant first begins to boil. The bubble point of a zeotropic refrigerant blend, at constant pressure, is lower than the dew point. The "dew point temperature" is defined as the vapour saturation temperature of a refrigerant at the specified pressure, the temperature at which the last drop of liquid refrigerant boils. The dew point of a zeotropic refrigerant blend, at constant pressure, is higher than the bubble point.

^b The sum of the composition tolerances for R152a and R142b shall be between 0 and -2 %.

^c Blend components are conventionally listed in order of increasing normal boiling point.

^d Practical Limit, calculated from the values for the individual components as listed in [Table B.1](#).

^e Ozone Depletion Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^f Global Warming Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^g Acute-Toxicity Exposure Limit or Oxygen Deprivation Limit, whichever is lower.

^h Lower Flammability Limit which is based on WCF for 2L flammable refrigerants.

Table B.2 (continued)

Refrigerant number	Composition ^c mass %	Composition tolerances %	Safety group	Practical limit ^d kg/m ³	ATEL/ODL ^g kg/m ³	Flammability LFL ^h kg/m ³	Vapour density 25 °C, 101,3 kPa ^a kg/m ³	Relative molar mass ^a	Bubble point/dew point ^a at 101,3 kPa °C	ODP ^{a,e}	GWPs ^{a,f} (100 yr ITH)	Auto-ignition temperature °C
444A	R-32/152a/1234ze(E) (12,0/5,0/83,0)	±1,0/±1,0/±2,0	A2L/A2L	0,064	0,289	0,319	4,03	95,20	-34,3 / -24,3	0	93	ND
444B	R-32/152a/1234ze(E) (41,5/10,0/48,5)	±1,0/±1,0/±1,0	A2L/A2L	0,056	0,328	0,278	3,02	72,98	-44,6 / -34,9	0	296	ND
445A	R-744/134a/1234ze(E) (6,0/9,0/85,0)	±1,0/±1,0/±2,0	A2L/A2L	0,069	0,232	0,347	4,29	104,70	-50,3 / -23,5	0	135	ND
446A	R-32/1234ze(E)/600 (68,0/29,0/3,0)	+0,5, -1,0/+2,0, -0,6/+0,1, -1,0	A2L/A2L	0,048	0,071	0,238	2,6	62,37	-49,4 / -44,0	0	461	ND
447A	R-32/125/1234ze(E) (68,0/3,5/28,5)	+1,5-0,5/+1,5-0,5/±1,0	A2L/A2L	0,066	0,361	0,331	2,61	63,10	-49,3 / -44,2	0	584	ND
447B	R-32/125/1234ze(E) (68,0/8,0/24,0)	+1,0-2,0/+2,0-1,0/+1,0-2,0	A2L/A2L	0,062	0,362	0,313	2,6	63,11	-50,1 / -46,0	0	740,7	ND
448A	R-32/125/1234yf/134a/134a/1234ze(E) (26,0/26,0/20,0/21,0/7,0)	+0,5-2,0/+2,0-0,5/+0,5-2,0/+2,0-1,0/+0,5-2,0	A1/A1	0,389	0,389	NF	3,58	86,28	-45,9 / -39,8	0	1 387	ND
449A	R-32/125/1234yf/134a (24,3/24,7/25,3/25,7)	+2,0-1,0/+1,0-0,2/+0,2-1,0/+1,0-0,2	A1/A1	0,357	0,357	NF	3,62	87,21	-46,0 / -39,9	0	1 397	ND
449B	R-32/125/1234yf/134a (25,2/24,3/23,2/27,3)	+0,3-1,5/+1,5-0,3/+0,3-1,5/+1,5-0,3	A1/A1	0,354	0,354	NF	3,59	86,37	-46,1 / -40,2	0	1 410	ND
449C	R-32/125/1234yf/134a (20,0/20,0/31,0/29,0)	+0,5-1,5/+1,5-0,5/+0,5-1,5/+1,5-0,5	A1/A1	0,362	0,362	NF	3,76	90,3	-44,6 / -38,1	0	1 251	ND

^a ODP, GWP, vapour density, "bubble point", and "dew point" temperatures are not part of this International Standard; they are provided for information only. The "bubble point temperature" is defined as the liquid saturation temperature of a refrigerant at the specified pressure, the temperature at which a liquid refrigerant first begins to boil. The bubble point of a zeotropic refrigerant blend, at constant pressure, is lower than the dew point. The "dew point temperature" is defined as the vapour saturation temperature of a refrigerant at the specified pressure, the temperature at which the last drop of liquid refrigerant boils. The dew point of a zeotropic refrigerant blend, at constant pressure, is higher than the bubble point.

^b The sum of the composition tolerances for R152a and R142b shall be between 0 and -2 %.

^c Blend components are conventionally listed in order of increasing normal boiling point.

^d Practical Limit, calculated from the values for the individual components as listed in [Table B.1](#).

^e Ozone Depletion Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^f Global Warming Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^g Acute-Toxicity Exposure Limit or Oxygen Deprivation Limit, whichever is lower.

^h Lower Flammability Limit which is based on WCF for 2L flammable refrigerants.

Table B.2 (continued)

Refrigerant number	Composition ^c mass %	Composition tolerances %	Safety group	Practical limit ^d kg/m ³	ATEL/ODL ^e kg/m ³	Flammability LFL ^h kg/m ³	Vapour density 25 °C, 101,3 kPa ^a kg/m ³	Relative molar mass ^a	Bubble point/dew point ^a at 101,3 kPa °C	ODP ^{a,e}	GWP ^{a,f} (100 yr ITH)	Auto-ignition temperature °C
450A	R-134a/1234ze(E) (42,0/58,0)	±2,0/±2,0	A1/A1	0,320	0,320	NF	4,54	108,67	-23,4/-22,8	0	605	ND
451A	R-1234yf/134a (89,8/10,2)	±0,2/±0,2	A2L/A2L	0,068	0,462	0,341	4,71	112,71	-30,8/-30,5	0	150	ND
451B	R-1234yf/134a (88,8/11,2)	±0,2/±0,2	A2L/A2L	0,068	0,461	0,341	4,7	112,60	-31,0/-30,6	0	164	ND
452A	R-32/125/1234yf (11,0/59,0/30,0)	±1,7/±1,8/+0,1-1,0	A1/A1	0,424	0,424	NF	4,3	103,5	-47,0/-43,2	0	2 140	ND
452B	R-32/125/1234yf (67,0/7,0/26,0)	±2,0/±1,5/±2,0	A2L/A2L	0,062	0,364	0,310	2,63	63,5	-51,0/-50,3	0	698	509C
452C	R-32/125/1234yf (12,5/61,0/26,5)	+0,5-1,5/±1,0/ +0,5-1,5	A1/A1	0,417	0,417	NF	4,23	101,9	-47,5/-44,2	0	2 220	ND
453A	R-32/125/134a/227ea/600/ 601a (20/20/53,8/5/0,6/0,6)	±1,0/±1,0/±1,0/ ±0,5/+0,1-0,2/ +0,1-0,2	A1/A1	0,123	0,423	NF	3,69	88,78	-42,2/-35,0	0	1 770	ND
454A	R-32/1234yf (35,0/65,0)	±2,0/±2,0	A2L/A2L	0,056	0,462	0,281	3,34	81,8	-48,4/-41,6	0	239	457C
454B	R-32/1234yf (68,9/31,1)	±1,0/±1,0	A2L/A2L	0,059	0,361	0,297	2,59	63	-50,9/-50,0	0	466	496C

^a ODP, GWP, vapour density, "bubble point", and "dew point" temperatures are not part of this International Standard; they are provided for information only. The "bubble point temperature" is defined as the liquid saturation temperature of a refrigerant at the specified pressure, the temperature at which a liquid refrigerant first begins to boil. The bubble point of a zeotropic refrigerant blend, at constant pressure, is lower than the dew point. The "dew point temperature" is defined as the vapour saturation temperature of a refrigerant at the specified pressure, the temperature at which the last drop of liquid refrigerant boils. The dew point of a zeotropic refrigerant blend, at constant pressure, is higher than the bubble point.

^b The sum of the composition tolerances for R152a and R142b shall be between 0 and -2 %.

^c Blend components are conventionally listed in order of increasing normal boiling point.

^d Practical Limit, calculated from the values for the individual components as listed in [Table B.1](#).

^e Ozone Depletion Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^f Global Warming Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^g Acute-Toxicity Exposure Limit or Oxygen Deprivation Limit, whichever is lower.

^h Lower Flammability Limit which is based on WCF for 2L flammable refrigerants.

Table B.2 (continued)

Refrigerant number	Composition ^c mass %	Composition tolerances %	Safety group	Practical limit ^d kg/m ³	ATEL/ODL ^e kg/m ³	Flammability LFL ^h kg/m ³	Vapour density 25 °C, 101,3 kPa ^a kg/m ³	Relative molar mass ^a	Bubble point/dew point ^a at 101,3 kPa °C	ODP ^{a,e}	GWPa,f (100 yr ITH)	Auto-ignition temperature °C
454C	R-32/1234yf (21,5/78,5)	±2,0/±2,0	A2L/A2L	0,058	0,446	0,292	3,78	92,5	-46,0/-37,8	0	148	444C
455A	R-744/32/1234yf (3,0/21,5/75,5)	+2,0-1,0/+1,0-2,0/±2,0	A2L/A2L	0,086	0,429	0,432	3,64	89,4	-51,6/-39,1	0	148	ND
456A	R-32/134a/1234ze(E) (6,0/45,0/49,0)	±1,0/±1,0/±1,0	A1/A1	0,320	0,320	NF	4,23	101,4	-30,4/-25,6	0	687	ND
457A	R-32/1234yf/152a (18,0/70,0/12,0)	+0,5-1,5/+0,5-1,5/+0,1-1,9	A2L/A2L	0,043	0,396	0,216	3,65	88,04	-42,7/-35,5	0	139	ND
458A	R-32/125/134a/227ea/236fa (20,5/4,0/61,4/13,5/0,6)	±0,5/±0,5/±0,5/±0,5/±0,1	A1/A1	0,280	0,280	NF	3,69	89,9	-39,8/-32,4	0	1 650	ND
459A	R-32/1234yf/1234ze(E) (68,0/26,0/6,0)	+0,5-1,5/±2,0/+1,5-0,5	A2L/A2L	0,056	0,361	0,279	2,61	63,6	-39,8/-32,4	0	460	ND
459B	R-32/1234yf/1234ze(E) (21,0/69,0/10,0)	+0,5-1,0/±2,0/±1,0	A2L/A2L	0,075	0,486	0,373	3,79	92,1	-50,3/-48,6	0	145	ND
460A	R-32/125/134a/1234ze(E) (12,0/52,0/14,0/22,0)	±1,0/±1,0/±1,0/±1,0	A1/A1	0,379	0,379	NF	4,18	100,6	-44,0/-36,1	0	2 103	ND
460B	R-32/125/134a/1234ze(E) (28,0/25,0/20,0/27,0)	±1,0/±1,0/±1,0/±1,0	A1/A1	0,417	0,417	NF	3,52	84,8	-44,6/-37,2	0	1 352	ND
460C	R-32/125/134a/1234ze (2,5/2,5/46,0/49,0)	(±0,5/±0,5/±1,0/±1,0)	A1/A1	0,334	0,334	NF	4,40	111,7	-45,2/-37,1	0	766	ND
461A	R-125/143a/134a/227ea/600a (55,0/5,0/32,0/5,0/3,0)	±1,0/±0,5/±1,0/±0,5/+0,1-0,4	A1/A1	0,274	0,274	NF	4,56	109,6	-29,2/-26,0	0	2 768	ND

^a ODP, GWP, vapour density, "bubble point", and "dew point" temperatures are not part of this International Standard; they are provided for information only. The "bubble point temperature" is defined as the liquid saturation temperature of a refrigerant at the specified pressure, the temperature at which a liquid refrigerant first begins to boil. The bubble point of a zeotropic refrigerant blend, at constant pressure, is lower than the dew point. The "dew point temperature" is defined as the vapour saturation temperature of a refrigerant at the specified pressure, the temperature at which the last drop of liquid refrigerant boils. The dew point of a zeotropic refrigerant blend, at constant pressure, is higher than the bubble point.

^b The sum of the composition tolerances for R152a and R142b shall be between 0 and -2 %.

^c Blend components are conventionally listed in order of increasing normal boiling point.

^d Practical Limit, calculated from the values for the individual components as listed in [Table B.1](#).

^e Ozone Depletion Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^f Global Warming Potential, calculated from the values for the individual components as listed in [Table B.1](#).

^g Acute-Toxicity Exposure Limit or Oxygen Deprivation Limit, whichever is lower.

^h Lower Flammability Limit which is based on WCF for 2L flammable refrigerants.