

ADDENDA

ANSI/ASHRAE Addendum a to ANSI/ASHRAE Standard 34-2022

Designation and Safety Classification of Refrigerants

Approved by ASHRAE and the American National Standards Institute on December 30, 2022.

This addendum was approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. Instructions for how to submit a change can be found on the ASHRAE[®] website (www.ashrae.org/continuous-maintenance).

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FOREWORD

Addendum a adds burning velocity (BV) data to Table 4-1, "Refrigerant Data and Safety Classifications," and Table 4-2, "Data and Safety Classifications for Refrigerant Blends." Burning velocity data for previously approved refrigerants are added where available.

In instances where refrigerant LFL and/or BV at the WCF does not exist, the WCFF data are reported. Refrigerants that contain HCFCs were not included for additional flammability data, as those refrigerants are older and the data are not available. Additionally, refrigerant applications for R-419A and R-419B are not available to review for WCF data.

Addendum a also corrects several calculation errors that were identified, particularly for RCL values driven by flammability vs. toxicity.

Note: In this addendum, changes to the current standard are indicated in the text by <u>underlining</u> (for additions) and strikethrough (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum a to Standard 34-2022

Modify Tables 4-1 and 4-2 as shown. Portions of Tables 4-1 and 4-2 that are not shown are unchanged.

Table 4-1 Refrigerant Data and Safety Classifications \mathbf{N}

						RCL °			LFL		<u>BV</u>	Highly Toxic
Refrigerant Number	Chemical Name ^{a,b}	Chemical Formula ^a	OEL ^f , ppm v/v	Safety Group	ppm v/v	lb/1000 ft ³	g/m ³	ppm v/v	lb/1000 ft ³	g/m ³	<u>(cm/s)</u>	Under Code Classification
Methane Seri	es											
[]												
32	difluoromethane (methylene fluoride)	CH_2F_2	1000	A2L	36,000	4.8	77	144,000	19.1	306	<u>6.7</u>	Neither
[]												
50	methane	CH ₄	1000	A3				50,000			<u>40</u>	Neither
Ethane Series	\$											
[]												
143a	1,1,1-trifluoroethane	CH ₃ CF ₃	1000	A2L	21,000	4.4	70	82,000	17.5	282	<u>7.1</u>	Neither
152a	1,1-difluoroethane	CH ₃ CHF ₂	1000	A2	12,000	2.0	32	48,000	8.1	130	<u>23</u>	Neither
170	ethane	CH ₃ CH ₃	1000	A3	7000	0.54	8.6	31,000	2.4	38	<u>47</u>	Neither
Ethers												
E170	methoxymethane (dimethyl ether)	CH ₃ OCH ₃	1000	A3	8500	1.0	16	34,000	4.0	64	<u>54</u>	Neither
Propane Serie	es											
[]												
290	propane	CH ₃ CH ₂ CH ₃	1000	A3	5300	0.59	9.5	21,000	2.4	38	<u>46</u>	Neither
[]												
Miscellaneous	s Organic Compounds											
hydrocarbons												
600	butane	CH ₃ CH ₂ CH ₂ CH ₃	1000	A3	1000	0.15	2.4	20,000	3.0	48	<u>45</u>	Neither
600a	2-methylpropane (isobutane)	CH(CH ₃) ₂ CH ₃	1000	A3	4000	0.59	9.5	16,000	2.4	38	<u>41</u>	Neither
[]												

a. The chemical name and chemical formula are not part of this standard. Chemical names conform to IUPAC nomenclature^{6,7} except where shortened, unambiguous names are used following ASHRAE Standard 34 convention.

b. The preferred chemical name is followed by the popular name in parentheses.
c. Data taken from Calm^{8,9,10}, Coombs^{11,12}, and Wilson and Richard ¹³ (see Section 10).

d. Highly toxic, toxic, or neither, where highly toxic and toxic are as defined in the International Fire Code¹, Uniform Fire Code², and OSHA regulations, and neither identifies those refrigerants having lesser toxicity than either of those groups^{1,2,3}.

e. At locations with altitudes higher than 4920 ft (1500 m), the ODL and RCL shall be 69,100 ppm.

f. The OELs are eight-hour TWAs, as defined in Section 3, unless otherwise noted; a "C" designation denotes a ceiling limit.

g. At locations with altitudes higher than 3300 ft (1000 m) but below or equal to 4920 ft (1500 m), the ODL and RCL shall be 112,000 ppm, and at altitudes higher than 4920 ft (1500 m), the ODL and RCL shall be 69,100 ppm.

Table 4-1 Refrigerant Data and Safety Classifications (Continued)

					RCL ^c		LFL		<u>BV</u>	Highly Toxic		
Refrigerant Number	Chemical Name ^{a,b}	Chemical Formula ^a	OEL ^f , ppm v/v	Safety Group	ppm v/v	lb/1000 ft ³	g/m ³	ppm v/v	lb/1000 ft ³	g/m ³	<u>(cm/s)</u>	Under Code Classification
Inorganic Co	mpounds											
[]												
717	ammonia	NH ₃	25	B2L	320	0.014	0.22	167,000	7.2	116	<u>7.2</u>	Neither
[]												
Unsaturated	Organic Compounds											
[]												
1150	ethene (ethylene)	CH ₂ =CH ₂	200	A3				31,000	2.2	36	<u>80</u>	Neither
[]												
1234yf	2,3,3,3-tetrafluoro-1-propene	CF ₃ CF=CH ₂	500	A2L	16,000	4.5	75	62,000	18.0	289	<u>1.5</u>	Neither
1234ze(E)	trans-1,3,3,3-tetrafluoro-1-propene	CF ₃ CH=CFH	800	A2L	16,000	4.7	76	65,000	18.8	303	<u>1.2</u>	Neither
[]												

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b. The preferred chemical name is followed by the popular name in parentheses.
c. Data taken from Calm^{8,9,10}, Coombs^{11,12}, and Wilson and Richard ¹³ (see Section 10).

d. Highly toxic, toxic, or neither, where highly toxic and toxic are as defined in the International Fire Code¹, Uniform Fire Code², and OSHA regulations, and neither identifies those refrigerants having lesser toxicity than either of those groups^{1,2,3}.

e. At locations with altitudes higher than 4920 ft (1500 m), the ODL and RCL shall be 69,100 ppm.

f. The OELs are eight-hour TWAs, as defined in Section 3, unless otherwise noted; a "C" designation denotes a ceiling limit.

g. At locations with altitudes higher than 3300 ft (1000 m) but below or equal to 4920 ft (1500 m), the ODL and RCL shall be 112,000 ppm, and at altitudes higher than 4920 ft (1500 m), the ODL and RCL shall be 69,100 ppm.

+ Table 4-2 Data and Safety Classifications for Refrigerant Blends

				RCL ^a		LFL ^j			<u>BV</u> ^p	Highly Toxic	
Refrigerant Number	Composition (Mass%) (Composition Tolerances)	OEL ^h , ppm v/v	Safety Group	ppm v/v	lb/1000 ft ³	g/m ³	ppm v/v	lb/1000 ft ³	g/m ³	<u>(cm/s)</u>	Under Code Classification
Zeotropes											
[]											
444A	R-32/152a/1234ze(E) (12.0/5.0/83.0) (±1.0/±1.0/±2.0)	850	A2L	21,000	5.1<u>5.0</u>	81<u>80</u>	82,000	19.9	324.8 <u>319.4</u>	<u><4.0</u>	Neither
444B	R-32/152a/1234ze(E) (41.5/10.0/48.5) (±1.0/±1.0/±1.0)	930	A2L	23,000	4.3	69<u>70</u>	93,000	17.3	277.3 278.1	<u>6.3</u>	Neither
445A	R-744/134a/1234ze(E) (6.0/9.0/85.0) (±1.0/±1.0/±2.0)	930	A2L	16,000	4 <u>.25.4</u>	67<u>87</u>	63,000	2.7 21.6	347.4	<u><4.0</u>	Neither
446A	R-32/1234ze(E)/600 (68.0/29.0/3.0) (+0.5, -1.0/+2.0, -0.6/+0.1, -1.0)	960	A2L	16,000 <u>23,000</u>	2.5 <u>3.7</u>	39<u>59</u>	62,000 ^m <u>93,000</u>	13.5 ^m <u>14.8</u>	217.4 ^m <u>237.7</u>	<u>8.6</u>	Neither
447A	R-32/125/1234ze(E) (68.0/3.5/28.5) (+1.5, -0.5/+1.5, -0.5/+1.0, -1.0)	960	A2L	16,000 <u>32,000</u>	2.6<u>5.2</u>	4 <u>283</u>	65,000 ^m <u>128,000</u>	18.9 ^m <u>20.6</u>	303.5 ^m 331.4	<u>4.7</u>	Neither
447B	R-32/125/1234ze(E) (68.0/8.0/24.0) (+1.0, -2.0/+2.0, -1.0/+1.0, -2.0)	970	A2L	16,000 <u>30,000</u>	2.6 <u>4.8</u>	42<u>78</u>	121,000	20.6 <u>19.5</u>	312.7	<u><4.0</u>	Neither

Informative Note: LFL dData values highlighted in gray in this table are based on conditions other than WCF @ 23°C (73.4°F). Refer to applicable table footnotes for details.

a. Data taken from Calm^{8,9,10}, Coombs^{11,12}, and Wilson and Richard¹³ (see Section 10).

b. Azeotropic refrigerants exhibit some segregation of components at conditions of temperature and pressure other than those at which they were formulated. The extent of segregation depends on the particular azeotrope and hardware system configuration.

c. The exact composition of this azeotrope is in question, and additional experimental studies are needed.

d. R-507, R-508, and R-509 are allowed alternative designations for R-507A, R-508A, and R-509A due to a change in designations after assignment of R-500 through R-509. Corresponding changes were not made for R-500 through R-506.

e. The RCL values for these refrigerant blends are approximated in the absence of adequate data for a component comprising less than 4% m/m of the blend and expected to have only a small influence in an acute, accidental release.

f. Highly toxic, toxic, or neither, where highly toxic and toxic are as defined in the International Fire Code¹, Uniform Fire Code², and OSHA regulations, and neither identifies those refrigerants having lesser toxicity than either of those groups ^{1,2,3}.

g. At locations with altitudes higher than 4920 ft (1500 m), the ODL and RCL shall be 69,100 ppm.

h. The OELs are eight-hour TWAs as defined in Section 3 unless otherwise noted; a "C" designation denotes a ceiling limit.

i. At locations with altitudes higher than 3300 ft (1000 m) but below or equal to 4920 ft (1500 m), the ODL and RCL shall be 112, 000 ppm, and at altitudes higher than 4920 ft (1500 m), the ODL and RCL shall be 69,100 ppm.

j. LFL is based on WCF @23°C (73.4°F) unless otherwise noted.

k. WCFF LFL @60°C (140°F)

1. Reserved for future assignment

m. WCFF LFL @23°C (73.4°F)

n. WCF LFL @100°C (212°F)

o. Reserved for future assignment

p. BV is based on WCF @23°C (73.4°F) unless otherwise noted.

q. WCFF BV @23°C (73.4°F)

Table 4-2 Data and Safety Classifications for Refrigerant Blends (Continued)

				RCL ^a		LFL ^j			<u>BV</u> ^p	Highly Toxic	
Refrigerant Number	Composition (Mass%) (Composition Tolerances)	OEL ^h , ppm v/v	Safety Group	ppm v/v	lb/1000 ft ³	g/m ³	ppm v/v	lb/1000 ft ³	g/m ³	<u>(cm/s)</u>	Under Code Classification
451A	R-1234yf/134a (89.8/10.2) (±0.2/±0.2)	530	A2L	18,000	5.0 <u>5.3</u>	81	70,000 ^m <u>74,000</u>	$\frac{20.3^{\text{m}}}{21.3}$	326.6^{-m} <u>341</u>	<u><4.0</u>	Neither
451B	R-1234yf/134a (88.8/11.2) (±0.2/±0.2)	530	A2L	18,000	5.0	81	70,000 ^m <u>74,000</u>	$\frac{20.3}{21.3}$ m	326.6 ^m <u>341.6</u>	<u><4.0</u>	Neither
[]											
452B	R-32/125/1234yf (67.0/7.0/26.0) (±2.0/±1.5/±2.0)	870	A2L	30,000	4.8	77	119,000	19.3	310.5	<u><4.0</u>	Neither
[]											
454A	R-32/1234yf (35.0/65.0) (+2.0/-2.0, +2.0/-2.0)	690	A2L	16,000 <u>21,000</u>	<u>3.24.4</u>	52<u>70</u>	63,000 ^m <u>84,000</u>	18.3 ^m <u>17.5</u>	293.9 ^m 281.4	<u>1.4</u>	Neither
454B	R-32/1234yf (68.9/31.1) (+1.0/-1.0, +1.0/-1.0)	850	A2L	19,000 <u>29,000</u>	3.1<u>4.6</u>	49 <u>74</u>	77,000 ^m <u>115,000</u>	22.0 ^m <u>18.5</u>	352.6^{-m} 296.8	<u>5.2</u>	Neither
454C	R-32/1234yf (21.5/78.5) (±2.0/±2.0)	620	A2L	19,000	<u>4.44.6</u>	71<u>73</u>	62,000 ^m <u>77,000</u>	18.0 ^m <u>18.2</u>	289.5 ^m 291.7	<u><4.0</u> ª	Neither
455A	R-744/32/1234yf (3.0/21.5/75.5) (+2.0, -1.0/+1.0, -2.0/±2.0)	650	A2L	22,000 <u>30,000</u>	4 <u>.96.8</u>	79<u>108</u>	118,000	26.9	432.1	<u><1.5</u>	Neither

Informative Note: LFL dData values highlighted in gray in this table are based on conditions other than WCF @ 23°C (73.4°F). Refer to applicable table footnotes for details.

a. Data taken from Calm^{8,9,10}, Coombs^{11,12}, and Wilson and Richard ¹³ (see Section 10).

b. Azeotropic refrigerants exhibit some segregation of components at conditions of temperature and pressure other than those at which they were formulated. The extent of segregation depends on the particular azeotrope and hardware system configuration.

c. The exact composition of this azeotrope is in question, and additional experimental studies are needed.

d. R-507, R-508, and R-509 are allowed alternative designations for R-507A, R-508A, and R-509A due to a change in designations after assignment of R-500 through R-509. Corresponding changes were not made for R-500 through R-506.

e. The RCL values for these refrigerant blends are approximated in the absence of adequate data for a component comprising less than 4% m/m of the blend and expected to have only a small influence in an acute, accidental release.

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g. At locations with altitudes higher than 4920 ft (1500 m), the ODL and RCL shall be 69,100 ppm.

h. The OELs are eight-hour TWAs as defined in Section 3 unless otherwise noted; a "C" designation denotes a ceiling limit.

i. At locations with altitudes higher than 3300 ft (1000 m) but below or equal to 4920 ft (1500 m), the ODL and RCL shall be 112, 000 ppm, and at altitudes higher than 4920 ft (1500 m), the ODL and RCL shall be 69,100 ppm.

j. LFL is based on WCF @23°C (73.4°F) unless otherwise noted.

k. WCFF LFL @60°C (140°F)

1. Reserved for future assignment

m. WCFF LFL @23°C (73.4°F)

n. WCF LFL @100°C (212°F)

o. Reserved for future assignment

p. BV is based on WCF @23°C (73.4°F) unless otherwise noted.

<u>q.</u> <u>WCFF BV @23°C (73.4°F)</u>

• Table 4-2 Data and Safety Classifications for Refrigerant Blends (Continued)

				RCL ^a			LFL ^j			<u>BV p</u>	Highly Toxic
Refrigerant Number []	Composition (Mass%) (Composition Tolerances)	OEL ^h , ppm v/v	Safety Group	ppm v/v	lb/1000 ft ³	g/m ³	ppm v/v	lb/1000 ft ³	g/m ³	<u>(cm/s)</u>	Under Code Classification
457A	R-32/1234yf/152a (18.0/70.0/12.0) (+0.5, -1.5/+0.5, -1.5/+0.1, -1.9)	650	A2L	15,000	3.4	54	60,000	13.5	216.3	<u>6.3</u>	Neither
[]											
459A	R-32/1234yf/1234ze(E) (68.0/26.0/6.0) (+0.5, -1.5/±2.0/+1.5, -0.5)	870	A2L	27,000	4.3	69	107,000	17.4	278.7	<u>5.0</u>	Neither
459B	R-32/1234yf/1234ze(E) (21.0/69.0/10.0) (+0.5, -1.0/±2.0/±1.0)	640	A2L	25,000	5.8	92	99,000	23.3	373.5	<u><4.0</u>	Neither

[...]

Informative Note: LFL dData values highlighted in gray in this table are based on conditions other than WCF @ 23°C (73.4°F). Refer to applicable table footnotes for details.

a. Data taken from Calm^{8,9,10}, Coombs^{11,12}, and Wilson and Richard ¹³ (see Section 10).

b. Azeotropic refrigerants exhibit some segregation of components at conditions of temperature and pressure other than those at which they were formulated. The extent of segregation depends on the particular azeotrope and hardware system configuration.
 c. The exact composition of this azeotrope is in question, and additional experimental studies are needed.

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g. At locations with altitudes higher than 4920 ft (1500 m), the ODL and RCL shall be 69,100 ppm.

h. The OELs are eight-hour TWAs as defined in Section 3 unless otherwise noted; a "C" designation denotes a ceiling limit.

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j. LFL is based on WCF @23°C (73.4°F) unless otherwise noted.

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<u>q.</u> <u>WCFF BV @23°C (73.4°F)</u>

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ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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