

**ANSI/ASHRAE Addenda m, n, o, p, q, r, s, t, u, and v to
ANSI/ASHRAE Standard 34-2007**



ASHRAE STANDARD

Designation and Safety Classification of Refrigerants

Approved by the ASHRAE Standards Committee on June 21, 2008; by the ASHRAE Board of Directors on June 25, 2008; and by the American National Standards Institute on June 26, 2008.

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**American Society of Heating, Refrigerating
and Air-Conditioning Engineers, Inc.**
1791 Tullie Circle NE, Atlanta, GA 30329
www.ashrae.org

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FOREWORD

This addendum adds the refrigerant concentration limit (RCL) to the purpose and scope of Standard 34.

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

Addendum m to Standard 34-2007

Revise Sections 1 and 2 as follows.

1. PURPOSE

This standard is intended to establish a simple means of referring to common refrigerants instead of using the chemical name, formula, or trade name. It ~~also~~ establishes a uniform system for assigning reference numbers, ~~and~~ safety classifications, and refrigerant concentration limits to refrigerants. The standard ~~also~~ identifies requirements to apply for designations and safety classifications for refrigerants, ~~including blends, and to determine refrigerant concentration limits in addenda or revisions to this standard.~~

2. SCOPE

This standard provides an unambiguous system for numbering refrigerants and assigning composition-designating prefixes for refrigerants. Safety classifications based on toxicity and flammability data are included along with refrigerant concentration limits for the refrigerants. This standard does not imply endorsement or concurrence that individual refrigerant blends are suitable for any particular application.

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FOREWORD

This addendum adds R-435A, a new zeotropic refrigerant blend, to Tables 2 and D2.

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

Addendum n to Standard 34-2007

Add the following to Table 2 in the columns indicated:

TABLE 2— DATA AND SAFETY CLASSIFICATIONS FOR REFRIGERANT BLENDS

Refrigerant Number = 435A

Composition (Mass %) = R-E170/152a (80.0/20.0)

Composition Tolerances = (±1.0 /±1.0)

Safety Group = A3

RCL = 8,500 ppm (v/v), 17 g/m³, 1.1 lb/Mcf

Highly Toxic or Toxic Under Code Classification = Neither

Add the following to Table D2 in the columns indicated:

TABLE D2— DATA FOR REFRIGERANT BLENDS

Refrigerant Number = 435A

Composition (Weight %) = R-E170/152a (80.0/20.0)

Average Molecular Mass = 49.04

Bubble Point (°C) = -26.1

Dew Point (°C) = -25.9

Bubble Point (°F) = -15.0

Dew Point (°F) = -14.6

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FOREWORD

This addendum adds R-510A, a new azeotropic refrigerant blend, to Tables 2 and D2.

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

Addendum o to Standard 34-2007

Add the following to Table 2 in the columns indicated:

TABLE 2— DATA AND SAFETY CLASSIFICATIONS FOR REFRIGERANT BLENDS

Refrigerant Number = 510A

Composition (Mass %) = R-E170/600a (88.0/12.0)

Composition Tolerances = (±0.5 /±0.5)

Safety Group = A3

RCL = 7,300 ppm (v/v), 14 g/m³, 0.87 lb/Mcf

Highly Toxic or Toxic Under Code Classification = Neither

Add the following to Table D2 in the columns indicated:

TABLE D2— DATA FOR REFRIGERANT BLENDS

Refrigerant Number = 510A

Composition (Weight %) = R-E170/600a (88.0/12.0)

Azeotropic Temperature = -25.2 (°C), -13.4 (°F)

Azeotropic Molecular Mass = 47.24

Normal BPt. (°C) = -25.2

Normal BPt. (°F) = -13.4

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FOREWORD

This addendum adds R-436A, a new zeotropic refrigerant blend, to Tables 2 and D2.

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

Addendum p to Standard 34-2007

Add the following to Table 2 in the columns indicated:

TABLE 2— DATA AND SAFETY CLASSIFICATIONS FOR REFRIGERANT BLENDS

Refrigerant Number = 436A

Composition (Mass %) = R-290/600a (56.0/44.0)

Composition Tolerances = (±1.0 /±1.0)

Safety Group = A3

RCL = 4,000 ppm (v/v), 8 g/m³, 0.5 lb/Mcf

Highly Toxic or Toxic Under Code Classification = Neither

Add the following to Table D2 in the columns indicated:

TABLE D2— DATA FOR REFRIGERANT BLENDS

Refrigerant Number = 436A

Composition (Weight %) = R-290/600a (56.0/44.0)

Average Molecular Mass = 49.33

Bubble Point (°C) = -34.3

Dew Point (°C) = -26.2

Bubble Point (°F) = -29.7

Dew Point (°F) = -16.2

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FOREWORD

This addendum adds R-436B, a new zeotropic refrigerant blend, to Tables 2 and D2.

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

Addendum q to Standard 34-2007

Add the following to Table 2 in the columns indicated:

TABLE 2 DATA AND SAFETY CLASSIFICATIONS FOR REFRIGERANT BLENDS

Refrigerant Number = 436B

Composition (Mass %) = R-290/600a (52.0/48.0)

Composition Tolerances = (±1.0 /±1.0)

Safety Group = A3

RCL = 4,000 ppm (v/v), 8.1 g/m³, 0.5 lb/Mcf

Highly Toxic or Toxic Under Code Classification = Neither

Add the following to Table D2 in the columns indicated:

TABLE D2— DATA FOR REFRIGERANT BLENDS

Refrigerant Number = 436B

Composition (Weight %) = R-290/600a (52.0/48.0)

Average Molecular Mass = 49.87

Bubble Point (°C) = -33.4

Dew Point (°C) = -25.0

Bubble Point (°F) = -28.1

Dew Point (°F) = -13.0

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

This addendum adds R-437A, a new zeotropic refrigerant blend, to Tables 2 and D2.

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

Addendum r to Standard 34-2007

Add the following to Table 2 in the columns indicated:

TABLE 2— DATA AND SAFETY CLASSIFICATIONS FOR REFRIGERANT BLENDS

Refrigerant Number = 437A

Composition (Mass %) = R-125/134a/600/601
(19.5/78.5/1.4/0.6)

Composition Tolerances =
(+0.5,-1.8 / +1.5,-0.7 / +0.1,-0.2 / +0.1,-0.2)

Safety Group = A1

RCL = 19,000 ppm v/v, 81 g/m³, 5 lb/Mcf

Highly Toxic or Toxic Under Code Classification = Neither

Add the following to Table D2 in the columns indicated:

TABLE D2— DATA FOR REFRIGERANT BLENDS

Refrigerant Number = 437A

Composition (Weight %) = R-125/134a/600/601
(19.5/78.5/1.4/0.6)

Average Molecular Mass = 103.7

Bubble Point (°C) = -32.9

Dew Point (°C) = -29.2

Bubble Point (°F) = -27.2

Dew Point (°F) = -20.6

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

This addendum revises the oxygen deprivation limit (ODL) adjustment for altitude by adding an intermediate adjustment at 1500 m.

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

Addendum s to Standard 34-2007

7.1.2 Oxygen Deprivation Limit (ODL). The ODL shall be 140,000 ppm by volume for locations with altitudes at and below 1000 m (3300 ft) above sea level. At locations ~~with altitudes greater~~ higher than 1000 m (3300 ft) ~~but below or equal~~

to 1500 m (4920 ft), the ODL shall be 112,000 ppm and at altitudes higher than 1500 m (4920 ft) above sea level, the ODL shall be 69,100 ppm (19.5% oxygen by volume).

Correct footnote f to Table 1 and footnote ab to Table 2 to read as follows:

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

In addition to the refrigerants already footnoted accordingly, footnote f shall be added to R-116 and R-125 in Table 1 and footnote ab shall be added to R-434a and R-502 in Table 2.

Add the following new footnote h to Table 1 and footnote am to Table 2, as shown below. The new footnote shall replace footnote ab for R-404A, R-410A, R-410B, R-504, and R-507A, and shall be added to R-115:

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

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

This addendum adds occupational exposure limits (OELs) for the refrigerants to Tables 1 and 2.

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

Addendum t to Standard 34-2007

Revise Tables 1 and 2 as follows. The last column, “Highly Toxic or Toxic Under Code Classification” is not shown; all the values in that column remain the same as in 34-2007 and published addenda.

TABLE 1 Refrigerant Data and Safety Classifications

Refrigerant Number	Chemical Name ^{a,b}	Chemical Formula ^a	OEL ^g	Safety Group	(ppm v/v)	RCL ^c (g/m ³)	(lb/Mcf)
Methane Series							
11	trichlorofluoromethane	CCl ₃ F	<u>C1000</u>	A1	1100	6.2	0.39
12	dichlorodifluoromethane	CCl ₂ F ₂	<u>1000</u>	A1	18,000	90	5.6
12B1	bromochlorodifluoromethane	CBrClF ₂					
13	chlorotrifluoromethane	CClF ₃	<u>1000</u>	A1			
13B1	bromotrifluoromethane	CBrF ₃	<u>1000</u>	A1			
14 ^{d,f}	tetrafluoromethane (carbon tetrafluoride)	CF ₄	<u>1000</u>	A1	110,000	400	25
21	dichlorofluoromethane	CHCl ₂ F		B1			
22	chlorodifluoromethane	CHClF ₂	<u>1000</u>	A1	59,000	210	13
23	trifluoromethane	CHF ₃	<u>1000</u>	A1	41,000	120	7.3
30	dichloromethane (methylene chloride)	CH ₂ Cl ₂		B2			
31	chlorofluoromethane	CH ₂ ClF					
32	difluoromethane (methylene fluoride)	CH ₂ F ₂	<u>1000</u>	A2	36,000	77	4.8
40	chloromethane (methyl chloride)	CH ₃ Cl		B2			
41	fluoromethane (methyl fluoride)	CH ₃ F					
50	methane	CH ₄	<u>1000</u>	A3			
Ethane Series							
113	1,1,2-trichloro-1,2,2-trifluoroethane	CCl ₂ FCClF ₂	<u>1000</u>	A1	2600	20	1.2
114	1,2-dichloro-1,1,2,2-tetrafluoroethane	CClF ₂ CClF ₂	<u>1000</u>	A1	20,000	140	8.7
115 ^{d,h}	chloropentafluoroethane	CClF ₂ CF ₃	<u>1000</u>	A1	120,000	760	47
116 ^f	hexafluoroethane	CF ₃ CF ₃	<u>1000</u>	A1	97,000	550	34
123	2,2-dichloro-1,1,1-trifluoroethane	CHCl ₂ CF ₃	<u>50</u>	B1	9100	57	3.5
124	2-chloro-1,1,1,2-tetrafluoroethane	CHClF ₂ CF ₃	<u>1000</u>	A1	10,000	56	3.5
125 ^f	pentafluoroethane	CHF ₂ CF ₃	<u>1000</u>	A1	75,000	370	23
134a	1,1,1,2-tetrafluoroethane	CH ₂ FCF ₃	<u>1000</u>	A1	50,000	210	13
141b	1,1-dichloro-1-fluoroethane	CH ₃ CCl ₂ F	<u>500</u>		2600	12	0.78
142b	1-chloro-1,1-difluoroethane	CH ₃ CClF ₂	<u>1000</u>	A2	20,000	83	5.1
143a	1,1,1-trifluoroethane	CH ₃ CF ₃	<u>1000</u>	A2	21,000	70	4.5
152a	1,1-difluoroethane	CH ₃ CHF ₂	<u>1000</u>	A2	12,000	32	2.0
170 ^d	ethane	CH ₃ CH ₃	<u>1000</u>	A3	7000	8.7	0.54

TABLE 1 Refrigerant Data and Safety Classifications (Continued)

Refrigerant Number	Chemical Name ^{a,b}	Chemical Formula ^a	OEL ^g	Safety Group	(ppm v/v)	RCL ^c (g/m ³)	(lb/Mcf)
Ethers							
E170	dimethyl ether	CH ₃ OCH ₃	1000	A3	8500	16	1.0
Propane							
218 ^f	octafluoropropane	CF ₃ CF ₂ CF ₃	1000	A1	90,000	690	43
227ea ^f	1,1,1,2,3,3,3-heptafluoropropane	CF ₃ CHFCF ₃	1000	A1	84,000	580	36
236fa	1,1,1,3,3,3-hexafluoropropane	CF ₃ CH ₂ CF ₃	1000	A1	55,000	340	21
245fa	1,1,1,3,3-pentafluoropropane	CHF ₂ CH ₂ CF ₃	300	B1	34,000	190	12
290	propane	CH ₃ CH ₂ CH ₃	1000	A3	5300	9.5	0.56
Cyclic Organic Compounds							
C318 ^d	octafluorocyclobutane	-(CF ₂) ₄ -	1000	A1	69,000	570	35
See Table 2 for Blends							
Miscellaneous Organic Compounds							
hydrocarbons							
600	butane	CH ₃ CH ₂ CH ₂ CH ₃	1000	A3			
600a	isobutane	CH(CH ₃) ₂ CH ₃	1000	A3	4000	9.6	0.6
601	pentane	CH ₃ CH ₂ CH ₂ CH ₂ CH ₃	600				
601a	isopentane	(CH ₃) ₂ CHCH ₂ CH ₃	600	A3	1000	2.9	0.2
oxygen compounds							
610	ethyl ether	CH ₃ CH ₂ OCH ₂ CH ₃	400				
611	methyl formate	HCOOCH ₃	100	B2			
sulfur compounds							
620	(Reserved for future assignment)						
Nitrogen Compounds							
630	methyl amine	CH ₃ NH ₂					
631	ethyl amine	CH ₃ CH ₂ (NH ₂)					
Inorganic Compounds							
702	hydrogen	H ₂		A3			
704	helium	He		A1			
717	ammonia	NH ₃	25	B2	320	0.22	0.014
718	water	H ₂ O		A1			
720	neon	Ne		A1			
728	nitrogen	N ₂		A1			
732	oxygen	O ₂					
740	argon	Ar		A1			
744	carbon dioxide	CO ₂	5000	A1	40,000	72	4.5
744A	nitrous oxide	N ₂ O					
764	sulfur dioxide	SO ₂		B1			

TABLE 1 Refrigerant Data and Safety Classifications (Continued)

Refrigerant Number	Chemical Name ^{a,b}	Chemical Formula ^a	OEL ^g	Safety Group	(ppm v/v)	RCL ^c (g/m ³)	(lb/Mcf)
Unsaturated Organic Compounds							
1150	ethene (ethylene)	CH ₂ =CH ₂	<u>200</u>	A3			
1270 ^d	propene (propylene)	CH ₃ CH=CH ₂	<u>500</u>	A3	1000	1.7	0.1

^aThe chemical name and chemical formula are not part of this standard.

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

^cData taken from J.M. Calm, "ARTI Refrigerant Database," Air- Conditioning and Refrigeration Technology Institute (ARTI), Arlington, VA, July 2001; J.M. Calm, "Toxicity Data to Determine Refrigerant Concentration Limits," Report DE/CE 23810-110, Air- Conditioning and Refrigeration Technology Institute (ARTI), Arlington, VA, September 2000; J.M. Calm, "The Toxicity of Refrigerants," *Proceedings of the 1996 International Refrigeration Conference*, Purdue University, West Lafayette, IN, pp. 157-62, 1996; D.P. Wilson and R.G. Richard, "Determination of Refrigerant Lower Flammability Limits (LFLs) in Compliance with Proposed Addendum p to ANSI/ASHRAE Standard 34-1992 (1073-RP)," *ASHRAE Transactions* 2002, 108(2); D.W. Coombs, "HFC-32 Assessment of Anesthetic Potency in Mice by Inhalation," Huntingdon Life Sciences Ltd., Huntingdon, Cambridgeshire, England, February 2004 and amendment February 2006; D.W. Coombs, "HFC-22 An Inhalation Study to Investigate the Cardiac Sensitization Potential in the Beagle Dog," Huntingdon Life Sciences Ltd., Huntingdon, Cambridgeshire, England, August 2005; and other toxicity studies.

^dThe RCL values for these refrigerants are provisional based on data found in searches for other refrigerants, but not fully examined.

^eHighly toxic, toxic, or neither, where highly toxic and toxic are as defined in the *International Fire Code, Uniform Fire Code*, and OSHA regulations, and neither identifies those refrigerants having lesser toxicity than either of those groups.^{12,13,14}

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

^gThe OELs are 8-hour TWAs as defined in section 3 unless otherwise noted; a C designation denotes a ceiling limit.

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

TABLE 2 Data and Safety Classifications for Refrigerant Blends

Refrigerant Number	Composition (Mass %)	OEL ^{a,l}	Safety Group	(ppm v/v)	RCL ^a (g/m ³)	(lb/Mcf)
Zeotropes						
400	R-12/114 (must be specified)		A1			
	(50.0/50.0)	<u>1000</u>	A1	28,000	160	10
	(60.0/40.0)	<u>1000</u>	A1	30,000	170	11
401A	R-22/152a/124 (53.0/13.0/34.0) ^e	<u>1000</u>	A1	27,000	110	6.6
401B	R-22/152a/124 (61.0/11.0/28.0) ^e	<u>1000</u>	A1	30,000	120	7.2
401C	R-22/152a/124 (33.0/15.0/52.0) ^e	<u>1000</u>	A1	20,000	84	5.2
402A	R-125/290/22 (60.0/2.0/38.0) ^f	<u>1000</u>	A1	33,000	140	8.5
402B	R-125/290/22 (38.0/2.0/60.0) ^f	<u>1000</u>	A1	63,000	240	15
403A	R-290/22/218 (5.0/75.0/20.0) ^g	<u>1000</u>	A1	33,000	120	7.6
403B ^{ab}	R-290/22/218 (5.0/56.0/39.0) ^g	<u>1000</u>	A1	70,000	290	18
404A ^{am}	R-125/143a/134a (44.0/52.0/4.0) ^f	<u>1000</u>	A1	130,000	500	31
405A ^t	R-22/152a/142b/C318 (45.0/7.0/5.5/42.5) ^h	<u>1000</u>		57,000	260	16
406A	R-22/600a/142b (55.0/4.0/41.0) ⁱ	<u>1000</u>	A2	21,000	25	4.7
407A ^{ab}	R-32/125/134a (20.0/40.0/40.0) ^o	<u>1000</u>	A1	78,000	290	18
407B ^{ab}	R-32/125/134a (10.0/70.0/20.0) ^o	<u>1000</u>	A1	77,000	320	20
407C ^{ab}	R-32/125/134a (23.0/25.0/52.0) ^o	<u>1000</u>	A1	76,000	270	17
407D	R-32/125/134a (15.0/15.0/70.0) ^o	<u>1000</u>	A1	65,000	240	15
407E ^{o,ab}	R-32/125/134a (25.0/15.0/60.0) ^o	<u>1000</u>	A1	75,000	260	16
408A ^{ab}	R-125/143a/22 (7.0/46.0/47.0) ^f	<u>1000</u>	A1	95,000	340	21
409A	R-22/124/142b (60.0/25.0/15.0) ^k	<u>1000</u>	A1	29,000	110	7.1
409B	R-22/124/142b (65.0/25.0/10.0) ^k	<u>1000</u>	A1	30,000	120	7.3
410A ^{am}	R-32/125 (50.0/50.0) ^l	<u>1000</u>	A1	130,000	390	25
410B ^{am}	R-32/125 (45.0/55.0) ⁿ		A1	130,000	390	24
411A ^u	R-1270/22/152a (1.5/87.5/11.0) ^m	<u>990</u>	A2	14,000	46	2.9

TABLE 2 Data and Safety Classifications for Refrigerant Blends (Continued)

Refrigerant Number	Composition (Mass %)	OEL ^{al}	Safety Group	RCL ^a		
				(ppm v/v)	(g/m ³)	(lb/Mcf)
411B ^u	R-1270/22/152a (3.0/94.0/3.0) ^m	<u>980</u>	A2	13,000	45	2.8
412A	R-22/218/142b (70.0/5.0/25.0) ^k	<u>1000</u>	A2	22,000	82	5.1
413A	R-218/134a/600a (9.0/88.0/3.0) ^q	<u>1000</u>	A2	22,000	94	5.8
414A	R-22/124/600a/142b (51.0/28.5/4.0/16.5) ^s	<u>1000</u>	A1	26,000	100	6.4
414B	R-22/124/600a/142b (50.0/39.0/1.5/9.5) ^s	<u>1000</u>	A1	23,000	95	6.0
415A	R-22/152a (82.0/18.0) ⁿ	<u>1000</u>	A2	57,000	190	12
415B	R-22/152a (25.0/75.0) ⁿ	<u>1000</u>	A2	52,000	120	9.3
416A ^{t,u}	R-134a/124/600 (59.0/39.5/1.5) ^v	<u>1000</u>	A1	14,000	62	3.9
417A ^{t,u}	R-125/134a/600 (46.6/50.0/3.4) ^w	<u>1000</u>	A1	13,000	56	3.5
418A	R-290/22/152a (1.5/96.0/2.5) ^x	<u>1000</u>	A2	59,000	200	13
419A ^{ab}	R-125/134a/E170 (77.0/19.0/4.0) ^y	<u>1000</u>	A2	70,000	310	19
420A	R-134a/142b (88.0/12.0) ^z	<u>1000</u>	A1	45,000	190	12
421A	R-125/134a (58.0/42.0) ⁿ	<u>1000</u>	A1	61,000	280	17
421B	R-125/134a (85.0/15.0) ⁿ	<u>1000</u>	A1	69,000	330	21
422A	R-125/134a/600a (85.1/11.5/3.4) ^{ac}	<u>1000</u>	A1	63,000	290	18
422B	R-125/134a/600a (55.0/42.0/3.0) ^{ad}	<u>1000</u>	A1	56,000	250	16
422C	R-125/134a/600a (82.0/15.0/3.0) ^{ad}	<u>1000</u>	A1	62,000	290	18
422D	R-125/134a/600a (65.1/31.5/3.4) ^{ae}	<u>1000</u>	A1	58,000	260	16
423A	R-134a/227ea (52.5/47.5) ⁿ	<u>1000</u>	A1	59,000	310	19
424A ^{t,u}	R-125/134a/600a/600/601a (50.5/47.0/0.9/1.0/0.6) ^{af}	<u>970</u>	A1	23,000	100	6.2
425A	R-32/134a/227ea (18.5/69.5/12.0) ^{ag}	<u>1000</u>	A1	67,000	250	16
426A ^{t,u}	R-125/134a/600a/601a (5.1/93.0/1.3/0.6) ^{ah}	<u>990</u>	A1	20,000	83	5.2
427A	R-32/125/143a/134a (15.0/25.0/10.0/50.0) ^{ai}	<u>1000</u>	A1			
428A	R-125/143a/290/600a (77.5/20.0/0.6/1.9) ^{ah}	<u>1000</u>	A1			
429A	R-E170/152a/600a (60.0/10.0/30.0) ^y	<u>1000</u>	A3	6300	13	0.81
430A	R-152a/600a (76.0/24.0) ⁿ	<u>1000</u>	A3	8000	21	1.3
431A	R-290/152a (71.0/29.0) ⁿ	<u>1000</u>	A3	5500	11	.069
432A	R-1270/E170 (80.0/20.0) ⁿ	<u>710</u>	A3	1200	2.1	0.13
433A	R-1270/290 (30.0/70.0) ⁿ	<u>880</u>	A3	3100	5.5	0.34
434A ^{ab}	R-125/143a/134a/600a ^{aj}	<u>1000</u>	A1	73000	320	20
435A	R-E170/152a (80.0/20.0) ⁿ	<u>1000</u>	A3	8500	17	1.1
436A	R-290/600a (56.0/44.0) ⁿ	<u>1000</u>	A3	4000	8	0.5
436B	R-290/600a (52.0/48.0) ⁿ	<u>1000</u>	A3	4000	8	0.5
437A	R-125/134a/600/601 (19.5/78.5/1.4/0.6) ^{ak}	<u>990</u>	A1	19000	81	5
Azeotropes^b						
500	R-12/152a (73.8/26.2)	<u>1000</u>	A1	30,000	120	7.6
501	R-22/12 (75.0/25.0) ^c	<u>1000</u>	A1	54,000	210	13
502 ^{ab}	R-22/115 (48.8/51.2)	<u>1000</u>	A1	73,000	330	21
503	R-23/13 (40.1/59.9)	<u>1000</u>				
504 ^{t,am}	R-32/115 (48.2/51.8)	<u>1000</u>		140,000	460	29

TABLE 2 Data and Safety Classifications for Refrigerant Blends (Continued)

Refrigerant Number	Composition (Mass %)	OEL ^{al}	Safety Group	RCL ^a		
				(ppm v/v)	(g/m ³)	(lb/Mcf)
505	R-12/31 (78.0/22.0) ^c					
506	R-31/114 (55.1/44.9)					
507A ^{am}	R-125/143a (50.0/50.0)	1000	A1	130,000	520	32
508A	R-23/116 (39.0/61.0)	1000	A1	55,000	220	14
508B	R-23/116 (46.0/54.0)	1000	A1	52,000	200	13
509A ^{ab}	R-22/218 (44.0/56.0)	1000	A1	75,000	390	24
510A	R-E170/600a (88.0/12.0)	1000	A3	7300	14	0.87

^aThe chemical name and chemical formula are not part of this standard.

^bAzeotropic 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.

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

^dR-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.

^eComposition tolerances are (±2.0/+0.5, -1.5/±1.0).

^fComposition tolerances are (±2.0/±1.0/±2.0).

^gComposition tolerances are (+0.2, -2.0/±2.0/±0.0).

^hComposition tolerances for the individual components are (±0.0/±1.0/±1.0/±2.0) and for the sum of R-152a and R-142b are (+0.0, -2.0).

ⁱComposition tolerances are (±2.0/±1.0/±0.0).

^kComposition tolerances are (±2.0/±2.0/±1.0).

^lComposition tolerances are (+0.5, -1.5/+1.5, -0.5).

^mComposition tolerances are (+0.0, -1.0/±2.0, -0.0/+0.0, -1.0).

ⁿComposition tolerances are (±1.0/±1.0).

^oComposition tolerances are (±2.0/±2.0/±2.0).

^qComposition tolerances are (±1.0/±2.0/+0.0, -1.0).

^rComposition tolerances are (±2.0/+1.0, -1.0/±2.0).

^sComposition tolerances are (±2.0/±2.0/±0.5/+0.5, -1.0).

^tThe RCL values for these refrigerants are provisional based on data found in searches for other refrigerants, but not fully examined.

^uThe 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.

^vComposition tolerances are (+0.5, -1.0/+1.0, -0.5/+1.0, -0.2).

^wComposition tolerances are (±1.1/±1.0/+0.1, -0.4).

^xComposition tolerances are (±0.5/±1.0/±0.5).

^yComposition tolerances are (±1.0/±1.0/±1.0).

^zComposition tolerances are (+1.0, -0.0/+0.0, -1.0).

^{aa}Highly toxic, toxic, or neither, where highly toxic and toxic are as defined in the *International Flre Code*, *Uniform Flre Code*, and OSHA regulations, and neither identifies those refrigerants having lesser toxicity than either of those groups.^{12,13,14}

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

^{ac}Composition tolerances are (±1.0/±1.0/+0.1, -0.4).

^{ad}Composition tolerances are (±1.0/±1.0/+0.1, -0.5).

^{ae}Composition tolerances are (+0.9, -1.1/±1.0/+0.1, -0.4).

^{af}Composition tolerances are (±1.0/±1.0/+0.1, -0.2/+0.1, +0.2/+0.1, -0.2).

^{ag}Composition tolerances are (±0.5/±0.5/±0.5).

^{ah}Composition tolerances are (±1.0/±1.0/+0.1, -0.2/+0.1, -0.2).

^{ai}Composition tolerances are (±2.0/±2.0/±2.0/±2.0).

^{aj}Composition tolerances are (±1/±1/±0.1, -0.2).

^{ak}Composition tolerances are (+0.5, -1.8/+1.5, -0.7/+0.1, -0.2/+0.1, -0.2).

^{al}The OELs are 8-hour TWAs as defined in section 3 unless otherwise noted; a C designation denotes a ceiling limit.

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

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

This addendum adds a definition of OEL to Section 3 and revises Section 6.1.2 to clarify the intent.

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

Addendum u to Standard 34-2007

Add the following definition to Section 3:

occupational exposure limit (OEL): the time-weighted average concentration for a normal eight-hour work day and a 40-hour work week to which nearly all workers can be repeatedly

exposed without adverse effect, based on the OSHA PEL, ACGIH TLV-TWA, the AIHA WEEL, or consistent value.

Revise Section 6.1.2 as follows:

6.1.2 Toxicity Classification. Refrigerants shall be assigned to one of two classes—A or B—based on allowable exposure:

Class A refrigerants are of a lower degree of toxicity as indicated by a PEL of 400 ppm or greater, if assigned; otherwise, a recommended occupational exposure limit (OEL) of 400 ppm or greater signifies refrigerants for which toxicity has ~~not been identified at concentrations less than or equal to 400 ppm by volume, based on data used to determine threshold limit value—time-weighted average (TLV—TWA) or consistent indices.~~

Class B refrigerants are those of higher degree of toxicity as indicated by a PEL of less than 400 ppm, if assigned; otherwise, a recommended OEL of less than 400 ppm signifies refrigerants for which there is evidence of toxicity at concentrations below 400 ppm by volume, based on data used to determine TLV TWA or consistent indices.

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

This addendum modifies data for R-600 in Table E1 by adding an anesthetic NOEL of 130,000 and changing “Other” to 10,000.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and

~~striking through~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum v to Standard 34-2007

Add the following to Table E1 for R-600, butane, in the columns indicated:

TABLE E1—
TOXICITY TABLE FOR STANDARD 34—
ATEL, ODL, FCL, AND RCL VALUES FOR
SINGLE-COMPOUND REFRIGERANTS (PPM V/V)

R-600, butane
Anesthesia NOEL = 130,000
Other = 10,000

**POLICY STATEMENT DEFINING ASHRAE'S CONCERN
FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES**

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.