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.

This standard is under continuous maintenance 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. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site, http://www.ashrae.org, or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide) or toll free 1-800-527-4723 (for orders in US and Canada).

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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 ~~strikethrough~~ (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 ~~strikethrough~~ (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/m^3, 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

(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-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 ~~strikethrough~~ (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/m^3, 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 ~~strikethrough~~ (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/m^3, 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

(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-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 ~~strikethrough~~ (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/m^3, 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 ~~strikethrough~~ (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/m^3, 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 ~~strikethrough~~ (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 ~~strikethrough~~ (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	RCL[c] (ppm v/v)	RCL[c] (g/m^3)	RCL[c] (lb/Mcf)
Methane Series							
11	trichlorofluoromethane	CCl_3F	C1000	A1	1100	6.2	0.39
12	dichlorodifluoromethane	CCl_2F_2	1000	A1	18,000	90	5.6
12B1	bromochlorodifluoromethane	$CBrClF_2$					
13	chlorotrifluoromethane	$CClF_3$	1000	Al			
13B1	bromotrifluoromethane	$CBrF_3$	1000	Al			
14[d,f]	tetrafluoromethane (carbon tetrafluoride)	CF_4	1000	Al	110,000	400	25
21	dichlorofluoromethane	$CHCl_2F$		B1			
22	chlorodifluoromethane	$CHClF_2$	1000	Al	59,000	210	13
23	trifluoromethane	CHF_3	1000	Al	41,000	120	7.3
30	dichloromethane (methylene chloride)	CH_2Cl_2		B2			
31	chlorofluoromethane	CH_2ClF					
32	difluoromethane (methylene fluoride)	CH_2F_2	1000	A2	36,000	77	4.8
40	chloromethane (methyl chloride)	CH_3Cl		B2			
41	fluoromethane (methyl fluoride)	CH_3F					
50	methane	CH_4	1000	A3			
Ethane Series							
113	1,1,2-trichloro-1,2,2-trifluoroethane	CCl_2FCClF_2	1000	A1	2600	20	1.2
114	1,2-dichloro-1,1,2,2-tetrafluoroethane	$CClF_2CClF_2$	1000	A1	20,000	140	8.7
115[d,h]	chloropentafluoroethane	$CClF_2CF_3$	1000	A1	120,000	760	47
116[f]	hexafluoroethane	CF_3CF_3	1000	A1	97,000	550	34
123	2,2-dichloro-1,1,1-trifluoroethane	$CHCl_2CF_3$	50	B1	9100	57	3.5
124	2-chloro-1,1,1,2-tetrafluoroethane	$CHClFCF_3$	1000	A1	10,000	56	3.5
125[f]	pentafluoroethane	CHF_2CF_3	1000	A1	75,000	370	23
134a	1,1,1,2-tetrafluoroethane	CH_2FCF_3	1000	A1	50,000	210	13
141b	1,1-dichloro-1-fluoroethane	CH_3CCl_2F	500		2600	12	0.78
142b	1-chloro-1,1-difluoroethane	CH_3CClF_2	1000	A2	20,000	83	5.1
143a	1,1,1-trifluoroethane	CH_3CF_3	1000	A2	21,000	70	4.5
152a	1,1-difluoroethane	CH_3CHF_2	1000	A2	12,000	32	2.0
170[d]	ethane	CH_3CH_3	1000	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	RCL[c] (ppm v/v)	RCL[c] (g/m^3)	RCL[c] (lb/Mcf)
Ethers							
E170	dimethyl ether	CH_3OCH_3	1000	A3	8500	16	1.0
Propane							
218[f]	octafluoropropane	$CF_3CF_2CF_3$	1000	A1	90,000	690	43
227ea[f]	1,1,1,2,3,3,3-heptafluoropropane	CF_3CHFCF_3	1000	A1	84,000	580	36
236fa	1,1,1,3,3,3-hexafluoropropane	$CF_3CH_2CF_3$	1000	A1	55,000	340	21
245fa	1,1,1,3,3-pentafluoropropane	$CHF_2CH_2CF_3$	300	B1	34,000	190	12
290	propane	$CH_3CH_2CH_3$	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	$CH_3CH_2CH_2CH_3$	1000	A3			
600a	isobutane	$CH(CH_3)_2CH_3$	1000	A3	4000	9.6	0.6
601	pentane	$CH_3CH_2CH_2CH_2CH_3$	600				
601a	isopentane	$(CH_3)_2CHCH_2CH_3$	600	A3	1000	2.9	0.2
oxygen compounds							
610	ethyl ether	$CH_3CH_2OCH_2CH_3$	400				
611	methyl formate	$HCOOCH_3$	100	B2			
sulfur compounds							
620	(Reserved for future assignment)						
Nitrogen Compounds							
630	methyl amine	CH_3NH_2					
631	ethyl amine	$CH_3CH_2(NH_2)$					
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_2O		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_2O					
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	RCL[c] (ppm v/v)	RCL[c] (g/m^3)	RCL[c] (lb/Mcf)
Unsaturated Organic Compounds							
1150	ethene (ethylene)	$CH_2=CH_2$	200	A3			
1270[d]	propene (propylene)	$CH_3CH=CH_2$	500	A3	1000	1.7	0.1

[a]The chemical name and chemical formula are not part of this standard.
[b]The preferred chemical name is followed by the popular name in parentheses.
[c]Data 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.
[d]The RCL values for these refrigerants are provisional based on data found in searches for other refrigerants, but not fully examined.
[e]*Highly 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]
[f]At locations with altitudes higher than 1500 m (4920 ft), the ODL and RCL shall be 69,100 ppm.
[g]The OELs are 8-hour TWAs as defined in section 3 unless otherwise noted; a C designation denotes a ceiling limit.
[h]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.

TABLE 2 Data and Safety Classifications for Refrigerant Blends

Refrigerant Number	Composition (Mass %)	OEL[al]	Safety Group	RCL[a] (ppm v/v)	RCL[a] (g/m^3)	RCL[a] (lb/Mcf)
Zeotropes						
400	R-12/114 (must be specified)		A1			
	(50.0/50.0)	1000	A1	28,000	160	10
	(60.0/40.0)	1000	A1	30,000	170	11
401A	R-22/152a/124 (53.0/13.0/34.0)[e]	1000	A1	27,000	110	6.6
401B	R-22/152a/124 (61.0/11.0/28.0)[e]	1000	A1	30,000	120	7.2
401C	R-22/152a/124 (33.0/15.0/52.0)[e]	1000	A1	20,000	84	5.2
402A	R-125/290/22 (60.0/2.0/38.0)[r]	1000	A1	33,000	140	8.5
402B	R-125/290/22 (38.0/2.0/60.0)[r]	1000	A1	63,000	240	15
403A	R-290/22/218 (5.0/75.0/20.0)[g]	1000	A1	33,000	120	7.6
403B[ab]	R-290/22/218 (5.0/56.0/39.0)[g]	1000	A1	70,000	290	18
404A[am]	R-125/143a/134a (44.0/52.0/4.0)[f]	1000	A1	130,000	500	31
405A[t]	R-22/152a/142b/C318 (45.0/7.0/5.5/42.5)[h]	1000		57,000	260	16
406A	R-22/600a/142b (55.0/4.0/41.0)[i]	1000	A2	21,000	25	4.7
407A[ab]	R-32/125/134a (20.0/40.0/40.0)[o]	1000	A1	78,000	290	18
407B[ab]	R-32/125/134a (10.0/70.0/20.0)[o]	1000	A1	77,000	320	20
407C[ab]	R-32/125/134a (23.0/25.0/52.0)[o]	1000	A1	76,000	270	17
407D	R-32/125/134a (15.0/15.0/70.0)[o]	1000	A1	65,000	240	15
407E[o,ab]	R-32/125/134a (25.0/15.0/60.0)[o]	1000	A1	75,000	260	16
408A[ab]	R-125/143a/22 (7.0/46.0/47.0)[f]	1000	A1	95,000	340	21
409A	R-22/124/142b (60.0/25.0/15.0)[k]	1000	A1	29,000	110	7.1
409B	R-22/124/142b (65.0/25.0/10.0)[k]	1000	A1	30,000	120	7.3
410A[am]	R-32/125 (50.0/50.0)[l]	1000	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]	990	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)	RCL[a] (g/m^3)	RCL[a] (lb/Mcf)
411B[u]	R-1270/22/152a (3.0/94.0/3.0)[m]	980	A2	13,000	45	2.8
412A	R-22/218/142b (70.0/5.0/25.0)[k]	1000	A2	22,000	82	5.1
413A	R-218/134a/600a (9.0/88.0/3.0)[q]	1000	A2	22,000	94	5.8
414A	R-22/124/600a/142b (51.0/28.5/4.0/16.5)[s]	1000	A1	26,000	100	6.4
414B	R-22/124/600a/142b (50.0/39.0/1.5/9.5)[s]	1000	A1	23,000	95	6.0
415A	R-22/152a (82.0/18.0)[n]	1000	A2	57,000	190	12
415B	R-22/152a (25.0/75.0)[n]	1000	A2	52,000	120	9.3
416A[t,u]	R-134a/124/600 (59.0/39.5/1.5)[v]	1000	A1	14,000	62	3.9
417A[t,u]	R-125/134a/600 (46.6/50.0/3.4)[w]	1000	A1	13,000	56	3.5
418A	R-290/22/152a (1.5/96.0/2.5)[x]	1000	A2	59,000	200	13
419A[ab]	R-125/134a/E170 (77.0/19.0/4.0)[y]	1000	A2	70,000	310	19
420A	R-134a/142b (88.0/12.0)[z]	1000	A1	45,000	190	12
421A	R-125/134a (58.0/42.0)[n]	1000	A1	61,000	280	17
421B	R-125/134a (85.0/15.0)[n]	1000	A1	69,000	330	21
422A	R-125/134a/600a (85.1/11.5/3.4)[ac]	1000	A1	63,000	290	18
422B	R-125/134a/600a (55.0/42.0/3.0)[ad]	1000	A1	56,000	250	16
422C	R-125/134a/600a (82.0/15.0/3.0)[ad]	1000	A1	62,000	290	18
422D	R-125/134a/600a (65.1/31.5/3.4)[ae]	1000	A1	58,000	260	16
423A	R-134a/227ea (52.5/47.5)[n]	1000	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]	970	A1	23,000	100	6.2
425A	R-32/134a/227ea (18.5/69.5/12.0)[ag]	1000	A1	67,000	250	16
426A[t,u]	R-125/134a/600a/601a (5.1/93.0/1.3/0.6)[ah]	990	A1	20,000	83	5.2
427A	R-32/125/143a/134a (15.0/25.0/10.0/50.0)[ai]	1000	A1			
428A	R-125/143a/290/600a (77.5/20.0/0.6/1.9)[ah]	1000	A1			
429A	R-E170/152a/600a (60.0/10.0/30.0)[y]	1000	A3	6300	13	0.81
430A	R-152a/600a (76.0/24.0)[n]	1000	A3	8000	21	1.3
431A	R-290/152a (71.0/29.0)[n]	1000	A3	5500	11	.069
432A	R-1270/E170 (80.0/20.0)[n]	710	A3	1200	2.1	0.13
433A	R-1270/290 (30.0/70.0)[n]	880	A3	3100	5.5	0.34
434A[ab]	R-125/143a/134a/600a[aj]	1000	A1	73000	320	20
435A	R-E170/152a (80.0/20.0)[n]	1000	A3	8500	17	1.1
436A	R-290/600a (56.0/44.0)[n]	1000	A3	4000	8	0.5
436B	R-290/600a (52.0/48.0)[n]	1000	A3	4000	8	0.5
437A	R-125/134a/600/601 (19.5/78.5/1.4/0.6)[ak]	990	A1	19000	81	5
Azeotropes[b]						
500	R-12/152a (73.8/26.2)	1000	A1	30,000	120	7.6
501	R-22/12 (75.0/25.0)[c]	1000	A1	54,000	210	13
502[ab]	R-22/115 (48.8/51.2)	1000	A1	73,000	330	21
503	R-23/13 (40.1/59.9)	1000				
504[t,am]	R-32/115 (48.2/51.8)	1000		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)	RCL[a] (g/m^3)	RCL[a] (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

[a]The chemical name and chemical formula are not part of this standard.
[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]Composition tolerances are (±2.0/+0.5, –1.5/±1.0).
[f]Composition tolerances are (±2.0/±1.0/±2.0).
[g]Composition tolerances are (+0.2, -2.0/±2.0/±.0).
[h]Composition tolerances for the individual components are (±.0/±1.0/±1.0/±2.0) and for the sum of R-152a and R-142b are (+0.0, –2.0).
[i]Composition tolerances are (±2.0/±1.0/±.0).
[k]Composition tolerances are (±2.0/±2.0/±1.0).
[l]Composition tolerances are (+0.5, –1.5/+1.5, –0.5).
[m]Composition tolerances are (+0.0, –1.0/+2.0, –0.0/+0.0, –1.0).
[n]Composition tolerances are (±1.0/±1.0).
[o]Composition tolerances are (±2.0/±2.0/±2.0).
[q]Composition tolerances are (±1.0/±2.0/+0.0,–1.0).
[r]Composition tolerances are (±2.0/+1.0,–1.0/±2.0).
[s]Composition tolerances are (±2.0/±2.0/±0.5/+0.5, –1.0).
[t]The RCL values for these refrigerants are provisional based on data found in searches for other refrigerants, but not fully examined.
[u]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.
[v]Composition tolerances are (+0.5,–1.0/+1.0,–0.5/+1.0,–0.2).
[w]Composition tolerances are (±1.1/±1.0/+0.1,–0.4).
[x]Composition tolerances are (±0.5/±1.0/±0.5).
[y]Composition tolerances are (±1.0/±1.0/±1.0).
[z]Composition 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 FIre Code*, *Uniform FIre 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 ~~strikethrough~~ (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 ~~strikethrough~~ (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.