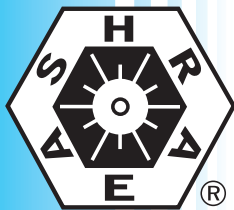


ANSI/ASHRAE Addenda d, j, l, m, and t to
ANSI/ASHRAE Standard 34-2004



ASHRAE STANDARD

Designation and Safety Classification of Refrigerants

Approved by the ASHRAE Standards Committee on January 27, 2007; by the ASHRAE Board of Directors on March 2, 2007; and by the American National Standards Institute on March 3, 2007.

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 requirement for refrigerant applications in electronic format in addition to the printed copies.

***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 d to 34-2004

8.8.3 ~~Written Form~~Printed and Electronic Format. Required information and evidence must be submitted in ~~written or~~ both printed and electronic form formats.

8.8.4 Format. Applications shall be provided on 8½-by-11-inch or A4 (21-by-29.7cm) paper. Reproductions may be either single- or double-sided (on one or both sides of the paper). Pages shall be bound using a cover that facilitates disassembly, insertion of supplementary pages, and reassembly without staples or binding machines, such as notebook or covers with spring clips ~~three-ring binders or covers with three bend-over tabs~~ (standard two- or four-ring binders or covers with two bend over tabs for A4 paper). Tabbed dividers shall be inserted before each part identified in 8.2 except the cover.

8.8.5 Quantity. Thirty-five bound copies shall be provided for committee and administrative use plus one unbound set for further reproduction by ASHRAE if needed. In addition, 35 compact disks with the application in electronic format shall be provided. The electronic format shall be a true PDF file. A scanned PDF file with large memory requirements is not acceptable except for figures and other inserts. Committee members may request only the compact disk, thereby reducing the number of bound paper copies required.

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FOREWORD

This addendum adds a designation of R-427A to the blend R-32/125/143a/134a (15.0/25.0/10.0/50.0) with tolerances of ($\pm 2.0/\pm 2.0/\pm 2.0/\pm 2.0$) and a safety classification of A1.

***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 j to 34-2004

Add to Table 2 the following entries for R-427A:

TABLE 2
Data and Safety Classifications for Refrigerant Blends

Refrigerant Number	=	<u>427A</u>
Composition (Mass %)	=	<u>R-32/125/143a/134a/ (15.0/25.0/10.0/50.0)</u>
Composition Tolerances	=	<u>($\pm 2.0/\pm 2.0/\pm 2.0/\pm 2.0$)</u>
Safety Group	=	<u>A1</u>

(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 designation of R-428A to the blend R-125/143a/290/600a (77.5/20.0/0.6/1.9) with tolerances of ($\pm 1.0/\pm 1.0/+0.1,-0.2/+0.1,-0.2$) and a safety classification of A1.

***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 I to 34-2004

Add to Table 2 the following entries for R-428A:

TABLE 2
Data and Safety Classifications for Refrigerant Blends

Refrigerant Number	=	<u>428A</u>
Composition (Mass %)	=	<u>R-125/143a/290/600a (77.5/20.0/0.6/1.9)</u>
Composition Tolerances	=	<u>($\pm 1.0/\pm 1.0/+0.1,-0.2/+0.1,-0.2$)</u>
Safety Group	=	<u>A1</u>

(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 removes data element requirements that are not needed for determining the refrigerant designation or safety classifications.

***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 34-2004

Remove the following four data requirements in Standard 34-2004, Section 8, Application Instructions, and re-letter the remaining requirements.

8.5.1 Refrigerant Identification

8.5.1.1 Single-compound refrigerants shall be identified in accordance with Section 4 with the exception of subsection 3.4, which applies to blends.

8.5.1.2 Blends shall be identified by listing the individual components in order of increasing normal boiling point followed by the composition in weight percent. For example, a 10/90 weight % mixture of Refrigerants 12 and 22 will be indicated as R-22/12 (90/10). Applicants shall indicate whether the blend is azeotropic or zeotropic (including near azeotropic) as defined in Section 3.

8.5.2 Refrigerant Data

8.5.2.1 Individual Compounds. The following information shall be provided for single-compound refrigerants or for each component of blends:

- (a) Chemical name.
- (b) Chemical formula.
- (c) Chemical Abstract Service registry number.
- (d) Molecular mass.
- ~~(e) Freezing or triple point.~~
- ~~(ef)~~ Normal boiling point (at 101.3 kPa).
- ~~(fg)~~ Saturation vapor pressure at 20°C and 60°C.
- ~~(gh)~~ Temperature at the critical point.
- ~~(hi)~~ Specific volume at the critical point.
- (ij) Uses and typical application temperatures (i.e., evaporating and condensing ranges).

8.5.2.2 Azeotropic Blends. The following additional information shall be provided for azeotropes:

- (a) Azeotropic temperature.
- (b) Formulation at the azeotropic temperature.
- (c) Molecular mass as formulated.
- (d) Molecular mass of the saturated vapor at 60°C.
- (e) Normal boiling point temperature (bubble-point temperature) at 101.3 kPa as formulated.
- (f) Normal dew-point temperature (at 101.3 kPa as formulated).
- (g) Maximum temperature glide at the normal boiling point and at 20°C.
- ~~(h) Vapor composition for the as formulated saturated liquid composition at the normal boiling point and at 20°C.~~
- ~~(hi)~~ Saturation vapor pressure at 20°C and 60°C as formulated.
- (ij) Evidence of azeotropy, including a detailed description of testing and a vapor-liquid equilibrium diagram (optional supporting information may be provided as an appendix).
- ~~(jk)~~ Latent heat of vaporization at 60°C.
- ~~(kl)~~ Specific heat ratio of the vapor at 60°C.
- ~~(lm)~~ Temperature at the critical point.
- ~~(mn)~~ Specific volume at the critical point.
- ~~(no)~~ Uses and typical application temperatures (i.e., evaporating and condensing ranges).
- ~~(op)~~ Proposed composition tolerances for classification.
- ~~(pq)~~ Worst case formulation (WCF) of the blend.
- ~~(qr)~~ Worst case fractionated formulation (WCFF) of the blend.

8.5.2.3 Zeotropic Blends. The following additional information shall be provided for zeotropes (including near azeotropes):

- (a) Formulation.
- (b) Molecular mass as formulated.
- (c) Molecular mass of the vapor at 60°C.
- (d) Bubble-point temperature at 101.3 kPa.
- (e) Dew-point temperature at 101.3 kPa.
- (f) Maximum temperature glide at the normal boiling point and at 20°C.
- ~~(g) Vapor composition for the as formulated saturated liquid composition at the normal boiling point and at 20°C.~~
- ~~(h) Dew point vapor pressure at 20°C and 60°C.~~
- ~~(gi)~~ Latent heat of vaporization at 60°C.
- ~~(hj)~~ Specific heat ratio of the vapor at 60°C.
- ~~(ik)~~ Temperature at the critical point.
- ~~(jl)~~ Specific volume at the critical point.
- ~~(km)~~ Uses and typical application temperatures (i.e., evaporating and condensing ranges).
- ~~(ln)~~ Proposed composition tolerances for classification.
- ~~(mo)~~ Worst case formulation (WCF) of the blend.
- ~~(np)~~ Worst case fractionated formulation (WCFF) of the blend.

(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 an informative appendix containing refrigerant data removed from the standard by Addendum 34u-2004 and bubble/dew points for azeotropic blends.

Addendum t to 34-2004

APPENDIX D REFRIGERANT DATA (INFORMATIVE)

TABLE D1 Refrigerant Data

Refrigerant Number	Chemical Name ^a	Chemical Formula	Molecular Mass	Normal Boiling Point	
				(°C)	(°F)
Methane Series					
11	trichlorofluoromethane	CCl ₃ F	137.4	24	75
12	dichlorodifluoromethane	CCl ₂ F ₂	120.9	-30	-22
12B1	bromochlorodifluoromethane	CBrClF ₂	165.4	-4	25
13	chlorotrifluoromethane	CClF ₃	104.5	-81	-115
13B1	bromotrifluoromethane	CBrF ₃	148.9	-58	-72
14	tetrafluoromethane (carbon tetrafluoride)	CF ₄	88.0	-128	-198
21	dichlorofluoromethane	CHCl ₂ F	102.9	9	48
22	chlorodifluoromethane	CHClF ₂	86.5	-41	-41
23	trifluoromethane	CHF ₃	70.0	-82	-116
30	dichloromethane (methylene chloride)	CH ₂ Cl ₂	84.9	40	104
31	chlorofluoromethane	CH ₂ ClF	68.5	-9	16
32	difluoromethane (methylene fluoride)	CH ₂ F ₂	52.0	-52	-62
40	chloromethane (methyl chloride)	CH ₃ Cl	50.5	-24	-12
41	fluoromethane (methyl fluoride)	CH ₃ F	34.0	-78	-108
50	methane	CH ₄	16.0	-161	-259
Ethane Series					
113	1,1,2-trichloro-1,2,2-trifluoroethane	CCl ₂ FCClF ₂	187.4	48	118
114	1,2-dichloro-1,1,2,2-tetrafluoroethane	CClF ₂ CClF ₂	170.9	4	38
115	chloropentafluoroethane	CClF ₂ CF ₃	154.5	-39	-38
116	hexafluoroethane	CF ₃ CF ₃	138.0	-78	-109
123	2,2-dichloro-1,1,1-trifluoroethane	CHCl ₂ CF ₃	153.0	27	81
124	2-chloro-1,1,1,2-tetrafluoroethane	CHClFCF ₃	136.5	-12	10
125	pentafluoroethane	CHF ₂ CF ₃	120.0	-49	-56
134a	1,1,1,2-tetrafluoroethane	CH ₂ FCF ₃	102.0	-26	-15
141b	1,1-dichloro-1-fluoroethane	CH ₃ CCl ₂ F	117.0	32	90
142b	1-chloro-1,1-difluoroethane	CH ₃ CClF ₂	100.5	-10	14
143a	1,1,1-trifluoroethane	CH ₃ CF ₃	84.0	-47	-53
152a	1,1-difluoroethane	CH ₃ CHF ₂	66.0	-25	-13
170	ethane	CH ₃ CH ₃	30.0	-89	-128

TABLE D1 Refrigerant Data (Continued)

Refrigerant Number	Chemical Name ^a	Chemical Formula	Molecular Mass	Normal Boiling Point	
				(°C)	(°F)
Ethers					
E170	dimethyl ether	CH ₃ OCH ₃	46.1	-25	-13
Propane Series					
218	octafluoropropane	CF ₃ CF ₂ CF ₃	188.0	-37	-35
236fa	1,1,1,3,3,3-hexafluoropropane	CF ₃ CH ₂ CF ₃	152.0	-1	29
245fa	1,1,1-3,3-pentafluoropropane	CF ₃ CH ₂ CHF ₂	134.0	15	59
290	propane	CH ₃ CH ₂ CH ₃	44.0	-42	-44
Cyclic Organic Compounds					
C318	octafluorocyclobutane	-(CF ₂) ₄ -	200.0	-6	21
Miscellaneous Organic Compounds					
<i>Hydrocarbons</i>					
600	butane	CH ₃ CH ₂ CH ₂ CH ₃	58.1	0	31
600a	isobutane	CH(CH ₃) ₂ CH ₃	58.1	-12	11
<i>Oxygen Compounds</i>					
610	ethyl ether	CH ₃ CH ₂ OCH ₂ CH ₃	74.1	35	94
611	methyl formate	HCOOCH ₃	60.0	32	89
<i>Sulfur Compounds</i>					
620	(Reserved for future assignment)				
Nitrogen Compounds					
630	methylamine	CH ₃ NH ₂	31.1	-7	20
631	ethyl amine	CH ₃ CH ₂ (NH ₂)	45.1	17	62
Inorganic Compounds					
702	hydrogen	H ₂	2.0	-253	-423
704	helium	He	4.0	-269	-452
717	ammonia	NH ₃	17.0	-33	-28
718	water	H ₂ O	18.0	100	212
720	neon	Ne	20.2	-246	-411
728	nitrogen	N ₂	28.1	-196	-320
732	oxygen	O ₂	32.0	-183	-297
740	argon	Ar	39.9	-186	-303
744	carbon dioxide	CO ₂	44.0	-78	-109
744A	nitrous oxide	N ₂ O	44.0	-90	-129
764	sulfur dioxide	SO ₂	64.1	-10	14
Unsaturated Organic Compounds					
1150	ethene (ethylene)	CH ₂ =CH ₂	28.1	-104	-155
1270	propene (propylene)	CH ₃ CH=CH ₂	42.1	-48	-54

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

TABLE D2 Data for Refrigerant Blends

Zeotropes						
Refrigerant Number	Composition (Weight %)	Average Molecular Mass	Bubble Point (°C)	Dew Point (°C)	Bubble Point (°F)	Dew Point (°F)
400	R-12/114 (must be specified) (50.0/50.0) (60.0/40.0)					
401A	R-22/152a/124 (53/13/34) ^d	94.4	-34.4	-28.8	-29.9	-19.8
401B	R-22/152a/124 (61/11/28) ^d	92.8	-35.7	-30.8	-32.3	-23.4
401C	R-22/152a/124 (33/15/52) ^d	101.0	-30.5	-23.8	-22.9	-10.8
402A	R-125/290/22 (60/2/38) ^e	101.6	-49.2	-47.0	-56.6	-52.6
402B	R-125/290/22 (38/2/60) ^e	94.7	-47.2	-44.9	-53.0	-48.8
403A	R-290/22/218 (5/75/20) ^f	92.0	-44.0	-42.3	-47.2	-44.1
403B	R-290/22/218 (5/56/39) ^f	103.3	-43.8	-42.3	-46.8	-44.1
404A	R-125/143a/134a (44/52/4) ^e	97.6	-46.6	-45.8	-51.9	-50.4
405A	R-22/152a/142b/C318 (45/7/5.5/42.5) ^g	111.9	-32.9	-24.5	-27.2	-12.1
406A	R-22/600a/142b (55/4/41) ^h	89.9	-32.7	-23.5	-26.9	-10.3
407A	R-32/125/134a (20/40/40) ^m	90.1	-45.2	-38.7	-49.4	-37.7
407B	R-32/125/134a (10/70/20) ^m	102.9	-46.8	-42.4	-52.2	-44.3
407C	R-32/125/134a (23/25/52) ^m	86.2	-43.8	-36.7	-46.8	-34.1
407D	R-32/125/134a (15/15/70) ^m	91.0	-39.4	-32.7	-38.9	-26.9
407E	R-32/125/134a (25/15/60) ^o	83.8	-42.8	-35.6	-45.0	-32.1
408A	R-125/143a/22 (7/46/47) ^e	87.0	-45.5	-45.0	-49.9	-49.0
409A	R-22/124/142b (60/25/15) ⁱ	97.4	-35.4	-27.5	-31.7	-17.5
409B	R-22/124/142b (65/25/10) ⁱ	96.7	-36.5	-29.7	-33.7	-21.5
410A	R-32/125 (50/50) ^j	72.6	-51.6	-51.5	-60.9	-60.7
410B	R-32/125 (45/55) ^l	75.6	-51.5	-51.4	-60.7	-60.5
411A	R-1270/22/152a (1.5/87.5/11.0) ^k	82.4	-39.7	-37.2	-39.5	-35.0
411B	R-1270/22/152a (3.0/94.0/3.0) ^k	83.1	-41.6	-41.3	-42.9	-42.3
412A	R-22/218/143b (70/5/25) ⁱ	92.2	-36.4	-28.8	-33.5	-19.8
413A	R-218/134a/600a (9/88/3) ⁿ	104.0	-29.3	-27.6	-20.7	-17.7
414A	R-22/124/600a/142b (51/28.5/4/16.5) ^p	96.9	-34.0	-25.8	-29.2	-14.4
414B	R-22/124/600a/142b (50/39/1.5/9.5) ^p	101.6	-34.4	-26.1	-29.9	-15.0
415A	R-22/152a (82.0/18.0) ^l	81.9	-37.5	-34.7	-35.5	-30.5
415B	R-22/152a (25.0/75.0) ^l	70.2	-23.4	-21.8	-10.1	-7.2
416A	R-134a/124/600 (59.0/39.5/1.5) ^q	111.9	-38.0	-32.9	-36.4	-27.2
417A	R-125/134a/600 (46.6/50.0/3.4) ^r	106.7	-41.2	-40.1	-42.2	-40.2
418A	R-290/22/152a (1.5/96.0/2.5) ^s	84.6	-42.6	-36.0	-44.7	-32.8
419A	R-125/134a/E170 (77.0/19.0/4.0) ^t	109.3	-25.0	-24.2	-13.0	-11.6
420A	R-134a/142b (88.0/12.0) ^u	101.8	-34.4	-28.8	-29.9	-19.8

TABLE D2 Data for Refrigerant Blends (Continued)

Azeotropes ^a						
Refrigerant Number	Composition (Weight %)	Azeotropic Temperature		Azeotropic Molecular Mass	Normal BPt. ^a (°C)	Normal BPt. ^a (°F)
		(°C)	(°F)			
500	R-12/152a (73.8/26.2)	0	32	99.3	-33	-27
501	R-22/12 (75.0/25.0) ^b	-41	-42	93.1	-41	-42
502	R-22/115 (48.8/51.2)	19	66	112.0	-45	-49
503	R-23/13 (40.1/59.9)	88	126	87.5	-88	-126
504	R-32/115 (48.2/51.8)	17	63	79.2	-57	-71
505	R-12/31 (78.0/22.0) ^b	115	239	103.5	-30	-22
506	R-31/114 (55.1/44.9)	18	64	93.7	-12	10
507A ^c	R-125/143a (50/50)	-40	-40	98.9	-46.7	-52.1
508A ^c	R-23/116 (39/61)	-86	-122	100.1	-86	-122
508B	R-23/116 (46/54)	-45.6	-50.1	95.4	-88.3	-126.9
509A ^c	R-22/218 (44/56)	0	32	124.0	-47	-53

^a 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.

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

^c 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.

^d Composition tolerances are (±2/+0.5, -1.5/±1).

^e Composition tolerances are (±2/±1/±2).

^f Composition tolerances are (+0.2, -2.0/±2.0/±2.0).

^g Composition tolerances for the individual components are (±2/±1/±1/±2) and for the sum of R-152a and R-142b are (+0, -2).

^h Composition tolerances are (±2/±1/±1).

ⁱ Composition tolerances are (±2/±2/±1).

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

^k Composition tolerances are (+0, -1/+2, -0/+0, -1).

^l Composition tolerances are (±1/±1).

^m Composition tolerances are (±2/±2/±2).

ⁿ Composition tolerances are (±1/±2/+0,-1).

^o Composition tolerances are (±2, ±2, ±2).

^p Composition tolerances are (±2, ±2, ±0.5/+0.5, -1).

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

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

^s Composition tolerances are (±0.5/±1.0/±0.5).

^t Composition tolerances are (±1.0/±1.0/±1.0).

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

**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.