

**ANSI/ASHRAE Addendum ak to
ANSI/ASHRAE Standard 34-2007**



ASHRAE STANDARD

Designation and Safety Classification of Refrigerants

Approved by the ASHRAE Standards Committee on January 23, 2010; by the ASHRAE Board of Directors on January 27, 2010; and by the American National Standards Institute on February 24, 2010.

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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ISSN 1041-2336



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ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

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- b. participation in the next review of the Standard,
- c. offering constructive criticism for improving the Standard, or
- d. permission to reprint portions of the Standard.

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FOREWORD

This addendum adds an optional 2L subclass to the existing Class 2 flammability classification, signifying class 2 refrigerants with a burning velocity less than or equal to 10 cm/s.

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 ak to 34-2007

3. DEFINITION OF TERMS

burning velocity (S_u): the maximum velocity (cm/s) at which a laminar flame propagates in a normal direction relative to the unburned gas ahead of it.

flame propagation (for determining flammability according to Appendix B): any combustion that moves upward and outward from the point of ignition as defined in Section B1.8 in Normative Appendix B.

propagation velocity of flame: the velocity at which the flame propagates in the test space.

6.1.3 Flammability Classification. Refrigerants shall be assigned to one of three classes – 1, 2, or 3, and one optional subclass – 2L – based on lower flammability limit testing, heat of combustion, and the optional burning velocity measurement. Flammability tests Tests shall be conducted in accordance with ASTM E681² using a spark ignition source. Testing of all halocarbon refrigerants shall be in accordance with the Annex of ASTM E681. Single-compound refrigerants shall be assigned a single flammability classification. Refrigerant blends shall be assigned flammability classifica-

tions as specified in Section 6.1.5. Blends shall be assigned a flammability classification based on their WCF and WCFF, as determined from a fractionation analysis (see Section B2 in Normative Appendix B). A fractionation analysis for flammability is not required if the components of the blend are all in one class; the blend shall be assigned the that same class (see Table 3).

Burning velocity measurements shall be conducted according to a credible method. The method shall be in agreement with established methods of determining burning velocity by demonstrating measurement results of 6.7 ± 0.7 cm/s burning velocity for R-32 and 23.0 ± 2.3 cm/s for R-152a, or by presenting other evidence supporting the accuracy of the method. One acceptable method is the vertical tube method as detailed by Jabbour (2004) and summarized by Jabbour and Clodic (2004). Measurements shall be conducted starting from the LFL to at least 125% of the stoichiometric concentration. Measurements shall be done with increments of at most 10% of the stoichiometric concentration and each measurement shall be repeated at least 2 times. The burning velocity is the maximum value obtained from a least-squares fit to the measured data. The gas mixture shall be made by any method that produces a blend of air/ refrigerant that is accurate to $\pm 0.1\%$ in the test chamber. Dry air (less than 0.00015 grams of water vapor per gram of dry air) containing $21.0 \pm 0.1\%$ O₂ shall be used as the oxidant. The flammable gas shall have a minimum purity of 99.5% by weight. Note: Methods that have been used include: (a) pressurized mixture made by using partial pressure, or (b) quantitative flow methods like volumetric flow meters and mass flow controllers fixing the ratio of air and refrigerant.

References:

Jabbour, T., (2004) Flammable Refrigerant Classification Based on the Burning Velocity. PhD Thesis, Ecole des Mines: Paris, France.

Jabbour, T. and Clodic, D.F., (2004) Burning velocity and refrigerant flammability classification. ASHRAE Trans., Vol. 110, part 2.

6.1.3.2.1 Subclass 2L (optional)

Refrigerants that meet the following additional condition:

1. Have a maximum burning velocity of ≤ 10 cm/s when tested at 23 °C and 101.3 kPa.

6.1.4 Matrix Diagram of Safety Group Classification System. The toxicity and flammability classifications described in Sections 6.1.1, 6.1.2, and 6.1.3 yield six separate safety group classifications (A1, A2, A3, B1, B2, and B3) and two subclasses (A2L and B2L) for refrigerants. These classifications are represented by the matrix shown in Figure 1.

6.1.5 Safety Classification of Refrigerants

(add A2L and B2L classifications to Figure 1 as shown)

		Safety group	
Higher Flammability		A3	B3
	Lower Flammability	A2 ----- A2L*	B2 ----- B2L*
No flame Propagation		A1	B1
		Lower Toxicity	Higher Toxicity

*A2L and B2L are lower flammability refrigerants with a maximum burning velocity of ≤ 10 cm/s

9.7.2 Burning Velocity Information (optional). Applications seeking an assignment of 2L shall include the following:

- a. a full description of the test method employed
- b. results of standards testing with the specified test approach to ensure agreement with accepted values:
 - burning velocity for R-32 (acceptable range is 6.7 ± 0.7 cm/s) and burning velocity for R-152a (acceptable range is 23.0 ± 2.3 cm/s),
 - or other evidence supporting the accuracy of the method against accepted burning velocity values for other class 2 refrigerants above and below 10 cm/s
- c. duplicate test results from the LFL to at least 125% of the stoichiometric concentration

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.