ANSI/ASHRAE Addenda a, b, c, d, and e to
ANSI/ASHRAE Standard 15-2007

ASHRAE ADDENDA

2008 SUPPLEMENT

Safety Standard for Refrigeration Systems

See Appendix for approval dates.

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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SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus standard developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). *Consensus* is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this standard as an ANS, as "substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution." Compliance with this standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

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.

The Assistant Director of Technology for Standards and Special Projects of ASHRAE should be contacted for:

a. interpretation of the contents of this Standard,
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.

CONTENTS

ANSI/ASHRAE Addenda to ANSI/ASHRAE Standard 15-2007 Safety Standard for Refrigeration Systems

NOTE

When addenda, interpretations, or errata to this standard have been approved, they can be downloaded free of charge from the ASHRAE Web site at www.ashrae.org.

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FOREWORD

The current version of ANSI/ASHRAE Standard 15-2007 provides guidance on the discharge location for pressure relief devices and fusible plugs that protect components from overpressure. Currently, there are several requirements that dictate that the discharge vent be to atmosphere; however, there are situations where a machinery room would be required but the provisions that trigger piping discharge lines to atmosphere may not apply. As a result, one could interpret that discharging lines into a machinery room would be permissible. This addendum revises the requirements for terminating relief vent discharge lines to atmosphere to include any system that requires a machinery room.

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

Addendum a to Standard 15-2007

Revise Section 9.7.8 to read as follows:

9.7.8 ~~Pressure relief devices and fusible plugs on any system containing a Group A3 or B3 refrigerant; on any system containing more than 6.6 lb (3 kg) of a Group A2, B1, or B2 refrigerant; and on any system containing more than 110 lb (50 kg) of a Group A1 refrigerant~~ For systems in which one or more of the following conditions apply, pressure relief devices and fusible plugs shall discharge to the atmosphere at a location not less than 15 ft (4.57 m) above the adjoining ground level and not less than 20 ft (6.1 m) from any window, ventilation opening, or exit in any building:

a. Any system containing a Group A3 or B3 refrigerant.

b. Any system containing more than 6.6 lb (3 kg) of a Group A2, B1, or B2 refrigerant.

c. Any system containing more than 110 lb (50 kg) of a Group A1 refrigerant.

d. Any system for which a Machinery Room is required by the provisions of Section 7.4.

The discharge shall be terminated in a manner that will prevent both the discharged refrigerant from being sprayed directly on personnel in the vicinity and foreign material or debris from entering the discharge piping. Discharge piping connected to the discharge side of a fusible plug or rupture member shall have provisions to prevent plugging the pipe in the event the fusible plug or rupture member functions.

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FOREWORD

The current version of ANSI/ASHRAE Standard 15-2007 requires pressure relief protection for all positive displacement compressors equipped with a stop valve in the discharge line, regardless of size. The change described in this addendum will bring Standard 15 into alignment with UL 984, Hermetic Refrigerant-Motor Compressors, and except small compressors due to their self-limiting nature in building excessive discharge pressure if started while isolated. Also, the first sentence of Section 9.8 was revised to clarify its meaning.

The project committee wishes to acknowledge Carl Radcliffe for his contributions to the development of this addendum.

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 b to Standard 15-2007

Revise Section 9.8 to read as follows.

9.8 Positive Displacement Compressor Protection. Every positive displacement compressor ~~When equipped~~ with a stop valve in the discharge connection~~, every positive displacement compressor~~ shall be equipped with a pressure-relief device of adequate size and pressure setting, as specified by the compressor manufacturer, to prevent rupture of the compressor or to prevent the pressure from increasing to more than 10% above the maximum allowable working pressure of any other component located in the discharge line between the compressor and the stop valve or in accordance with Section 9.7.5, whichever is larger. The pressure-relief device shall discharge into the low-pressure side of the system or in accordance with Section 9.7.8.

Exception: Hermetic refrigerant motor-compressors that are listed and have a displacement less than or equal to 50 ft^3/min (1.42 m^3/min).

The relief device(s) shall be sized based on compressor flow at the following conditions:

1. **High-Stage or Single-Stage Compressors:** Flow is to be calculated based on 50°F (10°C) saturated suction temperature at the compressor suction.
2. **Low-Stage or Booster Compressors:** For those compressors that are capable of running only when discharging to the suction of a high-stage compressor, flow is to be calculated based on the saturated suction temperature equal to the design operating intermediate temperature.

Exception for items 1 and 2: The discharge capacity of the relief device is allowed to be the minimum regulated flow rate of the compressor when the following conditions are met:

a. the compressor is equipped with capacity regulation,
b. capacity regulation actuates to minimum flow at 90% of the pressure-relief device setting, and
c. a pressure-limiting device is installed and set in accordance with the requirements of Section 9.9.

Appendix F describes one acceptable method of calculating the discharge capacity of positive displacement compressor relief devices.

(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

Recently, ASHRAE Standard 34-2004 included Addendum u as part of the 2004 version of that standard. Addendum u established a new refrigerant safety metric defined as "Refrigerant Concentration Limits" (RCL) for occupied spaces. Furthermore, Addendum u revised Tables 1 and 2 to delete molecular mass, normal boiling point, zeotropic molecular mass, and azeotropic temperature data and now includes RCL data. Addendum v to Standard 34-2004 revised the oxygen deprivation limit (ODL) upward from 69,100 ppm to 140,000 ppm for elevations at or below 1000 m; increased cardiac sensitization default from 0 to 1000 ppm; incorporated new toxicity information for R-22, R-32, and R-227ea; incorporated new lower flammability limits; and added data for several new refrigerants. All of these addenda were fully incorporated into the newest version of ASHRAE Standard 34-2007.

The changes identified in Addendum c to ASHRAE Standard 15-2007 update Standard 15 to be consistent with the 2007 version of Standard 34. One of the more significant changes included herein is the removal of the existing Table 1 (refrigerant quantity limits) in Standard 15 with the appropriate references for required refrigerant concentration limits now being made directly to Tables 1 and 2 in Standard 34. This change is intended to remove any inconsistencies in refrigerant concentration limits or classifications between Standard 15 and Standard 34. Appendix C has been deleted in this addendum for the same reason.

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 c to ANSI/ASHRAE Standard 15-2007

Revise the following paragraphs in the informative Foreword to Standard 15 as shown below. The foreword is being updated for consistency with the proposed changes described in this addendum.

While Standard 15-2007 is generally written as a self-sufficient document, it does normatively reference several other standards (see Normative Appendix E). One of those standards is ANSI/ASHRAE Standard 34, Designation and Safety Classification of Refrigerants*, which prescribes the Refrigerant Classification System as well as refrigerant ~~quantity~~ concentration limits that are vitally important in the context of this refrigeration-system safety standard. Because of the close relation between Standard 15 and Standard 34, ASHRAE began bundling these two standards in 2007. Although changes to Standard 15 are closely coordinated with those to Standard 34, users of Standard 15 need to refer to ~~should also review~~ the most recent version of Standard 34 and its associated addenda for the latest information related to refrigerant designations, ~~and~~ safety classifications, and concentration limits.*

Presently, Tables 1 and 2 in Standard ~~15~~ 34 show~~s~~ the ~~amount of~~ refrigerant concentration limit intended to reduce the risk of acute toxicity, asphyxiation, and flammability hazards in normally occupied, enclosed spaces. A machinery room is required when the complete discharge of refrigerant from each independent circuit of high probability systems in a given space ~~that, when exceeded, requires a machinery room~~exceeds this amount. When ~~a refrigerant~~ considering the application of a refrigerant ~~is~~ not classified in Standard 34 or its addenda ~~or not shown in Table 1~~, it is the responsibility of the owner of a refrigerating system to make this concentration limit judgment. For blends, Informative Appendix A is offered to aid in determining allowable concentrations.

Revise the following sections of Standard 15 as shown below and delete Table 1, referencing Tables 1 and 2 of Standard 34 instead, and renumber Tables 2 and 3 of Standard 15 as Tables 1 and 2, respectively.

5.2 Refrigerant System Classification. For the purpose of applying ~~Tables 1 and 2~~ the data shown in Table 1 or Table 2 of ASHRAE Standard 34, a refrigerating system shall be classified according to the degree of probability that a leakage of refrigerant will enter an occupancy-classified area as follows.

6.1 Single-Compound Refrigerants. Single-compound refrigerants shall be classified into safety groups~~, based on toxicity and flammability,~~ in accordance with *ANSI/ASHRAE Standard 34, Designation and Safety Classification of Refrigerants.*[1] The classifications indicated in the referenced edition of ASHRAE Standard 34 shall be used for refrigerants that have them assigned. Other refrigerants shall be classified in accordance with the criteria in Standard 34; such classifications shall be submitted for approval to the authority having jurisdiction.

7.2 Refrigerant Concentration ~~Quantity~~ Limits. The concentration ~~quantity~~ of refrigerant in a complete discharge of each independent circuit of high probability systems shall not exceed the amounts shown in Table 1 or Table 2 of *ASHRAE Standard 34*[1] ~~Table 1~~, except as provided in Sections 7.2.1 and 7.2.2. The volume of occupied space shall be determined in accordance with Section 7.3~~, based on volumes determined in accordance with Section 7.3. For refrigerant blends not listed in Table 1, the amount of each component shall be limited in the same manner and the total of all components in each circuit shall not exceed the quantity that would equal 69,100 ppm by volume upon release to the volume determined by Section 7.3.~~

Exceptions:

a. Listed equipment containing not more than 6.6 lb (3 kg) of refrigerant, regardless of its refrigerant

safety classification, is exempt from Section 7.2 provided that the equipment is installed in accordance with the listing and with the manufacturer's installation instructions.

b. Listed equipment for use in laboratories with more than 100 ft^2 (9.3 m^2) of space per person, regardless of the refrigerant safety classification, is exempt from Section 7.2 provided that the equipment is installed in accordance with the listing and the manufacturer's installation instructions.

7.2.1 Institutional Occupancies. The amounts shown in ~~Table 1~~ Table 1 or Table 2 of ASHRAE Standard 34[1] shall be reduced by 50% for all areas of institutional occupancies. Also, the total of all Group A2, B2, A3, and B3 refrigerants shall not exceed 550 lb (250 kg) in the occupied areas and machinery rooms of institutional occupancies.

7.4 Location in a Machinery Room or Outdoors. All components containing refrigerant shall be located either in a machinery room or outdoors, where

a. the quantity of refrigerant needed exceeds the limits in Section 7.2 or
b. direct-fired absorption equipment, other than sealed absorption systems not exceeding the refrigerant quantity limits indicated in ~~Table 2~~ Table 1 of this standard, is used.

7.5.1.2 Corridors and Lobbies. Refrigerating systems installed in a public corridor or lobby shall be limited to either

a. unit systems containing not more than the quantities of Group A1 or B1 refrigerant indicated in ~~Table 1~~ Table 1 or Table 2 of ASHRAE Standard 34,[1] or
b. sealed absorption and unit systems having refrigerant quantities less than or equal to those indicated in ~~Table 2~~ Table 1 of this standard.

7.5.2 Applications for Human Comfort. Group A2, A3, B1, B2, and B3 refrigerants shall not be used in high-probability systems for human comfort.

Exceptions:

a. This restriction does not apply to sealed absorption and unit systems having refrigerant quantities less than or equal to those indicated in ~~Table 2~~ Table 1 of this standard.
b. This restriction does not apply to industrial occupancies.

8.10.3 Refrigerant piping shall not penetrate floors, ceilings, or roofs.

Exceptions:

a. Penetrations connecting the basement and the first floor.
b. Penetrations connecting the top floor and a machinery penthouse or roof installation.
c. Penetrations connecting adjacent floors served by the refrigeration system.
d. Penetrations of a direct system where the refrigerant ~~quantity~~ concentration does not exceed ~~Table 1~~ that listed in Table 1 or Table 2 of ASHRAE Standard 34[1] ~~quantity~~ for the smallest occupied space through which the refrigerant piping passes.
e. In other than industrial occupancies and where the refrigerant ~~quantity~~ concentration exceeds ~~Table 1~~ that listed in Table 1 or Table 2 of ASHRAE Standard 34[1] ~~quantity~~ for the smallest occupied space, penetrations that connect separate pieces of equipment that are
   1. enclosed by an approved gas-tight, fire-resistive duct or shaft with openings to those floors served by the refrigerating system or
   2. located on the exterior wall of a building when vented to the outside or to the space served by the system and not used as an air shaft, closed court, or similar space.

9.7.8.5 The maximum length of the discharge piping installed on the outlet of pressure-relief devices and fusible plugs discharging to the atmosphere shall be determined by the method in Appendix H. ~~See Table 3 for the allowable flow capacity of various equivalent lengths of discharge piping for conventional safety relief valves.~~

9.15 Nameplate. Each unit system and each separate condensing unit, compressor, or compressor unit sold for field assembly in a refrigerating system shall carry a nameplate marked with the manufacturer's name, nationally registered trademark or trade name, identification number, the design pressures, and the refrigerant for which it is designed. The refrigerant shall be designated by the refrigerant number (R number) as shown in ~~Table 1~~ Table 1 or Table 2 of ASHRAE Standard 34.[1] ~~If the refrigerant is not listed in Table 1, the refrigerant shall be designated in accordance with Standard 34.~~

Revise the definition of* $\mathbf{LV_i}$ *in Section A2 of Appendix A as follows.

LV_i = (limiting volume percent ~~from Table 1~~)/100

Delete Normative Appendix C in its entirety.

Update the following reference in Appendix E.

1. *ANSI/ASHRAE Standard 34-~~2001~~2007, Designation and Safety Classification of Refrigerants*, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA 30329.

Revise the table number of Table 3 to Table 2 in the first paragraph of Appendix H.

The design back pressure due to flow in the discharge piping at the outlet of pressure-relief devices and fusible plugs, discharging to atmosphere, shall be limited by the allowable equivalent length of piping determined by Equations H-1 or H-2. See ~~Table 3~~Table 2 for the flow capacity of various equivalent lengths of discharge piping for conventional relief valves.

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FOREWORD

There has been a trend toward increased use of cascade systems in refrigeration applications, such as in supermarkets, refrigerated warehouses, and industrial plants. The changes to ANSI/ASHRAE Standard 15-2007 described in this addendum are intended to provide a foundation for additional revisions to the standard to better support the safety of these refrigeration systems.

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 Standard 15-2007

Add the following new definitions to the existing definitions in Section 3.

cascade refrigerating system: a refrigerating system having two or more refrigerant circuits, each with a pressure-imposing element, a condenser, and an evaporator, where the evaporator of one circuit absorbs the heat rejected by another (lower-temperature) circuit.

compound refrigerating system: a multi-staged refrigerating system in which a single charge of refrigerant circulates through all stages of compression. See *multi-stage refrigerating system*.

multi-stage refrigerating system: a refrigerating system in which compression of refrigerant is carried out in two or more steps.

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FOREWORD

There has been a trend toward increased use of cascade systems in refrigeration applications, such as in supermarkets, refrigerated warehouses, and industrial plants. The changes to ANSI/ASHRAE Standard 15-2007 described in this addendum are intended to provide appropriate guidance for the protection of positive displacement compressors when used in cascade refrigeration system configurations.

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 e to Standard 15-2007

Revise Section 9.8 as follows.

9.8 Positive Displacement Compressor Protection. When equipped with a stop valve in the discharge connection, every positive displacement compressor shall be equipped with a pressure-relief device of adequate size and pressure setting, as specified by the compressor manufacturer, to prevent rupture of the compressor or to prevent the pressure from increasing to more than 10% above the maximum allowable working pressure of any other component located in the discharge line between the compressor and the stop valve or in accordance with Section 9.7.5, whichever is larger. The pressure-relief device shall discharge into the low-pressure side of the system or in accordance with Section 9.7.8.

The relief device(s) shall be sized based on compressor flow at the following conditions:

1. ~~**High Stage or Single-Stage Compressors:**~~ **Compressors in Single-Stage Systems and High-Stage Compressors of Other Systems:** Flow shall ~~is to~~ be calculated based on 50ºF (10ºC) saturated suction temperature at the compressor suction.
2. **Low-Stage or Booster Compressors in Compound Systems:** For those compressors that are capable of running only when discharging to the suction of a high-stage compressor, flow shall ~~is to~~ be calculated based on the saturated suction temperature equal to the design operating intermediate temperature.
3. **Low-Stage Compressors in Cascade Systems:** For those compressors that are located in the lower-temperature stage(s) of cascade systems, flow shall be calculated based on the suction pressure being equal to the pressure setpoint of the pressure-relieving devices that protect the lowside of the stage against overpressure.

Exception for items 1 ~~and~~, 2, and 3: The discharge capacity of the relief device is allowed to be the minimum regulated flow rate of the compressor when the following conditions are met:

a. the compressor is equipped with capacity regulation,
b. capacity regulation actuates to minimum flow at 90% of the pressure-relief device setting, and
c. a pressure-limiting device is installed and set in accordance with the requirements of Section 9.9.

Appendix F describes one acceptable method of calculating the discharge capacity of positive displacement compressor relief devices.

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APPENDIX
18-MONTH SUPPLEMENT
ADDENDA TO ANSI/ASHRAE STANDARD 15-2007

This supplement includes Addenda a, b, c, d, and e to ANSI/ASHRAE Standard 15-2007. The following table lists each addendum and describes the way in which the standard is affected by the change. It also lists the ASHRAE and ANSI approval dates for each addendum.

Addendum	Section(s) Affected	Description of Changes*	ASHRAE Standards Committee Approval	ASHRAE BOD Approval	ANSI Approval
a	Section 9.7.8	This addendum revises the requirements for terminating relief vent discharge lines to atmosphere to include any system requiring a machinery room. Currently, there are several requirements that dictate that the discharge vent be to atmosphere; however, there are situations where a machinery room is required but the provisions that trigger piping discharge lines to atmosphere may not apply. As a result, one could interpret that discharging lines into a machinery room is permissible.	6/23/07	6/27/07	7/25/07
b	Section 9.8	This addendum revises Section 9.8 of Standard 15-2007, which requires pressure relief protection for all positive displacement compressors equipped with a stop valve in the discharge line, regardless of size. The proposed change will bring Standard 15 in to alignment with UL 984 (Hermetic Refrigerant-Motor Compressors) and except small compressors due to their self-limiting nature in building excessive discharge pressure if started while isolated.	1/19/08	1/23/08	1/24/08
c	Table 1, Sections 5.2, 6.1, 7.2, 7.4, 7.5, 8.10, 9.7, and 9.15, Section A2 in Appendix A, and Appendix H	This addendum updates Standard 15 to be consistent with the 2007 version of ASHRAE Standard 34. One of the more significant changes included herein is the removal of the existing Table 1 (refrigerant quantity limits) in Standard 15 with the appropriate references for required refrigerant concentration limits now being made directly to Tables 1 and 2 in ASHRAE Standard 34. This change is intended to remove any inconsistencies in refrigerant concentration limits or classifications between Standard 15 and Standard 34. Appendix C has been deleted in this addendum for the same reason.	6/21/08	6/25/08	6/26/08
d	Section 3	This addendum adds three definitions to Standard 15-2007 so that the standard can better provide for the safety of cascade refrigeration systems. There has been a trend toward increased use of cascade systems in refrigeration applications. The definitions provide a foundation for additional revisions to the standard.	1/19/08	1/23/08	2/27/08
e	Section 9.8	This addendum is revises Standard 15-2007 to provide appropriate guidance for the protection of positive displacement compressors when used in cascade refrigeration system configurations.	1/19/08	1/23/08	1/24/08

* These descriptions may not be complete and are provided for information only.

NOTE

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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.