

(This foreword is for information only and is not part of this addendum)

FORWORD

Changes in this addendum to ANSI/ASHRAE 15-1994 are made to add water as a refrigerant, include absorption refrigeration machines in the standard and clarification of wording in selected sections as a result of Continuous Maintenance submissions. This addendum eliminates several of the unnecessary references (informative and normative). When reviewing this addendum it is important that the reviewer have access to approved addenda 15a, 15c and 15d to ASHRAE 15-1994 (available on ASHRAE web page at www.ashrae.org). The changes in this addendum include:

- Change in the title and scope to include absorption refrigeration machines and water as a refrigerant.
- Two new definitions in Section 3 and changes to 4 existing definitions.
- Change in the title of Table 2.
- revise the wording of 8.3 and delete 8.4 and 8.6.
- Addition of Exception (b) to 8.13.2.1, Exception (1) in 8.13.6, and the addition of an Exception in 8.16.
- Add a maximum temperature to 8.13.5(b).
- Clarification of the refrigerant detector wording in 8.13.6 and 8.14.
- Adding the requirement for refrigerating equipment to be designed for a vacuum and a design pressure for absorption machines in 9.2.1.
- Adding requirements to 9.5.1 for relief valves discharging into other parts of the system
- Clarification of the wording in 9.12.1 and 9.12.3 along with the deletion of 9.12.2.
- Adding 9.14.1.1 Test Procedure for factory tests.
- Adding 9.13 Listed Equipment to section 9 to replace 2.4 deleted from the Scope.
- Adding R-718 (water) to Table 1.
- Delete unnecessary references in Appendix D.
- Delete unnecessary references in Appendix E.

Note to reviewers: Portions deleted are shown with a line through the text; added text is underlined.

Title: Safety ~~Code Standard~~ for ~~Mechanical~~ Refrigeration ~~Systems~~

1. PURPOSE ~~The purpose of this~~ This standard ~~is to specify~~ specifies safe design, construction, installation, and operation of ~~refrigerating~~ refrigeration systems.

2. SCOPE

2.1 This ~~code standard~~ establishes safeguards for life, limb, health, and property, and prescribes safety ~~standards~~ requirements.

2.2 This ~~code standard~~ applies

- (a) to ~~the design, construction, test, installation, operation and inspection of~~ mechanical ~~and absorption~~ refrigeration systems ~~including and~~ heat pump systems used in ~~stationary applications, the occupancies defined in Section 4 and installed subsequently to adoption of this code; and~~
- (b) to ~~modifications including replacement of~~ parts or components ~~if they are not identical in function and capacity, added after adoption of this code, or a change to a refrigerant of a different number designation (per ANSI/ASHRAE Standard 34-1992⁴) after adoption of this code; and~~
- (c) to ~~substitutions of refrigerant having a different designation~~ parts or components replaced after adoption of this code only if they are not identical in function.

~~**2.3** This code does not apply where water is the primary refrigerant.~~

~~**2.4** Equipment listed by an approved, nationally recognized testing laboratory is deemed to meet the design, manufacture, and factory test requirements section of this code for the refrigerant or refrigerants for which the equipment was designed.~~

~~**2.5** The authority having jurisdiction has the authority to grant exceptions from the requirements of this code or allow, for local jurisdictional purposes, the use of other devices, materials, or methods when evidence is provided to demonstrate equivalent protection and performance.~~

3 DEFINITIONS:

~~**accessible:** easy to approach for service or use (also see readily accessible).~~

~~**readily accessible:** capable of being reached safely and quickly for operation, repair and inspection without requiring those to whom ready access is required to climb over or remove obstacles or to resort to the use of portable access equipment.~~

~~**refrigerant detector:** a device that is capable of sensing the presence of refrigerant vapor.~~

~~**sealed ammonia/water absorption system:** an absorption system where ammonia (R-717) is the refrigerant and water is the absorbent and all refrigerant-containing parts are made permanently tight by welding or brazing.~~

Lithium Bromide/water absorption system: an absorption system where water (R-718) is the refrigerant and lithium bromide (LiBr) is the absorbent.

~~**secondary coolant:** any liquid used for the transmission of heat, without a change of state vaporization., and having no flash point or a flash point above 150°F (65.5°C) as determined by the ASTM D93.*~~

TABLE 2
Special Quantity Limits for Sealed Ammonia/Water Absorption and Self-Contained Systems

<u>Occupancies</u>	<u>Maximum Pounds (kg) for Various</u>				
	<u>Type of Refrigeration System</u>	<u>Institutional</u>	<u>Pub/Large Mercantile</u>	<u>Residential</u>	<u>Commercial</u>
<u>Sealed Ammonia/Water Absorption System</u>					
	In public hallways or lobbies	0(0)	0(0)	3.3(1.5)	3.3(1.5)
	In adjacent outdoor locations	0(0)	0(0)	22(10)	22(10)
	In other than public hallways or lobbies	0(0)	6.6(3)	6.6(3)	22(10)
<u>Unit Systems</u>					
	In other than public hallways or lobbies	0(0)	0(0)	6.6(3)	22(10)

~~**8.3 Safe Access.** A clear and unobstructed approach and space shall be provided for inspection, service and emergency shutdown of condensing units, compressor units, condensers, stop valves and other serviceable components of refrigerating machinery. Access, including ladders, platforms, and clear space for inspection and servicing of condensing units, compressors, condensers, and other machinery, Permanent ladder, platforms or portable access equipment shall be provided in accordance with the requirements of the authority having jurisdiction.~~

~~**8.4 Enclosures.** Condensing units or compressor units with enclosures shall be readily accessible for servicing and inspection.~~

~~**8.6 Illumination.** Illumination adequate for inspection and servicing of condensing units or compressor units shall be provided.*~~

8.13.2.1

Exceptions: (a) For ammonia refer to 8.14(g).

(b) Detectors not required when only systems using R-718 (water) are located in the refrigerating machinery room.

8.13.5

(b) operable, when occupied if necessary for operator comfort, at a volume required to not exceed the higher of a maintain a maximum temperature rise of 18°F (10°C) above inlet air temperature or a maximum temperature of 122°F (50°C) based on all of the heat-producing machinery in the room.

8.13.6 No open flames that use combustion air from the machinery room shall be installed where any refrigerant is used. ~~The use of matches, lighters, halide leak detectors, and similar devices shall not be considered a violation of 8.13.6.~~ Combustion equipment shall not be installed in the same machinery room with refrigerant-containing equipment except under one of the following conditions:

- (a) combustion air is ducted from outside the machinery room and sealed in such a manner as to prevent any refrigerant leakage from entering the combustion chamber, or
- (b) a refrigerant ~~vapor~~ detector, conforming to 8.13.2.1, is employed to automatically shut down the combustion process in the event of refrigerant leakage.

Exceptions: (1) Machinery rooms where only R-744 (carbon dioxide) or R-718 (water) is the refrigerant.

(2) Machinery rooms where only R-717 (ammonia) is the refrigerant and internal combustion engines are used as the prime mover for the compressors.

8.14 Machinery Room, Special Requirements.

- (h) When ammonia is used, the machinery room is not required to meet Class 1, Division 2, of the National Electric Code providing (1) the mechanical ventilation system in the machinery room is run continuously and failure of the mechanical ventilation system actuates an alarm or (2) the machinery room is equipped with a ~~vapor~~ detector, conforming to 8.13.2.1, except that will automatically start the mechanical ventilation system and actuate an alarm at a detection level not to exceed the detector shall alarm at 1000 ppm.

8.16 Purge Discharge. The discharge ~~effrom~~ purge systems shall be governed by the same rules as pressure-relief devices and fusible plugs (see 9.7.8) and shall be piped in conjunction with these devices.

Exception: When R-718 (water) is the refrigerant

9.2.1 Design pressures shall not be less than pressure arising under maximum operating, standby, or shipping conditions. When selecting the design pressure, allowance shall be provided for setting pressure-limiting devices and pressure-relief devices to avoid nuisance shutdowns and loss of refrigerant. The *ASME Boiler and Pressure Vessel Code*¹⁴ Section VIII, Division I, Appendix M, contains information on the appropriate allowances for design pressure.

Refrigerating equipment shall be designed for a vacuum of 29.0 in Hg (3.12 kPa). Design pressure for lithium bromide absorption systems shall not be less than 5 psig (34.7 kPa gage). Design pressure for mechanical refrigeration systems shall not be less than 15 psig (103.4 kPa gage) and, except as noted in 9.2.2, 9.2.3, 9.2.4, and 9.2.5, shall

not be less than the saturation pressure (gage) corresponding to the following temperatures:

- (a) Lowsides of all systems: 80°F (26.7°C).
- (b) Highsides of all water-cooled or evaporatively cooled systems: 30°F (16.7°C) higher than the summer 1% wet-bulb for the location as applicable or 15°F (8.3°C) higher than the highest design leaving condensing water temperature for which the equipment is designed or 104°F (40°C), whichever is greatest.
- (c) Highsides of all air-cooled systems: 30°F (16.7°C) higher than the highest summer 1% design dry-bulb for the location but not lower than 122°F (50°C).

9.5.1 Pressure-Relief Valve Setting. Pressure-relief valves shall start to function at a pressure not to exceed the design pressure of the parts of the system protected.

Exception: See 9.7.8.1 for relief valves that discharge into other parts of the system.

~~9.7.8.1 Pressure-relief devices required in 9.4 and 9.7 shall not discharge into the lowside of the system unless the pressure-relief device is a type not affected by back pressure and the lowside is equipped with pressure-relief devices capable of relieving any increased refrigerant quantity. Such a lowside pressure-relief device shall be set in accordance with 9.5.1 and vented to the outside of the building in accordance with 9.7.8. The application of pressure relief valves which discharge from a higher pressure vessel into a lower pressure vessel of the system shall comply with (a) and (b) below:~~

~~(a)The sum of the set pressure of the pressure relief valve discharging into a lower pressure vessel within the system and the set pressure of the system relief valve, required by 9.7.8.1(b), shall not exceed the design pressure of the system protected with a relief valve in accordance with 9.7.1.~~

~~(b)The capacity of the pressure relief valve protecting the part of the system receiving a discharge from a pressure relief valve protecting a higher pressure vessel shall be at least the sum of the capacity required in 9.7.5 plus the capacity of the pressure relief valve discharging into that part of the system.~~

Exception: Hydrostatic relief valves

9.12 Service Provisions

9.12.1 All serviceable components of refrigerating systems shall be provided with safe access ~~safely accessible~~.

~~9.12.2 Access, including ladders, platforms, and clear space for inspection and servicing of condensing units, compressors, condensers,~~

~~and other machinery, shall be provided in accordance with approved safety standards⁵ and the requirements of the authority having jurisdiction.~~

9.12.3 Condensing units or compressor units with enclosures shall be provided with safe access without the need to climb over or remove any obstacles, or the use of portable access equipment readily accessible for servicing and inspection.

9.14.1 All refrigerant-containing parts or unit systems shall be tested and proved tight by the manufacturer at not less than the design pressure for which they are rated. Pressure vessels shall be tested in accordance with 9.3.

9.14.1.1 Testing Procedure. Tests shall be performed with dry nitrogen or another nonflammable nonreactive, dried gas. Oxygen, air, or mixtures containing them shall not be used. The means used to build up the test pressure shall have either a pressure-limiting device or a pressure reducing device and a gage on the outlet side. The pressure relief device shall be set above the test pressure but low enough to prevent permanent deformation of the system's components.

Exceptions:

- (a) Mixtures of dry nitrogen, inert gases, nonflammable refrigerants allowed for factory tests.
- (b) Mixtures of dry nitrogen, inert gases, or a combination of them with flammable refrigerants in concentrations not exceeding the lesser of a refrigerant weight fraction (mass fraction) of 5% or 25% of the LFL are allowed for factory tests.
- (c) Compressed air without added refrigerant is allowed for factory tests provided the system is subsequently evacuated to less than 1,000 microns (132 Pa) before charging with refrigerant. The required evacuation level is atmospheric pressure for systems using R-718 (water) or R-744 (carbon dioxide) as the refrigerant

13 Listed Equipment Equipment listed by an approved nationally recognized testing laboratory and identified, as part of the listing, as being in conformance with this standard, is deemed to meet the design, construction of equipment, and factory test requirement sections of this standard for the refrigerants or refrigerants for which the equipment was designed.

Add Water and footnote f to **Table 1** as follows:

TABLE 1
Refrigerant^a and Amounts^{b,e}

Refrigerant Chemical	Quantity of Refrigerant per Occupied Space	
	Lb per	PPM

Number	Name	Chemical Formula	1000 ft ³ a,c	by vol	g/m ³ a,c
<u>Group A1</u>					

R-718	Water	H ₂ O	f	f	f
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^f The quantity is unlimited when R-718 (water) is used as the refrigerant

APPENDIX D

(This appendix is not part of this standard but is included for information purposes only.)

INFORMATIVE REFERENCES

This appendix contains full citations for informative references only. Full citations for normative references are listed in Appendix E. References in this standard are numbered in the order in which they appear in the document, and so the numbers for the normative references are shown for the convenience of the user.

~~1. NIOSH Pocket Guide to Chemical Hazards (1985), U.S. Department of Health and Human Services, Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. (IDLH definition)~~

~~2. Not an informative reference.~~

~~3. ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (1990-1991), American Conference of Governmental and Industrial Hygienists, Cincinnati, OH.~~

4. Not an informative reference

~~5. ANSI/NFPA 101-1988, Code for Safety to Life from Fire in Buildings and Structures, National Fire Protection Association (NFPA), Quincy, MA 02269.~~

~~6. ANSI/ASME B15.1-1984, Safety Code for Mechanical Power Transmission Apparatus and Addendum B15.1-A-1986, American Society of Mechanical Engineers (ASME), New York, NY 10017.~~

~~Note: This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users this reference is informative.~~

~~7. ANSI/UL 303-1987, UL 1995-95 Heating and Cooling Equipment Refrigeration and Air-Conditioning Condensing and Compressor Units, Underwriters Laboratories Inc. Northbrook, IL 60062~~

~~Note: This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users this reference is informative.~~

~~8. ANSI/IES RP-7-1983, Practice for Industrial Lighting, Illuminating Engineering Society of North America (IES), New York, NY 10017.~~

~~Note: This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users this reference is informative.~~

9. Not an informative reference.

~~10. NFPA Standard 54-1988 (ANSI Z223.1-1988), National Fuel Gas Code, National Fire Protection Association (NFPA), Quincy, MA 02269.~~

~~Note: This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users this reference is informative.~~

- ~~11. ANSI/NFPA 37-1990, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, National Fire Protection Association (NFPA), Quincy, MA 02269.~~

~~———— **Note:** This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users this reference is informative.~~
- ~~12. ANSI/NFPA 90A-1989, Standard for the Installation of Air Conditioning and Ventilating Systems, National Fire Protection Association (NFPA), Quincy, MA 02269.~~

~~———— **Note:** This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users this reference is informative.~~
- ~~13. ANSI/NFPA 90B-1989, Standard for the Installation of Warm Air Heating and Air Conditioning Systems, National Fire Protection Association (NFPA), Quincy, MA 02269.~~

~~———— **Note:** This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users this reference is informative.~~
14. Not an informative reference.

~~ASME Boiler and Pressure Vessel Code, Section VIII, Rules for Construction of (Pressure Vessels, Division 1, 1992, American Society of Mechanical Engineers (ASME), New York, NY 10017.~~

~~———— **Note:** This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users this reference is informative.~~
15. Not an informative reference.

~~ASME/ANSI B31.5-1987, Refrigeration Piping and Addendum B31.5A-1989, American Society of Mechanical Engineers (ASME), New York, NY 10017.~~

~~———— **Note:** This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users this reference is informative.~~
16. Not an informative reference.
17. Not an informative reference.
18. Not an informative reference.
19. Not an informative reference.
20. Not an informative reference.
- ~~21. U.S. Department of Transportation Code of Federal Regulations 49, TRANSPORTATION, Parts 100-199, "Regulations for Transportation of Explosive and other Dangerous Articles by Land and Water in Rail Freight Service and by Motor Vehicle (Highway) and Water, Including Specifications for Shipping Containers." Revised at least once each calendar year and issued as of October 1. U.S. Department of Transportation (DOT), Office of Hazardous Materials, Transportation, Washington, DC 20590.~~

~~———— **Note:** This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users this reference is informative.~~
- ~~22. NFPA 68-1988, Guide for Venting of Deflagrations, National Fire Protection Association (NFPA), Quincy, MA 02269.~~
- ~~23. USAF Facility Design and Planning Engineering Weather Data, AFM 88-29, Department of the Air Force, the Army, and the Navy, Washington, DC.~~
24. ASHRAE Handbook of Fundamentals, 1989

25. *IIAR Bulletin 114, 9/91, Guidelines for Identification of Ammonia Refrigeration Piping and System Components*, International Institute of Ammonia Refrigeration, 1101 Connecticut Ave, N.W. Washington, DC 20036.

26. Not an informative reference

APPENDIX E

(This appendix is part of this standard, and is required for its use.)

NORMATIVE REFERENCES

This appendix contains full citations for normative references. Full citations for references that are solely informative are included in Appendix D. Note that in some locations within the standard, normative references are also used as informative references. References in this standard are numbered in the order in which they appear in the document, and so the numbers for the informative references are shown for the convenience of the user.

~~1. Not a normative reference.~~

~~2. ASTM D93-85, Standard Test Methods for Flash Point by Pensky-Martens Closed Tester, American Society for Testing and Materials (ASTM), Philadelphia, PA 19103.~~

~~3. Not a normative reference.~~

4. *ANSI/ASHRAE 34-1997 with addenda a-f, Designation and Safety Classification of Refrigerants*, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., Atlanta, GA, 30329.

~~Note: This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users, this reference is informative.~~

~~5. Not a normative reference.~~

~~6. ANSI/ASME B15.1-1984, Safety Code for Mechanical Power Transmission Apparatus and Addendum B15.1-A 1986, American Society of Mechanical Engineers (ASME), New York, NY 10017.~~

~~Note: This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users, this reference is informative.~~

7. *ANSI/UL 303-1987, UL 1995-95 Heating and Cooling Equipment Refrigeration and Air-Conditioning Condensing and Compressor Units*, Underwriters Laboratories Inc. Northbrook, IL 60062

~~Note: This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users, this reference is informative.~~

~~8. ANSI/IES RP-7-1983, Practice for Industrial Lighting, Illuminating Engineering Society of North America (IESNA), New York, NY 10017.~~

~~Note: This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users, this reference is informative.~~

9. *ANSI/NFPA 70-1999, National Electrical Code*, National Fire Protection Association (NFPA), Quincy, MA 02269.

~~10. NFPA Standard 54-1988 (ANSI Z223.1-1988), National Fuel Gas Code, National Fire Protection Association (NFPA), Quincy, MA 02269.~~

~~**Note:** This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users, this reference is informative.~~

~~11. ANSI/NFPA 37-1990, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, National Fire Protection Association (NFPA), Quincy, MA 02269.~~

~~**Note:** This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users, this reference is informative.~~

~~12. ANSI/NFPA 90A-1989, Standard for the Installation of Air Conditioning and Ventilating Systems, National Fire Protection Association (NFPA), Quincy, MA 02269.~~

~~**Note:** This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users, this reference is informative.~~

~~13. ANSI/NFPA 90B-1989, Standard for the Installation of Warm Air Heating and Air Conditioning Systems, National Fire Protection Association (NFPA), Quincy, MA 02269.~~

~~**Note:** This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users, this reference is informative.~~

14. ASME Boiler and Pressure Vessel Code, Section VIII, Rules for Construction of Pressure Vessels, Division 1, 1992, American Society of Mechanical Engineers (ASME), New York, NY 10017.

Note: This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users, this reference is informative.

15. ASME/ANSI B31.5-1987, Refrigeration Piping and Addendum B31.5A-1989, American Society of Mechanical Engineers (ASME), New York, NY 10017.

Note: This reference is mandatory for designers, manufacturers, and producers of refrigerating equipment. For all other users, this reference is informative.

16. ANSI/ASTM B88-~~89~~ 96, Standard Specification for Seamless Copper Water Tube, American Society for Testing and Materials (ASTM), Philadelphia, PA 19103 100 Barr Harbor Drive, West Conshohocken, PA 19428-

17. ANSI/ASTM B280-~~88~~ 94A, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service, American Society for Testing and Materials (ASTM), Philadelphia, PA 19103 100 Barr Harbor Drive, West Conshohocken, PA 19428.

18. ASTM B68-~~86~~ 95, Standard Specification for Seamless Copper Tube, Bright Annealed, American Society for Testing and Materials (ASTM), Philadelphia, PA 19103 100 Barr Harbor Drive, West Conshohocken, PA 19428.

19. ASTM B75-~~86~~ 95A, Standard Specification for Seamless Copper Tube, American Society for Testing and Materials (ASTM), Philadelphia, PA 19103 100 Barr Harbor Drive, West Conshohocken, PA 19428.

20. ANSI A13.1-1981 (R1985), Scheme for the Identification of Piping Systems, American Society of Mechanical Engineers (ASME), New York, NY 10017.

~~21. U.S. Department of Transportation Code of Federal Regulations 49, TRANSPORTATION, Parts 100-199, "Regulations for Transportation of Explosive and other Dangerous Articles by Land and Water in Rail Freight Service and by Motor Vehicle (Highway) and Water, Including Specifications for Shipping Containers." Revised at least once each calendar year and issued as of October 1. U.S. Department of Transpor-~~

~~tation (DOT), Office of Hazardous Materials, Transportation, Washington, DC 20590.~~

~~———— **Note:** This reference is mandatory for designers, manufacturers, and producers of refrigeration equipment. For all other users, this reference is informative.~~

~~22. Not a normative reference.~~

~~23. Not a normative reference.~~

24. Not a normative reference.

25. Not a normative reference.

26 *ANSI/ARI 700-1995, Specifications for Fluorocarbon and Other Refrigerants*, Air-Conditioning & Refrigeration Institute, 4301 North Fairfax Drive, Arlington, VA 22203.

Note: The references remaining will have to be renumbered and the superscript in the text changed to reflect the new numbers of the references.