UL 207

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Refrigerant-Containing Components and Accessories, Nonelectrical

Underwriters Laboratories Inc. (UL)
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UL Standard for Safety
for
Refrigerant-Containing Components and Accessories, Nonelectrical, UL 207

Sixth Edition, Dated March 25, 1993

Revisions: This Standard contains revisions through and including October 29, 1997.

A change is indicated by a note following the affected item. The note is preceded and followed by an asterisk.

The new and/or revised requirements are substantially in accordance with UL's Bulletin on this subject dated January 9, 1997. The bulletin is now obsolete and may be discarded.

These revisions dated October 29, 1997 were also issued to correct an editorial error on page 13.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

As indicated on the title page (page 1), this UL Standard for Safety has been adopted by the Department of Defense.

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New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing, Recognition, and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

This Standard consists of pages dated as shown in the following checklist:

Page	Date
tr1 – tr4	October 29, 1997
1	March 25, 1993 (Reprinted: April 17, 1997)
2	April 17, 1997
3	April 17, 1997
4, 5	March 25, 1993
6, 6A, 6B	October 29, 1997
7, 8	March 15, 1995
9	April 17, 1997
10, 11	March 15, 1995
12	April 17, 1997
13	October 29, 1997
14	March 25, 1993
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16	March 25, 1993
17, 18	April 17, 1997
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20, 20A, 20B, 21, 22	February 25, 1994
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Standard for

Refrigerant-Containing Components and Accessories, Nonelectrical

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March 25, 1993

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated March 25, 1993. These pages should not be discarded when revised or additional pages are issued if it is desired to retain the ANSI approved text.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

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Approved as ANSI/UL 207 – 1981 (R 1986), August 15, 1986
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The Department of Defense (DoD) has adopted UL 207 on April 30, 1976. The publication of revised pages or a new edition of this standard will not invalidate the DoD adoption.

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements cover nonelectrical refrigerant-containing components and accessories, intended for field installation in accordance with the Safety Code for Mechanical Refrigeration, ANSI/ASHRAE 15, in refrigeration systems, air conditioning equipment, or both, charged with the refrigerants identified for use in the component or accessory. The requirements also apply to components and accessories intended for use by manufacturers in factory-assembled systems or units, in which case the component or accessory is also judged under the requirements for the individual system or unit.

1.2 These requirements do not apply to:

a) Electric valves and electric refrigeration controllers, hermetic refrigerant motor-compressors, tubing fittings such as flare or compression type fittings, and the like, which are covered in or as part of separate, individual requirements.

b) Electrical components of assemblies incorporating these refrigerant-containing components or accessories, and

c) Pressure vessels bearing the ASME Code "U" symbol which are within the Scope of the ASME Boiler and Pressure Vessel Code, Section VIII.

1.3 A product that contains features, characteristics, components, materials, or systems new or different from those in use when the standard was developed, and that involves a risk of fire, electric shock, or injury to persons, shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the level of safety for the user of the product as originally anticipated by the intent of this standard.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

2.1.2 A component need not comply with a specific requirement that:

a) Involves a feature or characteristic not needed in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

2.1.3 A component shall be used in accordance with its recognized rating established for the intended conditions of use.

2.1.4 Specific components are recognized as being incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits and shall be used only under those specific conditions for which they have been recognized.

2.2 Units of Measurement

2.2.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

2.3 Terminology

2.3.1 As used in this standard, the term "component" refers to a refrigerant-containing component or accessory unless otherwise specified.

2.4 Undated References

2.4.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

2.5 Refrigerants

2.5.1 The kind of refrigerant employed in the system shall comply with the Standard for Refrigerants, UL 2182.

2.5.1 added October 29, 1997

3 Glossary

3.1 General

3.1.1 For the purpose of this standard the following definitions apply.

3.1.1 revised March 15, 1995

3.2 Refrigerant-containing components

3.2.1 ACCUMULATOR – A storage chamber for low side liquid refrigerant; also known as surge drum, surge header. Also, a pressure vessel whose volume is used in a refrigerant circuit to reduce pulsation.

3.2.2 COMPRESSOR, OPEN-TYPE – A refrigerant compressor with a shaft or other moving part extending through its casing to be driven by an outside source of power thus requiring a shaft seal or equivalent rubbing contact between a fixed and moving part.

3.2.3 CONDENSER COIL – A condenser constructed of pipe or tubing other than a shell and tube or shell and coil type.

3.2.4 CONDENSER, SHELL-AND-TUBE (OR SHELL-AND-COIL) – A condenser in which a nest of tubes or pipes, or a coil of tube or pipe, is contained in a shell. The tube(s) or pipe(s) carries fluid through it while the shell is also provided with an inlet and outlet for fluid flow.

3.2.5 CONDENSER, TUBE-IN-TUBE – Consists of one or more assemblies of two tubes, one within the other, in which the refrigerant vapor is condensed either in the annular space or in the inner tube.

3.2.6 CONDENSER, WATER-COOLED – An assembly of elements by which the flows of the refrigerant vapor and water are maintained in such a heat transfer relationship that the refrigerant vapor is condensed into a liquid and the water is heated.

3.2.7 DRIER – A device containing a desiccant placed in the refrigerant circuit, its primary purpose being to collect and hold within the desiccant all water in the system in excess of the amount which can be tolerated in the circulating refrigerant.

3.2.8 EVAPORATOR COIL – An evaporator constructed of pipe or tubing other than a shell-and-tube or shell-and-coil type.

3.2.9 FILTER – A device intended to remove solid material from a fluid.

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3.2.10 HEAT EXCHANGER (INTERCHANGER) – A device specifically designed to transfer heat between refrigerant in the high side and low side of the system.

3.2.11 LIQUID RECEIVER – A vessel permanently connected to a system by inlet and outlet pipes for the storage of liquid refrigerant.

3.2.11 revised March 15, 1995

3.2.12 MUFFLER – Intended to dampen or remove hot gas pulsations set-up by a compressor, inserted in the discharge line as close to the compressor as is practical.

3.2.13 OIL SEPARATOR – A device for separating oil and oil vapor from the refrigerant, usually installed in the compressor discharge line.

3.2.14 STRAINER – A device for withholding foreign matter from a flowing liquid or gas.

3.3 Accessories

3.3.1 FUSIBLE PLUG – A device having a predetermined-temperature fusible member for the relief of pressure.

3.3.2 LIQUID INDICATOR – A device located in the liquid line of a refrigerating system and having a sight port by which liquid flow may be observed.

3.3.3 PRESSURE-RELIEF DEVICE – A pressure actuated valve or rupture member designed to automatically relieve excessive pressure.

3.3.4 PRESSURE-RELIEF VALVE – A pressure actuated valve held closed by a spring or other means and designed to automatically relieve pressure in excess of its setting.

3.3.5 RUPTURE MEMBER – A device which will rupture at a predetermined pressure.

3.3.6 VALVE, CHARGING – A valve used to charge or add refrigerant to the system, or add oil to the compressor crankcase.

3.3.7 VALVE, CHECK – A valve allowing (fluid) flow in one direction only.

3.3.8 VALVE, STOP – A device intended to shut off the flow of refrigerant

3.4 Terminology

3.4.1 CONDENSER – That part of the system designed to liquefy refrigerant vapor by removal of heat.

3.4.2 CRITICAL PRESSURE, CRITICAL TEMPERATURE AND CRITICAL VOLUME – Terms given to the state points of a substance at which liquid and vapor have identical properties. Above the critical pressure or critical temperature there is no line of demarcation between liquid and gaseous phases.

3.4.3 DESICCANT – Any adsorbent that removes water or water vapor from the refrigerant.

3.4.4 DESIGN PRESSURE – The maximum allowable working pressure for which a specific part of a system is designed.

3.4.5 EVAPORATOR – That part of the system designed to vaporize liquid refrigerant to produce refrigeration.

3.4.6 FIN – An extended surface, such as metal sheets attached to tubes, intended to increase the heat transfer area.

3.4.7 HIGH SIDE – The parts of a refrigerating system subjected to condenser pressure.

3.4.7 revised March 15, 1995

3.4.8 JOINT, BRAZED – A gastight joint obtained by the joining of metal parts with alloys which melt at temperatures higher than 800EF (427EC) but less than the melting temperatures of the joined parts.

3.4.9 JOINT, MECHANICAL – A gastight joint obtained by the joining of metal parts through a positive holding mechanical construction.

3.4.10 JOINT, SOLDERED – A gastight joint obtained by the joining of metal parts with metallic mixtures or alloys which melt at temperatures not exceeding 800EF (427EC) and above 400EF (204EC).

3.4.11 JOINT, WELDED – A gastight joint obtained by the joining of metal parts in the plastic or molten state.

3.4.12 LIMITED-CHARGE SYSTEM – A system in which, with the compressor idle, the internal volume and total refrigerant charge are such that the design pressure will not be exceeded by complete evaporation of the refrigerant charge.

3.4.13 LOW SIDE – The parts of a refrigerating system subjected to evaporator pressure.

3.4.14 MANIFOLD – That portion of the refrigeration circuit in which several branches are close together. Also, a single piece in which there are several fluid paths.

3.4.15 PIPING – The pipe or tube mains for interconnecting the various parts of a refrigerating system. Piping includes pipe, flanges, bolting, gaskets, valves, fittings, the pressure containing parts of other components such as expansion joints, strainers, and devices which serve such purposes as mixing, separating, snubbing, distributing, metering or controlling flow, pipe supporting fixtures and structural attachments.

3.4.16 PRESSURE, SATURATION – The pressure at which there is stable coexistence of the vapor and liquid, or the vapor and solid phase.

3.4.17 PRESSURE, SUCTION (BACK) – The operating pressure measured in the suction line at the compressor inlet.

3.4.18 PRESSURE, VAPOR – The pressure exerted by a vapor. Sometimes synonymous with saturated vapor pressure.

3.4.19 PRESSURE-LIMITING DEVICE – A pressure-responsive mechanism designed to automatically stop the operation of the pressure imposing element at a predetermined pressure.

3.4.20 REFRIGERANT – A substance used to produce refrigeration by its expansion or vaporization.

3.4.21 TEMPERATURE, SATURATION – For a fluid, the boiling point corresponding to a given pressure; evaporation temperature; condensation temperature.

3.4.22 TUBE, FINNED – A heat transfer tube or pipe with extended surface in the form of fins, discs or ribs.

3.4.23 TUBE, SEAMLESS – A tube produced with an initially continuous periphery.

3.4.24 TUBE, SOFT COPPER – A seamless, soft copper tube, annealed to assure quality for bending and flaring.

3.4.25 TUBE, WELDED – A tube made from plate, sheet or strip with welded longitudinal or helical joint.

3.4.26 ULTIMATE STRENGTH – The highest stress level which the component can tolerate without rupture.

3.4.26 revised March 15, 1995

3.4.27 UNPROTECTED TUBING – Tubing which is not protected by an enclosure or suitable location so that it is exposed to crushing, abrasion, puncture or similar mechanical damage under installed conditions.

3.4.28 VESSEL, PRESSURE – Any refrigerant-containing receptacle of a refrigerating system, other than evaporators [each separate section of which does not exceed 1/2 cubic foot (0.014 m^3) of refrigerant-containing volume], evaporator coils, compressors, condenser coils, controls, headers and piping.

CONSTRUCTION

4 Materials

4.1 The material used in the fabrication and assembly of a component, such as the desiccant in a drier, shall be compatible with the type of refrigerant and oil used.

4.2 Copper or brass materials shall not be used in the fabrication or assembly of a component intended to handle ammonia as a refrigerant.

4.3 Magnesium alloys shall not be used in the fabrication or assembly of a component intended to handle any of the halogenated refrigerants.

4.4 Aluminum, zinc, or magnesium alloys shall not be used in the fabrication or assembly of a component intended to handle methyl chloride refrigerant.

4.5 All pressure retaining components shall be of corrosion-resisting materials or shall be protected against external corrosion.

4.6 With reference to 4.5, components shall be constructed of corrosion-resistant material, such as copper, or shall be plated, dipped, coated, or otherwise treated to resist external corrosion. Generally, a coating of water-resistant paint is adequate for protection against external corrosion for iron or steel components. Aluminum may be used where the material is not subject to galvanic corrosion.

4.7 Tubing connections, including fittings, of dissimilar metals, such as aluminum and copper, shall be protected against moisture to minimize galvanic action.

4.8 A component made of drawn or machined brass shall be capable of withstanding, without cracking, a 10-Day Moist Ammonia Air Stress Cracking Test, See Section 17A.

4.8 revised April 17, 1997

5 Refrigerant Tubing

5.1 Copper or steel tubing provided to interconnect components shall have a wall thickness not less than indicated in Table 5.1. See 5.3.

5.2 Special alloys or constructions used in component, including tubing with a wall thickness less than indicated in Table 5.1 may be considered acceptable. Among the factors taken into consideration when judging the acceptability are:

a) Resistance to mechanical abuse,

b) Strength against internal pressure,

c) Resistance to corrosion,

d) Protection against refrigerant contamination, and

e) Conformity with requirements of safety codes; such as the Safety Code for Mechanical Refrigeration, ANSI/ASHRAE 15–1992, as compared to tubing of the minimum wall thickness indicated.

5.2 revised March 15, 1995

5.3 In judging the protection of tubing, consideration is given to the likelihood of damage occurring during handling, packing and shipment. Shielding to prevent accidental damage from objects such as tools falling on or otherwise striking the tubing shall be provided in the form of baffles, channels, flanges, perforated metal, or similar means.

5.4 Capillary tubing which is protected against mechanical damage by the assembly or other means shall have a wall thickness not less than 0.020 inch (0.51 mm).

Table 5.1
Wall thickness for copper and steel tubing

Outside diameter,		Minimum wall thickness, inches[a] (mm)					
		Copper				Steel	
Inches	(mm)	Protected		Unprotected[b]			
3/16	(4.76)	0.0245	(0.62)	0.0265	(0.67)	0.025	(0.64)
1/4	(6.35)	0.0245	(0.62)	0.0265	(0.67)	0.025	(0.64)
5/16	(7.94)	0.0245	(0.62)	0.0265	(0.67)	0.025	(0.64)
3/8	(9.53)	0.0245	(0.62)	0.0265	(0.67)	0.025	(0.64)
1/2	(12.70)	0.0245	(0.62)	0.0285	(0.72)	0.025	(0.64)
5/8	(15.88)	0.0315	(0.80)	0.0315	(0.80)	0.032	(0.81)
3/4	(19.05)	0.0315	(0.80)	0.0385	(0.98)	0.032	(0.81)
7/8	(22.23)	0.0410	(1.04)	0.0410	(1.04)	0.046	(1.17)
1	(25.40)	0.0460	(1.17)	0.0460	(1.17)	–	
1-1/8	(28.58)	0.0460	(1.17)	0.0460	(1.17)	0.046	(1.17)
1-1/4	(31.75)	0.0505	(1.28)	0.0505	(1.28)	0.046	(1.17)
1-3/8	(34.93)	0.0505	(1.28)	0.0505	(1.28)	–	
1-1/2	(38.10)	0.0555	(1.41)	0.0555	(1.41)	0.062	(1.58)
1-5/8	(41.28)	0.0555	(1.41)	0.0555	(1.41)	–	
2-1/8	(53.98)	0.0640	(1.63)	0.0640	(1.63)	–	
2-5/8	(66.68)	0.0740	(1.88)	0.0740	(1.88)	–	

[a] Nominal wall thickness of tubing will have to be greater than the thickness indicated to maintain the minimum wall thickness.

[b] See 3.4.27.

Table 5.1 revised February 25, 1994

5.5 Tubing shall be constructed of corrosion-resistant material such as copper or shall be plated, dipped, coated, or otherwise treated to resist external corrosion. Aluminum tubing may be used. See 4.7 and 5.2.

5.6 Tubing connections shall be made by means of flare-type fittings with steel or forged brass nuts, by soldering or brazing, or by equivalent means. The dimensions of flare-type fittings shall conform to the Standard for Refrigeration Tube Fittings, ANSI/SAE J513f-JUN90.

5.6 revised March 15, 1995

5.7 Joints on copper tubing used on components for use with Group 2 or 3 refrigerant, as classified in the Safety Code for Mechanical Refrigeration, ANSI/ASHRAE 15–1992, shall be brazed joints. See 3.4.8 and Table 12.1.

5.7 revised March 15, 1995

5.8 Tubing forming part of components such as evaporators or condensers, where protection is afforded by inherent construction, shall be judged by the Strength Test requirements of this standard.

5.8 revised February 25, 1994

5.9 **Deleted February 25, 1994**

REFRIGERANT-CONTAINING PARTS

6 General

6.1 The parts of a refrigerant-containing component subjected to refrigerant pressure shall withstand without failure the pressure indicated in the Performance Section of this standard.

7 Pressure Vessels

7.1 Pressure vessels over 6 inches (152 mm) inside diameter with a design pressure greater than 15 psig (103 kPa) shall be designed, tested, and stamped in accordance with the 1992 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII, for a design pressure in compliance with the Performance Section of this standard. The manufacturer shall submit evidence of compliance of these vessels with the 1986 ASME Boiler and Pressure Vessel Code, Section VIII.

7.1 revised March 15, 1995

7.2 Pressure vessels bearing the ASME Code "UM" symbol shall be tested to determine compliance with the Performance Section of this standard.

8 Pressure Relief

8.1 A component provided with a fusible plug(s), a pressure-relief device(s), or both shall comply with the requirements of 8.8 – 11.1 as applicable.

8.2 With reference to 8.3, 8.4, 8.5, and 8.7, a component such as a drier, filter, filter-drier, oil separator, or strainer is not considered to be a pressure vessel unless identified as an ASME pressure vessel. See paragraph 3.4.15.

8.3 Except as indicated in 8.7, a pressure vessel over 3 inches (76 mm) inside diameter, but not exceeding 3 cubic feet (0.085 m^3) internal gross volume, which may contain liquid refrigerant shall be provided with a pressure-relief device or fusible plug or shall have provision, such as a fitting, for the installation of a pressure-relief device or fusible plug.

8.4 Except as indicated in 8.7, a pressure vessel exceeding 3 cubic feet (0.085 m^3) but less than 10 cubic feet (0.283 m^3) internal gross volume, which may contain liquid refrigerant shall be provided with a pressure-relief device or shall have provision, such as a fitting, for the installation of such a device.

8.5 A pressure vessel of 10 cubic feet (0.283 m^3) internal gross volume or larger, other than an evaporator, which may contain liquid refrigerant, shall be protected by a relief system consisting of a pressure-relief valve in parallel with a second pressure-relief valve, or shall have provision, such as a fitting(s) for the installation of such a system. Each relief valve shall have a discharge capacity as determined by 9.1. See 8.6 and 8.7.

8.6 A single pressure-relief valve, or a fitting provided for its installation, may be provided on a pressure vessel having an internal gross volume of 10 cubic feet (0.283 m^3) or more if:

a) The vessel is intended to be used in a system where the pressure-relief valve is to discharge into the low side of the refrigeration system, and

b) The valve is of a type not adversely affected by back pressure.

8.7 A pressure vessel intended to be used as an evaporator or part of an evaporator and having an inside diameter greater than 3 inches (76 mm) but not greater than 6 inches (152 mm) shall be provided with a pressure-relief device or fusible plug or shall have provision such as a fitting, for the installation of a pressure-relief device or fusible plug. A pressure vessel intended to be used as an evaporator or part of an evaporator and having an inside diameter greater than 6 inches (152 mm) shall be provided with a pressure-relief device or shall have provision, such as a fitting, for the installation of a pressure-relief device.

8.8 There shall be no stop valve between the pressure-relief means and the components protected except when the parallel relief devices mentioned in 8.5 are so arranged that only one can be rendered inoperative at a time for testing or repair purposes.

8.8 revised April 17, 1997

9 Required Discharge Capacity

9.1 **Deleted April 17, 1997**

10 Relief Valves

10.1 Pressure-relief valves shall comply with the requirements of the 1992 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII. Valves of nominal 1/2 inch pipe size and larger shall bear the authorized Code "UV" symbol together with the set pressure, capacity, and pipe size of the valve inlet. Valves of less than nominal 1/2 inch pipe size shall be similarly marked, except that where the size does not permit, the code symbol may be omitted and the set pressure and capacity may be stamped on the valve or on a metal plate attached to it. Manufacturers of valves which do not bear the code symbol shall provide evidence of certification of the valve and its pressure and capacity rating by proper code authorities.

10.1 revised March 15, 1995

10.2 Pressure-relief valves shall be set and sealed to start-to-function at a pressure not exceeding the marked design pressure of the pressure vessel protected.

10.3 The marked discharge capacity of a pressure-relief valve installed on a pressure vessel shall be not less than the minimum required discharge capacity required for that pressure vessel as computed from 9.1.

11 Fusible Plugs or Rupture Members

11.1 The minimum required discharge capacity and the rated discharge of a rupture member or fusible plug shall be in accordance with the calculations specified in the Safety Code for Mechanical Refrigeration, ANSI/ASHRAE 15-1994.

Revised 11.1 effective April 17, 1998

DESIGN PRESSURE

12 General

12.1 The design pressure of a component shall be selected high enough for all operating and standby conditions, including shipping conditions, with consideration given to the setting of pressure-limiting devices, pressure-relief devices, or both, provided on the component or with which the component is to be used.

12.2 The minimum design pressure shall be not less than 15 psig (103 kPa), and except as indicated in 12.3, shall be not less than the saturation pressure of the refrigerant at the following temperatures.

a) Low sides of all systems 80EF (26.7EC)

b) High side of water or evaporatively cooled systems 105EF (40.6EC)

c) High sides of air-cooled systems 125EF (51.7EC)

Corresponding minimum pressures are given in Table 12.1 for the refrigerants in common use. Higher design pressures may be required to conform with 12.1.

Table 12.1

Refrigerant	Group[b]	Name	Minimum design pressures[a] pounds per square inch gauge (kPa)					
			Low side		High side			
					Water or evaporatively cooled		Air-cooled	
R-11	A1	Trichlorofluoromethane	15	(103)	15	(103)	21	(145)
R-12	A1	Dichlorodifluoromethane	85	(586)	127	(876)	169	(1165)
R-13	A1	Chlorotrifluoromethane	521	(3592)	547	(3772)	547	(3772)
R-13B1	A1	Bromotrifluoromethane	230	(1586)	321	(2213)	410	(2827)
R-14	A1	Tetrafluoromethane	544	(3751)	544	(3751)	544	(3751)
R-21	B1	Dichlorofluoromethane	15	(103)	29	(200)	46	(317)
R-22	A1	Chlorodifluoromethane	144	(993)	211	(1455)	278	(1917)
R-30	B2	Methylene Chloride	15	(103)	15	(103)	15	(103)
R-40	B2	Methyl chloride	72	(496)	112	(772)	151	(1041)
R-113	A1	Trichlorotrifluoroethane	15	(103)	15	(103)	15	(103)
R-114	A1	Dichlorotetrafluoroethane	18	(124)	35	(241)	53	(365)
R-115	A1	Chloropentafluoroethane	152	(1048)	194	(1338)	252	(1738)
R-123	B1	Dichlorotrifluoroethane	15	(103)	15	(103)	18	(124)
R-134a	A1	Tetrafluoroethane	88	(606)	135	(930)	186	(1282)
R-170	A3	Ethane	616	(4247)	709	(4888)	709	(4888)
R-290	A3	Propane	129	(889)	188	(1296)	244	(1682)
R-C318	A1	Octafluorocyclobutane	34	(234)	59	(407)	85	(586)
R-401 (53/13/34)	A1[c]	53 percent chlorodifluoromethane, 13 percent 1,1-difluoroethane, and 34 percent 2, chloro-1,1,1,2-tetrafluoroethane.	85	(586)	133	(917)	182	(1255)
R-401 (61/11/28)	A1[c]	61 percent chlorodifluoromethane, 11 percent 1,1-difluoroethane, and 28 percent 2, chloro-1,1,1,2-tetrafluoroethane	93	(641)	143	(986)	195	(1344)
R-402 (38/2/60)	A1[c]	38 percent pentafluoroethane, 2 percent propane, and 60 percent chlorodifluoromethane	170	(1172)	247	(1703)	324	(2234)
R-402 (60/2/38)	A1[c]	60 percent pentafluoroethane, 2 percent propane, and 38 percent chlorodifluoromethane	183	(1262)	265	(1828)	347	(2394)
R-500	A1	Dichlorodifluoromethane 73.8 percent and Ethylidene Fluoride 26.2 percent	102	(703)	153	(1055)	203	(1399)
R-502	A1	Chlorodifluoromethane 48.8 percent and Chloropentafluorethane 51.2 percent	162	(1117)	232	(1599)	302	(2082)
R-600	A3	N-Butane	23	(159)	42	(290)	61	(421)
R-600A	A3	Isobutane	39	(269)	63	(434)	88	(607)
R-611	B2	Methyl Formate	15	(103)	15	(103)	15	(103)
R-717	B2	Ammonia	139	(958)	215	(1482)	293	(2020)
R-744	A1	Carbon Dioxide	955	(6685)	1058	(7295)	1058	(7295)
R-764	B1	Sulfur Dioxide	45	(310)	78	(538)	115	(793)
R-1150	A3	Ethylene	732	(5047)	732	(5047)	732	(5047)

[a] See Section 12.
[b] Classification in accordance with ANSI/ASHRAE 34-1992.
[c] Provisional classification

Table 12.1 revised February 25, 1994

12.3 When a part of a Limited Charge System is protected by a pressure-relief device, the design pressure of that part need not exceed the setting of the pressure-relief device.

PERFORMANCE

13 General

13.1 Refrigerant-containing parts: high side

13.1.1 The requirements of 13.1.2 – 13.1.4 apply to condensers, condenser-receivers, mufflers, and oil separators, as well as driers, filters, strainers, and other components designed for installation in the high side of the refrigeration system. The requirements also apply to the high side section of components, such as compressors and heat exchangers, which may be connected in both the high side and low side of the system.

13.1.2 The component or section of the component exposed to high side pressure shall withstand without failure a pressure equal to five times the minimum high side design pressure specified in Table 12.1 for the refrigerant, or a pressure equal to five times the design pressure marked on the component, whichever is higher.

13.1.3 A high side component, having a pressure-relief device, shall withstand without failure a pressure equal to five times the start-to-discharge pressure of the relief valve or to five times the nominal rated rupture pressure, see 15.3, of the rupture member.

13.1.4 In addition to meeting the requirements of 13.1.2 and 13.1.3, a component which is provided with a fusible plug shall withstand without failure a pressure equal to 2-1/2 times the vapor pressure of the refrigerant at the relief temperature of the fusible plug, or at the critical temperature of the refrigerant used, whichever is smaller.

13.2 Refrigerant-containing parts: low side

13.2.1 The requirements of 13.2.2 – 13.2.4 apply to evaporators, accumulators, and other components designed for installation in the low side of a refrigeration system.

13.2.2 Except for a pressure vessel, the component or section of the component exposed to low side pressure shall withstand without failure a pressure equal to three times the design pressure of the component. If such a component is provided with a pressure relief device, it shall withstand without failure a pressure equal to three times the start-to-discharge pressure of the relief valve or to three times the nominal rated rupture pressure, see 15.3, of the rupture member.

13.2.3 A low side pressure vessel shall withstand without failure a pressure equal to five times the minimum low side design pressure specified in Table 12.1 for the refrigerant, or a pressure equal to five times the design pressure marked on the component, whichever is higher. If such vessel is provided with a pressure-relief device, it shall withstand without failure a pressure equal to five times the start-to-discharge pressure of the relief valve or to five times the nominal rated rupture pressure, see 15.3, of the rupture member.

13.2.4 In addition to meeting the requirements of 13.2.2 and 13.2.3, a low side pressure vessel which is provided with a fusible plug shall withstand without failure a pressure equal to 2-1/2 times the vapor pressure of the refrigerant at the relief temperature of the fusible plug, or at the critical temperature of the refrigerant used, whichever is smaller.

13.3 Water-containing parts

13.3.1 The requirements of 13.3.2 apply to the water-containing sections of water-cooled condensers, liquid coolers, and similar components designed for connection to a water source.

13.3.2 The section of the component exposed to water pressure shall withstand without failure a gauge pressure equal to 150 psi (1035 kPa) or two times the water-side design pressure marked on the component, whichever is higher.

14 Strength Tests

14.1 Two samples of each type of component are to be tested. If a range of types and sizes is involved, tests on the weakest assemblies may be taken as representative of the type or group. The test samples are to be filled with water to exclude air and are to be connected in a hydraulic pump system. The pressure is to be raised gradually until the highest pressure as required by 13.1.2–13.1.4 and 13.2.2–13.2.4, and 13.3.2, as applicable, is reached. This pressure is to be maintained for 1 minute, during which time the sample shall not burst or show visible leakage except as indicated in 14.3 and 14.4.

14.2 Strength Tests for components such as condensers and evaporators constructed of continuous tubing and components constructed of lengths of tubing having telescoped joints are not required, provided the tubing employed in the assembly meets the minimum thickness requirements of Table 5.1 and does not exceed 1-1/2 inches (38 mm) outside diameter.

14.3 If gaskets or mechanical seals, such as mating machined surfaces other than simple threaded joints, are employed in components designed for use in systems containing Refrigerant 12, 22, 500 or 502, visible leakage at the gaskets or seals will not be considered a failure, provided the leakage occurs at a pressure greater than twice the design pressure.

14.4 In reference to 14.3, the component shall withstand the required Strength Test pressure even though visible leakage occurs at the gaskets or seals.

15 Rupture Member Test

15.1 A rupture member shall burst at a pressure within 5 percent of its nominal rated rupture pressure.

15.2 Three samples of each size are to be tested as follows. Each sample is to be connected to a pressure source (carbon dioxide, air, or other acceptable medium) and the pressure increased until rupture occurs. The rate of pressure increase is to be not greater than 5 percent of the minimum marked bursting pressure per minute after the pressure reaches 90 percent of the minimum marked bursting pressure.

15.3 The nominal rated rupture pressure is the average of the minimum and maximum marked bursting pressures.

16 Fusible Plug Test

16.1 A fusible plug shall function within 10EF (5.6EC) of its marked temperature rating when tested as described below.

16.2 Three samples of each size are to be tested. Each sample is attached to a length of coiled copper tubing, 10 feet (3.05 m) long, within which air pressure of not less than 40 psig (276 kPa) is maintained. The coil and test sample are to be immersed in a fluid, the temperature of which is 20EF (11.1EC) below the marked temperature of the plug. After 5 minutes, the temperature is to be increased at the rate of 1EF (1/2EC) per minute. The relief temperature is that temperature at which the test pressure is relieved and at which complete blowout of the fusible element occurs.

16.3 A blowout is complete if the area of the relief opening is such that the resulting discharge capacity complies with the requirements of 9.1 and 11.1.

17 Mercurous-Nitrate Immersion Test

Section 17 deleted April 17, 1997

17A 10-Day Moist Ammonia Air Stress Cracking Test

Section 17A added April 17, 1997

17A.1 After being subjected to the conditions described in 17A.2 – 17A.4, a brass part containing more than 15 percent zinc when examined using 25X magnification shall:

a) Show no evidence of cracking; or

b) Comply with the Hydrostatic Strength Test, in Section 14, if there is evidence of cracking.

17A.2 Each test sample is to be subjected to the physical stresses normally imposed on or within a part as the result of assembly with other components. Such stresses are to be applied to the sample prior to and maintained during the test. Samples with threads, intended to be used for installing the product in the field, are to have the threads engaged and tightened to the torque specified in Table 17A.1. Teflon tape or pipe compound is not to be used on the threads.

Table 17A.1
Torque requirements for threaded connections

Nominal thread size, inches	Torque pound-inches (N•m)	
1	1200	(135.6)
1-1/4	1450	(163.8)
1-1/2	1550	(175.1)
2	1650	(186.4)
2-1/2	1750	(197.7)
3	1800	(203.4)

17A.3 Three samples are to be degreased and then continuously exposed in a set position for ten days to a moist ammonia-air mixture maintained in a glass chamber approximately 305 by 305 by 305 mm (12 by 12 by 12 inches) having a glass cover.

17A.4 Approximately 600 ml of aqueous ammonia having a specific gravity of 0.94 is to be maintained at the bottom of the glass chamber below the samples. The samples are to be positioned 1-1/2 inch (38.1 mm) above the aqueous ammonia solution and supported by an inert tray. The moist ammonia-air mixture in the chamber is to be maintained at atmospheric pressure and at a temperature of 34 ±2EC (93.2 ±3.6EF).

18 Marking Plate Adhesion Tests

18.1 General

18.1.1 To determine if a marking plate secured by cement or adhesive complies with 20.2, representative samples are to be subjected to the following tests. In each test, three samples of the marking plate are to be applied to the same test surface as employed in the intended application. The marking plate is to be applied to the test surface no less than 24 hours prior to testing.

18.1.2 A marking plate is considered to comply with the requirements if, immediately following removal from each test medium, and also after being exposed to room temperature for 24 hours following removal from each test medium:

a) Each sample demonstrates positive adhesion and the edges shall not be curled.

b) The marking plate resists defacement or removal as demonstrated by scraping across the test panel with a flat metal blade 1/16 inch (1.6 mm) thick, held at a right angle to the test panel.

c) The printing is legible and is not defaced by rubbing with thumb or finger pressure.

18.2 Oven aging

18.2.1 Three samples of the marking plates under test are to be placed in an air oven maintained at the temperature indicated in Table 18.1 for 240 hours.

Table 18.1
Air-oven test temperatures

Maximum normal operating temperature of surface of applied label Degrees C (F)	Air oven test temperature Degrees C (F)
60 (140) or less	87 (189)
80 (176) or less	105 (221)
100 (212) or less	121 (250)
125 (257) or less	150 (302)
150 (302) or less	180 (356)

18.3 Immersion

18.3.1 Three samples of the marking plates under test are to be immersed in water at a temperature of 23 ±2EC (73.4 ±3.6EF) for a period of 48 hours.

18.4 As-received

18.4.1 Three samples of the marking plates under test are to be tested as-received.

MANUFACTURING AND PRODUCTION TESTS

19 General

19.1 To determine compliance with these requirements in production, the manufacturer shall provide the necessary production control, inspection, and tests. The program shall include at least the following:

a) The refrigerant-containing parts of every component shall be tested and proved tight at not less than the marked design pressure.

Exception 1: A method other than pressure testing at the design pressure may be employed if it can be demonstrated that the alternate test method produces results that are at least equivalent to the pressure test method.

Exception 2: The following high-side components need not be pressure tested.

a) Components that are formed by spinning down the ends of a single piece of copper tubing meeting the minimum wall thickness requirements.

b) Components constructed of continuous tubing meeting the minimum wall thickness requirements.

b) **Deleted February 25, 1994**

c) **Deleted February 25, 1994**

d) The manufacturer shall conduct a Strength Test, see (e), on components of the shell type which have an inside diameter greater than 3 inches (76 mm), except that vessels bearing the ASME Code "U" symbol need not be so tested.

e) The tests specified in (d) shall be conducted on at least one sample of each size and type. The sample shall not fail when subjected to pressures indicated under Strength Tests. These tests shall be conducted at least once every three months on current production, and records of such tests are to be made available for review.

f) Components which permit leakage shall be rejected or repaired. Components which have been repaired shall be retested as required for that particular component.

19.1 revised February 25, 1994

19.2 If the test described in 19.1(a) is conducted prior to reforming or bending of the coil assembly, the test is to be repeated on at least one finished coil assembly from each production run, but not less than four times each year. Records of such tests are to be made available for review.

19.2 added February 25, 1994

MARKING

20 General

20.1 A component shall be permanently marked with the following. See 20.3.

a) The manufacturer's or private labeler's name or identifying symbol.

b) A distinctive model, part number, or type designation.

c) The kind of refrigerant(s) to be used.

Exception: Unless tested specifically for a certain refrigerant because of required tests on gaskets and the like, a component that does not employ a refrigerant holding charge need not be marked with the kind of refrigerant if a tag or marking on the shipping carton is provided indicating that the design pressure shall not be less than the values outlined in Section 8.2 of ANSI/ASHRAE 15 for the refrigerant used in the system. The marking shall also indicate that after charging the equipment shall be marked with the refrigerant used and the oil used.

d) The refrigerant design pressure, except for fusible plugs and rupture members.

e) Fusible plugs in addition to items (a) and (b) shall be stamped with the relief temperature in degrees Fahrenheit.

f) Rupture members in addition to items (a) and (b) shall be stamped with the minimum and maximum bursting pressures, psig.

g) The design pressure of the water-containing section of refrigerant-containing components intended to be connected to a water source.

20.1 revised February 25, 1994

20.1.1 A component manufactured of copper or brass material that does not employ a kind of refrigerant marking shall have a tag or marking indicating that the component is not suitable for use with ammonia (R717). This marking may be on the shipping box or carton.

20.1.1 added February 25, 1994

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20.2 A marking that is required to be permanent shall be molded, die-stamped, paint-stenciled, stamped or etched metal that is permanently secured, or indelibly-stamped lettering or pressure-sensitive labels secured by adhesive, that, upon investigation, see 18.1.1–18.4.1, is found to be adequate for the application. Ordinary usage, handling, and the like, of the apparatus, and the atmosphere in which used are considered in the determination of the permanency of the marking.

20.3 The markings may be on one or more plates or, except for 20.1 (a), (d), (e), (f), and (g), those markings which cannot be adequately marked on the component, due to size, material, or otherwise, shall be placed on the carton or other container in which the component is shipped or on a separate sheet or tag of specifications to be included in each carton or container.

20.4 Except as indicated in 20.5, a component exposed to both high side and low side pressures, such as heat exchangers, shall be marked with the appropriate high side and low side design pressures.

20.5 A component exposed to both high side and low side pressures, such as heat exchangers, may be marked with only the maximum design pressure provided that all parts have been individually tested at not less than the marked design pressure indicated.

20.6 The kind of refrigerant shall be designated by number. The number shall be prefixed or suffixed with the word "Refrigerant" or it shall be prefixed with the letter "R" or the trade name of the refrigerant. Combinations of these marks are acceptable, except that employing the letter "R" and the word "Refrigerant" in the same marking group is not appropriate.

20.6 revised February 25, 1994

20.7 Examples for refrigerant marking are as follows: R 12, Refrigerant 12, or 12 Refrigerant: (Trade Name) 12, (Trade Name) R12, or (Trade Name) 12 Refrigerant, as shown in the Number Designation and Safety Classification of Refrigerants, ANSI/ASHRAE 34-1992.

20.7 revised February 25, 1994

20.8 If a manufacturer produces components at more than one factory, each individual assembly shall have a distinctive marking to identify it as the product of a particular factory.

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Superseded requirements for

the Standard for

Refrigerant-Containing Components and Accessories, Nonelectrical

UL 207, Sixth Edition

The requirements shown are the current requirements that have been superseded by requirements in this edition. The numbers in parentheses refer to the new requirements with future effective dates that have superseded these requirements. To retain the current requirements, do not discard the following requirements until the future effective dates are reached.

11.1 The discharge capacity of a fusible plug or rupture member in pounds of air per minute shall be determined by the following formula:

$$C = 0.8Pd^2$$

where:

C – Rated discharge capacity in pounds of air per minute (kg/s x 132.3).

d – Smallest of the internal diameter of the inlet pipe, retaining flanges, fusible plug or rupture member in inches (mm x 0.039).

P – (For fusible plugs) – Absolute saturation pressure, corresponding to the marked melting temperature of the fusible plug or the critical pressure of the refrigerant used, whichever is smaller, psig (kPa x 0.145).

P – (For rupture members) – 14.7 plus [Nominal rated rupture pressure in psig (kPa x 0.145) multiplied by 1.1]. See 15.3.

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