UL 207

STANDARD FOR SAFETY

Refrigerant-Containing Components and Accessories, Nonelectrical

UL Standard for Safety for Refrigerant-Containing Components and Accessories, Nonelectrical, UL 207

Ninth Edition, Dated August 26, 2022

Summary of Topics

This new edition of ANSI/UL 207 dated August 26, 2022 includes the following changes in requirements:

– Revisions to 17.2 to remove reference to the deleted Table 11.1, Refrigerant minimum design pressures

– Revision to 9.8 to include ASHRAE Group 2L Refrigerants

The revised requirements are substantially in accordance with Proposal(s) on this subject dated October 15, 2021, February 25, 2022, May 20, 2022, and July 22, 2022.

No Text on This Page

ANSI/UL 207-2022

UL 207

Standard for Refrigerant-Containing Components and Accessories, Nonelectrical

The First edition was titled Refrigerant-Containing Components and numbered, UL 207 (C).

First Edition – January, 1954
Second Edition – October, 1973
Third Edition – May, 1975
Fourth Edition – January, 1982
Fifth Edition – December, 1986
Sixth Edition – March, 1993
Seventh Edition – November, 2001
Eighth Edition – April, 2009

Ninth Edition

August 26, 2022

This ANSI/UL Standard for Safety consists of the Ninth Edition.

The most recent designation of ANSI/UL 207 as an American National Standard (ANSI) occurred on August 26, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

No Text on This Page

CONTENTS

INTRODUCTION

CONSTRUCTION

REFRIGERANT-CONTAINING PARTS

DESIGN PRESSURE

PERFORMANCE

MANUFACTURING AND PRODUCTION TESTS

MARKING

ANNEX A (Normative) – REQUIREMENTS FOR REFRIGERATION FITTINGS

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, 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 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.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.2 A component is not required to comply with a specific requirement that:

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

b) Is superseded by a requirement in this standard.

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

2.4 Specific components are 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.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

4 Terminology

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

5 Undated References

5.1 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.

6 Refrigerants

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

7 Glossary

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

7.2 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.

7.3 CAPILLARY TUBE – Device made of tubing with an outer diameter less than 3/16 in. (4.7 mm) and used to reduce the pressure of the refrigerant between the condenser and evaporator. It also regulates the refrigerant flow.

7.4 CASCADE SYSTEM – A refrigeration system that incorporates two or more independent vapor-compressor refrigeration cycles in series. This is done to acquire low temperatures that may not be readily achieved with a single refrigeration cycle.

7.5 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.

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

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

7.8 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.

7.9 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.

7.10 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.

7.11 CONTINUOUS OPERATING TEMPERATURE – The expected degree of hotness or coldness of a component surface during normal operating conditions and when the component is used in an expected application.

7.12 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.

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

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

7.15 DOUBLE WALL CONSTRUCTION – A refrigerant containing component, such as a heat exchanger having two distinct thicknesses of material separating the fluid on one side of the component from the heat transfer fluid on the other side of the component. A component of this type incorporates either a vented interface or redundant construction to prevent the leakage from one fluid into the other. For the purposes of this definition, the term “fluid” is meant to encompass both liquids and gases.

7.16 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.

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

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

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

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

7.21 FUSIBLE ELEMENT – A metal with a relatively low melting point located within the relief opening of a fusible plug. The metal is intended to melt and flow away allowing the release of pressure if a pre-determined temperature is reached.

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

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

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

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

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

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

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

7.29 LINE SETS, REFRIGERATION – Pipes or tubing carrying refrigerant and connected between a condenser and a remotely located evaporator. One line is the “suction line” (also known as the “return” or “vapor” line) which carries the cooler gas refrigerant from the evaporator to the compressor and the other line is the “liquid line” which carries the warmer liquid refrigerant from the condenser to the expansion device/evaporator. The suction line would typically be insulated and have a larger diameter than the liquid line. These pipes or tubing can be used in both refrigeration or air conditioning applications.

7.30 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.

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

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

7.33 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.

7.34 MAXIMUM ABNORMAL PRESSURE – The maximum pressure that could occur within a specific part of a system during any abnormal operating condition.

7.35 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.

7.36 NOMINAL RATED RUPTURE PRESSURE – The average of the minimum and maximum marked bursting pressures of a rupture member.

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

7.38 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.

7.39 PRESSURE REGULATING RELIEF VALVE – Similar to a pressure relief valve except specifically intended for use with refrigeration systems utilizing carbon dioxide (R744) as the refrigerant. The pressure relief setting of this valve is always lower than the relief setting of a pressure relief valve. This valve may open and re-close many times during the life of the system.

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

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

7.42 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.

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

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

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

7.46 REDUNDANT CONSTRUCTION – A type of double wall construction used within a refrigerant containing component, such as a heat exchanger, that is not provided with a vented interface. Any leakage of a fluid through one wall of the component is prevented from entering the other side of the component by the second (redundant) wall.

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

7.48 RELIEF TEMPERATURE, FUSIBLE PLUG – The temperature at which a complete blowout of the fusible element occurs allowing pressure to be relieved.

7.49 REFRIGERATION FITTING – Device used for joining together tubing, piping or refrigerant-containing components within air conditioning and refrigeration systems including but not limited to flare and compression types; press types and those designed for quick-connection or disconnection. This type of fitting is also considered to be a mechanical joint.

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

7.51 SECONDARY LOOP – A piping circuit containing a fluid circulating within the circuit. The fluid transfers heat from a remote type refrigerator to a colder heat exchanger located within the circuit. The circuit normally includes a circulating pump as well as other associated fittings. Such a circuit is considered to be equivalent to the low-side parts that are located in a refrigeration system.

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

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

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

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

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

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

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

7.59 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.

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

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

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

7.63 VENTED INTERFACE – A type of double wall construction used within a refrigerant-containing component, such as a heat exchanger but in which space exists between the two interior double walls of the component. Any leakage of a fluid through one wall of the component is prevented from entering the other side of the component by being vented to the outside of the component.

7.64 VESSEL, PRESSURE – Any refrigerant-containing receptacle of a refrigerating system, other than certain evaporators, see Table 12.1, evaporator coils, compressors, condenser coils, controls, headers and piping. 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.

7.65 VIBRATION ELIMINATOR – Device made of either a coil of refrigerant tubing or flexible metallic hose and designed to prevent the transmission of noise and vibration from a motor-compressor through the refrigeration or air conditioning piping. The device can be installed in either the suction or discharge lines, or both.

CONSTRUCTION

8 Materials

8.1 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.

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

8.3 Magnesium alloys shall not be used in the fabrication or assembly of a component intended to handle any chlorofluorocarbon (CFC, such as R-11, R-12 or R-502) or hydrochlorofluorocarbon (HCFC, such as R-22 or R-123) refrigerants.

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

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

8.6 With reference to 8.5, 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.

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

8.8 A component made of drawn or machined brass and containing more than 15 % zinc shall be capable of withstanding, without cracking, a Moist Ammonia Air Stress Cracking Test, See Section 24.

8.9 Except for nonmetallic materials used as gaskets or seals, a nonmetallic material, such as thermal insulation, which may be provided on a component and having:

a) Any single unbroken section of the material with a surface area that does not exceed 10 ft^2 (0.93 m^2) shall be marked in accordance with 31.15 and:

1) Be rated 5VA in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94; or

2) Comply with the 127 mm end-product flame test in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

b) Any single unbroken section of the nonmetallic material with a surface area that exceeds 10 ft^2 (0.93 m^2) shall have a flame spread rating of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with the Standard for Test for Surface Burning Characteristics of Building Materials, UL 723.

NOTE: As an example and in reference to 8.9, pipe/tube insulation having a 2 in (51 mm) outside diameter and more than 19 ft (5.8 m) long will exceed 10 ft^2 (0.93 m^2).

9 Refrigerant Tubing

9.1 Unless subjected to the tests specified in Sections 18 or 20, copper or steel tubing provided to interconnect components shall have a wall thickness not less than indicated in Table 9.1.

9.2 Components constructed of continuous tubing or of lengths of tubing having telescoped joints shall either:

a) Comply with the minimum thickness requirements of Table 9.1 and not exceed 1-1/2 inches (38 mm) outside diameter; or

b) Be tested in accordance with Sections 18 or 20.

9.3 Special alloys or constructions used in component, including tubing with a wall thickness less than indicated in Table 9.1 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, ASHRAE 15, as compared to tubing of the minimum wall thickness indicated.

9.4 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.

9.5 Copper or steel 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 9.1
Wall Thickness for Aluminum, Copper and Steel Tubing

Outside diameter,		Minimum wall thickness, inches[a] (mm)							
		Copper				Steel		Aluminum	
		Protected		Unprotected[b]		Protected or unprotected		Protected or unprotected	
Inches	(mm)	Inches	(mm)	Inches	(mm)	Inches	(mm)	Inches	(mm)
3/16	(4.76)	0.0245	(0.62)	0.0265	(0.67)	0.025	(0.64)	0.0350	(0.89)
1/4	(6.35)	0.0245	(0.62)	0.0265	(0.67)	0.025	(0.64)	0.0350	(0.89)
5/16	(7.94)	0.0245	(0.62)	0.0265	(0.67)	0.025	(0.64)	0.0350	(0.89)
3/8	(9.53)	0.0245	(0.62)	0.0265	(0.67)	0.025	(0.64)	0.0350	(0.89)
1/2	(12.70)	0.0245	(0.62)	0.0285	(0.72)	0.025	(0.64)	0.0350	(0.89)
5/8	(15.88)	0.0315	(0.80)	0.0315	(0.80)	0.032	(0.81)	0.0488	(1.24)
3/4	(19.05)	0.0315	(0.80)	0.0385	(0.98)	0.032	(0.81)	0.0488	(1.24)
7/8	(22.23)	0.0410	(1.04)	0.0410	(1.04)	0.046	(1.17)	0.0650	(1.65)
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 7.59.

9.6 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 8.7 and 9.3.

9.7 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, SAE J513f.

9.8 Joints on tubing used on components for use with Group 2, 2L, or 3 refrigerants, as classified in the Safety Code for Mechanical Refrigeration, ASHRAE 15, shall be brazed or welded joints or be refrigeration fittings complying with 15.1. See 7.25.

9.9 Copper tubing joints not complying with 9.8 shall be soldered joints and be intended for use only with Group 1 refrigerant.

9.10 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.

REFRIGERANT-CONTAINING PARTS

10 General

10.1 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.

10.2 Heat exchangers intended for the connection of a potable water system shall be of double wall construction and be marked as specified in 32.2.

10.3 Heat exchangers with other than double wall (e.g., single-wall construction) shall not be intended for connection to a potable water system. The heater exchanger shall be marked as specified in 32.3.

10.4 A vented interface provided in a heat exchanger shall have continuity to enable water to exit the vented interface when tested in accordance with 18.4.1(a).

10.5 A vented interface provided in a heat exchanger shall have sufficient strength to withstand, without leaking, not less than 1-1/2 times the maximum rated design pressure for the highest pressure refrigerant intended for use in either side of the heat exchanger when tested in accordance with 18.4.1(b).

11 Pressure Vessels

11.1 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 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 ASME Boiler and Pressure Vessel Code, Section VIII.

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

12 Pressure Relief

12.1 Except as specified in 12.2, a pressure vessel shall be provided with the type of pressure-relief specified in Table 12.1.

Table 12.1
Pressure Relief Type Based on Pressure Vessel Size

Pressure vessel inside diameter in (mm)	Pressure vessel internal gross volume ft^3 (m^3)	Type of pressure relief required
Over 3 (76)	3 (0.085) or less	Fusible plug, rupture member or pressure-relief valve
Over 3 (76)	Over 3 (0.085) but less than 10 (0.283)	Rupture member or pressure- relief valve
Over 3 (76)	10 (0.283) or more	At least one pressure-relief valve in parallel with a second pressure-relief valve[a]
Over 3 (76) but not over 6 (152)[b]	Over 0.5 (0.014)[c]	Fusible plug, rupture member or pressure-relief valve
Over 6 (152)[b]	Over 0.5 (0.014)[c]	Rupture member or pressure- relief valve

[a] If only a single pressure-relief valve is provided, the pressure vessel shall be intended for use in a system where the pressure-relief valve discharges into the low pressure side of the refrigerant system. This type of pressure relief valve shall not be adversely affected by back pressure.

[b] Applies only to an evaporator or part of an evaporator intended for use as a pressure vessel.

[c] If each separate section of an evaporator or the total volume of an evaporator does not exceed 0.5 ft^3 (0.014 m^3), the evaporator is not considered a pressure vessel.

12.2 A pressure vessel not provided with the pressure relief specified in 12.1 and Table 12.1 shall have provision, such as a fitting(s) for the installation of the required pressure relief.

12.3 Except as specified in 12.4, there shall be no stop valve between the pressure-relief and the components being protected.

12.4 In reference to 12.3, if a stop valve is located between the component and the pressure-relief, the component shall exceed 10 ft^3 (0.283 m^3) of internal gross volume and the parallel pressure relief valves required by Table 12.1 shall be arranged so that only one can be rendered inoperative at a time for testing or repair purposes.

13 Relief Valves

13.1 Except as specified in 13.2, pressure-relief and pressure regulating-relief valves shall:

a) Comply with the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII;

b) Bear the authorized Code "UV" symbol; and

c) Be marked with the set pressure, capacity, and pipe size of the valve inlet.

13.2 In reference to 13.1, pressure-relief and pressure regulating-relief valves of less than nominal 1/2 inch pipe size and:

a) Not bearing the code "UV" symbol shall be provided with evidence of certification of the valve; and

b) Not marked with the set pressure, capacity and pipe size of the valve inlet shall have this information stamped on a metal plate attached to the valve.

13.3 The set minimum start-to-discharge pressure for pressure-relief valves shall not exceed the marked design pressure of the pressure vessel protected. When a pressure-relief valve is located on a pressure vessel intended to utilize carbon dioxide (R744) in a secondary loop or a cascade system, the start-to-discharge pressure shall not be less than 500 psig (3448 kPa) for high-side parts and 300 psig (2069 kPa) for low-side parts.

13.4 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 in accordance with the calculations specified in the Safety Code for Mechanical Refrigeration, ASHRAE 15.

13.5 The marked discharge capacity of a pressure regulating relief valve shall be not less than 20 % of the marked discharge capacity of a required pressure relief valve.

14 Fusible Plugs or Rupture Members

14.1 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, ASHRAE 15.

15 Refrigeration Fittings

15.1 Refrigeration fittings for use with refrigerant-containing components, tubing, line sets and related equipment shall be connected by brazing or welding or comply with:

a) Annex A of this Standard in addition to any relevant requirements within this Standard;

b) The Standard for Tube Fittings for Flammable and Combustible Fluids, Refrigeration Service, and Marine Use, UL 109; or

c) The Standard for Refrigerating Systems and Heat Pumps – Qualification of Tightness of Components and Joints, ISO 14903.

16 Refrigeration Line Sets

16.1 Copper or steel tubing or piping intended for use as a refrigeration line set shall:

a) Be subject to the relevant tests in Sections 18 – 20; or

b) Be copper tubes, with a rated pressure not intended to exceed 700 psig (4.83 MPa) at 250 °F (121 °C) and comply with Standard Specification for Seamless Copper Tubes for Linesets, ASTM B1003-16; or

c) Have a wall thickness complying with one of the following:

1) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service, ASTM B280-18; Table 1: "Standard Dimensions and Weights, and Tolerances in Diameter and Wall Thickness for Straight Lengths", for straight lengths of copper tubing; or

2) ASTM B280-18; Table 2: "Standard Dimensions and Weights, and Tolerances in Diameter and Wall Thickness for Coil Lengths", for coil copper tubing; or

3) Nominal Pipe Size (NPS), Schedule 80, for steel pipe; or

4) NPS, Schedule 40 for steel pipe intended for use only with refrigerants designated as Group A1 in accordance with the Standard for Designation and Safety Classification of Refrigerants, ANSI/ASHRAE 34; or

5) Standard Specification for Seamless Copper Pipe, Standard Sizes, ASTM B42-15a; Table 3, "Standard Dimensions, Weights, and Tolerances", for copper pipe; or

6) Standard Specification for Seamless Copper Water Tube, ASTM B88-16; Table 1, "Dimensions, Weights, and Tolerances in Diameter and Wall Thickness for Nominal or Standard Copper Water Tube Sizes", for type K or type L copper tube.

16.2 In reference to 16.1, Type F steel pipe as specified in the Standard for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless, ASTM A53/A53M, shall not be used as a refrigeration line set.

16.3 In addition to any tests in Sections 18 – 25 that may apply, refrigeration line sets shall comply with Sections 26 – 28.

DESIGN PRESSURE

17 General

17.1 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.

17.2 Except as indicated in 17.3 the minimum design pressure shall not be less than 15 psig (103 kPa), and not less than the saturation pressure of the refrigerant at the following temperatures.

a) Low sides of all systems 80 °F (26.7 °C)

b) High side of water or evaporatively cooled systems 105 °F (40.6 °C)

c) High sides of air-cooled systems 125 °F (51.7 °C)

17.3 In reference to 17.2, the design pressure marked on a refrigerant-containing component intended to utilize carbon dioxide (R744) in a secondary loop or a cascade system shall be not less than 500 psig (3448 kPa) for high-side parts and 300 psig (2069 kPa) for low-side parts.

PERFORMANCE

18 General

18.1 Refrigerant-containing parts: high side

18.1.1 The requirements of 18.1.2 – 18.1.7 shall be applied to components designed for installation in the high side of the refrigeration system. The requirements shall also be applied 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.

18.1.2 A component or section of a component exposed to high side pressure shall:

a) Withstand without failure a pressure equal to five times the higher of the pressures specified in 18.1.3; or

b) Comply with the Fatigue Test in Clause 20; or

c) Withstand without failure a pressure equal to three times the higher of the pressures specified in 18.1.3, if the component additionally complies with 18.1.5.

18.1.3 In reference to 18.1.2 (a) and (c), the test pressures shall be based on the higher of the following:

a) Refrigerant minimum high side design pressure specified in 17.2 (b) or (c);

b) Design pressure marked on the component;

c) Start-to-discharge pressure of the relief device, if the component is intended to be protected by a pressure relief device; or

d) Nominal rated rupture pressure (see 7.36) of a rupture member.

18.1.4 For heat exchangers, the test shall be conducted with the low or water side unpressurized (open to the atmosphere).

18.1.5 A refrigerant containing component complying with 18.1.2(c), shall be intended for use in a refrigeration system in which the critical pressure of the refrigerant is designed to be exceeded. In addition, the component shall be provided with either:.

a) A pressure relief valve complying with Clause 13; or

b) The marking specified in 31.13.

18.1.6 In addition to complying with 18.1.2, a component which is provided with a fusible plug shall withstand without failure a pressure equal to the smaller of 2-1/2 times the:

a) Vapor pressure of the refrigerant at the relief temperature of the fusible plug, or

b) Critical pressure of the refrigerant used.

18.1.7 In reference to 18.1.2(b), unless the Fatigue Test in Section 20 is used for determining compliance, refrigerant-containing components intended to utilize carbon dioxide (R744) in a secondary loop or a cascade system shall have an ultimate strength of not less than five times the start-to-discharge value of the pressure relief valve and not less than 2500 psig (17238 kPa).

18.2 Refrigerant-containing parts: low side

18.2.1 The requirements of 18.2.2 – 18.2.7 shall be applied to:

a) Components designed for installation in the low side of a refrigeration system; and

b) Low side pressure vessels other than those described by 11.1.

18.2.2 Except as specified in 18.2.5, a pressure vessel exposed to low side pressure shall withstand without failure a pressure equal to the higher of five times the:

a) Refrigerant minimum low side design pressure specified in 17.2(a);

b) Design pressure marked on the pressure vessel;

c) Start-to-discharge pressure of the pressure relief device, if the pressure vessel is provided with a pressure relief device; or

d) Nominal rated rupture pressure (see 7.36) of a rupture member.

18.2.3 A component other than a pressure vessel exposed to low side pressure shall withstand without failure a pressure equal to three times the:

a) Refrigerant minimum low side design pressure specified in 17.2(a);

b) Design pressure marked on the component;

c) Start-to-discharge pressure of the relief device, if the component is intended to be protected by a pressure relief device; or

d) Nominal rated rupture pressure (see 7.36) of a rupture member.

18.2.4 In reference to 18.2.2 and 18.2.3, for heat exchangers, the test shall be conducted with the high side unpressurized (open to the atmosphere).

18.2.5 If the test specified in 18.2.2 is not conducted, a low side pressure vessel shall be subjected to the Fatigue Test, Clause 20. The Fatigue Test is not applicable to low side components other than pressure vessels.

18.2.6 In addition to complying with 18.2.2 or 18.2.5, a low side pressure vessel which is provided with a fusible plug shall withstand without failure a pressure equal to the smaller of 2-1/2 times the:

a) Vapor pressure of the refrigerant at the relief temperature of the fusible plug; or

b) Critical pressure of the refrigerant used.

18.2.7 In reference to 18.2.2 – 18.2.6, refrigerant-containing components intended to utilize carbon dioxide (R744) in a secondary loop or a cascade system shall have an ultimate strength of not less than three times the start-to-discharge value of the pressure relief valve and not less than 900 psig (6206 kPa).

18.3 Water-containing parts

18.3.1 The requirements of 18.3.2 apply to the water-containing sections of water-cooled condensers, liquid coolers, heat exchangers, and similar components designed for connection to a water source.

18.3.2 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 when tested in accordance with Section 19. The test shall be conducted with any other sections of the component unpressurized (open to the atmosphere).

18.4 Heat exchanger vented interface test

18.4.1 In addition to the tests in 18.1 – 18.3, heat exchangers provided with a vented interface shall be tested:

a) By being connected to a water source at one end of the vented interface. Water at a pressure not higher than 10 psig (69 kPa) shall be allowed to flow into the interface. One sample shall be tested and shall comply with 10.4.

b) According to Section 19 with the pressure to the vented interface held at a value not less than 1-1/2 times the maximum rated design pressure of the highest pressure refrigerant intended for use in either side of the heat exchanger. Two samples shall be tested and both shall comply with 10.5.

19 Strength Tests

19.1 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 medium is to be any nonhazardous liquid, such as water. The test samples are to be filled with the test medium 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 Section 18, 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 19.2 and 19.3.

19.2 When gaskets or mechanical seals, such as mating machined surfaces other than simple threaded joints, are employed in components designed for use with refrigerants classified A1 or A1/A1 in accordance with the Standard for the Designation and Safety Classification of Refrigerants, ASHRAE 34, 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.

19.3 In reference to 19.2, the component shall withstand the required Strength Test pressure even though visible leakage occurs at the gaskets or seals.

20 Fatigue Test

20.1 General

20.1.1 When subjected to the following test, a refrigerant-containing component other than those specified in 20.1.2, shall not rupture, burst, or leak.

20.1.2 A refrigerant-containing component intended for use with refrigerants classified A1 or A1/A1 in accordance with ASHRAE 34 and employing a gasket or seal shall comply with 20.2.1 and 20.3.10 even though visible leakage occurs at the gasket or seal.

20.1.3 When visible leakage occurs as permitted by 20.1.2, leakage shall not occur at or below twice the design pressure marked on the component.

20.2 Test method

20.2.1 Two samples of each refrigerant-containing component shall be completely filled with an incompressible, inert fluid to exclude all air, and connected to a hydraulic pump system. The pressure shall be raised gradually and maintained for 1 minute to the higher of three times the:

a) Maximum abnormal pressure marked on the refrigerant-containing component,

b) Minimum design pressure specified in 17.2 for the refrigerant,

c) Design pressure marked on the component,

d) Start-to-discharge value of the pressure relief valve for refrigerant-containing components intended to utilize carbon dioxide (R744) in a cascade system.

20.3 Cycle test specification

20.3.1 For aluminum, copper or steel components, the test temperature shall be conducted based on the continuous operating temperature marked on the component (see 31.12) as follows:

a) For aluminum or copper components with a continuous operating temperature of:

1) 250 °F (121 °C) or less, the test temperature shall be not less than 68 °F (20 °C)

2) Over 250 °F (121 °C), the test temperature shall be not less than 300 °F (149 °C)

b) For steel components with a continuous operating temperature of:

1) 400 °F (204 °C) or less, the test temperature shall be not less than 68 °F (20 °C)

2) Over 400 °F (204 °C), the test temperature shall be not less than 500 °F (260 °C)

20.3.2 For materials differing from or temperatures higher than those specified in 20.3.1, the effects of temperature on the material fatigue characteristics shall be evaluated.

20.3.3 Three samples of each refrigerant-containing component shall be completely filled with an incompressible, inert fluid to exclude all air, and connected to a pressure driving source. The samples used for this part of the test may be different from the ones used in the test described in 20.2.1.

20.3.4 The test pressure for the first cycle shall be the pressure identified in 20.2.1 prior to multiplying by three.

20.3.5 Except as specified in 20.3.6 the test pressure for the remainder of the test cycles shall be as follows:

a) Except as indicated in (c), for components subject to high side pressures, the upper pressure value shall not be less than the saturated vapor pressure of the refrigerant at 120 °F (49 °C), and the lower pressure value shall not be greater than the saturated vapor pressure of the refrigerant at 40 °F (4.4 °C).

b) Except as indicated in (c), for pressure vessels subjected to only low side pressures, the upper pressure value shall be not less than the saturated vapor pressure of the refrigerant at 80 °F (26.7 °C), and the lower pressure value shall be any convenient value between 0 psig, and the greater of either:

1) 5 psig (34.5 kPa), or

2) the saturated vapor pressure of the refrigerant at 10 °F (minus 12.2 °C).

When the saturated vapor pressure of the refrigerant at 10 °F (minus 12.2 °C) is a negative value, then 20.3.5(b) is intended to permit the lower pressure value to be any convenient value between 0 psig (0 kPa) up to and including 5 psig (34.5 kPa).

c) For refrigerant containing components intended to utilize carbon dioxide (R744) in a cascade system, the upper pressure value shall not be less than the start-to-discharge value of the pressure regulating relief valve. The lower pressure shall be not more than 100 psig (690 kPa).

20.3.6 If the component is marked with a refrigerant having a vapor pressure at 120 °F (49 °C) that equals or exceeds the critical pressure of the refrigerant, then the upper pressure for the remaining cycles shall be not less than 95 % of the first cycle test pressure as determined by 20.3.4.

20.3.7 In reference to 20.3.6, the lower pressure for all cycles shall not be greater than the saturated vapor pressure of the refrigerant at 40 °F (4.4 °C). For R744, this value is 553 psig (3.8 MPa).

20.3.8 The pressure within each sample shall be raised and lowered such that the full specified upper and lower pressure cyclic values are maintained for at least 0.1s. The rate at which the pressure is cycled between upper pressure and the lower pressure is unspecified.

20.3.9 The number of cycles shall be not less than 250,000.

20.3.10 Following the specified number of test cycles, the test pressure shall be increased and maintained for 1 minute without rupture, burst or leak at the higher of:

a) Two times the minimum upper pressure values specified in 20.3.5; or

b) One and one-half times the design pressure marked on the component

20.3.11 If a component is marked for use with more than one refrigerant in accordance with 31.4, either the:

a) Upper and lower cycle pressure test values shall be based on the refrigerant having the highest saturated pressure if the difference between the highest pressure refrigerant upper and lower cycle values exceeds the difference between the lowest pressure refrigerant upper and lower cycle values; or

b) Upper cycle pressure test values shall be based on the refrigerant having the highest saturated pressure; and the lower cycle pressure test values shall be based on the refrigerant having the lowest saturated pressure.

21 Rupture Member Test

21.1 Rupture members having a nominal rated rupture pressure (see 7.36) that:

a) Does not exceed 40 psig shall burst within ±2 psig of their nominal rated rupture pressure; or

b) Exceeds 40 psig shall burst at a pressure within ±5 % of their nominal rated rupture pressure.

21.2 Three samples of each size are to be tested as follows. Each sample is to be installed as intended and 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 % of the marked minimum bursting pressure per minute after the pressure reaches 90 % of the marked minimum bursting pressure.

22 Fusible Plug Test

22.1 When tested as specified in 22.2, a fusible plug shall:

a) Function within 10 °F (5.6 °C) of its marked relief temperature rating; and

b) Have a fusible element blowout of the relief opening that permits the required minimum discharge specified in 14.1.

22.2 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 20 °F (11.1 °C) below the marked temperature of the plug. After 5 minutes, the temperature is to be increased at the rate of 1 °F (1/2 °C) per minute until blowout of the fusible element occurs.

23 Regulating Relief Valve Endurance Test

23.1 This test applies to pressure regulating relief valves which may be used on pressure vessels using carbon dioxide (R744) in a secondary loop or in a cascade system.

23.2 Three samples of the valve are to be tested. Each sample is to be connected to a gas source, such as air, carbon dioxide, or nitrogen, but oxygen or any flammable gas is not to be used. The sample is to be immersed in water, and the pressure is to be gradually increased until the valve starts to discharge as evidenced by the occurrence of bubbles in the water.

23.3 The average of the initial three start-to-discharge pressure values is to be used as a reference and this average value shall not exceed the marked setting of the regulating relief valve. Also, each individual sample shall have a start-to-discharge pressure within ±7 % of the marked setting of the regulating relief valve.

23.4 The same three test samples shall then be cycled 300 times between the start-to-discharge pressure and any lower pressure such that no air is discharged through the test samples.

23.5 At the conclusion of the test, the start-to-discharge pressure obtained on the final cycle for each of the three test samples shall be averaged and compared to the initial referenced value. The final averaged value shall be within ±7 % of the initial averaged reference value and each individual sample valve shall have a start-to-discharge pressure within ±10 % of the marked setting of the regulating relief valve.

24 Moist Ammonia Air Stress Cracking Test

24.1 General

24.1.1 Except as specified in 24.1.2, after being subjected to the conditions described in 24.1.3 and either 24.2 or 24.3, a part made of drawn or machined brass and containing more than 15 % zinc shall be examined using 25X magnification and shall show no evidence of cracking. At least three samples of the part shall be tested.

24.1.2 If one of the three tested samples displays evidence of cracking, then all three samples shall comply with 18.1 for high-side parts or 18.2 for low side parts.

24.1.3 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 24.1. Teflon® tape or pipe compound is not to be used on the threads.

Table 24.1
Torque Requirements for Threaded Connections

Nominal thread size	Torque	
inches	pound-inches	(N·m)
1/8	150	(16.9)
1/4	250	(28.2)
3/8	450	(50.8)
1/2	800	(90.5)
3/4	1000	(113.0)
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)
4	1900	(214.6)

24.2 10-Day moist ammonia air stress cracking test

24.2.1 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.

24.2.2 An amount of 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 an absolute pressure of 101 ±3 kPa (14.7 ±0.5 psia) and at a temperature of 34 ±2 °C (93.2 ±3.6 °F).

24.3 24-Hour moist ammonia air stress cracking test

24.3.1 The 24-Hour Moist Ammonia Air Stress Cracking Test shall be considered to be an alternate method for the 10-Day Moist Ammonia Air Stress Cracking Test referenced in 24.2.

24.3.2 The three samples shall be tested in accordance with the Standard Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys, ASTM B858. The parts of this ASTM Standard that apply are as follows:

a) Apparatus (Section 6);

b) Reagents and Materials (Section 7);

c) Test Media (Section 8);

d) Test Specimen Preparation (9.3 – 9.4); and

e) Test Procedure (10.1 – 10.4) except that the test samples shall be examined using 25X magnification.

24.3.3 The test solution pH level shall be 10.0 – 10.5 and the exposure temperature shall be 77±2 °F (25 ±1 °C).

24.3.4 The test duration shall be for not less than 24 h.

25 Marking Plate Adhesion Tests

25.1 General

25.1.1 To determine whether a marking plate secured by cement or adhesive complies with 31.10, 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.

25.1.2 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.

25.2 Oven aging

25.2.1 Three samples of the marking plates under test are to be placed in an air oven maintained at the temperature indicated in Table 25.1 for 240 hours.

Table 25.1
Air-Oven Test Temperatures

Maximum normal operating temperature of surface of applied label °C (°F)	Air oven test temperature °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)

25.3 Immersion

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

25.4 As-received

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

26 General – Refrigeration Line Set Test Conditions and Arrangement

26.1 At least two representative samples of a refrigeration line set together with any refrigeration fittings that may be provided as part of the line set shall be subjected to each test. Additional samples may be used if needed.

26.2 The test ambient temperature shall be maintained at 77 ±5 °F (25 ±3 °C).

26.3 Sample refrigeration line sets and fittings shall be of the straight connector type.

26.4 The wall thickness of each line set test sample shall be the minimum for a specified outside diameter of tube or pipe.

26.5 Each refrigeration line set sample shall be arranged such that:

a) Two female parts of a refrigeration fitting shall be installed on either end of the line set in accordance with the intended fitting installation method or as specified in the fitting installation instructions; and

b) Threads of the male part of each refrigeration fitting shall be lubricated with SAE No. 10 (ISO Grade 32) machine oil and then connected to the female part using the torque specified in the Standard for Tube Fittings for Flammable and Combustible Fluids, Refrigeration Service, and Marine Use, UL 109, 6th Edition, dated June 19, 1997, Table 7.2 “Torque Requirements for Pipe Connections”, or as specified in the refrigeration fitting installation instructions.

27 Refrigeration Line Set Pull Test

27.1 Refrigeration line set tubing or piping shall not pull out of a refrigeration fitting, nor shall the tubing, piping or fitting rupture, if loads are applied axially to a refrigeration line set and its connections.

27.2 The Pull Test, Section 7 in UL 109, shall be conducted except that:

a) If fittings are not provided as part of the line set, appropriate fittings shall be used for connecting the line set sample into the tensile testing machine.

b) The pull load shall be 120 lbf (534 N) if the refrigeration line set is intended to be used only with refrigerants designated as Class A1 in accordance with ANSI/ASHRAE 34.

c) If the line set refrigeration fittings are other than flare or compression type fittings, the pull load shall be based on the pipe or tube size as specified in the “Gas fittings, all types” column of Table 7.1 “Pull Strength Test” of UL 109.

28 Refrigeration Line Set Vibration Test

28.1 A refrigeration line set, including any refrigeration fittings that may be provided as part of the line set, shall be capable of withstanding exposure to vibration without leakage.

28.2 Fittings provided as part of the line set shall be used to connect each sample line set into the stationary metal blocks shown in Figures 8.1 and 8.2 of UL 109. If fittings are not provided as part of the line set, appropriate fittings shall be used to connect the line set sample into the metal blocks.

28.3 The Vibration Test, Section 8 of UL 109, shall be conducted on two sample line sets together with any provided fittings. The female parts of the fitting shall be installed on either end of a line set conforming to the test arrangement, including the overall length, as described in:

a) Figure 8.1 "Vibration Test – Bend" for the "bend" test assembly except that for line set tubing having an outside diameter exceeding 7/16 in (11 mm) and for all rigid (non-flexible) tubing or pipe line sets, a 90° bend may be substituted in place of the coil.

b) Figure 8.2 "Vibration Test – In-Line" for the "in-line" test assembly.

28.4 In reference to 28.3, the male part of each refrigeration fitting shall then be connected into the female part and with the opposite (unthreaded) end of each male part under test secured to a suitable length of steel pipe or tube (that may include any necessary fittings) for connecting into the stationary metal blocks shown in Figures 8.1 and 8.2 of UL 109.

28.5 The tolerances for the test parameters specified in Section 8 of UL 109 shall be as follows:

a) The air pressure source provided to each test assembly shall be 50 ±5 psig (345 ±35 kPa).

b) The amplitude of vibration shall be 0.125 ±0.06 in (3.18 ±1.5 mm).

c) The frequency of vibration shall be 1000 ±20 vibrations per minute.

d) The test duration shall be for not less than 30 consecutive hours.

MANUFACTURING AND PRODUCTION TESTS

29 General

29.1 To determine compliance with these requirements in production, the manufacturer shall provide the necessary production control, inspection, and tests in accordance with:

a) 29.2 – 29.5; and

b) 29.6 or 30.1 for components subjected to the Strength Test in Section 18 or Fatigue Test in Section 20, respectively.

29.2 Except as specified in 29.3, the test program shall include one or more of the following:

a) The refrigerant-containing parts of every component shall be tested and proved tight at pressures not less than those specified in 17.2 and not less than the marked design pressure.

b) Another test method may be employed if it can be demonstrated that the alternate test method produces results that are at least equivalent to item a) above.

29.3 In reference to 29.2, components are not required to be subjected to the production tests if they are formed either:

a) From a single piece of copper tubing having spun-down ends that meet the minimum wall thickness requirements of Table 9.1 and having a design pressure not less than those specified in 17.2, or

b) From continuous copper or steel tubing meeting the minimum wall thickness requirements of Table 9.1.

29.4 When the test described in 29.2(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.

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

29.6 The manufacturer shall conduct a strength test in accordance with Section 18 on components of the shell type which have an inside diameter greater than 3 inches (76 mm), unless the component:

a) Is marked with the ASME Code "U" symbol; or

b) Has been tested in accordance with the Fatigue Test in Section 20. In this case, the test in 30.1 shall be applied.

29.7 The test specified in 29.6 shall be conducted on at least one sample of each size and type. The sample shall not fail when subjected to pressures indicated in Section 19, Strength Tests. These tests shall be conducted a minimum of once every three months on current production, and records of such tests are to be made available for review.

30 Production Fatigue Test

30.1 A Fatigue Test as specified in Section 20 shall be performed annually for any parts or complete systems that were tested in accordance with the Fatigue Test.

MARKING

31 General

31.1 A component shall be legibly and permanently marked with the manufacturer's name, trade name, trademark, or identifying symbol or other descriptive marking by which the organization responsible for the product may be identified.

31.2 Except as specified in 31.3, a component shall be legibly and permanently marked with a distinctive model, part number, or type designation or the equivalent.

31.3 A component not complying with 31.2 shall be provided with a distinctive model, part number, or type designation or the equivalent legibly marked on:

a) The shipping carton;

b) A separate instruction sheet included with the shipping carton; or

c) A tag attached to the component.

31.4 Except as specified in 31.6, 31.7, or 31.8, a component shall be legibly and permanently marked with each refrigerant type for which the component is intended. The refrigerant type shall be specified by a trade name or a refrigerant number.

31.5 In reference to 31.4, if a refrigerant number is marked, it shall not employ the letter “R” and the word “Refrigerant” in the same marking group (e.g., the term “Refrigerant R 134a” is not acceptable), but shall be consistent with the refrigerant number specified in the Standard for Designation and Safety Classification of Refrigerants, ASHRAE 34 and shall:

a) Be prefixed or suffixed with the word “Refrigerant” (e.g., the term “Refrigerant 134a” would be acceptable if this type of refrigerant were used);

b) Be prefixed with the letter “R” (e.g., the term “R 134a would be acceptable if this type of refrigerant were used); or

c) Be prefixed with the refrigerant trade name (e.g. “Trade Name” R134a or “Trade Name” 134a Refrigerant” would be acceptable if the trade name and refrigerant number are used to denote this type of refrigerant).

31.6 In reference to 31.4, a component made of copper or brass and not provided with the refrigerant type marking shall comply with 31.7 if the component is not provided with a holding charge or with 31.8 if the component is provided with a holding charge or has been tested specifically for use with a certain refrigerant. In addition, a statement indicating that the copper or brass component is not suitable for use with ammonia (R717) shall be legibly marked on the component or on:

a) The shipping carton;

b) A separate instruction sheet included with the shipping carton; or

c) A tag or label attached to the component.

31.7 In reference to 31.4 and 31.6, a component without the refrigerant type marking and without a refrigerant holding charge shall:

a) Be marked with the following or equivalent statement: “The design pressure marked on this component shall not be less than the installed system working pressure or less than the values outlined in ASHRAE 15 for the charged refrigerant. After charging, mark the installed equipment with the refrigerant type and oil used.” This marking shall be provided on:

1) The shipping carton;

2) A separate instruction sheet included with the shipping carton; or

3) A separate tag or label attached to the component.

b) Not be tested specifically for a certain refrigerant, such as might be required if certain gasket materials are used.

31.8 In reference to 31.4 and 31.6, a component without the refrigerant type marking and either with a holding charge or which has been tested specifically for a certain refrigerant shall be legibly marked with the refrigerant type on:

a) The shipping carton;

b) A separate instruction sheet included with the shipping carton; or

c) A tag or label attached to the component.

31.9 A component shall be legibly and permanently marked with the refrigerant design pressure in psig (kPa) unless the component is:

a) A fusible plug;