

ANSI/ASHRAE Standard 15

What is ANSI/ASHRAE Standard 15 ?

The following paragraph comes directly from the foreword of Standard 15.

" ASHRAE Standard 15 is directed toward the safety of persons and property on or near the premises where refrigeration facilities are located. It includes specifications for fabrication of refrigerating systems."

Standard 15 has 13 sections. Each section will be briefly summarized. Direct quotes will be shown in italics.

Section 1- PURPOSE

This standard specifies safe design, construction, installation, and operation of refrigeration systems.

Section 2- SCOPE

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

2.2 This standard applies

- a. to the design, construction, test, installation, operation, and inspection of mechanical and absorption refrigeration systems including heat pump systems used in stationary applications,*
- b. to modifications including replacement of parts or components if they are not identical in function and capacity, and*
- c. to substitutions of refrigerant having a different designation.*

Section 3- DEFINITIONS

As its name suggests, this section is essentially a glossary of all the technical terms used in the standard.

Section 4- OCCUPANCY

Occupancy classifications consider the ability of people to leave the building where the refrigeration system is located. The types of occupancy are listed below. The descriptions are paraphrased from the actual standard.

4.1.1 Institutional occupancy A place occupants cannot readily leave without help because they are disabled, debilitated, or confined. Hospitals, nursing homes, asylums, and prisons are examples.

4.1.2 Public assembly occupancy A place where large numbers of people gather and from which occupants cannot quickly leave the space. Auditoriums, ballrooms, classrooms, passenger depots, restaurants, and theaters are examples.

4.1.3 Residential occupancy A place where people live. Residential occupancies include dormitories, hotels, multi-unit apartments, and private residences.

4.1.4 Commercial occupancy A place where people transact business. Commercial occupancies include office and professional buildings, small stores, and work or storage areas that do not qualify as industrial occupancies.

4.1.5 Large mercantile occupancy A place where more than 100 persons gather on levels above or below street level to purchase personal merchandise.

4.1.6 Industrial occupancy A place that is not open to the public that is used to manufacture, process, or store goods such as chemicals, food, ice, meat, or petroleum.

4.1.7 Mixed occupancy occurs when two or more occupancies are located within the same building. When each occupancy is isolated from the rest of the building by tight walls, floors, and ceilings and by self-closing doors, the requirements for each occupancy shall apply to its portion of the building. When the various occupancies are not so isolated, the occupancy having the most stringent requirements shall be the governing occupancy.

Section 5- REFRIGERATING SYSTEM CLASSIFICATION

Section 5 defines refrigerating systems by the method they use for moving heat and the probability of people coming in contact with the refrigerant in the event of a leak. Systems are classified as either direct systems or indirect systems. Indirect systems are further classified by their specific application. Paraphrased descriptions are listed below.

5.1.1 A direct system has an evaporator or condenser that is in direct contact with the air being cooled or heated.

5.1.2 An indirect system uses a secondary refrigerant that is cooled or heated by the refrigerating system. The secondary refrigerant is then circulated to the air to be cooled or heated.

5.1.2.1 An indirect open spray system sprays the secondary coolant into the air to be cooled or heated.

5.1.2.2 A double indirect open spray system uses two heat exchangers. One heat exchanger between the refrigerant and a secondary coolant, and another heat exchanger between this secondary coolant and yet another coolant which is sprayed into the air being heated or cooled.

5.1.2.3 An indirect closed system passes the secondary coolant through a closed circuit in the air being cooled or heated.

5.1.2.4 An indirect, vented closed system passes the secondary coolant through a closed circuit in the air being cooled or heated, except that the secondary loop is in an open or vented tank.

5.2 A Study of Probability

Section 5.2 describes systems as either high probability systems or low probability systems.

5.2.1 High-Probability Systems are systems that would be very likely to release refrigerant into occupied areas in the event of a leak. Examples of high probability systems would be

(a) direct systems

(b) indirect open spray systems in which the refrigerant is capable of producing pressure greater than the secondary coolant.

5.2.2 Low-Probability Systems are systems that would be very unlikely to release refrigerant into occupied space in the event of a leak. Typical low-probability systems are

a. indirect closed systems

b. double indirect systems

c. indirect open spray systems if the secondary coolant pressure remains greater than the refrigerant pressure in all conditions.

5.3 Changing Refrigerant

This section discourages changing refrigerant from the original design by providing a long list of approvals required to change refrigerant. Being a high probability system versus a low probability system matters. What is safe for a low probability system may not be safe for a high probability system. Some designs are classified by the type of refrigerant and secondary coolant used. Do not substitute other chemicals for the refrigerant and/or secondary coolant because a change in chemicals can turn a safe design into a hazardous one.

Section 6- REFRIGERANT SAFETY CLASSIFICATION

Single compound refrigerants are classified for safety according to ASHRAE standard 34. For the purposes of standard 15, zeotropic blends are to be rated according to their worst case fractionation.

Section 7- RESTRICTIONS ON REFRIGERANT USE

This section details in a dizzying array of specificity exactly how much of what kind of refrigerant may be used in which types of systems.

7.1 Restrictions are based on the type of occupancy, the type of refrigeration system, and the refrigerant safety classification.

7.2 Refrigerant Concentration Limits

The concentration of refrigerant in a complete discharge of each independent circuit of high-probability systems shall not exceed the amounts shown in ASHRAE Standard 34. This amount is dependent upon the occupancy, the type of refrigeration system, and the refrigerant safety classification. This is particularly important when designing VRF systems with large, interconnected refrigerant piping networks or systems that use A2L refrigerant. Sections 7.3 – 7.6 provide details for specific types of systems, occupancies, and refrigerant. There is a large section (7.6) describing all the conditions for using an A2L refrigerant in a high probability system. Issues addressed include charge limits, refrigerant leak monitoring systems, and required ventilation systems.

The use of A2, A3, B1, B2, or B3 refrigerant is prohibited in high probability systems designed for human comfort. The total of all flammable refrigerants, types '2' and '3' shall not exceed 1100 pounds. Although ammonia IS a B2 refrigerant, it is NOT considered in this total because ammonia has its own limits.

Section 8- INSTALLATION RESTRICTIONS

This section also contains a large amount of very specific information. A few of the more important items are listed below.

8.1 *Foundations* should be non-combustible.

8.2 *Guards* All moving machinery should be guarded.

8.3 *Safe Access* All serviceable equipment should have a clear and unobstructed approach and access.

8.11.2 Machinery Rooms should have tight fitting doors which swing out.

8.11.5 The machinery room shall contain a detector, located in an area where refrigerant from a leak will concentrate. It should sound an alarm and automatically start a mechanical ventilation system. The alarm should be set at a value not greater than the refrigerant's TLV-TWA.

8.11.9 No open flames or combustion equipment that use combustion air from the machinery room shall be installed in the refrigeration machinery room UNLESS the combustion air is ducted from outside and sealed to prevent any refrigerant leakage from entering the

combustion chamber OR a refrigerant detector automatically shuts down the combustion process in the event of refrigerant leakage.

8.12 The machinery and ventilation equipment shall be operable from outside the equipment room.

Section 9- DESIGN AND CONSTRUCTION OF EQUIPMENT AND SYSTEMS

This section, like the two before it, contains many details. Here are a few of the more important ones.

9.1 Materials

Materials used for piping refrigerant shall be compatible with the refrigerant. Some examples of incompatibility are

- a. Magnesium is not compatible with halogenated refrigerants (CFCs, HFCs, and HCFCs)
- b. Copper is not compatible with ammonia.

9.2 System Design Pressure

Design pressure for mechanical refrigeration

systems shall not be less than gage pressure corresponding to the following temperatures:

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

Refrigerant-Containing Pressure Vessels

Lots of detail in sections 9.3 – 9.15 concerning protection of refrigeration system components from rupture due to excessive pressure. Here are a few important ones:

Pressure vessels like evaporators, condensers, or receivers should be protected by pressure relief valves or fusible plugs.

All pressure vessels should generally conform to ASME standards. Low pressure evaporators are a notable exception. They must be able to withstand 3 times the design pressure, but do not have to meet ASME standards.

For most systems, the discharge from pressure relief valves or rupture disks should be piped outside, away from windows, doors, or fresh air intakes.

The relief valve may discharge inside for systems containing less than 110 lbs of A1 or A2L refrigerant.

Protective enclosures or covers shall be provided for annealed copper tube erected on the premises for Group A2L, A2, A3, B1, B2L, B2, and B3 refrigerants.

Section 10- OPERATION AND TESTING

10.1 Every refrigerant containing part of every system that is erected on the premises ... shall be tested and proved tight after complete installation and before operation.

Systems should be leak tested with dry nitrogen, NOT with compressed air or oxygen.

- Mixtures of dry nitrogen and 5%, by weight, refrigerant are allowed for leak testing.
- 10.2 For systems containing 55 lbs or more of refrigerant, a dated declaration stating when the system was tested, the name of the refrigerant, the field test pressure applied to the high side and the field test pressure applied to the low side.

Section 11- GENERAL REQUIREMENTS

This section details general requirements for the mechanical room.

11.1 General Restrictions—Safeguards

Piping, controls, and refrigeration equipment shall be protected from accidental damage or rupture by external sources.

11.2 Signs and Identification

Each refrigerating system erected on the premises shall be provided with a legible permanent sign indicating

- a. the name and address of the installer,
- b. the refrigerant number and amount of refrigerant,
- c. the lubricant identity and amount, and
- d. the field test pressure applied.

Systems containing more than 110 lb (50 kg) of refrigerant shall have signs designating

- a. valves or switches for controlling the refrigerant flow, the ventilation, and the refrigeration compressors; and
- b. the kind of refrigerant or secondary coolant contained in exposed piping outside the machinery room.

Each entrance to a refrigerating machinery room shall have a legible permanent sign reading “Machinery Room— Authorized Personnel Only.”

11.3 Charging, Withdrawal, and Disposition of Refrigerants.

No service containers shall be left connected to a system except while charging or withdrawing refrigerant.

Refrigerant circuit access ports located outdoors shall be secured to prevent unauthorized access.

11.5 Storing Refrigerant

The total amount of refrigerant stored in a machinery room in all containers shall not exceed 330 lb.

11.6 Periodic Tests

Detectors, alarms, and mechanical ventilating systems shall be tested in accordance with manufacturers’ specifications and the requirements of the authority having jurisdiction.

11.7 Responsibility for Operation and Emergency Shutdown

Refrigeration systems containing more than 55 lb (25 kg) of refrigerant must have directions for the operation of the system including emergency shutdown procedures. Emergency shutdown procedures shall be displayed as near as possible to the refrigerant compressor.

Section 12- PRECEDENCE WITH CONFLICTING REQUIREMENTS

This section states that in the event of a conflict, local building, electrical, fire, mechanical, or other adopted codes take precedence over this standard.

Section 13- LISTED EQUIPMENT

This section states that equipment must be listed by an approved, nationally recognized testing laboratory and used with the refrigerant for which the equipment was designed.