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Refrigerating systems and heat pumps — Safety and environmental requirements —

Part 1: Definitions, classification and selection criteria

Systèmes de réfrigération et pompes à chaleur — Exigences de sécurité et d'environnement —

Partie 1: Définitions, classification et critères de choix

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Foreword

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ISO 5149-1 was prepared by Technical Committee ISO/TC 86, *Refrigerating systems and air conditioning*, Subcommittee SC 1, *Safety of refrigerating systems*.

This first edition of ISO 5149-1, together with ISO 5149-2, ISO 5149-3 and ISO 5149-4, cancels and replaces ISO 5149:1993.

ISO 5149 consists of the following parts, under the general title *Refrigerating systems and heat pumps — Safety and environmental requirements*:

— *Part 1: Definitions, classification and selection criteria*

— *Part 2: Design, construction, testing, marking and documentation*

— *Part 3: Installation site*

— *Part 4: Operation, maintenance, repair and recovery*

Introduction

The purpose of ISO 5149 is to promote the safe design, construction, disposal, installation, and operation of refrigerating systems.

The industry response to the CFC (Chloro Fluoro Carbon) issue has accelerated the introduction of alternative refrigerants. The entry of new refrigerants and blends in the market and the introduction of new safety classifications prompted the revision of ISO 5149:1993.

ISO 5149 is directed to the safety of persons and property on or near the premises where refrigeration facilities are located. It includes specifications for fabricating a tight system.

ISO 5149 is intended to minimize possible hazards to persons, property and environment from refrigerating systems and refrigerants. These hazards are essentially associated with the physical and chemical characteristics of refrigerants as well as the pressures and temperatures occurring in the refrigeration cycles (see Annex A).

Attention is drawn to hazards common to all compression systems, such as high temperature at discharge, liquid slugging, erroneous operation or reduction in mechanical strength caused by corrosion, erosion, thermal stress, fatigue stresses, liquid hammer or vibration.

Corrosion, however, should have special consideration as conditions specific to refrigerating systems arise because of the alternate frosting and defrosting or the covering of equipment by insulation.

Commonly used refrigerants except ammonia (R-717) are heavier than air. Care should be taken to avoid stagnant pockets of heavy refrigerant vapours by proper location of ventilation inlet and exhaust openings. All machinery rooms are required to have mechanical ventilation controlled by oxygen deficiency alarms or refrigerant vapour alarms.

Refrigerating systems and heat pumps — Safety and environmental requirements —

Part 1: Definitions, classification and selection criteria

1 Scope

ISO 5149 specifies the requirements for the safety of persons and property, provides guidance for the protection of the environment and establishes procedures for the operation, maintenance and repair of refrigerating systems and the recovery of refrigerants.

This part of ISO 5149 specifies the classification and selection criteria applicable to the refrigerating systems and heat pumps. These classification and selection criteria are used in ISO 5149-2, ISO 5149-3 and ISO 5149-4.

This part of ISO 5149 applies to:

a) refrigerating systems, stationary or mobile, of all sizes including heat pumps;

b) secondary cooling or heating systems;

c) the location of the refrigerating systems; and

d) replaced parts and added components after adoption of this International Standard if they are not identical in function and in capacity.

This part of ISO 5149 applies to fixed or mobile systems, except to road vehicle air-conditioning systems covered by a specific product standard, e.g. ISO 13043 and SAE J 639.

This part of ISO 5149 is applicable to new refrigerating systems, extensions or modifications of already existing systems, and for used systems being transferred to and operated on another site. Deviations are permissible only if equivalent protection is ensured.

This part of ISO 5149 also applies in the case of the conversion of a system for another refrigerant.

Annex A shows that the amount of refrigerant in a given space, when exceeded, requires additional consideration including use of a machinery room or additional protective measures to avoid the risk of a hazard.

Annex B specifies criteria for safety and environmental considerations of different refrigerants used in refrigeration and air conditioning.

Systems containing refrigerants which are not listed in ISO 817 are not covered by this part of ISO 5149.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 817:—[1)], *Refrigerants — Designation system*

1) To be published.

ISO 5149-2:—[2], *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation*

ISO 5149-3:—[3], *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 3: Installation site*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO 817 and the following apply.

3.1 Refrigerating systems

3.1.1
absorption system
refrigerating system in which refrigeration is effected by evaporation of a refrigerant, the vapour then being absorbed or adsorbed by an absorbent or adsorbent medium, respectively, from which it is subsequently expelled at a higher partial vapour pressure by heating and then liquefied by cooling

3.1.2
cascade system
two or more independent refrigerant circuits where the condenser of one system rejects heat directly to the evaporator of another

3.1.3
direct releasable system
system with one degree of separation from the occupied space

NOTE 1 Systems in which the secondary coolant is in contact with the air or the goods to be cooled or heated (e.g. spray systems) are direct releasable systems.

NOTE 2 For the purpose of this part of ISO 5149, direct and indirect systems are defined with respect to the potential to leak refrigerant into human occupied space. Direct and indirect systems exist where human occupied space is not involved based on the system design.

EXAMPLE Evaporator or condenser of the refrigerating system in contact with the air or the substance to be cooled or heated.

3.1.4
indirect system
system with more than one degree of separation from the occupied space

EXAMPLE Evaporator cools or condenser heats the secondary coolant which passes through closed circuit containing heat exchangers that are in direct contact with the substance to be treated.

3.1.5
double indirect system
indirect system for which the heat-transfer medium passes through a second heat exchanger located externally to the space and cools or heats a second heat-transfer medium fluid which is brought into direct contact with the substance concerned, e.g. by sprays or similar means

3.1.6
limited charge system
refrigerating system in which the internal volume and total refrigerant charge are such that, with the system idle, the allowable pressure is not exceeded when complete evaporation of the refrigerant occurs

2) To be published.

3) To be published.

3.1.7
high pressure side
part of a refrigerating system operating at approximately the condenser pressure

3.1.8
low pressure side
part of a refrigerating system operating at approximately the evaporator pressure

3.1.9
refrigerating system (heat pump)
combination of interconnected refrigerant-containing parts constituting one closed circuit in which the refrigerant is circulated for the purpose of extracting and rejecting heat (i.e. heating and cooling)

NOTE Refrigerating is used to refer to the on-going process, while refrigeration is used to refer to something that is completed, such as the equipment (refrigeration equipment).

3.1.10
self-contained system
complete factory-made refrigerating system in a suitable frame and/or enclosure, that is fabricated and transported complete or in two or more sections and in which no refrigerant-containing parts are connected on site other than by isolation valves, such as companion [block] valves

3.1.11
sealed system
refrigerating system in which all refrigerant-containing parts are made tight by welding, brazing or a similar permanent connection

NOTE A connection that is tightness tested for a leakage rate of less than 3 g refrigerant per year under a pressure of at least 0,25 × PS (see 3.3.3) and where the mechanical joints are prevented from improper use by the need of a special tool (glue, etc.) is considered as a similar permanent connection. This can include capped valves and capped service ports.

3.1.12
system
set of components working together as a mechanism or interconnected network

NOTE Examples of systems are given in 4.2.

3.1.13
unit system
self-contained system that has been assembled, filled, made ready for use and tested prior to its installation and is installed without the need for connecting any refrigerant-containing parts

3.1.14
multisplit system
split system
air conditioner or heat pump incorporating a single refrigerant circuit, multiple indoor unit and one or more outdoor units

3.2 Locations

3.2.1
crawl space
space that is in general accessed for maintenance only and where it is not possible to walk or access by walking

NOTE Usually, the height of crawl spaces is less than 1 m.

3.2.2
exit
opening in the outer wall, with or without door or gate

3.2.3
exit passageway
passageway in the immediate vicinity of the door through which people leave the building

3.2.4
hallway
corridor for the passage of people

3.2.5
machinery room
enclosed room or space, vented by mechanical ventilation, sealed from public areas and not accessible to the public, which is intended to contain components of the refrigerating system

NOTE A machinery room can contain other equipment provided its installation requirements are compatible with the requirements for the safety of the refrigerating system.

3.2.6
occupied space
space bounded by walls, floors and ceilings in buildings which are occupied for a significant period by persons

NOTE 1 Where the spaces around the apparent occupied space are, by construction or design, not air-tight, these shall be considered as part of the human occupied space, e.g. false ceiling voids, crawl ways, ducts, movable partitions and doors with transfer grilles.

NOTE 2 Storage areas, closets, etc. are not considered occupied space.

3.2.7
open air
any unenclosed space, which can or cannot be roofed

3.2.8
special machinery room
machinery room intended to contain only components of the refrigerating system, having no combustion element (except where the refrigerating system is direct gas fired absorption), and accessible only to competent personnel for the purposes of inspection, maintenance and repair

3.2.9
ventilated enclosure
enclosure containing the refrigerating system that does not communicate with the room and has a ventilation system that produces airflow from the enclosures to the open air through a ventilation duct

3.3 Pressures

3.3.1
design pressure
pressure chosen for the strength calculation of each component

NOTE It is used for determining the necessary materials, thickness and construction for components with regard to their ability to withstand pressure.

3.3.2
tightness test pressure
pressure that is applied to test a system or any part of it for tightness under pressure

3.3.3
maximum allowable pressure
PS
maximum pressure for which a system or component is designed, as specified by the manufacturer

3.3.4
strength test pressure
pressure that is applied to test the strength of a refrigerating system or any part of it

3.3.5
ultimate strength of a system
pressure at which a part of the system ruptures or bursts

3.4 Components of refrigerating systems

3.4.1
coil
part of the refrigerating system constructed from pipes or tubes suitably connected and serving as a heat exchanger (evaporator or condenser)

NOTE A header connecting the tubes of the heat exchanger is part of the coil.

3.4.2
compressor
device for mechanically increasing the pressure of a refrigerant vapour

3.4.2.1
compressor unit
combination of one or more compressors and the regularly furnished accessories

3.4.2.2
positive displacement compressor
compressor in which compression is obtained by changing the internal volume of the compression chamber

3.4.2.3
non-positive displacement compressor
compressor in which compression is obtained without changing the internal volume of the compression chamber

3.4.2.4
open compressor
compressor having a drive shaft penetrating the refrigerant-tight housing

3.4.3
heat exchanger
device designed to transfer heat between two physically separated fluids

3.4.4
condenser
heat exchanger in which vaporized refrigerant is liquefied by removal of heat

3.4.5
condensing unit
combination of one or more compressors, condensers or liquid receivers (when required) and the regularly furnished accessories

3.4.6
evaporator
heat exchanger in which liquid refrigerant is vaporized by absorbing heat from the substance to be cooled

3.4.7
pressure vessel
any refrigerant-containing part of a refrigerating system other than:

— compressors;

— pumps;

— component parts of sealed absorption systems;

— evaporators, each separate section of which does not exceed 15 l of refrigerant-containing volume;

— coils;

— piping and its valves, joints and fittings;

— control devices;

— pressure-containing components (including headers) having an internal diameter or largest cross-sectional dimension not greater than 152 mm

3.4.8
fade-out vessel
vapour receiver connected to the low temperature stage of a limited charge cascade system which is of sufficient size to limit the rise in pressure during system standstill

NOTE The receiver provides sufficient volume to accommodate the total refrigerant charge of the circuit as vapour at ambient temperature without exceeding the allowable pressure of the system.

3.4.9
liquid receiver
vessel permanently connected to a system by inlet and outlet pipes for accumulation of liquid refrigerant

3.4.10
internal net volume
volume calculated from the internal dimensions of a vessel, after the subtraction of the volume of the parts within the internal dimensions

3.4.11
refrigerating equipment
components forming a part of the refrigerating system, e.g. compressor, condenser, generator, absorber, adsorber, liquid receiver, evaporator, surge drum

3.4.12
surge drum
vessels containing refrigerant at low pressure and temperature and connected by liquid feed and vapour return pipes to an evaporator(s)

3.5 Piping, joints and fittings

3.5.1
brazed joint
joint obtained by the joining of metal parts with alloys which melt at temperatures in general higher than 450 °C but less than the melting temperatures of the joined parts

3.5.2
companion [block] valves
pairs of mating stop valves, isolating sections of systems and arranged so that these sections can be joined before opening these valves or separated after closing them

3.5.3
compression joint
pipe joint in which the tightening of a nut compresses a shaped ring that presses on the outside of the pipe sealing the system

3.5.4
flanged joint
joint made by bolting together a pair of flanged ends

3.5.5
flared joint
metal–metal compression joint in which a conical spread is made on the end of the tube

3.5.6
header
pipe or tube component of a refrigerating system to which several other pipes or tubes are connected

3.5.7
isolating valves
valves which prevent flow in either direction when closed

3.5.8
joint
connection made between parts which assures the gas tightness

3.5.9
piping
pipes or tubes (including any hose, bellows or flexible pipe) for interconnecting the various parts of a refrigerating system

3.5.10
quick closing valve
shut-off device which closes automatically (e.g. by weight, spring force, quick closing ball) or has a closing angle of 130 degrees or less

3.5.11
service duct
duct containing the electrical supply, refrigerant piping, plumbing, other ducts or equivalent service required for operation of the product

3.5.12
shut-off device
device to shut off the flow of the fluid

3.5.13
tapered thread joint
threaded pipe joint requiring filler materials in order to block the spiral leakage path

3.5.14
three-way valve
service valve that connects one refrigerant line to one or two other refrigerant lines and generally intended to permit servicing part of a refrigerating system without removing the refrigerant from the complete system

3.5.15
welded joint
assembly of metal parts in the plastic or molten state

3.6 Safety devices

3.6.1
bursting disc
disc or foil which bursts at a predetermined differential pressure

NOTE Bursting disc is also called rupture disc or rupture member.

3.6.2
changeover device
valve controlling two safety devices and so arranged that only one can be made inoperative at any one time