

Australian/New Zealand Standard™

**Refrigerating systems and heat
pumps—Safety and environmental
requirements**

**Part 1: Definitions, classification and
selection criteria
(ISO 5149-1:2014, MOD)**



AS/NZS 5149.1:2016

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Australian National Retailers Association
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Consumer Electronics Suppliers Association
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Department of Natural Resources and Mines, Qld
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Green Cooling Association
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Australian/New Zealand Standard™

Refrigerating systems and heat pumps—Safety and environmental requirements

Part 1: Definitions, classification and selection criteria (ISO 5149-1:2014, MOD)

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME-006 Refrigeration, to supersede, in part, AS/NZS 1677.2, *Refrigerating systems, Part 2: Safety requirements for fixed applications*.

The objective of this Standard is to promote the safe design, construction, disposal, installation and operation of refrigerating systems.

This Standard does not address the hazards caused by products of combustion or decomposition of refrigerants. These products may include (but are not limited to) hydrogen fluoride. Exposure to these products can be harmful.

Lubricants and associated hazards are also not covered by this Standard. Lubricants can present significant health and environmental hazards.

AS/NZS 60079.14 is the current Australian/New Zealand Standard on electrical installations design, selection and erection in explosive atmospheres.

The AS/NZS 5149 series 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 (ISO 5149-1:2014, MOD)* (this Standard)

Part 2: *Design, construction, testing, marking and documentation (ISO 5149-2:2014, MOD)*

Part 3: *Installation site (ISO 5149-3:2014, MOD)*

Part 4: *Operation, maintenance, repair and recovery (ISO 5149-4:2014, MOD)*

This Standard is an adoption with national modifications and has been reproduced from ISO 5149-1:2014, *Refrigerating systems and heat pumps—Safety and environmental requirements, Part 1: Definitions, classification and selection criteria*, and has been varied as indicated to take account of Australian/New Zealand conditions. The modifications are specified in the normative Appendix ZZ following the source text.

These modifications to the ISO source text are essential for compliance with this Australian/New Zealand Standard.

Appendix ZA provides guidance and examples on refrigerant charge limit determination for information only.

This Standard is to be read in conjunction with relevant legislation, regulation and national Refrigeration Industry Codes of Practice.

As this Standard is reproduced from an International Standard, the following applies:

- (a) In the source text ‘this International Standard’ should read ‘this Australian/New Zealand Standard’.
- (b) A full point substitutes for a comma when referring to a decimal marker.

References to International Standards should be replaced by references to Australian or Australian/New Zealand Standards, as follows:

<i>Reference to International Standard</i>		<i>Australian/New Zealand Standard</i>	
ISO		AS/NZS	ISO
817	Refrigerants—Designation and safety classification	817	Refrigerants—Designation and safety classification

Only normative references that have an alternative Australian or Australian/New Zealand Standard have been listed.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the annex or appendix to which they apply. A ‘normative’ annex or appendix is an integral part of a Standard, whereas an ‘informative’ annex or appendix is only for information and guidance.

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INTRODUCTION

The purpose of this International Standard is to promote the safe design, construction, disposal, installation, and operation of refrigerating systems.

The industry response to the chlorofluorocarbon (CFC) 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 this International Standard.

This International Standard 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.

This International Standard 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 specific conditions to refrigerating systems arise due to the alternate frosting and defrosting or the covering of equipment by insulation.

Commonly used refrigerants except 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.

AUSTRALIAN/NEW ZEALAND STANDARD

Refrigerating systems and heat pumps—Safety and environmental requirements**Part 1:**

Definitions, classification and selection criteria (ISO 5149-1:2014, MOD)

1 Scope

This International Standard 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;
- d) replaced parts and added components after adoption of this part of ISO 5149 if they are not identical in function and in the capacity.

This part of ISO 5149 applies to fixed or mobile systems, except to 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.

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

[Annex A](#) specifies the limits for the quantity of refrigerant charge permitted in systems in various locations and occupancy classes.

[Annex B](#) specifies the 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 in this part of ISO 5149.

2 Normative references

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

ISO 817:2014, *Refrigerants — Designation and safety classification*

ISO 5149-2:2014, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation*

ISO 5149-3:2014, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 3: Installation site*

3 Terms and definitions

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

3.1 Refrigerating system

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 an occupied space

Note 1 to entry: 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 to entry: For the purpose of this part of ISO 5149, direct and indirect systems are defined with respect to the potential to leak refrigerant into an occupied space. When the system does not serve an occupied space, it can be classed as direct or indirect depending on the system design.

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

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

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

3.1.8 low-pressure side
part of a refrigerating system operating approximately at 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. cooling and heating)

Note 1 to entry: 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 completely, 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 1 to entry: 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 X PS, and where the mechanical joints are prevented from improper use by the need of a special tool (e.g. glue), 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 1 to entry: Examples of systems are given in 4.2.

3.1.13**unit system**

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

3.1.14**split system**

refrigerating system, air conditioner, or heat pump incorporating one or more refrigerant circuits, comprising one or more factory-built indoor units providing cooling or heating to the space and or more factory-built outdoor units

3.1.15**multisplit system**

split system with at least more than one indoor unit

3.2 Location**3.2.1****crawl space**

space that is generally accessed for maintenance only and where it is not possible to walk or access by walking

Note 1 to entry: 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, with mechanical ventilation, sealed from public areas and not accessible to the public, which is intended to contain components of the refrigerating system

Note 1 to entry: A machinery room can contain other equipment provided that the design and its installation requirements are compatible with the requirements for the safety of the refrigerating system.

3.2.6**occupied space**

space in a building which is bounded by walls, floors, and ceilings and which is occupied for a significant period by persons

Note 1 to entry: Where the spaces around the apparent occupied space are, by construction or design, not airtight with respect to the occupied space, these can be considered as part of the occupied space, e.g. false ceiling voids, crawl ways, ducts, movable partitions, and doors with transfer grilles.

3.2.7**open air**

any unenclosed space, possibly but not necessarily 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 enable air to flow from the enclosure to the surrounding space, and has a ventilation system that produces airflow from the enclosures to the open air through a ventilation duct

3.3 Pressure**3.3.1****design pressure**

pressure chosen for the strength calculation of each component

Note 1 to entry: 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 which 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

3.4 Components of refrigerating system

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 1 to entry: 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 refrigerant vapour 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, and
- 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 1 to entry: 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, and surge drum

3.4.12

surge drum

vessel containing refrigerant at low pressure and temperature, and connected by liquid feed and vapour return pipes to an evaporator(s)

3.5 Piping, joint, and fitting

3.5.1

brazed joint

joint obtained by the joining of metal parts with alloys which melt at temperatures that is generally higher than 450 °C, but less than the melting temperatures of the joined parts

3.5.2

companion (block) valve

pair 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 valve**

valve which prevent flow in either direction when closed

3.5.8**joint**

connection which assures the gas-tight connection between parts

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° 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 device**3.6.1****bursting disc**

disc or foil which bursts at a predetermined differential pressure

Note 1 to entry: 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

3.6.3**fusible plug**

device containing any material which melts at a predetermined temperature and relieves the pressure

3.6.4**liquid level cut out**

actuated device designed to prevent unsafe liquid levels

3.6.5**overflow valve**

pressure relief device discharging to the low pressure side of the refrigerating system

3.6.6**pressure limiter**

switching device for limiting the pressure that resets automatically

3.6.7**pressure relief device**

pressure relief valve or bursting disc device designed to relieve excessive pressure automatically

3.6.8**pressure relief valve**

pressure-actuated valve held shut by a spring or other means and designed to relieve excessive pressure automatically

3.6.9**refrigerant detector**

sensing device which responds to a pre-set concentration of refrigerant in the environment

3.6.10**safety switching device for limiting the pressure**

type-approved pressure-actuated device that is designed to stop the operation of the pressure generator

3.6.11**self-closing valve**

valve that closes automatically, e.g. by weight or spring force

3.6.12**temperature limiting device**

temperature-actuated device that is designed to prevent excessive temperatures

Note 1 to entry: A fusible plug is not a temperature limiting device.

3.6.13**type-approved component**

component for which the examination is performed on one or more samples of this component by following a recognized standard for type approval

3.6.13.1**type-approved pressure cut out**

safety switching device for limiting the pressure that requires to be manually reset

3.6.13.2**type-approved pressure limiter**

safety switching device for limiting the pressure that automatically resets

3.6.13.3**type-approved safety pressure cut out**

safety switching device for limiting the pressure that requires to be reset manually only with the aid of a tool

3.7 Fluid

3.7.1

lubricant

fluid present in the internal volume of the refrigerating system, present for the main purpose of lubrication of wearing surfaces

3.7.2

azeotrope

blend composed of two or more refrigerants whose equilibrium vapour and liquid phase compositions are the same at a given pressure, but can be different at other condition

Note 1 to entry: See [Table B.3](#).

[SOURCE: ISO 817:2014, 2.5 — Note 1 to entry has been added.]

3.7.3

zeotrope

blend composed of two or more refrigerants whose equilibrium vapour and liquid phase compositions are not the same at any pressure below the critical pressure

[SOURCE: ISO 817:2014, 2.1.44]

Note 1 to entry: See [Table B.2](#).

3.7.4

halocarbon

chemical compound consisting of halogen (fluorine, chlorine, bromine, or iodine), carbon, and in some cases, hydrogen

3.7.5

hydrocarbon

chemical compound consisting of hydrogen and carbon

3.7.6

heat-transfer fluid**HTF**

fluid (e.g. brine, water, air) for the transmission of heat

3.7.7

auto-ignition temperature

lowest temperature of a substance at or above which a chemical can spontaneously ignite in a normal atmosphere, without an external source of ignition, such as a flame or spark

3.7.8

outside air

air from outside of the building

3.7.9

refrigerant

fluid used for heat transfer in a refrigerating system, which absorbs heat at a low temperature and a low pressure of the fluid, and rejects it at a higher temperature and a higher pressure of the fluid usually involving changes of the phase of the fluid

Note 1 to entry: Refrigerants are listed in ISO 817.

[SOURCE: ISO 817:2014, 2.32 — Note 1 to entry has been added.]

3.7.10**refrigerant type**

chemical compound or blend of compounds used as a specific nomenclature designation

Note 1 to entry: Designation is given in ISO 817.

3.7.11**toxicity**

ability of a refrigerant or a heat-transfer fluid to be harmful or lethal or to impair a person's ability to escape due to acute or chronic exposure by contact, inhalation, or ingestion

Note 1 to entry: Temporary discomfort that does not impair health is not considered to be harmful.

3.7.12**flammability**

ability of a refrigerant or heat-transfer fluid to propagate a flame from an ignition source

3.7.13**practical limit**

concentration used for simplified calculation to determine the maximum acceptable amount of refrigerant in an occupied space

Note 1 to entry: Refrigerant Concentration Limit (RCL) is determined by toxicity or flammability tests, but practical limit is derived from RCL or historically established charge limit.

3.8 Heat transfer circuit**3.8.1****heat-transfer circuit**

circuit which is composed of at least two heat exchangers and interconnecting pipes

3.9 Refrigerant disposal**3.9.1****disposal**

to dispose of or to convey a product usually for scrapping or destruction

3.9.2**reclaim**

to process used refrigerants to new product specifications

3.9.3**recover**

to remove refrigerant in any condition from a system and store it in an external container

3.9.4**recycle**

reduction of contaminants in used refrigerants by separating oil, removing non-condensables, and using devices to reduce moisture, acidity, and particulate matter

Note 1 to entry: Devices can include filters and dryers.

3.9.5**reuse**

use (charge) of recovered refrigerant without any processing to remove impurities

3.10 Miscellaneous

3.10.1

factory made

manufactured at a dedicated production location under control of a recognized quality system

3.10.2

dilution transfer opening

opening which allows the leaked refrigerant to flow out from the room to an adjacent room or corridor by density difference, dilution, convection, or ventilation

3.10.3

quantity limit with additional ventilation

charge of refrigerant that results in a concentration equal to the Oxygen Deprivation Limit (ODL), if the total charge leaked with the occupied space

Note 1 to entry: See [A.5](#) for the use of Quantity Limit with Additional Ventilation (QLAV) to manage risk for systems in occupied spaces where the level of ventilation is sufficient to disperse the leaked refrigerant within 15 min.

3.10.4

quantity limit with minimum ventilation

charge of refrigerant that results in a concentration equal to the RCL in a room of non-airtight construction with a moderately severe refrigerant leak

Note 1 to entry: See [A.5](#) for the use of QLAV to manage risk for systems in occupied spaces not below ground level where the level of ventilation is not sufficient to disperse the leaked refrigerant within 15 min. The calculation is based on an opening of 0,003 2 m² and a leak rate of 2,78 g/s.

4 Abbreviated terms

A/C	Air Conditioning systems
ATEL	Acute Toxicity Exposure Limit
GWP	Global Warning Potential
HTF	Heat-Transfer Fluid
ITH	Integration Time Horizon
LFL	Lower Flammability Limit
MSDS	Material Safety Data Sheet
ODL	Oxygen Deprivation Limit
ODP	Oxygen Deprivation Potential
PS	Maximum Allowable Pressure
QLAV	Quantity Limit with Additional Ventilation
QLMV	Quantity Limit with Minimum Ventilation
RCL	Refrigerant Concentration Limit

5 Classification

5.1 Occupancies classification

For the purpose of this International Standard, occupancy classification shall be determined according to [Table 1](#).

Machinery rooms shall not be considered as an occupied space except as defined in ISO 5149-3:2014, 5.1.

Table 1 — Categories of occupancy

Categories	General characteristics	Examples ^a
General occupancy a	Rooms, parts of buildings, building where — sleeping facilities are provided, — people are restricted in their movement, — an uncontrolled number of people are present, or — to which any person has access without being personally acquainted with the necessary safety precautions.	Hospitals, courts or prisons, theatres, supermarkets, schools, lecture halls, public transport termini, hotels, dwellings, and restaurants
Supervised occupancy b	Rooms, parts of buildings, buildings where only a limited number of people can be assembled, some being necessarily acquainted with the general safety precautions of the establishment.	Business or professional offices, laboratories, places for general manufacturing, and where people work
Authorized occupancy c	Rooms, parts of buildings, buildings where only authorized persons have access, who are acquainted with general and special safety precautions of the establishment and where manufacturing, processing, or storage of material or products take place.	Manufacturing facilities, e.g. for chemicals, food, beverage, ice, ice-cream, refineries, cold stores, dairies, abattoirs, and non-public areas in supermarkets
^a The list of examples is not exhaustive.		

NOTE Occupancies can be classified by national requirements.

5.2 Systems classification

5.2.1 General

Refrigerating systems are classified according to

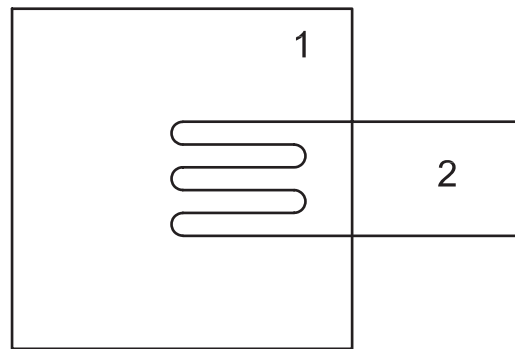
- the method of extracting heat from the atmosphere (cooling),
- the method of adding heat to the atmosphere (heating),
- the substance to be treated, or
- the refrigerant leak entering the occupied space.

5.2.2 Direct releasable system

5.2.2.1 Direct systems

A direct system shall be classed as a direct releasable system if a single rupture of the refrigerant circuit results in a refrigerant release to an occupied space, irrespective of the location of the refrigerant circuit (see [Figure 1](#)).

Direct systems are considered to be located in location classification I (see [5.3.5](#)) or II (see [5.3.4](#)).

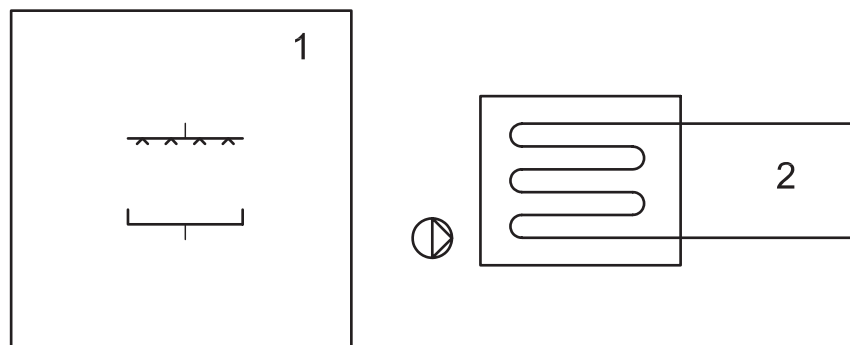
**Key**

- 1 occupied space
- 2 refrigerant-containing part(s)

Figure 1 — Direct system**5.2.2.2 Open spray system**

An open spray system shall be classed as a direct releasable system if the heat-transfer medium is in direct communication with the refrigerant-containing parts of the circuit and the indirect circuit is open to an occupied space (see [Figure 2](#)).

Open spray systems are considered to be located in location classification I (see [5.3.5](#)) or II (see [5.3.4](#)).

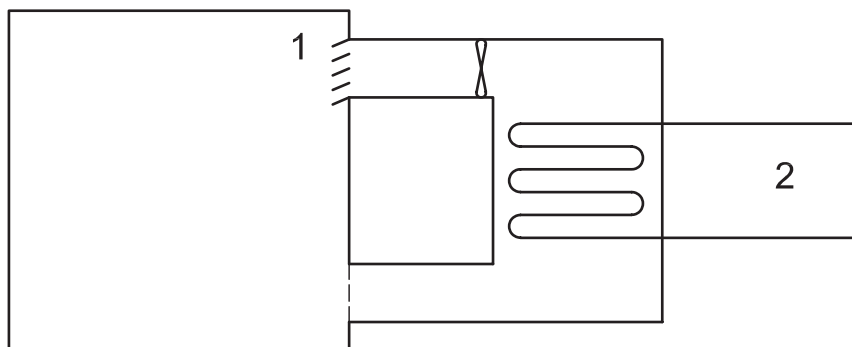
**Key**

- 1 occupied space
- 2 refrigerant- containing part(s)
- ... heat-transfer medium

Figure 2 — Open spray system**5.2.2.3 Direct ducted system**

A direct ducted system shall be classed as a direct releasable system if the conditioned air is in direct communication with the refrigerant-containing parts of the circuit and is supplied to an occupied space (see [Figure 3](#)).

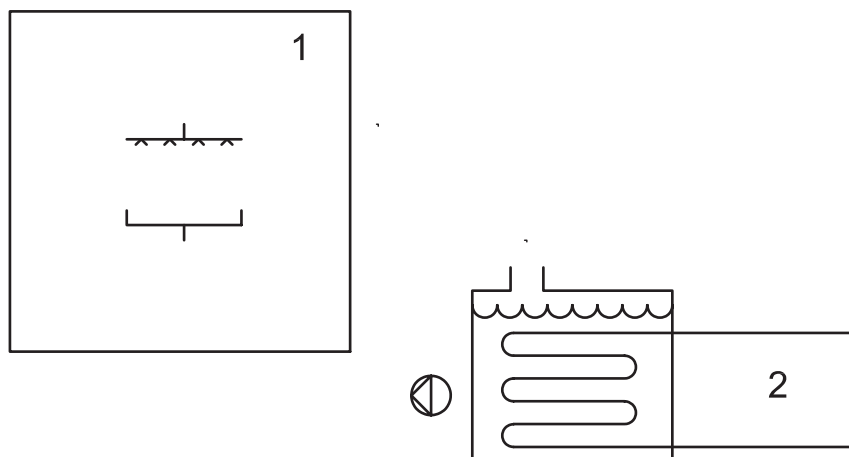
Direct ducted systems are considered to be located in location classification I (see [5.3.5](#)) or II (see [5.3.4](#)).

**Key**

- 1 occupied space
- 2 refrigerant-containing part(s)

Figure 3 — Direct ducted system**5.2.2.4 Open vented spray system**

An open vented spray system shall be classed as a direct releasable system if the heat-transfer medium is in direct contact with refrigerant-containing parts of the circuit and the indirect circuit is open to an occupied space (see [Figure 4](#)). The heat-transfer medium shall be vented to the atmosphere outside the occupied space, but the possibility remains that a single rupture of the refrigerant circuit could result in a refrigerant release to the occupied space.

**Key**

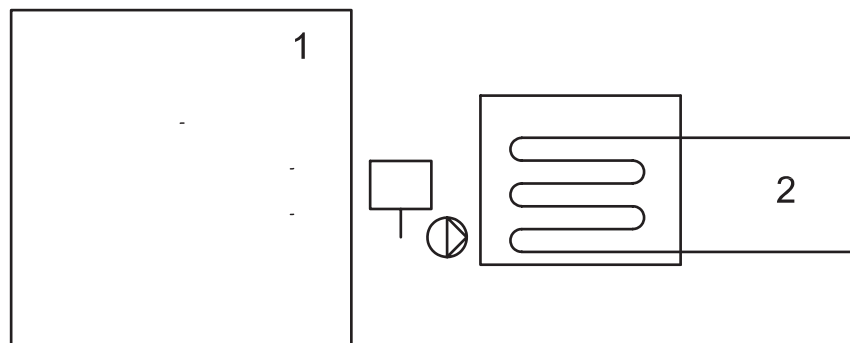
- 1 occupied space
- 2 refrigerant-containing part(s)
- ... heat-transfer medium

Figure 4 — Open vented spray system**5.2.3 Indirect systems****5.2.3.1 Indirect closed system**

An indirect system shall be classed as indirect closed system if the heat-transfer medium is in direct communication with an occupied space, and a refrigerant leak into the indirect circuit can enter the occupied space if the indirect circuit also leaks or purged (see [Figure 5](#)).

Indirect closed systems are considered to be located in location classification I (see [5.3.5](#)) or II (see [5.3.4](#)).

NOTE A pressure relief device (or purger) on a secondary circuit is an appropriate method to prevent the refrigerant leaking into the occupied space. Such a system is not considered as an indirect closed system (see [5.2.3.3](#)).



Key

- 1 occupied space
- 2 refrigerant-containing part(s)
- ... heat-transfer medium

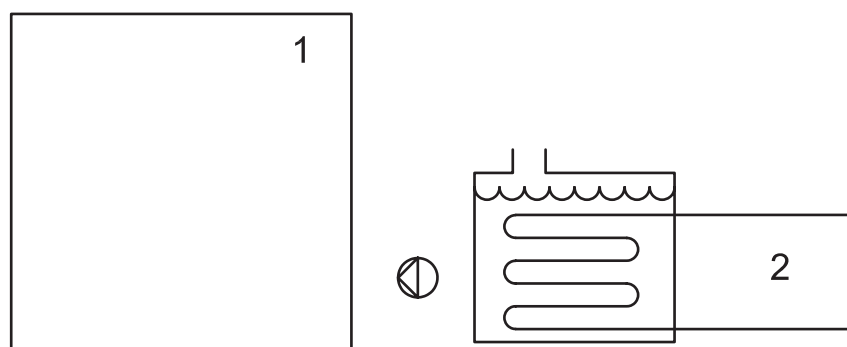
Figure 5 — Indirect closed system

5.2.3.2 Indirect vented system

An indirect system shall be classed as indirect vented system if the heat-transfer medium is in direct communication with an occupied space, and a refrigerant leak into the indirect circuit can vent to atmosphere outside the occupied space (see [Figure 6](#)).

NOTE This can be achieved by using a double-walled heat exchanger.

Indirect vented systems are considered to be located in location classification III (see [5.3.3](#)).



Key

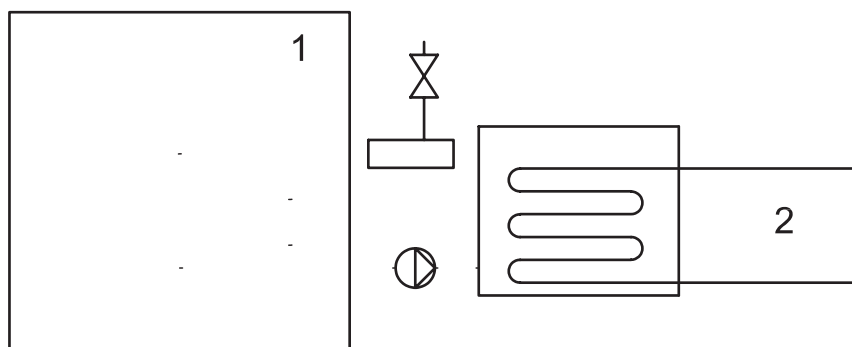
- 1 occupied space
- 2 refrigerant-containing part(s)
- ... heat-transfer medium

Figure 6 — Indirect vented system

5.2.3.3 Indirect vented closed system

An indirect system shall be classed as an indirect vented closed system if the heat-transfer medium is in direct communication with an occupied space and a refrigerant leak into the indirect circuit can vent to atmosphere, through a mechanical vent, outside the occupied space (see [Figure 7](#)).

Indirect vented closed systems are considered to be located in location classification III (see [5.3.3](#)).



Key

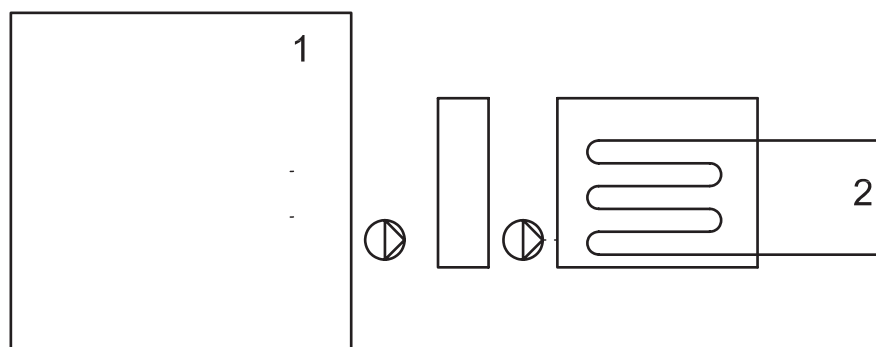
- 1 occupied space
- 2 refrigerant-containing part(s)
- ... heat-transfer medium

Figure 7 — Indirect vented closed system

5.2.3.4 Double indirect system

An indirect system shall be classed as a double indirect system if the heat-transfer medium is in contact with refrigerant-containing parts, and the heat be exchanged with a second indirect circuit that passes into an occupied space (see [Figure 8](#)). A refrigerant leak cannot enter the occupied space.

Double indirect vented systems are considered to be located in location classification III (see [5.3.3](#)).



Key

- 1 occupied space
- 2 refrigerant-containing part(s)
- ... heat-transfer medium

Figure 8 — Double indirect system