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

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

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

Partie 4: Fonctionnement, maintenance, réparation et récupération

ISO 5149-4:2022

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 86, *Refrigeration and air-conditioning*, Subcommittee SC 1, *Safety and environmental requirements for refrigerating systems*.

This second edition cancels and replaces the first edition (ISO 5149-4:2014), which has been technically revised.

The main changes are as follows:

- revision of [Figure 2](#);
- addition of guidelines for repairs of equipment using flammable refrigerants in [Annex E](#).

A list of all parts in the ISO 5149 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Refrigerating systems and heat pumps — Safety and environmental requirements —

Part 4: Operation, maintenance, repair and recovery

1 Scope

This document specifies requirements for safety and environmental aspects in relation to operation, maintenance and repair of refrigerating systems and the recovery, reuse and disposal of all types of refrigerant, refrigerant oil, heat transfer fluid, refrigerating system and part thereof.

This document does not cover "motor vehicle air conditioners" constructed according to the product standards such as ISO 13043.

These requirements are intended to minimize risks of injury to persons and damage to property and the environment resulting from improper handling of the refrigerants or from contaminants leading to system breakdown and resultant emission of the refrigerant.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 5149-1, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 1: Definitions, classification and selection criteria*

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

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

ISO 11650, *Performance of refrigerant recovery and/or recycling equipment*

IEC 60335-2-104, *Household and similar electrical appliances — Safety — Part 2-104: Particular requirements for appliances to recover and/or recycle refrigerant from air conditioning and refrigeration equipment*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5149-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 General requirements

4.1 Operation instructions

4.1.1 Care shall be taken to ensure that the personnel charged with the operation, supervision and maintenance of the refrigerating system are adequately instructed and competent with respect to their tasks. The installer of the refrigerating system shall draw attention to the necessity for adequate instruction of operating and supervising personnel. Typical in-service inspection requirements are shown in [Annex D](#).

4.1.2 Personnel in charge of the refrigerating system shall have knowledge and experience of the mode of functioning, operation and day-by-day monitoring of this system.

4.2 Instruction of operating personnel

Before a new refrigerating system is put into service, the person responsible for placing the system in operation shall ensure that the operating personnel are instructed on the basis of the instruction manual about the construction, supervision, operation and maintenance of the refrigerating system, as well as the safety measures to be observed, and the properties and handling of the refrigerant used.

It is advisable that the operating personnel are present during evacuation, charging with refrigerant and adjustment of the refrigerating system as well as, if possible, during assembly on site.

4.3 Documentation

4.3.1 The person responsible for the refrigerating system shall keep an updated logbook of the refrigerating system.

4.3.2 In the logbook the following information shall be recorded:

- a) details of all maintenance and repair work;
- b) quantities and kind of (new, reused or recycled) refrigerant which have been charged on each occasion, and the quantities of refrigerant which have been transferred from the system on each occasion (see also [6.6](#));
- c) the result from analysis or test of any reused refrigerant shall be kept in the logbook (see also [6.2.1](#));
- d) source of the reused refrigerant;
- e) changes and replacements of components of the system;
- f) results of all periodic routine tests;
- g) record of significant periods of non-use.

4.3.3 The logbook shall be readily accessible at the equipment or made available upon request.

5 Maintenance and repair

5.1 General

5.1.1 Each refrigerating system shall be subjected to preventive maintenance in accordance with the instruction manual (see ISO 5149-2).

NOTE The frequency of such maintenance depends on the type, size, age, use, etc. of the system. In many cases more than one maintenance service is required in the course of one year.

5.1.2 The person responsible for the refrigerating system shall ensure that the system is inspected, regularly supervised and maintained.

5.1.3 Systems should be subject to tightness inspection in accordance with [Annex D](#) by a competent person. If, during the inspection the suspicion of a leak exists, e.g. through refrigerant temperature checks or capacity reduction, then the leak shall be located with suitable detection equipment and shall be repaired and checked again after the repair; national regulations can apply. The results of the inspection and measures taken afterwards shall be included in the logbook.

Refer to [Annex D](#) for detailed specification regarding in service inspection.

5.1.4 The person responsible for the refrigerating system shall also be responsible when another person uses the refrigerating system, unless another division of responsibility has been agreed upon.

5.1.5 Regular maintenance which does not include interference with, nor adjustment of, the refrigerating system and which requires no specialized knowledge of refrigeration engineering shall be carried out by a person with appropriate skills.

5.1.6 In the case of refrigerating systems located within a ventilated enclosure and considered as indirect systems, only authorized persons shall be permitted in the space surrounding the enclosure during maintenance and repair operations because the separation between refrigerant containing parts and occupants of the room is no longer effective and leaks of refrigerant into the surrounding space become possible.

5.1.7 Any markings to the compressor or equipment shall be refreshed if any of the existing text has become illegible.

5.1.8 The mixing of different refrigerants within a system shall not be permitted under any circumstances. Change of the refrigerant type shall be in accordance with [5.4](#).

5.2 Maintenance

5.2.1 Maintenance shall be undertaken by a competent person in such a way that:

- a) accidents to personnel are prevented;
- b) damage to goods is prevented;
- c) components of the system remain in good working order;
- d) the purpose and availability of the system are maintained;
- e) leakage of refrigerant or oil is identified and remedied;
- f) waste of energy is minimized.

5.2.2 The extent and time schedule for maintenance shall be fully described in the instruction manual (see ISO 5149-2).

5.2.3 If the discharge line of a pressure relief device is connected into a common discharge line and the valve is temporarily dismantled for reasons of testing and maintenance, the connecting ends of the remaining ends entering the common discharge header are to be blocked.

5.2.4 When a secondary cooling or heating system is used, the heat-transfer medium shall be periodically inspected in accordance with manufacturer instructions for its composition, and the secondary system shall be tested and inspected for the presence of refrigerant from the primary circuit.

5.2.5 Regular leak tests, inspections and checking of the safety equipment shall be carried out (see [Annex D](#)).

5.2.6 When oil is drained from a refrigerating system it shall be carried out safely in accordance with the instruction manual. The procedure shall be in accordance with [Annex A](#).

5.3 Repair

5.3.1 Repairs on refrigerant containing components shall be carried out by a competent person in the following order, if appropriate:

- a) conducting a hazard analysis and risk assessment for the proposed repair;
- b) instructing of the maintenance staff;
- c) emptying, recovery and evacuation;
- d) disconnecting and safeguarding of the components to be repaired (e.g. power drive, pressure vessel, piping);
- e) cleaning and purging (e.g. with nitrogen);
- f) releasing for repair;
- g) carrying out the repair;
- h) testing and checking of the repaired component (pressure test, leakage test, functional test), see ISO 5149-2;
- i) replacing, evacuating and recharging with refrigerant.

NOTE For welding or using arc- and flame-producing apparatus, specific personnel and welding or brazing procedure approvals are used.

5.3.2 Refrigerant leaks shall be identified and repaired without undue delay by a competent person and the system shall only be put into service again when all the leaks have been repaired.

5.3.3 During each periodic maintenance and following each repair, as necessary, at least the following tasks shall be performed:

- a) all safety, control and measurement devices as well as alarm systems shall be checked to verify their correct operation and that they are within the calibration period;
- b) leakage tests shall be carried out at the relevant repaired part of the refrigerating system or the entire system;
- c) charge isolation and evacuation of the repaired part of the refrigerating system.

5.3.4 Maintenance and repair requiring the assistance of other skilled personnel (such as welders, electricians, measuring and control specialists) shall be carried out under the supervision of a competent person.

5.3.5 Welding and brazing shall only be carried out by qualified personnel and only after the section has been purged according to an approved procedure.

5.3.6 Replacements of components or changes to the refrigerating system shall be ordered and carried out by a competent person or by authorized repair service centre for systems that do not require periodic maintenance.

5.3.7 Any pressure relief valve which discharges to atmosphere shall be inspected after it has been actuated and shall be replaced if it has not fully reseated.

5.3.8 The vacuum procedure shall be applied as follows. A stationary vacuum pump shall be connected to the assembly or relevant part of an assembly and an absolute pressure of less than 270 Pa shall be achieved. The achieved pressure should be maintained at this level for sufficient time after the pump has been isolated from the assembly to ensure that the moisture has been removed and the system is not leaking. For smaller systems a lower vacuum pressure may be necessary. The competent person that executes this operation, shall decide when the vacuum can be broken and whether the vacuum procedure should be repeated. At the end of the vacuum procedure, the assembly can be filled with the appropriate refrigerant. A certificate for the vacuum and filling procedure shall be provided. This certificate indicates the method used, the results of the procedure, the pressures applied and the duration of the test. A similar documentation in the logbook is regarded equal.

5.4 Change of refrigerant type

5.4.1 General

In the event of a change of the refrigerant type used in the refrigerating system, the following planning and execution activities shall be carried out and conformance to the relevant requirements of ISO 5149-1, ISO 5149-2 and ISO 5149-3 shall be implemented where applicable.

5.4.2 Planning the change of refrigerant type

Before changing the refrigerant type, a plan shall be prepared. It shall include at least the following actions:

- a) verify that the refrigerating system and components are suitable for the refrigerant type change;
- b) examine all materials used in the refrigerating system to ensure they are compatible with the new refrigerant type;
- c) determine whether the existing lubricant type is suitable for use with the new refrigerant type;
- d) verify that the system allowable pressure (*PS*) shall not be exceeded;
- e) verify that the pressure relief device required discharge capacity is adequate for the new refrigerant type;
- f) verify that the motor and switchgear current ratings are adequate for the new refrigerant type;
- g) verify that the liquid receiver is sufficiently large for the new refrigerant charge;
- h) if the new refrigerant has a different classification, ensure that the consequences of the change of refrigerant classification are addressed.

Guidance on equipment suitability for refrigerant type change should be sought from the original equipment manufacturer, new refrigerant manufacturer and lubricant manufacturer, as appropriate.

5.4.3 Execution of the change of refrigerant type

Follow the recommendations of the equipment manufacturer, the compressor manufacturer, the refrigerant supplier or apply the following procedure with the plan developed according to [5.4.2](#):

- a) record a full set of system operating parameters to establish baseline performance;

- b) repair any issues identified by a);
- c) conduct a thorough leak check and identify any joints and seals to be replaced;
- d) recover the original refrigerant in accordance with [6.2](#);
- e) drain the lubricant;
- f) check whether the lubricant is in good condition. If not, then remove the residual lubricant from the system;
- g) change the joints, seals, indicating and control devices, filters, oil filters, driers and relief valves as required;
- h) evacuate the system to less than 132 Pa absolute pressure;
- i) charge with lubricant;
- j) charge with refrigerant;
- k) adjust indicating and control devices, including software modifications if required;
- l) amend all indications as to the refrigerant type used, including the log book and documentation at operating site;
- m) conduct a thorough leak check and repair any joints and seals as required;
- n) record a full set of system operating parameters to compare with the previous baseline performance.

6 Requirements for recovery, reuse and disposal

6.1 General requirements

6.1.1 Disposal

Disposal of refrigerating systems and parts shall be undertaken properly. National regulations can apply.

6.1.2 Personnel

Recovery, reuse, recycle, reclaim and disposal shall only be undertaken by competent persons.

6.1.3 Parts of refrigerating systems

All parts of refrigerating systems (e.g. refrigerant, oil, heat-transfer medium, filter, drier, insulation material) shall be recovered, reused and/or disposed of properly; national regulations can apply (see [6.5](#)).

6.1.4 Refrigerants

All refrigerants shall be recovered for reuse, recycled or reclaimed for reuse, or shall be properly disposed; national regulations can apply (see [6.3](#)).

Destruction of refrigerants shall require an authorized facility for destruction.

See [Figure 1](#) for the relationship between the processes.