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

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

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

Partie 4: Fonctionnement, maintenance, réparation et récupération

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 5149-4 was prepared by Technical Committee ISO/TC 86, *Refrigeration and air-conditioning*, Subcommittee SC 1, *Safety and environmental requirements for refrigerating systems*.

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

ISO 5149 consists of the following parts, under the general title *Refrigerating systems and heat pumps — Safety and environmental requirements*: (standards.iteh.ai)

Part 1: Definitions, classification and selection criteria ISO 5149-4:2014

Part 2: Design, construction, testing, marking and documentation <https://standards.iteh.ai/catalog/standards/sist/c8cca7c8-8d9c-49ab-b24e-5639a7c51a9/iso-5149-4-2014>

Part 3: Installation site

Part 4: Operation, maintenance, repair and recovery

Refrigerating systems and heat pumps — Safety and environmental requirements —

Part 4: Operation, maintenance, repair and recovery

1 Scope

This part of ISO 5149 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.

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.

[Subclauses 4.1.1, 4.1.2, 4.3, 5.1.1](#) to [5.1.4, 5.2, 5.3.1, 5.3.3](#) and [6.6](#) of this part of ISO 5149 are not applicable to unitary systems having a power cord, being factory sealed, and in conformance with IEC 60335 series.

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2 Normative references (standards.iteh.ai)

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 5149-1:2014, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 1: Definitions, classification and selection criteria*

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

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.

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.

4.1.3 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](#).

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.

NOTE 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 party concerned 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) analysis of any reused refrigerant, if available, the results of which shall also be kept in the logbook;
- 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 either be kept in the machinery room, or the data shall be stored in a computer of the party concerned with a printout in the machinery room, in which case the information shall be accessible to the competent person when servicing or testing.

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 in accordance with legal requirements.

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

5.1.3 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.

5.1.4 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 of appropriate competence employed by the person responsible.

5.2 Maintenance

5.2.1 Maintenance shall be undertaken 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. A procedure is provided in [Annex A](#).

5.3 Repair

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

- a) instructing of the maintenance staff;
- b) emptying, recovery and evacuation;
- c) disconnecting and safeguarding of the components to be repaired (e.g. powerdrive, pressure vessel, piping);
- d) cleaning and purging (e.g. with nitrogen);
- e) releasing for repair;
- f) carrying out the repair;
- g) testing and checking of the repaired component (pressure test, leakage test, functional test), see ISO 5149-2;
- h) 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 as soon as practicable 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 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 competent 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 After a pressure relief valve, which discharges to atmosphere, has been actuated, it shall be replaced if it is not tight.

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 steps shall be taken.

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 relief valve 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.

NOTE 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 in accordance 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 in accordance with national regulations.

6.1.2 Personnel

Recovery, reuse, recycle, reclaim and disposal shall only be undertaken by competent persons. See [Figure 1](#) for the relationship between the processes.

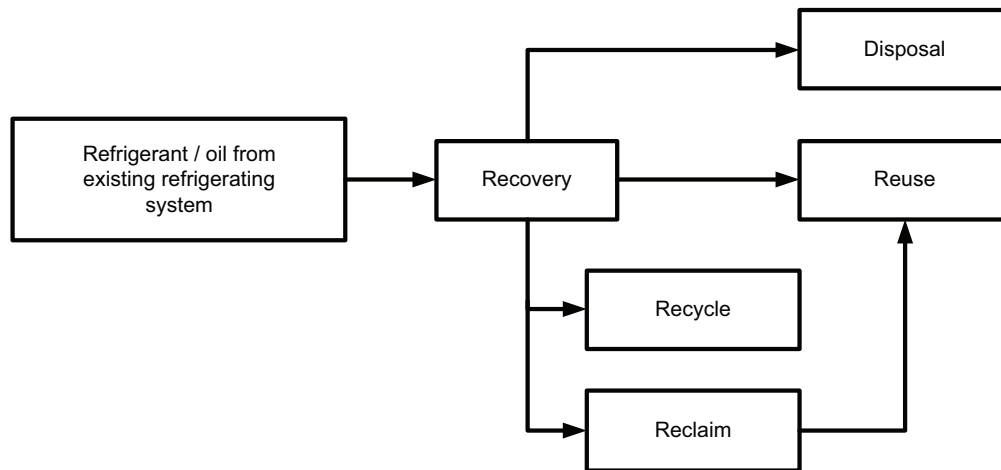


Figure 1 — Simplified representation of the relationship between the processes

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 in accordance with national regulations (see 6.5).

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6.1.4 Refrigerants

All refrigerants shall be recovered for reuse, recycled or reclaimed for reuse, or shall be properly disposed in accordance with national regulations (see 6.5).

Destruction of refrigerants shall require an authorized facility for destruction.

6.1.5 Handling

The method of handling of the refrigerant shall be decided before it is removed from the refrigerating system or the equipment (see also Annex C).

Such decision shall be based upon considerations including:

- history of the refrigerating system;
- type and disposition of the refrigerant in the refrigerating system;
- reason for removal of the refrigerant from the refrigerating system;
- condition of the refrigerating system or the equipment and whether or not it shall be returned to service.

6.2 Requirements for recovery and reuse of refrigerant

6.2.1 General

The directions given regarding the treatment of recovered refrigerant before reuse shall apply to all types of refrigerant.

Dependent on the situation, recovered refrigerant shall follow one of the paths indicated in Figure 2.

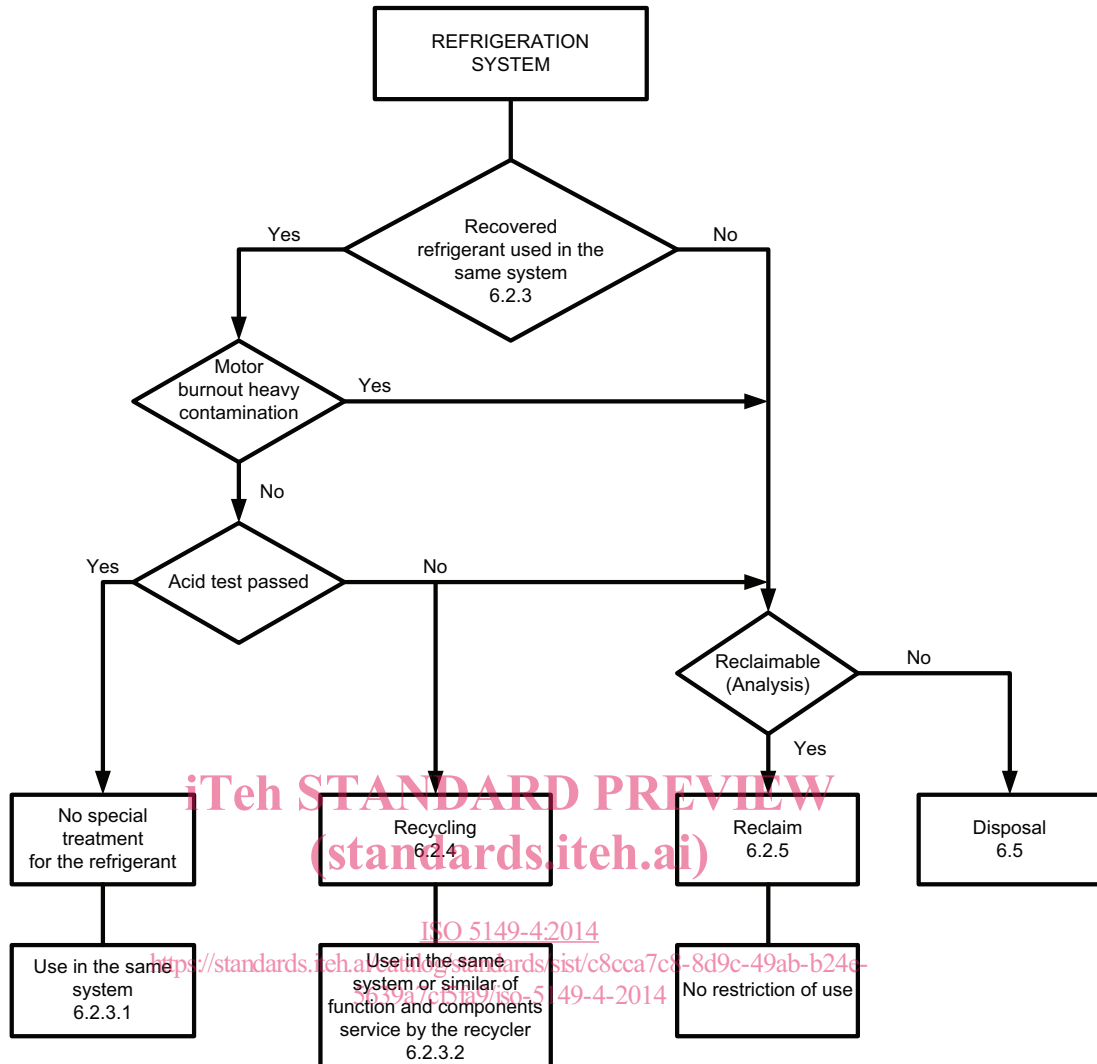


Figure 2 — Flow chart for recovered refrigerant

6.2.2 Recovery for general reuse

Recovered refrigerants intended for reuse in refrigerating systems shall be reclaimed and shall comply with the appropriate specification for new refrigerants.

NOTE Pass and fail criteria are outlined in AHRI 700:2011.

The acceptability shall be determined before reuse of the refrigerant.

6.2.3 Recovery for reuse in the same or similar system

6.2.3.1 For reuse in the same system

For halocarbon refrigerant, the following tests shall be carried out.

a) Acid test

The acid test uses the titration principle to detect any compound that ionizes as an acid. The test requires a sample of between 100 g and 120 g and has a lower detection limit of $0,1 \times 10^{-6}$ by mass (as HCl).