



SLOVENSKI STANDARD
SIST EN 378-4:2017+A1:2019

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Hladilni sistemi in toplotne črpalke - Varnostnotehnične in okoljevarstvene zahteve
- 4. del: Delovanje, vzdrževanje, popravilo in recikliranje

Refrigerating systems and heat pumps - Safety and environmental requirements - Part 4:
Operation, maintenance, repair and recovery

Kälteanlagen und Wärmepumpen - Sicherheitstechnische und umweltrelevante
Anforderungen - Teil 4: Betrieb, Instandhaltung, Instandsetzung und Rückgewinnung

Systèmes frigorifiques et pompes à chaleur - Exigences de sécurité et d'environnement -
Partie 4 : Fonctionnement, maintenance, réparation et récupération

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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

Kälteanlagen und Wärmepumpen - Sicherheitstechnische und umweltrelevante Anforderungen - Teil 4: Betrieb, Instandhaltung, Instandsetzung und Rückgewinnung

This European Standard was approved by CEN on 3 September 2016 and includes Amendment 1 approved by CEN on 26 August 2019.

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EN 378-4:2016+A1:2019**European foreword**

This document (EN 378-4:2016+A1:2019) has been prepared by Technical Committee CEN/TC 182 “Refrigerating systems, safety and environmental requirements”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2020, and conflicting national standards shall be withdrawn at the latest by March 2020.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document includes Amendment 1 approved by CEN on 26 August 2019.

This document supersedes **A1** EN 378-4:2016 **A1**.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**.

EN 378 consists of the following parts under the general title “Refrigerating systems and heat pumps — Safety and environmental requirements”:

- *Part 1: Basic requirements, definitions, classification and selection criteria;*
- *Part 2: Design, construction, testing, marking and documentation;*
- *Part 3: Installation site and personal protection;*
- *Part 4: Operation, maintenance, repair and recovery.*

The main changes in part 4 with respect to the previous edition are listed below:

- *harmonisation as far as possible with ISO 5149:2014;*
- *addition of vacuum procedure in 5.3.8;*
- *addition of moisture test in 6.2.3.*

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European 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.

The term “refrigerating system” used in this European Standard includes heat pumps.

This standard applies:

- a) to refrigerating systems, stationary or mobile, of all sizes including heat pumps;
- b) to secondary cooling or heating systems;
- c) to the location of the refrigerating systems;
- d) to parts replaced and components added after adoption of this standard if they are not identical in function and capacity.

This standard does not cover “motor vehicle air conditioners” constructed according to product standards such as ISO 13043.

Systems using refrigerants other than those listed in EN 378-1:2016, Annex E are not covered by this standard unless they have been assigned to a safety class according to ISO 817.

This standard does not apply to goods in storage.

This standard is not applicable to refrigeration systems and heat pumps which were manufactured before the date of its publication as a European Standard except for extensions and modifications to the system which were implemented after publication.

This standard is applicable to new refrigerating systems, extensions or modifications of already existing systems, and for existing stationary systems, being transferred to and operated on another site.

This standard also applies in the case of the conversion of a system to another refrigerant type, in which case conformity to the relevant clauses of parts 1 to 4 of the standard shall be assessed.

This Part 4 of the European Standard 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 minimise 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, 5.1.1 to 5.1.4, 5.2, 5.3.1, 5.3.3 and 6.6 of this European Standard are not applicable to unitary systems having a power cord, being factory sealed, and in conformance with EN 60335 series.

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.

EN 378-1:2016, *Refrigerating systems and heat pumps — Safety and environmental requirements - Part 1: Basic requirements, definitions, classification and selection criteria*

EN 378-2:2016, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation*

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EN 378-3, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 3: Installation site and personal protection*

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

ISO 13043, *Road vehicles — Refrigerant systems used in mobile air conditioning systems (MAC) — Safety requirements*

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, definitions and abbreviated terms

For the purposes of this document, the terms, definitions and abbreviated terms given in EN 378-1:2016 apply.

4 General requirements**4.1 Operating instructions**

4.1.1 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 according to 4.1.2.

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.

4.1.2 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, as well as the safety measures to be observed, and the properties and handling of the refrigerant used. Typical in-service inspection requirements are shown in Annex D.

4.2 Documentation

The logbook shall be updated following any maintenance or repair. The logbook shall either be kept in the machinery room, or the data shall be stored digitally by the operator 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 EN 378-2).

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 operator of 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 in accordance with national regulations. 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 operator of 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 work on, 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.

5.1.6 In the case of refrigerating systems located within a ventilated enclosure and considered as indirect systems under EN 378-1, 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 minimised.

5.2.2 The extent and time schedule for maintenance shall be fully described in the instruction manual (see EN 378-2).

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

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

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5.2.5 Regular leak tests and inspections shall be carried out including checking of the safety equipment.

NOTE 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 by a competent person in the following order, if appropriate:

- a) conducting a hazard analysis and risk assessment for the proposed repair;
- b) instructing the maintenance staff;
- c) emptying, recovery and evacuating;
- d) disconnecting and safeguarding of the components to be repaired (e.g. compressor, 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 EN 378-2);
- i) evacuating and recharging with refrigerant.

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5.3.2 Refrigerant leaks shall be identified and repaired without undue delay.

5.3.3 During each periodic maintenance the following tasks shall be performed:

- a) all safety, control and measurement devices and alarm systems shall be checked to verify their correct operation;
- b) leakage tests shall be carried out at the relevant part of the refrigerating system.

This shall also apply where appropriate following any repair.

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.

NOTE Welding or the use of arc-producing and flame-producing apparatus requires specific personnel and welding or brazing procedure approvals.

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

5.3.7 After a pressure relief valve, which discharges to atmosphere, has been actuated, it shall be replaced if it is not tight.

5.3.8 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 (according to EN 13313) 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 EN 378-1, EN 378-2 and EN 378-3 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 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 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.

EN 378-4:2016+A1:2019**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) conduct a thorough leak check and repair any joints and seals as required;
- i) evacuate the system to less than 132 Pa absolute pressure;
- j) charge with lubricant;
- k) charge with refrigerant;
- l) adjust indicating and control devices, including software modifications if required;
- m) amend all indications as to the refrigerant type used, including the log book and documentation at operating site;
- 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.