BS EN 378-4:2016

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Refrigerating systems and heat pumps — Safety and environmental requirements

Part 4: Operation, maintenance, repair and recovery

bsi.

National foreword

This British Standard is the UK implementation of EN 378-4:2016. It supersedes BS EN 378-4:2008+A1:2012 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RHE/18, Refrigeration safety.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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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.

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European foreword

This document (EN 378-4:2016) 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of an identical text or by endorsement, at the latest by May 2017, and conflicting national standards shall be withdrawn at the latest by May 2017.

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

This document supersedes EN 378-4:2008+A1:2012.

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 organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, 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*

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 dismounted 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.

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.

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.

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.

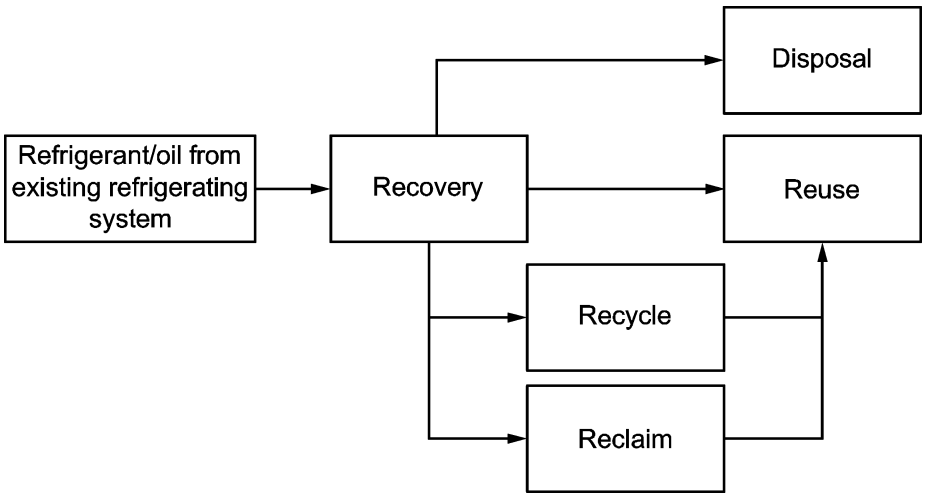

Figure 1 — Simplified representation of the relationship between the processes

6.1.3 Parts of refrigerating systems

All parts of refrigerating systems, e.g. refrigerant, oil, heat-transfer fluid, filter, drier, insulation material, shall be recovered, reused and/or disposed of properly (see 6.5).

6.1.4 Refrigerants

All refrigerants shall be recovered for reuse, recycled or reclaimed for reuse, or shall be disposed of properly (see 6.5).

Destruction of refrigerants shall require an authorised 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 is to 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.

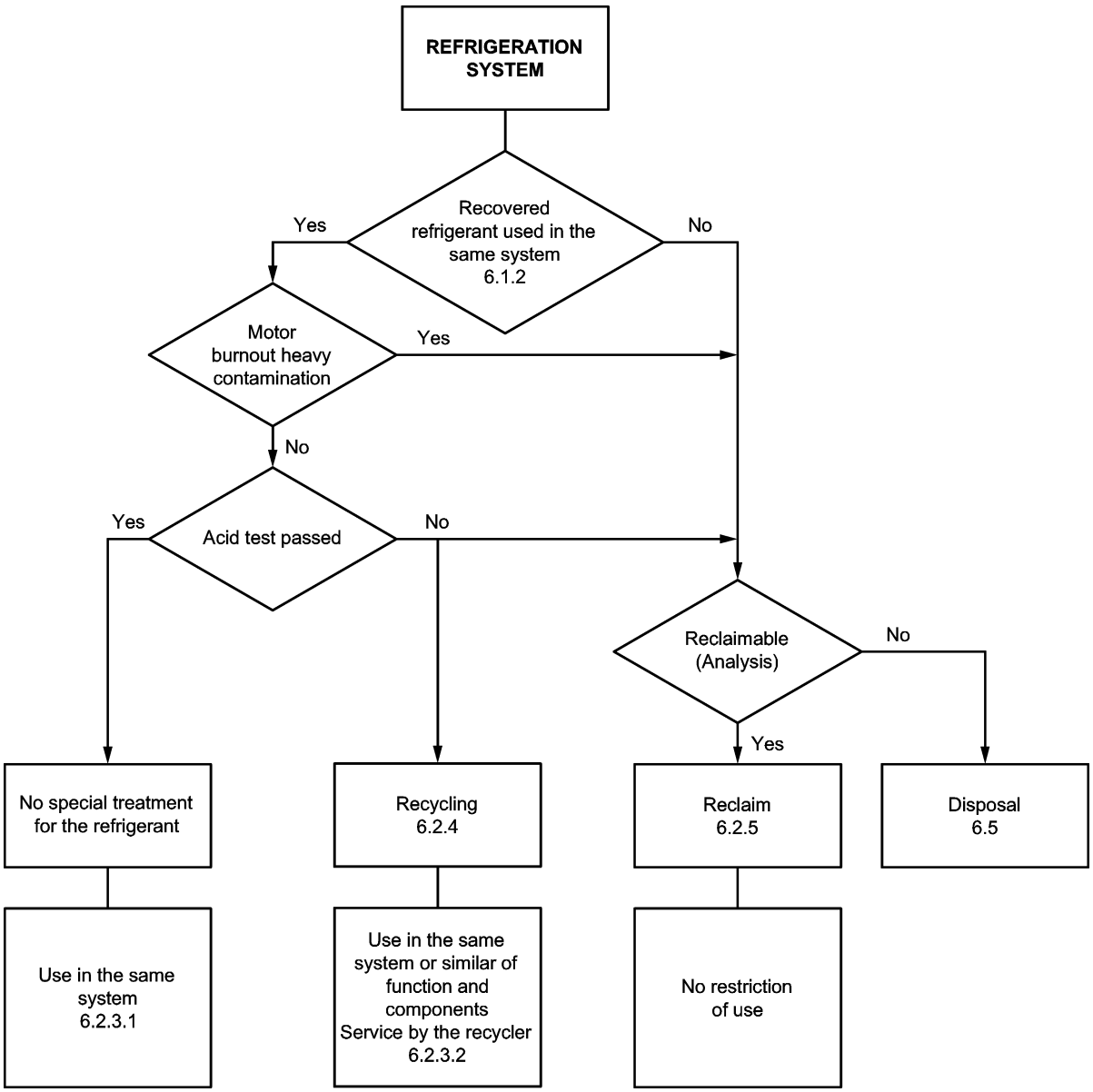

Figure 2 — Flow chart for recovered refrigerant

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 700:2015.

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 refrigerants, the following tests shall be carried out.

a) Acid test

The acid test uses the titration principle to detect any compound that ionises 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).

If the acid test fails, the total refrigerant charge shall undergo a recycling or reclaiming process, and the filter drier(s) in the refrigerating system shall be replaced.

NOTE 1 Pass and fail criteria are outlined in AHRI 700:2015.

Such a test is usually not required if recovery is from a refrigerating system during its manufacture.

NOTE 2 Refrigerant recovered from a refrigerating system (e.g. removed overcharge, refrigerant taken out for system service, local non-contaminating repair, major overhaul or replacement of a component) can normally be returned to the same system.

When a refrigerating system has been taken out of service because of heavy contamination of the refrigerant or motor burnout, the refrigerant shall be reclaimed or disposed of properly.

The evacuation and charging procedures specified in this European Standard shall be followed when returning the refrigerant to the refrigerating system.

NOTE 3 It is recommended that the refrigerant is recharged through a filter drier to remove moisture which may have contaminated the fluid during recovery.

b) Moisture test

The Coulometric Karl Fischer Titration shall be used for determining the water content of refrigerants. This method can be used for refrigerants that are either a liquid or a gas at room temperature. For all refrigerants, the sample for water analysis shall be taken from the liquid phase of the container to be tested.

If the moisture test fails, the total refrigerant charge shall undergo a recycling or reclaiming process, and the filter drier(s) in the refrigerating system shall be replaced.

6.2.3.2 For use in a similar system

The use of recycled refrigerant in a refrigerating system, which is similar in function and components, shall comply with the following requirements:

— the system is serviced by the competent person or company who recycled the refrigerant;

— the recycling equipment complies with the requirements of 6.2.4;

— the history of the refrigerant and the refrigerating system is known from the date of commissioning;

— the competent person or company informs the operator when recycled refrigerant is used and the source from which it comes and the result of the tests or, if necessary, of the analysis.

For halocarbon refrigerants, tests shall be carried out in accordance with 6.2.3.1.

If any of the above conditions is not met or the history of the refrigerant indicates a heavy contamination of the refrigerant, e.g. motor burnout, then the refrigerant shall be either reclaimed or disposed of properly.

A recycled refrigerant should comply with the specifications in Annex B.

6.2.4 Requirements for refrigerant recovery and recycling equipment and procedures

Recovery and recycling equipment shall comply with IEC 60335-2-104 and for halocarbon refrigerants with ISO 11650.

Equipment shall be regularly inspected to verify that equipment and instruments are well maintained and in good order. Equipment and instruments shall be function tested and calibrated regularly.

6.2.5 Reclaim

6.2.5.1 Analysis

A refrigerant sent for reclaim shall be analysed and either reclaimed or disposed of properly.

6.2.5.2 Specification

After the refrigerant has been reclaimed it shall meet the specifications for new refrigerant.

NOTE Reclaimed refrigerant can be used as new refrigerant.

6.3 Requirements for refrigerant transfer, transport and storage

6.3.1 General

Appropriate safety practices shall be followed during transfer of refrigerant from a refrigerating system to a refrigerant container for transport or storage.

6.3.2 Refrigerant transfer

6.3.2.1 Procedure

Transfer/evacuation of the refrigerant shall be carried out as follows:

a) If the compressor of the refrigerating system cannot be used for the transfer, refrigerant recovery equipment shall be connected to the refrigerating system in order to transfer the refrigerant, either into another part of the refrigerating system, or into a separate container.

b) Before service, repair, etc., which involves opening the system, the pressure of the refrigerating system or of the relevant parts shall be reduced to 30 kPa absolute or lower.

Thereafter the pressure can be further reduced using a vacuum pump before breaking the vacuum with dry, oxygen-free nitrogen.

Atmospheric pressure is acceptable for R-744 (carbon dioxide) systems.

c) Before disposal of the refrigerating system, the refrigerating system or its parts shall be evacuated down to a pressure of 30 kPa absolute or lower.

NOTE 1 The above pressures apply in an ambient temperature of 20 °C. For other temperatures the pressure will need to be changed accordingly.

NOTE 2 The time required for transfer or emptying is dependent on the pressure. The process should only be stopped when the pressure remains constant after switching off the compressor of the recovery machine.

6.3.2.2 Refrigerant container

The refrigerant shall only be transferred to a container suitable for the specific refrigerant involved.

The container shall be clearly identified and marked by a colour code or otherwise as being intended to hold the refrigerant involved.

NOTE 1 AHRI Guideline N provides information on colour coding.

The container with recovered refrigerant shall be specifically marked to note any special conditions, e.g. “R-407C — Recovered — Do not use before investigation” or “R-717 (Ammonia) — Recovered”.

NOTE 2 National regulations sometimes give a specific colour for recovery cylinders.

NOTE 3 In the case of transport, it is the responsibility of the person recovering the refrigerant to ensure that the recovery cylinder complies with the ADR legislation (European Agreement Concerning the International Carriage of Dangerous Goods by Road 1999).

6.3.2.3 Disposable container

A disposable “one way” container shall not be used because of the possibility of the remaining gas content being discharged into the atmosphere when the container is discarded.

6.3.2.4 Container filling

The refrigerant container shall not be overfilled.

When a container is filled with refrigerant, the maximum charge shall always be observed, taking into account that possible refrigerant-oil mixtures have a lower density than pure refrigerant. The usable container capacity shall therefore be reduced for a refrigerant-oil mixture (80 % of maximum refrigerant charge or 70 % bottle volume, whichever is lower) controlled by mass.

The allowable pressure of the container shall not be exceeded, even temporarily, during any operation.

NOTE 1 Special valves can be fitted to the refrigerant container to avoid the possibility of overfilling.

NOTE 2 Additional information can be found in C.2.

6.3.2.5 Different refrigerants

Different refrigerants shall not be mixed and shall be stored in different containers.

A refrigerant shall not be placed in a container that contains a different or an unknown refrigerant.

An unknown refrigerant already in a container is not to be vented to the atmosphere but shall be identified and reclaimed or shall be disposed of properly.

NOTE A refrigerant contaminated with another refrigerant may make it impossible to reclaim.

6.3.3 Transport

Refrigerants shall be transported in a safe manner.

6.3.4 Storage

Refrigerants shall be stored in a safe manner.

NOTE Additional information can be found in C.3.

6.4 Requirements for recovery equipment

6.4.1 General

The recovery equipment draws refrigerant/oil out of the refrigerating system and transfers it into a container in a safe manner, and shall be leak-tight.

Refrigerant recovery machines shall conform to the relevant safety standard e.g. IEC 60335-2-104.

NOTE The equipment can employ replaceable core filter driers to remove moisture, acid, particles and other contaminants.

6.4.2 Operation with respect to the environment

The recovery equipment shall be operated in such a way as to minimise the risk of emission of refrigerants or oil to the environment.

6.4.3 Performance

The recovery equipment shall at a temperature of 20 °C be able to operate down to a final pressure of 30 kPa absolute.

NOTE A method for measuring the performance of this equipment is contained in ISO 11650.

6.4.4 Operation and maintenance

The recovery equipment and filters shall be operated and maintained in accordance with ISO 11650 and the specifications of the manufacturer of the recovery equipment.

When changing replaceable core filter driers in the recovery equipment, the section containing the filters should be isolated and the refrigerant should be transferred into a suitable storage container prior to opening the filter shell. Any air introduced into the recovery equipment during the core change should be removed by evacuation and not by flushing out or purging out with the refrigerant.

6.5 Requirements for disposal

6.5.1 Refrigerant not intended for reuse

Used refrigerant, which is not intended for reuse, shall be dealt with as waste for safe disposal.

Discharge of refrigerants shall only be permitted in a manner which is not harmful to persons, property and the environment and in accordance with legal requirements.

6.5.2 Absorbed R-717 (ammonia)

After absorbing ammonia in water, the “mixture” shall be dealt with as waste for safe disposal.

NOTE Additional information can be found in C.4.

6.5.3 Refrigerating machine oil

Used oil, which cannot be reprocessed, shall be stored in a separate appropriate container and shall be dealt with as waste for safe disposal.

6.5.4 Other components

Other components of the refrigerating system containing refrigerant or oil shall be disposed of appropriately.

When necessary, a person competent in dealing with the disposal of refrigerants and oils should be consulted.

6.6 Requirements for documentation

All operations of recovery and reuse of refrigerant, and its source, shall be recorded in the logbook of the refrigerating system (see 4.2). If requested, a certificate shall be supplied by the refrigerant supplier or by the service company.

Annex A
(normative)

Draining the oil from a refrigerating system

A.1 General

The oil shall be drained by competent personnel.

During the draining operation the room shall be effectively vented. Smoking and the presence of any other open flame or ignition source shall be prohibited.

When draining oil from compressors (or collectors) by means of a drain plug, it is required to reduce the pressure in the compressor (or collector) to atmospheric pressure before removing the plug.

Oil shall not be discharged onto the ground or into sewers, waterways, groundwater or seawater.

A.2 Ammonia systems

A.2.1 General

Usually both the high and the low pressure sides of a refrigerating system containing R-717 (ammonia) are equipped with oil collectors with draining valves in order to be able to remove the entrained and accumulated oil from the system. The oil draining apertures shall be equipped with a stop valve and a self-closing valve downstream, or a catch pot oil collecting system, which enables isolation from the part of the refrigerating system containing liquid refrigerant, safe venting of oil containing refrigerant, and isolation of the vapour line before the oil is drained off.

A.2.2 Draining procedure

The pressure of the section from which the oil is drained shall be above atmospheric pressure.

If the draining aperture is blocked, additional care is necessary.

Two valves are provided on the oil drain, one manually operated valve and one self closing valve. If the self-closing valve is partly opened and no oil or refrigerant is emitted it shall be disassembled, cleaned and reinstalled. Ensure that the manually operated valve remains closed during this operation.

NOTE It is recommended that oil is drained regularly in order to avoid interference with liquid level control, which could lead to compressor or pump damage.

Annex B
(informative)

Guide specification for recycled refrigerant

This European Standard specifies performance requirements for equipment to recycle halocarbon (and some other) refrigerants. It recognizes that for certification purposes, such equipment can only be tested against "standard contaminated refrigerant samples", as defined in ISO 11650.

In practice, refrigerants being recovered cannot be expected at all times to reproduce only these standard contaminants and currently it is not certain with what levels of contamination systems are coping.

This European Standard makes no direct reference to a specification for recycled refrigerants, the parameters for which have, in any case, still to be determined.

The recoverer may compare the results of analysis for the recycled refrigerant to the specifications for virgin products, understanding that the recycled refrigerant may not meet the virgin refrigerant specification.

Attention is drawn to the possibility of significant property changes if mixed refrigerants are recycled in proportions different from the original mixture or if other refrigerants not in the original blend have contaminated the mixture.

Annex C
(informative)

Handling and storage of refrigerants

C.1 General

Information about handling and storage given in this annex may be used where no similar criteria exist in national regulations.

Losses of refrigerants to the atmosphere should be minimised during handling and storage of refrigerant.

C.2 Handling

Refrigerant should only be charged into refrigerating systems after a pressure and tightness test.

Refrigerant containers should not be connected to a system at a higher pressure or to piping with hydraulic pressure of liquid refrigerant where the pressure is sufficient to cause a backflow into the container. Backflow of refrigerant can result in the container being overfilled. This could result in a dangerous increase in the container pressure.

Charging lines should be as short as possible and equipped with valves or self-closing connections to minimise the losses of refrigerant. Charge lines should be selected considering the effect of the pressure created by the transfer of the refrigerant from the cylinder during charging.

Refrigerant transferred to a system should be measured by either mass or volume using scales or a volumetric charging device. When charging zeotropic mixtures, the refrigerant is charged from the liquid phase in accordance with the refrigerant manufacturer's instructions. When charging a system, care should be taken that its maximum permissible charge is never exceeded, in view of, among other things, the danger of liquid entering the compressor. Charging with refrigerant should preferably be done in the low pressure part of the system. Each point downstream from a closed shut-off valve in the main liquid line is regarded as a low pressure side point.

Before charging refrigerant into a system the content of the refrigerant containers should be checked precisely. The adding of an unsuitable substance may cause explosions or other accidents.

Refrigerant containers should be slowly and carefully opened. Refrigerant containers should be disconnected from the system immediately upon completion of the addition or removal of the refrigerant. Refrigerant containers should not be knocked, dropped, thrown on the ground or exposed to thermal radiation during the addition or removal. Refrigerant containers should be checked for corrosion.

When adding a refrigerant to a system, e.g. after repair, care should be exercised to add refrigerant in small amounts to avoid overcharging, while monitoring high and low side pressures. If the maximum permissible refrigerant charge of a system has been exceeded and it is necessary to transfer part of the refrigerant charge to refrigerant containers, the containers should be weighed during transfer, taking care that the maximum charge for the container is never exceeded. The container should not be charged to a point where hydrostatic expansion of liquid refrigerant, as a consequence of a temperature rise, can cause a rupture. The maximum permitted mass should be marked on the containers.

Refrigerant containers should be constructed to meet different requirements for refillable applications according to national regulations. This may include an appropriately set pressure relief device and a valve guard.

Applying a manifold on multiple refrigerant containers when decanting refrigerant could cause uncontrolled refrigerant transfer resulting in overfilling of the coldest container.

When filling refrigerant containers, the maximum carrying capacity should not be exceeded. The carrying capacity is a function of the internal volume of the container and the liquid density of the refrigerant at a reference temperature (80 % liquid by volume at 50 °C).

Refrigerants should only be transferred into appropriately labelled containers having appropriate pressure rating as different refrigerants have different saturation pressures.

To avoid the danger of mixing different refrigerant types and grades, e.g. recycled, the receiving container should only have been used previously for that grade of refrigerant. The grade should be clearly marked.

Transferring refrigerant from one container to another should be carried out using safe and approved methods. A pressure differential should be established between the containers by either cooling the receiving container or heating the discharge container. Heating should be achieved using blanket heater equipment with a thermostat set at 55 °C or less and a thermal fuse or a non self-resetting thermal cut out, set at a temperature at which the refrigerant saturation pressure does not exceed 85 % of the container pressure relief device setting. Under no circumstances should refrigerants be vented to the atmosphere from the receiving container in order to lower the temperature to assist filling of the receiving container. Direct heating of refrigerant containers by open flames or radiant heaters to increase the flow velocity of the refrigerant is not permitted. Charging cylinders with graduated volumetric scales should be equipped with a pressure relief valve. Immersion heaters for this type of cylinder are permissible without a temperature limiting device if the power input is limited by a current limiter, so that continuous operation of the heater results in a cylinder pressure for the subject refrigerant of less than 85 % of the safety valve setting, regardless of the liquid level inside the cylinder.

C.3 Storage

Refrigerant containers should be stored in a dedicated space, which is cool, dry, and protected from fire risk, direct sunlight and sources of direct heating.

Containers stored outside should be weather resistant and protected from solar radiation.

Mechanical damage to the container and its valve should be avoided by careful handling. Even if fitted with a valve guard, containers should not be dropped. In the storage area, containers should be effectively secured to prevent them from falling.

The container valve should be closed and capped when the container is not in use. Gaskets should be replaced as required.

C.4 Special provisions for handling ammonia vapour during maintenance or decommissioning

C.4.1 General

Where subsections of an ammonia system are to be opened for maintenance, repair or dismantling the ammonia must be removed from the system safely. Small quantities of vapour (up to 10 kg) can be vented to atmosphere, subject to local or national regulations. This must be done safely and in a manner which does not damage the local environment. It is also possible to absorb the residual ammonia vapour in water to reduce the loss of ammonia to atmosphere. However this creates a solution of aqua-ammonia, which must be handled with care and removed from site safely.

C.4.2 Limitations of ammonia vapour absorption

The maximum quantity of aqua-ammonia that should be produced during this procedure is 200 l. The solution concentration should be no more than 30 %, so it follows that the maximum amount of ammonia vapour which can be extracted by this method is 60 kg. Preferably the solution strength created by the procedure should not be more than 10 %.

NOTE A 30 % solution of aqua-ammonia has a vapour pressure of 1 bar absolute pressure at 25 °C. Higher concentrations are likely to emit ammonia vapour at standard temperature and pressure.

The solution strength can be determined by measuring the pH of the solution. Table C.1 gives solution strengths.

Table C.1 — Aqua-ammonia solution strength at standard temperature and pressure

Solution mass fraction	1 %	5 %	10 %	30 %
pH	11,7	12,2	12,4	13,5

The specific gravity of the liquid can also be used. The specific gravity of a 28,5 % mass fraction solution is 0,9.

C.4.3 Procedure for ammonia vapour absorption

Before starting work, prepare a written risk assessment and method statement. Ensure that all necessary notifications have been made (site managers, workers in the vicinity and neighbours as appropriate). Estimate the quantity of ammonia to be removed. To minimize the quantity, transfer as much liquid as possible to other parts of the system and then lower the pressure of the part of the system to be opened by connecting a vapour line from the vent point to a low pressure part of the system. The pressure should be reduced to less than 5 bar gauge in this way, and preferably as low as possible.

EXAMPLE 1 60 g of ammonia vapour has a volume of 12,6 m^3 at 5 bar and a temperature of 10 °C.

EXAMPLE 2 60 kg of ammonia liquid has a volume of 96 l at 5 bar and a temperature of 10 °C.

Ensure that the following precautions are observed.

a) Use suitable personal protective equipment in accordance with the risk assessment.

b) Position a suitable water container outdoors in a well-ventilated, safe location. The container should have a wide neck, but should have a lid to prevent liquid spills when it is being moved. Securely fix the water container so that it cannot move during the operation.

c) Use a hose fitted with non-return valve to ensure that water cannot enter the refrigeration system. Fit the hose to the system vent valve.

d) Fill the water container to no more than 75 % full (maximum quantity 200 l).

e) Securely fix the hose outlet well below the water level.

f) Gradually open the vent valve.

g) Monitor the water container to ensure that splashes do not spill and the hose or container do not become loose. The absorption reaction is quite vigorous and generates heat so the water will get warm. There will be a strong smell of ammonia in the vicinity.

h) Do not leave the water container or the vent valve unattended at any time. If the vent valve is indoors then this will require at least two operatives in attendance at all times.

i) As soon as bubbles are no longer visible at the hose outlet, close the vent valve and disconnect the hose. This is to prevent water siphoning into the refrigeration system.

j) When the system pressure has dropped to atmospheric pressure, close the vent valve and disconnect the hose.

k) Vent the remaining vapour to atmosphere in a safe and controlled manner.

The system can be opened up, but beware that there may still be liquid ammonia in low areas, and the vapour in the system is at atmospheric pressure.

NOTE Ammonia has a very strong affinity for water and draws water into the system against a pressure of several bar if care is not taken. This is why it is essential to monitor the hose outlet and close the vent valve quickly.

C.4.4 Disposal of the aqua-ammonia solution

Aqua-ammonia solution has many industrial uses, including window-cleaning fluid, NO_x reduction agent in furnaces and fertilizer. However the ammonia recovered from a refrigeration system may be contaminated with lubricant, so it may not be sufficiently pure to be used for these purposes. If the aqua-ammonia is oil-free and sufficiently pure to be used as fertilizer, it should be diluted to strength of less than 10 % mass fraction (pH 12,4, specific gravity 0,96 at 15 °C) and applied at a concentration of not more than 20 l/m^2.

The aqua-ammonia solution should not be put into storm drains, watercourses or on land which drains to a water course, as it is highly toxic to aquatic life. It may be released in a controlled manner to a foul drain by prior arrangement with the waste water company. The waste water company may require the solution to be further diluted and they may require a period of notice to prepare their plant for the ammonia solution. If it is removed from site then local and national hazardous waste transfer regulations apply.

The pH of the aqua-ammonia solution can be reduced by dosing with a weak acid solution or by leaving the open container to stand in an outdoor, well ventilated location. This location should not be accessible to the general public.

Annex D
(informative)

In-service inspection

D.1 During the operational life of the system, inspection and testing are carried out according to national regulations.

Information about in-service inspection given in this annex can be used where no similar criteria exist in national regulations.

Table D.1 — In-service inspection

Subclause	Inspection		Test		
	External visual EN 378-2:2016, Annex G	Corrosion	Pressure test for system	Refrigerant [a] leakage indication system	Safety device check
D.2	X		X	X	
D.3	X		X	X	
D.4	X			X	
D.5				X	
D.6					X
D.7	X			X	
D.9		X [b]			

[a] The pressure of the system should be above atmospheric pressure for the tightness test.

[b] Not for new equipment.

D.2 In-service inspection is carried out after service work that is likely to affect strength, or when a change in use has occurred, or when changing to another refrigerant at a higher pressure, or after standstill for longer than two years. Components, which do not conform, are changed. Test pressures higher than appropriate for the PS of the components are not applied.

D.3 In-service inspection is carried out after repair or significant alterations or extensions to the systems or components.

Testing should be restricted to the parts affected.

D.4 In-service inspection is carried out after reinstalling on another site.

D.5 Leak testing of the system is to be performed if serious suspicion of leaks is raised. For the purposes of this paragraph, “inspected for leakage” means that the equipment or system is examined primarily for leakage using direct or indirect measuring methods, focusing on those parts of the equipment or system most likely to leak.

Frequency of inspection for leakage varies from:

— once every 12 months for systems with 3 kg or more of refrigerant except for hermetically sealed systems containing less than 6 kg;

— once every 6 months for applications containing 30 kg or more of refrigerant;

— once every 3 months for applications containing 300 kg or more of refrigerant.

The systems should be inspected for leakage within one month after a leak has been repaired to ensure that the repair has been effective.

For applications containing 3 kg or more of refrigerant the operator should maintain records on the quantity and type of refrigerant installed, any quantities added and the quantity recovered during maintenance, servicing and final disposal.

For applications containing 300 kg or more of refrigerant, the operator should install leakage indication systems. These leakage indication systems should be inspected at least once every 12 months to ensure their proper functioning.

Where a properly functioning appropriate leakage indication system is in place, the frequency of the inspections may be halved.

High leakage rates are unacceptable. Action should be taken to eliminate every detected leak.

NOTE Fixed refrigerant detectors are not leak detectors because they do not locate the leak.

D.6 Safety devices are checked on site: annually for safety switching devices (see EN 378-2:2016 6.3.4.3.3), emergency signals and alarm systems; every five years for external pressure relief devices.

D.7 Pressure relief valves and bursting discs are visually checked in accordance with EN 378-2:2016, 6.3.4.3.1, 6.3.4.3.4, and 6.3.4.3.5 and leak tested annually.

D.8 For unit systems and self-contained systems, in-service inspection is carried out after repairs have been made. If loss of refrigerant is evident the whole system is leak tested.

D.9 Where piping, piping supports, components and component supports are not insulated, they should be visually inspected. Insulated piping and components should be visually inspected if the vapour barrier is damaged or if it does not function as intended.

Annex E
(informative)

Guidelines for repairs of equipment using flammable refrigerants

E.1 General requirements for equipment

The operating instructions should at least contain the following information:

— only competent persons that are trained in the use of flammable refrigerants are permitted to open equipment housings or to break into the refrigerant circuit;

— instructions covering normal operation including start-up and shut-down;

— instructions covering systematic maintenance and repair including safe opening of equipment and components;

— instructions covering the testing of equipment safety systems and components;

— information of the risks of possible explosive atmospheres and preventing them;

— information on the working procedure for preventing the risk of flammable refrigerant leaking into the atmosphere as much as possible;

— reference to national rules and regulations that apply to explosive atmospheres (e.g. reference to EN 1127-1).

E.2 Repairs to electrical components

E.2.1 Repairs to electrical components

The repair of electrical components should include in-service tests to be able to determine the effects of ageing, wear or mechanical stress, e.g. through compressor or fan, on these components.

E.2.2 Repairs to sealed components

The relevant power feed should be switched off before the sealed components are opened. If it is not necessary to switch off the relevant electrical components for repair work, the concentration in the atmosphere in the area concerned should be monitored continuously in order to be able to warn people about a potentially dangerous situation.

Leak detection equipment is set at 20 % of the LFL of the refrigerant within the equipment and should be calibrated for the refrigerant in question.

The protective conductor connections should be checked according to the national rules and regulations each time a repair is made. The wiring and cabling should also be checked to make sure they are not damaged.

If a defect is found, which puts the reliable operation of the refrigerating systems at risk, the installation should not be started up again.

E.2.3 Repairs to intrinsically safe components

Any permanent inductive or capacitance loads to the circuit should not be applied without ensuring that this will not exceed the permissible voltage and current permitted for the refrigerant used.

Intrinsically safe components are the only type that can be worked on whilst live in the presence of a flammable atmosphere. Test apparatus should also be of an appropriate rating.

E.3 Repairs to refrigerating system

The following precautions should be taken before working on the refrigerant circuit:

— obtain permit for hot work (if required);

— ensure that no flammable materials are stored in the work area and that no ignition sources are present anywhere in the work area;

— ensure that suitable fire extinguishing equipment is available;

— ensure that the work area is properly ventilated before working on the refrigerant circuit or before welding, brazing or soldering work;

— ensure that the leak detection equipment being used is non-sparking, adequately sealed or intrinsically safe;

— ensure that all maintenance staff have been instructed.

NOTE If the installation permits, it is recommended that the equipment is removed from its existing position to a controlled workshop environment where work can be conducted safely.

The following procedure should be followed before working on the refrigerant circuit:

a) remove refrigerant (specify the residual pressure);

b) purge circuit with inert gas (e.g. nitrogen);

c) evacuate to a pressure of 30 kPa absolute (or 0,03 MPa);

d) purge again with inert gas (e.g. nitrogen);

e) open the circuit.

The area should be checked with an appropriate refrigerant detector prior to and during any hot work to make the technician aware of a potentially flammable atmosphere.

If compressors or compressor oils are to be removed, it should be ensured that it has been evacuated to an acceptable level to ensure that there is no flammable refrigerant remaining within the lubricant.

Only refrigerant recovery equipment designed for use with flammable refrigerants should be employed.

If the national rules or regulations permit the refrigerant to be drained, this should be done safely, using a hose, for example, through which the refrigerant is discharged into the outside atmosphere in a safe area. It should be ensured that an inflammable explosive refrigerant concentration cannot occur in the vicinity of an ignition source or penetrate into a building under any circumstance.

In the case of refrigerating systems with an indirect system, the heat-transfer fluid should be checked for the possible presence of refrigerant.

After any repair work, the safety devices, for example refrigerant detectors and mechanical ventilation systems, should be checked and the results recorded.

It should be ensured that any missing or illegible label on components of the refrigerant circuit is replaced.

Sources of ignition should not be used when searching for a refrigerant leak.

E.4 Requirements for the competent persons

Maintenance and repair requiring the assistance of other skilled personnel should be carried out under the supervision of the person competent in the use of flammable refrigerants. Any person conducting servicing or maintenance on a system or associated parts of the equipment should be competent according to EN 13313.

Persons working on refrigerating systems with flammable refrigerants should have competence in safety aspects of flammable refrigerant handling supported by evidence of appropriate training. This will include the following requirements:

— knowledge of legislation, regulations and standards relating to flammable refrigerants;

— detailed knowledge of and skill in handling flammable refrigerants, personal protective equipment, refrigerant leakage prevention, handling of cylinders, charging, leak detection, recovery and disposal.

Competent persons should be able to understand and to apply in practise the requirements in this European Standard.

Regular further training might be necessary to maintain this expertise.

Bibliography

[1] EN 1127-1, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

[2] EN 13313, *Refrigerating systems and heat pumps — Competence of personnel*

[3] ISO 817, *Refrigerants — Designation and safety classification*

[4] AHRI Standard 700, 2011, Standard for Specifications for Fluorocarbon Refrigerants

[5] AHRI Guideline N, Assignment of Refrigerant Container Colours

[6] EN 60335-1, *Safety of household and similar electrical appliances — Part 1: General requirements (IEC 60335-1)*

[7] EN 60335-2-24, *Household and similar electrical appliances — Safety — Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice makers (IEC 60335-2-24)*

[8] EN 60335-2-34, *Household and similar electrical appliances — Safety — Part 2-34: Particular requirements for motor-compressors (IEC 60335-2-34)*

[9] EN 60335-2-40, *Household and similar electrical appliances — Safety — Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers (IEC 60335-2-40)*

[10] EN 60335-2-89, *Household and similar electrical appliances — Safety — Part 2-89: Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant condensing unit or compressor (IEC 60335-2-89)*

[11] REGULATION (EU) No 517/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006

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