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AMENDMENT 1
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Amendment 1

Household and similar electrical appliances – Safety –

Part 2-40: Particular requirements for electrical heat pumps, air conditioners and dehumidifiers

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FOREWORD

This amendment has been prepared by subcommittee 61D: Appliances for air-conditioning for household and similar purposes, of IEC technical committee 61: Safety of household and similar electrical appliances.

The text of this amendment is based on the following documents:

FDIS	Report on voting
61D/138/FDIS	61D/140/RVD

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

The contents of the corrigendum of May 2006 have been included in this copy.

CONTENTS

Add the titles of new Annexes BB to GG as follows:

1 Scope

Delete the word "sealed" from the first paragraph.

Add, after the second paragraph, the following new paragraph:

This standard also applies to electric **heat pumps**, **air conditioners** and **dehumidifiers** containing **flammable refrigerant**. **Flammable refrigerants** are defined in 3.120.

Replace the existing Note 101 by the following:

NOTE 101 A definition of 'motor-compressor' is given in IEC60335-2-34, which includes the statement that the term motor-compressor is be used to designate either a hermetic motor-compressor or semi-hermetic motor-compressor.

Add, after Note 102, the following new paragraph:

This standard does not take into account chemicals other than group A1, A2, or A3 as defined by 3.121.

Replace the existing Note 103 by the following:

NOTE 103 This standard specifies particular requirements for the use of flammable refrigerants. Unless specifications are covered by this standard, including the annexes, requirements for refrigerating safety are covered by ISO 5149.

The sections and clauses in ISO 5149 of particular concern to this standard are as follows:

– Section 3: Design and construction of equipment applies to all appliances and systems.

– Section 4: Requirements for utilization applies to appliances and systems which are for "similar electrical appliances", i.e. commercial and light industrial.

– Section 5: Operating procedures applies to appliances and systems which are for "similar electrical appliances", i.e. commercial and light industrial.

Replace, in Note 4, the last dashed item by the following:

– In many countries additional requirements are specified, for example, by the national health authorities responsible for the protection of labour and the national authorities responsible for storage, transportation, building constructions and installations.

2 Normative references

The clause of Part 1 is applicable except as follows.

Add to the existing list the titles of the following standards:

IEC 60079-14, *Electrical apparatus for explosive gas atmospheres – Part 14: Electrical installations in hazardous areas (other than mines)*

IEC 60079-15:2001, *Electrical apparatus for explosive atmospheres – Part 15: Type of protection "n"*

ISO 817:1974, *Organic refrigerants – number designation*

ISO 3864:1984, *Safety colours and safety signs*[1)]

ISO 5149:1993 *Mechanical refrigerating systems used for cooling and heating – Safety requirements*

ISO 7000: Graphical symbols for use on equipment – Index synopsis

ANSI/ASHRAE 34:2001, *Designation and safety classification of refrigerants*

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1) ISO 3864:1984 has been replaced by ISO 3864-1 2002, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs in workplaces and public areas* and ISO 7010:2003, *Graphical symbols – Safety colours and safety signs -- Safety signs used in workplaces and public areas.* However the safety sign referred to here in ISO 3864 (symbol B.3.2, Caution, risk of fire) is no longer contained in either ISO 3864-1 or ISO 7010.

3 Definitions

Add the following new definitions:

3.121
flammable refrigerant
refrigerant with a classification of class A2 or A3 in compliance with ANSI/ASHRAE 34-2001 [ISO817] classification.

3.122
refrigerating system
combination of interconnected refrigerant containing parts constituting one closed refrigerant circuit in which refrigerant is circulated for the purpose of extracting heat at the low temperature side to reject heat at the high temperature side by changing the state of the refrigerant

3.123
maximum allowable pressure
a limit to the refrigerating system operating pressure, generally the maximum pressure for which the equipment is designed, as specified by the manufacturer

NOTE Maximum allowable pressure constitutes a limit to the operating pressure whether the equipment is working or not, see Clause 21.

3.124
low-pressure side
the part(s) of a refrigerating system operating at the evaporator pressure

3.125
high-pressure side
the part(s) of a refrigerating system operating at the condenser pressure

3.126
service port
a means to access the refrigerant in a refrigerating system for the purpose of charging or servicing the system, typically a valve, tube extension or entry location

5 General conditions for the tests

Add the following subclause:

5.2 *Addition:*

The testing of Clause 21 may be carried out on separate samples. The testing of Clauses 11, 19 and 21 shall require that pressure measurements be made at various points in the ***refrigerating system***

At least one additional specially prepared sample is required for the tests of Annex FF (Leak simulation tests), if that test option is selected.

The temperatures on the refrigerant piping should be measured during the test of Clause 11.

NOTE Due to the potentially hazardous nature of the tests of Clause 21 and Annexes EE and FF, special precautions need to be taken when carrying out the tests.

5.102 *Motor compressors that are tested and comply with IEC 60335-2-34 need not be additionally tested for Clause 21.*

7 Marking and instructions

7.1 *Modification:*

Add the following paragraphs to the existing addition:

The flame symbol and the instruction manual symbol of 7.6 shall be visible when a **flammable refrigerant** is employed and the following conditions exist:

– accessing parts expected to be subjected to maintenance or repair;

– observing the appliance under sale or installed conditions;

– observing the appliance packaging, if the appliance is charged with refrigerant.

If a flammable refrigerant is used, the symbols for “read operator’s manual”, “operator’s manual; operating instructions” and “service indicator; read technical manual” (symbols 0790, 1641 and 1659 of ISO 7000) shall be placed on the appliance in a location visible to the persons required to know the information. The perpendicular height shall be at least 10 mm.

An additional warning symbol (flame symbol: B.3.2 of ISO 3864) shall be placed on the nameplate of the unit near the declaration of the refrigerant type and charge information. The perpendicular height shall be at least 10 mm, and the symbol need not be in colour.

NOTE 101 When installed, the marking should be visible after removing a **detachable** part.

The following warning shall also be applied to the appliance when a **flammable refrigerant** is employed.

WARNING **Appliance** shall be installed, operated and stored in a room with a floor area larger than ‘X’ m^2 (only applies to **appliances** that are not **fixed appliances**).

For **appliances,** which are not **fixed appliances**, the minimum room size X shall be specified on the appliance. The X in the marking shall be determined in m^2 by the procedure described in paragraph 2 of Annex GG for unventilated areas and the X in the marking shall be 4 if the refrigerant charge of the appliance is less than m_1 (see Annex GG, paragraph 1.1).

The maximum allowable pressure for the low-pressure side and the high-pressure side shall be marked on the product.

NOTE 102 For the **refrigerating system**; if the **maximum allowable pressure** of the **low-pressure side** and the **high-pressure side** is the same, a single indication is permitted.

If not already visible when accessing a **service port** and if a **service port** is provided, the **service port** shall be marked to identify the type of refrigerant. If the refrigerant is flammable, symbol B.3.2 of ISO 3864, shall be included, without specifying the colour.

Add the following subclause:

7.6 *Addition:*

When a **flammable refrigerant** is employed, a warning symbol B.3.2 of ISO 3864, including colour and format, shall be permanently placed on the appliance. The perpendicular height of the triangle containing the "Caution, risk of fire" symbol shall be at least 30 mm.

When a **flammable refrigerant** is employed, a symbol requiring reference to the manual [0790 of ISO 7000], including colour and format, shall be permanently placed on the appliance.

7.12 *Addition*:

For **appliances** using **flammable refrigerants**, an installation, service and operation manual, either separate or combined manuals, shall be provided and include the information given in Annex DD.

19 Abnormal operation

Add the following subclause after subclause 19.10

19.10.1 *The test of 19.10 is repeated on class 01 appliances and class 1 appliances incorporating tubular sheathed or embedded heating elements. However, controls are not short-circuited but one end of the element is connected to the sheath of the heating element.*

The test is repeated with the polarity of the supply to the appliance reversed and with the other end of the element connected to the sheath.

The test is not carried out on appliances intended to be permanently connected to fixed wiring and on appliances where **all-pole disconnection** occurs during the test of 19.10.

19.14 *Amend the opening of the first sentence to read:*

"During the tests of 19.2 to 19.10.1 and 19.11..."

21 Mechanical strength

Add the following paragraph:

Safety requirements specified in Annex EE shall apply. The pressure test in Annex EE applies to parts other than pressure vessels.

22 Construction

Add the following new subclauses:

22.112 The construction of the **refrigerating system** shall comply with the requirements of Section 3 of ISO 5149.

22.113 When a **flammable refrigerant** is used, refrigerant tubing shall be protected or enclosed to avoid mechanical damage. The tubing shall be protected to the extent that it will not be handled or used for carrying during moving of the product. Tubing located within the confines of the cabinet is considered to be protected from mechanical damage.

Compliance is checked by inspection.

22.114 When a **flammable refrigerant** is used, low temperature solder alloys, such as lead/tin alloys, are not acceptable for pipe connections.

22.115 The total refrigerant mass (M) of all **refrigerating systems** within the appliance employing **flammable refrigerants,** shall not exceed m_3 as defined in Annex GG.

22.116 Appliances using **flammable refrigerants** shall be constructed so that any leaked refrigerant will not flow or stagnate so as to cause a fire or explosion hazard in areas within the appliance where electrical components, which could be a source of ignition and which could function under normal conditions or in the event of a leak, are fitted.

Separate components, such as thermostats, which are charged with less than 0,5 g of a flammable gas are not considered to cause a fire or explosion hazard in the event of leakage of the gas within the component itself.

All electrical components that could be a source of ignition and which could function under normal conditions or in the event of a leak, shall comply with one of the following.

– IEC 60079-15:2001, Clauses 9 to 26, for group IIA gases or the refrigerant used or an applicable standard that makes electrical components suitable for use in Zone 2, 1 or 0 as defined in IEC 60079-14.
– Not be located in an area where a potentially flammable gas mixture will accumulate as demonstrated by the test of Annex FF
– Be located in an enclosure. The enclosure containing the electrical components shall comply with IEC 60079-15:2001 for enclosures suitable for use with group IIA gases or the refrigerant used.

NOTE The test current for a switching component is the rated current of the component or the actual load to be switched, whichever is greater.

22.117 Temperatures on surfaces that may be exposed to leakage of **flammable refrigerants** shall not exceed the auto-ignition temperature of the refrigerant reduced by 100 K; some typical values are given in Annex BB.

Compliance is checked by measuring the appropriate surface temperatures during the tests of Clauses 11 and 19, except those which during the tests of Clause 19 are terminated in a non-self-resetting way.

22.118 When a **flammable refrigerant** is used, all appliances shall be charged with refrigerant at the manufacturing location or charged on site as recommended by the manufacturer.

A part of an appliance that is charged on site, which requires brazing or welding in the installation shall not be shipped with a **flammable refrigerant** charge. Joints made in the installation between parts of the **refrigerating system**, with at least one part charged, shall be made in accordance with the following.

– A brazed, welded, or mechanical connection shall be made before opening the valves to permit refrigerant to flow between the refrigerating system parts. A vacuum valve shall be provided to evacuate the interconnecting pipe and/or any uncharged refrigerating system part.
– Reusable mechanical connectors and flared joints are not allowed indoors.
– Refrigerant tubing shall be protected or enclosed to avoid damage.

Flexible refrigerant connectors (such as connecting lines between the indoor and outdoor unit) that may be displaced during normal operations shall be protected against mechanical damage.

Compliance is checked according to the manufacturer's installation instructions and a trial installation if necessary.

Annexes

Add the following new annexes:

Annex BB
(normative)
Selected information about refrigerants

The normative component of this annex involves the “Lower limit” column of Table BB.1. The rest of the annex is informative.

Refrigerant designation[1]	Description	Formula	Auto-ignition temperatures °C	Density (2),(5) kg/m^3	Molar mass[3] kg/kmol	Lower flammability limit[2]	
						kg/m^3[4]	% v/v
R32	Difluoromethane	CH_2F_2	648	2,13	52,0	0,306	14,4[7]
R50	Methane	CH_4	645	0,65	16,0	0,032	4,9[8]
R143a	1,1,1 – Trifluoroethane	CF_3CH_3	750	3,43	84,0	0,282	8,2[7]
R152a	1, 1 – Difluoroethane	CHF_2CH_3	455	2,70	66,0	0,130	4,8[7]
R170	Ethane	CH_3CH_3	515	1,23	30,1	0,038	3,1[7]
R290	Propane	$CH_3CH_2CH_3$	470	1,80	44,1	0,038	2,1[7]
R600	n-Butane	$CH_3CH_2CH_2CH_3$	365	2,37	58,1	0,043	1,8[9]
R600a	Isobutane	$CH(CH_3)_3$	460	2,37	58,1	0,043	1,8[10]
R1150	Ethylene	$CH_2=CH_2$	425	1,15	28,1	0,036	3,1[7]
R1270	Propylene	$CH_2=CHCH_3$	455	1,72	42,1	0,040	2,3[11]
E170	Dimethylether	CH_3 °CH_3	235	1,88	46,1	0,064	3,4[12]
R142b	1-chloro-1,1-difluoroethane	CH_3CClF_2	750[6]	4,11	100,5	0,329	8,0[7]

(1) The refrigerant designations are in accordance with ISO 817

(2) These values are at 25°C and at 1013,2 mbar

(3) For comparison, the molecular mass of air is taken equal to 28,8 kg/kmol

(4) Multiply % v/v by the corresponding molar mass * 0,000409 to give the flammability limit in kg/m^3

(5) Divide molar mass by 24,465 to give the density in kg/m3

(6) Estimated from molecular structure

(7) WILSON, DP. and Richard, RG. Determination of Refrigerant Lower Flammability Limits in Compliance with Proposed Addendum p to Standard 34. *ASHRAE Transactions:* 2002 V. 108, Pt. 2.

(8) BURRELL, GA. and OBERFELL, GG. U.S. Bur. Mines, Tech. Paper 119, (1915)

(9) LAFFITTE, P. and DELBOURGO, R. *4th Symp. on Combust.*, p.114(1953)

(10) ZABETAKIS, MG., SCOTT, GS., JONES, GW. *Ind. Eng. Chem.*, 43, 2120, (1951)

(11) Estimated from LFL for propane analogs and data from JABBOUR, T., CLODIC, D. Burning Vel °City and Refrigerant Flammability Classification, Ecole de Mines, Paris, France, *ASHRAE Transactions* 2004.

(12) Atofina application to ASHRAE for safety classification of R-E170, 13 December 2001

Annex CC
(informative)

Transportation, marking and storage for units that employ flammable refrigerants

The following information is provided for units that employ flammable refrigerants:

CC.1 Transport of equipment containing flammable refrigerants

Attention is drawn to the fact that additional transportation regulations may exist with respect to equipment containing flammable gas. The maximum number of pieces of equipment or the configuration of the equipment, permitted to be transported together will be determined by the applicable transport regulations.

CC.2 Marking of equipment using signs

Signs for similar appliances used in a work area generally are addressed by local regulations and give the minimum requirements for the provision of safety and/or health signs for a work location.

All required signs are to be maintained and employers should ensure that employees receive suitable and sufficient instruction and training on the meaning of appropriate safety signs and the actions that need to be taken in connection with these signs.

The effectiveness of signs should not be diminished by too many signs being placed together.

Any pictograms used should be as simple as possible and contain only essential details.

CC.3 Disposal of equipment using flammable refrigerants

See National Regulations.

CC.4 Storage of equipment/appliances

The storage of equipment should be in accordance with the manufacturer's instructions.

CC.5 Storage of packed (unsold) equipment

Storage package protection should be constructed such that mechanical damage to the equipment inside the package will not cause a leak of the refrigerant charge.

The maximum number of pieces of equipment permitted to be stored together will be determined by local regulations.

Annex DD
(normative)

Service operations

DD.1 General

For appliances using **flammable refrigerants**, an installation, service and operation manual, in the form of either separate or combined manuals, shall be provided and shall include the following information.

DD.2 Symbols

The symbol referred to in 7.6 (without colours is permitted) and the information of the warning marking shall be provided as follows:

WARNING
Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.
The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater.
Do not pierce or burn.
Be aware that refrigerants may not contain an odour,
Appliance shall be installed, operated and stored in a room with a floor area larger than X m^2.

NOTE The manufacturer may provide other suitable examples or may provide additional information about the refrigerant odour.

DD.3 Information in manual

DD.3.1 The following information shall be specified in the manual where the information is needed for the function of the manual and as applicable to the appliance:

– information for spaces where pipes containing flammable refrigerant are allowed, including statements
  - that the installation of pipe-work shall be kept to a minimum;
  - that pipe-work shall be protected from physical damage and shall not be installed in an unventilated space, if that space is smaller than A_{min} in Annex GG;
  - that compliance with national gas regulations shall be observed;
  - that mechanical connections made in accordance with 22.118, shall be accessible for maintenance purposes;
  - that the minimum floor area of the room shall be mentioned in the form of a table or a single figure without reference to a formula;
– the maximum refrigerant charge amount (M);
– the minimum rated airflow, if required by Annex GG;
– information for handling, installation, cleaning, servicing and disposal of refrigerant;
– the minimum floor area of the room or the special requirements for the room in which the appliance can be located as defined in Annex GG, except where the refrigerant charge (M) is less than or equal to m_1 ($M \leq m_1$);

– a warning to keep ventilation openings clear of obstruction;

– a notice that servicing shall be performed only as recommended by the manufacturer.

DD.3.2 The manual shall include a statement advising that an unventilated area where the appliance using **flammable refrigerants** is installed shall be so constructed that should any refrigerant leak, it will not stagnate so as to create a fire or explosion hazard. This shall include:

– a warning that the appliance shall be stored in a well-ventilated area where the room size corresponds to the room area as specified for operation;

– a warning that the appliance shall be stored in a room without continuously operating open flames (for example an operating gas appliance) and ignition sources (for example an operating electric heater).

NOTE The manufacturer should specify other potential continuously operating sources known to cause ignition of the refrigerant used.

The appliance shall be stored so as to prevent mechanical damage from occurring.

DD.3.3 The manual shall contain specific information about the credentials of qualified service personnel as follows.

– Any person who is involved with working on or breaking into a refrigerant circuit should hold a current valid certificate from an industry-accredited assessment authority, which authorises their competence to handle refrigerants safely in accordance with an industry recognised assessment specification.

– Servicing shall only be performed as recommended by the equipment manufacturer. Maintenance and repair requiring the assistance of other skilled personnel shall be carried out under the supervision of the person competent in the use of flammable refrigerants.

DD.4 Information on servicing

The manual shall contain specific information for service personnel who shall be instructed to undertake the following when servicing an appliance that employs a flammable refrigerant.

DD.4.1 Checks to the area

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimised. For repair to the refrigerating system, the following precautions shall be complied with prior to conducting work on the system.

DD.4.2 Work procedure

Work shall be undertaken under a controlled procedure so as to minimise the risk of a flammable gas or vapour being present while the work is being performed.

DD.4.3 General work area

All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided. The area around the workspace shall be sectioned off. Ensure that the conditions within the area have been made safe by control of flammable material.

DD.4.4 Checking for presence of refrigerant

The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with flammable refrigerants, i.e. non-sparking, adequately sealed or intrinsically safe.