

# INTERNATIONAL STANDARD



## AMENDMENT 1

**Household and similar electrical appliances – Safety –  
Part 2-34: Particular requirements for motor-compressors**

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With Norm



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### Household and similar electrical appliances – Safety – Part 2-34: Particular requirements for motor-compressors

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## FOREWORD

This amendment has been prepared by sub-committee 61C: Safety of refrigeration appliances for household and commercial use, 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
61C/597/FDIS	61C/603/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 stability 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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

The contents of the corrigendum of June 2015 have been included in this copy.

NOTE The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## INTRODUCTION

*Delete the ninth paragraph.*

### 1 Scope

*Add the following new paragraphs before Note 101:*

This standard also covers

- multi-speed **motor-compressors**, that are **motor-compressors**, the speed of which can be set to different values;
- variable capacity **motor-compressors**, that are **motor-compressors** where the capacity of the compressor is controlled at fixed speeds.

### 2 Normative references

*Replace "This clause of Part 1 is applicable." by "This clause of Part 1 is applicable except as follows.*

*Addition:"*

IEC 60079-15:2010, *Explosive atmospheres – Part 15: Equipment protection by type of protection "n"*

IEC 60851-4, *Methods of test for winding wires – Part 4: Chemical properties*

IEC 60851-5:2008, *Winding wires – Test methods – Part 5: Electrical properties*

ISO 7010, *Graphical symbols – Safety colours and safety signs – Registered safety signs*

### 3 Terms and definitions

**3.107** *Replace Note 1 to entry by the following:*

Note 1 to entry: For the purpose of this standard, the following classifications of application categories are made relative to the evaporation temperature range:

- low back pressure (LBP): denotes an evaporation temperature range from –35 °C to –15 °C;
- medium back pressure (MBP): denotes an evaporation temperature range from –20 °C to 0 °C;
- high back pressure (HBP): denotes an evaporation temperature range from –5 °C to +15 °C.

*Add the following new definition:*

#### **3.111**

##### **two-stage motor-compressor**

**motor-compressor** comprising two compressors and one motor in a single **housing**

### 5 General conditions for the tests

*Add the following new subclause:*

**5.103** *For cascade systems comprising two or more motor-compressor circuits, each **motor-compressor** circuit is tested separately in the end product. IEC 60335-2-34 is not applicable for the system but each **motor-compressor** can be tested according to this standard.*

## 6 Classification

**6.101** Delete the third paragraph.

Add the following new subclause:

**6.105** Motor-compressors using refrigerant R744 shall be classified as used in a **transcritical refrigeration system** or in a **non-transcritical refrigeration system**.

*Compliance is checked by inspection and by the relevant tests.*

## 7 Markings and instructions

Add the following:

**7.1** Addition:

**Motor-compressors** suitable for use with a flammable refrigerant shall be marked with symbol ISO 7010 W021.

**7.6** Addition:



Symbol ISO 7010 W021

Warning; flammable materials

Add the following new subclause:

**7.101** Refrigerants that can be used with the **motor-compressor** shall be listed in the instructions.

*Compliance is checked by inspection.*

## 22 Construction

**22.7** Add the following as a new second dashed item to the second paragraph of the test specification:

- for R-744 **non-transcritical refrigeration systems**, a minimum of 3,5 times the saturated vapour pressure of the refrigerant at 27 °C, rounded up to the next 0,5 MPa (5 bar).

Add the following after the existing second dashed as a new dashed item to the second paragraph of the test specification:

- if the **motor-compressor** employs a bypass valve, a minimum of 3 times the maximum high side pressure, but not less than the minimum test pressure as required in Table 101.

In the third paragraph of the test specification beginning "The test values for some refrigerants are given in Table 101" change the style to italic font.

Add the following as a last entry to Table 101:

Non-transcritical CO <sub>2</sub>	R-744	23,0	(230)
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Add the following as new paragraphs immediately before Note 102:

A **housing** which is exposed only to low side pressure in **R-744 non-transcritical refrigeration systems** shall be subjected to a pressure equal to a minimum of 5 times the saturated vapor pressure of the refrigerant at – 6,5 °C or equal to 13,5 MPa (135 bar), whichever is higher, rounded up to the next 0,2 MPa (2 bar).

A **housing** which is exposed only to low side pressure in **transcritical refrigeration systems** shall be subjected to a pressure equal to a minimum of 5 times the **design pressure** but not less than the minimum test pressure as required by Table 102.

For a **motor-compressor** employing a bypass valve, the **housing** which is exposed only to low side pressure shall be subjected to a pressure equal to 3 times the maximum low side pressure, but not less than the minimum test pressure as required in Table 102.

In the existing fifth paragraph of the test specification beginning "The test values for some refrigerants are given in Table 102" change the style to italic font.

Add the following as a last entry to Table 102:

Non-transcritical CO <sub>2</sub>	R-744	14,0	(140)
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**22.9** Replace Note 101 by the following:

For the types of refrigerant and types of oil for which the **motor-compressor** is intended to be used, compliance of winding wire insulation shall be checked by the tests detailed in Annex BB or **motor-compressors** that do not use oil by test 16 in IEC 60851-4 for resistance to refrigerants.

For test 16 in IEC 60851-4, the percentage of extractable matter shall not exceed 0,5 %. The breakdown voltage shall be at least 75 % of the minimum specified value.

For the types of refrigerant and types of oil for which the **motor-compressor** is intended to be used, compliance of tie cords and insulation materials other than winding wire insulation shall be checked by the tests detailed in Annex CC.

## 24 Components

Add the following new subclause:

**24.101** In **motor-compressors** that employ flammable refrigerants, components that may arc or spark during **normal operation** of the end product shall comply with the requirements of IEC 60079-15, as modified by Annex DD, for group IIA gases or the refrigerant used. This requirement is not applicable to components within the **housing**.

Compliance is checked by inspection and the appropriate tests of IEC 60079-15.

**Annex AA – Running overload tests for motor-compressors classified as tested with Annex AA**

**AA.1** Add the following to the end of the first paragraph:

*Excluding starting current, the maximum value of the current averaged over any 5 min period is recorded. The interval between current measurements shall not exceed 30 s. The starting current is considered to be excluded if the first current measurement is made approximately 1 min after starting.*

NOTE 1 The current is recorded to aid in checking reproducibility of test results.

Renumber existing Notes 1 to 6 as Notes 2 to 7.

**AA.2** Add the following to the first paragraph as a new second sentence:

*However, for R-744 refrigerant intended for use in a **transcritical refrigeration system**, for all tests the maximum operating discharge pressure is 12 MPa and the return gas temperature is +25 °C.*

**Table AA.1 – Substitute refrigeration circuit conditions for operating under running overload conditions**

Replace the fourth column by the following:

Evaporation temperature °C
-15
-15
0
0
+15
+15
-15
-15
0
0
+15
+15
-15
-15
0
0
+15
+15

Add a new row at the bottom of the table as follows:

NOTE For R-744 refrigerant intended for use in a non-**transcritical refrigeration system**, for all tests the evaporation temperature is -15 °C, the condensation temperature is +20 °C , the **motor compressor** ambient temperature is +43 °C and the return gas temperature is +2 °C.

**AA.4** Add the following to the first paragraph as a new second sentence:

However, for R-744 refrigerant intended for use in a **transcritical refrigeration system**, for all tests the maximum operating discharge pressure is 12 MPa and for tests 4 and 6 the return gas temperature is +25 °C.

Replace the text of the second paragraph first dashed item by the following:

- the temperature rises of the **motor-compressor control system** and the **motor-compressor protection system** containing **electronic components** are measured and shall not exceed the values given in Table 3 of Part 1, reduced by 7 K;

**Table AA.2 – Substitute refrigeration circuit conditions for operating under maximum and minimum load conditions**

Replace the fourth column by the following:

Evaporation temperature
°C
–15
–35
–15
–35
0
–20
0
–20
+15
–5
+15
–5

**AA.5** Replace the first sentence of the third paragraph by the following:

For refrigerants other than R-744, the condensing temperature is then increased in steps of 5 K until steady conditions are reached at each step.

Add the following as a new fourth paragraph:

For R-744 refrigerant, the operating discharge pressure is then increased in steps of 0,8 MPa until steady conditions are reached at each step. This procedure is continued until one of the following conditions occurs:

- the **motor-compressor protective electronic circuit** operates to disconnect the **motor-compressor** from the supply;
- the **motor-compressor** stalls and steady conditions are reached

Replace the text of the first paragraph of the Note by the following:

The resistance of the windings at the end of the test can be determined by taking resistance measurements as soon as possible after switching off, and then at short intervals so that a curve of resistance against time can be plotted for ascertaining the resistance at the instant of switching off.

**Figure AA.1 – Substitute refrigeration circuit**

In the second sentence of Note 3, change “may” to “can”.

Add the following new annexes:

## Annex BB (normative)

### Winding wire insulation compatibility tests

NOTE CAUTION: Extreme care should be taken when conducting this test. There are elevated pressure levels within the test vessels which are also under elevated ambient conditions. In addition, mixing of some chemicals and/or lubricants followed by exposure to high temperatures could produce toxic fumes and/or materials.

**BB.1** Testing of winding wire insulation shall be conducted on two sets of six representative samples as follows:

- a) Film-coated winding wire shall be prepared in accordance with 4.4.1 of IEC 60851-5:2008 except that samples for the refrigerant and oil exposure shall not have the loop at the end removed until after the refrigerant and oil exposure.
- b) Other winding wires shall be straight lengths of wire.

**BB.2** The size of the test samples shall be the smallest nominal wire size (diameter) intended for use on the **motor-compressor**.

**BB.3** One set of six samples shall be maintained in the as-received condition (no exposure to refrigerant and oil). Another set of six samples shall be prepared for the refrigerant and oil exposure testing.

**BB.4** The six as-received samples of winding wire shall be subjected to the electric strength test of 16.3 except that the applied voltage shall be 125 % of the maximum **working voltage** of the **motor-compressor**, but not less than 500 V. The test voltage is applied between the conductors of the wires. The winding wire tested shall withstand the application of the test voltage specified without breakdown.

**BB.5** The set of six samples prepared for the refrigerant and oil exposure testing shall be placed in test vessel(s) and each test vessel shall be provided with a pressure relief device. Each test vessel shall then be sealed, evacuated to 100 µm of mercury or less and heated to not less than 150 °C for at least 1 h.

NOTE A safety control other than a pressure relief device can be used if it serves the purpose of preventing excessive pressure build-up within a test vessel.

**BB.6** The oil shall be added within each test vessel so that all samples will remain partially immersed in the refrigerant-oil-mixture throughout the duration of the test, including during the no heat period.

**BB.7** Each test vessel shall then be re-sealed, evacuated and heated in accordance with Clause BB.5.

**BB.8** Each test vessel shall then be charged with the refrigerant vapour in a manner which does not permit air to be introduced into the test vessel. The pressure of the refrigerant vapour shall be any convenient pressure between 1,0 MPa and 2,4 MPa for any refrigerant other than transcritical R-744, which shall be at a pressure of not less than 7,3 MPa.

**BB.9** The test samples shall be tested as detailed in Table BB.1. The time of heating shall be divided into five equal heating periods. Each heating period is followed by a period without heating. The period without heating shall be at a temperature of approximately 25 °C for 48 h.

**BB.10** The time temperature heating cycle used for the test is selected by the manufacturer.

**Table BB.1 – Time temperature heating cycles**

Heating temperature °C	Total heating time h	Heating period h
140	1 440	288
145	1 080	216
150	720	144
155	540	108
160	360	72
175	240	48

**BB.11** Immediately after being exposed to the refrigerant and oil, the winding wire samples shall be subjected to the electric strength test of 16.3 except that the applied voltage shall be not less than 100 % of the maximum **working voltage** of the **motor-compressor** for which the winding wire is intended to be used. The test voltage is applied between the conductors of the wires. The winding wire tested shall withstand the application of the test voltage specified without breakdown.

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## Annex CC (normative)

### Tie cords and insulation compatibility tests

NOTE 1 CAUTION: Extreme care should be taken when conducting this test. There are elevated pressure levels within the test vessels which are also under elevated ambient conditions. In addition, mixing of some chemicals and/or lubricants followed by exposure to high temperatures could produce toxic fumes and/or materials.

NOTE 2 Annex CC is not applicable to winding wire insulation.

**CC.1** Testing of tie cords, insulating system materials or parts shall be conducted on two sets of six representative samples as follows:

- a) Tie cords shall be at least 500 mm long and of the minimum nominal thickness intended for use on the **motor-compressor**.
- b) Insulating system materials shall be of an amount approximately proportional to their use in the system. They shall be of the minimum nominal thickness intended for use on the **motor-compressor** and having an overall size so the test in Clause CC.3 can be conducted without flashover.
- c) Parts such as an internal motor terminal assembly or lead connection block shall be the actual type and size as intended for use in the **motor-compressor**.

NOTE A suggested overall size for the other insulating system materials is approximately 50 mm × 50 mm.

**CC.2** One set of six samples shall be maintained in the as-received condition (no exposure to refrigerant and oil). Another set of six samples shall be prepared for the refrigerant and oil exposure testing.

**CC.3** The six as-received samples of insulating materials or parts shall be subjected to the electric strength test of 16.3 except that the applied voltage shall be not less than 125 % of the maximum **working voltage** of the circuit for which the materials are intended, but not less than 500 V.

**CC.4** If the parts to be tested are:

- a) insulating materials other than tubing or leads, the test electrodes shall be opposing cylindrical rods, sized 5 mm diameter with edges rounded to a 1 mm radius;

NOTE The electrode size can be varied from the size specified to accommodate testing of small parts.

- b) tubing, the test electrodes shall be a copper conductor and spherical metal shot. The copper conductor shall be of a size approximately equal to the tubing internal diameter and then inserted into the tubing. The tubing and conductor shall be bent 180° over a mandrel having a diameter of not more than 10 mm. The metal shot shall be sized 2 mm to 3 mm diameter. The tubing and conductor shall be inserted into the metal shot such that the test voltage is applied between the conductor within the tubing and the metal shot;
- c) leads, the tests electrodes shall be the wire within the lead and metal foil 50 mm long, wrapped around the lead and centred on the lead length. The test voltage shall be applied between the wire within the lead and the metal foil.

**CC.5** The insulation or parts tested shall withstand the application of the test voltage specified without breakdown.

**CC.6** The six as-received sample tie cords shall be subjected to a breaking test as follows:

- a) Tie cord breaking strength shall be determined by using constant rate of specimen extension tensile testing machine. Clamping jaws, such as of the drum or capstan type to prevent slippage or breakage of the tie cord, shall be used. The distance between the contact points of the jaws shall be adjusted to 250 mm ±10 mm.