

# TECHNICAL SPECIFICATION



Refrigerant detection systems for flammable refrigerants

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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**REFRIGERANT DETECTION SYSTEMS  
FOR FLAMMABLE REFRIGERANTS**

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IEC TS 63542 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. It is a Technical Specification.

This first edition is based on Annex LL of IEC 60335-2-40:2022:

- Clause 4 – based on Clause LL.1, but without the 1st paragraph. An additional last paragraph has been added to link to relevant application standards;
- Clause 5 – based on Clause LL.2. An introductory sentence has been added to link to test conditions in the relevant application standard;
- Clause 6 – based on Clause LL.3;
- Clause 7 – based on Clause LL.4;
- Clause 8 – based on Clause LL.5;
- Clause 9 – based on Clause LL.6;

- Clause 10 – based on Clause LL.7;
- Clause 11 – based on Clause LL.8;
- Clause 12 – based on Clause LL.9;
- Clause 13 – based on Clause LL.10;
- Clause 14 – based on Clause LL.11;
- Clause 15 – based on Clause LL.12;
- Clause 16 – based on Clause LL.13;
- Clause 17 – based on Clause LL.14.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
61D/531/DTS	61D/534/RVDTS

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

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

NOTE The following print types are used:

- requirements: in roman type;
- *test specifications: in italic type;*
- notes: in small roman type.

Words in **bold** in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and associated noun are also in bold.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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## INTRODUCTION

It has been assumed in the drafting of this document that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

A refrigerant detection systems that complies with the text of this document will not necessarily be considered to comply with the safety principles of the document if, when examined and tested, it is found to have other features that impair the level of safety covered by these requirements.

A refrigerant detection systems employing materials or having forms of construction differing from those detailed in the requirements of this document may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with this document.

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# REFRIGERANT DETECTION SYSTEMS FOR FLAMMABLE REFRIGERANTS

## 1 Scope

This document applies to **refrigerant detection systems** for use in appliances complying with a relevant standard of the IEC 60335 series using **flammable refrigerants**.

Relevant standards of the IEC 60335-series include:

- IEC 60335-2-40, Household and similar electrical appliances – Safety – Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers
- IEC 60335-2-89, Household and similar electrical appliances – Safety – Part 2-89: Particular requirements for commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor
- 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
- IEC 60335-2-118, Household and similar electrical appliances – Safety – Part 2-118: Particular requirements for professional ice-cream makers

This document does not take into account refrigerants other than group A2L, A2 and A3 as defined by ISO 817.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60335-2-40:2022, *Household and similar electrical appliances – Safety – Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers*

IEC 60335-2-89, *Household and similar electrical appliances – Safety – Part 2-89: Particular requirements for commercial refrigerating appliances and ice-makers with an incorporated or remote refrigerant unit or motor-compressor*

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*

IEC 60335-2-118, *Household and similar electrical appliances – Safety – Part 2-118: Particular requirements for professional ice-cream makers*

ISO 817, *Refrigerants – Designation and safety classification*

ISO 7000:2004, *Graphical symbols for use on equipment – Registered symbols*



### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

#### 3.1

##### **flammable refrigerant**

refrigerant classified as safety group A2L, A2 or A3 according to ISO 817

#### 3.2

##### **refrigerant detection system**

sensing system which gives an output signal in response to a pre-set concentration of refrigerant in the environment

Note 1 to entry: A **refrigerant detection system** can have multiple **refrigerant sensors**.

#### 3.3

##### **lower flammability limit**

###### *LFL*

minimum concentration of the refrigerant that is capable of propagating a flame through a homogeneous mixture of the refrigerant and air

[SOURCE: ISO 817:2014, 3.1.24, modified – "under the specified test conditions at 23,0 °C and 101,3 kPa" and Notes to entry deleted.]

#### 3.4

##### **refrigerant sensor**

assembly in which the sensing element is housed and that may also contain associated circuit components

[SOURCE: IEC 60079-29-1:2016, 3.3.2, modified – "sensor" replaced by "refrigerant sensor"]

#### 3.5

##### **limited life refrigerant sensor**

**refrigerant sensor** which is expected to fail within the life of the appliance

### 4 General requirement

**Refrigerant detection systems** shall give an output signal at a predetermined alarm set point in response to leaked refrigerant.

**Refrigerant detection systems** may respond directly to the refrigerant concentration or may respond to gases being displaced by the refrigerant.

In this document, where *LFL* is referenced and for refrigerant used for all tests, the composition shall be the nominal composition as specified in the relevant appliance standard.

The **refrigerant detection systems** shall be capable of detecting refrigerant concentration above the alarm set point, for the refrigerant marked on the appliance, over the full range of operating temperature and humidity as specified by the appliance manufacturer. Worst case combined effects of declared manufacturing tolerances and drift shall be considered.

*The tests of Clause 8, Clause 9, Clause 10, and Clause 14 are carried out on 3 separate samples for each clause; these samples shall not be used for other tests. All samples shall pass the tests.*

*The tests in other clauses of this document shall be done with 3 samples and the tests are carried out in the following order: Clause 7, Clause 11, Clause 12, Clause 13, Clause 6. All samples shall pass the tests.*

Where this document requires a notification to the user that replacement of the **refrigerant sensor** is required, this may be implemented as a signal to the appliance, which the appliance relays to the user.

NOTE IEC 60335-2-40 is an example of how an application standard sets requirements to forward such a signal.

## 5 Test gases and default test conditions

Where test conditions are not defined in this document, the test conditions of the relevant application standard applies.

For the test in Clause 6, the test gas shall be 24 % to 25 % of *LFL*.

For the test in Clause 7, the low ratio test gas shall be  $(3 \pm 0,3)$  % of *LFL* below the alarm set point declared by the manufacturer, but no lower than  $(1,1 \pm 0,1)$  % of *LFL*.

For the test in Clause 7, the high ratio test gas shall be  $(3 \pm 0,3)$  % of *LFL* above the alarm set point declared by the manufacturer, but no higher than  $(24,7 \pm 0,3)$  % of *LFL*.

For the tests in 8.9, Clause 9, Clause 10, Clause 11, Clause 12, and Clause 13, the low ratio test gas shall be  $(6 \pm 0,6)$  % of *LFL* below the alarm set point declared by the manufacturer, but no lower than  $(1,1 \pm 0,1)$  % of *LFL*.

For the tests in 8.9, Clause 9, Clause 10, Clause 11, Clause 12, and Clause 13, the high ratio test gas shall be  $(6 \pm 0,6)$  % of *LFL* above the alarm set point declared by the manufacturer, but no higher than  $(24,7 \pm 0,3)$  % of *LFL*.

Table 1 illustrates the relationship between alarm set point, tolerances, and test gas concentrations.

For the test in Clause 14, the test gas shall be  $(110 \pm 0,5)$  % of the stoichiometric concentration.

*The test shall be made in a test gas chamber whose construction shall be such as to ensure that the apparatus is exposed to a specific volume ratio of test gas in a reproducible manner.*

*Unless otherwise specified, the following conditions shall be maintained within the test gas chamber:*

- *at constant temperature  $\pm 2$  °C within the range 15 °C to 25 °C throughout the duration of each test;*
- *at constant relative humidity  $\pm 10$  % RH within the range 30 % RH to 70 % RH throughout the duration of each test;*
- *at constant pressure  $\pm 1$  kPa within the range of 86 kPa to 108 kPa throughout the duration of the test.*