

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Household and similar electrical appliances – Test code for the determination of airborne acoustical noise –
Part 2-14: Particular requirements for refrigerators, frozen-food storage cabinets and food freezers**

**Appareils électrodomestiques et analogues – Code d’essai pour la détermination du bruit aérien –
Partie 2-14: Règles particulières pour les réfrigérateurs, conservateurs et congélateurs**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – TEST CODE FOR THE DETERMINATION OF AIRBORNE ACOUSTICAL NOISE –

Part 2-14: Particular requirements for refrigerators, frozen-food storage cabinets and food freezers

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International Standard IEC 60704-2-14 is published under the responsibility of IEC technical committee 59: Performance of household and similar electrical appliances.

It cancels and replaces International Standard ISO 8960 prepared by ISO technical committee 86: Refrigeration and transferred to the IEC subsequent to IEC/SMB decision 127/11.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The list of all the parts of the IEC 60704 series, under the general title *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise*, can be found on the IEC website.

This Part 2-14 is intended to be used in conjunction with the second edition (1997) of IEC 60704-1: *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 1: General requirements*.

The relevant text of Part 1 as amended by this publication establishes the test code for refrigerators, frozen-food storage cabinets and food freezers.

This Part 2-14 supplements or modifies the corresponding clauses in IEC 60704-1. When a particular subclause of Part 1 is not mentioned in this Part 2-14, that subclause is applicable as far as reasonable. Where this standard states “addition”, “modification” or “replacement”, the relevant requirements, test specifications or explanatory matter in Part 1 should be adapted accordingly.

Subclauses or figures that are additional to those in Part 1 are numbered starting from 101. Additional annexes are lettered AA, BB, etc.

The committee has decided that the contents of this 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

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HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – TEST CODE FOR THE DETERMINATION OF AIRBORNE ACOUSTICAL NOISE –

Part 2-14: Particular requirements for refrigerators, frozen-food storage cabinets and food freezers

1 Scope

This part of IEC 60704 specifies methods for measuring airborne acoustical noise emitted by electric refrigerators, frozen-food storage cabinets, food freezers and their combinations for household and similar uses, supplied from the mains or from batteries.

The term "similar use" means "use under conditions similar to those in a household", for example, in cafés, restaurants, hotels, and similar establishments.

This standard does not apply to appliances, equipment or machines designed exclusively for industrial or commercial purposes.

This standard is concerned with objective methods of engineering accuracy (engineering method, grade 2, according to ISO 2204) for determining sound power levels, (L_W expressed in decibels with reference to a sound power of 1 pW, of airborne acoustical noise within the specified frequency range of interest, and for specified operating conditions of the appliance to be measured.

The frequency range of interest includes the octave bands with centre frequencies between 125 Hz and 8 000 Hz (this interval being, for practical reasons, narrower than the frequency range of audible sound).

The following sound power levels are used:

- A-weighted sound power level, L_{WA} ;
- octave band sound power levels, L_{WOct} .

In general, the methods described are specified for appliances operated with no operator present.

The noise measurements are made while the compressors are running.

Requirements as to an indication of the noise emission values are not the subject of this standard.

NOTE 1 The uncertainties of measurement according to this standard usually result, for A-weighted sound power levels, in standard deviations generally not exceeding approximately 2 dB, provided that the noise spectrum does not contain pronounced discrete frequencies; if it does, the magnitude of the uncertainties will be larger. The standard deviations referred to reflect the cumulative effects of all causes of measurement uncertainties, excluding variations in the noise level of the appliance from test to test.

NOTE 2 The noise values obtained under the conditions described in this standard will not necessarily correspond with the noise experienced under the operational conditions of practical use (see 6.4.1).

NOTE 3 For quality control during production, etc., simplified methods may be appropriate. For noise control purposes (for example, development of quieter appliances, insulation of equipment, etc.), other measurement methods using, for example, narrow-band frequency analysis will usually have to be applied. These methods are not covered in this standard.

This standard does not include methods for determining sound power levels with precision accuracy (precision method, grade 1, according to ISO 2204) specified, for example, in ISO 3741, ISO 3742 and ISO 3745; they may, however, be applied if the appropriate instrumentation and test environments are available.

2 Normative reference

The following referenced documents are indispensable for the application 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 60704-1:1997, *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 1: General requirements*

3 Terms and definitions

Clause 3 of IEC 60704-1 is applicable.

4 Measurement methods and acoustical environments

Clause 4 of IEC 60704-1 is applicable.

5 Instrumentation

Clause 5 of IEC 60704-1 is applicable.

6 Operation and location of appliances under test

Clause 6 of IEC 60704-1 is applicable with the following modifications.

6.1 Equipping and pre-conditioning of appliances

6.1.2 Addition

Loose components inside the appliance which create undue vibrations (for example, shelves or ice-trays) shall be secured, for example, by tape, or may be adjusted.

Adjustable feet (if any) shall be adjusted to attain minimum noise emission.

Doors or lids shall be closed.

6.1.3 Replacement

Prior to noise measurements, the appliance, equipped as for the intended use, shall have been in operation for at least 16 h for running-in at a room temperature of $25\text{ °C} \pm 5\text{ K}$.

The thermostat shall be set for the specified test temperature, which may be found during this running-in period.

6.1.4 Replacement

Immediately before each series of noise measurements, the appliances shall be operated until a steady state has been reached but at least for three complete operating cycles. Steady-state conditions are considered as being achieved when the duration of the compressor running time does not deviate by more than 10 % from the running time of the previous cycle.

6.2 Supply of electric energy

6.2.1 Replacement

Appliances with mains-powered electric motor(s) shall be supplied with nominal system voltage and frequency for the country in which the appliance is intended to be used, with a tolerance of $\pm 1\%$ on voltage and ± 1 Hz on frequency. These values may deviate from the manufacturer's rated voltage and frequency.

The supply voltage shall be measured at the plug of a non-detachable cable or cord, or at the appliance inlet if a detachable cable is provided, but in no case at the entrance of extension cables or cords.

6.2.2 Replacement

Appliances with battery-powered electric motors shall be operated at the manufacturer's recommended voltage, with a tolerance of $\pm 1\%$.

6.3 Climatic and temperature conditions

Replacement

The appliance shall be operated under the following conditions.

Test room conditions

Ambient temperature: $22\text{ °C} \pm 3\text{ K}$

Relative humidity: 30 % to 85 %

Atmospheric pressure: 86 kPa to 106 kPa (860 mbar to 1 060 mbar)

The ambient temperature shall be measured 1 m above the floor of the test room, 35 cm to one side of the cabinet.

The vertical temperature gradient shall not exceed 2 K/m.

Cabinet internal temperature

Refrigerators:

Fresh-food storage compartment: $5\text{ °C} \pm 2\text{ K}$

Frozen-food storage compartment: no limitation

Chiller compartment (if applicable): no limitation

Freezers: $-22\text{ °C} \pm 2\text{ K}$

Refrigerators-freezers:

Fresh-food storage compartment: $5\text{ °C} \pm 2\text{ K}$

Food freezer compartment without separate thermostat: no limitation

Food freezer compartment with separate thermostat: $-22\text{ °C} \pm 2\text{ K}$

Chiller compartment (if applicable): no limitation

NOTE 4 This temperature is the air temperature and not the temperature that is measured in test packages in accordance with ISO 5155 and ISO 8187. An air temperature of $-22\text{ }^{\circ}\text{C}$ approximately corresponds to a test package temperature of $-18\text{ }^{\circ}\text{C}$.

These temperatures shall be measured by a thermocouple weighted by a copper cylinder with a mass of 25 g in the geometric centre of the storage compartment; they shall be considered to be the mean values during a total operating cycle.

6.4 Loading and operating of appliances

6.4.1 Addition

The appliance shall be operated without loading (i.e., empty).

Adjustable slots and openings between different compartments which may be operated by the user shall be closed.

6.4.2 Replacement

The measurement shall commence 1 min after the start of a running period and shall pause at the end of the same running period.

The readings shall be taken at constant time intervals over at least three running periods.

At least 30 readings shall be taken. In the case of a moving microphone, the measurements may be made continuously over at least three running periods.

NOTE 5 This averaging can be made automatically with an L_{eq} meter connected to the moving microphone or to the multiplexer which has to be used in the case of fixed microphone positions.

The readings shall be averaged on an energy basis.

Combined appliances with two compressors shall be tested with the refrigerator unit operating under the specified temperature conditions and the freezer unit operating continuously. The highest result shall be reported.

NOTE 6 In the case of simultaneous running of two compressors, beats are possible.

6.4.3 Replacement

It is recommended that a graphic level recorder to make a recording of the A-weighted sound pressure level during the operational cycle(s) – time history – be applied at one of the microphone positions (preferably in front of the appliance to be tested) or with a moving microphone.

From this time history, the running time of the compressor can be determined.

6.5 Location and mounting of appliances

6.5.2 Subclause 6.5.2 of IEC 60704-1 is not applicable.

6.5.3 Replacement

Floor-standing appliances and counter-top or table-type appliances for placing against a wall shall be placed in a normal position, without any resilient means other than those incorporated or supplied with the appliance

- either on the floor of the reverberation test room with a distance of 1 cm between the rear of the appliance and a wall and with a minimum distance of 1 m between any other surface of the appliance and the nearest corner of the room;
- or on the reflecting plane of the free-field environment and with a distance of 1 cm between the rear of the appliance and the second vertical reflecting plane (wall), giving consideration to the shape and size of the specified measurement surface.

For both types of test environment the following requirements shall be met.

- The acoustic absorption coefficient of the vertical wall shall be less than 0,06 inside the representative field of frequencies.
- Care shall be taken to avoid any direct contact between the appliance (including protruding parts, work-tops, spacers, etc.) and the vertical reflecting wall.
- The distance between the vertical plane and the appliance shall be established by placing the appliance in direct contact with the wall and then moving it away for a distance of 1 cm.

6.5.4 Replacement

Wall-mounted appliances, including their accessories (if any) shall be fastened or held by an appropriate fixture in close contact, at a height of the lowest edge of approximately 0,5 m from the floor, without any resilient means other than those incorporated or supplied with the appliance

- either on a wall of the reverberation test room with a minimum distance of 1 m between any surface of the appliance and the nearest corner of the room;
- or on the second, vertical reflecting plane (wall) of the free-field environment, giving consideration to the shape and size of the specified measurement surface.

The acoustic absorption coefficient of the vertical wall shall be less than 0,06.

6.5.5 Replacement

Appliances for building-in shall be built in accordance with the manufacturer's instructions into appropriate cabinets without any resilient means other than those incorporated or supplied with the appliance. The cabinet, including the built-in appliance, shall be located as specified for floor-standing appliances for placing against a wall (see 6.5.3).

The cabinet shall consist of uncoated chipboard, 19 mm thick, having a density of $700 \text{ kg/m}^3 \pm 50 \text{ kg/m}^3$.

Irrespective of the manufacturer's instruction, the cabinet shall be closed at the rear with a sheet of the same material, taking into account openings for ventilation, if required.

7 Measurement of noise levels

Clause 7 of IEC 60704-1 is applicable with the following modifications.

7.1 Microphone array and measurement surface for free-field conditions

7.1.1 Addition

For wall-mounted appliances, the measurement surface according to 7.1.2 (Figure 2) shall be used.