

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Household and similar electrical appliances – Test code for the determination of airborne acoustical noise –
Part 1: General requirements

Appareils électrodomestiques et analogues – Code d'essai pour la détermination du bruit aérien –
Partie 1: Exigences générales

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 1: General requirements

FOREWORD

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International Standard IEC 60704-1 has been prepared by IEC technical committee 59: Performance of household and similar electrical appliances.

This third edition cancels and replaces the second edition published in 1997 and constitutes an update and an editorial revision. It also includes the description of an appropriate test enclosure for appliances to be built in.

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

FDIS	Report on voting
59/546/FDIS	59/549/RVD

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

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

A list of all the parts in 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.

The committee has decided that the contents of this 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

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INTRODUCTION

Although the noise emitted by household appliances does not generally present a hazard to the hearing of the operator and other exposed persons, the need for standardization procedures for the determination of the noise emitted has been recognized for a long time. Such procedures should be specified, not only for special types of appliances, but also the principles should be applicable to the majority of appliances in general use.

Generally, the determination of noise levels is only part of a comprehensive testing procedure covering many aspects of the properties and performances of the appliance. It is therefore important that the requirements for noise measurements (such as test environment, instrumentation, and amount of labour involved) should be kept at a modest level.

The results of noise measurements will be used for many purposes, for example for noise declaration, as well as for comparing the noise emitted by a specific appliance to the noise emitted by other appliances of the same family. In other cases, the results will be taken as a basis for engineering action in the development stages of new pieces of equipment, or in deciding on means for sound insulation. For all purposes, it is important to specify procedures with known accuracy so that the results of measurements taken by different laboratories can be compared.

These conditions have, as far as possible, been taken into account in the preparation of this test code. The acoustic measuring methods are based on those described in ISO 3743-1, ISO 3743-2 and ISO 3744.

The adoption of these methods permits the use of semi-anechoic rooms, special reverberation test rooms and hard-walled test rooms. The result of the measurements is the sound power level of the appliance. Within the measuring uncertainty specific to these methods, the results from the determination under free field conditions over a reflecting plane are equal to those obtained in reverberant fields. The use of intensity methods as described in ISO 9614-1 and ISO 9614-2 is subject to a specific part 2. IEC conditions 2010
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It should be emphasized that this test code is concerned with airborne noise only. In some cases, structure-borne noise, for example transmitted to the adjoining room, may be of importance.

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

Part 1: General requirements

1 Scope and object

1.1 Scope

1.1.1 General

This part of IEC 60704 applies to electric appliances (including their accessories or components) for household and similar use, supplied from mains or from batteries.

By similar use is understood the use in similar conditions as in households, for example in inns, coffee-houses, tea-rooms, hotels, barber or hairdresser shops, laundrettes, etc., if not otherwise specified in part 2.

This standard does not apply to

- appliances, equipment or machines designed exclusively for industrial or professional purposes;
- appliances which are integrated parts of a building or its installations, such as equipment for air conditioning, heating and ventilating (except household fans, cooker hoods and free standing heating appliances), oil burners for central heating, pumps for water supply and for sewage systems;
- separate motors or generators;
- appliances for outdoor use.

1.1.2 Types of noise

A classification of different types of noise is given in ISO 12001. The method specified in ISO 3744 is suitable for measurements of all types of noise emitted by household appliances. The methods specified in ISO 3743-1 and ISO 3743-2 are suitable for all types of noise, except for sources of impulsive noise consisting of short duration noise bursts. This will be taken into account in the preparation of parts 2.

1.1.3 Size of the source

The method specified in ISO 3744 is applicable to noise sources of any size. Limitations for the size of the source are given in 1.3 of ISO 3743-1 and ISO 3743-2. This will be taken into account in the preparation of parts 2.

1.2 Object

This standard is concerned with objective methods of engineering accuracy (grade 2 according to ISO 12001) for determining sound power levels L_W , expressed in decibels (dB) with reference to a sound power of one picowatt (1 pW), of airborne acoustical noise within the specified frequency range of interest (generally including the octave bands with centre frequencies from 125 Hz to 8 000 Hz), and for prescribed operating conditions of the appliance to be measured.

The following quantities are used:

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

In general, the described methods are specified for appliances without an operator present. A part 2 can specify that an operator will be present only for the (rare) cases where an appliance can only be operated, or must be fed, by an operator.

Methods for determining sound power levels with precision accuracy (grade 1 according to ISO 12001), specified for example in ISO 3741 and ISO 3745, are not included in this standard. They may, however, be applied if the appropriate test environment and instrumentation are available.

NOTE 1 The noise values obtained under the described conditions of this part will not necessarily correspond with the noise experienced under the operational conditions of practical use.

NOTE 2 For quality control during production etc., simplified methods may be appropriate. For noise reduction purposes, other measurement methods employing, for example, narrow-band analysis or intensity techniques usually will have to be applied. These methods are not covered by this part.

1.3 Measurement uncertainty

The estimated values of the standard deviations of reproducibility of sound power levels determined according to this part are given in 1.4 of ISO 3743-1 and of ISO 3743-2, and in 1.4 of ISO 3744. But for a particular family of appliances of similar size with similar operating conditions, the standard deviations of reproducibility may be smaller than these values. Hence, in part 2, standard deviations smaller than those listed in ISO standards may be stated if substantiation is available from the results of suitable interlaboratory tests.

IEC 60704-3 gives values of standard deviations of reproducibility for several categories of appliances.

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In case of discrepancies between the measurements where the results normally remain inside the foreseen standard deviation, it will be necessary to perform measurements according to the upper grade of accuracy: grade 1, laboratory or precision, as described in ISO 3741 or ISO 3745.

2 Normative references

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 60038:2009, *IEC standard voltages*

IEC 60704-3:2006, *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 3: Procedure for determining and verifying declared noise emission values*

IEC 61260:1995, *Electroacoustics – Octave-band and fractional-octave-band filters*

IEC 61672-1:2002, *Electroacoustics – Sound level meters – Part 1: Specifications*

ISO 3741:1999, *Acoustics – Determination of sound power levels of noise sources using sound pressure – Precision methods for reverberation rooms*

ISO 3743-1:1994, *Acoustics – Determination of sound power levels of noise sources – Engineering methods for small, movable sources in reverberant fields – Part 1: Comparison method for hard-walled test rooms*

ISO 3743-2:1994, *Acoustics – Determination of sound power levels of noise sources using sound pressure – Engineering methods for small, movable sources in reverberant fields – Part 2: Methods for special reverberation test rooms*

ISO 3744:1994, *Acoustics – Determination of sound power levels of noise sources using sound pressure – Engineering method in an essentially free field over a reflecting plane*

ISO 3745:2003, *Acoustics – Determination of sound power levels of noise sources using sound pressure – Precision method for anechoic and hemi-anechoic rooms*

ISO 6926:1999, *Acoustics – Requirements for the performance and calibration of reference sound sources used for the determination of sound power levels*

ISO 12001:1996, *Acoustics – Noise emitted by machinery and equipment – Rules for the drafting and presentation of a noise test code*

3 Terms and definitions

For the purposes of this document, the following definitions apply. Terms and definitions pertinent to the determination of sound power levels may be found in ISO 3743-1, ISO 3743-2 and ISO 3744.

3.1

measurement time interval

portion or a multiple of an operational period or operational cycle for which the sound power levels are determined

3.2

operational period

an interval of time during which a specified process is accomplished by the appliance under test (for example washing or rinsing or drying for a dishwasher)

3.3

operational cycle

a specific sequence of operational periods occurring while the appliance under test performs a complete work cycle. During the operational cycle, each operational period is associated with a specific process that may occur only once, or may be repeated (for example, for a dishwasher, washing and rinsing and drying)

3.4

time history

a continuous recording of the sound pressure level (for a distinct microphone position) as a function of time, which is obtained during one or more operational periods of an operational cycle

3.5

standard test operator

a person necessary for operating or feeding the appliance under test, not wearing abnormally sound absorptive clothing which might influence the sound measurements

3.6

centre of location or position of a source

the term used for describing the location or position of the source (appliance) to be tested within the test environment and, in free field environment, with respect to the co-ordinate system of microphone positions

The centre of location is such that the centre of the appliance coincides with the centre of a parallelepiped drawn around the main part of hand-held, suspended, or stand-type appliances.

The centre of location is such that the centre of the appliance coincides with the centre of a rectangle drawn around the projection of the main part of the appliance on the floor, for floor-supported appliances, and on the wall, for wall-mounted appliances.

3.7

nominal height

h_n

the smallest integer multiple of 5 mm that accommodates the height of the installation opening according to the manufacturer's installation instructions

3.8

nominal width

w_n

the smallest integer multiple of 5 mm that accommodates the width of the installation opening according to the manufacturer's installation instructions

3.9

nominal depth

d_n

the smallest integer multiple of 5 mm, equal to or greater than 515 mm, that accommodates the depth of the installation according to the manufacturer's installation instructions

4 Measurement methods and acoustical environments

4.1 General

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The total noise emitted by machinery or equipment and radiated in all directions to the space surrounding the machine can be characterized by the sound power of the machine. The sound power of a machine is essentially independent of the environment in which the machine is installed.

Therefore, the concept of sound power level has been chosen for expressing the noise emission of appliances for household and similar purposes.

The preferred noise emission quantity is the A-weighted sound power level, L_{WA} , in decibels (ref. 1 pW).

According to this standard, two principal methods exist, the direct method and the comparison method, as described in 4.2 and 4.3 below. These two methods can be used alternatively.

Different types of environments, as described in 4.4, may be used. A part 2 may, if necessary, exclude one or several combinations among those available.

4.2 Direct method

The direct method can be used only for measurements in qualified test environments according to ISO 3744 for free field conditions over reflecting plane(s), and according to ISO 3743-2 for special reverberation test rooms.

With this method, the sound power level is determined

- in free field conditions over reflecting plane(s), from time-averaged sound pressure levels (on a mean-square basis) over the measurement surface and from the area of the measurement surface;

- in special reverberation test rooms, from averaged sound pressure levels, and from the reverberation time and the volume of the test room.

This method yields results expressed in A-weighted sound power levels (and in octave-band sound power levels, if required) which are calculated directly from measured sound pressure levels.

NOTE This method can also be used in conjunction with more precise methods, as for instance as given in ISO 3741 and ISO 3745.

4.3 Comparison method

The comparison method for measurement is explicitly described in ISO 3743-1 and in ISO 3743-2.

NOTE The term "comparison method" is not explicitly given in ISO 3744, but when applying the "absolute comparison test" for the determination of the environmental correction given in Clause A.3 of ISO 3744, by using a reference sound source, the procedure is, in fact, a comparison method.

With this method, the sound power level is determined by comparing the averaged values (on a mean-square basis) of the sound pressure levels produced by the source in the test room to the averaged values of the sound pressure levels produced in the same room by a calibrated reference sound source (RSS) of known sound power output, complying with the requirements of ISO 6926. The difference in sound pressure levels is equal to the difference in sound power levels when conditions are the same for both sets of measurements.

This method yields results expressed in octave-band sound power levels, and the A-weighted sound power level is calculated from the octave-band sound power levels.

To check whether there is a systematic difference between results obtained in different environments, the use of the comparison method is recommended.

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4.4 Acoustical environments

4.4.1 General requirements and criterion for adequacy of the test environment

They are given in Clause 4 of

- ISO 3743-1 for hard-walled test rooms;
- ISO 3743-2 for special reverberation test rooms;
- ISO 3744 for free field conditions over reflecting plane.

NOTE For free field conditions over reflecting plane, the absolute comparison test for the qualification of the environment, described in Clause A.3 of ISO 3744, is preferred.

Guidelines for the design of simple test rooms with free field conditions are given in Annex C of this standard.

Guidelines for the design of a suitable special reverberation test room are given in Annex A of ISO 3743-2.

4.4.2 Criterion for background noise level

Requirements for the background noise level are given in Clause 4 of ISO 3743-1, ISO 3743-2 and ISO 3744. Averaged over the microphone positions, the background noise level shall be at least 6 dB below, and preferably more than 15 dB below the sound pressure level to be measured.

NOTE If the difference between the sound pressure levels of the background noise and the appliance noise is less than 6 dB, see 8.2.

4.4.3 Environmental conditions

Environmental conditions having an adverse effect on the microphone used for the measurements (for example, strong electric or magnetic fields, wind, impingement of air discharge from the equipment being tested, high or low temperatures) shall be avoided by proper selection or positioning of the microphone.

The instructions of the manufacturers of the measurement instruments regarding adverse environmental conditions shall be followed. The microphone shall always be oriented in such a way that the angle of incidence of the sound waves is that for which the microphone is calibrated.

5 Instrumentation

5.1 Instrumentation for measuring acoustical data

Requirements for the instrumentation system and for its calibration are given in Clause 5 of ISO 3743-1, ISO 3743-2 and ISO 3744.

The instrumentation system shall meet the requirements for a type 1 instrument laid down in IEC 61672-1, according to the basic standard used. For measurements in octave bands, the instrumentation system shall meet the requirements of IEC 61260.

Reference sound sources (RSS) shall meet the requirements of ISO 6926, and shall be calibrated annually.

5.2 Instrumentation for measuring climatic conditions

5.2.1 The temperature is determined with instruments having an accuracy of ± 1 °C.

5.2.2 The relative humidity is determined with instruments having an absolute accuracy of ± 2 % within the measuring range.

5.3 Instrumentation for measuring operating conditions

5.3.1 The voltage at the plug of the cable or cord of mains-powered appliances is measured with voltmeters having an accuracy of class 0,5 instruments.

5.3.2 The voltage at the battery terminals of battery-powered appliances is measured with voltmeters having an accuracy of class 0,5 instruments.

5.3.3 The rotational speed of motors, attachments, etc. is measured, if necessary, with speed indicators having an accuracy of ± 1 % of full scale.

6 Operation and location of appliances under test

6.1 Equipping and pre-conditioning of appliances

6.1.1 The appliance is equipped with attachments, accessories, etc. as delivered by the manufacturer for the intended use or function.

6.1.2 Care shall be taken to ensure that any auxiliary equipment (such as electrical conduits or cables, piping for water supply or drainage, air ducts, etc.) necessary for the operation of the appliance, does not radiate a significant amount of sound energy into the test environment or change the sound output of the appliance. Guidelines are given in 6.4 of ISO 3743-1, ISO 3743-2 and ISO 3744.

6.1.3 Prior to noise measurements, the appliance, equipped as for intended use, shall have been in operation long enough to prevent excessive noise due to parts not being run-in. Running-in should take place at the highest speed setting, if any, and unless otherwise stated, without load. The part 2 shall indicate the total period for running-in and the rated operating times, unless the manufacturer has recommended otherwise.

6.1.4 Immediately before each series of noise measurements, the appliance, equipped as for the intended use, is operated for stabilizing at the highest speed setting, if any and unless otherwise stated, without load, as indicated in part 2 or according to the manufacturer's instructions.

6.2 Supply of electric energy and of water or gas

6.2.1 Appliances with mains powered electric motor(s) are supplied at rated voltage and at rated frequency. Appliances designed for DC only are supplied with DC. If a voltage range and/or a frequency range are indicated, then the supply voltage and/or frequency shall be the nominal system voltage and/or system frequency of the country in which the appliance is intended to be used. Tolerances shall not exceed $\pm 2\%$ for voltage and $\pm 1\%$ for frequency throughout the test.

The nominal system voltage and its values are defined in IEC 60038.

If the rated voltage of a mains supplied appliance differs from the nominal system voltage as common in the country of use, measurements should be carried out at the nominal voltage as common in the country of use.

The supply voltage is 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.

[IEC 60704-1:2010](https://standards.iteh.ai/catalog/standards/sist/1404d7b8-468c-435b-83e4-4b07e007e000/iec-60704-1-2010)

[https://standards.iteh.ai/catalog/standards/sist/1404d7b8-468c-435b-83e4-](https://standards.iteh.ai/catalog/standards/sist/1404d7b8-468c-435b-83e4-4b07e007e000/iec-60704-1-2010)

6.2.2 Appliances with battery-powered electric motor(s) are started, for noise measurements, with full-charged batteries as specified by the manufacturer, and the measurements are interrupted when the battery voltage under load has dropped for lead-acid batteries to 0,9 times and for other batteries to 0,8 times the battery voltage under load at the beginning of the test.

The battery voltage is measured at the battery terminals.

6.2.3 Appliances incorporating heating, either electric or gas, may be operated without heating, if the heating does not change the noise emission of the appliance.

6.2.4 The water and/or gas supply, if any, shall be as specified by the manufacturer.

If not specified by the manufacturer, the water supply pressure shall be $240 \text{ kPa} \pm 50 \text{ kPa}$, the temperature of cold water shall be $+15 \text{ °C} \pm 2 \text{ °C}$ and the temperature of hot water shall be $+55 \text{ °C} \pm 2 \text{ °C}$, unless otherwise specified in part 2.

NOTE When, in some countries, the water supply pressure/temperature differs from the water supply pressure/temperature of the country concerned, measurements carried out at rated pressure/temperature may be misleading for the consumer. In this case, additional measurements may be necessary. If the test pressure/temperature differs from the rated pressure/temperature, this should be reported.

6.3 Climatic conditions

In general, household appliances (unless otherwise specified for a special family) are operated under the following climatic conditions:

ambient temperature	t	$= 23 \text{ °C} \pm 5 \text{ °C}$
relative humidity	RH	$= 50 \% \pm 20 \%$