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This full version of IEC 60704-2-3:2025 includes the content of the references made to IEC 60704-1:2021

Household and similar electrical appliances – Test code for the determination of airborne acoustical noise –
Part 2-3: Particular requirements for dishwashers

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FOREWORD

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9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

This extended version (EXV) of the official IEC Standard provides the user with the full content of the Standard.

IEC 60704-2-3:2025 EXV includes the content of IEC 60704-2-3:2025, and the references made to IEC 60704-1:2021.

The specific content of IEC 60704-2-3:2025 is displayed on a blue background.

IEC 60704-2-3 has been prepared by subcommittee 59A: Electric dishwashers, of IEC technical committee 59: Performance of household and similar electrical appliances. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2017. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) alignment to IEC 60704-1:2021,
b) change of the position of the test sample in the test enclosure (aligned to IEC 60704-1:2021),
c) detergent changed (aligned to IEC 60436:2025).

The text of this International Standard is based on the following documents:

Draft	Report on voting
59A/272/FDIS	59A/275/RVD

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 International Standard 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. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

This International Standard is intended to be used in conjunction with the fourth edition of IEC 60704-1:2021.

This document supplements or modifies the corresponding clauses in IEC 60704-1:2021, so as to establish the test code for dishwashers. When a particular subclause of IEC 60704-1:2021 is not mentioned in this Part 2-3, 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 IEC 60704-1:2021 should be adapted accordingly.

Subclauses, tables and figures that are numbered starting from 101 are additional to those in IEC 60704-1:2021.

Unless notes are in a new subclause or involve notes in IEC 60704-1:2021, they are numbered starting from 101, including those in a replaced clause or subclause.

Additional annexes are lettered AA, BB, etc.

In this standard, the following print types are used:

- terms defined in Clause 3: **bold type**.

A list of all parts in the IEC 60704 series, published 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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION to IEC 60704-1:2021

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) be kept at a modest level.

The results of noise measurements are 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 are 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 3743-1:2010, ISO 3743-2:2018 and ISO 3744:2010.

The adoption of these methods permits the use of hemi-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 9614-1:1993, ISO 9614-2:1996, and ISO 9614-3:2002 is applicable under special conditions, which are described in specific parts of the IEC 60704-2 series.

This test code is concerned with airborne noise only. In some cases, structure-borne noise, for example transmitted to the adjoining room, can be of importance.

INTRODUCTION to IEC 60704-2-3:2025

The measuring conditions specified in this document provide for sufficient accuracy in determining the noise emitted and comparing the results of measurements taken by different laboratories, whilst simulating as far as possible the practical use of dishwashers.

It is recommended to consider the determination of noise levels as part of a comprehensive testing procedure covering many aspects of properties and performance of household dishwashers.

NOTE As stated in the Introduction to IEC 60704-1:2021, this test code concerns airborne noise only.

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

Part 2-3: Particular requirements for dishwashers

1 Scope

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 conditions similar to those found in households, for example in inns, coffee houses, tea rooms, hotels, barber or hairdresser shops, launderettes, etc., if not otherwise specified in the IEC 60704-2 series.

This document does not apply to

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

For determining and verifying noise emission values declared in product specifications, see IEC 60704-3:2019.

These particular requirements apply to single unit electric dishwashers for household and similar use, with or without automatic programme control, for cold and/or warm water supply, for detachable or permanent connection to water supply or sewage systems, intended for placing on the floor against a wall, for building-in or placing under a counter, a kitchen worktop or under a sink, for wall-mounting or on a counter.

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 60436:2025, *Electric dishwashers for household use – Methods for measuring the performance*

IEC 60704-2 (all parts), *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise*

IEC 60704-3:2019, *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 61260-1:2014, *Electroacoustics – Octave-band and fractional-octave-band filters – Part 1: Specifications*

IEC 61672-1:2013, *Electroacoustics – Sound level meters – Part 1: Specifications*

ISO 3743-1:2010, *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 3743-2:2018, *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 3744:2010, *Acoustics – Determination of sound power levels of noise sources using sound pressure – Engineering method in an essentially free field over a reflecting plane*

ISO 9614-1:1993, *Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 1: Measurement at discrete points*

ISO 9614-2:1996, *Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 2: Measurement by scanning*

ISO 9614-3:2002, *Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 3: Precision method for measurement by scanning*

ISO 6926:2016, *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 terms and definitions apply. Terms and definitions pertinent to the determination of sound power levels can be found in ISO 3743-1:2010, ISO 3743-2:2018 and ISO 3744:2010.

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

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

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
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
sequence of operational periods starting with the initiation of the programme (excluding any user programmed delay) and ending when all activity ceases (i.e. the dishwasher can revert to off mode or it can have a steady state power consumption until the user opens the dishwasher or turns the unit off)

Note 1 to entry: Audible programme end signals should be switched off or set to the lowest configuration. If this is not possible, the audible signals shall be included in the measurement.

3.4
time history
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
reference box
hypothetical right parallelepiped terminating on the reflecting plane(s) on which the noise source under test is located, that just encloses the source including all the significant sound radiating components and any test table on which the source is mounted

[SOURCE: ISO 3744:2010, 3.10, modified – The note has been omitted.]

3.6
test enclosure
enclosure used for simulating the typical acoustic built-in or/and mounting conditions

3.101
rated dishwasher capacity
whole number of place settings together with the serving pieces which can be cleaned and dried in one cycle when loaded in accordance with the manufacturer's instructions

Note 1 to entry: The **rated dishwasher capacity** is declared by the manufacturer and expressed as a number of place settings.

[SOURCE: IEC 60436:2025, 3.1.12]

3.102
drying
operational period during which the load is dried, beginning when the washing pump has stopped after final rinse and ending with the end of the **operational cycle**

4 Measurement methods and acoustical environments

4.1 General

This document is concerned with objective methods of engineering accuracy grade 2 in accordance with ISO 12001:1996 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.

Methods for determining sound power levels with precision accuracy grade 1 in accordance with ISO 12001:1996, as specified for example in ISO 3741 and ISO 3745, are not included in this document. 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 document will not necessarily correspond to the noise experienced under the operational conditions of practical use.

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

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. Within the accuracy range of this document, the sound power of a machine is basically 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 dB (re 1 pW).

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

Different types of environments, as described in 4.4, may be used. A part of the IEC 60704-2 series 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 in accordance with ISO 3744:2010 for free field conditions over reflecting plane(s), and in accordance with ISO 3743-2:2018 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, S, or
– in reverberation and special reverberation test rooms, from averaged sound pressure levels, and from the reverberation time and the volume of the test room.

If for a measurement in a free field, reverberation or special reverberation room is not possible because the appliance cannot be placed or operated in such an environment, the intensity method in accordance with ISO 9614-1:1993, ISO 9614-2:1996, and ISO 9614-3:2002 shall be applied. For the intensity method, the standard deviations given in the parts of the IEC 60704-2 series and IEC 60704-3:2019 are not applicable unless stated explicitly.

These methods yield results expressed in A-weighted sound power levels (and in octave- or 1/3 octave-band sound power levels, if required) that are calculated directly from measured sound pressure levels.

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

If pure tone components are present in the noise emitted by the source, the estimated standard deviation of the measured sound pressure levels in the special reverberation room can increase. In such cases, additional microphone positions or source positions can be necessary, as specified in ISO 3743-2:2018.

4.3 Comparison method

The comparison method for measurement is explicitly described in ISO 3743-1:2010 and in ISO 3743-2:2018.

NOTE The term "comparison method" is not explicitly given in ISO 3744:2010, but when applying the "absolute comparison test" for the determination of the environmental correction given in A.3 of ISO 3744:2010, 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 6926:2016. 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- or 1/3 octave-band sound power levels, and the A-weighted sound power level is calculated from the octave- or 1/3 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.

If pure tone components are present in the noise emitted by the source, the estimated standard deviation of the measured sound pressure levels in the hard-walled test room or in the special reverberation room can increase. In such cases, additional microphone positions or source positions can be necessary, as specified in ISO 3743-1:2010 or ISO 3743-2:2018.

4.4 Acoustical environments

4.4.1 General requirements and criterion for adequacy of the test environment

They are given in the following clauses:

– Clause 4 of ISO 3743-1:2010 for hard-walled test rooms;
– Clause 5 of ISO 3743-2:2018 for special reverberation test rooms and
– Clause 4 of ISO 3744:2010 for free-field conditions over a reflecting plane.

A classification of different types of noise is given in ISO 12001:1996. The method specified in ISO 3744:2010 is suitable for measurements of all types of noise emitted by household appliances. The methods specified in ISO 3743-1:2010 and ISO 3743-2:2018 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 of the IEC 60704-2 series.

The method specified in ISO 3744:2010 is applicable to noise sources of any size. Limitations for the size of the source are given in 4.2 of ISO 3743-1:2010 and in Clause 5 of ISO 3743-2:2018. This will be taken into account in the preparation of parts of the IEC 60704-2 series.

NOTE For free-field conditions over a reflecting plane, the absolute comparison test for the qualification of the environment, described in Clause A.2 of ISO 3744:2010, is preferred.

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

Guidelines for the design of a suitable special reverberation test room are given in ISO 3743-2:2018, Annex A.

The methods specified in ISO 3743-1:2010, ISO 3743-2:2018 and ISO 3744:2010 can be used for measuring noise emitted by electric dishwashers.

4.4.2 Criterion for background noise level

Requirements for the background noise level are given in 4.5 of ISO 3743-1:2010, in 6.5 of ISO 3743-2:2018 and in 4.2 of ISO 3744:2010. 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.

4.5 Measurement uncertainties

4.5.1 General

The estimated values of the standard deviations of reproducibility of sound power levels determined in accordance with this document are given in 9.1 of ISO 3743-1:2010, in 11.1 of ISO 3743-2:2018 and in 9.1 of ISO 3744:2010. But for a particular family of appliances of similar size with similar operating conditions, the standard deviations of reproducibility can be smaller than these values. Hence, in the IEC 60704-2 series, standard deviations smaller than those listed in ISO standards can be stated if substantiation is available from the results of suitable interlaboratory tests.

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

4.5.2 Standard deviations on repeatability and reproducibility and standard deviations related to declaration and verification

The estimated values of standard deviations of sound power levels determined according to this document are given in Table 1:

Table 1 – Standard deviations of sound power levels

Standard deviation dB	
σ_r (repeatability)	σ_R (reproducibility)
0,4	0,8

For the purpose of determining and verifying declared noise emission values according to IEC 60704-3, the values in Table 2 apply:

Table 2 – Standard deviations for declaration and verification

Standard deviation dB		
σ_P (production)	σ_t (total)	σ_M (reference)
1,0 to 1,5	1,3 to 1,7	2,0

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 3743-1:2010, in Clause 7 of ISO 3743-2:2018 and in Clause 5 of ISO 3744:2010.

The instrumentation system shall meet the requirements for a type 1 instrument laid down in IEC 61672-1:2013, in accordance with the basic standard used. For measurements in octave- and 1/3 octave-bands, the instrumentation system shall meet the requirements of IEC 61260-1:2014.

RSS shall meet the requirements of ISO 6926:2016, 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.

5.2.3 The absolute air pressure is determined with instruments having an accuracy of ±0,5 kPa.

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 into the test environment or change the sound output of the appliance. Guidelines are given in 6.2 of ISO 3743-1:2010, in 8.4 of ISO 3743-2:2018 and in 6.2 ISO 3744:2010.

6.1.3 Prior to commencing measurements, the inner surfaces of the appliance and filters shall be clean. The salt container, if included, shall be filled according to manufacturer's instructions. The rinse aid container, if included, shall be filled with rinse aid. The type and the settings for the salt and the reference rinse aid to be used are defined in IEC 60436:2025 , 5.8 and 5.9.

Before conducting noise tests on a new dishwasher, it shall be operated for at least two cycles, using a programme suitable for normally or heavily soiled tableware, with reference