

**Test code for the
determination of airborne
acoustical noise emitted by
household and similar
electrical appliances
Part 1. General requirements**

The European Standard EN 60704-1 : 1994 has the status of a
British Standard

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee CPL/59, Performance of household electrical appliances, upon which the following bodies were represented:

- Association of Manufacturers of Domestic Electrical Appliances
- Consumer Policy Committee of BSI
- Consumers' Association
- Department of the Environment (Energy Efficiency Office)
- Electricity Association
- Portable Electric Tool Manufacturers' Association
- Rotating Electrical Machines Association (BEAMA Ltd.)

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National foreword

This British Standard has been prepared by Technical Committee CPL/59 and is the English language version of EN 60704-1 : 1994 *Test code for the determination of airborne acoustical noise emitted by household and similar electrical appliances Part 1. General requirements*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 704-1 : 1982 published by the International Electrotechnical Commission (IEC).

BS EN 60704-1 : 1995 should be read in conjunction with the relevant Part 2 which supplements or modifies clauses in this standard. These standards are being published concurrently with this standard and will replace the relevant Part 2 to BS 6686.

This British Standard supersedes BS 6686 : Part 1 : 1986 (implementation of CENELEC HD 423.1 : 1982) which is withdrawn.

Cross-references

Publication referred to	Corresponding British Standard
EN 60651 (IEC 651)	BS EN 60651 : 1994 <i>Specification for sound level meters</i>
IEC 50(8)	BS 4727 : Part 3 : 1985 <i>Terms particular to telecommunications and electronics</i> Group 08 : 1985 <i>Acoustics and electroacoustics terminology</i>
IEC 225	BS 2745 : 1964 <i>Specification for octave and one-third octave band-pass filters</i>
ISO 3741	BS 4196 <i>Sound power levels of noise sources</i> Part 1 : 1991 <i>Precision methods for determination of sound power levels for broad-band sources in reverberation rooms</i>
ISO 3742	Part 2 : 1991 <i>Precision methods for determination of sound power levels for discrete-frequency and narrow-band sources in reverberation rooms</i>
ISO 3743	Part 3 : 1991 <i>Engineering methods for determination of sound power levels for sources in special reverberation test rooms</i>
ISO 3744	Part 4 : 1981 <i>Engineering methods for determination of sound power levels for sources in free-field conditions over a reflecting plane</i>
ISO 3745	Part 5 : 1981 <i>Precision methods for determination of sound power levels for sources in anechoic and semi-anechoic rooms</i>
ISO 6926	Part 8 : 1991 <i>Specification for the performance and calibration of reference sound sources</i>

Product certification. Users of this British Standard are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing surveillance, which may be coupled with assessment of a supplier's quality systems against the appropriate Part of BS EN ISO 9000.

Enquiries as to the availability of third party certification schemes will be forwarded by BSI to the Association of British Certification Bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members,

Compliance with a British Standard does not of itself confer immunity from legal obligations.

English version

Test code for the determination of airborne acoustical
noise emitted by household and similar electrical
appliances

Part 1: General requirements

(IEC 704-1 : 1982)

Code d'essai pour la détermination du bruit
aérien émis par les appareils
électrodomestiques et analogues
Première partie: Règles générales
(CEI 704-1 : 1982)

Prüfvorschrift für die Bestimmung der
Luftschallemission von elektrischen Geräten
für den Hausgebrauch und ähnliche Zwecke
Teil 1: Allgemeine Anforderungen
(IEC 704-1 : 1982)

This European Standard was approved by CENELEC on 1994-07-05. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

At the request of CENELEC Technical Committee TC 59X, Consumer information related to household electrical appliances, HD 423.1 S1 : 1982 (IEC 704-1 : 1982) was submitted to the CENLEC voting procedure for conversion into a European Standard.

The text of the International Standard was approved by CENELEC as EN 60704-1 on 5 July 1994.

The following dates were fixed:

- latest date of publication
of an identical national
standard (dop) 1995-07-15
- latest date of withdrawal
of conflicting national
standards (dow) -

Annexes designated 'normative' are part of the body of the standard. Annexes designated 'informative' are given only for information. In this standard, annex A is informative and annex ZA is normative.

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

Part 1: General requirements

INTRODUCTION

Although the noise levels produced by household appliances do not generally present a hazard to the hearing of the operator or other exposed persons, the need for standardized 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 the principles should be applicable to the majority of appliances in general use.

The potential users of such methods will be manufacturers of household appliances, testing laboratories, labelling organizations, and consumers' unions. Generally, the determination of noise levels is only part of a comprehensive testing procedure covering many aspects of the properties and performance of the appliance. It is therefore important that the requirements for noise measurements (e.g., test environment, instrumentation, and amount of labour involved) should be kept at a modest level.

In most cases, the results of noise measurements will be used for noise level indication purposes (e.g., for noise labelling), i.e. the results will be utilized for comparing the noise emitted by a specific appliance with the noise emitted by other appliances of the same family. In other cases, the results will be taken as basis for engineering action, for example, in the development stages of a new piece 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 code. The acoustic measuring methods are based on those described in ISO Standard 3743 "Acoustics — Determination of sound power levels of noise sources — Engineering methods for special reverberation test rooms" and ISO 3744 "Acoustics — Determination of sound power levels of noise sources — Engineering methods for free-field conditions over a reflecting plane".

The adoption of these methods permits the use of anechoic (or more correctly, semi-anechoic) chambers and specially adapted reverberant rooms. The result of the measurements is the sound power level of the appliance. Within the measuring uncertainty specific of these methods, the results from determination under free-field conditions over a reflecting plane are equal to those obtained in a special reverberant test room.

It should be emphasized that this code is concerned with airborne noise only. In some cases, structure-borne noise, for example transmitted to the adjoining room, may be of importance.

1. Scope and object

1.1 Scope

This standard 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, launderettes, 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.

1.2 Object

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 (dB) with reference to a sound power of 1 picowatt (1 pW), of airborne acoustical noise within the specified frequency range of interest, including the octave bands between 125 and 8 000 hertz (Hz) (this interval being, for practical reasons, narrower than the frequency range of audible sound), and for prescribed operating conditions of the appliance to be measured.

The following sound power levels are used:

- A-weighted sound power level, L_{wA} , and
- octave band sound power levels, L_{wOct} .

In general, the described methods are specified for appliances operated with no operator present. Only for the (rare) cases where an appliance can only be operated by an operator, or must be fed by an operator, shall a standard test operator be present, as specified in the relevant Part 2.

The uncertainties of measurements according to this standard tend to 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 mentioned standard deviations reflect the cumulative effects of all causes of measurement uncertainties, excluding variations in the noise level of the appliance from test to test.

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

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 employing, for example, narrow-band frequency analysis will usually have to be applied. These methods are not covered by this standard.

Not included in this standard are methods for determining sound power levels with precision accuracy (precision method, grade 1 according to ISO 2204) specified for example in ISO Standards 3741, 3742 and 3745; they may, however, be applied if the appropriate instrumentation and test environment is available.

2. References

- ISO 2204-1979: Acoustics — Guide to international standards on the measurement of airborne acoustical noise and evaluation of its effects on human beings.
- ISO 3741-1975: Acoustics — Determination of sound power levels of noise sources — Precision methods for broad-band sources in reverberation rooms.
- ISO 3742-1975: Acoustics — Determination of sound power levels of noise sources — Precision methods for discrete-frequency and narrow-band sources in reverberation rooms.
- ISO 3743-1976: Acoustics — Determination of sound power levels of noise sources — Engineering methods for special reverberation test rooms.
- ISO 3744-1981: Acoustics — Determination of sound power levels of noise sources — Engineering methods for free-field conditions over a reflecting plane.
- ISO 3745-1977: Acoustics — Determination of sound power levels of noise sources — Precision methods for anechoic and semi-anechoic rooms.
- ISO 6926 (in preparation): Acoustics — Characteristics and methods of calibration of reference sound sources.
- IEC Publication 50(08): International Electrotechnical Vocabulary — Electro-acoustics.
- IEC Publication 225: Octave, Half-octave and Third-octave Band filters Intended for the analysis of Sounds and Vibrations.
- IEC Publication 651: Sound Level Meters.

3. Terms and definitions

3.1 *Terms and definitions pertinent to determination of sound power levels*

These may be found in ISO Standards 3743 and 3744.

3.2 *Direct method*

Method in which the sound power level is calculated from the measured sound pressure levels produced by the source to be tested, as follows:

- in free-field conditions: the sound pressure levels are averaged on the measurement surface and in time, the sound power level is calculated from the area of the measurement surface;
- in reverberant field conditions: the sound pressure levels are averaged in space and time, the sound power level is calculated from the volume and the reverberation time or the total absorption of the test room.

3.3 *Comparison method*

Method in which the sound power level is calculated by comparing the measured sound pressure levels produced by the source to be tested, with the sound pressure levels produced by a reference sound source in the same test environment and, as far as possible, in the same location and position.

3.4 *Period of observation*

The time interval during which acoustical data are obtained. The period of observation is specified depending upon the characteristics of the noise being measured, upon the required accuracy of the measurements and upon the characteristics of the instrumentation.

3.5 *Period*

A time interval during which a specified process is accomplished by the appliance to be tested, for example, washing, rinsing or drying in a dishwasher.

3.6 *Operational cycle*

A sequence of periods occurring in the appliance during normal use.

3.7 *Time history*

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

3.8 *Standard test operator*

A person necessary for operating or feeding the source (appliance) to be tested, not wearing abnormally sound absorptive clothing which might influence sound measurements.

Additional details are given, if necessary, in Part 2.

3.9 *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 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.

4. Measurement methods and acoustical environments

4.1 General information

The sound power of a noise source is the total sound energy radiated per second by the source, unit: watt. The sound power of a source is usually expressed as sound power level equal to ten times the logarithm to the base of 10 of the ratio of the sound power of the source to the reference sound power 1 pW ($= 10^{-12}$ W). Unit: decibel (dB).

The concept of sound power level has been chosen for expressing the noise emission of appliances for household (and similar purposes) mainly because:

1. For most purposes, it gives an adequate description of the noise emission of the appliance.
2. It can be determined with known accuracy from relatively simple acoustic measurements made under a variety of specified acoustic conditions.

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

For each method, two types of environment, as described in Sub-clause 4.4, may be used. A Part 2 may, if necessary, exclude one or several combinations among the four thus available.

4.2 Direct method

4.2.1 The direct method can be used only for measurements in qualified test environments according to ISO Standard 3744 for free-field conditions over a reflecting plane and according to ISO Standard 3743 for special reverberation rooms.

With this method the sound power level is determined:

- in free-field conditions, from the time-averaged sound pressure levels, measured on the measurement surface and from the area of the measurement surface;
- in reverberant field conditions, from the space and time-averaged sound pressure levels and the equivalent sound absorption of the test room (or from the reverberation time and the volume of the test room).

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

4.3 Comparison method

The comparison method for measurements in a special reverberation test room is explicitly described in ISO Standard 3743, Sub-clause 8.3. The term “comparison method” is not explicitly given in ISO Standard 3744 for measurements in free-field conditions but when applying the “absolute comparisons tests” for the determination of the environmental correction given in Clause A.3 of ISO Standard 3744, by using a reference sound source, the procedure is, in fact, a comparison method.