
**Acoustics — Test code for the
measurement of airborne noise
emitted by rotating electrical
machines**

*Acoustique — Code d'essai pour le mesurage du bruit aérien émis par
les machines électriques tournantes*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2, www.iso.org/directives.

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The committee responsible for this document is ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This second edition cancels and replaces the first edition (ISO 1680:1999), which has been technically revised.

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Acoustics — Test code for the measurement of airborne noise emitted by rotating electrical machines

1 Scope

This International Standard specifies all the information necessary to carry out efficiently and under standardized conditions the determination, declaration, and verification of the noise emission characteristics of rotating electrical machines. It specifies noise measurement methods that can be used, and specifies the operating and mounting conditions required for the test.

Noise emission characteristics include the sound power level and emission sound pressure level. The determination of these quantities is necessary:

- for comparing the noise emitted by machines;
- to enable manufacturers to declare the noise emitted; and
- for the purposes of noise control.

The use of this International Standard as a noise test code ensures the reproducibility of the determination of the noise emission characteristics within specified limits determined by the grade of accuracy of the basic noise measurement method used. Noise measurement methods allowed by this International Standard are precision methods (grade 1), engineering methods (grade 2) and survey methods (grade 3). Methods of engineering grade (grade 2) are to be preferred.

This International Standard is applicable to rotating electrical machines of any length, width or height.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3741, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Precision methods for reverberation test rooms*

ISO 3743-1, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for small movable sources in reverberant fields — Part 1: Comparison method for a hard-walled test room*

ISO 3743-2, *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 and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*

ISO 3745:2012, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Precision methods for anechoic rooms and hemi-anechoic rooms*

ISO 3746, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane*

ISO 3747, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering/survey methods for use in situ in a reverberant environment*

ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

ISO 7574-4, *Acoustics — Statistical methods for determining and verifying stated noise emission values of machinery and equipment — Part 4: Methods for stated values for batches of machines*

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

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

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

ISO 11203, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level*

IEC 60034-1, *Rotating electrical machines — Part 1: Rating and performance*

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

3 Terms and definitions

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

3.1 time averaged sound pressure level

$L_{p,T}$

ten times the logarithm to the base 10 of the ratio of the time average of the square of the sound pressure, p , during a stated time interval of duration, T (starting at t_1 and ending at t_2), to the square of a reference value, p_0 , expressed in decibels

$$L_{p,T} = L_{p,eqT} = 10 \lg \left[\frac{\frac{1}{T} \int_{t_1}^{t_2} p^2(t) dt}{p_0^2} \right] \text{ dB}$$

where the reference value, p_0 , is 20 μPa

Note 1 to entry: Because of practical limitations of the measuring instruments, p^2 is always understood to denote the square of a frequency-weighted and frequency-band-limited sound pressure. If a specific frequency weighting as specified in IEC 61672-1 and/or specific frequency bands are applied, this should be indicated by appropriate subscripts; e.g. $L_{p,A,10\text{ s}}$ denotes the A-weighted time-averaged sound pressure level over 10 s.

3.2 measurement surface

hypothetical surface of area S , enveloping the source on which the measurement points are located

Note 1 to entry: The measurement surface terminates on one or more reflecting planes.

3.3 surface sound pressure level

$\overline{L_p}$

energy average of the time-averaged sound pressure levels at all the microphone positions on the measurement surface, with the background noise correction K_1 and the environmental correction K_2 applied

Note 1 to entry: It is expressed in decibels.

3.4 sound intensity

$\bar{I}$

time-averaged value of the product of the instantaneous sound pressure and the associated sound velocity at a point in a temporally stationary sound field

3.5 normal sound intensity level

L_{I_n}

ten times the logarithm to the base 10 of the ratio of the unsigned value of the normal component of the sound intensity (which is radiated by the sound source under test and determined in a direction perpendicular to the measurement surface) to the reference sound intensity

Note 1 to entry: It is expressed in decibels.

Note 2 to entry: The reference sound intensity is $10^{-12} \text{ W m}^{-2}$.

3.6 sound power level

L_W

ten times the logarithm to the base 10 of the ratio of the sound power, P , to a reference value, P_0 , expressed in decibels

$$L_W = 10 \lg \frac{P}{P_0} \text{ dB}$$

where the reference value, P_0 , is 1 pW

Note 1 to entry: If a specific frequency weighting as specified in IEC 61672-1 and/or specific frequency bands are applied, this should be indicated by appropriate subscripts; e.g. L_{WA} denotes the A-weighted sound power level.

Note 2 to entry: This definition is technically in accordance with ISO 80000-8:2007, 8-23^[15].

3.7 emission sound pressure

p

time-averaged sound pressure, at a specified position near a noise source, when the source is in operation under specified operating and mounting conditions on a reflecting plane surface, excluding the effects of background noise as well as the effects of reflections from room surfaces other than the plane or planes permitted for the purpose of the test

Note 1 to entry: It is expressed in pascals.

3.8 emission sound pressure level

L_p

ten times the logarithm to the base 10 of the ratio of the square of the emission sound pressure, $p^2(t)$, to the square of the reference sound pressure, p_0^2 , measured with a particular time weighting and a particular frequency weighting, selected from those defined in IEC 61672-1

Note 1 to entry: It is expressed in decibels. The reference sound pressure is 20 μPa .