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Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane

Acoustique — Détermination des niveaux de puissance acoustique et des niveaux d'énergie acoustique émis par les sources de bruit à partir de la pression acoustique — Méthodes d'expertise pour des conditions approchant celles du champ libre sur plan réfléchissant

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Technical Committee ISO/TC 43, *Acoustics,* Subcommittee SC 1, *Noise,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 211, *Acoustics,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition of ISO 3744 cancels and replaces the third edition (ISO 3744:2010), which has been technically revised.

The main changes are as follows:

— removed sound energy level determination due to lack of use and because it was highly duplicative of other text in the method,

— moved many of the special case measurement conditions and measurement parameters into Annexes to simplify the main body of the standard to focus on the basic sound power level determination method for typical sources and test environments,

— removed absolute background noise criteria and replaced with new criteria for conformity with background noise requirements,

— removed the estimation methods for K_2 from an estimation of the equivalent sound absorption area,

— instrumentation requirements revised to accommodate modern modular computerized instrumentation systems,

— requirements for the cylinder were updated to be consistent with ISO 7779,

— qualification methods for the test environment, other than the absolute comparison test, removed and moved to ISO 26101-2,

— new Annex I specifies procedures that testing laboratories can apply to reduce measurement uncertainties associated with the test method,

— measurements using a cylindrical measurement surface were clarified.

This revision does not change the basic measurement procedure for sound power level determination as specified in the 2010 version of this document. The standard deviation of reproducibility for measurements conducted in accordance with the main body of this revision remains the same as in the 2010 version. Measurements conducted in accordance with the 2010 version are expected to be equivalent to those obtained using this revision, unless the ISO 3744:2010 measurements were conducted in a test environment that was qualified using a K_2 that was calculated from an estimation of the equivalent sound absorption area, since this way to determine K_2 was removed from this revision of the document.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This corrected version of ISO 3744:2025 incorporates the following corrections:

— Correction of formulae in Figures C.3 and C.4.

Introduction

This document is one of the series ISO 3741 to ISO 3747[2]to[6] which specify various methods for determining the sound power levels of noise sources including machinery, equipment and their sub-assemblies. General guidelines to assist in the selection are provided in ISO 3740[1]. The selection depends on the available test environment and on the precision of the sound power level values required. A noise test code can be established (see ISO 12001) for the individual noise source in order to select the appropriate sound measurement surface and microphone array from among those allowed in each member of the ISO 3741[2] to ISO 3747[6] series, and to give requirements on test unit mounting, loading and operating conditions under which the sound power levels are to be obtained. The sound power emitted by a given source into the test environment is calculated from the mean square sound pressure that is measured over a hypothetical measurement surface enclosing the source, and the area of that surface.

The methods specified in this document permit the determination of the A-weighted sound power level and optionally the sound power level in octave or 1/3-octave frequency bands.

The main body of this document specifies test environment qualification criteria, testing procedures and the associated measurement uncertainties for basic compliance with the method. Annex I specifies additional requirements that may be applied by testing laboratories to reduce measurement uncertainty. For applications where even greater accuracy is required, reference can be made to ISO 3745, ISO 3741[2] or ISO 9614[9][10][11]. If the relevant criteria for the measurement environment specified in this document are not met, it might be possible to refer to another standard from this series, or to ISO 9614[9][10][11].

This document specifies methods of accuracy grade 2 (engineering grade) as defined in ISO 12001, when the measurements are performed in a space that approximates an acoustically free field over a reflecting plane. Such an environment can be found in a specially designed room, or within industrial buildings or outdoors. Ideally, the test source should be mounted on a sound-reflecting plane located in a large open space. For sources normally installed on the floor of machine rooms, corrections are specified to account for undesired reflections from nearby objects, walls and ceiling, and for background noises.

This test method was originally issued as ISO 4872 in 1978. It was first released as ISO 3744 in 1994. A brief history of the technical requirements associated with the revisions of this test method follows.

ISO 3744:1994 required a test environment with a $K_{2f} \leq 2\,\text{dB}$ in all frequency bands of interest and required measurements to be conducted in octave or one-third octave bands, with A-weighted levels being calculated from the band level data over the frequency range of interest.

ISO 3744:2010 relaxed the requirements on the test environment to require $K_{2\text{A}} \leq 4\,\text{dB}$ and allowed A-weighted levels to be determined either by calculation from frequency band level measurements or by direct measurement using an A-weighted filter. These changes to the requirements for the test environment and instrumentation were made to facilitate in-situ and field sound power level determinations using equipment without proportional octave band filtering for evaluation of compliance with regulatory requirements. Round robin studies were conducted to verify that the stated measurement uncertainties associated with the method could be maintained using these requirements[18].

In addition, the 2010 revision added methods for sound energy level determination of short duration transient events, several special case sound power level determination conditions to the main body of the standard and several new measurement parameters.