
**Acoustics — Determination of airborne
sound power levels emitted by machinery
using vibration measurement —**

**Part 2:
Engineering method including
determination of the adequate radiation
factor**

*Acoustique — Détermination des niveaux de puissance acoustique
aériens émis par les machines par mesurage des vibrations —*

*Partie 2: Méthode d'expertise incluant la détermination d'un facteur
de rayonnement approprié*



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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 7849-2 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This first edition of ISO/TS 7849-2, together with ISO/TS 7849-1, cancel and replace the first edition of ISO/TR 7849:1987, which has been technically revised.

ISO/TS 7849 consists of the following parts, under the general title *Acoustics — Determination of airborne sound power levels emitted by machinery using vibration measurement*:

- *Part 1: Survey method using a fixed radiation factor*
- *Part 2: Engineering method including determination of the adequate radiation factor*

The following part is under preparation:

- *Part 3: Amplitude and phase measurements*

Introduction

This part of ISO/TS 7849 gives a procedure for the determination of the sound power of the airborne noise caused by machinery vibration, including determination and application of the adequate radiation factor.

The determination of airborne noise emission of a machine by measuring vibration of the machine's outer surface may be of interest when:

- undesired background noise (e.g. noise from other machines or sound reflected by room boundaries) is high compared with the noise radiated directly by the machine under test;
- noise radiated by structure vibration is to be separated from noise of aerodynamic origin;
- noise radiated by structure vibration is high compared to the aerodynamic component so that the total noise radiation is predominantly affected by the structure vibration;
- sound intensity measurement techniques [ISO 9614 (all parts)^[14]] cannot easily be applied;
- structure vibration generated noise from only a part of a machine, or from a component of a machine set, is to be determined in the presence of noise from the other parts of the whole source.

ISO/TS 7849 (all parts) describes methods for the determination of the airborne noise emission of a machine caused by vibration of its outer surface, expressed by the associated airborne sound power being related to normalized meteorological conditions. This airborne sound power is determined under the assumption that this quantity is proportional to the mean square value of the normal component of the velocity averaged over the area of the vibrating outer surface of the machine, and is directly proportional to the area of the vibrating surface.

The calculation of the airborne sound power needs data of the radiation factor, ε , as a function of frequency for the machine under test. These values can be taken as unity ($\varepsilon = 1$) independently of frequency, yielding an upper limit for the sound power (see ISO/TS 7849-1); or, it can be determined for specific machines as described in this part of ISO/TS 7849.

Details of ISO/TS 7849 (all parts) are given in the foreword.

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Acoustics — Determination of airborne sound power levels emitted by machinery using vibration measurement —

Part 2: Engineering method including determination of the adequate radiation factor

1 Scope

This part of ISO/TS 7849 gives basic requirements for a reproducible method for the determination of the sound power level of the noise emitted by machinery or equipment by using surface vibration measurements, together with the knowledge of the machinery specific sound radiation factor in the frequency bands. The method is only applicable to noise which is emitted by vibrating surfaces of solid structures and not to noise generated aerodynamically.

This vibration measurement method is especially applicable in cases where accurate direct airborne noise measurements, e.g. as specified in ISO 3746^[4], ISO 3747^[8], and ISO 9614 (all parts)^[14], are not possible because of high background noise or other parasitic environmental interferences; or, if a distinction is required between the total radiated sound power and its structure vibration generated component.

NOTE 1 One of the applications of this part of ISO/TS 7849 is the distinction between the radiation of airborne sound power generated by structure vibration and the aerodynamic sound power components. Such a distinction is not feasible with ISO 3744^[5], ISO 3745^[6], ISO 3746^[7] and ISO 9614 (all parts)^[14].

NOTE 2 Problems may occur if the noise is generated by small parts of machinery surfaces (sliding contacts, e.g. slip ring brush or the commutator and the brush in electrical machines).

The methods described in this part of ISO/TS 7849 apply mainly to processes that are stationary with respect to time.

Recommendations on the selection of frequency bands are given in Annex C.

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.

ISO 5348, *Mechanical vibration and shock — Mechanical mounting of accelerometers*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

IEC 61260, *Electroacoustics — Octave-band and fractional-octave-band filters*

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