

Industrial fans — Determination of fan sound power levels under standardized laboratory conditions —

Part 4: Sound intensity method

ICS 17.140.20; 23.120

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National foreword

This British Standard is the UK implementation of ISO 13347-4:2004, incorporating corrigendum October 2006. Together with BS ISO 13347-1:2004 (BS 848-2.1:2004), BS ISO 13347-2:2004 (BS 848-2.2:2004), BS ISO 13447-3:2004 (BS 848-2.3:2004), it supersedes BS 848-2:1985, which is now withdrawn.

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags. Text altered by ISO corrigendum October 2006 is indicated in the text by **AC1** **AC1**.

The UK participation in its preparation was entrusted to Technical Committee MCE/17, Industrial fans.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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Industrial fans — Determination of fan sound power levels under standardized laboratory conditions —

Part 4: Sound intensity method

*Ventilateurs industriels — Détermination des niveaux de puissance
acoustique des ventilateurs dans des conditions de laboratoire
normalisées —*

Partie 4: Méthode par intensité acoustique



Contents		Page
Foreword.....		iv
Introduction		v
1	Scope.....	1
2	Normative references	1
3	Instruments and methods of test	2
4	Equipment and test set-ups.....	4
5	Test method.....	12
6	Calculations.....	16
7	Report and results	18
Annex A (normative) Indicators for use in case of difficulty		20
Annex B (normative) Alternative procedure for testing of large fan equipment		21
Annex C (normative) Radiation of sound by fan casing		23
Bibliography		25

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.

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 13347-4 was prepared by Technical Committee ISO/TC 117, *Industrial fans*.

ISO 13347 consists of the following parts, under the general title *Industrial fans — Determination of fan sound power levels under standardized laboratory conditions*:

- *Part 1: General overview*
- *Part 2: Reverberant room method*
- *Part 3: Enveloping surface methods*
- *Part 4: Sound intensity method*

Introduction

This part of ISO 13347 establishes a method for determining the sound power level of a fan. The method is reproducible in all laboratories which are qualified according to the requirements of this part of ISO 13347.

The method employs standard sound measurement instrumentation. The test set-ups are generally designed to represent the physical orientation of a fan as installed, in accordance with ISO 5801.

Since sound power levels are considered independent of the acoustic environment around the fan, a good comparison may be made between two or more fans proposed for any specific air performance condition. Moreover, these values establish an accurate base for estimating the acoustical outcome of the fan installation in terms of sound pressure levels. A successful estimate of sound pressure levels requires extensive information on the fan and the environment in which it is to be located.

It is often advantageous for the equipment user to employ acoustical consultation to ensure that all factors which affect the final sound pressure levels are considered. More detailed information on the complexity of this situation may be found in acoustic textbooks.

This part of ISO 13347 has been developed in response to the need for a reliable and accurate enveloping surface method for determining the sound power levels of fan equipment. Where possible, it has been based on existing National standards and combines state-of-the-art with practical considerations.

At a meeting of ISO/TC 117 in October 1997, it was resolved that the latest editions of ISO 9614-1 and AMCA 320 should be used as the basis for this part of ISO 13347.

This edition continues the original philosophy of the National Standards in combining the theoretical and the practical. Where there have been successful improvements in the state-of-the-art, full advantage is taken.

Industrial fans — Determination of fan sound power levels under standardized laboratory conditions —

Part 4: Sound intensity method

1 Scope

This part of ISO 13347 applies to industrial fans as defined in ISO 5801 and ISO 13349. It is limited to the determination of airborne sound emission for the specified set-ups. Vibration is not measured, nor is the sensitivity of airborne sound emission to vibration effects determined.

The sizes of the fan, which can be tested in accordance with this part of ISO 13347, are limited only by the practical aspects of the test installations.

This part of ISO 13347 determines sound power by using sound intensity measurements on a measurement surface which encloses the sound source. It provides guidelines on the acoustical environment, ambient noise, measurement surface, and number of measurements. The test set-ups are generally designed to represent the physical orientation of a fan installed in accordance with ISO 5801 and also used in ISO 13347-2.

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 5136, *Acoustics — Determination of sound power radiated into a duct by fans and other air-moving devices — In-duct method*

ISO 5801:1997, *Industrial fans — Performance testing using standardized airways*

ISO 9614-1:1993, *Acoustics — Determination of sound power levels of noise source 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 13347-1:2004, *Industrial fans — Determination of fan sound power levels under standardized laboratory conditions — Part 1: General overview*

ISO 13347-2:2004, *Industrial fans — Determination of fan sound power levels under standardized laboratory conditions — Part 2: Reverberant room method*

ISO 13349:1999, *Industrial fans — Vocabulary and definitions of categories*

IEC 61094-2:1992, *Measurement microphones — Part 2: Primary method for pressure calibration of laboratory standard microphones by the reciprocity technique*

3 Instruments and methods of test

3.1 General

Full details of the instrumentation and its requirements are given in ISO 13347-1. Particular requirements for this part of ISO 13347 are given in the following subclauses.

3.2 Reference sound source (RSS)

The RSS shall be used to qualify the performance of the sound intensity measurement system and personnel, and to determine a sound power level adjustment for the specific site conditions. To be used for these purposes, the RSS shall be of an appropriate type, be calibrated accurately and be properly maintained. All requirements for the RSS are specified in ISO 13347-1.

NOTE For sound intensity measurements, the use of two or more different configurations of the intensity probe, or different probes, may be required to cover the entire frequency range in conformance with Table 1.

The useful frequency range for accurate sound intensity measurements is dependent upon the character of the sound field. Care should be taken to verify that sound intensity measurements are accurate in the actual measurement environment.

Table 1 — Tolerances for the instrumentation system

One-third octave band centre frequency Hz	Tolerance dB
50 to 80	$\pm 1,5$
100 to 4 000	$\pm 1,0$
5 000 to 8 000	$\pm 1,5$
10 000	$\pm 2,0$
12 500	$\pm 3,0$

3.3 Transducer and instrumentation system calibration checks

Before and after each sound power determination, the following calibration checks shall be performed. A calibration check of the entire measuring system at one or more frequencies within the frequency range of interest shall be made for each microphone. An acoustical calibrator conforming to IEC 61094-2 and having an accuracy of $\pm 0,5$ dB shall be used for this purpose. In conformance with IEC 61094-2, the calibrator shall be checked at least once every year to verify that its output has not changed. In addition, an electrical calibration of the instrumentation system over the entire frequency range of interest shall be performed periodically, at intervals of not more than one year.

In addition to the calibration check, the field check procedure for sound intensity measurement specified by the manufacturer shall be performed. If no field check procedure is specified, the following procedure shall be performed.

The intensity probe shall be placed on the measurement surface, oriented normal to the surface, at a position where the noise is characteristic for the fan equipment under test. The sound intensity shall be measured. The intensity probe shall be rotated through 180° and placed with its acoustical centre in the same position as the initial measurement. The sound intensity shall be measured again. The intensity probe should be mounted on a stand or other mechanical device so that its acoustical centre retains the same position when the probe is rotated. For the octave band with the highest level, the absolute difference between the two levels shall be less than the value in Table 2 for the measuring equipment to be acceptable. The two sound intensities shall be of opposite sign.

Table 2 — Tolerances for difference in sound intensity levels for field check

Octave band centre frequency Hz	Difference dB
63 to 125	1,5
250 to 4 000	1,0
8 000	1,5

3.4 Performance verification

Periodically, the performance of the instrumentation system shall be verified by determining the sound power of a reference sound source using the procedures specified in ISO 13347-1.

The sound power level determined for the reference source shall differ from its calibrated value over the frequency range of interest by no more than the tolerances given in Table 3.

Table 3 — Tolerances for sound power level determined for reference sound source

Octave band centre frequency Hz	Tolerance dB
63	± 5,0
125	± 3,0
$\boxed{AC_1}$ 250 to 500 $\boxed{AC_1}$	± 2,0
1 000 to 4 000	± 1,5
8 000	± 2,5

3.5 Test method

The basis of the test method originated in ISO 9614-1. The test method covers a wider frequency range and contains requirements somewhat more specific and restrictive than those of ISO 9614-1, and also provides for sound power level adjustments as described below. With the exception of the adjustments, however, measurements made in conformance with this test method will be in conformance with ISO 9614-1 over their common frequency range.

The basic requirement is the measurement of the sound intensity distribution around the fan. A measurement surface is defined which encloses the entire fan, fan inlet, or fan outlet, depending upon the objective of the test. A set of sound intensity measurements is made about this surface. The results of these measurements are compared with a set containing half the number of measurements, to ensure the adequacy of the number of measurements and the accuracy of the data. The sound power level is calculated using the surface area and the measured sound intensity data. Adjustments shall be made for duct-end corrections, if required, and based on measurements of a calibrated RSS.

Prior to sound intensity measurements on the source of interest, the sound intensity measurement instrumentation and personnel are to be qualified by conducting measurements about an RSS.

The sound power levels resulting from the test method can be expected to be identical to those that would be produced using ISO 13347-2, within the uncertainty of both methods, to the extent that each method is applicable and that the installations tested are identical. It should be noted that the present method differs substantially from ISO 13347-2 in both the test environment requirements and the measured quantities.