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

**Part 2:
Reverberant room method**

iTeh STANDARD PREVIEW
*Ventilateurs industriels — Détermination des niveaux de puissance
acoustique des ventilateurs dans des conditions de laboratoire
normalisées —*
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Partie 2: Méthode de la salle réverbérante

ISO 13347-2:2004

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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.

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 13347-2 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*

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Introduction

The need for this new International Standard, ISO 13347, has been evident for some time. Whilst a number of national standards exist for the measurement of fan noise, none has received universal acceptance nor may comparisons be readily made.

Forming part of the ISO/TC 117 series of fan standards, this part of ISO 13347 deals with the determination of the fan sound power level appropriate to a particular application. In describing the test and rating procedures, numerous references are made to ISO 5801 as well as to other relevant ISO standards. This reverberant room method should be read in conjunction with ISO 13447-1 and each parts of ISO 13347 which details other methods for determining the sound power radiated by a fan in specified installation conditions as a function of frequency.

This part of ISO 13347 primarily deals with the determination of sound power levels of industrial fans used for ducted applications.

The test procedures described in this part of ISO 13347 relate to laboratory conditions. The measurement of performance under site conditions is not included. Acoustic system effects can be considerable where the airflow into and out of the fan is not free from swirl, nor the velocity profile there fully developed.

This part of ISO 13347 describes methods for determining sound power levels of fans in one-third octave bandwidths.

Data obtained in accordance with this part of ISO 13347 may be used for the following purposes amongst others:

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- ISO 13347-2:2004
- a) comparison of fans which are similar in size and type;
 - b) comparison of fans which are different in size and type;
 - c) determining whether a fan complies with a specified upper limit of sound emission;
 - d) scaling of fan noise from one size and speed to another size and speed;
 - e) prediction of sound pressure level in an installation of which the fan forms a part;
 - f) engineering work to assist in developing quiet machinery and equipment.

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

Part 2: Reverberant room method

1 Scope

This part of ISO 13347 gives a detailed description of reverberant room methods for the determination of fan sound power levels. It is for use under standardized laboratory conditions and recognises that tests in situ are subject to increased uncertainty. These test procedures are not necessarily appropriate to site test conditions. Acoustic system effects are presently the subject of considerable research effort.

ISO 5136, which covers the in-duct method, and ISO 10302 for small fans, should be used in conjunction with this part of ISO 13347.

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2 Normative references (standards.iteh.ai)

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 3740:2000, *Acoustics — Determination of sound power levels of noise sources — Guidelines for the use of basic standards*

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

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

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 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 7235:2003, *Acoustics — Laboratory measurement procedures for ducted silencers — Insertion loss, flow noise and total pressure loss*

ISO 10302:1996, *Acoustics — Method for the measurement of airborne noise omitted by small air-moving devices*

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

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

ISO 13350:1999, *Industrial fans — Performance testing of jet fans*

3 Limitations on use

This part of ISO 13347 is intended to apply 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 size of the fan which can be tested in accordance with this part of ISO 13347 is limited only by the practical aspects of the test set-up. Test fan dimensions and air performance will control the room size. (Small fans may be tested according to this standard or to ISO 10302, according to usage).

The test arrangements in this part of ISO 13347 establish the laboratory conditions necessary for a successful test. Rarely will it be possible to meet these requirements in situ, and this part of ISO 13347 is not intended for field measurements. Intending users are reminded that, in these situations, the acoustic environment is unlikely to meet the specified conditions and there may well be additional acoustic system effects where inlet and outlet conditions at the fan are less than ideal.

4 Field of application

This part of ISO 13347 deals with the determination of the acoustic performance of industrial fans and, in addition, may be used to determine the acoustic performance of fans combined with an ancillary device such as a roof cowl or damper or, where the fan is fitted with a silencer, the sound power resulting from the fan and silencer combination.

For low power fans (up to 3 kW) that could be run from a domestic power supply (single phase AC at a voltage not exceeding 250 V and a current not exceeding 16 A), reference should be made to the appropriate IEC standard for household and similar fans, IEC 60704-2-7.

For reverberant field tests, the size of equipment under test is limited to less than 2 % of the room volume.

A test procedure is specified in Clause 9 of ISO 13350:1999 for testing jet fans.

The test procedures specified in this part of ISO 13347 are intended principally for tests conducted using standardized test configurations and under specified environments and conditions, and may not be appropriate to site test conditions.

The fan installation conditions conform to the four categories of installation types specified in ISO 5801:

- a) type A: free inlet, free outlet;
- b) type B: free inlet, ducted outlet;
- c) type C: ducted inlet, free outlet;
- d) type D: ducted inlet, ducted outlet.

4.1.1 Noise source

The noise source is a fan. The noise measured may contain contributions from the fan drive and transmission.

4.1.2 Character of noise

Steady broad band with discrete frequency tones.

4.1.3 Uncertainty

Engineering grade as defined in ISO 3740.

4.1.4 Quantities to be measured

Sound pressure levels in one-third octave frequency bands at discrete microphone positions or on a prescribed path.

Fan aerodynamic performance indicators including rotational speed, fan pressure and flowrate.

5 Instrumentation

Full details of the instrumentation and its requirements are given in ISO 13347-1. This also details the requirements for the reference sound source which shall be used to qualify the test room and shall be the basis of the substitution method. To be used for these purposes, the reference sound source (RSS) shall be of an appropriate type, be calibrated accurately and be properly maintained.

6 Test method

The test method is based on a reference sound source (RSS) substitution for the determination of sound power. The reference documents for this method are ISO 3743-1 and ISO 3743-2.

Application of the test method requires that the fan to be tested be set in position in a test room, which is qualified according to the requirements of Annex A.

Once the test room has been qualified, sound pressure levels are recorded with the RSS operating. The fan is then operated without the RSS in operation at various performance points of interest for the given test speed, and the fan sound pressure levels are recorded. Since the sound power levels of the RSS are known, the substitution method is used to determine the sound power levels of the fan for each operating point.

7 Acoustic environment

7.1 Test environment

The test environment shall be a reverberant environment. Measurements shall be taken in appropriate conditions (see Annex D of ISO 13347-1:2004).

7.2 Reverberant room

An enclosure meeting the requirements of Annex A is mandatory for the purposes of this part of ISO 13347. An enclosure meeting the requirements of Annex B is recommended for broad-band sound testing and is mandatory for the purpose of investigating pure tones and narrow bands.

8 Test set-up and ducting

8.1 Set-up categories

A number of specific fan test set-ups are allowed. They are determined by the airflow direction and the particular mounting arrangement of the test device. The fan sound pressure levels are measured in a reverberant room, which may be connected to a chamber or any other system to provide control and measurement of the fan air volume flowrate.

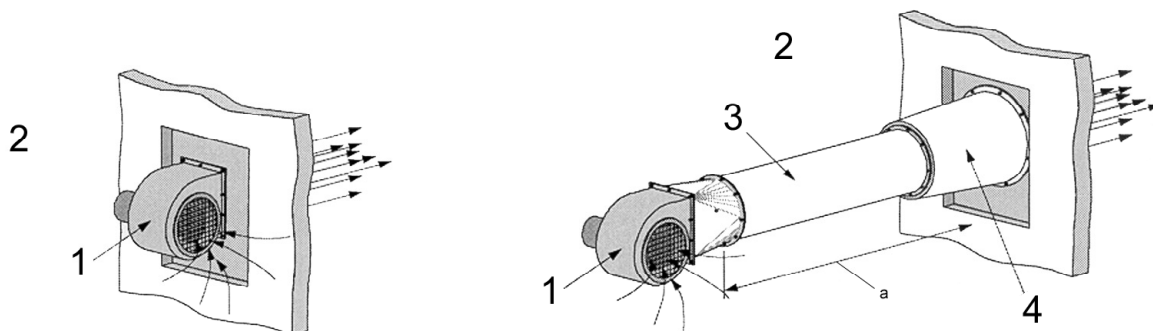
ISO 13347-2:2004(E)

This part of ISO 13347 allows for the duct on the non-measured side to be plain or fitted with a simplified anechoic termination (see ISO 13347-1). Whether an anechoic term has been fitted or not, should be clearly stated in any test report.

Figure 1 shows the mounting for the determination of fan-inlet sound pressure levels and Figure 2 for the determination of fan-outlet sound levels. Figure 3 shows the mounting for the determination of fan casing sound levels for type D installations. With this arrangement, the following different sound power levels can be measured, using the notations defined in Table 1 of ISO 13347-1:2004:

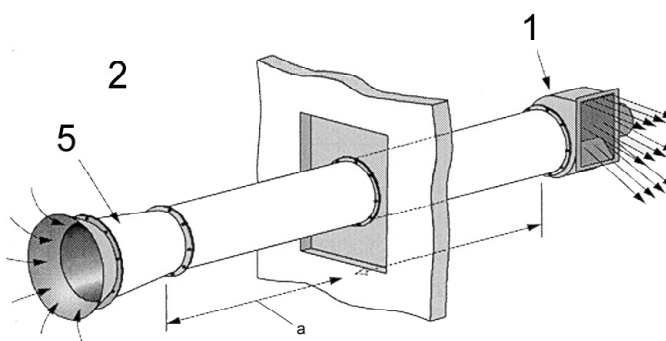
L_W (A,in)	: free inlet, type A installation
L_W (A,out)	: free outlet, type A installation
L_W (B,in + cas)	: free inlet + casing, type B installation
L_W (B,out)	: ducted outlet, type B installation
L_W (C,in)	: ducted inlet, type C installation
L_W (C,out + cas)	: free outlet + casing, type C installation
L_W (D,in + cas)	: ducted inlet + casing, type D installation
L_W (D,out)	: ducted outlet, type D installation
L_W (D,cas)	: casing, type D installation

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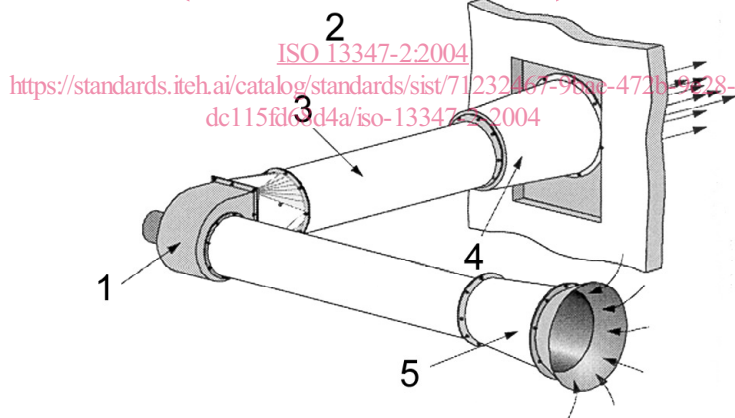


a) A: free inlet, free outlet

b) B: free inlet, ducted outlet



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 c) C: ducted inlet, free outlet
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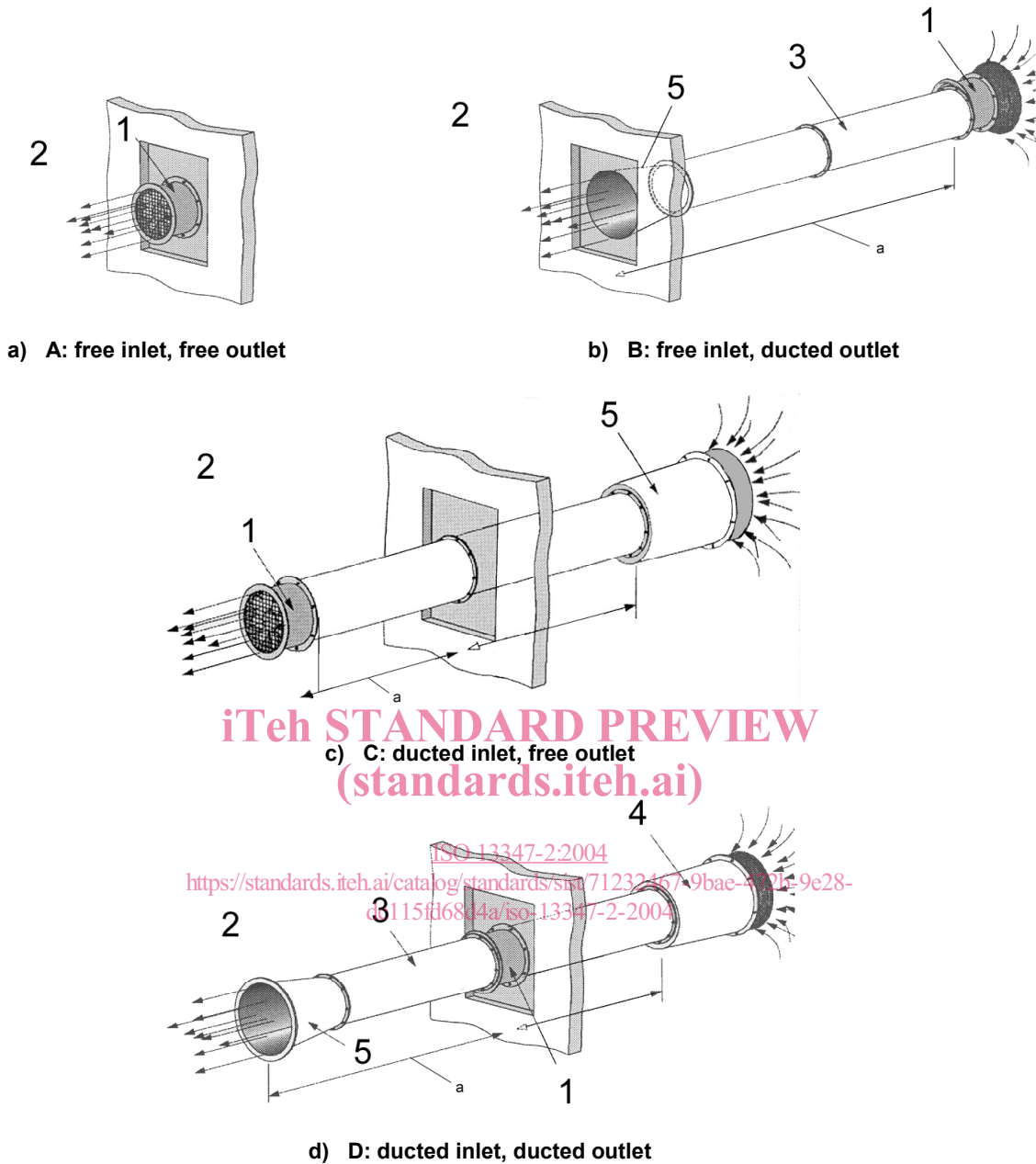


d) D: ducted inlet, ducted outlet

Key

- 1 fan
- 2 reverberant room
- 3 common part
- 4 simplified anechoic termination (see Annex D of ISO 13347-1:2004)
- 5 transmission element according to ISO 7235
- a Reverberant room wall, alternative positions

Figure 1 — Test set-up for fan-inlet sound measurement (centrifugal fan shown)



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Key

- 1 fan
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- 5 transmission element according to ISO 7235
- a Reverberant room wall, alternative positions

Figure 2 — Test set-up for fan-outlet sound measurement (axial fan shown)