



**NSAI**  
Standards

Irish Standard  
I.S. EN ISO 5136:2009

# Acoustics - Determination of sound power radiated into a duct by fans and other air-moving devices - In-duct method (ISO 5136:2003)

## I.S. EN ISO 5136:2009

*Incorporating amendments/corrigenda issued since publication:*

<i>This document replaces:</i> EN ISO 5136:2003	<i>This document is based on:</i> EN ISO 5136:2009 EN ISO 5136:2003	<i>Published:</i> 5 August, 2009 29 August, 2003	
This document was published under the authority of the NSAI and comes into effect on: 21 September, 2009		ICS number: 17.140.20 23.120	
<b>NSAI</b> 1 Swift Square, Northwood, Santry Dublin 9	T +353 1 807 3800 F +353 1 807 3838 E standards@nsai.ie W NSAI.ie	<b>Sales:</b> T +353 1 857 6730 F +353 1 857 6729 W standards.ie	<b>Price Code:</b> V
Údarás um Chaighdeáin Náisiúnta na hÉireann			

English Version

Acoustics - Determination of sound power radiated into a duct by fans and other air-moving devices - In-duct method (ISO 5136:2003)

Acoustique - Détermination de la puissance acoustique rayonnée dans un conduit par des ventilateurs et d'autres systèmes de ventilation - Méthode en conduit (ISO 5136:2003)

Akustik - Bestimmung der von Ventilatoren und anderen Strömungsmaschinen in Kanäle abgestrahlten Schalleistung - Kanalverfahren (ISO 5136:2003)

This European Standard was approved by CEN on 20 July 2009.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

<b>Contents</b>	<b>Page</b>
<b>Foreword</b> .....	<b>3</b>
<b>Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 98/37/EC</b> .....	<b>4</b>
<b>Annex ZB (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC</b> .....	<b>5</b>

## **Foreword**

The text of ISO 5136:2003 has been prepared by Technical Committee ISO/TC 43 "Acoustics" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 5136:2009 by Technical Committee CEN/TC 211 "Acoustics" the secretariat of which is held by DS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2010, and conflicting national standards shall be withdrawn at the latest by February 2010.

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

This document supersedes EN ISO 5136:2003.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EC Directives.

For relationship with EC Directives, see informative Annexes ZA and ZB, which are integral parts of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

### **Endorsement notice**

The text of ISO 5136:2003 has been approved by CEN as a EN ISO 5136:2009 without any modification.

**Annex ZA**  
(informative)

**Relationship between this European Standard and the Essential Requirements of EU Directive 98/37/EC**

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 98/37/EC, amended by 98/79/EC on machinery.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

**WARNING** - Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

## **Annex ZB** (informative)

### **Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC**

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

**WARNING —** Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

*This page is intentionally left BLANK.*



I.S. EN ISO 5136:2009

# INTERNATIONAL STANDARD

# ISO 5136

Second edition  
2003-04-01

---

---

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

*Acoustique — Détermination de la puissance acoustique rayonnée  
dans un conduit par des ventilateurs et d'autres systèmes de  
ventilation — Méthode en conduit*



Reference number  
ISO 5136:2003(E)

© ISO 2003

**PDF disclaimer**

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

© ISO 2003

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

## Contents

Page

Foreword .....	iv
Introduction .....	v
<b>1 Scope</b> .....	<b>1</b>
<b>1.1 General</b> .....	<b>1</b>
<b>1.2 Types of sound source</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>2</b>
<b>3 Terms, definitions and symbols</b> .....	<b>2</b>
<b>4 Uncertainty of the measurement method</b> .....	<b>7</b>
<b>5 Test facilities and instrumentation</b> .....	<b>8</b>
<b>5.1 General requirements</b> .....	<b>8</b>
<b>5.2 Duct specifications</b> .....	<b>9</b>
<b>5.3 Instrumentation</b> .....	<b>16</b>
<b>5.4 System calibration</b> .....	<b>19</b>
<b>6 Test arrangement</b> .....	<b>20</b>
<b>6.1 Sampling tube mounting</b> .....	<b>20</b>
<b>6.2 Microphone position</b> .....	<b>20</b>
<b>6.3 Operating condition control equipment</b> .....	<b>21</b>
<b>7 Test procedure</b> .....	<b>21</b>
<b>7.1 Operating conditions</b> .....	<b>21</b>
<b>7.2 Sound pressure level readings</b> .....	<b>21</b>
<b>7.3 Measurements with and without flow straightener on the outlet side</b> .....	<b>22</b>
<b>7.4 Inlet side measurements — Large fans: installation category D (according to ISO 5801:1997)</b> .....	<b>22</b>
<b>8 Calculations</b> .....	<b>23</b>
<b>8.1 Average sound pressure level</b> .....	<b>23</b>
<b>8.2 Sound power level</b> .....	<b>23</b>
<b>9 Information to be recorded</b> .....	<b>24</b>
<b>10 Information to be reported</b> .....	<b>24</b>
<b>Annex A (normative) Determination of the combined mean flow velocity and modal correction <math>C_{3,4}</math></b> .....	<b>25</b>
<b>Annex B (normative) Determination of the signal-to-noise ratio of sound vs. turbulent pressure fluctuation in the test duct</b> .....	<b>31</b>
<b>Annex C (normative) Computational procedures for calculating the A-weighted sound power level from one-third-octave-band sound power levels</b> .....	<b>34</b>
<b>Annex D (informative) Example of calculation of <math>C_{3,4}</math> for a given duct diameter and mean flow velocity</b> .....	<b>35</b>
<b>Annex E (informative) Guidelines for the design and construction of an anechoic termination</b> .....	<b>38</b>
<b>Annex F (informative) Evaluation of performance of anechoic terminations</b> .....	<b>47</b>
<b>Annex G (informative) Sampling tube information</b> .....	<b>50</b>
<b>Annex H (informative) Test method for small ducted fans</b> .....	<b>54</b>
<b>Annex I (informative) Test method for large ducted fans</b> .....	<b>58</b>
<b>Annex J (informative) Measurement of the swirl component</b> .....	<b>65</b>
<b>Bibliography</b> .....	<b>66</b>

## 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 5136 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This second edition cancels and replaces the first edition (ISO 5136:1990), which has been technically revised.

## Introduction

This International Standard describes a procedure for the measurement of sound pressure levels in the inlet or outlet ducts of a fan and a method to use these sound pressure levels to calculate the sound power levels radiated by the fan to the duct system.

Annex A lists values of coefficients for the determination of the combined mean flow velocity and modal correction. Annex B specifies two procedures for the determination of the signal-to-noise ratio of sound versus turbulence. A computational procedure for the calculation of the A-weighted sound power level from one-third-octave band levels is given in Annex C. Annex D shows an example of the calculation of the combined mean flow velocity and modal correction.

The sound power radiated into a duct by a fan or other air-moving device depends to some extent on the type of duct, characterized by its acoustical impedance. For a measurement method, the test duct has, therefore, to be clearly specified. In this International Standard, the test duct is of circular cross-section and terminated anechoically. Details of typical anechoic terminations are given in Annex E. The sound power obtained under these special conditions is a representative value for actual applications, as the anechoic termination forms an impedance about midway between the higher and lower impedances found in practice. The sound power radiated in actual applications can, in theory, be estimated from data on air-moving devices and duct impedances. Since this information is at present incomplete, these effects are not usually considered in acoustical calculations.

In order to suppress the turbulent pressure fluctuations at the microphone, the use of a long cylindrical windscreen ("sampling tube") is preferred. The microphone, with the sampling tube, is mounted at a radial position such that the sound pressure is well related to the sound power by the plane wave formula to an acceptable extent, even in the frequency range in which higher-order acoustic modes are possible.

The uncertainty of measurement (see Clause 4) is given in terms of the standard deviation to be expected if the measurements were repeated in many different laboratories.

The procedures for measuring the operating conditions (performance measurements) are not specified in detail in this International Standard. The operating conditions are specified in ISO 5801.

This International Standard is one of a series specifying different methods for determining the sound power levels of fans and other air-moving devices.

In general, the sound powers radiated from a fan inlet or outlet into free space and into a duct are different because of the reflection of sound energy at the fan inlet or outlet plane when there is no connected duct. The in-duct method according to this International Standard is suitable for determining the sound power radiated into a duct by a fan inlet or outlet. The sound power radiated into free space by a fan inlet or outlet should be determined using the a reverberation room method (ISO 3741, ISO 3743), a free-field method (ISO 3744, ISO 3745, ISO 3746) or a sound intensity method (ISO 9614).



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

## 1 Scope

### 1.1 General

This International Standard specifies a method for testing ducted fans and other air-moving devices to determine the sound power radiated into an anechoically terminated duct on the inlet and/or outlet side of the equipment.

NOTE 1 For the sake of brevity, wherever the term “fan” occurs in the text, it means “fan or other air-moving device”.

The method is applicable to fans which emit steady, broad-band, narrow-band and discrete-frequency sound and to air temperatures between  $-50\text{ °C}$  and  $+70\text{ °C}$ . The test duct diameter range is from 0,15 m to 2 m. Test methods for small ( $d < 0,15\text{ m}$ ) and large ( $d > 2\text{ m}$ ) test ducts are described in the informative Annexes H and I, respectively.

The maximum mean flow velocity at the microphone head for which the method is suitable depends on the type of microphone shield used, and is as follows:

- foam ball 15 m/s;
- nose cone 20 m/s;
- sampling tube 40 m/s.

Above these values the suppression of turbulent pressure fluctuations by the microphone shield (see 3.9) may be insufficient.

It is expected that sound power tests will be conducted in conjunction with airflow performance tests in accordance with ISO 5801. The ducting arrangement will therefore normally incorporate a “star” type flow straightener on the outlet side of the fan which will minimize swirl (see 7.3). Where it is permissible to delete the straightener as, for example, with large fans to installation category C according to ISO 5801:1997, the method is limited to a swirl angle of  $15^\circ$ . (An example of a method for determining the angle of swirl is given in Annex J.)

NOTE 2 The installation categories defined in ISO 5801 imply that the fan is either ducted on the outlet side only (category B), on the inlet side only (category C) or on both sides (category D).

### 1.2 Types of sound source

The method described in this International Standard is applicable to a sound source in which a fan is connected to ducts on at least one side. It is also applicable to other fan/attenuator combinations or equipment incorporating fans which can be considered as “black boxes”.

Examples of fans and other equipment covered by this International Standard are

- ducted centrifugal fans,
- ducted axial flow fans,

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

- 
- [Looking for additional Standards? Visit Intertek Inform Infostore](#)
  - [Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation](#)
-