



SLOVENSKI STANDARD SIST EN ISO 9614-1:1997

01-april-1997

5_i gh_U!l [cHj`Ub^fUj b]nj c b\ 'a c]j]fcj \ fi dUn'a Yf^b^Ya `U_cgh]nj c_U!
%rXY. 'A Yf^b^bUX]g_fYfb\ 'lc _U`fGC`- *% !%%- ' Ł

Acoustics - Determination of sound power levels of noise sources using sound intensity -
Part 1: Measurements at discrete points (ISO 9614-1:1993)

Akustik - Bestimmung der Schalleistungspegel von Schallquellen aus
Schallintensitätsmessungen - Teil 1: Messungen an diskreten Punkten (ISO 9614-
1:1993)

STANDARD PREVIEW
(standards.iteh.ai)

<https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1c6c938a2a7/sist-en-iso-9614-1-1997>

Acoustique - Détermination par intensimétrie des niveaux de puissance acoustique émis
par les sources de bruit - Partie 1: Mesurages par points (ISO 9614-1:1993)

Ta slovenski standard je istoveten z: EN ISO 9614-1:1995

ICS:

17.140.01 Acoustic measurements and noise abatement in general

SIST EN ISO 9614-1:1997 en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN ISO 9614-1:1997](https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c8538d2a4/sist-en-iso-9614-1-1997)

<https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c8538d2a4/sist-en-iso-9614-1-1997>

EUROPEAN STANDARD

EN ISO 9614-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 1995

ICS 17.140.10

Descriptors: acoustics, sound sources, noise (sound), tests, acoustic, tests, determination, sound power, acoustic measurements

English version

**Acoustics - Determination of sound power levels
of noise sources using sound intensity - Part 1:
Measurement at discrete points
(ISO 9614-1:1993)**

Acoustique - Détermination par intensimétrie des niveaux de puissance acoustique émis par les sources de bruit - Partie 1: Mesurages par points (ISO 9614-1:1993)

Akustik - Bestimmung der Schalleistungspegel von Schallquellen aus Schallintensitätsmessungen - Teil 1: Messungen an diskreten Punkten (ISO 9614-1:1993)

This European Standard was approved by CEN on 1995-02-02. 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 Central Secretariat or to any CEN member.

The European Standards exist 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

<https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c8538d2a4/sist-en-iso-9614-1-1997>

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

© 1995

All rights of reproduction and communication in any form and by any means reserved in all countries to CEN and its members.

Ref. No. EN ISO 9614-1:1995 E

Foreword

The text of the International Standard has been taken as a European Standard by the Technical Committee CEN/TC 211 "Acoustics" from the work of ISO/TC 43 "Acoustics" of the International Organization for Standardization (ISO).

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 October 1995, and conflicting national standards shall be withdrawn at the latest by October 1995.

This European Standard 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 Directive(s).

According to CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

Endorsement notice

The text of the International Standard ISO 9614-1:1993 has been approved by CEN as a European Standard without any modification.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN ISO 9614-1:1997

<https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c851e32a7/sist-en-iso-9614-1-1997>



SIST EN ISO 9614-1-1997

INTERNATIONAL STANDARD

ISO 9614-1

First edition
1993-06-01

Acoustics — Determination of sound power levels of noise sources using sound intensity —

Part 1: Measurement at discrete points

*Acoustique — Détermination par intensimétrie des niveaux de puissance
acoustique émis par les sources de bruit —*

Partie 1: Mesurages par points

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN ISO 9614-1:1997](https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c8538d2a4/sist-en-iso-9614-1-1997)

<https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c8538d2a4/sist-en-iso-9614-1-1997>



Reference number
ISO 9614-1:1993(E)

Contents

	Page
1 Scope	1
2 Normative references	1
3 Definitions	1
4 General requirements	3
5 Acoustic environment	4
6 Instrumentation	5
7 Installation and operation of the source	5
8 Measurement of normal sound intensity component levels	6
9 Calculation of sound power level	7
10 Information to be reported	8

Annexes

A Calculation of field indicators	10
B Procedure for achieving a desired grade of accuracy	12
C Effects of airflow on measurement of sound intensity	16
D Effect of sound absorption within the measurement surface	17
E Bibliography	18

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN ISO 9614-1:1997](https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c8538d2a4/sist-en-iso-9614-1-1997)

<https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c8538d2a4/sist-en-iso-9614-1-1997>

© ISO 1993

All rights reserved. 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 the publisher.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland



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.

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.

International Standard ISO 9614-1 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Sub-Committee SC 1, *Noise*.

ISO 9614 consists of the following parts, under the general title *Acoustics — Determination of sound power levels of noise sources using sound intensity*.

- Part 1: *Measurement at discrete points*
- Part 2: *Measurement by scanning*

Annexes A and B form an integral part of this part of ISO 9614. Annexes C, D and E are for information only.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN ISO 9614-1:1997](https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c8538d2a4/sist-en-iso-9614-1-1997)

<https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c8538d2a4/sist-en-iso-9614-1-1997>

Introduction

0.1 The sound power radiated by a source is equal in value to the integral of the scalar product of the sound intensity vector and the associated elemental area vector over any surface totally enclosing the source. Previous International Standards which describe methods of determination of sound power levels of noise sources, principally ISO 3740 to ISO 3747, without exception specify sound pressure level as the primary acoustic quantity to be measured. The relationship between sound intensity level and sound pressure level at any point depends on the characteristics of the source, the characteristics of the measurement environment, and the disposition of the measurement positions with respect to the source. Therefore ISO 3740 to ISO 3747 necessarily specify the source characteristics, the test environment characteristics and qualification procedures, together with measurement methods which are expected to restrict the uncertainty of the sound power level determination to within acceptable limits.

The procedures specified in ISO 3740 to ISO 3747 are not always appropriate, for the following reasons.

- a) Costly facilities are necessary if high precision is required. It is frequently not possible to install and operate large pieces of equipment in such facilities.
- b) They cannot be used in the presence of high levels of extraneous noise generated by sources other than that under investigation.

The purpose of ISO 9614 is to specify methods whereby the sound power levels of sources may be determined, within specific ranges of uncertainty, under test conditions which are less restricted than those required by the series ISO 3740 to ISO 3747. The sound power is the *in situ* sound power as determined by the procedure of this part of ISO 9614; it is physically a function of the environment, and may in some cases differ from the sound power of the same source determined under other conditions.

[SIST EN ISO 9614-1:1997](https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c8538d2a4/sist-en-iso-9614-1-1997)

[https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-](https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c8538d2a4/sist-en-iso-9614-1-1997)

0.2 This part of ISO 9614 complements the series ISO 3740 to ISO 3747 which specify various methods for the determination of sound power levels of machines and equipment. It differs from these International Standards principally in three aspects.

- a) Measurements are made of sound intensity as well as of sound pressure.
- b) The uncertainty of the sound power level determined by the method specified in this part of ISO 9614 is classified according to the results of specified ancillary tests and calculations performed in association with the test measurements.

- c) Current limitations of intensity measurement equipment restrict measurements to the one-third-octave range 50 Hz to 6,3 kHz. Band-limited A-weighted values are determined from the constituent one-octave or one-third-octave band values and not by direct A-weighted measurements.

0.3 This part of ISO 9614 gives a method for determining the sound power level of a source of stationary noise from measurements of sound intensity on a surface enclosing the source. In principle, the integral over any surface totally enclosing the source of the scalar product of the sound intensity vector and the associated elemental area vector provides a measure of the sound power radiated directly into the air by all sources located within the enclosing surface, and excludes sound radiated by sources located outside this surface. In the presence of sound sources operating outside the measurement surface, any system lying within the surface may absorb a proportion of energy incident upon it. The total sound power absorbed within the measurement surface will appear as a negative contribution to source power, and may produce an error in the sound power determination; in order to minimize the associated error, it is therefore necessary to remove any sound-absorbing material lying within the measurement surface which is not normally present during the operation of the source under test.

This part of ISO 9614 is based on discrete-point sampling of the intensity field normal to the measurement surface. The resulting sampling error is a function of the spatial variation of the normal intensity component over the measurement surface, which depends on the directivity of the source, the chosen sampling surface, the distribution of sample positions, and the proximity of extraneous sources outside the measurement surface.

The precision of measurement of the normal component of sound intensity at a position is sensitive to the difference between the local sound pressure level and the local normal sound intensity level. A large difference may occur when the intensity vector at a measurement position is directed at a large angle (approaching 90°) to the local normal to the measurement surface. Alternatively, the local sound pressure level may contain strong contributions from sources outside the measurement surface, but may be associated with little net sound energy flow, as in a reverberant field in an enclosure; or the field may be strongly reactive because of the presence of the near-field and/or standing waves.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN ISO 9614-1:1997](https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c8538d2a4/sist-en-iso-9614-1-1997)

<https://standards.iteh.ai/catalog/standards/sist/02ad09c7-0fd6-4e45-a044-1e8c8538d2a4/sist-en-iso-9614-1-1997>

Acoustics — Determination of sound power levels of noise sources using sound intensity —

Part 1: Measurement at discrete points

1 Scope

1.1 This part of ISO 9614 specifies a method for measuring the component of sound intensity normal to a measurement surface which is chosen so as to enclose the noise source(s) of which the sound power level is to be determined. The one-octave, one-third-octave or band-limited weighted sound power level is calculated from the measured values. The method is applicable to any source for which a physically stationary measurement surface can be defined, and on which the noise generated by the source is stationary in time (as defined in 3.13). The source is defined by the choice of measurement surface. The method is applicable *in situ*, or in special purpose test environments.

1.2 This part of ISO 9614 is applicable to sources situated in any environment which is neither so variable in time as to reduce the accuracy of the measurement of sound intensity to an unacceptable degree, nor subjects the intensity measurement probe to gas flows of unacceptable speed or unsteadiness (see 5.3 and 5.4).

In some cases, it will be found that the test conditions are too adverse to allow the requirements of this part of ISO 9614 to be met. In particular, extraneous noise levels may vary to an excessive degree during the test. In such cases, the method given in this part of ISO 9614 is not suitable for the determination of the sound power level of the source.

NOTE 1 Other methods, e.g. determination of sound power levels from surface vibration levels as described in ISO/TR 7849, may be more suitable.

1.3 This part of ISO 9614 specifies certain ancillary procedures, described in annex B, to be followed in conjunction with the sound power determination. The results are used to indicate the quality of the deter-

mination, and hence the grade of accuracy. If the indicated quality of the determination does not meet the requirements of this part of ISO 9614, the test procedure should be modified in the manner indicated.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 9614. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 9614 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5725:1986, *Precision of test methods — Determination of repeatability and reproducibility for a standard test method by inter-laboratory tests.*

IEC 942:1988, *Sound calibrators.*

IEC 1043:—,¹⁾ *Instruments for the measurement of sound intensity.*

3 Definitions

For the purposes of this part of ISO 9614, the following definitions apply.

3.1 sound pressure level, L_p : Ten times the logarithm to the base 10 of the ratio of the mean-square sound pressure to the square of the reference sound pressure. The reference sound pressure is 20 μPa .

Sound pressure level is measured in decibels.

1) To be published.

3.2 instantaneous sound intensity, $\vec{I}(t)$: Instantaneous rate of flow of sound energy per unit of surface area in the direction of the local instantaneous acoustic particle velocity.

This is a vectorial quantity which is equal to the product of the instantaneous sound pressure at a point and the associated particle velocity:

$$\vec{I}(t) = p(t) \cdot \vec{u}(t) \quad \dots (1)$$

where

$p(t)$ is the instantaneous sound pressure at a point;

$\vec{u}(t)$ is the associated instantaneous particle velocity at the same point;

t is the time, in seconds.

3.3 sound intensity, \vec{I} : Time-averaged value of $\vec{I}(t)$ in a temporally stationary sound field:

$$\vec{I} = \lim_{T \rightarrow \infty} \frac{1}{T} \int_0^T \vec{I}(t) dt \quad \dots (2)$$

where T is the integration period.

Also

I is the signed magnitude of \vec{I} ; the sign is an indication of directional sense, and is dictated by the choice of positive direction of energy flow;

$|I|$ is the unsigned magnitude of \vec{I} .

3.4 normal sound intensity, I_n : Component of the sound intensity in the direction normal to a measurement surface defined by the unit normal vector \vec{n} .

$$I_n = \vec{I} \cdot \vec{n} \quad \dots (3)$$

where \vec{n} is the unit normal vector directed out of the volume enclosed by the measurement surface.

3.5 normal sound intensity level, L_n : Logarithmic measure of the unsigned value of the normal sound intensity $|I_n|$, given by:

$$L_n = 10 \lg[|I_n|/I_0] \text{ dB} \quad \dots (4)$$

where I_0 is the reference sound intensity ($= 10^{-12} \text{ W/m}^2$).

It is expressed in decibels.

When I_n is negative, the level is expressed as $(-)$ XX dB, except when used in the evaluation of δ_{pl} (see 3.11).

3.6 sound power

3.6.1 partial sound power, P_i : Time-averaged rate of flow of sound energy through an element (segment) of a measurement surface, given by:

$$P_i = \vec{I}_i \cdot \vec{S}_i = I_{ni} \cdot S_i \quad \dots (5)$$

where

I_{ni} is the signed magnitude of the normal sound intensity component measured at position i on the measurement surface;

S_i is the area of the segment of surface associated with point i .

3.6.2 sound power, P : Total sound power generated by a source as determined using the method given in this part of ISO 9614, given by:

$$P = \sum_{i=1}^N P_i \quad \dots (6)$$

and

$$|P| = \left| \sum_{i=1}^N P_i \right| \quad \dots (7)$$

where N is the total number of segments of the measurement surface.

3.6.3 sound power level, L_W : Logarithmic measure of the sound power generated by a source, as determined using the method given in this part of ISO 9614, given by:

$$L_W = 10 \lg[|P|/P_0] \text{ dB} \quad \dots (8)$$

where

$|P|$ is the magnitude of the sound power of the source;

P_0 is the reference sound power ($= 10^{-12} \text{ W}$).

Sound power level is expressed in decibels.

When P is negative, the level is expressed as $(-)$ XX dB for record purposes only.

NOTE 2 This part of ISO 9614 is not applicable if the value of P of the source is found to be negative.

3.7 measurement surface: Hypothetical surface on which intensity measurements are made, and which either completely encloses the noise source under test or, in conjunction with an acoustically rigid, continuous surface, encloses the noise source under test. In cases where the hypothetical surface is penetrated by bodies possessing solid surfaces, the measure-