

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

## Part 2: Measurement by scanning

The European Standard EN ISO 9614-2:1996 has the status of a British Standard

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# Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee EH/1, Acoustics, upon which the following bodies were represented:

- Association of Consulting Engineers
- British Broadcasting Corporation
- British Occupational Hygiene Society
- British Telecommunications plc
- Department of the Environment (Building Research Establishment)
- Department of Health
- Health and Safety Executive
- Institute of Acoustics
- Institute of Occupational Hygienists
- Institute of Sound and Vibration Research
- Institution of Electrical Engineers
- National Physical Laboratory
- Royal Institute of British Architects
- Society of Environmental Engineers

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Advanced Manufacturing Technology Research Institute
- Agricultural Engineers Association
- British Cement Association
- British Compressed Air Society
- British Industrial Truck Association
- British Iron and Steel Producers Association
- Construction Industry Research and Information Association
- Engineering Industries Association
- Fan Manufacturers Association
- Federation of the Electronics Industry
- Federation of Manufacturers of Construction Equipment and Cranes
- Federation of Piling Specialists
- Hevac Association
- Institution of Engineering Designers
- Institution of Mechanical Engineers
- National Engineering Laboratory
- National Specialist Contractors Council
- Rotating Electrical Machines Association
- University of Liverpool
- University of Manchester

This British Standard, having been prepared under the direction of the Health and Environment Sector Board, was published under the authority of the Standards Board and comes into effect on 15 April 1997

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## National foreword

This British Standard has been prepared by Technical Committee EH/1 and is the English language version of EN ISO 9614-2:1996 *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning*, published by the European Committee for Standardization (CEN), which is identical with ISO 9614-2:1996 published by the International Organization for Standardization (ISO).

### Cross-reference

| Publication referred to | Corresponding British Standard                          |
|-------------------------|---------------------------------------------------------|
| IEC 942:1988            | BS 7189:1989 <i>Specification for sound calibrators</i> |

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN ISO title page, page 2, the ISO title page, page ii, pages 1 to 18, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

English version

Acoustics — Determination of sound power levels  
of noise sources using sound intensity —  
Part 2: Measurement by scanning

(ISO 9614-2:1996)

Acoustique — Détermination par intensimétrie  
des niveaux de puissance acoustique émis par  
les sources de bruit — Partie 2: Mesurage par  
balayage (ISO 9614-2:1996)

Akustik — Bestimmung der  
Schalleistungspegel von Geräuschquellen  
durch Schallintensitätsmessung —  
Teil 2: Messig mit kontinuierlicher Abtastung  
(ISO 9614-2:1996)

This European Standard was approved by CEN on 1996-05-19. 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.

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**CEN**

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

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

## Foreword

The text of the International Standard ISO 9614-2:1996 has been prepared by Technical Committee ISO/TC 43 “Acoustics” in collaboration with 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 1997, and conflicting national standards shall be withdrawn at the latest by February 1997.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of 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 and the United Kingdom.

## Endorsement notice

The text of the International Standard ISO 9614-2:1996 was approved by CEN as a European Standard without any modification.

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# INTERNATIONAL STANDARD

# ISO 9614-2

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

### **Part 2:** Measurement by scanning

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

*Partie 2: Mesurage par balayage*



Reference number  
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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.

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 9614-2 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee 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;*
- *Part 3: Precision method for measurement by scanning.*

Annex A and Annex B form an integral part of this part of ISO 9614.

Annex C, Annex D, Annex E and Annex F are for information only.

**Descriptors:** Acoustics, sound sources, noise (sound), tests, acoustic tests, determination, sound power, acoustic measurements.

## 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 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.

**0.2** This part of ISO 9614 specifies methods of determining the sound power levels of sources, within specific ranges of uncertainty, under test conditions which are less restricted than those required by ISO 3740 to ISO 3747. The sound power level is the *in situ* sound power level 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 level of the same source determined under other conditions. It is recommended that personnel performing sound intensity measurements according to this part of ISO 9614 are appropriately trained and experienced.

**0.3** This part of ISO 9614 complements ISO 9614-1 and 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 the ISO 3740 to ISO 3747 series 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 which conforms to IEC 1043 restricts 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 measurement.

**0.4** 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 practice, this exclusion is effective only if the source under test and other sources of extraneous intensity on the measurement surface are stationary in time. 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 method is based on sampling of the intensity field normal to the measurement surface by moving an intensity probe continuously along one or more specified paths. The resulting sampling error is a function of the spatial variation of the normal intensity component over the measurement surface, which depends upon the directivity of the source, the chosen sampling surface, the pattern and speed of the probe scanning, and the proximity of extraneous sources outside the measurement surface.