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STANDARD **9614-2**

First edition
1996-08-01

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

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Foreword

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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*

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

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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:

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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.

The accuracy 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.

The accuracy of determination of sound power level is adversely affected by a flow of sound energy into the volume enclosed by the measurement surface through a portion of that surface, even though it is, in principle, compensated by increased flow out of the volume through the remaining portion of the surface. This condition is caused by the presence of a strong extraneous source close to, but outside, the measurement surface.