SLOVENSKI STANDARD
SIST EN ISO 11690-3:1999

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Acoustics - Recommended practice for the design of low-noise workplaces containing machinery - Part 3: Sound propagation and noise prediction in workrooms (ISO/TR 11690-3:1997)

Akustik - Richtlinien für die Gestaltung lärmarmer maschinenbestückter Arbeitsstätten - Teil 3: Schallausbreitung und vorausberechnung in Arbeitsräumen (ISO/TR 11690-3:1997)

Acoustique - Pratique recommandée pour la conception de locaux de travail a bruit réduit contenant des machines - Partie 3: Propagation du son et prévision du bruit dans les locaux de travail (ISO/TR 11690-3:1997)

Ta slovenski standard je istoveten z: **EN ISO 11690-3:1998**

ICS:

13.140	Vpliv hrupa na ljudi	Noise with respect to human beings
17.140.20	Emisija hrupa naprav in opreme	Noise emitted by machines and equipment

SIST EN ISO 11690-3:1999   **en**

iTeh STANDARD PREVIEW

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 11690-3

November 1998

ICS

Descriptors: See ISO document

English version

Acoustics - Recommended practice for the design of low-noise workplaces containing machinery - Part 3: Sound propagation and noise prediction in workrooms (ISO/TR 11690-3:1997)

Acoustique - Pratique recommandée pour la conception de locaux de travail à bruit réduit contenant des machines - Partie 3: Propagation du son et prévision du bruit dans les locaux de travail (ISO/TR 11690-3:1997)

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This European Standard was approved by CEN on 9 January 1998.

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.

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 Central Secretariat has the same status as the official versions.

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

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

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

Ref. No. EN ISO 11690-3:1998 E

Foreword

The text of the International Standard from Technical Committee ISO/TC 43 "Acoustics" of the International Organization for Standardization (ISO) has been taken over as an European Standard 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 May 1999, and conflicting national standards shall be withdrawn at the latest by May 1999.

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

Warning

This document was published as a European Standard to provide a harmonized base for national standards.

It is a guidance document which means that it cannot be used for type-approval purposes.

The guidance contained in this standard is not intended to be exhaustive, but to highlight important aspects to which attention should be given.

Endorsement notice

The text of the International Standard ISO/TR 11690-3:1997 has been approved by CEN as a European Standard without any modification.

TECHNICAL REPORT

ISO/TR 11690-3

First edition
1997-02-15

Acoustics — Recommended practice for the design of low-noise workplaces containing machinery —

Part 3:
Sound propagation and noise prediction in workrooms

Acoustique — Pratique recommandée pour la conception de locaux de travail à bruit réduit contenant des machines —

Partie 3: Propagation du son et prévision du bruit dans les locaux de travail

Reference number
ISO/TR 11690-3:1997(E)

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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.

The main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 11690-3, which is a Technical Report of type 3, was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

ISO 11690 consists of the following parts, under the general title *Acoustics — Recommended practice for the design of low-noise workplaces containing machinery*:

— *Part 1: Noise control strategies*

— *Part 2: Noise control measures*

— *Part 3: Sound propagation and noise prediction in workrooms*

Introduction

This Technical Report is intended for use by all parties involved in noise reduction in workplaces and design of low-noise workplaces. The objective is:

- to make them aware of what is the current technical consensus regarding sound propagation and noise prediction in workrooms,

- to aid the interaction between them within a common technical framework,

- to promote the understanding of the desired noise control requirements.

This Technical Report provides the connection between the emission of sound sources e.g. machines and the sound pressure level at workstations caused by their operation in a workroom. Therefore, it allows an interchange of information between machine suppliers, who are responsible for noise emission values, and machine users, who require low noise immission values.

A further target is the assessment of the acoustical performance of a workroom.

These tasks are connected by the determination of the sound propagation descriptors of a workroom.

A methodology for noise prediction in workrooms is presented and a structure is given for the classification of prediction methods according to the level of detail of input parameters.

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Acoustics — Recommended practice for the design of low-noise workplaces containing machinery — Part 3 : Sound propagation and noise prediction in workrooms

1   Scope

In this part of ISO 11690, sound propagation in a room is considered together with the prediction of sound pressure levels and of noise immission at the workplace.

Details of the description of the physical phenomena involved in a noise prediction scheme are strongly dependent on the situation being considered and the way this situation is modelled (input parameters, calculation techniques). This dependency is surveyed and the methodology for noise prediction is described. Recommendations are provided concerning the use of noise prediction as an aid for noise control in workrooms. Examples of use of noise prediction methods are given in annexes A to E.

2   References

References listed in ISO 11690-1 should also be consulted when using this Technical Report.

3   Definitions

Definitions given in ISO 11690-1 apply to this Technical Report.

4 Basic principles of sound propagation in rooms

4.1 Sound propagation descriptors

A basic element for noise prediction in workrooms is the prediction of the distribution of sound pressure levels caused by an omnidirectional point source. This distribution is influenced by :

- the shape and the volume of the room,

- the absorption of the surfaces,

- the fittings.

1

The resulting sound level distribution can be considered using a spatial sound distribution curve (see definition 3.4.11 of part 1 and figures 1 and 2 of this Technical Report). The information contained in this curve can be summarized, for a given distance range, by two quantities (see definitions 3.4.12 and 3.4.13 of part 1) :

- the rate of spatial decay of sound pressure level per distance doubling (DL2),

- the excess of sound pressure level with respect to a free field (DLf).

The spatial sound distribution curve and these two quantities are used to describe the acoustical characteristics of a room. The sound pressure level caused by a given source is indeed smaller if DLf is low and DL2 is high (see 6.3 of part 2). Annex D shows how the acoustical characteristics of a room can be described from spatial sound distribution curves.

The spatial sound distribution curve is determined on a free path with no obstacle between the source and the receiver. For its measurement, see 8.4 of part 2.

NOTES

1   An International Standard specific to the measurement of spatial sound distribution curves in rooms is in preparation (ISO 14257 presently at the stage of draft).

2   When sound sources (machines) with dimensions too large to be neglected are considered, the sound distribution curve may differ from that of a point source for distances less than the typical dimension of the machine.

4.2 Rooms with diffuse sound fields

If diffuse sound field conditions are met (see definitions 3.4.8 and 3.4.9 of part 1), at a certain distance from the source, sound pressure levels are nearly constant and independent of receiver position, as shown in figure 1.
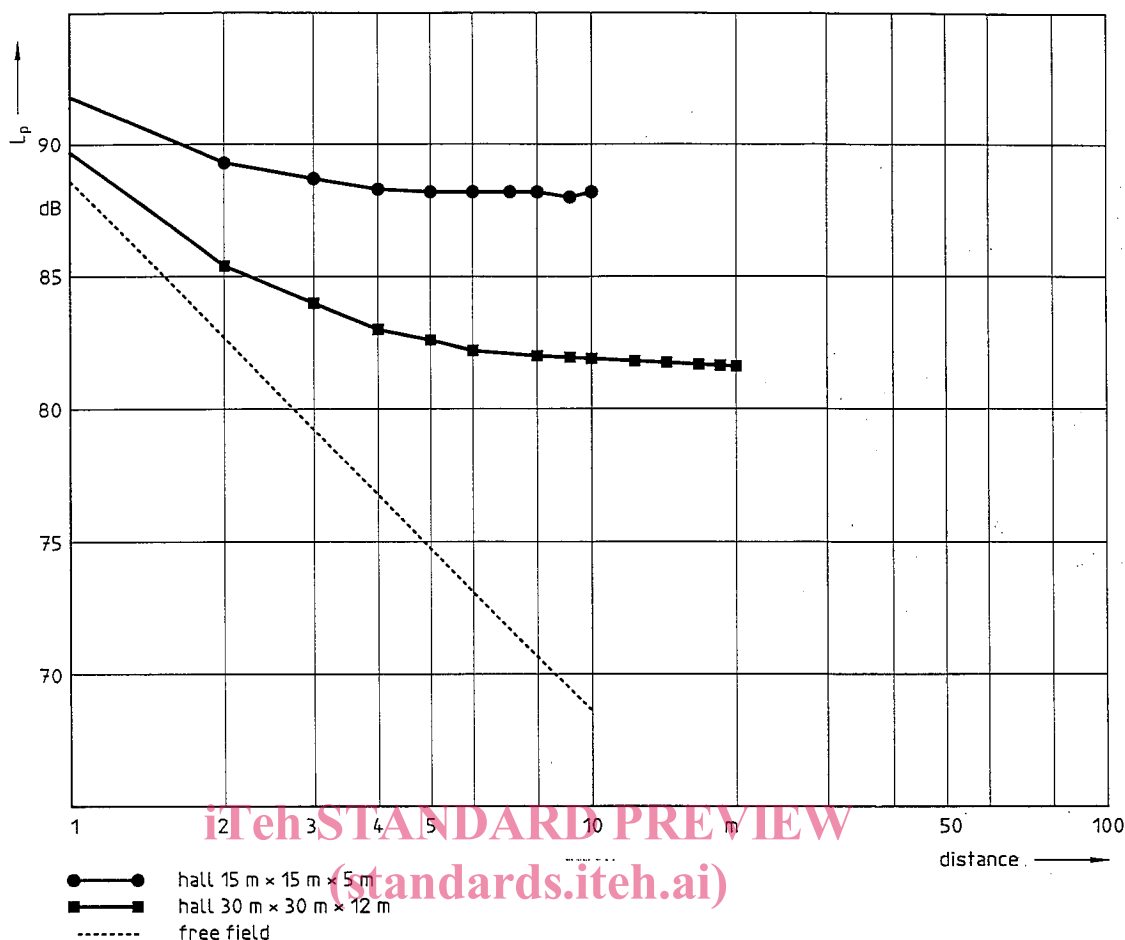
Figure 1 : Examples of spatial sound distribution curves for an omnidirectional point source and two rooms with different sizes, equal absorption coefficients and diffuse field. The dotted curve is the spatial sound distribution curve under total free field conditions. L_p denotes the sound pressure level at a given point when the sound power level of the source is 100 dB.

The sound pressure level of the diffuse field depends only on the total sound power level of all sources in the room and on the equivalent absorption area A. In rooms with a diffuse sound field, there is a direct connection between the reverberation time and the expected spatial sound distribution curve. It is therefore also possible to qualify such rooms by their reverberation time. In this case, noise prediction is relatively simple.

4.3 Rooms with uniform sound propagation

In many workrooms, diffuse sound field conditions cannot be assumed e.g. because the height of the room is less than one third of the length (flat rooms). In such rooms, even far from the source, the sound field depends on the position being considered and is characterized by a spatial sound distribution curve.

In many workrooms, it can be assumed that the absorption and the fitting density are similar in different parts of the room (this includes a room with an absorbing ceiling and a reflecting floor). In this case, a single spatial sound distribution curve along a free path (not close to walls or fittings) represents the sound propagation and the acoustical quality of the room.

As an example, figure 2 shows two typical spatial sound distribution curves in a flat room containing fittings.

with fittings, with reflecting ceiling
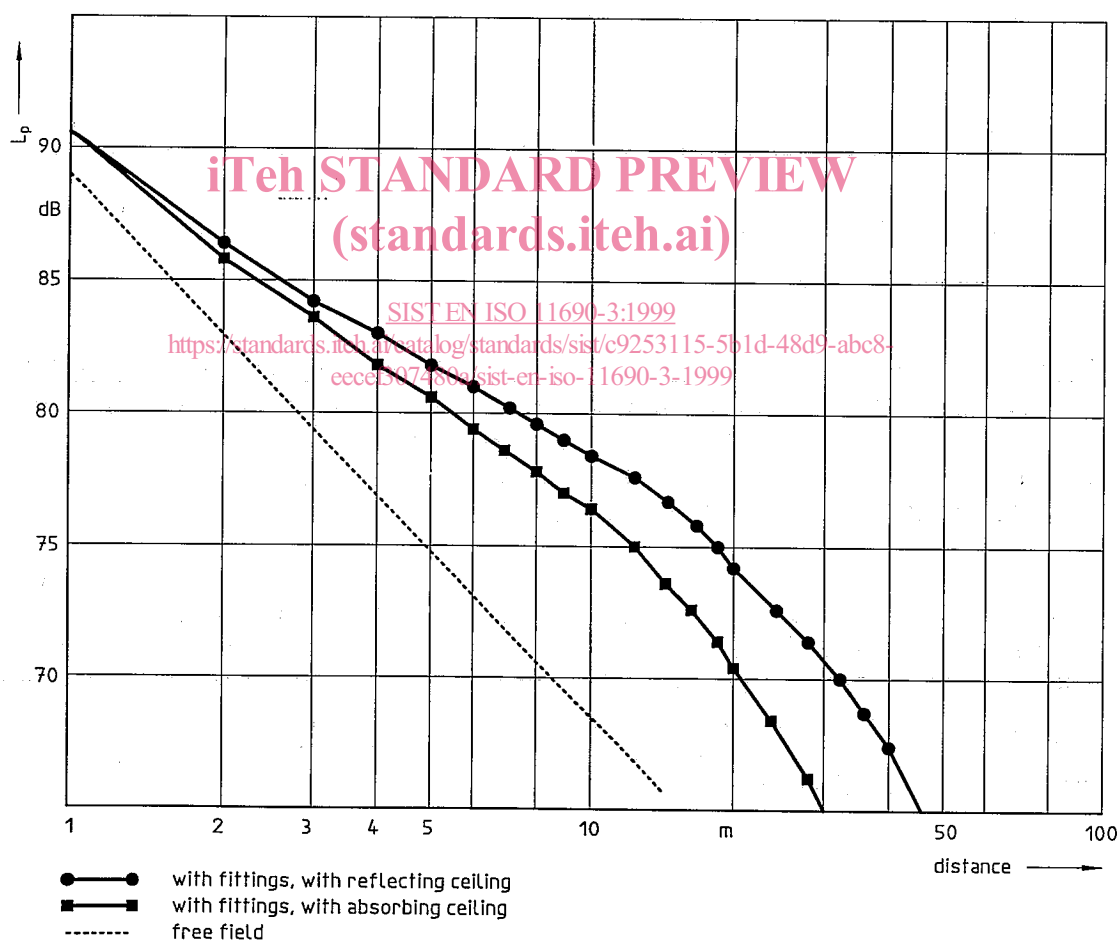with fittings, with absorbing ceiling
-------- free field

Figure 2 : Examples of typical spatial sound distribution curves for the same flat and fitted room, with and without sound absorbing ceiling. The dotted curve is the spatial sound distribution curve under total free field conditions. L_p denotes the sound pressure level at a given point when the sound power level of the source is 100 dB.

4

It is often useful to split the spatial sound distribution curve into three sections depending on the distance from the source (see 3.4.11 of part 1). The first section corresponds to the region near the source. In this region, the sound field is dominated by the direct field. The rate of spatial decay per distance doubling, DL2, is in most cases approximately 5 dB to 6 dB. Increasing the number of fittings in the vicinity of the source tends to increase the sound pressure level close to the source and to reduce it far from the source.

The second section of this curve corresponds to a middle region. In this region, DL2 lies in the range 2 dB to 5 dB and DLf in the range 2 dB to 10 dB.

In the far region (third part), scattering effects of fittings are important. The absorption of the walls, the density and the absorption of fittings have a dominant influence on the sound propagation far away from the source. Therefore, in this region, DL2 may be greater than 6 dB and DLf may be negative.

4.4 Rooms with non uniform sound propagation

In some situations, the room shape, absorption and fitting density differ from one part of the room to the other to such an extent that it is not possible to describe the sound propagation in the room with a single spatial sound distribution curve. In such situations, it may be necessary to describe the sound field in a way which takes into account the above factors. Fittings can also be considered individually.

5 Noise prediction in workrooms

Noise prediction in workrooms (see 9 of part 1) is an aid in making decisions regarding noise control measures. It allows calculation of the sound pressure level at any point and determination of sound propagation descriptors. It is therefore possible to compare these values with specified values or limits and to compare various solutions of a noise control programme. Although several noise prediction methods are available, all of them are based on a common procedure. This procedure is summarized in the flow chart shown in figure 3 and is outlined in the next clause.

6 Methodology for noise prediction in workrooms

Noise prediction in workrooms should follow five steps described below.

6.1 Objectives - Values to be achieved

At an early stage of a noise prediction scheme, acoustical descriptors must be chosen and target values defined by the parties involved, taking account of the various constraints associated with the project. Such descriptors can be sound pressure levels at workstations, immission and/or exposure data, spatial sound