BRITISH STANDARD

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Safety of machinery — Guidance for the drafting of the noise clauses of safety standards

The European Standard EN 1746:1998 has the status of a British Standard

ICS 13.110

National foreword

This British Standard is the English language version of EN 1746:1998.

The UK participation in its preparation was entrusted by Technical Committee EH/1, Acoustics, to Subcommittee EH/1/4, Machinery noise, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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Safety of machinery — Guidance for the drafting of the noise clauses of safety standards

Sécurité des machines — Guide relatif à la rédaction des articles "bruit" des normes de sécurité

Sicherheit von Maschinen — Anleitung für die Abfassung der Abschnitte über Geräusche in Sicherheitsnormen

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CEN

European Committee for Standardization
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Foreword

This European Standard has been prepared 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of an identical text or by endorsement, at the latest by March 1999 and conflicting national standards shall be withdrawn at the latest by March 1999.

This European Standard has been prepared by Technical Committee CEN/TC 211, Acoustics, the Secretariat of which is held by Denmark, as a guidance document to be used by CEN machinery Technical Committees as the basis for the preparation of the clauses concerning noise in their type C-Standards. “Guidance” is used, because the document is a general one and therefore may not be applicable in all details for a specific type of machinery.

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 EU Directive(s).

Several documents concerning noise referred to in this European Standard are at the moment at the stages of draft. The latest reference document numbers are given which makes it possible to obtain these documents from a national member body.

This European Standard also contains two annexes which are informative.

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.

Introduction

For many machines, noise is a significant hazard, i.e. a hazard which an assessment carried out in accordance with EN 1050 has led to identify as being connected with one or more essential requirements decreed in annex I of the Machinery Directive and which requires a specific action on the part of the manufacturer or supplier (see EN 414:1992, **6.4.2**). The information contained in this European Standard is based on the following principles:

a) noise reduction is an integral part of machinery safety; and

b) machinery must be so designed and constructed that risks resulting from the emission of airborne noise are reduced to the lowest level taking account of technical progress and available means of reducing noise, in particular at source; and

c) specific quantitative information on airborne noise emitted by machinery under specified operating and mounting conditions shall be given in accordance with the relevant noise test code, or, if no test code exists, under specified individual conditions;

d) the noise clauses of type C-Standards shall deal with noise emission aspects including residual risk; but information on how the noise emission at the work station can be further reduced, including advice on personal protection equipment, may be helpful.

1 Scope

This European Standard gives guidance on how to deal with noise in type C-Standards where noise is identified as a significant hazard (see EN 292-1:1991, **4.5**). As such, this European Standard supplements the rules given in EN 414:1992.

The exact way that noise is dealt with for a particular type of machinery will depend on the structure of the type C-Standards and is the responsibility of the type C-Standard Technical Committees.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 292-1:1991, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology.*

EN 292-2:1991/A1:1995, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles and specifications.*

EN 414:1992, *Safety of machinery — Rules for the drafting and presentation of safety standards.*

prEN ISO 3740, *Acoustics — Determination of sound power levels of noise sources — Guidelines for the use of basic standards* (ISO/DIS 3740:1998).

prEN ISO 3741, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Precision methods for reverberation chambers* (ISO/DIS 3741.2:1998).

EN ISO 3743-1, *Determination of sound power levels of noise sources — Engineering methods for small, movable sources in reverberant fields — Part 1: Comparison method in hard-walled test rooms* (ISO 3743-1:1994).

EN ISO 3743-2, *Acoustics — Determination of sound power levels of noise sources — Engineering methods for small, movable sources in reverberant fields — Part 2: Methods for special reverberation test rooms* (ISO 3743-2:1994).

EN ISO 3744, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane* (ISO 3744:1994).

EN ISO 3746, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane* (ISO 3746:1995).

prEN ISO 3747, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Comparison method for use in situ* (ISO/DIS 3747:1998).

EN ISO 4871, *Acoustics — Declaration and verification of noise emission values of machinery and equipment* (ISO 4871:1996).

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

EN ISO 9614-2, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Scanning method* (ISO 9614-2:1996).

EN ISO 11200, *Acoustics — Noise emitted by machinery and equipment — Guidelines for the use of basic standards for the determination of emission sound pressure levels at the work station and at other specified positions* (ISO 11200:1995).

EN ISO 11201, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at the work station and at other specified positions — Engineering method in an essentially free field over a reflecting plane* (ISO 11201:1995).

EN ISO 11202, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at the work station and at other specified positions — Survey method in situ* (ISO 11202:1995).

EN ISO 11203, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at the work station and at other specified positions from the sound power level* (ISO 11203:1995).

EN ISO 11204, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at the work station and at other specified positions — Method requiring environmental corrections* (ISO 11204:1995).

EN ISO/TR 11688-1, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning* (ISO/TR 11688-1:1995).

EN ISO 11689, *Acoustics — Procedure for the comparison of noise emission data for machinery and equipment* (ISO 11689:1996).

EN ISO 12001, *Acoustics — Noise emitted by machinery and equipment — Rules for the drafting and presentation of a noise test code* (ISO 12001:1996).

ISO 3745, *Acoustics — Determination of sound power levels of noise sources — Precision methods for anechoic and semi-anechoic rooms.*

ISO/TR 11688-2[1)], *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 2: Introduction to the physics of low-noise design.*

3 Requirements for drafting the noise clauses of type C-Standards

3.1 General drafting rules

The type C-Standard shall reflect, in accordance with EN 414:1992, **6.8** the application of the strategy defined in EN 292-1:1991, clause **5**, *Strategy for selecting safety measures*, with a view to reducing the noise emission to the lowest level taking account of technical progress and the available technical measures for noise control at the source.

In addition, in every type C-Standard dealing with noise, there is a need to provide information on how the technical measures can be verified (see EN 414:1992, **6.9**). This verification shall be based on noise emission values, see **3.4.1**.

The information for use of the machinery (see EN 414:1992, **6.10**) shall include not only information on noise emission but also sufficient information on additional noise reduction, if necessary.

NOTE If, for a particular type of machinery, noise is considered by the relevant type C-Standard Technical Committee not to be a significant hazard the following statement should be included in the safety standard.

"Noise is not considered to be a significant hazard for these machines. This does not mean that the manufacturer of the machine is absolved from reducing noise and making noise declaration".

The following rules for the drafting of the noise clauses of a type C-Standard are given in accordance with the structure as laid down in EN 414:1992:

— list of hazards, see **3.2;**

— safety requirements and/or measures, see **3.3**;

— verification of the effect of the safety measures, see **3.4**;

— information for use, see **3.5**.

3.2 Clause on "noise as a hazard"

If noise is accepted as a significant hazard (see EN 292-1:1991, **4.5**) this shall be stated in the list of hazards and, if appropriate, the hazardous situation.

3.3 Clause on "noise reduction as a safety requirement"

3.3.1 *Noise reduction at source by design*

In this clause of the type C-Standard, a description shall be given of the internal sound sources of the specific family or group of machinery covered.

If applicable, a list of examples of possible technical measures for noise reduction at source may be given. Such a list of measures should be given in an informative annex.

Care must be taken that the technical information given in the list does not discourage innovation with respect to machinery safety. When a list is given, the type C-Standards should state that "this list is not exhaustive, alternative technical measures for noise reduction with identical or greater efficacy can be used by a manufacturer". EN ISO/TR 11688 gives general technical information on widely recognized technical rules and means to design low-noise machinery. The above mentioned list of technical measures for noise reduction at source should be derived from the recommendations given in EN ISO/TR 11688 and the current practice of manufacturers.

The criterion for assessing the efficiency of these measures is the actual noise emission values from the machine in relation to other machines of the same family (see **3.4**) and not the nature of the reduction measures themselves (see EN 414:1992, **6.8.2** and **6.8.5**).

3.3.2 *Noise reduction by protective devices*

If it is not possible to achieve the noise reduction at the source by design methods then this clause shall indicate that, whenever practical, it will be necessary to equip the machine with devices such as noise enclosures, screens fitted to the machinery, silencers etc. (see EN ISO 11546, EN ISO 11691, EN ISO 11820, EN ISO 11821).

[1)] At the stage of draft

3.3.3 ***Noise control by information***

For some machinery, consideration of noise control at the design stage may show that noise emission levels after taking all possible technical measures for noise control at source will be so high that further protection of the operator will be necessary. In this case the instruction handbook shall contain such additional information as given in **3.5**.

3.4 Clause on "verification of compliance with the safety requirements and measures"

3.4.1 ***Verification based on noise emission values***

Noise declaration requires the measurement of noise emission quantities. A noise test code (see EN ISO 12001) is essential for noise declaration since it specifies how noise emission is to be determined and declared for a specified family of machinery. The preparation of noise test codes is the responsibility of the Technical Committees preparing type C-Standards. Depending on the structure of the type C-Standards, a noise test code may be a separate type C-Standard or a discrete part or an annex of a type C-Standard. The rules for the preparation of noise test codes by type C-Standard Technical Committees are given in EN ISO 12001.

This clause shall state that measurement of noise emission values shall be made in accordance with the relevant noise test code, including declaration of dual-number noise emission values and verification in accordance with EN ISO 4871.

The term "noise emission value" is a general one that can represent an emission sound pressure level (at a workstation or some other specified position) and/or the sound power level.

If the noise test code for the family or group of machinery concerned is not yet available, it shall be stated in this clause that, in the absence of a noise test code, the noise declaration shall indicate precisely:

— the mounting and operating conditions of the machinery during noise emission measurement;

— the work station position(s) where noise emission sound pressure levels have been determined;

— the noise emission measurement methods used, (i.e. chosen from the EN ISO 3740 series (guidance for the selection given in EN ISO 3740), the EN ISO 9614 series, and the EN ISO 11200 series (guidance for the selection given in EN ISO 11200);

— the criteria on which the noise declaration is made (i.e. EN ISO 4871).

3.4.2 ***Verification of noise reduction***

This clause shall provide means by which the designer or any other user of the type C-Standard can verify that the technical noise reduction measures have been successfully implemented. An assessment of the noise reduction achieved can be performed by comparing the actual noise emission values to the range of noise emission values from other machines of the family concerned, measured as indicated in **3.4.1**. Where available, these emission values from the family of machines should be published for comparison with the actual noise emission value for the machine.

This can be done by describing the population of noise emission values declared for the specific family of machinery, and by analysing the population according to EN ISO 11689. Such an analysis might be undertaken by the type C-Standard Technical Committee, manufacturers or suppliers, purchasers, enforcement authorities, etc.

The description of the population of noise emission values and the analysis may be published by the above mentioned bodies using criteria that they consider best suited to the family or group of machinery they are dealing with. The population of noise emission values should be reviewed regularly to consider if it needs to be adjusted to take account of technical progress.

Further guidance on the evaluation of noise emission data is given in annex A

NOTE At the moment there are few data available to obtain values describing the noise control performance. It is hoped that as test codes become more widely available and data collection more systematic, values can be quoted with confidence.

3.5 Clause on "instruction handbook"

This clause of a type C-Standard shall state that the instruction handbook and the technical documentation describing the machinery, including sales literature, shall:

— give the declared noise emission values of the machinery in accordance with EN 292-2:1991/A1:1995, annex A **1.7.4** and EN ISO 4871, preferably by dual-number noise emission values;

— give the reference to the noise test codes upon which the determination of these values is based (see **3.4.1**);

— if feasible, give information on spectral components or time waveform (tonality, impulsiveness).

Additionally, if further protection of the operator is necessary, as mentioned in **3.3.3**, the instruction handbook shall:

— give information on possible special noise enclosures, screens fitted to the machinery, silencers etc.;

— recommend additional noise reduction measures (see EN ISO 11690-1 and 2), for example the use of noise cabins (see EN ISO 11957) as well as necessary requirements relating to installation and assembly for reducing noise (e.g. use of dampers, type and mass of foundation block, etc.);

— recommend the use of low-noise operating modes, or limited time of operation;

— recommend the wearing of personal hearing protectors (see EN 352).

Annex A (informative)
Further guidance on the evaluation of noise emission data

The analysis mentioned in **3.4.2** makes it possible to determine the noise control performance as described in EN ISO 11689.

The noise control performance can be expressed by single numbers or regression lines, representing noise emission values as a function of some other quantity (in most cases the power of the machine). These are not limit values which all machinery in a given family or group must comply with, but are intended to be used as reference values in comparison to which the noise emission of a machine can be assessed. The noise control performance shall not prevent the achievement of lower emission sound pressure levels and sound power levels. It is a recommendation only and irrelevant as regards the authorization to put a machine on the market.

The noise control performance as described above may, if appropriate, be set by the competent type C-Standard Technical Committee or another relevant body, see **3.4.2**. It shall be realistic and based on what is possible, account being taken of the progress achieved with respect to noise control measures and their implementation. A noise control performance should be set with noise emission values low enough that encouragement is given to reduce noise further in most machinery of a given family on the market. The noise control performance should be reviewed regularly to consider if it needs to be adjusted to take account of the technical progress.

NOTE 1 A noise control performance as described above may be taken as one possible way to represent the achievable noise emission values as defined by CR 1100, and already used by some type C-Standard Technical Committees.

NOTE 2 The absence of noise test codes and noise control performance values should not inhibit noise reduction measures as defined in **3.3**.

Annex B
(informative)
Bibliography

CR 1100, *Memorandum on health and safety standardisation in support of "New approach" Directives — Application in the field of machinery*

EN 352-1, *Hearing protectors — Safety requirements and testing — Part 1: Ear muffs.*

EN 352-2,*Hearing protectors — Safety requirements and testing — Part 2: Earplugs.*

EN 352-3, *Hearing protectors — Safety requirements and testing — Part 3: Ear muffs attached to an industrial safety helmet.*

prEN 352-4, *Hearing protectors — Safety requirements and testing — Part 4: Level-dependent ear-muffs.*

EN 1050, *Hazard assessment principles.*

EN ISO 11546-1, *Acoustics — Determination of sound insulation performance of enclosures. Part 1: Measurements under laboratory conditions (for declaration purposes)* (ISO 11546-1:1995).

EN ISO 11546-2, *Acoustics — Determination of sound insulation performance of enclosures. Part 2: Measurements in situ (for acceptance and verification purposes)* (ISO 11546-2:1995).

EN ISO 11690-1, *Acoustics — Recommended practice for the design of low-noise workplaces containing machinery — Part 1: Noise control strategies* (ISO 11690-1:1996).

EN ISO 11690-2, *Acoustics — Recommended practice for the design of low-noise workplaces containing machinery — Part 2: Noise control measures* (ISO 11690-2:1996).

EN ISO 11691, *Acoustics — Measurement of insertion loss of ducted silencers without flow. Laboratory survey method* (ISO 11691:1995).

EN ISO 11820, *Acoustics — Testing of silencers in situ* (ISO 11820:1996).

EN ISO 11821, *Acoustics — Measurement of the in situ sound attenuation of a removable screen* (ISO 11821:1997).

EN ISO 11957, *Acoustics — Determination of sound insulation performance of cabins. Laboratory and in situ measurements* (ISO 11957:1996).

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