SLOVENSKI STANDARD
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Safety of machinery - Guidance for the drafting of the vibration clauses of safety standards

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Sicherheit von Maschinen - Anleitung für die Abfassung der Abschnitte über Schwingungen in Sicherheitsnormen

Sécurité des machines - Guide relatif à la rédaction des clauses vibrations des normes de sécurité

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01.120	Standardizacija. Splošna pravila	Standardization. General rules
13.110	Varnost strojev	Safety of machinery
17.160	Vibracije, meritve udarcev in vibracij	Vibrations, shock and vibration measurements

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EUROPEAN STANDARD
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English version

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This European Standard was approved by CEN on 7 July 1999.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 231 "Mechanical vibration and shock", the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by February 2000, and conflicting national standards shall be withdrawn at the latest by February 2000.

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.

It is a guidance document to be used by CEN machinery TCs as the basis for the preparation of the clauses concerning vibration 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.

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

Annex A is informative.

Introduction

For many machines, vibration is a significant hazard, i. e. a hazard which an assessment carried out in accordance with EN 1050 has lead 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 6.4.2 of EN 414:1992). The information contained in this European Standard is based on the following principles:

a) vibration reduction is an integral part of machinery safety;

b) machinery shall be so designed and constructed that risks resulting from vibration produced by the machinery are reduced to the lowest level taking account of technical progress and available means of reducing vibration, in particular at source, and

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

d) the vibration clauses of type C-standards shall deal with vibration aspects including residual risk; information on personal protective equipment may be helpful.

1 Scope

This European Standard gives guidance on how to deal with vibration in type C-standards where vibration is identified as a significant hazard (see 4.6 of EN 292-1:1991). As such, this European Standard supplements the rules given in EN 414.

The exact way that vibration is dealt with for particular machinery will depend on the structure of the type C-standards and is the responsibility of the type C-standards 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 414:1992
Safety of machinery – Rules for the drafting and presentation of safety standards

EN 1032
Mechanical vibration – Testing of mobile machinery in order to determine the whole-body vibration emission value – General

EN 1033
Hand-arm vibration – Laboratory measurement of vibration at the grip surface of hand-guided machinery – General

EN 1299
Vibration isolation of machines – Information for the application of source isolation

EN 12096
Mechanical vibration – Declaration and verification of vibration emission values

EN 28662-1
Hand-held portable power tools – Measurement of vibrations at the handle – Part 1: General (ISO 8662-1:1988)

EN 30326-1
Mechanical vibration – Laboratory method for evaluating vehicle seat vibration – Part 1: Basic requirements (ISO 10326-1:1992)

EN ISO 10819
Mechanical vibration and shock – Hand-arm vibration – Method for the measurement and evaluation of the vibration transmissibility of gloves at the palm of the hand (ISO 10819:1996)

EN ISO 11689
Acoustics – Procedure for the comparision of noise-emission data for machinery and equipment (ISO 11689:1996)

CR 1030-1
Hand-arm vibration – Guidelines for vibration hazards reduction – Part 1: Engineering methods by design of machinery

3 Requirements for drafting the vibration clauses in type C-standards

3.1 General drafting rules

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

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

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

NOTE: If, for a particular type of machinery, vibration 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:

"Vibration is not considered to be a significant hazard for these machines and no test method is given. This does not mean that the manufacturer of the machine is absolved from reducing vibration and making vibration declaration."

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

- 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 "Vibration as a hazard"

If vibration is accepted as a significant hazard (see 4.6 of EN 292-1:1991) this shall be stated in the list of hazards and, if appropriate, the hazardous situation.

3.3 Clause on "Vibration reduction as a safety requirement"

3.3.1 Vibration reduction at source by design

In this clause of the type C-standard, a description shall be given of main vibration sources of the specific family or group of machinery covered.

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

Care shall 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-standard should state that: "This list is not exhaustive; alternative technical measures for vibration reduction with identical or greater efficiency can be used by a manufacturer."

Regarding hand-arm vibration, CR 1030-1 gives general technical information on widely recognized technical rules and means to design low-vibration hand-held and hand-guided machinery. In some cases, a reference to CR 1030-1 will replace the above mentioned list.

The criterion for assessing the efficiency of these measures is the actual vibration emission value 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 6.8.2 and 6.8.5 of EN 414:1992).

3.3.2 Vibration reduction by protective devices

If it is not possible to achieve the vibration reduction of the source then this clause shall indicate that, wherever practical, it will be necessary to equip the machine with devices such as vibration isolators, additional mass, resonating masses, specially designed foundation, specially designed suspension seats, etc.

Regarding mobile machines, this clause shall state that seats shall be selected to fulfil criteria defined in EN 30326-1 and further standards specific to the family of machines.

For some machinery, consideration of vibration control at the design stage may show that vibration emission values, after taking all possible technical measures for vibration control at source and on the transmission path, will be so high that further protection for the operator will be necessary. One method, applicable to some machines, could be to limit the duration for which the machine may be operated (see 3.5). The type C-standard shall indicate that this information shall be given in the instruction handbook and the technical literature.

3.4 Clause on "Verification of the safety requirements and/or protective measures"

3.4.1 Verification based on vibration emission values

Vibration declaration requires the measurement of vibration quantities. A vibration test code is essential for vibration declaration since it specifies how vibration emission is to be determined, declared and verified for a specified family of machinery. A vibration test code should be based on EN 1032 for whole-body vibration and on EN 1033 or EN 28662-1 for hand-arm vibration. The preparation of vibration test codes is the responsibility of the Technical Committees preparing type C-standards. Depending on the structure of the type C-standards, a vibration test code may be

a separate type C-standard or a discrete part or an annex of a type C-standard.

This clause shall state that measurement of vibration emission values shall be made in accordance with the relevant vibration test code, including declaration and verification in accordance with EN 12096.

If the vibration 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 vibration test code, the vibration declaration shall indicate precisely:

- the operating conditions of the machinery during vibration measurement, including a description of a test track, if appropriate,
- the transducer mounting positions during measurement,
- the vibration measurement methods used,
- the criteria on which the vibration declaration is made (i. e. EN 12096).

3.4.2 Verification of vibration reduction

This clause shall provide means by which the manufacturer and any other user of the type C-standard can verify that the technical vibration reduction measures have been successfully implemented. An assessment of the vibration reduction achieved can be performed by comparing the actual vibration emission value to the range of vibration 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 vibration emission value for the machine.

This can be done by describing the population of vibration emission values declared for the specific family of machinery, and by analysing it as defined in 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 vibration 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 vibration 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 vibration emission data is given in annex A.

NOTE: At the moment there are few data available to obtain values describing the vibration 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 vibration emission values of the machinery as defined in EN 12096,
- give the reference to the vibration test codes including operating conditions upon which the determination of these values is based (see 3.4.1),

- if applicable (see 3.3.2), give information on possible technical measures for vibration reduction such as type and mass of foundation block, use of dampers, machine alignment and balance quality, (for mobile machines – operating surface quality, type of tyres, seats) and maintenance modes which reduce vibration, if any (see also EN 1299),

- if applicable, give information on the class of seats which shall equip the specified mobile machine (see EN 30326-1),

- if applicable (see 3.3.2), give information on ways to minimize vibration exposure by limiting the operation modes of the machine, by controlling the method of operation or by limited duration of operation,

- if applicable, give information on personal protective equipment (e. g. gloves, see EN ISO 10819),

- if applicable, give information on other factors that affect the risk of injury or desease.