BS EN 12786:2013

BSI Standards Publication

Safety of machinery — Requirements for the drafting of the vibration clauses of safety standards

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National foreword

This British Standard is the UK implementation of EN 12786:2013. It supersedes BS EN 12786:1999 which is withdrawn.

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This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Safety of machinery - Requirements for the drafting of the vibration clauses of safety standards

Sécurité des machines - Exigences relatives à la rédaction des clauses vibrations des normes de sécurité

Sicherheit von Maschinen - Anforderungen an die Abfassung der Abschnitte über Schwingungen in Sicherheitsnormen

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Foreword

This document (EN 12786:2013) 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of an identical text or by endorsement, at the latest by August 2013, and conflicting national standards shall be withdrawn at the latest by August 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12786:1999.

The main changes to the first edition EN 12786:1999 are:

– adapted to the requirements of Machinery Directive 2006/42/EC;

– Annex B with content of Directive 2006/42/EC relevant to vibration added;

– referenced documents updated.

This document 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).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This European Standard supplements and develops examples of how to deal with vibration as a health risk to machine operators as set out in the Guide to application of the Machinery Directive 2006/42/EC.

Risks to machine operators from hand-transmitted and whole-body vibration can be assessed by reference to EN ISO 5349-1 and ISO 2631-1, respectively, and by reference to the Non-binding guide to good practice for implementing Directive 2002/44/EC (Vibrations at Work).

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

For many machines, vibration is a significant hazard, i.e. a hazard which an assessment has identified as requiring a specific action on the part of the manufacturer or supplier (see EN ISO 12100:2010, 3.8).

If the manufacturer ensures that a machine complies with the relevant harmonized type-C safety standard, the machine is presumed to comply with all of the essential requirements addressed by that standard. The information contained in this European Standard will help writers of standards to address the essential requirements relevant to vibration and is based on the following principles:

a) vibration risk 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) where vibration is assessed as a significant hazard, the vibration clauses of the type-C standard shall deal with aspects including minimizing the risk through design and protective measures, the provision of information about residual risk and instructions for safe use.

For portable hand-held and hand-guided machinery, and mobile machinery, the declaration of vibration emission is mandatory. This requirement is not dependent on the assessment of vibration as a significant hazard. The type-C standard should address the declaration of vibration emission.

Employers are required to comply with national legislation on the health and safety requirements regarding the exposure of workers to the risks arising from vibration. Employers should assess those risks and control them. The duties of machinery suppliers indicated in this standard are complementary to those of employers: by supplying safe work equipment, giving warnings of residual risk and providing information to enable safe use of the machinery they can help employers to control risks. It is therefore important that type-C safety standards deal adequately with vibration risks.

This document is a type-B standard as stated in EN ISO 12100.

The provisions of this document can be supplemented or modified by a type-C standard.

For machines which are covered by the scope of a type-C standard and which have been designed and built according to the provisions of that standard, the provisions of that type-C standard take precedence over the provisions of this type-B standard.

The provisions of this document are intended to be used by the Technical Committee drafting a type-C standard, while taking account of the specific requirements for the machinery dealt with and of the structure of the type-C standard. It is important that type-C safety standards deal adequately with vibration risks.

1 Scope

This European Standard gives guidance for the writers of harmonized type-C machinery safety standards on how to deal with vibration where hand-transmitted vibration and/or whole-body vibration is identified as a significant hazard.

This European Standard also gives guidance on how to deal with the requirement for declaration of the vibration emission of portable hand-held and/or hand-guided machinery and for mobile machinery.

This European Standard supplements EN ISO 12100.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

EN 1032, *Mechanical vibration — Testing of mobile machinery in order to determine the vibration emission value*

EN 12096, *Mechanical vibration — Declaration and verification of vibration emission values*

CEN/TR 15172-1, *Whole-body vibration — Guidelines for vibration hazards reduction — Part 1: Engineering methods by design of machinery*

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

EN ISO 5349-1, *Mechanical vibration — Measurement and evaluation of human exposure to hand-transmitted vibration — Part 1: General requirements (ISO 5349-1)*

EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 20643, *Mechanical vibration — Hand-held and hand-guided machinery — Principles for evaluation of vibration emission (ISO 20643)*

ISO 2631-1, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1: General requirements*

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

3.1 General drafting rules

3.1.1 General

The provisions of this European Standard shall be used by the Technical Committee drafting a type-C standard, while taking account of the specific requirements for the machinery dealt with and of the structure of the type-C standard.

3.1.2 Vibration as a significant hazard

Hazardous vibration from human contact with machinery (see EN ISO 12100:2010, Table B.1 row 5) is generally categorized as:

— hand-transmitted vibration (hand-arm vibration), usually from hand-held, hand-guided or hand-fed machines, or from the controls of some mobile machines; or

— whole-body vibration from the supporting surface (e.g. seat or floor), usually (but not exclusively) in mobile machines.

The requirements for managing risks from hand-transmitted vibration and whole-body vibration are different and, where appropriate, they are treated separately in the clauses below.

Machine manufacturers are required to reduce the vibrations transmitted to the operator to the lowest level, taking account of technical progress and the availability of means of reducing vibration, in particular at source (see Annex B, rows 2 and 3). The requirements of the type-C standard shall meet this objective. This should be achieved by applying the following three step method so far as possible in the order presented (see Annex B, row 1):

— by inherent safe design (see EN ISO 12100:2010, 6.2);

— by safeguarding (see EN ISO 12100:2010, 6.3); and

— by information for use (see EN ISO 12100:2010, 6.4);

If, for the machinery identified in the scope of the type-C standard, the vibration hazard is considered to be significant the type-C standard shall

— include vibration in the list of significant hazards, see 3.2;

— formulate measures for reducing risk so far as possible, see 3.3;

— provide information on how compliance with these requirements can be verified, see 3.4; and

— include in the clause “Information for use” requirements on information regarding management of residual risk from vibration, see 3.5.

Vibration emission values shall be declared and these have an important role in the verification that risks from vibration have been reduced to the lowest level, along with other factors such as ergonomics and the efficiency of a machine, see 3.4.

Where a machine exposes the operator to vibration or shock that is not adequately dealt with by EN ISO 5349-1 or ISO 2631-1 (e.g. single shocks, recoils from cartridge-operated hand held tools, extremes of vibration frequency), where there is evidence of a risk to the operator (e.g. evidence of ill health), this shall be addressed in the type-C standard.

If, for the machinery in the scope of the type-C standard, vibration is considered to be a relevant but not significant hazard (see EN ISO 12100:2010, 3.7 and 3.8) the type-C standard shall not formulate specific design requirements concerning vibration. In the normal structure of a type-C standard, these hazards are dealt with by the second sentence of the standard introduction of the clause dealing with safety requirements and/or protective measures: “In addition, the machine shall be designed according to the principles of EN ISO 12100 for relevant but not significant hazards, which are not dealt with by this document."

The Technical Committee should also consider the suitability of the following additional statement (e.g. as a Note, see 3.3):

"*As a general rule, vibration is not considered to be a significant hazard for the machinery in the scope but this does not absolve the manufacturer from the obligation to minimize vibration risk*."

3.1.3 Declaration of vibration emission

For portable hand-held and hand-guided machinery and mobile machinery, the declaration of vibration emission of the machine is mandatory. This requirement is not dependent on the identification of vibration as a significant hazard (but may indicate that vibration needs to be included as a significant hazard). The type-C standard shall address the measurement and declaration of vibration emission and its uncertainty, by including, or referring to, a vibration test code that meets the requirements of the relevant type-B standard (EN ISO 20643 for hand-held and hand-guided machines or EN 1032 for mobile machines, see 3.6). The operating conditions in which the vibration is to be measured shall be specified.

3.2 Clause "List of significant hazards"

If vibration is considered to be a significant hazard (see EN ISO 12100:2010, 3.8) for the machinery in the scope of the type-C standard it shall be included in the list of significant hazards, with information on the hazardous situations and hazardous events (i.e. the circumstances in which people are at risk from vibration).

Hand-transmitted vibration and whole-body vibration are considered to be significant hazards if they have the potential to cause a risk to health (or safety) in intended use or foreseeable misuse of the machine. Vibration will usually be considered a significant hazard if it is likely that the vibration emission will exceed the threshold value for declaration of 2,5 m/s^2 for hand-transmitted vibration and 0,5 m/s^2 for whole-body vibration (see Annex B, row 6), although there may be exceptions for machines that are used only for very short periods of time.

3.3 Clause "Safety requirements and/or protective measures"

3.3.1 General

Where vibration has been included in the list of significant hazards, this clause shall include appropriate design requirements and technical measures for minimizing the vibration risk. The complementary requirements for the provision of information shall be dealt with in the clause on information for use (see 3.5).

3.3.2 Minimizing vibration risk by design and by protective measures

3.3.2.1 General

This clause of a type-C standard shall address the requirement to minimize vibration risk by design (see Annex B, row 2). Vibration risk is dependent on the vibration emission and duration of exposure and also on parameters such as coupling forces and operator posture which can modify the transmission to the human body and the effects of that vibration.

A description shall be given of typical sources of vibration emission for the specific family or group of machines.

If appropriate, a list of examples of technical measures suitable for vibration reduction at source for the family of machines shall be given. Such a list may be given in an informative annex.

It is important that the technical information given in the examples does not discourage innovation with respect to machinery safety. When a list of examples is given, the type-C standard should state that: "This list is not exhaustive; alternative technical measures that would be equally effective or that would further reduce vibration risks may, where suitable, be adopted by the manufacturer."

Measures to minimize vibration-related risk shall be selected taking into account:

— the potential reduction in vibration emission;

— comparison with other machines in the same family of similar size and power;

— the effect on performance as far as this would affect the exposure of the operator;

— ergonomic and other factors affecting the vibration risk;

— the availability of appropriate vibration reducing measures; and

— the balance between vibration-related and other risks to the operator.

3.3.2.2 Hand-transmitted vibration

CR 1030-1 gives general technical information on widely recognized principles for the design of hand-operated machinery. A reference to CR 1030-1 will usually be appropriate.

When technical measures to reduce hand-transmitted vibration risk are provided in accordance with 3.3.2.1, this shall include the following, as appropriate:

— internal isolation of reciprocating forces for percussive tools,

— automatic balancing devices for rotary tools,

— isolated or suspended handles,

— efficient operation to reduce vibration exposure duration,

— ergonomic design to prevent inappropriate postures and minimize forces applied by the operator.

Preference should be given to vibration reduction techniques that do not rely on operator instruction or training (e.g. those that do not require a feed force within a specified range to provide vibration isolation).

3.3.2.3 Whole-body vibration

CEN/TR 15172-1 gives general technical information on widely recognized principles for the design of mobile machinery. A reference to CEN/TR 15172-1 will usually be appropriate.

When technical measures to reduce whole-body vibration risk are provided in accordance with 3.3.2.1, this shall include the following, as appropriate:

— machine size and mass suitable for the intended purpose and terrain,

— wheel, chassis and seat suspension designed to minimize vibration and shocks, in all directions, without introducing excessive pitching and rolling,

— ergonomic design of cab and driver position to ensure good visibility and appropriate driver posture,

— seat design with tuned suspension and suitable support of the driver.

The seat should minimize the transmission of vibration to the operator (see Annex B, row 3). The type-C standard shall require that a seat is selected to minimize the risk from whole-body vibration and/or shock. Testing of seats in accordance with the relevant harmonized seat test standard for the family of machines or, if none, with EN 30326-1, can help identify potentially suitable seats for further evaluation. If EN 30326-1 is used, the type-C standard shall define an input spectrum for this purpose.

3.3.3 Minimizing vibration risk by managing the use of the machine

For some machinery, vibration risk remains after minimizing vibration at the design stage and additional measures need to be taken by the user. The type-C standard shall indicate that appropriate information shall be given in the information for use (see 3.5).

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

This clause shall describe the means by which the manufacturer can verify and demonstrate that technical vibration reduction measures in the design and manufacture of the machinery have been successfully implemented.

For portable hand-held and hand-guided machines and mobile machines, there is a requirement to declare the vibration emission, see 3.6. These declared vibration emission values should provide an indication of compliance with the corresponding requirements of the type-C standard and should provide an indication of the vibration likely to be experienced during intended use.

Verification of the level of vibration control achieved can be performed by comparing the vibration emission value with the range of vibration emission values from other machines of the same family and with similar size, power, etc. This can be achieved by describing and analysing the population of vibration emission values for the specific family of machinery. An analysis of this kind might be undertaken by the type-C standard Technical Committee, manufacturers or suppliers, purchasers, enforcement authorities, etc. so that the type-C standards committee can consider whether an indicative value, representing state of the art, is appropriate.

NOTE 1 EN ISO 11689 describes such a procedure for noise emission values which can also be applied to vibration.

NOTE 2 An example of such data collections can be found in ISO/TR 25398 for earth-moving machinery.

Further guidance on comparative vibration emission data is given in Annex A.

If a procedure such as that described in EN ISO 11689 is not used in the type-C standard, then the standard shall require the manufacturer to demonstrate during verification how the vibration emission compares with the declared vibration emissions of other machines. When making such comparisons it is important to consider the uncertainty, *K*.

It is important, when setting requirements to minimize risk (see Annex B, rows 1 and 2) and verifying compliance with them, that the judgement is based on the risk from vibration, and not solely on the vibration emission value. The risk from exposure to vibration can be affected by contact forces, operator posture, probable exposure time and many other factors. It is also important to take account of other significant hazards identified for the machine and the consequent risks associated with the intended uses of the machine. The type-C safety standard shall require the manufacturer to take these factors into consideration.

For machines for which declaration of vibration emission is not required (e.g. hand-fed machines such as pedestal grinders, or fixed machinery where the operator is exposed to whole-body vibration) but for which vibration has been identified as a significant hazard, the type-C safety standard shall require the manufacturer to demonstrate during verification that the design features and any other measures taken to minimize risk from vibration are effective.

3.5 Clause ”Information for use"

It is common for significant residual vibration risks to remain, even if the risk has been minimized through the design and construction of the machinery. The user shall then manage the use of the machine to minimize the vibration risk. For this purpose, appropriate information shall be included in the information for use. This clause of the type-C standard shall state that the instruction manual shall

a) where declaration of vibration emission is required (see 3.6):

— give the declared vibration emission values of the machinery, with the uncertainty, as defined in EN 12096,

— give a reference to the vibration test code and a description of the operating conditions upon which the determination of these values is based,

— if, for any reason, the declared emission value does not adequately warn of risk, give supplementary information on the likely range of vibration in foreseeable use of the machine, sufficient to allow the user to manage the risk (e.g. a warning that a reaction bar used with a riveting hammer is likely to emit a greater level of vibration than the riveting hammer itself);

b) if applicable, give information on the selection of accessories (e.g. inserted tools) that are suitable for the task;

c) if applicable, give information on the technical devices and measures required for vibration reduction that are to be provided by the user, such as type and mass of foundation block, use of dampers, machine alignment and balance quality (see also EN 1299), and maintenance which reduces vibration, if any (for mobile machines – e.g. operating surface quality, tyres, suspension seats);

d) if applicable, give information on the class of seats which shall equip the specified mobile machine (see EN 30326-1). An appropriate seat should be fitted to the machine when supplied – but instructions may be needed on adjustment, maintenance and occasional replacement of seats;

e) if applicable, give information on the correct use and operation of the machine, and any training which may be required for the operator;

f) if applicable, give information on ways to minimize vibration risk by limiting the operation modes of the machine, by controlling the method of operation or by limited duration of operation (e.g. a balancer or tensioner to support the weight of a powered hand-held tool and reduce the operator's forces);

g) if applicable explain the uses of the machine for which it is, and is not, suitable;

h) if applicable, give warnings about misuse of the machine (e.g. holding a power tool at the wrong position, or driving an off-road machine too fast) that will increase risks from vibration;

i) if applicable, give information on other factors that affect the risk of vibration-related injury or disease (e.g. ergonomic factors);

j) if applicable, give information on the correct adjustment and maintenance of the machine and accessories used with it;

k) if applicable, make recommendations regarding the maximum daily time for which an individual should operate the machine.

3.6 Declaration of vibration emission

3.6.1 General

The declaration of vibration emission, by presenting data in the instruction manual and sales literature, is a requirement for portable hand-held and/or hand-guided machines and mobile machines (see Annex B, row 6). This requirement is independent of the identification of vibration as a significant hazard (see 3.2).

As a minimum requirement, for these machines, the following text shall be inserted in each type-C standard:

"The vibration emission value and its uncertainty shall be stated in the instruction manual in accordance with EN 12096."

3.6.2 Portable hand-held and hand-guided machinery

The type-C safety standard shall require declaration (in the instruction manual) of a vibration emission value, *a*, (measured using a specified test code) and its uncertainty, *K*, (determined according to EN 12096). However, if the vibration emission is less than 2,5 m/s^2 the standard should allow the manufacturer to state this fact and not give the actual value.

This clause shall indicate how the vibration emission shall be measured. Ideally the type-C standard should include, or refer to, a vibration test code specifying how vibration emission is to be determined, declared and verified for a specified family of machinery. The preparation of vibration test codes is the responsibility of the Technical Committees preparing type-C standards. The vibration test code should comply with the type-B standard EN ISO 20643. It shall require measurement of the vibration total value at all grip positions (where appropriate) and shall specify operating conditions for the machine under test representative of the highest vibration values likely to occur in typical and normal use of the machine.

Depending on the structure of the type-C safety standard, the vibration test code may be:

— included in the type-C safety standard;

— a normative annex to the type-C safety standard; or

— a separate type-C standard.

If the vibration test code does not fully comply with EN ISO 20643 an explanation of the reason should be included as a Note.

If the vibration test code for the family of machines concerned is not yet available, it shall be stated in this clause that the general method in EN ISO 20643 should be followed and the vibration declaration should indicate precisely:

— the operating conditions of the machinery during vibration measurement including, as appropriate, operating speed, applied forces, accessories and the material being worked; and

— the transducer mounting positions.

If, for a family of machines, the Technical Committee identifies that the vibration emission value is always less than 2,5 m/s^2 in foreseeable use, the type-C safety standard need not include a vibration test code other than a reference to EN ISO 20643. In such cases, the following text shall be inserted in the type-C standard:

"*Experience has shown that for the machines in the scope the vibration total value to which the hand-arm system is subjected is in general significantly below 2,5 m/s^2. In this case it is sufficient to mention that the acceleration is below this limit.*"

3.6.3 Mobile machinery

3.6.3.1 Whole-body vibration

The type-C safety standard shall require declaration (in the instruction manual) of a whole-body vibration emission value, *a*, (measured using a specified test code) and its uncertainty, *K*, (determined according to EN 12096). However, if the vibration emission is less than 0,5 m/s^2 it is sufficient to state this fact and not to give the actual value.

This clause shall indicate how the vibration emission shall be measured. Ideally the type-C standard should include, or refer to, a vibration test code, specifying how vibration emission is to be determined, declared and verified for a specified family of machinery. The preparation of vibration test codes is the responsibility of the Technical Committees preparing type-C standards. The vibration test code should comply with the type-B standard EN 1032. It shall require measurement in three directions at the supporting surface (floor or seat)

and shall specify operating conditions for the machine under test that produce vibration emissions representative of real use of the machine.

Depending on the structure of the type-C safety standard, the vibration test code may be:

— included in the type-C safety standard;

— a normative annex to the type-C safety standard; or

— a separate type-C standard.

If the vibration test code does not fully comply with EN 1032 an explanation of the reason should be included as a Note.

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 the general method in EN 1032 should be followed and the vibration declaration should indicate precisely the operating conditions of the machinery during vibration measurement including, as appropriate, e.g. operating speed, test track.

For some families of mobile machine, differences between the vibration emissions for different operating conditions are much greater than the differences between models of machine (when machines of similar size, power and purpose are compared). A vibration emission value, measured in a single standardized operating condition, is therefore unlikely to help the user to choose between competing machines or to assess and manage the risk. The Technical Committee preparing the type-C safety standard may choose to publish or refer to data on the range of vibration emissions for a family of machines, for specified but typical operating tasks (e.g. ISO/TR 25398 for earth-moving machinery). The type-C safety standard may allow manufacturers to declare vibration emission by quoting the appropriate data, provided the manufacturer has evidence that the vibration emission for the specific machine lies within the range of values published for this class of machines.

If, for a family of machines, the Technical Committee identifies that the whole-body vibration emission value is always less than 0,5 m/s^2 in foreseeable use, the type-C safety standard need not include a vibration test code. In such cases the following text shall be inserted in the type-C standard:

"*Experience has shown that for the machines in the scope the highest axis vibration value to which the human body is subjected is in general significantly below 0,5 m/s². In this case it is sufficient to mention that the acceleration is below this limit.*"

3.6.3.2 Hand-transmitted vibration

The type-C safety standard shall require declaration (in the instruction manual) of a hand-transmitted vibration emission value, *a*, (measured using a specified test code) and its uncertainty, *K*, (determined according to EN 12096). However, if the vibration emission is less than 2,5 m/s^2 it is sufficient to state this fact and not to give the actual value.

The requirements are identical to those for portable hand-held and hand-guided machines (see 3.6.2).

Annex A
(informative)

Further guidance on comparative vibration emission data

The analysis mentioned in 3.4 will make it possible to determine the vibration-control performance. This is the performance determined by the vibration emission values of all machines in a given set. The procedure for developing comparative emission data is described (with respect to noise, but applicable to vibration) in EN ISO 11689.

The vibration-control performance can be expressed by single numbers or regression lines, representing vibration emission values as a function of some other quantity (typically the power of the machine). The data on which they are based should ideally be provided by more than one laboratory. These are not limit values, with which all machinery in a given family or group shall comply, but are intended to be used as reference values against which the vibration emission of a machine can be assessed. The vibration-control performance should not prevent the achievement of lower vibration emission.

The vibration-control performance, as described above, may be based on data collected and analysed by the relevant type-C standard Technical Committee or another relevant competent body. In either case the relevant type-C standard Technical Committee should take responsibility for their assessment and implementation. It should be realistic and based on what is possible, account being taken of the progress achieved with respect to vibration control measures and their implementation. A vibration-control performance should be set with vibration emission values low enough that encouragement is given to reduce vibration further in most machinery of a given family on the market. The vibration-control performance should be reviewed regularly to consider if it needs to be adjusted to take account of the technical progress.

NOTE A vibration-control performance as described above is one possible way to represent the achievable vibration emission values, and is already used by some type-C standard Technical Committees.

The absence of vibration test codes and vibration-control performance values should not inhibit vibration reduction measures as defined in 3.3.

Annex B
(informative)

Content of Directive 2006/42/EC relevant to vibration

Row	**Essential requirement** (Clause in Annex I of Directive 2006/42/EC)	**Summary of content**
1	General principles of safety integration *1.1.2 (various subsections)*	The manufacturer or supplier shall: — eliminate or reduce risks to health and safety, so far as is possible (inherently safe machinery design and construction); — take the necessary measures in relation to risks that cannot be eliminated; and — inform users of residual risks.
2	Design and construction for minimum vibration risk *1.5.9 (also parts of 1.1.2)*	Machinery shall be designed and constructed so that risks from vibration are reduced to the lowest level, taking account of technical progress. The level of vibration emission may be assessed with reference to comparative emission data for similar machinery.
3	Seating *1.1.8*	The seat shall be designed and constructed to reduce the vibration transmitted to the operator to the lowest level that is reasonably possible.
4	Warning of residual risks *1.7.2, 1.7.4.2 (l)* *(also parts of 1.1.2)*	Where risks remain, provide warnings. In the instructions, give information about the residual risks that remain after safe design.
5	Instructions for safe use *1.7.4 (also parts of 1.1.2)*	Instructions shall cover: — instructions for use and, if necessary, instructions for training of operators; — warnings about foreseeable misuse; — protective measures to be taken by the user; — tools that may be fitted to the machinery; and — adjustment and maintenance required.
6	Declaration of vibration emission *2.2.1.1 (portable hand-held and hand-guided machinery)* *3.6.3.1 (mobile machinery)* *1.7.4.3 (sales literature)*	For hand-arm vibration, the instructions shall give the vibration total value, if it exceeds 2,5 m/s^2, and the uncertainty – and include the same information in sales literature describing the performance characteristics of machinery. For whole-body vibration, the instructions shall give the highest (axis) r.m.s. weighted acceleration, if it exceeds 0,5 m/s^2, and the uncertainty – and include the same information in sales literature describing the performance characteristics of machinery. Harmonized vibration test standard or the most appropriate measurement code shall be used, and the operating conditions during measurement specified.

Row	**Technical file** (Clause in Annex VII of Directive 2006/42/EC)	**Summary of content**
7	1. (a)	The technical file shall include: — the documentation on risk assessment demonstrating the procedure followed, including — a list of the essential health and safety requirements which apply to the machinery and — the description of the protective measures implemented and the indication of the residual risks; — the standards and other technical specifications used, indicating the essential health and safety requirements covered by these standards; — any technical reports giving the results of the tests carried out. NOTE The requirements of the technical file are not within the scope of this standard.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide one means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

NOTE This standard outlines the requirements for dealing in type-C standards with the hazard arising from vibration. Presumption of conformity with the relevant Essential Requirements is dependent on compliance with a suitable type-C standard developed with the assistance of this guidance.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

CEN Guide 414, *Safety of machinery — Rules for the drafting and presentation of safety standards*

CR 1030-2, *Hand-arm vibration — Guidelines for vibration hazards reduction — Part 2: Management measures at the workplace*

EN 1299, *Mechanical vibration and shock — Vibration isolation of machines — Information for the application of source isolation*

EN 14253, *Mechanical vibration — Measurement and calculation of occupational exposure to whole-body vibration with reference to health — Practical guidance*

CEN/TR 15172-2, *Whole-body vibration — Guidelines for vibration hazards reduction — Part 2: Management measures at the workplace*

EN ISO 5349-2, *Mechanical vibration — Measurement and evaluation of human exposure to hand-transmitted vibration — Part 2: Practical guidance for measurement at the workplace (ISO 5349-2)*

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

ISO 2041, *Mechanical vibration, shock and condition monitoring — Vocabulary*

ISO 5805, *Mechanical vibration and shock — Human exposure — Vocabulary*

ISO/TR 25398, *Earth-moving machinery — Guidelines for assessment of exposure to whole-body vibration of ride-on machines — Use of harmonized data measured by international institutes, organizations and manufacturers*

Directive 2002/44/EC of the European Parliament and of the Council of 25 June 2002 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (vibration)

Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery

Non-binding guide to good practice for implementing Directive 2002/44/EC (Vibrations at Work)
http://ec.europa.eu/social/main.jsp?catId=148&langId=en&pubId=325&type=2&furtherPubs=yes

Guide to application of the Machinery Directive 2006/42/EC
http://ec.europa.eu/enterprise/sectors/mechanical/machinery/

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