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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 (ISO/TR 25398:2006)

Engins de terrassement - Lignes directrices pour l'évaluation de l'exposition des vibrations à l'ensemble du corps sur les machines à conducteur porté - Utilisation des données harmonisées mesurées par des instituts internationaux, des organisations et des fabricants (ISO/TR 25398:2006)

Mechanische Schwingungen - Anleitung zur Beurteilung der Belastung durch Ganzkörpervibrationen auf Erdbaumaschinen mit aufsitzendem Maschinenführer - Unter der Verwendung hamonisierter Daten gemessen von internationalen Instituten und Herstellern (ISO/TR 25398:2006)

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Foreword

The text of ISO/TR 25398:2006 has been prepared by Technical Committee ISO/TC 127 “Earth-moving machinery” of the International Organization for Standardization (ISO) and has been taken over as CEN/TS 15730:2008 by Technical Committee CEN/TC 151 “Construction equipment and building material machines - Safety” the secretariat of which is held by DIN.

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The text of ISO/TR 25398:2006 has been approved by CEN as a CEN/TS 15730:2008 without any modification.

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TECHNICAL REPORT

ISO/TR 25398

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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

Engins de terrassement — Lignes directrices pour l'évaluation de l'exposition des vibrations à l'ensemble du corps sur les machines à conducteur porté — Utilisation des données harmonisées mesurées par des instituts internationaux, des organisations et des fabricants

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, 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), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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ISO/TR 25398 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety requirements and human factors*.

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Introduction

This Technical Report provides information on how to assess the whole-body vibration exposure of operators of earth-moving machines. The method is based on measured vibration emission under real working conditions. It needs to be noted that vibration emissions are influenced by many different parameters, originating from

— operator (e.g. training, behaviour, mode, stress),

— jobsite (e.g. organization, preparation, environment, weather, material), and

— machine (e.g. type, quality of seat and suspension system, attachment, equipment, condition).

It is therefore not possible to obtain precise exposure figures. The values given in this Technical Report need to be used with great care since they were measured for a limited number of operators, defined work situations, and machine types.

On the one hand, the actual work situation for a specific machine operator can be very different, thus creating different vibration. On the other hand, values from real work that can be found in the literature are only correct for the specific work situation and time when they were measured. The user of this Technical Report needs to be aware that the exposure to vibration depends not only on the machine used but also to a large extent on the operator, jobsite and machine, and other factors. All these factors need to be taken into account in order to make a practical assessment of vibration magnitude.

There are typical operating conditions for machine types in accordance to ISO 6165 identified and listed in Annex A. This list may not be complete, but it represents most of the real working conditions.

Properly adjusting and maintaining machines, operating machines smoothly, and maintaining the terrain conditions can reduce whole-body vibrations. The guidelines given in Annex E can help users of earth-moving machines reduce the whole-body vibration levels.

The daily vibration exposure to be assessed depends on both the magnitude of vibration at the surface in contact with the whole body and the total daily duration for which an employee is in contact with that vibration.

The vibration levels for the same type of machine are assumed to be the same. If a vibration-reduction feature is added to the machine, then a lower vibration level can be used. In order to determine the reduction in vibration levels for a machine vibration-reduction feature, the appropriate vibration measurements must be made. Annex F provides guidelines for vibration measurements.

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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

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1 Scope

This Technical Report provides guidelines for those such as employers, national authorities and manufacturers of earth-moving machinery who are required to determine, assess and document the daily whole-body vibration exposure for ride-on machines as defined in ISO 6165. It also provides guidelines for reducing vibration levels on machines and for determining the vibration reduction from machine improvements to reduce vibration levels. It is intended to assist in establishing documentation for specific earth-moving machinery under typical operating conditions.

It gives guidance on determining the daily vibration exposure A(8), in accordance with ISO 2631 and EN 14253, offering a simple method for determining the daily vibration exposure by means of a table which indicates the daily exposure as a function of the equivalent vibration total value and the associated exposure duration. Both methods can be used even in cases of multiple exposures on the same day.

Methods are provided for calculating exposure using reported emission values, valid for machines equipped with a seat in accordance to ISO 7096.

NOTE Additional information is given in the EN 474 and EN 500 series of standards.

Workplace measurements are required where suitable data are unavailable to represent the vibration under the specific working conditions, or if the calculation results are not useful for determining whether or not the vibration exposure limit value or exposure action value is likely to be exceeded.

It is important that the vibration values used in the exposure assessment are representative of those in the specific use of the machines.

This Technical Report does not deal with assessments of exposure to shock.

NOTE The guidelines for determining, assessing and documenting the daily vibration exposure from use of ride-on operated earth-moving machinery also cover the requirements of the European Physical Agents Directive (Vibration) 2002/44/EC.

2 Normative references

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

ISO 2631-1:1997, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1: General requirements*

ISO 6165: 2001, *Earth-moving machinery — Basic types — Vocabulary*

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ISO 7096:2000, *Earth-moving machinery —- Laboratory evaluation of operator seat vibration*

EN 14253:2003, *Mechanical vibration — Measurement and calculation of occupational exposure to whole-body vibration with reference to health — Practical guidance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2631 and ISO 6165 and the following apply.

3.1
operating time
ride-on time
daily duration of the operating time on the earth-moving machinery

NOTE It includes the interruptions required by the operating conditions and the break periods directly related to use.

3.2
exposure duration
T
total duration during which the whole body is in direct contact with the vibrating surface (seat) and exposed to relevant vibration

NOTE It is often confused with the operating time when determining the daily exposure duration, T. For example, the operating time on a wheel loader in a quarry is estimated by the operator at 7,5 h per day. However, the exposure duration is 5 h loading dumper (e.g. waiting for dumpers) and 1 h mining application (e.g. waiting for detonation), which yields T = 6,0 h.

3.3
equivalent vibration value
$a_{w,eq}$
maximum of the time-averaged totals of the vibration values of the various machines and their typical operating conditions, $a_{wi,x,y,z}$, during their associated exposure durations, T_i

NOTE 1 It is the maximum of $a_{w,eqx}$, $a_{w,eqy}$ or $a_{w,eqz}$, calculated using Equation (1):

$$a_{w,eqx} = \sqrt{\frac{1}{T}\sum_{i=1}^{n}(a_{wxi})^2 \cdot T_i}$$

$$a_{w,eqy} = \sqrt{\frac{1}{T}\sum_{i=1}^{n}(a_{wyi})^2 \cdot T_i} \qquad (1)$$

$$a_{w,eqz} = \sqrt{\frac{1}{T}\sum_{i=1}^{n}(a_{wzi})^2 \cdot T_i}$$

where n is the number of partial equivalent vibration values considered.

NOTE 2 Vibration values for the x and y directions are multiplied by a factor of 1,4, and this is included in the data in Annex B. If data are used from another source, care needs to be taken to ensure that the factor is included there also.

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