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Earth-moving machinery — Laboratory evaluation of operator seat vibration



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Preface

This Standard was prepared by the Standards Australia Committee ME-063, Earthmoving Equipment.

The objective of this document is to specify, in accordance with ISO 10326-1:2016, a laboratory method for measuring and evaluating the effectiveness of the seat suspension in reducing the vertical whole-body vibration transmitted to the operator of earth-moving machines at frequencies between 1 Hz and 20 Hz. It also specifies acceptance criteria for application to seats on different machines.

This document applies to operator seats used on earth-moving machines as defined in ISO 6165.

The tests and criteria defined in this document are intended for operator seats used in earth-moving machines of conventional design.

Vibration which reaches the operator other than through the seat, for example that sensed by the operator's feet on the platform or control pedals or by the operator's hands on the steering-wheel, is not covered.

This document defines the input spectral classes required for the following earth-moving machines. Each class defines a group of machines having similar vibration characteristics:

(a) rigid-frame dumpers > 4 500 kg operating mass;

(b) articulated-frame dumpers;

(c) scrapers without axle or frame suspension[1];

(d) wheeled loaders > 4 500 kg operating mass;

(e) graders;

(f) wheeled dozers;

(g) soil compactors;

(h) backhoe loaders;

(i) crawler dumpers;

(j) crawler loaders;

(k) crawler-dozers ≤ 50 000 kg operating mass[2];

(l) compact dumpers ≤ 4 500 kg operating mass;

(m) wheeled compact loaders ≤ 4 500 kg operating mass; and

(n) skid-steer loaders, wheeled ≤ 4 500 kg and tracked ≤ 6 000 kg operating mass.

The following machines impart sufficiently low vertical vibration inputs at frequencies between 1 Hz and 20 Hz to the seat during operation that these seats do not require suspension for the attenuation of transmitted vibration:

(i) excavators, including walking excavators and cable excavators[3];

(ii) trenchers;

(iii) landfill compactors;

(iv) non-vibratory rollers, except soil compactors;

(v) vibratory rollers, except soil compactors;

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(vi) pipelayers; and

(vii) horizontal directional drills (HDD).

This document is identical with, and has been reproduced from, ISO 7096:2020, *Earth-moving machinery — Laboratory evaluation of operator seat vibration*.

As this document has been reproduced from an International Standard, a full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

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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 procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety, ergonomics and general requirements*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 151, *Construction equipment and building material machines - Safety*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 7096:2000), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Clause 1, horizontal direction drills added to the list of machines with low vertical vibration inputs;

— crawler dumpers added to Table 4 and aligned with Figure 7;

— whole document, update of normative references;

— skid steer loaders with tracks have been added;

— 5.4, reference to the posture of the test person added and total mass of heavy person updated;

— 5.5.2, informative note for bag filling;

— 5.5.3, damping test for active and semi-active suspension systems added;

— Table 2, Power Spectral Density of class EM 1 and EM 3 modified;

— Table 3, Filter cut-off frequencies of class EM 1 modified;

— Table 4, Characteristics of the simulated input vibration modified for the following machine types:

  — Articulated or rigid frame dumper >4 500 kg;

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— Wheel loader >4 500 kg.

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Introduction

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

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organisations, market surveillance etc.)

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people with special needs);

— service providers, e. g. for maintenance (small, medium and large enterprises);

— consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

The operators of earth-moving machinery are often exposed to a low frequency vibration environment partly caused by the movement of the machines over uneven ground and the tasks carried out. The seat constitutes the last stage of suspension before the operator. To be efficient at attenuating the vibration, the suspension seat should be chosen according to the dynamic characteristics of the machine. The design of the seat and its suspension are a compromise between the requirements of reducing the effect of vibration and shock on the operator and providing him with stable support so that he can control the machine effectively.

Thus, seat vibration attenuation is a compromise of a number of factors and the selection of seat vibration parameters needs to be taken in context with the other requirements for the seat.

The performance criteria provided in this document have been set in accordance with what is attainable using what is at present the best design practice. They do not necessarily ensure the complete protection of the operator against the effects of vibration and shock. They could be revised in the light of future developments and improvements in suspension design.

The test inputs included in this document are based on a very large number of measurements taken in situ on earth-moving machinery used under severe but typical operating conditions. The test methods are based on ISO 10326-1:2016, which is a general method applicable to seats for different types of machines.

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NOTES

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Earth-moving machinery — Laboratory evaluation of operator seat vibration

1 Scope

1.1 This document specifies, in accordance with ISO 10326-1:2016, a laboratory method for measuring and evaluating the effectiveness of the seat suspension in reducing the vertical whole-body vibration transmitted to the operator of earth-moving machines at frequencies between 1 Hz and 20 Hz. It also specifies acceptance criteria for application to seats on different machines.

1.2 This document is applicable to operator seats used on earth-moving machines as defined in ISO 6165.

1.3 This document defines the input spectral classes required for the following earth-moving machines. Each class defines a group of machines having similar vibration characteristics:

— rigid-frame dumpers >4 500 kg operating mass;

— articulated-frame dumpers;

— scrapers without axle or frame suspension[1)];

— wheeled loaders >4 500 kg operating mass;

— graders;

— wheeled dozers;

— soil compactors;

— backhoe loaders;

— crawler dumpers;

— crawler loaders;

— crawler-dozers ≤50 000 kg operating mass[2)];

— compact dumpers ≤4 500 kg operating mass;

— wheeled compact loaders ≤4 500 kg operating mass;

— skid-steer loaders, wheeled ≤4 500 kg and tracked ≤6 000 kg operating mass.

1.4 The following machines impart sufficiently low vertical vibration inputs at frequencies between 1 Hz and 20 Hz to the seat during operation that these seats do not require suspension for the attenuation of transmitted vibration:

— excavators, including walking excavators and cable excavators[3)];

— trenchers;

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1) For scrapers with suspension, either a seat with no suspension can be used, or one having a suspension with high damping.

2) For crawler dozers greater than 50 000 kg, the seat performance requirements are suitably provided by a cushion type seat.

3) For excavators, the predominant vibration is generally in the fore and aft (X) axis.

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