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Earth-moving machinery — Laboratory evaluation of operator seat vibration

*Engins de terrassement — Évaluation en laboratoire des vibrations
transmises à l'opérateur par le siège*



Reference number
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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 3.

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.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 7096 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety requirements and human factors*.

This third edition cancels and replaces the second edition (ISO 7096:1994), which has been technically revised.

Introduction

The operators of earth-moving machinery are often exposed to a low frequency vibration environment partly caused by the movement of the vehicles over uneven ground and the tasks carried out. The seat constitutes the last stage of suspension before the driver. To be efficient at attenuating the vibration, the suspension seat should be chosen according to the dynamic characteristics of the vehicle. 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 International Standard 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 may be revised in the light of future developments and improvements in suspension design.

The test inputs included in this International Standard 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, which is a general method applicable to seats for different types of vehicles.

Earth-moving machinery — Laboratory evaluation of operator seat vibration

1 Scope

1.1 This International Standard specifies, in accordance with ISO 10326-1, 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 International Standard is applicable to operator seats used on earth-moving machines as defined in ISO 6165.

1.3 This International Standard 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 mass¹⁾
- articulated frame dumpers
- scrapers without axle or frame suspension²⁾
- wheel-loaders > 4 500 kg operating mass¹⁾
- graders
- wheel-dozers
- soil compactors (wheel type)
- backhoe-loaders
- crawler loaders
- crawler-dozers $\leq$ 50 000 kg operating mass^{1), 3)}
- compact dumpers $\leq$ 4 500 kg operating mass¹⁾
- compact loaders $\leq$ 4 500 kg operating mass¹⁾
- skid-steer loaders $\leq$ 4 500 kg operating mass¹⁾

1) See ISO 6016.

2) For tractor scrapers with suspension, either a seat with no suspension may be used, or one having a suspension with high damping.

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

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 excavators⁴⁾
- trenchers
- landfill compactors
- non-vibratory rollers
- milling machines
- pipelayers
- finishers
- vibratory rollers

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

NOTE Other tests may be appropriate for machines with design features that result in significantly different vibration characteristics.

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

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 2041:1990, *Vibration and shock — Vocabulary*.

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

ISO 6016:1998, *Earth-moving machinery — Methods of measuring the masses of whole machines, their equipment and components*.

ISO 6165:1997, *Earth-moving machinery — Basic types — Vocabulary*.

ISO 8041:1990, *Human response to vibration — Measuring instrumentation*.

ISO 10326-1:1992, *Mechanical vibration — Laboratory method for evaluating vehicle seat vibration — Part 1: Basic requirements*.

ISO 13090-1:1998, *Mechanical vibration and shock — Guidance on safety aspects of tests and experiments with people — Part 1: Exposure to whole-body mechanical vibration and repeated shock*.

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