

MULLATÖÖMASINAD. OPERAATORI ISTME
VIBRATSIOONI LABORATOORNE HINDAMINE

Earth-moving machinery - Laboratory evaluation of
operator seat vibration (ISO 7096:2020)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN ISO 7096:2020 sisaldab Euroopa standardi EN ISO 7096:2020 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 7096:2020 consists of the English text of the European standard EN ISO 7096:2020.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 11.03.2020.	Date of Availability of the European standard is 11.03.2020.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 13.160, 53.100

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

English Version

Earth-moving machinery - Laboratory evaluation of operator seat vibration (ISO 7096:2020)

Engins de terrassement - Évaluation en laboratoire des
vibrations transmises à l'opérateur par le siège (ISO
7096:2020)

Erdbaumaschinen - Laborverfahren zur Bewertung der
Schwingungen des Maschinenführersitzes (ISO
7096:2020)

This European Standard was approved by CEN on 13 February 2020.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

This document (EN ISO 7096:2020) has been prepared by Technical Committee ISO/TC 127 "Earth-moving machinery" in collaboration with Technical Committee CEN/TC 151 "Construction equipment and building material machines - Safety" 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 September 2020, and conflicting national standards shall be withdrawn at the latest by September 2020.

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

This document supersedes EN ISO 7096:2008.

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

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

Endorsement notice

The text of ISO 7096:2020 has been approved by CEN as EN ISO 7096:2020 without any modification.

Annex ZA (informative)

Relationship between this European Standard and the essential requirements of Directive 2006/42/EC aimed to be covered

This European Standard has been prepared under a Commission's standardization request "M/396 Mandate to CEN and CENELEC for Standardisation in the field of machinery" to provide one voluntary means of conforming to essential requirements of Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast).

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Annex I of Directive 2006/42/EC

The relevant Essential Requirements of Directive 2006/42/EC	Clause(s)/sub-clause(s) of this EN	Remarks/Notes
1.1.8 Seating, 4 th para, first sentence	All normative clauses	

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

Contents

Page

Foreword	iv
Introduction	vi
1 Scope	1
2 Normative references	2
3 Terms, definitions, symbols and abbreviated terms	2
3.1 Terms and definitions	2
3.2 Symbols and abbreviated terms	3
4 General	4
5 Test conditions and test procedure	4
5.1 General	4
5.2 Simulation of vibration	5
5.3 Test seat	5
5.3.1 General	5
5.3.2 Run-in	5
5.3.3 Seat adjustment	5
5.4 Test person and posture	5
5.5 Input vibration	6
5.5.1 Simulated input vibration test to evaluate the SEAT factor	6
5.5.2 Damping test	6
5.5.3 Damping test for active and semi-active suspension systems	7
5.6 Tolerances on input vibration	7
5.6.1 General	7
5.6.2 Distribution function	7
5.6.3 Power spectral density and rms values	7
6 Acceptance values	8
6.1 SEAT factor	8
6.2 Damping performance	8
7 Seat identification	9
8 Information for use	9
8.1 General	9
8.2 Test report	9
Bibliography	23

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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;
 - Wheel loader >4 500 kg.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This document is a preview generated by EVS

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.

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 suspension¹⁾;
- wheeled loaders >4 500 kg operating mass;
- graders;
- wheeled dozers;
- soil compactors;
- backhoe loaders;
- crawler dumpers;
- crawler loaders;
- crawler-dozers ≤50 000 kg operating mass²⁾;
- 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 excavators³⁾;

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.