

**Tööstuslike mootorkärude ohutus. Vibratsiooni  
mõõtmise katsemeetodid KONSOLIDEERITUD  
TEKST**

Safety of industrial trucks - Test methods for measuring  
vibration CONSOLIDATED TEXT

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN 13059:2002+A1:2008 sisaldab Euroopa standardi EN 13059:2002+A1:2008 ingliskeelset teksti.</p> <p>Standard on kinnitatud Eesti Standardikeskuse 18.08.2008 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.</p> <p>Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 23.07.2008.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN 13059:2002+A1:2008 consists of the English text of the European standard EN 13059:2002+A1:2008.</p> <p>This standard is ratified with the order of Estonian Centre for Standardisation dated 18.08.2008 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.</p> <p>Date of Availability of the European standard text 23.07.2008.</p> <p>The standard is available from Estonian standardisation organisation.</p>
--	---

ICS 13.160, 53.060

**Võtmesõnad:** human body, industrial truck, occupational safety, pallet trucks, safety, safety requirements, specification (approval), specifications, whole body vibrations, vibration, vibration effects (human body), vibration measurement, vibration meters, workplace safety

### Standardite reprodutseerimis- ja levitamisoigus kuulub Eesti Standardikeskusele

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

Kui Teil on küsimusi standardite autorikaitse kohta, palun võtke ühendust Eesti Standardikeskusega:  
Aru 10 Tallinn 10317 Eesti; [www.evs.ee](http://www.evs.ee); Telefon: 605 5050; E-post: [info@evs.ee](mailto:info@evs.ee)

ICS 13.160; 53.060

English Version

## Safety of industrial trucks - Test methods for measuring vibration

Sécurité des chariots de manutention - Méthodes d'essai  
pour mesurer les vibrations

Sicherheit von Flurförderzeuge - Schwingungsmessung

This European Standard was approved by CEN on 15 June 2008.

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 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 Management Centre has the same status as the official versions.

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







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

Management Centre: rue de Stassart, 36 B-1050 Brussels

## Contents

	page
Foreword .....	4
Introduction .....	6
1 Scope .....	7
2 Normative references .....	7
3 Terms and definitions .....	7
4 Quantities to be measured .....	8
5 Instrumentation .....	9
5.1 Whole-body vibration .....	9
5.1.1 General .....	9
5.1.2 Transducers .....	9
5.1.3 Frequency weighting .....	9
5.1.4 Integration time .....	9
5.2 Truck speed .....	9
6 Vibration measurement direction and location .....	9
6.1 Measurement direction .....	9
6.2 Measurement location .....	9
7 Set up and equipment .....	10
7.1 General .....	10
7.2 Test track .....	10
7.3 Equipment and condition of the truck .....	10
7.3.1 Truck .....	10
7.3.2 Load .....	11
7.3.3 Tyres .....	11
7.3.4 Trucks with a cab .....	11
7.3.5 Trucks with seated operators .....	11
7.4 Operators .....	11
7.4.1 Standing operator .....	11
7.4.2 Seated operator .....	11
7.5 Environmental parameter .....	12
8 Measurement procedure and validity .....	12
8.1 Speed .....	12
8.2 Test procedure .....	12
8.3 Validity of test .....	12
8.4 Coefficient of variation .....	13
8.5 Reported vibration values .....	13
8.5.1 Trucks with standing operator .....	13
8.5.2 Trucks with seated operator .....	13
8.5.3 Trucks with standing and seated operator .....	13
9 Items to be included in a test report .....	14
10 Declaration of vibration emission values .....	14
11 Verification of vibration emission values .....	15
Annex A (informative) Guidance for testing "all terrain" trucks - Category 6 .....	18
Annex B (informative) Guidance for reporting vibration data .....	20

<b>B.1</b>	<b>Truck with standing operator .....</b>	<b>20</b>
<b>B.2</b>	<b>Truck with seated operator .....</b>	<b>20</b>
<b>B.2.1</b>	<b>The seat has passed the seat test code .....</b>	<b>20</b>
<b>B.2.2</b>	<b>The seat has not passed the seat test code.....</b>	<b>21</b>
<b>B.3</b>	<b>Truck with standing and seated operator.....</b>	<b>21</b>
<b>Annex C</b>	<b>(informative) Procedure for developing a measurement method for a specific category of industrial truck.....</b>	<b>22</b>
<b>Annex D</b>	<b>(informative) Reference of ETRTO publication .....</b>	<b>23</b>
<b>Annex ZA</b>	<b>(informative)  Relationship between this European Standard and the Essential Requirements of EU Directive 98/37/EC  .....</b>	<b>24</b>
<b>Annex ZB</b>	<b>(informative)  Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC  .....</b>	<b>25</b>
<b>Bibliography</b>	<b>.....</b>	<b>26</b>

## Foreword

This document (EN 13059:2002+A1:2008) has been prepared by Technical Committee CEN/TC 150 "Industrial trucks - Safety", the secretariat of which is held by BSI.

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 January 2009, and conflicting national standards shall be withdrawn at the latest by January 2009.

This document includes Amendment 1, approved by CEN on 2008-06-15.

This document supersedes EN 13059:2002.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

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 EC Directives.

A1 For relationship with EC Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. A1

This European Standard is one of a series of European Standards for the safety of industrial trucks.

EN 1175-1, *Safety of industrial trucks — Electrical requirements - Part 1: General requirements for battery powered trucks*

EN 1175-2, *Safety of industrial trucks — Electrical requirements - Part 2: General requirements of internal combustion engines*

EN 1175-3, *Safety of industrial trucks — Electrical requirements - Part 3: Specific requirements for the electric power transmission systems of internal combustion engine powered trucks*

EN 1459, *Safety of industrial trucks — Self-propelled variable reach trucks*

EN 1525, *Safety of industrial trucks — Driverless trucks and their systems*

EN 1526, *Safety of industrial trucks — Additional requirements for automated functions on trucks*

EN 1551, *Safety of industrial trucks — Self propelled trucks over 10 000 kg capacity*

EN 1726-1, *Safety of industrial trucks — Self propelled trucks up to and including 10000 kg capacity and industrial tractors with a drawbar pull up to and including 20000 N - Part 1: General requirements*

EN 1726-2, *Safety of industrial trucks — Self propelled trucks up to and including 10000 kg capacity and industrial tractors with a drawbar pull up to and including 20000 N - Part 2: Additional requirements for trucks with elevating operator position and trucks specifically designed to travel with elevated loads*

EN 1755, *Safety of industrial trucks — Operation in potentially explosive atmospheres – Use in flammable gas, vapour, mist and dust*

EN 1757-1, *Safety of industrial trucks — Pedestrian propelled trucks - Part 1: Stacker trucks*

EN 1757-2, *Safety of industrial trucks — Pedestrian propelled trucks - Part 2: Pallet trucks*

EN 1757-3, *Safety of industrial trucks — Pedestrian propelled trucks - Part 3: Platform trucks*

EN 1757-4, *Safety of industrial trucks — Pedestrian propelled trucks - Part 4: Scissor lift pallet trucks*

EN 12053, *Safety of industrial trucks — Test methods for measuring noise emissions*

EN 12895, *Industrial trucks — Electromagnetic compatibility*

EN 13059, *Safety of industrial trucks — Test methods for measuring vibration*

EN ISO 13564<sup>1)</sup>, *Safety of industrial trucks — Test method for measuring visibility from self propelled trucks (ISO/DIS 13564:1996)*

The Machinery Directive 98/37/EC amended by Directive 98/79/EC requires that vibration measurements be made and values put into the instruction books if the whole-body vibration values are greater than 0,5 m/s<sup>2</sup>.

A type test procedure is specified so that different establishments obtain comparable results of vibration measurements within specified limits. The specified procedure consists of measuring the vibration transmitted to the operator when the truck is travelling over a test track made of a straight length of good quality surface with obstacles whose characteristics depend on the type of truck and its wheel characteristics.

The annexes A, B, C and D are informative.

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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

---

<sup>1</sup> Under preparation, using the Vienna agreement with ISO lead.

## Introduction

This European Standard has been prepared to be a harmonized standard to provide one means of conforming to the essential safety requirements of the Machinery Directive and associated EFTA regulations. This European Standard is a type C standard as stated in EN 1070.

The aim of this standard is to provide a method for the measurement of vibration emission transmitted to the whole body of operators of industrial trucks which will enable the information requirements of the Machinery Directive to be satisfied. It is intended that the results obtained also can be used to compare industrial trucks of the same category or a given truck when equipped with different seats or tyres, etc. This standard cannot be used for field measurements to determine the daily exposure of the operator to vibration.

For the measurements trucks shall be fitted with equipment corresponding to that offered by the manufacturers on the standard truck data sheet (lifting devices, batteries, etc.).

Type test measurements require accurate and reproducible results. It is essential that different establishments obtain comparable results within specified limits. This requires that the process or way in which the machinery is used during the measurement is precisely defined. This process will reproduce the whole-body vibration values typical of the machinery when in normal travelling use.

In the case of industrial trucks, there may be three predominant operating modes: travelling, lifting and engine idling; of these, only travelling exposes the driver to significant whole-body vibration. Therefore, in accordance with EN 1032, the test for whole-body vibration is based on the travelling operating mode.

Research has shown that the magnitude of hand-arm vibration on the steering wheel or control levers of trucks will normally be lower than  $2,5 \text{ m/s}^2$ . Therefore no test method has been developed for its measurement.

In practice, exposure over a working day is a mixture of the three modes and the average vibration values will generally be lower than the values given by this standard. Fitting the industrial trucks with different seats, changing the tyres, etc. can lead to different vibration values. Due to the specific operation of industrial trucks however, the existing EN 1032 standard cannot be applied directly, so that preparation of this standard for industrial trucks became necessary.

Although studies showed that it is possible to obtain repeatable and representative results with all-terrain trucks tested on an artificial test track, this family of trucks is covered by Informative annex A. The reason is that an inexplicable difference of about 20 % was found in the emission from one truck when it was tested at two different times of the year. Further consideration should be given to including all-terrain trucks in the normative section of the standard when more data is available for these trucks.

For the verification of the measurements the uncertainty is fixed at 0,3 times the vibration emission value reported in accordance with EN 12096. Further consideration should be given to revise this range of uncertainty when emission vibration data obtained from different places is available.



## 1 Scope

This European Standard is a type test procedure for establishing the values of vibration emission transmitted to the whole body of operators of industrial trucks under specified conditions. It is not applicable to hand-arm vibration.

This standard is applicable to powered industrial trucks listed in ISO 5053:1987. The annex A is applicable for "all-terrain" trucks. It also applies to other powered industrial trucks not covered by ISO 5053:1987, e.g. variable-reach trucks and "low-lift" "order picking" trucks, etc.

NOTE The standard may however be useful also for existing trucks.

This standard is not applicable to non-stacking "low-lift" straddle carriers (as specified in 3.1.3.2.3 of ISO 5053:1987) and stacking "high-lift" straddle carriers (as specified in 3.1.3.1.11 of ISO 5053:1987).

The test results, however, are not applicable to the determination of whole-body vibration exposure.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 292-1, *Safety of machinery – Basic concepts, general principles for design - Part 1: Basic terminology, methodology.*

EN 292-2, *Safety of machinery – Basic concepts, general principles for design - Part 2: Technical principals and specifications.*

EN 1032:1996, *Mechanical vibration — Testing of mobile machinery in order to determine the whole-body vibration emission value — General.*

EN 1070, *Safety of machinery – Terminology.*

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

ISO 2041, *Vibration and shock — Vocabulary.*

ISO 5053:1987, *Powered industrial trucks — Terminology.*

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

## 3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1070, ISO 2041, ISO 5053 and ISO 5805, and the following apply.

### 3.1

#### **truck family**

trucks sharing the same major components that influence vibration emission