



SLOVENSKI STANDARD

SIST EN 13059:2003

01-maj-2003

Varnost vozil za talni transport - Preskusne metode za merjenje vibracij

Safety of industrial trucks - Test methods for measuring vibration

Sicherheit von Flurförderzeugen - Verfahren zur Schwingungsmessung

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

iTeh STANDARD PREVIEW

(standards.iteh.ai)

Ta slovenski standard je istoveten z: **EN 13059:2002**

SIST EN 13059:2003
<https://standards.iteh.ai/catalog/standards/sist/60ded152-9d0f-41c2-b77e-e2ddb8973c83/sist-en-13059-2003>

ICS:

13.160	Vpliv vibracij in udarcev na ljudi	Vibration and shock with respect to human beings
53.060	Industrijski tovornjaki	Industrial trucks

SIST EN 13059:2003

en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 13059:2003

<https://standards.iteh.ai/catalog/standards/sist/66ded152-9d0f-41c2-b77e-e2ddb8973c83/sist-en-13059-2003>

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 Flurförderzeugen - Verfahren zur
Schwingungsmessung

This European Standard was approved by CEN on 30 December 2001.

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 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 13059:2003

<https://standards.iteh.ai/catalog/standards/sist/66ded152-9d0f-41c2-b77e-e2ddb8973c83/sist-en-13059-2003>



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.1	Truck with standing operator	20
B.2	Truck with seated operator	20
B.2.1	The seat has passed the seat test code	20
B.2.2	The seat has not passed the seat test code	21
B.3	Truck with standing and seated operator	21
Annex C (informative)	Procedure for developing a measurement method for a specific category of industrial truck	22
Annex D (informative)	Reference of ETRTO publication	23
Annex ZA (informative)	Relationship of this document with EC Directives	24
Bibliography	25

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 13059:2003](https://standards.iteh.ai/catalog/standards/sist/66ded152-9d0f-41c2-b77e-e2ddb8973c83/sist-en-13059-2003)

<https://standards.iteh.ai/catalog/standards/sist/66ded152-9d0f-41c2-b77e-e2ddb8973c83/sist-en-13059-2003>

Foreword

This document has been prepared by Technical Committee CEN/TC 150 "Industrial trucks", 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 October 2002, and conflicting national standards shall be withdrawn at the latest by October 2002.

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.

For the relationship with EC Directives, see annex ZA, which is an integral part of this document.

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 13564¹⁾, *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/s².

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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 13059:2003](https://standards.iteh.ai/catalog/standards/sist/66ded152-9d0f-41c2-b77e-e2ddb8973c83/sist-en-13059-2003)

<https://standards.iteh.ai/catalog/standards/sist/66ded152-9d0f-41c2-b77e-e2ddb8973c83/sist-en-13059-2003>

¹ 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.

[SIST EN 13059:2003](#)

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 m/s². 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.* [SIST EN 13059:2003](https://standards.iteh.ai/catalog/standards/sist/66ded152-9d0f-41c2-b77e-85c5c1e01181/en-292-1-2010)

EN 292-2, *Safety of machinery – Basic concepts, general principles for design - Part 2: Technical principals and specifications.* <https://standards.iteh.ai/catalog/standards/sist/66ded152-9d0f-41c2-b77e-85c5c1e01181/en-292-2-2010>

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

3.2

wheel diameter

arithmetic mean of the outside diameters of the load bearing wheels, e.g. : if the truck has some wheel(s) of diameter D_1 , some wheel(s) of diameter D_2 and some wheel(s) of diameter D_3 , the wheel mean diameter equals $(D_1 + D_2 + D_3)/(\text{number of tyre sizes fitted})$

The outside diameter, D , is the maximum in service diameter quoted in the ETRTO manual (see annex D) for the size(s) and type(s) of tyres fitted. If a tyre is not listed, consult the tyre's manufacturer.

3.3

tyre

the tyre can be pneumatic or solid. Amongst the solid tyres a distinction can be made between high-load "non-rubber" solid tyres (Vulkollan, Contilan, etc.) and rubber solid tyres

Rubber solid tyres can be fitted to a cylindrical or conical base (e.g. cushion "bandages") or to a pneumatic tyre rim (e.g. super elastic tyres).

3.4

seat base

surface on which the seat and its suspension, if fitted, are mounted

3.5

seat pan

seat surface on which the operator is seated

iteh STANDARD PREVIEW
(standards.iteh.ai)

4 Quantities to be measured

The quantities to be measured are as follows: [SIST EN 13059:2003](https://standards.iteh.ai/catalog/standards/sist/66ded152-9d0f-41c2-b77e-31d18973e916/iso-13059-2002)

[https://standards.iteh.ai/catalog/standards/sist/66ded152-9d0f-41c2-b77e-](https://standards.iteh.ai/catalog/standards/sist/66ded152-9d0f-41c2-b77e-31d18973e916/iso-13059-2002)

4.1 $a_{w,z}$: root mean square (r.m.s.) acceleration of whole-body vertical frequency-weighted vibration in accordance with EN 1032;

4.2 $\bar{a}_{w,zF}$: mean value of N r.m.s. weighted vertical acceleration values of a valid test series measured on the floor of the driving position with one standing operator;

4.3 $\bar{a}_{w,zS}$: average of acceleration mean values obtained for each of the two operators for a valid test series measured on the seat pan under the seated operator;

4.4 the mean truck speed when travelling on the test track. This may be determined from the time taken to drive along the test track or by means of the measuring instruments specified in 5.2;

4.5 pneumatic tyre pressures shall be checked;

4.6 ambient air temperature.

5 Instrumentation

5.1 Whole-body vibration

5.1.1 General

The specifications for the instrumentation given in EN 1032:1996, 5.1, for the measurement of whole-body vibration apply.

5.1.2 Transducers

General requirements for mounting of vibration transducers are given in EN 1032:1996, 5.2. In the case where the measurements are made on a seat pan the transducer shall be mounted in a semi rigid disc as described in EN 1032:1996, 5.2.

In the case where the measurements are made at the seat base or on the floor the transducer shall be firmly fixed to rigid parts of trucks e.g. by means of a magnet, or adhesive, etc.

NOTE In the case of stand on trucks, it is convenient to mount the transducer on a light rigid plate upon which the operator can place both feet.

5.1.3 Frequency weighting

Frequency weighting and band limiting characteristics shall be in accordance with 5.3 of EN 1032:1996.

5.1.4 Integration time

For each run, the r.m.s. acceleration shall be a linearly integrated average over one complete test run (see 8.2).

<https://standards.iteh.ai/catalog/standards/sist/66ded152-9d0f-41c2-b77e-e2ddb8973c83/sist-en-13059-2003>

5.2 Truck speed

The truck speed on the test track shall be measured using instruments measuring the average speed with an accuracy of $\pm 5\%$.

NOTE An alternative method is to measure the time to travel over the full length of the test track. From knowledge of the length of the track and the time taken to travel it, the truck average speed is calculated.

6 Vibration measurement direction and location

6.1 Measurement direction

Measurement shall be made in the vertical (Z) direction.

6.2 Measurement location

In the case where the exposed persons are sitting, the transducer mounted in a semi rigid disc shall be placed on the surface of the seat such that the transducer is located midway between the ischial tuberosities of the seated person. For comfort reasons, it is acceptable if the centre of the disc is located slightly in front (up to 5 cm) of the ischial tuberosities (Figure 1).