SLOVENSKI STANDARD
SIST EN 16929:2019

01-marec-2019

Preskusne metode - Leseni stropi - Ugotavljanje vibracijskih lastnosti

Test methods - Timber floors - Determination of vibration properties

Prüfverfahren - Holzdecken - Bestimmung der Schwingungseigenschaften

Méthodes d’essais - Planchers en bois - Détermination des propriétés vibratoires

Ta slovenski standard je istoveten z: EN 16929:2018

ICS:

91.060.30	Stropi. Tla. Stopnice	Ceilings. Floors. Stairs
91.080.20	Lesene konstrukcije	Timber structures

SIST EN 16929:2019 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16929

December 2018

ICS 91.060.30; 91.080.20

English Version

Test methods - Timber floors - Determination of vibration properties

Méthodes d'essais - Planchers en bois - Détermination des propriétés vibratoires

Prüfverfahren - Holzdecken - Bestimmung der Schwingungseigenschaften

This European Standard was approved by CEN on 9 November 2018.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, 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

Ref. No. EN 16929:2018 E

Contents

Page

European foreword

This document (EN 16929:2018) has been prepared by Technical Committee CEN/TC 124 “Timber structures”, the secretariat of which is held by AFNOR.

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 June 2019 and conflicting national standards shall be withdrawn at the latest by June 2019.

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.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The serviceability requirements of timber floors are becoming more decisive in design because of factors including longer spans, the use of lightweight materials, higher loadings and more demanding performance requirements. Beside deflection requirements for static loads, given in appropriate design codes, the dynamic aspects has to be considered, especially for lightweight and long span timber floors where a pedestrian body mass is quite influential. Human footfall is a significant source of vibration and if its effects are not assessed accurately during the design of a floor structure it may be rendered uncomfortable for occupants.

Vibrations induced by footsteps in floors can annoy occupants or disturb the operation of sensitive equipment and processes, if the vibrations are not properly controlled. Proper controlling relies on a good understanding of the nature of floor vibrations induced by footsteps. The magnitude and type of floor vibrations induced by footsteps from normal walking are mainly controlled by the inherent dynamic properties of the floor: stiffness, mass and its capacity to dissipate vibration energy (damping). These properties are in turn determined by floor materials, design and construction.

When assessing the response of a floor to pedestrian induced vibration, only frequencies below 40 Hz to 50 Hz are of interest. Floors with a fundamental frequency below 8 Hz are labelled as a low-frequency floor and will have to deal with resonance effects caused by walking action. Vibrations with frequencies over 40 Hz to 50 Hz are no longer perceivable by occupants. Several vibration modes below this limit may occur.

The wide range of floor construction types, support and loading conditions, make it impossible to specify simple procedures that work in all circumstances. It is therefore important that the procedures described in this standard are carried out by persons with sufficient competence in structural dynamics, testing procedures and evaluation of results.

1 Scope

This document specifies test methods for the determination of natural frequencies, damping, unit point load deflection and acceleration of floors composed of sawn timber, engineered wood products, and mass timber beams or slabs (e.g. cross laminated timber CLT, glued laminated timber GL, nail laminated timber), with or without concrete screeds, as well as for timber-concrete composite floors.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13183 (all parts), *Moisture content of a piece of sawn timber*

EN 322, *Wood-based panels — Determination of moisture content*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/

- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
acceleration
absolute peak value or root mean square (*rms*) value of the measured rate of change of velocity

Note 1 to entry: The time interval over which the root-mean-square values are calculated should be indicated or implied.

3.2
damping
energy dissipation of a vibrating system

Note 1 to entry: Damping consists of material damping and structural damping as well as damping by furniture, occupancy and floor finishing, e.g. floating topping.

3.3
decking
surface element that contributes to the integrity of the floor system and is connected to the joists or other structural members

Note 1 to entry: The characteristic of the decking is that it is supported by joists and, when subjected to load, free to deflect between the joists.

3.4
floor
specified assembly of structural components, with or without toppings and layers for serviceability requirements

3.5
floor system
specified assembly of structural components, including toppings and layers for serviceability requirements, on defined support conditions

3.6
free drop
impulse on the floor created by releasing a mass providing an impact to the floor which can be monitored

3.7
fundamental frequency
lowest natural frequency f_1

3.8
hammer drop
impulse on the structure with a soft-tipped hammer, instrumented with a force transducer, allowing to the measurement of the response of the floor using an accelerometer

3.9
heel drop
impulse on the structure made by a person raising themselves on the balls of their feet, and suddenly dropping onto their heels, providing an impact to the floor which can be monitored

3.10
internal support beam
beam that acts as a non-rigid support for joists or other load carrying members

Note 1 to entry: A support beam acts as intermediate support or as end-support for joists or other load carrying members.

3.11
joist
beam made with timber and/or engineered wood products, to support and connect to the decking

3.12
modal damping ratio
ratio of the actual damping coefficient to the critical damping coefficient, associated with a vibration mode

3.13
natural frequency
frequency of free vibration of a vibration system, associated with a mode of vibration

3.14
point load deflection
deflection corresponding to a concentrated point load of 1 kN where the maximum deflection is expected

3.15
response factor *R*
factor obtained by dividing the acceleration of a floor by a baseline value, used for assessing the acceptability of a floor

3.16
span
distance between supports in the direction parallel to the main floor load bearing elements

3.17
vibration
oscillation of a system about its equilibrium position

3.18
vibration mode
behaviour of a system or an object that is characterized by its natural frequency, modal damping and mode shape

Note 1 to entry: A system can have many vibration modes and multiple vibration modes can be oscillating (and interfering) at the same time. Each vibration mode depends on the structure configuration, material properties and boundary conditions of the system.

4 Determination of the dimensions of a floor system

The span, length, width and depth of the floor system shall be measured:

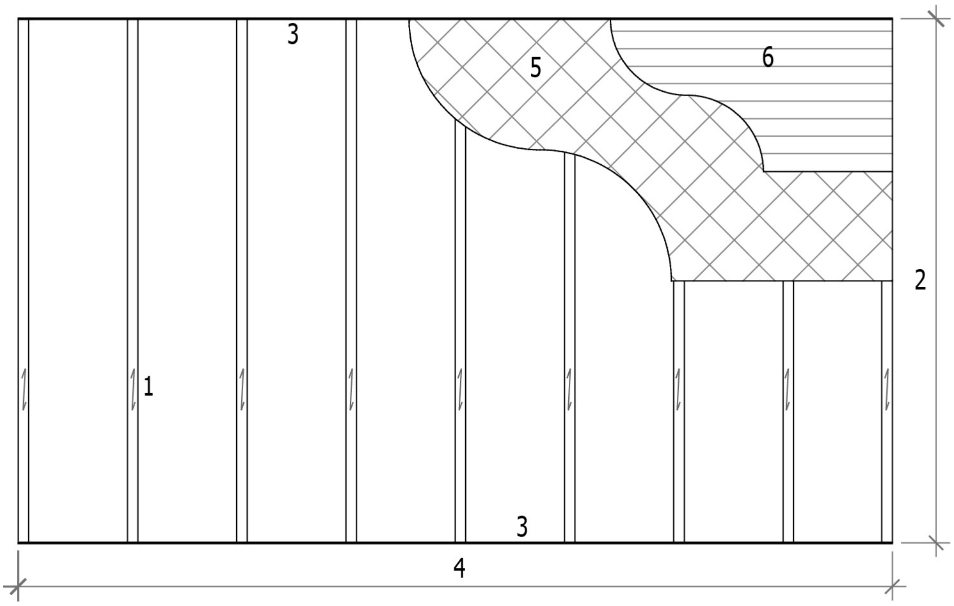
— in laboratory tests width and depth of structural members to an accuracy of 1 mm, length and span to an accuracy of 10 mm. The width and depth measurements shall not be taken at a location closer than 150 mm to the ends;

— in *in situ* tests width and depth of structural members to an accuracy of 1 %, length and span to an accuracy of 10 mm or as precisely as possible.

The composition of the floor to be tested indicating all materials and connections used, the dimensions of the construction elements, their spacing and span, etc., shall be documented.

NOTE 1 As tests are carried out considering a multitude of boundary conditions, no standard floor layups or standard geometries can be prescribed.

NOTE 2 Figure 1 shows a typical floor system composed of joists and decking. Floors systems composed by mass timber slabs are defined analogously.



Key

1 joist or main load carrying direction for slabs
2 span
3 end support for joists or slabs
4 width
5 decking
6 topping

Figure 1 — Typical floor system

5 Determination of moisture content

For laboratory tests, the moisture content of the floor components shall be determined, for timber in accordance with EN 13183, and for wood-based products in accordance with EN 322. For *in situ* tests, the moisture content of the floor components may be estimated by using appropriate measuring devices.

6 Determination of the floor mass

For laboratory tests, the mass of the whole floor or individual components shall be determined using a balance with an accuracy of at least 1 % and reported in kg/m^2. For *in situ* tests, the mass of the whole floor or individual components may be estimated by using measured or documented dimensions and gravity loads.

7 Conditioning

For *in situ* and laboratory tests, the air temperature and relative humidity at the test location, at the time of the test shall be recorded.