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Standing ladder durability test specification

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Standing ladder durability test specification

Méthode d'essais de la durabilité des échelles

Prüfung der Dauerhaltbarkeit von Stehleitern

This Technical Specification (CEN/TS) was approved by CEN on 20 January 2014 for provisional application.

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Foreword

This document (CEN/TS 16665:2014) has been prepared by Technical Committee CEN/TC 93 “Ladders”, the secretariat of which is held by DIN.

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Introduction

The use of a CEN Technical Specification has been agreed by CEN/TC 93 to enable further testing and validation of a standing ladder durability test and ultimately rapid incorporation into EN 131-2.

1 Scope

This Technical Specification specifies the method of the test for the standing ladder durability requirements evaluation.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 131-1:2007+A1:2011, *Ladders - Part 1: Terms, types, functional sizes*

EN 10088-2:2005, *Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 131-1:2007+A1:2011 and the following apply.

3.1
ladder collapse
collapse that happens when the defined load value of (1500 ± 50) N is not maintained by the thrust device

3.2
ladder rupture
rupture that happens when the ladder breaks and this impairs the fitness for use of the ladder

3.3
test step
sequence of 10 000 cycles

Note 1 to entry: see 4.5.

4 Durability test method

4.1 General

This test is for standing ladders or combination ladders used as standing ladders.

4.2 Principle

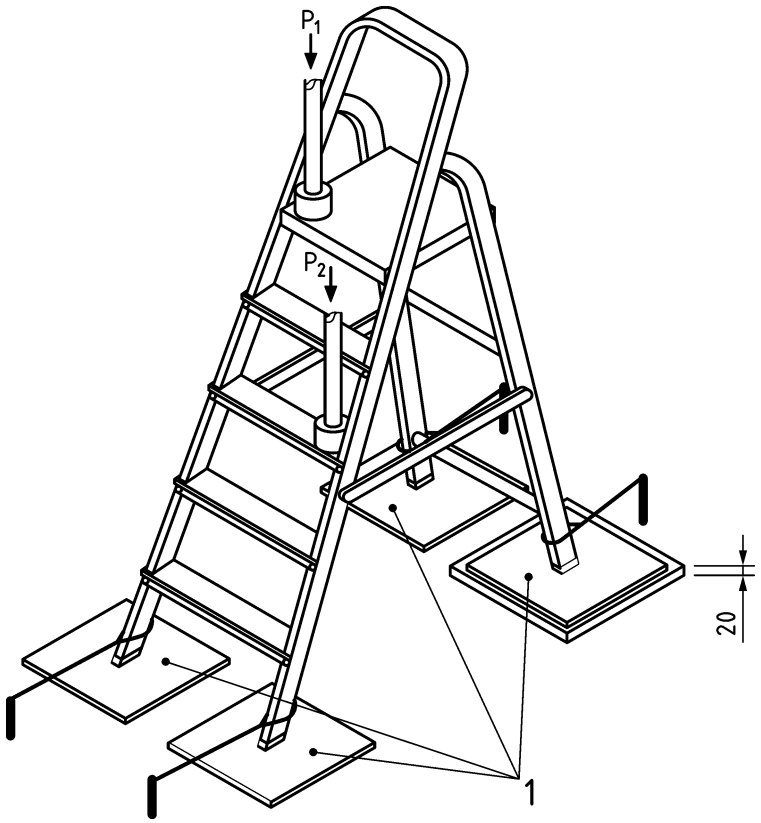
The standing ladder is placed in position of use on the testing surface with the 4 standing ladder stiles constrained to a fixed part by elastic rope/tape to prevent excessive progressive movement of the standing ladder (see Figure 1).

Two equal loads P_1 and P_2 are applied to the standing ladder by testing apparatus following a well defined load versus time law of cycles: one load is applied to the topmost rung/step/platform and the other one is applied to the rung/step in the middle of the ascending leg.

The load application shall continue until the defined load value is maintained by the thrust device or until to the collapse of standing ladder.

The maximum number of cycles is registered.

Dimensions in millimetres



Key

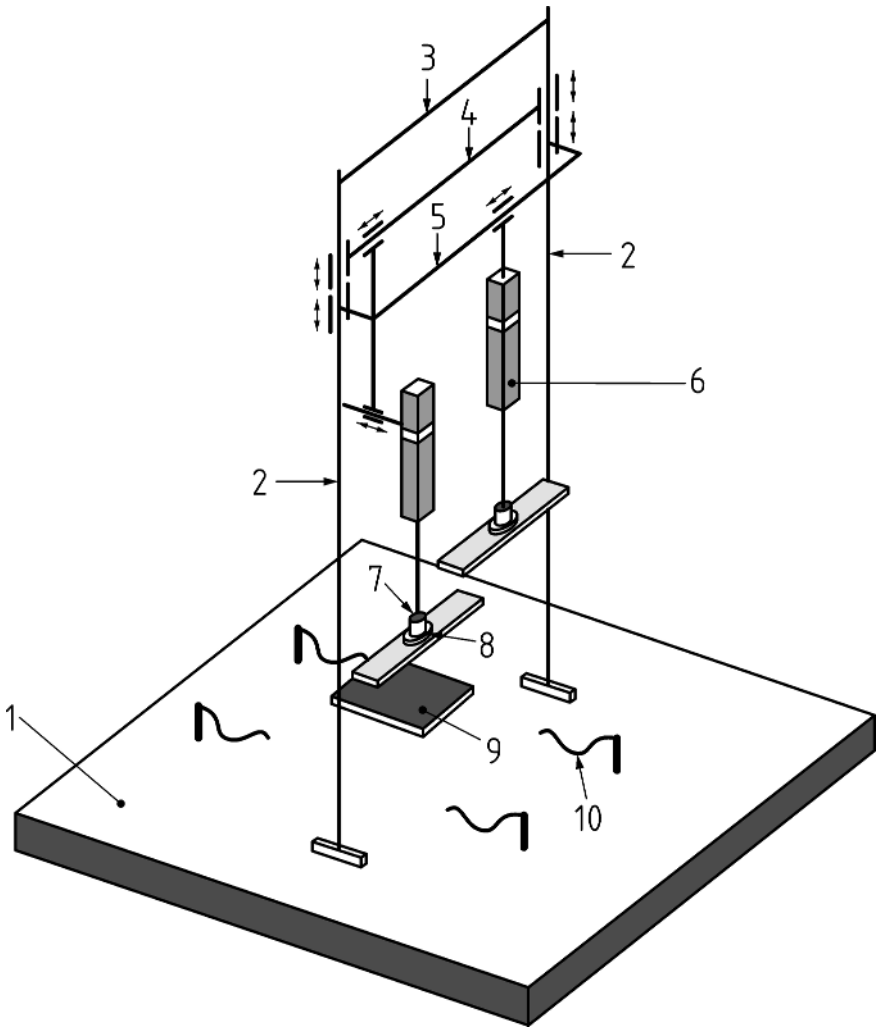
1	stainless steel
P_1 and P_2	equal loads

Figure 1 — Scheme of principle of the test durability for standing ladder

4.3 Apparatus

4.3.1 General

The load shall be provided by pneumatically or oleodynamic system. An equipment of control and of check of the overall system shall be installed in order to ensure the requirements of 4.5 (see Figure 2).



Key

1 rigid testing surface
2 rigid uprights
3 rigid cross bar to join permanently the two uprights
4 1 rigid upper mobile cross bar to secure one cylinder
5 1 rigid lower mobile cross bar to secure one cylinder
6 2 cylinders
7 2 cylindrical pads as thrust surface
8 2 load cells
9 1 flat element of 20 mm of thickness
10 4 elastic ropes/tapes

Figure 2 — Example of apparatus that could be used to apply the load

4.3.2 Thrust surface/pad

The two loads shall be applied to the rung/step/platform by a cylindrical rubber pad as thrust surface.

Pad dimension shall be the following: (60 ± 5) mm of diameter and a height of (25 ± 5) mm (see Figure 3).

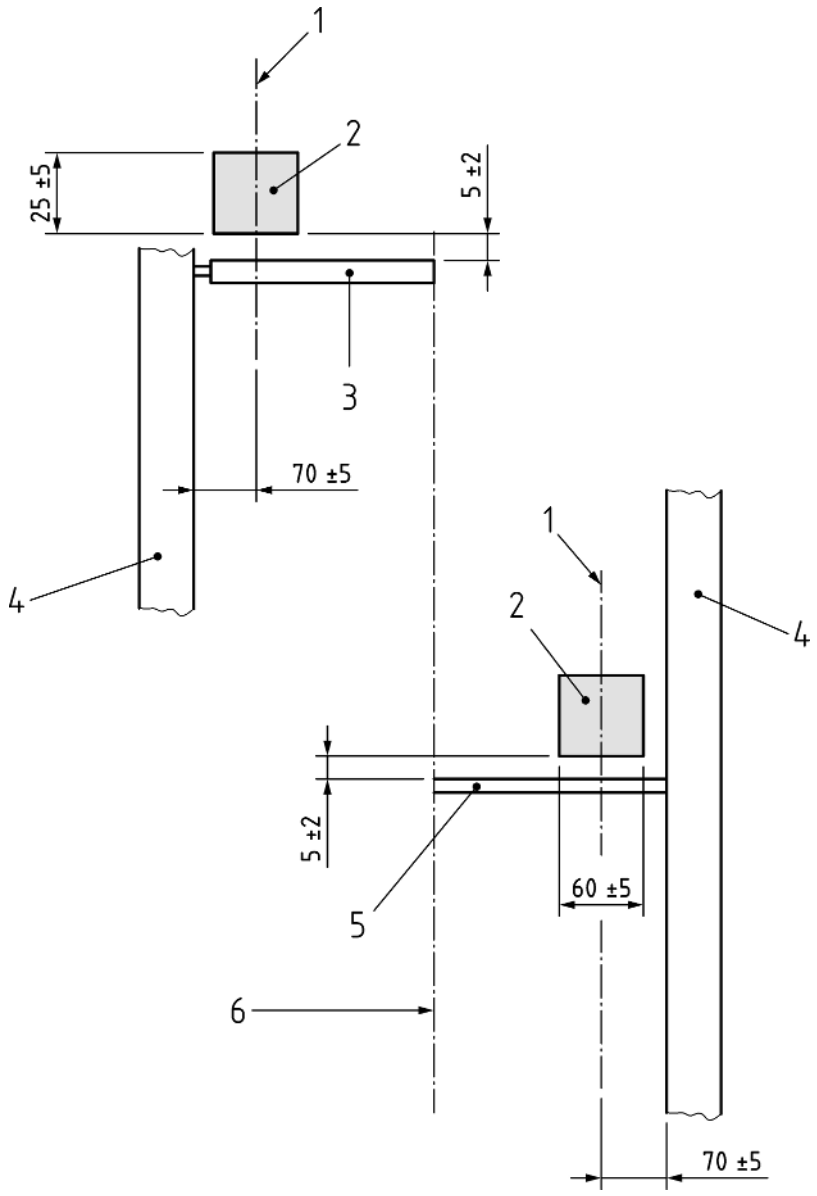
Pad shore hardness shall be in the following range: (60 ± 5) SHA

4.3.3 Rigid structure to secure the cylinders and pads position

The structure shall be so rigid in such manner to be capable to support the two cylinders so that during the test their central vertical axes are indeed vertical and so that it does not move.

The structure shall permit to adjust the two cylinders position in x, y and z direction (see Figure 2) in order to meet the pads position respect to the stile both to the rung/step and platform as shown in Figures 3 and 4.

Dimensions in millimetres

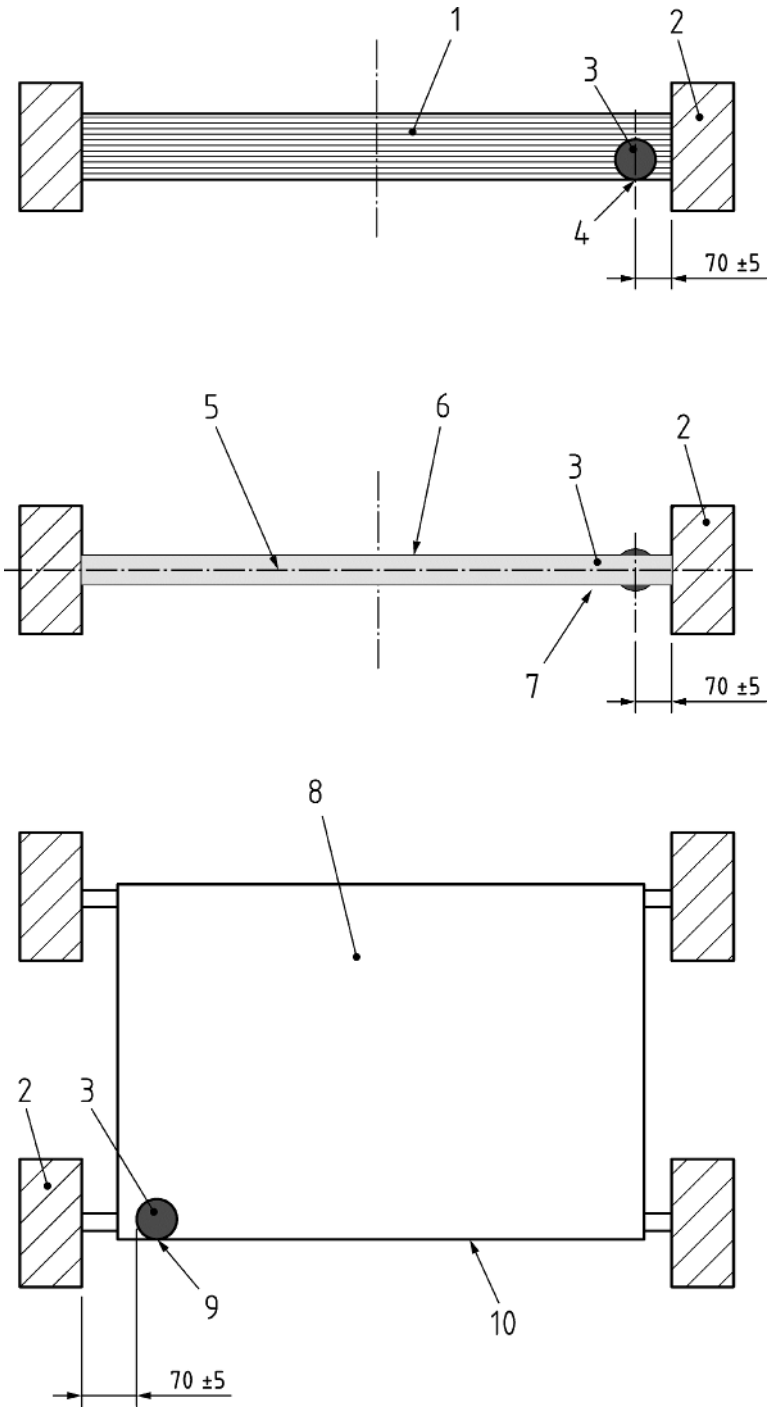


Key

1 load direction and pad centreline
2 pad
3 standing ladder rung/step/platform
4 standing ladder stile
5 standing ladder rung/step
6 standing ladder centre line

Figure 3 — The initial position of the pad

Dimensions in millimetres



Key

1	flat step/rung	6	rounded rung
2	stile	7	pad in the middle of the rounded rung
3	pad	8	platform
4	pad tangent to the border of the flat rung/step	9	pad tangent to the border of the platform
5	axis of rounded rung	10	frontal part of the platform

Figure 4 — Position of the pad

4.3.4 Testing surface

Stainless steel plate such as number 1.4301, type 2B (cold rolled ground) conforming to EN 10088-2:2005 shall be used as testing surface. The plates shall be cleaned before testing.

4.3.5 Elastic ropes/tapes

The four elastic ropes/tapes shall be installed in order to maintain the ladder position during the test in an average position respect to the initial position. The characteristics of the ropes/tapes shall not produce measurable changes in the constrains of simple support between the base of the uprights and the test surface.

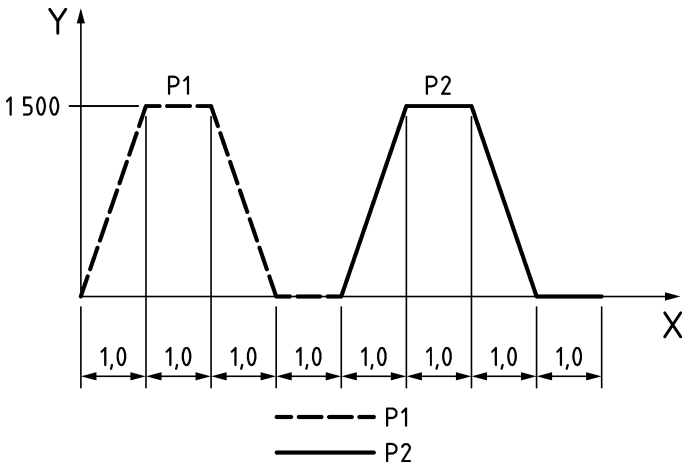
4.4 Test condition

4.4.1 Ambient condition

The ambient temperature shall be (20 ± 5) °C before testing and remain within this temperature range during the test.

4.5 Test requirements

The load shall be applied to achieve the pattern of loading as shown in Figure 5.



Key

P1 P_1 cylinder

P2 P_2 cylinder

X time in seconds

Y load in Newtons

Figure 5 — Test load sequence (cycles of loads application)

The sum of first cycle P1 and the second cycle P2 constitutes the durability test cycle.

4.6 Test procedure

The test procedure consists of the following steps:

a) verify that no defects are present on the standing ladder;

b) place the standing ladder in its position of use at its maximum extension with opening restraints engaged on the test surface with one of the rear feet positioned on the 20 mm thick flat raised element, in order to simulate an uneven surface (see Figure 1);

c) determine the rung/step at the position located horizontally from the mid-point of the ascending leg. If no rung/step is suitably positioned then select the closest rung/step above this location;

d) place one pad/cylinder (P_2) on the rung/step determined in (c) so that its centreline is (70 ± 5) mm from the inside face of the stile corresponding to the side of the ladder where the rear foot is positioned on the 20 mm thick raised element. (see Figures 3 and 4);

e) adjust the pad/cylinder so that it's vertical distance to the rung/step surface is (5 ± 2) mm (see Figures 3 and 4);

f) place the second pad/cylinder (P_1) on the top rung/step/platform so that its centreline is (70 ± 5) mm from the inside face of the opposite stile to P_2 and adjust it so that the vertical distance from the pad/cylinder to the rung/step surface is (5 ± 2) mm (see Figures 3 and 4);

g) constrain each of the 4 ladder stiles to a fixed element (e.g.by elastic, rubber, rope, tape etc.) to prevent excessive progressive movement of the ladder;

h) verify that each pad/cylinder is separately capable of exerting the test load of (1 500 ± 50) N;

i) set the test step at 10 000 cycles;

j) start the test as per the test load sequence described in 4.5;

k) the load application shall continue until:

— the defined load value of (1 500 ± 50) N is not maintained by the thrust device (ladder collapse), or

— the rupture of the standing ladder, or

— 10 000 cycles has been reached without collapse or rupture of the standing ladder. The maximum number of cycles of the test step is registered;

l) where no rupture or collapse of the standing ladder is noted set the next test step of an additional 10 000 cycles;

m) repeat steps (j) to (l) up to a maximum of 50 000 completed cycles;

n) the total cycles of the durability test is the sum of each cycle.

4.7 Test report

The test report shall contain at least:

a) total cycles of the durability test;

b) description of the mode failure if any: ladder collapse or ladder rupture;

c) description of damaged elements if any, e.g. hinge joint, pivots/seats, element connections, opening restrain devices and their attachments, bearing elements, rung/step, platform;

d) significant photos of the ladder after the durability test including damages if any;

e) photos of the apparatus used.

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