BS EN 15534-6:2015

BSI Standards Publication

Composites made from cellulose-based materials and thermoplastics (usually called wood-polymer composites (WPC) or natural fibre composites (NFC))

Part 6: Specifications for fencing profiles and elements

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National foreword

This British Standard is the UK implementation of EN 15534-6:2015.

The UK participation in its preparation was entrusted to Technical Committee PRI/42, Fibre reinforced thermosetting plastics and prepregs.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Composites made from cellulose-based materials and thermoplastics (usually called wood-polymer composites (WPC) or natural fibre composites (NFC)) - Part 6: Specifications for fencing profiles and elements

Composites à base de matières cellulosiques et de thermoplastiques (communément appelés composites bois-polymères (WPC) ou composites fibres d'origine naturelle (NFC)) - Partie 6 : Spécifications relatives aux profilés et éléments pour clôtures

Verbundwerkstoffe aus cellulosehaltigen Materialien und Thermoplasten (üblicherweise Holz-Polymer-Werkstoffe (WPC) oder Naturfaserverbundwerkstoffe (NFC) genannt) - Teil 6: Anforderungen an Zaunprofile und -elemente

This European Standard was approved by CEN on 15 August 2015.

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European foreword

This document (EN 15534-6:2015) has been prepared by Technical Committee CEN/TC 249 “Plastics”, the secretariat of which is held by NBN.

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of an identical text or by endorsement, at the latest by March 2016, and conflicting national standards shall be withdrawn at the latest by March 2016.

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

EN 15534 comprises the following parts:

— EN 15534-1, *Composites made from cellulose-based materials and thermoplastics (usually called wood-polymer composites (WPC) or natural fibre composites (NFC)) — Part 1: Test methods for characterization of compounds and products*

— EN 15534-4, *Composites made from cellulose-based materials and thermoplastics (usually called wood-polymer composites (WPC) or natural fibre composites (NFC)) — Part 4: Specifications for decking profiles and tiles*

— EN 15534-5, *Composites made from cellulose-based materials and thermoplastics (usually called wood-polymer composites (WPC) or natural fibre composites (NFC)) — Part 5: Specifications for cladding profiles and tiles*

— EN 15534-6, *Composites made from cellulose-based materials and thermoplastics (usually called wood-polymer composites (WPC) or natural fibre composites (NFC)) — Part 6: Specifications for fencing profiles and fencing elements*

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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This part of EN 15534 specifies the characteristics of fencing profiles and elements made from cellulose-based materials and thermoplastics, usually called wood-polymer composites (WPC) or natural fibre composites (NFC).

It is applicable to fencing profiles and elements for non-structural fencing systems.

The security systems, perimeter protections, handrails and load bearing applications are out of the scope of this part of EN 15534.

Any systems made from profiles in the scope of this part of EN 15534 that are affected by regulations are under the responsibility of the system supplier.

EN 15534-1 specifies some of the test methods relevant to this part of EN 15534.

NOTE For editorial reasons, in EN 15534 the abbreviation "WPC" is used for "composites made from cellulose-based materials and thermoplastics".

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 927-6, *Paints and varnishes — Coating materials and coating systems for exterior wood — Part 6: Exposure of wood coatings to artificial weathering using fluorescent UV lamps and water*

EN 16472, *Plastics — Method for artificial accelerated photoageing using medium pressure mercury vapour lamps*

EN 15534-1:2014, *Composites made from cellulose-based materials and thermoplastics (usually called wood-polymer composites (WPC) or natural fibre composites (NFC)) — Part 1: Test methods for characterisation of compounds and products*

EN ISO 4892-1:2000, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance (ISO 4892-1:1999)*

EN ISO 4892-2, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps (ISO 4892-2)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 15534-1:2014 and the following apply.

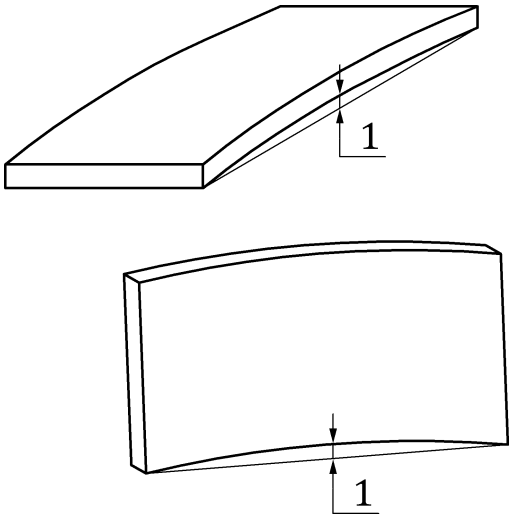
3.1
fencing profile
single profile intended to be assembled in a fencing element

3.2
fencing element
assembly of two posts and one or several fencing profile(s) and possibly, fastenings and accessories

3.3
fencing system
several assembled fencing elements

3.4
bow
curvature of a fencing profile across its length

Note 1 to entry: see Figure 1.



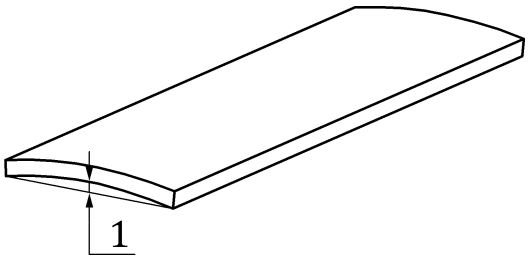
Key

1 bow

Figure 1 — Illustration of bow

3.5
cupping
curvature of a fencing profile across its width

Note 1 to entry: see Figure 2.



Key

1 cupping

Figure 2 — Illustration of cupping

4 Requirements for fencing profiles

4.1 General

Initial type testing shall be performed to demonstrate compliance with the requirements specified in Clause 4 of this part of EN 15534. The tests according to 4.5.6 shall be carried out if the performance is to be declared by the manufacturer. Initial type testing shall be repeated, whenever a change occurs in the composition of the product, its geometry or in the production process. In case of a minor change, only the properties which could be influenced by this change shall be tested.

NOTE Minimum frequencies of testing for factory production control purposes are given in Annex A.

4.2 Material

The base polymer, from which the material is produced, and the type and content of cellulose-based material shall be declared by the manufacturer.

Reprocessable and/or recyclable materials may be used for manufacturing profiles provided that they satisfy to the provisions of this part of EN 15534.

WPC materials are recyclable materials which can be treated in a material recovery process intended to save resources while minimizing harmful emissions into air, water and soil as well as their impacts on human health.

NOTE A scheme for the characterization of plastics waste is given in EN 15347 [1] and guideline for the recovery and recycling are given in ISO 15270 [2].

4.3 Appearance

For production control purposes, the manufacturer shall compare three samples drawn at random from the same profile production batch with a control sample, under the illumination conditions defined in EN 15534-1:2014, 6.1.

The control samples shall be stored in a dark room and renewed every six months.

If a control sample is put in contact with water, it shall be renewed immediately.

4.4 Physical properties

When tested in accordance with the test methods as specified in Table 1, using the parameters indicated, the fencing profiles, as delivered to the customer, shall have properties conforming to the requirements given in Table 1.

Table 1 — Physical properties

Property	Requirements	Test method	Number of test specimens
Linear mass	Individual values ≥ 95 % declared value by the manufacturer. The linear mass and tolerances shall be declared by the manufacturer.	EN 15534–1:2014, 6.5	3 specimens
Thickness, width and length	The relevant dimensional values and their tolerances shall be declared by the manufacturer.	EN 15534–1:2014, 6.6.2	3 specimens
Deviation from straightness	The deviation of straightness and its tolerance shall be declared by the manufacturer.	EN 15534–1:2014, 6.6.3	3 specimens
Cupping (if relevant)	The cupping value and its tolerance shall be declared by the manufacturer.	EN 15534–1:2014, 6.6.4	3 specimens

4.5 Mechanical properties

4.5.1 Falling mass impact resistance

When tested in accordance with the test methods as specified in Table 2, using the parameters indicated, the fencing profiles, as delivered to the customer, shall have properties conforming to the requirements given in Table 2.

Table 2 — Falling mass impact resistance

Requirements	Test parameters	Test method	Number of test specimens
Non-cellular material profiles			
No more than one test specimen out of 10 test specimens shall show a failure.	H: (1 000 ± 5) mm M_s: (500 ± 2) g	EN 15534–1:2014, 7.1.2.2.1	10 specimens/face[a]
Cellular material profiles			
No more than one test specimen out of 10 test specimens shall show a failure.	H: (1 000 ± 5) mm M_s: (500 ± 2) g	EN 15534–1:2014, 7.1.2.2.2	10 specimens/face[a]
[a] On both faces of the fencing profile, if relevant.			

4.5.2 Flexural properties

When tested in accordance with the test method as specified in Table 3, using the parameters indicated, the fencing profiles, as delivered to the customer, shall have properties conforming to the requirement given in Table 3.

Table 3 — Flexural properties

Requirement	Test parameters	Test method	Number of test specimens
Declaration of the modulus of elasticity in bending and the bending strength	Span l_1: 20 times the thickness h of the test specimen, and Span $l_1 \geq 100$ mm.	EN 15534–1:2014, Annex A	4 specimens/face [a]
[a] On both faces of the fencing profile, if relevant.			

4.5.3 Durability of the material against biological agents

For the purpose of this part of EN 15534, use classes according to the environmental conditions are defined in Table 4.

Table 4 — Use class and occurrence of biological agents

Use class[a]	Service situation	Biological agents
3	External use, above ground	Basidiomycetes
4	External use, in ground contact	Soft rotting micro-fungi
NOTE Use classes 3 and 4 are derived from EN 335:2013 [3], Table 1.		
[a] A profile may be classified in use class 3 or 4 or both.		

When tested in accordance with the test methods as specified in Table 5, using the parameters indicated, the materials shall have properties conforming to the requirements given in Table 5.

Table 5 — Resistance against biological agents

Property	Requirements	Test method	Number of test specimens
Resistance against basidiomycetes	The test result shall be declared	EN 15534–1:2014, 8.5.2	See EN 15534–1:2014, Table 2
Resistance against soft rotting micro-fungi	The test result shall be declared	EN 15534–1:2014, 8.5.3	See EN 15534–1:2014, Table 3
NOTE At the date of publication of this part of EN 15534, there is a lack of experience to specify requirements for these properties.			

4.5.4 Durability of the fencing profiles against ageing and moisture

When tested in accordance with the test methods as specified in Table 6, using the parameters indicated, the fencing profiles, as delivered to the customer, shall have properties conforming to the requirements given in Table 6.

Table 6 — Durability of the fencing profiles against ageing and moisture

Property	Requirements	Test parameters	Test method	Number of test specimens
Resistance to artificial weathering	- ΔL^*, Δa^*, Δb^* shall be declared	300 h EN ISO 4892-2 2016 h EN 927–6 750 h EN 16472	EN 15534–1:2014, 8.1	1 specimen/colour (5 measurements /specimen)
Moisture resistance under cyclic test conditions	- Mean value of decrease of bending strength ≤ 20 % of initial value - Individual values of decrease of bending strength ≤ 30 % of initial value	Temperature of water bath: a) (20 ± 1) °C or b) (23 ± 2) °C	EN 15534–1:2014, 8.3.2 and 7.3.2	8 specimens mounted to the test apparatus in the same way as for the bending test according to 4.5.2 giving the lower mean value for the maximum force [a]

[a] On both faces of the fencing profile, if relevant.

4.5.5 Thermal properties

When tested in accordance with the test methods as specified in Table 7, the materials shall have a property conforming to the requirements given in Table 7.

Table 7 — Thermal property

Property	Requirements	Test method	Number of test specimens
Linear thermal expansion coefficient	≤ $50 \cdot 10^{-6}$ K^{-1}	EN 15534–1:2014, 9.2	3 specimens

4.5.6 Additional properties

Additional propertie(s) to those given in Tables 1 to 7, listed in Table 8 and 9, shall be assessed when required by the customer, a third party or to comply with regulations. The corresponding test result(s) and performance(s), as applicable, shall be declared by the manufacturer.

Table 8 — Resistance to natural ageing

Property	Requirements	Test parameters	Test method	Number of test specimens
Resistance to natural ageing	- The decrease of bending strength shall be declared. - ΔL^*, Δa^*, Δb^* ΔE^* or gray scale rating shall be declared. - The change of the modulus of elasticity in bending shall be declared. - The appearance criteria, as defined by the manufacturer shall be declared. - The location of exposure and conditions shall be declared.	Exposure duration: 8 760 h	EN 15534–1:2014, 8.2	1 specimen/colour (5 measurements /specimen) mounted to the test apparatus in the same way as for the bending test according to 4.5.2 giving the lower mean value for the maximum force

Table 9 — Additional properties

Properties	Test method	Number of test specimens
Thermal properties		
Heat reversion (applicable to profiles)	EN 15534–1:2014, 9.3	3 specimens
Heat build-up	EN 15534–1:2014, 9.4	3 specimens
Mechanical properties		
Resistance to indentation	EN 15534–1:2014, 7.5	3 specimens
Nail and screw withdrawal	EN 15534–1:2014, 7.6	10 specimens
Pull through resistance	EN 15534–1:2014, 7.7	10 specimens
Resistance against biological agents		
Resistance against termites [a]	EN 15534–1:2014, 8.4	5 specimens
Resistance against discolouring micro-fungi [a]	EN 15534–1:2014, 8.5.4 and 8.5.5	5 specimens
Resistance against discolouring algae [a]	EN 15534–1:2014, 8.5.6	5 specimens
Other properties		
Resistance to salt spray (NSS test)	EN 15534–1:2014, 8.6	2 specimens
Degree of chalking for coated products, only	EN 15534–1:2014, 10.1	3 specimens
Peel strength (profiles with laminated foil)	EN 15534–1:2014, 10.3	4 specimens
[a] If products of different geometries are made from the same material, only one product shall be tested.		

5 Requirements for fencing elements

When tested in accordance with the test method as specified in Table 10, the fencing elements, as delivered by the manufacturer, shall have a property conforming to the requirements given in Table 10.

The test specimens shall be a representative fencing element of the system.

Table 10 — Fencing elements properties

Property	Requirements	Test method
Deformation due to the exposure to thermal radiations from the sun	Maximum bow: 1 % of the span (distance between two fixations) Maximum cupping: 1 % of the width of the fencing element	Annex B

The impact energy of a fencing element submitted to a soft body impact may be determined according to Annex D.

NOTE At the date of publication of this part of EN 15534, there is a lack of experience to specify a requirement for the impact energy.

6 Marking

The minimum required marking on the fencing profiles shall conform to Table 11 and shall be marked on the product or on a label attached to it. Where this is not possible, it shall be affixed to the packaging.

Table 11 — Minimum required marking

Aspects	Mark or symbol
Reference of this part of EN 15534	EN 15534–6
Base polymer	e.g. PVC
Type of cellulose-based material [a]	e.g. W
Average content of cellulose-based material (%)	e.g. 50
Use class according to the environmental conditions[b]	e.g. UC3
[a] See Table 12. [b] See Table 4.	

Table 12 — Code for cellulose-based material

Cellulose-based material	Symbol
Wood	W
Flax	F
Hemp	H
Rice	R
Bamboo	B
Paper	P
Sisal	S
Coconut	C
Other	O

EXAMPLE 1 A fencing profile according to this part of EN 15534, made from polypropylene and wood, wood content: 60 %, use class 3

EN 15534–6 PP W60 UC3

EXAMPLE 2 A fencing profile according to this part of EN 15534, made from unplasticized poly(vinyl chloride) and hemp, hemp content: 50 %, use class 3

EN 15534–6 PVC-U H50 UC3

Annex A
(informative)

Minimum frequencies of testing for factory production control purposes

Table A.1 — Minimum frequency of testing for factory production control purposes

Property	Minimum frequency of testing
Linear mass	1 specimen/production line ≤ 12 h
Thickness, width, length	1 specimen/production line ≤ 12 h
Straightness, cupping	1 specimen/production line ≤ 12 h
Appearance	1 specimen/production line ≤ 12 h
Flexural properties (modulus of elasticity in bending and bending strength)	1 specimen/production line ≤ 12 h, cut on the face giving the lowest value [a]
Heat reversion	3 specimens/ production line ≤ 12 h
[a] On both faces of the fencing profile, if relevant.	

Annex B
(normative)

Deformation due to the exposure to thermal radiations from the sun

B.1 Principle

The purpose of this method is to determine the deformation of a representative fencing element due to the exposure of one of its faces to the thermal radiations from the sun.

The bow and the cupping of the fencing element are measured initially and at the end of the exposure.

B.2 Apparatus

B.2.1 Frame, rigid and capable of supporting the test specimen in such a way that it will not be significantly deformed by any force transmitted from the specimen.

B.2.2 Device for measuring the bow, accurate to ± 0,1 mm.

B.2.3 Device for measuring the cupping, accurate to ± 0,05 mm.

B.2.4 Radiant panel, fitted with filament infrared lamps positioned in such way that the emitted radiation emission energy will be distributed as evenly as possible over the test specimen. The power of the radiant panel shall be such that the reference temperature, T_r, measured on the test specimen, can be reached within 2 h and maintained afterwards within a range of ± 5 °C. See Annex C for detailed information.

B.2.5 Black panel, according to EN ISO 4892-1:2000, 5.2.2.2.

B.2.6 IR-thermometer, with an emission factor E = 0,95.

B.3 Test specimen

The test specimen shall be a representative fencing element of the system.

If the fencing element is not symmetrical, then the two faces shall be tested separately.

B.4 Conditioning

The test specimens shall be conditioned according to EN 15534-1:2014, 5.2.

B.5 Procedure

B.5.1 Mount the test specimen in the supporting frame in a compatible way with the manufacturer's fixing instructions. However, the bow of any part of the test specimen connected to the supporting frame shall not exceed 1 mm.

B.5.2 Record the ambient temperature, T_i, and position the test specimen and the radiant panel relatively to each other.

B.5.3 Measure and record the initial bow, db_i, and the initial cupping, dc_i, of the most critical parts of the test specimen.

B.5.4 Switch on the radiant panel and adjust the reference temperature, T_r, of the test specimen, measured by means of the IR-thermometer, between 70 °C and 75 °C by changing either the distance between the radiant panel and the test specimen or the power of the infrared lamps.

The reference temperature, T_r, defined as the average temperature of several measurements across the area of the test specimen, shall be determined as follows:

a) if the test specimen area does not exceed 2 m^2: three measurements along one diagonal, one measurement at midspan and two measurements at each end of the diagonal;

b) If the test specimen area exceeds 2 m^2: five measurements along the two diagonals, one measurement at midspan and four measurements at each end of the two diagonals.

B.5.5 After an irradiation of (2 ± 0,1) h, measure and record the bow, db_m, and the cupping, dc_m, of the initially measured parts of the test specimen, while the irradiation is still on. Examine visually the test specimen and record any damage to the test specimen.

B.6 Expression of the results

Calculate the variation of the bow by using Formula (B.1):

$$\Delta db = db_m - db_i \quad \text{(B.1)}$$

where

Δdb is the variation of the cupping, expressed in millimetres;

db_m is the cupping after the irradiation at the end of testing (B.5.5), expressed in millimetres;

db_i is the initial cupping (B.5.3), expressed in millimetres.

Calculate the variation of the cupping using Formula (B.2):

$$\Delta dc = dc_m - dc_i \quad \text{(B.2)}$$

where

Δdc is the variation of the bow, expressed in millimetres;

dc_m is the bow after the irradiation at the end of testing (B.5.5), expressed in millimetres;

dc_i is the initial bow (B.5.3), expressed in millimetres.

B.7 Test report

The test report shall include the following information:

a) a reference to this annex (EN 15534-6:2015, Annex B);

b) all the information necessary for identification of the fencing element of fence tested, including type, source, manufacturer's code number and history, where these are known;

c) the detailed description of the test specimens;

d) the conditioning and test conditions;

e) the number of specimens tested;

f) the reference temperature T_r;

g) the variations of the bow and the cupping (B.6) and the results of the visual examination as recorded in B.5.5.

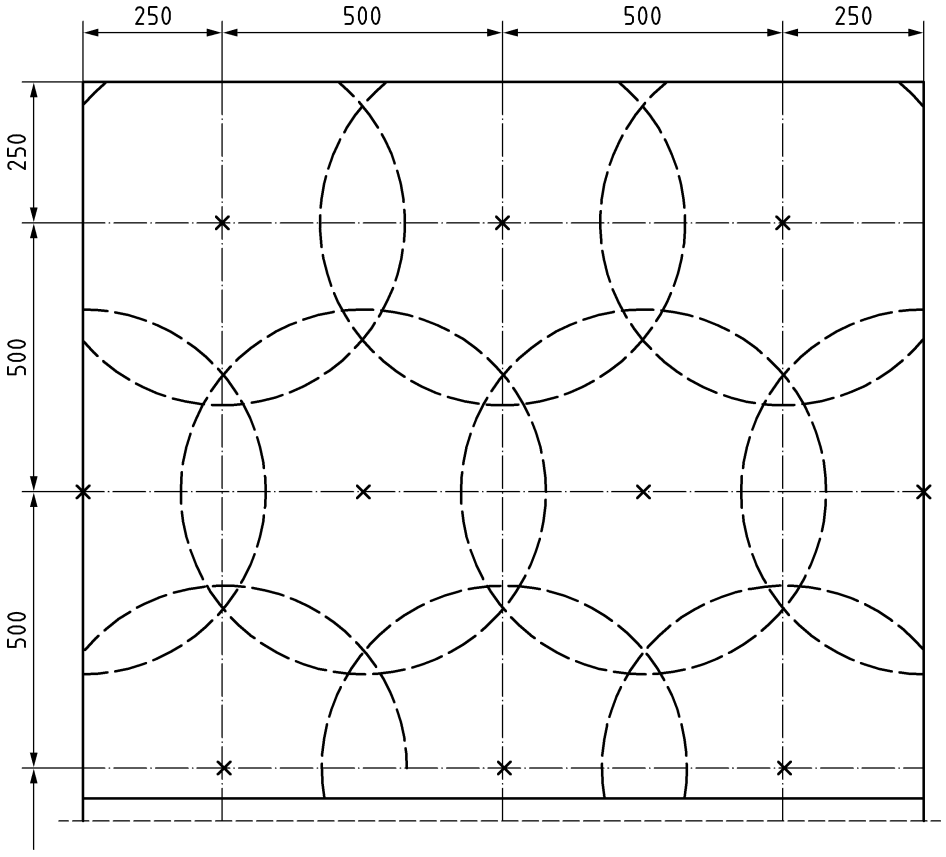
h) any factors which may have affected the results, such as any incidents or any operating details not specified in this annex.

Annex C
(informative)

Description and arrangement of infrared lamps

Type of lamp:	Filigran infrared lamp
Input energy:	250 W
Angle of radiation:	80°
Position:	In grid pattern
Distance between the lamps	(500 ± 20) mm (see Figure C.1)

Dimensions in millimetres



Key

× position of the infrared lamps

cone of radiation

Figure C.1 — Typical arrangement of infrared lamps

Annex D
(informative)

Soft body impact test

D.1 Principle

An element of a fencing system is subjected to an impact from a soft body, perpendicularly to its plane, at a chosen energy. The impact energy of the weakest point of the fencing element is determined.

NOTE This method is based on EN 596 [4].

D.2 Apparatus

D.2.1 Coarse canvas bag, containing a thin polyethylene bag of the same size, of a mass, *M*, (50 ± 0,2) kg when filled with hardened solid glass spheres each having a diameter of (3 ± 0,5) mm. See Figure D.1 for the shape of the bag.

The sidewall of the sphero-conical bag is made of eight sections of coarse linen canvas (approx 600 g/m^2) sewn together.

The bottom of the bag is strengthened by a circular piece of leather of (120 ± 5) mm diameter sewn into it.

The top of the bag is slightly truncated in order to make an opening of (80 ± 5) mm diameter. This opening is strengthened by a leather strip sewn into the bag, to which are fixed four equidistant rings held together by a suspension ring.

D.2.2 Arrangement, whereby the bag is suspended by a rope in such a way that while vertically at rest the bag is just touching the test specimen surface at the point of impact. See Figure D.2 for the arrangement.

D.2.3 Device, capable of hoisting and instantaneously releasing the bag.

Dimension in millimetres

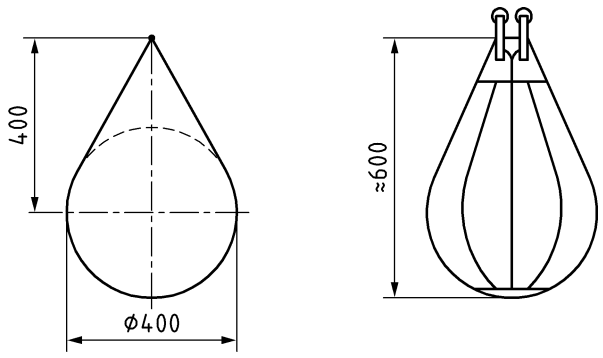
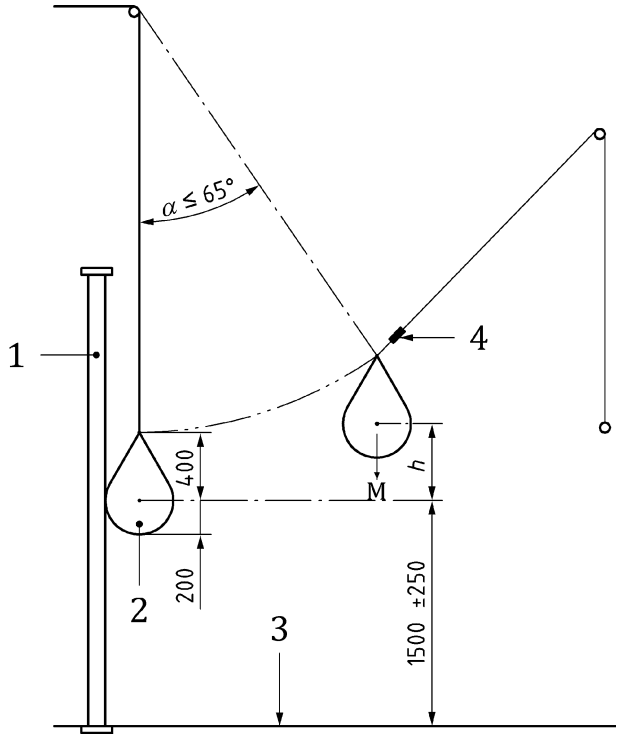


Figure D.1 — Canvas bag

Dimension in millimetres



Key

1 fencing element
2 canvas bag
3 ground level
4 snap hook releasable from a distance
h drop height

Figure D.2 — Apparatus

D.3 Test specimens

The test specimens should be a representative fencing element of the system.

The number of test specimens is depending on the number of tests necessary to determine the weakest point of the fencing element.

D.4 Conditioning

The test specimens should be conditioned according to EN 15534-1:2014, 5.2.

D.5 Procedure

Submit the test specimen to the following procedure in the same atmosphere as during conditioning.

The test specimen shall be erected vertically. The posts shall be firmly fixed to the ground in order to avoid any deflection of the posts during the impact.

The point of impact shall be at the weakest point of the test specimen. Preliminary tests may be necessary to determine the weakest point of the test specimen.

Before an impact load is applied, the bag shall be rolled to loosen the spheres.

The bag shall be placed at the impact point in such a way that, when it is suspended from the rope, it just touches the surface of the test specimen.

The bag shall then be drawn away from the test specimen surface such that the maximum angle to the vertical α subtended by the movement of the rope shall be not greater than 65° (cf. Figure D.2).

The bag is then released and allowed to drop freely in an arc onto the face of the test specimen.

After each drop, the test specimen shall be visually examined and any damage to the test specimen shall be recorded.

D.6 Expression of results

The impact energy W shall be calculated from Formula (D.1)

$$W = \frac{M \cdot h \cdot g}{1000} \tag{D.1}$$

where

W is the impact energy, in Joules;

g is the acceleration due to gravity, in metres per square second;

h is the drop height, in millimetres;

M is the mass of the bag, in kilograms;

D.7 Test report

The test report shall include the following information:

a) a reference to this annex (EN 15534-6:2015, Annex D);

b) all the information necessary for identification of the element of fence tested, including type, source, manufacturer's code number and history, where these are known;

c) the detailed description of the test specimens;

d) the conditioning and test conditions;

e) the number of specimens tested;

f) the impact energy W, the number of drops and drop height, and the results of the visual examination as recorded in D.5;

g) any factors which may have affected the results, such as any incidents or any operating details not specified in this annex.

Bibliography

[1] EN 15347, *Plastics — Recycled Plastics — Characterisation of plastics wastes*

[2] ISO 15270, *Plastics — Guidelines for the recovery and recycling of plastics waste*

[3] EN 335:2013, *Durability of wood and wood-based products — Use classes: definitions, application to solid wood and wood-based products*

[4] EN 596, *Timber structures — Test methods - Soft body impact test of timber framed walls*

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