

Approval body for construction products  
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and  
Laender Governments



## European Technical Assessment

ETA-14/0178  
of 8 May 2019

English translation prepared by DIBt - Original version in German language

### General Part

Technical Assessment Body issuing the  
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

FHS string stair

Product family  
to which the construction product belongs

Prefabricated stair with steps and strings made of solid  
wood or wood based products for use as an indoor stair in  
buildings

Manufacturer

FHS Treppen GmbH  
Kampenwandstraße 8  
83224 Grassau  
DEUTSCHLAND

Manufacturing plant

Frisch Holz-Systembau

This European Technical Assessment  
contains

15 pages including 3 annexes which form an integral part  
of this assessment

This European Technical Assessment is  
issued in accordance with Regulation (EU)  
No 305/2011, on the basis of

EAD 340006-00-0506

This version replaces

ETA-14/0178 issued on 21 August 2014

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## Specific Part

### 1 Technical description of the product

The FHS String stair is a prefabricated stair system, which consists of steps, strings and system fasteners. The steps are connected with the strings by system fasteners on both sides. The steps and strings are made of solid wood, the system fasteners are made of steel.

The product description is given in Annex A. The material values, dimensions and tolerances of the components of the stair not indicated in the annexes shall correspond to the values laid down in the technical documentation<sup>1</sup>.

### 2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the stair is used in compliance with the specifications and conditions given in Annex B.

The verification and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the stair of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

<sup>1</sup> The technical documentation comprises all information of the holder of this ETA necessary for the production, installation and maintenance of the stair; these are in particular the structural analysis, design drawings and the manufacturer's installation instructions. The part to be treated confidentially is deposited with Deutsches Institut für Bautechnik and, as far as this is relevant to the tasks of the approved bodies involved in the procedure of the AVCP system, shall be handed over to the approved body.

### 3 Performance of the product and references to the methods used for its assessment

#### 3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Load-bearing capacity of stair	See Annex C2
Load-bearing capacity of fixings	See technical documentation of this European Technical Assessment
Load/displacement behaviour	See Annex C2
Vibration behaviour	First natural frequency: $f_1 \geq 5$ Hz (inclusive a single mass of 100 kg) Deflection under a single load $F = 1$ kN: $w \leq 5$ mm
Prevention of progressive collapse	Failure of individual components of the stair does not lead to a progressive collapse of the complete stair
Residual load-bearing capacity	Local material failure does not lead to an abrupt total loss of load-bearing capacity of the stair
Long-term behaviour	Load-bearing capacity are ensured under an appropriate use and maintenance over the indicated working life
Resistance to earthquakes	No performance assessed
Durability against physical, chemical and biological agents	Adequate durability for the intended use under an appropriate use and maintenance

#### 3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	See Annex A6
Resistance to fire	No performance assessed

#### 3.3 Hygiene, health and the environment (BWR 3)

Essential characteristic	Performance
Release of formaldehyde	Sold wood: Wood adhesive does not contain formaldehyde Wood based products: Class E1
Release of pentachlorophenol	No pentachlorophenol treated materials are used
Radioactive emission	Not relevant

**3.4 Safety in use (BWR 4)**

Essential characteristic	Performance
Geometry	See Annex C1
Slipperiness	No performance assessed
Equipment of the stair for a safe use	No performance assessed
Safe breakage of components	No brittle failure of individual components made of wood
Impact resistance	No performance assessed

**4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base**

In accordance with the European Assessment Document EAD No. 340006-00-0506 the applicable European legal act is: 1999/89/EC

The System to be applied is: 2+

In addition, with regard to reaction to fire for products covered by the European Assessment Document EAD No. 340006-00-0506 the applicable European legal act is: 2001/596/EC

The System to be applied is: 4

**5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document**

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

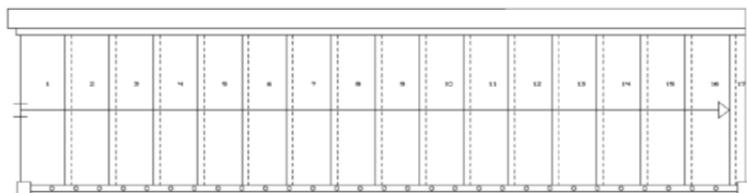
Issued in Berlin on 8 May 2019 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow  
Head of Department

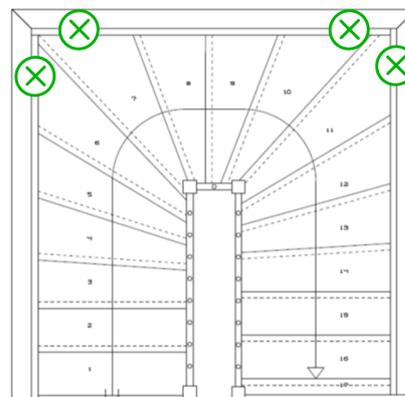
*beglaubigt:*  
Stiller

### Types of Plan without landing

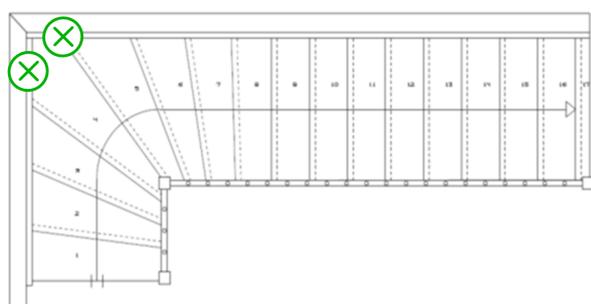
**Type G**



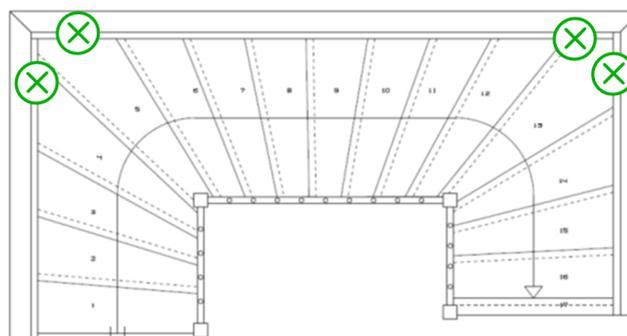
**Type H**



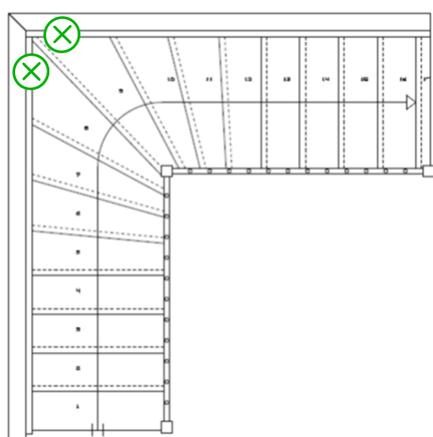
**Type V1**



**Type VV**



**Type V2**



⊗ Additional support for vertical loads

Horizontal fixings to the wall according to technical documentation

A maximum of 18 rises possible, depending on the type of plan and the wood species according to the technical documentation

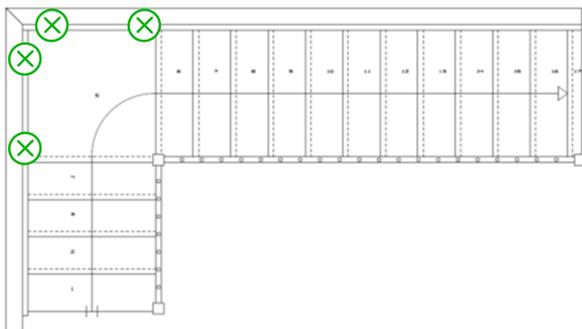
**FHS string stair**

Product (Types of plan without landing)

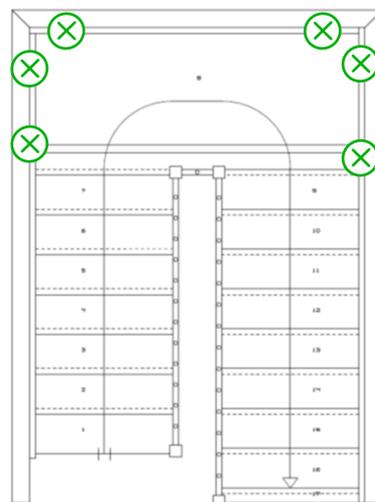
**Annex A1**

### Types of Plan without landing

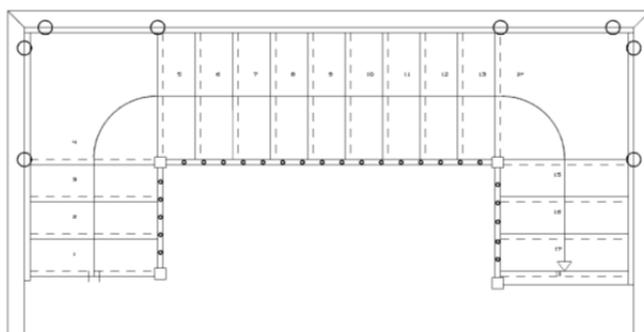
**Type GPoV**



**Type GPoH**



**Type GPoVV**



Additional support for vertical loads

Horizontal fixings to the wall according to technical documentation

A maximum of 18 rises is possible, depending on the type of plan and the wood species according to the technical documentation

### Types of construction

open



with risers



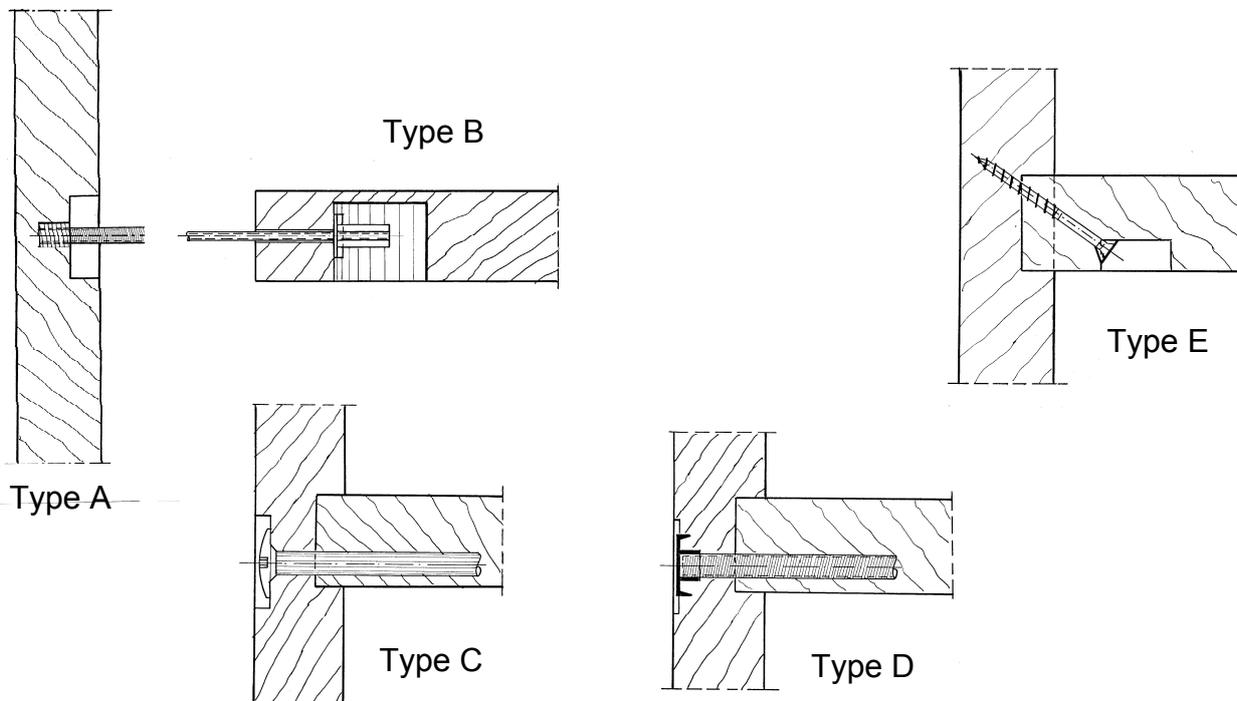
**FHS string stair**

Product (Types of plan with landing and types of construction)

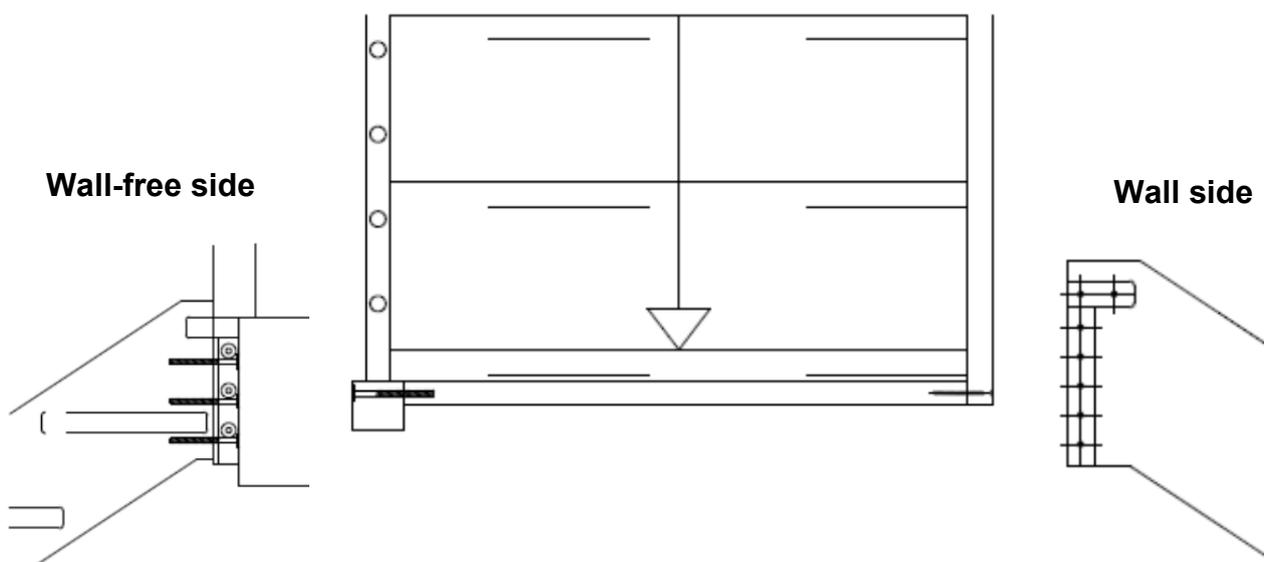
**Annex A2**

### Step-string-joint

(Relationship of joints to the wood species and types of plan according to the technical documentation)



### Joint at top



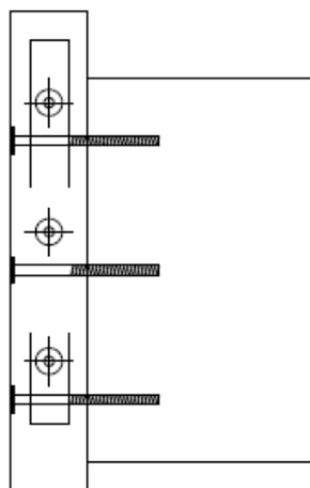
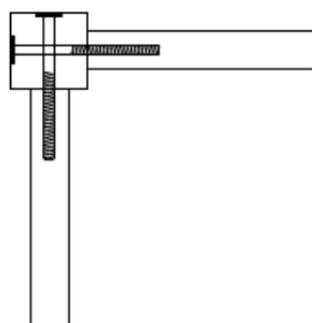
**FHS string stair**

Step-string-joint, Joint at top

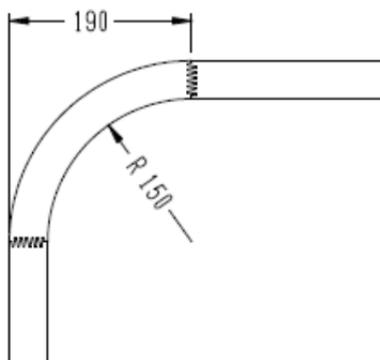
**Annex A3**

### String-corner-joint

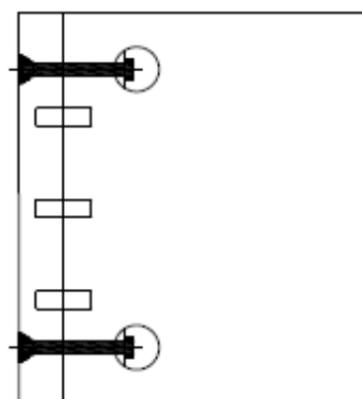
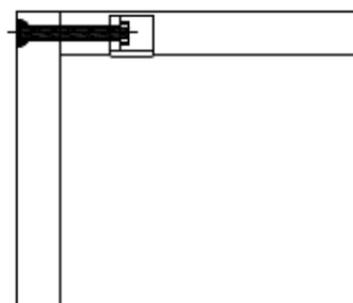
**Wall-free side**  
Type post



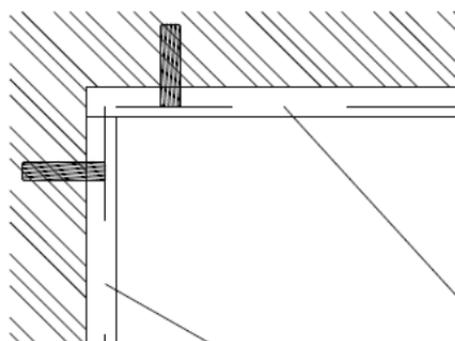
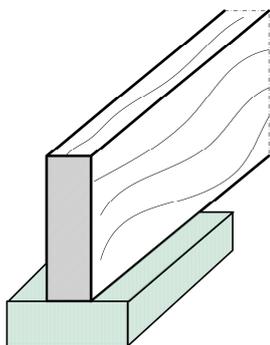
**Wall-free side**  
Type finger jointed



**Wall side / Wall-free side**  
Type butt jointed



### Intermediate support



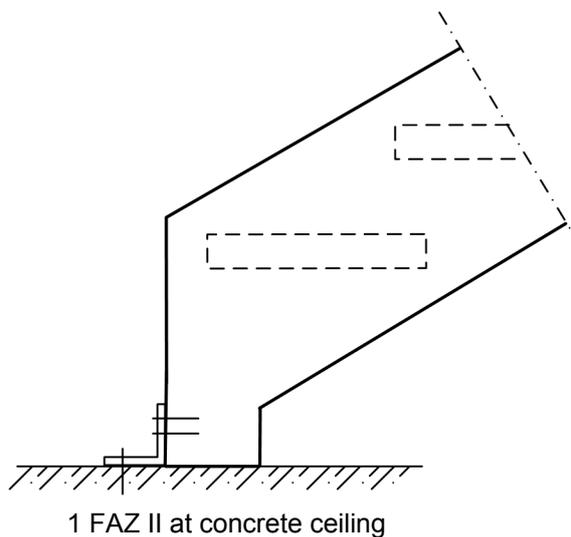
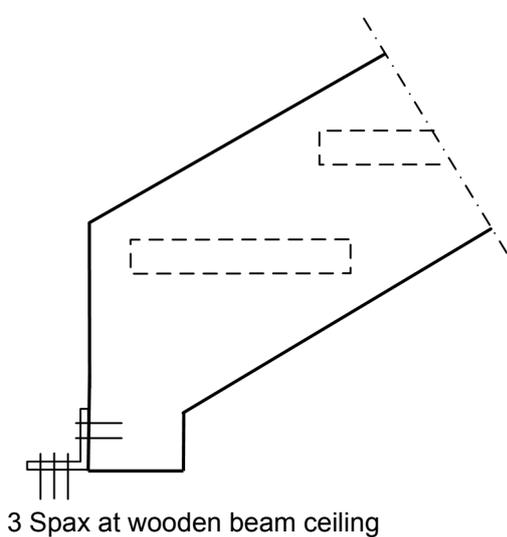
More details according to technical documentation

### FHS string stair

String-corner-joint, Intermediate support

**Annex A4**

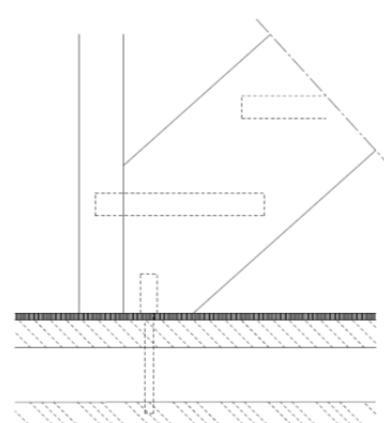
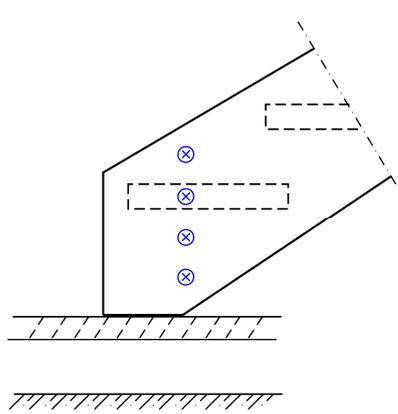
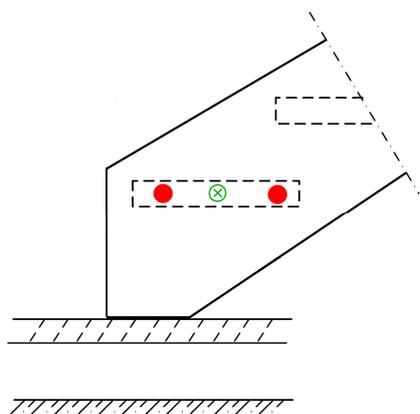
**Joint at bottom  
(Wall side, wall-free side)**



**Joint at bottom**

**Wall side**

**Wall-free side**



More details according to technical documentation

**FHS string stair**

Joint at bottom

**Annex A5**

**Table 1: Minimum dimensions of components of stair and reaction to fire**

Component of stair	Material <sup>1)</sup>	Dimension		Value	Reaction to fire
Step	Solid wood/wood based product <sup>2)</sup>	Thickness	[mm]	40	D-s2, d0
String	Solid wood/ wood based product <sup>2)</sup>	Group 1 Type V2 Group 2	Width x Height [mm]	40 <sup>4)</sup> x 300	D-s2, d0
		Group 1 all other Types		40 <sup>4)</sup> x 280	
Angle	Steel	- <sup>3)</sup>			A1
System fastener	Steel	- <sup>3)</sup>			A1

<sup>1)</sup> Characteristic values of material according to technical documentation

<sup>2)</sup> Only wood of following species:

Group 1: birch, beech, oak, acacia, maple, ash, pine, merbau, doussie, larch, nut tree, elm, cheery tree

Group 2: spruce, multiplex

<sup>3)</sup> According to technical documentation

<sup>4)</sup> Minimum 44 mm at butt jointed strings at the wall-free side

**FHS string stair**

Minimum dimensions of components of stair and reaction to fire

**Annex A6**

## Specification of intended use (Part 1)

### Intended use:

- European Technical Assessment applies for a construction system.
- For the specific case of use the corresponding type of stair is manufactured within the context of the values defined in this European Technical Assessment.
- Values of this ETA apply to all types of stairs, the real dimensions follow in accordance with the relevant case of use.

### Stair subject to:

- Static and quasi static loads

### Use conditions:

- Indoor stair
- Air temperatures between +5 °C and +30 °C
- Relative air humidity between 30% and 70%
- To the individual requirements handrail and barrier can be attached to the stair optionally. Conditions for possible handrail/barrier:

Dead load ≤ 0.15 kN/m

Height ≤ 1.00 m

Distance of baluster ≤ 0.27 m

### Design:

- Design of the stair according to the annexes and the technical documentation of this European Technical Assessment.
- Fastening of the stair to the construction works according to the annexes and the technical documentation of this Technical European Assessment.
- Verification of the transmission of loads to the construction works by the civil engineer responsible for the construction works.
- Load bearing capacity at ultimate limit state:

$$q_k \cdot \gamma_Q \leq q_{RK} / \gamma_M$$

$$Q_k \cdot \gamma_Q \leq Q_{RK} / \gamma_M$$

$$h_k \cdot \gamma_Q \cdot \psi_0 \leq h_{RK} / \gamma_M$$

with

$q_{RK}, Q_{RK}, h_{RK}$ : characteristic values of resistance; see Table 3

$\gamma_M$ : recommended material partial safety factor; see Table 3

$q_k, Q_k, h_k$ : characteristic values of imposed loads according to EN 1991-1-1:2002 + AC:2009

$\gamma_Q = 1.5$ : recommended partial safety factor, in absence of other national regulations

$\psi_0 = 0.7$ : recommended combination factor, in absence of other national regulations

- Maximum characteristic values of imposed loads under consideration of the partial factors mentioned above; see Table 5

**FHS string stair**

Specification of intended use (Part 1)

**Annex B1**

### Specification of intended use (Part 2)

**Installation:**

- Installation by personal appropriately trained and authorized by the manufacturer by means of the technical documentation of this European Technical Assessment
- Installation only in the way as specified in the technical documentation of this European Technical Assessment
- Installation of timber components when moisture content of timber components is  $8 \pm 2 \%$
- Sufficient support of the stair when assembling
- Installation of stair components without imposed deformations
- Installation of stair components without significant defects and cracks
- Replacing of stair components, which begin tearing when assembling
- Bolted connection are protected such that they will not be loosened by vibrations

**Indication of the manufacturer:**

- Ensure that all persons involved will be appropriately informed about the specific conditions according to sections 1 and 2 (including the annexes to which reference is being made as well as the not confidential parts of the technical documentation deposited to this European Technical Assessment)
- Packaging of timber components such that the wood moisture is  $8 \pm 2 \%$  during transport and storage
- Instructions for use should provide information as to use, maintenance and repair of the stair. Including the information of avoidance of moisture penetration of the timber components

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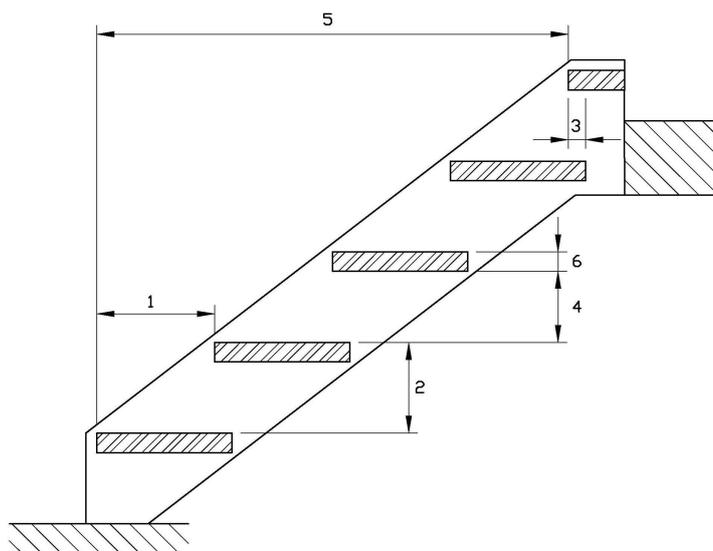
<b>FHS string stair</b>	<b>Annex B2</b>
Specification of intended use (Part 2)	

**Table 2: Geometry**

Designation			Dimension	
			Minimum	Maximum
Going	Step on walking line <sup>1)</sup>	[mm]	210	370 <sup>2)</sup>
	Tapered step	[mm]	100 <sup>2) 3)</sup>	570 <sup>2) 4)</sup>
Rise of the stairs <sup>1)</sup>		[°]	140 <sup>2)</sup>	210
Pitch of the walking line <sup>1)</sup>		[mm]	21	45
Overlap of the steps	Wall side	[mm]	0	- <sup>5)</sup>
	Wall-free side	[mm]	0	- <sup>5)</sup>
Number of rises	Group 1	[-]	3	18 <sup>6)</sup>
	Group 2	[-]	3	16
Openings	Between stair and wall	[mm]	- <sup>5)</sup>	0
	Between consecutive steps	[mm]	- <sup>5)</sup>	170
Clear width of stairs		[mm]	500	960
Minimum headroom		[mm]	- <sup>5)</sup>	
Length of the flight	Group 1	[mm]	- <sup>5)</sup>	4590 <sup>6) 7)</sup>
	Group 2	[mm]	- <sup>5)</sup>	4050
Thickness of steps		[mm]	40	- <sup>5)</sup>

- 1) Values are constant within one flight
- 2) Tolerance between nominal value and actual value = ± 5 mm
- 3) Wall-free side of tapered step
- 4) Wall side of tapered step
- 5) Not relevant
- 6) Type V2 in wood species elm, cherry tree, pine and larch max. 16 rises (L = 4050 mm)
- 7) Landing stair max. 5400 mm

- 1 **Going**
- 2 **Rise**
- 3 **Overlap**
- 4 **Opening between consecutive steps**
- 5 **Length of the flight**
- 6 **Thickness of steps**



**FHS string stair**

Geometry of the stairs

**Annex C1**

**Table 3: Load-bearing capacity - Characteristic values of resistance**

Component	Type of loading	Characteristic values of resistance			$\gamma_M$
Flight	vertical variable uniformly distributed load	$q_{Rk}$	[kN/m <sup>2</sup> ]	6.8	1.5 <sup>1)</sup>
	vertical variable single load	$Q_{Rk}$	[kN]	4.5	
	horizontal variable uniformly distributed load on barrier	$h_{Rk}$	[kN/m]	0.8	
Joint at bottom and top	vertical variable uniformly distributed load	$q_{Rk}$	[kN/m <sup>2</sup> ]	5.0	1.1 <sup>2)</sup>
	vertical variable single load	$Q_{Rk}$	[kN]	3.3	
	horizontal variable uniformly distributed load on barrier	$h_{Rk}$	[kN/m]	0.6	

1) Recommended partial safety factor (wood decisive), in absence of other national regulations

2) Recommended partial safety factor (steel decisive), in absence of other national regulations

**Table 4: Deflections under loading**

Deflections of the flight under uniformly distributed load				
Uniformly distributed load		$q_k$	[kN/m <sup>2</sup> ]	3.0
Length of the median line of the flight	Group 1	L	[mm]	4590
	Group 2	L	[mm]	4050
	Landing stair	L	[mm]	5400
Deflection related to the median line of flight		w	[-]	≤ L/200
Deflection of the step under single point load				
Single load		$Q_k$	[kN]	2.0
Clear width of the stair		L	[mm]	960
Deflection related to the clear width of stair		w	[-]	≤ L/200

**Table 5: Imposed loads**

Type of loading	Imposed loads		
Vertical variable uniformly distributed load	$q_k$	[kN/m <sup>2</sup> ]	3.0
Vertical variable single load	$Q_k$	[kN]	2.0
Horizontal variable uniformly distributed load on barrier	$h_k$	[kN/m]	0.5

**FHS string stair**

Load-bearing capacity - Characteristic values of resistance  
Deflections under loading  
Imposed loads

**Annex C2**