

Approval body for construction products  
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and  
Laender Governments



## European Technical Assessment

**ETA-07/0298**  
**of 1 December 2017**

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

DHTI - TSH folded plate stair

Product family  
to which the construction product belongs

Prefabricated stair with steps and risers made of wood-  
based panels for use as an indoor stair in buildings

Manufacturer

TSH System GmbH  
Gesellschaft für Systemlösungen des Tischler-  
und Schreinerhandwerks mbH  
Fürstenrieder Straße 250  
81377 München  
DEUTSCHLAND

Manufacturing plant

Werk 1 bis 85

This European Technical Assessment  
contains

14 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

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## Specific Part

### 1 Technical description of the product

The DHTI - TSH folded plate stair is a prefabricated stair system, which consists of steps and risers, as well as fasteners and wall ties. The steps and risers are connected bending resistant. On the wall side each step is equipped with two wall ties which are anchored in the staircase wall. Alternatively, the staircase wall may also be replaced by a stringer.

The steps and risers are made of wood-based panels, the fasteners and the wall ties are made of steel and the stringers are made of solid wood or 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 attestation of conformity, 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 steps.
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 A5
Fire resistance	No performance assessed

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

Essential characteristic	Performance
Release of formaldehyde	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
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

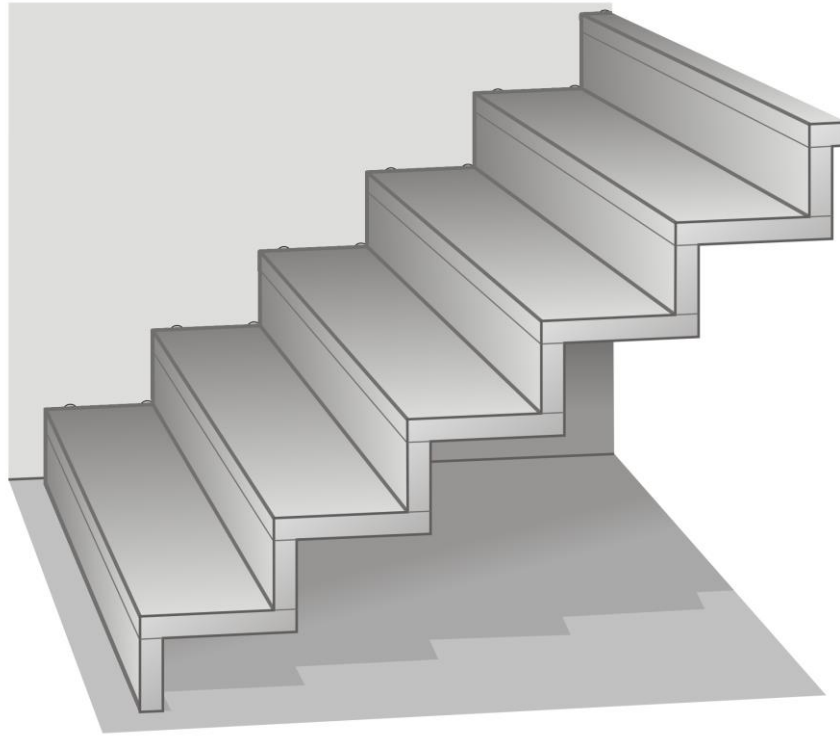
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 1 December 2017 by Deutsches Institut für Bautechnik

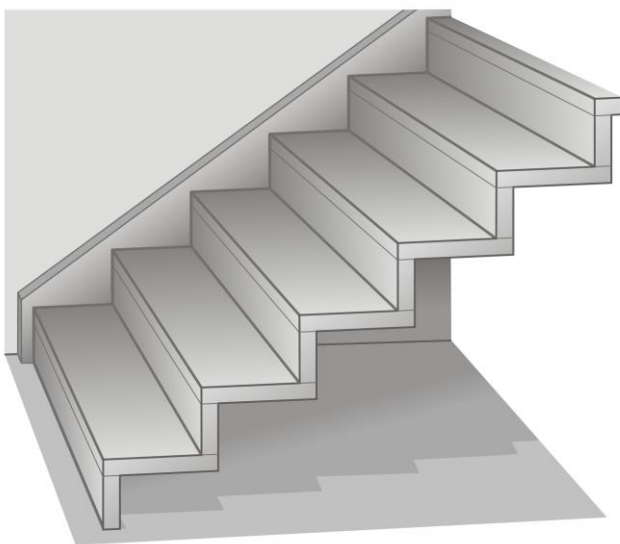
BD Dipl.-Ing. Andreas Kummerow  
Head of Department

*beglaubigt:*  
Stiller

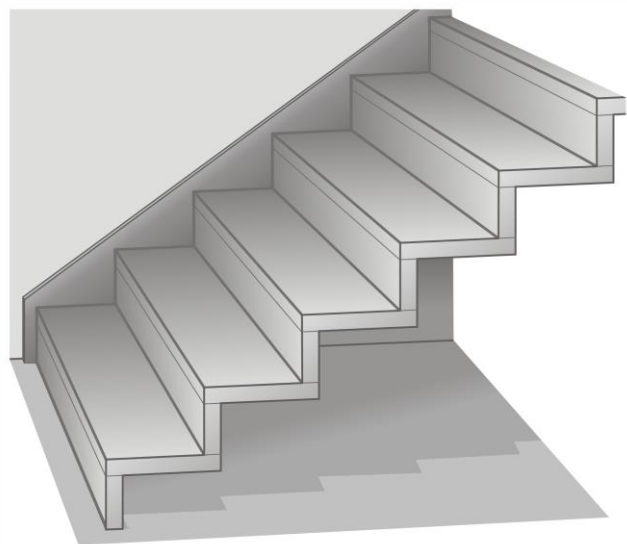
## Types of construction



### Wall ties



**Solid wood string**  
Chiselled or drilled



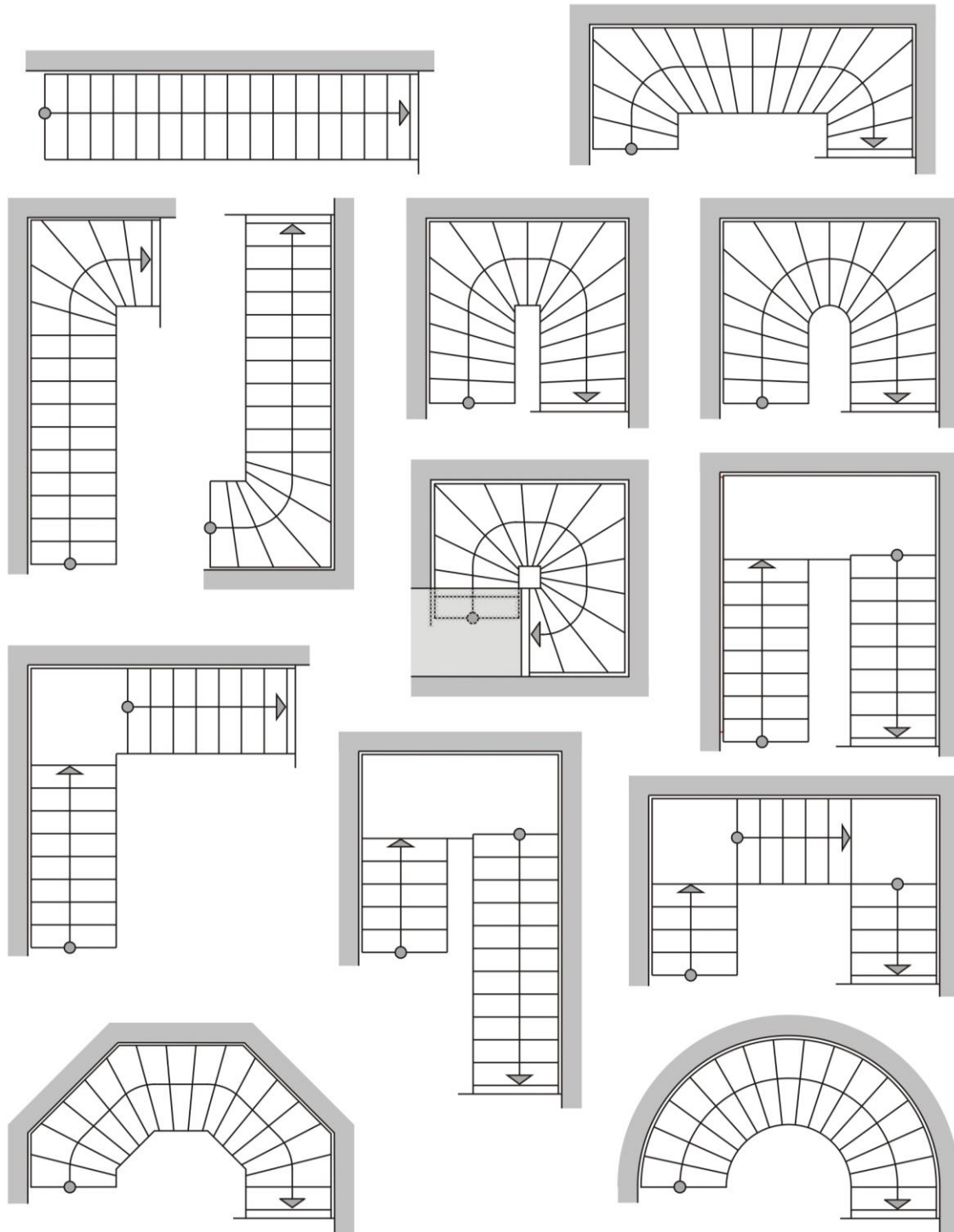
**Steel string**  
Screwed / bolted

**DHTI – TSH folded plate stair**

Product (Types of construction)

**Annex A1**

### Types of plan



Walking line is exemplified, position may be chosen freely within the walking zone, walking zone is 20 % of the clear width of the stair in the middle of the stair

Additional supports for vertical loads for types of construction with wall string according to the technical documentation

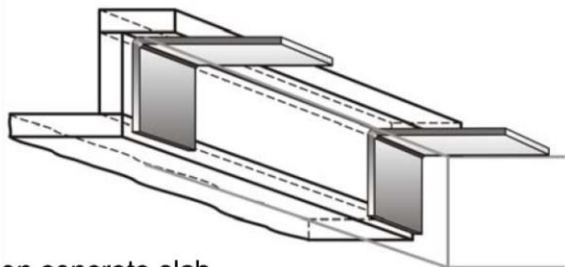
**DHTI – TSH folded plate stair**

Product (Types of plan)

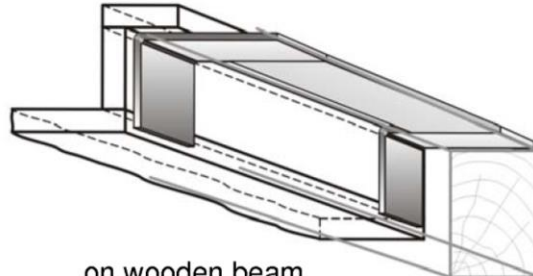
**Annex A2**

## Fixing of bottom step and top step (standard)

Alternatives according to technical documentation

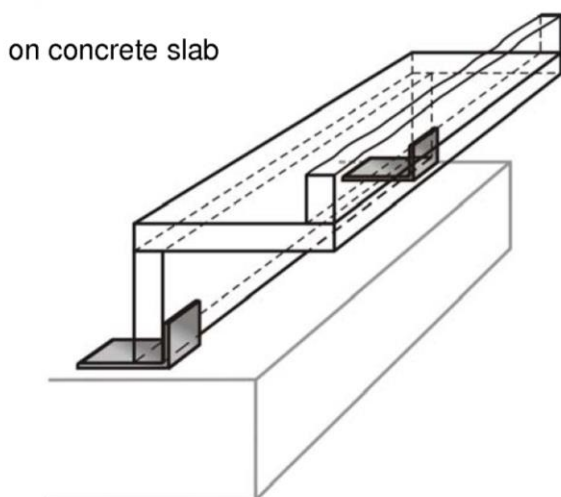


on concrete slab

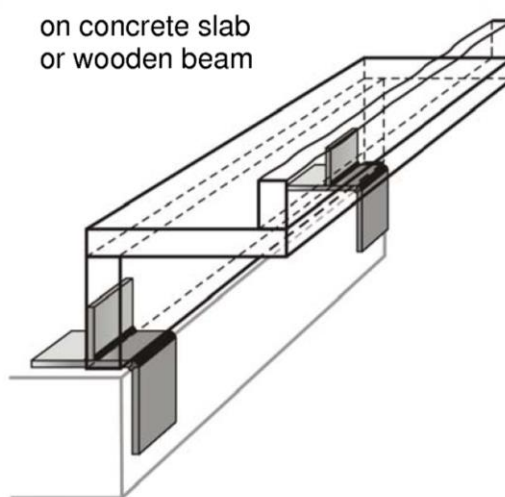


on wooden beam

Screwed and high performance fasteners according to technical documentation



on concrete slab



on concrete slab  
or wooden beam

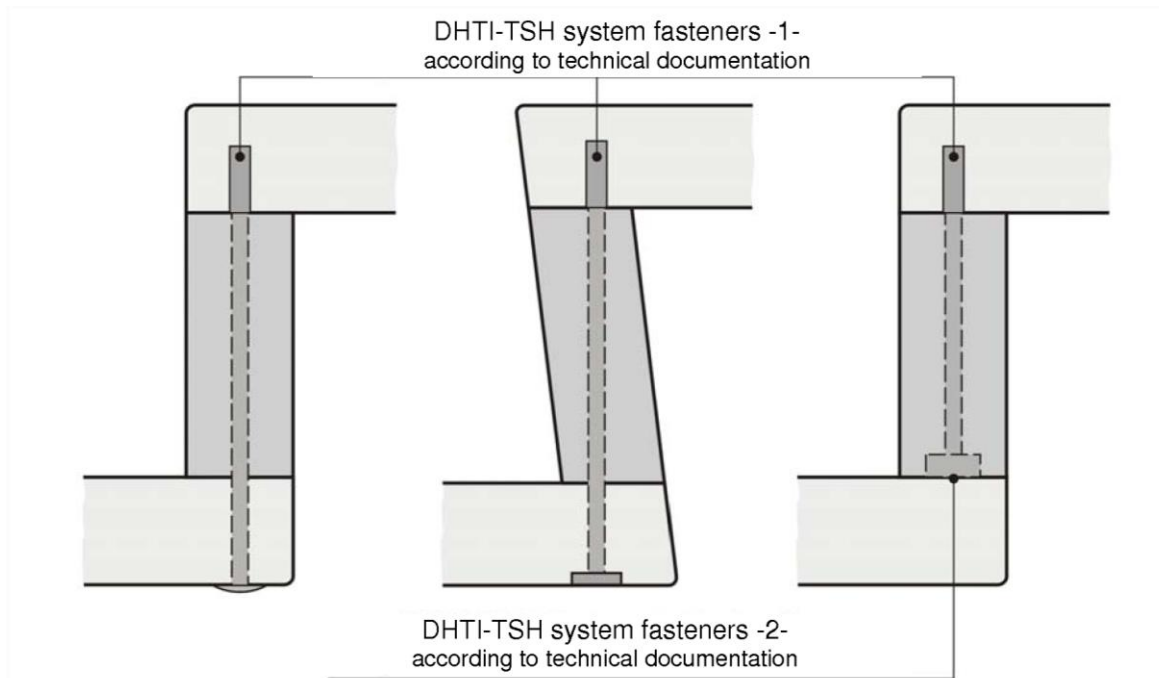
**DHTI – TSH folded plate stair**

Fixing of bottom step and top

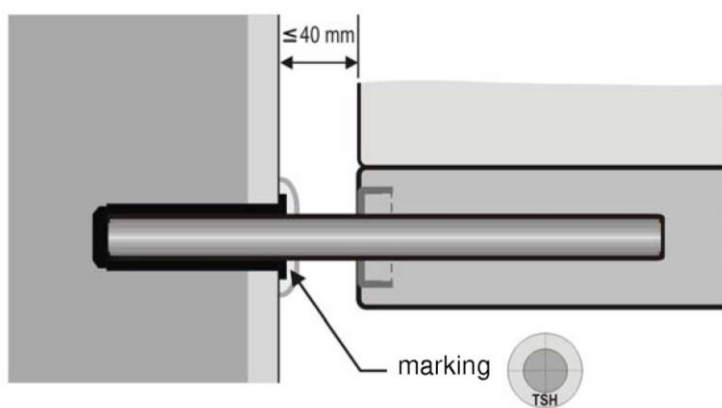
**Annex A3**



### Step – riser – joints



### Wall tie



- bearing sleeve (permanently elastic)
- round steel bar & 16 mm
- ferrule (edge strengthening according to technical documentation)
- plastic cover rosette

**DHTI – TSH folded plate stair**

Step – riser – joints, Wall tie

**Annex A4**

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

Component of stair	Material <sup>2)</sup>	Dimension		Value	Reaction to fire	
Steps	wood based panel type 1 <sup>3)</sup>	thickness	[mm]	52 <sup>4)</sup>	no performance assessed	
	wood based panel type 2 <sup>3)</sup>	thickness	[mm]	55 <sup>4)</sup>	no performance assessed	
Risers	wood based panel type 1 <sup>3)</sup>	thickness	[mm]	52 <sup>4)</sup>	no performance assessed	
	wood based panel type 2 <sup>3)</sup>	thickness	[mm]	55 <sup>4)</sup>	no performance assessed	
System fasteners	steel	- <sup>1)</sup>		- <sup>1)</sup>	A1	
Wall ties	round steel	diameter		[mm]	16	A1
		Embed-ment depth wall	Masonry	[mm]	70	
			Concrete	[mm]	40	
			String <sup>5)</sup>	[mm]	30	
			OSB <sup>5)</sup>	[mm]	30	
			Flake board <sup>5)</sup>	[mm]	32	
embedment depth step		[mm]	120			
Ferrule (wall tie)	steel	- <sup>1)</sup>		- <sup>1)</sup>	A1	
Bearing sleeve (wall tie)	plastics / rubber	diameter	[mm]	30	not relevant	
Strings	solid wood	height / width	[mm]	- <sup>1)</sup>	D-s2, d0	
	steel	height / width	[mm]	- <sup>1)</sup>	A1	

- 1) characteristic values according to technical documentation
- 2) characteristic values of materials according to technical documentation
- 3) layer composition according to technical documentation
- 4) straight flights with a length of  $2.50 \text{ m} \leq l \leq 3.50 \text{ m}$ :  $d = 60 \text{ mm}$ ,  
straight flights with a length of  $l > 3.50 \text{ m}$ :  $d = 65 \text{ mm}$
- 5) construction according to technical documentation

**DHTI – TSH folded plate stair**

Minimum dimensions of relevant stair components and reaction to fire

**Annex A5**

## 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  $\leq 0.31$  kN/m
  - Height  $\leq 1.00$  m
  - Distance of baluster  $\leq 1.08$  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

**DHTI – TSH folded plate 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

**DHTI – TSH folded plate stair**

Specification of intended use (Part 2)

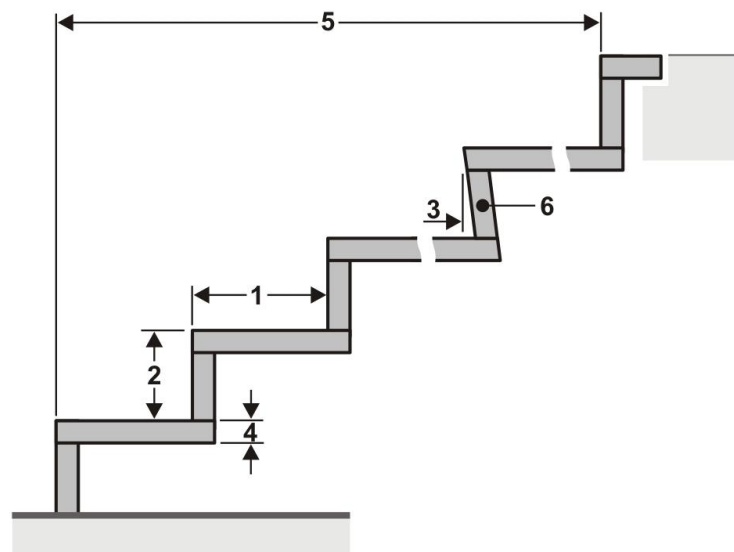
**Annex B2**

**Table 2: Geometry**

Designation			Dimension	
			Minimum	Maximum
Going	step on walking line <sup>1)</sup>	[mm]	210	370 <sup>2)</sup>
	tapered step	[mm]	60 <sup>2) 3)</sup>	600 <sup>2) 4)</sup>
Rise of the stairs <sup>1)</sup>		[mm]	140 <sup>2)</sup>	210
Pitch of the walking line <sup>1)</sup>		[°]	21	45
Overlap of the steps		[mm]	0	20
Number of rises		[-]	3	17 <sup>6)</sup>
Openings	between stairs and wall	[mm]	- <sup>5)</sup>	40
	between consecutive steps	[mm]	- <sup>5)</sup>	- <sup>5)</sup>
Clear width of stairs		[mm]	500	1000
Minimum headroom		[mm]	- <sup>5)</sup>	
Length of the flight		[mm]	- <sup>5)</sup>	4320
Thickness of steps		[mm]	52/55 <sup>7)</sup>	- <sup>5)</sup>

- 1) values are constant within one flight
- 2) tolerance between nominal value and actual value =  $\pm 5$  mm (1.rise  $\pm 15$  mm)
- 3) inside of tapered step
- 4) outside of tapered step
- 5) not relevant
- 6) straight flight according to technical documentation
- 7) according to Table 1

- 1 going
- 2 rise
- 3 overlap
- 4 thickness of steps
- 5 length of the flight
- 6 alternative riser



**DHTI – TSH folded plate stair**

Geometry of stair

**Annex C1**

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

Type of loading	Characteristic values of resistance			$\gamma_M$ <sup>1)</sup>
vertical variable uniformly distributed load	$q_{R,k}$	[kN/m <sup>2</sup> ]	6,8	1,5
vertical variable single load	$Q_{R,k}$	[kN]	4,5	
horizontal variable uniformly distributed load on barrier	$h_{R,k}$	[kN/m]	1,1	

<sup>1)</sup> Recommended partial safety factor, in absence of other national regulations

**Table 4: Deflections under loading**

Deflection 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	L	[mm]	4320
deflection under load $F_S$ related to the median line of the 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]	1000
deflection under load $F_S$ related to the clear width of the stair	w	[-]	≤ L/200

**Table 5: Imposed loads**

Type of loading	Imposed loads		
vertical variable uniformly distributed load	q	[kN/m <sup>2</sup> ]	3.0
vertical variable single load	Q	[kN]	2.0
horizontal variable uniformly distributed load on barrier	h	[kN/m]	0.5

**DHTI – TSH folded plate stair**

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

**Annex C2**