

Approval body for construction products  
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and  
Laender Governments



## European Technical Assessment

**ETA-08/0133**  
**of 18 December 2018**

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

Krieger WE1- and WE2-Stair in load-bearing bolt style or  
folded plate style

Product family  
to which the construction product belongs

Prefabricated stair with steps made of solid wood and  
load-bearing bolts for use as an indoor stair in buildings

Manufacturer

Treppenbau  
"System Krieger" GmbH  
Gewerbegebiet Wolf  
56841 Traben-Trarbach  
DEUTSCHLAND

Manufacturing plant

Krieger Treppen GmbH plant 1 to 99

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

This version replaces

ETA-08/0133 issued on 29 May 2018

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## Specific Part

### 1 Technical description of the product

The Krieger WE1- and WE2-Stair in load-bearing bolt style or folded plate style is a prefabricated stair system, which consists of steps, load-bearing bolts and wall ties. The stair can also be formed as a folded plate stair by additional risers.

On the wall-free side the steps of the WE1-stair in load-bearing bolt style are connected with each other by a load-bearing bolt. The steps of the WE2-stair in load-bearing bolt style are connected with each other by load-bearing bolts on the wall side and on the wall-free side. In case of the folded plate style there are three load-bearing bolts at least inside of the riser. On the wall side each step is equipped with two wall tie, which are anchored in the staircase wall. Alternatively to the support by wall ties a stringer can be used.

The steps and risers are made of solid wood, the load-bearing bolts are made of steel and solid wood, the fasteners and wall ties 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 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 A4
Fire resistance	No performance assessed

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

Essential characteristic	Performance
Release of formaldehyde	Wood adhesive does not contain formaldehyde
Release of pentachlorophenol	No pentachlorophenol treated materials are used
Radioactive emission	Not relevant

English translation prepared by DIBt

**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**

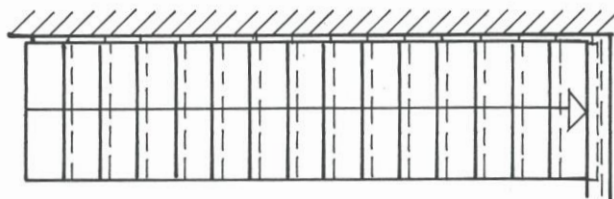
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 18 December 2018 by Deutsches Institut für Bautechnik

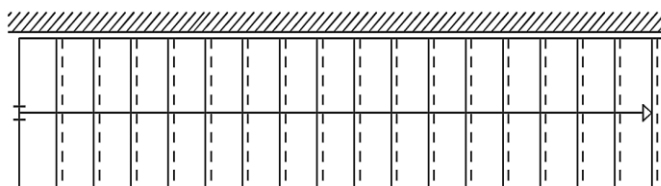
BD Dipl.-Ing. Andreas Kummerow  
Head of Department

*beglaubigt:*  
Stiller

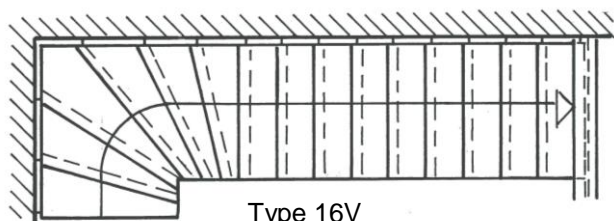
Types of plan



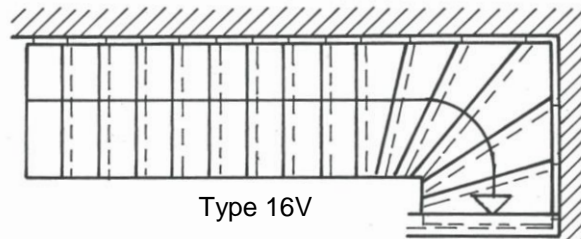
Type 16G



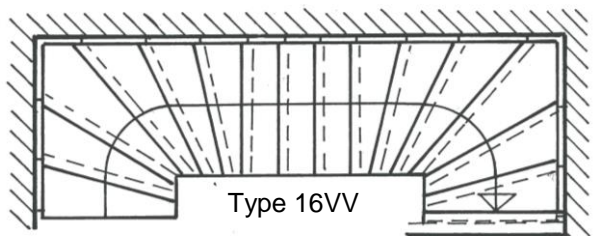
Type 18G



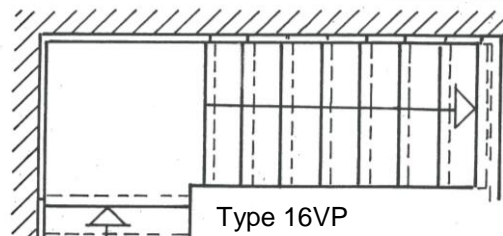
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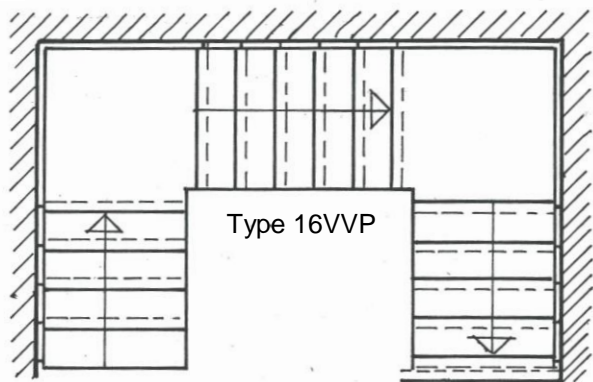
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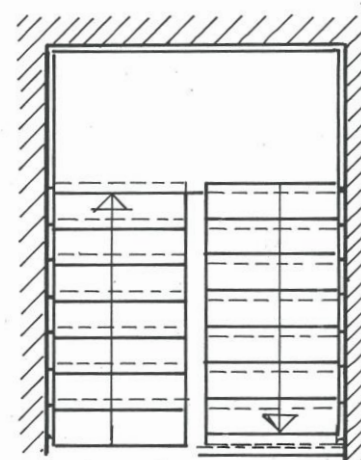
Type 16VV



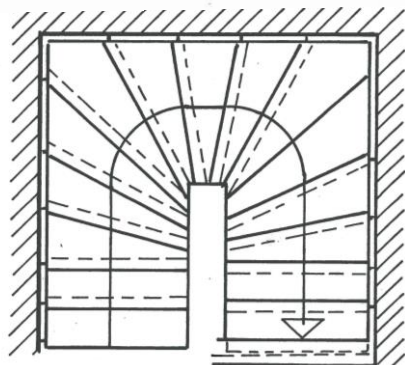
Type 16VP



Type 16VVP



Type 16HP



Type 16H

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

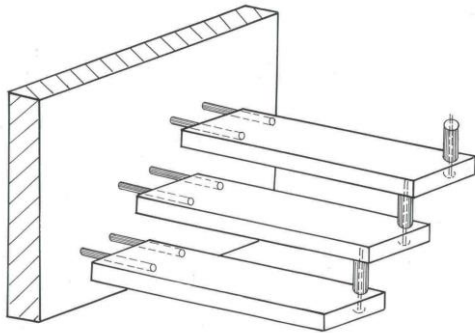
(Additional supports according to Annex A5, Table 2 und technical documentation)

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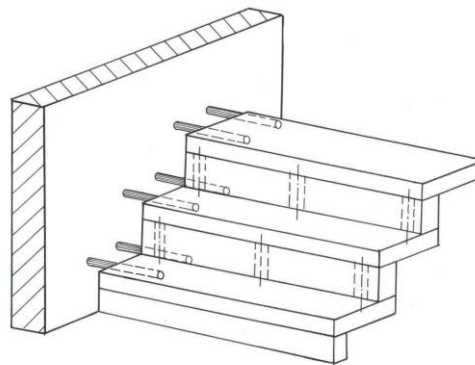
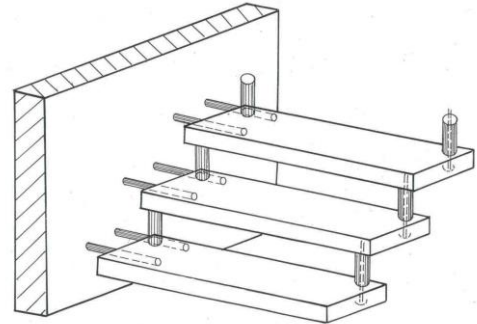
<p><b>Krieger WE1- and WE2- stair in load-bearing-bolt style or folded plate style</b></p>	<p><b>Annex A1</b></p>
<p>Product (Types of plan)</p>	

### Construction

WE1-Stair



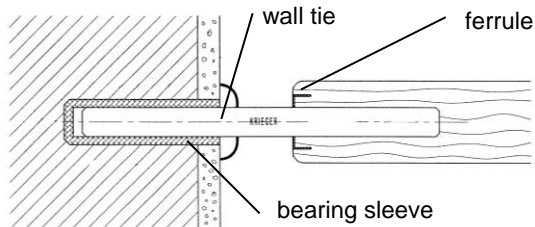
WE2-Stair



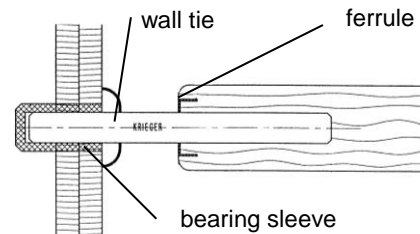
Stair in folded  
plate style

### Wall ties

Concrete or masonry



OSB-plate



Minimum wall thickness and minimum strength of wall materials according to the technical documentation

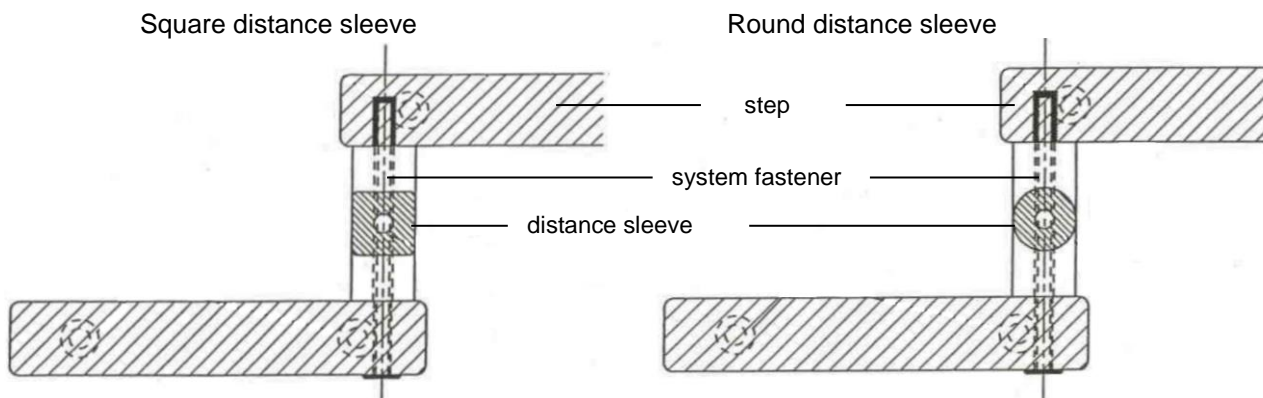
**Krieger WE1- and WE2- stair in load-bearing-bolt style or folded plate style**

Construction, Wall ties

**Annex A2**

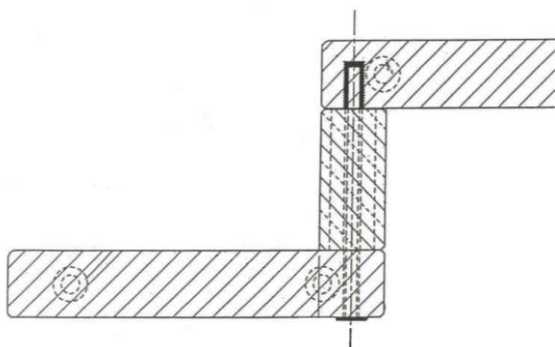
### Load-bearing bolts

#### Load-bearing bolt style

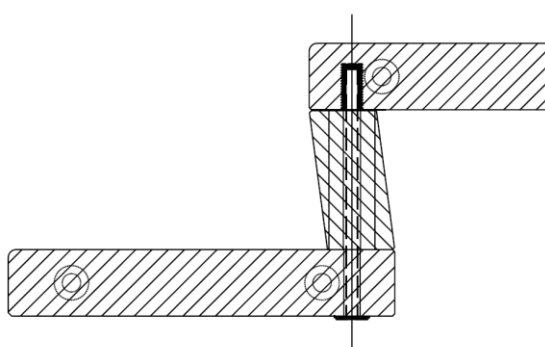


#### Folded plate style

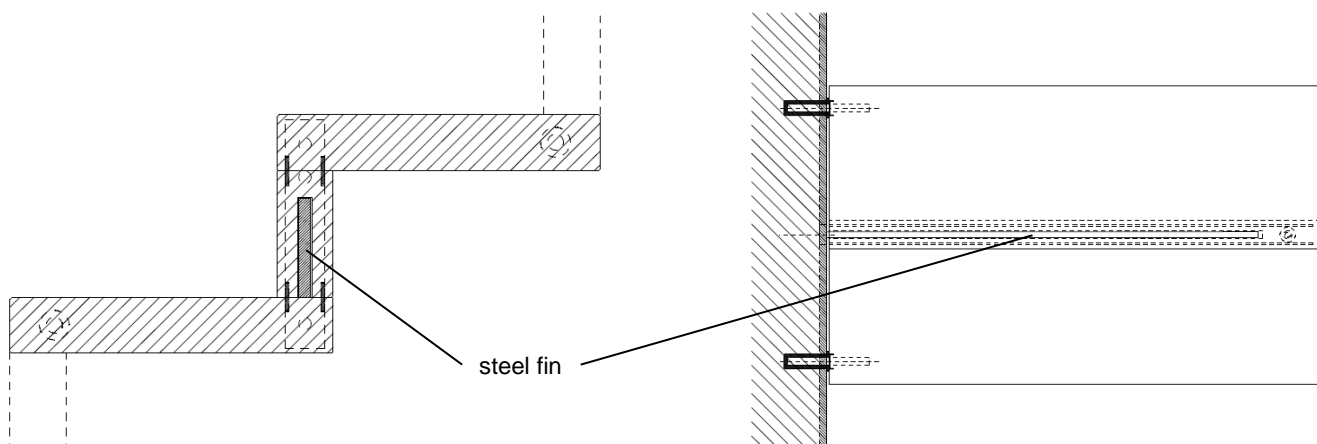
Load-bearing bolt and vertical riser



Load-bearing bolt and raked riser



#### Riser with steel fin for type of plan G18



Krieger WE1- and WE2- stair in load-bearing-bolt style or folded plate style

Load-bearing bolts, Steel fin for type of plan G18

**Annex A3**



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

Component	Material <sup>1)</sup>	Dimension		Value	Reaction to fire
Steps, risers	Solid wood <sup>2)</sup>	Thickness	[mm]	54	D-s2, d0
Load-bearing bolt - threaded rod	Steel	Diameter	[mm]	10	A1
Load-bearing bolt distance sleeve	Solid wood <sup>2)</sup>	Diameter	[mm]	45 <sup>3)</sup>	D-s2, d0
		Cross section a x b	[mm]	50 x 50 <sup>3)</sup>	
System fastener	Steel	- <sup>6)</sup>		- <sup>6)</sup>	A1
Wall tie	Round steel	Diameter	[mm]	16	A1
		Embedment depth wall	[mm]	80 / 40 / 30 <sup>5)</sup>	
		Embedment depth step	[mm]	80 (110) <sup>4)</sup>	
Bearing sleeve (wall tie)	Plastics	Diameter	[mm]	25	not relevant

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

<sup>2)</sup> Only hardwood of the following species: Beech, Oak, Ash, Maple, Nut tree, Acacia, Merbau

<sup>3)</sup> Type 18G, 16G and 16V according to Table 2

<sup>4)</sup> Value in brackets applies for oak and common ash

<sup>5)</sup> Embedment depth masonry: 80 mm, concrete: 40 mm, OSB-plate: 30 mm

<sup>6)</sup> Characteristic values according to technical documentation

**Krieger WE1- and WE2- stair in load-bearing-bolt style or folded plate style**

Minimum dimensions of relevant stair components and reaction to fire

**Annex A4**

**Table 2: Minimum dimensions of relevant stair components of straight flights and flights with one quarter turn**

Type of plan	Type of construction	Thickness of step	Section of load-bearing bolt	Steps without additional support	Length of the walking line between supports
18G	WE1	57 mm	Ø 45 and Ø 50 mm	6	≤ 1620 mm
	WE1	57 mm	50 x 50 mm	8	≤ 2160 mm
	folded plate style	57 mm	Riser with 3 bolts	11	≤ 2970 mm
	folded plate style	57 mm	Riser with 3 bolts	17 <sup>1)</sup>	≤ 4590 mm <sup>1)</sup>
16G	WE1	57 mm	Ø 45 und Ø 50 mm	6	≤ 1620 mm
			50 x 50 mm	8	≤ 2160 mm
	folded plate style	57 mm	Riser with 3 bolts	11	≤ 2970 mm
			60 mm	Riser with 4 bolts	15
	WE2	72 mm	Ø 50 mm	15	≤ 4050 mm
			70 mm	50 x 50 mm	15
66 mm			70 x 70 mm	15	≤ 4050 mm
16V	WE1	57 mm	Ø 45 mm	11	≤ 2970 mm
			Ø 50 mm	12	≤ 3240 mm
	folded plate style	57 mm	Riser with 3 bolts	14	≤ 3780 mm
			60 mm	Riser with 4 bolts	15
	WE2	60 mm	Ø 50 mm	15	≤ 4050 mm

<sup>1)</sup> Steel fin inside riser 7 and 13 according to Annex A3

**Krieger WE1- and WE2- stair in load-bearing-bolt style or folded plate style**

**Annex A5**

Minimum dimensions of relevant stair components of straight flights and flights with one quarter turn

## 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:

Type of plan:	16G, 16V, 16VV, 16H, 16VP, 16HP, 16VVP	18G, WE 1	18G, folded plate style
Dead load:	≤ 0.15 kN/m	≤ 0.23 kN/m	≤ 0.40 kN/m
Height:	≤ 1.00 m	≤ 1.00 m	≤ 1.00 m
Distance of baluster:	≤ 0.85 m	≤ 0.27 m	≤ 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 5

$\gamma_M$ : recommended material partial safety factor; see Table 5

$q_k$ ,  $Q_k$ ,  $h_k$ : 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 7

**Krieger WE1- and WE2- stair in load-bearing-bolt style or folded plate style**

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 and retightens the bolting of the load-bearing bolts and connections according to Annex A3 after the first heating season and the information on the relationship between moisture content of timber components, air temperature and relative air humidity

**Krieger WE1- and WE2- stair in load-bearing-bolt style or folded plate style**

Specification of intended use (Part 2)

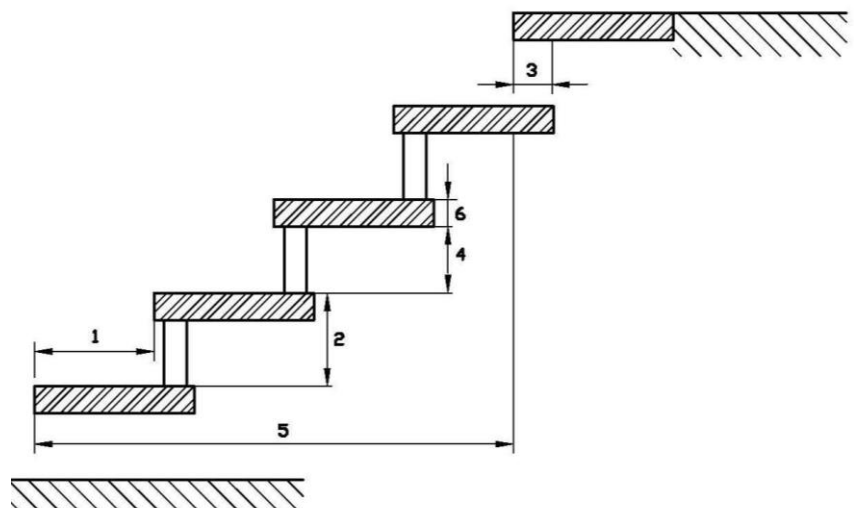
**Annex B2**

**Table 4: 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>	540 <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 <sup>6)</sup>	70
Number of rises		[-]	3	16 <sup>7)</sup>
Openings	between stairs and wall	[mm]	- <sup>5)</sup>	50
	between consecutive steps	[mm]	- <sup>5)</sup>	156
Clear width of stairs		[mm]	500	1000
Length of the flight		[mm]	- <sup>5)</sup>	4050 <sup>7)</sup>
Thickness of steps		[mm]	54	- <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) With riser
- 7) Type 18G max. 18 risers (L = 4590 mm)

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



**Krieger WE1- and WE2- stair in load-bearing-bolt style or folded plate style**

Geometry of the stair

**Annex C1**

**Table 5: 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	
Landing beam	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	

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 6: 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]	4050 <sup>1) 2)</sup>
deflection under load $F_S$ related to the median line of the flight	w	[-]	$\leq L/200$
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	[-]	$\leq L/200$

1) For types with additional support L= reference length = distance between supports

2) Type 18G max. L = 4590 mm

**Table 7: 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

**Krieger WE1- and WE2- stair in load-bearing-bolt style or folded plate style**

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

**Annex C2**