

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-07/0127
of 13 June 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

Kenngott WF2 - Stone stair

Product family
to which the construction product belongs

Load-bearing-bolt stair with steps made of natural stone
or artificial stone for use as an indoor stair in buildings

Manufacturer

Kenngott - Treppen Servicezentrale
Longlife - Treppen GmbH
Neulandstraße 31
74889 Sinsheim
DEUTSCHLAND

Manufacturing plant

Kenngott -Treppen, Werk 3

This European Technical Assessment
contains

16 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

European Assessment Document (EAD)
340006-00-0506

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Specific Part

1 Technical description of the product

The "Kenngott WF2 - Stone stair" is a prefabricated stair system, which consists of steps made of natural stone or artificial stone (cement bonded or reaction resin bonded), load-bearing bolts and wall ties.

The steps consist of two plates that are glued together by an intermediate GFK-layer.

On the wall-free side and on the wall side the steps are connected with each other by a load-bearing bolt. On the wall side each step is equipped with a wall tie, which is anchored in the staircase wall. In the area of openings in the wall alternatively a construction with double load-bearing bolts and strengthened wall ties at the beginning and at the end (according to Annex A3) or a stringer can be used. By using a stringer the steps are fastened to the stringer by an angle supported with a system fastener.

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 documentation¹.

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.

¹ 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 C4
Load-bearing capacity of fixings	See technical documentation of this European Technical Assessment
Load/displacement behaviour	See Annex C4
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	Not relevant
Release of pentachlorophenol	Not relevant
Radioactive emission	No performance assessed

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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 stair components
Impact resistance	Verified for steps made of natural stone or artificial stone up to a fall height of a steel weight (50 kg) of 200 mm

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 13 June 2017 by Deutsches Institut für Bautechnik

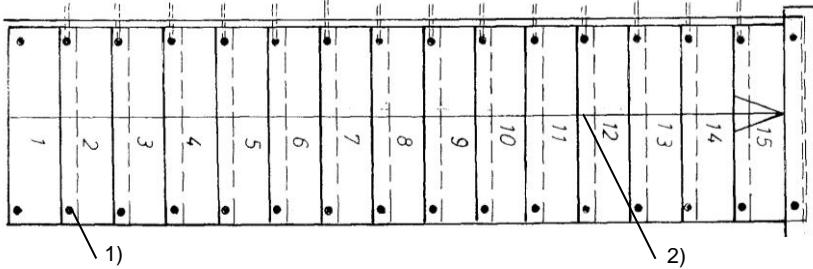
BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Stiller

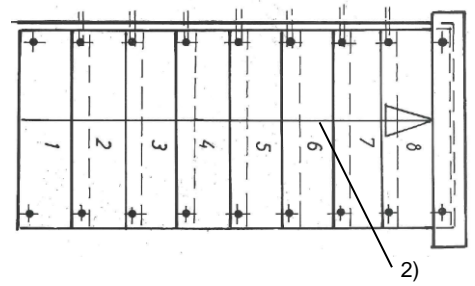
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Types of plan

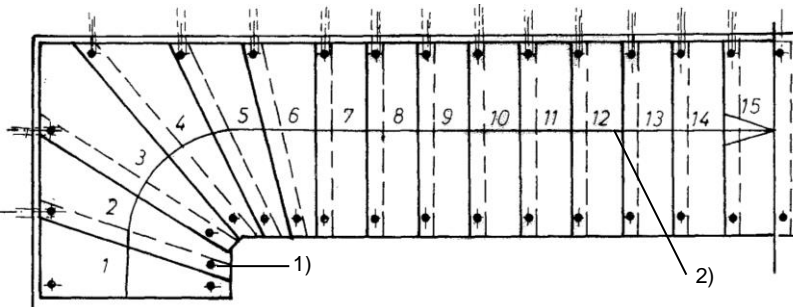
Type 16G



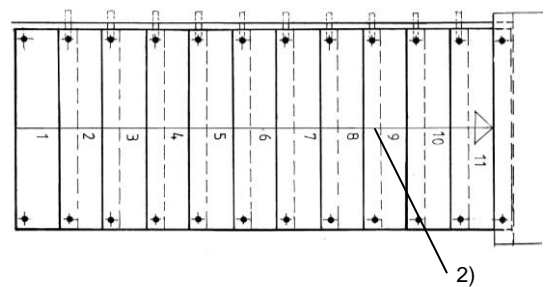
Type 9G



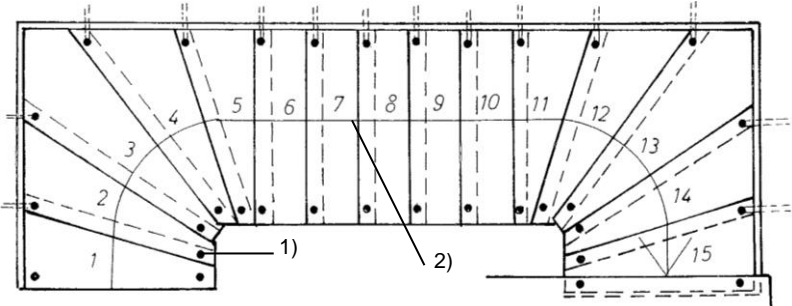
Type 16V



Type 12G

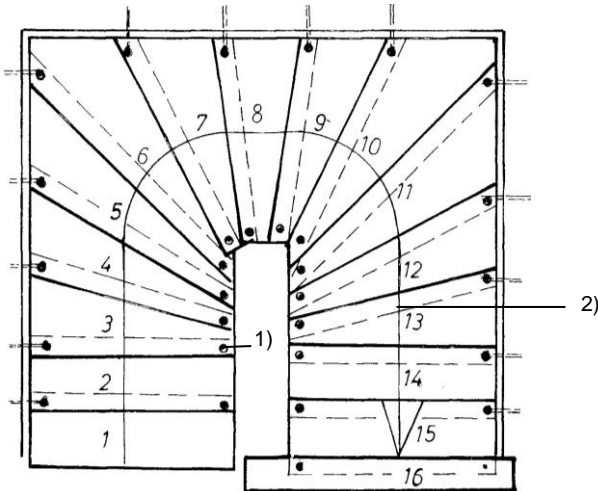


Type 16VV

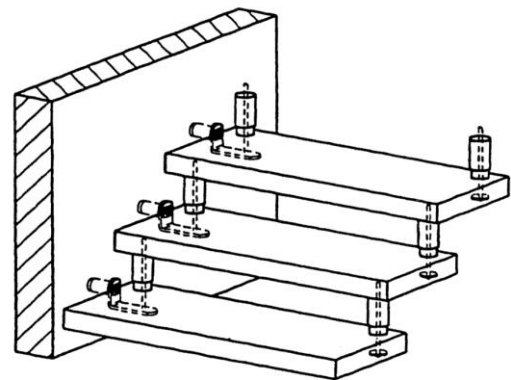


- 1) additional support (according to Annexes C2 and C3)
- 2) walking line is exemplified, position may be chosen freely within the walking zone, walking zone is 20 % of the clear width of the stair in the middle of the stair

Type 16H



Construction



Kenngott WF2 – Stone stair

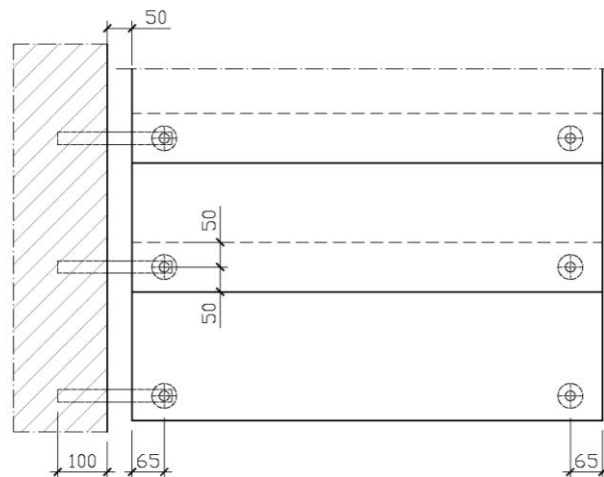
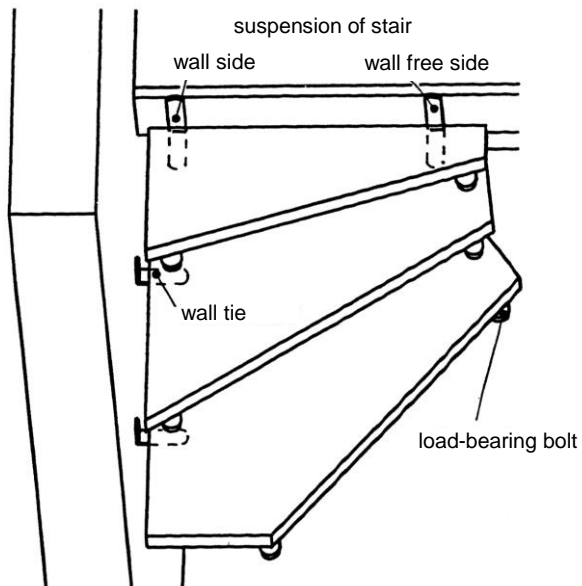
Product

Annex A1

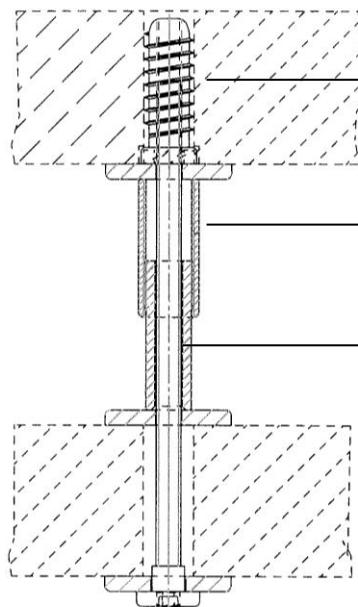
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Edge distances of load-bearing bolts

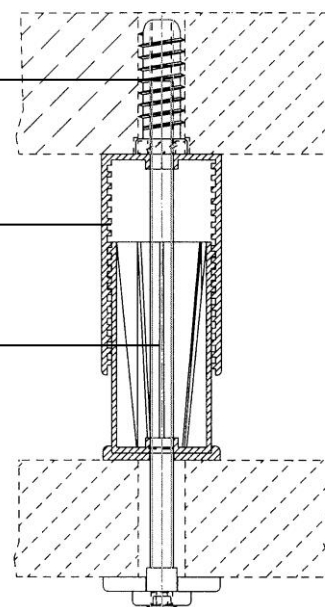
dimensions in mm



Load-bearing bolt with steel sleeve



Load-bearing bolt with polyamide sleeve



system fastener

distance sleeve

threaded rod

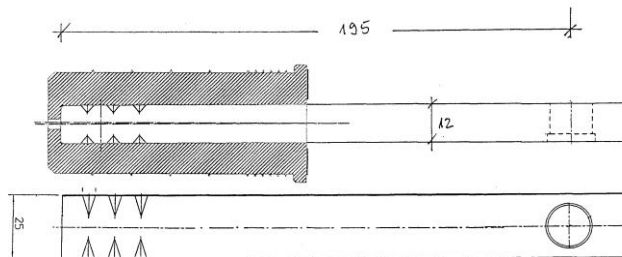
Kenngott WF2 – Stone stair

Load-bearing bolts

Annex A2

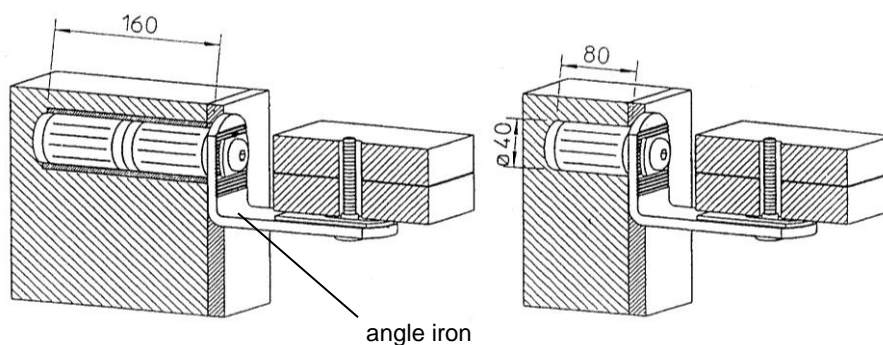
Wall tie – flat steel

dimensions in mm

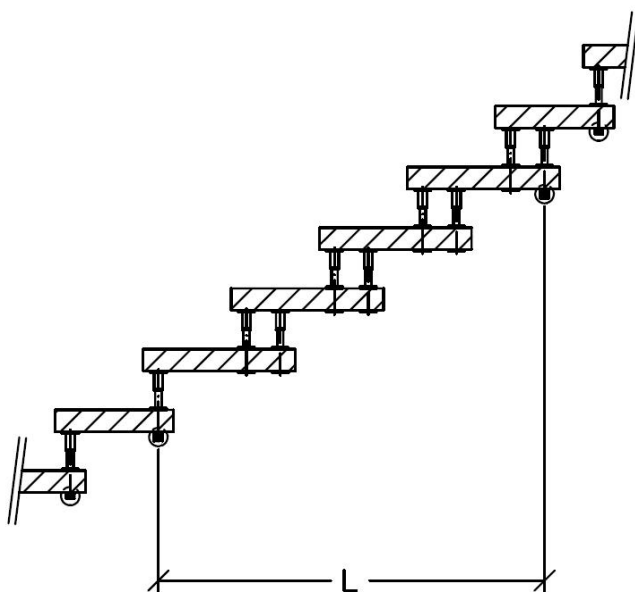


Wall tie – angle iron

dimensions in mm



Wall-replacement-beam



Load bearing bold made of steel

The reaction forces at the end of the wall-replacement-beam (see technical documentation) shall be transferred by additional structural components which are not component of the ETA.

Maximum length L of wall-replacement-beam:
1.30 m for artificial stone
1.04 m for natural stone

Further details according to the technical documentation

Kenngott WF2 – Stone stair

Wall ties, Wall-replacement-beam

Annex A3

Table 1: Characteristic values of materials of relevant stair components

component of stair	material	characteristic values (minimum values)				
components made of natural stone		$E_{0,mean}$	G_{mean}	$f_{m,k}$	$f_{v,k}$	$\gamma_M^{1)}$
		[N/mm ²]	[N/mm ²]	[N/mm ²]	[N/mm ²]	[-]
steps	resistance class I	30000	10000	6.5	6.25	1.8
	resistance class II				7.50	
	resistance class III				8.75	
	resistance class IV				10.00	
	resistance class V				11.25	
components made of artificial stones		$E_{0,mean}$	G_{mean}	$f_{m,k}$	$f_{v,k}$	$\gamma_M^{1)}$
		[N/mm ²]	[N/mm ²]	[N/mm ²]	[N/mm ²]	[-]
steps	resistance class 0	30000	10000	6.5	5,0	1.6
	resistance class I				6.25	
	resistance class II				7.50	
	resistance class III				8.75	
	resistance class IV				10.00	
	resistance class V				11.25	
components made of steel		$E_{0,mean}$	G_{mean}	$f_{y,k}$	$f_{u,k}$	$\gamma_M^{1)}$
		[N/mm ²]	[N/mm ²]	[N/mm ²]	[N/mm ²]	[-]
load bearing bolt – threaded rod	steel	210000	81000	300	500	1.1
wall tie – angle iron	steel	210000	81000	240	360	1.1
wall tie – flat steel	steel	210000	81000	240	360	1.1
components made of plastic		characteristic values				
wall tie - bearing sleeve	plastic	- ²⁾				
load bearing bolt - distance sleeve	plastic	- ²⁾				

1) recommended partial safety factor, in absence of other national regulations

2) characteristic values according to the technical documentation

Kenngott WF2 – Stone stair

Characteristic values of materials of relevant stair components

Annex A4

Table 2: Minimum dimensions of relevant stair components and reaction to fire

component	material	dimension		value	reaction to fire
steps	natural stone	thickness	[mm]	61 ²⁾	A1
	artificial stone cement bonded	thickness	[mm]	61 ²⁾	A1
	artificial stone reaction resin bonded	thickness	[mm]	61 ²⁾	No performance assessed
load-bearing bolt – threaded rod	steel	diameter Ø	[mm]	10	A1
load-bearing bolt – distance sleeve	steel	diameter Ø	[mm]	18 / 25	A1
	polyamide	diameter Ø	[mm]	50	No performance assessed
wall tie	angle iron	height / width / length	[mm]	8 / 50 / 120	A1
		embedment depth - wall	[mm]	160 (80) ¹⁾	
	flat steel	height / width / length	[mm]	15 / 25 / 210	A1
		embedment depth - wall	[mm]	100	

1) smaller value does only apply for solid brick walls

2) two plates (minimum thickness 30 mm) and intermediate GFK-layer (thickness 1 mm)

Kenngott WF2 – Stone stair

Minimum dimensions of relevant stair components,
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 ≤ 0.15 kN/m

Height ≤ 1.00 m

Design:

- Design of the stair according to the annexes and the technical documentation of this European Technical Assessment.
- Depending on the relevant type of plan and on the relevant use case (load step 1 or load step 2 according to Annex C4, Table 8) declared resistance class of the steps shall not be less than the required resistance class according to Annex C2 or C3.
- 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

γ_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

Kenngott WF2 – Stone 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
- Sufficient support of the stair when assembling
- Installation of stair components without imposed deformations
- Installation of stair components without significant defects and cracks
- 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)
- Instructions for use should provide information as to use, maintenance and repair of the stair.

Kenngott WF2 – Stone stair

Specification of intended use (Part 2)

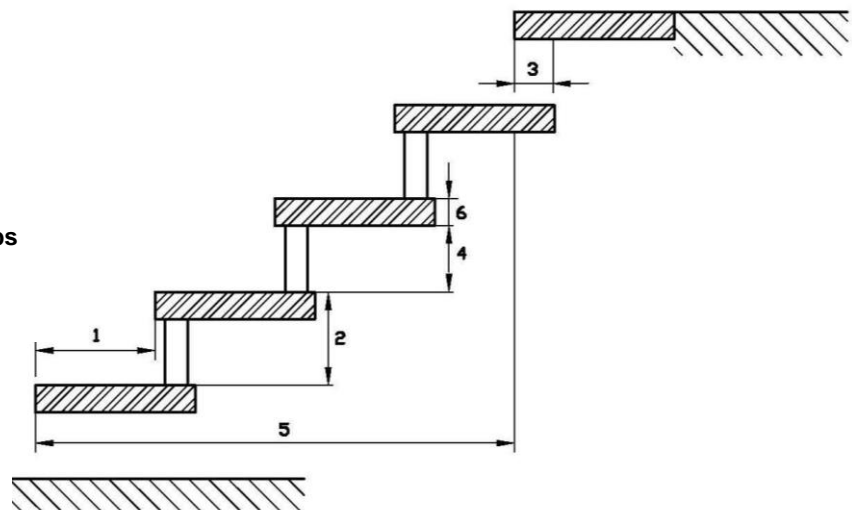
Annex B2

Table 3: Geometry

designation			dimension	
			minimum	maximum
going	step on walking line ¹⁾	[mm]	210	290 ²⁾
	tapered step	[mm]	190 ^{2) 3)}	550 ^{2) 4)}
rise of the stairs ¹⁾		[mm]	140 ²⁾	210
pitch of the walking line ¹⁾		[°]	21	45
overlap of the steps		[mm]	90	- ⁵⁾
number of rises		[-]	3	16
openings	between stairs and wall	[mm]	- ⁵⁾	50
	between consecutive steps	[mm]	- ⁵⁾	149
clear width of stairs		[mm]	500	1000 (1280) ⁶⁾
minimum headroom		[mm]	- ⁵⁾	
length of the flight		[mm]	- ⁵⁾	3900
thickness of steps		[mm]	61	- ⁵⁾

- 1) values are constant within one flight
- 2) tolerance between nominal value and actual value = ± 5 mm
- 3) inside of tapered step
- 4) outside of tapered step
- 5) not relevant
- 6) 1280 mm for type of plan 12G

- 1 going
- 2 rise
- 3 overlap
- 4 opening between consecutive steps
- 5 length of the flight
- 6 thickness of steps



Kenngott WF2 – Stone stair

Geometry of the stair

Annex C1

Table 4: Required resistance class according to Annex A4, Table 1 for stairs of load step 1 according to Annex C4, Table 8

type of plan	support at step	number of steps ²⁾	thickness of steps 61 mm		thickness of steps 71 mm	
			artificial stone	natural stone	artificial stone	natural stone
16G	0 = 15	15	V	V	III	IV
	1 or 14	14	IV	V	II	III
	2 or 13	13	III	IV	II	III
	3 or 12	12	II	III	I	II
	4 or 11	11	II	III	I	I
16V	0 = 15	15	IV	V	II	III
	1	14	III	IV	II	III
	2	13	III	IV	II	II
	3	12	II	III	I	I
	14	14	III	IV	II	III
	13	13	III	III	II	II
	12	12	II	III	I	II
16VV	0 = 15	15	II	II	I	I
	0 = 15 ¹⁾	15	III	III	I	II
	1 or 14	14	II	II	I	I
	3 or 12	12	I	II	I	I
16H	0 = 15	15	III	IV	II	III
	1	14	III	IV	II	II
	2	13	II	III	I	II
	14	14	III	III	I	II
	13	13	II	III	I	II

¹⁾ if straight bottom step or straight top step

²⁾ number of steps without additional support

Kenngott WF2 – Stone stair

Required resistance class for stairs of load step 1

Annex C2

Table 5: Required resistance class according to Annex A4, Table 1 for stairs of load step 2 according to Annex C4, Table 8

type of plan	support at step	number of steps ²⁾	thickness of steps 61 mm		thickness of steps 71 mm	
			artificial stone	natural stone	artificial stone	natural stone
9G	0 = 8	8	I	I	I	I
16G	0 = 15	15	IV	V	II	III
	1 or 14	14	III	IV	II	II
	2 or 13	13	III	III	I	II
	3 or 12	12	II	III	I	I
	4 or 11	11	II	II	I	I
16V	0 = 15	15	III	IV	II	III
	1	14	III	IV	II	II
	2	13	II	III	I	II
	3	12	I	II	I	II
	14	14	III	III	II	II
	13	13	II	III	I	II
	12	12	II	II	I	I
16VV	0 = 15	15	I	II	I	I
	0 = 15 ¹⁾	15	II	III	I	I
	1 or 14	14	I	II	I	I
	3 or 12	12	I	I	I	I
16H	0 = 15	15	III	IV	II	II
	1	14	II	III	I	II
	2	13	II	III	I	I
	14	14	II	III	I	I
	13	13	II	III	I	I

1) if straight bottom step or straight top step

2) number of steps without additional support

For the type of plan 12G without support artificial stone of the resistance class ≥ 0 and a thickness of steps of 81 mm is required

Kenngott WF2 – Stone stair

Required resistance class for stairs of load step 2

Annex C3

Table 6: Load-bearing capacity – Characteristic values of resistance

material	type of loading		Characteristic values of resistance F_{Rk}			γ_M ¹⁾
natural stone	vertical variable uniformly distributed load	load step 1	$q_{R,k}$	[kN/m ²]	9.45	1.8
		load step 2			8.10	
	vertical variable single load		$Q_{R,k}$	[kN]	5.40	
	horizontal variable uniformly distributed load on barrier		$h_{R,k}$	[kN/m]	0.95	
artificial stone	vertical variable uniformly distributed load	load step 1	$q_{R,k}$	[kN/m ²]	8.40	1.6
		load step 2			7.20	
	vertical variable single load		$Q_{R,k}$	[kN]	4.80	
	horizontal variable uniformly distributed load on barrier		$h_{R,k}$	[kN/m]	0.84	

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

Table 7: Deflections under loading

Deflection of the flight under uniformly distributed load			
uniformly distributed load	q_k	[kN/m ²]	3.5
length of the median line of the flight	L	[mm]	3900
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 (1280) ¹⁾
deflection under load F_s related to the clear width of the stair	w	[-]	$\leq L/200$

¹⁾ Value in brackets for type of plan 12G

Table 8: Imposed loads

minimum value from proof of ultimate limit state and serviceability limit state				
vertical variable uniformly distributed load	load step 1	q	[kN/m ²]	3.5
	load step 2			3.0
vertical variable single load		Q	[kN]	2.0
horizontal variable uniformly distributed load on barrier		h	[kN/m]	0.5

Kenngott WF2 – Stone stair

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

Annex C4