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# DIBt

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## European Technical Approval ETA-10/0400

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung <i>Trade name</i>	Spindeltreppe System "Thumm" <i>Spiral stair system "Thumm"</i>
Zulassungsinhaber <i>Holder of approval</i>	Thumm & Co. Maschinenbau GmbH In der Au 14 72622 Nürtingen DEUTSCHLAND
Zulassungsgegenstand und Verwendungszweck  <i>Generic type and use of construction product</i>	Spindeltreppe mit Trittstufen aus Naturwerkstein oder Betonwerkstein zur Verwendung als innenliegende Treppe in Gebäuden  <i>Spiral stair with steps made of natural stone or artificial stone for use as an indoor stair in buildings</i>
Geltungsdauer: <i>Validity:</i>	6 January 2011  6 January 2016
Herstellwerk <i>Manufacturing plant</i>	Thumm & Co. Werk 1-20

Diese Zulassung umfasst  
*This Approval contains*

15 Seiten einschließlich 7 Anhänge  
*15 pages including 7 annexes*



Europäische Organisation für Technische Zulassungen  
European Organisation for Technical Approvals

## I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:
  - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products<sup>1</sup>, modified by Council Directive 93/68/EEC<sup>2</sup> and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council<sup>3</sup>;
  - Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998<sup>4</sup>, as amended by law of 31 October 2006<sup>5</sup>;
  - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>;
  - Guideline for European technical approval of "Prefabricated stair kits - Part 1: Prefabricated stair kits in general (excluding severe climatic conditions)", ETAG 008-01.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- 3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.
- 4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
- 5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.
- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

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1 Official Journal of the European Communities L 40, 11 February 1989, p. 12

2 Official Journal of the European Communities L 220, 30 August 1993, p. 1

3 Official Journal of the European Union L 284, 31 October 2003, p. 25

4 *Bundesgesetzblatt Teil I 1998*, p. 812

5 *Bundesgesetzblatt Teil I 2006*, p.2407, 2416

6 Official Journal of the European Communities L 17, 20 January 1994, p. 34

## **II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL**

### **1 Definition of product and intended use**

#### **1.1 Definition of product**

The Spiral stair system "Thumm" with an external diameter of maximum 2500 mm is a prefabricated stair system (hereinafter referred to as stair) which consists of steps, landings, a newel and load-bearing bolts. Barrier and handrail are not part of the stair system, but may be attached to the stair optionally according to the individual requirements.

The steps and landings made of natural stone or artificial stone (reaction resin bonded) have a minimum thickness of 62 mm. They consist of two plates with a minimum thickness of 30 mm that are glued together by an intermediate GFK-layer with a thickness of 2 mm.

The steps are stressed together between spindle pots with a tensioning bolt (newel). On the outside the steps are connected which each other by load-bearing bolts. Spindle pots, tensioning bolt and load-bearing bolts are made of steel.

Annex 1 shows the stair in plan view and front view.

#### **1.2 Intended use**

The stair may be used as an indoor stair in buildings with air temperatures between +5 °C and +30 °C and relative air humidity between 30 % and 70 %.

The European technical approval covers a construction system. For the specific case of use the corresponding type of stair is manufactured within the context of the values defined in the European technical approval. The values apply to all types of stairs, the real dimensions follow in accordance with the relevant case of use.

The provisions made in this European technical approval are based on an assumed working life of the stair of 50 years; provided that the conditions laid down in sections 4 and 5 are met. 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.

### **2 Characteristics of the product and methods of verification**

#### **2.1 General**

The stair corresponds to the drawings and data of the annexes. 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>7</sup>.

#### **2.2 Mechanical resistance and stability**

##### **2.2.1 General**

The stair has a sufficient mechanical resistance and stability in order to resist static or quasi-static loads.

<sup>7</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.

The characteristic values of resistance of the stair given in Annex 7, Table 6 were determined by loading tests and by structural analysis. The structural analysis is an integral part of the technical documentation of this European technical approval.

#### 2.2.2 Prevention of progressive collapse

Failure of individual components of the stair does not lead to a progressive collapse of the complete stair.

#### 2.2.3 Residual load-bearing capacity

The stair loaded by service loads stated in Annex 7, Table 8 has a sufficient residual load-bearing capacity. A local material failure does not lead to an abrupt total loss of load-bearing capacity of the stair.

#### 2.2.4 Long-term behaviour

The characteristic values of resistance stated in Annex 7, Table 6 are ensured under an appropriate use and maintenance over the indicated working life.

#### 2.2.5 Resistance to earthquakes

No performance determined (NPD).

#### 2.2.6 Load/displacement behaviour and vibration behaviour

The characteristic values concerning the load/displacement behaviour were determined by test and calculation. The values determined are given in Annex 7, Table 7.

The vibration behaviour was determined by calculation. The stair shows under a single load of  $F = 1,0$  kN acting on the most unfavourable point at the wall-free side a deflection of  $w \leq 5$  mm. The first natural frequency of the stair (inclusive a single mass of 100 kg) is greater than 5 Hz.

#### 2.2.7 Resistance of the fixings

The design loads which are passed on by the fasteners (support of newel, landing and load-bearing bolt) to the construction works are given in Annex 4, Table 1.

### 2.3 Safety in case of fire

#### 2.3.1 Reaction to fire

The classification of the reaction to fire of the components of the stair is given in Annex 5, Table 3.

#### 2.3.2 Fire resistance

No performance determined (NPD).

### 2.4 Hygiene, health and the environment

According to the manufacturer's declaration, taking account of the EU database<sup>8</sup>, the stair does not contain any dangerous substances.

In addition to the specific clauses relating to dangerous substances contained in this European technical approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

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<sup>8</sup> Notes are stated in Guidance Paper H: "A harmonized approach relating to dangerous substances under the Construction Products Directive", Brussels, September 2002.

## **2.5 Safety in use**

### **2.5.1 Geometry of the stair**

The geometry of the stair is stated in Annex 6, Table 5. The position of the constant pitch line / walking line is exemplified in Annex 1. The position of the walking line may be chosen freely within the walking zone. The walking zone is 20 % of the clear width of the stair and is located in the middle of the stair flight.

### **2.5.2 Slipperiness**

No performance determined (NPD).

### **2.5.3 Equipment of the stair for a safe use**

Barrier and handrail:

Barrier and handrail are not part of the stair system.

Note: If barrier and handrail shall be attached to the stair, the conditions of Annex 7, Table 6 of this European technical approval apply concerning the static requirements. The construction of the connection between barrier and steps is given in the technical documentation to this European technical approval.

Tactility and visibility:

No performance determined (NPD).

### **2.5.4 Safe breakage of components**

A brittle failure of individual components is excluded.

### **2.5.5 Impact resistance**

The impact resistance of steps made of natural stone or artificial stone was determined by drop tests with a hard body impact load. The steps have a sufficient resistance after the impact of a dropped steel weight of 50 kg from a height of 200 mm directed to the step.

## **2.6 Durability and serviceability**

### **2.6.1 Resistance to deterioration caused by physical, chemical and biological agents**

Under an appropriate use and maintenance and at an indoor climate with air temperatures between +5 °C and +30 °C and relative air humidity between 30 % and 70 % the stair will have for the intended use an adequate resistance to

- physical agents like effects of temperature, radiation of sun and variations of relative humidity,
- chemical agents like effects of cleaning agents, water, carbon dioxide, oxygen and naturally occurring corrosives and pollution agents and
- biological agents like effects of fungi, bacteria, algae and insects.

### **2.6.2 Finishes and surface layers**

The surfaces of components from natural stone and artificial stone (steps, landings) are non-treated or polished.

## **3 Evaluation and attestation of conformity and CE marking**

### **3.1 System of attestation of conformity**

According to the Decision 99/89/EC of the European Commission<sup>9</sup> the System 2+ of attestation of conformity applies.

In addition, according to the Decision 2001/596/EC of the European Commission<sup>10</sup> the System 4 of attestation of conformity applies with regard to reaction to fire.

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<sup>9</sup> Official Journal of the European Communities L .29 of 03.02.1999

<sup>10</sup> Official Journal of the European Communities L 209/33 of 02.08.2001

These systems of attestation of conformity are defined as follows:

System 2+: Declaration of conformity of the product by the manufacturer on the basis of:

(a) Tasks for the manufacturer:

- (1) initial type-testing of the product;
- (2) factory production control;
- (3) testing of samples taken at the factory in accordance with a prescribed test plan.

(b) Tasks for the approved body:

- (4) certification of factory production control on the basis of:
  - initial inspection of factory and of factory production control;
  - continuous surveillance, assessment and approval of factory production control.

System 4: Declaration of conformity of the product by the manufacturer on the basis of:

Tasks for the manufacturer:

- (1) initial type-testing of the product;
- (2) factory production control.

*Note: Approved bodies are also referred to as "notified bodies".*

## **3.2 Responsibilities**

### **3.2.1 Tasks of the manufacturer**

#### **3.2.1.1 Factory production control**

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use initial materials and components stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the control plan<sup>11</sup> which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Deutsches Institut für Bautechnik.

For each laminate process but at least each 100 m<sup>2</sup> the bending resistance of at least one step have to be tested according to ETAG 008, Figure E.3. On the basis of the ultimate bending resistance reached the material is to be classified to the resistance classes according to Annex 5, Table 2. The ultimate bending resistance shall not be less than values  $f_{m,k}$  of the appropriate resistance class.

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

#### **3.2.1.2 Other tasks of manufacturer**

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of stairs in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

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<sup>11</sup> The control plan is a confidential part of the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity. See section 3.2.2.

### 3.2.2 Tasks of approved bodies

The approved body shall perform the following tasks in accordance with the provisions laid down in the control plan:

- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the factory production control stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

### 3.3 CE marking

The CE marking shall be affixed on a label attached to the stair or on the accompanying commercial documents (e.g. the EC declaration of conformity). The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- name or identifying mark and address of the producer of the stair (legal entity responsible for the manufacturer),
- identification of the stair (trade name),
- the last two digits of the year in which the CE marking was affixed,
- number of the EC certificate of conformity for the factory production control,
- number of the European technical approval,
- ETAG 008, Part 1,
- resistance class I to VI (bending resistance).

If the CE marking is affixed on the accompanying commercial documents, the following minimum information shall be given on a label attached to the stair:

- initials "CE" followed by the identification number of the certification body,
- name or identifying mark of the manufacturer of the stair,
- identification of the stair (trade name),
- the last two digits of the year in which the CE marking was affixed.

## 4 Assumptions under which the fitness of the product for the intended use was favourably assessed

### 4.1 Manufacture

The European technical approval is issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced.

Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

## 4.2 Design

The fitness for use of the stair is given under the following assumptions:

The stair is designed according to the drawings and data of the annexes and the technical documentation to this European technical approval.

Depending on the relevant type of stair the declared resistance class of the steps shall not be less than the required resistance class according to Annex 6, Table 4.

The stair is fixed to the construction works according to the drawings and data of the annexes and the technical documentation to this European technical approval. The proof of the fixing of the landings and the proof of the transmission of loads in the construction works are made by the civil engineer responsible for the construction works.

The load-bearing capacity of the stair at ultimate limit state is verified according to Annex 7, Table 6. The load-bearing capacity of the stair at serviceability limit state is verified according to Annex 7, Table 7.

## 4.3 Installation

The fitness for use of the stair can be assumed only, if the following installation conditions are adhered to:

- installation by personnel appropriately trained and authorized by the holder of the approval by means of the technical documentation of this European technical approval,
- installation only in the way as specified in the technical documentation of this European technical approval,
- sufficient support of the stair when assembling,
- installation of steps without imposed deformations,
- installation of steps without significant defects and cracks,
- bolted connections are protected such that they will not be loosened by vibrations
- depending on the type of stair the nuts and the couplings of the tensioning bolt have to be tightened with the torque moment according to Annex 6, Table 4 .

## 5 Indications to the manufacturer

### 5.1 Manufacturer's responsibilities

It is the manufacturer's responsibility to make sure that all persons involved will be appropriately informed about the specific conditions according to sections 1, 2, 4.2 and 4.3 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 approval.

### 5.2 Packaging, transport and storage

The glued parts of plates or the steps should be packed such that they can not be damaged during transport and storage.

### 5.3 Use, maintenance and repair

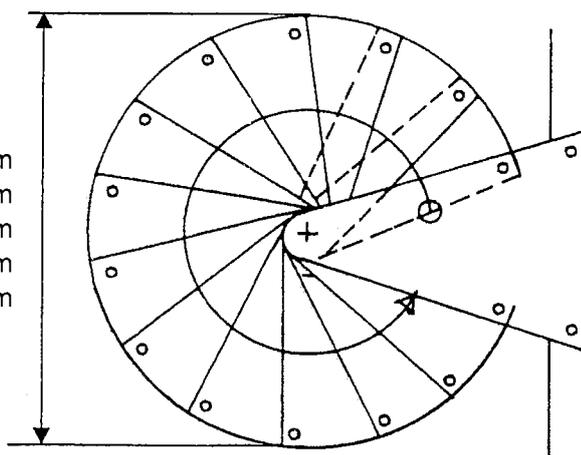
In his instructions for use the manufacturer provide information as to use, maintenance and repair of the stair.

Georg Feistel  
Head of Department

*beglaubigt*  
Wittstock

**Plan view**

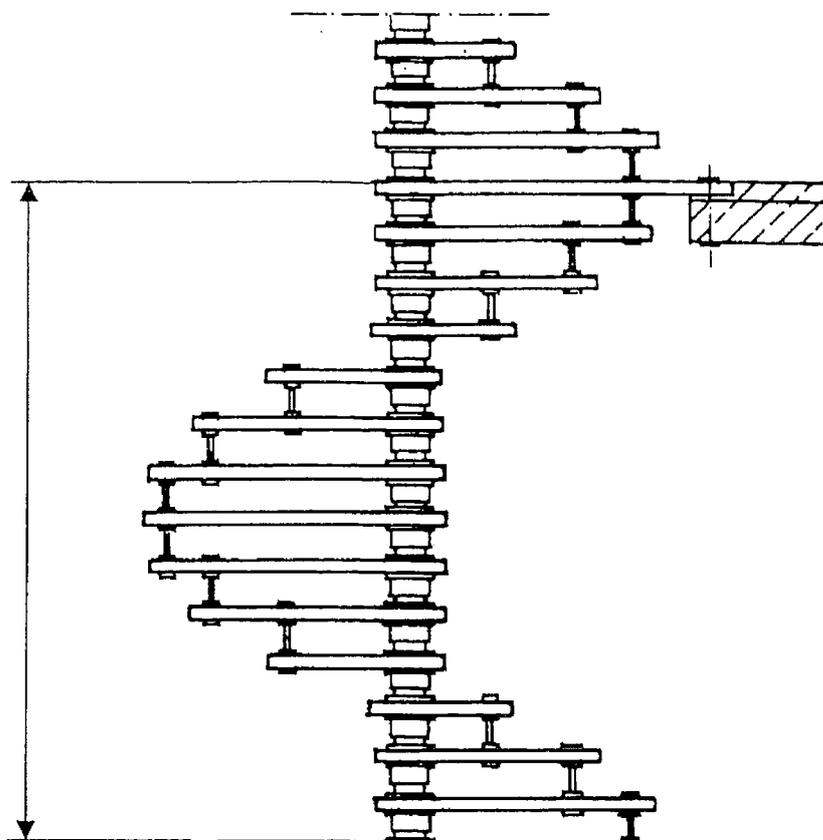
- Type I, II  $\varnothing \leq 1600$  mm
- Type III, IV  $\varnothing \leq 1800$  mm
- Type V, VI  $\varnothing \leq 2000$  mm
- Type VII  $\varnothing \leq 2250$  mm
- Type VIII  $\varnothing \leq 2500$  mm



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

**Front view**

$\leq 3300$  mm  
 $\leq 18$  rises



**Spiral stair system "Thumm"**

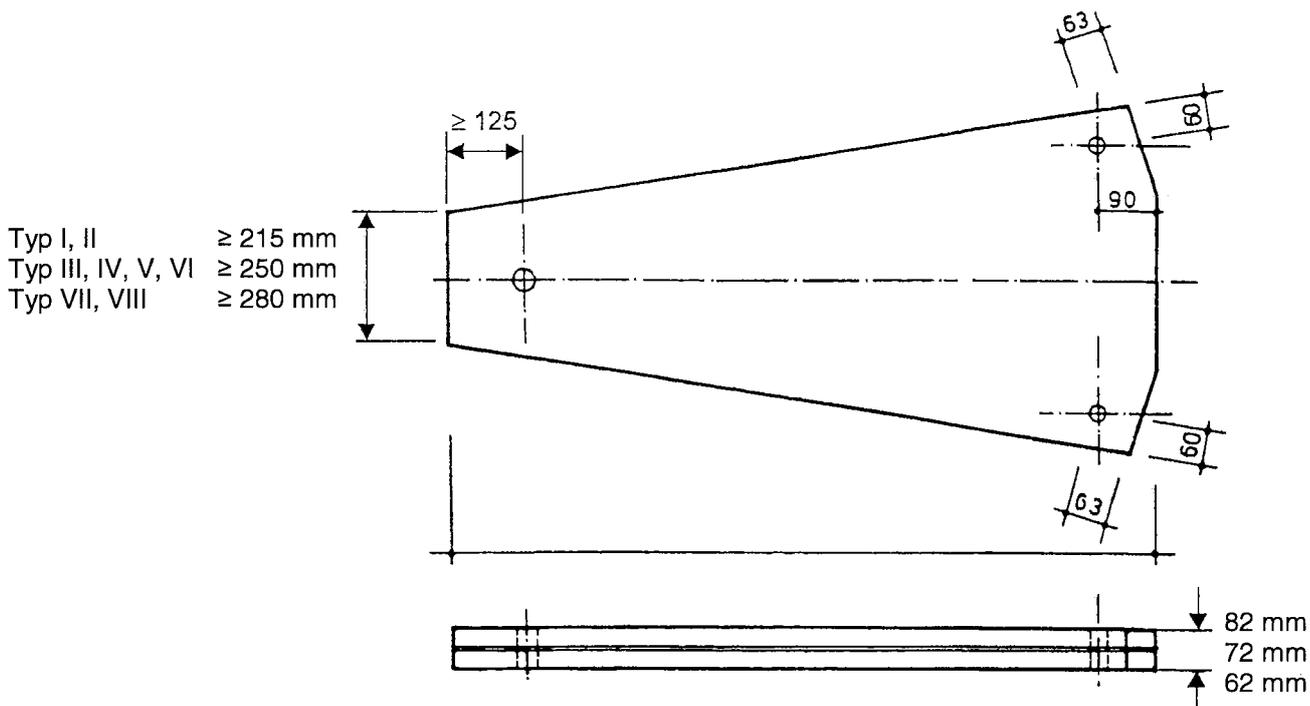
Product and intended use

**Annex 1**

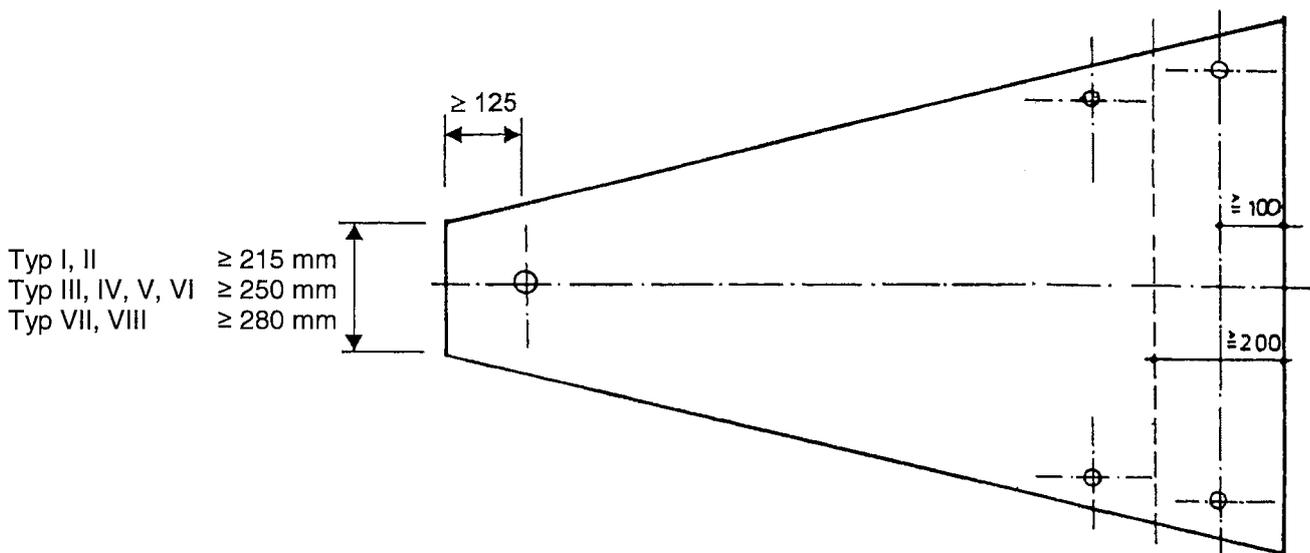
**of European technical approval**

**ETA-10/0400**

### Step



### Landing



all dimensions in mm

Spiral stair system "Thumm"

Annex 2

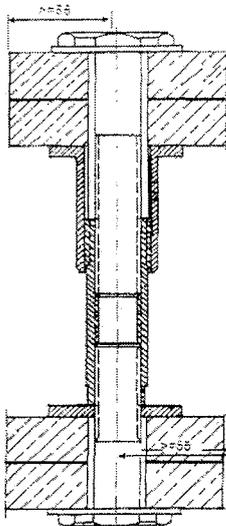
of European technical approval

ETA-10/0400

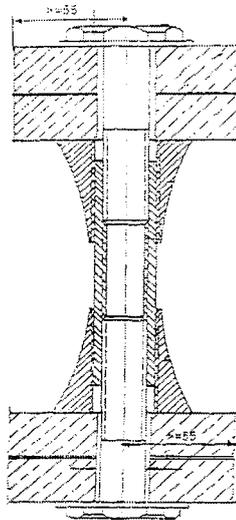
Step and landing

### Load-bearing bolts

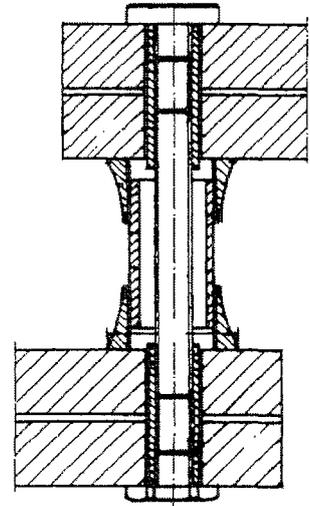
**Type IA**



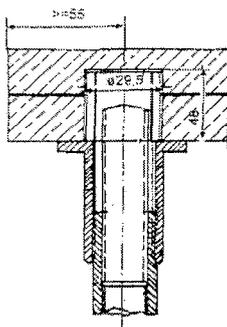
**Type IIA**



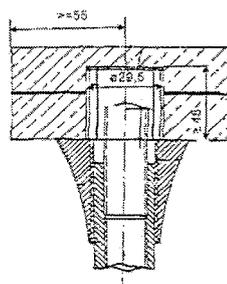
**Type III**



**Type IB**



**Type IIB**



dimensions in mm

More details according to technical documentation

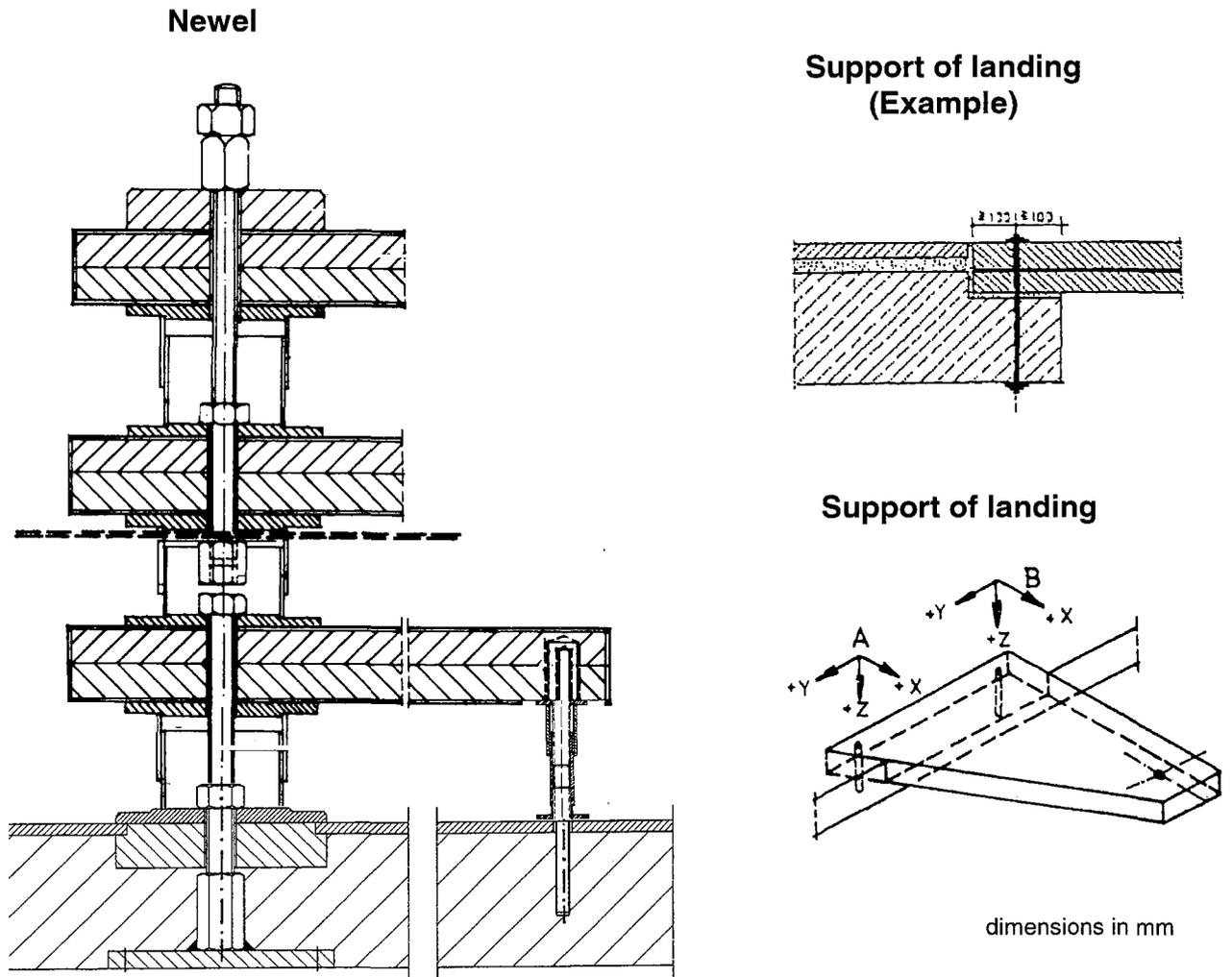
**Spiral stair system "Thumm"**

Load-bearing bolts

**Annex 3**

of European technical approval

**ETA-10/0400**



**Table 1: Design loads for transmission of the loads in the construction works**

Type of stair			I	II	III	IV	V	VI	VII	VIII
Support of newel	x = y	[kN]	± 0,6	± 0,7	± 0,8	± 1,0	± 2,5	± 2,0	± 2,0	± 3,5
	z	[kN]	23,9	25,5	30,5	32,4	43,3	47,0	53,0	59,2
	z	[kN]	47,8	51,0	61,0	64,8	86,6	94,0	106,0	118,4
Support of newel	z	[kN]	71,7	76,5	91,5	97,2	129,9	141,0	159,0	177,6
	z	[kN]	2,8	3,0	3,6	3,7	6,5	5,0	5,5	6,5
Support of landing at the top	x	[kN]	± 0,8	± 1,1	± 1,2	± 1,5	± 3,0	± 2,0	± 2,0	± 3,5
	y	[kN]	± 0,3	± 0,4	± 0,5	± 0,5	± 3,0	± 2,0	± 2,0	± 2,5
Support of intermediate landings	x	[kN]	± 1,6	± 2,2	± 2,4	± 3,0	± 6,0	± 4,0	± 4,0	± 7,0
	y	[kN]	± 0,6	± 0,8	± 1,0	± 1,2	± 6,0	± 4,0	± 4,0	± 5,0
Support of load-bearing bolt	z	[kN]	2,9	3,0	3,6	3,7	4,1	3,0	3,0	4,3
	x = y	[kN]	0	0	0	0	± 0,8	± 0,6	± 0,7	± 1,1

**Spiral stair system "Thumm"**

Newel, support of landings,  
 Design loads for transmission

**Annex 4**

**of European technical approval**

**ETA-10/0400**

**Table 2: Characteristic values of materials of relevant stair components**

component of stair		material	characteristic values (minimum values)				
components made of natural stone and artificial stone			$E_{0,mean}$	$G_{mean}$	$f_{m,k}$	$f_{v,k}$	$\gamma_M$ <sup>1)</sup>
			[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[-]
Steps, landings	resistance class I	45000	15000	6.25	6.25	1.8 <sup>3)</sup>	
	resistance class II			7.50	7.50		
	resistance class III			8.75	8.75		
	resistance class IV			10.00	10.00	1.6 <sup>3)</sup>	
	resistance class V			11.25	11.25		
	resistance class VI			12.50	12.50		
components made of steel			$E_{0,mean}$	$G_{mean}$	$f_{y,k}$	$f_{u,k}$	$\gamma_M$ <sup>1)</sup>
			[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[N/mm <sup>2</sup> ]	[-]
System fasteners	steel	210000	81000	240 <sup>2)</sup>	400 <sup>2)</sup>	1.1	
Distance sleeve	GD-Al Si 8 Cu 3	70000	27000	160	240	1.1	
	steel	210000	81000	240 <sup>2)</sup>	400 <sup>2)</sup>	1.1	
Spindle pots, head plate, foot plate	steel	210000	81000	360	510	1.1	
Tensioning bolt and nuts	steel	210000	81000	900	1000	1.1	

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

2) values for load-bearing bolt type I and II, load-bearing bolt type III according to technical documentation

3) natural stone :  $\gamma_M = 1,8$ ; artificial stone :  $\gamma_M = 1,6$

**Table 3: Minimum dimensions of relevant stair components and reaction to fire**

component	material	dimension		value	reaction to fire <sup>1)</sup>
Steps, landings	Natural stone	thickness	[mm]	62 <sup>3)</sup>	F (keine Leistung festgestellt – KLF)
	Artificial stone (reaction resin bonded)	thickness	[mm]	62 <sup>3)</sup>	
System fastener	steel	diameter	[mm]	14	A1 (96/603/EC)
Distance sleeves	GD-Al Si 8 Cu 3, steel	Inner diameter	[mm]	14	A1 (96/603/EC)
newel	Steel pipe	diameter	[Zoll]	3 ½	A1 (96/603/EC)
	Tensioning bolt	diameter	[mm]	24	A1 (96/603/EC)

1) according to the provisions of EC decisions

2) minimum value, required values depending on the type of stair according to Table 4, more details according to technical documentation

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

<b>Spiral stair system "Thumm"</b>	<b>Annex 5</b> <b>of European technical approval</b> <b>ETA-10/0400</b>
Characteristic values of materials, minimum dimensions of relevant stair components and reaction to fire	

**Table 4: Dimensions of relevant stair components und required resistance classes of steps according to Annex 5, Table 2 depend on the type of stair**

Type of stair		I	II	III	IV	V	VI	VII	VIII
Diameter of stair	[mm]	1600	1600	1800	1800	2000	2000	2250	2500
Thickness of steps	[mm]	62	72	72	82	82	82	82	82
Width of Steps (inner side)	[mm]	215	215	250	250	250	250	280	280
Type of load-bearing bolt	[-]	I, II	I, II	I, II	I, II	III	III	III	III
Resistance class natural stone	[-]	III	II	IV	III	V	II	IV	VI
Resistance class artificial stone	[-]	II	II	III	II	IV	II	III	V
Diameter of newel	[inch]	3 ½	3 ½	5	5	5	8	8	8
Diameter of head and foot plate	[mm]	160	160	187	187	187	240	240	240
Diameter of tensioning bolt	[mm]	24	24	24	24	24	30	30	30
Pre-stressing moment	[Nm]	400	400	510	510	764	707	825	1131
Pre-stressing force	[kN]	110	110	140	140	210	150	175	240

**Table 5: Geometry**

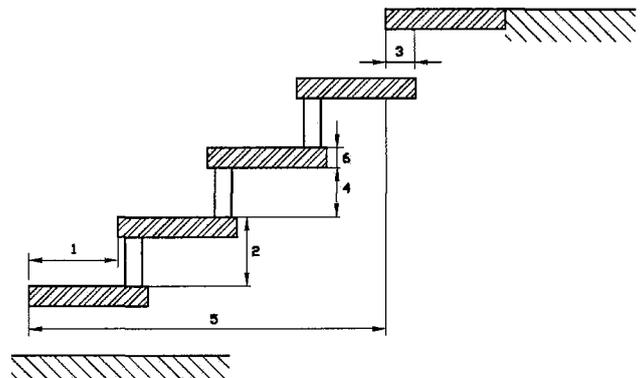
designation		dimension	
		minimum	maximum
going step on walking line <sup>1)</sup>	[mm]	210	290 <sup>2)</sup>
rise of the stairs <sup>1)</sup>	[mm]	140 <sup>2)</sup>	220
pitch of the walking line <sup>1)</sup>	[°]	21	45
overlap of the steps	[mm]	110	- <sup>3)</sup>
number of rises	[-]	3	18
openings between consecutive steps	[mm]	- <sup>3)</sup>	158
clear width of stairs	[mm]	645	1130
Clear height between floors	[mm]	- <sup>3)</sup>	3300
length of the flight	[mm]	- <sup>3)</sup>	4930
Thickness of steps	[mm]	62	82

<sup>1)</sup> values are constant within one flight

<sup>2)</sup> tolerance between nominal value and actual value = ± 5 mm

<sup>3)</sup> not relevant

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



**Spiral stair system "Thumm"**

Dimensions of relevant stair components,  
 Geometry of the stair

**Annex 6**

of European technical approval

**ETA-10/0400**

**Table 6: Load-bearing capacity at ultimate limit state <sup>1)</sup> - Characteristic values of resistance  $R_k$**

Component of stair	Type of loading	resistance $F_{Rk}$			$\gamma_M$ <sup>2)</sup>
Step (natural stone)	vertical variable uniformly distributed load	$q_{R,k}$	[kN/m <sup>2</sup> ]	8.10	1.8
	vertical variable single load	$Q_{R,k}$	[kN]	5.40	
Step (artificial stone)	vertical variable uniformly distributed load	$q_{R,k}$	[kN/m <sup>2</sup> ]	7.20	1.6
	vertical variable single load	$Q_{R,k}$	[kN]	4.80	
Newel	vertical variable uniformly distributed load	$q_{R,k}$	[kN/m <sup>2</sup> ]	4.95	1.1
	vertical variable single load	$Q_{R,k}$	[kN]	3.30	
Barrier <sup>3)</sup>	horizontal variable uniformly distributed load <sup>4)</sup>	$h_{R,k}$	[kN/m]	0.58	1.1

<sup>1)</sup> Proof of ultimate limit state is only given if the design value of the actions does not exceed the design value of the resistance:  $F_d \leq R_d$  with  $F_d = F_k \cdot \gamma_F$  and  $R_d = R_k / \gamma_M$

$R_k$  and  $\gamma_M$  according to Table 6

$F_k$  = characteristic values of actions (imposed loads according to EN 1991-1-1)

$\gamma_F = 1.5$  (recommended partial safety factor, in absence of other national regulations)

<sup>2)</sup> Recommended partial safety factor, in absence of other national regulations

<sup>3)</sup> Barrier and handrail are not part of the stair system. Conditions for possible barrier/handrail: dead load  $\leq 0.15$  kN/m, height  $\leq 1.00$  m, distance of baluster  $\leq 0.85$  m

<sup>4)</sup> Accompanying action (min.  $\gamma_M = 1,1$ ;  $\psi_0 = 0,7$ , recommended combination factor, in absence of other national regulations); load acting on barrier

**Table 7: Load-bearing capacity at serviceability limit state <sup>1)</sup> - Deflections under loading**

deflection of the step under single point load			
load $F_S$	$Q_S =$	[kN]	2.0
clear width of the stair	$l \leq$	[mm]	1130
deflection under load $F_S$ related to the clear width of the stair	$w \leq$	[-]	1/200

<sup>1)</sup> Proof of serviceability limit state is only given if the characteristic value of the actions (imposed loads according to EN 1991-1-1) does not exceed the value  $F_S$  according to Table 7:  $F_k \leq F_S$

**Table 8: Load-bearing capacity - Service loads <sup>1)</sup>**

minimum value from proof of ultimate limit state and serviceability limit state			
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 <sup>2)</sup>	$h$	[kN/m]	0.5

<sup>1)</sup> Service load =  $\min (R_k / (\gamma_M \cdot \gamma_F); F_S)$  with  $R_k$ ,  $\gamma_M$ ,  $\gamma_F$  according to Table 6 and  $F_S$  according to Table 7

<sup>2)</sup> Load acting on barrier (see Table 6)

<b>Spiral stair system "Thumm"</b>	<b>Annex 7</b> <b>of European technical approval</b> <b>ETA-10/0400</b>
Load-bearing capacity at ultimate limit state, Load-bearing capacity at serviceability limit state, Load-bearing capacity – service loads	