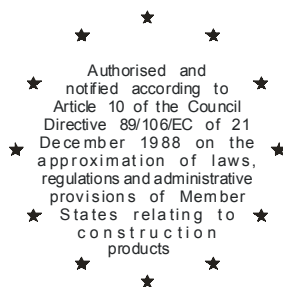


**TECHNICKÝ A ZKUŠEBNÍ ÚSTAV  
STAVEBNÍ PRAHA, s.p.**

Prosecká 811/76a  
CZ-190 00 Praha 9  
Tel.: +42 286 019 412  
Fax: +42 286 883 897  
Internet: www.tzus.cz



MEMBER OF EOTA

## European Technical Approval

## ETA - 05/0055

(English language translation, the original version is in Czech language)

Obchodní název  
*Trade name*

**BRAVOLL® PTH-KZ 60/8-L<sub>a</sub> , PTH-KZL 60/8-L<sub>a</sub>,  
PTH 60/8-L<sub>a</sub> , PTH-L 60/8-L<sub>a</sub>**  
*BRAVOLL® PTH-KZ 60/8-L<sub>a</sub> , PTH-KZL 60/8-L<sub>a</sub> , PTH  
60/8-L<sub>a</sub> , PTH-L 60/8-L<sub>a</sub>*

Držitel schválení  
*Holder of approval*

BRAVOLL spol. s.r.o.  
Sidliště č.p. 696  
394 68 Žirovnice

Typ a použití výrobku

Plastové kotvy pro kotvení vnějších kontaktních  
tepelně izolačních systémů s omítkou v betonu a zdivu  
*Plastic nailed-in anchors for fixing of external thermal  
insulation composite systems with rendering in concrete and  
masonry*

*Generic type and use  
of construction product*

Platnost od  
*Validity from*

15.03.2005

do  
*to*

15.03.2009

Výrobna  
*Manufacturing plant*

BRAVOLL spol. s.r.o.  
Sidliště č.p. 696  
394 68 Žirovnice

Toto evropské technické schválení  
obsahuje

16 stran včetně 7 příloh

*This European Technical Approval contains*

*16 pages including 7 annexes*



European Organisation for Technical Approvals  
Evropská organizace pro technické schvalování

## I. LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Technický a zkušební ústav stavební Praha, s.p. 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>, amended by the Council Directive 93/68/EEC of 22 July 1993<sup>2</sup>;
  - the Government Decree No. 190/2002 Code
  - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex of Commission Decision 94/23/EC<sup>3</sup>;
  - Guideline for European Technical Approval of „Plastic Anchors for Fixing of External Thermal Insulation Composite Systems with Rendering“, ETAG 014, Edition November 2001.
- 2 Technický a zkušební ústav stavební Praha, s.p. is authorised 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 Technický a zkušební ústav stavební Praha, s.p., in particular after information by the Commission on the basis of Article 5 (1) of Council Directive 89/106/EEC.
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- 6 The European Technical Approval is issued by the approval body in its official language. This version corresponds to the version circulated within EOTA. Translations into other languages have to be designated as such.

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<sup>1</sup> Official Journal of the European Communities N° L 40, 11.02.1989, p. 12

<sup>2</sup> Official Journal of the European Communities N° L 220, 30.08.1993, p. 1

<sup>3</sup> Official Journal of the European Communities N° L 17, 20.01.1994, p. 34

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

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

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

The BRAVOLL anchors: PTH-KZ 60/8-L<sub>a</sub> , PTH-KZL 60/8-L<sub>a</sub> , PTH 60/8-L<sub>a</sub> , PTH-L 60/8-L<sub>a</sub> consist of plastic sleeve with a plate made of material according to Table 2 Annex 4 and an accompanying specific expansion pin of material according to Table 2 Annex 4. Anchors PTH-KZ 60/8-L<sub>a</sub> , PTH-KZL 60/8-L<sub>a</sub> PTH 60/8-L<sub>a</sub> , PTH-L 60/8-L<sub>a</sub> may additionally be combined with the anchor plates BRAVOLL IP PTH 100 and IP PTH 140, which are shown in Annex 7.

The installed anchor is shown in Annex 1.

#### **1.2 Intended use**

The anchor is intended to be used for anchorages for which requirements for safety in use in the sense of the Essential Requirement 4 of Council Directive 89/106/EEC shall be fulfilled and failure of anchorages made with these products would cause low risk to human life. The anchor is to be used only as multiple fixing for the anchorage of bonded thermal insulation composite systems (ETICS) according to ETAG 004 in concrete and masonry. The base material shall consist of reinforced or unreinforced normal weight concrete of strength class C12/15 at minimum and C50/60 at maximum according to EN 206-1:2000-12 or of masonry walls according to Table 6, Annex 6.

The anchor may only be used for transmission of wind suction loads and shall not be used for the transmission of dead loads of the thermal insulation composite system. The dead loads have to be transmitted by the bonding of the thermal insulation composite system.

The provisions made in this European Technical Approval are based on an assumed working life of the anchor of 25 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 products in relation to the expected economically reasonable working life of the works.

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

#### **2.1 Characteristics of product**

The anchors correspond to the drawings and information give in Annexes 2 - 4. The characteristic material values, dimensions and tolerances of the anchor not indicated in these Annexes shall correspond to the respective values laid down in the technical documentation<sup>4</sup> of this European Technical Approval.

The characteristic values for the desing of the anchorages are given in Annexes 4-6.

Each anchor is to be marked with the producer name, brand name the type and the length of the anchor. The minimum effective anchorage depth also shall be marked.

The anchor shall only be packaged and supplied as a complete unit.

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<sup>4</sup> The technical documentation of this European Technical Approval is deposited at the Technický a zkušební ústav stavební Praha, s.p, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity producer, is handed over to the approved bodies.

## 2.2 Methods of verification

The assessment of the fitness of the anchor for the intended use in relation to the requirements for safety in use in the sense of Essential Requirement 4 has been made in compliance with the Guideline for European Technical Approval of "Plastic Anchors for Fixing of External Thermal Insulation Composite Systems with Rendering", ETAG 014, based on the use categories A, B and C.

## 3 Evaluation of conformity of the product and CE marking

### 3.1 Attestation of Conformity System

The system of attestation of conformity 2 (ii) (allocated to system 2+) according to Council Directive 89/106/EEC Annex III provides:

- (a) tasks of the manufacturer:
  - (1) initial type-testing of the product,
  - (2) factory production control,
  - (3) testing of samples taken at the factory by the manufacturer in accordance with a control plan.
- (b) tasks of 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.

### 3.2 Responsibility

#### 3.2.1 Tasks of the manufacturer; factory production control

The manufacturer has a factory production control system in the plant and exercises permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written policies and procedures. The factory production control system ensures that the product is in conformity with the European Technical Approval.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the control plan<sup>5</sup>. The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of incoming materials shall include control of inspection documents presented by the manufacturer of the raw materials (comparison with nominal values) by verifying the dimensions and determine the material properties.

The manufactured components of the anchor shall be subjected to the following tests:

#### - Plastic sleeve

- Shape,
- Dimensions (diameter, lengths),
- Markings,
- Properties of polypropylen granules (density, melt mass-flow rate (MFR), DSC-curve),
- Documentation of adjusting data of injection moulding machine.

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<sup>5</sup> The control plan has been deposited at the Technický a zkušební ústav stavební Praha, s.p. and is handed over only to the approved bodies involved in the conformity attestation procedure.

- **Plastic expansion pin**
  - Shape,
  - Dimensions (diameter, lengths),
  - Properties of polypropylen granules (density, melt mass-flow rate (MFR), DSC-curve),
  - Documentation of adjusting data of injection moulding machine.
- **Steel expansion pin**
  - Dimensions (diameter, lengths)
  - Material property (ultimate strength)
  - Check of coating (electro galvanisation)
  - Check of the additional coating of the head of the screw
- **Visual control of correct assemblage and of completeness of the anchor.**

The frequency of controls and tests conducted during production and on the assembled anchor is laid down in the control plan taking account of the automated manufacturing process of the anchor.

The results of factory production control are recorded and evaluated. The records include at least the following information:

- designation of the product, basic materials and components;
- type of control or testing;
- date of manufacture of the product and date of testing of the product or basic materials or components;
- results of controls and tests and, if appropriate, comparison with requirements;
- signature of person responsible for factory production control.

The records shall be presented to the inspection body involved in continuous surveillance.

On request they shall also be presented to the Technický a zkušební ústav stavební Praha, s.p.

Details of extent, nature and frequency of testing and controls to be performed within the factory production control shall correspond to the control plan<sup>6</sup> which is the part of the technical documentation of this European Technical Approval.

### **3.2.2 Tasks of approved body**

#### **3.2.2.1 Initial inspection of factory and of factory production control**

The approved body shall ascertain that, in accordance with the control plan, the factory, in particular the staff and equipment, and the factory production control are suitable to ensure a continuous and orderly manufacturing of the anchor with the specifications mentioned in 2.1 as well as in the Annexes to the European Technical Approval.

#### **3.2.2.2 Continuous surveillance**

The approved body shall visit the factory at least once a year for surveillance. It has to be verified that the system of factory production control and the specified automated manufacturing process are maintained taking account of the control plan.

Continuous surveillance and assessment of factory production control have to be performed according to the control plan.

The results of continuous surveillance shall be made available on demand by the inspection body to the Technický a zkušební ústav stavební Praha,s.p.

### **3.3 CE marking**

The CE-marking<sup>6</sup> shall be affixed on each packaging of the anchor. The symbol "CE" shall be accompanied by the following information:

- identification number of an approved body;
- name or identifying mark of producer and manufacturing plant;
- the last two digits of the year in which the CE-marking was affixed;
- number of the European Technical Approval;
- use categories A, B and C.

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

### **4.1 Manufacturing**

The anchor is manufactured in accordance with the provisions of the European Technical Approval using the automated manufacturing process as verified by the inspection of the plant performed by the Technický a zkušební ústav stavební Praha, s.p. as laid down in the technical documentation.

### **4.2 Installation**

#### **4.2.1 Design of anchorages**

##### **4.2.1.1 General**

The ETA only applies to the manufacture and use of the anchor. Verification of stability of the external thermal insulation composite system including application of load on the anchor and on the additional plate are not subject of this European Technical Approval.

Fitness for the intended use of the anchor is given under the following conditions:

The design of anchorages is carried out in compliance with ETAG 014 "Guideline for European Technical Approval of Plastic Anchors for Fixing of External Thermal Insulation Composite Systems with Rendering" under the responsibility of an engineer experienced in anchorages.

Verifiable calculation notes and drawings shall be prepared taking account of the loads to be anchored, the nature and strength of the base materials, the thickness of insulation and the dimensions of the anchorage as well as of the relevant tolerances.

Proof of direct local application of load on the base material shall be delivered.

The anchor shall only be used for the transmission of wind suction loads. All other loads such as dead load and restraints shall be transmitted by the adhesion of the relevant external thermal insulation composite system.

##### **4.2.1.2 Resistance**

The characteristic values of the tension resistance of the anchor are given in Table 6, Annex 6. If there is a difference to the given characteristic values of the base material or use of similar base material of category B and C supposed; the job-site

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<sup>6</sup> Notes on the CE marking are stated in Guidance Paper D „CE marking under the Construction Products Directive“, Brussels, 01 August 2002

tests according to 4.2.3 shall be carried out and the characteristic tension resistance shall be determined.

#### **4.2.1.3 Characteristic values, spacing and dimensions of anchorage member**

The minimum spacing and dimensions of anchorage member according to Annex 4 shall be observed.

#### **4.2.1.4 Displacement behaviour**

When loaded to the design value of resistance in normal weight concrete; masonry made of solid clay bricks and perforated clay bricks a displacement of approximately 0,9 mm in load direction is expected.

### **4.2.2 Installation of anchor**

The fitness for use of the anchor can only be assumed if the following conditions of installation are met:

- Anchor installation carried out by appropriately qualified personnel under the supervision of the person responsible for technical matters on site.
- Use of the anchor only as supplied by the manufacturer without exchanging any component of the anchor.
- Anchor installation in accordance with the manufacturer's specifications and drawings using the tools indicated in this European Technical Approval.
- Checks before placing the anchor, to ensure that the characteristic values of the base material in which the anchor is to be placed, is identical with the values, which the characteristic loads apply for.
- Observation of the drill method (Drill holes in masonry made of vertically perforated clay bricks may only be drilled using the rotary drill. Other drilling methods may also be used if job-site tests according to 4.2.3 evaluate the influence of hammer or impact drilling.)
- Placing drill holes without damaging the reinforcement
- Temperature during installation of the anchor  $\geq 0^{\circ}\text{C}$ .
- Exposure to UV due to solar radiation of the anchor not protected by rendering  $\leq 6$  weeks.

### **4.2.3 Job site tests**

The characteristic tension resistance of the anchor may be determined by means of job site pull-out tests carried out on the material actually used, if a characteristic resistance of the base material does not exist (for example masonry made of other solid masonry units or made of perforated clay bricks).

The characteristic resistance of the anchor shall be determined by carrying out at least 15 centric tension load pull-out tests on site. These tests are also possible under the same conditions in a laboratory.

Execution and evaluation of the tests as well as the issue of the test report and the determination of the characteristic resistance should be under the responsibility of approved testing laboratories or the supervision of the person responsible for the execution of the works on site.

Number and position of the anchors to be tested shall be adapted to the relevant special conditions of the site and, for example, to be increased in the case of hidden and larger areas, such that reliable information about the characteristic resistance of the anchor in the base material in question can be derived. The tests shall take into account the most unfavourable conditions of the practical execution.

#### 4.2.3.1 Assembly

The anchor to be tested shall be installed (e.g. preparation of drill hole drilling tool to be used, drill bit) and the spacing and the edge distances shall be in the same way as planned for the fixing of the external thermal insulation composite system.

Depending on the drilling tool and according to ISO 5468, hard metal hammer-drill bits or hard metal percussion drill bits, respectively, shall be used. The cutting diameter shall be at the upper tolerance limit.

#### 4.2.3.2 Execution test

The test rig used for the pull-out test shall provide a continuous slow increase of the load, controlled by calibrated load cell. The load shall be applied perpendicularly to the surface of the base material and shall be transmitted to the anchor via an hinge. The reaction force shall be transmitted into the base material at a distance of at least 15 cm from the anchor. The load shall be increased continuously in a way, that the ultimate load is reached after about 1 minute. The load is measured when the ultimate load ( $N_1$ ) is achieved.

#### 4.2.3.3 Test report

The test report shall include all information necessary to assess the resistance of the tested anchor. It shall be included in the construction dossier.

The minimum data required are:

- Construction site, owner of building; date and location of the tests, air temperature; type of member (ETICS) to be fixed
- Masonry (type of brick, strength class, all dimensions of bricks, mortar group); visual assessment of masonry (flush joints, joint clearance, regularity)
- Plastic sleeve and expansion pin, value of the cutting diameter of hard metal hammer-drill bits, measured before and after drilling
- Test rig; results of tests including the indication of value  $N_1$
- Tests carried out or supervised by; signature

#### 4.2.3.4 Evaluation of test results

The characteristic resistance  $N_{Rk1}$  is derived from the measured values  $N_1$  as follows

$$N_{Rk1} = 0,6 \cdot N_1 \leq 1,5 \text{ kN}$$

$N_1$  = the mean value of the five smallest measured values at ultimate load

#### 4.2.4 Responsibility of the manufacturer

It is in the responsibility of the manufacturer to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to 4.2.1, 4.2.2 and 5 is given to those who are concerned. This information may be made by reproduction of the respective parts of the European Technical Approval. In addition, all installation data shall be shown clearly on the packaging and/or on an enclosed instruction sheet, preferably using illustrations.

The minimum data required for manual are:

- base material for the intended use,
- drill bit diameter,
- maximum thickness of the ETICS,
- minimum effective anchorage depth,
- minimum hole depth,
- information on the installation procedure,
- identification of the manufacturing batch.

All data shall be presented in a clear and explicit form.

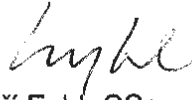
## 5 Recommendations for the manufacturer

### 5.1 Recommendations on packaging, transportation and storage

The anchor shall only be packaged and supplied as a complete unit.

If there is no conditioning (moisturisation) after the production of the plastic expansion pin, the pin may only be delivered after 5 weeks.

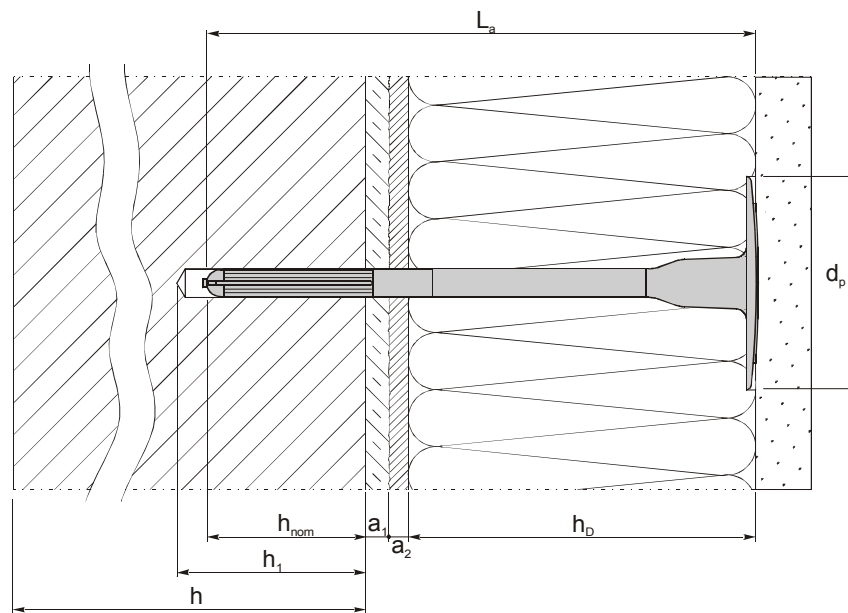
The anchor shall be stored under normal climatic conditions in its original light-proof packaging. Before installation, it shall neither be extremely dry nor frozen.



Ing. Jiří Eybl, CSc.  
Head of the Approval Body



Anchor in its install condition



Intended Use

Fixing of external thermal insulation composite systems in categories A, B and C.

**Legend:**

- $h_{ef}$  = effective anchorage depth
- $h_{nom}$  = overall embedment depth
- $h_1$  = depth of drill hole in base material
- $h$  = thickness of base material
- $h_D$  = thickness of insulation material
- $a_1$  = thickness of equalization layer or non-load bearing coating
- $a_2$  = toleration of thickness of equalisation layer or non-load bearing coating
- $L_a$  = total length of the anchor
- $d_p$  = doiameter of plate

Determination of total length of the anchor

$$L_a \geq h_D + \min. h_{nom} + \max. a_1 + \max. a_2$$

BRAVOLL® PTH-KZ 60/8- $L_a$  , PTH-KZL 60/8- $L_a$   
 PTH 60/8- $L_a$  , PTH-L 60/8- $L_a$

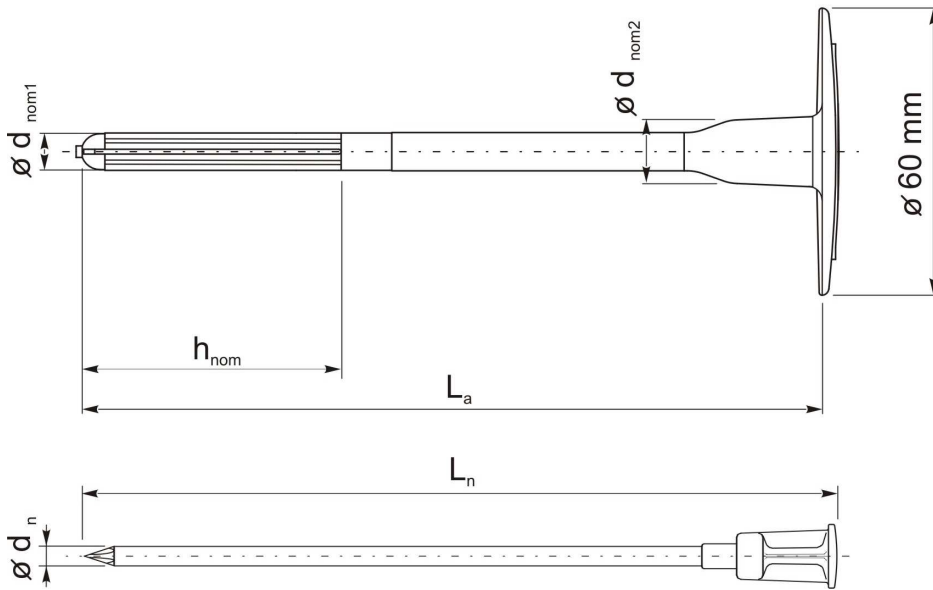
Intended use

Annex 1

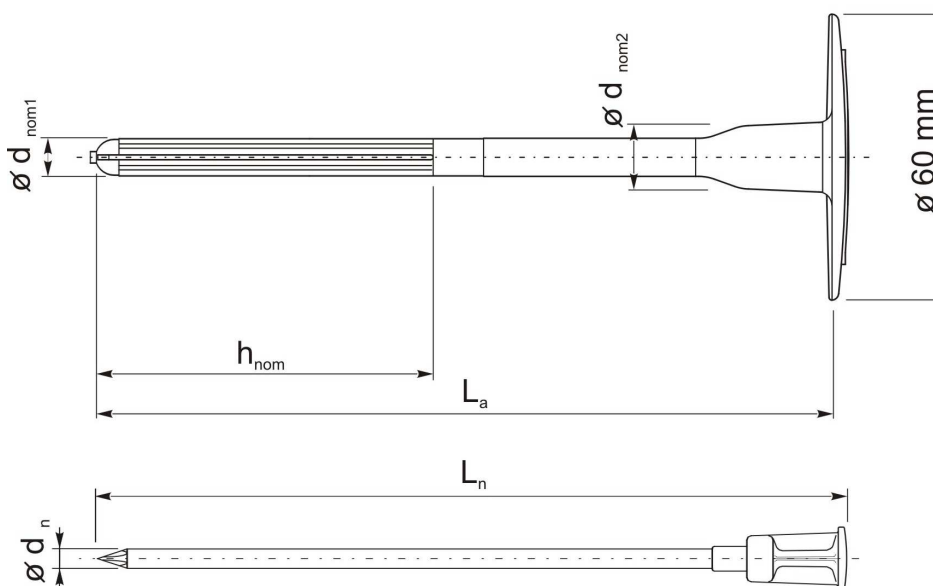
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 ETA – 05/0055

Anchor sleeve and expansion pin

**BRAVOLL® PTH-KZ 60/8- L<sub>a</sub>,**



**BRAVOLL® PTH-KZL 60/8- L<sub>a</sub>**

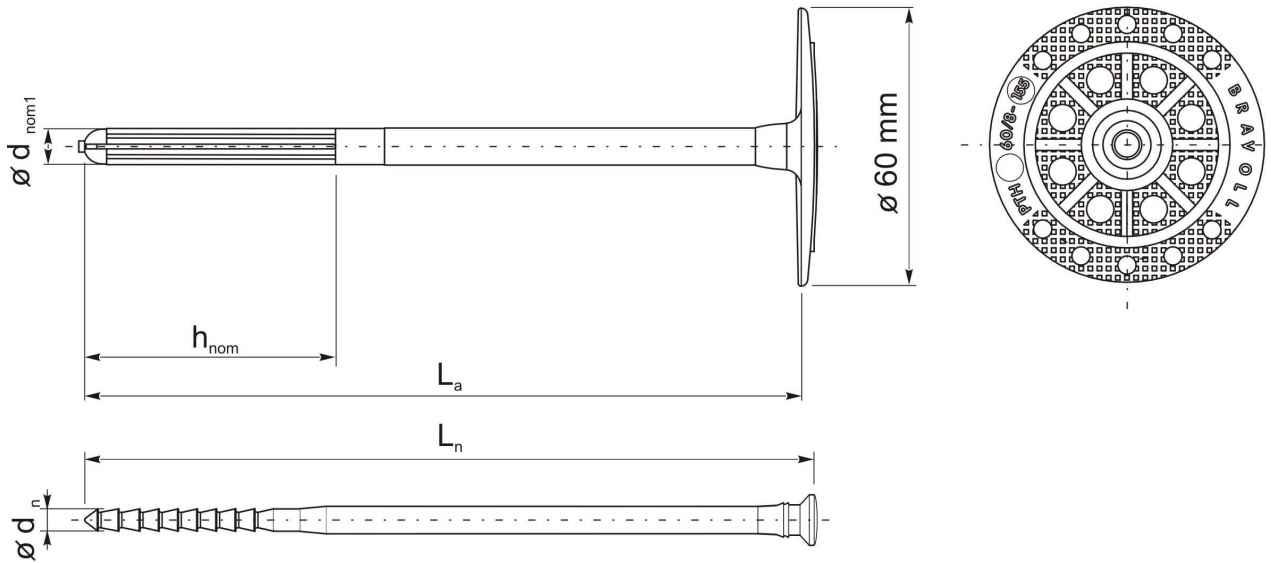


BRAVOLL® PTH-KZ 60/8-L<sub>a</sub> , PTH-KZL 60/8-L<sub>a</sub>  
 PTH 60/8-L<sub>a</sub> , PTH-L 60/8-L<sub>a</sub>

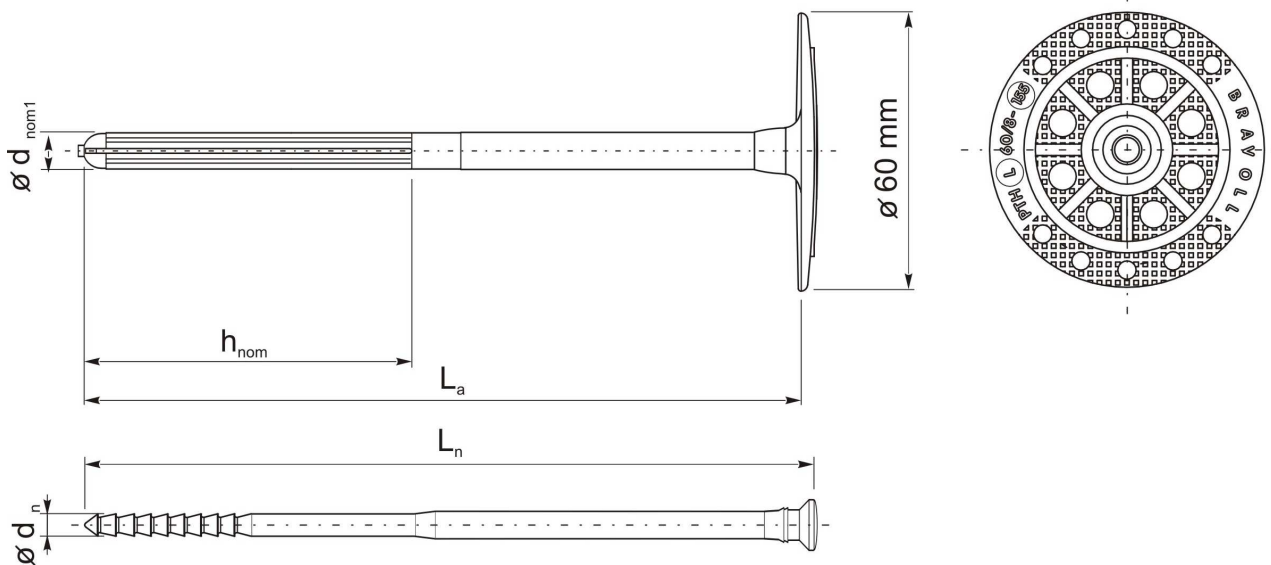
Anchor types

Annex 2  
 of European Technical Approval  
 ETA – 05/0055

**BRAVOLL® PTH 60/8- L<sub>a</sub>**



**BRAVOLL® PTH-L 60/8- L<sub>a</sub>**



BRAVOLL® PTH-KZ 60/8-L<sub>a</sub> , PTH-KZL 60/8-L<sub>a</sub> ,  
 PTH 60/8-L<sub>a</sub> , PTH-L 60/8-L<sub>a</sub>

Anchor types

Annex 3

of European Technical Approval  
 ETA – 05/0055

Table 1: Anchor types and dimensions [mm]

	Anchor sleeve				
	$d_{nom}$	$h_{ef}$	$h_{nom}$	$L_a$	
PTH-KZ 60/8- $L_a$	8	30	35	75-356	75-356
PTH-KZL 60/80- $L_a$	8	50	55	95-356	95-356
PTH 60/8- $L_a$	8	30	35	55-215	55-215
PTH-L 60/8- $L_a$	8	50	55	75-215	75-215

Table 2: Materials

Designation	Colour	Material
Anchor sleeve PTH-KZ 60/8- $L_a$	orange or colour of anchor is colour of TIPPLEN	Kopolymer polypropylen, TIPPLEN K 693
Expansion pin PTH-KZ 60/8- $L_a$	pin is colour of galvanized and pins head is colour natural	Steel strength class 8, galvanized $\geq 5\mu\text{mm}$ with head of pin has plastic coating
Anchor sleeve PTH-KZL 60/80- $L_a$	orange or colour of anchor is colour of TIPPLEN	Kopolymer polypropylen, TIPPLEN K 693
Expansion pin PTH-KZL 60/80- $L_a$	pin is colour of galvanized and pins head is colour natural	Steel strength class 8, galvanized $\geq 5\mu\text{mm}$ with head of pin has plastic coating
Anchor sleeve PTH 60/8- $L_a$	yellow or colour of anchor is colour of TIPPLEN	Kopolymer polypropylen, TIPPLEN K 693
Expansion pin PTH 60/8- $L_a$	colour of Polyamid	Polyamid PA6 GF30,
Anchor sleeve PTH-L 60/8- $L_a$	colour of anchor is colour of TIPPLEN	Kopolymer polypropylen, TIPPLEN K 693
Expansion pin PTH-L 60/8- $L_a$	colour of Polyamid	Polyamid PA6 GF30,
Plate BRAVOLL IP PTH 100	colour of Polyamid	Polyamid PA6 GF30
Plate BRAVOLL IP PTH 140	colour of Polyamid	Polyamid PA6 GF30

Table 3: Installation Characteristics

Anchor type	nominal diameter of drill bit $d_o$ [mm]	Cutting diameter of drill bit $d_{cut,max} \leq$ [mm]	Cutting diameter of drill bit $d_{cut,min} \leq$ [mm]	Depth of dtil hole $h_1 \geq$ [mm]	Effective anchorage depth $h_{ef}$ [mm]	Overall embedment depth $h_{nom}$ [mm]
PTH-KZ 60/8- $L_a$	8	8,45	8,0	45	30	35
PTH-KZL 60/80- $L_a$	8	8,45	8,0	65	50	55
PTH 60/8- $L_a$	8	8,45	8,0	45	30	35
PTH-L 60/8- $L_a$	8	8,45	8,0	65	50	55

**BRAVOLL® PTH-KZ 60/8- $L_a$  , PTH-KZL 60/8- $L_a$  , PTH 60/8- $L_a$  , PTH-L 60/8- $L_a$**

Anchor types, materials and installation characteristics

**Annex 4**  
of European Technical Approval  
ETA – 05/0055

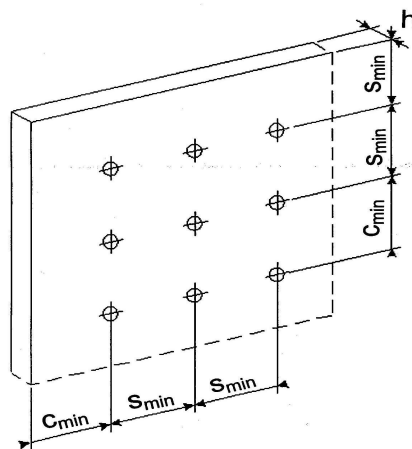
Table 4: Minimum thickness of concrete, edge distance and anchor spacing

Anchor type	Minimum thickness of base material $h$ [mm]	Minimum spacing $s_{min}$ [mm]	Minimum edge distance $c_{min}$ [mm]
PTH-KZ 60/8-L <sub>a</sub>	100	100	100
PTH-KZL 60/80-L <sub>a</sub>	100	100	100
PTH 60/8-L <sub>a</sub>	100	100	100
PTH-L 60/8-L <sub>a</sub>	100	100	100

Table 5: Minimum thickness of other base material, edge distance and anchor spacing

Anchor type	Minimum thickness of base material $h$ [mm]	Minimum spacing $s_{min}$ [mm]	Minimum edge distance $c_{min}$ [mm]
PTH-KZ 60/8-L <sub>a</sub>	115	100	100
PTH-KZL 60/80-L <sub>a</sub>	115	100	100
PTH 60/8-L <sub>a</sub>	115	100	100
PTH-L 60/8-L <sub>a</sub>	115	100	100

### Scheme of distance and spacing



BRAVOLL® PTH-KZ 60/8-L<sub>a</sub> , PTH-KZL 60/8-L<sub>a</sub> ,  
PTH 60/8-L<sub>a</sub> , PTH-L 60/8-L<sub>a</sub>

Installation Characteristics

Annex 5  
of European Technical Approval  
ETA – 05/0055

Table 6: Characteristic resistance to tension loads  $N_{Rk}$  [kN] in concrete and masonry for singl anchor

Base material	Bulk density class [kg/dm <sup>3</sup> ]	min. compressive strength $\beta$ [N/mm <sup>2</sup> ]	General remarks	PTH-KZ 60/8-L <sub>a</sub>	PTH-KZL 60/80-L <sub>a</sub>	PTH 60/8-L <sub>a</sub>	PTH-L 60/8-L <sub>a</sub>
Concrete C 12/15			EN 206-1	0,50	-	0,60	-
Concrete C 16/20 – C50/60			EN 206-1	0,60	-	0,90	-
Solid clay bricks e.g. according to ČSN EN 771-1	≥1,7	30		0,75	-	0,90	-
Perforated clay bricks e.g. according to ČSN EN 771-1	≥ 0,7	10		-	0,50	-	0,60
partial safety factor	$\gamma_M =$	2,0*					

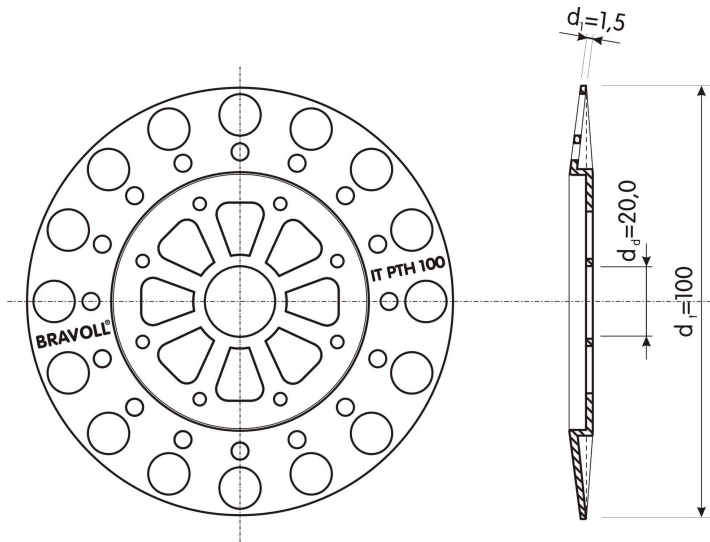
\* In the absence of other national regulations

**BRAVOLL® PTH-KZ 60/8-L<sub>a</sub> , PTH-KZL 60/8-L<sub>a</sub> , PTH 60/8-L<sub>a</sub> , PTH-L 60/8-L<sub>a</sub>**

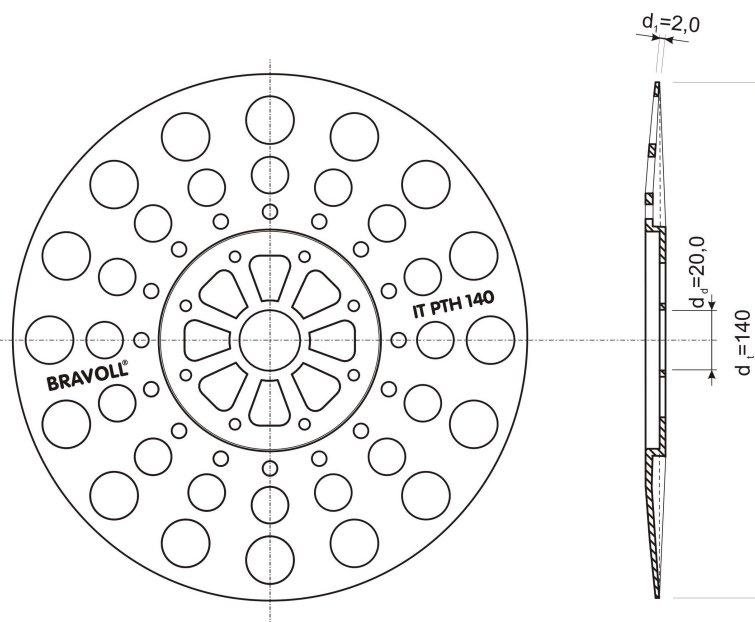
Characteristic resistance

**Annex 6**  
of European Technical Approval  
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### BRAVOLL® IP PTH 100



### BRAVOLL® IP PTH 140



**BRAVOLL®**  
**IP PTH 100 and IP PTH 140**

Plate in combination with BRAVOLL® PTH-KZ 60/8-L<sub>a</sub> ,  
 PTH-KZL 60/8-L<sub>a</sub> , PTH 60/8-L<sub>a</sub> , PTH-L 60/8-L<sub>a</sub>

**Annex 7**  
 of European Technical Approval  
 ETA – 05/0055