

## National technical approval / General construction technique permit

### Zulassungsstelle für Bauprodukte und Bauarten Bautechnisches Prüfamt

Eine vom Bund und den Ländern  
gemeinsam getragene Anstalt des öffentlichen Rechts

Mitglied der EOTA, der UEAtc und der WFTAO

Date: 12 April 2018      Reference:  
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**Number:**  
**Z-16.32-477**

**Applicant:**

**Calenberg Ingenieure GmbH**  
Am Knübel 2-4  
31020 Salzhemmendorf, Germany

**Validity**

from: **12 April 2018**  
to: **12 April 2023**

**Subject of decision:**

**Calenberg Compact Bearing S 70**

The subject named above is herewith granted a national technical approval (*allgemeine bauaufsichtliche Zulassung*) / general construction technique permit (*allgemeine Bauartgenehmigung*). This decision contains eight pages.

Translation authorised by DIBt

DIBt

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## I GENERAL PROVISIONS

- 1 This decision confirms the fitness for use and application of the subject concerned in accordance with the Building Codes of the federal states (*Landesbauordnungen*).
- 2 This decision does not replace the permits, approvals and certificates required by law for carrying out building projects.
- 3 This decision is granted without prejudice to the rights of third parties, in particular private property rights.
- 4 Notwithstanding further provisions in the 'Special Provisions', copies of this decision shall be made available to the user and installer of the subject concerned. It shall also be pointed out to the user and installer that this decision must be available at the place of use or application. Upon request, copies of the decision shall be provided to the authorities involved.
- 5 This decision may be reproduced in full only. Partial publication requires the consent of Deutsches Institut für Bautechnik. Texts and drawings in promotional material shall not contradict this decision. In the event of a discrepancy between the German original and this authorised translation, the German version shall prevail.
- 6 This decision may be revoked. The provisions may subsequently be supplemented and amended, in particular if this is required by new technical findings.
- 7 This decision is based on the information and documents provided by the applicant. Alterations to this basis are not covered by this decision and shall be notified to Deutsches Institut für Bautechnik without delay.
- 8 The general construction technique permit included in this decision also serves as a national technical approval for the construction technique.

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## II SPECIAL PROVISIONS

### 1 Subject concerned and field of use and/or application

#### 1.1 Subject of approval

The subject of approval is a compact, unreinforced elastomeric bearing based on ethylene propylene diene monomer (EPDM) rubber used as a bearing pad in buildings.

Rectangular bearings shall be formed. They may be supplied in point or strip form. Point bearings can also be supplied as round bearings.

#### 1.2 Subject of permit

The unreinforced elastomeric bearings can be used at temperatures between -25 °C and 50 °C. The bearings may be exposed to temperatures up to +70 °C for short-term recurring periods of less than 8 hours.

The resultant bearing rotation may be up to 40‰ depending on the size and shape of the bearing and in consideration of the total loads imposed simultaneously. Rotations of 40‰ at maximum shall be permitted on each bearing side.

The unreinforced elastomeric bearings are used to transfer forces and to compensate deformations perpendicular to the bearing plane. Although elastomeric bearings enable shear deformations, they may not be used for the planned transfer of constant external shear forces.

### 2 Provisions for the unreinforced elastomeric bearings

#### 2.1 Properties and composition

##### 2.1.1 Dimensions

For the bearing dimensions, the following conditions shall be complied with:

bearing thickness:  $t = 10 \text{ mm} / 15 \text{ mm} / 20 \text{ mm}$

$$t \leq a/5 \text{ where } t_{\max} = 20 \text{ mm}$$

$$t \geq a/30 \text{ where } t_{\min} = 10 \text{ mm.}$$

For rectangular bearings:

$$a \geq 70 \text{ mm, } b \geq 70 \text{ mm.}$$

Additionally for rectangular bearings of thickness  $t = 10 \text{ mm}$ :

$$a \geq 50 \text{ mm if}$$

$$b \geq 100 \text{ mm.}$$

For round bearings:

$$D \geq 80 \text{ mm}$$

with the nominal dimensions:

t thickness of unloaded bearing [mm]

a short side of bearing [mm]

b long side of bearing [mm]

D diameter of bearing [mm].

Regarding the dimensional tolerances to be adhered to:

length class L3 in accordance with Table 6 of DIN ISO 3302-1:1999

width class L3 in accordance with Table 6 of DIN ISO 3302-1:1999

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thickness class M4 in accordance with Table 1 of DIN ISO 3302-1:1999.

Up to two drilled holes shall be permitted per bearing, whereby the total hole area may not exceed 10 per cent of the total bearing area. The hole spacing shall be at least  $2 \times d$ . For the hole, an edge distance of at least  $0.3 \times a$  shall be chosen.

For the hole dimensions, the following conditions shall be complied with:

$$d \leq 50 \text{ mm}$$

where:

$d$  diameter of each hole.

### 2.1.2 Materials

The physical characteristics and the chemical composition as well as the material properties of the bearings are deposited with Deutsches Institut für Bautechnik.

The properties of the starting materials used shall be verified through inspection certificate type 3.1 in accordance with DIN EN 10204:2005-01.

## 2.2 Manufacture, transport and marking

### 2.2.1 Manufacture and transport

The bearings shall be produced in the shape of panels using the vulcanisation technique and then cut to size.

Detailed information about the manufacturing process is deposited with Deutsches Institut für Bautechnik.

Regarding the transport of the bearings the manufacturer's specifications shall be observed.

### 2.2.2 Marking

The manufacturer shall affix the national conformity mark (*Ü-Zeichen*) to the construction product in accordance with the Conformity Marking Ordinances (*Übereinstimmungszeichen-Verordnungen*) of the federal states. The mark may only be affixed if the requirements given in Section 2.3 are met. When applied accordingly, the marking shall be permanent with continuous labelling on panels produced in accordance with Section 2.2.1.

## 2.3 Confirmation of conformity

### 2.3.1 General

The confirmation of conformity of the bearings with the provisions of this national technical approval shall be issued for every manufacturing plant in the form of a certificate of conformity based on factory production control and regular external surveillance including initial type-testing of the bearings in accordance with the following provisions.

To issue the certificate of conformity and for external surveillance including the associated product testing to be carried out in the process, the manufacturer of the bearings shall use an appropriately recognised certification body and an appropriately recognised inspection body.

The declaration of conformity shall be submitted by the manufacturer through marking of the construction products with the national conformity mark including statement of the intended use. Should this not be possible in exceptional cases, the instruction sheet of the bearing shall be marked with the national conformity mark in accordance with the Conformity Marking Ordinances of the federal states.

The certification body shall send a copy of the certificate of conformity issued by it to Deutsches Institut für Bautechnik.

A copy of the initial type-testing evaluation report shall also be sent to Deutsches Institut für Bautechnik.

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**2.3.2 Factory production control**

A factory production control system shall be set up and implemented in each manufacturing plant. Factory production control shall be understood to be continuous surveillance of production by the manufacturer to ensure that the manufactured construction products satisfy the provisions of the national technical approval covered by this decision.

Factory production control shall be carried out in accordance with the test plan deposited with Deutsches Institut für Bautechnik.

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

- designation of the construction product or the starting material and the components,
- type of check or test,
- date of manufacture and testing of the construction product or the starting material or the components,
- result of the checks and tests as well as, if applicable, comparison with requirements,
- signature of the person responsible for factory production control.

The records shall be kept for at least five years. They shall be submitted to Deutsches Institut für Bautechnik and the competent supreme building authority upon request.

If the test result is unsatisfactory, the manufacturer shall immediately take the necessary measures to resolve the defect. Construction products which do not meet the requirements shall be handled in such a way that they cannot be confused with compliant products. After the defect has been remedied, the relevant test shall be repeated immediately - where technically feasible and necessary to show that the defect has been eliminated.

**2.3.3 External surveillance**

The factory production control system shall be inspected regularly, i.e. at least twice a year, by means of external surveillance at each bearing manufacturing plant. The results of the checks carried out by the manufacturer in accordance with Section 2.3.2 shall be statistically evaluated.

Initial type-testing of the bearing shall be carried out within the scope of external surveillance. Samples shall also be drawn at random for testing. Sampling and testing shall be the responsibility of the recognised inspection body.

The scope and frequency of external surveillance shall be taken from the test plan deposited with Deutsches Institut für Bautechnik.

The results of certification and external surveillance shall be kept for at least five years. They shall be presented by the certification or inspection body to Deutsches Institut für Bautechnik and the competent supreme building authority upon request.

**3 Provisions for planning, design and execution**

**3.1 Planning**

The bearings shall be installed in single layers. The dimensions of the bearings shall be taken from the structural engineer's specifications and the installation plans.

Structural analysis shall be carried out in each individual case to verify the structural safety of the bearings in the ultimate limit state for all relevant design situations and load cases.

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The verification concept in accordance with DIN EN 1990:2010-12 in conjunction with the National Annex shall apply. The bearings may only be used for static or quasi-static loads imposed on the structural members.

The type, dimensions and arrangement of the bearings shall result from the structural requirements as well as the resistance values of the adjacent structural members. Based on the bearing selection, an installation plan from which the exact positions of the bearings in the structural layout can be seen shall be drawn up insofar as the installation situation requires it.

Installation shall be carried out in accordance with the manufacturer's specifications.

**3.2 Design**

The possible load case combinations shall be taken from DIN EN 1990:2010-12.

The design values of the effects of the actions (loads)  $E_{\perp d}$  shall be determined from the characteristic values of the actions in consideration of the partial safety factors  $\gamma_f$  and the combination coefficients  $\psi$  in accordance with the Technical Building Rules.

In the ultimate limit state, the following verification shall be provided:

$$\frac{E_{\perp d}}{R_{\perp d}} \leq 1$$

where:

$E_{\perp d}$  load acting on bearing perpendicular to the bearing plane [N/mm<sup>2</sup>]

$R_{\perp d}$  design value of associated bearing resistance [N/mm<sup>2</sup>] perpendicular to bearing plane depending on shape factor S for a compressive strain of  $\epsilon = 40\%$  in accordance with Table 1

S shape factor for rectangular bearings:

$$S = \frac{a \cdot b}{2t(a + b)}$$

$S_{\text{hole}}$  shape factor for rectangular bearings with holes:

$$S = \frac{a \cdot b - \frac{\pi}{4} (d_1^2 + d_2^2)}{2t(a + b) + t\pi(d_1 + d_2)}$$

$S_{\text{mod}}$  modified shape factor for round bearings:

$$S_{\text{mod}} = \frac{D}{4\sqrt{2}t}$$

where a, b, t and D in accordance with Section 2.1.1

$d_i$  radius of hole i.

Table 1: Bearing resistance for loads perpendicular to bearing plane for point and strip bearings

Shape factor range S (S, $S_{\text{hole}}$ or $S_{\text{mod}}$ )	Function for determining the design value of resistance [N/mm <sup>2</sup> ]
$1.25 \leq S \leq 5$	$R_{\perp d} = 6.99 \cdot S$
$S > 5.00$	$R_{\perp d} = 34.95$

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Round bearings used for transferring vertical loads shall be designed using the design of a square bearing with a horizontal projection corresponding to the size of the inscribed square. For determining the resistance to horizontal loads and rotations, round bearings shall be designed using the actual base area of the bearing.

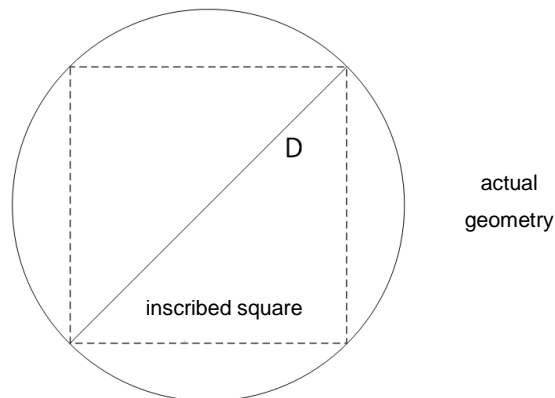


Figure 1: Area to be applied to round bearings for determining the shape factor  $S_{mod}$ .

The structural members adjacent to the bearing shall be designed such that the interaction with the structural behaviour of the bearing is taken into account. It shall be observed that loading of an elastomeric bearing leads to a load concentration. Rotation of the elastomeric bearings leads to eccentricities in the load concentration and hence to a restoring moment. The transverse tensile force arising in the adjacent structural members as a result of the strain constraint of the unreinforced elastomeric bearing shall be verified and transmitted through the corresponding measures.

The compression of the bearing shall be taken into account as a product-specific value in the determination of the actions on the overall load-bearing structure. If the contact areas of the adjacent structural members deviate from planar parallelism, e.g. as a result of manufacturing and installation tolerances, these deviations shall be taken into account in the design of the bearing. If more detailed verification is not provided, the angle of rotation of the adjacent structural members shall be determined through adding the following factors:

- obliqueness with 10‰
- unevenness with  $625/a$  ‰.

If the adjacent structural members are made from steel or in-situ concrete the unevenness may be halved.

For rotations on both perpendicular sides of the bearing, amounts for angular displacement shall be proportionally added to the respective design values.

The positional stability shall be verified.

For point bearings, the maximum twist for rotation about an axis shall be determined as follows:

$$\alpha_{b,max} = \frac{450 \cdot t}{a} \leq 40\text{‰}$$

where:

$\alpha_{b,max}$  maximum angle of twist for a rotation about the central axis parallel to side b.

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The formula shall be used analogously for determination of the maximum angle of twist about the central axis parallel to side a. Verification that edge contact with the adjacent structural members is avoided at simultaneous occurrence of the maximum compression and the maximum twist shall be provided during the structural design.

For biaxial torsional stress, the following boundary condition shall be adhered to:

$$\alpha_{\text{resultant}} = \sqrt{\alpha_{a,\text{max}}^2 + \alpha_{b,\text{max}}^2} = 40\text{‰}$$

The transverse tensile force acting on the adjacent structural members due to the central load acting on the bearing shall be determined as follows:

for rectangular bearings:

$$Z_a = 1.5 \cdot E_{\perp,d} \cdot a \cdot t$$

$$Z_b = 1.5 \cdot E_{\perp,d} \cdot b \cdot t$$

where:

$Z_a$  transverse tensile force perpendicular to the short side of the bearing a [N]

$Z_b$  transverse tensile force perpendicular to the long side of the bearing b [N]

for round bearings:

$$Z = 1.5 \cdot E_{\perp,d} \cdot D \cdot t$$

where:

Z transverse tensile force [N]

D diameter of bearing [mm].

The bulging of the bearing depends on its size and shape. During the structural design (edge distances etc.) the bulging of the bearing shall be taken into account and requested from the manufacturer in advance.

The lateral surfaces of the bearing may not be hindered in their planned deformation.

### 3.3 Execution

The bearings shall be stored in a dry condition. The bearings shall be protected from direct sunlight. The substrate shall be smooth and level. The support surfaces shall be carefully deburred for protecting the bearing. Voids in the adjacent concrete surfaces shall be avoided. If necessary height compensation may be carried out by means of a suitable mortar bed. The adjacent structural members shall be compatible with the bearing material. It shall be ensured that the bearing and the adjacent structural members are kept free of damaging chemical and physical effects as well as contaminants. The surfaces of the adjacent structural members shall be swept clean and free of snow, ice, grease and bond breakers. Stagnant water shall be avoided. The manufacturer's specifications regarding installation shall be observed.

## 4 Provisions for use, maintenance and repair

The bearings shall be installed such that they are maintenance-free.

Andreas Schult  
Head of Section

Drawn up by