Deutsches Institut für Bautechnik

DIBt

Public-law institution jointly founded by the federal states and the Federation

Technical authority granting approvals and permits for construction products and construction techniques

National technical approval / General construction technique permit

Date: 20 Aug 2021

Reference number: I 32-1.16.32-11/21

Number:
Z-16.32-474

Validity
from: **20 August 2021**
to: **21 May 2026**

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

Subject of decision:
Calenberg Compact Bearing S 65

The subject named above is herewith granted a national technical approval (*allgemeine bauaufsichtliche Zulassung*) / general construction technique permit (*allgemeine Bauartgenehmigung*). This decision contains nine pages. This national technical approval/general construction technique permit replaces national technical approval no. Z-16.32-474 of 21 May 2021. The subject concerned was granted the first national technical approval on 14 June 2016.

Translation authorised by DIBt

I GENERAL PROVISIONS

1 This decision confirms the fitness for use and application of the subject concerned within the meaning of 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 construction 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. The user and installer of the subject concerned shall also be made aware that this decision must be made available at the place of use or place of application. Upon request, copies of the decision shall be provided to the authorities involved.

5 This decision shall be reproduced in full only. Partial publication requires the consent of DIBt. 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 contained herein 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 DIBt without delay.

II SPECIAL PROVISIONS

1 Subject concerned and field of use and application

1.1 Subject of approval

The subject of approval is the compact unreinforced elastomeric bearing 'Calenberg Compact Bearing S 65' made of the material EPDM used to transfer forces and to compensate deformations perpendicular to the bearing plane.

Rectangular bearings are supplied in point, strip or full surface form, whereas round bearings are supplied in point form only.

1.2 Subject of permit

The subject of the permit is the planning, design and execution of the elastomeric bearings used in buildings. The structural members adjacent to the bearing shall be made of steel, concrete or wood. Use of films above or beneath the bearing shall not be permitted. The elastomeric bearings may 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.

Although elastomeric bearings can transfer shear deformations, they shall not be used for the planned transfer of constant external shear forces.

2 Provisions for the construction product(s)

2.1 Properties and composition

2.1.1 Dimensions

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

bearing thickness: t = 10 mm / 15 mm / 20 mm / 25 mm / 30 mm

$t \leq a/5$

$t \geq a/30$.

For rectangular bearings:

$a \geq 70$ mm, $b \geq 70$ mm.

Additionally for rectangular bearings of thickness t = 10 mm:

$a \geq 50$ mm if

$b \geq 100$ mm.

For round bearings:

$r \geq 40$ mm

where:

t	thickness of unloaded bearing	[mm]
a	short side of bearing	[mm]
b	long side of bearing	[mm]
r	radius of bearing	[mm].

Regarding the tolerances to be adhered to:

length class L3 in accordance with Table 7 of DIN ISO 3302-1:2018

width class L3 in accordance with Table 7 of DIN ISO 3302-1:2018

thickness class M4 in accordance with Table 1 of DIN ISO 3302-1:2018.

Up to four drilled holes per bearing shall be permitted. The total drill hole area shall not exceed 10 per cent of the total bearing area. The hole spacing shall be at least 2 x D_{hole}. The edge distance shall be at least t (thickness of member).

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

$D_{hole} \leq 50$ mm

where:

D_{hole} diameter of each hole.

2.1.2 Materials

The physical characteristics and the chemical composition as well as the material properties of the bearing and the adhesive are deposited with DIBt.

The properties of the starting materials and adhesive 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 and rolls using the vulcanisation technique and then cut to size.

Detailed information on the manufacturing process is deposited with DIBt.

Regarding the transport and installation 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 shall only be applied if the requirements given in Section 2.3 are met. When applied accordingly, the marking shall be permanent with continuous labelling on rolls and panels produced in accordance with Section 2.2.1.

2.3 Confirmation of conformity

2.3.1 General

The manufacturer shall confirm for each manufacturing plant that the bearings comply with the provisions of this national technical approval by way of a declaration of conformity based on factory production control and a certificate of conformity issued by a recognised certification body, as well as by way of regular external surveillance carried out by a recognised inspection body in accordance with the following provisions:

To issue the certificate of conformity and for external surveillance, including the associated product testing, the manufacturer of the bearings shall use a certification body and an inspection body recognised for these purposes.

The declaration of conformity shall be submitted by the manufacturer through marking of the construction products with the national conformity mark (*Ü-Zeichen*), including statement of the intended use.

The certification body shall send a copy of the certificate of conformity issued by it to DIBt.

A copy of the initial type-testing evaluation report shall also be sent to DIBt.

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 this national technical approval.

Factory production control shall be carried out in accordance with the test plan deposited with DIBt.

The results of factory production control shall be recorded and evaluated. The records shall include at least 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 DIBt 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 for random testing shall also be taken. 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 DIBt.

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

3 Provisions for planning, design and execution

3.1 Planning

The Technical Building Rules (*Technische Baubestimmungen*) shall apply to the planning unless otherwise specified below. The bearings shall be installed in single layers. The dimensions of the bearings shall be taken from the designer'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.

The verification concept set out in 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 bearing shall result from the verification of stability. Based on the bearing selection, an installation plan which shows the exact position of the bearings in the structural layout shall be drawn up if the installation situation so requires.

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

3.2 Design

The Technical Building Rules shall apply to the design unless otherwise specified below.

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

The design values of the effects of the actions (loads) Ed shall be determined from the characteristic values of the actions in consideration of the partial safety factors gf and the combination coefficients y 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/mm²]

$R_{\perp d}$ design value of associated bearing resistance [N/mm²] perpendicular to bearing plane depending on shape factor S for a compressive strain of ε = 40% in accordance with Table 1 (compressive strain of 40% is considered the failure criterion)

S shape factor for rectangular cross-sections: $S = \frac{a \cdot b}{2 \cdot t(a+b)}$

S_{mod} modified shape factor for round bearings: $S_{mod} = \frac{r}{\sqrt{8} \cdot t}$.

The drilled holes shall be taken into account in the calculation of the shape factor. Here, S = contact area under compressive loading / unloaded area.

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

Shape factor range *S* (S or S_{mod})	**Function for determining** the design value of resistance [N/mm²]
$1.25 \leq S \leq 6.25$	$R_{\perp d} = 4.03 \cdot S^{1.16}$
$S > 6.25$	$R_{\perp d} = 33.9$

The function for determining the design value of resistance shall apply to bearings without drilled holes. If drilled holes are present in accordance with Section 2.1.1, the base area decreased by the drilled holes and the increased lateral surface area shall be taken into account in the calculation of the shape factor.

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.

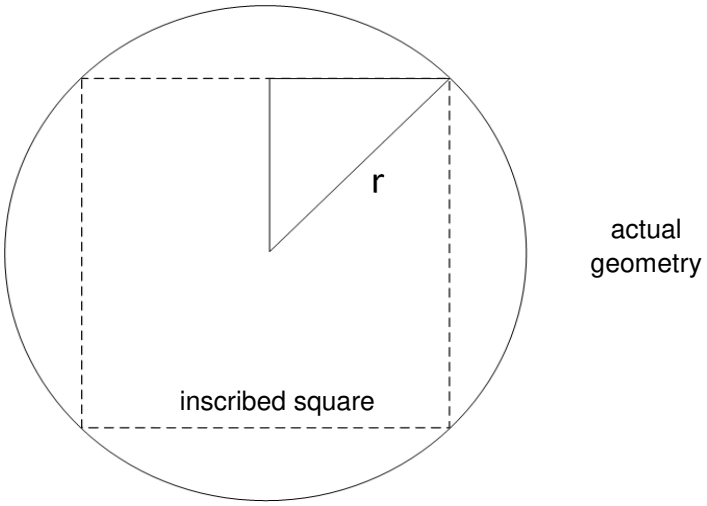

Figure 1: Area to be applied to round bearings for determining the shape factor S_{mod}

The material partial safety factor for a compressive strain of $\varepsilon = 40\%$ is $\gamma_{m,40\%} = 1.16$.

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 elastomer bearing leads to a load concentration. Rotation of the elastomer 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 corresponding measures.

The compressive strain of the bearing shall be taken into account as a product-specific value in the determination of the actions on the overall structure. If the contact surfaces 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 of the following factors:

- obliqueness with 10‰
- unevenness with 625 mm/a [‰].

where:

a in [mm].

If the adjacent structural members are made of 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 the central axis parallel to side b shall be determined as follows:

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

where:

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

t thickness of unloaded bearing in mm

a short side of bearing in mm

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:

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

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 Technical Building Rules (*Technische Baubestimmungen*) shall apply to the execution unless otherwise specified below.

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.

In accordance with Section 16a(5) of the Model Building Code (MBO) in conjunction with Section 21(2) MBO, the executing company shall confirm in writing that the bearings have been installed in conformity with the provisions of this national technical approval.

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