Deutsches Institut für Bautechnik

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

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

Date: 23 Aug 2023

Reference number: I 32-1.16.32-7/22

National technical approval / General construction technique permit

Number:
Z-16.32-435

Validity
from: **23 August 2023**
to: **23 August 2028**

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

Subject of decision:
Compact Bearing CR 2000

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.
The subject concerned was granted the first national technical approval on 21 February 2003.

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 unreinforced elastomeric 'Compact Bearing CR 2000' used to transfer forces and to compensate deformations perpendicular to the bearing plane. The 'Compact Bearing CR 2000' is made of chloroprene rubber (CR) and has a compact as well as a profiled honeycombed bearing surface.

The bearings can be supplied as rectangular bearings in point or strip form or as circular bearings.

1.2 Subject of the 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 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.

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

The bearings may have drill holes.

2 Provisions for the bearings

2.1 Properties and composition

2.1.1 Dimensions

2.1.1.1 General

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

bearing thickness:

t = 11 mm / 16 mm / 21 mm

length, width or radius of the bearing:

rectangular bearings (except for square bearings): a ≥ 50 mm, b ≥ 100 mm

square bearings: a ≥ 70 mm, b ≥ 70 mm

circular bearings: r ≥ 35 mm.

Additional conditions:

t ≥ a/30 or t ≥ r/15

for rectangular bearings:

a ≥ 50 mm for t = 11 mm

a ≥ 80 mm for t = 16 mm

a ≥ 110 mm for t = 21 mm

for circular bearings:

2 · r ≥ 70 mm for t = 11 mm

2 · r ≥ 80 mm for t = 16 mm

2 · r ≥ 110 mm for t = 21 mm

with the nominal dimensions:

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

Regarding the dimensional tolerances to be adhered to:

length	class L3 in accordance with Table 6 of DIN ISO 3302-1:2018
width	class L3 in accordance with Table 6 of DIN ISO 3302-1:2018
thickness	class M4 in accordance with Table 1 of DIN ISO 3302-1:2018.

2.1.1.2 Drill holes

For bearings with drill holes, the following applies:

smallest bearing geometry [mm]:	70 x 70 or r ≥ 35 mm
maximum percentage of holes:	10 % of the bearing area
maximum diameter of drill hole:	$D_{i,max}$ = 50 mm
maximum number of drill holes:	n_{max} = 4
minimum edge distance:	t – 1 mm
minimum drill hole spacing:	2 · D_i
type of hole:	round hole

where D_i diameter of drill hole i [mm]
n number of drill holes per bearing

2.1.1.3 Dimensions of the depressions in the profiled bearing surface

One side of the bearing shall have depressions in the form of truncated pyramids. The depressions shall be arranged in a square pattern with a centre-to-centre spacing of approx. 10 mm. They shall be approx. 2 mm deep and have an edge length of approx. 6 mm at their base.

2.1.2 Materials

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

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. The round holes are produced by mechanical drilling.

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 panels produced in accordance with Section 2.2.1.

2.3 Confirmation of conformity

2.3.1 General

The confirmation of conformity of the bearing with the provisions of the national technical approval included in this decision 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, 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, 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 DIBt.

A copy of the initial type-testing 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 the national technical approval included in this decision.

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 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 one layer. 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 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 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

3.2.1 General

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

The possible load case combinations shall be taken from DIN EN 1990:2021-10.

The design values of the effects of the actions (loads) E_d shall be determined from the characteristic values of the actions in consideration of the partial safety factors γ_f and the combination coefficients ψ in accordance with the Technical Building Rules.

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 (see Section 3.2.4) 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.

3.2.2 Vertical resistance

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

S shape factor

for rectangular bearings: $S = \frac{a \cdot b}{2t\,(a + b)}$

for circular bearings: $S = \frac{r}{2 \cdot t}$

S_{hole} shape factor for bearings with drill holes:

$$S_{hole} = \frac{A_{bearing} - A_{hole}}{t \cdot (U_{bearing} + U_{hole})}$$

where A area of the drill hole or the bearing

U circumferential area of the drill hole or the bearing

a, b, r, t in accordance with Section 2.1.1

Table 1: Bearing resistance for loads perpendicular to bearing plane

Shape factor range S (S or S_{hole})	**Function for determining the design resistance or design resistance [N/mm²]**
1.25 ≤ S < 5.68	$R_{\perp d} = 6.0 \cdot S^{1.44}$
S ≥ 5.68	$R_{\perp d} = 73.31$

The material safety factor shall be $\gamma_m = 1.25$.

3.2.3 Rotation

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/a ‰ (with 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 an axis shall be determined as follows:

rectangular bearings: $\alpha_{b,max} = \frac{400 \cdot t}{a} \leq 40$ ‰

circular bearings: $\alpha_{circular,max} = \frac{400 \cdot t}{2r} \leq 40$ ‰

where:

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

$\alpha_{circular,max}$ maximum angle of twist for a rotation in case of circular bearings

a, r, t in accordance with Section 2.1.1

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:

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

3.2.4 Transverse tensile force

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:

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

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

for circular bearings:

$$Z = 1.5 \cdot E_{\perp d} \cdot 2r \cdot t$$

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].

Z transverse tensile force in case of circular bearings [N]

r,t in accordance with Section 2.1.1.

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.

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

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
Hoppe