Deutsches Institut für Bautechnik

DIBt

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

National technical approval

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Applicant:

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Subject of approval:

Unreinforced elastomeric bearing ESZ type 200

The subject of approval named above is herewith granted a national technical approval (*allgemeine bauaufsichtliche Zulassung*).
This national technical approval contains nine pages. The subject was granted the first national technical approval on 1 December 1992.

Translation authorised by DIBt

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I GENERAL PROVISIONS

1 This national technical approval confirms the fitness for use of the subject of approval within the meaning of the Building Codes of the federal states (*Landesbauordnungen*).

2 The national technical approval does not replace the permits, approvals and certificates prescribed by law for carrying out building projects.

3 The national technical approval is granted without prejudice to the rights of third parties, in particular private property rights.

4 Notwithstanding further provisions in the 'Special Provisions', manufacturers and distributors of the subject of approval shall make copies of the national technical approval available to the user and point out that the national technical approval must be available at the place of use. Upon request, copies of the national technical approval shall be placed at the disposal of the authorities involved.

5 The national technical approval shall be reproduced in full only. Partial publication requires the consent of Deutsches Institut für Bautechnik. Texts and drawings in promotional materials shall not contradict the national technical approval. In the event of a discrepancy between the German original of the national technical approval and this authorised translation, the German version shall prevail.

6 The national technical approval may be revoked. The provisions of the national technical approval can 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 on the subject of approval during the approval procedure. Alterations to the information on which this national technical approval was based are not covered by this decision and shall be notified to Deutsches Institut für Bautechnik without delay.

II SPECIAL PROVISIONS

1 Subject of Approval and field of use

The approved construction product is a compact, unreinforced elastomeric bearing made of vulcanised chloroprene rubber (CR) 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.

The national technical approval covers bearings 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 50‰ 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 national technical approval shall apply to the transfer of forces and the compensation of 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 construction products

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 up to 20 mm

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

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

For rectangular bearings:

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

For round bearings:

$r \geq 40$ mm

with the nominal dimensions:

- t thickness of unloaded bearing
- a short side of bearing
- b long side of bearing
- r radius of bearing.

Regarding the dimensional tolerances to be adhered to:

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

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

thickness class M3 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 x D_{hole}. For the hole, an edge distance of at least 0.3 x a shall be chosen.

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 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 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 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 (*Ü-Zeichen*) 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.

2.3.2 Factory production control

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

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 responsibility of the respective 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.
The verification concept given 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 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_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.

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 $\varepsilon = 40\%$ in accordance with Table 1

S shape factor for rectangular bearings:

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

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

$$S = \frac{a \cdot b - 2\pi\,(r_1 + r_2)}{2t\,(a + b) + 2t\,\pi\;\;(r_1 + r_2)}$$

S_{mod} modified shape factor for round bearings:

$$S_{mod} = \frac{r}{\sqrt{8t}}$$

where a, b, t and r in accordance with Section 2.1.1
r_n = radius of hole n.

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

Shape factor range S (S, S_{hole} or S_{mod})	**Function for determining the design value of resistance [N/mm²]**
0.88 - 3.75	$R\perp_d = 17.17 \cdot S - 11.32$
3.75 - 4.00	$R\perp_d = 35.94 \cdot S - 81.67$
4.00 - 10.00	$R\perp_d = 1.17 \cdot S + 57.39$
≥ 10.00	$R\perp_d = 69.10$

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.

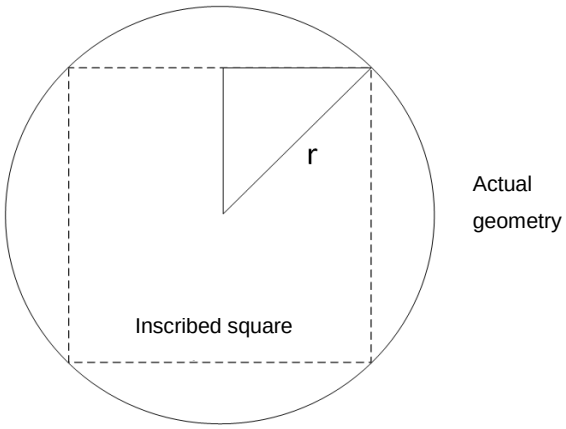

Figure 1: Area to be applied to round bearings for determining the shape factor S_{mod}.

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 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 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/a ‰.

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:

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

where:

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

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:

$$\alpha_{resultant} = \sqrt{\alpha_{a,max}^2 + \alpha_{b,max}^2} = 50‰.$$

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