Deutsches Institut für Bautechnik

DIBt

National technical approval / General construction technique permit

Approval body for construction products and techniques

Structural Design Control Authority

A public law institution jointly funded by the German Federal Government and the federal states

Member of the EOTA, UEAtc and WFTAO

Date: 06.02.2019

Reference number: I 32-1.16.32-6/18

Number:
Z-16.32-497

Validity:
from: **6. February 2019**
to: **28. November 2022**

Applicant:
matteco GmbH
Kohlmattstraße 7
77876 Kappelrodeck

Subject of this notification:
matteco elastomer bearing, type ELR 8

The subject matter named above is hereby granted national technical approval (allgemeine bauaufsichtliche Zulassung).
This notification comprises nine pages.
This national technical approval/general construction technique permit replaces national technical approval no. Z-16.32-497 of 28 November 2017. The subject matter was first granted national technical approval on 28 November 2017.

I GENERAL PROVISIONS

1 This notification confirms the fitness for use and fitness for application of the subject matter within the meaning of the regional building regulations of the German federal states.

2 This notification does not replace the legally prescribed permits, agreements and certificates required by law to carry out construction projects.

3 This notification is granted without prejudice to the rights of third parties, in particular private property rights.

4 Notwithstanding further provisions in the “Special Provisions”, users or installers of the subject matter must be provided with copies of this notification. In addition, users or installers of the subject matter must be informed that this notification must be made available at the place of use or application. Copies of this notification must also be made available to the public authorities involved upon request.

5 This notification may only be reproduced in full. Partial publication requires the consent of the Deutsches Institut für Bautechnik. Texts and drawings in promotional materials must not contradict this notification; translations must include the note “Translation of the original German version not reviewed by the Deutsches Institut für Bautechnik”.

6 This notification may be revoked. The provisions may subsequently be supplemented and amended, particularly if this becomes necessary due to new technical findings.

7 This notification is based on the information and documents provided by the applicant. Any amendments to these basic principles are not covered by this notification and must be immediately reported to the Deutsches Institut für Bautechnik.

8 The general construction technique permit covered by this notification is also regarded to be the national technical approval for the construction technique.

II SPECIAL PROVISIONS

1 Subject matter and field of use or application

1.1 Subject of approval

The subject of approval is a non-reinforced, flexible elastomer bearing, type ELR 8, made of granulated waste tyre rubber powder (NR/SBR) which is heated with a binding agent and compressed. The construction product is used in structural engineering. Point bearings can also be implemented as round bearings.

1.2 Subject of the permit

Non-reinforced elastomer bearings are used for the absorption and compensation of deformations perpendicular to the bearing plane. Although elastomer bearings enable shear deformations, they may not be used for the planned absorption of constant external shear forces.

Non-reinforced elastomer bearings can be used in temperature ranges between -25 °C and 50 °C. The bearings may be exposed to temperatures of up to +70 °C for short, recurring periods of less than 8 hours.

The resulting bearing rotation may be up to 1.6 $^{0}/_{00}$, depending on the size and shape of the bearing and taking into consideration the simultaneously acting loads.

Rotations of max. 1.6 $^{0}/_{00}$ can occur on each bearing side.

The construction elements adjacent to the bearing must be made of steel, concrete or wood. The use of sheeting above or beneath the bearing is not permitted.

2 Provisions for the non-reinforced elastomer bearing

2.1 Properties and composition

2.1.1 Dimensions

The following conditions must be complied with for the bearing dimensions:

bearing thickness: t = 10 mm, 15 mm, 20 mm

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

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

The following applies to square bearings:

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

The following also applies to square bearings of thickness t = 10 mm:

$a \geq 50$ mm, if

$b \geq 100$ mm

The following applies to round bearings:

$D \geq 80$ mm

with nominal dimensions:

t thickness of non-reinforced bearing

a shorter side of bearing

B longer side of bearing

D diameter of bearing

The following applies regarding the dimension tolerances to be complied with:

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

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

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

Up to two drilled holes are permitted for each bearing, whereby the surface area of the holes must not exceed 10 percent of the total bearing area. The distance between the holes must be at least 2 x d. A distance-to-edge of at least 0.3 x a (on square bearings) or at least 0.3 x D (on round bearings) must be selected for the hole.

The following condition must be complied with for the hole dimensions:

$d \leq 50$ mm

where

d diameter per hole

2.1.2 Materials

The physical characteristics, chemical composition and material properties of the bearing have been deposited with the Deutsches Institut für Bautechnik.

The properties of the raw materials used must be documented by acceptance test certificate 3.1 according to DIN EN 10204:2005-01.

2.2 Manufacture, transport and marking

2.2.1 Manufacture and transport

The bearings are produced in the form of panels in a hot-pressing method and then cut to size.

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

The manufacturer's specifications must be observed with regard to transporting and installing the bearings.

2.2.2 Marking

The manufacturer must affix the German mark of conformity (Ü-Zeichen) to the bearing's delivery note and to the bearing itself according to the conformity mark regulations of the German federal states. The mark may only be affixed if the conditions set out in section 2.3 are satisfied. When applied accordingly, the marking must be permanent with consecutive labelling on the panels produced in accordance with section 2.21.

2.3 Confirmation of conformity

2.3.1 General information

The confirmation of conformity of the bearing with the provisions of the national technical approval covered by this notification must be issued for each manufacturing plant by means of a declaration of conformity based on a factory production inspection and regular external monitoring, including an initial test of the bearings according to the following provisions.

To issue the certificate of conformity and for the external monitoring, including the associated product tests to be carried out, the manufacturer of the bearings must engage the services of a recognised certifying body as well as an appropriately recognised inspection body.

The manufacturer must submit the declaration of conformity by marking the construction products and the delivery note with the German mark of conformity (Ü-Zeichen) together with a statement of intended use.

The certifying body must submit a copy of the certificate of conformity which it issues to the Deutsches Institut für Bautechnik for their attention.

A copy of the initial test report must also be submitted to the Deutsches Institut für Bautechnik for their attention.

2.3.2 Factory production inspection

A factory production inspection must be arranged and carried out in each manufacturing plant. “Factory production inspection” is understood to mean continuous production monitoring to be carried out by the manufacturer, by means of which the latter ensures that the construction products that it manufactures comply with the provisions of the national technical approval covered by this notification.

The factory production inspection must be carried out in accordance with the test plan deposited with the Deutsches Institut für Bautechnik.

The results of the factory production inspection must be recorded and evaluated. The records must contain at least the following information:

- designation of the construction product or the raw material and the construction elements,
- type of check or test,
- date of manufacture and testing of the construction product or the source material or the construction elements,
- result of the checks and tests and, where applicable, comparison with the requirements,
- signature of the person responsible for the factory production inspection.

The records must be kept for at least five years. They must be submitted to the Deutsches Institut für Bautechnik and the highest responsible building supervisory authority upon request.

In the event of an unsatisfactory test result, the manufacturer must implement the measures required to correct the shortcoming without undue delay. Construction products which do not comply with the requirements must be handled in such a way that they cannot be confused with compliant construction products. After the shortcoming has been corrected, the respective test must—as far as technically possible and necessary to show that the shortcoming has been corrected—be repeated without undue delay.

2.3.3 External monitoring

In each bearing manufacturing plant, the factory production inspection must be checked by external monitoring at regular intervals, however, at least twice a year. The results of the checks carried out by the manufacturer in accordance with section 2.3.2 must be statistically analysed.

An initial test must be carried out within the scope of the external monitoring. Furthermore, samples must be taken at random for testing. Sampling and testing are the responsibility of the respective recognised inspection body.

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

The results of the certification and external monitoring must be kept for at least five years. They must be submitted by the certifying body or the inspection body to the Deutsches Institut für Bautechnik and the highest responsible building supervisory authority upon request.

3 Provisions for planning, design and implementation

3.1 Planning

The bearings must be installed in single layers. The dimensions of the bearings can be taken from the structural engineers' specifications and the installation plans.

In each individual case, the structural safety of the bearings in the ultimate limit state of bearing capacity for all relevant design situations and load cases must be proven by a static calculation.

The verification concept according to DIN EN 1990:2010-12 applies in conjunction with the National Annex. The bearings may only be used for construction elements subject to static or quasi-static loads.

The type, dimensions and arrangement of the bearings are derived from the static requirements and the bearing capacity of the connected construction elements. Based on the selection of bearings, an installation plan must be drawn up, insofar as the installation situation requires this, showing the exact positions of the bearings in the structural layout.

The installation must be carried out in accordance with the manufacturer's specifications.

3.2 Design

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

The design values of the effect of actions (loads) Ed are determined from the characteristic values of the actions, taking into account the partial safety coefficient yt and the combination coefficients i// in accordance with the Technical Building rules.

In the ultimate limit state of bearing capacity, the following verification must be provided:

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

where:

$E_{\perp d}$ load acting on the bearing perpendicular to the bearing plane [N/mm²]

$R_{\perp,d}$ design value of the associated bearing capacity of the bearing [N/mm²] perpendicular to the bearing surface depending on shape factor S and temperature T for a compression strain of e = 25% in accordance with table 1

The material safety coefficient is $\gamma_m = 1.27$

S shape factor for square bearings without holes:

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

The holes must be taken into account when determining the shape factor.

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

$$S_{hole} = \frac{a \cdot b - \frac{\pi}{4}\left(d_1^{\,2} + d_2^{\,2}\right)}{2t\,(a+b) + t\,\pi\,(d_1 + d_2)}$$

S_{mod} modified shape factor for round bearings:

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

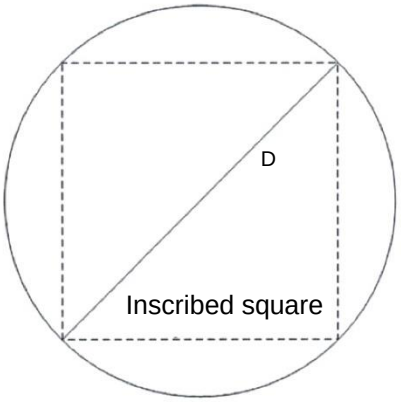
where a, b, t, D according to section 2.1.1

d_i diameter of hole i

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

Shape factor range S (S, S_{hole} or S_{mod})	**Function for determining the design value of the bearing capacity at room temperature [N/mm²]**
0.88 – 4.17	$R_{\perp d} = 0.422 \cdot e^{0.698 \cdot S}$
> 4.17	$R_{\perp d} = 7.75$
Shape factor range S (S, S_{hole} or S_{mod})	**Function for determining the design value of the bearing capacity at 50° [N/mm²]**
0.88 – 2.50	$R_{\perp d} = 0.422 \cdot e^{0.698 \cdot S}$
2.50 – 4.17	$R_{\perp d} = 0.422 \cdot e^{0.562 \cdot S}$
> 4.17	$R_{\perp d} = 6.18$

Round bearings used for absorbing vertical loads are designed based on the design of a square bearing with a horizontal projection corresponding to the size of the inscribed square. To determine the resistance to horizontal loads and rotations, round bearings must be designed using the actual base area of the bearing.



Actual geometry

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

The construction elements adjacent to the bearing must be designed so that the interaction with the load-bearing behaviour of the bearing is taken into account. In this case, it must borne in mind that loading an elastomer bearing leads to a concentration of the load. Rotation of elastomer bearings leads to eccentricities in the concentration of the load and hence to a restoring moment. The transverse tensile force arising in the adjacent construction elements as a result of the plane strain constraint of the non-reinforced elastomer bearing must be verified and recorded using corresponding measures.

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

- obliqueness with 10 $^0/_{00}$
- unevenness with 625/a $^0/_{00}$

If the adjacent construction elements are made of steel or in-situ concrete, the unevenness may be halved.

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

The positional stability must be verified.

For point bearings, the maximum twist for a rotation around an axis must be determined as follows:

$$\alpha_{b,max} = \frac{200 \cdot t}{a} \leq 16\ ‰$$

where:

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

t thickness of the non-reinforced bearing in mm

a shorter side of the bearing in mm

b longer side of the bearing in mm

The formula is used in the same way to determine the maximum angle of twist around the central axis parallel to side a. When planning the support structure, evidence must be provided that edge contact with the adjacent construction elements is avoided at simultaneous occurrence of maximum compression and maximum twist.

In the event of biaxial torsional stress, the following boundary condition must be observed:

$$\alpha_{Resultant} = \sqrt{\alpha_{a,max}^2 + \alpha_{b,max}^2} \leq 16\ ‰$$

The transverse tensile force acting on the adjacent construction elements due to the central load acting on the bearing is determined as follows:

For square 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 shorter side of the bearing a

Z_b transverse tensile force perpendicular to the longer side of the bearing b

For round bearings:

$$Z=1{,}5 \cdot E_{\perp,d} \cdot D \cdot t$$

where:

Z transverse tensile force

D diameter of the bearing

The bulging of the bearing depends on its size and shape. When planning the support structure (distances-to-edge, etc.), the bulging of the bearing must be taken into account and requested from the manufacturer in advance.

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

3.3 Execution

The bearings must be stored in a dry condition. The bearings must be protected from direct sunlight. The substrate must be smooth and level. The support surfaces must be carefully deburred to protect the bearings. Voids in the adjacent concrete surfaces must be avoided. If necessary, height compensation may be provided by means of a suitable mortar bed. The adjacent construction elements must be compatible with the bearing material. It must be ensured that the bearing and the adjacent construction elements are kept free from chemical and physical influences as well as from contaminants. The surfaces of the adjacent construction elements must be swept clean, and kept free of snow, ice, grease and releasing agents. Stagnant water must be avoided. Follow the manufacturer's instructions.

4 Provisions for use, maintenance and repair

The bearings must be installed in such a way that they are maintenance-free.

Andreas Schult
Head of Division

Deutsches Institut für Bautechnik