Introduction

MK4 Elastomeric Bearings are deformable structural components constructed partially or wholly from elastomer. They are essentially designed to transmit vertical loads and accommodate movements between a bridge and its supporting structure simultaneously, especially for:

- transmission of vertical load;
- horizontal displacement in all directions;
- rotation of the bearing surfaces about all axes;
- accommodation of transition horizontal forces with or without additional fixings.

The bearings comprise a block of vulcanized elastomer that may be reinforced with one or more steel plates. In addition to any internal reinforcement, bearings may have external steel load plates bonded to the upper or lower elastomer layers or both.

MK4’s Technical Department has engineers with the relevant expertise and experience to assist with the selection of the appropriate bearing for a given application as well as providing the best solution for the client’s specific problems.

Since we recognize the importance of simplicity, clarity and ease of use, we emphasize that we can offer both: the simple standardized series of products and also highly sophisticated customized solutions for specific problems.

This brochure is intended to provide a quick and expedient reference and guide for designers, engineers and contractors alike.
Elastomeric bearings are equipped with several vulcanized steel plates in order that internal lateral contraction will be prevented. The result is that load carrying capacity increases, resilience is reduced, while lateral displacement and distortion of the adjacent structural elements can be compensated by the bearing. Reinforced elastomeric bearings are of simple construction, do not require maintenance and are corrosion proof. They have a long service life, even under extremely onerous environmental conditions.

**Bearings fully covered with Elastomer**

**Non Anchored Types**

Reinforced elastomeric bearings are designed in accordance with loads to be absorbed and displacement and distortion movements to be expected. Allowable surface contact pressures must be taken into account, as well as the resulting bearing reaction forces, movements and installation tolerances:

<table>
<thead>
<tr>
<th>Contact area</th>
<th>Admissible Pressure Nmax</th>
<th>Required Pressure Nmin</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 50,000 mm²</td>
<td>10,0 N/mm²</td>
<td>3,0 N/mm²</td>
</tr>
<tr>
<td>&lt; 120,000 mm²</td>
<td>12,5 N/mm²</td>
<td>3,0 N/mm²</td>
</tr>
<tr>
<td>&gt; 120,000 mm²</td>
<td>15,0 N/mm²</td>
<td>5,0 N/mm²</td>
</tr>
</tbody>
</table>

The rubber cover is generally 2,5 mm on top and bottom surfaces and 5-6 mm laterally. The number and thickness of layers is defined by the required translation and rotation. Therefore they are different for each bearing and are given in page 6.

**Type A:** Laminated bearings fully covered with elastomer comprising only one steel reinforcing plate (former Type 1)

**Type B:** Laminated bearings fully covered with elastomer comprising a minimum of two steel reinforcing plates (former Type 1)
Bearings with outer Steel Plates

Anchored Types

Whenever the minimum surface contact pressures falls below 3 N/mm² the following bearings should be used. All these bearings are provided with external steel plates (see page 6).

Bearings with outer steel plates and anchorages

These bearings are especially useful where traction and high horizontal forces are to be transmitted. The anchoring of these bearings is effected by dowels or bolts.

**Type C(1):** Laminated bearings with outer steel plates and bolts (former Type 2a).
Especially for use with cast-in-situ beams with occasional, temporary and irregular traction forces. These bearings are non-replaceable.

**Type C(2):** Laminated bearings with outer steel plates, anchor-plates and dowels (former Type 2b).
Especially for use with steel beams with occasional, temporary and irregular traction forces. These bearings are replaceable.

**Type C(3):** Laminated bearings with outer steel plates, anchor-plates and shear-keys (former Type 4).
These bearings are especially useful in case of large movements but small loads. They are replaceable.

Bearings with profiled outer steel plates

**Type C(4):** Laminated bearings with profiled outer steel plates (former Type 5).
These bearings can be utilized on a variety of structures. The anchoring is effected by increased friction between substructure and bearing by the dowel-like action of the vulcanized bonded chequered or channelled plates on the mortar bed. They are designed for both cast-in-situ concrete and precast concrete elements. These bearings are non-replaceable.
Non-standard types

Low-Friction Sliding Bearings

Since the deformation capacity relates to the geometrical form of the bearings, there is the facility to allow for larger movements by adding a sliding surface in combination with a PTFE surface and stainless steel. MK4 sliding bearings consist of a reinforced elastomeric bearing with a sliding system, including optional horizontal force absorption. Also here the combination of all available basic types is possible.

**Type D:** Type B with PTFE sheet bonded to the elastomer.

**Type E:** Type C with one outer plate bonded to the elastomer and PTFE sheet recessed in the steel.

Plain Pad Bearings and Strip Bearings

Non-reinforced elastomeric bearings also absorb displacements and distortions, but only to a limited extent due to their reduced thickness and size, compared with reinforced elastomeric bearings. They are especially useful for loads upto 100-150 kN.

These bearings can be produced in any desired size upto 1000 mm in length.

**Type F:** Plain pad bearings and strip bearings.

Guided Elastomeric Bearings

Combined vertical loads and horizontal forces can be transferred with side restraints. For major horizontal forced, as they occur in large bridge spans, it is more appropriate to use horizontal guided bearings. They transfer these horizontal forces independently into the substructure.

Horizontal guided bearings transfer loads in both longitudinal and transverse directions.

**Type G:** Guided Elastomeric Bearings.
High Rotation Bearings

In the case of large rotations, all the above basic types can be manufactured with alternate internal steel-plates reduced in plan size so as to offer less resistance to rotations.

The thickness of the elastomeric layers and of the steel-plates is identical to the standard bearing types.

**Type H**: High rotation bearings.

ILM Bearing Pads

Incremental launching for bridges combines the advantage of on-site concreting with prefabricated elements. MK4's special launching pads are for use with the incremental launching method of construction and other techniques of sliding bridges. They can be supplied in various formats.

**Type I**: ILM Bearing Pads

Special Bearings

MK4's Technical Department is also well equipped and willing to provide customized solutions to specific problems.
<table>
<thead>
<tr>
<th>Admissible load Dimension No. of layers</th>
<th>Admissible displacement +/- Dimension</th>
<th>Effective thickness of plates</th>
<th>Total Height excl. anchor plates</th>
<th>Total Height</th>
<th>Effective elastomer thickness</th>
<th>Anchorages for Types C1(C1) C2(C2)</th>
<th>Admissible notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.10 100x100</td>
<td>7 14 10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4 Bolts M12 with Dowels 30x30x150</td>
<td>4</td>
</tr>
<tr>
<td>0.15</td>
<td>11 21 15</td>
<td>7</td>
<td>42 72</td>
<td>32 10</td>
<td>46</td>
<td>20俗</td>
<td>8</td>
</tr>
<tr>
<td>0.30 150x200</td>
<td>14 49 39</td>
<td>14</td>
<td>56 86</td>
<td>46 20</td>
<td>46</td>
<td>37俗</td>
<td>24</td>
</tr>
<tr>
<td>0.31 ø 200</td>
<td>18 63 45</td>
<td>25</td>
<td>84 114</td>
<td>74 40</td>
<td>84</td>
<td>54俗</td>
<td>24</td>
</tr>
<tr>
<td>0.63 ø 200x200</td>
<td>21 79 50</td>
<td>27</td>
<td>91 121</td>
<td>81 45</td>
<td>84</td>
<td>54俗</td>
<td>24</td>
</tr>
<tr>
<td>0.9 1.8 ø 300 300x400</td>
<td>24 96 69</td>
<td>38</td>
<td>115 145</td>
<td>105 64</td>
<td>84</td>
<td>54俗</td>
<td>24</td>
</tr>
<tr>
<td>1.2 350</td>
<td>27 129 93</td>
<td>40</td>
<td>179 216</td>
<td>156 72</td>
<td>84</td>
<td>54俗</td>
<td>24</td>
</tr>
<tr>
<td>2.4 350x450</td>
<td>30 64 90</td>
<td>39</td>
<td>111 151</td>
<td>121 72</td>
<td>84</td>
<td>54俗</td>
<td>24</td>
</tr>
<tr>
<td>1.9 3.0 ø 400 400x500</td>
<td>33 106 115</td>
<td>44</td>
<td>176 226</td>
<td>156 110</td>
<td>84</td>
<td>54俗</td>
<td>24</td>
</tr>
<tr>
<td>Admissible load Dimension</td>
<td>Admissible displacement +/-</td>
<td>Effective thickness</td>
<td>Effective displacement +/-</td>
<td>Effective thickness</td>
<td>Anchorage for Types C(2), C(3)</td>
<td>Admissible notation</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2,4 4,1 Ø 450 450x600</td>
<td>23 81 121 61 33</td>
<td>32 135 155 75 45</td>
<td>23 81 121 61 33</td>
<td>32 135 155 75 45</td>
<td>4 Bolts M20 with Dowels</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2,9 3,6 Ø 500 500x600</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>4 Bolts M20 with Dowels</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>4,2 5,0 Ø 600 600x700</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>4 Bolts M20 with Dowels</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>5,8 6,6 Ø 700 700x800</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>4 Bolts M20 with Dowels</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>7,5 8,5 Ø 800 800x800</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>4 Bolts M20 with Dowels</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>9,5 12,0 Ø 900 900x900</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>32 95 135 75 45</td>
<td>4 Bolts M20 with Dowels</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>
MK4 and all their sub-suppliers are subject to a strict quality-control system as a part of the ISO 9001/EN 29002 certification.

The quality of the MK4 bearing production is continuously monitored by independent testing laboratories and internal quality control complies with established international standards.

Quality control procedures and other verifications are applied throughout the production phase for:
- materials;
- workmanship;
- finished product;

to ensure that the components satisfy the relevant standards.

If required, load tests on finished bearings can be performed both in-house and externally at official testing laboratories.

Furthermore, all elastomeric bearings can be, if required, manufactured under the control of Technical University Munich and are entitled to display TUM-sticker or under French standards (NF-sticker).

In addition, MK4 engineers are available to provide technical advice relative to quality standards of the interfaces, bearing installation, cement joint forming, bearing plinth design, etc.
Professional installation is the unconditional prerequisite for optimum use and service life of the bearings.

Elastomeric bearings are sensitive to rough handling during construction operations. They should therefore be treated carefully during transportation, assembly and installation.

Handling and installation of bearings should only be carried out by qualified personnel whose knowledge and experience are well proven.

Generally bearings should be installed horizontally on an intermediate bed of mortar which serves as a levelling course.

It must be taken into account that, due to its type of deformation, elastomeric material will not be suitable if it is restrained laterally.

Care should be taken to keep the bearing clean and protected to avoid damage by grout or concrete and to ensure that it can be replaced without difficulty if required. Suitable preventative measures should also be taken to ensure that the bearings do not come into contact with grease, solvents or similar materials.

If required, MK4 can submit a technical manual which contains a detailed description of the installation process.
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