

Press Release – June 2006

## CE-Mark for MAURER MSM<sup>®</sup> Spherical Bearings

A unique sliding material that displays strengths at high and low temperatures, high accumulated sliding displacements, high displacement velocities, and high contact pressures.

**Munich. It is almost 3 years now that MSM<sup>®</sup> – Maurer Sliding Material – has appeared on the market of sliding bearings. Now, a further milestone has been reached with the award of the European Technical Approval. The ETA 06/0131 for “Spherical bearings with special sliding material” rules the use of MSM<sup>®</sup> spherical bearings as structural bearings for all members of the European Union. The ETA was reached in close cooperation with the German Institute of Civil Engineering (DIBt) and the State Material Testing Institute of the Stuttgart University (MPAS)**

Within the frame of the approval, the innovative characteristics of MSM<sup>®</sup> were confirmed, and in comparison to the German General Technical Approval, the scope of application was even enhanced. This scope of application now stretches from - 50°C to + 48°C, which geographically expressed ranges from Scandinavia to Southern Italy. Compared to conventional Teflon (PTFE), MSM<sup>®</sup> can accommodate at least the double contact pressure.

This means that according to the new ETA approval the MSM<sup>®</sup> spherical bearings can cover a vertical load range of up to 20,000 tons (PTFE: 10,000 tons). Further, MSM<sup>®</sup> can accommodate at least a 5-fold accumulated sliding displacement and a 7.5-fold displacement velocity. In the ETA, the lifetime is indicated as at least the 5-fold value of PTFE, which then calculates to 50 years. Because the limiting state has only rarely to be taken into account, the structural bearings usually will reach the lifetime of the structure itself. “With the European Approval of MSM<sup>®</sup> Spherical Bearings, the excellent performance characteristics of this sliding material is confirmed, and the design and use of MSM<sup>®</sup> bearings for the world market is greatly facilitated”, Dr. Braun, Managing Director of the Structural



Protection Systems Division of Maurer Soehne,  
points out.

## **Below Additional Information on the Material as well as on the Approval Process**

### **Back Ground Information on MSM®**

MSM® was especially developed for the use in bridge sliding bearings, in order to correspond to the increasing performance requirements: higher accumulated sliding displacements, higher vertical loads, and higher displacement velocities at a wider temperature range. It is however also suitable for the use in sliding bearings in other scopes of application. Due to the improved load capacity, spherical bearings can be designed considerably smaller, which has a positive impact on the price, in particular when compared to large pot bearings or elastomeric sliding bearings. Additionally, cost savings can be achieved because bridges can be designed more slender, which results in materials savings.

All tests and experiments were conducted and supervised at the MPA Stuttgart.

### Deep and high temperatures

According to ETA, the MSM®-scope of application reaches from - 50°C to + 48°C. This has different consequences at high and low temperatures. Deep temperatures increase the friction and therefore put strain onto the bridge bearings. The design value of the coefficient of friction of MSM® is 2% in case of a temperature above -35°C, for PTFE we have 3%. In case of a temperature as low as -50°C, for MSM® we have 2.7%, and PTFE cannot be used. Thus, MSM® is the only sliding material that can be used at continuous temperatures of as low as -50°C.

At high temperatures, if we are above certain limiting temperatures, the values for the contact pressure have to be reduced by 2% for each centigrade of excess temperature (a so called request for reduction): This limiting temperature lies for MSM® at 35°C, for PTFE at 30°C. Further, MSM® can take the double contact pressure, thus its base value is double as high. In case of a continuous temperature of 48°C, MSM® can accommodate a 2.3-fold contact pressure as compared to PTFE.

In the course of the ETA approval process, special experiments were conducted. So, at a temperature of 70°C, the same load capacity could be proven as for PTFE at effective bearing temperatures below 30°C. PTFE cannot be used at such high temperatures.

For the design of bridge bearings, as the “effective bearing temperature” the extreme temperatures in the shade have to be used. For Germany we have a range of -24/+37°C. Thus, the request for reduction at high temperatures means for PTFE a reduction of the load capacity of 14%.

### Double Contact Pressure

MSM<sup>®</sup> can accommodate double as high contact pressures as PTFE. Thus, increased loads can be covered. The new ETA allows for MSM<sup>®</sup> (like the EN1337 for PTFE) spherical bearings with a diameter of the sliding material of up to 1,500 mm. Thus, a bearing of a vertical load of up to 200 MN can be designed (PTFE: 100 MN). At the same vertical load, MSM<sup>®</sup> spherical bearings can be designed half the size as compared to PTFE. This facilitates the installation, reduces the costs of the bearings as well as the adjacent structural members, and assists when considering architectural requirements. The horizontal guiding elements can even accommodate 6-fold contact pressures caused by dead loads. This big difference is particularly relevant for bridges, which have continuous contact to the guides, caused for example by its dead load combined with a longitudinal slope, or caused by constraints, like at curved bridges.

### 50 Years Life Time

Contrary to EN 1337, the ETA 06/0131 cites a life time: 50 years for MSM<sup>®</sup>. What at first sight looks like a constraint, at a closer look can be taken as a confirmation of the high performance characteristics of MSM<sup>®</sup>. Because, if the life time of PTFE would be calculated exactly according to the conditions that apply for MSM<sup>®</sup>, PTFE should last only 10 years. Background of this consideration is the fact that, because MSM<sup>®</sup> did not display any signs of wear after a long term sliding test of 50 km, however PTFE displayed wear after already 10 km.

Further, these long term sliding tests were conducted at a displacement velocity of 15 mm/s (PTFE 2 mm/s, factor 7.5), and this under the double contact pressure. In a reverse conclusion, for MSM<sup>®</sup> spherical bearings can be followed that at accumulated sliding displacements of up to 25,000 m, the usual life time of bridges of 100 years will be reached.

### Spherical Bearings

MSM<sup>®</sup> will bring about a break through of spherical bearings in the world market, a bearing type which to date was rated as very good, but too expensive. Next to the advantages of small and size independent displacement resistances which already could be reached with PTFE, MSM<sup>®</sup> facilitates a geometrically and economically optimum solution.

### Seismic Isolation

Both EN 1337 and ETA 06/0131 do *not* rule the application of sliding bearings in seismic areas, however they serve as base regulations for the use of seismic devices according to the norm EN 15129 which presently is under work. This norm only permits sliding materials according to EN1337, respectively ETA. MSM<sup>®</sup> spherical bearings in a special design with curved main sliding surfaces, so called Maurer SIP sliding pendulum bearings, are excellent seismic isolators.

### **Back Ground Information on the Approval Process**

MSM<sup>®</sup> is patented as „Sliding Material for Structural Bearings“. The German General Technical Approval was issued in 2003, the European Technical Approval has just been issued. MSM<sup>®</sup> spherical bearings are third party supervised, and so far were marked with the compliance mark (Ü-mark). From now on they will also bear the European Conformity Mark (CE mark). Expert opinions on the environmental compatibility and the chemical stability can be presented. Both in Germany and also in Europe, only structural products, and not materials only, are approved. Because spherical



bearings are most ideally suited to display all the advantages of MSM<sup>®</sup>, Maurer first subjected this bearing type to this European technical approval. MSM<sup>®</sup> was developed in the course of the development of the Maglev track, and its use was approved by the German Railway Administration (EBA).

To cite a few reference projects: MSM<sup>®</sup> was employed in the Tejo Bridge in Lisbon, the Millau Viaduct in France, the Suspension Train in Wuppertal, the Nuclear Power Sarcophagus in Tschernobyl, and the Tsing Ma Suspension Bridge in Hongkong. Reference projects for the use of seismic isolators are the new Akropolis Museum and the Onassis House of Fine Arts and Letters, both located in Athens.

In Europe, since June 1<sup>st</sup>, 2005 the EN 1337 Part 7 Spherical Bearings, is exclusively relevant. Being introduced in 2000 and revised in 2004, it is expressively constrained to the use of PTFE according to EN 1337 Part 2. For the new and considerably superior sliding material MSM<sup>®</sup> there existed no norm, according to which MSM<sup>®</sup> could be applied without proofs in the individual case.

For this reason, in May 2003 Maurer applied by way of the DIBt at the EOTA, which is the European Organisation of Technical Approvals, for the approval of MSM<sup>®</sup>.

### Background of Approvals

Contrary to Germany, in the EU norms and approvals (European Technical Approvals) are rated to be equal. Base for this is the European "Construction products directive CPD". To be normed are frequently occurring structural products. For example, to be approved are patent protected products (because technical information is not publicly accessible), or products that only have 1 manufacturer, or which are of innovative nature, as it applies for example for MSM<sup>®</sup>.

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