



Expansion joints

TENSA® POLYFLEX® Advanced PU

Testing & Verification





Testing and Verification

Wheel Tracking Comparison Test

A wheel tracking test according to EN 12697-22 was performed by the Testing Institute MAPAG in August of 2009. Testing was done on two different plug joint systems with the following results:

Estimation of working life:	
conventional asphaltic plug expansion joints (picture ①)	0
BT 16 HS LKS (common asphaltic surfacing)	1
TENSA®POLYFLEX®Advanced PU (picture ②)	≥ 2

In practice, this means that the expected working life for TENSA®POLYFLEX® Advanced PU flexible plug expansion joints will be more than 2 times higher than the working life of the adjacent road surfacing.

- 1 Traditional bituminous plug joint after 100 load cycles at 60 °C (140 °F)
- 2 TENSA®POLYFLEX expansion joint after 30,000 load cycles at 60 °C (140 °F)



Mechanical Resistance and Resistance to Fatigue

At the testing facility of Technical University of Munich, Germany (Prüfamt für Verkehrswegbau, TU München) tests of mechanical resistance and resistance to fatigue according to ETAG 032-3, Annex 3-M were carried out on two test specimens of a PA 75 TENSA®POLYFLEX®Advanced PU expansion joint.

These tests included:

- test method a) “resistance to vertical static load and recovery after unloading” and
- test method b) “resistance to repeated vertical dynamic load”

Test **method a)** was carried out at an ambient temperature of 23 °C ±2 °C (73.4 °F ±3.6 °F) using a mean contact pressure of 0.94 MPa applied with a vertical force of 150 kN through a load distribution pad of 400 × 400 mm (15.7 × 15.7 in) simulating the wheel print defined in ETAG 032-1, Annex G. The specimen further showed an opening position of 100 % of the declared value for the tested type PA75.

After applying the load for 5 minutes, elastic deformations and recovery during the following hour were recorded. The recordings showed a highest value for elastic deformation of 0.5 mm (0.02 in) directly after unloading and a full recovery after one hour.

The test was then carried out again after cutting the load distribution pad in two halves resulting in a halved wheel print of 400 × 200 mm (15.7 × 7.9 in) and a doubled mean contact pressure of 1.87 MPa. Even under these extreme testing conditions, the highest elastic deformation was only 1.4 mm (0.05 in) and the remaining deformation after one hour was only 0.5 mm (0.02 in) directly under the load distribution pad.

Test **method b)** was a “classic” roll-over test carried out at an inner specimen temperature of 45 °C (113 °F) using standard twin tires 7.50R15. The tires were vertically



- 3 Resistance to vertical static load and recovery after unloading
- 4 Resistance to repeated vertical dynamic load

loaded with 45 kN and inflated with a pressure of 10 bar (145 psi) resulting in a contact pressure of approximately 1.0 MPa – more than twice the required value of 0.46 MPa as per ETAG 032-3. The roll-over speed was chosen as 0.2 m/s and a lateral shifting of wheel tracks in a range of ±20 mm (±0.8 in) was simulated. The specimen was showing an opening position of 60 % of the declared value for the tested type. Next, 3,000 roll-over cycles were carried out followed by another 30 cycles with a simulated braking force of 10 % of the vertical load. The number of load cycles was 50 % higher than the 2,000 cycles required according to ETAG 032-3.

The surface profile was recorded after every 500 cycles to show possible effects of wheel tracking, but the elastic deformations were negligibly small and no remaining wheel tracking was recorded.



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Movement Capacity Test & Material Characteristics Test

At the Federal Institute for Materials Research and Testing (BAM) in Berlin, Germany, movement capacity tests according to ETAG 032-3, Annex 3-N have been carried out on a test sample of a PA 50 TENSA®POLYFLEX®Advanced PU expansion joint.

During test method a) "Movement capacity under slow occurring movements", the temperature of the specimen was controlled according to the applied movements. Therefore, the maximum tension of 33 mm (1.3 in) was applied at -40 °C (-40 °F) and the maximum compression of 17 mm (0.7 in) at 60 °C (140 °F).

Reaction forces resulting from the applied movements were recorded as well as the surface profiles at extreme positions. At maximum tension and a temperature of -40 °C (-40 °F), the system showed reaction forces of approximately 50 kN per running meter of joint while the maximum vertical displacement under maximum compression at 60 °C (140 °F) was only 6 mm (0.2 in).

Test method b) "Movement capacity under fast occurring movements" was run with 7.5 million load cycles at 15 °C (59 °F) and an additional 180,000 cycles at -40 °C (-40 °F). A dynamic amplitude of +1 mm (+0.04 in) and a frequency of 5 Hz was chosen for this test.

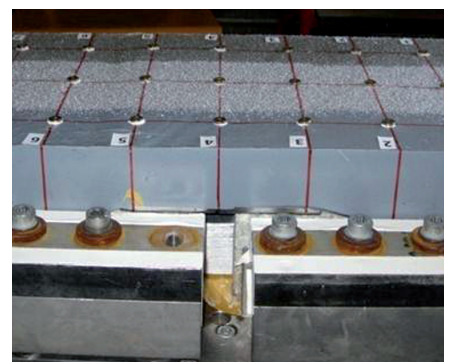
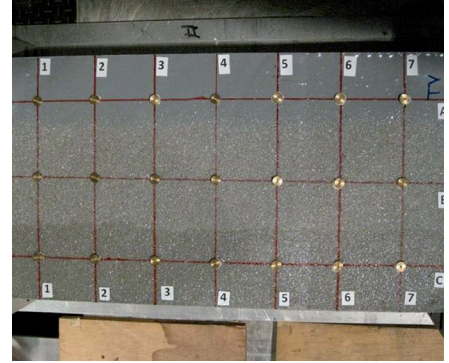
Further tests have been successfully completed including artificial weathering, artificial aging, spectroscopy analysis, thermal analysis, hardness testing, tensile testing, dynamic-mechanical analysis, and bonding tests.

All determined test results are far better than comparable values of traditional bituminous plug expansion joints. This again emphasizes the extraordinary capabilities of the new TENSA®POLYFLEX®Advanced PU expansion joint system.

Since July 2012, mageba received the European Technical Approval ETA 12/0260 for the product system TENSA®POLYFLEX®Advanced PU. An update took place in April 2019.

This European technical approval has been issued in accordance with Regulation (EU) No 305/2011 on the basis of:

- EAD 120011 01 0107; „Flexible Plug Expansion joints for road bridges with flexible filling based on synthetic polymer as binder“
- ETAG 032-1; „Guideline for European technical approval of Expansion joints for road bridges“, edition of May 2013



Movement capacity tests TENSA®POLYFLEX® Advanced PU