BUILDING COMMON GROUND

MAX FRANK®

Test certificate

Egcodist C, Egcodist CG

2006.0946 | 27.06.2006 | english

Mechanical properties of bearings according to DIN 4141

Tested by: MPA, Hannover

Note: This is a translation of the German original document not examined by MPA, Hannover

Max Frank GmbH & Co. KG

Mitterweg 1 | 94339 Leiblfing | Germany | Phone +49 9427 189-0 | Fax +49 9427 1588 | info@maxfrank.com

**This document is only a translated version of the Test Report 2006.0946;
not legally attested**

Test Certificate

Order no.:	**2006.0946**
Version:	**27 June 2006 MP – KP/Wt**
Client:	**Max Frank GmbH &Co.KG** **Mitterweg 1** **94339 Leiblfing**
Order of:	**11 May 2006** **received:** **15 May 2006**
Order size:	**Basic testing of structural bearings according to DIN 4141 part 3**
Test objects:	**Type 1: non-reinforced elastomeric bearing with centre strip DEL lamination PE foam** **Type 3: non-reinforced elastomeric location bearing with friction bearing DEDAL lamination PE foam, sliding film POM film** **in different dimensions**
Delivered:	**May 2006**
By:	**Applicant**
Test period:	**May – June 2006**

This test certificate is 5 pages in total.
Diagrams in the annex.

The test results refer exclusively to the test objects. The test certificate – or parts thereof – may not be published without the written consent of the Institute for Material Testing.

State company acc. to section 26 Nieds. LHO
Management:
Prof. Dr.-Ing. Behrens (spokesman)
Dr.-Ing. Kinzel, Dr.-Ing. Seidel (directors)

Schönebecker Allee 2, D-30823 Garbsen, Germany
Tel +49 (0) 511-762-4362 Fax +49 (0) 511-762-3002
Email: info@mpa-hannover.de
Internet: www.mpa-hannover.de

1. Process

The applicant commissioned the Institute for Material Testing with the determination of mechanical data on the above mentioned bearings.

2. Sample material

The applicant provided bearings according to the following technical specifications:

Bearing type	Centre strip thickness in mm	Centre strip breadth in mm
1	5	20
1	10	33
1	5	100
1	10	100
3	5	20
3	10	33

Table 1:
Dimensions of the tested bearings, types 1 and 3

3. General

3.1 The inspection basis for the test certificate no. 20060946 is provided by the Building Rules List A, part 2 for non-reinforced and reinforced elastomeric bearings according to DIN 4141, part 3, Structural bearings, bearing class 2.

3.2 Technical rules and standards for structural and building bearings shall be applied in the respective valid version, including but not limited to

- DIN 4141 Structural bearings

4. Description

Type 1: non-reinforced elastomeric bearing with centre strip DEL
lamination PE foam

- centre strip made of rubber-cork compound
- lamination made of PE foam

Type 3: non-reinforced elastomeric location bearing with friction bearing DEDAL

- centre strip made of rubber-cork compound
- lamination made of PE foam
- sliding film POM film
- special lubricant

The specifications of the chemical composition and the physical properties are deposited at the Institute for Material Testing Hannover.

5. Tests

5.1 Testing equipment

The following testing machines and devices were used for the tests:
- compression testing machine Zwick, 250kN
- sliding test device
- shear modulus testing device

5.2 Test procedure

5.2.1 Compression deformation test (type 1)

The static compression spring characteristics were determined between fibre cement boards.
Three loading and unloading curves were performed respectively. The initial load was approx. 1% of the max. testing voltage. The testing speed was 10mm/min. The 3rd compression spring characteristic has been recorded as a diagram.

5.2.2 Sliding test type 3

The static friction and the sliding values depending on the sliding distance and/or the movement cycles were determined as a ratio of horizontal and vertical force analogously to the experimental setup for the determination of the shear modulus according to DIN 4141 parts 140 and 150. Here, bearing pairs were moved cyclically with a speed of 0.4mm/sec within a deformation and sliding distance interval of +/- 1/3 of the breadth of the centre strip. A stop time of 4 seconds respectively was predetermined at the upper and lower corner points of the movement distance.
The movement distance of one cycle was approx. 33mm for a centre strip breadth of 25mm and approx. 44mm for a centre strip breadth of 33mm. 101 cycles were performed in total.
The following friction coefficients have been derived:
- static friction coefficient at the start of the tests
- static friction coefficients after finishing the stop times as function of the sliding distance covered and/or the number of cycles
- sliding friction coefficients during the sliding as function of the sliding distance covered and/or the number of cycles

5.2.3 Compressive failure test (type1)

One bearing type 1 of 100 (length) x 100 (breadth) x 5/10 (thickness) mm^3 respectively was loaded with a peak load of 7.5N/mm^2 between fibre cement boards. The testing speed was 10mm/min.

The bearings were loaded once.

The bearing was checked for possible signs of failure by analysing the force/path diagram and by visually inspecting the free lateral faces and the surfaces.

5.2.4 Shear modulus test (type 1)

The shear deformation curves were determined on bearings of type 1 on the basis of DIN 4141 part 150 between corundum-coated steel plates with a deformation speed of 1.5mm/sec.
Here, the bearings were tested with different initial tensions of 1.0, 2.0 and 2.5N/mm^2.
The third loading was recorded and evaluated with regard to the shear deformation modulus between the bearing deformations 0.1 x bearing thickness to 0.3 x bearing thickness. Higher deformations were not evaluable since there was an experiment-related slipping in the shear testing equipment.

6. Results

6.1 Compression deformation curves

The compression deformation curves can be found in the compression spring characteristics in the annex.

6.2 Friction value

A static friction coefficient (friction surface lubricated POM film) of

$$\gamma = 0.06$$

was determined at the start of the bearing movement.

The sliding values, depending on the number of cycles and/or the added sliding distance respectively, are listed in the attached diagrams.
There was only a slight deviation of the static friction values at the end of the stop times from the sliding friction values (maximum excess of the static friction compared to the sliding friction approx. 5% relating to the sliding friction coefficient of the corresponding friction cycle).

6.3 Compressive failure test:

The force/deformation curve can be found in the annex.
After the compressive failure test, the bearing did not show visible abrasion or any cracks or damage. The functionality of the bearings under compressive load can be assumed without restrictions.

6.4 Shear modulus test

The shear modulus curves can be found in the annex.

7. Summary evaluation

The present test certificate serves as verification of the bearing reactions.

The results show that the tested bearings

Type 1: non-reinforced elastomeric bearing with centre strip DEL lamination PE foam

Type 3: non-reinforced elastomeric location bearing with friction bearing DEDAL

are in principle suitable for elastic bearing according to DIN 4141 part 3, bearing class 2, Structural and machine part bearings within the scope of the verified bearing reactions.

Garbsen, 27 June 2006

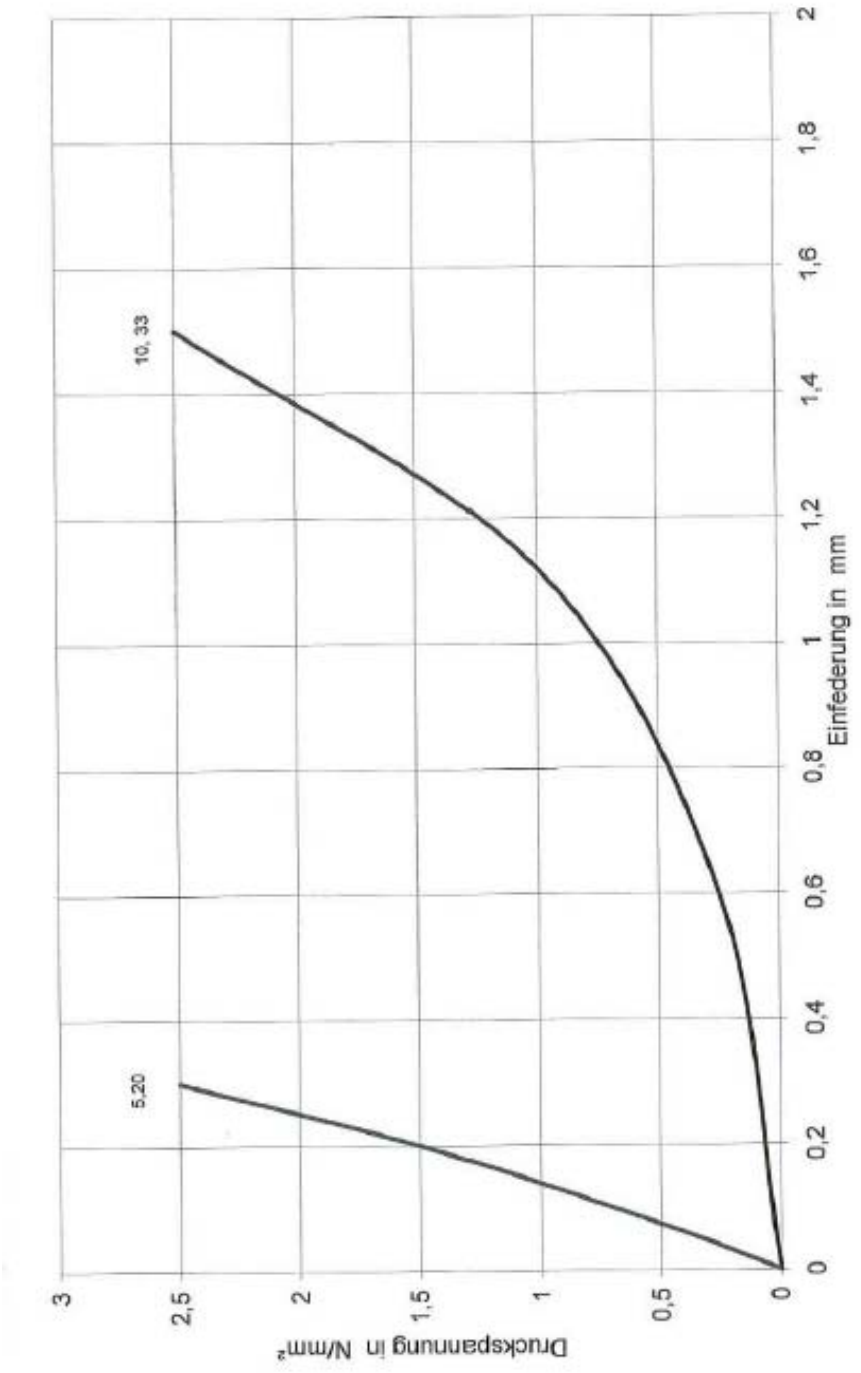
Managing Director:		Person in charge:
<<signature, illegible>>		<<signature, illegible>>
RD Dr.-Ing. Seidel	<<stamp: MPA Hannover>>	Dipl.-Ing. Witte

Annexes: diagrams

2006.0946, compression spring characteristic
Type 1: non-reinforced elastomeric bearing with centre strip DEL, lamination PE foam
Bearing dimensions: 200mm x centre strip breadth x centre strip thickness
Identification: centre strip thickness, centre strip breadth

Compression stress in N/mm^2

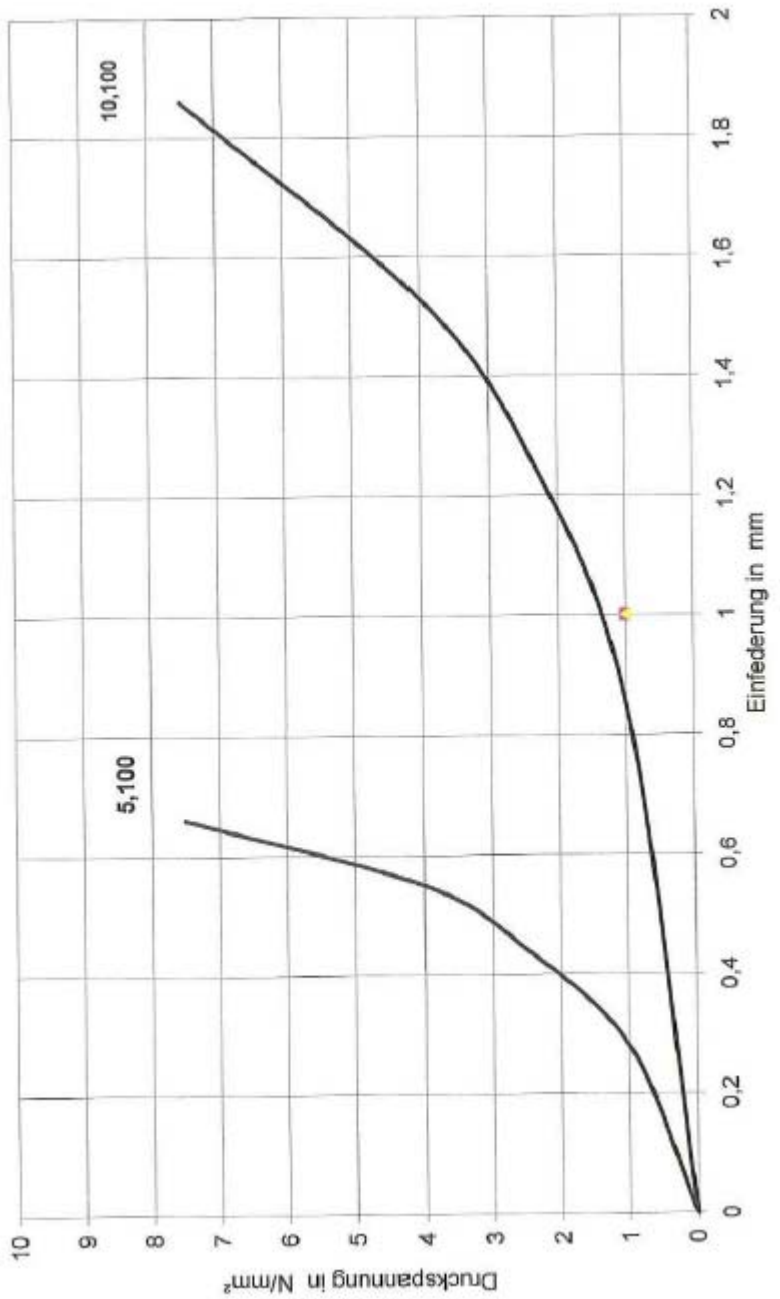
Spring compression in mm



2006.0946, compression break spring characteristic
Type 1
Identification: centre strip thickness, centre strip breadth

Compression stress in N/mm^2

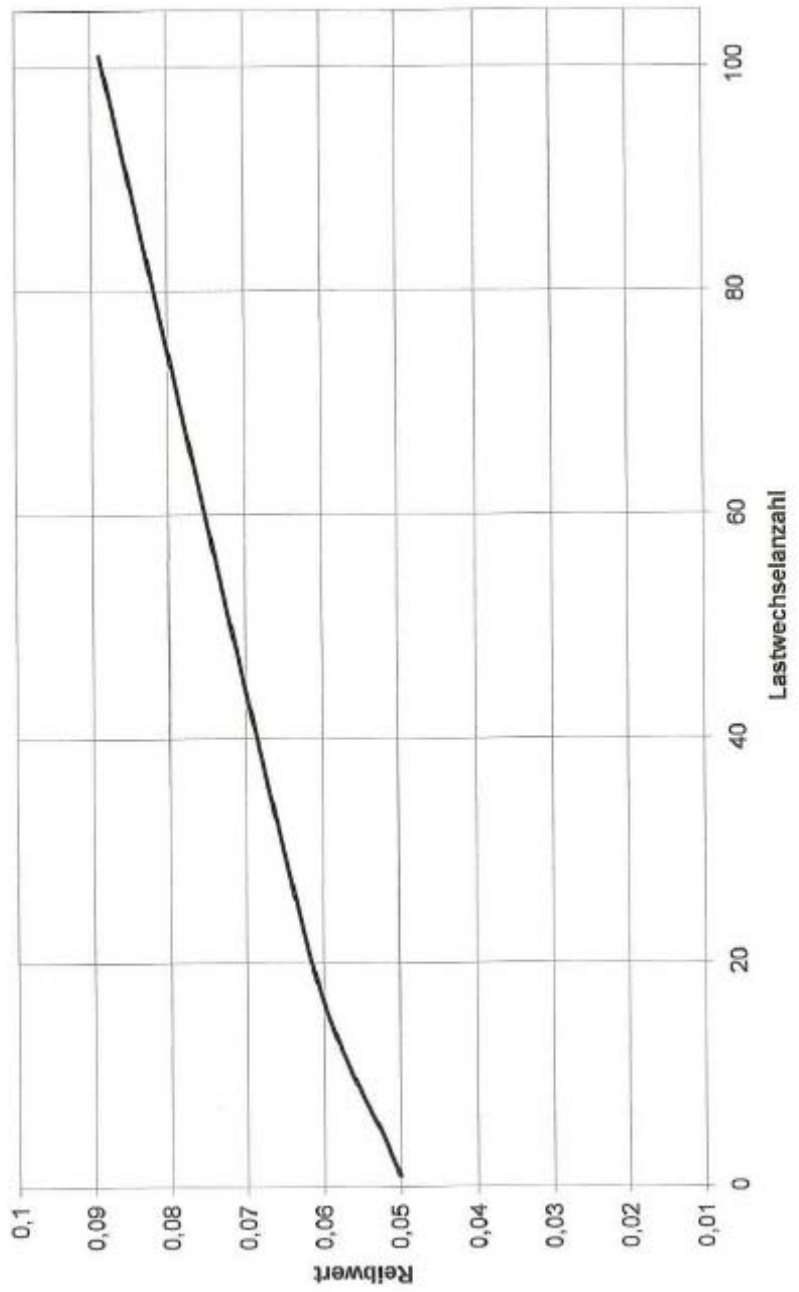
Spring compression in mm



2006.0946 Sliding friction values after finishing of the stop times
depending on the number of load cycles
(stop times 4 seconds each, one cycle corresponds to 4 x 1/3 of the centre strip breadth)

Friction value

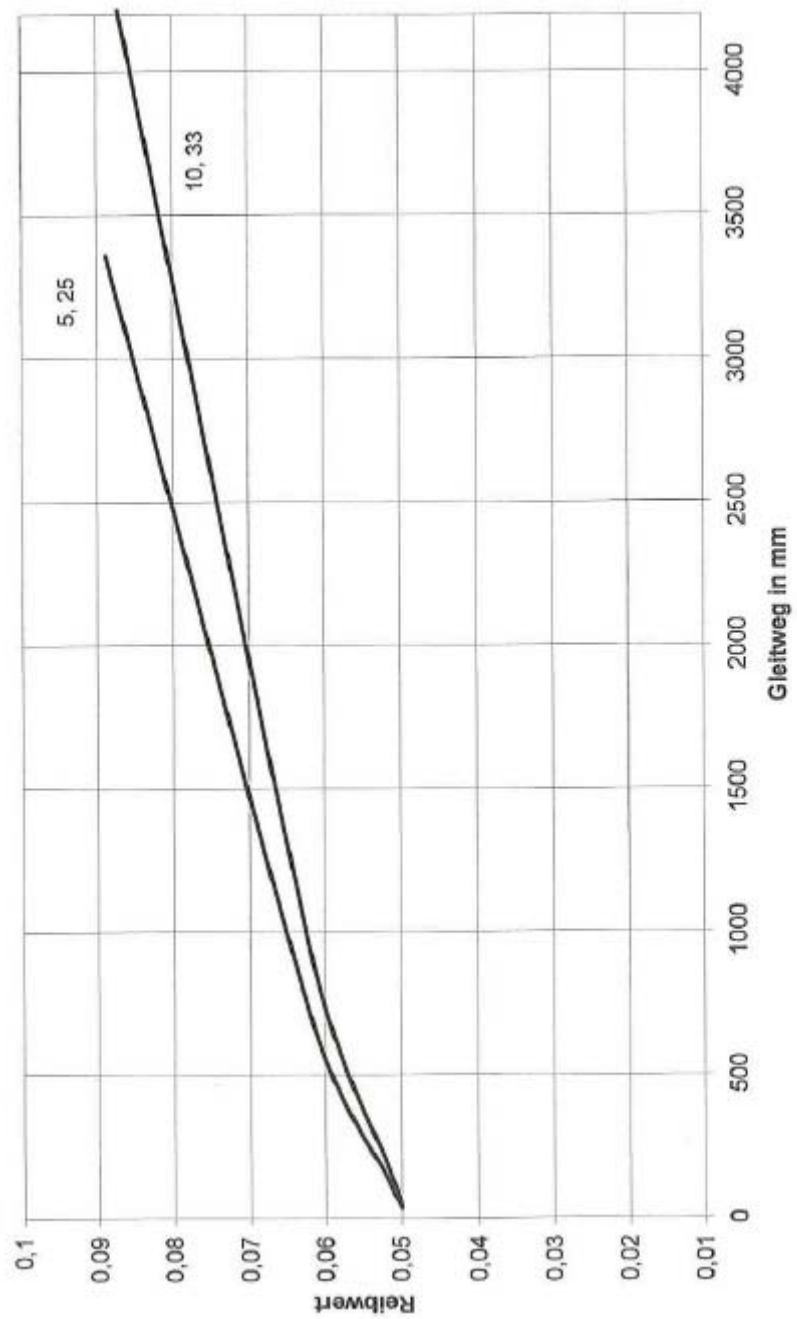
Number of load cycles



2006.0946 Sliding friction values after finishing of the stop times
depending on the added sliding distance
(stop times 4 seconds each, one cycle corresponds to 4 x 1/3 of the centre strip breadth)
Identification: centre strip thickness, centre strip breadth

Friction value

Sliding distance in mm



2006.0946, Shear modulus
Type 1
Identification: centre strip thickness, centre strip breadth

Shear modulus in N/mm^2

Initial load in N/mm^2