METHOD OF TEST
FOR
COMPRESSIVE DEFORMATION OF LAMINATED BEARINGS

1. SCOPE

1.1 This test method covers the test procedures for determining the compressive deformation characteristics of laminated bearings.

2. RELEVANT DOCUMENT

2.1 OPSS 1202 Material Specification for Bearings - Elastomeric Plain and Steel Laminated

3. DEFINITION

3.1 The compressive deformation of laminated bearings is the deformation at 7.0 MPa expressed as a percentage of the effective elastomer thickness.

4. APPARATUS

4.1 *Compression Testing Machine* **-** A compression testing machine conforming to the requirements of ASTM E 4, Standard Practices for Force Verification of Testing Machines. The machine shall be of sufficient capacity to fully load the bearing by applying force gently and without impact.

4.2 *Displacement Gauge* **-** The deformation shall be read on a digital or dial gauge graduated in hundredths of millimetres.

4.3 *Measuring Tape* **-** The dimensions of the specimen should be measured using a measuring tape graduated to the nearest millimetre.

4.4 *Load Distribution Plate* – Rigid machined plates (top & bottom) that can withstand the compressive stresses without bending.

5. TEST SPECIMENS

5.1 Test specimens shall be according to OPSS 1202 and Contract Documents.

6. PREPARATION OF SPECIMENS

6.1 Upon delivery, the specimens shall be stored and left undisturbed for at least 24 hours at a temperature of 23°C ± 2°C prior to testing.

6.2 No adjustments or modifications shall be made to the specimen except that the surfaces of the specimen that will contact the platens of the testing machine shall be cleaned of any dust, bloom, grease, or other foreign material.

7. NATURE OF TEST

7.1 Compressive forces are applied and removed in three successive cycles. The first two cycles are for conditioning the specimen.

8. CALCULATION (BEFORE TESTING)

8.1 Calculate the surface area using the measured dimensions

8.2 Calculate the loading rate to cause a stress increase of 1.5 MPa / minute

8.3 Calculate the corresponding loads for each stress level from 1.5 MPa to 7.5 MPa at increments of 0.5 MPa

9. EXAMPLE OF CALCULATION (BEFORE TESTING)

9.1 Dimensions of Bearing (mm):
Length = 350
Width = 250

9.2 From bearing dimensions calculate the following:

a. Effective Elastomer Thickness T_e = 49.36 mm (determined by LS-429)
b. Measured Area Area = 350 x 250 = 87,500 mm^2

9.3 Load Rate = 1.5 N/mm^2/minute x 87,500mm^2 = 131.25 kN / minute

9.4 Calculate the load for each stress level

Load = Stress x Area = (2.0 N/mm^2) x (87,500 mm^2) = 175 kN

Stress	Load	Gauge # 1	Gauge # 2	Average	Deformation
MPa	kN	mm	mm	mm	mm
1.5	131	-	-	-	-
2.0	175	-	-	-	-
2.5	219	-	-	-	-
3.0	263	-	-	-	-
3.5	306	-	-	-	-
4.0	350	-	-	-	-
4.5	394	-	-	-	-
5.0	438	-	-	-	-
5.5	481	-	-	-	-
6.0	525	-	-	-	-
6.5	569	-	-	-	-
7.0	613	-	-	-	-
7.5	656	-	-	-	-

10. TEST PROCEDURE

10.1 Centre the specimen between the platens of the testing machine. If load distribution plates are used, the plates shall be centred under the platens and the specimen centred under the plates. Plates or platens in contact with the specimen shall be at least 25 mm greater than the test specimen in both plan dimensions.

10.2 At least two displacement gauges shall be positioned at the centre of opposite sides in the long dimension of the specimen to measure deformation.

10.3 The specimen shall be initially loaded to cause a stress of 1.5 MPa. The displacement gauge readings shall be recorded at this point.

10.4 The loading shall be increased at a rate of 1.5 MPa / min until the specimen has attained a stress of 7.5 MPa. The displacement gauge reading shall be recorded at this point.

10.5 The bearing shall be unloaded at a rate of 1.5 MPa / min until the stress on the bearing returns to 1.5 MPa. The displacement gauge reading shall be recorded at this point.

10.6 The stress on the bearing shall be maintained at 1.5 MPa for 15 minutes. The displacement gauge reading at the end of this 15 minute period shall be recorded.

10.7 The bearing shall be subjected to a 2nd cycle by repeating steps 10.4, 10.5 and 10.6.

10.8 In the 3rd cycle, the bearing shall be reloaded to 7.5 MPa in the same manner as step 10.4 except the displacement gauge readings shall be recorded after each 0.5 MPa increment starting at 1.5 MPa.

10.9 The data recorded during the 3rd cycle shall be plotted on a graph of stress versus deformation. A 'best-fit' straight line using the least-squares method shall be constructed through the data points. The line shall start at the point corresponding to 1.5 MPa stress and zero deformation.

11. CALCULATION (AFTER TESTING)

11.1 If 'T_e ' is zero, no further calculations are required and the specimen shall be reported as 'rejected'.

11.2 Determine the deformation (d) at 7.0 MPa from the Stress/Deformation graph and calculate the percent compressive deformation (A) using the effective elastomer thickness (T_e) determined by Test Method LS-429. Express the result to the nearest 0.1 %.

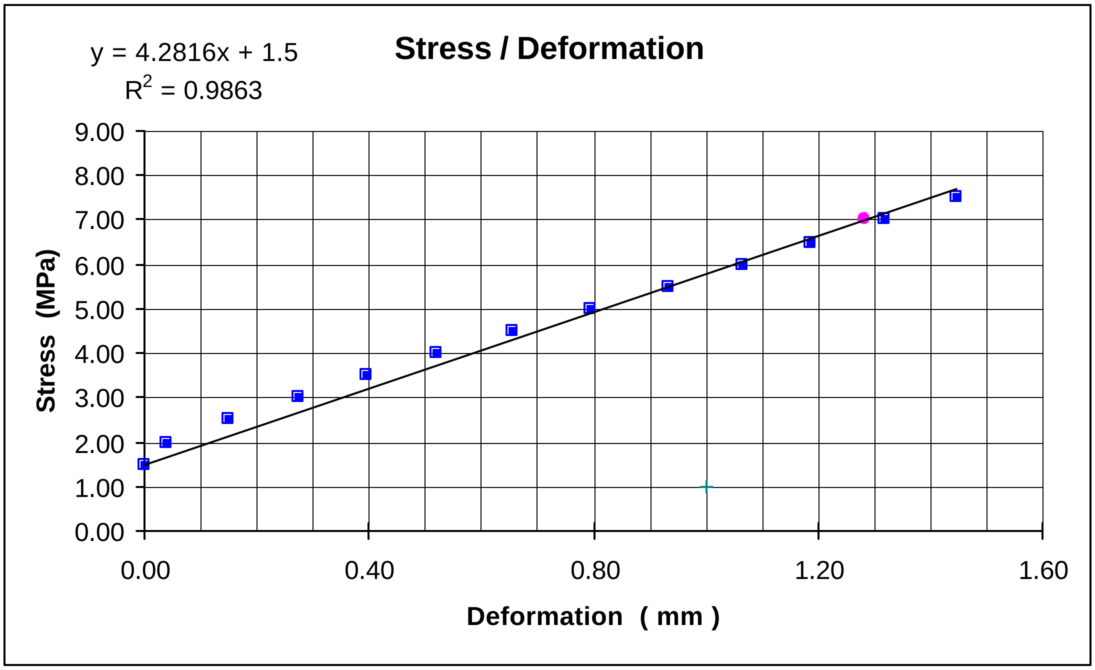
$$A = (d / T_e) \times 100$$

12. EXAMPLE OF CALCULATION (AFTER TESTING)

12.1 The deformation is determined by subtracting the average gauge reading at 1.5 MPa from each average gauge reading. For example, the deformation at 2.0 MPa is 0.53 mm – 0.49 mm = 0.04 mm

Stress	Load	Gauge # 1	Gauge # 2	Average	Deformation
MPa	kN	mm	mm	mm	mm
1.5	131	0.04	0.93	0.49	0.00
2.0	175	0.02	1.03	0.53	0.04
2.5	219	0.11	1.16	0.64	0.15
3.0	263	0.21	1.31	0.76	0.28
3.5	306	0.31	1.45	0.88	0.40
4.0	350	0.41	1.60	1.01	0.52
4.5	394	0.54	1.74	1.14	0.66
5.0	438	0.66	1.90	1.28	0.80
5.5	481	0.78	2.06	1.42	0.94
6.0	525	0.89	2.21	1.55	1.07
6.5	569	1.00	2.34	1.67	1.19
7.0	613	1.12	2.49	1.81	1.32
7.5	656	1.23	2.63	1.93	1.45

12.2 Determine the deformation at 7.0 MPa from the Stress/Deformation graph. Use the value determined from the best-fit line and not the actual measured value at 7.0 MPa.



Deformation at 7.0 MPa = 1.28 mm

12.3 Compressive Deformation = (Deformation at 7.0 MPa / T_e) x 100

Compressive Deformation = (1.28 / 49.36) x 100 = 2.6%