



Designation: D7107 – 04

Standard Test Method for Creep Measurement of Self-Lubricating Bushings¹

This standard is issued under the fixed designation D7107; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method determines the amount of creep exhibited by self-lubricating bushings exposed to a high load for an extended period of time.

1.2 This test method is designed to reproduce conditions typical of those encountered by trunnion bushings in hydropower applications and any other bushings subjected to high continuous loading and low-speed oscillating applications.

1.3 This test method is conducted on cut segments of the bushings.

1.4 The values given in SI units are to be regarded as the standard in all property and dimensional tables.

NOTE 1—There is no known ISO equivalent to this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.*

2. Terminology

2.1 Definitions:

2.1.1 *creep strain, n* —total strain, at any given time, produced by the applied stress during a creep test.

3. Summary of Test Method

3.1 Segments of the bushing are mounted in-line on the test apparatus such that when load is applied at one end of the apparatus, by means of a hydraulic cylinder, all specimens are simultaneously loaded exactly the same.

3.2 Bearing test pressure is maintained at 55 160 kPa (8000 psi) on the projected area of the bushing specimen.

3.3 Pressure is held constant by means of an automatic pumping system and an accumulator.

3.4 The actual amount of creep is measured over an extended period of time.

4. Significance and Use

4.1 Self-lubricating bushings with low creep rates are used in hydropower turbines and other applications in which bushing distortion could cause misalignment of shafts and linkages.

4.2 An assumption is made that if the creep is satisfactory at 55 160 kPa (8000 psi), it will also be satisfactory at lower pressures.

5. Apparatus

5.1 The loading frame shall be capable of applying and maintaining the required load on the specimens, despite any change in the dimensions of the specimens.

5.2 Bushing specimens are mounted in-line on the test apparatus such that when load is applied at one end of the apparatus (by means of a hydraulic cylinder) all specimens receive the same load.

5.3 Bearing test pressure is maintained at 55 160 kPa (8000 psi) on the projected area of the bushing specimen.

5.4 Pressure is held (nearly) constant by means of an automatic pumping system and an accumulator.

5.5 A suitable test frame configuration is shown in [Annex A1](#).

5.6 The creep-measuring device consists of an eddy-current sensor anchored to one end of a specimen group (four test samples) directed at a target attached to the other end of the group.

5.7 The overall change in lengths of the four specimens is monitored to an accuracy of 2.54 μ m (0.0001 in.).

6. Test Specimens and Test Units

6.1 Paragraph 6.2 and [Fig. 1](#) define the test sample configuration. The samples are clamped into sample supports as described in [Section 7](#).

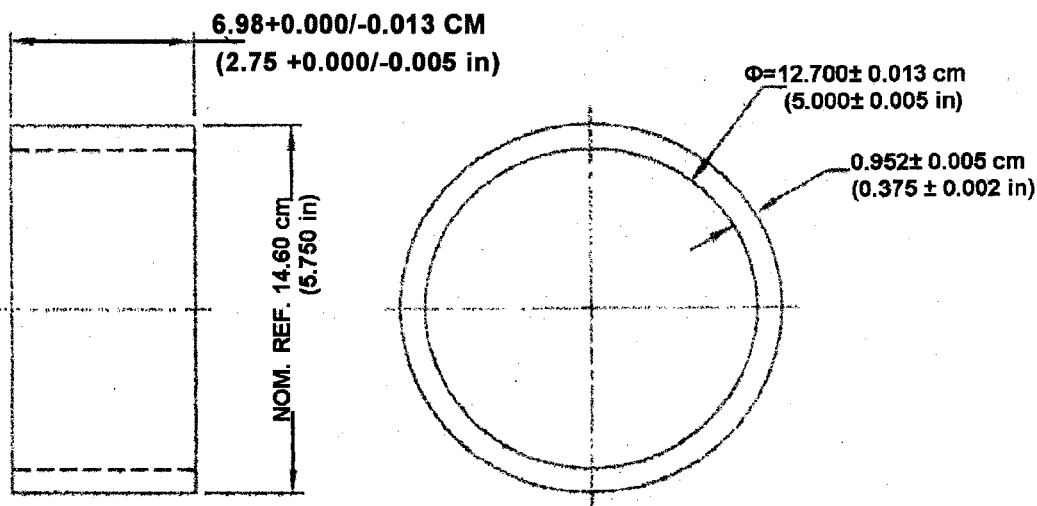
6.2 Each test shall use four identical bushing material specimens meeting the following requirements (reference [Fig. 1](#)):

6.2.1 *Inside Radius of Tubular Form*— 6.350 ± 0.013 cm (2.500 ± 0.005 in.),

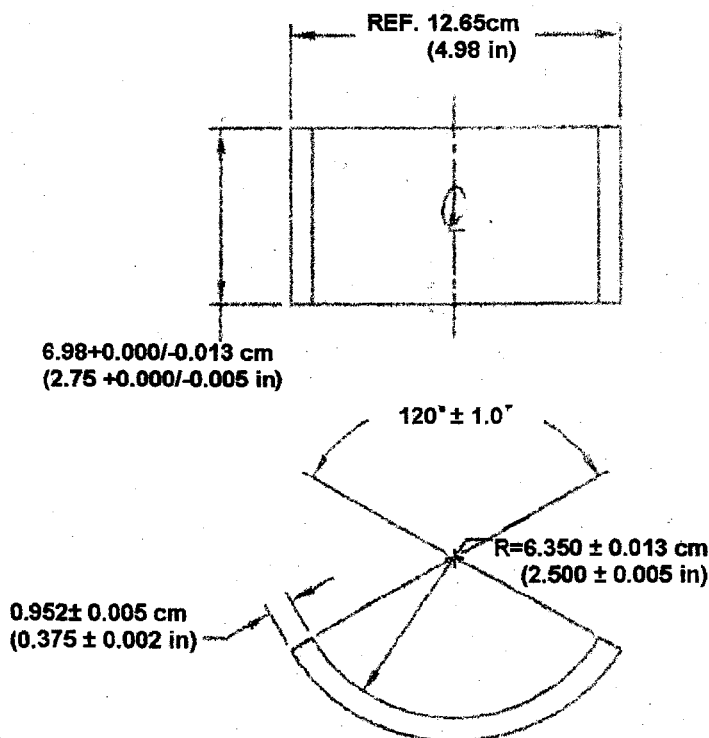
6.2.2 *Thickness*— 0.952 ± 0.005 cm (0.375 ± 0.002 in.),

6.2.3 *Length*— $6.98 + 0.000/-0.013$ cm ($2.75 + 0.000/-0.005$ in.),

¹ This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.10 on Mechanical Properties. Current edition approved Dec. 1, 2004. Published December 2004. DOI: 10.1520/D7107-04.



FINISHED BUSHING



FINISHED BUSHING SPECIMEN

FIG. 1 Test Sample Configuration

6.2.4 Angle of Arc (Each Finished Specimen)— $120 \pm 1.0^\circ$, and

6.2.5 Surface Finish— R_a 3.2 μ m (125 μ in.) minimum.

7. Preparation of Apparatus

7.1 Sample Spacer:

7.1.1 Material and Temper—AL 6061 T6 or T6511,

7.1.2 Diameter— 2.700 ± 0.005 cm (5.000 ± 0.002 in.),

7.1.3 Length— $6.985 \pm 0.000 / -0.025$ cm ($2.75 \pm 0.000 / -0.010$ in.),

7.1.4 Perpendicularity—Ends perpendicular with cylinder axis within 50 μ m (0.002 in.), and

7.1.5 Surface Finish— R_a 0.4 μ m (16 μ in.) minimum.

7.2 Sample Supports:

7.2.1 Material and Temper—AL 6061 T6 or T6511,

7.2.2 Radii— 7.302 ± 0.025 cm (2.835 ± 0.010 in.),