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SAE ARP5483/5

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Rolling Element Bearing Test Method for Radial Limit and Fracture Load Testing

RATIONALE

ARP5483/5 is a conversion of the MIL-STD-2159 (which had only been issued previously in draft form).

1. SCOPE

This test method outlines the recommended procedure for performing static radial limit and ultimate load tests on rolling element bearings used in airframe applications. Bearings covered by this document shall be antifriction ball bearings and spherical roller bearings in either annular or rod end configurations.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E 4 Standard Methods of Verification of Testing Machines

ASTM E 83 Method of Verification and Classification of Extensometers

2.1.2 ANSI/NCSL Publications

Available from NCSL, 1800 30th Street Suite 305B, Boulder, CO 80301-1026.

ANSI/NCSL Z540-1 Calibration Laboratories and Measuring and Test Equipment - General Requirements

2.1.3 ISO Publications

Available from International Organization for Standardization, 1, rue de Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland, Tel: +41-22-749-01-11, www.iso.org.

ISO 10012 Quality Assurance Requirements for Measuring Equipment

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2.2 Definitions

RADIAL LIMIT LOAD: The maximum radial load which, when applied and released, does not affect the smoothness of operation of the test bearing. The load for each bearing size is specified in the applicable document. This load is the maximum load that should be applied to the bearing in application.

RADIAL STATIC FRACTURE LOAD: The radial load equal to 1.5 times the Radial Limit Load, unless otherwise specified in the applicable document. Bearings subjected to this load shall be capable of being turned by hand and shall have no fractured components.

BRINELL: Permanent deformation of a bearing raceway caused by a rolling element. Brinelling occurs when a bearing is subjected to a static load which causes the stress in the ball contact area to exceed the yield stress of the material.

3. GENERAL REQUIREMENTS

3.1 Test Apparatus

3.1.1 Test Machine

The fixture shall be mounted onto a test machine capable of applying the required load at a controlled rate. The calibration system for the machine shall conform to ANSI/NCSL Z540-1 and ISO 10012. Its accuracy shall be verified every 12 months by a method complying with ASTM E 4. The limit and ultimate loads of the test bearing shall be within the loading range of the testing machine as defined in ASTM E 4.

3.1.2 Test Fixtures

Dimensions of the test fixtures shall provide sufficient section thickness to assure rigid support of the test specimen when subjected to the fracture load. For threaded rod end bearings, the shank shall be mated with a fixture allowing a thread engagement of at least 1-1/2 times the thread pitch diameter.

3.1.3 Material

The mounting apparatus shall be fabricated from steel and heat treated to a hardness of HRc 40 minimum. The test pin shall be fabricated from high strength tool steel or equivalent and heat treated to a hardness of HRc 50 minimum.

3.1.4 Mounting Fit

Clearance between the mounting bolt and the inner ring shall be 0.0000 to 0.0010 in or as specified in the applicable document. Clearance between the fixture and the outer ring shall be 0.0000 to 0.0010 in or as specified in the applicable document.

NOTE: The above approach for mounting the test bearing produces generally repeatable results by promoting stiff structural performance. The use of thin section fixtures or looser fits may result in significantly different results.

3.1.5 Measuring Equipment

Inspection equipment shall be capable of measuring an indentation in the inner or outer ring raceway that is 0.0005 times the rolling element diameter.

3.2 Specimen

3.2.1 Bearings for Radial Load Tests

Bearings shall be tested as received. Only new bearings shall be used.

3.2.2 Quantity

The number of test specimens shall be as specified in the referencing document.

3.2.3 Disposition of Test Bearings

Bearings tested per this method shall not be put into service.

4. DETAILED REQUIREMENTS

4.1 Radial Limit Load Test

4.1.1 Pre-Test Checks

Before application of limit load, the test bearing shall be evaluated as specified in the applicable document regarding parameters such as internal clearance, and rotational torque. These measurements are required to establish data whereby failure may be determined. This may be done with the test specimen in the fixtures. It is permissible to make evaluations in separate fixtures providing the internal bearing clearance is not changed by mounting.

4.1.2 Testing

Mount the test bearing as shown in Figure 1. The test bearing and fixtures shall be installed in a loading device such as a tensile test machine and the load gradually increased to the radial limit load specified in the applicable document at an even rate to reach the radial limit load in not less than 100 s. The load shall be held for not less than 1 min and during this time the applied load shall not drop below the specified load. After 1 min has passed, gradually release the load at a rate 1% of the specified load per second.

4.1.3 Evaluation

The test specimens shall be evaluated after the limit load test has been performed. The pass/fail criteria are specified in the applicable document. Typically the bearing is rotated with a 5 lb weight applied in the same direction as the static load and the pass criteria is that there shall be no perceptible change in the smoothness of the bearing. Another method of evaluation is to disassemble the test bearing and measure the depth of the brinells on the inner and outer raceways. The typical passing criterion for this inspection is that the maximum depth of any brinell shall not exceed 0.0005 times the diameter of the rolling elements.

4.2 Radial Static Fracture Load

4.2.1 Pre-Test Checks

Before application of ultimate load, the test bearing shall have successfully passed the limit load test

4.2.2 Testing

Using the same apparatus from 4.1.2, a radial load of 1.5 times the limit load shall be applied at a rate of 1% per second and held steady for a minimum of 1 min at full load before being released at a rate of 1% per second.

4.2.3 Evaluation

The tested specimen shall be removed from the fixturing and inspected for failure. The pass/fail criteria will be described in the applicable specification. The typical passing criteria are that the bearing shall be capable of being turned by hand and that there can be no evidence of fractured bearing components when disassembled and inspected. Additionally, the bearing rings can be magnetic particle inspected to insure that there are no cracks as a result of testing.

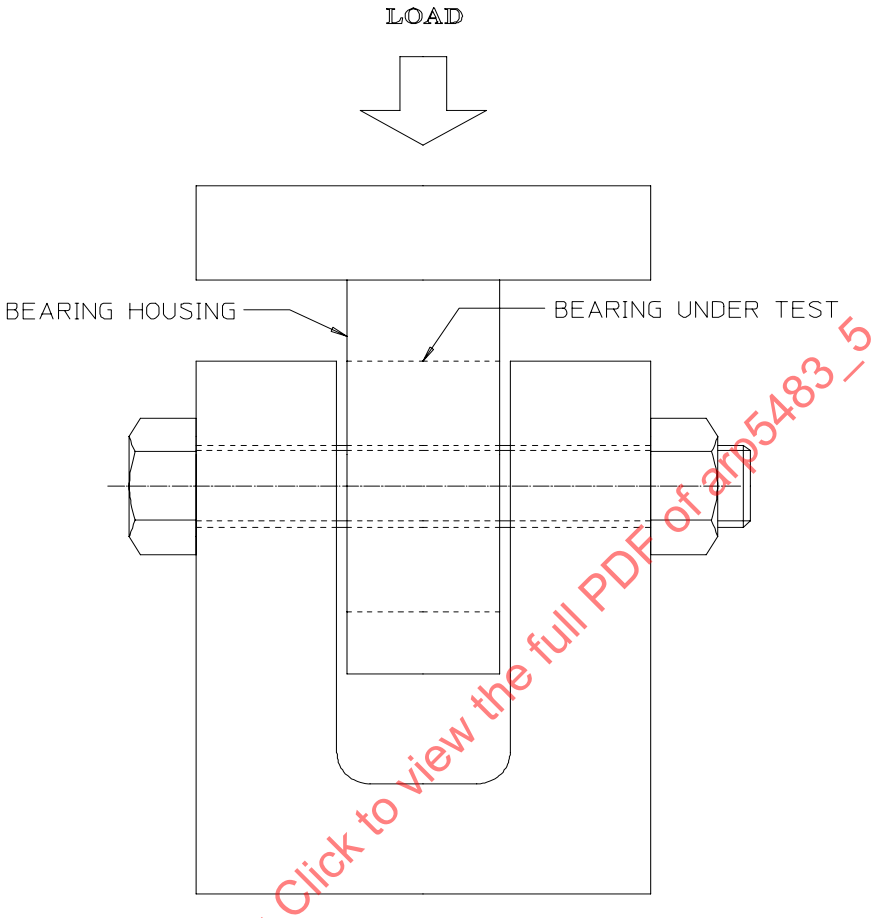

FIGURE 1 - SCHEMATIC FOR RADIAL LIMIT/FRACTURE LOAD TEST

5. NOTES

5.1 Intended Use

This test method is intended to provide a means for evaluating the performance criteria of a bearing when subjected to the radial limit load and radial fracture load specified in the applicable document.

5.2 Method of Reference

This test method is intended to be referenced in general and in detailed specifications, standards, and drawings for antifriction airframe bearings. Specific test and data requirements are given in the applicable document. The following note shall be used to reference this test method:

NOTE: The bearings shall be tested in accordance with ARP5483/5. The slash number refers to the specific test method.