



# AEROSPACE RECOMMENDED PRACTICE

ARP5448™/7

REV. A

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Superseding ARP5448/7

## Plain Bearing Wear Measurement

### RATIONALE

Changes to this document are the result of a five year review, updating minor technical details and bringing formatting in accordance with current SAE standards.

#### 1. SCOPE

This standard details two methods of inspecting PTFE lined spherical or journal bearing wear outside the test apparatus. The methods described herein are applicable only to bearings which were unidirectionally loaded and the area of sliding wear is known and held constant throughout the dynamic test. The two methods described are:

- a. Destructive Inspection - Cut and measure (not applicable to molded liners)
- b. Nondestructive Inspection - Radial play (gauge) measurement

#### 2. REFERENCES

There are no referenced publications specified herein.

#### 2.1 DEFINITIONS

**RADIAL PLAY:** Refers to the total diametrical clearance in a bearing. The term radial refers to the direction of gauge load and measurement axis. Radial play does not refer to taking only half the diametrical clearance nor measuring across the radius.

#### 3. REQUIREMENTS

**NOTE:** This method shall be useful only if the lined race of a spherical bearing or if the journal bearing were known to have remained stationary during the dynamic test. This method shall be useful only for unidirectional loading. Load reversal during a wear test will require alternate techniques.

#### 3.1 Destructive Inspection

The scope of this test method shall be to measure the thickness of bearing liner remaining in the dynamic load zone with respect to unworn liner at a position 180 degrees to the load zone. The required equipment shall be a metallurgical cut-off saw (preferred) or a hand hacksaw, micrometer calipers with a ball anvil adapter, and a razor blade knife.

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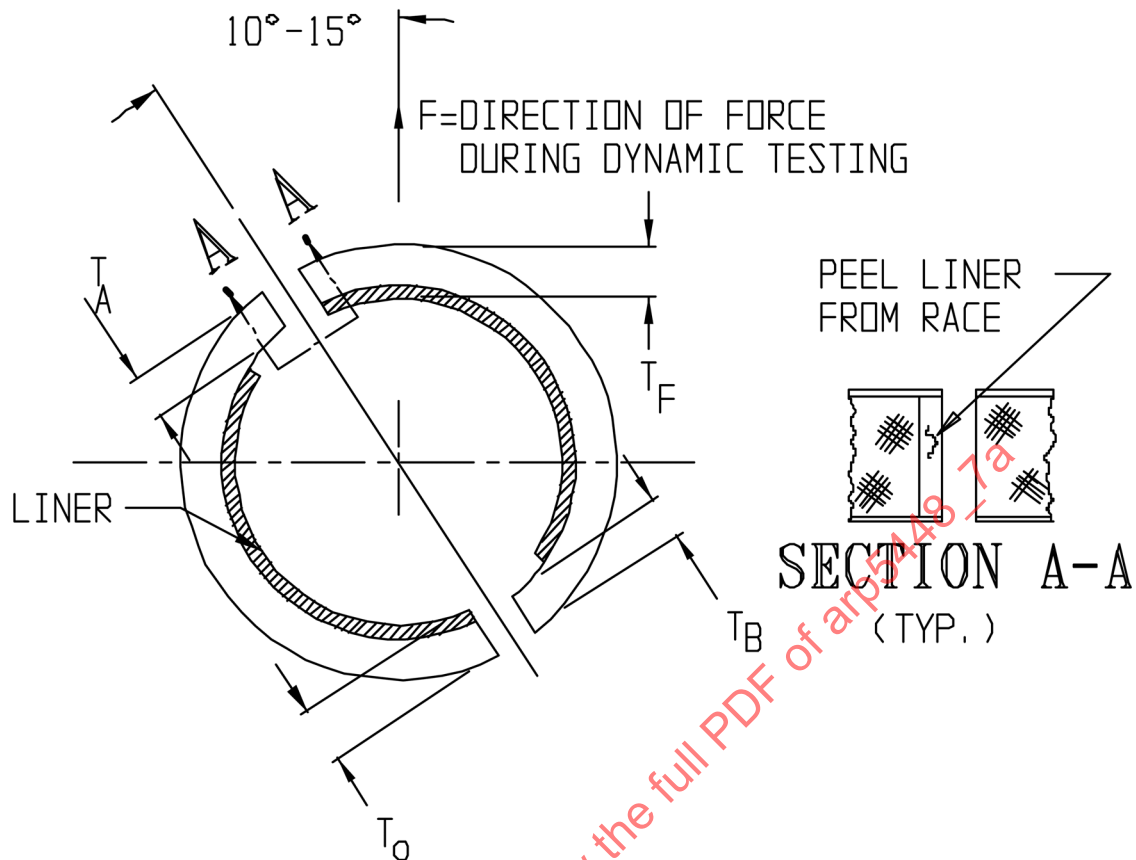
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### 3.1.1 Test Specimen Preparation

Prior to measurement, misalign the ball and wipe clean to remove loose material. Repeat misalignment and wipe several times at different diameter locations. Compressed air may be used to flush out loose material, but care must be used to ensure that debris is not wedged into the bearing.

### 3.1.2 Measurement Procedure

- a. Cut race at a location approximately 10 to 15 degrees with respect to the center of the load zone. When using a metallurgical cut-off saw the cut shall proceed through the race and ball component as shown in Figure 1. If a hand hacksaw is to be employed, cut the race through the same 10 to 15 degrees off load center and then at a location at 180 degrees about the race to make two equal race halves.
- b. Trim and scrape the liner material and adhesive from the race in the areas shown ( $T_A$  and  $T_B$ ) in section A-A of Figure 1. When a spherical bearing race is being prepared, only the centerline of the race where the metal is the thinnest requires complete cleaning to the metal substrate. Be careful not to remove any metal when scraping away the bonded adhesive. Journal bearings should be completely stripped across the full width so that wear may be evaluated on both edges as they often wear unevenly due to misalignment.
- c. Take at least three measurements of the metal substrate thickness in the equatorial area of a spherical or across the width of a journal bearing in the areas scraped clean of adhesive. Determine the minimum thickness and record measurements (Regions  $T_A$  and  $T_B$ ).
- d. Take at least three measurements of the liner and metal backing thickness in the center of the loaded area of a spherical race or at each end and center of a journal bearing (wear zone) to determine minimum thickness and record measurements (Regions  $T_O$  and  $T_F$ ).
- e. Repeat operation (c) approximately 180 degrees from the loaded area of the race or journal bearing to determine minimum thickness of the metal substrate and record measurements. This region is considered the "unloaded zone" and the liner is considered unworn in this area.
- f. Repeat operation (d) approximately 180 degrees to the loaded area of the race or journal bearing to determine minimum liner plus substrate thickness and record. This region is considered the "unloaded zone" and the liner is considered unworn in this area.
- g. Subtract the "race only" measurement that is adjacent to the center of the unloaded area from the measurement of the liner and race thickness in the unloaded area of the race. Take at least three measurement readings. Use the minimum recorded value for each measurement. The difference is the thickness of the unworn section of liner material.
- h. Subtract the thickness of the worn section of liner from unworn section of liner, using the minimum recorded value of each measurement. The difference is the total wear of the liner system.



$T_F$  - \_\_\_\_\_ Thickness of TFE lined race in the load zone.  
 $T_A$  - \_\_\_\_\_ Thickness of Metal race only adjacent to the load zone.  
 (TFE liner removed, scraped, peeled etc.)  
 $T_O$  - \_\_\_\_\_ Thickness of TFE lined race 180° from the load zone.  
 $T_B$  - \_\_\_\_\_ Thickness of Metal race only in the unloaded zone  
 (TFE liner removed, scraped, peeled etc.)  
 $X$  = New (unworn) TFE Liner thickness =  $T_O - T_B$   
 $Y$  = TFE liner thickness remaining at load zone =  $T_F - T_A$   
 $W$  = Total dynamic wear =  $X - Y$   
 (X) (Y)

W = \_\_\_\_\_ - \_\_\_\_\_ = \_\_\_\_\_

Bearing P/N \_\_\_\_\_ No. of Cycles \_\_\_\_\_ Load \_\_\_\_\_

Serial No. \_\_\_\_\_ Condition: \_\_\_\_\_

**Figure 1 - Worksheet**

### 3.2 Nondestructive Inspection

The scope of this test method shall be to measure the radial play before and after a dynamic test to determine the increased radial play which shall be assumed to be liner wear. The required equipment shall be a radial play gauge per ARP5448/8 and a bore shaft or arbor if journal bearings are being tested.

#### 3.2.1 Measurement Procedure

- a. Place the test bearing in the radial play gauge per ARP5448/8. Ensure that the applied gauge loads are in accordance with the applicable specification. The radial play of the new bearing shall be recorded. The location of the measurement should be marked on the bearing permanently. The marked position shall be the load zone during dynamic testing. The initial radial play shall be used as a baseline to compare the play after dynamic testing. This method may be used to measure journal bearing wear by placing a pin within the bore that is close to the bore size. The pin must be clamped and the journal bearing subject to the reversing load of the play tester.
- b. Remove the test bearing from the radial play gauge and perform dynamic testing as specified in the applicable specification.
- c. After dynamic testing verify that the race or journal bearing has not rotated within its housing before removing it from the test machine. Misalign the ball of spherical bearings and wipe clean to remove loose wear debris. Repeat misalignment and wipe several times at different locations. Compressed dry air may be used to help flush out loose debris, but care must be used to ensure material is not wedged into the bearing. The inner lined surface of journal bearings must simply be wiped of loose debris.
- d. Place the test specimen into the radial play gauge as shown in Figure 2 so that the loaded area of the race and ball are in line with the radial play gauge loading. Measure and record the radial play of the test specimen with the marked load zone in line with the reversing load of the play gauge.
- e. Determine the total wear of the liner system by subtracting the radial play before dynamic testing from the radial play after dynamic testing.

### 3.3 Test Parameters

Test parameters shall include the following:

- a. Test specimen design envelope
- b. Dynamic test specification
- c. Test duration
- d. Failure criteria (maximum radial clearance)