AEROSPACE RECOMMENDED PRACTICE

ARP5507™	REV. A

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Superseding ARP5507

Aircraft Tire-to-Wheel Performance Characteristics

RATIONALE

This recommended practice has been amended to remove references to obsolete ISO standards, to update references to relevant U.S. government publications, to amend the recommended test procedure, and to provide for a revised set of in-service performance assessments.

FOREWORD

The performance of an aircraft tire/wheel assembly in service is dependent on the geometrical fit, load distribution, and performance at the tire/wheel interface while rolling. This document focuses on the tire-to-wheel circumferential movement for a new tubeless tire.

1. SCOPE

This SAE Aerospace Recommended Practice (ARP) defines the performance criteria and validation for tire circumferential movement on the rim, in the laboratory, by a static test, as well as a performance assessment in service. This document is applicable to braked wheel positions using both bias ply and radial aircraft tires.

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 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

ARP5265 Minimum Operational and Maintenance Responsibilities for Aircraft Tire Usage

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/ARP5507A

2.1.2 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

TSO-C62 Technical Standard Order, Aircraft Tires

2.1.3 Tire and Rim Association Publications

Available from Tire and Rim Association, Inc., 4000 Embassy Parkway, Suite 390, Akron, OH 44333, www.us-tra.org.

TRA Aircraft Year Book

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AS4833 Aircraft New Tire Standard - Bias and Radial

2.2.2 EASA Publications

Available from European Union Aviation Safety Agency, Konrad-Adenauer-Ufer 3, D-50668 Cologne, Germany, Tel: +49 221 8999 000, www.easa.europa.eu.

ETSO-C62 European Technical Standard Order, Aircraft Tyres

2.2.3 U.S. Government Publications

Copies of these documents are available online at https://quicksearch.dla.mil.

MIL-DTL-5041 Detail Specification, Tires, Ribbed Tread, Pneumatic, Aircraft

3. TECHNICAL BACKGROUND

3.1 General

Aircraft tire/wheel assemblies should develop friction and load-bearing capabilities at the tire-to-wheel interface. The design and dimensional control of the wheel seating surface and the tire bead contact area should support the following functions:

- Ease of mounting and dismounting, without damage to tire or wheel;
- Sealing of the tire/wheel interface against inflation pressure loss;
- Transmitting torque during braking;
- Sustaining the bending forces of standard deflection and over-deflection; and
- Sustaining side load forces without loss of inflation pressure.

In performing the above functions, tires have been observed to move circumferentially relative to the wheel. Since there is no mechanical lock or fixed alignment between the tire and the wheel at the tire/wheel interface, movement from the initial seated location can occur under certain conditions.

This ARP defines the performance criteria and validation for tire circumferential movement on the rim, in the laboratory, by a static test, as well as a performance assessment in service.

3.2 Referenced Dimensional Requirements

3.2.1 Wheel

The test wheel should be dimensioned and contoured per the standards of The Tire and Rim Association (TRA).

3.2.2 Tire

Each tire should be a new tire that meets the established TRA standard for the size.

3.3 Performance Demonstration - Laboratory

The recommended practice for demonstrating tire/wheel interface resistance to circumferential movement is described below.

3.3.1 Test Machine

a. The test machine should be capable of applying and maintaining a constant radial load equal to the rated load (see 2.1.3) of the test tire.

b. The test machine should be capable of applying a fore-aft force, perpendicular to the radial load, of at least 65% of the radial load.

c. The load surface should be flat and perpendicular to the plane of the tire/wheel assembly. The load surface should be capable of maintaining a coefficient of friction to achieve the fore-aft force of at least 65% of the radial load.

d. The fore-aft force may be applied by tangential motion of the load surface or by rotating the tire/wheel assembly. In either system, the opposing element should be maintained as a stationary component.

3.3.2 Test Procedure

a. Prior to mounting the tire on the wheel, all bead seat areas of the wheel and tire should be cleaned. No bead seat lubricants of any kind should be used. Mount the tire on the wheel.

b. Inflate the tire/wheel assembly to rated (unloaded) pressure of the tire.

c. Condition the tire/wheel assembly by performing at least two standard taxi cycles in accordance with TSO-C62.

d. Allow the tire/wheel assembly to return to ambient temperature (18 to 38 °C, or 65 to 100 °F) and readjust pressure to rated (unloaded) pressure of the tire.

e. At the location of the tire serial number, mark a continuous radial line on the sidewall of the tire that continues onto the flange of the wheel (a “match mark”) to serve as a movement reference line (serial side only).

f. Force the tire/wheel assembly against the load surface, or load surface against the tire/wheel assembly, with the radial line perpendicular to the load surface. The applied force should be equal to the rated load of the tire.

g. Apply a tangential force in the fore-aft direction equal to 65% of the rated load of the tire at a rate up to 2 in/min, while maintaining the radial force.

h. Upon achieving the specified tangential force, release the tangential force at a rate of 2 in/min and then release the radial force.

i. Record the movement (if any) between the tire and the wheel. Photograph the previously created reference line capturing any movement that may have occurred. Make sure to include a scale in the photo. This can serve as a qualitative measure of sensor measurements accuracy.

j. Rotate the tire/wheel assembly 180 degrees from the tire serial number and mark a continuous radial line on the tire sidewall and wheel flange at the 180-degree location (serial side only).

k. Repeat steps f. through i. at the 180-degree location - all conditions identical to step g.

l. At a location 90 degrees clockwise from the tire serial number, mark a continuous radial line on the tire sidewall and wheel flange (serial side only).

m. Repeat steps f. through i. at the 90-degree location - all conditions identical to step g.

n. Rotate the tire/wheel assembly to 270 degrees clockwise from the tire serial number and mark a continuous radial line on the tire sidewall and wheel flange (serial side only).

o. Repeat steps f. through i. at the 270-degree location - all conditions identical to step g.

p. If the movement between the tire and wheel surpasses the allowable amount at any location, the tire should be considered to have failed the entire test. A complete retest of this entire test procedure should be repeated, once the cause of the previous test failure has been suitably investigated and rectified in accordance with all necessary certification requirements.

q. After the completion of the testing, an inflation retention test should be run. Adjust the tire/wheel assembly to rated inflation pressure. Measure the inflation pressure after 24 hours. The ambient temperature should be measured at the start and finish of the test to assure that any pressure change was not caused by an ambient temperature change.

3.3.3 Laboratory Acceptance Criteria

After each individual tangential tire loading, any displacement between the tire and wheel should be less than 5 degrees, as measured at the tire bead. Displacement should be calculated from the start position (when the vertical load is fully applied but no tangential load has been applied yet), to the end position (after the tangential load has been applied and then released prior to the vertical load being released). For the air retention test, the tire should retain the inflation pressure within 5% of the initial pressure for a period of 24 hours.

3.4 Performance Assessment - In-Service

Historically, in service tire-to-wheel circumferential movement was limited to a maximum of 20 degrees per installation. This value is still used in the laboratory assessment of tire-to-wheel fitment but does not adequately address the range of potential impacts from poor tire-to-wheel fitment which could be encountered in service.

More recent assessment is that the limit of acceptable rotation should not be based on a maximum angle but instead to be determined by the effects that accompany it. Any amount of circumferential movement of the tire on the wheel rim is unacceptable if it is associated with one or more of the following conditions:

- Loss of tire pressure.
- Vibration.
- Damage to the wheel bead seat area.
- Degradation of braking capability.