



AEROSPACE RECOMMENDED PRACTICE

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Aircraft Tire Selection and Qualification

RATIONALE

A need exists to guide those involved in new aircraft tire specification and selection on the basics of tire function, construction, and qualification information. This document meets this need.

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1. SCOPE

This document provides basic information that should be considered when an aircraft tire is needed for a new application. These guidelines are harmonized with existing regulatory and SAE documents and with the Care and Service Manuals of the tire manufacturers. In general, they should be pertinent to both civil and military aircraft.

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 (U.S. and Canada only) or +1 724-776-4970 (outside U.S. and Canada), www.sae.org.

AIR1780	Aircraft Flotation Analysis
AIR1904	Tire Spray Suppression - Airplane Design and Consideration for
AIR6246	Landing Gear (Engine Off) Taxi System
ARP1821	Aircraft Ground Flotation Analysis Methods
ARP4955	Recommended Practice for Measurement of Static and Dynamic Characteristic Properties of Aircraft Tires
ARP5257	Tire Overspeed Landing Test
ARP5507	Aircraft Tire-to-Wheel Performance Characteristics
ARP6152	Aircraft Tires Service Overload Capability
AS4833	Aircraft New Tire Standard - Bias and Radial

Cepic, A., "Hydroplaning of H-Type Aircraft Tires," SAE Technical Paper 2004-01-3119, 2004, <https://doi.org/10.4271/2004-01-3119>.

2.1.2 Code of Federal Regulations (CFR) Publications

Copies of these documents are available online at www.ecfr.gov.

14 CFR Part 25 Airworthiness Standards, Transport Category Airplanes

2.1.3 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.

AMC 25.1091 Precipitation Covered Runways

AMC 25.1591 The derivation and methodology of performance information for use when taking-off from slippery wet and contaminated runways

AMC 25.734 Protection against wheel and tyre failures

CS-25 Certification Specifications for Large Aeroplanes

ETSO-C62 Aircraft Tyres

2.1.4 ETRTO Publications

Available from European Tyre & Rim Technical Organisation, Avenue d'Auderghem 22-28, Box 9 - B, 1040 Brussels, Belgium, Tel: 32.2.344.40.59, www.etrto.org.

The European Tyre and Rim Technical Organisation (ETRTO) Standards Manual

2.1.5 FAA Publications

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

AC 20-124 Water Ingestion Testing for Turbine Powered Airplanes

TSO-C62 FAA Standard For Aircraft Tires

2.1.6 Tire and Rim Association Publications

Available from Tire and Rim Association, Inc., 4000 Embassy Parkway, Suite 390, Akron, OH 44333, Tel: 330-666-8121, www.us-tra.org.

The Tire and Rim Association (TRA) Aircraft Tire Year Book and Other Publications

2.1.7 U.S. Government Publications

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

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

MIL-DTL-7726 Performance Specification Retread Tires, Ribbed Tread, Pneumatic, Aircraft

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 (U.S. and Canada only) or +1 724-776-4970 (outside U.S. and Canada), www.sae.org.

AIR5651 History of Commercial Aircraft New Tire Qualification Testing

ARP4834 Aircraft Tire Retreading Practice - Bias and Radial

AS50141 Tube, Pneumatic Tire, Aircraft

2.2.2 Other Documents

Bridgestone: Tire Specification & Maintenance Manual

Dunlop: Tyre Care & Maintenance Manual (DM1172)

Goodyear: Aircraft Tire Care and Maintenance Manual

Michelin: Aircraft Tire Care & Service Manual

3. AIRCRAFT TIRE INTRODUCTION/OVERVIEW

The aircraft tire plays a vital role in safe aircraft operations during the taxi, takeoff, and landing phases of flight. It is subjected to heavy loads, high speeds, and extreme temperatures. The requirements for the tire and its interface with the other landing gear and airframe components, systems, and structures should be considered and integrated early in the process when a new aircraft/application is being developed.

3.1 Tire Function and Purpose

3.1.1 Aircraft Tire Main Functions

3.1.1.1 Carry the Vertical Load

The load is supported pneumatically by containing the needed volume of inert gas (nitrogen is recommended) within the tire's structure. As a first approximation, 85 to 95% of the aircraft's static load is supported by the main landing gear tires, depending on the size and type of aircraft.

In addition to static loading conditions, dynamic loading during acceleration, touchdown, and deceleration should also be supported by the main and nose tires.

A secondary aspect of the load-carrying function is to absorb shocks, noise, and mechanical vibrations while rolling.

3.1.1.2 Generate and Transmit Lateral, Torsional, and Longitudinal Forces

Steering inputs at taxi and lower takeoff and landing roll speeds are primarily transmitted by the nose tires. Some main landing gear tire positions on a few large commercial aircraft are also steerable.

Tires in all positions are subject to significant lateral and torsional forces during ground maneuvering.

Tires transmit braking force from the brake and wheel to the tire-runway interface to decelerate the aircraft when brake torque is generated. The maximum available brake force is limited by available friction between the tire and the runway. Tire characteristics are significant and must be accounted for in braking control and anti-skid system designs.

The effective transmission of forces requires a precise fit between the wheels and tires. The interface standards are defined in the TRA Year Book and the ETRTO standards manual.

Transmission of torque to provide traction. Electric motors driving wheels for taxiing and moving on jetways is a potential application being investigated. Refer to AIR6246 for further information.