

WHEELS AND BRAKES - MINIMUM REQUIREMENTS
FOR CIVIL AIRCRAFT APPLICATIONS

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1. PURPOSE: To specify minimum requirements for aircraft wheels and brakes for civil aircraft applications.
2. SCOPE: This specification covers minimum requirements for all aircraft wheels and brakes in a range of sizes to accommodate the standard sizes and types of tires.

3. GENERAL REQUIREMENTS:

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3.1 Materials and Workmanship:

3.1.1 Materials: Materials shall be suitable for the purpose intended. All metals used in the construction of wheels and brakes shall be corrosion resistant unless suitably plated or treated to resist corrosion during stocking and normal service life. The use of dissimilar metals, especially brass, copper, or steel in contact with aluminum, magnesium, or alloys thereof, shall be avoided where practicable.

3.1.2 Workmanship: The workmanship and finish shall be in accordance with high grade aircraft wheel and brake manufacturing practices.

3.2 Identification: Each wheel and each brake assembly shall be plainly marked, in such a way that the marking will not be obliterated or effaced as a result of service usage, as follows:

- a. Name of manufacturer responsible for compliance.
- b. Serial number and date of manufacture (may be combined) on both wheel halves and demountable flanges.
- c. Assembly number.

4. DETAIL REQUIREMENTS:

4.1 Design:

4.1.1 Brake Operating Medium: All brakes shall be designed and tested to operate with the medium (air, oil or other fluid) specified for the airplane on which the brakes are to be used.

4.1.2 Lubricant Retainers: Suitable retainers shall be provided to prevent lubricant from reaching the braking surfaces and to prevent foreign matter from entering the bearings.

4.1.3 Removable Flanges: All removable flanges shall be assembled onto the wheel in a manner that will prevent the removable flange and its retaining device from leaving the wheel if a tire should deflate while the wheel is rolling.

4.1.4 Adjustment: When necessary to insure safe performance, the brake mechanism shall be equipped with suitable adjustment devices.

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4.1.5 Inflation Pressure Release: When wheel and/or tire explosion hazards are created as a result of brake heat, each wheel thus affected shall be equipped with an inflation pressure release device. Suitable tests, as agreed upon by the aircraft and wheel manufacturers, shall be conducted for the purpose of demonstrating satisfactory performance of the safety device.

4.2 Amphibian Applications:

4.2.1 Water Seal: Provision shall be made to seal the wheels of amphibious aircraft to prevent entrance of water into the wheel bearings or other portions of the wheel or brake where the presence of water might be detrimental. Unsealed brake assemblies will be permitted if all exposed materials therein are corrosion resistant or if the design is such that brake action and service life will not be impaired by the presence of sea water or fresh water.

4.3 Construction:

4.3.1 Casting Quality Control: The quality of magnesium and aluminum wheel castings shall be initially developed and subsequently maintained in accordance with the procedures stated in AS 586A. The same procedures shall apply to brake castings which function as primary landing-load carrying elements of the landing gear. When valid inspection procedures including samplings plans have prior approval of a U.S. Government Agency (Air Force, Navy, etc.), these procedures may be used in lieu of the procedures outlined above when authorized by FAA.

4.3.2 Forgings: Forgings shall be of uniform condition, free from blisters, fins, folds, seams, laps, cracks, segregation, and other defects. If strength and serviceability are not impaired, imperfections may be removed.

4.3.3 Rim Surfaces:

4.3.3.1 Wheel Rims for Tires and Tubes: The surface of the rim shall be free from defects which are injurious to the tire or tube. Depressions in the rim or bead seats which might injure the tube or casing shall be filled with a hard surface permanent filler before applying the primer coat.

4.3.3.2 Wheel Rims for Tubeless Tires: The surface of the rim shall be free from defects which may cause leakage of inflation pressure or which may damage the tire beads.

4.3.4 Rim Joints: Joints in the rim surface and joints between rim surfaces and demountable flanges shall be smooth, close-fitting, and non-injurious to the inner tube while mounting the tire or while in service.

4.3.5 Rivets and Bolts: When rivets are used, they shall be well headed over, and rivets or bolts coming in contact with the casing or tube shall be smooth enough not to damage the tube or casing during normal operation.

4.3.6 Bolts and Studs: When bolts and studs are used for fastening together sections of a wheel, the length of the threads for the nut extending into and bearing against the sections shall be held to a minimum; and there shall be sufficient unthreaded bearing area to carry the required load.



4.4 Protective Treatment:

- 4.4.1 Steel Parts: Wherever possible all steel parts, except braking surfaces and those parts fabricated from corrosion resistant steel, shall be cadmium plated or zinc plated. Where cadmium or zinc plating cannot be applied, the surface shall be thoroughly cleaned and suitably protected from corrosion.
- 4.4.2 Aluminum Parts: All aluminum alloy parts shall be anodized or have equivalent protection from corrosion.
- 4.4.3 Magnesium Parts: All magnesium alloy parts shall receive a suitable dichromate treatment or have equivalent protection from corrosion.
- 4.4.4 Bearing and Braking Surface: The bearings and braking surfaces shall be protected during the application of finish to the wheels and brakes.
- 4.4.5 Operating Cylinders: Prior to inspection tests, the cylinders shall be suitably cleaned to remove all metal particles and other foreign matter. The cylinder ports shall be suitably capped to prevent entrance of foreign matter.

5. QUALIFICATION TESTS:

- 5.1 Ratings: Each design of wheel or wheel-brake shall have the following ratings as applicable:

S = Maximum Static Load in lbs.

L = Maximum Limit Load in lbs.

KE_{ML} = Maximum Landing Kinetic Energy Capacity in ft. lbs.

KE_{RTO} = Maximum Rejected Take-off Kinetic Energy Capacity in ft. lbs.

V_{so} = Power off Stall Speed in mph (not applicable to Method II analysis per paragraph 5.3.7.1.2).

- 5.2 Tests Required: The ratings for wheel assemblies and brake assemblies shall be substantiated by the following tests as applicable:

- (a) Wheel, Table I
- (b) Brake, Table II

5.3 Test Methods:

- 5.3.1 Radial Load Test: The required limit load shall be determined by the air-frame manufacturer from the ground load requirements of CAR, and shall be equal to the operating condition of maximum radial load reaction with side load equal to zero. If the critical combined load condition as defined under the combined load test, has a limit radial component in excess of the required limit radial load, the radial load test shall be omitted. This test shall be performed by applying the radial load to the wheel through a tire inflated to an initial pressure equal to the rated inflation pressure. Either air or water inflation may be used. If the tire is filled with water, the water shall be bled off during loading to approximate the same tire deflection that would result if air inflation were used and the inflation

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5.3.1 Radial Load Test: (continued)

pressure shall not exceed the pressure at maximum tire deflection. The radial load shall be applied to the wheel by means of a straight axle passing through the hub. The tire shall be loaded directly against a flat, non-deflecting surface. Deflection and permanent set readings shall be taken at suitable points on the wheel to indicate deflections of the wheel rim at the bead seat. The use of strain gages or special coating to indicate regions of high stress is desirable. Wheels intended for tubeless tire mounting shall be tested in the same manner, unless otherwise specified. The required radial load tests are specified below.

5.3.1.1 Yield Radial Load Test: The wheel shall support the yield radial load applied consecutively at 0°, 90°, 180° and 270° followed by two more load applications at the 0° position. The 0° position shall be the initial load contact point which shall normally include the valve hole. The 90° increments shall be altered if other positions are more critical. The successive loadings at the 0° position shall not cause radial permanent set increments of increasing magnitude. The permanent set increment caused by the last loading (at the 0° position) shall not exceed 5% of the deflection caused by the last loading. There shall be no yielding of the wheel such as would result in loose bearing cups, air leakage, or interference in any critical clearance areas. The bearing cups and cones and rollers shall be used for this test.

5.3.1.2 Ultimate Radial Load Test: The ultimate load shall be applied at the 0° position of the same wheel on which the yield radial loads were applied. The wheel shall support the ultimate load for ten seconds. The bearing cones may be replaced with conical bushings, but the cups shall be used. A tubeless tire may be replaced with a tire and tube.

5.3.2 Combined Load Test: The combined load test shall be performed by applying the load to the wheel through a tire inflated to an initial pressure equal to the rated inflation pressure. Air or water inflation pressure may be used. If the tire is filled with water, the water shall be bled off during loading to approximate the same tire deflection that would result if air inflation were used and inflation shall not exceed the pressure at maximum tire deflection. Yield loads shall be applied in both inboard and outboard directions on the same wheel and at the ground angle and magnitude determined by the airframe manufacturer to demonstrate compliance with CAR. The required limit combined load components, both inboard and outboard, shall be determined by the airframe manufacturer and furnished to the wheel manufacturer. The wheel and tire assembly shall be mounted on a straight axle passing through the hub. The tire shall be loaded directly against a flat, non-deflecting surface. The loads shall be applied simultaneously, either continuously or in increments of approximately 10% of the specified values. Readings shall be taken at suitable points on the wheel to indicate deflections and permanent sets.

5.3.2.1 Yield Combined Load Test: The wheel shall support the components of the yield combined load applied consecutively at 0°, 90°, 180°, and 270° followed by two more load applications at the 0° position. The 0° position shall be the initial load contact point which shall normally include the valve hole. The 90° increments shall be altered if other positions are