

WHEELS AND BRAKES  
MINIMUM REQUIREMENTS FOR CIVIL AIRCRAFT APPLICATIONS

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Revised

1. **PURPOSE:** To specify minimum requirements for Aircraft Wheels and Brakes for civil aircraft applications.
2. **SCOPE:** This specification covers minimum requirements for wheels and brakes in a range of sizes to accommodate the sizes and types of standard casings listed by the Tire and Rim Association, Inc.
3. **GENERAL REQUIREMENTS:**

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:** Workmanship and finish shall be in accordance with high grade aircraft wheel and brake manufacturing practice.
- 3.2 **Identification:** Each wheel and each brake assembly shall be plainly marked as follows, and as applicable, in accordance with the ratings selected:

|                                            | Wheel | Brake |
|--------------------------------------------|-------|-------|
| (a) AS-227                                 | x     | x     |
| (b) Size                                   | x     |       |
| (c) Serial number and date of manufacture  | x     | x     |
| (d) Manufacturer's name and drawing number | x     | x     |
| (e) Maximum static rating of wheel         | x     |       |

Markings shall be of such character that they will not be obliterated or effaced as a result of service usage.

4. **DETAIL REQUIREMENTS:**

4.1 **Design:**

- 4.1.1 **Brake Fluid:** All hydraulic brakes shall be designed and tested to operate with hydraulic brake fluid or oil specified for the airplane on which the brakes are used.
- 4.1.2 **Lubricant Retainers:** Suitable retainers shall be provided to prevent lubricant from reaching the braking surface and to prevent foreign matter from entering the bearings.

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4.1.3 Removable Flanges: All removable flanges shall be assembled to the wheel in a manner that will prevent the removable flange and its retaining device from leaving the wheel in case a flat tire occurs 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.

#### 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 to 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 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 X-Ray Control: Castings shall be produced under X-Ray control when a new foundry source is established, when new size or shape castings are made, or when a change is made in foundry technique.

4.3.2 Castings: Castings shall be of high quality, clean, sound, and free from blowholes, porosity, or surface defects caused by slag inclusions, except that loose sand or entrapped gases may be allowed when the serviceability of the casting has not been impaired.

4.3.3 Rim Surfaces: The surface of the rim between bead seats shall be free from defects or casting protrusions which will be injurious to the inner tube. Acceptable depressions in rim or bead seats which might injure the tube or casing shall be filled with a hard surface permanent filler before the primer coat is applied. No holes which extend entirely through the casting shall be filled in this manner, but shall be drilled out and filled with a flush plug.

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 during mounting the tire or 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 or 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.

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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 and 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 Bearings 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 assembly shall be tested as described herein to establish the following ratings as applicable.

S - Maximum Static Load in Pounds  
L - Maximum Limit Load in Pounds  
K.E. - Maximum Kinetic Energy Capacity in Foot-Pounds  
V<sub>so</sub> - Minimum Stalling Speed in M.P.H.

- 5.2 Tests Required: Except as qualified by 5.3, the ratings for wheel and wheel-brake assemblies shall be substantiated by the following tests as applicable:

- (a) Radial Load  
(1) Limit  
(2) Ultimate
- (b) Side Load  
(1) Limit  
(2) Ultimate
- (c) Burst
- (d) Dynamic Torque
- (e) Structural Torque
- (f) Static Pressure
- (g) Roll

- 5.3 Exceptions: Ratings for wheels, and wheel-brake assemblies shall be substantiated by all the tests described in 5.2 with the following exceptions:

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- (a) Tail wheels need not be roll tested.
- (b) Wheels used for rotorcraft may be given a rating of 1.5 times S.
- (c) Overload stops under dynamic torque test (5.4.3b) applies only to wheel-brake assemblies for use on transport airplanes certificated in accordance with Civil Air Regulations Part 04b.

#### 5.4 Test Requirements and Methods:

5.4.1 Radial Load Test: This test shall consist of the application of a load equally on both sides of the wheel, to a straight axle passing through the hub, with the tire restrained against a flat non-deflecting surface so that the point of application of the resisting force is centered midway between two spokes. In applying this load, the tire may be inflated with water to the specified pressure and the water gradually bled out as the load is increased so that the pressure in the completely deflected tire will equal that of the completely deflected air inflated tire.

- (a) A maximum radial limit load shall be determined by test by loading the wheel assembly to the yield radial load (115% of maximum radial limit load) for three separate applications at the same point on the wheel. Successive loadings shall not cause radial permanent set increments of increasing magnitude, and permanent set increment caused by the third loading shall not exceed 5% of the total deflection under that load. Deflections and permanent set readings shall be taken at a suitable point on the wheel to indicate deflections of the wheel rim at the head seat.

The wheel manufacturer shall select the limit load for which the wheel assembly will be rated.

- (b) After determining the maximum radial limit load, the load shall then be increased at least to the ultimate load which is 1.875 times the maximum radial limit load. The wheel shall support the ultimate load for at least three seconds without failure.

For forged wheels of either ferrous or non-ferrous alloys, the ultimate load may be considered to be 1.5 times the maximum radial limit load.

5.4.2 Side Load Test: This test shall consist of the application of a load to the critical side of the wheel in a direction parallel to the axis of the wheel hub, to the side of the tire casing by means of a block which shall cover an arc of not more than 60 degrees and whose centroid shall fall on a point midway between the rim flange O.D. and the nominal tire O.D. In applying this load, the wheel shall be restrained only by the axle and the tire may be inflated with water to any pressure, not exceeding the burst test pressure, necessary to accomplish the test.