Section 37167 Aircraft Tires -- TSO-C62c

(a) Applicability. This technical standard order (TSO) prescribes the minimum performance standards that tires, excluding tailwheel tires, must meet in order to be identified with the applicable TSO marking. Tires which are to be so identified and which are manufactured on or after December 31, 1979, must meet the requirements of the "Federal Aviation Administration Standard for Aircraft Tires," effective December 31, 1979, set forth at the end of this section.

b) Marking. In lieu of the marking requirements of Section 37.7(d), aircraft tires must be legibly and permanently marked at least with the following:

(1) Brand name and the name or registered trademark of the manufacturer responsible for compliance.

(2) Speed rating, load rating, size, skid depth, serial number, and the manufacturer's part number and plant code.

(3) Applicable technical standard order (TSO) number.

(c) Data requirements. (1) In addition to the data specified in Section 37.5, the manufacturer must also furnish to the Chief, Engineering and Manufacturing Branch, Federal Aviation Administration (or, in the case of the Western Region, the Chief, Aircraft Engineering Division), in the region in which the manufacturer is located, one copy, or copies as otherwise requested by the regional office, of the following technical data: speed rating, load rating, rated inflation pressure, tire size, width, outside diameter, mold skid depth, nominal loaded radius at rated load inflation pressure, permissible tolerance on the nominal loaded radius, the actual loaded radius of the test tire at rated load and inflation pressure, weight, static unbalance of the test tire, wheel rim designation, manufacturer's part number and, for high-speed tires, a load deflection curve at loads up to 1.5 times load rating, and a summary of the load-speed-time parameters used in the dynamometer tests. As used in this section, the term "high-speed tire" means a tire tested at a speed greater than 120 mph.

(2) The manufacturer must also furnish the applicable maintenance and repair instructions to the regional office identified in paragraph (c)(1) of this section. The maintenance data provided by the manufacturer must include inspection criteria for tires to determine eligibility for used tires to be continued in service. Recapping procedures must be included in the maintenance information along with any special repair methods applicable to the tire and special nondestructive inspection techniques.

(d) Previously approved equipment. (1) Notwithstanding Section 37.3(a) and (b) of this part and the provisions of any specific previous TSO approval, after December 31, 1982, no person may identify or mark a tire having a speed rating above 100 mph with TSO numbers TSO-C62, TSO-C62a, or TSO-C62b.

(2) Aircraft tires, except for those specified in paragraph (d)(1) of this section, approved prior to December 31,1979, may continue to be manufactured under the provisions of their original approval.

Federal Aviation Administration Standard for Aircraft Tires

1.0 Purpose. This document contains minimum performance standards for new aircraft tires, excluding tailwheel tires, that are to be identified as meeting the standards of TSO-C62c

2.0 Scope. These minimum performance standards apply to aircraft tires having speed and load ratings that are established on the basis of the speed and loads to which the tires have been tested.

3.0 Material requirement. Materials must be suitable for the purpose intended. The suitability of the materials must be determined on the basis of satisfactory service experience or substantiating dynamometer tests.

4.0 Design and construction.

4.1 Unbalance. The moment (M) of static unbalance in inch ounces may not be greater than the value determined using the formula, moment (M) = $0.025D^2$ rounded off to the next lower whole number, D = maximum outside diameter of the tire in inches.

4.2 Balance marker. A balance marker, consisting of a red dot, must be affixed on the sidewall of the tire immediately above the bead to indicate the lightweight point of the tire. The dot must remain for any period of storage plus the original tread life of the tire.

4.3. Overpressure. The tire must withstand for at least 3 seconds a pressure of at least 4.0 times the rated inflation pressure (as specified in paragraph 5.2) at ambient temperature.
4.4 Temperature.
4.4.1 Ambient. It must be substantiated by applicable tests or shown by analysis that the physical properties of the tire materials have not been degraded by exposure of the tire to the temperature extremes of not higher than -40°F and not lower than +100°F for a period of not less than 24 hours at each extreme.
4.4.2 Wheel rim bead. It must be substantiated by the applicable tests or shown by analysis that the physical properties of the tire materials have not been degraded by exposure of the tire to a wheel bead set temperature of not lower than 300°F for at least 1 hour, except that low-speed tires or nose-wheel tires may be tested or analyzed at the highest wheel-bead seat temperature expected to be encountered during normal operations.
4.5 Tread design. Changes in materials that affect performance or changes in number or location of tread ribs and grooves or skid depth increases, made subsequent to the tire qualification, are major changes and must be substantiated by dynamometer tests in accordance with paragraph 6.0.
4.6 Slippage. Tires tested in accordance with the dynamometer tests provided by paragraph 6.0 may not slip on the wheel rim during the first five dynamometer cycles. Slippage that subsequently occurs may not damage the tube, valve, or the air seal of the tire bead of tubeless tires.
4.7 Leakage. After an initial 12-hour minimum stabilization period, the tire must be capable of retaining air pressure with a loss of pressure not exceeding 5 percent in 24 hours from the initial pressure equal to the rated inflation pressure.
5.0 Ratings.
5.1 Load ratings. The load ratings of aircraft tires must be established in accordance with the provisions under Sections 23.733, 25.733, 27,733, and 29.733 of this chapter, in effect on December 31, 1979, as appropriate.
5.2 Rated inflation pressure. The rated inflation pressure must be established at an identified ambient temperature on the basis of the rated load as established under paragraph 5.1.
5.3 Loaded radius. The loaded radius is defined as the distance from the axle centerline to a flat surface for a tie initially inflated to the rated inflation pressure and then loaded to its rated load against the flat surface. The nominal loaded radius, the allowable tolerance on the loaded radius, and the actual loaded radius for the test tires must be identified.
6.0 Dynamometer test requirements. The tire may not fail the applicable dynamometer tests specified herein or have visible signs of deterioration other than normal expected tread wear except as provided in paragraph 6.3.3.3.
6.1 General. The following conditions apply to both low-speed and high-speed tires when these tires are subjected to the applicable dynamometer tests.
6.1.1 Tire test load. Unless otherwise specified herein for a particular test, the tire must be forced against the dynamometer flywheel at not less than the rated load of the tire during the entire roll distance of the test.
6.1.2 Test inflation pressure. The test inflation pressure must be the pressure required at an identified ambient temperature to obtain the same loaded radius against the flywheel of the dynamometer as the loaded radius for a flat surface as defined in paragraph 5.3 of this standard. Adjustments to the test inflation pressure may not be made to compensate for increases due to temperature rise occurring during the tests.
6.1.3 Test specimen. A single tire specimen must be used in the applicable dynamometer tests specified herein.
6.2 Low speed tires. Tires operating at ground speeds of 120 mph or less must withstand 200 landing cycles on a dynamometer at the following test temperature and kinetic energy and using either test method A or test method B.
6.2.1 Test temperature. The temperature of the air contained in the tire or of the carcass measured at the hottest point of the tire must be not lower than 105°F at the start of at least 90 percent of the test cycles. For the remaining 10 percent of the test cycles, the contained air or carcass temperature must be not lower than 80°F at the start of each cycle. Rolling the tire on the flywheel is acceptable for obtaining the minimum starting temperature.

6.2.2 Kinetic energy. The kinetic energy of the flywheel to be absorbed by the tire must be calculated as follows:
K.E. = CWV^2 = 162.7W = Kinetic energy in foot pounds.
where

C = 0.0113,
W = Load rating of the tire in pounds,
V = 120 mph.
6.2.3 Test method A -- variable mass flywheel. The total number of dynamometer landings must be divided into two equal parts having speed ranges shown below. If the exact number of flywheel plates cannot be used to obtain the calculated kinetic energy value or proper flywheel width, a greater number of plates must be selected and the dynamometer speed adjusted to obtain the required kinetic energy.
6.2.3.1 Low-speed landings. In the first series of 100 landings, the maximum landing-speed is 90 mph and the minimum unlanding speed is 0 mph. The landing speed must be adjusted so that 58 percent of the kinetic energy calculated under paragraph 6.2.2 will be absorbed by the tire. If the adjusted landing speed is calculated to be less than 80 mph, the following must be done: The landing speed must be determined by adding 28 percent of the kinetic energy calculated under paragraph 6.2.2 to the flywheel kinetic energy at 64 mph, and the unlanding speed determined by subtracting 28 percent of the kinetic energy calculated under paragraph 6.2.2 from the flywheel kinetic energy at 64 mph.
6.2.3.2 High-speed landings. In the second series of 100 landings, the minimum landing speed is 120 mph and the nominal unlanding speed is 90 mph. The unlanding speed must be adjusted as necessary so that 44 percent of the kinetic energy calculated under paragraph 6.2.2 will be absorbed by the tire.
6.2.4 Test method B -- fixed mass flywheel. The total number of dynamometer landings must be divided into two equal parts having speed ranges indicated below. Each landing must be made in a time period, T, calculated so that the tire will absorb the kinetic energy determined under paragraph 6.2.2. The time period must be calculated using the equation:

$$T_C = \frac{KE_C}{\left(\frac{KE_{W(UL)} - KE_{W(LL)}}{T_{L(UL)} - T_{L(LL)}}\right) - \left(\frac{KE_{W(UL)} - KE_{W(LL)}}{T_{W(UL)} - T_{W(LL)}}\right)}$$

For the, 90 mph to 0 mph test, the equation reduces to:

$$T_C = \frac{KE_C}{\left(\frac{KE_{W(UL)}}{T_{L(UL)}}\right) - \left(\frac{KE_{W(UL)}}{T_{W(UL)}}\right)}$$

where:
T_C = Calculated time, in seconds, for the tire to absorb the required kinetic energy.
KE_C = Kinetic energy, in foot pounds, the tire is required to absorb during each landing cycle.
KE_W = Kinetic energy, in foot pounds, of the flywheel at given speed.
T_L = Coast down time, in seconds, with rated tire load on flywheel.
T_W = Coast down time, in seconds, with no tire load on flywheel.
(UL) = Subscript for upper speed limit.
(LL) = Subscript for lower speed limit.
6.2.4.1 Low-speed loadings. In the first series of 100 landings, the tire must be landed against the flywheel with the flywheel having a peripheral speed of not less than 90 mph. The flywheel deceleration must be constant from 90 mph to 0 mph in the time T_C.
6.2.4.2 High-speed landings. In the second series of 100 landings, the tire must be landed against the flywheel with the flywheel having a peripheral speed of not less than 120 mph. The flywheel deceleration must be constant from 120 mph to 90 mph in the time T_C.

6.3 High-speed tires. Except as provided in the alternate test, tires operating at ground speeds greater than 120 mph must be tested on a dynamometer in accordance with paragraph 6.3.3. The curves to be used as a basis for tests under paragraph 6.3.3 must be established in accordance with the provisions of Sections 23.733 or 25.733, as appropriate. The load at the start of the test must be equal to the rated load of the tire. The load at any time during the test must be equal to the load shown on the established curve at the speed times the rated load of the tire divided by the initial load-speed-time curve load of the tire. Alternate tests involving a landing sequence for tires operating at ground speeds greater than 120 mph and not over 160 mph are set forth in paragraph 6.3.4.

6.3.1 Test temperature. The temperature of the air contained in the tire or of the carcass measured at the hottest point of the tire must be not lower than 120°F at the start of at least 90 percent of the test cycles specified in paragraph 6.3.3.4 and at least 105°F at the start of the overload test (6.3.3.3) and of at least 90 percent of the test cycles specified in paragraphs 6.3.3.2 and 6.3.4. For the remaining 10 percent of each group of cycles, the contained air or carcass temperature must be not lower than 80° F at the start of each cycle. Rolling the tire on the dynamometer is acceptable for obtaining the minimum starting temperature.

6.3.2 Dynamometer test speeds. Applicable dynamometer test speeds for corresponding maximum ground speeds are as follows:

Medium ground speed of aircraft, mph		Speed rating of tire, mph	Minimum dynamometer speed at S_O, mph
Over	Not Over		
120	160	160	160
160	190	190	190
190	210	210	210
210	225	225	225
225	235	235	235
235	245	245	245

For ground speeds over 245 mph, the tire must be tested to the maximum applicable load-speed-time requirements and appropriately identified with the proper speed rating.

6.3.3 Dynamometer cycles. The test tire must withstand 50 takeoff cycles, 1 overload takeoff cycle, and 10 taxi cycles described below. The sequence of the cycles is optional.

6.3.3.1 Symbol definitions. The numerical values which are used for the following symbols must be determined from the applicable airplane load-speed-time data:

L_0 = Tire load at start of takeoff, pounds (not less than rated load).
L_1 = Tire load at rotation, pounds.
L_2 = Zero tire load (liftoff).
RD = Roll distance, feet.
S_0 = Zero tire speed.
S_1 = Tire speed at rotation, mph.
S_2 = Tire speed at liftoff, mph (not less than speed rating).
T_0 = Start of takeoff.
T_1 = Time to rotation, seconds.
T_2 = Time to liftoff, seconds.

6.3.3.2 Takeoff cycles. For these cycles the loads, speeds, and distance must conform to either Figure 1 or Figure 2. Figure 1 defines a test cycle that is generally applicable to any aircraft. If figure 2 is used to define the test cycle, the loads, speeds, and distance must be selected based on the most critical takeoff conditions established by the applicant.

6.3.3.3 Overload takeoff cycle. The cycle must duplicate the takeoff cycles specified under paragraph 6.3.3.2 except that the tire load through the cycle must be increased by a factor of at least 1.5. Upon completion of the overload takeoff cycle, the tire must be capable of retaining air pressure with the loss of pressure not exceeding 10 percent in 24 hours from the initial test pressure. Good condition of the tire tread is not required.

6.3.3.4 Taxi cycles. The tire must withstand at least 10 taxi cycles on a dynamometer under the following test conditions:

Number of test cycles	Minimum tire load, lbs	Minimum speed mph	Minimum roll distance, ft.
8	Rated load	40	35,000
2	1.2 times rated load	to	35,000

6.3.4 Alternate dynamometer tests. For tires with a speed rating of 160 mph, test cycles which simulate landing may be used in lieu of the takeoff cycles specified in paragraphs 6.3.3.2 and 6.3.3.3. The tire must withstand 100 test cycles at rated load in accordance with paragraph 6.3.4.1 followed by 100 test cycles at rated load in accordance with paragraph 6.3.4.2.
6.3.4.1 Low-speed landings. In the first series of 100 landings, the test procedure for low-speed landings established under paragraphs 6.2.3 or 6.2.4, as appropriate, must be followed.
6.3.4.2 High-speed landings. In the second series of 100 landings, the test procedure for low-speed landings established under paragraphs 6.2.3 or 6.2.4, as appropriate, must be followed, except that the tire must be landed against the flywheel rotating at a speed of 160 mph with the rated load applied for the duration of the test. The unlanding speed must be adjusted as necessary in order that 44 percent of the kinetic energy, as calculated in paragraph 6.2.2, is absorbed by the tire during the series of tests.

FIGURE 1

GRAPHIC REPRESENTATION OF A UNIVERSAL LOAD-SPEED-TIME TEST CYCLE

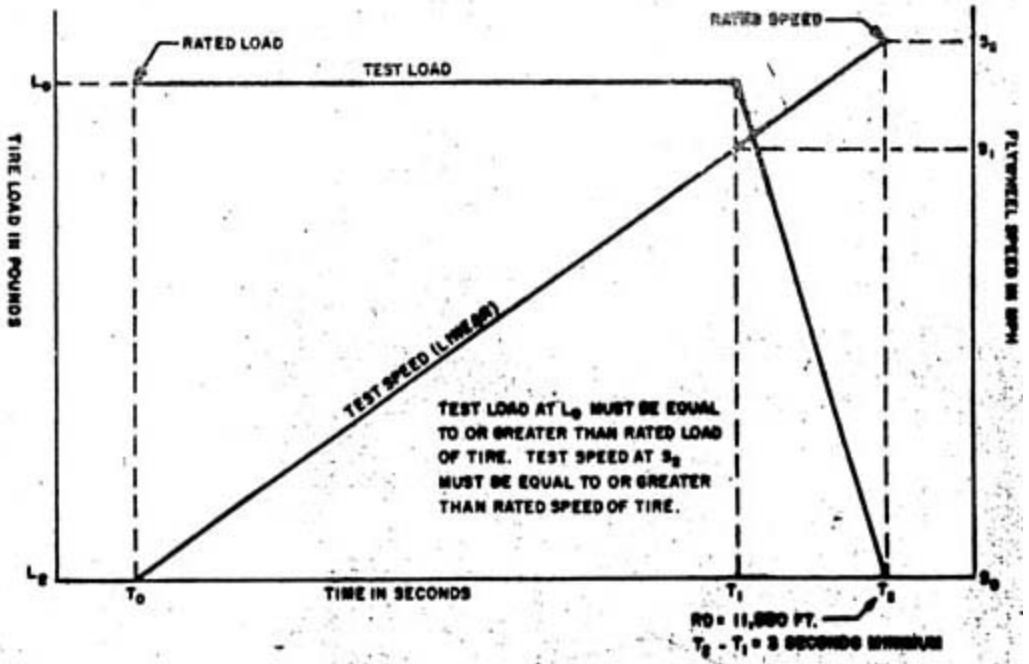
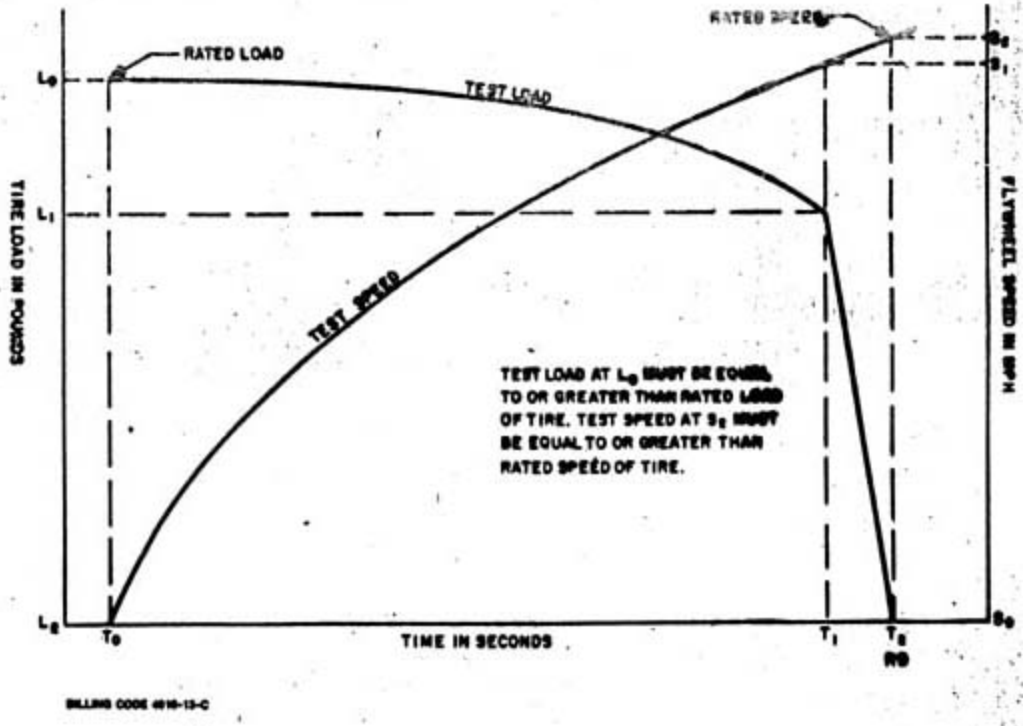


FIGURE 2

GRAPHIC REPRESENTATION OF A RATIONAL LOAD-SPEED-TIME TEST CYCLE



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7.0 Requalification tests. Requalification in accordance with paragraph 6.0 of a given load rated tire required as a result of a tread design or material change will automatically qualify the same changes in a lesser load rated tire of the same size, speed rating, and skid depth provided--

7.1 The lesser load rated tire has been qualified to the applicable requirements specified in this standard; and

7.2 The ratio of qualifications testing load to rated load for the lesser load rated tire does not exceed the same ratio for the higher load rated tire at any given test condition.

(Secs. 313(a), 601 and 603, Federal Aviation Act of 1958, as amended (49 U.S.C. 1354(a), 1421 and 1423); sec. 6(c), Department of Transportation Act (49 U.S.C. 1655(c)).