The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE STANDARD

SAE J918c

REV. MAY70

Issued 1965-06
Revised 1970-05

Superseding J918b

Submitted for recognition as an American National Standard

(R) PASSENGER CAR TIRE PERFORMANCE REQUIREMENTS AND TEST PROCEDURES

Foreword—This Document has also changed to comply with the new SAE Technical Standards Board Format.

1. Scope—This SAE Standard provides minimum performance requirements and accompanying uniform laboratory test procedures for evaluating certain essential characteristics of new tires and newly retreaded tires intended for use on passenger cars.

(The requirements published in this SAE Standard pertain to tire sizes currently used on American passenger cars and popular sizes used on imported passenger cars. For related information on tire sizes not listed, contact Society of Automotive Engineers, Inc., Detroit Branch Office, 18121 East Eight Mile Road, East Detroit, Michigan 48021.)

2. References

2.1 Applicable Publication—The following publication forms a part of the specification to the extent specified herein.

2.1.1 TRA PUBLICATION—Available from 175 Montrose West Avenue, Suite 150, Copley, OH 44321.

TRA Yearbook

3. Definitions

3.1 Bead—That part of the tire which is shaped to fit the rim. Made of high tensile steel wires, wrapped and reinforced by the plies.

3.2 Bead Separation—Breakdown of the bond between components in the bead area.

3.3 Bias Ply Tire—Pneumatic tire in which the ply cords extending to the beads are laid at alternate angles substantially less than 90 deg to the centerline of the thread.

3.4 Carcass—Tire structure, excepting tread and sidewall rubber.

3.5 Chunking—Separation of the tread from the carcass in particles which may range from a very small size to several square inches in area.

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3.6 Cord—Textile, steel wire strands, and the like, forming the plies in the tire.

3.7 Cord Separation—Parting of cords from adjacent rubber compounds.

3.8 Groove—Space between two adjacent tread ribs or lugs.

3.9 Load Range—The term “Load Range” with a letter (A, B, C, etc.) in tire identification is used to identify a given size tire with its load and inflation limits when used in a specific type of service, as defined in heading of TRA tables.

3.10 Measuring Rim—Rim of specific width and profile as specified by the Tire & Rim Association, Inc. (TRA) on which basic tire measurements are determined.

3.11 Ply—Layer of rubber-coated parallel cords forming tire body.

3.12 Ply Rating—Index of tire strength; does not necessarily represent the actual number of plies in the tire. It is used to relate a given size tire with its load and inflation limits as does load range. Ply rating has been replaced by “load range.” See paragraph 3.9.

3.13 Ply Separation—Parting of rubber compound between adjacent plies.

3.14 Radial Ply Tire—Pneumatic tire in which the ply cords which extend to the beads are laid substantially 90 deg to the centerline of the tread.

3.15 Retreaded Tire—A used tire to which a new tread has been affixed to extend the useful life of the tire.

3.16 Rib—Tread section element circumferentially around tire.

3.17 Rim—Metal support for tire or tire and tube assembly on the wheel.

3.18 Section Width—The linear distance between the exteriors of the sidewalls of an inflated tire at its widest point, excluding elevations due to labeling, decorations or protective bands.

3.19 Sidewall—Portion of tire between tread and bead.

3.20 Size Factor—The sum of the tire section width (on the measuring rim) and the outer diameter.

3.21 Tread—Portion of tire which comes in contact with road.

3.22 Tread Separation—Tread pulling away from tire carcass.

4. Requirements

4.1 Strength—When tested in accordance with the procedures described in paragraph 5.1, the average energy absorbed by the tire at break (or bottoming) shall meet or exceed the requirements established in Tables 1A through 1C. In the event that the plunger bottoms against the rim before the tire breaks at all five points tested, the tire shall be deemed to have passed the test regardless of the energy values. Breaking energy value for a tire size not listed in these tables shall not be less than that shown for the nearest smaller size tire of the same ply rating, ply cord material and construction.

Static breaking energy values for nylon and polyester cord tires are established substantially higher than those for rayon cord tires. These differentials are necessary in static test requirements in order to insure comparable impact resistance under dynamic conditions.

TABLE 1A—MINIMUM BREAKING ENERGY VALUES
(BIAS PLY TIRES, DESIGN SECTION WIDTH BELOW 6.00 IN. (155 MM.))

Cord Material	Load Range, in.-lb B (4-Ply Rating)	Load Range, in.-lb C (6-Ply Rating)	Load Range, in.-lb D (8-Ply Rating)
Rayon	1000	1500	2000
Nylon or Polyester	1600	2400	3200

TABLE 1B—MINIMUM BREAKING ENERGY VALUES
(BIAS PLY TIRES, DESIGN SECTION WIDTH OF 6.00 IN. (155 MM.) AND ABOVE)

Cord Material	Load Range, in.-lb B (4--Ply Rating)	Load Range, in.-lb C (6-Ply Rating)	Load Range, in.-lb D (8-Ply Rating)
Rayon	1650	2475	3300
Nylon or Polyester	2600	3900	5200

TABLE 1C—MINIMUM ENERGY BREAKING VALUES
(RADIAL PLY TIRES)

Design Section Width	Load Range, in.-lb B (4-Ply Rating)	Load Range, in.-lb C (6-Ply Rating)	Load Range, in.-lb D (8-Ply Rating)
Below 6.00 in. (155 mm.)	1600	2400	3200
6.00 in. (155 mm.) and Above	2600	3900	5200

4.2 Tire Endurance—When tested in accordance with the procedures described in paragraph 5.2, tires shall show no evidence of tread, ply, cord or bead separation, tread chunking, or broken cord.

4.3 High Speed Performance—When tested in accordance with the procedures described in paragraph 5.3, tires shall show no evidence of tread, ply, cord or bead separation, tread chunking, or broken cord.

4.4 Tubeless Tire Resistance to Bead Unseating—When tested in accordance with the procedures described in paragraph 5.4, the applied force required to unseat the tire bead at the point of contact shall not be less than:

1. 1,500 lb for tires with a design section width of less than 6.00 in.
2. 2000 lb for tires with a design section width of 6.00 in. or more but less than 8.00 in.
3. 2500 lb for tires with a design section width of 8.00 in. or more.

Use the section width specified in current TRA Year Book for applicable tire size designation and type.

These tire sizes should be tested on any one of the optional bead seat contours as specified in the current TRA Year Book.

4.5 Physical Dimensions—Using the procedure described in paragraph 5.5, all tires shall meet the requirements of the minimum size factor dimensions listed in the current TRA Year Book.

4.6 Test Sample—Three new or newly retreaded tires are required for each test sample as follows:

1. First tire shall be used for *physical dimensions, resistance to bead unseating*, and *strength* in this sequence.
2. Second tire shall be used for *tire endurance*.
3. Third tire shall be used for high *speed performance*.

5. Test Procedures

5.1 Strength

5.1.1 PREPARATION OF TIRE FOR STRENGTH TEST—The tire shall be mounted on the rim and shall be conditioned at approximately the temperature of the room in which the test shall be conducted for at least 3 hr, after which the pressure shall be adjusted to the values shown in Table 2. For convenience in testing, a tube may be used with tubeless tires.

TABLE 2—TEST INFLATION PRESSURES

	Load Range B (4-Ply Rating)	Load Range C (6-Ply Rating)	Load Range D (8-Ply Rating)
Maximum Permissible Inflation Pressure (psi)	32	36	40
Pressure (psi) to be used in tests for physical dimensions, tire strength, tire endurance and bead unseating.	24	28	32
Pressure (psi) to be used in tests for high speed performance.	30	34	38

5.1.2 EQUIPMENT—The test machine shall be one which can force a cylindrical steel plunger ¾ in. in diameter, with a hemispherical end, into the tire at a rate of 2 in./minute.

5.1.3 PROCEDURE—The plunger shall be forced into the tread as near to the centerline as possible, avoiding penetration into a tread groove. Five measurements of force and penetration at break (or bottoming of the plunger against the rim) shall be made at points approximately equally spaced around the circumference of the tire.

Average energy absorbed shall be calculated from the five energy values obtained at break (or bottoming) by means of the following formula:

$$W = \frac{F \times P}{2} \qquad \text{(Eq. 1)}$$

where: W = energy at break, in.-lb
F = force at break (or bottoming), lb
P = penetration at break (or bottoming), in.

5.2 Endurance Test

5.2.1 PREPARATION OF TIRE FOR ENDURANCE TEST—The tire shall be mounted on any rim specified in the current TRA Year Book for the size being tested and inflated to the pressure shown in Table 2. It shall then be conditioned at a temperature of 100 ± 5 °F for a minimum of 3 hr. Immediately prior to test, the inflation pressure shall be adjusted to the value specified in Table 2.

5.2.2 EQUIPMENT—The test wheel shall be a flat-faced steel wheel, 67.23 in. in diameter, and at least the same width as the tread width of the tire to be tested. The tire while being tested shall be located in an air space controlled at a temperature of 100 ± 5 °F. The location for the temperature sensing device to determine the airspace temperature shall conform to the following:

1. For each tire position, the sensor shall be located approximately 6 in. horizontally out from the edge of the rim flange at any point in the circumference on either or both sides of the tire or at a point in the test room where the same temperature readings exist.
2. It shall be located away from any wall or ceiling and not in a path where it can be influenced by intakes or outlets, room ventilators, exhaust vents, generators, and so forth.

NOTE—Alternate diameter test wheels may be used providing adequate correlation to 62.23 in. test wheel is provided.

5.2.3 PROCEDURE—The tire and wheel assembly shall be mounted on the text axle and pressed against the test wheel with the required axle load: Specifications for the test shall be as shown in Table 3.

TABLE 3—TIRE ENDURANCE TEST(1)

Speed, m.p.h.	Inflation Pressure, psi Load Range B (4-PR)	Inflation Pressure, psi Load Range C (6-PR)	Inflation Pressure, psi Load Range D (8-PR)	Test Load See Table 5 (Col. No.)	Hrs.	Total Miles
50	24	28	32	1	4	—
50	—	—	—	2	6	—
50	—	—	—	3	24	1700

1. The test will be conducted without adjustment of inflation pressure or other interruption. This permits normal pressure buildup.

5.3 High Speed Performance

5.3.1 PREPARATION OF TIRE FOR HIGH SPEED TEST—The tire shall be mounted on any rim specified in current TRA Year Book for the size being tested and inflated to the pressure shown in Table 2. It shall then be conditioned at a temperature of 100 ± 5 °F for a minimum of 3 hr. Immediately prior to test, the inflation pressure shall be adjusted to that specified in Table 2.

5.3.2 EQUIPMENT—The test wheel shall be a flat-faced steel wheel 67.23 in. in diameter and at least the same width as the tread width of the tire to be tested. The tire, while being tested, shall be located in an air space controlled at a temperature of 100 ± 5 °F.

The location for the temperature sensing device to determine the airspace temperature shall conform to the following:

1. For each tire position, the sensor shall be located approximately 6 in. out from the edge of the rim flange at any point in the circumference on either or both sides of the tire or at a point in the test room where the same temperature readings exist.
2. It shall be located away from any wall or ceiling and not in a path where it can be influenced by intakes or outlets, room ventilators, exhaust vents, generators, and so forth.

NOTE—Alternate diameter test wheels may be used providing adequate correlation to 67.23 in. test wheel is provided.

5.3.3 PROCEDURE—The tire and wheel assembly shall be mounted on the test axle and pressed against the test wheel with the required axle load. Specifications for the progressive test speeds and conditions shall be as shown in Table 4.

TABLE 4—HIGH SPEED PERFORMANCE

Speed, mph	Inflation Pressure, psi Load Range B (4-PR)	Inflation Pressure, psi Load Range C (6-PR)	Inflation Pressure, psi Load Range D (8-PR)	Test Load See Table 5 (Col. No.)	Hrs.	Total Miles
50	30	34	38	1	2	—
75	30	34	38	1	1/2	—
80	—	—	—	1	1/2	—
85	—	—	—	1	1/2	220

After 2 hr breakin running at 50 mph, the tire shall be cooled to an equilibrium temperature of 100 ± 5 °F. Inflation pressure shall then be readjusted to initial pressure and test continued without further adjustment in inflation pressure. This permits normal pressure buildup.

After cooling period resume test at 75 mph. Increase speed 5 mph every ½ hr until maximum indicated speed has been achieved. Standard highway tires shall be tested at speed up to and including 85 mph requirement. Deep tread winter tires shall be tested at speeds up to and including the 80 mph requirement.

TABLE 5—TEST LOADS(1)

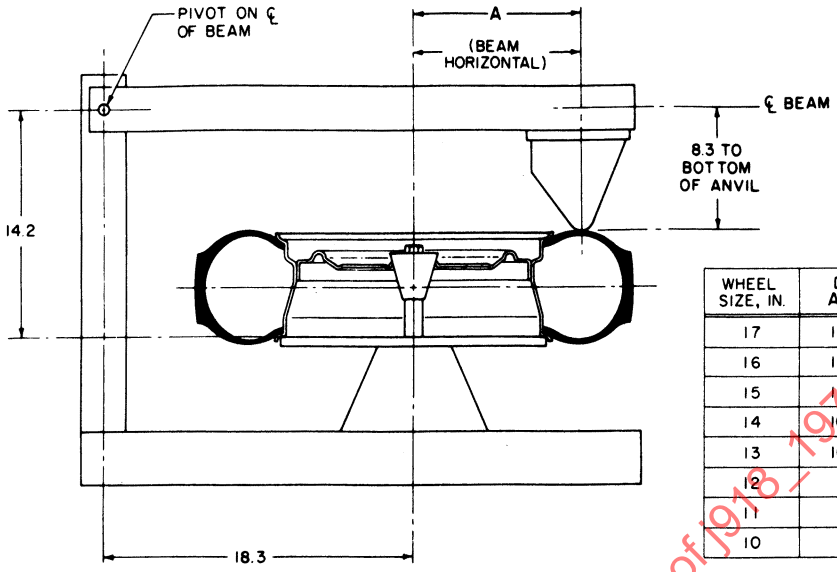
Load Range	psi Col. 1	psi Col. 2	psi Col. 3
B (4-ply rating)	24	28	32
C (6-ply rating)	28	32	36
D (8-ply rating)	32	36	40

1. Use loads for indicated pressures as found in current TRA Year Book for the particular tire size and load range.

5.4 Tubeless Tire Resistance to Bead Unseating

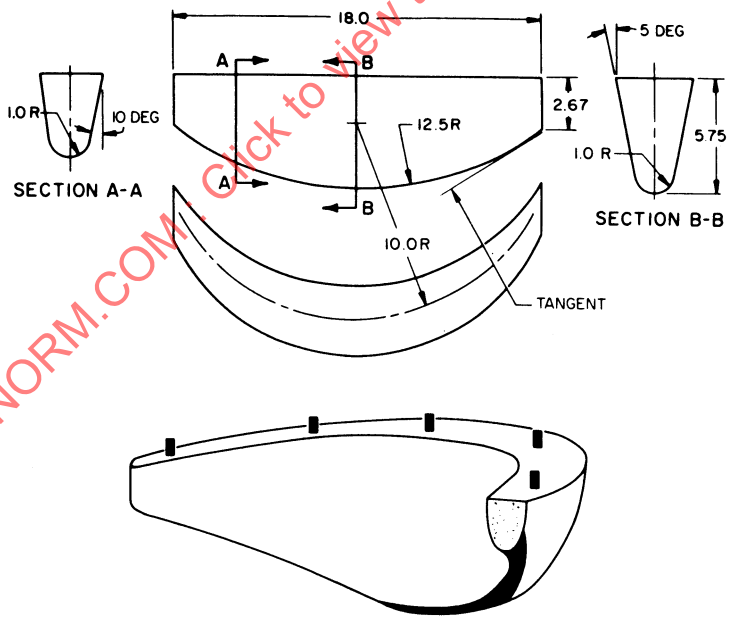
5.4.1 PREPARATION OF TIRE-WHEEL ASSEMBLY FOR BEAD UNSEATING TEST—The tire shall be washed and dried at the two beads, mounted on a clean and painted rim without the use of lubrication, and inflated to the applicable pressure, Table 2, at ambient temperature.

5.4.2 EQUIPMENT—A fixture used to support the mounted tire-wheel assembly is shown in Figure 1. A standard block, detailed in Figure 2, is forced against the tire side wall as dictated by the fixture geometry, at a point on the side wall as indicated by distance “A” in Figure 1. This load may be applied by a hydraulic ram or its equivalent.



WHEEL SIZE, IN.	DIM A, IN.
17	12.0
16	11.5
15	11.0
14	10.5
13	10.0
12	9.5
11	9.0
10	8.5

FIGURE 1—BEAD UNSEATING TEST FIXTURE



MATERIAL CAST ALUMINUM NO 355
T-6 CONDITION
FINISH - 50 MU IN.

FIGURE 2—BLOCK DIAGRAM