SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J2530

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Aftermarket Wheels-Passenger Cars and Light Truck - Performance Requirements and Test Procedures

1. Scope

This SAE Recommended Practice provides performance and sampling requirements, test procedures, and marking requirements for aftermarket wheels intended for normal highway use on passenger cars, light trucks, and multipurpose passenger vehicles. For aftermarket wheels on trailers drawn by passenger cars, light trucks or multipurpose vehicles, see SAE J1204. These performance requirements apply only to wheels made of materials included in Table 1 and Table 2. New nomenclature and terms are added to clarify wheel constructions typically not used in OEM applications. The testing procedures and requirements are based on SAE standards listed in the references.

2. References

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J328—Wheels - Passenger Car and Light Truck Performance Requirements and Test Procedures
SAE J175—Wheels - Impact Test Procedure - Road Vehicles
SAE J1204—Wheels - Recreational and Utility Trailer Test Procedure
SAE J1982—Nomenclature - Wheels for Passenger Cars, Light Trucks, and Multipurpose Vehicles.
SAE J179—Labeling-Disc wheels and Demountable Rims-Truck

2.1.2 TIRE AND RIM ASSOCIATION PUBLICATION

Available from The Tire and Rim Association, Inc., 175 Montrose West Avenue, Suite 150, Copley OH 44321.

Yearbook, The Tire and Rim Association, Inc.

3. Definitions

3.1 Aftermarket wheel

The classification used for wheels generally designed for fitment to multiple vehicle applications that may be sold to the general public subsequent to the initial purchase of such vehicles. Aftermarket wheels are sold as an intended replacement of OEM wheels provided for said vehicles.

3.2 Functional Fastener

A connection device such as a bolt, rivet or wire spoke used to join together the individual components of the wheel assembly.

3.3 Lug Nut/Bolt

Hardware designed for securing the wheel to the vehicle.

3.4 Offset

The inset, zeroset or outset of the wheel as defined in SAE J1982 Figure 3.

3.5 Wheel Load

The maximum load rating of the wheel as specified by the wheel manufacturer and shall be no less than one-half of the vehicle static load of the heaviest axle (as specified by the vehicle manufacturer) of any vehicle for which the wheel is intended (as determined by the wheel manufacturer)

4. Wheel markings

Wheels that comply with this specification must be permanently marked with the following information. The characters shall be legible and the character size shall not be less than 3.0mm(.12 in).

4.1 Wheel manufacturer's name, trademark or symbol**.**

4.2 Date of manufacture of the wheel, indicating the month/day/year or month/year, which may be either coded or specifically indicated**.**

4.3 Manufacturer's part number or code**.**

4.4 Country of manufacture**.**

4.5 Rim size designation –Rim diameter and width**.**

4.6 The manufacturer's wheel load rating as established by design validation testing to this specification expressed in lbs or kg**.**

4.7 The largest overall diameter of an installed tire at its maximum rated inflation pressure, per wheel manufacturer recommendation expressed in inches or mm**.**

4.8 If the wheel manufacturer recommends restricting wheel use with certain types of tires then the finished wheel must be permanently marked with the restriction, for example "Not for Use with Radial Tires".

4.9 The symbol "DOT", constituting a certification by the manufacturer of the rim that the rim complies with all applicable motor vehicle safety standards. Following the symbol, "DOT", a designation which indicates the source of rim's published nominal dimensions as follows:

"T" indicates The Tire and Rim Association Inc
"E" indicates The European Tyre and Rim Technical Organisation
"J" indicates Japan Automobile Tire Manufacturers Association, Inc.
"D" indicates Deutsche Industrie Norm.
"B" indicates British Standards Institution.
"S" indicates Scandinavian Tire and Rim Organization
"A" indicates Tyre and Rim Association of Australia

4.10 "SAE J2530" shall be cast in, stamped on, or labeled on wheels that conform to this specification.

5. Wheel Qualification

When possible, test samples shall be uncoated but must pass through all of the processes to duplicate the effects and/or characteristics of the final product.

5.1 Test Sample Selection

Test samples shall be representative of wheels produced or to be produced.

5.2 Sample Size for Tests

The sample size for the Dynamic Cornering fatigue test (Section 6) are shown in Table 1 and for the Dynamic Radial fatigue test (Section 7) are shown in Table 2.The sample size shown is between 2 and 7 wheels with the appropriate minimum cycles requirements for that sample size. The cycles are based on the material fatigue curves and use Weibull statistics with a reliability of 90%, a confidence level of 50%, and a beta (slope) of 2. Any combination is acceptable as long as the minimum cycles for all sample wheels are reached.

The sample size for the Impact test (Section 8) is 2 wheels.

5.3 Retest and Additional Model Variation Requirements

Changes in either style, diameter, material, increase in wheel load rating, cross sectional dimensions, maximum tire diameter, rim offset, or functional fasteners will require retesting.

For wheels that vary only in width and offset, it is required to test the model variations with the mathematically highest bending moment and include test samples per section 5 with the largest bolt circle and test samples per section 5 with the smallest bolt circle and least number of lug holes.

5.4 Inspection of Test Samples

Visual inspection for crack identification shall be executed via corrected 20/20 vision without optical assistance. Dye penetrant inspection for crack verification is recommended, however is not mandatory.

5.5 Acceptance Criteria

Wheels conform to the specification if they meet the acceptance criteria for the testing specified in Sections 6, 7, and 8.

6. Dynamic Cornering Fatigue

6.1 Performance Requirements

The test wheels, when submitted to the following test procedures, shall meet the minimum performance requirement as specified in Table 1.

6.2 Equipment

See SAE J328

6.3 Procedure

See SAE J328

6.4 Bending Moment

Calculate the bending moment (Force x Load Arm Length) to be applied to the test wheel as follows.

$$M = W (R\mu + d) S \qquad \text{(Eq. 1)}$$

Where:

W = Load rating of the wheel as specified by the wheel manufacturer.

R = One half of the largest overall diameter of the tires to be used on the wheel as specified by the current Tire and Rim Association yearbook or the vehicle/wheel manufacturer.

μ = Coefficient of friction developed between the tire and the road.
Use $\mu = 0.7$

d = The inset or outset of the wheel (offset): use positive sign for inset and negative sign for outset.

S = Load factor - See Table 1. Use one of the factors for the type of wheel being tested

NOTE: When calculating the Bending Moment, all units of measurement must be of the same system.

6.5 Test Criteria/Test Termination

6.5.1 ACCEPTANCE CRITERIA

The wheel conforms to this test if all the elements of wheel qualification in Section 5 are used and the samples under test must complete the minimum number of test cycles for the sample size used without termination.

6.5.2 TEST TERMINATION

Terminate the test when any of the following conditions occur.

a. Wheel exceeds the initial deflection at point of load application by 20%.
b. A visually detected crack penetrating through a section of the wheel in the base metal or propagation of any existing fracture/crack resulting in a fatigue crack penetrating through any section of the wheel at the minimum cycles for the sample size used specified as in Table 1. Inspection should be done at the minimum cycles for the sample size used in Table 1. Cracking in the wheel coating alone shall not be the basis for finding a test termination.
c. One or more lug nuts loosening to less than 60% of the initial torque at the minimum cycles for the sample size used as specified in Table 1. If loosening is due to broken wheel bolts, studs or nuts see 6.5.2 e. Inspection should be done at the minimum cycles for the sample size used as specified in Table 1.
d. Break or crack of a functional fastener.
e. Broken lug bolts or other parts of the test fixture do not require test termination but may result in damage to the wheel and test invalidation.

7. Dynamic Radial Fatigue

7.1 Performance Requirements

The test wheels, when submitted to the following test procedures, shall meet the minimum performance requirements as specified in Table 2.

7.2 Equipment

See SAE J328

7.3 Procedure

See SAE J328

7.4 Radial Load

The radial load to be applied to the wheel shall be determined as follows.

$$F=WK \qquad \text{(Eq. 2)}$$

Where:

F = Radial load

W = Load rating of the wheel as specified by the wheel manufacturer.

K = Load factor - See Table 2. Use one of the factors for the type of wheel being tested

NOTE: When calculating the Radial Load, all units of measurement must be of the same system.

7.5 Test Criteria/Test Termination

7.5.1 ACCEPTANCE CRITERIA

The wheel conforms to this test if all the elements of wheel qualification in Section 5 are used and the samples under test must complete the minimum number of test cycles without termination.

7.5.2 TEST TERMINATION

Terminate the test when any of the following conditions occur.

a. Inability of the wheel to sustain the test load.
b. A visually detected crack penetrating through a section of the wheel in the base metal or propagation of any existing fracture/crack resulting in a fatigue crack penetrating through any section of the wheel at minimum cycles for the sample size used as specified in Table 2. Inspection should be done at the minimum cycles for the sample size used in Table 2.Cracking in the wheel coating alone shall not be the basis for finding a test termination.
c. Loss of air pressure through a fatigue crack in rim.
d. One or more lug nuts loosening to less than 60% of initial torque at minimum cycles for the sample size used as specified in Table 2. If loosening is due to broken wheel bolts, studs or nuts see 7.5.2 f. Inspection should be done at the minimum cycles for the sample size used in Table 2.
e. Break or crack of a functional fastener
f. Failure of the test tire, broken lug bolts or studs, or other parts of the test fixture do not require test termination but may result in damage to the wheel and test invalidation.

TABLE 1—TEST FACTORS AND MINIMUM CYCLE REQUIREMENTS FOR WHEELS IN NORMAL HIGHWAY SERVICE –DYNAMIC CORNERING FATIGUE

Wheel Type (Material)	S	Minimum Cycles						
		Sample Size =	2	3	4	5	6	7
Ferrous and Ferrous Wire Wheels	1.6		35,000	30,000	25,000	22,000	20,000	18,000
Aluminum Cast and Forged, Aluminum/Steel Two-Piece, and Aluminum Modular	2		95,000	75,000	65,000	60,000	55,000	50,000
	1.6		150,000	120,000	105,000	95,000	85,000	80,000
	1.35		475,000	375,000	325,000	300,000	275,000	250,000

TABLE 2-—TEST FACTORS AND MINIMUM CYCLE REQUIREMENTS FOR WHEELS IN NORMAL HIGHWAY SERVICE -DYNAMIC RADIAL FATIGUE

Wheel Type (Material)	K	Minimum Cycles						
		Sample Size =	2	3	4	5	6	7
Ferrous and Ferrous Wire Wheels	2.25		750,000	600,000	525,000	475,000	425,000	400,000
Aluminum Cast and Forged, Aluminum/Steel Two-Piece, and A luminum Modular	2.5		1,100,000	900,000	775,000	700,000	650,000	600,000
	2		1,850,000	1,500,000	1,300,000	1,200,000	1,100,000	1,000,000