SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

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Wheels/Rims—Performance Requirements and Test Procedures—Truck and Bus

RATIONALE

This SAE Recommended Practice provides minimum performance requirements and uniform laboratory procedures for fatigue testing of wheels and demountable rims intended for normal highway use on trucks, buses, truck-trailers, and multipurpose vehicles. During the 5 year review we found that dimensions for the wheel test adapter (wheel backup diameter) were missing from the document. SAE J694 was added to the document list. A note was also added to the procedure sections to go to SAE J694 for test adapter dimensions (wheel backup diameter). Appendix B was updated to include current production tires and their slr (static loaded radii).

1. SCOPE

This SAE Recommended Practice provides minimum performance requirements and uniform laboratory procedures for fatigue testing of wheels and demountable rims intended for normal highway use on trucks, buses, truck-trailers, and multipurpose vehicles. For other wheels intended for normal highway use and temporary use on passenger cars, light trucks, and multipurpose vehicles, see SAE J328. For wheels used on trailers drawn by passenger cars, light trucks, or multipurpose vehicles, see SAE J1204. For bolt together military wheels, see SAE J1992. This document does not cover other special application wheels and rims.

2. REFERENCES

2.1 Applicable Publications

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

2.1.1 SAE Publications

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J328 Wheels—Passenger Cars and Light Truck Performance Requirements and Test Procedures

SAE J393 Nomenclature—Wheels, Hubs, and Rims for Commercial Vehicles

SAE J694 Disc Wheel/Hub or Drum Interface Dimensions—Commercial Vehicles

SAE J1204 Wheels—Recreational and Utility Trailer Test Procedure

SAE J1992 Wheels/Rims—Military Vehicles—Test Procedures and Performance Requirements

SAE HS 3300 Wheels Standards Manual

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

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.

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 ISO Publications

Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 3006 Road vehicles—Passenger car wheels—Test methods

ISO 3894 Road vehicles—Truck—wheels/rims—Test methods

ISO 3911 Wheel/rims—Nomenclature, designation, marking, and units of measurement

2.2.2 OSHA Publication

Available from OSHA Publication Office, Room S-4203, 200 Constitution Avenue, NW, Washington, DC 20210, www.osha.gov.

OSHA Standard 29 CFR Part 1910.177 Servicing of Multi-Piece and Single-Piece Rim Wheels

3. DYNAMIC CORNERING FATIGUE TEST (FOR DISC WHEELS ONLY)

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

TABLE 1 - CORNERING FATIGUE TEST
TEST LOAD FACTORS AND CYCLE REQUIREMENTS

Disc Wheel/Rim Description (All Mountings) Material	Disc Wheel/Rim Description (All Mountings) Rim Diameter Code	Disc Wheel/Rim Description (All Mountings) Inset/Outset mm	Disc Wheel/Rim Description (All Mountings) Inset/Outset in	Performance Requirements Accelerated Test Factor	Performance Requirements Minimum Cycle Life
Ferrous	13, 14, 15	Less than 101.6	Less than 4	1.60	18 000
Ferrous	16 and larger(1)	Less than 101.6	Less than 4	1.45	30 000
Ferrous	All	101.6 or more	4 or more	1.10 1.30	60 000 40 000
Aluminum	16	127 or more	5 or more	1.35 1.63	250 000 80 000
Aluminum	17.5 and larger(1)	All	All	1.35	250 000

1. Exclude 17.5 and larger with rim width of 266.7 mm (10.50 in) and wider (wide base tire wheels).

3.1 Equipment

Use a test machine that:

a. Imparts a constant rotating bending moment to the wheel. See Figure 1A or 1B.

b. Maintains the test load within ±3%.

c. Monitors and measures the deflection of the system.

d. Has a rigid load arm shaft.

3.2 Procedure

a. Use a test adapter, studs, and nuts representative of those specified for the wheel. Dimensions for the test adapter (Wheel backup diameter) can be found in SAE J694.

b. Verify the mating surfaces of the adapter are free of foreign material or excessive wear.

c. Attach the wheel to a rigid load arm shaft and test adapter.

d. Tighten the nuts to the torque specified in Appendix A for the stud size and type of nut. Torque shall be checked and reset periodically during the course of a test in order to compensate for the "wearing in" of mating surfaces.

e. Clamp the rim securely to the test device.

f. Adjust the system so that shaft runout is not more than 0.25 mm (0.010 in) total indicator reading at the point of loading.

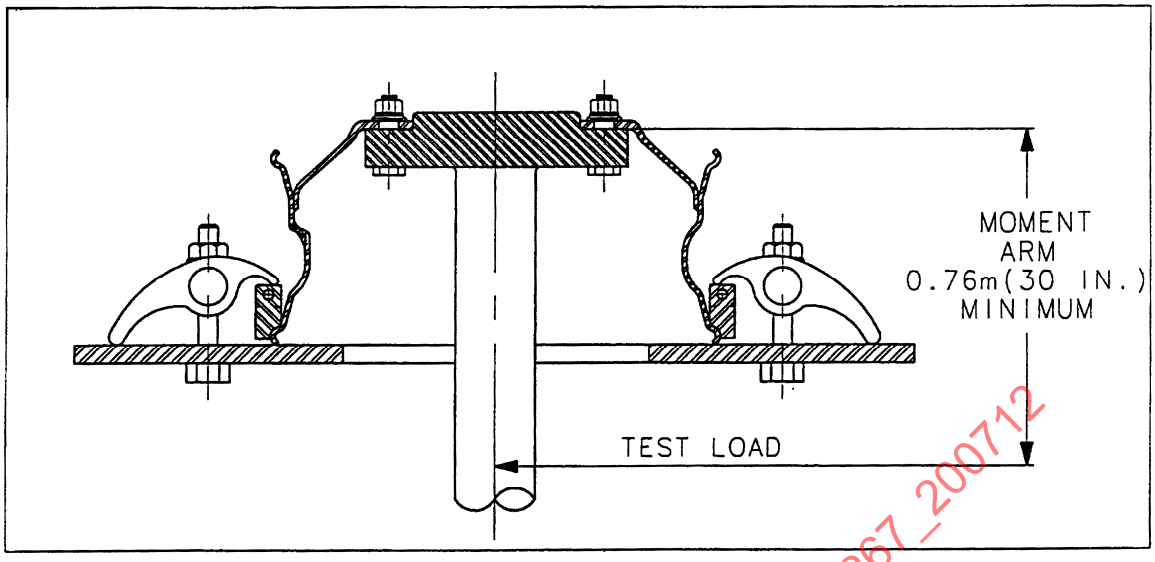

FIGURE 1A

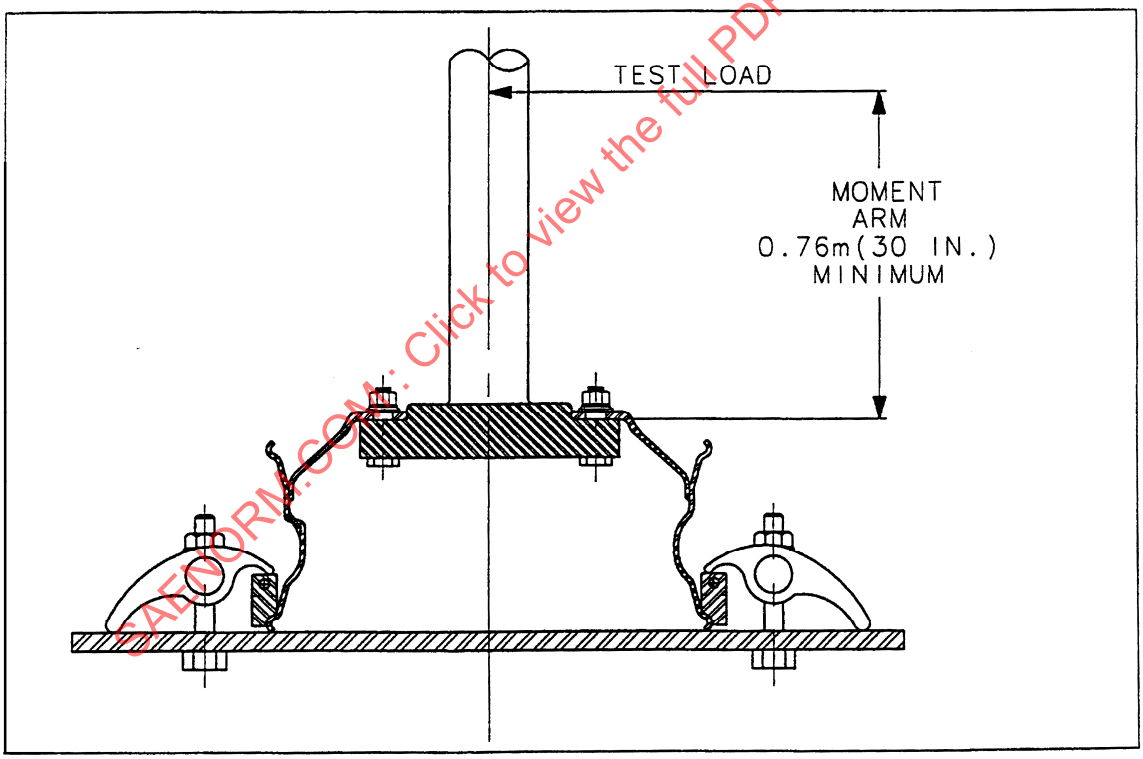

FIGURE 1B

FIGURE 1 - CORNERING FATIGUE - 90 DEGREE LOADING METHOD (TYPICAL SETUP)

3.3 Test Loading

a. Test Load and Bending Moment Determination—The test load is determined by Equation 1:

$$\text{Test Load} = \frac{M}{\text{Moment arm}} \text{(see Figure 1A or 1B)} \quad \text{(Eq. 1)}$$

M is determined by Equation 2:

$$M = (L)[u(slr) + d](S) \quad \text{(Eq. 2)}$$

where:

M = Bending moment, N-m (lbf-in)
u = Coefficient of friction developed between tire and road, use 0.7 for u.
slr = Largest static loaded radius of the tires to be used on the wheel as specified by the current Tire and Rim Association Yearbook or the vehicle/wheel manufacturer, mm x 10^{-3} (in). Use the values of slr found in Appendix B.
d = Inset or outset, mm x 10^{-3} (in). (Positive for inset, negative for outset) of the wheel. If wheel may be used as inset or outset, use inset. See SAE J393.
S = Accelerated test factor. See Table 1.
L = Load rating of the wheel as specified by the wheel manufacturer, N (lbf).

b. For minimum cycle life, see Table 1.

c. Apply the test load parallel to a plane through the center of the rim as shown in Figure 1A or 1B. Load may push against shaft or pull the shaft.

3.4 Test Wheels

Use only fully processed new wheels, which are representative of wheels intended for the vehicle and ready for road use. New wheels/rims and new related components of multi-piece rims will be used for each test.

3.5 Test Criteria/Test Termination

The wheel under test must complete the minimum number of test cycles prior to test termination. The test shall be terminated by the inability of the wheel to sustain load and/or a visually detected fatigue crack penetrating through a section. Broken studs or other parts of the test fixture do not require test termination but may result in damage to the wheel and test invalidation.

4. DYNAMIC RADIAL FATIGUE TEST, DISC WHEELS, AND DEMOUNTABLE RIMS

The test wheels, when subject to the following test procedures, shall meet the minimum performance requirement specified in Table 2.

4.1 Equipment

Use a test machine that:

a. Has a driven rotatable drum, which presents a smooth surface wider than the loaded test tire section width.

b. Has a suggested drum diameter of 1707.06 mm (67.23 in), giving 187.5 revolutions per kilometer (300 revolutions per mile).

c. Imparts a constant load to the wheel. This load must be perpendicular to the surface of the drum and in line radially with the center of the test wheel and the center of the drum.

d. Can maintain the test load and inflation within ±3%.

e. Holds the axis of the test wheel and the drum parallel.

TABLE 2 - RADIAL FATIGUE TEST
TEST LOAD FACTORS AND CYCLE REQUIREMENTS

Disc Wheel/Rim Description (All Mountings) Material	Disc Wheel/Rim Description (All Mountings) Rim Diameter Code	Disc Wheel/Rim Description (All Mountings) Inset/Outset[1] mm	Disc Wheel/Rim Description (All Mountings) Inset/Outset[1] in	Performance Requirements Accelerated Test Factor	Performance Requirements Minimum Cycle Life
Ferrous	13, 14, 15, 16, 17 5 degrees Drop Center	All	All	2.2 1.8	500 000 1 000 000
Ferrous	15, 17, 18, 20, 22, 24 5 degrees Flat Base 17.5HC, 19.5, 22.5, 24.5 15 degrees Drop Center	All	All	2.0 1.9 1.8 1.7 1.6	500 000 600 000 700 000 850 000 1 000 000
Aluminum	16	127 or more	5 or more	2.8 2.0	100 000 1 000 000
Aluminum	17.5 and larger	All	All	2.8 2.0	100 000 1 000 000

1. Offset for demountable rims.

4.2 Procedure

a. Select test tires that are representative of the maximum size and type approved by the vehicle or wheel manufacturer for the wheel under test.

b. Use a test adapter, studs, and nuts (and clamps for demountable rims) that are representative of those specified for the wheel/rim. Dimensions for the test adapter (Wheel backup diameter) can be found in SAE J694.

c. Mount and inflate the tire to 448 kPa ± 14 kPa (65 psi ± 2 psi) for tires with usage pressure of 310 kPa (45 psi) or less. For wheels and tires intended for use at higher pressures, use 1.2 times the usage pressure, but not less than 448 kPa ± 14 kPa (65 psi ± 2 psi).

d. Tighten the nuts to the torque specified in Appendix A for the stud size and type of nut. Torque shall be checked and reset periodically during the course of a test in order to compensate for the "wearing in" of mating surfaces.

e. There may be an increase in inflation pressure during the test. This is normal, but it is permissible to adjust back to the test pressure.

4.3 Radial Test Loading

a. Radial Load Determination—The radial load is determined as follows in Equation 3:

$$R = (S)L \qquad \text{(Eq. 3)}$$

where:

R = Radial load, N (lbf)
S = Accelerated test factor. See Table 2.
L = Load rating of the wheel/rim as specified by the wheel/rim manufacturer, N (lbf)

b. For minimum cycle life, see Table 2.

4.4 Test Wheels

Use only fully processed new wheels/rims which are representative of wheels/rims intended for the vehicle and ready for road use. New wheels/rims and new related components of multi-piece rims will be used for each test.

4.5 Test Criteria/Test Termination

The wheel under test must complete the minimum number of test cycles prior to test termination. The test shall be terminated by the inability of the wheel to sustain load and/or a visually detected fatigue crack penetrating through a section. Failure of the test tire, broken studs, or other parts of the test fixture do not require test termination but may result in damage to the wheel and test invalidation.

5. NOTES

5.1 Marginal Indicia

The change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

PREPARED BY THE SAE TRUCK AND BUS WHEEL SUBCOMMITTEE
OF THE SAE TRUCK AND BUS BRAKE COMMITTEE