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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1204

REV. JUN97

Issued 1977-11
Revised 1997-06

Superseding J1204 DEC89

Submitted for recognition as an American National Standard

(R) WHEELS—RECREATIONAL AND UTILITY TRAILER TEST PROCEDURE

1. ***Scope—***This SAE Recommended Practice provides uniform procedures and minimum performance requirements for fatigue testing ferrous and aluminum wheels intended for normal highway use on travel, camping, and boat and light utility trailers drawn by passenger cars, light trucks, and multipurpose vehicles. (See Figures 1 and 2.) For procedures and minimum performance requirements for wheels used on trucks, see SAE J267, and for wheels used on passenger cars, see SAE J328. For the application of passenger car and light truck wheels [inset less than 0.10 m (0.33 ft)] to this trailer service, use this procedure. For the application of heavier truck wheels [inset 0.10 m (0.33 ft) or more] use SAE J267. Mobile home service is outside the scope of this document.

There are two basic test procedures described, a cornering fatigue test and radial fatigue test. The cornering test is directed at the wheel disc; whereas the radial test also examines the rim and attachment portion of the wheel. Both test procedures are required to obtain a thorough examination of the wheel.

2. ***References***

2.1 **Applicable Publications—**The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of SAE publications shall apply.

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

SAE J267—Wheels/Rims—Trucks—Test Procedures and Performance Requirements
SAE J328—Wheels—Passenger Cars—Performance Requirements and Test Procedures

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

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

2.2.2 ISO PUBLICATION—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

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

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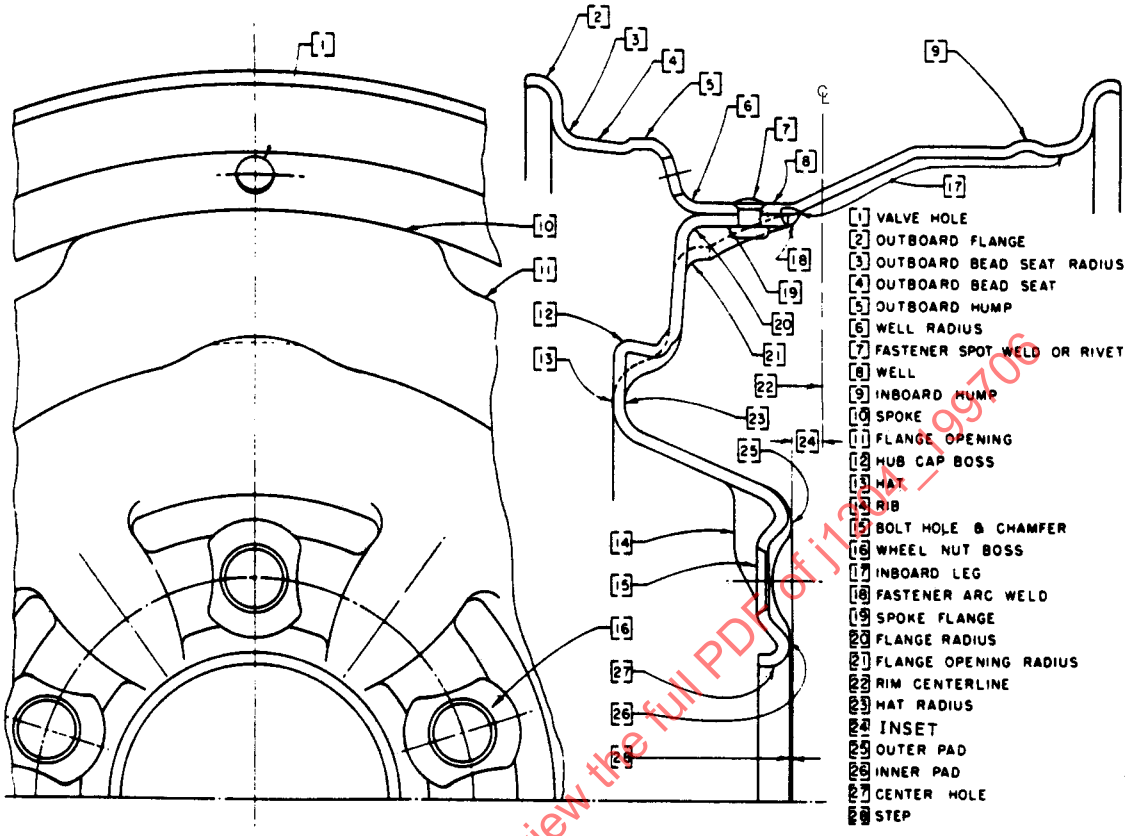

FIGURE 1—NOMENCLATURE FOR DROP CENTER WHEEL

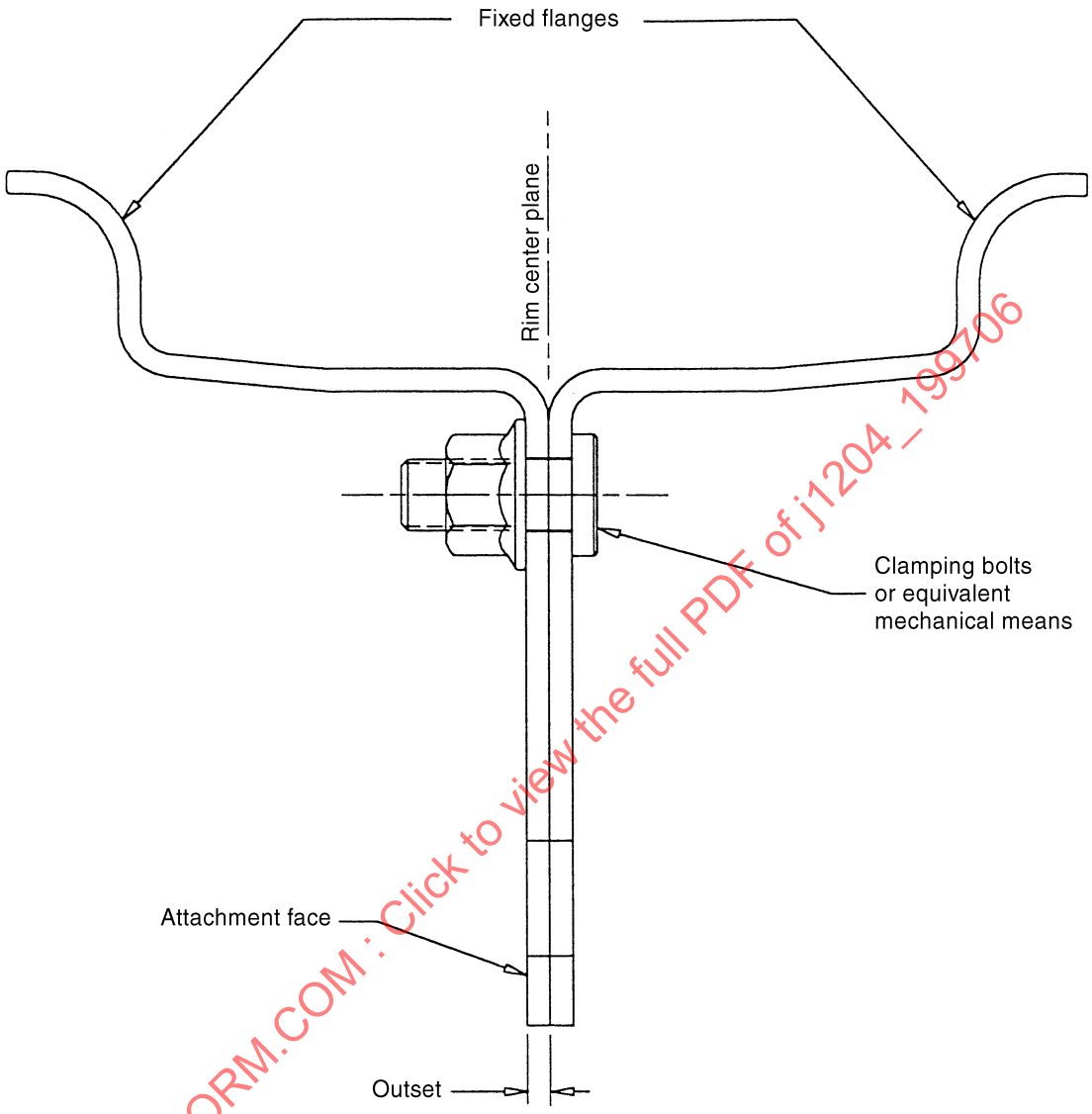

FIGURE 2—NOMENCLATURE FOR DIVIDED WHEEL

3. *Test Procedures*

3.1 Wheels for Test—Use only fully processed new wheels that are representative of production parts intended for the vehicle and ready for road use. Separate wheels are to be used for each test.

3.2 Dynamic Cornering Fatigue

3.2.1 EQUIPMENT—The test machine shall be one with a means to impart a constant rotating bending moment of the wheel.

3.2.2 PROCEDURE—The rim shall be clamped securely to the test device. A rigid load arm shaft with a test adaptor shall be attached to the mounting surface of the wheel, using studs and nuts representative of those specified for the wheel.

These wheel nuts shall be tightened to the torque limits specified in Table 1 for the stud size and the type of nut. The mating surface of the test adaptor and wheel shall be free of build-up of paint, dirt, wear, or foreign matter. The final clamped position of the wheel without load shall not exceed an eccentricity of 0.25 mm (0.010 in) total indicator reading normal to the shaft axis at the point of loading. The application of the test load will be parallel to a plane through the center of the rim as shown in Figure 3. The loading system should maintain the bending moment within ±3%.

TABLE 1—MOUNTING NUT TORQUES(1) FOR LABORATORY WHEEL/TESTS

Application	Thread Size	Torque (dry) N·m	Torque (dry) lbf·ft
Disc Wheels	7/16 – 20	115 ± 7	85 ± 5
	12 x 1.5 mm	115 ± 7	85 ± 5
	1/2 – 20	115 ± 7	85 ± 5
	14 x 1.5 mm	158 ± 7	115 ± 5
	9/16 – 18	158 ± 7	115 ± 5
	5/8 – 18	178 ± 7	130 ± 5

1. Nut torque values may be checked and reset during the course of a wheel test in order to compensate for the "wearing in" of mating surfaces of nuts and bolt holes. This shall be done at 1000 cycles and it may be done again at 5000 cycles.

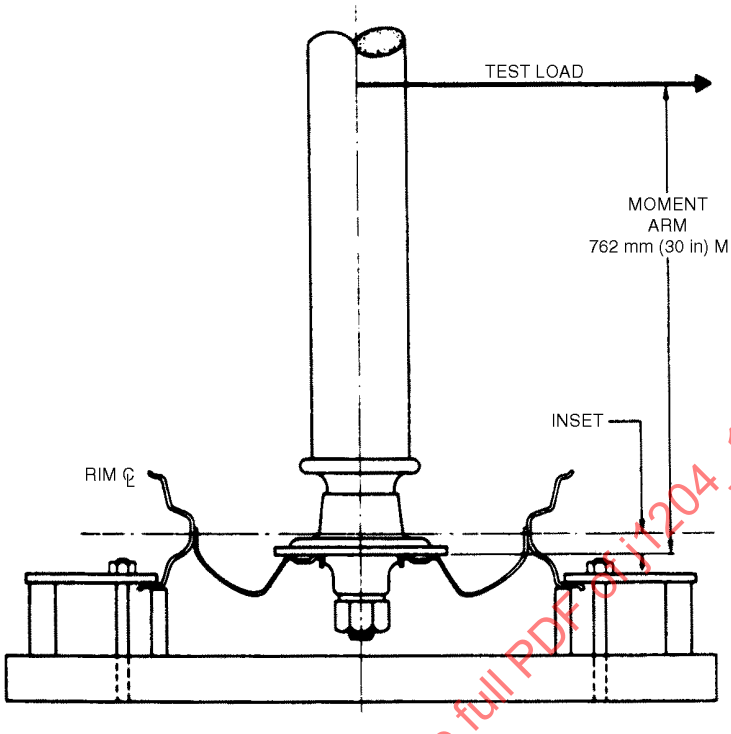

FIGURE 3—ROTARY TEST

3.2.3 BENDING MOMENT—Bending moment is determined by Equation 1:

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

where:

M = Bending moment N·m (lbf·ft)
W = The maximum static wheel load as specified by vehicle manufacturer and/or wheel manufacturer; N (lbf)
R = Static loaded radius of the largest tire to be used on the wheel as specified by the vehicle and/or wheel manufacturer; m (ft)
μ = Coefficient of friction between the tire and the road; use μ - 0.7
d = The inset or outset of the wheel m (ft). Use positive sign for inset and negative sign for outset.
S = Load Factor (see Table 2)

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

Wheel Type (Material)	"S"	Minimum Cycles
Ferrous All	1.45	18 000
Cold Formed Aluminum	1.55	50 000
5000 Series' Aluminum Cast and Forged With 3% or less magnesium content.	1.75	50 000

The test load is determined from Equation 2:

$$F = \frac{M}{D} \text{ (see Figure 3)} \qquad \text{(Eq. 2)}$$

where:

F = Test load; N (lbf)
D = Moment arm; m (ft)
M = Bending moment N·m (lbf·ft)

3.2.4 Minimum Cycle Requirement = See Table 2.

3.2.5 TEST TERMINATION DEFINITIONS—The wheel under test must complete the minimum number of test cycles (see Table 2) prior to test termination. The test shall be terminated when the operating deflection exceeds the initial deflection at point of load application by 20%. Broken studs or other parts of the test fixture do not require test determination but may result in damage to the wheel and test invalidation.

3.3 Dynamic Radial Fatigue Test

3.3.1 EQUIPMENT—The test machine shall be one with a driven rotatable drum, which presents a smooth surface wider than the loaded test tire section width. The suggested diameter of the drum is 1707.6 m (67.23 in) which is 187.5 rev/km (300 rev/mile). The test wheel and tire must provide loading normal to the surface of the drum and in line radially with the center of the test wheel and the drum. The axes of the test wheel and the drum must be parallel. Equipment must hold test load to within ±3%.

3.3.2 PROCEDURE—Tires selected for this test shall be representative of the maximum size and type approved by the trailer or the wheel manufacturer for the wheel under test. The test adaptor, studs, and nuts shall be representative of those specified for the wheel. The wheel nuts shall be torqued to the torque limits specified in Table 1 for stud size and type of nut used. Test inflation pressures shall be selected in accordance with Table 3.

TABLE 3—TEST INFLATION PRESSURES

Usage Tire Pressure kPa	Usage Tire Pressure psi	Test Pressure ±20 kPa kPa	Test Pressure ±3 psi psi
Up to 280	Up to 40	450	65
280 – 410	41 – 60	550	80
420 – 550	61 – 80	690	100
560 – 690	81 – 100	900	130

3.3.3 RADIAL LOAD DETERMINATION—The radial load is determined by Equation 3:

$$F_r = WK \qquad \text{(Eq. 3)}$$

where:

F_r = Radial load; N (lbf)
W = The maximum static wheel load as specified by the wheel or trailer manufacturer; N (lbf)
K = Load factor = See Table 4