



SURFACE VEHICLE RECOMMENDED PRACTICE

J267™

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Superseding J267 NOV2014

Wheels/Rims - Truck and Bus - Performance Requirements and Test Procedures for Radial and Cornering Fatigue

RATIONALE

Modified during the Five-Year Review process. (1) Updated SAE and ISO publications titles to current revisions. (2) Updated 5.1.b for the difference in revolution/miles calculation. (3) All changes for this recommended practice were made for clarification purposes.

1. SCOPE

This SAE Recommended Practice provides minimum performance target 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. Users may establish design criteria exceeding the minimum performance target for added confidence in a design. The cycle target noted in Tables 1 and 2 are based on Weibull statistics using two parameter, median ranks, 50% confidence level and 90% reliability, and beta equal to two, typically noted as B10C50. For other wheels intended for normal highway use and temporary use on passenger cars, light trucks, and multipurpose vehicles, refer to SAE J328. For wheels used on trailers drawn by passenger cars, light trucks, or multipurpose vehicles, refer to SAE J1204. For bolt together military wheels, refer to SAE J1992. This document does not cover other special application wheels and rims.

2. REFERENCES

2.1 Applicable Documents

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 International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (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 and Hub or Drum Interface Dimensions - Truck and Bus
SAE J1204	Wheels - Recreational and Utility Trailer Fatigue Test Procedure and Performance Requirements

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For more information on this standard, visit
https://www.sae.org/standards/content/J267_202102

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

SAE J2530 Aftermarket Wheels - Passenger Cars and Light Truck - Performance Requirements and Test Procedures

Kinstler, J., "The Science and Methodology of SAE Wheel Fatigue Test Specifications," SAE Technical Paper 2005-01-1826, 2005, <https://doi.org/10.4271/2005-01-1826>.

2.1.2 Tire and Rim Association Publication

Available from The Tire and Rim Association, Inc., 4000 Embassy Parkway, Suite 390, Akron, OH 44333, www.us-tra.org.

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 SAE Technical Report.

2.2.1 ISO Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ISO 3006 Road Vehicles - Passenger Car Wheels - Test Methods

ISO 3894 Road Vehicles - Wheels/Rims for Commercial Vehicles - Test Methods

ISO 3911 Wheels and Rims for Pneumatic Tyres - Vocabulary, Designation and Marking

3. DEFINITIONS

3.1 DESIGN CRITERIA

A performance target consisting of a cycle target and multiple tests established to provide adequate confidence that a population of wheels meets or exceeds the minimum performance target of this recommended practice.

3.2 EXTERIOR PROFILE

Surfaces of the wheel that determine (define) the cross sectional contour(s) of the wheel. Walls of holes in the wheel are not considered to be part of the exterior profile. (See Figures 2A, 2B, and 2C.)

3.3 MINIMUM PERFORMANCE RECOMMENDATION

A wheel design that meets or exceeds the pairing of test factor and target minimum cycles in Tables 1 and 2 should have acceptable field performance in its intended service. The target minimum cycles associated with seven samples in Tables 1 and 2 represent historical, non-statistical, minimum performance target. Pairings of test factor and cycle targeting for sample sizes less than seven represent equivalent confidence and reliability.

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

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

**Table 1 - Cornering fatigue test,
test load factors, sample size, and cycle requirements**

Disc Wheel/Rim Description (All Mountings)				Minimum Performance Requirements Sample Sizes Reflect Same Confidence and Reliability						
Material	Rim Diameter Code	Inset/Outset		Accelerated Test Factor	Two Samples	Three Samples	Four Samples	Five Samples	Six Samples	Seven Samples
		mm	Inches		Cycle Requirements					
Ferrous	16 and larger ⁽¹⁾	Less than 101.6	Less than 4	1.45	57000	46000	40000	36000	33000	30000
				1.6	34000	28000	24000	22000	20000	18000
Ferrous	All	101.6 or more	4 or more	1.10	113000	92000	80000	71000	65000	60000
				1.30	75000	62000	53000	48000	44000	40000
Aluminum	16	127 or more	5 or more	1.35	468000	382000	331000	296000	271000	250000
				1.63	150000	123000	106000	95000	87000	80000
Aluminum	17.5 and larger ⁽¹⁾	All	All	1.35	468000	382000	331000	296000	271000	250000
				1.63	150000	123000	106000	95000	87000	80000

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

4.1 Equipment

Use a test machine that:

- Imparts a constant rotating bending moment to the wheel. See Figures 1A or 1B.
- Maintains the test load within $\pm 3\%$.
- Monitors and measures the deflection of the system.
- Has a rigid load arm shaft.

4.2 Procedure

- Use a test adapter, studs, and lug nuts representative of those specified for the wheel. Dimensions for the test adapter (wheel backup diameter) can be found in SAE J694.
- Verify the mating surfaces of the adapter are free of foreign material or excessive wear.
- Attach the wheel to a rigid load arm shaft and test adapter.
- Tighten the lug nuts to the torque specified in Appendix A for the stud size and type of lug 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.
- Clamp the rim securely to the test device.
- Adjust the system so that shaft runout is not more than 0.25 mm (0.010 inch) total indicator reading at the point of loading.

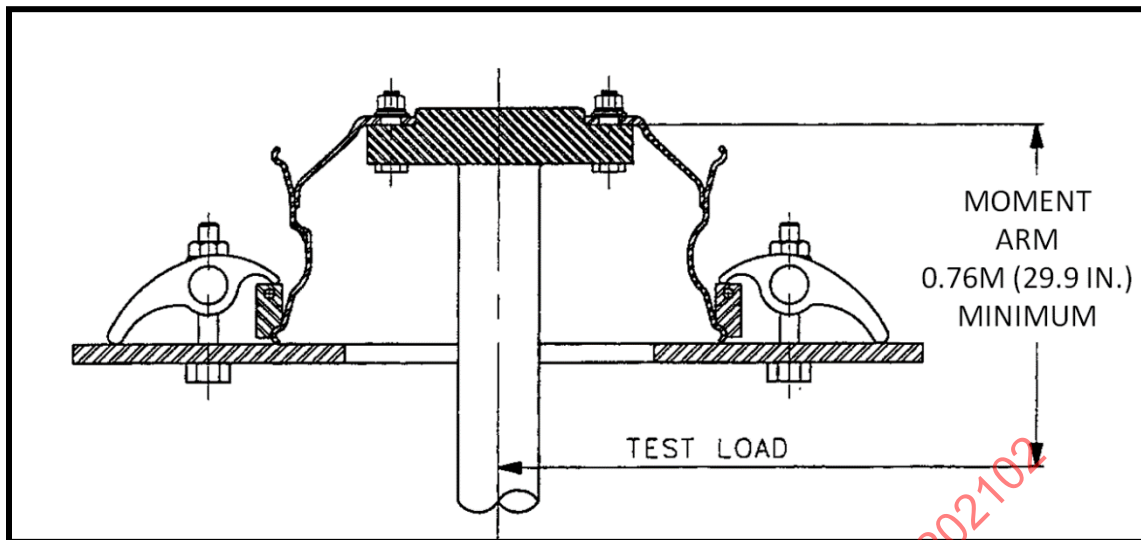


Figure 1A

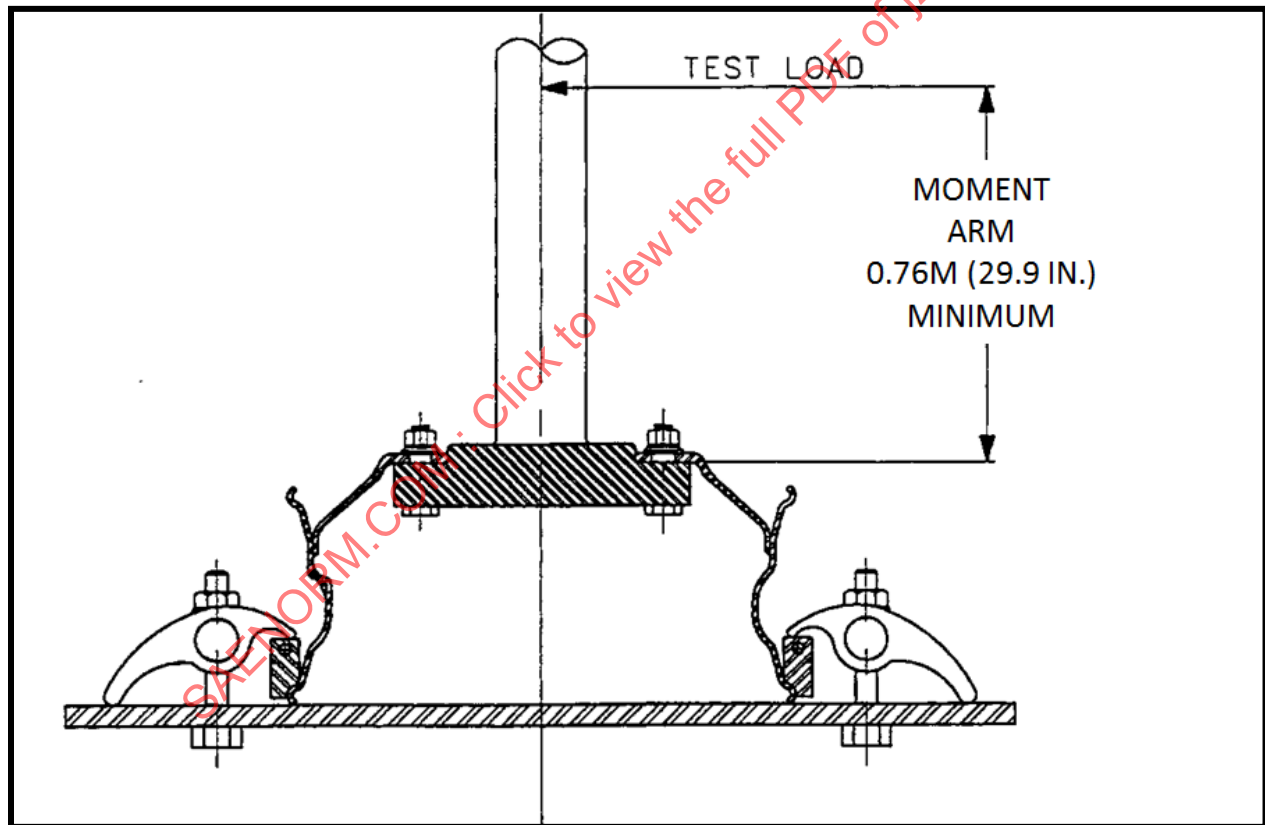


Figure 1B

Figure 1 - Cornering fatigue - 90-degree loading method (typical setup)

4.3 Test Loading

- a. Test load and bending moment determination: The test load is determined by Equation 1.

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

M is determined by Equation 2:

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

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 (inches); use the values of slr found in Appendix B

d = inset or outset; mm x 10⁻³ (inches) (positive for inset, negative for outset) of the wheel; if wheel may be used as inset or outset, use inset (refer to 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 performance recommendation, see Table 1.
- c. Apply the test load parallel to a plane through the center of the rim as shown in Figures 1A or 1B. Load may push against shaft or pull the shaft.

4.4 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.

4.5 Test Criteria/Test Termination

4.5.1 Ferrous Products

The wheel under test must complete the target number of test cycles prior to termination to be considered successful. The test shall be terminated by:

- The inability of the wheel to sustain load;
- 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.

4.5.2 Aluminum Products

The wheel under test must complete the target number of test cycles prior to termination to be considered successful. The test shall be terminated by:

- The inability of the wheel to sustain load;
- A visually detected fatigue crack penetrating through a section;
- A visually detected fatigue crack exceeding 10 mm in length, provided that both of the following conditions are met:
 - The crack is outside of a diameter equal to the “disc flat clearance diameter” plus 15 mm (“disc flat clearance diameter” is dimension E in SAE J694);
 - The crack is on the exterior profile of the wheel. (See Figures 2A, 2B, and 2C.)

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.

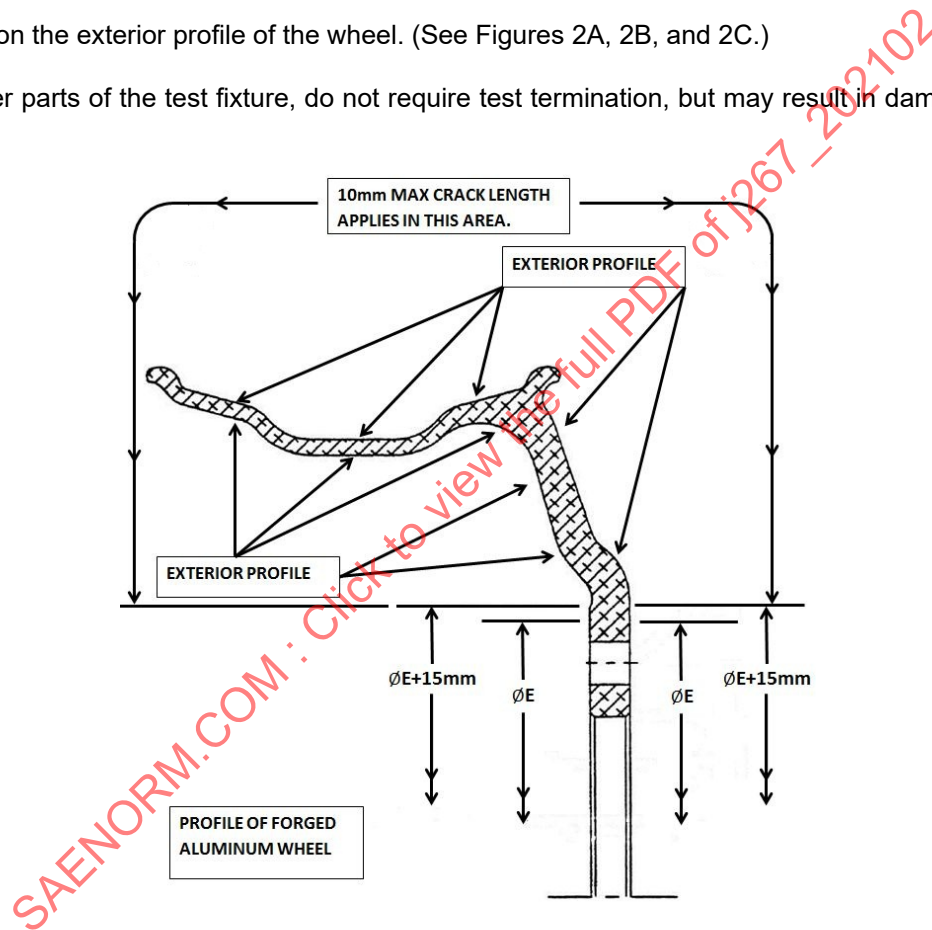


Figure 2A

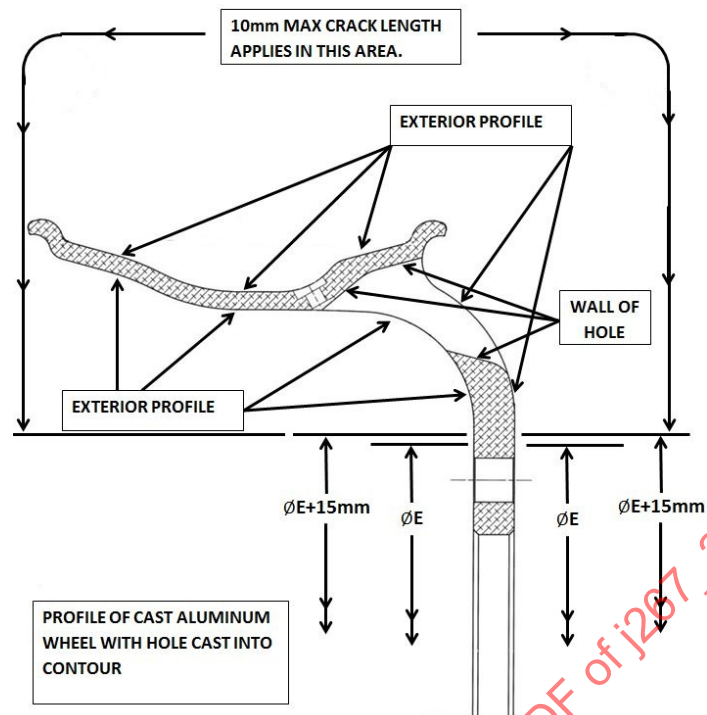


Figure 2B

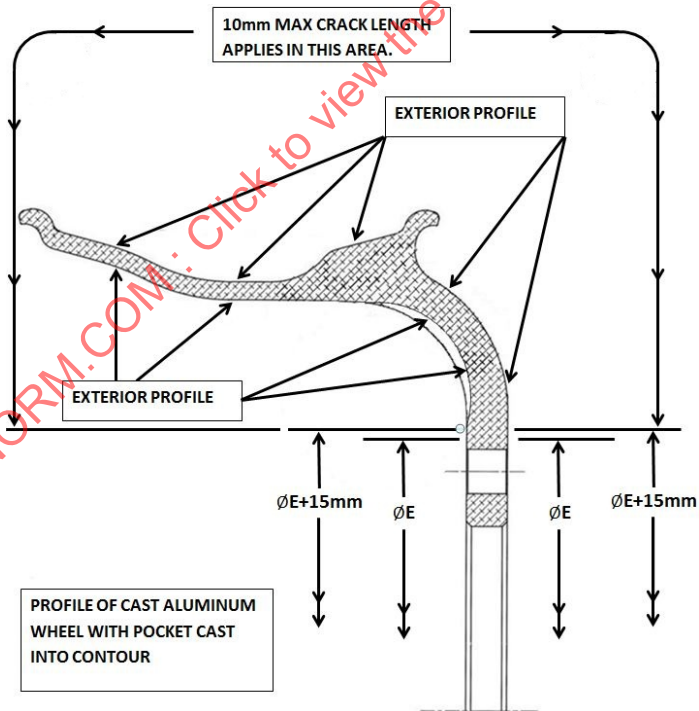


Figure 2C

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

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

5.1 Equipment

Use a test machine that:

- Has a driven rotatable drum, which presents a smooth surface wider than the loaded test tire section width.
- Has a suggested drum diameter of 1707.06 mm (67.21 inches), giving 186.47 revolutions per kilometer (300.09 revolutions per mile).
- 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.
- Can maintain the test load and inflation within $\pm 3\%$.
- Holds the axis of the test wheel and the drum parallel.

**Table 2 - Radial fatigue test,
test load factors, sample size, and cycle requirements**

Disc Wheel/Rim Description (All Mountings)				Minimum Performance Requirements Sample Sizes Reflect Same Confidence and Reliability						
Material	Rim Diameter Code	Inset/Outset ⁽¹⁾		Accelerated Test Factor	Two Samples	Three Samples	Four Samples	Five Samples	Six Samples	Seven Samples
		mm	Inches		Cycle Requirements					
Ferrous	16 and larger; 5-degree Drop Center	All	All	2.2	940000	765000	665000	595000	545000	500000
				1.8	1875000	1530000	1325000	1185000	1085000	1000000
Ferrous	15, 17, 18, 20, 22, 24; 5-degree Flat Base	All	All	2.0	940000	765000	665000	595000	545000	500000
				1.9	1125000	920000	795000	710000	650000	600000
				1.8	1310000	1070000	930000	830000	760000	700000
				1.7	1600000	1300000	1125000	1010000	920000	850000
				1.6	1875000	1530000	1325000	1185000	1085000	1000000
Aluminum	16	127 or more	5 or more	2.8	190000	155000	135000	120000	110000	100000
				2.6	330000	270000	235000	210000	190000	175000
				2.2	985000	805000	695000	625000	570000	525000
				2.0	1875000	1530000	1325000	1185000	1085000	1000000
Aluminum	17.5 and larger	All	All	2.8	190000	155000	135000	120000	110000	100000
				2.6	330000	270000	235000	210000	190000	175000
				2.2	985000	805000	695000	625000	570000	525000
				2.0	1875000	1530000	1325000	1185000	1085000	1000000

⁽¹⁾ Offset for demountable rims.

5.2 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 lug 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 $448 \text{ kPa} \pm 14 \text{ kPa}$ ($65 \text{ psi} \pm 2 \text{ psi}$) 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 $448 \text{ kPa} \pm 14 \text{ kPa}$ ($65 \text{ psi} \pm 2 \text{ psi}$).
- d. Tighten the lug nuts to the torque specified in Appendix A for the stud size and type of lug 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.

5.3 Radial Test Loading

- a. Radial load determination: The radial load is determined as follows in Equation 3,

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

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 performance recommendation (see Table 2)

5.4 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.

5.5 Test Criteria/Test Termination

5.5.1 Ferrous Products

The wheel under test must complete the target number of test cycles prior to termination to be considered successful. The test shall be terminated by:

- The inability of the wheel to sustain load;
- 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.