



Electrical Resistance of Vehicle Tires

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This test procedure is intended for the evaluation of vehicle tires with regard to their electrostatic characteristics. It describes a procedure for testing the electrical resistance of tires on a loading unit and specifies a limit value for the electrical resistance.

1.2 Applicability. This test procedure is applicable for all tires independent from design or compounds (carbon black, silica, etc.)

1.3 Remarks.

1.3.1 Due to driving on road surfaces or filling the vehicle's fuel tank, the vehicle body can become charged and this may cause sparks to occur. Electrostatically conductive tires shall prevent charging or permit non-dangerous leakage.

1.3.2 The method described in this procedure was previously identified as "Method B".

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

2.2 GM Standards/Specifications.

GMW16590

3 Resources

3.1 Facilities. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.2 Equipment.

3.2.1 The test setup shall be generally configured, as shown in Figure 1.

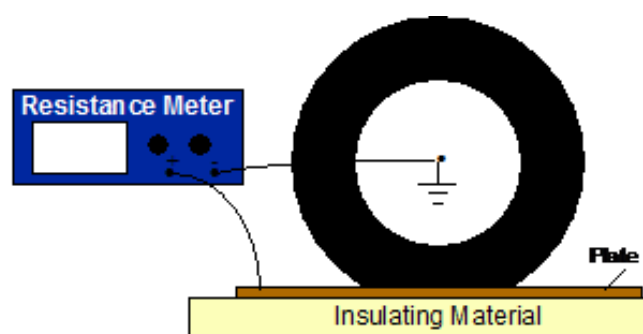


Figure 1: Test Setup

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3.2.2 Test Equipment Specifications.

3.2.2.1 Loading Mechanism. The system shall have the capability to attain a vertical load of 10 000 N. Vertical load shall be accurate to $\pm 1\%$ within the test measurement range.

3.2.2.2 Inflation Pressure Gage. The inflation pressure gage shall be accurate to ± 3 kPa.

3.2.2.3 Loading Surface (Plate). The tire shall be loaded against a plate made of stainless steel, copper, brass, or other conductive, non-corrosive material (not aluminum).

The plate shall be of dimensions large enough to encompass the entire contact patch of the tire under test conditions.

3.2.2.4 Insulating Material. The loading surface (plate) shall be electrically isolated from ground using an insulating material providing a minimum resistance of $10^{14} \Omega$.

- The insulating material shall be non-hygroscopic.
- Teflon or Delrin are recommended materials.
- The insulating material shall extend at least 2.54 cm (1 in) beyond the plate on all sides.

3.2.2.5 Resistance Measurement. Tire resistance shall be measured by an instrument which provides a reading in ohms (Ω). The voltage source shall be capable of applying 1000 V.

- Input impedance of the meter and probe combination shall be $> 10^{12} \Omega$.

3.2.2.6 Electrical Connections. All electrical connections shall be multipoint in nature; no single point connections shall be used. Specifically, all connections shall be capable of full current load at 1000 V.

- Impedance of all connections and cables shall be $< 5 \Omega$.
- Electrical connection to the wheel shall be made at an uncoated location. That is, no paint or coatings shall be present.

3.2.2.7 Test Wheels. Steel or aluminum wheels may be used. No coatings shall be present in the bead seat area which may affect the resistance measurement.

3.2.2.8 Temperature and Humidity. Temperature and humidity measuring equipment shall have the following accuracy:

- **Temperature:** ± 1 °C.
- **Humidity:** $\pm 3\%$ relative humidity.

3.3 Test Vehicle/Test Piece.

3.3.1 The test shall be performed on at least three (3) tires.

3.3.2 New Tires: For tests of new tires, no modifications to the tread surface shall be made. The surface shall not be roughened or polished. Force ground or buffed tires are not permitted.

3.3.3. Worn Tires: For worn tire tests, tread depth shall generally be one-half ($\frac{1}{2}$) of new tire depth across the full surface of the tread.

3.3.3.1 In practice, any material on the tread surface which does not transcend the full depth of the tread shall be removed.

3.3.3.2 Tread removal can be accomplished by on-vehicle or lab wear test, or by other means such as grinding or buffing the tire so long as the requirement of 3.3.3.1 is met.

3.4 Test Time.

Calendar time: 1 d

Test time: 1 h

Coordination time: 3 h

3.5 Test Required Information.

3.5.1 Exact list of required information is determined by the local test site. Required information includes tire size, construction number, load rating, service description, and wheel width.

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Documents

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3.6 Personnel/Skills.

3.6.1 Test operator should have adequate training and be familiar with the local operators' procedure.

4 Procedure

4.1 Preparation.

4.1.1 Tire Preconditioning.

4.1.1.1 The vehicle tires to be measured shall be stored for at least 8 h in the test environment.

4.1.1.2 The tire surface shall be clean and dry prior to testing.

4.1.1.2.1 Mounting lube may be used sparingly, but care shall be taken to avoid any lube on the tire sidewall or tread.

4.1.1.2.2 The vehicle test tire shall be cleaned after fixing the mounted tire to the test rig. The use of organic solvents that may cause swelling of the tire or attack the rubber is forbidden. A high purity (90% or higher) isopropyl alcohol or a similar agent which does not attack the rubber shall be used.

4.1.1.3 The vehicle tires shall be preloaded twice for 1 minute, then a third time for 3 minutes, and again unloaded once before the test.

4.1.2 The loading surface (plate) shall be cleaned prior to each test with high purity (90% or higher) isopropyl alcohol or a similar cleaning agent.

4.2 Conditions.

4.2.1 **Environmental Conditions.** Ambient temperature shall be maintained at $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$. Relative humidity in the test area shall be $\leq 50\%$.

4.2.2 **Test Conditions.** Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.2.2.1 Test Load.

4.2.2.1.1 Passenger car tires: 70% of maximum load ($\pm 5\%$).

4.2.2.1.2 Light truck or commercial tires: 70% of maximum load at 350 kPa ($\pm 5\%$).

4.2.2.2 Test Inflation.

4.2.2.2.1 Passenger car tires: 210 kPa ($\pm 5\text{ kPa}$).

4.2.2.2.2 Light truck or commercial tires: 350 kPa ($\pm 5\text{ kPa}$).

4.3 Instructions.

4.3.1 Measurement Procedure

4.3.1.1 **Preloading.** The test tire shall be loaded to the specified test load, held for 1 minute, and unloaded at least once prior to application of the test load for measurement purposes.

Preloading shall occur at each measurement location.

4.3.1.2 **Test Sequence.** The test load shall be applied to the tire immediately following the preloading cycle.

- Voltage shall be applied to the tire immediately after the test load has been attained.
- Applied voltage shall be maintained for a period of 3 minutes.

4.3.1.3 Resistance readings shall be taken 10 s after initial voltage apply and continuously thereafter during the 3 minute period at a frequency of at least once every 10 s.

4.3.1.4 The final resistance measurement shall be taken at $3\text{ minutes} \pm 10\text{ s}$ and represents the electrical resistance result for that measurement location.

4.3.1.5 A tire shall be measured in at least four (4) equally spaced circumferential measurement locations.

The first measurement location shall be at the Department of Transportation (DOT) marking, and shall be designated as zero (0) degrees.

If the tire has a known circumferential discontinuity, measurement locations shall be selected such that this location is measured.

A discontinuity is defined as an isolated circumferential location on the tire with electrical resistance statistically higher or lower than that of the majority of the tire circumference.

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