

Automotive, Transportation / R&D, Testing

Testing for Protection Against Electrocutation in Electric and Hybrid Vehicles

Comply with Safety Standards Requirements of a Minimum 0.2A Testing Current and 0.1Ω Resistance Reading

Vehicle Safety During Operation and After a Collision

National and global vehicle safety standards such as those issued by the U.S. National Highway Traffic Safety Administration (NHTSA) determine vehicle performance requirements that protect driver and passenger safety after a crash and during everyday, normal operation of an electric, hybrid electric or other alternative energy vehicle. The United Nations World Forum for Harmonization of Vehicle Regulations (WP.29¹) has also established a working group to address safety issues associated with electric vehicles.

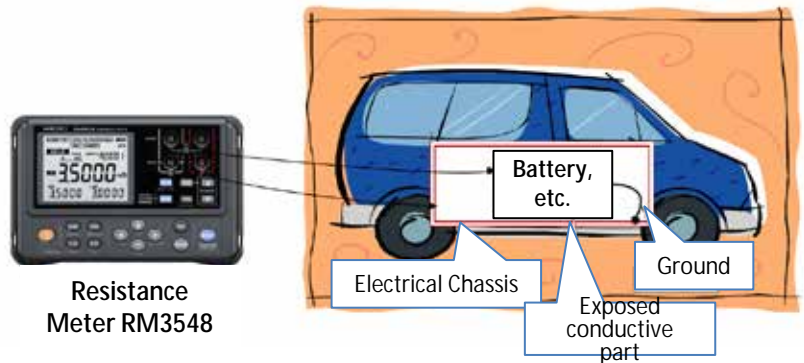
Included in many standards are electrical safety requirements to protect against direct and indirect contact of high voltage sources, or loss in electrical isolation, involving use of physical barriers in order to prevent contact by vehicle occupants. They limit the spilling of electrolyte and retention of electric energy storage/conversion devices during and after a crash in order to protect passengers and emergency rescue personnel from harmful electric shock.

In NHTSA's Federal Motor Vehicle Safety Standard (FMVSS) No. 3052, for example, the following two safety characteristics are required of vehicles when tested according to prescribed procedures using a resistance meter in order to verify protection against indirect contact from high voltage sources:

- The resistance between all exposed conductive parts of electrical protection barriers and the electrical chassis shall be **less than 0.1 Ω**; and
- The resistance between any two simultaneously reachable exposed conductive parts of the electrical protection barriers that are less than 2.5 meters from each other shall be **less than 0.2 Ω**

Test Methods and Equipment

Safety authorities do not specify a particular model or brand of instrument to verify resistance values but do stipulate test methods to be carried out by either a resistance meter or combination of DC power supply, voltmeter and ammeter. When using a resistance meter, one that can measure current levels of at **least 0.2 Amperes** with a resolution of 0.01 Ω or less is required for the above tests.



A Convenient Solution in the Hioki RM3548 Resistance Meter

The Hioki RM3548 Resistance Meter offers both the advanced specifications and portability to carry out these tests quickly and accurately thanks to its **0.0 μΩ to 3.5 MΩ measurement range, 0.1 μΩ resolution and 1A maximum testing current**, more than sufficient to meet the low resistance characteristics demands, very fine resolution and testing current levels.

How to Test

1. Use the Hioki DT4221 Digital Meter at its voltage function to test that voltage is not present between exposed conductors and electrical chassis
2. Set the test current of the 300mΩ range on the RM3548 to 300mA (0.3A)
3. Touch one of the test leads of the RM3548 to the exposed conductive part, and the other to the electrical chassis
4. Set the RM3548 to the 30mΩ or 300mΩ range and maintain the testing current of at least 300mA
5. Verify that the resistance reading is not more than 0.1Ω (100mΩ) as per the requirements

¹UNECE: http://www.unece.org/trans/main/wp29/presentation_wp29.html. Accessed 2019/12/6.

²Federal Motor Vehicle Safety Standards; Electric-Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection, A Rule by the National Highway Traffic Safety Administration on 09/27/2017

Products used

- Resistance Meter RM3548
- Digital Multimeter DT4221

Information valid as of December 2019

Specifications are subject to change and revision without notice.