

Electric Motor Testing Procedure

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1 Objective

To determine the electrical and mechanical characteristics of the motor: power, speed range, consumption, supply voltage, operating temperature, and verify the motor's reliability.

2 Reference Documentation

- Test request module TI-101
- Test result module TI-102

3 Testing Equipment

Instrumented power control bench.

- Fan for motor cooling
- Power supply for the motor
- Temperature sensors

4 Specific Test Data

Fully completed test request document, TI-101

5 Electrical, Dimensional, and Material Characteristics

Verify dimensional compliance according to motor blueprint specifications. Verify that the material and surface protection meet the design requirements with the help of laboratory or material certification attached to the test.

6 External Appearance

Check the following:

- Manufacturer's emblem
- Manufacturing date and traceability
- Supply voltage and power
- Phase indications both on the motor label and at each cable output.

7 Electrical Tests

Environmental conditions for the test:

- Temperature 23 +/-5°C
- Ambient humidity between 50 and 75%
- Pressure between 860 and 1060 mbar.
- Supply voltage must be the nominal voltage +/- 3.7%.

7.1 Resistance Measurement

Control of the resistance of each winding (using a milli-ohmmeter $m\Omega$), and the result must be according to design specifications.

7.2 Insulation Resistance

Check Verify that the insulation characteristics are $\geq 10M\Omega$ measured with a 500VDC voltage. (Using a specific $M\Omega$ instrument).

7.3 Dielectric Strength

Check Verify that applying a 500 V rms voltage for 1 minute between each end of the winding and the motor structure does not result in perforation discharges. (Manufacturer reference instrumentation).

8 Electromechanical, Environmental, and Durability Tests

8.1 Characterization Test for Reference

Initial characterization test according to standard reference.

8.2 Rapid Thermal Shock Cycle Test

To perform this test, we need a double chamber that can rapidly switch from cold to hot and vice versa. Description of the test temperature cycle:

- For the low-temperature test, the chamber must be kept at $-20\text{ }^{\circ}\text{C} \pm 2$
- For the high-temperature test, the chamber must be kept at $80\text{ }^{\circ}\text{C} \pm 2$ -The temperature must be stabilized for 1 hour in each state.
- The transition from low to high temperature must be performed in less than 3 minutes. 10 cycles must be carried out Once these cycles are completed, materials must be analyzed, and their proper operation must be controlled according to the specifications of the analyzed device, and no cracks or deformations should appear.

8.3 Operation under Extreme Temperatures and Voltages

This test must be performed in a chamber at extreme temperatures and with extreme feeding. -The procedure is as follows: -Feed at +25% of the nominal voltage and at a temperature of $-15\text{ }^{\circ}\text{C}$ and then at $+80\text{ }^{\circ}\text{C}$ for 60 minutes -Feed at -25% of the nominal voltage and at a temperature of $-15\text{ }^{\circ}\text{C}$ and then at $+80\text{ }^{\circ}\text{C}$ for 60 minutes. Then it must work fully according to design specifications.

8.4 Vibration Test

8.5 Water and Dust Ingress Test

The test will be carried out in simulated rain in an arc bench and with a hose washing system, and the following tests will be carried out. Simulated rain test, With the vehicle complete with all protections in real conditions, it will be placed in a rain cabin with a rotating platform at a speed of approximately 3 rotations per minute, performing 100

rotations in one direction and 100 rotations in the opposite direction. The device to be tested must be subjected to this test for approximately 2 hours. The coverage radius is 350 mm. and an Angle of +65 -65 degrees of arc

8.6 Salt Spray Test

Procedure to perform this test is as follows: -Keep the device in salt spray composed by 5 parts of pure sodium chloride per 95 parts of water at 35°C temperature, -The pH of the solution should be between 6.5 and 7.2. -The test time must be specific for each device and according to the application and the manufacturer.

8.7 Bench Life Tests

The motor must be operated simulating a predefined circuit and the test must be carried out up to the kilometer limit defined in the vehicle specifications.

8.8 Vehicle Life Tests

The defined kilometers in the vehicle test plan will be carried out.

9 Motor Mounting on Power Bench for Testing Execution

A rigid mounting on the power bench must be provided to prevent possible vibrations that may modify the reading, and the transmission must be direct with flexible coupling of the motor shaft to the brake of the bench. A test must be carried out to certify that it meets the design specifications and then the characterization test according to the reference standard must be carried out.

10 Acceptance Criteria

At the end of the test, the correct functionality must be checked according to the functional specifications of the design. The result must be presented with the result module sheet TI-102.