



Performance Test Procedure for Automotive Generator with Regulated Voltage Control

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. The purpose of this test procedure is to characterize generator functionality and performance in a bench setup.

1.2 Applicability. This procedure is applicable to all 14 V generators with Regulated Voltage Control (RVC).

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14036

2.3 Additional References.

- As-Built-As-Tested Bill of Materials (ABAT BOM) database/process at Uniform Resource Locator (URL) <https://abat.gm.com/abat> (ID)

- Test Request from the Requesting Engineer

(ID) = This standard is limited to internal distribution within General Motors and shall not be distributed outside this company. Contact the GM Lead Engineer for further instructions. See 3.5.

3 Resources

3.1 Facilities. Electrical laboratory with equipment capable of testing automotive generators.

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

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Generator dynamometer test stand with a data acquisition system and the following:

- Thermal test chamber capable of maintaining ambient temperature between -30 °C and 125 °C
- Maximum speed of at least 10 000 Revolutions per Minute (RPM)
- Torque capability of at least 15 Nm

3.2.2 Digital oscilloscope with four channels, 20 MHz frequency bandwidth, and capability of 2500 sample points per ten divisions.

3.2.3 Function voltage generator capable of 0 V to 5 V square wave waveform with variable frequency of 1 Hz to 1 kHz, and variable duty cycle of 0% to 100%.

3.2.4 Digital multi-meter capable of measuring voltage (1 V to 16 V) and current (0 A to 1 A).

3.3 Test Vehicle/Test Piece. Production intent and/or benchmark generator.

3.4 Test Time.

Calendar time: ≤ 10 days

Test hours: ≤ 80 hours

Coordination hours: 3 to 6 hours

3.5 Test Required Information. Test Request from the Requesting Engineer. If executing this procedure at GM, communicate with the GM test technician through the As-Built-As-Tested Bill of Materials (ABAT BOM) database/process for proper test execution. Access the ABAT BOM site at Uniform Resource Locator (URL) <https://abat.gm.com/abat/>.

3.6 Personnel/Skills. The technician assigned to perform this test must be familiar with the charging system and has knowledge about RVC as described in generator component technical specification GMW14036.

4 Procedure

4.1 Preparation.

4.1.1 Sample Inspection. The sample generator shall be visually inspected for any damage.

4.1.2 Instrumentation Calibration. All instrumentation shall be calibrated and the calibration date shall not be more than one year from the date the testing is performed.

4.2 Conditions.

4.2.1 Environmental Conditions. Not applicable.

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.

4.3 Instructions.

4.3.1 Install the generator on the dynamometer.

4.3.2 Connect the generator B+ terminal to a load bank and a LNx, 60% $\pm$ 10% Ah and 600% $\pm$ 10% SAE International Cold Cranking Amperes (CCA) (500% $\pm$ 10% European Norm (EN) CCA) battery.

Note: LNx refers to LN2, LN3 and LN4 batteries where LN2 is 242 mm (9.5 in), LN3 is 277 mm (10.9 in) and LN4 is 250.5 mm (9.9 in).

4.3.3 Connect the regulator L-terminal to the function generator with 5 V peak to peak (V_{p-p}), 128 Hz square waveform output, and 471 Ω resistor in series.

4.3.4 Performance Test. The purpose of this test is to verify the maximum net stabilized output current at specified voltage, speed and generator inlet temperatures.

4.3.4.1 Set the test chamber temperature to 25 °C, and set the generator output voltage to 14 V by adjusting L-terminal duty cycle, and measure stabilized output current at the following generator speeds in RPM: 1600, 1800, 2000, 2500, 3000, 3500, 4000, 6500 and 10 000.

4.3.4.2 Set the test chamber temperature to 105 °C, and set the generator output voltage to 13.25 V by adjusting L-terminal duty cycle, and measure stabilized output current at the following generator speeds in RPM: 1600, 1800, 2000, 2500, 3000, 3500, 4000, 6500 and 10 000.

4.3.4.3 Set the test chamber temperature to 125 °C, and set the generator output voltage to 13 V by adjusting L-terminal duty cycle, and measure stabilized output current at the following generator speeds in RPM: 1600, 1800, 2000, 2500, 3000, 3500, 4000, 6500 and 10 000.

4.3.5 Efficiency Test.

4.3.5.1 Verband der Automobilindustrie (VDA) Efficiency Test.

4.3.5.1.1 Set the test chamber temperature to 25 °C, and adjust the L-terminal duty cycle for a 14 V generator output voltage, and the generator load to half the full load at a generator speed 6000 RPM.

4.3.5.1.2 Measure the generator torque, speed, current and voltage at generator speeds in RPM: 1800, 3000, 6000, and 10 000.

4.3.6 Generator Parasitic Current. Measure and record the generator parasitic current and battery voltage with the generator:

- Not running (0 RPM)
- L-terminal signal duty cycle set to 0%
- Test temperature at 25 °C
- Generator B+ terminal connected to the battery

Note: Measurements should be taken after generator is stabilized, approximately (~) 15 minutes.

4.3.7 Generator Self Start-up Characteristics.

4.3.7.1 Set the test chamber temperature to 25 °C and perform 4.3.7.1.1 through 4.3.7.1.8.

4.3.7.1.1 Set the generator speed to 0 RPM and L-terminal signal duty cycle set to 0%.

4.3.7.1.2 Add a 25 A load.

4.3.7.1.3 Increase the generator speed to 800 RPM.

4.3.7.1.4 Increase the generator speed until the field signal is enabled.

4.3.7.1.5 Increase the generator speed until the generator output is enabled.

4.3.7.1.6 Decrease the generator speed to 1600 RPM.

4.3.7.1.7 Increase the generator speed to 6500 RPM.

4.3.7.1.8 Decrease the generator speed to 0 RPM.

4.3.7.2 For each step record the following data:

- Generator speed
- F-terminal duty cycle and frequency
- Generator voltage and output current
- Battery voltage and current

4.3.8 Generator Normal Start-up Characteristics.

4.3.8.1 Set the test chamber temperature to 25 °C, L-terminal signal duty cycle to 10%, generator load to 50 A, and perform 4.3.8.1.1 through 4.3.8.1.7.

4.3.8.1.1 Set the generator speed to 0 PRM.

4.3.8.1.2 Increase the generator speed to 800 RPM.

4.3.8.1.3 Increase the generator speed until the generator F-terminal output is enabled.

4.3.8.1.4 Increase the generator speed until the generator output current is enabled.

4.3.8.1.5 Increase the generator speed to 6500 RPM.

4.3.8.1.6 Decrease the generator speed until the L-terminal signal is pulled low.

4.3.8.1.7 Decrease the generator speed to 0 RPM.

4.3.8.2 For each step, record the following data:

- L-terminal duty cycle and peak to peak value
- Generator speed
- F-terminal duty cycle and frequency
- Generator voltage and output current
- Battery voltage and current

4.3.8.3 Repeat 4.3.8.1.1 through 4.3.8.2 with 100% L-terminal signal duty cycle and 25 A load.

4.3.8.4 Repeat 4.3.8.1.1 through 4.3.8.2 with 50% L-terminal signal duty cycle and 25 A load.

4.3.9 Previously Enabled Generator Regulation Characteristics.

4.3.9.1 Set the test chamber temperature to 25 °C, generator speed to 3000 RPM, and perform 4.3.9.1.1 through 4.3.9.1.8.

4.3.9.1.1 Set the L-terminal signal duty cycle to 60% and generator load to 25 A.