



Electronic Stability Control Electrical Test

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. To define the tests that will determine if a vehicle meets the requirements of sections S5.3, S5.4.3, S5.4.4 and S5.5 of Federal Motor Vehicle Safety Standard (FMVSS) FMVSS 126 for Electronic Stability Control (ESC).

Guidance for interpreting FMVSS requirements may be obtained from Safety Regulations and Consumer Information through the Validation Engineering Group.

1.2 Applicability. This standard applies to passenger cars, multipurpose passenger vehicles, trucks, and buses with a gross vehicle weight rating of 4536 kg (10 000 lb) or less.

1.3 Remarks. This standard covers the test requirements of FMVSS 126 for sections S5.3, S5.4.3, S5.4.4 and S5.5 only for ESC telltales and controls.

All components involved must have the latest production intent released level software and production intent calibrations.

1.3.1 Legal Requirements. The FMVSS 126 requirements are found in the GM Global Legal Database. The GM Global Legal Database contains the most recent version of FMVSS requirements and supercedes those listed in any test procedure. Guidance for interpreting FMVSS requirements may be obtained from GM Safety and Field Investigations group.

1.3.2 Uniform Parts Code(s) (UPC). The UPC comprehended in this procedure is 12.

2 References

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

2.1 External Standards/Specifications.

CMVSS 101 FMVSS 101 FMVSS 126

2.2 GM Standards/Specifications.

GMW15924 (ID)

(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.

2.3 Additional References.

GM Global Legal Database. (I)

(I) = This database is internal within General Motors. Contact the GM Lead Engineer for further instructions.

3 Resources

3.1 Facilities. A service garage with vehicle lift may be required to emulate the system malfunctions described in Data Sheet A3. In Appendix A.

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.

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3.2 Equipment. Complete Data Sheet A1 in Appendix A.

3.2.1 Stopwatch with graduated increments of 1 s and an accuracy of at least 0.5 s.

3.3 Test Vehicle/Test Piece. The test vehicle(s) should be selected as being representative of the group of vehicles whose compliance to FMVSS 126 is being demonstrated.

3.4 Test Time.

Calendar time: 2 days

Test hours: 8 hours

Coordination hours: 8 hours

3.5 Test Required Information. See Data Sheet A3 in Appendix A for required information. The requestor is responsible for providing information to complete this data sheet.

3.6 Personnel/Skills. Personnel must have the ability to emulate the system malfunctions described in Data Sheet A3 in Appendix A or have access to technician assistance.

4 Procedure

4.1 Preparation. Following vehicle procurement, assemble a Test Readiness Team (TRT) with the following members; Validation Engineer (VE), Vehicle System Engineer (VSE), Design Release Engineers (DRE) of each test component, Vehicle Software Integration Engineer (VSIE) and Assembly Verification Software Engineer/Dynamic Vehicle Testing (AVSE/DVT). This team will determine the proper component hardware, software and calibration configurations required for test, and verify that the test components are production intent per the appropriate tracking system (i.e., Calibration Development System (Cal-DS), General Motors Electronic Controller (GMEC), Global Data File Release System (GDFRS)).

4.1.1 Obtain TRT approval on vehicle configuration and complete Data Sheet A2 in Appendix A. Explain any additional readiness steps taken to complete vehicle update.

4.1.2 Complete Data Sheet A3 in Appendix A with input from the requesting engineer.

4.2 Conditions.

4.2.1 Environmental Conditions. This test can be performed under any conditions.

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 ESC Malfunction Telltale (Data Sheet A4 in Appendix A).

4.3.1.1 Verify whether the vehicle is equipped with an ESC malfunction telltale and whether it is part of a common display space. See Data Sheet A3 in Appendix A.

4.3.1.2 With the vehicle stationary, and the ignition locking system in the "Lock" or "Off" position, activate the ignition locking system to the "On" or "Run" position, disengaging any starter interlock.

4.3.1.3 Verify that the ESC malfunction telltale illuminates for a short time ("bulb check") and then extinguishes. Bulb check is not required if the telltale is part of a common display space.

4.3.1.4 Deactivate the ignition locking system to the "Lock" or "Off" position and emulate the ESC malfunction to be tested from Data Sheet A3 in Appendix A.

4.3.1.5 With the vehicle stationary, and the ignition locking system in the "Lock" or "Off" position, activate the ignition locking system to the "On" or "Run" position.

4.3.1.6 Verify that the ESC malfunction telltale illuminates and remains illuminated. If necessary, drive the vehicle at a speed of 48 km/h $\pm$ 8 km/h (30 mph $\pm$ 5 mph) for up to 2 minutes (including at least one left and one right turning maneuver and one service brake apply) until the telltale illuminates.

4.3.1.7 Stop the vehicle and deactivate the ignition locking system to the "Lock" or "Off" position.

4.3.1.8 After 5 minutes, restart the engine and verify the ESC malfunction telltale illuminates and stays illuminated. No driving is allowed.

4.3.1.9 Deactivate the ignition locking system to the "Lock" or "Off" position.

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4.3.1.10 Reactivate the ignition locking system to the "On" or "Run" position and verify the ESC malfunction telltale illuminates and stays illuminated. No driving is allowed.

4.3.1.11 Deactivate the ignition locking system to the "Lock" or "Off" position and restore the ESC system to normal operation.

4.3.1.12 With the ignition locking system in the "Lock" or "Off" position, and after ESC system has been restored, exit vehicle and close the Driver's door. Wait 2 minutes. Reenter vehicle, reactivate the ignition locking system to the "On" or "Run" position and verify that the ESC malfunction telltale extinguishes. If necessary, drive the vehicle at a speed of 48 km/h $\pm$ 8 km/h (30 mph $\pm$ 5 mph) for up to 2 minutes (including at least one left and one right turning maneuver and one service brake apply) until the telltale extinguishes.

4.3.1.13 Repeat steps 4.3.1.4 to 4.3.1.12 for each additional malfunction from Data Sheet A3 in Appendix A.

4.3.2 "ESC Off" Telltale (Data Sheet A5 in Appendix A).

4.3.2.1 Verify whether the vehicle is equipped with an "ESC Off" telltale and whether it is part of a common display space. See Data Sheet A3 in Appendix A.

4.3.2.2 With the vehicle stationary, and the ignition locking system in the "Lock" or "Off" position, activate the ignition locking system to the "On" or "Run" position.

4.3.2.3 Verify that the "ESC Off" telltale illuminates for a short time ("bulb check") and then extinguishes. Bulb check is not required if the telltale is part of a common display space.

4.3.2.4 Select any position on any control (from Data Sheet A3 in Appendix A) that has the effect of putting the ESC system in a mode that no longer satisfies the performance requirements of S5.2.1, S5.2.2 and/or S5.2.3. This includes any dedicated "ESC Off", multifunction or ancillary control except for Four Wheel Drive (4WD) high gear if it meets S5.2.1 and S5.2.2. List the control on Data Sheet A5 in Appendix A.

4.3.2.5 Verify that the "ESC Off" telltale illuminates and remains illuminated.

4.3.2.6 Return the control to its original position that satisfies the performance requirements of S5.2.1, S5.2.2 and S5.2.3, and verify that the "ESC Off" telltale extinguishes.

4.3.2.7 Again select the same control position and verify that the "ESC Off" telltale illuminates and remains illuminated.

4.3.2.8 Deactivate the ignition locking system to the "Lock" or "Off" position.

4.3.2.9 Wait 10 s and then reactivate the ignition locking system to the "On" or "Run" position and verify that the "ESC Off" telltale extinguishes (except for vehicles that remain in 4WD low gear after the ignition cycle).

4.3.2.10 Verify that the control and/or the control position is identified by the required symbol or words for "ESC Off" from Table 1 of FMVSS 101. Refer to GMW15924.

4.3.2.11 Repeat steps 4.3.2.4 to 4.3.2.10 for each additional control position from Data Sheet A3.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results.

5.2.1 The ESC telltales and controls evaluated in this test must also pass the related sections of FMVSS 101. (Refer to GMW15924.) Record this data on Data Sheet A3 in Appendix A.

5.2.2 Only "Yes" answers to the "Yes" or "No" questions on Data Sheets A4 and A5 in Appendix A constitute passing this procedure. For any "No" answers, contact the test requestor immediately.

5.3 Test Documentation. Fill out and include the appropriate data sheets with the Evaluation Report as specified by the Validation Engineer.

6 Safety

This standard may involve hazardous materials, operations, and equipment. This standard does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

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7 Notes

7.1 Glossary.

Ancillary Control: A control for another system that has the ancillary effect of placing the ESC system in a mode where it no longer satisfies the performance requirements of S5.2.1, S5.2.2 and/or S5.2.3.

Bulb Check: A telltale illuminates for a short duration as a check of lamp function either when the ignition locking system is activated to the "On" ("Run") state when the engine is not running, or when the ignition locking system is in a position between "On" ("Run") and "Start" that is designated as a check position. The telltale need not illuminate when a starter interlock is in operation. The duration is usually 1 s to 5 s.

Common Display Space: A display area in which more than one telltale, indicator, identifier, or other message may be displayed, but not simultaneously.

Dedicated Control: A control (switch, button, knob, etc.) the sole purpose of which is to deactivate or place the ESC system in a mode where it will no longer satisfy the performance requirements of 5.2.

Drive Configuration: Driver selected, or default condition for distributing power from the engine to the drive wheels (examples include, but are not limited to, Two Wheel Drive (2WD), Front Wheel Drive (FWD), Rear Wheel Drive (RWD), All Wheel Drive (AWD), 4WD high gear with locked differential, and 4WD low gear).

Electronic Stability Control (ESC) System: A system that has all of the following attributes:

- That augments vehicle directional stability by applying and adjusting the vehicle brake torques individually to induce a correcting yaw moment to a vehicle;
- That is computer controlled with the computer using a closed-loop algorithm to limit vehicle over steer and to limit vehicle under steer;
- That has a means to determine the vehicle's yaw rate and to estimate its side slip or side slip derivative with respect to time;
- That has a means to monitor driver steering inputs;
- That has an algorithm to determine the need and a means to modify engine torque, as necessary, to assist the driver in maintaining control of the vehicle; and
- That is operational over the full speed range of the vehicle (except at vehicle speeds less than 20 km/h (12.4 mph), when being driven in reverse, or during system initialization).

ESC Off Telltale: A yellow telltale identified by the symbol shown for the "ESC Off Telltale" or the specified words listed in Table 1 of FMVSS 101 that illuminates according to the conditions specified in this standard.



or words "ESC OFF"

ESC Malfunction Telltale: A yellow telltale identified by the symbol shown for "ESC Malfunction Telltale" or the specified words listed in Table 1 of FMVSS 101 that illuminates according to the conditions specified in this standard.



or word "ESC"

Four Wheel Drive High Gear: A drive configuration that is designed for operation at higher speeds on snow, sand or dirt packed roads and that has the effect of locking the drive gears at the front and rear axles together.

Four Wheel Drive Low Gear: A drive configuration that is designed for low speed, off road driving and that has the effect of locking the drive gears at the front and rear axles together and providing an additional gear reduction between the engine speed and vehicle speed of at least 2.0.

Mode: An ESC performance algorithm, whether driver selected or not (examples include, but are not limited to, standard (default), performance (competition), snow (slippery road), or "Off").

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