Traction Control System, Straight Line Performance

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 determine vehicle traction performance characteristics during straight ahead driving maneuvers on test surfaces with various coefficients of friction. These measured characteristics can be used for validation or development.

1.2 Applicability. This procedure is applicable to cars and light duty trucks equipped with a brake/powertrain Traction Control System (TCS) (Regular Production Option (RPO) NW9), or powertrain management traction control system with a locking differential (RPO NW7 with RPO G80).

1.3 Remarks. For evaluation of traction control during acceleration while turning maneuvers refer to procedure GMW15051.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW15051

2.3 Additional References.

- Subsystem Technical Specification (SSTS)
- Uniform Parts Code(s) (UPC)
- Vehicle Technical Specification (VTS), Platform level

3 Resources

3.1 Facilities.

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.

3.1.3 Non-deformable Surface. This procedure is written for use at a test facility with level uniform, non-deformable test tracks with high, medium, and low friction surfaces. The high, medium, and low Mu test tracks must also be capable of having split coefficient of friction (Mu) and transitions for high/medium and high/low.

3.1.4 Deformable Test Surface. Loose gravel, loose sand or packed snow deformable surface test tracks may be needed depending on Platform VTS requirements.

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3.2 Equipment.

3.2.1 Install instrumentation as specified. The following is a list of the minimum instrumentation.

3.2.1.1 TCS input signal for rear wheel speed.

3.2.1.2 TCS disabled monitor.

3.2.1.3 Multi-channel digital data acquisition system (DAS) capable of 100 Hz scan rate.

3.2.1.4 Fifth wheel to monitor vehicle speed and distance.

3.2.1.5 Device to monitor accelerator pedal position through a pedal position sensor.

3.2.1.6 TCS active monitor.

3.2.1.7 Brake switch monitor, pedal force transducer or other device to indicate start of a brake apply.

3.2.1.8 Antilock brake system (ABS) enable/disable switch to supply and remove power to the ABS unit.

3.2.1.9 Accelerometer oriented to measure longitudinal acceleration.

3.2.1.10 Transmitting/receiving device with reflector.

3.2.1.11 RPO NW9 Only; Thermocouples for drive wheel brake linings.

3.2.1.12 RPO NW9 Only; Pressure transducer for measuring brake pressure at left rear wheel.

3.2.1.13 RPO NW9 Only; Pressure transducer for measuring brake pressure at right rear wheel.

3.2.1.14 Steering angle position sensor.

3.2.1.15 Yaw rate sensor.

3.2.1.16 Wheel speed measurement device for measuring angular velocity of left rear wheel.

3.2.1.17 Wheel speed measurement device for measuring angular velocity of right rear wheel.

3.2.2 Additional instrumentation may be required to measure the following parameters.

3.2.2.1 Lateral acceleration.

3.2.2.2 Requested torque.

3.2.2.3 Delivered torque.

3.2.2.4 Engine speed (recommend measurement device with revolutions per minute (rpm) readout).

Note: All instrumentation is to be calibrated as required. Record instrumentation details and date of calibration in the final test report, unless the information is otherwise preserved in the testing laboratory records or corporate archives.

3.3 Test Vehicle/Test Piece.

3.3.1 The vehicle to be tested must be in safe operating condition.

3.3.2 The vehicle must have all standard equipment installed, such as spare tire, and have all fluid containers filled. Exceptions to standard equipment includes equipment the responsible design engineer determines will impact vehicle traction, e.g., the largest engine available to the model under test, a transmission with the lowest effective first gear ratio, lowest axle ratio, etc. The tire size, tread condition and wheel base is to be dictated by the responsible design engineer.

3.3.3 The vehicle must be equipped with a TCS. The system must have a manual override feature to allow for vehicle operation with TCS disabled.

3.4 Test Time. Total test time will vary by program due to surface requirements and vehicle configurations. The following estimate is provided for planning purposes only.

Calendar time:	4 to 7 days
Test time:	32 to 56 hours
Coordination time:	8 hours

3.5 Test Required Information. It may be necessary to modify the test speeds and/or the maneuvers of the test according to the facility and conditions. Any deviations from the procedure should be thoroughly documented.

3.6 Personnel/Skills. Driver/Technician capable of performing the technical duties and driving maneuvers described in Section 4 of this procedure.

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4 Procedure

4.1 Preparation.

4.1.1 Install instrumentation and data acquisition equipment as stated in 3.2. Calibrate instrumentation as required.

4.1.2 The vehicle's brake components should be inspected and if worn should be replaced.

4.1.3 The vehicle's brakes must be burnished for RPO NW9 only.

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.1.1 The tests are to be conducted on uniform surfaces with consistent friction characteristics.

4.2.1.2 Wet test surfaces must be kept adequately watered to achieve a uniform low friction surface.

4.2.1.3 The dry surface must be nominally dry to preserve its traction capability.

4.2.1.4 Test runs are not to be made if the wind velocity is greater than 48 km/h (30 mph). Contact Design Responsible Engineer for additional restrictions when testing on low friction surfaces, especially ice.

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 Vehicle fuel should never be less than ½ full throughout the test.

4.2.2.2 The vehicle is to be tested at T1 ballast condition (driver and required test instrumentation).

4.3 Instructions.

4.3.1 Launch and Acceleration on Uniform Surfaces.

Note: This portion of the procedure can be performed in any order with respect to surface Mμ.

4.3.1.1 Move the test vehicle to a test track with high, medium, or low Mμ surface.

Note: For reasons of consistency in the surface Mμ values, the same test track facility should be utilized for all parts of this test.

4.3.1.2 The test track shall have a 3.5 m (3.83 yd) wide test lane.

4.3.1.3 When testing on ice surfaces run one (1) 32 km/h (19.88 mph) Mμ check stop.

4.3.1.4 Position the test vehicle at the appropriate acceleration distance from the test lane.

4.3.1.5 For each test condition listed on Appendix A, Table A1, perform eight (8) runs in the following sequence: two (2) driver's best effort runs with TCS disabled, four (4) TCS active runs, and two (2) driver's best effort runs with TCS disabled.

Note: For all TCS active runs on RPO NW9 systems, monitor rear brake temperatures to ensure they are within 38 °C to 177 °C (100 °F to 350 °F) at the start of each run.

4.3.1.6 Recheck instrumentation calibration on all appropriate channels.

4.3.1.7 Bring the speed of the vehicle to the initial speed stated Appendix A, Table A1. Enter the test lane with the vehicle centered in the lane. Start data acquisition and apply throttle as stated in Appendix A, Table A1.

Note: Throttle application begins the 5.0 s test window. During the test window, reasonable effort should be taken to maintain the vehicle within the test lane.

4.3.1.8 Continue throttle application for a minimum of 5.0 s.

4.3.1.9 At the conclusion of each test run, record whether the vehicle was maintained within the test lane. Also, the driver should indicate any significant occurrences in the "Driver's Comments" on the data/run sheet. Contact Vehicle Dynamics Center for latest copy of data/run sheets.

4.3.1.10 If testing on ice run one (1) 32 km/h (19.88 mph) check stop after each eight (8) run set.

4.3.1.11 Repeat 4.3.1.3 thru 4.3.1.10 until all runs within a surface are completed before beginning to test on other surfaces.

4.3.1.12 The test engineer is to determine the 2 s distance or calculate the average acceleration during the first 2 s of throttle application (TCS active) for each surface and each initial speed. This data will be used for 4.3.3 start marker location.

4.3.2 Launch and Acceleration on Split Mμ, Uniform, Non-Deformable Surfaces.

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