



Park Subsystem Durability 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 demonstrate the durability of the Park subsystem which includes the following scenarios, snap into Park, load on grade, and pullout of Park on grade. This test was developed to ensure the Park subsystem endures the rigors of high cycle testing.

1.2 Applicability. This testing is only applicable to automatic transmission/transaxle Park subsystems without Electronic Transmission Range Select (ETRS).

1.2.1 Individual model characteristics must be evaluated before parameters can be selected for use in this procedure. The actual number of cycles at each phase will depend upon sample size, design life, reliability target and Weibull slope. The Design Release Engineer (DRE), Technical Specialist and Development/Validation Engineers are to review and provide appropriate cycle counts for the test.

1.3 Remarks. This schedule is one part of an entire battery of testing for the Park subsystems (these Park subsystem tests comply with the distribution process in CG4941). The testing is used to ensure the Park subsystem and its components meet defined durability requirements based on sample size and cycle counts. The components under scrutiny include, but are not limited to: the Park gear, Park pawl, Park pawl shaft, Park pawl return spring, actuator assembly, actuator guide, detent lever (Internal Mode Switch (IMS)), manual shaft, detent spring assembly and case.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

2.3 Additional References.

- CG4941
- CTS
- Park Subsystem Bill of Design (BOD) requirement
- SSTs

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.

3.2 Equipment. Provide the ability to index the Park gear to load multiple teeth and record data as needed.

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3.2.1 An apparatus is required, capable of providing a torque (clockwise and counter clockwise) equivalent to the maximum calculated value while the Park pawl is engaged, simulating vehicle loading on grade. The specified grade and torque shall be per the Park Subsystem Bill of Design (BOD) requirement.

3.2.2 A method is required to measure the manual shaft torque or linear force required to shift. Linkage to the manual shaft should include production intent brackets for cable or linkage mounting. Alternatively, the point and direction of application of force to manual shaft external lever should be production intent.

3.2.3 Lab Engineer must confirm capability of equipment to meet torque load requirement. The load applied should be < 75% of the equipment capacity.

3.3 Test Vehicle/Test Piece.

3.3.1 A minimum test sample size shall be three (3) for validation, refer to 4.2.2 for deviation.

3.3.2. If possible use 100% inspected parts and obtain inspection data from the supplier.

3.3.3 When the test is used for validation, production intent parts shall be used. Any modifications to parts or processing must not compromise the actual function of the desired design features of the Park subsystem of a production intent transmission. Any deviations shall be documented and agreed to by DRE.

3.3.4 Number of cycles required for the Snap into Park phase of the test shall be based on customer usage data representative of the Park subsystem to be run. A Weibull slope of 3 should be assumed for part strength distribution, unless there is other data available to define the part strength.

3.3.5 Number of cycles for the Load on Grade phase of the test shall be based on expected customer usage. Half the cycles are to simulate the vehicle in a "nose-up" and half in a "nose-down" attitude. The pull out of Park requirement must be defined by the DRE, who extracts this information from the SSTS requirements.

3.4 Test Time. Per one (1) sample.

Calendar time: 45 days

Test time: 1080 h

Coordination time: 48 h

3.5 Test Required Information.

3.5.1 Number of cycles required for all phases of the test shall meet the Park subsystem reliability requirement as specified in the Park Subsystem BOD for the life of the transmission, where life is defined by the SSTS and CTS.

3.5.2 Maximum allowable torque at the manual shaft or force at actuator required to pull out of Park while loaded to simulate grade.

3.5.3 The required quantity of test samples needed to demonstrate the reliability requirements.

3.5.4 Establish the force or torque required to disengage the actuator rod assembly from Park when the transmission is loaded to the defined static torque.

3.5.5 Limits for shutdown due to Park gear load are to be set as per directed with supplied Appendix A, Data Sheet A1.

3.5.6 Static torque requirement at Park gear. Define the torque path to the Park gear taking into account all gear reductions (e.g., final drive gear reduction). Adjust the applied torque accordingly to simulate maximum torque target at Park gear and state in Appendix A, Datasheet A1. Torque may be defined to perform envelope testing as defined in the Glossary. Consult DRE/Technical Specialist for applicability of envelope testing and defined torque.

3.6 Personnel/Skills. Knowledge of instrumentation fundamentals is required. Only authorized technicians can operate test equipment. Knowledge of Park subsystem fundamentals is required. Knowledge of programing and operation of the rotary servo station and linear actuator system are required.

4 Procedure

4.1 Preparation. Pre and post inspections are required for testing. For the Park subsystem components visual inspection for cracks shall be performed, optionally, magnetic particle inspection can be used to determine the presence of cracks. Powder metal parts should go through ultra-sound inspection for the detection of internal cracks. Once complete de-magnetize all parts. Measure all pertinent functional dimensions per DRE.

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