



High and Low Fatigue Test Procedure Specification for Park Gear and Park Pawl

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. This standard specifies the requirements of park gear and park pawl (to be achieved at component level), which shall then provide confidence that the park subsystem durability test can be completed successfully.

1.2 Applicability. Park gear and park pawl for passenger or commercial vehicles and trucks.

1.3 Remarks. This GM standard shall not replace park subsystem durability test requirements listed in the park subsystem durability test specification.

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.

- Computer Aided Design (CAD) layout.
- Design Review Based on Test Results (DRBTR).
- Park subsystem durability test specification.

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.

3.2.1. List of equipment necessary to run the test, but not limited to, shall be:

- Torque Load Cell.
- Rotary Actuator Test Stand.
- Servo Valve.
- Hydraulic Manifold.

3.3 Test Vehicle/Test Piece. Test shall be performed on park gear and park pawl using a fixture on a Rotary Test Stand.

3.4 Test Time. Following is an estimated plan on how long it might take to complete the test. Times may vary based on availability and capacity of test bench, and also the availability of technician to run the test.

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Calendar time: 10 days

Test hours: 80 h

Coordination hours: 15 h

3.5 Test Required Information. Test report shall be provided to the Design Release Engineer (DRE). In case of failure, the DRE and Development and Validation (Dev/Val) Engineer shall be informed within 24 h. Test shall be run with positional control limits of Rotary Actuator set to 5% of initial position, and tripping this limit shall suspend the test, until root cause analysis is performed.

3.6 Personnel/Skills. Lab personnel shall have experience running the test. This personnel shall also have enough experience to choose the right size rotary that meets the torque load requirement.

4 Procedure

4.1 Preparation.

4.1.1 Pre-Inspection and Post-Inspection. Park gears and park pawls shall be visually inspected, before and after the test, for cracks and defects.

4.1.2 Test Fixture. The test fixture design shall be reviewed by GM DRE, Dev/Val Engineer, Test Engineer and/or Test Responsible Person. Once agreed upon the test fixture, the Test Engineer and/or Test Responsible Person shall submit a request for test fixture.

4.2 Conditions.

4.2.1 Environmental Conditions. Unless otherwise specified, the standard ambient testing temperature is defined as $(23 \pm 5) ^\circ\text{C}$.

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.

Deviations from the requirements of this standard shall have been agreed upon by the GM DRE, Dev/Val Engineer and Test Engineer.

4.2.3 Input Types.

4.2.3.1 The worst case static torque, which is provided by the DRE, shall be used during the test to ensure park gears and park pawls can meet the reliability and durability requirements.

4.2.3.2 No dynamic torque maneuvers shall be applied, rather, the worst case dynamic torque limit, which is provided by the DRE, shall be applied as static torque, to ensure park gears and park pawls can meet the reliability and durability requirements.

4.3 Instructions. (Requirements and Test Procedure).

4.3.1 Loading of the components shall simulate forward and reverse park system loading on grade. Forward and reverse loading shall be achieved by rotating the Rotary Actuator in clockwise and counterclockwise direction.

4.3.2 Test shall be unidirectional and run in torque control mode. The frequency of Rotary Actuator used, shall be set to 3 Hz unless otherwise stated by the DRE.

4.3.3 Three different ranges of torque in two different directions shall be applied. Refer to Appendix A, Table A1 and Table A2. Static torque limit and dynamic torque limit shall be provided by the DRE.

4.3.3.1 First torque range shall be from 50 Nm to static torque limit or until failure.

4.3.3.2 Second torque range shall be from 50 Nm to dynamic torque limit or until failure.

4.3.3.3 Third torque range shall be from 50 Nm to the ultimate failure torque of the park gear or park pawl, where either of these or both crack, break or fail, or Torque Load Cell is overloaded. The torque at which failure occurs shall be recorded as the ultimate torque of the corresponding component.

4.3.4 Test shall be run on a pair of teeth, 180 degrees apart, on the park gear. If there isn't a park gear tooth at exactly 180 degrees, then a park gear tooth closest to 180 degrees shall be selected. The gear teeth shall be labelled X and Y, and referred with these labels on the test report, see Figure 1. Optionally, four (4) teeth per park gear can be used, upon DRE's request. The four (4) teeth shall be approximately 90 degrees apart, and this deviation must be documented in the test report.

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