



Transmission Synchronization and Internal Shift Mechanism Fatigue Test

1 Scope

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. Determination of the service-life of transmission synchronization and internal shift mechanism components.

1.2 Foreword. To determine the durability of synchronizer devices and internal shift mechanism parts, the completion of this bench test is mandatory. This test correlates to 160 000 km customer mileage.

1.3 Applicability. Synchronizer parts and internal shift systems of all FWD, AWD and RWD transmissions.

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

3 Resources

3.1 Facilities.

3.1.1 Pneumatically, electronically or hydraulically actuated synchronizer test bench (see Appendix C).

Note: Applicable for all new-built bench cabins maximum allowable output speed stability decay of 10 % shall be maintained.

3.2 Equipment.

3.2.1 Control and monitoring system.

3.2.2 Acceleration transducer and noise monitoring unit.

3.2.3 Heating blower with temperature adjustment.

3.3 Test Vehicle/Test Piece. Transmission assembly.

3.4 Test Time.

Calendar time: 35 days

Test hours: 40 h

Coordination hours: 20 h

3.5 Test Required Information. Possible sources are:

- I. SOR
- II. VTS (Vehicle Technical Specifications)
- III. SSTS (Sub System Technical Specifications)
- IV. ADV Plan

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Originating Department: GME Specification Center

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- V. CTS (Component Technical Specifications)
- VI. VCRI
- VII. Application engineer
- VIII. Development Groups
- IX. Drawings

3.6 Personnel/Skills. Not applicable.

4 Procedure

4.1 Preparation.

4.1.1 Determine appropriate parameters of the synchronization components (see Appendix D) and check if the parts are compliant with drawing specifications.

4.1.2 Install all components into the transmission according to specifications of installation.

4.1.3 Assemble the clutch plate having the maximum flywheel inertia J (in kgm^2) corresponding to the transmission type to the input shaft.

4.1.4 Install the transmission assembly onto the test bench.

4.1.5 Determine the amount and grade of transmission oil and fill the bench accordingly.

4.1.6 Assemble the dynamometer and the external shift control to the transmission to measure the synchronizing force F_S .

4.2 Conditions.

4.2.1 Environmental Conditions. As stated in paragraph 4.3.

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 Calibrate the shift robot with the shift rod and test amplifier.

4.3.2 Select appropriate durability test according to Appendix A, paragraph A1.1 and A1.2. Implement required test data into automation system.

4.3.3 Set the transmission input speed (clutch plate) to nominal speed in lower gear of the shift to be performed.

4.3.4 Start the test stand.

4.3.5 Start the acceleration meter.

4.3.6 Adjust the shift force F_S (see Appendix A, paragraph A1.1 and A1.2) by the pressure regulator or the control unit of the shift robot.

(For indication of F_S refer to the testing system data displayed. For shift force curve refer to Appendix B).

4.3.7 Record the synchronizing time (t_{syn}) every time you check the shift force.

4.3.8 Check F_S after 100 cycles at first. Then check it again after 500 cycles and again after 1000 cycles. Adjust if necessary.

Maximum allowable deviation of the shift force during the test is $\pm 5\%$. Maximum allowable RPM decay during a 2-1 shift is -10% . For all other gears the decay is -3% maximum during the test.

4.3.9 The transmission oil temperature shall be at $(+80 \pm 5)^\circ\text{C}$.

4.3.10 Upon completion of the test recheck dimensionally the samples (see Appendix D).

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. The samples shall complete the number of cycles as specified in the table of Appendix 1 (5 speed manual transaxle) or Appendix 1a (6 speed manual transaxle) without any failure of the synchronization.

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For completion of the test an execution of 4 transmission synchronization tests is required.

For evaluation complete visual check, measuring of synchronization parts in new condition and re-measuring of synchronization parts upon completion of the test (see Appendix D) is mandatory.

5.3 Test Documentation.

5.3.1 Transmission Data. Record name and number of all parts removed or installed (gear, synchronization parts, sleeves), cell and transmission numbers, test hours on parts and on transmission, together with reason part was eventual removed.

5.3.2 Comment. Report a detailed comment of the transmission performance and of individual components.

5.3.3 Rating. Record test rating of transmission as a whole (for evaluation criteria, see paragraph 5.2).

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.

6.1 Shut-Down Types and Alarm.

- Terminate test if temperature of transmission oil exceeds +120 °C.
- Terminate test if shift force at shift sleeve exceed 10 % of value according to Appendix A, paragraphs A1.1 and A1.2.
- Terminate test if the acceleration goes five times beyond its permissible level.

7 Notes

7.1 Glossary. Not applicable.

7.2 Acronyms, Abbreviations, and Symbols. Not applicable.

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Test to GMW16790

9 Release and Revisions

This standard was originated in April 2012. It was first approved by Powertrain Transmission PMT in July 2012. It was first published in July 2012.

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1	JUL 2012	Initial publication.

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