



Axle and/or Power Transfer Unit (PTU)/Transfer Case Vent Leakage

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. The purpose of this specification is to evaluate lubricant leakage through the axle and/or PTU/Transfer Case vent under various road conditions.

1.2 Foreword. This test procedure has historically been run during high ambient temperature conditions to induce worst case thermal load, subsequent fluid expansion and increased possibility of expulsion event. Note that a procedure sub section has been added to account for low temperature expulsion phenomena; appropriate test procedure is to be determined jointly by applicable Design, Validation and Development groups.

1.3 Applicability. This specification applies to passenger cars and light trucks.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14264

3 Resources

3.1 Facilities. Facilities should be similar to those found at Milford Proving Ground as described. Design, Validation and Development groups should mutually select suitable test roads and facilities for this activity. Test roads should have easy on/off access and allow sustained high speed vehicle runs conducive to building high axle and/or PTU/Transfer Case fluid temperatures, and energetic dispersal of fluid inside axle and/or PTU/Transfer Case housing.

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. Thermocouples and sensors to monitor axle and/or PTU/Transfer Case lubricant temperature, ambient temperature and axle and/or PTU/Transfer Case internal pressure.

Note: A calibrate instrumentation as required by divisional practices; record instrument details in Appendix A, on Data Sheet A1.

3.3 Test Vehicle/Test Piece.

3.3.1 Test Vehicle. The test vehicle may be any vehicle for which the test axle and/or PTU/Transfer Case is released.

3.3.2 Test Materials/Components.

3.3.2.1 One (1) axle and/or PTU/Transfer Case assembly.

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3.3.2.2 Sufficient quantity of the test lubricant to fill the test axles and/or PTU/Transfer Case to the manufacturer's recommended level. Record lubricant data.

3.3.2.3 Vent material, construction and location should be verified as production intent prior to start of test, if test is developmental in nature, then each iteration, if different, should be documented for location and orientation if requested by Design Engineer.

3.4 Test Time. Not applicable.

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Not applicable.

4 Procedure

4.1 Preparation.

4.1.1 Install a thermocouple in the axle and/or PTU/Transfer Case assembly such that it is always immersed in the axle and/or PTU/Transfer Case lubricant.

4.1.2 Install a sensor or other method to measure axle and/or PTU/Transfer Case internal pressure

4.1.3 Clean the surface of the axle and/or PTU/ Transfer Case in the area of the vent. Mask the vent and paint the area with white paint for ease of leakage detection. Record axle and/or PTU/Transfer Case and vent descriptions in Appendix A, on Data Sheet A2.

4.1.4 Fill the axle and/or PTU/Transfer Case with the recommended quantity of lubricant. Record the quantity of fill.

4.1.5 Install the test axle and/or PTU/Transfer Case assembly in the test vehicle. Record the required description of test vehicle on data sheet.

4.2 Conditions.

4.2.1 Environmental Conditions. Design responsible engineer should define environmental operating temperatures for vehicle in the program subsystem technical specification. It is suggested that the axle and/or PTU/Transfer Case be tested at the following temperatures: -35 °C, an ambient temperature between 5 °C and 25 °C and hot conditions of 40 °C or above.

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.

4.2.3. Monitor for and note in comments section any odors due to vapor leakage during all testing procedures.

4.3 Instructions. Record the ambient and the axle and/or PTU/Transfer Case lubricant temperatures at the beginning and the end of each of the following cycles:

4.4 Ambient Temperature Test.

4.4.1 Proceed to the Circular Track, or similar road system allowing sustained high speed testing, without making hard accelerations or decelerations. Drive at 65 km/h to 130 km/h (40 mph to 80 mph) until the axle and/or PTU/ Transfer Case lubricant temperature reaches 64 °C (150 °F).

4.4.2 Inspect for vent leakage and rate the amount of leakage per GMW14264. If leakage has occurred, clean the vent area thoroughly and restore the fluid level to the level in 4.1.4.

4.4.3 Proceed to the Ride and Handling Loop, or suitable road system with similar surface and vehicle input content, at posted speeds. Run two laps in the right-hand lane at posted speeds and repeat 4.4.2.

4.4.4 Proceed to the Circular Track, or similar road system allowing sustained high speed testing, at posted speeds. Accelerate to 162 km/h (100 mph) or to 8 km/h (5 mph) under top speed if 161 km/h (100 mph) cannot be attained. Run five laps of the track at that speed and repeat 4.4.2. Repeat at highest rated speed or speed agreed upon with the design responsible engineer and repeat 4.4.2.

4.4.5 Proceed to previously determined suitable road segment, similar to Milford Proving Grounds (MPG) East-West Straightaway, at posted vehicle speed limit. Make ten tight turning circles on the previously approved expansive paved Vehicle Dynamics and Test type test area, at the maximum safe speed. The direction of the turns should be such that the vent is toward the outside of the circle from the vehicle centerline and repeat 4.4.2. Repeat by making ten tight turning circles in opposite direction and repeat 4.4.2.

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Note: On power steering equipped vehicles, steering input should be just short of the gear stop to prevent steering pump and lubricant damage.

4.4.6 Proceed to a pre-determined, approved road segment with very rough undulating surface, similar to MPG Belgian Blocks, via appropriate access road at posted speeds. Run five laps at 48 km/h to 56 km/h (30 mph to 35 mph). Repeat 4.4.2.

4.5 Cold Temperature Performance.

4.5.1 Soak vehicle in cold chamber to -35 °C for a minimum of 8 h.

4.5.2 Leave cold chamber area and proceed to circular track or similar road system and drive vehicle at 162 km/h (100 mph) (or agreed upon speed) until axle and/or PTU/Transfer Case temperature stabilizes or four laps of track have been accomplished and repeat 4.4.2.

4.6 Hot Temperature Performance.

Note: This requirement can be achieved either by operating vehicle in hot ambient conditions (40 °C and above) or by insulating differential as to limit cooling ability by blocking underbody air flow and insulating axle and/or PTU/Transfer Case. Fiberglass insulation can be wrapped around underside of differential to accomplish this task.

4.6.1 Leave building area and proceed to circular track or similar road system and drive vehicle at highest rated speed or speed agreed upon with design responsible engineer on the circular track until axle and/or PTU/Transfer Case temperature reaches the excursion temperature for the axle and/or PTU/Transfer Case lubricant. Temperature should not stabilize if the axle and/or PTU/Transfer Case is being operated in lower ambient conditions and insulation is being used to achieve elevated axle and/or PTU/Transfer Case temperatures. Stabilization below excursion limit is acceptable when operating at hot ambient conditions (40 °C and above) and when stabilization temperature has been previously established through physical tests in hot ambient conditions and repeat 4.4.2.

5 Data

5.1 For increased statistical confidence in the test results, repeat this procedure (Section 4) using at least two more axle and/or PTU/Transfer Case assemblies of the same configuration.

5.2 Calculations. Not applicable.

5.3 Interpretation of Results. See Data Sheet A2.

5.4 Test Documentation. See Data Sheet A2.

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.

7 Notes

7.1 Glossary. Not applicable.

7.2 Acronyms, Abbreviations, and Symbols.

MPG Milford Proving Grounds

PTU Power Transfer Unit

8 Coding System

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

Test to GMW15848

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