



Axle and Prop Shaft Noise Subjective Evaluation Procedure

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. To establish a structured process to subjectively evaluate and rate rear drive axles, front drive axles, and propeller shafts within the setting of a proving grounds. This is an evaluation of the axles and propeller shaft as installed in the vehicle. This is not an evaluation of the vehicle.

1.2 Foreword. The intended use of the procedure is to identify and define any issues of the axles and propeller shaft and to subjectively track the progress in the resolution of those issues.

1.3 Applicability. Passenger cars, multi-purpose passenger vehicles, light duty trucks, and light commercial vehicles that are rear drive or all wheel drive.

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. Appropriate road surfaces as follows:

3.1.1 Circular Track. Circular track or equivalent road for performing the vehicle warm up.

3.1.2 Straightaway Track. Straightaway track or equivalent road for performing noise evaluations.

3.1.3 Paved Parking Lot. Paved parking lot or equivalent facility for performing specific noise evaluations on locking or limited slip axles.

3.1.4 Belgian Block Track. Belgian block track or equivalent road with lateral wall for performing

specific rattle evaluations on locking or limited slip axles.

3.2 Equipment. Not applicable.

3.3 Test Vehicle/Test Piece. This procedure may be performed on development vehicles, production vehicles or competitive vehicles. Prior to conducting the evaluation, note the following vehicle configuration information and record it on the field sheet (see Appendix A, Data Sheet A1) along with the evaluation data. Record vehicle identification number (VIN), GM fleet number, and the build stage if appropriate. Record engine displacement, orientation, configuration (vee or in-line), and whether it is gasoline or diesel fueled. Record the driveline configuration; Rear Wheel Drive (RWD), All Wheel Drive (AWD), or Four Wheel Drive (4WD). Record the number of forward gears and whether the transmission is automatic or manual. Record the testing date, time and location.

3.4 Test Time.

Calendar time: 1 day

Test hours: 4 hours

Coordination hours: 4 hours

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. An experienced engineer or technician trained in subjective evaluation of driveline systems using the Subjective Rating Scale specified in GMW14264.

4 Procedure

4.1 Preparation. Inspect vehicle for any unwanted content or issues and eliminate.

4.1.1 Vehicle Preparation. Check that the speedometer and tachometer are functional. Ensure all fluid levels are full, including fuel (Curb Weight). Check to be sure the vehicle is empty; i.e., no spare or development parts stored in the trunk, no left over instrumentation, no test equipment, etc. Ensure the tires are inflated to the vehicle's recommended pressures. Turn off all vehicle accessories that generate noise such as the climate control blower and all entertainment systems.

4.2 Conditions.

4.2.1 Environmental Conditions. Procedure should be conducted on a dry track surface.

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 Vehicle Warm Up. Warm the vehicle up to operating temperature by driving at least 20 km on the circle track at high speed. Limit vehicle speed to local safe track limits or 160 km/h. Proceed immediately to the straightaway after completion.

4.3.2 Whine Noise Test. On the straightaway track, evaluate the vehicle for whine under DRIVE, FLOAT, and COAST conditions at 50 km/h to 130 km/h. Enter the vehicle speed that the whine peaks at and the subjective rating on the field sheet. A sample field sheet is included in Appendix A. Enter the values in the appropriate speed range or ranges where they are heard. Repeat the procedure as many times as necessary. If the test vehicle is 4WD, evaluate the vehicle in Two Wheel Drive (2WD) first and then in 4WD.

For vehicles with a manual transmission, conduct the evaluation in the gear that is closest to but still higher than a 1:1 transmission output ratio. For vehicles with an automatic transmission, conduct the evaluation with the vehicle in drive and the transmission operating in the 2 highest gears.

4.3.3 Creeping Noise Test (For Vehicles with Manual Transmissions Only). On the straightaway track, engage 1st gear and allow the vehicle to travel without input to the accelerator. Evaluate the vehicle for "Creeping" noise. Repeat this process in 2nd and 3rd gears. Record the findings and subjective ratings on the field sheet.

4.3.4 Clank Noise Test. On the straightaway track, operate the vehicle in 1st gear drive at slightly faster than idle engine speed. Accelerate at wide open throttle (WOT) and decelerate (foot completely off) harshly several times (power on and power off, similar to a square wave input to the accelerator) and evaluate "Clank" noise. Record the findings and ratings in the field sheet. Repeat this procedure in 2nd and 3rd gears and record the findings and subjective ratings.

Note: When evaluating a "High Powered" vehicle a WOT input may brake traction and defeat the evaluation. A lower input level is then needed for an appropriate evaluation.

4.3.5 Metallic Noise Test. On the straightaway in 3rd gear, begin the test by cruising at approximately 1000 engine revolutions per minute (erpm). Perform a WOT acceleration to maximum engine speed. Then perform a coast deceleration to approximately 1000 (erpm). During this maneuver, evaluate the drive train for "Metallic" noise under both DRIVE and COAST. Record the finding and subjective rating in the field sheet.

4.3.6 Locking or Limited Slip Axles Specific Noise Tests.

4.3.6.1 Click/Squeak Noise Test. In a paved parking lot or other appropriate facility, slowly drive the vehicle in tight left and right circles. Evaluate the vehicle for any click, squeaks, or other noises originating from the front or rear axles. For vehicles with a manual transmission use 1st gear. For vehicles with an automatic transmission, operate the vehicle in Drive. Record the findings and subjective ratings in the field sheet.

4.3.6.2 Rattle Noise Test. Requires a road surface called "Belgian Blocks" with a lateral wall to reflect sound from the vehicle back at the vehicle as shown in Appendix B, Figures B1 and B2. With the windows down and the transmission in neutral, coast over the Belgian Blocks at speeds from 30 km/h to 20 km/h. Evaluate the driveline for "Rattle" noise. Record the findings and subjective rating on the field sheet.

Not all regions have the combination of a "Belgian Block" surface and a lateral wall. In the regions where this is the case, local experts shall develop a substitute evaluation based on the surfaces and facilities available, and the particular road surface and lateral wall configuration shall be noted on the field sheet.

4.3.6.3 Clunk Noise Test. There are 2 methods to evaluate the driveline for "Clunk", both methods are to be used.

The first test is to be done on the "Belgian Block" and "Belgian Block with potholes" or equivalent, as shown in Appendix B, Figures B1 and B2. This test is for manual transmission vehicles. It is performed with the windows down. In 1st gear accelerate to 30 km/h. When the vehicle reaches 30 km/h, with torque still being applied to the driveline from the engine, quickly and fully apply the clutch. Evaluate the driveline for "Clunk" and/or "Clatter" noise.

Repeat this test at different acceleration rates; this is to evaluate the driveline with different torque levels applied.

Also repeat the process in 2nd and 3rd gears.

The second evaluation method is done on the same road surfaces, "Belgian Block" and "Belgian Block with potholes". The test begins at